A Nonpoint Source Control Plan for the Milwaukee River South Priority Watershed Project

MILWAUKEE RIVER
Priority Watersheds Program

Prepared by the **Wisconsin Department of Natural Resources** and the **Department of Agriculture, Trade, and Consumer Protection** in Cooperation with the **Ozaukee County Land Conservation Department** and the **Milwaukee River South Advisory Subcommittee**

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A NONPOINT SOURCE CONTROL PLAN FOR THE MILWAUKEE RIVER SOUTH PRIORITY WATERSHED PROJECT

The Wisconsin Nonpoint Source Water Pollution Abatement Program

This Plan was Cooperatively Prepared by:

Wisconsin Department of Natural Resources
Wisconsin Department of Agriculture, Trade and Consumer Protection
Milwaukee River South Watershed Citizens Advisory Committee
and the Counties of: Ozaukee and Milwaukee

December 1991

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September 19, 1991

File Ref: 3200

Mr. David Schultz, Executive, Milwaukee County
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Mayor John O. Norquist, City of Milwaukee
Mr. James Gormley, President, Village of Whitefish Bay
Mr. Michael Schulte, President, Village of Shorewood
Mayor Donald Voith, City of Glendale
Mr. Carl Weigell, President, Village of River Hills
Mr. Perry Cohn, President, Village of Bayside
Mr. Earl McGovern, President, Village of Brown Deer
Mr. Jerome Hardt, President, Village of Fox Point

I am pleased to be able to approve the Milwaukee County portion of A Nonpoint Source Control Plan for the Milwaukee River South Priority Watershed Project. I am taking this action under NR 120.08(2)(cr) Wis. Adm. Code. This action follows recommendations for approval of the waterhsed plan by: the Milwaukee River Basin Citizens' Advisory Committee (November 20, 1990), the Ozaukee County Board of Supervisors (December 5, 1990), the Wisconsin Department of Agriculture, Trade and Consumer Protection (February 8, 1991), and the Milwaukee County Board of Supervisors (September 5, 1991).

This approval authorizes the Department to make grants under its Nonpoint Source Water Pollution Abatement Program for the control of urban and rural nonpoint pollution sources in those portion of Milwaukee County and its incorporated municipalities that are 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.

Thank you for your cooperation 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

N1002-1S
cc: Gloria McCutcheon, Director, DNR Southeast District
Christine Bastian, Urban Co-Chair, Milwaukee River Basin Citizens' Advisory Committee
County Board Supervisor Reuben Schmahl, Rural Co-Chair, Milwaukee River Basin Citizens' Advisory Committee
Richard Farrenkopf, Chairman, Menomonee River Watershed Advisory Subcommittee

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February 11, 1991

File Ref: 3200

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I am pleased to be able to approve the *Ozaukee County portion* of A Nonpoint Source Control Plan For The Milwaukee River South 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 on November 20, 1990, and approval of the plan by the Ozaukee County Board of Supervisors on December 5, 1990 and by the Wisconsin Department of Agriculture, Trade, and Consumer Protection on February 8, 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 portions of *Ozaukee County and its incorporated municipalities* 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 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

Mayor Norbert Hynek, Urban Co-Chair, Milwaukee River Basin Citizens' Advisory Committee

County Board Supervisor Reuben Schmahl, Rural Co-Chair, Milwaukee River Basin Citizens' Advisory Committee

Mr. Robert Chernow, Chairman, Milwaukee River South Watershed Advisory Subcommittee

State of Wisconsin
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801 West Badger Road
PO Box 8911
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February 6, 1991

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

Dear ~~Mr. Baker~~ Bruce:

The Department has reviewed A Nonpoint Source Control Plan for the Milwaukee River South Priority Watershed Project. Our review included the revisions which have been made to the plan resulting from the public hearings and the comments of the advisory subcommittees involved. We hereby approve this watershed plan and look forward to assisting the Department of Natural Resources and Ozaukee County in implementing this project.

I recommend that DNR move forward with implementing the watershed plan in the rural areas within Ozaukee County. The rural portion of the project should move forward regardless of the action taken by the Milwaukee County Board and the urban implementation portion of this project. The public hearings occurred in May of 1990. Additional postponement of implementing the rural portion of this project will likely impact the interest of landowners in Ozaukee County, ultimately affecting participation.

Please let me know if the Department can be of any further assistance in moving forward to implement the rural portions of this project.

Sincerely,

David Jelinski, Chief
Soil and Water Resource Management Section
AGRICULTURAL RESOURCE MANAGEMENT DIVISION

cc: Chuck Burney
Andy Holschbach
Nick Neher
Jim Vanden Brook

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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RECEIVED
DEC 12 1990
WATER RESOURCES MGMT.

RESOLUTION NO. 90-55

MILWAUKEE RIVER SOUTH BRANCH
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 South Branch 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 May 9, 10 and 17, 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 South Branch 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/ Rose Hass Leider
Rose Hass Leider

James N. Speiden

s/ Elizabeth Brelsford
Elizabeth Brelsford

(S E A L)

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

Harold C. Dobberpuhl
Harold C. Dobberpuhl
County Clerk

s/ Howard Cralley
Howard Cralley
LAND CONSERVATION COMMITTEE

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SUMMARY

INTRODUCTION

The Milwaukee River South Watershed is a 157 square-mile elongated drainage area located in Ozaukee and Milwaukee Counties, Wisconsin (Maps 1 & 2). Some 340,000 people live within this watershed that includes all or part of 21 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 95 percent of the watershed's population live in urban areas. The watershed is one of the five watersheds that make up the Milwaukee River Basin, which also includes: the North Branch of the Milwaukee River, the Menomonee River, Cedar Creek, and the East and West Branch Watersheds of the Milwaukee River.

The Milwaukee River South Watershed was designated a "priority watershed" in 1984 under the Wisconsin Nonpoint Source Water Pollution Abatement Program (nonpoint source 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 Milwaukee River South 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, snowmelt, 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 Milwaukee River South Watershed includes 152 miles of streams. There are no significant lakes within the watershed, 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 68 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 acreage 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 4,000 acres, or 4 percent of the watershed.

The Milwaukee 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. Most are too small to support sport fish, but do have 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. Many of these problems are most severe in the impoundments along the river. 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 also important, affecting 25 percent of the watershed's perennial streams and 35 percent of its intermittent streams. Nine impoundment structures are located along the Milwaukee River alone.

Nonpoint Pollution Sources

Urban Nonpoint Sources: About 50 percent of the Milwaukee River South Watershed is in urban land use. Nearly two-thirds of the urban land use occurs 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 (PCB's, 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.

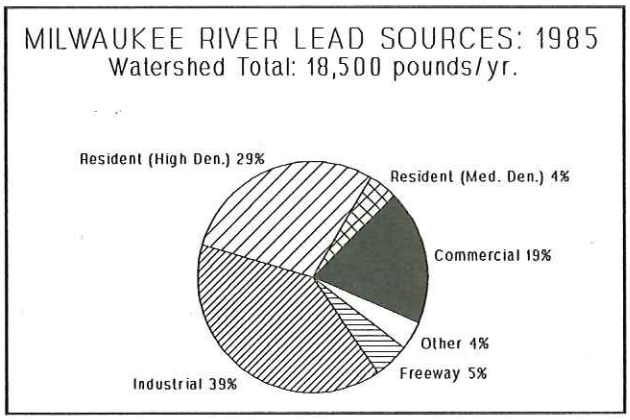
Runoff from new urban development is a major source of nonpoint pollution. Constructing roads, utilities and buildings disturbs large areas, exposing large amounts of soil to erosion. Without adequate controls, construction site erosion can cause catastrophic effects on urban rivers and streams, can clog storm sewers, and can 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 rainstorms, and decrease below normal levels between rainstorms. This produces "flashy" streams with

temperatures and chemical characteristics which limit animal life and recreational uses.

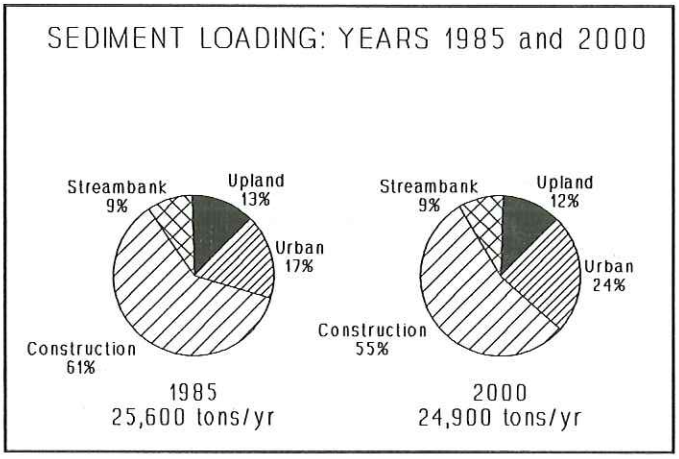
Streambanks along most of the streams, which drain the urbanized portions of the watershed, were surveyed. The most extensive areas of erosion caused by urban runoff exist along Lincoln and Indian Creeks. Along Lincoln Creek, about 4.5 miles, or 50 percent, of the streambanks are eroding. Along Indian Creek, about .6 miles, or 25 percent, of the streambanks are eroding. These eroding areas contribute an estimated 540 tons of sediment annually to these two streams and the Milwaukee River, to which they are tributary.

The relative importance of urban land uses as sources of heavy metals in the watershed is shown in the figure entitled "Milwaukee River Lead Sources: 1985". Lead is used as an indicator pollutant for urban areas, although many other pollutants are present.



Within the urban areas, land uses most important in generating these pollutants include commercial, industrial, and high density residential areas. These calculations do not include pollutant loads to the Milwaukee River that originate in the combined sewer overflow area (CO) of the city of Milwaukee and the village of Shorewood. In CO area, sewage and stormwater runoff flows are combined in the same drainage pipes, most of which discharge into the Milwaukee River below the North Avenue Dam.

The relative importance of watershed sediment sources is shown in the figure entitled "Sediment Loading: Years 1985 and 2000". Construction site erosion has been the most significant sediment source, and is projected to remain so. Urban runoff is also an important sediment source, particularly in lower portions of the watershed. It will become increasingly important as rural upland erosion and construction site erosion decline.



Rural Nonpoint Sources: Rural nonpoint pollution sources in the Milwaukee River South Watershed include barnyards, winter-spread manure, cropland erosion and streambank erosion.

Within the Milwaukee River South Watershed, 102 barnyards were inventoried. Only 68 are hydraulically connected to rivers and streams and are considered to have potential to contaminate surface waters. Of the phosphorus and other pollutants attributed to barnyards, 90 percent originate at these 68 farms. Sixteen, or 24 percent, of these 68 barnyards produce high levels of pollution and 13, or 20 percent, produce moderate quantities of pollution. The remaining 39 contribute low levels of pollution.

An inventory was done to identify farms where manure is spread in critical areas during winter. Critical areas are defined as lands that have slopes of at least 6 percent or that are located in flood prone areas. An estimated 500 acres were winterspread in critical areas, primarily in the floodplain. Fifteen farms were found to have a high pollution potential, 14 were found to have moderate potential, and the remaining 62 were found to have a low pollution potential.

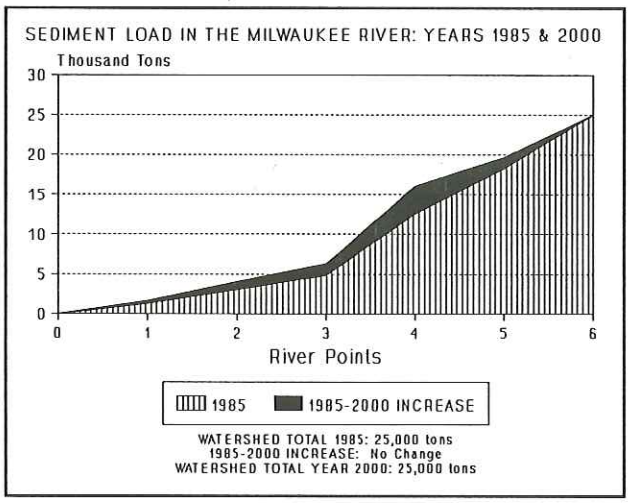
Streambanks along 140 miles of perennial and intermittent streams in the watershed's rural areas were surveyed. About 7 percent of the streambanks are eroding, producing 1600 tons per year of sediment. Most of the sediment is produced along the Milwaukee River in the Mequon Subwatershed.

On a watershed basis, about 3,300 tons of soil are washed into streams annually from eroding uplands. Virtually all of the delivered sediment comes from eroding cropland. Between 60 percent and 85 percent of the sediment delivered to surface waters from uplands originates from croplands that are currently eroding at less than 3 tons/acre/year. This rate of erosion is very small; equivalent to about the thickness of a dime over the land surface.

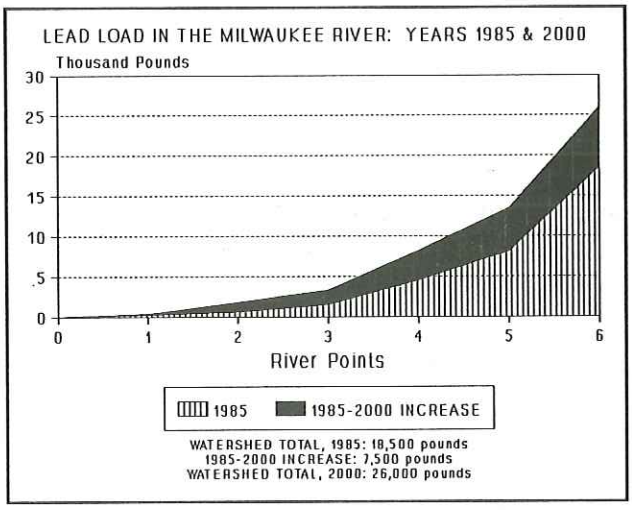
The importance of rural nonpoint sources to total annual generation of sediment in the watershed is shown in the figure entitled "Sediment Loading: Years 1985 and 2000". Although upland erosion is a small part of the problem at the mouth of the watershed, it is the primary sediment source to the rural streams located in Ozaukee County, and it will continue to be important in the

future. Streambank erosion is also an important contributor. Although less important overall as a sediment contributor than other sources, it produces significant localized impacts.

Trends: The figure entitled "Sediment Load in the Milwaukee River: Years 1985 and 2000" shows the cumulative sediment load from all nonpoint sources at six points along the Milwaukee River under year 1985 and year 2000 conditions. The six river points in this figure are: River Point 1, between Fredonia and Saukville; River Point 2, just below Saukville; River Point 3, just below Grafton; River Point 4, at the Mequon/Ozaukee County line; River Point 5, at Silver Spring Drive in the city of Milwaukee; and River Point 6, near the North Avenue Dam in the city of Milwaukee. The figure entitled "Sediment Load in the Milwaukee River: Years 1985 and 2000" shows that the future trend in sediment loading varies for different points along the river. Sediment loads can be expected to increase about 30 percent for each of the river points within Ozaukee County, primarily due to projected increases in construction activity. The sediment loads at River Points 5 and 6 are projected to remain about the same, as the decrease in construction activity projected for Milwaukee County offsets the sediment load increases occurring upstream.



The figure entitled "Lead Load in the Milwaukee River: Years 1985 and 2000" shows the cumulative lead load from all nonpoint sources at six points along the Milwaukee River under year 1985 and year 2000 conditions. The watershed's lead loads will increase by 40 percent due to increased urban area runoff if nonpoint source controls are not enacted. The largest percent increases will occur in the vicinity of Saukville and Grafton, although increases in all portions of the river must be considered significant. Although lead is used as an indicator pollutant in the figure, there are many other pollutants of concern present in urban runoff.



POLLUTION REDUCTION GOALS

Extensive water quality and aquatic habitat investigations were conducted as part of the planning effort for the Milwaukee River South 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 Milwaukee 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.

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

In addition, reductions are needed in stormwater pollutant concentrations in order to meet acute toxicity standards for effluent. Land uses that most frequently produce pollutant concentrations in excess of the state toxicity standards include freeway, commercial, industrial, and high density residential. Reductions needed in stormwater concentrations from these land uses range from 20 percent to 90 percent for lead, 70 percent to 85 percent for zinc, and 50 percent to 80 percent for copper. Reductions needed for specific storm sewer pipes are site specific, and will depend upon the mix of land uses contributing pollutants.

MANAGEMENT ACTIONS

Management actions are described in terms of best management practices (BMPs). These are the management measures or engineered structures needed to control nonpoint 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. In urban areas, state funds help support:

* Equipment expenses for accelerated street sweeping in existing urban areas.

* Stormwater control structures such as detention ponds and infiltration devices in existing urban areas.

* Detailed engineering studies and stormwater plans for carrying out planning recommendations in existing and planned 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.

Landowners, land renters, counties, cities, villages, towns, metropolitan sewage districts, and sanitary districts are eligible for the financial assistance available through this project.

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

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

Rural Management Program: The rural management program has four elements, as summarized in the following Rural Management Recommendations Table. The elements are: streambank erosion control; upland erosion control; barnyard

runoff control; and manure spreading management. These elements are discussed below and depicted on Map 14.

Streambank Erosion Control: Forty-two sites in the watershed are targeted for streambank erosion control practices. These sites account for 36,000 feet, or 38 percent, of the eroding streambank in the watershed and 1,000 tons, or 59 percent, of the streambank sediment production.

Uplands Erosion Control: Nearly 14,000 acres of uplands are targeted for sediment control practices. These targeted areas deliver 2,000 tons, or 60 percent, of the sediment from this source.

Barnyard Runoff Control: Forty-three barnyards (42 percent of total) are targeted for management practices. They represent 94 percent of the potential pollution delivered to surface waters from this source.

Manure Spreading Management: Twenty-nine livestock operations (32 percent of total) are targeted for management practices. They account for 430 acres, or 85 percent, of the total critical acres that are winter-spread with manure.

RURAL MANAGEMENT RECOMMENDATIONS

SOURCE	NUMBER SOURCE TARGETED	% SOURCE TARGETED
Barnyards	43 Sites 94% Load	42% Sites
Manure	29 Farms 85% Load	32% Farms
Uplands	32% Upland 60% Load	14,000 Acres
Streambanks	36,000 Feet	38% Feet 59% Load
Easements	187,000 Feet, 230 Acres Eligible Mole & Ulao Creeks High Priority	

Urban Management Program: The urban management program has four elements, as summarized in the following Urban Management Recommendations Table. These elements are: construction site erosion control; existing urban area runoff control; planned urban area control; and streambank erosion control. These elements are discussed following the table and depicted on Maps 15, 16, 17, and 18.

These recommendations do not generally include the portion of the city of Milwaukee and the village of Shorewood contained within the combined sewer overflow area (CO). Existing urban runoff from this area will receive a very high (greater than 90 percent) level of control under the combined sewer overflow abatement project currently being completed by the Milwaukee Metropolitan Sewage District.

Construction Site Erosion: About 7,000 acres of new urban development are expected in the watershed. New construction erosion control ordinances and suitable enforcement are needed in the two counties and nine cities and villages. Improved staffing and enforcement are needed in six other communities which already have adequate 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 16,000 existing urban acres, or 40 percent of the total urban acreage, in seven critical land use categories are targeted for nonpoint source control. Possible urban nonpoint source controls involve detention ponds, infiltration devices, street sweeping, and good housekeeping practices. If detention ponds and street sweeping are used, nearly 175 acres of wet detention ponds will need to be constructed.

Infiltration devices should not pose a threat to groundwater if properly sited and constructed. Based on information about existing detention ponds, they should not pose a public health hazard if properly constructed with a safety shelf, protected from spills of concentrated hazardous materials, and are posted to prohibit contact recreation or consumptive fishing. Existing information indicates that dredged sediments from detention ponds in commercial and residential areas can be disposed in conventional landfills provided the ponds are protected from spills and dumping of hazardous materials. The bioaccumulation hazard to wildlife from contaminated sediments in detention ponds needs further study.

In addition to urban structural practices, over 22,000 curb miles of more intensive street sweeping per year is recommended.

URBAN MANAGEMENT RECOMMENDATIONS

SOURCE	MANAGEMENT NEEDS
Construction Sites	**Manage 7,000 Acres** New Ordinances For: 2 Counties (5 Towns) 9 Cities & Villages Effective Programs For: Unincorporated Area (7 Governments) 14 Cities & Villages
Existing Urban	**Manage 16,000 Acres** Engineering Feasibility Studies For: 16,000-35,000 Acres 2 Counties, 14 Cities & Villages Stormwater Management Equivalent 90-175 Acres Detention 22,000 Curb Miles Sweeping **Manage 16,000 Ft. Streambank** Lincoln Creek, 14,400 Feet City of Milwaukee, Milw. Co., DNR, US Army, MMSD, city of Glendale Indian Creek, 1,820 Feet Villages of River Hills, Fox Point, Bayside
Planned Urban	**Manage 7,000 Acres** Stormwater Plans for All 7,000 Acres of New Development in 21 Government Jurisdictions Stormwater Management Equivalent 70 Acres of Detention

Planned Urban Areas: Nearly 7,000 acres of planned urban development expected to occur by the year 2000 will need stormwater controls. The construction of 70 acres of 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, could be used in selected areas. This would provide additional

benefits in moderating urban stream flow, and would decrease the amount of detention needed.

Streambank Erosion Control: Approximately 16,000 feet of streambank erosion at 16 sites in urban areas are targeted for control. These sites are located primarily along Indian and Lincoln Creeks.

"Core" Elements of the Urban Management Program: The "core" elements of the urban nonpoint source program, which are 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:

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

* 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 modifications in the timing and scheduling of leaf collection.

* 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 most 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:

* Adopt and enforce a comprehensive stormwater management ordinance consistent with the state's "model" stormwater ordinance, which is now being prepared.

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

* Conduct detailed engineering studies to determine the best means to implement community specific nonpoint source control measures for existing urban areas. This element will use detention ponds and infiltration devices in addition to accelerated sweet sweeping as components of the control strategy for existing urban areas.

* Design and install structural urban best management practices for existing urban areas with completed detailed engineering studies.

COSTS

The total estimated costs of carrying out the recommendations presented in this plan for rural and urban areas ranges from $88 million to $158 million. Individual landowners, the State of Wisconsin through its Nonpoint Source Water Pollution Abatement Program (nonpoint source program), and many local units of government will share this cost. The table entitled "Cost of Implementing Plan Recommendations in Rural and Urban Areas" summarizes the estimated costs for major project components and shows how these costs would be apportioned among major project participants.

Rural Costs: Carrying out the project in rural areas will cost about $3.4 million. Principle 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 NPS Program, which would cover about 79 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 costs of practice installation. Individual landowners would cover 20 percent of the total cost for rural areas. In addition, landowners are responsible for all costs associated with maintaining the practices.

Urban "Core" Costs (Planned Areas): Carrying out "Core" activities in planned urban areas will cost about $3.3 million. Principle 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. The continuation of these activities through local units of government would constitute about 17 percent of the total costs for this component. Individual landowners and developers would bear the largest portion (53 percent) of the cost for urban "core" activities in planned areas. These costs 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 $5.5 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.

Individual landowners and developers would bear over 93 percent of the engineering and capital cost of practice installation. In addition, these parties would be responsible for supporting the cost of practice maintenance. The NPS Program would cover about 7 percent of the cost for this component through the program's support for costs associated with preparing stormwater management studies.

Urban "Segment" Costs (Existing Areas): The implementation of "segment" activities in existing urban areas will require an estimated $77 million to $147 million. 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 citing practices in the existing urban areas.

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 capital cost of constructing wet detention ponds in existing urban areas is an estimated $12 million, other components such as purchase of land, which includes 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 ($70 million to $140 million) presented for the wet detention ponds.

Overall, 10 to 20 percent of the total costs for this component would be covered by the state through the NPS Program, and 80 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 required to prepare these studies.

* Assistance for installing urban structural practices such as wet detention ponds includes 100 percent of the practice

COST OF IMPLEMENTING PLAN RECOMMENDATIONS IN RURAL AND URBAN AREAS (IN MILLIONS OF DOLLARS)

	TOTAL COST	STATE SHARE	LOCAL GOV'T	LANDOWNER SHARE
RURAL				
Practices	2.4	1.7	0	0.7
Easements	0.2	0.2	0	0
Staff	0.8	0.8	0	0
Subtotal	3.4	2.7	0	0.7
URBAN "CORE" (Planned Areas)				
Practices	1.7	0	0	1.7
Staff	1.6	1.0	0.6	0
Subtotal	3.3	1.0	0.6	1.7
URBAN"SEGMENTS" (Planned Areas)				
Practices	5.1	0	0	5.1
Staff	0.4	0.4	0	0
Subtotal	5.5	0.4	0	5.1
URBAN "SEGMENTS" (Existing Areas)				
Detention	70-140	9.3	60.7-130.7	
Street Sweeping	4.3	1.9	2.4	
Streambank	0.4	0.3	0.1	
Staff	2.5	2.5	0	
Subtotal	77.2-147.2	14.0	63.2-133.2	
WATERSHED				
TOTAL	**89.4-159.4**	**18.1**	**63.8-133.8**	**7.5**

Footnotes:

1. Cost of structural practices includes engineering.
2. Cost for an eight-year period to administer and enforce local construction erosion control ordinances. State share covers all costs for a five-year "seed" period. Local costs cover three years.
3. Cost of preparing stormwater management plans for new development.
4. Part of this local government share may be paid directly by individual landowners.
5. Includes all costs associated with an accelerated street sweeping program over an eight-year period. State costs cover some costs for a five-year "seed" period. Local costs cover three years.
6. Cost of preparing detailed site-feasibility studies.
7. Includes materials only.

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.

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

Local units of government in the watershed indicate that alternative financing mechanisms must be found in order to feasibly implement this portion of the watershed project. The watershed plan endorses a continuing investigation into alternative state and local financing plans for urban stormwater runoff controls, and identifies the need to identify better source control activities that will reduce the generation of urban pollutants in the first place.

Information and Education: This component will cost about $50,000 for non-staff related expenses over a three-year period. These costs, in addition to 100 percent of the costs required to maintain two regional education specialists, are supported by the nonpoint source program.

PROJECT IMPLEMENTATION

Project implementation was scheduled to begin in Summer, 1990. The first three years of implementation are the period for participants to 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. Milwaukee and Ozaukee Counties, local units of government, and 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 can be done to reduce it.

* 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 Milwaukee River South 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 Milwaukee River South Watershed is one of five drainage areas in the Milwaukee River Basin. Each of the watersheds in the basin was designated as a "priority watershed" in 1984 under the Wisconsin Nonpoint Source Water Pollution Abatement Program. Map 1 shows the Milwaukee River South Watershed in relation to the other priority watersheds in the basin. It joins 38 other watersheds statewide, encompassing more than three 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).

The DNR, the Department of Agriculture, Trade, and Consumer Protection (DATCP), and local units of government cooperatively prepare the priority watershed plan that 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 implementation of these practices to improve water quality.

NONPOINT SOURCE WATER POLLUTION ABATEMENT PROGRAM

In 1978 the state Legislature created the Nonpoint Source Water Pollution Abatement Program (nonpoint source program) was created. The program 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 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 or seepage, and snowmelt.

The following is an overview of the program.

* DNR and DATCP administer the program. The program focuses on critical hydrologic units called priority watersheds. The program is implemented through priority watershed projects, which include implementation plans.

* Local units of government implement the plan. 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, sanitary districts, metropolitan sewage districts, regional planning commissions, and lake districts are eligible to participate.

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

* Informational and educational activities are employed to encourage participation.

PROJECT PLANNING AND IMPLEMENTATION PHASES

PLANNING PHASE

The planning phase of the project began in 1986. The planning phase 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 wastewater 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

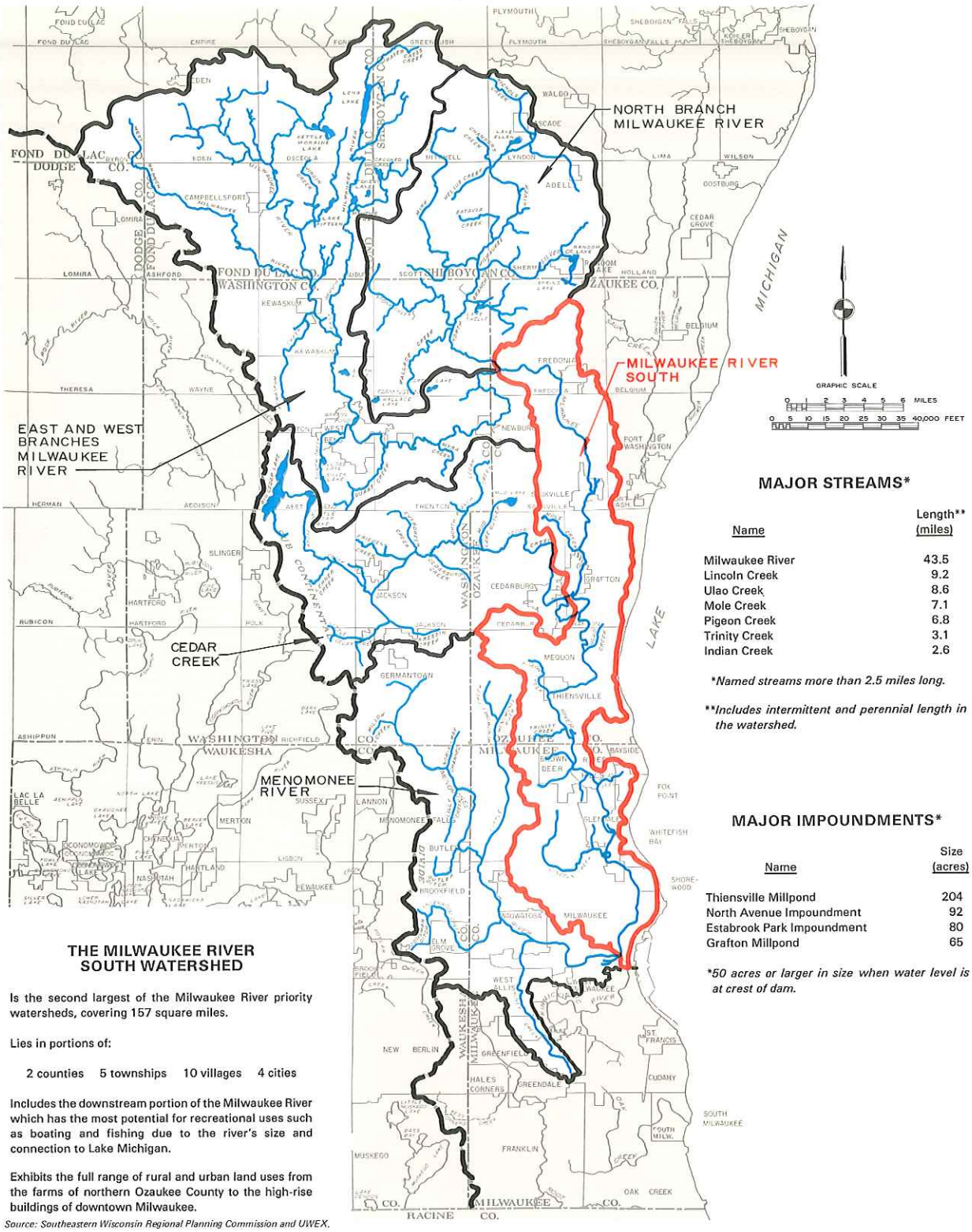
The implementation phase begins following review of the draft priority watershed plan, a public hearing, and approval by the DNR, DATCP, and the Board of Supervisors for Milwaukee and Ozaukee Counties. Public review during plan development occurred primarily through the efforts of the Milwaukee River Basin Advisory Committee and the Milwaukee River South Watershed Advisory Subcommittee, including its technical workgroups.

During the implementation phase:

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

2. In the rural portions of the watershed, the Ozaukee County Land Conservation Department staff contact eligible landowners to determine their interest in voluntarily installing best management practices in the plan. Milwaukee County may need to make a limited number of contacts.

Map 1



MAJOR STREAMS*

Name	Length** (miles)
Milwaukee River	43.5
Lincoln Creek	9.2
Ulao Creek	8.6
Mole Creek	7.1
Pigeon Creek	6.8
Trinity Creek	3.1
Indian Creek	2.6

**Named streams more than 2.5 miles long.*

***Includes intermittent and perennial length in the watershed.*

MAJOR IMPOUNDMENTS*

Name	Size (acres)
Thiensville Millpond	204
North Avenue Impoundment	92
Estabrook Park Impoundment	80
Grafton Millpond	65

**50 acres or larger in size when water level is at crest of dam.*

THE MILWAUKEE RIVER SOUTH WATERSHED

Is the second largest of the Milwaukee River priority watersheds, covering 157 square miles.

Lies in portions of:

2 counties 5 townships 10 villages 4 cities

Includes the downstream portion of the Milwaukee River which has the most potential for recreational uses such as boating and fishing due to the river's size and connection to Lake Michigan.

Exhibits the full range of rural and urban land uses from the farms of northern Ozaukee County to the high-rise buildings of downtown Milwaukee.

Source: Southeastern Wisconsin Regional Planning Commission and UWEX.

MILWAUKEE RIVER PRIORITY WATERSHEDS

In the urban portions of the watershed, the DNR or its designee contacts local units of government to discuss in detail the required actions for implementing plan recommendations.

3. The landowner and the county sign the cost-share agreements for rural practices that outline the practices, costs, cost-share amounts, and a schedule for installation of management practices. In urban areas a similar process is used. The local unit of government and the DNR sign some agreements for urban practices. In some cases the agreements will be between local units of government and their private landowners. All practices are scheduled for installation up to five years from the date an agreement is signed.

LEGAL STATUS OF THE NONPOINT SOURCE CONTROL PLAN

The Milwaukee River South priority watershed plan was prepared under the authority of the Wisconsin Nonpoint Source Water Pollution Abatement Program described in Section 144.25 of the Wisconsin Statutes and Chapter NR 120 of the Wisconsin Administrative Code. It was prepared under the cooperative efforts of DNR, DATCP, the Ozaukee County Land Conservation Department, local units of government, and the Milwaukee River South Advisory Subcommittee.

This watershed plan is the basis for the DNR to enter into cost-share and local assistance grants with agencies responsible for implementation 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.

Comprehensive water quality management plans pertaining to the Milwaukee River South Watershed have been completed by the Southeastern Wisconsin Regional Planning Commission (SEWRPC 1971, 1979). The SEWRPC more recently 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 contained in the Milwaukee River Watershed.

Following approval by the DATCP, Ozaukee County, and Milwaukee County, the DNR will approve this priority watershed plan. This watershed is covered under the adopted areawide water quality management plan for Southeastern Wisconsin prepared by the SEWRPC. 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 1 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." It uses the nonpoint source control program as the foundation for coordinating other departmental environmental quality (solid waste, wastewater, water regulation and zoning, water resources management, water supply) and resource management (fisheries, forest Management, parks and recreation, and wildlife and endangered resources management) efforts.

This coordinated program is documented in a seven volume report entitled Milwaukee River Integrated Basin Management Plan: 2000 (DNR, 1990). It is being prepared by the DNR 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 STORMWATER DISCHARGE PERMIT PROGRAM

Recent changes to the Federal Water Quality Act will play an important role in improving water quality in the Milwaukee River South 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 stormwater sewer systems by February 4, 1990. These permits (called WPDES in Wisconsin) are the same as are issued by the DNR for public and private wastewater treatment plants and industrial dischargers of wastewater.

The DNR, in accordance with regulations issued by the U.S. Environmental Protection Agency (EPA), will have responsibility for implementing this new program. The EPA published draft regulations in December 1989 issued final regulations by November 1990. Appendix A is a summary of the federal stormwater regulations.

The amendments to the act require pollutants in municipal stormwater discharges to be controlled to the "Maximum Extent Practicable". Many of the probable permit requirements overlap with the management actions specified in this plan for improving water quality in the watershed. For example, adoption and enforcement of construction site erosion control ordinances are specifically mentioned in the regulations and are identified in this nonpoint

source plan as a critical component of the sediment control strategy. Implementation of the Milwaukee River South nonpoint source plan will likely meet this and many other permit requirements.

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

The coordinated implementation of the stormwater permit program and this nonpoint source control plan will help ensure that the water quality objectives for the Milwaukee River and its tributaries will be achieved. Specific information on the relationship between implementing these two programs is presented in Chapter IV, "A Detailed Program for Implementation".

PLAN ORGANIZATION

The remainder of this plan is divided into three parts:

* Part 1: The Watershed Assessment.
* Part 2: A Detailed Program for Implementation.
* Part 3: 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 the nonpoint sources impacting them.

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

Part 2: A Detailed Program for Implementation

Chapter VI. "Detailed Program for Implementation" describes the means by which the local units of government administer the project, estimates a local assistance and management practice cost-share budget, identifies an information and education program, and identifies technical and financial assistance available to local units of government through the project.

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

PART ONE
WATERSHED ASSESSMENT

CHAPTER II - GENERAL WATERSHED CHARACTERISTICS

CHAPTER III - WATERSHED PLANNING METHODS

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

CHAPTER V - NONPOINT SOURCE CONTROL NEEDS

CHAPTER II
GENERAL WATERSHED CHARACTERISTICS

INTRODUCTION

The Milwaukee River South Watershed is a 157-square mile, linear shaped drainage area located in Ozaukee and Milwaukee Counties, Wisconsin. It is the second largest of five watersheds that make up the Milwaukee River Basin, occupying about 19 percent of the basin area.

Land use changes dramatically within the watershed from north to south. The northern one-half of the watershed contains several small urban municipalities, but is primarily agricultural in nature. The lower third of the watershed, on the other hand, is located entirely within Milwaukee County and is heavily urbanized, containing only small tracts of agricultural land uses. The middle one-sixth of the watershed is mixed agricultural/urban land use and is rapidly urbanizing.

The watershed receives drainage water from three other watersheds in the Milwaukee River Basin: the North Branch Milwaukee River Watershed, the East-West Branch Milwaukee River Watershed, and the Cedar Creek Watershed. All are tributary within Ozaukee County. These tributary areas contribute a significant portion of the Milwaukee River's flow, thereby having a important influence on its character.

The Milwaukee River South Watershed, divided into 16 smaller hydrologic subwatersheds for study purposes, is shown in 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, South Branch Watershed Integrated Resource Management Plan (DNR, 1990).

CULTURAL FEATURES

CIVIL DIVISIONS

The Ozaukee County portion of the watershed encompasses 100-square miles or 64 percent of the drainage area. This portion of the watershed contains parts of five civil townships including Fredonia, Port Washington, Saukville, Grafton, and Cedarburg. This portion of the watershed also contains all or significant portions of five incorporated municipalities including the villages of Fredonia, Saukville, Thiensville, and Grafton, and the city of Mequon. In addition, it contains a small portion of the city of Cedarburg.

The Milwaukee County portion of the watershed encompasses 57-square miles or 36 percent of the drainage area. The city of Glendale and the villages of Brown Deer are located entirely within the drainage area. This portion of the watershed also includes significant portions of five other incorporated

municipalities including the city of Milwaukee, and the villages of River Hills, Fox Point, Whitefish Bay, and Shorewood. The watershed also contains a small part of the village of Bayside.

Table 2-1 and Map 3 show the extent of incorporated and unincorporated municipalities within the Milwaukee River South Watershed.

Population Size And Distribution

The 1985 population in the Milwaukee River South Watershed was estimated to be 341,648 persons. Ninety percent or 296,500 persons, of the population, live in Milwaukee County; the rest reside in Ozaukee County. Ninety-five percent or, approximately 325,000 persons, of the population, lives in the urban portions of the watershed. Remaining persons reside outside the incorporated areas of the watershed primarily in subdivisions, isolated small enclaves of residential development, or on farmsteads.

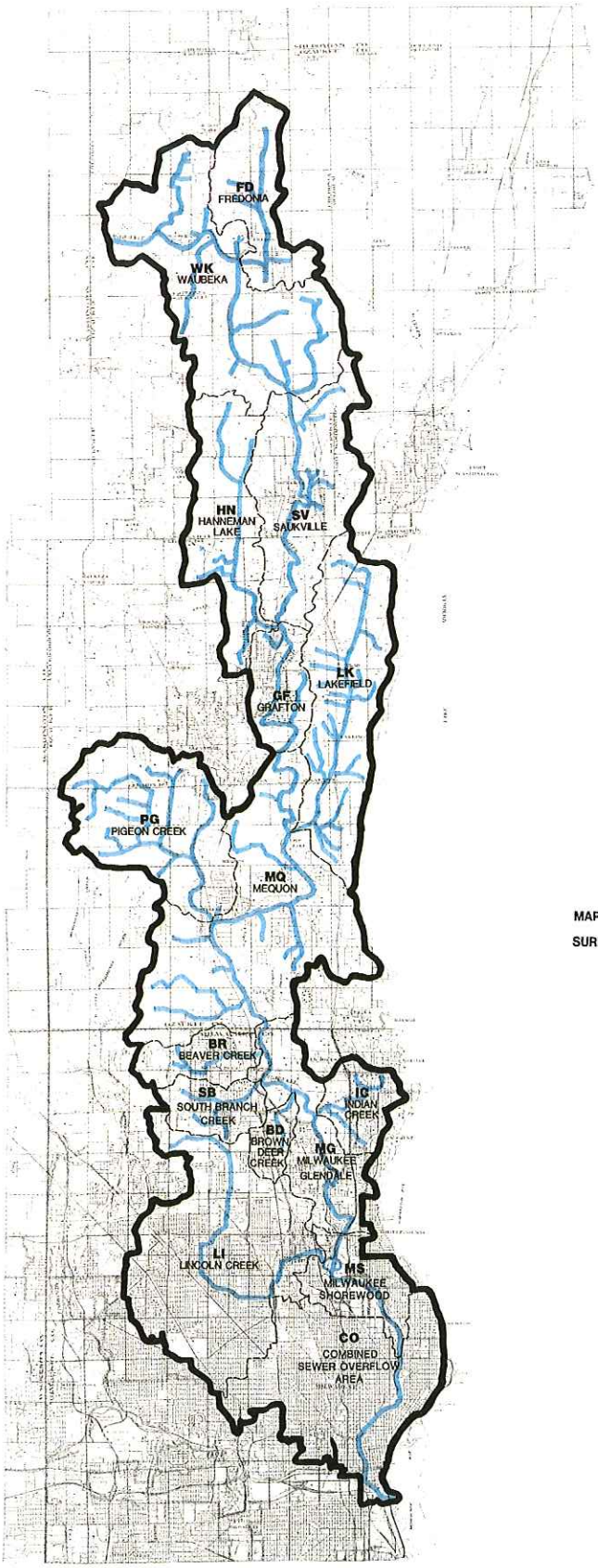
Although regional and watershed specific trends suggest that the population of the watershed will decrease by eight percent over the next 20 years, the population in the Ozaukee County portion is expected to increase by roughly 10,000--an increase of 30 percent. This, in combination with a trend towards a decrease in the size of households, will result in an increase in the amount of urban development.

Land Uses

Table 2-2 summarizes existing land use in the watershed. Rural land uses comprise more than 83 square miles or 54 percent of the drainage area. The predominant rural land uses are agricultural and related open space land uses, occupying 66 square miles or 43 percent of the watershed. The remaining rural land uses include wetlands and surface water, which together cover 12 square miles or 8 percent. Woodlands occupy less than six square miles or four percent.

Urban land uses currently occupy 71 square miles or 46 percent of the watershed. Residential development is the predominant urban land use, covering over 34 square miles or 48 percent of the urban area. The remainder includes transportation and utilities, recreational, governmental and institutional, industrial, and commercial land uses.

Future urbanization, including conversion to residential, commercial, industrial, freeway, and government/institutional land uses, will occur throughout the watershed. These land uses will increase by about 25 percent in the Fredonia area, 50 percent in the Saukville area, 35 percent in the Grafton Area, 35 percent in the Mequon/Thiensville/Cedarburg area, and by 10 percent within Milwaukee County. Nearly one-half of this urbanization will occur in the Mequon/Thiensville/Cedarburg area.



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MAP 2

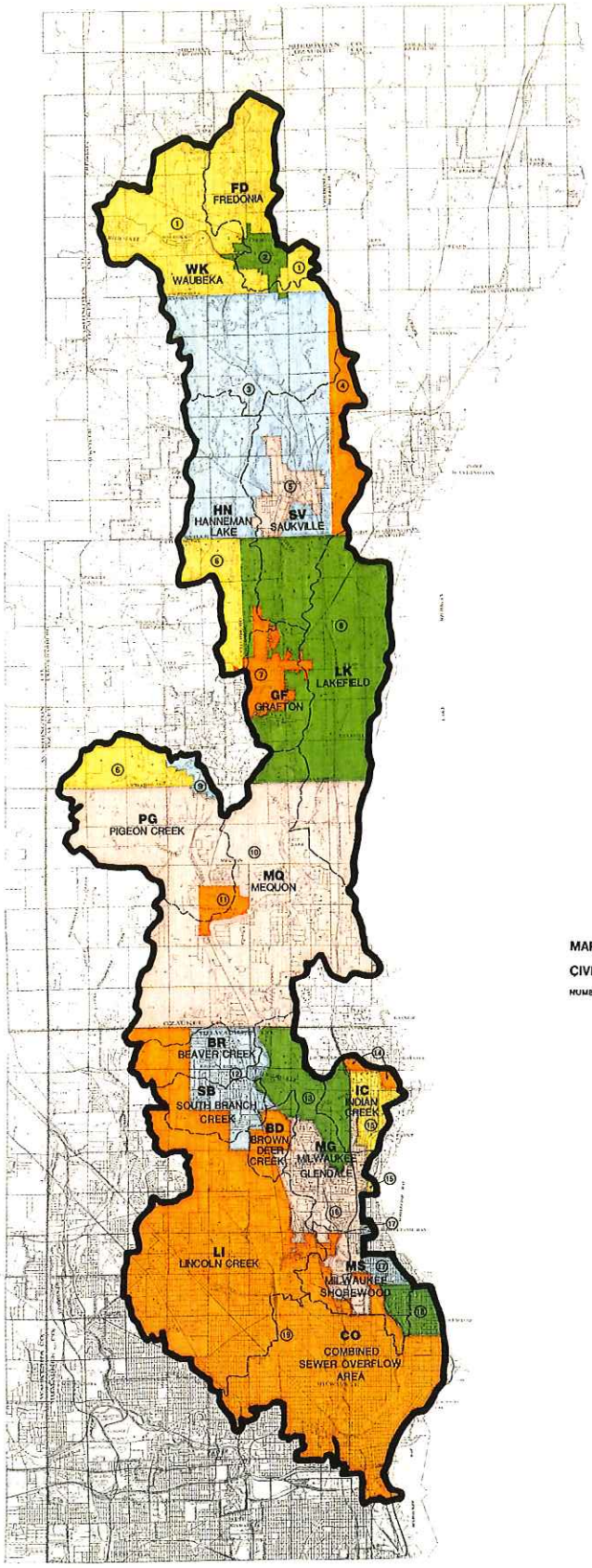
SURFACE WATER RESOURCES

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

MILWAUKEE RIVER SOUTH WATERSHED

OZAUKEE AND MILWAUKEE COUNTIES WISCONSIN

WISCONSIN DEPARTMENT OF NATURAL RESOURCES



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MAP 3

CIVIL DIVISIONS

NUMBER ON MAP	CIVIL DIVISION
1	TOWN OF FREDONIA
2	VILLAGE OF FREDONIA
3	TOWN OF SAUKVILLE
4	TOWN OF PORT WASHINGTON
5	VILLAGE OF SAUKVILLE
6	TOWN OF CEDARBURG
7	VILLAGE OF GRAFTON
8	TOWN OF GRAFTON
9	CITY OF CEDARBURG
10	CITY OF MEQUON
11	VILLAGE OF THIENSVILLE
12	VILLAGE OF BROWN DEER
13	VILLAGE OF RIVER HILLS
14	VILLAGE OF BAYSIDE
15	VILLAGE OF FOX POINT
16	CITY OF GLENDALE
17	VILLAGE OF WHITEFISH BAY
18	VILLAGE OF SHOREWOOD
19	CITY OF MILWAUKEE

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

Compiled by the Southeastern Wisconsin Regional Planning Commission using data from Wisconsin State Cartographer's Office, Wisconsin Department of Natural Resources, Ozaukee County Planning Department, Milwaukee County Department of Parks, Recreation and Culture, Milwaukee Metropolitan Sewerage District, and Southeastern Wisconsin Regional Planning Commission.

MILWAUKEE RIVER SOUTH WATERSHED

OZAUKEE AND MILWAUKEE COUNTIES WISCONSIN

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Table 2-1. Extent of counties, cities, villages, and towns within the Milwaukee River South Priority Watershed.

County	Civil Division	Area In Watershed (Square Miles)	Percent of Watershed
Milwaukee	City of Glendale	6.14	3.9
	City of Milwaukee	38.78	24.7
	Village of Bayside	.34	.2
	Village of Brown Deer	4.23	2.7
	Village of Fox Point	1.50	1.0
	Village of River Hills	4.10	2.6
	Village of Shorewood	1.45	.9
	Village of Whitefish Bay	.62	.4
Ozaukee	City of Cedarburg	.99	.6
	City of Mequon	30.14	19.2
	Village of Fredonia	1.48	.9
	Village of Grafton	3.71	2.4
	Village of Saukville	4.83	3.1
	Village of Thiensville	1.05	.7
	Town of Cedarburg	5.24	3.3
	Town of Fredonia	13.91	8.9
	Town of Grafton	16.84	10.7
	Town of Port Washington	2.44	1.5
	Town of Saukville	19.27	12.3
TOTAL		157.06	100.0

Source: Southeastern Wisconsin Regional Planning Commission.

Table 2-2. Land use in the Milwaukee River South Watershed: 1985.

Land Use Types	MILWAUKEE COUNTY Area (sq. mi.)	MILWAUKEE COUNTY Percent	OZAUKEE COUNTY Area (sq. mi.)	OZAUKEE COUNTY Percent	TOTAL Area (sq. mi.)	TOTAL Percent
Urban Land Use						
Residential	22.54	39.3	11.52	11.9	34.06	22.1
Commercial	1.86	3.2	.48	0.5	2.34	1.5
Industrial	2.39	4.2	.57	0.6	2.96	1.9
Transportation/ Utilities	15.88	27.7	6.63	6.9	22.51	14.6
Government/Institutional	2.93	5.1	.91	0.9	3.84	2.5
Recreation	3.21	5.6	1.94	2.0	5.15	3.3
Urban Subtotal	48.81	85.1	22.05	22.8	70.86	45.9
Rural Land Uses						
Agriculture, Open Land	6.44	11.1	59.09	61.0	65.53	42.6
Wetland	.34	0.6	9.06	9.4	9.40	6.1
Woodland	.91	1.6	4.69	4.9	5.60	3.6
Surface Water	.92	1.6	1.80	1.9	2.72	1.8
Rural Subtotal	8.61	14.9	74.64	77.2	83.25	54.1
All Land Uses	57.42	100.0	96.69	100.0	154.11	100.0

Source: Southeastern Wisconsin Regional Planning Commission.

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, South Branch Watershed Integrated Resource Management Plan (DNR, 1990). Most of these point sources are controlled through permits issued by the DNR under the WPDES permit system. Importantly, a major effort to reduce pollution from combined sewer overflows and discharges from separate sanitary relief devices in the Milwaukee Sewer Service Area is currently being undertaken.

Sanitary Sewer Service

Sanitary sewer service availability is extensive throughout the Milwaukee River South Watershed. Approximately 290,000 persons or 88 percent of the watershed population receive service. The villages of Fredonia, Saukville and Grafton each have municipal treatment facilities that discharge to the Milwaukee River. The remaining sewered areas are served by the Milwaukee Metropolitan Sewage District, which discharges to the Milwaukee Harbor Estuary. Wastewater generated by the remainder of the watershed residents (39,000 persons) is disposed of by private on-site systems.

Water Supply Service

Water supplies used in the Milwaukee River South Watershed are obtained from both municipal and non-municipal 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 privately owned wells, or is obtained by municipal pumping facilities. Ten communities are served by large municipal water supply systems. In addition, there are 49 community water systems in the watershed.

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 surface waters. Precipitation events throughout the watershed are most frequently 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 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 soil is either frozen or saturated.

Topography

Topographic relief in the watershed ranges from approximately 1,000 feet above sea level in the northern and western portions of the watershed 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.

The Hochheim-Sisson-Casco soils are well drained loamy soils with subsoils of loam to clay loam, that are underlain by glacial till, outwash, and lake-laid deposits. They formed in uplands, on terraces and on old lakebeds. Soils of the Kewaunee-Manawa Association are well drained to somewhat poorly drained loamy soils that have subsoils of clay to silty clay loam, and are formed in thin loess and silty clay loam glacial till in uplands. The Ozaukee-Morley-Mequon soils are well drained to somewhat poorly drained silty soils with subsoils of silty clay loam and silty clay, that are formed in thin loess and silty clay loam glacial till on moraines.

Other important soils present in the watershed include the Fabius, Fox, Houghton, and Adrian Soil Series.

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 152 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 Milwaukee River, 44 miles in length, is the principal perennial stream in the watershed. Intermittent streams, with a combined length of 82 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.

Many of the perennial and intermittent streams have been extensively modified through channelization and impoundment. Twenty miles, or nearly 30 percent of the perennial stream miles have been modified through impoundment and channelization. Twenty-eight miles or 34 percent of the intermittent stream miles have been channelized.

The Milwaukee River contains nine water control structures. These create impoundments at Waubeka, Grafton, and Thiensville, plus three impoundments in Milwaukee County at Kletsch Park, Estabrook Park, and at North Avenue. Larger impoundments include those at Grafton, where three separate structures impound 35 acres, and at Thiensville, where a single structure impounds 45 acres. Historically, these impoundments were created when dams and sills were installed to provide water power to mills, flood control, or recreation. Many are no longer serving their original function and offer limited recreational opportunities because of shallow depth, prolific weed and algae growth, degraded water quality conditions, and dominant rough fish populations. The structures also prohibit upstream migration of forage and game fish and restrict navigation.

Many of the tributary streams, particularly in Milwaukee County, have been channelized and some have been concrete lined for flood control purposes. Where channelization has occurred, habitat for fish and aquatic life has been severely degraded. Where concrete channelization has occurred, habitat has been completely destroyed.

Named perennial streams in the watershed are listed in Table 2-3.

Lakes: There are no large (over 50 acres), naturally occurring lakes in the watershed. The only two naturally occurring lakes are Haneman Lake (6 acres) and Drzewicki Lake (two acres). Both are located in the Haneman Lake Subwatershed, Ozaukee County.

Wetlands: Wetlands are some of the most valuable natural resource features in the watershed. Their values include wildlife habitat, fish spawning and rearing, recreation, attenuation of runoff and flood flows and removal of pollutants. They comprise 3,928 acres, or 4 percent, of the watershed.

Table 2-3. Perennial streams of the Milwaukee River South Watershed.

Stream Name	Stream Miles
Beaver Creek	2.8*
Brown Deer Creek	2.3
Fredonia Creek	4.0
Indian Creek	2.6*
Lincoln Creek	9.0*
Milwaukee River	43.5
Mole Creek	6.5
Pigeon Creek	5.0
Trinity Creek	2.1
Ulao Creek	6.0

* Portions of the stream have been lined with concrete or enclosed in conduit.

Source: Wisconsin Department of Natural Resources.

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 Milwaukee River South Watershed are discussed in order of occurrence beneath the surface.

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

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

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

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

Environmental corridors and isolated natural areas have been identified by the DNR and the SEWRPC (SEWRPC, 1979). These areas contain primarily wetlands, woodlands and surface water and comprise approximately 22 square miles, or about 14 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

Natural areas were identified statewide by the Wisconsin Scientific Areas Preservation Council and the DNR's Bureau of Endangered Resources. These areas are contained exclusively in environmental corridors and isolated natural areas. They are tracts of land or water that 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 three sites have been identified: Lincoln Creek Exposure and Estabrook Park Exposure in Milwaukee County, and Kurtz Woods in the town of Cedarburg in Ozaukee County. The site in Estabrook Park has been designated as having county-wide significance.

Endangered Species

The DNR has documented the occurrence of five fish species in the watershed that are classified as endangered, threatened or rare in Wisconsin. All were found in Milwaukee County in the Milwaukee River. The greater redhorse (Moxostoma valenciennesi), the american eel (Anguilla rostrata), and the redfin shiner (Notropis umbratilis) are on the state watch list. The longear sunfish (Lepomis megalotis) is a threatened species, and the striped shiner (Notropis chrysocephalus) is classified as endangered.

CHAPTER III
WATERSHED PLANNING METHODS

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

* 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 1985-86. Through these investigations water quality problems were evaluated and a basis for setting water resource management objectives was established. Most perennial and intermittent streams and all of the major lakes were evaluated.

Detailed assessment results are documented in water resources appraisal reports prepared for the Milwaukee River South Watershed (Warzyn, 1989).

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 16 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 was collected using techniques developed by the DNR. The information included flow rate and depth, substrate quality, channel configuration, streambank stability, and water temperature. The data was evaluated using the DNR's Stream Classification Guidelines (Ball, 1982).

Water Quality Assessment: Water quality was assessed using a combination 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 assessed 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 of stream navigability were determined based on: evidence of canoeing or boating; field data including evidence of stream alteration or use; and information provided by landowners or other local experts. 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 identified 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.

Generic use classifications and supporting water quality standards are discussed below.

Biological Stream Use Classification: Biological stream use classes describe the fish species or other aquatic organisms supported by a stream system. Designation is based on the ability of a stream to provide suitable habitat and water quality conditions for those fish and other forms of aquatic life. The following biological stream use classification system was used in preparing this watershed plan. After this plan and its associated maps were prepared, the stream classification system for the state of Wisconsin were modified. The new stream classification designations are contained in NR 102(04)(3).

Fish and Aquatic Life (FAL) A Coldwater Communities. These streams are capable of supporting a community of coldwater fish (trout, sculpin) and other aquatic life, or serve as spawning areas for coldwater fish species.

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

FAL C Warmwater 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 tolerant of pollution, or fish and aquatic invertebrates tolerant of pollution. Small physical stream size and reduced stream flow usually limit the aquatic community.

Limited Aquatic Life (Marginal Surface Waters). At best, these streams are capable 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 based on the 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 designations 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 NR 102, NR 104, and NR 105 Wisconsin Administrative Code. Additional information to assess the suitability of surface waters for biological uses includes recommended maximum nutrient levels, suspended solids concentrations, and the extent to which stream beds are clogged with sediment.

In addition to these standards, other criteria were used to assess the suitability of surface waters for recreational and biological uses. Stream size and accessibility data helped determine the suitability and types of recreation which a stream could support. Users at public access points

provided information on current recreational use of surface waters, and discussions with local officials provided information to assess suitability of surface waters for recreation.

ASSESSING POLLUTION SOURCES

The pollution source assessment identified 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 from 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 feeding, pasturing, and loafing areas.
* Eroding uplands which deliver sediment to surface waters.
* Eroding, slumping, or trampled streambanks.
* Areas contributing runoff of winterspread livestock manure.

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

Barnyard and Livestock Area Runoff: The Ozaukee County Land Conservation Department(LCD) staff mapped locations of 103 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 developed by the U.S. Department of Agriculture, Agricultural Research Service (Young, 1982). Information on mass loading of total phosphorus and chemical oxygen demand that was generated from each barnyard during a 10 year-24 hour rainfall event assessed the relative pollution potential of each barnyard. The livestock operations were then ranked according to their potential to impact surface water and/or groundwater quality.

Upland Erosion and Sediment Delivery: The Ozaukee County LCD staff conducted the inventory on 78 square miles, or 51 percent of the watershed, using existing data and field investigations. Only lands in Ozaukee County were included.

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 based on a "typical" year of precipitation. Estimated sediment delivery assessed the relative pollution potential of each farm field in the watershed.

Streambank Erosion: The Ozaukee County LCD staff conducted field surveys on 141 miles of perennial and intermittent streams located in rural areas. The survey method used is a modification of the streambank erosion analysis. This analysis is included in Phase II of the Land Inventory Monitoring (LIM) process used by the U.S. Department of Agriculture, Soil Conservation Service. At locations where erosion was occurring, the following site specific information was recorded: length of trampled or eroding bank; vertical height; estimated annual rate of recession; adjacent land uses; and potential management measures.

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

Runoff from Areas Winterspread with Livestock Waste: This analysis estimated the pollution potential in the watershed associated with winterspreading livestock waste. This evaluation included the information collected for the barnyard and upland erosion surveys.

This analysis was completed using a three-step process. First, the number of acres needed by each livestock operation 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. This estimation was based on the number of acres needed for winterspreading and the proportion of environmentally sensitive lands available to the livestock operation. 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 in urban stormwater runoff include some of the same pollutants associated with rural nonpoint source runoff. Examples of these pollutants are: sediment, nutrients, oxygen demanding organic materials, bacteria, and pesticides. Other pollutants, many of which are potentially toxic, are transmitted to surface water 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 that destroy stable habitat for aquatic life. This often converts natural streams into stormwater conveyance channels to reduce flood damage.

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.

Stormwater pollutant concentrations, runoff volumes, and pollutant yields vary with urban land use (residential, commercial, industrial) and development characteristics (intensity of the development, stormwater 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 estimated the existing and potential future urban pollutant loads.

Existing Urban Areas: Five study areas were delineated in the watershed and include all incorporated municipalities and surrounding lands sufficient to accommodate planned future development. Four study areas in Ozaukee County were delineated to include portions of the following incorporated municipalities within the watershed: Fredonia, Saukville, Grafton, Mequon, Thiensville, and Cedarburg. One study area was delineated for Milwaukee County, and includes portions of the following municipalities contained within the watershed: Milwaukee, Glendale, River Hills, Brown Deer, Fox Point, Bayside, Shorewood, and Whitefish Bay.

Existing land use categories were delineated on 1"=400′ scale aerial photos, digitized, quantified, and mapped by the Southeastern Wisconsin Regional Planning Commission (SEWRPC). Land use definitions are presented in Appendix B.

New Urban Development: The SEWRPC delineated areas of planned development for each study area in Ozaukee and Milwaukee counties. The delineations represent long-range (up to 50 years) projections for urban development. The information for Ozaukee County was plotted on 1"=1,000′ scale maps and for Milwaukee County on 1"=2000 ′ scale maps. This information was based on existing land use configuration, SEWRPC sanitary sewer service area plans, other available land use plans, 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 Commission estimated the portion of the planned urban area expected to undergo conversion by the year 2000 and used to determine potential increases in urban pollutant loading.

The DNR used 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. These pollutants include sediment, phosphorus, and lead, which were chosen to represent urban toxic materials. Information on existing pollutant loads identified the magnitude and distribution of the current urban nonpoint source loadings, and identified 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 the level of management needed in reducing 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 by the year 2000. The adequacy of existing local construction erosion control programs was evaluated through a survey developed by University of Wisconsin Cooperative Extension Service and the DNR. An authorized representative from each local unit of government completed the surveys.

Streambank Erosion: Rural streambank erosion survey techniques were applied to portions of urban streams where erosion was suspected as a problem. Sites were selected based on information from DNR water resources staff and local municipal staff. The sites surveyed include: Fredonia Creek below County Highway A; Indian Creek below U.S. Highway 43; isolated sections of Brown Deer, Beaver, and South Branch Creeks; and Lincoln Creek.

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 may overshadow 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 Milwaukee River South Watershed. In addition the DATCP, the DNR, and the University of Wisconsin Extension

Service 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 major lakes and streams 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 setting water resources objectives include: existing water quality and aquatic habitat; factors or pollutants that may be keeping the surface water from its full potential to support 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 set 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, 1971, 1979, 1987).

