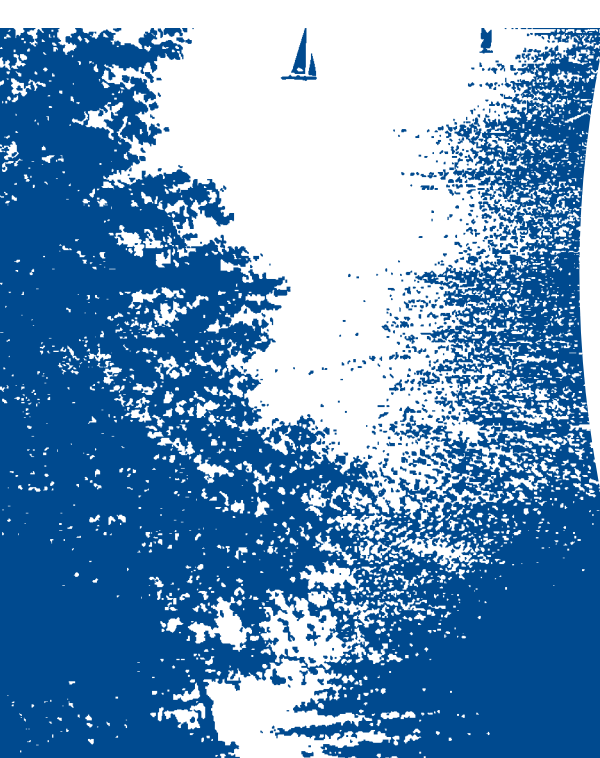


Dane County Water Quality Plan



Summary Plan

2004

Dane County Water Quality Plan

Summary Plan 2004

Adopted September 29, 2004

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C	Point Source Inventory and Analysis (2004)
D	Urban Nonpoint Source Analysis (1979)
E	Agricultural Nonpoint Source Analysis (1988)
F	Residual and Solid Waste Disposal (1988)
G	Groundwater Protection Plan (1999)
H	Lake Management (1979)
I	On-Site Wastewater Systems Management (1998)
J	Legal and Institutional Analysis (1978)
K	Summary of Public Participation (1979)
	2020 Land Use & Transportation Plan (1997)
	Environmental Corridors Report (1996)

1

Background and Setting

Introduction and Background
Regional Setting
Trends and Forecasts
Land Use and Water Quality
Environmental Protection Strategy

INTRODUCTION AND BACKGROUND

The *Dane County Water Quality Plan* is the official areawide water quality management plan for Dane County, Wisconsin. The purpose of the plan is to provide a policy framework and guidance for federal, state, and local water quality protection programs in Dane County. The *Dane County Water Quality Plan* has been continually revised, updated and expanded since its initial adoption and certification in 1979.

Before 1975, there had been a long history of water quality studies and plans in Dane County. Most of these studies were concerned with municipal sewage discharges, and the effects of those discharges on the Yahara River lakes. The diversion of sewage effluent from the lakes was essentially completed by the early 1970s, so attention began to be directed at remaining sources of pollution causing lake problems. The federal Water Pollution Control Act Amendments of 1972 required states to develop comprehensive areawide water quality management plans addressing the full range of water quality problems. The federal law provided for the designation of special areas with complex water quality problems, and procedures for designating agencies to accomplish the planning. In 1975, the Governor designated Dane County as an area with complex water quality problems, and the Dane County Regional Planning Commission as the local representative planning agency charged with developing an areawide comprehensive water quality management plan for the region. The Regional Planning Commission worked with federal, state, and local management agencies over the next several years to develop the initial *Dane County Water Quality Plan*. The plan was adopted and certified by the state in 1979 as the official areawide water quality management plan for Dane County.

In accordance with the directives of the federal law, the state established a continuing areawide water quality management planning process. This process is described in and guided by state Administrative Rule NR 121, enacted in 1981. The *Dane County Water Quality Plan* is the areawide water quality management plan for Dane County, but Dane County is also included in the water quality management plans for major river basins, which are prepared by the Wisconsin Department of Natural Resources as part of the statewide continuing water quality management planning process. Basin water quality plans applicable to Dane County include those for the Lower Wisconsin River Basin, the Sugar-Pecatonica River Basin, and the Upper and Lower Rock River Basins (which include the Yahara River, Koshkonong Creek, and the Maunasha River Watersheds). The intent and objective is consistency and mutual support between the *Dane County Water Quality Plan* and the applicable basin plans.

Since completion and certification of the initial *Water Quality Plan* in 1979, the *Dane County Water Quality Plan* has been continually revised, updated, and expanded. Many changes have been made to reflect the achievement or implementation of programs or projects recommended in the initial plan and subsequent updates. The plan was also expanded to include subject areas (such as groundwater protection and on-site wastewater management) which

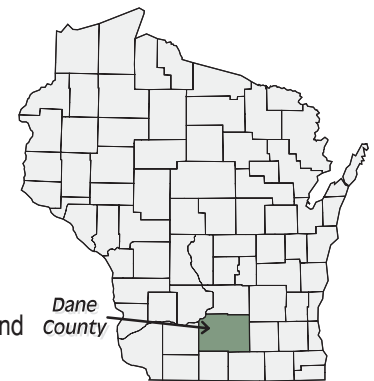
were not fully addressed in the initial plan. Finally, several major sections of the plan have been updated to reflect changes in conditions or changes in federal and state programs and laws.

This summary plan represents a brief overview of the highlights of the full *Dane County Water Quality Plan*. The plan includes 11 technical appendices containing detailed data and supporting information in a variety of subject areas, and incorporates and is based on adopted regional land use and development plans, including the *Dane County Land Use and Transportation Plan* and the *Dane County Farmland Preservation Plan*. The *Summary Water Quality Plan* has been updated to reflect 2004 conditions, and includes updated program recommendations for all water quality management program areas, and updated short-range priority actions for all local designated management agencies.

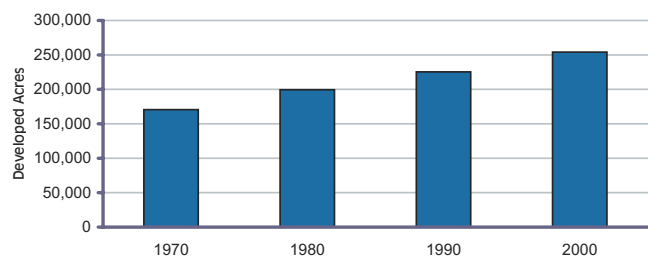
REGIONAL SETTING

Dane County occupies 1,230 square miles in the heart of an agricultural state. Most of the land is very productive farmland. In the center of this farmland is the City of Madison, the state capital and the main campus of the state university. Most of the work force is employed in trade or service industries such as government agencies, insurance companies, retail trade, or the University. Manufacturing provides a relatively small proportion of the available jobs.

As state government and the University have grown in recent years, the population of Dane County has also grown. The City of Madison and other cities and villages have expanded into neighboring agricultural land. In addition, many individual houses and subdivisions have been built on unsewered lots scattered outside of these urban areas. Both the pressures of urbanization and changes in the farm economy have pushed farmers to convert more land to cash crops such as corn. Pastureland has been converted to hay, and drainage in wet areas has been improved to make more land available for crops or pasture.



1970 - 2000 Trends in Developed Area, Dane County



TRENDS AND FORECASTS

The expansion of urban areas and changes in farming have affected the region's lakes and streams. There has been some pollution from new industries or overloaded municipal wastewater treatment plants, but the primary problem has been nonpoint source pollution—the runoff from urban and agricultural land. Runoff from construction sites and from fields has carried heavy loads of sediment into lakes and streams. Runoff from urban areas has carried a variety of pollutants, including salt, oil and grease, lead, fertilizers, and organic materials such as leaves and grass. Spawning beds for trout and smallmouth bass have been smothered by silt in many streams. Over the years, the shallow, weedy areas in lakes have increased, algae populations have blossomed, and fish species have been reduced or eliminated from some water bodies. Recreational use of lakes and streams has been impaired by changes in fish species; by weedy areas which are difficult to swim in or navigate; and by algae blooms which discourage swimming and are odorous and visually offensive, and even toxic if ingested.

Trends in population growth, urbanization and agriculture are expected to continue. Therefore, the quality of the region's lakes and streams will deteriorate unless special measures are taken, in both urban and rural areas, to decrease runoff and its accompanying load of sediment, nutrients, and other pollutants.

As the second-largest metropolitan area in Wisconsin, and the seat of state government, Dane County experienced rapid growth in the 1960s and early 1970s. More moderate growth rates prevailed through the 1980s, but rapid growth returned in the 1990s. Dane County is expected to reach a total population of nearly 580,000 people by the year 2030—an increase of about 36 percent over the 2000 population. About two-thirds of the current population is located in the central urban area, 23 percent in outlying urban communities, and 14 percent scattered throughout rural areas of the county.

The growth and development trend which is expected to continue into the future is a slightly greater proportion of new growth occurring in outlying urban communities compared to the central urban area, with rural areas maintaining a smaller proportion of development. New urban development is expected to occupy slightly less land than older development. This is due to higher densities of new residential, industrial and commercial construction, partly due to increasing land costs. Other significant trends that are expected to continue include an increasingly older population, and even greater proportion of jobs in the service sector. The trends and forecasts that have been presented and provide the basis for current plans were developed from the 2000 Census and statewide forecasts.

Dane County Forecasts

Item	2000	2010	2020	2030
Population	426,526	480,573	527,534	579,976
Dwelling Units	180,398	206,255	229,363	255,496
Total Employment	285,000	330,800	355,000	382,600
Developed Acres	127,055	141,208	155,361	169,513
Residential Developed Acres	49,236	55,000	60,762	66,528
Other* Developed Acres	77,819	86,208	94,599	102,985

* Consists primarily of streets, commercial, industrial, and institutional development

Population Forecasts For Urban Service Areas

USA	2000	2005	2010	2015	2020	2025	2030
Belleville	1,890	2,074	2,257	2,414	2,571	2,768	2,965
Black Earth	1,340	1,384	1,427	1,459	1,490	1,538	1,585
Blue Mounds	708	783	858	940	1,022	1,116	1,209
Brooklyn	916	1,015	1,113	1,200	1,286	1,381	1,476
Cambridge	3,438	3,618	3,793	3,958	4,119	4,284	4,444
Central	268,850	281,390	293,929	304,671	315,413	327,318	339,222
Cottage Grove	4,059	4,829	5,599	6,460	7,320	8,273	9,226
Cross Plains	3,084	3,368	3,651	3,903	4,155	4,455	4,755
Dane	799	883	967	1,042	1,116	1,203	1,290
Deerfield	2,059	2,202	2,344	2,483	2,622	2,791	2,960
Koshkonong	487	487	487	487	487	487	487
Marshall	3,432	3,705	3,978	4,269	4,559	4,903	5,247
Mazomanie	1,500	1,568	1,636	1,679	1,722	1,784	1,846
Morrisonville	352	367	381	392	402	416	430
Mount Horeb	5,860	6,552	7,244	7,906	8,567	9,331	10,095
Northern	9,901	11,273	12,644	13,799	14,953	16,287	17,621
Oregon	7,514	8,397	9,279	10,164	11,048	12,066	13,083
Rockdale	214	217	220	220	219	222	224
Roxbury	282	298	314	331	347	369	390
Stoughton	12,671	13,769	14,866	15,989	17,111	18,435	19,759
Sun Prairie	20,533	22,993	25,453	27,575	29,696	32,172	34,647
Verona	7,306	8,819	10,331	11,484	12,636	13,944	15,251
Waunakee	9,000	10,402	11,803	13,133	14,463	15,971	17,479

Source: Dane County Regional Planning Commission and the Census.

LAND USE AND WATER QUALITY

The areawide water quality management planning process acknowledges the importance of the relationship between land use and water quality. Land use considerations permeate nearly all aspects of water quality management, ranging from attaining cost-effective sewer service areas (by concentrating urban development and avoiding sprawl) to utilizing land use planning and management to limit pollution and protect important environmental resources from the impacts of urban development and rural land use and agricultural practices.

Areawide water quality management plans are required to address the relationship of water quality to land and water resources and uses, to include existing and projected land use patterns and delineation of sewer service areas, and to delineate areas which should not be developed or disturbed because of resource value or environmental or physical constraints (Wisconsin Administrative Rule NR 121).

The Dane County Land Use and Transportation Plan

The *Dane County Land Use and Transportation Plan* is the overall comprehensive land use and development policy framework and guide for Dane County. This plan, which was adopted by the Dane County Regional Planning Commission in 1997, replaced the 1985 *The Regional Development Guide for Dane County*, which previously provided the same policy framework. The objective, in planning in Dane County, has been to develop more detailed plans for specific geographic areas (such as city, village and town master plans) or plans for specific functional or subject areas (such as the *Dane County Water Quality Plan*) consistent with, and in the context and framework of the *Dane County Land Use and Transportation Plan* policies and objectives.

The overall regional development objectives and policies are illustrated by four major mapped concept elements illustrating the intended regional development concept. These include: (1) the outer limits of planned urban development, known as the urban service area boundaries; (2) the identification of areas intended to be protected from development, known as open space corridors; (3) rural areas that include farmland preservation areas and rural development areas; and (4) limited service areas where only one or a few urban services are provided to accommodate special or unique facilities or institutional uses, or areas of existing development experiencing wastewater disposal or water supply problems.

Urban Service Areas (USAs) are those areas in and around existing communities that are most suitable for urban development and capable of being provided with a full range of services. Urban services are public services normally provided or needed in urban areas, including: public water supply and distribution systems; public sanitary sewerage systems; higher levels of police and fire protection; solid waste collection; urban storm management systems; streets with curbs and gutters; street lighting; and urban

transportation facilities such as sidewalks and mass transit. Appendix 1 includes a brief Fact Sheet on Urban Service Areas, describing the service area planning, delineation and revision process.

The rural areas shown on the *Regional Development Plan* map (Map 1-1) are areas outside of urban service areas intended to remain predominantly rural in character. They include farmland preservation lands (Agricultural Preservation Areas), as well as rural non-farm development (Rural Development Areas), which, although they are not identified on the *Regional Development Plan* map, are included in adopted farmland preservation plans and local town plans. Local planning and zoning authorities are using tools such as the transfer or purchase of development rights to direct growth where it best serves the needs of the entire community, while keeping in mind the importance of farmland as a countywide resource.

The open space corridors shown on the *Regional Development Plan* map include two distinct components: urban environmental corridors within urban service areas and rural resource protection areas outside urban service areas. The urban environmental corridors are a continuous open space network based on natural features and environmental lands such as streams, lakes, shorelands, floodplains, wetlands, steep slopes, woodlands, parks, and publicly-owned lands. Rural resource protection areas are based primarily on floodplains, wetlands and shoreland areas—lands protected through zoning or other regulations—together with existing or proposed publicly-owned or controlled lands. These two corridor elements combine to provide a continuous countywide network of open spaces and environmental resources considered to be most critical for protection.

Limited Services Areas (LSAs) are areas where only one or a few urban services, such as sanitary sewer service, are provided to accommodate special or unique facilities or institutional uses which are appropriately located outside urban service areas, or areas of existing development experiencing wastewater disposal or water supply problems.

A. Types of Limited Service Areas

- (1) Special facilities: including, but not limited to, landfills, parks, recreational and tourist facilities such as park shelters, golf courses, club houses, etc.
- (2) Institutional uses: including, but not limited to, schools, correctional facilities, etc.
- (3) Existing development: existing residential or commercial development experiencing wastewater disposal or water supply problems. Existing development means development existing in the local unit of government on the date the application for Limited Service Area establishment or expansion is submitted.

Appendix I includes special policies that apply to LSAs.

Other Adopted Plans

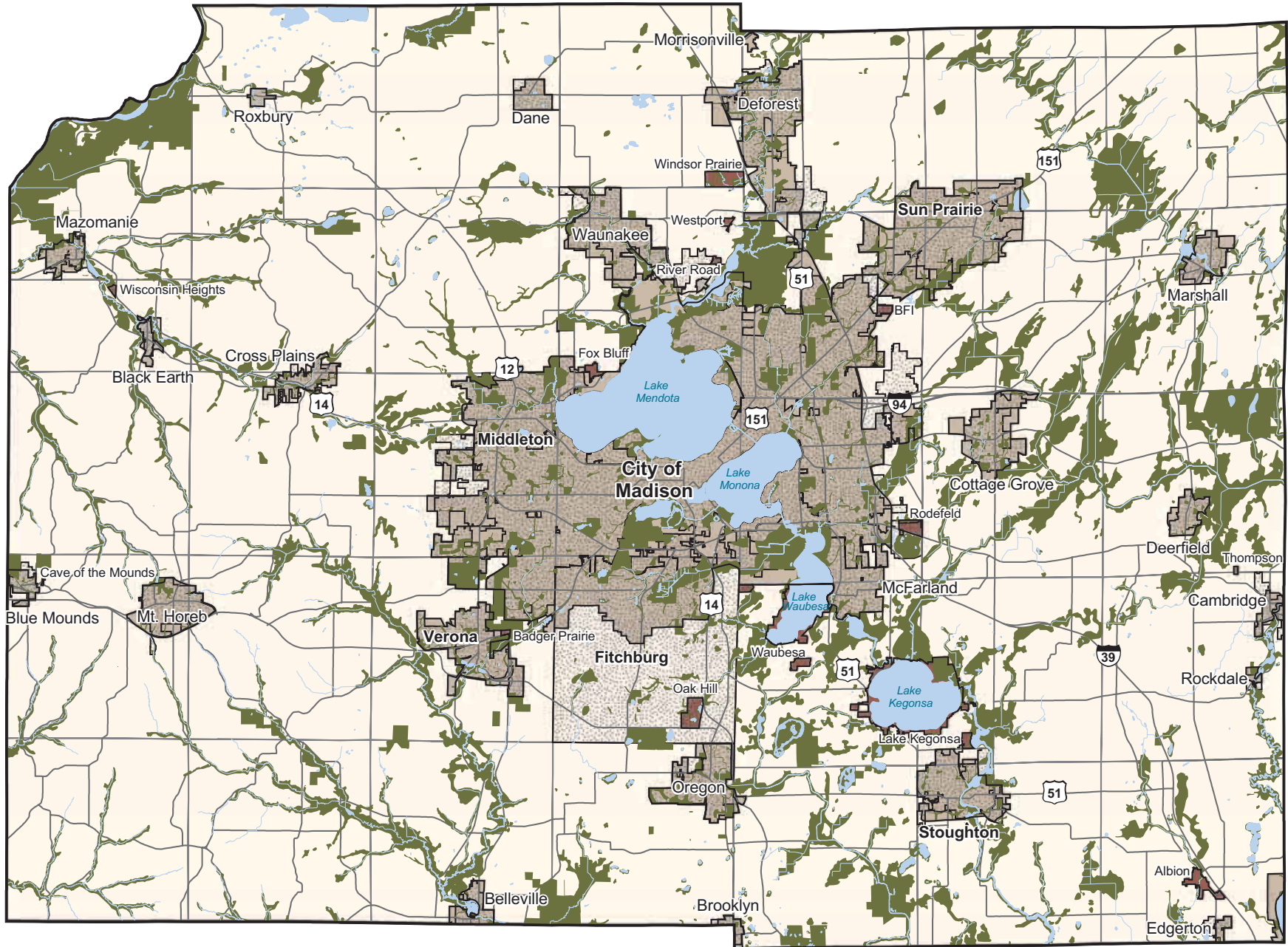
The *Dane County Farmland Preservation Plan*, which incorporates land use plans for each of the 34 towns in Dane County, as well as specific city and village master plans, land use plans and comprehensive plans, have been prepared and adopted for most areas in Dane County. In most cases, these plans have been developed within the framework of, and are consistent with, the objectives and policies of the *Land Use and Transportation Plan*. Other regional plans have been prepared and adopted for specific subject areas. Those which are pertinent to the *Dane County Water Quality Plan* include the *Dane County Parks and Open Space Plan*, and the *Dane County Solid Waste and Recycling Plan*.

ENVIRONMENTAL PROTECTION STRATEGY

In its mission to provide for a safe, healthy and attractive environment for Dane County residents, the Regional Planning Commission has worked with local units of government to develop and adopt a variety of environmental protection plans, including the *Dane County Water Quality Plan*. In the preparation of plans for environmental protection, the Commission has developed a strategy that incorporates both **pollution control** and **resource protection**. Pollution control is not limited to waste treatment facilities, or technology such as emission control devices. Land design and management is recognized as one of the most effective and important approaches to preventing and controlling pollution. Appropriate location and siting of development and of waste treatment and disposal facilities, vegetation management, erosion control, utilization of natural drainage systems and buffer areas—these approaches can go far in protecting the environment if they are used consistently and in concert with resource protection.

Resource protection recognizes that land and natural resources perform critical environmental functions such as groundwater recharge and discharge, water quality improvement, erosion control, storage of floodwaters, wildlife habitat and scenic beauty. Some lands are particularly vulnerable in urban and developing areas. It is important that these critical and vulnerable lands and resources be identified and their environmental functions protected.

The environmental protection strategy in all of the Regional Planning Commission's environmental protection plans, including the *Dane County Water Quality Plan*, is founded on both pollution control and resource protection—recognizing that either approach alone would not be sufficient.



Regional Development Plan Map Dane County, Wisconsin

- Open Space Corridor
- Incorporated Area
- Urban Service Area
- Limited Service Area

Map 1-1

Projection:
Lambert Conformal Conic
Dane County Coordinates - NAD 83(91)

Prepared by: The Dane County
Regional Planning Commission



Feb., 2005

2

Water Quality Conditions

- Introduction
- Surface Water Quality Conditions
- Groundwater Quality Conditions

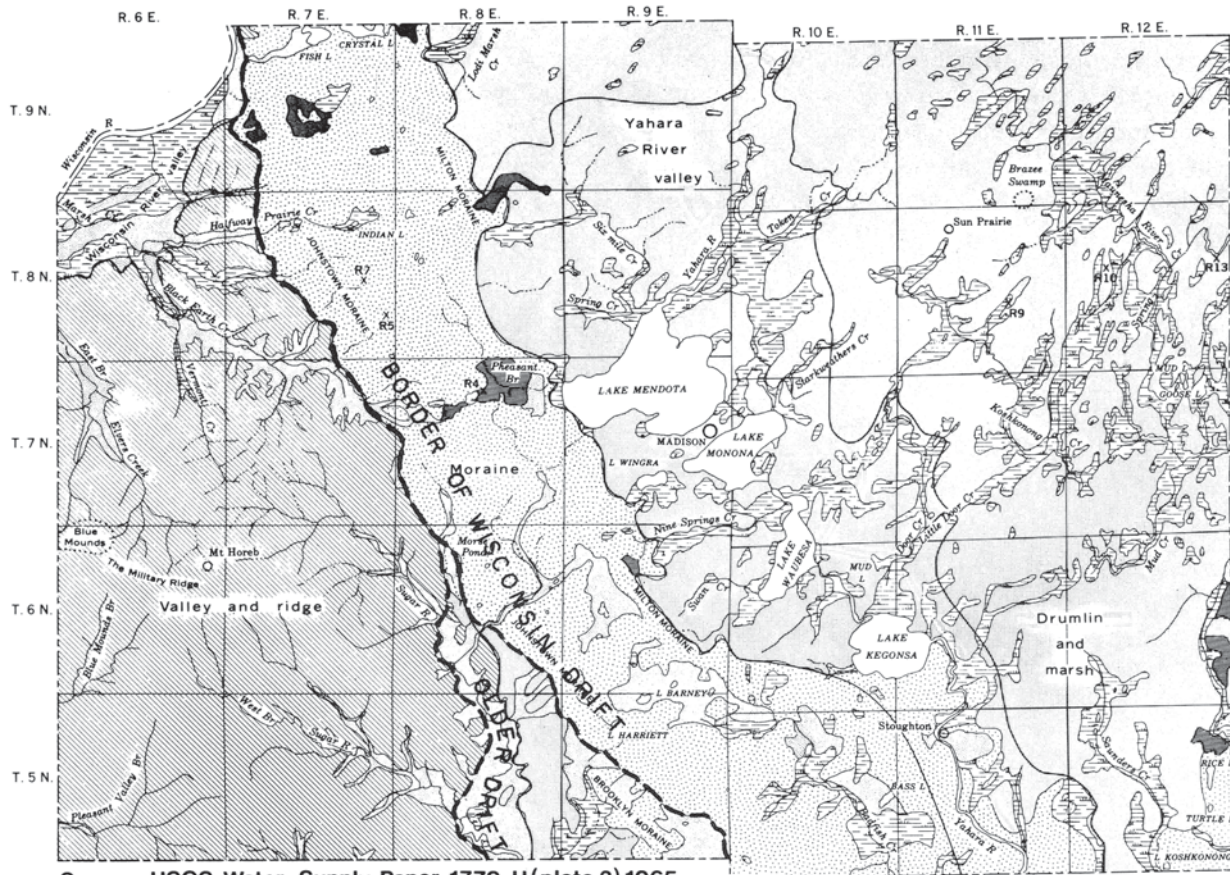
INTRODUCTION

The basic facts and conditions most important in understanding water quality issues in Dane County include the climate, the geologic and physiographic setting, and the primary purposes and uses of water resources.

Climate

The climate in Dane County is typical of the Great Lakes states. Winters tend to be long, cold and snowy, while summers are short and sometimes humid. The temperature ranges from an average of 17°F in January to 70°F in July. Average annual precipitation is 31 inches, with 60 percent falling from May through September. June is the wettest month with over four inches of precipitation, and February is the driest with about one inch. Snowfall averages 40 inches per year. The ground usually begins to freeze at the end of November and thaws in mid-April. Maximum frost depth averages over 18 inches. Severe storms often occur from late fall through mid-spring. The potential for runoff and severe erosion is often high in March and early April, when heavy rainstorms and snowmelt occur on ground sparsely covered by dead vegetation or bare due to fall plowing.

Map 2-1
Map of Dane County, Wisconsin, Showing Physiographic Areas and Deposits of Quaternary Age



Source: USGS Water - Supply Paper 1779-U (plate 2) 1965

Geology modified from Alden (1918)

- 
Pre-Quaternary rocks
Quaternary deposits thin or absent
- 
Marsh deposits
Muck and peat
- 
Glacial lake deposits
Stratified clay, silt, sand, and marl
- 
Undifferentiated glacial deposits
mainly ground moraine
Clay, silt, sand, gravel, and boulders, unstratified to stratified, unsorted to sorted
- 
Morainal deposits
Clay, silt, sand, gravel, and boulders, mostly unsorted and unstratified
- 
Outwash and alluvium
Mostly sand and gravel, sorted and stratified

Physical Setting

Dane County has a varied and unique geologic and physiographic setting. The western part of the county, known as the valley and ridge physiographic area, or the driftless area, is the only part of the county not affected by glaciation (see Map 2-1). This area is characterized by steep ridges and valleys drained by fast-flowing streams, generally without natural lakes or impoundments. Most of the streams are fed by springs and seeps flowing from water-bearing layers of bedrock exposed on hillsides. The hills are covered by an irregular layer of soil (quite thin in many places) overlying fractured dolomite or sandstone bedrock. The large valley of the Wisconsin River, also in the western part of the county, consists of deep alluvial deposits of sand and gravel with some organic material, and extensive marsh deposits in the floodplain of the Wisconsin River.



To the east of the driftless area is an area of glacial moraines, located at a major drainage divide where the headwaters of many of the streams in the Wisconsin, Sugar and Rock River basins originate. The moraines include the Johnstown terminal moraine at the western edge of the glaciated area, and the Milton recessional moraine farther east. The moraines include hills and mixed and variable deposits of glacial till (including clay, silt, and boulders with sand and gravel lenses) which were deposited and left behind as the glaciers retreated.

East of the moraines, in the center of the county, is the Yahara River valley. Here deep glacial deposits dammed up large valleys, forming a chain of large lakes and wetlands. The Yahara River valley physiographic area is primarily glacial ground moraine, with extensive areas of peat and marsh deposits. Streams in this physiographic area are generally flatter and more sluggish than those in the driftless area, and fewer are spring-fed.

The eastern part of the county is known as the drumlin and marsh physiographic area, and consists primarily of general glacial deposits with extensive areas of marsh deposits. This area includes many small drumlin hills interspersed with shallow glacial deposits which create an extensive system of interconnected wetlands with poorly defined drainage. Small streams wind slowly through the lowlands and there are few springs supplying streamflow. The only lakes in this area are small stream impoundments, or shallow marshy lakes.

Water Uses

Nearly all domestic and industrial water supplies in Dane County are obtained from groundwater. Surface water resources are put to the following uses: habitat for fish and aquatic life; recreational uses (mainly fishing, boating and swimming); limited livestock watering in some areas; and dilution and assimilation of treated municipal and industrial wastewater effluent. These are discussed in more detail in the following sections.



SURFACE WATER QUALITY CONDITIONS

Major Drainage Basins

Map 2-2 displays the principal lakes and streams in Dane County, as well as the four major river basins which include smaller-sized watersheds that drain to individual water bodies. Approximately 18 percent of the 1,230 square miles in the county lies within the Wisconsin River drainage basin, 22 percent within the Sugar–Pecatonica River basin, 60 percent within the Rock River Basin.

Stream Classifications

A stream classification system based on aquatic organisms has been established by the Wisconsin Department of Natural Resources (chapter NR 102 of the state Administrative Code). This classification system provides an indication of water quality conditions and fishery classification for all Dane County streams. DNR use classifications for specific streams are illustrated on Map 2-3.

ORW and ERW Waters

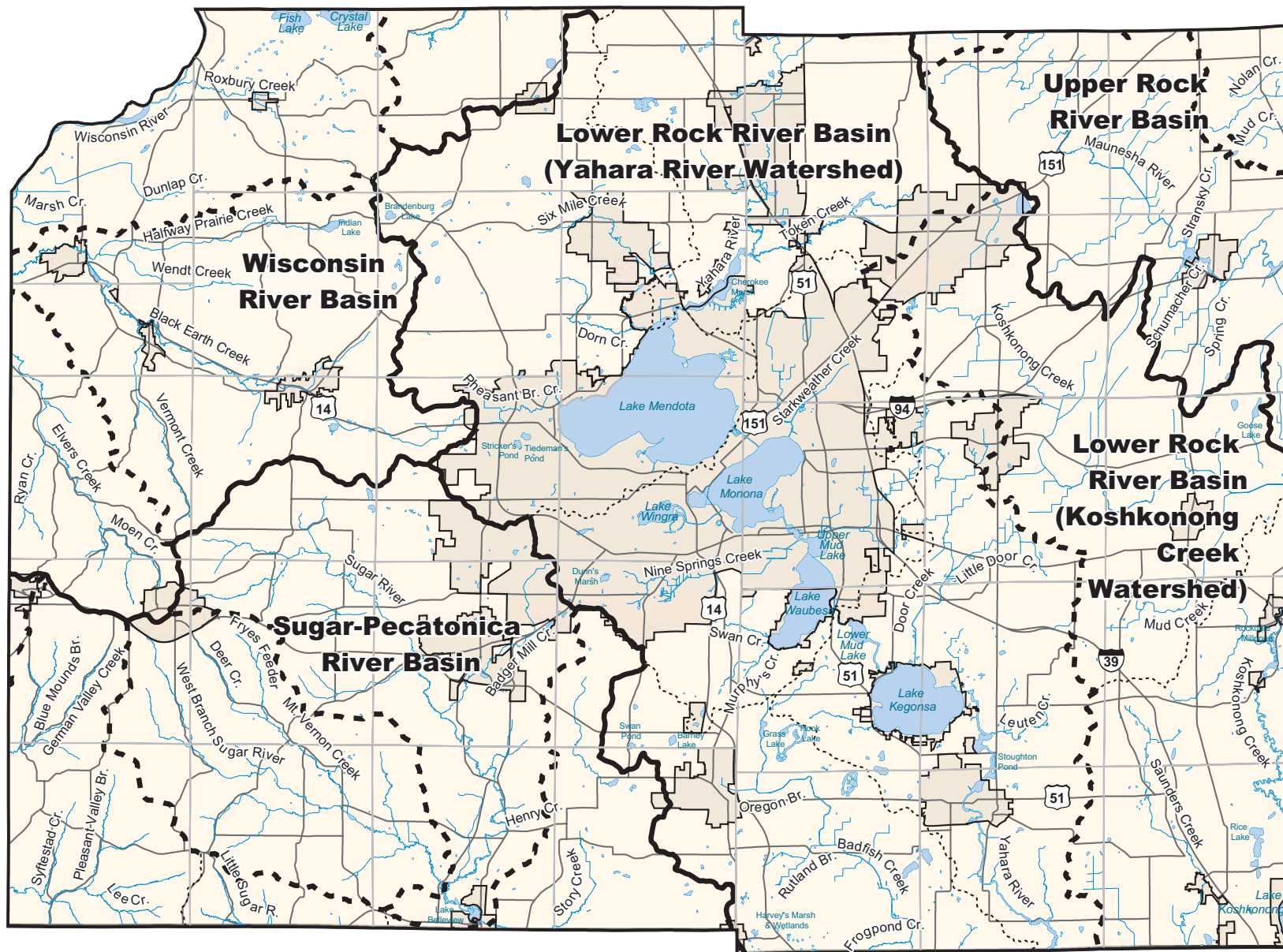
Streams classified as Outstanding Resource Waters (ORW) and Exceptional Resource Waters (ERW) are listed in Chapter NR 102 and presented on Map 2-4. Outstanding Resource Waters have excellent water quality, high recreational value, and high-quality fisheries. They do not receive treated wastewater discharges, and point source discharges will not be allowed in the future unless the quality of such discharges meets or exceeds the quality of the receiving water. Exceptional Resource Waters exhibit the same high quality resource values as outstanding waters, but may already receive treated wastewater discharges or may receive future discharges necessary to correct environmental or public health problems.

303 (d) Waters

Section 303(d) of the Clean Water Act requires states to report all waters in the state that are not meeting water quality standards. A list of these water bodies must be submitted to the U.S. Environmental Protection Agency every two years. Water bodies are delisted as the water quality problems are corrected. DNR has developed a list, and is working on an implementation strategy that would restore water quality over the next 20 years. The restoration mechanisms include development and implementation of “total maximum daily load” (TMDL) analyses. TMDL analyses involve the following:




- Identification of all sources of pollutant(s) of concern;
- Allocation of discharges from point and nonpoint sources of pollution, and
- Interactive monitoring and modeling to ensure the biological community and/or chemical status of the waters is fully restored.

Wisconsin lists more than 500 lakes, streams, wetlands, harbors and bays on the 303(d) list. A water body is placed on the list if it does not meet water quality criteria, or if it is determined that “designated uses” codified in state water quality standards are not being met. These impaired waters are categorized in one or more of the major source categories that are causing the problem(s). Map 2-4 shows the 303(d) water bodies in Dane County. Information is currently being reviewed by DNR to possibly remove the West Branch Sugar River from the list, and add Nine Springs Creek.



