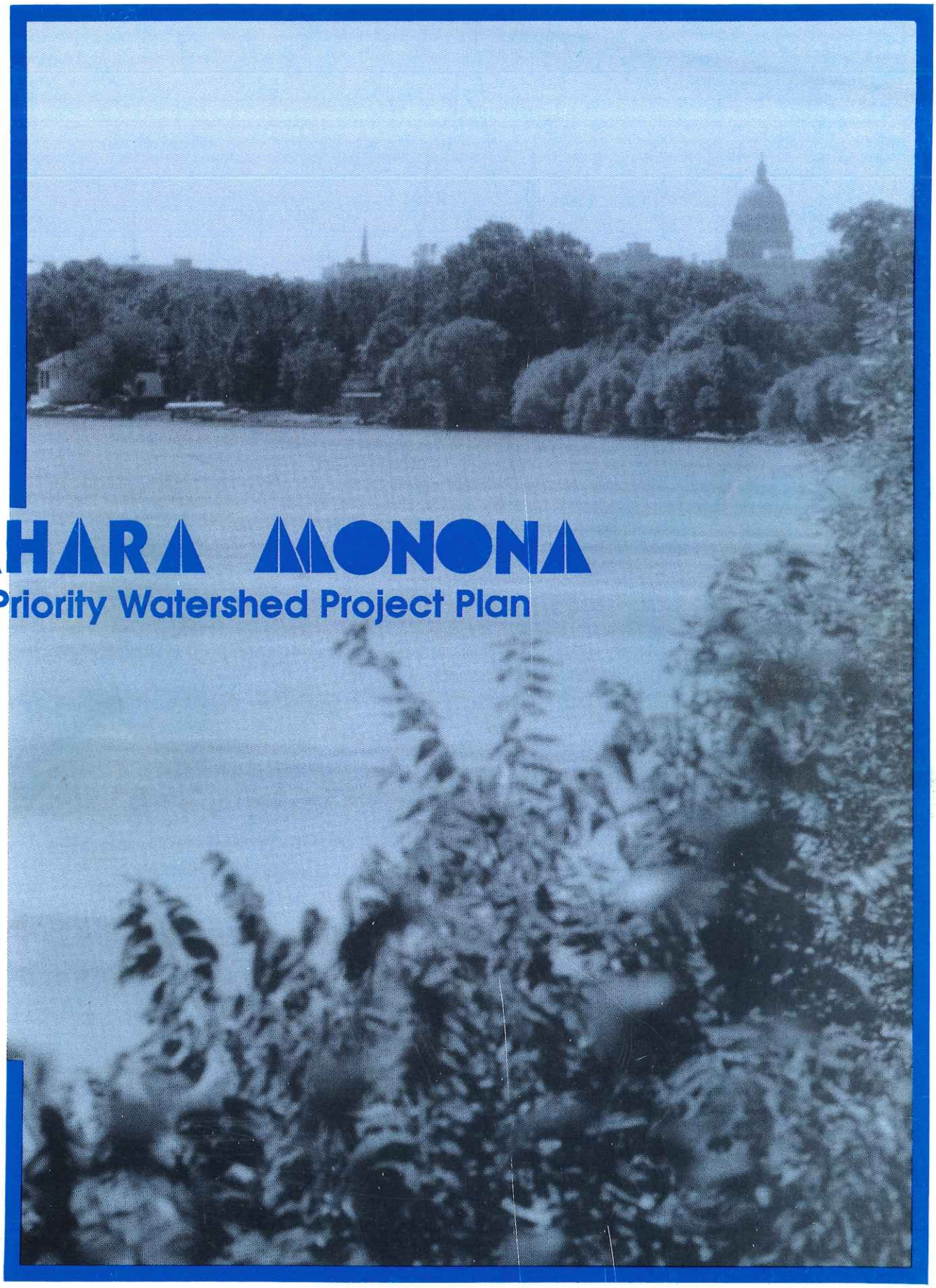

YAHARA MONONA

Priority Watershed Project Plan

Prepared by the Dane County Regional Planning Commission

RES. 109, 1991-92 08/15/91

ADOPTION OF THE YAHARA-MONONA PRIORITY WATERSHED PLAN

Dane County has supported and accepted designation of the Yahara-Monona Watershed as a Wisconsin Nonpoint Source Water Pollution Abatement Project. The Dane County Regional Planning Commission, as the official water quality planning agency for the county, was designated to prepare the watershed plan in association with the Yahara-Monona Steering Committee and state and local management agencies and units of government.

The Yahara-Monona Priority Watershed Plan is now developed for review and approval by the Dane County Board and the Wisconsin Department of Natural Resources. The plan describes and analyzes nonpoint source pollution and water quality problems in the drainage area to Lakes Monona and Waubesa, and proposes nonpoint source pollution control programs and policies to address those problems. Cost-sharing and technical assistance funds from the Wisconsin Nonpoint Program will be available for reimbursement for implementation of Best Management Practices as identified in the watershed plan. Dane County is the proposed governmental unit to assume overall project management and public information and education activities during the project implementation period and funding to support these efforts will be provided by the Nonpoint Program. The findings and management proposals in the Yahara-Monona Plan are fully consistent with the findings, policies and recommendations of the adopted Dane County Water Quality Plan and will serve to implement those policies and recommendations.

NOW, THEREFORE, BE IT RESOLVED that the Dane County Board of Supervisors hereby adopts the Yahara-Monona Priority Watershed Plan and supports its implementation.

Regional Planning and Lakes & Watershed Commissions, and Zoning & Natural Resources, Finance, and Public Works Committees recommend adoption of Res. 109. Motion carried.

Resolution RPC No. 579

ADOPTING THE YAHARA-MONONA PRIORITY WATERSHED PLAN

WHEREAS, the Dane County Water Quality Plan was prepared and adopted by the Dane County Regional Planning Commission and certified by the Governor in 1979 as the Areawide Water Quality Management Plan for Dane County, Wisconsin; and

WHEREAS, the Water Quality Plan describes and analyzes nonpoint source pollution and water quality problems throughout Dane County and proposes nonpoint source pollution abatement programs and policies to address those problems; and

WHEREAS, the Regional Planning Commission, in association with the Yahara-Monona Steering Committee and state and local management agencies, has prepared the Yahara-Monona Priority Watershed Plan, which details nonpoint source pollution problems and proposes management practices to address those problems in the Yahara-Monona Watershed; and

WHEREAS, the findings and management proposals recommended in the Yahara-Monona Priority Watershed Plan are fully consistent with the findings, policies and recommendations of the Dane County Water Quality Plan and will serve to implement those policies and recommendations;

NOW, THEREFORE, BE IT RESOLVED that the Dane County Regional Planning Commission hereby adopts the Yahara-Monona Priority Watershed Plan as a part of the Dane County Water Quality Plan and as a part of the official Master Plan for the region, and supports its implementation.

August 22, 1991
Date Adopted

Truman Nienstedt
Truman Nienstedt, Secretary

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

WISCONSIN
DEPT. OF NATURAL RESOURCES

Carroll D. Besadny
Secretary

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

March 18, 1992

Richard J. Phelps, County Executive
Dane County
Room 421 City-County Building
210 Martin Luther King Jr. Blvd.
Madison, WI 53709

Dear Mr. Phelps:

I am pleased to approve the Yahara - Monona Priority Watershed Plan prepared through the Wisconsin Nonpoint Source Water Pollution Abatement Program. This plan, prepared by the Dane County Regional Planning Commission with involvement of Dane County, cities and villages in the watershed and many citizens, meets the intent and conditions of s. 144.25, Wisconsin Statutes, and Chapter NR 120, Wisconsin Administrative Code. This plan has also been approved by the Department of Agriculture, Trade and Consumer Protection. I am also approving the Yahara - Monona Priority Watershed Plan as an amendment to the Dane County and Lower Rock Areawide Water Quality Management Plans.

I would like to express the Department's appreciation to the Dane County staff that participated in preparing this plan. The implementation of the Yahara - Monona project will be successful, and be a major step in achieving clean water in the Yahara Lakes.

We look forward to assisting Dane County and the cities and villages in the watershed in the implementation of the Yahara - Monona Priority Watershed Plan.

Sincerely,

C. D. Besadny
Secretary

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YAHARA-MONONA PRIORITY WATERSHED PLAN

EXECUTIVE SUMMARY

The quality of water resources in the Yahara-Monona Watershed is degraded from rainfall and snowmelt washing pollutants off various urban and rural land surfaces. Because of this and concerns expressed by local units of government, the watershed has been targeted for detailed management planning, educational activities, and water quality practices that can be implemented with financial assistance available through the Wisconsin Priority Watershed Program.

The Yahara-Monona Plan serves as the basis for management action; it emphasizes pollution control strategies and natural area preservation. The plan presents the specific water quality problems that exist; describes the critical sources causing these problems; and indicates what is needed to be done in order to protect and improve the conditions of lakes, streams, wetlands and groundwater in the watershed.

Major findings and water quality problems revealed in the plan include:

- Over 60 percent of the watershed is urban or urbanizing and pollution problems originate from sources such as construction site erosion and stormwater runoff from streets and parking lots. These sources contribute sediment, bacteria, nutrients and metals to waterbodies. A significant amount of rural land has high soil erosion rates, above "tolerable" soil conservation standards, and can contribute large amounts of sediment to lakes and streams. These "nonpoint" sources of pollution are most important to control in the watershed, rather than "point" sources, such as industrial or sewage treatment plant discharges.

- Wetlands and stream/lakeshore corridor lands are numerous and provide important water quality, recreation, wildlife habitat, drainage and open space functions, even though some areas have been degraded from land use activities.

- Streams such as Starkweather, Murphy (Wingra) and Nine Springs Creek suffer from poor habitat, low dissolved oxygen and flow, bank erosion and the presence of undesirable metals in bottom sediments.

- Lakes Monona, Waubesa and Wingra suffer from nuisance algae and weed growth due to high phosphorus levels in urban and rural stormwater runoff. Sediment at the bottom of Lakes Monona and Waubesa is contaminated with mercury, due in large part to past municipal and industrial wastewater discharges. Public health concerns exist over the consumption of particular fish (large walleyes) that contain mercury above recommended standards.

- Concentrations of certain metals (e.g., zinc and copper) in water being discharged from urban storm sewer pipes to lakes and streams can exceed toxicity standards for aquatic life.

- Levels of salt (chloride) and nitrate-nitrogen, which are pollution indicators, have increased in ground and surface waters. This is associated with road deicer use and suburban and agricultural land use.

- Continued urban development and agricultural uses without water quality management practices will increase pollutant discharges, and lake and stream conditions will further deteriorate. Paved surfaces from development can limit rainwater infiltration and groundwater replenishment, which may negatively impact the baseflow of streams and sensitive wetlands in the watershed.

Based on urban and rural land uses, computer models were used to determine critical pollution source areas, pollutant quantities and the effects of management practices on reducing pollutant discharges from water runoff. Small-scale drainage basins were delineated for the urban part of the watershed. Model results show that the isthmus area and the Starkweather Creek subwatershed have relatively high pollutant discharges (see Fig. 1). While these areas are of significant concern, management practices should be pursued for most of the urban land in the watershed in order to safeguard water quality. Rural model results also indicate that about 5,000 acres of cropland and 11 livestock operations should have additional management controls.

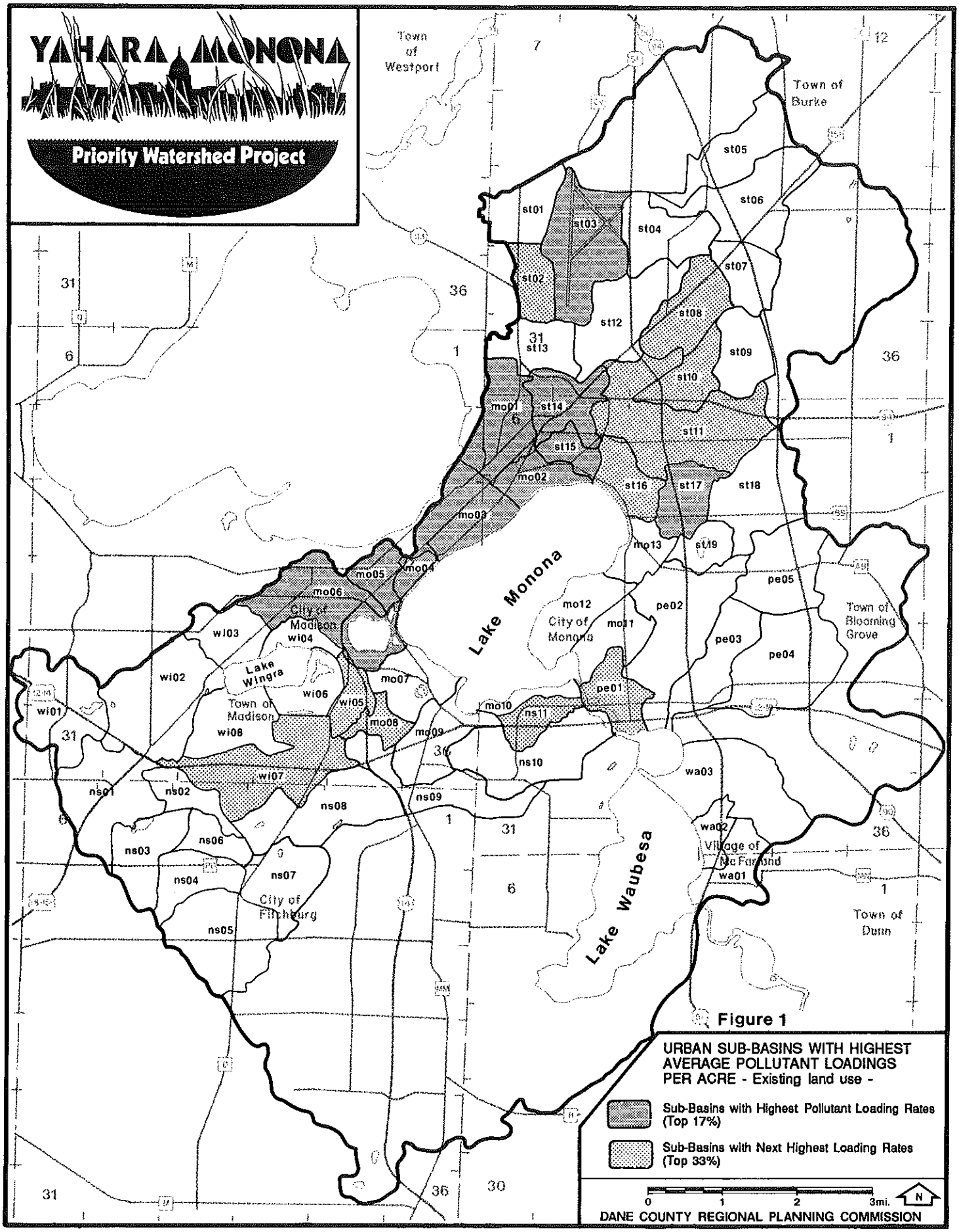
YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
Lake Monona
City of Madison
City of Monona
Lake Wingra
Town of Madison
City of Fitchburg
Lake Waubesa
Village of McFarland
Town of Bloming Grove
Town of Dunn
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Figure 1
URBAN SUB-BASINS WITH HIGHEST AVERAGE POLLUTANT LOADINGS PER ACRE - Existing land use -
Sub-Basins with Highest Pollutant Loading Rates (Top 17%)
Sub-Basins with Next Highest Loading Rates (Top 33%)
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DANE COUNTY REGIONAL PLANNING COMMISSION

Management recommendations presented in the plan to address resource concerns include:

1. **Local units of government should seek additional protection and functional enhancement of wetlands, stream/lakeshore corridor lands, and other important resource areas through land use review and regulatory procedures, acquisition, and water control practices or other management techniques, where needed. Areas in the watershed targeted for management and protection programs are displayed in Figure 2. Examples of proposed activities include streambank erosion control for Starkweather and Wingra Creeks and wetland protection and restoration along Nine Springs Creek (e.g., Dunn's Marsh), and Starkweather Creek south of East Towne Mall.**

2. **Communities should increase enforcement of their construction site erosion and runoff control ordinances and pursue measures that allow for infiltration of precipitation, such as requiring roof drainage to grassed areas for new development.**

3. **Communities should prepare stormwater management plans that include water quality protection measures for existing and new development, and then implement appropriate management practices, such as wet detention basins, improved street sweeping, and grass drainage systems. Urban areas identified for engineering studies and possible structural management practices (e.g., wet detention basins) are shown in Figure 2. Aggressive street sweeping should be carried out in the isthmus area.**

4. **Rural landowners and operators should work with Dane County to develop and implement farm conservation plans that seek to reduce both soil erosion and actual sediment losses to waterbodies to tolerable levels in order to meet soil conservation and water quality goals (see Fig. 2). As part of conservation plans, management practices also should be included that limit runoff from animal lots and promote sound use of fertilizers and pest controls.**

5. **All units of government should reduce use of road deicers to the extent possible and evaluate alternative practices.**

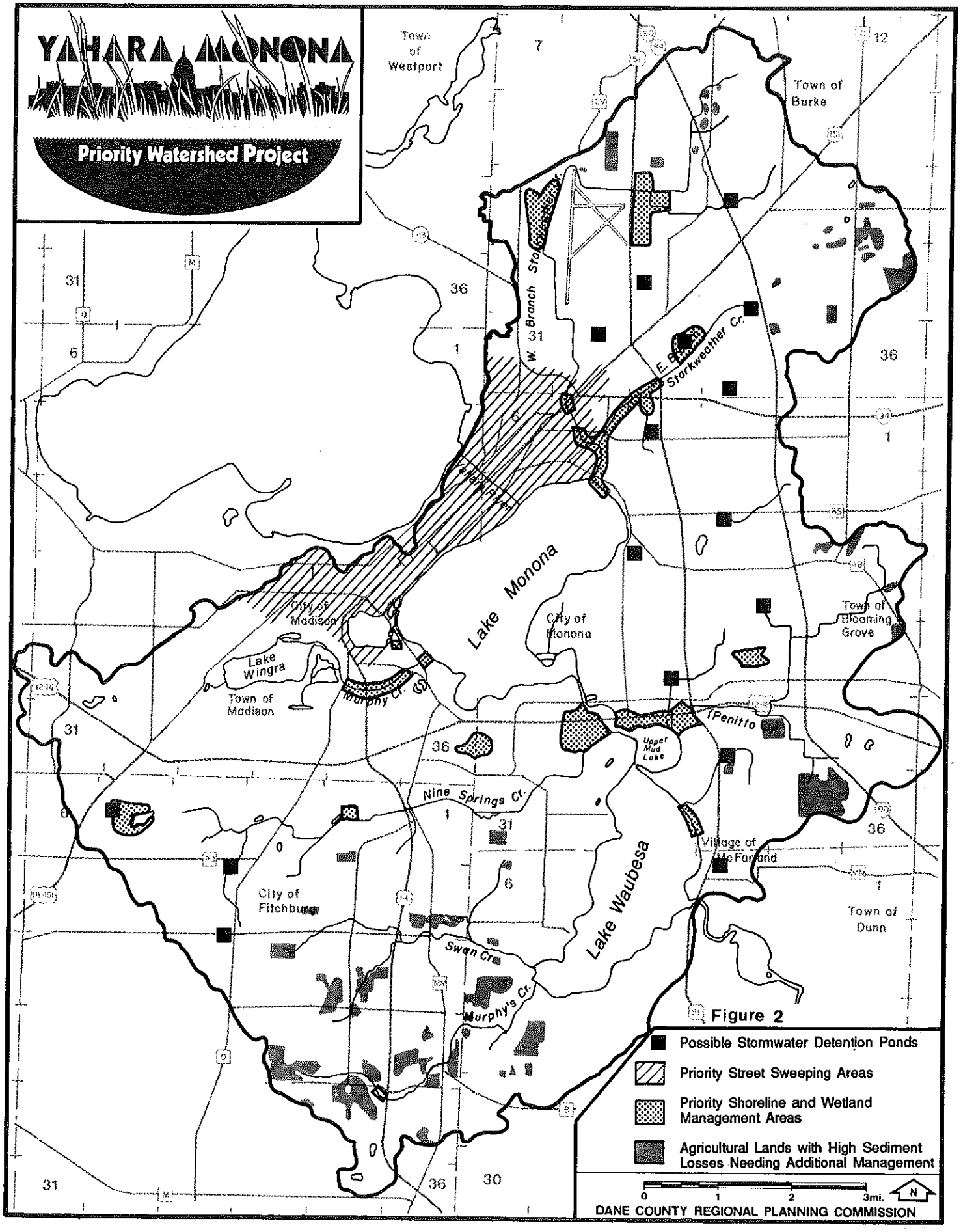
6. **Watershed residents need to take individual actions to reduce water pollution, such as keeping leaves and grass clippings off streets and avoiding excess use of lawn fertilizers and pesticides.**

What kind of assistance exists to carry out the plan's recommendations and what are the expected results?

State cost-share funding is available through the Priority Watershed Project for particular management practices that reduce pollutants from critical urban and rural land areas. In rural areas, cost-sharing is available for soil conservation and animal waste management practices, such as conservation tillage, water diversions, contour cropping and livestock fencing. In urban areas, the project will pay for 70 percent of construction costs for stormwater quality practices, such as wet detention basins, grass drainage systems and infiltration basins in existing development. The project will also pay up to 50 percent of land acquisition and storm sewer rerouting costs associated with these practices. Remaining costs need to be paid by the municipality or private landowner.

The project does not pay for management practice construction in areas to be developed. These costs are to be borne locally by the municipality and/or developer. Detailed stormwater management feasibility and engineering studies, though, can be funded through the project. Communities should place emphasis on implementing stormwater quality management practices in developing areas, since sufficient land space can be reserved for practices before development occurs. Practices can help offset additional pollution discharges associated with new development.

Alternative management strategies were evaluated as part of the planning process. Total project costs associated with the various alternatives ranged from about $9.9 million to $51.5 million. To implement the recommended management alternative, approximately $21 million in funding may be needed over an eight-year project period (see following table). State funds could provide up to $11.5 million of the total cost, with the remaining amount coming from local municipalities and landowners.


YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
W. Branch Starkweather Cr.
E. Branch Starkweather Cr.
Yahara River
Lake Monona
City of Madison
City of Monona
Town of Blooming Grove
Lake Wingra
Town of Madison
Murphy Cr.
Penitto Cr.
Upper Mud Lake
Nine Springs Cr.
Village of McFarland
Lake Waubesa
City of Fitchburg
Town of Dunn
Swan Cr.
Murphy's Cr.
Possible Stormwater Detention Ponds
Priority Street Sweeping Areas
Priority Shoreline and Wetland Management Areas
Agricultural Lands with High Sediment Losses Needing Additional Management
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DANE COUNTY REGIONAL PLANNING COMMISSION

Figure 2

ESTIMATES OF COST-SHARE FUNDS NEEDED TO IMPLEMENT PRIORITY WATERSHED PROJECT		
Management Activities	**Estimated Funding For 8-Year Period (in millions)**	
	State Share	**Local Share**
Urban Management Practices Design and Construction of Stormwater Detention Basins on 50% of Critical Existing Land Area and Additional Street Sweeping on Other 50% (cost based on $120,000 per acre of detention basin and $25 per curb mile for upgrading street-sweeping frequencies)[1]	$8.95	$8.92
Rural Management Practices Cropland Management Animal Waste Management	 0.14 0.10	 0.05 0.04
Shoreline Stabilization and Habitat Restoration	1.00	0.40
Public Information and Education	0.40	--
Staffing to Implement Project (Public Information Officer, Project Manager, Soil Conservation Technician and Construction Erosion Control)	0.89	0.17
TOTAL	**$11.48**	**$9.58**
[1]With alternative management strategies, urban management costs vary. See Chapter 5 of Plan.		

While participation in the project is voluntary, there are recent federal stormwater and conservation-compliance regulations that require rural landowners, the City of Madison and possibly surrounding communities to protect water quality from soil erosion and stormwater runoff. Since management activities can be expensive, it is often in a community's and landowner's best interest to become involved in a priority watershed project. There are certain "basic" management activities that all municipalities should initially pursue that don't require substantial funding and technical evaluations. Examples of activities include changes in the timing and scheduling of basic street sweeping and leaf collection practices so they are more effective in removing pollutants during critical times of the year.

Without the management practices proposed in the priority watershed project plan, nonpoint pollution will continue to escalate and deteriorate the quality of land and water resources in the watershed. The proposed management practices will more than offset the expected large future increases in nonpoint pollution that would otherwise occur, and will even provide some improvement over existing water quality conditions.

Although a dramatic improvement in lake water quality conditions is not likely to occur in the short-term future from implementation of this plan, water resources can be protected from additional deterioration that will occur without controls. Selected stream and other natural resource areas (e.g., wetlands) can be improved and certain problem pollutants (e.g., metals and pesticides) can be controlled.

In order for this to happen, though, municipalities and rural and urban residents will need to participate in the project and pursue all management proposals put forth. No less than a major commitment by all involved parties will ensure that water quality and environmental resource protection goals are attained--the measure of a successful project.

CHAPTER 1

INTRODUCTION

Project Description

The Yahara-Monona Watershed has been designated as a priority watershed project under the Wisconsin Nonpoint Source Water Pollution Abatement Program (Nonpoint Source Program). This designation, made in 1988, makes state cost-sharing grants available to municipalities and landowners in the watershed to plan and install management practices designed to reduce "nonpoint source" water pollution. Nonpoint pollution is water from rainfall and snowmelt that carries sediment, nutrients and other contaminants into water bodies from broad urban and rural land areas.

The reasons why the watershed has been designated are:

1) the severity of water quality problems in the watershed,
2) the importance of controlling nonpoint pollution sources to improve or protect water quality, and
3) the capability and willingness of local units and agencies of government to participate in the project.

The priority watershed project provides another opportunity for residents and local governments to participate in Dane County's ongoing water quality protection efforts and is to be coordinated with activities of the Dane County Lakes and Watershed Commission. The Yahara-Monona Watershed joins over 40 other drainage systems statewide, covering more than three million acres, for which cleanup of nonpoint source pollution is a priority.

The watershed includes all of the land area draining to lakes Monona, Waubesa and Wingra in central Dane County (see Fig. 1-1). Several perennial streams also exist, as well as several thousand acres of wetlands, which provide important resource functions. Groundwater is a highly valued water supply source for residents in the watershed. Other prominent environmental resources include the University of Wisconsin Arboretum, Nine Springs E-Way and L. R. Head Nature Center.

Objectives

A principal objective of the project is to protect and improve the quality and functional uses of water resources in the Yahara-Monona Watershed. This can be attained by:

1) **expanding the implementation of nonpoint source pollution control practices,**
2) **improving wetland, stream corridor and lakeshore management, and**
3) **increasing public awareness and individual actions through information/education activities.**

In carrying out these activities other objectives, such as protecting soil productivity, preventing drainage and flooding problems and improving recreational use, also can be achieved.

Project Planning and Implementation Phases

A priority watershed project has two components: planning and implementation. The planning phase for a project typically involves a one and a half to two-year timeframe, culminating in the publication of a watershed plan. The plan identifies the type, location and costs of management activities needed to address water resource concerns. Planning includes the following information-gathering and evaluation steps:

1) Determine the conditions and uses of lakes, streams, wetlands and groundwater.
2) Inventory types of land uses and severity of nonpoint sources impacting water bodies.
3) Evaluate the types and severity of other factors that may be affecting water quality.
4) Determine levels of nonpoint source control and measures necessary to improve and/or protect water quality.
5) Conduct and review planning activities with the assistance of a local advisory committee.
6) Conduct information/education activities to improve public awareness and incorporate public concerns into the planning process.
7) Prepare and gain approval for a priority watershed plan documenting the above evaluations, costs and implementation procedures.

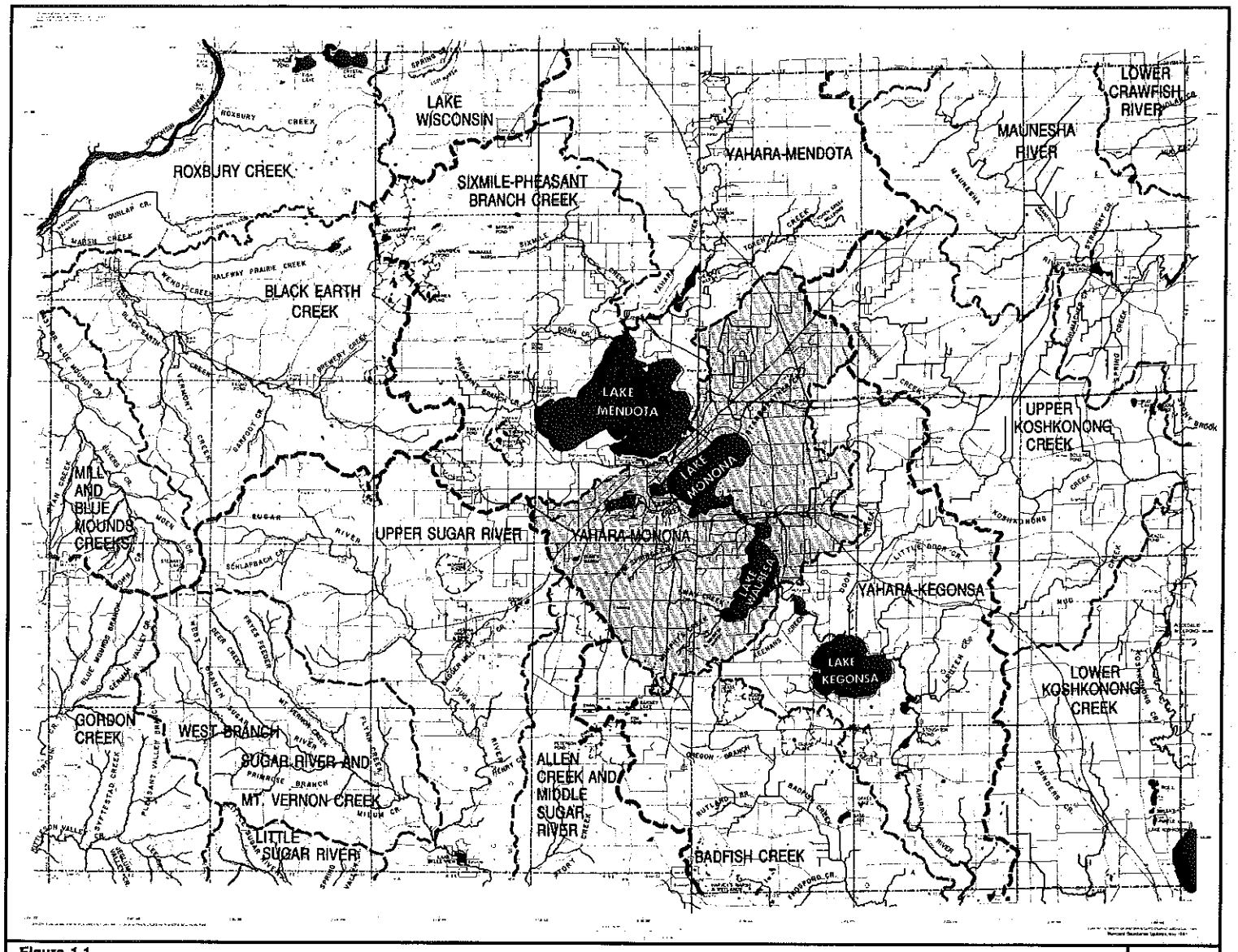


Figure 1-1

PRINCIPAL WATERSHEDS DANE COUNTY, WISCONSIN

Major Basin Divide
Watershed Divide
Non-Contributing Basin
Lakes
Rivers & Streams

For the Yahara-Monona Priority Watershed Project, the Dane County Regional Planning Commission (DCRPC) has been designated by the Wisconsin Department of Natural Resources (DNR) as the lead agency for developing the watershed plan. A grant for planning work was awarded to the DCRPC in May 1989. A local advisory committee, entitled the Yahara-Monona Steering Committee, was formed at this time to provide guidance during the planning process. The committee consists of representatives from various interest groups and municipalities in the watershed (see membership listing at beginning of plan).

The intent of the Yahara-Monona Watershed Plan is to be a comprehensive management guide. It addresses environmental resource management activities that can be pursued beyond the direct scope of the state Nonpoint Source Program. The plan is not static; it can and should be amended and refined as future management concerns warrant.

Following completion, public review and approval of the watershed plan by the state and Dane County, the implementation phase of the project will begin. Management activities identified in the plan can be carried out, in many cases with the assistance of state cost-sharing funds. The installation of eligible management practices is often cost-shared at a 50 to 70 percent level by the state, with landowners or municipalities responsible for the remaining 30 to 50 percent of the installation costs. Since the project is largely voluntary, this type of financial assistance serves as a significant incentive for project participation. Cost-share agreements are to be entered into within three years of the plan approval date, and management practices can be implemented up to five years from the date an agreement is signed. Thus the total implementation period for a priority watershed project can span a period of eight years.

Legal Status of the Watershed Plan

The Yahara-Monona Priority Watershed Plan has been 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 has been prepared through the cooperative efforts of the DCRPC, DNR, Department of Agriculture, Trade and Consumer Protection, Dane County, local units of government, and the Yahara-Monona Steering Committee.

The watershed plan is the basis for awarding cost-share and local assistance grants to parties responsible for management practice implementation. In the event that a discrepancy occurs between this plan and the statutes or the administrative rules, or if the statutes or rules are changed during implementation, the statutes and rules will override the plan. Following approval of the watershed plan, it will become an element of the adopted Dane County Water Quality Plan (DCRPC, 1979) and the Lower Rock River Basin Management Plan (DNR, draft 1991).

Relationship of Watershed Plan to the Federal Stormwater Discharge Permit Program

Recent amendments to the Federal Clean Water Act also will play an important role in addressing nonpoint source pollution in the Yahara-Monona Watershed. The U.S. Environmental Protection Agency (EPA) has approved regulations requiring large municipalities (over 100,000 people) and industries to obtain National Pollutant Discharge Elimination System (NPDES) permits for stormwater system discharges. These permits are the same as those issued for public and private wastewater treatment plants.

In Wisconsin, the DNR will be designated with the responsibility of administering the new regulations. Currently, the only municipality in the Yahara-Monona Watershed affected by this regulatory program is the City of Madison. However, the DNR in defining municipal stormwater systems can designate interconnected or interrelated cities and/or counties for inclusion in the NPDES program, regardless of population size. Thus the City of Monona, for example, could be included with the City of Madison in the permit program. A decision on this matter has not yet been officially made. It is possible that communities surrounding the City of Madison will be required to join the program within the next few years. If a community desires, it also can petition to be included in the program.

The regulations require that pollutants in municipal stormwater discharges be controlled to the "maximum extent practicable." A two-part permit application is established for municipal storm sewer systems. The Part 1 application requires considerable data collection and an assessment of the existing local stormwater pollution control program. Additional elements of Part 1 include a description of the municipality's legal authority to control discharges to the storm sewer system, a description of the storm sewer system including the locations of outfalls and land uses associated with each outfall, discharge characterization including existing monitoring data

and a field screening analysis for illicit connections, and a description of the fiscal resources available to proceed with Part 2 of the application. The Part 2 application outlines the comprehensive stormwater management program that will be the basis of the NPDES permit. Part 2 must include quantitative data for five to ten outfalls designated by the permitting authority, an estimate of the annual pollutant load to receiving waters and the proposed management plan to reduce pollutant loading to the maximum extent practicable. The City of Madison must complete the Part 1 application by May 1992, with Part 2 due in May 1993.

EPA is currently evaluating the need to include smaller cities and towns under the NPDES stormwater permit program. A decision regarding those jurisdictions not covered under the initial program is required by October 1, 1992. This decision could impact other communities in Dane County. In addition to municipal requirements, all industrial facilities are required to obtain stormwater permits.

Much of the inventory work conducted for this plan should be of assistance to the City of Madison in preparing its Part 1 and 2 applications. Many of the actual permit requirements also are likely to overlap with management actions specified in this plan for improving water quality in the watershed. Thus implementation of the watershed plan will help to meet permit requirements and should be closely coordinated with the NPDES program.

Plan Organization and Contents

The remainder of this plan is divided into three sections: the watershed assessment, development of alternative management strategies, and the recommended management, implementation and evaluation strategy. The contents of each section are summarized below.

Section II: The Watershed Assessment

Chapter 2. "General Watershed Characteristics" is a summary of the cultural and natural resource features important to recognize in management planning for the priority watershed project.

Chapter 3. "Watershed Planning Methods" presents the water resource and land use inventory procedures used to determine the condition of water bodies and the pollution problems that exist in the watershed. Development of project objectives and pollution reduction goals are also discussed.

Chapter 4. "Water Resource Conditions, Objectives and Nonpoint Source Pollution Inventory" characterizes the existing condition of water bodies and presents water resource objectives by subwatershed. Results of urban and rural nonpoint pollution inventories are discussed.

Section III: Alternative Management Strategies

Chapter 5. "Urban, Rural, Wetland and Stream/Lakeshore Corridor Management Strategies" presents the water quality impacts associated with various levels of management practice implementation, ranging from a minimum to a maximum level of effort for urban and rural areas in the watershed. The extent of attaining water resource objectives with different management strategies, as well as associated costs, are described.

Section IV: Recommended Management, Implementation and Evaluation Strategy

Chapter 6. "Recommended Program for Implementation" presents the optimum management approach and describes the means by which the project is to be administered. State local assistance and management practice cost-sharing are discussed. A public information/education plan of action is described, and municipal and agency responsibilities for carrying out the recommended program are outlined.

Chapter 7. "Project Evaluation and Monitoring" discusses the means for assessing the amount of nonpoint source pollution control gained through implementation of the priority watershed project. Water quality evaluation monitoring outlines the general strategy for directly monitoring water bodies to assess water quality changes associated with the installation of recommended management practices.

CHAPTER 2

GENERAL WATERSHED CHARACTERISTICS

The Yahara-Monona Watershed, including water bodies, is a 94-square-mile surface water drainage area located in central Dane County (see Fig. 2-1). It is considered the middle Yahara River watershed located between the Upper Yahara River-Lake Mendota drainage basin and the Lower Yahara River-Lake Kegonsa basin. Water flows to Lake Monona and downstream Lake Waubesa principally via the Yahara River, although other smaller tributary streams also discharge to the lakes. The flow of the Yahara River, which is the principal tributary to all four Yahara Lakes, is controlled by dams at the lakes' outlets.

Over 60 percent of the land use in the Yahara-Monona Watershed is classified as urban or urbanizing. Remaining land use is considered rural, with agricultural lands being prevalent in the southern part of the watershed.

The watershed is divided into eight smaller hydrologic subwatersheds for general study purposes. Subwatersheds are classified in accordance with predominant drainage and receiving water bodies.

The following is an overview of the watershed's important cultural and natural resource features. The quality and quantity of water resources in the watershed are reflected by the presence of these features.

Cultural Features

Civil Divisions

The Yahara-Monona Watershed is located entirely within Dane County. The watershed includes parts or all of three cities, Madison, Monona and Fitchburg; one village, McFarland; and four towns, Blooming Grove, Burke, Dunn and Madison. The City of Madison accounts for approximately 50 percent of the total land area in the drainage basin (see Table 2-1). Figure 2-2 displays the extent of incorporated and unincorporated municipalities within the Yahara-Monona Watershed in 1990.

TABLE 2-1
EXTENT OF CITIES, VILLAGES AND TOWNS WITHIN THE YAHARA-MONONA WATERSHED IN 1990

Civil Division	Area in Watershed (Square Miles)	Percent of Land in Watershed
City of Madison	42.3	50%
City of Monona	3.4	4
City of Fitchburg	11.2	13
Village of McFarland	1.9	2
Town of Blooming Grove	5.6	7
Town of Burke	9.5	11
Town of Dunn	6.9	8
Town of Madison	3.6	4

Population Size, Distribution and Trends

The population in the Yahara-Monona Watershed was estimated to be more than 150,000 persons in 1990. This represents more than 40 percent of Dane County's total population. The majority of the population resides in the City of Madison.

The population of all municipalities in the watershed increased from 1980 to 1990, except for the City of Monona. The City of Madison showed the largest population gain of approximately 20,000 people for the entire city, while the Village of McFarland experienced the greatest rate of population growth (38%) for this period, followed by the City of Fitchburg (31%). Dane County, overall, led all urban counties in Wisconsin in population increases during the 1980s. The county's population has been projected to grow by about 12 percent between 1990 and 2010 to a total of slightly over 400,000 people.

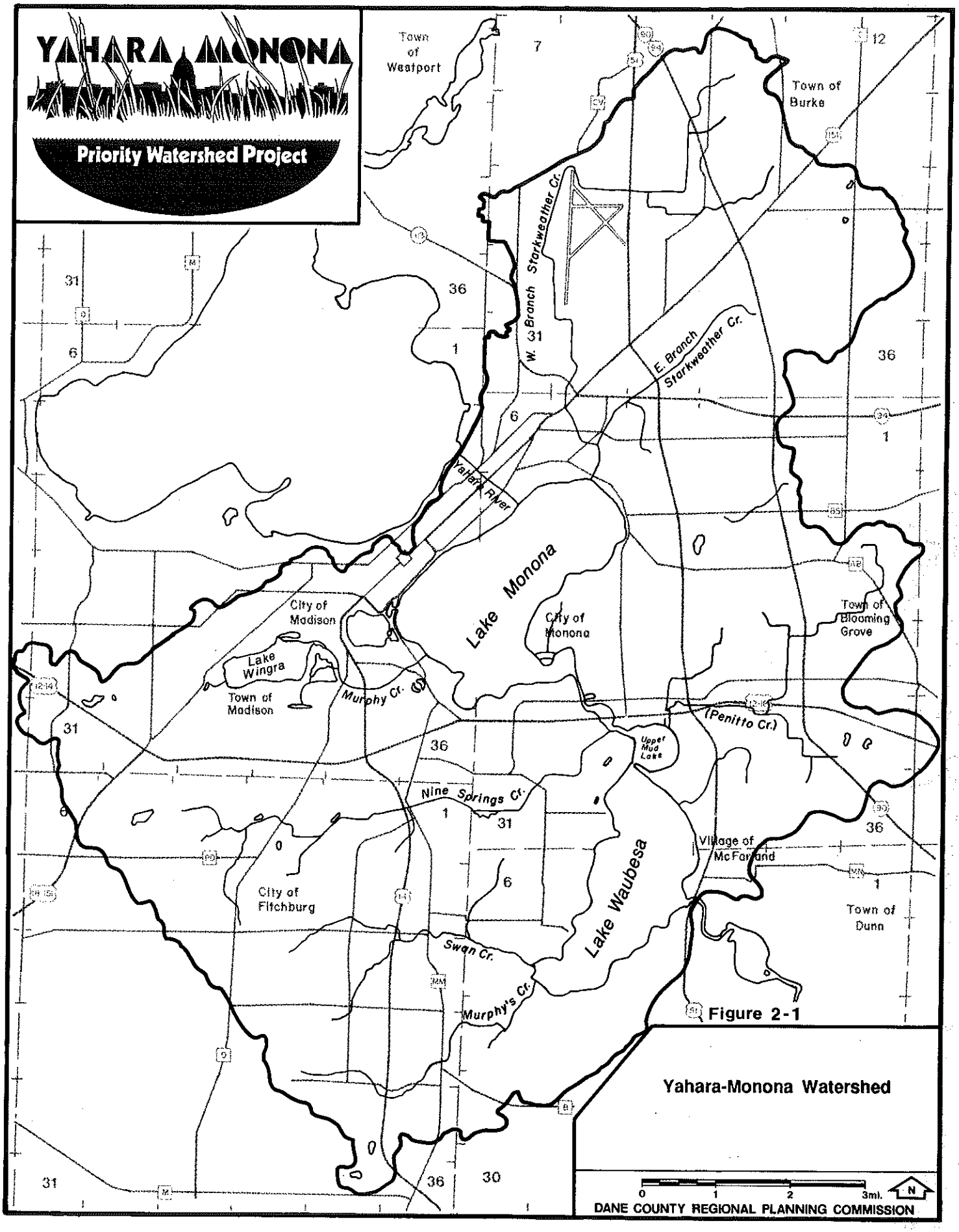


Figure 2-1

Yahara-Monona Watershed

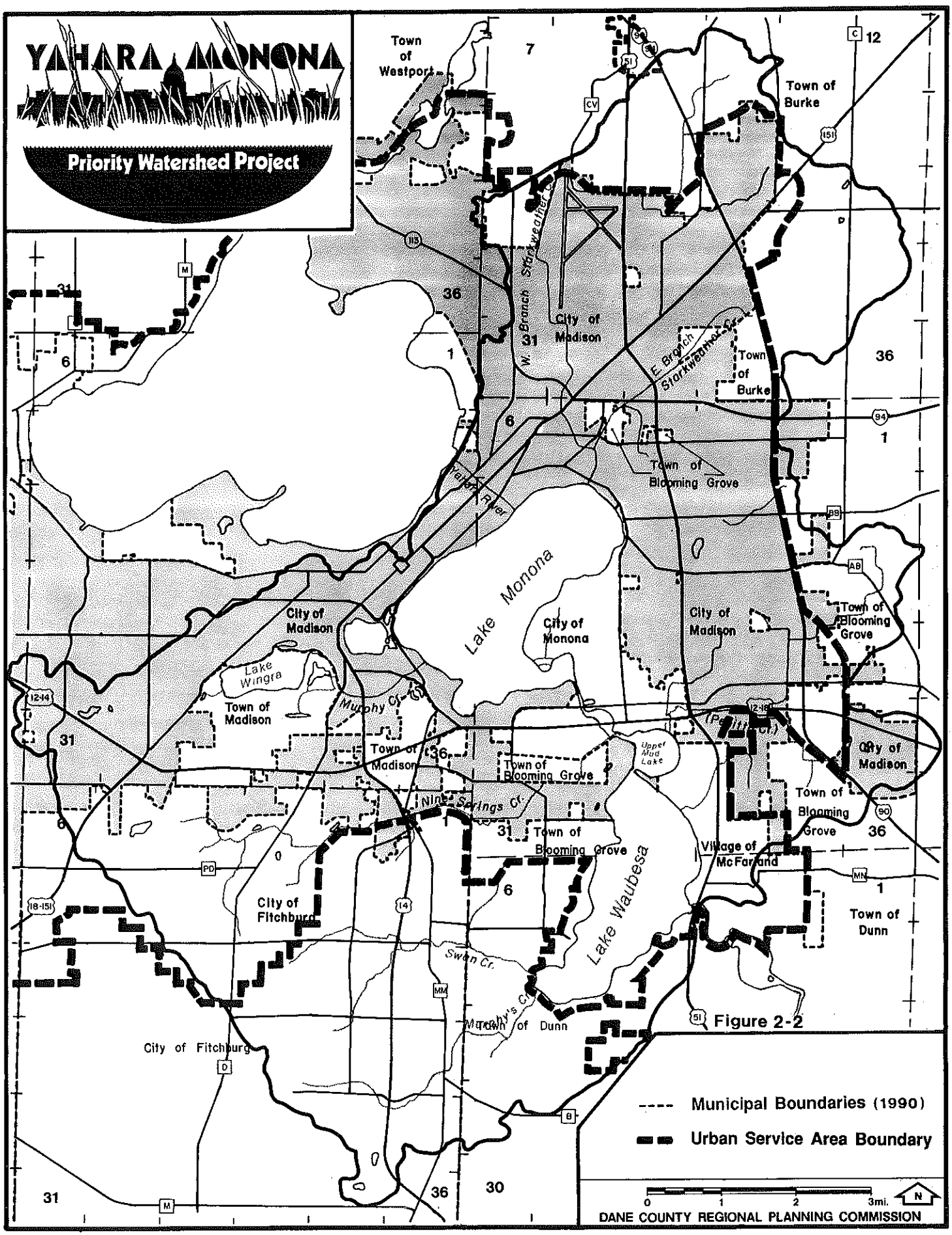

YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
City of Madison
Town of Burke
Town of Blooming Grove
Lake Monona
City of Monona
City of Madison
Town of Blooming Grove
City of Madison
Lake Wingra
Town of Madison
Town of Madison
Town of Blooming Grove
Upper Mud Lake
City of Madison
Town of Blooming Grove
Town of Blooming Grove
Village of McFarland
Town of Dunn
City of Fitchburg
Lake Waubesa
Town of Dunn
City of Fitchburg
Municipal Boundaries (1990)
Urban Service Area Boundary
0 1 2 3mi.
N
DANE COUNTY REGIONAL PLANNING COMMISSION

Figure 2-2

Future population growth is expected to occur largely in the southwestern periphery of the watershed in the City of Fitchburg and in the northern and eastern ends of the watershed in the City of Madison. Significant growth is not projected to occur in the City of Monona and the part of the Village of McFarland that exists within the watershed due to the landlocked nature of these communities by the City of Madison.

Land Uses

Table 2-2 summarizes 1990 land use in the Yahara-Monona Watershed. Existing urban land uses, including urban parks and open space areas, comprise about 55 percent of the total land area in the Yahara-Monona Watershed. When combined with transitional or urbanizing land areas, this percentage increases to about 63 percent, presuming complete development within the existing 20-year urban service area boundary. Such extensive development is not likely to occur by 2010, but plans illustrate that urban growth will continue and even more substantially dominate land use in the watershed. Land use transition to urban development can adversely impact surface and ground water quality if appropriate management measures are not imposed.

Rural land uses, including agriculture, open space and unsewered development, currently comprise about 45 percent of the watershed's land area. Much of the rural land is located in the southern part of the watershed in the City of Fitchburg and Town of Dunn. Soil erosion and animal waste runoff from this land can degrade water quality.

TABLE 2-2
LAND USE IN THE YAHARA-MONONA WATERSHED IN 1990

Land Use Types	Area in Watershed (Square Miles)	Percent of Land in Watershed
Urban Land Use		
Residential	16.4	20.0%
Commercial	4.1	5.0
Industrial	3.0	3.5
Parks/Open Space	11.2	13.0
Wetlands (urban only)	6.4	7.5
Other (Public Assembly, Institutional, etc.)	5.1	6.0
Agriculture, Open Land	34.9	41.0
Wetlands (rural only)	3.6	4.0
Surface Water	9.3	0.0
TOTAL	**94.0**	**100.0%**

Sanitary Sewer and Water Supply Services

All of the municipalities in the watershed are included to some extent in the Central Urban Service Area (CUSA) (see Fig. 2-2.) An urban service area represents an area planned for urban development, and where it is intended that a full range of urban services be provided within a particular planning period (commonly 20 years). Urban services include such features as public water supply and sanitary sewerage systems, urban drainage facilities, high levels of fire and police protection, urban mass transit, etc. Using the urban service area concept in land use and growth decisionmaking permits communities to plan for the orderly and cost-efficient extension of utilities and public services.

Sanitary sewer service is provided to developments in the Central Urban Service Area, and several outlying service areas not in the watershed, by the Madison Metropolitan Sewerage District (MMSD). MMSD treats sanitary waste at its Nine Springs Wastewater Treatment Plant. When the district formed in 1930, treated wastewater was discharged from the plant to Lake Waubesa. However, since 1958 discharges have been diverted around Lake Waubesa (and consequently also Lake Kegonsa) and directed to Badfish Creek, which is located outside of the Yahara-Monona Watershed. MMSD has expanded over the years to serve communities upstream of the Yahara lakes and to comply with a state law banning the discharge of treated wastewater into any of the lakes. As a result, point source pollution to water bodies in the Yahara-Monona Watershed is generally no longer considered a significant water quality concern. However, there have been some water quantity concerns raised over well water pumping and diversion of wastewater out of the watershed, which can affect and reduce groundwater levels, stream baseflow, lake levels and wetlands in the watershed.

Wastewater from residences and developments outside of the urban service area is disposed of through private on-site sewage systems. Most of these systems are found in the towns of Burke and Dunn and the City of Fitchburg.

Public water supply is derived from groundwater and is provided by individual municipalities. Groundwater serves as the sole source of drinking water for residents. In 1989, 33 municipal wells existed in the watershed, with 20 of these belonging to the City of Madison. In addition, over 60 public non-community and other-than-municipal wells (i.e., wells that serve restaurants, service stations, churches, subdivisions, etc.) have been identified in the watershed and are being monitored for water quality. Many residences in rural areas have private well water systems, which do not have water quality monitoring requirements. It's estimated that over 3,000 private wells exist in the watershed. In total, more than 22 million gallons of groundwater are pumped in the watershed and used every day.

Natural Resource Features

Climate

The Yahara-Monona Watershed lies in a humid, continental climatic zone. The frequency, duration and amount of precipitation in the watershed influences surface and ground water quantity and quality. Average annual precipitation is approximately 31 inches, 59 percent of which occurs from May through September. Monthly precipitation averages range from a high of over four inches in June to a low of about one inch in February. Snowfall averages 40 inches annually.

The annual temperature range is large, with frequent sharp fluctuations. The mean annual temperature is about 45°F. The coldest month of the year is January, which averages 17°F, while the warmest month, July, averages 70°F. Soil freezing typically begins in late November and lasts until mid-April. Most surface water runoff occurs in March, April and May when soil is either frozen or saturated.

Topography

The landscape of the watershed has been impacted by glaciers, with ground moraine, drumlins and lacustrine plains near the lakes being predominant glacial features. This relatively flat or rolling topography was formed as glacial ice removed topsoil and rock from hills and deposited it in the valleys. Topographic relief in the watershed ranges from approximately 1,130 feet above sea level in the southern part of the drainage basin to 845 feet at lakes Monona and Waubesa. Due to this small range in relief, most stream gradients are low. Much of the tributary stream drainage in the watershed is intermittent in nature and is associated with marshy areas.

Soils

While the soil comprises only the upper three to five feet of unconsolidated materials at the earth's surface, its characteristics are among the most important features in determining surface water runoff, erosion potential and the susceptibility of groundwater to pollution.

The soils in the watershed are formed mainly from materials transported by glaciers (till), deposited by glacial meltwater (outwash) or deposited by the wind (loess). A smaller percentage of soils is also formed from alluvium and from peat and muck.

Much of the watershed is covered by moderately permeable, medium-textured soils (silt loams) underlain by glacial till of varying thickness. There are three primary soil associations in the watershed. Two of these are the Dodge-St. Charles-McHenry association and the Plano-Ringwood-Griswold association, which consist of well drained and moderately well drained, deep silt loam and loam soils. Generally, these soils have good pollutant attenuation capacities, although seasonal high water tables may pose attenuation problems in lowland areas. The third association is the Batavia-Houghton-Dresden association, which consists of well drained and poorly drained, deep silt loams and mucks that were formed in outwash material. These soils are often found in lowland areas. Their associated pollutant attenuation capacities range from good to poor. Most soils being farmed in the agricultural areas of the watershed are susceptible to erosion at rates above what is considered tolerable to maintain soil productivity.

Surface and Ground Water Resources

A detailed discussion of surface and ground water resources is presented in Chapter 4 of this plan. In summarizing data, there are eight perennial streams that extend over 30 miles, three lakes that cover nine square miles and also about ten square miles of wetlands in the watershed. All streams, except the Yahara River, have relatively low baseflow discharges of less than ten cubic feet per second.

Groundwater is found in two principal aquifers (water-bearing geologic formations) in the watershed. The aquifers are based on well construction practices which, in turn, reflect water movement patterns. The upper aquifer system, which consists of sand and gravel and bedrock of Ordovician geologic age, is used as a water supply source in rural areas and for small public water systems. The upper aquifer also directly supplies water to lakes, streams and wetlands in the watershed. Underlying this aquifer is the lower sandstone aquifer of late Cambrian age. This aquifer can yield large quantities of water (more than 1,000 gallons per minute) and is used primarily for municipal water supplies.

Environmental Corridors

Environmental corridors are continuous systems of open space that include environmentally sensitive lands requiring protection from development, and lands needed for open space and recreational use. They are based mainly on drainageways and stream channels, floodplains, wetlands, woodlands, steep slopes and other important resource lands and features.

Environmental corridors are used in community and regional plans to address the multiple concerns of drainage, water quality, recreation, and open space. Protection and preservation of environmental corridors contribute to environmental protection in general, and specifically to water quality through reduction of nonpoint source pollution and protection of natural drainage systems.

The Dane County Regional Planning Commission has identified and mapped environmental corridors within urban service areas, and also "rural resource protection areas" located outside of service areas (see Fig. 2-3). Approximately 7,700 acres of environmental corridors have been delineated in the Yahara-Monona Watershed.

Natural Area Sites

Natural areas are classified as tracts of land or water that exhibit pristine pre-settlement conditions and/or contain unique plant and animal communities. Because of the inherent value of these lands, they should be preserved. Natural areas have been delineated by the Wisconsin Scientific Areas Preservation Council and DNR Bureau of Endangered Resources.

Sixteen state natural areas, covering more than 1,300 acres, have been identified in the Yahara-Monona Watershed. Sites are located in five municipalities, although half are found within the University of Wisconsin Arboretum in the Town of Madison. Specific locations and descriptions of these natural areas are presented in Appendix A. Lands associated with two natural areas--Nine Springs Creek and the Lake Waubesa Wetlands--have been targeted by Dane County in its 1990-1995 Parks and Open Space Plan as being of priority for further acquisition.

Endangered Species

Information on rare animal and plant species in the Yahara-Monona Watershed was obtained from the Wisconsin Natural Heritage Inventory Program (NHIP) within the DNR's Bureau of Endangered Resources. This is a comprehensive inventory program; however, the absence of known endangered species occurrences in the NHIP does not preclude the possibility of their presence, and detailed site investigations may still be necessary.

The NHIP indicates that two state endangered plants, the Purple Milkweed (Asclepias purpurascens) and Prairie White-fringed Orchid (Platanthera leucophaea), and one threatened plant, the White Lady's-slipper (Cypripedium candidum), have been identified in the University of Wisconsin Arboretum. Inventory information also indicates that the endangered Blanchard's Cricket Frog (Acris crepitans) and the threatened Blanding's Turtle (Emydoidea blandingi) may be present in the watershed near Lake Waubesa. No other endangered plant or animal species have been inventoried, although a field investigation of the Vondron/Femrite wetland on the east side of the City of Madison revealed the presence of a species of fern (Ophioglossum vulgatum), which is on a DNR "watch list" for possible endangered status.

