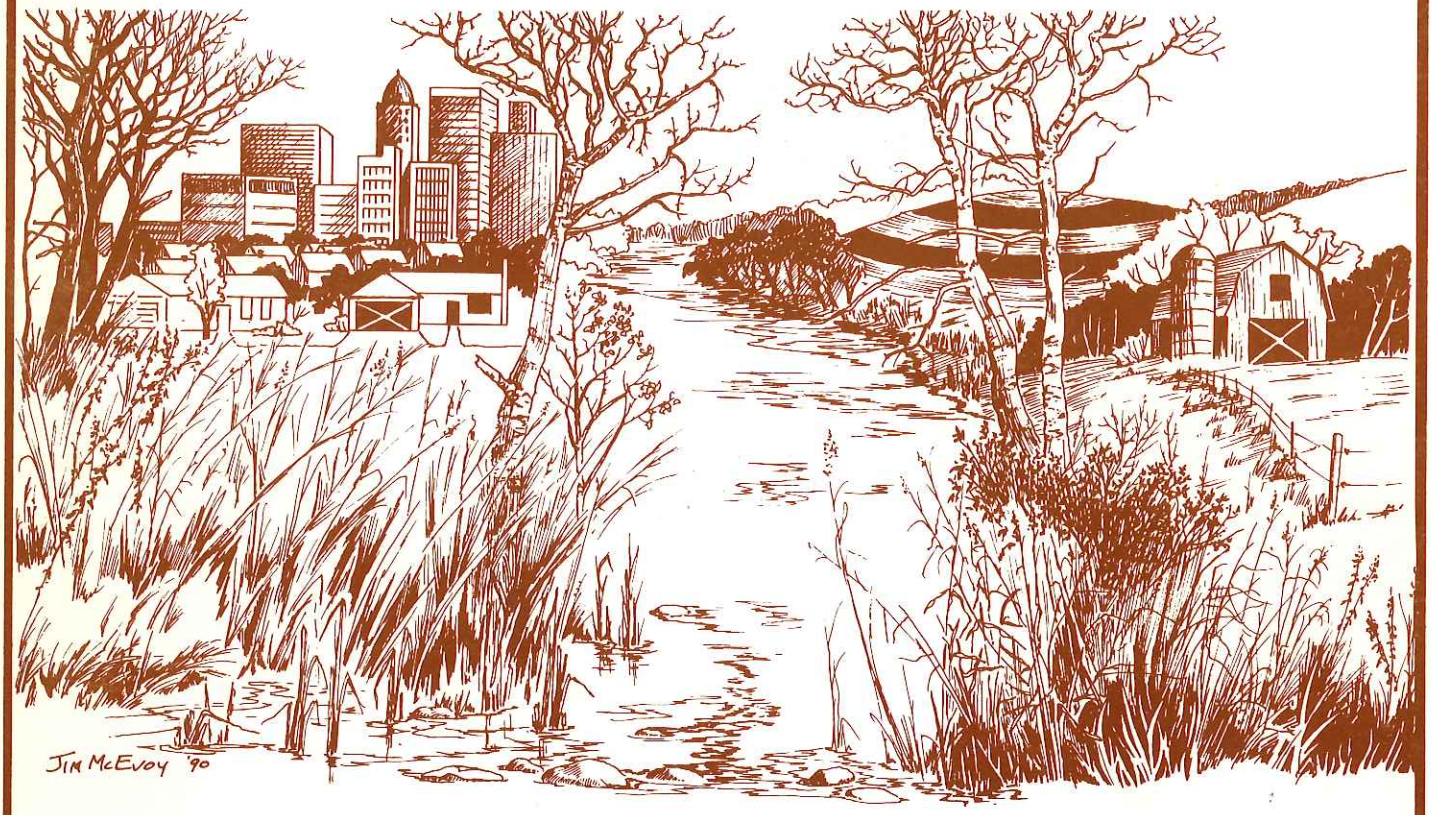
A Nonpoint Source Control Plan for the Menomonee River Priority Watershed Project



MILWAUKEE RIVER
Priority Watersheds Program

This plan was prepared under the provisions of the Wisconsin Nonpoint Source Water Pollution Abatement Program by the **Wisconsin Department of Natural Resources,** the **Department of Agriculture, Trade and Consumer Protection,** and the **Milwaukee, Waukesha, Ozaukee, and Washington County Land Conservation Departments.**

WATERSHED PLAN ORGANIZATION INFORMATION

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Wisconsin Department of Natural Resources

C. D. Besadny, Secretary
Lyman Wible, Administrator, Division for Environmental Quality
Bruce Baker, Director, Bureau of Water Resources Management
Rebecca Wallace, Chief, Nonpoint Source & Land Management Section

Wisconsin Department of Agriculture, Trade and Consumer Protection

Alan Tracy, Secretary
Nicholas Neher, Administrator, Division of Agriculture Resource Management
Dave Jelinski, Director, Bureau of Land and Water Resources

A NONPOINT SOURCE CONTROL PLAN FOR THE MENOMONEE RIVER PRIORITY WATERSHED PROJECT

The Wisconsin Nonpoint Source Water Pollution Abatement Program

March 1992

This Plan Was Cooperatively Prepared By:

The Wisconsin Department of Natural Resources and
The Department of Agriculture, Trade, and Consumer Protection
In cooperation with
The Ozaukee, Washington, and Waukesha County
Land Conservation Departments
and
The Menomonee River Advisory Subcommittee

Publication WR-244-92

For copies of this document please contact:

Wisconsin Department of Natural Resources
Bureau of Water Resources Management
Nonpoint Source and Land Management Section
P.O. Box 7291
Madison, WI 53707

The Wisconsin 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.

WATERSHED PLAN ACKNOWLEDGEMENTS

Author

James D'Antuono, Southeast District, Department of Natural Resources (DNR)
Keith Foye, Department of Agriculture, Trade and Consumer Protection (DATCP)

Editor

Cindy Lukas, Nonpoint Source & Land Management Section, DNR

Graphics/Maps

Jim McEvoy, DNR
Southeastern Wisconsin Regional Planning Commission

Contributors

Menomonee River Watershed Advisory Subcommittee
Andy Holschbach, Ozaukee County Land Conservation Department
Perry Lindquist, Washington County Land Conservation Department
Dale Shaver, Waukesha County Land Conservation Department
Ken Baun, DNR
Keith Foye, DATCP
Carolyn Johnson, University of Wisconsin–Extension
Steve Mace, Southeast District, DNR

Word Processing

Word Processing Staff, DNR

MILWAUKEE RIVER BASIN ADVISORY COMMITTEE

Norbert J. Hynek, Urban Co-Chair, Milwaukee Metropolitan Sewerage District Committee

Reuben J. Schmahl, Rural Co-Chair, Washington Cty. Bd. of Supervisors

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Honorable Margaret Farrow, State Senate

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Brigid Sullivan, Milwaukee County Board

Kurt W. Bauer, Executive Director, Southeastern WI Regional Planning Committee

Bruce Baker, Director, Bureau of Water Resources Management, DNR

Bill Carity, Siepmann Realty, Inc.

Norman Huth, Director, Milwaukee County Conservation Alliance

Gary Jackson, Water Quality Education Coordinator, UWEX

Jim Johnson, Director, Land Resource Bureau, DATCP

Rose Hass Leider, Chair, Ozaukee County Land Conservation Committee

Ted Manning, Area Conservationist, Soil Conservation Service

Donald A. Roensch, Director of Public Works and County Engineering, City of Mequon

Hilbert Schuenemann, Supervisors, Washington County Board

Gerald Schwerm, Transportation Director, Milwaukee County Department of Public Works

Wallace White, Director, Milwaukee Metropolitan Sewerage District

MENOMONEE RIVER ADVISORY SUBCOMMITTEE

Richard Farrenkopf (Chair): Village Administrator, Menomonee Falls

John Kohl (Vice-Chair): Washington County Supervisor

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Harry L. Behrens: Town of Brookfield

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Michael J. Kolodzyk: Environmental Science Educator & Fishing Club Representative

Greg Laabs: Associate City Planner, City of Wauwatosa

Curtis E. Manke: Chairman, Waukesha County Board of Supervisors

Jan Marsh: Representative, Milwaukee Audubon Society

Alderman Michael Murphy: City of Milwaukee

Milan Racic: Representative, Milwaukee County Land Conservation Committee

Bruce Rubin: Chief Land Use Planner, Southeastern Wisconsin Regional Planning Commission

Jenny Schuler: President, Village of West Milwaukee

Brigid Sullivan: Director, Milwaukee County Parks, Recreation and Culture Department

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

WISCONSIN
DEPT. OF NATURAL RESOURCES

Carroll D. Besadny
Secretary

101 South Webster Street
Box 7921
Madison, Wisconsin 53707
TELEPHONE 608-266-2621
TELEFAX 608-267-3579
TDD 608-267-6897

April 23, 1991

IN REPLY REFER TO: 3200

Mayor Constance Pukaite, City of Mequon
Mr. James L. Swan, Chair, Ozaukee County Board of Supervisors
Mr. Reuben J. Schmahl, Chair, Washington County Board of Supervisors
Mr. Charles W. Crump, President, Village of Germantown
Mr. Curtis Manke, Chair, Waukesha County Board of Supervisors
Mr. Daniel M. Finley, County Executive, Waukesha County
Mayor Kathryn C. Bloomberg, City of Brookfield
Mayor Timothy Tully, City of New Berlin
Mr. Robert Steliga, President, Village of Menomonee Falls
Mr. Randall A Burr, President, Village of Elm Grove
Mr. Richard Ensslin, President, Village of Butler

Dear:

I am pleased to be able to approve the Ozaukee, Washington and Waukesha counties portions of A Nonpoint Source Control Plan For The Menomonee River Priority Watershed Project. I am taking this action under NR 120.08(2)(cr), Wis. Adm. Code. This action follows a recommendation for approval of the watershed plan by: the Milwaukee River Basin Citizen's Advisory Committee (November 20, 1990), the Ozaukee County Board of Supervisors (December 5, 1990), the Waukesha County Board of Supervisors (January 15, 1991), the Washington County Board of Supervisors (February 12, 1991), and the Wisconsin DATCP (April 26, 1991).

This approval authorizes the use of state Nonpoint Source Water Pollution Abatement Program funds for the control of urban and rural nonpoint pollution sources in those incorporated and unincorporated portions of Ozaukee, Washington and Waukesha counties located within the project area. These funds must be used consistent with Section 144.25, Stats., NR 120, Wis. Adm. Code, and the approved priority watershed plan.

As you work with the Department of Natural Resources' staff to implement the recommendations in the watershed plan, the Department will continue working with Milwaukee County to get its plan approval. I anticipate that in the near future I will be able to approve the remaining portion of the watershed plan so that Nonpoint Source Program funds can be made available to help in the significant nonpoint source clean-up efforts needed within Milwaukee County.

Thank you for your cooperation to date in this vital nonpoint source control effort, and I look forward to working with you to implement the nonpoint source control plan.

Sincerely,

C. D. Besadny, Secretary
Wisconsin Department of Natural Resources

cc: Gloria McCutcheon, Director, DNR Southeast District
Christine Bastian - Milw. River Basin CAC, Urban Co-Chair
Reuben Schmahl - Milw. River Basin CAC, Rural Co-Chair
Richard Farrenkopf, Chairman, Menomonee River Watershed Advisory Sub-Comm.

Burney

State of Wisconsin
Department of Agriculture, Trade & Consumer Protection

Alan T. Tracy
Secretary

801 West Badger Road
PO Box 8911
Madison, WI 53708-8911

April 24, 1991

Mr. Bruce Baker, Director
Bureau of Water Resources Management
Wisconsin Department of Natural Resources
Box 7921
Madison, Wisconsin 53707

Dear ~~Mr. Baker~~ Bruce:

The Department has received the request from the Department of Natural Resources to approve "A Nonpoint Source Control Plan For The Menomonee River Priority Watershed Project". We were very involved with assisting in completion of the Menomonee Plan and have reviewed the revisions to the April 1990 public hearing draft. A majority of the revisions were to the urban portions of the watershed plan. The Department, hereby, approves the Menomonee Watershed plan as revised.

The approval of this plan, along with the approval last month of the Milwaukee River South Watershed Plan, provides an opportunity to begin implementation of best management practices for the urbanizing portions of the Milwaukee River Basin. We look forward to assisting DNR and the Land Conservation Committees in Ozaukee, Washington, and Waukesha Counties in the implementation of the rural portions of the plan.

Please contact the Department if we can be of any further assistance in moving the project to implementation.

Sincerely,

Dave Jelinski

Dave Jelinski, Acting Director
Land and Water Resources Bureau
AGRICULTURAL RESOURCE MANAGEMENT DIVISION
(608) 266-0157

cc: Charles G. Burney

RESOLUTION NO. 66-90-91

Approval of Nonpoint Source Control Plan for the Menomonee River Priority Watershed

WHEREAS, the Milwaukee River Watershed (including the Menomonee River) has been selected by the State Legislature and the Department of Natural Resources for priority funding to control nonpoint sources of water pollution; and

WHEREAS, the Land Conservation Committee (LCC) is responsible for implementation of control strategies in the unincorporated areas, which would include providing technical assistance and administering cost sharing agreements with rural landowners through the Land Conservation Department; and

WHEREAS, the Department of Natural Resources has prepared a final draft of the Nonpoint Source Control Plan for the Menomonee River which must be approved by the County Board before cost sharing dollars can be made available to local landowners; and

WHEREAS, the Land Conservation Committee has reviewed the final draft of the Menomonee River plan and recommends approval of the plan by the board;

NOW, THEREFORE, BE IT RESOLVED by the Washington County Board of Supervisors that they hereby approve the Nonpoint Source Control Plan for the Menomonee River Priority Watershed;

BE IT FURTHER RESOLVED that the Land Conservation Committee is hereby authorized to enter into a Nonpoint Source Grant Agreement with the DNR for the purpose of administering cost sharing dollars to rural landowners with the understanding that there be no direct costs to the county.

DATED this 12th day of February, 1991.

APPROVED:

_____

Corporation Counsel

Dated_____

Introduced by members of the LAND CONSERVATION COMMITTEE as filed with the County Clerk.

Considered FEB 12 1991

Adopted FEB 12 1991

Ayes_____ Noes_____ Absent_____

Voice Vote_____

Reuben J. Schmahl, Chairperson

Frank B. Falter

John B. Kohl

Daniel W. Stoffel

Paul A. Tuchscherer

(No Fiscal Effect)

Enrolled (44)

PROPOSED RESOLUTION 145-~~41~~

APPROVAL OF THE NONPOINT SOURCE PLAN
FOR THE MENOMONEE RIVER PRIORITY
WATERSHED PLAN

WHEREAS in May, 1984, Wisconsin Senate Bill 548 was signed into law, directing the Wisconsin Department of Natural Resources to undertake a nonpoint source water pollution abatement program for the Milwaukee River basin, and

WHEREAS the Waukesha County Land Conservation Committee and the Menomonee River Advisory Committee have reviewed the Menomonee River Watershed Plan and a public hearing was held on April 30, 1990, and

WHEREAS the objective of the Menomonee River Watershed Plan is to achieve optimum biological and recreational uses and control nonpoint pollution in the Menomonee River and its tributary streams, and

WHEREAS the Plan requires grant assistance agreements with participating landowners and municipalities for installing nonpoint pollution control practices.

NOW THEREFORE BE IT HEREBY RESOLVED by the Waukesha County Board of Supervisors that the report entitled "A Nonpoint Source Control Plan For The Menomonee River Watershed Project", be adopted, a copy of which is on file in the County Clerk's Office and adopted by reference, as a guide for the future implementation of the provisions, suggestions and recommendations contained in the plan.

RESOLUTION NO. 90-54

MENOMONEE RIVER
PRIORITY WATERSHED PLAN

WHEREAS, the Ozaukee County Board of Supervisors, through Resolution No. 85-20, expressed its support of the designation of the Milwaukee River Basin as a Priority Watershed project; and

WHEREAS, the Menomonee River Watershed is one of five watersheds in Ozaukee County which are included in the Milwaukee River Basin; and

WHEREAS, the inventory and planning phases of the project have been completed, under the direction of the Ozaukee County Land Conservation Committee, in cooperation with the Wisconsin Department of Natural Resources; 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 April 30, 1990; 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 Ozaukee County's water resources.

NOW, THEREFORE, BE IT RESOLVED, that the Ozaukee County Board of Supervisors does hereby approve the "Non Point Source Control Plan for the Menomonee River Watershed of the Milwaukee River Priority Watershed" and that the Land Conservation Committee be given the authority and responsibility to act in behalf of Ozaukee County to administer this Priority Watershed Project as outlined in the plan.

Dated at Port Washington, Wisconsin, this 5th day of December, 1990.

TO WHOM IT MAY CONCERN:

I, Harold C. Dobberpuhl, County Clerk for Ozaukee County, Wisconsin, hereby certify that the foregoing is a true and correct copy of a Resolution adopted by the Ozaukee County Board of Supervisors on December 5, 1990.

(S E A L)

Harold C. Dobberpuhl
County Clerk

s/ Rose Hass Leider
Rose Hass Leider

James N. Speiden

s/ Elizabeth Brelsford
Elizabeth Brelsford

s/ Robert A. Fechter, Sr.
Robert A. Fechter, Sr.

s/ Howard Cralley
Howard Cralley
LAND CONSERVATION COMMITTEE

By Supervisors Podell and Valenti, Chairpersons,

From the Joint Committees on Energy, Environment and Extension Education and Parks, Recreation and Culture:

File No. 91-198

(Journal, February 21, 1991)

(ITEM 1) From the Wisconsin Department of Natural Resources, submitting copies of 1) A Nonpoint Source Control Plan for the Milwaukee River South Priority Watershed Project and 2) A Nonpoint Source Control Plan for the Menomonee River Priority Watershed Project, by recommending adoption of the following resolution:

WHEREAS, the State of Wisconsin Legislature, under Act 416 in 1984, identified the Milwaukee and Menomonee Rivers, and tributaries, as priority watersheds; and

WHEREAS, as a result, the Wisconsin Department of Natural Resources (DNR) has been conducting major studies of these watersheds in order to provide a comprehensive approach to improving and protecting their environmental quality; and

WHEREAS, the studies state that control of nonpoint pollution is important to improving degraded surface waters for improved opportunities for aesthetic, recreational and biological uses of the river systems; and

WHEREAS, since the study impacts Milwaukee County park land for many watershed improvements, the County's concerns regarding these plans include:

1. The plans currently call for significant local costs. County staff from the County Board, Department of Public Works and the Parks Department raised concern about these costs. County staff made it clear that other State or Federal programs should be substituted for these local costs. Other charges and fees to those responsible for generating pollutants would also be explored, according to the plan. The plan was revised to state that "this financing plan recognizes that additional funding through new initiatives must be provided."

2. The County should not assume long-term maintenance liability for practices placed on its property when those practices are installed to control pollutants and storm water flows generated from urban lands located in other governmental jurisdictions. This is anticipated to be the case in nearly all situations along County park land.

3. The plans were revised to indicate that the Parks Department will review each Nonpoint Source Control proposal that involves County park land on a case-by-case basis to determine whether the County supports use of the land for such a purpose. The Parks Department is concerned that the plans call for widespread wet detention basins that could potentially flood valuable park land and remove it from existing passive and recreational uses.

and

WHEREAS, total costs for the urban segments of the plan vary from $77 to $147 million in the Milwaukee River Watershed Plan and $94 to $184 million in the Menomonee River Watershed Plan; and

WHEREAS, the plan states . . . "some local governments have indicated that there may be an inability to fund some components of the identified costs. Therefore, the financing plan recognizes that additional funding through new initiatives must be provided to improve full program implementation"; and

WHEREAS, the plan also states that . . . "municipalities have indicated a desire for additional state or federal funding"; and

WHEREAS, on April 25, 1991, the County Board forwarded summaries of the plans to each municipality in Milwaukee County that includes parts of the subject watersheds and each municipality was requested to review the plans and respond to Milwaukee County, indicating whether the County should either approve, modify or disapprove the plans prior to County Board action, with the following results:

Approve:	Disapprove:
City of Greenfield	Village of West Milwaukee
City of West Allis	Village of Glendale
City of Milwaukee	Village of Fox Point
Village of River Hills	Village of Brown Deer
Village of Bayside	Village of Shorewood
No Response:	**Placed on File in Committee**
Village of Whitefish Bay	City of Wauwatosa

and,

WHEREAS, the State has agreed to provide 100 per cent funding for a County Parks Department planning analyst position to help carry out necessary plan coordination and monitoring to represent the County's interests; and

WHEREAS, the Director of Parks, Recreation and Culture has submitted her recommendations and this proposed resolution to the Committee on Energy, Environment and Extension Education and the Committee on Parks, Recreation and Culture; and

WHEREAS, at a special joint meeting on Tuesday, August 20, 1991, the Committee on Energy, Environment and Extension Education, by vote of 3-1, and the Committee on Parks, Recreation and Culture, by vote of 5-2, did act to recommend adoption of the proposed resolution recommended by the Director of Parks, Recreation and Culture; and

WHEREAS, the Wisconsin State law governing the non-point source pollution control program requires local county approval of the priority watershed plans in order for the local municipalities to be eligible for State cost-sharing grants for plan implementation; now, therefore,

BE IT RESOLVED, That the Milwaukee County Board of Supervisors endorses the goals and objectives of the Milwaukee River South and Menomonee River Priority Watershed Programs; and

BE IT FURTHER RESOLVED, That the Milwaukee County Board of Supervisors interprets the financing plan to mean that other State program initiatives will be provided to offset underfunded local share costs; and

BE IT FURTHER RESOLVED, That Milwaukee County's specific concerns, as stated in Lines 50 through 71 on Page 1 and Lines 1 through 5 on Page 2 of this resolution, will be incorporated into the Milwaukee River-South and Menomonee River Nonpoint Source Control Plans; and

BE IT FURTHER RESOLVED, That the Director of Parks, Recreation and Culture and the Director of the Department of Administration are hereby authorized and directed to process the necessary appropriation transfer and administrative tasks associated with the 100 per cent State-financed planning analyst position, to be created within the Parks Department; and

BE IT FURTHER RESOLVED, That the Milwaukee County Board of Supervisors does hereby approve, in principle, the Milwaukee River-South and Menomonee River Nonpoint Source Control Plans.

FISCAL NOTE: The Planning Analyst position within the Parks Department will be 100 per cent financed by the Wisconsin Department of Natural Resources. The plans are approved with the interpretation that these programs are primarily financed by the State and municipalities in Milwaukee County, and the costs to Milwaukee County government budgets are minimal. The plans are further interpreted to reduce local share costs by the introduction of new State funding program initiatives. This fiscal note was prepared by the Department of Parks, Recreation and Culture staff.

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SUMMARY

INTRODUCTION

The Menomonee River Watershed is a 136 square-mile elongated drainage area located in Ozaukee, Milwaukee, Washington, and Waukesha counties, Wisconsin (Maps 1 and 2). Some 333,000 people live in this watershed that includes all or part of 20 governmental jurisdictions (Map 3). Land uses are divided between agricultural areas in the northern third, densely urbanized areas in the lower third, and rapidly urbanizing areas in between. Nearly 85 percent of the population lives in urban areas. The watershed is one of the five watersheds that make up the Menomonee River Basin, which also includes: the North Branch, Milwaukee River-South, Cedar Creek and the East and West Branch watersheds.

The Menomonee River Watershed was designated a "priority watershed" in 1984 under the Wisconsin Nonpoint Source Water Pollution Abatement Program. It joins 46 other watersheds statewide, encompassing more than 3.5 million acres, in which the clean-up and protection of water resources through control of nonpoint sources of pollution is a priority for the Department of Natural Resources (DNR).

Nonpoint source pollution is pollution which cannot be traced to a single point such as a municipal or industrial wastewater plant discharge pipe. Nonpoint source pollution in the Milwaukee River-South Watershed has degraded surface waters and reduced opportunities for aesthetic, recreational, and biological uses of the river system.

Nonpoint sources in the Menomonee River Watershed include eroding agricultural lands, eroding streambanks and roadsides, runoff from livestock wastes, erosion from developing urban areas, and runoff from established urban areas. Pollutants from nonpoint sources are carried to the surface water or groundwater through the action of rainfall runoff, snow melt, and seepage. Principal pollutants of concern include sediment, nutrients, bacteria, urban toxicants—such as heavy metals, oils and grease, and excessive stormwater flow.

WATER QUALITY

The Menomonee River Watershed includes 167 miles of streams. No significant lakes are present, although the river is tributary to Lake Michigan.

Perennial and intermittent streams are the predominant surface water features of the watershed. Perennial streams have a combined length of about 84 miles. Intermittent streams, with a combined length of 83 miles, are the headwaters of many of the larger perennial streams. Their small size makes them particularly susceptible to nonpoint source pollution.

Wetlands have been seriously reduced in areal extent, but are still some of the most valuable natural resource features in the watershed. Their principal values include

wildlife habitat, fish spawning and rearing, reduction of runoff and flood flows, and removal of pollutants. Wetlands comprise 6,000 acres, or 7 percent of the watershed.

The Menomonee River has the potential to support a balanced warm water sport fish community and full body contact recreation throughout its length. Tributary streams vary in their abilities to support biological and recreational uses, with most being too small to support sport fish, but having characteristics necessary to support good forage fish communities. Nearly all of these streams are only partially meeting, or not meeting, their full potential due to cultural impacts.

Recurring problems in rural areas include loss of aquatic habitat, excessive aquatic plant growth, low dissolved oxygen, and high bacteria levels. Pollutants that originate, at least in part, from rural nonpoint sources include sediment, nutrients, and fecal material. In urban areas, the list of problems and pollutants is expanded to include contaminated sediments and chronic toxicity in surface waters from heavy metals, and destabilization of stream hydrology caused by increased stormwater runoff and loss of stream base flows.

Loss of habitat caused by channelizing natural streams is more prevalent in the Menomonee than any other portion of the Menomonee River Basin. Approximately 70 percent of the streams have been dredged or straightened and in some cases lined with concrete.

NONPOINT POLLUTION SOURCES

URBAN NONPOINT SOURCES

About 60 percent of the Menomonee River Watershed is in urban land use. Nearly all is located in densely populated Milwaukee County.

Principal urban nonpoint sources include construction site erosion, streambank erosion, and runoff from established urban areas such as commercial, industrial, and residential lands.

Pollutants found primarily in runoff from existing urban areas include heavy metals (lead, copper, zinc, cadmium or chromium) and a large number of toxic organic chemicals (PCBs, aromatic hydrocarbons, esters and many others). Other substances in urban runoff that are also contained in runoff from rural areas include sediment, nutrients, bacteria and other pathogens, and pesticides. Pollution from urban areas will increase as new areas are developed.