Water Resources

Dane County, Wisconsin

-  Major Basin Boundaries
-  Watershed Boundaries
-  Sub-Watershed Boundaries

 Lakes, Rivers, & Streams

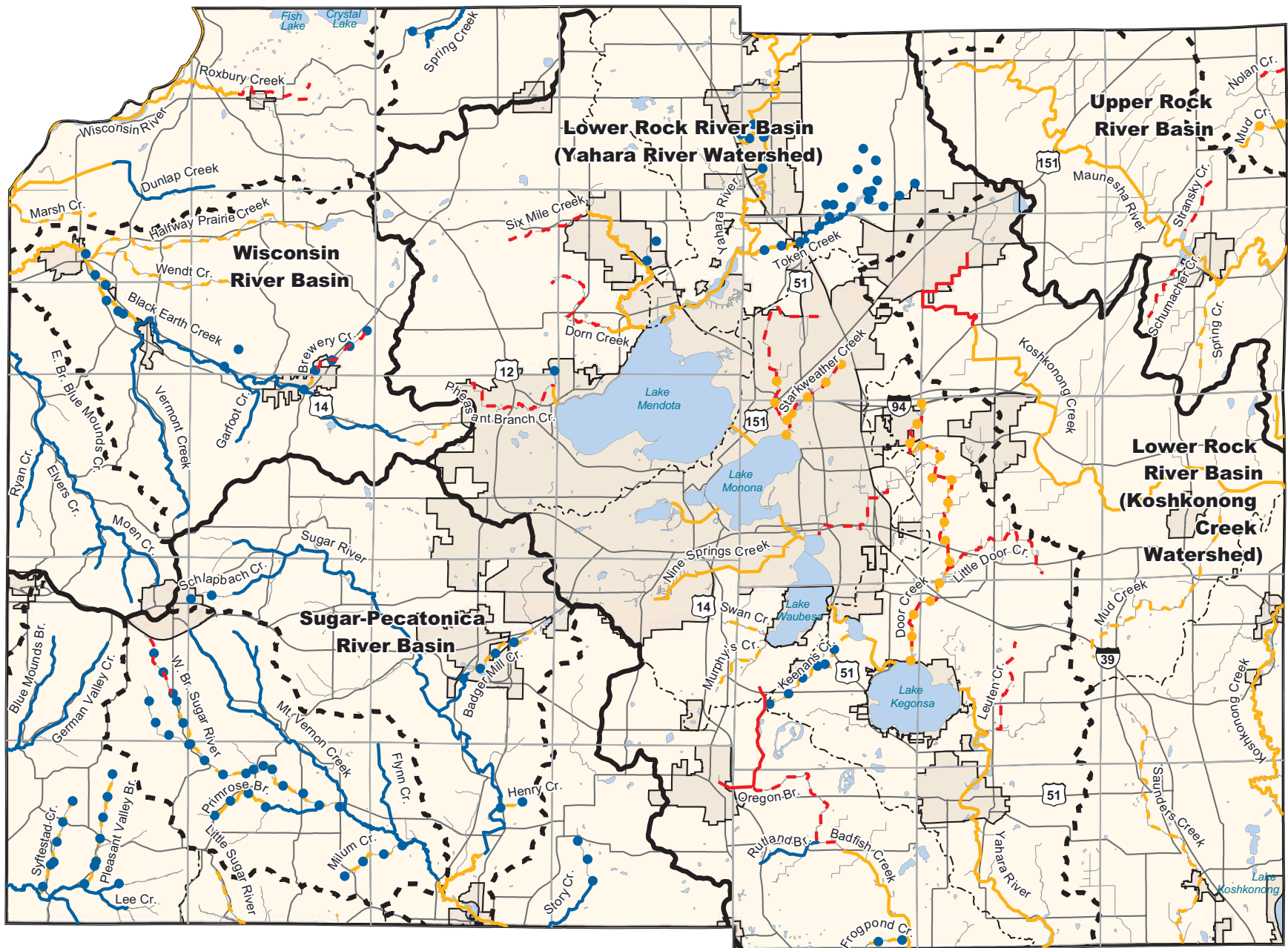
Map 2-2

Projection:
Lambert Conformal Conic
Dane County Coordinates - NAD 83(91)

Prepared by: The Dane County
Regional Planning Commission



Feb., 2005



Fish and Aquatic Life in Streams

Dane County, Wisconsin

Source: DNR Basin Plan stream tables

Classification			
Existing	Potential		
		Limited Aquatic Life (LAL)	
		Limited Forage Fishery (LFF)	
		Warm Water Forage Fishery (WWFF)	
		Warm Water Sport Fishery (WWSF)	
		Cold Water Fishery (COLD)	

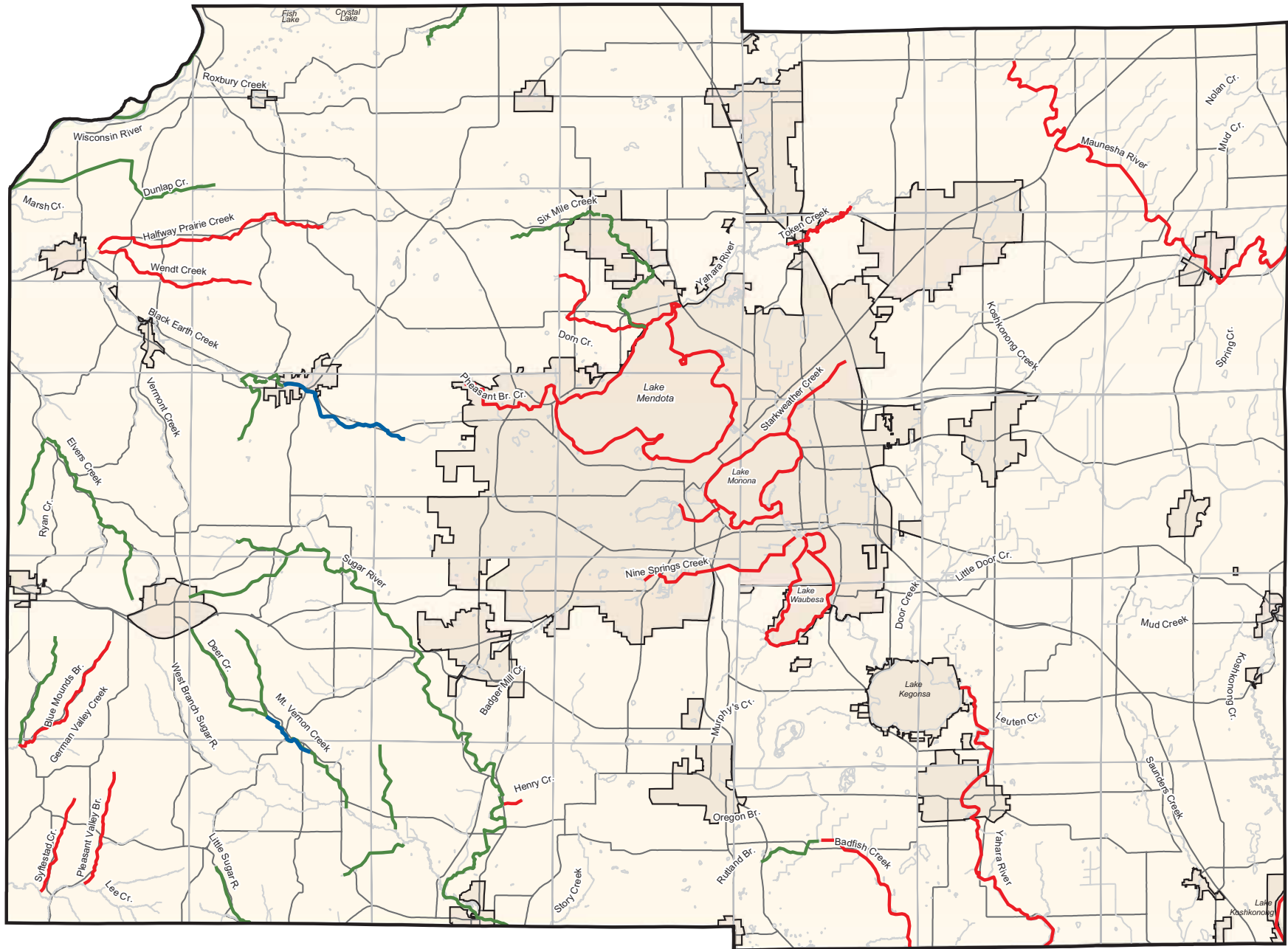
Map 2-3

Projection:
Lambert Conformal Conic
Dane County Coordinates - NAD 83(91)

Prepared by: The Dane County
Regional Planning Commission



Feb., 2005



Outstanding, Exceptional, and Impaired Waters

Dane County, Wisconsin

Source: WDNR Dec. 2004

- Outstanding Resource Waters
- Exceptional Resource Waters
- 303(d) Impaired Waters
- Streams & Lakes

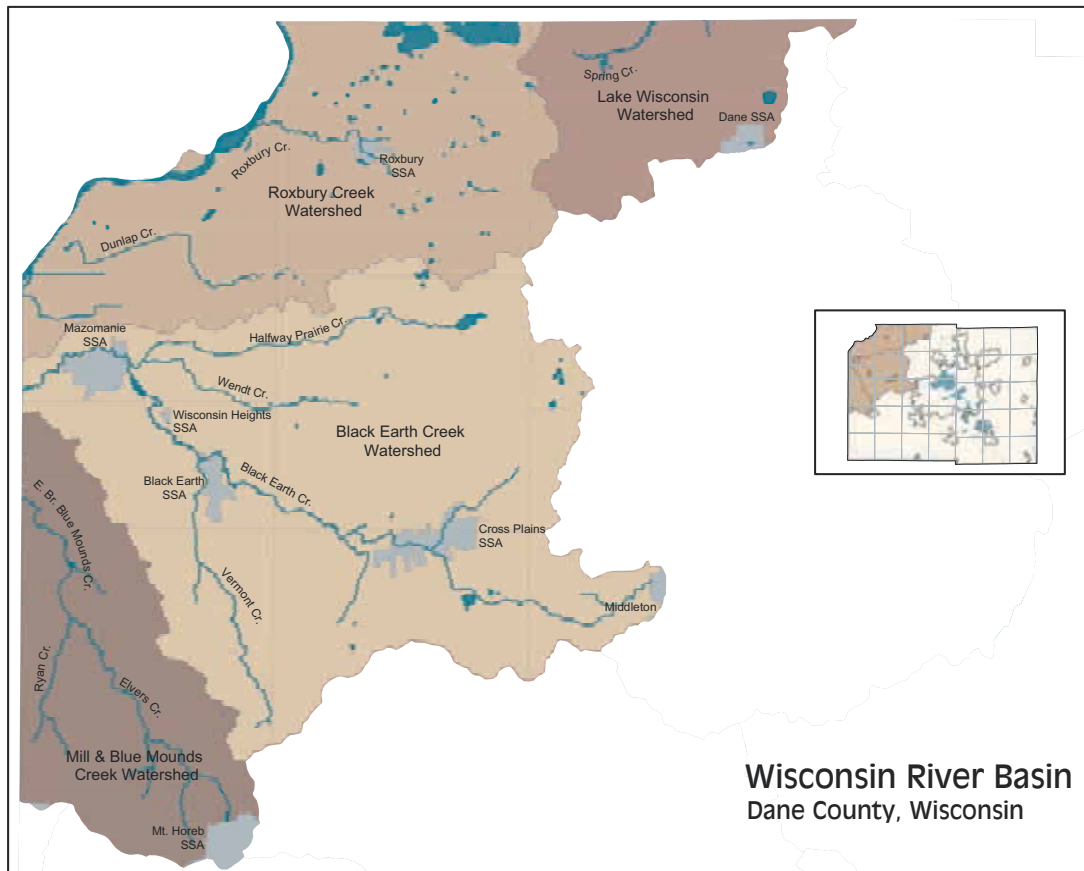
Map 2-4

Feb., 2005

Projection:
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Dane County Coordinates NAD - 83(91)

Prepared by: The Dane County
Regional Planning Commission





Wisconsin River Basin

The northern part of the Wisconsin River Basin includes the bottomlands and floodplain of the Wisconsin River Valley; a hillier moraine area to the east; and a drumlin–marsh glacial area east of the moraines. The Wisconsin River bottomlands include extensive wetland and marsh deposits underlain by deep alluvial deposits. The creeks which wind through the bottomlands generally are spring-fed, but have a flat gradient and little baseflow. The morainal areas are characterized by few streams and small, internally drained areas with kettle holes occupied by marshes or small seepage lakes. The southern part of the Wisconsin River Basin consists mainly of the watershed of Black Earth Creek and its tributaries. While the headwaters of Black Earth Creek are located in the morainal area, most of the watershed lies in the driftless area. Streams generally have steep gradients, gravel and rubble beds, and cool steady baseflow.

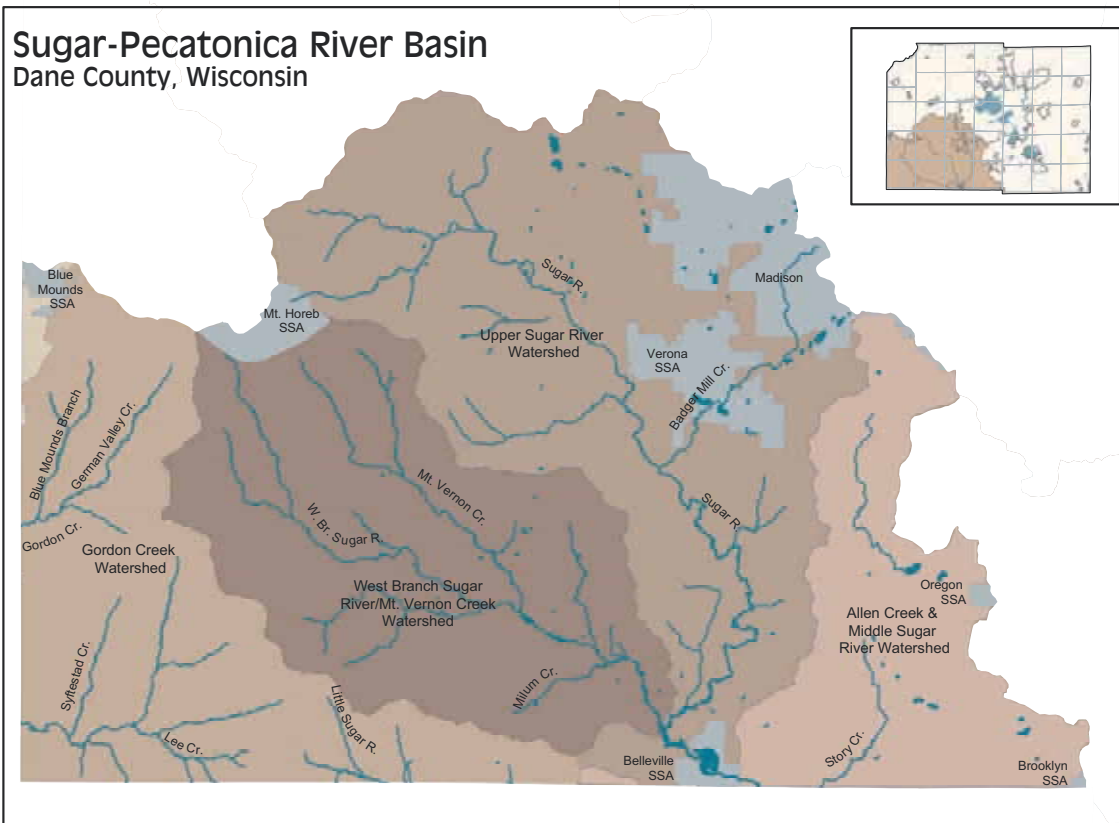
Land use in the Wisconsin River Basin is primarily rural and agricultural. The basin includes the unincorporated hamlet of Roxbury in the northern part of the basin, and the villages of Cross Plains, Black Earth and Mazomanie located on Black Earth Creek. Cropland occupies most land in the northern part of the basin, while steep wooded slopes along with cropland predominate in the Black Earth Creek watershed. The number and concentration of livestock operations ranges from low in the northern part of the basin to moderate in the Black Earth Creek Watershed. The main sources of pollution in the Wisconsin River basin include treated municipal

wastewater discharges (from the unincorporated community of Roxbury in the northern part of the basin, and the communities of Cross Plains and Mazomanie along Black Earth Creek), and from agricultural nonpoint sources (primarily soil erosion from cropland but also including some organic pollution from barnyard runoff).

The Wisconsin River is a large river with a diverse warm water fishery. Water quality of the river is largely determined by point and nonpoint sources of pollution located outside of Dane County in its large watershed. Fish Lake is a 252 acre, relatively deep (maximum depth 62 feet) stratified lake which supports a cold water fishery. There has been evidence of increasing eutrophication in recent years. Pollutant discharges from agricultural areas and from septic tanks and development around the lake are suspected causes. Crystal Lake is a shallow, naturally eutrophic lake which supports a dense growth of aquatic plants and algae, and suffers winterkill problems. Spring Creek, in the northeastern part of the basin, supports a Class II trout fishery and is classified as an Exceptional Resource Water. Dunlap Creek supports a stocked trout fishery in its upper portions, as well as a diverse warm water fishery in its lower reaches.

The upper part of Black Earth Creek supports one of the two Class I trout fisheries in Dane County. Several tributary streams (Vermont Creek, Garfoot Creek, Ryan Creek, Bohn Creek, Elvers Creek, East Branch of Blue Mounds Creek) support stocked trout fisheries. Many of these streams have the potential to support a naturally reproducing trout population if nonpoint source pollution is adequately controlled. The portion of Black Earth Creek downstream from the Village of Mazomanie supports a diverse warm water fishery, including smallmouth bass. Other tributaries of Black Earth Creek, including Halfway Prairie Creek and Wendt Creek, support forage fish, but have the potential to support a trout fishery with reduced nonpoint source pollution and improved habitat. General or baseflow water quality conditions in the Black Earth Creek watershed are good. Water quality monitoring conducted on Black Earth Creek indicates a fertile stream with ample baseflow which is moderately high in nutrients (especially phosphorus) and other dissolved solids. The generally good water quality of Black Earth Creek, and its ability to support one of the state's most productive trout fisheries, is highly dependent on the maintenance of high baseflow from groundwater contributions, as well as maintaining a consistent and high level of performance at the wastewater treatment plants discharging to the stream. Studies and monitoring of Black Earth Creek conducted as part of the Black Earth Creek Priority Watershed Plan provided additional information and pinpointed pollution sources in the upper part of the stream. These studies indicated that, in addition to the overall or major sources of pollution in the basin, erosion from construction activities and barnyard runoff are creating serious localized water quality impacts. Earlier streambank erosion surveys had indicated that streambank erosion, due in part to livestock grazing, is a substantial problem for several streams in the Black Earth Creek watershed.





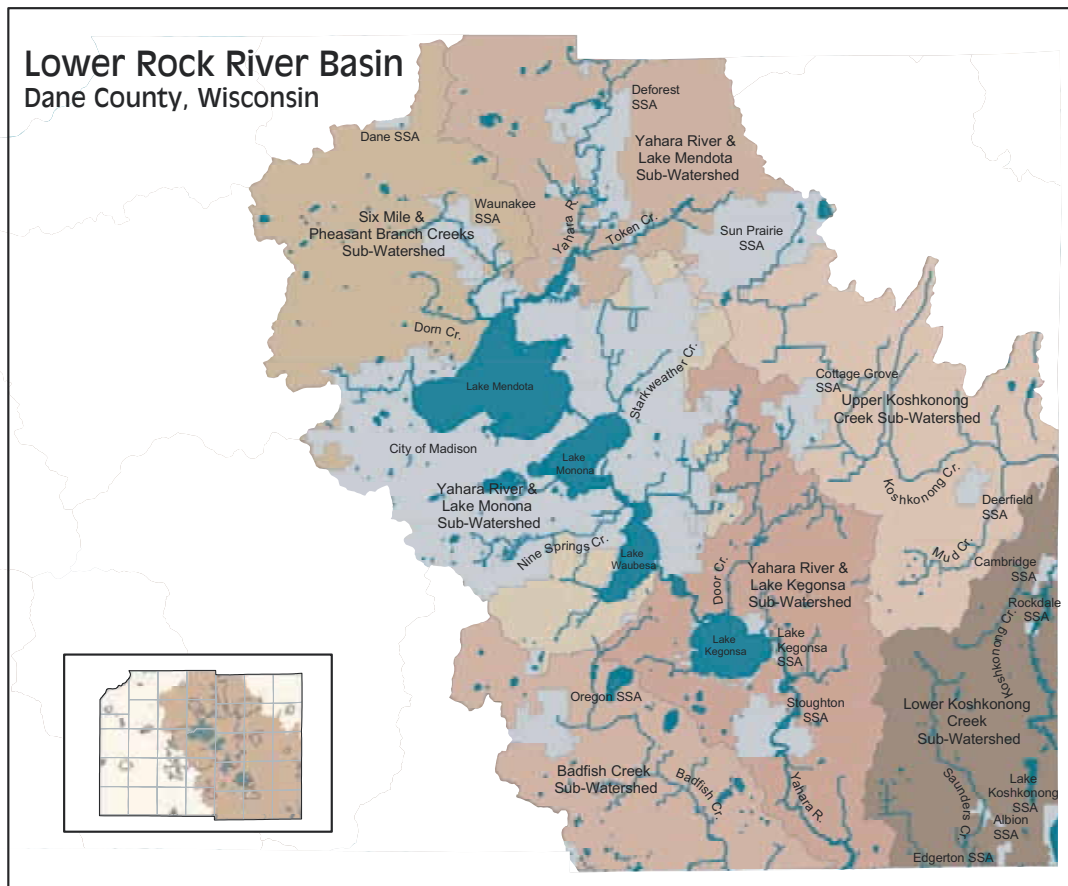
Sugar–Pecatonica River Basin

Most of the Sugar–Pecatonica River Basin falls within the valley and ridge or driftless area of Dane County. This area is characterized by thin soils over bedrock, steep wooded slopes, and narrow stream valleys with alluvial deposits, few wetlands, and no natural lakes or impoundments. Streams are typically fed by groundwater from bedrock outcrops exposed along hillsides. Stream gradients, temperature, baseflow, and habitat conditions are appropriate for trout fisheries in many streams. The morainal area bounding the eastern part of the basin has a poorly developed drainage pattern, with many internally-drained areas.

Land use in the Sugar–Pecatonica River Basin is mostly rural and agricultural. Cropland erosion rates are of concern, and this basin has the highest concentration of livestock and dairy farming activities, particularly in the western part of the basin. Municipal and industrial wastewater discharges also represent significant impacts on surface waters in the Sugar–Pecatonica River Basin, including those at the communities of Blue Mounds, Mt. Horeb, Belleville and Brooklyn. Wastewater generated in the City of Verona is treated at the MMSD Nine Springs Wastewater Treatment Facility. Groundwater withdrawal by municipal wells and diversion of wastewater to MMSD were shown to result in the complete loss of baseflow in Badger Mill Creek (a Sugar River tributary). Consequently, MMSD has constructed an effluent return forcemain which returns highly treated effluent to Badger Mill Creek. This has resulted in the restoration of flow in the Creek. Urban nonpoint sources of pollution represent less serious impacts, except for localized situations. The southwestern portion of this basin represents the areas of most significant potential for livestock waste pollution problems in Dane County.

The primary water resources in the Sugar–Pecatonica River Basin include the Sugar River and its tributaries, and the headwater streams tributary to the Pecatonica River, in the extreme southwestern corner of Dane County. The Pecatonica River tributaries: the Sugar River; the West Branch of the Sugar River, Mt. Vernon Creek, and their tributaries; and Story Creek support trout fisheries. Mt. Vernon Creek supports a Class I trout fishery. Lake Belle View is a small millpond on the Sugar River at the Village of Belleville where sediment deposition is a concern.

Available water Quality monitoring information indicates that water quality conditions in the basin are generally good, but are quite sensitive to levels of agricultural nonpoint source controls, and to the performance of wastewater treatment plants. Since many of the streams in this basin are limited primarily because of sedimentation impacts from erosion, substantial improvements in stream quality and potential can be achieved through agricultural nonpoint source management practices. For example, intensive efforts at soil conservation and streambank protection programs in the Mt. Vernon Creek watershed have demonstrated that substantial (up to 50%) reductions in erosion and impacts on stream habitat can be achieved with aggressive nonpoint source control programs. In addition, the watershed has been the focus of various projects and efforts as part of a pilot Upper Sugar River Initiative, coordinated among representative state and local water resource management agencies and private citizen groups.



Lower Rock River Basin/Yahara River Watershed

Most of the Yahara River Watershed is in the Yahara River valley physiographic area, where deep glacial deposits dammed up large preglacial valleys, forming a chain of large lakes and wetlands. This physiographic area is characterized by general glacial ground moraine deposits, interspersed with large areas of wetlands with marsh and peat deposits. Stream gradients range from flat to moderate in most of the basin. Glacial moraines are located at the western edge of the basin. The morainal area has a less developed drainage pattern, with many internally drained areas and quite variable glacial surface deposits.

Most of the Yahara River Watershed is within Dane County, but slightly over 30 square miles of the headwaters of the Watershed are located in Columbia County to the north. Much of the land in the Watershed north of Lake Mendota is devoted to agriculture, with a fairly high percentage of cropland. Urban communities in this part of the Watershed include the Villages of Dane, Waunakee, and DeForest, and the unincorporated hamlets of Windsor, Morrisonville, and Burke. Wastewater from this part of the basin is transmitted to the Madison Metropolitan Sewerage District's treatment plant and diverted around the lakes, and some is discharged to groundwater. There are no significant impacts on surface waters in this part of the basin from wastewater discharges. The primary source of pollution is erosion from agricultural lands, which contribute sediment and nutrients to the Yahara River and

lakes. However, rapid urban development is taking place and erosion from construction sites and runoff from urban land uses are of growing importance and concern in this part of the basin.

The central part of the Watershed—the area surrounding lakes Mendota, Monona and Waubesa—is primarily urban, with limited agricultural uses on the fringe of the central urban area. In this part of the basin, urban nonpoint sources of pollution (including erosion from construction and development activities) predominate, delivering sediment, nutrients and toxic substances directly to the lakes and urban streams such as Starkweather Creek, Pheasant Branch Creek, Nine Springs Creek, and Murphy (Wingra) Creek. Agricultural sources of pollution are relatively minor. There are few industrial discharges in this part of the Watershed, and municipal wastewater is collected and diverted around the lakes, protecting them from any significant wastewater discharges.

The southern portion of the Yahara River Watershed, including the area directly tributary to Lake Kegonsa, is predominantly agricultural, with only the communities of Stoughton and Oregon contributing any significant urban influence. The main sources of pollution in this part of the basin include agricultural nonpoint source pollution from both cropland erosion and livestock operations, and point sources of pollution—wastewater discharges from the City of Stoughton to the Yahara River, and from the Village of Oregon and the Madison Metropolitan Sewerage District (the principal wastewater discharge in Dane County) to Badfish Creek.

The surface water resources of the Yahara River Watershed are the most heavily-used and highly-valued in Dane County. The Yahara River chain of lakes—Mendota, Monona, Waubesa, and Kegonsa—provide a spectacular setting for the central urban region of the County, including the state capital, the main campus of the state university, and the majority of the county's population. The Yahara River lakes are by far the most heavily used recreational resource in the region, and their scenic beauty is one of the prized assets of Dane County. Other important water resources in the basin include the Yahara River and its tributaries, rural and urban streams draining directly to the lakes, including Token Creek, Sixmile Creek, Pheasant Branch Creek, Starkweather Creek, Nine Springs Creek, and Door Creek.

Badfish Creek plays a major role in receiving all of the treated municipal wastewater effluent generated in the basin, and transmitting it around the lakes, so that none of the Yahara lakes receives any significant point source pollution. Other important resources in the basin include Lake Wingra in the University Arboretum, and large wetland areas, such as Cherokee Marsh.

The streams in the northern part of the Yahara River Watershed—upstream from Lake Mendota—have generally good baseflow water quality conditions. Token Creek has substantial groundwater inflow, and is the most significant contributor of baseflow to Lake Mendota. The ample baseflow of Token Creek supports a Class III trout fishery above USH 51, which, prior to the millpond drawdown and subsequent dam removal in 1999, was limited by impoundment effects and habitat conditions. Plans are being coordinated among various federal, state, and local agencies to restore a brook trout fishery supported by the significant springs that supply the Creek. Other streams in this part of the basin generally support warm water fisheries dominated by forage fish, with influxes of northern pike and panfish from Lake Mendota during spawning season. The Yahara River supports a more diverse year-round warm water fishery just above Lake Mendota, including game species.

Urban streams in the central part of the basin suffer from alteration and channelization, and from the impacts of urban pollution. For example, Starkweather and Nine Springs Creeks are both highly-altered urban streams with low gradients, and generally poor water quality conditions resulting from previous point source discharges and urban runoff. Pheasant Branch Creek has experienced serious stream erosion problems from increased stormwater runoff. Water bodies in the central part of the Watershed also suffer from the effects of groundwater pumping and diversion through sanitary sewers, which have substantially reduced groundwater discharge and baseflow that once sustained these resources.

Streams in the lower part of the Yahara River Watershed are mainly impacted by agricultural nonpoint source and point sources of pollution. In several instances, point sources of pollution tend to overshadow nonpoint sources. Badfish Creek is a small stream which receives nearly 42 million gallons per day of treated wastewater effluent from the Madison Metropolitan Sewerage District and from the Village of Oregon. The wastewater is treated to high levels, and Badfish Creek has been meeting water quality standards for

fish and aquatic life below County Trunk Highway A. Water quality conditions in Badfish Creek have improved substantially since the completion of advanced waste treatment facilities at the Madison Metropolitan Sewerage District's Nine Springs Wastewater Treatment Plant. Wastewater from the City of Stoughton is treated and discharged to the Yahara River below Lake Kegonsa, where there is adequate baseflow to assimilate the treated wastewater. The water quality conditions and problems in the lower part of the Yahara River are due primarily to the effects of impoundments on the Yahara River, and in-stream biological activity supported by substantial nutrient inputs from the Yahara River lakes.



Yahara Lakes

Lake Mendota is a large (9,800 acres) and deep (maximum depth 83 feet) lake which seasonally stratifies and supports a diverse warm water fishery as well as cisco, a cold water species. Lake Mendota is eutrophic and suffers from nuisance levels of algae and aquatic weeds, which interfere with recreational use and scenic enjoyment. There is little evidence that there have been any major changes in water quality conditions since the turn of the century, however, the lake was at that time already experiencing the impacts of agriculture and urban growth in its watershed. There are no records of unpolluted natural water quality and aquatic community for Lake Mendota before the earliest settlement.

The Lake Mendota Watershed is primarily composed of agricultural land; however, significant urban areas also drain to the lake. Sediment and nutrients washed from the land surface are the primary cause of the accelerated eutrophication and weed and algae problems of Lake Mendota and the other Yahara River lakes. There are no wastewater treatment plants discharging to Lake Mendota or to the other Yahara lakes. Although Lake Mendota water quality conditions seem to have remained relatively stable over the years, there was a major change in the 1960s in the aquatic weed community in shallow areas of the lake, with the invasion and dominance of the Eurasian water milfoil, a less desirable aquatic plant than previously existed. Recent field surveys indicate that water milfoil is on the decline and native plant species are becoming more abundant.

Lake Monona is a smaller (3,300 acres) stratified lake with a maximum depth of 74 feet immediately downstream from Lake Mendota. Nearly all of the direct drainage to Lake Monona is from surrounding urban areas; however, the main source of nutrients to the lake is the Yahara River outflow from Lake Mendota. Lake Monona received major inputs of pollutants and nutrients from municipal and industrial wastewater discharges until after World War II. Historic data indicate extremely high levels of nutrients and severe eutrophication problems resulting from these discharges. Water quality conditions improved substantially after the discharges were eliminated. The lake is still eutrophic and suffers from nuisance levels of algae and aquatic weeds.

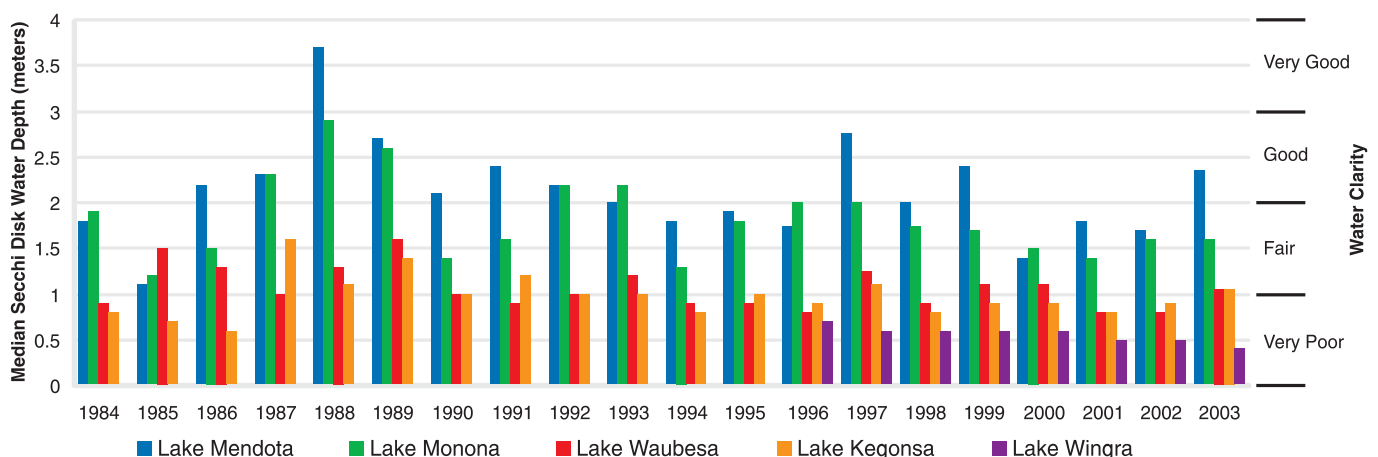
Previous municipal and industrial discharges to the lake and its tributaries, and the use of chemicals for aquatic weed and algae control have contributed potentially toxic materials to the sediment of Lake Monona and some of its tributaries (including mercury, arsenic, copper, and PCBs). While these toxic materials do not appear to be at levels high enough to represent a direct health exposure risk, DNR has issued general “safe-eating guidelines” for all waters of the state because of potential concentration in the food chain. These fish consumption guidelines typically focus on women of childbearing years and children under the age of fifteen. For older women and men the guidelines are less restrictive. Lake Monona has a PCB advisory for carp (no more than 1 meal/month), as do other Dane County waters: Lake Mendota (carp), Wisconsin River (lake sturgeon and carp), and Badfish Creek (brown trout and carp).

Lake Wingra is a small (348 acre) shallow (maximum depth 21 feet) lake located in the middle of the urban area in the University Arboretum. It is a shallow, highly eutrophic lake mainly impacted by urban runoff, and has a warm water panfish fishery.

Lake Waubesa is a shallower (maximum depth of 38 feet) 2,100 acre lake downstream from Lake Monona which supports a diverse warm water fishery. The lake receives direct runoff from both urban and rural areas, but most of the nutrient input to the lake is from the Yahara River outflow from Lake Monona. Lake Waubesa also suffered the effects of direct wastewater discharges until a collection system was completed in 1958 to divert wastewater discharge. When treated wastewater effluent was discharged directly, Lake Waubesa experienced severe eutrophication problems and extreme nuisance weed and algae problems. Since wastewater was diverted, nutrient levels and water quality conditions have improved in Lake Waubesa; however, the lake is still highly eutrophic and suffers from serious aquatic weed and algae nuisance problems.

Lake Kegonsa is a 3,200 acre lake with a maximum depth of 32 feet, and is the farthest downstream of the Yahara River lakes. The lake supports a diverse warm water fishery. Lake Kegonsa is located outside of the central urban area, and its direct watershed is primarily agricultural, with some development around the lake shoreline. The lake is highly eutrophic with serious algae problems, although aquatic weed problems are somewhat less severe than the other Yahara River lakes. Lake Kegonsa also suffered from the effects of early wastewater discharges to the upper lakes, since its major input is the Yahara River discharging from Lake Waubesa. During the years when wastewater discharges were affecting Lakes Monona and Waubesa, these effects were also transmitted downstream to Lake Kegonsa, and very serious eutrophication and nuisance algae problems resulted. Since 1958, when wastewater was diverted around the Yahara River lakes, water quality and algae conditions have improved, but the lake has continued to exhibit a higher level of eutrophication than the other Yahara lakes. This may be due in part to continued wastewater inputs that the lake received from the Village of Cottage Grove until 1982. More recently, local governments have provided sewer service to development around the lake shoreline to eliminate possible pollutant discharges from septic tanks.

Yahara Lakes Summer Water Clarity



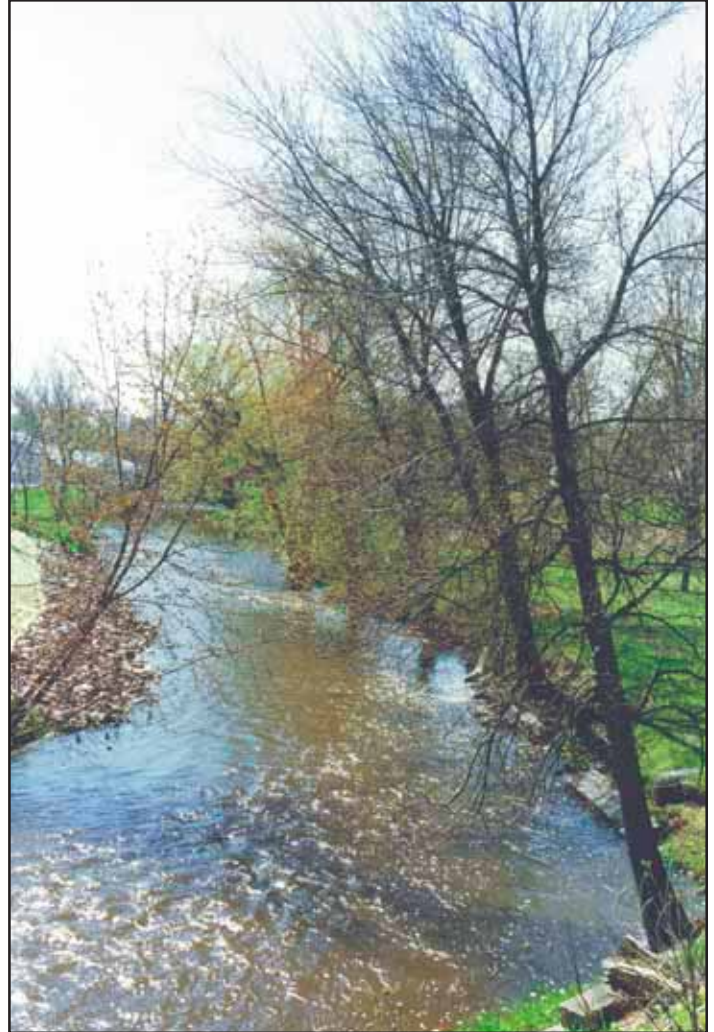
Source: Wisconsin Dept. of Natural Resources Bureau of Research, and U.W. Center for Limnology (1995-2003)

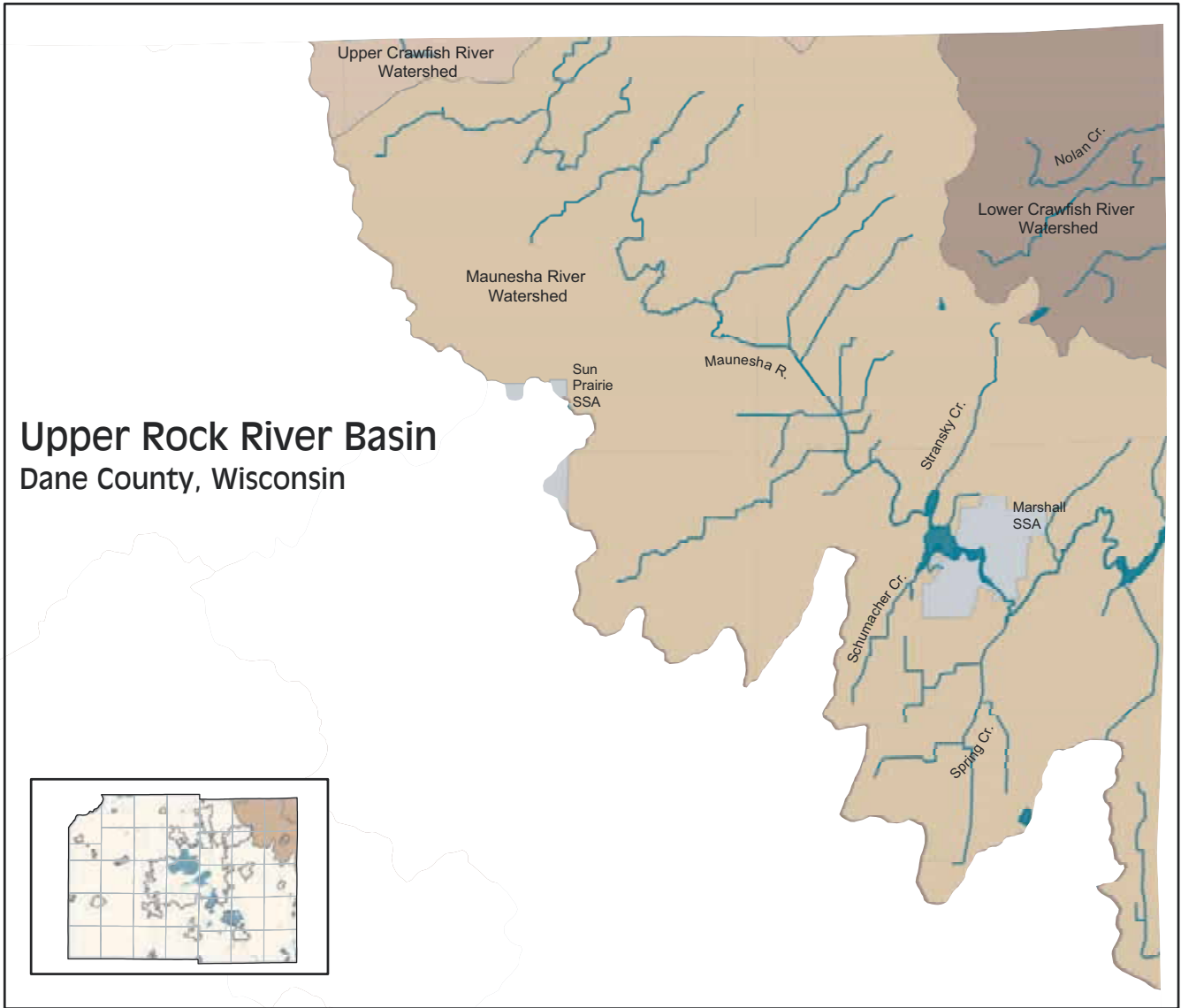
Lower Rock River Basin/Koshkonong Creek Watershed

The Koshkonong Creek Watershed is in the drumlin and marsh physiographic area of eastern Dane County. In this physiographic region, large areas of interconnected wetlands drained by sluggish streams are bounded by low hills of glacial till called drumlins. Baseflow in streams is generally low and water temperatures are warm because groundwater recruitment is minimal. The small streams which wind slowly through the wetlands have been ditched and straightened in many places to provide more efficient drainage.