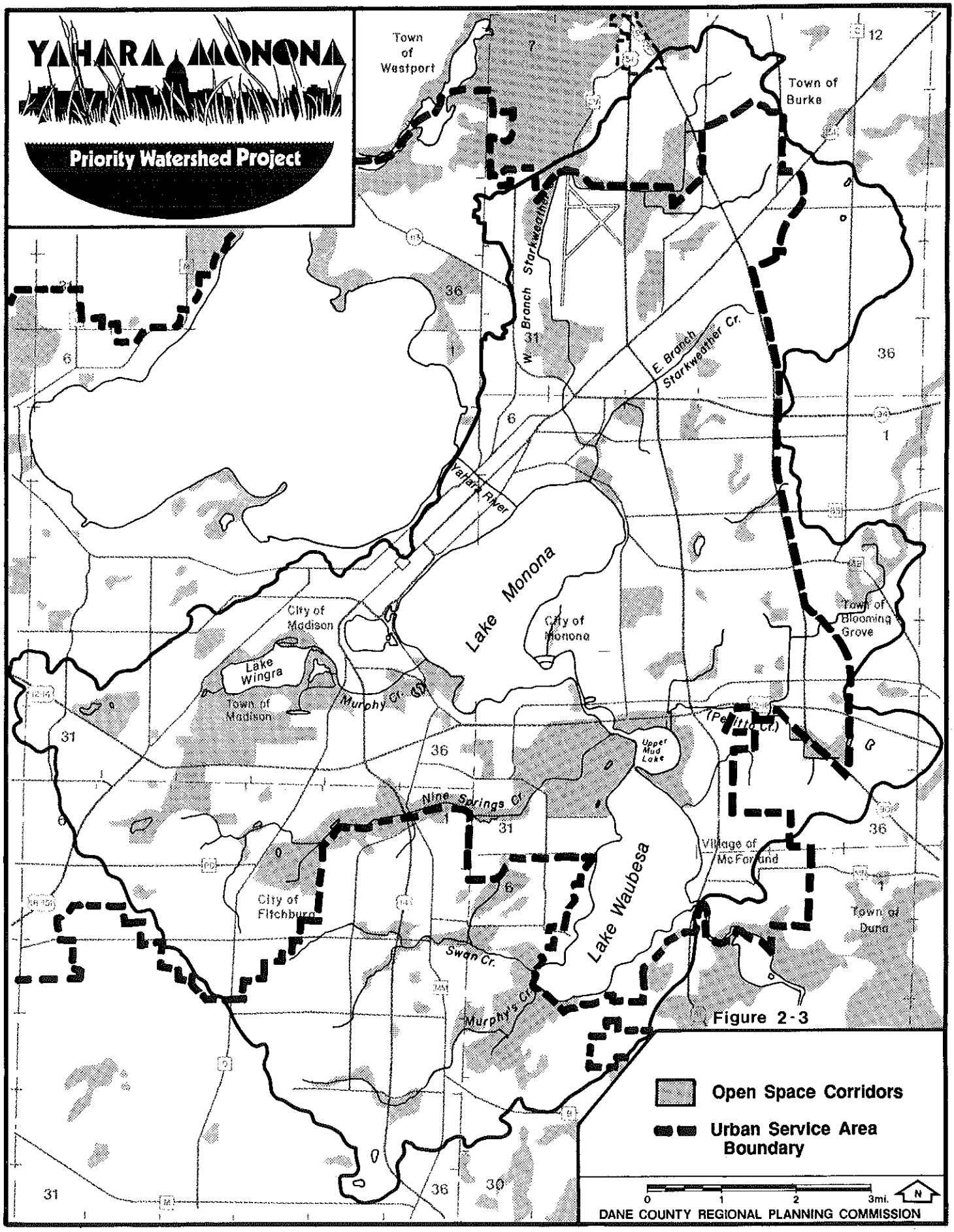

YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
W. Branch Starkweather
E. Branch Starkweather Cr.
Yahara River
Lake Monona
City of Madison
City of Monona
Town of Blooming Grove
Lake Wingra
Town of Madison
Murphy Cr.
(Pelletier Cr.)
Upper Mud Lake
Nine Springs Cr.
Village of McFarland
Lake Waubesa
City of Fitchburg
Town of Dunn
Swan Cr.
Murphy's Cr.
Open Space Corridors
Urban Service Area Boundary
0 1 2 3mi.
N
DANE COUNTY REGIONAL PLANNING COMMISSION

Figure 2-3

CHAPTER 3

WATERSHED PLANNING METHODS

This chapter outlines the methods used to prepare the watershed plan. These include:

- water resource and land use assessments
- establishing water resource objectives
- establishing pollution reduction goals
- public and local unit of government involvement

Water Resource and Land Use Assessments

Water resource and land use information were collected and evaluated as part of the watershed planning process. Water quality data were analyzed to determine where pollution problems exist in the watershed. Land use information was used to run computer models that simulated the type and amount of pollutants originating from urban and rural land areas during times of water runoff. Critical land areas that contribute significant quantities of pollutants were thus able to be identified.

Specific watershed inventory components consisted of:

1) water resource appraisals,
2) urban nonpoint source (land use) inventory,
3) rural nonpoint source (land use and animal waste management) inventory, and
4) inventory of other potential pollution sources

Water Resource Appraisals

Existing water quality data were compiled and evaluated for lakes, streams and groundwater in the watershed in order to determine existing and potential resource uses, as well as threats to or problems impairing these uses. State and local agency data were insufficient to determine the present condition of all surface waterbodies; thus an interagency monitoring plan was prepared and monitoring carried out to obtain supplemental data to characterize selected streams and lakes.

Also as part of the appraisal process, field surveys and analyses of all wetlands over two acres in size in the watershed were conducted. This work was done by graduate students of the University of Wisconsin-Madison 1990 Water Resource Management Workshop. A principal objective was to assess the various functions of these wetlands, such as providing water quality, flood control and recreational benefits. In addition, detailed wetland management studies for a number of targeted sites were prepared by the students to serve as examples of how to enhance and protect important resource functions.

An assessment of critical shoreline erosion sites in the watershed also was performed. Critical sites were identified through the input of state and local management agency staff, 1990 air photo interpretation, and field investigations of selected stream and lakeshore reaches.

Urban Nonpoint Source Inventory

Small-scale drainage basins and detailed land use information were determined for urbanized areas in the Yahara-Monona Watershed. This information served as input for a DNR water quality model, entitled SLAMM (Source Loading and Management Model), that estimates the amount of various pollutants that may be discharged from urban lands to waterbodies as a result of rainfall-runoff events.

Municipal storm sewer records and available topographic information were used to delineate small drainage basins. Approximately 60 sub-basins were established for urban and urbanizing land areas. Basins range in size from about 100 to 1,500 acres, with most being less than 1,000 acres. Land use data (type and acreage) were compiled for each sub-basin. This information was determined for the City of Madison from the city's automated parcel file data base and from 1990 aerial photography. Information for other communities in the watershed was obtained from 1990 aerial photography and field surveys. Based upon these data and selected field information, SLAMM was used to determine pollutant loadings by sub-basin and by municipality under existing land use and management conditions. For urbanizing sub-basins, the model was also operated based on projected land use.

Future pollutant loadings were determined assuming full urban development within the urban service area boundary. A survey of urban management practices that affect nonpoint source pollution, such as the frequency of street sweeping and quantities of road deicer used, also was conducted via distribution of a questionnaire form to municipal public works departments' staff.

In addition, estimates of pollution potential (sediment loss) from construction site erosion were made from the identification of vacant developable land in the watershed and projected annual rates of land development for each municipality. Vacant developable land was determined by the use of 1990 aerial photographs. Only vacant lands within the current 20-year central urban service area boundary were included in the analysis. Isolated vacant parcels in the middle part of the CUSA were excluded, as well as any vacant lands in environmental corridors, parks, schools, playgrounds, drainageways, areas around public buildings, or small parcels under five acres in size. Developable lands were mapped and acreages computed in accordance with urban sub-basins.

Estimates of future land development rates were calculated from average annual residential building permit data for each municipality for 1980-1988. These figures were divided by an average residential building density (units/acre) for each municipality to determine acres of residential land development. Annual industrial and commercial development acreages were calculated from DCRPC 20-year place of work employment forecasts for industrial and commercial labor forces divided by standard labor force employee densities (number of employees/acre). Development acreages were then multiplied by an average soil erosion rate (tons/acre) for construction sites to estimate potential sediment losses.

Rural Nonpoint Source Inventory

The rural inventory consisted of land use and livestock waste management assessments to estimate sediment, animal waste and associated nutrient loadings to waterbodies from agricultural areas in the watershed.

To determine where animal waste pollution problems exist, a field inventory of all livestock operations and associated lots in the watershed was performed by the Dane County Land Conservation Department. Information on the number and type of animals, lot characteristics and management of the operation was collected and used to run a barnyard runoff computer model, entitled BARNY. (BARNY is a DNR-modified version of a U.S. Agricultural Research Service model.) The model estimates pollutant loads from animal lots for a selected rainfall event. Model results were used to identify barnyards that are of management priority because of high potential pollutant loadings.

Evaluations on the landspreading and storage of animal waste also were carried out as part of the livestock operation inventory. Evaluations were based on site suitability and acreage requirements for the landspreading of manure for each operation.

To estimate soil erosion and sediment delivery to surface waterbodies, existing farm field, land use, soil and hydrologic information was compiled by the University of Wisconsin-Madison Land Information and Computer Graphics Facility. An automated geographic information system (GIS) was used to facilitate data collection and formatting necessary to operate a sediment delivery computer model, entitled the Wisconsin Nonpoint Source (WIN) Model, developed by the DNR. The model calculates soil erosion and actual sediment delivery rates to waterbodies from agricultural fields in the watershed. The rates are determined based on a "typical" year of precipitation. Results indicate where priority attention for soil erosion control should be placed in order to safeguard water quality.

Inventory of Other Potential Pollution Sources

Other potential nonpoint as well as point sources of pollution in the watershed were identified and evaluated based on perceived threats to water quality. Sources such as landfills, unsewered subdivisions, bulk fertilizer and pesticide storage facilities, hazardous waste storage sites and sludge application sites were reviewed and mapped from available agency file records.

Establishing Water Resource Objectives

Water resource objectives were established for waterbodies and are presented according to subwatershed in Chapter 4. Objectives identify what resource changes are desired as a result of management practice implementation. Factors considered in setting objectives include: existing water quality and habitat, existing or potential pollutants that may keep waterbodies from meeting their full resource potential, threshold lake fertility (trophic) levels, and the feasibility of reducing pollutants.

Establishing Pollution Reduction Goals

Pollution reduction goals are estimates of the level of nonpoint source control that is desired to meet water resource objectives in the plan. These goals, presented in Chapter 4, and the water resource objectives are set together since they are mutually related.

Pollution reduction goals established for lakes and streams focus on the control of sediment, heavy metals and phosphorus. Groundwater pollution reduction emphasizes the control of nitrate-nitrogen, pesticides and road salt throughout the watershed.

Heavy metals and phosphorus are often attached to sediment and carried by runoff during storm events and snowmelt, thus management controls for these three pollutants are closely related. Sediment and phosphorus reduction goals are based on ambitious yet achievable management practice performance levels and targeted lake phosphorus concentrations, which if attained could in the long term reduce nuisance algae growth and improve water clarity in lakes Monona and Waubesa. Pollution reduction for heavy metals is based on an approach to reduce the exceedance of acute biological toxicity standards in stormwater being discharged to lakes and streams. Specific pollution reduction goals have not been established for groundwater since meaningful and measurable goals can not be developed based on existing information. For groundwater, as well as heavy metals, a goal of reducing the discharge of pollutants to the maximum extent practicable is proposed.

Involving the Public and Local Units of Government

At the beginning of the planning process in May 1989, the Yahara-Monona Watershed Association was established by the Regional Planning Commission with membership on an invitational basis to a wide range of public interest groups (e.g., neighborhood associations, environmental groups and civic organizations) and state and local management agencies. Representatives of this group volunteered to serve on a local advisory committee entitled the Yahara-Monona Steering Committee. This 15-member committee is composed of individuals from various interest groups and local units of government in the watershed. The committee met approximately monthly during the planning period and provided guidance and review of project planning activities.

In addition to the advisory committee, other efforts were made to inform the public and local units of government about the project and to obtain information from them to incorporate as part of the planning process. Newsletters, public meetings, project displays at community events and a teacher in-service tour were carried out (see Chapter 6 for further description). A half-time public information and education officer was hired in September of 1990 to assist in conducting public outreach activities and in developing an information/education plan of action for the implementation phase of the project.

CHAPTER 4

WATER RESOURCE CONDITIONS, OBJECTIVES AND NONPOINT SOURCE POLLUTION INVENTORY

Summary of Surface Water Resources

In the Yahara-Monona Watershed, there are eight major subwatersheds draining to Lakes Monona, Waubesa and Wingra. They are Starkweather Creek, Lake Monona, Lake Wingra, Nine Springs Creek, Upper Mud Lake (Penitto Creek), Lake Waubesa, Swan Creek and Murphy's Creek (see Fig. 4-1). The total drainage area encompasses approximately 85 square miles of land. The Yahara River connects the two largest lakes (Monona and Waubesa, which cover about five and three square miles, respectively) in the watershed, and the river also serves as a direct connection of outflowing water from nearby Lake Mendota to Lake Monona.

Most of the tributary streams in the watershed are affected by a combination of factors including low gradients and low flows, channel straightening, sedimentation and excessive aquatic plants. These factors in turn negatively affect habitat conditions and stream dissolved oxygen levels, which are critical to the support of fish and other aquatic life.

All three major lakes in the Yahara-Monona Watershed are classified as eutrophic (i.e., nutrient rich, supporting many aquatic plants). The water quality of the lakes has been impacted by municipal and industrial sewage discharges, which now have been diverted around the lakes, and urban and rural nonpoint pollution. Nutrient loadings from these sources have enriched the lakes and their sediments resulting in high levels of phosphorus that stimulate algae and rooted aquatic plant growth. Further high nutrient loadings from nonpoint source pollution can worsen fertility conditions (i.e., increase plant growth) and limit existing or potential lake uses.

In addition, heavy metals (e.g., mercury, lead, zinc) and organic compounds (e.g., PCBs) have been released to the lakes through past wastewater discharges, nonpoint source pollution, applications of inorganic aquatic herbicides, spills and atmospheric deposition. These pollutants have accumulated in lake sediments and can pose environmental toxicity concerns for fish and other aquatic life. Associated public health concerns from the consumption of fish (e.g., large walleyes) in Lakes Monona and Waubesa are also evident since mercury levels in some walleyes have exceeded recommended health standards.

Wetlands also are important resources in the Yahara-Monona Watershed. They comprise over 6,000 acres of land and provide many water quality, wildlife habitat, aesthetic, recreation and hydrologic functions. Many wetland areas in the watershed have been lost as a result of ditching and draining to provide land for agriculture, filling to provide building sites or dredging to provide lagoons and boat harbors. It has been estimated that over 80 percent of the original wetland area in the Yahara-Monona Watershed was lost between 1835 and 1974. A detailed inventory and report on wetlands in the watershed was developed by graduate students of the University of Wisconsin-Madison 1990 Water Resource Management Workshop (UW, 1990).

A summary of water resource conditions, pollution threats and pollutant reduction goals for all major water resources in the watershed is presented in Table 4-1. Biological uses for each lake and stream in the watershed are displayed in Figure 4-2.

Water Resource Conditions by Subwatershed

A narrative summary of surface water conditions and management objectives for each subwatershed is provided on the following pages. Groundwater conditions and management objectives are then summarized for the entire watershed, rather than on a subwatershed basis. Appendix B contains water resource monitoring results for water bodies in the Yahara-Monona Watershed.

Starkweather Creek Subwatershed

This subwatershed encompasses approximately 24 square miles and drains to Lake Monona. Starkweather Creek is the largest subwatershed in the Yahara-Monona basin. It includes the northeast side of the City of Madison and parts of the Towns of Burke and Blooming Grove. Significant urbanization is now occurring in the upper end of this watershed.

TABLE 4-1
WATER BODIES OF THE YAHARA-MONONA WATERSHED
SUMMARY OF CONDITIONS AND PROBLEMS

Water Body	Current Use Classification[1]	Potential Use Classification[1]	Are Potential Uses (e.g., recreational, fishery) Fully Attained?	Water Resource Problems	Observed or Potential Sources of Problems	Pollutant Reductions or Change Needed
1. Streams						
Starkweather Creek						
--W. Branch (7 miles)	LFF	WWSF	No. Fishery impaired by low dissolved oxygen (DO) levels.	Poor habitat: low dissolved oxygen (DO); low flow; streambank erosion Sedimentation High fertility Water and sediment toxicity potential	Channelization; groundwater pumping and wastewater diversion reduce baseflow Construction site erosion Urban and rural runoff; deicer runoff from airport Past point source discharges and spills; urban runoff	30-50% reduction in phosphorus and sediment
--E. Branch (3.5 miles)	LFF	WWSF	No. Fishery impaired by low DO levels and flow.	Poor habitat: low DO; low flow; streambank erosion Fertility and nuisance vegetation Sedimentation Water and sediment toxicity potential	Channelization; aquatic plant respiration; groundwater pumping and wastewater diversion reduce baseflow Urban and rural runoff Construction site erosion Past point source discharges and spills; urban runoff	Reduce metal loadings in urban runoff below acute toxicity levels
Yahara River (2 miles)	WWSF	WWSF	No. Recreational use impaired by excessive fertility and aquatic plant growth.	Sedimentation and fertility	Urban and rural runoff Lakes outflow	Limit pollutants to all Yahara lakes
Murphy (Wingra) Creek (2 miles)	WWSF	WWSF	No. Fishery impaired by low DO levels and flow.	Increasing salinity Poor habitat: low DO; low flow; streambank erosion Sedimentation High fertility, nuisance vegetation Water and sediment toxicity potential	Road salt use; Lake Wingra outflow Channelization; aquatic plant respiration Urban runoff Nutrients from Lake Wingra outflow Past point source discharges; urban runoff	30-50% reduction in phosphorus and sediment. Limit road salt use to the extent feasible. Reduce metal loadings in urban runoff below acute toxicity levels
Nine Springs Creek (6 miles)	WWSF	WWSF	No. Fishery impaired by low DO levels at night.	Sedimentation Marginal habitat: low DO; high temperatures High fertility; nuisance vegetation	Construction site erosion; rural runoff Channelization; aquatic plant respiration Urban and rural runoff	30-50% reduction in phosphorus and sediment
Tributary of Upper Mud Lake (Penitto Creek) (4 miles)	LFF	LFF	No. Fishery impaired by low stream flow and channelization.	Poor habitat: low flow Sedimentation	Channelization Urban and rural runoff	30-50% reduction in phosphorus and sediment
Swan Creek (2 miles)	WWFF	WWFF	Yes, but protect from degradation. Fishery limited by natural low flow conditions.	Marginal habitat: low flow Sedimentation	Natural condition Rural runoff; some construction site erosion	30% reduction in sediment; 50% reduction in phosphorus from animal waste
Murphy's Creek (3 miles)	WWFF	WWFF	Yes, but protect from degradation. Fishery limited by natural low flow conditions.	Low flow Sedimentation	Natural condition Rural runoff	30% reduction in sediment; 75% reduction in phosphorus from animal waste

Water Body	Current Use Classi-fication[1]	Potential Use Classi-fication[1]	Are Potential Uses (e.g., recreational, fishery) Fully Attained?	Water Resource Problems	Observed or Potential Sources of Problems	Pollutant Reductions or Change Needed
2. Lakes						
Lake Monona (3,274 acres)	WWSF	WWSF	No, recreational use impaired by excessive fertility, nuisance algal blooms and weed growth.	Sedimentation and nuisance vegetation Water and sediment toxicity potential near storm sewer outfalls	Urban runoff and Lake Mendota outflow; carp recycle nutrients Past point source discharges; urban runoff	30-50% reduction in phosphorus and sediment for all the lakes Reduce metal loadings in urban runoff below acute toxicity levels
Lake Waubesa (2,080 acres)	WWSF	WWSF	No, recreational use impaired by excessive fertility, nuisance algal blooms and weed growth.	Sedimentation and nuisance vegetation Water and sediment toxicity potential near storm sewer outfalls	Urban and rural runoff; Lake Monona outflow Carp recycle nutrients Past point source discharges; urban runoff	
Lake Wingra (345 acres)	WWSF	WWSF	No, recreational use impaired by excessive fertility, nuisance algal blooms and weed growth.	Sedimentation, nuisance vegetation, water toxicity potential near storm sewer outfalls	Urban runoff	
Water Body			**Are Potential Water Supply Uses Fully Attained?**	**Water Resource Problems**	**Observed or Potential Sources of Problems**	**Pollutant Reductions or Change Needed**
3. Groundwater			Some areas of groundwater pollution. Protect from further degradation.	Private wells exceed public drinking water standard for nitrates Increasing salinity Volatile organic chemicals Baseflow reduction and wetland dewatering throughout watershed	Rural fertilizer use and septic tank systems Road salt use Leaking underground tanks and waste disposal sites Municipal well pumping and wastewater diversion	Limit fertilizer and road salt use to the extent feasible Stringently review and manage development and well sitings

[1]

DNR Use Designation	Description	Minimum Dissolved Oxygen Criteria
COLD	Cold Water Sport Fishery (e.g., trout)	6.0 mg/l
WWSF	Warm Water Sport Fishery (e.g., bass, pike)	5.0 mg/l
WWFF	Warm Water Forage Fishery (e.g., shiners, minnows)	5.0 mg/l
LFF	Limited Forage Fishery	3.0 mg/l
LAL	Limited Aquatic Life	1.0 mg/l

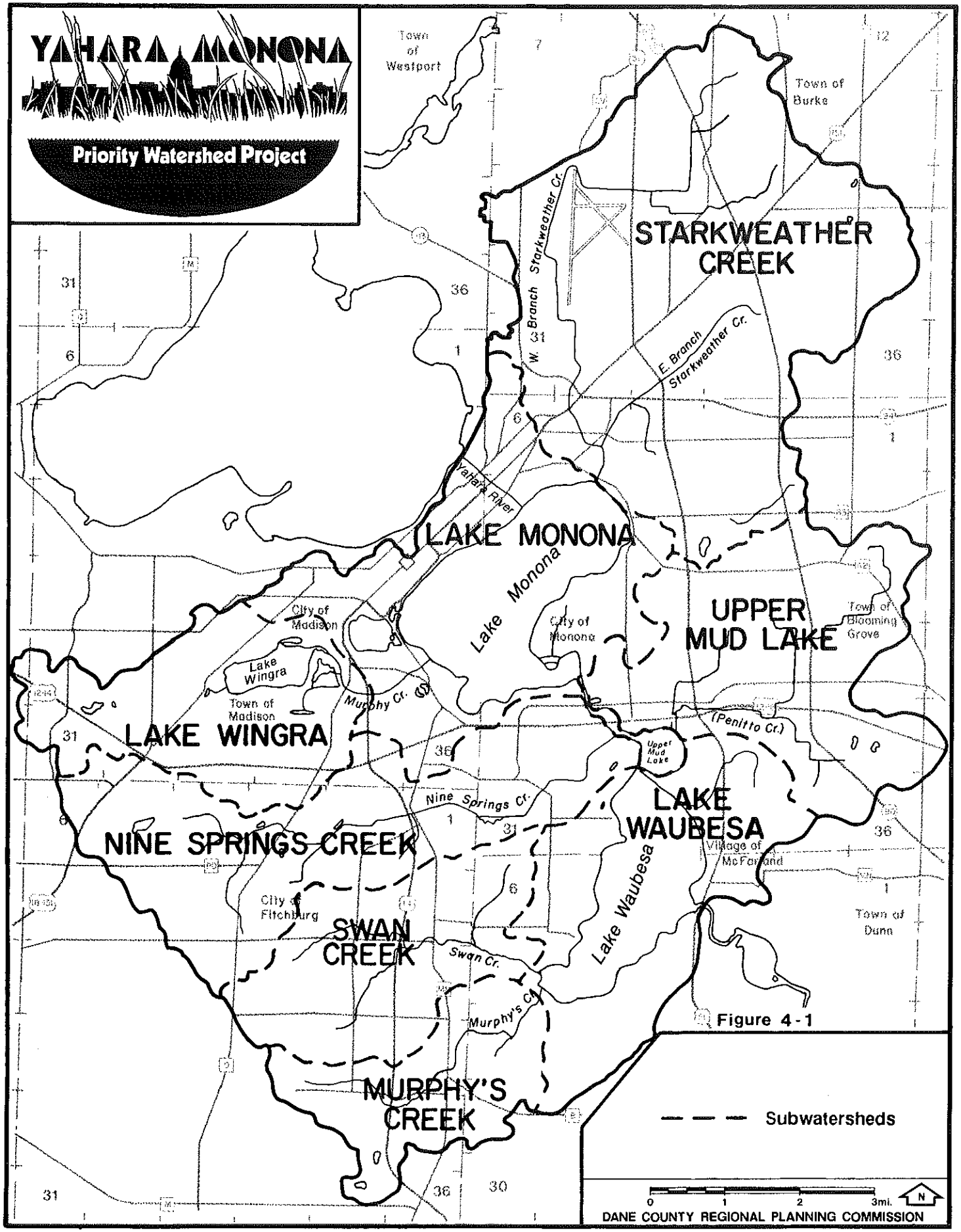
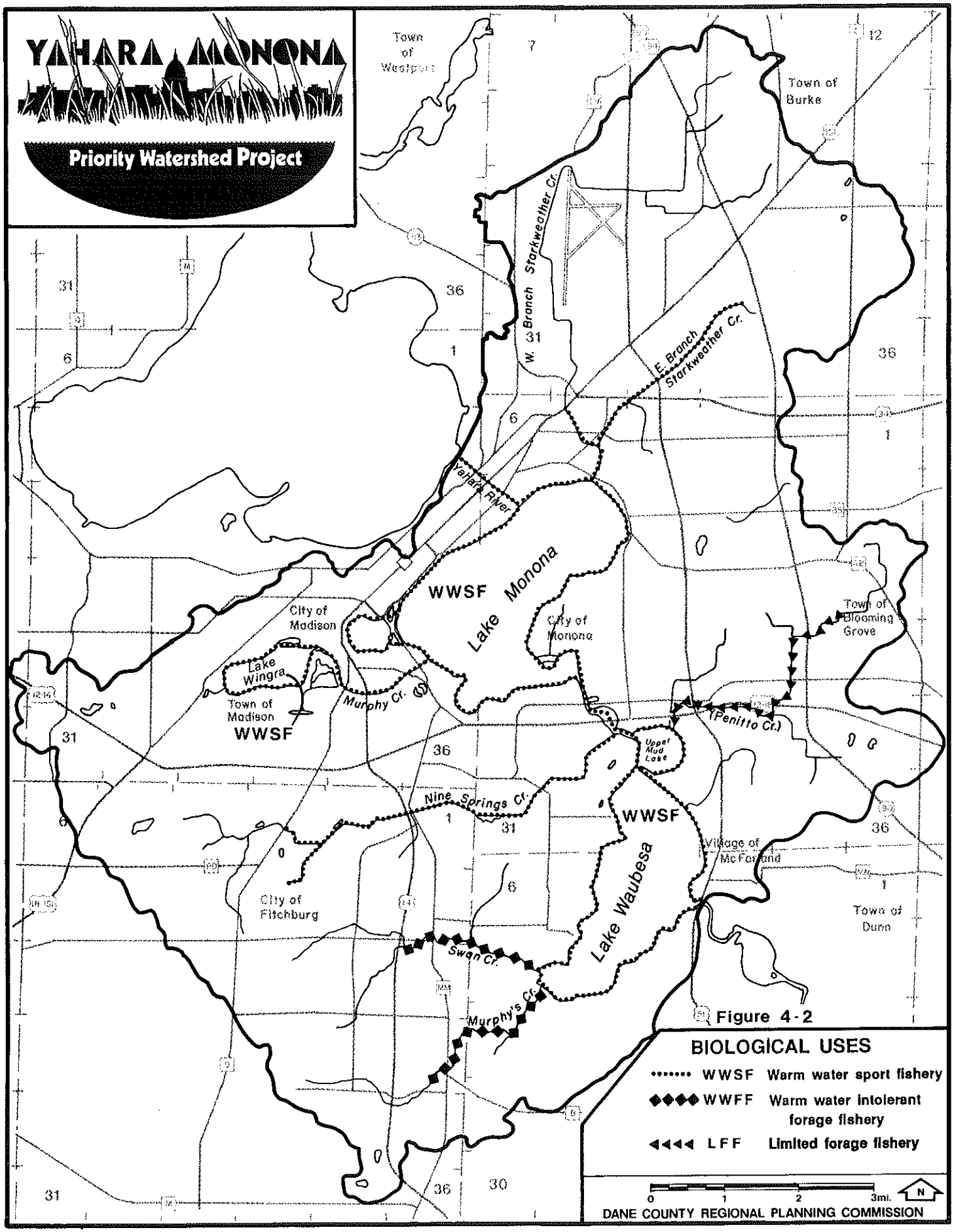

YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
STARKWEATHER CREEK
W. Branch Starkweather Cr.
E. Branch Starkweather Cr.
Yahara River
LAKE MONONA
Lake Monona
City of Madison
City of Monona
UPPER MUD LAKE
Town of Blooming Grove
Lake Wingra
Town of Madison
Murphy Cr.
LAKE WINGRA
(Penitto Cr.)
Upper Mud Lake
Nine Springs Cr.
LAKE WAUBESA
NINE SPRINGS CREEK
Village of McFarland
Lake Waubesa
City of Fitchburg
SWAN CREEK
Swan Cr.
Town of Dunn
Murphy's Cr.
MURPHY'S CREEK
Subwatersheds
0 1 2 3mi.
N
DANE COUNTY REGIONAL PLANNING COMMISSION

Figure 4-1


YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
W. Branch Starkweather Cr.
E. Branch Starkweather Cr.
Yahara River
WWSF
Lake Monona
City of Madison
City of Monona
Town of Blooming Grove
Lake Wingra
Town of Madison
WWSF
Murphy Cr.
(Penitto Cr.)
Upper Mud Lake
Nine Springs Cr.
WWSF
Village of McFarland
Lake Waubesa
City of Fitchburg
Town of Dunn
Swan Cr.
Murphy's Cr.
Figure 4-2
BIOLOGICAL USES
WWSF Warm water sport fishery
WWFF Warm water intolerant forage fishery
LFF Limited forage fishery
0 1 2 3mi.
N
DANE COUNTY REGIONAL PLANNING COMMISSION

Two perennial stream systems exist--the East and West Branches of Starkweather Creek--that join south of Milwaukee Street to form the main stem Starkweather Creek. The East and West Branches drain areas of 5,500 acres and 7,600 acres, respectively. The Olbrich Park drainage basin and direct drainage to the creek's main stem comprise the remaining 2,200 acres.

Streams

East Branch Starkweather Creek

The East Branch Starkweather Creek originates in the far northeast side of Madison between the Interstate Highway and East Towne Mall. The stream is approximately 3.5 miles in length and has a low gradient of five feet/mile. A variety of land uses have affected the water quality of the stream including parking lot runoff, cropland runoff, construction site erosion, toxic spills, deliberate and accidental industrial discharges, and littering. All of these factors have contributed to the degradation of the stream, but historic channel straightening and wetlands drainage and filling probably had the greatest impact on the stream. The resource value of Starkweather Creek and its surrounding wetlands was overshadowed by development. Ultimately the stream has been neglected and often managed as a wastewater conduit (Marshall, 1989).

The East Branch is best characterized as a sluggish urban ditch choked with aquatic vegetation and sediment. In some areas, bottom sediments are contaminated with heavy metals from past industrial discharges and urban nonpoint source pollution. Of all the sediment samples collected in the Yahara-Monona Watershed, the highest lead concentration (400 milligrams/kilogram) was recorded from the East Branch Starkweather Creek, above Midwest Steel Company. Levels above 60 mg/kg are considered heavily polluted according to EPA classification criteria. Detectable levels of DDT metabolites and PCBs also were found in sediment samples from the East Branch.

Very slow current coupled with substantial sediment deposits create an undesirable habitat for aquatic insects in the stream. Fish populations vary throughout the year, reflecting seasonal migrations from Lake Monona, but are limited primarily to a few forage species. During summer low flow conditions, fish are scarce in the stream because of severe daily dissolved oxygen fluctuations indicating respiration and photosynthesis of aquatic plants. Nighttime respiration of aquatic plants regularly causes dissolved oxygen levels to fall below 1.0 mg/l, which is substantially below the state water quality standard of 5.0 mg/l for warm water streams.

Low flow conditions are characterized by clear water and no apparent flow. The estimated seven-day low flow that occurs on an average of once in ten years (Q7,10) is 0.10 cubic feet per second (cfs) at Milwaukee Street. Following periods of runoff, the water becomes extremely turbid and the current becomes visible. Surface runoff appears to be the primary source of streamflow.

Water resource monitoring conducted between October 1989 and August 1990 indicated the average baseflow of the stream is only 0.60 cfs at Milwaukee Street. Baseflow nitrogen, phosphorus and chloride concentrations are considered relatively high (see Appendix B).

West Branch Starkweather Creek

The West Branch Starkweather Creek originates near Cherokee Marsh and flows past the Dane County Regional Airport before joining the East Branch one-half mile above Lake Monona. The stream is about seven miles in length and has a low gradient of 3.7 feet/mile.

The history of land use and water quality of the West Branch is similar to the East Branch. The West Branch is a sluggish ditch with substantial sediment deposits contaminated with heavy metals. The highest concentrations of mercury (3.5 mg/kg) and zinc (1,000 mg/kg) recorded for bottom sediments sampled in the Yahara-Monona Watershed were found in the West Branch Starkweather Creek, near Fair Oaks Avenue. Mercury and zinc levels above 1 mg/kg and 200 mg/kg, respectively, are considered heavily polluted according to EPA classification criteria. Other heavy metals measured include arsenic, barium, cadmium, chromium, copper, lead, nickel, selenium and silver. Detectable levels of PCBs and DDT metabolites also were found.

Unlike the East Branch, aquatic plants are scarce and wide daily dissolved oxygen fluctuations were not observed in 1989. Even though significant fluctuations were not observed in the West Branch, dissolved oxygen levels dropped below the five mg/l water quality standard during three 24-hour surveys.

The average baseflow of the West Branch in 1989 and 1990 was 1.2 cfs at Milwaukee Street and the estimated seven-day low flow occurring once every ten years is only 0.02 cfs. In fact, the stream is subject at times to strong windblown currents that reverse the apparent flow in the creek. Baseflow nitrogen levels are considered high, chloride levels moderately high and phosphorus levels moderate.

Spring 1990 water resource monitoring revealed significant numbers of Sphaerotilus natans bacteria (an indicator of severe pollution) in the West Branch near Anderson Street. This bacterial contamination was associated with deicer (ethylene glycol) runoff emanating from the Dane County Regional Airport. Ethylene glycol existing in a drainage ditch at the airport was found to have a very high Biochemical Oxygen Demand (BOD) of 8,000 mg/l, which can suppress dissolved oxygen in the stream to low levels. Ethylene glycol also contains high concentrations of phosphorus and can be toxic to fish and other aquatic life. Management plans to control this pollutant are currently being prepared by an engineering consultant to the Airport.

Streambank stabilization measures have been installed by the City of Madison on the West Branch between Darbo and Milwaukee Streets in response to erosion and sloughing problems. There are also bank stabilization concerns for the creek south of Milwaukee Street, including the main stem down to Olbrich Park.

Considering the volume of water in both the East Branch and West Branch of Starkweather Creek coupled with their close proximity to Lake Monona, the use classifications for both branches should be warm water sport fishery (WWSF) even though habitat conditions are poor. Dissolved oxygen and bacteria monitoring indicates that stream use potentials are not attained.

Lakes

Starkweather Creek discharges to Lake Monona; however, there are no lakes in this subwatershed.

Wetlands

Approximately 1,000 acres of wetlands exist in the Starkweather Creek subwatershed. This constitutes about seven percent of the Starkweather drainage basin. Many of the wetlands have been impacted by development activities and are not currently providing diverse resource functions. Large wetland complexes are found around the Dane County Regional Airport adjacent to the West Branch of Starkweather Creek, and south of East Towne Mall and Highway 30 alongside the East Branch of the creek. A detailed management evaluation of the wetland complex south of East Towne Mall is provided in the University of Wisconsin-Madison Water Resource Management Workshop report (UW, 1990).

Water Resource Management Objectives for the Starkweather Creek Subwatershed

1. Improve in-stream habitat conditions of Starkweather Creek and protect Lake Monona from further heavy metal, nutrient and organic contamination.

    a. Remove contaminated sediments in Starkweather Creek between Olbrich Park and Milwaukee Street on both branches of the creek.
    b. Reduce nonpoint source pollutant loadings of phosphorus and sediment by 30 to 50 percent.
    c. Reduce urban nonpoint source pollutant loadings of heavy metals to the maximum extent practicable.
    d. Install streambank stabilization and landscaping improvement measures on the main stem and selected reaches of the East and West Branches Starkweather Creek.
    e. Pursue development of a northern pike rearing pond adjacent to the stream.

2. Improve dissolved oxygen conditions in both branches of Starkweather Creek to enhance use by forage and sport fish.

    a. Limit ethylene glycol discharge to the West Branch Starkweather Creek.
    b. Implement stream aeration equipment on the main stem Starkweather Creek.
    c. Initiate an aquatic plant management or removal project on the East Branch Starkweather Creek.

3. Enhance functional roles of degraded wetlands within stream corridor.

    a. Install drainage control structures to hydrologically restore selected wetlands with initial focus on the East Branch Starkweather Creek.

Lake Monona Subwatershed

The Lake Monona subwatershed includes all of the area that directly contributes surface runoff to Lake Monona. The subwatershed covers about nine square miles and is entirely urbanized. Many of the oldest sections of the City of Madison are within the watershed, as well as numerous storm sewers that discharge to Lake Monona and the Yahara River. Tributaries of Lake Monona include Starkweather Creek, the Yahara River flowing from Lake Mendota, and Murphy (Wingra) Creek originating from Lake Wingra.

Streams

Yahara River

The Yahara River between Lakes Mendota and Monona is channelized and flow is controlled by a dam at the Lake Mendota outlet. Average baseflow is approximately 70 cfs. This stretch of the Yahara River is about one mile long. The river has a relatively flat overall gradient of 3.6 feet/mile. The water quality of the river is representative of conditions found in Lake Mendota. Average baseflow phosphorus concentrations are considered moderate. Past water quality monitoring has indicated that over 50 percent of the total annual phosphorus loading to Lake Monona occurs via the river's discharge from Lake Mendota. The use classification of the Yahara River is warm water sport fishery (WWSF).

Murphy (Wingra) Creek

Murphy Creek (commonly called Wingra Creek) is a small, channelized stream, that flows from Lake Wingra to Lake Monona. It is two miles long. The creek has a flat gradient of about two feet/mile. The average baseflow of the creek in 1989 and 1990 was 3.5 cfs. Stagnant conditions frequently exist and the stream has no flow during parts of the summer. Nearly all of the frontage on the creek is publicly owned as part of the University of Wisconsin Arboretum or as parkway. Streambank sloughing and erosion problems, which have widened the creek, are evident from Fish Hatchery Road to Olin Avenue.

The sluggish nature of the stream coupled with urban nonpoint source pollution have contributed to sedimentation and excessive rooted aquatic plant growth. The depth and volume of water in the channel support game fish part of the year, but low dissolved oxygen levels frequently become a limiting factor. Daily dissolved oxygen (d.o.) measurements taken in 1989 indicate significant photosynthesis and respiration of aquatic plants near Fish Hatchery Road. On August 16, 1989, an afternoon d.o. measurement of 12.1 mg/l dropped to 4.6 mg/l overnight. Downstream at Olin Avenue, sustained low d.o. levels were observed with minimum concentrations less than 1.0 mg/l. On June 24, 1988, a fish kill of mostly panfish was attributed to low nighttime d.o. levels. In addition to aquatic plant respiration, sediment oxygen demand and water rich with phytoplankton probably contribute to the d.o. problem. Nutrient-rich waters of Lake Wingra support heavy blue-green algae blooms that flow into Murphy Creek (Marshall, 1989).

Baseflow water quality monitoring indicates very high chloride levels in Murphy Creek. The average chloride concentration in the creek is currently 83 mg/l, which is about double the average concentration (44 mg/l) measured between 1976 and 1979. The high chloride levels are associated with road salt use in the Lake Wingra subwatershed. Although current chloride levels are not high enough to represent a threat to aquatic life, the rate of increase poses environmental concerns. Average baseflow phosphorus levels are considered moderate, while total nitrogen levels are considered low.

Murphy Creek contains extensive deposits of sediment. In-place pollutant monitoring conducted in October 1988 revealed that stream sediment contains moderate-to-high levels of heavy metals. Detectable levels of PCBs and DDT metabolites were also found. In fact, of all streams sampled in the Yahara-Monona Watershed, Murphy Creek has the highest reported concentration of PCBs in its sediment, which was found near the stream's outlet to Lake Monona. Possibly past industrial discharges and urban nonpoint source pollution are suspected as causing this contamination.

The use classification of the stream is warm water sport fishery (WWSF). Dissolved oxygen monitoring indicates that the stream use potential is not attained.

Lakes

Lake Monona

Lake Monona is the largest lake in the Yahara-Monona Watershed, covering 3,274 acres. This eutrophic lake has a maximum depth of 74 feet and flushes on the average of once/year. The lake contains an abundance of aquatic plants and experiences frequent blooms of blue-green algae. It thermally stratifies in the summer. Lake Monona supports a warm water fishery with a remnant population of cisco, a cold water species. The lake also supports a variety of "rough fish" species, with the most common being carp.

Lake Monona received heavy loads of municipal and industrial pollution until about 1950. This pollution increased the nutrient loading to the lake and contributed to nuisance conditions, especially algae blooms and associated odors. The lake has recovered significantly since 1950 because most point sources of pollution have been diverted or eliminated. However, past point sources of pollution and urban stormwater runoff have deposited heavy metals, such as lead and mercury, and organic compounds (e.g., PCBs) in the bottom sediments of Lake Monona.

Compared with over 40 other inland lakes sampled in Wisconsin, deep water sediment in Lake Monona exhibits a high degree of mercury contamination. Peak mercury levels in the sediment coincide with the time of direct municipal wastewater discharge into the Yahara lakes. Mercury has bioaccumulated in walleyes in the lake, with concentrations exceeding recommended health standards in some fish that have been tested. Because of this, Lake Monona was placed on the Wisconsin Fish Consumption Health Advisory List in 1987.

PCBs also are widely distributed in Lake Monona sediment; however, the level of contamination is relatively low compared to other PCB contamination sites around the state. Highest PCB concentrations have been found in the sediment on the north side of Monona Bay. This site also exhibits high mercury levels, with a possible source for the contaminants being a large storm sewer outfall located 200 feet away.

Sediment near Esther, Olbrich and Schluter Park beaches on Lake Monona have been tested for pesticides, such as 2,4-D and 2,4,5-T. One sample near Olbrich Park showed a detectable level of 2,4-D (0.75 ug/l). A source for the pesticide is not easy to specify; it may have occurred from urban stormwater runoff or past aquatic herbicide treatments.

Additionally, sediment surveys have revealed elevated copper and arsenic concentrations in deep water sediment of Lake Monona. Copper levels are associated with the use of copper sulfate as a herbicide to control algae populations. Fortunately, the application of copper compounds is substantially less now than in the past--less than 200 pounds are applied per year compared to as much as 100,000 pounds per year during the 1930s. Sodium arsenite was used extensively in Lake Monona to control rooted aquatic plants between 1926 and 1964. It is now banned from use. Herbicides containing Diquat are now applied to the lake. These applications are regulated and supervised by the DNR. In 1989, 46 gallons of Diquat were sprayed on the lake by a commercial applicator.

In general, sediment samples reveal a buildup of several heavy metals above background levels in Lake Monona sediment. Except for mercury, heavy metals found in Lake Monona have a low potential for bioaccumulation in fish, and do not pose a human health threat. However, deposition of heavy metals and other contaminants in sediment can restrict future lake management options, particularly dredging, due to regulatory limitations on sediment disposal (Marshall, 1989).

In terms of lake water quality, there have generally been improvements in water clarity, total phosphorus, and chlorophyll-a (a measure of algal biomass) levels in Lake Monona since the mid-1970s. Decreased phosphorus and algae in the water during 1977-89 is associated with lower than normal spring runoff in most years during this period. Sodium and chloride concentrations in the lake, however, have increased over the past 30 years, with chloride levels showing the greatest increase. Road salt use is associated with elevating the concentrations of these two constituents. Present levels of chloride and sodium are substantially below levels considered toxic to freshwater aquatic life, and increases at current rates should not be a concern for aquatic life in the foreseeable future.

Historically, water quality degradation in Lake Monona has led to a decline in the numbers and types of high-value aquatic plants in the lake. As the lake became more eutrophic, high-value plants were largely replaced by "weedy" species including coontail and Eurasian water milfoil. Densities of water milfoil became extensive in Lake Monona by the mid-1960s. Weed beds, dominated by milfoil, continued in large densities to the mid-1970s,

decreased dramatically in 1976, and again increased from 1981 to 1989. A significant decline in milfoil has taken place since 1989.

The DNR has identified sensitive or critical areas in Lake Monona where aquatic plants are managed. Sensitive areas are designated to protect water quality, high value aquatic plants, fish and wildlife habitat and shorelines susceptible to erosion. The DNR has indicated that critical fish spawning habitats comprise nearly 95 percent of Lake Monona's shoreline. Herbicide treatments are prohibited in these areas until mid-June to protect fish spawning. Non-critical areas, where early herbicide treatments are permitted, comprise seven percent of the total shoreline and occur in three locations: 3,735 Monona Drive to 4100 Monona Drive, Winnequah boat landing to Tecumseh access point, and Brittingham Park to Bernie's Beach. The Olin Park shoreline, managed by the City of Madison Parks Department, is the least disturbed shoreline of the lake, and it is not to receive any herbicide treatments.

Wetlands

Less than 100 acres of wetlands exist in the Lake Monona subwatershed. Dredging and filling activities associated with the building of the City of Madison is responsible for the loss of wetlands in the watershed. Remaining wetlands include the Tenney Park lagoon area, the outlet of Murphy (Wingra) Creek to Lake Monona, the Lake Monona outlet to the Yahara River and the Coliseum-Rimrock Road marsh, which is situated in a triangular area between Rimrock Road, John Nolen Drive and Highway 12 & 18.

Water Resource Management Objectives for the Lake Monona Subwatershed

1. Protect against further degradation and seek long-term improvement of lake fertility conditions and heavy metal levels in the sediment of Lake Monona.

    a. Reduce urban nonpoint source pollutant loadings of phosphorus and sediment by 30 to 50 percent.
    b. Reduce urban nonpoint source pollutant loadings of heavy metals to the maximum extent practicable.

2. Attempt to reestablish desirable, native aquatic plants (e.g., water lily) in selected areas of Lake Monona.

3. Improve in-stream habitat conditions of Murphy (Wingra) Creek to enhance use by forage and sport fish.

    a. Remove contaminated sediments in Murphy Creek near stream outlet to Lake Monona.
    b. Install streambank stabilization, landscaping and other corridor improvement measures.
    c. Implement stream aeration equipment.

Lake Wingra Subwatershed

The Lake Wingra subwatershed covers all of the land area that directly contributes surface runoff to Lake Wingra. This subwatershed is eight square miles in size, and is about 75 percent urbanized, with the remaining amount being part of the University of Wisconsin Arboretum. There are no major tributary streams to Lake Wingra. The outlet from the lake forms Murphy (Wingra) Creek, tributary to Lake Monona.

Streams

No perennial streams exist in this subwatershed.

Lakes

Lake Wingra

Lake Wingra is a shallow, eutrophic lake located within the City of Madison. The lake has a maximum depth of 21 feet and covers 345 acres. Lake Wingra does not stratify and flushes on the average of twice per year. A warm water fishery exists in the lake, with panfish being the dominant species. Nearly all frontage on the lake is in public ownership, either as parkway, city park, or part of the University of Wisconsin Arboretum. Substantial scientific information has been gathered on Lake Wingra, since it has been the subject of intensive in-lake and watershed ecosystem studies conducted by researchers at the University of Wisconsin from 1969 through much of the 1970s.

Man-made changes to the lake and surrounding wetlands and watershed have had substantial environmental impacts. Dredging, draining, urbanization, construction, and road salt use have been major factors affecting the physical and chemical characteristics of Lake Wingra. The introduction of carp and the aquatic plant Eurasian water milfoil also had negative impacts on the lake's biology.

During the summer, dissolved phosphorus concentrations in Lake Wingra are reduced to very low levels (below 0.005 mg/l) because of extensive nutrient uptake by aquatic plants. The lake not only supports a large community of rooted aquatic plants, it also supports high populations of phytoplankton. Summer water clarity readings have averaged about three feet in depth, indicating turbid water or phytoplankton (e.g., blue-green algae) blooms. The major source of phosphorus to Lake Wingra is urban runoff; however, the fertility of the lake is largely governed by internal recycling of phosphorus already present in the lake sediments.

Lake Wingra was not targeted for sediment sampling as part of water resource monitoring activities because previous studies demonstrated relatively low levels of heavy metals compared to sediment in Lakes Monona and Waubesa. Lake Wingra does not have a history of inorganic herbicide treatments, municipal wastewater discharge and is not on the Wisconsin Fish Consumption Health Advisory List. Relatively "clean" sediment in Lake Wingra reflects the absence of such pollution. Although concentrations of most heavy metals in Lake Wingra are substantially less than the other Yahara lakes affected by sewage discharges, higher concentrations have been found in "younger" sediment, probably as a result of urban nonpoint source pollution and atmospheric deposition (Marshall, 1989).

Significant concern has been expressed over increasing trends in chloride and sodium levels in Lake Wingra and associated road salt use in this subwatershed. Prior to 1965, Lake Wingra measured less than 20 mg/l chloride and only five mg/l in 1945. City road salting began in 1952. By 1973, the chloride concentration in the lake measured 63 mg/l. At this time, a road salt reduction program was initiated by the city for the Lake Wingra drainage area and is still in effect. By 1979, the average chloride concentration in the lake declined to 40 mg/l. However, concentrations have again increased, with 1989 monitoring displaying an average concentration of 82 mg/l. Highest chloride concentrations have been identified in the drainage areas and wetlands south and east of the lake.

In comparison to chloride, sodium concentrations have not increased as dramatically in Lake Wingra. The average sodium concentration in 1989 was 38 mg/l; it was 25 mg/l in 1977. The use of calcium chloride as a road salt may be partly responsible for higher lake loadings of chloride compared to sodium. Fortunately, current concentrations of both chloride and sodium are well below levels considered harmful to aquatic life. Further research and evaluation on the sources of these constituents to the lake is being conducted by the City of Madison Public Health Department.

Monroe Street Detention Basin

Water quality monitoring of urban stormwater runoff to the Monroe Street detention basin west of Lake Wingra has revealed high levels of sediment, nutrients and bacteria (significantly exceeding state standards). In addition, heavy metals, pesticides and PAHs (polycyclic aromatic hydrocarbons) have been detected at levels that can pose acute toxicity concerns for aquatic life. Monitoring results show the detention basin is effective in controlling much of the sediment and heavy metals from this predominantly residential area, although pesticides and other contaminants are not as effectively controlled. Additional monitoring of the detention basin's inlet and outlet is planned, as well as potential upstream pollutant source areas (e.g., lawns, gutters, parking lots).

Wetlands

Approximately 700 acres of wetlands exist in this subwatershed. The majority of the wetlands are situated around Lake Wingra, with about 75 acres also found on Odana Golf Course grounds. Most of the wetlands around Lake Wingra are now part of the University of Wisconsin Arboretum and thus are given management and protection emphasis. Extensive marsh areas that once bordered the lake, however, have been reduced more than half by dredging and filling activities.

Water Resource Management Objectives for the Lake Wingra Subwatershed

1. Protect against further degradation and seek long-term improvement of lake fertility conditions.

   a. Reduce urban nonpoint source pollutant loadings of phosphorus and sediment by 30 to 50 percent.

2. Protect lake water quality from significant salinity and heavy metal impacts.

   a. Reduce pollutant loadings of chlorides from road salt use.
   b. Reduce urban nonpoint source pollutant loadings of heavy metals to the maximum extent practicable.

3. Protect lake water quality from severe bacterial and pathogen contamination.

   a. Identify sources and reduce pollutant loadings of bacteria.

4. Enhance diversity and relative abundance of sport fish.

Nine Springs Creek Subwatershed

The Nine Springs Creek subwatershed encompasses approximately 13 square miles and extends as a long valley from Orchard Ridge School on the southwest side of the City of Madison to the Yahara River north of Upper Mud Lake. Nine Springs Creek is the only perennial stream in the watershed. It begins as an intermittent stream near the outlet of Dunn's Marsh and receives much of its baseflow further east near the Nevin Fish Hatchery, where several springs exist and there is a discharge of water (two million gallons per day) from DNR trout rearing ponds. Downstream, the creek flows around the Madison Metropolitan Sewerage District sludge lagoons before discharging to the Yahara River. The watershed includes both urban and agricultural lands, although urban or urbanizing areas now constitute over half of the land area in the watershed.

Streams

Nine Springs Creek

Nine Springs Creek is six miles long and has a low gradient of only 3.3 feet per mile. Average stream baseflow in 1989 and 1990 was 7.6 cfs at Highway 14. The creek has a history of cultural impacts including ditching and channelization, agricultural and urban runoff, and wastewater discharge from the Madison Metropolitan Sewerage District until 1958.

Nine Springs Creek supports a diverse fishery including warm water sport fish and forage populations, as well as trout that escape from the Nevin Fish Hatchery. During the summertime, trout are restricted to the wetland immediately below the hatchery where temperatures are optimum. Temperatures become too warm for trout survival in the lower section of the stream.

Although current water quality concerns rest with construction site erosion and urban and agricultural runoff, previous channel straightening has had the most devastating impact on the stream. Effects of channelization include increased summer water temperatures, reduced habitat, sedimentation and excessive growth of aquatic plants. Substantial fluctuations of daily dissolved oxygen levels reflect photosynthesis and respiration of numerous aquatic plants. At Syene Road, for example, nighttime dissolved oxygen levels dropped below the 5.0 mg/l state water quality standard during three field surveys in 1989. Downstream at Moorland Road, wide dissolved oxygen fluctuations were observed, but levels did not fall below standards (Marshall, 1989). In addition, aquatic insects collected at this location indicated "fair" water quality conditions based on a biotic index classification system. Baseflow nitrogen, phosphorous and chloride concentrations recorded at Highway 14 are considered high.

In 1988, PCB and organic pesticide levels were below detection limits for sediment samples from Nine Springs Creek at Moorland Road. However, mercury was detected at low levels in sediment at this location, with concentrations ranging from 0.13 to 0.24 mg/kg. The source of the mercury may have been past wastewater treatment plant discharges to the stream.

The overall use classification for Nine Springs Creek is a warm water sport fishery (WWSF), supporting diverse fish populations. The use potential, however, is impaired by low nighttime dissolved oxygen levels.

Lakes

There are no lakes in this subwatershed.

Wetlands

This subwatershed includes the largest acreage of wetlands of any subwatershed in the Yahara-Monona basin. Over 2,000 acres of wetlands exist. This makes up nearly 25 percent of the land area in the Nine Springs Creek subwatershed and represents approximately one-third of the total wetland acreage in the Yahara-Monona Watershed.

Many of the wetlands are located in the Nine Springs E-Way Corridor, extending from Dunn's Marsh near Seminole Highway east to Lake Farm Park on Lake Waubesa. Because many of the wetlands are in the E-Way, they are currently in public ownership or are planned to be publicly acquired. The Nine Springs wetland complex between the Nevin State Fish Hatchery and Highway 14 was studied in detail by the UW Water Resource Management Workshop (UW, 1990). Management alternatives for various units of this complex are presented in the workshop's report. General management strategies to enhance the Nob Hill wetland area north of Moorland Road also are included in the report. In addition, the U.S. Geological Survey has conducted a detailed hydrologic study of the Nevin Fish Hatchery wetland (Novitzki, 1978).

An extensive amount of monitoring also has been conducted in and near the Madison Metropolitan Sewerage District's (MMSD) sludge lagoons. The lagoons, which were formerly wetland sites, have been tested for PCBs, and results have revealed levels of PCBs greater than 50 ppm (EPA disposal standard) in some sludge samples. To characterize the extent and impact of the PCBs, fish and water from nearby Nine Springs Creek have been analyzed. Local groundwater also has been monitored. Results indicate that PCBs are not adversely affecting these resources. PCBs are being largely contained within the sludge lagoons. Plans for restoring the sludge lagoons are currently being developed by MMSD.

Water Resource Management Objectives for the Nine Springs Creek Subwatershed

1. Improve habitat and dissolved oxygen conditions in Nine Springs Creek to enhance use by forage and sport fish.

    a. Reduce nonpoint source pollutant loadings of phosphorus and sediment by 30 to 50 percent.
    b. Reduce urban nonpoint source pollutant loadings of heavy metals.
    c. Initiate an aquatic plant management or removal project.

2. Protect and enhance functional roles of wetlands in the Nine Springs Creek corridor.

Upper Mud Lake or Penitto Creek Subwatershed

This subwatershed covers about 11.5 square miles and includes the drainage area to Upper Mud Lake. Parts of the Town of Blooming Grove, City of Monona, and east side of the City of Madison are within the subwatershed, and there are land use plans for further urban development.

One perennial stream exists in the subwatershed. It has no official name but has been referred to as Penitto Creek.

Streams

Penitto Creek

This small tributary begins as a perennial stream in Section 14 of the Town of Blooming Grove and flows south and west to the confluence with Upper Mud Lake. The stream is four miles long and has a gradient of three feet/mile. Stream habitat is poor because of low stream flows and channel straightening. Croplands and urban development have contributed sediment to the stream. Even though the habitat is poor, the abundance of certain aquatic insects, such as Gammarus pseudolimneus (amphipods), indicate groundwater seepage and "very good" water quality based on a biotic index classification system. During a field survey in 1989, plant communities of curly leaf pondweed and elodea (waterweed) were found, which also indicate groundwater discharge and cool water temperatures (Marshall, 1989).

In general, channelization, sediment and low flow contribute to poor stream habitat. The stream supports an unbalanced forage and macroinvertebrate insect community, and the use classification should be limited forage fishery (LFF).

Lakes

Upper Mud Lake

Upper Mud Lake is a shallow, fertile lake that was formed by a railroad grade crossing a marsh at the inlet of the Yahara River to Lake Waubesa. The lake covers approximately 265 acres, and much of its shoreline is in public ownership.

Upper Mud Lake is surrounded by marsh and wet meadow. Spawning habitat for game fish is excellent, and the lake supports a diverse warm water sport fishery (WWSF). The Yahara River is the source of a large, constant flow of nutrients into the lake that stimulates the growth of aquatic vegetation.

Sediment samples from Upper Mud Lake were tested as part of the South Beltline dredging project in 1986. Samples were relatively clean of contamination. PCB concentrations were below the detection limit and the highest mercury concentration was only 0.12 mg/kg in one of four samples. The dredging project deepened the lake from 4 to 25 feet near the eastern shore, which has helped to improve fish habitat conditions.

Wetlands

About 1,000 acres of wetlands exist in the Upper Mud Lake subwatershed. This represents 13 percent of the Upper Mud Lake drainage area. Many of the wetlands are located adjacent to Penitto Creek and Upper Mud Lake. A 25-acre wetland restoration project associated with the building of the new South Beltline Highway has occurred near Mud Lake to compensate the loss of wetlands from construction.