Runoff from new urban development is a major source of nonpoint pollution. Constructing roads, utilities and buildings disturbs large areas, exposing large amounts of soil to erosion. Without adequate controls, construction site erosion can have catastrophic impacts on urban rivers and streams, clog storm sewers, and accumulate on road surfaces and sidewalks.

Runoff from urban areas also impacts stream hydrology. This occurs as runoff volume increases a great deal over a short period of time, creating large increases in stream

peak flows and flow volumes. When compared to natural streams, these flows dramatically increase during rain storms, and decrease below normal levels between rain storms. This produces "flashy" streams with temperatures and chemical characteristics which limit animal life and recreational uses.

Streambanks along most of the streams draining the urbanized portions of the watershed were surveyed. The most extensive areas of erosion caused by urban runoff exist along Lilly Creek, Little Menomonee Creek, and the headwaters of the Menomonee River. Along Lilly Creek, about seven miles, or 40 percent, of the streambanks are eroding.

The importance of urban nonpoint sources to the total annual generation of heavy metals and sediment in the watershed is shown in Figures 1 and 2. Lead is used as an indicator pollutant for urban areas, though other pollutants are present. These calculations do not include pollutant loads to the Menomonee River that originate in the combined sewer overflow area (CSO) of the city of Milwaukee. In this area, both sewage and stormwater runoff are combined in the same drainage pipes. During dry periods and small rainstorms, the sewage and stormwater drain to the wastewater treatment plant. But during larger rainstorms, the pipes overflow and drain into the river.

As seen in Figure 1, urban land uses are the principal source of many toxicants, including lead. Within the urban areas, land uses most important in generating these pollutants include commercial, industrial, and high density residential areas.

As Figure 2 illustrates, construction site erosion has been the most significant sediment source, and is projected to remain so. Urban runoff is also important, particularly in lower portions of the watershed, and will become increasingly important as upland erosion and construction sites decline.

RURAL NONPOINT SOURCES

Rural nonpoint pollution sources in the Menomonee River Watershed include barnyards, winterspread manure, cropland erosion and streambank erosion.

Within the Menomonee River Watershed, 50 barnyards were inventoried; 36 are considered to have potential to contaminate surface waters. Of the phosphorus and other pollutants attributed to barnyards, 92 percent originate at these 36 farms. Six, or 17 percent, of these 68 barnyards produce high levels or moderate levels of pollution.

An inventory was done to identify farms where manure is spread in critical acres during winter. Critical areas are defined as lands having slopes of at least six percent or that are located in flood prone areas. An estimated 120 acres were winterspread in critical areas, primarily in the floodplain. Ten farms were found to have a high or moderate pollution potential.

Streambanks along 40 miles of perennial and intermittent streams in the watershed's rural areas were surveyed. Less than one percent of the streambanks are eroding, producing only small amounts of sediment. On a watershed basis, about 2,500 tons of

soil is washed into streams annually from eroding uplands. Virtually all of the delivered sediment comes from eroding cropland. Between 40 percent and 75 percent of the sediment delivered to surface waters from uplands originates from croplands that are currently eroding at less than three tons per acre per year. This rate of erosion is very small, equivalent to about the thickness of a dime over the land surface.

The importance of rural nonpoint sources to total annual generation of sediment in the watershed is shown in Figure 2. Although upland erosion is a small part of the problem at the mouth of the watershed, it is the primary sediment source to small streams in Ozaukee and Washington counties.

TRENDS

Figure 3 shows the cumulative sediment load from all nonpoint sources at four points along the Menomonee River under year 1985 and year 2000 conditions. The four points in Figure 3 are: River Point 1, the Menomonee River, one-half mile south of the Washington/Waukesha county line; River Point 2, the Menomonee River, one-quarter mile south of Silver Spring Drive; River Point 3, the Menomonee River, just downstream from the confluence with the Little Menomonee River at Hampton Avenue; River Point 4, the Menomonee River at South 37th Street. Sediment loads can be expected to increase by between 20-30 percent in the downstream portions of the watershed. The increase is due primarily to anticipated construction erosion associated with new urban development.

Figure 4 shows the cumulative lead load from all nonpoint sources at four points along the Menomonee River under year 1985 and year 2000 conditions. It also shows the potential future increase in lead loads generated within the watershed if nonpoint source controls are not enacted. Watershed lead loads will increase 40 percent due to increased urban area runoff. The largest percent increases will occur in the downstream portions of the Menomonee River, and in the main stem downstream of the village of Menomonee Falls.

Lead is used as an indicator pollutant in Figure 4, though other pollutants are present.

POLLUTION REDUCTION GOALS

Extensive water quality and aquatic habitat investigations were conducted as part of the planning effort for the Menomonee River Watershed Project. The results indicate that significant reductions are needed in several key pollutants to achieve the watershed project's water quality objectives.

Overall a *50 percent reduction in the existing 1985 sediment loading is needed* to improve the aquatic habitat in nearly all streams in the watershed. This level will eventually reduce the amount of sediment in the stream bottom and enhance its ability to support healthier and more diverse aquatic communities.

In addition, *a high reduction level (50 percent to 70 percent) in phosphorous loading to most streams is needed* to reduce the prevalence of excessive aquatic weed and algae growth.

Another important means for improving water quality in the Menomonee River and its tributaries is to reduce the concentrations of heavy metals and other toxic materials in urban runoff. In this watershed, lead is being used as an indicator pollutant for evaluating the impact of urban runoff on water quality.

Watershed-wide *a 35 percent to 70 percent reduction in lead concentrations in stormwater effluents is needed* to achieve a level below the acute toxicity standard set forth in Chapter NR 105 of the Wisconsin Administrative Code.

A reduction in heavy metals from future urban areas (existing and planned areas) to 50 percent of the 1985 level will also be needed to reduce the lead concentrations measured in the Menomonee River to levels that do not violate chronic toxicity standards for fish and aquatic life.

MANAGEMENT ACTIONS

Management actions are described in terms of best management practices (BMPs). These are management measures or engineered structures that are needed to control nonpoint pollution sources to the levels described above. State level funding is available to help offset the expense of installing these practices and managing the local nonpoint source control program recommended in this plan.

Financial assistance is available from the nonpoint source program for a variety of activities. Landowners, land renters, counties, cities, villages, towns, metropolitan sewerage districts, and sanitary districts are eligible for the financial assistance available through this project. In urban areas, state funds help support:

* Best management practices.
* Additional stormwater control structures in existing urban areas.
* Local staff for enforcement of local ordinances controlling construction site and stormwater runoff, and the implementation of street sweeping programs.
* Information and education programs.

In rural areas, state funds provide assistance for:

* Installing best management practices.
* Providing local government staff support to contact landowners and help them design and install management practices.
* Information and education programs.

Participation in watershed projects is voluntary. Projects are implemented by local units of government, such as cities, villages, and counties. The Department of Natural Resources and the Department of Agriculture, Trade and Consumer Protection review the progress of local units of government and provide them with assistance throughout the life of the project. The Department of Natural Resources monitors improvements in water quality resulting from the control of nonpoint sources.

The following is an overview of both urban and rural management actions needed to meet water quality goals in the Menomonee River Watershed.

URBAN MANAGEMENT PROGRAM

The urban management program has four elements, as summarized in Table 1. This includes construction erosion control, existing urban area control, planned urban area control, and streambank erosion control.

Construction Site Erosion: About 7,400 acres of new urban development is expected in the watershed. New construction erosion control ordinances and suitable enforcement are needed in the four counties and 11 cities and villages. Improved staffing and enforcement is needed in seven other communities which already have construction erosion control ordinances.

Existing Urban Areas: The control program for existing urban areas is based on the pollution reduction goals for urban toxic materials, as indicated by lead and other heavy metals.

Approximately 31,600 acres, or 65 percent, of the urban area are targeted for nonpoint source control. Possible urban nonpoint source controls involve wet detention ponds, infiltration devices, street sweeping, and good housekeeping practices. If wet detention and street sweeping are used, nearly 230 acres of wet detention ponds need to be constructed, and over 1,000 curb miles of more intensive street sweeping per year is recommended.

Planned Urban Areas: Nearly 7,400 acres of planned urban areas will need stormwater controls over the years of 1985-2000. The construction of 159 acres of wet detention ponds is one alternative for reducing nonpoint source pollution from these areas. Alternatively, infiltration devices, including grassed swale drainage and redirection of rooftop drain pipes to grassed areas, can be used in selected areas. This will provide additional benefits in moderating urban stream flow, and will decrease the amount of detention needed.

Streambank Erosion Control: Approximately 7,000 feet of streambank erosion at 50 sites in urban areas are targeted for control. These sites are located primarily along Lilly Creek and the Menomonee River.

"Core" Elements of the Urban Management Program: The "core" elements of the urban nonpoint source control program applicable to local units of government include basic measures that can be implemented without further study. Adopting a community specific

core program is the first step in the implementation process. *As such, communities will need to commit within the first three years of the project to implement the core program. This is a requirement to receive technical and financial assistance through the priority watershed project.*

The basic elements of the "core" program are:

1) Develop, adopt and enforce a construction erosion control ordinance consistent with the "model" developed jointly by the Wisconsin League of Municipalities and the Department of Natural Resources. Construction erosion control practices should be consistent with the standards and specifications in the "Wisconsin Construction Site Best Management Practice Handbook."

2) Develop and implement a community specific program of urban "housekeeping" practices which reduce urban nonpoint source pollution. This may include a combination of information and education efforts, adoption of ordinances regulating pet wastes or changes in the timing and scheduling of leaf collection.

3) Implement an information and education program containing the elements and achieving the goals of the urban information and education strategy.

"Segmented" Elements of the Urban Management Program: The "segmented" elements of the urban nonpoint source program include those *requiring site specific investigations prior to implementation.* These elements also include changes in schedules and equipment used for street sweeping.

Best management practices implemented under this portion of the program likely will include detention ponds, infiltration devices, streambank erosion controls and other structural means for reducing urban nonpoint source pollution.

Detailed studies will include engineering feasibility and other site specific investigations for existing and new development. The results will determine the best means for reducing urban nonpoint sources in a specific community by more site specific application of the plan's recommendations.

The basic elements of the segmented program are:

1) Adopt and enforce a comprehensive stormwater management ordinance consistent with the state's "model" stormwater ordinance under preparation.

2) Develop, as needed, management plans for *planned urban development.* These plans will identify the type and locations of structural urban best management practices.

3) Conduct detailed engineering studies to determine the best means to implement community specific nonpoint source control measures for existing urban areas. This element will consider structural urban practices such as detention and accelerated street sweeping.

4) Design and install structural urban best management practices for existing urban areas with complete, detailed engineering studies.

RURAL MANAGEMENT PROGRAM

The rural management program has four elements, as summarized in Table 2. They are streambank erosion, upland erosion, barnyards, and manure spreading.

Streambank Erosion: Two sites in the watershed are targeted for streambank erosion control practices. These sites account for 1,200 feet of eroding streambank.

Uplands Erosion: Nearly 5,300 acres of uplands are targeted for sediment control practices. These targeted areas deliver over 1,100 tons, or 47 percent, of the sediment from this source.

Barnyards: Six barnyards (12 percent of total) are targeted for management practices. They represent 85 percent of the potential pollution delivered to surface waters from this source.

Manure Spreading: Ten livestock operations (20 percent of total) are targeted for management practices. They account for about 100 acres, or 80 percent, of the total critical acres winterspread with manure.

COSTS

The total estimated cost of carrying out the recommendations presented in this plan for rural and urban areas ranges from $110 million to $200 million. This cost will be shared by individual landowners, the State of Wisconsin through its Nonpoint Source Water Pollution Abatement Program, and many local units of government. Table 3 summarizes the estimated costs for major project components and shows how these costs would be apportioned amongst major project participants.

RURAL COSTS

Carrying out the project in rural areas will cost approximately $1.4 million. Principal cost components include: local staffing to work with landowners in planning and designing best management practices, capital costs for installing best management practices, and purchase of land easements in key areas.

Costs would be borne primarily by the nonpoint source program, which would cover about 83 percent of the total cost. The state support would cover virtually all of the costs associated with local staffing and purchase of easements, and nearly 70 percent of the capital practice installation costs. Individual landowners would cover the remaining 17 percent of the total cost for rural areas. These costs consist primarily of 30 percent of

the capital practice installation costs. In addition, landowners are responsible for all practice maintenance costs.

URBAN "CORE" COSTS: PLANNED AREAS

Carrying out "core" activities in planned urban areas will cost about $3.4 million. Principal cost components include measures needed to control construction site erosion over the eight-year project period. Costs incurred would be primarily for the installation of best management practices to control construction site erosion, and local staffing to administer and enforce erosion control ordinances.

The nonpoint source program would cover about 30 percent of the total cost for this component. The state support would be intended to cover about 60 percent of the costs of increasing local enforcement and administrative staff for the eight-year project period. The state would cover all costs associated with these activities for a five-year "seed" period, after which the local units of government would cover all costs for these activities. This continuation of these activities by local units of government would constitute about 17 percent of the total costs for this component. The largest portion (53 percent) of the cost for this component would be borne by individual landowners and developers, who would cover 100 percent of the engineering and capital costs for designing and installing construction erosion control practices.

URBAN "SEGMENT" COSTS: PLANNED AREAS

It will require an estimated $11.7 million to carry out "segment" activities in planned urban areas. Costs would be incurred primarily for preparation of stormwater management studies for areas of new development, and for the engineering and capital costs required to install urban structural practices.

Over 95 percent of these costs would be borne by individual landowners and developers to cover the engineering and capital cost of practice installation. In addition, these parties would be responsible for supporting the cost of practice maintenance. About five percent of the cost for this component would be covered by the nonpoint source program, through its support for costs associated with the preparation of stormwater management studies.

URBAN "SEGMENT" COSTS: EXISTING AREAS

It will require an estimated $94 million to $184 million to carry out "segment" activities in existing urban areas. Principal costs would include engineering, construction, and maintenance of wet detention ponds or some other urban structural practices that provide equivalent levels of pollution control, an accelerated schedule for street sweeping, and staff to prepare detailed engineering feasibility studies for siting practices in the existing urban area.

The large range in the cost estimate for this component reflects the variability of costs associated with placing urban structural practices, such as wet detention ponds, in existing urban areas. Although the capitol cost of constructing wet detention ponds in existing urban areas is an estimated $15 million, other components such as the purchase of land, including home relocation where necessary, and re-routing storm sewer pipes where needed can increase the total cost from five to 10 times. This is reflected in the cost range ($90 million to $180 million) presented for the wet detention ponds.

Overall, 10 percent to 20 percent of the total costs for this component would be covered by the state through the nonpoint source program, and 80 percent to 90 percent would be paid for locally. The state share would cover several items.

* Assistance for preparing detained engineering site feasibility studies to locate and select urban structural practices includes 100 percent of the costs incurred by additional staff who are required in order to prepare these studies.

* Assistance for installing urban structural practices such as wet detention ponds includes 100 percent of the practice design costs and 70 percent of the capital cost for installation of urban structural practices (land purchase costs and storm sewer work are not included, however).

* Assistance for starting an accelerated street sweeping schedule includes 100 percent of the staff and 50 percent of the equipment related costs of accelerated sweeping for a five-year period.

Primarily, local units of government would probably cover the remaining costs associated with installing urban structural practices, including maintenance, and continuing on with the accelerated street sweeping schedule past the five-year "seed" period. However, a part of the local government share could be paid for by landowners who install practices on private property.

INFORMATION AND EDUCATION

This component will cost about $50,000 for non-staff related expenses over a three-year period. The nonpoint source program supports these costs and 100 percent of the costs required to maintain two regional education specialists.

PROJECT IMPLEMENTATION

Project implementation {is scheduled to begin} in Summer, 1990. The first three years of implementation is the period in which participants sign cost-share agreements. Cost-share recipients have five years for practice installation.

This results in an eight-year project period. In rural areas all cost-share agreements will be developed within three years. In urban areas, practices may be added to agreements

throughout the eight-year project period, provided that the municipality conducts its "core" activities.

INFORMATION AND EDUCATION

An information and education program will be conducted throughout the project period. The Milwaukee and Waukesha Land Conservation Department, local units of government, and the UW-Extension staff have overall responsibility for the program. The program will be most intensive during the first three years, as land owners and local governments sign up for state cost-sharing for pollution control. The program includes:

* A media campaign to inform the public about nonpoint source pollution and what they can do to reduce this type of pollution.

* More intensive educational activities, such as meetings, workshops, tours, and demonstration projects for landowners and local government officials who must adopt new pollution control techniques.

* Water quality newsletters for farmers, local government officials, community groups, and concerned citizens to inform them about watershed activities, implementation processes, and pollution control methods.

* Educational activities and service projects for youth to inform them about water resource issues and help them develop a conservation ethic.

FURTHER INFORMATION

If you want more information about the Menomonee Priority Watershed Project, or a copy of the watershed plan, contact one of the following:

Milwaukee River Program Coordinator
Department of Natural Resources
Southeast District Headquarters
Milwaukee, WI
(414) 263-8500

Urban Water Quality Educator
University of Wisconsin–Extension
Southeastern Wisconsin Regional Planning Commission
Waukesha, WI
(414) 547-6271

CHAPTER I
PLAN PURPOSE AND LEGAL STATUS

INTRODUCTION

The Menomonee River Watershed is one of five drainage areas in the Milwaukee River Basin designated as a "priority watershed" in 1984 under the Wisconsin Nonpoint Source Water Pollution Abatement Program. Map 1 shows the Menomonee River Watershed in relation to the other priority watersheds in the Milwaukee River Basin. It joins 39 other watersheds statewide, encompassing more than three million acres, in which the cleanup and protection of water resources through control of nonpoint sources of pollution is a priority for the Department of Natural Resources (DNR).

The priority watershed plan is prepared cooperatively by the DNR, Department of Agriculture, Trade, and Consumer Protection (DATCP) and local units of government, and guides the priority watershed project. The priority watershed plan assesses nonpoint and other sources of water pollution and identifies best management practices needed to meet specific water resource objectives. The plan guides the implementation of these practices to improve water quality.

NONPOINT SOURCE WATER POLLUTION ABATEMENT PROGRAM

The Nonpoint Source Water Pollution Abatement Program (the nonpoint source program) was created in 1978 by the Wisconsin State Legislature. Its goal is to reduce pollutants from urban and rural nonpoint sources to improve and protect the water quality of streams, lakes, wetlands and groundwater.

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

The following is an overview of the nonpoint source control program.

> The DNR and the DATCP administer the program which focuses on critical hydrologic units called priority watersheds. The program is implemented through priority watershed projects for which a plan is prepared.
>
> Local units of government implement the watershed project. Water quality improvement is achieved through voluntary implementation of nonpoint source controls (best management practices) and adoption of ordinances. Landowners, land renters, counties, cities, villages, towns, metropolitan sewerage districts, sanitary districts, lake districts, and regional planning commissions are eligible to participate.

Technical assistance is provided to aid in the design of best management practices. State level cost-share assistance is available to help offset the cost of installing these practices.

Informational and educational activities are employed to encourage participation.

PRIORITY WATERSHED PROJECT PLANNING AND IMPLEMENTATION PHASES

PLANNING PHASE

The planning phase of the project began in 1986 and included the following information-gathering and evaluation steps:

1. Determine the conditions and uses of streams and lakes.

2. Inventory types of land uses and severity of nonpoint sources impacting streams and lakes.

3. Evaluate the types and severity of other factors which may be affecting water quality. Examples include discharges from municipal sewage treatment plants and natural or endemic stream conditions. This will be accomplished through the ongoing integrated resource management planning efforts in the Milwaukee River Basin.

4. Determine levels of nonpoint source control and measures necessary to improve and/or protect water quality.

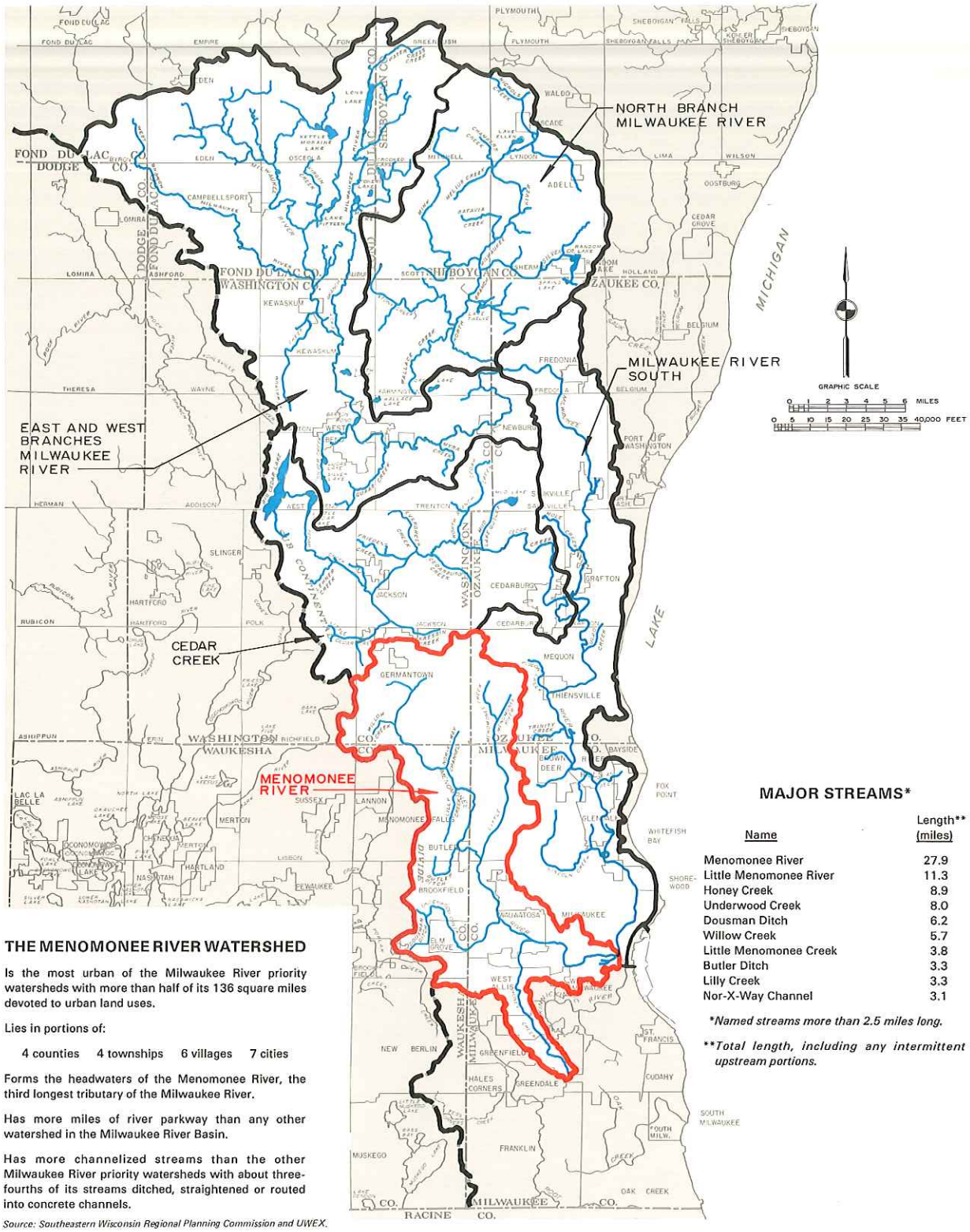
5. Prepare and gain approval for a priority watershed plan documenting the above evaluations, implementation procedures and costs.

IMPLEMENTATION PHASE

The implementation phase began in the summer of 1990 following review of the priority watershed plan by the Milwaukee River Basin Advisory Committee, the Menomonee River Watershed Advisory Subcommittee, a public hearing and approval by the DNR, the DATCP, and the Board of Supervisors for Milwaukee, Ozaukee, Washington, and Waukesha Counties. This phase is characterized below:

* The DNR enters into local assistance agreements with local units of government with implementation responsibilities identified in the plan. These agreements provide funds necessary to maintain the resources and staff required for plan implementation.

Map 1



THE MENOMONEE RIVER WATERSHED

Is the most urban of the Milwaukee River priority watersheds with more than half of its 136 square miles devoted to urban land uses.

Lies in portions of:

4 counties 4 townships 6 villages 7 cities

Forms the headwaters of the Menomonee River, the third longest tributary of the Milwaukee River.

Has more miles of river parkway than any other watershed in the Milwaukee River Basin.

Has more channelized streams than the other Milwaukee River priority watersheds with about three-fourths of its streams ditched, straightened or routed into concrete channels.

Source: Southeastern Wisconsin Regional Planning Commission and UWEX.

MAJOR STREAMS*

Name	Length** (miles)
Menomonee River	27.9
Little Menomonee River	11.3
Honey Creek	8.9
Underwood Creek	8.0
Dousman Ditch	6.2
Willow Creek	5.7
Little Menomonee Creek	3.8
Butler Ditch	3.3
Lilly Creek	3.3
Nor-X-Way Channel	3.1

**Named streams more than 2.5 miles long.*

***Total length, including any intermittent upstream portions.*

MILWAUKEE RIVER PRIORITY WATERSHEDS

* In the rural portions of the watershed, the Ozaukee, Washington, and Waukesha County Land Conservation Departments contact eligible landowners to determine their interest in voluntarily installing best management practices identified in the plan.

  In the urban portions of the watershed, the DNR or its designee contact local units of government to discuss the actions to implement plan recommendations.

* For rural practices, the landowner and the county sign cost-share agreements outlining the practices, costs, cost-share amounts and a schedule for installation of management practices. All practices are scheduled for installation up to five years from the date the agreement is signed. The DNR and the local units of government sign similar agreements for urban practices.

LEGAL STATUS OF THE NONPOINT SOURCE CONTROL PLAN

The Menomonee 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. The plan was prepared under the cooperative efforts of the DNR, the DATCP, the Ozaukee, Washington, and Waukesha County Land Conservation Departments, local units of government, and the Menomonee River Advisory Subcommittee.

This watershed plan is the basis for the DNR to enter into cost-share and local assistance grants and will be used as a guide to implement measures to achieve 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.

The Southeastern Wisconsin Regional Planning Commission (SEWRPC) completed the comprehensive water quality management plans pertaining to the Menomonee River Watershed (SEWRPC 1976, 1979). More recently, the SEWRPC completed a water quality management plan for the Milwaukee Harbor Estuary (SEWRPC 1987). These reports recognize the importance of reducing nonpoint sources to achieve improved water quality in the streams and lakes in the Menomonee River Watershed and in downstream areas of the Milwaukee River Basin.