The nonpoint source pollution reduction goals in this plan specifically target the control of sediment in rural areas, and the control of sediment, total lead (an indicator pollutant), and streamflows in urban areas. Pollution reduction goals for sediment are based on the change in substrate embeddedness needed to restore aquatic habitat. Pollution reduction goals for total lead are based on changes needed to meet chronic toxicity standards in the Milwaukee River and acute toxicity standards in the stormwater effluents discharged to the river. Importantly, reducing the quantity of these substances reaching surface water will also decrease the amount of other substances such as phosphorus, pesticides and bacteria, which also degrade water quality.

In developing reduction goals, it is assumed that the recommended levels of urban and rural nonpoint source control specified in priority watershed plans for the East-West Branch Milwaukee River Watershed, the North Branch Milwaukee River Watershed, and the Cedar Creek Watershed will be achieved.

Water resources 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 additional management needs will include implementation of other recommended management actions that the SEWRPC establishes in the areawide water quality management plan for southeastern Wisconsin, which subsequent planning studies amend. These studies include the water resources management plan for the Milwaukee Harbor Estuary, the integrated resource management plan for the Milwaukee River Basin, and the remedial action plan (in preparation) for the Milwaukee River area of concern (SEWRPC, 1979; SEWRPC, 1987; DNR, 1990).

DEVELOPING A NONPOINT SOURCE CONTROL STRATEGY

The final step in the planning process involved developing a strategy to achieve the nonpoint source pollution reduction goals identified in the plan. The strategy identifies several items including: critical nonpoint sources and best management practices; project responsibilities and local workload estimates; budget requirements to support practice and staffing costs; state funding guidelines; information and education needs; and project evaluation needs.

Eligibility of specific sources for cost share and technical assistance was identified. The eligibility was based on the overall reduction in pollutant loads needed to meet water quality goals and the relative contribution of each source to the sediment and lead loading. Steps in the process include:

1. Evaluate the pollutant loading for each source (e.g. barnyard, eroding field, urban land use) in each subwatershed.

2. Determine the relative importance of controlling each source in achieving the pollutant reduction goals for the Milwaukee River and its principle tributary streams.

3. Develop eligibility criteria for each major nonpoint source type (e.g.barnyards, eroding uplands, existing urban areas) which will provide the required level of control.

4. Apply the criteria to each source (e.g. barnyard, eroding field, urban land use) to identify specific sites that need to be controlled in the priority watershed project.

This evaluation was completed on a subwatershed and watershed basis for the rural and urban nonpoint sources. The result is a site-specific ranking of nonpoint sources. The evaluation also determined the assistance needed to be made available through the nonpoint source program.

INVOLVING THE PUBLIC AND LOCAL UNITS OF GOVERNMENT

The DNR convened an advisory committee and several technical workgroups to assist in preparing this watershed plan.

The advisory committee contains representatives from cities, counties, villages, and towns in the watershed, the SEWRPC, Milwaukee Metropolitan Sewage District, University of Wisconsin, Wisconsin DATCP, representatives from environmental, sportsmen's and neighborhood groups, and interested citizens. This committee provided guidance during the planning process through review and comment on plan chapters.

Three types of technical workgroups were convened to help with developing technical aspects of the plan. These included the water resources appraisal workgroup, the agricultural workgroup, and an urban workgroup. These groups were involved in reviewing land and water resources assessment information, developing water resources objectives and pollution reduction goals, and in developing the pollution control strategy.

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

INTRODUCTION

This chapter documents the urban and rural nonpoint pollution sources that exist in the Milwaukee River South Watershed and identifies the observed impacts on rivers and streams caused, at least in part, by these pollution sources. The chapter also establishes the surface water resources objectives for the watershed project, and the level of pollutant reduction that must be achieved to accomplish these water resource improvements. Chapter V presents specific nonpoint source control actions that must be taken to achieve the designated level of pollutant reduction.

The information in this chapter is presented in five sections. The first section serves as a watershed overview, presenting results of the land and water resources assessments in a series of tables and maps. The second section applies this information to selected points along the main stem of the Milwaukee River; while the third section applies the information to major tributary subwatersheds. Each of the assessments in sections two and three document the interplay between nonpoint sources and associated water resources impacts for that area of the watershed. The fourth section presents statements of the water resources objectives to be achieved through the nonpoint source program in this watershed. Finally, the fifth section presents the reduction goals for principal pollutants that must be achieved in order to attain the water resources objectives.

WATERSHED OVERVIEW

SURFACE WATER CONDITIONS

The Wisconsin Department of Natural Resources (DNR) has classified the Milwaukee River and most of its perennial and intermittent tributary streams according to their potentials for supporting recreational, fish, and aquatic life uses. These classifications reflect the capability of each surface water to support these uses assuming that cultural limitations, such as those that point and nonpoint sources of pollution cause, are reduced or eliminated. The DNR documented the potential uses determined for all surface waters in the watershed (Wawrzyn, 1989).

Use classifications for the Milwaukee River and selected tributary streams are shown in Map 4. In Ozaukee County, the Milwaukee River has the potential to support a warmwater sport fish community and full body contact recreation throughout its length. Smaller streams within the county vary in their abilities to support fish and aquatic life.

Mole Creek, located in the Haneman Lake Subwatershed, is unique in its potential to support a coldwater fish community along its main stem and balanced warmwater forage fish communities in its tributaries. Ulao Creek, located in the Lakefield Subwatershed, is an important stream for spawning game fishes and is consequently classified for supporting a balanced warmwater sport fish community. The streams tributary to Ulao Creek support balanced warmwater forage fish communities. Fredonia Creek, Pigeon Creek and most of the remaining tributaries in the watershed are capable of supporting either balanced or limited forage fish communities. The ephemeral tributary streams are extremely limited in their capabilities, supporting only limited aquatic life.

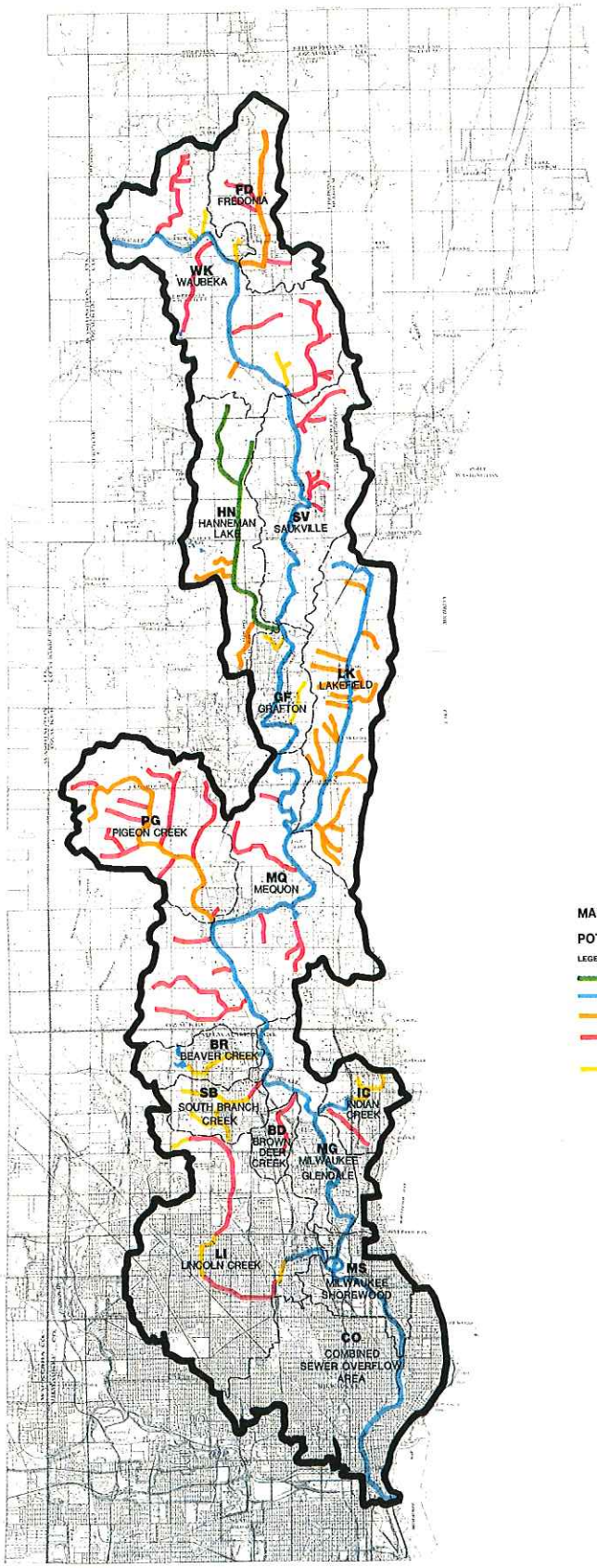
In Milwaukee County, the Milwaukee River has the potential to support a warmwater sport fish community and full body contact recreation. Tributaries vary in their potential uses in direct response to varying degrees of stream channelization and concrete lining. Some natural stream sections are capable of supporting warmwater sport fish communities, such as the lower portions of Indian Creek, Lincoln Creek, and Beaver Creek. Other natural stream sections are capable only of supporting limited forage fish communities, such as Brown Deer Creek and sections of Lincoln Creek. Where streams have been lined with concrete, such as in portions of Indian Creek, Lincoln Creek, Beaver Creek, and South Branch Creek, stream potential has been severely reduced to limited aquatic life.

Map 5 shows the degree to which principal surface waters in the watershed are supporting their potential uses. In general, the surface waters in this watershed do not fully support their potential uses due to cultural influences. These influences include municipal and industrial point source discharges, hydrologic modifications such as stream channelization and wetland drainage, and nonpoint source pollution.

Ironically, most of the streams considered to be fully meeting their potential uses (such as portions of South Branch, Indian Creek, and Beaver Creek) are those that irrevocably destroyed through concrete-lining and can only be managed as open storm sewers. In most instances, current surface water conditions only partially support the uses of which they are capable, and the quality of the use is very low due to degraded environmental conditions. This is the case throughout the Milwaukee River above the North Avenue Dam, and in Mole Creek. In many, although fewer, instances the degradation is so severe that the potential uses are not being met at all. Notably, this occurs in the main stems of Fredonia Creek, Pigeon Creek, and Ulao Creek, all principal tributary streams within Ozaukee County. It also occurs in significant portions of Lincoln Creek and Indian Creek.

The multitude of cultural factors affecting each of these surface waters is documented in the Milwaukee River Integrated Basin Management Plan: 2000, Volume 4, South Branch Watershed Integrated Resources Management Plan (DNR, 1990). The water quality problems associated specifically with nonpoint source pollution have been excerpted from that plan and summarized for each of these streams in Table 4-1.

Recurring problems in rural areas include loss of aquatic habitat, excessive aquatic plant growth, low dissolved oxygen, and high bacteria levels. Responsible pollutants that originate, at least in part, from nonpoint sources



MAP 4

POTENTIAL BIOLOGICAL USES OF SURFACE WATERS

LEGEND

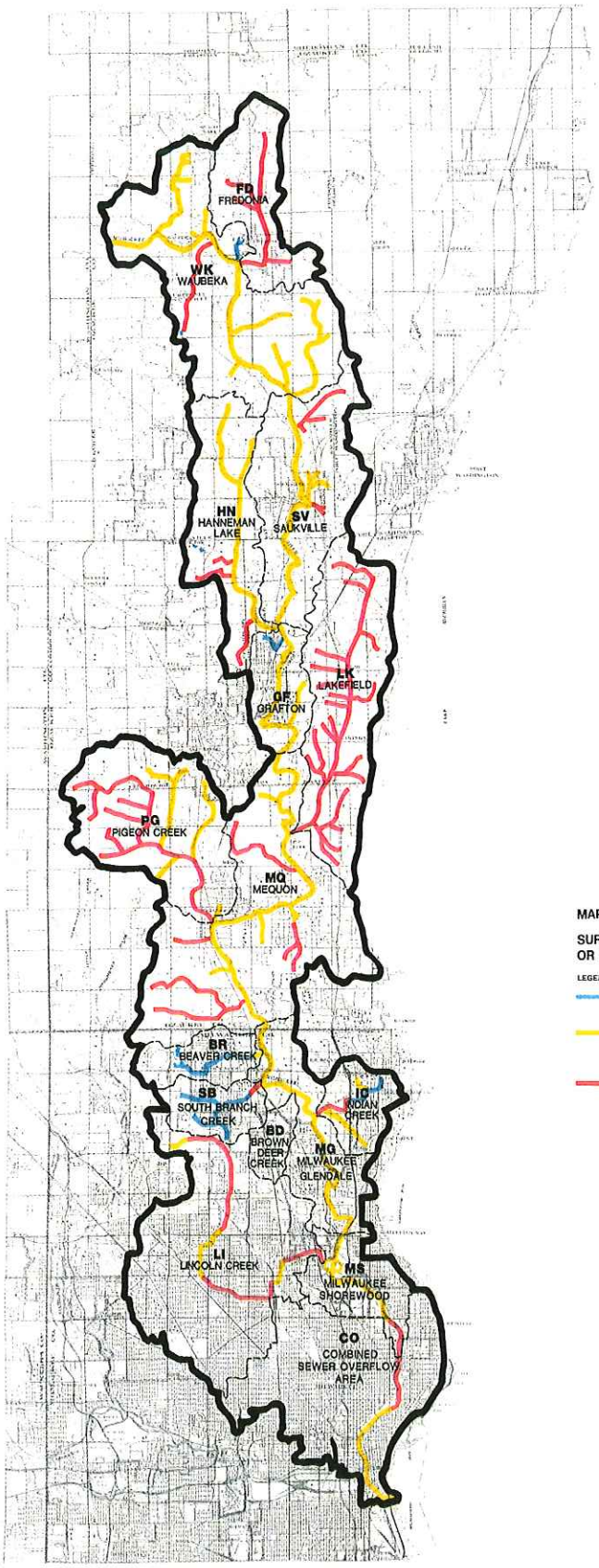
- FAL-A COLD WATER COMMUNITIES
- FAL-B WARM WATER SPORT FISH COMMUNITIES
- FAL-C WARM WATER FORAGE FISH COMMUNITIES
- LIMITED FORAGE FISH COMMUNITIES (INTERMEDIATE SURFACE WATERS)
- LIMITED AQUATIC LIFE (MARGINAL SURFACE WATERS)

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

MILWAUKEE RIVER SOUTH WATERSHED

OZAUKEE AND MILWAUKEE COUNTIES WISCONSIN

WISCONSIN DEPARTMENT OF NATURAL RESOURCES



-LEGEND-

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

MILWAUKEE RIVER SOUTH WATERSHED

OZAUKEE AND MILWAUKEE COUNTIES WISCONSIN

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Table 4-1. Nonpoint source impacts on major rivers and streams in the Milwaukee River South Watershed.*

Subwatershed	Stream/River Name	Length (Miles)	Water Quality Problem**	Nonpoint Source Pollution
FREDONIA	Fredonia Creek	4.0	Loss of aquatic habitat (2)	Sediment, Hydraulic scour
	Intermittents	3.0	Loss of aquatic habitat (2)	Sediment
WAUBEKA	Milwaukee River	8.2	Loss of aquatic habitat Low dissolved oxygen Excessive plant growth Bacteria (1)	Sediment Nutrients (N&P) Nutrients (N&P) Fecal material
	Perennial A (T11N R21E S3SWSE)	1.8	Loss of aquatic habitat	Sediment
	Intermittents	16.9	Loss of aquatic habitat Bacteria (2)	Sediment, Hydraulic scour Fecal material
SAUKVILLE	Milwaukee River	7.2	Loss of aquatic habitat Low dissolved oxygen Excessive plant growth Bacteria (1)	Sediment Nutrients (N&P) Nutrients (N&P) Fecal material
	Perennial A (T11N R21E S36NENE)		(2)	
	Intermittents	2.5	Loss of aquatic habitat (2)	Sediment
HANEMAN LAKE	Mole Creek	6.5	Loss of aquatic habitat Elevated water temperature Bacteria Cattle Access (2)	Sediment Fecal material
	Perennial A (T10N R21E S12SESW)		Loss of aquatic habitat Elevated water temperature (2)	Sediment
	Perennial B (T10N R21E S2SESE)	1.2	Loss of aquatic habitat Elevated water temperature (2)	Sediment
	Perennial C (T10N R20E S2SENW)	1.0	Loss of aquatic habitat Elevated water temperature (2)	Sediment
GRAFTON	Milwaukee River	4.8	Loss of aquatic habitat Low dissolved oxygen Excessive plant growth Bacteria Aesthetics (1)	Sediment Nutrients (N&P) Nutrients (N&P) Fecal material Sediment
	Intermittents	2.3	Loss of aquatic habitat	Sediment

Table 4-1. (Continued) Nonpoint source impacts on major rivers and streams in the Milwaukee River South Watershed.*

Subwatershed	Stream/River Name	Length (Miles)	Water Quality Problem**	Nonpoint Source Pollution
LAKEFIELD	Ulao Creek	6.0	Loss of aquatic habitat Bacteria Cattle Access (1),(2)	Sediment Fecal material
	Intermittents	13.9	Loss of aquatic habitat Bacteria (2)	Sediment Fecal material
PIGEON CREEK	Pigeon Creek	5.0	Loss of aquatic habitat Bacteria Filamentous algae Cattle Access (1),(2)	Sediment Fecal material Nutrients (N&P)
	Perennial A (T9N R21E S23NWNW)	1.0	Loss of aquatic habitat Filamentous algae Bacteria (2)	Sediment Nutrients (N&P) Fecal material
	Intermittents	12.6	Loss of aquatic habitat Bacteria (2)	Sediment, Nutrients (N&P) Fecal material
MEQUON	Milwaukee River	13.0	Turbidity Loss of aquatic habitat Low dissolved oxygen Excessive phytoplankton growth Bacteria Aesthetics Chronic Toxicity (1)	Suspended Sediment, Algae Sediment Nutrients (N&P) Nutrients (N&P) Fecal material Sediment Total Lead, Total Cadmium
	Trinity Creek	2.1	Loss of aquatic habitat (2)	Sediment
	Perennial A (T9N R22E S18NWNW)	2.2	Loss of aquatic habitat (2)	Sediment
	Intermittents	4.0	Loss of aquatic habitat (2)	Sediment
SOUTHBRANCH CREEK	Southbranch Creek, natural sections	.3	Loss of aquatic habitat Bacteria (1),(2)	Sediment Fecal material
	Southbranch Creek, concrete section	2.6	Loss of aquatic habitat Bacteria (1),(2)	Excessive stormwater flows Fecal material
BEAVER CREEK	Northridge Lake		Turbidity Sedimentation Bacteria Acute Toxicity	Suspended Sediment Sediment Fecal material Herbicides

Table 4-1. (Continued) Nonpoint source impacts on major rivers and streams in the Milwaukee River South Watershed.*

Subwatershed	Stream/River Name	Length (Miles)	Water Quality Problem**	Nonpoint Source Pollution
	Beaver Creek, concrete section	2.6	Loss of aquatic habitat Bacteria (1),(2)	Excessive stormwater flows Fecal material
	Beaver Creek, natural sections	.3	Loss of aquatic habitat Bacteria (1),(2)	Sediment Fecal material
BROWN DEER CREEK	Brown Deer Creek, natural sections	2.0	Loss of aquatic habitat Loss of aquatic habitat Bacteria (1),(2)	Excessive hydraulic loads Sediment Fecal material
INDIAN CREEK	Indian Creek, concrete section	1.3	Loss of aquatic habitat Bacteria (1),(2)	Excessive stormwater flows Fecal material
	Indian Creek, natural section	1.3	Loss of aquatic habitat Low dissolved oxygen Filamentous Algae Aesthetics Chronic Toxicity (1)	Sediment, Hydraulic scour Nutrients (N&P) Nutrients (N&P) Filamentous Algae Total Lead
MILWAUKEE RIVER-GLENDALE	Milwaukee River	6.0	Turbidity Loss of aquatic habitat Low dissolved oxygen Excessive phytoplankton growth Bacteria Aesthetics Contaminated Sediments Chronic Toxicity (1)	Suspended Sediment, Algae Sediment Nutrients (N&P) Nutrients (N&P) Fecal material Sediment Heavy Metals Total Lead, Total Cadmium
LINCOLN CREEK	Lincoln Creek, natural sections	6.6	Loss of aquatic habitat Low dissolved oxygen Bacteria Chronic Toxicity Contaminated Sediments (1),(2)	Sediment, Hydraulic scour Organics Fecal material Total Lead, Total Zinc Total Lead, Zinc, Chromium, Copper, Nickel, Oil&Grease
	Lincoln Creek, concrete sections		Loss of aquatic habitat Bacteria (1),(2)	Excessive stormwater flows Fecal material
MILWAUKEE RIVER-SHOREWOOD	Milwaukee River	6.7	Turbidity Loss of aquatic habitat Low dissolved oxygen Low dissolved oxygen Excessive phytoplankton growth Bacteria	Suspended Sediment, Algae Sediment Nutrients (N&P) Sediment oxygen demand Nutrients (N&P) Fecal material

Table 4-1. (Continued) Nonpoint source impacts on major rivers and streams in the Milwaukee River South Watershed.*

Subwatershed	Stream/River Name	Length (Miles)	Water Quality Problem**	Nonpoint Source Pollution
			Aesthetics Contaminated Sediments Chronic Toxicity (1)	Sediment Heavy Metals Total Lead, Total Cadmium

* This table reflects observed or measured nonpoint source impacts. Other impacts are footnoted, and described further in the Milwaukee River Integrated Basin Management Plan: 2000, Volume 4, South Branch Watershed Integrated Resources Management Plan (WDNR, 1990).

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

(1) Affected by at least one of the following: concrete channelization, point source discharge, landfill leachate.

(2) Affected by channelization (without concrete) and/or drainage of wetlands.

include sediment, nutrients, and fecal material. In urban areas, the list of problems is expanded to include contaminated sediments and chronic toxicity in surface waters from heavy metals, and destabilization of stream hydrology caused by increased runoff and loss of stream base flows. This information provides a basis for identifying nonpoint source control needs in the Milwaukee River South Watershed.

Rural Nonpoint Pollution Sources

Rural nonpoint pollution sources described for this watershed include barnyards, winterspread manure, upland erosion and sediment delivery, and streambank erosion. These are the principal sources of nutrients, sediment, and bacteria coming from agricultural land use. These sources were inventoried in the eight subwatersheds in Ozaukee County.

Barnyard Runoff: Table 4-2 summarizes the pollution potential of barnyard runoff in the watershed. There are 102 barnyards in this watershed; 68 of which drain directly or indirectly to rivers and streams. The remainder have no opportunity to affect flowing waters. This is either because the animals are totally confined to their barns or because any runoff generated ends up in an isolated area such as a pocket wetland or other area of internal drainage.

The 68 barnyards draining to rivers and streams can generally be divided into three groups based on their relative contributions of pollutants to surface waters. Sixteen barnyards are considered to produce high amounts of pollutants, 13 are considered to produce moderate levels, and 39 are considered to produce relatively small amounts of pollutants. The highest barnyard pollution loading to surface waters occurs in the Waubeka, Haneman Lake, Saukville, and Lakefield Subwatersheds.

The most concentrated barnyard pollution loading per mile of perennial stream occurs in the Waubeka and Haneman Lake Subwatersheds, with slightly lesser amounts of barnyard pollution per mile of stream in the Saukville, Fredonia, and Lakefield subwatersheds. Two of the four barnyards draining to pocket wetlands are of moderate concern due to their potential impacts on wetland environments.

Winterspread Manure: The pollution potential associated with winterspreading manure in the watershed is presented in Table 4-3. Approximately 1,900 acres of land are needed to daily spread the manure generated during the period of snowcover and snowmelt. Although there are 3,500 acres of cropland available for winterspreading, not all of these lands are environmentally safe. During this period, when manure cannot be incorporated into the soil, lands located in the floodplain or that have slopes over 6 percent are considered environmentally unsafe because manure spread in these areas is highly prone to wash-off into surface waters.

It is estimated that on a watershed basis, there are about 1,300 acres of environmentally unsafe lands for winterspreading. This leaves an estimated 2,200 acres that are environmentally safe, more than adequate to meet the watershed need. However, these safe acres are not distributed according to the needs of the 91 various livestock operations. As a result, it is estimated that approximately 500 acres of environmentally unsafe lands, mostly located within the floodplain, are winterspread annually.

Table 4-2. Pollution potential of barnyard runoff in the Milwaukee River South Watershed.

Runoff Destination		Subwatershed								
		Fredonia	Waubeka	Saukville	Haneman L.	Grafton	Lakefield	Pigeon C.	Mequon	TOTAL
Rivers, streams	Number	9	22	12	11	6	6	2		68
	Load*	75	240	168	176	107	20	31		816
Pocket wetlands	Number		2		1	1				4
	Load*		36		16		5			57
Deep soils	Number		5	2	1	2		1		11
	Load*		21	12		7		8		48
No runoff	Number	2	6	3	1		2	4	1	19
	Load*									
Total	Number	11	35	17	14	2	9	11	3	102
	Load*	75	297	180	192	7	112	28	31	921

*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.

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade, and Protection; and the Ozaukee County Land Conservation Department.

Table 4-3. Pollution potential of winterspread manure in the Milwaukee River South Watershed.

Subwatershed	Number of Livestock Operations	Acres Needed for Manure Spreading	Acres Available		Estimated Number of Unsafe Acres Winterspread per Year
			Safe Acres	Unsafe Acres*	
Fredonia	10	315	403	125	60
Waubeka	32	743	627	584	265
Saukville	15	305	336	210	35
Haneman L.	12	247	325	144	60
Grafton	1	25	22	20	<5
Lakefield	9	116	179	106	45
Pigeon C.	10	125	287	88	25
Mequon	2	36	26	17	15
TOTAL	91	1,912	2,205	1,294	505

*Unsafe acres are those that are in the floodplain or that have slopes greater than 6%. Manure spread on lands with these characteristics can be easily washed off into streams during spring rainfall and snowmelt.

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade, and Consumer Protection, and the Ozaukee County Land Conservation Department.

The 91 livestock operations can be divided into three groups based on their relative pollution potentials associated with winterspreading manure. Fifteen are considered to have a high pollution potential, 14 are considered to have a moderate pollution potential, and 62 are considered to have a low pollution potential. Over 50 percent of the pollution potential occurs in the Waubeka Subwatershed, with the Haneman Lake and Fredonia Subwatersheds each having 10 percent of the pollution potential. The Saukville, Lakefield, Pigeon Creek, and Lakefield Subwatersheds have lesser pollution potentials associated with winterspread manure. The Waubeka and Fredonia Subwatersheds have the highest pollution potential per perennial stream mile.

Upland Erosion and Sediment Delivery: Table 4-4 shows the acreage for various rural land use types in the watershed. The rural land use composition is 54 percent cropland, 22 percent grassland, 12 percent wetland, 9 percent woodlot, with the remaining 3 percent distributed amongst farmsteads, pastures, and grazed woodlots.

Table 4-5 summarizes gross soil loss and sediment delivery from eroding uplands in Ozaukee County. Gross soil erosion totals 86,100 tons per year; however, very little of this eroded soil makes its way to surface waters. On a watershed basis, only 4 percent of the eroded soil, or 3,270 tons per year, is delivered to surface waters.

The Mequon, Waubeka, and Lakefield Subwatersheds produce the highest annual loads of sediment delivered from uplands. Each contributes between 20 percent and 25 percent of this sediment source. Pigeon Creek, Saukville, Fredonia and Haneman Lake Subwatersheds each contribute between 6 percent and 10 percent of this sediment source. The Grafton Subwatershed contributes only 3 percent. The highest amount of delivered sediment per stream mile occurs in the Lakefield and Waubeka Subwatersheds. Lowest rates are in the Saukville, Haneman Lake, and Grafton Subwatersheds. The Pigeon Creek, Mequon, and Fredonia Subwatersheds experience intermediate rates of sediment delivery per perennial stream mile.

Virtually all of this delivered sediment comes from eroding cropland. Importantly, most of the delivered sediment originates on croplands that are experiencing low rates of soil erosion. For example, between 60 percent and 85 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 portion is largest in the Waubeka, Fredonia, Saukville, and Haneman Lake Subwatersheds where 75 percent to 85 percent of the delivered sediment comes from lands with these low erosion rates. The portion is less in the Grafton, Lakefield, Pigeon Creek, and Mequon Subwatersheds where 45 percent to 60 percent of delivered sediment originates.

Streambank Erosion: Table 4-6 shows the results of the streambank erosion survey conducted on stream sections within Ozaukee County. The streambanks along 140 miles of perennial streams were surveyed. This resulted in assessments for about 1,493,600 feet of streambank in the watershed. Streambank erosion in Ozaukee County occurring within city or village limits is included in this portion of the report, since many of the sites in these areas occur adjacent to rural and open type land uses. The truly "urban" streambank erosion is summarized in the section of this chapter that addresses urban nonpoint sources.

Table 4-4. Rural land use, in acres, for subwatersheds in the Milwaukee River South Watershed.

	Land Use Type							
Subwatershed	Crop-land	Farm-stead	Grass-land	Pasture	Woodlot	Grazed Woodlot	Wet-Land	Total
Fredonia	2,429	50	308	132	325	28	662	3,934
Waubeka	7,346	285	1,909	190	1,148		1,361	12,239
Saukville	3,206	118	1,479	136	343		840	6,122
Haneman L.	2,614	83	999	112	300		1,017	5,125
Grafton	426	24	262	17	301		111	1,141
Lakefield	3,999	114	1,806	101	510	7	882	7,419
Pigeon C.	2,837	132	1,530	113	808		380	5,800
Mequon	3,898	85	2,345	51	622	14	636	7,651
Total	26,755	891	10,638	852	4,357	49	5,889	49,431

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade, and Consumer Protection; and the Ozaukee County Land Conservation Department.

Table 4-5. Soil erosion and sediment delivery from eroding uplands for subwatersheds in the Milwaukee River South Watershed.*

Subwatershed	Acres Eroding	Gross Soil Loss (tons/y)	Sediment Delivery to Surface Waters (tons/y)
Fredonia	3,272	5,593	191
Waubeka	10,878	18,960	741
Saukville	5,282	7,484	276
Haneman L.	4,108	6,592	226
Grafton	1,030	2,033	82
Lakefield	6,537	15,367	630
Pigeon C.	5,420	9,701	325
Mequon	7,015	20,376	800
Total	43,542	86,106	3,271

*Eroding uplands include croplands, grasslands, pastures, woodlots, and farmsteads.

Source: Wisconsin Department of Natural Resources, Wisconsin Department of Agriculture, Trade, and Consumer Protection, and Ozaukee County Land Conservation Department.

Table 4-6. Streambank erosion in the Ozaukee County portion of the Milwaukee River South Watershed.

Subwatershed	Name of Stream/River	Feet of Streambank Surveyed*	Feet of Streambank Degraded	Sediment Produced (tons/y)
Fredonia	Fredonia C.	72,400	2,205	77
	Tributaries to Fredonia C.	19,360		
Waubeka	Milwaukee R.	84,240	6,435	115
	Tributaries to Milwaukee R.	167,280		
Saukville	Milwaukee R.	72,960	15,450	302
	Tributaries to Milwaukee R.	63,380		
Haneman L.	Mile Creek	90,120	10,560	74
	Tributaries to Mole C.	36,400		
Grafton	Milwaukee R.	54,080	8,415	76
	Tributaries to Milwaukee R.	25,680		
Lakefield	Ulao C.	39,360	4,530	58
	Tributaries to Ulao C.	176,280		
Pigeon C.	Pigeon C.	116,880	5,880	56
	Tributaries to Pigeon C.	93,880		
Mequon	Milwaukee R.	117,760	42,375	776
	Tributaries to Milwaukee R.	263,540	4,220	109
Sub-Total	Milwaukee River	329,040	72,675	1,269
	Principle Tributaries	318,760	23,215	265
	Other Tributaries	845,800	2,620	109
Total		1,493,600	98,510	1,643

*Includes streambanks along both sides of the stream or river.

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade, and Consumer Protection; ant the Ozaukee County Land Conservation Department.

Approximately 6.5 percent of the streambanks surveyed in the Ozaukee County portion of the watershed are eroding, producing a total estimated annual sediment load of 1,643 tons. The erosion is worst along the Milwaukee River, where 72,700 feet or 22 percent of the streambanks surveyed are eroding. These erosion sites contribute 1,270 tons of sediment directly to the river annually. Along the principal tributaries, 22,400 feet or 7 percent of the streambanks surveyed are eroding. These sites produce 260 tons of sediment annually. Smaller tributaries experience streambank erosion along 2,600 feet or less than 1 percent of their length. These sites produce about 110 tons of sediment annually.

Sediment production from streambanks is greatest in the Mequon Subwatershed. This subwatershed produces 885 tons of sediment annually from this source. This constitutes 54 percent of the total streambank sediment production within Ozaukee County. Most of this occurs directly on the Milwaukee River. Other subwatershed contributions to the rural streambank sediment production are: Saukville 18 percent; Waubeka 7 percent; Grafton, Haneman Lake, Fredonia, Lakefield, and Pigeon Creek each with about 4 percent. The highest rate of sediment delivery per stream mile occurs in the Mequon Subwatershed. The Saukville Subwatershed also has a high rate.

Urban Nonpoint Sources

Urban areas produce a wide array of pollutants, some of which are unique to urban area runoff and some of which are also produced by agricultural land uses. Pollutants produced in common with agricultural land uses include sediment, nutrients, bacteria and other pathogens, and pesticides. Pollutants generated primarily in urban areas include a wide range of heavy metals such as lead, copper, zinc, cadmium, or chromium, and a large number of toxic organic chemicals.

In addition, creation of urban areas causes extreme changes in the hydrology of streams. This occurs as runoff volume not only increases in magnitude, but is produced in a shorter period of time creating large increases in peak stream discharge. 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 flows needed to sustain fish and aquatic life during periods of low rainfall.

These urban impacts produce "flashy" streams which are thermally and chemically polluted, hydrologically unstable environments for fish and aquatic life. Streambank erosion is increased as the stream attempts to continually cut a channel in equilibrium with widely variable stream flows. Flooding problems are also created that result in loss of property. Ultimately, such streams may be channelized and even lined with concrete to reduce property damage. Such practices create, in effect, an open storm sewer which destroy the stream environment.

Urban nonpoint pollution sources described in this section include: existing streambank erosion; existing urban areas such as commercial, industrial, and residential land uses; and areas where new urbanization is expected to occur, posing an increased potential for pollution from construction erosion and runoff from new urban surfaces.

Streambank Erosion: Urban stream sections targeted for the field survey are all located in Milwaukee County. Stream sections that were surveyed include:

* Lincoln Creek, from Teutonia Avenue to Mill Road.

* Sections of Indian Creek and its principal tributary downstream of U.S. Highway 43, within the Village of River Hills.

* Isolated sections on Beaver Creek and Brown Deer Creek within the Village of Brown Deer.

The survey covered about 7.5 miles of perennial streams and 79,600 feet of streambank. All sections surveyed had earthen channels, some natural and meandering, and some straightened. No concrete lined stream sections were surveyed for erosion.

Table 4-7 shows the results of the streambank erosion survey conducted on these urban stream sections. Approximately 34 percent of the urban streambanks surveyed in the watershed are eroding, producing a total estimated annual sediment load of about 550 tons.

Urban streambank erosion is worst along Lincoln Creek in the city of Milwaukee, where 24,000 feet or 52 percent of the banks surveyed along the stream are eroding. These erosion sites contribute 430 tons of sediment to Lincoln Creek annually. In the section of Lincoln Creek between the Milwaukee River and Teutonia Avenue, 5,200 feet or 43 percent of the streambanks are eroding, producing about 50 tons of sediment per year. In this segment, large fluctuations in water level occur due to periodic drawdown of the pool at the Estabrook Park Dam. In the section of Lincoln Creek between 32nd Street and Hampton Boulevard, 9,500 feet or 40 percent of the streambanks are eroding, producing 240 tons of sediment per year. In the section that winds through the United States Army Property and the DNR Havenwoods Forest Preserve and Nature Center, 9,300 feet or 96 percent of the streambanks are eroding, producing 140 tons of sediment per year.

Indian Creek also experiences relatively serious streambank erosion problems below U.S. Highway 43. Here, 3,150 feet or 23 percent of the surveyed streambanks are eroding, producing 106 tons of sediment annually. Erosion problems along other urban streams surveyed, including sections of Fredonia Creek, Beaver Creek, South Branch Creek, and the tributary to Indian Creek, are relatively insignificant.

Existing Urban Area Runoff: The delivery to surface waters of urban pollutants from established urban areas varies greatly depending on the type of urban land use, the stormwater conveyance system, and urban housekeeping practices.

The impact that land use type has on the production of pollutants in urban areas is shown in Table 4-8. The pollutants chosen include suspended sediment and phosphorus, indicative of pollutants also produced in the agricultural areas, and two heavy metals, lead and zinc, which represent toxicants produced primarily in urban areas. Other toxicants of concern are also listed as a reminder that urban runoff constituents are widely diverse.

Table 4-7. Streambank erosion in the Milwaukee County portion of the Milwaukee River South Watershed.

Subwatershed	Name of Stream/River	Municipality	Feet of Streambank Surveyed*	Feet of Streambank Degraded	Sediment Produced (tons/y)
Beaver C.	Beaver C.	Village of Brown Deer	5,200	215	11
South Branch C.	South Branch C.	Village of Brown Deer	5,200		
Indian C.	Indian C.	Village of River Hills	13,600	3,150	106
	Tributary to Indian C.	Village of River Hills	9,600		
Lincoln C.	Lincoln C.	City of Milwaukee	46,000	23,965	430
Totals			79,600	27,330	547

*Includes streambanks along both sides of the river or stream.

Source: Wisconsin Department of Natural Resources.

Table 4-8. Unit area pollutant generation rates for 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), PAH's(2)
Industrial	1,000	1.5	2.4	2.1	Pesticides(3), PCB's(4), PAH's, esters(5), volatile organics, aliphates(6)
Commercial	1,000	1.5	2.7	2.1	Volatile organics, PAH's
Shopping Centers	440	0.5	1.1	0.6	Volatile organics, PAH's
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 the environment.
(2) Polynuclear aromatic hydrocarbons (PAH's) are composed of rings of benzene and other aliphates. Some PAH's are carcinogenic.
(3) Pesticides are hazardous chemicals and may adversely affect aquatic and human health.
(4) Polychlorinated biphenyls (PCB's) are very stable compounds which persist in the environment for long periods of time. They are passed through the food chain 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 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.

Generally freeways, industrial areas, and commercial areas are the greatest generators of urban pollutants on a per acre basis. High density residential lands are also significant for some pollutants. Medium density residential areas are of much less importance for sediment and lead on a per acre basis, but continue to be significant as sources of pesticides, bacteria, and household or automotive maintenance products dumped into the storm sewer system. Low density residential areas are generally important only if housekeeping practices, including use of pesticides and fertilizers, are poor.

The variability seen in this table is the result of how "source areas" within each urban land use are distributed. Source areas, such as streets, parking lots, rooftops, and lawn areas are present in different proportions for different land uses. For example, residential areas contain more lawn areas than commercial areas, while commercial areas contain more rooftop, street, and parking lot surfaces.

These source areas vary in the types and amounts of pollutants available for transport by rainfall and runoff and vary in the extent to which pollutant-producing surfaces are hydrologically "connected" to the storm sewer system. These two factors are at the core of what makes urban land uses significant as pollution sources. 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. Commercial areas and urban freeways are also highly "connected" to storm sewers and have little or no pollutant buffering. Lawn areas, important contributors of nutrients, pesticides, and sediment, are more prevalent in residential areas. Rooftops are important sources of zinc and asbestos, vary in the proportion of land they cover in each urban land use, and also vary in the degree to which they are "connected" to the storm sewer system. Generally, "connectedness" is higher in commercial areas than residential areas.

Maps 6 and 7 show the 1985 urban land use distribution for the Ozaukee County portion of the watershed. Table 4-9 provides more detailed urban land use information for Ozaukee County, including how the urban area in each subwatershed is distributed amongst different urban land use types. Map 8 and Table 4-10, present similar information for the Milwaukee County portion of the watershed.

Table 4-11 lists some basic information concerning stormwater conveyance systems and street sweeping practices for communities in the watershed. These factors will affect the portion of pollutants originally deposited on urban surfaces that will be delivered to surface waters. Street sweeping removes some of the particulate pollutants from street and parking lot surfaces before rainfall and runoff transport them to surface waters.

A good sweeping program would include about 28 passes during the year (once per week) for heavily used street surfaces, alternating use of brush style and vacuum style sweepers to trap both small and larger size particles. Repeated sweeping of heavily used street surfaces in the early spring results in the greatest water quality benefit.

Sweeping during the fall is also important to reduce transport of leaf fragments to surface waters. Grassed swale conveyance, as opposed to curb and gutter drainage, also serves to reduce the proportion of urban pollutant loads that are delivered to surface waters, and in residential areas will lessen the need for intensified street sweeping. Appendix C includes more detailed information on accelerated street sweeping schedules.

Grassed swales reduce pollutants primarily through stormwater infiltration, and secondarily through pollutant filtration. Although grassed swales can be highly effective pollution reduction practices, it is assumed that existing swales in the watershed are minimally effective due to past construction techniques that have reduced their capability to infiltrate stormwater. The exception is grassed swales draining sections of U.S. Highway 43 north of Good Hope Road. These swales are wide enough to be considered very effective in reducing freeway pollutant loads in these areas.

Table 4-12 shows the 1985 urban pollutant loading for all subwatersheds in the Milwaukee River South Watershed. Urban areas in Ozaukee County produce about 25 percent of the watershed lead load and 25 percent of the urban suspended sediment load. The Mequon Subwatershed is responsible for nearly one-third of this. The Grafton, Lakefield, and Pigeon Creek Subwatersheds are roughly equal producers, combining to contribute about one-half of the Ozaukee County urban loads. Milwaukee County urban areas produce about 75 percent of the watershed urban lead and suspended sediment loads. The Lincoln Creek Subwatershed dominates the pollution production, contributing 55 percent of the Milwaukee County urban pollutant load and 40 percent of the urban load generated in the entire watershed. The Milwaukee River-Shorewood Subwatershed is also a highly significant contributor of urban pollutants.

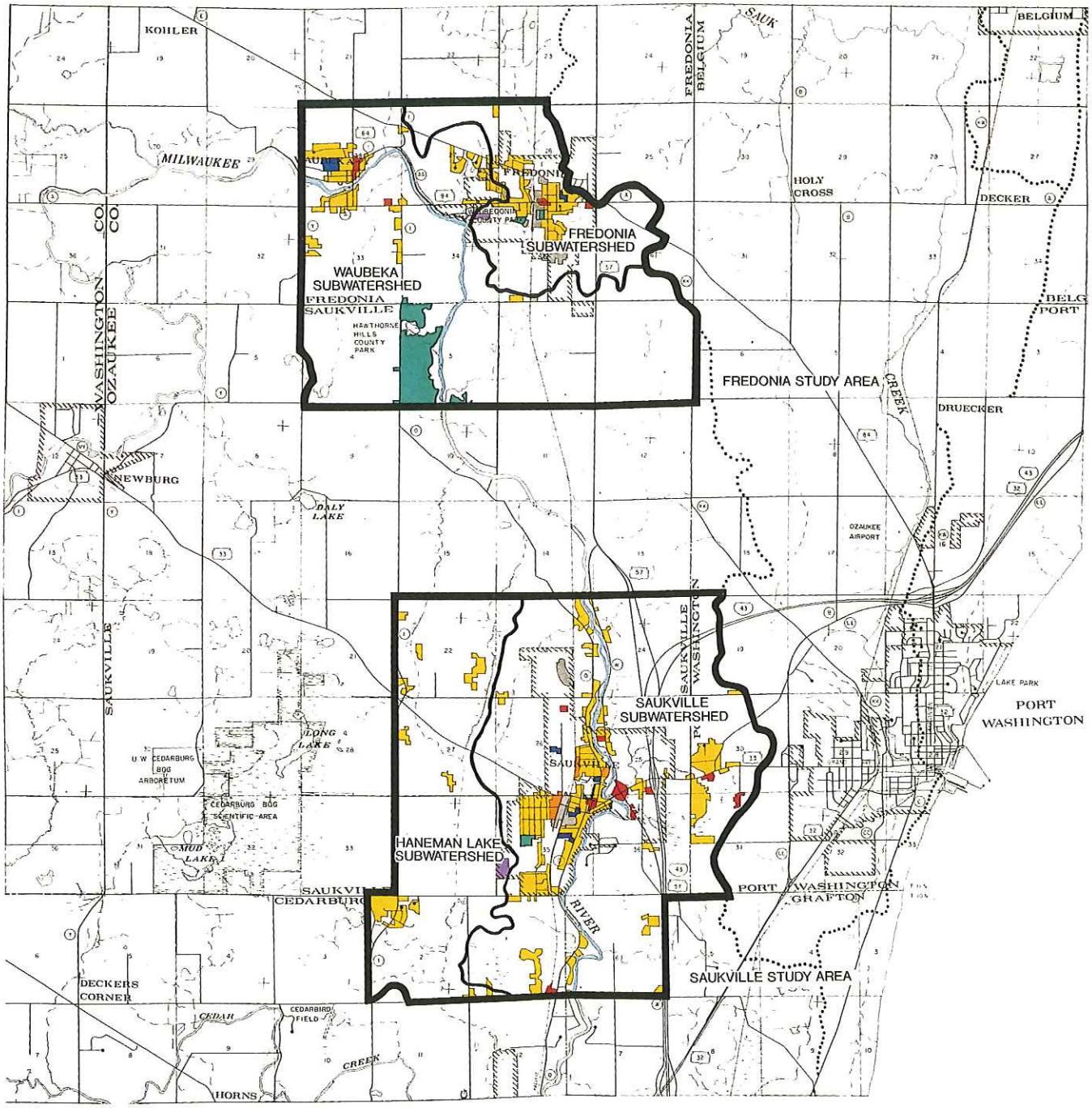
It is important to identify those land uses that are most important in contributing to the total urban pollutant load. Land uses gain significance based on a combination of factors, including the unit area rate of pollutant production for the land use and the total mass loading from a particular land use. Table 4-13 shows the proportion of the urban pollutant loading that is generated by various land uses in subwatersheds within Ozaukee County. Table 4-14 shows the same type of information for subwatersheds in Milwaukee County.

In most subwatersheds throughout the Milwaukee River South Watershed, commercial and industrial areas produce the most significant portion of the lead loading. These land uses also have significantly higher unit area lead loads than the other land uses. High density and multi-family residential areas challenge commercial and industrial land uses in importance for the Lincoln Creek and Milwaukee River-Shorewood Subwatersheds. This is primarily because of the large acreage devoted to these land uses, since their unit area loads are less significant. In the Indian Creek Subwatershed, the medium density residential land use generates a significant portion of the urban pollutant load for the same reasons.

When considering sources of sediment, Tables 4-13 and 4-14 show that medium and high density residential areas take on greater significance across the watershed, competing more closely with commercial and industrial areas as important sources of the urban sediment loading.

Map 6

EXISTING URBAN LAND USES IN THE FREDONIA AND SAUKVILLE STUDY AREAS: 1985



LEGEND

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

GRAPHIC SCALE

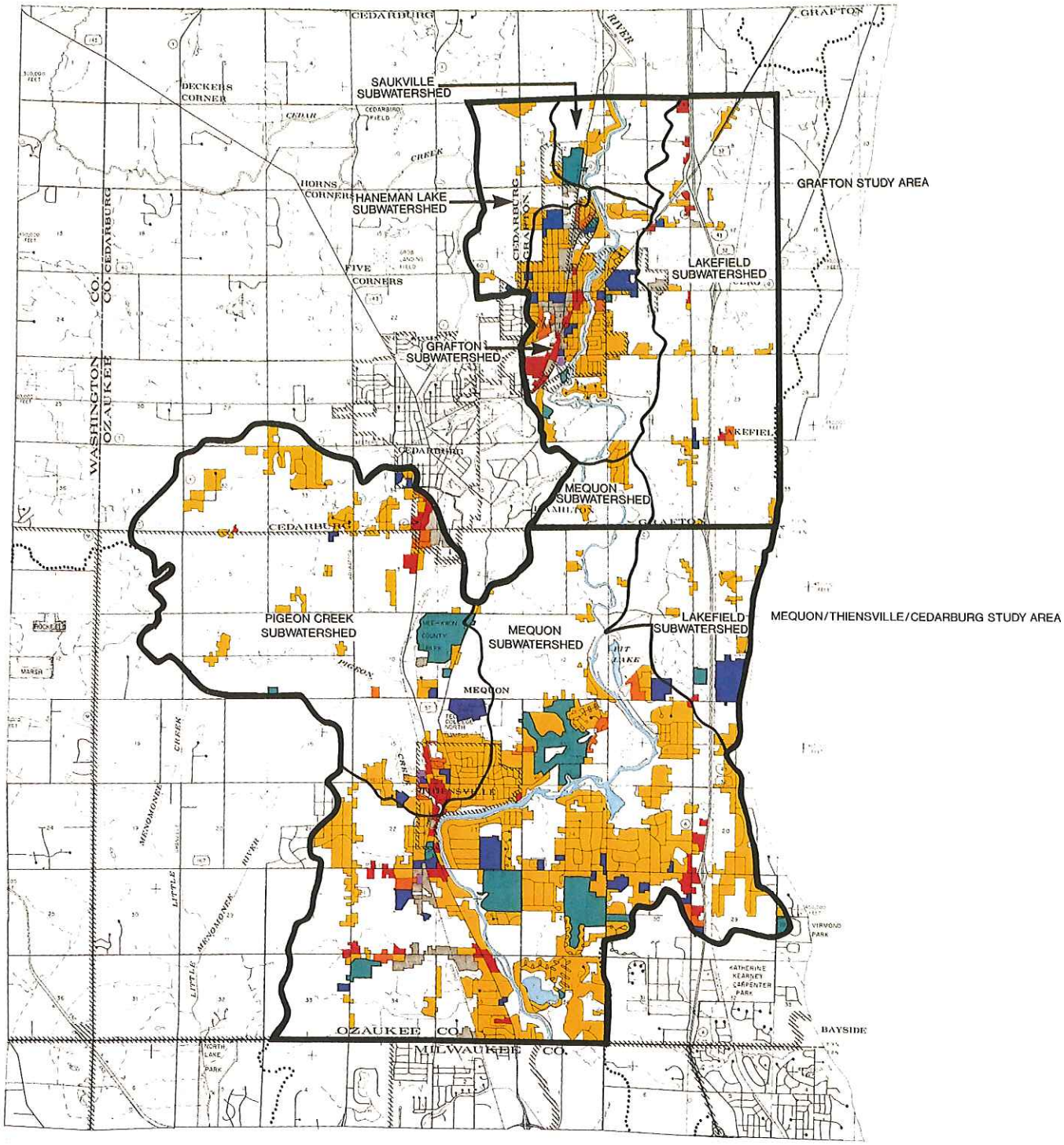
0 1/2 1 MILE

0 2000 4000 6000 8000 FEET

Source: SEWRPC.

Map 7

EXISTING URBAN LAND USES IN THE GRAFTON AND MEQUON/THIENSVILLE/CEDARBURG STUDY AREAS: 1985



LEGEND

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

Source: SEWRPC.

Table 4-9. Areal extent, in acres, of urban land uses for subwatersheds in the Ozaukee County portion of the Milwaukee River South Watershed: 1985*.

Subwatershed	Municipalities Included	Residential Density Low	Medium	High	Commer-cial	Indus-trial	Free-way	Insti-tutional	Parks Open	Total
Fredonia	V. of Fredonia	21	133	9	12	40		8	73	296
Waubeka	V. of Fredonia Tns. of Fredonia, Saukville; Waubeka(unincorp.)	196	62	2	15	31		25	294	625
Saukville	V. of Saukville V. of Grafton Tns. of Saukville, Port Washington, Grafton	535	253	42	57	75	192	16	281	1,451
Haneman L.	V. of Saukville V. of Grafton Tns. of Saukville, Cedarburg, Grafton	287	21	2	1	18		4	39	372
Grafton	V. of Grafton Tn. of Grafton	301	463	69	101	254		141	198	1,527
Lakefield	C. of Mequon V. of Grafton Tn. of Grafton	371		16	65	162	311	128	135	1,188
Pigeon C.	C. of Mequon C. of Cedarburg V. of Thiensville Tn. of Cedarburg	788	219	74	102	174		128	392	1,877
Mequon	C. of Mequon Tn. of Grafton	3,127	398	135	229	398	90	263	1,290	5,930
Total		5,626	1,549	349	582	1,152	593	713	2,702	13,266

*Includes lands contained within the four study areas delineated for this project.

Source: Wisconsin Department of Natural Resources

Table 4-10. Areal extent, in acres, of urban land uses for subwatersheds in the Milwaukee County portion of the Milwaukee River South Watershed: 1985*.

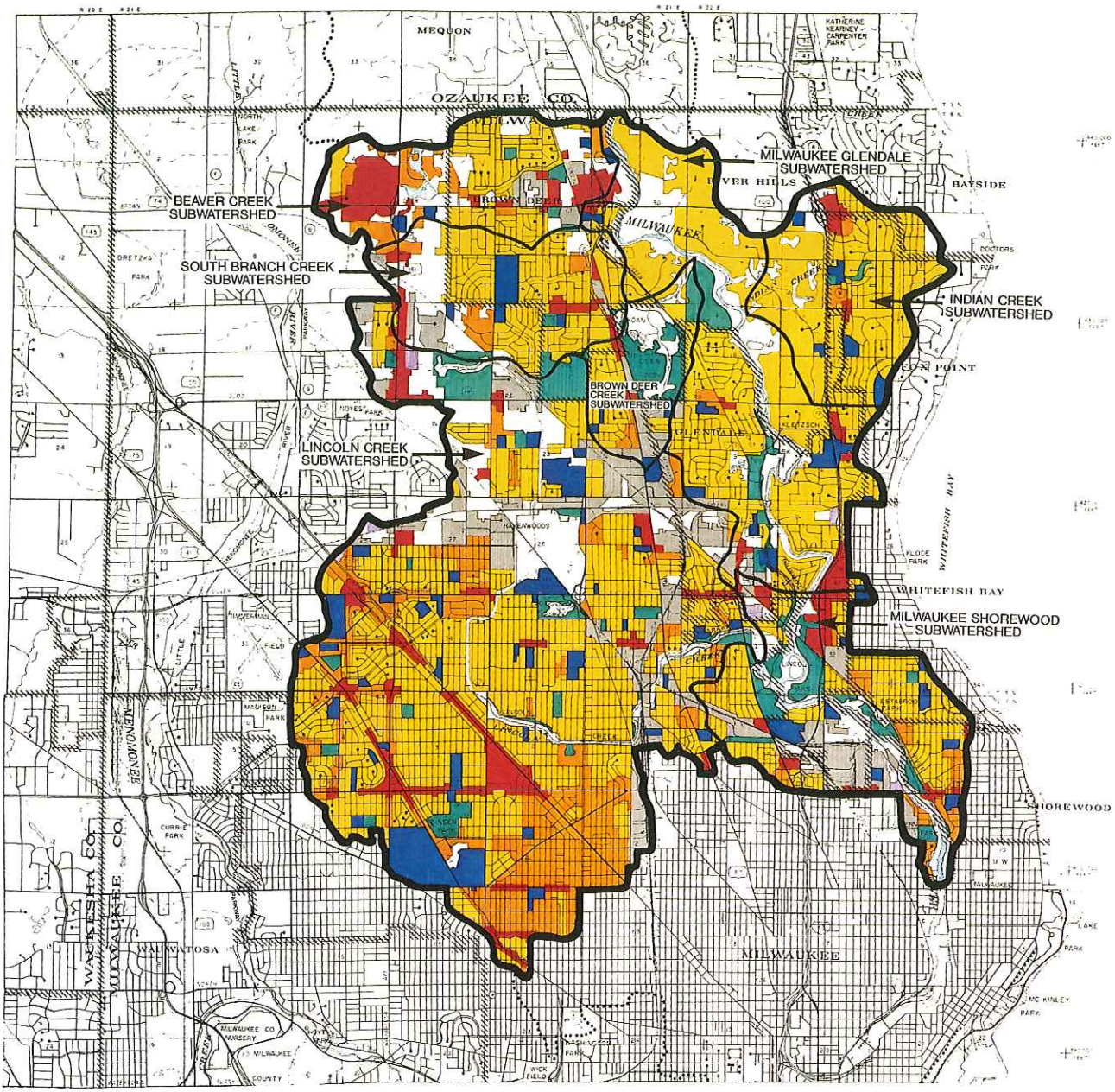
Subwatershed	Municipalities Included	Residential Density Low	Medium	High	Commer-cial	Indus-trial	Free-way	Insti-tutional	Parks Open	Total
Beaver C.	C. of Milwaukee V. of Brown Deer	97	552	238	267	131		40	425	1,750
South Branch C.	C. of Milwaukee V. of Brown Deer	218	682	141	110	271		140	381	1,943
Brown Deer C.	C. of Glendale C. of Milwaukee V. of River Hills	69	197	68	52	149		51	388	974
Indian C.	V. of Bayside V. of Fox Point V. of River Hills C. of Glendale	667	557	58	85		83	105	125	1,680
Milwaukee River-Glendale	V. of Brown Deer V. of River Hills C. of Glendale	737	1230	113	161	245	39	193	471	3,189
Lincoln C.	C. of Milwaukee C. of Glendale V. of Brown Deer	55	441	6525	836	1531	77	625	2591	12,681
Milwaukee River-Shorewood	C. of Milwaukee C. of Glendale V. of White Fish Bay V. of Shorewood		60	1092	233	478	72	127	693	2755
Totals		1,843	3,719	8,124	1,744	2,805	271	1,281	5,074	24,971

*Includes lands contained within the four study areas delineated for this project.

Source: Wisconsin Department of Natural Resources.

Map 8

EXISTING URBAN LAND USES IN THE MILWAUKEE STUDY AREA: 1985



LEGEND

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

Source: SEWRPC.

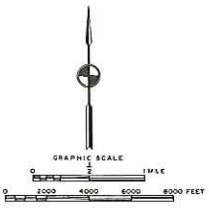


Table 4-11. Street sweeping schedule and grass swale location by land use for municipalities in the Milwaukee South Watershed.

	Residential & Institutional		Commercial & Industrial	
	Street Sweeping* (frequency)	Grass Swales (% area)	Street Sweeping* (frequency)	Grass Swales (% area)
V. of Fredonia	twice/month	0	twice/month	0
V. of Saukville	once/week	0	once/week	0
V. of Grafton	once/month	0	twice/month	0
C. of Cedarburg	once/year	0	once/year	0
V. of Thiensville	once/year	30	once/month	0
C. of Mequon	none	100	none	100
V. of River Hills	none	100	none	100
V. of Bayside	none	100	none	100
V. of Fox Point	twice/year	100	twice/year	100
C. of Glendale	twice/month	80	twice/month	0
V. of Brown Deer	once/month**	100	once/month	0
V. of Shorewood	twice/month	0	once/week	0
V. of Whitefish Bay	once/week	0	once/week	0
C. of Milwaukee	twice/month***	0	once/week	0

* Beginning 04/01/89 and ending 10/15/89.
** Institutional areas are not swept.
*** Institutional areas are swept once/week.

Source: Wisconsin Department of Natural Resources.

Table 4-12. Urban nonpoint source pollutant loads for subwatersheds in the Milwaukee River South Watershed: 1985*.

Subwatershed	Suspended Solids (lb/y)	Total Phosphorus (lb/y)	Total Lead (lb/y)
Fredonia	72,212	156	135
Waubeka	67,211	139	152
Saukville	160,740	360	295
Haneman L.	28,145	58	63
Grafton	423,493	869	849
Lakefield	257,500	450	660
Pigeon C.	334,228	680	703
Mequon	706,000	1,350	1,670
Beaver C.	442,514	943	875
South Branch C.	455,710	966	867
Brown Deer C.	214,137	440	437
Indian C.	192,400	430	320
Milwaukee River-Glendale	558,116	1,267	1,128
Lincoln C.	3,749,942	7,830	7,866
Milwaukee River-Shorewood	1,092,966	2,175	2,504
Totals	8,755,314	18,113	18,524

*Includes lands contained within the four study areas delineated for this project. Does not include construction site erosion.

Source: Wisconsin Department of Natural Resources.

Table 4-13. Land use contributions to the urban pollutant loading for subwatersheds in the Ozaukee County portion of the Milwaukee River South Watershed: 1985*.

Subwatershed	Urban Area (a.c.)	Land Use	%Subwatershed Urban Area	% Subwatershed Urban Pollutant Load		
				Lead	Phosphorus	Sediment
Fredonia	296	Medium Industrial	13%	55%	31%	41%
		Medium Residential	45%	22%	48%	39%
		Commercial	3%	14%	8%	10%
		Multi-family Residential	3%	6%	6%	6%
Waubeka	625	Medium Industrial	4%	55%	33%	43%
		Commercial	2%	27%	16%	21%
		Medium Residential	9%	9%	26%	20%
		Institutional	4%	4%	10%	8%
Saukville	1,451	Medium Industrial	5%	42%	31%	31%
		Commercial	3%	25%	15%	18%
		Medium Residential	17%	18%	40%	33%
		Multi-family Residential	3%	12%	13%	12%
Haneman L.	372	Industrial	4%	78%	47%	62%
		Medium Residential	5%	7%	20%	15%
		Commercial	<1%	5%	3%	4%
		Multi-family Residential	<1%	3%	3%	3%
Grafton	1,527	Medium Industrial	16%	56%	36%	46%
		Commercial	6%	19%	13%	14%
		Medium Residential	30%	13%	31%	23%
		Multi-family Residential	5%	7%	9%	8%
		Institutional	9%	3%	9%	7%
Lakefield	1,188	Medium Industrial	13%	66%	54%	60%
		Commercial	5%	27%	22%	25%

Table 4-13. (Continued) Land use contributions to the urban pollutant loading for subwatersheds in the Ozaukee County portion of the Milwaukee River South Watershed: 1985*.

Subwatershed	Urban Area (a.c.)	Land Use	%Subwatershed Urban Area	% Subwatershed Urban Pollutant Load		
				Lead	Phosphorus	Sediment
Pigeon C.	1,877	Medium Industrial	8%	52%	37%	44%
		Commercial	5%	27%	18%	21%
		Multi-family Residential	3%	8%	11%	19%
		Medium Residential	12%	7%	17%	13%
		Institutional	7%	4%	10%	8%
Mequon	5,930	Medium Industrial	7%	57%	38%	49%
		Commercial	3%	29%	19%	25%
		Multi-family Residential	2%	4%	9%	8%
		Institutional	4%	3%	9%	7%
		Medium Residential	7%	2%	11%	8%

*Land uses with less than 2% contribution to the urban pollutant loading are not listed.
Does not include construction site erosion.

Source: Wisconsin Department of Natural Resources.

