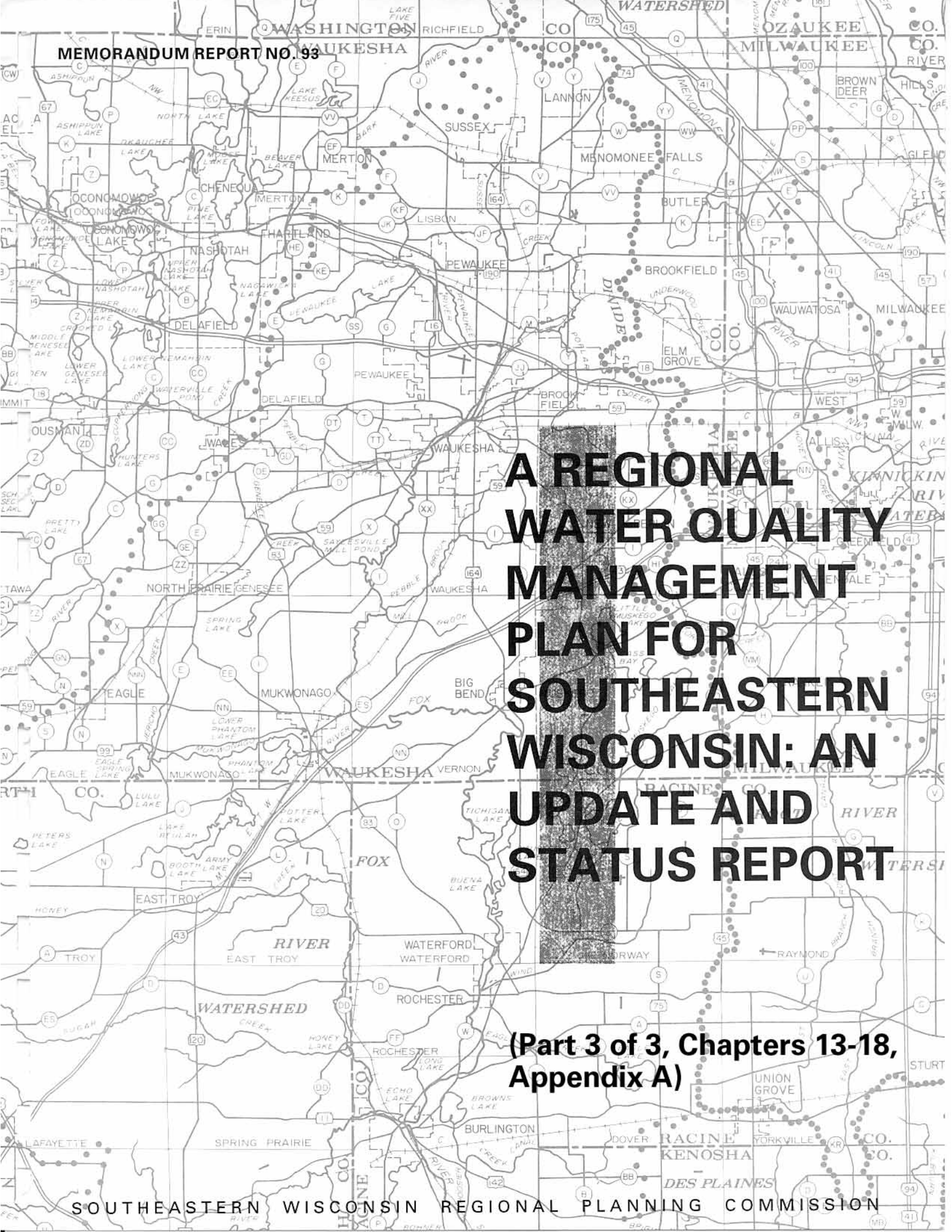

MEMORANDUM REPORT NO. 93

A REGIONAL WATER QUALITY MANAGEMENT PLAN FOR SOUTHEASTERN WISCONSIN: AN UPDATE AND STATUS REPORT

(Part 3 of 3, Chapters 13-18, Appendix A)

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

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MEMORANDUM REPORT
NUMBER 93

A REGIONAL WATER QUALITY MANAGEMENT PLAN FOR SOUTHEASTERN WISCONSIN: AN UPDATE AND STATUS REPORT

Prepared by the

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SEWRPC Memorandum Report No. 93

REGIONAL WATER QUALITY MANAGEMENT PLANNING IN SOUTHEASTERN WISCONSIN: A PLAN UPDATE AND STATUS REPORT

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Chapter XIII

ROOT RIVER WATERSHED--REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

INTRODUCTION

This chapter presents a description of the recommendations contained in the initial regional water quality management plan and amendments thereto and progress made toward plan implementation from 1975--the base year of the initial plan--through 1990--the base year of the plan update. In addition, this chapter presents information on water quality and biological conditions in the surface water system of the Root River watershed through 1993, where available. Finally, this chapter presents a description of the substantive water quality management issues that remain to be addressed in the Root River watershed as part of the continuing water quality planning process. The status of the initial plan and the current plan recommendations are presented in separate sections for the land use plan element, the point source pollution abatement and sludge management plan elements, the nonpoint source pollution abatement plan element, and the water quality monitoring plan elements. In addition, a separate section on lake management is included which is limited for the Root River watershed as there are no major lakes within the watershed. Designated management agency responsibilities for plan implementation are presented in Chapter XVII on a regional basis.

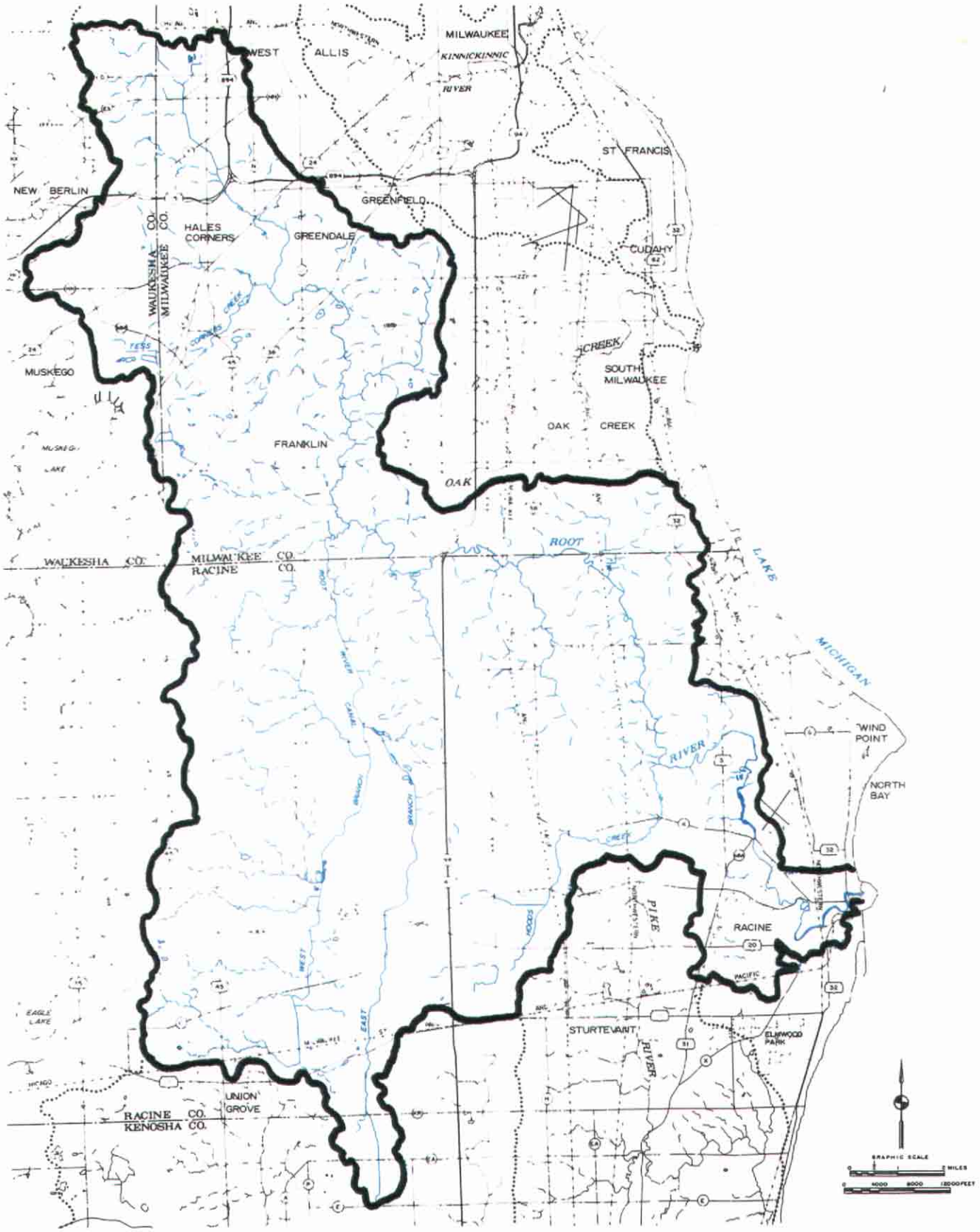
The Root River watershed is located in the east-central portion of the Region and covers an area of approximately 196 square miles. The main stem of the Root River rises in Milwaukee County within the City of Milwaukee urbanized area and flows approximately 44 miles southerly and then easterly to discharge into Lake Michigan in the City of Racine in Racine County. Rivers and streams in the watershed are part of the Lake Michigan drainage system as the watershed lies east of the subcontinental divide. The boundaries of the basin, together with the locations of the main channels of the Root River and its principal tributaries, are shown on Map XIII-1. The Root River watershed contains no lakes with a surface area of 50 acres or more.

LAND USE PLAN ELEMENT

The land use plan element of the initial plan, the status of the initial plan recommendations, as well as the new year 2010 plan, were described in Chapter III of this report on a regional basis. This section, more specifically, describes the changes in land use which have occurred within the Root River watershed since 1975, the base year of the initial regional water quality management plan, as well as planned changes in land use in the watershed to the year 2010. The data are presented for the watershed in order to permit consideration of the relationship of the changes in land use to the other plan elements and to water quality conditions within the watershed. The conversion of land from rural to urban land uses has the potential to impact on water quality as a result of increased point and nonpoint source loadings to surface waters. The amount of wastewater gener-

Map XIII-1

ROOT RIVER WATERSHED



addition, the amount of stormwater runoff is expected to increase due to an increase in impervious surfaces. The amounts of certain nonpoint source pollutants in stormwater, such as metals and chlorides, can also be expected to increase with urbanization.

Table XIII-1 summarizes the existing land uses in the Root River watershed in 1990 and indicates the changes in such land uses since 1975--the base year of the initial regional water quality management plan. Although the watershed contains numerous urbanized areas, 72 percent of the watershed was still in rural and other open space land uses in 1990. These rural uses included about 56 percent of the total area of the watershed in agricultural and related rural uses, about 4 percent in woodlands, about 6 percent in surface water and wetlands, and about 6 percent in other open lands. The remaining 28 percent of the total watershed was devoted to urban uses. Existing land uses within the watershed are shown on Map XIII-2.

Within the Root River watershed, major concentrations of urban development exist in portions of three counties, with the majority of development located in Milwaukee and Racine Counties. Urban development has been taking place rapidly in and around the Cities of Franklin, Greenfield, Milwaukee, Muskego, New Berlin, Oak Creek, Racine, Milwaukee, and West Allis; the Villages of Union Grove, Greendale and Hales Corners; and in the Towns of Caledonia and Mount Pleasant adjacent to the City of Racine. The watershed contains a major industrial center, Racine East, in the City of Racine, and two major commercial centers, the Central Business District located in the City of Racine, and a portion of the Regency Mall Commercial Center, located east of STH 31 in the City of Racine.

In the portion of the watershed contained in Waukesha County, urban-related land uses are located primarily in and around the northern and eastern portions of the City of Muskego and in the City of New Berlin. In the portion of the watershed contained in Racine County, urban-related land uses are located primarily in and around the Village of Union Grove, as well as in the portion of the City of Racine contained within the watershed and the areas directly adjacent to the City of Racine in the Towns of Caledonia and Mount Pleasant. In the portion of the watershed contained in Milwaukee County, urban-related land uses are located in and around the Villages of Greendale and Hales Corners, and the Cities of Greenfield, Milwaukee, and West Allis, and scattered development has occurred in the City of Franklin. Rapid urban development has also occurred along the STH 100 corridor in the Cities of West Allis and Greenfield, and in the Village of Hales Corners.

As shown in Table XIII-1, from 1975 to 1990, urban land uses in the watershed increased from about 31,500 acres, or 49 square miles, to about 35,400 acres, or 55 square miles, or by about 12 percent. As shown in Table XIII-1, residential land represents the largest urban land use in the watershed. Residential use has increased within the watershed, from about 17,100 acres, or 27 square miles, in 1975, to about 19,300 acres, or 30 square miles, in 1990, a 13 percent increase. Commercial and industrial lands increased from about 1,200 acres, or two square miles, to about 1,700 acres, or three square miles, an increase of 36 percent.

The 55.2 square miles of urban land uses in the watershed as of 1990 approximated the staged 1990 planned level of about 55.7 square miles envisioned in the

Table XIII-1

LAND USE IN THE ROOT RIVER WATERSHED: 1975 and 1990[a]

Land Use Category	1975		1990		Change 1975-1990	
	Acres	Percent	Acres	Percent	Acres	Percent
Urban						
Residential	17,073	13.6	19,303	15.4	2,230	13.16
Commercial	735	0.6	935	0.7	200	29.2
Industrial	490	0.4	730	0.6	240	49.0
Transportation, Communication, and Utilities[b] . .	9,294	7.4	10,190	8.1	896	9.6
Governmental and Institutional . . .	1,422	1.1	1,443	1.2	21	1.5
Recreational	2,537	2.0	2,760	2.2	223	8.9
Subtotal	31,551	25.1	35,361	28.2	3,810	12.1
Rural						
Agricultural and Related	75,781	60.4	70,253	55.9	- 5,528	7.36
Lakes, Rivers, Streams and Wetlands	6,930	5.5	7,509	6.0	579	8.4
Woodlands	5,143	4.1	5,157	4.1	14	0.3
Open Lands[c], Landfills, Dumps, and Extractive	6,168	4.9	7,318	5.8	1,150	18.6
Subtotal	94,022	74.9	90,237	71.8	- 3,785	- 4.0
Total	125,573	100.0	125,598	100.0	25[d]	--

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

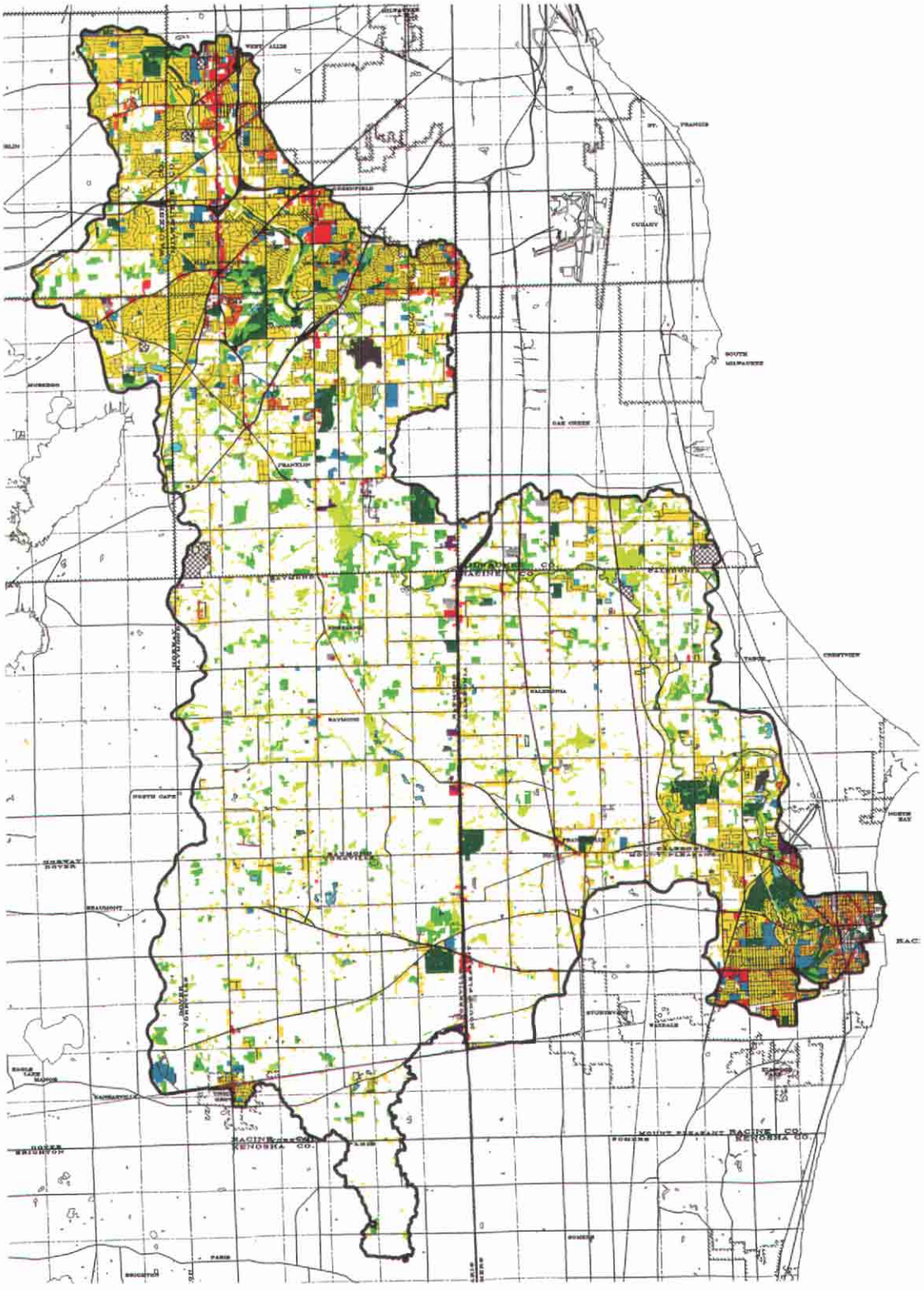
[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

[d] The change in total area of the watershed from 1975 to 1990 is the net effect of Lake Michigan shoreline erosion and accretion and of landfill activities.

Source: SEWRPC.

MAP XIII–2
LAND USES IN ROOT RIVER WATERSHED: 1990



–LEGEND–

- SINGLE–FAMILY RESIDENTIAL
- MULTI–FAMILY RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- STREETS AND HIGHWAYS
- PARKING
- OTHER TRANSPORTATION, COMMUNICATION AND UTILITIES
- GOVERNMENTAL AND INSTITUTIONAL
- RECREATIONAL
- SURFACE WATER
- WETLANDS
- WOODLANDS
- EXTRACTIVE
- LANDFILL
- AGRICULTURAL AND OTHER OPEN LANDS

0 1 2

GRAPHIC SCALE IN MILES

The Root River watershed is about 196 square miles in areal extent, or about 7 percent of the total Region. In 1990, about 55 square miles, or about 29 percent of the watershed, was in urban land uses.

Source: SEWRPC

adopted year 2000 land use plan. The current status of development in the Root River watershed and in adjacent portions of Racine, Kenosha, Milwaukee, and Waukesha Counties was considered in developing the new year 2010 land use plan element described in Chapter III for the Region as a whole.

Table XIII-2 summarizes the year 2010 planned land use conditions set forth in the adopted year 2010 land use plan in the Root River watershed and compares the recommended land use conditions to the 1990 conditions. Under planned land use conditions, as described in Chapter III, urban uses are expected to increase in Racine County in and around the southern portion of the Town of Caledonia and the Town of Mt. Pleasant in the northern portion of the City of Racine. Additional development is anticipated in the IH 94 corridor area north of STH 11.

In Milwaukee County, the adopted year 2010 land use plan anticipates increased urbanization in the City of Greenfield, and the northern and eastern portions of the City of Franklin and the southern portion of the City of Oak Creek. Additional urban development is also expected for Waukesha County in the eastern portions of the City of New Berlin.

In order to meet the needs of the expected resident population and employment envisioned under the intermediate growth-centralized land use plan future conditions, the amount of land devoted to urban use within the Root River watershed, as indicated in Table XIII-2, is projected to increase from the 1990 total of about 55 square miles, or about 28 percent, of the total area of the watershed, to about 63 square miles, or about 32 percent of the total area of the watershed, by year 2010. Under the high growth-decentralized land use plan future scenario, the land devoted to urban uses is projected to increase to about 66 square miles, or about 34 percent, of the total watershed by year 2010. It is important to note that the 66 to 68 percent of the watershed remaining in rural uses is partly comprised of primary environmental corridor lands consisting of the best remaining natural resource features, and, as recommended in the year 2010 regional land use plan, is proposed to be preserved largely in open space uses through joint State-local zoning or public acquisition. In addition, certain other lands classified as wetlands, and floodplains outside of the primary environmental corridors are, in some cases, precluded from being developed by State and Federal regulations. Thus, the demand for urban land will have to be satisfied primarily through the conversion of a portion of the remaining agricultural and other open lands of the watershed from rural to urban uses. Rural land uses may be expected to decline collectively from about 141 square miles in 1990 to about 133 square miles in the year 2010 under the intermediate growth-centralized land use plan and to about 130 square miles under the high growth-decentralized land use plan, decreases of about 6 and 8 percent between 1990 and 2010 for the two year 2010 plans considered.

POINT SOURCE POLLUTANT CONTROL PLAN ELEMENTS

This section describes the recommendations and status of implementation of the initial regional water quality management plan, as well as current plan recommendations updated by incorporating all amendments and implementation actions for the abatement of water pollution from point sources of pollution in the Root River watershed--including consideration of public and private sewage treatment

Table XIII-2

EXISTING AND PLANNED LAND USE IN THE ROOT RIVER WATERSHED: ACTUAL 1990 AND PLANNED 2010[a]

Land Use Category	Existing 1990		Year 2010 Intermediate Growth - Centralized Land Use				Year 2010 High Growth - Decentralized Land Use			
			2010		Change 1990-2010		2010		Change 1990-2010	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Urban										
Residential	19,303	15.4	22,478	17.9	3,175	16.4	23,397	18.6	4,094	21.2
Commercial	935	0.7	971	0.8	36	3.9	1,088	0.9	153	16.4
Industrial	730	0.6	970	0.8	240	32.9	1,394	1.1	664	91.0
Transportation, Communication, and Utilities[b]	10,190	8.1	11,398	9.1	1,208	11.9	11,955	9.5	1,765	17.3
Governmental and Institutional	1,443	1.2	1,562	1.2	119	8.2	1,582	1.3	139	9.6
Recreational	2,760	2.2	2,990	2.3	230	8.3	3,010	2.4	250	9.1
Subtotal	35,361	28.2	40,369	30.1	5,008	14.1	42,426	33.8	7,065	20.0
Rural										
Agricultural and Related	70,253	55.9	68,707	54.7	- 1,546	- 2.2	66,505	52.9	- 3,748	- 5.3
Lakes, Rivers, Streams, and Wetlands	7,509	6.0	7,135	5.7	- 374	- 5.0	7,135	5.7	- 374	- 5.0
Woodlands	5,157	4.1	4,986	4.0	- 171	- 3.3	4,924	3.9	- 233	- 4.5
Open Lands[c], Landfills, Dumps, and Extractive	7,318	5.8	4,401	3.5	- 2,917	- 39.9	4,608	3.7	- 2,710	- 67.9
Subtotal	90,237	71.8	85,229	67.9	- 5,008	- 5.5	83,172	66.2	- 7,065	- 7.8
Total	125,598	100.0	125,598	100.0	0	--	125,598	100.0	0	--

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

plants, points of public sewage collection system overflows, intercommunity trunk sewers, and industrial wastewater treatment systems and discharges. Because of the interrelationship of the treatment plant solids or sludge management plan element with the public and private sewage treatment plant plan component, this section also covers the solids management plan element as described in the initial plan. This section also includes a status report on the public sanitary service areas located in the watershed.

It should be noted that, during 1995, the Milwaukee Metropolitan Sewerage District initiated work on an update of its Section 201 sewerage facility plan[1] for the entire Milwaukee metropolitan area. The update will have a plan year 2010, the same as the update of the regional plan. It is recommended that that facility plan re-examine certain system level decisions that were made in the past including trunk sewer needs, and the retention of the one remaining small sewage treatment plan in the Milwaukee metropolitan area--the City of South Milwaukee plant. The resultant sewage facilities plan update is intended, then, upon its adoption by all of the agencies concerned, to constitute an amendment to the regional water quality management plan update herein presented. Such an amendment could impact on the facilities within the Root River watershed.

Public and Private Wastewater Treatment Systems and Sewer Service Areas Existing Conditions and Status of Plan Implementation: In 1975, there were five public sewage treatment facilities located in the Root River watershed, as shown on Map XIII-3. The Caddy Vista Sanitary District treatment plant which served the Town of Caledonia discharged effluent to the main stem of the Root River; the Village of Union Grove treatment plant discharged to the West Branch Root River Canal; the Village of Hales Corners and Rawson Homes Sewer and Water Trust treatment plants discharged to tributaries of Whitnall Park Creek; and the City of Muskego-Northeast District treatment plant discharged directly to Tess Corners Creek. Of these five plants, the City of Muskego-Northeast District, the Village of Hales Corners, the Caddy Vista Sanitary District, and Rawson Homes Sewer and Water Trust plants were abandoned after 1975, as recommended in the initial plan. The status of implementation in regard to the abandonment, upgrading and expansion, and construction of the public and private sewage treatment plants in the Root River watershed, as recommended in the initial regional water quality management plan, is summarized in Table XIII-3.

As can be seen by review of Table XIII-3, full implementation of the initial plan would provide for the construction of a new and subsequent expansion for the Village of Union Grove sewage treatment plant, and the upgrading and expansion of the Racine County Highway and Park Commission private sewage treatment plant which was converted to the Town of Yorkville Sewer Utility District No. 1 public sewage treatment plant. Implementation of these recommendations has been largely completed. The Village of Union Grove and the Town of Yorkville Sewer Utility District No. 1 public sewage treatment plants have not fully provided facilities to specifically reduce the phosphorus concentrations in plant effluents to the levels identified in the initial plan as being needed to fully meet the water use objectives. The steps needed to achieve the recommended level of phosphorus

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[1]Milwaukee Metropolitan Sewerage District, MMSD Wastewater System Plan, June 1980.

Map XIII-3

SEWER SERVICE ARES, SEWAGE TREATMENT PLANTS AND OTHER POINT SOURCES OF POLLUTION IN THE ROOT RIVER WATERSHED: 1990

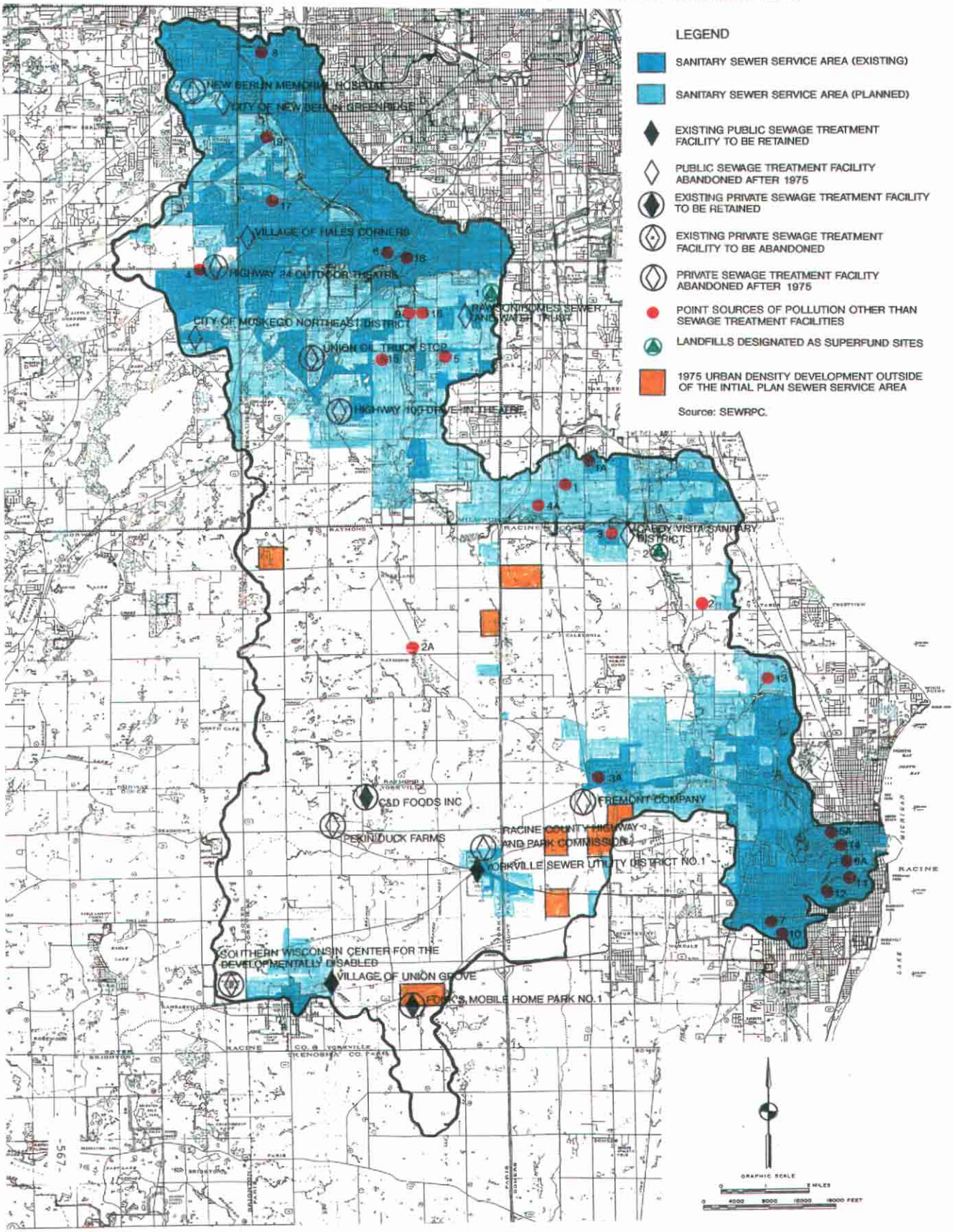

Table XIII-3

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN FOR PUBLIC AND PRIVATE SEWAGE TREATMENT PLANTS IN THE ROOT RIVER WATERSHED: 1990

Public Sewage Treatment Plants	Disposal of Effluent	Plan Recommendation	Implementation Status
Village of Union Grove	West Branch of Root River Canal	Construct new plant, expand	Plant in operation, plant expansion under construction in 1994
Town of Yorkville Sewer Utility District No. 1	Hoods Creek	Upgrade and expand[a]	Completed
Caddy Vista Sanitary District	Root River	Abandon plant	Plant abandoned (1982)
Village of Hales Corners	Whitnall Park Creek tributary	Abandon plant	Plant abandoned (1981)
City of Muskego-Northeast District	Tess Corners Creek	Abandon plant	Plant abandoned (1985)
Rawson Homes Sewer and Water Trust	East Branch Root River	Abandon plant	Plant abandoned (1977)
Private Sewage Treatment Plants			
C&D Foods Inc., and York Duck Farms	Tributary of West Branch Root River Canal	Maintain and upgrade as needed	Plant maintained
Fonk's Mobile Home Park No. 1	East Branch Root River Canal	Maintain and upgrade as needed	Plant maintained
Pekin Duck Farm, Inc.	Soil Absorption	Maintain and upgrade as needed	Plant abandoned (1989)
Racine County Highway and Park Commission	Hoods Creek	Maintain and expand as a public plant to serve Town of Yorkville Sanitary District No. 1	Facility upgraded and expanded as a public plant
The Fremont Company[b]	Hoods Creek	Abandon plant	Plant abandoned (1985)
Highway 100 Drive-In Theater	Soil Absorption	Abandon plant	Plant abandoned
Highway 24 Outdoor Theater	Soil Absorption	Abandon plant	Plant abandoned (1984)
New Berlin Memorial Hospital	Tributary of Root River	Abandon plant	Plant abandoned
Southern Wisconsin Center for the Developmentally Disabled[c]	West Branch Root River Canal	Abandon plant	Facility planning underway to enable abandonment
Union Oil Truck Stop	Tributary of Root River	Abandon plant	Plant abandoned (1980)

[a] The initial regional water quality management plan recommended the conversion and expansion of the Racine County Highway and Park Commission private sewage treatment facility to a public sewage treatment facility that would serve the entire Yorkville sewer service area. A proposed revision to the initial regional water quality management plan, documented in A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Racine Area, recommends the abandonment of the Town of Yorkville treatment plant, and for the Yorkville sewer service area to be served by the City of Racine sewage treatment plant.

[b] Formerly Frank's Pure Food Company.

[c] Formerly Southern Colony Training School and Treatment Facility.

Source: SEWRPC.

control have been partially implemented by the completion of a study by the Wisconsin Department of Natural Resources to refine the procedure for establishing site specific phosphorus limitations on all public sewage treatment plants, and in 1993, by the adoption of rules to allow for placement of such limitations. Thus, as sewage treatment plant permits are issued, the use of the identified procedure should result in findings requiring reduced phosphorus loadings. Selected characteristics of the two public sewage treatment plants currently existing in the watershed are given in Table XIII-4.

In addition to the publicly-owned sewage treatment facilities, 10 private sewage treatment facilities were in existence in 1975 in the Root River watershed. These plants served the following land uses: C & D Foods Inc., Fonk's Mobile Home Park No. 1, Pekin Duck Farm Inc., Racine County Highway and Park Commission, The Frank Pure Food Company (currently the Fremont Company), Highway 100 Drive-In Theater, Highway 24 Outdoor Theater, New Berlin Memorial Hospital, Southern Wisconsin Center for the Developmentally Disabled, and Union Oil Truck Stop.

As indicated in Table XIII-3, six of the 10 private sewage treatment plants in the watershed were recommended to be abandoned in the initial plan. As of 1990, five of these plants had been abandoned. The connection of the Southern Wisconsin Center private sewage treatment plant to the Village of Union Grove sewerage system, enabling the abandonment of the private plant, was under construction in 1994. The Racine County Highway and Park Commission private plant was recommended to be expanded as a public plant in the initial plan. As of 1990, this facility had been upgraded and expanded as the Town of Yorkville Sewer Utility District No. 1 public sewage treatment plant. The remaining private plants were recommended to be maintained and upgraded to provide effluent quality which would be determined on a case-by-case basis as part of the Wisconsin Pollutant Discharge Elimination System (WPDES).

The initial regional water quality management plan included a set of specific options to be considered in facilities planning for management of solids generated at the public and private sewage treatment plants in the Root River watershed. These options included methods for processing, transportation, and utilization or disposal of treatment plant solids. As facility plans are prepared, they are reviewed for conformance with the plan recommendations. Since sludge management planning is generally carried out as part of the sewage treatment plant facility planning, implementation of this element of the regional plan generally parallels the municipal and private treatment plant implementation described above. One of the principal recommendations under this plan element concerns the preparation of a plant-specific sludge management plan. Since 1977, the Department of Natural Resources has included, as a part of the discharge permitting process, the requirement that the designated management agencies develop and submit a sludge management report. In addition, the permit requires that, upon approval and implementation of the sludge management plan, records be maintained of sludge application sites and quantities, and that the sites be monitored for adverse environmental, health, or social effects that may be experienced due to sludge disposal. At the present time, such reports have been prepared and submitted to the Department, or are under preparation, for both of the public and private sewage treatment plants currently within the watershed.

Table XIII-4

SELECTED CHARACTERISTICS OF EXISTING PUBLIC SEWAGE TREATMENT PLANTS IN THE ROOT RIVER WATERSHED

Name of Public Sewage Treatment Plant	1990 Estimated Total Area Served (square mile)	1990 Estimated Total Population Served	Date of Construction and Major Modification	Sewage Treatment Unit Processes[a]	Name of Receiving Water to which Effluent is Disposed	WPDES Permit Expiration Date
Village of Union Grove[b]	1.1	3,700	1937, 1962, 1979	Activated sludge contact stabilization, rotating biological contactors, phoshorus removal, sand filtration, chlorination	West Branch Root River Canal	3-31-96
Town of Yorkville Sewer Utility District No. 1	0.3	100	1965, 1972, 1983	Activated sludge extended air, clarification, chlorination	Tributary of Hoods Creek	6-30-93

Name of Public Sewage Treatment Plant	Hydraulic Loading[c] (mgd)				BOD_5 Loading[c] (pounds/day)				Suspended Solids Loading[c] (pounds/day)			
	Existing				Existing				Existing			
	Average Annual	Maximum Monthly Average	Design Average Annual	Number of Months in 1990 in Which the Monthly Average Loadings Exceeded the Design Capacity	Average Annual	Maximum Monthly Average	Design Average Annual	Number of Months in 1990 in Which the Monthly Average Loadings Exceeded the Design Capacity	Average Annual	Maximum Monthly Average	Design Average Annual	Number of Months in 1990 in which the Monthly Average Loadings Exceeded the Design Capacity
Village of Union Grove	0.67	0.99	0.88	2	593	824	1,205	0	652	914	2,000	0
Town of Yorkville Sewer Utility District No. 1	0.04	0.06	0.15	0	86	123	720	0	60	100	344	0

[a] In addition, plants typically include headworks and miscellaneous processes such as pumping, flow metering and sampling, screening and grit removal, as well as sludge handling and disposal facilities.

[b] Expansion of the Village of Union Grove public sewage treatment plant was under construction in 1994.

[c] Loadings data were obtained from the 1990 Wisconsin Department of Natural Resources summary report of discharge monitoring data.

Source: Wisconsin Department of Natural Resources and SEWRPC.

The initial regional water quality management plan recommended that all of the sanitary sewer service areas identified in the plan be refined and detailed in cooperation with the local units of government concerned. There were eight sewer service areas identified within, or partially within, the Root River watershed: Milwaukee Metropolitan Sewerage District, Muskego, New Berlin, Caddy Vista, Union Grove, Center for the Developmentally Disabled, Racine, and Yorkville. As of 1993, all of these areas, with the exception of the Milwaukee Metropolitan Sewerage District service area and a portion of the Yorkville sanitary sewer service area, had undergone refinements as recommended. In addition, the Franklin sewer service area, which was initially included as part of the Milwaukee Metropolitan Sewerage District service areas, was identified and refined since the completion of the initial plan.[2] The boundaries of the sewer service areas through 1993 are shown on Map XIII-3. Table XIII-5 lists the plan amendment prepared for each refinement and the date the Commission adopted the document as an amendment to the regional water quality management plan. The table also identifies the original service area names and the relationship of these service areas to the service areas names following the refinement process. The planned sewer service areas in the Root River watershed, as refined through 1993, total about 64 square miles, or about 33 percent of the total watershed area, as shown in Table XIII-5.

Current Plan Recommendations: The current point source plan element recommendations provide for the continued operation with expansion and upgrading, as necessary, of the Village of Union Grove sewage treatment plant. In addition, the plan recommendations continue to provide for the continued operation of the Yorkville Sewer Utility District No. 1 sewage treatment plan. The recommendation regarding plant facility upgrading and expansion, as needed, also applies to the treatment plant solids management element for these two sewage treatment plants.

With regard to the treatment plant operated by the Town of Yorkville Sewer Utility District No. 1, further consideration should be given to evaluating a potential change in the recommendations set forth in the initial plan. That potential change is based upon the findings of a 1992 sanitary sewerage and water supply system plan which was completed for the greater Racine area. The findings and recommendations of the planning work are contained in a report prepared by Alvord, Burdick & Howson, entitled A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Racine Area. That report, which was prepared for a study area including all of the eastern portion Racine County extending from Lake Michigan to a distance of about two miles west of IH 94, includes major portions of the Root River watershed. The report identified the sanitary sewer and water supply needs of that planning area, and evaluated alternative means of meeting those needs; recommended a coordinated set of design year 2010 sewerage and water supply system plans for the area; identified the intergovernmental, administrative, legal, and fiscal issues inherent in the implementation of the system plans; and recommended an institutional structure for implementation of those plans. The recommended sewerage system and planned service area developed in

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[2]In September 1994, the sewer service area for the City of Oak Creek, which was initially included as part of the Milwaukee Metropolitan Sewerage District service area, was identified and refined as set forth in SEWRPC Community Assistance Planning Report No. 213, A Sanitary Sewer Service Area for the City of Oak Creek, Milwaukee County, Wisconsin.

Table XIII-5

PLANNED SANITARY SEWER SERVICE AREAS IN THE ROOT RIVER WATERSHED: 1993

Name of Initially Defined Sanitary Sewer Service Area(s)	Planned Sanitary Sewer Service Area (square miles)	Name of Refined and Detailed Sanitary Sewer Service Area(s)	Date of SEWRPC Adoption of Plan Amendment	Plan Amendment Document
Refined Sanitary Sewer Service Areas				
Milwaukee Metropolitan Sewerage District (portion)	24.3	Franklin	December 5, 1990	SEWRPC CAPR No. 176, Sanitary Sewer Service Area for the City of Franklin, Milwaukee County
Muskego	3.7	Muskego	March 3, 1986	SEWRPC CAPR No. 64, 2nd Edition, Sanitary Sewer Service Area for the City of Muskego, Waukesha County, Wisconsin
New Berlin	10.0	New Berlin	December 7, 1987	SEWRPC CAPR No. 157, Sanitary Sewer Service Area for the City of New Berlin, Waukesha County, Wisconsin
Racine Caddy Vista	23.6	Racine Caddy Vista	December 1, 1986	SEWRPC CAPR No. 147, Sanitary Sewer Service Area for the City of Racine and Environs, Racine County, Wisconsin
Union Grove Center for the Developmentally Disabled	2.3	Union Grove Southern Wisconsin Center	September 12, 1990	SEWRPC CAPR No. 180, Sanitary Sewer Service Area for the Village of Union Grove and Environs, Racine County, Wisconsin
Yorkville	0.4	Yorkville	December 5, 1990	Amendment to the Regional Water Quality Management Plan-2000, Towns of Yorkville and Mt. Pleasant
Subtotal	64.3			
Unrefined Sanitary Sewer Service Areas				
Milwaukee Metropolitan Sewerage District (portion)[a]	25.9			
Yorkville (portion)	0.7			
Subtotal	26.6			
Total	90.9			

Note: CAPR - Community Assistance Planning Report

[a] As of September 1994, the City of Oak Creek sanitary sewer service area portion of the Milwaukee Metropolitan Sewerage District was refined as set forth in SEWRPC Community Assistance Planning Report No. 213, Sanitary Sewer Service Area Plan for the City of Oak Creek, Milwaukee County, Wisconsin. This refined Oak Creek sanitary sewer service area encompasses 8.1 square miles within the Root River watershed.

Source: SEWRPC.

this subregional system plan are shown on Map XIII-4A. As of December 1994, the intergovernmental actions and approvals needed to proceed with the attendant changes to the regional water quality management plan had not been put in place. Thus, the inclusion of these plan recommendations in the updated plan is pending intergovernmental agreement on the recommendations.

On the basis of the recommendations contained in this subregional sewerage system plan, the following revisions to the initially adopted plan are proposed, pending approval of the system plan by the local units of government involved:

1. The sewer service areas as set forth in the adopted plan are to be revised to conform with those set forth under the recommended Racine area sewerage system plan as shown in Map XIII-4.

2. The Racine Water and Wastewater Utility sewage treatment plant is to be designated as the sole public sewage treatment plant to serve the area considered, as shown on Map XIII-4; and the public sewage treatment plant operated by the Town of Yorkville Sewer Utility District No. 1 is recommended to be abandoned during the planning period.

3. The intercommunity trunk sewers needed to provide service, as shown on Map XIII-4, are recommended to be added to the regional plan recommendations.

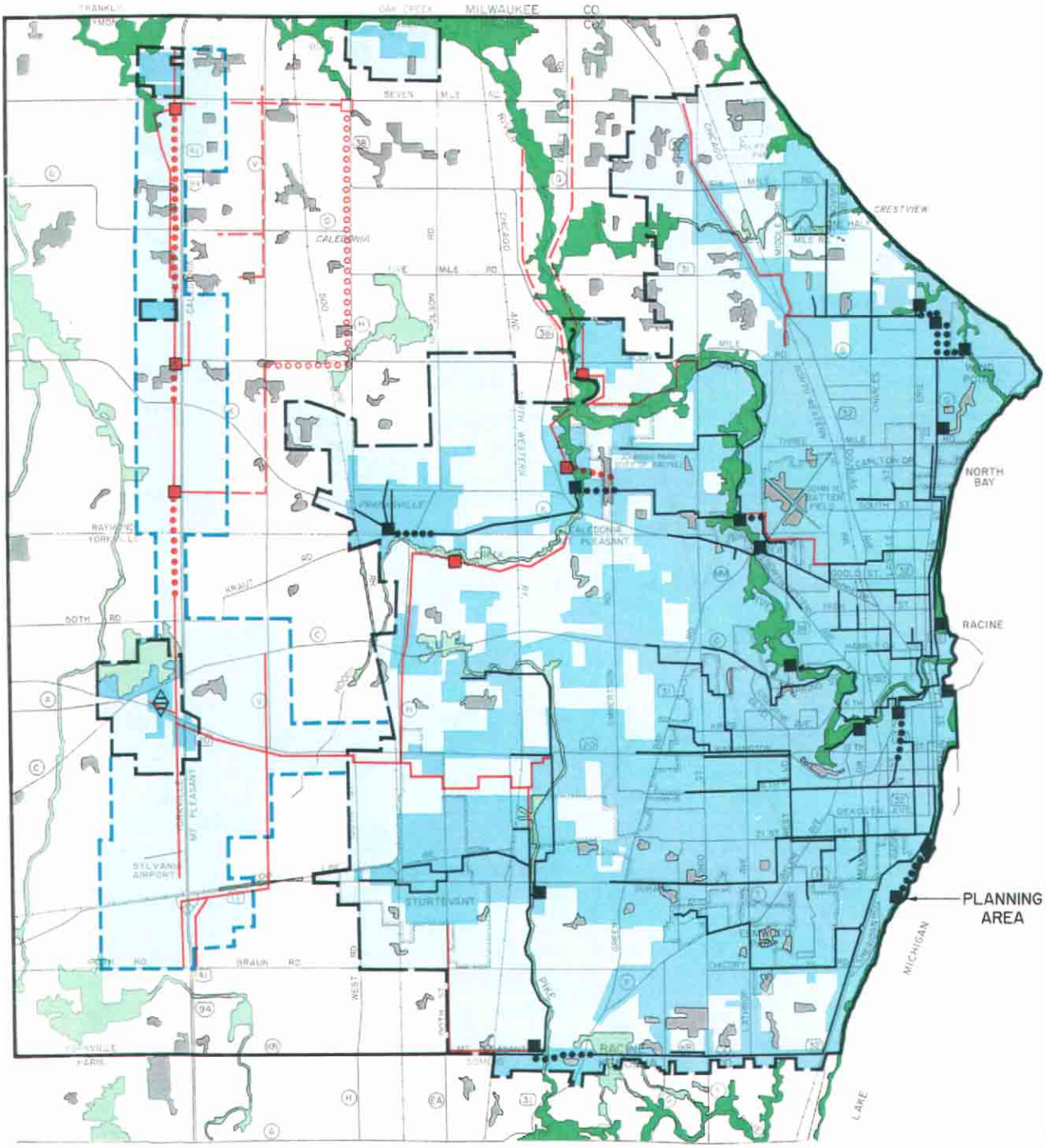
The current point source pollution abatement plan element, including the planned sewer service areas, is summarized on Map XIII-4. Table XIII-6 presents selected design data for the public sewage treatment plants recommended to be maintained in the Root River watershed. It is important to note that in 1990 the Village of Union Grove plant has recorded monthly average flows which exceeded the average design capacity of the plant. However, the Village has, during 1993 and 1994, carried out sewerage system improvements to reduce infiltration and inflow and to increase the system capacity.

Table XIII-6 shows expected increases in sewered populations and attendant increases in sewage hydraulic loading rates for two different year 2010 growth scenarios for the two public treatment plants in the Root River watershed. During 1994, the Yorkville Utility District No. 1 was conducting facility planning to determine its future sewage system needs and alternatives. In addition, the Village of Union Grove was constructing sewerage system improvements, including improvements to reduce infiltration and inflow and sewage treatment plant modifications.

The current planned sanitary sewer service areas in the Root River watershed are shown on Map XIII-4. The existing and planned year 2010 population data for each sewer service area are presented in Chapter XVIII on a regional basis. All or portions of the Muskego, New Berlin, Milwaukee Metropolitan Sewerage District, Franklin, Racine, Caddy Vista, Union Grove, Southern Wisconsin Center, and Yorkville sewer service areas are located in the Root River watershed. Together, the planned service areas within the watershed total about 91 square miles, or about 46 percent of the Root River watershed.

Map XIII-4A

RECOMMENDED SEWERAGE SYSTEM FACILITIES FOR THE GREATER RACINE UTILITY PLANNING AREA AS DEVELOPED IN 1992 SUBREGIONAL SYSTEM PLAN



LEGEND

- PRIMARY ENVIRONMENTAL CORRIDOR
- SECONDARY ENVIRONMENTAL CORRIDOR
- ISOLATED NATURAL AREA
- CURRENTLY APPROVED GROSS SANITARY SEWER SERVICE AREA BOUNDARY
- NET SANITARY SEWER SERVICE AREA (EXISTING)
- NET SANITARY SEWER SERVICE AREA (PROPOSED)
- BOUNDARY OF AREA TO BE ADDED TO THE CURRENTLY APPROVED GROSS SANITARY SEWER SERVICE AREA
- EXISTING PUBLIC SEWAGE TREATMENT PLANT
- EXISTING PUBLIC SEWAGE TREATMENT PLANT TO BE ABANDONED
- EXISTING GRAVITY SEWER
- EXISTING FORCE MAIN
- EXISTING LIFT OR PUMPING STATION
- PROPOSED GRAVITY SEWER: 2010
- PROPOSED FORCE MAIN: 2010
- PROPOSED PUMPING STATION: 2010
- PROPOSED GRAVITY SEWER: BEYOND 2010
- PROPOSED FORCE MAIN: BEYOND 2010
- PROPOSED PUMPING STATION: BEYOND 2010

Map XIII-4

UPDATED REGIONAL WATER QUALITY MANAGEMENT POINT SOURCE PLAN FOR THE ROOT RIVER WATERSHED: 2010

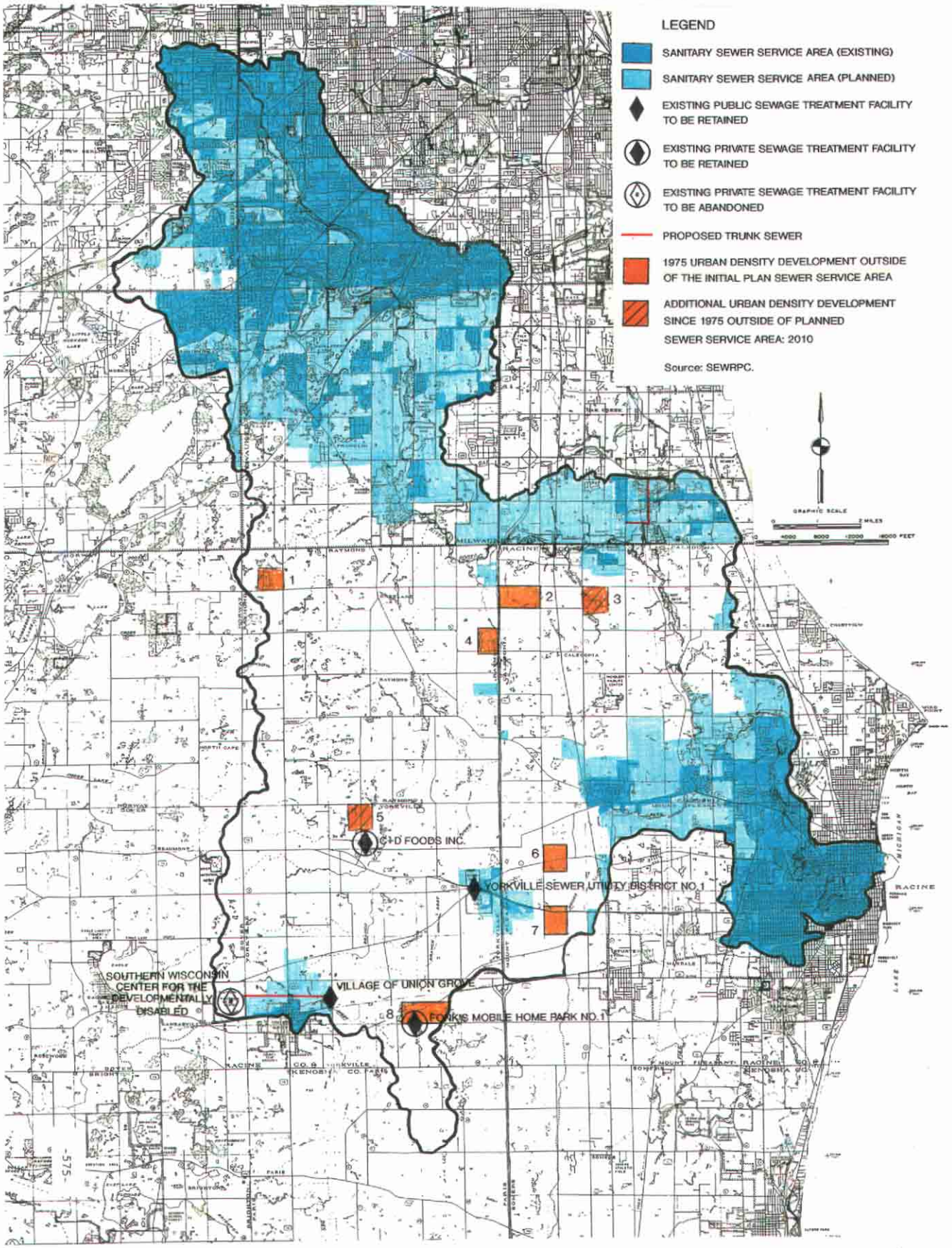


Table XIII-6

SELECTED DESIGN DATA FOR PUBLIC SEWAGE TREATMENT PLANTS
IN THE ROOT RIVER WATERSHED: 1990 AND 2010

Name of Public Sewage Treatment Plant	Sewer Service Area	Design Capacity-Average Annual Hydraulic (mgd)	Existing 1990			Planned Year 2010						
							Intermediate Growth Centralized Land Use Plan			High Growth Decentralized Land Use Plan		
			Average Hydraulic Loading (mgd)	Total Area Served (square miles)	Resident Population Served	Planned Sewer Service Area (square mile)	Resident Population Served	Design Average Hydraulic Loading (mgd)	Approximate Facility Planning Year[a]	Resident Population Served	Design Average Hydraulic Loading (mgd)	Approximate Facility Planning Year[a]
Village of Union Grove	Union Grove Southern Wisconsin Center	0.88	0.67	1.1	3,700	3.9	5,900	0.94	2000[b]	8,100	1.22	1998[b]
Town of Yorkville Utility District No. 1	Yorkville	0.15	0.05	0.4	100	1.1	100	0.33	1995[c]	200	0.67	1995[c]

[a]Approximate year in which facility planning for a plant expansion would be initiated in order to allow for expansion during the subsequent three years prior to plant capacity being exceeded. Date is based upon review of average design flows compared to average annual and maximum monthly flows, and age of facilities based upon date of last major construction.

[b]During 1993, the Village of Union Grove completed facility planning for sewerage system improvements including sewer system improvements to reduce infiltration and inflow and sewage treatment plant improvements.

[c]As of 1994, the Yorkville Utility District No. 1 had initiated facility planning to evaluate its future sewerage system needs and alternatives.

Source: SEWRPC.

As noted above, most of the service areas in the watershed have been refined as part of the ongoing regional water quality management plan updating process. Additional refinements are envisioned to be needed for the Milwaukee Metropolitan Sewerage District sewer service area and for the unrefined portion of Yorkville. It is recommended that these refinements be conducted in 1995 and 1996. It is recommended that the sanitary sewer service areas and attendant planned population levels set forth herein be utilized in subsequent sewerage system facility planning and sanitary sewer extension design. Particular attention should be given to the preservation and protection of the primary environmental corridor lands designated in the individual sanitary sewer service area plans and in the adopted 2010 regional land use plan.

In addition to the public plants, there were three private sewage treatment plants in operation within the Root River watershed in 1990. These facilities generally serve isolated enclaves of urban land uses which are located beyond the current limits of the planned sanitary public sewer service areas. In 1990, of the three plants in operation, the plant serving the Center for the Developmentally Disabled was recommended for abandonment with connection to the Village of Union Grove sewerage system. In 1994, the connection of this facility to the Union Grove sewerage system was under construction. For the two remaining private sewage treatment plants serving Fonk's Mobile Home Park No. 1 and C & D Foods Inc., the need for upgrading and level of treatment should be formulated on a case-by-case basis during plan implementation as part of the Wisconsin Pollutant Discharge Elimination System permitting process.

Sewer System Flow Relief Devices

Existing Conditions and Status of Plan Implementation: In 1975, there were eight known combined sewer outfalls and 53 known sanitary sewer system flow relief devices located in the Root River watershed: of the latter, 20 were sanitary sewerage system bypasses; 11 were portable pumping stations; and 22 were cross-overs. Of the total of 61 flow relief devices and combined sewer outfalls, 56 discharged directly to the main stem of the Root River; two discharged directly to the East Branch Root River Canal; two discharged directly to Hoods Creek; and one discharged directly to the West Branch Root River Canal. During the period of 1988 through 1993, the majority of the bypasses were eliminated as the plants were upgraded or abandoned, as recommended in the initial regional water quality management plan. As shown in Table XIII-7, 22 points of sanitary sewer system flow relief were reported during 1988 through 1993 in the Root River watershed. These flow relief points are located in five sewerage systems. However, these flow relief points have only been in operation infrequently, with the average discharge occurrence frequency over this five-year period being about once per three years per flow relief location. This equates to an average of about seven isolated overflow occurrences per year considering all reported bypassing.

Current Plan Recommendations: It is recommended that the Cities of Milwaukee, Muskego, and Racine, and the Villages of Hales Corners and Union Grove continue to monitor their sewerage system operations to ensure that the use of the existing sewerage system flow relief devices is limited to periods of power or equipment failure, or in cases where infiltration and inflow due to wet weather conditions exceed the flows expected in the system design. It is recommended that planning for all sewerage system expansion and upgrading within the watershed be conducted with the assumption that there will be no planned bypasses of

Table XIII-7

KNOWN SEWAGE FLOW RELIEF DEVICES
IN THE ROOT RIVER WATERSHED: 1988-1993

Sewerage System	Sewage Treatment Plant Flow Relief Device	Sewage Flow Relief Devices in the Sewer System				Total	Comments
		Crossovers	Pumping Station Bypasses	Other Bypasses	Portable Pumping Systems		
City of Milwaukee	--	3[a]	--	--	--	3	Used only in case of extreme wet weather
City of Muskego	--	--	1	2	--	3	Used only in case of equipment failure or extreme wet weather
Village of Hales Corners	--	--	2	--	1	3	Used only in case of extreme wet weather
City of Racine	--	3	2	5	--	10	Used in case of equipment failure or extreme wet weather
Village of Union Grove	1	--	--	1	--	2	Used in case of equipment failure or extreme wet weather
Town of Caledonia Sewer Utility District No. 1	--	--	1	--	--	1	Used only in case of extreme wet weather
TOTAL	1	6	6	8	1	22	

[a] Crossovers are quipped with electric pumps to allow for bypassing.

Source: SEWRPC.

untreated sewage and that the use of all flow relief devices will ultimately be eliminated, with the only bypasses remaining designed to protect the public and treatment facilities from unforeseen equipment or power failure. In 1994, the City of Racine conducted sewer system facility planning which resulted in recommendations for sewer rehabilitation, relief sewer construction, and pumping station upgrading. This project should result in the elimination of the use of flow relief devices in that system.