Nearly all of the land in the Koshkonong Creek Watershed is agricultural. The City of Sun Prairie, located at the headwaters of Koshkonong Creek, is the largest urban community in the Watershed. Other communities include the villages of Deerfield, Cambridge and Rockdale. The primary water quality impacts from these urban communities result from the discharge of treated wastewater to the Creek. The low baseflow and marginal background water quality of the receiving stream makes it relatively sensitive to pollution. Because of the small area devoted to urban land uses in the Watershed, urban nonpoint source pollution is only of primary concern in localized circumstances immediately downstream urban areas. The main source of nonpoint source pollution is erosion from cropland.

The fishery and water quality conditions of streams in the Watershed are limited by natural background conditions, including low baseflow, flat gradients, warm temperatures, and high inputs of nutrients and sediment from the fertile agricultural watersheds. The lower Koshkonong Creek supports a warm water fishery, but most other streams in the basin are capable of supporting only forage fish with occasional spawning use where wetlands remain. The marginal background conditions are also reflected in the fact that many of the streams that receive wastewater discharges have classifications lower than full fish and aquatic life. Nonetheless, the sensitivity of the receiving waters means that many of the wastewater discharges have to be treated to relatively high levels to meet water quality standards. Koshkonong Creek is one of the tributaries to Lake Koshkonong, situated at the southeastern corner of Dane County. Lake Koshkonong is a large lake experiencing severe eutrophication from sediments and nutrients contributed from communities and farmlands in its very large and fertile watershed. The Koshkonong Creek Watershed also includes many important and extensive wetland areas, such as the Mud Lake and Goose Lake wetlands.





Upper Rock River Basin

The Mauneshia River rises in Columbia County, flows through northeastern Dane County and a corner of Jefferson County to eventually join the Crawfish River in Dodge County. The Mauneshia River and its tributaries drain 88 square miles of primarily agricultural land in Dane County. Many of the wetlands in the watershed have been ditched and drained. The major remaining wetland is Deansville Marsh, which is located over a mile upstream from the Village of Marshall.

The Mauneshia River is a shallow, meandering, wetland drainage stream with a low gradient. The river is about 20 miles long in Dane County. Except for the portion which flows through the Deansville Marsh, most of the Mauneshia River has not been ditched. The river is dammed at the Village of Marshall to form a shallow millpond.



The water quality of the Mauneshia River is fairly good compared to other baseflow monitored streams in Dane County. Summer dissolved oxygen and bacteria levels, however, can pose water quality concerns. Baseflow nitrate-nitrogen are relatively high compared to other monitored streams in the county and have increased. This increase may be the result of continued use of commercial agricultural fertilizers in the watershed.

The fishery in the Mauneshia River is dominated by forage species. Large numbers of carp have caused turbidity problems. The river has been chemically treated several times to eradicate rough fish and has been restocked with game fish.

The Marshall Wastewater Treatment Plant is the only point source of wastewater discharge to the river in Dane County. Agricultural nonpoint source pollution is the major water quality concern for the Mauneshia River. The river carries heavy silt loads due to erosion from adjacent cropland and pastured streambanks and ditches. Some of the silt settles out at the Marshall Millpond, which is one of the few lakes in eastern Dane County that is suitable for intensive recreational use. Dredging has been done on the millpond to remove silt. The only natural condition which imposes a significant limitation on the fishery and use potential of the river is low baseflow and the possibility of nocturnal dissolved oxygen sags from aquatic vegetation.

Water Quality Assessments

One indicator of stream water quality condition is the type of insects found living on rocks and other stream bottom materials. Certain species of insects will tolerate only undisturbed conditions with limited organic material, while others are able to survive in various types of habitat and water quality conditions. The Hilsenhoff Biotic Index or HBI (Hilsenhoff, 1982) indicates the degree of organic enrichment in a stream by the types of insects living there. Tolerance values are assigned to various species of insects and an overall score is calculated for the water body. HBI determinations for various Dane County streams are displayed on Map 2-5. The Index of Biotic Integrity (IBI) is another widely applied and effective tool using fish community data to assess the environmental quality of aquatic habitats.

Water quality assessments are also made based on chemical data. Water chemistry monitoring of selected Dane County streams has been conducted by the US Geological Survey during baseflow (dry-weather) conditions, which occur most of the time and represent the most critical conditions for survival of fish and other aquatic life as well as for recreational uses.

Summary data on Dane County water resources, including baseflow chemistry monitoring results, are presented in Appendix 2. Drainage basin and watershed size information are also presented.

Baseflow water quality information has been collected from representative Dane County streams over the last 25 years. While the quality of surface water and groundwater in Dane County is generally good, water pollution problems are evident. There have also been areas of noticeable improvement. A 1999 DCRPC report reaches the following conclusions:

- Despite the significant growth and development that has occurred in Dane County, surface water quality in streams is generally not declining, and may actually be improving due to wastewater treatment plant upgrades.
- Over-fertilization and sedimentation of our lakes from urban and rural nonpoint source stormwater runoff, however, continues to be a problem. These impacts are more difficult to measure and to remedy, since they cannot usually be traced to a single point or origin, but rather result from storm runoff washing sediment, nutrients and other pollutants off the land.
- Groundwater quality indicates worsening trends, especially increasing nitrate levels from the overuse of fertilizers, and increasing salt concentrations. Concentrations of atrazine in wells, on the other hand, have shown improvement due largely to state restrictions on atrazine use.

Water Quality Scale		
Hilsenhoff Biotic Index	Water Quality Scale	Degree of Organic Pollution
0.00 - 3.50	Excellent	Organic Pollution Unlikely
3.51 - 4.50	Very Good	Possible Slight Organic Pollution
4.51 - 5.50	Good	Some Organic Pollution Probable
5.51 - 6.50	Fair	Fairly Substantial Pollution Likely
6.51 - 7.50	Fairly Poor	Substantial Pollution Likely
7.51 - 8.50	Poor	Very Substantial Pollution Likely
8.51 - 10.00	Very Poor	Severe Organic Pollution Likely

Interpretation of IBI Scores		
Index of Biotic Integrity (IBI) Score	Integrity Rating	Interpretation and Fish Community Attributes
100 - 90	Excellent	Comparable to the best situations with the least human disturbance.
80 - 60	Good	Evidence for some environmental degradation and reduction in biotic integrity.
50 - 30	Fair	The stream reach has experienced moderate environmental degradation, and biotic integrity has been significantly reduced.
20 - 10	Poor	Major environmental degradation has occurred, and biotic integrity has been severely reduced.
0 or no score	Very Poor	Human disturbance and environmental degradation have decimated the natural fish assemblage.

GROUNDWATER QUALITY CONDITIONS

Surface water, shallow groundwater, and deep groundwater are intimately connected in Dane County. Almost all groundwater in Dane County originates as recharge occurring within the County. Most lakes and streams in the county are discharge points for groundwater where the water table intersects the land surface. In general, the water table is a subdued reflection of the land topography. The depth to groundwater in the county ranges from zero at the fringes of lakes and wetlands to over 200 feet beneath the ridges in the southwest. Map 2-6 shows the configuration of the water table in Dane County. The water table is highest (over 1,000 feet above sea level) in the western part of the county near Mt. Horeb and Blue Mounds, and is lowest (less than 840 feet) along the Yahara River in the southeast.

The shallow water table in Dane County forms several naturally occurring basins, analogous to but not entirely coincident with surface water basins (Map 2-7). Shallow groundwater moves away from groundwater divides. Near major lakes, streams, and wetlands, shallow groundwater flows towards surface water bodies. Note that groundwater and surface water divides in Dane County do not coincide completely. There are various places in the county where shallow groundwater can move horizontally beneath topographic divides and opposite surface water flow.

Groundwater Sources and Uses

Groundwater supplies nearly all of the water for domestic, commercial and industrial uses in Dane County. Although there is a relatively unlimited groundwater supply in the county, it is critically important that the quality of groundwater be protected for these uses. Groundwater is also very important in providing baseflow discharges to wetlands and streams, which support these resources especially during periods of dry weather. Groundwater that is withdrawn and used in Dane County is for the most part recharged

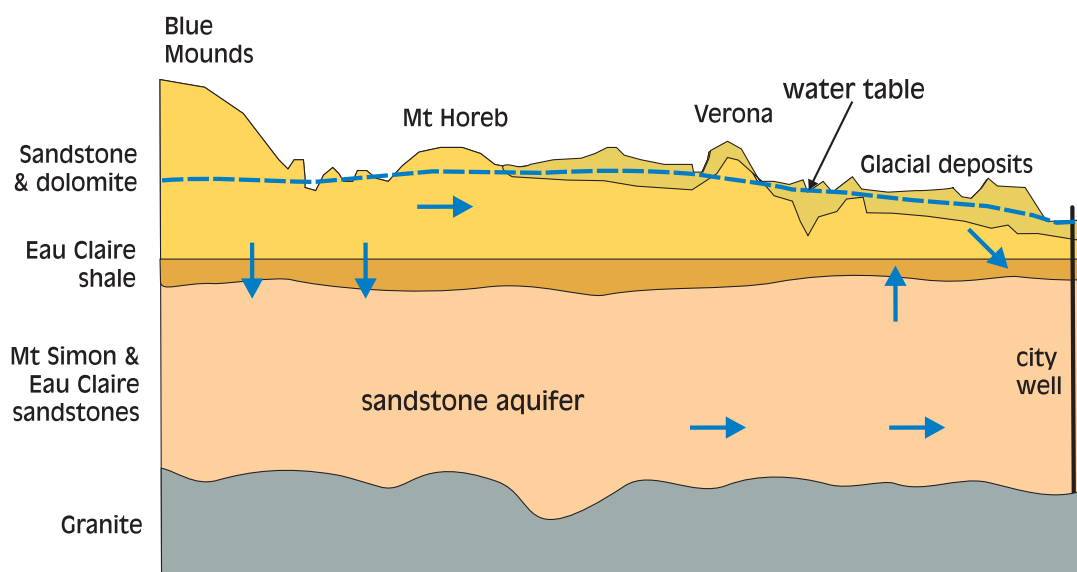
locally from infiltration of precipitation. Water supplies are drawn from the upper sandstone and unconsolidated aquifers, which provide water for shallow domestic wells in rural areas, and the deep sandstone (Mt. Simon) aquifer, which is a source of water for nearly all of the deep municipal wells in the county (see figure below).

The upper or shallow groundwater flow system mirrors the topography of the land surface, recharging in upland and hillside areas, and flowing toward and discharging in low-lying areas such as streams and wetlands. The shallow groundwater flow system is of primary importance in questions of local pollution of water supply wells from nearby waste disposal sites, and will show the earliest evidence of contamination from most pollution sources.

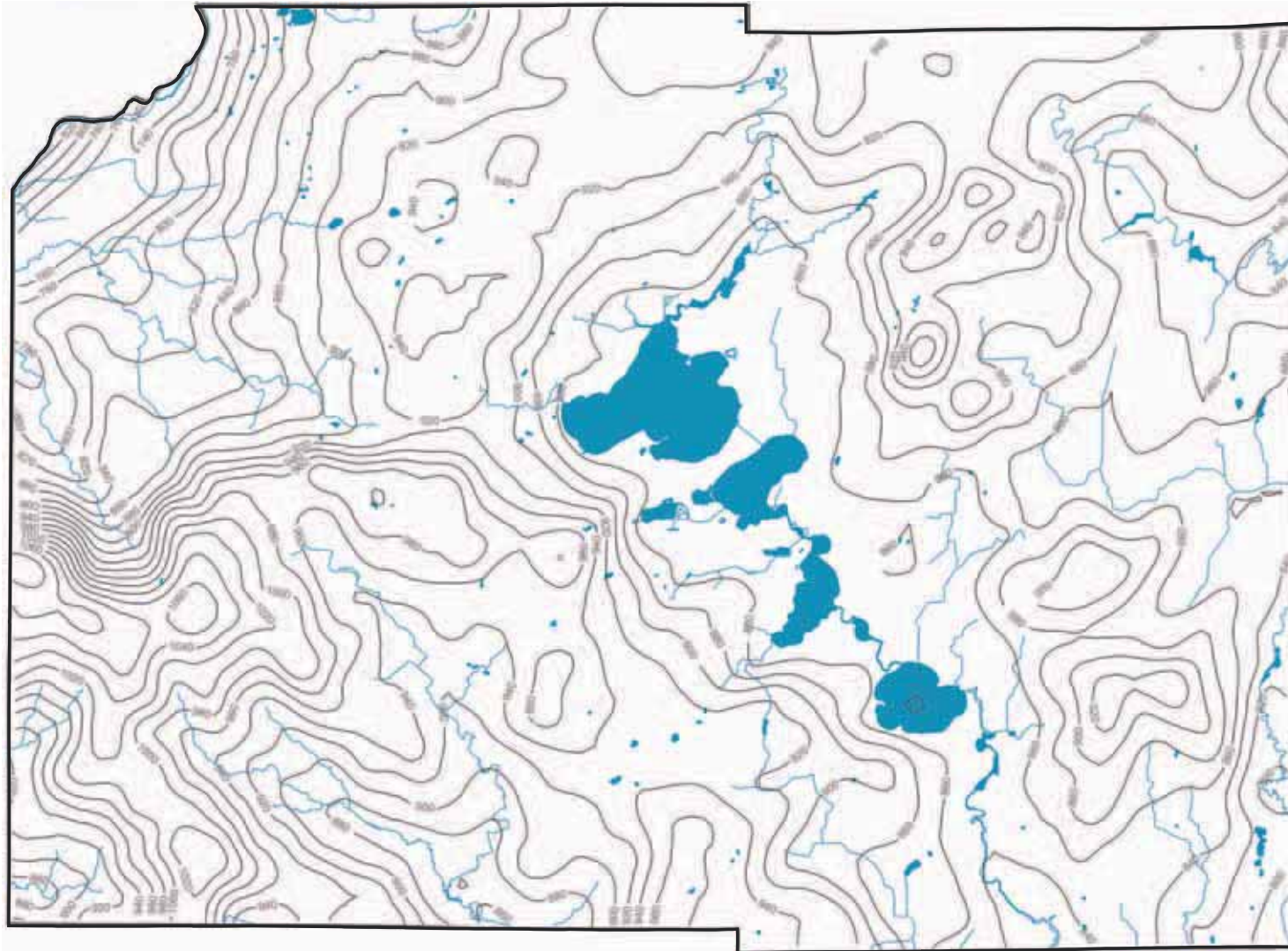
Groundwater withdrawn from the deep sandstone aquifer for municipal use is replaced by percolation from overlying aquifers; thus, this water use is also replaced mainly by local recharge of precipitation.

Over 60 million gallons per day (mgd) of groundwater is withdrawn and used—about 140 gallons per person per day. Most of this water is returned to surface water after use. Public water supplies account for about 75 percent of total groundwater use. This includes water withdrawn and used in municipal and private systems for residential, industrial, and commercial purposes. Private sources, such as irrigation, stock watering, rural domestic, and self-supplied industry make up the remaining groundwater use. For rural domestic supplies, over 21,000 wells serving over 55,000 people exist in the county. Urban areas account for 80 percent of groundwater use. The City of Madison is the largest single consumer, withdrawing over 30 mgd, and accounts for over half of the total use in the County. (Map 2-9)

Hydrogeologic Cross Section.



Map 2-6



Measured Elevation of the Water Table Level

Dane County, Wisconsin

Source: Wisconsin Geological and Natural History Survey, 1999.

— Water Table Elevation Contours (20ft)

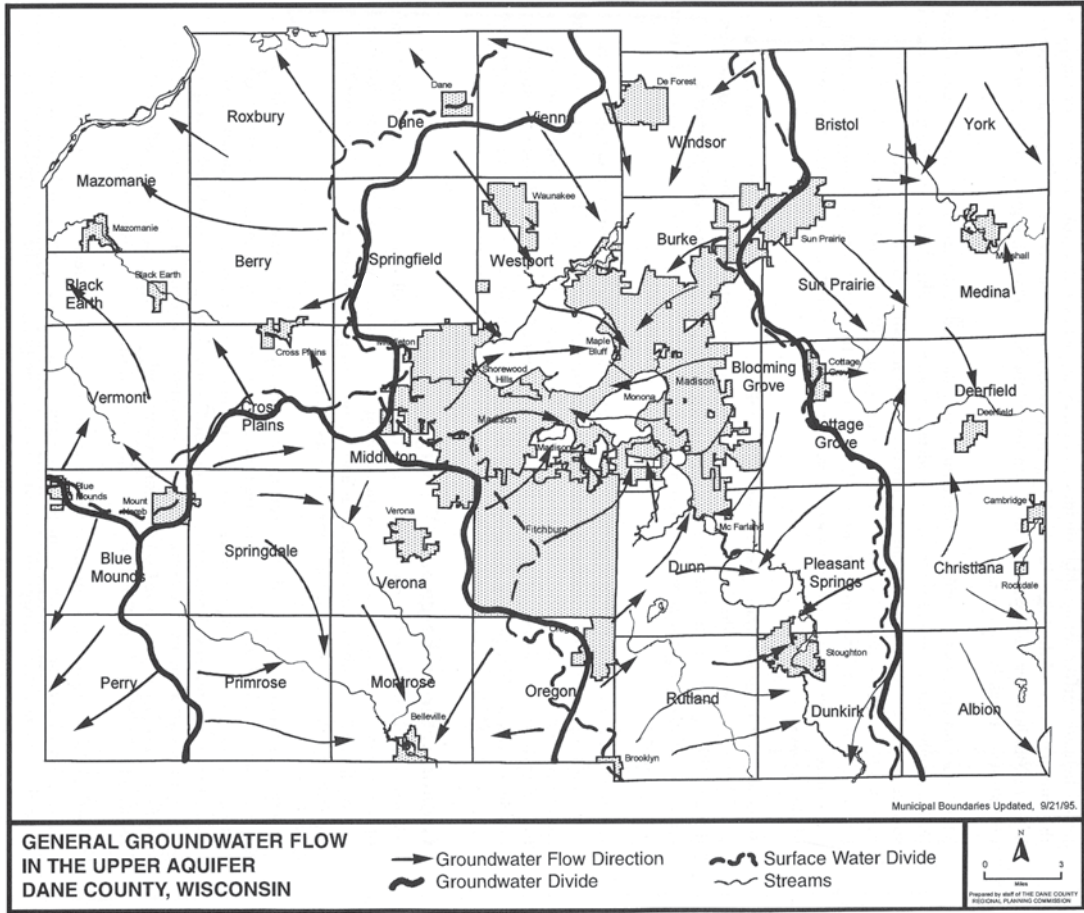
Projection:
Lambert Conformal Conic
Dane County Coordinates - NAD 83(91)

Prepared by: THE DANE COUNTY
REGIONAL PLANNING COMMISSION



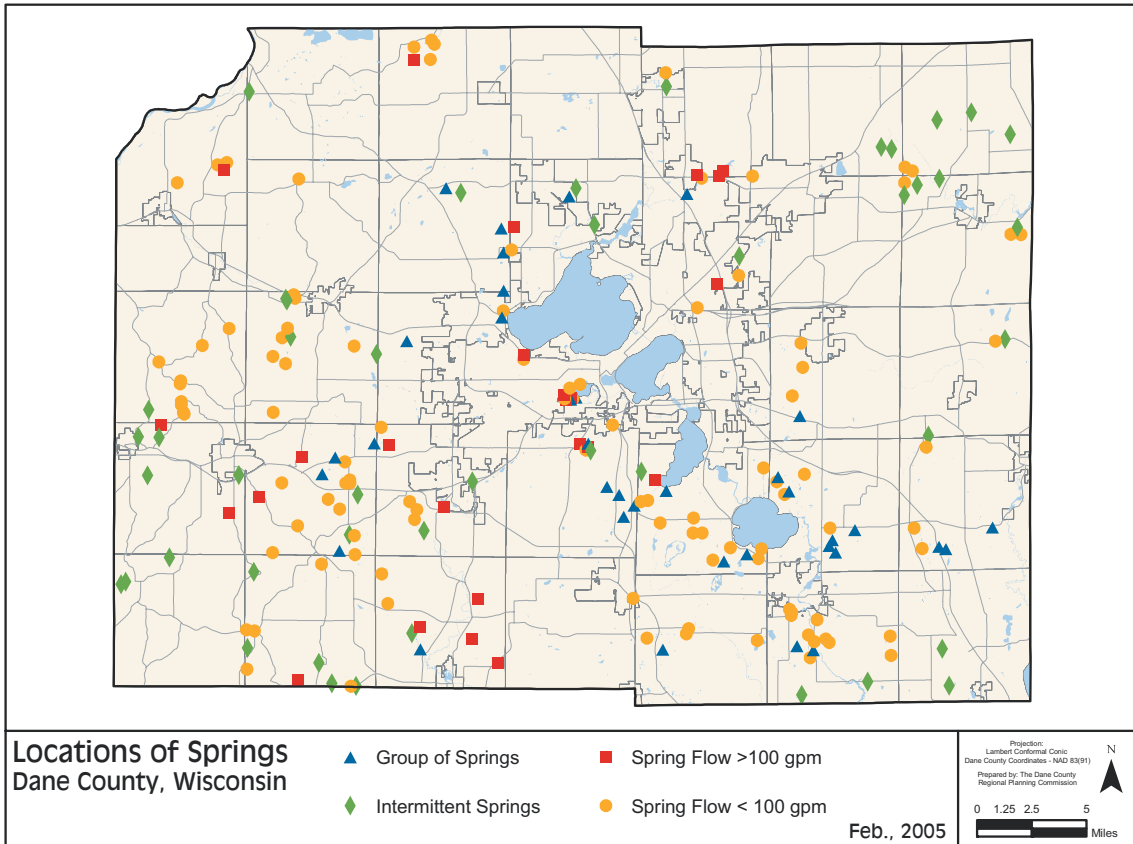
Feb., 2005

Map 2-7



Source: Wisconsin Geological and Natural History Survey, 1995.

Map 2-8



Effects of Groundwater Pumping and Diversion

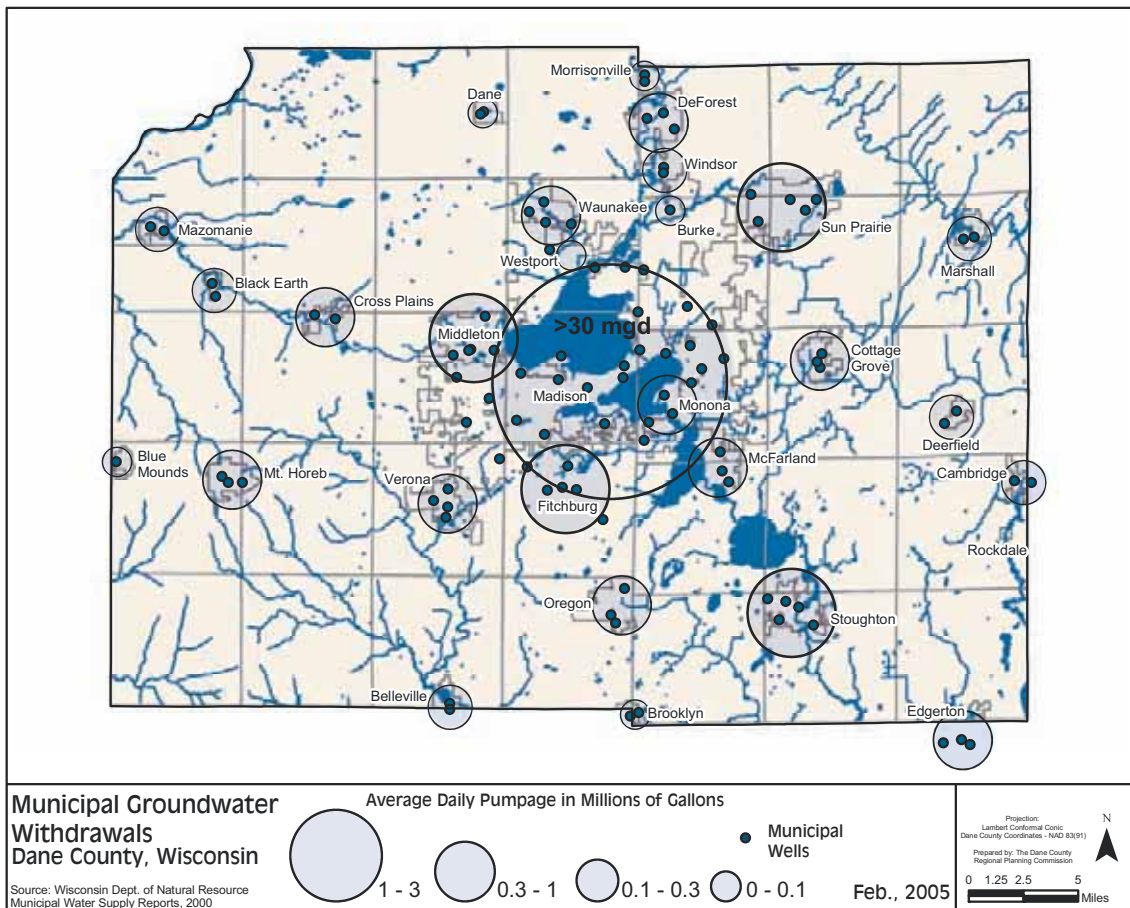
Pumping or withdrawal of groundwater, and its eventual return to surface water in a different location, can have indirect but serious impacts on local hydrology and water quality conditions. These impacts can be particularly pronounced in urban areas, where concentrated pumping of groundwater lowers the water table, reducing baseflow contributions to streams and lakes. The impacts are also heightened in urban areas as a result of increased paving and impervious areas which substantially reduce local infiltration of precipitation to recharge groundwater. In Dane County, these effects are most apparent for the central urban area, where most of the groundwater used in the County is withdrawn in a concentrated urban setting, and the used water is subsequently diverted, after treatment, around the natural Yahara River discharge and flow system, and discharged to Badfish Creek. As a result, there have been significant impacts from lowered groundwater levels on wetlands and stream baseflow in the central urban area, including lower baseflows in the Yahara River system downstream from Lake Mendota.

Map 2-6 shows the current water table elevations in Dane County, which generally mirror the topography. Map 2-10 shows the water table decline or “cone of depression” underlying the Madison Municipal area that has resulted from pumping and diversion of groundwater. This represents the numerical difference between water table levels in 2000 compared to predevelopment (early 1900) conditions. This should not be confused with current water table elevations. Rather, it shows water level decline from predevelopment conditions. Water table levels have declined over 60 feet southwest of Madison and nearly 50 feet northeast. Additional decline by as much as 20 feet are expected as a result of future pumping and development on the metropolitan fringe areas.

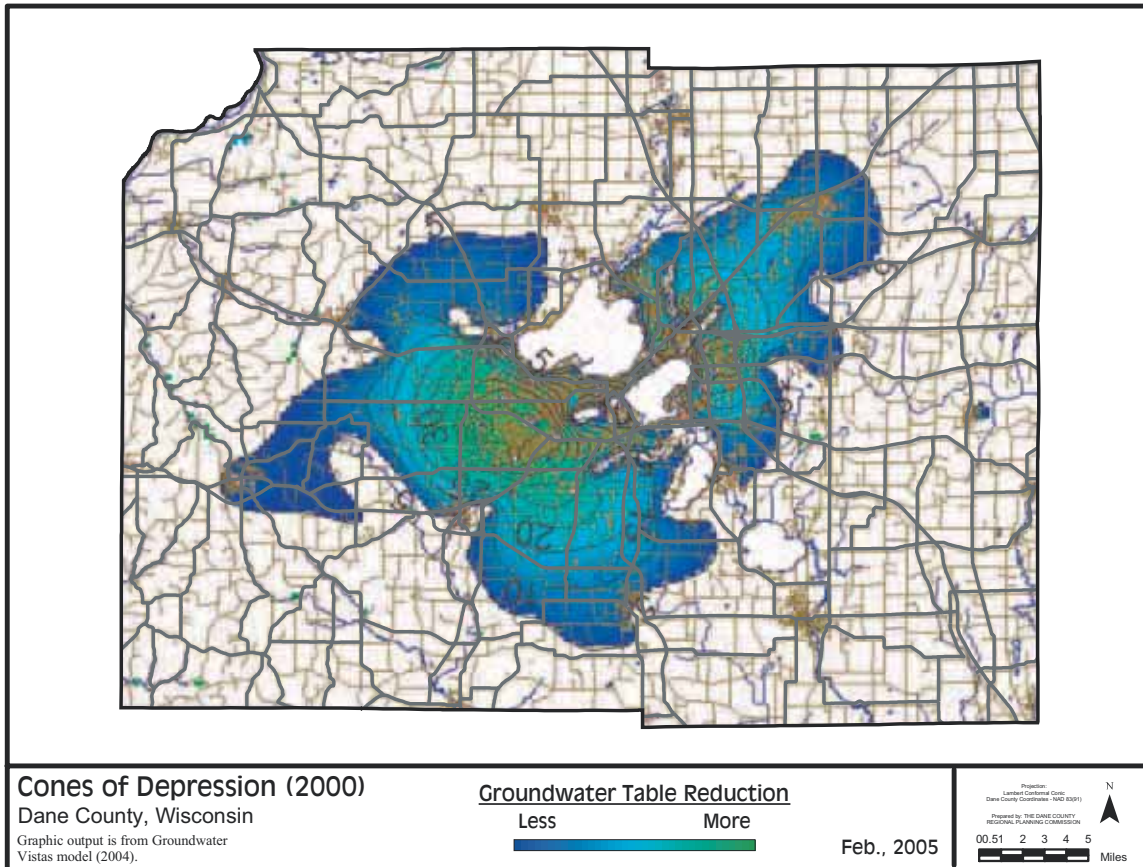
While groundwater previously discharged to the lakes, this trend has been reversed. The fact that there are two cones of depression indicates that the Yahara lakes are a significant source of recharge to groundwater.

The concentrated withdrawal of groundwater in the central urban area has enlarged the area effected by the drawdown, capturing more water from surrounding basins, as well as inducing more rapid movement of potential contaminants to groundwater and municipal water supplies.

Map 2-9



Map 2-10



To better identify existing and potential impacts of urban development, groundwater withdrawal and interbasin water transfer on the ground and surface water resources of Dane County, a Regional Hydrologic Study has been conducted through a cooperative effort by the Dane County Regional Planning Commission, the Wisconsin Geological and Natural History Survey, and the US Geological Service.

As part of the study, a groundwater flow model has been developed to simulate changes in groundwater levels due to pumping, identify important recharge and discharge areas, provide estimates of the directions and rates of groundwater movement, and better define ground and surface water relationships. The model serves as an ongoing management tool to evaluate the effects of selected management strategies to mitigate adverse ground and surface water impacts. Strategies such as selective pumping in the City of Madison, maximizing infiltration, increased lake storage, and return of highly treated wastewater effluent show promising opportunities for mitigating the impacts of wastewater diversion around the Yahara lakes system (DCRPC, 1997).

A Yahara lakes routing model was also developed which simulates storage, flow, and lake level elevations using over 70 years of rainfall and stage data. These models provide, for the first time, a regional framework for undertaking more detailed local hydrologic

studies to provide more refined information for site-specific development and resource management investigations.

Groundwater is a critical resource in Dane County. An ongoing Regional Hydrologic Modeling and Management Program has been coordinated by the RPC to use the information and tools developed from the Regional Hydrologic Study. The inter-agency management program allows local management agencies to annually update the groundwater database, refine and improve the ground and surface water computer models, and use these models for water resources management as well as impact evaluation.

NR151 contains requirements for infiltration maximization measures as part of stormwater management for new development. It requires 60% of pre-development infiltration volume to be infiltrated after development. Although this is a helpful measure, the adverse impact of development on groundwater is not limited to loss of recharge due to increased impervious area. A larger impact is caused by groundwater pumpage and diversion. Therefore, in some sensitive watersheds, the requirements of NR151 will not adequately mitigate the impacts of development on the groundwater, and need to be augmented by more aggressive groundwater recharge measures. Examples of such sensitive watersheds include Token Creek, Six Mile Creek, Upper Yahara River, and Sugar River and their tributaries.

Groundwater Quality

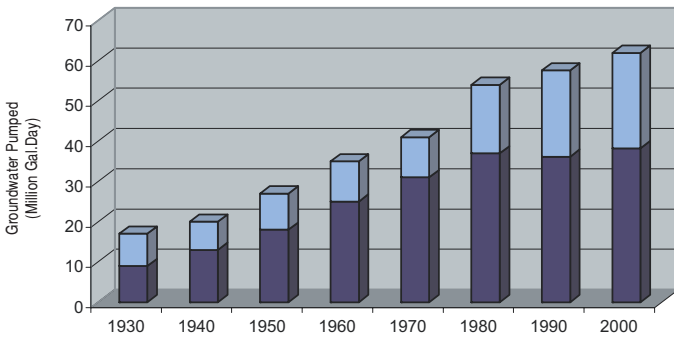
Groundwater in Dane County is generally of good quality and uniform in composition within all aquifers. Although of generally high quality, groundwater has been affected by certain land use activities. The most common and widespread groundwater quality concern is the level of nitrate-nitrogen in shallow wells (Map 5-11). Twenty-five to thirty-five percent of the private wells in Dane County have nitrate-nitrogen levels above the 10 mg/l level established as a drinking water standard for infants. These high concentrations of nitrate-nitrogen in the shallow aquifer probably result from high background levels of nitrate-nitrogen from areawide fertilizer application and locally by discharges from on-site sewage systems, manure or silage pits, or other nearby sources of nitrogen. It has become evident, for example, that background levels of nitrate-nitrogen are high enough in many areas that a concentration of on-site wastewater systems, as in a rural subdivision, can result in raising nitrate levels in nearby wells to above drinking water standards.

Bacterial pollution of shallow domestic wells is also a common problem, but usually is caused by improper well construction and very localized sources of contamination. The problems of bacterial contamination can usually be solved on-site. Another groundwater quality problem of concern is that of volatile organic chemicals (VOCs). VOCs have been detected in several private and municipal wells in Dane County. The most common sources of VOC contamination are suspected to be abandoned landfills and leaking underground gasoline tanks.

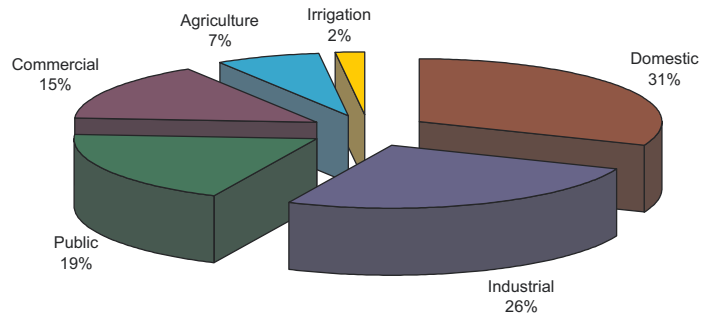
Groundwater monitoring has detected common agricultural pesticides, such as atrazine, in about 45 percent of rural wells in the county (WDNR, 1995). Because of this, the state Department of Agriculture, Trade and Consumer Protection has enacted rules to limit and, in many areas of Dane County, prohibit the use of this herbicide. Follow-up research by DATCP has shown concentration reductions of atrazine in contaminated wells due largely to state restrictions on atrazine use. Pesticide contamination is an area of increasing concern, and additional attention is being given to monitoring groundwater for various pesticides as well as their breakdown products (metabolites). Current research also indicates possible synergistic effects from combinations of nitrates and pesticides at low concentrations.

Public water supplies are regularly sampled and tested by local management agencies and by the state. Since municipal wells in the County obtain water from the deep sandstone aquifer, the quality is generally quite high and safe for use. There have been a small number of municipal wells where VOCs have been detected and corrective action taken. In addition, sampling of Madison wells has indicated increasing levels of sodium and chlorides, probably from road deicing.