The 1990 UW Water Resource Management Workshop identified the Vondron/Femrite Fen near the northeast corner of the intersection of Vondron and Femrite Roads as a high quality wetland containing diverse flora. This 84-acre wetland is in a developing industrial area and the Workshop has indicated that appropriate protection measures be pursued so that adverse development impacts to the wetland do not occur.

Water Resource Management Objectives for the Upper Mud Lake Subwatershed

1. Protect against further degradation and seek long-term improvement of habitat and fertility conditions in Upper Mud Lake.

    a. Reduce urban nonpoint source pollutant loadings of phosphorus and sediment by 30 to 50 percent.
    b. Reduce urban nonpoint source pollutant loadings of heavy metals to the maximum extent practicable.

2. Protect and seek to enhance functional roles of high quality wetlands.

Swan Creek Subwatershed

This subwatershed drains seven square miles of land within the City of Fitchburg and Town of Dunn. Drainage occurs to Lake Waubesa. Rural land use is predominant in this subwatershed, with several unsewered lots and subdivisions in existence. Only one perennial stream--Swan Creek--is found in the drainage basin. It originates as a perennial stream near Highway 14.

Streams

Swan Creek

Swan Creek is a small tributary that flows into the southwestern end of Lake Waubesa in the Town of Dunn. The creek is about two miles long and has a moderate gradient of 16.1 feet/mile. Swan Creek has a low base discharge of about 1 cfs. Extensive dredging and straightening of the creek has occurred.

Water quality in the stream is considered good based on dissolved oxygen levels and a biotic index classification. During a fish shocking survey in 1989, abundant populations of bluntnose minnows, johnny darters and sticklebacks were found. In comparison, northern pike, white suckers, brown bullheads, brook sticklebacks and johnny darters were identified during a DNR survey in 1975.

The primary limiting factor for growth of fish and aquatic insects in the stream is habitat. Low flows limit the fishery to forage populations and sedimentation appears to benefit the insect Gammarus pseudolimneus over other macroinvertebrates (Marshall, 1989). Gammarus (amphipod) is an indicator of good water quality but can thrive in streams affected by sediment.

Based on the physical, chemical and biological stream characteristics, Swan Creek should be classified as a warm water intolerant forage fishery (WWFF). It is capable of supporting healthy forage fish and macroinvertebrate insect populations.

Lakes

No lakes exist in this subwatershed.

Wetlands

Over 400 acres of wetland are found in the Swan Creek subwatershed. This constitutes about ten percent of the creek's drainage area. Most wetlands occur adjacent to the stream (e.g., Swan Creek wetland in Section 12 of the City of Fitchburg). A 98-acre wetland site, however, is located near a tributary to Swan Creek in Section 6 of the Town of Dunn. A portion of the Waubesa Wetlands also is found in this subwatershed. The 1990 University of Wisconsin Water Resource Management Workshop has identified and classified the Swan Creek Wetland (79 acres) and the Waubesa Wetlands (592 acres) as exceptional quality wetlands that should be protected from detrimental land use impacts.

Water Resource Management Objectives for the Swan Creek Subwatershed

1. Protect against degradation of habitat and water quality conditions in Swan Creek.

    a. Reduce rural nonpoint source pollutant loadings of sediment by at least 30 percent.
    b. Reduce animal waste pollutant loadings of phosphorus by at least 50 percent.

2. Protect high-quality wetlands from detrimental development impacts.

Murphy's Creek Subwatershed

This subwatershed is less than six square miles in size and is the smallest subwatershed in the Yahara-Monona drainage basin. Agricultural land use and wetlands are prevalent. A large wetland complex (the South Waubesa Wetlands) is found at the outlet of the watershed near Lake Waubesa. Murphy's Creek is the only perennial stream in the watershed.

Streams

Murphy's Creek

Murphy's Creek is a small spring-fed tributary of Lake Waubesa. The stream is three miles long and has a low gradient of eight feet/mile. It also has a low baseflow discharge of about two cfs. Murphy's Creek begins as a perennial stream near Byrne Road in Section 24 of the City of Fitchburg.

Historically, Murphy's Creek was affected by wastewater discharges from the Oakhill Correctional Institute. In 1983, the facility was connected to the Oregon sanitary sewer system; thus the only point source pollution discharge has been eliminated from the stream.

Water resource appraisal monitoring indicated good water quality in the lower reach of Murphy's Creek in 1989. Dissolved oxygen levels did not fall below 7.9 mg/l during two field surveys. Aquatic plants are scarce in the stream as indicated by minimal daily dissolved oxygen fluctuations. Aquatic insects indicated good water quality based on a biotic index classification. Gammarus pseudolimneus was the most abundant species collected (Marshall, 1989).

Groundwater seepage and wetland vegetation contribute to good water quality and habitat in the lower reach of Murphy's Creek. The fishery is limited to forage populations because the stream is too small to support gamefish. During a fish shocking survey in 1989, numerous bluntnose minnows and one johnny darter were identified. In 1975, mudminnows, stonerollers, fathead minnows, creek chubs, white suckers, brook sticklebacks and green sunfish were found in the lower section of Murphy's Creek.

In the upper watershed, the fishery, water quality and habitat are limited by low flow conditions. During cold weather, ground water seepage keeps the lower reach open while the headwaters freeze over because groundwater discharge is negligible. Cropland runoff may have an impact on the stream even though severe erosion was not observed during field surveys.

Based on physical, chemical, and biological characteristics, the stream use classification of Murphy's Creek should be warm water intolerant forage fishery (WWFF). A diverse forage fishery can be supported.

Lakes

There is a small, unnamed pond in the southeast quarter of Section 26 of the City of Fitchburg. It covers 4.4 acres and has a maximum depth of eight feet. The pond is not managed as a fishery, and water quality information has not been collected. The state Department of Health and Social Services owns the land around the pond.

Wetlands

Approximately 600 acres of wetland exist in the Murphy's Creek subwatershed. This represents about 16 percent of the creek's drainage area. The Waubesa Wetlands constitute over half of the wetland acreage in this subwatershed and are classified as exceptional quality wetlands that should be protected. Much of these wetlands are under Nature Conservancy or public ownership.

Water Resource Management Objectives for the Murphy's Creek Subwatershed

1. Protect against degradation of habitat and water quality conditions in Murphy's Creek.

    a. Reduce rural nonpoint source pollutant loadings of sediment by at least 30 percent.
    b. Reduce animal waste pollutant loadings of phosphorus by at least 75 percent.

2. Protect high quality wetlands from detrimental development impacts.

Lake Waubesa Subwatershed

The Lake Waubesa subwatershed includes all of the area that directly contributes surface runoff to Lake Waubesa. The subwatershed covers about 9.5 square miles and includes parts of the Village of McFarland, City of Madison, and Towns of Dunn and Blooming Grove. A variety of land use (e.g., municipal, industrial and agricultural) exists in the watershed.

Streams

No perennial streams are found in this subwatershed.

Lakes

Lake Waubesa

Lake Waubesa is a moderately shallow, eutrophic lake located below Lake Monona. The lake has a maximum depth of 34 feet and covers 2,080 acres. Because of its shallowness, Lake Waubesa exhibits only brief periods of summer stratification. It flushes on the average of three times per year. Much of the flow and nutrient load to the lake is contributed by the Yahara River, flowing from Lake Monona.

A productive, diverse warm water fishery exists in Lake Waubesa. Dominant species include panfish and bass. Large populations of rough fish, especially carp, are also present.

Lake Waubesa supports abundant populations of rooted aquatic plants and algae. The lake was severely affected by large amounts of municipal wastewater received from the Nine Springs Sewage Treatment Plant in the 1940s and 1950s. Though water quality has improved considerably since this wastewater was diverted, the lake still suffers from the effects of the large nutrient load it once received. Bottom sediments now contain high concentrations of phosphorus, which is released and recycled in the lake, promoting the annual occurrence of blue-green algae blooms.

In terms of rooted aquatic plants, sago pondweed was the only species found in any abundance in Lake Waubesa from the late 1930s through the early 1950s. Rooted plants were sparse in the early 1960s. Densities of Eurasian milfoil were high in the early 1970s, and then declined in 1976 as in the other Yahara River lakes. Milfoil became abundant again in the early 1980s and continued to proliferate until 1989, when a substantial decline again occurred. While no actual measurements have been made, the maximum depth of plant growth probably increased slightly during the 1980s.

The DNR has recently identified sensitive or critical areas in Lake Waubesa where aquatic plants are managed. Sensitive areas are designated to protect water quality, high value aquatic plants, fish and wildlife habitat and shorelines susceptible to erosion. Within sensitive areas, aquatic herbicide applications can be prohibited or curtailed, whichever is necessary to protect these concerns. Undeveloped shorelines of Lake Waubesa are managed by the Nature Conservancy, DNR and Dane County. To reinforce current management and identify benchmark areas in the lake, herbicide treatments are prohibited along these shorelines. Critical fish spawning habitats occur along the entire Lake Waubesa shoreline. Thus, herbicide treatments are prohibited until mid-June to protect fish spawning along all privately owned lands.

Lake Waubesa has received extensive water quality monitoring since the mid-1970s. In general, total phosphorus, chlorophyll-a and water clarity levels have improved slightly over the years. Water clarity levels, however, are still considered poor, largely as a result of reoccurring algae blooms. During 1976-1980, water clarity in the lake was very poor, with most secchi disk transparency measurements less than three feet in depth. Dissolved phosphorus levels in Lake Waubesa were below analytical detection for most of 1981-1989, which indicates that phosphorus was extensively used by plants and could have been growth-limiting to algae. The decrease in phosphorus levels can be attributed to reduced phosphorus loadings to the lake from the outlet discharge of Lake Monona and because of less than average spring runoff in most years from 1977-1987. Sodium and chloride concentrations, as well as rates of increase, in Lake Waubesa are approximately the same as in Lake Monona.

Sediment monitoring has also been carried out for Lake Waubesa. In 1972, mercury was detected at a concentration of 1.1 mg/kg in the surface layer of a sediment core sample. In 1987, sediment cores displayed significantly lower mercury levels (0.3 and 0.4 mg/kg) in surface layers, indicating reduced mercury deposition.

Although mercury levels have decreased substantially since 1972, Lake Waubesa still contains the second highest mercury levels (behind Lake Monona) in surface sediment compared to 42 other inland lakes tested in Wisconsin. Elevated mercury levels in the sediment of the lake probably have resulted primarily from municipal wastewater discharges received via Nine Springs Creek from 1936 until 1958. Mercury has also been found at levels of public health concern in some large walleyes that have been tested from Lake Waubesa. Consequently, walleyes from the lake were placed on the Wisconsin Fish Consumption Health Advisory List in 1988.

In addition to mercury sampling, levels of lead, cadmium, chromium, copper, nickel and zinc were measured in Lake Waubesa sediment in the early 1970s. At that time, a sediment core displayed the highest concentrations of lead, chromium, copper and zinc in younger sediment, indicating recent buildup of heavy metals, which probably stemmed from nonpoint source pollution and atmospheric deposition.

Wetlands

Slightly over 500 acres of wetlands exist in the Lake Waubesa subwatershed. Significant wetland areas are located along the northeastern, south and southeastern shorelines of Lake Waubesa. Many of these wetlands maintain important resource functions. An example of a wetland that has been hydrologically modified by shoreline development activities, but still retains significant functions, is the Radio Tower-East Waubesa Wetland. This 139-acre site adjacent to the southeast side of Lake Waubesa was identified by the UW Water Resource Management Workshop as having significant aesthetic and recreational qualities that make it a desirable wetland for management efforts.

Water Resource Management Objectives for the Lake Waubesa Subwatershed

1. Protect against further degradation and seek long-term improvement of lake fertility and habitat conditions.

    a. Reduce urban and rural nonpoint source pollutant loadings of phosphorus and sediment by at least 30 percent.
    b. Reduce urban nonpoint source pollutant loadings of heavy metals to the maximum extent possible.

2. Protect and enhance functional roles of selected wetlands.

Public Beach Monitoring Results

As part of the priority watershed project, water quality monitoring was conducted at selected public beaches in the Yahara-Monona Watershed. This was done to help determine if rainfall-runoff events discharge pollutants at levels that pose public use or health concerns at beaches adjacent to storm sewer outfalls. Bacteria (fecal coliform and fecal streptococci), human pathogen (Staphylococcus aureus) and heavy metal monitoring was performed by the Madison Public Health Department at four swimming beaches on Lake Monona (Brittingham, Frostwoods, Olbrich and Olin) and one beach on Lake Waubesa (Goodland), which served as a control site since there are no storm sewer outfalls adjacent to this beach. Two beaches on Lake Mendota, which is not in the priority watershed project, were also sampled. Water quality monitoring was done at the beaches immediately following two rainfall-runoff events in the summer of 1989, as well as two times during dry weather periods in order to determine background parameter concentrations.

In general, results indicate that rainfall events did not substantially increase the concentrations of monitored contaminants at the public beach areas. Concentrations of fecal coliform bacteria, an indicator of fecal contamination, did not exceed established swimming water quality standards (State Division of Health guidelines for beach closure of 1,000 colonies per 100 ml for a single sample). Fecal coliform levels did increase following rainfall-runoff events at Frostwoods and Olbrich Park beaches, although levels at Olin and Brittingham beaches were somewhat less after runoff events than during dry weather periods. Levels of fecal streptococci, an indicator of animal waste contamination, were also low and changes were similar to that observed for fecal coliform. The pathogen Staphylococcus aureus, which is associated with causing human ear infections, was not detected in any water sample from all seven public beaches. In addition, heavy metal concentrations were often at or below detection limits and did not increase following rainfall events. An exception is noted for silver (Ag), which was measured at 0.07 mg/l at Brittingham Beach following a rainfall, compared to background levels of 0.01 mg/l. A similar concentration increase was also recorded for silver at Spring Harbor beach on Lake Mendota following a rainfall event in August 1989. The source of the silver is not known.

Results of beach bacteria monitoring differ considerably from bacteria levels recorded during rainfall events at the Monroe Street detention basin, west of Lake Wingra. Counts of over several thousand fecal coliform colonies per 100 ml have been measured by the U.S. Geological Survey in samples from the detention basin, which receives water from a storm sewer drainage system serving a residential area. The reason for the much lower bacteria counts at the beach sites may be a result of substantial water dilution from the large volume of water in the lakes and greater downgradient distances from storm sewer outfalls.

While stormwater runoff did not substantially increase indicator bacteria levels at the monitored beaches, an association between elevated bacteria levels at Madison public beaches and fecal contamination from ducks has been made by the City Public Health Department. To deal with this problem, lifeguards are instructed to regularly rake sandy beaches near swimming areas to destroy bacteria and pathogenic organisms that may exist from duck feces. This effort has been successful in reducing swimming area bacteria counts.

Summary of Groundwater Resources

Groundwater quality data are collected on an ongoing basis in the Yahara-Monona Watershed by several government agencies (e.g., DNR, Madison Metropolitan Sewerage District, local municipalities) that test wells used for supplying drinking water.

Evaluation of well water monitoring data indicates three contaminants--nitrate-nitrogen, salt (sodium and chloride) and volatile organic chemicals (VOCs)--are of primary groundwater quality concern in the Yahara-Monona Watershed. Nitrate-nitrogen and salt are associated to some extent with nonpoint source pollution, while VOCs are more directly related to point sources of pollution (e.g., landfills, underground storage tanks).

MMSD monitors nitrate-nitrogen, as well as coliform bacteria, zinc, chloride and conductivity, in private wells near agricultural fields that receive sewage sludge applications as part of the District's "Metrogro" program. Approximately 50 percent of the 177 wells tested by MMSD in the Yahara-Monona Watershed in 1989 exceeded the recommended public drinking water standard for nitrate-nitrogen of 10 mg/l. (This standard has been established based on health concerns for infants under six months of age, rather than concerns for adults and older children.) The average concentration of all wells tested was 11.9 mg/l, with several wells testing between 20 and 30 mg/l, but few testing above 30 mg/l.

Nitrate testing also is done by the DNR for municipal and non-community wells (e.g., wells serving restaurants, parks, churches, schools). Of 61 non-community wells tested in the watershed from 1979 to 1989, 14.8 percent exceeded the recommended nitrate standard. The average concentration of all tested wells was five mg/l. No municipal wells tested above the standard. The reason for the lower nitrate concentrations in these wells compared to private wells tested by MMSD is probably due to deeper well casing depths and possibly stricter adherence to well construction codes.

Several of the private wells testing above the 10 mg/l nitrate standard exist in unsewered subdivisions, although high testing wells also exist in areas where there are low densities of homes. Figure 4-3 displays areas in the watershed where there are clusters of wells that have tested above and below the nitrate standard.

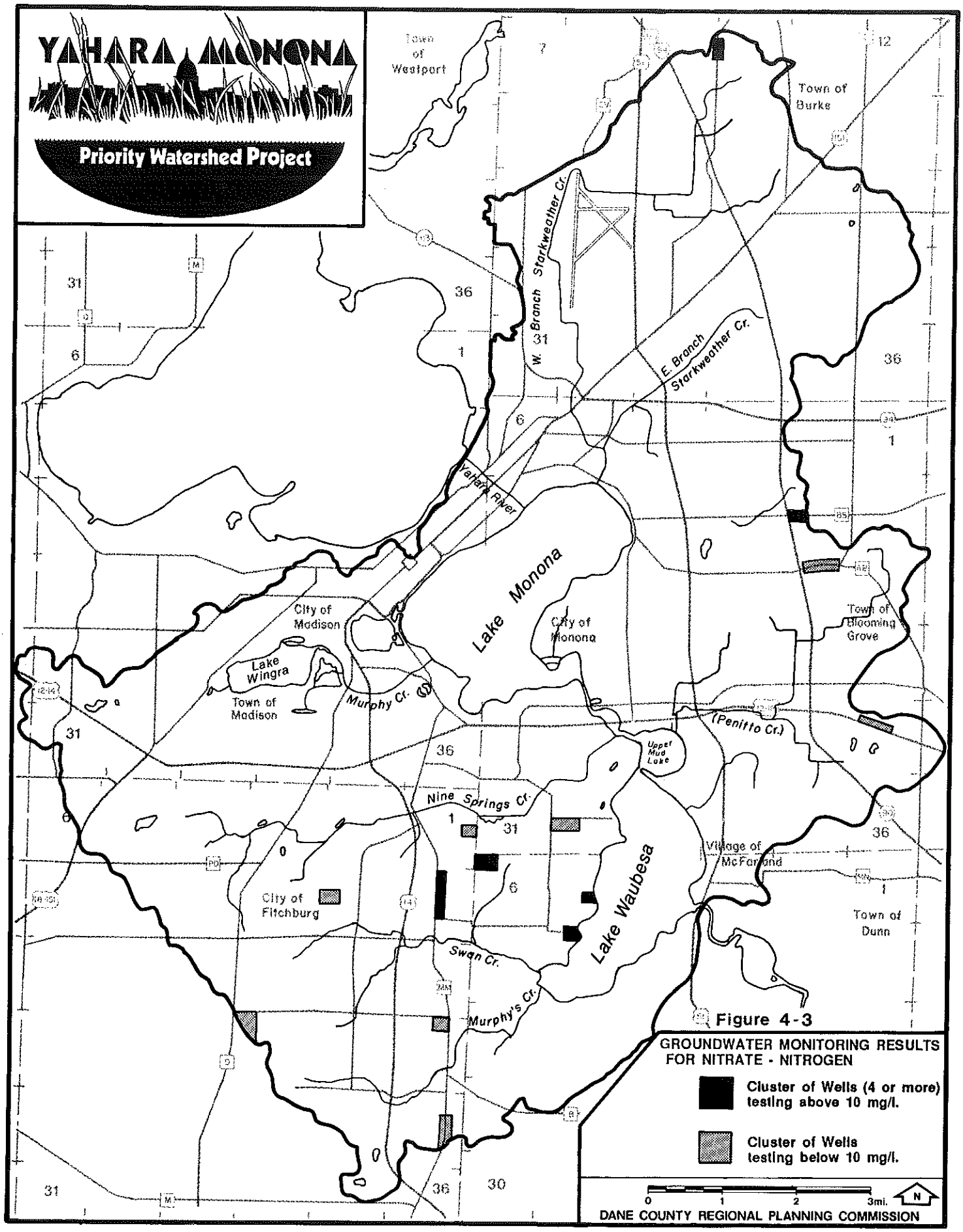
Possible sources of nitrate-nitrogen include fertilizer applications, septic tank system discharges and the land-spreading of sludge, septage and animal waste. Fertilizer applications and septic tank discharges are probably the most important contributors, due to the prevalence of agriculture and unsewered residential development in parts of the watershed. Sewage sludge is widely applied to agricultural lands in the watershed, but it is not believed to be significantly impacting groundwater nitrate levels. Well water monitoring by MMSD near sludge application sites indicates current (post-application) nitrate levels are no higher than pre-application levels measured in the late 1970s.

Municipal well water testing in the City of Madison has revealed increasing concentrations of chloride and sodium in some wells over the past 20 to 30 years. The highest chloride concentrations and the greatest rates of increase have been found in unit wells Nos. 2, 3 and 4--all located in the downtown Isthmus area. Sodium concentrations in these three wells have also exceeded the advisory level (20 mg/l) for people on low sodium diets. The wells, however, are no longer actively used by the city. The increases in sodium and chloride concentrations are associated with salt use for road deicing in the watershed.

Volatile organic chemicals also have been detected in some private and municipal wells in and near the Cities of Madison and Fitchburg and Village of McFarland. Well No. 3 in the City of Fitchburg has been closed because of high concentrations of these chemicals. VOCs are found in fuel oils, degreasers and solvents, which have entered the groundwater from leaks in underground storage tanks, old landfills, and chemical spills.

A limited amount of pesticide monitoring has been conducted for private wells in the watershed. Pesticides, such as atrazine, have been detected in water from a few wells; thus there are selected areas of pesticide use and pollution concerns. Generally, however, groundwater pollution from pesticide applications is not as significant of a concern in the watershed as in other areas of Dane County (e.g., western, unglaciated area). This is because more extensive agricultural land use and limiting physical resource factors (e.g., shallow depths to bedrock) make groundwater more susceptible to pollution in other parts of the county.

In summary, while good groundwater quality generally exists in the watershed, certain land use activities have impacted this resource. A high concentration of nitrate-nitrogen is common in the shallow groundwater system, which has probably resulted to a large degree from fertilizer use and on-site sewage system wastes. Sodium and chloride levels have been increasing in the groundwater beneath the City of Madison, which is associated with road salt use. In addition, organic chemicals and pesticides have been detected in some potable wells as a result of leakage from nearby landfills, underground storage tanks, chemical spills and agricultural applications.


YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
W. Branch Starkweather Cr.
E. Branch Starkweather Cr.
Yahara River
Lake Monona
City of Madison
City of Monona
Town of Blooming Grove
Lake Wingra
Town of Madison
Murphy Cr.
(Penitto Cr.)
Upper Mud Lake
Nine Springs Cr.
Village of McFarland
City of Fitchburg
Lake Waubesa
Town of Dunn
Swan Cr.
Murphy's Cr.
Figure 4-3
GROUNDWATER MONITORING RESULTS FOR NITRATE - NITROGEN
Cluster of Wells (4 or more) testing above 10 mg/l.
Cluster of Wells testing below 10 mg/l.
0 1 2 3mi.
N
DANE COUNTY REGIONAL PLANNING COMMISSION

Groundwater pollution hazard maps have been developed, that display on a 40-acre basis the relative potential for pollution in the watershed (see Fig. 4-4 as an example). Two maps were prepared for the Dane County Groundwater Protection Plan (DCRPC, 1987) in accordance with surface and subsurface land use or waste disposal activities. The maps represent a graphical interpretation of several physical resource factors (e.g., soils, depth to bedrock and groundwater, bedrock type). Pollution hazard classifications are based on a numerical approach to rating these factors. In general, many lowland areas in the watershed, where there is a shallow depth to groundwater, have been assigned moderate to greatest pollution hazards. By assessing relative hazards from the maps, groundwater quality may be protected by prioritizing areas of concern in the watershed and pursuing necessary management and/or monitoring practices.

Well protection zones also are shown on the pollution hazard maps. The zones are delineated around municipal water supply wells and are intended to identify the immediate land area contributing groundwater to wells. These areas should receive special attention and protection from potentially polluting waste disposal or land use practices.

In addition to water quality, another concern that exists with groundwater in the Yahara-Monona Watershed is the effects of heavy municipal groundwater pumping on stream baseflow and wetlands. Large water withdrawals in the Madison metropolitan area have induced a significant groundwater level drawdown in the deep sandstone aquifer, which supplies municipal water needs. McLeod (1978) used a computer model to simulate the maximum drawdown in the sandstone aquifer from the beginning of pumping in Madison in 1882 until 1975. The drawdown was estimated to be 75 feet (see Fig. 4-5). The drawdown in the overlying shallow or upper aquifer can also be affected by such pumping. This drawdown was simulated by McLeod and determined to be 10 to 20 feet below prepumping levels.

Lowering of the shallow groundwater table through pumping can reduce the groundwater contribution to stream baseflow during dry periods, when the baseflow in many streams is almost totally dependent on groundwater contributions. Shallow water table declines can also cause serious wetland dewatering and adverse hydrologic and habitat impacts. These types of impacts have probably occurred in the Starkweather Creek subwatershed. Although there is insufficient historic flow data on Starkweather Creek to quantify declines in baseflow, the small amount of data available and an analysis of groundwater withdrawals support a belief that baseflow declines in the creek have been substantial.

The combined effect of groundwater pumping and diversion of wastewater out of the Yahara-Monona Watershed to the lower Yahara River Basin (via MMSD's wastewater discharge to Badfish Creek) has had, and will continue to have, a pronounced effect on baseflow in the Yahara River below the Madison metropolitan area. The reduced baseflow in the Yahara River could have serious consequences during drought conditions.

Baseflow reduction resulting from wastewater diversion was evaluated in the Madison Metropolitan Sewerage District's Facilities Plan (O'Brien & Gere, 1976). The mean flow of the Yahara River at McFarland was estimated to be reduced by about 35 percent as a result of diversion, with an approximate 1:1 relationship between the volume of the diverted flow (now about 60 cubic feet per second) and the reduction in baseflow. It was indicated that if wastewater diversion continued without appropriate controls, there was a significant probability that the seven-day low flow of the Yahara River could reach a zero discharge by 1990. Fortunately this has not occurred and groundwater pumping and subsequent water diversion has not increased as much as originally projected. Nevertheless, additional hydrologic studies are needed to determine appropriate management schemes that could be used to avert such a severe low flow condition.

While pumping in the Madison metropolitan area has created a large drawdown, it has not significantly dewatered the sandstone aquifer. Groundwater modeling by McLeod showed that water declines from pumping and interbasin wastewater diversion should not be a serious detriment to the available groundwater supply.

In addition to well pumping impacts, further urbanization in the Yahara-Monona Watershed can reduce local groundwater recharge, which sustains stream baseflow. This occurs when impervious surfaces, such as streets, parking lots and rooftops, are established that limit the infiltration of precipitation into the soil and groundwater and in turn promote greater stormwater runoff and nonpoint source pollution. Thus, management measures that promote the infiltration of water should be emphasized as an accompaniment to urban development wherever environmentally feasible in the watershed. Remaining open space areas that are important in providing local groundwater recharge should be identified and protected. Figure 4-6 displays general areas in the watershed that may be important in providing groundwater recharge, based on the surficial geology that exists (e.g., presence of coarse, outwash materials).

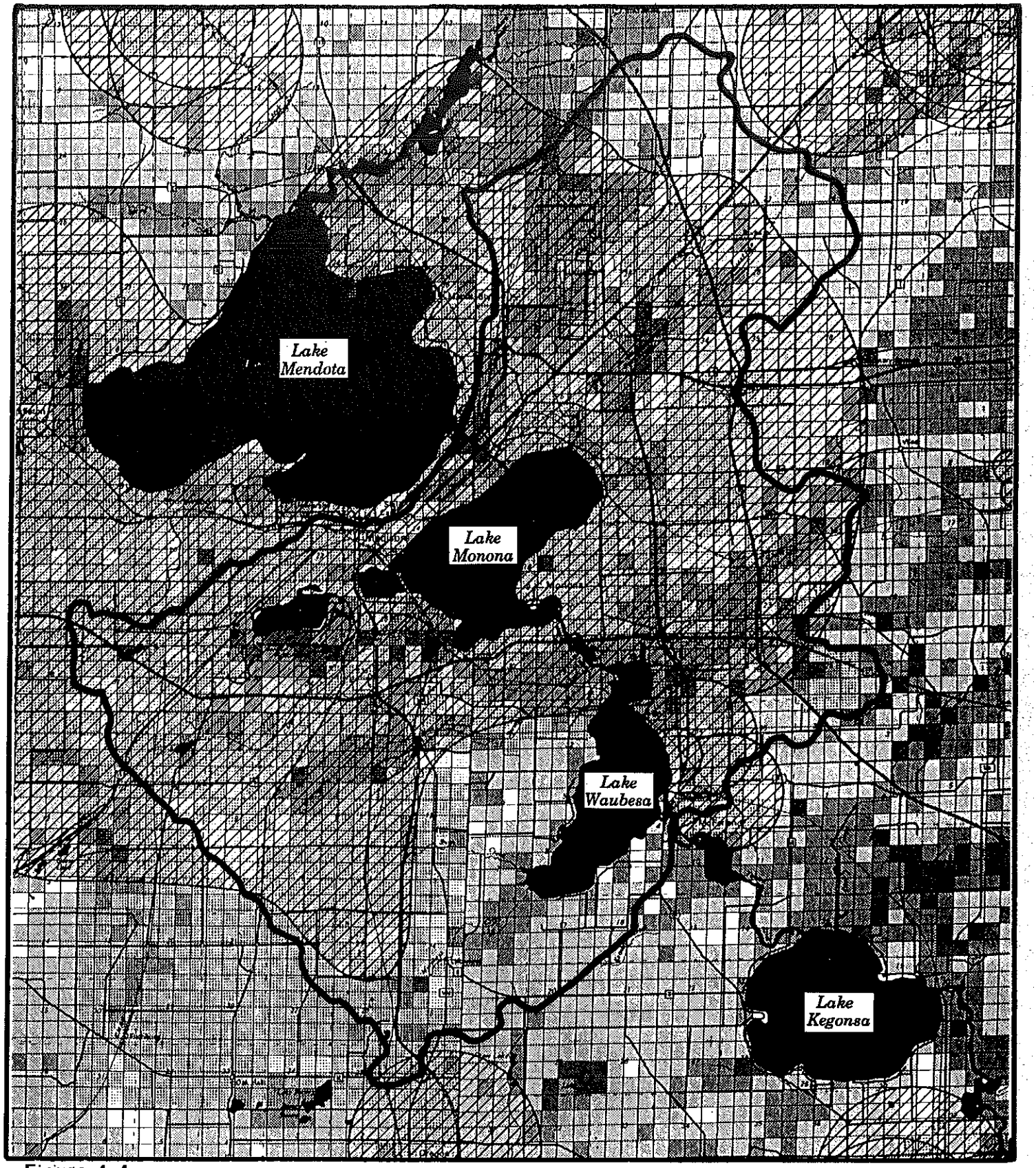


Figure 4-4

GROUNDWATER POLLUTION HAZARD TO THE BEDROCK AQUIFER FROM SURFACE ACTIVITIES*

*(SUCH AS PESTICIDE, FERTILIZER, SLUDGE, AND SEPTAGE APPLICATIONS)

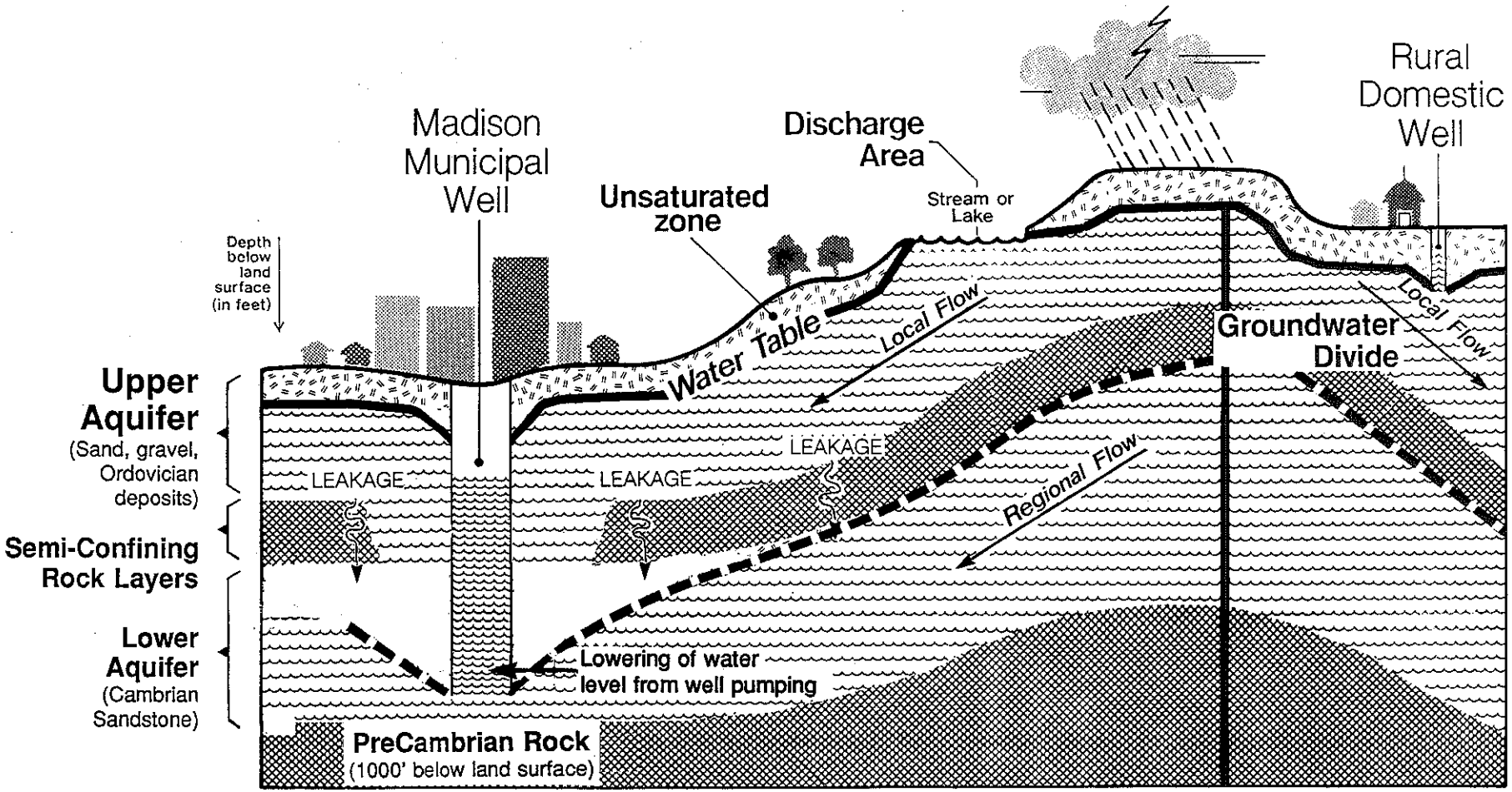
Greatest Hazard
Moderate
Marginal
Least

Well Protection Zone

Note: Individual grid squares represent approximately 40 acres.

Figure 4-5

GENERALIZED AQUIFER SYSTEM IN DANE COUNTY



Groundwater Resource Management Objectives for the Yahara-Monona Watershed

1. Protect the shallow groundwater system from further loadings of nitrate-nitrogen.

    a. Reduce nitrogen fertilizer use
    b. Reduce impacts from on-site wastewater systems through stringent siting review of proposed unsewered development.

2. Protect the groundwater system from additional increases in salinity.

    a. Reduce pollutant loadings of chlorides from road salt use.

3. Protect the groundwater system from further VOC and pesticide contamination.

    a. Ensure adequate protection measures exist for potential VOC pollution sources.
    b. Emphasize agricultural management practices (e.g., integrated pest management) aimed at limiting the overall use of pesticides.

4. Preserve stream baseflow by maintaining groundwater contributions.

    a. Evaluate the effects of high-capacity well siting and groundwater withdrawals, as well as hydrologic management practices, on stream baseflow.
    b. Identify and protect important local groundwater recharge areas.
    c. Implement management measures as part of new development that will promote water infiltration.

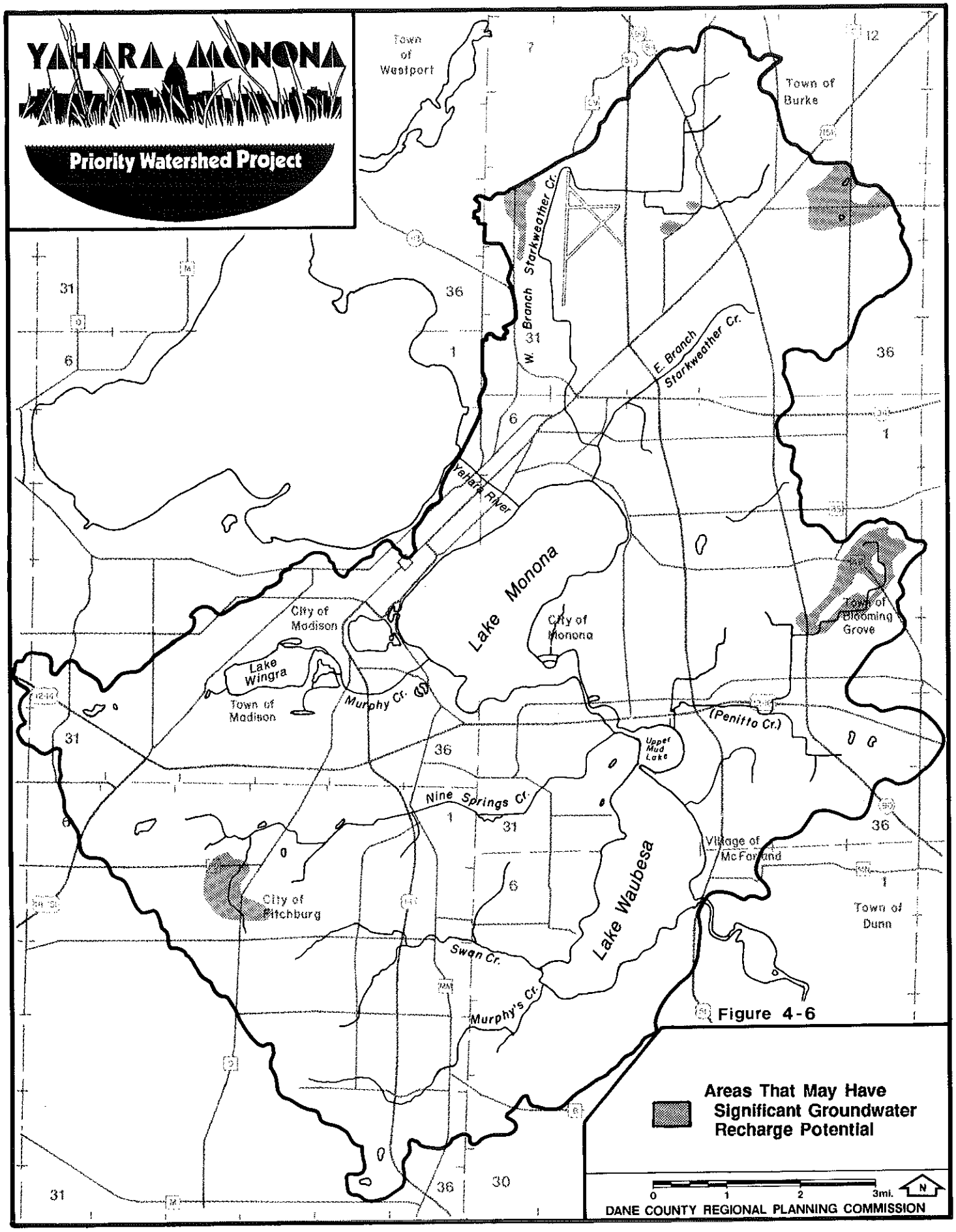

YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
W. Branch Starkweather Cr.
E. Branch Starkweather Cr.
Yahara River
Lake Monona
City of Madison
City of Monona
Town of Blooming Grove
Lake Wingra
Town of Madison
Murphy Cr.
(Penitto Cr.)
Upper Mud Lake
Nine Springs Cr.
Village of McFarland
City of Fitchburg
Lake Waubesa
Town of Dunn
Swan Cr.
Murphy's Cr.
Areas That May Have Significant Groundwater Recharge Potential
0 1 2 3mi.
N
DANE COUNTY REGIONAL PLANNING COMMISSION

Figure 4-6

Urban Nonpoint Source Inventory

Urban land uses can contribute significant amounts of pollutants to nearby waterbodies. Water resource problems that may result from urban developments include:

- water runoff that contains high levels of sediment, nutrients, bacteria, heavy metals, and other toxic materials;
- hydrologic changes caused by paved or impervious surfaces, including flashy peak stream flows, streambank erosion and loss of groundwater recharge to stream baseflow;
- stream channel modifications, including straightening and lining with concrete.

Water quality problems are related to the increase in pollutants that emanate in populated areas from roadways, parking lots, vehicles, lawns, chemical use, construction activities, waste disposal, etc. (see Fig. 4-7). Water runoff often transports pollutants quickly to lakes or streams through storm sewers that have been constructed to efficiently drain water in urban areas. Sources of urban pollutants include leaves, grass clippings and lawn and garden pesticides and fertilizers, which are significant contributors of organic matter, nutrients and toxics in urban runoff. Motor vehicles are responsible for a wide range of pollutants that are found on street surfaces and hence in stormwater runoff. Metals and PAHs (polycyclic aromatic hydrocarbons) originate from exhaust emissions; leakage of oil, gas, coolants and hydraulic fluids; particles worn from brake shoes, clutch linings and tires; rust, dirt and undercoating that fall off undercarriages; and abrasion of asphalt surface materials. Also, street deicing materials contribute sand and salt (chloride) to urban runoff, and pet waste may be an important source of bacterial pollution.

The type and amount of pollutants generated in urban areas vary by land use. In general, pollutant loadings for substances such as phosphorus and heavy metals are higher per unit area from commercial and industrial lands as compared to residential land use. In addition to land use, the age of the type of development affects pollutant runoff. For instance, many older residential areas often have grass drainage systems instead of curb and gutters. The grass systems slow down and infiltrate water runoff, thereby reducing pollutant loadings.

To determine the critical sources, type and quantity of pollutants originating from the urbanized area of the Yahara-Monona Watershed, a detailed land use inventory was conducted. Inventory results showing acreages of different land uses by subwatershed are presented in Table 4-2.

Urban and urbanizing lands account for slightly more than 60 percent of the total land area in the watershed. About one-third of the urban land is in residential land use and another third consists of urban parks and open spaces. Approximately 14 percent of urban land is in industrial and commercial land uses. The greatest amount of industrial and commercial land exists within the Starkweather Creek subwatershed. The Lake Monona subwatershed has the highest percentage of residential land of any subwatershed--approximately 50 percent. The Lake Monona subwatershed also contains the lowest percentage of parks and open space lands of any subwatershed, although this figure is still nearly 20 percent.

Urban land uses also have been categorized by municipalities in the Yahara-Monona Watershed (see Table 4-3). Most urban and urbanizing land is found in the City of Madison--approximately 63 percent. The City of Fitchburg has the second highest percentage of urban land, but this amounts to less than 12 percent of the total. About 76 percent of commercial and 68 percent of industrial land in the watershed lies within the City of Madison.

Pollutant Loadings from Existing Urban Areas

1990 urban land use information served as input for a DNR water quality model (SLAMM), which estimated pollutant loadings from the 59 urban sub-basins delineated in the watershed. Results were then aggregated by subwatershed. Loadings for pollutants, such as phosphorus, suspended solids and heavy metals (e.g., zinc, lead, copper, cadmium, and copper) were determined.

Model results indicate that the Lake Monona subwatershed has the highest average pollutant loadings per acre of land of any subwatershed (see Table 4-4). The Starkweather Creek subwatershed has the second highest average pollutant loadings and contributes the greatest quantity of pollutants of any subwatershed. From 35 to 41 percent of the total suspended solids, zinc (a representative heavy metal) and phosphorus loadings from urban lands in the Yahara-Monona Watershed originate from the Starkweather Creek basin.

Figure 4-8 displays the urban sub-basins with the highest average pollutant loadings for suspended solids, zinc and phosphorus. Sixteen out of the 21 sub-basins with the highest average loadings exist in the Starkweather Creek and Lake Monona subwatersheds. This can be attributed largely to extensive commercial, industrial and high density residential development in these subwatersheds. The Dane County Airport in the Starkweather Creek basin is another source for the high pollutant loadings.

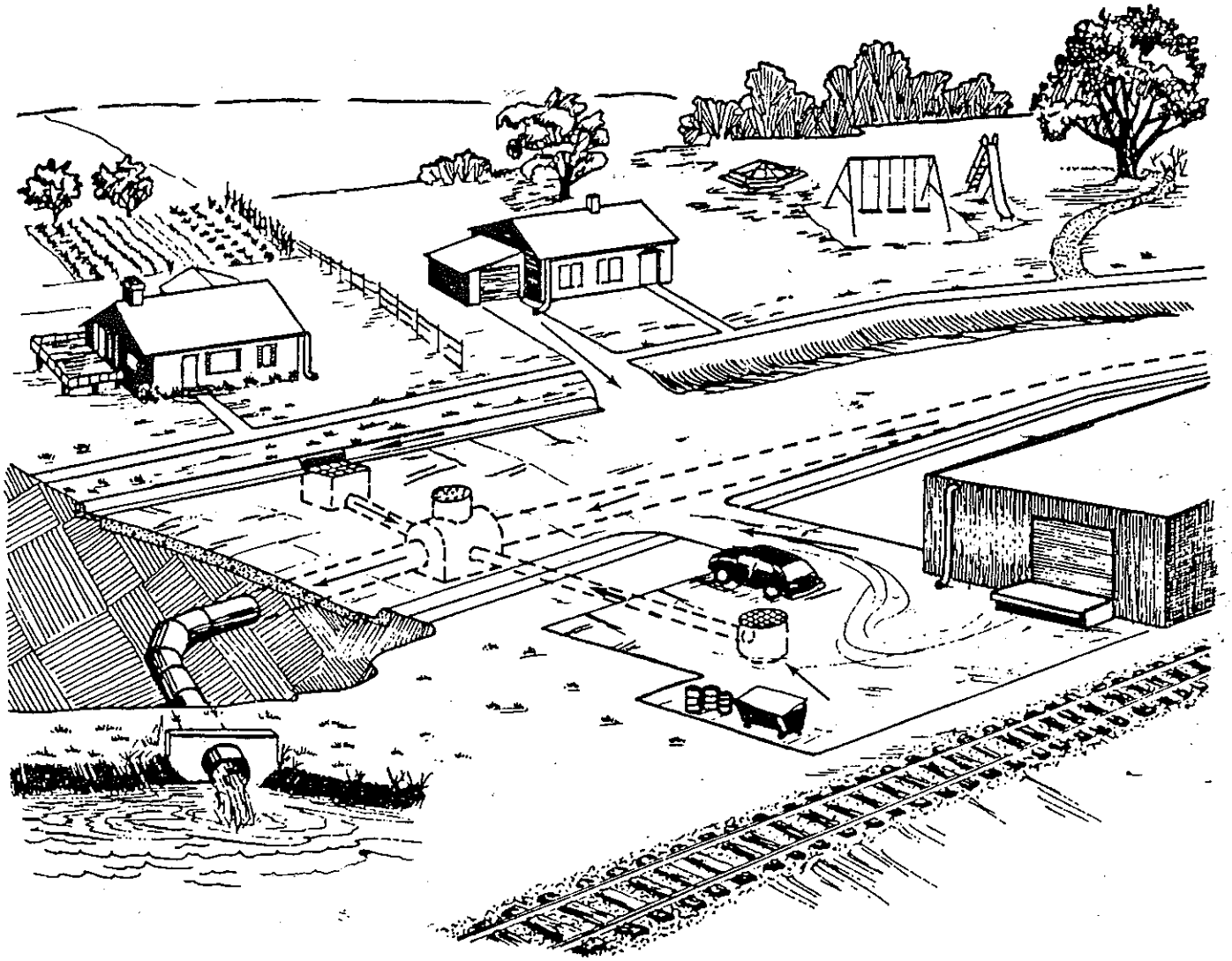


Figure 4-7. Urban Runoff Source Areas and Drainage System

From: Wisconsin Department of Natural Resources. Source loading and management model user's manual, vol. III.

TABLE 4-2
1990 ACREAGE OF LAND USE FOR URBAN AND URBANIZING SUBWATERSHEDS
YAHARA-MONONA PRIORITY WATERSHED PROJECT

Subwatershed	Residential Density			Commercial	Industrial	Freeway	Institutional	Parks/ Open	Ag Land	Other	Urban Total
	Low	Medium	High								
Starkweather Creek[1]	170	1,586 (25%)	1,023	911 (8%)	702 (6%)	341 (3%)	356 (3%)	2,883 (26%)	2,056 (19%)	1,033 (Airport) (9%)	11,061
Lake Monona[2]	117	1,310 (50%)	1,335	628 (11%)	369 (7%)	0	475 (9%)	1,054 (19%)	0	253 (Public Assembly) (5%)	5,541
Lake Wingra[3]	87	1,486 (37%)	239	407 (8%)	72 (1%)	68 (1%)	150 (3%)	2,418 (49%)	1	0	4,928
Nine Springs Creek[4]	783	891 (26%)	97	346 (5%)	246 (4%)	118 (2%)	120 (2%)	2,775 (41%)	1,345 (20%)	3 (Public Assembly) --	6,724
Upper Mud Lake (Penitto Creek)[5]	241	667 (24%)	20	257 (6%)	319 (8%)	168 (4%)	67 (2%)	1,654 (43%)	495 (13%)	0	3,888
Lake Waubesa[6]	128	317 (25%)	0	60 (3%)	231 (13%)	0	83 (5%)	478 (27%)	455 (26%)	0	1,752
Totals	**1,526**	**6,257 (31%)**	2,714	2,609 (8%)	1,939 (6%)	695 (2%)	1,251 (4%)	11,262 (33%)	4,352 (13%)	1,289 (4%)	33,894

[1]Cities of Madison and Monona; Towns of Burke and Blooming Grove.
[2]Cities of Madison and Monona; Towns of Madison and Burke.
[3]Cities of Madison and Fitchburg; Town of Madison.
[4]Cities of Madison, Monona and Fitchburg; Towns of Madison and Blooming Grove.
[5]Cities of Madison and Monona; Town of Blooming Grove.
[6]City of Madison; Village of McFarland; Town of Blooming Grove.

TABLE 4-3
1990 MUNICIPAL LAND USE ACREAGE TOTALS BASED ON URBAN AND URBANIZING SUB-BASINS
YAHARA-MONONA PRIORITY WATERSHED PROJECT

Land Use[1]	City of Madison	City of Monona	City of Fitchburg	Village of McFarland	Town of Madison	Town of Burke	Town of Blooming Grove	Total
HRNA	1,979	4	0	0	61	0	50	2,094
(HRWA)	420	0	0	0	0	0	0	420
MRNA	4,318	902	353	317	273	7	22	6,192
(MRWA)	65	0	0	0	0	0	0	65
LR	155	67	540	60	73	35	0	930
SUBR	227	0	223	10	0	72	64	596
MOBR	163	17	0	0	20	0	0	200
CST	1,297	125	48	52	100	39	45	1,700
SC	211	39	7	8	12	0	0	277
OP	389	53	17	0	49	0	0	508
MI	565	33	42	27	32	38	78	815
LI	751	26	42	204	48	47	6	1,124
FREE	433	83	0	0	113	15	51	695
MISC	310	40	99	17	14	0	2	482
SCH	567	68	5	66	1	0	24	731
HOSP	30	0	0	0	0	8	0	38
PARK	2,523	98	455	28	95	0	29	3,228
OSUD	3,749	553	834	355	1,198	315	74	7,078
CU	453	4	29	0	4	10	287	787
PA	70	0	0	0	186	0	0	256
AIR	1,033	0	0	0	0	0	0	1,033
AG	1,583	0	1,279	53	1	1,051	385	4,352
CDT	124	0	0	0	0	0	0	124
CEM	118	51	0	0	0	0	0	169
TOTAL								
Acres	**21,527**	**2,163**	**3,973**	**1,197**	**2,280**	**1,637**	**1,173**	**33,894**
Percent	**63.51**	**6.38**	**11.72**	**3.53**	**6.73**	**4.83**	**3.29**	**100**

[1]Key to Land Use Code

HRNA High Density Residential, without alleys (>6 units/acre)
HRWA High Density Residential, with alleys (>6 units/acre)
MRNA Medium Density Residential, without alleys (2-6 units/acre)
MRWA Medium Density Residential, with alleys
LR Low Density Residential (1-2 units/acre)
SUBR Suburban (<1 unit/acre)
MOBR Trailer Park
CST Strip Commercial
SC Shopping Center
OP Office Park
MI Medium Industrial
LI Light Industrial
FREE Freeway
MISC Government/Institutional
SCH School
HOSP Hospital
PARK Open Space - Park
OSUD Open Space - Undeveloped
CU Communication/Utilities
PA Public Assembly
AIR Airport
AG Farmland
CDT Downtown Commercial
CEM Cemetery

TABLE 4-4
ANNUAL URBAN POLLUTANT LOADINGS BY SUBWATERSHED
BASED ON 1990 LAND USE

Subwatershed	Acreage	Average Suspended Solids Loading (Tons/Acre)	Average Zinc Loading (Lbs./Acre)	Average Phosphorus Loading (Lbs./Acre)	Total Suspended Solids Loading (Tons)	Total Zinc Loading (Lbs.)	Total Phosphorus Loading (Lbs.)
Lake Monona	5,541	.17	.46	.71	930	2,563	3,939
Starkweather Creek	11,061	.14	.42	.49	1,502	4,628	5,373
Lake Wingra	4,928	.09	.22	.39	440	1,099	1,936
Nine Springs Creek	6,724	.09	.24	.34	621	1,628	2,264
Upper Mud Lake (Penitto Creek)	3,888	.08	.23	.33	328	879	1,266
Lake Waubesa	1,752	.08	.20	.32	137	359	566
Watershed Totals	**33,894**	**.12**	**.33**	**.45**	**3,958**	**11,156**	**15,344**

TABLE 4-5
POLLUTANT LOADINGS FOR EXISTING AND
PLANNED LAND USE BY MUNICIPALITY

Municipality	Suspended Solids (Tons/year)		Phosphorus (Lbs./year)		Heavy Metals (zinc) (Lbs./year)	
	Existing[1]	Planned (Additional Load)[2]	Existing[1]	Planned (Additional Load)[2]	Existing[1]	Planned (Additional Load)[2]
City of Madison	2,972	1,036	11,547	3,537	8,715	3,160
City of Monona	236	--	1,005	--	567	--
City of Fitchburg	149	233	601	997	393	531
Village of McFarland	138	--	562	--	362	--
Town of Madison	196	--	738	--	554	--
Town of Burke	70	106	227	380	216	324
Town of Blooming Grove	185	70	602	307	412	151
Total	**3,946**	**1,445**	**15,282**	**5,221**	**11,219**	**4,166**

[1]Accounts for current level of management practices (e.g., frequency of street sweeping) by each municipality.
[2]Planned land use scenario 2 - Complete development with possible urban service area expansion. Assumes no management practices are implemented. Does not include sediment from construction site erosion.

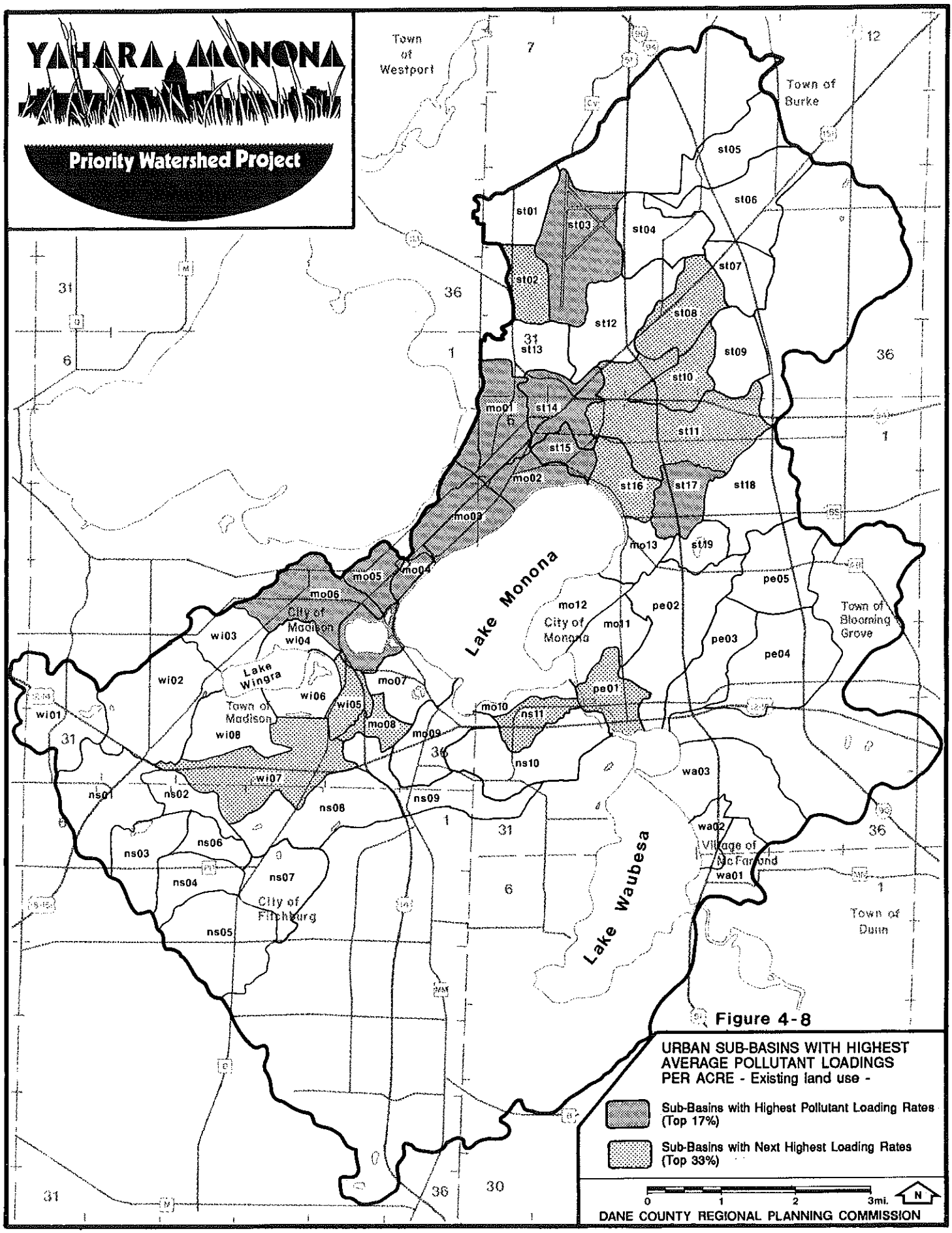


Figure 4-8

URBAN SUB-BASINS WITH HIGHEST AVERAGE POLLUTANT LOADINGS PER ACRE - Existing land use -

Pollutant loadings also have been categorized by municipality (see Table 4-5). Approximately 75 percent of the existing phosphorus, suspended solids and heavy metal loadings in the watershed originate from the City of Madison. The City of Monona has the second highest pollutant loadings, but the city's contributions amount to only five to seven percent of the total for the watershed.