Intercommunity Trunk Sewers

Existing Conditions and Status of Plan Implementation: The initial regional water quality management program, as updated, recommended the construction of eight intercommunity trunk sewers within or partially within the Root River watershed, as shown in Table XIII-8. The New Berlin and Hales Corners trunk sewer would permit the abandonment of the Hales Corners sewage treatment plant, as well as the Regal Manors plant located in the Fox River watershed. The Franklin-Muskego trunk sewer would permit the abandonment of the City of Muskego Northeast District sewage treatment plant and the Big Muskego sewage treatment plant located in the Fox River watershed. Similarly, the Caddy Vista Sanitary District trunk sewer would permit the abandonment of the Caddy Vista sewage treatment plant. The Center for the Developmentally Disabled trunk sewer would convey wastewater from the Center to the Village of Union Grove sewerage system permitting the abandonment of the private sewage treatment plant serving the Center. The Union Grove trunk sewer would convey wastewater from the Village and the Center for the Developmentally Disabled to the Village's current plant site. The Root River and Franklin-Northeast trunk sewers would provide needed relief sewer capacity to serve existing and planned urban development, reducing bypassing and basement backup of sewage and providing capacity for areas served by onsite sewage disposal systems. These trunk sewers have all been completed, with the exception of the Center for the Developmentally Disabled-Union Grove trunk sewer.

Current Plan Recommendations: The current regional water quality management plan includes recommendations for those trunk sewers necessary to extend centralized sanitary sewer service to the Root River watershed as shown on Map XIII-4. As of 1990, all of the trunk sewers recommended to be constructed in the watershed under the initial plan had been constructed, with the exception of the trunk sewer providing the connection of the Center for the Developmentally Disabled plant to the Union Grove facility. Construction of this trunk sewer was underway in 1994. As previously discussed in Chapter X, and as shown on Map XIII-4, a new trunk sewer--the Oak Creek Southeast trunk sewer--is included as part of this plan update. Upon local approval of a plan amendment document, based upon the aforementioned 1992 sanitary sewer and water supply system plan for the greater Racine area, new trunk sewers would be added to the plan to convey wastewater from existing and proposed sewer service areas in the vicinity of IH-94 to the City of Racine sewerage system, enabling the abandonment of the Town of Yorkville plant, as shown on Map XIII-4A.

Point Sources of Wastewater Other Than Public and Private Sewage Treatment Plants

Existing Conditions and Status of Plan Implementation: In 1975, there were a total of 13 known point sources of pollution identified in the Root River watershed other than public and private sewage treatment plants. These sources dis-

Table XIII-8

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN FOR INTERCOMMUNITY TRUNK SEWERS IN THE ROOT RIVER WATERSHED: 1990

Intercommunity Trunk Sewer	Status of Implementation
Root River	Completed (1984)
Hales Corners	Completed (1981)
New Berlin	Completed (1984)
Franklin-Muskego	Completed (1984)
Franklin-Northeast	Completed (1984)
Caddy Vista Sanitary District	Completed (1982)
Center for the Developmentally Disabled-Union Grove	Construction underway
Union Grove	Completed (1979)

Source: SEWRPC.

charged industrial cooling, process, rinse, wash waters, and filter backwash waters through 20 outfalls directly or indirectly to the surface water or groundwater system. Of these 20 outfalls, 13 were identified as discharging only cooling water. The remaining seven were other types of wastewater discharges. Four of these discharged directly to the Root River main stem, 11 to the Root River indirectly via storm sewers, drainage ditches, or unnamed tributaries, three discharge to the River via tributaries, and two utilized soil absorption systems. The initial regional water quality plan includes a recommendation that these industrial sources of wastewater be monitored, and discharges limited to levels which must be determined on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System permit process.

As of 1990, there were 25 such known point sources of wastewater discharging to the Root River and its major tributaries or the groundwater system in the watershed. Table XIII-9 summarizes selected characteristics of these other point sources and Map XIII-3 shows their locations. Due to the dynamic nature of permitted point sources, it is recognized that the number of wastewater sources change as industries and other facilities change location or processes and as decisions were made with regard to the connection of such sources to public sanitary sewer systems.

Current Plan Recommendations: As of 1993, there were 49 known point sources of wastewater other than public and private sewage treatment plants discharging to surface waters or groundwater in the Root River watershed. These point sources of wastewater discharge, primarily industrial cooling, process, rinse, and wash water, discharge directly, or following treatment, to the groundwater or the surface waters of the Root River watershed. It is recommended that these sources of wastewater continue to be regulated and controlled on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System.

Existing Unsewered Urban Development Outside the Proposed Sanitary Sewer Service Area

As of 1975, there were seven enclaves of unsewered urban development located outside of the then proposed year 2000 sewer service areas. As of 1990, one of these urban areas had been added to the planned 2010 sewer service area as part of the plan amendment process. Due to increased urban growth within the watershed since 1975, two new enclaves of urban development have been created beyond the planned sewer service areas, as shown on Map XIII-4. The corresponding urban enclave population and the distance to the nearest planned year 2010 sewer service area are listed in Table XIII-10. One of these urban enclaves is served by a private sewage treatment plant. The remaining seven of these areas are covered by soils or have lot sizes which indicate a high probability of not meeting the criteria of Chapter ILHR 83 of the Wisconsin Administrative Code covering conventional onsite sewage disposal systems. Thus, it is recommended that these areas consider an intensive inspection and maintenance program for the onsite systems and that further site-specific planning be conducted to determine the best wastewater management practice at such time as significant problems become evident.

Miscellaneous Potential Pollution Sources

Landfills: Landfills in the Root River watershed, including those currently abandoned, have the potential to affect surface water quality through the release

Table XIII-9

CHARACTERISTICS OF OTHER KNOWN POINT SOURCES OF WATER POLLUTION IN THE ROOT RIVER WATERSHED: 1990[a]

Facility Name	County	Map ID No.[b]	Permit Type	Permit No.	Expiration Date	Standard Industrial Classification Code	Industrial Activity	Receiving Water	Treatment System[c]
Root River Watershed									
Air Products & Chemicals, Inc.	Milwaukee	1	General	0046531-1	--	2813	Industrial gases	Root River via unnamed tributary	- -
Best Block Company - Racine Plant	Racine	2	General	0046507-2	9-30-95	3271	Concrete block and brick	Groundwater discharge	- -
Caddy Vista Water Treatment Plant	Racine	3	General	0046540-1	9-30-95	4941	Water supply	Root River	- -
Carri-Crete Corp.	Waukesha	4	General	0046507-2	9-30-95	3273	Ready-mix concrete	Groundwater discharge	- -
Franklin High School (Pool)	Milwaukee	5	General	0046523-2	9-30-95	8211	Secondary school	East Branch Root River	- -
Greendale High School (Pool)	Milwaukee	6	General	0046523-2	9-30-95	8211	Secondary school	Dale Creek	- -
Moxness Prod. Div.-Vers. Tech., Inc.	Racine	7	General	0044938-3	9-30-95	3069	Fabricated rubber products	Root River via storm sewer	- -
Nathan Hale High School (Pool)	Milwaukee	8	General	0046523-2	9-30-95	8211	Secondary school	Root River via storm sewer	- -
Payne & Dolan-Franklin Aggregates	Milwaukee	9	General	0046515-2	9-30-95	1429	Crushed & broken stone	Root River via unnamed tributary	- -
Printing Developments, Inc.	Racine	10	General	0044938-3	9-30-95	2796/3861	Plate making serv.;photo equip.	Root River via storm sewer	- -
Racine Heat Treating Company	Racine	11	General	0044938-3	9-30-95	3398	Metal heat treating	Root River	- -
Racine School District: Park H.S.	Racine	12	General	0046523-1	9-30-95	8211	Secondary school	Root River	- -
Racine Stamping Corp.	Racine	13	General	0044938-3	9-30-95	3469	Metal stampings	Root River via storm sewer	- -
Rainfair, Inc. - Albert Street	Racine	14	General	0044938-3	9-30-95	2385	Waterproof outerwear	Root River via storm sewer	- -
Tuckaway Country Club	Milwaukee	15	General	0046523-2	9-30-95	7997	Membership sports & rec. club	Root River via unnamed tributary	- -
Vulcan Materials Co., Rawson Plant	Milwaukee	16	General	0046515-2	9-30-95	3281	Cut stone & stone products	Root River via unnamed tributary	- -
Whitnall High School (Pool)	Milwaukee	17	General	0046523-2	9-30-95	8211	Secondary school	Root River via unnamed tributary	- -
Wikk Industries, Inc.	Milwaukee	18	General	0044938-3	9-30-95	3429	Hardware	Dale Creek	- -
YMCA of Milw. - SW Family Branch	Milwaukee	19	General	0046523-2	9-30-95	7991	Physical fitness facility	Root River	- -
Accutec (A Federal Hoffman Fac.)	Milwaukee	1A	Specific	0046493	12-31-92	3499	Fabricated metal products	Root River via unnamed tributary	2
Fohrs Meat Service, Inc.	Racine	2A	Specific	0053287	9-30-93	2011	Meat packing plant	Groundwater discharge	3
Harry Hansen Meat Service, Inc.	Racine	3A	Specific	0053295	9-30-93	2011	Meat packing plant	Groundwater discharge	3
PPG Industries Inc.	Milwaukee	4A	Specific	0029149	12-31-82	2851	Paints & allied products	Root River via storm sewer	5
Racine Steel Castings	Racine	5A	Specific	0042170	9-30-91	3325	Steel foundry	Root River via storm sewer	None
Western Publishing Inc. - Main Plant	Racine	6A	Specific	0026107	1-31-95	2731	Book publishing	Root River	None

[a] Table XIII-9 includes 25 known, permitted point sources of wastewater discharging to the Root River and its tributaries, or to the groundwater system in the Root River watershed. As of 1993, there were 49 known, permitted point sources of water pollution

[b] See Map XIII-3, Sewer Service Areas, Sewage Treatment Plants, and Other Point Sources of Pollution in the Root River Watershed: 1975 and 1990.

[c] The number code refers to the following treatment systems:

1. Aerated lagoon
2. Holding pond
3. Land spreading
4. Multimedia filters
5. Oil and grease removal
6. Secondary clarification
7. Spray Irrigation
8. Stabilization lagoon

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table XIII-10

EXISTING URBAN DEVELOPMENT OUTSIDE OF THE PLANNED PUBLIC SANITARY SEWER SERVICE AREA IN THE ROOT RIVER WATERSHED: 2010

Number[a]	Major Urban Concentration[b]	1990 Estimated Resident Population	Distance from Year 2010 Sewer Service Area (miles)
1	Town of Raymond-Section 6[c]	125	2.5
2	Town of Caledonia-T4N, R22E, Section 7[c]	207	1.0
3	Town of Caledonia-T4N, R22E, Section 9[c]	116	0.3
4	Town of Raymond, Section 13[c]	102	2.0
5	Town of Yorkville-Section 4[c]	117	2.6
6	Town of Mt. Pleasant-T3N, R22E, Sec. 8[c]	62	0.5
7	Town of Mt. Pleasant-T3N, R22E, Section 17[c]	86	0.2
8	Town of Yorkville-Sections 26 and 27[c,d]	457	0.6
	Total	815	6.0

[a] See Map XIII-4

[b] Urban development is defined in this context as concentrations of urban land uses within any given U.S. Public Land Survey quarter section that has at least 32 housing units, or an average of one housing unit per five gross acres, and is not served by public sanitary sewers.

[c] Based upon consideration of soils, lot sizes, and density, further site specific planning should be conducted during the planning period to determine the best means of providing for wastewater management.

[d] Served by a private sewage treatment plant.

Source: SEWRPC.

of leachates from the landfill to ground and surface waters. These landfills potentially contain some toxic and hazardous substances due to the disposal of such wastes from households and other sources. In some cases, toxic and hazardous substances have begun to leach into surrounding soils and aquifers, and can potentially be transmitted to the surface waters.

There are currently two active landfills and 42 known abandoned landfills located in the Root River watershed. Two of the abandoned landfills, the Fadrowski Drum Disposal Site in the City of Franklin and the Hunt's Disposal-Caledonia Landfill in the Town of Caledonia, were designated as high priority sites for the U.S. Environmental Protection Agency Superfund program which provides for the identification, evaluation, and clean up of hazardous waste sites. The location of these landfills is shown on Map XIII-3 and in Table XIII-11.

In 1986, the Fadrowski Drum Disposal Site was designated as a high priority site for the Superfund Program. The landfill was in operation between 1970 and 1982 and received various industrial wastes, including hazardous waste. Lubricant sludges and several hundred drums of waste materials were reportedly buried on the site. Analyses conducted between 1988 and 1991 to determine the impacts of the landfill on surface water found low levels of cyanide and volatile organic compounds (VOCs) in a tributary stream to the Root River along the western boundary of the site. Elevated levels of mercury, benzene, chromium, and barium were also found in groundwater down gradient of the site. Remedial actions are currently underway at this landfill site. These remedial actions include: excavation, removal and treatment of containerized waste and contaminated soils; construction of a landfill cover; limitations on land and groundwater use; and monitoring of groundwater and surface water.

The Hunt's Disposal Landfill was designated as a Superfund site in 1987. During its operation from 1959 to 1974, municipal and industrial wastes were accepted at the site, including newspaper ink solvents and arsenic acid sludges. Samples collected from residential wells and surface water near the site, including the Root River main stem, indicated contamination of surface and ground waters with volatile organic compounds (VOCs) and semi-volatile organic compounds including acetone, 1,2-dichloroethene, carbon disulphide, methylene chloride, pentachlorophenol, toluene and vinyl chloride, and 4-methylphenol, benzoic acid, and naphthalene; heavy metals including chromium, copper, lead, manganese and nickel; and several polyaromatic hydrocarbons (PAHs). Remediation actions are currently underway at this landfill site. The actions under design include: fencing; excavation and consolidation of contaminated soil; construction of a multi-layer landfill cap and slurry wall barrier; groundwater extraction; and residential well monitoring. The preliminary remediation plans recommend treatment of the extracted groundwater followed by discharge to a drainageway leading to the Root River main stem at a location just to the west of the site.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the Root River watershed have the potential to affect water quality through the release of substances into the surrounding soil and groundwater. Sites with leaking underground storage tanks are eligible for remediation under the U.S. Environmental Protection Agency Leaking Underground Storage Tank (LUST) program, designed to facilitate the clean up of such sites, primarily those sites containing petroleum storage tanks. In selected cases, sites undergoing clean up

Table XIII-11

MISCELLANEOUS POTENTIAL POLLUTION SOURCES IN THE ROOT RIVER WATERSHED: 1990

Map ID Number[a]	Landfills Indicated To Be Potential Pollution Sources	Civil Division Location	Surface Water Potentially Impacted
1	Fadrowski Drum Disposal Site[b]	City of Franklin, Milwaukee County	Root River
2	Hunt's Disposal Landfill Site[b]	Town of Caledonia, Racine County	Root River
	Leaking Underground Storage Tank Sites[c,d]		Receiving Water
	none		
	Additional Groundwater Contamination Sites[c]		Receiving Water
	none		

[a] Refers to Map XIII-3, Sewer Service Areas, Sewage Treatment Plants and Other Point Sources of Pollution in the Root River Watershed: 1990.

[b] Superfund site.

[c] Includes those sites which are permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation waste water to surface or ground waters.

[d] As of 1993, there were three leaking underground storage tank sites in the Root River watershed whose remediation discharges were permitted under the Wisconsin Pollutant Discharge Elimination System: Bob's Mobil Inc. in the Village of Union Grove, Racine County which is permitted to discharge to the Root River via a storm sewer; Speedy Lube Gas Station (currently the Pahle Small Animal Clinic) in the City of West Allis, Milwaukee County which is permitted to discharge to the Root River; and Phillips 66 Gas Station in the City of New Berlin, Waukesha County which is permitted to discharge to the Root River.

Source: Wisconsin Department of Natural Resources and SEWRPC.

efforts are permitted under the Wisconsin Pollutant Discharge Elimination System (WPDES) to discharge remediation wastewater to surface or groundwater. Discharges from these sites are required to meet specified water quality discharge standards set forth by the Wisconsin Department of Natural Resources.

As of 1993, there were three known, permitted leaking underground storage tank sites that were discharging remediation waters to surface waters in the Root River watershed, as indicated in Table XIII-11.

As of 1993, there were 180 leaking underground storage tanks in the Root River watershed identified by the DNR that were not discharging remediation wastewater directly to surface or ground waters. While there is no specific evidence to document the impact of these individual point sources on water quality within the watershed, it can be reasonably assumed that the cumulative effect of multiple leaking underground storage tanks has the potential to result in detrimental effects on water quality over time.

Additional Groundwater Contamination Sites: Additional groundwater contamination sites which are undergoing remediation may also be permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation wastewater to surface or ground waters. As of 1993, there were no known such sites in the Root River watershed.

NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT

The nonpoint source pollution abatement plan element of the initial regional water quality management plan includes recommendations relating to diffuse sources of water pollution. Nonpoint sources of water pollution include runoff from urban and rural land uses, runoff from construction sites, wastes from livestock operations, malfunctioning septic systems, and pollutant contributions from the atmosphere.

Existing Conditions and Status of Plan Implementation

For the Root River watershed, the initial plan recommended nonpoint source pollution control practices for urban lands designed to reduce the pollutant loadings from nonpoint sources by about 50 percent, in addition to urban construction erosion control, onsite sewerage disposal system management, and streambank erosion controls. For rural lands, the plan generally recommended nonpoint source control practices designed to reduce pollutant loadings by about 25 percent. Within the rural areas of the Root River Canal drainage area, the plan recommends additional measures to provide a reduction in nonpoint source pollutants of about 50 percent, in addition to streambank erosion control.

In 1966, the Commission prepared a comprehensive watershed plan for the Root River watershed[3] in cooperation with various Federal, State, and local authorities. This comprehensive plan established the necessary framework for the conduct of subsequent detailed stormwater management planning for the urban and urbanizing areas in the watershed. Such subsequent planning was and will

[3]See SEWRPC Planning Report No. 9, A Comprehensive Plan for the Root River Watershed, September 1966.

continue to be directed toward reducing nonpoint source pollutant loadings as well as providing for local drainage needs in the watershed.

Implementation of the recommended nonpoint source control practices has been achieved on a limited basis in the Root River watershed through local regulation and programs. In the area of construction site erosion control, significant progress has been made. As of January 1993, the Cities of Franklin, Greenfield, Milwaukee, Muskego, New Berlin, Oak Creek, and West Allis had adopted construction erosion control ordinances which are based upon the model ordinance developed cooperatively by the Wisconsin Department of Natural Resources and League of Wisconsin Municipalities. There are also ongoing programs of onsite sewage disposal system regulation administered by Kenosha, Racine, and Waukesha Counties.

With regard to rural nonpoint source control, Chapter NR 243 of the Wisconsin Administrative Code sets forth design standards and accepted animal waste management practices for large animal feeding operations. This program is administered by the Wisconsin Department of Natural Resources, which works with the County Land Conservation Departments to resolve identified significant animal waste problems. This program and other programs, such as the Conservation reserve Program administered by the U.S. Department of Agriculture, Soil Conservation Service, and the wetland restoration programs administered by the Wisconsin Department of Natural Resources and others are utilized primarily for cropland soil erosion control and wildlife habitat purposes and will have positive water quality impacts.

Chapter ATCP 50 of the Wisconsin Administrative Code requires that soil erosion on all croplands be reduced to tolerable levels by the year 2000. Tolerable levels are defined as soil loss tolerances or T-values, which are the maximum annual average rates of soil loss for each soil type that can be sustained economically and indefinitely without impairing the productivity of the soil. These values have been determined for each soil type by the U.S. Soil Conservation Service. Chapter 92 of the Wisconsin State Statutes requires that soil erosion control plans be prepared and maintained for counties identified by the Wisconsin Department of Agriculture, Trade and Consumer Protection, as priority counties for soil erosion control. The Commission has prepared agricultural soil erosion control plans for Kenosha, Racine, and Waukesha Counties. Thus, these plans have been prepared for all rural areas of the Root River watershed. Those plans identify priority areas for cropland soil erosion control within these counties and the watershed, and, additionally, recommend farm management practices intended to reduce cropland soil erosion to tolerable levels. Soil conservation and management are closely related to the issues of stormwater management, flood control, control of nonpoint source pollutants, changing land use, and deterioration of the natural resource base. Therefore, it is important that soil conservation be considered within the framework of a comprehensive watershed planning program which will enable the formulation of coordinated, long-range solutions.

The initial regional plan also recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans. Such plans are to identify the nonpoint source pollution control practices that should be applied to

specific lands. Working with the individual county land conservation committees, local units of government, and the Commission, the Wisconsin Department of Natural Resources is carrying out the recommended detailed planning for nonpoint source water pollution abatement on a watershed-by-watershed basis. This detailed planning and subsequent plan implementation program is known as the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program. This planning and grant funding program was established in 1978 by the Wisconsin Legislature and provides cost-sharing funds for an individual project, or land management practice, to local governments and private landowners upon completion of the detailed plans. These funds are provided through nonpoint source local assistance grants administered by the Wisconsin Department of Natural Resources. The Root River watershed was designated a "priority watershed" in 1979. Planning for the Root River Priority Watershed Project was completed in 1980, and implementation of practices occurred from 1980 through 1989.

The Root River priority watershed program established nonpoint source pollutant reduction goals for the entire watershed by subwatershed. A pollutant reduction goal of 50 percent was established for urban areas of the watershed. In order to meet this goal, the plan recommended onsite sewage disposal system management, construction erosion controls, and the implementation of various land management practices including increased street sweeping, streambank and roadside drainageway erosion controls, industrial and commercial site housekeeping practices, installation of oil and chemical disposal stations, and public education and information programs. For rural areas, pollutant reduction goals of 25 percent were established for the watershed. Additional reduction goals of 50 percent were established for the drainage areas tributary to the East Branch, West Branch, and main stem of the Root River Canal. In order to achieve this level of control, the plan recommends the following measures:

Nonpoint Source Measure	Amount
Crop rotation	750 acres
Contour Strip Cropping	490 acres
Conservation Tillage	11,900 acres
Diversions	50,000 feet of diversion
Terraces	1,224,200 feet of terraces
Grass Waterways	182 acres
Grade Stabilization Structures	111 structures
Stream Fending for Livestock Exclusion	3,350 feet
Stream Bank Shaping and Seeding	26,370 feet
Stream Bank Riprap	13,650 feet
Stream Cattle Crossings	10 crossings
Critical Area Planting	18 acres
Vegetative Buffer Strips	170 acres
Livestock Waste Runoff Management	44 systems
Livestock Waste Storage	23 systems

With the exception of the stabilization of critical areas, participation in the Priority Watershed Program was generally under 50 percent for the practices recommended being installed. Very limited implementation of the urban practices was achieved. The urban measures that were implemented included streambank protection projects, one retention pond, limited street sweeping programs, and

oil disposal stations. The DNR final report on the project suggests that the Root River water quality and biological condition have not improved significantly between 1981 and 1990.

Current Plan Recommendations

Given the limited implementation of the nonpoint source priority watershed plan recommendations, it is recommended that construction site erosion control, onsite sewerage system management, and streambank erosion control, in addition to land management which, when coupled with the urban practices implemented during the priority watershed project, will provide about a 50 percent reduction in nonpoint source pollutant loadings in the urban area of the Root River watershed. Review of the characteristics of the Root River watershed indicates that it would meet the criteria for the "high" priority watershed ranking as documented in a memorandum[4] prepared by the Regional Planning Commission for use by the Wisconsin Department of Natural Resources in prioritizing the watershed for selection under the priority watershed program. Thus, it is recommended that the Wisconsin Department of Natural Resources consider reopening the commitment--or "sign-up" period for urban practices on the Root River watershed for a two-year period followed by a five-year implementation period. It is also recommended that the need for further nonpoint source reductions in the rural areas of the watershed be reviewed and reevaluated given the levels of nonpoint source control achieved during the priority watershed plan preparation. It is further recommended that these levels of reduction in the urban areas be refined in subsequent detailed stormwater management planning. The reevaluation of the levels of nonpoint source pollution control needed should be based upon additional monitoring which would be conducted as described in the next section. Such refinement would include further consideration of toxics reduction requirements.

The types of practices recommended to be considered for these various levels of nonpoint source control are summarized in Appendix A.

WATER QUALITY MONITORING PLAN ELEMENT

Existing Conditions and Status of Implementation

While substantial progress has been made in the regional water quality management plan elements described in the previous sections, the most direct measure of the impact of plan implementation on water quality conditions can only be achieved by a well-planned areawide water quality and biological condition monitoring program.

As of 1993, long-term monitoring has been carried out in the Root River watershed on a sustained basis by the Wisconsin Department of Natural Resources at one station along the main stem of the Root River at Johnson Park, as shown on Map XIII-5. Short-term monitoring has also been conducted at 11 sites by the DNR during 1981 and 1982, as shown on Map XIII-5 and described later in this chapter.

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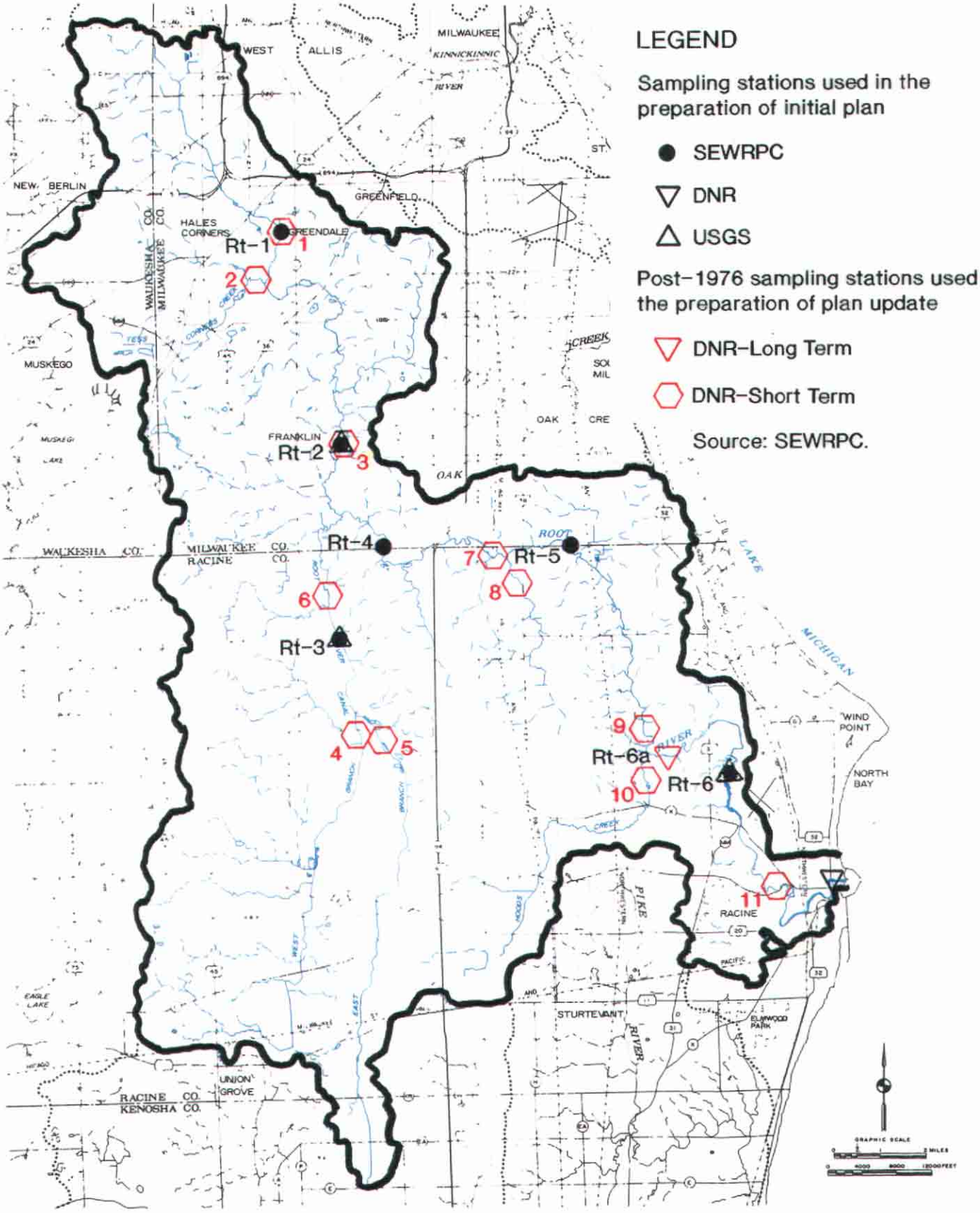
[4]See SEWRPC Memorandum entitled "Assessment and Ranking of Watersheds for Nonpoint Source Management Purposes in Southeastern Wisconsin: 1993."

Map XIII-5
LOCATIONS OF WATER QUALITY SAMPLING STATIONS IN THE ROOT RIVER WATERSHED



Current Plan Recommendation

Increased water quality and biological conditions monitoring will be needed in the watershed to document current conditions and to demonstrate water quality condition changes over time. It is recommended that water quality data collection be continued by the Wisconsin Department of Natural Resources at Station Rt-6a on a continuing long-term basis. In addition, it is recommended that an intensive water quality and biological condition monitoring program be conducted over a one-year period at this station and at eight selected additional stations, with four stations located on the main stem of the Root River and one station each located on the Root River Canal, Tess Corners Creek, Hoods Creek, and the West Branch Root River Canal. It is recommended that this program be conducted within the next five to seven years and repeated at approximately five- to seven-year intervals. These recommendations can be coordinated, and are consistent, with the Wisconsin Department of Natural Resources current surface water monitoring strategy developed to conduct monitoring activities and perform basic assessments for each watershed in the Region in an approximate five to seven year rotating cycle.

LAKES MANAGEMENT PLAN ELEMENT

The initial regional water quality management plan included recommendations for reducing nonpoint sources of pollution in the tributary areas of lakes and for consideration of other lake management measures, including in-lake measures such as aeration, nutrient inactivation, and fishery management programs. For major lakes, the initial plan recommended that comprehensive lake management plans be prepared to consider in more detail the applicability and preliminary design of watershed and in-lake management measures. The preparation of such a comprehensive plan requires supporting water quality and biological conditions monitoring programs to be established.

As noted above, there are no major lakes in the Root River watershed. However, there are smaller water bodies such as park-oriented ponds and small lakes in the watershed. It is recommended that water quality planning and supporting monitoring be conducted for smaller, lake-like water bodies in the watershed which are less than 50 acres in size which are deemed to be important for water quality protection. In such cases, the management techniques similar to those recommended to be applicable for consideration on the major lakes in the Region are considered applicable for management purposes.

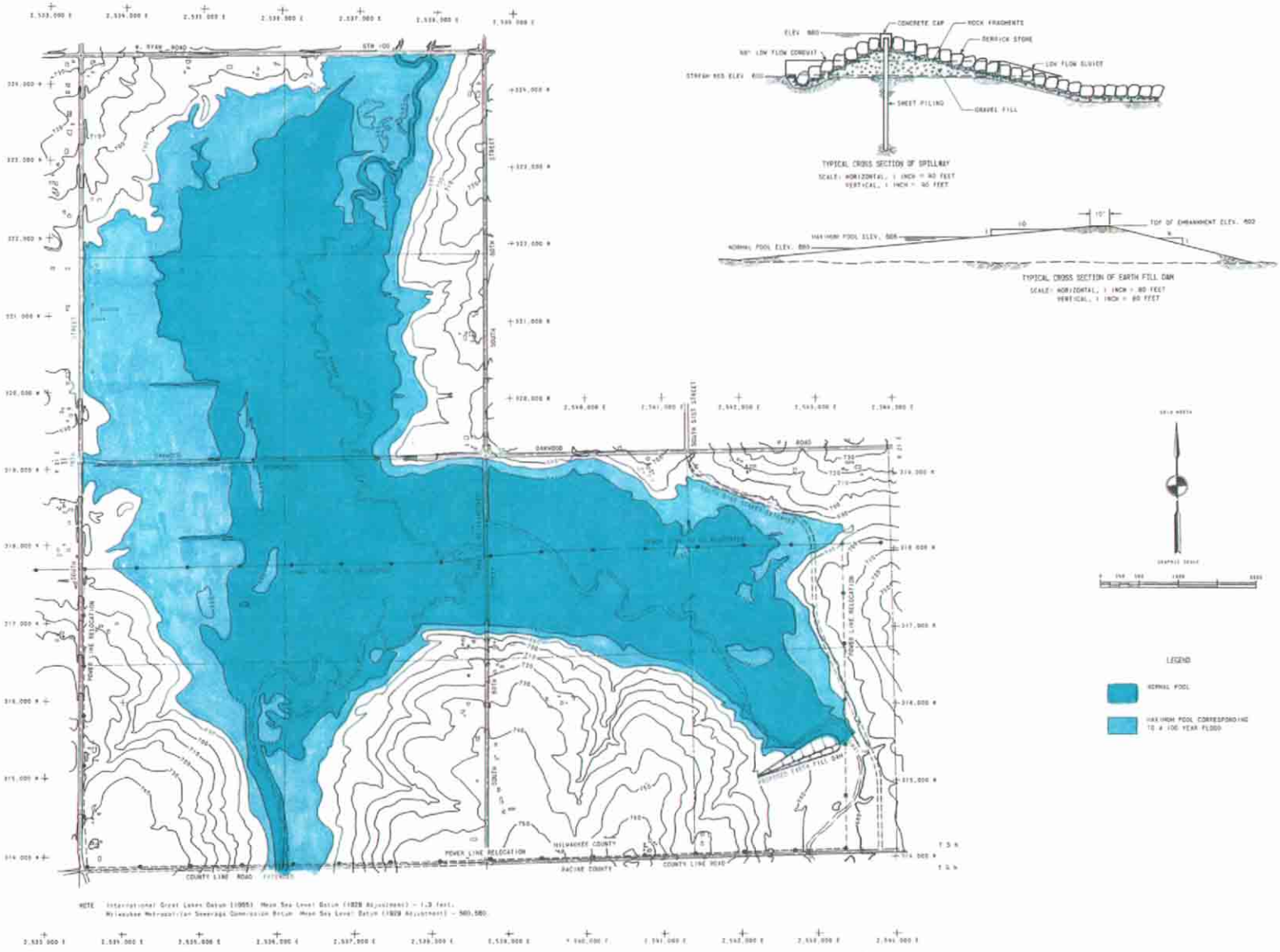
Oakwood Lake Considerations

The Commission's adopted comprehensive plan for the Root River watershed recommended the development of a permanent multipurpose reservoir near the confluence of the Root River and the North Branch of the Root River in the City of Franklin. Lowlands lying in this area form a natural reservoir during flood periods, the outflow of which is regulated by a narrow cross section of the Root River channel and floodplain near W. County Line Road. The recommended reservoir, which has been named Oakwood Lake, is shown on Map XIII-6. This lake would artificially increase the flood regulation effect of the natural reservoir and would provide a water body for recreation, conservation, and low-flow augmentation purposes.

As proposed in the adopted Root River watershed plan, the normal water surface area of the lake would be about 660 acres. It was proposed that about 400 acres

Map XIII-6

GENERAL PLAN OF OAKWOOD LAKE AS PROPOSED IN THE COMPREHENSIVE PLAN FOR THE ROOT RIVER WATERSHED



Source: SEWRPC.

of land underlying the lake be excavated to provide for such recreational pursuits as boating and fishing. The remaining 260 acres of lake area were envisioned to provide shallow water for fish and wildlife habitat. The normal water surface of the lake would be held between elevations of 679 feet and 680 feet above National Geodetic Vertical Datum by means of a low rock dam. Water stored between these elevations would be available for release for streamflow augmentation at a rate varying from three to five cubic feet per second (cfs), depending upon lake level. A flow of three cfs would result in a stream 24 feet wide and 6 inches deep flowing at a velocity of 0.25 foot per second. In the recreation portion of the proposed lake, a mean bottom elevation of 675 feet would be established to provide a mean water depth of four to five feet. As proposed in the plan, the lake would have a normal shoreline of about five miles. The plan envisioned that a portion of the shoreline would be developed for recreational use, with the remainder left in a natural state.

At the present time, there is no interest being expressed by Milwaukee County, the Wisconsin Department of Natural Resources, or other agencies to carry out this long-standing recommendation. This proposal has been reconsidered a number of times since the initial recommendations were made. The last such reconsideration was made as part of the stormwater drainage and flood control plan for the Milwaukee Metropolitan Sewerage District completed in 1990.[5] At that time, it was again found that the construction of the reservoir would result in no major flood damage-abatement benefits. It was noted, however, that the reservoir would provide recreational and water quality benefits and it was recommended that the development of Oakwood Lake continue to be pursued by State and local officials. Given this action, Oakwood Lake is recommended to remain a component of the regional water quality management plan.

WATER QUALITY AND BIOLOGICAL CONDITIONS

Streams

Stream water quality data available for use in preparing the initial regional water quality management plan were collected during the 1964 through 1965 Commission benchmark stream water quality study; the 1965 through 1975 Commission stream water quality monitoring effort; the 1976 Commission monitoring program conducted under the regional water quality management planning effort; and the U. S. Geological Survey and Wisconsin Department of Natural Resources sampling programs. Available data collected in those programs for the Root River watershed included samplings at six Commission stations, five of which were located on the main stem of the Root River and one on the West Branch of the Root River Canal downstream of its confluence with the East Branch Root River Canal; at one Department of Natural Resources station; and at three U. S. Geological Survey stations. The sampling station locations are shown on Map XIII-5.

Long-term post-1976 comparable water quality data have been collected at the current DNR sampling station Rt-6a on the Root River at Johnson Park in Racine

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[5]SEWRPC Community Assistance Planning Report No. 152, A Stormwater Drainage and Flood Control System Plan for the Milwaukee Metropolitan Sewerage District, December 1990.

County. The DNR has also collected water quality data on a short-term basis at 11 locations in the Root River watershed. Data collected at these sites in 1981 and 1982 were used, along with the long-term data previously noted, to characterize water quality conditions. These sites are shown on Map XIII-5. Biological condition data collected by the DNR in 1981 and 1990 were also available for use in the assessment of current water quality conditions. In addition to the data obtained since preparation of the initial plan, the assessment of current conditions relied in part upon the uniform areawide characterization of surface water conditions developed under the initial planning effort by simulation modeling. The modeling results developed under the initial plan included simulation of water quality conditions under various levels of point source and nonpoint source pollution control and under both the then current 1975 land use conditions and under planned year 2000 land use conditions. Review of these data can provide insight into the current water quality conditions and the current potential for achieving the established water use objectives in the Root River watershed.

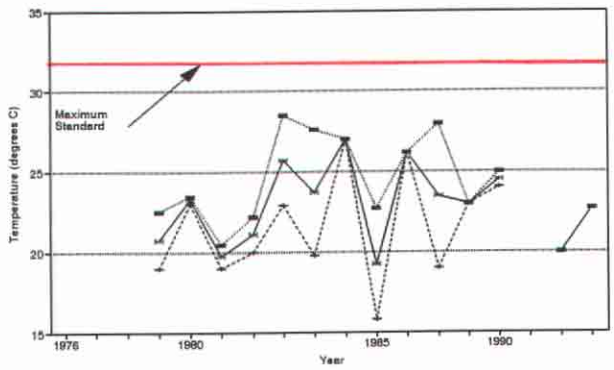
The long-term water quality data obtained at the Department of Natural Resources sampling station Rt-6a on the Root River at Johnson Park, for the period 1976 through 1993, are summarized in Figure XIII-1. The short-term data collected by the DNR in 1981 and 1982 are summarized in Figures XIII-1 through XIII-3 and in Table XIII-12. The water quality standards indicated in Figures XIII-1 through XIII-3 and in Table XIII-12 are those set forth for specific biological and recreational use objectives as described in Chapter II.

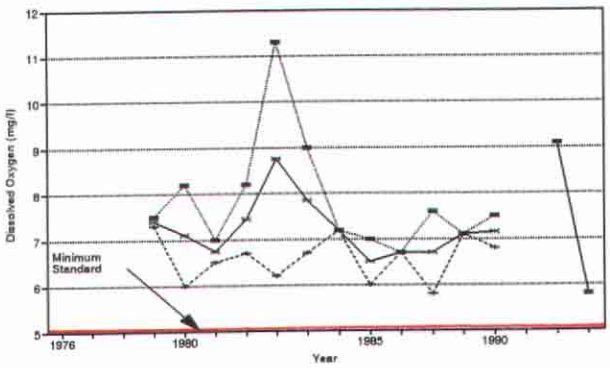
Review of those data for station Rt-6a indicate that the only change perceived from 1979 to 1993 is an improvement following 1981, as evidenced by lower total phosphorus levels and less variability in dissolved oxygen levels. This improvement may be attributed, in part, to the abandonment of several sewage treatment plants including the plants serving City of Muskego-Northeast District, Village of Hales Corners, the Rawson Homes Sewer and Water Trust, and Caddy Vista Sanitary District. Several private sewage treatment plants were also abandoned including those serving the Highway 100 Drive-In Theater, Union Oil Truck Stop, Highway 24 Outdoor Theater, and New Berlin Memorial Hospital. It should be noted that levels of total phosphorus, un-ionized ammonia and fecal coliform bacteria still exceed the standards associated with warmwater sport fish and full recreational water use objectives, as set forth in Chapter II. Temperature, dissolved oxygen, pH, and chloride levels remained variable with no apparent trends, but appear to meet the standards. The remaining water quality data collected on a short-term basis throughout the watershed illustrate that the phosphorus and fecal coliform standards are exceeded throughout the watershed.

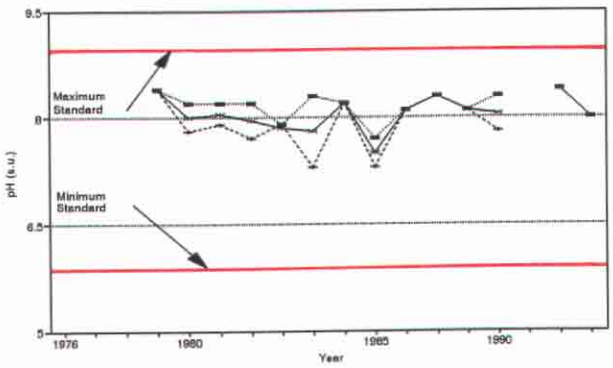
Biological condition monitoring conducted by the DNR in 1981 and 1990 as part of the Root River priority watershed project, indicated slight decreases in water quality in Hoods Creek, the East Branch Root river Canal, and portions of the Root River main stem. Slight water quality improvements were noted in Husher Creek and in the Root river Canal. Monitoring conducted on the remaining stream reaches in the watershed indicated no change in conditions.

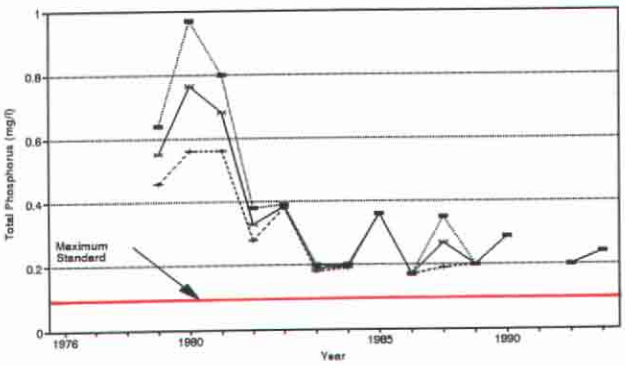
Toxic and Hazardous Substances: Sampling and analysis for pesticides, polychlorinated biphenyls (PCBs), and heavy metals were conducted by the Wisconsin Department of Natural Resources in the Root River watershed in 1973. The

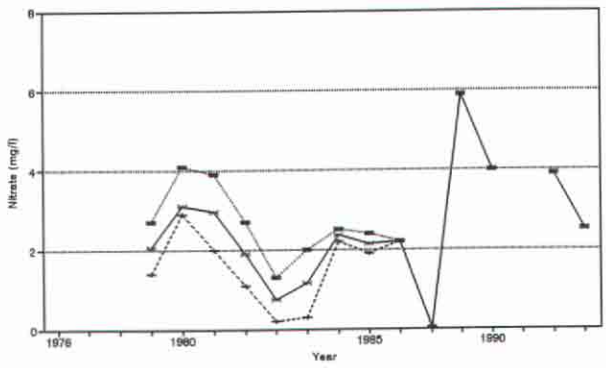
Figure XIII-1
WATER QUALITY DATA FOR THE ROOT RIVER
AT STATION Rt-6a: 1976-1993

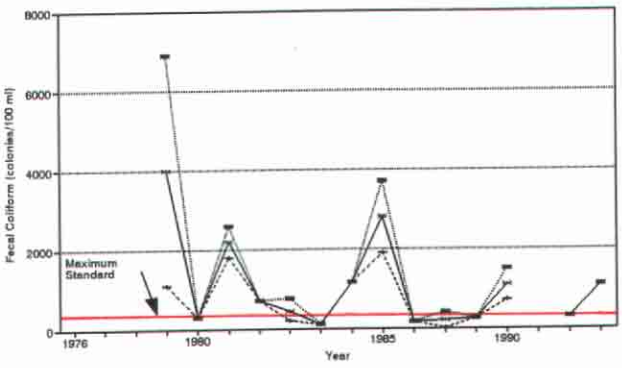


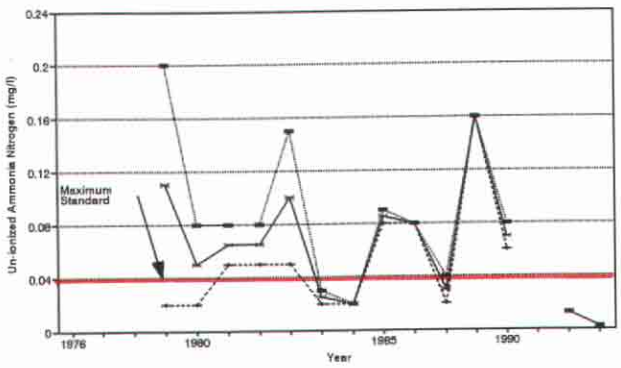


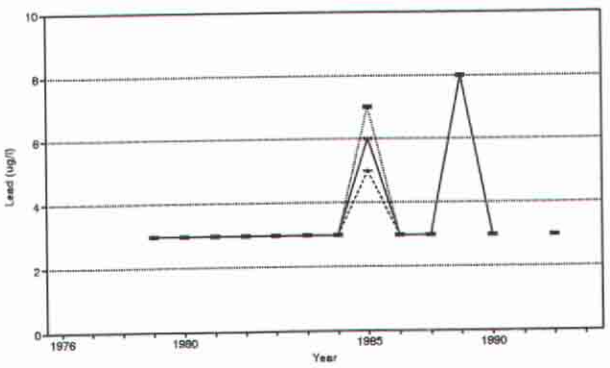






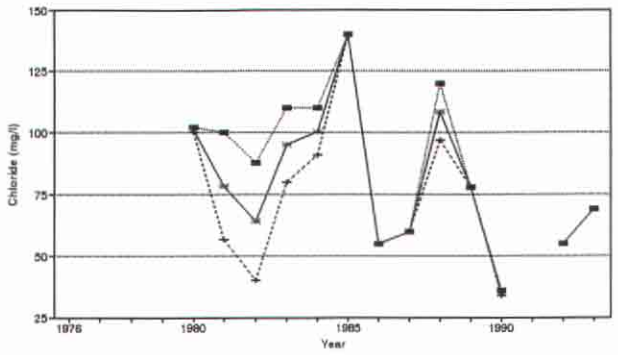






Note: The acute standard of 408.6 ug/l was not violated in any year.
The chronic standard of 24.4 ug/l was not violated in any year.

Figure XIII-1 (cont'd)



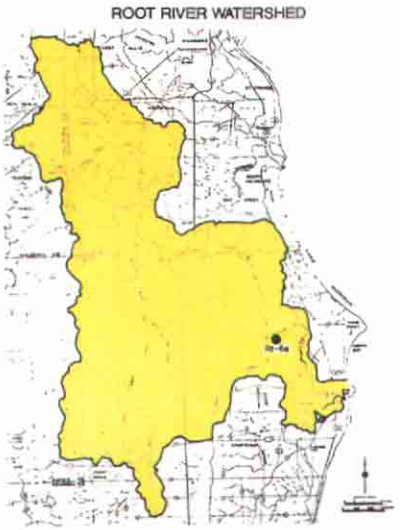
Note: The maximum standard of 1000 mg/l was not violated in any year.

LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

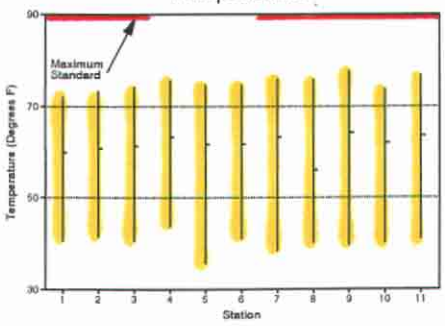


Source: Wisconsin Department of Natural Resources and SEWRPC.

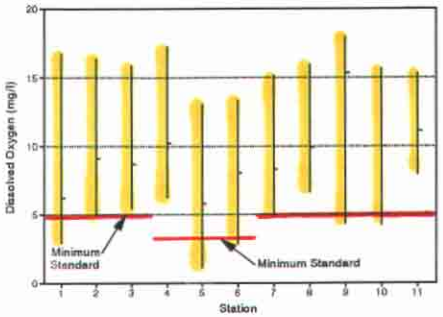
Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

Figure XIII-2
Root River Watershed Short-Term Water Quality Sampling Data: 1981

Temperature

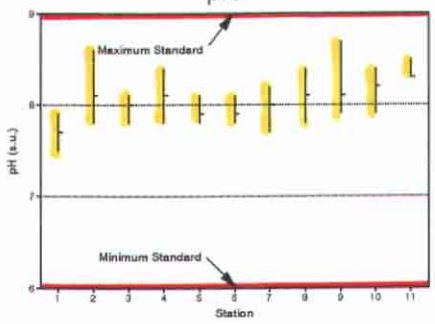


Dissolved Oxygen

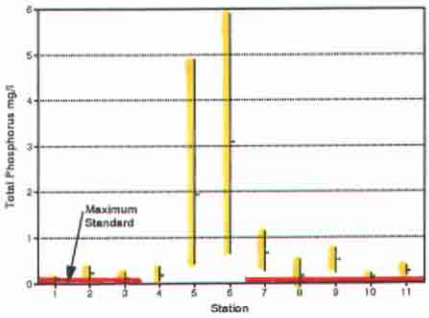


Note: No standard has been established for surface waters classified as limited forage fish communities.

pH

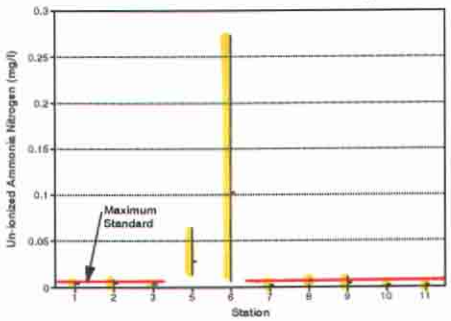


Total Phosphorus



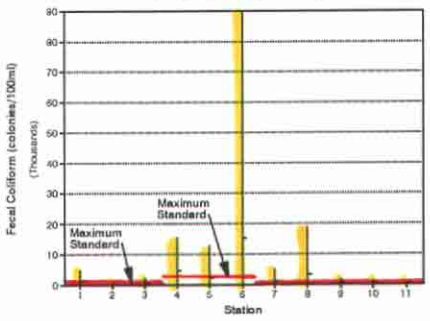
Note: No standard has been established for surface waters recommended for limited recreational uses.

Un-ionized Ammonia Nitrogen



Note: No standard has been established for surface waters classified as limited forage fish communities.

Fecal Coliform



Note: The maximum standard of 200/400 colonies per 100 ml was violated at stations 1-3 and 7-11 and the maximum standard of 1000/2000 colonies per 100 ml was violated at stations 4-6.

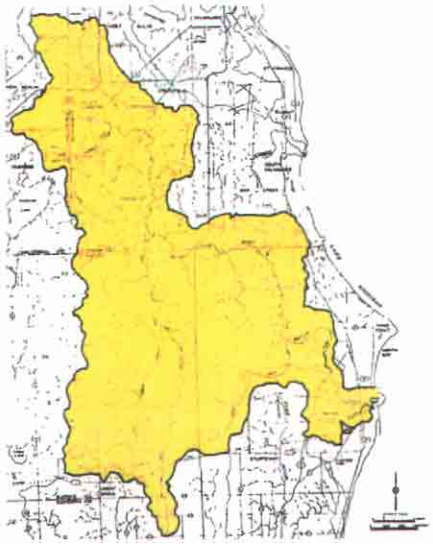
LEGEND

Maximum

Average

Minimum

ROOT RIVER WATERSHED

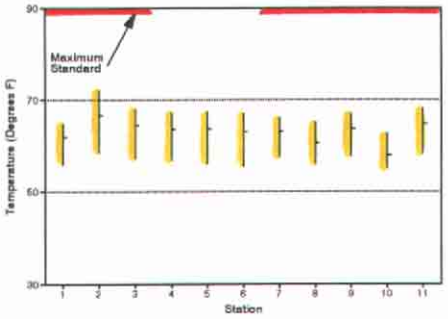


Standards indicated are those established for warmwater sport fish or warmwater forage fish and full recreational use objectives, with the exception of stations 4-6. Standards indicated for stations 4-6 are those established for limited forage fish and limited recreational use objectives. See Chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria. Refer to Table XIII-12 for summarized water quality data.

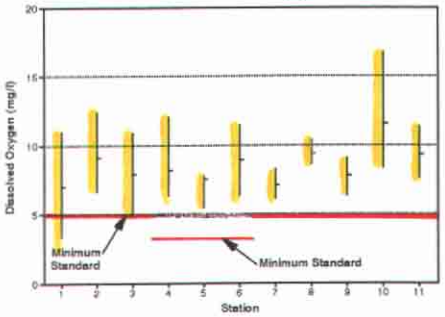
Source: Wisconsin Department of Natural Resources and SEWRPC.

Figure XIII-3
Root River Watershed Short-Term Water Quality Sampling Data: 1982

Temperature

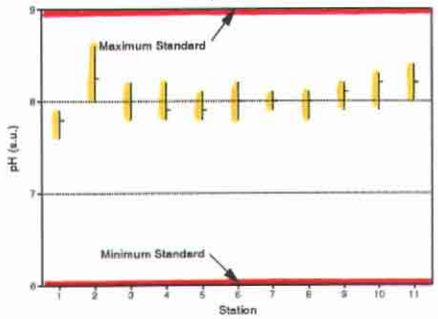


Dissolved Oxygen

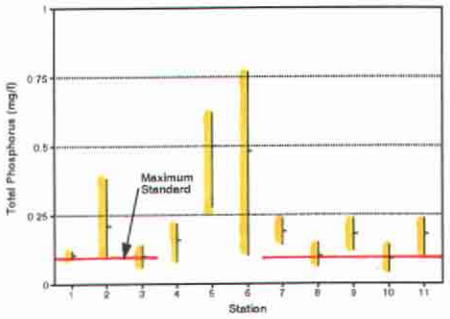


Note: No standard has been established for surface waters classified as limited forage fish communities.

pH

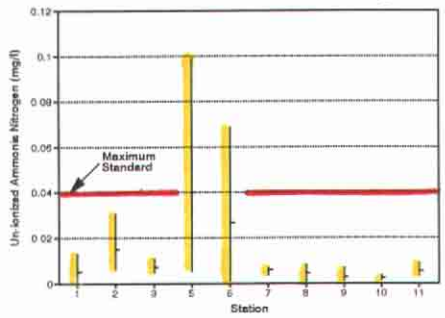


Total Phosphorus

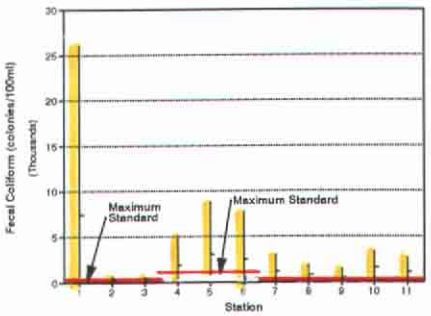


Note: No standard has been established for surface waters recommended for limited recreational uses.

Un-ionized Ammonia Nitrogen



Fecal Coliform



Note: No standard has been established for surface waters classified as limited forage fish communities.

Note: The maximum standard of 200/400 colonies per 100 ml was violated at stations 1-3 and 7-11 and the maximum standard of 1000/2000 colonies per 100 ml was violated at stations 4-6.