Following approval of this priority watershed plan by the DATCP, Milwaukee, Ozaukee, Washington, and Waukesha Counties, the DNR will approve this plan. This watershed is covered under the adopted areawide water quality management plan for southeastern Wisconsin, which SEWRPC has prepared. Consequently, the DNR will request that the SEWRPC recommend to the DNR 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. 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 basin contains nearly 500 miles of streams and 21 major lakes with a combined surface area of 3,400 acres.

The DNR has designed and implemented a new approach to natural resource management in the basin, an approach called "integrated resource management." The DNR 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, wildlife and endangered resources management) efforts.

This coordinated program is documented in a seven-volume report entitled Milwaukee River Integrated Basin Management Plan: 2000. The DNR is preparing the report 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 DNR'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 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 DNR to develop "an integrated resource management strategy to protect or enhance fish and wildlife habitat, aesthetics, and other natural resources" for priority watersheds.

RELATIONSHIP OF THE NONPOINT SOURCE CONTROL PLAN TO THE FEDERAL STORM WATER DISCHARGE PERMIT PROGRAM

Recent changes to the Federal Water Quality Act will play an important role in improving water quality in the Menomonee River Watershed. Amendments to the act, approved in 1987, required large cities including the city of Milwaukee, major industries, and potentially other municipalities to apply for a National Pollutant Discharge Elimination System (NPDES) permit for the discharge of pollutants from separate storm water sewer systems by February 4, 1990. These permits (called WPDES in Wisconsin) are the same as those which the DNR issues for public and private wastewater treatment plants and industrial dischargers of wastewater.

The DNR, in accordance with the U.S. Environmental Protection Agency (EPA) regulations, will have responsibility for implementing this new program. The EPA published final regulations in October 1990. Appendix A is a summary of EPA's final regulations.

The amendments to the Federal Water Quality Act require pollutants in municipal storm water discharges to be controlled to the "maximum extent practicable." Many of the probable permit requirements overlap with the management actions in this plan, which are needed to improve water quality in the watershed. For example, adoption and enforcement of construction site erosion control ordinances are specifically mentioned in the draft regulations and are identified in this nonpoint source plan as a critical component of the sediment control strategy. Implementation of the Menomonee River Priority Watershed Plan will most likely meet this and many other permit requirements.

Importantly, the nonpoint source plan calls for management actions not required in the storm water management program including stabilization of eroding streambanks. Also, the permit program will most likely require activities beyond the nonpoint source plan including water quality monitoring of selected storm sewer outfall by the permittee and adoption of municipal ordinances to control storm water discharges from lands associated with industrial activities.

The coordinated implementation of the storm water permit program and this nonpoint source control plan will help ensure that the water quality objectives for the Menomonee River and its tributaries will be achieved. Specific information on the relationship between implementing these two programs is presented in Chapter VI, "Nonpoint Source Project Implementation.

PLAN ORGANIZATION

The remainder of this plan is divided into three parts:

* The Watershed Assessment.
* A Detailed Program for Implementation.
* Project Evaluation.

The contents of each part are described below:

PART 1: THE WATERSHED ASSESSMENT

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

Chapter III, "Watershed Planning Methods," describes the inventory and evaluation techniques and procedures used to determine the condition of the surface water resources and nonpoint sources impacting them.

CHAPTER IV, "Water Resources 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 and evaluations and water resource objectives are discussed.

CHAPTER V, "Nonpoint Source Pollution Control Strategy," 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.

PART 2: A DETAILED PROGRAM FOR IMPLEMENTATION

CHAPTER VI, "Detailed Program for Implementation," describes the means in which the local units of government administer the project, estimates a local assistance and management practice cost-share budget, and identifies an information and education program.

PART 3: PROJECT EVALUATION

Chapter VII, "Project Tracking," discusses the means for assessing the amount of nonpoint source control gained through installation of best management practices.

Chapter VIII, "Water Quality Monitoring and Evaluation," presents and strategy and a schedule for monitoring streams and lakes to determine the water quality impacts of implementing nonpoint source controls.

PART ONE
THE WATERSHED ASSESSMENT

Chapter II: General Watershed Characteristics

Chapter III: Watershed Planning Methods

Chapter IV: Water Resources Conditions, Nonpoint Sources and Water Resources Objectives

Chapter V: Nonpoint Source Control Needs

CHAPTER II
GENERAL WATERSHED CHARACTERISTICS

INTRODUCTION

The Menomonee River Watershed is a 136-square mile, elongated drainage area located in Ozaukee, Milwaukee, Washington, and Waukesha Counties in Wisconsin. It is the fourth largest of five watersheds that make up the Milwaukee River Basin, occupying about 17 percent of the Basin area. It is divided into 20 smaller hydrologic subwatersheds as shown on Map 2.

The following is a brief overview of the watershed's cultural and natural resource features important in planning a nonpoint source pollution control effort. Additional descriptive information is contained in the Milwaukee River Integrated Basin Management Plan: 2000, Volume 4, Menomonee River Watershed Integrated Resource Management Plan (WDNR, 1990).

CULTURAL FEATURES

CIVIL DIVISIONS

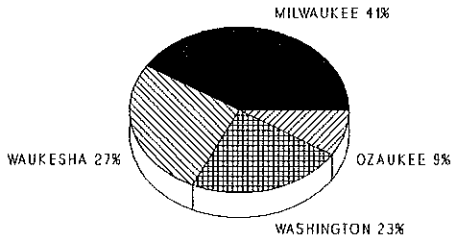
The area of the watershed within the four counties in which it lies is shown in Figure 1. Civil divisions in the watershed are presented in Table 1 and shown on Map 3.

The majority of the watershed lies in Milwaukee (41 percent) and Washington Counties (32 percent). Five of the watershed's 17 communities, the city of Milwaukee (23 percent), village of Germantown (22 percent) and the village of Menomonee Falls (14 percent), the city of Brookfield (10 percent) and the city of Wauwatosa (10 percent); comprise nearly 80 percent of the area.

POPULATION SIZE AND DISTRIBUTION

The 1985 population in the Menomonee River Watershed was estimated to be 333,340 persons, with 80 percent residing in Milwaukee County. The remainder live in Waukesha (15 percent), Washington (four percent) and Ozaukee (one percent) Counties. An estimated 80 percent of the watershed's population live in "urbanized" areas. Regional and watershed specific trends suggest that the watershed's population will increase by about four percent over the next 20 years.

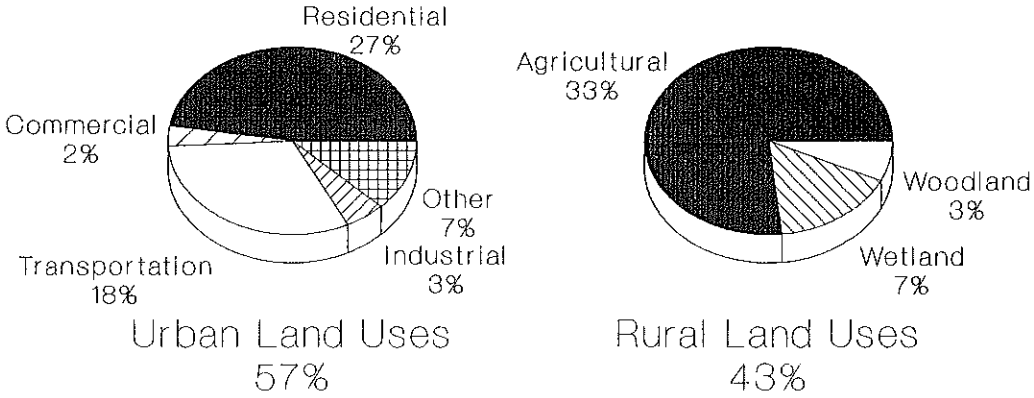
FIGURE 1
PORTION OF MENOMONEE RIVER WATERSHED IN MILWAUKEE, OZAUKEE, WASHINGTON, AND WAUKESHA COUNTIES

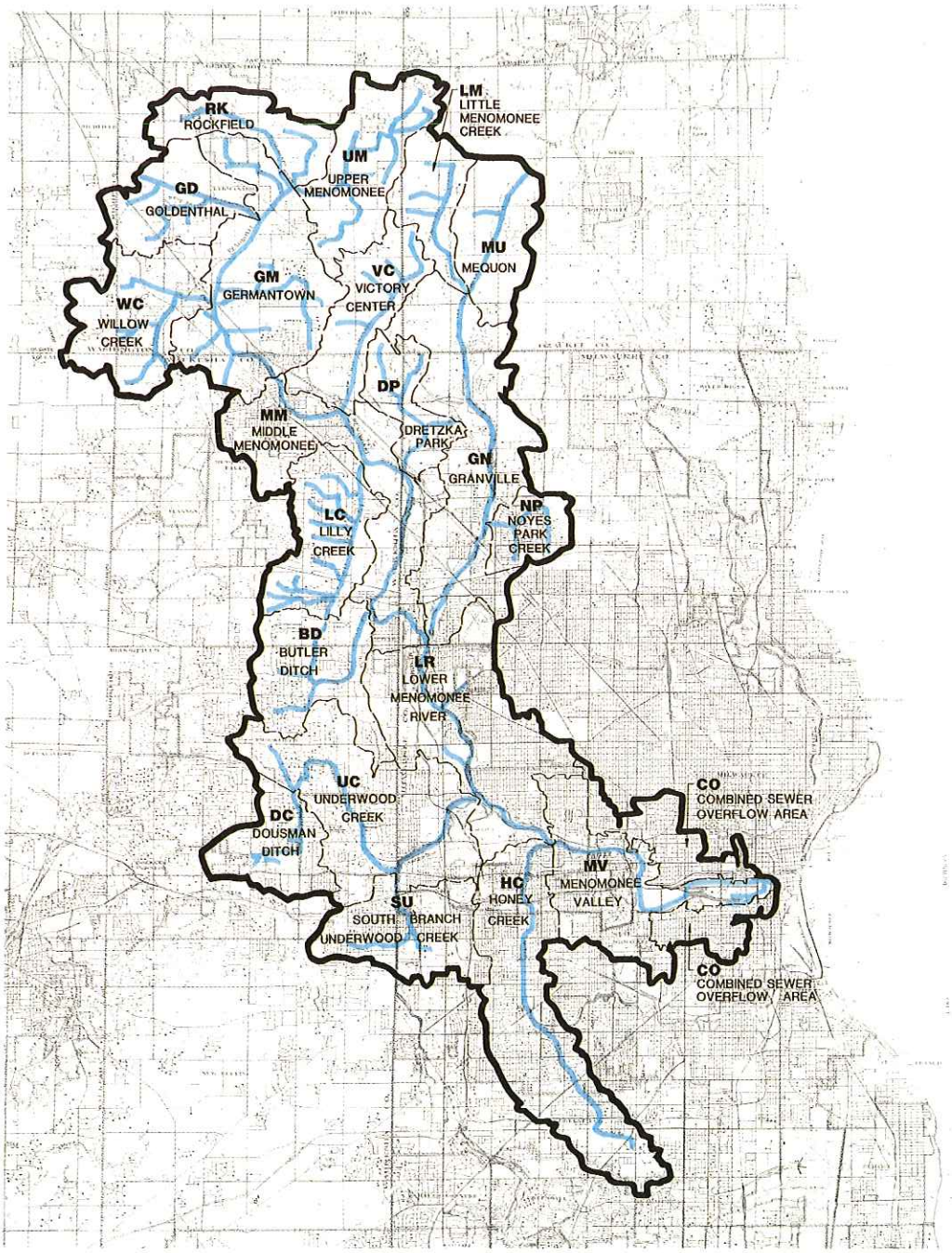


LAND USES

The Menomonee River Watershed is the most urbanized in the Milwaukee River Basin, with urban land uses comprising about 77 square miles, or 57 percent. Land use composition is shown in Figure 2. Residential and transportation uses predominate, occupying about 61 percent of the urbanized area.

FIGURE 2
MENOMONEE RIVER LAND USES: 1985





MAP 2

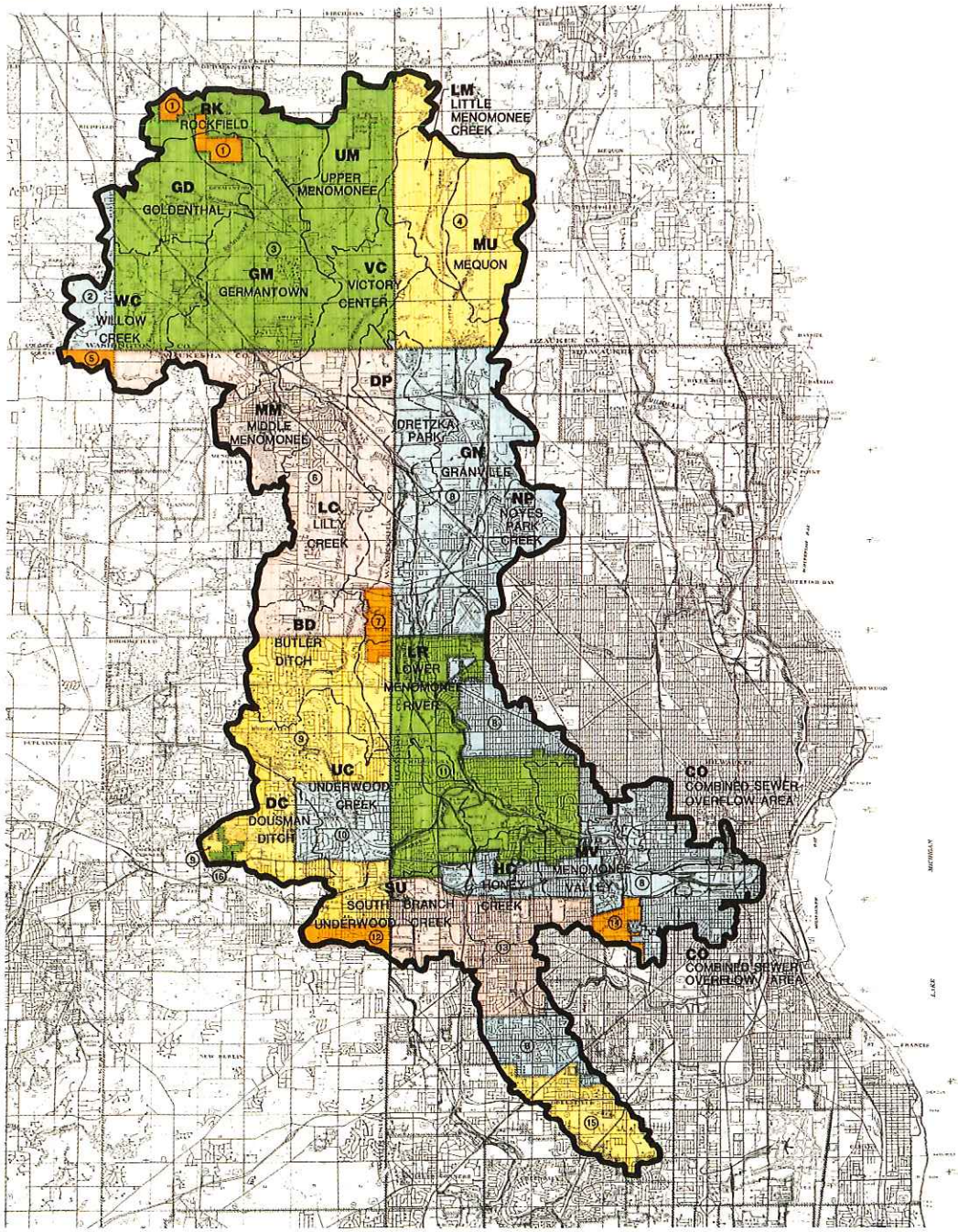
SURFACE WATER RESOURCES

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

Compiled by the Southeastern Wisconsin Regional Planning Commission from USGS Topographic Maps, Wisconsin Department of Natural Resources Information, and Southeastern Wisconsin Regional Planning Commission Land Use Inventory Data. Plotted on Wisconsin State Plane Coordinate System Grid. Base Data Based upon Lambert Conformal Conic Projection. Completed: Date 1/4/2000

MILWAUKEE RIVER
MENOMONEE RIVER WATERSHED
MILWAUKEE, OZAUKEE, WASHINGTON, AND WAUKESHA COUNTIES WISCONSIN

WISCONSIN DEPARTMENT OF NATURAL RESOURCES



MAP 3

CIVIL DIVISIONS

NUMBER ON MAP	CIVIL DIVISION
1	TOWN OF GERMANTOWN
2	TOWN OF RICHFIELD
3	VILLAGE OF GERMANTOWN
4	CITY OF MEQUON
5	TOWN OF LISBON
6	VILLAGE OF MENOMONEE FALLS
7	VILLAGE OF BUTLER
8	CITY OF MILWAUKEE
9	CITY OF BROOKFIELD
10	VILLAGE OF ELM GROVE
11	CITY OF WAUWATOSA
12	CITY OF NEW BERLIN
13	CITY OF WEST ALLIS
14	VILLAGE OF WEST MILWAUKEE
15	CITY OF GREENFIELD
16	TOWN OF BROOKFIELD

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

Compiled by the Southeastern Wisconsin Regional Planning Commission from USGS Topographic Maps, Wisconsin Department of Transportation Maps, and Southeastern Wisconsin Regional Planning Commission Rectified Aerial Photography. Map Compiled on a Wisconsin State Plane Coordinate System Using Lambert Conformal Conic Projection. Map Projection Completed June 1, 1980.

MILWAUKEE RIVER
MENOMONEE RIVER WATERSHED

MILWAUKEE, OZAUKEE, WASHINGTON, AND WAUKESHA COUNTIES WISCONSIN

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Table 1. Extent of Counties, Cities, Villages and Towns within the Menomonee River Watershed.

		Area Located Within	
		Total Watershed	
County	Civil Division	Square Miles	Percent
Milwaukee	City of:		
	Greenfield	2.8[a]	2.1
	Milwaukee	31.9	23.5
	Wauwatosa	13.2	9.7
	West Allis	6.7	4.9
	Village of:		
	West Milwaukee	0.6	0.5
	Subtotal	55.2	40.7
Ozaukee	City of:		
	Mequon	11.7	8.6
	Subtotal	11.7	8.6
Washington	Village of:		
	Germantown	29.3	21.6
	Town of:		
	Germantown	0.7	0.6
	Richfield	1.6	1.1
	Subtotal	31.6	23.3
Waukesha	City of:		
	Brookfield	13.5	9.9
	New Berlin	0.7	0.5
	Village of:		
	Butler	0.8	0.6
	Elm Grove	3.2	2.4
	Menomonee Falls	18.5	13.6
	Town of:		
	Brookfield	0.2	0.2
	Lisbon	0.3	0.2
	Subtotal	37.2	27.4
Total		135.8	100.0

[a] Data for village of Greendale is included with city of Greenfield due to area extent less than 0.2 miles.

Source: Southeastern Wisconsin Regional Planning Commission.

Rural land uses occupy 59 square miles or 43 percent of the watershed. Agricultural and related open space uses are the most important rural land uses that comprise 80 percent of the non-urbanized area. Urban land uses are anticipated to increase approximately 10,000 acres by the year 2000.

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 water resources. An inventory of point sources is presented in the Milwaukee River Integrated Basin Management Plan: 2000, Volume 4, Menomonee River Watershed Integrated Resource Management Plan. Most of these point sources are controlled through permits that the Department of Natural Resources (DNR) issues under the Wisconsin Pollution Discharge Elimination System (WPDES). Importantly, a major effort to reduce pollution from combined sewer overflows and discharges from separate sanitary relief devices in a portion of the Milwaukee Metropolitan Sewerage District (MMSD) service area is underway.

SANITARY SEWER SERVICE

Sanitary sewer service availability is extensive throughout the Menomonee River Watershed. Approximately 220,000 persons, 90 percent of the watershed population, receive service. The MMSD provides service for most of the area. Those portions of the city of Brookfield that the MMSD does not serve is served by the city's own collection and wastewater treatment plant. Treated wastewater from municipal wastewater treatment plants is not discharged in the Menomonee River Watershed. Wastewater generated by the remainder of the watershed residents is disposed of through private on-site systems.

WATER SUPPLY SERVICE

Water supplies used in the Menomonee River Watershed are obtained from both groundwater sources and municipal systems providing water service from Lake Michigan. There are three principal aquifers lying beneath the watershed from which groundwater is obtained. Water obtained from these aquifers is either pumped from individual wells owned by homeowners or businesses, or is obtained through municipal pumping facilities.

Municipal water supply systems supply more than 90 percent of the watershed population. The City of Milwaukee Water Works provides water obtained from Lake Michigan to most of the watershed, including the cities of Milwaukee, Wauwatosa and West Allis. Individual municipal supply systems provide water obtained primarily from the dolomite aquifer.

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 usually moderate in duration and quantity. An 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's 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

Topographic relief in the watershed ranges from approximately 1,100 feet above sea level in the town of Richfield to about 580 above sea level at the Milwaukee Harbor. Physiography is typical of rolling ground moraine, although surface drainage networks are generally well connected leaving relatively few areas of the watershed that are internally drained.

SOILS

The most common soil associations occurring in the watershed are the Hochheim-Sisson-Casco, the Kewaunee-Manawa, and the Ozaukee-Morley-Mequon Associations. The erosion potential of these soils is based on their texture, structure, organic matter content, permeability, slope, and position on the landscape. All are susceptible to erosion.

SURFACE WATER RESOURCES

STREAMS: Perennial and intermittent streams are the predominant surface water features. The undulating, irregular topography resulted in the natural creation of the 167 miles of streams.

Perennial streams, which have a combined length of about 84 miles, maintain at least a small continuous flow throughout most of the year. The Menomonee River, 32 miles in length, is the principal perennial stream in the watershed. Other perennial streams of significant length include the Little Menomonee River (12 stream miles), Honey Creek (10 stream miles), and Underwood Creek (8 stream miles).

Intermittent streams, with a combined length of 83 miles, flow only when there is runoff or when groundwater discharge is highest. Intermittent waterways are the headwaters of

many of the larger perennial streams and their small size makes them particularly susceptible to nonpoint source pollution. Their dynamic nature does allow rapid improvement, however, if pollution sources are reduced.

Channelization and impoundment of natural streams is more prevalent in this watershed than any other portion of the Milwaukee River Basin. Approximately 75 percent of the perennial stream miles and 70 percent of the intermittent stream miles have been channelized.

LAKES: There are no large (over 50 acres), naturally occurring lakes in the watershed. Thirteen ponds with a combined surface area of 27 acres are present.

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. Wetlands comprise 6,000 acres, or seven percent, of the watershed.

GROUNDWATER RESOURCES

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 Menomonee River Watershed are discussed in order of occurrence.

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. Locally, this is an important 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 South 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 the 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.

The DNR and the SEWRPC have identified environmental corridors and isolated natural areas (SEWRPC, 1976). These areas contain primarily wetlands, woodlands and surface water. They comprise approximately 17 square miles, or about eight percent 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

The Wisconsin Scientific Areas Preservation Council and the DNR's Bureau of Endangered Resources identified natural areas statewide. These areas are contained exclusively in environmental corridors and isolated natural areas. These 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 nine sites have been identified, all of which are of at least statewide significance.

ENDANGERED SPECIES

The DNR has documented the occurrence of two animal and 26 plant species in the watershed that are classified as endangered, threatened or rare in Wisconsin.

CHAPTER III
WATERSHED PLANNING METHODS

This chapter describes the steps and procedures used to prepare this plan. These are:

* Evaluating water quality and aquatic habitat.
* Assessing pollution sources.
* Establishing water resources objectives.
* Establishing pollution reduction goals.
* Developing a nonpoint source control strategy.
* Involving the public and local units of government.

EVALUATING WATER QUALITY AND AQUATIC HABITAT

The Department of Natural Resources (DNR) is responsible for: designating the biological and recreational uses that surface waters can support under proper management; prescribing the water quality required to sustain these designated uses; and indicating the methods to implement, achieve and maintain those conditions.

The DNR's Southeast District water resources management staff conducted investigations of the existing quality and natural resource conditions for lakes and streams during 1985-1986. Their purpose was to evaluate water quality problems and establish a basis for setting water resource management objectives. Detailed assessment results are documented in water resources appraisal reports.

DATA COLLECTION

The following is a summary of the five elements comprising the water quality and aquatic habitat investigation.

Subwatershed Delineation and Stream Segmentation: Prior to collecting field data, the watershed was divided into 20 hydrologic subwatersheds. This was accomplished using 1985 1"=400' scale aerial photographs and 1"=2,000'(7.5 minute) U.S. Geological Survey quadrangle maps. These maps were also used to divide the perennial and intermittent stream network into segments. Stream segments were used to separate portions of waterways where either natural conditions or human induced changes resulted in pronounced differences in stream character and/or water quality.

Stream Habitat Evaluation: Information characterizing stream habitat—including flow rate and depth, substrate quality, channel configuration, streambank stability, and water temperature—were collected using techniques that the DNR developed. The data were evaluated using the Department's Stream Classification Guidelines (Ball, 1982).

Water Quality Assessment: Water quality was assessed through review of historical water chemistry data and an evaluation of bottom dwelling animals (macroinvertebrates) using the Hilsenhoff Biotic Index (Hilsenhoff, 1982). Extensive bacteria (fecal coliform) surveys were conducted to assess the suitability of surface waters for recreational use.

Fisheries Resource Assessment: Fish communities were assessed qualitatively using a combination of historical data (Fago, 1984) and information collected during this investigation. Resident fish populations in the streams, lakes, and impoundments were sampled using seines and electrical shocking equipment.

Navigability and Recreational Use Determinations: The extent and degree to which streams are navigable was determined based on evidence of canoeing or boating, field data including evidence of stream alteration or use, and information that landowners or other local experts provided. Recreational uses were determined through field observations, file data and information from local users. Information from local users was collected, in part, through a survey of urban residents conducted during 1989.

DATA INTERPRETATION

This information was used to determine the existing and potential biological and recreational uses for surface waters. The existing uses reflect present biological and recreational conditions. Potential uses reflect biological and recreational conditions that could be achieved under prescribed types and levels of management. Even though existing and potential uses of a surface water are the same, management programs can result in significant and perceptible changes in the quality of the aquatic environment. Use classifications and supporting water quality standards used in evaluating water resource conditions are discussed below.

BIOLOGICAL STREAM USE CLASSIFICATION

Biological stream use classes describe the fish species or other aquatic organisms which a stream system supports. Designation is based on the ability of a stream to provide suitable habitat and water quality conditions for fish and other aquatic life. The following biological stream use classification system was used statewide and was applied to surface waters in the Menomonee River Watershed. After this plan and its associated maps were prepared, the stream classification system for Wisconsin was modified. The new stream classification designations are contained in NR 102(04)(3).