Pollutant Loadings from Planned Urban Areas

As part of the planning process, municipal land use plans and areas of vacant developable land in the watershed were evaluated. This information provided the basis for identifying transitional sub-basins where significant urban development from present agricultural or open space use is likely to occur in the future (i.e., within the next 20 to 40 years). Estimates of pollutant loadings from these sub-basins were made using the urban water quality model (SLAMM). Complete development within the urban service area of each sub-basin was assumed.

Most future urban development is projected to occur in the upper parts of the Starkweather Creek and Upper Mud Lake subwatersheds in the City of Madison and the Nine Springs Creek subwatershed in the City of Fitchburg. A significant increase in commercial land use is likely to take place in the Starkweather Creek subwatershed, while extensive light industrial development is planned in the Upper Mud Lake subwatershed (see Table 4-6). Primarily residential development is planned in the Nine Springs Creek subwatershed.

TABLE 4-6
ACREAGE COMPARISON OF 1990 AND PLANNED LAND USE ASSUMING FULL BUILD-OUT WITHIN EXISTING URBAN SERVICE AREA BOUNDARY[1]

Subwatershed	Residential		Commercial		Industrial		Parks/Open		Ag Land	
	1990	Planned	1990	Planned	1990	Planned	1990	Planned	1990	Planned
Starkweather Creek	2,779 (25%)[2]	3,245 (29%)	911 (8%)	2,011 (18%)	702 (6%)	1,171 (11%)	2,883 (26%)	2,397 (22%)	2,056 (19%)	487 (4%)
Nine Springs Creek	1,771 (26%)[2]	2,811 (42%)	346 (5%)	649 (10%)	246 (4%)	264 (4%)	2,775 (41%)	2,680 (40%)	1,345 (20%	79 (1%)
Upper Mud Lake (Penitto Creek)	928 (24%)[2]	1,131 (29%)	257 (7%)	286 (7%)	319 (8%)	978 (25%)	1,654 (43%)	928 (24%)	495 (13%)	250 (6%)
TOTAL[3]	**10,497 (31%)**	**12,206 (36%)**	**2,609 (8%)**	**4,041 (12%)**	**1,939 (6%)**	**3,085 (9%)**	**11,262 (33%)**	**9,895 (29%)**	**4,352 (13%)**	**1,227 (4%)**

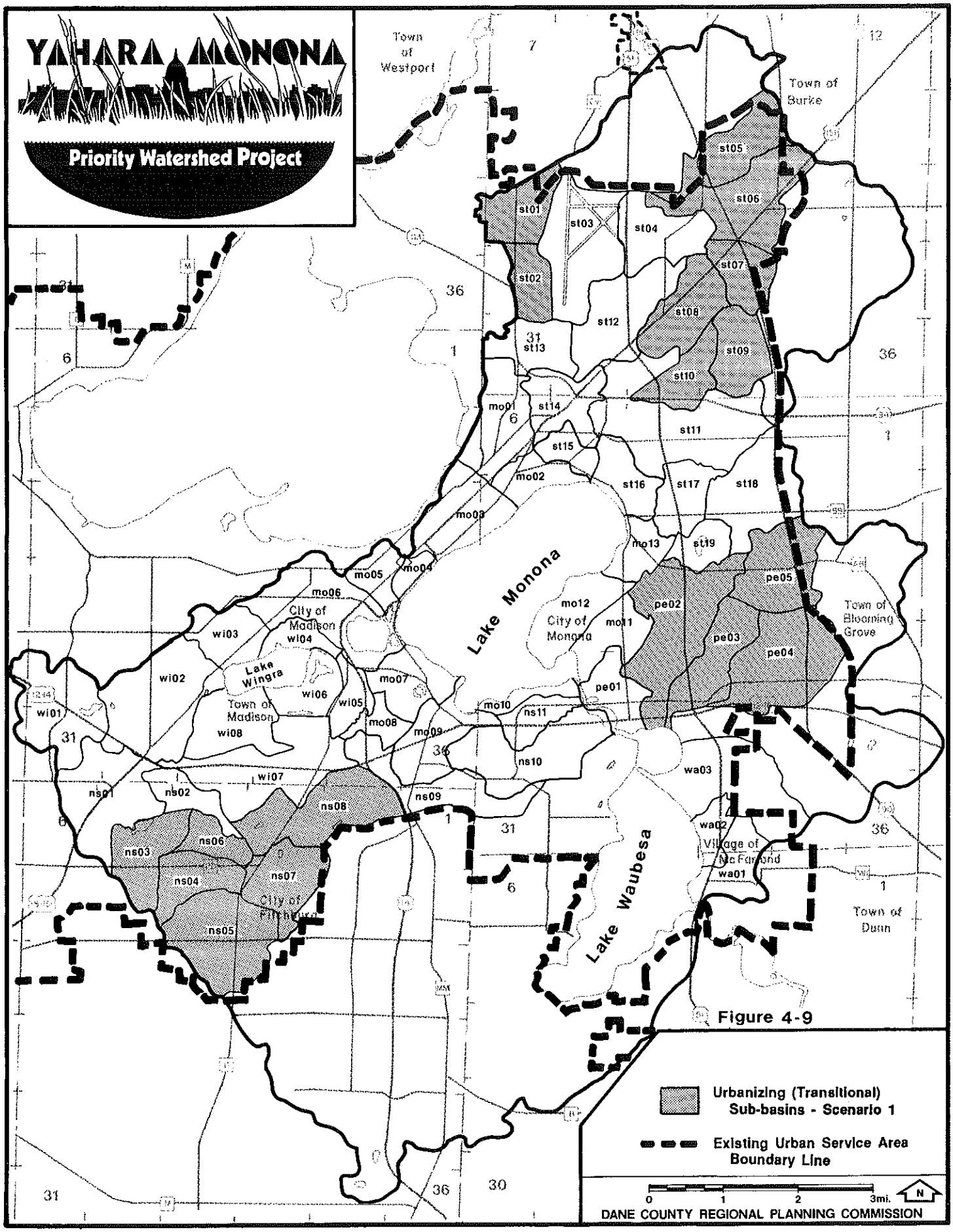
[1]Based on land use plans for designated "transitional" sub-basins only.
[2]Percentage of total urban/urbanizing land use in subwatershed.
[3]Also includes acreage from other three urban subwatersheds that will not have extensive development.

To estimate future pollutant loadings, two planned land use scenarios were analyzed. The first scenario addresses planned land use within the existing Central Urban Service Area boundary. Eighteen transitional sub-basins were identified under this scenario (see Fig. 4-9). The second scenario takes into account the possible expansion of the service area. This scenario includes planned land use within the existing urban service area boundary, as well as for areas where the boundary line may be expanded. Thus, the second scenario is the most conservative--estimating the most amount of land development that may occur in the future. Two additional transitional sub-basins, making for a total of 20, were delineated for this scenario (see Fig. 4-10).

Pollutant loadings for suspended solids, phosphorus and heavy metals (e.g., zinc) increased under scenario one by 29 to 33 percent over existing pollutant loadings. Under the second scenario, pollutant loadings increased by another five percent to a range of 34 to 37 percent over existing loadings. These loadings do not account for pollution that may result from construction site erosion.

Transitional sub-basins that are projected to have the highest average pollutant loadings are displayed in Figure 4-11. Most of these sub-basins are located in the Starkweather Creek subwatershed. One of the sub-basins is in the Upper Mud Lake (Penitto Creek) subwatershed.

Approximately 68 to 76 percent of the planned land use loadings for suspended solids, phosphorus and heavy metals are expected to be from the City of Madison. The municipality with the second highest planned land use loadings for these pollutants is the City of Fitchburg. The city's contribution will account for about 13 to 19 percent of the total loadings of each pollutant.


YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
Town of Blooming Grove
Town of Dunn
Lake Monona
Lake Waubesa
Lake Wingra
City of Madison
City of Monona
Village of McFarland
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Urbanizing (Transitional) Sub-basins - Scenario 1
Existing Urban Service Area Boundary Line
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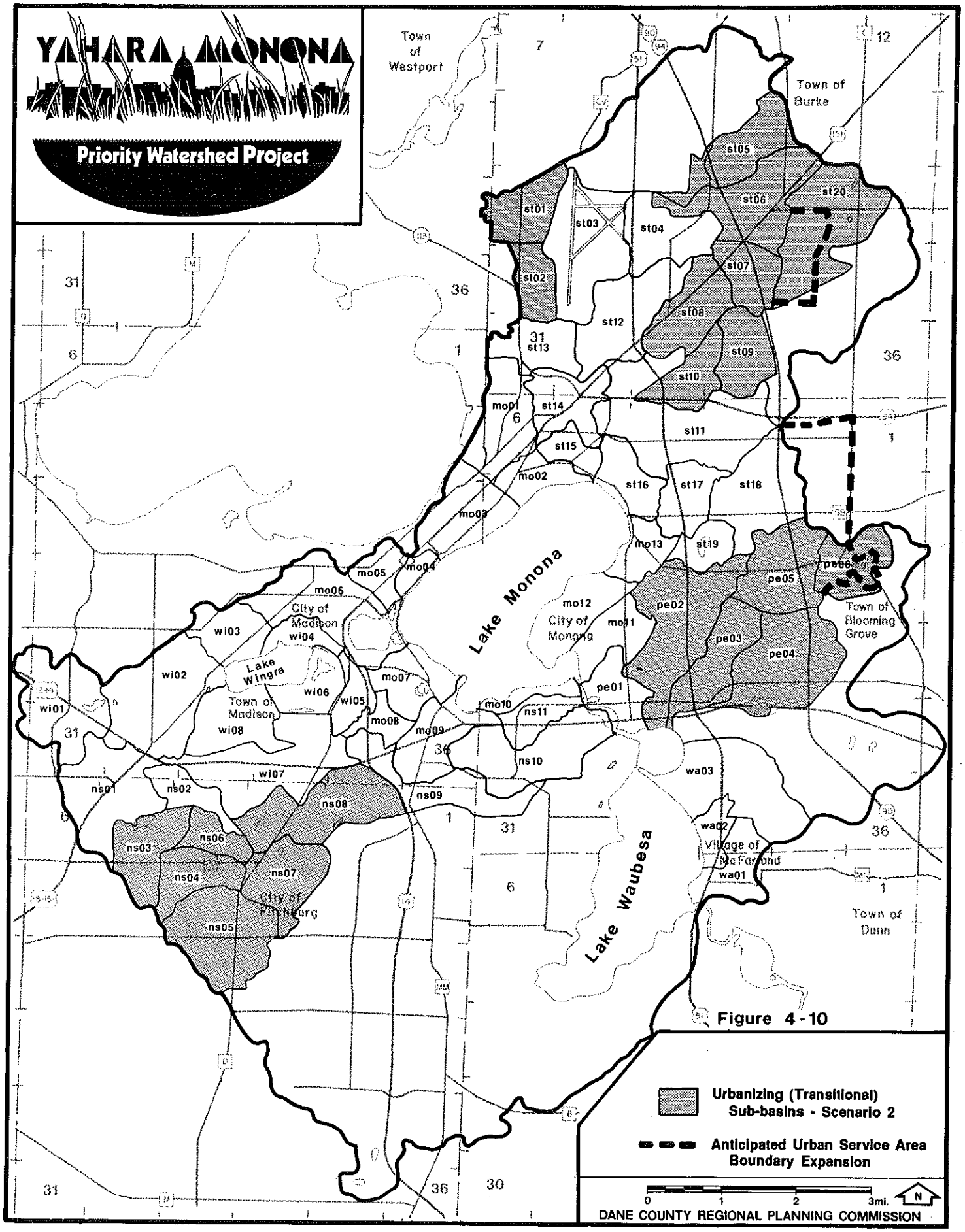
DANE COUNTY REGIONAL PLANNING COMMISSION

Figure 4-9


YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
Lake Monona
Lake Wingra
Lake Waubesa
City of Madison
City of Monona
Town of Madison
City of Fitchburg
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Urbanizing (Transitional) Sub-basins - Scenario 2
Anticipated Urban Service Area Boundary Expansion
0 1 2 3mi.
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DANE COUNTY REGIONAL PLANNING COMMISSION

Figure 4-10

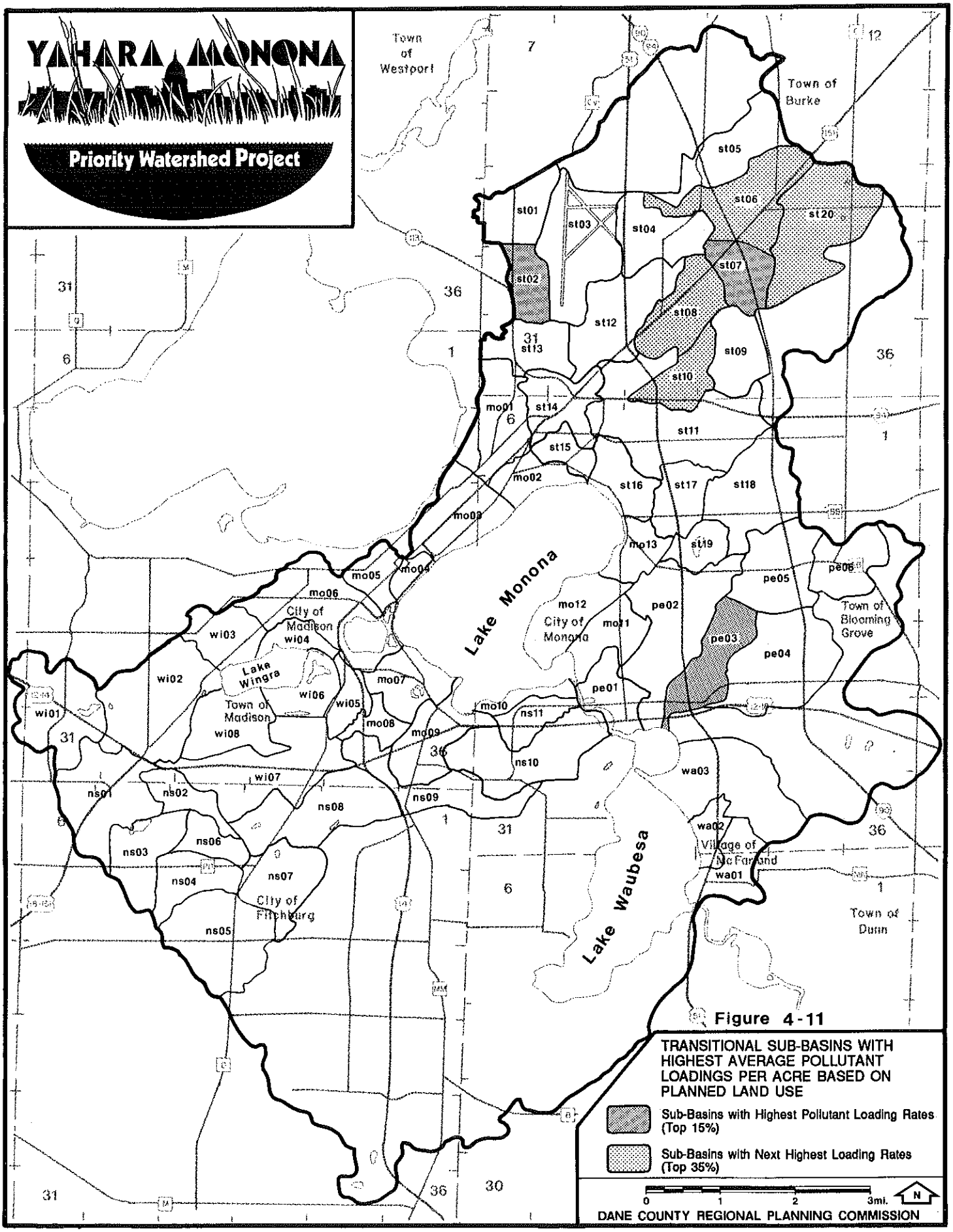
YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
Lake Monona
City of Madison
City of Monona
Lake Wingra
Town of Madison
Town of Blooming Grove
Lake Waubesa
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Figure 4-11
TRANSITIONAL SUB-BASINS WITH HIGHEST AVERAGE POLLUTANT LOADINGS PER ACRE BASED ON PLANNED LAND USE
Sub-Basins with Highest Pollutant Loading Rates (Top 15%)
Sub-Basins with Next Highest Loading Rates (Top 35%)
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DANE COUNTY REGIONAL PLANNING COMMISSION

Construction Site Erosion From Vacant Developable Land

Acreages of vacant developable land were estimated for sub-basins and aggregated by subwatershed (see Table 4-7). Figure 4-12 displays the location of developable lands in the watershed, as well as where the most amount of development has taken place since 1986. Approximately 6,200 acres of vacant developable land have been identified, 68 percent of which is in the Starkweather Creek and Nine Springs Creek subwatersheds. Over 3,000 acres of vacant developable land are located in the City of Madison and about 1,500 acres exist in the City of Fitchburg. Soil erosion from these lands as a result of future construction activities can be a major source of water pollution. It has been estimated that soil erosion from construction sites can equal and even exceed 30 tons/acre/year, which is considerably higher than average soil loss rates from agricultural lands.

In reviewing past development trends, an average of 163 acres of land have been developed annually in the watershed. If this acreage is multiplied by a construction site erosion rate of 30 tons/acre/year, then annual soil loss equals 4,890 tons/year, which is almost 1,000 tons more than annual suspended solid loadings originating from existing urban areas. This represents a worst-case scenario assuming no management controls, and actual soil loss from construction sites can be substantially lower if vigorous enforcement of construction site erosion control ordinances is pursued by municipalities in the watershed.

Streambank and Lakeshore Erosion

Areas of streambank and lakeshore erosion were also inventoried as part of project planning activities. Eroding banks can add to sediment pollutant loadings, degrade habitat conditions and limit recreational uses of water bodies.

In the urbanized area of the Yahara-Monona Watershed, streambank erosion and sloughing problems were identified on the main stem and both branches of Starkweather Creek. Much of Murphy (Wingra) Creek also was identified as having similar problems (see Fig. 4-13).

A field inspection of streambank conditions for Starkweather Creek south of Milwaukee Street to Olbrich Park was conducted by DNR and City of Madison Engineering staff. They identified 8,000 linear feet of streambank in need of shaping and stabilization measures, such as rock-riprap, vegetative plantings and sheet piling. Bank stabilization concerns also have been expressed for other selected reaches of the stream. These include a small segment of the West Branch immediately north of East Washington Avenue and a 0.5-mile reach upstream of Highway 51. A 1.1-mile stretch of the East Branch between Milwaukee Street and Highway 51 also has erosion problems. The streambanks along this portion of the Creek extend as much as six to eight feet above the water surface. Of particular concern is an area at the Highway 30 overpass where tightly compacted soils are devoid of vegetative cover.

City of Madison Engineering staff also have conducted a field survey of Murphy (Wingra) Creek. Streambank sloughing and erosion problems, which have widened the stream, have been identified for a distance of 5,900 feet from Fish Hatchery Road to Olin Avenue and from John Nolen Drive to Lake Monona. Bank stabilization needs are similar to those of Starkweather Creek.

Lakeshore erosion sites in urban areas of the watershed were field inspected. Within the Village of McFarland, significant bank erosion is evident along the Lake Waubesa shoreline at McDaniel Park for a distance of about 600 feet. Bank heights are four to six feet in some areas, and an annual loss of three to four feet of shoreline has been estimated. The cause of this erosion is thought to be primarily ice build-up and movement. Wave action from southwesterly winds may also contribute to erosion.

Shoreline erosion is also occurring on a thin strip of land separating Squaw Bay on Lake Monona and the Yahara River at the lake's outlet. This peninsula is about 300 feet long and 12 feet wide in some areas. Erosion is reducing the peninsula's width and removing trees. Wave action from substantial motor boat traffic, elevated lake levels and high winds may be responsible for this problem.

Elsewhere on Lake Monona, shoreline erosion is significant near the Hudson beach area, where there are steep gradients to the lake, and along Monona Bay near the end of Lawrence Street. At Olbrich Park, wave and ice action is responsible for unstable shoreline conditions. Although soil erosion is not substantial here, some trees may soon be uprooted and lost.

TABLE 4-7
1990 VACANT DEVELOPABLE LAND FOR SUBWATERSHEDS AND TRANSITIONAL SUB-BASINS IN THE YAHARA-MONONA WATERSHED

Subwatershed	Vacant Developable Land (acres)
Starkweather Creek	2,350
Lake Monona	95
Lake Wingra	195
Upper Mud Lake	1,120
Nine Springs Creek	1,860
Lake Waubesa	585
Total	6,205
Transitional Sub-basins	
Starkweather Creek	
ST01	220
ST02	108
ST05	410
ST06	595
ST07	138
ST08	160
ST09	344
ST10	80
Upper Mud Lake (Penitto Creek)	
PE02	198
PE03	288
PE04	404
PE05	111
Nine Springs Creek	
NS03	232
NS04	213
NS05	435
NS06	178
NS07	160
NS08	156

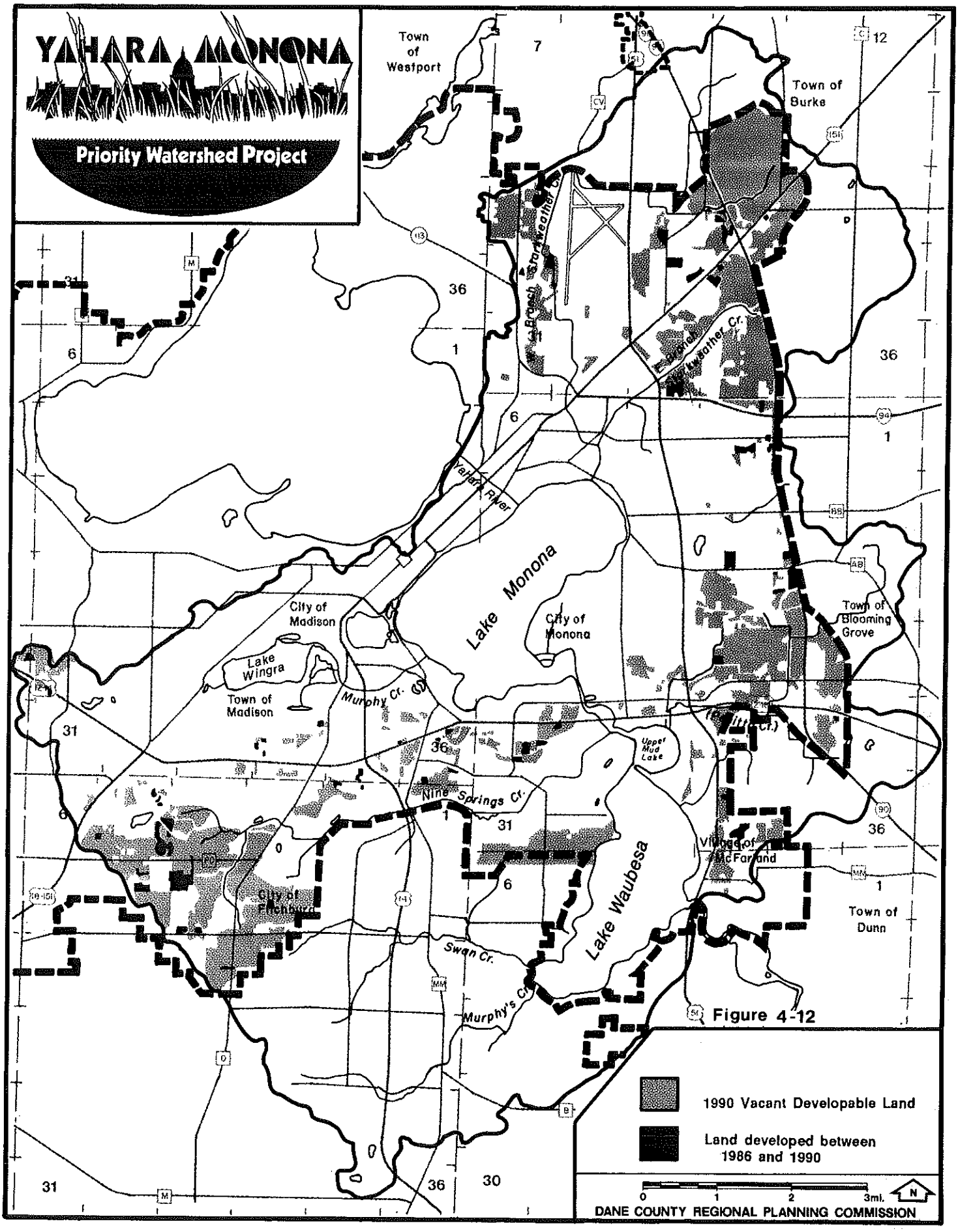

YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
Lake Monona
City of Madison
City of Monona
Lake Wingra
Town of Madison
Town of Blooming Grove
Upper Mud Lake
Nine Springs Cr.
Lake Waubesa
Village of McFarland
City of Fitchburg
Town of Dunn
Swan Cr.
Murphy's Cr.
Yahara River
1990 Vacant Developable Land
Land developed between 1986 and 1990
0 1 2 3mi.
N
DANE COUNTY REGIONAL PLANNING COMMISSION

Figure 4-12

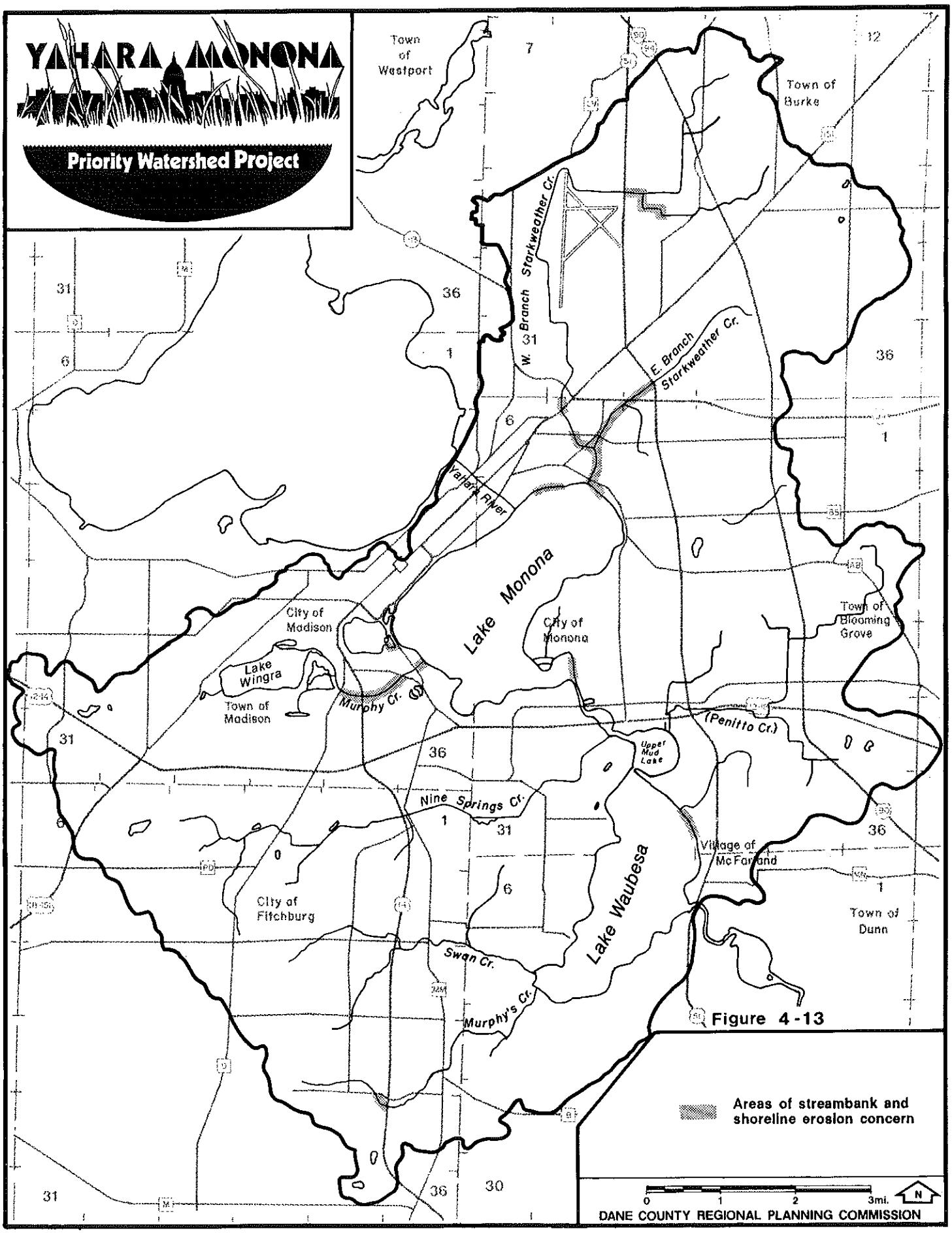

YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
W. Branch Starkweather Cr.
E. Branch Starkweather Cr.
Yahara River
Lake Monona
City of Madison
City of Monona
Town of Blooming Grove
Lake Wingra
Town of Madison
Murphy Cr.
(Penitto Cr.)
Upper Mud Lake
Nine Springs Cr.
Village of McFarland
City of Fitchburg
Lake Waubesa
Town of Dunn
Swan Cr.
Murphy's Cr.
Areas of streambank and shoreline erosion concern
0 1 2 3mi.
N
DANE COUNTY REGIONAL PLANNING COMMISSION

Figure 4-13

Urban Management Practices

As part of the urban nonpoint source inventory, information was collected on municipal management activities relating to nonpoint source pollution control. Summarized information concerning construction site erosion control, stormwater drainage systems, levels of street sweeping, yard waste disposal services, pet waste ordinances and road deicer use for municipalities in the watershed is presented below and in tables in Appendix C.

Construction Site Erosion and Stormwater Control Ordinances

All urban municipalities in the watershed have adopted construction site erosion and stormwater runoff control ordinances (see Table C-1 in Appendix C). These ordinances require the implementation of management measures to limit sediment loss and peak rates of water runoff associated with development. While the ordinances address permissible peak rates of runoff from developments, there are no requirements concerning the implementation of particular types of management practices (e.g., wet detention or infiltration basins) that also provide significant stormwater quality benefits. As a result, less elaborate "dry" detention basins are often constructed to fulfill ordinance requirements. These basins decrease peak flow rates but generally do not improve water quality. This is not to imply, however, that stormwater quality management measures are absent in the Yahara-Monona Watershed. Some large wet detention basins have been constructed, primarily in the cities of Madison and Fitchburg and Town of Madison.

In addition, there are sometimes concerns regarding the adequacy of ordinance enforcement by the municipalities, particularly in regard to construction site erosion control. All of the communities in the watershed have recently been devoting more attention to this issue. (e.g., training sessions for enforcement staff). Continued emphasis should be placed on erosion control, since a large amount of sediment pollution in urban areas is typically from construction activities.

Stormwater Drainage Systems

The type of stormwater drainage system built to serve developments affects the amount of water runoff and pollutants being discharged to water bodies. For instance, grass-lined ditches (often termed grass swales) decrease water runoff and pollutant loadings going to lakes and streams as compared to open concrete channels or conventional storm sewer pipes. Most of the urbanized municipalities have a relatively low percentage of their total drainage system in grass swales, while the rural towns have much higher percentages (see Table C-2).

Another factor influencing stormwater runoff is the extent to which building rooftops are connected to impervious areas leading to storm sewer systems as compared to unpaved areas where water can infiltrate. During limited land use field surveys conducted for the priority watershed project, several buildings in every community were found to have downspouts directly connected to impervious driveways or parking lots. Results of a more extensive field survey by the City of Madison in 1990 also indicate that a large percentage (30% to 50%) of downspouts attached to new multifamily and commercial buildings are directed to paved areas or to storm sewers. For new single-family residences, however, only five percent of downspouts were directed to paved areas. In old residential developments, this percentage may be significantly higher.

As part of storm sewer systems, small catch basins or pits have often been constructed to retain debris and prevent the clogging of sewers. Frequent cleaning of catch basins can reduce the discharge of heavier sediment particles to receiving water bodies. Most communities in the watershed have an average maintenance schedule for catch basin cleaning of once/year (Table C-2). The need for more frequent cleaning of catch basins should be evaluated based on the characteristics of each collection system and specific stormwater management objectives. In general, the accumulation of sediment in catch basins does not appear to impair solids-trapping efficiencies until 40 to 50 percent of the basin's storage depth is filled. In filled catch basins, washout can exceed sedimentation.

Street Sweeping

Street sweeping can limit the transport of street solids to storm sewer systems and consequently to lakes and streams. Where lengthy periods exist between cleanings, it is likely that accumulated street solids will be moved by rainfall or wind, and sweeping operations will capture little of the total material. Conversely, cleaning cycles more frequent than once every seven days with mechanical broom sweepers can be counterproductive in terms of solids removal efficiency versus effort and expenditure. Several municipalities in the Yahara-Monona Watershed maintain sweeping frequencies of approximately once/month for residential as well as industrial/commercial areas (see Table C-3). The City of Madison, however, performs daily sweeping for the Capitol Square and immediate

downtown area. More frequent sweeping intervals by the municipalities, particularly in early spring and late fall, would assist in decreasing pollutant loadings.

The type of sweeping equipment used also is important in removing pollutants as well as access to the near-curb area where most pollutants accumulate. Generally, vacuum sweepers are considerably more efficient in the removal of material than broom sweepers. The Village of McFarland and City of Monona each purchased a vacuum-type sweeper in 1991 and currently are the only communities in the watershed that have one.

Yard Waste Disposal

Leaves and grass clippings have been recognized as important sources of organic matter and nutrients in urban runoff. Phosphorus monitoring at the Monroe Street detention basin in the City of Madison has displayed high levels of phosphorus during autumn rainfall events, which is associated with the time of leaf fall. Most communities in the watershed provide some kind of leaf and yard waste disposal service, whether it be direct pickup or the operation of central drop-off sites (see Table C-4). Residents can also recycle this vegetation on their properties via composting or mulching. Leaves should not be raked into street gutters and/or burned, since this can hasten the decomposition of leaves and make phosphorus more readily available. Two urban municipalities (City of Monona and Village of McFarland) do permit leaf burning by homeowners.

Pet Waste Ordinances

Monitoring of urban stormwater runoff has shown high levels of bacteria. This pollution may be caused in part by pet waste that is not picked up and properly disposed of by pet owners. Some communities, such as the cities of Madison and Monona, have pet waste ordinances that require waste to be safely disposed. This can be done by toilet flushing or burying waste in the ground. Waste is not to be placed with garbage or composted.

Road Deicing Practices

Road deicing practices can also impact water quality. Sand and salt from road deicers can cause sedimentation problems and increase chloride levels in nearby lakes and streams. In the Yahara-Monona Watershed, Lake Wingra is thought to be noticeably impacted by road deicer use since lake chloride levels have increased significantly following the start of municipal road salt use. Because of this, the City of Madison has instituted a road salt reduction program for the entire city. Table C-5 displays the amount and estimated rate of road deicers used by municipalities in the watershed for a selected winter season. The City of Madison has the most road miles of any municipality in the watershed and uses the most salt and sand. The city, however, has a relatively low salt usage rate per road mile. Its sand usage rate is relatively high to compensate for its salt use.

Rural Nonpoint Source Inventory

Rural land uses also can contribute significant quantities of pollutants to water bodies. Water quality threats related to rural land uses include:

- soil erosion from agricultural fields,
- water runoff that contains high levels of nutrients, bacteria and organic matter from animal waste,
- streambank erosion caused by livestock access,
- extensive fertilizer or pesticide use that may impact lakes, streams or groundwater.

Although rural land use does not predominate in the Yahara-Monona Watershed, associated pollution problems are no less important than those originating from urbanized areas. Like urban areas, the type and amount of pollutants generated in rural areas vary by land use and the extent of management controls. For instance, erosion and sediment loadings from row-cropped fields without soil conservation practices are substantially higher than agricultural fields where soil conservation and water quality measures are implemented. Examples of such measures include conservation tillage practices, grass waterways, contour strip-cropping, and terraces.

To determine the critical sources, type and quantity of pollutants originating from the rural area of the Yahara-Monona Watershed, detailed land use and livestock operation inventories were conducted. Inventory results are presented on the following pages.

Barnyard and Animal Waste Management Inventory

Field evaluations of animal lots and waste management practices in the watershed were carried out to evaluate potential pollutant loadings to downgradient water bodies. As part of site investigations, types and numbers of livestock were recorded (see Table 4-8). A total of 18 barnyards were inventoried and potential pollutant (i.e., phosphorus and chemical oxygen demand) discharges determined by use of the Wisconsin Barnyard Runoff (BARNY) computer model. During the inventory process, eight horse operations also were inspected; however, with constant changeovers ranging from 2 to 14 horses per operation, an accurate assessment of potential pollutant runoff from these sites could not be made.

BARNY uses phosphorus as an indicator of the amount of manure reaching water bodies, and phosphorus loadings above five pounds generally signify that pollution problems can occur. Computer model results indicate that 11 of the 18 barnyards in the watershed can potentially discharge phosphorus at levels above five pounds from a ten-year storm (i.e., about a four-inch rainfall in 24 hours). Phosphorus loadings per barnyard ranged from 1.1 to 74.2 pounds. Chemical oxygen demand (COD) loadings, resulting from the breakdown of organic matter, are generally proportional to phosphorus loadings. High COD loadings can deplete dissolved oxygen in receiving waters.

Livestock operations were grouped by subwatershed and ranked according to phosphorus pollution potential. Seven operations can discharge phosphorus at levels above 20 pounds (see Table 4-9) and are of highest priority concern. Six of these operations are located in the Murphy's and Swan Creek subwatersheds (see Fig. 4-14). The highest ranking operation, though, exists in the Lake Waubesa subwatershed. The Starkweather Creek subwatershed was found to have no livestock operations posing significant pollution concerns.

Field location and waste spreading practices also were evaluated. Generally, there is sufficient land area and suitable site conditions at each livestock operation to safely landspread animal waste. An exception exists for one farm in the Lake Waubesa subwatershed where additional land is needed. Three of the inventoried farms have animal waste storage facilities that allow farmers to landspread animal waste at proper rates during favorable weather conditions and at times of crop nutrient needs. The evaluation indicates that with proper spreading and suitable storage of animal waste in the watershed, there is minimal pollution potential to water resources.

TABLE 4-8
TYPE AND NUMBER OF LIVESTOCK
IN THE YAHARA-MONONA WATERSHED (FALL 1989)

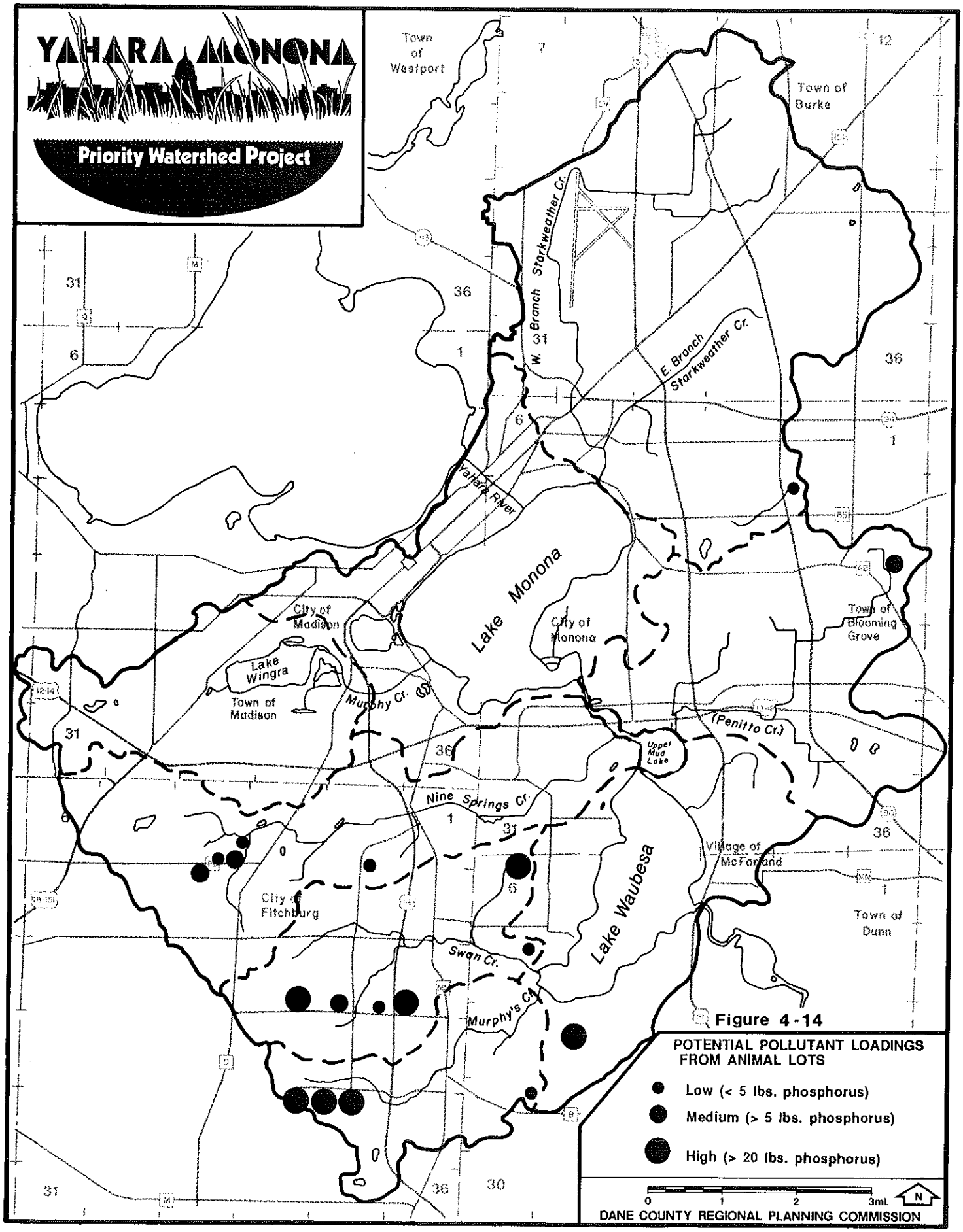
Subwatershed	No. of Dairy Cattle	No. of Young Stock	No. of Beef Cattle	No. of Hogs	Total No. of Animal Units[1]
Swan Creek	80	85	155	950	664
Murphy's Creek	120	100	210	--	398
Lake Waubesa	70	40	55	--	128
Nine Springs Creek	50	110	--	--	92
Upper Mud Lake	60	40	--	--	92
Starkweather Creek	--	50	--	--	10
Totals	**380**	**425**	**420**	**950**	**1,384**

[1]Animal Equivalency Factors: 1 Dairy Cattle = 1.4 animal units, 1 calf = 0.2 a.u., 1 beef cattle = 1.0 a.u., 1 hog = 0.4 a.u.

TABLE 4-9
ANIMAL LOT POLLUTANT LOADS BY SUBWATERSHED

Subwatershed	Number of Operations With Phosphorus Loading[1]			Total Phosphorus Loading (lbs.)	Total COD Loading (lbs.)
	<5 lbs.	5-20 lbs.	>20 lbs.		
Murphy's Creek	0	0	3	114	6,404
Swan Creek	2	1	3	92	4,890
Lake Waubesa	1	0	1	76	2,731
Nine Springs Creek	3	2	0	32	3,010
Upper Mud Lake	0	1	0	8	710
Starkweather Creek	1	0	0	2	238
Total	**7**	**4**	**7**	**324**	**18,073**

[1]Loading based on a 10-year, 24-hour rainfall event.


YAHARA MONONA
Priority Watershed Project
Town of Westport
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W. Branch Starkweather Cr.
E. Branch Starkweather Cr.
Yahara River
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City of Madison
City of Monona
Town of Blooming Grove
Lake Wingra
Town of Madison
Murphy Cr.
(Penitto Cr.)
Upper Mud Lake
Nine Springs Cr.
Village of McFarland
Lake Waubesa
City of Fitchburg
Town of Dunn
Swan Cr.
Murphy's Cr.
Figure 4-14
POTENTIAL POLLUTANT LOADINGS FROM ANIMAL LOTS
Low (< 5 lbs. phosphorus)
Medium (> 5 lbs. phosphorus)
High (> 20 lbs. phosphorus)
0 1 2 3mi.
N
DANE COUNTY REGIONAL PLANNING COMMISSION

Agricultural Soil Erosion and Sediment Losses to Water bodies

Intensive agricultural practices can cause considerable soil erosion and substantial amounts of sediment to reach lakes, streams and wetlands in the Yahara-Monona Watershed. Chemical fertilizers, herbicides and insecticides can also be carried along with sediment during times of water runoff. Of all nonpoint pollution sources, eroding agricultural lands may be the most difficult to recognize as a significant pollutant source, since soil erosion often does not occur in a pronounced manner.

To determine agricultural lands where soil erosion and sediment losses are of management concern, the Wisconsin Nonpoint Source (WIN) computer model was used to simulate soil erosion and actual sediment delivery rates from individual farm fields to nearby water bodies. Summarized model results are presented on a subwatershed basis in Table 4-10. An estimated 119,000 tons of soil erode annually from cropped agricultural lands. About seven percent of this total (8,750 tons/year) actually reaches lakes, streams or wetlands in the watershed. The rest of the sediment settles out on fields or dry channels before reaching surface waters.

Croplands are the major source of sediment that is lost to water bodies. Although this land use accounts for about 60 percent of the rural land cover in the watershed, it contributes over 90 percent of the total sediment load. The average sediment delivery rate for agricultural lands is 0.66 tons/acre/year. Predominantly rural land areas with high sediment delivery rates are displayed in Figure 4-15.

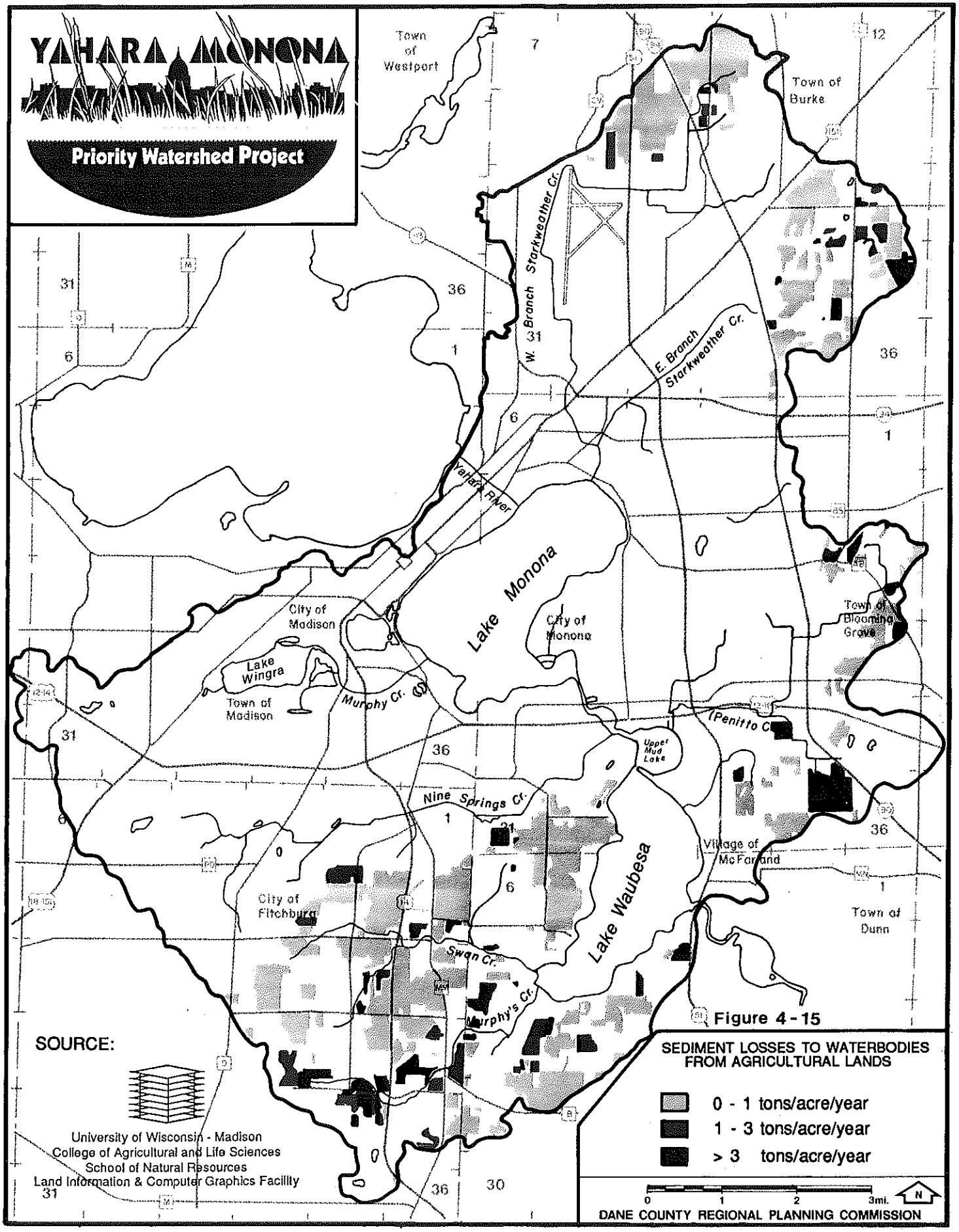
TABLE 4-10
RURAL SOIL EROSION AND SEDIMENT LOADS[1]
TO WATER BODIES BY SUBWATERSHED,
1990 LAND USE CONDITIONS

Subwatershed	Total Cropland Acreage	Total Soil Erosion (Tons/Year)	Total Sediment Load Reaching Water Bodies (Tons/Year)
Starkweather Creek	3,655	32,505	2,411
Upper Mud Lake (Penitto Creek)	1,697	12,865	1,096
Nine Springs Creek	1,883	13,180	1,105
Lake Waubesa	1,885	19,560	1,014
Swan Creek	2,737	20,015	1,418
Murphy's Creek	1,489	20,760	1,708
Total	**13,346**	**118,885**	**8,752**

[1]As determined by WIN computer model.

Rural Streambank Erosion

Since most rural streams in the watershed have a fairly flat gradient and erosion from livestock and other sources is not prevalent, a comprehensive field survey of streambank erosion was not conducted. Air photos (1990) were reviewed to locate potential problem sites, and general field assessments were performed for selected stream reaches. Significant erosion was identified along an intermittent tributary of Murphy's Creek (see Fig. 4-13). This erosion is associated with livestock access to the stream, which should be controlled to prevent further water quality degradation.


YAHARA MONONA
Priority Watershed Project
Town of Westport
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W. Branch Starkweather Cr.
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City of Madison
City of Monona
Town of Blooming Grove
Lake Wingra
Town of Madison
Murphy Cr.
Penitto Cr.
Upper Mud Lake
Nine Springs Cr.
Village of McFarland
Lake Waubesa
City of Fitchburg
Town of Dunn
Swan Cr.
Murphy's Cr.
SOURCE:
University of Wisconsin - Madison
College of Agricultural and Life Sciences
School of Natural Resources
Land Information & Computer Graphics Facility
SEDIMENT LOSSES TO WATERBODIES FROM AGRICULTURAL LANDS
0 - 1 tons/acre/year
1 - 3 tons/acre/year
> 3 tons/acre/year
0 1 2 3mi.
N
DANE COUNTY REGIONAL PLANNING COMMISSION

Figure 4-15

Commercial Fertilizer and Pesticide Use

Fertilizers

Commercial fertilizer is often used in modern intensive agriculture to supplement nutrients stored in the soil and those released from landspread animal waste and decomposing crop residues. Fertilizer not only can increase crop yields, but helps to establish an earlier and more intensive ground cover. The primary plant nutrients in commercial fertilizer are nitrogen, phosphorus and potassium. Though beneficial for crop growth, these nutrients can be washed off the land surface or leach through the soil to affect surface and ground water quality. Thus fertilizer should only be added when the soil's nutrient supply fails to meet crop needs. Fertilizer programs should be based on soil test results and realistic yield goals.

Nitrogen and phosphorus entering surface waters from fertilizers can promote rooted aquatic plant and algae growth. High levels of nitrogen in drinking water also can pose a public health concern for infants. The relatively high concentrations of nitrate-nitrogen commonly found in private well water supplies throughout the watershed are associated, in part, with nitrogen fertilization practices (DCRPC, 1987).

Information is not available regarding total fertilizer use in the watershed. The Wisconsin Department of Agriculture does maintain statewide fertilizer sales information, which indicates that commercial fertilizer consumption in Wisconsin has increased dramatically over the last 30 years. This also is undoubtedly reflective of use in Dane County.

Pesticides

Pesticides are widely used in agriculture for insect, weed and disease control. If properly applied, most pesticides will be taken up by plants or rapidly broken down by microorganisms or sunlight. Research shows that pesticide losses from agricultural fields seldom exceed a minor percentage of the amount applied. Nevertheless, the potential exists for pesticide runoff or percolation that can degrade surface and ground water quality.

An inventory of commonly used agricultural pesticides in Dane County is displayed in Table 4-11. Pesticides currently used are primarily synthetic organic compounds.

TABLE 4-11
PESTICIDES MOST COMMONLY USED IN DANE COUNTY

Insecticides	Herbicides
Counter (terbufos)[1]	Atrazine[2]
Furadan (carbofuran)[1]	Bladex (cyanazine)
Lorsban (chlorpyrifos)[1]	Dual (metolachlor)
Thimet (phorate)[1]	Lasso (alachlor)
	Prowl (pendimethalin)
	Roundup (glyphosate)
	Sutan+ (butylate + safener)
	Treflan (trifluralin)

[1]Restricted-use pesticide, for use only by certified applicators.
[2]Special state limitations on use.

Source: Dane County Extension Office.

Extensive water resource monitoring for pesticides has recently been initiated in Wisconsin. Private well water sampling and analyses in Dane County, including a few sites in the Yahara-Monona Watershed, have revealed widespread detections of atrazine in groundwater. Additional monitoring is taking place, and the state has enacted more stringent regulations than federal guidelines concerning the use of this herbicide.

Integrated pest management (IPM) is a key best management practice that can be used to reduce the use of pesticides and minimize detrimental impacts to the environment. IPM uses detailed pest, crop and weather monitoring data in making pest control decisions and promotes the use of non-chemical control methods, such as crop rotation, pest-resistent varieties, tillage practices and adjusted planting/harvesting dates. Chemical control is often used only when pest populations exceed levels that will result in economic loss. IPM can be more widely adopted by farmers in the watershed, and the priority watershed project can provide financial assistance for pest management scouting for up to three years on a farm operation.

Inventory of Other Potential Pollution Sources

In addition to the urban and rural nonpoint source inventories, information on other potential water pollution sources in the watershed was obtained. Several of these sources are facilities that need to operate in compliance with various state regulatory programs. Sources may exist above ground, such as sewage sludge application sites, bulk fertilizer and pesticide storage facilities, pesticide mixing and handling sites, hazardous waste storage facilities and salvage or junk yards; or they may be located below the land surface, such as solid waste disposal sites, underground storage tanks and on-site wastewater systems in unsewered subdivisions. Maps and descriptions of these sources are presented on the following pages.

Sewage Sludge Application Sites

Sludge is an organic by-product of wastewater treatment. It is commonly viewed as a valuable source of plant nutrients and organic matter for agricultural crops. Consequently, sludge is often landspread or injected into the soil as a recycling practice. There are constituents of sludge, such as heavy metals and bacteria, that can degrade water quality, however, if the sludge is not properly applied to suitable sites.

The Madison Metropolitan Sewerage District applies sludge annually to approximately 3,500 to 4,000 acres of land in central Dane County, most of which is in the Yahara-Monona Watershed. This program is regulated by the DNR. The majority of the permitted application sites are in the City of Fitchburg and towns of Blooming Grove and Dunn (see Fig. 4-16). MMSD uses special application vehicles to inject sludge into the soil to avoid runoff and other environmental problems.

As part of MMSD's sludge application program (commonly termed Metrogro), a groundwater monitoring program has been conducted. Water samples from approximately 500 private wells located near sludge application sites have been collected since 1978. Comparison of background and post-application data indicates that land application of sludge has not adversely affected the water quality of nearby wells. Monitoring is continuing in order to evaluate any possible effects of continued sludge application. MMSD is currently updating its facilities planning, including the daily management of sludge. Ways of dewatering sludge so it can be recycled more cost-effectively are being reviewed.

Bulk Fertilizer and Pesticide Storage Facilities

Facilities that store bulk quantities of liquid fertilizers and pesticides can be a ground or surface water pollution concern. To minimize pollution threats, standards for storage containers, backup containment for spills and leaks, and maintenance have recently been established for bulk storage facilities by the Department of Agriculture, Trade and Consumer Protection. Five such facilities have been identified in the Yahara-Monona Watershed, four of which are in the Starkweather Creek subwatershed (see Fig. 4-17). Nitrogen fertilizer and molasses feed spills that have impacted the East Branch Starkweather Creek have been reported from one of these sites (Comstock Seed and Feed Company).

Pesticide Mixing and Loading Sites

Pesticide mixing and loading sites also represent potential sources of groundwater pollution. Such sites often include farms, nurseries, lawn care companies and city, village and town garages. Pollution can occur from improper handling of pesticides resulting in spills and inadequate containment. Twelve pesticide mixing and loading sites have been identified in the watershed (see Fig. 4-18).

Hazardous Waste Storage Facilities

Leaks or spills of hazardous waste from storage tanks can pose major pollution problems. Due to the nature of waste stored, even a small spill could have a tremendous water quality impact if not properly contained. Hazardous wastes that are commonly stored include solvents, paint residues and sludges. There are only two

facilities in the watershed that store hazardous waste for an extended period (greater than 90 days). They are the University of Wisconsin Mills Street building and the Safety Kleen Corporation site in the City of Madison. These facilities are closely regulated and licensed by the DNR.

Salvage and Junk Yards

Salvage and junk yards may contain hazardous substances from automobile parts or other abandoned materials. Such substances often include solvents, battery acids, grease and oil. If a yard is not properly managed and materials are not adequately contained, these substances can run off or infiltrate into the ground and degrade water quality. Seven junk and scrap metal businesses have been identified in the watershed (see Fig. 4-19). At one site (Midwest Steel Company) discharges of heavy metals, such as lead and zinc, and PCB's have impacted wetlands adjacent to the East Branch Starkweather Creek.