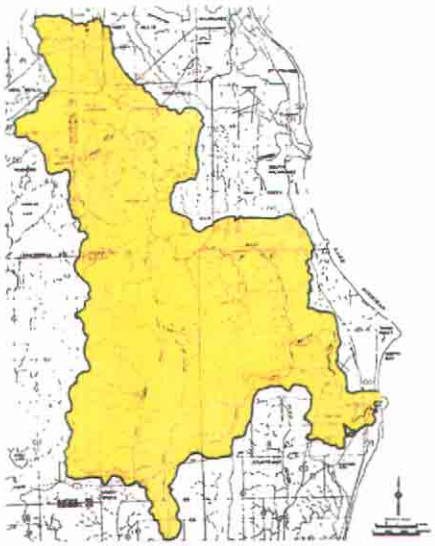
LEGEND

Maximum

Average

Minimum

ROOT RIVER WATERSHED



Standards indicated are those established for warmwater sport fish or warmwater forage fish and full recreational use objectives, with the exception of stations 4-6. Standards indicated for stations 4-6 are those established for limited forage fish and limited recreational use objectives. See Chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria. Refer to Table XII-12 for summarized water quality data.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table XIII-12

ROOT RIVER WATERSHED SHORT-TERM STREAM WATER QUALITY SAMPLING DATA: 1981-1982

Sampling Station Number[a]	Parameter (Units)	Applicable Standards[b]	Range	Violation of Accepted Standard	Sampling Dates	Total Number of Samples
1	Temperature (°F)	Maximum of 89.0	40.6 - 72.1 55.9 - 64.9	No No	July - November 1981 May 1982	12 4
	Dissolved Oxygen (mg/l)	Minimum of 5.0	2.9 - 16.8 3.3 - 11.0	Yes Yes	July - November 1981 May 1982	12 4
	pH (s.u.)	Maximum of 9.0 Minimum of 6.0	7.5 - 7.9 7.6 - 7.9	No No	July - November 1981 May 1982	12 4
	Total Phosphorus (mg/l)	Maximum of 0.1	0.04 - 0.16 0.09 - 0.12	Yes Yes	July - November 1981 May 1982	12 4
	Un-ionized Ammonia Nitrogen (mg/l)	Maximum of 0.04	.002 - .006 .001 - .013	No No	July - August 1981 May 1982	4 4
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	170 - 4600 580 - 26,000	Yes Yes	July - November 1981 May 1982	12 4
2	Temperature (°F)	Maximum of 89.0	41.1 - 73.4 58.6 - 72.0	No No	July - November 1981 May 1982	12 4
	Dissolved Oxygen (mg/l)	Minimum of 5.0	4.9 - 16.4 6.6 - 12.4	Yes No	July - November 1981 May 1982	12 4
	pH (s.u.)	Maximum of 9.0 Minimum of 6.0	7.8 - 8.6 8.0 - 8.6	No No	July - November 1981 May 1982	12 4
	Total Phosphorus (mg/l)	Maximum of 0.1	0.38 - 0.06 0.38 - 0.1	Yes No	July - November 1981 May 1982	12 4
	Un-ionized Ammonia Nitrogen (mg/l)	Maximum of 0.04	.002 - .008 .006 - .031	No No	July - November 1981 May 1982	5 4
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	10 - 630 20 - 750	Yes Yes	July - November 1981 May 1982	12 4
3	Temperature (°F)	Maximum of 89.0	40.6 - 74.3 14.0 - 20.0	No No	July - November 1981 May 1982	12 4
	Dissolved Oxygen (mg/l)	Minimum of 5.0	5.4 - 15.9 4.8 - 10.9	No Yes	July - November 1981 May 1982	12 4
	pH (s.u.)	Maximum of 9.0 Minimum of 6.0	7.8 - 8.1 7.8 - 8.2	No No	July - November 1981 May 1982	12 4
	Total Phosphorus (mg/l)	Maximum of 0.1	0.03 - 0.24 0.06 - 0.14	Yes Yes	July - November 1981 May 1982	12 4
	Un-ionized Ammonia Nitrogen (mg/l)	Maximum of 0.04	.002 - .005 .005 - .011	No No	July - August 1981 May 1982	4 3
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	30 - 2200 20 - 560	Yes Yes	July - November 1981 May 1982	11 4
4	Temperature (°F)	Maximum of 89.0	35.6 - 74.8 55.6 - 67.1	No No	July - November 1981 May 1982	12 4
	Dissolved Oxygen (mg/l)	Minimum of 5.0	2.8 - 13.4 6.3 - 11.5	Yes No	July - November 1981 May 1982	11 4
	pH (s.u.)	Maximum of 9.0 Minimum of 6.0	7.8 - 8.1 7.8 - 8.2	No No	July - November 1981 May 1982	12 4
	Total Phosphorus (mg/l)	Maximum of 0.1	0.62 - 5.9 0.1 - 0.77	Yes Yes	July - November 1981 May 1982	11 4

Table XIII-12 (continued)

Sampling Station Number[a]	Parameter (Units)	Applicable Standards[b]	Range	Violation of Accepted Standard	Sampling Dates	Total Number of Samples
4	Un-ionized Ammonia Nitrogen (mg/l)	Maximum of 0.04	.006 - .273 .001 - .069	Yes Yes	July - November 1981 May 1982	7 4
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	450 - 90,000 200 - 7800	Yes Yes	July - November 1981 May 1982	12 4
5	Temperature (°F)	--	43.6 - 75.7 56.7 - 67.3	-- --	July - November 1981 May 1982	12 4
	Dissolved Oxygen (mg/l)	Minimum of 3.0	6.2 - 17.3 6.3 - 12.1	No No	July - November 1981 May 1982	12 4
	pH (s.u.)	Maximum of 9.0 Minimum of 6.0	7.8 - 8.4 7.8 - 8.2	No No	July - November 1981 May 1982	12 4
	Total Phosphorus (mg/l)	--	0.06 - 0.37 0.08 - 0.22	-- --	July - November 1981 May 1982	12 4
	Fecal Coliform (colonies per 100 ml)	Maximum of 1000/2000	70 - 15,600 380 - 5100	-- --	July - November 1981 May 1982	12 4
6	Temperature (°F)	--	41.0 - 74.8 56.1 - 67.5	-- --	July - November 1981 May 1982	12 4
	Dissolved Oxygen (mg/l)	Minimum of 3.0	1.1 - 13.1 5.4 - 7.8	Yes No	July - November 1981 May 1982	12 4
	pH (s.u.)	Maximum of 9.0 Minimum of 6.0	7.8 - 8.1 7.8 - 8.1	No No	July - November 1981 May 1982	12 4
	Total Phosphorus (mg/l)	Maximum of 0.1	0.43 - 4.9 0.28 - 0.62	Yes Yes	July - November 1981 May 1982	12 4
	Un-ionized Ammonia Nitrogen (mg/l)	--	.013 - .065 .005 - .099	-- --	July - November 1981 May 1982	6 4
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	390 - 13,000 740 - 8800	Yes Yes	July - November 1981 May 1982	12 4
7	Temperature (°F)	Maximum of 89.0	38.3 - 76.1 57.6 - 66.2	No No	July - November 1981 May 1982	12 4
	Dissolved Oxygen (mg/l)	Minimum of 5.0	4.9 - 15.2 6.1 - 8.3	Yes No	July - November 1981 May 1982	12 4
	pH (s.u.)	Maximum of 9.0 Minimum of 6.0	7.7 - 8.2 7.9 - 8.1	No No	July - November 1981 May 1982	12 4
	Total Phosphorus (mg/l)	Maximum of 0.1	0.27 - 1.14 0.14 - 0.24	Yes Yes	July - November 1981 May 1982	12 4
	Un-ionized Ammonia Nitrogen (mg/l)	Maximum of 0.04	.0005 - .0036 .0035 - .007	No No	July - November 1981 May 1982	5 4
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	120 - 5200 30 - 3000	Yes Yes	July - November 1981 May 1982	12 4
8	Temperature (°F)	Maximum of 89.0	40.1 - 76.1 56.1 - 65.3	No No	July - November 1981 May 1982	12 4
	Dissolved Oxygen (mg/l)	Minimum of 5.0	6.6 - 16.0 8.6 - 10.4	No No	July - November 1981 May 1982	12 4
	pH (s.u.)	Maximum of 9.0 Minimum of 6.0	7.8 - 8.4 7.8 - 8.1	No No	July - November 1981 May 1982	12 4
	Total Phosphorus (mg/l)	Maximum of 0.1	0.05 - 0.53 0.06 - 0.15	Yes Yes	July - November 1981 May 1982	12 4

Table XIII-12 (continued)

Sampling Station Number[a]	Parameter (Units)	Applicable Standards[b]	Range	Violation of Accepted Standard	Sampling Dates	Total Number of Samples
8	Un-ionized Ammonia Nitrogen (mg/l)	Maximum of 0.04	.0005 - .0018 .0008 - .0086	No No	July - November 1981 May 1982	5 4
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	270 - 19,000 200 - 1900	Yes Yes	July - November 1981 May 1982	12 4
9	Temperature (°F)	Maximum of 89.0	39.6 - 77.9 57.7 - 67.1	No No	July - November 1981 May 1982	12 4
	Dissolved Oxygen (mg/l)	Minimum of 5.0	4.3 - 18.0 6.3 - 9.1	Yes No	July - November 1981 May 1982	12 4
	pH (s.u.)	Maximum of 9.0 Minimum of 6.0	7.9 - 8.7 7.9 - 8.2	No No	July - November 1981 May 1982	12 4
	Total Phosphorus (mg/l)	Maximum of 0.1	0.23 - 0.76 0.12 - 0.24	Yes Yes	July - November 1981 May 1982	12 4
	Un-ionized Ammonia Nitrogen (mg/l)	Maximum of 0.04	.0017 - .0108 .009 - .0073	No No	July - November 1981 May 1982	5 4
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	140 - 1700 20 - 1500	Yes Yes	July - November 1981 May 1982	12 4
10	Temperature (°F)	Maximum of 89.0	40.1 - 73.9 55.0 - 62.8	No No	July - November 1981 May 1982	12 4
	Dissolved Oxygen (mg/l)	Minimum of 5.0	4.2 - 15.7 8.3 - 16.8	Yes No	July - November 1981 May 1982	12 4
	pH (s.u.)	Maximum of 9.0 Minimum of 6.0	7.9 - 8.4 7.9 - 8.3	No No	July - November 1981 May 1982	12 4
	Total Phosphorus (mg/l)	Maximum of 0.1	0.06 - 0.22 0.04 - 0.14	Yes Yes	July - November 1981 May 1982	12 4
	Un-ionized Ammonia Nitrogen (mg/l)	Maximum of 0.04	.0014 - .0027 .0012 - .0037	No No	July - August 1981 May 1982	4 4
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	90 - 1300 90 - 3400	Yes Yes	July - August 1981 May 1982	12 4
11	Temperature (°F)	Maximum of 89.0	41.0 - 77.0 58.3 - 68.2	No No	July - August 1981 May 1982	12 4
	Dissolved Oxygen (mg/l)	Minimum of 5.0	7.9 - 15.3 7.6 - 11.4	No No	July - August 1981 May 1982	12 4
	pH (s.u.)	Maximum of 9.0 Minimum of 6.0	8.0 - 8.5 8.0 - 8.4	No No	July - August 1981 May 1982	12 4
	Total Phosphorus (mg/l)	Maximum of 0.1	0.17 - 0.39 0.1 - 0.24	Yes Yes	July - August 1981 May 1982	12 4
	Un-ionized Ammonia Nitrogen (mg/l)	Maximum of 0.04	.0008 - .0031 .009 - .0032	No No	August, November 1981 May 1982	2 4
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	20 - 790 220 - 2700	Yes Yes	July - November 1981 May 1982	12 4

[a] See Map XIII-5 for sampling station locations.

[b] Standards indicated for stations 1-3 and stations 7-11 are those established for warmwater sport fish and full recreational use objectives. Standards indicated for station 4 are those established for limited forage fish and full recreational use, while standards for stations 5 and 6 are those established for limited aqautic life and limited recreational use. See Chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria.

Source: Wisconsin Department of Natural Resources and SEWRPC.

analyses indicated that recommended level of heptachlor epoxide was exceeded in one of 11 samples. Sample analyses for cadmium, chromium, copper, lead, nickel, zinc, DDT, DDE, DDD, aldrin, heptachlor, lindane, dieldrin, methoxychlor, and phthalate uncovered no violations of U.S. Environmental Protection Agency (EPA) recommended levels.

Recent data for lead levels in the Root River watershed are shown in Figure XIII-1 and indicate that levels of lead did not exceed the chronic or acute toxicity levels. No current sampling results were available for additional metals in the Root River watershed. No sampling of bottom sediments was conducted on the Root River.

Since the completion of the initial regional water quality management plan, 47 spills of toxic substances into streams within the Root River watershed have been documented by the Wisconsin Department of Natural Resources. Of these spills, 46 have occurred in the main stem of the Root River, 32 in the City of Racine, eight in the Town of Caledonia, three in the City of Franklin, and one each in the City of West Allis, the City of Greenfield, and the Town of Mt. Pleasant. One toxic substance spill occurred in a tributary stream, in the West Branch of the Root River Canal in the Village of Union Grove. The majority of the substances that were spilled into surface waters were oil and related petroleum products.

Water Quality Assessments: Based upon recent available data, the water quality and biological characteristics of the Root River and its major tributaries were assessed, with the results set forth in Table XIII-13. Fish populations and diversity were poor throughout the watershed. One fish kill has been documented in the Root River watershed since the completion of the initial plan. This fish kill occurred in Hoods Creek due to an unknown cause.

Standards for fecal coliform were estimated to be exceeded in the majority of the streams in the Root River watershed. Total phosphorus concentrations exceeded the standards in the Root River upstream of County Line Road, downstream of Nicholson Road, and in Tess Corners Creek. Dissolved oxygen levels were estimated to be below the standards in the Root River Canals and portions of the Upper Root River main stem but were expected to meet standards in Tess Corners Creek and in the lower Root River main stem.

In general, the biotic index ratings, which are biological indicators of water quality within a stream system, were fair to poor throughout, with the exception of the East Branch Root River Canal which was very poor.

Table XIII-14 sets forth the water quality index classifications[6] used in the initial plan for 1964, 1974-75, and for 1989-1990 conditions for selected sampling stations in the watershed. The use of the index is discussed in Chapter II. As indicated in Table XIII-14, recent comparative water quality data were available from one station on the Root River main stem at Johnson Park, Rt-6a. This

[6] For a detailed description of the water quality index, see SEWRPC Technical Report No. 17, Water Quality of Lakes and Streams in Southeastern Wisconsin: 1964-1975, June 1978.

Table XIII-13

CHARACTERISTICS OF STREAMS REACHES IN THE ROOT RIVER WATERSHED

Stream Reach	Stream Length (miles)	Fish Population and Diversity[a]	Recorded Fish Kills	Water Quality Problems[b]					Biotic Index Rating[c]	Streambed Sedimentation	Physical Modifications to Channel[d]
				DO	NH_3	Total P	Fecal Coliform	Toxics			
Root River upstream Grange Avenue	4.8	Poor	No	Yes	No	Yes	Yes	- -	Fairly poor	- -	- -
Root River downstream Grange Avenue to Ryan Road	9.8	Poor	No	No	No	Yes	Yes	- -	Fair	- -	- -
Root River downstream Ryan Road to County Line Road	3.4	Poor	No	Yes	No	Yes	Yes	- -	Fairly poor	- -	- -
Root River downstream County Line Road to Nicholson Road	5.7	Poor	No	Yes	No	No	No	- -	Fairly poor	- -	- -
Root River downstream Nicholson Road to STH 38	12.5	Poor	No	No	Yes	Yes	Yes	- -	Fairly poor	- -	- -
Root River downstream STH 38	6.0	Poor	No	No	No	Yes	Yes	- -	Fairly poor	- -	- -
West Branch Root River Canal	13.5	Poor	No	Yes	No	- -	Yes	- -	Fairly poor	- -	- -
Root River Canal	4.9	Poor	No	Yes	No	- -	Yes	- -	Fairly poor	- -	- -
East Branch Root River Canal	11.6	Poor	No	Yes	No	- -	Yes	- -	Very poor	- -	- -
Tess Corners/Whitnall Park Creek	9.9	Poor	No	No	No	Yes	Yes	- -	Fair	- -	- -
Husher Creek	3.4	Poor	No	Yes	No	No	No	- -	Fair	- -	- -
Hoods Creek	8.6	Poor	Yes[e]	Yes	No	No	Yes	- -	Fairly poor	- -	- -
TOTAL	94.8										

[a] Based upon professional judgment of area fish managers.

[b] The most recent water quality data available as described in Figure XIII-1 were used to evaluate water quality in the Root River system. Reported violations of the water quality standards set forth in Chapter II were indicated as water quality problems. In cases where no updated water quality data were available, simulation modeling analyses data developed in the initial plan were used to estimate current water quality for Root River stream reaches based upon year 2000 land use conditions and current level of pollution control

[c] Biotic Index ratings are based upon the Hilsenhoff Biotic Index (HBI) discussed in Wisconsin Department of Natural Resources Technical Bulletin No. 132, "Using a Biotic Index to Evaluate Water Quality in Streams," Hilsenhoff, 1982. Biotic index ratings are from sampling conducted in 1990. Sampling was also conducted in the watershed in 1987.

[d] Physical modifications to the channel were defined as: major if 50 percent or more of the stream reach was modified by structural measures or was deepened and straightened; moderate if 25 to 50 percent of the stream reach was modified; and low if up to 25 percent of the reach was modified.

[e] Unknown cause.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table XIII-14

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATIONS OF THE ROOT RIVER WATERSHED 1964, 1974-1975, AND 1990

Water Quality Sampling Stations[a]	July, August, September, and October of 1964	August of the Years 1974-1975	July and August of 1989-1990
Main Stem Stations			
Rt-1	Fair	Poor	- -
Rt-2	Poor	Poor	- -
Rt-4	Fair	Fair	- -
Rt-5	Fair	Poor	- -
Rt-6	Fair	Fair	Good
Tributary Station			
Rt-3	Poor	Poor	- -
Watershed Average	Fair	Fair	- -

[a] See Map XIII-5 for sampling station locations.

Source: SEWRPC.

station and additional locations where water quality data were collected by the Wisconsin Department of Natural Resources are shown on Map XIII-5. The data obtained for the DNR sampling station Rt-6a were used for comparative purposes in conjunction with earlier data from Station Rt-6 located on the Root River at Nicholson Road. The limited data available indicate that water quality conditions improved from "fair" in 1964 and 1974 through 1975 to "good" in 1989 and 1990 at station Rt-6.

A summary of potential pollution sources in the Root River watershed by stream reach is shown in tabular summary in Table XIII-15. Review of the data indicate the majority of the conversion of lands from rural to urban uses has occurred in the area tributary to the Root River main stem in Milwaukee County. It should be noted that the majority of the documented spills of toxic substances and the majority of the permitted industrial discharges have occurred in the Root River main stem in and around the City of Racine. Data on nonpoint source pollution, public and private sewage treatment plants discharging to surface waters, and additional potential impacts to surface water quality are included in Table XIII-15.

Compliance with Water Use Objectives

As indicated in Chapter II, the majority of the stream reaches in the Root River watershed as of 1993, are generally recommended for warmwater sport fish or warmwater forage fish and full recreational uses. These water use objectives and the associated water quality standards are discussed in Chapter II. Tess Corners Creek and Hoods Creek have limitations for sport fish habitat and are recommended for warmwater forage fish and full recreational uses. The Root River Canal, the East Branch Root River Canal downstream of STH 20, and the West Branch of the Root River Canal downstream of CTH C have further limitations for warmwater sport or forage fish and recreational utilities and are therefore recommended for limited forage fish and limited recreational uses. The West Branch of the Root River Canal upstream of CTH C and the East Branch Root River Canal upstream of STH 20 are recommended for limited aquatic life and limited recreational uses.

Based upon the available data for sampling stations in the watershed, the main stem of the Root River and the Root River Canal did not meet the water quality standards associated with the recommended water use objectives during and prior to 1975, the base year of the initial plan. Based upon a review of the data summarized in Figures XIII-1 through XIII-3 and in Table XIII-12, and upon review of the water quality sampling and water quality simulation data developed in the initial plan and the status of plan implementation, it is likely that violations of the fecal coliform and phosphorus standards occur along the majority of the main stem of the Root River and the recommended water use objectives continue to be only partially met in the majority of the major streams in the watershed.

There are currently two stream reaches for which the water use objectives set forth herein are higher than the objectives set forth in Chapter NR 104 of the Wisconsin Administrative Code. These include Tess Corners Creek and Hoods Creek. Chapter NR 104 classifies both streams as capable of supporting limited forage fish communities, while the objectives set forth herein recommend warmwater forage fish objectives for both streams. It is recommended that stream appraisals to further assess the potential for higher use objectives be conducted for

Table XIII-15

SUMMARY OF POTENTIAL SURFACE WATER POLLUTION SOURCES IN THE ROOT RIVER WATERSHED: 1990

Stream Reach[a]	Extent of Conversion of Lands from Rural to Urban[b]		Documented Toxic Spills 1976-1990	Remaining Potential Surface Water Pollution Sources							Ongoing Pollution Abatement Efforts[c]
	Historical 1976-1990	Expected 1990-2010		Urban Nonpoint Source Pollution	Rural Nonpoint Source Pollution	Public Sewage Treatment Plants	Private Sewage Treatment Plants	Number of Permitted Industrial Discharges	Other Known Potential Impacts to Surface Water Quality	Comments	
Root River u/s Grange Avenue	Moderate[d]	Insignificant[a]	1987-cloudy substance	X	X	- -	- -	2		New Berlin Memorial Hospital private sewage treatment plant abandoned in 1984	1, 2
Root River d/s Grange Avenue to Ryan Road	Moderate	Major	1986-cleaning fluid 1990-antifreeze 1990-fuel oil 1991-gasoline	X	X	- -	- -	5	Fadrowski Drum Disposal site[e]	Rawson Homes Sewer and Water Trust public sewage treatment plant abandoned in 1977 Union Oil Truck Stop private sewage treatment plant abandoned	1, 2
Root River d/s Ryan Road to County Line Road	Insignificant	Significant	- -	- -	X	- -	- -	0			1, 2
Root River d/s County Line Road to Nicholson Rd	Insignificant	Moderate	1982-heavy oil 1992-Baby Fresh lotion	X	X	- -	- -	3			1, 2
Root River d/s Nicholson Road to STH 38	Insignificant	Significant	1984-waste oil 1986-diesel fuel 1987-petroleum 1987-waste oil 1987-waste oil 1987-unknown 1990-gasoline	X	X	- -	- -	3	Hunt's Disposal landfill site[e]	Caddy Vista Sanitary District public sewage treatment plant abandoned in 1982	2
Root River d/s STH 38	Insignificant[d]	Insignificant[d]	1983-diesel fuel 1983-diesel fuel 1983-oil 1983-machine oil 1983-unknown 1983-oil 1983-gasoline 1983-oil 1983-oil 1984-oil 1984-waste oil 1984-oil 1984-oil-like substance 1984-cooking grease 1984-cooking grease 1986-hydraulic oil 1986-gasoline	X	X	- -	- -	7			2

Table XIII-15 (continued)

Stream Reach[a]	Extent of Conversion of Lands from Rural to Urban[b]		Documented Toxic Spills 1976-1990	Remaining Potential Surface Water Pollution Sources							Ongoing Pollution Abatement Efforts[c]
	Historical 1976-1990	Expected 1990-2010		Urban Nonpoint Source Pollution	Rural Nonpoint Source Pollution	Public Sewage Treatment Plants	Private Sewage Treatment Plants	Number of Permitted Industrial Discharges	Other Known Potential Impacts to Surface Water Quality	Comments	
Root River d/s STH 38 (continued()			1986-diesel fuel 1986-hydraulic fluid 1986-diesel oil 1986-acid 1986-cooking grease 1986-hydraulic oil 1987-light oil 1988-acid 1988-petroleum 1988-brown slime substance 1988-oil 1989'diesel fuel 1990-petroleum product 1990-pertroleum product 1990-white oily substance on water								
West Branch Root River Canal	Insignificant	Insignificant	1984-fuel oil	X	X	1	2	0			2, 3
Root River Canal	Insignificant	Insignificant	- -	- -	X	- -	- -	1			2
East Branch Root River Canal	Insignificant	Insignificant	- -	- -	X	- -	1	1			2
Tess Corners/ Whitnall Park Creek	Moderate	Significant	- -	X	X	- -	- -	1		Village of Hales Corners public sewage treatment plan abandoned in 1981 City of Muskego-Northeast District public sewage tretment plant abandoned in 1985	1, 2
Husher Creek	Insignificant	Insignificant	- -	- -	X	- -	- -	0			2
Hoods Creek	Insignificant	Significant	- -	X	X	1	- -	0		The Fremont Company private sewage treatment plant abandoned in 1985	2

[a]Includes the tributary drainage area of each stream reach.

[b]Extent of urban land conversions were determined as a percentage of the watershed as follows:

major	> 20%
moderate	10 - 20%
significant	5 - 10%
insignificant	0 - 5%

[c]Number codes refer to the following ongoing pollution abatement efforts:

1. Construction Erosion Control Ordinances in place
2. Rural Nonpoint Source Controls Implemented
3. Abandonment of Private Sewage Treatment Plant Underway

[d]Considerable urban development existing pre-1976.

[e]Superfund site

Source: Wisconsin Department of Natural Resources and SEWRPC.

both streams as part of the next one-year monitoring period envisioned to be carried out in the Root River watershed.

WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

Based upon the current status of plan implementation, current land use planning, local nonpoint source pollution abatement and sewerage system planning, there are three major issues which remain to be addressed in the Root River watershed. The first issue relates to the implementation of the findings and recommendations of the sanitary sewerage and water supply system plan for the greater Racine area. The second issue relates to the degree of nonpoint source pollution abatement still required in the watershed. The third issue relates to potential changes to the plan based upon recommendations set forth in the ongoing Milwaukee Metropolitan Sewerage District facility plan updating. In addition, it is also recommended that the Wisconsin Department of Natural Resources conduct a water quality and biological conditions survey on Hoods Creek and Tess Corners and to re-assess the water use objectives currently set forth in the Wisconsin Administrative Code.

Sanitary Sewerage and Water Supply System Plan Implementation

The only major issue remaining to be resolved with regard to point sources of pollution deals with the implementation of the findings and recommendations set forth in the system level plan documented in the report prepared by Alvord, Burdick & Howson and Applied Technologies, Inc. entitle, A Coordinated Sanitary Sewerage and Water Supply System Plan, Greater Racine Area, Wisconsin, September 1992. The recommendations of that plan include revisions to the planned sewer service areas in the greater Racine area and provisions to abandon the existing sewage treatment plant operated by the Town of Yorkville Utility District No. 1, with the area served by that plant being connected to the City of Racine system for treatment plant purposes. As of December 1994, the intergovernmental agreements needed to proceed with an amendment of the regional water quality management plan to incorporate the findings of the 1992 system plan had not been forthcoming. An amendment to the plan continues to be needed in this regard.

Reassessment of the Future Levels of Nonpoint Source Controls in the Entire Root River Watershed

The nonpoint source priority watershed program implementation period has now been completed for the Root River watershed. Following completion of detailed water quality and biological condition monitoring in the Root River watershed under the DNR ongoing monitoring program, it is recommended that the need for further nonpoint source controls be assessed based upon the current level of plan implementation and water quality and biological conditions data.

Milwaukee Metropolitan Sewerage District Facility Plan Update

A future amendment to the regional plan for the Root River watershed may potentially be developed under the facility plan update initiated by the Milwaukee Metropolitan Sewerage District in 1995. That plan update is anticipated to constitute an amendment to the regional plan once it is adopted by all of the agencies involved.

Stream Reclassification Evaluation

Hoods Creek and Tess Corners Creek are currently included under the limited forage fish classifications in Chapter NR 104 of the Wisconsin Administrative Code. However, it is recommended that the objectives for these streams be upgraded to provide for forage fish classification. It is recommended that the Wisconsin Department of Natural Resources include further stream appraisals for Hoods Creek and Tess Corners Creek as part of the monitoring program during the next period when the Department is conducting monitoring efforts in the Root River watershed as is envisioned within the next five to seven years.

Chapter XIV

SAUK CREEK WATERSHED--REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

INTRODUCTION

This chapter presents a description of the recommendations contained in the initial regional water quality management plan and amendments thereto and progress made toward plan implementation from 1975--the base year of the initial plan--through 1990--the base year of the plan update.

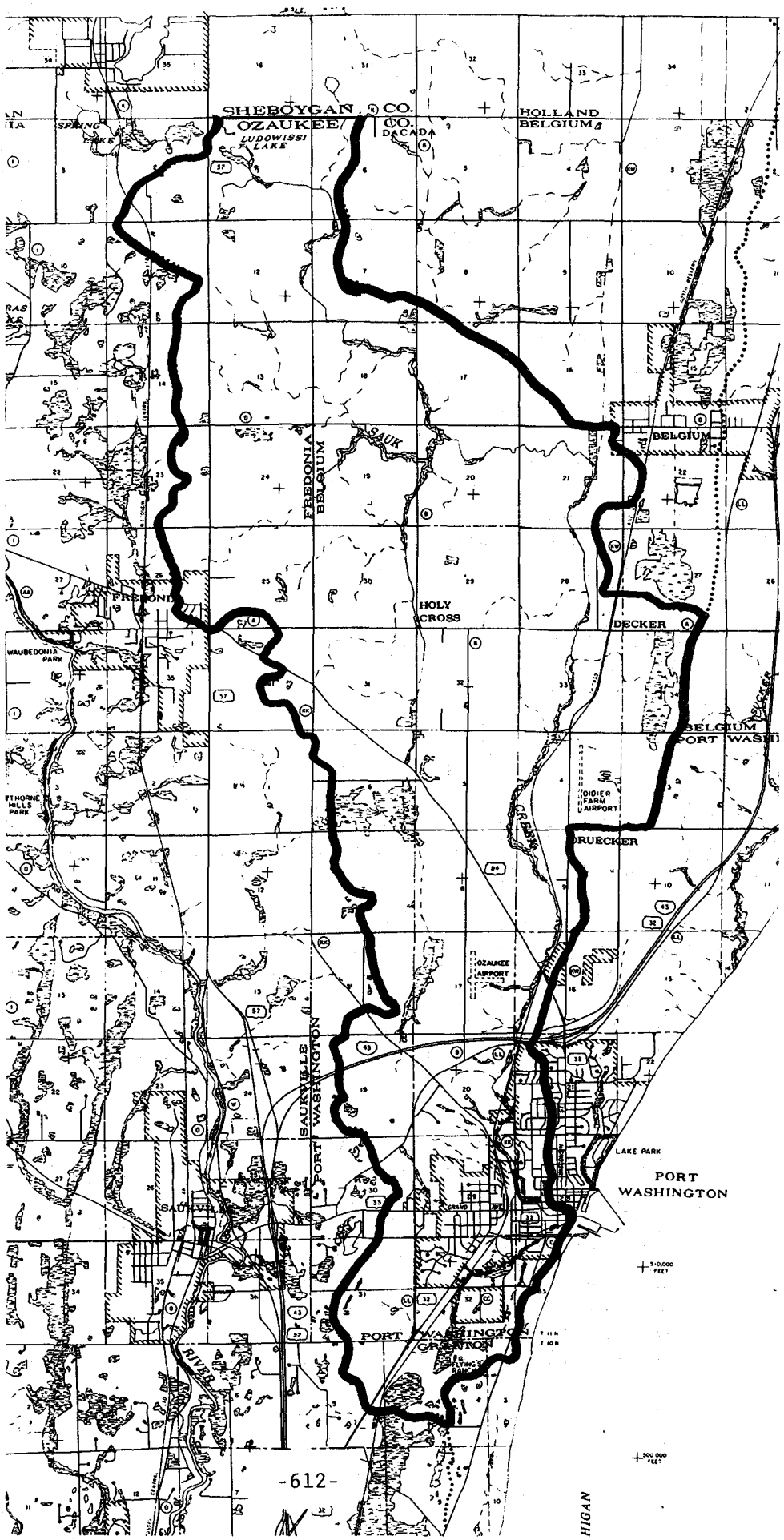
In addition, this chapter presents information on water quality and biological conditions in the surface water system of the Sauk Creek watershed through 1993, where available. Finally, this chapter presents a description of the substantive water quality management issues that remain to be addressed in the Sauk Creek watershed as part of the continuing water quality planning process. The status of the initial plan and the current plan recommendations are presented in separate sections for the land use plan element, the point source pollution abatement and sludge management plan elements, the nonpoint source pollution abatement plan element, and the water quality monitoring plan elements. In addition, a separate section on lake management is included which is limited to the Sauk Creek watershed as there are no major lakes located on the watershed. Designated management agency responsibilities for plan implementation are presented in Chapter XVII on a regional basis.

The Sauk Creek watershed is located in the northeast portion of the Region and all but 0.9 square mile of the approximately 34 square mile area of the watershed lies within the Region. The main stem of the Sauk Creek rises in Ozaukee County, and flows southeasterly for approximately 18.8 miles and discharges into Lake Michigan in the City of Port Washington in Ozaukee County. Rivers and streams in the watershed are part of the Lake Michigan drainage system as the watershed lies east of the subcontinental divide. The boundaries of the basin, together with the locations of the main channels of the Sauk Creek and its principal tributaries, are shown on Map XIV-1. The Sauk Creek watershed contains no lakes with a surface area of 50 acres or more.

LAND USE PLAN ELEMENT

The land use plan element of the initial plan, the status of the initial plan recommendations, as well as the new year 2010 plan, were described in Chapter III of this report on a regional basis. This section, more specifically, describes the changes in land use which have occurred within the Sauk Creek watershed since 1975, the base year of the initial regional water quality management plan, as well as the planned changes in land use in the watershed to the year 2010. The data are presented for the watershed in order to permit

Map XIV-1
SAUK CREEK WATERSHED



consideration of the relationship of the changes in land use to the other plan elements and to water quality conditions within the watershed. The conversion of land from rural to urban lake uses has the potential to impact on water quality as a result of increased point and nonpoint source loadings to surface waters. The amount of wastewater generated by industrial and municipal point sources of pollution discharged to surface waters will also increase as areas are converted into urban uses. In addition, the amount of stormwater runoff is expected to increase due to an increase in impervious surfaces. The amounts of certain nonpoint source pollutants in stormwater, such as metals and chlorides, can also be expected to increase with urbanization.

Table XIV-1 summarizes the existing land uses in the Sauk Creek watershed in 1990 and indicates the changes in such land uses since 1975--the base year of the initial regional water quality management plan. The watershed contains a limited amount of urbanized areas, 90 percent of the watershed was still in rural and other open space land uses in 1990. These rural uses included about 81 percent of the total area of the watershed in agricultural and related rural uses, about 2 percent in woodlands, about 5 percent in surface water and wetlands, and about 2 percent in other open lands. The remaining 10 percent of the total watershed was devoted to urban uses. Existing land uses within the watershed are shown on Map XIV-2.

Within the Sauk Creek watershed, urban development has occurred in the Village of Fredonia and in and around the City of Port Washington.

As shown in Table XIV-1, from 1975 to 1990, urban land uses in the watershed increased from 1,934 acres, or about 3.0 square miles, to 2,195 acres, or about 3.4 square miles, or by about 14 percent. As shown in Table XIV-1, residential land use has increased within the watershed, from 665 acres or about 1.0 square miles in 1975 to 798 acres, or about 1.3 square miles in 1990, a 20 percent increase. Commercial and industrial lands increased from 113 acres to 140 acres, or about 0.2 square miles, an increase of about 24 percent.

The 2,195 acres, or about 3.4 square miles of urban land uses in the watershed as of 1990 can be compared to the staged 1990 planned level of about 2,365 acres envisioned in the adopted year 2000 land use plan. The current status of development in the Sauk Creek watershed and in adjacent portions of Ozaukee County was considered in developing the new year 2010 land use plan element described in Chapter III for the Region as a whole.

Table XIV-2 summarizes the year 2010 planned land use conditions set forth in the adopted year 2010 land use plan in the Sauk Creek watershed and compares the recommended land use conditions to the 1990 conditions. Under planned land use conditions, as described in Chapter III, urban uses are expected to increase in and adjacent to the City of Port Washington, north and east of the Village of Fredonia, and south and west of the Village of Belgium.

In order to meet the needs of the expected resident population and employment envisioned under the intermediate growth-centralized land use plan future conditions, the amount of land devoted to urban use within the Sauk Creek watershed, as indicated in Table XIV-2, is projected to increase from the 1990 total of about 3.4 square miles, or about 10 percent of the total area of the watershed, to about 3.8 square miles, or about 11 percent of the total area of

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Table XIV-1

LAND USE IN THE SAUK CREEK WATERSHED: 1975 and 1990[a]

Land Use Category	1975		1990		Change 1975-1990	
	Acres	Percent	Acres	Percent	Acres	Percent
Urban						
Residential	665	3.0	798	3.6	133	20.0
Commercial	31	0.1	46	0.2	15	48.4
Industrial	82	0.4	94	0.4	12	14.6
Transportation, Communication, and Utilities[b]	1,016	4.6	1,096	4.9	80	7.9
Governmental and Institutional	97	0.4	129	0.6	32	33.0
Recreational	43	0.2	32	0.1	- 11	- 25.6
Subtotal	1,934	8.7	2,195	9.8	261	13.5
Rural						
Agricultural and Related	18,252	82.4	18,004	81.3	- 248	- 1.4
Lakes, Rivers, Streams and Wetlands	1,088	4.9	1,061	4.8	- 27	- 8.4
Woodlands[c]	393	1.8	409	1.9	16	4.1
Open Lands, Landfills, Dumps, and Extractive	477	2.2	475	2.2	- 2	- 0.4
Subtotal	20,210	91.3	19,949	90.2	- 261	- 1.3
Total	22,144	100.0	22,144	100.0	0	--

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban lands.

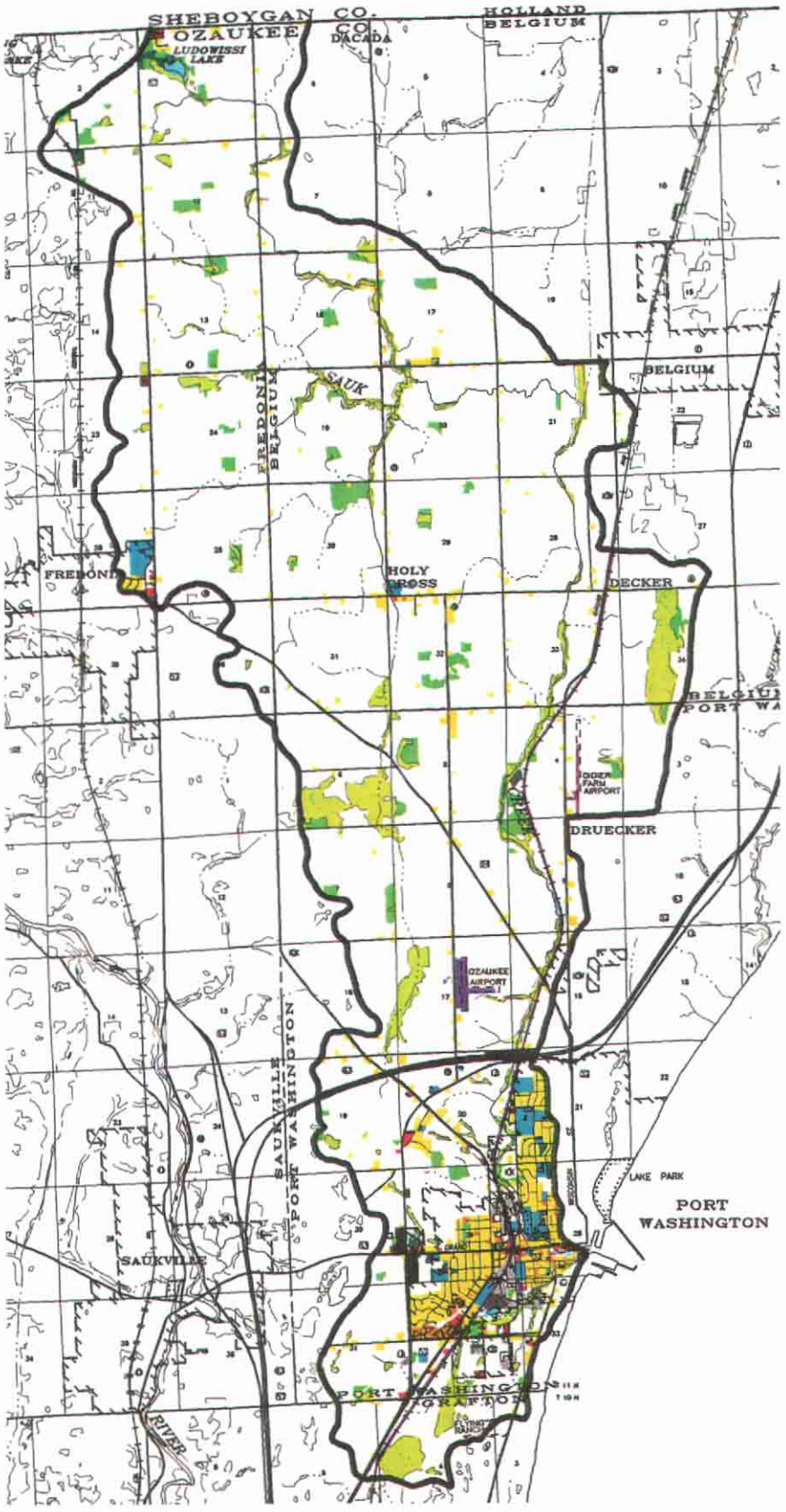
Source: SEWRPC.

MAP XIV–2

LAND USES IN THE SAUK CREEK WATERSHED: 1990

–LEGEND–

- SINGLE–FAMILY RESIDENTIAL
- MULTI–FAMILY RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- STREET AND HIGHWAYS
- PARKING
- OTHER TRANSPORTATION COMMUNICATION AND UTILITIES
- GOVERNMENTAL AND INSTITUTIONAL
- RECREATIONAL
- SURFACE WATER
- WETLANDS
- WOODLANDS
- EXTRACTIVE
- LANDFILL
- AGRICULTURAL AND OTHER OPEN LANDS



0 1 2

GRAPHIC SCALE IN MILES

The Sauk Creek watershed is about 35 square miles in areal extent, or about 1 percent of the total Region. In 1990, about 3 square miles, or about 10 percent of the watershed, was in urban land uses.

Source: SEWRPC.

Table XIV-2

EXISTING AND PLANNED LAND USE IN THE SAUK CREEK WATERSHED: ACTUAL 1990 AND PLANNED 2010[a]

Land Use Category	Existing 1990		Year 2010 Intermediate Growth - Centralized Land Use				Year 2010 High Growth - Decentralized Land Use			
			2010		Change 1990-2010		2010		Change 1990-2010	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Urban										
Residential	798	3.6	971	4.4	173	21.7	1,562	7.1	764	95.7
Commercial	46	0.2	40	0.2	6	13.0	46	0.2	0	0.0
Industrial	94	0.4	160	0.7	66	70.0	205	0.9	111	118.1
Transportation, Communication, and Utilities[b]	1,096	4.9	1,120	5.1	24	2.2	1,338	6.1	242	22.1
Governmental and Institutional	129	0.6	109	0.5	20	15.5	129	0.6	0	0.0
Recreational	32	0.1	54	0.2	22	68.8	97	0.4	65	203.1
Subtotal	2,195	9.8	2,454	11.1	359	11.8	3,377	15.3	1,182	53.8
Rural										
Agricultural and Related	11,004	81.3	17,830	80.5	- 174	- 1.0	16,955	76.6	- 1,049	- 5.8
Lakes, Rivers, Streams, and Wetlands	1,061	4.8	1,042	4.7	- 19	- 1.8	1,042	4.7	- 19	- 1.8
Woodlands	409	1.9	386	1.7	- 23	- 5.6	386	1.7	- 23	- 4.9
Open Lands[c]	475	2.2	432	2.0	- 43	- 9.1	384	1.7	- 91	- 19.2
Subtotal	19,949	90.2	19,690	88.9	- 259	- 1.3	18,767	84.7	- 1,182	- 5.9
Total	22,144	100.0	22,144	100.0	0	- -	22,144	100.0	0	- -

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both urban and rural open lands.

Source: SEWRPC.

the watershed, by year 2010. Under the high growth-decentralized land use plan future scenario, the land devoted to urban uses is projected to increase to about 5.3 square miles, or about 15 percent of the total watershed by year 2010. It is important to note that the 85 to 89 percent of the watershed remaining in rural uses is partly comprised of primary environmental corridor lands consisting of the best remaining natural resource features, and as recommended in the year 2010 regional land use plan, and is proposed to be preserved, largely in open space uses through joint State-local zoning or public acquisition. In addition, certain other lands classified as wetlands and floodplains outside the primary environmental corridors are, in some cases, precluded from being developed by State and Federal regulations. Thus, the demand for urban land will have to be satisfied primarily through the conversion of the remaining agricultural and other open lands of the watershed from rural to urban uses. Rural land uses may be expected to decline collectively from about 31.2 square miles in 1990 to about 30.7 square miles in the year 2010 under the intermediate growth-centralized land use plan and to about 29.3 square miles under the high growth-decentralized land use plan, decreases of about 2 and 6 percent between 1990 and 2010 for the two year 2010 plans considered.

POINT SOURCE POLLUTANT CONTROL PLAN ELEMENTS

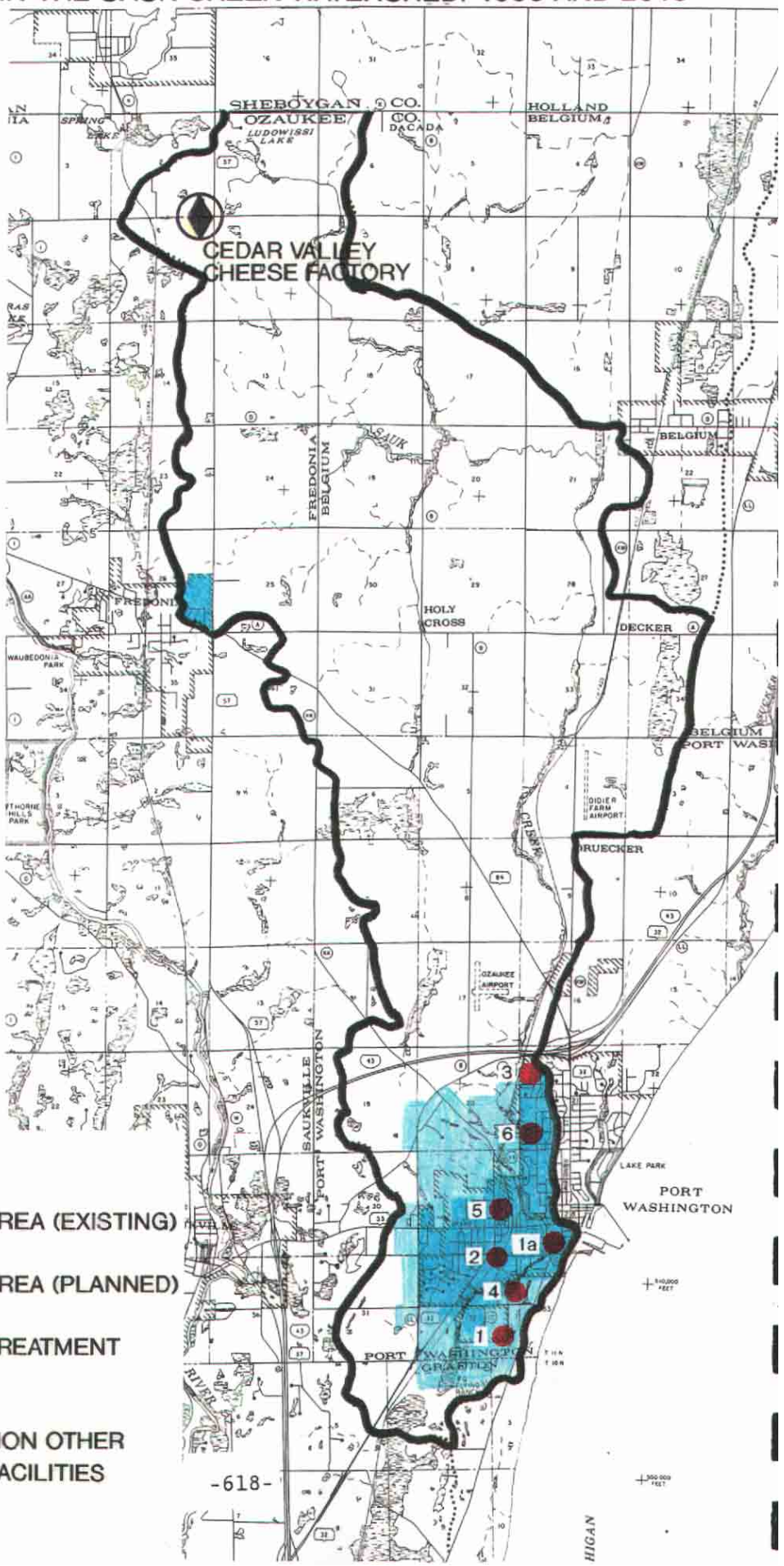
This section describes the recommendations and status of implementation of the current initial regional water quality management plan, as well as current plan recommendations for the abatement of water pollution from point sources of pollution in the Sauk Creek watershed--including consideration of private sewage treatment plants, points of public sewage collection system overflows, and industrial wastewater treatment systems and discharges. This section also includes a status report on the public sanitary service areas located in the watershed.

Public and Private Wastewater Treatment Systems and Sewer Service Areas Existing Conditions and Status of Plan Implementation: In 1975, there were no public sewage treatment facilities located in the Sauk Creek watershed. One private sewage treatment plant serving the Cedar Valley Cheese Factory in the Town of Fredonia was in operation in 1975, as shown on Map XIV-3. The status of implementation in regard to the private sewage treatment plant in the Sauk Creek watershed, as recommended in the initial regional water quality management plan, is shown in Table XIV-3. As indicated in Table XIV-3, the private plant serving the Cedar Valley Cheese Factory was recommended to be maintained and upgraded to provide effluent quality which would be determined on a case-by-case basis as part of the Wisconsin Pollutant Discharge Elimination System (WPDES).

The initial regional water quality management plan recommended that all of the sanitary sewer service areas identified in the plan be refined and detailed in cooperation with the local units of government concerned. There were two sewer service areas identified within, or partially within, the Sauk Creek watershed, Port Washington, and Fredonia. Currently, these areas have undergone refinements as recommended. The boundaries of the sewer service areas, as currently refined, are shown on Map XIV-3. Table XIV-4 lists the plan amendment prepared for each refinement and the date the Commission adopted the document as an amendment to the regional water quality management plan. The table also identifies the original service area names and the relationship of these service areas to the service areas names following the refinement process. The planned sewer

Map XIV-3

SEWER SERVICE AREAS, SEWAGE TREATMENT PLANTS AND OTHER POINT SOURCES OF POLLUTION IN THE SAUK CREEK WATERSHED: 1990 AND 2010



GRAPHIC SCALE

0 1 2 MILES

0 4000 8000 12000 16000 FEET

LEGEND

- SANITARY SEWER SERVICE AREA (EXISTING)
- SANITARY SEWER SERVICE AREA (PLANNED)
- EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE RETAINED
- POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES

Source: SEWRPC.

Table XIV-3

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN
FOR PUBLIC AND PRIVATE SEWAGE TREATMENT PLANTS
IN THE SAUK CREEK WATERSHED: 1990

Public Sewage Treatment Plants	Disposal of Effluent	Plan Recommendation	Implementation Status
--	--	--	--
Private Sewage Treatment Plants	**Disposal of Effluent**	**Plan Recommendation**	**Implementation Status**
Cedar Valley Cheese Factory	Soil absorption	Maintain and upgrade as needed	Plant maintained

Source: SEWRPC.

Table XIV-4

PLANNED SANITARY SEWER SERVICE AREAS IN
THE SAUK CREEK WATERSHED: 1993

Name of Initially Defined Sanitary Sewer Service Area(s)	Planned Sanitary Sewer Service Area (sq. miles)	Name of Refined and Detailed Sanitary Sewer Service Area(s)	Date of SEWRPC Adoption of Plan Amendment	Plan Amendment Document
Port Washington	3.9	Port Washington	December 1, 1983	SEWRPC CAPR. No. 95, Sanitary Sewer Service Area for the City of Port Washington, Ozaukee County, Wisconsin
Fredonia Waubeka	0.1	Fredonia Waubeka	September 13, 1984	SEWRPC CAPR. No 96, Sanitary Sewer Service Area for the Village of Fredonia, Ozaukee County, Wisconsin
Total	4.0			

Note: CAPR - Community Assistance Planning Report

Source: SEWRPC.

service area for the Sauk Creek watershed, as refined through 1993, totals about four miles, or about 11 percent of the total watershed area, as shown in Table XIV-4.

Current Plan Recommendations: The current point source plan element recommendations provide for the continued operation and maintenance of the private sewage treatment plant serving the Cedar Valley Cheese Factory.

The current planned sanitary sewer service areas in the Sauk Creek watershed are shown on Map XIV-3. The existing and planned year 2010 population data for each sewer service area is presented in Chapter XVIII on a regional basis. In the Sauk Creek watershed, these sewer service areas include Fredonia and Port Washington. Together, these sewer service areas total about four miles, or about 11 percent of the Sauk Creek watershed.

As noted above, each of these service areas in the watershed has been refined as part of the ongoing regional water quality management plan updating process. Thus, no specific additional refinements are envisioned to be needed. It is recommended that the sanitary sewer service areas and attendant planned population levels be utilized in subsequent sewerage system facility planning and sanitary sewer extension designs. Particular attention should be given to the preservation and protection of the primary environmental corridor lands designated in the individual sanitary sewer service area plans and in the adopted 2010 regional land use plan.

There is currently one private sewage treatment plant in operation within the Sauk Creek watershed. This facility serves the Cedar Valley Cheese facility which is located beyond the current limits of the planned public sanitary sewer service area. It is recommended that this plant be maintained and upgraded as needed as part of the Wisconsin Pollution Discharge Elimination System permitting process.

Sewer Flow Relief Devices

Current Conditions and Status of Plan Implementation: In 1975, there were two known separate sewer flow relief devices located in the Sauk Creek watershed, both draining to Sauk Creek from the City of Port Washington. During the period of 1988 through 1993, the only flow relief devices which existed in the sanitary sewer systems were selected bypasses which physically remained in the sewerage system but which function only under conditions of power or equipment failure or excessive infiltration and inflow during extreme wet weather conditions. As shown in Table XIV-5, two points of sanitary sewer system flow relief were reported during 1988 through 1993 in the Sauk Creek watershed. Both of these flow relief points are located in the City of Port Washington. These flow relief points have been in operation infrequently, with the average discharge occurrence frequency over this five-year period, being about once per five years per flow relief location. This equates to an average of about one isolated overflow occurrence every two to three years considering all reported bypassing.

Current Plan Recommendations: It is recommended that the City of Port Washington continue to monitor the sewerage system operations to ensure that the use the existing sewerage system flow relief devices is limited to periods of power or equipment failure, or in cases where infiltration and inflow due to wet weather conditions exceed the flows expected in the system design. It is

Table XIV-5

KNOWN SEWAGE FLOW RELIEF DEVICES
IN THE SAUK CREEK WATERSHED: 1988-1993

Sewerage System	Sewage Treatment Plant Flow Relief Device	Sewage Flow Relief Devices in the Sewer System					Comments
		Crossovers	Pumping Station Bypasses	Other Bypasses	Portable Pumping Systems	Total	
City of Port Washington	--	--	--	2	--	2	Used only in case of extreme wet weather

Source: SEWRPC.

recommended that planning for all sewerage system expansion and upgrading be conducted with the assumption that there will be no planned bypasses of untreated sewage and that the use of all flow relief devices will ultimately be eliminated, with the only by passes remaining designed to protect the public and treatment facilities from unforeseen equipment or power failure.

Intercommunity Trunk Sewer

Existing Conditions and Status of Plan Implementation: The initial regional water quality management plan contained no intercommunity trunk sewers recommended for construction within the Sauk Creek watershed.

Current Plan Recommendations: No new intercommunity trunk sewers are recommended for construction in the Sauk Creek watershed under the current plan.

Point Sources of Wastewater Other Than Public and Private Sewage Treatment Plants

Current Conditions and Status of Plan Implementation: In 1975, there was a total of two known point sources of pollution identified in the Sauk Creek watershed other than public and private sewage treatment plants. These sources discharged industrial cooling and process waters to the surface water system. Of these, one was identified as discharging only cooling water and the other discharged a process wastewater. The initial regional water quality plan includes a recommendation that these industrial sources of wastewater be monitored and discharges limited to levels which must be determined on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System permit process.

As of 1990, there were seven such point sources of wastewater discharging to Sauk Creek or the groundwater system of the Sauk Creek watershed. Table XIV-6 summarizes selected characteristics of these other point sources and Map XIV-3 shows their locations. Due to the dynamic nature of permitted point sources, it is recognized that the number of wastewater sources change as industries and other facilities change location or processes and as decisions are made with regard to the connection of such sources to public sanitary sewer systems.

Current Plan Recommendations: As of 1993, there were seven known, permitted point sources of wastewater other than public and private sewage treatment plants discharging to surface or groundwaters in the Sauk Creek watershed. These point sources of wastewater discharge, primarily industrial cooling process, rinse, and wash water, discharge directly or following treatment to the groundwater or the surface waters of the Sauk Creek watershed. It is recommended that these sources of wastewater continue to be regulated and controlled on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System.

Existing Unsewered Urban Development Outside the Proposed Sanitary Sewer Service Area

As of 1975, there were no enclaves of unsewered urban development located outside of the then proposed year 2000 sewer service area. As of 1990, no new enclaves of urban development have been created beyond the planned sewer service areas, as shown on Map XIV-3.

Table XIV-6

CHARACTERISTICS OF OTHER KNOWN POINT SOURCES OF WATER POLLUTION IN THE SAUK CREEK WATERSHED: 1990[a]

Facility Name	County	Map ID#[b]	Permit Type	Permit #	Expiration Date	Standard Industrial Classification Code	Industrial Activity	Receiving Water	Treatment System[c]
Sauk Creek Watershed									
Kickhaefer Mfg. Co.	Ozaukee	1	General	0044938-3	09/30/95	3469/3496	Metal stampings, misc. wire prod.	Sauk Creek	--
Modern Equipment Co.	Ozaukee	2	General	0044938-3	09/03/95	3559	Special industry machinery	Sauk Creek via storm sewer	--
Port Washington Park and Rec. Dept.	Ozaukee	3	General	0046523-2	09/03/95	9199	General government	Sauk Creek	--
Schmitz Ready Mix - Port Washington	Ozaukee	4	General	0046507-2	09/03/95	3273	Ready-mix concrete	Groundwater discharge	--
Simplicity Manufacturing	Ozaukee	5	General	SPEC PERM	--	3524	Lawn & garden equipment	Sauk Creek	--
Swietlik Residence	Ozaukee	6	General	HEAT PUMP	--	8811	Private household	Sauk Creek via storm sewer	--
WI Electric Power Co. - Port Wash.	Ozaukee	1A	Specific	0000922	12-31-93	4911	Electric services	Lake Michigan via Sauk Creek	3, 2, 5, 6

[a]Table XIV-6 includes seven known, permitted point sources of wastewater discharging to Sauk Creek or to the groundwater system in the Sauk Creek watershed. As of 1993, there were seven known, permitted point sources of water pollution.

[b]See Map XIV-3, Sewer Service Areas, Sewage Treatment Plants and Point Sources of Pollution in the Sauk Creek Watershed: 1990 and 2010.

[c]The number code refers to the following treatment systems:

1. Aerated lagoon
2. Coagulation flocculation
3. Gravity sedimentation
4. Holding pond
5. pH control
6. Secondary clarification
7. Spray irrigation

Source: Wisconsin Department of Natural Resources and SEWRPC.

Miscellaneous Potential Pollution Sources

Landfills: Landfills in the Sauk Creek watershed, including those currently abandoned, have the potential to affect water quality through the release of leachates from the landfill to ground and surface waters. These landfills potentially contain some toxic and hazardous substances due to the disposal of such wastes from households and other sources. In some cases, toxic and hazardous substances have begun to leach into surrounding soil and aquifers, and can potentially be transmitted to the surface waters.

There are currently six known abandoned landfills located in the Sauk Creek watershed. There is no indication that any of these landfills are negatively impacting surrounding surface waters.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the Sauk Creek watershed have the potential to affect water quality through the release of substances into the surrounding soil and groundwater. Sites with leaking underground storage tanks are eligible for remediation activities under the U. S. Environmental Protection Agency Leaking Underground Storage Tank (LUST) program, designed to facilitate the cleanup of such sites, primarily those sites containing petroleum storage tanks. In selected cases, sites undergoing cleanup efforts are permitted under the Wisconsin Pollutant Discharge Elimination System (WPDES) to discharge remediation wastewater to surface or ground water. Discharges from these sites are required to meet specified water quality discharge standards set forth by the Wisconsin Department of Natural Resources.

As of 1990, there were no known, permitted leaking underground storage tank sites that were discharging remediation waters to surface waters or ground water in the Sauk Creek Watershed. As of 1993, there were 19 leaking underground storage tank sites in the Sauk Creek watershed. None of these sites involved discharging remediation wastewater directly to surface or ground waters. While there is no specific evidence to document the impact of these individual point sources on water quality within the watershed, it can be reasonably assumed that the cumulative effect of multiple leaking underground storage tanks has the potential to result in detrimental effects on water quality over time.

Additional Groundwater Contamination Sites: Additional groundwater contamination sites which are undergoing remediation may also be permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation waste water to surface or ground waters. As of 1990, there were no permitted sites discharging to surface or ground waters in the Sauk Creek watershed.

NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT

The nonpoint source pollution abatement plan element of the adopted regional water quality management plan includes recommendations relating to diffuse sources of water pollution. Nonpoint sources of water pollution include runoff from urban and rural land uses, runoff from construction sites, wastes from livestock operations, malfunctioning onsite sewage disposal systems, and pollutant contributions from the atmosphere.

Existing Conditions and Status of Plan Implementation

For the Sauk Creek watershed, the plan generally recommended nonpoint source pollution control practices for both urban and rural lands designed to reduce the pollutant loadings from nonpoint sources by about 25 percent, in addition to urban construction erosion control, streambank erosion control, and onsite sewage system disposal management. Implementation of the recommended nonpoint source control practices has been achieved on a very limited basis in the Sauk Creek watershed through a variety of State and local regulations and programs. These programs include the regulation of onsite sewage disposal systems under the program currently administered by Ozaukee County. This program provides for the system installation requirements as set forth in Chapter ILHR 83 of the Wisconsin Administrative Code, for ongoing maintenance of newer systems, and for problem resolution of failing systems where they are identified. In addition, significant progress has also been made in the area of construction site erosion control. As of January 1993, the Village of Fredonia had adopted a construction erosion control ordinance which is based upon the model ordinance developed cooperatively by the Wisconsin Department of Natural Resources and League of Wisconsin Municipalities, while the City of Port Washington had an existing ordinance that pre-dated the model.

With regard to rural nonpoint source control, Chapter NR 243 of the Wisconsin Administrative Code sets forth design standards and accepted animal waste management practices for large animal feeding operations. This program is administered by the Wisconsin Department of Natural Resources, which works with the County Land Conservation Departments to resolve identified significant animal waste problems. This program and other programs, such as the Conservation Reserve Program administered by the U. S. Department of Agriculture, Soil Conservation Service, and the wetland restoration programs administered by the Wisconsin Department of Natural Resources and others are utilized primarily for cropland soil erosion control and wildlife habitat purposes and will have positive water quality impacts.