> ***FAL A Cold Water Communities***: These streams are capable of supporting a community of cold water fish (trout, sculpin) and other aquatic life, or serve as spawning areas for cold water fish species.

FAL B Warm Water Sport Fish Communities: These streams are capable of supporting a community of warm water sport fish (bass, walleye, pike) or serve as spawning areas for warm water sport fish.

FAL C Warm Water Forage Fish Communities: These streams are capable of supporting an abundant, diverse community of forage fish (shiners, minnows) and other aquatic life (insects, clams, crayfish).

Limited Forage Fish Communities (Intermediate Surface Waters): These streams are capable of supporting small populations of forage fish that tolerate pollution, or fish and aquatic invertebrates that tolerate pollution. Small physical stream size and reduced stream flow usually limit the aquatic.

Limited Aquatic Life (Marginal Surface Waters): These streams are capable at best of supporting a limited community of aquatic life. These streams are usually small, such as intermittent streams and ditches, or have been extensively modified through channel straightening or concrete lining.

RECREATIONAL STREAM USE CLASSIFICATION

Recreational stream use classifications are described by a level of human body contact determined to be safe and reasonable. The system applies to all surface waters including those categorized as intermediate or marginal under the above referenced biological use classification system. Three designations are used under the recreational stream classification system. These are: full body contact; partial body contact; and noncontact.

Full Body Contact: These waters are used for human recreation where immersion of the head is expected and occurs often. Recreation activities classified as full body contact include swimming, waterskiing, sailboarding and other similar activities.

Partial Body Contact: These waters are used for human recreation where immersion of the head is not frequent and contact is most often incidental or accidental. Recreational activities classified as partial body contact include boating, canoeing, fishing and wading.

Noncontact: These waters should not be used for human recreation. This category is used infrequently when extenuating circumstances such as high concentrations of in-place pollutants, an uncontrollable pollution source, or other conditions dictate that contact with the water would be an unnecessary health risk.

WATER QUALITY STANDARDS AND CRITERIA

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 104, and NR 105 Wisconsin Administrative Code.

In addition to these standards, other criteria were used to assess the suitability of surface waters for recreational and biological uses. Data characterizing stream size and

accessibility were used to help determine the suitability and types of recreation a stream is capable of supporting. Information on current recreational use of surface waters (provided by users at public access points and discussions with local officials) was also used to assess suitability of surface waters for recreation.

Additional information used to assess the suitability of surface waters for biological uses includes recommended maximum nutrient levels, suspended solids concentrations and the extent to which streambeds are clogged with sediment. Selected water quality standards and other evaluation criteria used in assessing surface waters are presented in Appendix B.

ASSESSING POLLUTION SOURCES

The purpose of the pollution source assessment is to identify the rural and urban sources and quantities of pollutants impacting surface waters. Rural and urban pollutant sources assessed for this watershed are discussed below.

RURAL NONPOINT SOURCES

Excessive quantities of sediment, nutrients, oxygen demanding substances, pesticides and bacteria are pollutants carried in runoff draining agricultural areas. These pollutants degrade surface water quality thereby restricting recreational and biological uses. The principal rural nonpoint sources evaluated in preparing this plan include:

* Barnyards and livestock area runoff.
* Eroding uplands delivering sediment to surface waters.
* Eroding, slumping, or trampled streambanks.
* Areas contributing runoff of winterspread livestock manure.

The Ozaukee and Washington County Land Conservation Department (LCD) staffs conducted inventories during 1986 and 1987. Inventory procedures are documented in a manual that the DNR developed for the Milwaukee River Basin (WDNR, 1985). The DNR in cooperation with the Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP) and the LCD staffs completed data analyses. Inventory and evaluation procedures are summarized below.

Barnyard and Livestock Area Runoff: The LCD staffs mapped the locations of 50 barnyards in the watershed on 1985 1"=400' scale aerial photographs. A field survey of each barnyard was conducted to collect information needed to determine its pollution potential.

The barnyard data was used in the "BARNY" Model (Baun, 1987), a modification of the animal lot runoff model, which the U.S. Department of Agriculture, Agricultural Research Service developed (Young, 1982). Information about the mass loading of total phosphorus and chemical oxygen demand generated during a 10-year, 24-hour rainfall

event was used to evaluate the relative pollution potential of each barnyard. The livestock operations were ranked according to their potential to impact surface and/or groundwater quality.

Upland Erosion and Sediment Delivery: The LCD staffs conducted the inventory on about 25 square miles, or 20 percent of the watershed, using existing data and field investigations. Cropland, pastures, grasslands, woodlands and other open (non-urban) land uses were investigated. Existing data sources included site specific farm conservation plans, 1985 1"=400' scale aerial photographs, and U.S. Geological Survey 1"=2,000' scale quadrangle maps. The information obtained for each parcel included size, soil type and erodibility, slope percent and length, land cover, crop rotation, present management, overland flow distance and destination, channel type and receiving water.

Upland erosion and sediment delivery was determined using the Wisconsin Nonpoint Source (WIN) Model (Baun & Snowden, 1987). The WIN model calculates the average annual quantity of eroded soil reaching surface waters from each farm field. The determination is made based on a "typical" year of precipitation. Estimated sediment delivery was used to assess the relative pollution potential of each farm field in the watershed.

Streambank Erosion: The LCD staffs and the DNR conducted field surveys on about 65 miles of perennial and intermittent streams located in rural areas. The method used is a modification of the streambank erosion analysis included in Phase II of the Land Inventory Monitoring process used by the U.S. Department of Agriculture, Soil Conservation Service. At locations where erosion was occurring, the following information was recorded:

* Length of trampled or eroding bank.
* Vertical height.
* Estimated annual rate of recession.
* Adjacent land uses.
* Potential management measures.

The amount of sediment lost annually was calculated for each erosion site. In addition, areas adjacent to streams impacted by livestock, but which were not necessarily eroding at a high rate, were also noted.

Runoff from Areas Winterspread with Livestock Waste: This analysis was done to estimate the pollution potential associated with winterspreading livestock waste in the watershed. The information collected for the barnyard and upland erosion surveys was used in this evaluation.

This analysis was completed using a three-step process. First, the number of acres that each livestock operation needed to landspread manure was calculated for a six-month period approximating when manure cannot be incorporated into the ground because of

frozen or saturated conditions. The amount of manure that each operation generated was based on the number and type of livestock. The area required for spreading was based on an application rate of 25 tons per acre per year.

Second, the land available to each livestock operation for winterspreading was characterized according to its environmental sensitivity. Lands having slopes equal to or greater than six percent or located within the floodplain were considered to have a high potential to deliver landspread manure to lakes and streams during periods of spring thaw.

Third, the number of sensitive acres winterspread with manure was estimated for each livestock operation based on the number of acres needed for winterspreading and the proportion of lands available to the livestock operation determined to be environmentally sensitive. This number was used to indicate the relative pollution potential of each livestock operation due to runoff of winterspread manure.

URBAN NONPOINT SOURCES

Nationwide investigations confirm that urban runoff can have a significant adverse impact on receiving waters. The result is that urban areas and activities can upset several important components of a stream including stream flow, habitat, water quality, bottom sediment quality, and stream biology (Pitt, 1987).

Pollutants carried in urban storm water runoff include some of the same pollutants associated with rural nonpoint source runoff—such as sediment, nutrients, oxygen demanding organic materials, bacteria and pesticides. Other pollutants, many of which are potentially toxic, are transmitted to surface and groundwater primarily by urban runoff. These include heavy metals (lead, zinc, chromium, copper, cadmium and arsenic) and a wide range of hazardous organic compounds. Urbanization also causes devastating hydrologic changes in streams by reducing groundwater recharge and increasing the volume and peak of streamflow during storms. This results in flashy streams which destroy stable habitat for aquatic life and often necessitates the conversion of natural streams into storm water conveyance channels to reduce flood damages.

Principal urban nonpoint sources evaluated in preparing this plan include:

* Existing urban land uses.

* New urban development, including the potential for construction site erosion as well as increased pollutant loading from the newly established urban surfaces.

* Eroding streambanks.

Storm water pollutant concentrations, runoff volumes, and pollutant yields vary according to the urban land use (residential, commercial, industrial) and development characteristics (intensity of the development, storm water conveyance system). The inventory of existing and planned urban areas was designed to quantify the urban land

use and development characteristics for existing and planned urban development. This information was used to estimate the existing and future urban pollutant loads.

Existing Urban Areas: Three study areas were delineated in the watershed and included all incorporated municipalities and surrounding lands sufficient to accommodate planned future development. The study areas cover those portions of the watershed in Ozaukee, Washington and Waukesha, and Milwaukee Counties, respectively.

The Southeastern Wisconsin Regional Planning Commission (SEWRPC) delineated on 1"=400' scale aerial photos, digitized, quantified, and mapped existing land use categories.

New Urban Development: The SEWRPC delineated, quantified, and mapped areas of planned development for each study area on 1"=2000' scale maps. This information was based on existing land use configuration, SEWRPC sanitary sewer service area plans, other land use plans where available and meetings with local officials to discuss information on committed or planned development projects. It was assumed that environmental corridors and isolated natural areas would not be urbanized.

The DNR used this information on existing and planned urban development in its Source Loading and Management Model (Pitt and Voorhees, 1989) to estimate urban nonpoint source loads for three pollutants—sediment, phosphorus, and lead (representing urban toxic materials). Information on existing pollutant loads was used to identify the magnitude and distribution of the current urban nonpoint source loadings and to identify high priority land uses responsible for most of these loads. Information on planned urban development was used to estimate the future pollution potential associated with uncontrolled development. The effectiveness of applying urban management practices to existing and planned urban areas was also evaluated to determine what level of management is needed to reduce current urban pollutant loads to acceptable levels by the year 2000.

The potential for construction site impacts was assessed based on the number of acres planned for development and the adequacy of existing local construction erosion control programs. The SEWRPC provided the number of acres planned for development to the DNR. The adequacy of existing local construction erosion control programs was evaluated through a survey, which the University of Wisconsin Cooperative Extension Service (UWEX) and the DNR jointly developed, and completed by an authorized representative from each local unit of government.

Streambank Erosion: Rural streambank erosion survey techniques were applied to portions of urban streams where streambank erosion was suspected to be a problem. Sites were selected based on information from the DNR water resources staff and local municipal staff.

OTHER POLLUTION SOURCES

Additional sources of surface water pollution beyond those discussed in this plan are degrading water quality in the watershed. These pollution sources have the potential of overshadowing improvements in water quality that might otherwise occur as a result of the priority watershed program.

The DNR conducted an inventory and evaluation of these other pollution sources. Inventory results and recommendations for alleviating the water quality impacts of these other pollution sources are documented in the integrated resources management plan for the Menomonee River Watershed (WDNR 1990).

In addition, the DATCP, the DNR, and the UWEX are cooperatively working through a technical committee to define fertilizer and pesticide use guidelines to minimize threats to surface and groundwater quality. The results will be applicable statewide and will be incorporated into this watershed project when available.

ESTABLISHING WATER RESOURCES OBJECTIVES

Recreational and biological water resources objectives were established for each of the streams and lakes in the watershed. These objectives identify how the project is anticipated to change the quality of the aquatic environment for recreational and biological uses. Factors considered in establishing water resources objectives include: existing water quality and aquatic habitat; factors or pollutants that may be preventing the surface water from reaching its full potential of supporting biological and recreational uses; and the practicality of reducing pollutants.

ESTABLISHING POLLUTION REDUCTION GOALS

Nonpoint pollution reduction goals are estimates of the level of nonpoint source control needed to meet the water quality and recreational use objectives identified in this plan. Pollution reduction goals and water resources objectives are established together since they are integrally related.

Nonpoint source pollution reduction goals contained in this plan are a refinement of recommendations contained in water quality management plans prepared by the Southeastern Wisconsin Regional Planning Commission (SEWRPC; 1976, 1979, 1987).

The nonpoint source pollution reduction goals in this plan specifically target the control of sediment and phosphorus in rural areas and the control of sediment, phosphorus, urban toxic materials and stream flow changes in urban areas. Importantly, reducing the quantity of these substances reaching surface water decreases the amount of other substances such as pesticides and bacteria which degrade water quality.

Water resource objectives presented in this plan recognize that pollution control and resource management efforts beyond the scope of the nonpoint source control program are needed to achieve the identified objectives. These will include implementation of

other recommended management actions which the SEWRPC establishes in the amended areawide water quality management plan for southeastern Wisconsin, the water resources management plan for the Milwaukee Harbor Estuary, and the integrated resource management plan for the Milwaukee River Basin (SEWRPC, 1979; SEWRPC, 1987; WDNR, 1990).

DEVELOPING A NONPOINT SOURCE CONTROL STRATEGY

The final step in the planning process is the development of a strategy for achieving the nonpoint source pollution reduction goals identified in the plan. Several items are addressed in developing the control strategy including:

* Critical nonpoint pollution sources.

* Effective management practices and guidelines for use of state cost share funds for practice installation.

* Responsibilities, estimated workloads and work schedules for local implementing agencies, and guidelines for use of state funds to support local implementation activities.

* Estimated cost of installing practices and supporting staff at the local level.

* Information and education needs.

* Project evaluation needs.

Identification of critical nonpoint sources eligible for cost share and technical assistance under the Nonpoint Source Water Pollution Abatement Program were determined by:

* Evaluating pollutant loading for each nonpoint source in each subwatershed.

* Determining the relative importance of controlling each source (barnyards, urban runoff, cropland erosion, etc.) to achieving the water resource objectives.

* Developing criteria to determine which sources need to be controlled.

* Applying the criteria to determine eligibility for participation in the priority watershed project.

This evaluation was carried out on a subwatershed and watershed basis for the rural and urban nonpoint sources. The result is a site specific ranking of nonpoint sources and a

determination of assistance to be made available through the nonpoint source program for their control.

INVOLVING THE PUBLIC AND LOCAL UNITS OF GOVERNMENT

The DNR convened an advisory subcommittee and several technical work groups to assist in preparing this watershed plan. The advisory subcommittee contains representatives from cities, counties, villages, and towns in the watershed, the SEWRPC, Milwaukee Metropolitan Sewerage District, the UWEX, the DATCP, environmental groups and interested citizens. This subcommittee primarily provided policy guidance during the planning process and reviewed plan chapters.

Three types of technical work groups were convened to help with developing technical aspects of the plan—a water resources appraisal work group, an agricultural work group and an urban work group. These groups reviewed land and water resources assessment information, assisted in developing water resources objectives and pollution reduction goals and assisted in developing the pollution control strategy.

CHAPTER IV
WATER RESOURCES CONDITIONS, NONPOINT SOURCES AND WATER RESOURCES OBJECTIVES

This chapter discusses the type and extent of urban and rural nonpoint pollution in the Menomonee River Watershed and identifies the observed impacts on rivers and streams. It also sets forth water quality improvement objectives for the Menomonee River and its tributaries. These objectives determine the needed level of nonpoint source pollution control which is the basis for the pollution control strategy presented in Chapter V, "Nonpoint Source Control Needs."

The chapter is divided into three sections. The first is a watershed overview, presenting results of the land and water resource assessments. The second applies this information to selected major drainage areas in the watershed. Finally, the third section presents the water resources objectives and pollution reduction goals to be achieved through the nonpoint source program.

WATERSHED OVERVIEW

Surface Water Conditions

The Menomonee River and most of its perennial and intermittent tributary streams are classified by the Wisconsin Department of Natural Resources (DNR) according to their potential to support recreational, fish, and aquatic life uses. The stream classifications, shown on Map 4 recognize the capability to support these uses assuming that cultural limitations, such as point and nonpoint pollution sources are reduced or eliminated. The stream classifications are based on the State stream classification system and supporting water quality criteria contained in Chapters NR 102, 104, and 106 of the Wisconsin Administrative Code.

Warm water sport fish communities have the potential to be supported along the entire length of the Menomonee River. Diverse forage fish communities have the potential to exist in the Little Menomonee River, Willow Creek, Goldenthal Creek, Lilly Creek and several other tributaries. However, streams in the Menomonee River Watershed exhibit fair to poor water quality. As shown on Table 2 and Map 5. There are approximately 32 miles of streams with the potential to support warm water forage fish communities with approximately 48 miles which could support warm water sport fish such as northernpike, smallmouth bass and bluegill. Currently, however, because of human-

induced changes in the landscape and persistent pollution, 98 percent of these streams are not meeting their full biological or recreational potential.

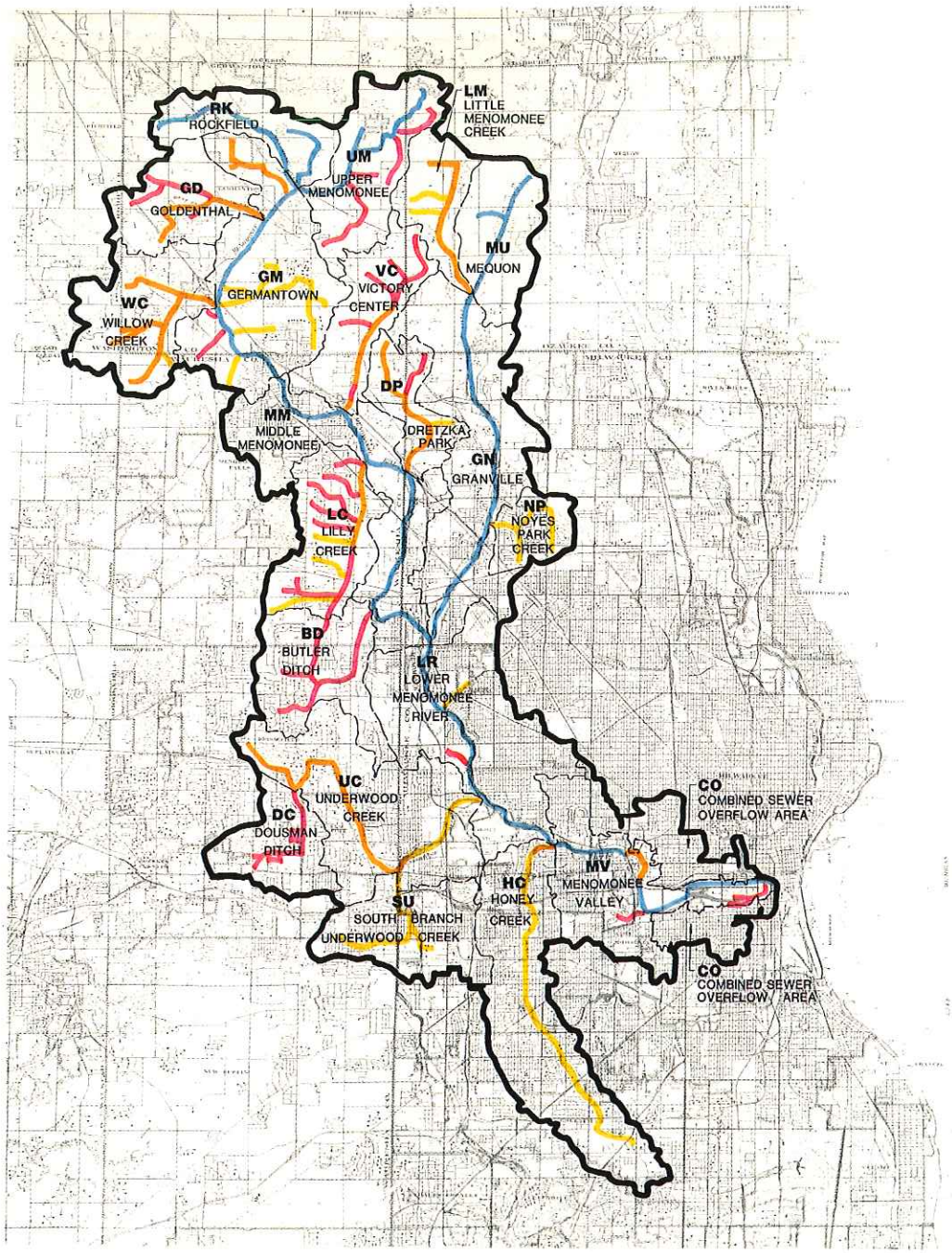
Table 2. Summary of Water Quality Conditions in the Menomonee River Watershed

	Current Use Classification	Potential Use Classification	Supporting Highest Potential Use		
			Fully	Partially	Not
	(miles)	(miles)	(miles)		
Full fish and aquatic life					
* Cold water communities	FAL-A	---	---	---	---
* Warm water sport fish communities	FAL-B	26.9	48.3	---	26.9	21.4
* Warm water and cold water forage fish communities	FAL-C	35.6	32.2	2.0	21.1	9.1
Intermediate					
* Limited forage fish communities	INT-D	53.5	41.8	0.7	36.5	4.6
Marginal					
* Limited aquatic life	MAR-E	37.8	30.9	22.8	7.5	0.6
Unknown		12.9	---	---	---	---
Total Stream Miles		166.7	166.7	25.5[1]	92.0[1]	35.7[1]

[1] This does not include the 12.9 miles of stream for which current use classifications are unknown.

Source: Wisconsin Department of Natural Resources 153.2[1].

Water quality problems attributable to nonpoint sources are shown in Table 3 and summarized below. Nonpoint source urban runoff carrying heavy metal contaminants, grease, oil, debris, and sediment further degrades water quality affected by sediment, excess nutrients, pesticides and bacteria from the rural landscape. Stream turbidity and degraded aquatic habitat are two obvious results. Livestock pasturing along streambanks results in sedimentation, as well as ammonia and phosphorus contributions from livestock waste, causing severe impacts to fish and other aquatic life habitat. Pasturing



-LEGEND-

MAP 4

POTENTIAL BIOLOGICAL USES OF SURFACE WATERS

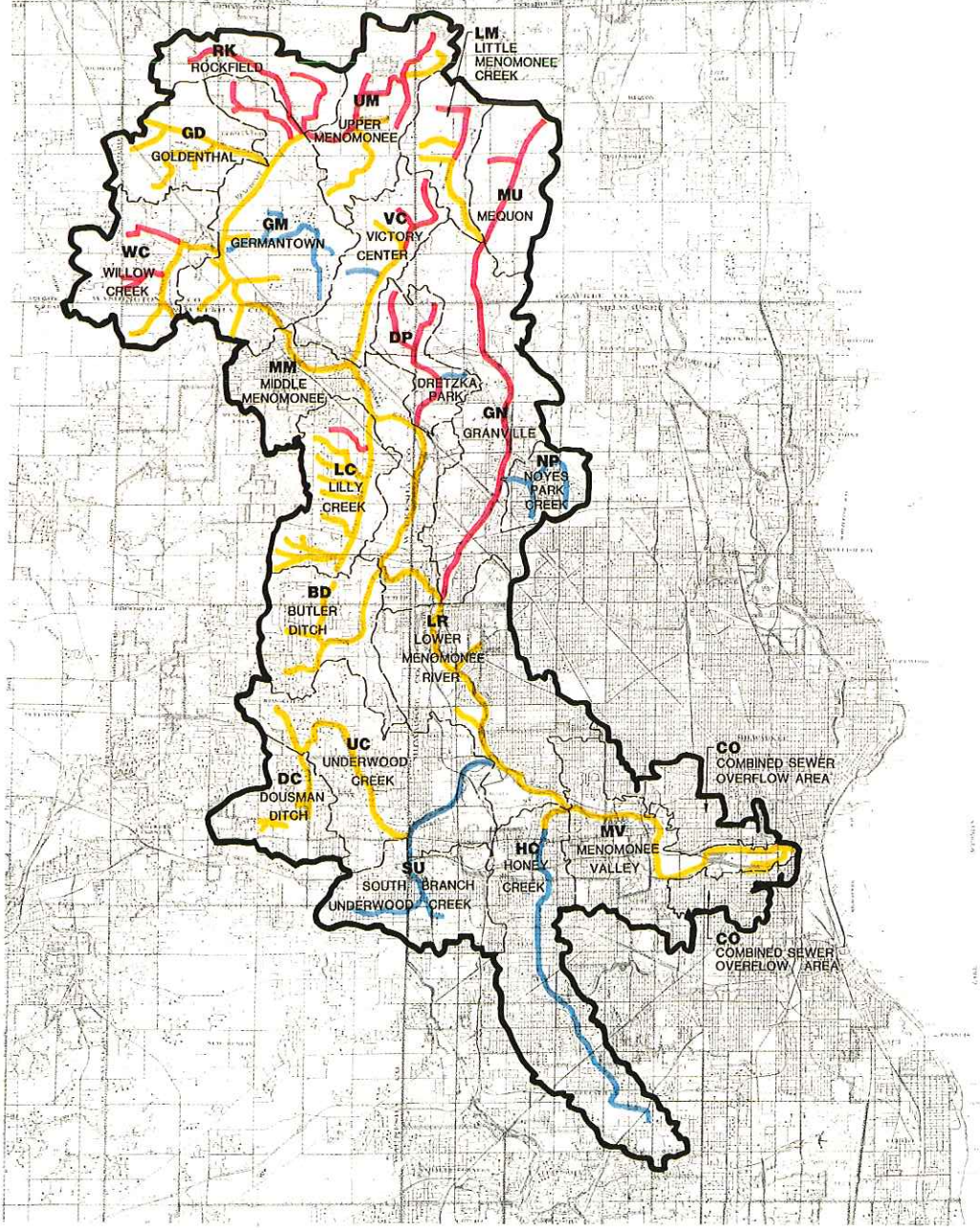
LEGEND

- FAL-A COLD WATER COMMUNITIES
- FAL-B WARM WATER SPORT FISH COMMUNITIES
- FAL-C WARM WATER FORAGE FISH COMMUNITIES
- LIMITED FORAGE FISH COMMUNITIES (INTERMEDIATE SURFACE WATERS)
- LIMITED AQUATIC LIFE (MARGINAL SURFACE WATERS)

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

MILWAUKEE RIVER
MENOMONEE RIVER WATERSHED
MILWAUKEE, OZAUKEE, WASHINGTON, AND WAUKESHA COUNTIES WISCONSIN

WISCONSIN DEPARTMENT OF NATURAL RESOURCES



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MAP 5

SURFACE WATERS FULLY, PARTIALLY, OR NOT MEETING POTENTIAL BIOLOGICAL USES

LEGEND

FULLY MEETING POTENTIAL BIOLOGICAL USES - A surface water's biological community is not adversely impacted by controllable factors.

PARTIALLY MEETING POTENTIAL BIOLOGICAL USES - A surface water's biological community would increase in diversity and abundance if controllable factors were eliminated or reduced.

NOT MEETING POTENTIAL BIOLOGICAL USES - A surface water's biological community would change significantly to one requiring higher water and habitat quality if limiting factors were controlled.