Solid Waste Disposal Sites

Waste disposal sites can pose significant threats to ground and/or surface water quality. Contact between water and refuse in the disposal site and subsequent decomposition produces a polluted liquid called leachate. If not adequately confined or attenuated, this liquid can seep into groundwater or run off into surface waters.

Nearly 50 solid waste disposal sites have been identified in the Yahara-Monona Watershed (see Fig. 4-20). Most of these sites are no longer in operation. Presently, only seven sites are accepting refuse, with most waste being sent to the Dane County Rodefeld landfill.

A limited amount of water monitoring and field inspection data have been obtained for most of the closed waste disposal sites. Consequently, existing and potential impacts are often difficult to ascertain. Some sites are receiving groundwater monitoring because they are of priority concern. These include the Truax and Sycamore landfills in the Starkweather Creek subwatershed, and the Demetral Field and Olin Avenue landfills in the Lake Monona subwatershed. The Truax landfill has significantly polluted groundwater and has been included in the state Environmental Repair Fund (ERF) program, which is the state's counterpart to the federal Superfund program. Polluted groundwater from the Truax landfill is not moving toward Starkweather Creek. However, surface water quality concerns for the creek do exist from the Sycamore landfill, as well as for Murphy (Wingra) Creek from the Olin Avenue landfill. The DNR Bureau of Solid Waste Management and the City of Madison are conducting additional monitoring and evaluating remediation alternatives for these sites.

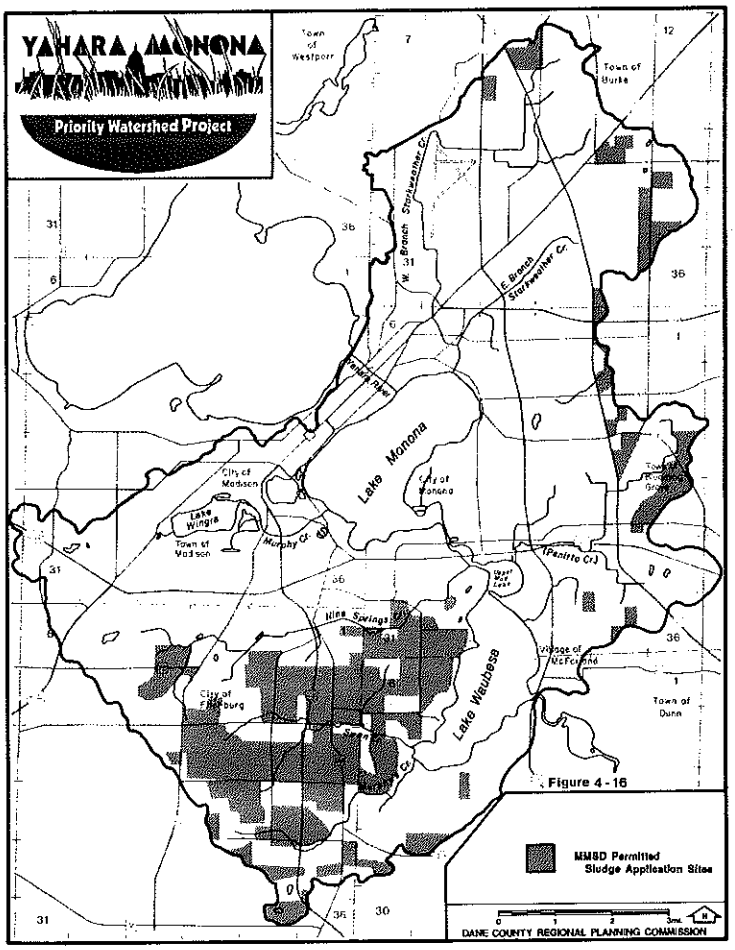
Site evaluations for nearly all of the operating disposal sites indicate fair to good conditions exist. Generally, operating problems are not known or significant. The only significant problem at an active disposal site has been identified at the Madison Metropolitan Sewerage District's sludge lagoons where PCB contamination has occurred. However, there has been minimal PCB migration off-site and no known impacts to the nearby Nine Springs Creek. A sludge lagoon remediation study is currently being conducted by MMSD.

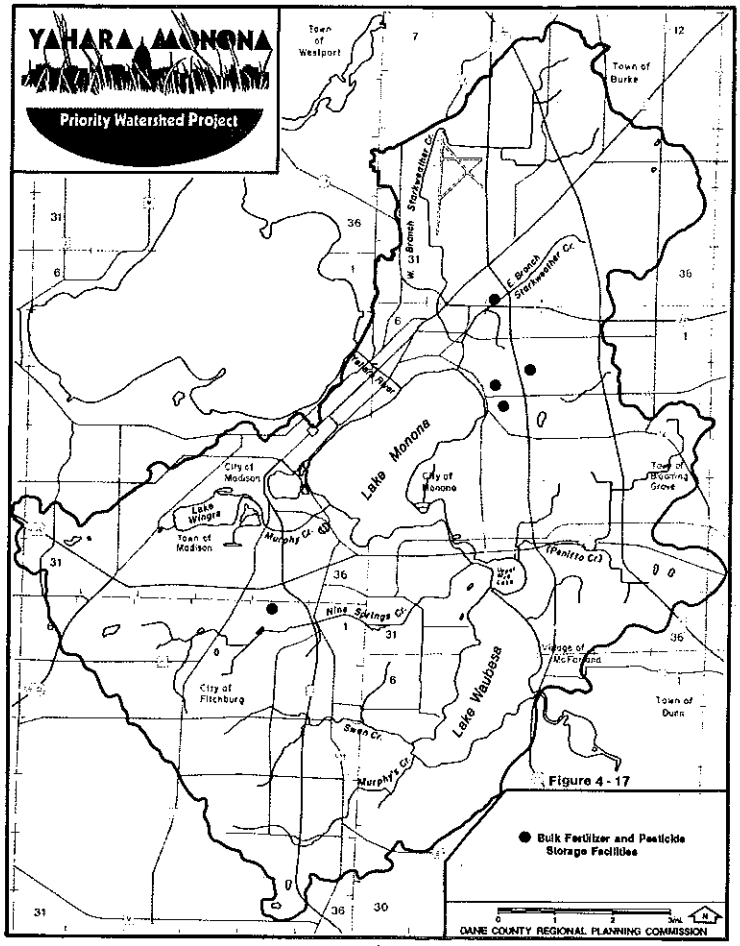
Siting of future solid waste disposal sites is also an issue of substantial concern in the watershed. In May 1990, the Yahara-Monona Steering Committee endorsed a resolution opposing the proposed Libby Landfill, west of Lake Waubesa in the Town of Blooming Grove. Concerns over potential pollution of surface and ground water were expressed by the committee.

Underground Storage Tanks

Leaking underground, as well as aboveground, storage tanks can release petroleum and other chemicals into the environment causing ground or surface water pollution. Nationally, it is estimated that between 10 and 25 percent of the existing underground petroleum storage tanks are leaking. Of principal concern are tanks 20 or more years old that may now be leaking because they have deteriorated.

The state Department of Industry, Labor and Human Relations is administering a regulatory program for underground tanks. More than 1,000 tanks have been registered in the Yahara-Monona Watershed. Leaks and groundwater contamination from some tanks in the watershed have been recorded. One notable example of a petroleum leak or spill that is currently being investigated is along John Nolen Drive between the Highway 12 & 18 interchange and Lakeside Street in the Lake Monona subwatershed.


YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
W. Branch Starkweather Cr.
E. Branch Starkweather Cr.
Yahara River
Lake Monona
City of Madison
Lake Wingra
Town of Madison
City of Monona
Murphy Cr.
(Panitto Cr.)
Nine Springs Cr.
Village of McFarland
Lake Waubesa
City of Fitchburg
Town of Dunn
Swan Cr.
Figure 4-16
MMSD Permitted Sludge Application Sites
DANE COUNTY REGIONAL PLANNING COMMISSION


YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
W. Branch Starkweather Cr.
E. Branch Starkweather Cr.
Yahara River
Lake Monona
City of Madison
Lake Wingra
Town of Madison
City of Monona
Town of Blooming Grove
Murphy Cr.
(Panitto Cr.)
Nine Springs Cr.
Village of McFarland
Lake Waubesa
City of Fitchburg
Town of Dunn
Swan Cr.
Murphy Cr.
Figure 4-17
Bulk Fertilizer and Pesticide Storage Facilities
DANE COUNTY REGIONAL PLANNING COMMISSION

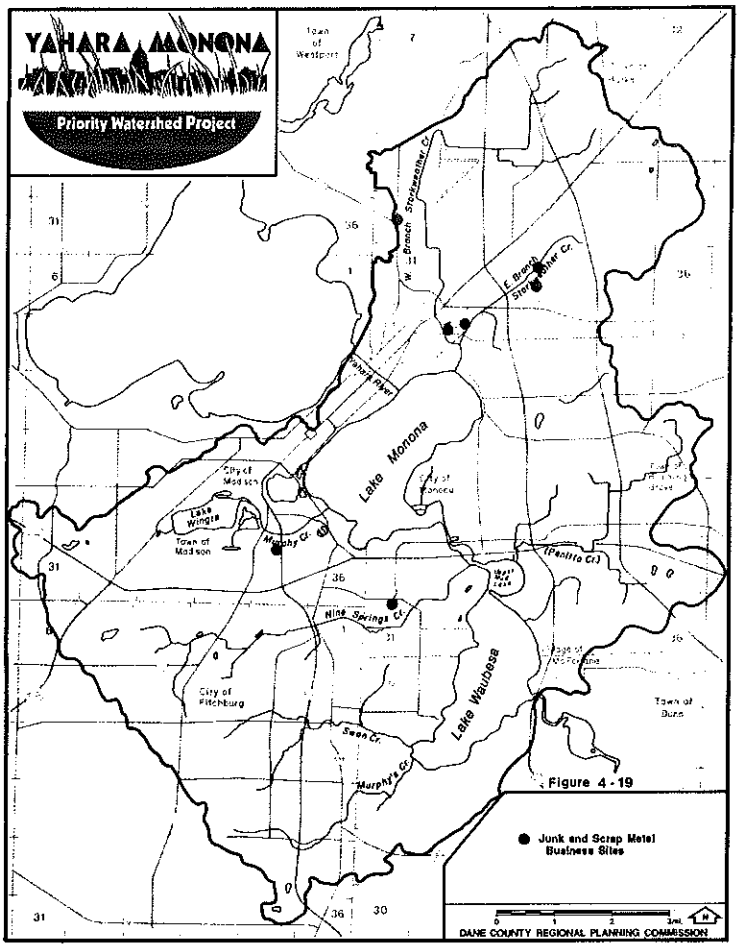


Figure 4-19

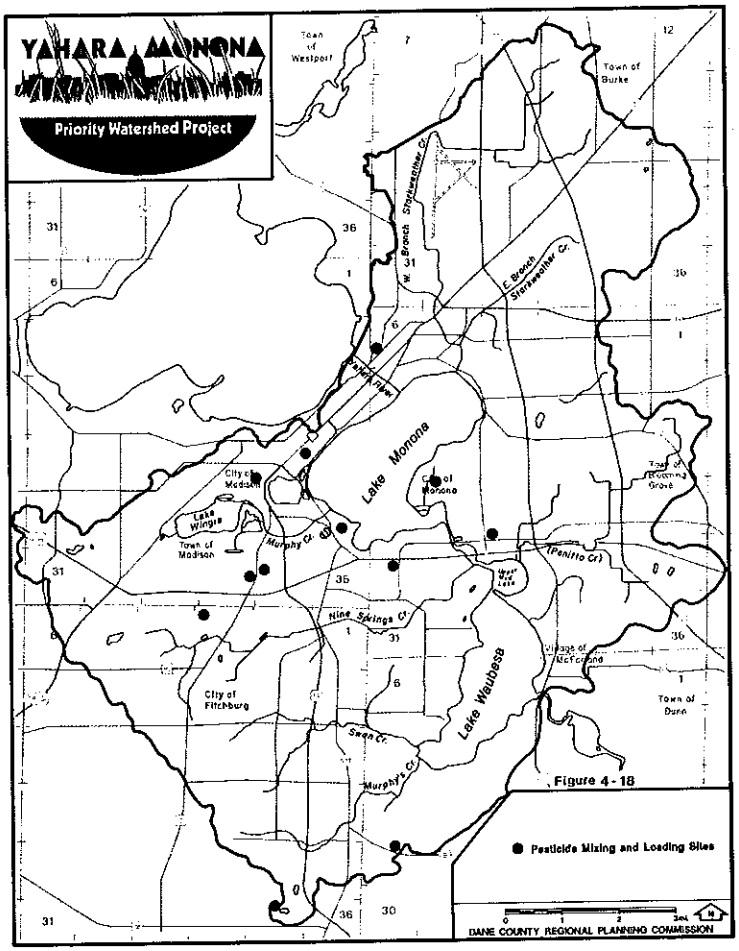


Figure 4-18

Unsewered Subdivisions

On-site wastewater (e.g., septic tank) systems in some unsewered subdivisions are associated with elevating nitrate-nitrogen and bacteria levels in groundwater. Where high septic tank densities exist or there is a shallow depth to groundwater, nitrate concentrations in excess of the recommended public drinking water standard may be present in the local groundwater supply. The locations of unsewered subdivisions in the watershed are displayed in Fig. 4-21. Several subdivisions exist in the City of Fitchburg and Town of Burke. An example of where septic tank system problems may be polluting groundwater is in the Greenfield Park subdivision in Sec. 23 of Fitchburg. There is a shallow depth to groundwater in this area, making it easier for pollutants to reach the water table.

Trends and Forecasts

Recent trends regarding the implementation of nonpoint source pollution control practices by municipalities and landowners in the watershed were evaluated. This was done to estimate what general level of management practice adoption might occur in the future and where significant management deficiencies might exist. Both urban and rural management programs were reviewed.

Urban Programs

Local construction site erosion and stormwater runoff control ordinances have been the primary regulatory mechanism for addressing potential adverse water quality and hydrologic impacts to waterbodies from urban development. These ordinances require new developments to have management measures that control soil loss off-site during construction, as well as peak rates of water runoff following construction.

Such ordinances have been adopted by all communities in the watershed since the early to mid-1980s. While the ordinances provide a legal foundation for dealing with particular water resource-related problems (primarily soil erosion and flooding), they are currently not designed to require water quality measures (e.g., wet detention basins) that remove pollutants in urban runoff. As a result, there has been a limited number of practices actually implemented in the watershed that provide substantial water quality benefits. This trend would be expected to continue for new developments in the absence of any broader regulatory or strong voluntary incentive programs. Also, without such programs, there would be a limited likelihood of municipalities retrofitting already developed areas with stormwater quality management practices.

In addition, the adequacy of construction site erosion control enforcement by the municipalities in the watershed is sometimes questioned. This may be due in part to the priority given to this issue at a municipal and agency level, particularly in regard to other competing duties that agency inspection staff are often required to perform. Without additional attention placed on ordinance enforcement by the municipalities, existing program performance levels will probably continue and not be improved. Such municipal attention could be gained either through information/education efforts or through mandatory performance standards that could be established at a state or county level.

The new federal stormwater discharge permit program will increase the implementation of stormwater quality management practices in the watershed, but at this time the program only pertains to the City of Madison. Also no funding is available through the program to assist municipalities in implementing management measures necessary to meet permit requirements. Without a targeted funding source, management practice adoption will be slower and more difficult to achieve.

The Yahara-Monona Priority Watershed Project will provide cost-share funding to the City of Madison and other municipalities to implement stormwater quality management practices, that otherwise could prove difficult to undertake and fund alone. The project also can be of assistance to municipalities in upgrading their enforcement of construction site erosion control ordinances, which has emerged as an issue of increasing concern.

Rural Programs

Over 150 rural landowners, with more than 20 acres of land each, are located in the Yahara-Monona Watershed. Adoption of soil conservation practices by farmers has been advanced recently through the conservation compliance provisions of the U.S. Food Security Act and the Wisconsin Farmland Preservation Program. In order for landowners to remain eligible for program-related benefits, they must be in compliance with conservation provisions established to limit soil erosion to tolerable (T) levels on individual fields. The majority of landowners in the watershed have developed farm conservation plans required by these federal and state

programs. They have until 1995 to implement management practices specified in the plans. In addition, about 700 acres of land in the watershed have been enrolled in the Conservation Reserve Program (CRP), which is an element of the Food Security Act and is designed to take highly erodible farm land out of production for 10 years.

Conservation compliance requirements are being relied upon to propel most farmers to implement soil conservation practices, which should also provide some water quality benefits. Additional water quality management measures (e.g., barnyard runoff controls, nutrient and pesticide management and higher levels of sediment control) will probably be necessary in some situations, however, to adequately protect waterbodies from pollution. Financial incentives for implementing these measures will also be needed. Thus, the types of management practices and financial cost-sharing offered through the Yahara-Monona Priority Watershed Project represent a good opportunity to fill water quality management gaps that are still likely to exist in the watershed in spite of federal and state soil conservation compliance programs.

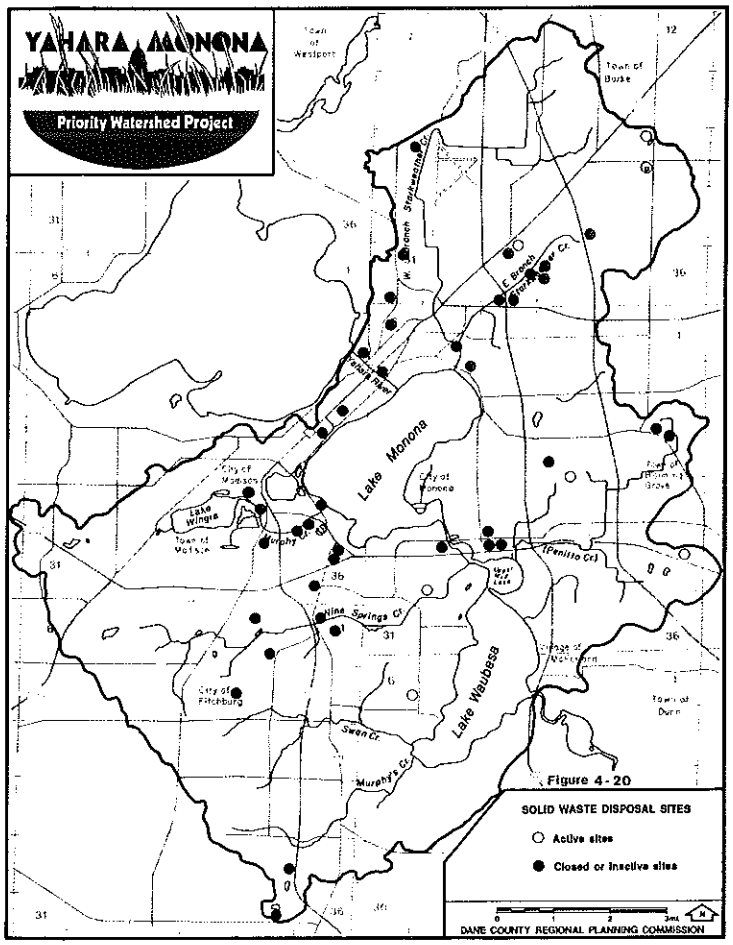


Figure 4-20

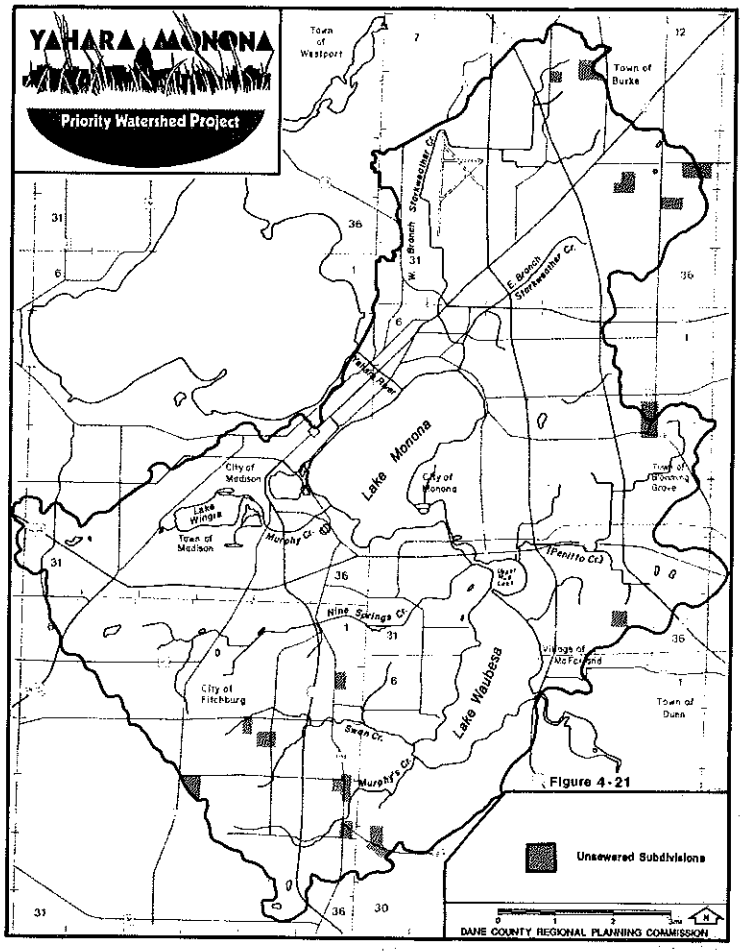


Figure 4-21

CHAPTER 5

ALTERNATIVE MANAGEMENT STRATEGIES

This chapter presents the various urban and rural management strategies that were developed and evaluated to determine pollutant reductions that could be expected from management practice implementation. The approach to wetland and stream/lakeshore corridor management is also presented. Urban and rural management strategies include a range of implementation levels, from no additional activities to pursuing a maximum level of management controls in the watershed. Cost estimates associated with management scenarios are indicated. Evaluation results are compared with pollutant reduction goals established to meet water resource objectives, as presented in Chapter 4. The first section of this chapter addresses urban management alternatives.

Urban Area Management Strategies

There are certain "basic" or "housekeeping" management activities that should be a component of any urban pollution control strategy and which can be readily adopted by local communities without substantial technical evaluations and funding. These activities include changes in the timing and scheduling of basic street-sweeping and leaf collection practices so they are more effective in removing debris and pollutants during critical times of the year. Public information activities that inform residents about the importance of properly disposing/recycling of leaves and pet waste should also be pursued. Additional examples of "basic" management activities are presented under the "Recommended Urban Management Program" in Chapter 6 of this plan. Adopting a community-wide program should be the first step in carrying out a comprehensive urban nonpoint source pollution control strategy.

The DNR's urban water quality computer model (SLAMM) was used to evaluate four different "site-specific" pollutant control strategies for the existing urban area of the Yahara-Monona Watershed. These strategies include:

1) Maintain the current level of management. Do nothing extra. (Results of this strategy are shown in Chapter 4.)

2) Pursue an aggressive street sweeping program of approximately once/week for all critical (i.e., high pollutant contributing) land uses.

3) Pursue wet detention basins on half of the critical land uses, as well as an aggressive street sweeping program for all critical land uses.

4) Pursue wet detention basins on all of the critical land uses.

For areas in the watershed planned for urban development, strategies one, three and four were also evaluated. Street sweeping, however, was not included for any planned land uses as part of strategy three. Because land availability generally does not represent a limiting management factor for planned urban development compared to existing urban areas, the opportunity to install detention basins or other large structural practices is greater for planned land use. These practices are more effective in reducing pollutants than street sweeping; thus street sweeping was not evaluated as a management alternative for planned development.

Urban land uses differ in their production of stormwater pollutants and flow. Lands considered the most critical to control because of their associated pollutant loadings have been identified for each municipality in the watershed and acreages are summarized in Table 5-1. This identification is based on two primary factors: 1) the unit area rate, in pounds/acre or tons/acre, at which each land use produces pollutants; and 2) the portion of the total urban pollutant load produced by each land use, even if the land use does not have a high unit area rate. The purpose of identifying critical urban land uses is to focus budget and staff resources on areas where management activities will have the greatest water quality impact and be cost-effective.

Freeways, industrial, commercial, and high density residential land uses are usually considered critical because they have high pollutant loading rates. In addition, for most urban communities in the Yahara-Monona Watershed, medium density residential lands (2-6 homes/acre) are also grouped into the critical category because they are extensive and contribute a significant portion of the total urban pollutant load (see Table 5-2). Low density residential development is not considered a critical land use for any municipality in the watershed.

The analysis of the management strategies for existing and planned urban development relies primarily on the high level of pollutant control provided by wet detention basins for certain pollutants. Wet detention basins are assumed to trap about 90 percent of the suspended sediment, and about 70 percent of the heavy metals in urban runoff. However, other pollutants, such as pesticides and phosphorus, are not reduced as substantially by wet basins. Since wet basins and other large structural practices do not address all pollution concerns, the need for pollution prevention or direct source controls (e.g., limiting lawn pesticide use and proper leaf pickup and disposal) by individuals and municipalities in the watershed is reinforced (see page 78).

Computer modeling of the above management strategies does not account for pollution from construction site erosion, which can be substantial. Strict control of this pollution source through enforcement of existing erosion control ordinances is the most effective and cost-efficient approach to limit high sediment loadings from lands undergoing development. On the other hand, modeling also does not take into account the effects of wetlands and stream-side vegetation, which can be important in reducing runoff and certain pollutants from urban lands.

TABLE 5-1
CRITICAL EXISTING URBAN LAND ACREAGES BY MUNICIPALITY THAT NEED STORMWATER QUALITY PRACTICES[1]

Municipality	Critical Urban Area (Acres)	Percent of Total Urban/Urbanizing Area in Municipality[2]
City of Madison	12,968	65
City of Monona	1,377	64
City of Fitchburg	642	24
Village of McFarland	691	58
Town of Madison	893	39
Town of Blooming Grove	470	64
Town of Burke	157	27
Watershed Totals	17,198	58

[1]In order to reduce heavy metal concentrations in urban runoff below acute toxicity levels.
[2]Excludes agricultural land use within municipal boundary.

TABLE 5-2
IDENTIFIED CRITICAL LAND USES WITHIN THE URBAN AREAS OF THE YAHARA-MONONA WATERSHED[1]

Municipality	Critical Land Uses				
	Industrial	Commercial	Institutional	High Density Residential	Medium Density Residential
C. Madison	X	X	X	X	X
C. Monona	X	X	X	X	X
C. Fitchburg	X	X	X	N/A	X
V. McFarland	X	X	X	N/A	X
T. Madison	X	X	X	X	X
T. Blooming Grove	X	X	X	X	
T. Burke	X	X	X	X	

[1]Need management practices in order to reduce heavy metal loadings below acute toxicity levels.

Results of Urban Management Strategy Evaluations

For existing urban areas, pollutant reductions that were simulated by the computer model for the various management strategies are presented in Table 5-3. Results are displayed on a municipality basis. Urban management strategies were initially evaluated in accordance with meeting pollutant reduction goals. Reduction goals are identified by subwatershed in Chapter 4 and are summarized below.

1) Reduce heavy metal concentrations in stormwater runoff to the maximum extent practicable so as not to exceed acute toxicity standards. (Approximately a 70 percent reduction in existing heavy metal (e.g., zinc) loadings is needed to consistently achieve this goal.)

2) Reduce phosphorus and sediment loadings in runoff to levels that will not degrade existing water quality in lakes and streams and which may, in the long term, provide some water quality improvement. (To potentially obtain an improvement in water quality, a 30 to 50 percent reduction in existing phosphorus and sediment loadings is needed.)

Results of the alternative management strategies indicate that an aggressive street sweeping program by itself does not provide a high level of pollution reduction in the watershed. Loading reductions for zinc (a representative heavy metal), phosphorus and suspended solids are generally less than 20 percent from existing conditions, which falls significantly short of reduction goals. The next management alternative, which includes street sweeping and wet detention basins on half of the high polluting land uses, provides a significantly higher level of pollutant reduction. Zinc and phosphorus are reduced by about 30 to 40 percent and suspended solids by 50 to 60 percent per municipality.

TABLE 5-3
RESULTS OF ALTERNATIVE MANAGEMENT STRATEGIES BY MUNICIPALITY FOR EXISTING LAND USE

Urban Municipality	Percent Zinc Reduction Goal[1]	Street Sweeping Once/Week			Detention Basins on Half of Critical Land Uses Plus Street Sweeping			Detention Basins on All Critical Land Uses		
		Percent Zinc Reduction[2]	Percent Phosphorus Reduction	Percent Suspended Solids Reduction	Percent Zinc Reduction[2]	Percent Phosphorus Reduction	Percent Suspended Solids Reduction	Percent Zinc Reduction[2]	Percent Phosphorus Reduction	Percent Suspended Solids Reduction
C. Madison	73	1	10	10	41	30	55	70	45	89
C. Monona	57	1	9	9	36	29	49	70	45	89
C. Fitchburg	64	10	12	19	41	30	54	69	41	87
V. McFarland	58	1	11	12	36	31	51	70	45	89
T. Madison	66	1	10	10	36	29	50	70	43	88
T. Blooming Gr.	81	9	10	13	36	29	51	61	44	88
T. Burke	75	7	24	29	39	40	60	70	43	88
Averages	68	4	12	15	38	31	53	69	44	88

[1]To reduce discharge from storm sewer pipes below acute toxicity levels.
[2]Percent reduction from current pollutant loadings. Note: Modeling does not account for pollution reduction from wetlands and environmental corridor lands; thus actual reduction percentages may be greater than what is reflected in the table.

The most ambitious management alternative--wet detention basins on all high polluting land uses--provides the greatest pollutant reduction. Zinc and suspended solids are reduced by another 30 percent compared to the alternative of detention basins on half of the critical lands, while phosphorus is generally reduced by another 10 to 15 percent per municipality. Under this strategy, zinc is reduced by a total of approximately 70 percent from existing conditions, suspended solids nearly 90 percent and phosphorus about 45 percent. This is the only strategy that would, for the most part, achieve heavy metal reduction goals for developed areas.

Results of applying the alternative management strategies to planned urban areas are displayed in Table 5-4. For the alternative of detention basins on half of the critical land uses, zinc and suspended solids are reduced by 34 to 42 percent compared to pollutant loadings that would result without management practices in developing areas. Phosphorus is reduced by about 20 percent. For the alternative of detention basins on all critical land uses, pollutant reductions for all three parameters are approximately double the results achieved under the first strategy. If an aggressive street-sweeping program was included for this strategy (i.e., detention basins on half of the critical land uses), pollutant reductions would increase by about another 5 to 15 percent.

TABLE 5-4
RESULTS OF ALTERNATIVE MANAGEMENT STRATEGIES BY MUNICIPALITY FOR PLANNED URBAN LAND USE

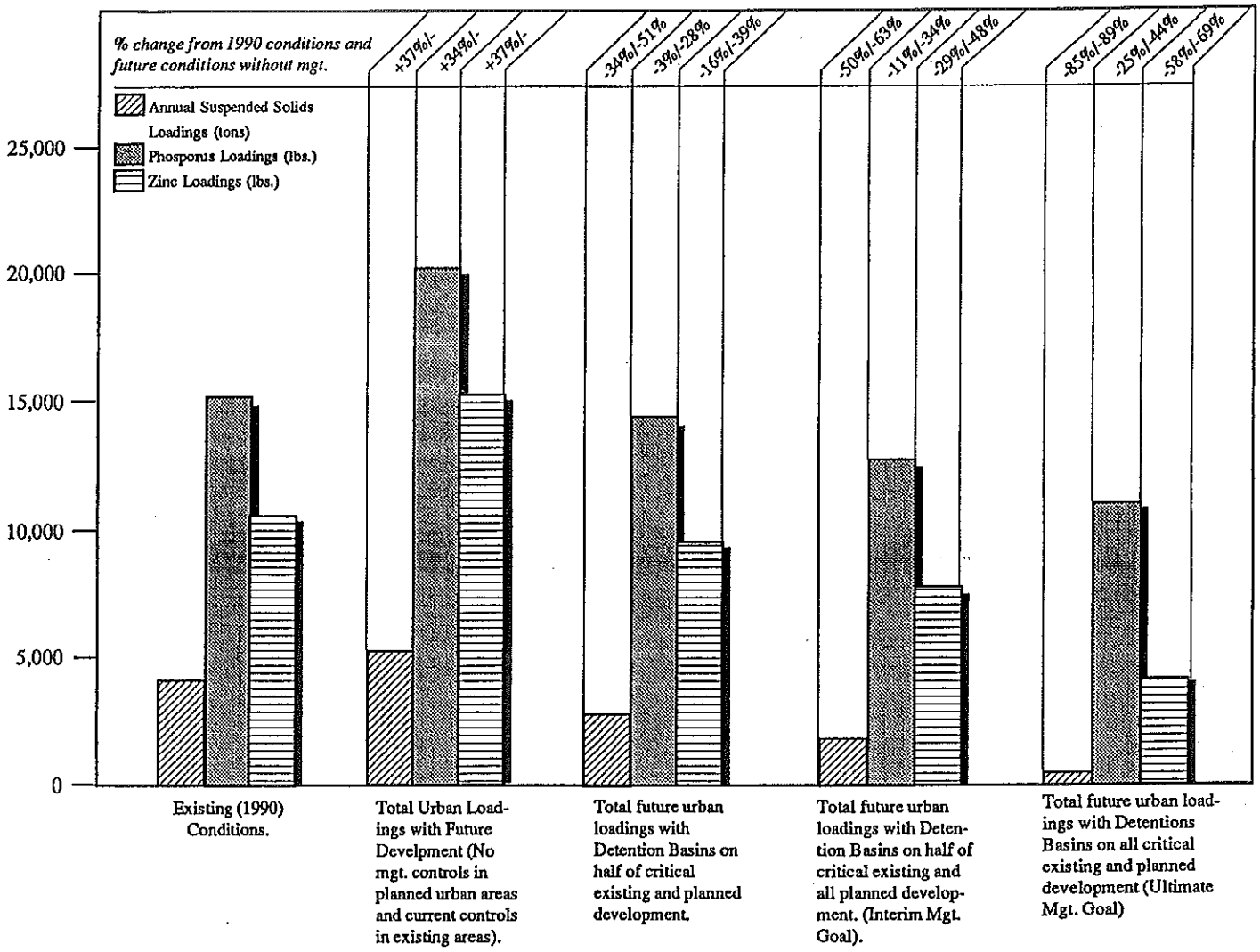
Urban Municipality	Percent Zinc Reduction Goal[1]	Detention Basins on Half of Critical Land Uses No Street Sweeping			Detention Basins on All Critical Land Uses		
		Percent Zinc Reduction[2]	Percent Phosphorus Reduction	Percent Suspended Solids Reduction	Percent Zinc Reduction[2]	Percent Phosphorus Reduction	Percent Suspended Solids Reduction
C. Madison	78	35	23	45	70	45	90
C. Fitchburg	60	35	23	45	70	46	90
T. Blooming Gr.	53	30	15	33	59	30	66
T. Burke	76	35	22	45	70	44	89
Averages	67	34	21	42	67	41	84

[1]To reduce discharge from storm sewer pipes below acute toxicity levels.
[2]Percent reduction from pollutant loadings in planned urban areas, assuming no management controls.

Pollutant reduction results from combining existing and planned urban area management strategies are displayed in Figure 5-1. This represents total future urban pollutant loadings, excluding construction site erosion. Assuming no additional management activity in existing or planned urban areas, pollutant loadings for suspended solids, phosphorus and zinc increase from 34 to 37 percent over existing loadings. Under management scenario 3 in Figure 5-1, phosphorus is reduced by only 3 percent, zinc by 16 percent and suspended solids by 34 percent from existing conditions. Implementation of the most aggressive management scenario (scenario 5 for existing and planned development) results in phosphorus loadings being reduced by 25 percent, zinc by 58 percent and suspended solids by 85 percent from existing conditions. While this strategy comes closest to achieving overall pollutant reduction goals, it may be difficult to pursue in the short-term future because of limited space availability for practices, such as wet detention basins, on all existing critical land areas. Consequently, management scenario 4, which seeks stringent control of pollutants from half of the critical land uses in existing development and all critical land uses for planned urban areas, may be the most reasonable strategy to immediately pursue. This should not be interpreted, however, as forestalling communities from striving to achieve the ultimate goal of management scenario 5 (i.e., wet detention basins or other structural management practices on all existing and planned development) as redevelopment and other land use opportunities permit.

Figure 5-1

Effects of Management Alternatives on Total Future Urban Pollutant Loadings



Costs of implementing the different management alternatives for existing urban areas were also determined. Based on the total critical land acreages in each municipality, the amount (acreage) of wet detention basins required to treat runoff was estimated. This was done assuming that wet detention basins are sized at 1 to 3 percent of a drainage basin's total area, depending on predominant land use, in order to control up to 90 percent of the suspended sediment load from the basin. Acreages of wet detention basins needed by each municipality were then multiplied by an average construction cost of $70,000/acre to determine total capital costs (see Table 5-5). These costs, however, do not include land acquisition and storm sewer rerouting costs, which can be substantial and often need to be addressed as part of construction. When these costs are taken into account, the cost per acre of wet detention may range from $100,000 to $500,000. A breakdown of cost sharing available through the priority watershed project for the capital costs is displayed in Table 5-5, as well as estimates of annual operation and maintenance costs, which are not currently eligible for state cost-share assistance.

TABLE 5-5 WET DETENTION BASIN NEEDS AND COSTS TO CONTROL RUNOFF IN EXISTING DEVELOPED AREAS					
Municipality	Acreage Needs for Wet Detention Basins (Treating 100% of Critical Land Areas)	Estimated Capital Cost[1] Moderate Expenditure Level ($120,000/acre)	State Share	Local Share	Annual Operation & Maintenance Costs ($2,400/acre) (100% Local Share)
C. of Madison	183	$21,960,000	$13,542,000	$8,418,000	$439,200
C. of Monona	16	1,920,000	1,184,000	736,000	38,400
C. of Fitchburg	8	960,000	592,000	368,000	19,200
V. of McFarland	9	1,080,000	666,000	414,000	21,600
T. of Blooming Grove	9	1,080,000	666,000	414,000	21,600
T. of Burke	3	360,000	222,000	138,000	7,200
T. of Madison	14	1,680,000	1,036,000	644,000	33,600
TOTAL	**242**	**$29,040,000**	**$17,908,000**	**$11,132,000**	**$580,800**

[1]Based on an estimate of $70,000/acre for construction, plus $50,000/acre for land acquisition and storm sewer rerouting costs.

Costs of street sweeping were determined based on the estimated street mileage associated with critical land areas in each municipality and the number of sweeping passes required to upgrade street sweeping frequencies to once/week for March through November. These figures were multiplied by a total street sweeping cost of $25 per curb mile to arrive at annual sweeping costs for each municipality. Generally, these costs are not eligible for state cost-share assistance, unless the municipality converts from brush to vacuum-type sweepers.

Table 5-6 summarizes on a municipality basis the costs of various management alternatives. These include street sweeping only for critical existing urban areas, street sweeping on half of the critical land areas plus detention basins on the other half, and detention basins on all of the critical land areas. Costs for the project period range from $6.7 million for upgraded street sweeping only to approximately $29 million for wet detention basins (assuming a cost of $120,000/acre of detention) on all critical land areas. If higher land acquisition and installation costs are assumed, the total cost for wet detention basins on all critical land areas could be about $38 million to $48 million (see Table 5-6). These costs do not include operation and maintenance costs for wet detention basins, which are also reflected in Table 5-6.

Cost estimates for the installation of wet detention basins in planned urban areas are presented in Table 5-7. Costs reflect the amount of wet basins needed to control runoff from all projected critical land uses, assuming full development within the urban service area boundary of each community and an average construction cost of $70,000/acre. Expensive land acquisition and storm sewer rerouting costs should not be incurred with planned, future developments; thus, these costs are not assumed.) Construction costs for management practices in new developments are to be funded entirely by the municipality and/or developers, since the priority watershed project provides financial assistance only for stormwater management feasibility studies for planned urban areas. The project is not intended to subsidize construction of water quality management practices in these areas.

Table 5-8 displays overall cost estimates obtained by combining existing and planned urban area management costs, which are associated with "short-term" and "ultimate" water quality management goals. The cost for the "short-term" management program, which seeks detention basins on half of the critical existing urban areas and street sweeping on the other half plus detention basins on all critical planned urban areas, is approximately $23 million. The capital cost for pursuing the "ultimate" management goal, which seeks detention basins on all critical existing and planned urban areas, is approximately $34 million. These capital costs are based on an average of $120,000/acre for wet detention basins in existing development and $70,000/acre for detention basins in planned development.

TABLE 5-6
COSTS OF ALTERNATIVE URBAN MANAGEMENT STRATEGIES FOR EXISTING DEVELOPMENT FOR 8-YEAR PROJECT IMPLEMENTATION PERIOD

Municipality	Upgrade Street Sweeping to Once/Week for all Critical Land Areas ($25 per curb mile)	Wet Detention Basins on Half of Critical Areas Plus Street Sweeping on Other Half [1]	Total Operation & Maintenance Costs for Wet Detention[2]	Wet Detention Basins on All Critical Land Areas (Scenario 1)[1]	Total Operation & Maintenance Costs[2]	Wet Detention Basins on All Critical Land Areas (Scenario 2)[3]
C. Madison	$620,675/yr x 8 yrs = $4,965,400	$13,462,700	$1,756,800	$21,960,000	$3,513,600	$29,280,000
C. Monona	74,050/yr x 8 yrs = 592,400	1,256,200	153,600	1,920,000	307,200	2,560,000
C. Fitchburg	43,085/yr x 8 yrs = 344,680	652,340	76,800	960,000	153,600	1,280,000
V. McFarland	28,730/yr x 8 yrs = 229,840	654,920	86,400	1,080,000	172,800	1,440,000
T. Blooming Gr.	27,560/yr x 8 yrs = 220,480	650,240	86,400	1,080,000	172,800	1,440,000
T. Burke	5,490/yr x 8 yrs = 43,920	201,960	28,800	360,000	57,600	480,000
T. Madison	39,935/yr x 8 yrs = 319,480	999,740	134,400	1,680,000	268,800	2,240,000
TOTALS	**$6,716,200**	**$17,878,100**	**$2,323,200**	**$29,040,000**	**$4,646,400**	**$38,720,000**
(State Share)	($0 unless vacuum sweepers used)	($8,954,000)	($0)	($17,908,000)	($0)	($22,748,000)
(Local Share)	($6,716,200; if vacuum sweepers are used, cost is less)	($8,924,100)	($2,323,200)	($11,132,000)	($4,646,400)	($15,972,000)

[1]Wet detention basin costs are assumed to be $120,000/acre.
[2]Operation and maintenance costs for wet detention basins are not eligible for state financial assistance.
[3]Fifty percent of all wet detention basins are assumed to have higher land acquisition and installation costs totaling $200,000/acre and other 50% are based on $120,000/acre. If all wet detention basins are assumed to cost $200,000/acre, total cost would be $48.4 million and state share would be $27.6 million.

TABLE 5-7
WET DETENTION BASIN NEEDS AND COSTS TO CONTROL RUNOFF IN PLANNED URBAN AREAS[1]

Municipality	Acreage Needs for Wet Detention Basins (Treating 100% of Critical Land Areas)	Estimated Capital Cost ($70,000/acre)[2]	Annual Operation & Maintenance Costs ($2,400/acre)[3]
C. of Madison	51	$3,570,000	$122,400
C. of Fitchburg	14	980,000	33,600
T. of Blooming Grove	2	140,000	4,800
T. of Burke	5	350,000	12,000

[1]Based on complete development within urban service area boundary.
[2]Excludes land acquisition and storm sewer rerouting costs. All construction costs for planned development will be borne by municipality. State financial assistance is available for stormwater management feasibility studies only.
[3]Costs to be borne by municipality.

TABLE 5-8
COSTS ASSOCIATED WITH SHORT-TERM AND ULTIMATE URBAN MANAGEMENT GOALS

Municipality	Short-Term Program Costs		Ultimate Program Costs	
	Wet Detention Basins on Half of Existing Critical Areas--Street Sweeping on Other Half for 8 Years & Wet Detention Basins on All Critical Planned Urban Areas[1]	Total Future Annual Operation & Maintenance Costs ($2,400/acre of wet detention)	Wet Detention Basins on All Critical Existing & Planned Urban Areas	Total Future Annual Operation & Maintenance Costs ($2,400/acre of wet detention)
C. Madison	$17,032,700	$342,000	$25,530,000	$561,600
C. Monona	1,256,200	19,200	1,920,000	38,400
C. Fitchburg	1,632,340	43,200	1,940,000	52,800
V. McFarland	654,920	10,800	1,080,000	21,600
T. Blooming Grove	790,240	15,600	1,220,000	26,400
T. Burke	551,960	15,600	710,000	19,200
T. Madison	999,740	16,800	1,680,000	33,600
TOTALS	$22,918,100	$463,200/year	$34,080,000	$753,600/year
(State Share)	($8,954,000--more if vacuum sweepers are used)	($0)	($17,908,000)	($0)
(Local Share)	($13,964,100--less if vacuum sweepers are used)	($463,200)	($16,172,000)	($753,600)

[1]Costs are based on $120,000/acre of wet detention for existing development, $70,000/acre for planned development and $25 per curb mile for upgrading street sweeping frequencies to once/week.

Costs are based on 1990 dollars and do not account for inflation.

Source Reduction Control

Source reduction control is another way of limiting water pollution by preventing the production of urban pollutants as close to the source as possible. Ideally, pollutant generation is stopped. At a minimum, limited amounts of pollutants are generated prior to entering the storm sewer system.

Source controls are generally nonstructural 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, pollution control may require a structure.

Policies that prevent the generation of pollutants, such as the removal of lead from gasoline and asbestos from brake linings, are ultimately the most effective. This type of control, however, cannot be readily initiated at the local level. National action is often required. Citizen activity that leads to this kind of control is an important component of a long-range urban management strategy.

Source 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 quality 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 (see public I&E strategy in Chapter 6). Several source control alternatives recognized in this plan are:

- 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 of automobile waste fluids, such as radiator water and engine oil, to keep them out of the storm sewer system;
- keep leaves, dirt and debris off paved surfaces and out of the storm sewer system;
- limit use of deicing compounds.

Rural Area Management

Sediment loadings to water bodies from cropland erosion and phosphorus loadings from barnyards under existing management conditions are displayed in Chapter 4. Loadings were estimated by the Wisconsin Nonpoint Source (WIN) and BARNY computer models. The models also determine the effects of different management measures on reducing phosphorus, soil erosion and sediment delivery to water resources.

The WIN model was operated to determine sediment loads that would result from adoption of conservation practices that reduce soil erosion on all farm fields to "tolerable" (T) levels. (Tolerable soil loss is an estimate of the maximum loss from a given field that can be tolerated, with long-term soil productivity still being maintained.) This is also a management goal put forth in the State Soil and Water Conservation Act of 1982 (Wisconsin Statutes Chapter 92), which indicates that T should be achieved on each cropland field in the state by the year 2000. Interim goals have also been established. To meet desired goals, Dane County has developed a Soil Erosion Control Plan. The plan assesses current soil erosion and conservation practice conditions and provides guidance for future management of erosion problems.

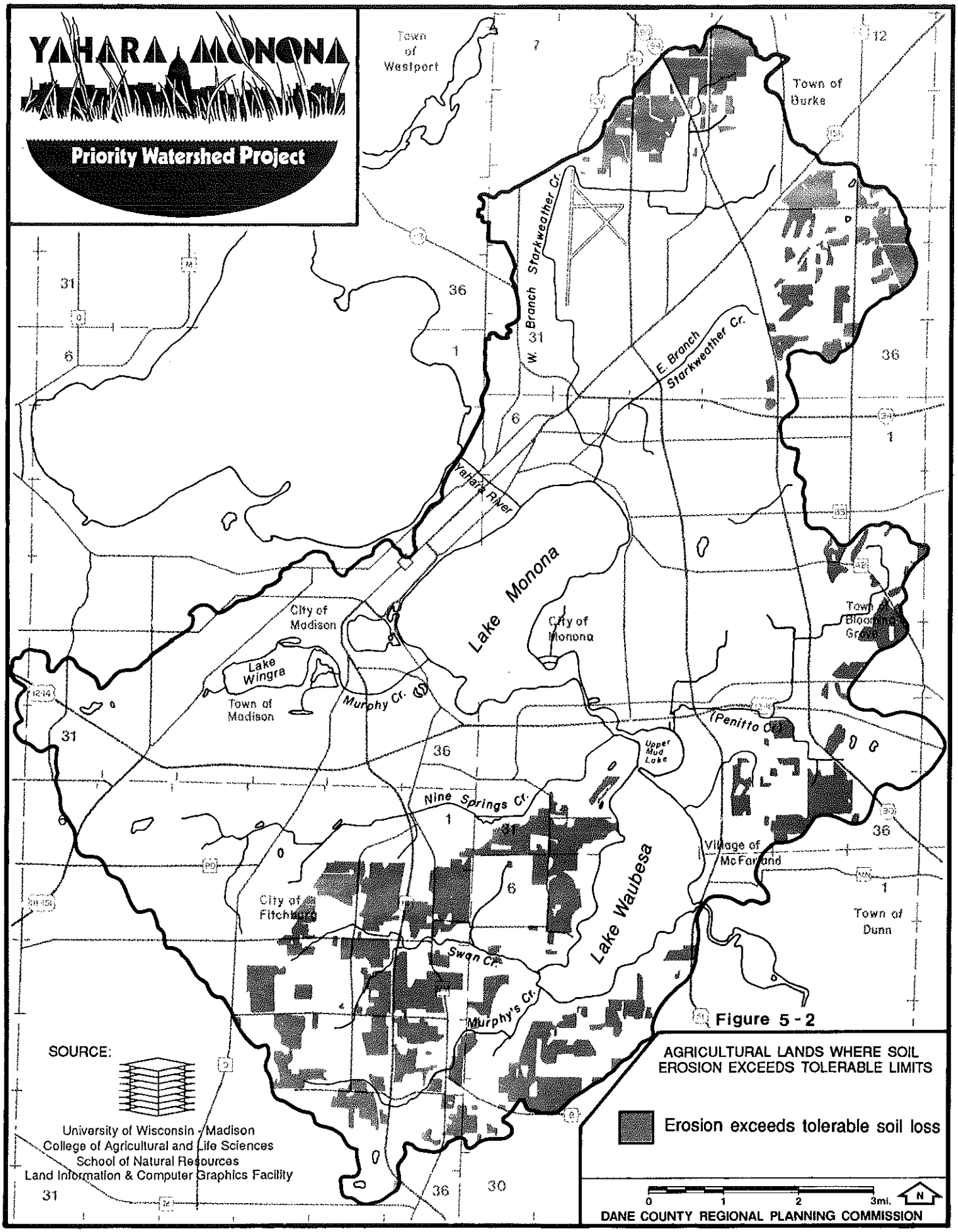
About two-thirds of the cropped land in the Yahara-Monona Watershed currently has soil erosion rates above tolerable levels (see Fig. 5-2). WIN model results indicate that current annual sediment loads to water bodies from agricultural fields would decrease 45 percent by reducing soil erosion on all fields to tolerable levels through implementation of management practices. This surpasses the 30 percent sediment reduction goal put forth in Chapter 4 for rural subwatersheds. This pollutant reduction goal also can be achieved by reducing soil erosion to T levels on all fields that currently exceed this standard <u>and</u> also have high sediment delivery rates (above at least 0.5 tons/acre/year). A 37 percent reduction in sediment loading is achieved with this management strategy. This strategy represents the most cost-effective approach in terms of protecting water quality. Thus while all fields exceeding T should be targeted for soil conservation practices to achieve county soil erosion control goals, financial assistance from the Priority Watershed Project for management measures should be directed primarily to those fields and farm operations that have both high soil erosion and sediment delivery rates. It's estimated that the installation of soil conservation practices to achieve sediment reduction goals in the watershed will have a total cost of approximately $200,000.

The BARNY computer model was used to determine pollutant (phosphorus) discharges associated with animal waste runoff from livestock operations. Model results indicate that 11 of 18 barnyards in the watershed can potentially discharge phosphorus at levels that can impair water quality (above five pounds from a ten-year, 24-hour storm). All of these barnyards should receive additional management measures to help reduce phosphorus and organic loadings to downgradient water bodies. The estimated cost to install these measures is approximately $135,000.

Total Sediment Loading From Urban, Rural and Developing Land Areas

Model results indicating suspended solids and sediment loadings from both urban and rural areas in the watershed were added to approximate a composite loading value from the watershed. For developing areas, an estimate of sediment loading from construction site erosion (see Chapter 4, page 52) was taken into account to arrive at a total loading value. Model results for future land use conditions with and without recommended management controls also were combined and totals are displayed in Table 5-9. Total loading figures show that future sediment discharges to water bodies can be reduced by 45 percent with the implementation of management practices, compared to future conditions without any additional management controls.

Since different computer models (SLAMM and WIN) were used to estimate loadings from urban and rural areas, results are not truly comparable and the implicit shortcomings of adding these numbers together should be recognized. In addition, the only pollutant parameter that can be compared from the models is suspended solids/sediment. Other pollutants of concern, such as heavy metals, that are primarily associated with urban land use are not displayed in Table 5-9. Thus tabular results should not be misinterpreted, which might downplay the significance of urban pollutant loadings.


YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
W. Branch Starkweather Cr.
E. Branch Starkweather Cr.
Yahara River
Lake Monona
City of Madison
City of Monona
Lake Wingra
Town of Madison
Murphy Cr.
Penitto Cr.
Upper Mud Lake
Nine Springs Cr.
Village of McFarland
Lake Waubesa
City of Fitchburg
Town of Dunn
Swan Cr.
Murphy's Cr.
Figure 5-2
AGRICULTURAL LANDS WHERE SOIL EROSION EXCEEDS TOLERABLE LIMITS
Erosion exceeds tolerable soil loss
SOURCE:
University of Wisconsin - Madison
College of Agricultural and Life Sciences
School of Natural Resources
Land Information & Computer Graphics Facility
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DANE COUNTY REGIONAL PLANNING COMMISSION

TABLE 5-9 ANNUAL SUSPENDED SOLID/SEDIMENT LOADING IN YAHARA-MONONA WATERSHED[1] FROM URBAN, RURAL AND DEVELOPING AREAS (IN TONS)					
	1990 Condition	Future Condition With No Additional Management Controls	% Change From 1990	Future Condition With Recommended Management Controls	% Change From 1990
1. Urban Area (SLAMM computer model results)	3,950	5,390	+36%	1,980	-50%
2. Construction Site Erosion (from estimate of annual acreage of land developed and erosion rate of 30 tons/acre)	4,890	4,890	--	2,445[2]	-50%
3. Rural Area (WIN computer model results)	8,750	6,605[3]	-24%	4,160	-52%
Total	**17,590**	**16,885**	**-4%**	**8,585**	**-49%**

[1]Sediment is the only pollutant that may be compiled from different land uses. Heavy metals and other pollutants associated primarily with urban land uses are not reflected and their importance should not be discounted.
[2]Assumes 50% additional control of soil erosion from construction sites than in 1990 through stringent enforcement of ordinances.
[3]Sediment reduction is from agricultural land being taken out of production. Increases in other pollutants as a result of conversion to urban land use are not displayed.

Wetland and Stream/Lakeshore Corridor Management

The protection and management of wetlands and stream/lakeshore corridors plays a particularly important role in the overall management strategy for the Yahara-Monona Watershed. Wetland and corridor protection (i.e., natural area preservation), and prevention of incompatible land uses, complement nonpoint source control practices and assure the continuity of natural drainage networks in areas subject to urbanization. These environmental corridors can also provide important public recreation, wildlife habitat, groundwater discharge and open space benefits, which help justify investments in water quality improvement and shoreline stabilization measures (see Table 5-10). Since urban environmental corridors provide multipurpose functions and have competing resource demands, they often need to be more highly managed than open space corridors in rural areas.

The maintenance and/or establishment of vegetative cover within environmental corridors create "buffer zones," which decrease overland runoff and reduce the delivery of sediment and associated pollutants to water bodies (see Fig. 5-3). In addition, drainageways in the watershed are afforded a measure of protection from accelerated channel erosion, which may be due to increased upland development or to negligent management practices. The protection of environmental corridors in urbanizing areas preserves stormwater management options that may be exercised during the land conversion process, and reserves sufficient land area to provide for the incorporation of natural stormwater management and drainage facilities at the time of development. The existence and official recognition of corridors can also provide a guide for dedication of lands during the platting process.

It is important to recognize that while wetlands provide several valuable resource functions, such as filtering sediment in runoff and storing flood waters, they also are a sensitive resource that can be overloaded and degraded by pollution. Thus wetlands need to be protected, similar to lakes and streams, from substantial pollution discharges. The inherent water quality functions of wetlands can be recognized and enhanced, however, as long as the integrity of the wetland system is not placed in jeopardy. This takes a careful management approach, which may require the pre-treatment of stormwater runoff via a detention basin before water is discharged to a wetland. Practical experience in wetland management and water level manipulation is not yet prevalent, and thus any management program should be thoroughly evaluated before it is instituted.

There are several federal, state and local regulations that currently exist to protect wetland, shoreland and floodplain areas contained within environmental corridors (see UW, 1990). Regulations range from U.S. Army Corps of Engineers Section 404 permits, which regulate the discharge of dredge and fill materials into water bodies, including wetlands of five acres or more; to local floodplain and shoreland-wetland zoning ordinances, which include a specific listing of permitted and prohibited uses in these areas.

Dane County, the cities of Madison, Monona and Fitchburg, and the Village of McFarland have all adopted floodplain and shoreland-wetland zoning ordinances. Both the cities of Madison and Fitchburg have adopted protection standards in their shoreland-wetland ordinances that are more stringent than mandated by the state.

Their ordinances are applicable to wetlands over two acres in size, compared to the five-acre minimum in the state model ordinance.

While these types of regulations help to protect sensitive resource areas from direct on-site impacts, they generally do not address the control of upland sources of pollution to these areas, nor do they serve to enhance the functional roles of the resource features. Past land use activities have degraded many wetlands and stream corridors in the Yahara-Monona Watershed, and pollutant loadings associated with projected urban development may pose further threats. Consequently, if additional management strategies beyond existing regulations are not pursued, the quality of wetland and shoreland resources will not be improved above present conditions and an opportunity to fulfill their potential beneficial functions will be lost. In fact, as a result of current management gaps, some existing wetland acreage and shoreline access will probably continue to be lost. Upgraded regulations (e.g., expansion of county shoreland-wetland zoning to include wetlands smaller than five acres) and aggressive acquisition programs (e.g., State Stewardship Fund and County Conservation Fund) should be implemented to ensure more complete protection of wetlands and stream/lakeshore corridors. The Dane County Parks and Open Space Plan and Greenspace Plan indicate priority areas for land acquisition.