Chapter ATCP 50 of the Wisconsin Administrative Code requires that soil erosion on all croplands be reduced to tolerable levels by the year 2000. Tolerable levels are defined as soil loss tolerances to T-values, which are the maximum annual average rates of soil loss for each soil type that can be sustained economically and indefinitely without impairing the productivity of the soil. These values have been determined for each soil type by the U. S Soil Conservation Service. Chapter 92 of the Wisconsin State Statutes requires that soil erosion control plans be prepared and maintained for counties identified by the Wisconsin Department of Agriculture, Trade, and Consumer Protection as priority counties for soil erosion control. The Commission has prepared agricultural soil erosion control plans for Ozaukee County. Thus, such a plan has been prepared for all areas of the Sauk Creek watershed. That plan identifies priority areas for cropland soil erosion control within Ozaukee County, and, additionally, recommends farm management practices intended to reduce cropland soil erosion to tolerable levels. Soil conservation and management are closely related to the issues of stormwater management, flood control, control of nonpoint source pollutants, changing land use, and deterioration of the natural resource base. Therefore, it is important that soil conservation be considered within the framework of a comprehensive watershed planning program which will enable the formulation of coordinated, long-range solutions.

While these local programs described above have likely resulted in some modest reduction in the pollutant loadings from nonpoint sources, this element of the plan remains largely unimplemented.

The initial regional plan also recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans. Such plans are to identify the nonpoint source pollution control practices that should be applied to specific lands. Working with the individual county land conservation committees, local units of government, and the Commission, the Wisconsin Department of Natural Resources is carrying out the recommended detailed planning for nonpoint source water pollution abatement on a watershed-by-watershed basis. This detailed planning and subsequent plan implementation program is known as the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program. This planning program was established in 1978 by the Wisconsin Legislature and provides cost-sharing funds for an individual project, or land management practice, to local governments and private landowners upon completion of the detailed plans. These funds are provided through nonpoint source local assistance grants administered by the Wisconsin Department of Natural Resources. To date, the Sauk Creek watershed has not been selected for inclusion in the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program.

Current Plan Recommendations

Nonpoint source pollution control practices designed to provide about a 25 percent reduction in nonpoint source pollutant loadings, plus construction site erosion control, onsite sewage system management, and streambank erosion control are recommended to be carried out throughout the Sauk Creek watershed. The types of practice recommended to be considered for this level of nonpoint source control are summarized in Appendix A.

It is further recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans to identify the nonpoint source pollution control practices that should be applied to specific lands in the most cost-effective manner. In this regard, the watershed should be included in the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program in order to make State cost-sharing funds and related programs available for nonpoint source pollution control measures. The current priority ranking of watersheds for inclusion in that program is documented in a memorandum[1] prepared by the Regional Planning Commission using Wisconsin Department of Natural Resources procedures and is summarized in Chapter XVIII. That ranking included the Sauk Creek watershed in the high category, indicating that inclusion in the program will be possible when existing planning projects are completed and staff becomes available within the Department of Natural Resources.

[1]See SEWRPC Memorandum entitled "Assessment and Ranking of Watershed for Nonpoint Source Management Purposes in Southeastern Wisconsin: 1993."

WATER QUALITY MONITORING PLAN ELEMENT

Existing Conditions and Status of Implementation

While substantial progress has been made in the regional water quality management plan elements described in the previous section, the most direct measure of the impact of plan implementation on water quality conditions can only be achieved by a well-planned areawide water quality and biological condition monitoring program. As of 1993, no water quality monitoring has been conducted in the Sauk Creek watershed.

Current Plan Recommendations

Increased water quality and biological conditions monitoring will be needed in the watershed to document current conditions and to demonstrate water quality condition changes over time. It is recommended that an intensive water quality and biological condition monitoring program be conducted over a one-year period at Stations Sk-1 and Sk-2, the locations of which are shown on Map XIV-4. It is recommended that this program be conducted within the next five to seven years and repeated at approximately five to seven year intervals. These recommendations can be coordinated with, and are consistent with, the Wisconsin Department of Natural Resources current surface water monitoring strategy developed to conduct monitoring activities and perform basic assessments for each basin in the Region in an approximate five to seven year rotating cycle.

LAKE MANAGEMENT PLAN ELEMENT

The initial regional water quality management plan included recommendations for reducing nonpoint sources of pollution in the tributary areas of lakes and for consideration of other lake management measures, including in-lake measures such as aeration, nutrient inactivation, and fishery management programs. For major lakes, the initial plan recommended that comprehensive lake management plans be prepared to consider in more detail the applicability and preliminary design of watershed and in-lake management measures. The preparation of such a comprehensive plan requires supporting water quality and biological condition monitoring programs to be established.

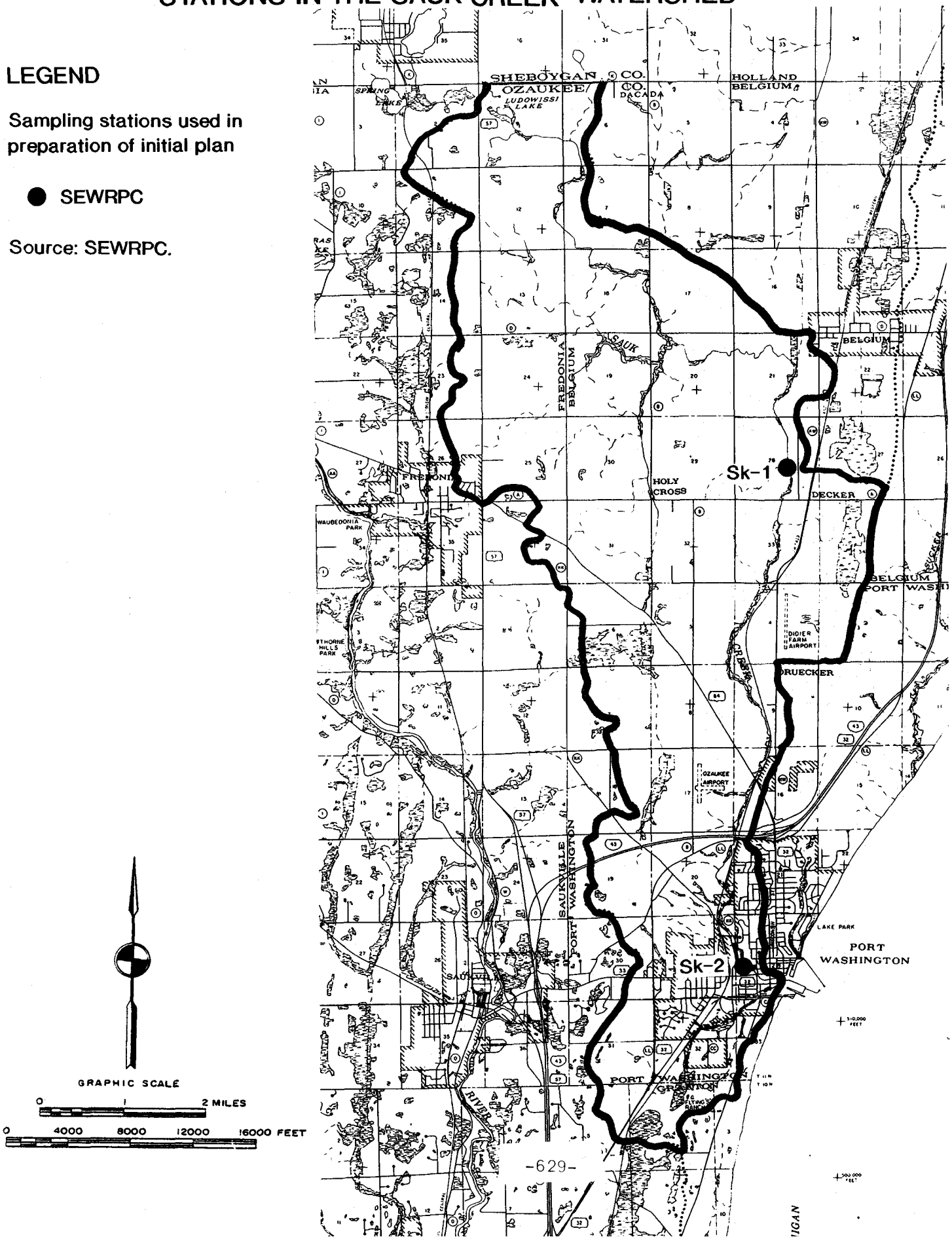
As noted above, there are no major lakes in the Sauk Creek watershed. However, there are smaller water bodies such as park-oriented ponds and small lakes in the watershed. It is recommended that water quality planning and supporting monitoring be conducted for smaller, lake-like water bodies in the watershed which are less than 50 acres in size which are deemed to be important for water quality protection. In such cases, the management techniques similar to those recommended to be applicable for consideration on the major lakes in the region are considered applicable for management purposes.

WATER QUALITY AND BIOLOGICAL CONDITIONS

Streams

Streamwater quality data available for use in preparing the initial regional water quality management plan were collected during the 1964 through 1965 Commission benchmark streamwater quality study, the 1965 through 1975 Commission streamwater quality monitoring effort, and the 1976 Commission monitoring program conducted under the regional water quality management planning effort. Available data collected in those programs for the Sauk Creek watershed included

Map XIV-4
LOCATIONS OF WATER QUALITY SAMPLING STATIONS IN THE SAUK CREEK WATERSHED



samplings at two Commission stations on the Sauk Creek main stem. The sampling station locations are shown on Map XIV-4.

No known post-1976 water quality data were available from the Sauk Creek watershed. The assessment of current conditions relied upon the uniform areawide characterization of surface water conditions developed under the initial planning effort by simulation modeling. The modeling results developed under the initial plan included simulation of water quality conditions under various levels of point source and nonpoint source pollution control and under both the then current 1975 land use conditions and under planned year 2000 land use conditions. Review of this data can provide insight into the current water quality conditions and the current potential for achieving the established water use objectives in the Sauk Creek watershed.

Toxic and Hazardous Substances: No known stream water or bottom sediment sampling for toxic and hazardous materials in the form of heavy metals, polychlorinated biphenyls (PCB's), or pesticides have been conducted within the Sauk Creek watershed.

Since the completion of the initial regional water quality management plan, five spills of toxic substances into streams within the Sauk Creek watershed have been documented by the Wisconsin Department of Natural Resources. All of these spills have occurred in the main stem of Sauk Creek in the City of Port Washington. The majority of the substances that were spilled into the creek were oil.

Water Quality Assessments: Based upon the available data, the water quality and biological characteristics of Sauk Creek were assessed with the results set forth in Table XIV-7. Fish population and diversity is fair. Problems with levels of fecal coliform are estimated to exceed standards in Sauk Creek. Dissolved oxygen, phosphorus, and un-ionzed ammonia nitrogen levels are estimated to meet the standards. No recent data were available on toxic pollutants or on the biotic index ratings, which are biological indicators of water quality within a stream system. High levels of streambed sedimentation were noted throughout the watershed.

Table XIV-8 sets forth water quality index classifications[2] used in the initial plan for 1964, 1974-75, and for 1990-91 conditions for selected sampling stations in the watershed. The use of the index is discussed in Chapter II. As indicated in Table XIV-8, no recent comparative data were available.

A summary of potential pollution sources in the Sauk Creek watershed by stream reach is shown in Table XIV-9. Review of the data indicate that a limited number of spills of toxic substances have occurred in the watershed, and six industrial discharges have been permitted to discharge to Sauk Creek. It should be noted that all of the spills and discharges have discharged to the portion of Sauk Creek located within the City of Port Washington. Data on nonpoint source pollution is also included in Table XIV-8.

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[2]For a detailed description of the water quality index, see SEWRPC Technical Report No. 17, Water Quality of Lakes and Streams in Southeastern Wisconsin: 1964-1975, June 1978.

Table XIV-7

CHARACTERISTICS OF STREAMS WITHIN THE SAUK CREEK WATERSHED

Stream Reach	Stream Length (miles)	Fish Population and Diversity[a]	Recorded Fish Kills	Water Quality Problems[b]					Biotic Index Rating	Streambed Sedimentation	Physical Modifications to Channel[c]
				DO	NH_3	Total P	Fecal Coliform	Toxics			
Sauk Creek . . .	18.8	Fair	No	No	No	No	Yes	--	--	High (clay, gravel, silt)	Moderate

[a]Based upon professional judgment of area fish managers.

[b]Simulation modeling analyses data developed in the initial plan were used to estimate current water quality for Sauk Creek based upon year 2000 land use conditions and current level of pollution control.

[c]Physical modifications to the channel were defined as: major if 50 percent or more of the stream reach was modified by structural measures or was deepened and straightened; moderate if 25 to 50 percent of the stream reach was modified; and low if up to 25 percent of the reach was modified.

Source: Wisconsin Department of Natural Resources, and SEWRPC.

Table XIV-8

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATIONS OF THE SAUK CREEK WATERSHED 1964, 1974-1975, AND 1990-91

Water Quality Sampling Stations[a]	July, August, September, and October of 1964	August of the Years 1974-1975	July, August, 1990 and 1991
Main Stem Stations			
Sk-1	Poor	Poor	--
Sk-2	Good	Fair	--
Watershed Average	Fair	Fair	--

[a]See Map XIV-4 for sampling station locations.

Source: SEWRPC.

Table XIV-9

SUMMARY OF POTENTIAL SURFACE WATER POLLUTION SOURCES IN THE SAUK CREEK WATERSHED: 1990

Stream Reach[a]	Extent of Conversion of Lands from Rural to Urban[b]		Documented Toxic Spills 1976-1990	Remaining Potential Surface Water Pollution Sources							Ongoing Pollution Abatement Efforts[c]
	Historical 1976-1990	Expected 1990-2010		Urban Nonpoint Source Pollution	Rural Nonpoint Source Pollution	Public Sewage Treatment Plants	Private Sewage Treatment Plants	Number of Permitted Industrial Discharges	Other Known Potential Impacts to Surface Water Quality	Comments	
Sauk Creek	Insignificant	Insignificant	1988 - oil 1989 - hydraulic oil brown foam hydraulic oil hydraulic oil	X	X	--	--	6			X[c]

[a]Includes the tributary drainage area of each stream reach.

[b]Extent of urban land conversions were determined as a percentage of the watershed as follows:

major	> 20%
moderate	10 - 20%
significant	5 - 10%
insignificant	0 - 5%

[c]Construction Erosion Control Ordinances in place

Source: Wisconsin Department of Natural Resources and SEWRPC.

Compliance with Water Use Objectives

As indicated in Chapter II, Sauk Creek is recommended for warmwater sport fish and full recreational use. These water use objectives and the associated water quality standards are discussed in Chapter II. Based upon the available data for sampling stations in the watershed, the main stem of Sauk Creek did not fully meet water quality standards associated with the recommended water use objectives during and prior to 1975, the base year of the initial plan. No current water quality sampling data are available to assess the current compliance with the water quality standards for the Sauk Creek watershed. Simulation modeling developed in the initial plan indicates that it is likely that the standards associated with the recommended water use objectives are largely being met with the exception of the fecal coliform levels. Thus, the water use objective is being partially met.

WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

Based upon the current status of pollution abatement planning and land use decisions, there are no major water quality issues remaining to be addressed specific to the Sauk Creek watershed.

Chapter XV

SHEBOYGAN RIVER WATERSHED--REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

INTRODUCTION

This chapter presents a description of the recommendations contained in the initial regional water quality management plan and amendments thereto and progress made toward plan implementation from 1975--the base year of the initial plan--through 1990--the base year of the plan update. In addition, this chapter presents information on water quality and biological conditions in the surface water system of the Sheboygan River watershed through 1993, where available. Finally, this chapter presents a description of the substantive water quality management issues that remain to be addressed in the Sheboygan River watershed as part of the continuing water quality planning process. The status of the initial plan and the current plan recommendations are presented in separate sections for the land use plan element, the point source pollution abatement and sludge management plan elements, the nonpoint source pollution abatement plan element, and the water quality monitoring plan elements. In addition, a separate section on lake management is included which is limited for the Sheboygan River watershed as there are no major lakes located in the watershed. Designated management agency responsibilities for plan implementation are presented in Chapter XVII on a regional basis.

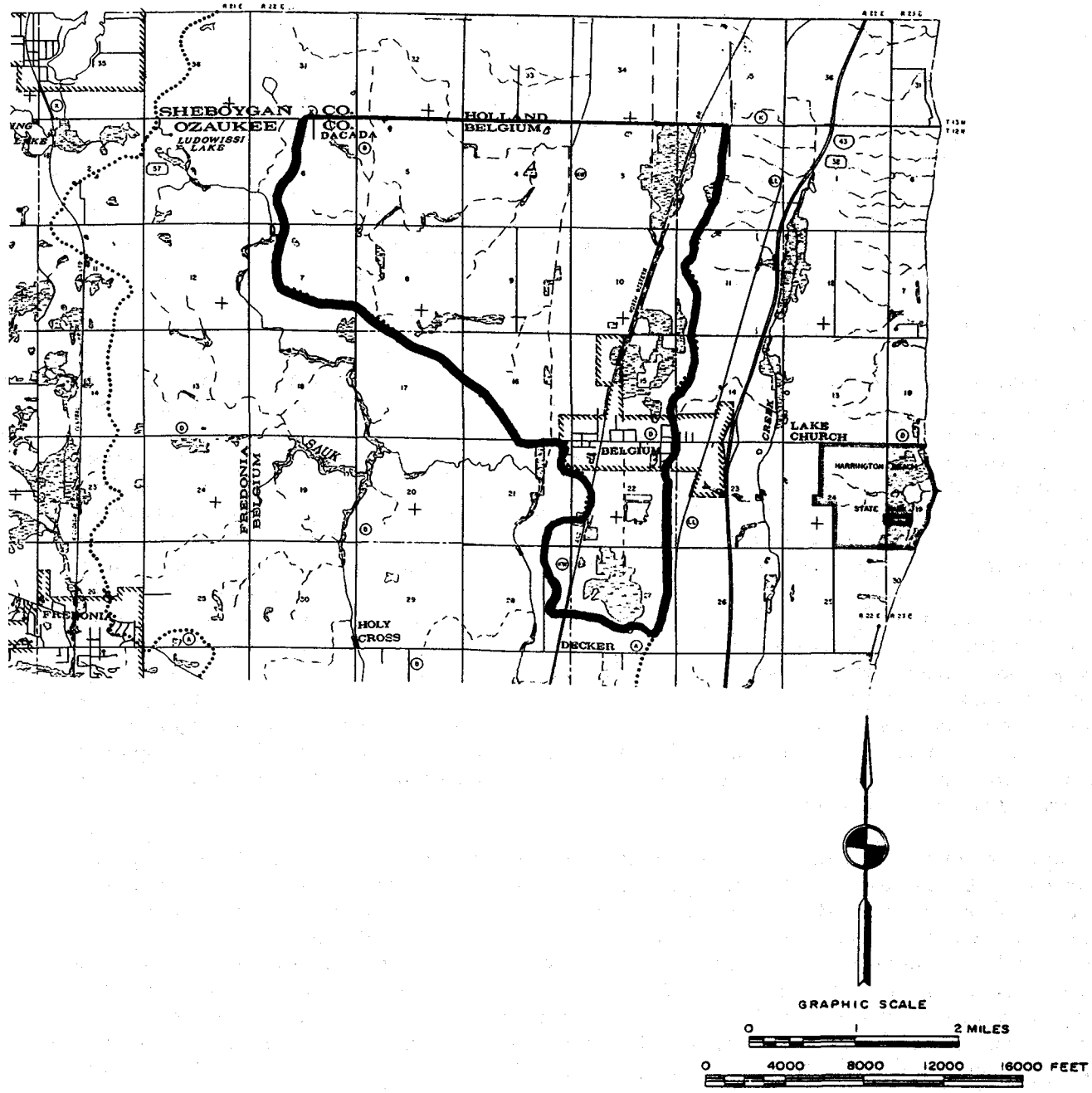
The Sheboygan River watershed is located in the northern portion of the Region. That part of the watershed contained within the Region--about 10.8 square miles--is only a small part of a much larger watershed. Both the East Branch and West Branch of Belgium Creek rise and are tributary to the southern portion of the watershed in Ozaukee County, and flow northward into Sheboygan County, where the Onion River discharges into the Sheboygan River. Rivers and streams in the watershed are part of the Lake Michigan drainage system as the watershed lies east of the subcontinental divide. The boundaries of the Sheboygan River basin, together with the location of Belgium Creek, are shown on Map XV-1. The Sheboygan River watershed contains no lakes with a surface area of 50 acres or more.

LAND USE PLAN ELEMENT

The land use plan element of the initial plan, the status of the initial plan recommendations, as well as the new year 2010 plan, were described in Chapter III of this report on a regional basis. This section, more specifically, describes the changes in land use which have occurred within the Sheboygan River watershed

Map XV-1

SHEBOYGAN RIVER WATERSHED



since 1975, the base year of the initial regional water quality management plan, as well as the planned changes in land use in the watershed to the year 2010. The data are presented for the watershed in order to permit consideration of the relationship of the changes in land use to the other plan elements and to water quality conditions within the watershed. The conversion of land from rural to urban land uses has the potential to impact on water quality as a result of increased point and nonpoint source loadings to surface waters. The amount of wastewater generated by industrial and municipal point sources of pollution discharging to surface waters will also increase as areas are converted into urban uses. In addition, the amount of stormwater runoff is expected to increase due to an increase in impervious surfaces. The amounts of certain nonpoint source pollutants, such as metals and chlorides, can also be expected to increase with urbanization.

Table XV-1 summarizes the existing land uses in the Sheboygan River watershed in 1990 and indicates the changes in such land uses since 1975--the base year of the initial regional water quality management plan. Although the watershed contains a limited amount of urbanized areas, 93 percent of the watershed was still in rural and other open space land uses in 1990. These rural uses included about 82 percent of the total area of the watershed in agricultural and related rural uses, about 1 percent in woodlands, about 9 percent in surface water and wetlands, and about 1 percent in other open lands. The remaining 7 percent of the total watershed was devoted to urban uses. Existing land uses within the watershed are shown on Map XV-2.

Within the Sheboygan River watershed, limited urban development has occurred within the Village of Belgium. As shown in Table XV-1, from 1975 to 1990, urban land uses in the watershed increased from about 432 acres to about 459 acres, or by about 7 percent. As shown in Table XV-1, residential land use within the watershed remained relatively constant, from 132 acres in 1975 to 139 acres in 1990, about a 5 percent increase. Commercial and industrial lands increased from 25 acres to 30 acres, an increase of about 17 percent.

The 459 acres of urban land uses in the watershed as of 1990 exceeded the staged 1990 planned level of about 431 acres envisioned in the adopted year 2000 land use plan. The current status of development in the Sheboygan River watershed and in adjacent portions of Ozaukee County was considered in developing the new year 2010 land use plan element described in Chapter III for the Region as a whole.

Table XV-2 summarizes the year 2010 planned land use conditions set forth in the adopted year 2010 land use plan in the Sheboygan River watershed and compares the recommended land use conditions to the 1990 conditions. Under planned land use conditions, as described in Chapter III, urban land uses are expected to increase in Ozaukee County within and around the Village of Belgium.

In order to meet the needs of the expected resident population and employment envisioned under the intermediate growth-centralized land use plan future conditions, the amount of land devoted to urban use within the Sheboygan River watershed, as indicated in Table XV-2, is projected to increase from the 1990 total of about 459 acres, or about 7 percent of the total area of the watershed, to about 599 acres, or about 9 percent of the total area of the watershed, by year 2010. Under the high growth-decentralized land use plan future scenario, the

Table XV-1

LAND USE IN THE SHEBOYGAN RIVER WATERSHED: 1975 and 1990[a]

Land Use Category	1975		1990		Change 1975-1990	
	Acres	Percent	Acres	Percent	Acres	Percent
Urban						
Residential	132	1.9	139	2.0	7	5.3
Commercial	4	0.1	5	0.1	1	25.0
Industrial	21	0.3	25	0.4	4	19.0
Transportation, Communication, and Utilities[b]	253	3.6	266	3.8	13	5.1
Governmental and Institutional	16	0.2	18	0.2	2	12.5
Recreational	6	0.1	6	0.1	0	0.0
Subtotal	432	6.2	459	6.6	27	6.3
Rural						
Agricultural and Related	5,721	82.5	5,724	82.5	3	0.1
Lakes, Rivers, Streams and Wetlands	666	9.6	629	9.1	- 37	- 5.6
Woodlands	79	1.1	75	1.1	- 4	- 5.1
Open Lands, Landfills, Dumps, and Extractive[c]	41	0.6	52	0.7	11	26.8
Subtotal	6,507	93.8	6,480	93.4	- 27	- 0.4
Total	6,939	100.0	6,939	100.0	0	--

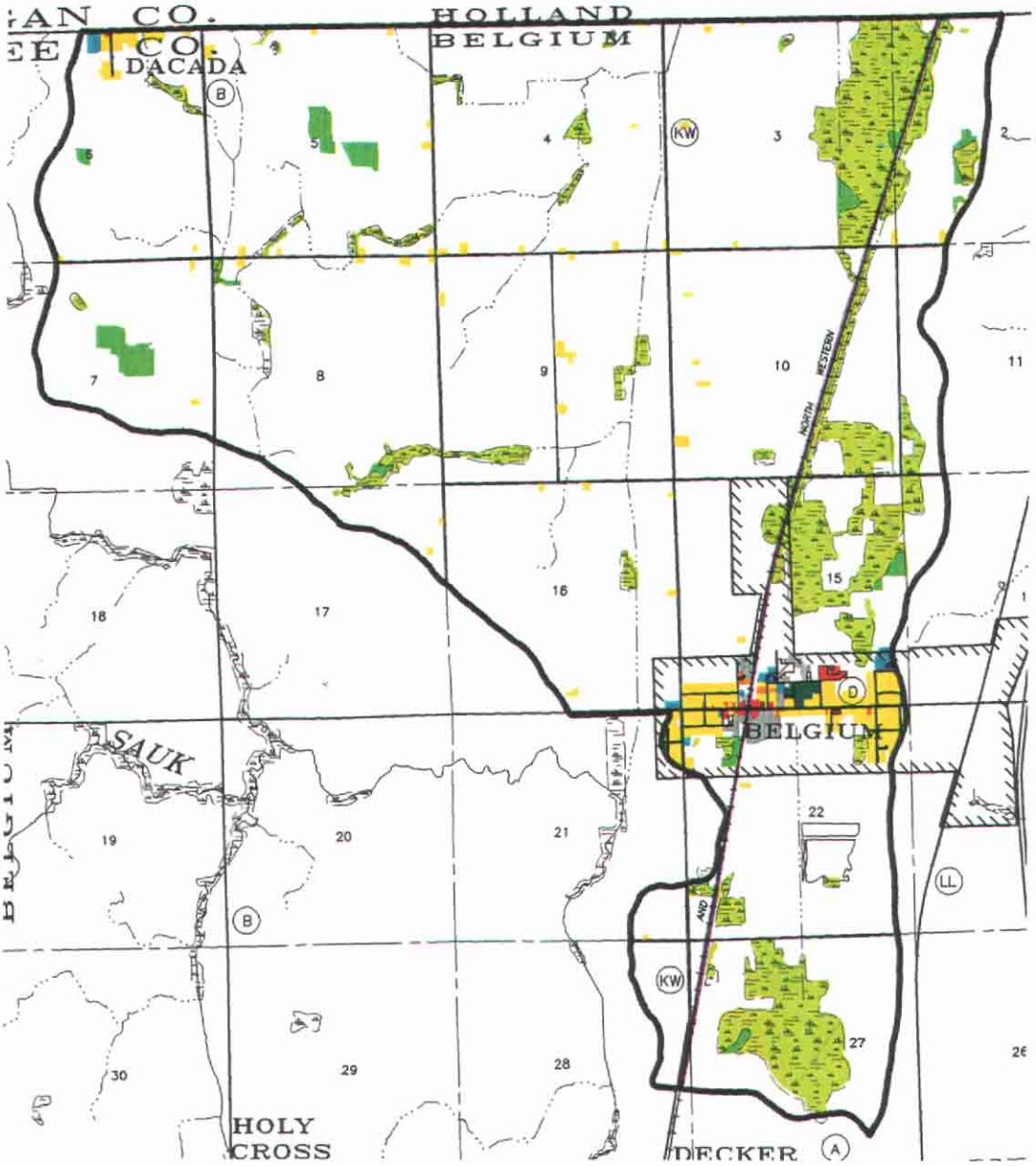
[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

MAP XV–2
LAND USES IN THE SHEBOYGAN RIVER WATERSHED: 1990



–LEGEND–

- SINGLE–FAMILY RESIDENTIAL
- MULTI–FAMILY RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- STREET AND HIGHWAYS
- PARKING
- OTHER TRANSPORTATION COMMUNICATION AND UTILITIES
- GOVERNMENTAL AND INSTITUTIONAL
- RECREATIONAL
- SURFACE WATER
- WETLANDS
- WOODLANDS
- EXTRACTIVE
- LANDFILL
- AGRICULTURAL AND OTHER OPEN LANDS

0 1 2
GRAPHIC SCALE IN MILES

The Sheboygan River watershed is about 11 square miles in areal extent, or less than 1 percent of the total Region. In 1990, about 0.7 square miles, or about 7 percent of the watershed, was in urban land uses.

Source: SEWRPC

Table XV-2

EXISTING AND PLANNED LAND USE IN THE SHEBOYGAN RIVER WATERSHED: ACTUAL 1990 AND PLANNED 2010[a]

Land Use Category	Existing 1990		Year 2010 Intermediate Growth - Centralized Land Use				Year 2010 High Growth - Decentralized Land Use			
			2010		Change 1985-2010		2010		Change 1990-2010	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Urban										
Residential	139	2.0	228	3.3	89	64.0	277	4.0	138	99.3
Commercial	5	0.1	5	0.1	0	0.0	5	0.1	0	0.0
Industrial	25	0.4	38	0.6	13	52.0	59	0.8	34	136.0
Transportation, Communication, and Utilities[b]	266	3.8	300	4.3	34	12.8	321	4.6	55	20.7
Governmental and Institutional	18	0.2	19	0.3	1	5.6	21	0.3	3	16.7
Recreational	6	0.1	9	0.1	3	50.0	11	0.2	5	83.3
Subtotal	459	6.6	599	8.7	140	30.5	694	10.0	235	51.2
Rural										
Agricultural and Related	5,724	82.5	5,601	80.7	- 123	- 2.1	5,518	79.5	- 206	- 3.6
Lakes, Rivers, Streams, and Wetlands	629	9.1	633	9.1	4	0.6	633	9.1	4	0.6
Woodlands	75	1.1	76	1.1	1	1.3	76	1.1	1	1.3
Open Lands, Landfills, Dumps, and Extractive[c]	52	0.7	30	0.4	- 22	- 42.3	18	0.3	- 34	- 65.4
Subtotal	6,480	93.4	6,340	91.3	- 140	- 2.2	6,245	90.0	- 235	- 3.6
Total	6,939	100.0	6,939	100.0	0	--	6,939	100.0	0	--

[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

land devoted to urban uses is projected to increase to about 694 acres, or about 10 percent of the total watershed by year 2010. It is important to note that the 90 to 91 percent of the watershed remaining in rural uses is partly comprised of primary environmental corridor lands consisting of the best remaining natural resource features, and, as recommended in the year 2010 regional land use plan, is proposed to be preserved largely in open space use through joint zoning or public acquisition. In addition, certain other lands classified as wetlands and floodplains outside the primary environmental corridors are, in some cases, precluded from being developed by State and Federal regulations. Thus, the demand for urban land will have to be satisfied primarily through the conversion of a portion of the remaining agricultural and other open lands of the watershed from rural to urban uses. Rural land uses may be expected to decline collectively from about 10.1 square miles in 1990 to about 9.9 square miles in the year 2010 under the intermediate growth-centralized land use plan and to about 9.7 square miles under the high growth-decentralized land use plan, decreases of about 2 and 4 percent between 1990 and 2010 for the two-year 2010 plans considered.

POINT SOURCE POLLUTANT CONTROL PLAN ELEMENTS

This section describes the recommendations and status of implementation of the initial regional water quality management plan, as well as the current plan recommendations updated by incorporating all amendments and implementation actions for the abatement of water pollution from point sources of pollution in the portion of the Sheboygan River watershed within the Southeastern Wisconsin Region--including consideration of public and private sewage treatment plants, points of public sewage collection system overflows, intercommunity trunk sewers, and industrial wastewater treatment systems and discharges. Because of the interrelationship of the treatment plant solids or sludge management plan element with the public and private sewage treatment plant plan component, this section also covers the solids management plan element as described in the initial plan. This section also includes a status report on the public sanitary sewer service area located in the watershed.

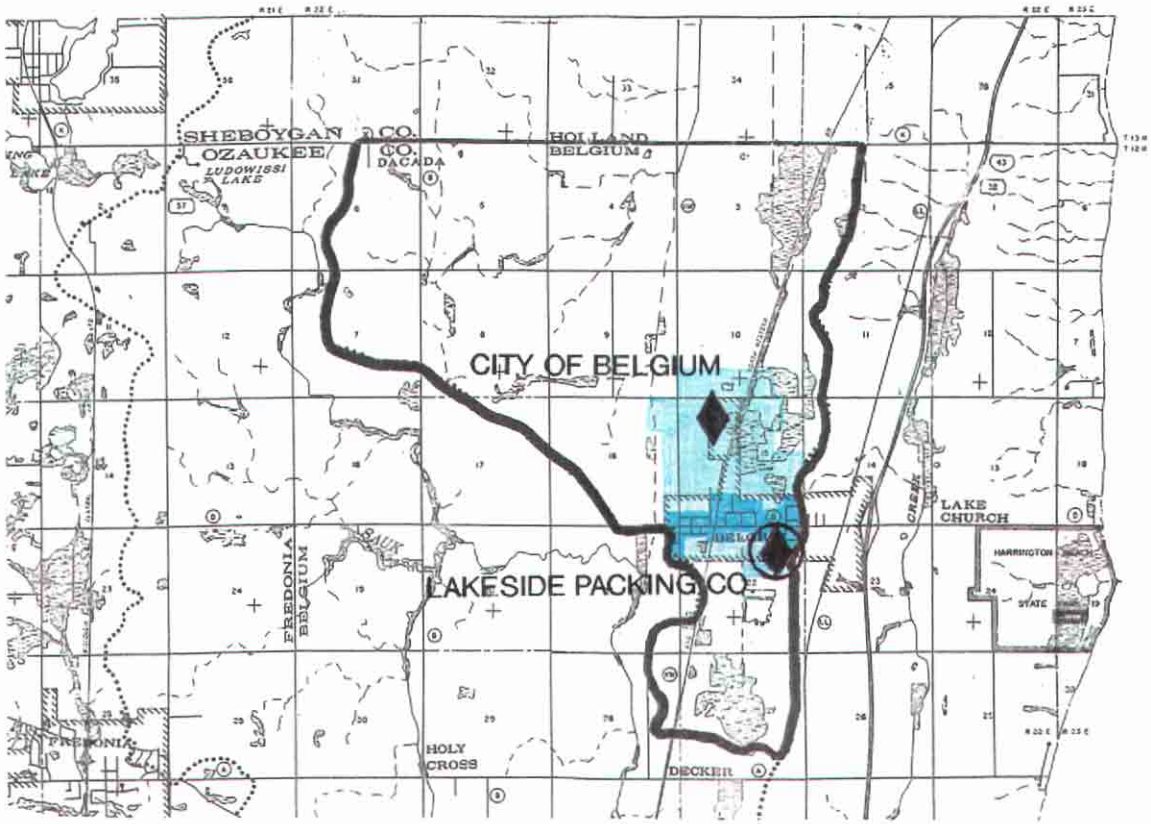
Public and Private Wastewater Treatment Systems and Sewer Service Areas Existing Conditions and Status of Plan Implementation: In 1975, there was one public sewage treatment facility located in the Sheboygan River watershed, as shown on Map XV-3. The Village of Belgium sewage treatment plant discharged directly to the East Branch of Belgium Creek. The status of implementation with regard to the upgrading, expansion, and relocation of the public and private sewage treatment plants in the Sheboygan River watershed, as recommended in the initial regional water quality management plan, is summarized in Table XV-3.

As can be seen by review of Table XV-3, full implementation of the initial plan would provide for the expansion and relocation of the public sewage treatment plant operated by the Village of Belgium. Implementation of this recommendation has been completed. The Village of Belgium plant has not fully provided facilities to specifically reduce the phosphorus concentrations in plant effluents to the levels identified in the initial plan as being needed to fully meet the water use objectives. The steps needed to achieve the recommended level of phosphorus control have been partially implemented by the completion of a study by the Wisconsin Department of Natural Resources to refine the procedure for establishing site specific phosphorus limitations on all public sewage

Map XV-3

SEWER SERVICE AREAS AND SEWAGE TREATMENT PLANTS

IN THE SHEBOYGAN RIVER WATERSHED: 1990 AND 2010



LEGEND

SANITARY SEWER SERVICE AREA (EXISTING)

SANITARY SEWER SERVICE AREA (PLANNED)

EXISTING PUBLIC SEWAGE TREATMENT FACILITY TO BE RETAINED

EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE RETAINED

GRAPHIC SCALE

0 1 2 MILES

0 4000 8000 12000 16000 FEET

Source: SEWRPC.

Table XV-3

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN FOR PUBLIC AND PRIVATE SEWAGE TREATMENT PLANTS IN THE SHEBOYGAN RIVER WATERSHED: 1990

Public Sewage Treatment Plants	Disposal of Effluent	Plan Recommendation	Implementation Status
Village of Belgium	East Branch of Belgium Creek	Expand	Completed--plant relocated (1984)
Private Sewage Treatment Plants	**Disposal of Effluent**	**Plan Recommendation**	**Implementation Status**
Lakeside Packing Co.[a]	Soil absorption and East Branch of Belgium Creek	Maintain and upgrade as needed	Plant maintained

[a] Formerly Krier Preserving Company

Source: SEWRPC.

treatment plants, and in 1993, by the adoption of rules to allow for placement of such limitations. Thus, as specific sewage treatment plant permits are issued, the use of the identified procedure should result in findings requiring reduced phosphorus loadings. Selected characteristics of the public sewage treatment plant currently existing in the watershed are given in Table XV-4.

In addition to the publicly-owned sewage treatment facilities, one private sewage treatment plant was in existence in 1975 in the Sheboygan River watershed. This plant served the Krier Preserving Company (currently the Lakeside Packing Company). As indicated in Table XV-3, this plant was recommended to be maintained and upgraded to provide effluent quality which would be determined on a case-by-case basis as part of the Wisconsin Pollutant Discharge Elimination System (WPDES).

The initial regional water quality management plan included a set of specific options to be considered in facilities planning for management of solids generated at the public and private sewage treatment plants in the Sheboygan River watershed. These options included methods for processing, transportation, and utilization or disposal of treatment plant solids. As facility plans are prepared, they are reviewed for conformance with the plan recommendations. Since sludge management planning is generally carried out as part of the sewage treatment plant facility planning, implementation of this element of the regional plan generally parallels the municipal and private treatment plant implementation described above. One of the principal recommendations under this plan element concerns the preparation of a plant-specific sludge management plan. Since 1977, the Department of Natural Resources has included, as a part of the discharge permitting process, the requirement that the designated management agencies develop and submit a sludge management report. In addition, the permit requires that, upon approval and implementation of the sludge management plan, records be maintained of sludge application sites and quantities, and that the sites be monitored for adverse environmental, health, or social effects that may be experienced due to sludge disposal. At the present time, such reports have been prepared and submitted to the Department, or are under preparation, for all of the public and private sewage treatment plants currently within the watershed.

The initial regional water quality management plan recommended that all of the sanitary sewer service areas identified in the plan be refined and detailed in cooperation with the local units of government concerned. Belgium is the only sewer service area identified in the portion of the Sheboygan River watershed within the Region. This area was refined as recommended in the initial plan. The boundaries of the sewer service area, through 1993, are shown on Map XV-3. Table XV-5 lists the plan amendment prepared for the refinement and the date the Commission adopted the document as an amendment to the regional water quality management plan. The planned sewer service area in the Sheboygan River watershed, as refined through 1993, totals about 0.8 square miles, or about 7 percent of the total watershed area, as shown in Table XV-5.

Current Plan Recommendations: The current point source plan element recommendations provide for the continued operation with expansion and upgrading, as necessary, for the Village of Belgium sewage treatment plant and for the continued operation and maintenance of the private plant serving the Lakeside Packing Corporation facility. Estimated approximate dates for beginning facility

Table XV-4

SELECTED CHARACTERISTICS OF EXISTING PUBLIC SEWAGE TREATMENT PLANTS IN THE SHEBOYGAN RIVER WATERSHED: 1990

Name of Public Sewage Treatment Plant	1990 Estimated Total Area Served (square mile)	1990 Estimated Total Population Served	Date of Construction and Major Modification	Major Sewage Treatment Unit Processes[a]	Name of Receiving Water to which Effluent is Disposed	WPDES Permit Expiration Date
Village of Belgium	0.5	900	1949, 1970, 1984	Aerated lagoon, sand filtration, chlorination, post aeration	East Branch of Belgium Creek	3/31/90

Name of Public Sewage Treatment Plant	Hydraulic Loading[b] (mgd)				BOD_5 Loading[b] (pounds per day)				Suspended Solids Loading[b] (pounds per day)			
	Existing				Existing				Existing			
	Average Annual	Maximum Monthly Average	Design Average Flow	Number of Months in 1990 in which the Monthly Average Loadings Exceeded the Design Capacity	Average Annual	Maximum Monthly Average	Design Average Flow	Number of Months in 1990 in which the Monthly Average Loadings Exceeded the Design Capacity	Average Annual	Maximum Monthly Average	Design Average Flow	Number of Months in 1990 in which the Monthly Average Loadings Exceeded the Design Capacity
Village of Belgium	0.13	0.19	0.19	0	109	176	300	0	108	160	300	0

[a] In addition, plants typically include headworks and miscellaneous processes such as pumping, flow metering and sampling, screening and grit removal, as well as sludge handling and disposal facilities.

[b] Loadings data were obtained from the 1990 Wisconsin Department of Natural Resources summary report of discharge monitoring data.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table XV-5

PLANNED SANITARY SEWER SERVICE AREAS IN
THE SHEBOYGAN RIVER WATERSHED: 1993

Name of Initially Defined Sanitary Sewer Service Area(s)	Planned Sanitary Sewer Service Area (square miles)	Name of Refined and Detailed Sanitary Sewer Service Area(s)	Date of SEWRPC Adoption of Plan Amendment	Plan Amendment Document
Belgium	0.8	Belgium	September 15, 1993	SEWRPC CAPR No. 97, 3rd Edition, Sanitary Sewer Service Area for the Village of Belgium, Ozaukee County, Wisconsin

Note: CAPR - Community Assistance Planning Report

Source: SEWRPC.

planning for public sewage treatment plant expansion and upgrading are indicated in Table XV-6. This recommendation regarding plant facility upgrading and expansion, as needed, also applies to the treatment plant solids management element.

The current point source pollution abatement plan element, including the planned sewer service areas, is summarized on Map XV-3. Table XV-6 presents selected design data for the Village of Belgium public treatment plant recommended to be maintained in the Sheboygan River watershed. It is important to note that the plant has not currently recorded monthly average flow which has equalled or exceeded the average design capacity of the plant, as shown in Table XV-4.

Table XV-6 shows expected increases in sewered populations and attendant increases in sewage hydraulic loading rates for two different year 2010 growth scenarios for the public sewage treatment plant in the Sheboygan River watershed. Under the intermediate scenario, the plant is not anticipated to have a loading rate equal to or higher than the average annual design capacity. It appears that facility planning should be between the years 2000 and 2005 for the Village of Belgium sewage treatment plant, as indicated in Table XV-6. Under the high growth scenario, a plant expansion would be required late in the planning period.

The current planned sanitary sewer service area in the Sheboygan River watershed is shown on Map XV-3. The existing and planned year 2010 population data for each sewer service area are presented in Chapter XVIII on a regional basis. A portion of the Belgium sewer service area is located in the Sheboygan River watershed. The planned service area within the portion of the watershed within the Region totals about 0.7 square mile, or about 6 percent of the Sheboygan River watershed.

As noted above, the Belgium sewer service area has been refined as part of the ongoing regional water quality management plan updating process. No additional refinements are envisioned to be needed. It is recommended that the sanitary sewer service area and attendant planned population levels set forth herein be utilized in subsequent sewerage system facility planning and sanitary sewer extension design. Particular attention should be given to the preservation and protection of the primary environmental corridor lands designated in the individual sanitary sewer service area plans and in the adopted 2010 regional land use plan.

In addition to the public plant, there was one private sewage treatment plant in operation within the Sheboygan River watershed in 1990. The facility serves the Lakeside Packing Company facility, located near the current limits of the planned sanitary public sewer service area of the Village of Belgium. Because of the special character and the associated treatment needs of the wastewater generated at the facility, it is recommended that the private plant continue to be operated. The need for upgrading and level of treatment should be formulated on a case-by-case basis during plan implementation as part of the Wisconsin Pollutant Discharge Elimination System permitting process.

Sewer System Flow Relief Devices

Existing Conditions and Status of Plan Implementation: In 1975, there was one known separate sewer flow relief devices in the Sheboygan River watershed; a bypass located at the Village of Belgium wastewater treatment facility

Table XV-6

SELECTED DESIGN DATA FOR PUBLIC SEWAGE TREATMENT PLANTS
IN THE SHEBOYGAN RIVER WATERSHED: 1990 AND 2010

Name of Public Sewage Treatment Plant	Sewer Service Area	Design Capacity-Average Annual Hydraulic (mgd)	Existing 1990			Planned Year 2010						
							Intermediate Growth Centralized Land Use Plan			High Growth Decentralized Land Use Plan		
			Average Hydraulic Loading (mgd)	Total Area Served (square mile)	Resident Population Served	Planned Sewer Service Area (square mile)	Resident Population Served	Average Hydraulic Loading (mgd)	Approximate Facility Planning Year[a]	Resident Population Served	Average Hydraulic Loading (mgd)	Approximate Facility Planning Year[a]
Village of Belgium	Belgium Lake Church	0.19	0.13	0.5	900	3.2	1,500	0.21	2004	3,900	0.51	2000

[a] Approximate year in which facility planning for plant expansion would be initiated in order to allow for expansion during the subsequent three years prior to plant capacity being exceeded. Date is based upon review of average design flows compared to average annual and maximum monthly flows and age of facilities based upon date of last major construction.

Source: SEWRPC

discharging to the East Branch of Belgium Creek. This bypass has been eliminated as the plant was upgraded, as recommended in the initial regional water quality management plan. As of 1993, there were no known points of sanitary sewer flow relief in the Sheboygan River watershed.

Current Plan Recommendations: As noted above, there are currently no known points of sewage flow relief in the sanitary sewerage systems in the Sheboygan River watershed.

Intercommunity Trunk Sewer

Existing Conditions and Status of Plan Implementation: The initial regional water quality management plan as updated, recommended the construction of one intercommunity trunk sewer in the Sheboygan River watershed. This trunk sewer would connect the Lake Church sewer service area to the Village of Belgium sewerage system. As of 1993, the implementation of the public sewer system in the Lake Church area has not yet been implemented and the trunk sewer connection has not been made.

Current Plan Recommendations: The current regional water quality management plan includes a recommendation to extend public sanitary sewer services to the Lake Church area. Thus, the plan continues to recommend the construction of the trunk sewer to connect that area to the Village of Belgium sewerage systems. This trunk sewer is discussed in Chapter IX and is shown on Map IX-4, since it is located within the drainage area tributary to Lake Michigan immediately east of the Sheboygan River watershed.

Point Sources of Wastewater Other Than Public and Private Sewage Treatment Plants

Existing Conditions and Status of Plan Implementation: In 1975 and in 1990, there were no known point sources of pollution identified in the Sheboygan River watershed other than public and private sewage treatment plants. The initial regional plan recommends that such industrial sources of wastewater be monitored, and discharges limited to levels which must be determined on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System permit process.

Current Plan Recommendations: As of 1993, there were five known, permitted point sources of wastewater other than public and private sewage treatment plants discharging to surface or groundwater systems in the portion of the Sheboygan River watershed contained within the Region. These point sources of wastewater discharge industrial cooling process, rinse, and wash water directly, or following treatment, to the groundwater or the surface waters of the Sheboygan River watershed. It is recommended that such sources of wastewater continue to be regulated and controlled on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System.

Existing Unsewered Urban Development Outside the Proposed Sanitary Sewer Service Area

As of 1975, there were no enclaves of unsewered urban development located outside of the then proposed year 2000 sewer service areas. As of 1990, no new enclaves of unsewered urban development have been created beyond the proposed 2010 sewer service area.

Miscellaneous Potential Pollution Sources

Landfills: Landfills in the Sheboygan River watershed, including those currently abandoned, have the potential to affect water quality through the release of leachates from the landfill to ground and surface waters. These landfills potentially contain some toxic and hazardous substances due to the disposal of such wastes from households and other sources. In some cases, toxic and hazardous substances have begun to leach into surrounding soils and aquifers, and can potentially be transmitted to the surface waters.

There are currently no active landfills and one known, abandoned landfill located in the portion of the Sheboygan River watershed located within the Region. There is no indication that this landfill is negatively impacting surrounding surface waters.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the Sheboygan River watershed have the potential to affect water quality through the release of substances into the surrounding soils and ground water. Sites with leaking underground storage tanks are eligible for remediation activities under the U.S. Environmental Protection Agency Leaking Underground Storage Tank (LUST) Program, designed to facilitate the clean up of such sites, primarily those sites containing petroleum storage tanks. In selected cases, sites undergoing clean up efforts are permitted under the Wisconsin Pollutant Discharge Elimination System (WPDES) to discharge remediation wastewater to surface or ground waters. Discharges from these sites are required to meet specified water quality discharge standards set forth by the Wisconsin Department of Natural Resources.

As of 1993, there were four known leaking underground storage tanks in the portion of the Sheboygan River watershed contained within the Region. None of these involved the discharging of remediation wastewater directly to surface or ground waters. While there is no specific evidence to document the impact of these individual point sources on water quality within the watershed, it can be reasonably assumed that the cumulative effect of multiple leaking underground storage tanks has the potential to result in detrimental effects on water quality over time.

Additional Groundwater Contamination Sites: Additional groundwater contamination sites which are undergoing remediation may also be permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation wastewater to surface or ground waters. As of 1993, there were no such permitted sites discharging to surface or ground waters in the Sheboygan River watershed.

NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT

The nonpoint source pollution abatement plan element of the initial regional water quality management plan includes recommendations relating to diffuse sources of water pollution. Nonpoint sources of water pollution include runoff from urban and rural land uses, runoff from construction sites, wastes from livestock operations, malfunctioning on site sewage disposal systems, and pollutant contributions from the atmosphere.

Existing Conditions and Status of Plan Implementation

For the Sheboygan River watershed, the initial plan generally recommended urban and rural nonpoint source pollution control practices designed to reduce the pollutant loadings from nonpoint sources by about 25 percent, in addition to urban construction erosion control, onsite systems management, and streambank erosion. Implementation of the recommended nonpoint source control practices has been achieved on a limited basis in the Sheboygan River watershed through a variety of local and State regulations and programs. These programs include the regulation of onsite sewage disposal systems under programs currently administered by Ozaukee County in the unincorporated areas. These programs provide for the system installation requirements as set forth in Chapter ILHR 83 of the Wisconsin Administrative Code, for ongoing maintenance of newer systems, and for problem resolution of failing systems where they are identified.

With regard to rural nonpoint source controls, Chapter NR 243 of the Wisconsin Administrative Code sets forth design standards and accepted animal waste management practices for large animal feeding operations. This program is administered by the Wisconsin Department of Natural Resources, which works with the County Land Conservation Departments to resolve identified significant animal waste problems. This program has been used in a few selected cases in the Sheboygan River watershed. Other programs, such as the Conservation Reserve Program administered by the U. S. Department of Agriculture, Soil Conservation Service, and wetland restoration programs administered by the Wisconsin Department of Natural Resources and others, are utilized primarily for cropland soil erosion control and wildlife habitat purposes and will have positive water quality impacts.

Chapter ATCP 50 of the Wisconsin Administrative Code requires that soil erosion on all croplands be reduced to tolerable levels by the year 2000. Tolerable levels are defined as soil loss tolerances or T-values, which are the maximum annual average rates of soil loss for each soil type that can be sustained economically and indefinitely without impairing the productivity of the soil. These values have been determined for each soil type by the U.S. Soil Conservation Service. Chapter 92 of the Wisconsin State Statutes requires that soil erosion control plans be prepared and maintained for counties identified by the Wisconsin Department of Agriculture, Trade, and Consumer Protection as priority counties for soil erosion control. The Commission has prepared an agricultural soil erosion control plan for Ozaukee County, and thus for all areas of the Sheboygan River watershed contained within Southeastern Wisconsin. This plan identifies priority areas for cropland soil erosion control within the County and the watershed, and, additionally, recommends farm management practices intended to reduce cropland soil erosion to tolerable levels. Soil conservation and management are closely related to the issues of stormwater management, flood control, control of nonpoint source pollutants, changing land use, and deterioration of the natural resource base. Therefore, it is important that soil conservation be considered within the framework of a comprehensive watershed planning program which will enable the formulation of coordinated, long-range solutions.

While the local programs described above have probably resulted in some modest reduction in pollutant loadings from nonpoint sources, this element of the plan remains largely unimplemented.

The initial regional plan also recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans. Such plans are to identify the nonpoint source pollution control practices that should be applied to specific lands. Working with the individual county land conservation committees and the Commission, the Wisconsin Department of Natural Resources is carrying out the recommended detailed planning for nonpoint source water pollution abatement on a watershed-by-watershed basis. This detailed planning and subsequent plan implementation program is known as the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program. This planning program provides cost-sharing funds for an individual project, or land management practice, to local governments and private landowners upon completion of the detailed plans. These funds are provided through nonpoint source local assistance grants administered by the Wisconsin Department of Natural Resources.

Onion River Priority Watershed Project: The Onion River priority watershed project was designated a "priority watershed" in 1981. Planning for the Onion River priority watershed project was completed in 1981[1], and implementation of practices occurred from 1981 through 1989.[2] The planning was conducted for the entire 101.5-square-mile Onion River watershed, which is tributary to the Sheboygan River. About 91 square miles, or about 90 percent of the watershed is located in Sheboygan County. The Onion River priority watershed program established pollutant reduction goals which provided for a reduction of about 40 percent, as well as reduction in bacterial counts and improved fish population and habitat. These reductions were considered to be consistent with the initial water quality management plan.

To achieve these pollutant reduction goals, the Onion River priority watershed project included recommendations and funding eligibility for barnyard runoff and manure storage systems, streambank protection programs, and the construction of grassed waterways and other cropland management practices. Participation in the priority watershed program as measured by the actual installation of practice compared to the practice recommended was generally about 25 percent or less. The Department of Natural Resources final report[3] on the project suggests that the Onion River water quality and biological conditions has improved between 1981 and 1990 although the level of such improvement remains to be relatively low.

Current Plan Recommendations

Given the partial implementation of the nonpoint source priority watershed plan recommendations, it is recommended that the need for further nonpoint source

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[1] Wisconsin Department of Natural Resources Publication, The Onion River Priority Watershed Plan, May 1981.

[2]Wisconsin Department of Natural Resources Publication No. WR-277-91, An Evaluation of Water Quality in the Onion River Priority Watershed and the Effects of Best Management Practice Implementation: Final Report, January 1991.

[3]Wisconsin Department of Natural Resources Publication No. WR-268-91. Onion River Priority Watershed Project: Final Report: Nonpoint Source Water Pollution Abatement Program, May 1992.

reductions in the Sheboygan River watershed be reviewed and reevaluated. It is also recommended that construction site erosion control onsite sewage system management and streambank erosion control be carried out in the watershed. The reevaluation of the levels of nonpoint source pollution control needed should be based upon additional monitoring which would be conducted as described in the next section.

WATER QUALITY MONITORING PLAN ELEMENT

Existing Conditions and Status of Implementation

While substantial progress has been made in the regional water quality management plan elements described in the previous sections, the most direct measure of the impact of plan implementation on water quality conditions can only be achieved by a well-planned areawide water quality and biological condition monitoring program. As of 1993, no long-term monitoring has been carried out in the Sheboygan River watershed within the Region on a sustained basis.

Current Plan Recommendation

Increased water quality and biological conditions monitoring will be needed in the watershed to document current conditions and to demonstrate water quality condition changes over time. It is recommended that an intensive water quality and detailed biological condition monitoring program be conducted by the Wisconsin Department of Natural Resources over a one-year period at one station on the West Branch of Belgium Creek and at one station on the East Branch of Belgium Creek, both near the Ozaukee County-Sheboygan County line. It is recommended that this program be conducted within the next five to seven years and be repeated at approximately five to seven year intervals. These recommendations can be coordinated, and are consistent, with the Wisconsin Department of Natural Resources current surface water monitoring strategy developed to conduct monitoring activities and perform basic assessments for each watershed in the Region in an approximate five to seven year rotating cycle.

LAKE MANAGEMENT PLAN ELEMENT

The initial regional water quality management plan included recommendations for reducing nonpoint sources of pollution in the tributary areas of lakes and for consideration of other lake management measures, including in-lake measures such as aeration, nutrient inactivation, and fishery management programs. For major lakes, the initial plan recommended that comprehensive lake management plans be prepared to consider in more detail the applicability and preliminary design of watershed and in-lake management measures. The preparation of such a comprehensive plan requires supporting water quality monitoring programs to be established.

As noted above, there are no major lakes in the Sheboygan River watershed. However, there are smaller water bodies such as park-oriented ponds and small lakes in the watershed. It is recommended that water quality planning and supporting monitoring be conducted for smaller, lake-like water bodies in the watershed which are less than 50 acres in size which are deemed to be important for water quality protection. In such cases, the management techniques similar to those recommended to be applicable for consideration on the major lakes in the Region are considered applicable for management purposes.

WATER QUALITY AND BIOLOGICAL CONDITIONS

Streams

Stream water quality data available for use in preparing the initial regional water quality management plan were collected during the 1964 through 1965 Commission benchmark stream water quality study; the 1965 through 1975 Commission stream water quality monitoring effort; and the 1976 Commission monitoring program conducted under the regional water quality management planning effort. Available data collected in those programs for the Sheboygan River watershed included samplings at one Commission station on the West Branch of Belgium Creek. The sampling station location is shown on Map XV-4.

No post-1976 known water quality data have been collected in the watershed. The assessment of current conditions relied upon the uniform areawide characterization of surface water conditions developed under the initial planning effort by simulation modeling. The modeling results developed under the initial plan included simulation of water quality conditions under various levels of point source and nonpoint source pollution control and under both the then current 1975 land use conditions and under planned year 2000 land use conditions, as discussed in Chapter II. Review of these data can provide insight into the current water quality conditions and the current potential for achieving the established water use objectives in the Sheboygan River watershed.

Toxic and Hazardous Substances: No known stream or bottom sediment sampling for toxic and hazardous materials had been available for use in preparing the initial regional water quality management plan or in preparing the current plan.

Water Quality Assessments: Based upon the available data, the water quality and biological characteristics of the Onion River subwatershed was assessed with the results set forth in Table XV-7. Fish population and diversity was classified as being poor in the West Branch of Belgium Creek. Standards are estimated to be exceeded for fecal coliform levels in the West Branch of Belgium Creek. Dissolved oxygen, ammonia nitrogen, and total phosphorus levels are estimated to meet the standards.

No recent data were available on biotic index ratings, which are biological indicators of water quality within a stream system. High levels of streambed sedimentation were noted in the West Branch of Belgium Creek.