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

Compiled by the Southeastern Wisconsin Regional Planning Commission from USGS Topographic Maps, Wisconsin Department of Transportation Maps, Wisconsin Department of Natural Resources Maps, Southeastern Wisconsin Regional Planning Commission Aerial Photography. Map Created in Wisconsin State Plane Coordinate System Lambert Conformal Projection, North Zone. Map Date: December, June 1, 2000

MILWAUKEE RIVER
MENOMONEE RIVER WATERSHED
MILWAUKEE, OZAUKEE, WASHINGTON, AND WAUKESHA COUNTIES WISCONSIN

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Table 3. Nonpoint Source Impacts on Major Rivers and Streams in the Menomonee River Watershed.

Subwatershed	Stream/River Name	Length (Miles)	Water Quality Problems	Nonpoint Source Pollutant
Rockfield	Perennial RK002 (T9N R20E S15SWNE)	3.8	Loss of aquatic habitat	Stream flow fluctuations Sediment
	Perennial RK001 (T9N R20E S15)	1.9	Loss of aquatic habitat	Stream flow fluctuations Sediment
Goldenthal	Goldenthal Creek	2.6	Loss of aquatic habitat -- Bacteria	Sediment Stream flow fluctuations Hydraulic scour Nutrients (N&P) Fecal material
Willow Creek	Willow Creek	3.6	Loss of aquatic habitat	Sediment Nutrients (N&P)
	Intermittents	0.6	Loss of aquatic habitat	Sediment Nutrients (N&P)
Upper Menomonee	Menomonee River	4.4	Loss of aquatic habitat --	Stream flow fluctuations Sediment Nutrients (N&P)
Germantown	Menomonee River	6.0	Loss of aquatic habitat Bacteria Toxicity	Stream flow fluctuations Sediment Fecal material Heavy metals
	Intermittents	2.1	Loss of aquatic habitat	Sediment Stream flow fluctuations

Table 3. Nonpoint Source Impacts on Major Rivers and Streams in the Menomonee River Watershed. (continued)

Subwatershed	Stream/River Name	Length (Miles)	Water Quality Problems	Nonpoint Source Pollutant
Victory Center	Nor-X-Way Channel	3.0	-- -- --	Nutrients (N&P) Sediment Hydraulic scour
	Stream Seg. 1	0.5	Loss of aquatic habitat	Stream flow fluctuations Sediment
	Intermittents	0.7		
Middle Menomonee	Menomonee River	9.4	Loss of aquatic habitat Bacteria Contaminated sediments Toxicity --	Sediment Stream flow fluctuations Fecal material -- -- Nutrients (N&P)
Dretzka Park	Perennial FC001-003-5 (T8N R21E S18)	3.6	Loss of aquatic habitat -- Toxicity	Sediment Stream flow fluctuations Nutrients (N&P) Pesticides
	Intermittents	2.1	Loss of aquatic habitat	--
Lilly Creek	Lilly Creek	3.3	Loss of aquatic habitat -- Bacteria Toxicity	Sediment Nutrients (N&P) Fecal material Organic chemicals
	Intermittents	11.8	Loss of aquatic habitat Bacteria Toxicity Excessive plant growth	Sediment Stream flow fluctuations Fecal material Organic chemicals Nutrients (N&P)

Table 3. Nonpoint Source Impacts on Major Rivers and Streams in the Menomonee River Watershed. (continued)

Subwatershed	Stream/River Name	Length (Miles)	Water Quality Problems	Nonpoint Source Pollutant
Butler Ditch	Butler Ditch	3.3	Loss of aquatic habitat	Sediment
			--	Nutrients (N&P)
	Intermittents	5.0	Loss of aquatic habitat	Stream flow fluctuations
Little Menomonee	Little Menomonee	3.8	--	Sediment
			--	Nutrients (N&P)
			Bacteria	Fecal material
			Toxicity	Heavy metals
				Pesticides
Mequon	Little Menomonee	3.0	Loss of aquatic habitat	Sediment
				Stream flow fluctuations
			Low dissolved oxygen	Nutrients (N&P)
			Bacteria	Fecal material
			Toxicity	Ammonia
Noyes Park	Noyes Park Creek	4.4	--	Sediment
			--	Nutrients (N&P)
			Toxicity	Heavy metals
Granville	Little Menomonee	8.3	Contaminated sediments	Organic chemicals
			Toxicity	Heavy Metals
			Bacteria	Fecal material
			--	Nutrients (N&P)
			--	Hydraulic scour
Lower Menomonee	Lower Menomonee	6.3	Contaminated sediments	--
			--	Sediment
			--	Nutrients (N&P)
			Bacteria	Fecal material
			Toxicity	Heavy metals

Table 3. Nonpoint Source Impacts on Major Rivers and Streams in the Menomonee River Watershed. (continued)

Subwatershed	Stream/River Name	Length (Miles)	Water Quality Problems	Nonpoint Source Pollutant
Dousman Ditch	Stream Complex 1	4.7	Loss of aquatic habitat --	Stream flow fluctuations Temperature fluctuations
	Perennial DD007	0.9	Loss of aquatic habitat Bacteria -- -- --	Sediment Stream flow fluctuation Fecal material Heavy metals Nutrients (N&P) Temperature fluctuations
Underwood Creek	Underwood Creek	8.0	Loss of aquatic habitat Bacteria Toxicity --	Sediment Stream flow fluctuations Fecal material Heavy metals Nutrients (N&P)
South Branch Underwood Creek	South Branch Underwood Creek	2.3	Loss of aquatic habitat Toxicity	Stream flow fluctuations --
Honey Creek	Honey Creek	8.9	Loss of aquatic habitat Bacteria Toxicity --	Sediment Stream flow fluctuations Fecal materials Heavy metals Nutrients (N&P)
Menomonee Valley	Menomonee River	6.2	Loss of aquatic habitat Contaminated sediments Toxicity Bacteria --	Sediment Heavy metals PCB bioaccumulation Heavy metals Fecal material Nutrients (N&P)

Table 3. Nonpoint Source Impacts on Major Rivers and Streams in the Menomonee River Watershed. (continued)

Subwatershed	Stream/River Name	Length (Miles)	Water Quality Problems	Nonpoint Source Pollutant
	South Menomonee Canal	0.8	Loss of aquatic habitat	--
			Contaminated sediments	--
			Toxicity	Pesticides Organic chemicals Heavy metals
			Odors	--
			--	Temperature fluctuations
			Low dissolved oxygen	--
	Burnham Canal	0.5	Loss of aquatic habitat	Sediment
			Toxicity	Organic chemicals Heavy metals
			--	Temperature fluctuations
			Low dissolved oxygen	--
	Wood Creek	1.0	Loss of aquatic habitat	Stream flow fluctuations

**Loss of aquatic habitat means loss of fish and invertebrate habitat.

Source: Wisconsin Department of Natural Resources.

results in trampled banks, and wider, shallower streams which provide fewer pools for feeding and hiding. Loss of streambank vegetation also increases water temperature and reduces instream woody cover used by most fish species.

Ditching and channelizing streams or wetlands to improve drainage is also a problem having immediate effects on chemical water quality in addition to long-term effects on stream base flows and temperature, and fish and wildlife habitat. Turbidity in the Menomonee River main stem is also aggravated by relatively high numbers of bottom-feeding fish and rough fish.

There are no natural lakes in the Menomonee River Watershed. However, water quality of ponds in the watershed is generally fair to poor. One sizeable millpond and five other impoundments exhibit excessive aquatic weed growth and with few exceptions offer habitat for rough fish populations. Warming of stream temperatures, periodic low dissolved oxygen levels and discharge of organic matter are other downstream impacts resulting from these impoundments.

Past municipal and industrial wastewater discharges have contributed heavy organic loads streams in the Middle Menomonee, Lower Menomonee, Menomonee Valley, and portions of the Little Menomonee Subwatersheds. Consequently, low dissolved oxygen levels and excessive weed and algae growth result. Treatment facility upgrading with recommended toxic screening capability is currently progressing under the WPDES permitting process. All industrial wastewater dischargers appear to be in compliance with current permit regulations. Spills of toxic materials from industrial accidents or intentional disposal continue to degrade water quality.

While there are no municipal wastewater discharges within the Menomonee River Watershed, storm sewer bypasses and overflows are a major concern, especially in the Milwaukee Metropolitan area where combined sewer overflows and sanitary sewer overflows significantly affect water quality. Discharges from this system should be reduced when the Milwaukee Metropolitan Sewerage District Deep Tunnel Project is completed and on-line in the mid-1990s.

There are fish and waterfowl consumption advisories posted for the Menomonee River Watershed for portions of the Menomonee River downstream of the Falk Corporation Dam due to heavy metal and polychlorinated biphenyl (PCB) contamination of bottom sediments. These contaminants accumulate through the food chain, warranting the consumption advisories.

RURAL NONPOINT POLLUTION SOURCES

Rural nonpoint sources include barnyards, winter-spread manure, cropland erosion and streambank erosion. In general, these sources are not a widespread threat to water quality, but never the less degrade the condition of streams in the headwaters area of the Menomonee River, Little Menomonee River, and several of their tributaries. In these areas, agricultural lands are the principal sources of nutrients, sediment and bacteria flowing into streams. Rural nonpoint pollution was identified and assessed in 16 of the 20 watersheds where rural land uses occur. These sources are discussed below.

Barnyard Runoff. The Menomonee River Watershed has the fewest livestock operations of any of the Milwaukee River Basin's five watersheds. With few exceptions these barnyards are not significant pollution sources. Fifty barnyard/livestock operations were inventoried; 36 are hydraulically connected to rivers and streams. Runoff from the remainder flows to internally drained areas overlain by deep soils, or have animals confined inside buildings.

As shown in Table 4, an estimated 311 pounds, or 92 percent of the phosphorus attributed to barnyards, originates at the 36 barnyards hydraulically connected to rivers and streams. Ten or L percent, produce high to moderate levels of pollution and 26 or 72 percent, produce small quantities of pollution. The highest barnyard pollution loading to streams occurs in the Mequon (69 percent of total) and Little Menomonee (28 percent of total) subwatersheds.

Limited amounts of pollution (28 pounds of phosphorus, or eight percent of the total) originates at the six barnyards draining to internally drained areas overlain by deep soils. These barnyards are not a significant threat to either surface or groundwater quality.

Winter-spread Manure. The potential for water quality problems caused by winterspreading manure generated at the 50 livestock operations was assessed using the barnyard and cropland inventory data. The limited number of livestock operations with significant numbers of animals, reduces the potential for water quality problems caused by winterspreading manure.

Approximately 620 acres of land are needed to daily spread the manure generated during the approximate six month period when the soil is frozen and the pollution potential from this source is greatest. Watershedwide, 1,350 acres of cropland are available for winterspreading manure; however, only about 1,000 acres are suitable. The remaining 350 acres are not suitable as they are located in floodplains or have slopes exceeding six percent, and have a high potential to be pollution sources during periods of heavy rainfall or rapid snowmelt.

Not all landowners have an adequate amount of suitable acres on which to spread manure. Consequently, some manure is spread on an estimated 120 acres of unsuitable land. Fortunately, the number of affected acres for any one operation is small and generally is not a serious source of pollution.

Upland Erosion and Sediment Delivery. Land uses, erosion rates and sediment delivery to streams attributable to the 16,000 acres of agricultural land evaluated is summarized in Table 5. Gross soil erosion totals an estimated 63,000 tons per year. Very little of this eroded soil makes its way to surface waters. On a watershed basis, only four percent or about 2,500 tons of eroded soil, is washed into streams annually.

Virtually all of the delivered sediment comes from eroding cropland. Most originates on cropland exhibiting low rates of soil erosion. For example, between 40 percent and 75 percent of the sediment delivered to surface waters from uplands originates from croplands that are currently eroding at less than three tons/acre/year. This rate of erosion is very small, equivalent to about the thickness of a dime over the land surface.

Table 4. Pollution Potential of Barnyard Runoff in the Menomonee River Watershed[1].

	RUNOFF DESTINATION						
	River & Streams		Deep Soils		Total		
Subwatershed	No. barnyds	Lbs of phosphorus[1]	No. barnyds	Lbs of phosphorus	No. Runoff[2]	No. barnyds	Lbs of phosphorus
Germantown	2	0	--	--	1	3	0
Goldenthal	5	3	1	5	1	7	8
Granville	1	0	--	--	--	1	0
Lilly Creek	2	0	--	--	--	2	0
Little Menomonee	10	86	1	1	--	11	87
Mequon	9	214	1	4	--	10	218
Rockfield	3	5	2	6	2	7	11
Upper Menomonee	3	3	1	12	2	6	15
Victory Center	1	0	--	--	1	2	0
Willow Creek	--	--	--	--	1	1	0
Total:	36	311	6	28	8	50	339

[1] Pollution potential is based on the mass load of total phosphorus, in pounds, delivered by runoff during a 10-year, 24-hour recurrence interval rainstorm.

[2] These operations have no runoff and no potential for pollution because the animals are confined inside.

Source: Wisconsin Department of Natural Resources.

Most of the sediment affecting streams (1,600 tons, or 63 percent) originates in the Germantown, Lilly Creek, Rockfield, Upper Menomonee, and Victory Center Subwatersheds. Importantly, the urbanizing nature of the watershed means that cropland erosion and sediment delivery will no longer occur in those areas undergoing development. However, without measures to control storm water runoff, the new urban areas will become additional sources of pollution.

Streambank Erosion. Streambanks along 60 miles of perennial and intermittent streams in the watershed's rural areas were surveyed. The extent and severity of streambank erosion is not significant and is generally not a major water quality problem. Erosion was recorded for only limited stretches (4,000 feet or one percent) of streambank, all of which is in the Goldenthal and Little Menomonee Subwatersheds. Unrestricted livestock access to streams causes most of the erosion.

Table 5. Summary of Upland Erosion and Sediment Delivery Analysis for the Menomonee River Watershed. (1)

Subwatershed		Cropland	Farmstead	Grassland	Pasture	Woodlot	Open Water	Wetland	Totals	Delivered Sediment(2)
Butler Ditch	Acres	267	0	291	0	230	0	0	788	
	Soil Loss (tons)	968	0	0	0	0	0	0	968	
	Sediment(tons)(2)	38	0	0	0	1	0	0	39	3.9%
Dousman Ditch	Acres	22	0	301	0	244	0	0	567	
	Soil Loss (tons)	38	0	0	0	0	0	0	38	
	Sediment (tons)	2	0	0	0	0	0	0	3	6.1%
Dretzka Park	Acres	438	0	212	0	126	0	27	803	
	Soil Loss (tons)	2,377	0	0	0	0	0	0	2,377	
	Sediment (tons)	91	0	0	0	0	0	0	91	3.8%
Goldenthal	Acres	1,403	74	258	73	97	2	409	2,316	
	Soil Loss (tons)	3,666	0	0	44	0	0	0	3,710	
	Sediment (tons)	160	4	0	1	0	0	1	165	4.4%
Germantown	Acres	2,241	80	651	47	180	36	920	4,155	
	Soil Loss (tons)	9,935	0	0	11	0	0	0	9,946	
	Sediment (tons)	445	6	1	0	0	0	1	452	4.5%
Granville	Acres	1,125	14	279	0	278	1	190	1,887	
	Soil Loss (tons)	4,125	0	0	0	0	0	0	4,125	
	Sediment (tons)	140	1	0	0	0	0	0	142	3.4%
Lilly Creek	Acres	988	6	304	0	290	0	0	1,588	
	Soil Loss (tons)	6,485	0	0	0	0	0	0	6,485	
	Sediment (tons)	273	0	0	0	0	0	0	274	4.2%
Little Menomonee	Acres	1,260	65	95	48	186	30	126	1,810	
	Soil Loss (tons)	3,203	0	0	17	23	0	0	3,243	
	Sediment (tons)	128	5	0	0	0	0	0	134	4.0%
Lower Menomonee	Acres	26	0	61	0	15	0	0	102	
	Soil Loss (tons)	44	0	0	0	0	0	0	44	
	Sediment (tons)	0	0	0	0	0	0	0	0	0%

Table 5. Summary of Upland Erosion and Sediment Delivery Analysis for the Menomonee River Watershed. (1) (continued)

Subwatershed		Cropland	Farmstead	Grassland	Pasture	Woodlot	Open Water	Wetland	Totals	Delivered Sediment(2)
Middle Menomonee	Acres	489	2	550	0	786	2	0	1,827	
	Soil Loss (tons)	3,399	0	0	0	0	0	0	3,399	
	Sediment (tons)	100	0	0	0	1	0	0	100	2.9%
Mequon	Acres	1,782	69	220	40	68	6	206	2,391	
	Soil Loss (tons)	5,348	0	5	14	6	0	0	5,373	
	Sediment (tons)	109	2	0	0	0	0	0	111	2.0%
Rockfield	Acres	1,521	70	78	6	42	8	400	2,125	
	Soil Loss (tons)	4,082	0	0	3	0	0	0	4,085	
	Sediment (tons)	190	4	0	0	0	0	0	195	4.7%
Underwood Creek	Acres	37	3	335	0	244	0	0	619	
	Soil Loss (tons)	288	0	0	0	0	0	0	288	
	Sediment (tons)	0	0	0	0	1	0	0	1	0.1%
Upper Menomonee	Acres	1,962	76	261	49	136	2	815	3,301	
	Soil Loss (tons)	7,549	0	0	12	0	0	0	7,561	
	Sediment (tons)	324	4	0	0	0	0	1	330	4.3%
Victory Center	Acres	1,250	54	368	19	262	6	183	2,142	
	Soil Loss (tons)	8,260	0	0	37	0	0	0	8,297	
	Sediment (tons)	326	3	0	0	1	0	0	330	3.9%
Willow Creek	Acres	1,110	33	460	24	302	7	477	2,413	
	Soil Loss (tons)	3,140	0	0	57	0	0	0	3,197	
	Sediment (tons)	113	2	1	0	0	0	0	116	3.6%
Watershed Totals	Acres	15,921	544	4,724	306	3,486	100	3,753	28,834	
	Soil Loss (tons)	62,908	0	5	194	29	0	0	63,136	
	Sediment (tons)	2,439	31	4	1	4	0	3	2,482	3.9%

(1) This evaluation is based on surveys conducted by the Ozaukee and Washington County Land Conservation Departments for 1985 conditions.

(2) Calculated amount of sediment delivered to surface waters.

URBAN NONPOINT SOURCES

Urban runoff carries a wide array of pollutants to surface water; some are unique to urban runoff while others also are contained in runoff from agricultural areas. Pollutants found primarily in urban runoff include heavy metals (lead, copper, zinc, cadmium or chromium) and a large number of toxic organic chemicals (PCBs, aromatic hydrocarbons, esters and many others). Other substances in urban runoff that are also contained in runoff from rural areas include sediment, nutrients, bacteria and other pathogens, and pesticides.

Runoff from urban areas also affects stream hydrology. This occurs as runoff volume increases in magnitude and is produced in a short time period creating large increases in peak stream flows. In some areas, groundwater recharge is also significantly reduced as concrete and other impervious surfaces prevent rainwater and snowmelt from soaking into the ground. This reduces base stream flows needed to sustain fish and aquatic life during periods of low rainfall.

Overall, urban runoff produces "flashy" streams with temperatures and chemical characteristics which limit animal life and recreational uses. Streambank erosion may increase as the stream tries to cut a channel in equilibrium with widely variable stream flows. Flooding of adjacent property may also occur, sometimes requiring channelization and/or lining with concrete to accommodate flood flows or prevent flood damage. This often destroys the natural stream system and speeds the transport of pollutants downstream.

Urban nonpoint sources described below include: streambank erosion; runoff from existing urban areas including established commercial, industrial, and residential land uses; and runoff from areas where new urbanization is anticipated. The analysis addresses urban nonpoint sources for 20 subwatersheds. It does not include that portion of the watershed within the combined sewer area of the Milwaukee Metropolitan Sewerage District (MMSD). Most storm water originating in this area will eventually be diverted to the MMSD deep tunnel system and treated at the Jones Island or South Shore wastewater treatment facilities.

Streambank Erosion. Streambanks along most of the streams draining the urbanized portions of the watershed were surveyed. The most extensive areas of erosion exist along Lilly Creek, and portions of the main stem of the Menomonee River. As shown in Table 6, approximately five miles of streambanks, or about five percent of the area inventoried is eroding. These eroding areas contribute an estimated 1,200 tons of sediment annually to streams.

Existing Urban Area Characteristics and Pollutant Loading. The delivery of urban pollutants to streams from existing urban areas depends on: the type of urban land use; the type of storm water conveyance system; and urban housekeeping practices including but not limited to street sweeping and leaf collection. Each factor is discussed below.

Table 6. Streambank Erosion Inventory Results For The Menomonee River Watershed.

Subwatershed	Name of Surveyed Stream/River	Feet of Streambank Degraded	Feet of Streambank (tons/yr)	Sediment Produced
Germantown	Menomonee River	31,680	1,000	5
Middle Menomonee	Menomonee River	49,630	4,400	580
Dretzka Park	Unnamed tributary	29,010	1,600	60
Lilly Creek	Lilly Creek	34,848		
	Unnamed tributaries	124,608	7,105	202
Butler Ditch	Butler Ditch	34,848		
	Unnamed tributaries	52,800	50	3
Noyes Park	Noyes Park Creek	46,404	20	1
Granville	Little Menomonee River	12,670	2,525	2
Lower Menomonee	Lower Menomonee River	66,528		
	Unnamed intermittents	14,784	2,600	206
Underwood Creek	Underwood Creek	84,480	775	49
South Branch Underwood Creek	South Branch Underwood Creek	24,288	2,060	28
Honey Creek	Honey Creek	93,984	2,665	33
Watershed Total	--	700,562	24,800	1,168

Source: Wisconsin Department of Natural Resources

Urban Land Uses—The Menomonee River Watershed, with 77 square miles of urban land uses, is the most intensely urbanized major drainage area in the Milwaukee River Basin. Map 6 (Washington and Ozaukee County) and Map 7 (Milwaukee and Waukesha County) show the 1985 urban land use distribution in the watershed. Table 7 summarizes the type and extent of urban land uses for communities by subwatershed. Urban land uses as sources of pollutants in runoff are shown in Table 8. Freeways, industrial areas, commercial areas, and high density residential areas are the greatest collectors of sediment, lead, and zinc on a per acre basis. Medium density residential areas are less important sources of sediment and lead, but are significant sources of pesticides, bacteria, and household or automotive maintenance products dumped into the storm sewer system. Low density residential areas are important where the improper use and disposal of pesticides, fertilizers, and automotive maintenance products occurs.

The variability of pollutants in urban runoff also depends on the configuration of "source areas." Source areas—defined as streets, parking lots, rooftops and lawn areas—are present in different proportions depending on the type of land use. For example, residential areas contain more lawn area than commercial areas, while commercial areas have more rooftop, street, and parking lot surfaces. Lawns can be important sources of fertilizers and pesticides. Rooftops, important sources of zinc and asbestos, vary in the proportion of land they cover in each urban land use, and also in the degree they are connected to the storm sewer system. Streets are sources of significant amounts of lead, cadmium, and other pollutants, depending on their condition and the amount of traffic.

Predicting rates of construction site erosion is difficult. However, erosion rates exceeding 75 tons/acre/year can occur. This erosion rate is greater than occurs on the most severely eroding croplands and 65 times the sediment loading rate from existing commercial and industrial areas. Often the proximity of construction sites to storm sewers or other drainage ways serving urban areas results in nearly all of the sediment being delivered to streams.

Storm Water Conveyance—Storm water is most commonly conveyed to streams through storm sewers either separately or in combination with grassed swales or roadside ditches. Storm sewers transport runoff rapidly with no "treatment" or filtering of the runoff before it enters streams. Properly designed grassed swales generally transport lesser amounts of runoff because of infiltration and vegetation serves to remove some pollutants from the runoff before it flows into streams or storm sewer systems.

The types and amounts of pollutants transported by runoff, depends on the extent to which pollutant-producing surfaces are hydrologically "connected" to the storm sewer system. For example, automobile traffic density, a prime determinant in the production of lead, asbestos, cadmium, and street dirt, is highest for street surfaces in commercial areas and freeways. Normally, these areas are connected to storm sewers.

Urban Housekeeping Practices—Table 9 lists basic information concerning storm water conveyance systems and street sweeping practices for communities in the watershed. These factors affect the portion of pollutants from urban surfaces carried to streams by runoff. Street sweeping removes some of the particulate pollutants from street and parking lot surfaces before they can be transported to surface waters. The most benefit is realized by repeated sweeping of commercial and industrial areas in the early spring.

Other sweeping is primarily cosmetic, and serves little role in reducing urban pollutant loads.

Nonpoint Source Loadings—The quantity of existing 1985 urban land uses and the associated amount and types of pollutant loading to streams are shown in Table 10. As might be expected, the greatest amount of urban land (48 percent) is in the six subwatersheds in Milwaukee County. Waukesha County also has a significant amount (40 percent) of the watershed's urban area.

Three substances (sediment, phosphorus, and lead) were chosen to characterize the type and severity of urban nonpoint pollution. Subwatersheds with the greatest amount of urban area generate the greatest quantities of pollutants. Four subwatersheds—Lower Menomonee, Honey Creek, Menomonee Valley, and Middle Menomonee—contribute more than 50 percent of the estimated sediment, phosphorus, and lead loading to streams in the watershed.

In most subwatersheds, commercial and industrial areas have high unit area loads and produce the most significant amounts of lead. Medium density and multi-family residential areas also generate high amounts of lead. This occurs primarily because of the large area these land uses occupy. High density residential areas take on even greater significance across the watershed as important sources of sediment.

New Urban Development. Runoff from new urban development anticipated to take place over about the next 10 to 15 years has the potential to affect stream water quality for two reasons. First constructing roads, utilities and buildings disturbs large areas, exposing large amounts of soil to erosion. This sediment can easily be carried by runoff to drainageways, storm sewers and ultimately streams. Without adequate controls, construction site erosion can have catastrophic impacts on urban rivers and streams, clog storm sewers, and accumulate on road surfaces and sidewalks. Second, newly established urban surfaces accumulate pollutants which are carried in runoff to streams. Consequently as new areas urbanize, water quality problems caused by urban pollutants and excessive storm water runoff can worsen.

Maps 8 and 9 show the extent of anticipated new development in the watershed. Table 11 displays the increases in urban land use estimated to occur by the year 2000. Urban land use is expected to increase by nearly 7,412 acres, or 18 percent by about the year 2000. The largest combined increase is anticipated to occur in the Granville, Germantown, Lilly Creek, Middle Menomonee and Victory Center Subwatersheds. Areas expected to have the greatest percent increase in urban area are the Mequon (84 percent), Goldenthal (66 percent), Germantown (85 percent), and Victory Center (60 percent) Subwatersheds.