The development of detailed management strategies is unique to each wetland or natural area and depends in part on how highly the resource rates in providing certain functions, as well as the number of functions in which it rates highly. Other factors that determine management approaches include site ownership and use, and budget and policy considerations.

Results of a functional classification of individual wetlands in the Yahara-Monona Watershed, conducted by the 1990 University of Wisconsin Water Resource Management Workshop, are displayed in Table 5-11; and general wetland locations are shown for illustrative purposes only in Figure 5-4. Eight wetland functions were field assessed. They include: wetland fauna, flora, corridor/contiguity with other open space, flood storage/sediment trapping potential, nutrient trapping, aesthetics/scenic beauty, shoreline anchoring/erosion dissipation, groundwater recharge and discharge, and special features (e.g., location in existing parks or conservancy areas that have special protection status). A four-level ranking system ("low," "medium," "high," and "exceptional") was applied for each function. It should be noted that the UW functional classification system does not represent a DNR-approved system under Chapter NR 103 (Wetland Water Quality Standards) and is not used for regulatory purposes.

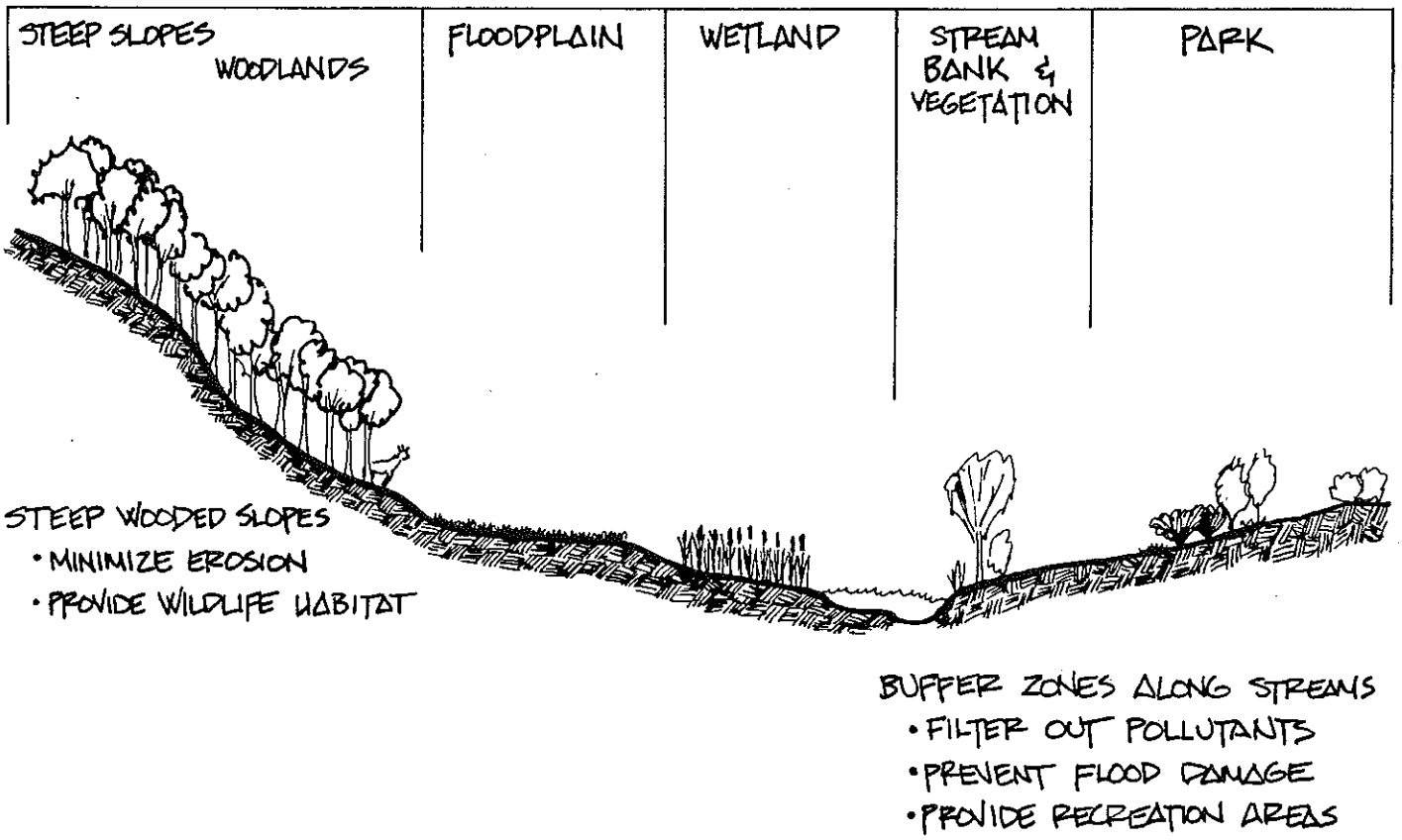
An evaluation of wetland and associated land management and protection strategies for the Yahara-Monona Watershed is also presented in the UW-Madison Water Resource Management report (UW, 1990). Four basic management tools--laws and regulations, acquisition, structural enhancement techniques and education--are described in detail. No general cost estimates for management activities are presented in the report, since management programs must be specifically tailored for each natural area and can be highly variable. The report is instrumental in providing the groundwork and resource assessment information for the wetland and environmental corridor management recommendations presented in Chapter 6.

OPEN SPACE FUNCTIONS OF ENVIRONMENTAL CORRIDOR RESOURCE FEATURES

FUNCTION	RESOURCE FEATURES: Lakes, Ponds & Streams	Wetlands	Floodplains	Shoreland Buffer Strips	Steep Slopes	Woodlands	Parks	Unique Vegetation or Geology	Problem Soils
Protect Water Resources, Drainage & Hydrologic Functions	▲	▲	▲	▲		△			△
Provide Pollution Control		▲	△	▲	▲	△	△		
Protect Public Health, Safety & Property	▲	△	▲		▲				▲
Provide Outdoor Recreation & Education Opportunities	▲	△	△	△		△	▲	△	
Provide Wildlife Habitat	▲	▲	△	△		▲	△	△	
Enhance Scenic Beauty & Shape Urban Form	▲	▲	△	▲	▲	▲	▲	▲	

▲ Primary Function △ Secondary or Supplemental Function

RESOURCE COMPONENTS OF ENVIRONMENTAL CORRIDORS



This schematic diagram depicts the resource elements one finds in a typical environ mental corridor. Often one or more elements are found in the same locality, such as woodlands and steep slopes.

TABLE 5-11
FUNCTIONAL CLASSIFICATIONS FOR THE WETLANDS EVALUATED WITH THE URBAN WETLAND EVALUATION CHECKLIST[1]

Code	Location	Wetland Name	Acres	Fauna	Flora	Corr./ Contig.	Flood/ Sed. Trap	Nutr. Trap	Scenic Beauty	Shoreln. Achorng.	GW Dis/ Recharge	Spec. Feature
1	T6R10S18	Waubesa Wetlands	592	Excpnl	Excpnl	Excpnl	Medium	High	Excpnl	Medium	High	Excpnl
2	T6R10S3C	Indian Mound Park Wetland	9	Medium	Low	Medium	Low	Medium	Medium	N/A	Low	Low
3	T6R10S5AB	N. Gammon Wetland	49	Medium	Medium	High	Medium	Medium	High	N/A	Medium	Medium
4	T6R10S5C	S. Gammon Wetland	8	Low	Low	Low	Low	Low	Low	N/A	Medium	Low
5	T6R10S6BD	Larsen Carr	98	High	Medium	High	High	Medium	Medium	N/A	Medium	Medium
6	T6R10S9	Radio Tower-East Waubesa	139	High	Medium	High	High	Medium	High	N/A	Low	Medium
7	T6R9S10AB	9 Springs Far West	119	High	Medium	Excpnl	High	Low	High	N/A	High	Excpnl
8	T6R9S10BD	9 Springs Southwest	171	Excpnl	Excpnl	Excpnl	Excpnl	Low	High	N/A	Excpnl	Excpnl
9	T6R9S11DB	Rodeo Pond	7	Low	Low	Low	Medium	High	Low	N/A	Medium	Low
10	T6R9S11DD	Q106 Country Wetland	88	Medium	Medium	High	High	Medium	Medium	N/A	Medium	Low
13	T6R9S13CD	Irish Marsh	15	Medium	Medium	Medium	High	Medium	High	N/A	Medium	Low
14	T6R9S14DB	Syene/CNW RR	27	Medium	Low	Low	Medium	Medium	Medium	N/A	Low	Low
15	T6R9S15CD	Hillside Heights Pond	0.4	Medium	Low	Medium	Medium	Medium	High	N/A	High	High
16	T6R9S1A	9 Springs Pump Station	113	Low	Low	Excpnl	Low	High	Medium	N/A	Low	High
17	T6R9S23D	S. Syene Wetland	69	Medium	Medium	Medium	Low	Medium	High	N/A	Medium	Low
18	T6R9S24A	Murphy Pond	60	High	High	High	High	Medium	High	N/A	High	Low
19	T6R9S24BB	S. U.S. 14 Pond	13	Low	Low	Low	High	Medium	Medium	N/A	Medium	Low
20	T6R9S25B	Cherokee Kennels Wetland	116	Medium	Medium	Medium	Medium	Medium	High	N/A	Medium	Low
21	T6R9S26AA	Byrne Riparian	10	Medium	Medium	Medium	Low	Low	Medium	N/A	Low	Low
22	T6R9S2BC	9 Springs N. Berm Marsh	63	High	High	Excpnl	High	Medium	High	N/A	Medium	Excpnl
23	T6R9S2D	9 Springs Central Wetland	520	Medium	Low	Excpnl	Excpnl	Medium	Medium	N/A	High	Excpnl
24	T6R9S5	Dunn's Marsh	71	High	High	Medium	High	High	High	Medium	Low	High
25	T7R10S10C	Acewood Park Retention Pond	23	High	Medium	Medium	High	Medium	High	Medium	Low	High
27	T7R10S13A	Buckeye/CNW East Wetland	10	Low	Low	Low	Medium	High	Medium	N/A	Medium	Low
30	T7R10S14D	Sprecher/CNW Wetland	70	Low	Low	Medium	Medium	Low	Medium	N/A	Medium	Low
31	T7R10S21C	Edna Taylor Park Wetland	46	High	Medium	Medium	High	Low	High	N/A	Low	High
32	T7R10S21D	TCI-Femrite Wetland	18	Medium	Low	Medium	High	Medium	High	Medium	Low	High
33	T7R10S22BA	Pflaum-UPS Wetland	3	Low	Low	Low	Low	Low	Low	N/A	Medium	Low
35	T7R10S22DA	Vondron/Femrite Fen	84	High	Excpnl	Medium	Low	Low	High	N/A	High	Medium
36	T7R10S22DC	Marsh/Broadway Wetland	69	Low	Low	Low	Medium	Low	Low	N/A	Low	Low
37	T7R10S23CC	Quality Inn/Broadway	6	Low	Medium	Low	Medium	Medium	Medium	N/A	Low	Low
39	T7R10S26A	Motel 6 Wetland	24	Medium	Medium	Low	Medium	High	Medium	N/A	Medium	Low
40	T7R10S26BD	I-90 Riparian	73	Medium	Medium	Medium	Low	Medium	Medium	Medium	Low	Low
41	T7R9S27BC	Wingra-Edgewood Wetland	8	High	High	Medium	Low	Low	High	Medium	Low	Medium
43	T7R10S28	Mud Lake Periphery Wetland	359	Excpnl	High	Excpnl	Low	Low	High	High	Low	Medium
44	T7R10S28A	51/Broadway Restored Marsh	26	Medium	Low	Low	Low	Medium	Medium	N/A	High	Medium
45	T7R10S28B	Monona Wetland	709	Medium	Medium	Excpnl	Medium	Low	High	N/A	Medium	Medium
46	T7R10S28BA	Goodyear Wetland	24	Low	Low	Low	Medium	Medium	Medium	N/A	Medium	Medium
47	T7R10S30C	Nob Hill Wetland	91	Medium	Medium	Medium	High	Low	High	N/A	Medium	Low
48	T7R10S32A	Lake Farm County Park Pond	20	Medium	Medium	High	High	Low	High	N/A	Medium	High
49	T7R10S32D	Waubesa Northwest Point	9	Medium	Medium	Medium	Low	Low	Medium	N/A	Low	Low
50	T7R9S36A	Coliseum-Rimrock Marsh	21	High	Low	Low	High	High	High	N/A	Low	Low
51	T7R10S4B	U.S. 51/U.S. 30 Wetland	128	Medium	Medium	Low	High	Medium	Medium	N/A	Medium	Low
52	T7R10S5DB	Lansing Park	13	Low	Low	Low	Medium	Low	Medium	N/A	Low	Medium
53	T7R10S9A	U.S. 51 N. of BB Wetland	6	Low	Low	Low	High	High	Low	N/A	Low	Low
54	T7R10S9D	U.S. 51 S. of BB Wetland	3	Low	Low	Low	Medium	Medium	Low	N/A	Low	Low
55	T7R9S20C	Paunack Park	26	Medium	Low	Low	Medium	Medium	Medium	N/A	Medium	Medium
57	T7R9S27AD	Arboretum - N. Gardner	117	High	Medium	Excpnl	High	Low	High	N/A	High	Excpnl
59	T7R9S27DC	Arboretum - S. Gardner	188	Medium	Low	High	Low	Low	Medium	N/A	Medium	High
60	T7R9S28DB	Arboretum - Monroe Wetland	64	High	High	High	High	High	High	N/A	High	High
61	T7R9S28DC	Arboretum - Wingra Marsh	141	High	Excpnl	Excpnl	High	Low	Excpnl	N/A	High	Excpnl
62	T7R9S34AC	Radio Tower - Fish Hatchery	82	Medium	Medium	High	Low	Low	Medium	N/A	Low	High
64	T8R10S19D	CV Near Mobile Home Park	137	Low	Low	High	Low	Low	High	N/A	Medium	Low
65	T8R10S33A	Starkweather Creek	113	Low	Low	Medium	Low	High	Low	N/A	Medium	Medium
67	T6R9S12D	Swan Creek Wetland	79	High	High	High	High	Low	Excpnl	N/A	High	Low
69	T8R10S16D	Hanson Nettle Wetland	147	Low	Low	High	Low	Medium	Low	N/A	Medium	Low
70	T8R10S21B	Hwy. 51 E. of Truax	272	Medium	Medium	Medium	Medium	Medium	Medium	N/A	Medium	Low
71	T8R10S20A	Messerschmidt Wetland	32	Medium	Medium	Medium	Low	Medium	Medium	N/A	Medium	Low
81	T7R9S31A	Odana Golf Course Wetland	73	Medium	Medium	Medium	High	Excpnl	Medium	Medium	Low	High

[1]University of Wisconsin-Madison Water Resource Management Workshop, 1990.

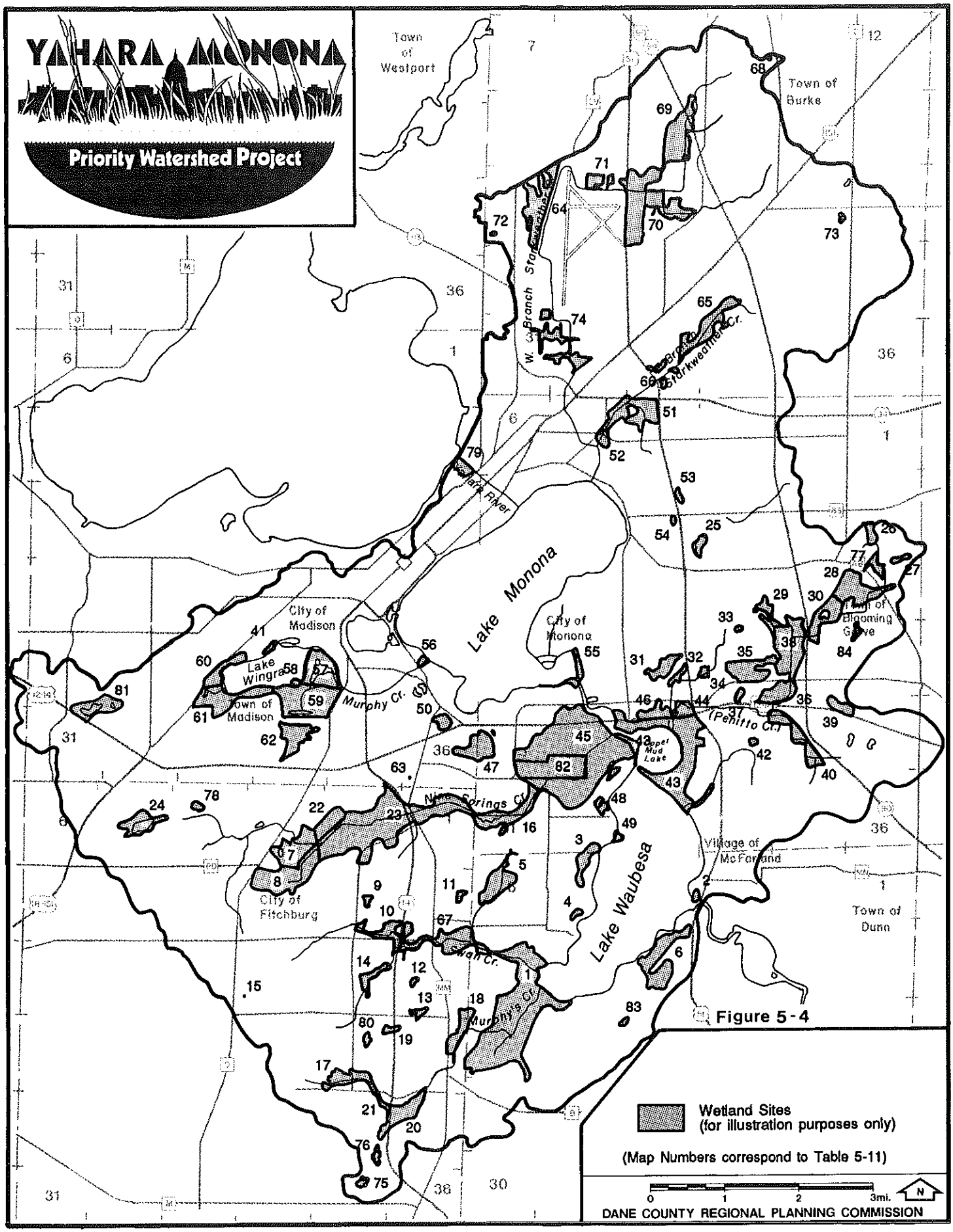

YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
Lake Monona
City of Madison
City of Monona
Lake Wingra
Town of Madison
Murphy Cr.
Pehrito Cr.
Upper Mud Lake
Nine Springs Cr.
Lake Waubesa
Village of McFarland
City of Fitchburg
Town of Dunn
Town of Blooming Grove
Swan Cr.
Murphy's Cr.
Starkweather Cr.
Wetland Sites
(for illustration purposes only)
(Map Numbers correspond to Table 5-11)
0 1 2 3mi.
N
DANE COUNTY REGIONAL PLANNING COMMISSION

Figure 5-4

Effects of Management Strategies on Phosphorus and Fertility Levels in the Yahara Lakes

Phosphorus is considered the critical or limiting nutrient responsible for aquatic plant growth in the Yahara River lakes. All of the lakes are considered eutrophic (i.e., nutrient rich, supporting many aquatic plants) largely because of elevated phosphorus concentrations. High phosphorus concentrations promote excessive weed and algae growth that reduces water clarity and causes nuisance conditions. Reducing available phosphorus in the lakes can decrease weed and algae populations if reductions are substantial enough.

Each of the Yahara Lakes has a steady-state total phosphorus concentration that exceeds 0.03 milligrams/liter (mg/l), and because concentrations surpass this threshold level the lakes are classified as eutrophic. If steady-state phosphorus concentrations are between 0.01 and 0.03 mg/l, lakes generally have a lower level of fertility and are classified as mesotrophic. Lakes with concentrations below 0.01 mg/l have a very low level of fertility and are categorized as oligotrophic. Deep, clear Canadian lakes are often used as an illustrative example of what constitutes an oligotrophic condition.

An evaluation of responses by the Yahara Lakes to phosphorus loading reductions that theoretically can be achieved under various management strategies was recently conducted (see Table 5-12). This evaluation was originally performed in the late 1970s during development of the Dane County Water Quality Plan (DCRPC, 1979). At that time, average total phosphorus concentrations in the lakes (Mendota and Monona) were significantly higher (by 0.03 to 0.05 mg/l) than average concentrations calculated for the period 1982-1989. The decreased phosphorus concentrations in the Yahara Lakes in recent years are an encouraging sign that water quality improvements can be achieved. However, because part of this reduction may be due to less than normal spring runoff during this period, the decrease may have been temporary (Lathrop, 1988). This concern has been validated to some extent by higher total phosphorus concentrations in the lakes in 1990, due in part to substantial spring runoff that contributed high phosphorus loadings.

The evaluation presented in Table 5-12 displays the lake phosphorus concentrations that result from 10, 30 and 50 percent reductions in phosphorus loadings from rural and urban runoff for each lake drainage area. In addition, in-stream phosphorus removal by a hypothetical treatment facility at the outlet of Lake Mendota is included for comparative purposes. Results from this strategy are interesting, although capital and annual operating costs for such a facility would prove expensive (probably at least $500,000 annually for chemical costs alone).

Table 5-12 displays the importance of the Yahara River as the major external phosphorus loading source to the Yahara Lakes. For example, in the case of Lake Monona, reductions in urban and rural runoff in the lake's direct drainage basin do not produce a significant decrease in lake phosphorus concentrations because the major loading source to the lake is the outlet water from Lake Mendota. Phosphorus changes in Lake Monona will likewise impact Lake Waubesa because of the connection between these lakes by the Yahara River.

Based on management evaluations presented earlier in this chapter, perhaps a 10 percent reduction in future phosphorus loadings (based on existing and planned development) to Lakes Monona and Waubesa is one of the most reasonable goals that can be established in the Yahara-Monona Watershed. Such a reduction could provide a minor, long-term improvement in lake phosphorus concentrations, which also could be augmented by phosphorus loading reductions in the Lake Mendota drainage basin achieved through nonpoint source pollution controls. Average total phosphorus concentrations in lakes Monona and Waubesa, however, would not be lowered to mesotrophic levels, where a significant long-term improvement in water clarity could be realized.

The fact that mesotrophic conditions are not likely to be achieved by any management program does not mean that predicted changes from reduced phosphorus loadings would not be beneficial to the lakes. A beneficial effect could include the extension of the seasonal (summer) period of phosphorus limitation, when algal growth is restricted because lake inorganic phosphorus levels are very low and are not sufficient to sustain algal production. Loading reductions also would prevent the further degradation of the lakes' existing water quality. In light of projected development in the Yahara-Monona Watershed, a water quality protection goal is a worthwhile and significant aspiration.

It is important to recognize that any reductions in lake phosphorus concentrations predicted by a model as a result of a management program will not occur instantaneously, but will be influenced by the degree of internal phosphorus recycling from lake bottom sediments. Extensive internal recycling will extend the time period for reductions to be observed.

TABLE 5-12
PREDICTED IN-LAKE PHOSPHORUS IMPROVEMENT FOR LAKES MENDOTA, MONONA AND WAUBESA DUE TO VARIOUS MANAGEMENT STRATEGIES[1]

PRESENT CONDITIONS

Lake	Total Phosphorus Actual Lake Concentrations (Avg. 1982-89) (mg/l)[2]	Entire Phosphorus Loading (lbs.)[3] (Includes All Phosphorus Sources)	Rural and Urban Phosphorus Runoff (lbs.)[3]	Upstream Lake Outlet Phosphorus Load (avg. 1982-89 Discharge & Lake Concentrations) (lbs.)
Mendota	.068	83,600	66,000	--
Monona	.060	28,600	9,900	16,100
Waubesa	.063	30,800	10,600	17,800

PREDICTED IN-LAKE RESPONSE - MG/L OF TOTAL PHOSPHORUS (% IMPROVEMENT)

Management Strategy	Mendota	Monona[4]	Waubesa[5]
1. 10% reduction rural & urban runoff - Mendota only	.066 (3%)	.059 (2%)	.062 (2%)
30% "	.055 (19%)	.054 (19%)	.059 (6%)
50% "	.043 (37%)	.043 (37%)	.055 (13%)
2. 10% reduction rural & urban runoff - Monona only or Waubesa only		.059 (2%)	.061 (3%)
30% "		.055 (8%)	.057 (10%)
50% "		.051 (15%)	.053 (16%)
3. 10% reduction rural & urban runoff - Mendota & Monona & Waubesa	.066 (3%)	.057 (5%)	.059 (6%)
30% "	.055 (19%)	.047 (22%)	.048 (24%)
50% "	.043 (37%)	.037 (38%)	.038 (40%)
4. 80% removal of inorganic P from Mendota outlet water by treatment facility		.044 (27%)	.053 (16%)
" + 10% reduction rural & urban runoff - Monona only, or Monona & Waubesa only		.042 (30%)	.050 (21%)
" + 30% "		.038 (37%)	.043 (32%)
" + 50% "		.034 (43%)	.036 (43%)

[1]Predictions based on Dillon (1975) input/output model.
[2]Lake concentrations from DNR Bureau of Research Monitoring (Dick Lathrop).
[3]Based on average annual phosphorus budgets determined in the late 1970s for Lakes Mendota and Monona in Appendix H of the Dane County Water Quality Plan.
[4]Monona response to Mendota loading reduction calculated by multiplying new steady state Mendota concentration times average Mendota outflow.
[5]Waubesa response to Monona calculated by multiplying new steady state Monona concentration times average Monona outflow.

Source: Dane County Regional Planning Commission.

CHAPTER 6

RECOMMENDED PROGRAM FOR IMPLEMENTATION

This chapter presents the recommended management program for the Yahara-Monona Priority Watershed Project and describes the means by which the project is to be administered. A description is provided of the agencies and governments involved in the implementation process, their responsibilities and the grants which are used to convey funds for carrying out the recommendations of this plan. Budgets for urban, rural, environmental corridor and public information activities are indicated to the extent that they can be currently defined. A detailed discussion of the public information and education strategy, which is an integral component of this project, is presented at the end of this chapter.

Framework for Implementation

It is important to recognize that the specific implementation plan for the Yahara-Monona Priority Watershed Project stems from a broader planning and policy context, which is presented in the Dane County Water Quality Plan (DCRPC, 1979). The Water Quality Plan is the official areawide water quality management plan for the county and provides the overall framework and guidance for federal, state and local water resource protection programs. The plan was initially adopted in 1979, and it is being continually updated, revised and expanded. Emphasis is placed in the Water Quality Plan on both pollution control and resource protection activities--recognizing that either approach alone will not be a sufficient environmental protection strategy. This two-prong approach is incorporated into the recommended implementation program for the Yahara-Monona Watershed Plan. Urban and rural pollution controls are addressed as well as natural area preservation and protection.

While the Yahara-Monona Plan is more specific, it is consistent with the overall objectives, policies and institutional structure put forth in the Dane County Water Quality Plan. The Water Quality Plan provides a description of local management agencies which are designated to carry out recommendations and programs. Management agency designations have been based on current program responsibilities, and on detailed analyses of the capability and legal and financial authority to implement recommended actions. The Water Quality Plan includes an extensive listing of priority actions for designated management agencies. Some highlights of this listing that are pertinent to the Yahara-Monona Watershed are presented below.

1) Communities should prepare stormwater management plans that incorporate water quality protection measures;

2) Communities should increase their street sweeping programs to provide frequent (e.g., weekly) sweeping of streets in commercial and industrial areas and regular (e.g., biweekly) sweeping of residential streets throughout the sweeping season, with extra efforts at cleaning all streets in early spring and late fall;

3) Communities should increase their enforcement of erosion/runoff control ordinances and revise building ordinances to require roof drainage to grassed areas, where feasible, for new development;

4) Communities should evaluate reducing use of road salt;

5) Dane County should complete soil erosion control plans for all high-erosion agricultural lands to meet federal and state (Chapter 92) and local (Dane County Soil Erosion Control Plan) requirements. Priority should be placed on directing technical and cost-sharing assistance to locations and practices where water quality benefits are greatest;

6) Dane County should develop a system of improved and more precise operating rules for lake level management and flow control for the Yahara lakes.

The Water Quality Plan also underscores the value of protecting lands that are part of multipurpose open space or environmental corridors. Open space corridors provide a foundation and framework for resource protection, including stream and shoreland protection and management. The delineation of a continuous areawide corridor system is based on the recognition of the interrelatedness of adjacent landscape types and the importance of protecting valuable ecological units and linkages. The corridor system, therefore, is often associated with water features and emphasizes the importance of the land/water edge.

The corridor network, illustrated in Figure 6-3 for the Yahara-Monona Watershed, has evolved from a general planning concept to a specific and detailed tool used for guiding land use and management decisions. Corridors have been mapped by the RPC and incorporated into local land use and comprehensive plans by most communities in the county. Environmental corridor delineations provide the basis for decisions on acquisition, regulation and protection of open space in urbanizing areas. The primary protection mechanisms for environmental corridor lands and resources at the local level include land use regulations (such as floodplain, wetland, shoreland and conservancy zoning, subdivision regulations and official mapping), and acquisition (through purchase or dedication).

Corridor lands are intended to remain generally open and undeveloped and are not intended to receive public sanitary sewer service. Protection of open space corridors from disturbance and development is important because these lands are critical to a variety of community concerns and environmentally important functions, such as: protection of water resources, drainage and hydrologic functions; pollution control; protection of public health, safety and property; provision of outdoor recreation and educational opportunities; protection of wildlife habitat; and enhancement of scenic beauty and shaping of urban form. Communities in the Yahara-Monona Watershed need to be continually aware of the value of these functions and the overall corridor system.

General Institutional Arrangement for Project Implementation

There are numerous local and state management agency functions that exist in implementing a priority watershed project. Examples of these functions are presented below and are grouped into three general categories.

Project Implementation Functions		
Overall Project Management	**Project Information/ Education Activities**	**Practice Design, Construction, Operation and Maintenance**
Initiation, coordination and sustainment of agency roles	Carry out activities	Project and management practice detailed design/specifications
Project bookkeeping and fiscal management (coordinate grant agreements with management agencies)	Prepare annual work plan and budgets	Administer cost-sharing contracts with private parties/landowners
Technical and administrative assistance/support	Document accomplishments	Construction supervision and quality control
Ensure proper operation and maintenance review of practices		Management Practice O & M and annual programming/budgeting
Help prepare and review annual work plans		Monitoring/reporting progress and projects completion
Establish annual watershed project review meetings		
Track and monitor management practice installation, pollutant load reductions, and water quality changes		

Various management agency options also exist to perform the above functions, and flexibility is granted in state Administrative Code NR 120 to determine appropriate governmental roles for project implementation in accordance with legal capabilities. Thus, during the planning process, the Yahara-Monona Steering Committee evaluated the most desirable management agency framework for carrying out project activities. The committee determined that there should be a designated governmental agency and staff person (half-time position) to assume overall project management responsibilities. The committee recommended that the preferred governmental unit to assume this role in the Yahara-Monona Watershed is Dane County. The committee also recommended that the County serve as the lead party for overall public information and education activities and that the present project information officer position be continued for the implementation period.

These responsibilities are consistent with the intergovernmental liaison and public information/education duties granted to the County through recent state enabling legislation (Wisconsin Act 324--creation of Dane County Lakes and Watershed Commission). The commission is to have flexibility to contract out and work with other parties/agencies to perform necessary tasks, as deemed appropriate. It is intended that a close working relationship between the Commission and local municipalities be established. Intergovernmental agreements can be formulated.

This implementation approach is different, however, than what has been conventionally pursued in other urban priority watershed projects, where the DNR has assumed project management functions. Thus, Dane County will need to work closely with the DNR and adhere to state program policies and requirements in order to make this approach workable. To ensure that state program objectives and requirements are being satisfied, the DNR and DATCP will have ultimate responsibility for overall project review and approvals.

Other local units of government in the watershed are to be actively involved in decision-making processes during the implementation period through continued representation on the Yahara-Monona Steering Committee. It is intended that the committee will continue to meet to provide a project overview and advisory role. Changes in membership to the Steering Committee can be made at annual Watershed Association meetings when elections of authorized agency and interest group officers will be held.

Urban units of government will be responsible for following through on pertinent management practice design, construction, operation and maintenance functions for state cost-shared activities. *It will be crucial for each municipality to make a significant commitment to the Yahara-Monona project (i.e., follow through on all applicable management recommendations in this plan) in order to accomplish watershed protection and improvement goals.* Specific participant roles in the watershed project are presented beginning on page 112.

For rural practices, Dane County through the Land Conservation Department will assume project implementation responsibilities. A summarization of recommended management agencies and associated project implementation functions is displayed below.

TABLE 6-1
MANAGEMENT AGENCIES AND IMPLEMENTATION FUNCTIONS

Project Implementation Functions	Management Agency Performing Function						
	Dane County			RPC[3]	DNR & DATCP	Local Municipality	Yahara-Monona Steering Committee
	LCD[1]	Extension	L&WC[2]				
Project Management			X	†	O		
Public Information & Education		†	X	†	O		†
Design, Construction, Operation & Maintenance	X (Rural)				O	X (Urban)	
Project Overview							X

X = Principal Role
† = Liaison and Assistance Role
O = Review and Approval Role

[1]Land Conservation Department.
[2]Lakes and Watershed Commission.
[3]Dane County Regional Planning Commission.

Recommended Urban Management Program

This section of the recommended management program addresses urban management activities. Recommended actions are categorized into "basic" community-wide program elements that should be immediately pursued by local municipalities and "site-specific" proposals that can be pursued over the long-term implementation period of the project. "Site-specific" activities are presented by major subwatershed, with the roles of appropriate municipalities indicated. *All management recommendations are important and feasible to implement to achieve water quality goals.*

The "Basic" Community-Wide Management Program

There are certain "basic" elements of the urban management program that can be readily adopted by local units of government without further technical studies or substantial funding. Adopting a community-wide program is the first step in the implementation process. As such, communities will be required to commit within the first three years of the project to implement the "basic" program. This is a condition that needs to be met in order to receive technical and financial assistance through the priority watershed project.

Elements of the "basic" program include:

1) Confirm in writing an authorized representative to continue to serve on the Yahara-Monona Steering Committee during the project implementation period.

2) Promote on-site management measures as part of new developments that have stormwater quality benefits. For example, communities can incorporate a provision, or revise existing building ordinances, to require roof drainage to grassed areas, where feasible, for new construction.

3) Indicate an intention to pursue development of community-wide stormwater management plans that incorporate water quality protection.

4) Develop and implement a community-specific program of urban "housekeeping" practices that reduce nonpoint source pollution. The program can include a variety of activities and emphasize information and education efforts. Information and education activities can be developed by working with the project public information officer. Other measures that should be considered include changes in the timing and scheduling of basic street sweeping and leaf collection and adoption of pet waste ordinances.

5) Be involved with the DNR, Dane County and the RPC in considering participation in the federal stormwater permit program. (The City of Madison already is required to take part in the program.)

"Site-Specific" Urban Management Proposals

"Site-specific" elements of the urban management program are those generally requiring detailed investigations prior to implementation (e.g., construction of wet detention basins following completion of an engineering feasibility study). Communities are eligible to receive cost-sharing for these elements provided their community-wide program is being developed and implemented. Cost-sharing will be limited to site-specific proposals initiated within the eight-year implementation period of the project.

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 that can be implemented under this part of the program include detention basins, infiltration practices, changes in street sweeping schedules and equipment, streambank erosion controls and other structural measures for reducing urban nonpoint source pollution.

Eligible components of "site-specific" proposals include:

1) Conducting detailed engineering studies to determine the best means to implement community-specific nonpoint source control measures for existing urban areas.

2) Designing and installing structural urban best management practices for existing urban areas.

3) Developing management studies for planned future urban development. These studies will identify the types and locations of structural urban best management practices.

4) Adopting and enforcing a comprehensive stormwater management ordinance encompassing current and planned future development.

Recommended site-specific proposals for local communities are presented by major subwatershed on the following pages.

Starkweather Creek Subwatershed

1) **The City of Madison and Dane County should place high priority on stringent enforcement of construction site erosion and stormwater runoff control ordinances in projected development areas. The city and county should consider hiring additional enforcement staff, with financial assistance provided by the priority watershed project (see Chapter NR 120.21(4) regarding eligible costs).**

   Most of the vacant developable land in the Yahara-Monona Watershed is found in the Starkweather Creek subwatershed (over 2,000 acres), and there are land use plans for substantial commercial development. Strict enforcement of ordinances is the most efficient and cost-effective way to reduce future sediment loadings and peak flows to Starkweather Creek and Lake Monona.

2) **The City of Madison and Town of Burke should pursue stormwater quality management plans and structural practices, particularly those promoting infiltration, in planned development areas (e.g., in urban sub-basins St01-St02, St05-St10 and St20). The city should work with the DNR and consider initiating an infiltration (e.g., porous pavement) demonstration project in this subwatershed with financial assistance from the priority watershed project. One possible site location is near Reindahl Park.**

   The baseflow and wetlands of Starkweather Creek have been adversely impacted by extensive development that has reduced groundwater recharge and has increased stormwater runoff. To protect the existing baseflow in the stream, infiltration practices should be pursued in the headwaters area of this subwatershed. Particularly important groundwater recharge areas (e.g., in sub-basins St01 and St20) should be identified and protected.

3) **The City of Madison should pursue stormwater quality management plans and structural practices in critical land areas (see Table 5-2) in this subwatershed. Figure 6-1 displays possible areas for management studies and practices. Several of these areas would address runoff from both existing and planned urban development. Financial assistance is available from the priority watershed project for eligible practices identified in Chapter NR 120.14(22) (also see Table 6-5 of this plan).**

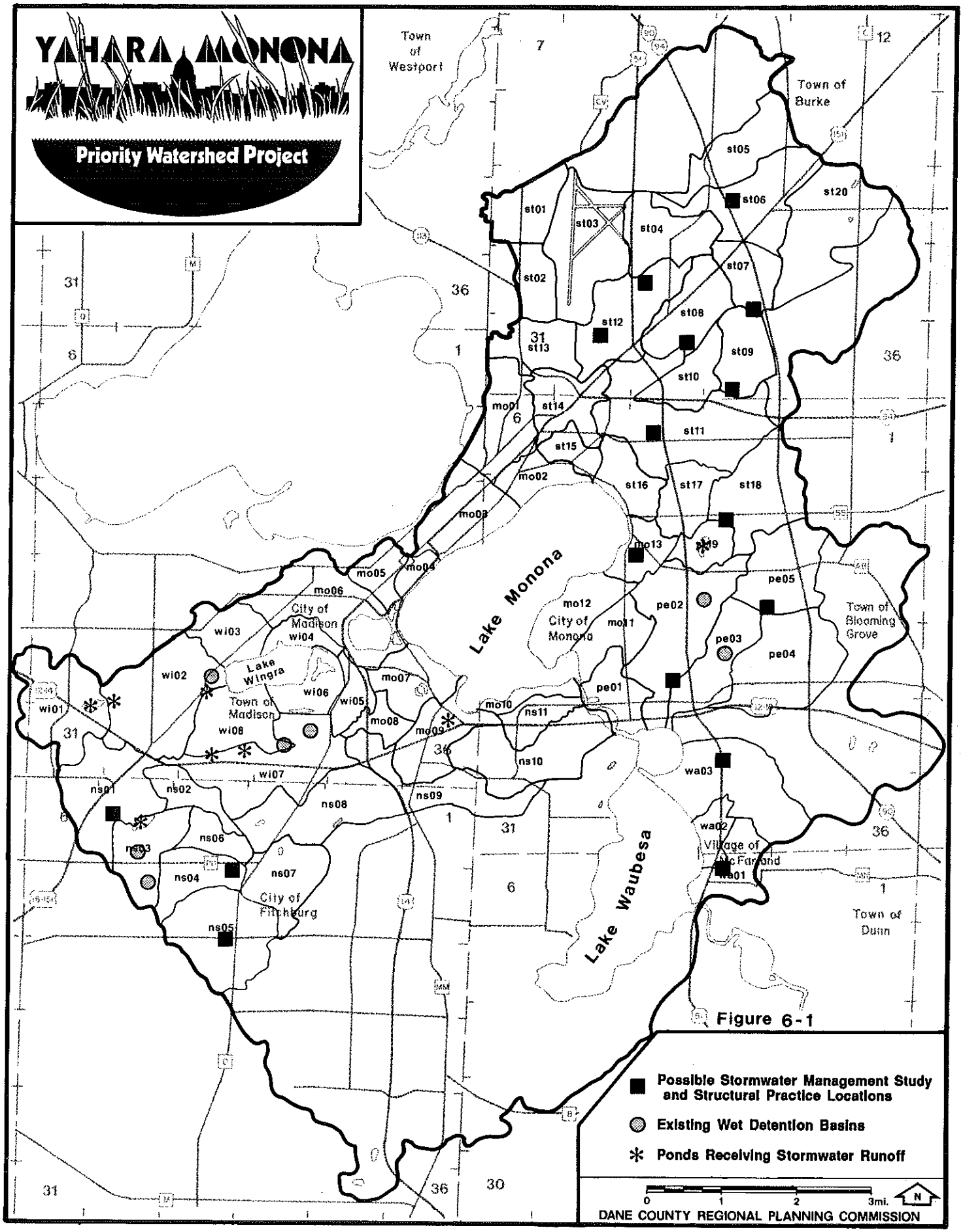
   The Starkweather Creek subwatershed contributes the highest total pollutant loading from existing urban areas of any subwatershed. Numerous sub-basins have high pollutant loading rates that need to be controlled in order to achieve water quality improvement objectives for the creek and Lake Monona.

4) **The City of Madison should pursue non-structural management measures (e.g., improved catch basin maintenance and street sweeping) in critical areas (e.g., in urban sub-basins St11 and St14-St17) where there may be limited opportunities for large structural practices.**

   There are some sub-basins that are highly developed and have high pollutant loading rates, but there is limited land space for the siting of structural management practices. For these areas, the feasibility of other water quality practices should be explored.

5) **Dane County should implement permanent stormwater management practices for controlling deicer runoff from the Dane County Regional Airport as identified in the engineering plan currently being developed. Practices at this site are not eligible for financial assistance from the priority watershed project.**

   Water quality monitoring revealed organic pollution to the West Branch of Starkweather Creek from deicer use at the airport. A temporary management measure has been installed to control runoff and an engineering study has been undertaken to develop a long-term solution.


YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
Lake Monona
Lake Waubesa
Lake Wingra
City of Madison
City of Monona
Town of Madison
City of Fitchburg
Village of McFarland
Town of Blooming Grove
Town of Dunn
st01
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Possible Stormwater Management Study and Structural Practice Locations
Existing Wet Detention Basins
Ponds Receiving Stormwater Runoff
0 1 2 3mi.
N
DANE COUNTY REGIONAL PLANNING COMMISSION

Figure 6-1

Lake Monona Subwatershed

1) **The Cities of Madison and Monona should pursue stormwater quality management plans and structural practices for critical land areas (see Table 5-2). Financial assistance can be provided by the priority watershed project for eligible practices identified in Chapter NR 120.14(22) (also see Table 6-5 of this plan).**

   Due to extensive urban development, the Lake Monona subwatershed has the highest average pollutant loading rate of any subwatershed. Because of high development densities, the availability of land space for structural management practices can be limited. Every opportunity should be taken to install structural practices that reduce pollutants being directly discharged to Lake Monona.

2) **The Cities of Madison and Monona and Town of Madison should undertake non-structural management measures (e.g., improved catch basin maintenance and street sweeping) in critical areas (e.g., downtown isthmus area in Madison) where there may be limited opportunities for large structural practices.**

   Where structural management practices can not be sited, alternative water quality practices should be explored in order to reduce high pollutant loads.

3) **The City of Madison and DNR should further investigate the possible sources of organic and heavy metal pollution to Monona Bay, and additional sediment monitoring of "toxics" should be conducted in Lake Monona. The need and feasibility of dredging contaminated sediment should be evaluated, with a subsequent objective to remedy pollution problems. (Dredging is not eligible for cost-share assistance through the priority watershed project.)**

   Sediment monitoring in Monona Bay revealed high PCB and metal concentrations, with a possible source being a large storm sewer outfall located 200 feet from the site. More detailed pollution source identification and sediment monitoring is needed, as well as an evaluation of the environmental and recreational benefits and costs of removing contaminated sediment from the bay and other priority areas of the lake.

4) **The City of Monona should place high priority on stringent enforcement of its construction site erosion and runoff control ordinance for redevelopment projects. The city should consider hiring additional enforcement staff, with possible financial assistance provided by the priority watershed project (see Chapter NR 120.21(4) regarding eligible costs).**

   Plans for significant construction work as part of redevelopment projects are expected to occur over the next few years in the city. Because of the close proximity of these projects to Lake Monona, strict enforcement of the city's ordinance is needed to prevent water quality degradation.

Lake Wingra Subwatershed

1) **The City of Madison and Town of Madison should pursue stormwater quality management plans and structural practices for critical land areas (see Table 5-2) in this subwatershed (e.g., in urban sub-basin Wi05), with financial assistance provided by the priority watershed project for eligible practices.**

   Areas with relatively high pollutant loading rates, for example, areas of significant commercial development, should be controlled to protect water quality.

2) **The City of Madison, Town of Madison, University of Wisconsin and Dane County should continue to emphasize judicious use of road deicers. Priority attention should be given to the South Beltline Highway and Fish Hatchery Road. Alternatives to road salt and sand use should continue to be evaluated.**

   Salt (chloride) concentrations in Lake Wingra and the groundwater system have increased significantly since road salting began in the watershed. Concentrations are highest in the southern and eastern edges of the lake that receive runoff from the South Beltline area. Wetland vegetation also can be adversely impacted by deicers. Heavy sand use can cause sedimentation and associated

fish habitat destruction. Limiting salt and sand use and exploring alternative methods can help prevent further water quality and habitat degradation.

Nine Springs Creek Subwatershed

1) **The City of Fitchburg should place high priority on stringent enforcement of its construction site erosion and runoff control ordinance in projected development areas. The city should consider hiring additional enforcement staff, with financial assistance provided by the priority watershed project (see Chapter NR 120.21(4) regarding eligible costs).**

   About 1,500 acres of vacant developable land in the Yahara-Monona Watershed exist in the City of Fitchburg, and there are land use plans for extensive residential development. Strict enforcement of the city's ordinance is the most efficient and cost-effective way to limit future sediment loads and reduce peak flows to Nine Springs Creek and Lake Waubesa.

2) **The City of Fitchburg should pursue stormwater quality management plans and structural practices for planned urban areas.**

   Additional urban development in this subwatershed will increase nonpoint source pollution to Nine Springs Creek. Management practices are needed to protect the stream's existing water quality.

3) **The Cities of Fitchburg and Madison should pursue stormwater quality management plans and structural practices for critical existing urban areas (see Table 5-2). Figure 6-1 displays possible areas for management studies and practices. High priority should be placed on preparing a detailed stormwater management plan for the area around Dunn's Marsh. Financial assistance can be provided by the priority watershed project for eligible practices.**

   In order to prevent further water quality degradation to Dunn's Marsh and Nine Springs Creek, the siting of effective management measures should be evaluated through comprehensive feasibility studies.

Upper Mud Lake (Penitto Creek) Subwatershed

1) **The City of Madison and Dane County should place high priority on stringent enforcement of construction site erosion and runoff control ordinances in projected development areas.**

   About 900 acres of vacant developable land exist in the Upper Mud Lake subwatershed, and there are land use plans for light industrial development. Strict enforcement of ordinances is needed to prevent future sediment loadings and reduce peak flows (which can cause bank erosion) to Penitto Creek and Upper Mud Lake.

2) **The City of Madison should pursue stormwater quality management plans and structural practices for planned urban areas.**

   Additional urban development will increase pollutant loads to Penitto Creek and Upper Mud Lake unless management practices are implemented. Some sub-basins, such as Pe03, are expected to have high pollutant loading rates under planned development conditions.

3) **The Cities of Madison and Monona should pursue stormwater quality management plans and structural practices for critical existing urban areas (e.g., in urban sub-basin Pe01). Figure 6-1 displays possible areas for management studies and practices. Financial assistance can be provided by the priority watershed project for eligible practices.**

   Structural management practices are needed to reduce pollutant loads from existing urban areas, such as the extensive commercial developments in sub-basin Pe01.

Lake Waubesa Subwatershed

1) **The Village of McFarland should pursue stormwater quality management plans and structural practices for critical existing urban areas (see Table 5-2). Priority for a stormwater management study should be placed on controlling runoff from urban sub-basin Wa01 (see Fig. 6-1). The village should pursue upgraded street sweeping for critical land uses where there are limited opportunities for structural practices. Financial assistance for eligible activities identified in Chapter NR 120.14(22) can be provided by the priority watershed project.**

   Although the Lake Waubesa subwatershed does not have a high overall pollutant loading rate, it does drain directly to Lake Waubesa and contains areas where there is significant commercial development that contributes relatively high loadings. Runoff should be controlled from such development in order to reduce the direct discharge of pollutants to Lake Waubesa.

Entire Yahara-Monona Watershed

1) **The cities of Madison, Monona and Fitchburg, the Village of McFarland and Dane County should modify their current construction site erosion and stormwater runoff control ordinances, where needed, to include water quality protection provisions.**

   Local regulatory provisions are needed to strengthen existing ordinances to ensure that stormwater quality concerns are adequately addressed for new development. Guidance and standards will likely be forthcoming from both the state and Dane County.

2) **A regional hydrologic study should be undertaken to evaluate the effects of groundwater withdrawals from urban development and water diversion on ground and surface water resources, as well as to evaluate management strategies to offset negative impacts. As part of new development, all communities should implement measures that promote water infiltration and groundwater recharge, where feasible.**

   Urban development can limit groundwater recharge and increase groundwater withdrawals via well pumping. This can reduce groundwater contributions to streams, lakes and wetlands. Management studies and practices should be immediately pursued that address these water quantity and related quality issues.

3) **All communities and Dane County should limit use of road deicers to the extent possible and evaluate alternative practices.**

   Use of road deicers has increased sedimentation and salt (chloride) concentrations in groundwater and in Lakes Monona, Waubesa and Wingra. Limiting deicer use can help prevent additional water quality impacts.

4) **Communities should increase surveillance of non-stormwater discharges to their storm sewer systems, and work with businesses and industries along waterbodies to seek correction of sources of contaminated runoff. Sufficient staff resources should be made available to accomplish this activity, and neighborhood involvement in surveillance activities should be encouraged.**

   In some areas of the watershed, such as the Starkweather Creek and Upper Mud Lake subwatersheds, runoff from business sites may be directly discharging to water resources. Efforts to control this runoff and prevent unregulated discharges to storm sewer systems should take place.

Urban Management Budget

Costs for the urban management program include several elements, such as engineering feasibility/siting studies, construction costs for structural practices, land costs, and operation and maintenance costs. These elements are discussed below, along with general funding estimates if available at this time. Future engineering studies will indicate the costs of specific practices and thus provide the basis for a more detailed urban management budget.

Engineering Feasibility/Siting Studies

Engineering feasibility studies may be needed for several thousand acres of "critical" existing urban development (see Table 5-1) in order to choose and site management practices. These studies may be carried out by the private sector and will determine detailed practice needs and costs. State funding through the Nonpoint Program can support the costs of the studies. No estimate, however, of the total cost for feasibility studies has been made at this time.

Studies to choose and site stormwater quality management practices in areas of new development will be needed for about 5,000 acres of "critical" urban land uses. These studies can be performed by the private sector, with much of the costs eligible for state financial assistance.

Detailed Engineering Designs

Once management practices are sited, detailed designs must be prepared. These designs may be developed by the private sector or by local government staff. The cost of site designs for structural practices in existing and planned urban areas is included in cost estimates presented in Tables 5-5 and 5-7. Design work for best management practices in existing urban areas is supported 100 percent by the Nonpoint Program and included under the state's costs.

Cost of Installing Structural Practices in Existing Urban Areas

There are several factors that can affect the cost of constructing practices to control existing urban runoff. Key factors include: labor rates, land costs, excavation costs, and costs of rerouting storm sewers. The relative importance of these costs will vary significantly on a case-by-case basis. For example, land costs will vary by community and include acquisition costs for land procured from the private sector, as well as the opportunity cost of using land currently held in the public domain.

Table 5-5 presents costs for implementing wet detention basins in existing urban areas. This table assumes the cost of designing and constructing the practice, as well as land acquisition and storm sewer rerouting costs.

Under these assumptions, the cost of implementing wet detention basins to control runoff from all of the critical land areas in the watershed is about $29 million. This probably is not a realistic management budget for the next eight to ten years, however, due to land space constraints for such extensive siting of structural practices and limited redevelopment opportunities. The cost to control runoff from half of the critical land areas with structural management practices, which is at least initially a more reasonable management strategy, is about $14.5 million. The state share would be 70 percent of the management practice construction cost and 50 percent of land acquisition and storm sewer rerouting costs.

Cost of Installing Structural Practices in Planned Urban Areas

Table 5-7 presents estimates of the costs for wet detention basins in planned urban areas. A total of about $5 million may be needed to install wet basins. The factors that make retrofitting stormwater management practices so expensive should not be a substantial concern in developing areas, since good planning can assure that land is set aside for such practices. The entire cost for these practices, however, must be borne locally, since Nonpoint Source Program funds can not be used to implement practices in areas of new development. These control measures can be designed into newly platted areas, with costs borne by the developer and consumers.

Operation and Maintenance for Structural Practices

Operation and maintenance costs for detention basins are about 5 percent of the capital construction cost per year. These cost estimates are reflected in Tables 5-5 and 5-7. O&M costs must be borne locally.

Cost of Street Sweeping in Existing Urban Areas

Table 5-6 presents the estimated cost of sweeping all critical urban land uses. The costs presented in the table assume a total cost of $25 per curb mile per municipality. The total annual cost of improving local street sweeping programs to just above the "base" level recognized in this plan is $840,000. In general, the "base" level program consists of a once/week sweeping frequency for commercial and industrial developments and a twice/month frequency for residential areas from March through November. The cost of street sweeping to this

level is not eligible for state financial assistance. Cost-share funding is available to communities for conversion from broom to vacuum-type sweepers.

Cost of Administering a Construction and Stormwater Control Ordinance

Administration and enforcement of ordinances can be a substantial cost for some communities. For the first five years, a local government's cost of providing additional staff to adequately enforce ordinances and which cannot be initially covered under a fee structure, can be supported 100 percent by the Nonpoint Program. After five years, the total cost of continuing to administer the ordinance should be borne locally through fee-supported programs.

Recommended Rural Management Program

This section of the recommended management program addresses rural management activities. These activities are classified into cropland, animal waste, rural streambank, nutrient and pesticide, and other pollution management programs. The types of best management practices needed to control pollutants on critical rural lands are indicated, as well as the cost of practice installation, including cost-sharing, technical assistance and administration. A listing and description of rural best management practices eligible for cost-sharing is presented on page 118 and in Appendix E.

The general management approach for addressing nonpoint source pollution from croplands, animal lots, streambank erosion, and fertilizer and pesticide use is initially presented for the entire Yahara-Monona Watershed. This is followed by a listing of recommended management proposals by major subwatersheds.

General Management Strategy for All Rural Lands in the Watershed

Cropland Management

To control sediment pollution from croplands, priority will be placed on fields that are considered critical because they exceed a targeted sediment delivery rate (as determined by the WIN computer model) that is essential to attain in order to achieve water quality objectives and pollution reduction goals. Existing sediment loads from cropped land generally should be reduced by at least 30 percent in the watershed to protect water quality and habitat conditions. Figure 6-2 displays agricultural lands that have relatively high sediment losses.

> Highest priority will be placed on fields with high soil erosion and sediment delivery rates that have existing conservation plans. These plans seek to reduce soil erosion to tolerable levels for maintaining soil productivity. The WIN model indicates that approximately 5,000 acres of agricultural land exceed targeted sediment delivery and soil erosion rates. These fields are eligible for management practices that can be cost-shared through the priority watershed project. All existing conservation plans will be followed up by Land Conservation Department staff. Currently, 140 of 245 tracts[1] of land in the watershed have conservation plans. Plans will be reviewed and revised as necessary to meet soil conservation and/or water quality goals.
>
> Next highest priority will be placed on fields that have high sediment delivery rates but are below tolerable soil erosion levels or do not have soil conservation plans because they are not affected by federal or state conservation-compliance requirements.
>
> Priority will also be given in specific situations to fields that may be causing pollution loading and water quality problems due to their location or large size even though their sediment delivery rates may not be particularly high. In this situation, financial assistance for management practices may not be available through the priority watershed project, and other agricultural soil and water conservation programs may need to be relied upon.

Animal Waste Management

An animal lot inventory to determine management needs was completed on all major livestock operations in the watershed using the Barnyard Runoff (BARNY) computer model. Model results indicate that 11 of 18 operations potentially discharge pollutants (e.g., phosphorus in manure) above a target level (i.e., five pounds of phosphorus for a ten-year, 24-hour storm), which is associated with degrading water quality. Seven operations contribute approximately 80 percent of the total phosphorus load. The amount of animal waste runoff needs to be reduced on these sites to no more than the target management level (five pounds of phosphorus for a ten-year storm). Cost-share assistance from the priority watershed project for animal waste management practices is available only to those operations exceeding the target pollution level. Manure spreading management plans will also be developed for these operations to limit animal waste from entering water bodies.