Table XV-8 sets forth the water quality index classification[4] used in the initial plan for 1964, 1974-75, and for 1990-1991 conditions for the sampling station in the watershed. The use of the index is discussed in Chapter II. The limited data indicate that water quality conditions remained "fair" from 1964 through 1974 and 1975. As indicated in Table XV-8, no recent data were available to assess the water quality conditions on a similar basis in 1990 or 1991 within the watershed. However, the aforementioned project evaluating report of the Onion River nonpoint source priority watershed program indicates that there was a very small improvement in water quality conditions between 1980 and 1990. The

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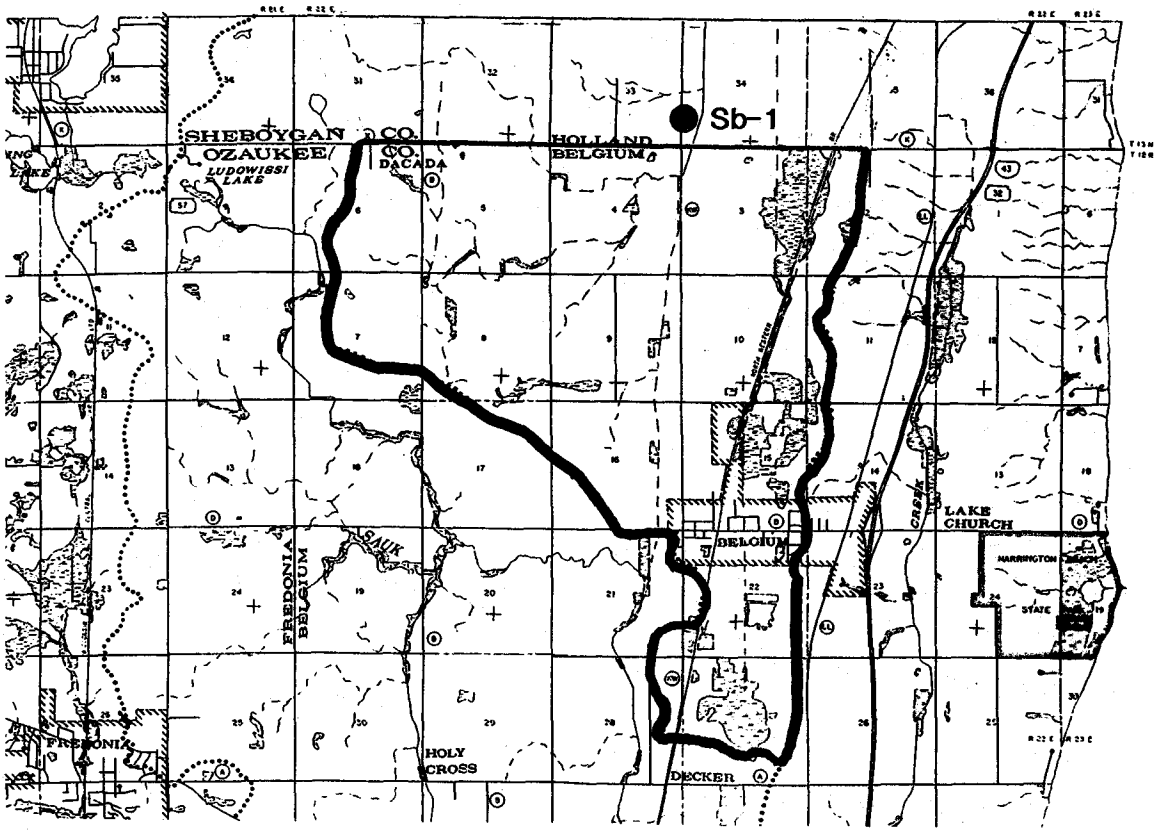
[4]For a detailed description of the water quality index, see SEWRPC Technical Report No. 17, Water Quality of Lakes and Streams in Southeastern Wisconsin: 1964-1975, June 1978.

Map XV-4
LOCATIONS OF WATER QUALITY SAMPLING STATIONS IN THE SHEBOYGAN RIVER WATERSHED



LEGEND

Sampling stations used in preparation of initial plan

● SEWRPC

Source: SEWRPC.

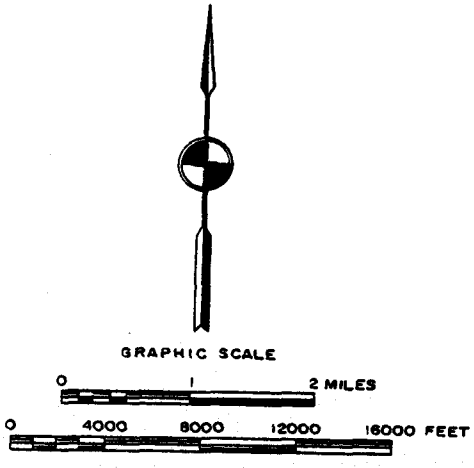


Table XV-7

CHARACTERISTICS OF STREAMS REACHES IN THE SHEBOYGAN RIVER WATERSHED

Stream Reach	Stream Length (miles)	Fish Population and Diversity[a]	Recorded Fish Kills	Water Quality Problems[b]					Biotic Index Rating	Streambed Sedimentation	Physical Modifications to Channel[c]
				DO	NH_3	Total P	Fecal Coliform	Toxics			
West Branch Belgium Creek Upstream Sheboygan County Line	3.0	Poor	No	No	No	No	Yes	- -	--	High (muck)	Major
East Branch Belgium Creek	4.2	- -	No	- -	- -	- -	- -	- -	- -	- -	Major

[a] Based upon stream appraisal documentation set forth in the May 1981 Onion River Priority Watershed Plan and professional judgement of area fish managers.

[b] Simulation modeling analyses data developed in the initial plan were used to evaluate current water quality for the Sheboygan River watershed based upon year 2000 land use conditions and current level of pollutant control.

[c] Physical modifications to the channel were defined as: major if 50 percent or more of the stream reach was modified by structural measures or was deepened and straightened; moderate if 25 to 50 percent of the stream reach was modified; and low if up to 25 percent of the reach was modified.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table XV-8

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATION IN THE SHEBOYGAN RIVER WATERSHED 1964, 1974-1975, AND 1990-91

Water Quality Sampling Station[a]	July, August, September, and October of 1964	August of the Years 1974-1975	July, August, 1990 and 1991
Sb-1	Fair	Fair	- -
Watershed Average	Fair	Fair	- -

[a] See Map XV-4 for sampling station locations.

Source: SEWRPC.

conclusion was based upon a comparison of biotic indices taken in the headwaters of the Onion River, which are upstream of the confluence with the Belgium Creek.

A summary of potential pollution sources in the portion of the Sheboygan River watershed contained within the Region is shown in tabular summary in Table XV-9. Review of the data indicate that an insignificant amount of land within the watershed has been converted from rural to urban uses. Data on nonpoint source pollution, public and private sewage treatment plans discharging to surface waters are included in Table XV-9.

Compliance with Water Use Objectives

As indicated in Chapter II, both the East and West Branches of Belgium Creek are recommended for warmwater sport fish and full recreational uses. These water use objectives and the associated water quality standards are discussed in Chapter II.

Based upon the available data for the sampling station in the watershed, the West Branch of Belgium Creek partially meets the water quality standards associated with the recommended water use objectives during and prior to 1975, the base year of the initial plan. As part of the Onion Creek priority watershed planning program, the DNR staff conducted field inspections and limited sampling in order to assess the water quality and biological conditions in 1981 and 1990 of the streams in the Onion River watershed. Review of the data collected in those investigations and a review of the water quality sampling and water quality simulation data developed in the initial plan and the status of plan implementation, it is estimated that violations of fecal coliform standards occur throughout the watershed, and thus, the water use objectives are being partially met.

It should be noted that the water use objectives set forth herein for both the East and West Branches of Belgium Creek are higher than the objectives set forth in Chapter NR 104 of the Wisconsin Administrative Code. Chapter NR 104 classifies the East and West Branches of Belgium Creek as capable of supporting only a limited aquatic life community, while the objectives set for herein recommend a warmwater sport fish objective. It is recommended that a stream appraisal to further assess the potential for a higher use objective be conducted for the East and West Branches of Belgium Creek as part of the next one-year monitoring period envisioned to be carried out in the Sheboygan River watershed by the Wisconsin Department of Natural Resources.

WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

Based upon the current status of plan implementation, current land use planning and local nonpoint source pollution abatement and sewerage system planning, there are two major issues which remain to be addressed in the Sheboygan River watershed. One issue related to the degree of nonpoint source pollution abatement still required in the watershed. In addition, it is also recommended that the Wisconsin Department of Natural Resources conduct a water quality and biological conditions survey on the East and West Branches of Belgium Creek to re-assess the water use objectives currently set forth in the Wisconsin Administrative Code.

Table XV-9

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN FOR INTERCOMMUNITY TRUNK SEWERS IN THE SHEBOYGAN RIVER WATERSHED: 1990

Intercommunity Trunk Sewer	Status of Implementation
Lake Church - Belgium	No action

Source: SEWRPC.

Reassessment of the Future Levels of Nonpoint Source Controls In the Onion River Watershed

The nonpoint source priority watershed program implementation period has now been completed for the Onion River watershed. Following completion of detailed water quality and biological condition monitoring in the Onion River watershed under the Wisconsin Department of Natural Resources ongoing monitoring program, it is recommended that the need for further nonpoint source controls be assessed based upon the current level of plan implementation and water quality and biological conditions data.

Stream Reclassification Evaluation

The East Branch of Belgium Creek is currently included under the limited classifications in Chapter NR 104 of the Wisconsin Administrative Code. However, it is recommended that the objective for this stream be upgraded to provide for water sport fish classifications. It is recommended that the Wisconsin Department of Natural Resources include further stream appraisals for Belgium Creek as part of the monitoring program during the next period when the Department is conducting monitoring efforts in the Sheboygan River watershed as is envisioned within the next five to seven years.

Chapter XVI

STATUS OF GROUNDWATER MANAGEMENT PLAN ELEMENT

INTRODUCTION AND BACKGROUND

Groundwater resources constitute an extremely valuable element of the natural resource base of Southeastern Wisconsin. The groundwater reservoir not only sustains lake levels and provides the base flow of the streams in the Region, but comprises a major source of water supply for domestic, municipal, industrial, and agricultural water users. Like surface water, groundwater is susceptible to depletion in quantity and to deterioration in quality. An important consideration in regional water quality planning, therefore, is the protection of the quantity and quality of this valuable resource.

A groundwater management plan element of the regional water quality management plan is currently under preparation in a cooperative program being carried out by the University of Wisconsin-Extension, Wisconsin Geologic and Natural History Survey, and the Regional Planning Commission. This chapter describes the groundwater resources in Southeastern Wisconsin; presents the purpose and objectives, as well as scope of the groundwater management plan being prepared; and sets forth the current status and the timetable for completion of the plan element.

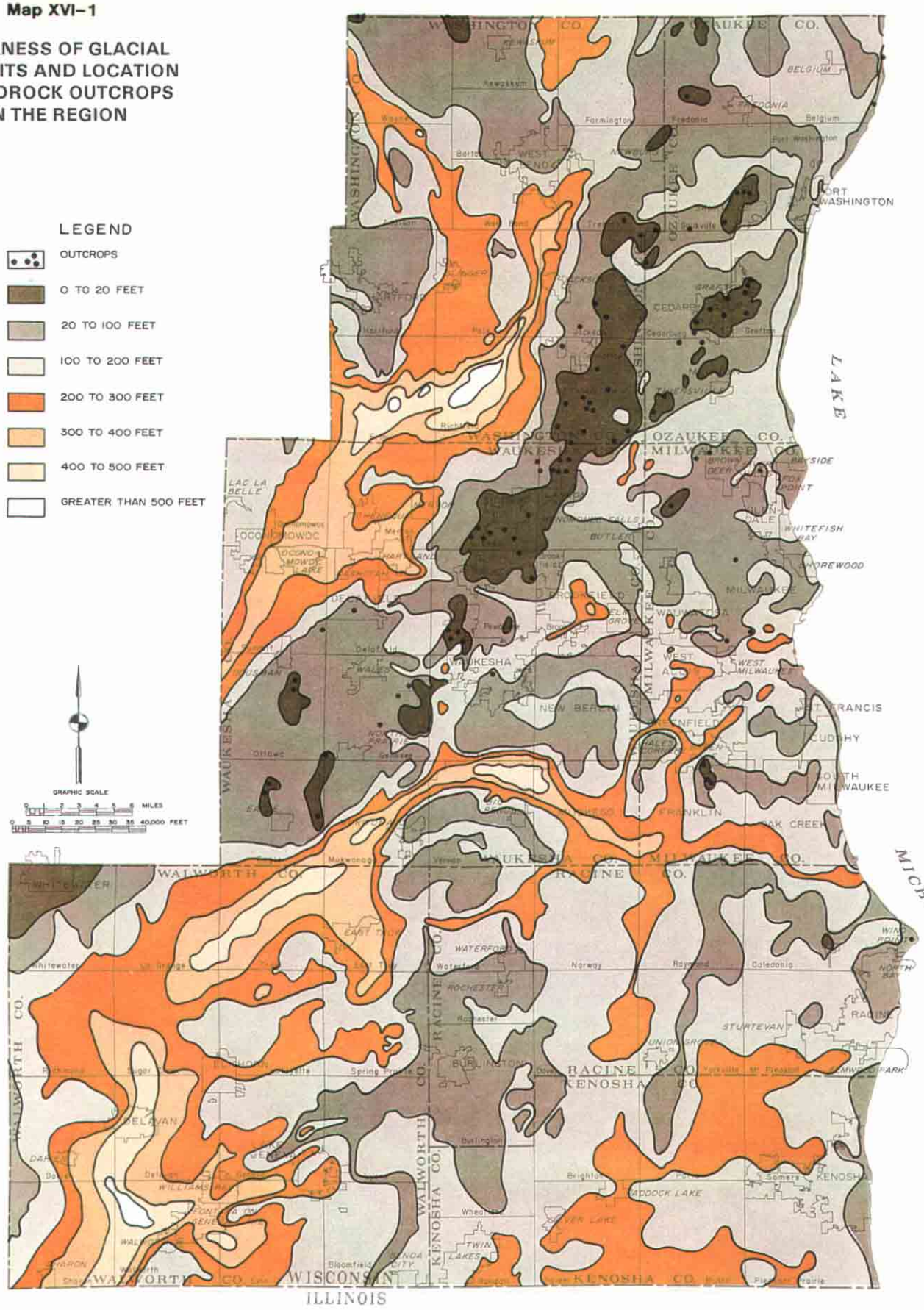
GROUNDWATER RESOURCES DESCRIPTION

Three major aquifers exist within the seven-county Region. From land's surface downward, they are: 1) the sand and gravel deposits in the glacial drift; 2) the shallow dolomite strata in the underlying bedrock; and 3) the deeper sandstone, dolomite, siltstone, and shale strata. Because of their relative proximity to the land's surface, and because of the hydraulic interconnection, the first two aquifers are commonly referred to collectively as the "shallow aquifer," while the latter is referred to as the "deep aquifer." Wells tapping these aquifers are referred to as shallow or deep wells, respectively. Except in the western portions of Walworth and Waukesha Counties, the shallow and deep aquifers are separated by the Maquoketa shale, which forms a relatively impermeable barrier between the two aquifers. The spatial distribution of the unconsolidated surficial material and the thickness and orientation of the bedrock strata are depicted on Map XVI-1 and Figure XVI-1; lithologic descriptions of the surficial deposits and the bedrock are provided in Table XVI-1.

Some water is recharged to the deep sandstone aquifer underlying the Region by vertical movement through wells open to both the shallow and deep aquifers and by slight vertical movement downward through the Maquoketa shale. The principal source of recharge to the deep aquifer, however, is precipitation percolating

Map XVI-1

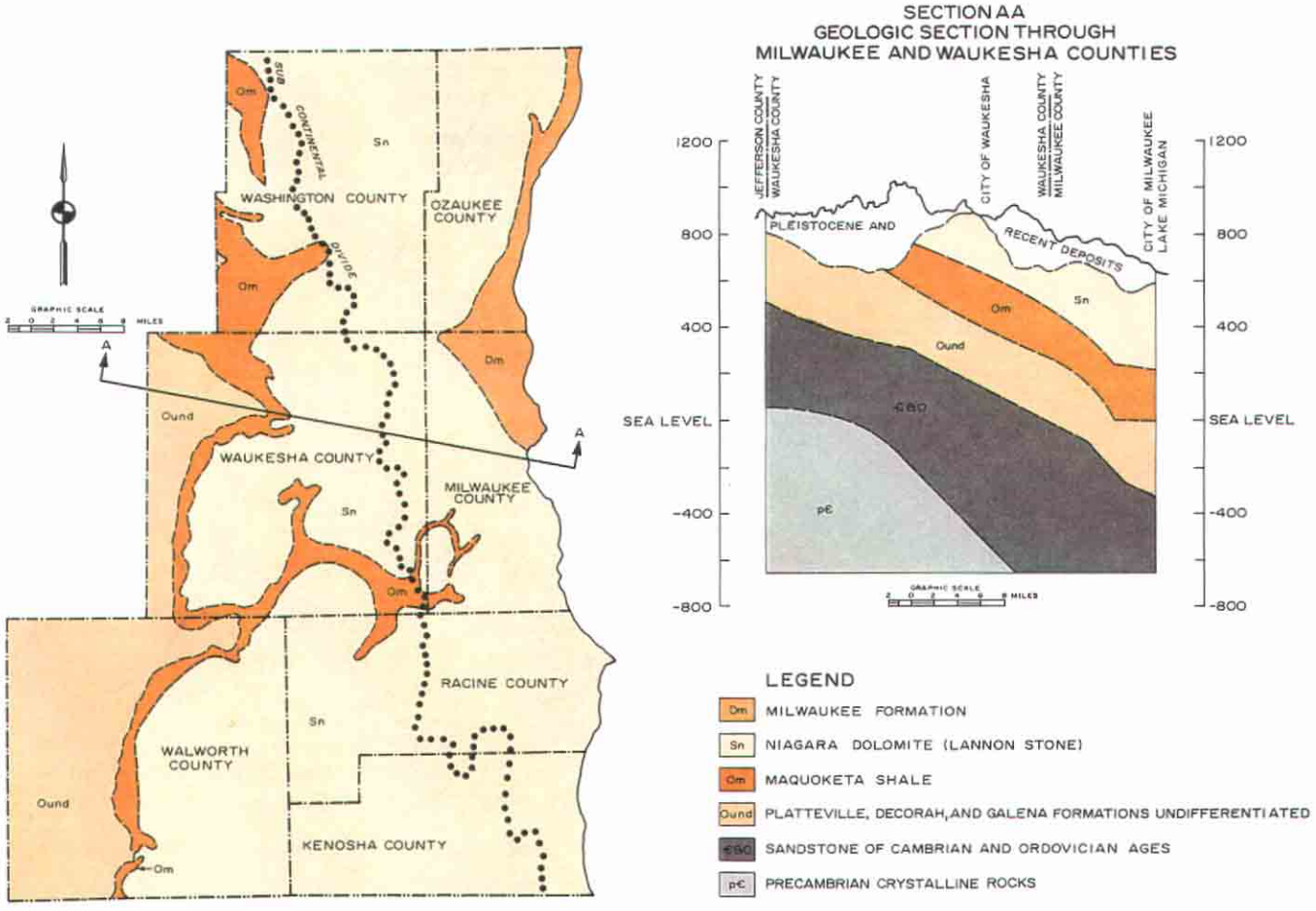
THICKNESS OF GLACIAL DEPOSITS AND LOCATION OF BEDROCK OUTCROPS IN THE REGION



Source: T. O. Friz, Man and the Materials of Construction, How They Interrelate in the Seven Counties of Southeastern Wisconsin, Ph.D. Dissertation, University of Wisconsin, Madison, 1969.

Figure XVI–1

MAP AND CROSS-SECTION OF BEDROCK GEOLOGY IN THE REGION



Source: SEWRPC.

Table XVI-I

STRATIGRAPHIC COLUMN OF BEDROCK AND GLACIAL DEPOSITS IN THE REGION

System	Series	Formation	Lithologic Description
Quaternary		Recent deposits	Soils, muck, peat, alluvium, beach sand and gravel. Zero to five feet thick
		Pleistocene deposits	Till and outwash sand and gravel. Zero to 430 feet thick.
		Kenwood	Shale, black, carbonaceous. Fossiliferous. No outcrops. Found in City of Milwaukee intake tunnel--Lake Michigan. Approximately 55 feet thick.
Devonian	Middle Erian	Milwaukee	Shale, shaly limestone; lower one-third dolomite. Fossiliferous. Approximately 130 feet thick.
		Thiensville	Dolomite, thick- to thin-bedded. Some fossils. Small amounts of bitumen. Approximately 65 feet thick.
		Lake Church	Dolomite, thick- to thin-bedded. Fossiliferous. Pyritic in places. Approximately 27 feet thick.
Silurian	Cayugan	Waubakee	Dolomite, thin-bedded, hard and brittle. Fossils scarce. Approximately 30 feet thick.
	Niagaran	Racine	Dolomite, fine to coarsely crystaline. Thick- to thin-bedded. Barren to fossiliferous. Approximately 100 feet thick.
		Manistique	Dolomite--lower part thin-bedded. Fossils. Upper--fairly thin-bedded, cherty. Many corals. Approximately 150 feet thick.
		Burnt Bluff	Dolomite, thick-bedded or thin-bedded. Lower part, a few fossils. Upper part, semilithographic. No fossils. Approximately 110 feet thick.
	Alexandrian	Mayville	Dolomite, thick-bedded, compact to coarsely crystalline. Brecciated in places, cherty, many reef structures. Approximately 175 feet thick.
Ordovician	Cincinnatian	Meda	Red-brown oolitic iron ore and nonoolitic ore. Missing in Racine, Milwaukee, Ozaukee, Door, and Dodge Counties. In lenses up to approximately 55 feet thick.
		Maquoketa	Shale, dolomitic, and beds of dolomite. Fossiliferous. Ninety to 225 feet thick.
	Champlainian	Salena	Dolomite, thick- to thin-bedded, fine to coarsely crystalline. Cherty. Shaly and sandy in places; some fossils. Approximately 227 feet thick.

Source: SEWRPC.

downward through glacial deposits into the deep aquifer which is exposed beneath the glacial deposits within the Region only in the western one-half of Walworth County and the western one-quarter of Waukesha County. The deep aquifer recharge area within Southeastern Wisconsin is a long narrow zone oriented in a generally north-south direction. It is bounded on the east by the Maquoketa shale and on the west by a groundwater divide, the separation between eastward and westward groundwater movements, located along the western edge of Waukesha and Walworth Counties. Groundwater in the deep aquifer beneath the Region moves in a generally easterly direction from the primary western recharge areas toward Lake Michigan. Thus, most of the water withdrawn from the deep sandstone aquifer by communities and industries in the seven-county Region originally entered the aquifer via the Waukesha and Walworth county recharge areas.

Pumping from the confined sandstone aquifer has altered the potentiometric surface[1] of that aquifer over the past century. Prior to intensive pumpage from the aquifer, the movement of groundwater in the aquifer was generally from west to east, with the potentiometric surface being located just below the ground surface and in some instances actually above the ground surface as evidenced by reports of flowing or artesian wells. Since 1880, the original potentiometric surface of the sandstone aquifer has been markedly altered, primarily as a result of pumpage in the major urban areas in the Region, as well a heavy groundwater use south of the Region in Northeastern Illinois. Drawdowns of up to 350 feet have occurred in the Milwaukee-Waukesha area, while drawdowns in excess of 275 feet have occurred at the Wisconsin-Illinois line.

Whereas the primary source of recharge for the deep sandstone aquifer is located partly outside of Southeastern Wisconsin, the shallow aquifer, composed of the glacial draft and interconnected dolomitic bedrock, is recharged locally by downward percolation of precipitation and surface water. In contrast to the deep aquifer, the direction of water movement in the shallow aquifer is much more variable and complex. Movement occurs from local recharge areas toward multiple points of discharge, such as streams, lakes, marshes, and wells. Compared to the deep aquifer, the shallow aquifer is more susceptible to pollution by wastewater because it is nearer, both in terms of distance and time, to potential pollution sources, thus minimizing the potential for dilution, filtration, and other natural processes that tend to reduce the potential detrimental effects of pollutants.

The current quality of groundwater in both the shallow and deep aquifers throughout the Region is generally good, although localized water quality problems affect some areas. Groundwater throughout the Region may be characterized as hard, containing high concentrations of calcium, magnesium, sulfates, and other dissolved solids; therefore, softening is required for almost all water uses. Localized water quality problems include hardness, expressed as calcium carbonate, in excess of 500 mg/l in the deep sandstone aquifer along much of the

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[1]The potentiometric surface represents the static head of water in an aquifer as defined by the levels to which water will rise in wells penetrating the aquifer.

eastern edge of the Region. Some wells in the Village of River Hills in Milwaukee County, for example, have measured hardnesses exceeding 1,500 mg/l and total dissolved solids concentrations in excess of 6,000 mg/l.

Groundwater quality conditions can be impacted by sources of pollution, such as landfills, agricultural fertilizer or manure storage and application sites, pesticide application sites, chemical spills, leaking surface or underground storage tanks, and nonpoint sources of pollution, including onsite sewage disposal systems. In addition, concerns exist in isolated cases in Southeastern Wisconsin with regard to naturally occurring substances. Within Southeastern Wisconsin, isolated groundwater problems have been encountered relating to several types of groundwater quality problems an issues.

The first groundwater quality concern relates to radium concentrations. Certain formations within the Cambrian sandstones in Southeastern Wisconsin are known to produce relatively high concentrations of naturally occurring radium. This naturally occurring radium has been found to exceed the State standard for radium in a number of municipal wells using the sandstone aquifer as a source. Evaluations are being undertaken to consider alternative means of reducing the radium level in these wells. In addition, the U. S. Environmental Protection Agency and the Wisconsin Department of Natural Resources are continuing to evaluate the standard for radium in order to assess the suitability of the current standards.

Another groundwater quality problem found in Southeastern Wisconsin is the presence at certain locations of volatile organic materials. These volatile organic materials enter the groundwater system primarily through commercial, industrial, and municipal waste disposal systems or spills. Most of these organic materials are industrial solvents or household products, such as spot and stain removers, paints and thinners, drain cleaners, and air fresheners. Other sources of volatile organics are leaking underground storage tanks for gasoline and other petroleum products. The Wisconsin Department of Natural Resources has tested all municipal water supplies in the State and a large number of private wells for volatile organic materials. An isolated number of municipal wells in Southeastern Wisconsin have been found to contain detectable levels of volatile organic materials. The areas where these materials have been encountered are relatively limited; in most cases remedial actions have been carried out or are underway to resolve the problems. In addition, the increased awareness and monitoring activity is expected to resolve these isolated problems over time.

Isolated cases of bacterial and nitrogen contamination have also been identified in Southeastern Wisconsin. Such cases have occurred most often in areas where the limestone formations are near the surfaces, including portions of northeastern Waukesha County. These problems can often be traced to nonpoint pollution sources and septic system discharges. Public awareness of these problems is increasing and improved monitoring is underway. The continued installation of public centralized sewerage systems will help to resolve many of these isolated problems over time.

REGIONAL GROUNDWATER MANAGEMENT PLANNING PROGRAM

Purpose and Objectives

The purpose of the groundwater management plan element is to complete a comprehensive groundwater resource data inventory and analysis, including a series of groundwater resource maps of the Region and a technical report describing the findings of the inventory and analysis; to complete a groundwater pollution source inventory and supporting mapping; and to develop groundwater protection and management recommendations for the Region.

The primary objectives relating to the Southeastern Wisconsin Region are:

1. To interpret soil survey information and determine and map the pollutant attenuation capacity of soils.

2. To map the geology of the Region, concentrating on the Pleistocene geology and depth to bedrock and to compile bedrock geology data from existing information.

3. To revise and refine existing water-table maps and identify groundwater divides and regional groundwater flow directions.

4. To evaluate hydrogeology of the soils, unconsolidated materials, and the underlying bedrock, and evaluate the susceptibility of groundwater to contamination.

5. To identify and evaluate the potential contamination sources of groundwater.

6. To develop groundwater management protection recommendations for the Region based upon the inventories and analyses.

The planning program is intended to form the basis for a groundwater management element of the regional water quality management plan. In addition, the planning program will provide, on a regional basis, valuable hydrogeologic information for use in parallel and subsequent groundwater planning programs, such as well head protection planning.

Scope of Work

The project elements include inventory and analyses of existing data; field and laboratory work; mapping; and report preparation. The initial inventory work will include:

1. Review of existing information on the Region's groundwater and other related resources.

2. Gathering data on soils, geology, groundwater, precipitation, streamflow, and water levels.

3. Inventory of existing well logs and observation stations for measuring precipitation, streamflow, and groundwater levels.

4. Inventory of major potential contamination sources, such as solid and liquid waste disposal sites.

The mapping and field and laboratory work is envisioned to include the following work elements:

1. The preparation of maps illustrating the soil pollutant attenuation potential. Maps will be prepared at a scale of one inch equals 8,000 feet for the following parts of the Region: Washington and Ozaukee Counties, Waukesha and Milwaukee Counties, Racine and Kenosha Counties, and Walworth County. In addition, a regional map at a scale of one inch equals 8,000 feet will be prepared.

2. The preparation of Pleistocene hydrogeologic maps at a scale of one inch equals 8,000 feet, with cross sections, for Washington and Ozaukee Counties, Racine and Kenosha Counties, Milwaukee County, Walworth County, and Waukesha County. In addition, a regional Pleistocene hydro-stratigraphic map at a scale of one inch equals 8,000 feet will be prepared.

3. The preparation of depth to bedrock maps at a scale of one inch equals 8,000 feet will be prepared for Ozaukee and Washington Counties, Kenosha and Racine Counties, Waukesha and Milwaukee Counties, and Walworth County.

4. The bedrock geology in the Region will be evaluated to the extent necessary for the evaluation of hydrogeology and of the groundwater susceptibility to contamination. Bedrock hydrogeologic units will be defined. Adequate data will be collected and mapping developed to refine the limits of the Maquoketa shale where it covers the suspected recharge area of the deep sandstone aquifer in the Region. This mapping update will be limited to the boundary of the Maquoketa shale with the sandstone aquifer recharge area.

5. The preparation of refined and updated water-table maps at a scale of one inch equals 8,000 feet for the shallow aquifer for Ozaukee and Washington Counties, Kenosha and Racine Counties, Waukesha and Milwaukee Counties, and Walworth County. These maps will be constructed using well constructor's reports and other available information. The water-table maps will show hydrogeologic boundaries and general direction of groundwater flow, in addition to contour lines of the water-table surface.

6. The preparation of a regional groundwater pollution vulnerability map will be prepared at a scale of one inch equals 8,000 feet and will be prepared based upon the relative vulnerability of aquifers to contamination from surface and near-surface contamination sources and activities, utilizing all of the inventory information gathered for the project. Mapping system and criteria will be described.

7. The preparation of a map at a scale of one inch equals 8,000 feet showing public supply wells, other high-capacity wells, potential

flowing wells, observation wells, precipitation stations, and surface water gaging stations, known waste disposal sites, known and potential groundwater pollution sources, and other relevant potential groundwater pollution sources.

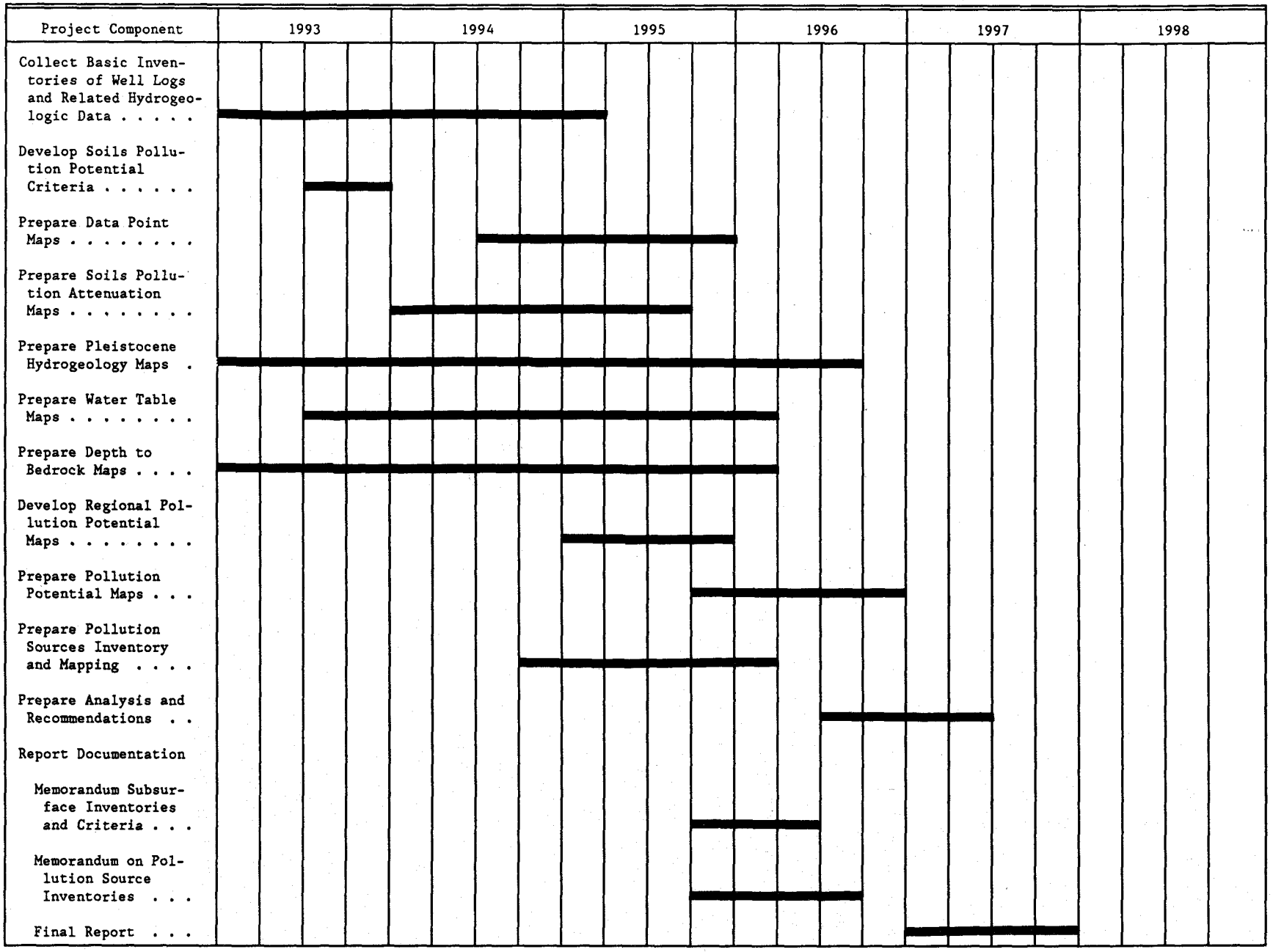
8. The preparation of a map at a scale of one inch equals 8,000 feet showing land uses.

A final report will be prepared summarizing the findings of the inventories and analyses conducted characterizing the groundwater resources of the Region and susceptibility of those resources to contamination; describing the existing and potential sources of pollution; and describing recommended means of protecting the groundwater resources which can be determined by the inventories and analyses conducted.

Current Status and Schedule for Completion

The ongoing water quality management planning program is being conducted over a multi-year period 1993 through 1997. The current status and schedule for completion of the program is summarized in Figure XVI-2. As can be seen by review of Figure XVI-2, as of March 1995, work has been completed on collecting and collating the basic subsurface inventory data needed, including well logs and related subsurface data. The mapping of soils pollution attenuation maps for all seven counties has been completed in draft form with final maps expected to be completed by mid-1995. Mapping of depth to bedrock, water table, and pleistocene geology, pollution sources and inventory are currently under preparation and are expected to be completed by mid-1996. Regional pollution potential criteria and the final mapping of the pollution potential for the Region are expected to be completed by the end of 1996. Recommendations and final report preparation is to be completed in 1997.

SCHEDULE FOR COMPLETION OF GROUNDWATER MANAGEMENT PLANNING PROGRAM



Source: SEWRPC.

Chapter XVII

DESIGNATED MANAGEMENT AGENCIES--REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

INTRODUCTION

Section 208 of the Federal Clean Water Act as amended sets forth a detailed planning process to be adopted by States pursuant to the goal of the Act--the attainment of surface waters, wherever attainable, to "fishable and swimmable" conditions. Importantly, this planning process includes the designation of areawide planning agencies and plan implementation management agencies. Within the seven-county Southeastern Wisconsin Region, the Southeastern Wisconsin Regional Planning Commission has been designated as the areawide water quality management planning agency by the Governor of Wisconsin under Section 208(a)(5). The Wisconsin Department of Natural Resources is the agency responsible for regulatory oversight of water quality management within the Region and throughout the State. The current regional water quality management plan has been described in Chapters IV through XVI on a watershed basis and is summarized in Chapter XVIII.

Implementation of the areawide water quality management plan, in terms of the process set forth in Section 208(b)(2)(D) of the Federal Clean Water Act as amended and Chapter NR 121 of the Wisconsin Administrative Code, requires that management agencies be designated and responsibilities defined for the major components of the plan. Accordingly, this chapter presents recommendations for such management agency designations and sets forth the various actions that must be undertaken in order for the plan to be carried out as it has now been described in its current form. As was done in the initial plan, the plan implementation recommendations regarding management agency designations, are to the maximum extent possible related to the existing governmental institutional structure and programs, and to existing enabling legislation.

As noted in Chapter III of this report, the most fundamental and basic element of the areawide water quality management plan is the land use element. The various recommended means of implementing the regional land use plan have been discussed in detail in Chapter XII of SEWRPC Planning Report No. 40, A Regional Land Use Plan and a Regional Transportation Plan for Southeastern Wisconsin: 2010, Volume Two, Alternatives and Recommended Plans. These various methods of land use plan implementation are not to be repeated here, but rather are hereby directly incorporated by reference into the plan implementation component for the regional water quality management plan. The local governmental management agencies designated for each of the other plan elements of the recommended regional water quality management plan--point source pollution abatement, nonpoint source pollution abatement, and water quality monitoring and lakes management plan elements--are set forth in this Chapter.

POINT SOURCE POLLUTION ABATEMENT AND SLUDGE MANAGEMENT PLAN ELEMENT IMPLEMENTATION

The local governmental management agencies for the point source pollution abatement and sludge management elements of the recommended areawide water quality management plan are identified in Table XVII-1. As previously noted, sludge management planning is generally carried out as part of the detailed sewage treatment plant planning, design, and construction and, since 1977, has been a requirement of the Wisconsin Pollutant Discharge Elimination System permitting process. Consequently, recommendations regarding the management of sewage sludges are included herein as an integral component of the point source pollution abatement plan element. The designated point source management agencies are comprised of all of the units and agencies of government that currently provide centralized sanitary sewer service in the Region, and which operate or would operate a sewage treatment facility under the plan, together with proposed new agencies where such are deemed necessary to carry out the plan recommendations.

In Kenosha County, a total of 16 management agencies have been designated, all except one of which are existing agencies. Eleven of the 15 existing management units are special purpose units of government. One new agency is proposed to be formed, that being a new utility or sanitary district to provide for public sanitary sewer service to the urban development around Powers, Benedict, and Tombeau Lakes, which is currently unsewered, but is recommended to be provided with a public sanitary sewer system. Of the 15 existing management agencies, 11 are special purpose units of government. A subregional sewer and water supply system plan prepared for the Greater Kenosha Area[1] recommended the creation of an areawide sewer and water authority as the best approach to implementing the recommended sewerage and water supply system plans. Such an authority would own and operate all of the major, that is, areawide sewerage and water supply facilities in the planning area. It is envisioned that the regional water quality management plan will be amended to reflect the findings of this subregional plan at such time as there is general agreement on the recommendations of the plan. This would add a new management agency, an areawide sewer and water authority. As of December 1994, the intergovernmental agreements needed to proceed with an amendment of the regional water quality management plan to incorporate the findings of the 1991 system plan had not been forthcoming. An amendment to the plan continues to be needed in this regard.

In Milwaukee County, a total of 20 agencies have been designated. All 20 of these agencies, which consist of the 19 local units of government in the County and the Milwaukee Metropolitan Sewerage District, already provide centralized sanitary sewer service.

In Ozaukee County, a total of 10 agencies have been designated. Nine of the agencies currently exist. One of the existing management agencies is a special purpose unit of government. One new agency is proposed to be formed, that being a sanitary or utility district in the Town of Belgium to provide centralized sanitary sewer service to the Lake Church and Harrington Beach area of the Town.

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[1]Ruekert & Mielke, Inc., A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Kenosha Area, October 1991.

Table XVII-1

LOCAL GOVERNMENTAL MANAGEMENT AGENCY DESIGNATIONS AND SELECTED RESPONSIBILITIES FOR THE POINT SOURCE POLLUTION ABATEMENT ELEMENT OF THE RECOMMENDED REGIONAL WATER QUALITY MANAGEMENT PLAN FOR SOUTHEASTERN WISCONSIN

Point Source Management Agency	Refine and Detail Sewer Service Area	Construct, Maintain, and Operate Sewage Treatment Plant	Abandon Sewage Treatment Plant	Construct and Maintain Intercommunity Trunk Sewer	Construct and Maintain Local Sewer System	Abate Combined Sewer Overflow	Eliminate Discharges from All Points of Sewage Flow Relief
KENOSHA COUNTY							
City of Kenosha	--	X	--	--	X	--	--
Village of Paddock Lake	--	X	--	--	X	--	--
Village of Silver Lake	--	X	--	--	X	--	--
Village of Twin Lakes	--	X	--	--	X	--	X
Village of Pleasant Prairie							
Sewer Utility District No. 1	--	--	--	--	X	--	--
Sewer Utility District D	--	X	--	--	X	--	--
Sewer Utility District F	--	--	--	--	X	--	--
Sanitary District No. 73-1	--	X	--	--	X	--	--
Town of Bristol							
Utility District No. 1	--	X	--	--	X	--	--
Utility District No. 3	--	--	--	--	X	--	--
Utility District No. 4	--	--	--	--	X	--	--
Town of Salem							
Sewer Utility District No. 1	--	--	X	X	X	--	--
Sewer Utility District No. 2	--	X	--	X	X	--	--
Town of Somers							
Sanitary District No. 1	--	--	--	--	X	--	--
Utility District No. 1	--	--	--	--	X	--	--
Towns of Randall and Wheatland							
New District--Powers, Benedict, Tombeau Lakes District	X	X	--	X	X	--	--
MILWAUKEE COUNTY							
Milwaukee Metropolitan Sewerage District	X	X	--	X	--	X	X
City of Cudahy	--	--	--	--	X	--	X
City of Franklin	--	--	--	--	X	--	--
City of Glendale	--	--	--	--	X	--	--
City of Greenfield	--	--	--	--	X	--	--
City of Milwaukee	--	--	--	--	X	--	X
City of Oak Creek	--	--	--	--	X	--	--
City of St. Francis	--	--	--	--	X	--	--
City of South Milwaukee	X	X	--	--	X	--	X
City of Wauwatosa	--	--	--	--	X	--	X
City of West Allis	--	--	--	--	X	--	X
Village of Bayside	--	--	--	--	X	--	X
Village of Brown Deer	--	--	--	--	X	--	X
Village of Fox Point	--	--	--	--	X	--	--
Village of Greendale	--	--	--	--	X	--	--
Village of Hales Corners	--	--	--	--	X	--	X
Village of River Hills	--	--	--	--	X	--	X
Village of Shorewood	--	--	--	--	X	--	X
Village of West Milwaukee	--	--	--	--	X	--	--
Village of Whitefish Bay	--	--	--	--	X	--	X
OZAUKEE COUNTY							
City of Cedarburg	--	X	--	--	X	--	X
City of Mequon	--	--	--	--	X	--	X
City of Port Washington	--	X	--	--	X	--	X
Village of Belgium	--	X	--	--	X	--	--
Village of Fredonia	--	X	--	--	X	--	X
Village of Grafton	--	X	--	--	X	--	X
Village of Saukville	--	X	--	--	X	--	X
Village of Thiensville	--	--	--	--	X	--	--
Town of Belgium							
New District--Lake Church	X	--	--	X	X	--	--
Town of Fredonia							
Waubeka Area Sanitary District	--	--	--	X	X	--	--

Table XVII-1 (continued)

Point Source Management Agency	Refine and Detail Sewer Service Area	Construct, Maintain, and Operate Sewage Treatment Plant	Abandon Sewage Treatment Plant	Construct and Maintain Intercommunity Trunk Sewer	Construct and Maintain Local Sewer System	Abate Combined Sewer Overflow	Eliminate Discharges from All Points of Sewage Flow Relief
RACINE COUNTY							
Wisconsin Department of Health and Social Services	--	--	X	X	X	--	--
Western Racine County Sewerage District	--	X	--	X	--	--	--
City of Burlington	--	X	--	--	X	--	--
City of Racine	--	X	--	--	X	--	X
Village of Elmwood Park	--	--	--	--	X	--	--
Village of North Bay	--	--	--	--	X	--	X
Village of Rochester	--	--	--	--	X	--	--
Village of Sturtevant	--	--	--	--	X	--	X
Village of Union Grove	--	X	--	X	X	--	X
Village of Waterford	--	--	--	--	X	--	X
Town of Burlington							
Bohner Lake Sanitary District	--	--	--	X	X	--	--
Browns Lake Sanitary District	--	--	--	--	X	--	--
Town of Caledonia							
Sewer Utility District No. 1	--	--	--	--	X	--	X
Caddy Vista Sanitary District	--	--	--	--	X	--	--
Crestview Sanitary District	--	--	--	--	X	--	X
North Park Sanitary District[a]	--	--	--	--	X	--	X
Town of Dover							
Eagle Lake Sewer Utility District	--	X	--	--	X	--	--
Town of Mt. Pleasant							
Sewer Utility District No. 1	--	--	--	--	X	--	X
Town of Norway							
Sanitary District No. 1	X	X	--	--	X	--	X
Town of Rochester							
Sewer Utility District No. 1	--	--	--	--	X	--	--
Town of Waterford							
Sanitary District No. 1	--	--	--	--	X	--	--
Town of Yorkville							
Sanitary District No. 1	X	X	--	--	X	--	--
WALWORTH COUNTY							
Walworth County	--	--	--	--	X	--	--
Walworth County Metropolitan Sewerage District	--	X	--	X	--	--	X
Fontana-Walworth Water Pollution Control Commission	--	X	--	--	--	--	X
City of Delavan	--	--	--	--	X	--	--
City of Elkhorn	--	--	--	--	X	--	--
City of Lake Geneva	--	X	--	X	X	--	--
City of Whitewater	--	X	--	--	X	--	X
Village of Darien	--	--	X	X	X	--	--
Village of East Troy	--	X	--	--	X	--	--
Village of Fontana	X	--	--	X	X	--	--
Village of Genoa City	--	X	--	--	X	--	--
Village of Sharon	X	X	--	--	X	--	--
Village of Walworth	X	--	--	--	X	--	--
Village of Williams Bay	--	--	--	--	X	--	--
Town of Bloomfield							
Pell Lake Sanitary District	X	--	--	X	X	--	--
Town of Delavan							
Delavan Lake Sanitary District[b]	--	--	--	--	X	--	--
Geneva National Sanitary District	--	--	--	--	X	--	--
Town of East Troy							
Sanitary District No. 2	--	--	--	--	X	--	--
New District--Army Lake	--	--	--	--	X	--	--
Town of Geneva							
New District--Como Lake	--	--	--	X	X	--	--
Town of Linn							
Sanitary District	X	--	--	X	X	--	--
Town of Lyons							
Sanitary District No. 2	--	X	--	--	X	--	--
Town of Troy							
New District--Booth Lake	--	--	--	--	X	--	--
Town of Walworth							
Utility District No. 1	--	--	--	--	X	--	--

Table XVII-1 (continued)

Point Source Management Agency	Refine and Detail Sewer Service Area	Construct, Maintain, and Operate Sewage Treatment Plant	Abandon Sewage Treatment Plant	Construct and Maintain Intercommunity Trunk Sewer	Construct and Maintain Local Sewer System	Abate Combined Sewer Overflow	Eliminate Discharges from All Points of Sewage Flow Relief
WASHINGTON COUNTY							
City of Hartford	--	X	--	--	X	--	X
City of West Bend	--	X	--	--	X	--	X
Village of Germantown	--	--	--	--	X	--	X
Village of Jackson	--	X	--	--	X	--	X
Village of Kewaskum	--	X	--	--	X	--	X
Village of Newburg	--	X	--	--	X	--	X
Village of Slinger	--	X	--	--	X	--	--
Town of Addison							
Allenton Sanitary District	--	X	--	--	X	--	--
Town of Hartford							
Pike Lake Sanitary District	--	--	--	--	X	--	--
Town of Trenton							
Wallace Lake Sanitary District[c]	--	--	--	--	X	--	--
Town of West Bend							
Silver Lake District	--	--	--	--	X	--	--
WAUKESHA COUNTY							
Waukesha County	--	--	--	X	X	--	--
Delafield-Hartland Water							
Pollution Control Commission	--	X	--	X	--	--	--
City of Brookfield	--	X	--	--	X	--	X
City of Delafield	--	--	--	--	X	--	--
City of Muskego	--	--	--	--	X	--	X
City of New Berlin	--	--	--	--	X	--	--
City of Oconomowoc	--	X	--	X	X	--	--
City of Waukesha	--	X	--	--	X	--	X
Village of Butler	--	--	--	--	X	--	--
Village of Chenequa	X	--	--	X	X	--	--
Village of Dousman	--	X	--	--	X	--	X
Village of Elm Grove	--	--	--	--	X	--	X
Village of Hartland	--	--	--	--	X	--	--
Village of Lac La Belle	--	--	--	--	X	--	--
Village of Lannon	--	--	--	X	X	--	--
Village of Menomonee Falls	--	--	--	--	X	--	X
Village of Mukwonago	--	X	--	X	X	--	--
Village of Nashotah	--	--	--	--	X	--	--
Village of North Prairie	X	X	--	--	X	--	--
Village of Oconomowoc Lake	X	--	--	X	X	--	--
Village of Pewaukee	--	--	--	--	X	--	X
Village of Sussex	--	X	--	--	X	--	X
Village of Wales	X	X	--	--	X	--	--
Town of Brookfield	--	--	--	--	X	--	--
Town of Eagle							
Eagle Spring Lake Rehabilitation and Protection District	--	--	--	X	X	--	--
Town of Lisbon Sanitary							
District No. 1	--	--	--	--	X	--	--
Town of Merton							
New District-North Lake	X	--	--	X	X	--	--
New District-Beaver Lake	X	--	--	X	X	--	--
New District-Moose Lake	--	--	--	--	X	--	--
Town of Oconomowoc							
Blackhawk Drive Sanitary District	--	--	--	--	X	--	--
Mary Lane Sanitary District	--	--	--	--	X	--	--
New District-Okauchee Lake[d]	X	--	--	X	X	--	--
Town of Pewaukee							
Sanitary District No. 3	--	--	--	--	X	--	--
Pewaukee Lake Sanitary District[e]	--	--	--	--	X	--	--
Town of Summit							
New District-Nashotah-Nemahbin Lakes	--	--	--	X	X	--	--
New District-Silver Lake	--	--	--	--	X	--	--

[a]The North Park Sanitary District also serves the Village of Wind Point.
[b]The Delavan Lake Sanitary District also serves part of the Town of Walworth.
[c]The Wallace Lake Sanitary District also serves part of the Town of Barton.
[d]This new District would also serve part of the Town of Merton.
[e]The Pewaukee Lake Sanitary District also serves part of the Town of Delafield.

Source: SEWRPC.

Of the nine existing management agencies, eight currently provide centralized sanitary sewer service. One agency, the Waubeka Area Sanitary District in the Town of Fredonia, has been created and is anticipated to construct a local sewer system and trunk sewer in the Waubeka area of the Town of Fredonia, with treatment to be provided at the Village of Fredonia sewage treatment plant, at a future date.

In Racine County, a total of 22 management agencies have been designated, all of which currently exist. Thirteen of these management units are special purpose units of government. One agency, the Bohners Lake Sanitary District in the Town of Burlington, has been created and is anticipated to construct a local sewer system and trunk sewer to serve the Bohners Lake area, with treatment to be provided by the City of Burlington sewage treatment plant. A subregional sewer and water supply system plan prepared for the Greater Racine Area[2] recommended the creation of an areawide sewer and water authority as the best approach to implementing the recommended sewerage and water supply system plans. Such an authority would own and operate all of the major, that is, areawide sewerage and water supply facilities in the planning area. It is envisioned that the regional water quality management plan will be amended to reflect the findings of this subregional plan at such time as there is general agreement on the recommendations of the plan. This would add a new management agency, that being an areawide sewer and water authority. As of December 1994, the intergovernmental agreements needed to proceed with an amendment of the regional water quality management plan to incorporate the findings of the 1992 system plan had not been forthcoming. An amendment to the plan continues to be needed in this regard.

In Walworth County, a total of 24 management agencies have been designated, 21 of which currently exist. Three new agencies are proposed to be formed, one being a sanitary or utility district in the Town of Geneva to provide centralized sanitary sewer service to the Como Lake area of the Town and to construct a trunk sewer to the Walworth County Metropolitan Sewerage District sewerage system; one being a sanitary or utility district in the Town of East Troy to provide centralized sanitary sewer service to the Army Lake area; and one being a sanitary or utility district in the Town of Troy to provide centralized sewer service to portions of the Booth Lake area. Nine of the 21 agencies are special purpose units of government, one of which--Pell Lake Sanitary District--is not yet providing centralized sanitary sewer service.

In Washington County, a total of 11 agencies have been designated, all of which currently exist. Four of these management units are special purpose units of government.

In Waukesha County, a total of 36 management agencies have been designated. Of this total, 30 agencies currently exist. Seven of the 30 management agencies are special purpose units of government. Six new agencies are proposed to be created, consisting of sanitary or utility districts in the North Lake, Moose Lake, and Beaver Lake portions of the Town of Merton, the Okauchee Lake portion of the Town of Oconomowoc, and the Nashotah-Nemahbin and Silver Lake Portions of

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[2]Alvord, Burdick, and Howson, and Applied Technologies, Inc., A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Racine Area, September 1992.

the Town of Summit. Of the 30 existing management agencies in Waukesha County, 25 currently provide centralized sanitary sewer service. Four existing agencies which do not yet provide such service, but which are recommended to provide service in the plan consist of the Village of Chenequa, the Village of North Prairie, the Village of Wales, and Waukesha County. Waukesha County is recommended to provide service to Mukwonago County Park. One agency, the Village of Lannon, is anticipated to construct a local sewer system and trunk sewer in the Village of Lannon, with treatment to be provided by the Village of Sussex sewage treatment plant, at a future date.

For the Region as a whole, then, a total of 139 management agencies have been designated for point source pollution abatement and sludge management purposes. Of this total, all but 11 agencies currently exist. Forty-six of the existing management agencies are special purpose units of government. Eleven new agencies are proposed to be created, consisting of sanitary or utility districts created to provide centralized sewerage service to urban development in various towns throughout the Region. Of the 128 existing management agencies, 120 already provide centralized sanitary sewer service.

In addition to the foregoing local government management designations for point source pollution abatement and sludge management purposes, the Wisconsin Department of Natural Resources is designated as the management agency with primary responsibility for ensuring full implementation of the entire point source pollution abatement and sludge management plan element. It is envisioned that the primary mechanism to be used by the Wisconsin Department of Natural Resources to ensure plan implementation would be the waste discharge permit process established under the Wisconsin Pollutant Discharge Elimination System (WPDES). Certain other important tasks, however, would be attendant to the role of the Wisconsin Department of Natural Resources in implementation of the plan. The development of detailed sewerage facilities plans will require effluent limitation (waste load allocation) studies by the Department to refine and detail the allowable effluent limits for specific sewage treatment plants so that recommended water use objectives and supporting standards in the plan are met. The Wisconsin Department of Natural Resources may need to review its administrative rules and procedures with regard to the application of the recommended phosphorus standard to lakes and streams of the Region, and to attainment of that standard through the regulation of the design of facilities to abate point sources of pollution.

The major responsibilities of the designated management agencies in carrying out the areawide water quality management plan are also identified in Table XVII-1. As shown in the table, these management agency responsibilities include the refinement and detailing of sanitary sewer service areas; the construction, maintenance, and operation of sewage treatment plants; the abandonment of sewage treatment plants; the construction and maintenance of intercommunity trunk sewers; the construction and maintenance of local sewer collection systems; the abatement of combined sewer overflows; and the elimination of discharges from the remaining overflows of sanitary sewage.

Under the recommended water quality management plan for the Region, eight of the 27 existing private sewage treatment facilities are proposed to be abandoned over the plan design period. It is recommended that the Wisconsin Department of Natural Resources, in administering the Wisconsin Pollutant Discharge Elimination

System, schedule the abandonment of these eight identified private sewage treatment facilities recommended to be abandoned, with the precise scheduling to be determined by the Department as public centralized sanitary sewerage systems are constructed and extended.

It is recognized that the Department may receive during the plan implementation period requests to approve additional private sewage treatment facilities to serve new enclaves of isolated land use development. It is recommended that the Wisconsin Department of Natural Resources, with the assistance of the Southeastern Wisconsin Regional Planning Commission, evaluate each such proposal as it arises. Such evaluation should be made in light of the objectives sought to be achieved in both the adopted regional land use plan and the recommended areawide water quality management plan.

NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT IMPLEMENTATION

The local governmental management agencies designated to implement the nonpoint source pollution abatement element of the recommended areawide water quality management plan are identified in Table XVII-2. In urban areas, these designated agencies are comprised of all of the incorporated units of government in the Region, together with selected unincorporated towns that have large urban populations and selected utility, sanitary, and lake protection and rehabilitation districts within unincorporated towns. In rural areas, these designated agencies are comprised of each of the seven-county Land Conservation Committees in the Region, together with selected utility, sanitary, and lake protection and rehabilitation districts within unincorporated towns. New agencies are proposed in some instances, particularly in lake areas, where such action is deemed necessary to carry out the plan recommendations.

In Kenosha County, a total of 23 nonpoint source management agencies have been designated. Of this total, 19 are existing agencies, 11 of which are special purpose units of government. The four new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to Benedict Lake and Benet/Shangrila Lake in the Towns of Randall and Bristol, respectively; Dyer Lake in the Town of Wheatland; and the unnamed quarry lake in the Town of Pleasant Prairie.

In Milwaukee County, a total of 20 nonpoint source management agencies have been designated, all of which currently exist.

In Ozaukee County, a total of 12 nonpoint source management agencies have been designated, nine of which currently exist. The three new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to Lac du Cours in the City of Mequon, Mud Lake in the town of Saukville, and Spring Lake in the Town of Fredonia.