Table 4-14. Land use contributions to the urban pollutant loading for subwatersheds in the Milwaukee County portion of the Milwaukee River South Watershed: 1985.*

Subwatershed	Urban Area (a.c.)	Land Use	%Subwatershed Urban Area	% Subwatershed Urban Pollutant Load		
				Lead	Phosphorus	Sediment
Beaver C.	1,750	Commercial	15%	39%	26%	30%
		Light, Medium Industrial	7%	26%	2%	22%
		Multi-family Residential	13%	23%	27%	25%
		Medium Density Residential	31%	9%	24%	19%
South Branch C.	1,943	Light, Medium Industrial	13%	53%	32%	41%
		Commercial	5%	16%	13%	12%
		Multi-family Residential	7%	13%	16%	14%
		Medium Density Residential	35%	12%	31%	24%
Brown Deer C.	974	Light, Medium Industrial	15%	58%	37%	47%
		Commercial	5%	15%	11%	12%
		Multi-family Residential	6%	13%	16%	15%
		Medium Density Residential	20%	9%	24%	18%
		Institutional	6%	3%	6%	5%
Indian C.	1,680	Commercial	4%	57%	22%	32%
		Medium Density Residential	31%	24%	50%	41%
		Multi-family Residential	3%	12%	12%	15%
		Institutional	6%	7%	11%	10%
Milwaukee River-Glendale	3,189	Light, Medium Industrial	7%	38%	23%	32%
		Commercial	5%	21%	13%	16%
		Medium Density Residential	39%	15%	42%	30%
		Freeway	1%	10%	1%	4%
		Multi-family Residential	2%	4%	5%	<1%
		Institutional	6%	3%	7%	6%
		High Density Residential	1%	2%	3%	3%

Table 4-14. (Continued) Land use contributions to the urban pollutant loading for subwatersheds in the Milwaukee County portion of the Milwaukee River South Watershed: 1985.*

Subwatershed	Urban Area (a.c.)	Land Use	%Subwatershed Urban Area	% Subwatershed Urban Pollutant Load		
				Lead	Phosphorus	Sediment
Lincoln C.	12,681	High Density Residential	35%	33%	42%	38%
		Light, Medium Industrial	12%	32%	21%	27%
		Multi-family Residential	15%	14%	18%	16%
		Commercial	7%	14%	10%	11%
		Freeway	1%	5%	1%	2%
Milwaukee River-Shorewood	2,755	Light, Medium Industrial	17%	34%		31%
		High Density Residential	29%	26%		34%
		Commercial	8%	14%		12%
		Freeway	3%	14%		6%
		Multi-family Residential	10%	9%		12%

*Land uses with less than 2% contribution to the urban pollutant loading are not listed. Does not include construction site erosion.

Source: Wisconsin Department of Natural Resources.

New Urban Development: New urban development is potentially significant for two reasons. First, the act of constructing roads, utilities, and buildings creates mass disturbance, exposing large amounts of soil to erosion in areas where eroded soil is easily delivered to surface waters via established stormwater conveyance systems. If not carefully regulated, construction site erosion can have catastrophic impacts on urban rivers and streams, in addition to causing costly nuisance conditions and utility damage as soil is deposited on road surfaces and in storm sewers.

Second, newly established urban surfaces will add to the accumulation and discharge of many pollutants. Consequently, as areas urbanize, the current water quality problems that cause urban pollutants--including excessive stormwater flows--will get worse.

Maps 9 and 10 show the extent of anticipated new development in the Ozaukee County portion of the watershed. These maps reflect changes that might take several decades to occur. Table 4-15 shows the portion of this anticipated urbanization that is expected to occur by the year 2000. Urban land use in Ozaukee County is anticipated to increase by about 4,900 acres by the year 2000. This is an increase of 37 percent over the existing urban area. Nearly 2,000 acres of this new development will occur in the Mequon Subwatershed alone. Subwatersheds that will experience the greatest percent change in urban area include Haneman Lake (84 percent), Saukville (54 percent), and Pigeon Creek (42 percent).

Map 11 and Table 4-16 provide the same information for that portion of Milwaukee County within the watershed. Unlike Ozaukee County, all of the anticipated urban development in Milwaukee County is expected to occur by the year 2000. This amounts to about 2,100 acres of new development by the year 2000, an increase of 8 percent over the existing urban area. The greatest increase of the urban area is anticipated to occur in the Lincoln Creek, Beaver Creek, and South Branch Creek subwatersheds. Subwatersheds that will experience the greatest percent change of the urban area include Beaver Creek (27 percent) and South Branch Creek (21 percent).

Once established, these new urban areas will carry their own potential to further degrade surface waters unless stormwater controls are incorporated during development. Table 4-17 shows the increase in urban pollutant loading that will occur in the watershed if new urban source areas are not controlled. Urban pollutants, as indicated by lead, can be anticipated to increase by 7,500 pounds per year. This is a 40 percent increase over 1985 lead loads. About half of this increase will occur in Ozaukee County and half will occur in Milwaukee County. The Lincoln Creek, Saukville, and Mequon subwatersheds will make the largest contributions to this increase. Subwatersheds that will see the greatest percent increase over 1985 mass loads of lead include Saukville and Haneman Lake. Loads will increase four-fold in these subwatersheds if no controls are used. In the remaining subwatersheds, increases range from 10 percent to 90 percent. Increases in sediment loading from established urban areas would follow the same general trends as those for total lead.

Construction Site Erosion: Municipalities that will experience significant development within the Ozaukee County portion of the watershed include the city of Mequon, the villages of Fredonia and Saukville, and the towns of Fredonia, Saukville, Grafton, and Cedarburg. Municipalities within the

Ozaukee County portion of the watershed that will experience little additional urbanization include the city of Cedarburg, the villages of Grafton and Thiensville, and the town of Port Washington.

Municipalities that will experience significant development within the Milwaukee County portion of the watershed include the villages of River Hills and Brown Deer, and the cities of Milwaukee and Glendale. Municipalities within the Milwaukee County portion of the watershed that will experience little or no additional urbanization include the villages of Bayside, Shorewood, Fox Point and Whitefish Bay.

One potential impact from this new urbanization will come from construction site erosion. Construction erosion can produce unit area loads of 30 tons/acre/year, which is comparable to severe erosion on agricultural lands and 65 times the sediment loading rate from commercial and industrial lands.

During the period 1970-1985, the average annual rate of development for the watershed was about 520 acres. Assuming an average sediment yield of 30 tons/acre/year, the annual sediment contribution from construction sites has been about 16,000 tons per year. During the period 1985-2000, the estimated annual rate of development for the watershed will be 460 acres. This rate of development has an annual sediment pollution potential of about 14,000 tons per year. If not properly controlled, construction site erosion has been, and will continue to be, a major pollution source.

It is important to note that urban renewal of established urban areas should be considered as new development for purposes of water quality control. 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 do represent an opportunity to install stormwater controls for urban renewal properties as well as adjacent lands.

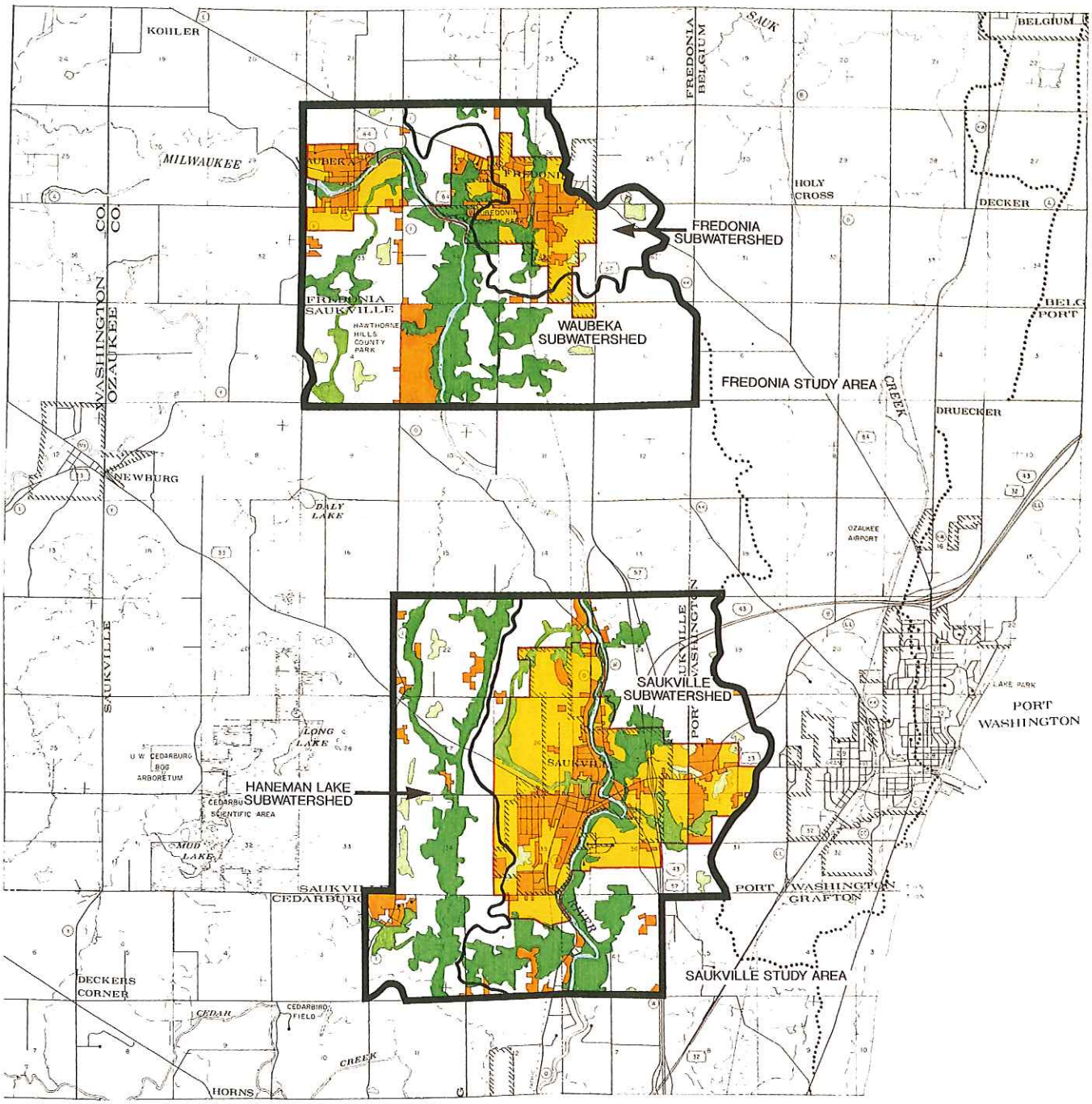
Establishment and enforcement of construction erosion control ordinances is recognized as an effective means to control this source. In 1986 the DNR and the League of Wisconsin Municipalities cooperatively developed a model ordinance for the control of construction site erosion (DNR, 1987). This ordinance contains provisions for planning, designing, installing, and maintaining erosion control practices as well as provisions for ordinance administration and enforcement.

Table 4-18 shows the status of construction site erosion control ordinance coverage for incorporated and unincorporated municipalities in the watershed. Additional comments concerning erosion control programs in each municipality are condensed from results of a survey prepared by the DNR and the University of Wisconsin Cooperative Extension Service (UWEX). Not all municipalities responded to the survey.

<u>City of Milwaukee.</u> The city adopted the state model ordinance 1988. The public works director, building inspector, and engineering inspector are responsible for reviewing erosion control plans, inspecting sites for plan compliance, and initiating enforcement actions if needed.

Map 9

EXISTING AND PLANNED URBAN LANDS IN THE FREDONIA AND SAUKVILLE STUDY AREAS



LEGEND

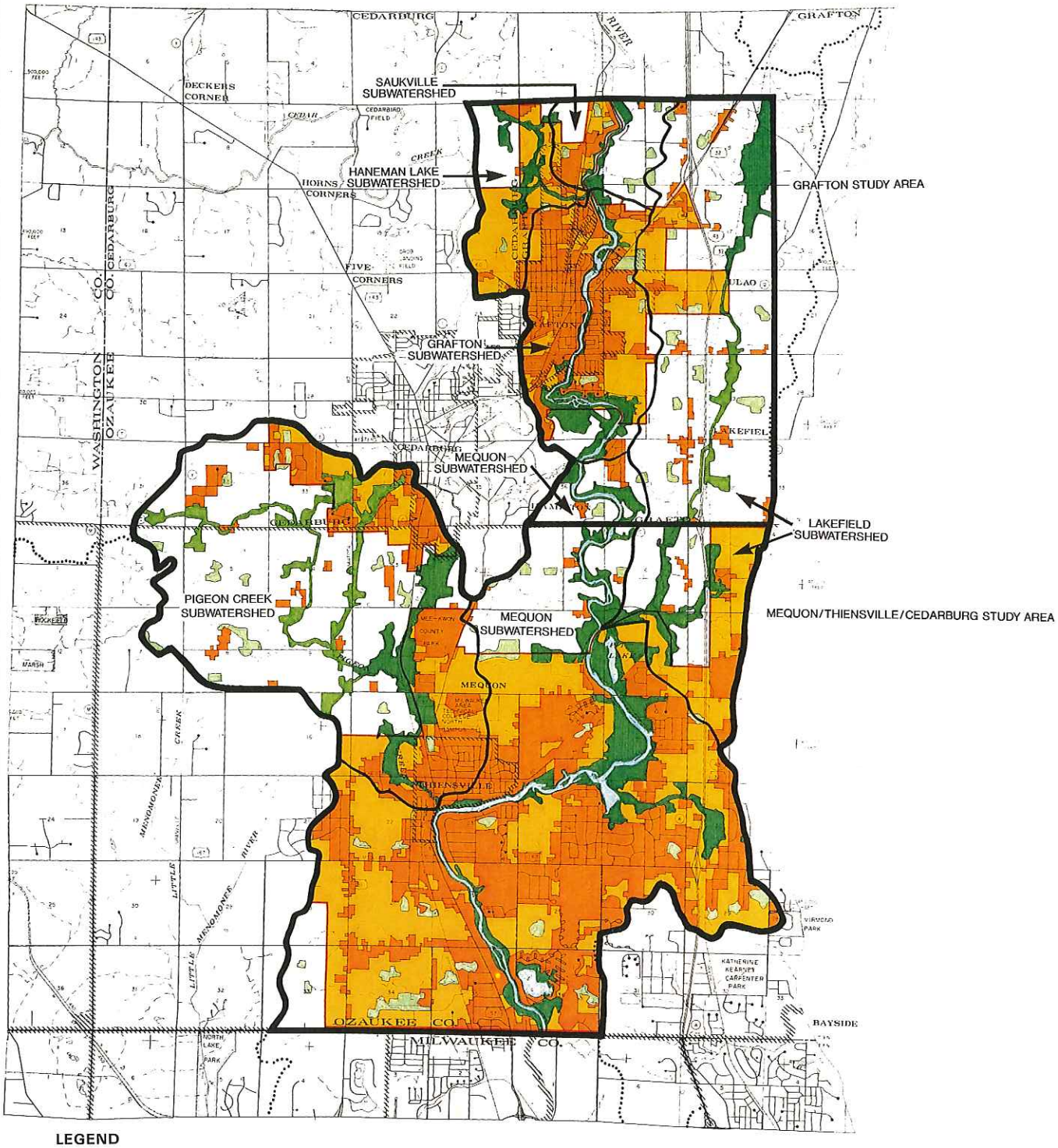
- PRIMARY ENVIRONMENTAL CORRIDOR
- SECONDARY ENVIRONMENTAL CORRIDOR
- ISOLATED NATURAL AREA
- EXISTING URBAN LANDS
- PLANNED ADDITIONAL URBAN LANDS
- SURFACE WATER
- URBAN SERVICE AREA BOUNDARY
- STUDY AREA BOUNDARY
- SUBWATERSHED BOUNDARY

GRAPHIC SCALE
0 ½ 1 MILE
0 2000 4000 6000 8000 FEET

Source: SEWRPC.

Map 10

EXISTING AND PLANNED URBAN LANDS IN THE GRAFTON AND MEQUON/THIENSVILLE/CEDARBURG STUDY AREAS



LEGEND

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

Source: SEWRPC.

GRAPHIC SCALE
0 ½ 1 MILE
0 2000 4000 6000 8000 FEET

Table 4-15. Projected increase in urban land use for subwatersheds in the Ozaukee County portion of the Milwaukee River South Watershed: 1985-2000.*

Subwatershed	Where Urbanization is Anticipated	Urban Area (acs.) 1985	Urban Area (acs.) 2000	Increase (acres)	Increase (%)
Fredonia	V. of Fredonia	296	406	110	37%
Waubeka	V. of Fredonia Tn. of Fredonia	625	735	110	18%
Saukville	V. of Saukville V. of Grafton Tns. of Saukville, Port Washington, Grafton	1,451	2,346	785	54%
Haneman L.	V. of Saukville V. of Grafton Tns. of Saukville Cedarburg, Grafton	372	684	312	84%
Grafton	V. of Grafton Tn. of Grafton	1,527	1,965	438	29%
Lakefield	V. of Grafton C. of Mequon Tn. of Grafton	1,188	1,591	403	34%
Pigeon C.	C. of Mequon C. of Cedarburg V. of Thiensville Tn. of Cedarburg	1,877	2,677	790	42%
Mequon	C. of Mequon	5,930	7,861	1,931	33%
Ozaukee County		13,266	18,145	4,879	37%

*Includes assessment of projected urban growth within the delineated urban study areas.

Source: Wisconsin Department of Natural Resources.

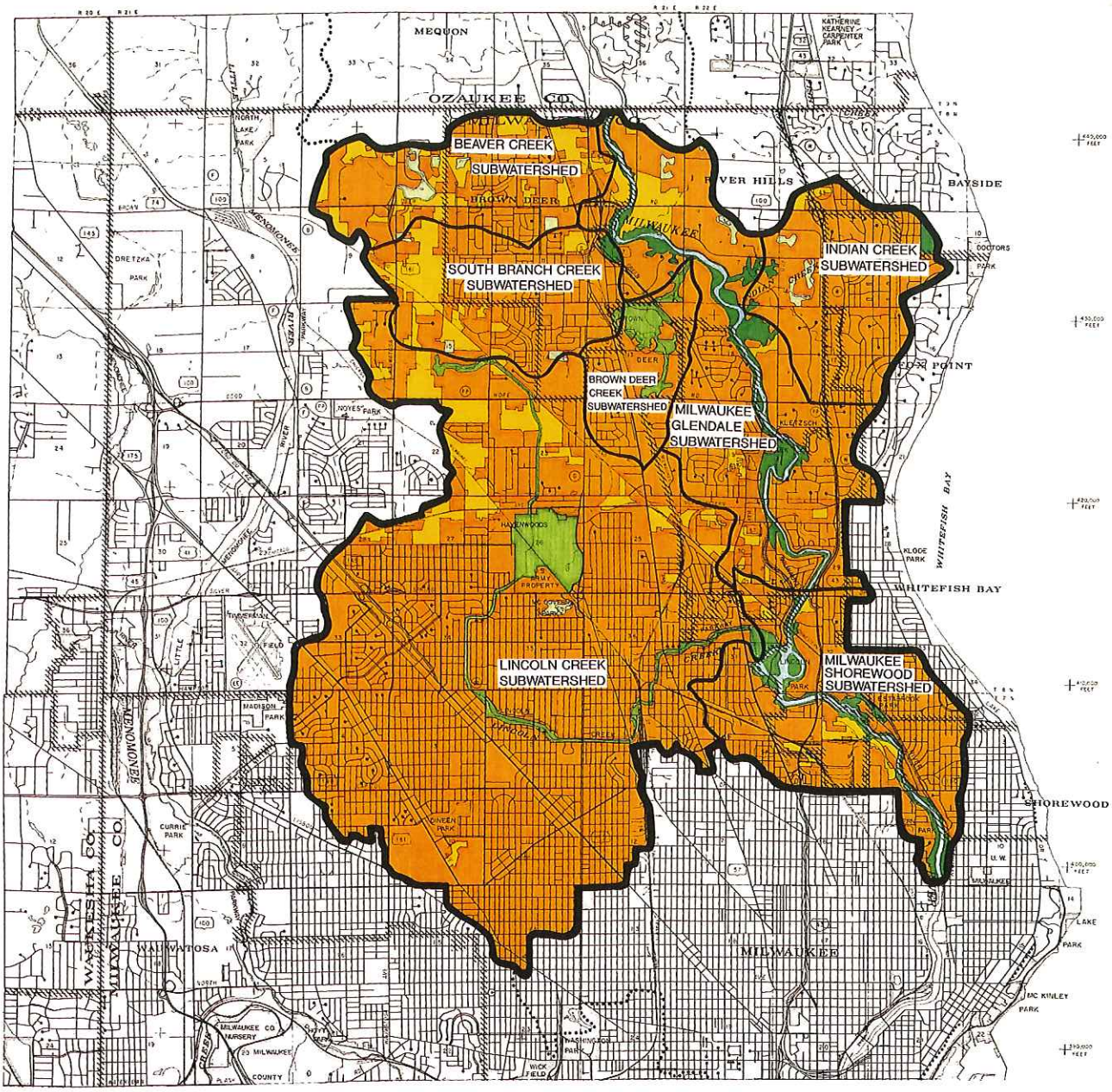
Table 4-16. Projected increase in urban land use for subwatersheds in the Milwaukee County portion of the Milwaukee River South Watershed: 1985-2000.*

Subwatershed	Where Urbanization is Anticipated	Urban Area (acres.) 1985	Urban Area (acres.) 2000	Increase (acres)	Increase (%)
Beaver C.	C. of Milwaukee V. of Brown Deer	1,750	2,216	466	27%
South Branch C.	C. of Milwaukee V. of Brown Deer	1,943	2,359	416	21%
Brown Deer C.	C. of Milwaukee	974	996	22	2%
Indian C.	V. of Fox Point V. of River Hills	1,680	1,716	36	2%
Milwaukee River-Glendale	C. of Glendale V. of River Hills	3,189	3,383	194	6%
Lincoln Creek	C. of Milwaukee C. of Glendale	12,681	13,450	769	6%
Milwaukee River-Shorewood	C. of Milwaukee C. of Glendale	2,755	2,914	159	6%
Milwaukee County		24,972	27,034	2,062	8%

Source: Wisconsin Department of Natural Resources.

Map 11

EXISTING AND PLANNED URBAN LANDS IN THE MILWAUKEE STUDY AREA



LEGEND

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

Source: SEWRPC.

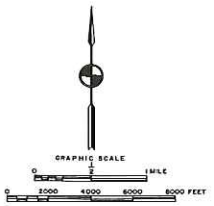


Table 4-17. Projected increase in urban nonpoint pollutant loads for subwatersheds in the Milwaukee River South Watershed: 1985-2000.*

	Sediment Increase		Phosphorus Increase		Lead Increase	
Subwatershed	Load (lb/y)	%	Load (lb/y)	%	Load (lb/y)	%
Fredonia	42,000	58%	85	54%	85	63%
Waubeka	28,000	42%	57	41%	65	43%
Saukville	410,000	255%	723%	201%	1,033	350%
Haneman L.	92,000	327%	175	302%	213	338%
Grafton	164,000	39%	321	37%	374	44%
Lakefield	82,000	32%	170	38%	167	25%
Pigeon C.	256,000	77%	542	80%	514	73%
Mequon	464,000	66%	794	59%	1,227	73%
Beaver C.	251,500	57%	460	50%	610	72%
South Branch C.	297,900	65%	490	50%	800	92%
Brown Deer C.	19,600	9%	30	5%	50	11%
Indian C.	15,400	8%	30	7%	40	13%
Milwaukee River-Glendale	95,100	17%	180	15%	220	20%
Lincoln C.	621,500	17%	1,040	13%	1,650	21%
Milwaukee River-Shorewood	149,300	14%	230	11%	420	17%
Watershed Total	2,988,300	34%	5,327	29%	7,468	40%

*Does not include the pollution potential of construction site erosion.

Source: Wisconsin Department of Natural Resources.

Table 4-18. Construction erosion control ordinance coverage for municipalities in the Milwaukee South Watershed as of July, 1990.

Extent of Ordinance Coverage		
None	Low - Moderate	High
Village of Brown Deer	Village of Bayside	City of Cedarburg*
Village of Fox Point	Village of Grafton	City of Glendale*
Village of River Hills	Village of Shorewood	City of Milwaukee*
Town of Fredonia	Village of Whitefish Bay	Village of Thiensville*
Town of Cedarburg		Village of Fredonia*
Town of Grafton		City of Mequon*
Town of Saukville		
Milwaukee County		
Ozaukee County		

* These communities have adopted the Construction Site Erosion Control Model Ordinance. 1987. WDNR/League of Wisconsin Municipalities.

Source: Wisconsin Department of Natural Resources.

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

City of Mequon. The city does not have a construction erosion control ordinance, but incorporates erosion and runoff control provisions into development agreements as a means to control this pollution source. The city engineer and his staff are responsible for reviewing erosion control plans, inspecting sites for plan compliance, and initiating enforcement actions if needed. 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 that would 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 seen as lower priorities.

City of Cedarburg. The city has adopted the state model ordinance. It is also applicable to the areas under the city's extraterritorial jurisdiction. The building inspector and engineering inspector are responsible for reviewing erosion control plans, inspecting sites for plan compliance, and initiating enforcement actions if needed.

Compliance with the ordinance is generally high. High priority items that would improve compliance include changes in the ordinance and local administrative procedures, and better practice design handbooks. Moderate priorities include better erosion control planning handbooks and training workshops for builders, contractors, and municipal staff. Lower priorities include consistent statewide requirements and more inspection staff.

City of Glendale. The city has adopted the state model ordinance. It is also applicable to the areas under the city's extraterritorial jurisdiction. The building inspector is responsible for reviewing erosion control plans, inspecting sites for plan compliance, and initiating enforcement actions if needed.

Compliance with the ordinance is generally medium to high. High priority items that would improve compliance include more inspection staff and training workshops for builders, contractors, and developers. Moderate priorities include training workshops for municipal staff, and consistent statewide requirements. Changes in the local ordinance and administrative procedures are a low priority.

Village of Thiensville. The village has a comprehensive construction erosion control ordinance that differs from the state model ordinance primarily in its approach to prescribing required practices. The engineer and building inspector are responsible for reviewing erosion control plans, inspecting sites for plan compliance, and initiating enforcement actions if needed.

Compliance with the ordinance is generally medium. High priority items that would improve compliance include more inspection staff, training workshops for community staff, and consistent statewide requirements. Moderate priority items include changes in local administrative procedures and training workshops for builders, contractors, and developers. Lower priority items include better practice design handbooks and handbooks for erosion control planning.

Village of Grafton. The village has limited provisions in its municipal code for controlling construction site erosion. The engineer, public works director, and engineering inspector share responsibility for erosion control plan review, although these plans are not required. Provisions for compliance inspections and initiation of enforcement actions are not contained in the municipal code.

Compliance with the municipal code language related to construction site erosion varies from low to high. Items that would improve compliance include local ordinance changes, more inspection staff, and training workshops for developers, builders, and contractors.

Village of Whitefish Bay. The village has limited provisions in its municipal code for controlling construction site erosion, and is considering upgrading its current codes to make them consistent with the state model ordinance. Erosion control plans are not required, and consequently there is no plan review function currently assigned to municipal staff. The community does inspect construction sites and can initiate enforcement actions for violations of municipal code related to construction erosion.

Compliance with the municipal code language relating to construction site erosion is generally low to medium. Items that would improve compliance include local ordinance changes and changes in administrative procedures, better practice design handbooks, and training workshops for municipal staff.

Village of Bayside. The village has limited provisions in its municipal code for controlling construction site erosion. The village manager and building inspector review erosion control plans, although none are required. Sites are inspected for compliance with erosion control provisions, and enforcement actions initiated if necessary.

Compliance with construction erosion provisions in the municipal code is generally high. Items that would improve compliance include consistent statewide requirements and workshops for developers, builders, and contractors.

Village of Brown Deer. The village has no provisions in its municipal code that can adequately address construction site erosion.

Needs expressed by the community include changes in the local ordinance and administrative procedures, consistent statewide erosion control requirements, and training workshops for developers, contractors, and builders.

Village of Saukville. The village has adopted an ordinance containing the major provisions of the state model ordinance. The engineer, public works director, building inspector, and village administrator share in the

responsibilities of erosion control plan review, site inspection, and initiation of enforcement actions. The county's Land Conservation Department staff has provided some assistance.

Compliance with the ordinance provisions is generally low. High priority items for improving compliance include adding more inspection staff and making some changes in administrative procedures. Training workshops for developers, builders, contractors, and municipal staff are also felt to be important, but of a lesser priority than the other items identified.

Town of Cedarburg. The town is considering adoption of the state model ordinance, but currently has limited provisions for construction erosion control. Currently, the building inspector is responsible for administrative functions of plan review, plan compliance, site inspection, and initiation of enforcement actions.

Existing compliance varies from low to high. High priority items needed to improve compliance with construction erosion control provisions include a change in existing ordinance coverage, new administrative procedures, and workshops for municipal staff.

Moderate priority items include better handbooks for practice designs and developing erosion control plans, and consistent statewide erosion control requirements. Lower priority items include training workshops for builders, developers, and contractors, and more inspection staff.

MILWAUKEE RIVER MAIN STEM

This section illustrates that nonpoint source pollutant loads to the river from watershed sources can be expected to change over the period 1985-2000 if management action is not taken. Also, it assesses the relative importance of different pollutant sources to the existing and projected pollutant loadings to the river. This information is critical in developing a nonpoint source control strategy for improving the water quality of the Milwaukee River.

Six points along the river were selected for this analysis:

* River Point 1: Where the Milwaukee River exits the Waubeka Subwatershed, above the village of Saukville.

* River Point 2: Where the Milwaukee River exits the Saukville Subwatershed, below the village of Saukville.

* River Point 3: Where the Milwaukee River exits the Grafton Subwatershed, below the village of Grafton.

* River Point 4: Where the Milwaukee River crosses the Ozaukee/Milwaukee County line, below the city of Mequon.

* River Point 5: Where the Milwaukee River exits the Milwaukee River-Glendale Subwatershed, at Silver Spring Drive.

* River Point 6: At the North Avenue Dam.

Two pollutants are included in this analysis. Sediment is chosen as one pollutant, since it has a major impact throughout the river; and since it is generated from a number of rural and urban sources. Total lead is chosen for the other pollutant to be evaluated for two reasons. Lead has been measured at elevated levels in the Milwaukee River from Pioneer Road down to Lake Michigan; and it is representative of heavy metal loadings generated primarily from urban areas.

SEDIMENT

This analysis includes only those sources located within the Milwaukee River South Watershed, even though sources located in tributary watersheds account for a large portion (60 percent) of the sediment pollutant load in the Milwaukee River system. The reason these other sources are not being considered in this analysis is that they are currently planned for control under watershed plans prepared for their respective areas (DNR 1990). Two of these watershed plans, the East-West Branch Milwaukee River and the North Branch Milwaukee River, are currently being implemented. The Cedar Creek Watershed Project is anticipated to begin implementation in the fall of 1990.

Sediment Loading Trends and Sources: Figure 1 shows the cumulative sediment load from all nonpoint sources at the six points along the Milwaukee River under year 1985 and year 2000 conditions. Table 4-19 presents the same information in tabular form. Map 12 shows the relative contribution of sediment from different sediment sources for these same years.

Year 1985. Figure 1 and Table 4-19 show that the estimated 1985 sediment load to the river from sources within the watershed is 25,600 tons per year. The sediment load accumulates at a fairly even rate from River Points 1 to 3; jumps severely between River Points 3 and 4; and then maintains a relatively large but steady rate of increase through River Points 5 and 6. The dramatic increase between River Points 3 and 4 is due to several factors including eroding uplands in the Lakefield and Mequon subwatersheds, streambank erosion in the Mequon Subwatershed, and construction site erosion in the Mequon Study Area. The increases occurring through River Points 5 and 6 are due primarily to the addition of sediment from construction sites and to a lesser degree from established urban areas, particularly in the Lincoln Creek Subwatershed.

As shown on Map 12, upland erosion is the dominant sediment source at River Point 1, and on par with construction site erosion at River Point 2. Construction site erosion is the dominant source at other points on the river, contributing from 47 percent to 62 percent of the sediment load.

Year 2000. Figure 1 and Table 4-19 show that the future trend in sediment loading varies for different points along the river. Sediment loads can be expected to increase about 30 percent for each of the river points within Ozaukee County, primarily due to projected increases in construction activity. The sediment load at River Points 5 and 6 is projected to remain about the same, as the decrease in construction activity projected for Milwaukee County offsets the sediment load increases occurring upstream. Map 12 shows interesting trends in the future relative importance of these sediment sources. Upland erosion maintains its dominance at River Point 1, although construction sites will be a more important factor than at present. At all

FIGURE 1

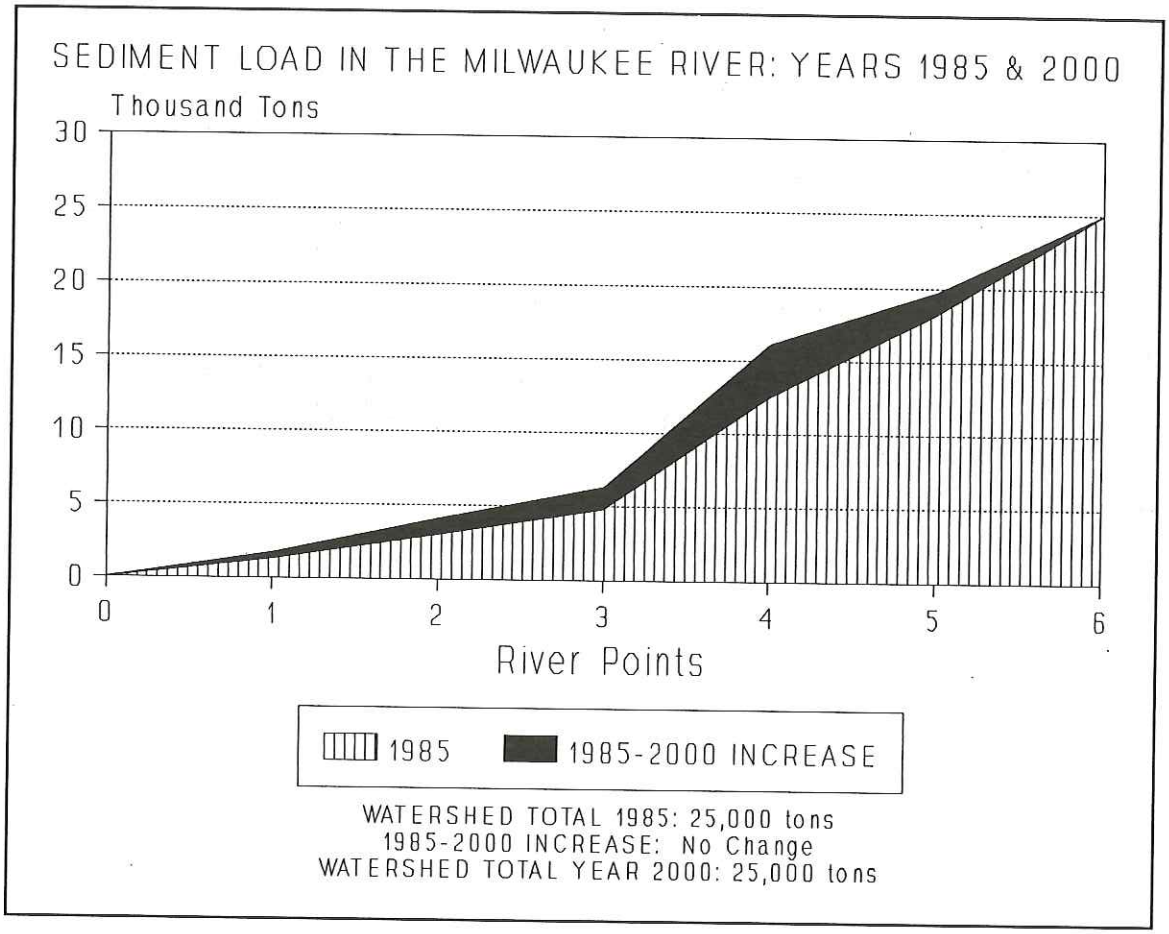
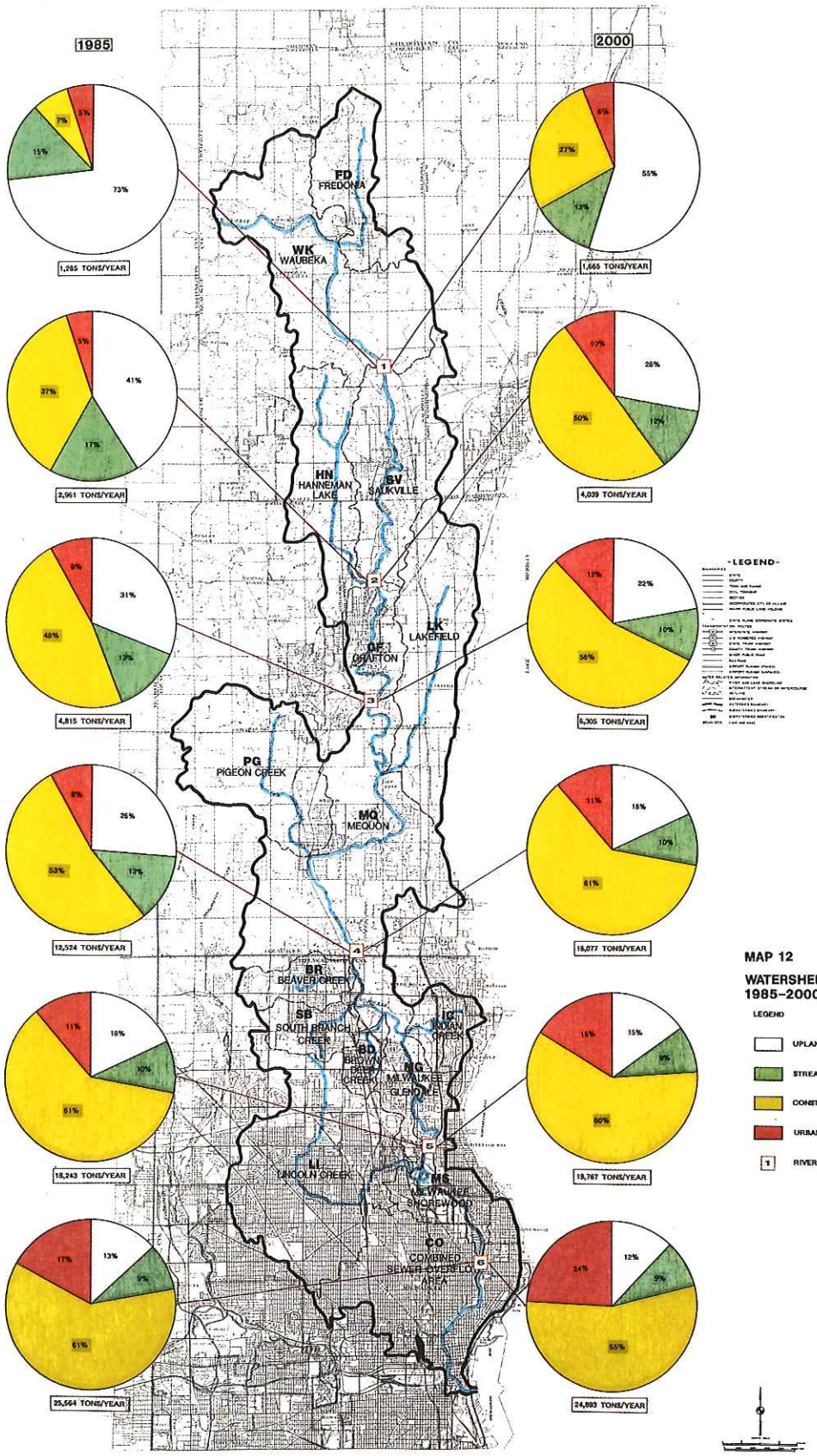

SEDIMENT LOAD IN THE MILWAUKEE RIVER: YEARS 1985 & 2000
Thousand Tons
30
25
20
15
10
5
0
0
1
2
3
4
5
6
River Points
1985
1985-2000 INCREASE
WATERSHED TOTAL 1985: 25,000 tons
1985-2000 INCREASE: No Change
WATERSHED TOTAL YEAR 2000: 25,000 tons

Table 4-19. Potential future increases in suspended sediment and total lead loads from all sources within the Milwaukee River South Watershed, as seen at selected points along the river.*

River Point	Contributing Subwatersheds**	Sediment Load (tons/yr) 1985	Sediment Load (tons/yr) 2000	% Change	Lead Load (lb/yr) 1985	Lead Load (lb/yr) 2000	% Change
1	FD,WK	1,285	1,665	30%	290	440	52%
2	FD,WK,SV	2,961	4,039	36%	580	1,763	204%
3	FD,WK,SV,GF,HN	4,815	6,305	31%	1,500	3,270	118%
4	FD,WK,SV,GF,HN, MQ,PG,LK	12,524	16,077	28%	4,500	8,178	82%
5	FD,WK,SV,GF,HN, MQ,PG,LK, BR,SB,BD,IC,MG	18,243	19,767	8%	8,130	13,528	66%
6	FD,WK,SV,GF,HN, MQ,PG,LK, BR,SB,BD,IC,MG, LI,MS	25,564	24,893	-3%	18,500	25,968	40%

*Includes construction site erosion.
** Abbreviations are: FD=Fredonia; WK=Waubeka; SV=Saukville; HN=Haneman Lake; GF=Grafton; LK=Lakefield; PG=Pigeon Creek; MQ=Mequon; BR=Beaver Creek; SB=South Branch Creek; BD=Brown Deer Creek; IC=Indian Creek; MG=Milwaukee River - Glendale; LI=Lincoln Creek; MS=Milwaukee River - Shorewood.

Source: Wisconsin Department of Natural Resources.



MAP 12

WATERSHED SEDIMENT SOURCES: 1985–2000

LEGEND

- UPLAND EROSION
- STREAMBANK EROSION
- CONSTRUCTION EROSION
- URBAN RUNOFF
- RIVER POINT

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other river points, construction site erosion will continue to dominate the sediment load, contributing from 50 percent to 61 percent. Runoff from established urban areas will increase in importance as a sediment source at all points along the river.

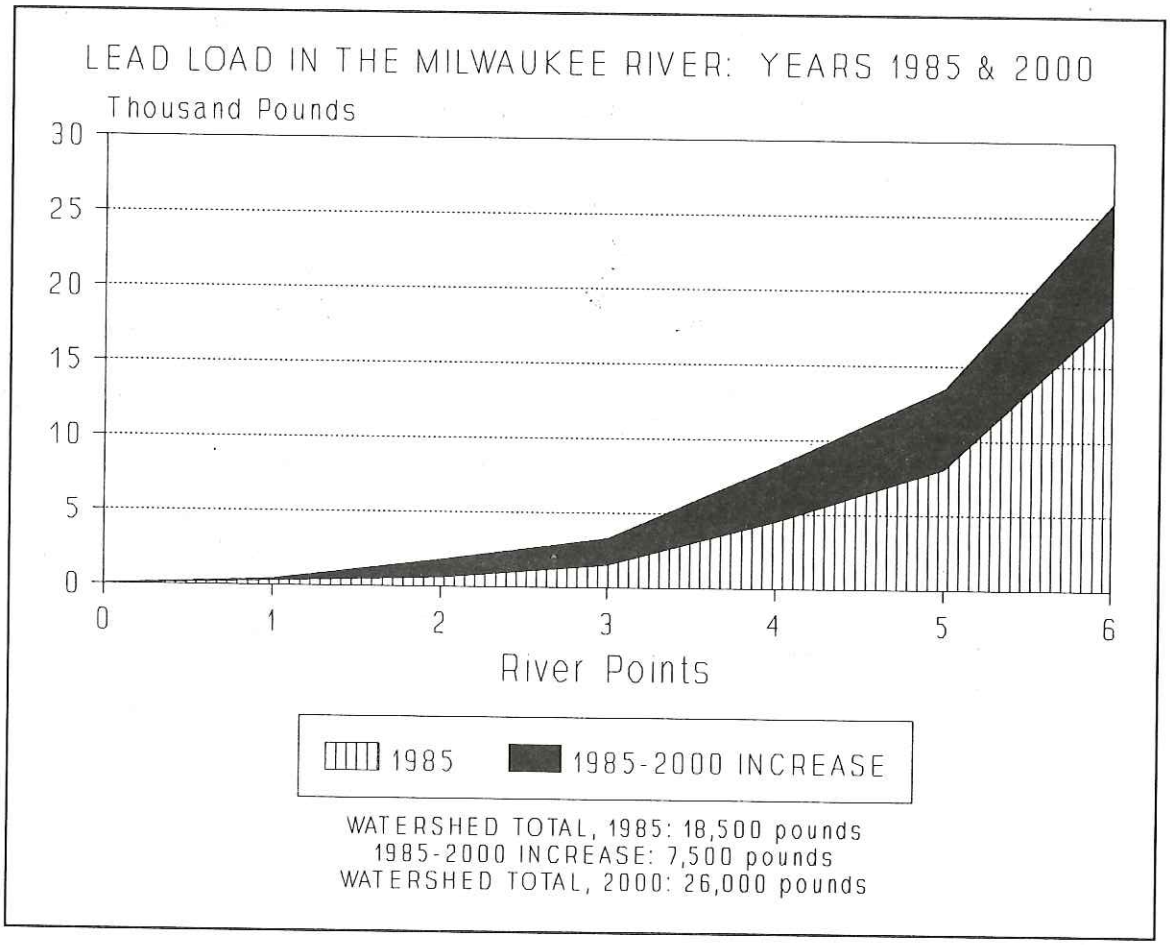
Lead Loading Trends and Sources: Figure 2 shows the cumulative lead load from all nonpoint sources at six points along the Milwaukee River under year 1985 and year 2000 conditions. Table 4-19 presents the same information in tabular form. Map 13 shows the relative contribution of lead from different urban land uses for these same years.

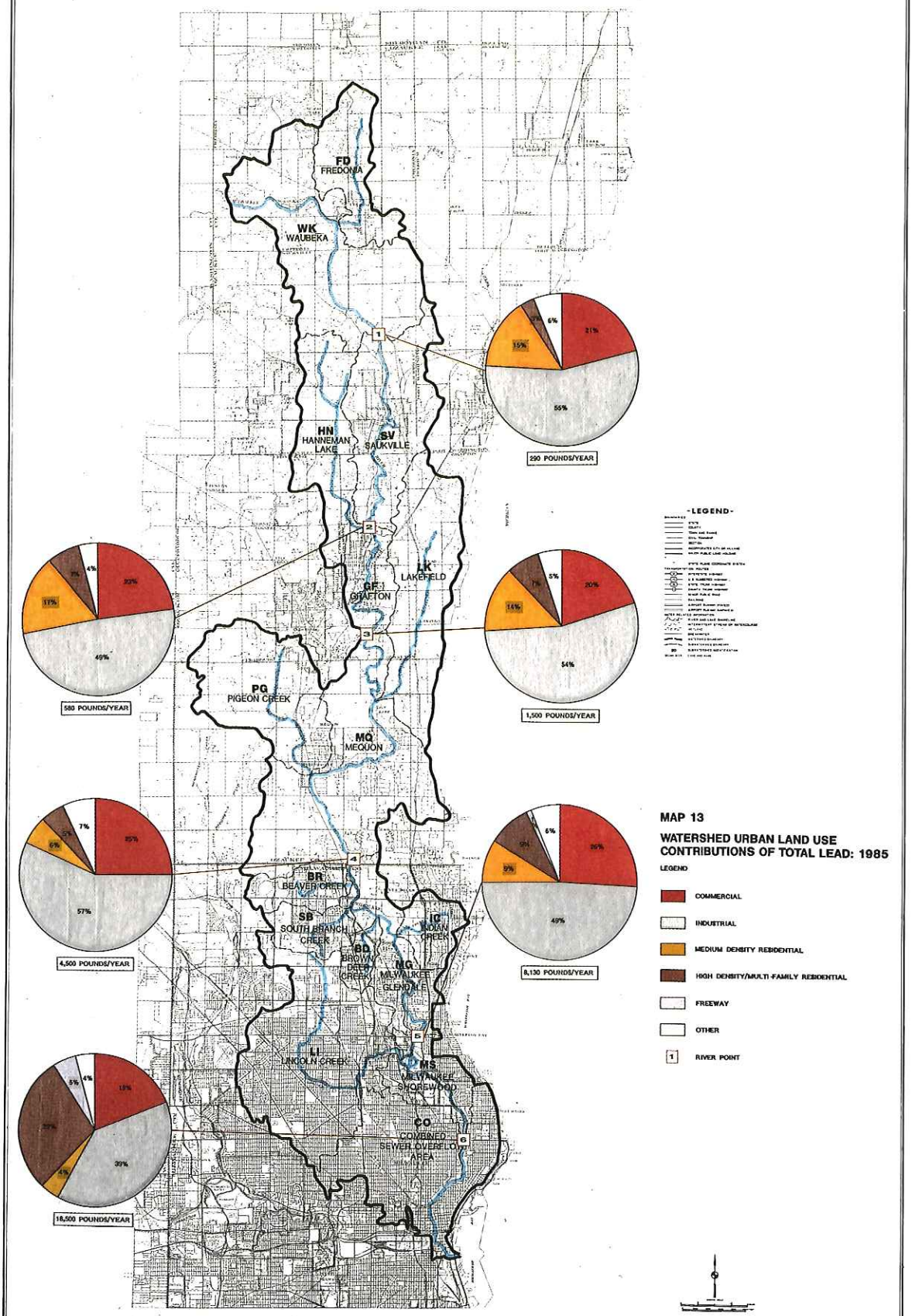
Year 1985. Figure 2 and Table 4-19 show that the estimated 1985 lead load to the river from urban lands within the watershed is 18,500 pounds per year. The lead load increases two to three times at each successive river point. The largest absolute increase in the lead loading to the river occurs between River Points 5 and 6, principally due to runoff in the Lincoln Creek Subwatershed.

Map 13 shows the relative importance of different urban land uses as contributors to the nonpoint source lead load. Throughout most of the river industrial lands contribute 45 percent to 55 percent of the lead load, commercial lands contribute 20 percent to 25 percent, medium density residential lands contribute 10 percent to 15 percent, and high density residential lands contribute 5 percent to 10 percent. A marked change occurs, however between River Points 5 and 6. Due to the significant influence of the Lincoln Creek Subwatershed, high density and multi-family residential land uses gain importance as sources of total lead. At this point in the river, high density residential lands are as important as industrial lands in contributing lead and other urban pollutants.

Year 2000. Figure 2 and Table 4-19 show the potential future increase in lead loads generated within the watershed if nonpoint source controls are not enacted. Watershed lead loads will increase by 40 percent due to increased urban area runoff. The largest percent increases will occur in the vicinity of Saukville and Grafton, although increases in all portions of the river must be considered significant.

FIGURE 2


LEAD LOAD IN THE MILWAUKEE RIVER: YEARS 1985 & 2000
Thousand Pounds
30
25
20
15
10
5
0
0
1
2
3
4
5
6
River Points
1985
1985-2000 INCREASE
WATERSHED TOTAL, 1985: 18,500 pounds
1985-2000 INCREASE: 7,500 pounds
WATERSHED TOTAL, 2000: 26,000 pounds



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MAJOR TRIBUTARY SUBWATERSHEDS

Major tributary streams in Ozaukee County include Fredonia Creek, Mole Creek (Haneman Lake Subwatershed), Ulao Creek (Lakefield Subwatershed), and Pigeon Creek. In Milwaukee County, major tributaries include Indian Creek and Lincoln Creek. Consideration must be made of the water resource problems and nonpoint sources in these tributary areas as well as at the six points identified along the Milwaukee River. Table 4-20 shows the expected future increases in sediment and lead loads assuming that no management action is taken. Table 4-21 shows the relative importance of sediment sources within these tributary subwatersheds for the years 1985 and 2000.

FREDONIA CREEK SUBWATERSHED

Land Use: This subwatershed is primarily rural, croplands being the main land cover. Urban lands, consisting primarily of residential areas in the village of Fredonia, are restricted to the lower reaches of the subwatershed.

Water Quality: Fredonia Creek has the potential to support a balanced warmwater forage fish community and partial body contact forms of recreation. Although the stream is generally meeting its recreational potential, it is not meeting its biological potential. Primary problems related to nonpoint pollution sources include loss of aquatic habitat that is caused by sedimentation and hydraulic scour. In addition, the stream suffers from channelization and the loss of wetlands.

Sediment Loading Trends and Sources: Table 4-20 shows that the sediment load can be expected to increase by about 50 percent without proper management. Table 4-21 shows that currently, uplands are the most significant sediment source for the subwatershed, and are the sole source to stream reaches north of the village of Fredonia. The emphasis will shift slightly by the year 2000, when erosion construction sites are anticipated to contribute 40 percent of the load--slightly more than agricultural lands. This is due to the 37 percent increase in urban lands anticipated for the subwatershed, most of which will occur within the Fredonia village limits.

Increased stormwater flows resulting from this urbanization will amplify the hydraulic scour already evident in lower reaches of Fredonia Creek, and will likely increase streambank erosion.

Nonpoint Sources of Lead and Other Urban Toxicants: Although information concerning toxic impacts on the creek has not been collected, Fredonia Creek does receive an estimated annual lead load of 135 pounds in addition to other urban toxicants. The urban land uses responsible for most of the lead load include industrial, medium density residential, and commercial. It is anticipated that future urbanization could increase the existing load of lead and other urban pollutants by nearly two-thirds.

Animal Waste Sources: Sources of animal waste pollution occur in the subwatershed, but are not widespread. Two barnyards have a high potential to impact Fredonia Creek, one has a moderate pollution potential, and six have a low pollution potential. Pollution from winterspread manure may also create localized problems, but is probably not widespread. These animal waste sources are significant mainly because they contribute to the overall pollution of the Milwaukee River.

Table 4-20. Potential future increases in suspended sediment and total lead loads from all sources within major tributary subwatersheds of the Milwaukee River South Watershed.*

Subwatershed	Sediment Load (tons/yr) 1985	2000	% Change	Lead Load (lb/yr) 1985	2000	% Change
Fredonia	359	524	46%	135	220	63%
Haneman L.	584	973	67%	63	276	338%
Lakefield	1,297	1,629	26%	660	827	25%
Pigeon C.	2,048	2,219	8%	703	1,217	73%
Indian C.	878	316	-64%	320	360	12%
Lincoln C.	6,505	4,146	-36%	7,866	9,516	21%

*Includes construction site erosion.

Source: Wisconsin Department of Natural Resources.

Table 4-21. Importance of sediment sources in principal tributary subwatersheds of the Milwaukee River South Watershed.*

Tributary Subwatershed	Total Sediment Load (tons/year)	Contribution: Established Urban	Construction Sites	Stream-banks	Uplands
YEAR 1985					
Fredonia	359	10%	17%	20%	53%
Haneman L.	584	2%	46%	13%	39%
Lakefield	1,297	10%	37%	4%	49%
Pigeon C.	2,048	8%	74%	2%	16%
Indian C.	878	16%	72%	12%	0%
Lincoln C.	6,505	29%	65%	7%	0%
YEAR 2000					
Fredonia	524	11%	40%	14%	35%
Haneman L.	973	6%	65%	8%	21%
Lakefield	1,629	10%	50%	3%	36%
Pigeon C.	2,219	13%	72%	2%	13%
Indian C.	316	47%	19%	34%	0%
Lincoln C.	4,146	53%	37%	10%	0%

*Includes construction site erosion.

Source: Wisconsin Department of Natural Resources.

HANEMAN LAKE SUBWATERSHED

Land Use: This subwatershed is primarily rural. Croplands, comprising 48 percent of the subwatershed and wetlands, comprising 20 percent, are the principal land use types. Urban lands, consisting primarily of residential areas, are scattered throughout the towns of Saukville, Cedarburg, Grafton, and the villages of Saukville and Grafton. Most of the more intensive urban land use occurs in and adjacent to the village of Grafton at the mouth of Mole Creek.

Water Quality: Mole Creek has the potential to support a coldwater fish community and partial body contact forms of recreation. It is the only coldwater stream in the Milwaukee River South Watershed, constituting a unique resource. The stream is generally meeting its recreational potential, although elevated bacteria counts are expected to occur. It is only partially meeting its biological potential. Primary problems related to nonpoint pollution sources include loss of aquatic habitat and elevated water temperatures. These problems are caused by sedimentation, and by hydrologic disturbances associated with the excavation of ponds that intercept spring flows discharging to Mole Creek. In addition, the stream suffers from channelization and the loss of wetlands.

Sediment Loading Trends and Sources: Table 4-20 shows that without proper management, a 67 percent increase in the sediment load is anticipated by the year 2000. Table 4-21 shows that currently, upland and construction site erosion are the two most significant sources. Nearly all of the streambank erosion occurs in isolated areas of uncontrolled livestock access. The emphasis will shift to construction sites by the year 2000, when these areas will contribute nearly two-thirds of the sediment load. This will occur as the urban area in the watershed grows by nearly 85 percent. This urbanization will occur in the towns of Cedarburg, Saukville, Grafton, and the villages of Saukville and Grafton.

Stormwater flows resulting from this urbanization can be expected to have adverse impacts on the stream unless properly managed. Preferably, management will include the use of infiltration techniques wherever possible to preserve the base flow and temperature conditions of this coldwater system.

Nonpoint Sources of Lead and Other Urban Toxicants: Although information concerning toxic impacts on Mole Creek has not been collected, the creek receives an estimated annual lead load of 63 pounds in addition to other urban toxicants. Industrial lands, located near the mouth of Mole Creek, contribute most of the urban pollutant load. Table 4-20 shows that by the year 2000 the load of lead and other urban pollutants could increase between three and four times the 1985 amounts.

Animal Waste Sources: There are 11 barnyards in the subwatershed that drain to Mole Creek or its tributaries. Four have a high pollution potential, three a moderate potential, and four a low potential. The impact of another barnyard, draining to a pocket wetland, is uncertain. Pollution from winterspread manure may also create localized problems, but is probably not widespread. These animal waste sources are locally significant sources of bacteria and nutrients, and also contribute to the overall pollution of the Milwaukee River.

LAKEFIELD SUBWATERSHED

Land Use: Rural land use, principally cropland and grassland, covers 86 percent of this subwatershed. Urban lands, primarily low density residential, cover 14 percent of the area. The section of freeway in the subwatershed is well buffered by large grassed swale drainage. The more intensive urban land uses (commercial, industrial) are scattered throughout the watershed, located in parts of the city of Mequon, village of Grafton, and town of Grafton.

Water Quality: Ulao Creek has the potential to support a balanced warmwater forage fish community and partial body contact forms of recreation. Importantly, the creek is the only major tributary to this section of the Milwaukee River that supports northern pike spawning. The stream is only partially meeting its recreational and biological potential. Primary problems affecting recreational use that are caused by nonpoint pollution sources include excessive fecal bacteria counts. Problems affecting biological uses that are caused by nonpoint pollution sources include habitat loss from sedimentation. In addition, the stream and its 13 tributaries suffer from extensive channelization and the loss of wetlands.

Sediment Loading Trends and Sources: Table 4-20 shows that without proper management, a 25 percent increase in the sediment load is anticipated by the year 2000. Table 4-21 shows that currently upland erosion contributes 49 percent and construction site erosion contributes 37 percent of the sediment load. The emphasis will shift by the year 2000, when construction erosion will contribute 50 percent of the load and upland erosion will contribute 36 percent. The emphasis on construction erosion will develop as the urban area in the watershed grows by nearly 35 percent. Urbanization will occur mainly in the town of Grafton and the city of Mequon.

Stormwater flows resulting from this urbanization might have localized adverse impacts on the stream, causing hydraulic scour and streambank erosion, unless properly managed.

Nonpoint Sources of Lead and Other Urban Toxicants: Although information concerning toxic impacts on Ulao has not been collected, the creek receives an estimated annual lead load of 660 pounds in addition to other urban toxicants. Industrial and commercial lands located in the headwater reaches of Ulao Creek, north of Highway Q and along U.S. Highway 43 in the village and town of Grafton, contribute most of the urban pollutant load. Table 4-20 shows that future urbanization could increase the existing load of lead and other toxic urban pollutants to Ulao Creek by 25 percent.

Animal Waste Sources: There are six barnyards in the subwatershed that drain to Ulao Creek or its tributaries. Two have a high pollution potential, one a moderate potential, and three a low potential. The impact of another barnyard, draining to a pocket wetland, is moderate. Pollution from winterspread manure may also create localized problems, but is probably not widespread. These animal waste sources are locally significant sources of bacteria and nutrients, and also contribute to the overall pollution of the Milwaukee River.

PIGEON CREEK SUBWATERSHED

Land Use: This subwatershed is 76 percent rural. Croplands, grasslands, and woodlots are the main rural land uses. Urban lands cover 24 percent of the subwatershed. Principal urban land uses include low density residential areas, medium/high density residential areas, and commercial/industrial lands. The intensive urban land uses, including commercial, industrial, and multi-family residential areas, are concentrated in the headwater reaches of Pigeon Creek within the city of Cedarburg, and at the mouth of Pigeon Creek within the village of Thiensville. The urban area within the city of Cedarburg is tributary to an impoundment. Consequently, the urban pollutant loading from Cedarburg to Pigeon Creek is probably somewhat reduced.

Water Quality: Pigeon Creek has the potential to support a balanced warmwater forage fish community and partial body contact forms of recreation. The stream is generally meeting its recreational potential, although elevated bacteria counts are expected to occur. It is not meeting its biological potential. The primary problem related to nonpoint pollution sources is loss of aquatic habitat, caused primarily by sedimentation. In addition, nutrients cause localized, excessive growth of aquatic plants in Pigeon Creek. Channelization and wetland loss are also limiting factors in this stream system.

Sediment Loading Trends and Sources: Table 4-20 shows that without proper management, an 8 percent increase in the sediment load is anticipated by the year 2000. Table 4-21 shows that both currently and as projected for the year 2000, construction site erosion dominates as a sediment source. This trend is related to the substantial yet even growth that has and will continue to occur in this subwatershed. It is anticipated that the urban area in the subwatershed will increase by 42 percent, due to urbanization in the Towns of Cedarburg, the cities of Mequon and Cedarburg, and the village of Thiensville. About two-thirds of the existing sediment load from established urban land uses enters the stream in its headwaters and flows to an impounding structure. The remaining 40 percent impacts the stream near its mouth. Streambank erosion is localized, occurring at selected sites in the uppermost sections of Pigeon Creek.

Stormwater flows resulting from this urbanization can be expected to have adverse impacts on the stream unless properly managed, resulting in hydraulic scour and streambank erosion.

Nonpoint Sources of Lead and Other Urban Toxicants: Although information concerning toxic impacts on Pigeon Creek has not been collected, the creek receives an estimated annual lead load of 703 pounds in addition to other urban toxicants. Industrial lands, located on a tributary stream in Cedarburg, and commercial lands distributed between Cedarburg and Thiensville contribute most of this loading. The impact of the impoundment on pollutant loads from Cedarburg is unknown. Table 4-20 shows that anticipated future urbanization could increase this loading by nearly 75 percent.

Animal Waste Sources: There are six barnyards in the subwatershed that drain to Pigeon Creek and its tributaries. Only one has a moderate pollution potential; three others pose few potential problems. Pollution from winterspread manure may also create localized problems, but is probably not

widespread. These animal waste sources are locally significant sources of bacteria and nutrients, and also contribute to the overall pollution of the Milwaukee River.

INDIAN CREEK SUBWATERSHED

Land Use: This subwatershed is 86 percent urban. Urban land uses include low density residential areas, which make up 34 percent of the subwatershed area, medium/high density residential areas (31 percent), commercial lands (4 percent), institutional lands (5 percent), and freeway (4 percent). Open space and undeveloped land comprise the remainder of the urban area. The intensive urban land uses, including commercial and multi-family residential, are concentrated to the east of U.S. Highway 43 in the village of Fox Point. Grassed swales in this subwatershed primarily drain U.S. Highway 43.

Rural lands, which cover 14 percent of the subwatershed, include primarily woodland, wetland, and scattered agricultural lands.