Table 7. Areal extent, in acres, of urban land uses for subwatersheds of the Menomonee River Watershed: 1985.

Subwatershed Acres	Municipalities Included	LAND USE IN ACRES: Residential Density Low	Medium	High	Commer-cial	Indus-trial	Free-way	Insti-tutional	Parks open	Total
Mequon	-C. of Mequon:	290	11	5	0	0	0	0	88	394
Little Menomonee	-C. of Mequon:	226	0	17	5	0	0	12	19	279
Germantown	-V. of Menomonee Falls; -V. of Germantown:	513	803	11	137	54	100	28	452	2,098
Goldenthal	-V. of Germantown:	200	0	3	0	54	43	0	81	381
Rockfield	-V. of Germantown:	89	0	0	0	8	0	0	32	129
Upper Menomonee	-C. of Mequon:	187	25	11	0	3	0	0	41	267
Victory Center	-V. of Menomonee Falls; -V. of Germantown:	229	54	13	59	317	81	0	255	1,008
Willow Creek	-V. of Germantown:	658	0	4	0	51	79	0	126	918
Butler Ditch	-C. of Brookfield; -V. of Menomonee Falls:	1,976	7	53	166	34	0	50	251	2,537
Dousman Ditch	-C. of Brookfield; -V. of Elm Grove; -T. of Brookfield:	899	156	19	191	1	0	118	252	1,636
Lilly Creek	-V. of Menomonee Falls:	1,296	6	21	96	152	0	71	318	1,960
Middle Menomonee	-C. of Milwaukee; -V. of Butler; -V. of Menomonee Falls:	850	1,079	226	322	336	304	189	1,002	4,308
South Branch Underwood Creek	-C. of West Allis; -C. of Milwaukee; -C. of New Berlin; -C. of Brookfield:	162	898	334	211	325	185	45	958	3,118
Underwood Creek	-C. of Brookfield; -C. of Wauwatosa; -V. of Elm Grove:	2,511	644	394	459	106	134	622	1,012	5,882

Table 7. Areal extent, in acres, of urban land uses for subwatersheds of the Menomonee River Watershed: 1985 (continued).

		LAND USE IN ACRES								
		Residential Density								
Subwatershed	Municipalities Included	Low	Medium	High	Commer-cial	Indus-trial	Free-way	Insti-tutional	Parks open	Total Acres
Dretzka Park	-C. of Milwaukee; -C. of Mequon; -V. of Menomonee Falls:	83	57	40	67	31	43	22	402	745
Granville	-C. of Milwaukee; -C. of Mequon:	496	732	572	209	500	104	200	1,237	4,050
Honey Creek	-C. of Milwaukee; -C. of Wauwatosa; -C. of West Allis; -C. of Greenfield:	298	1,465	2,668	402	145	146	638	998	6,760
Lower Menomonee	-C. of Brookfield; -C. of Milwaukee; -C. of Wauwatosa; -V. of Butler:	124	863	2,188	461	705	84	817	1,511	6,753
Menomonee Valley	-C. of Milwaukee; -C. of West Allis; -C. of West Milwaukee:	0	59	827	171	1,238	153	383	685	3,516
Noyes Park	-C. of Milwaukee:	9	417	212	106	101	24	92	364	1,325
Watershed Totals		11,096	7,276	7,618	3,062	4,161	1,480	3,287	10,084	48,064

Table 8. Pollutant Generation Rates From Urban Land Uses.

	Unit Area Load (lb/ac/yr)				
Land Use	Sediment	Phosphorus	Lead	Zinc	Other Pollutants of Concern
Freeways	880	0.9	5.5	2.1	volatile organics(1) PAHs(2)
Industrial	1,000	1.5	2.4	2.1	pesticides(3), PCBs(4), PAHs, esters(5), volatile organics, aliphates(6)
Commercial	1,000	1.5	2.7	2.1	volatile organics, PAHs
Shopping Centers	440	0.5	1.1	0.6	volatile organics, PAHs
High Density Residential	420	1.0	0.8	0.7	pesticides, esters, benzene(7)
Medium Density Residential	190	0.5	0.2	0.2	pesticides, esters, benzene
Low Density Residential	10	.04	.01	.04	pesticides, esters, benzene
Parks	3	.03	.005		pesticides, esters, benzene

1. Series of carbon compounds which have been shown to be harmful to human health and the environment.
2. Polynuclear aromatic hydrocarbons (PAHs) are composed of rings of benzene and other aliphates. Some PAHs are carcinogenic.
3. Pesticides are hazardous chemicals and may adversely affect aquatic and human health.
4. Polychlorinated biphenyls (PCBs) are very stable compounds which persist in the environment for long periods of time. They are passed through the food chain and are highly toxic.
5. A commonly encountered ester is acetyl acetate, frequently used as a solvent. The substance is toxic and considered a dangerous fire and explosive risk.
6. Any organic compound of hydrogen and carbon. An example of an aliphate of concern in the Menomonee River is methane gas.
7. Aromatic hydrocarbon. Clear, colorless water-soluble liquid. Recognized as a human carcinogen. Benzene is found in gasoline.

Source: Wisconsin Department of Natural Resources

Table 9. Street Sweeping Schedule and Grass Swale Location By Land Use For Selected Municipalities in the Menomonee River Watershed.

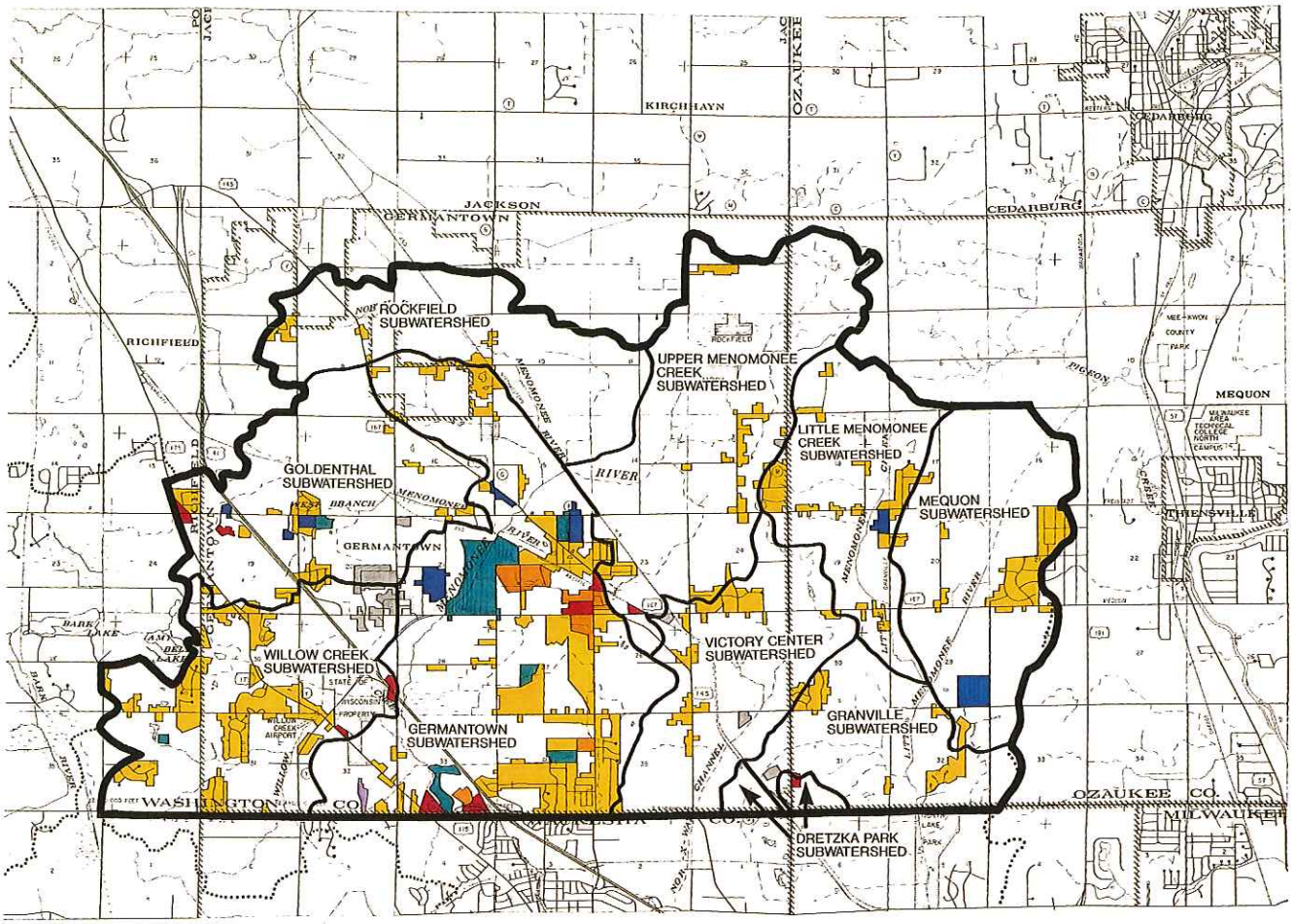
	Residential		Institutional		Commercial		Industrial	
	Street Sweeping[1]	Grass Swales	Street Sweeping[1]	Grass Swales	Street Sweeping[1]	Grass Sqales	Street Sweepint[1]	Grass Swales
Municipality	(frequency)	(% area)	(frequency)	(% area)	(frequency)	(% area)	(frequency)	(% area)
C. of Brookfield	twice/year	80	twice/year	25	twice/year	50	twice/year	50
C. of Greenfield	none	80	none	0	none	0	none	0
C. of Mequon	none	100	none	0	none	0	none	0
C. of Milwaukee	twice/month	0	once/week	0	once/week	0	once/week	0
C. of Wauwatosa	once/month	10	twice/year	20	4x/year	0	twice/year	0
C. of West Allis	twice/month	0	once/week	0	once/week	0	once/week	0
V. of Butler	twice/year	25	--	N/A	twice/year	20	twice/year	50
V. of Elm Grove	once/year	100	once/year	95	once/year	0	once/year	0
V. of Germantown	once/year[2]	8	once/year[2]	2	once/year[2]	2	once/year[2]	4
V. of Menomonee Falls	twice/year	30	twice/year	5	twice/year	10	twice/year	90
V. of West Milwaukee	once/month	100	none	100	once/month	100	once/month	100

[1]Beginning 04/01/89 and ending 10/15/89.
[2]Also as necessary in construction areas.

Source: Wisconsin Department of Natural Resources

Map 6

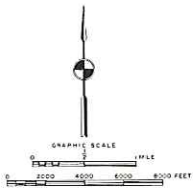
EXISTING URBAN LAND USES IN THE OZAUKEE AND WASHINGTON COUNTY PORTIONS OF THE WATERSHED: 1985



LEGEND

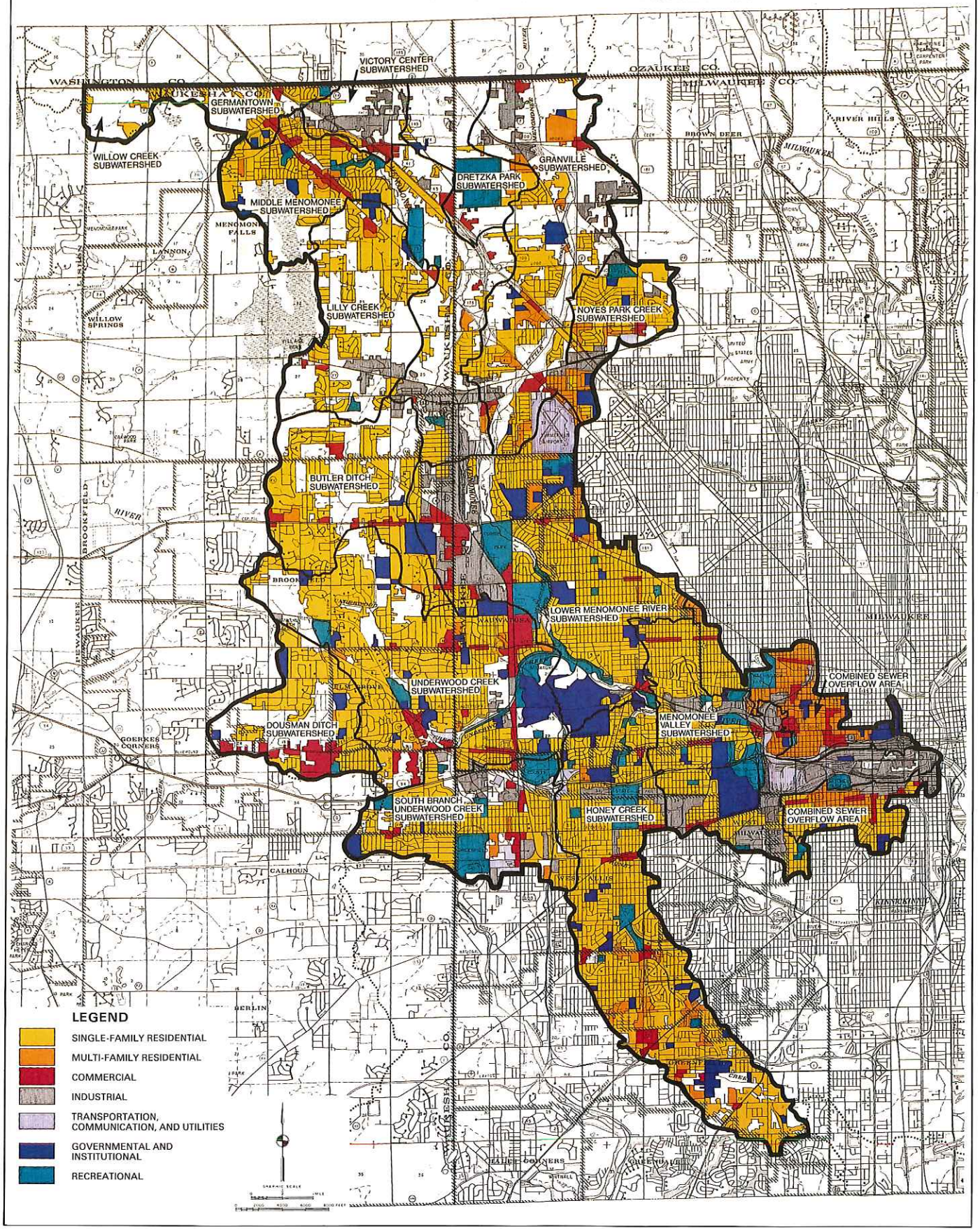
- SINGLE-FAMILY RESIDENTIAL
- MULTI-FAMILY RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- TRANSPORTATION, COMMUNICATION, AND UTILITIES
- GOVERNMENTAL AND INSTITUTIONAL
- RECREATIONAL

Source: SEWRPC.



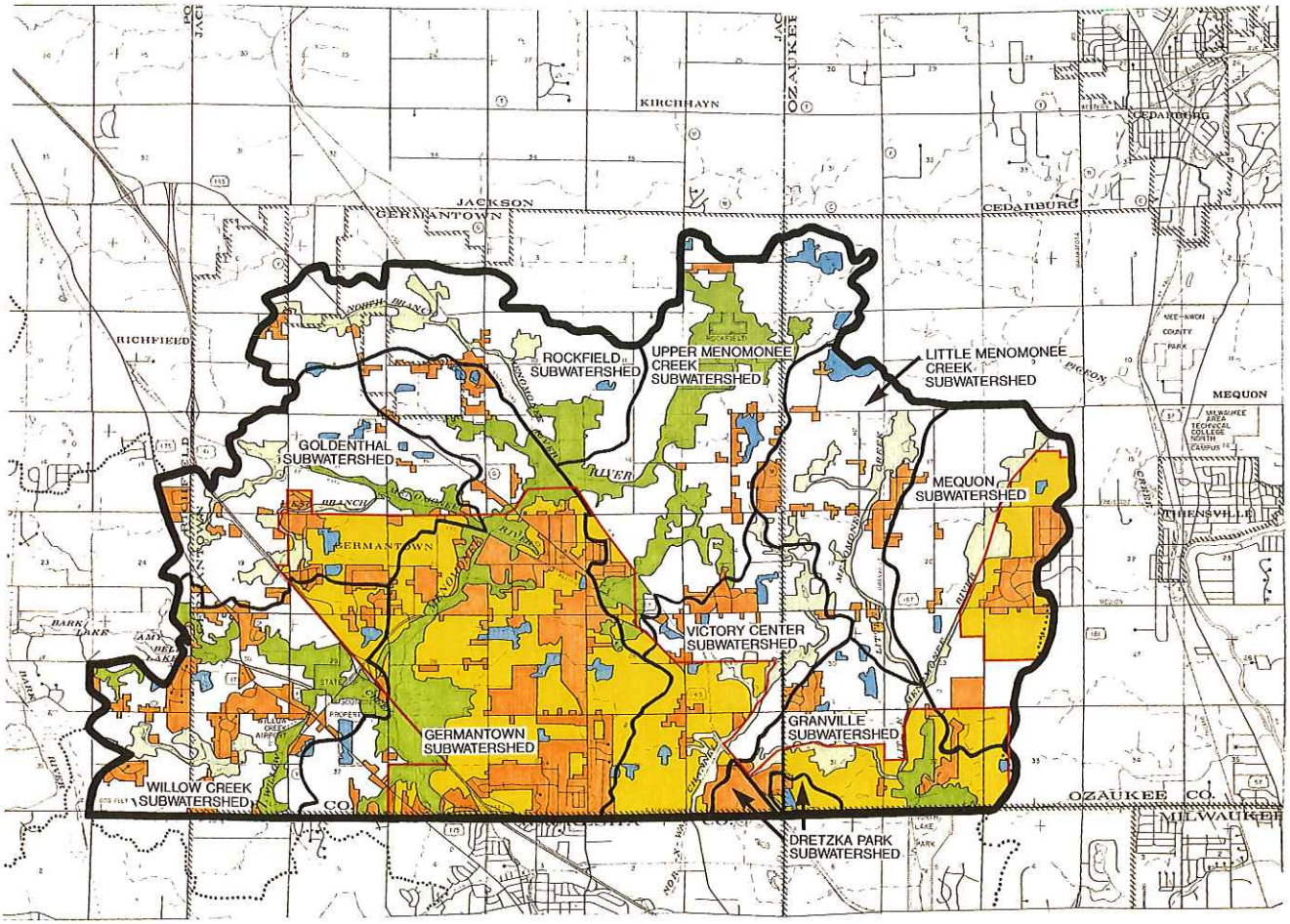
Map 7

EXISTING URBAN LAND USES IN THE MILWAUKEE AND WAUKESHA COUNTY PORTIONS OF THE WATERSHED: 1985



Map 8

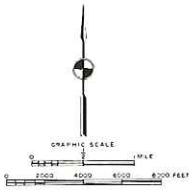
EXISTING AND PLANNED URBAN LANDS IN THE OZAUKEE AND WASHINGTON COUNTY PORTIONS OF THE WATERSHED



LEGEND

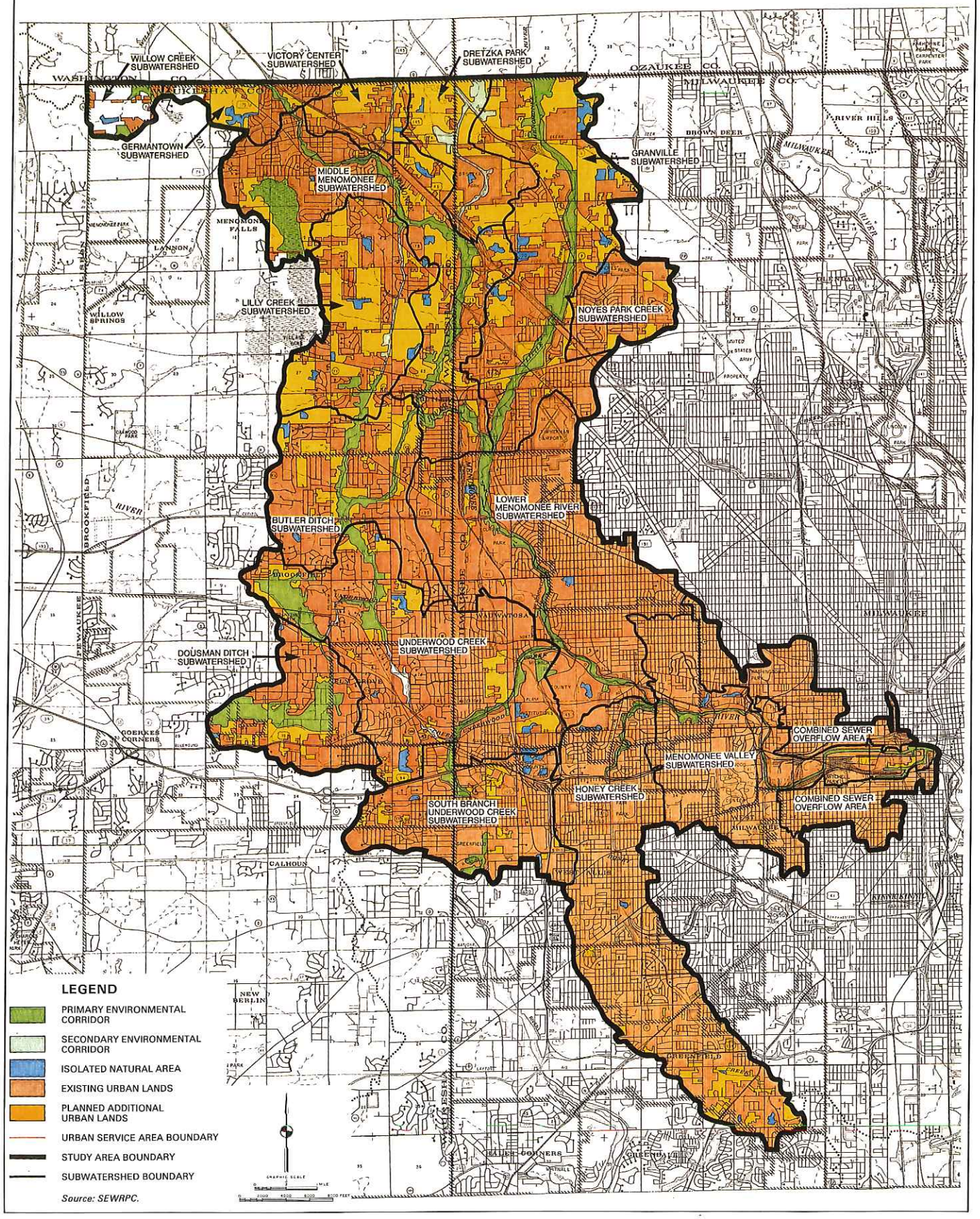
- PRIMARY ENVIRONMENTAL CORRIDOR
- SECONDARY ENVIRONMENTAL CORRIDOR
- ISOLATED NATURAL AREA
- EXISTING URBAN LANDS
- PLANNED ADDITIONAL URBAN LANDS
- URBAN SERVICE AREA BOUNDARY
- STUDY AREA BOUNDARY
- SUBWATERSHED BOUNDARY

Source: SEWRPC.



Map 9

EXISTING AND PLANNED URBAN LANDS IN THE MILWAUKEE AND WAUKESHA COUNTY PORTIONS OF THE WATERSHED



Source: SEWRPC.

Table 10. Urban Land Use and Nonpoint Source Loads in the Menomonee River Watershed: 1985.

	Urban Land Use		Sediment(1)		Phosphorus		Lead	
Subwatershed	Acres	Percent	(tons/yr)	Percent	(lb/yr)	Percent	(lb/yr)	Percent
Ozaukee County								
Mequon	395	1%	60	<1%	20	<1%	10	<1%
Little Menomonee	279	1%	220	1%	35	<1%	25	<1%
Washington County (2)								
Germantown	2,097	4%	1,080	5%	900	4%	1,060	4%
Goldenthal	380	1%	60	<1%	95	<1%	150	1%
Rockfield	128	<1%	65	<1%	10	<1%	20	<1%
Upper Menomonee	267	1%	160	1%	40	<1%	25	<1%
Victory Center	1,008	2%	530	2%	700	3%	1,430	5%
Willow Creek	917	2%	360	2%	110	<1%	145	<1%
Waukesha County (2)								
Butler Ditch	2,538	5%	390	2%	445	2%	590	2%
Dousman Ditch	1,635	3%	600	3%	455	2%	570	2%
Lilly Creek	1,959	4%	915	4%	485	2%	705	2%
Middle Menomonee	4,307	9%	3,040	14%	2,210	9%	3,530	12%
So. Br. Underwood	3,118	6%	1,470	7%	1,700	7%	2,350	8%
Underwood Creek	5,881	12%	1,865	9%	2,040	8%	2,580	9%
Milwaukee County (2)								
Dretzka Park	746	2%	200	1%	280	1%	490	2%
Granville	4,050	8%	590	3%	2,040	8%	2,300	8%
Honey Creek	6,760	14%	1,990	9%	4,810	19%	4,340	15%
Lower Menomonee	6,754	14%	5,970	28%	4,990	20%	5,120	17%
Menomonee Valley	3,516	7%	810	4%	2,770	11%	3,740	13%
Noyes Park	1,325	3%	925	4%	765	3%	720	2%
Watershed Total	48,060	100%	21,300	100%	24,900	100%	29,900	100%

1. Includes existing urban development (6,400 tons) and construction erosion (14,900 tons).
2. Includes subwatersheds whose area is located primarily in the county.

Source: Wisconsin Department of Natural Resources.

Runoff from new urban areas has the potential to further degrade stream water quality unless storm water management practices controls are incorporated during development. Table 11 shows the increase in urban nonpoint source loading that will occur in the watershed if new urban source areas are not controlled. Sediment and lead loads are anticipated to increase by more than 35 percent per year over 1985 levels. Areas with the greatest increases are the Mequon, Germantown, Goldenthal, Dretzka Park, Lilly Creek, and Granville Subwatersheds.

Renewal of established urban areas should be considered as new development for purposes of assessing their potential impact on water quality. Renovation of buildings and utilities can cause pollution from construction site erosion similar to new construction. In addition, even though urban renewal projects will not necessarily

increase the amount of established urban surface, they represent opportunities to install storm water management practices to treat runoff from both the renewal property and adjacent established areas.

Table 11. Increase in Urban Land Uses and Nonpoint Sources in the Menomonee River Watershed: 1985 - Year 2000.