In Racine County, a total of 23 nonpoint source management agencies have been designated. Of the 23 agencies, 20 are existing agencies and three would be new agencies. The three new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to Bueno Lake in the Town of Waterford, and Echo Lake and

Table XVII-2

LOCAL GOVERNMENTAL MANAGEMENT AGENCY DESIGNATIONS AND SELECTED RESPONSIBILITIES FOR THE NONPOINT SOURCE POLLUTION ABATEMENT ELEMENT OF THE RECOMMENDED REGIONAL WATER QUALITY MANAGEMENT PLAN FOR SOUTHEASTERN WISCONSIN

Urban Nonpoint Source Management Agency	Undertake Septic Tank System Management Program	Undertake Construction Erosion Control Program	Develop and Implement Detailed Plan for Application of Urban Land Practices	Undertake Livestock Waste Control Project	Develop and Implement Detailed Plan for Application of Rural Land Conservation Practices	Conduct Educational and Informational Programs	Provide Technical Assistance
KENOSHA COUNTY							
Kenosha County	X	X	X	X	X	X	X
City of Kenosha	--	X	X	--	--	X	--
Village of Paddock Lake	--	X	X	--	--	X	--
Village of Pleasant Prairie	--	--	X	--	--	X	--
New District--Unnamed Quarry Lake	--	--	--	--	X	X	--
Village of Silver Lake	--	X	X	--	--	X	--
Village of Twin Lakes	--	X	X	--	--	X	--
Town of Brighton							
Department of Natural Resources (East Lake Flowage)	X	--	--	--	X	o	--
Town of Bristol							
Utility District No. 1	--	--	X	--	--	X	--
George Lake Protection and Rehabilitation District	--	--	X	--	X	X	--
New District--Benet/Shangrila Lake	--	X	X	--	X	X	--
Town of Randall							
Powers Lake Management District[a]	X	--	X	--	X	X	--
Twin Lakes Protection and Rehabilitation District	--	--	X	--	--	X	--
New District--Benedict Lake	X	--	X	--	X	X	--
Town of Salem							
Sewer Utility District No. 1	--	--	X	--	--	X	--
Sewer Utility District No. 2	--	--	X	--	--	X	--
Paddock Lake Inland Lake Protection and Rehabilitation District	--	--	X	--	--	X	--
Hooker Lake Management District	--	--	X	--	--	X	--
Voltz Lake Management District	--	--	X	--	--	X	--
Camp and Center Lake Rehabilitation District	--	--	X	--	X	X	--
Town of Somers	--	--	X	--	--	X	--
Town of Wheatland							
Lilly Lake Protection and Rehabilitation District	--	--	X	--	--	X	--
New District--Dyer Lake	X	X	--	X	X	X	--

Table XVII-2 (continued)

Urban Nonpoint Source Management Agency	Undertake Septic Tank System Management Program	Undertake Construction Erosion Control Program	Develop and Implement Detailed Plan for Application of Urban Land Practices	Undertake Livestock Waste Control Project	Develop and Implement Detailed Plan for Application of Rural Land Conservation Practices	Conduct Educational and Informational Programs	Provide Technical Assistance
MILWAUKEE COUNTY							
Milwaukee County	--	X	X	--	--	X	X
City of Cudahy	--	X	X	--	--	X	--
City of Franklin	X	X	X	--	--	X	--
City of Glendale	--	X	X	--	--	X	--
City of Greenfield	--	X	X	--	--	X	--
City of Milwaukee	--	X	X	--	--	X	--
City of Oak Creek	X	X	X	--	--	X	--
City of St. Francis	--	X	X	--	--	X	--
City of South Milwaukee	--	X	X	--	--	X	--
City of Wauwatosa	--	X	X	--	--	X	--
City of West Allis	--	X	X	--	--	X	--
Village of Bayside	--	X	X	--	--	X	--
Village of Brown Deer	--	X	X	--	--	X	--
Village of Fox Point	--	X	X	--	--	X	--
Village of Greendale	--	X	X	--	--	X	--
Village of Hales Corners	--	X	X	--	--	X	--
Village of River Hills	--	X	X	--	--	X	--
Village of Shorewood	--	X	X	--	--	X	--
Village of West Milwaukee	--	X	X	--	--	X	--
Village of Whitefish Bay	--	X	X	--	--	X	--
OZAUKEE COUNTY							
Ozaukee County	X	X	--	X	--	X	--
City of Cedarburg	--	X	X	--	--	X	--
City of Mequon	X	X	X	--	--	X	--
New District--Lac du Cours	--	--	o	--	o	X	--
City of Port Washington	--	X	X	--	--	X	--
Village of Belgium	--	X	X	--	--	X	--
Village of Fredonia	--	X	X	--	--	X	--
Village of Grafton	--	X	X	--	--	X	--
Village of Saukville	--	X	X	--	--	X	--
Village of Thiensville	--	X	X	--	--	X	--
Town of Saukville							
New District--Mud Lake	--	--	--	X	o	X	--
Town of Fredonia							
New District--Spring Lake	X	o	o	--	o	X	--

Table XVII-2 (continued)

Urban Nonpoint Source Management Agency	Undertake Septic Tank System Management Program	Undertake Construction Erosion Control Program	Develop and Implement Detailed Plan for Application of Urban Land Practices	Undertake Livestock Waste Control Project	Develop and Implement Detailed Plan for Application of Rural Land Conservation Practices	Conduct Educational and Informational Programs	Provide Technical Assistance
RACINE COUNTY							
Racine County	X	X	X	X	X	X	X
City of Burlington	--	X	X	--	--	X	--
City of Racine	--	X	X	--	--	X	--
Village of Elmwood Park	--	X	X	--	--	X	--
Village of North Bay	--	X	X	--	--	X	--
Village of Rochester	--	X	X	--	--	X	--
Village of Sturtevant	--	X	X	--	--	X	--
Village of Union Grove	--	X	X	--	--	X	--
Village of Waterford	--	X	X	--	--	X	--
Village of Wind Point	--	X	X	--	--	X	--
Town of Burlington							
Browns Lake Sanitary District	--	--	X	--	X	X	--
Bohner Lake Sanitary District	X	--	X	--	--	X	--
New District--Long Lake[b]	X	--	X	--	X	X	--
New District--Echo Lake	--	X	X	X	--	X	--
Town of Caledonia	--	--	X	--	--	X	--
Town of Dover							
Eagle Lake Sewer Utility District	--	--	X	--	X	X	--
Town of Mt. Pleasant	--	--	X	--	--	X	--
Town of Norway							
Sanitary District No. 1	--	--	X	--	X	X	--
Wind Lake Management District	--	X	X	--	--	X	--
Town of Rochester							
Sewer Utility District No. 1	--	--	X	--	--	X	--
Town of Waterford							
Sanitary District No. 1	--	--	X	--	X	X	--
New District--Buena Lake	--	X	X	X	X	X	--
Town of Yorkville							
Sanitary District No. 1	--	--	X	--	--	X	--

Table XVII-2 (continued)

Urban Nonpoint Source Management Agency	Undertake Septic Tank System Management Program	Undertake Construction Erosion Control Program	Develop and Implement Detailed Plan for Application of Urban Land Practices	Undertake Livestock Waste Control Project	Develop and Implement Detailed Plan for Application of Rural Land Conservation Practices	Conduct Educational and Informational Programs	Provide Technical Assistance
WALWORTH COUNTY							
Walworth County	--	--	X	X	X	X	--
Geneva Lake Environmental Agency	--	X	--	--	--	X	X
City of Delavan	--	X	X	--	--	X	X
City of Elkhorn	--	X	X	--	--	X	--
City of Lake Geneva	--	X	X	--	--	X	--
City of Whitewater	X	o	X	--	--	X	--
New District--Tripp Lake	--	X	X	--	X	X	--
Village of Darien	--	X	X	--	--	X	--
Village of East Troy	--	X	X	--	--	X	--
Village of Fontana	--	X	X	--	--	X	--
Village of Genoa City	--	X	X	--	--	X	--
Village of Sharon	--	X	X	--	--	X	--
Village of Walworth	--	X	X	--	--	X	--
Village of Williams Bay	--	X	X	--	--	X	--
Town of Bloomfield							
Pell Lake Sanitary District	X	--	X	X	X	X	--
Powers Lake Management District	--	--	X	X	X	X	--
Town of Delavan							
Delavan Lake Sanitary District[c]	--	--	X	--	X	X	--
Comus Lake Protection and Rehabilitation District	--	--	X	--	X	X	--
Town of East Troy							
Beulah Lake Sanitary District No. 1	X	--	X	--	X	X	--
Sanitary District No. 1	--	--	X	--	--	X	--
Sanitary District No. 2	X	--	X	--	--	X	--
Potters Lake Protection and Rehabilitation District	--	--	X	--	X	X	--
New District--LaGrange Lake	X	--	X	--	X	X	--
Town of Geneva							
Como Lake District	--	--	X	--	X	X	--
Town of LaGrange							
Lauderdale Lake Management District	X	--	X	--	X	X	--
Pleasant Lake Protection and Rehabilitation District	X	--	X	--	X	X	--
New District--Army Lake	--	--	X	--	X	X	--
Town of Linn							
Sanitary District No. 1	X	--	X	--	--	X	--
Town of Richmond							
New District--Lake Loraine	X	--	X	X	X	X	--
New District--Turtle Lake	X	--	o	X	o	X	--

Table XVII-2 (continued)

Urban Nonpoint Source Management Agency	Undertake Septic Tank System Management Program	Undertake Construction Erosion Control Program	Develop and Implement Detailed Plan for Application of Urban Land Practices	Undertake Livestock Waste Control Project	Develop and Implement Detailed Plan for Application of Rural Land Conservation Practices	Conduct Educational and Informational Programs	Provide Technical Assistance
WALWORTH COUNTY (continued)							
Town of Spring Prairie							
Honey Lake Protection and Rehabilitation District	--	--	X	--	X	X	--
Town of Sugar Creek							
New District--North Lake	X	--	X	X	X	X	--
New District--Silver Lake	X	--	X	--	X	X	--
New District--Wandawega Lake	X	--	X	--	X	X	--
Town of Troy							
New District--Booth Lake	X	--	X	X	X	X	--
New District--Lulu Lake	--	--	o	X	o	o	--
New District--Peters Lake	--	--	X	X	X	X	--
Town of Whitewater							
Whitewater-Rice Lakes District	X	--	X	--	X	X	--
New District--Cravath Lake	--	o	X	--	X	X	--

Table XVII-2 (continued)

Urban Nonpoint Source Management Agency	Undertake Septic Tank System Management Program	Undertake Construction Erosion Control Program	Develop and Implement Detailed Plan for Application of Urban Land Practices	Undertake Livestock Waste Control Project	Develop and Implement Detailed Plan for Application of Rural Land Conservation Practices	Conduct Educational and Informational Programs	Provide Technical Assistance
WASHINGTON COUNTY							
Washington County	X	X	X	X	X	X	X
City of Hartford	--	X	X	--	--	--	--
City of West Bend	--	X	X	--	--	X	--
New District--Barton Pond	--	o	o	--	o	X	--
Village of Germantown	X	X	X	--	--	X	--
Village of Jackson	--	X	X	--	--	X	--
Village of Kewaskum	--	X	X	--	--	X	--
Village of Newburg	--	X	X	--	--	X	--
Village of Slinger	--	X	X	--	--	X	--
Town of Addison							
Allenton Sanitary District	--	--	X	--	--	X	--
Town of Barton							
New District--Smith Lake	X	--	o	X	o	X	--
Town of Erin							
Druid Lake Inland Protection and Rehabilitation District	--	--	--	--	X	X	--
Town of Farmington							
New District--Green Lake	X	--	X	--	X	X	--
New District--Lake Twelve	X	o	o	--	o	X	--
Town of Hartford							
New District--Pike Lake	--	--	X	--	X	X	--
Town of Richfield							
Richfield Sanitary District	X	--	X	X	X	X	--
New District--Bark Lake	X	--	X	--	X	X	--
New District--Freiss Lake	X	--	X	--	X	X	--
New District--Lake Five	X	--	X	--	X	X	--
Town of Trenton							
Wallace Lake Sanitary District	--	--	X	--	X	X	--
Town of West Bend							
Big Cedar Lake District	X	--	X	--	X	X	--
Little Cedar Lake Protection and Rehabilitation District	X	--	X	--	X	X	--
Silver Lake Rehabilitation District	--	--	X	--	X	X	--
New District--Lucas Lake	X	o	o	--	o	X	--

Table XVII-2 (continued)

Urban Nonpoint Source Management Agency	Undertake Septic Tank System Management Program	Undertake Construction Erosion Control Program	Develop and Implement Detailed Plan for Application of Urban Land Practices	Undertake Livestock Waste Control Project	Develop and Implement Detailed Plan for Application of Rural Land Conservation Practices	Conduct Educational and Informational Programs	Provide Technical Assistance
WAUKESHA COUNTY							
Waukesha County	X	X	X	X	X	X	X
City of Brookfield	--	X	X	--	--	X	--
City of Delafield	--	X	X	--	--	X	--
City of Muskego	--	X	X	--	--	X	--
Big Muskego Lake-Bass Bay Protection and Rehabilitation District	--	X	X	--	--	X	--
Little Muskego Lake Protection and Rehabilitation District	--	X	X	--	--	X	--
City of New Berlin	--	X	X	--	--	X	--
City of Oconomowoc	--	X	X	--	--	X	--
Fowler Lake Management District	--	X	X	--	--	X	--
City of Waukesha	--	X	X	--	--	X	--
Village of Big Bend	--	X	X	--	--	X	--
Village of Butler	--	X	X	--	--	X	--
Village of Chenequa	X	X	X	--	--	X	--
Village of Dousman	--	X	X	--	--	X	--
Village of Eagle	--	X	X	--	--	X	--
Village of Elm Grove	--	X	X	--	--	X	--
Village of Hartland	--	X	X	--	--	X	--
Village of Lac La Belle	--	X	X	--	--	X	--
Village of Lannon	--	X	X	--	--	X	--
Village of Menomonee Falls	--	X	X	--	--	X	--
Village of Merton	--	X	X	--	--	X	--
Village of Mukwonago	--	X	X	--	--	X	--
Village of Nashotah	--	X	X	--	--	X	--
Village of North Prairie	--	X	X	--	--	X	--
Village of Oconomowoc Lake	--	X	X	--	--	X	--
Village of Pewaukee	--	X	X	--	--	X	--
Village of Sussex	--	X	X	--	--	X	--
Village of Wales	--	X	X	--	--	X	--
Town of Brookfield	--	--	X	--	--	X	--
Town of Delafield	--	--	X	--	--	X	--
Town of Eagle Eagle Spring Lake Protection and Rehabilitation District	X	--	X	--	X	X	--
Town of Genesee	--	--	X	--	--	X	--
Town of Lisbon	--	--	X	--	--	X	--

Table XVII-2 (continued)

Urban Nonpoint Source Management Agency	Undertake Septic Tank System Management Program	Undertake Construction Erosion Control Program	Develop and Implement Detailed Plan for Application of Urban Land Practices	Undertake Livestock Waste Control Project	Develop and Implement Detailed Plan for Application of Rural Land Conservation Practices	Conduct Educational and Informational Programs	Provide Technical Assistance
WAUKESHA COUNTY (continued)							
Town of Merton							
North Lake Management District	X	--	X	--	X	X	--
New District--Beaver Lake	+	+	X	--	X	X	--
New District--Moose Lake	X	X	X	--	X	X	--
Lake Keesus Management District	X	--	X	--	X	X	--
Town of Mukwonago							
Phantom Lakes Protection and Rehabilitation District	X	--	X	--	X	X	--
New District--Spring Lake	--	--	X	--	X	X	--
Town of Oconomowoc							
Lac La Belle Management District	--	--	X	--	X	X	--
New District--Oconomowoc Lake	+	+	X	--	X	X	--
Okauchee Lake Protection and Rehabilitation District	X	--	X	--	X	X	--
Ashippun Lake Protection and Rehabilitation District	X	--	X	--	X	X	--
Town of Ottawa							
Pretty Lake Protection and Rehabilitation District	X	--	X	--	X	X	--
School Section Lake Protection and Rehabilitation District	X	--	X	--	X	X	--
Town of Pewaukee							
Pewaukee Lake Sanitary District	--	--	X	--	--	X	--
Town of Summit							
Middle Genesee Lake Management District	--	--	X	--	--	X	--
Upper Nemahbin Lake Management District	--	--	X	--	--	X	--
New District--Crooked Lake	X	--	+	--	+	X	--
New District--Upper Nashotah Lake	X	X	X	X	X	X	--
New District--Waterville Pond	X	--	X	--	X	X	--
Town of Vernon	--	--	X	--	--	X	--
Town of Waukesha	--	--	X	--	--	X	--

[a] This District also serves a portion of Walworth County.

[b] This new District would also serve a portion of the Town of Rochester.

[c] The Delavan Lake Sanitary District also serves part of the town of Walworth.

Source: SEWRPC.

Long Lake, in the Town of Burlington. The existing agencies designated in Racine County include eight special purpose units of government.

In Walworth County, a total of 39 nonpoint source management agencies have been designated. Of these 39 agencies, 27 are existing agencies and 12 would be new agencies. The 12 new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to: Lake Lorraine and Turtle Lake in the Town of Richmond; North Lake, Silver Lake and Wandawega Lake in the Town of Sugar Creek; Booth Lake, Lulu Lake, and Peters Lake in the Town of Troy; Army Lake in the Town of East Troy; LaGrange Lake in the Town of LaGrange; Cravath Lake in the Town of Whitewater; and Tripp Lake in the City of Whitewater. Of the 27 existing agencies, 15 are special purpose units of government.

In Washington County, a total of 24 nonpoint source management agencies have been designated. Of these 24 agencies, 15 are existing agencies and nine would be new agencies. The nine new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to: Smith Lake in the Town of Barton; Green Lake and Lake Twelve in the Town of Farmington; Pike Lake in the Town of Hartford; Bark Lake, Friess Lake, and Lake Five in the Town of Richfield; Lucas Lake in the town of West Bend; and Barton Pond in the City of West Bend. Of the 15 existing agencies, seven are special purpose units of government.

In Waukesha County, a total of 53 nonpoint source management agencies have been designated. Of this total, 46 are existing agencies and seven would be new agencies. The seven new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to: Beaver Lake and Moose Lake in the Town of Merton; Spring Lake in the Town of Mukwonago; Oconomowoc Lake in the Town of Oconomowoc; and Crooked Lake, Upper Nashotah Lake, and the Waterville Pond in the Town of Summit. Of the 46 existing management agencies in Waukesha County, 15 are special purpose units of government.

For the Region as a whole, then, a total of 194 management agencies have been designated for nonpoint source pollution abatement purposes. Of this total, all but 38 agencies currently exist. The 38 new agencies would be sanitary, utility and/or lake protection and rehabilitation districts created to provide an institutional framework for the development and implementation of detailed local plans for the application of urban and rural nonpoint source pollution abatement practices. Of the 194 designated nonpoint source pollution abatement management agencies, 104 have been previously designated for point source pollution abatement purposes.

The major responsibilities of the designated management agencies in carrying out the areawide water quality management plan are also identified in Table XVII-2. As shown in the table, these management agency responsibilities include the refinement and detailing of local nonpoint source pollution control practices; educational programs to encourage reductions in urban and rural nonpoint source loading to surface waters; and the minimization of all nonpoint source pollutants, especially those arising from onsite wastewater treatment practices, construction activities, and livestock operations. Not all agencies will be assigned all of these responsibilities.

LAKES MANAGEMENT PLAN ELEMENT IMPLEMENTATION

The local governmental management agencies designated to implement the lakes management element of the recommended areawide water quality management plan are identified in Table XVII-3. These designated agencies are comprised of all lake protection and rehabilitation districts created under Chapter 33 of the Wisconsin Statutes in the Region, together with selected utility and/or sanitary districts within unincorporated towns, and qualified lake associations, incorporated under Chapter 181 of the Wisconsin Statutes, as described in Chapters NR 119 and NR 191 of the Wisconsin Administrative Code.[3] New agencies are proposed-in some instances where such action is deemed necessary to carry out the plan recommendations.

In Kenosha County, a total of 13 governmental lake management agencies have been designated; two of which--Camp and Center Lake rehabilitation District and Twin Lakes Protection and Rehabilitation District--serve both Camp and Center Lakes and Elizabeth and Mary Lakes, respectively. A further three nongovernmental agencies also exist. Of the 13 governmental agencies, nine lake management agencies are existing agencies. The four new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to: Benedict Lake in the Town of Randall; Benet/Shangrila Lake in the Town of Bristol; Dyer Lake in the Town of Wheatland; and the unnamed quarry lake in the Town of Pleasant Prairie. Of the nine existing agencies, the Wisconsin Department of Natural Resources is the designated management agency for East Lake Flowage which is totally contained within the boundaries of the Bong Recreational Area.

In Milwaukee County, there are no major lakes. Consequently, no lake management agencies have been designated.

In Ozaukee County, three lake management agencies have been designated. All three would be new agencies that would be created to encompass urban and rural development tributary to: Lac du Cours in the City of Mequon; Spring Lake in the Town of Fredonia; and Mud Lake in the Town of Saukville.

In Racine County, a total of six governmental lake management agencies have been designated. A further four nongovernmental agencies also exist; one of which--Tri-Lakes Conservancy, Inc.--serves KeeNongGoMong, Waubeesee, and Wind Lakes. Of the six governmental agencies, three are existing agencies and three would be

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[3] Section 208 of the Federal Clean Water Act requires that local governmental units and agencies be identified as designated management agencies for areawide water quality management plan implementation. Cities, villages, towns, sanitary districts and public inland lake protection and rehabilitation districts are the principal local governmental management units having responsibility for plan implementation in the Region. In addition, however, Chapters NR 119 and 191 of the Wisconsin Administrative Code recognize certain nongovernmental agencies, qualified lake associations, as able to undertake lake management planning and protection activities. Although such agencies cannot be designated management agencies pursuant to Section 208, these agencies are shown in Table XVII-3 for completeness.

Table XVII-3

LOCAL GOVERNMENTAL MANAGEMENT AGENCY DESIGNATIONS AND SELECTED RESPONSIBILITIES FOR THE LAKE MANAGEMENT PLAN ELEMENT OF THE RECOMMENDED REGIONAL WATER QUALITY MANAGEMENT PLAN FOR SOUTHEASTERN WISCONSIN

County/Watershed Lake Management Agency[a]	Monitor Water Quality	Conduct Aquatic Plant Management Program	Conduct Fishing Management Program	Undertake Public Access and Recreation Program	Undertake Watershed Management[b] Program	Conduct Public Educational and Information Programs	Prepare Comprehensive Plan
KENOSHA COUNTY							
Des Plaines River							
New District--Benet/Shangrila[c]	O	+	+	+	+	+	+
East Lake Flowage--Wisconsin Department of Natural Resources	+	--	O	O	--	O	+
George Lake							
George Lake Protection and Rehabilitation District	O	O	+	X	+	O	O
Hooker Lake							
Hooker Lake Management District	O	+	+	X	+	+	O
Paddock Lake							
Paddock Lake Inland Lake Protection and Rehabilitation District	O	X	X	X	X	+	O
Unnamed Quarry Lake--New District	X	--	X	X	--	X	X
Fox River							
Benedict Lake--New District	O	+	+	+	+	+	+
Camp Lake							
Camp & Center Lake Rehabilitation District	O	+	+	X	X	+	O
Center Lake							
Camp & Center Lake Rehabilitation District	O	+	+	X	X	+	O
Cross Lake							
Cross Lake Improvement Association	O	+	+	+	+	+	O
Dyer Lake--New District	+	+	+	+	+	+	+
Elizabeth Lake							
Twin Lakes Protection and Rehabilitation District	O	X	+	X	X	+	X
Lilly Lake							
Lilly Lake Rehabilitation District	O	X	+	X	+	+	O
Marie Lake							
Twin Lakes Protection and Rehabilitation District	O	X	+	X	+	+	X
Powers Lake							
Powers Lake Management District	O	+	+	O	X	+	X
Silver Lake							
Silver Lake Protection Association	+	+	X	X	+	+	+
Silver Lake Sportsmans Club	X	X	+	X	X	+	X
Voltz Lake							
Voltz Lake Management District	O	+	+	+	+	+	O

Table XVII-3 (continued)

County/Watershed Lake Management Agency[a]	Monitor Water Quality	Conduct Aquatic Plant Management Program	Conduct Fishing Management Program	Undertake Public Access and Recreation Program	Undertake Watershed Management[b] Program	Conduct Public Educational and Information Programs	Prepare Comprehensive Plan
OZAUKEE COUNTY							
Milwaukee River							
Lac du Cours--New District . . .	+	--	+	+	X	+	+
Mud Lake--New District	+	--	--	+	X	+	+
Spring Lake--New District	+	--	+	+	X	+	+
RACINE COUNTY							
Fox River							
Bohner Lake Sanitary District . .	0	0	+	+	+	+	0
Bohner Lake Improvement Association	0	+	+	X	X	+	+
Browns Lake							
Browns Lake Sanitary District . .	0	X	X	X	+	+	0
Eagle Lake							
Eagle Lake Property Owners Improvement Association	0	0	X	X	+	+	0
Echo Lake--New District	+	--	+	+	+	+	+
Kee Nong Go Mong Lake							
Tri-Lakes Conservancy, Inc. . . .	0	+	+	X	+	+	0
Long Lake							
New District--Long Lake	+	+	+	+	+	+	+
Waterford Impoundment							
Buena Lake--New District	+	--	+	+	+	+	+
Tichigan Lake							
Tichigan Advancement Association	0	--	+	X	+	+	+
Waubeesee Lake							
Tri-Lakes Conservancy, Inc. . . .	0	+	+	X	+	+	0
Wind Lake							
Wind Lake Management District . .	0	+	X	X	X	+	X
Tri-Lakes Conservancy, Inc. . . .	X	X	X	X	+	0	X

Table XVII-3 (continued)

County/Watershed Lake Management Agency[a]	Monitor Water Quality	Conduct Aquatic Plant Management Program	Conduct Fishing Management Program	Undertake Public Access and Recreation Program	Undertake Watershed Management[b] Program	Conduct Public Educational and Information Programs	Prepare Comprehensive Plan
WALWORTH COUNTY							
Fox River							
Army Lake--New District	+	--	+	+	+	+	+
Booth Lake							
New District--Booth Lake	--	+	+	+	+	+	+
Booth Lake Property Owners Association	O	O	+	+	+	+	+
Lake Beulah							
Beulah Lake Sanitary District	X	+	X	X	X	+	X
Beulah Lake Protection and Improvement Association	O	X	+	X	+	+	+
Lake Como							
Como Lake District	O	O	+	+	+	+	+
Lake Geneva							
Geneva Lake Environmental Agency	O	+	X	X	X	+	X
Geneva Lake Conservancy, Inc.	X	X	X	X	+	O	X
Geneva Lake Association	X	X	X	X	X	+	X
Lauderdale Lake							
Lauderdale Lake Management District	O	+	+	X	+	+	O
Lulu Lake--New District	+	+	+	X	+	O	O
North Lake							
New District--North Lake	+	+	+	+	+	+	+
Pell Lake							
Pell Lake Sanitary District	+	--	+	+	+	+	+
Pell Lake Property Owners Association	+	X	+	+	+	+	+
Peters Lake--New District	+	+	+	+	+	+	+
Pleasant Lake							
Pleasant Lake Protection and Rehabilitation District	O	+	X	+	+	+	+
Pleasant Lake Association	X	X	X	X	X	+	X
Potters Lake							
Potters Lake Protection and Rehabilitation District	O	+	+	+	+	+	O
Silver Lake							
New District--Silver Lake	+	--	+	+	+	+	+
Wandawega Lake							
New District--Wandawega Lake	+	+	+	+	+	+	+
Rock River							
Comus Lake							
Comus Lake Protection and Rehabilitation District	+	+	+	+	X	+	+
Cravath Lake--New District	+	+	+	+	+	+	+
Delavan Lake							
Delavan Lake Sanitary District	X	X	X	X	X	+	X
Town of Delavan	O	X	X	X	X	O	+

Table XVII-3 (continued)

County/Watershed Lake Management Agency[a]	Monitor Water Quality	Conduct Aquatic Plant Management Program	Conduct Fishing Management Program	Undertake Public Access and Recreation Program	Undertake Watershed Management[b] Program	Conduct Public Educational and Information Programs	Prepare Comprehensive Plan
WALWORTH County--continued							
Rock River--continued							
La Grange Lake--New District	+	--	+	+	+	+	+
Lake Lorraine							
New District--Lake Lorraine	+	+	+	+	+	+	+
Lorraine Lake Property Owners Association	+	+	+	+	+	+	+
Rice Lake							
Whitewater-Rice Lakes Management District	O	O	+	X	+	O	O
Tripp Lake--New District	+	+	+	+	+	+	+
Turtle Lake							
New District--Turtle Lake	+	+	+	+	X	+	+
Turtle Lake Improvement and Protection Association	+	+	+	+	+	+	+
Whitewater Lake							
Whitewater-Rice Lakes Management District	O	+	X	X	+	O	O
WASHINGTON COUNTY							
Milwaukee River							
Barton Pond--New District	+	--	+	+	X	+	+
Big Cedar Lake							
Big Cedar Lake District	O	X	X	X	X	+	+
Big Cedar Lake Sanitary District	X	X	X	X	X	+	+
Big Cedar Lake Property Owners Association	X	X	X	X	X	+	+
Green Lake							
New District--Green Lake	O	--	+	+	X	+	+
Green Lake Property Owners Association of Washington County	O	+	+	X	+	+	+
Lake Twelve							
New District--Lake Twelve	+	--	+	+	X	+	+
Emerald Valley Property Owners Association	+	+	+	+	+	+	+
Little Cedar Lake							
Little Cedar Lake Protection and Rehabilitation District	O	X	+	X	X	+	+
Little Cedar Lake Advancement Association	X	X	X	X	X	+	X
Lucas Lake--New District	+	+	+	+	X	+	+
Silver Lake							
Silver Lake Sanitary District	O	+	+	X	+	+	+
Silver Lake Protection Association	X	X	X	X	X	+	X
Smith Lake--New District	+	+	+	+	X	+	+

Table XVII-3 (continued)

County/Watershed Lake Management Agency[a]	Monitor Water Quality	Conduct Aquatic Plant Management Program	Conduct Fishing Management Program	Undertake Public Access and Recreation Program	Undertake Watershed Management[b] Program	Conduct Public Educational and Information Programs	Prepare Comprehensive Plan
WASHINGTON COUNTY--continued							
Milwaukee River--continued							
Wallace Lake Sanitary District .	O	+	+	X	X	+	+
Rock River							
Bark Lake							
New District--Bark Lake	--	--	--	--	--	--	--
Richfield Sanitary District . .	+	+	+	+	+	+	+
Druid Lake							
Druid Lake Inland Protection and Rehabilitation District . . .	O	+	+	X	X	+	O
Friess Lake							
New District--Friess Lake . . .	--	--	--	--	--	--	--
Friess Lake Action Group . . .	O	+	+	+	X	+	X
Lake Five							
New District--Lake Five	--	--	--	--	--	--	--
Lake Five Advancement Association	O	+	+	+	+	+	+
Pike Lake							
New District--Pike Lake	O	+	+	X	+	+	+
Pike Lake Advancement Association, Inc.	--	--	--	--	--	+	--

Table XVII-3 (continued)

County/Watershed Lake Management Agency[a]	Monitor Water Quality	Conduct Aquatic Plant Management Program	Conduct Fishing Management Program	Undertake Public Access and Recreation Program	Undertake Watershed Management[b] Program	Conduct Public Educational and Information Programs	Prepare Comprehensive Plan
WAUKESHA COUNTY							
Rock River							
Ashippun Lake							
Ashippun Lake Protection and Rehabilitation District . . .	O	+	+	X	+	+	O
Beaver Lake							
New District--Beaver Lake . . .	+	+	+	+	+	+	+
Beaver Lake Environmental Protection Association	+	+	+	X	+	+	+
Beaver Lake Yacht Club	X	X	X	X	X	+	X
Crooked Lake--New District . . .	+	+	+	+	+	+	+
Fowler Lake							
Fowler Lake Management District	O	X	+	X	X	+	X
Golden Lake							
Golden Lake Association	O	+	+	X	+	+	+
Hunters Lake							
Hunters Lake Association . . .	+	+	+	+	+	+	+
Lac La Belle							
Lac La Belle Management District	O	O	X	X	X	O	X
Lake Keesus							
Lake Keesus Management District	O	X	+	+	X	+	+
Lake Keesus Advancement Association	X	X	X	X	X	+	X
Lower Genesee Lake							
Genesee Lakes Association . . .	O	+	+	+	+	+	+
Lower Nashotah Lake							
Lower Nashotah Lake Association	+	+	+	+	+	+	+
Lower Nemahbin Lake							
Lower Nemahbin Lake Association	O	+	+	+	+	+	+
Middle Genesee Lake							
Middle Genesee Lake District .	+	+	+	+	X	+	+
Genesee Lakes Association . . .	O	X	X	X	+	+	X
Moose Lake							
New District--Moose Lake . . .	+	+	+	+	O	+	+
Moose Lake Advancement Association	X	X	X	+	+	+	+
Moose Lake Association	+	+	+	X	X	+	+
Nagawicka Lake							
Nagawicka Lake Improvements Association	O	X	X	X	+	+	+
Nagawicka-Kettle Lake Preservation Society	X	X	X	X	X	+	X
North Lake							
North Lake Management District	O	+	+	+	+	+	X
North Lake Voluntary Association	X	X	X	X	X	+	X

Table XVII-3 (continued)

County/Watershed Lake Management Agency[a]	Monitor Water Quality	Conduct Aquatic Plant Management Program	Conduct Fishing Management Program	Undertake Public Access and Recreation Program	Undertake Watershed Management[b] Program	Conduct Public Educational and Information Programs	Prepare Comprehensive Plan
WAUKESHA COUNTY--continued							
Rock River--continued							
Oconomowoc Lake--New District	O	O	+	+	O	+	O
Okauchee Lake							
Okauchee Lake Management District	O	X	X	X	X	+	X
Pine Lake							
Pine Lake Association	+	+	+	X	X	+	+
Pretty Lake							
Pretty Lake Protection and Rehabilitation District	O	+	X	+	+	+	O
School Section Lake							
School Section Lake Management District	O	X	+	+	+	+	O
Silver Lake							
Silver Lake Environmental Association	O	X	+	+	X	+	O
Upper Nashotah Lake--New District	+	+	+	+	+	+	+
Upper Nemahbin Lake							
Upper Nemahbin Lake Management District	O	+	+	X	+	+	O
Waterville Pond							
New District--Waterville Pond	+	+	+	+	+	+	+
Fox River							
Big Muskego Lake							
Big Muskego-Bass Bay Protection and Rehabilitation District	O	+	X	X	X	O	O
Eagle Spring Lake							
Eagle Spring Lake Protection and Rehabilitation District	O	O	X	+	+	+	O
Lake Denoon							
Lake Denoon Advancement Association	O	+	+	+	+	+	+
Little Muskego Lake							
Little Muskego Lake Protection and Rehabilitation District	O	+	+	X	X	+	+
Little Muskego Lake Association	X	X	X	X	X	O	X
Lower Phantom Lake							
Phantom Lakes Management District	+	X	+	X	+	O	+
Pewaukee Lake							
Pewaukee Lake Sanitary District	O	+	X	+	+	O	X
Pewaukee Lake Improvement Association	X	X	+	X	X	+	X
Pewaukee Lake Sportsmans Club	X	X	X	X	X	+	X
Spring Lake							
New District--Spring Lake	O	--	+	+	+	+	+

Table XVII-3 (continued)

County/Watershed Lake Management Agency[a]	Monitor Water Quality	Conduct Aquatic Plant Management Program	Conduct Fishing Management Program	Undertake Public Access and Recreation Program	Undertake Watershed Management[b] Program	Conduct Public Educational and Information Programs	Prepare Comprehensive Plan
WAUKESHA COUNTY--continued							
Fox River--continued							
Upper Phantom Lake							
Phantom Lakes Management District	O	X	+	X	+	O	+

KEY:

O = Ongoing water quality monitoring, management activities, or information programming.
+ = Water quality monitoring recommended; development of detailed plan element recommended.
X = No action necessary at this time; detailed plan element completed--update and refine as necessary.
-- = Not applicable at this time; no action necessary.

[a] Section 208 of the Federal Clean Water Act requires that local governmental units and agencies be identified as designated management agencies for areawide water quality management plan implementation. Cities, villages, towns, sanitary districts, utility districts, and public inland lake protection and rehabilitation districts are the principal local governmental management units having responsibility for plan implementation in the Region. In addition, however, Chapters NR 119 and 191 of the Wisconsin Administrative Code recognize certain nongovernmental agencies, qualified lake associations, as able to undertake lake management planning and protection activities. Although such agencies cannot be designated management agencies pursuant to Section 208, these agencies are shown in this Table for completeness.

[b] The designated management agency should participate in the priority watershed or priority lakes projects affecting the lake--Table XII-2; in addition, the designated management agency may undertake additional activities aimed at reducing and controlling nonpoint source pollution in the lake watershed outside of participation in formal State programs.

[c] Creation of a new management agency is recommended; this agency may be a sanitary, utility, or lake protection and rehabilitation district, or appropriate non-governmental organization. Management actions may also be undertaken by the responsible local governmental agencies.

Source: SEWRPC.

new agencies. The three new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to Echo Lake and Long Lake, both in the Town of Burlington, and Buena Lake in the Town of Waterford.

In Walworth County, a total of 22 governmental lake management agencies have been designated; one of which--Whitewater-Rice Lake Management District--serves both Whitewater and Rice Lakes. A further eight nongovernmental agencies also exist. Of these 22 governmental agencies, 10 are existing agencies and 12 would be new agencies. The 12 new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to: Tripp Lake in the City of Whitewater; Lake Lorraine and Turtle Lake in the Town of Richmond; North Lake, Silver Lake, and Wandawega Lake in the Town of Sugar Creek; Cravath Lake in the Town of Whitewater; Army Lake in the Town of East Troy; LaGrange Lake in the Town of LaGrange; and Booth Lake, Lulu Lake, and Peters Lake in the Town of Troy. Of the existing governmental agencies, one--the Geneva Lake Environmental Agency--is a Section 66.30 intergovernmental agency created by the communities riparian to Lake Geneva to coordinate water quality management activities, and one--the Town of Delavan--is a local municipality which has constituted the Town of Delavan Lake Committee to coordinate and oversee lake protection and rehabilitation activities at Delavan Lake.

In Washington County, a total of 16 governmental lake management agencies have been designated. A further eight nongovernmental agencies also exist. Of these 16 agencies, seven are existing agencies and nine would be new agencies. The nine new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to: Barton Pond in the City of West Bend; Smith Lake in the Town of Barton; Green Lake and Lake Twelve in the Town of Farmington; Pike Lake in the Town of Hartford; Lucas Lake in the Town of West Bend; and Bark Lake, Friess Lake, and Lake Five in the Town of Richfield.

In Waukesha County, a total of 22 lake management agencies have been designated; one of which--Phantom Lakes Management District--serves both Upper and Lower Phantom Lakes. A further 19 nongovernmental agencies also exist. Of these 22 governmental agencies, 15 are existing agencies and seven would be new agencies. The seven new agencies would be sanitary, utility, or lake protection and rehabilitation districts that would be created to encompass urban and rural development tributary to: Beaver Lake in the Town of Merton; Waterville Pond, Upper Nashotah Lake, and Crooked Lake in the Town of Summit; Spring Lake in the Town of Mukwonago; Moose Lake in the Town Merton; and Oconomowoc Lake in the Town of Oconomowoc.

For the Region as a whole, then, a total of 124 management agencies have been designated for lake management purposes. Of this total, 82 agencies are sanitary, utility, or lake protection and rehabilitation districts, and similar agencies, including the Town of Delavan Lake Committee and the Geneva Lake Environmental Agency, created to encompass urban and rural development tributary to major lakes in the Southeastern Wisconsin Region. A further 42 agencies are nongovernmental agencies which may be qualified lake associations as defined in Chapters NR 119 and NR 191 of the Wisconsin Administrative Code. Of the 82 governmental agencies, all but 38 agencies currently exist. The 38 new agencies would be sanitary, utility, or lake protection and rehabilitation districts

created to provide an institutional framework for the development and implementation of detailed local plans for the application of lake management practices. Of the 124 designated governmental lake management agencies, 81 have been previously designated for point and nonpoint source pollution abatement purposes.

The major responsibilities of the designated management agencies in carrying out the areawide water quality management plan are also identified in Table XVII-3. As shown in the Table, these management agency responsibilities include the carrying out of water quality monitoring; educational programs to encourage reductions in urban and rural impacts on lake waters; and the development of specific and comprehensive lake management plans and plan elements. Not all agencies will be assigned all of these responsibilities.

In addition to these designated management agencies, general purpose governmental units riparian to lakes within the Southeastern Wisconsin Region retain responsibilities for lakes management within their jurisdictional boundaries. In particular, the seven counties and all cities and villages within the Region have specific responsibilities regarding establishment and administration of shoreland and floodplain zoning and stormwater management as set forth in the preceding sections of this chapter. These local units of government, together with Towns within the Region, also have specific powers relative to the establishment of lake protection and rehabilitation districts in terms of Chapter 33, Stats., and, where such new districts have been identified in Table XVII-3, these local governmental management agencies should give due consideration to the establishment of public inland lake protection and rehabilitation districts in the urban and rural areas tributary to the major lakes where such action is deemed necessary to carry out the plan recommendations. Local authorities and the designated management agencies set forth in Table XVII-3 insofar as their jurisdictions encompass urban and rural lands tributary to the numerous "minor" lakes and ponds in the Region having surface areas of less than 50 acres should recognize the aesthetic, recreational, and ecological value of these water bodies and likewise undertake management actions as may be necessary to prevent water quality degradation of these systems, including formation and technical support of lake organizations formed for the protection and rehabilitation of these lakes and ponds, preparation and implementation of management plans, and inclusion of such water bodies in watershed protection projects.

WATER QUALITY AND BIOLOGICAL CONDITION MONITORING PLAN ELEMENT IMPLEMENTATION

The recommended areawide water quality management plan calls for a comprehensive long-term water quality monitoring program within the Region that can serve both the needs of the Commission as an areawide water quality management planning agency and the needs of the Wisconsin Department of Natural Resources as a regulatory agency. The Wisconsin Department of Natural Resources is designated as the lead agency to carry out that mandatory program. The Department currently has in place a program to conduct intensive monitoring on a watershed-by-watershed basis on a rotating five-to-ten-year cycle.[4] It is recognized that the regional water quality will also conclude cooperative monitoring programs

[4]See Wisconsin Department of Natural Resources Publication No. Wr-299-92, Surface Water Monitoring Strategy, 1992.

being carried out by other units of government and agencies, including the U.S. Geological Survey, the U.S. Environmental Protection Agency, the Milwaukee Metropolitan Sewerage District, local public sewage treatment plant operators, and local inland lake management organizations.

It is recommended that the Wisconsin Department of Natural Resources and each sanitary, utility, and/or lake protection and rehabilitation district formed in the Region for each of the 101 major lakes conduct such lake water quality surveys as may be necessary to prepare detailed, local lake use and management plans. In addition, long-term water quality sampling efforts should be undertaken on lakes to monitor the effects of plan implementation actions and of continuing lake management efforts.

SUMMARY

This chapter has presented the recommended means for implementing the areawide water quality management plan for the seven-county Southeastern Wisconsin Region. The chapter includes the designation of management agencies and assignment of plan implementation responsibilities for point source pollution abatement and sludge management, nonpoint source pollution abatement, and water quality monitoring. A summary of local governmental management agencies designated to implement the recommended plan is set forth in Tables XVII-1 through XVII-3. A total of 228 management agencies have been designated for plan implementation purposes. Of this total, all but 44 currently exist. The 44 new agencies would be sanitary, utility, and/or lake protection and rehabilitation districts required to carry out a variety of plan implementation responsibilities in direct drainage areas to lakes or, in a few instances, to isolated enclaves of urban development within unincorporated towns. A total of 139 management agencies have been designated for point source pollution abatement purposes, 194 management agencies for nonpoint source pollution abatement purposes, and 124 management agencies for lake management purposes.

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Chapter XVIII

SUMMARY AND RECOMMENDATIONS--REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

INTRODUCTION AND BACKGROUND

Water resources constitute one of the most important elements of the natural resource base of Southeastern Wisconsin. A meaningful comprehensive regional planning effort must, therefore, recognize the central role of water resources as an important element of regional planning. This is particularly true in the highly urbanized seven-county Southeastern Wisconsin Region, a Region richly endowed with water resources. Properly husbanded, these water resources can constitute a valuable natural resource for the Region. Misused and mismanaged, however, these resources can become the focus of serious and costly developmental and environmental problems, and can be a severe constraint on the sound social, economic, and physical development of the Region. Water pollution is one manifestation of the misuse of water resources, and the public has become increasingly aware of, and concerned over, pollution which has seriously interfered with desired water uses.

In 1979, the Commission completed and adopted a regional water quality management plan[1] designed in part to meet the Congressional mandate that the waters of the United States be made to the extent practicable "fishable and swimmable." The plan provides recommendations for the control of water pollution from such point sources as sewage treatment plants, separate and combined sewer overflows, and industrial waste outfalls; and from such nonpoint sources as urban and rural stormwater runoff. The plan was subsequently endorsed by the Wisconsin Natural Resources Board and approved by the U. S. Environmental Protection Agency.

Since adoption of the plan in 1979, the Commission has carried on a continuing regional water quality management planning program. That program is intended, to the extent that available fiscal resources permit, to meet the planning requirements set forth in Chapter NR 121 of the Wisconsin Administrative Code. Those rules envision periodic amendment, revision, and updating of the original plan as may be found necessary and desirable. The systems level regional water quality management plan has been refined, detailed, and, as necessary, amended since 1979, as a result of various types of subregional planning and plan implementation efforts, including: sewer service area plans; detailed sewerage

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[1]SEWRPC Planning Report No. 30, A Regional Water Quality Management Plan for Southeastern Wisconsin: 2000, Volume One, Inventory Findings, September 1978; Volume Two, Alternative Plans, February 1979; and Volume Three, Recommended Plan, June 1979.

facilities plans; detailed nonpoint source pollution abatement plans; comprehensive lake management plans; and certain special studies. Many of these plan refinement and detailing efforts have led to formal amendments of that original plan by the Regional Planning Commission and the Wisconsin Department of Natural Resources. Those plan amendments, which were adopted only after public hearings and designated management agency approval, are documented in Chapter I.

In addition to these subregional planning efforts which are intended to refine and detail and, as necessary, amend the regional water quality management plan, the Commission carries on an important related regional land use planning program, which results from time-to-time in an updated and revised regional land use plan. The original regional water quality management plan directly incorporated the second generation design year 2000 regional land use plan that had been adopted by the Commission in 1978. Under the continuing regional planning program, the Commission prepared and adopted, in 1991, a third generation design year 2010 regional land use plan.[2] That plan also stands as an amendment to the systems level regional water quality management plan, and is being incorporated into detailed sanitary sewer area plans as those plans are prepared initially and revised from time-to-time.

This report is intended to provide a restatement of the areawide water quality management plan for Southeastern Wisconsin as updated over time through the amendment and revision process. The report documents the extent to which the plan, as amended, has been implemented since its adoption, by identifying--to the extent that available data permit--progress toward meeting the water use objectives and supporting water quality standards set forth in the plan. The report also identifies those issues which need to be addressed in the continuing planning process which may lead to further amendments, revisions, and updates of the plan. The updated regional water quality management plan for Southeastern Wisconsin consists of five major elements: a land use plan element, a point source pollution abatement plan element, a nonpoint source pollution abatement plan element, a water quality monitoring plan element, and a lake management plan element. Chapters IV through XV provide, for each of the twelve major watersheds in the Southeastern Wisconsin Region, a description of the various elements of the initial plan and the extent to which these elements have been implemented; to the extent available data permit, a description of current water quality conditions; a description of the plan elements as amended and updated based upon the status of implementation and the results of the ongoing continuing planning program; and a description of substantive water quality management issues that remain to be addressed. This chapter presents a summary of the findings of the inventory of existing water quality conditions, and a restatement of the design year 2010 plan, reflecting the amendments and extensions adopted since the completion of the original plan in 1979.

WATER QUALITY INVENTORY AND ANALYSIS

Water quality data available for use in preparing the initial regional water quality management plan were collected in the 1964 through 1965 Commission benchmark stream water quality study; the 1965 through 1975 Commission stream

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[2]SEWRPC Planning Report No. 40, A Regional Land Use Plan for Southeastern Wisconsin: 2010, January 1992.

water quality monitoring effort; the 1976 Commission sampling program; and the 1973 and 1976 Wisconsin Department of Natural Resources sampling programs. In addition, the results of the hydrologic-hydraulic water quality simulation modeling developed under the initial planning effort were also used to characterize existing conditions by considering model simulation which approximate current land use and levels of pollutant control.

Water quality data available for use in the plan review consisted of water quality, sediment quality, and biological condition data collected since the completion of the initial regional plan under monitoring programs operated by the Commission and by other agencies and local units of government, including the Wisconsin Department of Natural Resources, the Milwaukee Metropolitan Sewerage District, the U.S. Geological Survey, the U.S. Environmental Protection Agency, and local inland lake management organizations. In many cases, these data were collected for local or subregional planning and engineering purposes and thus do not represent a uniform data base comparable to that which was available for use in the initial regional plan preparation effort.

In addition to the aforereferenced data sources, the assessment of surface water quality conditions relied in part upon the uniform areawide characterization of surface water conditions developed under the initial planning effort and expanded upon under the Milwaukee Harbor estuary study.[3] Simulation modeling conducted under various levels of point source and nonpoint source pollution control, and under both the then current land use conditions and under planned year 2000 land use conditions, during these earlier planning programs, in many cases, was considered to remain valid. While the resulting data cannot be used to precisely quantify current water quality conditions, a review of these data together with knowledge of the current status of the pollution control recommendations contained in the original plan, provides insight into the current water quality conditions and the potential for achieving the adopted water use objectives and supporting water quality standards under current conditions.

Streams

To the extent possible, water quality data collected during the period 1976 through 1993 were utilized by the Commission to evaluate stream water quality conditions and trends in those conditions within the Region. The data concerned are presented by watershed in Chapters IV through XV, and as already noted, include water quality, sediment quality, and biological condition data. Water quality monitoring data were used to compare the instream water quality conditions to the instream water quality standards set forth in the adopted plan, as described in Chapter II. This comparison was then used to assess the extent to which the water use objectives were being achieved. The biological monitoring data were used to calculate biotic index values which were numerically grouped to indicate a relative measure of stream water quality as described in Chapter II. Sediment sampling data were used to compare to sediment quality criteria and standards to assess the level of contamination and relative quality of sediments.

As indicated on Map XVIII-1, comprehensive long-term water quality monitoring data collected following the preparation of the initial plan were available for

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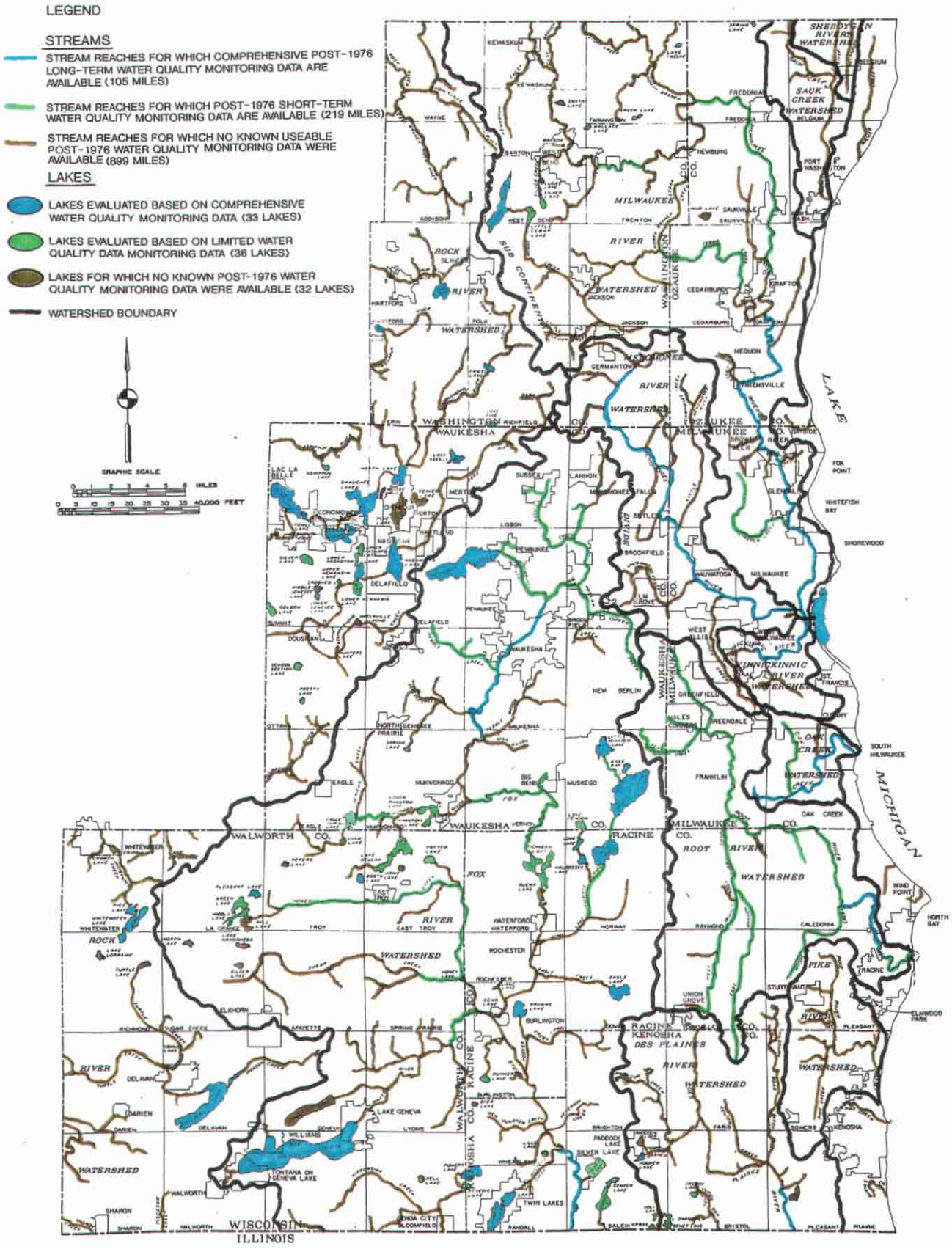
[3]SEWRPC Planning Report No. 37, A Water Resources Management Plan for the Milwaukee Harbor Estuary, December 1987.

Map XVIII-1

AVAILABILITY OF STREAM AND LAKE WATER QUALITY MONITORING DATA IN SOUTHEASTERN WISCONSIN: 1976-1993



Source: SEWRPC.

approximately 105 miles of stream, or about 9 percent, of the 1,223 stream miles within the Southeastern Wisconsin Region addressed in the planning effort. Short-term water quality monitoring data were available for an additional approximately 219 miles of stream, or about 18 percent of the total, as shown on Map XVIII-1. These latter data, while not adequate for use in definitively assessing trends in water quality, were used to supplement long-term monitoring data and provide information on existing conditions. No water quality data suitable for evaluating trends or existing conditions were available for the remaining approximately 899 stream miles, or about 73 percent of the total stream miles. It should be noted that while post-1976 data were available for only a relatively small percentage of the stream mileage within the Region, the streams for which data did exist included the main stem reaches of the major rivers which traverse the most highly urbanized areas of the Region and thus are the most susceptible to water pollution from urban sources, and for which a knowledge of current conditions and trends within the Region is most important.

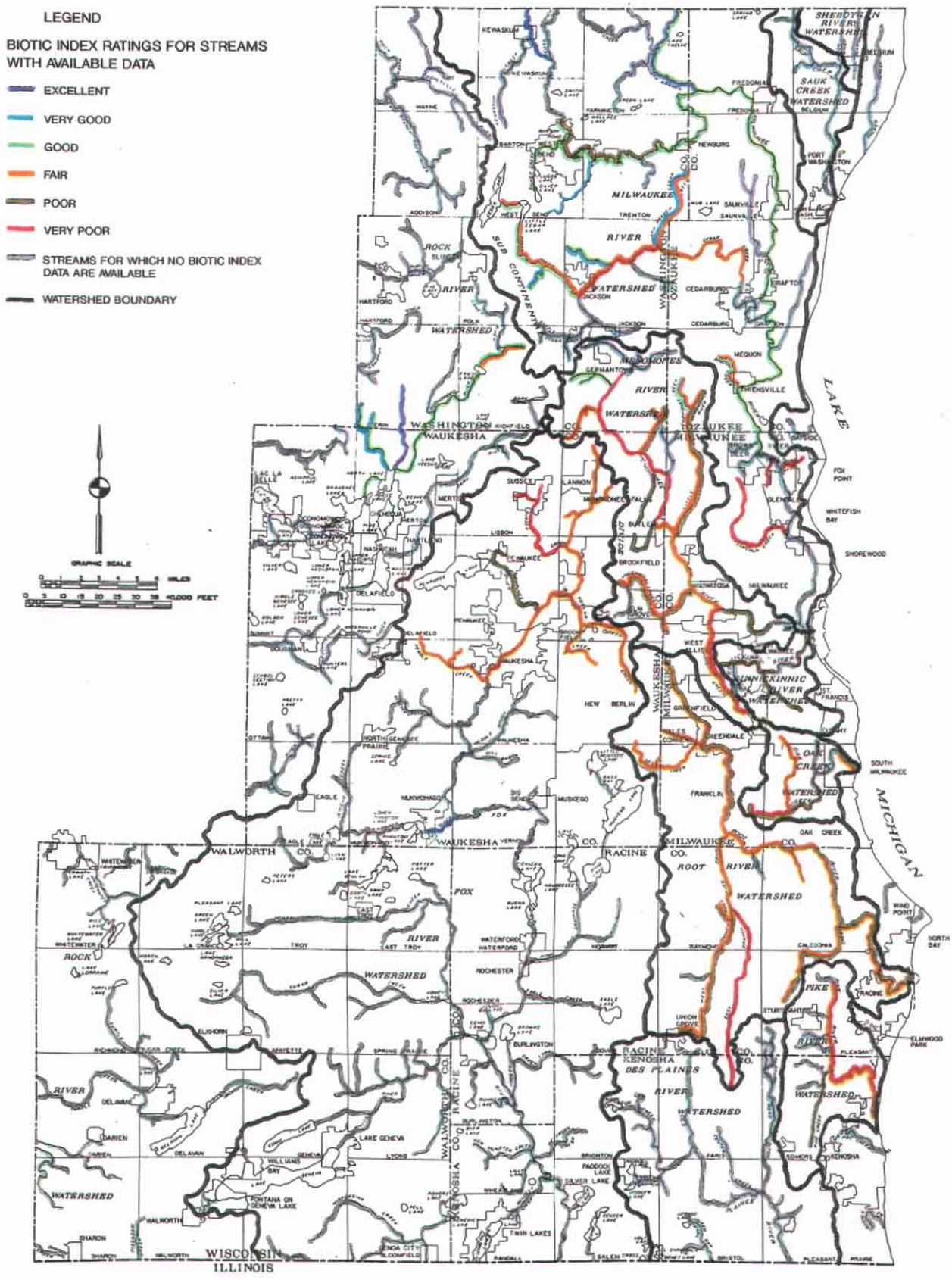
Recent biological condition data collected for streams within the Region were also available for use in characterizing water quality conditions, as indicated on Map XVIII-2. These data were collected for about 425 stream miles in the Region, or about 35 percent of the total stream miles within the Region addressed in the planning effort. These data provide a basis for the assessment of conditions in a manner different than that provided by water quality data. Thus, the data are not directly comparable with the earlier data to indicate trends. However, the biological monitoring data do serve as a measure of current conditions and can be used in the future to indicate trends as additional similar data are collected. The availability of water quality, biological conditions, and sediment condition data is summarized in Table XVIII-1. In total, some types of water quality and/or biological monitoring data were available for approximately 521 stream miles, or about 43 percent of the total stream miles concerned.

Sediment sampling data collected since the completion of the initial plan were also available for use in characterizing water quality conditions within the Region, as indicated on Map XVIII-3. Data were collected in the Milwaukee harbor estuary and in those stream reaches immediately upstream of the inner harbor; in Cedar Creek in the City of Cedarburg; and at 47 additional sampling sites within the Region. The majority of the data were collected for specific studies relating to harbor maintenance, dam removal evaluations, and special sediment contamination studies. These data were generally not adequate for use in definitively assessing trends in water quality, but were used as a measure of the current level of contaminants present in the sediments of the stream systems.

Instream Water Quality Conditions and Trends: An analysis of relative changes in surface water quality conditions based on long-term monitoring data over the period of 1976 through 1993 is summarized on Map XVIII-4. As already noted, adequate monitoring data to assess long-term trends in water quality were available for only about 105 miles, or about 9 percent of the stream miles within the Region addressed in the planning effort. The available data indicate that water quality conditions have improved for selected stream reaches in the Region, specifically portions of the Milwaukee, Menomonee, Fox, and Root River main stems, totaling 60 stream miles, or about 57 percent of those streams for which long-term, post-1976 water quality sampling data were available. The data also indicate that water quality conditions have deteriorated in short reaches of Oak Creek and the Kinnickinnic River, totaling about four miles, or about 4 percent

Map XVIII-2

SUMMARY OF BIOLOGICAL INDEX DATA FOR STREAMS IN SOUTHEASTERN WISCONSIN: 1976-1993



Source: SEWRPC.