Water Quality: The upstream portion of Indian Creek above U.S. Highway 43 is concrete lined, has the potential to support only limited aquatic life, and is considered to be fully meeting its potential use. Below U.S. Highway 43, the stream has the potential to support a balanced warmwater sport fish community and partial body contact forms of recreation, but is not meeting its potential. The primary problem related to nonpoint pollution sources is loss of aquatic habitat, caused primarily by sedimentation and hydraulic scour. In addition, low dissolved oxygen and excessive growths of aquatic plants are caused by excessive nutrient levels. Total lead concentrations during storm events have been measured, and rise to within 3 micrograms/liter (ug/l) of the chronic toxicity standard for fish and aquatic life. Excessive bacteria and poor aesthetics related to filamentous algae limit recreational quality. It is important to note that sanitary sewer bypasses exist on Indian Creek, contributing in part to these bacteria, nutrient, and dissolved oxygen related problems.

Sediment Loading Trends and Sources: Table 4-20 shows the anticipated trend in sediment loading to the creek if no management actions are taken. A drop of 60 percent in sediment loading is anticipated to occur because of the drastic drop in construction site activity, which, according to Table 4-21, has contributed about 70 percent of the sediment load in the past. In the future, established urban areas and streambanks will assume dominance as sediment sources. The small amount of urban growth expected in this subwatershed will occur in the village of River Hills and the village of Bayside, in the extreme northern tip of the subwatershed. The drainage from this area, however, may not enter Indian Creek.

One-fourth of the streambanks on Indian Creek in the village of River Hills, below U.S. Highway 43, are eroding. The streambanks on the tributary stream that joins Indian Creek below U.S. Highway 43 are basically stable.

Nonpoint Sources of Lead and Other Urban Toxicants: Indian Creek receives an estimated annual lead load of 320 pounds in addition to other urban toxicants. Commercial and medium density/multi-family residential, located primarily in the village of Fox Point above U.S. Highway 43, contribute most of this loading. Table 4-20 shows that by the year 2000 the load of these pollutants could increase by 12 percent.

LINCOLN CREEK SUBWATERSHED

Land Use: This is the largest urban subwatershed in the Milwaukee River South Watershed, draining 12,600 acres. This subwatershed is entirely urban, although there are large tracts of recreational and open space land including the U.S. Army Property, the state's Havenwoods Forest Preserve and Nature Center, the Milwaukee County Lincoln Creek Parkway, and golf courses and municipal parks.

Residential lands dominate this subwatershed. High density residential areas cover 35 percent of the subwatershed and multi-family residential areas cover an additional 15 percent. Industrial areas cover 12 percent and commercial areas 7 percent of the area. These land uses are scattered in a mosaic throughout the subwatershed, although large concentrations of each land use occur. Most of the subwatershed is contained within the city of Milwaukee. A small portion, contained within the city of Glendale, includes primarily industrial and multi-family land uses.

Water Quality: Lincoln Creek is almost entirely channelized, with the channel alternating between concrete-lined sections and earthen sections. The earthen section downstream of Teutonia Avenue has the potential to support a balanced warmwater sport fish community. The other natural sections, between 32nd Street and Hampton Avenue, and between Silver Spring Drive and the Brynwood Country Club, have the potential to support limited forage fish communities. Concrete-lined sections are capable of supporting only limited aquatic life. All sections of Lincoln Creek have the potential to support partial body contact forms of recreation.

Those portions of Lincoln Creek with the potential to support a balanced warmwater sport fish community and a limited forage fish community are not meeting their biological potential; other sections are only partially meeting their biological potentials. Recreational potential is only partially being met throughout the creek.

Limitations to biological uses in the earthen channel sections include loss of aquatic habitat, low dissolved oxygen, chronic toxicity, and contaminated sediments. Nonpoint source pollutants in part responsible for these problems include sediment and hydraulic scour, and a wide array of toxicants including, but not limited to, lead, zinc, chromium, copper, nickel, oils, and grease. High concentrations of bacteria are a problem for recreational users, such as children frequently seen playing in the Creek. In concrete-lined sections, these pollutants are also important but the major current limitation is the concrete itself.

It is important to note that there are a multitude of point sources affecting Lincoln Creek, including some combined sewer overflow pipes and illicit industrial dumping. These other sources and a recommended plan for their control have been documented by the DNR and the Southeastern Wisconsin Regional Planning Commission (SEWRPC, 1987; DNR, 1990).

Nonpoint Sources of Sediment: Table 4-20 shows that sediment loads to the creek can be expected to drop by about one-third. This is because construction activity, formerly contributing 65 percent of the sediment load, will drop significantly as shown in Table 4-21.

Established urban areas still contribute almost 2,000 tons of sediment annually to the Creek. This represents 42 percent of the total urban sediment load in the entire watershed, and about 10 percent of the total sediment load from all sources in the entire watershed. High density residential lands contribute about one-third of the subwatershed sediment load. Industrial and multi-family residential lands, combine to contribute an additional 40 percent of the load.

There are 24,000 feet of streambank erosion along Lincoln Creek, comprising 52 percent of the banks surveyed. In the section of Lincoln Creek between the Milwaukee River and Teutonia Avenue, 5,200 feet or 43 percent of the streambanks are eroding, producing about 50 tons of sediment per year. In this segment, large fluctuations in water level occur due to periodic drawdown of the pool at the Estabrook Park Dam. In the section of Lincoln Creek between 32nd Street and Hampton Boulevard, 9,500 feet or 40 percent of the streambanks are eroding, producing 240 tons of sediment per year. In the section that winds through the United States Army Property and the DNR Havenwoods Forest Preserve and Nature Center, 9,300 feet or 96 percent of the streambanks are eroding, producing 140 tons of sediment per year.

The urban area in this subwatershed is expected to grow by 6 percent between 1985 and the year 2000 due to urbanization in the city of Milwaukee. Nearly all of this will occur north of Silver Spring Drive, upstream of the DNR nature preserve. This will bring an increase in the sediment pollution potential for the creek unless the development is properly managed.

Stormwater flows resulting from this urbanization can also be expected to have adverse impacts on the stream unless properly managed, resulting in hydraulic scour and streambank erosion. The Milwaukee Metropolitan Sewage District, which has jurisdiction over Lincoln Creek for purposes of flood control, is evaluating alternative measures for dealing with this projected increase in flood waters.

Nonpoint Sources of Lead and Other Urban Toxicants: Lincoln Creek receives an estimated annual lead load of approximately 8,000 pounds, in addition to other toxicants present in the stormwater runoff. Important contributing land uses and their percent contributions to the lead load are: high density residential (33 percent), industrial (32 percent), multi-family residential (14 percent), and commercial (14 percent). Table 4-20 shows that if new development is not properly managed anticipated future urbanization could increase the existing load of lead and other toxicants present in urban runoff by 21 percent.

WATER RESOURCES OBJECTIVES

Biological and recreational objectives reflect the desired future state of water resources that will be pursued through abatement of nonpoint pollution sources. These objectives provide the rationale for controlling nonpoint pollution in the watershed, and provide a basis for a water quality evaluation to be conducted for the project upon its completion.

Map 5 shows the surface waters that are only partially meeting or are not meeting their full potential to support recreational and biological uses. Table 4-1 shows the contribution that nonpoint source pollution makes towards the water quality degradation that has occurred. The goal of this watershed

project is to protect those streams that fully meet their designated uses, enhance those streams that partially meet their designated uses, and improve those streams that are not currently meeting their potential uses.

"Protection" means that the resource is fully supporting its potential designated uses, and nonpoint source controls will be used to assure that the resource quality is maintained.

"Enhancement" means that the resource is moderately degraded and only partly meeting its designated beneficial uses. In this case, nonpoint source controls will not allow a resource to support a new use, but will greatly improve the quality of an existing use. For example, nonpoint source controls may be expected to result in a more widely diverse and vigorous forage fish community by restoring lost habitat, even though natural conditions preclude the stream ever supporting a warmwater sport fish population.

"Improvement" means that the resource is severely degraded and not meeting its designated use. In this case, nonpoint source controls may be expected to help achieve potential uses for the stream which are not currently being achieved. For example, a stream may have the natural characteristics suitable to support warmwater sport fish, but the animals may not be present in viable numbers due to severe nonpoint source impacts.

In many cases other cultural factors that limit these water resources, such as point sources, channelization, dams, or limited public access, will need to be rectified in order to see the full benefits of nonpoint source controls. Management needs in these other areas are set forth in the Milwaukee River Integrated Basin Management Plan: 2000, Volume 4, South Branch Watershed Integrated Resources Management Plan (DNR, 1990).

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.

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

Overall a 50 percent reduction in the existing 1985 sediment loading is needed to improve the aquatic habitat in 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.

STREAM FLOW

Site specific goals are not established for stream flow. There are three basic hydrologic goals that must be considered, particularly when working in urban areas. These are:

1. Maintain base flow through infiltration. This is particularly important in the Haneman Lake Subwatershed to enhance Mole Creek.

2. Reduce stream velocities in areas where stream flow is a prime cause of streambank erosion and habitat scour. The velocities must be reduced to non-erosive speeds. This is particularly important in Lincoln Creek, Indian Creek, Brown Deer Creek, and Fredonia Creek.

3. Maintain peak streamflow discharge for the 2-year, 24-hour storm at pre-development conditions for streams located in urbanizing areas. This is needed to protect the streambanks from erosion. It applies in particular to smaller streams such as Fredonia Creek, Mole Creek, Ulao Creek, and Pigeon Creek.

URBAN TOXIC MATERIALS

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.

"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 Wisconsin Administrative Code. These surface water standards are set so as not to exceed the LC-1. The LC-1 is the concentration that results in 1 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 4-22 shows the toxicity of urban runoff monitored from different land uses in the Milwaukee area during 1980-1982, using a stormwater hardness of 100 milligrams/liter (mg/l) and LC-1 toxicity standards of 170 ug/l for lead, 17 ug/l for copper, and 103 ug/l for zinc. Table 4-22 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 4-23 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, these calculations 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

Table 4-22. Percent of urban stormwater runoff samples that exceed 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%

Reduction Needed to Meet Chronic Toxicity Standards in the Milwaukee River: The second criterion is the reduction of lead concentrations needed in the Milwaukee River to achieve the chronic toxicity standards in Chapter NR 105 of the Wisconsin Administrative Code. Based on monitoring from Pioneer Road in Ozaukee County down to the North Avenue Dam, average lead concentrations exceed chronic toxicity standards for surface waters by 50 percent. Consequently, this formulates the second reduction goal for urban stormwater pollutants. Exceedences of the chronic toxicity standard for cadmium range from 30 percent between Pioneer Road and Port Washington Road, to 100 percent at the North Avenue Dam.

Table 4-23. Flow weighted average annual concentrations of lead and estimated pollutant reductions needed to achieve levels which are below state standards for acute toxicity.(1)

Total Lead Subwatershed	Total Lead (ug/l)(2)	% Reduction Needed(3)
Fredonia	240-370	30%-55%
Waubeka	300-520	40%-65%
Saukville	200-280	15%-40%
Haneman Lake	240-570	30%-70%
Grafton	270-360	35%-50%
Pigeon Creek	280-390	40%-55%
Lakefield	450-560	60%-70%
Mequon	380-450	55%-60%
Beaver Creek	230-300	25%-45%
South Branch Creek	230-330	25%-50%
Brown Deer Creek	260-310	35%-45%
Indian Creek	160-170	0%
Milwaukee River-Glendale	210-340	20%-50%
Lincoln Creek	270-290	35%-40%
Milwaukee River-Shorewood	370	45%

(1) Calculated for existing 1985 conditions based on annual pollutant load and annual water load.
(2) Low end of range is for all land uses, high end is for critical land uses.
(3) Acute toxicity standard (NR 105 of the Wisconsin Administrative Code) for lead is 170ug/l (hardness of 100mg/l $CaCO_3$).

Source: Wisconsin Department of Natural Resources.

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 4-23 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" only, as defined in Table 5-11.

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 4-24 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 land uses listed. It should be noted that the hardness of the stormwater was measured to be 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 4-24 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 4-22, 4-23, and 4-24 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 4-24. Reductions needed in the 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 extrapolation of monitoring data to these land uses.
2. Based on monitoring data collected for these land uses during 1990.

Other Considerations: Bottom sediments along the Milwaukee River have also probably been seriously polluted from urban runoff, although an extensive study has not been made. A study has been made on the Menomonee River, however. The sand and silt size fraction of the bottom sediments in the urban reaches had total lead concentrations four times higher than the rural reaches of the river, and the clay size fraction had a concentration ten times higher in the urban reaches (Dong, 1979). The clay and silt size fractions had lead 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 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 are 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 Milwaukee River South priority watershed project. These controls are based on water quality information, the results of the nonpoint source evaluations, and the identified 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 take into account the severity of the source, the need for its control, and the practicality of control. The management categories are in turn used in defining 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. The section then presents the selected alternatives and management actions for each local unit of government in the watershed. Finally, this section sets forth a conceptual framework for implementation of 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 control, Fisheries Management, Wildlife Management, and recreation are discussed in the integrated resource management plan prepared for this watershed (DNR, 1990).

RURAL NONPOINT SOURCE CONTROL NEEDS

NONPOINT SOURCE MANAGEMENT CATEGORIES

A management category is a statement of the relative need to control a specific source in order to meet water resources objectives. Management categories in turn determine eligibility of specific sources for financial and technical assistance under the priority watershed project. Sources are placed in management categories based on:

* Biological and recreational potential of streams being considered.

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

* Subwatershed pollutant 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 Milwaukee River from Waubeka to the North Avenue Dam.

Management categories are established for each major type of nonpoint source. These major divisions include the following: barnyard runoff, manure spreading, eroding croplands and other uplands, and streambank erosion or degradation. Each pollution source, such as an individual barnyard or a specific cropped field, is placed in a management category depending on criteria established for its major source type.

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

* Management Category I: Individual nonpoint sources in this category together contribute a significant amount of the pollutants impacting surface waters. A reduction in their pollutant loads 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--which are in this category, then 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 included in Management Category I. However their control may be important in achieving water quality objectives as they can offset sources in Management Category I that are not controlled. In some cases, sources are placed in Management Category II based on technical difficulty of controlling the source.

  Nonpoint sources in this category are also eligible for funding and/or technical assistance under the priority watershed project. Inclusion on cost-share agreements of sources in this category is optional. An example would be a landowner whose barnyard is in 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, the county project staff will encourage landowners to control all Management Category II sources.

* Management Category III: Sources in this category do not contribute a significant amount of the pollutants impacting surface waters.

  Nonpoint sources in this category are not eligible for funding and/or technical assistance under the priority watershed project. However, other Department of Natural Resources programs (Wildlife and Fisheries Management) may assist county project staff to control these sources if warranted for other reasons. For example, this would apply to eroding

croplands that are a problem from a soil conservation perspective, but contribute little sediment to streams because of their location. 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 the integrated resource management plan for this watershed.

Additionally, coordination of the nonpoint source control program with federal programs, such as Food Security, and state programs, such as Farmland Preservation, will also assist conservation efforts for these other sources.

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 operations, or other circumstances having occurred since completion of the inventories. Changes must be consistent, however, with the management category criteria set forth below for pollution sources.

Management Category Criteria For Barnyard Runoff

Criteria are established for several classes of barnyards. These classes are:

* Barnyards draining to rivers and streams that flow into one another and ultimately to the mouth of the Milwaukee River.
* Barnyards draining to non-riparian wetland areas generally isolated from rivers and streams.
* Barnyards draining to internally drained areas overlain with deep mineral soils.
* Confined animal operations where barnyard runoff does not occur.

Management category criteria are expressed for these sources as follows:

1. Barnyards draining to surface waters--pounds of phosphorus delivered to surface waters under the 10-year, 24-hour storm.
2. Barnyards draining to non-riparian wetlands--site specific determination that considers the phosphorus load in light of the particular wetland quality and sensitivity.
3. Barnyards internally drained over deep mineral soils--assumed to be insignificant as pollution sources since runoff percolates in areas of low environmental sensitivity.
4. Confined animal operations--assumed to be insignificant sources of barnyard runoff since little can be generated.

Barnyards Draining to Surface Water or Riparian Wetlands: Management categories were established so that pollution control goals would be met while maintaining as much consistency as possible with management category criteria

and pollution control goals established for barnyards in other watersheds of the Milwaukee River Basin. Table 5-1 shows the general criteria used in this watershed for placing barnyards into management categories.

Application of these criteria to the 68 barnyards draining to surface waters for each subwatershed is shown in Table 5-2. The result is that 43 barnyards are eligible for funding under the priority watershed project. Fifteen of these barnyard sites are classified as Management Category I, representing 22 percent of the barnyards and 60 percent of the barnyard pollution load. Thirteen sites are classified as Management Category II, representing 20 percent of the barnyards and 20 percent of the barnyard pollution potential. An additional 15 sites are classified as Management Category IIa, making them eligible for restricted funding up to $3,500. These sites represent 22 percent of the barnyards and 14 percent of the pollution potential. The locations of barnyards draining to rivers and streams that are targeted for control are shown on Map 14.

The 43 eligible sites represent 60 percent of the watershed's barnyards and 94 percent of the watershed's barnyard pollution load. Approximately 90-95 percent of the barnyard pollution potential above each of the four river points located in Ozaukee County will be targeted for control under this plan. This plan will also target large portions of the barnyard pollution loading to major tributary streams, including Fredonia Creek, Mole Creek (Haneman Lake Subwatershed), and Ulao Creek (Lakefield Subwatershed). The lower level of protection for Pigeon Creek is consistent with the lesser role played by barnyards as nutrient sources in this subwatershed.

The actual reduction in barnyard pollution loading will be affected by the efficiency of the control practices and the pollution load design target selected for each barnyard. 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 be equipped with controls designed to produce 100 percent attenuation of pollutants. Although residual pollutant loads from practices installed under this project should not exceed five pounds of phosphorus under the 10-year, 24-hour rainfall event, reducing the barnyard pollution potential below this point may not be cost-effective.

The combined effect of choosing a design target of five pounds phosphorus and an 85 percent efficiency of prescribed best management practices will still afford a 60 percent level of reduction in barnyard pollution loading to rivers and streams in the watershed. The level of barnyard pollution control afforded by this strategy will be sufficient to meet the reduction goals for nutrients identified in this plan. It will also significantly decrease the degree of fecal contamination found in these water resources.

Table 5-1. Criteria and management categories for barnyards draining to surface water in the Milwaukee River South Watershed.

Phosphorus Per Barnyard	Management Category	Portion of Watershed Phosphorus Load
17 pounds or more	I	60%
10 to 17 pounds	II	20%
5 to 10 pounds	IIa	15%
less than 5 pounds	III	5%

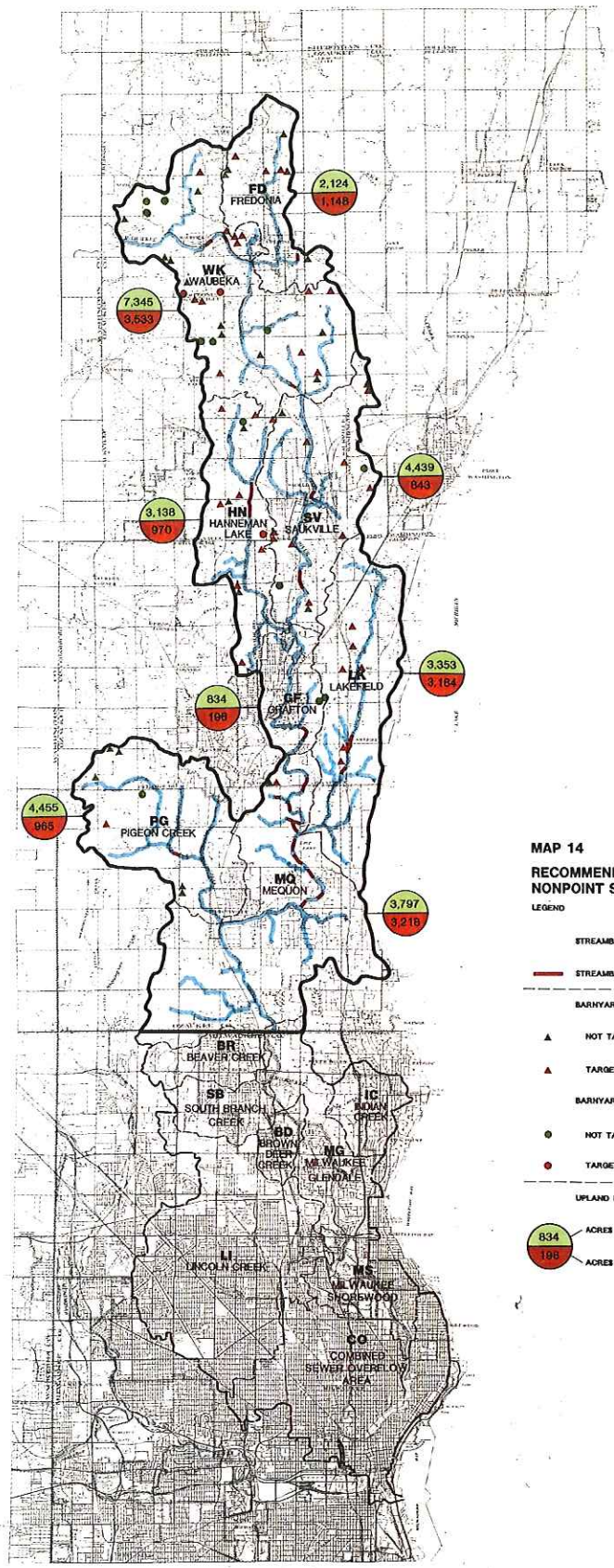
Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade, and Consumer Protection; and Ozaukee County Land Conservation Department.

Table 5-2. Barnyards draining to surface waters targeted for control in the Milwaukee River South Watershed.

	Management Category I			Management Category II			Total		
Sub-watershed(1)	Number of Barnyards	Pounds Phosphorus	% of Load	Number of Barnyards	Pounds Phosphorus	% of Load	Number of Barnyards	Pounds Phosphorus	% of Load
Fredonia Creek	2	44	59%	3	23	31%	5	67	90%
Waubeka	3	126	53%	10	98	40%	13	224	93%
Saukville	3	87	52%	6	74	44%	9	161	96%
Haneman L.	4	121	69%	4	51	29%	8	172	98%
Lakefield	2	77	72%	4	30	28%	6	107	100%
Pigeon Creek	0	0	0%	1	9	45%	1	9	45%
Mequon	1	29	94%	0	0	0%	1	29	94%
TOTAL	15	484	59%	28	285	35%	43	769	94%

(1) There are no barnyards draining to rivers or streams in the Grafton Subwatershed.

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade, and Consumer Protection; and the Ozaukee County Land Conservation Department.



-LEGEND-

MAP 14

RECOMMENDED RURAL NONPOINT SOURCE CONTROLS

LEGEND

STREAMBANKS NOT TARGETED FOR MANAGEMENT

STREAMBANKS TARGETED FOR MANAGEMENT

BARNYARDS DRAINING TO SURFACE WATERS

NOT TARGETED FOR MANAGEMENT

TARGETED FOR MANAGEMENT

BARNYARDS INTERNALLY DRAINED

NOT TARGETED FOR MANAGEMENT

TARGETED FOR MANAGEMENT

UPLAND EROSION - BY SUBWATERSHED

834 — ACRES NOT TARGETED FOR MANAGEMENT

196 — ACRES TARGETED FOR MANAGEMENT

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

MILWAUKEE RIVER
SOUTH WATERSHED
OZAUKEE AND MILWAUKEE COUNTIES WISCONSIN

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Barnyards Draining to Internally Drained Wetlands: Management categories for this class of barnyards are not established on a watershed or subwatershed basis, but are rather established based on site-specific field investigations. Site specific investigations will be made by staff from the DNR Southeast District Headquarters and the Ozaukee County Land Conservation Department. The DNR will make the final determination based on a subjective evaluation of each barnyard's impact on the water quality, wildlife habitat, and ecological integrity of the receiving wetlands.

The two barnyards in the Waubeka Subwatershed have phosphorus loads for the 10-year, 24-hour rainfall event of 10 and 26 pounds per year respectively. These two barnyards are placed in Management Category II. The barnyard in the Haneman Lake Subwatershed has a phosphorus load of 16 pounds. This barnyard is placed in Management Category III unless the farmed wetland receiving the runoff is restored. If the wetland is restored, the barnyard will be placed in Management Category I. The barnyard in the Lakefield Subwatershed has a phosphorus load of less than five pounds, and is placed in Management Category III. The locations of the barnyards draining to wetlands that are targeted for control are shown on Map 14.

Barnyards Draining to Internally Drained Areas Overlaid with Deep Mineral Soils: Eleven barnyards with a combined phosphorus load of 48 pounds drain to internally drained areas overlaid with deep (more than 60 inches) mineral soils. Generally, these sites have limited potential for surface or groundwater contamination. Consequently, they are assigned to Management Category III.

Confined Animal Operations: The 19 livestock operations that are totally confined are placed in Management Category III as sources of barnyard pollution.

MANAGEMENT CATEGORY CRITERIA FOR LIVESTOCK MANURE SPREADING

Management categories were developed for livestock operations based on the pollution potential associated with winterspreading manure in critical areas. This assessment is independent from that based on barnyard runoff.

For purposes of this assessment, a livestock operation is defined as one or more barnyards owned by the same operator who spreads manure from the animals in the same geographic area. Critical areas are defined as those lands having slopes of at least 6 percent or that are located in flood prone areas. Winterspread manure in these areas has a high probability of contaminating surface waters with phosphorus, bacteria, and other pollutants during the period of spring snowmelt.

Management category criteria are expressed as the number of critical acres winterspread with manure annually.

Management categories were established so that surface water pollution control goals established in Chapter IV would be met while maintaining as much consistency as possible with management category criteria established for this source in other watersheds of the Milwaukee River Basin. Table 5-3 shows the general criteria used in this watershed for placing livestock operations into management categories.

The decision criteria presented in this table are designed to address about 85 percent of the critical acres spread annually in the watershed. This is close to the percent of the barnyard pollution potential targeted for control. The respective portions of the pollution potential from this source assigned to Management Categories I and II are also similar to those established for barnyard runoff. Livestock operations placed in Management Category I represent 60 percent of the pollution potential from this source, and livestock operations placed in Management Category II represent 25 percent. The management category criteria for this source are identical to those established in other watersheds in the Milwaukee River Basin.

Table 5-4 shows the results of applying the management category criteria to the livestock operations in the watershed. Management Category I includes an estimated 15 livestock operations and Management Category II includes an estimated 14 livestock operations. Together, these categories include about one-third of the livestock operations and 85 percent of the estimated critical acres winterspread with manure annually.

As with barnyards targeted for 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 winterspread 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 the incremental control costs to determine if the additional control is cost effective. For example, if changes in manure management can be made without constructing a manure storage facility, and if such changes will result in reducing critical acres being spread from 10 acres to 5 acres, then the added cost of constructing a manure storage unit to control the remaining five acres may not be cost effective. Once a manure storage unit is constructed, however, there must be a requirement that critical acres be avoided entirely.

It is important to recognize that the current identification of high priority livestock operations is only preliminary because of the many assumptions about manure spreading practices of each livestock operation. During implementation, Land Conservation Department staff will need to recalculate the actual number of critical acres that each livestock operation spreads annually. Acreage criteria presented in Table 5-3 must be applied to updated information about each livestock operation in order to assign a revised management category based on actual spreading practices.

Management Category Criteria For Eroding Croplands And Other Uplands

Uplands Delivering Sediment to Rivers and Streams: Eroding uplands contribute a large portion of the sediment load to surface waters in the Ozaukee County portion of this watershed. They are the primary sediment source for most of the rural portions of tributary streams such as Fredonia Creek, Mole Creek (Haneman Lake Subwatershed), Ulao Creek (Lakefield Subwatershed), and Pigeon Creek. They are also the dominant source of sediment to the Milwaukee River above Saukville, contributing 75 percent of the total watershed sediment load at River Point 1. The relative importance of this source is less in lower reaches of the river due to the addition of other sediment sources. Even so,

Table 5-3. Criteria and management categories for livestock operations that spread manure during winter in the Milwaukee River South Watershed.

Number of Critical Acres Spread Annually	Management Category	Portion of Critical Acres Spread Annually
15 acres or more	I	60%
7 to 15 acres	II	25%
0 to 7 acres	III	15%

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade, and Consumer Protection; and Ozaukee County Land Conservation Department.

Table 5-4. Livestock operations targeted for control of winterspreading manure in the Milwaukee River South Watershed.

Management Category	Livestock Operations		Critical Acres Spread	
	Number	%	Number	%
I	15	16%	297	60%
II	14	15%	131	25%
TOTAL	29	32%	428	85%

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade and Consumer Protection; and Ozaukee County Land Conservation Department.

this source remains important as it represents 30 to 40 percent of the watershed's sediment contribution to the river within Ozaukee County and 15 to 25 percent of the sediment contribution to the Milwaukee River within Milwaukee County.

Reducing soil loss from the upland fields can control sediment delivery from these uplands. However, there are limits as to how far rates of soil loss can be reduced while maintaining a viable agricultural land use. Generally, soil loss rates of 3 tons/acre/year (T/A/Y) are tolerable in this part of Ozaukee County for purposes of maintaining long-range soil productivity. Soil loss rates less than 2 T/A/Y can be achieved, although it becomes increasingly difficult to attain rates below this level over large areas. This is a concern, since in many of the subwatersheds, a large portion of the delivered sediment (60 to 70 percent) originates on croplands eroding at rates less than 2 T/A/Y. Consequently, the management categories and eligibility criteria were first defined for this watershed based on the sediment reduction goals established for the water resources, and then modified to reflect the limitations in controlling soil loss.

Generally, the sediment reduction goal for surface waters in this watershed is 50 percent. Since eroding uplands in Ozaukee County have a significant impact on all major tributaries and points along the Milwaukee River, a 50 percent reduction in sediment from this source was established. This reduction level was set as a minimum desired level of control that should be achievable through the selected management category criteria. Where advantageous, this level of reduction could be increased in specified areas to achieve additional control.

Practical limitations on controlling soil erosion are used to separate that portion of the total achievable control that is assigned to each management category. Two alternative soil loss rates were investigated as a criterion for separating Management Category I and Management Category II. These are 3 T/A/Y and 2 T/A/Y. If 3 T/A/Y is used, too much of the potential control falls into Management Category II. Since lands assigned to this management category do not have to be controlled as part of a cost share agreement, there is less likelihood the desired management will occur. Consequently, 2 T/A/Y is chosen as the criterion for separating eligible sources into Management Category I or II.

Table 5-5 shows the management categories and eligibility criteria that will be used to target eroding uplands for management in this watershed project.

* In the Fredonia, Waubeka, Saukville, Haneman Lake, Grafton, and Pigeon Creek Subwatersheds only the land parcels having sediment delivery rates above a specified level are targeted for control. That portion of the sediment reduction that can be achieved by reducing soil loss rates down to 2 T/A/Y is designated as Management Category I. That portion that requires reducing soil loss rates to less than 2 T/A/Y is designated as Management Category II. Land parcels that have sediment delivery rates below the specified cut-off will not be targeted for management and are placed in Management Category III.

* In the Lakefield and Mequon Subwatersheds, a significant amount of additional control can be achieved by expanding Management Category II to include all lands with soil erosion rates over 2 T/A/Y. This

Table 5-5. Criteria and management categories for eroding agricultural uplands in the Milwaukee River South Watershed.

Subwatershed	Management Category	Criteria	
		Sediment Delivery	Soil Loss
Fredonia	I	over .05 T/A/Y	& over 2 T/A/Y
	II	over .05 T/A/Y	& under 2 T/A/Y
	III	under .05 T/A/Y	
Waubeka	I	over .05 T/A/Y	& over 2 T/A/Y
	II	over .05 T/A/Y	& under 2 T/A/Y
	III	under .05 T/A/Y	
Saukville	I	over .09 T/A/Y	& over 2 T/A/Y
	II	over .09 T/A/Y	& under 2 T/A/Y
	III	under .09 T/A/Y	
Haneman Lake	I	over .08 T/A/Y	& over 2 T/A/Y
	II	over .08 T/A/Y	& under 2 T/A/Y
	III	under .08 T/A/Y	
Grafton	I	over .15 T/A/Y	& over 2 T/A/Y
	II	over .15 T/A/Y	& under 2 T/A/Y
	III	under .15 T/A/Y	
Lakefield	I	over .16 T/A/Y	& over 2 T/A/Y
	II	over .16 T/A/Y	& under 2 T/A/Y
	II	under .16 T/A/Y	& over 2 T/A/Y
	III	under .16 T/A/Y	& under 2 T/A/Y
Pigeon Creek	I	over .10 T/A/Y	& over 2 T/A/Y
	II	over .10 T/A/Y	& under 2 T/A/Y
	III	under .10 T/A/Y	
Mequon	I	over .18 T/A/Y	& over 2 T/A/Y
	II	over .18 T/A/Y	& under 2 T/A/Y
	II	under .18 T/A/Y	& over 2 T/A/Y
	III	under .18 T/A/Y	& under 2 T/A/Y

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade, and Consumer Protection; and the Ozaukee County Land Conservation Department.

option is being exercised because these two subwatersheds have very high mass loadings of sediment delivered from uplands.

Table 5-6 shows the control strategy for eroding uplands. On a watershed basis, 60 percent of the sediment load from this source is targeted for control. In all subwatersheds, the portion of the sediment load from this source that is targeted for control equals or exceeds 50 percent. This will be adequate to improve habitat quality in major and minor tributary streams. Levels of control are significantly higher in the Fredonia, Waubeka, Mequon, and Lakefield Subwatersheds consistent with the importance of those areas as sediment sources to the Milwaukee River. The potential sediment reduction from eroding uplands under this management package varies from 65 percent at River Point 1 to 60 percent at River Point 4.

That portion of the control program that is designated Management Category I varies. This portion is 25 to 30 percent for Fredonia Creek and Mole Creek, 40 to 50 percent for Ulao Creek and Pigeon Creek, and ranges from 30 to 40 percent for points along the Milwaukee River within Ozaukee County.

This control strategy for eroding cropland and other uplands will require better management on 14,000 acres, or about one-third of the eroding uplands. Map 14 shows the distribution of eroding uplands in the watershed that are targeted for control.

Table 5-6. Eroding agricultural uplands targeted for control in the Milwaukee River South Watershed.

	Management Category I			Management Category II			Total
Subwatershed	Acres	Tons	Control*	Acres	Tons	Control*	Control*
Fredonia	646	49	26%	502	69	36%	62%
Waubeka	2,168	244	33%	1,365	249	34%	67%
Saukville	696	108	39%	147	32	12%	51%
Haneman Lake	680	67	30%	290	43	20%	50%
Grafton	196	40	49%				49%
Lakefield	1,435	298	48%	1,749	66	11%	59%
Pigeon Creek	750	137	43%	215	29	9%	52%
Mequon	1,463	399	50%	1,755	146	18%	68%
WATERSHED	8,034	1,342	41%	6,023	634	19%	60%

* Control is the percent reduction in tons of sediment delivered to surface waters.

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade, and Consumer Protection; and the Ozaukee County Land Conservation Department.

Uplands Delivering Sediment to Wetlands: The management category criteria identified in Table 5-5 are based on sediment delivery to rivers and streams. Eroding uplands that are buffered from streams and rivers by wetlands are not identified through the criteria in the table as needing management, since the wetlands act as sediment traps that reduce the sediment reaching surface waters. It is recognized, however, that in the process the wetland may itself suffer environmental damage. If it is severe enough, the wetland may lose its ability to continue to trap the eroding sediment.

If wetland degradation associated with sediment deposited from eroding uplands is suspected, site specific evaluations will be conducted during implementation by the DNR water resources management personnel and the county project management staff. The DNR will be determine eligibility for cost-sharing or technical assistance.

Cropland Eligible for Assistance to Comply With Other State or Federal Programs: Eligible croplands targeted through the priority watershed project may need practices in addition to those prescribed through the priority watershed project to meet other resource management objectives. In such cases, practices needed to further reduce erosion to levels necessary to comply with requirements of the State Farmland Preservation or Federal Food and Security Act programs may be eligible for funding under the priority watershed project. In general, funding for these additional practices will be eligible so long as the costs for these practices are low to moderate. Examples of such practices include contour strip cropping or reduced tillage. High cost measures to provide additional erosion control on these lands will not be eligible for funding under the priority watershed project. Examples of such practices include field diversions or terraces. The county project management staff will make eligibility determinations for practices needed to achieve this additional level of soil loss control.

MANAGEMENT CATEGORY CRITERIA FOR STREAMBANK DEGRADATION

Streambank erosion contributes a low to moderate portion of the total sediment load to the Milwaukee River and its four principal tributary streams (Fredonia Creek, Pigeon Creek, Ulao Creek, Mole Creek) located within Ozaukee County. Although this source is less significant than others as a contributor to the total sediment load, localized habitat impacts occur as a result of sediment deposition and degradation of streambank structure.

Management category criteria developed for eroding streambanks reflect the more localized nature of this impact. The criteria are based primarily on the rate at which streams are cutting into the streambanks and secondarily on the mass load of sediment being produced at the site.

Table 5-7 presents management category criteria for this source. All sites having moderate to severe rates of lateral recession are targeted for control. Within this group of sites, those producing 10 tons or more of sediment per year are the highest priority for control and are placed in Management Category I. Those producing less than 10 tons of sediment per year have a lower priority for control and are placed in Management Category II. Sites having low to moderate rates of lateral recession are targeted for control only if the site produces at least 10 tons of sediment per year. This type of site has a lower priority for control and is placed in Management Category II. Sites with slight rates of lateral recession are not targeted for control under any circumstances.

Table 5-7. Criteria and management categories for eroding streambanks on the Milwaukee River and tributary streams in the Milwaukee River South Watershed.

SITE CRITERIA(1)		
Lateral Recession Rate at Site(2)	Sediment Produced at Site	Management Category(3)
Moderate to severe	At least 10	I
	Less than 10	II
Low to moderate	At least 10	II
	Less than 10	III
Slight		III

(1) Any site with cattle access is placed in Management Category I.

(2) Moderate to severe is at least .3 ft/yr; Low to moderate in between .1-.3 ft/yr; Slight is less than .1 ft/yr.

(3) Where adjacent land use is residential, woodland, or wetland management alternatives may be restricted. See text for discussion.

Source: Wisconsin Department of Natural Resources; Wisconsin Department of of Agriculture, Trade, and Consumer Protection; and the Ozaukee County Land Conservation Department.

Cattle access is not a common cause of streambank degradation in the watershed, but causes severe habitat and water quality impairment where it occurs and is easily remedied. Consequently, sites having trampled or eroded streambanks associated with cattle access are placed in Management Category I.

Table 5-8 shows the results of applying these management category criteria to the 188 sites of streambank erosion identified along the Milwaukee River and its principal tributaries within Ozaukee County. A total of 35,850 feet of streambank degradation at 42 sites are targeted for control. These 42 sites encompass 38 percent of the length and 60 percent of the mass load coming from this source within the county. Most of these sites are located in unincorporated areas of Ozaukee County. There are four sites, however, that are located within the boundaries of two incorporated municipalities. The single site on Fredonia Creek (Management Category I) is situated in a rural area contained within the boundary of the village of Fredonia. Three sites in the Saukville Subwatershed (all Management Category I) are located on the Milwaukee River within the Saukville village limits. All sites in the Mequon Subwatershed targeted for control are situated in urban and rural settings within the Mequon city limits. The locations of streambank sites targeted for control are shown on Map 14.

Sites located in wetlands, woodlands, and some residential areas may be impractical to control for several reasons. Access may be limiting at any of these areas. In addition, structural controls may not be suited to wetland

Table 5-8. Eroding streambanks targeted for control in the Ozaukee County portion of the Milwaukee River South Watershed.

	Management Category I(1)				Management Category II(1)				Total Control	
			Tons				Tons			
Subwatershed	Sites	Feet	No.	%	Sites	Feet	No.	%	Eroding Feet	Eroding Tons
Fredonia(2)	1	1,440	72	94%					65%	94%
Waubeka	2	925	44	38%	1	1,200	21	18%	33%	56%
Saukville(2)	4	1,475	113	37%	3	1,525	30	10%	19%	47%
Haneman Lake	2	10,560	72	100%					100%	100%
Grafton					1	850	11	15%	10%	15%
Lakefield	3	4,110	37	64%	3	160	9	16%	94%	80%
Mequon(2)	13	7,840	450	51%	8	5,080	109	12%	29%	63%
Pigeon Creek	1	1,400	10	18%					25%	18%
OZAUKEE COUNTY	26	27,750	798	48%	16	8,815	180	11%	38%	59%

(1) Where adjacent land use is residential, woodland, or wetland management alternatives may be restricted. See text for discussion.

(2) Some sites targeted for control are located in incorporated areas. See text for discussion.

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade, and Consumer Protection; and the Ozaukee County Land Conservation Department.

areas as a result of limitations in substrate material. In woodland areas, site preparation for structural controls may require disturbances that pose significant environmental problems. As a result, sites located in these areas may need further evaluation prior to developing a control plan. Options to be considered include structural controls such as riprap or shaping and seeding. Less intrusive controls may also be appropriate, such as brushing to enable adequate light penetration for vegetation to grow. If the degree of site disturbance needed to install adequate practices poses an unacceptable threat to the water resource, control of the site will not be pursued. Table 5-9 shows the extent of the streambank erosion targeted for control within Ozaukee County that is located in residential, wetland, or woodland areas and subject to further evaluation.

Table 5-9. Portion of streambank erosion sites targeted for control in Ozaukee County that are located in residential, woodland, and wetland areas.

	Residential		Woodland		Wetland		TOTAL	
Subwatershed	Feet	Tons	Feet	Tons	Feet	Tons	Feet	Tons
Waubeka	85%	74%	15%	26%			100%	100%
Saukville	47%	16%	4%	5%			51%	21%
Mequon	20%	18%	9%	3%	25%	27%	54%	48%
OZAUKEE COUNTY	15%	20%	5%	5%	10%	15%	30%	40%

Source: Wisconsin Department of Natural Resources.

Removal of dams and similar in-stream structures in the Milwaukee River Basin is being evaluated under the previously described Milwaukee River Basin integrated resource management planning effort. If removal of these types of structures occurs, it is anticipated that newly exposed streambanks and lakebeds will become significant sediment sources unless adequately managed. Before these sources occur, the DNR and the appropriate unit of government will jointly evaluate the anticipated severity of the sources and a management category will be assigned. Eligibility of these sources for technical and financial assistance will be in accordance with the assigned management category.

RURAL POLLUTION CONTROL PRACTICES

This section describes the general types of rural nonpoint source control practices that will be needed to achieve the desired level of pollution control. It also contains special guidance on the use of terraces, shoreline buffers, agriculture sediment basins, and easements. A full list of best management practices for use in the watershed project is presented in Chapter VI, along with estimates of the practice quantities needed.

Upland Erosion Control Practices: Target sediment delivery rates on both rotated and continuous cropland can generally be achieved using a combination of rotation changes, reduced tillage, contour plowing, and contour strip cropping. About 10 percent of the eroding uplands will require additional protection, such as critical area seeding, in order to achieve sediment

delivery targets. To control existing gullies and prevent new ones from developing, grassed waterways, field diversions, and grade stabilization structures will be needed.

Cropland terracing will not be promoted in the watershed because it is not generally needed to meet sediment reduction goals and is expensive to construct. Terraces are eligible on a case-by-case basis, provided that the eroding field is in Management Category I and significant progress towards the sediment delivery target is not feasible using other practices. The county Land Conservation Department (LCD) and the Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP) should jointly determine the need for terraces.

Shoreline buffers are vegetated filter areas adjacent to waterways. They should be used wherever possible in reducing sediment delivery from those targeted lands that are located immediately adjacent to intermittent or perennial surface channels. In addition, they should be used along intermittent channels where flows overtop channel banks and scour adjacent fields. Guidance on buffer widths are presented in Appendix C.

Pesticide and Fertilizer Management Practices: Improved pesticide and fertilizer management will probably be needed in the watershed. Although NR 120 has identified best management practices, the required practice standards and specifications have not yet been developed. The Department of Agriculture, Trade, and Consumer Protection is responsible for developing these standards and specifications. As these become available, their application in this watershed project will be evaluated jointly by DNR, DATCP, the county's LCD and the University of Wisconsin Center for Nutrient and Pesticide Management. Until that time, appropriate aspects of pesticide and fertilizer management will be demonstrated as part of the information and education program presented in Chapter VI.

Streambank Stabilization Practices: Principal practices that will be needed include cattle exclusion, shoreline buffers, livestock and machinery crossings, shaping and seeding, and rip rap.

Shoreline buffers and agriculture sediment basins may be needed to augment source controls where soil erosion rates of contributing uplands cannot be sufficiently reduced. However, soil particles in motion are difficult and expensive to control. Consequently, these practices may only be used as off-site sediment filters provided that a reasonable level of control will be applied to tributary fields. Agriculture sediment basins should not be used in the Haneman Lake Subwatershed where such impoundments will add to the thermal stresses already being exerted on Mole Creek. This application of shoreline buffers will probably be most widespread in the Fredonia, Haneman Lake, and Waubeka Subwatersheds. In these areas, achieving the sediment reduction goals will require extensive work on lands eroding at rates below 2 T/A/Y.

Shoreline buffers may be used where streambank degradation results from intensive adjacent agricultural land uses such as livestock access or cropping too close to the stream.

Animal Waste Management Practices: Barnyard runoff control systems and manure spreading management plans will be the principal control practices. Manure storage facilities will be used if necessary to restrict winterspreading manure in accordance with recommendations in this plan.

Using Easements To Support Rural Pollution Control Practices

Nonpoint source program funds may be used to purchase land easements in order to support specified best management practices. These practices, which involve the establishment of permanent vegetative cover, include shoreline buffers, critical area stabilization, and wetland restoration.

Easements shall be for a period of no less than 20 years, although perpetual easements are preferred. The easement will be developed as an agreement separate from the cost sharing agreement for the best management practice.

Easements may be contracts between the landowner and the DNR, or between the landowner and the local unit of government. The local unit of government will retain responsibility for identifying how the easement will be used in controlling targeted pollution sources. Final approval of the easement rests with the DNR's Bureau of Water Resources Management.

To initiate the process, the local unit of government shall forward the easement proposal to the DNR district nonpoint source coordinator. The nonpoint source coordinator will be responsible for obtaining review comments from local DNR staff including those from Wildlife Management, Fisheries Management, and Water Regulation and Zoning. The nonpoint source coordinator will then forward the proposal to DNR bureau offices for Water Resources Management, Property Management, and other disciplines as appropriate.

Easements To Support Critical Area Stabilization And Shoreline Buffers

The following guidelines and criteria are for the purchase of easements used to support critical area stabilization, and shoreline buffers exclusive of wetland restoration. Guidelines for using easements to support wetland restoration are presented later on in this plan.

Riparian Lands Along "High Priority" Water Resources: These are the highest priority areas for obtaining easements to support critical area stabilization and shoreline buffer practices. These water resources are those streams that are most sensitive to nonpoint pollution. Also, these water resources will receive added benefits of permanent vegetative cover. These added benefits include enhanced aquatic habitat and, if agreed to by the landowner, improved public access to surface waters.

In this watershed "high priority" waters include those perennial and intermittent streams in the following subwatersheds: Haneman Lake; Lakefield; Pigeon Creek; and Fredonia Creek.

Easements to allow the establishment of permanent vegetative cover in these areas will be considered even though other lower cost practices, such as changes in crop rotation, reduced tillage, contour plowing, or contour strips may provide an adequate level of control. Easements in these areas will also be considered as a cost-effective alternative to more expensive practices such as cropland terraces or agricultural sedimentation basins.

Other Portions of the Watershed: Easements may also be used to support critical area stabilization and shoreline buffers in other portions of the watershed, although additional restrictions apply.

In these areas, the easement must offer pollution control at a cost that is competitive with that of other controls, as required by NR 120. For example,

the easement should be lower or similar in cost to expensive practices (such as terraces or agricultural sediment basins) for continuous row crops where the only other alternative is retiring the land.

Easements may not be purchased with program funds to establish shoreline protection or critical area stabilization practices outside high priority areas if significantly lower cost practices such as changes in crop rotation, reduced tillage, contour plowing, or contour strips provide an adequate level of control.

EASEMENTS TO SUPPORT WETLAND RESTORATION

Easements may be used to support eligible wetland restoration projects. The cost-effectiveness criterion for using wetland restoration is relaxed everywhere in the watershed, being similar to the criterion for easements for shoreline buffers and critical area stabilization in areas adjacent to "high priority waters."

If wetland restoration does not involve the purchase of an easement, then the LCD may sign a cost share agreement for the required costs and proceed to implement the practice.

Estimated Need for Easements: The estimated number of acres needed to control targeted pollution sources located adjacent to "high priority waters" is shown in Table 5-10. No estimate is available for other easement needs.

Table 5-10. Estimated acres of easements needed to support shoreline buffers in the Milwaukee River South Watershed.

	STREAMBANK PROTECTION(1)		UPLAND EROSION CONTROL(2)		TOTAL	
Subwatershed	Feet of Streambank	Acres of Easements	Feet of Streambank	Acres of Easements	Feet of Streambank	Acres of Easements
Fredonia Creek			26,000	35	26,000	35
Haneman Lake	4,000	6	11,000	10	15,000	16
Pigeon Creek	1,400	2	39,000	35	40,400	37
Lakefield	1,900	3	104,000	140	105,900	143
Watershed	7,300	11	180,000	220	187,300	231

(1) Table reflects 6 cattle access sites only: 2 in the Haneman Lake Subwatershed; 1 in the Pigeon Creek Subwatershed and 3 in the Lakefield Subwatershed.

(2) Table reflects lands that meet two conditions: a) are riparian to intermittent or perennial streams; and b) sediment delivery rates from upland erosion exceed the management target.

Source: Wisconsin Department of Natural Resources; Wisconsin Department of Agriculture, Trade, and Consumer Protection; and the Ozaukee County Land Conservation Department.

Wetland Restoration: Wetland restoration is an eligible best management practice for the purpose of controlling nonpoint sources of pollution. Secondary benefits of wetland restoration may be enhancement or fish habitat. However the primary justification for restoration under this nonpoint source pollution control project must be water quality improvement.

Wetland restoration includes: the plugging or breaking up of existing tile drainage systems; the plugging of open channel drainage systems; other methods of restoring the pre-development water levels of an altered wetland; or fencing of livestock out of a wetland.

Wetland restoration is an eligible practice when applied to any of the following:

1. Cultivated organic soils with tile or open channel drainage systems discharging to a lake, stream, or tributary.

   Wetland restoration will reduce the amount of nutrients and pesticides draining from the altered wetland to a water resource. Establishing permanent vegetation and disabling the drainage system will control this pollutant source.

2. Pastured wetlands riparian to lakes, streams, or tributaries.

   Eliminating livestock grazing within wetlands will reduce the organic and sediment loading to the wetland and adjacent water resource, and reduce the direct damage to the wetland from the livestock. Livestock exclusion by fencing will control the pollutants and restore the wetland.

3. Prior converted wetlands down slope or up slope from fields identified as critical upland sediment sources through the WIN model.

   Restoration of wetlands in these situations will do one of two things: creates a wetland filter which reduces the pollutants from an up-slope field(s) to a water resource; or reduces the volume and/or velocity of water flowing from an up-slope wetland to a down-slope critical field. Two eligibility conditions must be met to use wetland restoration in this situation:

   a. All upland fields draining to the wetland must be controlled to a soil loss rate that is less than or equal to 2 T/A/Y.

   b. One or more of these same fields must still have a sediment loss rate (after the application any erosion control measures) greater than the "sediment delivery rate" listed in Table 5-5 for the appropriate subwatershed.

INTEGRATING FISHERIES AND WILDLIFE MANAGEMENT CONCERNS

Fisheries and wildlife concerns will be identified and addressed during implementation of this watershed project. County LCD staff will contact the DNR Southeast District Wildlife Management and Fisheries Management staffs for the Milwaukee River Basin as conservation plans and cost share agreements are

developed. The purpose of this coordination is to maximize the fish and wildlife benefits of nonpoint source control practices, to identify wildlife habitat mitigation measures needed to offset habitat loss occurring from installation of best management practices, and to prevent use of practices that may have an adverse impact on water resources.

The conditions under which LCD staff are to contact DNR staff for consultation and assistance, and the role of the DNR when contacted are discussed in Chapter VI, "Cost Share Agreement and Administration."

URBAN NONPOINT SOURCE CONTROL NEEDS

URBAN NONPOINT SOURCES

The principal water quality problems for urban streams identified in Chapter IV are the result of many factors. These include:

* Stream channel modifications, including straightening and lining with concrete.

* High loadings of pollutants including sediment, nutrients, bacteria, heavy metals and other toxic materials.

* Hydrologic disturbances, including flashy high flows and loss of base flow.

* Streambank erosion.

Channel modifications, hydrologic disturbances, and streambank erosion are all related to the drastic changes that occur in the hydrology of urban streams. Pollution is related directly to the increase in pollutants generated within the urban landscape and the creation of highly efficient transport pathways (storm sewers) by which these pollutants make their way to surface waters.

Three principal sources in urban areas must be addressed in order to reduce the water quality impacts of urban runoff. These sources are established urban areas; developing urban areas; and eroding streambanks.

Established Urban Areas: Established urban area runoff is that which occurs after development has been completed and the land use stabilized. The established urban area is dynamic and will increase over time as a result of urbanization. That portion of the established urban area that was in place as of 1985 is called the "existing urban area." That portion that will be added through the year 2000 is called the "planned urban area." The projected urban area that will be established in the year 2000 is the sum of the existing and planned areas, and is called the "future urban area."

Established urban lands are important sources of hydrologic problems such as flashy streamflows. These flows have created streambank erosion problems and flooding problems. These problems have been traditionally dealt with through making extensive modifications to the stream channels. These modifications have destroyed fish habitat and have increased the problem of hydraulic scour of the stream substrate.

Established urban lands are also important sources of pollutants, particularly organic and inorganic toxic materials, and sediment. Existing urban lands

must be retrofitted with stormwater practices to control these problems. Land must be purchased, existing uses converted, and storm sewers rerouted. In planned urban areas stormwater practices may be planned as an integral part of the development, assuring that land is available for the necessary practices. Practices installed as part of the initial development can be five to ten times cheaper than those retrofitted for existing urban areas.

Developing Urban Areas: Developing urban areas are those in any of the various phases of construction that involve disturbing the soil through grading or excavation. Developing areas include those in which land use is being converted for the first time. Examples are creation of a new residential subdivision or industrial park. Development activities also take the form of renovation or redevelopment within the established urban landscape. These activities can include utility replacement, street replacement, bridge reconstruction, or rehabilitation of commercial, industrial, or residential areas that involves grading or excavation.

Developing urban lands are important primarily as sources of construction site sediment and attached pollutants, primarily phosphorus.

Streambank Erosion: Streambank erosion sites include those identified as part of the urban streambank survey. These sites are important as sources of sediment, and cannot provide the type of shoreline habitat required for healthy fish populations.

Identification Of Management Alternatives For Established Urban Areas

Alternatives for Existing Urban Lands: Existing urban land uses differ in their production of stormwater pollutants and flow. Based on the information presented in Chapter IV, those urban land uses that are considered the most critical to control have been identified for each subwatershed. The purpose of identifying critical urban land uses is to focus staff and budget resources so that the urban program is as cost-effective as possible.

Identification of critical urban land use is based on two contributing factors: the unit area rate, in pounds/acre, at which each land use produces pollutants; and the portion of the total urban pollutant load, in pounds/year, produced by each land use. Table 5-11 shows the critical urban land uses for each subwatershed.

Six management alternatives were applied to those existing urban lands that were determined to have critical land uses. These management alternatives span a range of management practices and control effectiveness. The management alternatives include:

* No activity.
* Increase street sweeping to once per week on critical lands.
* Redirect roof downspouts on critical lands to pervious areas.
* Detain 50 percent of the critical lands with wet ponds, increase street sweeping on the other 50 percent of the critical lands to once per week.

* Infiltrate 50 percent of the critical lands, increase street sweeping on the other 50 percent of the critical lands to once per week.

* Detain 100 percent of the critical lands with wet ponds.

Table 5-11. Critical urban land uses for existing urban areas, Milwaukee River South Watershed.

Subwatershed	Industrial	Commercial	Freeway	High Density Resid.	Multi-Family Resid.	Medium Density Resid.	Institutional
Fredonia	x	x			x		
Waubeka	x	x					x
Saukville	x	x			x		
Haneman Lake	x	x					
Grafton	x	x					x
Lakefield	x	x					
Pigeon Creek	x	x					x
Mequon	x	x					x
Beaver Creek	x	x			x		
South Branch	x	x			x		
Brown Deer Creek	x	x			x		x
Indian Creek	x	x			x	x	x
Milwaukee River-Glendale	x	x	x	x	x		x
Lincoln Creek	x	x	x	x	x		
Milwaukee River-Shorewood	x	x	x	x	x		

Source: Wisconsin Department of Natural Resources.

The analysis of management alternatives assumes that wet ponds will trap all sediment particles 5 microns or larger. This is a high level of control that will result in controlling 90 percent of the suspended sediment and about 70 percent of the heavy metals in urban runoff. The analysis assumes an infiltration rate of .25 inches per hour for infiltration basins and grassed swales. This is a moderate rate of infiltration that will provide less control of pollutants than the wet detention ponds. Higher infiltration rates of about 2.5 inches per hour would provide excellent control of pollutants. Existing levels of street sweeping and grassed swale drainage are accounted for in evaluating these alternatives.

Alternatives for Planned Urban Lands: Alternatives for planned urban areas are most useful in identifying the increases that will occur in mass loading of pollutants to the river and its tributaries under different levels of management in the urbanizing area. These increases are important to understand since they affect overall river quality and can compromise gains made through controls on existing urban lands. Three management alternatives were applied to planned urban areas. These include:

* Redirect roof downspouts on all lands to pervious areas.

* Detain 100 percent of all lands with wet ponds.

* Infiltrate residential areas using grassed swales, detain all commercial and industrial lands using wet ponds.

Alternatives for Future Urban Areas: The effects of managing existing urban areas are combined with those of managing planned urban areas to determine the net impacts on water quality under future conditions. Each of the six management alternatives for existing areas can be combined with each of the three management alternatives for planned urban areas, resulting in 18 alternative urban programs for established urban surfaces. Evaluation of the residual pollutant loads that will still be flowing into surface waters under each management program will reveal which program is required to meet pollutant reduction goals established for the river and its tributaries for the year 2000.

Identification Of Alternatives For Developing Urban Lands

It was assumed that construction site erosion will be controlled with an average control efficiency of 75 percent. An additional level of management (90 percent) was investigated to see how sensitive the total sediment control program is to the effectiveness of the construction erosion control program.

Identification Of Urban Streambank Erosion Control Alternatives

It was assumed that urban streambanks would be controlled using the same criteria specified for rural areas. Alternatives for achieving this level of control have not been evaluated, but will be required as part of any feasibility study for streambank erosion control prepared prior to installing practices. Flow reduction through application of upland practices, and practices applied to the eroding sites themselves will need to be investigated as alternatives.

Analysis Of Urban Management Alternatives

The long-term goal of urban nonpoint source controls in this watershed is to contribute towards the eventual elimination of toxicity in urban stormwater runoff and in receiving waters. The current wording in the plan reflects the fact that urban runoff is a significant, although not the sole, contributor of toxicity problems.

The Integrated Resource Management Plan for this watershed identifies toxic in-place pollutants (sediments) and industrial spills as other factors contributing to toxicity problems. Urban nonpoint source controls will

consequently reduce toxicity, but true elimination will require other management actions. Also, reducing the average concentrations of metals in stormwater effluent and receiving waters to acceptable levels will reduce the magnitude and frequency of concentrations that exceed state standards, but will not eliminate them entirely.

Stormwater management alternatives for established and developing urban areas are evaluated based on their capabilities to meet pollution reduction goals. Three reduction goals identified in Chapter IV are used as the principal criteria for evaluating the effectiveness of urban management alternatives. These goals are:

1. Decrease the 1985 suspended sediment loading to principal tributary streams and the Milwaukee River by 50 percent to reduce substrate embeddedness.

2. Reduce the heavy metals loading from existing urban areas in all subwatersheds as needed to reduce the acute toxicity of stormwater effluents (varies by subwatershed).

3. Reduce the heavy metals loading from the future urban area (existing and planned areas) to 50 percent of the 1985 level in order to reduce the chronic toxicity measured in the Milwaukee River at River Points 4, 5, and 6.

Results for Sediment: Construction erosion, runoff from established urban areas (existing and planned), and streambank erosion are the principal urban sediment sources. The relative importance of these urban sources to the existing and projected mass loading of sediment to the Milwaukee River and its tributaries is presented in Chapter IV.

The need for construction site and streambank erosion controls are presented below. The recommended levels of control, in association with those called for in the rural areas, form the backdrop for evaluating alternatives for established (existing and planned) urban area runoff.

Sediment Control for Developing Areas: Construction site erosion control throughout most of the watershed is a cornerstone to achieving sediment reduction goals. Throughout most of Ozaukee County, where most of the projected development will occur, annual construction activity will increase over past rates. Only two subwatersheds, Grafton and Pigeon Creek, will see rates remain the same. In all Ozaukee County subwatersheds, construction site erosion will either retain or establish its status as the dominant sediment source.

Past construction site erosion has been the dominant sediment source in nearly all of Milwaukee County. Projected trends in construction activity are significantly downward, however. The reduced rate of future construction activity will, in and of itself, contribute significantly to achieving sediment reduction goals in the Indian Creek and Lincoln Creek Subwatersheds. The impact on the Milwaukee River of this reduced construction activity will be less apparent, both within and upstream of Milwaukee County, because of the influence from other sediment sources.

Consequently, effective construction site controls are of primary importance to all portions of the Milwaukee River, and to the principal tributaries

within Ozaukee County. For the principal tributaries in Milwaukee County, including Lincoln Creek and Indian Creek, it remains a factor although it has reduced significance.

Sediment Control For Eroding Streambanks: Streambank erosion occurs along a significant portion of Indian and Lincoln Creeks. This erosion is caused primarily by the changing stream hydrology, which is characterized as "flashy" and having increasing discharge volume and peak flows. This acts to constantly widen the width of the stream channel, destroying its natural cross sectional morphology important as habitat for fish and aquatic life. Also, the channel is scoured during events, displacing in-stream cover such as rocks and logs and flushing away the organisms as well. This is most apparent in Lincoln Creek, where the stream bed in many places is literally scoured clean of any rocks or logs. Embeddedness resulting in part from eroding streambanks is still an important habitat restriction, but is limited more to pool areas.

Streambank erosion in urban areas will be targeted for control using the same criteria developed for other portions of the watershed. These criteria are shown in Table 5-7 and explained in the portion of this chapter that addresses rural control needs.

Sediment Controls For Established Urban Areas: The effectiveness of using stormwater controls in established urban areas is evaluated to determine if this additional step in managing sediment loading is cost-effective. Table 5-12 shows how managing stormwater runoff from established urban areas can be expected to affect total sediment loads from subwatersheds located in Ozaukee County. Table 5-13 shows similar information for Milwaukee County subwatersheds, and Table 5-14 presents the results for each of the six major points along the Milwaukee River.

This analysis assumes that the recommendations presented in this plan for the control of eroding uplands, rural and urban streambank erosion, and construction sites will be implemented. Some adjustments downward have been made to reflect management category implications for upland erosion and some potential technical difficulties in controlling streambank erosion. It will be assumed that future construction erosion control efforts will be 75 percent effective.

Stormwater controls on established urban areas are not required in order to meet sediment reduction goals for Pigeon Creek, Ulao Creek (Lakefield Subwatershed), Indian Creek, Lincoln Creek, River Point 5, or River Point 6. Alternative 1, which includes controls on only rural upland and streambank erosion sources, is sufficient in these areas to achieve the 50 percent reduction in sediment load being sought.