	Total Increase in Urban Land Use		Annual Increase in Sediment Load		Annual Increase in Phosphorus Load		Annual Increase in Lead Load	
Subwatershed	Acres	Percent	(tons/yr)	Percent	(lb/yr)	Percent	(lb/yr)	Percent
Ozaukee County								
Mequon	332	84%	14	529%	86	419%	28	433%
Little Menomonee	0	0%	0	0%	0	0%	0	0%
Washington County (2)								
Germantown	1,776	85%	302	135%	1,256	134%	1,192	109%
Goldenthal	252	66%	81	328%	253	306%	438	333%
Rockfield	0	0%	0	0%	0	0%	0	0%
Upper Menomonee	25	9%	2	28%	10	41%	5	30%
Victory Center	603	60%	180	82%	613	91%	940	67%
Willow Creek	78	9%	19	137%	63	121%	95	139%
Waukesha County (2)								
Butler Ditch	195	8%	23	56%	79	49%	134	68%
Dousman Ditch	149	9%	33	52%	112	44%	186	62%
Lilly Creek	414	21%	55	73%	181	64%	295	78%
Middle Menomonee	448	10%	107	24%	378	23%	538	20%
So. Br. Underwood	147	5%	44	12%	152	11%	226	12%
Underwood Creek	284	5%	64	24%	220	20%	334	25%
Milwaukee County (2)								
Dretzka Park	392	23%	127	194%	420	184%	681	168%
Granville	1,684	41%	368	86%	1,236	124%	1,958	102%
Honey Creek	299	4%	60	4%	269	3%	239	4%
Lower Menomonee	144	3%	64	6%	204	5%	362	8%
Menomonee Valley	52	2%	25	4%	74	3%	124	4%
Noyes Park	138	10%	54	38%	183	28%	304	51%
Watershed Total	7,412		1,555		5,272		8,079	

1. Does not include the pollution potential of construction site erosion.
2. Includes subwatersheds whose area is located primarily in the county.

Source: Wisconsin Department of Natural Resources.

Construction Site Erosion—Construction site erosion is an additional water quality concern associated with new urban development. Uncontrolled construction site erosion can devastate aquatic communities in streams receiving sediment-laden runoff. The reduced capacity of storm water conveyance systems can cause localized flooding. Importantly, water quality improvements occurring through implementation of nonpoint

source control practices for existing urban areas can be negated by these pollution sources.

An analysis of construction site erosion was conducted for existing 1985 and planned year 2000 conditions with the aid of land use inventory data provided by the SEWRPC. The average annual amount of land under construction in 1985 and the year 2000 was estimated by quantifying measured changes in urban land use for the period 1970 to 1985 and projected growth between 1985 to 2000, respectively. An estimated 500 acres of new urban land uses were estimated to be under construction in 1985, as compared with an anticipated development rate of about 700 acres annually in the year 2000.

Sediment loading to streams from construction erosion under existing 1985 and year 2000 conditions was determined by multiplying the amount of land under development by an average of 30 tons per acre per year. The rate of erosion assumes no on-site erosion controls and is based on measured data normalized for local climatic conditions and land development patterns. It was estimated that in 1985 construction erosion contributed 15,000 tons of sediment (60 percent of total from nonpoint sources) to streams in the watershed.

The impact of this sediment source increases in the year 2000, when an estimated 21,000 tons (65 percent of total from nonpoint sources) is projected to be delivered to streams.

Establishing and enforcing ordinances is an effective means to reduce construction site erosion and the associated adverse water quality impacts. In 1986 the DNR and the League of Wisconsin Municipalities cooperatively developed a model ordinance for the control of construction site erosion (WDNR, 1987). It contains provisions for planning, designing, installing and maintaining erosion control practices and the means for administering and enforcing the ordinance.

The results of a construction erosion survey taken of the Menomonee River Urban Technical Work Group is summarized below. The work group includes representatives from engineering and public works departments throughout the watershed. The participants were asked to describe the manner in which the community controlled construction erosion, the level of effectiveness and ways to improve compliance.

City of Brookfield: The city has provisions in the municipal code for controlling construction site erosion. The building inspector and city engineer are responsible for reviewing erosion control plans, inspecting sites for plan compliance and initiating enforcement actions.

Compliance with the code requirements is low to moderate. High priority items to improve compliance include more inspection staff, consistent statewide requirements and changes in the local ordinance. Moderate priorities include training workshops for builders, contractors and municipal staff and more consistent statewide erosion control requirements.

City of Greenfield: The city has limited provisions in its municipal code for controlling construction erosion. The public works department initiated development of a comprehensive construction erosion control ordinance in September 1989.

City of Mequon: The city does not have a construction erosion control ordinance, but incorporates erosion and runoff control provisions into development agreements. The engineer and staff are responsible for reviewing erosion control plans, inspecting sites for compliance and initiating enforcement actions. The city has a Memorandum of Understanding with the Ozaukee County Land Conservation Department for technical assistance.

Compliance with erosion control provisions in development agreements varies from low to high. High priority items to improve compliance include adopting a local ordinance, developing new administrative procedures and hiring more inspection staff. Moderate priority items include consistent statewide erosion control requirements and training workshops for builders, contractors and municipal staff. Better handbooks for erosion control planning and practice design are lower priorities.

City of Milwaukee: The city adopted the state model ordinance in 1988. The public works director, building inspectors and engineering inspectors are responsible for reviewing erosion control plans, inspecting sites for compliance and initiating enforcement actions.

Compliance with the ordinance is generally medium to high. High priority items to improve compliance include consistent statewide erosion control requirements, some changes in local administrative procedures and more local inspection staff. Moderate priorities are training workshops for developers, builders, contractors and municipal staff. Better handbooks for practice design and erosion control planning are lower priorities.

City of West Allis: The city adopted an ordinance with most of the provisions of the state model in October 1989. The building inspector is responsible for reviewing erosion control plans, inspecting sites for compliance and initiating enforcement actions. The ordinance becomes effective on January 1, 1990. High priority items for making the ordinance effective include training existing and/or hiring new staff, and conducting workshops for builders and contractors.

Village of Butler: The village has limited provisions in its municipal code for controlling construction site erosion. The building inspector is responsible for reviewing erosion control plans, inspecting sites for compliance and initiating enforcement actions.

Compliance with the municipal code language relating to construction site erosion is moderate. Items that would improve compliance include more inspection staff, changes in administrative procedures and revisions to the local ordinance.

Village of West Milwaukee: The village adopted a new comprehensive zoning ordinance in September 1989, which includes provisions for construction erosion control patterned after the model ordinance.

Stormwater Management. All counties and municipalities in the Menomonee River Watershed were surveyed regarding their current stormwater management practices and policies (Table 12). In most cases, counties do not require installation of stormwater management practices through county ordinance or policy. Exceptions include Milwaukee and Washington Counties which have existing plans and/or limited ordinances that require stormwater detention in some new development.

Ten of the 12 communities surveyed require curbs, gutters and storm sewers in all new development (Table 12). Most communities require roof downspout connections to storm sewers although exceptions occur where new storm sewer is available, or in certain types of development. Of the communities surveyed, only Mequon requires stormwater detention for new development.

Analysis of stormwater management techniques shows that certain best management practices (BMPs), such as infiltration and stormwater detention, can significantly reduce sediment and pollutant loading to streams. Adoption of stormwater management ordinances and use of stormwater management practices will be a priority in the implementation of this plan.

CUMULATIVE URBAN AND RURAL NONPOINT SOURCE ASSESSMENT

The following assesses existing 1985 and anticipated year 2000 urban and rural nonpoint source loads at four points in the Menomonee River system. The purpose of this analysis is to identify how pollutant loadings from nonpoint sources increase down river, and to understand the relative importance of different upstream sources at four specific points in the watershed. This information is critical to developing a nonpoint source control strategy for improving the water quality in the Menomonee River system and the Milwaukee Harbor Estuary.

Two pollutants—sediment and lead—are used for this analysis. Sediment generated from rural and urban sources has major impacts on water quality and aquatic habitat throughout the watershed. The sources and quantities of sediment under existing 1985 and planned year 2000 conditions are shown in Table 13. Total lead has been measured at elevated levels in the Menomonee River, and is representative of heavy metal loadings generated primarily from urban areas.

The four river points selected for this analysis are as follows:

River Point 1: On the main stem of the Menomonee River, one-half mile south of the Washington/Waukesha County line. The area draining to this point encompasses about 23 percent of the watershed and includes the Rockfield, Goldenthal, Willow Creek, Upper Menomonee and Germantown Subwatersheds.

River Point 2: On the main stem of the Menomonee River, one-quarter mile south of Silver Spring Drive. The area draining to this point encompasses 46 percent watershed and includes subwatersheds from Point 1 and the Victory Center, Middle Menomonee, Dretzka Park, Lilly Creek and Butler Ditch Subwatersheds.

Table 12. Summary of Selected Stormwater Management Practice/Policies for Local Units of Government in the Menomonee River Watershed.

Local Unit of Government	Are curbs, gutter and storm sewers required in new development?	Is roof downspout connection to storm sewers required?	Is storm water detention in new development required?
County			
Milwaukee	No jurisdiction or authority	No jurisdiction or authority	Yes[4]
Ozaukee	No	No	No
Washington	No	No	Yes[5]
Waukesha	No	No	No
City			
Brookfield	Yes	No	No
Greenfield	Yes	Yes[2]	No
Mequon	No	No	Yes
Milwaukee	Yes[1]	Yes	No
New Berlin	Yes	No	No
Wauwatosa	Yes	Yes	No
West Allis	Yes	Yes, commercial property only	No
Village			
Butler	Yes	Yes	No
Elm Grove	No	No	No
Germantown	Yes	No	No
Menomonee Falls	Yes	Yes[3]	No
West Milwaukee	Yes	Yes	No

1. Not required in planner urban development (POD) areas.
2. Not required where no storm sewer is available, optional for retrofitted development.
3. Required for commercial, industrial, and multi-family development.
4. As outlined in the Milwaukee Metropolitan Sewerage District (MMSD) Flood Control/Stormwater Drainage Plans.
5. Areas of 5 parcels or greater are covered under Washington County's Land Division Ordinance.

Table 13. Mass Balance of Sediment Sources in the Menomonee River Watershed: 1985 and Year 2000.

	Sediment Sources 1985					Sediment Sources Year 2000				
Subwatershed	Total Tons	Cropland Erosion	Stream Bank Erosion	Urban Runoff	Construction Erosion	Total Tons	Cropland Erosion	Stream Bank Erosion	Urban Runoff	Construction Erosion
Germantown	1,531	29%	0%	14%	57%	3,687	5%	0%	13%	82%
Goldenthal	228	72%	2%	12%	14%	743	18%	1%	16%	65%
Rockfield	258	76%	0%	1%	23%	198	98%	0%	2%	0%
Willow Creek	475	24%	0%	7%	69%	513	22%	0%	14%	64%
Upper Menomonee	488	68%	0%	2%	30%	399	82%	0%	3%	15%
River Point 1	2,980	42%	1%	9%	48%	5,540	17%	1%	12%	70%
Butler Ditch	431	9%	1%	28%	63%	1,720	0%	0%	12%	87%
Dretzka Park	350	26%	17%	23%	34%	1,351	2%	4%	18%	75%
Lilly Creek	1,392	20%	15%	10%	56%	2,903	1%	7%	10%	81%
Middle Menomonee	3,720	3%	16%	16%	65%	3,183	2%	18%	26%	54%
Victory Center	857	39%	0%	26%	35%	1,943	9%	0%	22%	69%
River Point 2	6,750	12%	14%	17%	58%	11,100	3%	8%	18%	71%
Granville	738	19%	0%	68%	12%	5,405	0%	0%	19%	81%
Little Menomonee	401	33%	12%	2%	52%	191	70%	26%	4%	0%
Mequon	174	64%	0%	2%	34%	786	11%	0%	2%	87%
Noyes Park	927	0%	0%	19%	81%	608	0%	0%	41%	59%
River Point 3	2,240	17%	2%	31%	50%	6,990	3%	1%	18%	78%
Dousman Ditch	609	0%	0%	20%	79%	829	0%	0%	24%	76%
Honey Creek	2,026	0%	2%	54%	45%	1,858	0%	2%	62%	36%
Lower Menomonee	6,181	0%	3%	19%	77%	1,818	0%	11%	70%	18%
Menomonee Valley	808	0%	0%	93%	7%	925	0%	0%	84%	16%
So Br Under	1,502	0%	2%	30%	68%	894	0%	3%	57%	40%
Underwood	1,914	0%	3%	27%	71%	2,176	0%	2%	31%	66%
River Point 4	13,040	0%	2%	32%	68%	8,500	1%	4%	54%	42%
WATERSHED TOTAL	25,010	10%	5%	25%	60%	32,130	5%	27%	4%	65%

Source: Wisconsin Department of Natural Resources.

River Point 3: On the Menomonee River's main stem just downstream from the confluence with the Little Menomonee River at Hampton Avenue. The area draining to this point encompasses about 64 percent of the watershed and includes the subwatersheds from Points 1 and 2 and the Mequon, Granville, Noyes Park and Little Menomonee Subwatersheds.

River Point 4: On the Menomonee River's main stem at the Falk Corporation Dam at South 37th Street. The area draining to this point encompasses about 95 percent of the watershed and includes the subwatersheds from Points 1, 2, and 3 and the Dousman Ditch, Underwood Creek, South Branch Underwood, Honey Creek and Menomonee Valley Subwatersheds.

RELATIVE SIGNIFICANCE OF SEDIMENT SOURCES

The cumulative annual sediment load to streams urban and rural nonpoint sources under existing 1985 and year 2000 conditions are shown in Table 14 and Map 10. The predominance of urban land uses and construction erosion are the most significant factors affecting the amount of sediment washing into streams.

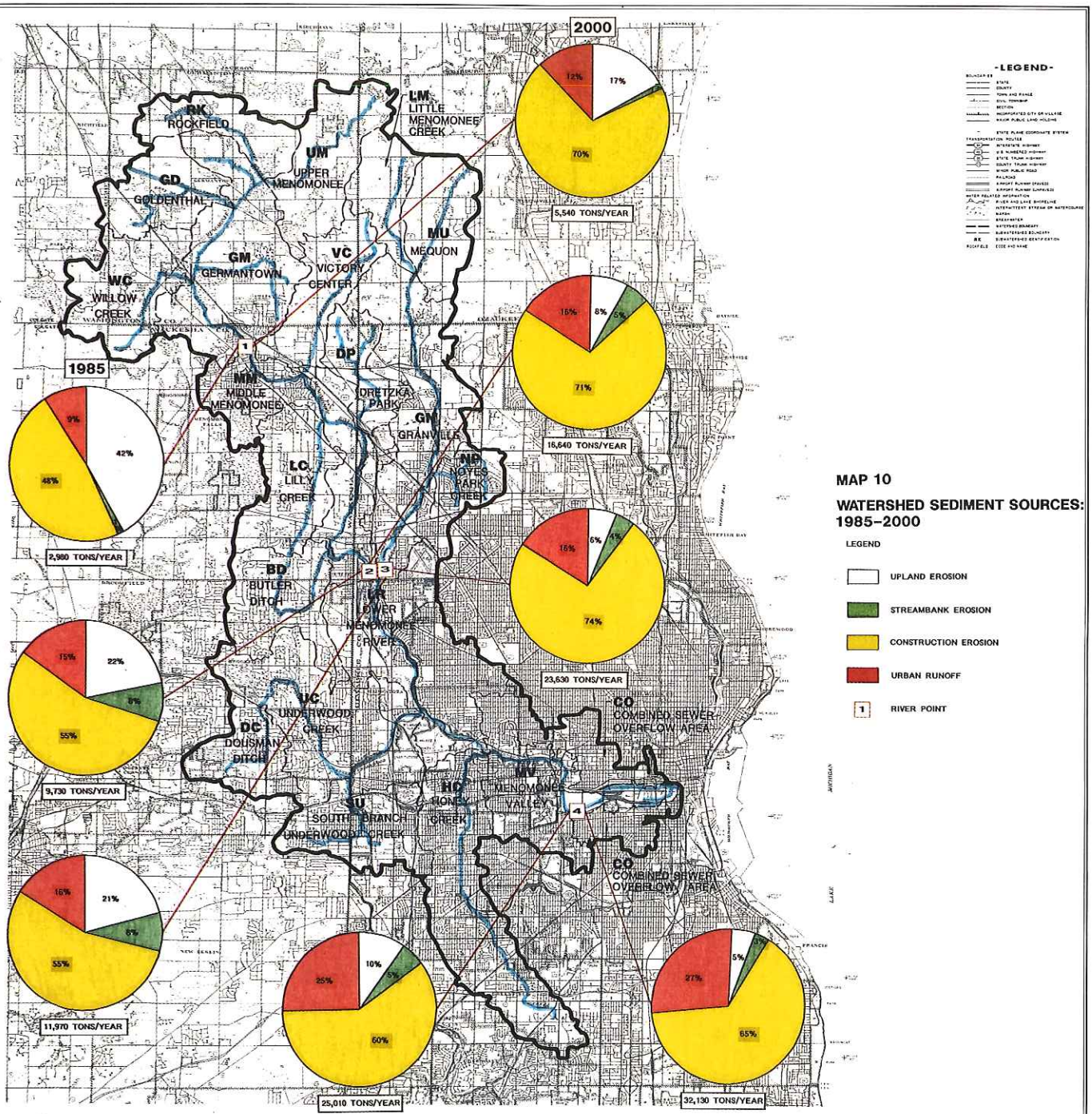
RELATIVE SIGNIFICANCE OF LEAD SOURCES

The amount of lead contributed to streams also increases downstream as more acres of urban land use are included. The most important urban land uses affecting lead loads are industrial and commercial areas, freeways, and high density residential development. As previously discussed, urban land uses with the greatest amount of impervious surface are the primary sources of pollutants. Lead is used as an indicator of the type and amounts of pollutants found primarily in urban runoff. As shown on Map 11, the increase in lead loading generally parallels sediment loading trends.

WATER RESOURCES OBJECTIVES

The objectives of this plan focus on achieving optimum biological and recreational uses in the Menomonee River and its tributary streams. These objectives provide the basis for controlling nonpoint pollution, and provide a basis for a water quality evaluation to be conducted for the project upon its completion.

The following objective statements are tied closely to Wisconsin's stream classification system. Generally, the objective will be either to "protect," "enhance," or "improve" the existing biological and recreational use of a surface water.



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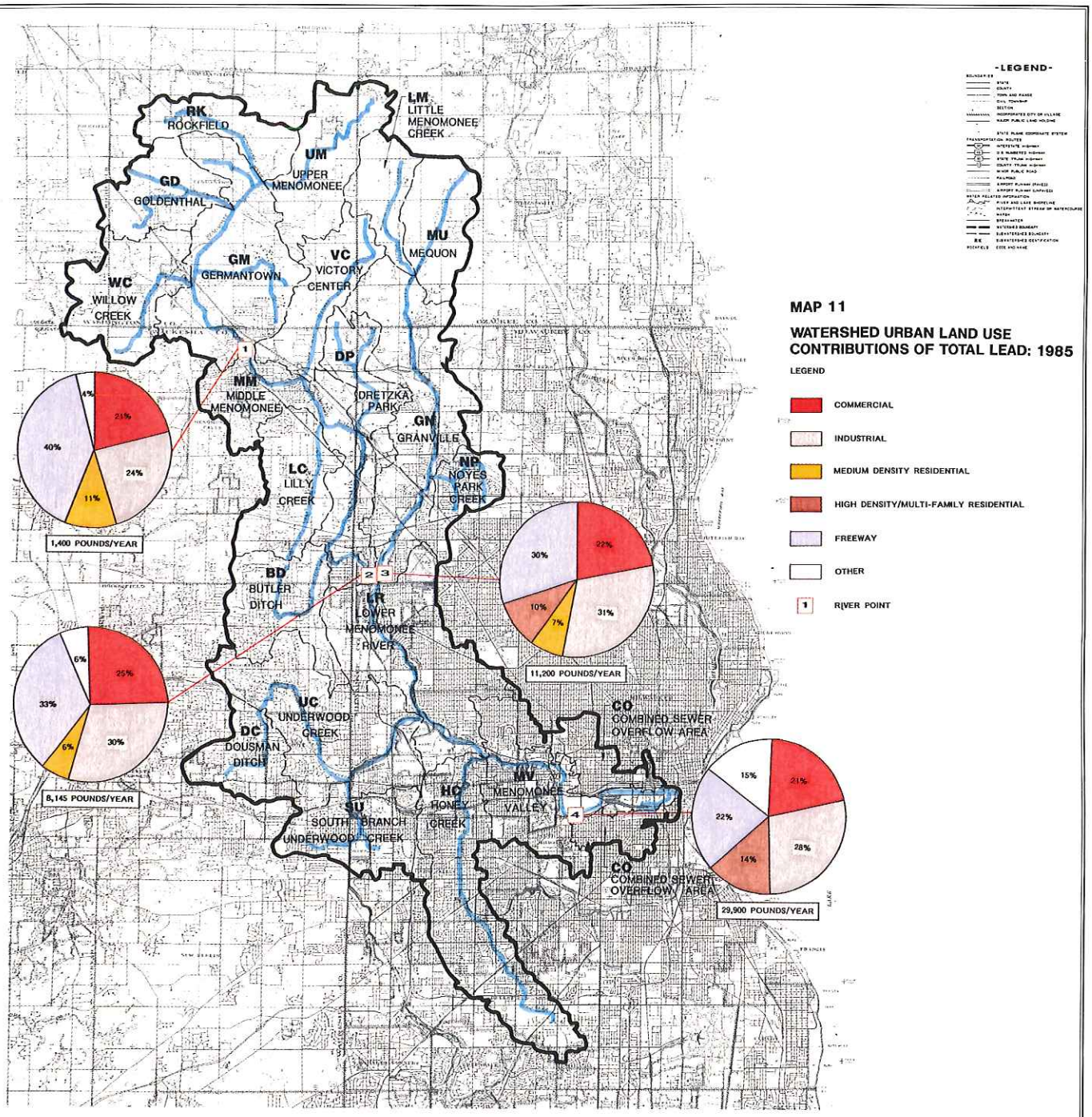

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Table 14. Sediment And Total Lead Loads From Urban Sources At Selected Points In The Menomonee River Watershed: 1985 & Year 2000.

River Point	Contributing Subwatersheds(1)	Sediment Load (tons/yr) 1985	2000(2)	Change	Lead Load (lbs/yr) 1985	2000	Change
1	RK,GD,WC,UM,GM	2,980	5,540	86%	1,400	3,195	128%
2	RK,GD,WC,UM,GM, VC,MM,DP,LC,BD	9,100	16,010	76%	8,145	14,375	76%
3	RK,GD,WC,UM,GM, VC,MM,DP,LC,BD, LM,MU,NP,GN	11,340	23,000	103%	11,200	20,590	84%
4	RK,GD,WC,UM,GM, VC,MM,DP,LC,BD, LM,MU,NP,GN,LR, DC,UC,SU,HC,MV	24,380	31,500	29%	29,900	41,700	39%

1. Abbreviations are: RK=Rockfield; GD=Goldenthal; WC=Willow Creek; UM=Upper Menomonee; GM=Germantown; VC=Victory Center; MM=Middle Menomonee; DP=Dretzka Park; LC=Lilly Creek; BD=Butler Ditch; LM=Little Menomonee; MU=Mequon; NP=Noyes Park; GN=Granville; LR=Lower Menomonee; DC=Dousman Ditch; UC=Underwood Creek; SU=South Branch Underwood; HC=Honey Creek; MV=Menomonee Valley.

2. This estimate considers the decrease in rural sediment delivery occurring as these lands urbanize.

Source: Wisconsin Department of Natural Resources.

"**Protection**" is used for streams fully supporting their potential biological and recreational uses. Controlling nonpoint sources is necessary to assure that the resource quality is maintained. For example, if a stream is supporting a healthy warm water sport fish population, this objective seeks to protect that use.

"**Enhancement**" is used for streams that are moderately degraded and only partially meeting their potential biological and recreational uses. Controlling nonpoint sources is necessary to enhance water quality to support a healthier aquatic community. For example, nonpoint source controls may result in a more widely diverse and vigorous forage fish community by restoring lost habitat, even though natural conditions preclude the stream from ever supporting a warm water sport fish population.

"**Improvement**" is used for streams that are severely degraded and not meeting their potential biological and recreational uses. In this case, nonpoint source controls can help achieve potential uses for the stream that cannot otherwise be attained. For example,

nonpoint source controls may result in a stream moving from supporting a limited forage fish community to a healthy warm water sport fishery.

In many cases other cultural factors that limit these water resources, such as point sources, channelization, dams, or limited public access, will also need to be rectified to see the full benefits of nonpoint source controls. Management needs addressing these issues are set forth in the Milwaukee River Integrated Basin Management Plan: 2000, Volume 5, Menomonee River Watershed Integrated Resources Management Plan (WDNR, 1990).

Water resources objectives are presented below. The objectives will be met in a manner consistent with the protection of existing fish and wildlife habitat, including wetlands. In addition, opportunities will be sought to achieve nonpoint source pollution reduction goals in ways that enhance currently degraded fish and wildlife habitat, such as through the use of restored wetlands and shoreline buffers.

The water resource objectives for the Menomonee River and its tributaries focus on providing environmental conditions which allow the watershed's streams to fully achieve their potential biological uses. These potential uses were described earlier in this chapter and shown on Map 4. Achieving the objectives will mean that 80 miles of stream, or more than 50 percent, will support warm water sport/forage fish communities. This compares with current conditions under which only 38 percent of the Menomonee River and its principal tributaries are fully supporting their potential biological uses.

In summary, reducing pollutants from nonpoint sources could result in significant improvement in water quality and aquatic habitat in an estimated 76 miles of streams. Application of the "protection, enhancement, and improvement" objectives to the watershed's streams in the watershed are presented below.

1. **Protect** 25.5 miles of perennial and intermittent streams currently meeting their potential biological uses.

2. **Enhance** 92.0 miles of perennial and intermittent streams partially meeting their potential biological uses.

3. **Improve** 35.7 miles of perennial and intermittent streams not meeting their potential biological uses.

POLLUTION REDUCTION GOALS

The following discussion establishes pollution reduction goals which target the control of sediment and phosphorus in rural areas and control of sediment, phosphorus, urban toxic materials, and stream flow changes in urban areas.

SEDIMENT AND PHOSPHORUS REDUCTION GOALS

As previously discussed, extensive water quality and aquatic habitat investigations were conducted as part of the planning effort for the Menomonee River Watershed Project. The results indicated that significant reductions were needed in the amount of sedimentation and nutrient (phosphorus) loadings to achieve the watershed's water quality objectives. A determination of the needed reductions was made by comparing the findings of these field investigations with the results of the urban and rural nonpoint pollution sources analyses.