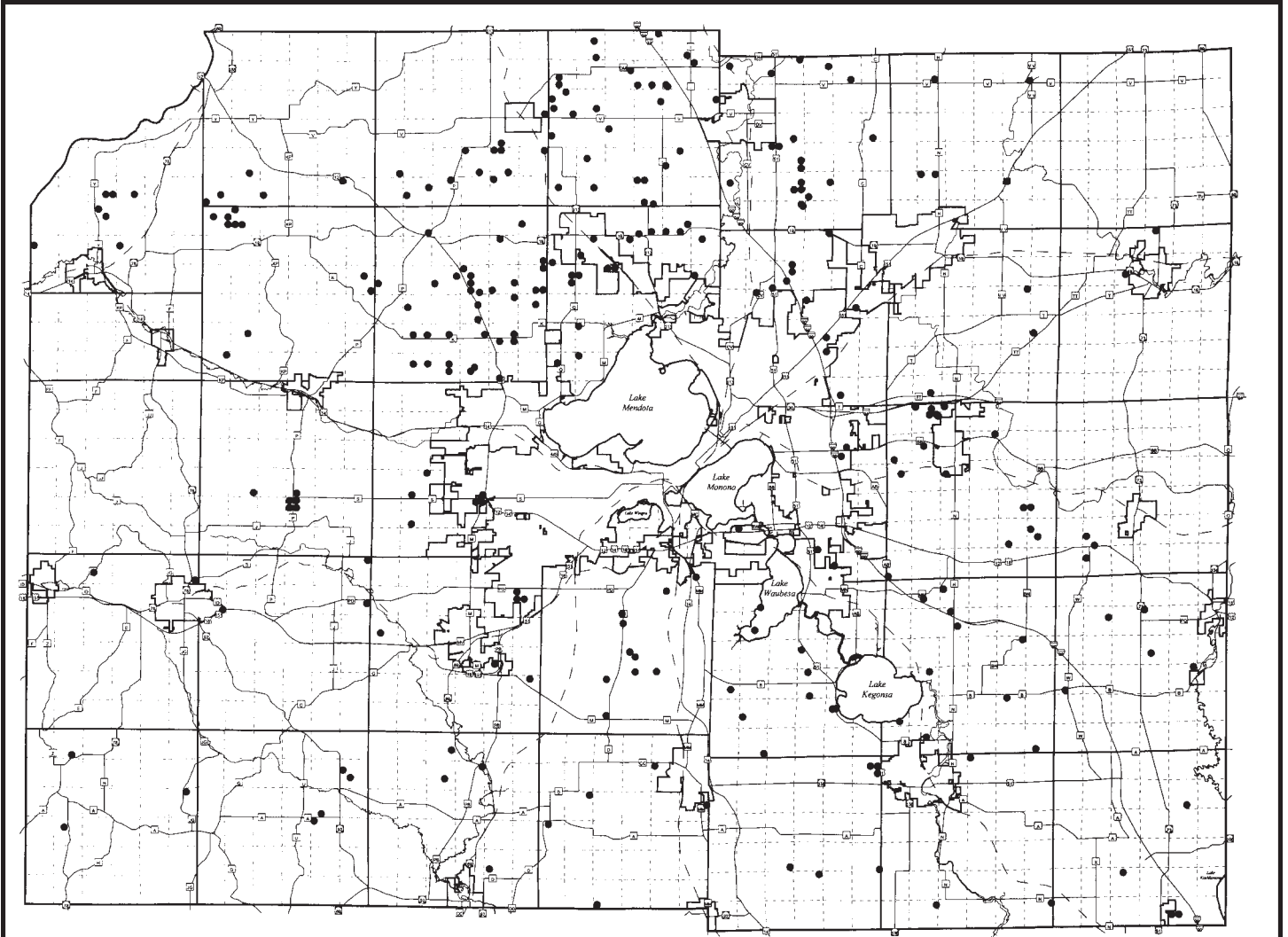
Estimated Groundwater Withdrawals in Dane County



Estimated Groundwater Use in Dane County



Map 2-11

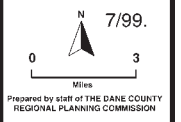


Municipal Boundaries Updated, 9/99.

**Nitrate-Nitrogen Exceedances in
Non-Community Wells in
Dane County, Wisconsin**

- Nitrate - Nitrogen > 10 mg/l
(period of record: 1988 - 1998)

(Source: DNR Groundwater Retrieval Network (GRN) database, 8/98).



Pollution Sources

There are a large variety of pollution sources which could potentially affect groundwater quality in Dane County. These sources are presented in the table on the next page. The *Dane County Groundwater Protection Plan* (Appendix G of the *Dane County Water Quality Plan*) and supporting RPC and state agency reports include inventories and assessments of these potential pollution sources, and propose specific management approaches to protect groundwater quality. Many potential contaminants are reduced or removed from water as it percolates through the soil and rock to the groundwater. This accounts for the high degree of groundwater protection and quality that we enjoy, despite the threat and growing exposure

of groundwater to potential pollutants. However, some pollutants, such as dissolved salts or nitrate-nitrogen, may not be materially reduced or removed from groundwater and can migrate long distances, potentially contaminating large areas. This can be a particularly difficult problem where treatment at the point of withdrawal and use is impractical. Once groundwater has become contaminated it is very difficult if not impossible to restore its original water quality. Strategies that promote both pollution control and resource protection for groundwater and surface water are developed in the following sections.

Aquifer Water Quality in Dane County

Constituent	Sandstone Aquifer			Sand and Gravel Aquifer		
	Concentrations		Number of Samples	Concentrations		Number of Samples
	Mean	Range		Mean	Range	
Dissolved Solids	353	183-659	99	325	255-464	12
Hardness (CaCO ₃)	327	88-574	104	295	146-385	19
Alkalinity (CaCO ₃)	289	25-367	102	278	197-364	11
Calcium	67	22-110	101	68	52-93	9
Magnesium	37	9-61	101	33	14-46	9
Sodium	4.6	1.4-41	74	3.8	1-10	8
Potassium	1.7	0.6-7	17	1.6	0.7-2.3	6
Iron (ug/l)	423	0-11500	104	2714	0-21000	19
Manganese (ug/l)	47	0-1406	101	119	0-570	19
Sulfate	22	1-133	102	21	1-58	19
Chloride	8.6	0-77	104	8.1	1.5-50	19
Fluoride	0.1	0-0.5	100	0.2	0.1-0.5	16
Nitrate-Nitrogen	1.5	0-19	76	2.8	0-14	15

Note: All concentrations are in milligrams per liter, unless otherwise noted. Source: Kammerer, P.A., Jr. Ground-Water-Quality Atlas of Wisconsin. US Geological Survey, Information Circular 39.

Potential Groundwater Pollution Sources

Place of Origin	Waste-Related				Non-Waste			
	Municipal	Industrial	Agricultural	Other	Municipal	Industrial	Agricultural	Other
At or near the land surface	Biosolids landspreading		Feedlots Manure storage & spreading	Septage landspreading Junkyards & salvage yards	Roadway deicing	Above and on-the-ground storage of chemicals		Lawn fertilizers, pesticides
	Wastewater irrigation & landspreading	Salt piles Snow piles			Stockpiles Spills	Irrigation, fertilizers, pesticides		
Contaminated stormwater infiltration				Underground Tanks Pipelines	Improperly constructed & abandoned wells			
Below the land surface	Landfills	Landfills	Manure pits Silage pits			On-site wastewater systems		
	Wastewater lagoons or infiltration ponds							
	Sanitary sewers							

3

Pollution Control

Point Sources-Municipal and Industrial Wastewater Discharges
Urban Nonpoint Sources
Agricultural Nonpoint Sources
Other Pollution Sources

POINT SOURCES — MUNICIPAL AND INDUSTRIAL WASTEWATER DISCHARGES

Introduction

Municipal and industrial discharges represent the most significant and concentrated, but also the most controllable, sources of water quality impacts and problems. Sewerage systems collect and concentrate large volumes of domestic and industrial wastewater at a single point for treatment and discharge, concentrating the impact. These discharges are often continuous, and may represent the primary or only source of pollution to water bodies between storms or runoff events. The continuous nature of these discharges usually means that large volumes of pollutants are discharged over time, and that these pollution sources are of primary importance for the majority of time when baseflow conditions exist and runoff and flooding is not occurring.

The general approach to management of point sources of pollution is to determine water quality standards which are suitable for the intended uses of the receiving water (supporting fish and aquatic life, recreational use, and water supply uses if appropriate). These receiving water quality standards are then used to determine the quality and amount of discharge (effluent limits) which can be tolerated without degrading the water quality seriously enough to interfere with its basic use and purpose. The effluent limits are then used to determine the level of treatment of the municipal or industrial wastewater needed to achieve water quality standards.

The pollutants of most concern in municipal and industrial wastewater discharges include:

- organic materials and solids, which can result in noxious deposits in receiving waters and reduce dissolved oxygen below the minimum levels needed to support fish and aquatic life;
- disease-causing bacteria, which can expose users or consumers of the receiving waters to health risks;
- materials such as pesticides or heavy metals, which can be toxic to fish and aquatic life or represent health hazards; and
- nutrients, such as phosphorus, which can stimulate excessive aquatic plant growth in receiving waters.

Status and Existing Conditions

There are 16 municipal and 14 industrial point source wastewater discharges in Dane County. Almost all are to surface waters. There are no significant wastewater discharges to the Yahara River lakes since diversion of municipal wastewater around the lakes. Municipal wastewater discharges are dominated by the discharge of the Madison Metropolitan Sewerage District's Nine Springs Wastewater Treatment Plant, which treats nearly 40 million gallons per day (mgd) of municipal wastewater from the Central Urban Service Area and from the communities of Waunakee, DeForest, Cottage Grove, Dane, Morrisonville, Verona, and Windsor. Most of the effluent from the MMSD treatment plant is discharged to Badfish Creek, which conveys the treated effluent around the Yahara lakes and returns it



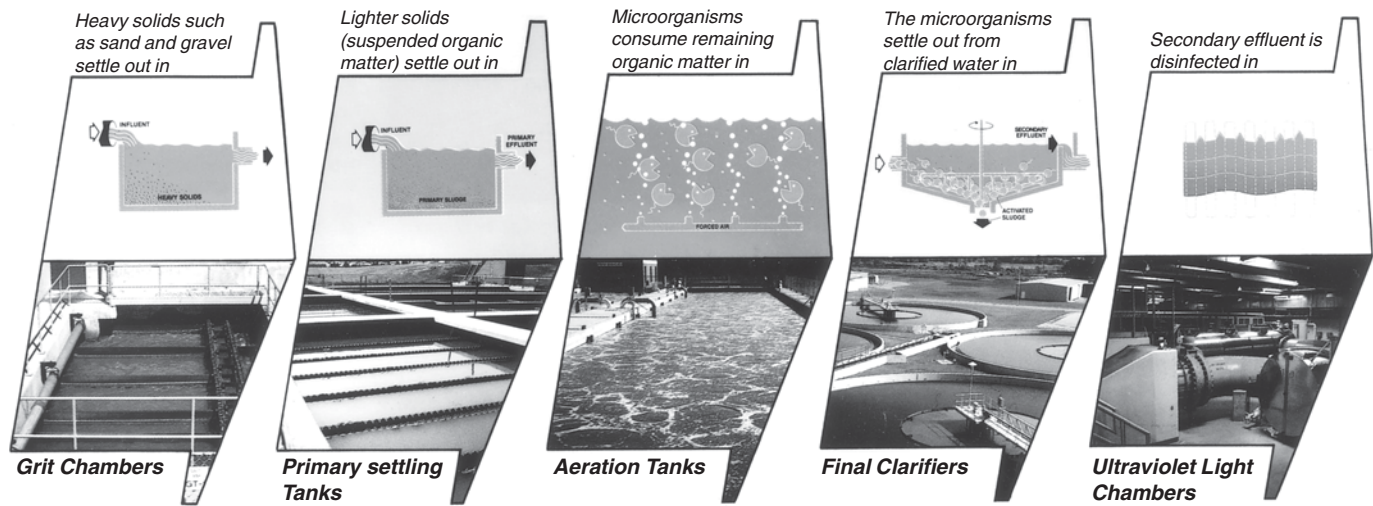
to the Yahara River in Rock County. About 3.6 mgd of the MMSD effluent is piped to Badger Mill Creek to augment the diminished baseflow of this stream (this volume is the equivalent of what is being transferred from the aquifer in this area [the Sugar River groundwater basin] and sent in the form of wastewater to MMSD).

The remaining 14 municipal wastewater discharges are associated with individual communities, and are much smaller, ranging in size up to 3 mgd. All of these treatment plants use a combination of physical and biological treatment processes, primarily designed to reduce solids and organic loading to levels which permit the receiving waters to meet basic water quality standards. Major investments in expanding and upgrading the wastewater treatment facilities in Dane County have been made since 1975. As a result, nearly all municipal wastewater discharges in Dane County are consistently meeting effluent limits, and basic water quality standards are being satisfied.

Issues

Since major investments have been made in upgrading and expanding wastewater treatment facilities in Dane County, the most important management issue is ensuring an adequate level of operation and maintenance so that facilities continue to meet effluent limits. An important aspect of this management strategy is the compliance maintenance program administered by DNR, which requires an annual evaluation of the performance and potential problems associated with each treatment plant. This allows early detection of emerging problems so they can be avoided or solved before water quality standards are violated.

Another important aspect of wastewater system management is the reduction of excessive inflows or pollutant loadings coming to the treatment plant. This management strategy is critical in: (1) reducing the amount of clear water entering the system through infiltration or inflow (which does not benefit from collection and treatment); (2) reducing excessive flows, and encouraging water conservation and wastewater minimization from households, businesses, and industries generating wastewater; and (3) reducing loadings of particular pollutants or materials from businesses and



industries through recycling or pretreatment requirements. All of these measures are of critical importance in allowing management agencies to economically operate and maintain wastewater treatment facilities, meet effluent limits and water quality standards, and avoid costly expansion and upgrading of wastewater treatment facilities.

There are a variety of potentially toxic materials in untreated wastewater. Most wastewater treatment plants are mainly designed to remove solids and organic materials. Their ability to reduce or remove specific compounds varies from pollutant to pollutant, and for each treatment process. In addition, there is limited monitoring data and information on the levels of potentially toxic materials in wastewater discharged to the treatment plants, in the treated effluent discharged from treatment plants, and in receiving waters. Water quality standards have been established for some toxic materials, and standards for new substances are being developed on a continuing basis. Increased monitoring of toxics is needed. The difficulty and exorbitant expense associated with trying to remove each of the large number of potentially toxic materials from wastewater at the treatment plant indicates that the best management approach is to place initial emphasis on reducing toxic pollutant discharges at the source.

Another issue having potentially major impacts on wastewater management strategy is nondegradation of existing water quality conditions. The state has enacted Administrative Rule NR 207, which has the objective of maintaining existing water quality conditions where they are higher than water quality standards, rather than allowing water quality to be further degraded to minimum water quality standards. Since nearly all communities in Dane County are growing, and wastewater discharges are increasing, only increasingly higher and more costly levels of treatment can meet this goal of nondegradation. These restrictions will have their most severe and early impacts for discharges to high-quality receiving waters such as trout streams. The Village of Cross Plains is an example of the circumstances where these restrictions may prove to be important.

Most treatment plants in Dane County have been upgraded to meet state requirements for phosphorus removal. State rules (NR 217) require all but the smallest treatment plants to reduce phosphorus in the effluent to low levels (1 mg/l), unless alternative or higher limits can be justified. Phosphorus removal is costly, can result in using chemical rather than biological treatment processes, and may not result in significant water quality improvement. It is, therefore, important for management agencies to carefully evaluate the level of phosphorus removal needed to achieve water quality objectives. It would be most desirable to approach phosphorus loading and limits on a comprehensive areawide or watershed planning basis, since it may be less costly to reduce phosphorus loading through alternative nonpoint source management practices (phosphorus trading).

The implementation of Wisconsin Administrative Rule NR 204 and USEPA 40 CFR part 503 rules require added attention by treatment plant operators to the quality of wastewater biosolid and the manner of biosolid disposal. As a result, treatment plant operators have had to evaluate and adjust their treatment process and biosolid management and disposal options to ensure cost-effective and environmentally sound approaches are in place. The Dane County Water Quality Plan has consistently supported the goal of the Clean Water Act for the beneficial reuse of wastewater biosolids.

Finally, an increasingly important wastewater management issue in Dane County is the hydrologic impact of intrabasin or interbasin transfer of water. When water is withdrawn for use at one location, and the used water is released at another location, the local groundwater and surface water hydrology is altered (substantially so in central Dane County), reducing groundwater discharge and dry weather baseflow to streams and wetlands. Wastewater facility planning, particularly consideration of regionalization or interconnection, should address this concern. Furthermore, facility planning for regional wastewater facilities such as MMSD should include evaluation of the feasibility of satellite treatment plants in locations that would minimize or reverse interbasin transfer and the resulting loss of dry-weather baseflow.

Table C-3 Municipal Wastewater Discharges

Map #	Receiving Water & Classification	Management Agency	Treatment Capacity & Process	Needs
1m	Sugar River, (ERW)	Village of Belleville	0.27 mgd, O.D.	1
2m	Williams Creek, (LFF)	Village of Blue Mounds	0.101 mgd, A.S., O.D.	5
3m	Allen Creek, (LFF)	Village of Brooklyn	0.116 mgd, O.D., S.F.	3,4,5
4m	Koshkonong Creek, (WWSF)	Village of Cambridge	0.355 mgd, A.L.	1
5m	Black Earth Creek, (COLD II/ERW)	Village of Cross Plains	0.45 mgd, O.D.	1,2
6m	Black Earth Creek, (WWSF)	Dane-Iowa Wastewater Commission	0.693 mgd, O.D.	
7m	Mud Creek, (LFF)	Village of Deerfield	0.393 mgd, A.S.	
8m	Badger Mill Creek, (LFF)	Madison Metropolitan Sewerage District	3.6* mgd, A.S.	
9m	Oregon Branch Badfish Creek, (LAL)	Madison Metropolitan Sewerage District	50 mgd A.S.	1,2
10m	Maunsha River, (WWSF)	Village of Marshall	0.57 mgd, O.D.	
11m	W. Branch Sugar River, (LFF)	Village of Mt. Horeb	0.6 mgd, R.B.C, S.F.	1
12m	Oregon Branch Badfish Creek, (LAL)	Village of Oregon	1.975 mgd, A.S.	2
13m	Koshkonong Creek, (WWSF)	Village of Rockdale	0.025 mgd, A.S., P.P.	1
14m	Roxbury Creek, (WWSF)	Roxbury Sanitary District #1	0.025 mgd, S.F.	
15m	Yahara River, (WWSF)	City of Stoughton	1.65 mgd, A.S.	1
16m	Koshkonong Creek, (LAL)	City of Sun Prairie	3.1 mgd, R.B.C., S.F.	1,2

NOTES:

Receiving Water Classifications	Treatment Process	Needs
COLD: Cold Water Community; I, II, III refers to class of trout stream	A.L.: Aerated Lagoon	1 = Capacity Expansion
WWSF: Warm Water SportFishery, which is also the default classification	A.S.: Activated Biosolids	2 = Clear Water Inflow Management
WWFF: Warm Water Forage Fish	O.D.: Oxidation Ditch	3 = Biosolids Storage Expansion
LFF: Limited Forage Fishery	R.B.C Rotating Biological Contactors	4 = Phosphorus Removal
LAL: Limited Aquatic Life	T.F.: Trickling Filter	5 = Needs Assessment
ORW: Outstanding Resource Water	S.F.: Sand Filter	
ERW: Exceptional Resource Water	P.P.: Polishing Pond	

*This is the discharge capacity for the effluent return outfall.

Table C-4 Industrial Wastewater Discharges*

Map #	Receiving Water & Classification	Discharge Permit Holder	Description of Discharge
1i	Black Earth Creek, (COLD I/ORW)	Capitol Sand & Gravel	Overflow process water and groundwater from quarry/lake is directed to Black Earth Creek to prevent flooding
2i	Land application sites in the lower Wisconsin River basin	Lactoprot USA	Cheese process water is landspread
3i	Groundwaters of Upper Rock River Basin, Maunsha River	Karem, Inc.	Dog food manufacturing process water is land spread
4i	Lake Monona	University of Wisconsin Charter St heating plant	Cooling water containing chlorine additive is discharged to Lake Monona
5i	Lake Monona	Madison Gas & Electric Co.	Roof drain water, turbine sump water, and cooling water discharged to Lake Monona via storm sewer
6i	Nine Springs Creek, (WWSF)	Wis. DNR — Nevin Fish Hatchery	Supply water for trout hatchery is discharged to Nine Springs Creek
7i	Groundwaters of the Lake Mendota/Yahara River Sub-Watershed	Blue Star Dairy Farms	Livestock manure is landspread
8i	A tributary to Koshkonong Creek and the groundwaters of the Lower Rock River Basin	Cenex Cottage Grove Cooperative	Overflow water that has been treated to remove pesticides and fertilizers enters surface and groundwaters via an underground pipe
9i	West branch of Starkweather Creek (LFF)	Dane County Regional Airport	Runoff containing glycol and other deicing chemicals enters Starkweather Creek via storm sewer
10i	Groundwater of the upper and lower Rock River Drainage Basins	Daybreak Foods Inc.	Manure is landspread
11i	Groundwater of the Six Mile and Pheasant Branch Sub-Watershed	Don's Mobile Manor	Community septic system discharges to the groundwater
12i	Fields in the Six Mile and Pheasant Branch Creek and the Yahara and Lake Mendota Sub-Watersheds	Genus Inc. DBA ABS Global	Livestock manure is landspread
13i	Groundwaters of the Six Mile and Pheasant Branch Creeks and the Yahara and Lake Mendota Sub-Watersheds	Ripps Dairy Valley	Livestock manure is landspread
14i	Fields in the Maunsha River Watershed and Upper Koshkonong Creek Sub-Watersheds	Statz Brothers Farm	Livestock manure is landspread

*Noncontact cooling water discharges without additives not listed.

POINT SOURCE CONTROL RECOMMENDATIONS

- P-1:** All municipal wastewater discharges should be treated to a level sufficient to achieve water quality standards for recreation and fish and aquatic life during periods of low streamflow.
- P-2:** Biological treatment processes which conserve energy and support maximum recycling of organic materials to the land should be preferred when considering treatment plant modifications or expansion.
- P-3:** Wastewater facilities planning and improvements should be conducted in the context of comprehensive areawide and watershed plans for pollution control and resource protection.
- P-4:** The extension of public sewer service should be limited to those areas designated as urban service or limited service areas. New or additional wastewater discharges, public or private, municipal or industrial, should not be permitted unless consistent with the areawide water quality management plan.
- P-5:** Wastewater facilities planning should address the land use and hydrologic effects of proposals, particularly where regionalization or interconnection of service areas is being considered. The adverse impacts of interbasin transfer on stream baseflow should be specifically addressed.
- P-6:** Point source management agencies should pursue aggressive source control and flow management strategies, including industrial flow management and correction of excessive infiltration/inflow problems, where cost-effective, to most efficiently conserve and utilize the capacity of wastewater collection and treatment facilities.
- P-7:** Point source management agencies should reduce potentially toxic and hazardous substances in wastewater discharges to levels compatible with water quality standards for the receiving water uses. Primary emphasis in most instances should be directed at reducing or removing toxic/hazardous materials at the source, rather than treatment or removal at the treatment plant.
- P-8:** Facilities for accepting and managing septage should be incorporated in treatment plant improvement and expansion plans.
- P-9:** All point source management agencies should provide adequate funds and personnel for operation and maintenance of municipal wastewater treatment plants.
- P-10:** Point source management agencies should conduct or participate in and support comprehensive and aggressive public information and education programs directed at household water conservation and hazardous waste issues.

URBAN NONPOINT SOURCES

Effects of Urbanization

Urbanization has one of the most severe impacts in terms of lasting effects on hydrology and water quality. The process of urban development involves a great deal of construction and land disturbance, and sediment eroded from these construction activities can be a major source of pollutants. After development is complete, the urban area has a much higher percentage of impervious or paved areas, and is often served by an efficient stormwater drainage system which is highly effective at transmitting pollutants to receiving waters. The main effects of urbanization on the hydrology of an area including the following:

- increase in the total volume of rainfall runoff;
- decrease in the amount of rainfall infiltrating into the soil;
- more rapid runoff and much higher peak flows; and
- reduced base flows in streams during dry weather periods.

While rural areas are almost completely pervious, over one-third of the land surface in the central urban area is covered by rooftops and paved areas (see Map 3-2). In addition to generating more surface runoff, which erodes the land and washes off more pollutants into water bodies, the hydrologic effects have less obvious but important downstream impacts. The greatly increased peak storm runoff rates and reduced baseflow associated with urbanization have serious negative impacts on receiving streams, usually resulting in bed erosion, sedimentation, and streambank instability. Combined with reduced baseflow, the scenic, recreational, and habitat values of the receiving streams can be seriously degraded, unless a vigorous effort is made to provide management practices and programs to counter the effects of urbanization.

Research shows a precipitous decline in stream quality as the extent of impervious surface area increases to ten percent of the watershed area. Stream quality is severely impacted as the extent of impervious surface area expands beyond ten percent of the watershed area. For watersheds where impervious surface area is over 25 percent of the total watershed area, stream quality is significantly degraded and the stream loses its capability to support aquatic life. It should be noted that this conclusion is based on historic development patterns lacking extensive stormwater management measures.

Map 3-2

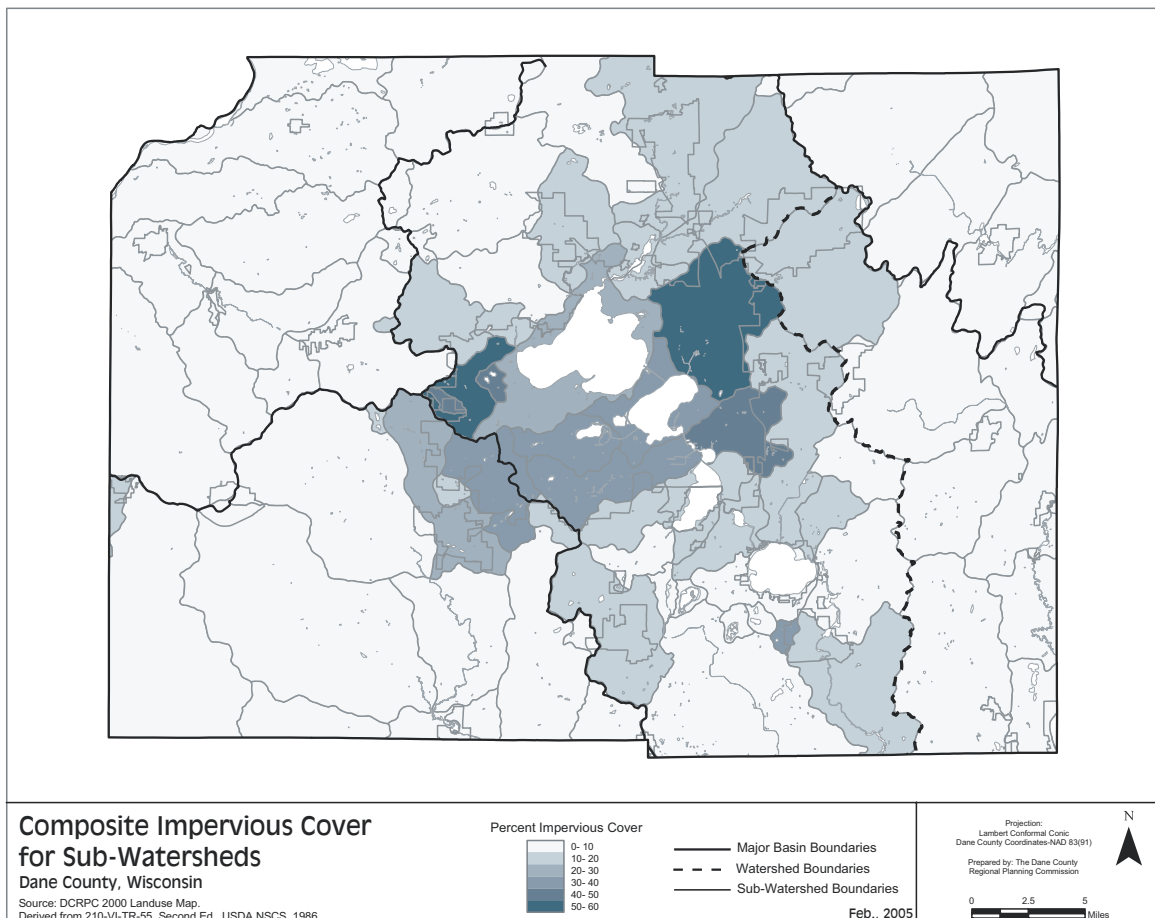
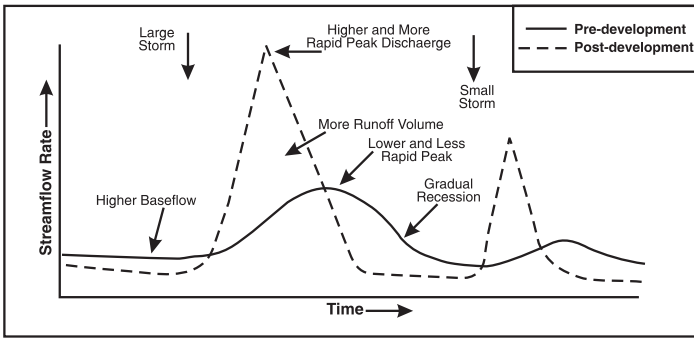


Figure 3-1
Effects of Urbanization on Streamflow



In addition to these hydrologic impacts, the effects of urban groundwater pumping and diversion in Dane County, particularly in the central urban area, has substantially added to the negative hydrologic impacts of urbanization. The importance and magnitude of the impacts of groundwater pumping and diversion were evaluated as part of the Dane County Regional Hydrologic Study and are described in a report evaluating alternative groundwater management strategies in Dane County (DCRPC, 1997).

Pollution Sources

The developed urban area, because of the extent of its impervious surfaces, efficiently transports pollutants from the land surface to receiving waters. The primary sources of urban water pollutants are the following:

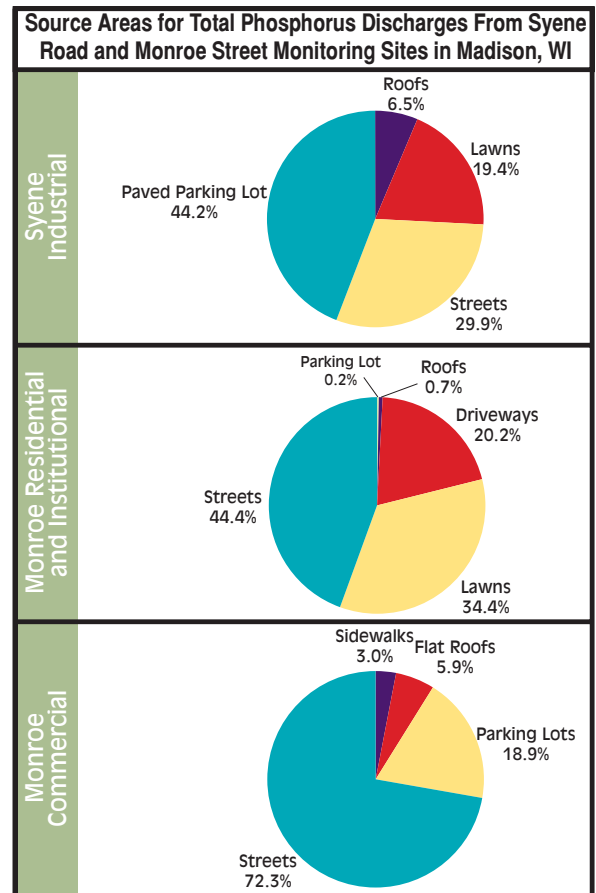
- vegetation (leaves, grass clippings, yard and garden debris)
- atmospheric (dustfall and precipitation)
- traffic-related debris
- deicing or nonskid materials (sand, salt)
- erosion (sediment)
- animal (pet) wastes
- lawn and garden fertilizers, pesticides, and herbicides
- general litter

These sources all contribute to the high levels of the contaminants of most concern in urban runoff: sediment, nutrients (especially phosphorus), organic matter, toxic materials, and bacteria. The relative importance and degree of contribution of each source to urban nonpoint source pollution is difficult to determine. Previous water quality modeling and surveys of urban conditions and practices have indicated that most urban runoff originates from paved or impervious surfaces, relatively less from grassed or pervious areas. Most pollutants in urban runoff, similarly, are those picked up from and washed off of impervious surfaces. The primary concern, therefore, is with those materials and pollutants which end up on streets and other paved surfaces and are washed off into the storm drainage system. Exceptions to this statement include erosion from construction sites, discussed elsewhere, and concerns about the leaching of road salt, fertilizers or pesticides to the groundwater from pervious areas.

Because much of the waste material transported in urban runoff is organic, it uses up the oxygen in receiving water and can result in depressed levels of dissolved oxygen in the receiving stream. The oxygen demand for urban stormwater can be greater than that for effluent from a wastewater treatment plant, but is normally experienced only for short periods. Oxygen demand and organic loading from urban runoff are related to flow, and are more of a problem during and after intense rainstorms than during periods of light or steady rainfall.

Most of the water quality effects of urban runoff in Dane County are apparent in the central urban area, where urban runoff is discharged to the Yahara River lakes. Since nutrient loadings (particularly phosphorus) are the most important factor in the eutrophication of the Yahara lakes, the nutrient contribution of urban runoff is a primary concern. Nutrient concentrations found in urban stormwater are much higher than natural background levels in Dane County streams. While phosphorus loading from urban runoff does not represent the major source of nutrient loading to the Yahara lakes, it is the most significant source other than agricultural runoff. To address this issue, the City of Madison and Dane County have adopted ordinances restricting the sale and use of lawn fertilizers that contain phosphorus. Most soils have been found to contain sufficient concentrations of phosphorus for a healthy lawn, and additional amounts are found to be unnecessary and harmful to lakes and ponds. Allowances have been made for newly established turf or areas that test below recommended levels. The phosphorus ban is expected to help reduce the amount of nutrients that flow into area waters.

Figure 3-2
Source Areas for Total Phosphorus Discharges From Syene Road and Monroe Street Monitoring Sites in Madison, WI



From: Bannaerman, R. (December 1991) *Saving our Urban Waterways - The Wisconsin Experience*. Wisconsin Department of Natural Resources

Management Practices and Recommendations

Concern has been increasing regarding the toxic materials contained in urban runoff. Concentrations of heavy metals in samples collected from urban storm sewers in Madison have exceeded acute toxicity criteria for aquatic life. Most of the metals in urban runoff consist of zinc, nickel, lead, copper, and chromium. Pesticides, such as Diazinon and Chlordane, and polycyclic aromatic hydrocarbons (PAHs), which are by-products of vehicle combustion, also are commonly detected in stormwater runoff at levels that violate surface water quality standards. Bacteria is another constituent of concern in urban runoff. Fecal coliform bacteria counts for urban stormwater are commonly 20 to 40 times higher than the public health standard for swimming. Pet and wildlife waste is a common source of bacteria in urban runoff.

Sampling of sediments in urban streams and lake sediments have indicated the deposition of toxic materials, including PCBs, mercury, arsenic, and copper. Some of these materials originated from discontinued industrial and municipal wastewater discharges to lakes and streams, others resulted from direct application of algicides and herbicides to the lakes, a third source is atmospheric deposition. It is difficult to determine the extent to which urban runoff has contributed to this problem.

Coordinated stormwater management planning for all communities in the central urban area is needed in order to attain maximum water quality and drainage control. The framework for this approach was established in 2000 by central urban area communities that agreed to co-sponsor a joint permit through the state's NR 216 stormwater permit program.

There are a variety of management practices and approaches which can be used to offset the hydrologic and water quality impacts of urbanization, and to control urban nonpoint sources of pollution. Some of these management practices are directed at dealing with the problem at the source—incorporating practices on individual homesites and building lots to control runoff and water quality. These on-site practices include: directing drains and downspouts to pervious areas; incorporating infiltration areas and on-site runoff control and reduction measures in site design and landscaping; and appropriate yard and garden management techniques, including limiting fertilizer and pesticide use as well as proper management, storage, and disposal of leaves, grass clippings, and other vegetative waste (e.g. on-site composting or recycling).

The approach needed to achieve a significant level of adoption of on-site management practices combines two elements: (1) a vigorous public information/education program, which informs and assists homeowners and businesses in controlling and reducing runoff and pollution from their own property; and (2) regulations and ordinances which require planning and implementation of management practices for sites or activities which could have significant impacts on downstream areas. Examples of typical ordinances and regulations include comprehensive erosion and storm water runoff control ordinances which require preparation of erosion control plans on sites where significant land areas are to be disturbed, as well as the preparation of stormwater management plans. Ordinances requiring the installation of flow management practices or pollution control practices on building projects are also effective, as are ordinances regulating the management, storage, and disposal of vegetative debris, such as prohibiting the depositing and/or burning of leaves or other vegetative matter in street gutters.

Table 3-1

BMP	Peak Discharge Control					
	2 Year Storm	10 Year Storm	100 Year Storm	Volume Control	Groundwater Recharge	Shearbank Erosion Control
Extended Detention						
Dry	●	●	●	◐	◐	●
Dry w/Marsh	●	●	●	◐	◐	●
Wet	●	●	●	◐	◐	●
Wet Pond	●	●	●	◐	◐	●
Infiltration Trench						
Full Exfiltration	●	◐	◐	●	●	●
Partial Exfiltration	●	●	◐	●	●	●
Water Quality Trench	◐	◐	◐	●	●	●
Infiltration Basin						
Full Exfiltration	●	◐	◐	●	●	●
Infiltration/Detention	●	●	●	●	●	◐
Off-Line Basin	◐	◐	◐	●	●	◐
Porous Pavement						
Full Exfiltration	●	◐	◐	●	●	●
Partial Exfiltration	●	●	◐	●	●	◐
Water Quality	◐	◐	◐	●	●	◐
Water Quality Inlet	◐	◐	◐	◐	◐	◐
Grassed Swale	◐	◐	◐	◐	◐	◐
Filter Strip	◐	◐	◐	◐	◐	◐

◐ Seldom or Never Provided ◐ Sometimes Provided w/Careful Design ● Usually Provided

Derived from: Schueler, Thomas R. (1987). *Controlling Urban Runoff: A practical manual for plan and designing urban BMPs*

Table 3-2

Comparison of Median Pollutant Removal Efficiencies Among Selected Practice Groups: Conventional Pollutants							
Median Removal Rate For Stormwater Pollutants (%)							
Practice Groups	N	TSS	TP	Sol P	Total N	Nitrate	Carbon
Detention Pond	2	7	10	2	5	3	(-1)
Dry ED Pond	6	61	19	(-9)	31	9	25
Wet Pond	30	77	47	51	30	24	45
Wet ED Pond	6	60	58	58	35	42	27
Ponds^a	36	67	48	52	31	24	41
Shallow Marsh	14	84	38	37	24	78	21
ED Wetland	5	63	24	32	36	29	ND
Pond/Wetland	11	72	54	39	13	15	4
Wetlands	35	78	51	39	21	67	28
Surface Sand Filters	6	83	60	(-37)	32	(-9)	67
Filters^b	11	87	51	(-31)	44	(-13)	66
Channels	9	0	(-14)	(-15)	0	2	18
Swales^c	9	81	29	34	ND	38	67

N = Number of performance monitoring studies. The actual number for a given parameter is likely to be slightly less.