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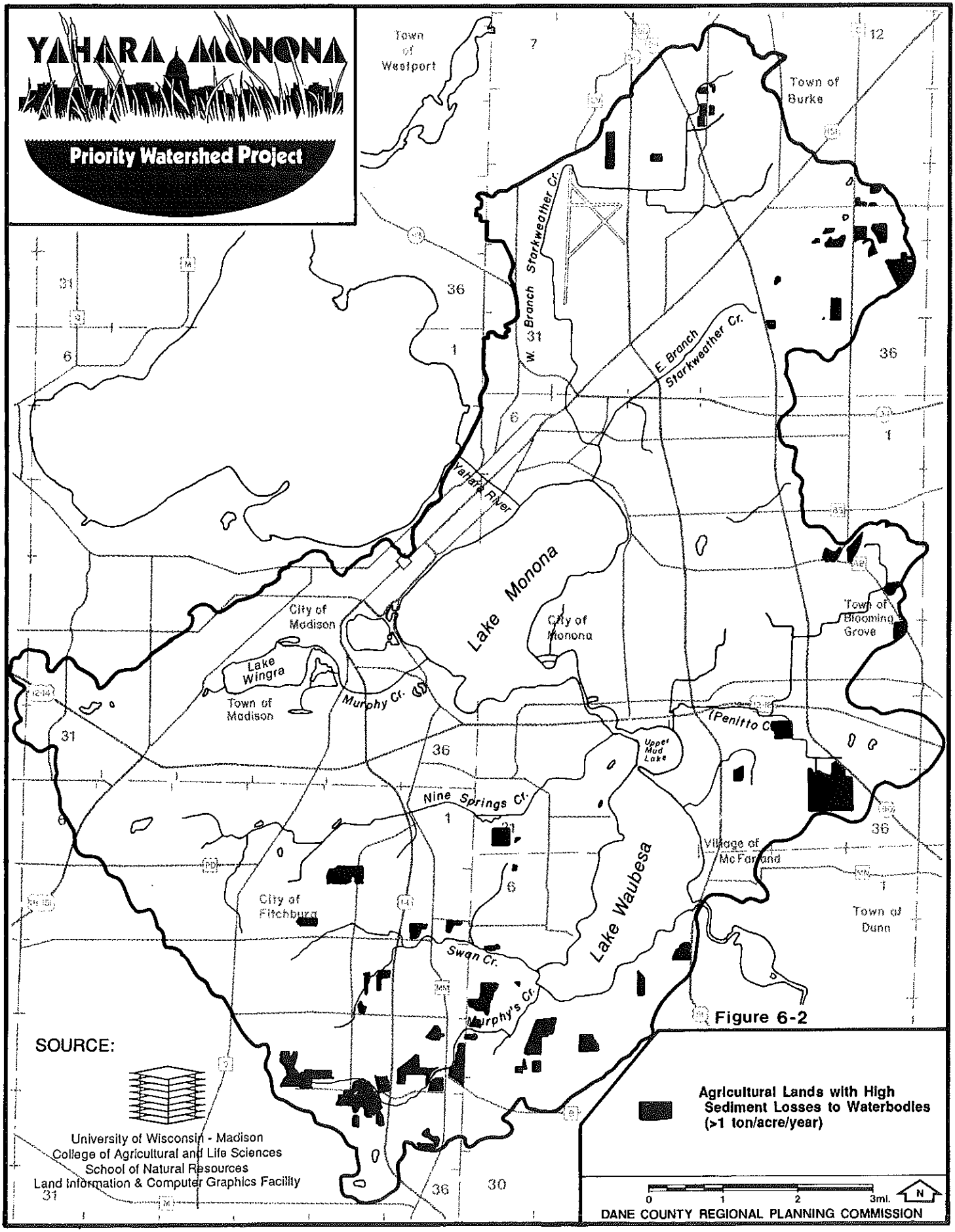
[1]Tracts are parcels of land that are not directly connected.


YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
W. Branch Starkweather Cr.
E. Branch Starkweather Cr.
Yahara River
Lake Monona
City of Madison
City of Monona
Town of Blooming Grove
Lake Wingra
Town of Madison
Murphy Cr.
Penitto Cr.
Upper Mud Lake
Nine Springs Cr.
Village of McFarland
City of Fitchburg
Lake Waubesa
Town of Dunn
Swan Cr.
Murphy's Cr.
SOURCE:
University of Wisconsin - Madison
College of Agricultural and Life Sciences
School of Natural Resources
Land Information & Computer Graphics Facility
Agricultural Lands with High Sediment Losses to Waterbodies (>1 ton/acre/year)
0 1 2 3mi.
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DANE COUNTY REGIONAL PLANNING COMMISSION

Figure 6-2

Rural Streambank Management

Management assistance will be provided to landowners cropping or pasturing land next to streams or lakes where water quality is being degraded. Management practices that will be available are fencing and shoreline buffers. Structural practices such as shaping, seeding, and riprap will be cost-shared when the following standards are exceeded:

- rate of bank recession exceeds 0.1 ft./yr. and
- rate of recession x bank height exceeds 0.3 sq. ft./yr.

From initial field evaluations and air photo interpretation, one stream reach along Murphy's Creek in the rural area of the watershed may require fencing or structural measures. Specific shoreline buffer needs will be determined during the implementation period of the project and reflected in annual agency work plans.

Nutrient and Pesticide Management

A nutrient and pesticide management demonstration project will be conducted during the first two years of the implementation period to address groundwater quality concerns over nitrate-nitrogen and pesticides and to encourage participation in the priority watershed project. Integrated pest management (IPM) practices and the management of the application of manure, legumes and commercial fertilizers will be displayed. The project will be directed at the numerous land renters in the watershed. Private well water quality samples will be collected and analyzed for pesticides to assist in determining where the need for management activities exists. It is intended that Dane County and UW-Extension (Nutrient and Pest Management Program) will provide assistance in conducting the demonstration project.

Depending on interest in the demonstration project, a more widespread pesticide sampling and farmstead assessment program concerning pesticide use will be initiated. The Priority Watershed Project can provide cost-sharing for up to three years in specific situations on cropland for soil testing (residual nitrogen analysis included), manure nutrient analysis and integrated pest management scouting.

Management of Other Sources of Pollution

Other potential pollution sources (e.g., salvage yards, solid waste disposal and silage storage sites) that may be located in rural areas should be closely evaluated, monitored and managed to prevent water quality degradation. Existing regulatory programs, if applicable, should be fully exercised to control pollution sources. For planned land uses posing environmental concerns, there should be stringent evaluations of possible environmental impacts before a facility is sited.

Recommended management proposals by major subwatersheds are presented below.

Starkweather Creek Subwatershed

1) Landowners and operators of agricultural fields that exceed tolerable soil erosion and targeted sediment delivery rates (0.75 tons/acre/year to achieve a 30 percent reduction in sediment) in this subwatershed should work with Dane County Land Conservation Department staff to reduce soil erosion and sediment losses to levels that will not cause any additional water quality degradation to Starkweather Creek and downstream Lake Monona. Cost-sharing for appropriate water quality management practices will be available through the priority watershed project (see Chapter NR 120.14 regarding eligible practices; also see Table 6-6 of this plan).

   There is only one inventoried animal lot in this subwatershed and model results indicate that potential pollution loads are below levels of water quality concern; thus no animal lot runoff control measures are needed at this time.

Nine Springs Creek Subwatershed

1) Landowners and operators of agricultural fields that exceed tolerable soil erosion and targeted sediment delivery rates (0.5 tons/acre/year) in this subwatershed should work with Dane County Land Conservation Department staff to reduce soil erosion and sediment delivery to levels that will not degrade the quality and habitat conditions of Nine Springs Creek and downstream Lake Waubesa. Cost-sharing for appropriate

water quality management practices will be available through the priority watershed project (see Chapter NR 120.14 regarding eligible practices; also see Table 6-6 of this plan).

2) Computer model results indicate that two of the five inventoried animal lots in the Nine Springs Creek watershed can discharge pollutants above targeted water quality levels (5 pounds of phosphorus for a 10-year, 24-hour storm). These two operations should install animal waste management control measures (i.e., clean water systems) and develop manure spreading plans to limit pollutant loadings to Nine Springs Creek. Financial assistance is available through the priority watershed project for eligible practices as identified in Chapter NR 120.14(19-21).

Upper Mud Lake (Penitto Creek) Subwatershed

1) Landowners and operators of agricultural fields that exceed tolerable soil erosion and targeted sediment delivery rates (0.75 tons/acre/year) in this subwatershed should work with Dane County Land Conservation Department staff to reduce soil erosion and sediment losses to levels that will not degrade the quality of Penitto Creek and Upper Mud Lake. Cost-sharing for suitable water quality management practices will be available through the priority watershed project (see Chapter NR 120.14 regarding eligible practices; also see Table 6-6 of this plan).

2) One animal lot was inventoried in this subwatershed and model results indicate that potential pollutant loadings may exceed the targeted water quality level of five pounds of phosphorus. Appropriate animal waste management practices and a spreading plan should be implemented, with cost-sharing provided by the priority watershed project for eligible practices.

Lake Waubesa Subwatershed

1) Landowners and operators of agricultural fields that exceed tolerable soil erosion and targeted sediment delivery rates (0.5 tons/acre/year) in this subwatershed should work with Dane County Land Conservation Department staff to reduce soil erosion and sediment losses to levels that will not degrade the water quality of Lake Waubesa. Cost-sharing for eligible water quality management practices will be available through the priority watershed project.

2) The animal lot with the highest pollutant loading rate in the Yahara-Monona Watershed is found in this subwatershed. Animal waste management control practices (i.e., a complete runoff control system) and a manure spreading plan should be developed to limit the direct discharge of pollutants to Lake Waubesa from this operation. Cost-share funding is available for eligible management practices from the priority watershed project.

Swan Creek Subwatershed

1) Landowners and operators of agricultural fields that exceed tolerable soil erosion and targeted sediment delivery rates (0.5 tons/acre/year) in this subwatershed should work with Dane County Land Conservation Department staff to reduce soil erosion and sediment losses to levels that will not degrade the water quality and habitat conditions of Swan Creek and downstream Lake Waubesa. Financial assistance for eligible management practices is available from the priority watershed project.

2) There are four animal lots in this subwatershed that can contribute pollutant loadings above targeted water quality levels. These sites are responsible for 27 percent of the phosphorus load from all animal lots in the Yahara-Monona Watershed. Appropriate animal waste management practices (three complete runoff control systems and one clean water diversion) and manure spreading plans should be developed, with financial assistance available through the priority watershed project.

3) This subwatershed should be considered as a possible location for the nutrient and pesticide demonstration project due to existing groundwater quality concerns over nitrate-nitrogen, the prevalence of agricultural land uses, and potentially interested participants residing in this subwatershed.

Murphy's Creek Subwatershed

1) Landowners and operators of agricultural fields that exceed tolerable soil erosion and targeted sediment delivery rates (1.5 tons/acre/year) in this subwatershed should work with Dane County Land Conservation Department staff to reduce soil erosion and sediment losses to levels that will not degrade the water quality

and habitat conditions of Murphy's Creek and downstream Lake Waubesa. Financial assistance for appropriate management practices is available from the priority watershed project (see Chapter NR 120.14 regarding eligible practices; also see Table 6-6 of this plan).

2) Computer model results indicate there are three animal lots that can discharge pollutants substantially above targeted water quality levels. These three sites contribute over 20 pounds of phosphorus each or about 35 percent of the total phosphorus load from animal lots in the Yahara-Monona Watershed. Complete barnyard runoff control systems and manure spreading plans should be developed, with financial assistance provided by the priority watershed project for eligible practices.

3) Streambank erosion control and fencing practices should be pursued along an intermittent tributary of Murphy's Creek to prevent water quality degradation to the stream from animal access (see Chapter NR 120.14(14) regarding eligible costs).

Rural best management practice and cost-share budget needs for the Yahara-Monona Priority Watershed Project are summarized in Table 6-2 (to the extent they can be currently defined). One hundred percent and 75 percent landowner participation levels were presumed for budgeting purposes. Staff hour estimates to provide technical assistance to rural landowners to install recommended management practices are shown in Table 6-3. These estimates indicate the need for a full-time staff position to work on rural project implementation activities. It is felt this work can be completed over a five-year period, rather than eight years, which is conventionally permitted through the Nonpoint Program.

TABLE 6-2
RURAL MANAGEMENT PRACTICE AND COST-SHARE BUDGET NEEDS FOR THE YAHARA-MONONA PRIORITY WATERSHED PROJECT

	Number	Cost/ Unit	Total Cost	100% Participation Level		75% Participation Level	
				State Share	Local Share	State Share	Local Share
Cropland Management Needs							
Change in Crop Rotation	1,700 ac.	NA	--	$0	$0	$0	$0
Contour Cropping	1,500 ac.	$6/ac.	$9,000	9,000	[2]	6,750	[2]
Contour Stripcropping	200 ac.	$12/ac.	2,400	2,400	[2]	1,800	[2]
Reduced Tillage	2,500 ac.	NA	--	0	[2]	0	[2]
Critical Area Stabilization	10 ac.	$300/ac.	3,000	2,100	900	1,575	675
Grass Waterways	40 ac.	$2,400/ac.	96,000	67,200	28,800	50,400	21,600
Field Diversions & Terraces	14,000 ft.	$2.50/ft.	35,000	24,500	10,500	18,375	7,875
Grade Stabilization Structures	7	$4,000/ea.	28,000	19,600	8,400	14,700	6,300
Agricultural Sediment Basin	4	$5,000/ea.	20,000	14,000	6,000	10,500	4,500
Shoreline Buffers[1]	--	$500/ac.	--	--	--	--	--
Wetland Restoration[1]	--	$4,000/site	--	--	--	--	--
Animal Waste Management							
Barnyard Runoff Control							
Complete Systems	7	$17,000/ea.	$119,000	$83,300	$35,700	$62,475	$26,775
Clean Water Systems	4	$4,000/ea.	16,000	11,200	4,800	8,400	3,600
Manure Spreading Management	1,800 ac.	NA	0	0	0	0	0
Streambank Erosion Control							
Shape & Seed	800 ft.	$7/ft.	$5,600	$3,920	$1,680	$2,940	$1,260
Fencing	4,000 ft.	$2/ft.	8,000	5,600	2,400	4,200	1,800
Riprap	None	$12/ft.	0	0	0	0	0
Livestock/Machinery Crossing	3	$2,400/ea.	7,200	5,040	2,160	3,780	1,620
Nutrient and Pest Management[1]	--	$11/ac.	--	--	--	--	--
Total			**$349,200**	**$247,860**	**$101,340**	$185,895	$76,005

[1]Specific shoreline buffer, wetland restoration and nutrient and pest management practice needs will be determined during the implementation period and reflected in annual work plans prepared by the LCD.
[2]Local share consists of labor and any additional equipment costs.
NA = Cost-sharing for these practices is not available.

TABLE 6-3
ESTIMATED DANE COUNTY LAND CONSERVATION DEPARTMENT STAFF NEEDS FOR PROJECT IMPLEMENTATION

Activity	Project Years When Work Will Be Done	Total Staff Hours For 5 Years (75% Landowner Participation)
Project and Financial Management	1-5	1,945
Pre-Contact Office Inventory, Landowner Contacts, and Progress Tracking and Update Inventory	1-3	960
Conservation Planning, Cost-Share Agreement Development	1-3	2,210
Plan Revisions and Status Review and Monitoring	1-5	1,000
Practice Design and Installation	1-5	
Upland Sediment Control		3,535
Barnyard Runoff Control (includes Manure Spreading Management and Storage)		675
Streambank Erosion Control		490
Training	1-5	1,180
Total LCD Workload		**11,995**
Estimated Staff Hours Required for Years 1-3		2,822 per year
Estimated Staff Hours Required for Years 4-5		1,765 per year

Recommended Wetland and Stream/Lakeshore Management Program

As indicated throughout this plan, wetlands and stream/lakeshore corridors provide numerous resource functions, and they are valuable areas that should be protected from significant pollution discharges. Protection of these "environmental corridors" is extremely important for several direct water quality and associated reasons. They are to: stabilize shorelines and reduce sediment and related pollution; protect groundwater discharge to streams and lakes; preserve stormwater management and drainage options; protect sensitive lands from incompatible development; reduce property damage from flooding and protect public health and safety; protect valuable wildlife habitat; enhance recreation and open space opportunities; and improve scenic beauty.

Lands that are part of environmental corridors vary in the type and number of functions they provide. Some wetland and stream corridors in the Yahara-Monona Watershed have been severely altered or degraded over time, so that they no longer provide diverse functions. Other areas, however, have not been significantly impacted, and they maintain many highly valued functions. It is the intent of this plan to promote the general protection of environmental corridors, and to seek enhancement of areas that are not currently fulfilling their potential functions. In some situations, very stringent management controls may be needed to protect sites that are of exceptional resource value and are particularly sensitive to land use impacts.

Wetlands and associated land uses in the Yahara-Monona Watershed were inventoried by the 1990 University of Wisconsin Water Resource Management Workshop. A functional classification system was devised and applied to most wetlands over two acres in size. Summarized classification results for individual wetlands are presented in the Workshop's report (UW, 1990) and in Chapter 5 of this plan. The report also presents general management strategies for wetlands, as well as case studies for selected wetland sites. This work has been of assistance in developing the following specific implementation proposals, which are categorized by major subwatershed. Roles of appropriate units of government are indicated.

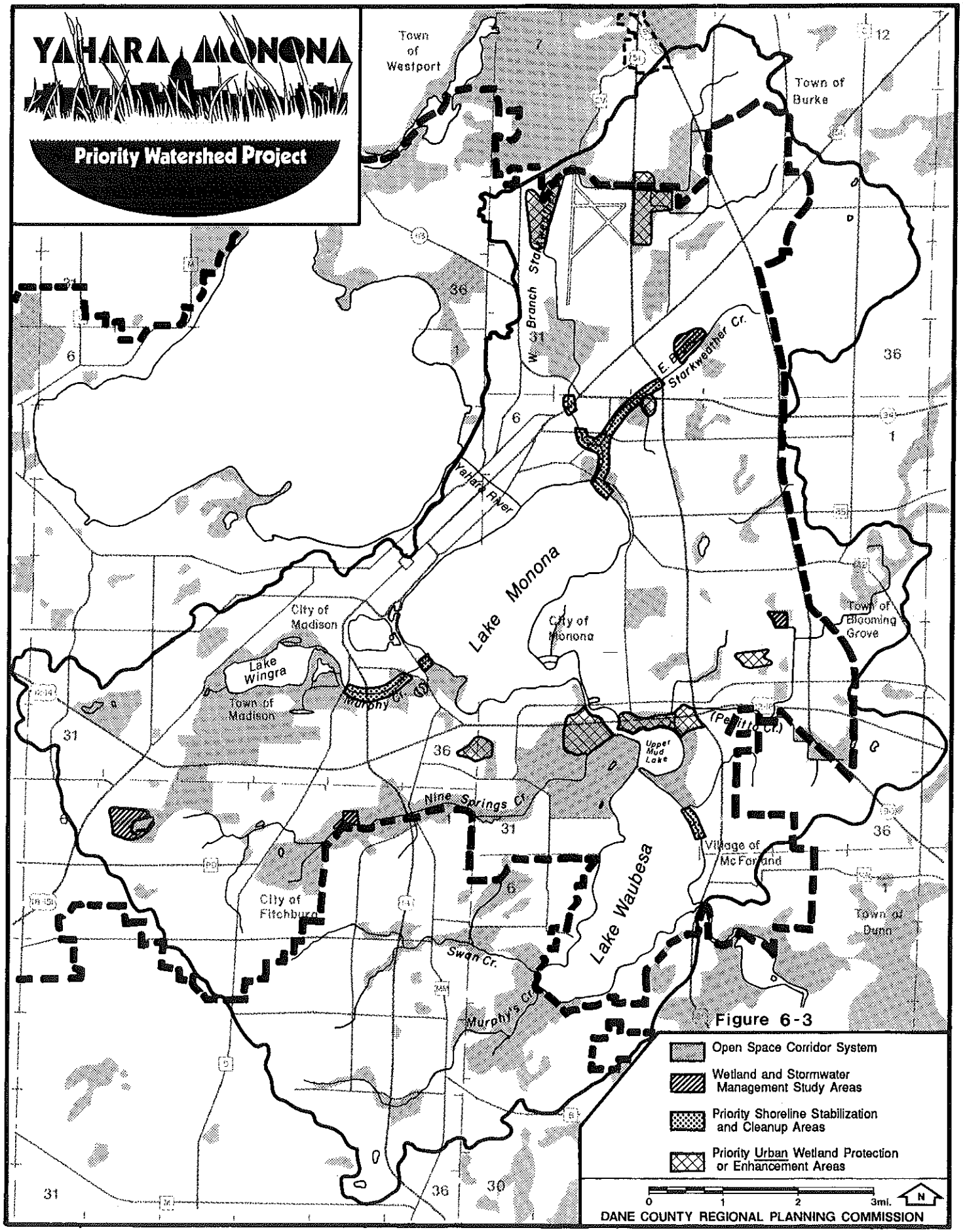
Starkweather Creek Subwatershed

1) **The City of Madison, Dane County and the DNR should implement stream corridor, habitat and recreational improvements on both branches of Starkweather Creek south of Milwaukee Street (see Fig. 6-3), as presented in the Starkweather Creek remedial demonstration project plan. This section of the stream should also serve as an educational site to display fish management practices. Emphasis should be placed on citizen participation in corridor improvement activities. Financial assistance for eligible streambank stabilization measures is available through the priority watershed project (see Chapter NR 120.14(14) regarding eligible costs).**

   To improve stream water quality and protect Lake Monona from further heavy metal (e.g., mercury) contamination, a demonstration project has been approved to remove about 17,000 cubic yards of contaminated sediment in Starkweather Creek. As part of the project, streambank stabilization and landscape improvements (supported by the Yahara-Monona Priority Watershed Project) are planned to address bank erosion, wildlife habitat and public access concerns. Other elements of the demonstration project include stream aeration and possibly a northern pike rearing pond in order to improve conditions for fish and other aquatic life. Public information and education activities also are intended to enhance public awareness and stewardship of Starkweather Creek. Citizen participation in stream corridor cleanup activities should be encouraged, possibly through establishment of an "Adopt A Stream" program.

2) **The City of Madison should pursue streambank stabilization and cleanup activities on the East Branch Starkweather Creek between Milwaukee Street and Highway 51, with funding assistance for eligible practices from the priority watershed project. Dredging of selected stream reaches should also be considered in order to improve stream channel and aquatic vegetation conditions. (Financial assistance for dredging is not available through the priority watershed project.)**

   The environmental quality of this section of the creek is particularly poor, with bank erosion, sediment, debris and aquatic vegetation problems evident. Bank stabilization and habitat improvements, as well as regular maintenance of the stream corridor, are needed in order to improve the water quality of the East Branch Starkweather Creek. Lands within the environmental corridor east of the creek and south of Highway 30 have potential for development as a recreation and open space resource. With eventual acquisition (through purchase or dedication) and preservation, the area could be managed as a park with ponds suitable for fishing, restored native plant communities and passive and active recreational areas.


YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
Lake Monona
City of Madison
City of Monona
Lake Wingra
Town of Madison
Town of Blooming Grove
Upper Mud Lake
Village of McFarland
City of Fitchburg
Lake Waubesa
Town of Dunn
Yahara River
Starkweather Cr.
Nine Springs Cr.
Swan Cr.
Murphy's Cr.
Open Space Corridor System
Wetland and Stormwater Management Study Areas
Priority Shoreline Stabilization and Cleanup Areas
Priority Urban Wetland Protection or Enhancement Areas
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DANE COUNTY REGIONAL PLANNING COMMISSION

Figure 6-3

3) **The City of Madison should seek to stabilize and improve other reaches of Starkweather Creek where degraded conditions exist. Examples include reaches of the West Branch immediately above East Washington Avenue and east of the Dane County Regional Airport.**

In addition to the lower reaches of Starkweather Creek, there are other more limited sections of the creek that are experiencing bank erosion and maintenance problems. Management of these areas should be addressed to help attain water resource improvement objectives.

4) **The City of Madison should support a wetland and stormwater management feasibility study near the East Branch Starkweather Creek between Sycamore and Lien Roads (see Fig. 6-3). The study should evaluate the potential to functionally restore this wetland area through overbank flooding, which could provide water quality benefits.**

Dredging and channelization have adversely impacted the natural water quality and hydrologic functions of this wetland area. A drainage ditch now conveys much of the stormwater runoff from the East Towne Mall area to Starkweather Creek, bypassing the filtering and flow control functions of the wetland. A case study done by the 1990 UW Water Resource Management Workshop recommends hydrologic restoration (overbank flooding) of this area to facilitate the reestablishment of several important wetland functions and to protect the water quality of Starkweather Creek (UW, 1990). The need for land use zoning changes and "buffer" areas should also be considered.

5) **The City of Madison should place high priority on protecting important wetland resources in this subwatershed, such as sites adjacent to the West Branch of Starkweather Creek near the Dane County Airport and high quality wetland areas on the East Branch south of Highway 30 (see Fig. 6-3). These wetlands are important in maintaining stream baseflow and reducing stormwater pollution.**

The baseflow in Starkweather Creek has probably been reduced in part by the draining of wetlands, which are often critical groundwater discharge sites to streams. Wetlands help maintain dry-weather flow in the creek and can filter sediment from stormwater runoff; thus emphasis should be placed on their protection.

Lake Monona Subwatershed

1) **The City of Madison should seek shoreline stabilization, stream corridor and recreational use improvements for Murphy (Wingra) Creek. Funding assistance for shoreline stabilization work should be sought from the priority watershed project. A detailed assessment of the need for dredging to remove contaminated sediment and to increase recreational use should be undertaken. The potential for stream aeration to improve fish habitat conditions should also be investigated. Public involvement efforts should be emphasized as part of management planning.**

Murphy (Wingra) Creek experiences many of the same water quality problems that exist with Starkweather Creek. The creek is not fulfilling its resource potential due to contaminated sediment, poor dissolved oxygen conditions and streambank erosion. The city has displayed interest in pursuing an improvement program for the creek, and can gain beneficial management experience from activities that will be done as part of the Starkweather demonstration project. Citizen and neighborhood involvement is essential in helping to formulate an overall management and maintenance approach for the Murphy Creek corridor.

2) **The DNR and Dane County should pursue an aquatic plant management project to try to reestablish native plant species (e.g., water lily) in Lake Monona (e.g., in Turville Bay).**

The near-shore areas of Lake Monona are often dominated by "low" quality plant species (e.g., coontail and water milfoil) that limit vegetative diversity and do not enhance fish habitat. Management attempts to increase the diversity and population of "higher" quality plant species should be promoted.

Lake Wingra Subwatershed

1) **The UW Arboretum should be encouraged to pursue wetland and shoreline restoration activities, with public information and involvement initiatives being coordinated to the extent possible with the priority watershed project.**

Most of the wetlands in this subwatershed are part of the University of Wisconsin Arboretum and thus are given management and protection emphasis. However, public awareness and involvement in ecological restoration activities to enhance existing resource functions should be supported and coordinated with other environmental education programs where feasible. The Yahara-Monona Public Information Officer can serve as liaison between the Arboretum and the priority watershed project.

Nine Springs Creek Subwatershed

1) **The cities of Madison and Fitchburg should jointly pursue a comprehensive stormwater and wetland management feasibility study for the Dunn's Marsh drainage basin in order to improve the water quality of the marsh.**

Excessive stormwater runoff is adversely impacting the marsh, and there has been a history of management concerns expressed by both communities and a local neighborhood association. A detailed stormwater and wetland management study should be conducted to develop an appropriate management solution.

2) **Dane County and the cities of Madison and Fitchburg should evaluate the feasibility of restoring the water quality and habitat functions of a degraded wetland area near Nine Springs Creek immediately west of Syene Road (see Fig. 6-3).**

A large amount of the wetlands in the Nine Springs Creek Corridor are in public ownership as part of the Nine Springs E-Way and are thus protected from being directly disturbed. However, some areas, such as near Syene Road, have been degraded by ditching and could be hydrologically restored to receive and filter stormwater runoff from upland sources. Such restoration could also improve the type and diversity of existing wetland vegetation. The 1990 UW Workshop conducted a case study of the Nine Springs wetland complex between Fish Hatchery Road and Highway 14 and recommended that hydrologic restoration (creation of a flood storage zone) be further evaluated west of Syene Road. Suggestions for recreational and educational use improvements for other areas in the Nine Springs Corridor are also presented in the Workshop's report (UW, 1990).

3) **The cities of Madison and Monona should protect the Nob Hill and Monona wetlands south of Lake Monona (see Fig. 6-3) and pursue recreational and educational use improvements.**

For both wetland sites, it has been demonstrated that with citizen involvement and relatively modest improvements, the value of these resources can be enhanced considerably. The City of Monona has already taken planning initiatives to expand management of their wetlands and additional activities should be encouraged. Improvements at these sites could serve as examples for other areas and would complement other environmental education and recreational opportunities available in the Nine Springs E-Way.

4) **The Madison Metropolitan Sewerage District should continue formulating a management strategy to restore their sewage sludge lagoons to wetland areas or enhance the lagoons to serve as a bird/ wildlife sanctuary.**

MMSD has funded technical feasibility studies that evaluate management alternatives to address PCB contamination problems and plan for the ultimate use of the sludge lagoons. The lagoons could potentially be restored to their original wetland status or enhanced to provide substantial wildlife habitat benefits. Additional management activities should be supported.

Upper Mud Lake (Penitto Creek) Subwatershed

1) **The City of Madison should undertake a stormwater and wetland management feasibility study for a tributary area of Penitto Creek near South Thompson Drive (see Fig. 6-3).**

The feasibility of a regional wet detention basin and wetland vegetation to control stormwater runoff from existing and planned development should be explored. If feasible and properly managed, such practices could help protect the water quality of Penitto Creek and Upper Mud Lake.

2) **The cities of Madison and Monona should seek stringent protection of important wetland resources, such as the Vondron/Femrite and Upper Mud Lake wetlands (see Fig. 6-3), from detrimental land use impacts in this subwatershed. The DNR should investigate the possibility of a restoration or enhancement project in the Upper Mud Lake wetlands to improve habitat.**

The Vondron/Femrite wetland has been recognized as a unique and high quality natural area that contains diverse flora, but it may be threatened by planned industrial or commercial development in the City of Madison (UW, 1990). Likewise, the Upper Mud Lake wetland provides several highly valued resource functions. Because of their inherent value, these resources should be protected from future development impacts. Land acquisition (through purchase or easements) and the establishment of buffer areas should be considered for protection purposes. Wildlife habitat restoration also should be pursued if feasible.

Lake Waubesa and Swan and Murphy's Creek Subwatersheds

1) **High quality wetland resources in these subwatersheds, such as the Swan Creek and Waubesa wetlands, should continue to be of priority for protection by state and local units of government as well as interest groups.**

These wetland areas are often recognized as providing exceptional resource functions (UW, 1990) and should be fully protected. Much land, in fact, has already been acquired and is being preserved in its natural state. Although most of these wetlands are not located in developing urban areas, they may face impacts from unsewered development or agricultural land use in upland sites. The importance of buffer zones to protect these resources should also be acknowledged in local land use planning efforts.

2) **The Village of McFarland should evaluate the effectiveness of its shoreline stabilization project and pursue cleanup practices near McDaniel Park on the eastern shoreline of Lake Waubesa (see Fig. 6-3).**

Although not caused by stormwater runoff or development activities, substantial lakeshore erosion is occurring at McDaniel Park. The Village has recently budgeted funds and implemented an experimental stabilization project on this shoreline. Associated cleanup of trash and debris in a tributary to the lake at McDaniel Park should also be considered, with possible assistance from the Dane County Youth Conservation Crew.

Entire Yahara-Monona Watershed

1) **Local units of government in the Yahara-Monona Watershed should continue to take appropriate actions to protect and preserve lands within officially mapped environmental corridors. Corridor lands should be protected through a combination of review, regulatory and legal mechanisms, and various forms of public acquisition, especially where public access and recreational use are desired.**

Municipalities need to be continually aware of the importance of environmental corridors in land use decision-making. Corridors not only address a number of local development and environmental protection goals, but also are essential to satisfactorily address regional or overall watershed management objectives.

Easement and Wetland Restoration Policies

Easements

Although easements are not considered a conventional management practice, easements can help achieve desired levels of nonpoint source pollution control under certain conditions. Easements are used to support best management practices, enhance landowner cooperation and to more accurately compensate landowners for loss or altered usage of property. The benefits of using easements in conjunction with a management practice are: 1) a riparian easement can serve as a buffer strip and reduce the delivery of upland pollutants to a water body as well as provide fish and wildlife habitat; 2) easements are generally perpetual, so resource protection can be for a longer time period than what a management practice may provide by itself; and 3) an easement may allow for limited public access, depending on the situation.

The Nonpoint Program can support the use of easements to address critical lands throughout the watershed where permanent vegetative cover will provide a cost-effective means of controlling nonpoint source pollution. The program will support up to 100 percent of easement costs. Specifically, easements may be used in conjunction with the following best management practices: 1) shoreline buffers; 2) wetland restoration; and 3) critical area stabilization. Easements must be for a period of at least 20 years and may be held by either a local unit of government or by the state.

Easements may also be supported by other management programs, such as the State Stewardship Fund - Streambank Easement Program and the Dane County Streambank Easement Program. The use of easements through other programs should be coordinated with the objectives of the priority watershed project to the extent possible. It should be noted that Starkweather Creek is one of 23 "priority streams" in Dane County included as part of either the state or county Streambank Easement Program. It is the only stream in the Yahara-Monona Watershed currently recommended for these programs.

Wetland Restoration

The restoration of wetlands is eligible for cost-sharing through the Nonpoint Program when the restoration is done to control nonpoint source pollution. Secondary benefits of wetland restoration may be for wildlife or fish habitat; however, the primary justification of the restoration must be for water quality improvement. Wetland restoration includes the construction of berms or other water control structures or the destruction of tile lines and drainage ditches to create conditions suitable for wetland vegetation.

Specific criteria have not been developed to determine situations in the Yahara-Monona Project where cost sharing could be available for wetland restoration. Dane County, DNR and DATCP must establish criteria for the use of this practice before it can be financially supported by the Nonpoint Program.

Wetland and Stream/Lakeshore Management Budget

An overall budget for wetland and stream/lakeshore corridor feasibility studies and improvement activities has not been developed due to the uncertainty and large variability in specific management approaches and costs. Reasonable budgets can only be prepared after detailed site investigations have taken place. Preliminary cost figures, however, for two corridor improvement projects--the Starkweather Creek Remedial Demonstration Project and Wingra Creek Improvement Program--have been estimated and may serve as examples of the type of financial commitment that can be associated with management efforts.

For the Starkweather Creek Demonstration Project, preliminary costs for streambank stabilization have been estimated to be $360,000, plus an additional $100,000 for landscaping, seeding and tree planting. Cost sharing for these practices is available through the Nonpoint Source Program. Stream dredging and spoil disposal, which is not eligible for cost-sharing through the Nonpoint Program, is also estimated to be about $100,000. Cost estimates for a stream aeration system and northern pike rearing pond are $3,000 and $17,000, respectively. Engineering plans and design costs are $30,000. The total preliminary project budget for two fiscal years is $640,000 (WDNR, 1990). Preliminary cost figures for particular management components (e.g., bank stabilization, dredging and landscaping) of the Wingra Creek Improvement Program are similar to those of Starkweather Creek, with a total project budget over a several year period estimated to be about $1 million.

Implementation Program - Specific Participant Roles

The specific roles and responsibilities for program participants are outlined below. Primary participants include local units of government (e.g., cities and village), the DNR, Dane County, other agencies (e.g., RPC), landowners and land operators.

Roles and Responsibilities of Local Units of Government (Cities, Villages and Urban Towns)

1. Identify in writing to the project management coordinator an authorized representative for the local unit of government.

2. Prepare and submit to the project management coordinator annual work plans for staff needs and activities necessary to implement the project.

3. Prepare and submit to the project management coordinator an annual report for the purposes of monitoring project implementation.

4. Participate in the annual watershed project review meeting.

5. If necessary, enter into a Local Assistance Grant Agreement or Nonpoint Source Grant Agreement (described later in this chapter).

6. Enter into cost-share agreements (described below) for best management practices.

    a. For practices installed and maintained by private individuals, the cost-share agreement is between the landowner and the unit of government. 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) Reimburse cost-share recipients for the eligible costs of installing best management practices,

        3) Monitor landowner compliance with requirements of the cost-share agreement.

    b. For practices installed and maintained by the municipality, a Nonpoint Source Grant Agreement between the municipality and state is developed.

7. Develop a community-based implementation approach for carrying out nonpoint source pollution control practices. This approach should include:

    a. For existing developed areas: Identify selected high priority areas the community will investigate for the installation of management measures. This list is meant to provide a starting point for where nonpoint source control practices will be used. The list can be amended throughout the eight-year project period.

    b. For areas planned for development: A description of the authorities and agreements that will be developed among the community and the towns and/or county to address nonpoint source control needs of the unincorporated areas most likely to undergo development. The agreements should include how construction erosion will be controlled in the unincorporated areas.

    c. For both existing and planned areas: Identify the funding sources (both public and private) that will be used to pay for the "local share" of the nonpoint source control program.

8. Conduct engineering feasibility and site location studies for urban nonpoint source control practices in high priority areas. The type and manner of practice installation will be guided by these studies. A commitment to implement the recommendations will be required as a condition for financial assistance of subsequent feasibility studies.

Department of Natural Resources

The Department 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 fish management concerns into selection and design of management practices, and conducting project evaluation activities. For the Yahara-Monona Priority Watershed Project, it is recommended that certain project implementation functions be delegated to a project management coordinator, as described below under Dane County's roles. The recommended DNR role in assisting local units of government in carrying out activities in the Yahara-Monona Watershed is as follows.

1. Work with the project management coordinator to provide guidance on project implementation responsibilities.

2. Review Local Assistance and Nonpoint Source Grant Agreements entered into by local units of government and eligible landowners.

3. Provide funding for Local Assistance Grant Agreements.

4. Provide cost-share reimbursement for the eligible costs of installing best management practices at the rates consistent with administrative rules and those established in this plan.

5. Review and approve technical guidelines and specifications for Best Management Practices.

6. Review and approve annual work plans for staff and activities necessary to implement the project.

7. Review and approve annual project implementation reports.

8. Participate in the annual watershed project review meeting.

Dane County

Dane County, through the Lakes and Watershed Commission, is the recommended governmental agency to coordinate project management for the Yahara-Monona Project. This role would involve acting as an intermediary between the DNR and local units of government to ensure project activities are initiated, funded, properly conducted, documented and sustained during the implementation period. This type of liaison position is intended to assist the state in project administration duties and to provide a specific focal point and accountability for the project. Suggested activities are as follows.

1. Provide primary staff assistance to the Yahara-Monona Steering Committee.

2. Work with communities to develop priorities, schedules and requirements for management activities.

3. Provide administration of Local Assistance and Nonpoint Source Grant Agreements.

4. Provide assistance to communities in developing annual work plans for staff and activities necessary to implement the project.

5. Participate in the selection of Best Management Practices (BMPs) and review designs of individual practices.

6. Coordinate and assist communities in preparing annual project implementation reports.

7. Set up annual watershed project review meetings.

8. Provide technical assistance to communities concerning implementation of management practices.

9. Prepare reports that track changes in urban pollutant loads using information supplied by local units of government.

The Dane County Land Conservation Committee (LCC) will act for the county and be responsible contractually for management of the project in areas with rural land uses. The County LCC will coordinate the activities of all other local agencies involved with the rural portion of the project.

The specific responsibilities for the LCC are defined in the Wisconsin Administrative Rules, s. NR 120.04, and are summarized below:

1. Contact all owners or operators of rural lands identified as significant nonpoint sources within one year of signing the nonpoint source grant agreement.

2. Develop farm conservation plans consistent with the needs of the project.

3. 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.

4. For lands the county owns or operates, to enter into cost-share agreements with DNR to correct identified nonpoint sources and fulfill its obligations as a cost-share recipient.

5. Design rural best management practices and verify proper practice installation.

6. Prepare and submit annual work plans for activities necessary to implement the project. The Dane 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.

7. Prepare and submit to the DNR and DATCP the annual resource management report required under s. NR 120.21(7) to monitor project implementation by tracking changes in the nonpoint source inventory, and quantifying pollutant load reductions that result from installing BMPs.

8. Participate in the annual watershed project review meeting.

Department of Agriculture, Trade and Consumer Protection

The role of the Department of Agriculture, Trade and Consumer Protection (DATCP) is identified in s. 144.25, stats., ch. 92 stats., and NR 120. In summary, the DATCP will:

1. Manage a training program for the staff involved with project implementation.

2. Cooperate with the University of Wisconsin-Extension to act as a clearinghouse for information related to agricultural best management practices, sustainable agriculture, and nutrient and pest management.

3. Assist the counties to carry out the information and education activities or tasks described in this plan.

4. Assist county staff to identify watershed participants subject to federal or state conservation compliance programs.

5. Assist county staff to complete annual workload analyses and grant applications for work conducted under the priority watershed project.

6. Participate in the annual project review meetings.

7. If the need arises, assist in developing technical standards for agricultural BMPs, and provide technical assistance to county staff concerning application of these practices.

8. Assist county staff to evaluate the site specific practicality of implementing rural best management practices.

Other Agencies With Implementation Responsibilities

Dane County Regional Planning Commission

The Dane County Regional Planning Commission has been the lead agency for coordinating and conducting project planning efforts. DCRPC can provide direct technical support to communities during the implementation period, as well as lend assistance to the public information and education program.

University of Wisconsin and Dane County Extension

County Extension agents will provide support in developing and conducting public information and education activities aimed at increasing participation in the project. This will include assistance to carry out the information and education activities identified in this plan.

Landowners and Land Operators

In rural and some urban areas, private landowners and operators will install BMPs on their property. They are important participants in the priority watershed project. Eligible landowners will participate in the project by signing cost-share agreements with the County Land Conservation Department or local units of government.

Project Grant Agreements, Administration and Eligible Best Management Practices

Local Assistance Grant Agreement

The Local Assistance Grant Agreement (LAGA) is a grant from the state to local units of government for supporting their staffing and direct costs of carrying out the urban and rural implementation program. Each local unit of government will have its own agreement. Consistent with Administrative Code NR 120 these grant funds will be used for:

1) additional staff to implement the project;
2) conduct information and education activities; and
3) design and construction checks of best management practices on land owned by the local unit of government.

Other items such as travel, training, and certain office supplies and equipment are also supported by the LAGA. Table 6-4 below summarizes the level of support for the various eligible activities. Further clarification of eligible costs supported by this grant is given in Chapter NR 120.21(4) and (6).

TABLE 6-4
IMPLEMENTATION ACTIVITIES ELIGIBLE FOR STATE FUNDING THROUGH LOCAL ASSISTANCE GRANT

Activity	State Funding Rate
Develop Construction Site Erosion Control Ordinances	100%
Develop Stormwater Management Ordinances	100%
Stormwater Management Feasibility Studies (Existing and Planned Urban Areas)	up to 100%[1]
Design and Engineering for Structural Best Management Practices (Existing Urban Areas)	100%
Staff for Enforcing Construction Erosion and Stormwater Management Ordinances	100%[2,3]
Additional Staff Needed for Accelerated Street Sweeping	100%[2]

[1]Funding not available for components dealing exclusively with drainage and flooding.
[2]Funding limited to 5 years. Level of staffing based on an approved work plan.
[3]A fee structure must be developed to continue effective ordinance implementation after state funding expires. During an initial 5-year period, state funding will cover up to 100% of the administrative costs not covered by fee revenue.

Source: Wisconsin Department of Natural Resources.

An annual review of the Local Assistance Grant Agreement is conducted through development of an annual work plan by the local unit of government. 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.

Nonpoint Source Grant Agreement

The Nonpoint Source Grant Agreement transmits funds from the state to the cities or villages to help pay for the installation of Best Management Practices (BMPs). The agreement usually runs for the full length of the project (8 years) and may be amended as needed. Once this grant is signed by both parties, then the city or village is funded to cost share practices on municipal land. If a practice is to be installed on private lands, then the funds are passed on to the landowner through a Cost-Share Agreement. Cost-share Agreements are described below.

Consistent with s. 144.25, Stats. and Chapter 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 entered into by landowners and the city or village within three years after approval of this watershed plan. The DNR may approve a variance to this schedule if circumstances warrant a change. The cost-share agreements are filed as part of the property deed. Management practices on municipal lands do not require a cost-share agreement, and thus may be installed any time during the eight-year implementation phase.

In the cases where a BMP is to be installed by a private landowner (on private lands) the city or village enters into the Cost-Share Agreement with the landowner. As described in Chapter NR 120, practices included on cost-share agreements must be installed within the schedule agreed to on 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. Practices affecting wetlands or the shoreline areas of lakes and streams are most likely to require a permit. 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. The responsible party will insure that BMPs installed through the program are maintained in accordance with the operation and maintenance plan for the practice.

Identifying Wildlife and Fishery Needs

Local units of government will consult with DNR's district wildlife management and fisheries management staff to optimize the wildlife and fish management benefits of nonpoint source control BMPs. Specifically, the DNR will be contacted if:

1. Streambank protection practices are considered.

2. Wetlands or other wildlife habitat components will be adversely affected by installation of BMPs.

The DNR staff will assist by:

1. Identifying streambank protection practices that benefit fish and wildlife.

2. Identifying wildlife habitat components that could be incorporated into vegetative filter strips along streams or in upland areas.

3. 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.

4. Assisting in questions concerning effects of nonpoint source BMPs on wetlands.

Cost Containment Procedures

Cost containment procedures for local units of government are governed by state statute. The statutory requirements will apply to the cases where the city or village is the cost-share recipient.

In the cases where a private landowner is the cost-share recipient, a minimum of three competitive bids must be received for the construction of the practice. The landowner must provide copies of the bids to the city or village before initiating construction. Cost-share funding will be provided based upon the lowest bid.

Fiscal Management Procedures, Reporting Requirements

The local units of government are required by NR 120 to maintain a financial management system that accurately tracks the disbursement of all funds used for the Yahara-Monona 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.

Best Management Practices

Best management practices are those practices identified in NR 120 and presented in this plan to be the most effective in reducing nonpoint sources of pollution. Design and installation of the urban and rural best management practices must meet the conditions listed in NR 120.

Preliminary specifications for the structural urban practices are described in Appendix D. Application of these practices will be guided by technical assistance provided by the DNR. Eligible urban management practices and state cost-share rates are listed in Table 6-5. Eligible rural management practices and state cost-share rates are listed in Table 6-6.

TABLE 6-5
STATE COST-SHARE RATES FOR URBAN BEST MANAGEMENT PRACTICES

Best Management Practice	State Cost-Share Rate
Structural Urban Practices (e.g., wet basins, infiltration areas, grass swales and porous pavement)	70%[1]
Land Purchases and Storm Sewer Rerouting for Detention or Infiltration Structures	50%[1]
Planting of Critical Eroding Areas	70%[2]
Drop Spillways and Channel/Grade Stabilization Structures (gully erosion control)	70%
Shoreline and Streambank Stabilization	70%
Shoreline Buffers	70%[2]
Wetland Restoration (eligible if done primarily for water quality improvement)	70%[2]
Upgraded Street Cleaning (e.g., vacuum sweepers)	50% for 5 yrs.[1,3]

[1]Applies only to structures for existing urban areas (not for new developments).
[2]Easements may be eligible in conjunction with these practices. The state or municipality may purchase the easement.
[3]This is an alternative best management practice not listed in NR 120 of the Wisconsin Administrative Code.

Source: Wisconsin Department of Natural Resources.

TABLE 6-6 STATE COST-SHARE RATES FOR RURAL BEST MANAGEMENT PRACTICES	
Best Management Practice	**State Cost-Share Rate (Percent)**
Contour Farming	50%[1,4]
Contour Strip Cropping	50[1,4]
Field Strip Cropping	50[1,4]
Field Diversions and Terraces	70
Grassed Waterways	70
Critical Area Stabilization	70
Grade Stabilization Structures	70[2]
Agricultural Sediment Basins	70
Shoreline and Streambank Stabilization	70
Shoreline Buffers	70[2]
Barnyard Runoff Management	70
Animal Lot Relocation	70
Manure Storage Facilities	70[5]
Livestock Exclusion From Woodlots	50
Wetland Restoration	70[2]
Roofs for Barnyard Runoff Management and Manure Storage Facilities	70
Nutrient and Pesticide Management	50[3]

[1]Flat rates for these BMPs can be found in Table 6-2.
[2]Easements may be entered into with landowners identified in the watershed plan in conjunction with these BMPs. See page 113 for where easements may apply.
[3]Spill control basins have a state cost-share rate of 70%.
[4]Wildlife habitat restoration components of this practice are cost-shared at 70%.
[5]Maximum cost-share amount is $10,000 including no more than $5,000 for manure transfer equipment.

Source: Wisconsin Department of Natural Resources.

Design and installation of all rural best management practices 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.

A brief description of the most commonly used rural BMPs listed in Table 6-2 is included in Appendix E. A more detailed description of these practices can be found in NR 120.14.

Activities and Sources of Pollution Not Eligible for Cost-Share Assistance

The following is a partial list of ineligible activities most often inquired about for cost-sharing. NR 120.10(2) contains a more complete list of ineligible activities.

1. Operation and maintenance of cost-shared best management practices (BMPs).
2. Construction erosion control practices.
3. Structural BMPs for new urban development.
4. BMPs installed prior to signing cost-share agreement.
5. Activities covered under the Wisconsin Pollution Discharge Elimination System (WPDES) Program.
6. Septic system controls or maintenance.
7. Dredging activities.
8. Activities and structures intended primarily for flood control.
9. Practices to be funded through other programs.
10. Manure spreading management.
11. Bulk storage of fertilizers and pesticides.

S.A.V.E. The Lakes
A Public Information & Education Campaign
Concept and Plan of Action
for the
Yahara-Monona Priority Watershed Project

Water resources within the Yahara-Monona Watershed are suffering, but there is no one to blame.

There are many at fault. Point source pollution is largely under control within the region. However, Lakes Monona, Waubesa and Wingra, along with a number of creeks and streams, continue to be plagued by symptoms of cultural eutrophication, such as algal blooms, excessive weed growth and sedimentation.

Clearly the culprit is nonpoint source pollution. To address the problem of nonpoint source pollution, we must stop pointing fingers. We must change the way people see the problem of water pollution, for we are all responsible for crimes against the water. To ease the suffering of the water resources within the Yahara-Monona watershed, many people must make significant changes in their behavior.

However, changes in human behavior require a complex series of steps, each step building on accurate information and accessible mechanisms for using such information. Behavior changes are most readily adopted when they mesh with commonly accepted cultural attitudes and concepts.

Thus, a conceptually based public information and education campaign is a prerequisite for the efficient functioning of any change-oriented program.

This campaign is based on concepts of consumer behavior and marketing, which indicate that individuals must pass through several clearly delineated stages prior to taking a specific action.

This campaign is structured around an acronym, which corresponds to different levels of public involvement with watershed activities and conveys the essential intent of all priority watershed activities.

It is called the S.A.V.E. the Lakes Campaign.

The "S" stage stands for the "Sensibility Phase," wherein activities are designed to develop and promote cultural attitudes conducive to the preservation of our water resources.

During the "Awareness Phase," watershed residents will learn about the threats to watershed resources, the origins of these threats and what they, as citizens, can do to protect their water resources.

The "Volition Phase" is designed to increase feelings of involvement with water resources and to encourage residents to want to do something about water quality.

The "Engagement Phase" provides watershed residents with means and opportunities to actively participate in efforts to preserve and improve water quality.

Changes in attitudes and behaviors do not happen quickly. This plan is designed to be implemented in overlapping and recurring phases, much the way that waves approach a shoreline. Basic messages will be repeated each year, in conjunction with activities and options designed to encourage increased understanding and involvement.

The S.A.V.E. the Lakes Campaign encompasses many activities designed to reach, educate and change the behavior of a wide range of audiences. Given the nature of the Yahara-Monona Watershed, the Information and Education plan could be no different.

Recent estimates place the population of the Watershed at 150,000 persons, representing nearly 40 percent of the population of Dane County. Direct contact for educational purposes and direct structural improvements on the property of significant landowners are not likely to be effective in such an urban area, with so many people and so many landowners.

Therefore, this Priority Watershed plan has elected to devote significant effort and resources to information and education. The S.A.V.E. the Lakes Campaign is designed to use existing networks of mass and special interest group communication to educate Watershed residents and change their behavior in relationship to their water resources. Once the message of the S.A.V.E. the Lakes Campaign has been delivered, area residents will know what they can do to protect their water resources and they will, if the program succeeds, install their own structural improvements.

The following section describes the process by which this Public Information and Education Plan was developed. The rest of the document includes discussion of the overall concept, rationale and goals of the S.A.V.E. the Lakes Program; description of the goals, objectives, target populations and activities of each level; a general timeline for implementation; cost estimates; and evaluation suggestions.

Project timelines, schedules and budget levels all followed from priority designation.

History

This Information and Education Plan for the Yahara-Monona Priority Watershed was developed through the efforts of the Yahara-Monona Steering Committee Public Information and Education Subcommittee.

The Subcommittee was established in December 1989. The group has met on a regular basis since that time. Initial discussion concerned target audiences. Four broad audience categories were identified: urban residents, rural residents, people living and working in developing areas, and local government officials.

Discussion then centered on how to reach selected populations, such as developers, and specific activities to be conducted with market segments.

Other major concerns included how to inform people of existing regulations and generate public excitement about water resource issues.

Public information and education plans for other priority watersheds were carefully examined. Materials reviewed include the Information and Education plan for the Black Earth Creek Priority Watershed, the Information and Education plan for the Milwaukee River Priority Watershed, and the Milwaukee River South Watershed Information and Education strategy. This plan is coordinated with the Dane County Lakes and Watershed Commission's Education Strategy.

A public opinion survey of Dane County residents, conducted by Wood Communications Group for the Dane County Lakes and Watershed Commission, has mapped the degree of information possessed by residents and measured residents' attitudes concerning water quality and nonpoint source pollution issues.

This information has been extremely useful in determining where information and education activities should begin and which activities should receive emphasis in the early stages of the watershed project.

In addition, many individuals have contributed their time and insight to the development of this plan. They include James Bachhuber, Roger Bannerman, Lloyd Eagan, Paul Gempler, Andrew Morton, James Schroeder, Jana Suchy and Wendy Weisensel. (So far.)

Priorities for Information and Education Activities within each phase of the S.A.V.E. the Lakes Campaign were set by the Public Information and Education Subcommittee. Highest priority activities are indicated by an asterisk on the following pages. Ongoing activities are indicated in bold type. The Yahara-Monona Steering Committee subsequently affirmed these activities and outlined project responsibilities for participating agencies.

Phase One: Sensibility

Public information and education will be a critical component in plans to develop "water-based consciousness," for we must change thoughts, behaviors and frames of reference for the general population.

Goal:

The goal of this portion of the public information and education campaign is to create a sensibility conducive to water resource management. A willingness to further the goal of the priority watershed project must be "in the air."

The specific principles for which we need to establish public acceptance are:

- point source pollution is not the sole cause of our polluted lakes;
- every individual in Dane County is, to some extent, responsible for the condition of our lakes;
- it takes a long time to see the benefits of water resource management;
- changes in behavior will not result in crystal clear lakes within the watershed;
- "mere" preservation of our water resources as they are is worth changing our behavior.

Objectives:

1. Develop a climate wherein education and behavioral changes can take place.

2. Promote acceptance of the principles of "water-based consciousness."

3. Assign water quality issues a prominent place on the public agenda.

Target Audience:

Media Representatives
Planners
Pundits
Ministers
Lake District
Community leaders
Student leaders
Fraternal organizations
Business leaders
Business associations
Movers
District environmental educators
Politicians
Activists
Conservationists
Environmentalists
Neighborhood associations
Cooperatives
Chambers of Commerce
Service organizations
Madison Club
Outdoors groups
Shakers

Suggested Activities: (* = High Priority)

*1. Get the "nonpoint message" out to influential community members.
   a. Develop mechanism to attract such individuals.
      (1) Recruit community leaders.
      (2) Establish a "club," e.g., "Lakesavers" or "Waterwatchers."
      (3) Set up system for recognition.
      (4) Establish meetings or other communication system with this group.
   b. Speak at meetings of influential community members.
      (1) Develop a Speaker's Bureau.
      (2) Promote bureau to relevant gatherings and associations.

*2. Build support among elected officials.
   a. Select likely supporters, key decision-makers throughout watershed.
   b. Address officials singly and in groups.
   c. Take officials on a tour of the watershed.

*3. Build support among business leaders, especially developers and contractors.
   a. Select likely supporters, key decision-makers throughout watershed.
   b. Address officials singly and in groups.
   c. Take business leaders on a tour of the watershed.

*4. Gain public exposure for issues and principles behind watershed activities.
   a. Arrange for "think pieces" in the press.
   b. Set up lengthy interviews for television and radio.

*5. Inform interested public of watershed plan and activities and get input.
   a. Send newsletters with survey questions.
   b. Distribute response forms at meetings.
   c. Ask attendees or those on mailing list to submit names of others interested.
   d. Consider increasing watershed newsletter frequency.

*6. Encourage influential community members to pass this "message" along.
   a. Provide rewards for carrying it on.
   b. Build continuation into message delivered.

*7. Develop or revise educational materials as needed.

*8. Review existing information and education materials.
   a. Solicit citizen input on available material and future needs.
   b. List available materials.

Phase Two: Awareness

This phase is predominantly educational in nature. In a recent survey, Dane County residents cited environmental concerns, such as water quality issues, at least four times as often as any single nonenvironmental issue as important for Dane County.

However, the same study indicated that . . . "by and large, residents do not believe that point source pollution is largely under control in Dane County and consequently, they do not believe that the focus of our remedial efforts must be controlling the multitude of nonpoint sources of runoff and sedimentation that we all generate."

Goal:

The goals of the Awareness phase of the S.A.V.E. the Lakes Campaign is to capitalize on citizen interest in water quality and provide watershed residents with specific and accurate information concerning:

- the nature of water quality problems in the watershed;
- the causes of these problems;
- what people can do to correct these problems.

Objectives:

1. Inform and educate the general public about water quality problems within the Yahara-Monona Watershed.

2. Teach the general public what causes water quality problems in the Yahara-Monona Watershed.

3. Show the general public how their actions can have a positive or negative effect on water resources.

4. Teach the general public behavior that will have a beneficial effect on water resources within the watershed.

5. Encourage people to adopt behavior that will protect water resources within the watershed.

Target Audiences:

The general public of urban and rural residents is, in general, the target for the awareness campaign. Specific activities are designed to reach specific segments of the population as follows:

Students
New residents
Gardeners
Students
Farmers
Pet owners
Travelers
Bus riders
Gas stations

Teachers
New homeowners
Outdoors people
Shoppers
Attendees at civic events
Children
Fraternal organization members
Beach users
Businesses

Suggested Activities: (* = High Priority)

*1. Develop signs designating the Yahara-Monona Priority Watershed. Put them up.
   a. Develop signs saying where things drain to, such as a "WARNING! Droplet crossing to Lake Wingra!" sign with a little raindrop on it.

*2. Develop and implement demonstrations of a variety of best management practices.
   a. Select specific best management practices appropriate to current needs.
   b. Implement demonstrations.
   c. Promote tours of demonstration projects.

*3. Develop public service announcements, video and audio, for each season and special events.
   a. Events include such activities as:
      (1) mulch time
      (2) storm drain stenciling
      (3) fertilizer use
      (4) pesticide use
      (5) street sweeping
      (6) weed harvesting
      (7) cleanup efforts
      (8) adopt-a-stream outings
      (9) detention basin demos
      (10) septic awareness pieces
      (11) more
   b. Develop and follow seasonal schedule of PSA placement.

4. Have an information booth at expositions, such as:
   a. the County Fair
   b. the Boat Show
   c. the Fishing Expo
   d. the Camping Show
   e. What about pet shows?

5. Papa Drop and Droplet visit schools to:
   a. perform a scripted piece
   b. assist in an educational presentation
   c. be donned by teachers with prepared scripts or their own ideas
   d. place articles in teacher association newsletters to discuss campaign and ways to get involved, such as having Papa Drop and Droplet come to their classes

6. Do slide show/video presentations for community groups, fraternal organizations, etc.
   a. Select key groups first, such as environmentalists, fishers, gardeners, pet owners

7. Arrange for realtors to distribute storm water management fact sheets to new homeowners.

*8. Encourage weather announcers to give water quality tips: "There's a 90 percent chance of rain; not a good day to fertilize your lawn," etc.