Table XVIII-1

AVAILABLE POST-1976 DATA FOR STREAMS IN SOUTHEASTERN WISCONSIN

WATERSHED Subwatershed Stream Reach	Stream Length (miles)	Recommended Water Use Objective	Water Quality Data			Biological Condition Data[a]	Sediment Condition Data	Water Quality Trends[b]	Compliance with Water Use Objective[c]
			Long-Term Monitoring	Short-Term Monitoring	Modeling				
DES PLAINES RIVER WATERSHED									
Brighton Creek and Salem Branch	17.5	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Dutch Gap Canal	5.8	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Kilbourn Road Ditch	14.8	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Des Plaines River u/s STH 50	8.8	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Des Plaines River d/s STH 50	13.5	Warmwater Sport Fish Community and Full Recreational Use	3.4 miles	--	x	--	--	3.4 miles = NC	P
Pleasant Prairie Tributary	0.8	Warmwater Forage Fish Community and Limited Recreational Use	--	--	--	--	--	--	--
Jerome Creek	1.4	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Center Creek	5.8	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	--
FOX RIVER WATERSHED									
Upper Fox River Subwatershed									
Fox River u/s Mill Road	5.2	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	f	--	--	P
Fox River d/s Mill Road to Sussex Creek inflow	4.7	Warmwater Sport Fish Community and Full Recreational Use	--	1.3 miles	x	f	--	--	P
Sussex Creek	7.7	Warmwater Forage Fish Community and Full Recreational Use	--	x	x	vp	--	--	P
Fox River d/s Sussex Creek to Watertown Road	6.8	Warmwater Sport Fish Community and Full Recreational Use	--	x	x	f	x	--	P
Fox River d/s Watertown Road to Prairie Avenue (Waukesha)	4.4	Warmwater Sport Fish Community and Full Recreational Use	3.1 miles	1.3 miles	x	f	x	3.1 miles = I	P
Fox River d/s Prairie Avenue to Pebble Creek inflow	2.7	Warmwater Sport Fish Community and Full Recreational Use	x	--	x	f	x	I	P
Deer Creek	7.0	Warmwater Sport Fish Community and Full Recreational Use	--	x	x	f	x	--	N
Pebble Creek and Brandy Brook	6.8	Coldwater Community and Full Recreational Use	--	x	x	f	--	--	P
Poplar Creek	7.0	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	f	x	--	N
Pewaukee River	7.5	Warmwater Sport Fish Community and Full Recreational Use	--	x	x	p	--	--	P

Table XVIII-1 (cont'd)

WATERSHED Subwatershed Stream Reach	Stream Length (miles)	Recommended Water Use Objective	Water Quality Data			Biological Condition Data[a]	Sediment Condition Data	Water Quality Trends[b]	Compliance with Water Use Objective[c]
			Long-Term Monitoring	Short-Term Monitoring	Modeling				
Middle Fox River Subwatershed									
Fox River d/s Pebble Creek inflow	13.3	Warmwater Sport Fish Community and Full Recreational Use	7.0 miles	--	x	--	--	7.0 miles = I	P
Fox River d/s I-43 to Waterford Impoundment	13.7	Warmwater Sport Fish Community and Full Recreational Use	--	x	x	--	x	--	P
Fox River d/s Waterford Impoundment to Echo Lake inflow	10.6	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Fox River d/s Echo Lake inflow to Spring Brook Creek inflow	1.3	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	F
Muskego Canal	2.4	Warmwater Sport Fish Community and Full Recreational Use	--	x	x	--	--	--	P
Wind Lake Drainage Canal	12.8	Warmwater Sport Fish Community and Full Recreational Use	--	4.7 miles	x	--	--	--	F
Genesee Creek u/s Spring Creek	4.5	Coldwater Community and Full Recreational Use	--	--	x	--	--	--	F
Genesee Creek d/s Spring Creek	3.7	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	F
Spring Creek	3.0	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	F
Eagle Creek	5.5	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Pebble Brook, Mill Brook, and Mill Creek	13.7	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Lower Fox River Subwatershed									
Fox River d/s Spring Brook Creek inflow to CTH JB	4.5	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Spring Brook Creek	3.9	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	7.5 miles = NC	P
tributary stream	1.4	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Fox River d/s CTH JB to State Line	11.8	Warmwater Sport Fish Community and Full Recreational Use	7.5 miles	--	x	--	--	--	P
tributary stream	2.3	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Hoosier, Palmer, and Peterson Creeks	21.8	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Bassett Creek	5.1	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	F
New Munster Creek	4.7	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	F
Mukwonago River Subwatershed									
Mukwonago River u/s Eagle Spring Lake	6.3	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	F
Mukwonago River d/s Eagle Spring Lake to Phantom Lakes	9.7	Warmwater Sport Fish Community and Full Recreational Use	--	3.0 miles	x	--	--	--	F
Mukwonago River d/s Phantom Lakes	2.3	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	e	--	--	F
Jericho Creek	6.9	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	F

Table XVIII-1 (cont'd)

WATERSHED Subwatershed Stream Reach	Stream Length (miles)	Recommended Water Use Objective	Water Quality Data			Biological Condition Data[a]	Sediment Condition Data	Water Quality Trends[b]	Compliance with Water Use Objective[c]
			Long-Term Monitoring	Short-Term Monitoring	Modeling				
Honey/Sugar Creeks Subwatershed									
Honey Creek	26.1	Warmwater Sport Fish Community and Full Recreational Use	--	24.0 miles	x	--	--	--	P
Spring Creek	4.2	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
tributary streams	4.5	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Sugar Creek	23.4	Warmwater Sport Fish Community and Full Recreational Use	--	3.2 miles	x	--	--	--	P
Spring Brook Creek	5.5	Coldwater Community and Full Recreational Use	--	--	x	--	--	--	P
tributary streams	5.2	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
White River/Nippersink Creek Subwatershed									
White River	22.5	Warmwater Sport Fish Community and Full Recreational Use	--	3.5 miles	x	--	--	--	P
Como Creek	3.6	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Ore Creek	11.5	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Lake Ivanhoe Outlet	8.4	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Nippersink Creek	21.6	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Potawatomi, Van Slyke, and Southwick Creeks	3.1	Coldwater Community and Full Recreational Use	--	--	x	--	--	--	--
KINNICKINNIC RIVER WATERSHED									
Kinnickinnic River u/s 27th Street	3.9	Limited Aquatic Life and Limited Recreational Use	1.6 miles	--	x	p	--	1.6 miles = NC	P
Kinnickinnic River 27th Street to 5th Street	2.2	Limited Aquatic Life and Limited Recreational Use	x	--	x	--	--	1.0 miles = D 1.2 miles = NC	P
Kinnickinnic River 5th Street to 1st Street	1.3	Warmwater Sport Fish Community and Limited Recreational Use	x	--	x	p	x	0.3 miles = D 1.0 miles = NC	P
Kinnickinnic River d/s 1st Street	1.4	Warmwater Sport Fish Community and Limited Recreational Use	x	--	x	p	x	NC	P
Lyons Creek	1.4	Limited Aquatic Life and Limited Recreational Use	--	--	x	--	--	--	P
Wilson Park Creek	3.7	Limited Aquatic Life and Limited Recreational Use	--	--	x	p	--	--	P
tributary stream	1.4	Limited Aquatic Life and Limited Recreational Use	--	--	x	--	--	--	P

Table XVIII-1 (cont'd)

WATERSHED Subwatershed Stream Reach	Stream Length (miles)	Recommended Water Use Objective	Water Quality Data			Biological Condition Data[a]	Sediment Condition Data	Water Quality Trends[b]	Compliance with Water Use Objective[c]
			Long-Term Monitoring	Short-Term Monitoring	Modeling				
MENOMONEE RIVER WATERSHED									
North Branch of Menomonee River u/s STH 145	10.0	Warmwater Sport Fish Community and Limited Recreational Use	--	--	x	--	--	--	N
Menomonee River West Branch	2.1	Warmwater Forage Fish Community and Limited Recreational Use	--	--	x	g	--	--	P
northern tributary	2.1	Warmwater Forage Fish Community and Limited Recreational Use	--	--	x	g	--	--	P
Menomonee River d/s STH 145 to CTH Q	3.8	Warmwater Sport Fish Community and Limited Recreational Use	x	--	x	f	x	I	P
Menomonee River d/s CTH Q to Lilly Road	3.8	Warmwater Sport Fish Community and Limited Recreational Use	x	--	x	f	--	I	P
Menomonee River d/s Lilly Road to Good Hope Rd	2.4	Warmwater Sport Fish Community and Limited Recreational Use	x	--	x	f	--	I	P
Dretzka Park tributary	4.7	Warmwater Sport Fish Community and Limited Recreational Use	--	--	x	--	--	--	N
Menomonee River d/s Good Hope Road to Silver Spring Drive	2.7	Warmwater Sport Fish Community and Limited Recreational Use	x	--	x	f	--	I	P
Menomonee River d/s Silver Spring Drive to Hampton Avenue	2.1	Warmwater Sport Fish Community and Limited Recreational Use	x	--	x	p	x	I	P
Menomonee River d/s Hampton Avenue to Capitol Drive	1.3	Warmwater Sport Fish Community and Limited Recreational Use	x	--	x	p	--	NC	P
Menomonee River d/s Capitol Drive to North Avenue	2.7	Warmwater Sport Fish Community and Limited Recreational Use	x	--	x	p	x	NC	P
Menomonee River d/s North Avenue to 70th Street	2.4	Warmwater Sport Fish Community and Limited Recreational Use	x	--	x	p	x	NC	P
Menomonee River d/s 70th Street to USH 41	1.5	Warmwater Sport Fish Community and Limited Recreational Use	x	--	x	vp	--	NC	P
Menomonee River d/s USH 41 to Falk Corp dam	2.4	Warmwater Forage Fish Community and Limited Recreational Use	x	--	x	vp	--	NC	P
Menomonee River d/s Falk Corp dam to 25th Street	0.5	Warmwater Sport Fish Community and Limited Recreational Use	x	--	x	vp	--	NC	P
Menomonee River d/s 25th Street to Milwaukee River	1.7	Warmwater Sport Fish Community and Limited Recreational Use	x	--	x	--	x	NC	N
S. Menomonee and Burnham Canals	1.5	Warmwater Sport Fish Community and Limited Recreational Use	--	--	x	--	x	--	P
Honey Creek u/s Wisconsin Avenue	7.5	Limited Aquatic Life and Limited Recreational Use	--	--	x	f to vp	--	--	P
Honey Creek d/s Wisconsin Avenue	0.9	Warmwater Forage Fish Community and Limited Recreational Use	--	--	x	f to vp	--	--	P
Underwood Creek u/s Watertown Plank Road	6.3	Warmwater Forage Fish Community and Limited Recreational Use	--	--	x	f to p	--	--	P
South Branch Underwood Creek	1.1	Warmwater Forage Fish Community and Limited Recreational Use	--	--	x	f to p	--	--	P
Underwood Creek d/s Watertown Plank Road	1.5	Limited Aquatic Life and Limited Recreational Use	--	--	x	f to p	--	--	P
Little Menomonee Creek	2.3	Warmwater Forage Fish Community and Limited Recreational Use	--	--	x	g to f	x	--	P
Little Menomonee River	9.7	Warmwater Sport Fish Community and Limited Recreational Use	--	--	x	f to p	x	--	N

Table XVIII-1 (cont'd)

WATERSHED Subwatershed Stream Reach	Stream Length (miles)	Recommended Water Use Objective	Water Quality Data			Biological Condition Data[a]	Sediment Condition Data	Water Quality Trends[b]	Compliance with Water Use Objective[c]
			Long-Term Monitoring	Short-Term Monitoring	Modeling				
MENOMONEE RIVER WATERSHED (cont'd)									
Butler Ditch	2.4	Limited Forage Fish Community and Limited Recreational Use	--	--	x	p	--	--	P
Dousman Ditch	2.5	Limited Forage Fish Community and Limited Recreational Use	--	--	x	--	--	--	P
Lilly Creek	3.4	Warmwater Forage Fish Community and Limited Recreational Use	--	--	x	p	x	--	P
Nor-X-Way Channel u/s Donges Bay Road	2.1	Limited Forage Fish Community and Limited Recreational Use	--	--	x	f to p	--	--	P
Nor-X-Way Channel d/s Donges Bay Road to Warren Street	1.9	Warmwater Forage Fish Community and Limited Recreational Use	--	--	x	f to p	--	--	P
Nor-X-Way Channel d/s Warren Street to Brown Deer Road	0.5	Limited Forage Fish Community and Limited Recreational Use	--	--	x	f to p	--	--	P
Willow Creek	3.2	Warmwater Forage Fish Community and Full Recreational Use	--	--	x	f	--	--	P
MILWAUKEE RIVER WATERSHED									
Cedar Creek Subwatershed									
Cedar Creek u/s Little Cedar Creek inflow	8.0	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	g to f	--	--	P
Little Cedar Creek	7.2	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Cedar Creek d/s Little Cedar Creek inflow to CTH M	9.8	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	6.2 miles = f to vp	--	--	P
Cedar Creek d/s CTH M to STH 60	9.5	Warmwater Sport Fish Community and Full Recreational Use	--	x	x	f	--	--	P
Cedar Creek d/s STH 60	6.7	Warmwater Sport Fish Community and Full Recreational Use	--	0.7 miles	x	--	x	--	P
North Branch Cedar Creek	7.3	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	vg to f	--	--	--
Friedens Creek	3.2	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	vg to g	--	--	--
Lehner Creek	1.8	Coldwater Community and Full Recreational Use	--	--	--	vg to g	--	--	--
Milwaukee River East and West Branches Subwatershed									
Milwaukee River d/s north Washington County Line to CTH H	5.4	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	e	--	--	F
Milwaukee River d/s CTH H to Woodford Drive	4.9	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	F
Milwaukee River d/s Woodford Drive to STH 33	13.6	Warmwater Sport Fish Community and Full Recreational Use	--	4.8 miles	x	10.8 miles = g to p	--	--	P
Milwaukee River d/s STH 33	9.9	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	g	--	--	P
Kewaskum Creek	6.4	Warmwater Forage Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Silver Creek	4.0	Warmwater Forage Fish Community and Full Recreational Use	--	--	x	g	--	--	P

Table XVIII-1 (cont'd)

WATERSHED Subwatershed Stream Reach	Stream Length (miles)	Recommended Water Use Objective	Water Quality Data			Biological Condition Data[a]	Sediment Condition Data	Water Quality Trends[b]	Compliance with Water Use Objective[c]
			Long-Term Monitoring	Short-Term Monitoring	Modeling				
Milwaukee River East and West Branches Subwatershed (cont'd)									
Quaas Creek u/s CTH G	2.7	Coldwater Community and Full Recreational Use	--	--	--	vg to f	--	--	--
Quaas Creek d/s CTH G	2.2	Warmwater Forage Fish Community and Full Recreational Use	--	--	--	vg to f	--	--	--
East Branch Milwaukee River d/s north Washington County Line	5.0	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Milwaukee River North Branch Subwatershed									
North Branch Milwaukee River	8.5	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	e to g	--	--	P
Stony Creek u/s STH 144	8.6	Coldwater Community and Full Recreational Use	--	--	--	--	--	--	--
Stony Creek d/s STH 144	1.4	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Wallace Creek u/s CTH A	1.2	Warmwater Forage Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Wallace Creek u/s CTH A	7.4	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Milwaukee River South Branch Subwatershed									
Milwaukee River u/s STH 33	11.1	Warmwater Sport Fish Community and Full Recreational Use	--	x	x	g	x	--	P
Milwaukee River d/s STH 33 to STH 57	6.0	Warmwater Sport Fish Community and Full Recreational Use	--	x	x	g	x	--	P
Mole Creek	7.7	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	x	--	P
Milwaukee River d/s STH 57 to CTH C	4.5	Warmwater Sport Fish Community and Full Recreational Use	1.2 miles	--	x	g	x	1.2 miles = I	P
Milwaukee River d/s CTH C to Mequon Road	7.5	Warmwater Sport Fish Community and Full Recreational Use	x	--	x	g	x	I	P
Lakefield tributary	5.9	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Milwaukee River d/s Mequon Road to Brown Deer Road	3.8	Warmwater Sport Fish Community and Full Recreational Use	x	--	x	g	--	I	P
Beaver Creek tributary	2.3	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Milwaukee River d/s Brown Deer Road to Port Washington Road	8.1	Warmwater Sport Fish Community and Full Recreational Use	x	--	x	--	x	I	P
South Branch Creek	2.3	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Milwaukee River d/s Port Washington Road to North Avenue	3.8	Warmwater Sport Fish Community and Full Recreational Use	x	--	x	--	x	I	P
Milwaukee River d/s North Avenue to Walnut Street	0.9	Warmwater Sport Fish Community and Limited Recreational Use	x	--	x	--	x	I	P
Milwaukee River d/s Walnut Street to Wells Street	0.8	Warmwater Sport Fish Community and Limited Recreational Use	x	--	x	--	x	NC	P
Milwaukee River d/s Wells Street to Water Street	0.6	Warmwater Sport Fish Community and Limited Recreational Use	x	--	x	--	x	NC	P

Table XVIII-1 (cont'd)

WATERSHED Subwatershed Stream Reach	Stream Length (miles)	Recommended Water Use Objective	Water Quality Data			Biological Condition Data[a]	Sediment Condition Data	Water Quality Trends[b]	Compliance with Water Use Objective[c]
			Long-Term Monitoring	Short-Term Monitoring	Modeling				
Milwaukee River South Branch Subwatershed (cont'd)									
Milwaukee River d/s Water Street	0.8	Warmwater Sport Fish Community and Limited Recreational Use	x	--	x	--	x	NC	P
Lincoln Creek u/s Silver Spring Drive	2.7	Limited Forage Fish Community and Limited Recreational Use	--	x	x	vp	--	--	N
Lincoln Creek d/s Silver Spring Drive to Hampton Avenue	1.3	Limited Aquatic Life and Limited Recreational Use	--	x	x	vp	--	--	P
Lincoln Creek d/s Hampton Avenue to 32nd Street	2.5	Limited Forage Fish Community and Limited Recreational Use	--	x	x	vp	--	--	N
Lincoln Creek d/s 32nd Street to Teutonia Avenue	0.6	Limited Aquatic Life and Limited Recreational Use	--	x	x	vp	--	--	P
Lincoln Creek d/s Teutonia Avenue	1.3	Warmwater Sport Fish Community and Limited Recreational Use	--	x	x	vp	--	--	N
Indian Creek u/s I-43	0.6	Limited Aquatic Life and Limited Recreational Use	--	--	x	vp	x	--	F
Indian Creek d/s I-43	1.3	Warmwater Sport Fish Community and Limited Recreational Use	--	--	x	vp	--	--	N
Brown Deer Creek	1.9	Limited Forage Fish Community and Limited Recreational Use	--	--	--	vp	--	--	--
Pigeon Creek	2.4	Warmwater Forage Fish Community and Full Recreational Use	--	--	x	g to f	--	--	N
WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN									
Fish Creek	3.4	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
unnamed stream in T4N R23E sections 21 and 22	0.9	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
unnamed stream in T4N R23E sections 17 and 20	1.7	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Barnes Creek Subwatershed									
Barnes Creek	3.0	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Pike Creek Subwatershed									
Pike Creek (Kenosha)	3.7	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Sucker Creek Subwatershed									
Sucker Creek	18.8	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	F

Table XVIII-1 (cont'd)

WATERSHED Subwatershed Stream Reach	Stream Length (miles)	Recommended Water Use Objective	Water Quality Data			Biological Condition Data[a]	Sediment Condition Data	Water Quality Trends[b]	Compliance with Water Use Objective[c]
			Long-Term Monitoring	Short-Term Monitoring	Modeling				
OAK CREEK WATERSHED									
Oak Creek u/s STH 100	2.8	Warmwater Sport Fish Community and Full Recreational Use	x	--	x	p to vp	--	NC	P
Oak Creek d/s STH 100 to Drexel Avenue	4.5	Warmwater Sport Fish Community and Full Recreational Use	x	--	x	p	--	NC	P
Oak Creek d/s Drexel Avenue to Pennsylvania Avenue	0.9	Warmwater Sport Fish Community and Full Recreational Use	x	--	x	--	--	NC	P
Oak Creek d/s Pennsylvania Avenue to 15th Avenue	1.9	Warmwater Sport Fish Community and Full Recreational Use	x	--	x	--	--	NC	P
Oak Creek d/s 15th Avenue	2.8	Warmwater Sport Fish Community and Full Recreational Use	x	--	x	f to p	--	D	P
Mitchell Field Ditch	2.3	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
North Branch Oak Creek	5.7	Warmwater Sport Fish Community and Full Recreational Use	--	x	x	f	--	--	P
PIKE RIVER WATERSHED									
Pike River u/s STH 20 to Bartlett Branch	1.0	Warmwater Forage Fish Community and Full Recreational Use	--	--	x	f to vp	--	--	P
Bartlett Branch	1.5	Limited Forage Fish Community and Limited Recreational Use	--	--	x	--	--	--	F
Pike River d/s STH 20 to Pike Creek	11.7	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	5.3 miles = f to vp	--	--	P
Pike River d/s Pike Creek	13.8	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	9.6 miles = f to vp	--	--	P
Pike Creek d/s STH 142	9.8	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	4.8 miles = p	--	--	P
Pike Creek u/s STH 142	0.7	Warmwater Forage Fish Community and Limited Recreational Use	--	--	x	p	--	--	P
ROCK RIVER WATERSHED									
Ashippun River Subwatershed									
Ashippun River u/s Druid Lake	4.3	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Ashippun River d/s Druid Lake to Washington County Line	5.2	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Ashippun River d/s Waukesha County Line to Ashippun Lake inflow	7.2	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Ashippun River d/s Ashippun Lake inflow	4.2	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--

Table XVIII-1 (cont'd)

WATERSHED Subwatershed Stream Reach	Stream Length (miles)	Recommended Water Use Objective	Water Quality Data			Biological Condition Data[a]	Sediment Condition Data	Water Quality Trends[b]	Compliance with Water Use Objective[c]
			Long-Term Monitoring	Short-Term Monitoring	Modeling				
Bark River Subwatershed									
Bark River u/s Nagawicka Lake	19.3	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	F
Bark River d/s Nagawicka Lake	12.3	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Scuppernong Creek u/s Waterville Pond	4.9	Coldwater Community and Full Recreational Use	--	--	x	--	--	--	F
Scuppernong Creek d/s Waterville Pond	7.6	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	F
Oconomowoc River Subwatershed									
Coney River	6.2	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Oconomowoc River u/s Friess Lake	2.8	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	g to f	--	--	--
Oconomowoc River d/s Friess Lake to North Lake	15.2	Warmwater Forage Fish Community and Full Recreational Use	--	--	--	10.3 miles = g	--	--	--
Oconomowoc River d/s North Lake to Okauchee Lake	1.8	Warmwater Forage Fish Community and Full Recreational Use	--	--	--	g	--	--	--
Oconomowoc River d/s Okauchee Lake to Oconomowoc Lake	0.4	Warmwater Forage Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Oconomowoc River d/s USH 16 to Fowler Lake	1.7	Warmwater Forage Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Oconomowoc River d/s Lac La Belle to Waukesha County Line	5.0	Warmwater Forage Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Little Oconomowoc River	5.7	Warmwater Forage Fish Community and Full Recreational Use	--	--	--	e	--	--	--
Mason Creek	6.5	Coldwater Community and Full Recreational Use	--	--	--	vg to g	--	--	--
Piscasaw Creek Subwatershed									
Piscasaw Creek	2.5	Warmwater Forage Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Rock River East Branch Subwatershed									
East Branch Rock River d/s CTH D	4.4	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Limestone Creek u/s CTH W	4.0	Warmwater Forage Fish Community and Full Recreational Use	--	--	--	--	--	--	--
tributary stream	0.9	Warmwater Forage Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Limestone Creek d/s CTH W	0.9	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
East Branch Rock River u/s CTH D	14.3	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Allenton Creek	3.4	Coldwater Community and Full Recreational Use	--	--	--	--	--	--	--

Table XVIII-1 (cont'd)

WATERSHED Subwatershed Stream Reach	Stream Length (miles)	Recommended Water Use Objective	Water Quality Data			Biological Condition Data[a]	Sediment Condition Data	Water Quality Trends[b]	Compliance with Water Use Objective[c]
			Long-Term Monitoring	Short-Term Monitoring	Modeling				
Rock River East Branch Subwatershed (cont'd)									
Kohlsville River	7.9	Coldwater Community and Full Recreational Use	--	--	--	--	--	--	--
West Branch Kohlsville River	2.3	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Wayne Creek	6.5	Warmwater Forage Fish Community and Full Recreational Use	--	--	--	--	--	--	--
Rubicon River Subwatershed									
Rubicon River u/s Hilldale Road	1.4	Warmwater Forage Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Rubicon River d/s Hilldale Road to Pike Lake	1.4	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Rubicon River d/s Pike Lake	9.8	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Scuppernong River Subwatershed									
Scuppernong River	14.9	Coldwater Community and Full Recreational Use	--	--	--	--	--	--	--
Steel Brook Creek	7.1	Coldwater Community and Full Recreational Use	--	--	--	--	--	--	--
Turtle Creek Subwatershed									
Jackson Creek	5.7	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Swan Creek	4.2	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	F
Turtle Creek u/s Comus Lake	10.2	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	F
Turtle Creek d/s Comus Lake to STH 11	3.3	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	F
Turtle Creek d/s STH 11 to Walworth County Line	7.1	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	F
Little Turtle Creek	7.5	Warmwater Forage Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Ladd Creek	1.1	Warmwater Forage Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Darien Creek	8.8	Warmwater Forage Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Sharon Creek	2.1	Warmwater Forage Fish Community and Full Recreational Use	--	--	--	--	--	--	--

Table XVIII-1 (cont'd)

WATERSHED Subwatershed Stream Reach	Stream Length (miles)	Recommended Water Use Objective	Water Quality Data			Biological Condition Data[a]	Sediment Condition Data	Water Quality Trends[b]	Compliance with Water Use Objective[c]
			Long-Term Monitoring	Short-Term Monitoring	Modeling				
Whitewater Creek Subwatershed									
Whitewater Creek u/s Bluff Creek inflow to Rice Lake	1.6	Coldwater Community and Full Recreational Use	--	--	x	--	--	--	P
western tributary stream	2.5	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Whitewater Creek d/s Bluff Creek inflow	3.2	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Spring Brook	2.9	Warmwater Forage Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Bluff Creek	1.9	Coldwater Community and Full Recreational Use	--	--	--	--	--	--	--
Galloway Creek	1.4	Warmwater Forage Fish Community and Full Recreational Use	--	--	--	--	--	--	--
ROOT RIVER WATERSHED									
Root River u/s Grange Avenue	4.8	Warmwater Sport Fish Community and Full Recreational Use	--	x	x	f to p	--	--	P
Root River d/s Grange Avenue to Ryan Road	9.8	Warmwater Sport Fish Community and Full Recreational Use	--	x	x	f to p	--	--	P
Root River d/s Ryan Road to County Line Road	3.4	Warmwater Sport Fish Community and Full Recreational Use	--	x	x	f	--	--	P
Root River d/s County Line Road to Nicholson Road	5.7	Warmwater Sport Fish Community and Full Recreational Use	--	3.8 miles	x	3.8 miles = f to p	--	--	P
Root River d/s Nicholson Road to STH 38	12.5	Warmwater Sport Fish Community and Full Recreational Use	7.5 miles	5.0 miles	x	f to p	--	7.5 miles = I	P
Root River d/s STH 38	6.0	Warmwater Sport Fish Community and Full Recreational Use	--	x	x	f to p	--	--	P
West Branch Root River Canal u/s CTH C	3.6	Limited Aquatic Life and Limited Recreational Use	--	3.0 miles	x	f to p	--	--	P
West Branch Root River Canal d/s CTH C	9.9	Limited Forage Fish Community and Limited Recreational Use	--	6.1 miles	x	7.9 miles = f to p	--	--	P
Root River Canal	4.9	Limited Forage Fish Community and Limited Recreational Use	--	x	x	f	--	--	P
East Branch Root River Canal u/s STH 20	6.6	Limited Aquatic Life and Limited Recreational Use	--	x	x	vp	--	--	P
East Branch Root River Canal d/s STH 20	5.0	Limited Forage Fish Community and Limited Recreational Use	--	x	x	vp	--	--	P
Tess Corners/Whitnall Park Creek	9.9	Warmwater Forage Fish Community and Full Recreational Use	--	x	x	f	--	--	P
Husher Creek	3.4	Warmwater Sport Fish Community and Full Recreational Use	--	x	x	f	--	--	P
Hoods Creek	8.6	Warmwater Forage Fish Community and Full Recreational Use	--	x	x	f to p	--	--	P

Table XVIII-1 (cont'd)

WATERSHED Subwatershed Stream Reach	Stream Length (miles)	Recommended Water Use Objective	Water Quality Data			Biological Condition Data[a]	Sediment Condition Data	Water Quality Trends[b]	Compliance with Water Use Objective[c]
			Long-Term Monitoring	Short-Term Monitoring	Modeling				
SAUK CREEK WATERSHED									
Sauk Creek	18.8	Warmwater Sport Fish Community and Full Recreational Use	--	--	X	--	--	--	P
SHEBOYGAN RIVER WATERSHED									
Belgium Creek - West Branch	3.0	Warmwater Sport Fish Community and Full Recreational Use	--	--	x	--	--	--	P
Belgium Creek - East Branch	4.2	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--	--
TOTAL	1223.2		105.4	219.4	980.3	--	--	--	--

Note: u/s = upstream
d/s = downstream
x = data available
-- = adequate data not available

[a] Letter codes are as follows:
e = excellecnt
e to g = excellent to good
vg to g = very good to good
vg to f = very good to fair
g = good
g to f = good to fair
g to p = good to poor
f = fair
f to p = fair to poor
f to vp = fair to very poor
p = poor
p to vp = poor to very poor
vp = very poor

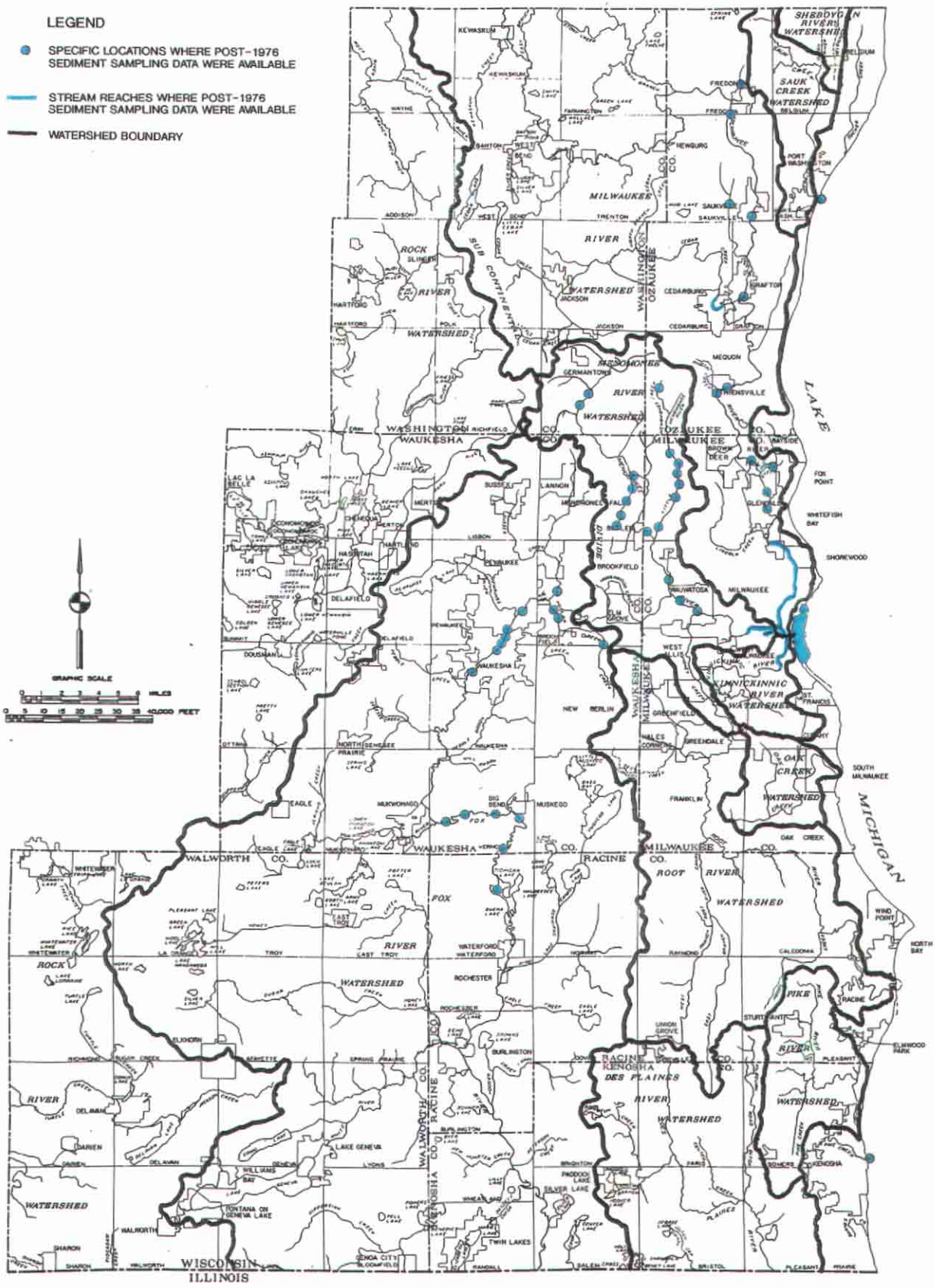
[b] I = improvement in water quality conditions based on long-term water quality monitoring data
D = decline in water quality conditions based on long-term water quality monitoring data
NC = no change in water quality conditions based on long-term water quality monitoring data

[c] F = fully meeting recommended water use objectives
P = partially meeting recommended water use objectives
N = not meeting recommended water use objectives

Source: Wisconsin Department of Natural Resources and SEWRPC.

Map XVIII-3

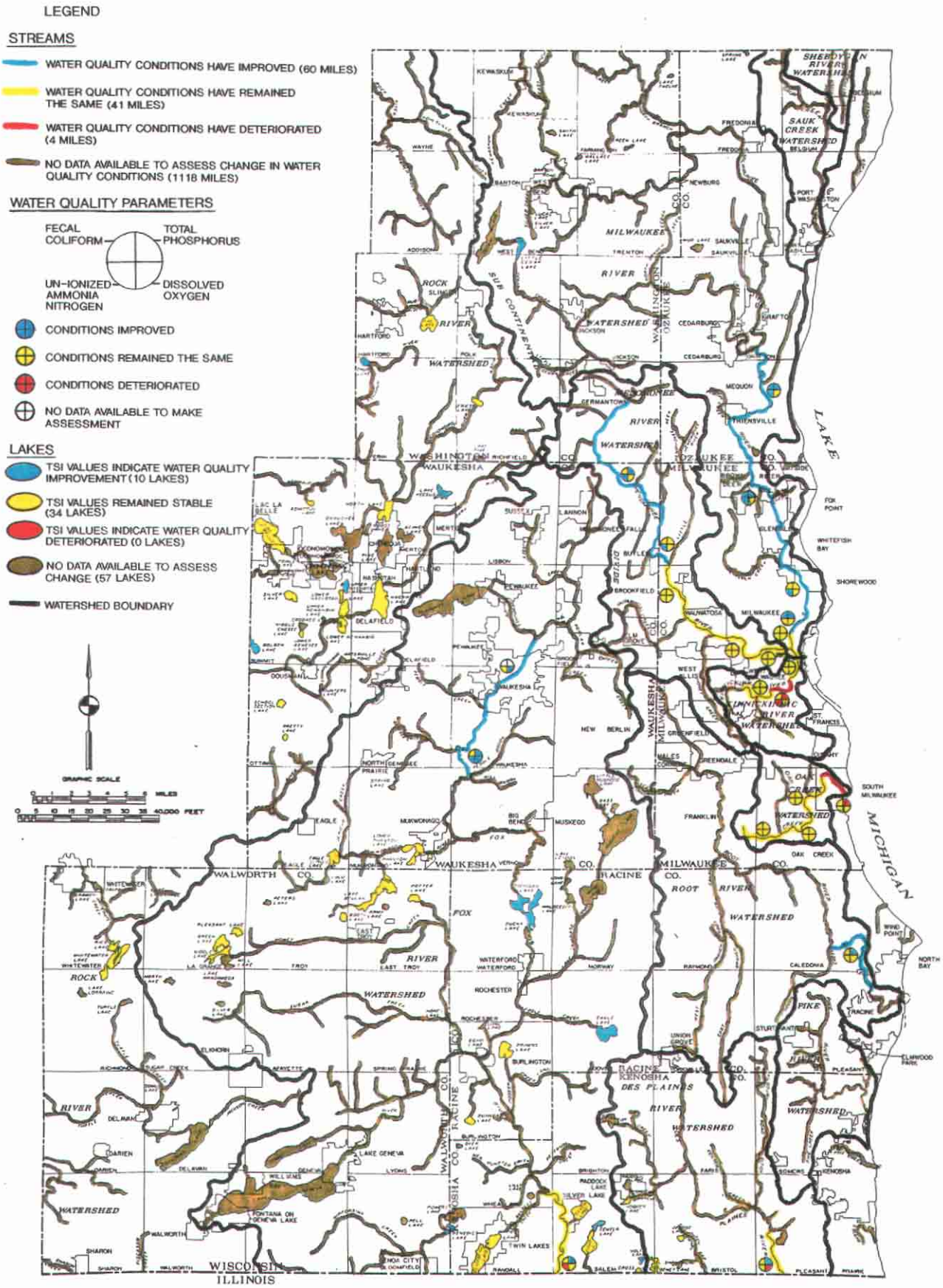
AVAILABILITY OF SEDIMENT SAMPLING DATA IN SOUTHEASTERN WISCONSIN: 1976-1993



Source: SEWRPC.

Map XVIII-4

SUMMARY OF TRENDS IN SURFACE WATER QUALITY CONDITIONS IN SOUTHEASTERN WISCONSIN: 1976-1993



Source: SEWRPC.

of the stream miles for which long-term data were available. For the remaining 41 miles of stream, or 39 percent of the stream miles, for which data were available, the data indicate that no significant changes in water quality conditions have occurred. These stream reaches include portions of the Des Plaines, Fox, Kinnickinnic, Menomonee, and Milwaukee Rivers and a portion of Oak Creek.

As indicated on Map XVIII-4, water quality improvement was noted in the Fox River watershed along the Fox River from the confluence with the Pewaukee River upstream of the City of Waukesha to the confluence with Pebble Brook in the Vernon Marsh Wildlife Area in Waukesha County. The improvement, which was evidenced by improvements in dissolved oxygen, phosphorus, and un-ionized ammonia nitrogen levels, may be attributed to improvements in the City of Waukesha and City of Brookfield sewage treatment plants; the abandonment of the Village of Pewaukee and City of New Berlin Regal Manors sewage treatment plants; as well as to reductions in pollutant loadings from industrial point sources. Although an improvement was noted, levels of fecal coliform and total phosphorus continue to generally exceed the standards for this reach of the Fox River. Dissolved oxygen and un-ionized ammonia nitrogen levels generally met the water quality standards in this reach. Chronic toxicity standards for heavy metals, as set forth in Chapter II of this document, were also generally met.

In the Menomonee River watershed, water quality improvement was noted in the Menomonee River upstream of the confluence with the Little Menomonee River, as shown on Map XVIII-4. This improvement is indicated by reduced levels of phosphorus and un-ionized ammonia nitrogen concentrations and may be attributed to the abandonment of the Village of Germantown and the Village of Menomonee Falls Pilgrim Road and Lilly Road sewage treatment plants, a reduction in the bypassing of raw sanitary sewage through flow relief devices; and reductions in pollutant loading from industry sources. Levels of fecal coliform continue to exceed the water quality standards associated with the water use objectives for the Menomonee River. Dissolved oxygen levels and un-ionized ammonia nitrogen levels occasionally violated water quality standards. Lead and cadmium concentrations repeatedly exceeded the chronic toxicity standards prior to 1986, while levels of copper and zinc occasionally exceeded the standard during the period of record. The levels of lead and cadmium exceeded the standards only occasionally after 1986.

In the Milwaukee River watershed, the water quality data indicate an improvement on the Milwaukee River main stem from the confluence with Cedar Creek in Ozaukee County downstream to Walnut Street in Milwaukee County, as shown on Map XVIII-4. The improvement is indicated by reduced levels of phosphorus, un-ionized ammonia nitrogen, and fecal coliform levels. In addition, reduced levels of biochemical oxygen demand, volatile suspended solids, and chlorophyll-a concentrations at some monitoring stations were demonstrated by the data. These improvements may be attributed to the improvements of the City of West Bend, the Village of Saukville, the Village of Grafton, and the City of Cedarburg sewage treatment plants; to the abandonment of the Village of Thiensville treatment plant; and to reductions in the frequency of sanitary sewer flow bypassing and in pollutant loadings from industrial point sources. In addition, limited implementation of nonpoint source pollution abatement programs within the watershed may have contributed to the improvements. The levels of phosphorus and fecal coliform generally exceeded the standards throughout the watershed. Levels of dissolved oxygen and un-ionized ammonia levels generally met but occasionally exceeded

water quality standards in those stream reaches in the downstream, highly urbanized areas of the watershed. Concentrations of cadmium and lead frequently exceeded the chronic toxicity standards prior to 1986. Since 1986, the levels of these metals have only occasionally exceeded the standards, and lead levels generally met the standards after 1986. An increase in the concentrations of chloride in the Milwaukee River was also noted. This increase may be the result of new urban development which has occurred in the watershed in Ozaukee and northern Milwaukee Counties and the associated increased use of salt in winter road maintenance. Chloride levels were still within acceptable limits as defined in Chapter II.

Within the Root River watershed, the water quality monitoring data indicate an improvement in the Root River main stem from the confluence with Hoods Creek in the Town of Caledonia to the Horlick dam in the City of Racine, as shown on Map XVIII-4. This improvement is indicated by a reduced level of phosphorus concentrations and reduced levels of un-ionized ammonia and fecal coliform. This improvement may be attributed to the abandonment of the four public and six private sewage treatment plants all located upstream of the reach for which long-term sampling data were available. Levels of phosphorus and fecal coliform continue to exceed the standards in the watershed. Dissolved oxygen levels and un-ionized ammonia levels generally meet the standard.

As indicated on Map XVIII-4, only four miles, or about 4 percent of the total of 105 miles of stream for which data were available indicated a decline in water quality conditions. This decline was noted in the Oak Creek downstream of Rawson Avenue and in the Kinnickinnic River from W. Cleveland Avenue to S. Chase Avenue, and may be attributed to possible changes in pollutant loadings attendant to increased urban nonpoint source loadings associated with development or redevelopment activities. The decline in water quality conditions was indicated by increases in total phosphorus levels in both streams. In Oak Creek, concentrations of total phosphorus and fecal coliform frequently violated water quality standards. Levels of dissolved oxygen did not violate the water quality standards. Levels of lead and cadmium frequently violated the chronic toxicity standards prior to 1986. After 1986 lead levels generally met the standards. In the Kinnickinnic River, fecal coliform concentrations exceeded the water quality standards. Exceedances of the chronic toxicity standards for cadmium and lead also occurred in the Kinnickinnic River main stem, with occasional exceedances of the chronic toxicity standards for copper and zinc.

The remaining approximately 41 miles, or about 39 percent, of stream reaches analyzed did not indicate any significant change in water quality conditions from 1976 through 1993. As shown on Map XVIII-4, these stream reaches include most of the main stem of Oak Creek; portions of the Kinnickinnic River; all of the Menomonee River main stem downstream of the confluence with the Little Menomonee River; and the lower reaches of the Des Plaines, Fox, and Milwaukee Rivers. For these stream reaches, phosphorus and fecal coliform levels generally exceeded the water quality standards. Dissolved oxygen levels generally met the standards with only infrequent periods where the standard was not achieved. Levels of toxic metals were noted to exceed the standard chronic toxicity standard during the analysis period, with the metals levels generally improving over time--particularly the lead levels which generally met the standards after 1986.

In the Des Plaines River downstream of Jerome Creek, levels of total phosphorus and fecal coliform frequently violated water quality standards. Levels of dissolved oxygen, cadmium, and lead only occasionally violated water quality standards.

Data collected on the Fox River downstream of Bassett Creek in Kenosha County exhibited an increase in un-ionized ammonia nitrogen levels and a slight improvement in dissolved oxygen levels. Violations of the fecal coliform and total phosphorus standards frequently occurred, while no violations of levels of un-ionized ammonia nitrogen or dissolved oxygen were noted. Violations of the chronic toxicity standards for lead, copper, cadmium, and zinc were also observed in this stream reach. It is of interest to note that chloride levels have increased in the Fox River in Kenosha County. This increase may be the result of new urban development which has occurred in the watershed and the impacts of increased winter road maintenance activities associated with urban development. Chloride levels were still within the acceptable limits as defined in Chapter II.

In the Kinnickinnic River portion of the inner harbor, levels of dissolved oxygen and fecal coliform frequently did not meet the water quality standards. In the Kinnickinnic River upstream of Cleveland Avenue, violations of the water quality standards for fecal coliform levels frequently occurred.

In the Menomonee River downstream of the Little Menomonee River inflow, concentrations of dissolved oxygen and fecal coliform frequently did not meet the water quality standards. Levels of lead and cadmium frequently violated the chronic toxicity standards prior to 1986. After 1986, lead levels generally met the standards. Occasional exceedances of chronic toxicity standards for copper and zinc also occurred in the lower reaches of the Menomonee River.

In the Milwaukee River downstream of Walnut Street, water quality standards were frequently exceeded for fecal coliform levels and occasionally for dissolved oxygen levels. Cadmium and lead levels frequently violated chronic toxicity standards before 1986. After 1986, lead levels generally met the standards.

In Oak Creek upstream of Rawson Avenue, fecal coliform levels frequently violated standards. Levels of dissolved oxygen and total phosphorus occasionally did not meet water quality standards. Lead and cadmium levels frequently violated chronic toxicity standards, with lower levels of lead noted after 1986.

It should be noted that the water quality data analyzed was collected prior to the completion of the Milwaukee Metropolitan Sewerage District inline deep tunnel storage system which went on line in 1994. Operation of that system over a period of time is expected to result in significant improvements in water quality conditions in the Kinnickinnic and the lower reaches of the Menomonee River and Milwaukee River. Such improvements will only be able to be quantified after a period of implementation coupled with water quality monitoring. The monitoring program currently being carried out by the Milwaukee Metropolitan Sewerage District should be adequate to demonstrate such changes in water quality.

Biological Conditions: As already noted, biological condition data were also collected for selected streams within the Region,as indicated on Map VIII-2. These data were collected for about 400 stream miles in the Region, or about 33 percent of the total stream miles considered under the planning effort. Most of

these data were collected after 1988 as part of the nonpoint source priority watershed projects undertaken within the Region. For the majority of the streams, data obtained from benthic macroinvertebrate sampling were used to calculate biotic index ratings based upon the Hilsenhoff Biotic Index (HBI)[4]. Fish community sampling was also used to calculate biotic index ratings based upon the Index of Biotic Integrity (IBI)[5], as indicated in Chapter II.

As indicated on Map XVIII-2, of the approximately 425 stream miles for which biotic index values were calculated, approximately 135 miles, or about 32 percent of the stream miles for which data were available, received a rating of good or higher. The majority of these streams were located in the Ozaukee County portion of the Milwaukee River watershed, in the upper tributary reaches of the Menomonee River watershed, and in the Oconomowoc River subwatershed. Water quality ratings of very poor were calculated for about 69 stream miles, or about 16 percent of the stream miles for which data were available, including Lincoln Creek, Indian Creek, Brown Deer Creek, Sussex Creek, Honey Creek, the East Branch Root River Canal, the Pike River mainstem, and portions of Cedar Creek and Oak Creek. Biotic index ratings of fair to poor were calculated for about 221 stream miles, or about 52 percent of the stream miles for which data were available, including portions of the Fox River and its major tributaries; most of the Root River and its major tributaries; the Kinnickinnic River and its major tributaries; most of Oak Creek and its major tributaries; Pike Creek, the Little Menomonee River, Butler Ditch, Lilly Creek, Underwood Creek, the Nor-X-Way Channel, Willow Creek, and a portion of Cedar Creek.

Sediment Conditions: Sediment data were collected for selected stream reaches in the Fox, Kinnickinnic, Milwaukee and Menomonee River watersheds, as well as in the Milwaukee, Port Washington, and Kenosha Harbors, as shown on Map XVIII-3. Specific concentrations of substances found to be present are set forth by watershed in Chapters IV through XV.

In the Fox River watershed, data collected in the Fox River in the City of Waukesha indicated levels of Polychlorinated Biphenyls (PCBs) which exceeded the lowest effect level (LEL) guidelines set forth in the draft screening criteria proposed by the Wisconsin Department of Natural Resources[6] as described in Chapter II. Sediment concentrations of copper, lead, mercury, and zinc exceeded the LEL guidelines in both the Waterford and Barstow impoundments. Severe effect level (SEL) guidelines were exceeded in the Waterford Impoundment for concentrations of chromium, copper, lead and nickel.

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[4]William L. Hilsenhoff, "Using a Biotic Index to Evaluate Water Quality in Streams," Wisconsin Department of Natural Resources Technical Bulletin No. 132, 1982.

[5]John Lyons, "Using the Index of Biotic Integrity (IBI) to Measure Environmental Quality in Warmwater Streams of Wisconsin," U. S. Department of Agriculture, Forest Service, General Technical Report NC-149, April 1992.

[6]Wisconsin Department of Natural Resources, (Draft) Inventory of Statewide Contaminated Sediment Sites and Development of a Prioritization System, June 1994.

In the Kinnickinnic River upstream to Chase Avenue, levels of Polycyclic Aromatic Hydrocarbons (PAHs) exceeded the LEL concentrations at the majority of sampling sites.

In the Menomonee River watershed, the available data indicated levels of PAHs which exceeded the LEL guidelines in the Lower Menomonee River and in the Menomonee River Canals. At those sampling sites in the Menomonee River main stem, in the Little Menomonee River, and in Lilly Creek, concentrations of heavy metals, PAHs, and other toxic substances exceeded the LEL guidelines for the majority of sites. In the Menomonee River portion of the Milwaukee Harbor estuary, sediment concentrations of ammonia, lead, zinc, and cadmium exceeded the proposed SEL guidelines at most of the sites sampled.

In the Milwaukee River watershed, sediment data collected from sampling stations located on the Milwaukee River and on certain major tributaries indicated PAH and heavy metal concentrations which generally exceeded LEL guidelines. Levels of PAHs and PCBs also exceeded LEL guidelines in sediments sampled in the Milwaukee River downstream of Lincoln Creek, including those sediments sampled as part of the North Avenue Dam feasibility study. Sediments sampled in Cedar Creek in the City of Cedarburg immediately upstream of each of four dams also indicated high levels of contamination of the sediments by PCBs. Data collected from above these dams indicated PCB levels which were higher than the SEL guidelines for three of the four dams.

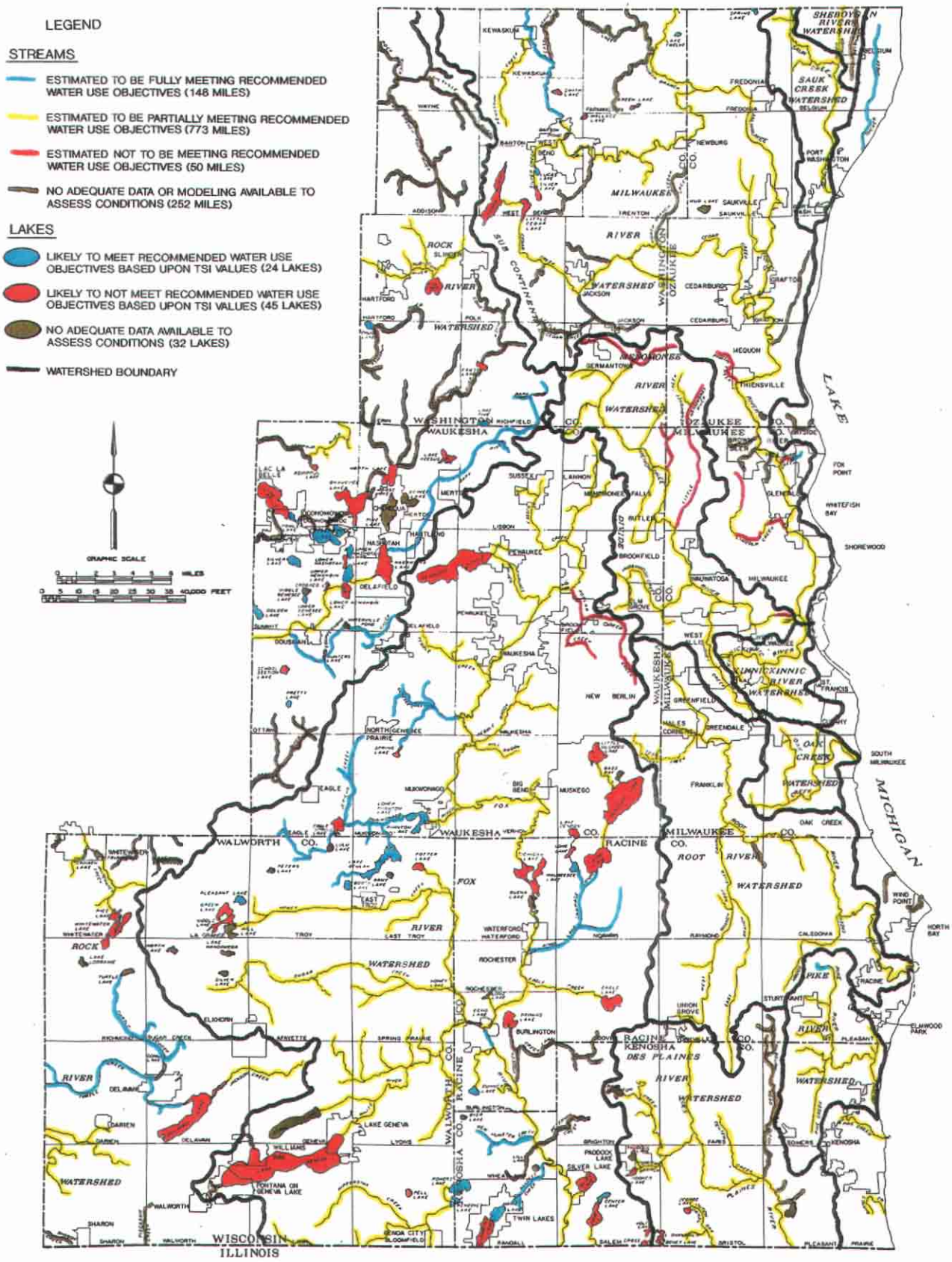
In the three harbors for which sediment samples were collected, levels of heavy metals exceeded the LEL guidelines for both the City of Port Washington and City of Kenosha harbors, and PAH levels exceeded LEL concentrations at the majority of the offshore stations in the Milwaukee Harbor estuary.

Water Use Objectives: The recommended water use objectives for streams in the Region are described in Chapter II and set forth by watershed in Chapters IV through XV. Based upon a review and analysis of available water quality monitoring data; in-stream field inventories and appraisals; the results of simulation modeling; and information on the current uses of certain streams, an assessment of the ability of current stream conditions to meet the recommended water use objectives was conducted, with the findings summarized in Table XVIII-1 and on Map XVIII-5. Streams for which the available water quality data indicated that all of the critical water quality standards were achieved, or for which field observation indicated the stream actually supported the intended water uses, were noted as "fully meeting" the water use objectives. Streams where water quality conditions indicated one or more, but not all of the critical water quality standards were being achieved, were noted to be "partially meeting" the water use objectives. Those streams for which field observation indicated the stream actually supported the intended water use objectives some of the time were also noted as partially meeting the objectives. Streams where actual or estimated water quality conditions indicated that none of the critical water quality standards were met, or where field inspection indicated the intended uses were generally not being met, were noted to be "not meeting" the water use objectives.

As shown in Table XVIII-1 and on Map XVIII-5, of the 1,223 stream miles assessed under this planning effort, 148 miles, or 12 percent, are estimated to fully meet the recommended water use objectives. The majority of the streams--773 miles, or 63 percent--are estimated to be partially meeting the recommended water use

Map XVIII-5

ESTIMATED CURRENT LEVEL OF ACHIEVEMENT FOR SURFACE WATER USE OBJECTIVES IN SOUTHEASTERN WISCONSIN: 1993



Source: SEWRPC.

objectives. About 50 stream miles, or 4 percent, are estimated not to be meeting the water use objectives. For 252 stream miles, or 21 percent of the total stream miles, no data were available to assess the potential level of achievement of the water use objectives.

Lakes

Available lake water quality data collected since the completion of the initial water quality management plan were utilized by the Commission to evaluate to the extent possible changes in lake water quality for the 101 major lakes within the Region. As indicated in Table XVIII-2 and on Map XVIII-1, water quality monitoring data collected since the completion of the initial plan were available for 69 of the major lakes in the Region. It is important to note that comprehensive water quality monitoring data collected as part of the Wisconsin Department of Natural Resources Long-Term Trends Lake Monitoring Program, U.S. Geological Survey monitoring programs, and other comprehensive monitoring programs, were available for 33 of these 69 lakes. Data on the other 36 lakes consisted primarily of Secchi disc data collected under the Wisconsin Department of Natural Resources Self-Help Monitoring Program.

Water Quality: Current available lake water chemistry data were compared with available lake monitoring data collected prior to 1981 to assess any potential changes in lake water quality over time, using the procedure set forth in Chapter II. Results are set forth in graphic summary in Map XVIII-4. Based upon the Trophic State Index (TSI) values, as described in Chapter II, 10 of the 44 lakes for which comparative data were available exhibited an improvement in lake water quality since the completion of the initial plan. These apparent improvements may be attributed, in part, to the construction of public sanitary sewerage systems at a number of the lakes, as well as to the recent implementation of programs of improved onsite sewage disposal system inspection and maintenance for areas served by private onsite sewage treatment systems. In addition, increased riparian awareness regarding water quality impacts and the subsequent implementation of better housekeeping practices by landowners may also have had positive impacts on lake water quality.

It should be noted that for those lakes with comparative water chemistry data available, none of the lakes exhibited a decline in water quality based upon Trophic State Index values. For the remaining 34 lakes where comparative water chemistry data were available, water quality conditions appeared to be unchanged from 1976 to 1993, even though a number of these lakes in the Region have experienced increased developmental pressures during this period.