Stormwater controls on established urban areas are needed to meet the sediment reduction goals elsewhere in the watershed, however. Fredonia Creek, Mole Creek (Haneman Lake Subwatershed), and River Points 3 and 4 will meet or closely approach their sediment reduction goals only if a controls on established urban areas are used. Alternative 2, which includes 100 percent detention of planned urban areas and increased street sweeping for existing urban areas, is sufficient for these areas. Most of the sediment reduction under Alternative 2 comes from controls on new development, with street sweeping on existing areas only contributing marginally to the overall sediment reduction.

Table 5-12. Projected change, year 1985-2000, in nonpoint source sediment loads for subwatersheds in the Ozaukee County portion of the Milwaukee River South Watershed, under alternative management programs.

	CHANGE IN SEDIMENT, BY MAJOR SOURCE							CHANGE IN TOTAL SEDIMENT			
			Urban Areas(1)				Construction	All Sources(3)			
	Uplands	Streambanks	1,1	2,2	2,4	2,6	Sites(2)	Alt 1	Alt 2	Alt 3	Alt 4
Fredonia	-48%	-95%	58%	0%	-22%	-44%	-12%	-41%	-46%	-49%	-51%
Waubeka	-50%	0%	41%	-21%	-42%	-62%	77%	-37%	-39%	-40%	-40%
Saukville	-45%	-40%	256%	18%	-5%	-28%	-62%	-34%	-45%	-46%	-48%
Haneman Lake	-40%	-100%	328%	14%	-26%	-29%	-41%	-41%	-49%	-49%	-50%
Grafton	-47%	-15%	39%	-2%	-28%	-56%	-75%	-52%	-59%	-63%	-68%
Pigeon Creek	-48%	-18%	77%	-4%	-28%	-52%	-73%	-58%	-65%	-67%	-69%
Lakefield	-54%	-80%	32%	-26%	-52%	-75%	-58%	-49%	-54%	-57%	-59%
Mequon	-60%	-20%	66%	-19%	-42%	-63%	-57%	-40%	-46%	-48%	-50%

(1) Includes existing and planned urban land uses. Alternative urban programs are:
- 1,1 Redirect downspouts on all new development, no management of existing urban areas.
- 2,2 Wet detention basins on all new development, increased street sweeping on existing critical land uses.
- 2,4 Wet detention on all new development, increased street sweeping on 50% of existing critical land uses and wet detention for the other 50% of the existing critical land uses.
- 2,6 Wet detention on all new development, wet detention on all existing critical land uses.

(2) Reductions in construction site sediment assume that practices are 75% effective.

(3) All alternatives include the reductions for upland erosion, streambank erosion, and construction site erosion included in the left half of this table. In addition:
- Alternative 1 includes urban program 1,1.
- Alternative 2 includes urban program 2,2.
- Alternative 3 includes urban program 2,4.
- Alternative 4 includes urban program 2,6.

Source: Wisconsin Department of Natural Resources.

Table 5-13. Projected change, year 1985-2000, in nonpoint source sediment loads for subwatersheds in the Milwaukee County portion of the Milwaukee River South Watershed, under alternative management programs.

	CHANGE IN SEDIMENT, BY MAJOR SOURCE						CHANGE IN TOTAL SEDIMENT			
		Urban Areas(1)					All Sources(3)			
	Streambanks	1,1	2,2	2,4	2,6	Construction Sites(2)	Alt 1	Alt 2	Alt 3	Alt 4
Beaver Creek	0%	65%	-1%	-32%	-70%	-78%	-57%	-66%	-71%	-76%
South Branch-Creek	100%	65%	-5%	-29%	-56%	-85%	-67%	-77%	-80%	-83%
Brown Deer Creek	n.a.	9%	-1%	-29%	-60%	-98%	-71%	-73%	-81%	-89%
Indian Creek	50%	5%	-12%	-43%	-74%	-95%	-70%	-78%	-84%	-88%
Milwaukee River-Glendale	n.a.	17%	-4%	-31%	-56%	-90%	-67%	-71%	-77%	-83%
Lincoln Creek	50%	17%	0%	-36%	-75%	-90%	-57%	-62%	-72%	-83%
Milwaukee River-Shorewood	n.a.	14%	-7%	-38%	-75%	-70%	-14%	-27%	-49%	-73%

(1) Includes existing and planned urban land uses. Alternative urban programs are:
- 1,1 Redirect downspouts on all new development, no management of existing urban areas.
- 2,2 Wet detention basins on all new development, increased street sweeping on existing critical land uses.
- 2,4 Wet detention on all new development, increased street sweeping on 50% of existing critical land uses and wet detention for the other 50% of the existing critical land uses.
- 2,6 Wet detention on all new development, wet detention on all existing critical land uses.

(2) Reductions in construction site sediment assume that practices are 75% effective.

(3) All alternatives include the reductions for upland erosion, streambank erosion, and construction site erosion included in the left half of this table. In addition:
- Alternative 1 includes urban program 1,1.
- Alternative 2 includes urban program 2,2.
- Alternative 3 includes urban program 2,4.
- Alternative 4 includes urban program 2,6.

Source: Wisconsin Department of Natural Resources.

Table 5-14. Projected change, year 1985-2000, in nonpoint source sediment loads at six points along the Milwaukee River under alternative management programs.

	CHANGE IN SEDIMENT, BY MAJOR SOURCE							CHANGE IN TOTAL SEDIMENT			
			Urban Areas(1)				Construction	All Sources(3)			
	Uplands	Streambanks	1,1	2,2	2,4	2,6	Sites(2)	Alt 1	Alt 2	Alt 3	Alt 4
River Point 1	-50%	-40%	50%	-9%	-31%	-53%	25%	-37%	-40%	-41%	-43%
River Point 2	-50%	-40%	160%	5%	-17%	-39%	-54%	-36%	-43%	-45%	-46%
River Point 3	-47%	-40%	98%	2%	-23%	-48%	-61%	-41%	-48%	-50%	-52%
River Point 4	-52%	-30%	75%	-10%	-34%	-57%	-64%	-44%	-51%	-53%	-55%
River Point 5	-52%	-30%	56%	-7%	-33%	-60%	-73%	-50%	-57%	-60%	-63%
River Point 6	-52%	-35%	34%	-4%	-35%	-68%	-78%	-51%	-58%	-63%	-69%

(1) Includes existing and planned urban land uses. Alternative urban programs are:
- 1,1 Redirect downspouts on all new development, no management of existing urban areas.
- 2,2 Wet detention basins on all new development, increased street sweeping on existing critical land uses.
- 2,4 Wet detention on all new development, increased street sweeping on 50% of existing critical land uses and wet detention for the other 50% of the existing critical land uses.
- 2,6 Wet detention on all new development, wet detention on all existing critical land uses.

(2) Reductions in construction site sediment assume that practices are 75% effective.

(3) All alternatives include the reductions for upland erosion, streambank erosion, and construction site erosion included in the left half of this table. In addition:
- Alternative 1 includes urban program 1,1.
- Alternative 2 includes urban program 2,2.
- Alternative 3 includes urban program 2,4.
- Alternative 4 includes urban program 2,6.

Source: Wisconsin Department of Natural Resources.

Similarly, stormwater controls on established areas are needed to help reduce sediment loads to River Points 1 and 2. Alternative 2 provides a 40 percent reduction in sediment loading at these two points. This falls short of the desired change. However, more rigorous treatment programs, such as Alternatives 3 or 4, provide little additional sediment control.

Each of the alternative sediment control programs presented in Tables 5-12 through Table 5-14 is very sensitive to the efficiency of construction site erosion controls. Improving efficiency of construction erosion control programs from 75 percent to 90 percent would dramatically improve the total sediment control throughout most of the watershed. In Ozaukee County, for example, total sediment control at River Points 2 to 4 and in the Fredonia, Haneman Lake, Pigeon Creek, and Lakefield Subwatersheds would increase by 10 to 15 percent with this higher efficiency construction erosion control program. Control at River Point 1 would increase by 5 percent. In Milwaukee County, the increase in total sediment control would be noticeable (10 percent) at River Points 5 and 6. The effect would be marginal in Lincoln Creek (4 percent) and non-existent in Indian Creek.

This further supports the conclusion that it is most cost-effective to optimize the construction erosion controls instead of retro-fitting existing urban areas with detention. Although achieving 90 percent efficiency of construction erosion control practices is probably unrealistic, failure to attain at least a 75 percent efficiency in these control programs will result in failure to meet sediment reduction goals in most surface waters. This shortfall in the sediment reduction goal would compromise gains made from controlling other sediment sources including upland erosion, streambanks, and planned urban areas.

Although installing urban stormwater controls in existing urban areas is not a cost-effective method of reducing sediment loads, it will be required to reduce the loading of urban toxic materials to acceptable levels. Since management actions needed to reduce toxicity are more stringent than those required to reduce sediment, the strategy to control toxic materials in runoff will dictate the recommended program for established urban areas. This is explained in more detail below.

Results for Total Lead: Chapter IV presents reduction goals related to reducing the acute toxicity of stormwater effluents and the chronic toxicity of the receiving waters into which these effluents flow. Investigating management actions that will satisfy these reduction goals requires two separate approaches.

One approach considers reducing the acute toxicity of stormwater effluents and the other considers reducing the chronic toxicity of receiving waters. Both of these approaches will also reduce the transport of lead and other urban toxic materials to the contaminated bottom sediments of receiving waters.

Reducing Acute Effluent Toxicity: Pollution reduction goals presented in Chapter IV address the acute toxicity of stormwater effluents. The appropriate approach for identifying management actions that will reduce stormwater effluent toxicity is to evaluate subwatersheds separately. This is because the individual stormwater pipes are the primary concern. Also, existing urban area runoff and planned urban area runoff should be looked at separately in evaluating how best to reduce effluent toxicity.

The need for reducing the potential for acute toxicity problems was presented in Chapter IV, which indicated that heavy metals concentrations in urban stormwater are a concern (Tables 4-23 and 4-24). One way of reducing the concentration of stormwater effluents is to reduce the mass load of pollutants entering the storm sewer system. Assuming that the volume of stormwater remains the same, the concentrations will be reduced in direct proportion to reductions in the load of pollutants entering the storm sewer system.

Table 5-15 shows the effect of different management alternatives on estimated pollutant concentrations in existing stormwater. When compared to the monitored and calculated concentrations of heavy metals in stormwaterpresented in Table 4-23 and 4-24, this information gives an indication of the intensity of management needed in the existing urban areas in order to reduce the potential for acute toxicity. Nearly all subwatersheds will require an ambitious retro-fitting program to adequately reduce acute toxicity in stormwater effluents. Most subwatersheds will require a combination of detention and accelerated street sweeping (see Appendix C), or will require detention on 100 percent of the existing critical land uses. This will require that control plans ranging from Alternative 3 to Alternative 4 be implemented in each subwatershed. The only subwatershed where acute effluent toxicity is projected to be less of a problem is in the Indian Creek Subwatershed.

Reducing Chronic Surface Water Toxicity. Pollution reduction goals presented in Chapter IV also address chronic toxicity of the surface waters receiving the urban pollutant loads. The appropriate approach for identifying management actions that will reduce chronic toxicity in the principal surface waters is quite different. These investigations proceed assuming that stormwater effluents and river water are well mixed. Large scale mass loading of pollutants are involved, and the surface waters will reflect changes in loading that occur over time from a multitude of storm sewer pipes. It is therefore appropriate to approach this problem by looking primarily at principal tributary subwatersheds and major points along the Milwaukee River. Also, it is appropriate to integrate the effects of managing both the existing and planned urban area runoff since both act together to influence pollutant concentrations in the surface waters.

Five of the 18 stormwater management alternatives were selected to show the level of management needed to meet the reduction goals presented in Chapter IV. The effectiveness of these five stormwater management alternatives on reducing total lead loads in the watershed is presented in three tables. Table 5-16 presents results for Ozaukee County subwatersheds, Table 5-17 presents results for Milwaukee County subwatersheds, and Table 5-18 presents results for each of the six points along the Milwaukee River.

In order to reduce chronic toxicity, an ambitious program of controls on both existing and planned urban areas is required. Alternative 4, representing extensive detention on both existing and planned urban areas, is required to sufficiently reduce mass loads at River Points 4, 5, and 6, where total lead and cadmium concentrations have been measured to exceed chronic toxicity standards. Consequently, all contributing subwatersheds need a high level of control on established urban areas. In addition to reducing chronic toxicity in the Milwaukee River, Alternative 4 will result in a significant reduction in loadings of heavy metals and other urban pollutants to Fredonia Creek,

Table 5-15. Estimated change in average subwatershed stormwater effluent concentrations of total lead under selected stormwater management alternatives(1).

	Urban Stormwater Management Alternatives(2)			
Subwatershed	A	B	C	D
Fredonia	0%	-8%	-30%	-60%
Waubeka	0%	-35%	-50%	-68%
Saukville	0%	-14%	-34%	-62%
Grafton	0%	-8%	-31%	-63%
Haneman Lake	0%	-32%	-48%	-65%
Lakefield	0%	-34%	-47%	-61%
Pigeon Creek	0%	-12%	-36%	-66%
Mequon	0%	-36%	-52%	-71%
Beaver Creek	0%	-9%	-30%	-70%
South Branch Creek	0%	-13%	-34%	-66%
Brown Deer Creek	0%	-2%	-26%	-60%
Indian Creek	0%	-19%	-46%	-69%
Milwaukee River-Glendale	0%	-6%	-33%	-62%
Lincoln Creek	0%	-2%	-29%	-68%
Milwaukee River-Shorewood	0%	-14%	-33%	-70%

(1) Represents the change in the 1985 average annual flow weighted concentration for lead. Estimated concentration are calculated from estimates of mass loading and flow for the subwatershed. Data is for existing urban area runoff only.

(2) Alternatives are as follows:

A. Do nothing with runoff from existing urban areas.
B. Increase street sweeping on existing critical urban areas to once per week.
C. Increase street sweeping on 50% of existing critical urban areas; provide 50% of existing critical urban areas with wet detention.
D. Provide 100% of existing critical urban areas with wet detention.

Source: Wisconsin Department of Natural Resources.

Table 5-16. Projected change, year 1985-2000, in urban nonpoint source loads of total lead in Ozaukee County, Milwaukee River South Watershed.

	Urban Stormwater Management Alternatives(1)				
Subwatershed	1	1a	2	3	4
Fredonia	63%	13%	5%	-17%	-47%
Waubeka	43%	9%	-26%	-41%	-59%
Saukville	350%	75%	62%	42%	14%
Haneman Lake	338%	73%	41%	25%	8%
Grafton	44%	9%	1%	-22%	-53%
Pigeon Creek	73%	16%	3%	-21%	-50%
Lakefield	25%	5%	-35%	-53%	-71%
Mequon	73%	16%	-21%	-36%	-55%

(1) Includes existing and planned urban land uses. Alternative urban programs are:

1 Redirect downspouts on all new development, no management of existing urban areas.
1a Wet detention basins on all new development, no management of existing urban areas.
2 Wet detention basins on all new development, increased street sweeping on existing critical land uses.
3 Wet detention on all new development, increased street sweeping on 50% of existing critical land uses and wet detention for the other 50% of the existing critical land uses.
4 Wet detention on all new development, wet detention on all existing critical land uses.

Source: Wisconsin Department of Natural Resources.

Table 5-17. Projected change, year 1985-2000, in urban nonpoint source loads of total lead in Milwaukee County, Milwaukee River South Watershed.

	Urban Stormwater Management Alternatives(1)				
	1	1a	2	3	4
Beaver Creek	71%	15%	7%	-15%	-54%
South Branch Creek	92%	20%	7%	-14%	-46%
Brown Deer Creek	11%	3%	-1%	-23%	-57%
Indian Creek	7%	1%	-17%	-45%	-67%
Milwaukee River-Glendale	20%	4%	-2%	-29%	-58%
Lincoln Creek	21%	5%	2%	-25%	-63%
Milwaukee River-Shorewood	17%	4%	-11%	-30%	-67%

(1) Includes existing and planned urban land uses urban programs are:

1 Redirect downspouts on all new development, no management of existing urban areas.
1a Detention basins on all new development, no management of existing urban areas.
2 Wet detention basins on all new development, increased street sweeping on existing critical land uses.
3 Wet detention on all new development, increased street sweeping on 50% of existing critical land uses and wet detention for the other 50% of the existing critical land uses.
4 Wet detention on all new development, wet detention on all existing critical land uses.

Source: Wisconsin Department of Natural Resources.

Table 5-18. Projected change, year 1985-2000, in urban nonpoint source loads of total lead at six points on the Milwaukee River, Milwaukee River South Watershed.

	Urban Stormwater Management Alternatives(1)				
	1	1a	2	3	4
River Point 1	52%	11%	-11%	-30%	-53%
River Point 2	204%	44%	26%	7%	-19%
River Point 3	118%	25%	12%	-9%	-38%
River Point 4	82%	18%	-8%	-27%	-51%
River Point 5	75%	21%	2%	-21%	-50%
River Point 6	44%	12%	0%	-24%	-58%

(1) Includes existing and planned urban land uses.urban programs are:

1 Redirect downspouts on all new development, no management of existing urban areas.
1a Wet detention basins on all new development, no management of existing urban areas.
2 Wet detention basins on all new development, increased street sweeping on existing critical land uses.
3 Wet detention on all new development, increased street sweeping on 50% of existing critical land uses and wet detention for the other 50% of the existing critical land uses.
4 Wet detention on all new development, wet detention on all existing critical land uses.

Source: Wisconsin Department of Natural Resources.

Pigeon Creek, Ulao Creek (Lakefield Subwatershed), Indian Creek, and Lincoln Creek. Because of the rapid future growth projected for the Haneman Lake Subwatershed, Alternative 4 will barely maintain the future loading of urban pollutants to Mole Creek at 1985 levels. Similarly, the rapid growth projected for the Saukville Subwatershed will significantly reduce the effectiveness of Alternative 4 to change urban pollutant loads at River Point 2, and moderately affect its effectiveness at River Point 3.

Even though the effectiveness of Alternative 4 is reduced in these areas, this stringent level of management is still recommended. Less control of urban stormwater pollution, such as that which would take place under Alternative 2 or 3, would result in future river conditions that are at best unchanged and at worst more degraded than those presently occurring at these points along the Milwaukee River.

Results for Flow: Hydrologic analyses have not been conducted to investigate the effect of management alternatives on reducing and preventing streambank erosion and bed scour, or on maintaining stream base flows. Hydraulic objectives are important for urban streams. These studies will need to be conducted as part of future feasibility studies for the existing and planned urban areas.

RECOMMENDED URBAN NONPOINT SOURCE CONTROL PROGRAM

The recommended urban nonpoint source control program for this watershed consists of five elements. Each element contains general recommendations and specifies the local units of government to which they apply. Where necessary, additional recommendations follow for specific units of government.

This plan acknowledges that although county park land represents a reserve of open space upon which urban structural practices could potentially be located, the Milwaukee County Parks Department (Parks Department) manages this land for many other purposes, including recreation. 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, and to determine the county's role as a provider of the local share for capital construction costs.

In addition, the Parks Department will not assume long-term maintenance liability for practices placed on its property when those practices are installed to control pollutants and stormwater flows generated from urban lands located in other governmental jurisdictions. This is anticipated to be the case in all or nearly all situations.

Recommendations for controlling urban runoff from existing and planned urban development are shown on Map 15 and 16 for Ozaukee County municipalities and on Map 17 for municipalities in Milwaukee County. Recommendations for controlling construction site erosion are shown on Map 18 for the entire watershed.

Construction Site Erosion Control Element: This plan assumes that effective construction erosion control programs will be in place throughout the watershed. These programs will be locally developed and administered. Each program requires a comprehensive ordinance, a set of practice standards and application guidelines, an effective administrative program, and effective enforcement. In areas that are completely developed, a program is still needed to control erosion from urban renewal projects, and particularly to control erosion associated with work on buried utilities. In addition, training programs are needed for staff that must administer the ordinances, and building industry people who must comply with ordinance requirements.

General Requirements: Ordinances must meet the applicability requirements of NR 120.16. Ordinances must also meet the content requirements in NR 120.16 that deal with erosion control.

The DNR and the League of Wisconsin Municipalities cooperatively developed the "Model Construction Site Erosion Control Ordinance" and suggested changes to the model ordinance that James H. Schneider, League Legal Counsel, set forth in the March 1989 issue of "The Municipality". This model ordinance will be used as a guide to determine the adequacy of ordinances. Erosion control practice standards and applicability criteria should be consistent with those set forth in the publication Wisconsin Construction Site Best Management Practice Handbook (DNR, 1989).

Education and training activities needed to control construction site erosion discussed in the information and education portion of Chapter VI. Assistance provided by the DNR nonpoint source program to support ordinance development,

ordinance modification, and ordinance administration/enforcement is also presented in Chapter VI.

SPECIFIC NEEDS OF LOCAL GOVERNMENTS:

* Ozaukee County and Milwaukee County. These governments need to: develop ordinances that cover unincorporated areas of each county; identify and fulfill staffing and training needs for ordinance administration and enforcement; and effectively administer and enforce ordinance provisions.
  Alternatively, such coverage in Ozaukee County could be provided by the towns of Fredonia, Saukville, Port Washington, Cedarburg, and Grafton, either in cooperation with Ozaukee County or as freestanding programs.

* The villages of Brown Deer, Fox Point, Fredonia, River Hills, Bayside, Grafton, Shorewood, Whitefish Bay; the city of Mequon. These governments need to: develop ordinance provisions; identify and fulfill staffing and training needs for ordinance administration and enforcement; and effectively administer and enforce ordinance provisions.

* Village of Thiensville. The village needs to: review existing ordinance with DNR to determine need for revisions; identify and fulfill staffing and training needs for ordinance administration and enforcement; and effectively administer and enforce ordinance provisions.

* Cities of Cedarburg, Glendale, Milwaukee, village of Saukville. These governments need to: identify and fulfill staffing and training needs for administration and enforcement of their existing ordinances; and effectively administer and enforce ordinance provisions.

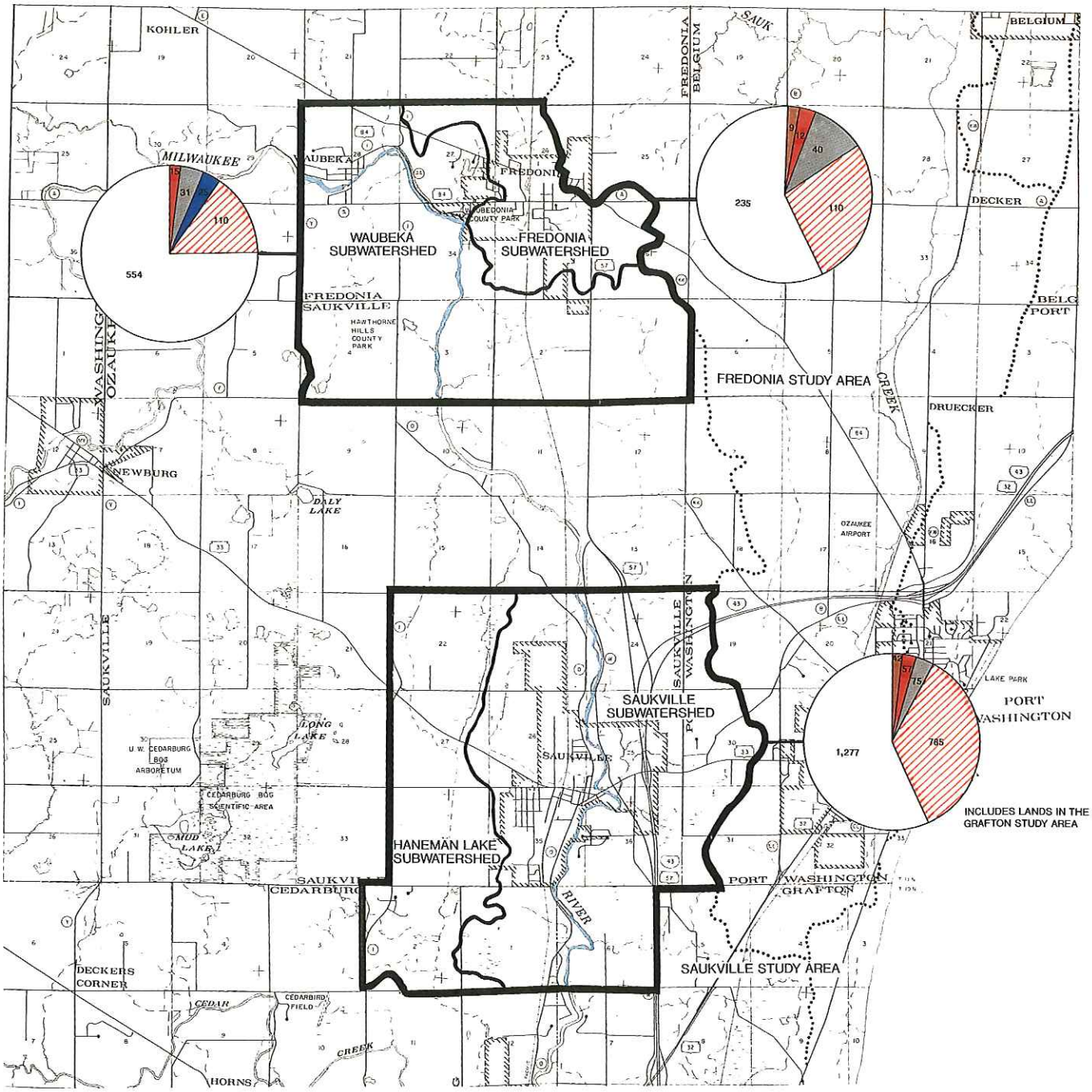
Established Urban Area Element-Existing Areas: The control program for existing urban areas is driven by the pollution reduction goals for urban toxic materials, as indicated by lead and other heavy metals. Sediment control will come primarily from the construction erosion control efforts.

General Requirements. The long-term management goal for all subwatersheds is to achieve a high level of control for existing critical land uses. A level of control equivalent to providing wet detention for 100 percent of the existing critical land uses is required as part of the control program for established urban areas. Infiltration should be considered as an alternative to wet detention where conditions are suitable for providing an equivalent level of control and where the conditions for groundwater protection can be met. Infiltration basins or trenches may be used following wet detention where needed to provide groundwater recharge and base flow enhancement. In the Haneman Lake Subwatershed, wet detention should not be used by itself. To protect base flows and stream temperatures in Mole Creek, infiltration should be used wherever possible. Wet detention, when used, should be followed by infiltration.

A combination of increased street sweeping and detention may be used as a stepping stone to achieving the significant level of detention required. As

Map 15

RECOMMENDED URBAN NONPOINT SOURCE CONTROLS FOR THE FREDONIA AND SAUKVILLE STUDY AREAS



LEGEND

EXISTING URBAN LANDS TARGETED FOR MANAGEMENT

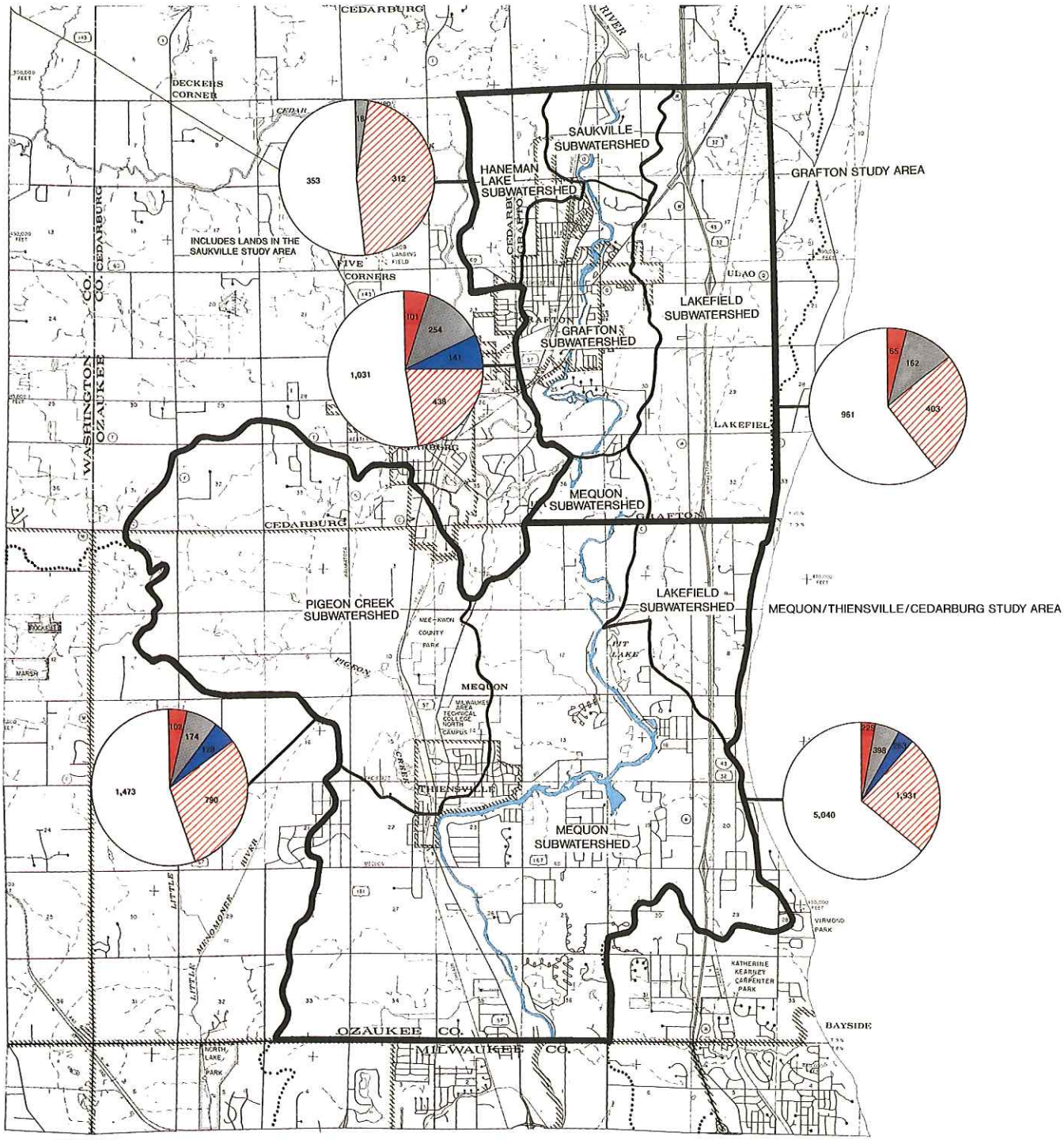
- 110 ACRES
- HIGH DENSITY RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- GOVERNMENTAL AND INSTITUTIONAL
- PLANNED URBAN LANDS TARGETED FOR MANAGEMENT
- OTHER EXISTING URBAN LANDS NOT TARGETED FOR MANAGEMENT

Source: SEWRPC.

GRAPHIC SCALE
0 1/2 1 MILE
0 2000 4000 6000 8000 FEET

Map 16

RECOMMENDED URBAN NONPOINT SOURCE CONTROLS FOR THE GRAFTON AND MEQUON/THIENSVILLE/CEDARBURG STUDY AREAS



LEGEND

EXISTING URBAN LANDS TARGETED FOR MANAGEMENT

312 ACRES

COMMERCIAL

INDUSTRIAL

GOVERNMENTAL AND INSTITUTIONAL

PLANNED URBAN LANDS TARGETED FOR MANAGEMENT

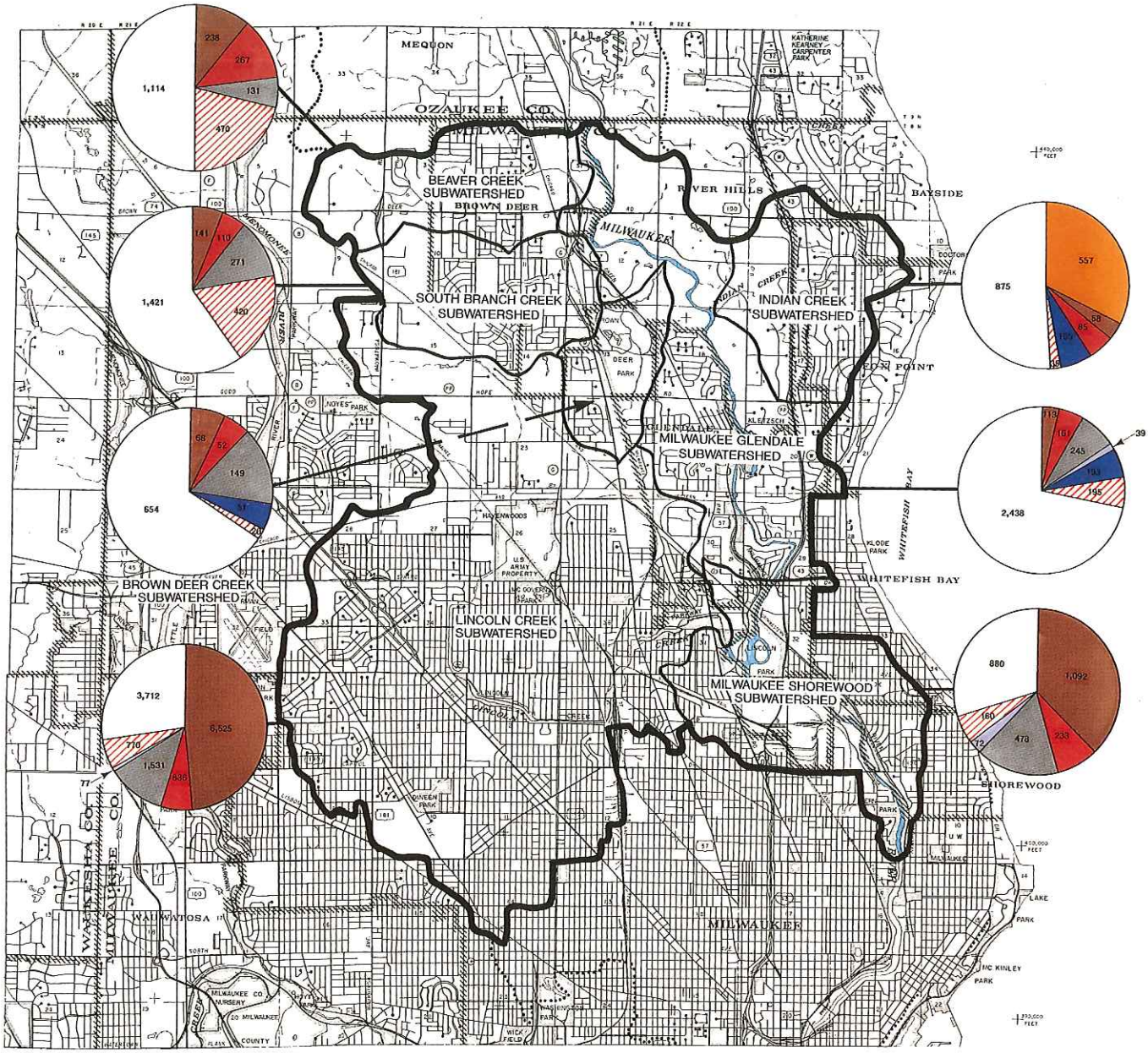
OTHER EXISTING URBAN LANDS NOT TARGETED FOR MANAGEMENT

Source: SEWRPC.

GRAPHIC SCALE

Map 17

RECOMMENDED URBAN NONPOINT SOURCE CONTROLS FOR THE MILWAUKEE STUDY AREA



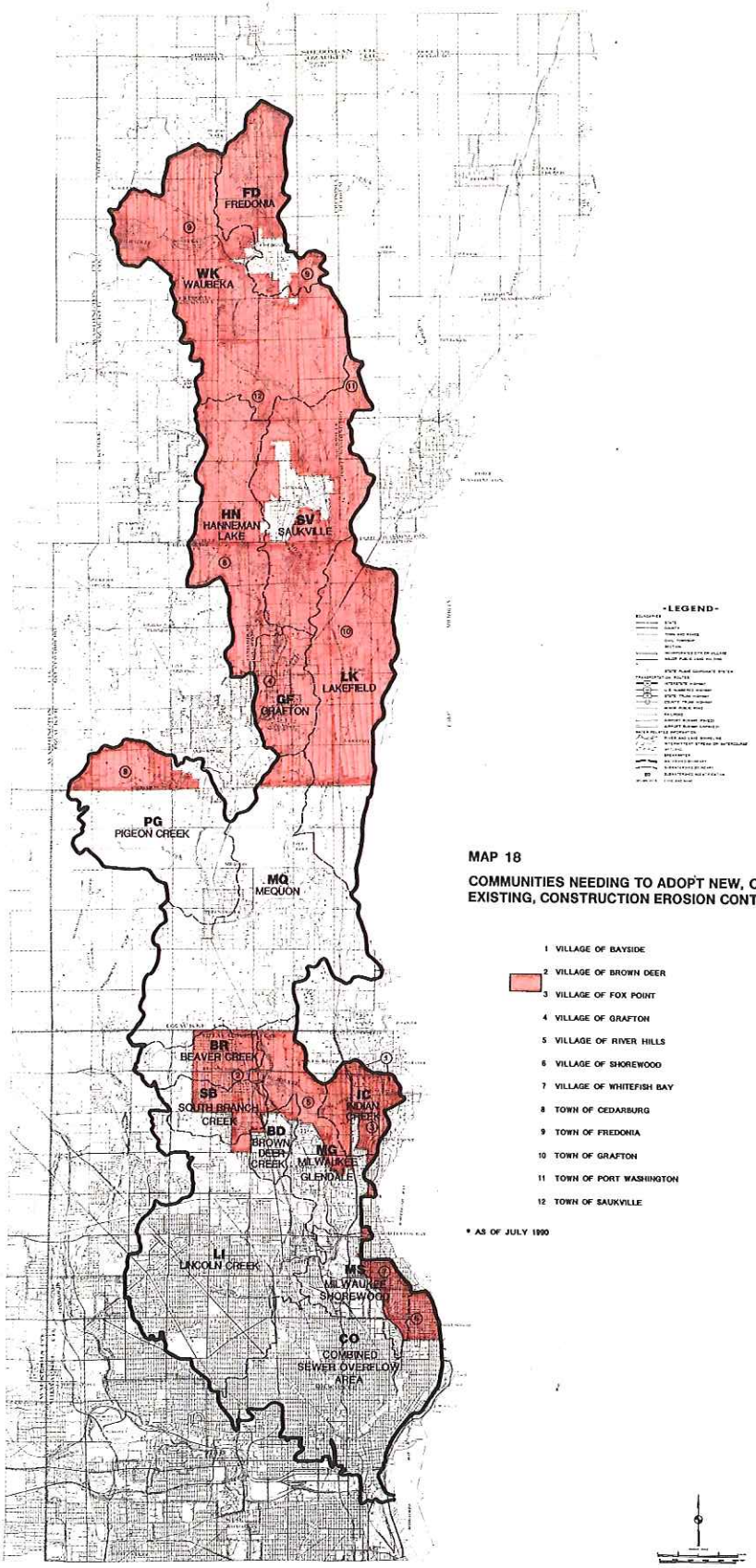
LEGEND

EXISTING URBAN LANDS TARGETED FOR MANAGEMENT

195 ACRES

- MEDIUM DENSITY RESIDENTIAL
- HIGH DENSITY RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- FREEWAY
- GOVERNMENTAL AND INSTITUTIONAL
- PLANNED URBAN LANDS TARGETED FOR MANAGEMENT
- OTHER EXISTING URBAN LANDS NOT TARGETED FOR MANAGEMENT

Source: SEWRPC.



MAP 18

COMMUNITIES NEEDING TO ADOPT NEW, OR UPGRADE EXISTING, CONSTRUCTION EROSION CONTROL ORDINANCES*

1 VILLAGE OF BAYSIDE
2 VILLAGE OF BROWN DEER
3 VILLAGE OF FOX POINT
4 VILLAGE OF GRAFTON
5 VILLAGE OF RIVER HILLS
6 VILLAGE OF SHOREWOOD
7 VILLAGE OF WHITEFISH BAY
8 TOWN OF CEDARBURG
9 TOWN OF FREDONIA
10 TOWN OF GRAFTON
11 TOWN OF PORT WASHINGTON
12 TOWN OF SAUKVILLE

* AS OF JULY 1990

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

MILWAUKEE RIVER SOUTH WATERSHED

OZAUKEE AND MILWAUKEE COUNTIES WISCONSIN

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

the areas served by wet detention increase and the two practices begin to overlap, the accelerated sweeping (see Appendix C) can be reduced.

Feasibility studies will be needed to select the site specific practices consistent with this watershed plan. The cost and complexity of studies will vary, depending on the availability of land for locating practices and the compatibility of the existing storm sewer networks with locating stormwater practices.

The assistance that will be made available to communities in addressing stormwater runoff from existing urban areas is presented in Chapter VI.

Community Specific Requirements. Table 5-19 shows the amount of stormwater management required for each community in its existing urban area. A range is provided for the wet detention requirements of each community. The low end of the range represents detention for 50 percent of the critical land uses. The high end represents detention for 100 percent of the critical land uses. The total land requirements to support these levels of detention are also presented, and are roughly two times the surface area requirements for the wet ponds. The curb-miles for street sweeping represent the maximum increase that would occur as part of a stepped approach to providing the full amount of wet detention.

The acres of urban land that may need to be addressed through more site specific feasibility studies are also listed in this table. The low end of the range reflects the number of acres in critical land uses. The high end of the range reflects all urban land uses. The acres that will need to be addressed in feasibility studies will vary depending upon how mixed the critical urban land uses are with other urban land uses, and the location of potential practice sites.

Established Urban Area Element-Planned Areas: The pollution reduction goals for urban toxic materials also drives the control program for planned urban areas. Sediment reductions that can be achieved from newly established urban surfaces are also of moderate importance in selected portions of the watershed, as indicated above.

General Requirements. The long-term management goal for all subwatersheds is to achieve a high level of control for planned urban development. These controls are needed as part of the complete package for established urban areas. A level of control is required that is equivalent to providing wet detention for 100 percent of the planned urban growth.Infiltration should be considered as an alternative to wet detention where conditions are suitable for providing an equivalent level of control. In particular, grassed swale drainage systems in planned residential areas should be investigated to both control pollutants and decrease the size of wet detention facilities where needed for additional pollution control. Infiltration basins or trenches may be used in conjunction with wet detention to provide groundwater recharge and base flow enhancement. In the Haneman Lake Subwatershed infiltration should be used by itself or in series following wet detention. This is to protect the base flow and temperature of Mole Creek.

Stormwater ordinances with provisions for controlling both pollutants and flows from new development are needed. Stormwater plans for areas where development is expected to occur are needed to assure that land is set aside

Table 5-19. Recommended urban best management practices for existing urban areas, Milwaukee River South Watershed(1).

Community	Management Plans(acs)(2)	Wet Detention(3) Pond Area (acres)	Wet Detention(3) Total Area (acres)	Street Sweeping (curb mi/yr)(4.)
OZAUKEE COUNTY				
V. of Fredonia	90 to 380	0.5 to 1.1	1.1 to 2.2	60
V. of Saukville	110 to 630	0.8 to 1.2	1.6 to 2.4	110
V. of Grafton	580 to 1,490	4.3 to 8.6	8.6 to 17.2	100
C. of Cedarburg	170 to 460	1.4 to 2.8	2.8 to 5.6	340
V. of Thiensville	90 to 740	0.7 to 1.4	1.4 to 2.8	800
C. of Mequon	1,200 to 6,300	9.5 to 19.1	19.1 to 38.2	350
Unincorporated Areas	- - -	1.8 to 3.8	3.6 to 7.6	450
MILWAUKEE COUNTY				
V. of Brown Deer	610 to 2,500	5.0 to 10.0	10.0 to 20.0	1,160
V. of River Hills	50 to 1,240	1.6 to 3.1	3.2 to 6.2	350
V. of Bayside	150 to 220	0.9 to 1.5	1.8 to 3.0	350
V. of Fox Point	550 to 1,030	2.5 to 4.7	5.0 to 9.4	1,200
C. of Glendale	1,470 to 3,710	10.9 to 20.2	21.8 to 40.2	2,150
V. of Whitefish Bay	380 to 430	1.4 to 2.8	2.8 to 5.6	
V. of Shorewood	340 to 460	1.3 to 2.6	2.6 to 5.2	470
C. of Milwaukee	10,240 to 15,120	45.9 to 91.5	91.8 to 183.0	13,900
WATERSHED TOTAL	16,030 to 34,710	88.6 to 174.4	177.2 to 348.8	21,790

(1) Infiltration may be feasible in some areas as an alternative or addition to detention.
(2) Low end of range includes only critical acres, high end represents all urban land uses.
(3) Low end of range is sufficient to detain runoff from 50% of critical urban land use.
High end of range is sufficient to detain runoff from 100% of critical urban land use.
Pond area is surface area of wet pond needed to trap 5 micron particle size.
Total area includes pond surface and surrounding land required to contain the pond.

Source: Wisconsin Department of Natural Resources.

for practices needed to meet the flow and pollutant load reductions specified in ordinances. Ordinance requirements and stormwater plans for new development must be closely coordinated amongst communities that impact common drainage areas.

The assistance available through the nonpoint source program to control urban stormwater quality and quantity in planned urban areas is presented in Chapter VI.

Community Specific Requirements. Tables 5-20 and 5-21 show the number of acres projected for new development that will need stormwater planning, and the estimated acres of detention needed as part of the established urban area control program. The total land requirements are also listed, and are two times the surface area needed for the ponds themselves. The use of grassed swale drainage in residential areas will reduce the acreage needed for detention.

Streambank Erosion Control Element: Streambanks along Lincoln Creek, Indian Creek, South Branch Creek, Beaver Creek, and Brown Deer Creek were surveyed for evidence of erosion. Urban streambank erosion sites targeted for control are limited primarily to Lincoln Creek and Indian Creek, with one additional small area of concern at the mouth of South Branch Creek. Consequently, control will probably require a combination of streambank protection practices. These practices can be applied directly to the eroding sites and other practices can be applied to reduce peak flows and flow velocities of runoff coming from urban areas tributary to the stream system.

A number of governmental units must coordinate planning and implementation activities associated with control of the eroding sites and the stormwater flows which cause them. The assistance provided to governmental units through the nonpoint source program to control streambank erosion is set forth in Chapter VI.

General Requirements. Table 5-22 shows the urban streambank erosion targeted for control on Lincoln and Indian Creeks. Local units of government that must share responsibility for reducing this streambank erosion are identified below. Community Specific Requirements.

* Milwaukee County: Approximately 63 percent of the streambank sediment and 47 percent of the eroding feet targeted for control on Lincoln Creek is located on land owned by Milwaukee County.

* Wisconsin DNR: Streambank erosion located within the Havenwoods Environmental Education Center property accounts for 17 percent of the streambank sediment load and 33 percent of the linear eroding feet targeted for control on Lincoln Creek.

* United States Army: Streambank erosion located within the United States Army Property accounts for approximately 20 percent of the streambank sediment load and 20 percent of the linear eroding feet targeted for control on Lincoln Creek.

Table 5-20. Recommended urban best management practices for planned urban areas in the Ozaukee County portion of the Milwaukee River South Watershed(1).

Subwatershed	Where Urbanization is Anticipated	Management Plans(acs)(2)	Wet Detention(3) Pond Area (acres)	Wet Detention(3) Total Area (acres)
Fredonia	V. of Fredonia	110	1.1	2.2
Waubeka	V. of Fredonia Tn. of Fredonia	110	0.9	1.8
Saukville	V. of Saukville V. of Grafton Tns. of Saukville, Port Washington, Grafton	785	8.6	17.2
Haneman Lake	V. of Saukville V. of Grafton Tns. of Saukville, Cedarburg, Grafton	312	3.0	6.0
Grafton	V. of Grafton Tn. of Grafton	438	3.8	7.6
Lakefield	V. of Grafton C. of Mequon Tn. of Grafton	403	3.4	6.8
Pigeon Creek	C. of Mequon C. of Cedarburg V. of Thiensville Tn. of Cedarburg	790	8.4	16.8
Mequon	C. of Mequon	1,931	16.3	32.6
OZAUKEE COUNTY TOTAL		4,879	45.5	91.0

(1) Infiltration may be feasible in some areas as an alternative or addition to detention.
(2) Sufficient to detain runoff from 100% of the planned urban land use.
(3) Pond area is surface area of wet pond needed to trap 5 micron particle size.
Total area includes pond surface and surrounding land required to contain the pond.

Source: Wisconsin Department of Natural Resources.

Table 5-21. Recommended urban best management practices for planned urban areas in the Milwaukee County portion of the Milwaukee River South Watershed(1).

Subwatershed	Where Urbanization is Anticipated	Management Plans (acres)(2)	Wet Detention(3) Pond Area (acres)	Wet Detention(3) Total Area (acres)
Beaver C.	C. of Milwaukee V. of Brown Deer	470	4.7	9.4
South Branch C.	C. of Milwaukee V. of Brown Deer	420	5.8	11.6
Brown Deer Creek				
Indian Creek	V. of River Hills V. of Bayside	35	0.4	0.8
Milwaukee River-Glendale	C. of Glendale V. of River Hills	195	1.3	2.6
Lincoln Creek	C. of Milwaukee C. of Glendale	770	11.8	23.6
Milwaukee River-Shorewood	C of Milwaukee C of Glendale	160	2.1	4.2
MILWAUKEE COUNTY TOTAL		2,070	26.5	53.0

(1) Infiltration may be feasible in some areas as an alternative or addition to detention.
(2) Sufficient to detain runoff from 100% of the planned urban land use.
(3) Pond area is surface area of wet pond needed to trap 5 micron particle size.
Total area includes pond surface and surrounding land required to contain the pond.

Source: Wisconsin Department of Natural Resources.

Table 5-22. Urban streambank erosion targeted for control in the Milwaukee River South Watershed.

	Management Category I(1)				Management Category II(1)				Total Control	
			Tons				Tons			
Subwatershed	Sites	Feet	No.	%	Sites	Feet	No.	%	Eroding Feet	Eroding Tons
Lincoln Creek	5	655	78	18%	7	13,750	244	57%	58%	75%
Indian Creek	1	800	72	45%	2	1,020	14	13%	58%	80%
South Branch Creek(1)	1	200	30	100%					100%	100%

(1) Site is located at the mouth of South Branch Creek.

Source: Wisconsin Department of Natural Resources.

* City of Milwaukee, city of Glendale: The city of Milwaukee is the primary source of stormwater flows responsible for the streambank erosion problems along most of Lincoln Creek. Runoff from the city of Glendale may have some influence on stream hydrology in the lowest reaches of Lincoln Creek.

* Milwaukee Metropolitan Sewage District: The Milwaukee Metropolitan Sewage District (MMSD) is responsible for managing stormwater flows in Lincoln Creek and maintaining structures designed to reduce flood damages. The District is currently developing a comprehensive stream corridor management approach for Lincoln Creek. The approach will consider flow reduction, alternative approaches for stabilizing eroding streambanks, and rehabilitation of concrete stream sections.

  The MMSD is working together with DNR to develop this comprehensive stream corridor management plan for Lincoln Creek.

  The MMSD may also play a role in addressing the streambank erosion problems on Indian Creek. The eroding sites are privately owned by citizen residents of the village of River Hills. However, A Stormwater Drainage and Flood Control Policy Plan For The Milwaukee Metropolitan Sewage District (SEWRPC, 1986) recommends that the District assume jurisdiction over Indian Creek for purposes of addressing certain types of drainage and flood control improvements. This policy plan needs to be interpreted in order to determine whether the District should play a role in helping to reduce the streambank erosion problems along Indian Creek.

URBAN BEST MANAGEMENT PRACTICES

There are four general classes of management practices used to reduce water quality problems that urban stormwater flows and the associated pollutant loads cause. These are: source reduction practices; infiltration practices; wet detention practices; and streambank erosion control practices.

Source Reduction Practices: These practices are meant to curb the generation of urban pollutants as close to the source as possible. Ideally, pollutant generation is stopped. At a minimum, pollutants that are generated are controlled prior to entering the storm sewer system.

Source area controls are generally non-structural in commercial and residential areas, relying instead on changes in products people use and in the way people live. Reducing the amount of automobile traffic in an area would be one example of a source control, since automobiles are the source of many urban pollutants. The current programs that remove lead from gasoline and asbestos from automobile brake linings are also examples of source controls. In other cases, such as for industrial materials storage areas, control of runoff may require a structure.

Source area controls that prevent the generation of pollutants, such as the removal of lead from gasoline and asbestos from brake linings, are ultimately the most effective. However this type of control cannot be readily initiated at the local level. Regional and often national action is required. Citizen action that leads to this type of control is an important component of a long range urban management strategy.

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

* Reduce the use of galvanized roof materials and gutters, a primary source of zinc in urban runoff.

* Remove pet wastes immediately from lawns, sidewalks, and streets so that bacteria contamination of urban runoff can be reduced.

* Manage the timing, amount and type of fertilizer and pesticide applications in urban areas.

* Properly dispose automobile waste fluids, such as radiator water and engine oil, to keep them out of the storm sewer system.

* Remove leaves and street dirt from street and parking lot surfaces through municipal sweeping and leaf collection.

* Reduce the amount of vehicle traffic.

* Reduce the areal extent of parking lots.

* Encourage that urban developments take place on lands within urban service area boundaries.

* Base zoning of land use, in part, on site suitability for stormwater management practices needed to meet water quality, habitat, and flood related objectives.

* Strictly limit construction site erosion.

* Keep use of street de-icing compounds to a minimum.

Increasing stormwater volumes and peak flows are responsible in part for streambank erosion. Consequently, reducing stormwater flows through infiltration and detention can be considered a source area control approach to streambank erosion problems. Stream bank erosion control will require a combination of stormwater flow management and stabilization of eroding sites.

Infiltration Practices: The volume of urban runoff transporting pollutants to surface waters during a rainstorm is directly related to the amount of impervious urban area that is directly connected to the receiving waters. Impervious areas include rooftops, parking lots, streets, and sidewalks. Directly connected areas are those that drain directly to storm sewer pipes or concrete channels.

Reducing pollutant transport to surface waters involves disconnecting the urban stormwater flow. This is accomplished by increasing the infiltration of stormwater into the ground. Stormwater infiltration on a suitable site will

effectively reduce all major stormwater pollutants. In addition to reducing pollutant loads, groundwater infiltration can help stabilize the hydrology of small urban streams. This occurs because infiltration helps to maintain stream base flows during dry periods, and will decrease peak flow discharges responsible for streambank erosion and habitat scouring. Infiltration can be used jointly with wet detention where needed to augment the water resources management capabilities of the less versatile wet detention pond. In addition, infiltration can be used in the drainage area to a wet pond in order to reduce the pond size required to control stormwater pollutants.

Infiltration practices may be located very close to an urban source area, such as a parking lot or large rooftop, or located at the end of a storm sewer pipe that collects runoff from a larger area. Practices that promote on-site infiltration include porous pavements, redirecting roof downspouts to grassy areas, and directing runoff waters to infiltration trenches. These practices are generally most applicable to small source areas such as rooftops and parking lots. The transport system that carries stormwater from impervious surfaces to surface waters can also be built to infiltrate stormwater. Grassed swale drainage systems, for example, work primarily through infiltration. Finally, infiltration basins can be located at storm sewer outlets for larger drainage areas. In this case, the basin is considered an off-site or end-of-pipe control measure.

Not all sites are appropriate for the use of infiltration practices. Heavy or poorly drained soils may limit the effectiveness of infiltration devices or result in practices too large to be practical. Slopes may limit the use of grassed swales in residential areas.

Most importantly, precautions must be taken when infiltrating urban stormwater to prevent groundwater contamination. Runoff from residential rooftops and driveways, and from rooftops in institutional, commercial, and non-manufacturing industrial areas can generally be infiltrated with little risk of groundwater contamination. Runoff from parking lots in institutional and commercial areas, and from separate employee or visitor parking lots in non-manufacturing industrial areas can be infiltrated provided that some form of pre-treatment is provided. Pre-treatment devices, such as grit chambers with surface baffles or wet detention ponds, will reduce some of the pollutants available for groundwater contamination.

Infiltration devices placed in these areas should be monitored to assure that groundwater contamination is not occurring. Highly contaminated runoff, such as that from storage and loading areas in commercial and industrial areas should not be infiltrated.

All infiltration devices should have a minimum separation distance of three feet between the bottom of the infiltration device and the water table or bedrock surface. Infiltration may also need to be restricted within certain distances of municipal wells. Finally, infiltration should occur wherever possible through a filtering layer of soil and sod.

Appendix D contains more details concerning suggested restrictions on the use of infiltration devices designed to control urban stormwater runoff.

Wet Detention Practices: Wet detention ponds are effective at controlling particulate pollutants and can be designed to control peak flow discharges. Consequently, they can be employed to serve many needs including pollution

control, flood control, and control of stormwater flows that may be causing streambank erosion and streambed scour. These ponds have limited effectiveness in controlling urban pollutants in the dissolved state, and cannot effectively reduce the total stormwater volume or enhance stream base flows. The wet pond can be situated near a small source area, such as a parking lot, but are more commonly used to control runoff coming from a larger area.

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

Streambank Erosion Control Practices: A combination of traditional and innovative techniques will be needed to control streambank erosion and scour in urban streams. Traditional practices such as riprap or gabions may be most appropriate in some places. However, there is a need to test innovative approaches that are less expensive and provide better shoreline habitat than rock riprap. Reshaping upper channel banks to allow dissipation of stream energy, and use of bio-engineering techniques for stabilizing eroding banks may be promising approaches, either as alternatives or additions to more traditional techniques. Detention ponds and infiltration devices in upland areas will probably be needed also to reduce the erosive streamflow velocities and peak discharges.

Using Easements To Support Urban Pollution Control Practices: Easements may be used to support wetland restoration, critical area stabilization, and shoreline buffers in urban areas in order to reduce the water quality impacts of stormwater runoff. Use of these practices as stormwater runoff control measures, and the use of easements to support these practices, must be reviewed on a case-by-case basis by the DNR Resources. The same general rules set forth for the use of easements in rural areas also apply to urban stream reaches.

Performance Standards And Design Criteria For Urban Structural Practices In Established Urban Areas

The guidelines in this section are presented to facilitate the urban practice design, review, and approval phases that are required before controls can be installed and cost-shared through the nonpoint source program. The design standards contained in this section are preliminary, and will need to be augmented by existing engineering references and design manuals. Also, the DNR Nonpoint Source and Land Management Section should be contacted prior to the start of practice design activities, in accordance with NR 120.

In order to meet water resources goals for the Milwaukee River and principal tributary streams, the combined effect of all practices must achieve about a 60 percent reduction of lead loads from existing areas and reduce to the maximum extent possible pollutant loads from new development. In addition, existing urban stormwater flows must be reduced sufficiently in Indian Creek and Lincoln Creek to help rehabilitate areas of active streambank erosion and habitat scour. In planned urban areas throughout the watershed, impacts on stream hydrology must be minimized. Conformance of individual practices to the following guidelines will assure that the total level of control is adequate, provided the recommended plan is fully implemented.

Standards: The following preliminary standards should be used to guide the design of individual practices. These preliminary standards will be superseded by standards developed as part of the model ordinance for stormwater, which the DNR is preparing.

1. Wet detention ponds in existing and planned urban areas should be designed to control 90 percent of the incoming suspended sediment load. This will be achieved by trapping the 5 micron particle size. This will provide approximately 70 percent control of the annual lead load from lands tributary to the pond. Where retro-fitted, ponds should be located to control runoff primarily from the critical land uses. Where planned as part of new development, ponds should be located to control runoff from all land uses.

2. Wet detention ponds in existing urban areas should contribute to reducing stream velocities to speeds that do not erode banks or scour habitat.

3. Wet detention ponds in planned urban areas should maintain peak flows for the 2-year, 24-hour storm at pre-development levels.

4. Infiltration devices in existing and planned urban areas should infiltrate all runoff from the one-inch storm. Infiltration basins and grassed swales are most effective, since they control runoff from all impervious surfaces (roofs, streets, parking lots) in the contributing area. If infiltration trenches are used that control selected impervious surfaces, such as parking lots and rooftops only, control efficiency drops significantly since street runoff remains uncontrolled. Where retro-fitted, these devices should be located to control runoff primarily from the critical land uses. Where planned as part of new development, ponds should be located to control runoff from all land uses. In locating practices, infiltration rates should be carefully considered as these are prime determinants of the pollution control efficiency for infiltration practices, particularly in non-residential areas.

5. Infiltration devices in existing urban areas should contribute to reducing stream velocities to speeds that do not erode banks or scour habitat.

6. Infiltration devices in planned urban areas should maintain peak flows for the 2-year, 24-hour storm at pre-development levels.

Design Criteria: NR 120.14(22) requires that the DNR participate in the practice design process, and approve detailed practice designs. Selected preliminary design criteria for wet detention ponds and infiltration devices are presented in Table 5-23.

It is important to note the inclusion of pretreatment and groundwater monitoring in the practice design for infiltration devices. Providing pretreatment for these devices will greatly reduce required maintenance to reduce clogging and restore infiltration. Pretreatment could include a sediment trap, a wet detention pond, a grass filter strip, or street sweeping. Selected practices should be equipped with groundwater monitoring wells to

Table 5-23. Selected preliminary design criteria for infiltration devices and wet detention basins.

PRACTICE		DESIGN CRITERIA
Wet Detention	1.	Percent of drainage required as pond surface for 90% control of solids.
		Freeways 2.8% Industrial 2.0% Commercial 1.7% Institutional 1.7% Residential 0.8% Open Space 0.6%
	2.	Permanent pond minimum 5 ft. deep when constructed.
	3.	Minimum 10 ft. shelf around pond perimeter.
	4.	Minimum 5:1 side slope to edge of pond.
	5.	Pond shape must be minimum 3:1 length to width ratio.
	6.	Maintain minimum pond depth of 3 ft.
	7.	Minimum 25 ft. vegetated buffer strip.
	8.	Protect outlet channel from erosion.
	9.	Minimum depth to groundwater 3 ft.*
Infiltration Devices		
Grass Swales	1.	Minimum grade of 0.5% and maximum of 5%.
	2.	Maximum side slopes of 3:1.
	3.	Minimum depth to groundwater 3 ft.*
	4.	Maximum flow velocity 6 fps.
	5.	Check infiltration rates annually.
	6.	Prevent compaction during construction.
	7.	Sweep streets to prevent clogging.
Infiltration Trenches	1.	Minimum depth to groundwater 3 ft.*
	2.	Pretreatment necessary (e.g., grass filter strip, wet detention basin, trap etc.).
	3.	Trench must be wider than it is deep.
	4.	Observation well must be installed.
	5.	Check infiltration rates annually.
	6.	Do no put near water supply wells.
Infiltration Basins	1.	Minimum depth to groundwater 3 ft. *
	2.	Test soil infiltration rates at least 5 ft. below the surface.
	3.	Do no put near water supply wells.
	4.	Pretreatment necessary (e.g., wet detention basin).
	5.	Prevent compaction of soil.

* As measured from bottom of practice to seasonally high groundwater.

assure that groundwater contamination remains within acceptable bounds. Finally, all detention and infiltration urban structural practices should be equipped with signs that clearly identify that the site contains urban stormwater pollutants. Such signs should also carry warnings, where appropriate, against using stormwater practices in ways which could endanger public health. Wet detention ponds should not be used for consumptive fishing, swimming, or wading. Infiltration basins might pose a hazard if usedduring dry periods as open recreational space, due to possible suspension of contaminated dust. These risks should be further investigated.

Information And Education Element

The urban information and education element is presented in Chapter VI.

Environmental And Public Health Concerns

Public concern has been expressed about the potential economic, environmental and public health impacts of stormwater detention ponds. Concern has been expressed about the toxicity of sediments and water in wet detention ponds and the danger posed to humans and wildlife. Concern was also expressed about the disposal of contaminated sediments and the costs which may be incurred in finding and utilizing suitable disposal technology.