Sol P = Soluble phosphorus, as measured as ortho-p, soluble reactive phosphorus or biologically available phosphorus.

Total N = Total Nitrogen. Carbon = Measure of organic carbon (BOD, COD, or TOC).

^a Excludes conventional and dry ED ponds.

^b Excludes vertical sand filters and vegetated filter strips.

^c Includes biofilters, wet swales and dry swales.

Aside from regulation of construction activities and on-site management practices, the primary source control management activities that are the responsibility of urban government management agencies include: general litter control, leaf and yard waste collection, and street cleaning; the use of deicing and nonskid materials; and the control of erosion and runoff from public sites and construction projects. To have a significant overall impact on urban nonpoint source pollution, it is necessary to pursue all of these approaches and management practices together—public and private, on-site and off-site. The difficulty and high expense of providing end-of-pipe treatment for urban stormwater discharge makes it imperative that urban management agencies and property owners do as much as possible to address the problem at its source.

Another area of urban management practice emphasis is the design and maintenance of the stormwater drainage system itself, which is usually managed by an urban government management agency—commonly a city or village. The primary emphasis in the planning and management of the stormwater drainage system is on preparing overall stormwater system management plans which incorporate water quality considerations and management practices. Management practices applicable to stormwater management systems include stormwater detention and infiltration practices, incorporation of natural drainage systems in the storm drainage network where possible (rather than reliance on underground storm sewers), channel and shoreline stabilization and vegetation management, and protection of floodplains, wetlands, and infiltration areas. It is particularly important that these community stormwater management plans are developed in the context of areawide or watershed comprehensive water quality plans which address all pollution sources and produce a comprehensive hydrologic model of the watershed. The hydrologic and water quality benefits provided by various stormwater management practices are shown in Table 3-1. It should be noted that several municipalities have created stormwater utilities to raise funds specifically for the implementation and maintenance of stormwater management facilities and measures. Creating stormwater utilities can be an effective strategy for financing stormwater management.

Under the federal Clean Water Act and state Adm. Code NR 216, municipalities with more than 100,000 residents, industrial facilities and construction sites are required to obtain stormwater discharge permits and control the amount of contaminants that enter water bodies. NR 216 has since been expanded to include “designated” communities with less than 100,000 residents. In 2004, DNR approved a group permit for the City of Madison and eighteen surrounding communities, including the University of Wisconsin and Dane County. It is likely that other municipalities will also join as a result of expanded phase II federal requirements. The permit includes six elements: 1) Public Education and Outreach; 2) Public Involvement and Participation; 3) Illicit Discharge Detection and Elimination; 4) Construction Site Pollution Control; 5) Post-construction in stormwater management; and 6) Pollution Prevention. The permit will be in effect for five years, after which it may be renewed. It is expected this inter-governmental approach will result in increased efficiency and economies of scale that would not otherwise be possible.

A comprehensive set of state administrative rules adopted in early 2002 has also been designed to address urban and agricultural nonpoint source pollution. These results are an outgrowth of the Clean Water Act of 1972 and represent a shift from voluntary controls to uniform statewide standards. NR 151 lies at the heart of the rules package, which became effective October 1, 2002. It contains performance standards for development in cities, villages, and towns, including standards for runoff from construction sites, as well as standards for transportation facilities.

Revisions to Dane County’s construction site erosion control ordinance went into effect on August 22, 2002. Adopted in 2001 by the Dane County Board, the amended Chapter 14 now includes countywide stormwater management standards which address the quantity and quality of stormwater runoff from construction sites in urban and rural areas, including farms. The ordinance also provides flexibility for landowners in how they meet these standards, in recognition of the unique characteristics of each project and every site. Through state enabling legislation (1989 WI Act 324) granted specifically to Dane County, the ordinance sets minimum performance standards that are applicable to all municipalities in the County. Every community in Dane County has either adopted an ordinance at least as restrictive or has authorized the County to administer the ordinance in their community.

URBAN NONPOINT SOURCE CONTROL RECOMMENDATIONS

- U-1: All urbanizing units of government should develop comprehensive stormwater management plans that account for water quality and quantity, that encourage infiltration of stormwater, and that are integrated into the long-term land use and open space plans of the area. Stormwater management plans should attempt to mitigate the adverse impacts of development on water resources to the maximum extent practicable.
- U-2: Management agencies should promote land use patterns and practices which preserve the integrity of the natural hydrologic system, including the balance between groundwater and surface water. Require future development to implement infiltration measures, wherever practicable, as a means of controlling stormwater impacts and ensuring groundwater recharge.
- U-3: Designated municipalities should implement the state NR 216, NR 151, and federal Phase II stormwater regulations along with the existing Erosion Control and Stormwater Management Ordinance (Chap. 14). Other municipalities should consider developing consistent programs, ordinances, and requirements.
- U-4: Dane County should apply to be certified by the DNR as a Local Qualified Program for the issuance of stormwater permits under NR 216.
- U-5: Prepare specific watershed plans incorporating flow and water quality management practices for all existing and developing urban drainage basins. Where possible, such plans should be prepared in the context of comprehensive watershed water quality plans.
- U-6 A coordinated stormwater management plan should be developed for all communities in the municipal NR 216 stormwater permit area.
- U-7 Eligible units of government should apply for funding through the DNR Targeted Runoff Management or Urban Nonpoint Pollution grant programs to develop stormwater management plans and install practices that control urban stormwater impacts.
- U-8: Management agencies should promote open drainage systems incorporating detention and infiltration areas and natural greenways in developing areas.
- U-9: Urban management agencies should work cooperatively with state and local agencies to incorporate stormwater infiltration practices into local erosion control/stormwater management ordinances. Infiltration practices should be designed to protect the groundwater.
- U-10: Evaluate and promote potential approaches for enhancing or improving sediment and phosphorus removal in the design, operation, and maintenance of urban drainage systems.
- U-11: Urban management agencies should cooperate in sponsoring field tests of the feasibility and effectiveness of innovative stormwater management ideas and technologies.
- U-12: Design urban drainage systems and associated land use practices to minimize the potential for toxic or hazardous materials being washed or discharged into surface waters, with emphasis on source control.
- U-13: Promote inter-agency review among the appropriate state and local designated management agencies to work with developers to streamline permitting while ensuring protection of the natural resources.
- U-14: Urban management agencies should enact and enforce leaf, yard, and garden debris storage and disposal ordinances in urban areas, including leaf pick-up in the fall, with emphasis on keeping leaves and yard waste off of streets and paved surfaces.
- U-15: Urban management agencies should include provisions in building codes and ordinances to require that, wherever feasible, drainage from roofs, driveways, and parking lots be directed toward grassed or vegetated areas, rather than paved areas or storm sewers.
- U-16: Conduct aggressive public education and information programs regarding source control, on an annual basis.
- U-17: Improve the water quality protection and effectiveness of street sweeping by providing frequent (weekly to biweekly) sweeping of streets in commercial and industrial areas, and regular (biweekly to monthly) sweeping of residential streets, with extra efforts at thoroughly cleaning all streets in early spring and late autumn. Vacuum sweepers should be used where feasible because of greater removal effectiveness.
- U-18: Continue to expand efforts to reduce ground and surface water impacts associated with road salt storage and use, and snow removal, including alternative materials and approaches.

AGRICULTURAL NONPOINT SOURCES

Impacts of Agriculture on Water Quality

Dane County is one of the most productive agricultural counties in the nation. About 50 percent of the land area in Dane County is devoted to cropland, and additional large land areas are in pasture, woodland, and other rural uses. In most watersheds in Dane County, agriculture represents the predominant land use and the major source of nonpoint pollution to water bodies.

The largest source of sediment and nutrients to lakes and streams is soil erosion from agricultural lands, with the most significant erosion occurring on sloping areas with exposed soils, particularly areas devoted to row crops. The geologic history of Dane County is responsible for the soils found here. Clay and silt loams are found primarily in glaciated portions of the county, while shallower sandy loams are found in driftless area. The average tolerable soil loss for Dane County is 4.138 tons per acre per year (T/Ac/Yr) while actual soil loss is slightly less at 3.959 t/Ac/Yr. This is a considerable improvement over the 1985 actual soil loss of 10.5 T/Ac/Yr. (See Map 3-3) In some areas, streambank erosion resulting from overgrazing and in-stream livestock watering is also a serious problem.

Livestock manure can contribute to high levels of nutrients and organic loading in runoff from barnyards and feedlots and from croplands where manure is spread on the land. The organic loading from runoff can cause bacterial contamination and depressed dissolved oxygen levels in receiving streams, in addition to adding nutrients to surface water bodies. Improper manure storage practices and excessive use of fertilizers can add to nitrate problems in groundwater (see Map 3-4). Finally, pesticides used to control weeds and insects contribute potentially toxic materials to groundwater and wells.

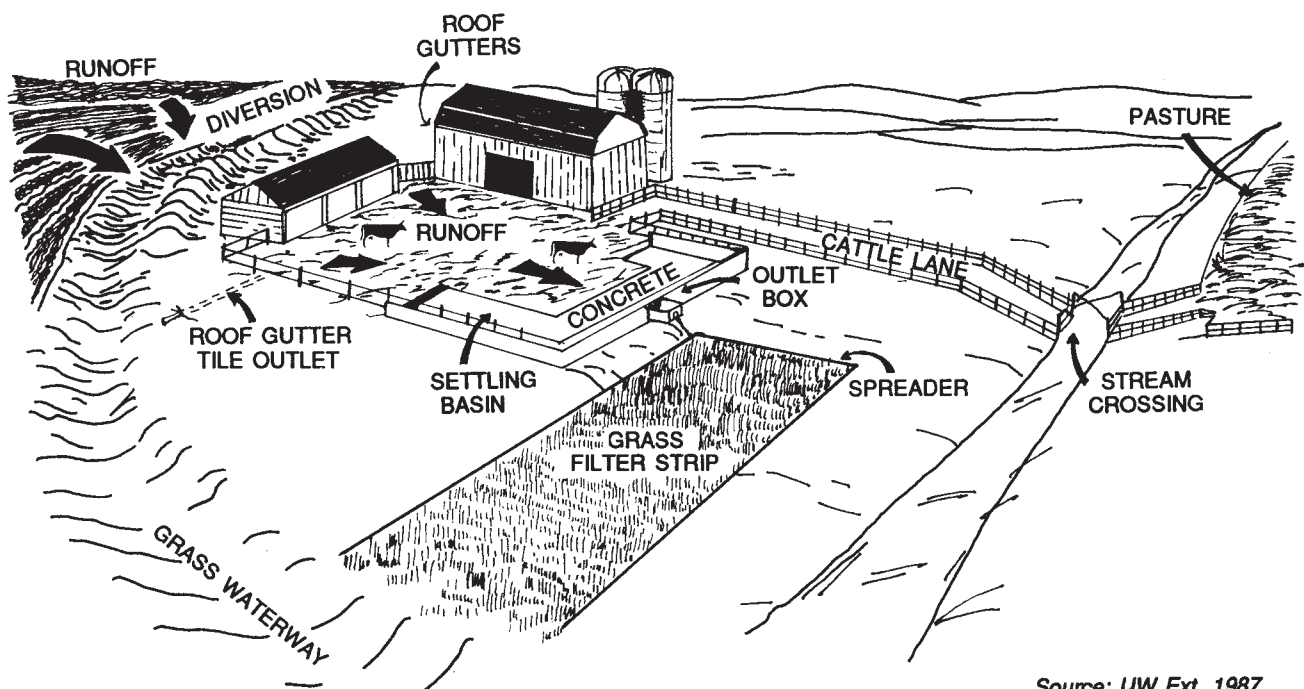
Trends and Issues

The economic pressures on agriculture have resulted in a number of trends, most of which have had negative impacts on water quality. In Dane County, these pressures and trends have resulted in fewer but larger farm operations, increasing emphasis on row crops, and greater concentrations of livestock and larger dairy herds. Pressures for greater economic efficiency and overall productivity have also resulted in extensive use of pesticides and inorganic fertilizers. Concerns over how these trends may be affecting the sustainability and viability of Wisconsin agriculture may be resulting in a reduction or reversal of some of these trends. The countertrends are reflected in the increasing acceptance and use of reduced tillage practices, more aggressive programs to encourage and require soil conservation planning and practices, and increasing concerns about agricultural pesticides showing up in groundwater and farm wells.

	1970	1978	1986	1994	2002
Number of Farms	4,010	3,570	3,140	3,050	2,887
Avg. Farm Size (acres)	167	181	199	195	179
Land in Farms (acres)	668,000	646,500	625,000	594,000	515,475
Corn for Grain (acres)	142,300	195,500	200,100	189,900	166,600
Cattle and Calves	168,000	155,800	159,000	149,000	124,000
Hogs and Pigs	135,000	130,800	86,500	69,000	30,500
Milk Cows	69,300	64,900	66,300	54,000	48,700
Dairy Herds	1,714	1,258	1,038	748	434
Avg. Dairy Herd Size	40	52	64	72	112

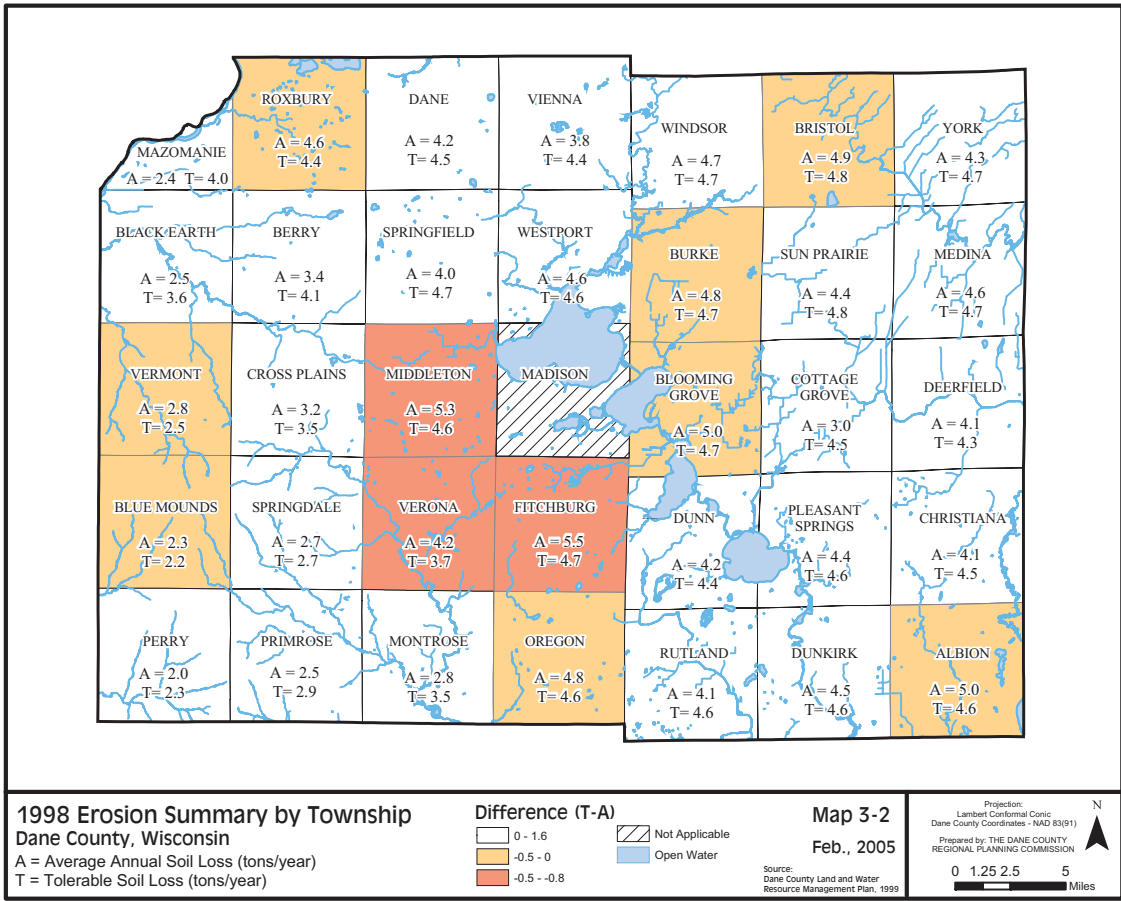
Source: Wisconsin Agricultural Statistics Service, 2004

Typical Barnyard Runoff Management System

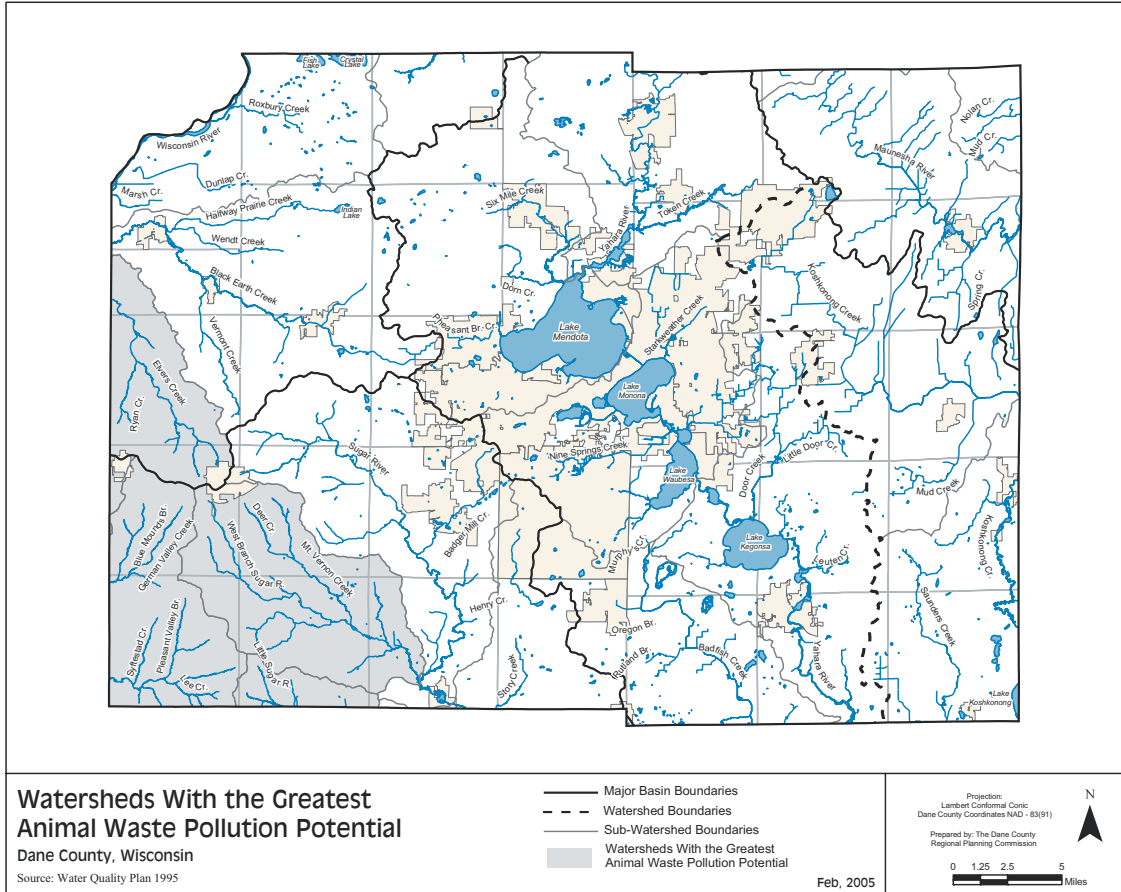


Source: UW Ext. 1987

Map 3-3



Map 3-4



Management Practices and Recommendations

One of the major trends and issues that has evolved over the last 20 years is a change in the management approach from a purely voluntary program, based on cost-sharing incentives, to a program which combines the traditional voluntary program with stronger incentives and requirements. The current approach includes federal cross-compliance requirements which provide additional significant economic incentives for adopting management practices, state requirements for soil conservation planning and practices, and some direct regulatory programs needed to deal with serious water quality problems not addressed by the other programs. A continuing issue will be the development of the best mix of these approaches to reduce the water quality impacts of agriculture consistent with the long-term protection of the land resource, and a stable and sustainable farm economy.

Through Wisconsin Act 27 (1997-1999 Biennial Budget Bill), Chapter 92 of the Wisconsin Statutes was amended, creating a county land and water resource management planning program. The Dane County Land and Water Resource Management (LWRM) Plan addresses soil and water quality concerns using local, state, and federal programs. It is a 5-year (2003 to 2008) action and implementation plan that emphasizes cooperation with conservation partners in Dane County. The LWRM Plan is intended to complement and coordinate existing plans rather than replace them.

The LWRM Plan outlines a comprehensive strategy for the implementation of soil and water conservation over the 5-year planning period. It identifies six goals for carrying out natural resource protection in Dane County, as follows:

1. Maintaining agricultural lands for long-term production;
2. Managing crop nutrients in an economic and environmentally sound manner;
3. Protecting and enhancing in-stream, riparian, wetland, and upland habitat;
4. Protecting and improving the quality of groundwater;
5. Implementing all applicable stormwater programs along with the existing Erosion Control and Stormwater Management Ordinance (Chap. 14) consistently throughout Dane County;
6. Partnering with and involving citizens on soil and water conservation initiatives in rural and urban areas.

In addition, state runoff guidelines and performance standards have been established through NR 151, which became effective on October 1, 2002. Through provisions in 1997 Act 27 and 1999 Act 9, the Legislature directed the DNR to develop performance standards and prohibitions for agricultural activities in cooperation with DATCP, including manure management standards. Manure storage and management is also regulated through Chap. 14, subchapter I, of the Dane County Code of Ordinances. The Ordinance is being revised to meet the applicable performance standards and prohibitions of NR 151 rules.

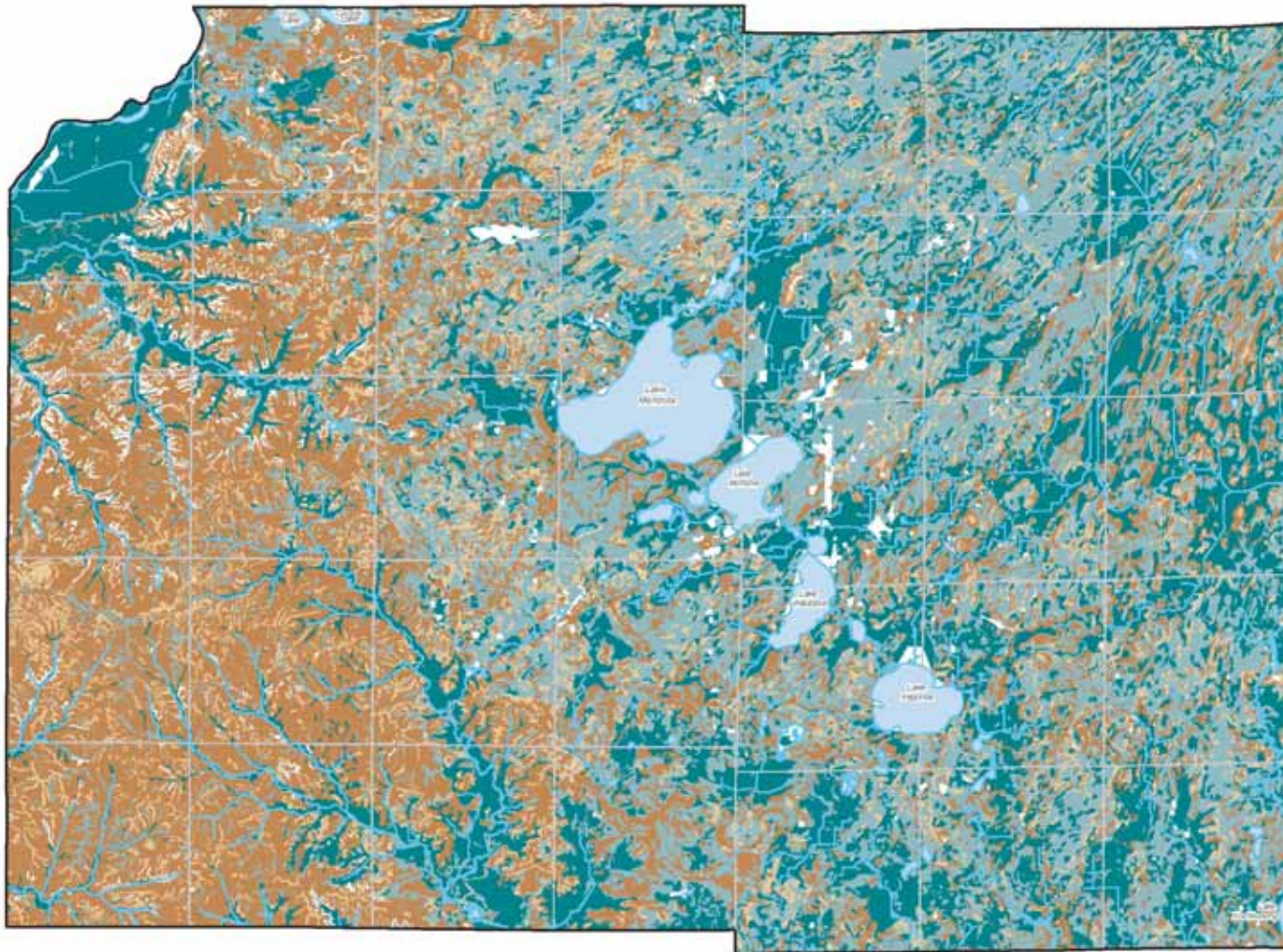
The basic approach to addressing agricultural nonpoint sources of pollution is for federal, state, and local agencies to work directly with individual landowners and farmers to develop plans and to implement management practices in their farm operations. In addition to preparing plans to allow farmers to comply with regulations or cross-compliance requirements, in many instances plans also provide a basis for providing cost-sharing funds to individual landowners to offset the cost of implementing management practices.

Many of the management practices directed at soil erosion are traditional soil conservation practices which have been utilized for many years, such as contour cropping, strip cropping, diversions, terraces, grass waterways, and similar practices. These traditional practices have been supplemented in recent years by reduced tillage practices which can provide both economic and soil conservation benefits to the farmer. Conservation tillage practices have helped to bring average soil erosion rates in the county down to tolerable (T) standards for maintaining long-term productivity. Barnyard runoff control plans and installation of manure storage facilities are common approaches to controlling pollution from animal wastes. Reduced use of pesticides and inorganic fertilizers often result from improved management and accounting, and integrated pest management approaches, which rely less on chemicals. Streambank erosion can be effectively corrected through the use of streambank fencing, buffers, and construction of livestock crossings.

The key to success in controlling agricultural nonpoint source water pollution is the aggressive pursuit of a mix of voluntary and regulatory programs, which are implemented with and through landowners and farmers on individual farms through the preparation of comprehensive erosion, animal waste, and fertilizer and pest management plans.

AGRICULTURAL NONPOINT SOURCE CONTROL RECOMMENDATIONS

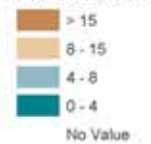
- A-1: Implement the statutory objectives of the soil conservation program (Chap. 92, Wis. Statutes) including the following elements:
- 1) enforce state and federal cross-compliance and other requirements to address most cropland erosion and runoff control needs;
 - 2) implement direct regulatory programs for significant problems or polluters not adequately addressed under 1);
 - 3) provide adequate cost-sharing funds to offset economic hardships and cost barriers to implementing best management practices required under 1) and 2).
- A-2: Implement the NR 151 agricultural performance standards and prohibitions.
- A-3: Technical assistance and cost-sharing should receive greatest emphasis in areas of the county where both water quality and soil conservation program priorities are high.
- A-4: The agricultural conservation program should continue to emphasize comprehensive farm conservation plans and long-term agreements with landowners.
- A-5: Farm conservation plans should include all farm operations that affect water quality. Additional emphasis should be placed on developing nutrient and pest management plans, as well as proper storage of pesticides, fertilizers, and fuel.
- A-6: Provide sufficient staff to enable contact with owners of high-erosion lands and follow-up on farm conservation plans. Landowners should also be required to maintain cost-shared practices for the effective economic life of the practice.
- A-7: Emphasis should be placed on increasing conservation information, education programs, and practices to heighten awareness of the importance of protecting soil and water resources.
- A-8: Dane County should place a high priority on the development of barnyard runoff control programs for all barnyards or feedlots where over 25 equivalent animal units (swine or cattle) are kept within 1,000 feet of a navigable stream or lake, for farm operations in vulnerable environmental areas, and for farm operations where pollutant load modeling (ARS Barnyard Model) indicates high animal waste contributions to adjacent water resources.
- A-9: The principal means of disposing of animal manure should continue to be application to cropland; however, in some instances provision of winter manure storage facilities may be desirable in order to provide water quality and farm operation benefits.
- A-10: Manure storage pits or lagoons should be located and designed in accordance with specifications designed to protect groundwater. Large (more than 300 animal units) storage lagoons should not be located in areas of high or extreme groundwater contamination risk (see Map 4-2).
- A-11: Continue to maintain an inventory of livestock, feedlots, and manure storage facilities.
- A-12: Streambank protection programs emphasizing streambank fencing and the construction of cattle watering points and crossings should have a high priority in the voluntary conservation program, particularly in the western parts of Dane County where the problem is greatest. Conservation easements for stream corridor improvement should be pursued where necessary, and volunteer groups should be solicited to provide assistance for such improvement work.
- A-13: Additional monitoring for pesticides in groundwater should be conducted in areas of extreme contamination risk where pesticides are commonly used.
- A-14: Promote educational programs and best management practices aimed at farmers, homeowners, and commercial applicators of pesticides and fertilizers in order to prevent excessive nutrient loss and contamination of ground and surface water resources.
- A-15: Partner with and promote watershed groups and involve citizens in soil and water conservation initiatives in both rural and urbanizing areas.



Erosion Index Dane County, Wisconsin

The soil erodibility index (EI) was originally created for conservation compliance provisions contained within the 1985 National Food Security Act. A soil map unit with an EI > 8 is considered to be highly erodible land. This map divides EI into several categories in order to display the relative potential erodibility for all Dane County soils. The erodibility index (EI) for a soil map unit is determined by dividing the potential erodibility for the soil map unit by the soil loss tolerance (T) value established for the soil in the FOTGas of January 1, 1990.

Erosion Index



Map 3-5

Feb., 2005

Prepared by:
Lambert Contracting Corp.
Dane County Contract #42 - 8207

Prepared by: The Dane County
Regional Planning Commission
In cooperation with Dane County
Land Conservation



OTHER POLLUTION SOURCES

Land-Disturbing Activities: Construction and Mineral Extraction

Soil erosion from nonagricultural land-disturbing activities, primarily construction and surface mining activities (sand and gravel extraction, quarries), are often one of the most significant localized sources of sediment and nutrients to receiving waters. Sometimes the localized impacts of this erosion are severe and highly visible, filling storm sewers and waterways with sediment, eroding visible gullies, creating turbid water, and degrading habitat. Even where the impacts of land-disturbing activities are not highly visible, this pollution source can represent a major proportion of the nonpoint source pollution load from any area where there is growth, development, and significant construction activity. Soil erosion from bare disturbed areas will often occur at rates 10-100 times that of tilled agricultural cropland during the period of disturbance and exposure, unless management practices are applied. Also, according to modeling done as part of the *Lake Mendota Priority Watershed Plan* (1997), while urban growth areas comprise only 0.3 percent of the total land use in the watershed, they contribute 23% of the total sediment loading and 19% of the total phosphorus loading to Lake Mendota.



The most common management approach to controlling the water quality impacts of land-disturbing activities is to require (through local and county ordinances) the preparation of specific site plans and designs to control erosion and runoff from construction and mineral extraction sites, during the active period of construction or extraction activities, as well as plans for site restoration and stabilization after the land-disturbing activity is complete. Recent state regulations (NR 216) require erosion control and stormwater management plans for all construction sites over 1 acre. This complements and supports the erosion control and stormwater management provisions of municipal ordinances.

Erosion control and stormwater management plans specify practices which are appropriate for the site, but are usually based on the common principles of: (1) minimizing the area which is disturbed or exposed at any one time; (2) protecting exposed soil by seeding, mulching, polymer application, and other protective mechanisms; (3) on-site management of stormwater, and diversion and control of erosive stormwater flows; and (4) installation of settling basins and silt barriers to prevent eroded soil from leaving the site.

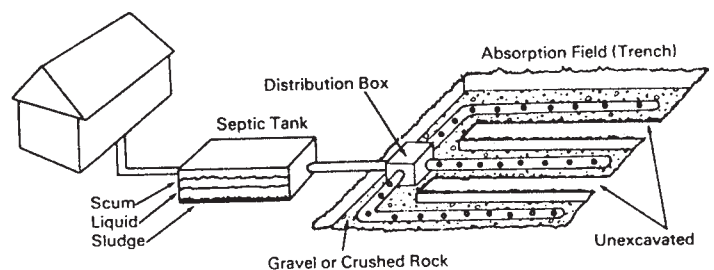
The principal need related to management of land-disturbing activities is to increase the enforcement and implementation of local ordinances. This need can be met by providing an adequate level of enforcement personnel, establishing enforcement of erosion and runoff control requirements as a high priority for enforcement personnel, and providing technical assistance, education and training for site designers, contractors, and enforcement personnel in design and implementation of erosion and runoff control management practices.

Chap. 74 of Dane County ordinance applies to mineral extraction activities. The purpose of this chapter is to implement effective reclamation requirements for non-metallic mining sites in Dane County, and to provide uniform and predictable reclamation standards in accordance with Wis. Admin. Code ch. NR 135 and Wis. Stats. Ch. 295, subchapter 1.

On-Site Wastewater Management

The treatment and disposal of domestic and commercial wastewater in rural areas outside of the sewer urban service areas is handled through the use of individual on-site wastewater disposal systems, primarily septic tanks discharging to subsurface tile disposal fields. There are a small number of on-site sewage holding tanks, where wastewater is temporarily stored before disposal by land application or at a wastewater treatment plant; however, these facilities are normally limited to circumstances involving only occasional or seasonal generation of wastewater, or where site conditions do not permit on-site wastewater disposal.

Septic tank system



The 2000 Census tallied approximately 22,764 housing units located in the rural areas of Dane County, an increase of 4,420 from 1990; by the year 2030, this number is expected to increase to 31,074 units.

Many existing on-site wastewater disposal systems were installed prior to 1970, when standards began to be strengthened and upgraded. Generally, newer on-site systems, particularly those installed since 1977, are quite reliable if properly maintained, and generally represent an environmentally suitable disposal technique. In addition to lack of proper maintenance, older systems may be functioning poorly because of inadequate design and construction standards in effect at the time they were built, or unsuitable site conditions.

Land Application of Wastes: Wastewater, Biosolids, Septage, and Solid Waste

One of the principal causes of poor functioning or failure of on-site wastewater disposal systems is neglect of proper maintenance and servicing of these systems. Septic systems should be inspected and pumped every two to three years, or they will eventually clog and fail. Although proper maintenance and servicing is not costly, it tends to be postponed or neglected until a serious problem or failure occurs. Since 1980, Dane County has required periodic evidence of adequate maintenance and servicing for all new or replacement on-site systems. In 1998, this requirement was expanded to include all on-site systems in Dane County. With the advent of the tri-annual inspection program, system failures are expected to decrease dramatically.

Another concern regarding on-site wastewater systems is the effect of these systems on nitrate levels in groundwater. Excessive nitrate levels in shallow groundwater and private wells is a problem throughout Dane County. It is not likely that scattered on-site systems contribute significantly to the overall problem, but they can be a source of nitrate contamination of nearby shallow wells. This is particularly true for large on-site systems, or cases where a number of on-site systems are clustered, as in a rural residential subdivision. The concentration of nitrate-nitrogen from large on-site systems or clusters of systems can, when added to background nitrate levels in groundwater, result in raising nitrate levels in nearby shallow wells to above drinking water standards.

In general, the current design, construction and siting standards for on-site wastewater disposal systems in Dane County result in systems which are reliable and have minimal environmental impact. On-site systems also have the beneficial effect of returning water directly to the source, avoiding the impacts of groundwater pumping and diversion through the sewer system. In addition, alternative designs, such as mound systems, are available to replace failing systems where site conditions would not permit conventional system replacement. The greatest need is to ensure a basic minimum level of maintenance and servicing of on-site systems to avoid failures and ensure continued functioning and a long life. This could be achieved by an expanded program of information and education on proper use and maintenance directed at rural homeowners.

The impacts and potential nitrate contamination resulting from large on-site systems or clusters of on-site systems (rural subdivisions) can be addressed by review and evaluation of specific proposals (permit applications, subdivision plat reviews) to determine if there is a likelihood that waste disposal practices will affect nitrate levels in nearby water supply wells. Finally, evaluation of the problems and impacts associated with concentrations of existing on-site systems need to be continued and expanded, and solutions to any significant problems evaluated and pursued. Appropriate solutions to serious problems can range from on-site improvement or replacement of individual systems, to providing centralized sewerage collection and treatment systems, depending on the magnitude and scale of the problem. In other cases, providing a protected water supply may be the best solution.

One of the fundamental environmental and resource planning principles in Dane County is the goal of returning or recycling organic wastes to the land, in ways that maximize the beneficial use of organic wastes. Realizing this objective requires careful management to avoid environmental problems and impacts on water quality.



All municipal and industrial wastewater in Dane County is discharged to surface water after treatment. A few industrial wastewater sources apply organic wastewater to the land surface through landspreading or spray irrigation, primarily wastewater from cannery, food processing or dairy wastes. These land applications are regulated under Wis. Adm. Code ch. NR 214.

Nearly all municipal wastewater biosolids (the solids removed from wastewater during treatment) are recycled as a fertilizer and soil conditioner to agricultural lands in Dane County. Biosolids represent a concentrated source of valuable organic material and plant nutrients. Biosolids can also contain metals and may contain other substances at trace levels. Comprehensive regulations have been developed by the Environmental Protection Agency (40 CFR, Part 503) and the Wisconsin Department of Natural Resources (Wis. Adm. Code ch. NR 204) to insure that biosolids recycling is conducted in a manner that protects human health and environmental quality, including the protection of both surface and groundwater resources. These regulations include the establishment of numeric limits, site management practices, and site approval requirements. NR 204 prohibits application during winter, except on a case-by-case basis. Exceptions are granted only in cases where adequate winter storage is not currently available and it can be demonstrated that application will not impact water quality. Adm. Code ch. NR 110 requires that all treatment plants either construct facilities that provide for 180 days of biosolids storage or have contractual arrangements to utilize existing storage facilities. Compliance schedules have been established for those plants that do not currently have 180 days of storage capacity. Construction of storage facilities will eliminate the need for winter application.