Overall a 50 percent reduction in the existing 1985 sediment loading is needed to improve the aquatic habitat in nearly all streams in the watershed. This level will eventually reduce the amount of embeddedness of sediment in the stream bottom and enhance their ability to support healthier and more diversified aquatic communities.

In addition, a high reduction level (50 percent to 70 percent) in phosphorus loading to most streams is needed to reduce the prevalence of excessive aquatic weed and algae growth.

Specific goals are not established for stream flow. However, maintenance of base flow conditions is an important element of improving aquatic habitat in most of the smaller streams in the rural portions of the watershed. Wetland drainage and channelization has contributed erratic stream flow and reduced capacities to support healthy aquatic communities. In urbanizing areas, increased urban land use results in greater amounts of runoff reaching streams. The "flashy" conditions often result in accelerated streambanks erosion, bottom scour, and in some cases flooding. Implementation of structural and non-structural best management practices for controlling rural and urban nonpoint sources will seek to reduce the fluctuating nature of stream flow in many of the watershed's streams.

URBAN TOXICS REDUCTION GOALS

The most important means for improving water quality in the Menomonee River and its tributaries is to reduce the concentrations of heavy metals and other toxic materials in urban runoff. As previously discussed, lead is being used as an indicator pollutant for evaluating the impact of urban runoff on water quality. Two criteria were used to establish reductions goals for lead.

The first is the reduction of lead concentrations needed in urban storm water runoff to meet acute toxicity standards in Chapter NR 105 of the Wisconsin Administrative Code. Table 15 summarizes calculated lead concentrations in urban storm water runoff for each subwatershed. Measured data for three streams—Honey Creek, Noyes Park Creek, and Underwood Creek—compare well with these calculated concentrations. This analysis indicates the reduction in lead concentrations to achieve the acute toxicity ranged from a low 35 percent in the Rockfield subwatershed to a high of 71 percent in the Victory Center Subwatershed. Watershedwide a 53 percent reduction in lead concentrations is needed to achieve a level below the acute toxicity standard.

Table 15. Flow-Weighted Average Annual Concentrations of Lead and Estimated Pollutant Reductions Needed to Achieve Levels Which are Below State Standards For Acute Toxicity.(1)

Subwatershed	Total Lead (ug/l)(2)	% Reduction Needed
OZAUKEE COUNTY		
Mequon	42	0%
Little Menomonee	152	0%
WASHINGTON COUNTY		
Germantown	319	47%
Goldenthal	412	59%
Rockfield	261	35%
Upper Menomonee	145	0%
Victory Center	582	71%
Willow Creek	275	38%
WAUKESHA COUNTY		
Butler Ditch	295	42%
Dousman Ditch	311	45%
Lilly Creek	367	54%
Middle Menomonee	444	62%
South Branch		
Underwood Creek	374	55%
Underwood Creek	347 (330)(3)	51%
MILWAUKEE COUNTY		
Dretzka Park	485	65%
Granville	312	46%
Honey Creek	320 (380)(3)	47%
Lower Menomonee	361	53%
Menomonee Valley	368	54%
Noyes Park	272 (140)(3)	38%
WATERSHED TOTALS	358	53%

1. Calculated for existing 1985 conditions.
2. Acute toxicity standard (NR 105 of the Wisconsin Administrative Code) for lead is 61 ug/l (hardness of 24 mg/l $CaCO_3$).
3. Based on monitored in-stream data for 1976 and 1977.

Source: Wisconsin Department of Natural Resources.

The second criterion is the reduction of lead concentrations needed in the Menomonee River to achieve the chronic toxicity standards in Chapter NR 105 of the Wisconsin Administrative Code. The following discussion focuses on the rational for lead reduction goals in the Menomonee River Watershed.

Reduction Needed to Meet Acute Effluent Toxicity Standards. The first criterion is the reduction needed in lead concentrations of urban runoff in order to meet acute toxicity standards under NR 105 Wis. Adm. Code. These surface water standards are set so as not to exceed the LC-1. The LC-1 is the concentration that results in one percent mortality of the test animal populations exposed to the contaminant. The exposure period is 96 hours for fish and 48 hours for invertebrates.

Historically, urban runoff in the Milwaukee area has been shown to contain concentrations of heavy metals that often exceed the surface water quality standards for acute toxicity (Bannerman et al, 1983). Table 16 shows the toxicity of urban runoff monitored from different land uses in the Milwaukee area during 1980-1982, using a stormwater hardness of 100 mg/l (milligrams per liter) and LC-1 toxicity standards of 170 ug/l (micrograms per liter) for lead, 17 ug/l for copper, and 103 ug/l for zinc. Table 16 shows the percent of monitored storm events for which the event mean concentration of the runoff exceeded the LC-1. Lead and zinc concentrations of runoff collected from commercial areas, parking lots, and high density residential areas, exceeded the toxicity standards most often. Copper concentrations of runoff from commercial areas also frequently exceeded the toxicity standards.

Table 16. Percent of Urban Stormwater Runoff Samples Exceeding State of Wisconsin Fish and Aquatic Life Acute Toxicity Standards for Heavy Metals.

Land Use	Lead	Zinc	Copper	Cadmium
Commercial	90%	90%	>50%	0%
Parking Lots	45%	55%	>10%	0%
High Density Res.	70%	75%	>10%	0%
Med. Density Res.	20%	30%	>10%	0%

Source: Wisconsin Department of Natural Resources

Table 15 shows the calculated average annual concentrations of lead in stormwater runoff for subwatersheds, and the degree to which these calculated concentrations exceed the LC-1 toxicity standard for lead. These calculations also assume a stormwater hardness of 100 mg/l and an LC-1 standard of 170 ug/l. In addition, they assume that all urban runoff occurring from each subwatershed is collected over a one-year period and completely mixed. Since stormwater concentrations vary by land use, and since the proportion of various land uses contributing to any one stormwater pipe also varies, this last assumption will result in overestimating concentrations in some areas and underestimating in others. The estimates are best where the urban development is dense, and a number of different land uses contribute to any particular storm sewer pipe. This is supported by measured data from three subwatersheds in the Menomonee River Watershed, where monitored and calculated values compare favorably.

Table 15 shows that the calculated average annual lead concentrations for most subwatersheds can be expected to exceed the LC-1 toxicity standard for lead by substantial amounts. The range of exceedences for each subwatershed in the table is a result of different assumed land use mixtures. The upper end of each range is calculated using runoff from "critical land uses." The lower end of each range assumes that runoff from all urban land uses is mixed. The general effect of changing assumptions about contributing land uses is seen to be significant in many areas.

Although the state of Wisconsin does not currently regulate stormwater discharges using numeric effluent limitations, it does use effluent limitations to regulate point source discharges from industries and municipalities. Effluent limitations are developed to assure that the LC-1 acute toxicity standards are met in the receiving waters. Where base flows in receiving waters are sufficient to dilute the effluent, the effluent discharge limits are set based on the LC-50, which is about two times greater than the LC-1.

Table 17 shows the percent reduction needed in urban pollutant concentrations from several different land uses in order to meet an LC-50 target. This table was developed from data collected during 1990 primarily from commercial and medium density residential areas in the cities of Milwaukee and Madison. This data was extrapolated to make estimates for the other listed land uses. It should be noted that the hardness of the stormwater was measured at 25 mg/l. This low level of water hardness greatly increases toxicity above that which would occur at a hardness of 100 mg/l. At this lower hardness level, the LC-50 acute toxicity concentrations are 61 ug/l for lead, 66 ug/l for zinc, 9 ug/l for copper, and 12 ug/l for cadmium.

Table 17 shows that the event mean concentrations in stormwater runoff from several land uses are significantly greater than the LC-50 concentrations for acute toxicity for lead, zinc, and copper. Concentrations of these three metals in runoff from commercial, industrial, and freeway land uses significantly exceed the LC-50. Concentrations of zinc and copper are also significantly higher than the LC-50 for institutional and high density land uses. High density residential area runoff is also high in lead, but the concentrations exceed the LC-50 by a lesser amount than these other exceedences.

The data presented in Tables 17, 18 and 19 all indicate that significant reductions will be needed to reduce the concentrations of metals in urban runoff to levels that will allow attainment of acute toxicity standards. The final identification of the reductions needed

for individual storm sewer pipes will have to be evaluated on a case-by-case basis during project implementation.

Table 17. The Percent By Which Average Event Mean Concentrations Of Metals In Urban Runoff Exceed The Acute LC-50 Concentrations For Fish And Aquatic Life.*

Land Use	Lead	Zinc	Copper	Cadmium
Low Density Residential(1.)	0%	0%	0%	0%
Med. Density Residential(2.)	0%	0%	0%	0%
High Density Residential(1.)	18%	70%	69%	0%
Commercial(2.)	51%	81%	81%	0%
Industrial(1.)	51%	81%	81%	0%
Institutional(1.)	0%	68%	50%	0%
Parks, Open(1.)	0%	0%	0%	0%
Freeway(1.)	95%	86%	81%	0%

* LC-50 concentrations are: 60 ug/l for lead, 66 ug/l for zinc, 9 ug/l for copper, and 12 ug/l for cadmium. Stormwater hardness is 25 ug/l. Samples were analyzed for recoverable metals and compared to the LC-50 to calculate percent exceedences.

1. Based on monitoring data collected for these land uses during 1990.
2. Based on extrapolation of monitoring data to these land uses.

Urban versus Rural Streams Impairments—Water quality monitoring and fishery survey information for the main stem of the Menomonee River collected between 1973 and 1978 provide for a comparison of rural and urban land use impacts on the same stream. The following discusses a comparison of fishery, water quality, and bottom sediment conditions for rural and urban areas of the Menomonee River.

Fishery. The results of a surveys conducted in 1973 indicated that only fish species tolerant of pollution and poor habitat conditions were present in all reaches of the

Menomonee River. Importantly, the number of fish declined dramatically from the rural to the urban reaches of the stream.

The fish populations would be expected to be larger in the downstream urban parts of the stream, given the larger size and more diverse habitat. The average number of fish surveyed at each site was 800, 165, and 20 in the upper, middle and lower reaches of the stream, respectively (SEWRPC, 1976). The surveyed areas in the upper reaches had an average of 40 times more fish than the sites in the urbanized downstream reaches.

The results of a 1984 fish survey on the Menomonee River revealed that the number of species of fish declined from 13 in the river reaches above the village of Menomonee Falls to three species in the lower urbanized reaches. This survey found more pollutant intolerant fish than the 1973 survey, and the increase was probably due to the closing of two wastewater treatment plants.

Water Quality. The concentration of pollutants was monitored during runoff events at both rural and urban reaches of the Menomonee River. The drainage area directly adjacent to three monitoring sites was selected as the boundary of the upper, middle and lower reaches of the river (Bannerman et al, 1983). The annual flow weighted event concentrations of suspended solids, and total lead increased ten times from the upper to lower reaches of the river. The concentrations of suspended solids and lead at the rural site were 50 mg/l (milligrams per liter) and 0.024 mg/l respectively. The concentrations of suspended solids and total lead for the urban site were 990 mg/l and 0.22 mg/l respectively. Total phosphorus concentrations were about the same at all monitoring sites.

Bottom Sediments. The higher flow weighted concentrations of lead in the urban reaches of the Menomonee River were reflected by higher concentrations of lead in the bottom sediments in the lower reaches of the river. The sand and silt size fraction of the bottom sediments in the urban reaches had total lead concentrations four times the concentrations of 33 ug/g and 12 ug/g (micrograms per gram) respectively in the upstream reaches and 301 ug/g and 63 ug/g respectively in the lower reaches.

The average concentration in the clay and silt size fraction of the predominant soils in the Menomonee River Watershed were 48 ug/g and 11 ug/g respectively (Dong, 1979). The similarity between the total lead concentration in the soils and the bottom sediments in the rural reaches indicate the rural bottom sediment is not contaminated. This contrasts with lead levels in the bottom sediments in the urban reaches which have moderate levels of contamination.

CHAPTER V
NONPOINT SOURCE CONTROL NEEDS

INTRODUCTION

This chapter identifies the nonpoint source controls to be implemented under the Menomonee River Priority Watershed Project. These controls are based primarily on water quality information, the results of the nonpoint source evaluations, and the levels of reduction for sediment, phosphorus, fecal contamination, heavy metals, and hydraulic scour needed to achieve the water quality objectives.

The first portion of this chapter addresses rural nonpoint source control needs. It defines management categories for each nonpoint source. These categories account for the severity, need for control, and feasibility of controlling each nonpoint source. The management categories are used to define which sources are eligible for financial and technical assistance under the priority watershed project.

The second section addresses urban nonpoint source control needs. It identifies basic best management practice alternatives for established and developing urban areas and evaluates alternatives based on their abilities to meet water resource goals. Selected alternatives and management actions for each local unit of government in the watershed are presented. Finally, this section sets forth a conceptual framework for implementing the urban best management practice needs.

As previously discussed, man-induced and natural factors beyond the scope of the priority watershed project affect water resources in this watershed. Management actions related to point source pollution control, fisheries management, wildlife management, and recreation are discussed in the previously referenced Menomonee River Watershed Integrated Resource Management Plan (WDNR, 1990).

RURAL NONPOINT SOURCE CONTROL NEEDS

NONPOINT SOURCE MANAGEMENT CATEGORIES

Management categories determine the eligibility of specific nonpoint sources for financial and technical assistance under the priority watershed project. Management categories are based on the need to control specific sources to meet water resources objectives. Sources are placed in management categories based on:

* Biological and recreational potential of streams.

* Current or expected future impacts of nonpoint sources on those biological and recreational uses.

* Subwatershed pollution load reductions needed to achieve desired water quality conditions in tributary streams.

* Pollutant load reductions needed to achieve water quality objectives at selected points along the Menomonee River.

Management categories are established for each major nonpoint source. These include: barnyard runoff, manure spreading, eroding uplands, and streambank erosion or general degradation. Each pollution source, such as an individual barnyard or a specific cropped field, is assigned a management category depending on eligibility criteria.

The basic management categories used in this project and their implications for funding are described below.

* ***Management Category I***: Sources in this category together contribute a significant amount of the pollutants impacting surface waters. A reduction in their pollutant load is essential for achieving the priority watershed project's water quality objectives.

  Nonpoint sources in this category are eligible for funding and/or technical assistance under the priority watershed project. As a condition of funding, control of all pollution sources in this category is required as part of any cost-share agreement. For example, if a landowner has several pollution sources on his/her property—barnyard, streambank erosion, cropland erosion—in this category, all of these sources need to be controlled to meet the conditions of the agreement.

* ***Management Category II***: Sources in this category together contribute less of the pollutant load than those in Management Category I. However their control may be important achieving water quality objectives. Most often they are identified to offset sources in Management Category I which may not be controlled. In some cases, sources are placed in this category because of the technical feasibility for control.

  Nonpoint sources in this category are also eligible for funding and/or technical assistance under the priority watershed project. Inclusion of sources in this category on cost-share agreements is optional. An example is a landowner whose barnyard is considered Management Category I but who also has areas of cropland erosion in Management Category II. The cost-share agreement for control of the barnyard runoff need not stipulate control of the cropland erosion, however, county project staff implementing the project will encourage control of all Management Category II sources.

* ***Management Category III***: Sources in this category do not contribute a significant amount of the pollutants affecting surface waters and are not eligible for funding and/or technical assistance under the priority watershed project.

  Other DNR programs (wildlife and fisheries management) can, if warranted, assist county project staff to control these sources. This may take the form of

technical assistance, application of program funds to create wildlife habitat, or soliciting the help of local conservation groups for funds or labor. Such efforts will occur as part of implementing this watershed's integrated resource management plan.

Additionally, coordinating nonpoint source control efforts with other programs such as the federal Food Security Act and the state Farmland Preservation Program may also assist conservation efforts.

CHANGE IN MANAGEMENT CATEGORY

The priority watershed project offers flexibility during implementation for reassigning pollution sources to a different management category. For example, this may be necessary as a result of a change in farm operation, or other circumstances having occurred since completion of the inventories. Changes must be consistent, however, with the management category criteria for each nonpoint pollution source.

MANAGEMENT CATEGORY CRITERIA FOR BARNYARD RUNOFF

Management category criteria were established for barnyards draining to rivers, streams and riparian wetlands. The criteria are expressed in terms of the pounds of phosphorus delivered to surface waters under the 10-year, 24-hour storm. As discussed below, barnyards draining to areas covered with deep (over 60" thick) mineral soils or with confined animals were not assigned specific management category criteria. In this watershed, these are not significant pollution sources.

Barnyards Draining to Surface Water or Riparian Wetlands: Management category criteria were established to reduce phosphorus loading from these barnyards by 70 percent. This is the level needed to achieve the pollution control objectives identified in Chapter IV, "Water Resources Conditions, Nonpoint Sources, and Water Resources Objectives." The management category criteria shown in Table 18 generally are consistent with that for barnyards in other watersheds of the Milwaukee River Basin.

The result of applying these criteria to the 36 barnyards draining to surface waters is shown in Table 19.

The result is that six barnyards, are eligible for funding under the priority watershed project. Five barnyards constituting 80 percent of the phosphorus load from these sources, are classified as Management Category I. One additional barnyard is classified as Management Category II. As shown on Map 12, the six eligible sites are located in the Mequon and Little Menomonee Creek Subwatersheds in Ozaukee County.

The efficiency of the control practices and the choice of a pollution load design target for each barnyard will affect the reduction in the barnyard pollution loading. For example, if practices are 85 percent efficient, then the actual level of barnyard pollution control achievable under this control plan is closer to 80 percent for the watershed. In addition, not all targeted barnyards need to be equipped with controls designed to

control 100 percent of the pollutant loads. Residual pollutant loads following practice installation should not exceed five pounds of phosphorus under the 10-year, 24-hour rainfall event. Reducing the barnyard pollution load below this point may not be cost-effective.

Table 18. Criteria and Management Categories for Barnyards Draining to Surface Water in the Menomonee River Watershed.

Phosphorus Per Barnyard	Management Category	Phosphorus Reduction
20 pounds or more	I	80 percent
10 to 20 pounds	II	85 percent
less than 10 pounds	III	15 percent

Source: Wisconsin Department of Natural Resources and the Wisconsin Department of Agriculture, Trade and Consumer Protection.

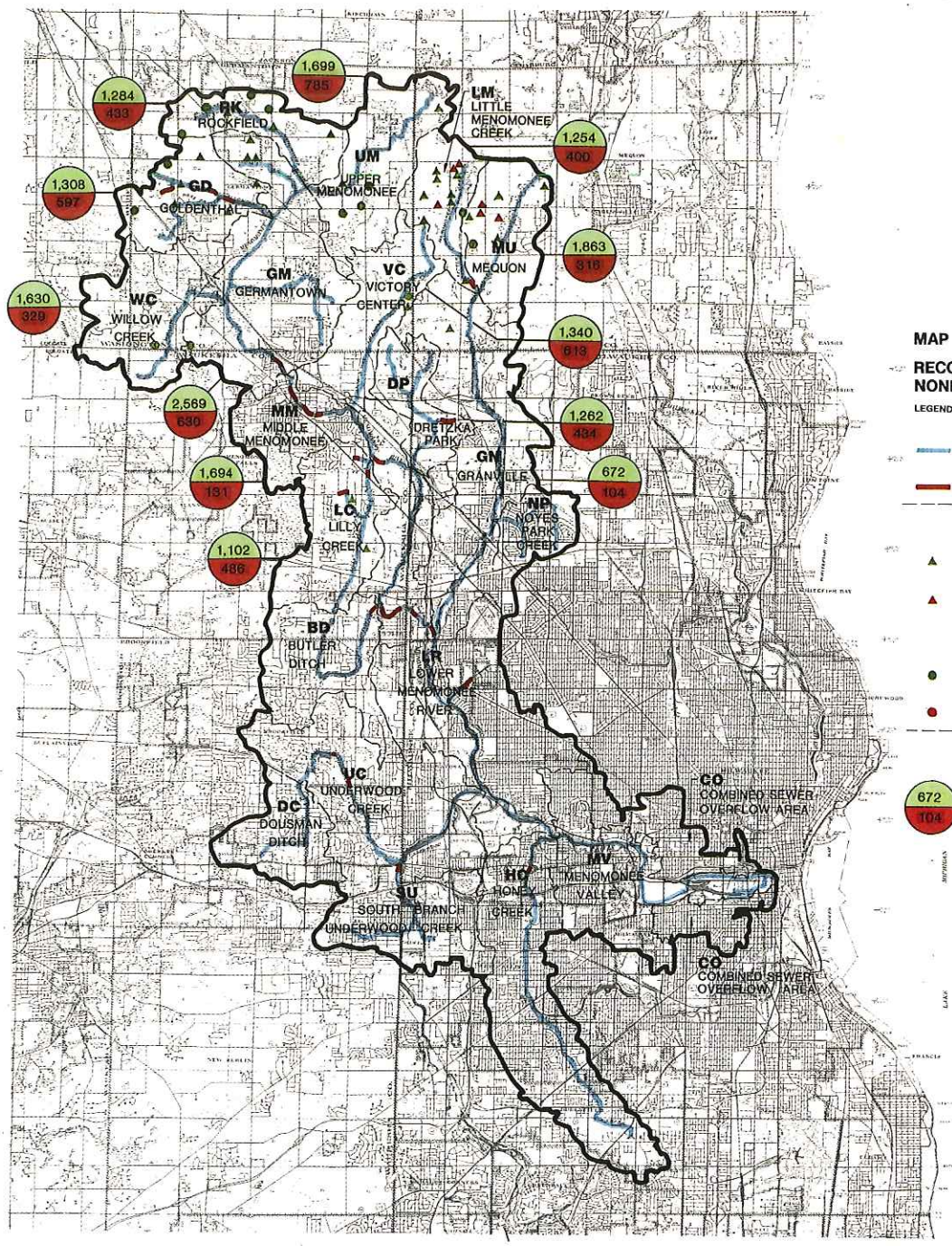
Table 19. Barnyards Draining to Surface Waters Targeted for Control in the Menomonee River Watershed.

	Management Category I		Management Category II		Total		
Subwatershed[1]	Number of Barnyards	Pounds Phosphorus	Number of Barnyards	Pounds Phosphorus	Number of Barnyards	Pounds Phosphorus	Runoff Control
Little Menomonee Creek	2	71	1	12	3	83	95 percent
Mequon	3	181	--	--	3	181	85 percent
TOTAL	5	252	1	12	6	264	85 percent

Source: Wisconsin Department of Natural Resources and the Wisconsin Department of Agriculture, Trade, and Consumer Protection.

The combined effect of choosing a design target of five pounds phosphorus which assumes an 85 percent efficiency of prescribed best management practices provides a 65 percent level of reduction in barnyard pollution loading in the watershed. The barnyard pollution control, which this strategy offers, will be sufficient to meet phosphorus reduction goals and will significantly decrease the degree of fecal bacteria contamination.

Barnyards Draining to Internally Drained Areas Overlain with Deep Mineral Soils: Six barnyards with a combined phosphorus load of 27 pounds drain to internally drained areas overlain with deep (more than 60 inches) mineral soils. Generally, these sites have limited potential for surface or groundwater contamination. Consequently, they are



SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

MILWAUKEE RIVER
MENOMONEE RIVER WATERSHED
MILWAUKEE, OZAUKEE, WASHINGTON, AND WAUKESHA COUNTIES WISCONSIN

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

assigned to Management Category III, and are not eligible for cost-sharing and/or technical assistance.

Confined Animal Operations: The eight livestock operations which have animals confined most of the time are not a significant source of phosphorus. They are assigned to Management Category III, and are not eligible for cost-sharing and/or technical assistance.

MANAGEMENT CATEGORY CRITERIA FOR LIVESTOCK MANURE SPREADING

Management categories were developed for livestock operations based on the pollution potential associated with winter-spreading manure in critical areas. For purposes of this assessment, a livestock operation is defined as one or more barnyards owned by the same operator who spreads manure in the same geographic area.

Critical areas are defined as lands having slopes of at least six percent or that are located in flood-prone areas. Manure spread in critical areas has a high probability of contaminating surface waters with phosphorus, bacteria, and other pollutants during the periods of heavy rain and snowmelt. Management category criteria are expressed as the number of critical acres winter-spread with manure annually.

Management category criteria were established to reduce pollution from these sources by about 70 percent, the necessary level to achieve water quality objectives. It also maintains as much consistency as possible with management category criteria established for this source in other watersheds of the Milwaukee River Basin. Table 20 shows the general criteria used in this watershed for placing livestock operations into management categories.

Table 20. Criteria and Management Categories for Livestock Operations that Spread Manure During Winter in the Menomonee River Watershed.

Number of Critical Acres Spread Annually	Management Category	Phosphorus Reduction
15 acres or more	I	25 percent
7 to 15 acres	II	55 percent
0 to 7 acres	III	20 percent

Source: Wisconsin Department of Natural Resources and the Wisconsin Department of Agriculture, Trade and Consumer Protection.

Table 21 shows the results of applying the management category criteria to the livestock operations in the watershed. Management Category I includes two livestock operations and Management Category II includes an estimated eight livestock operations. Together, these categories include 20 percent of the livestock operations and about 80 percent of the estimated critical acres winter-spread with manure annually.

Table 21. Livestock Operations Targeted for Control of Winter Spreading Manure in the Menomonee River Watershed.

Management Category	Livestock Operations Number	Livestock Operations Percent	Critical Acres Spread Number	Critical Acres Spread Percent
I	2	4 percent	33	25 percent
II	8	16 percent	73	55 percent
TOTAL	10	20 percent	106	80 percent

Source: Wisconsin Department of Natural Resources and Wisconsin Department of Agriculture Trade and Consumer Protection.

As discussed for barnyard pollution control, the pollution potential of manure spreading for targeted livestock operations does not need to be reduced to zero. At a minimum, targeted livestock operations should reduce critical acres winter-spread with manure down to five acres. This would afford a 60 percent reduction in the watershed pollution loading from targeted livestock operations. Control beyond this level should consider incremental costs to determine if additional control is cost effective.

This identification of high priority livestock operations does not determine eligibility for technical and/or cost-share assistance. The actual number of critical acres spread for each livestock operation will be recalculated by land conservation department staff during project implementation. The new information and the criteria in Table 19 will be used to assign updated management categories to each livestock operation.

MANAGEMENT CATEGORY CRITERIA FOR ERODING UPLANDS

Management category criteria were established for eroding uplands contributing sediment to rivers and streams. The criteria are expressed in terms of tons of sediment delivered annually to rivers and streams. Specific criteria were not developed for eroding uplands impacting wetlands. The means for addressing these areas are discussed below.

Uplands Delivering Sediment to Rivers and Streams: Eroding uplands contribute more than 40 percent of the sediment load to surface waters in the Washington and Ozaukee County portions of the watershed. They will continue to be an important localized