Information was collected in 1990 about the water and sediment quality in a wet detention pond serving a mixed residential and commercial area in Madison, Wisconsin. This information is discussed below as it relates to these public concerns. It is important to recognize that sediment and water quality may vary between detention ponds serving the same general land uses, due to differences in the specific mix of tributary land uses and spills or illegal connections to the storm sewer system. Caution should also be made against applying these data to ponds serving more intensive land uses, such as industrial areas.

Pond Water Quality: Samples were collected on each of nine different days between early May and late June. The study evaluated three heavy metals (lead, zinc, copper), bacteria, polyaromatic hydrocarbons, pesticides, and phthalate esters. Metals concentrations measured in the pond were compared to the chronic toxicity standards for warmwater fish and aquatic life; bacteria concentrations were compared to the standard for full body contact recreation; insecticide concentrations were compared to acute toxicity criteria for water fleas; polyaromatic hydrocarbon concentrations were compared to the human cancer criterion, and phthalate ester concentrations were compared to the human threshold criterion.

The study concluded that polyaromatic hydrocarbons, pesticides, and phthalate ester concentrations in the pond water did not exceed the applicable criteria on any of the dates sampled. Bacteria concentrations were found to significantly exceed the recreational standard on several sampling dates, with exceedences greatest after rainfall events. All heavy metals, however, were found to occasionally exceed the applicable criteria. Lead concentrations exceeded the chronic toxicity standard for all samples. Copper and zinc concentrations exceeded the chronic toxicity standard about 25 percent of the time. All exceedences were between one and one and one-half times the chronic toxicity standard, but well below any acute toxicity standards.

In addition to these tests, acute toxicity was evaluated through a 24-hour exposure bioassay test using water fleas as the test organisms. All samples tested completely negative, showing 0 percent mortality.

In summary, the water in ponds receiving runoff from commercial and residential areas should not be a concern except for the human health hazard associated with bacterial contamination. Ponds should not be used for any type of contact recreation. Although aquatic life will develop in these ponds, fish should not be stocked and consumptive fishing should be discouraged as an added precaution.

Pond Sediment Quality: Assuming a sediment accumulation rate of one to two inches per year and a pond storage depth of two feet, most wet detention ponds will require periodic dredging once every 15 to 20 years. The quality of pond sediments is a concern partially because it will determine available options for disposing of contaminated sediments.

The concentrations of eight heavy metals (lead, cadmium, zinc, copper, nickel, arsenic, chromium, and cyanide) were measured in sediment taken from a detention pond serving a mixed residential and commercial area in Madison, Wisconsin. Results are presented in Table 5-24. The concentrations were evaluated to determine whether the sediments could be land spread or placed in a conventional land fill, as opposed to requiring disposal in a special hazardous waste landfill at a significantly greater cost.

None of the eight metals tested from the commercial/residential area would require disposal at a hazardous waste landfill under Wisconsin state law. Only one metal, lead, showed any potential of posing a hazardous waste problem. Upon further testing, using the EP Toxicity Test and the TCLP Test, this metal was found to pose no hazard at the concentrations levels found.

In addition to heavy metals, organic pollutants were also measured in detention pond sediments. These included the pesticides diazanon, chlordane and DDT, PCB, PAH's, and phthalate esters. The chlordane concentrations are highest, and need to be evaluated to determine if they would require special disposal.

Based on heavy metal concentrations, two potential options for disposal would appear to be either land spreading or burying in a conventional landfill. In order to evaluate the suitability of sediments for land spreading, metals criteria set forth in NR 204 Wisconsin Administrative Code (Municipal Sludge Management) were used.

Table 5-24 shows that the concentrations of lead and cadmium in sediments would not restrict land spreading. Concentrations of lead in sediments throughout the detention pond are well below the limit of 250 mg/kg specified in NR 204. Concentrations of cadmium throughout the pond are also well below the 10 mg/kg threshold specified in NR 204.

Table 5-25 shows the maximum amount of various metals that can be applied through land spreading, as set forth in NR 204, and the mass load of these metals that would be applied with one acre-inch of sediments taken from the Madison detention pond. As shown, zinc would pose the greatest restriction for general applications. For application to crops directly consumed by humans, annual restrictions on cadmium applications would be most restrictive.

Table 5-24. Average concentrations of heavy metals in bottom sediments of a wet detention pond located in Madison, Wisconsin (1).

Metal	Concentration (mg/kg) Inlet	Rest of Pond
Lead	85	173
Cadmium	1	3
Zinc	225	457
Copper	30	60
Nickel	15	33
Arsenic	4	3
Chromium	20	40
Cyanide	1	1

(1) Sampling was conducted in 1990. The pond was constructed in 1980, has a surface area of 200 acres, and receives runoff from a mixture of commercial and medium density residential land uses.

Source: Wisconsin Department of Natural Resources.

Table 5-25. Comparison of land spreading criteria for metals and the mass of metals contained in sediments taken from a wet detention pond located in Madison, Wisconsin(1).

Metal	Mass of Metal (lbs/acre-inch) Inlet(2)	Rest of Pond(2)	Spreading Criteria(3) Annual	Total
Lead	15	11		445
Cadmium	0.2	0.2	.45	4.4
Zinc	39	30		225
Copper	5	4		110
Nickel	3	2		45

(1) Sampling was conducted in 1990. The pond was constructed in 1980, has a surface area of 200 acres, and receives runoff from a mixture of commercial and medium density residential land uses.

(2) Based on average concentrations.

(3) Criteria from NR 204 Wis. Adm. Code (Municipal Sludge Spreading). Assumes a soil cation exchange capacity of 5 meq/100 mg.

Source: Wisconsin Department of Natural Resources.

These data show that landspreading may be an option, but several cautions are needed. First, variability in cadmium and zinc concentrations, even within ponds draining residential and commercial land uses, may make some sediments marginally acceptable or unacceptable for land spreading. Secondly, some organic contaminants in sediments may restrict land spreading. Placement of dredge spoils in a land fill or adjacent to the wet detention pond in areas not used for the growing of food crops may be the best options.

Pollutant Bioaccumulation: There is also public concern over the potential for bioaccumulation of toxicants in wet detention ponds and their subsequent export back into the surrounding ecosystem. This is an area needing further investigation.

PART TWO

A DETAILED PROGRAM FOR IMPLEMENTATION

CHAPTER VI - DETAILED PROGRAM FOR IMPLEMENTATION

CHAPTER VI
DETAILED PROGRAM FOR IMPLEMENTATION

INTRODUCTION

This portion of the watershed plan serves as the strategy for meeting the pollution control needs identified in Chapter V, "Nonpoint Source Control Needs".

This chapter identifies:

* The agencies and units of government responsible for carrying out the identified tasks.
* The best management practices (BMPs) necessary to control pollutants on the critical sites identified in Chapter V.
* The funding sources and the administrative procedures for carrying out the project.
* The schedule for completion of the implementation tasks.
* The type and amount of staff that local units of government need to carry out the project.
* The cost of installing BMPs, including cost-sharing, technical assistance, and administration.
* The information and education activities that will be carried out in the project area.

This information is presented in three sections. The first section covers the implementation program for rural areas, the second section covers the program for urban and urbanizing areas, and the last section covers information and education activities.

RURAL PROGRAM FOR IMPLEMENTATION

PROJECT PARTICIPANTS: ROLES AND RESPONSIBILITIES

Landowners and Land Operators: Owners and operators of public and private lands are important participants in the priority watershed program. They will adopt BMPs which reduce nonpoint sources of water pollution and protect and enhance fish, wildlife and other resources. Landowners and land operators in the Milwaukee River South Watershed that are eligible for cost-share assistance through the priority watershed program include: individuals, Ozaukee County, Milwaukee County, other governmental units as described in NR 120.02(19), corporations, and the state of Wisconsin.

Milwaukee County: There are no significant rural nonpoint pollution sources located in the Milwaukee County portion of this watershed.

Ozaukee County: As required by statutes and administrative rules, Ozaukee County is responsible for implementing this plan in the unincorporated areas of the watershed in Ozaukee County. Ozaukee County is the primary agency responsible for implementing recommendations for the control of rural pollution sources. Since a large portion of the rural land use is actually contained within the municipal limits of the city of Mequon, the city has agreed to delegate its rural implementation responsibilities to Ozaukee County. On January 25, 1990, the Ozaukee County Land Conservation Department (LCD) sent a letter to the city of Mequon stating what assistance would be offered. According to the agreement, the Ozaukee County LCD will accept the responsibilities listed in NR 120.04 to fulfill the implementation needs which relate to cropland, animal waste, and shoreline and streambank protection within the city of Mequon.

The Ozaukee County Land Conservation Committee (LCC) will act for the Ozaukee County Board and will be responsible contractually and financially to the state of Wisconsin for management of the project in areas with rural land uses. The Ozaukee County LCC will coordinate the activities of all other local agencies involved with the rural portion of the project.

The specific responsibilities for these counties are defined in the Wisconsin Administrative Rules, s. NR 120.04, and are summarized below:

1. Identify in writing a person to represent the county during implementation of the project.

2. Contact all owners or operators of lands identified as significant nonpoint sources within one year of signing the nonpoint source grant agreement. The counties' strategies for contacting landowners are included in this chapter.

3. Develop farm conservation plans consistent with the needs of the project.

4. Enter into nonpoint source cost-share agreements with eligible landowners and enforce the terms and conditions of cost-share agreements as defined in s. NR 120.13, Wisconsin Administrative Code.

5. For lands the county owns or operates, to enter into cost-share agreements with DNR to correct identified nonpoint sources and fulfill their obligations as a cost-share recipient.

6. Design best management practices and verify proper practice installation.

7. Reimburse cost share recipients for the eligible costs of installing BMPs at the rates consistent with administrative rules and established in this plan.

8. Prepare and submit annual work plans for activities necessary to implement the project. The Ozaukee County LCD shall submit a

workload analysis and grant application to the Department of Agriculture, Trade and Consumer Protection (DATCP) as required in s. Ag. 166.50.

9. Prepare and submit to the Department of Natural Resources (DNR) and the DATCP the annual resource management report required under s. NR 120.21(7). This report will serve to monitor project's implementation by tracking changes in the nonpoint source inventory, and quantifying pollutant load reductions which result from installing BMPs.

10. Participate in the annual watershed project review meeting.

11. Conduct the information and educations activities identified in this plan for which they are responsible.

Ozaukee County, in cooperation with the city of Mequon, should enact a manure management ordinance meeting the provisions which DATCP outlines in AG. 166.98. The intent of this ordinance is to prevent pollution of groundwater due to poorly designed and constructed animal waste storage facilities.

Enactment of such an ordinance is not required for the county or city to receive funds from the DNR.

Department of Natural Resources(DNR): The role of the DNR is identified in s. 144.24, Stats. and s. NR 120, Wisconsin Administrative Code. (NR 120) The DNR has been statutorily assigned the overall administrative responsibility for the Wisconsin Nonpoint Source Pollution Abatement Program. The DNR's role is summarized below.

Project Administration. Project administration includes working with the counties to ensure that during the eight-year project implementation phase required work commitments can be met. The DNR will participate in the annual work planning process with the county.

The DNR will review cost-share agreements signed by the county and the participating landowners for installing BMPs. The DNR provides guidance when questions arise concerning the conformance of proposed activities with the statutes, administrative rules, and the watershed plan.

Financial Support. Financial support for implementation of the priority watershed project is provided to each county in two ways: a local assistance grant agreement, and a nonpoint source grant agreement. These agreements are described later in this chapter.

The DNR may also enter into cost-share agreements directly with local or state units of government for the control of pollution sources on land the governments own or operate.

Project Evaluation. The DNR has responsibility for priority watershed project monitoring and evaluation activities. These efforts determine if changes in water quality occur as best management practices and other pollution controls are installed or implemented. The water quality evaluation and monitoring strategy for the Milwaukee River South Watershed are included in Chapter VII. The DNR documents the results of monitoring and evaluation activities in interim and final priority watershed project reports.

Technical Assistance. The DNR provides technical assistance to the county on the design and application of best management practices.

Other Responsibilities. These include:

* Assisting county staff with site reviews to determine the impacts of nonpoint sources on wetlands and/or groundwater quality.

* Assisting county staff to integrate Wildlife and Fisheries Management concerns into selection and design of BMPs.

Department of Agriculture, Trade and Consumer Protection(DATCP): The role of DATCP is identified in s. 144.25, stats., Ch. 92 stats., and NR 120. In summary, the DATCP will:

* Manage a training program for the staff involved with project implementation.

* Cooperate with the University of Wisconsin-Extension to act as a clearinghouse for information related to agricultural best management practices (BMPs), sustainable agriculture, and nutrient and pest management.

* Assist the counties to carry out the information and education activities or tasks described in this plan.

* Assist county staff to identify watershed participants subject to federal or state conservation compliance programs.

* Assist county, if requested, to develop a manure storage ordinance.

* Assist county staff to complete annual workload analyses and grant applications for work conducted under the priority watershed project.

* Participate in the annual project review meetings.

* If the need arises, assist in developing technical standards for agricultural BMPs, and provide technical assistance to county staff concerning application of these practices.

* Assist county staff to evaluate the site specific practicality of implementing rural best management practices.

Other Agencies: The Milwaukee River South Watershed Project will receive assistance from the agencies listed below.

Soil Conservation Service (SCS): This agency works through the local LCC to provide technical assistance for planning and installing conservation practices. The local SCS personnel will work with the county staff to provide assistance with technical work. Personnel from the Area SCS office will provide staff training and engineering assistance for best management practices, especially where there is a lack of engineering job approval for particular practices. DATCP will make efforts to assist SCS in coordinating the Milwaukee River South Priority Watershed Project with the conservation

compliance and other conservation provisions of the 1985 and subsequent federal farm bills.

University of Wisconsin Extension (UWEX): County and Area Extension agents will provide support in developing and conducting a public information and education program aimed at increasing voluntary participation in the project. This will include assistance to carry out the information and education activities identified in this plan.

Agricultural Stabilization and Conservation Service (ASCS): ASCS administers most of the federal programs aimed at the stabilization of the prices paid producers for agricultural products and administers federal funds for rural soil and water and other resource conservation activities. The Agricultural Conservation Program (ACP), which the ASCS administers, will be coordinated to the best extent possible with the Milwaukee River South Priority Watershed Project. In addition other conservation incentives such as the Conservation Reserve Program (CRP) will be used whenever possible to control critical nonpoint sources of pollution.

BEST MANAGEMENT PRACTICES

BMPs Eligible for Cost Sharing And Their Rates: Best management practices are those identified in NR 120. These practices are determined to be the most effective controls of the nonpoint sources of pollution in this watershed plan. The practices eligible for cost-sharing under the Milwaukee River South Priority Watershed Project are listed in Table 6-1. The cost share rates for each BMP are also listed in the table. Design and installation of all BMPs must meet the conditions listed in NR 120. Generally these practices use specific standard specifications included in the SCS Field Office Technical Guide. In some cases additional specifications may apply. The applicable specifications for each BMP can be found in NR 120.14.

TABLE 6-1. State Cost-share Rates for Best Management Practices

BEST MANAGEMENT PRACTICE	STATE COST SHARE RATE
Contour	50% *
Contour Strip Cropping	50% *
Field Strip Cropping	50% *
Field Diversions and Terraces	70%
Grassed Waterways	70%
Reduced Tillage	50%
Critical Area Stabilization	70% (1)
Grade Stabilization Structures	70%
Agricultural Sediment Basins	70%
Shoreline and Streambank Stabilization	70%
Shoreline Buffers	70% (1)
Barnyard Runoff Management	70%
Animal Lot Relocation	70%
Manure Storage Facilities	70% **
Livestock Exclusion from Woodlots	50%
Wetland Restoration	70% (1)
Roofs for Barnyard Runoff Management and Manure Storage Facilities	70%
Nutrient and Pesticide Management	50% (2)

(1) Easements identified in the watershed plan in conjunction with these BMPs may be entered into with landowners. See Chapter V application of easements.

(2) Spill control basins have a state cost-share rate of 70 percent.

* Wildlife habitat restoration components of this practice are cost-shared at 70 percent.

** Maximum cost share amount is $10,000 including no more than $5,000 for manure transfer equipment.

The following is a brief description of some of the most commonly used cost-shared BMPs included in Table 6-1. A more detailed description of these practices can be found in NR 120.14.

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

* Contour and Field Stripcropping: Growing crops in a systematic arrangement, usually on the contour, in alternate strips of close grown crops, such as grasses or legumes, and tilled row crops.

* Reduced Tillage: A system which leaves a roughened surface or substantial amounts of crop residue in or on the soil surface after crops are planted. The system consists of no more then one primary tillage pass in the fall or spring and no more than two passes with light or secondary tillage equipment prior to planting. It is utilized in two situations; one for continuous row crops or long corn rotations, the other for short crop rotations or for the establishment of forages and small grains.

* Critical Area Stabilization: The planting of suitable vegetation on critical nonpoint source sites.

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

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

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

* Shoreline and Streambank Stabilization: The stabilization and protection of stream and lake banks against erosion and the protection of fish habitat and water quality from livestock access. This practice includes streambank fencing.

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

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

* Barnyard Runoff Management: Structural measures such as gutters, downspouts, or diversions to redirect surface runoff around the barnyard, and collect, convey and temporarily store runoff from the barnyard.

* Manure Storage Facility: A structure for the storage of manure for a period of time that is needed to reduce the impact of manure as a nonpoint source of pollution. Livestock operations where this

practice applies are those where manure is winter spread on fields that have a high potential for runoff to lakes, streams and groundwater. The facility is needed to store and properly spread manure according to a management plan.

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

* Shoreline Buffers: A permanently vegetated area immediately adjacent to lakes, streams, and wetlands designed and constructed to manage critical nonpoint sources or to filter pollutants from nonpoint sources.

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

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

* Roofs for Barnyard Runoff Management and Manure Storage Facilities: Construction of roofs to prevent rain and snow from contacting manure.

* Nutrient Management: The management of the application of manure, legumes, and commercial fertilizers including the rate, method and timing of application to minimize the amount of nutrients entering surface or groundwater.

* Pesticide Management: The management of the handling, disposal and application of pesticides including the rate, method and timing of application to minimize the amount of pesticides entering surface and groundwater.

BMPs Not Cost-Shared: BMPs not cost-shared, but which shall be included on the cost share agreement if necessary to control the nonpoint sources, are listed in NR 120.17. Several examples are included below.

* Practices to be funded through other programs.

* Practices previously installed and necessary to support cost-shared practices.

* Changes in crop rotations and other activities normally and routinely used in growing crops or which have installation costs that can be passed on to potential consumers.

* Changes in location of unconfined manure stacks involving no capital cost.

* Manure spreading management.

* Other activities the DNR determines are necessary to achieve the objectives of the watershed project.

Activities and Sources Of Pollution Not Eligible For Cost Share Assistance: Priority watershed cost-share funds cannot be used to control sources of pollution and land management activities specifically listed in NR 120.10(2). The following is a partial list of ineligible activities most often inquired about for cost-sharing in rural areas.

* Operation and maintenance of cost-shared BMPs.

* Actions which have drainage of land or clearing of land as the primary objective.

* Practices already installed.

* Activities covered under the Wisconsin Pollution Discharge Elimination System (WPDES) Program or covered in other ways by Chapter 147 of Wisconsin Statutes (including livestock operations with more than 1,000 animal units, or livestock operations issued a notice of discharge under ch. NR 243).

* Septic system controls or maintenance.

* Dredging activities.

* Silvicultural activities.

* Bulk storage of fertilizers and pesticides.

* Activities and structures intended primarily for flood control.

* Practices required to control sources which were adequately controlled at the time the cost-share agreement was signed.

* Other practices or activities that DNR determined not to meet the objectives of the program.

NONPOINT SOURCE GRANT AGREEMENT AND ADMINISTRATION

General Information: The Nonpoint Source (NPS) Grant Agreement is the means for transmitting funds from the DNR (through the nonpoint source program) to Ozaukee County for use in funding the state's share of cost share agreements. Cost share agreements are the means to transmit funds from Ozaukee County to the landowners.

A portion of the Nonpoint Source Grant is forwarded to Ozaukee County to allow the county to set up an "up front" account. The county will use funds from this account to pay landowners after practices are installed under the project. As this account is drawn down, the county will request reimbursements from DNR to replenish the account. The counties will submit reimbursement requests on a quarterly basis. This reimbursement schedule will insure that the "up front" account balance is maintained at an adequate level. The NPS Grant Agreement will be amended annually to provide funding needed for cost sharing for the year. The funds obligated under cost share agreements must never exceed the total funds in the NPS Grant Agreement.

Fiscal Management Procedures, Reporting Requirements: Counties are required by NR 120 to maintain a financial management system that accurately tracks the

disbursement of all funds used for the Milwaukee River South Watershed Project. The records of all watershed transactions must be retained for three years after the date of the project is finally settled. A more detailed description of the fiscal management procedures can be found in NR 120.25 and NR 120.26.

Cost Share Agreement And Administration

Purpose and Responsibilities: Consistent with s. 144.25, Stats. and NR 120, Wisconsin Administrative Code, cost-share funding is available to landowners for a percent of the costs of installing BMP's to meet the project objectives. Landowners have three years after formal approval of the watershed plan to enter into cost-share agreements. Practices included in the cost-share agreements must be installed within the schedule in the cost-share agreement. Unless otherwise approved, the schedule of installing BMPs will be within five years of signing of the cost-share agreement. Practices must be maintained for a minimum of ten years from the date of installing the final practice included in the cost-share agreement.

The cost-share agreement is a legal contract between the landowner and the county. The agreement includes the name and other information about the landowner and grant recipient, conditions of the agreement, the practices involved and their location, the quantities and units of measurement involved, the estimated total cost, the cost share rate and amount, the timetable for installation, and number of years the practice must be maintained. The agreements also identify and provide information on practices not cost-shared through the nonpoint program but that are essential to controlling pollution sources (such as crop rotations). Once both parties sign, they are legally bound to carry out the provisions in the agreement.

If landownership changes, the cost-share agreement remains with the property and the new owner is legally bound to carry out the provisions. NR 120.13(9) and (10) has more information on changes of landownership and the recording of cost-share agreements.

Local, state, or federal permits may be needed prior to installation of some BMP's. The areas most likely to need permits are zoned wetlands and the shoreline areas of lakes and streams. These permits are needed whether the activity is a part of the watershed project or not. Landowners should consult with the County Planning and Zoning Department or the LCD offices to determine if any permits are required. The landowner is responsible for acquiring the needed permits prior to installing practices.

The cost-share agreement binds the county to provide the technical assistance needed for the planning, design, and verification of the practices on the agreement, and to provide the cost-share portion of the practice costs.

Counties are responsible for enforcing compliance of cost-share agreements to which they are a party. Where DNR serves as a party to an agreement with a unit of government, the DNR will take responsibility for monitoring compliance. The responsible party will insure that BMPs installed through the program are maintained in accordance with the operation and maintenance plan of the practice for the appropriate length of time. Ozaukee County will check for compliance with practice maintenance provisions once every three years after the last practice has been installed. The county must check maintenance at its own expense after the NPS Grant Agreement has lapsed.

Landowner Contact Strategy: The following procedure will be used to make landowner contacts.

1. During the first three months of the implementation period, all landowners or operators with eligible nonpoint sources will receive from the county a mailing explaining the project and how they can become involved.

2. After the initial landowner mailings, county staff will make personal contacts with all landowners that have been identified as having critical nonpoint sources of pollution (Management Category I). These contacts will occur within a year of receiving the NPS Grant Agreement.

3. The county will continue to make contacts with eligible (Management Category I and II) landowners and operators until they have made a definite decision regarding participation in the program.

4. The county will contact all eligible landowners (as defined in (3) above) not signing cost-share agreements by personal letter six months prior to the end of the cost-share sign-up period.

Procedure for Developing a Cost Share Agreement: Eligibility for cost-sharing is verified following a site visit, using the criteria described in Chapter V.

The development of farm conservation plans will be the primary method used to develop cost-share agreements. These plans are specific to a particular landowner and are a comprehensive approach to the abatement of the nonpoint sources of pollution, and the conservation of soil and other resources. The farm plan takes into consideration the sustainability of the agricultural resources and the management decisions of the owner or operator.

When a landowner has livestock, a manure spreading plan will be developed. Participants in the watershed project will be required to limit winter-spreading of livestock manure in accordance with the criteria listed in Chapter V.

The cost share agreement specifies the items listed in the farm conservation plan that are necessary to reduce the nonpoint sources of pollution. The conservation plan and cost share agreement will document existing management which must be maintained to protect water quality.

The county will use the following procedure to develop and administer agreements. Below are steps beginning with the initial landowner contact through the completion of BMP maintenance.

1. Landowner and county staff meet to discuss the watershed project, NPS control practice needs, and coordination with conservation compliance provisions if applicable.

2. Landowner agrees to participate with the watershed project.

3. The county prepares a farm conservation plan.

4. The landowner agrees with the plan, a cost-share agreement (CSA) is prepared. The landowner and the county sign both documents. Two copies of the CSA are sent to the DNR Southeast District nonpoint source coordinator and a copy given to the landowner. The county will record the CSA with the County Register of Deeds.

5. The county, or their designee, design practices, and a copy of the design is provided to the landowner.

6. Landowner obtains the necessary bids or other information required in the cost containment policy.

6. Amendments to the CSA are made if necessary.

7. The county staff oversee practice installation.

8. The county verifies the installation.

9. The landowner submits paid bills and proof of payment (cancelled checks or receipts marked paid) to the county.

10. LCCs, and if required, county boards, approve cost-share payments to landowners.

11. The county issues checks to the respective landowners and project ledgers are updated.

12. The county records the check amount, number, and date.

13. DNR reimburses the county for expended cost-share funds.

Identifying Wildlife and Fishery Needs: The Ozaukee County staff will consult with DNR's Southeast District Wildlife and Fisheries Management staff to optimize the Wildlife and Fisheries Management benefits of nonpoint source control BMPs. Specifically, the county staff will contact DNR staff if:

* Streambank protection practices, agricultural sediment basins, or critical area stabilization practices are being considered.

* Fence rows, rock piles, wetlands, or other wildlife habitat components will be adversely affected by installation of agricultural BMPs.

The DNR staff will assist county staff by:

* Identifying streambank protection practices that benefit fish and wildlife.

* Identifying wildlife habitat components that could be incorporated into vegetative filter strips along streams or in upland areas.

* Reviewing placement of agricultural sediment basins to assure that negative impacts on stream fish and aquatic life do not occur and recommending wildlife habitat components.

* Providing technical assistance when the installation of BMPs will require the removal of obstructions or other wildlife habitat by proposing measures to minimize impact on wildlife habitat.

* Assisting to resolve questions concerning effects of agricultural nonpoint source BMPs on wetlands.

Submittal to the Department of Natural Resources: Cost-share agreements do not need prior approval from DNR, except in the following instances:

* Where cost-share funds are to be used for practices on land owned or controlled by the county.

* For agreements or amendments where the cost-share amount for all practices for a landowner exceeds $50,000 in state funds.

* For grade stabilization structures and agricultural sediment basins with embankment heights between 15 to 25 feet and impoundment capacities of 15 to 50 acre feet.

* For streambanks to be controlled using riprap or other materials with banks over six feet high.

* For animal lot relocation.

* For roofs over barnyards or manure storage facilities.

Cost Containment Procedures: Chapter NR 120 requires that cost containment procedures be identified in this plan. The cost containment that Ozaukee County will use are described below.

Cost-share payments will be based on actual installation costs. If actual installation costs exceed the amount of cost-sharing determined by the bidding and average cost methods the amount paid the grantee may be increased with the approval of the appropriate LCC. Appropriate documentation regarding the need for changes will be submitted to DNR.

Bids: Competitive bids will be required for all structural BMP's with estimated total costs--as determined by the project technicians--exceeding $5,000. The bidding process requires the cost share recipient to receive a minimum of two bids from qualified contractors in lump sum bid. The cost share recipient must provide copies of the bids to the county prior to initiating construction. In cases where the cost share recipient provides proof that bids were requested from a minimum of three qualified contractors but only one bid was received, the county will determine if the bid constitutes an appropriate cost for the project. If no bids are received or if the lone bid is not deemed appropriate, the county will limit cost sharing based on average costs.

Average Costs. Average costs will be used for all structural BMPs with an estimated cost equal to or less than $5,000, unless the cost share recipient decides to bid the installation of the BMPs. The average costs to be used will be sent to DNR and DATCP for approval prior to Ozaukee County signing cost share agreements. This average cost list will be reviewed periodically and appropriate changes made. If changes are made the list will be forwarded

to DNR and DATCP for final approval before the changes are used for calculating cost share agreements and payments.

Flat Rates. Several of the BMPs listed in Table 6-1 will use flat rates for determining the state's cost share funding amount. Practices using flat rates are shown in Table 6-2. The rates shown are the state's share of the practice installation costs.

Table 6-2: Practices Using a Flat Rate for State Cost-Share Funding

BEST MANAGEMENT PRACTICE	FLAT RATE
Contour Farming	$6.00/ac.
Strip Cropping	$12.00/ac.
Field Strip Cropping	$10.00/ac.
Reduced Tillage	$15.00/ac. (1)
Reduced Tillage	$45.00/ac. (2)

(1) Reduced tillage systems for short crop rotations, and establishment of forages and small grains (includes no-till).

(2) Reduced tillage systems for continuous row cropping or long rotations (does not include no-till).

LOCAL ASSISTANCE GRANT AGREEMENT ADMINISTRATION

General Information: The Local Assistance Grant Agreement (LAGA) is a grant from the DNR to Ozaukee County to support staff and costs in implementing this watershed plan. Consistent with NR 120, Ozaukee County will use funds from the LAGA for additional staff to implement the project and conduct information and education activities. The LAGA also supported other items such as travel, training, and certain office supplies. Further clarification of eligible costs supported by this grant is given in NR 120.14(4) and (6).

Grant Agreement Application Procedures: The county conducts an annual review of the LAGA through the development of an annual workload. This workload estimates the work needed to be accomplished each year. The workload is provided to DATCP and DNR for review and clarification. Along with the workload analysis, a grant application form is sent. Funds needed to complete the agreed upon annual workload are amended to the local assistance grant agreement.

Fiscal Management Procedures, Reporting Requirements: NR 120 requires Ozaukee and Milwaukee counties to maintain a financial management system that accurately tracks the disbursement of all funds used for the Milwaukee River South Watershed Project. The records of all watershed transactions must be retained for three years after the date of final project settlement. A more detailed description of the fiscal management procedures can be found in NR 120.25 and NR 120.26.

NR 120 requires quarterly reports to DATCP from each county in accordance with s. Ag. 166.40(4) accounting for staff time, expenditures, and accomplishments regarding activities funded through the watershed project. Reimbursement requests may be included with the submittal of the quarterly project reports.

Budget And Staffing Needs

This section estimates the funding and staffing required to conduct the rural portion of this project within Ozaukee County.

Costs of Installing BMPs: The quantity and type of management practices that are required to meet this project's water quality objectives are listed in Table 6-3. The capital cost of installing the BMPs are listed in this table assuming landowner participation rates of 100 percent and 75 percent. Also included are the units of measurement and cost share amount per unit for the various BMPs.

The capital cost of installing the BMPs in Ozaukee County is approximately $2.39 million dollars, assuming 100 percent participation. State funds necessary to cost-share this level of control are estimated at $1.69 million. The local share provided by landowners and other cost-share recipients would be about $0.69 million.

At a 75 percent level of participation, the state funds needed to cover capital installation would be $1.27 million.

Easement Costs: Chapter V identifies where nonpoint source program funds can be used to purchase easements. The estimated cost purchasing easements on eligible lands in Ozaukee County is shown in Table 6-3. At 100 percent participation, the estimated purchase price of easements on eligible lands would be $233,000. At 75 percent participation, the cost would be $175,000. The state would pay for the entire cost of the easements.

Staff Needs: Table 6-4 lists the total estimated staff needed to implement the project in Ozaukee County. Figures are provided for both the 50 percent and 75 percent levels of participation. A total of 18.5 staff years is required (1,820 hours per staff year) to implement this plan at a 75 percent landowner participation rate. This includes 1.2 staff years to carry out the information and education program. The estimated cost for staff at this landowner participation rate is $0.59 million. All of these costs, with the exception of some direct cost items, would be paid for by the state.

Total Project Cost: The total state funding required to meet the rural nonpoint source pollution control needs at a 75 percent level of landowner participation is presented in Table 6-5. This figure includes the capital cost of practices, staff support, and easement costs presented above. The estimated cost to the state would be $2.08 million.

Table 6-3. Cost-share budget needs for rural management practices in Ozaukee County.

Management Needs	Number	Cost/Unit	Total Cost (1)	100% Participation State Share	100% Participation Local Share	75% Participation State Share	75% Participation Local Share
BEST MANAGEMENT PRACTICES:							
Upland Sediment Control							
Change in Crop Rotation	3,942 ac	NA(3)	0	0	0	0	0
Contour Cropping	6,036 ac	$6	36,216	36,216	(2)	27,162	(2)
Contour Strip Cropping	4,250 ac	$12	51,000	51,000	(2)	38,250	(2)
Reduced Tillage (4)	5,150 ac	$45	231,750	231,750	(2)	173,813	(2)
Reduced Till.(5)	1,710 ac	$15	25,650	25,650	(2)	19,238	(2)
Critical Area Stabilization	1,700 ac	$100	170,000	119,000	51,000	89,250	38,250
Grass Waterways	90 ac	$2,500	225,000	157,500	67,500	118,125	50,625
Field Diversions & Terraces	20,000 ft	$3	60,000	42,000	18,000	31,500	13,500
Grade Stabilization	45 ea	$3,000	135,000	94,500	40,500	70,875	30,375
Agricultural Sediment Basin	5 ea	$3,000	15,000	10,500	4,500	7,875	3,375
Livestock Fencing from Woodlots	3,000 ft	$1	3,000	1,500	1,500	1,125	1,125
Pasture Management	20 ac	NA	0	0	0	0	0
Shoreline Buffers	233 ac	$150	34,950	24,465	10,485	18,349	7,864
Wetland Restoration	20 ea	$2,000	40,000	28,000	12,000	21,000	9,000

Table 6-3. (Continued) Cost-share budget needs for rural management practices in Ozaukee County.

Management Needs	Number	Cost/Unit	Total Cost (1)	100% Participation State Share	100% Participation Local Share	75% Participation State Share	75% Participation Local Share
Animal Waste Management							
Barnyard Runoff Control							
Complete System	28 ea	$15,000	420,000	294,000	126,000	220,500	94,500
Clean Water Diversion	15 ea	$4,000	60,000	42,000	18,000	31,500	13,500
Manure Storage Facility (6)	20 ea	$20,000	400,000	200,000	200,000	150,000	150,000
Manure Spreading Management	428 ac	NA	0	0	0	0	0
Streambank Erosion Control							
Shape and Seeding	22,330 ft	$4	89,320	62,524	26,796	46,893	20,097
Fencing	6,640 ft	$1	6,640	4,648	1,992	3,486	1,494
Riprap	18,775 ft	$20	375,500	262,850	112,650	197,138	84,488
Livestock/Machinery Crossing	6 ea	$1,500	9,000	6,300	2,700	4,725	2,025
Subtotal:			$2,388,026	$1,694,403	$693,623	$1,270,802	$520,217
EASEMENTS:	233 ac	$1,000	233,000	233,000	0	174,750	0
TOTALS			$2,621,026	$1,927,403	$693,623	$1,445,552	$520,217

(1) Total cost to control identified critical pollution sources.
(2) Local share consists of labor and any additional equipment costs.
(3) NA means that cost share funds are not available for this practice.
(4) This practice is reduced tillage on continuous row, or long rotational croplands.
(5) This practice is reduced tillage, including no-till, on short rotation croplands or for establishing forage crops.
(6) Maximum cost-share is $10,000 of which a maximum of $5,000 can be for waste transfer.

Table 6-4. Estimate of Ozaukee County LCD staff needs for project implementation.

Activity	Project Years When Work Will Be Done	75% Landowner Participation (Staff Years)	50% Landowner Participation (Staff Years)
Project & Financial Mgmt.	1-8	2.4	2.4
Information & Education Program	1-8	1.2	1.2
Pre-Contact Office Inventory; Landowner Contacts, & Progress Tracking	1-3	0.9	0.6
Conservation Planning; Cost Share Agrmt. Development	1-3	2.3	1.5
Practice Design & Installation	1-8		
Upland Sediment Control		7.0	4.7
Barnyard Runoff Control		1.3	0.9
Manure Spreading Mgmt. & Storage		0.7	0.4
Streambank Erosion Control		2.3	1.5
Training	1-8	0.5	0.5
Total LCD Workload:		18.5	13.7
Estimated Staff Required for Years 1-3:		3.1 per year	2.3 per year
Estimated Staff Required for Years 4-8:		1.9 per year	1.4 per year

Table 6-5: Share of project costs at 75% landowner participation rate.

Item	Costs (State Share)
Cost-Share Funds: Practices	$1,270,802
Cost-Share Funds: Easements	$174,750
Local Assistance Staff Support	$593,459*
Information/Education Direct	$6,000
Other Direct (travel, supplies, etc.)	$32,000
	$2,077,011

* Salary + Indirect = $32,000/year

Grant Disbursement And Project Management Schedule

Implementation may begin upon approval of this watershed plan by the Ozaukee County Board; Milwaukee County Board; Wisconsin Department of Agriculture, Trade and Consumer Protection; and the Department of Natural Resources. The priority watershed project implementation period lasts for eight years. It includes an initial three year period for contacting eligible landowners and signing cost-share agreements. Practices on any cost-share agreement must be installed within a five-year period.

Under extenuating circumstances, the DNR can extend the initial period for entering into cost-share agreements but only for a limited period if the extension will result in a significant increase in nonpoint source control. The DNR and DATCP also decide on the approval of limited extensions for the installation period for practices on individual cost-share agreements.

The disbursement of the grants (local assistance and nonpoint source programs) to Ozaukee County will be based on an annual workload analysis and grant application process. The estimated grant disbursement schedule based on 75 percent participation by eligible landowners can be found in Table 6-6.

Table 6-6. Disbursement schedule at 75% landowner participation rate for Ozaukee County.

	Project Year			
Item	1	2	3	4 - 8
Cost-Share Funds: Practices	$254,160	$508,320	$508,320	$0
Cost-Share Funds: Easements	58,250	58,250	58,250	0
Local Assistance Staff Support	99,200	99,200	99,200	295,859
Information/Education: Direct	1,500	1,000	1,000	2,500
Other Direct: (travel, supplies, etc.)	4,000	4,000	4,000	20,000
TOTAL	$375,510	$629,170	$629,170	$406,500

Coordination With State And Federal Conservation Compliance Programs

The Milwaukee River South Watershed Project will be coordinated with the conservation compliance features of the Wisconsin Farmland Preservation Program (FPP) which DATCP administers, and the Federal Food Security Act (FSA) which the SCS administers. DATCP will assist Ozaukee and Milwaukee County and the SCS offices to identify landowners within the watershed that are subject to the compliance provisions of FPP and FSA. Conservation Farm Plans were completed for all landowners in FPP and FSA on December 31, 1989.

There will be a need to implement the conservation plans and in the future amend these plans during the implementation phase of the watershed project. Watershed project supported staff will revise the conservation plans developed for FPP and FSA to include management decisions and the installation of needed BMPs for nonpoint source pollution abatement while addressing other resource conservation problems. This comprehensive approach to farm planning will facilitate consideration of the various goals and objectives for all the programs in which the landowner participates.

Some eroding uplands in Management Categories 1 and 2 may need control, in addition to that required for meeting sediment delivery targets, in order to meet soil erosion program goals established through other state and federal programs. Where this occurs, technical and financial assistance from the nonpoint source program can be used to support practice design and installation on these critical lands. This assistance applies only where the additional control needed to meet soil erosion goals can be achieved using low cost practices.

URBAN PROGRAM FOR IMPLEMENTATION

Timing And Sequencing Of Urban Management Program

The following discussion provides guidance on the manner in which the urban nonpoint source control program will be implemented. It considers, first, the relationship of the recommendations for existing and planned urban areas to the anticipated federal stormwater permit program. Second, the elements of a "core" program for controlling urban nonpoint source are discussed. Finally, the contents and means for implementing the more complex elements of the urban management program--detention, infiltration, and street sweeping--are presented.

Relationship of the Urban Management Program to the Federal Stormwater Permit Program: As discussed in Chapter I, "Plan Purpose and Legal Status" a federal stormwater permit program will begin early in the implementation phase of this priority watershed project. The requirements of the federal stormwater program will result in the issuance of permits under the Wisconsin Pollution Discharge Elimination System (WPDES) for discharging stormwater to surface water. Initially, only the city of Milwaukee and some industries will fall under the requirements of the federal program. However, it is likely that many communities and industries in the Milwaukee River watershed will ultimately be required to reduce pollution attributable to urban nonpoint sources.

Regulations guiding the conduct of the federal stormwater permit program will be released in August 1990. Implementation of the urban nonpoint source control recommendations in this plan will meet some of the requirements of the federal program. However, it is uncertain if financial assistance will be available for requirements specified in a stormwater permit. Consequently, communities and industries are encouraged to begin implementation of this plan's recommendations to take advantage of grant funds currently available under the nonpoint source program.

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.

This requirement applies only to the receipt of funds used directly by the municipality as a grantee, such as where the municipality installs, owns, and operates a management practice. It does not apply to those instances where the municipality acts as a grantor, passing cost share funds through to private landowners. This means that individual landowners could receive cost-share funds from the DNR for the installation of management practices prior to a municipality's agreement to conduct core elements of the urban program.

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 DNR. 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 presented at the end of this chapter.

"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. It is anticipated that many of these segmented elements will be implemented individually as discrete nonpoint source control practices. An example would be construction of one or more detention ponds in a given subwatershed following completion of an engineering feasibility study.

Importantly, the higher costs of implementing this portion of the urban management program will require communities to budget expenditures over the course of several years. Best management practices implemented under this portion of the program likely will include detention ponds, infiltration devices, stream bank erosion controls and other structural means for reducing urban nonpoint source pollution. These elements also include changes in schedules and equipment used for street sweeping.

The 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.

Communities can implement the segmented elements of the urban management strategy any time following development and initial implementation of the "core" program. However, cost sharing will be limited to those elements of the segmented program completed within the eight year implementation period.

The basic elements of the segmented program are:

1. Conduct detailed engineering studies to determine the best means to implement community specific nonpoint source control measures for existing urban areas. This element will also consider accelerated street sweeping as a component of the control strategy for existing urban areas.

   The detailed engineering feasibility studies should set forth the allocation of local costs between municipalities where more than one municipality contributes runoff to an urban structural practice. The allocation should result in an equitable distribution of costs based on the contribution of each municipality to the total pollutant loading or stormwater runoff volume being controlled.

   The effect of source reduction activities on the extent of urban structural practices needed to meet pollution reduction goals should be considered in conducting these studies. Some examples of source reduction activities that might be considered are presented in Chapter V of this plan in the section entitled "Urban Best Management Practices."

2. Design and install structural urban best management practices for existing urban areas with completed detailed engineering studies. (Practices for locations outside of areas having detailed engineering studies will be considered only on a case-by-case basis.)

3. Develop, as needed, management plans for planned urban development. These plans will identify the type and locations of structural urban BMPs.

4. Adopt and enforce a comprehensive stormwater management ordinance consistent with the State "model" stormwater ordinance under preparation.

5. Conduct detailed alternative financing/implementation studies which determine the means to pay for administering an urban nonpoint source control program in each municipality. These studies will be conducted on a parallel schedule with the other initial high priority elements undertaken in the segmented program.

PROGRAM PARTICIPANTS: ROLES AND RESPONSIBILITIES

The specific roles and responsibilities for program participants are summarized below. The primary participants include local units of government (cities, villages, towns, counties); the DNR; other agencies; landowners and land operators. Where applicable, the roles and responsibilities are discussed according to the previously described "core" and "segmented" approaches to project implementation. As noted in Chapter I, "Plan Purpose and Legal Status", implementation begins following approval of this priority watershed plan by the counties, DATCP, and DNR.

Local Units of Government "Core" Program Roles and Responsibilities: The following is a schedule for implementing the "core" elements of the urban nonpoint source control strategy for this priority watershed project. Each community wishing to participate should:

1. Identify in writing an authorized representative for the local unit of government within 30 days of the start of implementation.

2. Adopt an adequate ordinance, develop administrative procedures, and determine staff needs to enforce a construction erosion control ordinance in cities and villages within 12 months of the start of implementation.

3. Identify the roles and responsibilities of towns and counties for controlling construction erosion in unincorporated areas within six months of the start of implementation. Adopt adequate ordinances, develop administrative procedures, and determine staff needs to enforce a construction erosion control ordinance in unincorporated areas within 12 months of the start of implementation.

   Nonpoint source program funding to Ozaukee County for carrying out agricultural management recommendations is not contingent upon construction site erosion control coverage for the county.

4. Develop and implement a community specific program of urban "housekeeping" practices which reduce urban nonpoint source pollution. This may include but is not limited to a combination of information and education efforts, adoption of ordinances regulating pet wastes, and changes to the timing and scheduling of leaf collection. The content of the community specific program and a schedule for implementation will be negotiated by the local unit of government and the DNR within 12 months of the start of implementation.

5. Implement the information and education strategy according to the manner and schedule described in this chapter.

6. Prepare and submit annual work plans for staff and activities necessary to implement the project.

7. Prepare and submit to the DNR an annual report for the purposes of monitoring project implementation.

8. Participate in the annual watershed project review meeting.

Local Units of Government--"Segmented" Program Roles and Responsibilities: The following is a schedule for the "segmented" elements of the urban nonpoint source control strategy for this priority watershed project. Each community wishing to participate should:

1. Identify within six months of the start of implementation, the high priority segments the community wishes to pursue in existing and planned urban areas through the priority watershed project. This list can be amended throughout the eight year project period.

2. Conduct engineering feasibility and site location studies for urban nonpoint source control practices in high priority areas for existing urban development. The type and manner of practice installation will be guided by the above referenced detailed engineering studies. A commitment to implementing the recommendations will be required as a condition for subsequent financial assistance for these studies.

3. Adopt, administer, and enforce a comprehensive stormwater management ordinance for planned urban development within 12 months of completion of an approved state "model" ordinance.

4. Enter into cost-share agreements for eligible best BMPs.

   a. For practices installed and maintained by private individuals, the cost-share agreement is between the landowner and the local unit of government. The local units of government will be required to:

      1) Design or contract for the design of best management practices and verify proper practice installation,

      2) Request reimbursement from the DNR for practices installed by private landowners, and in turn reimburse those landowners for the eligible amount of cost sharing.

      3) Monitor landowner compliance with provisions of the cost-share agreement.

   b. For practices installed and maintained by the local unit of government, the cost-share agreement is between the unit of government and the DNR. Where more than one municipality contributes runoff to a control practice, the DNR will enter into cost share agreements consistent with an equitable allocation based on municipal contributions to the pollutant loads and stormwater volumes being controlled.

c. Practice maintenance is the responsibility of the grant recipient. In some cases, urban stormwater pollutants are generated wholly or in part by a community different than that in which the stormwater control practice is located. An example is the potential use of wet detention in Brown Deer Park (Milwaukee County) to control urban pollutants generated from the city of Milwaukee.

In these instances, there are several alternatives to properly distribute the financial burden of practice maintenance. Two examples are presented below. In each example, the "upstream" community generates all or part of the urban pollutant load to the best management practice, which is located in the "downstream" community.

1) The "downstream" community can act as grant recipient, which includes ultimate accountability for practice maintenance. The responsibility could then be delegated, all or in part, to the "upstream" community through an intergovernmental agreement.

2) The "upstream" community can act as the grant recipient, which includes ultimate accountability for practice maintenance. The "downstream" community could provide, through an intergovernmental agreement, all or part of the local share of the practice installation cost.

The Milwaukee County Parks Department has determined that it will not assume long-term maintenance liability for practices placed on its property when those practices are installed to control pollutants and stormwater flows generated from urban lands located in other governmental jurisdictions. This is anticipated to be the case in all or nearly all situations.

5. Submit information needed for project evaluation to DNR.

Department of Natural Resources (DNR): The DNR has been statutorily assigned the overall administrative responsibility for the Wisconsin Nonpoint Source Water Pollution Abatement Program. This includes providing financial support for local staff and installation of management practices, assisting local units of government to integrate Wildlife and Fisheries Management concerns into selection and design of BMPs, and conducting project evaluation activities.

The DNR's role in assisting local units of government in carrying out the "core" and "segmented" activities are as follows.

Core Program Roles and Responsibilities:

1. Assist local units of government to develop and adopt construction erosion control ordinances.

2. Review community specific programs of urban "housekeeping" practices for nonpoint source control.

3. Review and approve annual work plans for staff and activities necessary to implement the project.

4. Review and approve annual project implementation reports.

5. Participate in the annual watershed project review meeting.

6. Track changes in urban pollutant loads using information from local units of government.

Segmented Program Roles and Responsibilities:

1. Assist communities to develop priorities, schedules and requirements for segmented activities.

2. Develop a comprehensive stormwater management ordinance for planned urban development. Assist communities with adoption and enforcement of stormwater management ordinances.

3. Participate in the selection of BMPs and approve practice designs. Review nonpoint source cost-share agreements that local units of government sign with eligible landowners.

4. Enter into nonpoint source cost-share agreements for the eligible lands that the local unit of government owns or operates.

5. Review designs of urban nonpoint source control practices for which cost-share agreements are signed.

6. Reimburse cost share recipients for the eligible costs of installing BMPs at the rates consistent with administrative rules and those established in this plan.

Landowners and Land Operators: In some situations, private landowners will install BMPs on their property. As such, landowners can be important participants in the urban implementation strategy. Eligible landowners will participate in the project by signing cost-share agreements with local units of government. Maintenance responsibility can be allocated using agreements similar to those discussed above.

Other Agencies with Urban Implementation Responsibilities:

Soil Conservation Service (SCS). This agency works through the local LCC to provide technical assistance for planning and installing conservation practices. The local SCS personnel may work with the local units of government in selected circumstances to provide assistance with technical work.

University of Wisconsin Extension (UWEX). Area Extension agents will provide support in developing and conducting a public information and education program aimed at increasing voluntary participation in the project. These activities are described later in this chapter in the information and education strategy.

Milwaukee Metropolitan Sewage District. Sewage districts have all of the privileges and responsibilities of cities, counties, and villages when participating in the nonpoint source program. However, the district may only enter into grants with the DNR for carrying out core and segmented program elements consistent with this watershed plan if those elements are closely related to the DNR district's wastewater and stormwater management responsibilities.

BEST MANAGEMENT PRACTICES (BMPs)

BMPs Eligible For Cost-Sharing And Their Rates: Best management practices are those practices identified in NR 120 determined in this watershed plan to be the most effective in reducing nonpoint sources of pollution. Design and installation of the best management practices previously described under the rural implementation strategy must meet the conditions listed in NR 120. Generally these practices use specific standard specifications in the "U. S. Soil Conservation Service Field Office Technical Guide".

Specifications for the structural urban practices were described in Chapter V, "Nonpoint Source Control Needs." The DNR's technical assistance will guide the application of these practices. Eligible practices and state cost share rates are listed in Table 6-7.

Activities and Sources of Pollution Not Eligible for Cost Share Assistance: Priority watershed cost-share funds cannot be used to control sources of pollution and land management activities specifically excluded in NR 120.10 and NR 120.17. The following is a partial list of ineligible activities most often inquired about for cost-sharing in urban areas.

* Operation and maintenance of cost-shared best management practices (BMPs).
* Construction erosion control practices.
* Structural BMP's for new urban development. New urban development is defined as that for which construction activity commences after the DNR approves this watershed plan.
* BMPs installed prior to signing cost-share agreement.
* Activities covered under the Wisconsin Pollution Discharge Elimination System (WPDES) Program.
* On-site septic system controls or maintenance.
* Dredging activities.
* Activities and structures intended primarily for flood control.
* Purchase of land.
* Stormwater conveyance systems.
* Minimum levels of street sweeping (defined in Appendix C) and leaf collection.

Table 6-7. State Cost-share Rates for Urban Management Practices

BEST MANAGEMENT PRACTICE	STATE COST SHARE RATE
Critical Area Stabilization	70% (1)
Grade Stabilization Structures	70%
Shoreline and Stream Bank Stabilization	70%
Shoreline Buffers	70% (1)
Wetland Restoration	70% (1)
Structural Urban Practices	70% (2)
Street Sweeping	50% (3)

1. Easements may be used in conjunction with these practices.
2. Applies only to structures for established urban areas. Established urban surfaces are considered to be those in existence prior to the date the DNR approves this watershed plan.
3. This is an alternative best management practice not listed in NR 120, of the Wisconsin Administrative Code, See Appendix C for more information.

Source: Wisconsin DNR.

This plan recognizes that some items not eligible for funding under the nonpoint source program will be required to implement the plan recommendations. Examples include land purchase and the renovation or construction of storm sewer systems. Such activities will be needed to install structural urban practices such as wet detention ponds in many existing urban areas. These items are not currently eligible for funding under the nonpoint source program because of budgetary constraints.

These limits on funding eligibility, as set forth in this plan, are meant to apply only to the Nonpoint Source Water Pollution Abatement Program as administered under existing NR 120 Wisconsin Administrative Code. These limits are not meant to preclude separate budgetary or contractual financial assistance agreements that may be developed outside the existing scope of the nonpoint source program. Such agreements might be developed under new state or federal programs, or with other units of government. This plan endorses the use of funds procured through such agreements to implement the recommendations set forth in this plan.

Nonpoint Source Grant Agreement And Administration

The nonpoint source grant agreement is the means for transmitting funds from DNR to local units of government to provide cost sharing for installation of urban best management practices. In some cases the municipality will act only as a grantee. In this case, the municipality will use funds obtained under the grant agreement directly for practices it will install, own, and operate.

In other cases, the municipality will play an additional role as a grantor. In these situations, the municipality will pass the cost share funds it has received from the DNR to private landowners who have responsibility for installing, operating, and maintaining the management practices. When this occurs, the municipality will enter into a separate cost-sharing agreement with the private landowner receiving the state funds.

The procedures for administering nonpoint source grant agreements and cost share agreements parallel those contained in this plan's rural implementation strategy and in NR 120, Wisconsin Administrative Code.

Cost Share Agreement And Administration

Purpose and Responsibilities: Consistent with s. 144.25, Wisconsin Statutes and NR 120, cost-share funding is available to landowners and local units of government for a percent of the costs of installing BMPs to meet the project objectives. Cost-share agreements must be initiated within three years after formal approval of the watershed plan and are filed as part of the property deed. They may be amended throughout the eight year project period.

Practices included on cost-share agreements must be installed within the schedule agreed to on the cost-share agreement. Unless otherwise approved, the schedule of installing BMPs will be within five years of signing of the cost-share agreement. Practices must be maintained for a minimum of ten years from the date of installing the final practice included in the cost-share agreement.

Local, state, or federal permits may be needed prior to installation of some BMPs. The areas most likely to need permits are zoned wetlands and the shoreline areas of lakes and streams. These permits are needed whether the activity is a part of the watershed project or not. The cost share recipient is responsible for acquiring the needed permits prior to installation of practices.

Local units of government are responsible for enforcing compliance of cost-share agreements to which they are a party. Where the DNR serves as a party to an agreement with a unit of government, the DNR will take responsibility for monitoring compliance. The responsible party will insure that BMPs installed through the program are maintained in accordance with the operation and maintenance plan for the practice for the appropriate length of time.

Identifying Wildlife and Fishery Needs: The local units of government will consult with DNR's Southeast District Wildlife Management and Fisheries Management staffs to optimize the Wildlife and Fisheries Management benefits of nonpoint source control BMPs. Specifically, the DNR will be contacted if:

* Streambank protection practices or critical area stabilization practices are being considered.

* Wetlands or other wildlife habitat components will be adversely affected by installation of BMPs.

The DNR staff will assist by:

* Identifying streambank protection practices that benefit fish and wildlife.

* Identifying wildlife habitat components that could be incorporated into vegetative filter strips along streams or in upland areas.

* Providing technical assistance when the installation of BMPs will require the removal of obstructions or other wildlife habitat by proposing measures to minimize impact on wildlife habitat.

* Assisting to resolve questions concerning effects of nonpoint source BMPs on wetlands.

Cost Containment Procedures: State statute governs cost containment procedures for local units of government.

LOCAL ASSISTANCE GRANT AGREEMENT ADMINISTRATION

General Information: The Local Assistance Grant Agreement (LAGA) is a grant from the DNR to local units of government to support their staff support and to support costs of carrying out the urban implementation strategy. Each local unit of government will have its own agreement. Consistent with NR 120 these grant funds will be used for installation of BMPs on land that the local unit of government owns, additional staff to implement the project, and conduct information and education activities. LAGA also supports other items such as travel, training, and certain office supplies. Further clarification of eligible costs that this grant supports is given in NR 120.14(4) and (6).

Activities described in the "core" and "segmented" elements of the urban implementation strategy are eligible for financial assistance. The type of eligible activities and the amount of state funds available are described in Table 6-8.

Table 6-8. Urban Implementation Strategy Measures Eligible for State Funding

ACTIVITY	SUPPORT RATE
Development of Construction Erosion Control Ordinances	100%
Development of Stormwater Management Ordinances	100%
Engineering Studies for Existing Urban Areas; Studies for Planned Urban Areas	100% (1)
Design and Engineering for Structural Best Management Practices	100%
Staff for Enforcing Construction Erosion and Stormwater Management Ordinances	100% (2)
Additional Staff Needed for Accelerated Street Sweeping	100% (2)
Development of Alternative Financing and Administration Strategies	100%

(1) Funding not available for components dealing exclusively with drainage and flooding.
(2) Funding limited to five years. Level of staffing based on a work plan submitted by local units of government and approved by the DNR.

Source: Wisconsin Department of Natural Resources.

Grant Agreement Application Procedures: An annual review of the LAGA is conducted through an annual work plan which the local unit of government develops. This plan estimates the work needed to be accomplished each year. The work plan is provided to the DNR for review and clarification. Along with the work plan, a grant application form is sent. Funds needed to complete the agreed upon annual workload are amended to the local assistance grant agreement.

Fiscal Management Procedures, Reporting Requirements: NR 120 requires the local units of government to maintain a financial management system that accurately tracks the disbursement of all funds used for the Milwaukee River Watershed Project. The records of all watershed transactions must be retained for three years after the date of final project settlement. A more detailed description of the fiscal management procedures can be found in NR 120.25 and NR 120.26. NR 120 requires quarterly reports from each local unit of government accounting for staff time, expenditures, and accomplishments regarding activities funded through the watershed project. Reimbursement requests may be included with the submittal of the quarterly project reports.

Urban Budget And Staffing Needs

The urban program budget and staffing requirements include several key components. These are presented below, along with estimates of budget and staffing needs if available at this time. Estimated budget and staffing needs to conduct the urban program are presented in Table 6-9, Table 6-10, Table 6-11, and Table 6-12.

Tables 6-9 and 6-10 present the estimated costs of implementing the recommendations for existing urban areas. All of these costs are associated with the "Segmented" urban program. Table 6-9 shows the cost of preparing detailed engineering feasibility studies that will be needed before practices are designed and installed to control runoff from existing urban areas. These estimates are made for each municipality. Table 6-10 presents estimated costs of implementing the wet detention and street sweeping recommendations. The municipality also presents these costs. The cost of implementing the streambank erosion control element is presented in the text only, as it has yet to be determined how the costs may be divided.

Tables 6-11 presents the cost of implementing the recommendations for planned urban areas. Table 6-11 presents cost estimates for implementing "segmented" urban program activities, including stormwater planning and practice installation for urbanizing areas. These costs are presented by subwatershed only, since projections of urban growth were not made by municipality. Cost estimates for implementing the construction site erosion control element of this plan, a "core" urban program activity, are not included in Table 6-11, but are estimated in the text. Table 6-12, a summary of estimated costs for the rural and urban portions of the watershed project, summarizes the costs of conducting all urban "segmented" and "core" level activities.

Engineering Feasibility/Siting Studies: Table 5-19 estimates that detailed engineering feasibility studies will be needed for 16,000 to 35,000 acres of existing urban development in order to choose and site practices. The private sector will probably carry out most of these studies with most of the cost borne by the DNR. The estimated costs of preparing these feasibility studies for each community are presented in Table 6-9. In making these estimates, a planning cost of $100/acre was assumed.

Table 6-9. Estimated cost of preparing detailed engineering feasibility studies for existing urban areas in the Milwaukee River South Watershed.

Community	Planning Needs (acres)(1)	Estimated Cost(2)
OZAUKEE COUNTY		
V. of Fredonia	90 to 380	$9,000 to $38,000
V. of Saukville	110 to 630	$11,000 to $63,000
V. of Grafton	580 to 1,490	$58,000 to $149,000
C. of Cedarburg	170 to 460	$17,000 to $46,000
V. of Thiensville	90 to 740	$9,000 to $74,000
C. of Mequon	1,200 to 6,300	$120,000 to $630,000
Unincorporated Areas	--	--
MILWAUKEE COUNTY		
V. of River Hills	50 to 1,240	$5,000 to $124,000
V. of Bayside	150 to 220	$15,000 to $22,000
V. of Fox Point	550 to 1,030	$55,000 to $103,000
C. of Glendale	1,470 to 3,710	$147,000 to $371,000
V. of Whitefish Bay	380 to 430	$38,000 to $43,000
V. of Shorewood	340 to 460	$34,000 to $46,000
C. of Milwaukee	10,240 to 15,120	$1,024,000 to $1,512,000
WATERSHED TOTAL	16,030 to 34,710	$1,603,000 to $3,471,000

(1) Low end of range includes only critical acres, high end represents all urban land uses.
(2) Estimated cost of feasibility studies is $100/acre.

Source: Wisconsin Department of Natural Resources.

Table 6-10. Cost of implementing wet detention and street sweeping recommendations in existing urban areas of the Milwaukee River South Watershed(1).

Municipality	Wet Detention Component									Street Sweeping Component		
	Cost (2)			State Share (3)	Local Share(4)					Cost/ Year(5)	State Share(6)	Local Share(7)
Village of Bayside	$600,000	to	$1,200,000	$78,750	$521,250	to	$1,121,250			$8,750	$6,125	$2,625
Village of Brown Deer	$4,000,000	to	$8,000,000	$525,000	$3,475,000	to	$7,475,000			$29,000	$20,300	$8,700
Village of Cedarburg	$1,120,000	to	$2,240,000	$147,000	$973,000	to	$2,093,000			$8,500	$5,950	$2,550
Village of Fredonia	$440,000	to	$880,000	$57,750	$382,250	to	$822,250			$1,500	$1,050	$450
Village of Fox Point	$1,880,000	to	$3,760,000	$246,750	$1,633,250	to	$3,513,250			$30,000	$21,000	$9,000
City of Glendale	$8,080,000	to	$16,160,000	$1,060,500	$7,019,500	to	$15,099,500			$53,750	$37,625	$16,125
Village of Grafton	$3,440,000	to	$6,880,000	$451,500	$2,988,500	to	$6,428,500			$2,500	$1,750	$750
City of Mequon	$7,640,000	to	$15,280,000	$1,002,750	$6,637,250	to	$14,277,250			$8,750	$6,125	$2,625
City of Milwaukee	$36,600,000	to	$73,200,000	$4,803,750	$31,796,250	to	$68,396,250			$347,500	$243,250	$104,250
Village of River Hills	$1,240,000	to	$2,480,000	$162,750	$1,077,250	to	$2,317,250			$8,750	$6,125	$2,625
Village of Saukville	$480,000	to	$960,000	$63,000	$417,000	to	$897,000			$2,750	$1,925	$825
Village of Shorewood	$1,040,000	to	$2,080,000	$136,500	$903,500	to	$1,943,500			$11,750	$8,225	$3,525
Village of Thiensville	$560,000	to	$1,120,000	$73,500	$486,500	to	$1,046,500			$20,000	$14,000	$6,000
Village of Whitefish Bay	$1,120,000	to	$2,240,000	$147,000	$973,000	to	$2,093,000			$0	$0	$0
Unincorporated Areas	$1,520,000	to	$3,040,000	$199,500	$1,320,500	to	$2,840,500			$11,250	$7,875	$3,375
TOTAL	$69,760,000	to	$139,520,000	$9,156,000	$60,604,000	to	$130,364,000			$544,750	$381,325	$163,425

(1) Practice quantities are listed in Table 5-19.
(2) Detention pond costs include: (a) capital expenses of pond excavation and development; (b) cost of storm sewer rerouting; (c) cost of land purchase; and cost of relocating businesses or homes; and (d) engineering. Low end of cost range is $400,000/ acre and assumes extensive storm sewer rerouting but no relocation of existing structures. High end of cost range is $800,000/acre and assumes an additional cost for relocating existing structures such as businesses or homes.
(3) Includes 70% of capital costs for pond excavation and pond development, and 100% design work.
(4) Add operation and maintenance (O&M), estimated at $2,000 per surface acre per year.
(5) Assumes cost of $25/curb mile including: equipment; labor; O&M; depreciation; fuel; and disposal.
(6) Cost share rate is 50% for equipment related expenses, and 100% for additional staff.
(7) Applies to first five years only. See Appendix C for information on municipal obligation to continue practice.