9. Distribute information with pet, fishing and boat licenses.

*10. Develop and distribute water quality placemats.
   a. One design should be for rural cafes.
   b. Develop a second design for kids, featuring Papa Drop and Droplet.

11. Set up boat tours of the lakes, watershed.

12. Institute a Yahara Lakes Week, an annual event.
   a. Schedule several activities and demonstrations to take place during the week, including the State of the Lakes Report.

*13. Schedule public appearances and distribution of educational materials by Papa Drop and Droplet at parades, fairs, festivals, etc., such as:
   a. the Taste of Madison
   b. the Art Fair on the Square
   c. the Badger State Games
   d. the Concerts on the Square
   e. the Drum and Bugle Corps
   f. the Paddle and Portage
   g. the Sun Prairie Corn Festival
   h. other major events in watershed communities

14. Arrange for television appearances by Papa Drop and Droplet on Fox 47 All-Star show and through "For Kids' Sake" or "Wednesday's Child" spots.

15. Papa Drop and Droplet go to the Farmers' Market.
   a. volunteers staff an education table
   b. materials distributed to farmers selling

16. Set up an information booth at the Dane County Regional Airport.

17. Set up and promote a Speakers' Bureau.

18. Develop a lake water quality index, similar to the wind chill factor (the pea soup factor), have volunteers take readings regularly and distribute ratings to local media: "Today's PSF is 9, so if you're planning to go swimming make sure your feet are attached."

19. Provide informational material and signs at public beaches.

*20. Set up and distribute a special newspaper supplement on water quality issues in the watershed.

21. Distribute information at rural supply stores.

22. Papa Drop and Droplet go to the Malls at special events to promote water quality and hand out brochures.

23. Include educational materials in Welcome Wagon literature.

24. Include water quality information in literature for MATC and UW students.

25. Produce a record of local musicians, promoting water quality: "We are the weeds; we are the algae."

26. Arrange for kids to draw pictures about Saving the Lakes, then make a touring exhibition of these drawings, sent to other schools, government offices and businesses.

27. Develop and distribute bus cards featuring Papa Drop and Droplet, and water quality seasonal tips, to complement PSAs.

28. Place Papa Drop and Droplet on milk cartons.

29. Place Papa Drop and Droplet on shopping bags.

30. Arrange for banks to distribute informational pieces in their monthly statements.

31. Distribute information at oil purchase points.

Phase Three: Volition

Available research indicates that humans pass through a period of desiring a product or a change in behavior, prior to actually taking the action in question.

This phase of the Public Information and Education Plan for the Yahara-Monona Priority Watershed is designed to motivate watershed residents to change their behavior.

Through the "Sensibility" phase, they will have developed an attitude favorable to making an individual effort to promote water quality.

As a result of the "Awareness" phase, citizens are now better informed about the causes of water pollution and what they can do to improve the situation.

Goal:

The goal of the Volition phase of the S.A.V.E. the Lakes Campaign is to motivate watershed citizens to take personal, positive action to protect and improve water resources. Activities and information will be developed for large and small population segments to build involvement and provide specific groups with specialized information, motivation and reward.

Objectives:

1. Instill a desire to protect water resources.

2. Convince the general public that it is pleasurable and easy to take steps to preserve water quality.

3. Provide readily available and easily understood guidelines for changing behavior to promote water quality.

4. Provide multiple opportunities for people to "get their feet wet" in best management practices.

5. Make sure people know what to do or who to call if they want to take steps to protect water resources.

6. Provide positive reinforcement, such as cost-sharing or financial reimbursement, if appropriate, for those who do change their behavior to protect water resources.

Target Audiences:

Builders
Unions
Outdoors clubs
PTAs
Elected officials
Wildlife clubs
Veterinarians
Country clubs
Homeowners
Landlords
Pet owners
Swimmers
Gardeners
Sports enthusiasts
Children
Obedience schools
Garden clubs
Faculty groups
Outdoors stores
Neighborhood associations
Business people
Pet stores
Madison Ski Team
Churches
Tenants
Car washers
Boaters
Fishers
Shoreline residents
Nonelected officials
Lawn and garden businesses
Businesses

Suggested Activities: (* = High Priority)

*1. Develop a format for a "Run-Off Run" that would take contestants through drainage areas and alert them to stormwater control issues.
   a. Encourage neighborhood associations to use this format to educate their members, raise their own funds and visibility.

*2. Work with the Chamber of Commerce and the Convention and Visitor's Bureau to make people fall in love with the lakes.
   a. Make "I ♥ the Lakes" bumper stickers.
      (1) Or "The Yahara Lakes--Love 'em or Weed 'em"

b. What would Madison be without the lakes?
   (1) Have a contest to that effect with prizes for the funniest slogans.
   (2) Use those funny slogans on PSAs, T-shirts, hats, posters. Attach best management/water quality preserving practices to these goods.

*3. Demonstration sites of best-management techniques, with owners talking side by side with the experts about how good it feels to make these changes.
   a. Pay great attention to money-saving benefits.
   b. Some should be rural in emphasis.

4. Develop and distribute a series of testimonials/press releases/features, concerning best management techniques.
   a. Distribute materials through interest group networks; e.g., lawn things through garden clubs, pet waste through obedience schools.
   b. Arrange for leaders of these groups to push these practices.

5. Have a "Stormwater Stew" event, wherein people, kids, or groups from all over the watershed collect runoff from drains, downspouts, etc. Then they can analyze it themselves and/or send it someplace to find out what's in it. There will need to be appropriate instructions and safeguards for public health.
   a. Have prizes for dirtiest and cleanest samples.

6. Set up an organic lawns and gardens contest. Augment your soil naturally.

7. Sponsor a "Jump for the Lakes" jump rope contest, to raise money, visibility and heart rates for the Yahara Lakes.

*8. Sponsor a "Color Me Blue" coloring contest. What if it were for adults?

Phase Four: Engagement

The purpose of this phase of the S.A.V.E. the Lakes Campaign is to make sure Yahara-Monona Watershed citizens get wet. At least figuratively.

As the Yahara-Monona Priority Watershed Information and Education plan has developed, the public has progressed through a heightened SENSIBILITY of water resource concerns, to an enhanced AWARENESS of water resource issues, to a state of VOLITION, wherein they desire to do something to protect and improve water quality.

Goal:

The goal of the Engagement phase of this program is to actively involve citizens in the preservation of their water resources.

To coin a paraphrase, you can't clean up the lakes without getting a little bit wet.

Objectives:

1. To develop, promote and conduct educational, hands-on experiences of practices area residents can adopt to protect water resources.

2. To physically involve a broad spectrum of watershed citizens in water management activities.

3. To provide materials and support services that will encourage citizens to permanently adopt "water wise" behaviors.

4. To develop and establish reward mechanisms for individuals, organizations and businesses adopting such practices.

5. To encourage positive, goal-oriented interaction between elected officials and water quality activities.

Primary audience:

Neighborhood associations
Scout groups
Homeowners
Developers
Fraternities
Teachers
Elected officials
Absentee landowners
Sporting groups
Environmentalists
Farmers
Realtors
Sororities
Students
Political parties
Businesses

Suggested Activities: (* = High Priority)

*1. Develop activities for important and identified pollutant contributors as needed.
   a. Develop a plan for involving commercial areas in water quality efforts, such as a "B & B Club," which would involve businesses in beautification work.

*2. Develop an awards program to honor such entities as the Conservation Farmer of the Year, the Cleanest Parking Lot, the Ultimate Urban Homeowner, etc.

*3. Provide cost-sharing for implementation and demonstration of best management practices, to include small- and large-scale activities, such as:
   a. lawn terracing
   b. stream fencing
   c. porous pavement installation

4. Promote neighborhood involvement in hands-on activities associated with management practices in the priority watershed, such as landscaping sedimentation basins, cleaning out catch basins in their neighborhood with municipal assistance, etc.

5. Continue teacher in-service days, emphasizing curriculum adoption as part of their classes.

6. Continue Youth Conservation Corps activities.

*7. Work with private developer to develop a site to serve as an example to other developers.

8. Set up ways for conservation farmers to spread their message to their peers.

9. Establish a Neighborhood Watch kind of program, to promote water quality, such as "Watch for Papa."

10. Implement "Adopt a Stream" program.
   a. Get public schools, at appropriate levels, involved.
   b. Develop programs for older adults.
   c. Work these programs into Extension courses.
   d. Explore avenues such as Wisconsin Union mini-courses.
   e. Seek involvement from sporting groups.

11. Continue "Take a Stake in the Lake" activities.
   a. Develop competition between various groups involved in event (e.g., fraternities, etc.) concerning pounds of weeds harvested.

12. "It's Mulch Time" - Promote citizen interest and use of city mulch.

13. Establish volunteer groups that can be quickly mobilized to go out and do a little weeding in the lakes, on an ongoing basis.
   a. Publicize the existence of such groups.
      (1) They need a good name: Ninja Weeders, the WeedEqualizers, Operation "Death to Weeds," the Weed Team, the W Squad. . .
      (2) Time commitment would be minimal and established at the outset.

(3) Participants could wear green headbands, have secret identities, code words and, of course, the organizer would be known only by his code name, "Papa!"

b. Send appropriate information to lake shore residents.

c. Explore possibilities of making minimum payments to weeders.

Timeline of Activities

The S.A.V.E. the Lakes Information and Education Campaign is designed to be implemented in a series of overlapping waves, with elements of the Sensibility, Awareness, Volition and Engagement phases scheduled for each year of the project.

The program is structured to move individuals through stages of involvement with water resources in the Yahara-Monona Watershed. However, area residents currently have a wide-ranging awareness of water pollution and its causes. Thus, the information and education campaign is formulated to meet residents at their current level and take them through an educational process.

Repetition of phases is also a key element of the plan, for two reasons. First, the population of the Yahara-Monona Watershed can be highly transient, reflecting the presence of thousands of university students and general demographic patterns. Second, it takes a good deal of time and effort to change values and behavior. Not all people will absorb the message the first time around, so they must be exposed to it on an ongoing basis.

Ongoing programs administered by such organizations as the Dane County Extension and the Lakes and Watershed Commission have been incorporated in planning the S.A.V.E. the Lakes Campaign. This was done to maximize the effectiveness of public dollars and to allow the Yahara-Monona Priority Watershed project to benefit from such successful activities as Take A Stake in the Lakes, Adopt-A-Stream, the Dane County Youth Conservation Crew and teacher in-service days.

The public information officer will be responsible for the development of new programs detailed in this plan. At times work will be contracted out or performed by one of the many agencies involved in the Yahara-Monona Priority Watershed. Cost-sharing arrangements will be worked out wherever possible. The public information officer will oversee such arrangements and, in general, serve as a reference point for all information and education activities. Documentation of the project and general distribution of materials will also be the responsibility of the public information officer.

Table 6-7 outlines the nine-year timeline for proposed activities. Each year's activities will be evaluated and the plan revised accordingly. However, this document does provide a road map for the S.A.V.E. the Lakes Campaign, based on the plan's philosophy and the priorities set by the Yahara-Monona Information and Education Subcommittee.

TABLE 6-7
TIMELINE FOR PROPOSED ACTIVITIES

Area	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-
Sensibility	Influential community members Speakers Bureau Elected officials Watershed Tours	Speakers Bureau Business Leaders Watershed Tours Think pieces & interviews Newsletters	Speakers Bureau Newsletter	Speakers Bureau Watershed Tour Newsletter	Speakers Bureau Newsletter	Speakers Bureau Newsletter	Speakers Bureau Watershed Tour Newsletter	Speakers Bureau Newsletter	Speakers Bureau Watershed Tour Newsletter
Awareness	Signs Produce 2 PSAs Run PSAs Schedule PSAs Expo booth Drops at school Write Drop piece District contacts Realtors give out info Drops at fairs Drops on kids' TV	Set best mgt. demos Produce 2 PSAs Run PSAs Expo booth Drops at school Contact educators Review AV materials Adjust AV materials Do AV shows Realtors/info Yahara Lakes Week Drops at fairs Newspaper special ed	Start best mgt. demos Produce 2 PSAs Run PSAs Expo booth Drops at school Reach teachers Realtors/info Info w/pet, fish & boat licenses Boat tours Lakes Week Drops at fairs Drops at Farmers Mkt. Beach info	Tour best mgt. demos Produce 2 PSAs Run PSAs Expo booth Drops at school Reach teachers Realtors/info License/info Placemats Boat tours Lakes Week Drops at fairs Drops on TV Info at airport Water quality index-PSF Beach info	Tour best mgt. demos Produce 2 PSAs Run PSAs Expo booth Drops at school Reach teachers Realtors/info License/info Placemats Boat tours Lakes Week Drops at fairs Drops at Farmers Mkt. Airport/info PSF Beach info Rural supply stores/ info	Tour best mgt. demos Produce 2 PSAs Run PSAs Expo booth Drops at school Reach teachers Realtors/info License/info Placemats Boat tours Lakes Week Drops at fairs Airport/info PSF Beach info Rural supply stores/ info	Tour best mgt. demos Run PSAs Expo booth Drops at school Realtors/info Reach teachers Realtors/info License/info Placemats Boat tours Lakes Week Drops at fairs Drops at Farmers Mkt. Airport/info PSF Beach info Newspaper special ed Rural supply stores/info	Tour best mgt. demos Run PSAs Expo booth Drops at school Reach teachers Realtors/info License/info Placemats Boat tours Lakes Week Drops at fairs Drops on TV Airport/info PSF Beach info Rural supply stores/ info	Tour best mgt. demos Run PSAs Expo booth Drops at School Realtors/info License/info Placemats Boat tours Lakes Week Drops at fairs Airport/info PSF Beach info Rural supply stores/info
Volition	Contacts for "I Love the Lakes" Yard care demo Interest group dist. info Color Me Blue	Runoff Run Lake Love Campaign Business care demo Interest group info Rural care demo	Lake Love Campaign Business care demo Interest group info	Yard care demo Interest group info Stormwater stew	Yard care demo Organic lawns/ gardens contest	Business care demo Jump For the Lakes	Rural care demo Organic lawns/ gardens contest	Rural care demo Yard care demo Organic lawns contest	Demo Interest group Organic lawns contest
Engagement	Release info from models Teacher in-service YCC Adopt-A-Stream Take-A-Stake	Organize groups in key areas Do materials on key pollutants Cost-sharing programs	Do demos for key areas & pollutants Involve businesses Cost-sharing programs	Work w/groups in key areas Demo sign-up Involve businesses Cost-sharing programs	Work w/groups in key areas Involve businesses Awards program Cost-sharing Model developer programs	Work w/groups in key areas Involve businesses Awards program Cost sharing Community mail Cons. Farmer subsidies	Work w/groups in key areas Involve businesses Awards program Cost sharing Watch for Papa Rural	Work w/groups in key areas Involve businesses Awards program Cost sharing Adult ed Rural	Work w/groups in key areas Involve businesses Awards program Cost sharing Watch for Papa Rural

Change and adaptation are also anticipated components of the Information and Education plan. The Yahara-Monona Priority Watershed project will last for many years. Circumstances will change and activities will enjoy varying degrees of effectiveness and it is expected that revisions to the plan will be necessary in light of experience. The public information officer will make such changes as are needed, in cooperation with official agencies as required.

Summary of 1991-1992 Activities

The first year of the campaign will focus on Sensibility and Awareness activities, with development of Volition and Engagement plans (see Table 6-8 for summary of activities, staff hours and proposed budget).

In the Sensibility category, outreach and involvement of community leaders, from elected officials to corporate representatives, will be the highest priority. Community leaders prominent in all aspects of life within the watershed will be contacted, told about the priority watershed project and brought into the campaign. Development of a Speaker's Bureau and Watershed tours will also assist in the growth of a "water-based consciousness."

Signs, schools, fairs and flyers are the key Awareness activities for the first year of the campaign. Signs alerting passersby to the fact that they are in the Yahara-Monona Watershed will be developed and placed in strategic areas.

Papa Drop and Droplet, two water quality mascots, will visit schools within the watershed to teach children about nonpoint source water pollution and what they can do about it.

The giant water drops will also be prominent participants at area fairs and expositions, taking their water quality message to a general audience. "Better Lawns and Gutters," a guide to promoting water quality in your own backyard, will be distributed by participating realtors.

Highly produced public service announcements on television and radio will also build awareness for a general audience.

A major component of the Volition Phase for the first three years of the program is a project called "I Love the Lakes." Intended to make people fall in love with watershed resources and, hence, take care of them, this campaign will be a cooperative venture between public and private agencies. Initial contacts and planning for this project will take place in the first year of the S.A.V.E. the Lakes program.

A combination of educational outreach with a coloring contest, the "Color Me Blue" project, will be kicked off at the Dane County Fairs during the summer of 1991.

A yard care demonstration and distribution of resource material to interest groups round out activities planned in the Volition category for the first year of the campaign.

Release of information from computer modeling work, to the general public and targeted groups, will set the stage for Engagement activities in the first and following years of the S.A.V.E. the Lakes Campaign. The campaign will also connect with successful ongoing programs run by public agencies, such as the Dane County Youth Conservation Crew, Take a Stake in the Lakes, Adopt-A-Stream and teacher in-service days. These programs all help people get their feet wet--literally--with water quality issues.

Summary of 1992-1993 Activities

In the second year of the S.A.V.E. the Lakes Campaign, information and education activities will build upon elements from the first year of the project and develop new activities (see Table 6-9 for summary of activities, staff hours and budget).

In the Sensibility area, community leaders will continue to function as advisors and participants in the program. They will be briefed on the progress of the priority watershed project and encouraged to promote the project among their constituencies. The Speakers' Bureau and watershed tours will provide members of service organizations and professional groups with increased exposure to water quality issues. Long "think" pieces and interviews will be placed in print and broadcast media, to reach decision-makers and to establish nonpoint source pollution on the public agenda. The Yahara-Monona Watershed newsletter will be examined, revamped and the mailing list expanded as appropriate.

TABLE 6-8
YAHARA-MONONA I&E COSTS AND HOURS
JULY 1991 - 1992

Activity	Design	Printing	Production	Materials	Mailings	Supplies	Promotion	Trans.	PIO Hours	PMC Hours	Ext. Hours	RPC Hours	L&WC Hours	Outside Hours	Total Cost	Total Hours
Involve community leaders	$50	$50			$100	$100			60	100		10	15	Contract? $4,500	$4,800	185
Assist watershed, assoc. newsletters	1,000	500			450				60		10	20		RPC or contracted	1,950	90
Develop & promote Speaker's Bureau	200	300				75			30	50		10	10		575	100
Enlist municipal official support				275	75	50			45	100		40	20		400	205
Officials tour the watershed				275	75	100		150	25	25		25	20		600	95
Put up signs designating the watershed	300		600					300	30	25		10	10	Possible DCYCCC job	1,200	75
Mass media PSAs - audio & video			12,000						30				40	Contract	12,000	70
Staff displays at expositions				75		425			100	30		20	20		500	170
Review needs/options with educators									45		30	5	5	DC Environ. Council	0	85
Write educational play using Drops		75							40		25	5			75	70
Involve realtors with info distribution									25						0	25
Weather announcers add eco tips				75					35				20	Contract. $3,500	3,575	55
Papa Drop & Droplet on kids' TV									15				10	Contract. $3,440	3,440	25
"I Love the Lakes" Campaign				50	50	50			30	50	25	15	25	Contract. $3,000	3,150	145
Yard Care Demonstration - Spring 1992		1,000		500		500	500		15		80	10	20	Coord. $1,500	4,000	125
"Color Me Blue" contest	300	400	400	125		200	500		60		80	10	15	Contract. $5,000	6,925	165
Press conference on loading info - 1991				25	35				10	15		10	5		60	40
Teacher in-service[2]									15		75	10	10	DNR - D. Yockers		110
Youth Conservation Crew[2]									10	30						40
Adopt-A-Stream - Streambanks[2]									35							35
Take-A-Stake in the Lakes[2]									50	30		20				100
Meetings & agency coordination									60						0	60
Documentation		3,000							20		75		10		3,000	105
Distribution of materials		5,000[1]			250				30						5,250	30
Plan development, revision & updates									100						0	100
Storm drain stenciling				100	75				15				15		175	30
TOTAL	$1,850	$10,325	$13,000	$1,500	$1,110	$1,500	$1,000	$450	990	455	400	220	270	$20,440	$51,675	2,335

[1]For reprinting 10,000 copies of "Better Lawns & Gutters" booklet.
[2]Principal costs assumed by other agencies.
Note: PIO = Public Information Officer; PMC = Project Management Coordinator; Ext. = Dane County Extension; RPC = Regional Planning Commission; L&WC = Lakes & Watershed Commission (Watershed Mgt. Coordinator).

TABLE 6-9
YAHARA-MONONA I&E COSTS AND HOURS
1992 - 1993

Activity	PIO Hours	PMC Hours	Ext. Hours	RPC Hours	L&WC Hours	Outside Hours	Total Cost	Total Hours
Community leaders' involvement	60	100		10	20	Contract? $3,000	$3,300	190
Speaker's Bureau	20	50		10	10		500	90
Business leaders' involvement	30	100			10		150	140
Business leaders' watershed tour	25	25		15	15		650	80
Placement of long pieces, interviews	20	10			10		0	40
Coordinate watershed newsletter	80		10	20		RPC or contracted	1,950	110
Review materials, revise & reprint	25	10	25	10	10		1,000	80
Select BMPs appropriate for area	15	15		15	5		0	50
Mass media PSAs - audio & video	30				5	Contracted	12,000	35
Staff booths at appropriate expos	80	20		20	20		525	140
Papa Drop & Droplet teach kids	45		25		15		1,500	85
Make presentations to community groups	40	40	40	10	15		400	145
Yahara Lakes Week	55	50	50	20	25	Contract? $6,000	9,500	200
Papa Drop, Droplet & info at fairs	45	10	15	15	10		400	95
"I Love the Lakes" campaign	45	50	25	20	20	Contract? $6,000	7,575	160
Demo of rural BMP	40	20	25	20	15	Extension	1,650	120
Key loading areas - Runoff Run	70	10	25	10	20	Contract. $7,000	9,100	135
Develop materials on key pollutants	35		15	10	10	RPC or contracted	1,100	70
Teacher in-service[1]	15		75			DNR - D. Yockers		90
Adopt-A-Stream[1]	20							20
Take-A-Stake in the Lakes[1]	25	30						55
Distribute materials to interest groups	25	25	30				400	80
Coordination between agencies	60						0	60
Documentation	20		75	10	10		3,000	115
Distribute general materials	20						200	20
Revise & update plan	30						0	30
TOTAL	975	565	435	215	245		$54,900	2,435

[1]Principal costs assumed by other agencies.
Note: PIO = Public Information Officer; PMC = Project Management Coordinator; Ext. = Dane County Extension; RPC = Regional Planning Commission; L&WC = Lakes & Watershed Commission (Watershed Mgt. Coordinator).

Public demonstrations of best management practices for key polluting areas, as determined by watershed pollutant loading analysis, will be major Awareness activities during 1992. Production of new public service announcements and scheduling of existing inventory will continue to build awareness of water quality issues among the general population. Papa Drop and Droplet will visit schools, community fairs and expositions to continue educating and personalizing nonpoint source pollution issues. Audiovisual materials will be evaluated and revised as needed, prior to contacts and presentations for community groups. Realtors, banks, Welcome Wagons and other organizations dealing with new homeowners and newcomers will be asked to distribute "Better Lawns and Gutters, A Guide to Protecting Water Quality in Your Own Backyard." A special nonpoint source water pollution supplement to watershed-area newspapers will be distributed to a mass audience. Plans will be underway for institution of Yahara Lakes Week, to include events, major media coverage and the "State of the Lakes" report, all designed to educate and build awareness of water quality issues, solutions and progress.

Four major initiatives are planned for the Volition phase of the S.A.V.E. the Lakes in 1992, all designed to increase the desire of specific groups to become involved in efforts to protect our water resources. Work will continue on the public-private "I Love the Lakes" campaign, with initial materials produced and distributed this year.

Best management practices specific to businesses will be selected and specific businesses in this primarily urban watershed will be encouraged to adopt said practices--with attendant publicity. Interest groups with a close relationship to water resource issues will be contacted, informed about the priority watershed project and provided with possibilities for involvement, such as Adopt-A-Stream or Storm Sewer activities, revegetation, cleanup campaigns and more.

A "Run-Off Run" format will be developed for use by neighborhood associations and implemented. The run will serve many purposes: it will show participants the paths water takes in their areas, it will bring neighborhoods together and heighten collective understanding of water quality issues, and it will help raise funds to enable community groups to continue working on environmental problems.

Analysis of pollutant loading information and computer modeling work will provide the project with likely candidates for key pollutants in the Yahara-Monona Priority Watershed and areas contributing highly significant levels of pollutants. In the 1992 Engagement phase this information will lead to efforts to organize and mobilize community groups in significant areas. Materials on key pollutants will be developed and distributed through appropriate channels to the population with the greatest potential impact on these materials. Information and education activities will also support and promote the sign-up phase of the watershed project. The campaign will continue working with successful programs run by public agencies, such as the Dane County Youth Conservation Crew, Take A Stake in the Lakes, Adopt-A-Stream and teacher in-service days.

Summary of 1993-1994 Activities

Information and education activities will build upon elements from the first two years of the project, with the addition of new activities and expansion of others, in the third year of the S.A.V.E. the Lakes Campaign (see Table 6-10 for summary of activities, staff hours and budget).

The advisory group of community leaders will continue to be kept up to date on the progress of the priority watershed project and their influence will continue to promote the project among key constituencies, to promote the water-based consciousness central to the Sensibility phase of the project. The Speakers' Bureau and the Yahara-Monona Watershed newsletters will provide interested individuals, members of service organizations and professional groups with increased exposure to water quality issues.

Awareness plans for 1993 include distribution of focused informational flyers with pet, fishing and boating licenses, as appropriate. Posters providing nonpoint source information will be displayed at watershed beaches. Boat tours will provide participants with a better understanding of the watershed and its problems. Demonstrations of best management practices for key polluting areas will continue.

The general population will continue to learn about nonpoint pollution and what they can do about it through a growing roster of professionally produced public service announcements. Educational efforts will include teacher outreach, as well as visits from Papa Drop and Droplet to schools, community fairs and expositions. Organizations dealing with new homeowners and newcomers will distribute informational materials.

The second annual Yahara Lakes Week will take place, with events, coverage of watershed projects and the "State of the Lakes" report all focusing public attention on our water resources and efforts to protect them.

TABLE 6-10
YAHARA-MONONA I&E COSTS AND HOURS
1993 - 1994

Activity	PIO Hours	PMC Hours	Ext. Hours	RPC Hours	L&WC Hours	Outside Hours	Total Cost	Total Hours
Coordinate watershed newsletter	85		15	20	15	RPC/Contracted	$1,950	135
Speaker's Bureau	30	50	15	15	10		350	120
Community leaders (WaterWatchers)	40	100		15	20	Contract. $3,000	3,300	175
Best management practice demo	45	60	20	15	10		1,750	150
Mass media - audio and/or visual PSAs	25				5	Contracted	12,000	30
Papa Drop & Droplet visit schools	50		25		10		1,100	85
Give info with fish, boat, pet licenses	30		10	10	10		1,300	60
Yahara Lakes Week - contest & info	55	35	50	20	20	Contract. $7,500	11,050	180
Tables at expos, fairs, farmers' markets	75	10	10	15	15	Volunteers	625	125
Watershed boat tour	50	25	25	15	15		1,350	130
Information at beaches	45		20	20	10	Contract. $1,000	2,350	95
"I Love the Lakes" campaign-contest	75	40	25	15	20	Contract. $7,500	11,500	175
Business best management practice	30	40	15	10	10		2,000	105
Get info to interest groups	20	15	20	5	10		750	70
Demo at key loading area	45	45	15	15	15		4,000	135
Demo with key pollutant	45	25	30	10	10	Contract. $2,000	4,000	120
Involve commercial areas	35	50	15	10	15		800	125
Work with neighborhood associations	45		45	10	10		850	110
Take-A-Stake in the Lakes[1]	30	30						60
Coordination between agencies	60						0	60
Documentation	20		75				1,000	95
Distribute materials	20	10					200	30
Revise & update plan	20						0	20
TOTAL	975	535	430	220	230		$62,225	2,390

[1]Principal costs assumed by other agencies.
Note: PIO = Public Information Officer; PMC = Project Management Coordinator; Ext. = Dane County Extension; RPC = Regional Planning Commission; L&WC = Lakes & Watershed Commission (Watershed Mgt. Coordinator).

The "I Love the Lakes Campaign" will move into high gear in 1993, with a possible "Sloganeering" contest projected, along with massive publicity. Demonstration of a rural best management practice is planned, along with outreach efforts using official networks, rural media, social service organizations and informal contacts.

Business best management practices will be encouraged and enterprises adopting these practices will be featured through special interest communication networks. Work will continue with interest groups connected to water resource issues as these groups take on specific watershed projects.

Work with community groups in key loading areas will continue in the 1993 Engagement phase, with demonstrations of best management practices for these areas and key pollutants on the drawing board. Efforts to involve the business community in these projects will increase. Information and education activities will continue to support and promote the sign-up phase of the watershed project.

The campaign will continue its involvement with the Dane County Youth Conservation Crew, Take A Stake in the Lakes, Adopt-A-Stream and teacher in-service days.

Summary of Activities During the Planning Phase

A variety of public information and education activities have taken place during the planning stages of the Yahara-Monona Priority Watershed Project.

A lawn care field day and walking tour was conducted in the Westmorland Neighborhood in Madison. Over 300 people attended the event, which demonstrated how homeowners can help reduce nonpoint source pollution. A "Better Lawns and Gutters" publication was developed in conjunction with the event.

Papa Drop and Droplet, water quality mascots developed for the Dane County Lakes and Watershed Commission, have been quite busy. Papa Drop and the Lakes and Watershed Coordinator addressed all the third grade students at Aldo Leopold School and helped them learn about things they could do to help clean up our water resources. Papa Drop and Droplet also took part in the Holiday Parade and visited the Sun Prairie Middle School.

A teacher in-service day, organized by Dane County Extension in cooperation with the Regional Planning Commission and the Department of Natural Resources, brought together middle and high school teachers from throughout the watershed and showed them ways they could integrate water quality issues with their curricula. Many teachers have requested water testing kits, maps, brochures and other materials as a result of this experience.

Storm drain stenciling has also begun. This activity, suitable for all ages, brings together community groups and sends them out to mark storm sewers with the phrase "DUMP NO WASTE--DRAINS TO LAKE." This activity educates participants and passersby. Initial supplies were provided by a private business.

Water quality experts from the DNR, RPC and Dane County Lakes and Watershed addressed a neighborhood association within the watershed, telling audience members about the water quality problems in their own backyard and what they could do about them.

An informational display concerning the Yahara-Monona Priority Watershed, nonpoint source pollution and the many ways individuals can have an effect on the environment was set up at the Sequoya Branch Library in Madison.

Brochures promoting Extension workshops on construction site erosion control were distributed to Dane County contractors.

The Yahara-Monona Steering Committee sponsored a cleanup of Starkweather Creek by the Dane County Youth Conservation Corps.

Through two days of operating a booth at the Sixth Annual Fishing Expo roughly 800 Yahara Lakes brochures and a similar number of "Papa Drop" flyers were distributed to outdoors enthusiasts. Hundreds more passed a display describing the Yahara-Monona Priority Watershed, its goals and how to be a part of it. The booth has also been set up at the Dane County Fair and other community events.

Evaluation

Evaluation of the S.A.V.E. the Lakes Campaign will be multifaceted and ongoing, to make sure project efforts are effective.

Staff and steering committee members will regularly review specific projects to compare what these activities accomplished with their attendant costs and project objectives. These evaluations may result in the continuation or cancellation of certain activities.

The steering committee will examine the overall progress of the information and education campaign on at least an annual basis. Staff and volunteers will look at such indicators as number of people reached, materials developed, events generated, events attended and materials distributed.

However, it should be noted that these figures do not really indicate whether the S.A.V.E. the Lakes Campaign has reached the hearts and minds of watershed citizens. Accordingly, it is suggested that a survey be taken midway through the project to evaluate residents' response to the program.

In 1990 a benchmark survey of Dane County residents' attitudes and behaviors concerning water quality was conducted by the Wood Communications Group.

Telephone interviews were conducted with randomly selected adults in 400 households. The sample was representative of the county in terms of age, education and household income.

The survey included questions on use of Dane County surface waters, attitudes about sources of water quality problems, attitudes about effective action and individual responsibility for reducing nonpoint source water pollution.

The survey revealed that while there is widespread concern about water pollution and a general consensus concerning the importance of water quality issues, perceptions of the causes and cures of water pollution are as murky as the lakes themselves can be.

To evaluate the effectiveness of the Yahara-Monona Priority Watershed Information and Education campaign, it is suggested that this study be repeated within the watershed after the S.A.V.E. the Lakes Campaign has been in operation for roughly three to five years.

Comparison of the latter results with the original study will add a measure of accountability to public information efforts. Furthermore, it will allow for redirection of efforts as needed.

The estimated cost of such a survey is $10,000.

CHAPTER 7

PROJECT EVALUATION AND MONITORING

Introduction

This chapter briefly summarizes the plan for monitoring the progress and evaluating the effectiveness of the Yahara-Monona Priority Watershed Project. The evaluation strategy includes three components:

1) administrative review;
2) pollution reduction evaluation; and
3) water quality evaluation monitoring.

Information on the first two components will be submitted to the Project Management Coordinator by the Land Conservation Department (LCD) and local municipalities and will be reported on a regular basis to DNR and DATCP. The third component is performed primarily by the DNR. Additional information on the numbers and types of practices on cost-share agreements, funds encumbered on cost-share agreements, and funds expended will be provided by DNR's Bureau of Community Assistance.

Upon completion of the management practice sign-up period, an interim report will be prepared by the Project Management Coordinator in cooperation with the LCD, local municipalities, DATCP, and DNR. This report will summarize the administrative, pollutant load reduction, and water quality information that is available at that time. The report will make preliminary conclusions on the success of the project to date and will recommend actions to be taken during the rest of the implementation phase.

Administrative Review

The first component, the administrative review, will focus on the progress of municipalities and the county in implementing the project. The project will be evaluated with respect to: 1) accomplishments; 2) financial expenditures; and 3) staff time spent on project activities.

Urban Program

Accomplishment Reporting

Evaluation of urban program activities will be conducted by the Project Management Coordinator and local units of government. Local units of government will report semi-annually to the Project Management Coordinator on progress in implementing "basic" community-wide program activities. Reports will cover:

1) scheduled information and education activities,
2) completion of construction site erosion and runoff control ordinance modification,
3) acres of construction activity with adequate erosion control plans,
4) acres of construction activity monitored for compliance with provisions of ordinance and erosion control plans,
5) identification of needed changes in housekeeping, and
6) implementation of housekeeping program changes.

Local units of government will report annually on progress in implementing "site-specific" program activities. Reports will cover:

1) acres of new urban development, by land use, covered by plans for controlling urban pollutant loads and stormwater flows,
2) acres of new urban development, by land use, not covered by plans for controlling urban pollutant loads and stormwater flows,
3) feet and tons of eroding streambanks addressed in detailed engineering feasibility studies.

In addition, representatives of governments addressing urban pollution issues will meet annually with the Project Management Coordinator and other agency staff to review progress and identify work plan objectives for the subsequent year.

Financial Expenditures

Each local unit of government will provide the following financial data to the Project Management Coordinator on a semi-annual basis:

1) expenditures for equipment, materials, and supplies,
2) expenditures for professional services and staff support costs,
3) amount of money paid for installation of Best Management Practices, and money encumbered in cost-share agreements.

Time Spent on Project Activities

Each local unit of government will provide time summaries to the Project Management Coordinator for the following activities on a semi-annual basis:

1) project and fiscal management,
2) clerical assistance,
3) technical assistance: practice design, installation, cost-share agreement status review and monitoring,
4) education activities,
5) training activities, and
6) leave time.

Rural Program

Accomplishment Reporting

The LCD should provide the following data when requested:

1) number of personal contacts made with landowners,
2) number of farm conservation lands prepared for the project,
3) number of cost-share agreements signed,
4) number of farm conservation plan and cost-share agreement status reviews completed, and
5) number of farms and acres of cropland checked for proper maintenance of Best Management Practices.

In addition, County LCD representatives will meet annually with the Project Management Coordinator and other agency staff to review progress and plan for the subsequent year.

Financial Expenditures

The LCD should provide the following financial data when requested:

1) number of landowner cost-share agreements signed,
2) amount of money encumbered in cost-share agreements,
3) number of landowner reimbursement payments made for the installation of BMPs, and the amount of money paid,
4) staff travel expenditures,
5) expenditures for equipment, materials, and supplies,
6) expenditures for professional services and staff support costs,
7) total project expenditures for LCD staff, and
8) amount of money paid for installation of BMPs, and money encumbered in cost-share agreements.

The LCD should also provide the following financial data on an annual basis:

1) staff training expenditures,
2) interest money earned and expended, and
3) total county LCD budget and expenditures on the project.

Time Spent on Project Activities

The LCD should be able to provide time summaries for the following activities:

1) project and fiscal management,
2) clerical assistance,
3) pre-design and conservation planning activities,
4) technical assistance: practice design, installation, cost-share agreement status review and monitoring,
5) educational activities,
6) training activities, and
7) leave time.

Pollutant Load Reduction

Key Nonpoint Sources for Evaluating Pollutant Load Reductions

The purpose of the second evaluation component, pollutant load reduction, is to calculate reductions in the amount of key pollutants as a result of installing Best Management Practices. Three key sources have been identified for estimating changes in pollutant loads that reach waterbodies in the Yahara-Monona Watershed: a) urban stormwater runoff; b) upland sediment; and c) runoff from barnyards and fields spread with manure. Chapter 4 indicates the pollutant reductions recommended for each water resource.

Urban Area

Local units of government will provide the following information annually to the Project Management Coordinator so that the coordinator and DNR can evaluate changes in urban pollutant loading:

1) 1990 urban acres, by land use, served by urban stormwater practices, and information requested by the coordinator concerning practice characteristics,
2) acres of post-1990 urban development, by land use, served by stormwater practices, and information requested concerning practice characteristics,
3) acres of post-1990 urban development, by land use, not served by stormwater practices,
4) acres of construction site activity served by adequate erosion control practices,
5) acres of construction site activity not served by adequate erosion control practices,
6) changes in streambank erosion, in tons and feet of erosion, due to installation of erosion control and flow reduction practices.

Rural Area

The DNR will use the WIN (Wisconsin Nonpoint Source) model to estimate sediment reductions due to changes in cropping practices. Data for the WIN model will be provided semi-annually by the LCD using its current data base system (D-Base) and converting it to CAMPS, which is a Computer Assisted Management and Planning System that has been developed by the U.S. Soil Conservation Service (SCS). CAMPS is used by the SCS, DNR and DATCP to meet the accomplishment reporting requirements of all three agencies.

The LCD will use the BARNY (Modified ARS) model to estimate phosphorus reductions due to the installation of barnyard control practices. The LCD will report the information to the Project Management Coordinator.

Water Quality Evaluation Monitoring

Water resource monitoring should be conducted to evaluate changes in water quality resulting from the implementation of the priority watershed project and to determine if water resource objectives are being achieved. This monitoring should be supported primarily by the DNR, provided adequate staff and financial resources can be arranged, with participation from local units of government and interest groups where possible.

To determine short-term responses to management activities, it is recommended that sediment traps be installed at two to four monitoring sites in the watershed. The sites should be located near storm sewer outfalls to evaluate sediment and associated pollutant (e.g., heavy metal) loadings from a subwatershed area that is likely to receive management attention. Preferably the sites should be in lakes heavily influenced by urban nonpoint source pollution, such as Lake Wingra and/or Lake Monona. Several sediment traps (e.g., three to five) should be installed at each monitoring site and sampling should be conducted at least annually, preceding and following the

implementation of particular management activities (e.g., wet detention basin installation and increased public participation in "housekeeping" practices).

Appraisal monitoring already has been conducted to provide data on general water quality conditions of lakes and streams in the watershed. A description of appraisal monitoring activities and results is presented in a separate document entitled the Yahara-Monona Watershed Appraisal Monitoring Report (Marshall, 1989). Appraisal monitoring sites are displayed in Figure 7-1. To determine potential long-term responses to management efforts, the following monitoring is also recommended:

- Continue the existing DNR Bureau of Research monitoring of the Yahara River lakes to determine long-term trends in lake water quality (particularly phosphorus concentrations).

- Carry out the post-treatment monitoring activities identified in the work plan for the Starkweather Creek Remedial Demonstration Project (DNR, 1990). This detailed monitoring effort will not only help to evaluate the success of the dredging element of this project, but will also help determine changes resulting from other water quality management measures in the watershed. Post-treatment monitoring is tentatively scheduled for the latter half of 1993. Monitoring also should be done in subsequent years.

- Continue storm-event monitoring of urban runoff at the Monroe Street detention basin.

In addition, it is recommended that the DNR undertake additional sediment monitoring of lakes Monona and Waubesa during the project implementation period to better define the extent of toxic metal and organic compounds, which were detected through appraisal monitoring. Monitoring activities that will be performed by the City of Madison as part of meeting the requirements of the federal stormwater discharge permit program should also be coordinated with the priority watershed project, where possible.

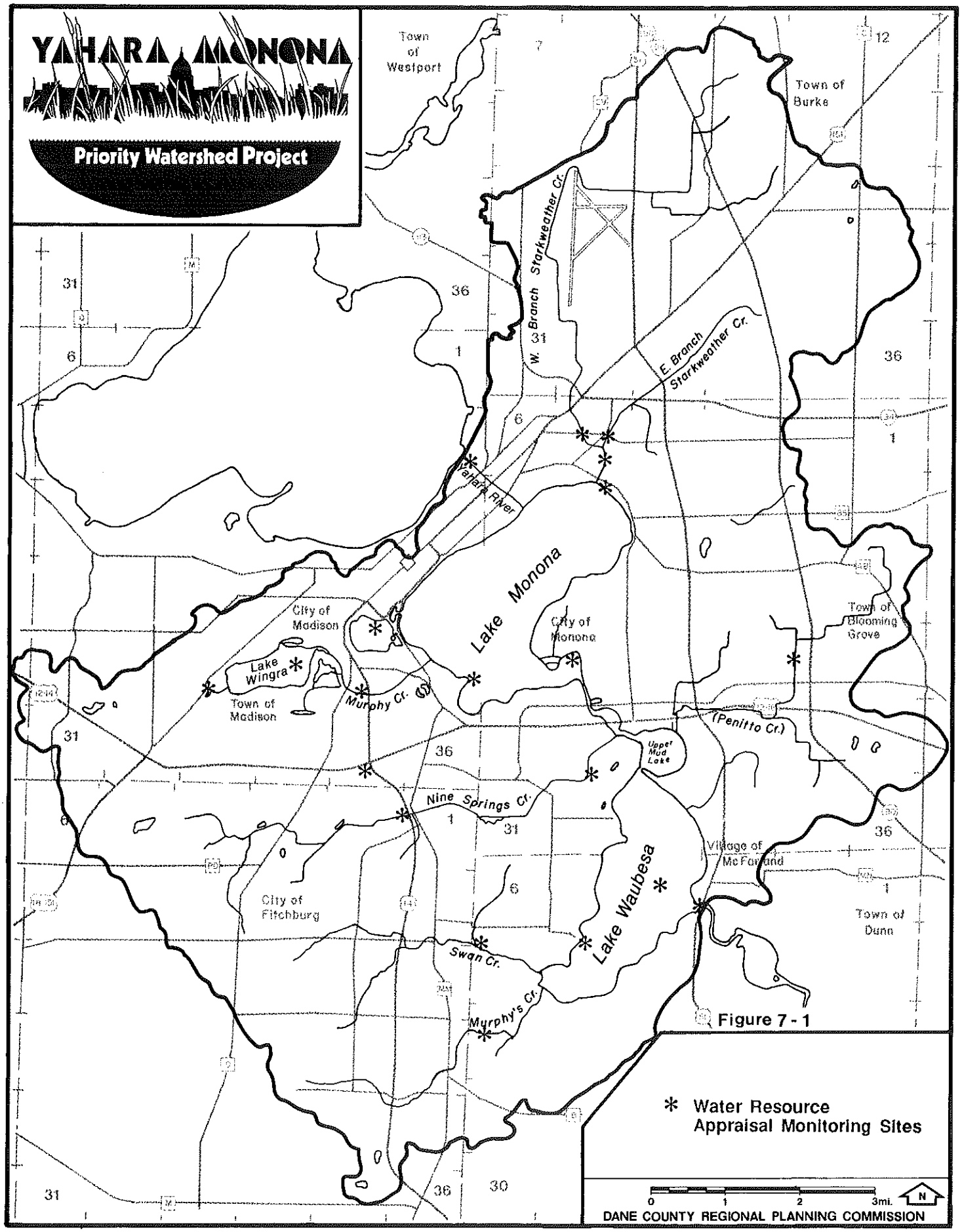
YAHARA MONONA
Priority Watershed Project
Town of Westport
Town of Burke
W. Branch Starkweather Cr.
E. Branch Starkweather Cr.
Yahara River
Lake Monona
City of Madison
City of Monona
Town of Blooming Grove
Lake Wingra
Town of Madison
Murphy Cr.
(Penitto Cr.)
Upper Mud Lake
Nine Springs Cr.
Village of McFarland
Lake Waubesa
City of Fitchburg
Town of Dunn
Swan Cr.
Murphy's Cr.
* Water Resource Appraisal Monitoring Sites
0 1 2 3mi.
N
DANE COUNTY REGIONAL PLANNING COMMISSION

Figure 7 - 1

APPENDIX A

Natural Area Sites
in the Yahara-Monona Watershed

YAHARA-MONONA WATERSHED
STREAM BASEFLOW WATER QUALITY AND HABITAT MONITORING RESULTS

Period of Record	Station		Flow cfs	Temperature °C	Dissolved Oxygen mg/l	pH s.u.	$NO^2 + NO^3$ Nitrogen mg/l	Ammonia Nitrogen mg/l	Organic Nitrogen mg/l	Total Nitrogen mg/l	Dissolved Phosphorus mg/l	Total Phosphorus mg/l	Specific Conductivity us/cm	Chloride mg/l	Alkalinity mg/l as CaCO3	Turbidity NTU	Chemical Oxygen Demand mg/l	Suspended Sediment mg/l	Fecal Coliform col/100ml	Biotic Index	Habitat Rating
1989-90 (Oct. - Aug.)	E. Branch Starkweather Creek @ Milwaukee St.	mean	0.60	–	7.6	7.7	1.9	0.91	0.55	3.4	0.10	0.14	662	50	247	10.2	33	73	4,022	–	237 (Poor)
		min.	0	0.5	2.9	7.3	1.1	0.19	0.30	2.2	0.04	0.04	547	39	183	1.0	11	7	10	–	–
		max.	1.1	24.0	12.3	8.2	3.7	1.6	1.0	5.8	0.17	0.23	805	66	295	27	55	263	16,000	–	–
		# samples	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	–	1
1989-90	W. Branch Starkweather Creek @ Milwaukee St.	mean	1.2	–	7.5	7.8	2.5	0.20	0.79	3.5	0.03	0.07	615	28	278	7.7	31	74	5,745	–	237 (Poor)
		min.	0.31	1.0	2.5	7.1	0.7	0.03	0.55	1.4	0.01	0.02	334	17	225	1.0	< 10	14	20	–	–
		max.	2.0	23.5	14.0	8.2	5.4	0.42	0.98	6.8	0.06	0.14	775	38	297	30	57	293	30,000	–	–
		# samples	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	–	1
1989-90	Main Stem Starkweather Creek @ confluence of E. & W. Branches	mean	1.5	–	8.1	7.8	2.1	0.47	0.63	3.2	0.06	0.12	610	38	234	13.5	37	24	12,888	–	–
		min.	-3.5	1.0	1.7	6.8	0.70	0.12	0.20	2.0	0.01	0.01	340	23	128	1.5	11	10	30	–	–
		max.	4.1	23.5	16.2	8.4	4.2	1.1	0.96	5.5	0.10	0.26	771	48	285	40	57	49	70,000	–	–
		# samples	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	–	–
1989-90	Murphy (Wingra) Creek @ Beld St.	mean	3.5	–	9.8	8.3	0.2	0.06	0.87	1.1	0.03	0.06	638	83	181	11.9	38	20	593	–	214 (Poor)
		min.	0.58	3.0	4.1	7.7	0.1	0.02	0.54	0.90	0.01	0.05	562	74	154	1.1	28	4	10	–	–
		max.	7.9	22.5	15.5	8.7	0.7	0.14	1.5	1.6	0.06	0.06	727	94	209	59	43	62	1,500	–	–
		# samples	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	–	1
1989-90	Nine Springs Creek @ Hwy. 14	mean	7.6	–	10.0	7.9	4.7	0.13	0.77	5.6	0.07	0.15	710	28	314	9.8	26	72	160	–	–
		min.	4.3	2.5	5.6	7.7	2.1	0.03	0.58	3.1	0.01	0.04	685	18	295	1.3	19	27	< 10	–	–
		max.	15	24.0	13.4	8.0	6.0	0.23	0.96	6.9	0.21	0.25	760	32	341	35	44	184	440	–	–
		# samples	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	–	–
1989-90	Nine Springs Creek @ Moorland Rd.	mean	–	–	7.99	7.9	3.86	0.37	0.88	4.8	< 0.2	0.12	708	31	315	–	< 2 (BOD)	19	203	6.1 (Fair)	173 (Fair)
		min.	–	3.5	4.6	7.9	1.9	0.06	0.5	3.5	< 0.1	0.06	660	29	291	–	< 1	5	24	–	–
		max.	–	21	14.35	8.0	5.0	1.1	1.0	5.9	< 1.0	0.20	820	35	353	–	< 2	37	500	–	–
		# samples	–	4	6	7	7	7	5	5	7	5	7	7	4	–	5	5	5	1	1
1989-90	Upper Mud Lake Tributary (Pentito Creek)	mean	No Chemistry Samples																	4.0 (Very Good)	235 (Poor)
		# samples																		1	1
1989-90	Swan Creek	mean	–	–	8.1	8.0	No Chemistry Samples													4.2 (Very Good)	180 (Fair)
		min.	–	12.2	7.8	7.8															
		max.	–	20.0	8.2	8.1															
		# samples	–	4	4	4														1	1
1989-90	Murphy's Creek	mean	–	–	8.3	8.1	No Chemistry Samples													4.6 (Good)	158 (Fair)
		min.	–	14.4	7.8	8.0															
		max.	–	19.0	9.0	8.2															
		# samples	–	4	4	4														2	1
1987-88 (Oct. - July)	Yahara River outlet of Lake Mendota	mean	–	–	10.74	8.74	0.20	–	0.39	0.59	–	0.06	431	25.3	177	–	19	6	–	–	–
		min.	–	2	9.63	8.44	0	–	0.15	0.41	–	0.05	405	24	166	–	12	0	–	–	–
		max.	–	27	11.80	8.97	0.44	–	0.50	0.80	–	0.07	460	26.7	187	–	26	15	–	–	–
		# samples	–	6	6	6	5	–	5	5	–	6	6	6	6	–	6	6	–	–	–
1987-88 (Oct. - July)	Yahara River outlet of Lake Waubesa	mean	147	–	9.9	8.95	0.33	–	0.38	0.64	–	0.06	445	31.3	174	–	31	14	–	–	–
		min.	15	3	7.2	8.8	0	–	0	0.11	–	0.03	390	28	153	–	19	0	–	–	–
		max.	237	26	12.3	9.2	0.55	–	0.85	0.98	–	0.11	490	33.8	190	–	41	40	–	–	–
		# samples	6	5	5	6	5	–	5	5	–	6	6	6	6	–	6	6	–	–	–

APPENDIX C

Urban Management Practice Survey

TABLE C-1
EROSION AND STORMWATER RUNOFF CONTROL ORDINANCES FOR COMMUNITIES IN THE YAHARA-MONONA WATERSHED

Community	Date Ordinance Adopted	Detention/Runoff Control Mandated	Design Frequency Controlled Runoff	Erosion Control Mandated
C. of Fitchburg	7/1986	3 acres commercial/ 5 acres residential	All Events (e.g., 2-, 10-, 100-year storms	4,000 ft^2/400 yd^3
C. of Madison	10/1982	3 acres commercial/ 5 acres residential	10-year storm	4,000 ft^2/400 yd^3
C. of Monona	7/1985	3 acres commercial/ 5 acres residential	10-year storm	4,000 ft^2/400 yd^3
V. of McFarland	10/1980	3 acres commercial/ 5 acres residential	All Events	5,000 ft^2/500 yd^3
Dane County[1]	9/1987	N/A	N/A	Development> Single-Family Unit

[1]Erosion control only.

TABLE C-2
STORMWATER DRAINAGE SYSTEM AND MAINTENANCE FOR URBAN COMMUNITIES IN THE YAHARA-MONONA WATERSHED

Community	Estimate of Grass Swales by Land Use and Percent Area[1]		Maintenance Schedule for Catch Basin Cleaning
	Percent Residential	Percent Commercial/ Industrial/Institutional	
C. of Fitchburg	10-20	5	No regular schedule
C. of Madison	5	5	Average of once/year
C. of Monona	5	5	Will be once/year
V. of McFarland	5	60-70 (tank farms)	Once/year
T. of Blooming Grove	85-95	85-95	Once/year
T. of Burke	85-95	10-20	As needed
T. of Madison	20-30	30-40	Once/year

[1]Remaining estimated percentage of land use is served by storm sewer pipes and/or curb and gutters.

TABLE C-3
STREET-SWEEPING FREQUENCIES FOR URBAN COMMUNITIES IN THE YAHARA-MONONA WATERSHED

Community	Residential Areas	Commercial/Industrial/Institutional
C. of Fitchburg	Once in spring for all curb and gutter areas. Areas without curb and gutter are broomed as required.	
C. of Madison	Monthly	Monthly, Daily for Capitol Square and immediate downtown area
C. of Monona	Monthly	Monthly
V. of McFarland	Every 1 to 2 months	Every 2 weeks
T. of Blooming Grove	3 times per summer	N/A
T. of Burke	Once/year for curb and gutter areas	
T. of Madison	Monthly	Monthly

TABLE C-4
LEAF AND YARD WASTE DISPOSAL SERVICES
FOR URBAN COMMUNITIES IN THE YAHARA-MONONA WATERSHED

Community	Frequency of Pickup Service	Permit Leaf Burning by Homeowners
C. of Fitchburg	Leaves and grass are collected once/week from a central drop-off site	Not in urban areas
C. of Madison	Leaves - October and November Grass - No service provided, 3 drop-off sites	No
C. of Monona	Leaves and yard waste are collected for 6 weeks in fall	Yes
V. of McFarland	Leaves - 4 weeks in fall and 3 weeks in spring Grass - No service provided	Yes
T. of Blooming Grove	Leaves - May and October Grass - No service provided	Not in platted areas
T. of Burke	No services provided	Yes
T. of Madison	Leaves - As required Grass - Weekly	No

TABLE C-5
DEICING PRACTICES FOR MUNICIPALITIES IN THE YAHARA-MONONA WATERSHED
(Winter of 1988-89[1])

Governmental Unit	Amount of Salt Used[2] (tons)	Amount of Sand Used[2] (tons)	Total Road Miles in Municipality	Salt Used Per Mile (tons/mile)	Sand Used Per Mile (tons/mile)
C. of Madison	4,390	12,865	580	7.6	22.2
C. of Monona	287	80	30	9.6	2.7
C. of Fitchburg	500	500	75	6.7	6.7
V. of McFarland	350	--	25	14.0	--
T. of Blooming Grove	69	60	22	3.1	2.7
T. of Burke	805	800	50	16.1	16.0
T. of Madison	150	175	14	10.7	12.5
Dane County	9,024		541	16.7	

[1]Represents a season of near average snowfall in City of Madison (36 inches compared to an average of 39) and near average number of plowings and saltings for the year (6 plowings compared to average of 6 and 23 spreadings of salt and/or sand compared to an average of 24).
[2]Estimate for entire municipality, including area outside of watershed.

APPENDIX D

Preliminary Design Criteria and Specifications for Urban Best Management Practices

URBAN BEST MANAGEMENT PRACTICES

Design Criteria

NR 120.14(22) requires the Department of Natural Resources to participate in the design process for urban management practices. Selected preliminary design criteria by the DNR for wet detention basins and infiltration devices are presented in Table D-1.

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 be a sediment trap, a wet detention pond, a grass filter strip, or street sweeping. Selected practices should be equipped with groundwater monitoring wells to assure that groundwater contamination remains within acceptable bounds.

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 basins should not be used for consumptive fishing, swimming, or wading. Infiltration basins might pose a hazard if used during dry periods as open recreational space, due to possible suspension of contaminated dust. These risks need to be further investigated.

TABLE D-1
SELECTED PRELIMINARY DESIGN CRITERIA
FOR WET DETENTION BASINS AND INFILTRATION DEVICES

Practice	Design Criteria		
Wet Detention	1. Percent of drainage required as permanent pond surface for 90% control of solids:		
	Freeways 2.8%	Commercial 1.7%	Residential 0.8%
	Industrial 2.0	Institutional 1.7	Open Space 0.6
	2. Permanent pond minimum 5 feet deep when constructed.		
	3. Minimum 10-foot 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 feet.		
	7. Minimum 25-foot vegetated buffer strip.		
	8. Protect outlet channel from erosion.		
	9. Minimum depth to groundwater 3 feet.*		
Infiltration Devices			
Grass Swales	1. Minimum grade of 0.5% and maximum of 5.0%.		
	2. Maximum side slopes of 3:1.		
	3. Minimum depth to groundwater 3 feet.*		
	4. Maximum flow velocity 6 feet/second.		
	5. Check infiltration rates annually.		
	6. Prevent compaction during construction.		
	7. Sweep streets of drainage area to prevent clogging of infiltration device.		
Infiltration Trenches	1. Minimum depth to groundwater 3 feet.*		
	2. Pretreatment necessary (e.g., grass filter strip, wet detention basin, trap).		
	3. Trench must be wider than it is deep.		
	4. Observation well(s) must be installed.		
	5. Check infiltration rates annually.		
	6. Do not put near water supply wells.		
Infiltration Basins	1. Minimum depth to groundwater 3 feet.*		
	2. Pretreatment necessary (e.g., grass filter strip, wet detention basin, trap)		
	3. Test soil infiltration rates at least 5 feet below the surface.		
	4. Observation well(s) must be installed.		
	5. Check infiltration rates annually.		
	6. Do not put near water supply wells.		
	7. Prevent compaction of soil during construction.		

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

Source: Wisconsin Department of Natural Resources.