Septage—the material pumped and removed from on-site wastewater systems—is hauled and disposed of both at wastewater treatment plants and at landspreading sites. Nearly 10 percent of the septage generated in Dane County is applied to a large number of mostly uncontrolled and unregulated land disposal sites. Approximately 2,600 tons per day of solid waste and biosolids are generated in Dane County. Almost 1,700 tons per day (64%) are recycled through community recycling efforts and land application of organic materials such as yard waste and wastewater biosolids, thereby allowing the beneficial use of the organic materials in the waste.

The most important water quality aspects of the management of land application of wastes include: (1) avoiding contamination of surface waters from runoff from application sites; (2) avoiding groundwater contamination from precipitation infiltrating through the waste materials into groundwater; and (3) preventing accumulation or buildup of toxic or hazardous materials in soil, water, or plants. It is, of course, also important to maximize the benefits of land application of organic materials to the greatest extent possible, rather than looking at land application merely as a disposal technique. This means selecting sites and applications where the benefits of the nutrients and organic materials are utilized to the greatest extent in improving soil fertility and productivity, reducing erosion, and reducing chemical fertilizer use.

The management principles and practices which provide the necessary foundation for environmentally sound land application of organic wastes include:

- use of a site selection and approval process which directs application to suitable sites (see Map 4-1);
- use of slope restrictions and setback distances at application sites;
- limiting application to agronomic rates, which are based on soil test recommendations from certified laboratories;
- requiring subsurface injection or incorporation of materials unless it can be demonstrated that surface application will not adversely impact water quality;
- monitoring of biosolids quality to insure compliance with regulatory limits.

Control Program Recommendations Other Pollution Sources

On-Site Wastewater Management

- O-1: Dane County should continue to maintain an aggressive inspection and enforcement program on all on-site wastewater disposal systems.
- O-2: Designated local management and planning agencies should jointly investigate problems and alternative solutions for existing concentrations of development on septic tank systems in unincorporated areas.
- O-3: Large on-site wastewater systems and clusters of systems (over 150 gallons/acre/day loading or 1.0 to 1.5 acre lots) should only be approved where wells and water supplies can be protected from excessive nitrate levels.
- O-4: Holding tanks should be used for wastewater disposal only in instances when adequate servicing and pumping can be assured, and when suitable disposal methods (well-regulated land disposal sites or wastewater treatment plants) are specifically available for receiving the wastes.
- O-5: Municipal wastewater treatment plants should include provisions for receiving and treating holding tank wastes and septage generated within a reasonable service area or distance. Point source management agencies and the Wisconsin Department of Natural Resources should cooperate in expanding the availability of authorized septage discharge points to municipal wastewater treatment systems.
- O-6: Explore innovative methods for improving waste disposal and groundwater quality through site design and new technologies.

Land Application of Wastes, Biosolids, Septage, and Solid Waste Disposal

- O-7: Land application sites for wastewater, biosolids, and septage should be carefully located and designed to avoid groundwater contamination, and should not be located in areas of extreme groundwater contamination risk or well protection zones (Map 4-1). Existing sites located in these areas should be monitored and subjected to stringent design and operating requirements.
- O-8: Dane County should assume responsibility for regulating land application sites for disposal of septage and holding tank wastes. The program should include site location and licensing requirements, application and operating criteria and procedures, surveillance and enforcement procedures, and revenue necessary to support the program.
- O-9: Organic biosolids produced by biological wastewater treatment processes should continue to be recycled as a fertilizer and soil conditioner to agricultural cropland, nurseries, sod farms, or other lands where plants utilize the nutrients and are harvested. Subsurface injection or other means of ensuring immediate incorporation into the soil should be required and practiced to minimize surface runoff.
- O-10: The location and operation of biosolids land application sites should continue to be regulated by the Wisconsin Department of Natural Resources. Criteria for sites should be expanded to reflect groundwater protection, and sites should not be located in areas of extreme groundwater contamination risk (Map 4-1).
- O-11: Wastewater treatment plants should have adequate biosolids storage capacity (180 days) to avoid the need to apply biosolids to land during winter months or under saturated soil conditions.
- O-12: Solid waste disposal sites and landfills should be located and designed to protect surface and groundwater. Proposed landfills should be located outside of municipal well protection zones and in areas of low to moderate groundwater contamination risk (Map 4-1).
- O-13: Groundwater monitoring of the effects of existing or closed solid waste disposal sites in areas of high or extreme groundwater contamination risk, and in municipal well protection zones (Map 4-1) should receive high priority.

4

Resource Management

Stream and Shoreland Management

Lake Management

Groundwater Management

STREAM AND SHORELAND MANAGEMENT

Environmental and Open Space Corridors

The open space corridors illustrated on the *Regional Development Plan* map (Map 1-1) provide the basic planning framework and foundation for resource protection, including stream and shoreland protection and management. The open space corridors are continuous open space systems based on natural resources and environmentally important lands. The corridors are based primarily on streams, lakes, shorelands, floodplains, and wetlands. Steep slopes, woodlands, parks and publicly-owned open space lands may also be included. 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, including the following:

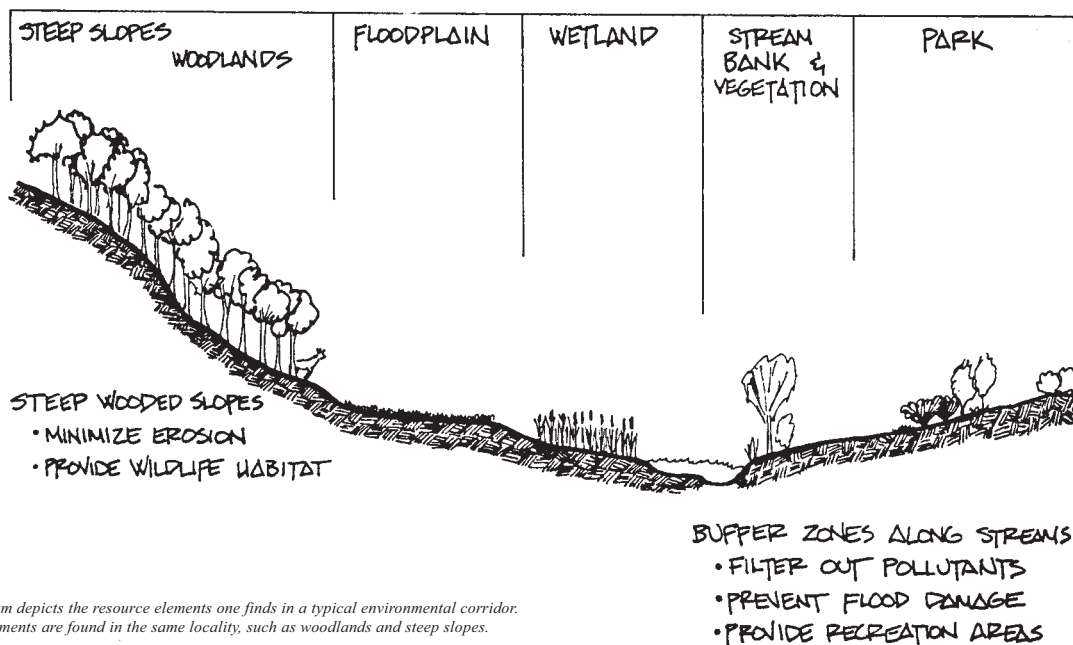
- protection of water resources, drainage, and hydrologic functions;
- pollution control;
- protection of public health, safety, and property;
- provision of outdoor recreation and education opportunities;
- protection of wildlife habitat; and
- enhancement of scenic beauty and shaping of urban form.

The delineation and protection of a continuous areawide open space 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 primarily associated with stream valleys and water features, emphasizes the importance of continuity of environmental systems and protection of the land/water edge.

The open space corridor system shown on the *Regional Development Plan* map includes **two distinct components: (1) urban environmental corridors** within urban service areas; and **(2) rural resource protection areas** outside of urban service areas. While both of these components represent continuous corridor systems, and they are connected with each other, there are some differences and distinctions between the two components.

Urban environmental corridors face greater pressure from the adverse impacts of development or modification, higher densities of surrounding development and land use, and greater need and use of corridors for public open space and recreation. As a result, the urban environmental corridors have a higher proportion of land in public ownership, are more extensively used for recreation, and have a greater emphasis on protecting intermittent streams and drainageways which are threatened by development and landscape alteration. The urban environmental corridors often require more stringent protection measures or acquisition to adequately protect critical or scarce resources and environmental functions.

The urban environmental corridor system represents a substantial framework for the basic open space and environmental network in a community. As an example, the environmental corridor system in the Central Urban Service Area (the largest urban service area in Dane County) includes approximately 15,500 acres of land, or about 20 percent of the total land area. About 11,400 acres (75 percent) of this land is in public ownership. Most of the remaining 4,100 acres is subject to environmental regulations of some sort (such as shoreland, wetland, or floodplain zoning), and some of this land will be acquired in the future through purchase or dedication.



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

Rural resource protection areas are based mainly on floodplains, wetlands, and shorelands delineated in town plans and protected through zoning or other regulations, together with existing and proposed publicly-owned or controlled lands needed for resource protection, continuity, or public recreation. There is less pressure for alteration or development of these lands, and less land is needed for public open space and recreational use. As a result, most of the lands in rural resource protection areas will remain in private ownership, and there is less need for acquisition or stringent regulation of such resources as intermittent streams and drainageways, woodlands or steep slopes.

The countywide open space corridor system illustrated on the *Regional Development Plan Map* has evolved from a general planning concept to a specific and detailed tool used for guiding land use and environmental management decisions. Urban environmental corridors have been mapped and adopted for all of the urban service areas in Dane County. The environmental corridor delineations have been incorporated into local land use and comprehensive plans, and 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, official mapping), and acquisition (through purchase or dedication). These protective mechanisms are reinforced by using the environmental corridors as the basis for federal (404 permits) and state (Chapter 30 and 31 permits) actions and decisions. In addition, the requirement that sanitary sewer extension approvals be based on a delineation of sewer service areas which include the identification of lands (environmental corridors) which are to be excluded from sewered development provides an additional powerful tool in protecting corridors from urban development. A fact sheet explaining environmental corridors and the mapping process is included in Appendix 1. (See the *Environmental Corridors Report, 1996*, for a more detailed treatment of the subject).

The open space corridor system shown on the *Regional Development Plan Map* represents the basic skeleton of an areawide open space network. It is expected that this basic system will be expanded by adding buffer areas, areas for protecting scenic views and community separation, and areas desired for active recreation or public use (such as trail systems). Adjacent or contiguous upland areas important for wildlife habitat, groundwater recharge, or protection of unique or valuable resources (unique vegetation, geologic features, archeological sites, etc.) should also be considered for addition to the corridors.

The most important current issues and priority needs concerning to open space and environmental corridor protection are as follows: (1) using the adopted open space/environmental corridor system as a consideration in all local land use and siting decisions and planning; (2) continuing to emphasize the use of the open space corridor network as basic guidance and priorities for open space acquisition and protection programs; and (3) providing emergency acquisition funds to ensure protection of important corridor lands and critical environmental resources which are endangered or threatened by development which cannot be adequately protected through other means.

Floodplain, Wetland, and Shoreland Protection Programs

Within the overall context of open space and environmental corridors protection there are several specific programs directed at protection of streams and shorelands from adverse impacts which would detract from the environmental functions of these resources. These programs are directed at regulating activities in floodplains, shorelands, and wetlands. Programs include the federal Section 404 permit program, administered by the U.S. Army Corps of Engineers, regulating the discharge of dredge or fill materials into all waters of the United States (generally all lakes, streams and adjacent wetlands which are part of a surface tributary system to and including navigable waters). State Chapter 30 and 31 permits, administered by the Department of Natural Resources, regulate a variety of activities in, or directly affecting the navigable waters of the state. DNR also administers NR 103, Wetland Water Quality Standards, which provides criteria for activities affecting wetlands. State law requires counties to adopt and enforce restrictive zoning of shorelands along navigable streams or lakes in unincorporated areas. Shorelands are defined as areas lying within 1,000 feet of lakes, ponds or flowages, and within 300 feet of rivers or streams, or to the landward side of the floodplain, whichever distance is greater. Minimum standards and criteria for regulation of land use in the shoreland areas are included in chapter NR 115 of the Wisconsin Administrative Code. State shoreland protection rules also require counties (in unincorporated areas) villages, and cities to adopt shoreland-wetland zoning ordinances which provide substantial additional protection measures for wetlands (5 or more acres)

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

▲ Primary Function △ Secondary or Supplemental Function

located within shoreland areas. NR 115 and NR 117 are the administrative rules providing standards and criteria for these zoning programs. State law also requires counties, cities, and villages to adopt floodplain zoning ordinances under criteria and standards established in NR 116 of the Administrative Code.

Dane County has adopted the required general shoreland, wetland, and floodplain zoning for the unincorporated areas of the county. Nearly all of the villages and cities in Dane County with areas subject to flooding have adopted floodplain zoning ordinances. Most villages and cities also have adopted shoreland-wetland ordinances.

The most important issues regarding floodplain, wetland, and shoreland protection programs are limitations in the degree of protection provided, and the incomplete scope or coverage required of the zoning programs. Since the basic intent of floodplain zoning is to limit flooding damages, these ordinances do not restrict development or other activities in the floodplain which adversely affect other environmental functions. Similarly, general shoreland zoning addresses certain basic criteria and standards for development and activities within the shoreland area, but many potential activities and impacts are not addressed. Shoreland-wetland zoning provides a greater degree of protection for wetlands than floodplain or general shoreland zoning, but shoreland-wetlands smaller than five acres, and wetlands outside the shoreland area are not covered by these ordinances. The protection of critical environmental resources afforded by these programs would be substantially improved if local units of governments adopted and enforced ordinances beyond the minimum state requirements. Vegetative buffers (75 to 300 feet) have proven to be especially effective in protective in protecting streams, wetlands and shorelands, and have been used to augment greenbelts and recreational area with great success in many parts of the country. In 1994, Dane County recently expanded the scope of wetland zoning in unincorporated areas to include all wetlands over 2 acres.

Wisconsin's shoreland zoning standards were originally developed in the late 1960s based on the best professional judgement at that time. Since then, there have been significant advances in the understanding of natural aquatic systems, and the public's knowledge and perceptions and the political landscape has changed as well. Current and future development trends pose major challenges to the shoreland program. Options for improving the shoreland zoning program are being considered at the state and local levels tied to regional classification systems specifically tailored to local circumstances and priorities. It is now recognized that one size doesn't fit all, and that different standards can be used for different situations. A classification system may also be used to guide program resources and promote cost-sharing opportunities and partnerships among various agencies and groups, directing their efforts where they will do the most good and have the largest beneficial effect.

In 2004, Dane County was awarded a DNR Lake Classification grant to develop a water body classification system that would include all navigable waters. The Phase I study will provide the technical basis and support for a subsequent Phase II management program developed in cooperation with local units of government, private citizen groups, and landowners, and incorporated into the County's Comprehensive Plan. The water body classification study is the first step toward developing a consistent set of countywide standards, policies, and strategies among cities, villages, and towns to help protect and restore the waters of the county. This would be based on the water body type, the quality of the resource, and its potential with the current level of development.

Streambank and Shoreline Protection and Improvement

The management and improvement of streambanks and shorelines is another important aspect of resource management. These programs include such management activities as acquisition of shorelands; easements and buffer strips; vegetation management; stream bed and bank stabilization measures and structures, such as riprap or sheetpiling, dredging, and grading; fencing and streambank crossings for livestock exclusion; improvements to upgrade recreational use and access; and improvements to enhance habitat for fish and wildlife. The basic purpose of these management programs and activities is to protect or enhance the basic environmental and open space functions of the resource, including maintenance of flow capacity, erosion control, improving recreational use and access, improving fish and wildlife habitat, and providing adequate protective buffers between land uses and environmental resources.

Other Stream Management Issues

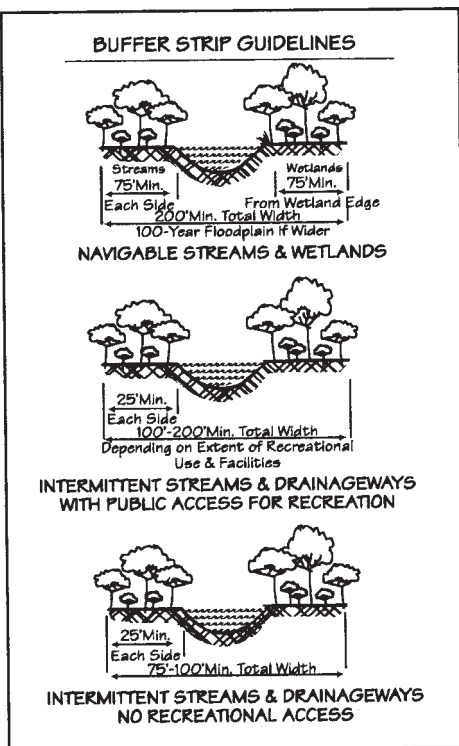
Other stream management issues include monitoring, fishery management and habitat improvement, maintaining and improving navigation and flood handling capacity, and providing access and facilities for in-stream recreation. In Dane County, there is a limited amount of up-to-date information on stream water quality conditions, and it is difficult to determine whether water quality in any particular stream is adequate or suitable for supporting the intended uses in that stream. It is, therefore, important to support a continuing program of monitoring streams to provide information on flow, chemical characteristics, and biological characteristics to determine whether the conditions are supporting the stream's potential for use, or whether the stream's use is being limited or impaired by pollution or other impacts.

In-stream construction, or dredging and grading activities designed to maintain or improve navigation and flood-carrying capacity, or to provide recreational facilities or access, can have adverse effects on water quality if not undertaken with care and in concert with an overall stream and shoreland management program.



From the standpoint of in-stream fishery or shoreland wildlife management programs, the Department of Natural Resources is the principal agency having both the technical expertise and the institutional responsibility. The role of local units of government is primarily to participate in and support those state management programs.

There is no clear-cut overall responsibility for stream management for major streams which involve more than one local jurisdiction. The Wisconsin Department of Natural Resources, designated the trustee of all waters of the state (including groundwaters), exercises fairly complete regulatory control over the navigable waters of the state, but its role in streambank and shoreline protection and improvement programs has generally been limited to specific projects and locations where the state has an active role in fish, game, and resource management. Local programs for streambank stabilization and shoreline protection and improvement projects have been pursued by individual local units of government for specific areas in their jurisdiction. These programs and projects have included streambank and channel stabilization projects and structures using public funds, equipment, and personnel; sponsoring or providing funding to private conservation groups for streambank and shoreline improvement projects; and sponsoring and supporting volunteer shoreline cleanup and vegetation management programs.



Dane County can play a much greater role in stream, streambank, and shoreline management under state legislation enacted in 1990 that grants the County Lakes and Watershed Commission additional authority and financing tools.

The importance and role of streambank and shoreline buffer strips and easements in protecting and managing streams is being increasingly recognized, and more attention and effort will need to be directed to acquisition programs, including dedication and easement approaches. Stream and shoreline buffer strip acquisition and protection is, of course, consistent with and supportive of the overall approach to open space and environmental corridors.

STREAM AND SHORELAND MANAGEMENT RECOMMENDATIONS

- S-1: The environmental and open space corridors illustrated on the Regional Development Plan Map should be adopted and incorporated into the plans, land use controls, and resource protection programs of all units of government in Dane County. The corridor system should be adopted as the basic skeleton or framework to promote community-wide and countywide open space and resource protection networks, and should be expanded to include additional needed lands and resources.
- S-2: Wetlands, steep slopes, buffer strips, and wooded areas in or near water bodies should be protected from development or adverse impacts through regulation or acquisition. Restore these areas where possible.
- S-3: Management agencies should endeavor to increase or maintain functional values of wetlands regardless of size, especially in urban settings where they have multiple functions. Restore farmed or prior-converted wetlands where possible.
- S-4: Park and open space land acquisition policies in Dane County should continue to place priority on acquisition of water-oriented parks, water-related resource protection areas, and public access.
- S-5: Enhance and promote the role of woodlands and hillsides in protecting water quality and hydrologic functions, such as groundwater recharge, through woodland management and protection plans, and financial incentives.
- S-6: Adequate vegetative cover and buffer strips to protect and stabilize the shoreline and stream corridor functions should be included in land use and development plans, controls or regulations.
- S-7: Support the efforts of watershed and conservation groups to protect and improve water resources.
- S-8: Work with lake, watershed, and conservation organizations to promote and install conservation buffers along intermittent and perennial streams, wetlands, ponds, and lakes through easements, land acquisitions, and voluntary cooperation from land owners.
- S-9: Municipalities should take advantage of federal, state, and private funding opportunities to implement streambank and in-stream habitat restoration, as well as increase public access along surface water areas.
- S-10: An ongoing program of monitoring stream water quality conditions, use suitability and limitations, and corridor evaluation should be supported and conducted by the Wisconsin Department of Natural Resources, Dane County, and local management agencies.
- S-11: Maintain and enhance the designation of all current Outstanding Resource Waters, Exceptional Resource Waters, Class I and Class II trout streams, and promote the improvement of impaired water bodies so they can be removed from the 303(d) list.
- S-12: Participate and support the development of a water body classification System for Dane County waters.
- S-13: Municipalities in which sewer service area boundary expansions are requested should review and revise existing floodplain zone maps to accommodate potential hydrologic modifications.
- S-14: Management agencies should endeavor to prevent development that would increase the potential for flood-related problems. Promote implementation of the Dane County Flood Mitigation Plan.
- S-15: Cities and villages should consider regulating their shoreland through conformance with county or model ordinances for shoreland protection – whichever are more protective – even though they are not required to regulate shorelands other than wetlands under NR 117.
- S-16: All units of government should be proactive in the preservation and conservation of aquatic natural resources while promoting environmentally sound development.

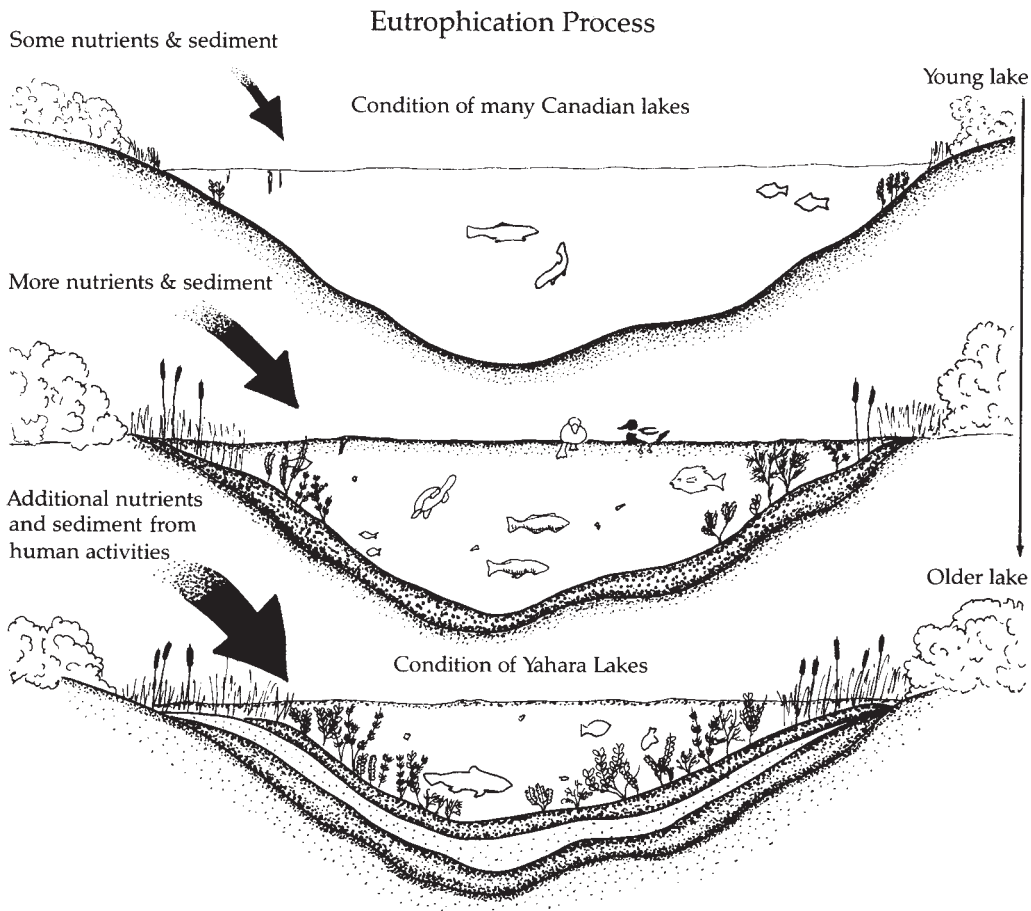
LAKE MANAGEMENT

Lake Conditions and Management Problems

Lake management issues in Dane County are dominated by the Yahara River chain of lakes, since these are the largest, the most prominent, and the most heavily used lakes. There are other, smaller lakes throughout Dane County including seepage lakes such as Fish Lake and Crystal Lake, as well as small stream impoundments and millponds like the Marshall and Rockdale millponds, Lake Belle View, and the Yahara River dams below Lake Kegonsa. The most important water quality problems and management concerns for most of these smaller lakes are the same as those for the Yahara River lakes—excessive fertility and eutrophication resulting from high nutrient and sediment loading. Specific and detailed management plans for each of these smaller lakes and impoundments need to be developed before management practices and programs can be undertaken, in order to reflect the particular problems, circumstances and pollution sources affecting each lake.

The Yahara lakes, Lake Wingra and most of the other lakes and impoundments in Dane County are classified as eutrophic lakes. Eutrophic lakes are nutrient-rich and usually have an abundant crop of aquatic weeds and algae. Natural eutrophication is a slow process in which sediment and nutrients enter the lake from runoff from the lake's watershed, causing increased plant growth and a

gradual filling of the lake. The time required for this filling or “aging” depends greatly on the surrounding landscape and on the nature of the lake itself. The rate of aging or eutrophication can be sped up by human inputs of sewage and polluted runoff from farms and cities. Through this process of “cultural” or accelerated eutrophication, the lake can quickly become more fertile and support nuisance levels of aquatic plants and algae. The Yahara lakes are examples of cultural eutrophication. Problems with algae growth were first reported in the 1880s, possibly caused by sewage discharging into Lake Monona from an expanding urban population. Although Lake Mendota never received large quantities of sewage, Lakes Monona, Waubesa and Kegonsa were all heavily affected by the discharge of treated sewage from the Madison area. Most sewage was diverted from Lake Monona in 1936 and from Lakes Waubesa and Kegonsa in 1958. Following these diversions, the lower three lakes improved greatly. In 1971, remaining treatment plant discharges from small communities upstream from Lake Mendota were diverted around the lakes; and in the 1980s, all remaining wastewater discharges tributary to the Yahara lakes were diverted, so that none of the lakes now receives point sources of pollution. However, the lakes continue to receive sediment, nutrients, and other types of pollutants in runoff from the surrounding farmlands and municipalities.



The public and lake users have long identified poor water quality and shoreline conditions caused by excessive aquatic weeds and algae as the main problems and obstacles to enjoying the lakes. Aquatic weeds and algae are natural and important elements in the lake ecosystem, but excessive growth of these plants causes nuisance conditions. Some species of blue-green algae produce toxins that, in large enough concentrations, can be toxic to humans and animals. Aquatic plant growth is fueled by the availability of nutrients, especially phosphorus, washed into the lakes from the watershed. Phosphorus in the water stimulates algae growth, while rooted aquatic plants obtain phosphorus from the sediment. Since this is the cause of the water quality problem, **the most important aspect of lake protection and management is reducing the input of sediment and nutrients to the lakes**, while also controlling and harvesting aquatic plants so they don't interfere with recreational and aesthetic enjoyment of the lakes. Reducing nutrients available to algae and weeds in the lakes can reduce the problem if the reductions are substantial enough.

It is difficult, however, to achieve dramatic or visible changes in the water quality of the Yahara lakes in the short term, because nutrients have accumulated in the sediment of the lakes and can be recycled and used by plants. Nevertheless, **an aggressive watershed pollution control and management program is absolutely essential and the most important ingredient in the long-term management strategy of the lakes** for the following reasons: (1) such programs, if aggressively pursued and well funded, can result in long-term improvement in lake water quality conditions; (2) aggressive watershed management programs are necessary to ensure that watershed nutrient loadings do not increase and worsen algae and weed problems to the point that they become unmanageable; and (3) most watershed nutrient and sediment control programs provide important benefits in addition to reducing nutrient loadings to the lakes--reduction of loss of topsoil and productivity on agricultural land, improved urban stormwater management and pollutant removal, and reduction of drainage and flooding problems. Thus, the most important element in the long-term strategy to protect and manage the lakes is the reduction in nutrient and sediment inputs from tributary watersheds, applying the urban and agricultural nonpoint source pollution control practices and programs described in Chapter 3.

Direct Lake Management Programs

In addition to reducing pollution inputs to the lakes, there are a variety of direct or in-lake management practices and programs which are designed to avoid or manage nuisance conditions or problems, enhance use and enjoyment of the lakes, and ensure that the lakes are safe and healthy environments for recreational use and support of fish and aquatic life.

Nuisance algae blooms, and subsequent die-off and decay, create obnoxious and odorous conditions which seriously impair or interfere with scenic enjoyment and recreational use of the lakes. The only safe and proven long-term strategy to preventing nuisance algae blooms is to reduce the nutrients which fuel these blooms. Algae can be controlled and killed by applying chemical algicides to the lakes, and algicides such as copper sulphate have been heavily used in the past for algae control on the Yahara River lakes. Chemical control of algae, while cheap and effective in treating short-term algae bloom problems, does not resolve the need for nutrient reduction, or avoid problems caused by the organic decay of dead algae. In addition, algicides accumulate in bottom sediment of the lakes to levels that can become of environmental concern. In summary, chemical control of algae, while an economical approach, is primarily of short-term and cosmetic benefit. Lasting effects are potentially deleterious, so that the use of chemicals for algae control is presently limited to small areas, and is not a significant lake management technique. A biological approach to algae control which has promise is the manipulation of the food chain and fish species composition in the lake to favor zooplankton which feed on algae. Experiments have been carried out in Lake Mendota. Further experimentation and evaluation is needed to determine whether or not this approach, combined with nutrient reduction, can be effective in reducing algae populations.

In addition to algae, excessive sediment and nutrient inputs can fuel growth of large aquatic plants and weeds to nuisance levels which interfere with aesthetic and recreational enjoyment and use of the lakes. Rooted aquatic plants are important and necessary elements in the lake ecosystem, and provide important fish habitat and cover as well as food.

In the 1960s, however, the Yahara lakes were invaded and dominated by a species of an exotic aquatic weed (Eurasian water milfoil) that was less desirable in many respects than previously dominant native plant communities. This change in species dominance increased the nuisance factor and management problems. The lake management problems caused by dense growths of aquatic rooted plants in shallow areas include serious interference with recreational boating and navigability; interference with swimming and other shallow area recreational activities; and acceleration of sediment deposition and filling of shallow areas (which also expands the area suitable for growth of weeds). Subsequent die-off and decay of excessive aquatic plants also contributes to the odors and oxygen depletion.

The primary management practices used for control of excessive weed growth include physical control (such as mechanical harvesting), and chemical control. Dane County presently maintains an aggressive program of mechanical cutting and harvesting of aquatic weeds in the Yahara lakes and other lagoons and lakes in the County. The basic purpose and objective of the mechanical harvesting program is to maintain adequate recreational navigability and access, and to enhance the overall recreational or aesthetic value of the lakes. Other physical weed management techniques which have promise and have been used in some circumstances include lake drawdowns to expose and kill or remove aquatic weeds in shallow shoreline areas, and the use of bottom screens or barriers to prevent or limit aquatic plant growth in small selected areas. Another promising approach is introducing the milfoil weevil which feeds on the invasive weed.

Application of chemical herbicides is an economical approach to killing aquatic weeds, and has been extensively used in the Yahara lakes in the past. The same concerns and effects are associated with the use of chemical herbicides such as sodium arsenite to control weeds as those described for the use of chemical algicides—the approach provides only short-term and cosmetic benefits, does not avoid the problems of nutrient availability and organic matter decay, and represents potential long-term environmental risks. At the present time, chemical herbicides are used for control of aquatic weeds only in small areas of the Yahara lakes, generally along private shorelines, and are restricted to approved herbicides applied under the DNR supervision.

A promising biological approach to managing aquatic plant problems is direct management of aquatic plant communities to create conditions which favor more desirable plant species and plant community compositions than those presently existing. This approach is receiving increasing attention and experimental efforts are being considered for the Yahara lakes.

The extent of rooted aquatic plant beds in the Yahara lakes is generally limited to shallow areas where sunlight is able to penetrate a sufficient depth to support plant growth. The expansion of shallow areas through sedimentation can increase the area suitable for rooted aquatic plant growth. Paradoxically, the improvement of water clarity from reduced algae populations can also expand the area suitable for aquatic plant growth. In other words, as the water becomes clearer and algae problems become less serious, the extent and growth of nuisance rooted aquatic plants can increase. Conversely, in lakes where algae problems are serious enough to create very poor water clarity, growth of aquatic weeds can be limited.

Another lake water quality concern is the deposition of potentially toxic or hazardous materials in lake sediment as a result of pollution sources or previous applications of chemicals for algae and aquatic weed control. Substances of concern which have been found in lake sediment include mercury, arsenic, copper and PCBs. Although levels of these materials in lake sediment do not appear to be a serious concern in terms of direct exposure, some of these materials can be concentrated or accumulated in the food chain. Because of this, DNR has issued general “safe-eating guidelines” for all waters of the state, generally focused on pregnant women and their fetuses. Current sources of these pollutants can be reduced through nonpoint source pollution control programs. The effects of dredging or disturbance of previously deposited in-place pollutants is of concern and requires careful evaluation.

Other Lake Management Issues

There are other important lake management issues related to lake use which are interrelated with water quality management concerns and programs. These include programs to enhance recreational use and scenic enjoyment of the lakes and lake shorelines, management of lake levels and lake outflows, lake shoreline cleanup and maintenance activities, dredging, and management of the fisheries of the lakes.

The Yahara River Lakes Water Recreation Study (RPC, 1987, 1995) examines lake recreational uses, problems and issues, many of which are related to lake water quality conditions and management programs. The study addresses management programs, in addition to water quality improvement and lake management, directed at providing sufficient access and support facilities for swimming and boating, developing and enforcing boating and water safety programs and regulations, and monitoring and evaluating the growth and patterns of recreational use of the lakes in order to anticipate and avoid future use conflicts and problems.

The Yahara lakes support a diverse fishery, and fishing is one of the most popular uses of the lakes. DNR is the principal agency having both the technical expertise and institutional responsibility for managing the fisheries in Dane County lakes. Fishery management includes a variety of approaches, including fishing regulations, stocking, habitat improvement, and rough fish removal. Fishery management is also interrelated with aquatic weed and algae control.

Dane County manages lake levels and lake outflows under criteria and guidelines established by DNR. It would be useful to develop improved, more sophisticated and more precise operating rules for lake levels and outflows, treating the Yahara River lakes as a series of multipurpose reservoirs. These operating rules would need to address all of the competing, and sometimes conflicting, concerns related to lake levels and outflows. Improved lake level and flow management could result in improved flood control benefits and reduced flooding problems, better satisfaction of recreational access and use concerns related to lake levels, maintenance of lake levels most conducive to fish spawning conditions, use of lake level manipulation to better control and manage shallow shoreline aquatic weed growth and conditions, reduced shoreline ice and erosion damage, and better baseflow control to offset the effects of groundwater pumping and diversion.

As part of the Dane County Regional Hydrologic Study, the U.S. Geological Survey developed a Yahara Lakes reservoir routing model. The model provides the basis for an ongoing comprehensive management program focused on the hydraulics and hydrology of the entire Yahara lakes system. Evaluations of alternatives are expected to be conducted over the long-term, providing options for addressing problems associated with fluctuating lakes levels and flow that are either higher or lower than DNR regulatory limits, establishing realistic and achievable regulatory lake levels that address multiple use concerns, and evaluating potential management or structural measures that could be employed to reduce future problems.

The Yahara River watershed is one of the most rapidly urbanizing areas in the state and the water resource problems are accelerating along with the increased development. The urban areas are all experiencing dramatic increases in the amount of impervious area, resulting in increasing stormwater runoff to the lakes and decreasing infiltration to the groundwater system. This development is creating a potential for more frequent and more severe flooding during wet periods and is also creating a water demand that results in more frequent and more severe drought conditions during periods of low flow. In order to address these issues, a watershed runoff model is currently being developed by Dane County, in cooperation with Madison Gas & Electric, as well as state and local units of government.

Finally, the Yahara lakes, particularly Lake Mendota, and Lake Wingra and the UW Arboretum, represent important field laboratories for technical and scientific analyses and the study of limnology and lake ecosystems. A substantial body of scientific and technical information has been gathered for these lakes over several decades. This body of knowledge is important in lake studies and limnological research and has benefits beyond the boundaries of Dane County. It is important to continue to monitor water quality as well as physical and biological conditions of the major lakes in Dane County (particularly the Yahara lakes, Lake Wingra, and Fish Lake). This will provide valuable information for managing the Yahara River lakes, and it will expand the scientific data base and increase our knowledge of limnology, lake ecosystem, and lake management. In addition, these lakes can serve as field laboratories for promising lake management programs and approaches, and research.

Public information and education about the lakes and lake management is critical in maintaining public support for lake protection and management programs, and for increasing public understanding of the lakes' complex ecosystems, the problems and their causes, and developing a realistic vision of what the lakes can become.