Table 6-11. Cost of implementing urban practices in planned urban areas, Milwaukee River South Watershed (1).

Subwatershed	Where Urbanization is Anticipated	Estimated Cost of Planning(2.)	Estimated Capital Cost of Detention(3.)
Brown Deer Cr.		$1,100	$29,110
Beaver Cr.	C. of Milwaukee V. of Brown Deer	$25,850	$335,120
Fredonia	V. of Fredonia	$6,050	$78,100
Grafton	V. of Grafton Tn. of Grafton	$24,090	$269,800
Haneman L.	V. of Saukville V. of Grafton Tns. of Saukville, Cedarburg, Grafton	$17,160	$213,000
Indian Cr.	V. of River Hills V. of Bayside	$1,925	$31,240
Lakefield	V. of Grafton C. of Mequon Tn. of Grafton	$22,165	$241,400
Lincoln Cr.	C. of Milwaukee C. of Glendale	$42,350	$839,220
Mequon	C. of Mequon	$106,205	$1,157,300
Milwaukee River-Glendale	C. of Glendale V. of River Hills	$10,725	$95,140
Milwaukee River-Shorewood	C. of Milwaukee C. of Glendale	$8,800	$149,100
Pigeon Cr.	C. of Mequon C. of Cedarburg V. of Thiensville Tn. of Cedarburg	$43,450	$596,400
Saukville	V. of Saukville V. of Grafton Tns. of Saukville, Port Washington, Grafton	$43,175	$610,600
South Branch Cr.	C. of Milwaukee V. of Brown Deer	$23,100	$411,800
Waubeka	V. of Fredonia Tn. of Fredonia	$6,050	$63,900
WATERSHED TOTAL		$382,195	$5,121,230

(1) Based on recommendations presented in Tables 5-20 and 5-21.
(2) Planning costs are estimated to be $60/acre planned.
(3) State cost share assistance is not available through the nonpoint source program for urban practices to control runoff from new development. Figures based on capital cost of $71,000 per acre of wet pond surface. Figure does not include cost of land or operation and maintenance.

Table 6-12. Summary costs, in millions of dollars, of implementing plan recommendations in urban and rural areas of the Milwaukee River South Watershed.

RECOMMENDATIONS	TOTAL COST	STATE SHARE	LOCAL GOV'T(1)	LANDOWNER SHARE
RURAL RECOMMENDATIONS:				
Management Practices	2.4	1.7 (70%)	0	0.7 (32%)
Easements	0.2	0.2 (100%)	0	0
Local Staffing	0.8	0.8 (100%)	0	0
URBAN RECOMMENDATIONS:				
EXISTING AREAS(2)				
Feasibility Studies	2.5	2.5 (100%)	0	0
Detention Ponds	70 to 140	9.3 (7-13%)	60.7 to 130.7(87-93%)	
Street Sweeping	4.3	1.9 (44%)	2.4 (56%)	0
Streambank Protection	0.4	0.3 (75%)	0.1 (25%)	0
PLANNED AREAS				
Erosion Controls(3)				
-Practices	1.7	0	0	1.7 (100%)
-Administration	1.6	1.0 (63%)	0.6 (37%)	0
Stormwater Controls(2)				
-Stormwater Plans	0.4	0.4 (100%)	0	0
-Detention Ponds	5.1	0	0	5.1 (100%)
WATERSHED TOTAL	89.4 to 159.4	18.1	71.3 to 141.3	

(1) 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.

(2) These costs are associated with "segmented" urban program activities.

(3) These costs are associated with "core" urban program activities. Information and education (I&E) costs for urban areas, which are also associated with "core" level activities, are not listed in this table. I&E cost data are presented in Table 6-13.

Table 5-20 estimates that studies to choose and site stormwater practices in areas of new development will be needed for about 7,000 acres. The private sector will probably carry out most of these studies with most of the cost borne by the DNR. The estimated costs of preparing these feasibility studies for each community are presented in Table 6-11. In making these estimates, a planning cost of $60 per acre was assumed.

Detailed Engineering Designs: Once practices are sited, detailed designs must be prepared. The private sector and local government staffs will probably partially prepare these designs. The cost of site designs for structural practices located in existing and planned urban areas is included in cost estimates presented in the following section. It is assumed that the private sector will prepare the designs with the DNR supporting the design cost 100 percent.

Cost of Installing Structural Practices in Existing Urban Areas: There are many factors that can affect the cost of construction practices to control existing urban runoff. Key factors include: labor rates; land costs; cost of relocating residences; excavation costs; and cost of rerouting storm sewers.

The relative importance of these costs will vary tremendously on a case-by-case basis. Land costs will vary by community, and include acquisition costs for land procured from the private sector and the opportunity cost of using land currently held in the public domain. Residences in densely urbanized areas may need to be relocated to make space for structural practices; where open land exists, this would not be necessary. Excavation costs for structures that must be put underground, such as detention chambers, are several times greater than excavation costs for a surface structure. Finally, rerouting storm sewers to the site of urban stormwater control practices can be costly.

Table 6-10 presents cost information for installing wet detention ponds in existing urban areas. The cost information assumes 100 percent detention of existing critical land uses. The total cost for installing these ponds in densely urbanized areas, such as the Lincoln Creek Subwatershed in the city of Milwaukee, ranges from $400,000 to $800,000 per surface acre of pond. This cost depends on the need to condemn and relocate existing structures such as homes or businesses. The lower cost assumes that open land is available for purchase, but that extensive rerouting of the storm sewer system is required. The upper end of the cost range assumes that land is completely developed and condemnation of existing businesses or homes would be required. Both figures assume that the cost of pond excavation and development, such as the construction of pond inlet and outlet structures and pond landscaping, costs about $70,000 per acre.

Under all scenarios, the state share of the cost is limited to 70 percent of the cost for pond excavation and development, and 100 percent of the design costs. This equals about $52,500 of state assistance per surface acre of detention pond. The remaining costs, including land purchase, storm sewer rerouting, and annual operation and maintenance are not eligible for cost sharing under the existing rules governing the state nonpoint source program. However, some of these costs may become eligible for cost sharing in the future.

Some local governments have indicated that there may be an inability to fund some components of these costs. Therefore, this financing plan recognizes

that additional funding through new initiatives must be provided to improve full program implementation.

Cost of Installing Structural Practices in Planned Urban Areas: Table 6-11 presents an estimate of the cost for wet detention in planned urban areas. The factors that contribute to the expense of retro-fitting should not be of concern in developing areas, because proper planning can assure that land is set aside and stormwater practices are located in harmony with the conveyance systems.

Table 6-11 shows that an estimated $5 million will be required to install wet detention in the planned urban areas. Land costs are additional. The entire cost would be borne locally, as nonpoint source program funds are not used for practices in areas of new development.

Operation and Maintenance for Structural Practices: Operation and maintenance costs for detention are about 5 percent of the capital construction cost per year. This cost is not included in Tables 6-10 or 6-11. It must be borne locally.

Cost of Street Sweeping in Existing Urban Areas: Table 6-10 shows the estimated cost of sweeping 50 percent of the critical urban land uses as part of a program that phases in the required level of wet detention. The costs presented in the table assume a total cost of $25/curb mile. Principal component costs include wages and salaries (34 percent), indirect labor benefits and overhead (9 percent), maintenance and fuel (25 percent), equipment depreciation (16 percent), and litter disposal (16 percent). The total annual cost of improving local street sweeping programs to the accelerated level recommended in this plan is about $.5 million. The annual state share would be approximately $.38 million and the annual local share about $.16 million.

After five years, local units of government would need to maintain the accelerated levels of sweeping at their own expense as the nonpoint source program funding is limited to a five-year period. As wet detention or other practices providing equivalent control are installed, the accelerated sweeping could be discontinued.

Cost of Preparing Construction Site Erosion Control Plans: This cost has not been estimated. It will be primarily the responsibility of the private sector to meet requirements of local ordinances.

Cost of Installing Construction Erosion Control Practices: It is assumed that construction site practices will average $250/acre. Using this unit cost, it will require an estimated $1,700,000 to install construction site erosion control practices in the watershed. All of this cost will be the responsibility of the private sector to satisfy local ordinances.

Cost of Administering a Construction and Stormwater Control Ordinances: It is estimated that five staff years of effort will be needed in the watershed. Assuming a unit cost of $40,000 per staff per year, the administrative cost is estimated to be $200,000 per year. Over the eight year life of the project, the estimated cost is $1,600,000. The nonpoint source program will support 100 percent of the required staff for a period of five years, or $1,000,000.

The remaining three years would be funded locally, probably in part through permit fees. Each local unit of government is expected to continue supporting these administrative costs as needed in the years following the end of this watershed project.

Alternative Funding Sources: A substantial portion of the estimated costs of implementing this plan's urban management recommendations is for the construction of stormwater management practices in existing urban areas to control pollutants generated by a wide variety of activities. Where urban structural practices are used to control stormwater pollutants, the state cost share is limited and the burden falls on local funding sources. This is a result of current constraints set forth in state statutes and administrative rules.

Some municipalities have endorsed a concept of internalizing the cost of pollution control. These municipalities developed a mechanism to charge the cost of pollution control to those responsible for generating the pollutants. In addition, municipalities have indicated a desire to pursue additional state or federal funding sources.

One way to internalize costs is to assess the source of each stormwater pollutant. This requires the identification of sources responsible for pollutant generation. This plan endorses investigations that identify sources of urban pollutants to reduce pollutant generation. If pollutant generation cannot be reduced, this identification would provide an alternative means of assigning pollution control costs.

State or federal programs could be developed to help internalize the cost of pollution control. This could be done by collecting pollution generation fees and redistributing these funds to local units of government. Such fees could be associated with the production or use of polluting materials. Current examples include the state's tire tax which is collected on every tire sale to finance long-term tire disposal. Alternatively, costs could be internalized by assessing local charges within the urban area based on the amount of polluted runoff generated. Current examples include utility districts and basin authorities being used throughout the country to finance stormwater management practices.

This plan endorses continuing investigation into source control alternatives as well as development of alternatives for internalizing local pollution control costs. Some of these alternatives, such as the collection and redistribution of fees at the state level and increased state funding for urban nonpoint source control practices should be investigated through the ongoing Legislative Council Study on Nonpoint Source Pollution Control. Other alternatives, such as the creation of local utility districts should be investigated by respective municipalities.

Milwaukee River South Watershed Project Cost Summary

Table 6-12 presents a summary of estimated costs for implementing the rural and urban portions of this watershed project. The estimated total project cost is $89.4 to $159.4 million. Rural recommendations will require 2 to 4 percent of this total to implement. The remainder of the cost is associated with controls in the existing and planned urban areas.

The most expensive aspects of the recommended plan include engineering feasibility studies and construction of structural practices to control stormwater pollution from existing urban areas. This plan element is anticipated to cost about $72.5 to $142.5 million, or 80 percent of the total plan cost. State cost-share assistance through the nonpoint source program can be partially defrayed, but most of the cost ($60.7 to $130.7 million) the local governments and individual landowners would incur under existing state cost share guidelines.

Control of construction site erosion is estimated to cost about $3.3 million, or 2 to 4 percent of the total project costs, while controlling stormwater runoff from areas of new development is estimated to cost $5.5 million or 3 to 6 percent of total project costs. These elements represent pro-active management actions that are very cost-effective.

In addition to these costs, an estimated $50,000 will be needed for non-staff related information and education expenses over the initial three years of the watershed project. The DNR will support these costs entirely, in addition to those needed to support two regional education specialists (one rural and one urban). A detailed discussion of the rural and urban information and education strategy, including activities, budget needs, and staffing needs, is presented in the next section.

INFORMATION AND EDUCATION STRATEGY

The Milwaukee River South Watershed educational strategy has been prepared as part of a basinwide information and education strategy. The strategy is based upon survey data from rural and urban residents, public meetings, committee review, staff suggestions, and other participatory processes. The strategy also draws on elements of the "Urban Water Quality Information and Education Strategy for the Milwaukee River Program" (Johnson, 1989) and other basinwide information and education materials. These basinwide materials contain support information and policy positions not included here.

PURPOSE AND PERSPECTIVES

The primary purpose of the information and education strategy for the Milwaukee River South Watershed is to enhance implementation of watershed plan objectives.

To achieve the most impact with available funds, educational program planning was viewed from several perspectives:

* Key audiences capable of having the greatest impact on the resource because they own, manage, or help govern critical lands.

* Key messages of the watershed project that need to be relayed.

* Potential uses of activities such as providing information, promoting participation, and instructing of specific practices.

* Opportunities for combining efforts of public and private agencies.

* Critical timeliness associated with phases in the watershed project.

* Educational approaches that are most effective for the purpose.

The resulting educational plan for the Milwaukee River South Watershed includes recommendations for both general and specifically targeted activities. It recognizes that certain targeted audiences hold the key to actions that can produce immediate and substantial improvements in water resources. At the same time, the plan acknowledges that educational activities designed for general audiences are important. These activities can influence both short and long-term management decisions. In part, this recognizes that numerous encounters with information are often required to motivate positive action. The general activities also address the public's "right-to-know" and "momentum-building" objectives. Even though these are general activities, the targeting of audiences and the refining of messages will be achieved to the extent that cost efficiency and program impacts are maximized.

Key Audiences And Outcomes

Ideally, the watershed project would be able to reach all key audiences throughout the project implementation. However, the realities of limited staff and resources require prioritizing activities for each stage of the project. Key audience groups include:

1. Those who must act:
   - Business and industry
   - Local elected and appointed officials
   - Rural landowners and operators (farmers)
   - Urban homeowners/residents

2. Those who can support change:
   - Agricultural organizations
   - Civic and service groups
   - Concerned citizens
   - Conservation and environmental groups
   - Fishing, boating and other water resource user groups
   - Local government associations

3. Future actors and supporters:
   - Youth
   - Teachers and youth leaders
   - General public

For the sign-up period, audiences will be addressed according to the following desired outcomes (in order of priority):

1. Watershed project participation, primarily through:

   a. Cost-sharing agreements with local governments or rural landowners.

   b. Community action through regulation of nonpoint source pollution (ordinances) or proper management (public works programs).

2. Widespread individual action on a voluntary basis without a cost-sharing agreement--including urban residents using good "housekeeping" practices and rural landowners using nutrient and pesticide best management practices.

3. Other state and federal conservation programs utilized to achieve water quality objectives in ways complementary to the nonpoint source program.

4. Support of the watershed project through the understanding, acceptance, and advocacy of project goals.

5. Increased awareness that the project exists and of what is being accomplished.

These outcomes complement the broad educational goals established for the Milwaukee River program (See Appendix E). More than one of these outcomes may apply to an activity and audiences may overlap. Furthermore, priorities will change as the project moves beyond sign-up through implementation to evaluation.

EFFECTIVE METHODS TO REACH KEY AUDIENCES

Key audiences have been grouped into five categories for this educational strategy:

* Rural landowners and operators
* Local governments
* Urban residents
* Business and industry
* Youth

Important characteristics of each group and information about the best ways to reach them are summarized below.

Rural Landowners and Operators: The educational methods selected to reach farmers in this watershed are methods used, to varying degrees, in other watersheds in the state:

* One-to-one contacts--with a folder of materials tailored to each contact.

* Watershed newsletters.

* Demonstration projects and tours.

* Town meetings.

* Fact sheets and workshops on recommended practices.

* Local radio talk shows and news programs.

* News articles in local newspapers.

* Articles in agricultural publications.

* Exhibits at county fairs.

Analysis of information on rural landowners and operators, collected through surveys and face-to-face meetings, can improve the effectiveness of these methods. According to a 1986 rural survey, most farmers in the Milwaukee River Basin (88 percent) believe that protecting water quality is important. However, more than 90 percent also believe that their farm does not cause water quality problems. Only 17 percent of those surveyed recognize soil erosion as a medium to large problem. Young farmers (18 to 35 years old) are more likely to recognize soil erosion problems (60 percent do so), but half of the farmers in this basin are over 55 years old.

Compared to urban residents, farmers are less likely to use water for recreation. About 5 percent of farmers swim or boat compared to about 60 percent of urban residents who swim and 25 percent who boat. The most popular water sport for farmers is fishing. About 20 percent of them fish compared to about 45 percent of urban residents.

Other characteristics of rural audiences in this watershed according to the survey and other observations include:

* More specialty crop and hobby farming.

* Short planning horizon for many farms due to landowner age and urbanization.

* High rate of absentee landlords.

* Economic pressure of escalating land values and taxes.

Fact sheets, newsletter articles and other materials should be adapted to speak directly to the concerns of local farmers. When surveyed, farmers express concerns about costs and benefits, tax exemptions, public access requirements for stream buffers, and maintenance requirements.

Local Governments: Other important audiences are the elected and appointed officials of local governments. There are 21 local governments (five towns, ten villages, four cities and two counties) in this watershed. All were invited to send representatives to the citizens and technical committees that

reviewed the plan, but many elected and appointed officials remain relatively uninformed. Characteristics of local government audiences which became apparent during the planning process include:

* Reluctance to regulate or tax more than neighboring communities and resistance to raising local taxes.

* Pressing social problems in the urban environment which compete with water quality problems for funding.

* Historical belief that cleaning up point source pollution was all that urban areas would need to do to solve water quality problems.

* Concern about economic issues such as job attraction and retention, maintaining property values, and expanding tax base.

The educational approach selected for this audience includes:

* Meetings (one-to-one or group)--with graphic summary materials.

* Watershed newsletters.

* Demonstration projects and tours.

* Workshops for staff on new practices--with handbooks and fact sheets.

* Regional water quality conferences.

* Speakers for local government associations--with high quality audio-visual and printed materials.

Considerable time and effort must be devoted to this audience due to the numbers of local governments and the importance of their action to control construction erosion, manage stormwater runoff, and stabilize eroding streambanks.

Urban Residents: The Milwaukee River Basin is the largest urbanized area encountered by the Wisconsin Nonpoint Source Priority Watershed Program. To determine the educational methods that will be most effective with urban residents, a survey was conducted during the summer of 1989. According to the survey, Milwaukee area residents find the following to be the most interesting methods in which to receive information about water quality:

* Community water quality newsletters.

* Television news reports.

* Educational materials received in the mail.

* Newspaper stories.

About 50 percent to 70 percent of the survey respondents report that they are "very likely" to learn about water quality through these means. On the other hand, less than 15 percent report that they are very likely to attend meetings or workshops, check out videotaped programs from local libraries, or visit demonstration sites. Workshops, videotaped programs and demonstration

projects are more appropriately used for highly-motivated, interested citizens and groups rather than the general public.

Other characteristics of this audience to keep in mind when developing educational activities and materials include:

* Value placed on "quality of life" and clean neighborhoods.

* Perception that industry is the leading cause of water quality problems.
* Pessimism about the degree of water quality improvement possible in the lower river and harbor.

* Reluctance to accept any degree of risk from toxic materials.

* Preference for funding sources other than property tax.

Educational methods selected for use with this audience include:

* Promotional media campaign--with assistance from professional public relations experts.

* Newspaper coverage including news, feature articles and limited advertising.

* Television coverage including news stories and interview shows.

* Radio coverage including news stories, talk shows and public service announcements.

* Watershed newsletters sent to interested citizens and groups.

* Speakers for local groups--with high quality audio-visual and printed materials.

* Workshops, volunteer leader training, demonstrations, audio-visual and printed materials about new practices for interested citizens.

* Exhibits at local events, especially water-related events.

The educational approach for the urban public relies primarily on the mass media. Workshops, speakers, demonstrations, and leader training are reserved for interested citizens and organizations.

Business and Industry: Another component of the urban audience, is the effect of nonpoint source plan recommendations on businesses and industries. Those development-related businesses which will encounter new construction erosion control and stormwater management requirements are most affected. Others that may be affected include owners of eroding streambanks or "critical areas" for retrofitting stormwater devices.

Characteristics of this audience that should be considered when selecting educational methods and developing materials include:

* Concern about economic costs and benefits.

* Sense of civic responsibility.

* Concern about Wisconsin's competitiveness as a place to do business compared to other states.

* Value placed on "quality of life" (including clean water for recreation) in decisions regarding corporate relocation.

* Seasonal variations in time availability for those in the construction industry.

Educational methods selected for use with this audience include:

* Articles in industrial newspapers and magazines.

* Speakers for business and industry associations.

* Workshops on new practices for those affected by new regulations--with handbooks, audio-visual and printed materials.

* Demonstration projects and tours.

* Exhibits at appropriate industrial shows and meetings.

Youth: Youth are addressed within this plan because they are those who must act and support action to reduce nonpoint source pollution in the future. The current statewide movement to infuse environmental education into school curricula makes the timing for water quality education initiatives especially appropriate. Characteristics of the youth audience in this watershed include:

* Interest of youth in water-based recreation.

* Limited access to high quality water resources.

* Limited water resource education due to scarcity of teachers with appropriate training and inadequate funding for field trips.

* Need to inform older youth about career opportunities related to water resources.

The educational approach developed for this audience includes:

* Teacher and youth leader workshops.

* Curriculum development.

* School programs including a water quality testing project for high school students.

* Youth group projects.

Due to limited resources available to the Milwaukee River Program, staff from private and public nature/environmental education centers that currently work with schools in the watershed will play a leading role in these activities. Private as well as public funds will be sought for expensive projects.

Coordination With Other Programs

Information and education for the nonpoint source control program in this watershed will be carefully coordinated with information and education for the Milwaukee Estuary Remedial Action Plan and other related resource programs. Wherever possible, individual program identities will be subsumed under one consistent clean water theme. Slide and videotape programs, fact sheets, exhibits, and media events will refer to the Milwaukee River Program. Printed and audio-visual materials will be developed in a way that allows their use by other aspects of the program.

Staff from UW-Extension, DNR, DATCP, and county LCDs will meet regularly to coordinate information and education efforts. Some overlap of citizen members and staff assignments for information and education committees will also enhance coordination.

Educational Strategy

The initial years of educational activity within the Milwaukee River South Watershed will be the most ambitious because the groundwork for a successful and extensive program needs to be established. Therefore, activities for the first three years--the sign-up period for cost sharing--are laid out in greater detail in Tables 6-13 and 6-14 and in Appendix F. The tables indicate the need for approximately 600 hours and $15,000 per year to support information and education activities for the watershed project during the sign-up period.

General information for the remaining years of the watershed project is included in Appendix F but details will be filled in during the updating process. The educational strategy will be updated regularly--probably on an annual basis. The first update will rank among the most important due to insights gained during the first year of project sign-up and implementation.

Table 6-13. EDUCATIONAL MATERIALS AND EVENTS--MILWAUKEE RIVER SOUTH WATERSHED

Educational Material/Event	Responsible Party (hours)[a] Milwaukee County UWEX Year 1	Year 2	Year 3	Ozaukee County UWEX Year 1	Year 2	Year 3	Ozaukee County LCD Year 1	Year 2	Year 3	Comments:
Printed Materials										
Watershed newsletter[b] articles	--	--	--	20	20	20	20	20	20	2/year
Watershed folder	--	--	--	--	--	--	20	10	5	Adaptation for individual landowners
Demonstration project fact sheets	--	--	--	--	--	--	20	--	--	See also: demonstrations
Rural management practice fact sheets	--	--	--	--	--	--	20	--	--	Water quality/wildlife habitat improvements
Yard care fact sheets	15	10	5	--	--	--	--	--	--	
Existing printed materials (reprinting)[d]	--	--	--	10	5	--	10	--	--	
Articles for "Ozaukee Dirt" newsletter	--	--	--	--	--	--	20	20	20	4/year
Audio-visual Materials										
Watershed slide program[e]	--	--	--	5	--	--	5	--	--	Taking slides for inclusion
Yard care slide program[c]	--	15	5	--	--	--	--	--	--	
Infosource tapes--homeowner practices[c,f]	10	10	10	--	--	--	--	--	--	
Exhibits										
County fairs-Milwaukee Co. 4-H Fair and Ozaukee County Fair	5	5	5	--	--	--	10	10	10	
Other Milwaukee County events[c] (Home Show, Lawn & Garden Show, State Fair, Conservation Days at Zoo)	--	25	25	--	--	--	--	--	--	
Other Ozaukee County locations (Libraries, other public buildings, and feed mills)	--	--	--	10	10	10	30	30	30	
Breakfast on the Farm	--	--	--	--	--	--	10	--	--	
Purchase of needed exhibit components	--	--	--	--	--	--	10	--	--	
Media										
Newspaper columns[g]	25	25	25	5	5	5	--	--	--	Ozaukee Co.-adaptation of basinwide columns
Radio talk shows[g]	5	5	5	--	--	--	--	--	--	
Radio PSAs[c]	--	--	--	--	--	--	--	--	--	
Articles submitted to local newspapers	--	--	--	15	15	15	15	15	15	6/year
Tours										
Local officials/leaders	--	--	--	40	--	--	60	--	--	
Annual LCC tour	--	--	--	--	--	--	20	20	20	
Animal waste management auto tour	--	--	--	--	25	--	--	25	--	
Cropland management tour	--	--	--	--	--	25	--	--	25	
Subtotal Hourly Commitments	60	95	80	105	80	75	280	150	145	

Table 6-13. (continued)

Educational Material/Event	Responsible Party (hours)[a] Milwaukee County UWEX Year 1	Year 2	Year 3	Ozaukee County UWEX Year 1	Year 2	Year 3	Ozaukee County LCD Year 1	Year 2	Year 3	Comments:
Demonstrations[h]										
Mervis riverfront management	15	10	10	--	--	--	--	--	--	
Brown Deer golf course[i]	NA	NA	NA	--	--	--	--	--	--	
South Branch Creek stormwater ponds	NA	NA	NA	--	--	--	--	--	--	
Roden Barnyard	--	--	--	10	--	--	10	--	--	
Greenhouse[h]	NA	NA	NA	--	--	--	--	--	--	
All-farm demonstration of combined practices	--	--	--	--	60	--	--	--	--	
Conservation tillage[j]	--	--	--	--	20	--	--	20	--	
Nutrient and pesticide management[j]	--	--	--	20	--	--	60	--	--	
Model yards[i]	NA	NA	NA	--	--	--	--	--	--	
Signs										
Demonstration projects	--	--	--	--	--	--	--	--	--	See: demonstrations
Rural cooperator signs and visor hats[k]	--	--	--	--	--	--	10	10	10	Ongoing
At key watershed locations[l]	--	--	--	10	--	--	--	--	--	Ongoing with emphasis in first year(s)
Workshops										
Yard care leader training[c]	--	15	30	--	--	--	--	--	--	
Meetings										
Local governments	30	15	15	15	10	10	15	10	10	
Community groups	5	5	5	10	10	10	--	--	--	2/year
Agricultural groups	--	--	--	10	10	10	10	10	10	4/year
Youth Education										
Testing the waters[c]	35	35	35	--	--	--	--	--	--	
Storm sewer stenciling[c]	NA	NA	NA	--	--	--	--	--	--	
River Resource Center	10	10	10	--	--	--	--	--	--	
School classroom presentations	--	--	--	--	--	--	10	10	10	3/year
Annual Educational Strategy Update	10	10	10	10	10	10	10	10	10	
Subtotal Hourly Commitments	105	100	115	85	120	40	125	70	50	
Total[m]	165	195	205	190	200	115	405	220	195	

NA = not available.

Table 6-13. (continued)

Footnotes

[a] Many activities will utilize Area UWEX staff leadership or assistance, as reflected in separate annual work plans. This priority watershed educational plan reflects only county time commitments and budgetary needs. Ozaukee County will be the lead responsible party for rural activities and Milwaukee County will be the lead responsible party for urban activities pertaining to their respective jurisdictions.

[b] Watershed newsletters may be combined into an Upper Milwaukee River Basin newsletter which emphasizes rural issues and a Lower Milwaukee River Basin newsletter, which emphasizes urban issues.

[c] Activity with basinwide applicability that is especially important for the successful implementation of this watershed project.

[d] The identification and purchase of existing bulletin materials (including fact sheets, brochures, newsletters, etc.) will prevent unnecessary duplication and make use of already published expertise. Conservation tillage, "sustainable agriculture", and crop rotations are several subjects for which this approach is anticipated.

[e] Part of a high quality basinwide slide program to be developed by contract with audio-visual experts.

[f] Taped information available by telephone.

[g] Radio talk shows and newspaper columns originating from Milwaukee will also benefit other watersheds and thus are a "basinwide" education activity.

[h] Hourly estimates for new demonstrations pertain to their investigation, formal proposal, and documentation with slides and fact sheets--not to the more time-consuming establishment, maintenance, and use.

[i] Hours have not been estimated because project plans are still being developed.

[j] Proposals are being advanced for new demonstration project(s) and/or assistance to informally demonstrate good management practices. This may be in conjunction with complementary resource management programs having water quality objectives.

[k] Visor hats for cooperating landowners is another type of "sign" undergoing approval for the watershed project. By providing these to individuals who understand the project and have made commitments, one-on-one education through local testimonials is anticipated.

[l] Signs placed at key watershed locations such as bridge crossings and public access points would be part of a basinwide plan to raise awareness of the Milwaukee River Program.

[m] At the time of plan adoption, a more clear and complete picture of activities, hourly commitments, and budgetary needs existed for year-one than for subsequent years. The annual updating process will address this matter by providing supplementary details. In addition, hourly and cost estimates may deviate somewhat from those finally required. Therefore, the entry of specific items in this table is more important than estimates of resources utilized.

Table 6-14. EDUCATIONAL BUDGET--MILWAUKEE RIVER SOUTH WATERSHED

Educational Material/Event	Responsible Party[a] Milwaukee County Year 1	Milwaukee County Year 2	Milwaukee County Year 3	Ozaukee County Year 1	Ozaukee County Year 2	Ozaukee County Year 3	Area UWEX Year 1	Area UWEX Year 2	Area UWEX Year 3	Comments:
Printed Materials										
Watershed newsletter articles	--	--	--	--	--	--	--	--	--	
Watershed folder	--	--	--	$500	--	--	$1500[b]	--	--	
Demonstration Project fact sheets	--	--	--	--	--	--	--	--	--	See demonstrations.
Rural management practice fact sheets	--	--	--	$500	$500	$500	--	--	--	
Yard care fact sheets[c]	--	--	--	--	--	--	$2500	$1000	$500	
Existing printed materials (reprinting)[d]	$100	$100	$100	$200	$200	$200	--	--	--	Estimated yearly need.
Articles for "Ozaukee Dirt" newsletter	--	--	--	--	--	--	--	--	--	
Audio-visual Materials										
Watershed slide program[c,e]	--	--	--	$100	--	--	--	--	--	County photos for inclusion in slide programs and exhibits.
Yard care slide program[c]	$50	--	--	--	--	--	--	--	--	County photos for inclusion in slide programs and exhibits.
InofSource tapes--homeowner practices[f]	$200	$100	$100	--	--	--	--	--	--	
Construction erosion control programs	--	--	--	$70	--	--	--	--	--	Purchase of D.Last programs.
Exhibits										
County fairs	--	--	--	--	--	--	--	--	--	
Other Milwaukee County events[c]	--	--	--	--	--	--	--	--	--	
Other Ozaukee County events	--	--	--	--	--	--	--	--	--	
Purchase of exhibit components[g]	$500	--	--	$1000	--	--	$500	$500	$500	
Media										
Newspaper columns	--	--	--	--	--	--	--	--	--	
Radio talk shows	--	--	--	--	--	--	--	--	--	
Radio PSAs[c,h]	--	--	--	--	--	--	$5000	$5000	$5000	
Articles submitted to local newspapers	--	--	--	--	--	--	--	--	--	
Tours										
Local officials/leaders	--	--	--	$600	--	--	--	--	--	
Annual LCC tour	--	--	--	--	--	--	--	--	--	Ongoing activity partly water quality.
Animal waste management auto tour	--	--	--	--	$100	--	--	--	--	
Cropland management tour[i]	--	--	--	--	--	--	--	--	NA	

Table 6-14. (continued)

Educational Material/Event	Responsible Party [a] Milwaukee County Year 1	Milwaukee County Year 2	Milwaukee County Year 3	Ozaukee County Year 1	Ozaukee County Year 2	Ozaukee County Year 3	Area UWEX Year 1	Area UWEX Year 2	Area UWEX Year 3	Comments:
Demonstrations[j]										
Mervis riverfront management	--	--	--	--	--	--	$1200	--	--	
Brown Deer golf course	--	--	--	--	--	--	$1200	--	--	
South Branch Creek stormwater ponds	--	--	--	--	--	--	$1200	--	--	
Roden barnyard	--	--	--	$650	--	--	--	--	--	
Greenhouse[k]	NA	--	--	--	--	--	--	--	--	
All-farm demonstration of combined practices[i]	--	--	--	$1200	--	--	--	--	--	
Conservation tillage[i]	--	--	--	NA	--	--	--	--	--	
Nutrient and pesticide management[i]	--	--	--	NA	--	--	--	--	--	
Model yards[j]	NA	--	--	--	--	--	--	--	--	
Subtotal	$850	$200	$200	$4820	$800	$700	$13,100	$6500	$6000	
Signs										
Demonstration projects	--	--	--	--	--	--	--	--	--	See: demonstrations.
Rural cooperators signs and visor hats	--	--	--	--	--	--	$2000	--	--	
At key watershed locations[i,j]	--	--	--	--	--	--	NA	--	--	
Workshops										
Yard care leader training	--	--	--	--	--	--	$100	$100	--	
Meetings										
Local governments	--	--	--	--	--	--	--	--	--	
Community groups	$50	$50	$50	$50	$50	$50	--	--	--	
Agricultural groups	--	--	--	$100	$100	$100	--	--	--	
Youth Education										
Testing the waters[l]	--	--	--	--	--	--	$5000	$5000	--	
Storm sewer stenciling	--	--	--	--	--	--	--	--	--	
River Resource Center	--	--	--	--	--	--	--	--	--	
School classroom presentations	--	--	--	--	--	--	--	--	--	
Subtotal	$50	$50	$50	$150	$150	$150	$7100	$5100	--	
Total[m]	$900	$250	$250	$4970	$950	$850	$20,200	$11,600	$6000	

NA = not available.

Table 6-14. (continued)

Footnotes

[a] Many activities will utilize Area UWEX staff leadership or assistance. This priority watershed educational plan reflects only county budgetary needs except for special items listed under the Area UWEX column. These items are activities with basinwide applicability that are especially important for this watershed project.

[b] Folder for local government officials throughout the basin. Cost split with Menomonee River Watershed.

[c] Activity with basinwide applicability that is especially important for the successful implementation of this watershed project.

[d] The identification and purchase of existing bulletin materials (including fact sheets), brochures, newsletters, etc.) will prevent unnecessary duplication and make use of already published expertise. Conservation tillage, "sustainable agriculture", and crop rotations are several subjects for which this approach is anticipated.

[e] Part of a high quality basinwide slide program to be developed by contract with audio-visual experts.

[f] Taped information available by telephone.

[g] Purchase of exhibit board and lights for counties. Update of display materials and replacement of boards for Area UWEX.

[h] Coordinated program for one week of prime time radio PSA coverage on 18 Milwaukee area radio stations including creation of PSA. Administrative fee only.

[i] Costs have not been estimated because project plans are still being developed.

[j] Cost estimates for new demonstrations pertain to signs and documentation with slides and fact sheets-not to the more costly establishment, maintenance, and use.

[k] Signs placed at key watershed locations such as bridge crossings and public access points would be part of a basinwide plan to raise awareness of the Milwaukee River Program.

[l] $5000/year/watershed (2 years, 5 watersheds) for a total of $50,000 in public funds to match $50,000 in private funds.

[m] At the time of plan adoption, a more clear and complete picture of activities and budgetary needs existed for year-one than for subsequent years. The annual updating process will address this matter by providing supplementary details. In addition, cost estimates may deviate somewhat from those finally required. Therefore, the entry of items in this table is more important than specific cost estimates.

PART THREE

PROJECT EVALUATION

CHAPTER VII - PROJECT TRACKING

CHAPTER VIII - WATER QUALITY MONITORING AND EVALUATION

CHAPTER VII
PROJECT TRACKING

INTRODUCTION

Project evaluation has three components: evaluation of project administration; evaluation of reduction in pollutant loading; and evaluation of changes in surface waters. This chapter briefly summarizes how progress will be measured in carrying out the required administrative activities, and in reducing nonpoint source pollutant loads to surface waters. The surface water evaluation monitoring activities planned for the project area are explained in Chapter VII.

This chapter is divided into four sections:

* Rural administrative review.
* Rural pollutant load reduction review.
* Urban administrative review.
* Urban pollutant load reduction review.

RURAL ADMINISTRATIVE REVIEW

The Ozaukee County Land Conservation Department (LCD) will evaluate the progress of administering the project and in reducing pollutant loads. The county's LCD will also report the information on a regular basis to DNR and DATCP. The administrative review will focus on indicators of accomplishment, financial expenditures made through the project, and staff time spent on project activities.

ACCOMPLISHMENT REPORTING

The Computer Assisted Management and Planning System (CAMPS), is a computer data management system that the U.S. Soil Conservation Service (SCS) developed, and which SCS, DNR and DATCP use to complete reporting requirements of all three agencies. The county, using CAMPS data on administrative accomplishments, will collect and provide this information to DNR and DATCP for program evaluation.

The county will provide the following data quarterly to DNR and DATCP:

* Status of landowner contacts.
* Completed information and education activities.
* Number of farm conservation plans prepared for the project.
* Number of cost share agreements signed.

* Number of farm conservation plan and cost share agreement status reviews completed.

* Number of farms and acres of cropland checked for proper maintenance of best management practices.

In addition, county representatives will meet with DNR and DATCP staff annually to review progress and identify workplan objectives for the subsequent year.

FINANCIAL EXPENDITURES

The County will provide the following data quarterly to DNR and DATCP:

* Money encumbered in cost share agreements.

* Number of landowner reimbursement payments made for installation of best management practices (BMPS), and amount of money paid.

* Staff travel expenditures.

* Information and education expenditures.

* Expenditures for equipment, materials, and supplies.

* Expenditures for professional services and staff support costs.

* Total project expenditures for LCD staff.

The county will provide the following information annually:

* Staff training expenditures.

* Interest money earned and expended.

* Total county LCD budget and expenditures on the project.

TIME SPENT ON PROJECT ACTIVITIES

The county will provide time summaries quarterly to DNR and DATCP for the following activities:

* Project and fiscal management.

* Clerical assistance.

* Pre-design and conservation planning activities.

* Technical assistance (practice design, installation, cost-share agreement status review, and compliance monitoring).

* Educational activities.

* Training activities.

* Leave time.

RURAL POLLUTION LOAD REDUCTION

The purpose of the second evaluation component, pollution load reduction, is to calculate reductions in the amount of key pollutants as a result of installing best management practices. Four sources have been identified for estimating changes in pollution loads reaching surface waters: streambank erosion; upland sediment; runoff from barnyards; and fields spread with manure.

STREAMBANKS

Ozaukee county will calculate changes in streambank sediment in terms of tons of sediment and length of eroding sites. A tally will be kept of landowners contacted, the amount of streambank sediment being generated at the time of contact, and changes in erosion levels estimated after installing best management practices. This information will be summarized and submitted to the DNR annually.

UPLAND SEDIMENT SOURCES

The county will estimate reductions in sediment delivery due to changes in cropping practices, and submit a summary annually to the DNR. Periodically, the DNR will calculate changes using the WIN model. Ozaukee County will provide data for the Wisconsin Nonpoint Model (WIN) through the Computer Assisted Management and Planning System (CAMPS).

BARNYARD RUNOFF

The county will use the "Barny Model" to estimate phosphorus reductions due to installation of barnyard control practices. This information will be summarized annually to DNR through CAMPS.

MANURE SPREADING

The county will update the inventory to identify the actual number of critical acres that each livestock operator spreads annually. The county will identify the number of critical acres where winterspreading will no longer occur as a result of implementing management practices. This information will be submitted to the DNR annually.

URBAN ADMINISTRATIVE REVIEW

ACCOMPLISHMENT REPORTING

The DNR and local units of government will jointly conduct an evaluation of the urban program components. Local units of government will report annually to the DNR on progress for "core" program activities. Reports will cover:

* Scheduled information and education activities.

* Completion of construction site erosion control ordinance modification or adoption.

* Acres of construction activity with adequate erosion control plans.

* Acres of construction activity monitored for compliance with provisions of ordinance and erosion control plans.

* Identification of needed changes in housekeeping.

* Implementation of housekeeping program changes.

Local units of government will report annually on progress for "segmented" program activities. Reports will cover:

* 1985 urban acres, by land use, covered by engineering feasibility studies.

* Acres of post 1985 urban development, by land use, covered by plans for controlling urban pollutant loads and stormwater flows.

* Acres of post 1985 urban development, by land use, not covered by plans for controlling urban pollutant loads and stormwater flows.

* Stormwater ordinance adoption or modification.

* Feet and tons of eroding streambanks addressed in detailed engineering feasibility studies.

In addition, representatives of governments addressing urban pollution issues will meet with DNR staff annually to review progress and identify workplan objectives for the subsequent year.

FINANCIAL EXPENDITURES, TIME SPENT ON PROJECT ACTIVITIES

Reporting on these items will parallel reporting specified in this plan for the rural areas.

URBAN POLLUTANT LOAD CHANGES

Local units of government will provide the following information annually to the DNR so that the DNR staff can evaluate changes in urban pollutant loading:

* 1985 urban acres, by land use, which urban stormwater practices serve, and information requested by the DNR concerning practice characteristics.

* Acres of post 1985 urban development, by land use, served by stormwater practices, and information requested by the DNR concerning practice characteristics.

* Acres of post 1985 urban development, by land use, not served by stormwater practices.

* Acres of construction site activity served by adequate erosion control practices.

* Acres of construction site activity not served by adequate erosion control practices.

* Changes in stream bank erosion, in tons and feet of erosion, due to installation of erosion control and flow reduction practices.

Source reduction activities that a community uses to reduce urban pollutant loadings should also be acknowledged. Although the effect on urban pollutant loadings may not be quantifiable, accomplishments should be recognized and publicized as having a positive impact on efforts to reduce pollutant loads.

CHAPTER VIII
WATER QUALITY EVALUATION MONITORING

INTRODUCTION

This chapter identifies general guidelines that the DNR will use to evaluate changes in water quality that result from implementation of this project. The monitoring details for this watershed will be developed as part of a comprehensive monitoring strategy to meet the evaluation needs of the remedial action and integrated resource management programs. The DNR will establish monitoring locations, procedures, staff needs, and costs within one month of the date that the DNR approves this plan. Implementation of the detailed evaluation monitoring plan will begin in the summer of 1990.

The evaluation monitoring will be conducted in at least two phases: pre-implementation monitoring to develop intensive baseline data suitable for project evaluation purposes; and final monitoring to assess changes in water quality and aquatic habitat following full implementation of the recommended nonpoint source control strategies.

An interim monitoring program may be conducted approximately midway through the implementation period following installation of some nonpoint source control practices.

PROCEDURES, CRITERIA AND SCHEDULES FOR THE MONITORING PROGRAM

The following guidelines will be used in developing the detailed evaluation monitoring program.

PHYSICAL, CHEMICAL AND OTHER RELATED EVALUATION PROCEDURES CONSIDERED IN DEVELOPING A MONITORING PROGRAM

* Chemical water quality and bottom sediment characteristics including conventional and toxic pollutants.

* Physical characteristics including stream and stormwater runoff rates and volumes and sediment quantities.

* Characteristics of stream, wetland and riparian habitats.

* Levels of bacteria and/or other pathogens in streams.

* Concentrations of toxic compounds in wildlife, fish and other aquatic life tissue.

* Characteristics of biological indicators used to determine the condition of streams including macro-invertebrate, fish, and aquatic plant communities.

* Bioassays of sediment, surface water, interstitial water, and stormwater.

* Changes in recreational uses and aesthetic characteristics.

Considerations In Selecting Monitoring Locations

The following considerations will be used to determine the locations for carrying out the field investigations necessary to evaluate the success of the priority watershed project:

* The potential for measuring changes in water quality and aquatic habitat resulting from implementation of nonpoint source controls.

* Suitability of the site for representing baseline conditions ("low" or "no" impact by nonpoint pollution sources) for water quality and aquatic communities.

* Drainage area size and complexity of impacts and sources.

* Similarity of the site to other sites, so that data can be extrapolated to sites where investigations cannot be made.

* Need for additional information to develop or confirm water resource management objectives.

* Existing or planned monitoring being conducted through other programs.

In addition to evaluating the impact of the project on surface waters, there will also be action taken to characterize the toxicity hazards associated with wet detention ponds. Information will be collected to evaluate sediment toxicity, water quality, and bioaccumulation potential.

BIBLIOGRAPHY

Southeastern Wisconsin Regional Planning Commission (SEWRPC)

1971. A Comprehensive Plan For The Milwaukee River Watershed, Volume I: Inventory Findings and Forecasts. SEWRPC, Waukesha. 514 p.

1979. A Regional Water Quality Management Plan For Southeastern Wisconsin: 2000, Volume III: Recommendations. SEWRPC, Waukesha. 309 p.

1987. A Water Resources Management Plan For The Milwaukee Harbor Estuary, Volume II: Alternative and Recommended Plans. SEWRPC, Waukesha. 373 p.

Wisconsin Department of Natural Resources (DNR)

1985. Milwaukee River Priority Watersheds Program Rural Nonpoint Source Inventory Procedures and Techniques. unpubl. report filed at Wis. Dep. Nat. Resour., Bureau of Water Resources Management, P.O. Box 7921, Madison, Wi. 53707. 27 p.

1987. Construction Site Erosion Control Model Ordinance. Pub. No. WR-231-87. DNR, Madison. 13 p.

1988. Wisconsin Construction Site Best Management Practice Handbook. Pub. No. WR-222-89. DNR, Madison.

1989. A Nonpoint Source Control Plan For The North Branch Milwaukee River Priority Watershed Project. Wis. Dep. Nat. Resour. Pub. No. WR-253-90. DNR, Madison. 161 p.

1990. A Nonpoint Source Control Plan For The East And West Branches Of The Milwaukee River Priority Watersheds Project. Wis. Dep. Nat. Resour. Pub. No. WR-255-90. DNR, Madison. 379 p.

1990. Milwaukee River Basin Integrated Management Plan, Volume 4: Milwaukee River South Watershed Integrated Resource Management Plan. Draft . DNR, Milwaukee. 215 p.

Bannerman, et. al. 1983. Evaluation Of Urban Nonpoint Source Pollution In Milwaukee County, Wisconsin, Volume I: Urban Stormwater Characteristics, Pollutant Sources, and Management By Street Sweeping. Wis. Dep. Natural Resources, Madison, Wi.

Baun, K. 1987. Wisconsin Barnyard Runoff Model User's Manual: Version 1.03. unpubl. report filed at Wis. Dep. Nat. Resour., Bureau of Water Resources Management, P.O. Box 7921, Madison, Wi. 53707. 16 p.

Baun, K. and S. Snowden, 1987. The Wisconsin (WIN) Model: Version 1.0 Model Documentation. unpubl. report filed at Wis. Dep. Nat. Resour., Bureau of Water Resources Management, P.O. Box 7921, Madison, Wi. 53707. 37 p.

Dong, et al. 1979. The IJC Menomonee River Watershed Study, Volume 6: Dispersibility Of Soils And Elemental Composition Of Soils, Sediments, And Dust And Dirt From The Menomonee River Watershed. USEPA Rep. No. EPA-905/4-79-029F. USEPA, Chicago, Il. 55 p.

Fago, D. 1984. Distribution And Relative Abundance of Fishes In Wisconsin, IV: Root, Milwaukee, Des Plains, and Fox River Basins. Wis. Dep. Nat. Resour. Tech. Bull. No. 147. DNR, Madison. 128 p.

Hilsenhoff, W. 1982. Using A Biotic Index To Evaluate Streams In Wisconsin. Wis. Dep. Nat. Resour. Tech. Bull. No. 132. DNR, Madison. 22 p.

Pitt, R. 1987. Draft Wisconsin State Construction Site Erosion Control And Stormwater Management Plan. unpubl. report filed at Wis. Dep. Nat. Resour., Bureau of Water Resources Management, P.O. Box 7921, Madison, Wi. 53707. 65 p.

Pitt, R. and J. Voorhees. 1989. Source Loading And Management Model, Volume III: User's Manual. Wis. Dep. Nat. Resour. Publ. No. WR-219-89. Wis. Dep. Nat. Resour., Madison. 96 p.

Warzyn, W. 1989. Water Resources Appraisal And Stream Classification For The Milwaukee River South Watershed. unpubl. report filed at Wis. Dep. Nat. Resour, Southeast District Headquarters, 2300 North Martin Luther King Drive, P.O. Box 12436, Milwaukee, Wi., 53212.

Young, R.A., M.A. Otterby, and A. Roos. 1982. An Evaluation System To Rate Feedlot Potential. USDA-Agricultural Research Service. Publ. ARM-NC-17. 78 p.

APPENDICES

APPENDIX A: SUMMARY OF FEDERAL STORMWATER REGULATIONS

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APPENDIX A
SUMMARY OF FEDERAL STORMWATER REGULATIONS

Federal regulations requiring permits for certain categories of stormwater discharges became effective November 16, 1990. The regulations address point sources of stormwater discharges and emphasize the use of best management practices to prevent contaminants from getting into stormwater. The Department of Natural Resources (DNR) will be the permitting authority in Wisconsin.

WHO IS REQUIRED TO APPLY FOR A PERMIT

Incorporated areas over 100,000 in population are required to apply for permits. In Wisconsin that includes the cities of Madison and Milwaukee. The DNR can also designate other communities surrounding these cities as permittees if the DNR feels they also are contributing significant amounts of pollutants to surface waters, are interconnected via drainage ways and are in the same watershed.

Other entities which are required to apply for permits include:

- Facilities currently subject to effluent limitations or performance standards.
- Manufacturing industries within Standard Industrial Classifications 20 - 39.
- Mining operations within Standard Industrial Classifications 10 - 14.
- Hazardous waste treatment, storage or disposal facilities.
- Landfills, land application sites and open dumps that receive or have received industrial waste.
- Recycling facilities (eg., scrapyards, battery reclaimers).
- Steam electric generating plants.
- Transportation facilities within Standard Industrial Classification 40, 41, 42 (except 4221-4225) 43, 44, 45 and 5171 which have vehicle maintenance shops, equipment cleaning operations and airport deicing operations.
- Treatment works over one million gallons per day in design flow treating domestic sewage or any other sewage sludge or wastewater treatment device or system over one million gallons per day in design flow.

- Construction activity resulting in the disturbance of five or more acres of land.

PERMIT APPLICATION REQUIREMENTS

Milwaukee and Madison (Incorporated Areas)

There are two parts to the permit applications for municipalities. Part One includes:

- Description of the municipality's legal authority to control discharges to the storm sewer system.

- A description of the storm sewer system including legal controls over discharges to the system, the locations of outfalls and land uses associated with each outfall, locations of any permitted discharges to the system, location of major structural controls for storm water discharges, location of landfills and location of recreation areas.

- Discharge characterization including monthly rainfall estimates, data describing the volume and quality of discharges from the system, list and description of the receiving water bodies and monitoring data from all major outfalls for pH, total chlorine, total copper, total phenol and detergents. A major outfall is one measuring 36 inches or greater in diameter or one measuring 12 inches or greater in diameter serving an industrial area or any outfall serving more then two acres of industrial area.

- A description of existing management programs to control pollutants from the municipal storm sewer system.

- A description of the fiscal resources available to proceed with Part Two of the application.

Part Two of the application includes:

- Quantitative data for five to 10 outfalls designated by the permitting authority. This includes an analysis for organic pollutants, toxic metals, cyanide, total phenols among other common constituents such as suspended solids and biochemical oxygen demand.

- An estimate of the annual pollutant load to receiving waters.

- A proposed management plan to reduce pollutant loading to the maximum extent practicable. This could include ordinances to control pesticide and fertilizer applications, pet waste control ordinances, increased street sweeping, educational efforts, construction erosion control measures and installation of detention basins.

Industries and other permittees

Nonmunicipal permit applications include only one part. These applicants will need to provide the following information:

- A site map showing the topography of the facility and surrounding land owned by the permit applicant, locations of stormwater outfalls, paved areas and buildings, material storage areas, hazardous waste treatment, storage or disposal areas and surface water bodies receiving stormwater runoff.

- An estimate of the area of impervious surfaces, total area drained by each outfall, a historical description of any materials stored or used on site including spills, descriptions of stormwater controls and a description of treatment of stormwater runoff including controls for illicit discharges to the system.

- Monitoring data for any pollutants suspected to be in the stormwater based on the activities performed on site. This includes flow rates, and data and duration of the storm events during which sampling occurred.

Construction Sites

Applications for construction site permits should include a description of the location and area of disturbed land, proposed erosion control measures, a runoff coefficient of the area and the name of the receiving water.

Group Applications

Groups of potential permittees may apply using a single application if they are industries within the same SIC code. Application information is similar to that for individual permit applications but there are two parts to these applications to allow more time for the applicants to collect and organize the required data.

APPLICATION DEADLINES

Municipalities:

Milwaukee

Part 1	November 18, 1991
Part 2	November 18, 1991

Madison

Part 1	May 16, 1992
Part 2	May 16, 1993

Industries and other applicants:

November 18, 1991 (EPA is proposing to change this to October 1, 1992)

Group Applicants:

(*Send these applications directly to EPA.)

Part 1	September 30, 1991
Part 2	May 16, 1992 (EPA is proposing to change this to October 1, 1992.)

PERMIT REQUIREMENTS

Permit requirements will require management plans to prevent pollutants from contaminating stormwater. Permits may also include numeric limits. Permittees will need to become familiar with best management practices to prevent pollutants from entering stormwater. These could range from performing as many manufacturing activities indoors or under cover as possible, using good spill prevention programs, installing detention basins, education efforts, increased street sweeping, fertilizer and pesticide control ordinances, pet waste control ordinances and reducing air pollutant emissions.

Permit applications may be obtained from the Department of Natural Resources. Write to Anne Mauel, Bureau of Wastewater Management, Wisconsin Department of Natural Resources, 101 S. Webster St., Madison, WI 53707. You may also call Anne at (608) 267-7634.

A copy of the regulations may be obtained from your local library. They were published in the November 16, 1990 Federal Register and were entitled 40 CFR Part 122.

APPENDIX B
LAND DEVELOPMENT CATEGORIES AND AND DESCRIPTIONS FOR URBAN AREAS

APPENDIX B

LAND DEVELOPMENT CATEGORIES AND DESCRIPTIONS FOR URBAN AREAS

Land Use	Code	Description
Residential:		
High Density with Alleys	HRWA	Urban single and two-family housing at a density of greater than 6 units per acre, including the house, driveway, yard, alley, and streets.
High Density with No Alleys	HRNA	Urban single and two-family housing at a density of greater than 6 units per acre, including the house, driveway, yard, and streets.
Medium Density with Alleys	MRWA	Urban Single and two-family housing at a density between 2 and 6 units per acres, including the house, driveway, yard, alley and streets.
Medium Density with No Alleys	MRNA	Urban Single and two-family housing at a density between 2 and 6.5 units per acres, including the house, driveway, yard, and streets.
Low Density	LR	Urban single and two-family housing at a density of between 0.7 and 2 units per acre, including the house, driveway, yard alley and streets.
Multiple Family	MF	Housing for three or more family units from 1 to 3 stories in height. Units may be adjoined up and down, side by side, or front and rear. Includes building, yard, parking lot, and driveways.
High Rise Apartments	HIR	Housing 4 or more stories in height. Units may be adjoined up and down, side by side, or front and rear. Includes building , yard, parking lot, and driveways.
Trailer Parks	MOBR	For a mobile home or trailer park, includes all vehicle homes, the yard, driveway, and office area.
Suburban	SUBR	Urban single family housing at a density of between 0.2 and 0.6 units per acre,

		including the house driveway, yard, alley and streets.
COMMERCIAL:		
Strip Commercial	CST	Commercial areas for which the primary function involves the sale of goods and/or services. This land includes the buildings, parking lots, and streets. This category does not include buildings used for the manufacture of goods or warehouses; nor does it include nurseries, tree farms, or lumber yards.
Shopping Centers	SC	Commercial areas were the related parking lot is at least 2.5 times the size of the building's roof area. The buildings in this land use are usually surrounded by the parking lot, ad the streets.
Office Park	OP	Land use where non-retail business takes place. The buildings are usually multi storied surrounded by larger areas of lawn and landscaping. This land use includes the buildings, lawn, and road areas.
Downtown Commercial	CDT	Highly impervious downtown areas of commercial land uses.
INDUSTRIAL:		
Manufacturing	MI	Those buildings and premises which are devoted to the manufacture of products. This category also includes utility power plants.
Non-Manufacturing	LI	Those buildings which are used for the storage and/or distribution of goods awaiting further processing or sale to retailers. This category includes warehouses and wholesalers. This category also includes businesses such as lumber yards, auto salvage yards, junk yards, oil tank farms, coal and salt storage areas, grain elevators, agricultural coops, and areas for bulk storage of fertilizers and pesticides.

INSTITUTIONAL:		
Hospitals	HOSP	Medical facilities that provide inpatient overnight care. Includes nursing homes, state, county, or private facilities. Includes the buildings, grounds, parking lots, and drives.
Education	SCH	Includes any public or private primary, secondary, or college educational institutional grounds. Includes buildings, playgrounds, athletic fields, roads, parking lots, and lawn care.
Miscellaneous/Institutional	MISC	Churches and large areas of institutional property. This includes government buildings, parking lots, lawns, and road areas.
OPEN SPACES:		
Cemeteries	CEM	Includes cemetery grounds, roads, and buildings located on the grounds.
Parks	PARK	Outdoor recreational areas including municipal playgrounds, botanical gardens, arboretums, golf courses, and natural areas.
Undeveloped	OSUD	Lands that are private and publicly owned with no structures and have a complete vegetative cover. This includes vacant lots.
Lands under development	CNST	Lands not yet fully developed at the time of the survey and bare soil is present.
FREEWAY:		
Freeways	FREE	Limited access highways and the interchange areas.

APPENDIX C

PART 1: GUIDELINES FOR CALCULATING SHORELINE BUFFER WIDTHS

The following tables identify the filtering of overland flow by vegetated buffers. These tables are derived from a procedure contained in an SCS recommended article, "Predicting Runoff Pollutant Reduction in Buffer Zones Adjacent to Land Treatment Sites" by Overcash, Bingman and Westerman (Transactions of the ASAE - 1981). Minimum filter strip widths shall not fall below minimums specified in SCS Standard 393.

Table C-1. Ratios of buffer length to source field length associated with various pollutant load reductions.

Soil Type	% Reduction	Ratio
loam, silt	100%	0.7
loam or sandy	75%	0.2
clay loam	50%	0.1
silty clay loam	20%	>1.0
	10%	0.4

Table C-2. Buffer widths associated with various ratios of buffer length to source field length presented in Table C-1*

Ratio	Original Field	Reduced Field	Buffer
0.1	400 feet	365 feet	35 feet (2 rods)
	300	275	25
	200	180	20
	100	90	10
0.2	400 feet	335 feet	65 feet (4 rods)
	300	250	50 (3 rods)
	200	165	35 (2 rods)
	100	85	15 (1 rod)
0.4	400 feet	290 feet	110 feet
	300	215	85
	200	145	55
	100	70	30 (2 rods)
0.7	400 feet	240 feet	160 feet
	300	180	120
	200	120	80
	100	60	40

*Assumptions: rainfall intensity of 0.5 inches/hour; very good vegetated cover

PART 2. ALTERNATIVE PRACTICE SPECIFICATIONS AND COST SHARING POLICIES FOR ACCELERATED STREET SWEEPING

Practice Description

Use of brush or vacuum style sweepers to remove leaf litter and accumulated dirt from street surfaces on an accelerated schedule designed for improving quality of surface waters.

Purpose

In the Milwaukee River South Watershed, extensive use of wet detention and infiltration practices is needed to meet the pollutant load reductions called for in this plan. However, accelerated sweeping can be useful on an interim basis to provide some level of reduction as wet detention and infiltration practices are being phased in. Once established, urban structural practices will provide the level of pollutant load reduction required. As the structural practices are installed, accelerated sweeping can be discontinued as a water quality measure in the areas served by these practices.

The purpose of accelerated sweeping in this watershed is to provide interim protection in areas that will ultimately be served by urban structural practices.

Conditions

Cost sharing is authorized for the support of a portion of an accelerated street sweeping program for existing critical land uses.

Accelerated sweeping is defined as that meeting the schedule set forth in Tables C-3 and C-4. It consists of two parts: 1) the "base level" and 2) the "additional level". The "base level" portion of the accelerated program is not eligible for support. The "additional level" portion of the accelerated program is eligible for support.

Existing urban areas are those in existance as of the date the Department of Natural Resources approves this watershed plan.

Critical land uses are those defined for each subwatershed in Table 5-11 of this watershed plan.

Cost sharing will be effective for a 5-year period for each municipality, beginning when the community first accepts cost share funds for sweeping. Eligible cost components include:

*direct and indirect staff costs to operate the sweeper including wages, salaries, benefits, and overhead (Only cost of "additional staff", as defined in NR 120.02, is eligible),
*fuel, equipment maintenance, and equipment depreciation,
*litter disposal.

Eligible staff related costs will be supported 100% through the Local Assistance Grant Agreement. Other costs will be supported at a cost share rate of 50%. The community may negotiate with the Department of Natural Resources a flat fee cost share amount per curb mile. Cost sharing will be on a reimbursement basis.

Following the five-year period of cost share eligibility, the community must maintain at its own expense an accelerated street sweeping schedule in those areas for which it received cost sharing. This ten year period will be waived at such time the area is retro-fitted with urban structural practices consistent with the intent of this watershed plan.