LAKE MANAGEMENT RECOMMENDATIONS

- L-1: Dane County should continue to provide sufficient funds and personnel for mechanical weed harvesting and other environmentally sound aquatic plant management programs. Harvested weeds should continue to be recycled to land as mulch, fertilizer and soil conditioner rather than disposed in landfills.
- L-2: The use of chemicals for control of aquatic plants should continue to be limited to shallow water areas where other suitable management alternatives do not exist, and should be supervised by the Wisconsin Department of Natural Resources. Chemical treatment should be prohibited in sensitive lake areas identified by the DNR.
- L-3: Dane County should research and evaluate flow and lake level management strategies for the Yahara River lakes as a series of multipurpose reservoirs, and develop optimal operating and outflow/lake level control rules for the entire Yahara River system.
- L-4: Dane County should work with other units of government to finance and develop a Yahara River Watershed rainfall/runoff model to help mitigate the impact of flooding and drought conditions.
- L-5: Dane County should conduct a countywide study of dredging needs and associated problems of recreational navigability.
- L-6: Dane County should continue to develop and maintain active shoreline cleanup, improvement and maintenance programs aimed at reducing shoreline erosion and loss of riparian lands, and improving the aesthetics and stability of shorelines. Dane County should continue to coordinate an annual volunteer lakeshore cleanup event on all the Yahara River lakes and other county lakes where interest exists.
- L-7: Dane County should continue the long-term program of monitoring indicators of lake conditions on the major lakes in Dane County.
- L-8: Management agencies responsible for lakeshore parks and beaches should continue to conduct frequent monitoring at beaches throughout the swimming season to ensure conditions are safe for water-contact recreation.
- L-9: Continue to explore, evaluate, and promote promising in-lake management techniques such as biomanipulation of the food chain, improved fisheries and lake level management, phosphorus inactivation, hypolimnetic pumping, re-establishment and management of more desirable and diversified aquatic plant communities, lake drawdown, dredging, etc.
- L-10: Conduct information and education about lake management and water quality issues along with other water quality information and education programs aimed at landowners, residents, citizens, and lake users.
- L-11: Educate and inform water users in Dane County about the threats by invasive and exotic aquatic species.
- L-12: Participate with other public agencies and private environmental and conservation groups to implement the recommendations contained in the Yahara Lakes Advisory Group (YLAG) Report.

GROUNDWATER MANAGEMENT

Introduction

Since groundwater represents the source of all water supplies in Dane County, protection and management of the groundwater resource is a high priority. The discussion of groundwater quality conditions and problems in Chapter 2 indicates that groundwater in Dane County is of generally good quality, but that there have been localized instances of contamination from nearby pollution sources, particularly in the upper or shallow aquifer, affecting most individual private water supply wells. Areawide water supply concerns relate primarily to potential increases in nitrates, dissolved salts, and volatile organic compounds, which could affect the deep aquifers, from which most municipal water supplies are drawn.

Groundwater hydrology and the impacts of groundwater pumping and diversion described in Chapter 2 have been addressed through the Dane County Regional Hydrologic Study, and ongoing modeling and management programs.

The basic approach to groundwater protection and management is founded on two major considerations:

- (1) Siting and land use decisions:
 - Locating potential pollution sources in areas that minimize the risk of contaminating groundwater supplies.
 - Locating groundwater supply sources in areas where they will be protected from pollution sources.
- (2) Employing management practices and programs that are designed to reduce the risk of groundwater contamination from *potential pollution* sources.

Siting and Land Use Decisions

Siting and land use decisions which are based on an evaluation of potential groundwater impacts are the most effective defense against groundwater contamination problems which are irreversible or very costly to correct. It is important to evaluate, as part of the process of making land use decisions, whether the location of a potentially polluting activity poses a high risk of contaminating the groundwater, or whether the location of a well in relation to pollution sources results in a high risk of well contamination. Examples of these land use and siting decisions include locating landfills, waste disposal and land application sites, zoning changes, subdivision reviews, and conditional use permits related to a variety of potentially polluting activities, such as large on-site wastewater disposal systems or clusters of on-site wastewater disposal systems (as in rural residential subdivisions), junkyards and salvage yards, and pesticide or hazardous waste storage and handling facilities.

As part of the Dane County Hydrologic Study, Groundwater Contamination Risk maps have been developed. Map 4-1 indicates the risk of groundwater contamination from *surface* pollution sources. The map represents a combined overlay of the attenuating effects of soil properties, depth to bedrock, depth to groundwater,

and groundwater flow patterns. By removing the soil layer, a groundwater contamination risk map from *subsurface* sources has also been created (Map 4-2). Note that removing the natural ability of the soil to treat and remove pollutants results in an increased risk of contamination in some areas. The surface map indicates the relative contamination risk from activities conducted on the surface of the land, such as pesticide, fertilizer, sludge (biosolids) and septage application. The subsurface map indicates the relative contamination risk to groundwater from subsurface activities such as landfills, underground storage tanks and other pollution sources which are located below the soil zone. The groundwater contamination risk maps have been developed as tools to assist in the initial screening and evaluation of the potential for groundwater pollution from pollution sources or land uses. Suggested guidelines and criteria for using the contamination risk maps and for siting decisions have also been developed. Potential groundwater pollution sources are listed and have been mapped for Dane County in the *Dane County Groundwater Protection Plan*.

Since the contamination risk maps are based on generalized areawide information, they cannot be used to indicate the potential for localized problems or contamination of shallow, private wells from nearby pollution sources. To determine potential problems for these cases, and to assess situations for which the initial evaluation indicates a potential risk, more detailed site-specific information needs to be developed.

The maps also indicate areas (well protection zones) where pollutants have a greater likelihood of reaching municipal water supplies. More refined water supply, or Zones of Contribution (ZOC) maps, have been prepared by the Wisconsin Geological and Natural History Survey in cooperation with the DCRPC and local water utilities (Map 4-3). The ZOC maps provide the basis for developing local wellhead protection plans and ordinances. They are based on 5-, 50-, and 100-year travel times, or the time it takes for water to reach a well under an assumed rate of withdrawal. The ZOCs delineated on Map 4-3 are based on projected 2030 withdrawals for each community distributed evenly among existing and planned wells. ZOCs will vary based on different configuration of wells and withdrawal rates in a community, as well as interference from wells in adjacent communities. The Well Protection Zones on the Contamination Risk maps are based on the length of the 100-year, "maximum sustained" (one-half capacity) well withdrawal as the radius for each protection zone. DNR requires wellhead protection plans for all new wells constructed after 1992 (Adm. Code NR 811), but requires only a 5-year ZOC. For most Dane County wells, the 5-year ZOC — typically less than 1,000 feet across — is probably too small to offer much protection. The ZOC maps provide the technical bases for communities to develop well protection plans based on local priorities which may extend beyond state requirements.

In April 2004, the Legislature passed Wisconsin Act 310 which sets new standards and conditions for DNR approval of high capacity wells (>100,000 gallons per day), as well as other requirements for the management and use of groundwater. One of the most significant changes in the new groundwater law is that it directs DNR to review the environmental consequences of proposed high capacity wells within 1,200 feet of “Outstanding Resource Waters,” Exceptional Resource Waters,” trout streams, or certain springs. In addition, DNR has nearly completed and delivered Source Water Assessments to each community public water supplier. The 1996 Amendments to the Safe Drinking Water Act (SDWA) require states to develop and implement a Source Water Assessment Program. An assessment is a document produced by DNR staff that provides basic information to public water suppliers regarding: where their drinking water comes from, and the degree to which it may be impacted by potential sources of contamination. It also provides recommendations for source water protection. In addition, public water suppliers are required to provide Consumer Confidence Reports to their customers about the condition of the water in their systems.

As communities continue to grow and groundwater withdrawals increase, protection of groundwater will become even more important. Intergovernmental coordination and cooperation will be especially critical in addressing future impacts to our ground water and surface water resources, which do not recognize jurisdictional boundaries.

Pollution Control Practices

The application of management practices to reduce the risk of groundwater contamination from pollution sources was noted in Chapter 3 (Pollution Control) for major sources of groundwater contamination. Many of the program recommendations in Chapter 3, therefore, are specifically directed to groundwater protection and management. Pollution control practices not specifically covered in the recommendations in Chapter 3 include registration, monitoring, and testing of underground and above-ground storage tanks for gasoline products and chemicals, and emergency response programs designed to control and manage spills of contaminants or hazardous materials during storage, handling, and transportation. Programs have been developed by various state and federal agencies to address these areas of groundwater protection, and they need to be further expanded and coordinated with appropriate municipal personnel.

Water Supply Protection

Another aspect of groundwater protection and management involves programs and practices for locating wells where they are not near pollution sources. These practices utilize the most protected groundwater sources (the lower sandstone aquifer) for water supply, and employ construction standards to ensure that water supply wells are protected from direct and inadvertent contamination. In addition, proper procedures for sealing and abandoning wells, and restrictions on the use of wells for disposal of waste are also important management tools.

Although the emphasis of this water quality plan is on preventing or avoiding groundwater contamination, there still may be instances of contaminated water supplies. Information and assistance is available to individuals and governmental units for developing contingency plans, alternative sources of water, and treatment options.

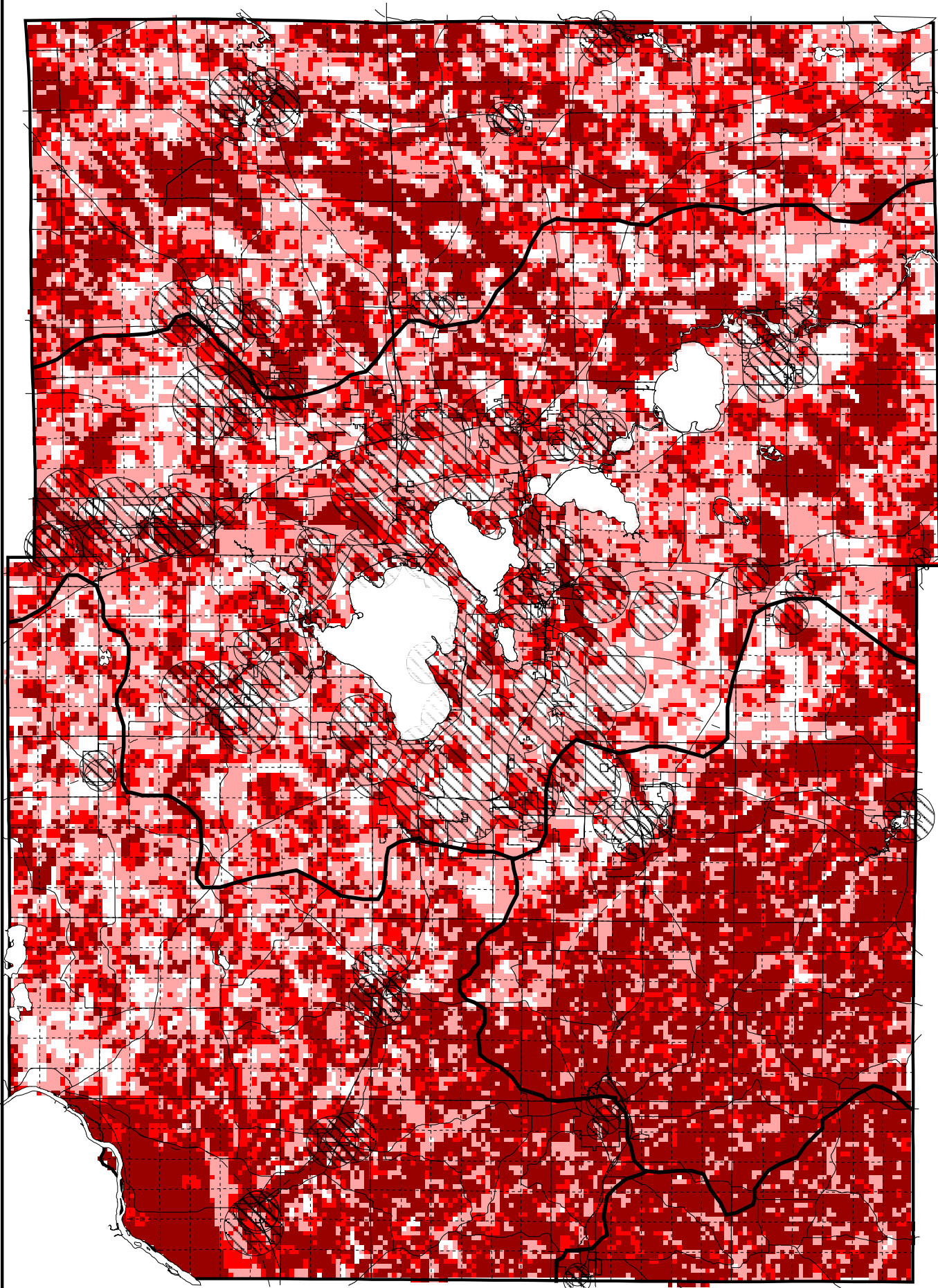
Information and Education Needs

In some cases, there is a lack of information on potential groundwater contamination problems, and additional monitoring is needed to determine the extent and seriousness of these problems. Problem areas which should receive priority for additional attention include monitoring of existing and abandoned landfills in municipal well protection zones; monitoring of agricultural pesticides in groundwater, particularly in areas most susceptible to contamination; and monitoring to determine the effects of clusters of on-site wastewater systems on local shallow groundwater nitrate levels.

An expanded public information and education program on groundwater is also needed. It should be directed at those households most vulnerable to potential groundwater contamination—rural households depending on shallow, private water supply wells. The information and education program should include guidance on proper siting, construction, and (especially) maintenance and servicing of on-site wastewater disposal systems; proper siting, construction, and testing needs for wells and water supplies; and information and recommendations on proper use, storage, and disposal of potentially hazardous or toxic materials such as pesticides, cleaning agents, and other potentially hazardous household products. Education efforts should emphasize the vulnerability of groundwater to contamination – that once it is contaminated it is very difficult, if not impossible, to restore to its original quality.

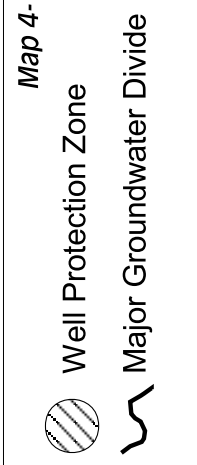
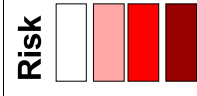
Groundwater Contamination Risk Maps Guidelines and Criteria

Pollution Source	Contamination Risk Map to Use	Guidelines and Criteria
1. Sanitary Landfill	Subsurface	Proposed landfills should be located outside of municipal well protection zones and areas of high or extreme contamination risk. High priority for monitoring active and abandoned landfills should be for those landfills in areas of high or extreme risk in municipal well protection zones.
2. On-Site Wastewater Systems	Subsurface	Proposed large on-site systems, or clusters of more than 20 on-site systems, which would result in an overall loading of more than 150 gall/acre/day (which roughly corresponds to a 1.0 to 1.5-acre lot size) should be carefully evaluated to ensure that groundwater standards will not be violated.
3. Wastewater Lagoons and Infiltration Ponds	Subsurface	Proposed wastewater lagoons and infiltration areas should be located outside of municipal well protection zones and areas of extreme contamination risk. Existing lagoons and ponds in municipal well protection zones should be monitored.
4. Wastewater Irrigation and Landspreading Sites	Surface	Proposed wastewater irrigation and landspreading sites should not be located in areas of extreme contamination risk. Existing and future sites in municipal well protection zones should be monitored and subject to stringent design and operating requirements.
5. Underground Storage Tanks	Subsurface	Stringent design and periodic testing for corrosion protection and leak containment should be required of all existing and proposed underground tanks storing hazardous or flammable materials within municipal well protection zones and in areas of extreme contamination risk outside of well protection zones. Existing tanks in these areas not providing adequate corrosion protection or leak containment should be immediately replaced or properly abandoned.
6. Above-ground Storage Tanks	Surface	Strict design criteria should be required for spill or leak containment for all above-ground tanks storing hazardous or flammable materials within municipal well protection zones and in areas of greatest pollution hazard outside of well protection zones. Existing tanks in these areas without adequate spill or leak containment should be replaced or properly abandoned.
7. Land Application of Sludge (Biosolids) and Septage	Surface	Application sites should not be located in areas of greatest pollution hazard. Sites in areas of high or moderate risk should receive highest priority in enforcement of existing siting guidelines, and should receive increased surveillance to ensure applications adhere to state guidelines and criteria.
8. Large Manure Storage Lagoons and Feedlots	Subsurface	Proposed large feedlots and manure storage lagoons should not be located in areas of high or extreme contamination risk. Strict design criteria and monitoring or storage lagoons should be required for all large lagoons in areas of moderate contamination risk.



Groundwater Contamination Risk from Surface Activities Dane County, Wisconsin

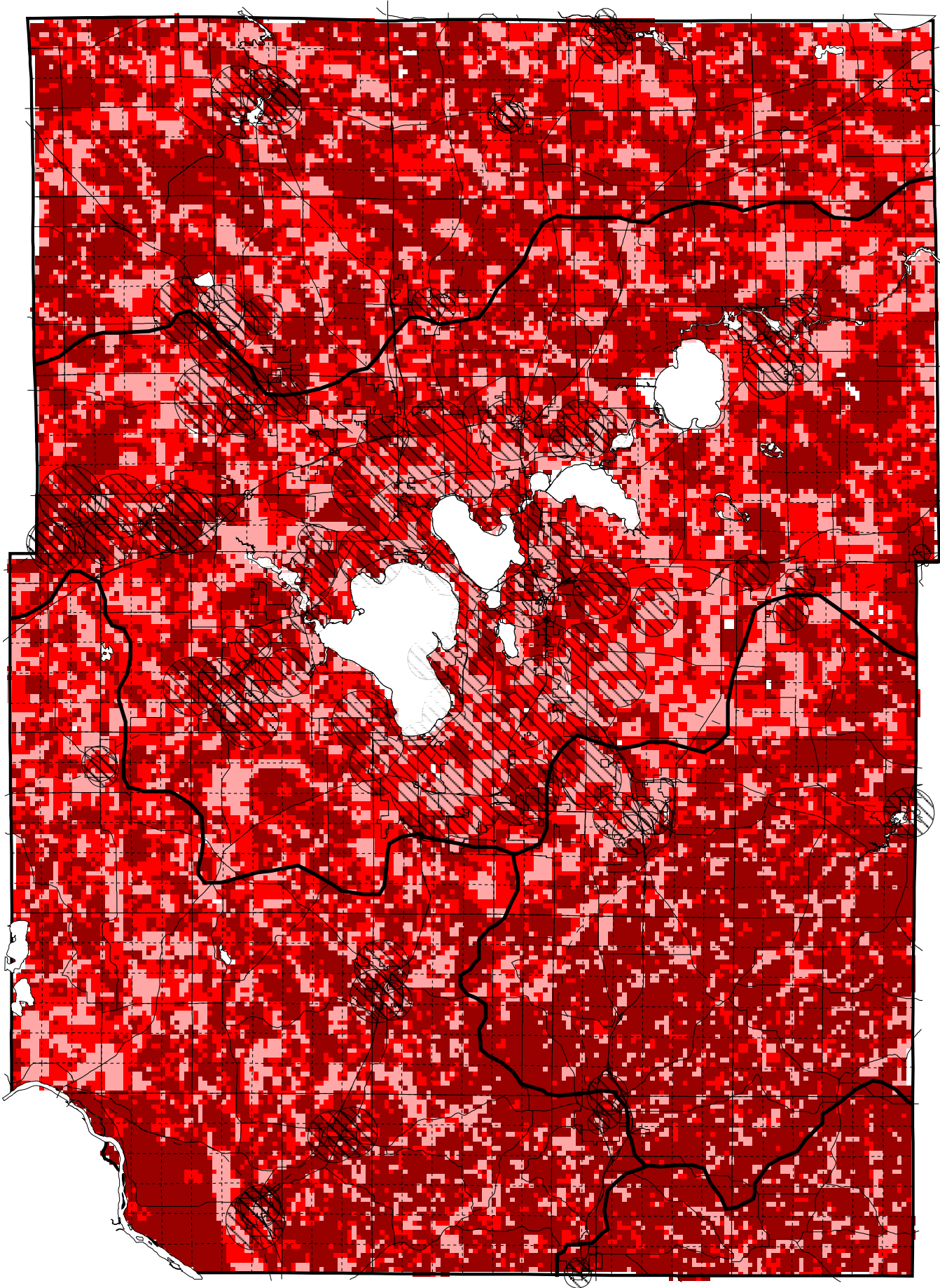
Source: Fritz, 1996, developed as part of the Dane County Regional Hydrologic Study



Prepared by: The Dane County
Regional Planning Commission

Projection:
Lambert Conformal Conic
Dane County Coordinates - NAD 83(91)





Groundwater Contamination Risk from Subsurface Activities Dane County, Wisconsin

Map 4-2

Risk

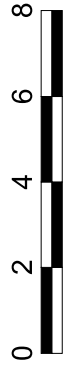
Low	Moderate	High	Extreme
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Well Protection Zone

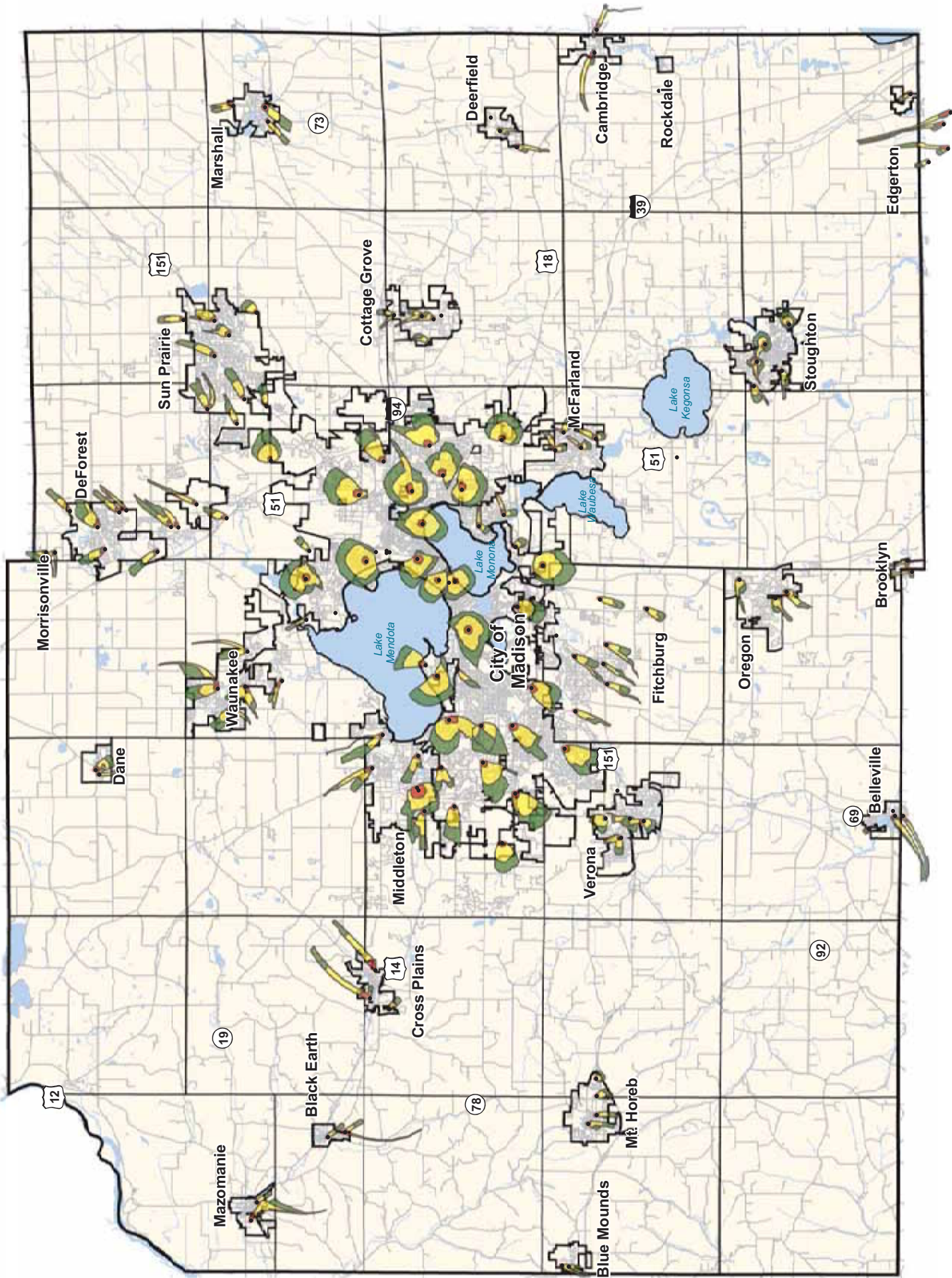
Major Groundwater Divide

Prepared by: The Dane County
Regional Planning Commission

Projection:
Lambert Conformal Conic
Dane County Coordinates - (MAD 83191)



Source: Fritz, 1996, developed as part of the Dane County Regional Hydrologic Study



Zones of Contribution for Municipal Wells (projected 2030 Pumping Rates) Dane County, Wisconsin

Well

Zones of Contribution

- 5 - Year
- 50 - Year
- 100 - Year

Map 4-3

Projection: Cyclic
Dane County Coordinates - NAD 83(91)
Prepared by: The Dane County
Regional Planning Commission

0 0.5 1 2 3 4 5
Miles

N

GROUNDWATER MANAGEMENT RECOMMENDATIONS

- G-1: All land use and siting decisions in Dane County should include evaluation of potential groundwater and hydrologic impacts. Incorporate and use the information, tools, criteria, and guidelines identified in the Dane County Groundwater Protection Plan, and coordinate with local agencies. Applicants for land use or siting approvals, such as zoning or subdivision approvals, site or development plan approvals, urban service area additions, or state, federal, or local land disturbance or discharge permit approvals, should provide sufficient information to allow the regulatory agency to evaluate the potential groundwater and hydrologic impacts of the proposed activity or development. Evidence of significant unaddressed or unmitigated groundwater or hydrologic impacts should provide the basis for withholding approval for the requested activity or development, or for requiring additional information to be submitted by the applicant before approval is granted. Compliance with state surface water and groundwater standards should be included in the evaluation along with hydrologic impacts. The guidelines and criteria listed in the table on page 62 should be used in conjunction with the groundwater contamination risk maps for preliminary screening and evaluating the potential impacts.
- G-2: State and local agencies should work cooperatively to develop wellhead protection programs to protect municipal water supplies, including adopting more stringent siting and land use regulations for potentially polluting activities in wellhead protection zones. The guidelines and criteria for using the groundwater contamination risk maps in the table on page 62 can provide a basis for these more stringent land use and siting criteria in well protection zones.
- G-3: Conduct additional groundwater quality monitoring related to the impacts of closed landfills, barnyard and livestock waste storage, agricultural fertilizer and pesticide use, unsewered subdivisions, and land application of septage.
- G-4: Underground and above-ground storage tank monitoring and testing programs, and emergency spill response and cleanup programs should continue to be developed.
- G-5: Dane County should conduct an aggressive public information and education program to inform rural homeowners of proper use and maintenance of on-site waste disposal systems, along with information on well protection and disposal of household hazardous wastes.
- G-6: Inform and educate farmers, homeowners, and commercial businesses on safe handling of chemicals, including the vulnerability of groundwater to contamination and the tremendous difficulty and expense of restoring it to its original condition. Proper on-farm storage of fuel, pesticides, and fertilizers should receive greater emphasis.
- G-7: Provide rural homeowners information, guidelines, and contacts for testing their wells and drinking water supplies.
- G-8: Develop a strategy for the proper abandonment of unused wells.
- G-9: Measures should be taken to protect groundwater recharge areas and springs. Especially in urban areas, the adverse impacts of development on groundwater, including diversion through pumpage and sewerage, as well as loss of recharge due to expanded impervious area, are significant and should be mitigated to the maximum extent practicable.
- G-10: State and local agencies should work together to develop a comprehensive groundwater information and education program.

5

Framework for Action

Designated Management Agencies-
Roles and Responsibilities

Nonpoint Source Pollution Control

Need for Areawide Planning and Coordination

Short-Range Priority Actions for Local Designated Management Agencies

DESIGNATED MANAGEMENT AGENCIES— ROLES AND RESPONSIBILITIES

All areawide water quality management plans, including the *Dane County Water Quality Plan*, must include a description of those local management agencies which are designated to carry out the recommendations, programs, and actions proposed in the plan. The management agency designations in the Water Quality Plan have been based on current programs and responsibilities, and on detailed analyses of the legal and financial authority and capability to carry out the programs and actions assigned to them. Management agency designations in the initial *Dane County Water Quality Plan*, along with the proposed recommendations and actions, were reviewed by all proposed management agencies prior to plan adoption. There have been only a few changes in management agency structure and designation since the adoption of the initial *Dane County Water Quality Plan*, which are reflected in this updated summary. The principal changes include the replacement of the state Board of Soil and Water Conservation Districts and Dane County Soil and Water Conservation District by the state Department of Agriculture, Trade and Consumer Protection, and the Dane County Land Conservation Committee as agencies with primary responsibility in the area of agricultural nonpoint source control. In addition, the state Department of Agriculture, Trade and Consumer Protection has been assuming increasing program responsibilities at the state level in the area of agricultural nonpoint source funding and regulatory programs and some groundwater protection programs, in concert with the Department of Natural Resources. State program responsibility in the area of on-site wastewater management has been transferred from the Department of Health and Social Services to the Department of Commerce (formerly Industry, Labor and Human Relations). Finally, Dane County created the Lakes and Watershed Commission to coordinate and pursue the County's role and responsibilities in lake and watershed management and water quality protection and

improvement programs. State legislation which became effective in May 1990 (Wis. Act 324), vested substantial additional authority and financing capabilities in the County Lakes and Watershed Commission, particularly in the areas of lake management, watershed management, and urban nonpoint source management.

Point Source Control (Wastewater Collection and Treatment). Federal agencies involved in wastewater collection and treatment include the U.S. Environmental Protection Agency, which administers federal laws and guidelines for water quality management programs and provides funding, and the USDA Rural Economic Community Development Services, which provides some funding. The Wisconsin Department of Natural Resources is the primary state agency with responsibility for administering point source control programs—establishing and enforcing water quality standards and effluent limits, issuing discharge permits, enforcing most state water quality standards and laws and regulations related to point source discharges, and providing loans for wastewater collection and treatment systems. Local management agencies responsible for constructing and operating wastewater collection and treatment systems include all cities and villages, town sanitary and utility districts with wastewater collection or treatment systems, and the Madison Metropolitan Sewerage District, which provides regional wastewater collection and treatment service for the communities within its jurisdiction. Since 1995, the Village of Dane has been added to the MMSD service area. In addition, a new management agency—the Dane-Iowa Joint Sewerage Commission—has been created to provide wastewater treatment for the villages of Black Earth, Mazomanie, and Arena (in Iowa County), and the Wisconsin Heights High School complex. The regional treatment plant for the Joint Sewerage Commission is located in the Village of Mazomanie.

Management Agencies	Point Source Program	Urban Nonpoint Sources Programs	Agricultural Nonpoint Source Programs	Control/Other Pollution Sources	Stream and Shoreland Mgmt.	Lake Management	Groundwater Management
Cities	Primary Role	Primary Role	Assisting or Advisory Role	Primary Role	Primary Role	Primary Role	Primary Role
Villages	Primary Role	Primary Role	Assisting or Advisory Role	Primary Role	Primary Role	Primary Role	Primary Role
Towns	Primary Role	Primary Role	Assisting or Advisory Role	Primary Role	Primary Role	Primary Role	Primary Role
Dane County	Primary Role	Primary Role	Primary Role	Primary Role	Primary Role	Primary Role	Primary Role
Dane County RPC (Dissolved 10/1/04)	Assisting or Advisory Role	Assisting or Advisory Role	Assisting or Advisory Role	Assisting or Advisory Role	Assisting or Advisory Role	Assisting or Advisory Role	Assisting or Advisory Role
Madison MSD	Primary Role	Primary Role	Primary Role	Primary Role	Primary Role	Primary Role	Primary Role
State Agencies	Primary Role	Primary Role	Primary Role	Primary Role	Primary Role	Primary Role	Primary Role
Federal Agencies	Primary Role	Assisting or Advisory Role	Assisting or Advisory Role	Assisting or Advisory Role	Assisting or Advisory Role	Assisting or Advisory Role	Assisting or Advisory Role

Urban Nonpoint Source Management. Urban nonpoint source management programs are primarily the responsibility of local urban governments—cities, villages, and towns with urban areas. Legislation enacted in 1990 expanded the role of the County in urban nonpoint source management by authorizing the County Lakes and Watershed Commission to develop and establish enforceable minimum requirements and guidelines for urban nonpoint source management practices. The County adopted an Erosion Control and Stormwater Management ordinance (Chap. 14) that supercedes less restrictive city and village ordinances (effective August 2002). Municipalities are also required to adopt and enforce the Uniform Dwelling Code (UDC) under a program administered by the Department of Commerce. The UDC contains provisions to control erosion during construction of one- and two-family dwellings. The Dane County Land Conservation Department oversees the implementation of the County Erosion Control and Stormwater Management Ordinance.

The federal Clean Water Act amendments of 1987 established programs to regulate stormwater discharges as point sources of pollution. This greatly expanded the role and authority of the DNR in regulating urban nonpoint source pollution from urban storm drainage systems, industrial facilities, and construction sites, through the state stormwater permit program (NR 216). Typical sites include residential subdivisions, industrial and business parks, golf courses, and private, local, and county roads. The threshold for projects requiring a permit was recently reduced from 5 acres to 1 acre of land disturbance, following the changes at the federal level. Urban and agricultural runoff standards have also been established under NR 151. These standards are intended to be minimum performance standards necessary to achieve water quality standards. DNR also provides financial assistance for nonpoint source management practices through the redesigned Priority Watershed and Priority Lake Program (NR120), Urban Nonpoint Source and Stormwater grant program (NR153), and Targeted Runoff Management grant program (NR152).

Agricultural Nonpoint Source Management. Federal agencies with primary roles in agricultural nonpoint source control programs include the USDA Consolidated Farm Service Agency, which provides cost-share funding for soil conservation practices and structures, and has primary administrative roles in the Conservation Compliance “Sodbuster” and “Swampbuster” provisions of the federal Food Security Acts of 1985 and 1990. The USDA Natural Resources Conservation Service works with the Consolidated Farm Service Agency and state and local management agencies in providing technical and financial assistance for planning and implementing conservation programs such as the Environmental Quality Incentives Program (IEQIP), the Conservation Reserve Enhancement Program (CREP), and the Wetlands Reserve Program (WRP).

State agencies with primary involvement in these programs include the Department of Agriculture, Trade and Consumer Protection (DATCP), which administers the state Soil Erosion Control Pro-

gram, and the Farmland Preservation Program which includes conservation compliance requirements. DATCP administers Wisconsin’s soil and water resource management program under chap. 92, Wis. Statutes. The program is designed to conserve the soil and water resources of the state, reduce soil erosion, prevent nonpoint source pollution, and enhance water quality. DATCP funds county soil and water conservation programs, and finances county cost-sharing grants to landowners to implement conservation practices, outlined in the county’s *Land and Water Resource Management Plan*.

DATCP also has joint responsibility with DNR in administering the state’s Nonpoint Source Pollution Control Program in agricultural areas. In 1997 Wis. Act 27 and 1999 Act 9, the legislature mandated a comprehensive redesign of the state programs related to nonpoint source pollution. It directed DATCP and DNR to establish agricultural performance standards and prohibitions for farms (NR 151). It also directed DATCP to adopt rules related to nutrient management. DATCP also regulates aspects of agricultural storage and use of pesticides and fertilizers.

While DNR administers the state’s Nonpoint Source Pollution Control Program, providing funding for projects in priority watersheds, DATCP administers grants to counties to operate watershed projects. As part of the redesign of the State Nonpoint Source Program, no new priority watershed or priority lake projects will be selected. Current projects will continue to the end of their terms. Instead, grant programs have been created to fund projects on a short term, competitive basis in rural and urban areas. DNR also participates with DATCP in enforcing laws regulating serious pollution problems caused by animal waste practices, and provides funds and technical assistance for streambank and shoreline stabilization and woodland management.

The Dane County Land Conservation Department is the lead local agency for carrying out local, state, and federal soil and water conservation programs. The Department operates under the authority of the Land Conservation Committee, a county committee which replaced the Soil and Water Conservation District. The LCD is involved in three primary functions in agricultural non-point source management: providing technical assistance to landowners; allocating and distributing cost-sharing funds; and carrying out public information and education activities in concert with the UW Extension.

Management Agencies—Other Pollution Sources. Regulation of land-disturbing activities has been primarily the responsibility of local general units of government—Dane County for unincorporated areas, and cities and villages for urban areas. Under Wis. Act 324, the Dane County Lakes and Watershed Commission may propose minimum criteria and guidelines for local ordinances regulating land-disturbing activities.

The state agency with primary responsibility for regulation of on-site wastewater systems is the Department of Commerce, with local enforcement and management responsibility vested in the Dane

County Environmental Health Division. DNR has primary responsibility for the regulation of large on-site systems, and in regulating the disposal of septage and holding tank wastes. The *Water Quality Plan* proposes an expansion of the authority and responsibility of Dane County in this program area.

State regulation of most programs involving land application of waste—landfills, wastewater application, land application of septage and wastewater biosolids—is the responsibility of DNR. These regulations control and manage the disposal practices of private firms as well as public solid waste and sewerage agencies. Some local general units of government—cities, villages, and towns—are involved in operating and managing land application programs. Dane County's role in the disposal of solid wastes in landfills has greatly increased as the result of recommendations of the *Dane County Solid Waste Plan*, which centralized the operation of landfills in the county. The *Water Quality Plan* recommends that the County expand its role in the land application of septage.

Stream and Shoreland Management. Stream and shoreland management program responsibilities are shared by DNR and local units of government. DNR has a variety of roles, ranging from administering state laws and regulations which provide the framework for floodplain, shoreland, and wetland zoning; directly regulating stream and shoreland activities through Chapter 30 and 31 permits; fishery and wildlife management and habitat improvement programs; acquiring and managing lands for fish and wildlife management areas, state parks, trails, and scientific areas; and providing financial assistance through the redesigned Nonpoint Source Pollution Control Program and other programs.

Dane County has a significant and growing management role in shoreland, floodplain, and wetland zoning in unincorporated areas; providing cost-sharing and supporting stream improvement and shoreline cleanup measures; and in land acquisition and management of county parks and open space areas. Local units of government engaged in land use regulation (cities and villages for urban areas, Dane County and the towns in rural areas) have primary responsibility for the land use regulation aspects of stream and shoreland management, particularly adoption and enforcement of shoreland, floodplain, and shoreland-wetland zoning ordinances. In addition, local units of government play a key role in developing and protecting environmental corridors, and implementing park and open space plans, both of which are essential ingredients in stream and shoreland management. Dane County and local units are also actively involved in stream and shoreline improvement, cleanup, and stabilization projects in their jurisdictions.

Lake Management. DNR is the state agency having primary responsibility for regulating lake management and lake use laws and regulations, including Chapter 30 and 31 permits, lake levels and dam safety, application of chemicals, enforcement of fishing and boating regulations, and fishery management.

The local agency with primary responsibility in lake management is Dane County. The County is responsible for the aquatic weed

harvesting program; for operation of locks, water flow and lake level management on the Yahara lakes; and for enforcing boating and other safety regulations. The County Lakes and Watershed Commission has additional authority in lake management activities, in financing lake management programs, and regulating lake use and activities. A few local units of government are also directly concerned with lake management issues on individual lakes within their jurisdiction. Public Inland Lake Protection and Rehabilitation Districts have been created for small impoundments in the Town of Windsor (Lake Windsor), the Town of Dunkirk (Dunkirk Dam), and the Town of Roxbury (Fish Lake and Crystal Lake).

Groundwater Management. DNR is the state agency with primary regulatory responsibility in the area of groundwater protection and management, although DATCP and COMM also have significant roles. These agencies administer a variety of laws and regulations related to specific pollution sources threatening groundwater quality, and share responsibility in administering the state's Groundwater Law.

Land use decisions and permits are the main areas of responsibility in groundwater management which are most directly controlled by local units of government. Dane County is the local management agency with the most authority and responsibility for groundwater protection and management programs. The role of cities, villages, and town water utilities are increasing as a result of state requirement and programs for wellhead protection. Dane County and local units also have important responsibilities in programs directed at protecting ground and surface water from leaks or spills from storage tanks, and from storage, handling, or transportation of hazardous materials.

NONPOINT SOURCE POLLUTION CONTROL

The Wisconsin Legislature established the Nonpoint Source Water Pollution Abatement Program in 1978, recognizing both urban and rural nonpoint pollution sources as contributors to the degradation of Wisconsin lakes, streams, groundwater, and wetlands. State and federal funding programs for nonpoint source control have generally adopted the approach of selecting priority watersheds for intensive funding and management efforts. The usual approach was to prepare detailed implementation plans for priority watersheds, and to direct implementation funding into these watersheds.

The Legislature restructured the nonpoint source program in 1997 and 1999, creating a new targeted runoff management grant program (NR 153), and a new urban nonpoint source and stormwater management grant program under NR 155. The legislature also instructed the Department of Natural Resources in Sec. 281.16 Statutes, to prepare nonpoint source performance standards. These performance standards are listed in NR 151. The priority watershed and priority lake projects established prior to the legislative restructuring are governed under NR 120 and chap. ATCP 50. While DNR possesses overall responsibility for this water quality program, local administration and implementation responsibilities fall to other governmental units. Chap. ATCP 50 contains

policies and procedures for DATCP for administering staffing grants to counties to operate watershed projects.

As part of the redesign of the State Nonpoint Source Pollution Control Program, no new priority watershed or lake projects will be selected. While the Black Earth Creek and the Yahara-Monona Priority Watershed projects have ended, the Lake Mendota Watershed and Dunlap Creek projects are continuing to the end of their ten-year terms, 2008 and 2004 respectively.

For all practical purposes, DNR has replaced the Nonpoint Source Program with Targeted Runoff Management (TRM), and Urban Nonpoint Source and Stormwater grant programs. TRM grants are competitive financial awards to support small-scale, short-term projects that are completed by local governmental units generally within 24 months. Both urban and rural projects can be funded through a TRM grant. Project selection is based on geographical water quality priorities, local support for the project, the ability of the project to control nonpoint pollution, and other factors.

Urban Nonpoint Source and Stormwater Grants promote urban runoff management for existing urban areas, developing urban areas, and urban re-development. The primary goals include implementing urban runoff performance standards (NR 151), achieving water quality standards, protecting the groundwater, and helping municipalities meet stormwater permit conditions (NR 216). Eligible planning projects may include projects such as municipal stormwater planning, stormwater and construction site erosion control ordinance development, development of local stormwater management financing options (such as stormwater utilities), and information and education.

NEED FOR AREAWIDE PLANNING AND COORDINATION

The need for areawide resource management and planning agencies is rooted in the realization that in large urban areas some problems cannot be solved within municipal boundaries, and decisions made by one municipality usually have adverse impacts on other municipalities. Pollution and use of resources (land, water, fisheries, etc.) fall in the category of problems that often do not stop at the municipal boundary. Therefore, areawide resource management agencies and regional governmental models have become mainstays in most metropolitan areas. This approach is aimed at maintaining local input and decision-making while addressing the shortcomings of fragmented governmental authority when numerous cities, villages, and towns compose a metropolitan area. Essentially, in metropolitan areas, the need to address problems associated with fast growing dense urban development has to be resolved through one of the following approaches, ordered by decreasing levels of central authority:

1. Disband all smaller units of government in favor of a unified metropolitan model. The boundary of the metropolitan unit of government needs to be expandable, otherwise new

jurisdictions will develop around the metropolitan boundary, resulting in the same fragmentation that the metropolitan government was created to address.

This approach can remove the decision-making process from the average resident. However, this is also a function of size. As the population grows, decision-making becomes more centralized. Fragmentation does not necessarily solve this problem in a large urbanizing area. The municipal boundary prevents residents of a town to have any input in the decisions of the neighboring village or city. It is possible to build democratic processes in the decision-making of a metropolitan area to avert centralized and undemocratic decision-making.

2. Evaluate the region's requirements for governance and level of government, and create the appropriate governmental entities that have adequate authority, scope, and size to provide effective resolution of current and future problems and needs. This is typically a council of governments with adequate planning implementation and taxing authority. Authority is usually provided by the state, specifically to provide review and approval jurisdiction over local units of government.
3. Create a regional planning commission through intergovernmental agreement. The RPC provides intergovernmental coordination and encourages and enhances cooperation between disparate units of government. It also has areawide authority over planning and management of the natural resources in the region.

This approach requires continued cooperation among units of government, but more importantly, it requires strong and consistent leadership within its constituent units of government in favor of regionalism.

This approach works well in providing areawide planning and management if it is not overly politicized. For example, an areawide planning commission is not the appropriate venue for annexation conflicts. It can encourage boundary agreements and conflict resolution discussions. However, management of areawide resources cannot favor one unit of government or another. Therefore, such politicization will only detract from the charge and promise of this approach.

Dane County has had an effective areawide planning agency for over three decades. By directing one of the fastest growth rates of the State to areas that can best accommodate it, the RPC has maintained and in some areas improved the health of the natural resources of the region. With its dissolution, there appears to be no successor entity to continue its crucial functions. If the natural resources of the region are to be protected and the high quality of life maintained for the residents of the area, an effective successor entity charged with areawide resource planning and management needs to be created quickly.

SHORT-RANGE PRIORITY ACTIONS FOR LOCAL DESIGNATED MANAGEMENT AGENCIES

The water quality management program recommendations which are presented in Chapters 3 and 4 represent the long-term recommendations, policies, and objectives of the *Dane County Water Quality Plan*. These general program recommendations provide a framework to evaluate whether actions proposed by individual management agencies are consistent with the plan. They also provide a framework and guidance for the development of specific projects by individual management agencies.

The following tables list specific short-range high priority implementation actions suggested for local designated management agencies. These priority actions represent actions which need to be carried out or initiated in the immediate future (over the next five to ten years), and represent significant actions which would have important beneficial impacts on water quality. The short-range priority actions are presented as an action plan to assist designated management agencies to carry out the policies and recommendations of the *Dane County Water Quality Plan*.

WISCONSIN RIVER BASIN

Management Agency

Priority Action

Village of Black Earth

- 1) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14).
- 2) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14, to protect Black Earth Creek and its tributaries from the adverse impacts of development.
- 3) Prepare a stormwater management plan for the Village, including practices to protect the water quality of Black Earth Creek.
- 4) Support the efforts of watershed and conservation groups to protect and improve water resources of Black Earth Creek.
- 5) Initiate semi-annual (spring and fall) street-sweeping program.
- 6) Evaluate deicer use and snow storage practices for potential water quality impacts. Adopt a written salt use management policy.

Village of Cross Plains

- 1) Implement the recommendations of the facility plan for the wastewater treatment plant.
- 2) Reduce clearwater intrusion into the wastewater collection system.
- 3) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14).
- 4) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14, to protect Black Earth Creek and its tributaries from the adverse impacts of development.
- 5) Revise building ordinances to require roof drainage to grassed areas, where feasible, for new development.
- 6) Implement the Village stormwater management plan, including practices to protect the water quality of Black Earth Creek.
- 7) Support the efforts of watershed and conservation groups to protect and improve the water resources of Black Earth Creek.
- 8) Evaluate deicer use and snow storage practices for potential water quality impacts. Adopt a written salt use management policy.
- 9) Develop a wellhead protection program for municipal wells.

Village of Mazomanie

- 1) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14).
- 2) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14 to protect Black Earth Creek from the adverse impacts of development.
- 3) Revise building ordinances to require roof drainage to grassed areas, where feasible, for new development.
- 4) Prepare a stormwater management plan for the Village, including practices to protect the water quality of Black Earth Creek.
- 5) Evaluate deicer use and snow storage practices for potential water quality impacts. Adopt a written salt use management policy.

Roxbury Sanitary District

- 1) Continue efforts to reduce clearwater intrusion into the sanitary sewer system.

Town of Roxbury

- 1) Assist the Fish and Crystal Lake District in ongoing lake management activities.

Village of Dane

- 1) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14).
- 2) Vigorously enforce and, in some cases, possibly expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14.
- 3) Revise building ordinances, to require roof drainage to grassed areas, where feasible, for new development.
- 4) Develop a wellhead protection program for municipal wells.
- 5) Evaluate use of deicers for potential groundwater quality impacts. Adopt a written salt use management policy.

See Lower Rock River Basin/Yahara River Watershed for other Village actions.

Village of Mt. Horeb

- 1) Implement stormwater management recommendations proposed in the Stewart Lake Restoration and Watershed Management Plan.

See Sugar-Pecatonica River Basin/ for other Village actions.

SUGAR – PECATONICA RIVER BASIN

Management Agency

Priority Action

Village of Belleville

- 1) Perform needs assessment before 2015 to determine the appropriate time to start facility planning for the wastewater treatment plant expansion.
- 2) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14).
- 3) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14, to protect the Sugar River and its tributaries from the adverse impacts of development.
- 4) Prepare a stormwater management plan for the Village, including practices to protect the water quality of the Sugar River and Lake Belle View, and protecting the groundwater from the infiltration of untreated stormwater.
- 5) Participate with other units of government, and watershed and conservation groups in water resources management activities for the Upper Sugar River Watershed.
- 6) Provide special leaf pickup in the fall, and specify practices for proper storage and disposal of yard and garden debris.
- 7) Evaluate deicer use and snow storage practices for potential water quality impacts. Adopt a written salt use management policy.
- 8) Apply for a lake management planning grant to develop long-term goals for Lake Belle View, and evaluate potential in-lake restoration practices. Consider the need to create an Inland Lake Protection and Rehabilitation District to be responsible for ongoing lake management activities.
- 9) Develop a wellhead protection program for municipal wells.

Village of Blue Mounds

- 1) Evaluate the performance of the wastewater treatment plant and address problems that are causing violation of BOD effluent limits.
- 2) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14).
- 3) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14, to protect Blue Mounds Branch from the adverse impacts of development.
- 4) Revise building ordinances to require roof drainage to grassed areas, where feasible, for new development.
- 5) Prepare a stormwater management plan for the Village, including water quality protection practices.
- 6) Initiate semi-annual (spring and fall) street-sweeping program.
- 7) Evaluate deicer use and snow storage practices for potential water quality impacts. Adopt a written salt use management policy.
- 8) Develop a wellhead protection program for municipal wells.

Village of Brooklyn

- 1) Expand biosolids storage capacity to 180 days or pursue cost-effective biosolids management alternatives.
- 2) Evaluate the water quality effects of phosphorus removal (by the wastewater treatment plant) on receiving waters, and determine the appropriate level of phosphorus removal.
- 3) Perform needs assessment to determine the reason for inconsistent performance of the wastewater treatment plant.

- 4) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14).
- 5) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14.
- 6) Prepare a stormwater management plan for the Village, including water quality protection practices. Include measures to protect the groundwater from infiltration of untreated stormwater.
- 7) Evaluate deicer use and snow storage practices for potential water quality impacts. Adopt a written salt use management policy.
- 8) Develop a wellhead protection program for municipal wells.
- 9) Expand coverage of the Village wetland zoning ordinance to be consistent with Dane County ordinance, regulating all wetlands over 2 acres.

Village of Mt. Horeb

- 1) Perform a needs assessment before 2006 to determine the appropriate time to start facility planning for wastewater treatment plant expansion.
- 2) Evaluate the feasibility of reducing influent BOD through source reduction and pretreatment.
- 3) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14).
- 4) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14, to protect the Sugar Rive and its tributaries from the adverse impacts of development.
- 5) Implement the Village stormwater management plan, including water quality protection practices.
- 6) Participate with other units of government and watershed and conservation groups in water resources management activities for the Upper and West Branch Sugar River, Mount Vernon Creek, Elvers Creek and Moen Creeks.
- 7) Evaluate deicer use and snow storage practices for potential water quality impacts. Adopt a written salt use management policy.
- 8) Develop a wellhead protection program for municipal wells.

See Wisconsin River Basin for other Village actions.

MMSD

- 1) Continue to evaluate and correct areas of high infiltration/inflow in the wastewater collection system.
- 2) Start facilities planning by 2006 to evaluate strategies to provide adequate treatment plant capacity for the service area. Include an evaluation of the feasibility of satellite plants in the Upper Yahara and Sugar River Watersheds.
- 3) Continue to evaluate industrial loading management measures.
- 4) Participate with other units of government, and watershed and conservation groups in watershed management activities for the Upper Sugar River and Badger Mill Creek.

See Lower Rock River Basin/Yahara River Watershed for other MMSD actions.

City of Verona

- 1) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14)
- 2) Vigorously enforce and, in some cases, possibly expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14, to protect The Sugar River and its tributaries from the adverse impacts of development.
- 3) Implement the City stormwater management plan in cooperation with neighboring jurisdictions. Consider creating a stormwater utility for financing stormwater management programs.
- 4) Participate with other units of government, and watershed and conservation groups in water resources management activities for the Upper Sugar River and Badger Mill Creek.
- 5) Evaluate deicer use and snow storage practices for potential water quality impacts. Adopt a written salt use management policy.
- 6) Develop a wellhead protection program for municipal wells.

City of Madison

- 1) Participate with other units of government in watershed management activities for the Upper Sugar River Watershed, and implement the stormwater management plans for the Badger Mill Creek subwatershed.

See Lower Rock River Basin/Yahara River Watershed for other City actions.

Lower Rock River Basin: Yahara River Watershed

Village of Dane

- 1) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14).
- 2) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14 to protect the Upper Yahara River from the adverse impacts of development. Revise building ordinances to require roof drainage to grassed areas, where feasible, for new development.
- 3) Work with Dane County and the DNR to implement nonpoint source programs and projects contained in the Lake Mendota Priority Lake Project Plan based on available funding.
- 4) Evaluate use of deicers for potential groundwater quality impacts. Adopt a written salt use management policy.
- 5) Develop a wellhead protection program for municipal wells.

See Wisconsin River Basin for other Village actions.

Village of DeForest

- 1) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14). Participate in the activities and efforts of the inter-jurisdictional NR 216 Madison Area Municipal Stormwater Partnership.
- 2) Vigorously enforce and erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14, to protect the Upper Yahara River from the adverse impacts of development.
- 3) Complete implementation of the Village stormwater management plan, including practices that protect the water quality of the Upper Yahara River and local wetlands. Assist Dane County and the DNR to implement nonpoint source programs contained in the Lake Mendota Priority Lake Project Plan based on available local state, and federal funding.

- 4) Evaluate use of deicers and snow storage practices for potential water quality impacts. Adopt written salt use management policy.
- 5) Develop a wellhead protection program for municipal wells.
- 6) Enforce infiltration maximization measures to replenish stream and spring baseflows in the area.

City of Fitchburg

- 1) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14). Participate in the activities and efforts of the inter-jurisdictional NR 216 Madison Area Municipal Stormwater Partnership.
- 2) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14, to protect Nine Springs Creek from the adverse impacts of development. Revise building ordinances to require roof drainage to grassed areas, where feasible, for new development. Increase enforcement of erosion and runoff control ordinance by hiring additional seasonal inspection staff.
- 3) Enforce infiltration maximization measures to protect Nine Springs Creek base flow.
- 4) Cooperate with other units of government in developing a coordinated stormwater quality management plan for the Central Urban Service Area.
- 5) Prepare a stormwater management and wetland protection plan for the Nine Springs Creek Watershed, below Dunn's Marsh, in conjunction with Dane County and the City of Madison.
- 6) Provide frequent sweeping (weekly to biweekly) of streets in commercial and industrial areas, with extra efforts at cleaning all City streets in early spring and late fall.

City of Madison

- 1) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14). Participate in the activities and efforts of the inter-jurisdictional NR 216 Madison Area Municipal Stormwater Partnership.
- 2) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14. Revise building ordinances to require roof drainage to grassed areas, where feasible, for new development. Continue to place emphasis on enforcement of the ordinance with additional attention given to large plat reviews.
- 3) Enforce infiltration maximization measures to replenish stream baseflows in the Nine Springs area.
- 4) Work with DNR and Dane County to implement nonpoint source programs and projects contained in the Lake Mendota Priority Lake Project Plan.
- 5) Cooperate with other units of government in developing a coordinated stormwater quality management plan for the Central Urban Service Area.
- 6) Support the efforts of watershed and conservation groups to protect and improve water resources of Starkweather Creek, Nine Spring Creek, Lake Wingra, and the Yahara lake chain.
- 7) Based on the results of the pilot street-sweeping program in the isthmus area, pursue expanded street sweeping in other priority areas of the City (commercial and industrial areas).
- 8) Expand catch basin cleaning program.
- 9) Participate with DNR in addressing toxic materials in stream and lake sediments, cleanup efforts and shoreline improvements for Murphy (Wingra) Creek, Starkweather Creek, and Monona Bay.
- 10) Participate with DNR, USGS, Dane County, City of Middleton and other units of government in an annual cooperative water resources monitoring program.

- 11) Evaluate snow removal and storage practices for potential water quality impacts, and pursue alternative storage locations if needed.
- 12) Develop a wellhead protection program for municipal wells.

See Sugar – Pecatonica Basin for other City actions.

Village of Maple Bluff

- 1) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14). Participate in the activities and efforts of the inter-jurisdictional NR 216 Madison Area Municipal Stormwater Partnership.
- 2) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14. Revise building ordinances to require roof drainage to grassed areas, where feasible, for new development.
- 3) Work with Dane County and the DNR to implement nonpoint source programs and projects contained in the Lake Mendota Priority Lake Project Plan.
- 4) Evaluate stormwater drainage system for opportunities to incorporate water quality protection measures.
- 5) Adopt an ordinance prohibiting leaf burning and specifying practices for storage and disposal of leaves and yard and garden debris. Provide special fall leaf pickup program.
- 6) Evaluate deicer use and snow storage practices for potential water quality impacts. Adopt a written salt use management policy.
- 7) Initiate semi-annual (spring and fall) street-sweeping program.

Village of McFarland

- 1) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14). Participate in the activities and efforts of the inter-jurisdictional NR 216 Madison Area Municipal Stormwater Partnership.
- 2) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14. Revise building ordinances to require roof drainage to grassed areas, where feasible, for new development.
- 3) Enforce infiltration maximization measures to replenish stream baseflows in the area.
- 4) Prepare a comprehensive Village stormwater management plan, including practices to protect the water quality of Lake Waubesa and local wetlands.
- 5) Support the efforts of watershed and conservation groups to protect and improve water resources of Lake Waubesa and Upper and Lower Mud Lakes.
- 6) Evaluate deicer use and snow storage practices for potential water quality impacts. Adopt a written salt use management policy.
- 7) Develop a wellhead protection program for municipal wells.

City of Middleton

- 1) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14). Participate in the activities and efforts of the inter-jurisdictional NR 216 Madison Area Municipal Stormwater Partnership.
- 2) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14 to protect Pheasant Branch Creek and Lake Mendota from the adverse impacts of development. Place additional emphasis on enforcement of ordinance by hiring seasonal inspection staff.

- 3) Enforce infiltration maximization measures to protect the baseflow in Fredrick Springs north of the Pheasant Branch March.
- 4) Develop a City stormwater quality management and wetland protection plan as part of the Joint NR 216 stormwater discharge permit. Consider creating a stormwater utility for financing stormwater management programs.
- 5) Work with DNR and Dane County to implement nonpoint source programs and projects proposed in the Lake Mendota Priority Lake Project Plan.
- 6) Cooperate with other units of government in developing a coordinated stormwater quality management plan for the Central Urban Service Area.
- 7) Participate with DNR, USGS, Dane County, City of Madison and other units of government in an annual cooperative water resource monitoring program.
- 8) Support the efforts of watershed and conservation groups to protect and improve water resources of Pheasant Branch Creek and Lake Mendota.
- 9) Increase street sweeping program to provide frequent (weekly to biweekly) sweeping of streets in commercial and industrial areas, with extra efforts at cleaning all city streets in early spring and late fall.
- 10) Evaluate deicer use and snow storage practices for potential water quality impacts.
- 11) Develop a wellhead protection program for municipal wells.

City of Monona

- 1) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14) to protect Lake Monona from the adverse impacts of development. Participate in the activities and efforts of the inter-jurisdictional NR 216 Madison Area Municipal Stormwater Partnership.
- 2) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14. Revise building ordinances to require roof drainage to grassed areas, where feasible, for new development.
- 3) Enforce infiltration maximization measures to replenish the baseflow of area streams.
- 4) Cooperate with other units of government in developing a coordinated stormwater quality management plan for the Central Urban Service Area. Consider creating a stormwater utility for financing stormwater management programs.
- 5) Adopt ordinance prohibiting the burning of leaves.
- 6) Evaluate deicer use and snow storage practices for potential water quality impacts. Adopt a written salt use management policy.
- 7) Develop a wellhead protection program for municipal wells.

Village of Oregon

- 1) Continue efforts to reduce clearwater intrusion into the sanitary sewer system.
- 2) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14).
- 3) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14, to prevent increased flooding in the area. Revise building ordinances to require roof drainage to grassed areas, where feasible, for new development.
- 4) Prepare a stormwater management plan for the Village, including water quality protection practices.
- 5) Evaluate deicer use and snow storage practices for potential water quality impacts. Adopt a written salt use management policy.
- 6) Develop a wellhead protection program for municipal wells.

Village of Shorewood Hills

- 1) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14). Participate in the activities and efforts of the inter-jurisdictional NR 216 Madison Area Municipal Stormwater Partnership.
- 2) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14, to protect Lake Mendota from the adverse impacts of development. Revise building ordinances to require roof drainage to grassed areas, where feasible, for new construction.
- 3) Cooperate with other units of government in developing a coordinated stormwater quality management plan for the Central Urban Service Area.
- 4) Work with Dane County and the DNR to implement nonpoint source programs and projects that will be proposed in the Lake Mendota Priority Lake Project Plan.
- 5) Evaluate deicer use and snow storage practices for potential water quality impacts. Adopt a written salt use management policy.
- 6) Adopt an ordinance specifying practices for storage and disposal of leaves and yard and garden debris, and provide special fall leaf pickup program.

City of Stoughton

- 1) Continue with capital improvements planning to address BOD and hydraulic capacity for the wastewater treatment plant.
- 2) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14).
- 3) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14. Revise building ordinances to require roof drainage to grassed areas, where feasible, for new development.
- 4) Prepare a stormwater management plan for the City, including water quality protection measures. Consider creating a stormwater utility for financing stormwater management programs.
- 5) Evaluate deicer use and snow storage practices for potential water quality impacts. Adopt a written salt use management policy.
- 6) Develop a wellhead protection program for municipal wells.

City of Sun Prairie

- 1) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14). Participate in the activities and efforts of the inter-jurisdictional NR 216 Madison Area Municipal Stormwater Partnership.
- 2) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14, to protect Token Creek from the adverse impacts of development. Revise building ordinances to require roof drainage to grassed areas, where feasible, for new development.
- 3) Enforce infiltration maximization measures to replenish the baseflow of area streams and springs.
- 4) Complete implementation of the stormwater management plan for the Token Creek subwatershed, including water quality protection practices. Work with Dane County and DNR to implement nonpoint source programs and projects proposed in the Lake Mendota Priority Lake Project Plan.
- 5) Support the efforts of watershed and conservation groups to protect and improve the water resources of Token Creek.

See Lower Rock River Basin/Koshkonong Creek watershed for other City actions.

Village of Waunakee

- 1) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14). Participate in the activities and efforts of the inter-jurisdictional NR 216 Madison Area Municipal Stormwater Partnership.
- 2) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14, to protect Six Mile Creek from the adverse impacts of development. Revise building ordinances to require roof drainage to grassed areas, where feasible, for new development.
- 3) Enforce infiltration maximization measures to replenish the baseflow of Six Mile Creek.
- 4) Complete implementation of the Village stormwater management plan, including practices to protect the water quality of Sixmile Creek and Lake Mendota. Work with Dane County and DNR to implement nonpoint source programs and projects that will be proposed in the Lake Mendota Priority Lake Project Plan.
- 5) Develop a wellhead protection program for municipal wells.
- 6) Provide special fall leaf pickup program and specify practices for proper storage and disposal of leaves and yard and garden debris.
- 7) Evaluate deicer use and snow storage practices for potential water quality impacts. Adopt a written salt use management policy.
- 8) Develop a wellhead protection program for municipal wells.

Town of Windsor–Morrisonville Sanitary District

- 1) Continue efforts to reduce clearwater intrusion into the sanitary sewer system.

Madison Metropolitan Sewerage District

- 1) Continue to investigate and correct areas of high infiltration/inflow in the wastewater collection system.
- 2) Start facilities planning by 2006 to evaluate strategies to provide adequate treatment plant capacity for the service area. Include an evaluation of the feasibility of satellite plants in the Upper Yahara and Sugar River Watersheds.
- 3) Continue to evaluate and institute industrial loading management measures.

See Sugar – Pecatonica River Basin for other MMSD Actions.

Village of Cottage Grove

- 1) Prepare a stormwater management plan for the Village, including practices to protect the water quality of Door Creek.

See Lower Rock River Basin/Koshkonong Creek watershed for other village actions.

Towns of Burke, Westport, and Windsor

- 1) Develop a wellhead protection program for municipal wells.

Towns with urban service areas tributary to the Yahara River lakes (Towns of Blooming Grove, Burke, Dunn, Madison, Middleton, Pleasant Springs, Westport, and Windsor)

- 1) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14). Consider developing programs, ordinances and requirements consistent with those of other urban communities in the watershed.
- 2) For areas within urban service areas, adopt package of urban nonpoint source management programs, including: a) building ordinance revisions to require roof drainage to grassed areas, where feasible, for new

construction; b) ordinance prohibiting burning of leaves and specifying practices for storage and disposal of leaves and yard and garden debris; c) providing semi-annual street sweeping in spring and fall, and special fall leaf collection program; d) evaluation of stormwater drainage system, and preparation of stormwater management plans, if appropriate, to include water quality protection measures; and e) evaluate deicer use and snow storage practices for potential water quality impacts. For designated communities, participate in the activities and efforts of the inter-jurisdictional NR 216 Madison Area Municipal Stormwater Partnership.

Lower Rock River Basin: Koshkonong Creek Watershed

Village of Cambridge

- 1) Implement the recommendations of the facility plan for treatment plant expansion.
- 2) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14).
- 3) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14. Revise building ordinances to require roof drainage to grassed areas, where feasible, for new development.
- 4) Prepare a stormwater management plan for the Village, including practices to protect the water quality of Koshkonong Creek.
- 5) Evaluate deicer use and snow storage practices for potential water quality impacts. Adopt a written salt use management policy.
- 6) Develop a wellhead protection program for municipal wells.
- 7) Expand coverage of the Village wetland zoning ordinance to be consistent with Dane County ordinance regulating all wetlands over 2 acres.

Village of Cottage Grove

- 1) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14). Consider developing programs, ordinances and requirements consistent with those of other communities.
- 2) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14. Revise building ordinances to require roof drainage to grassed areas, where feasible, for new development.
- 3) Prepare a stormwater management plan for the Village, including water quality protection practices.
- 4) Evaluate deicer use and snow storage practices for potential water quality impacts. Adopt a written salt use management policy.
- 5) Expand coverage of the Village wetland zoning ordinance to be consistent with Dane County ordinance regulating all wetlands over 2 acres.

See Lower Rock River Basin/Yahara River watershed for other village actions.

Village of Deerfield

- 1) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14).
- 2) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14. Revise building ordinances to require roof drainage to grassed areas, where feasible, for new development.
- 3) Prepare a stormwater management plan for the Village, including water quality protection practices.
- 4) Adopt floodplain and wetland zoning ordinances, consistent with Dane County ordinances.

Management Agency**Priority Action**

Village of Rockdale

- 1) Implement the recommendations of the facility plan to upgrade the wastewater treatment plant.
- 2) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14).
- 3) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14. Revise building ordinances to require roof drainage to grassed areas, where feasible, for new development.
- 4) Evaluate stormwater drainage system for potential for incorporating water quality protection measures.
- 5) Establish semi-annual (spring and fall) street-cleaning program.
- 6) Evaluate deicer use and snow storage practices for potential water quality impacts. Adopt a written salt use management policy.
- 7) Adopt floodplain ordinance, and expand coverage of the Village wetland zoning ordinance to be consistent with Dane County ordinance regulating all wetlands over 2 acres.

City of Sun Prairie

- 1) Implement the recommendations of the facility plan for wastewater treatment plant expansion.
- 2) Continue efforts to reduce clearwater intrusion into the sanitary sewer system.
- 3) Complete implementation of the City's stormwater management plan, including water quality and wetland protection practices.
- 4) Enforce infiltration maximization measures to replenish the baseflow of Token Creek and area springs.
- 5) Evaluate deicer use and snow storage practices for potential water quality impacts. Adopt a written salt use management policy.
- 6) Develop a wellhead protection program for municipal wells.

Upper Rock River Basin**Village of Marshall**

- 1) Implement the state NR 151, NR 216, and federal Phase II stormwater regulations (as applicable) along with the existing Erosion Control and Stormwater Management Ordinance (chap. 14).
- 2) Vigorously enforce and expand comprehensive erosion control and stormwater management requirements beyond the minimum standards of Dane County Ordinance, chap. 14. Revise building ordinances to require roof drainage to grassed areas, where feasible, for new development.
- 3) Prepare a stormwater management plan for the Village, including water quality protection practices.
- 4) Establish special fall leaf collection program and specify practices for storage and disposal of leaves and yard and garden debris.
- 5) Evaluate deicer use and snow storage practices for potential water quality impacts. Adopt a written salt use management policy.
- 6) Develop a wellhead protection program for municipal wells.

SHORT-RANGE PRIORITY ACTIONS FOR DANE COUNTY AND COUNTYWIDE AGENCIES

County Agencies or Departments

Priority Action

Lakes and Watershed Commission (L&WC), and Land Conservation Department (LCD)

- 1) Work with local municipalities to adopt minimum standards in L&WC *Water Quality Implementation Plan* for shoreland, floodplain and wetland zoning, road salt use, shoreline maintenance, and construction site erosion control ordinances. Continue to develop standards for stormwater management plans in conjunction with local and state management agencies.
- 2) implement the state NR 151, NR 216, and federal Phase II stormwater regulations along with the existing Erosion Control and Stormwater Management Ordinance (Chap. 14). Participate in the activities and efforts of the inter-jurisdictional NR 216 Madison Area Municipal Stormwater Partnership.
- 3) Vigorously enforce and comprehensive erosion control and stormwater management requirements contained in Chap. 14.
- 4) Dane County should apply to be certified by the DNR as a Local Qualified Program for the issuance of stormwater permits under NR 216.
- 5) Implement the goals and objectives proposed in the Yahara–Mendota Priority Watershed Project Plan.

LCD

- 6) Implement the NR 151 Agricultural Performance Standards and Prohibitions.
- 7) Conduct status reviews and compliance monitoring of all farm conservation plans to meet federal and state (Chapter 92) and local (Dane County Soil Erosion Control Plan) requirements. Place priority on directing technical and cost-sharing assistance to locations and practices where water quality benefits are greatest. Assess the need for regulations, additional cost-share funding or other incentives for management practice implementation where needed to meet soil erosion and water quality management goals.
- 8) Expand inventory efforts and develop animal waste management plans for farms where over 25 animal units are kept near water bodies, or where significant pollution potential exists.
- 9) Continue to work with state agencies (DNR and DATCP) to evaluate extent and severity of common agricultural pesticide (atrazine, etc.) groundwater contamination in Dane County.

L&WC, UW Extension, LCD

- 10) Continue to expand information and education efforts directed at agricultural nonpoint source control. Additional emphasis should be placed on fertilizer management and use, integrated pest management and minimization of pesticide use, and safe handling of pesticides and other hazardous farm materials.

L&WC, LCD, Public Works, Parks

- 11) Develop and implement a coordinated and comprehensive program directed at improvement and maintenance of shorelines, stream corridors, and shorelands. Program should include: a) continuation and expansion of existing volunteer lake shoreline cleanup program; b) continuation and expansion of stream channel and shoreline improvement and cleanup activities using youth employment programs; c) obtaining conservation easements and installing fencing, livestock crossings, and other improvements needed to protect stream corridors and reduce streambank erosion; and d) pursue other shoreline, corridor and shoreland improvements important to protecting and enhancing water quality and uses of water resources.

L&WC, LCD, Parks

- 12) Support the efforts of watershed and conservation groups to protect and improve water resources.

L&WC, LCD, Parks, Public Works

- 13) Continue to address recreational and lake management issues presented in the Yahara Lakes Advisory Group (YLAG) report and the Yahara River Lakes Water Recreation Study. Develop public boating access and waterway protection plans that meet the objectives of the state public boating access code (NR 1.90-1.93).

L&WC, Parks

- 14) Continue to expand and develop a comprehensive approach to aquatic weed management as presented in aquatic plant management plans for Lakes Monona and Waubesa. This includes expanding the current mechanical harvesting program, improving harvesting efficiency in shallow water areas, formalizing criteria and guidelines for chemical weed control practices, and exploring ways of improving and managing aquatic plant communities.

L&WC, Public Works

- 15) Conduct a study to determine overall maintenance, dredging needs, and problems of recreational navigability throughout Dane County, and formulate a program to finance and implement needed dredging.

L&WC, LCD

- 16) Develop a system of improved and more precise operating rules for hydrologic management (lake level management and flow control) for the Yahara River lakes system to better address multi-use goals and objectives. Work with other state and local agencies to finance and develop a Yahara River Watershed rainfall/runoff model to help mitigate the impacts of flooding and drought conditions.

L&WC, LCD, Public Works, Planning & Development

- 17) Seek funding and prepare river and lake management and protection plans for specific lake use and water quality problems. Work with and assist local, state, and federal agencies in developing surface water resource evaluations and implementation programs.

L&WC, Parks

- 18) Emphasize, in open space acquisition policies, protection and acquisition of lands which perform important environmental and water resources protection functions such as wetlands, shorelands, groundwater recharge areas, etc., that are threatened by adverse impacts or development. Establish or maintain specific acquisition funds directed at these lands.

Planning & Development, L&WC, LCD

- 19) Review and evaluate all proposed federal (404), state (Chapter 30), and county permits and land use decisions for impacts on water quality and water resources. County decisions to be reviewed and evaluated include zoning changes, subdivision reviews, conditional use permits, landfill and other waste disposal practices, and major construction projects. This evaluation and review includes urban service area additions and environmental corridor amendments by the designated management agency.

L&WC, LCD, Planning & Development

- 20) Work with federal, state, and local management agencies, such as USGS, WGNHS, DNR, MMSD, and City of Madison, to use the information and tools developed from the Dane County Regional Hydrologic Study. Pursue management actions needed to mitigate the hydrologic and groundwater impacts of urban development, groundwater withdrawals, and wastewater diversion described in the *Dane County Groundwater Protection Plan*.
- 21) Coordinate and expand, in cooperation with other local, state, and federal agencies, the cooperative countywide water resources monitoring program. Expand stream baseflow and groundwater monitoring to gather additional data on toxics and pesticides.

Environmental Health, UW Extension

- 22) Continue to implement the current program of required on-site wastewater system maintenance (requiring inspection and pumping of septic tanks every 3 years). Expand the distribution of public informational materials on proper use and maintenance of on-site wastewater systems and private wells. Provide rural homeowners information, guidelines, and contacts for testing their wells and drinking water supplies.

Environmental Health

- 23) Develop a program to regulate land disposal of septage from on-site wastewater systems. Enact a septage site disposal ordinance which specifies application procedures, land disposal site criteria and disposal practices, surveillance and enforcement procedures, and a schedule of fees for site licenses.
- 24) Identify areas where on-site waste systems represent potential groundwater contamination problems, and assist in preparing evaluations and facility plans for targeted areas.

L&WC, LCD, UW Extension

- 25) Continue to develop and expand a comprehensive information and education program directed at urban residents and households emphasizing on-site urban nonpoint source management practices. Program should address on-site flow and landscaping techniques (downspout redirection, rain gardens, etc.), use of fertilizers, pesticides and other toxic household materials, water conservation, and proper management and disposal of leaves and yard and garden vegetative waste.

LCD, Extension

- 26) Inform and educate farmers, homeowners, and commercial businesses on safe handling of chemicals including the vulnerability of groundwater to contamination and the tremendous difficulty and expense of restoring it to its original condition. Proper on-farm storage of fuel, pesticides, and fertilizers should receive greater emphasis.

Highway & Transportation, L&WC

- 27) Continue to monitor and evaluate deicer use and snow storage practices for potential water quality impacts and explore ways to reduce road salt applications consistent with highway safety concerns.

L&WC, Highway & Transportation, All Towns

- 28) Provide assistance and guidelines to all towns in evaluating deicer use and adopting written salt use management policies.

Highway & Transportation

- 29) Provide frequent sweeping of urban county highways in the Central Urban Service Area, semiannual sweeping in other urban areas. On a contractual basis, provide equipment and personnel to assist smaller communities with street sweeping.

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Note: This list is limited to general water quality planning reports for Dane County, and does not include numerous wastewater facilities plans and reports, detailed stormwater management reports, or scientific and technical research reports and studies related to this subject matter.