Table C-3. Components of accelerated street sweeping schedules for critical urban land uses, curb & gutter drainage (acelswp)

Season(1.)	Program Description	Freeway	Commercial, Industrial	High Density Residential
Spring	Accelerated Program(2.)	-once/week: vacuum	-once/week: alternate brush & vacuum	-once/week: alternate brush & vacuum
	Base component(3.)	-once/week: brush	-once/week: brush	-twice/month: brush
	Additional component(4.)	-convert to vacuum	-convert to vacuum on alternate passes	-two added passes with vacuum
Summer	Accelerated Program	-once/week: vacuum	-once/week: alternate brush & vacuum	-twice/month: alternate brush & vacuum
	Base component(3.)	-once/week: brush	-once/week: brush	-twice/month: brush
	Additional component(4.)	-convert to vacuum	-convert to vacuum on alternate passes	-convert to vacuum on alternate passes
Fall	Accelerated Program	-once/week: vacuum	-once/week: alternate brush & vacuum	-twice/month: alternate brush & vacuum
	Base component(3.)	-once/week: brush	-once/week: brush	twice/month: brush
	Additional component(4.)	-convert to vacuum	-convert to vacuum on alternate passes	-convert to vacuum on alternate passes

1. Spring is considered to be one month (March).
   Summer is considered to be 6 months (April-September).
   Fall is considered to be 2 months(October-November).
2. The Accelerated Program is made up of the base component and the additional component.
3. This component is not eligible for cost-share assistance.
4. This component is eligible for cost share assistance.

Table C-4. Components of accelerated street sweeping schedules for critical urban land uses, grassed swale drainage
(acelswpa)

Season(1.)	Program Description	Commercial, Industrial	High Density Residential
Spring	Accelerated Program(2.)	-once/week: alternate brush & vacuum	-once/month: vacuum
	Base component(3.)	-twice/month: brush	-once/month: brush
	Additional component(4.)	-two added passes with vacuum	-convert to vacuum
Summer	Accelerated Program	-once/week: alternate brush & vacuum	-once/month: vacuum
	Base component(3.)	-twice/month: brush	-once/month: brush
	Additional component(4.)	-two added passes with vacuum	-convert to vacuum
Fall	Accelerated Program	-once/week: alternate brush & vacuum	-once/month: vacuum
	Base component(3.)	-twice/month: brush	-once/month: brush
	Additional component(4.)	-two added passes with vacuum	-convert to vacuum

1. Spring is considered to be one month (March).
   Summer is considered to be 6 months (April-September).
   Fall is considered to be 2 months(October-November).
2. The Accelerated Program is made up of the base component and the additional component.
3. This component is not eligible for cost-share assistance.
4. This component is eligible for cost share assistance.

APPENDIX D
NONPOINT SOURCE POLLUTION CONTROL GUIDELINES FOR INFILTRATION DEVICES IN URBAN AREAS

APPENDIX D

NON-POINT SOURCE POLLUTION CONTROL GUIDELINES
FOR INFILTRATION DEVICES IN URBAN AREAS

Infiltration Device Type	Residential[4]	Institutional[5]		
		Rooftop	Parking Lot	
			0 - 5,000 sq. ft.	5,000 - 500,000 sq. ft.
Infiltration Basin[1]	Pretreatment with grit chamber.[3] Depth to GW > 3 ft.	No Pretreatment. Depth to GW > 3 ft.	Pretreatment with grit chamber.[3] Depth to GW > 3 ft.	Pretreatment with grit chamber.[3] Depth to GW > 3 ft. GW monitoring recommended.
Infiltration Trench[1]	Pretreatment with grit chamber.[3] Depth to GW > 3 ft.	No Pretreatment. Depth to GW > 3 ft.	Pretreatment with grit chamber. Depth to GW > 3 ft.	Pretreatment with grit chamber.[3] Depth to GW > 3 ft. GW monitoring recommended.
Grassed Swale[2]	Pretreatment with grit chamber.[3] Depth to GW > 3 ft.	No Pretreatment. Depth to GW > 3 ft.	Pretreatment with grit chamber. Depth to GW > 3 ft.	Pretreatment with grit chamber.[3] Depth to GW > 3 ft. GW monitoring recommended.
Other Infiltration Practices	Redirect downspouts and slope driveways to lawn, for infiltration. No pretreatment.	Redirect downspouts to lawn for infiltration. No pretreatment.	Slope lots to grass buffer strip.	

[1]Infiltration should take place through a surface layer of soil where feasible, to minimize risk of groundwater contamination.
[2]Special construction techniques are required to maintain original soil permeability.
[3]Pretreatment is considered for infiltration devices to minimize maintenance. There may be incidental protection to groundwater from pretreatment devices. All pretreatment devices should be equipped with oil and grease traps.
[4]Multi- and single-family dwellings.
[5]Churches, schools, and hospitals.

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NON-POINT SOURCE POLLUTION CONTROL GUIDELINES
FOR INFILTRATION DEVICES

	Commercial[4]					
Infiltration Device Type[3]	Rooftop Runoff		Parking Lot Runoff			Storage and Loading Acres Runoff[5]
	0-10,000 sq. ft.	> 10,000 sq. ft.	0-5,000 sq. ft.	5,000-500,000 sq. ft.	>500,000 sq. ft.	
Infiltration Basin[1]	No pretreatment. Depth to GW > 3 ft.	No pretreatment. Depth to GW > 3 ft.	Pretreatment with grit chamber.[3] Depth to GW > 3 ft.	Pretreatment with grit chamber.[3] Depth to GW > 3 ft. GW monitoring recommended.	Pretreatment with wet sedimentation basin.[3] Depth to GW > 3 ft. GW monitoring recommended.	Pretreatment with grit chamber.[3] Depth to GW > 3 ft. GW monitoring recommended.
Infiltration Trench[1]	No pretreatment. Depth to GW > 3 ft.	No pretreatment. Depth to GW > 3 ft.	Pretreatment with grit chamber.[3] Depth to GW > 3 ft.	Pretreatment with grit chamber.[3] Depth to GW > 3 ft. GW monitoring recommended.	Pretreatment with wet sedimentation basin.[3] Depth to GW > 3 ft. GW monitoring recommended.	Pretreatment with grit chamber.[3] Depth to GW > 3 ft. GW monitoring recommended.
Grassed Swale[2]	No pretreatment. Depth to GW > 3 ft.	No pretreatment. Depth to GW > 3 ft.	Pretreatment with grit chamber.[3] Depth to GW > 3 ft.	Pretreatment with grit chamber.[3] Depth to GW > 3 ft. GW monitoring recommended.	Pretreatment with wet sedimentation basin.[3] Depth to GW > 3 ft. GW monitoring recommended.	Pretreatment with grit chamber.[3] Depth to GW > 3 ft. GW monitoring recommended.
Other Control Practices	Redirect downspouts to lawn for infiltration. No pretreatment.		Slope lots to grass buffer strip.			

[1]Infiltration should take place through a surface layer of soil where feasible, to minimize risk of groundwater contamination.
[2]Special construction techniques are required to maintain original soil permeability.
[3]Pretreatment is considered for infiltration devices to minimize maintenance. There may be incidental protection to groundwater from pretreatment devices. Grit chambers remove particles down to 100 u and wet sedimentation removes particles down to 40-100 u. All pretreatment devices should be equipped with oil and grease traps.
[4]Retail and service operations.
[5]The use of infiltration practices in storage areas must be reviewed on a case-by-case basis.

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NON-POINT SOURCE POLLUTION CONTROL GUIDELINES
FOR INFILTRATION DEVICES

Industrial (Non-Manufacturing)[4]					
Infiltration Device Type[3]	Rooftop Runoff		Separate Employee & Visitor Parking Lot Runoff		Storage and Loading Area Runoff[5]
	0-10,000 sq. ft.	> 10,000 sq. ft.	5,000-500,000 sq. ft.	> 500,000 sq. ft.	
Infiltration Basin[1]	No pretreatment. Depth to GW > 3 ft.	No pretreatment. Depth to GW > 3 ft.	Pretreatment with grit chamber.[3] Depth to GW > 3 ft. GW monitoring recommended.	Pretreatment with wet sedimentation basin.[3] Depth to GW > 3 ft. GW monitoring recommended.	Infiltration prohibited.
Infiltration Trench[1]	No pretreatment. Depth to GW > 3 ft.	No pretreatment. Depth to GW > 3 ft.	Pretreatment with grit chamber.[3] Depth to GW > 3 ft. GW monitoring recommended.	Pretreatment with wet sedimentation basin.[3] Depth to GW > 3 ft. GW monitoring recommended.	Infiltration prohibited.
Grassed Swale[2]	No pretreatment. Depth to GW > 3 ft.	No pretreatment. Depth to GW > 3 ft.	Pretreatment with grit chamber.[3] Depth to GW > 3 ft. GW monitoring recommended.	Pretreatment with wet sedimentation basin.[3] Depth to GW > 3 ft. GW monitoring recommended.	Pretreatment required.[3] Depth to GW > 3 ft. GW monitoring recommended.
Other Control Practices	Redirect downspouts and driveways to lawn for infiltration. No pretreatment.				

[1]Infiltration should take place through a surface layer of soil where feasible, to minimize risk of groundwater contamination.
[2]Special construction techniques are required to maintain original soil permeability.
[3]Pretreatment is considered for infiltration devices to minimize maintenance. There may be incidental protection to groundwater from pretreatment devices. All pretreatment devices should be equipped with oil and grease traps.
[4]Good materials management practices should be practiced to prevent the risk of generating contaminated runoff in the first place.

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NON-POINT SOURCE POLLUTION CONTROL GUIDELINES
FOR INFILTRATION DEVICES

Industrial (Manufacturing)[4]				
Infiltration Device Type[3]	Rooftop Runoff		Separate Employee & Visitor Parking Lot Runoff	Storage and Loading Area Runoff[5]
	0-10,000 sq. ft.	> 10,000 sq. ft.		
Infiltration Basin[1]	Infiltration prohibited.	Infiltration prohibited.	Infiltration prohibited.	Infiltration prohibited.
Infiltration Basin[1]	Infiltration prohibited.	Infiltration prohibited.	Infiltration prohibited.	Infiltration prohibited.
Grassed Swale[2]	Pretreatment[3]. Depth to GW > 3 ft. GW monitoring recommended.	Pretreatment[3]. Depth to GW > 3 ft. GW monitoring recommended.	Pretreatment[3]. Depth to GW > 3 ft. GW monitoring recommended.	Pretreatment[3]. Depth to GW > 3 ft. GW monitoring recommended.
Other Control Practices				

[1]Infiltration should take place through a surface layer of soil where feasible, to minimize risk of groundwater contamination.
[2]Special construction techniques are required to maintain original soil permeability.
[3]Pretreatment is considered for infiltration devices to minimize maintenance. There may be incidental protection to groundwater from pretreatment devices. All pretreatment devices should be equipped with oil and grease traps.
[4]For the purpose of this table, industrial (manufacturing) consists of production industries. An example would be an industry with smokestacks that have the potential for emitting particulates that will settle on building rooftops and parking lots.
[5]Good materials management practices should be practiced to prevent the risk of generating contaminated runoff in the first place.

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APPENDIX E
MILWAUKEE RIVER PROGRAM BASINWIDE EDUCATIONAL GOALS

BASINWIDE GOAL PERTAINING TO EDUCATION

Educate key audiences regarding nonpoint source pollution and related resource management problems and solutions, thereby facilitating public involvement, informed decisionmaking, and plan implementation.

INFORMATION AND EDUCATION SUBCOMMITTEE-ADOPTED GOALS

The best available techniques, including research and survey results, will be utilized in educational strategy development, implementation, and evaluation. The Milwaukee River Priority Watersheds Information and Education Program will strive to:

* Improve the awareness/understanding of the watershed as a system, water quality problems, and the benefits available through integrated resources management, particularly nonpoint source pollution control.

* Inform people about the potentials of and instill a sense of responsibility or ethic for the natural resources within the Milwaukee River Basin.

* Achieve widespread participation in and support for the priority watershed and integrated resource management programs through the involvement of broadly-based and diverse groups.

* Develop and maintain a clear understanding of the steps the program will be taking among rural and urban landowners and users, watershed communities, community leaders, and other groups.

* Optimize both the use of rural and urban nonpoint source pollution control measures through voluntary cooperation, and the integrated use of complementary resource management techniques.

* Coordinate and cooperate with other federal, state, and local programs and promote all appropriate implementation strategies (including mandatory controls, where warranted) as mechanisms to achieve water quality improvements.

APPENDIX F
DESCRIPTION OF WATERSHED-SPECIFIC INFORMATION AND EDUCATION MATERIALS AND EVENTS

INTRODUCTION

This appendix to the educational strategy primarily addresses watershed-specific activities for the Milwaukee River South Watershed. However, some basinwide and statewide activities are included due to their importance for project success. Descriptions of other basinwide and statewide activities are included in the Urban Water Quality Information and Education Strategy for the Milwaukee River Program (Johnson, 1989).

NEWSLETTERS

Newsletters will be used to convey information to targeted groups such as local government officials, rural landowners, civic and environmental groups, fishing and boating groups, business and industry associations, interested citizens and other likely participants in the Milwaukee River Program. The objectives of newsletters will be to:

* Supply basic information on the program.
* Provide updates on important elements of the program including dates of upcoming events.
* Improve understanding of nonpoint source pollution problems and causes.
* Increase appreciation of lakes, streams and related natural resources in the watershed.
* Introduce landowners to recommended management practices.
* Provide information on available assistance including cost-sharing.
* Build a sense of momentum by providing information on participation and implemented practices.

Newsletters will be distributed to key audiences within the watershed and used as handouts at public meetings, tours and exhibits.

Many issues in the Milwaukee River Program transcend watershed boundaries and interest groups often have regional membership. Therefore, newsletters may be most efficiently written and distributed at the basinwide, rather than watershed level.

The lead responsible party for watershed newsletters will be the area UW-Extension Water Quality staff with state specialist assistance. Other UW-Extension, DNR and LCD staff will also be involved in newsletter preparation and distribution.

WATERSHED FOLDERS AND FACT SHEETS

Watershed folders will be used to communicate basic information about the watershed project and serve as "cover pieces" for educational packets assembled to meet the needs of rural landowners/operators and local government officials. Folders will contain different sets of information and education materials, including fact sheets, depending upon the audience groups to which it will be given.

Folders will bear a Milwaukee River Program rather than a watershed-specific identity. Most of the fact sheets will have basinwide or statewide applicability and be produced at those levels. An exception may be demonstration project fact sheets and write-ups describing good management practices which are viewed as "informal demonstrations." These could be localized to this watershed project.

County LCD staff will assemble the rural watershed folder contents and, in conjunction with County UW-Extension staff, draft fact sheets on demonstrations. DNR staff, with county or area UW-Extension staff assistance, will assemble the local government folder contents. Area UW-Extension staff will have the lead responsibility for publishing demonstration project fact sheets and Milwaukee River Program fact sheets. State UW-Extension specialists and DNR and DATCP staff will develop or assist with the development of fact sheets on rural and urban best management practices with statewide applicability.

WATERSHED SLIDE PROGRAM(S)

An automated slide program will be developed for use at public meetings, community group programs and volunteer training sessions. The program will have some modules which can be used throughout the basin such as those explaining the Milwaukee River Program, nonpoint source pollution, and rural and urban practices for abating nonpoint source pollution. Other modules will be specific to the watershed such as those explaining local nonpoint source pollution problems and causes, local examples of nonpoint source pollution abatement practices, landowner survey(s), inventory data, and plan recommendations.

County LCD and UW-Extension staff will provide slides and information for the watershed-specific portions of the slide program, will locally adapt basinwide portions of the program, and use the program for public meetings, community group programs and volunteer training sessions. The DNR or state or area UW-Extension staff will prepare many of the slides, especially graphic summaries of landowner surveys, inventory data and plan recommendations. Area UW-Extension Water Quality staff will be responsible for coordinating the production of the slide program.

LOCAL EXHIBITS

Exhibits on the Milwaukee River Program, on urban and rural nonpoint source pollution, on specific watershed plans and on best management practices will be used at county fairs, festivals, shows and other special events in the watershed. The purpose or focus of these exhibits will change as the program progresses. Thus interchangeable groups of exhibit components will be developed to cover a variety of themes.

Arrangements for use of exhibits in local areas will be the responsibility of county UW-Extension and Land Conservation Department (LCD) staff with assistance from area UW-Extension and district DNR staff. Most materials for the exhibits will be developed by area UW-Extension and district DNR staff. Watershed advisory committee members and other volunteers will staff exhibits whenever possible to augment staff resources.

MEDIA CONTACTS

An active program to involve the media in covering watershed events begins with conferences with the major newspapers and television stations in the watershed to further acquaint editors and reporters with the Milwaukee River Program. The lead responsible person for this activity is the public information officer for the DNR Southeast District. The Milwaukee River program coordinator and UW-Extension staff will also be involved.

News releases will be distributed to local newspapers, television and radio stations to announce watershed events such as tours, public information meetings, plan completion/amendment, demonstration project installations and grant awards. The lead responsible agency for the news releases will vary depending on which agency or private group is responsible for a particular event.

Newspaper feature articles and appearances on radio talk shows and television interview programs will be sought to provide more in-depth coverage of the program. Special feature articles or interview shows may involve direct participation by state or district DNR or UW-Extension staff.

County UW-Extension staff will be responsible for covering water quality issues in their regular radio talk shows and newspaper columns. Background material for radio programs and newspaper columns will often be prepared at the basinwide or state level, although county staff will prepare materials related to their field of expertise.

SERIES OF NEWSPAPER COLUMNS AND RADIO PUBLIC SERVICE ANNOUNCEMENTS

A coordinated series of newspaper columns and radio public service announcements will be used to inform people about nonpoint source pollution and best management practices. The focus of the series will be homeowner practices such as yard care, household hazardous waste, stream corridor and lakeshore management, automobile maintenance, and pet waste disposal. General information on the Milwaukee River Program, nonpoint source pollution and best management practices for municipalities will also be included.

Development of the series of newspaper columns and radio public service announcements will be coordinated at the basinwide level, but publication or distribution will be made part of the watershed implementation program. County UW-Extension agents will adapt newspaper columns and radio public service announcements for local use and will arrange for distribution to local newspapers and radio stations. Newspaper columns will also be distributed for publication in local civic and environmental group newsletters. County Extension agents may be involved in the development of newspaper columns or public service announcements related to their areas of expertise. Supportive educational materials such as fact sheets will be available, upon request, through county Extension offices. Such fact sheets and other written materials will generally be prepared at the basinwide or statewide level.

DEMONSTRATION SITE AND KEY RURAL PRACTICES TOURS

A meeting and tour will be conducted for the existing barnyard runoff management and pesticide mixing demonstration sites--and for future demonstrations including those planned for nutrient and pesticide management and well water testing. Priority landowners needing specific information and first-hand exposure to the demonstrated practices will be invited to the event(s). Transportation to and from the sites and organization around a social event such as a meal will be utilized as advisable and approved.

In addition, tours related to best management practices will be pursued as appropriate for specific audiences, making use of both formal and informal "demonstrations."

County LCD and UW-Extension staff are identified as having the major responsibility for these tours with area and state UW-Extension staff providing organizational and/or subject matter specialty assistance.

IMPLEMENTATION MEETING/TOUR

During the implementation phase in the watershed, a meeting and/or tour will be scheduled. The purposes of the meeting/tour will be to update local officials on program progress, to encourage more participation, and to inform the media and the public about implemented practices and water quality improvements. Rural and urban demonstration projects and other implemented practices will be featured in the meeting/tour. The meeting/tour should be scheduled before the end of the sign-up period for state cost-sharing. Implementation meetings and tours may be combined for adjacent watersheds where sign-up periods overlap.

The lead responsible party for arranging implementation meetings/tours will be the Milwaukee River Program coordinator. Assistance will also be provided by other DNR staff, county and area UW-Extension, and LCD staff.

DEMONSTRATION PROJECTS

The need for demonstrations of nonpoint source pollution control practices is being evaluated in the watershed on an ongoing basis. Where appropriate, demonstrations will be designed to enhance related natural resources such as fish and wildlife habitat as well as to improve water quality. Watershed demonstrations are evaluated according to the following criteria:

* Does the practice address an identified, major source of water pollution in the Milwaukee River Basin?

* Is the practice needed in a variety of areas in the watershed (or other parts of the Milwaukee River Basin) to achieve water quality goals?

* Is the practice unfamiliar and/or untested in the vicinity or in southeastern Wisconsin?

* Does the practice require further research and refinement before widespread application? Would a demonstration aid this process?

* Is the site proposed for the demonstration highly visible, easily accessible, or located where there would be credibility ascribed to the practice?

Milwaukee River Program staff, with the advice of watershed advisory committees and local governments, will identify and actively pursue needed demonstrations. Implementation of specific demonstrations will be the responsibility of appropriate DNR, LCD, local government and UW-Extension staff. Part of the plan for each demonstration will be an information and education element including--at a minimum--signs, slides, fact sheets and tours.

Area UW-Extension Water Quality staff will be the primary responsible party for reviewing demonstration project plans for information and education elements and printing fact sheets. County LCD staff will be the lead responsible parties for documenting costs and project progress, drafting fact sheets, taking slides and conducting tours.

SIGNS

Signs with the Milwaukee River Program logo will be used at selected locations to increase public awareness of the program. Potential sites for signs will be selected and prioritized by the Information and Education (I&E) Subcommittee. Signs will be produced via separate outside contracts. Primary responsibility for coordinating this sign project will be assigned to a staff member at the DNR Southeast District.

Signs identifying demonstration projects and other Milwaukee River Program cooperators will also be used. Wherever possible, more detailed signs explaining the watershed project and associated practices will be put up in prominent public locations such as parks, waysides, boat and fishing access sites, and river walkways.

TOWN MEETINGS

Two meetings are planned for each of the towns in the watershed in Ozaukee County. The primary purpose of town meetings scheduled for the first year of the project will be to indicate that implementation is underway and encourage participation. These meetings will also be a "courtesy call" for local officials who may be contacted by their constituents. Future meetings could be used to advise that sign-up for cost-sharing will end shortly and to offer suggestions for future involvement.

County UW-Extension and LCD staff will be responsible for these meetings. Area UW-Extension and DNR staff assistance will be available as needed for specific topics or the production of handout materials.

CITY AND VILLAGE MEETINGS

Meetings will also be scheduled with each city and village in the watershed. Purposes of the meetings scheduled during the first year of the project are to:

* Present inventory results, urban residents survey results, and plan recommendations for each community.

* Develop appropriate local assistance and cost-sharing agreements for implementation of the plan in each community.

In larger cities and villages, Milwaukee River Program staff may present the same information to municipal staff before meeting with the village board or city council. Separate meetings may also be scheduled with committees, commissions or boards of the village or city upon request.

The lead responsible party for scheduling meetings with municipal staff and elected officials will be the Milwaukee River Program coordinator. Other DNR and county or area Extension staff responsible for that watershed will provide assistance at these meetings as needed.

CONSTRUCTION EROSION CONTROL AND STORMWATER MANAGEMENT WORKSHOPS

One specific type of technical education and training assistance offered to local governments will be construction erosion control and stormwater management workshops. The workshops will be designed to provide technical information on these practices to local government staff, developers, builders, contractors and consultants. The most effective time to schedule them will be winter or early spring, before the busiest construction season.

The area UW-Extension urban water quality educator will be responsible for organizing these workshops. Materials for use in the workshops will be developed on a basinwide or state level. The "Wisconsin Construction Site Best Management Practice Handbook" will be the basic text for the workshop. DNR will provide copies of the handbook, but fees will cover remaining out-of-pocket expenses. DNR and LCD staff will assist with the workshops by speaking, developing handouts, evaluating results and providing publicity. County UW-Extension offices will assist with publicity and registration.

INDIVIDUAL CITY AND VILLAGE EDUCATIONAL PROGRAMS

Each city and village will have an information and education element included in any local assistance or cost-sharing agreement. At a minimum, these will include:

* Publicity for new leaf collection and street sweeping programs.

* Publicity for pet waste cleanup ordinances.

* Publicity for local waste oil recycling and hazardous waste collection programs.

* Information for the construction industry about new or changed local construction erosion control and stormwater management ordinances.

* Training of local government staff for construction erosion control, stormwater management, and streambank stabilization.

City and village staff will be responsible for implementing their community's information and education program. Appropriate county or area UW-Extension and DNR staff will assist local governments in the development and implementation of information and education programs for their residents, businesses and industries. DNR and Extension staff will also provide information on urban best management practices to city and village officials through telephone contacts, attending local government meetings, providing workshops, or other educational means.

Area and county UW-Extension staff will assist with the development of printed materials and with arranging workshops on urban best management practices. Specifically, the watershed project educational program for municipalities will require a series of fact sheets or brochures on urban "housekeeping" practices for water quality protection on the following general subjects:

* Reduction in pet waste runoff.

* Improved efficiency of leaf collection and street sweeping.

* Proper use and disposal of car care products and lawn-garden chemicals.

* Encouragement of precipitation infiltration and detention rather than runoff.

Many of these printed materials have been initiated through the "Yard Care and the Environment" fact sheet series under the leadership of area UW-Extension staff. These fact sheets will be formatted to allow easy adaptation and reprinting by city and village staff.

PROGRAMS FOR LOCAL GROUPS

To provide an organized approach for soliciting and meeting program requests from local groups, the Milwaukee River Program is developing a speakers bureau. Members of the speakers bureau will include state and local

government staff and members of the advisory committees. State or area staff, or contracted private or public agencies will develop videotapes, slide programs and supportive educational materials on a statewide or basinwide level for use by the speakers bureau.

The primary responsibility for maintaining the speakers bureau database will belong to the DNR Southeast District. Area UW-Extension staff will play a role in developing or coordinating the development of needed materials. Area and county UW-Extension, LCD, DNR and DATCP staff will publicize and participate in the speakers bureau and the development of information and education materials according to their areas of interest and available time.

YARD CARE PROGRAMS

Yard care information and education activities will be provided for urban residents as well as lake property owners. These activities will include a training program for volunteer leaders, a slide program on alternative yard care practices, printed materials, InfoSource taped messages, model yard contests or demonstrations, and a state fair exhibit.
Master gardeners and other volunteer leaders will be trained by county UW-Extension agents to provide programs for community groups on alternative yard care practices that reduce or prevent nonpoint source pollution. These programs will include topics such as reduced fertilizer use, alternative pest management techniques, yard waste reduction and reuse, selecting plants appropriate to the site, vegetative buffers for lakeshores and streambanks, and infiltration of stormwater.

County UW-Extension agents will train volunteers and coordinate model yard contests/demonstrations. Materials for the yard care program, including the "Yard Care and the Environment" fact sheet series, will be developed by county and area UW-Extension staff with state specialist assistance.

SCHOOL CURRICULUM AND TEACHER WORKSHOPS

Given the lack of knowledge evidenced by surveys of residents in the Milwaukee River Basin, nonpoint source pollution--causes, impacts and corrective actions--is a subject which should be included in the curriculum development process. Part of the curriculum development for schools in the basin should be materials on the Milwaukee River including: geology, history of use, fish and aquatic organisms, pollution problems and clean-up programs.

The lead responsible parties for curriculum development and associated teachers workshops and in-services will be private and public nature and environmental centers, DNR, and UW-Extension staff who work with school groups. These organizations will submit special grant proposals to private foundations and public agencies for curriculum development, teacher training and other youth activities related to nonpoint source pollution.

SCHOOL PROGRAMS

A consortium of nature/environmental education centers in the Milwaukee River Basin has met with DNR and UW-Extension staff to evaluate water quality education opportunities for teachers and students. The conclusion of the group is that a variety of environmental awareness programs that include water

quality are available for elementary and middle school teachers and students. However, programs for high school teachers and students are lacking. Therefore, the group has formulated a grant proposal for a high school water quality monitoring program called "Testing the Waters." This proposal is modeled after the Rouge River Project in Michigan.

The lead responsible parties for this project are the private and public nature/environmental education centers, DNR and UW-Extension staff who work with school groups. These organizations will submit special grant proposals to private foundations and public agencies for "Testing the Waters" and implement the program. Additional school programs may be developed by this group or individual nature/environmental education centers in future years.

YOUTH GROUP PROGRAMS

School water quality programs will be supplemented by youth group programs including educational events and community service projects. One proposal submitted to youth groups will be the storm sewer stencilling project developed in Seattle. The objectives of this project are to teach youth and adults that storm sewers carry materials directly to local lakes and streams and to discourage dumping of pollutants such as waste oil, antifreeze and paint into them.

The lead responsible party for this project will be county UW-Extension staff who work with youth groups. Area UW-Extension and DNR staff will provide assistance in procuring materials and developing associated educational programs. Information on hazardous waste reduction, recycling and proper disposal will also be provided through this program.

ANNUAL EDUCATIONAL STRATEGY UPDATE

The Milwaukee River South Watershed educational strategy will be reviewed and updated annually. Annual updates will further define educational materials and events, costs, and timing, and include estimates for the fourth through eighth years of the project.

Area UW-Extension staff will provide the leadership role in this annual plan updating process, and will be assisted by county UW-Extension and LCD staff. DNR and DATCP staff will also play an important role in the needs identification process.

APPENDIX G
GLOSSARY

ACUTE TOXICITY:
Any poisonous effect produced by a single short-term exposure to a chemical that results in a rapid onset of severe symptoms.

ADVANCED WASTEWATER TREATMENT:
The highest level of wastewater treatment for municipal treatment systems. It requires removal of all but 10 parts per million of suspended solids and biological oxygen and/or 50% of the total nitrogen. Advanced wastewater treatment is also known as " tertiary treatment."

AGRICULTURAL CONSERVATION PROGRAM (ACP):
A federal cost-sharing program to help landowners install measures to conserve soil and water resources. ACP is administered by the USDA ASCS through county ACP committees.

ALGAE:
A group of microscopic, photosynthetic water plants. Algae give off oxygen during the day as a product of photosynthesis and consume oxygen during the night as a result of respiration. Thus algae effect the oxygen content of water. Nutrient-enriched water increases algae growth.

AMMONIA:
A form of nitrogen (NH_3) found in human and animal wastes. Ammonia can be toxic to aquatic life.

ANAEROBIC:
Without oxygen.

AREA OF CONCERN:
Areas of the Great Lakes identified by the International Joint Commission (IJC) as having serious water pollution problems.

AREAWIDE WATER QUALITY MANAGEMENT PLANS (208 PLANS):
A plan to document water quality conditions in a drainage basin and make recommendations to protect and improve basin water quality. Each basin in Wisconsin must have a plan prepared for it, according to section 208 of the Clean Water Act.

ANTIDEGRADATION:
A policy which states that water quality will not be lowered below background levels unless justified by economic and social development considerations. Wisconsin's antidegradation policy is currently being revised to make it more specific and meet EPA guidelines.

AVAILABILITY:

The degree to which toxic substances or other pollutants that are present in sediments or elsewhere in the ecosystem are available to affect or be taken up by organisms. Some pollutants may be "bound up" or unavailable because they are attached to clay particles or are buried by sediment. The amount of oxygen, pH, temperature and other conditions in the water can affect availability.

BACTERIA:

Single-cell, microscopic organisms. Some can cause disease, and some are important in the stabilization of organic wastes.

BASIN PLAN:

See "Areawide Water Quality Management Plan".

BENTHIC ORGANISMS (BENTHOS):

The organisms living in or on the bottom of a lake or stream.

BEST MANAGEMENT PRACTICE (BMP):

The most effective, practical measures to control nonpoint sources of pollutants that runoff from land surfaces.

BIOACCUMULATION:

The uptake and retention of substances by an organism from its surrounding medium and from its food. Chemicals move through the food chain and tent to end up at higher concentrations in organisms at the upper end of the food chain such as predator fish, or in people or birds that eat these fish.

BIOASSAY STUDY:

A test for pollutant toxicity. Tanks of fish or other organisms are exposed to varying doses of treatment plant effluent; lethal doses of pollutants in the effluent are thus determined.

BIOCHEMICAL OXYGEN DEMAND (BOD):

A measure of the amount of oxygen consumed in the biological processes that break down organic matter in water. BOD_5 is the biochemical oxygen demand measured in a five day test. The greater the degree of pollution, the higher the BOD_5.

BIODEGRADABLE:

Waste which can be broken down by bacteria into basic elements. Most organic wastes such as food remains and paper are biodegradable.

BIOTA:

All living organisms that exist in an area.

BUFFER STRIPS:

Strips of grass or other erosion-resisting vegetation between disturbed areas and a stream or lake.

BULKHEAD LINES:

Legally established lines which indicate how far into a stream or lake an adjacent property owner has the right to fill. Many of these lines were established many years ago and allow substantial filling of the bed of the River and Bay. Other environmental laws may limit filling to some degree.

CARCINOGENIC:

A chemical capable of causing cancer.

CATEGORICAL LIMITS:

All point source discharges are required to provide a basic level of treatment. For municipal wastewater treatment plants this is secondary treatment (30 mg/l effluent limits for SS and BOD). For industry the level is dependent on the type of industry and the level of production. More stringent effluent limits are required if necessary to meet water quality standards.

CHLORINATION:

The application of chlorine to wastewater to disinfect it and kill bacteria and other organisms.

CHLORORGANIC COMPOUNDS (CHLORORGANICS):

A class of chemicals which contain chlorine, carbon and hydrocarbon. Generally refers to pesticides and herbicides that can be toxic. Examples include PCB's and pesticides such as DDT and dieldrin.

CHRONIC TOXICITY:

The effects of long-term exposure of organisms to concentrations of a toxic chemical that are not lethal is injurious or debilitating to an organism in one or more ways. An example of the effect of chronic toxicity could be reduced reproductive success.

CLEAN WATER ACT:

See "Public Law 92-500."

COMBINED SEWERS:

A wastewater collection system that carries both sanitary sewage and stormwater runoff. During dry weather, combined sewers carry only wastewater to the treatment plant; during heavy rainfall, the sewer becomes swollen with stormwater. Because the treatment plant cannot process the excess flow, untreated sewage is discharged to the plant's receiving waters, i.e., combined sewer outflow.

CONFINED DISPOSAL FACILITY (CDF):

A structure built for the containment and disposal of dredged material.

CONGENERS:

Chemical compounds that have the same molecular composition, but have different molecular structures and formula. For example, the congeners of PCB have chlorine located at different spots on the molecule. These differences can cause differences in the properties and toxicity of the congeners.

CONSERVATION TILLAGE:
Planting row crops while disturbing the soil only slightly. In this way a protective layer of plant residue says in the surface; erosion is decreases.

CONSUMPTION ADVISORY:
A health warning issues by WDNR and WDHSS that recommends that people limit the fish they eat from some rivers and lakes based on the levels of toxic contaminants found in the fish.

CONTAMINANT:
Some material that has been added to water that is not normally present. This is different from a pollutant, as a pollutant suggests that there is too much of the material present.

CONVENTIONAL POLLUTANT:
Refers to suspended solids, fecal coliforms, biochemical oxygen demand, and pH, as opposed to toxic pollutants

COST-EFFECTIVE:
A level of treatment or management with the greatest incremental benefit for the money spent.

CRITERIA:
See water quality standard criteria.

DDT:
A chlorinated hydrocarbon insecticide that has been banned because of its persistence in the environment.

DIOXIN (2,3,7,8-tetrachlorodibenso-p-dioxin):
A chlorinated organic chemical which is highly toxic.

DISINFECTION:
A chemical or physical process that kills organism that cause disease. Chlorine is often used to disinfect wastewater.

DISSOLVED OXYGEN (DO):
Oxygen dissolved in water. Low levels of dissolved oxygen cause bad smelling water and threaten fish survival. Low levels of dissolved oxygen are often due to inadequate wastewater treatment. The Department of Natural Resources considers 5 ppm DO necessary for fish and aquatic life.

DREDGING:
Removal of sediment from the bottom of water bodies.

ECOSYSTEM:
The interacting system of biological community and its nonliving surrounding.

EFFLUENT:
Solid, liquid or gas wastes (byproducts) which are disposed on land, in water or in air. As used in the RAP generally means wastewater discharges.

EFFLUENT LIMITS:
The Department of Natural Resources issues WPDES permits that establish the maximum amount of pollutant that can be discharged to a receiving stream. Limits depend on the pollutant involved and the water quality standards that apply for the receiving waters.

EMISSION:
A direct (smokestack particles) or indirect (busy shopping center parking lot) release of any contaminant into the air.

ENVIRONMENTAL PROTECTION AGENCY (USEPA):
The federal agency responsible for enforcing federal environmental regulations. The Environmental Protection Agency delegates some of its responsibilities for water, air and solid waste pollution control to state agencies.

ENVIRONMENTAL REPAIR FUND:
A fund established by the Wisconsin Legislature to deal with abandoned landfills.

EPIDEMIOLOGY:
The study of diseases as they affect populations rather than individuals, including the distribution and incidence of a disease mortality and morbidity rated, and the relationship of climate, age, sex, race and other factors. EPA uses such data to establish national air quality standards.

EROSION:
The wearing away of the land surface by wind or water.

EUTROPHIC:
Refers to a nutrient-rich lake. Large amounts of algae and weeds characterize a eutrophic lake (see also "Oligotrophic" and "Mesotrophic").

EUTROPHICATION:
The process of nutrient enrichment of a lake loading to increased production of aquatic organisms. Eutrophication can be accelerated by human activity such as agriculture and improper waste disposal.

FACILITY PLAN:
A preliminary planning and engineering document that identifies alternative solutions to a community's wastewater treatment problems.

FECAL COLIFORM:
A group of bacteria used to indicate the presence of other bacteria that cause disease. The number of coliform is particularly important when water is used for drinking and swimming.

FISHABLE AND SWIMMABLE:
Refers to the water quality goal set for the nation's surface waters by Congress in the Clean Water Act. All waters were to meet this goal by 1984.

FLOURANTHENE:
A polyaromatic hydrocarbon (PHA) with toxic properties.

FLY ASH:
Particulates emitted from coal burning and other combustion, such as wood burning, and exited into the air from stacks, or more likely, collected by electrostatic precipitators.

FOOD CHAIN:
A sequence of organisms in which each uses the next as a food source.

FURANS (2,3,7,8-tetra-chloro-dibenzpfurans):
A chlorinated organic compound which is highly toxic.

GREEN STRIPS:
See buffer strip.

GROUNDWATER:
Underground water-bearing areas generally within the boundaries of a watershed, which fill internal passageways of porous geologic formations (aquifers) with water which flows in response to gravity and pressure. Often used by the source of water for communities and industries.

HABITAT:
The place or type of site where a plant or animal naturally lives and grows.

HEAVY METALS:
Metals present in municipal and industrial wastes that pose long-tern environmental hazards if not properly disposed. Heavy metals can contaminate ground and surface waters, fish and other food stuffs. The metals of most concern are: Arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium and zinc (see also separate listings of these metals for their health effects).

HERBICIDE:
A type of pesticide that is specifically designed to kill plants and can also be toxic to other organisms.

HYDROCARBONS:
Any of a large family of chemicals containing carbon and hydrogen in various combinations.

INCINERATOR:
A furnace designed to burn wastes.

INFLUENT:

Influent for an industry would be the river water that the plant intakes for use in its processing. Influent to a municipal treatment plant is untreated wastewater.

IN-PLACE POLLUTION:

As used in the RAP refers to pollution from contaminated sediments. These sediments are polluted from post discharges from municipal and industrial sources.

INTERNATIONAL JOINT COMMISSION (IJC):

An agency formed by the United States and Canada to guide management of the Great Lakes and resolve border issues.

ISOROPYLBIPHENYL:

A chemical compound used as a substitute for PCB.

LANDFILL:

A conventional sanitary landfill is "a land disposal site employing an engineered method of disposing of solid wastes on land in a manner that minimizes environmental hazards by spreading solid wastes in thin layers, materials at the end of each operating day". Hazardous wastes frequently require various types of pretreatment before they are disposed of, i.e., neutralization chemical fixation encapsulation. Neutralizing and disposing of wastes should be considered a last resort. Repurifying and reusing waste materials or recycling them for another use may be less costly.

LC-1:

The concentration that results in 1 percent mortality of the test animal populations exposed to the contaminant.

LC_{50}:

Lethal concentration for 50% of the test population exposed to a toxicant substance.

LD_{50}:

Lethal dose for 50% of the test population exposed to a toxicant substance.

LEACHATE:

The contaminated liquid which seeps from a pile or cell of solid materials and which contains water, dissolved and decomposing solids. Leachate may enter the groundwater and contaminate or inking water supplies.

LOAD:

The total amount of materials or pollutants reaching a given local.

MACROPHYTE:

A rooted aquatic plant.

MASS:

The amount of material a substance contains after measured by its weight (in a gravitational field).

MASS BALANCE:

A study that examines all parts of the ecosystem to determine the amount of toxic or other pollutant present, its sources, and the processes by which the chemical moves through the ecosystem.

MESOTROPHIC:

Refers to a moderately fertile nutrient level of a lake between the oligotrophic and eutrophic levels. (See also "Eutrophic" and "Oligotrohpic.")

MILLIGRAMS PER LITER (mg/l):

A measure of the concentration of substance in water. For most pollution measurement this is the equivalent to "parts per million".

MITIGATION:

The effort to lessen the damages caused, by modifying a project, providing alternatives, compensating for losses. or replacing lost values.

MIXING ZONE:

The portion of a stream or lake in which effluent is allowed to mix with the receiving water. The size of the area depends on the volume and flow of the discharge and receiving water. For streams the mixing zone is one-third of the lowest flow that occurs once every 10 years for a seven day period.

NONPOINT SOURCE POLLUTION (NSP):

Pollution whose sources cannot be traced to a single point such as a municipal or industrial wastewater treatment plant discharge pipe. Nonpoint sources include eroding farmland and construction sites, urban streets, and barnyards. Pollutants from these sources reach water bodies in runoff, which can best be controlled by proper land management.

NPS:

See nonpoint source pollution.

OLIGOTROPHIC:

Refers to an unproductive and nutrient-poor lake. Such lakes typically have very clear water. (See also "Eutrophic" and "Mesotrophic.")

OUTFALL:

The mouth of a sewer, drain, or pipe where effluent from a wastewater treatment plant is discharged.

PATHOGEN:

Any infective agent capable of producing disease; may be a virus, bacterium, protozoan, etc.

PELAGIC:
Referring to open water portion of a lake.

PESTICIDE:
Any chemical agent used for control of specific organisms, such as insecticides, herbicides, fungicides, etc.

PH:
A measure of acidity or alkalinity, measured on a scale of 0 to 14 with 7 being neutral and 0 being most acid, and 14 being most alkaline.

PHENOLS:
Organic compounds that are byproducts of petroleum refining, textile, dye, and resin manufacture. High concentrations can cause taste and odor problems in fish. Higher concentration can be toxic to fish and aquatic life.

PHOSPHORUS:
A nutrient that when reaching lakes in excess amounts can lead to overfertile conditions and algae blooms.

PLANKTON:
Tiny plants and animals that live in water.

POINT SOURCES:
Sources of pollution that have discrete discharges, usually from a pipe or outfall.

POLLUTION:
The presence of materials or energy whose nature, location, or quantity produces undesired environmental effects.

POLYCHLORINATED BIPHENYLS(PCBs):
A group of 209 compounds, PCBs have been manufactured since 1929 for such common uses as electrical insulation and heating/cooling equipment, because they resist wear and chemical breakdown. Although banned in 1979 because of their toxicity, they have been detected on air, land and water, and recent surveys have found PCBs in every section for the country, even those remote from PCB manufacturers.

POLYCHLORINATED ORGANIC COMPOUNDS:
A group of toxic chemicals which contains several chlorine atoms.

PRETREATMENT:
A partial wastewater treatment required from some industries. Pretreatment removes some types of industrial pollutants before the wastewater is discharged to a municipal wastewater treatment plant.

PRIORITY POLLUTANT:
A list of toxic chemicals identified by the federal government because of their potential impact in the environment and human health. Major discharges are required to monitor for all or some of these chemicals when their WPDES permits are reissued.

PRIORITY WATERSHED:

A drainage area about 100,000 acres in size selected to receive Wisconsin Fund money to help pay the cost of controlling nonpoint source pollution. Because money is limited, only watersheds where problems are critical, control is practical, and cooperation is likely are selected for funding.

PRODUCTIVITY:

A measure of the amount of living matter which is supported by an environment over a specific period of time. Often described in terms of algae production for a lake.

PUBLIC LAW 92-500 (CLEAN WATER ACT):

The federal law that set national policy for improving and protecting the quality of the nation's waters. The law set a timetable for the cleanup of the nation's waters and stated that they are to be fishable and swimmable. This also required all discharges of pollutants to obtain a permit and meet the conditions of the permit. To accomplish this pollution cleanup billions of dollars have been made available to help communities pay the cost of building sewage treatment facilities. Amendments in the Clean Water Act were made in 1977 by passage of Public Law 95-217, and in 1987.

PUBLIC PARTICIPATION;

The active involvement of interested and affected citizens in governmental decision-making.

PUBLICLY OWNED TREATMENT WORKS (POTW):

A wastewater treatment plan owned by a city, village or other unit of government.

RAP:

See Remedial Action Plan.

RECYCLING:

The process by which waste materials are transformed into new products.

REMEDIAL ACTION PLAN:

A plan designed to restore beneficial uses to a Great Lakes Area of Concern.

REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RF/FS):

An investigation of problems and assessment of management options conducted as part of a superfund project.

RESOURCE CONSERVATION AND RECOVERY ACT OF 1976 (RCRA):

This federal law amends the Solid Waste Disposal Act of 1965 and expands on the Resource Recovery Act of 1970 to provide a program which regulates hazardous wastes, to eliminate open dumping and to promote solid waste management programs.

RETRO-FIT:
The placement of an urban structural practice in an existing urban area, which may involve rerouting existing storm sewers and/or relocating existing buildings or other structures.

RIPARIAN:
Belonging or relating to the bank of a lake, river or stream.

RIPRAP:
Broken rock, cobbles, or boulders placed on the bank of a stream to protect it against erosion.

RULE:
Refers to Wisconsin administrative rules. See Wisconsin Administrative Code.

RUNOFF:
Water from rain, snow melt, or irrigation that flows over the ground surface and returns to streams. Runoff can collect pollutants from air or land and carry them to receiving waters.

SECONDARY IMPACTS:
The indirect effects that an action can have on the health of the ecosystem or the economy.

SECONDARY TREATMENT:
Two-stage wastewater treatment that allows the coarse particles to settle out, as in primary treatment, followed by biological breakdowns of the remaining impurities. Secondary treatment commonly removes 90% of the impurities. Sometimes "secondary treatment" refers simply to the biological part of the treatment process.

SEDIMENT:
Soil particles suspended in and carried by water as a result of erosion.

SEICHES:
Changes in water levels due to the tipping of water in an elongated lake basin whereby water is raised in one end of the basin and lowered in the other.

SEPTIC SYSTEM:
Sewage treatment and disposal for homes not connected to sewer lines. Usually the system includes a tank and drain field. Solids settle to the bottom of the tank; liquid percolates through the drain field.

SLUDGE:
A byproduct of wastewater treatment; waste solids suspended in water.

SOLID WASTE:
Unwanted or discharged material with insufficient liquid to be free flowing.

STANDARDS:
See water quality standards.

STORM SEWERS:
A system of sewers that collect and transport rain and snow runoff. In areas that have separated sewers, such stormwater is not mixed with sanitary sewage.

SUPERFUND:
A federal program which provides for cleanup of major hazardous landfills and land disposal areas.

SUSPENDED SOLIDS (SS):
Small particles of solid pollutants suspended in water.

SYNERGISM:
The characteristic property of a mixture of toxicants that exhibits a greater-that-additive cumulative toxic effect.

TACs:
Technical advisory committees that assisted in the development of the Remedial Action Plan.

TERTIARY TREATMENT:
See advanced wastewater treatment.

TOP-DOWN MANAGEMENT:
A management theory that uses biomanipulation, specifically the stocking of predator species of fish to improve water quality.

TOTAL MAXIMUM DAILY LOADS:
The maximum amount of a pollutant that can be discharged into a stream without causing a violation of water quality standards.

TOXIC:
An adjective that describes a substance which is poisonous, or can kill or injure a person or plants and animals upon direct contact or long-term exposure. (Also, see toxic substance.)

TOXIC SUBSTANCE:
A chemical or mixture of chemicals which through sufficient exposure, or ingestion, inhalation of assimilation by an organism, either directly from the environment or indirectly by ingestion through the food chain, will, on the basis of available information cause death, disease, behavioral or immunologic abnormalities, cancer, genetic mutations, or development of physiological malfunctions, including malfunctions in reproduction or physical deformations, in organisms or their offspring.

TOXICANT:
See toxic substance.

TOXICITY:
The degree of danger posed by a toxic substance to animal or plant life. Also see acute toxicity, chronic toxicity and additivity.

TOXICITY REDUCTION EVALUATION:
A requirement for a discharger that the causes of toxicity in an effluent be determined and measures taken to eliminate the toxicity. The measures may be treatment, product substitution, chemical use reduction or other actions that will achieve the desired result.

TREATMENT PLANT:
See wastewater treatment plant.

TROPHIC STATUS:
The level of growth or productivity of a lake as measured by phosphorus content, algae abundance, and depth of light penetration.

TURBIDITY:
Lack of water clarity. Turbidity is usually closely related to the amount of suspended solids in water.

UNIVERSITY OF WISCONSIN-EXTENSION (UWEX):
A special outreach, education branch of the state university system.

VARIANCE:
Government permission for a delay or exception in the application of a given law, ordinance or regulation. Also, see water quality standard variance.

VOLATILE:
Any substance that evaporates at a low temperature.

WASTELOAD ALLOCATION:
Division of the amount of waste a stream can assimilate among the various dischargers to the stream. Results in the limit on the amount (in pounds) of chemical or biological constituent discharged from a wastewater treatment plant to a water body.

WASTEWATER:
Water that has become contaminated as a byproduct of some human activity. Wastewater includes sewage, washwater and the water-borne wastes of industrial processes.

WASTE:
Unwanted materials left over from manufacturing processes, refuse from places of human habitation or animal habitation.

WASTEWATER TREATMENT PLANT:
A facility for purifying wastewater. Modern wastewater treatment plants are capable of removing 95% of organic pollutants.

WATER QUALITY AGREEMENT:
The Great Lakes Water Quality agreement was initially signed by Canada and the United States in 1972 and was subsequently revised in 1978 and 1987. It proves guidance for the management of water quality, specifically phosphorus and toxics, in the Great Lakes.

WATER QUALITY LIMITED SEGMENT:
A section of river where water quality standards will not be met if only categorical effluent standards are met.

WATER QUALITY CRITERIA:
A measure of the physical, chemical or biological characteristics of a water body necessary to protect and maintain different water uses (fish and aquatic life, swimming, etc.).

WATER QUALITY STANDARDS:
The legal basis and determination of the use of a water body and the water quality criteria, physical, chemical, or biological characteristics of a water body, that must be met to make it suitable for the specified use.

WATER QUALITY STANDARD VARIANCE:
When natural conditions of a water body preclude meeting all conditions necessary to maintain full fish and aquatic life and swimming a variance may be granted.

WATERSHED:
The land area that drains into a lake or river.

WETLANDS:
Those areas that are inundates or saturated by surface or groundwater at a frequency and duration sufficient to support a variety of vegetative or aquatic life. Wetland vegetation requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs and similar areas.

WISCONSIN ADMINISTRATIVE CODE:
The set of rules written and used by state agencies to implement state statutes. Administrative codes are subject to public hearing and have the force of law.

WISCONSIN FUND:
A state program that helps pay the cost of reducing water pollution. Funding for the program comes from general revenues and bonds and is based on a percentage of the state;s taxable property value. The Wisconsin Fund includes these programs:

Point Source Water Pollution Abatement Grant Program - Provides grants for 60% of the cost of constructing wastewater treatment facilities. Most of this program's money goes for treatment plant construction, but 3% of this fund is available for repair or replacement of private , onsite sewer systems.

Nonpoint Source Water Pollution Abatement Grant Program - Funds to share the cost of reducing water pollution nonspecified sources are available in selected priority watersheds.

Solid Waste Grant Program - Communities planning for solid waste disposal sites are eligible for grant money. $500,000 will be available each year to help with planning costs.

WISCONSIN NONPOINT SOURCE WATER POLLUTION ABATEMENT GRANT PROGRAM:
A state cost-share program established by the State Legislature in 1978 to help pay the costs of controlling nonpoint source pollution. Also known as the nonpoint source element of the Wisconsin Fund or the Priority Watershed Program.

WISCONSIN POLLUTANT DISCHARGE ELIMINATION SYSTEM (WPDES):
A permit system to monitor and control the point source dischargers of wastewater in Wisconsin. Dischargers are required to have a discharge permit and meet the conditions it specifies.

PRIORITY WATERSHED PROJECTS IN WISCONSIN
1990

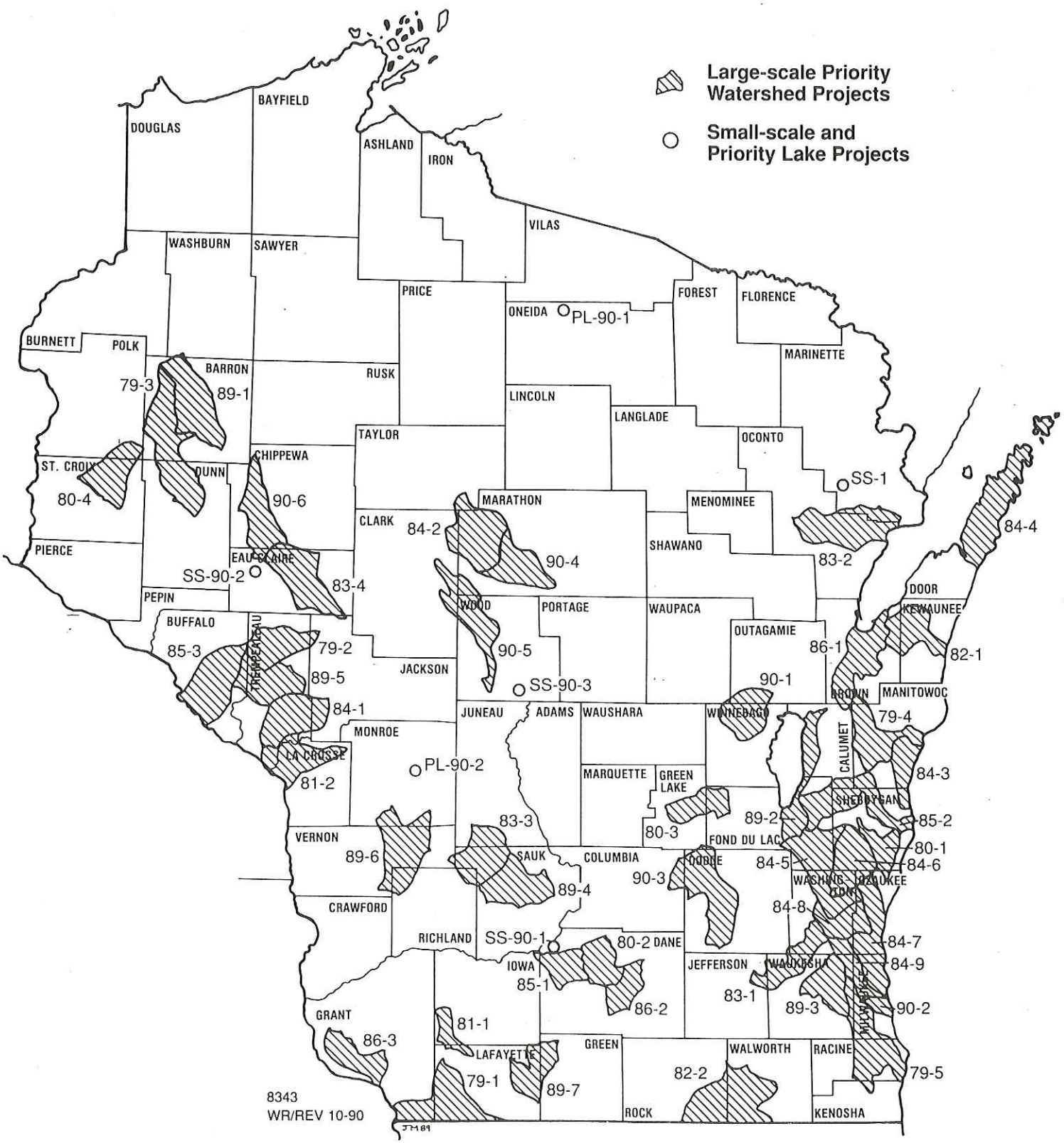
Map Number	Large-scale Priority Watershed Project	County(ies)	Year Project Selected
79-1	Galena River	Grant, Lafayette	1979
79-2	Elk Creek*	Trempealeau	1979
79-3	Hay River*	Barron, Dunn	1979
79-4	Lower Manitowoc River*	Manitowoc, Brown	1979
79-5	Root River	Racine, Milwaukee, Waukesha	1979
80-1	Onion River*	Sheboygan, Ozaukee	1980
80-2	Sixmile-Pheasant Branch Creek*	Dane	1980
80-3	Big Green Lake	Green Lake, Fond du Lac	1980
80-4	Upper Willow River	Polk, St. Crox	1980
81-1	Upper West Branch Pecatonica River	Iowa, Lafayette	1981
81-2	Lower Black River	La Crosse, Trempealeau	1981
82-1	Kewaunee River	Kewaunee, Brown	1982
82-2	Turtle Creek	Walworth, Rock	1982
83-1	Oconomowoc River	Waukesha, Washington, Jefferson	1983
83-2	Little River	Oconto, Marinette	1983
83-3	Crossman Creek/Little Baraboo River	Sauk, Juneau, Richland	1983
83-4	Lower Eau Claire River	Eau Claire	1983
84-1	Beaver Creek	Trempealeau, Jackson	1984
84-2	Upper Big Eau Pleine River	Marathon, Taylor, Clark	1984
84-3	Sevenmile-Silver Creeks	Manitowoc, Sheboygan	1984
84-4	Upper Door Peninsula	Door	1984
84-5	East & West Branch Milwaukee River	Fond du Lac, Washington, Sheboygan, Dodge, Ozaukee	1984
84-6	North Branch Milwaukee River	Sheboygan, Washington, Ozaukee, Fond du Lac	1984
84-7	Milwaukee River South	Ozaukee, Milwaukee	1984
84-8	Cedar Creek	Washington, Ozaukee	1984
84-9	Menomonee River	Milwaukee, Waukesha, Ozaukee, Washington	1984
85-1	Black Earth Creek	Dane	1985
85-2	Sheboygan River	Sheboygan, Fond du Lac, Manitowoc, Calumet	1985
85-3	Waumandee Creek	Buffalo	1985
86-1	East River	Brown, Calumet	1986
86-2	Yahara River —Lake Monona	Dane	1986
86-3	Lower Grant River	Grant	1986
89-1	Yellow River	Barron	1989
89-2	Lake Winnebago East	Calumet, Fond du Lac	1989
89-3	Upper Fox River (Ill.)	Waukesha	1989
89-4	Narrows Creek — Baraboo River	Sauk	1989
89-5	Middle Trempealeau River	Trempealeau, Buffalo	1989
89-6	Middle Kickapoo River	Vernon, Monroe, Richland	1989
89-7	Lower East Branch Pecatonica River	Green, Lafayette	1989
90-1	Arrowhead River & Daggetts Creek	Winnebago, Outagamie, Waupaca	1990
90-2	Kinnickinnic River	Milwaukee	1990
90-3	Beaverdam River	Dodge, Columbia, Green Lake	1990
90-4	Lower Big Eau Pleine River	Marathon	1990
90-5	Upper Yellow River	Wood, Marathon, Clark	1990
90-6	Duncan Creek	Chippewa, Eau Claire	1990

Map Number	Small-scale Priority Watershed Project	County(ies)	Year Project Selected
SS-1	Bass Lake	Marinette	1985
SS-90-1	Dunlap Creek	Dane	1990
SS-90-2	Lowes Creek	Eau Claire	1990
SS-90-3	Wood County Groundwater Prototype	Wood	1990

Map Number	Priority Lake Project	County(ies)	Year Project Selected
PL-90-1	Minocqua Lake	Oneida	1990
PL-90-2	Lake Tomah	Monroe	1990

** Project completed*

Priority Watershed Projects in Wisconsin
1990



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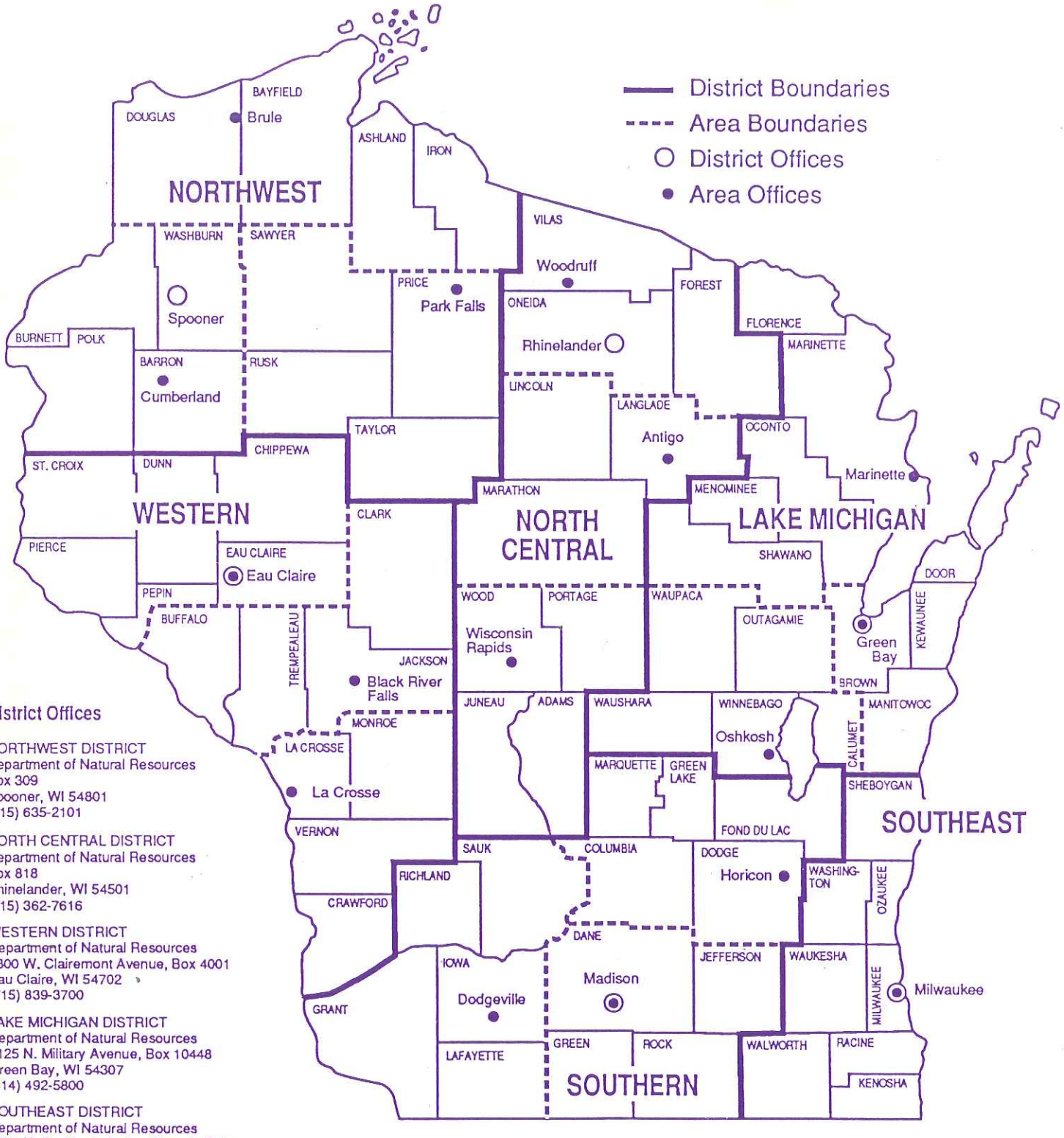
DNR Field Districts and Areas



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REV 8/91

OUR MISSION:

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

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

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

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

Wisconsin
Dept. of Natural Resources

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