Water Use Objectives: Based upon available Trophic State Index values, an assessment of the compliance of current lake water quality conditions to the recommended water use objectives was conducted, with results set forth in Table XVIII-2 and on Map XVIII-5. The data used in this assessment included data collected for 69 lakes since the preparation of the initial plan. Those lakes with a Trophic State Index value in excess of approximately 47, indicated to be eutrophic or very eutrophic, were assumed to be exceeding the total phosphorus standard associated with full recreational uses. As indicated in Map XVIII-5, 45, or about 65 percent, of the 69 lakes for which trophic state index data were available have an estimated water quality which indicates that the recommended water use objectives are unlikely to be fully met. The data indicate that the water use objectives are fully met for 24 lakes. It should be noted that those

Table XVIII-2

AVAILABLE POST-1976 DATA FOR LAKES IN SOUTHEASTERN WISCONSIN

WATERSHED Subwatershed Lake	Lake Area (acres)	Recommended Water Use Objective	Water Quality Data			Trophic State Index[a]	Water Quality Trends	Compliance with Water Use Objective
			Pre-1981 Monitoring	Post-1987 Comprehensive Monitoring	Post-1981 Limited Monitoring			
DES PLAINES RIVER WATERSHED								
Benet/Shangrila Lake	188	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	67	NC	N
East Lake Flowage	123	Warmwater Sport Fish Community and Full Recreational Use	+	--	--	--	--	--
George Lake	59	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	64	NC	N
Hooker Lake	87	Warmwater Sport Fish Community and Full Recreational Use	+	+	+	54	NC	N
Paddock Lake	112	Warmwater Sport Fish Community and Full Recreational Use	+	--	--	--	--	--
Unnamed Quarry Lake	100	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--
FOX RIVER WATERSHED								
Upper Fox River Subwatershed								
Pewaukee Lake	2493	Warmwater Sport Fish Community and Full Recreational Use	--	+	+	59	--	N
Middle Fox River Subwatershed								
Big Muskego Lake	2177	Warmwater Sport Fish Community and Full Recreational Use	--	+	+	70	--	N
Denoon Lake	162	Warmwater Sport Fish Community and Full Recreational Use	--	+	+	49	--	N
Eagle Lake	520	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	52	I	N
Kee Nong Go Mong Lake	88	Warmwater Forage Fish Community and Full Recreational Use	--	+	--	55	--	N
Little Muskego Lake	506	Warmwater Sport Fish Community and Full Recreational Use	--	+	+	62	--	N
Long Lake (Racine County)	102	Warmwater Sport Fish Community and Full Recreational Use	+	--	--	--	--	--
Spring Lake (Waukesha County)	105	Warmwater Sport Fish Community and Full Recreational Use	--	--	+	51	--	N
Waterford Impoundment								
Buena Lake	241	Warmwater Sport Fish Community and Full Recreational Use	+	--	--	--	--	--
Tichigan Lake	892	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	54	I	N
Waubeesee Lake	129	Warmwater Sport Fish Community and Full Recreational Use	--	+	+	46	--	F
Wind Lake	936	Warmwater Sport Fish Community and Full Recreational Use	--	+	+	69	--	N

Table XVIII-2 (continued)

WATERSHED Subwatershed Lake	Lake Area (acres)	Recommended Water Use Objective	Water Quality Data			Trophic State Index[a]	Water Quality Trends	Compliance with Water Use Objective
			Pre-1981 Monitoring	Post-1987 Comprehensive Monitoring	Post-1981 Limited Monitoring			
Lower Fox River Subwatershed								
Bohner Lake	135	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	45	NC	F
Browns Lake	396	Warmwater Sport Fish Community and Full Recreational Use	+	+	--	51	NC	N
Camp Lake	461	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	54	NC	N
Center Lake	129	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	35	I	F
Cross Lake	87	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	52	NC	N
Dyer Lake	56	Warmwater Sport Fish Community and Full Recreational Use	+	--	--	--	--	--
Lilly Lake	88	Warmwater Sport Fish Community and Full Recreational Use	+	--	--	--	--	--
Silver Lake (Kenosha County)	464	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	50	NC	N
Voltz Lake	52	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	57	I	N
Mukwonago River Subwatershed								
Army Lake	78	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--
Beulah Lake	834	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	46	NC	F
Booth Lake	113	Warmwater Sport Fish Community and Full Recreational Use	+	+	+	45	NC	F
Eagle Spring Lake	311	Warmwater Sport Fish Community and Full Recreational Use	+	+	+	49	NC	N
Lower Phantom Lake	433	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	43	NC	F
Lulu Lake	84	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--
Peters Lake	64	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--
Upper Phantom Lake	107	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	44	NC	F

Table XVIII-2 (continued)

WATERSHED Subwatershed Lake	Lake Area (acres)	Recommended Water Use Objective	Water Quality Data			Trophic State Index[a]	Water Quality Trends	Compliance with Water Use Objective
			Pre-1981 Monitoring	Post-1987 Comprehensive Monitoring	Post-1981 Limited Monitoring			
Honey/Sugar Creeks Subwatershed								
Lauderdale Lakes								
Green Lake	311	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	49	NC	N
Middle Lake	259	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	51	NC	N
Mill Lake	271	Warmwater Sport Fish Community and Full Recreational Use	+	--	--	--	--	--
North Lake (Walworth County)	191	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--
Pleasant Lake	155	Warmwater Sport Fish Community and Full Recreational Use	+	+	+	45	NC	F
Potters Lake	162	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	78	NC	N
Silver Lake (Walworth County)	85	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--
Wandawega Lake	119	Warmwater Sport Fish Community and Full Recreational Use	+	--	--	--	--	--
White River/Nippersink Creek Subwatershed								
Benedict Lake	78	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	44	I	F
Como Lake	946	Warmwater Sport Fish Community and Full Recreational Use	+	--	--	--	--	--
Echo Lake	71	Warmwater Forage Fish Community and Full Recreational Use	--	--	--	--	--	--
Elizabeth Lake	865	Warmwater Sport Fish Community and Full Recreational Use	+	+	+	52	NC	N
Geneva Lake	5262	Coldwater Community and Full Recreational Use	--	+	+	48	--	N
Mary Lake	315	Warmwater Sport Fish Community and Full Recreational Use	+	+	+	47	NC	F
Pell Lake	86	Warmwater Sport Fish Community and Full Recreational Use	--	+	--	60	--	N
Powers Lake	459	Warmwater Sport Fish Community and Full Recreational Use	--	+	+	45	--	F
MILWAUKEE RIVER WATERSHED								
Cedar Creek Subwatershed								
Big Cedar Lake	932	Warmwater Sport Fish Community and Full Recreational Use	--	+	+	59	--	N
Little Cedar Lake	246	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	59	I	N
Mud Lake (Ozaukee County)	245	Warmwater Sport Fish Community and Full Recreational Use	+	--[b]	--	--	--	--

Table XVIII-2 (continued)

WATERSHED Subwatershed Lake	Lake Area (acres)	Recommended Water Use Objective	Water Quality Data			Trophic State Index[a]	Water Quality Trends	Compliance with Water Use Objective
			Pre-1981 Monitoring	Post-1987 Comprehensive Monitoring	Post-1981 Limited Monitoring			
Milwaukee River East-West Branch Subwatershed								
Barton Pond	67	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--
Lucas Lake	78	Warmwater Sport Fish Community and Full Recreational Use	--	--	+	43	--	F
Silver Lake (Washington Co.)	118	Warmwater Sport Fish Community and Full Recreational Use	--	--	+	50	--	N
Smith Lake	86	Warmwater Sport Fish Community and Full Recreational Use	--	--	+	49	--	N
Milwaukee River North Branch Subwatershed								
Green Lake (Washington County)	71	Warmwater Sport Fish Community and Full Recreational Use	--	--	+	50	--	N
Spring Lake (Ozaukee County)	66	Warmwater Sport Fish Community and Full Recreational Use	--	--	+	43	--	F
Lake Twelve	53	Warmwater Sport Fish Community and Full Recreational Use	--	--	+	45	--	F
Wallace Lake	52	Warmwater Sport Fish Community and Full Recreational Use	--	--	+	59	--	N
Milwaukee River South Branch Subwatershed								
Lac du Cours	57	Warmwater Sport Fish Community and Full Recreational Use	+	--	--	--	--	--
ROCK RIVER WATERSHED								
Ashippun River Subwatershed								
Ashippun Lake	84	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	49	NC	N
Druid Lake	124	Warmwater Sport Fish Community and Full Recreational Use	+	+	+	47	I	F
Bark River Subwatershed								
Bark Lake	65	Warmwater Sport Fish Community and Full Recreational Use	+	--	--	--	--	--
Crooked Lake	58	Warmwater Sport Fish Community and Full Recreational Use	--	--	+	51	--	N
Golden Lake	250	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	42	I	F
Hunters Lake	65	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--
Lower Nashotah Lake	90	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	51	NC	N
Lower Nemahbin Lake	271	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	54	NC	N
Nagawicka Lake	957	Warmwater Sport Fish Community and Full Recreational Use	+	+	+	60	NC	N

Table XVIII-2 (continued)

WATERSHED Subwatershed Lake	Lake Area (acres)	Recommended Water Use Objective	Water Quality Data			Trophic State Index[a]	Water Quality Trends	Compliance with Water Use Objective
			Pre-1981 Monitoring	Post-1987 Comprehensive Monitoring	Post-1981 Limited Monitoring			
Bark River Subwatershed (cont'd)								
Pretty Lake	64	Warmwater Sport Fish Community and Full Recreational Use	+	+	+	42	NC	F
School Section Lake	125	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	53	NC	N
Upper Nashotah Lake	133	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	45	I	F
Upper Nemahbin Lake	283	Warmwater Sport Fish Community and Full Recreational Use	+	+	+	45	NC	F
Waterville Pond	68	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--
Oconomowoc River Subwatershed								
Beaver Lake	316	Warmwater Sport Fish Community and Full Recreational Use	+	--	--	--	--	--
Lake Five	102	Warmwater Sport Fish Community and Full Recreational Use	--	--	+	47	--	F
Fowler Lake	99	Warmwater Sport Fish Community and Full Recreational Use	--	+	+	43	--	F
Friess Lake	119	Warmwater Sport Fish Community and Full Recreational Use	+	+	+	59	NC	N
Lake Keesus	237	Warmwater Sport Fish Community and Full Recreational Use	+	+	+	50	I	N
Lac La Belle	1117	Warmwater Sport Fish Community and Full Recreational Use	+	+	+	54	NC	N
Lower Genesee	66	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	41	NC	F
Middle Genesee	102	Warmwater Sport Fish Community and Full Recreational Use	+	--	--	--	--	--
Moose Lake	81	Warmwater Sport Fish Community and Full Recreational Use	+	--	--	--	--	--
North Lake	437	Warmwater Sport Fish Community and Full Recreational Use	+	+	+	54	NC	N
Oconomowoc Lake	767	Warmwater Sport Fish Community and Full Recreational Use	--	+	+	44	--	F
Okauchee Lake	1187	Warmwater Sport Fish Community and Full Recreational Use	--	+	--	58	--	N
Pine Lake	703	Warmwater Sport Fish Community and Full Recreational Use	+	--	--	--	--	--
Silver Lake (Waukesha County)	222	Warmwater Sport Fish Community and Full Recreational Use	+	--	+	43	NC	F
Rubicon River Subwatershed								
Pike Lake	522	Warmwater Sport Fish Community and Full Recreational Use	+	+	+	52	NC	N
Scuppernong River Subwatershed								
LaGrange Lake	55	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--

Table XVIII-2 (continued)

WATERSHED Subwatershed Lake	Lake Area (acres)	Recommended Water Use Objective	Water Quality Data			Trophic State Index[a]	Water Quality Trends	Compliance with Water Use Objective
			Pre-1981 Monitoring	Post-1987 Comprehensive Monitoring	Post-1981 Limited Monitoring			
Turtle Creek Subwatershed								
Comus Lake	117	Warmwater Sport Fish Community and Full Recreational Use	+	--	--	--	--	--
Delavan Lake	2072	Warmwater Sport Fish Community and Full Recreational Use	--	+	+	64	--	N
Turtle Lake	140	Warmwater Sport Fish Community and Full Recreational Use	+	--	--	--	--	--
Whitewater Creek Subwatershed								
Cravath Lake	65	Warmwater Sport Fish Community and Full Recreational Use	+	--	--	--	--	--
Lake Lorraine	133	Warmwater Sport Fish Community and Full Recreational Use	--	--	--	--	--	--
Rice Lake	137	Warmwater Forage Fish Community and Full Recreational Use	+	+	+	60	NC	N
Tripp Lake	115	Warmwater Sport Fish Community and Full Recreational Use	+	--	--	--	--	--
Whitewater Lake	640	Warmwater Sport Fish Community and Full Recreational Use	+	+	+	61	NC	N

[a]Carslon Trophic State Index (TSI) classification based upon water chemistry data collected between 1981 and 1994.

[b]Fisheries survey conducted during priority watershed appraisal process.

Note: + = data available
-- = no data available
I = improvement in water quality conditions based on long-term water quality monitoring data
D = decline in water quality conditions based on long-term water quality monitoring data
NC = no change in water quality conditions based on long-term water quality monitoring data
F = likely to meet recommended water use objectives based on a TSI < or equal to 47
N = not likely to meet recommended water use objectives based on a TSI < or equal to 47

Source: Wisconsin Department of Natural Resources and SEWRPC.

lakes for which the data indicate the objectives are not fully met do in most cases provide for sport fishing and for positive recreation uses which are considered limited to various extents due to algae and aquatic plant problems.

LAND USE PLAN ELEMENT

The most fundamental and basic element of the regional water quality management plan is the land use element. The type, intensity, and distribution of urban and rural land uses within the Region will determine to a large degree the character, magnitude, and distribution of point and nonpoint sources of pollution; the location and size of wastewater treatment facilities and attendant collection and conveyance facilities; the kind and level of wastewater treatment required; the need for, and practicality of, various land management practices for nonpoint source pollution abatement; and ultimately, the quality of the surface waters of the Region.

The land use plan element of the initial regional water quality management plan consisted of the recommended regional land use plan for the design year 2000, adopted by the Regional Planning Commission on December 19, 1977.[7] The year 2000 land use plan emphasized a compact, centralized regional settlement pattern. The plan recommended that intensive urban development be encouraged to occur only in those areas of the Region covered by soils suitable for such development, that are not subject to special hazards, such as flooding or shoreline erosion, and that can be readily served by such essential urban services as sanitary sewer, public water supply, and mass transit; that all remaining primary environmental corridors be preserved in essentially natural, open uses; and that all remaining prime agricultural lands be retained in essentially agricultural uses. Between 1970 and 1985, major commercial, industrial, and recreational land use development proceeded in substantial conformance with the year 2000 regional land use plan recommendations. Residential development, however, occurred at a rate somewhat higher than envisioned under the plan; and approximately 30 percent of all housing units were developed at lower densities than recommended in the plan. Between 1970 and 1985, significant progress was made in the protection of primary environmental corridor lands, through the increase in both public land use regulation and in public ownership of the corridor lands. With regard to prime agricultural lands, substantial progress was made toward the preservation of these lands through the application of exclusive agricultural zoning. The land use plan recognized the loss of certain agricultural lands to accommodate continued urban growth and development within the Region. However, approximately 80 percent of the prime agricultural land lost to urban development was located in outlying rural areas generally recommended to remain in agriculture and related uses under the year 2000 land use plan.

The land use plan element of the current regional water quality management plan consists of the recommended regional land use plan[8] for the design year 2010 adopted by the Commission on September 23, 1992. This plan, as shown on Map

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[7]SEWRPC Planning Report No. 25, A Regional Land Use Plan and a Regional Transportation Plan for Southeastern Wisconsin: 2000, May 1978.

[8]SEWRPC Planning Report No. 40, A Regional Land Use Plan for Southeastern Wisconsin-2010, January 1992.

XVIII-6, seeks to centralize land use development to the greatest degree practicable; to encourage new urban development to occur at densities consistent with the provision of public centralized sanitary sewer, water supply, and mass transit facilities and services; to encourage new urban development to occur only in areas covered by soils well suited to urban use and not subject to special hazards, such as flooding; and to encourage new urban development and redevelopment to occur in areas in which essential urban facilities and services are available--particularly the existing urban centers of the Region--or into which such facilities and services can be readily and economically extended.

The new design year 2010 regional land use plan incorporated the use of an alternative futures approach in order to deal with uncertainties as to whether or not historic trends will continue. Under this approach, the development and evaluation of alternative land use plans was based not upon a single most probable forecast of future socio-economic conditions, but rather upon a number of alternative futures chosen to represent a range of conditions which may occur over the plan design period. Consideration of these alternative future conditions is particularly important in local plan implementation activities associated with the regional water quality management plan. To this end, design year 2010 data under the recommended plan and under the high growth future scenario are provided herein in order to present a reasonable range of conditions for use in local plan facility planning.

Under the alternative futures approach, the resident population of the Region may be expected to increase from 1,765,000 persons in 1980 to about 1,911,000 persons by 2010 under the intermediate-growth scenario, and to about 2,316,000 persons under the high-growth scenario. These population levels represent a range of from 8 to 32 percent in population increase over the planning period. The number of households in the Region may be expected to increase from 676,000 households in 1990 to 774,000 households by 2010 under the intermediate-growth scenario; and to about 856,000 households under the high-growth scenario. These household levels represnt a range of from 24 to 42 percent increases over the planning period. Similarly, total regional employment may be expected to increase from 884,000 jobs in 1980 to about 1,095,000 jobs by 2010 under the intermediate-growth scenario;, and to about 1,252,000 jobs under the high-growth scenario. These employment levels represent an increase of about 24 and 42 percent, respectively, over the planning period.

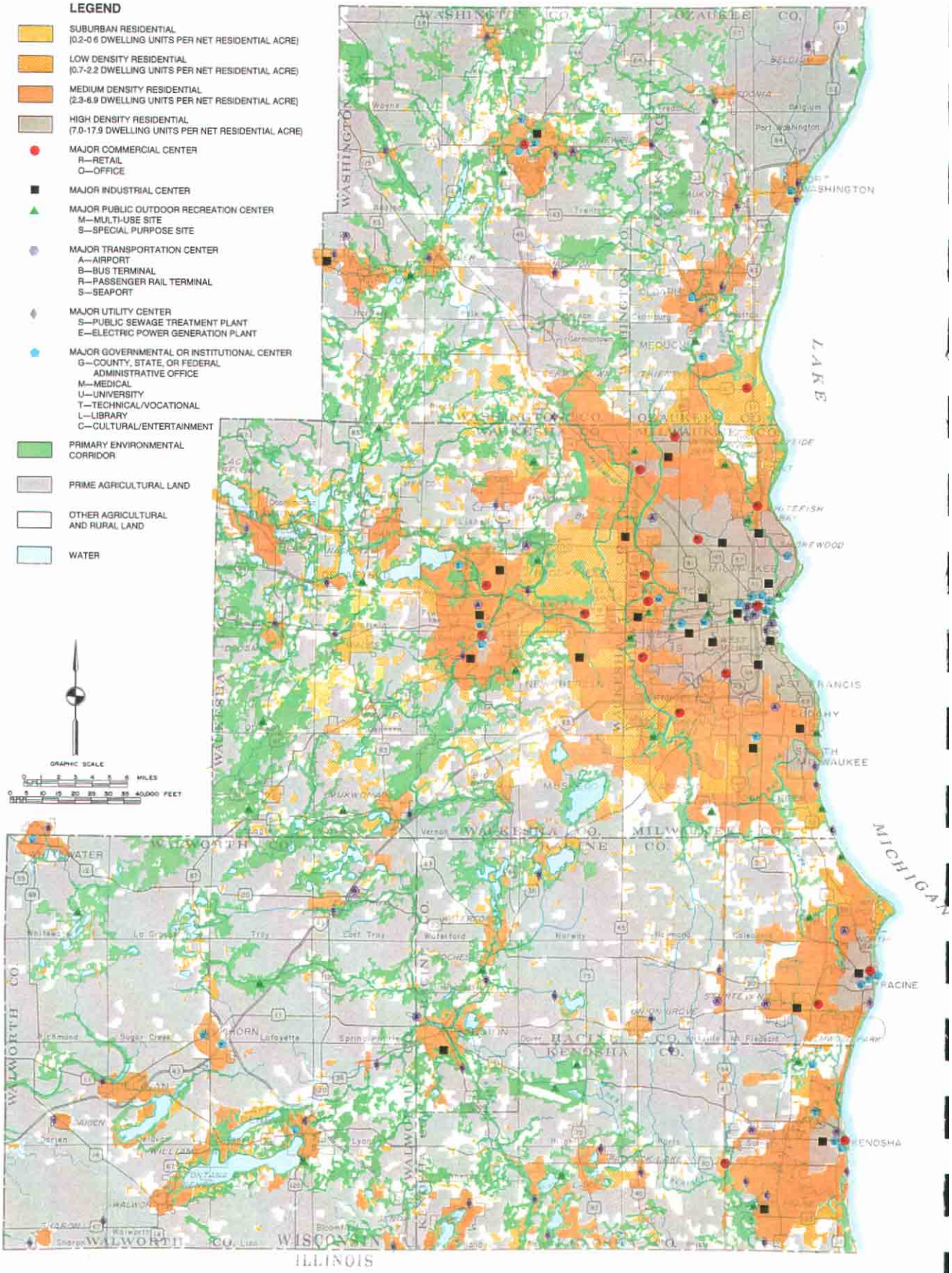
Urban Development and Density

In order to accommodate the anticipated increases in population, household and employment levels, the land use plan element envisions converting about 69 square miles of land from rural to urban use over the period 1990 through 2010, increasing the total stock of urban land to 691 square miles, or to about 26 percent of the total area of the Region.

The land use plan envisions that most new urban development would occur in planned neighborhood development units at medium density, with a typical single-family lot size of one-quarter acre and a typical multi-family development averaging about 10 dwelling units per net acre. Urban development would be provided with basic urban services and facilities, including, importantly, public sanitary sewer and water supply services. The plan envisions that by the year 2010 about 85 percent of all urban land and about 91 percent of the total

Map XVIII-6

RECOMMENDED LAND USE PLAN FOR THE SOUTHEASTERN WISCONSIN REGION: 2010



Source: SEWRPC.

population of the Region would be served with public sanitary sewer and water supply services.

The year 2010 land use plan seeks to discourage scattered, "leap frog" urban development--urban sprawl--in outlying areas of the Region, both through encouragement of higher density development in those areas of the Region that can be most readily served by essential urban services, and through the maintenance of rural development densities in the rural, outlying areas, that is, average lot sizes of at least five acres per dwelling unit.

Under the recommended plan, the population density within the developed area of the Region would decline from a 1985 level of about 3,600 persons per square mile to a year 2010 level of about 2,800 persons per square mile, continuing the trend toward declining densities evident in the Region since 1920. The rate of decline would be significantly reduced, however, by implementation of plan proposals to develop the majority of new urban land within the Region at medium, rather than low, densities and to provide such development with public sanitary sewer and water supply services.

Major Regional Commercial and Industrial Centers

As described in Chapter III, the recommended land use plan proposes retaining all 14 existing major commercial centers through the year 2010 and also proposes the expansion of certain of these centers. In addition to the proposed expansion of the centers, the plan recommends the development of five new major commercial centers in the Region.

The recommended regional land use plan proposes to retain all 22 of the existing major industrial centers and further proposes to add three new major industrial centers by the year 2010.

Park and Outdoor Recreation Areas

Under the recommended year 2010 land use plan, about 4,100 acres of land for intensive, public recreational land use would be added to the existing 26,000 acres currently designated as recreational lands. The additional recreational areas called for under the plan are based in part on neighborhood development standards, which seek to provide adequate neighborhood park land in developing areas. The year 2010 regional land use plan proposes a system of 31 major parks of regional size and significance to serve the needs of the Region through the year 2010. Such parks have an area of at least 250 acres and provide opportunities for a variety of resource-oriented outdoor recreational activities.

Environmentally Sensitive Lands

Environmental corridors are defined as linear areas in the landscape containing concentrations of natural resource and natural resource-related amenities. These corridors generally lie along the major stream valleys, around major lakes, and in the Kettle Moraine area of southeastern Wisconsin. Almost all of the remaining high-value wetlands, woodlands, wildlife habitat areas, major bodies of surface water, and delineated floodlands and shorelands are contained within these corridors. In addition, significant groundwater recharge and discharge areas, many of the most important recreational and scenic areas, and the best remaining potential park sites are located within the environmental corridors. Such environmental corridors are, in effect, a composite of the most important

individual elements of the natural resource base in Southeastern Wisconsin and have immeasurable environmental, ecological, and recreational value.

As described in Chapter III, the environmentally sensitive areas in Southeastern Wisconsin have been categorized into primary environmental corridors, secondary environmental corridors, and isolated natural areas. The primary environmental corridors encompass about 467 square miles, or about 17 percent of the Region. It is recommended that lands identified as primary environmental corridors not be developed for intensive urban use. Accordingly, the plan further recommends that sanitary sewers not be extended into such corridors for the purpose of accommodating urban development in the corridors. It was, however, recognized in the plan that it would be necessary in some cases to construct sanitary sewers across and through primary environmental corridors, and that certain land uses requiring sanitary sewer service could be properly located in the corridors, including park and outdoor recreation facilities and certain institutional uses. In some cases very low density single-family residential development on five-acre lots, compatible with the preservation of the corridors in essentially natural open uses, may also be permitted to occupy corridor lands and it may be desirable to extend sewers into the corridors to serve such uses. Basically, however, the plan element seeks to ensure that the primary environmental corridor lands are not destroyed through conversion to intensive urban uses.

Secondary environmental corridors are also identified in the year 2010 regional land use plan. The secondary environmental corridors, while not as significant as the primary environmental corridors in terms of the overall resource values, should be considered for preservation as the process of urban development proceeds because such corridors often provide economical drainageways, as well as needed "green space," through developing residential neighborhoods. Isolated natural areas are also identified in the year 2010 regional land use plan. Isolated natural areas generally consist of those natural resource base elements that have "inherent natural" value such as wetlands, woodlands, wildlife habitat areas, and surface water areas, but that are separated physically from the primary and secondary environmental corridors by intensive urban and agricultural land uses.

The updated regional water quality management plan recommends that county and local governments take appropriate actions to preserve and protect the resources found in secondary environmental corridors and isolated natural resource areas, as well as in the primary environmental corridors. In so doing, the resources concerned may be incorporated into drainageways, parks and parkways, and commonly held open space areas, depending upon the exercise of local planning judgements as local plans are prepared and development projects reviewed.

The regional plan recognizes, however, that the potential exists for at least some portions of the secondary environmental corridors and isolated natural resource areas to be converted to urban land uses and provided with sanitary sewer service. As the county and local governments concerned appropriately exercise their local planning authority attendant to secondary environmental corridors and isolated natural resource areas, it will be important to recognize that Federal, State, and even local regulations--and particularly State regulations set forth in Chapter NR 103 of the Wisconsin Administrative Code--may effectively preclude development of such areas with or without public sanitary sewer service. Of particular significance in this respect are those Federal and

State natural resource protection regulations dealing with wetlands, floodlands, shorelands, stormwater management, and erosion control. All or portions of secondary environmental corridors and isolated natural resource areas may also be found unsuitable for development to be served by sanitary sewer extensions because of physical or environmental constraints within the meaning of Section NR 121.05(1)(g)2c of the Wisconsin Administrative Code. Accordingly, it is important that the local units of government concerned, and landowners and developers determine the need for Federal, State, and local permits prior to undertaking any disturbances of lands classified as secondary environmental corridors and isolated natural resource areas.

As sanitary sewer service area plans are developed for the individual sewer service areas in the Region, as recommended in the updated plan, the primary environmental corridors, secondary environmental corridors, and isolated natural areas must be further delineated, quantified, and mapped in order to assist the designated management agencies in the protection of the primary environmental corridors and in considering protection of the secondary corridors and other environmentally sensitive lands.

Prime Agricultural Lands

The recommended land use plan recognizes that general agricultural lands are subject to conversion to urban lands. However, the plan seeks to minimize the development of new urban uses on lands which have been designated as prime agricultural lands. Those areas totaled just over 1,047 square miles, or 39 percent of the Region. The recommended year 2010 land use plan proposes to convert to urban use only those prime agricultural lands which were already committed to urban development due to proximity to existing and expanding concentrations of urban uses and the prior commitment of heavy capital investment in utility extensions.

The preservation of prime agricultural lands has important implications for water quality management planning. Prime agricultural land preservation will assist in the implementation of sound soil and water conservation practices and nonpoint source water pollution abatement measures.

POINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT

Point sources of water pollution include sewage treatment plant outfalls, industrial wastewater outfalls, and combined sanitary and stormwater drainage and separate sanitary sewerage system flow relief devices. Because pollutants associated with urban stormwater runoff have discharge characteristics related to the tributary land uses and associated land management practices, urban storm sewer system discharges were considered nonpoint, or diffuse, sources of water pollution and are addressed under the plan element relating to the abatement of pollution from such sources.

This section describes the recommended point source pollution abatement plan element. This element includes recommendations concerning the location and extent of sanitary sewer service areas; the location and capacity of sewage treatment facilities; the location, configuration, and size of trunk sewers; the abatement of pollution from separate and combined sewer overflows; the abatement of pollution from miscellaneous point source discharges; and the management of

sewage treatment plant solids. The point source plan element represents an update and refinement of the point source pollution abatement recommendations set forth in the initial plan, as modified by completed implementation actions, and all of the amendments made to the original plan. These amendments are based upon the findings of local and subregional facilities planning studies; changes in future resident population and employment levels; and attendant land use development patterns set forth in the new design year 2010 regional land use plan upon which the regional water quality management plan is based.

It should be noted that, during 1995, the Milwaukee Metropolitan Sewerage District initiated work on the preparation of a new sewerage facility plan[9] for the entire Milwaukee metropolitan service area. The new plan will have a design year 2010, updating the current facility plan. The resultant sewerage facilities plan is intended, upon its adoption by all of the agencies concerned, to constitute an amendment to the regional water quality management plan as herein presented.

Sewer Service Areas

The initial regional water quality management plan adopted in 1979 originally identified 85 sanitary sewer service areas. The initial regional water quality management plan recommended the refinement of the 85 sewer service areas identified in that plan within the Region. Subsequent to adoption of the original plan, the Commission has conducted a continuing effort to refine and detail the planned sewer service areas of the Region through local-level planning efforts resulting in amendments to the regional water quality management plan. As a result of this ongoing refinement and detailing process, by 1994, a total of 70 of the 85 initially identified sanitary sewer service areas had been refined and detailed. Because the refinement and detailing process sometimes involves the redefinition and combination of previously defined areas, these 70 originally defined areas have been combined into a total of 57 currently defined areas. In addition, the refinement and detailing process has resulted in the creation of new sanitary sewer service areas which were not envisioned in the initial plan. As of 1994, 13 such areas have been delineated by amendments to the regional water quality management plan. These 13 new areas are: the City of Franklin and City of Oak Creek portions of the Milwaukee Metropolitan Sewerage District in Milwaukee County; Powers Lake in Kenosha County; Bohner Lake in Racine County; Alpine Valley, Army Lake, the Country Estates Sanitary District, Griedanus Landfill and Pell Lake, all located in Walworth County; the Eagle Spring Lake Sanitary District, the Village of Lannon portion of the Lannon-Menomonee Falls areas, and the Mukwonago County Park area in Waukesha County; and Rainbow Springs, lying in both Waukesha and Walworth Counties. The current planned sanitary sewer service areas are shown on Map XVIII-7 and listed in Table XVIII-3.

As of 1994, refinements to the planned sewer service areas had been prepared cooperatively by the Commission and the local units of government involved for 70 of the current 85 sewer service areas. The 85 service areas include the 57 redefined areas, the 15 original areas which are unrefined, and the 13 newly identified areas.

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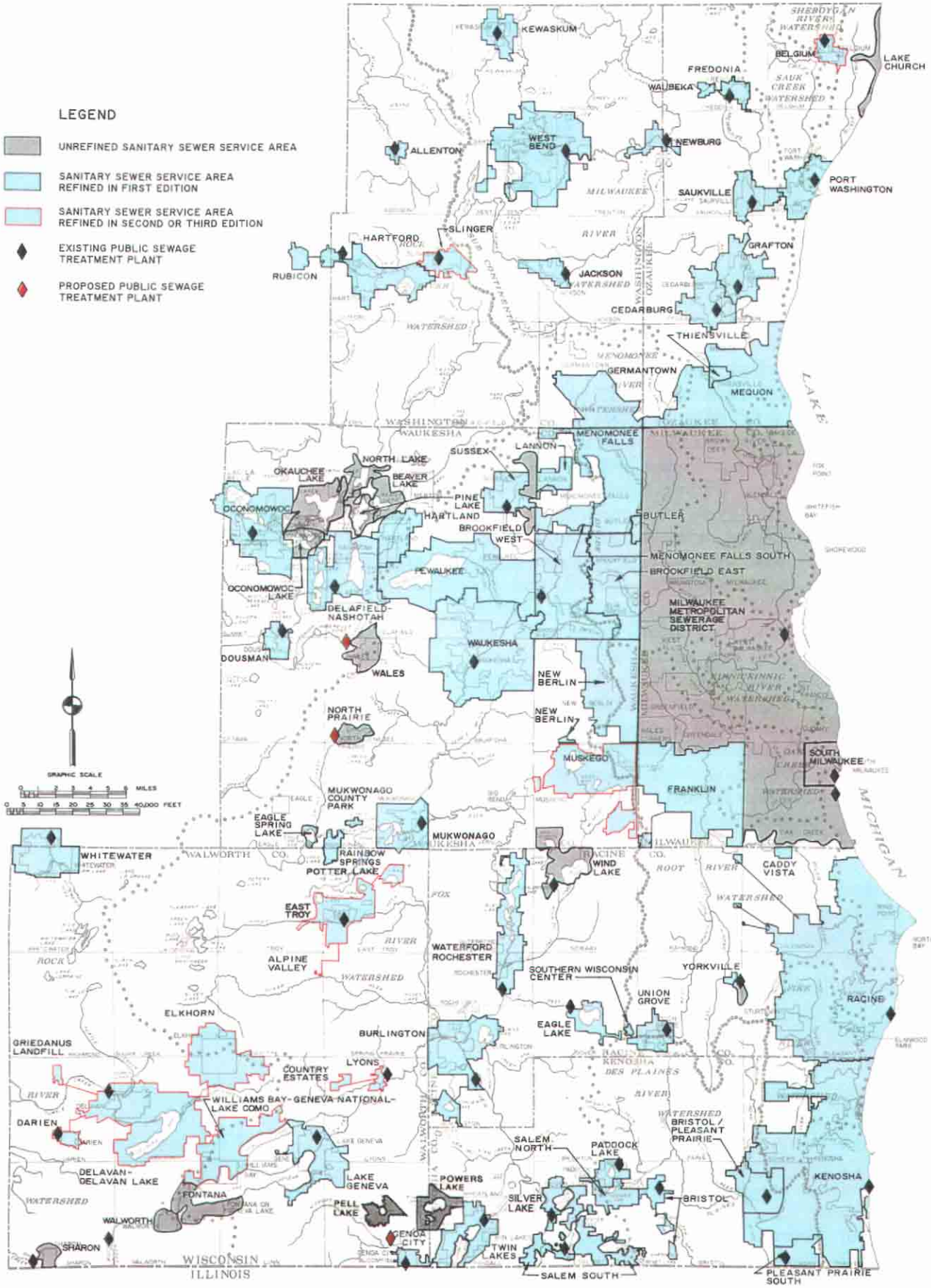
[9]Milwaukee Metropolitan Sewerage District, MMSD Wastewater System Plan, June 1980.

Map XVIII-7

RECOMMENDED SANITARY SEWER SERVICE AREAS IN THE REGION: 2010



Source: SEWRPC.

Table XVIII-3

PLANNED SANITARY SEWER SERVICE AREAS IN THE REGION

County	Name of Sanitary Sewer Service Area(s)	Area of Planned Sewer Service Area (square miles)	Sewer Service Area Population[a]		
				Planned Year 2010	
			Existing[b]	Intermediate Growth Centralized Plan	High Growth Decentralized Plan
Kenosha	Bristol[c]	2.3	1,200	2,500	2,700
	Bristol/Pleasant Prairie	6.7	1,600	5,500	6,500
	Salem South[d] Salem North[e]	10.7	4,700	9,300	10,200
	Kenosha	53.2	85,800	100,900	118,400
	Paddock Lake	2.1	2,250	4,000	4,300
	Pleasant Prairie South	3.4	300	2,200	3,100
	Powers Lake	2.7	1,430	--[f]	1,750
	Silver Lake	1.9	1,600	2,900	3,200
	Twin Lakes	7.8	4,000	7,000	7,400
Milwaukee	Franklin	26.7	17,600	27,900	32,100
	Oak Creek	28.4	19,400	33,700	51,800
	Milwaukee Metropolitan Sewerage District	174.6	897,000	851,000	844,000
	South Milwaukee	4.8	20,500	19,840	20,280
Ozaukee	Belgium	2.1	950	1,000	2,700
	Lake Church	1.1	--[g]	500	1,200
	Cedarburg	7.4	9,600	12,400	27,800
	Grafton	6.9	9,400	11,500	24,100
	Fredonia	1.6	1,600	1,800	4,900
	Waubeka	0.7	300	500	1,600
	Mequon Thiensville	28.2	16,600	24,500	50,500
	Port Washington	5.7	8,900	9,900	19,000
	Saukville	4.3	3,500	4,300	8,600
Racine	Bohner Lake	1.5	--[g]	--[f]	1,700
	Burlington[h]	10.3	10,550	13,500	17,100
	Eagle Lake	2.2	1,100	1,200	1,800
	Racine	60.4	122,100	133,400	167,800
	Caddy Vista	0.8	900	900	1,000
	Union Grove Southern Wisconsin Center	3.9	3,800	5,900	8,100
	Waterford/Rochester[i]	9.3	3,400	8,700	10,600
	Wind Lake	5.3	3,200	4,800	5,300
	Yorkville	1.1	100	100	200
Walworth	Alpine Valley	0.1	--	--	--
	Darien	1.2	1,100	1,500	2,500

Table XVIII-3 (continued)

County	Name of Sanitary Sewer Service Area(s)	Area of Planned Sewer Service Area (square miles)	Sewer Service Area Population[a]		
				Planned Year 2010	
			Existing[b]	Intermediate Growth Centralized Plan	High Growth Decentralized Plan
Walworth (continued)	Delavan-Delavan Lake Elkhorn Williams Bay-Geneva National-Lake Como	42.6	8,500 5,200 1,800[j]	11,800 7,600 3,300	21,900 14,400 7,600
	East Troy Potter Lake Army Lake	8.1	3,700	5,500	9,200
	Fontana	4.5	1,700	2,300	3,600
	Genoa City	1.6	1,200	1,800	3,000
	Lake Geneva	8.3	5,600	9,200	16,800
	Lyons Country Estates Sanitary District	1.5	600	1,500	2,400
	Pell Lake	2.2	2,000	--[f]	2,800
	Sharon	1.2	1,300	1,800	2,900
	Walworth	1.8	1,700	2,300	3,800
	Whitewater	8.3	11,500	10,600	19,200
Washington	Allenton	0.8	900	1,200	2,400
	Germantown	8.0	7,480	18,270	35,280
	Hartford[k]	10.5	7,700	12,400	24,000
	Jackson	2.7	1,800	3,500	7,800
	Kewaskum	3.8	2,400	2,900	7,100
	Newburg	2.2	900	1,100	2,000
	Slinger	3.6	1,600	2,700	4,400
	West Bend[l]	21.2	22,900	32,500	53,800
Waukesha	Beaver Lake	2.5	--[g]	--[f]	2,100
	Brookfield East	15.4	16,100	16,600	19,400
	Brookfield West	20.6	18,800	27,400	33,500
	Butler	0.8	2,000	1,900	2,000
	Delafield-Nashotah[m]	13.8	3,700	8,000	14,400
	Denoon Lake	1.4	800	1,100	1,500
	Dousman	2.4	1,800	3,100	5,600
	Eagle Spring Lake	0.9	--[g]	--[f]	1,200
	Hartland	5.3	6,500	10,200	14,100
	Menomonee Falls Lannon	24.7	29,100	35,800	51,600
	Mukwonago	7.8	4,300	7,500	18,000
	Mukwonago County Park	0.3	--	--	--
	Muskego	15.7	12,800	17,400	26,900
	New Berlin	19.2	23,400	36,500	59,100
	North Lake	1.2	--[g]	700	1,400
	North Prairie	1.9	1,100	--[f]	3,640
	Oconomowoc[n]	16.7	10,600	17,300	28,300

Table XVIII-3 (continued)

County	Name of Sanitary Sewer Service Area(s)	Area of Planned Sewer Service Area (square miles)	Sewer Service Area Population[a]		
				Planned Year 2010	
			Existing[b]	Intermediate Growth Centralized Plan	High Growth Decentralized Plan
Waukesha (continued)	Oconomowoc Lake	1.5	--[g]	500	900
	Okauchee Lake	4.8	--	5,100	8,700
	Pewaukee[o]	26.5	10,300	23,300	41,100
	Pine Lake	1.2	--[g]	--[f]	600
	Rainbow Springs	1.4	--	--	--
	Sussex	7.4	4,000	16,800	29,500
	Wales	2.8	2,200	3,600	7,900
	Waukesha	30.6	53,500	74,300	105,900
	Total	840.6	1,545,960	1,742,510	2,183,950

[a] The population levels for each sewer service area under the planned year 2010 growth scenarios include sewered population within the sewer service area in 1985, unsewered population within the sewer service area in 1985 which is envisioned to be provided with public sanitary sewer service by the year 2010, and incremental new population which is envisioned to occur wiathin the sewer service area between 1985 and 2010. Sewer service area populations indicate yuear-round, residential population. It should be noted that seasonal population may contribute to larger overall populations for some of the sewer service areas associated with the lake-oriented communities in the Region.

[b] 1985 population.

[c] Includes George Lake.

[d] Includes Camp Lake, Center Lake, Cross Lake, Rock Lake, and Wilmot.

[e] Includes Hooker Lake and Montgomery Lake.

[f] Planned year 2010 population levels assuming the provision of public sanitary sewer service were only developed under the high growth plan.

[g] Area currently not served by public sewer and having a significant seasonal population to be considered in addition to its resident population.

[h] Includes Browns Lake.

[i] Includes Tichigan Lake.

[j] Includes only Williams Bay.

[k] Includes Pike Lake.

[l] Includes Silver Lake.

[m] Includes Nashotah and Nemahbin Lakes.

[n] Includes Village of Lac La Belle and Silver Lake.

[o] Includes Pewaukee Lake, Town of Pewaukee, and Village of Pewaukee.

Source: SEWRPC.

In 1990, centralized sanitary sewer service in the Region was provided to a combined area of about 414 square miles, or 15 percent of the total area of the Region, and within this combined service area to approximately 1,560,000 persons, or about 86 percent of the total resident population of the Region. The planned year 2010 sewer service areas have a combined area of about 841 square miles, or about 31 percent of the total area of the Region. The designated sewer service areas represent general delineations designed to accommodate urban growth within the Region until the year 2010. The precise placement of future urban development in both time and space within the framework provided by sewer service areas delineated in the water quality management plan is properly the responsibility of local public officials. Accordingly, a certain amount of flexibility is intentionally provided within the boundaries of the designated sewer service areas to facilitate local planning and plan implementation. This flexibility derives from the need to provide for local preferences concerning such matters as population density, as well as to permit latitude in the placement within both time and space of envisioned urban development and redevelopment. Thus, the designated service areas are intended to accommodate, through local refinement, a broad range of housing types and styles, population densities, and commercial and industrial land use intensities, as well as, to the extent possible, the dictates of the urban land market, while meeting the agreed-upon areawide land use development and water quality management objectives.

The preparation of local sanitary sewer service area plans and sewerage facilities plans is intended to provide the means to adjust the recommended sewer service areas to meet local needs and objectives within the framework of the regional plans. It is recommended that the sewer service areas designated herein be utilized, along with subsequent additional duly prepared and adopted local refinements thereof, as the basis for the extension of public sanitary sewer service within the Region. Changes in those boundaries and the creation of new sewer service areas should be accommodated in the continuing planning process as it involves areawide systems planning and local facilities planning.

While the regional water quality management plan recommends the provision of centralized sanitary sewer service to much of the urban land use pattern identified in the newly adopted regional land use plan, some urban areas identified on that plan are not included within the recommended year 2010 sewer service areas. In most cases, these areas are relatively small, consisting of isolated enclaves of residential and commercial land uses located either along the shorelines of inland lakes or at rural highway intersections. Such areas were not included in a recommended sewer service area for a number of reasons, including the small size and isolated nature of some of this development; the presence of a significant number of seasonal homes; location in or adjacent to the Kettle Moraine State Forest and other environmentally sensitive areas where additional urban development should not be encouraged; or location on soils generally suited for the use of onsite soil absorption sewage disposal systems. It is recommended that detailed local studies be conducted of all such isolated enclaves of urban development as a step toward improved management of onsite sewage disposal facilities. Such detailed local studies may uncover serious existing or potential public health hazards, or ground and surface water pollution problems, and could result in recommendations for the provision of additional public centralized sanitary sewer service within the Region.

Public Sewage Treatment Facilities

The regional water quality management plan, as amended, envisions the maintenance and improvement of 48 existing public sewage treatment plants; the abandonment of 21 public sewage treatment facilities; and the construction of nine new public sewage treatment facilities within the Region. As of 1993, nine of the 21 public sewage treatment plants recommended for abandonment had been abandoned and their service areas connected to other sewerage systems for treatment purposes. In addition, facility planning for the abandonment of the Village of Darien sewage treatment plant was completed in 1994. Of the nine new public sewage treatment plants recommended, six had been constructed by 1993. The three plants proposed to serve the Village of North Prairie, the Village of Wales, and the Pell Lake and Powers-Benedict-Tombeau Lakes area had not yet been constructed.

Under the updated plan, sewage treatment would be provided at the 49 public facilities listed in Table XVIII-4 and shown on Map XVIII-8. These 49 plants include a new sewage treatment plant to be constructed in Walworth County to serve the Pell Lake sewer service area and the Powers-Benedict-Tombeau Lakes sewer service area. Two additional plants to serve the Villages of Wales and North Prairie are recommended to be constructed. However, the recommendations concerning these two plants may be affected by a comprehensive study of the best means for providing sewer service in Northwestern Waukesha County initiated by the Commission in cooperation with the County and local units of government concerned in 1995. Alternatives to be considered in that study include the connection of the Wales and North Prairie areas to an existing public sewerage system for treatment purposes, and continued reliance on onsite sewage disposal systems, as well as the construction of new sewage treatment facilities.

For each of the treatment plants recommended in the areawide water quality management plan, it is recommended that the levels of treatment set forth in the initial plan continue to be used, with final limits to be determined by site specific analyses and studies to be conducted during detailed sewerage system facility planning and as the issuance of new permits for the plants are considered under the Wisconsin Pollutant Discharge Elimination System. The findings of such studies would properly serve to refine the regional water quality management plan. Such studies should consider the water use objectives for the recovery stream; the existing water quality condition of the receiving stream; the potential water quality improvement associated with abatement of nonpoint source pollution; the presence of in-place pollutants; the slope, configuration, and biological characteristics of the receiving stream channel; the specific chemical composition of the wastewaters and receiving waters; and other localized factors which are typically beyond the scope of systems level planning.

Three plants--the Village of Pleasant Prairie Sanitary District No. 73-1, the Village of Pleasant Prairie Sewer Utility District "D", and the Town of Yorkville Sewer Utility District No. 1 treatment plants--have been proposed for abandonment in subregional system plans which have been prepared by the Commission in cooperation with the County and local units of government concerned for the

Table XVIII-4

RECOMMENDED PUBLIC SEWAGE TREATMENT PLANTS--REGIONAL WATER QUALITY MANAGEMENT PLAN: 2010

Sewage Treatment Plant (by watershed)	Sewer Service Areas	Planned Sewer Service Area (square miles)	Existing 1990			Planned Year 2010				Receiving Water to Which Effluent is Disposed
						Intermediate Growth		High Growth		
			Existing Design Capacity-Average Annual Hydraulic (mgd)	Population Served	Average Annual Hydraulic Loading (mgd)	Centralized Land Use Plan	Average Annual Hydraulic Loading (mgd)	Decentalized Land Use Plan	Average Annual Hydraulic Loading (mgd)	
Des Plaines River watershed										
Town of Bristol Utility District No. 1	Bristol	2.3	0.48	1,200	0.34	2,500	0.49	2,700	0.52	Bristol Creek tributary of Des Plaines River
Village of Paddock Lake	Paddock Lake	2.1	0.49	2,300	0.47	4,000	0.63	4,300	0.67	Brighton Creek
Village of Pleasant Prairie Sanitary District No. 73-1[a]	Pleasant Prairie South	3.4	0.40	600	0.21	2,200	0.41	3,100	0.52	Tributary of Des Plaines River
Village of Pleasant Prairie Sewer Utility District "D"[a]	Bristol/Pleasant Prairie	6.7	0.50	1,700	0.50	5,500	0.98	6,500	1.10	Tributary of Des Plaines River
Fox River Watershed										
City of Brookfield	Brookfield West, Pewaukee, Menomonee Falls	47.7	10.0	33,800	6.74	52,100	12.50[b]	78,000	15.50	Fox River
City of Burlington	Burlington, Bohner Lake	11.8	3.5[c]	10,400	2.15	13,500	2.54	18,800	3.20	Fox River
Eagle Lake Sewer Utility District	Eagle Lake	2.2	0.4	1,200	0.19	1,200	0.19	1,800	0.27	Eagle Creek
Village of East Troy	East Troy, Potter Lake, Army Lake, Alpine Valley	8.2	0.7	3,600	0.27	5,500	0.51	9,200	0.97	Honey Creek
City of Lake Geneva	Lake Geneva	8.3	1.74	6,400	1.24	9,200	1.59	16,800	2.54	White River
Village of Genoa City	Genoa City	1.6	0.22	1,200	0.10	1,800	0.18	3,000	3.2	Nippersink Creek
Town of Lyons Sanitary District No. 2	Lyons, Country Estates	1.5	0.1	1,000	0.08	1,500	0.14	2,400	0.26	White River
Village of Mukwonago	Mukwonago, Eagle Spring Lake, Mukwonago County Park, Rainbow Springs	10.4	1.5	4,400	0.51	7,500	1.0	19,200	2.46	Fox River
Town of Norway Sanitary District No. 1	Wind Lake, Denoon Lake	6.7	0.75	4,900	0.67	5,900	0.80	6,800	0.91	Wind Lake Drainage Canal
Town of Salem Sewer Utility District No. 2	Salem South, Salem North	10.7	1.57	4,900	0.78	9,300	1.33	10,200	1.44	Fox River

Table XVIII-4 (cont'd)

Sewage Treatment Plant (by watershed)	Sewer Service Areas	Planned Sewer Service Area (square miles)	Existing 1990			Planned Year 2010				Receiving Water to Which Effluent is Disposed
						Intermediate Growth		High Growth		
			Existing Design Capacity-Average Annual Hydraulic (mgd)	Population Served	Average Annual Hydraulic Loading (mgd)	Centralized Land Use Plan	Average Annual Hydraulic Loading (mgd)	Decentalized Land Use Plan	Average Annual Hydraulic Loading (mgd)	
Fox River Watershed (continued)										
Village of Silver Lake	Silver Lake	1.9	0.36	1,800	0.22	2,900	0.36	3,200	0.40	Fox River
Village of Sussex	Sussex, Lannon, Menomonee Falls	13.7	3.2[d]	4,400	0.98	19,800	2.91	33,100	4.57	Sussex Creek
Village of Twin Lakes	Twin Lakes	7.8	0.5	4,000	0.37	7,000	0.70	7,400	0.80	Bassett Creek
City of Waukesha	Waukesha	30.6	14.0[e]	57,000	8.74	74,300	14.0	105,900	15.0	Fox River
Western Racine County Sewerage District	Waterford, Rochester	9.3	1.0	6,400	0.71	8,700	1.0	10,600	1.24	Fox River
Proposed plant-Village of North Prairie[f]	North Prairie	1.9	--	--	--	--[g]	--	3,600	0.45	Groundwater system
Proposed plant-Powers Lake	Pell Lake, Powers Lake	4.9	--	--	--	--[g]	--	7,000	0.87	North Branch Nippersink Creek
Milwaukee River watershed										
City of Cedarburg	Cedarburg	7.4	2.75	10,100	1.58	12,400	1.87	27,800	3.80	Cedar Creek
Village of Fredonia	Fredonia, Waubeka	2.3	0.60	1,600	0.18	2,300	0.24	6,500	0.71	Milwaukee River
Village of Grafton	Grafton	6.9	2.2	9,300	1.35	11,500	1.60	24,100	3.16	Milwaukee River
Village of Jackson	Jackson	2.7	0.87	2,500	0.47	3,500	0.59	7,800	1.13	Cedar Creek
Village of Kewaskum	Kewaskum	3.8	0.50	2,500	0.36	2,900	0.42	7,100	0.94	Milwaukee River
Village of Newburg	Newburg	2.2	0.08	1,000	0.07	1,100	0.08	2,000	0.09	Milwaukee River
Village of Saukville	Saukville	4.3	1.0	3,700	0.56	4,300	0.63	8,600	1.17	Milwaukee River
City of West Bend	West Bend	21.2	9.0	23,900	3.45	32,500	4.53	53,800	7.18	Milwaukee River

Table XVIII-4 (cont'd)

Sewage Treatment Plant (by watershed)	Sewer Service Areas	Planned Sewer Service Area (square miles)	Existing 1990			Planned Year 2010				Receiving Water to Which Effluent is Disposed
						Intermediate Growth		High Growth		
			Existing Design Capacity-Average Annual Hydraulic (mgd)	Population Served	Average Annual Hydraulic Loading (mgd)	Centralized Land Use Plan	Average Annual Hydraulic Loading (mgd)	Decentalized Land Use Plan	Average Annual Hydraulic Loading (mgd)	
Watershed of Minor Streams and Direct Drainage Area Tributary to Lake Michigan										
City of Kenosha	Kenosha	53.2	28.6[h]	88,000	23.0	100,900	25.0	118,400	27.3	Lake Michigan
Milwaukee Metropolitan Sewerage District-Jones Island Plant	Milwaukee Metropolitan Sewerage District, Mequon, Thiensville, Germantown, Butler, Brookfield-East, New Berlin, Muskego, Caddy Vista, Franklin, Oak Creek, Menomonee Falls	335.6	200.0	1,036,000	123.2	1,060,000	125.0	1,134,000	128.0	Lake Michigan via Milwaukee Outer Harbor
Milwaukee Metropolitan Sewerage District-South Shore Plant			120.0		100.0		105.0		110.0	Lake Michigan
City of Port Washington	Port Washington	5.7	3.1	9,300	1.4	9,900	1.5	19,000	2.6	Lake Michigan
City of Racine	Racine	60.4	30.0	124,400	28.8	133,400	30.0	167,800	34.2	Lake Michigan
City of South Milwaukee	South Milwaukee	4.8	6.0	21,000	3.5	19,800	3.3	20,300	3.4	Lake Michigan
Rock River watershed										
Allenton Sanitary District No. 1	Allenton	0.8	0.36	800	0.15	1,200	0.20	2,400	0.36	Rock River - East Branch
Delafield-Hartland Water Pollution Control Commission	Delafield, Nashotah, Hartland	19.1	2.20	10,200	1.39	18,200	2.40	28,500	3.70	Bark River
Village of Dousman	Dousman	2.4	0.35	1,300	0.22	3,100	0.44	5,600	0.76	Bark River
Fontana-Walworth Water Pollution Control Commission	Fontana, Walworth	6.3	1.71	3,500	1.02	4,600	1.16	7,400	1.51	Tributary of Piscasaw Creek
City of Hartford	Hartford	10.5	2.0	8,200	1.46	12,400	2.00	24,000	3.44	Rubicon River
City of Oconomowoc	Oconomowoc	27.9[i]	4.0	11,500	2.33	23,600[i]	3.84[i]	42,000[i]	6.14[i]	Oconomowoc River
Village of Sharon	Sharon	1.2	0.26	1,300	0.16	1,800	0.23	2,900	0.37	Little Turtle Creek
Village of Slinger	Slinger	3.6	0.76	2,300	0.33	2,700	0.38	4,400	0.60	Rubicon River
Walworth County Metropolitan Sewerage District	Delavan, Delavan Lake, Elkhorn, Lake Como, Geneva National, Williams Bay, Darien	43.8	5.6[j]	19,100	2.92	24,200	3.53	46,400	6.33	Turtle Creek
City of Whitewater	Whitewater	8.3	3.65	12,600	1.43	13,100	1.50	21,600	2.56	Whitewater Creek
Proposed plant-Village of Wales[f]	Wales	1.5	--	--	--	3,600	0.45	7,900	1.0	Groundwater system[f]

Table XVIII-4 (cont'd)

Sewage Treatment Plant (by watershed)	Sewer Service Areas	Planned Sewer Service Area (square miles)	Existing 1990			Planned Year 2010				Receiving Water to Which Effluent is Disposed
						Intermediate Growth		High Growth		
			Existing Design Capacity-Average Annual Hydraulic (mgd)	Population Served	Average Annual Hydraulic Loading (mgd)	Centralized Land Use Plan	Average Annual Hydraulic Loading (mgd)	Decentalized Land Use Plan	Average Annual Hydraulic Loading (mgd)	
Root River watershed										
Village of Union Grove	Union Grove	3.9	0.88	3,700	0.67	5,900	0.94	8,100	1.22	West Branch of Root River Canal
Town of Yorkville Sewer Utility District No. 1[k]	Yorkville	1.1	0.15	100	0.05	100	0.33	200	0.67	Hoods Creek
Sheboygan River watershed										
Village of Belgium[l]	Belgium	3.2	0.19	900	0.13	1,500[l]	0.21[l]	3,900[l]	0.51[l]	Belgium Creek

[a] Recommendations contained in a subregional system plan documented in the report prepared by Ruekert & Mielke, Inc., entitled A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Kenosha Area, October 1991, provide for the abandonment of these plants. As of January 1995, the findings of this subregional study have not been incorporated into the regional plan by amendment.

[b] Based upon design year 2014 capacity proposed in a May 1993 facility plan.

[c] Based upon new plant which was placed into service in 1992.

[d] Based upon plant expansion ongoing in 1994.

[e] Based upon plant expansion ongoing in 1994. A design flow of 18.5 mgd also developed based upon average wet weather period.

[f] Alternative of constructing a new plant and the alternatives of connection to an existing sewerage system and continued use of onsite sewage disposal systems are recommended to be evaluated in further subregional system planning.

[g] Planned year 2010 population levels assuming the provision of public sanitary sewer service only developed under the high-growth plan.

[h] Based upon a 1994 plant expansion.

[i] Includes Beaver Lake, North Lake, Oconomowoc Lake, Okauchee Lake, and Pine Lake sewer service areas.

[j] Based upon a plant expansion ongoing in 1994.

[k] Recommendations contained in a subregional system plan documented in the report prepared by Alvord, Burdick & Howson and Applied Technologies, Inc., entitled, A Coordinated Sanitary Sewerage and Water Supply System Plan, Greater Racine Area, September 1992, provide for abandonment of this plant. As of January 1995, the findings of this subregional study have not yet been incorporated into the regional plan by amendment.

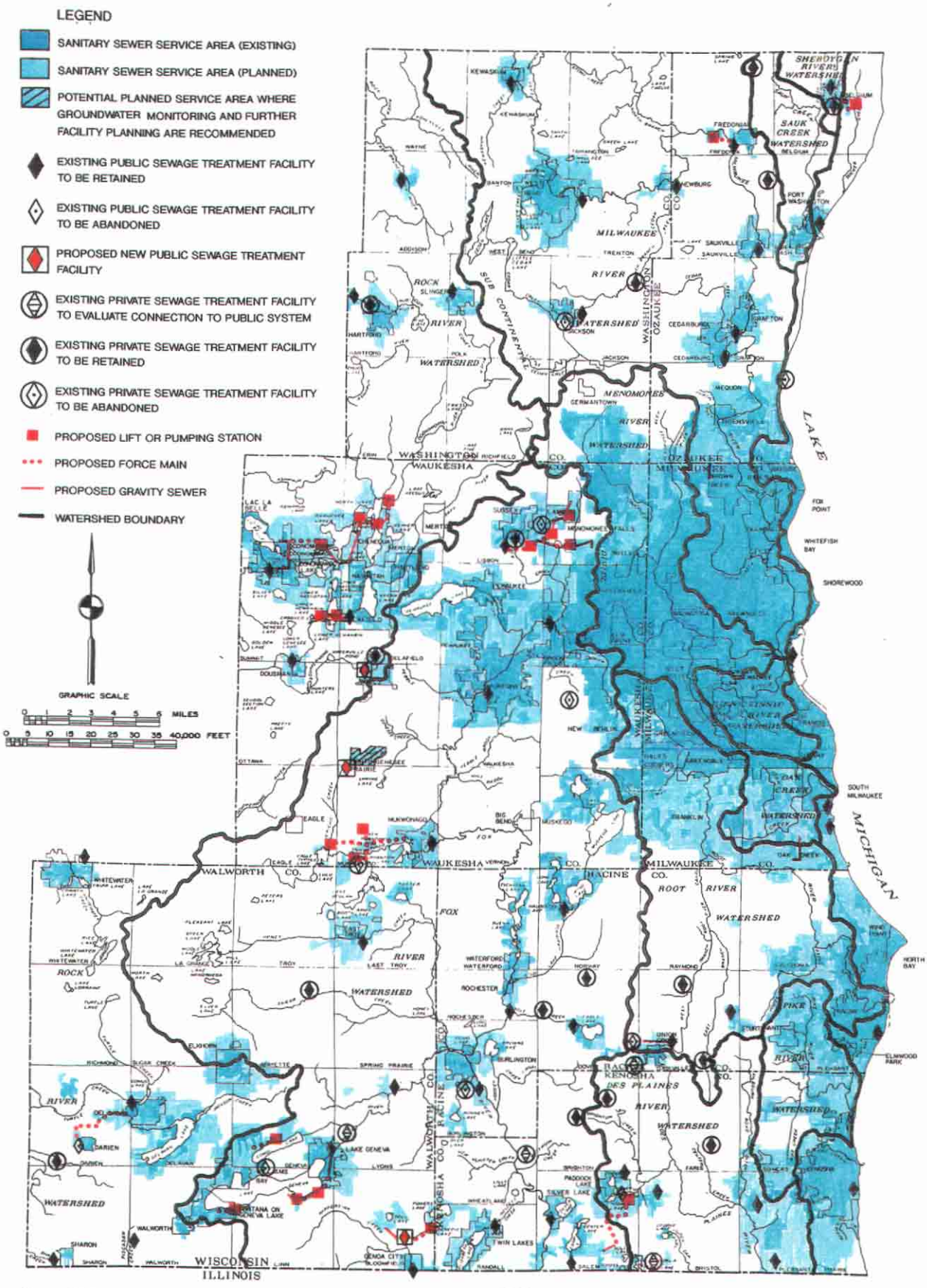
[l] Includes Lake Church sewer service area.

Source: SEWRPC.

Map XVIII-8

UPDATED REGIONAL WATER QUALITY MANAGEMENT

POINT SOURCE PLAN FOR SOUTHEASTERN WISCONSIN: 2010



Source: SEWRPC.

greater Kenosha and greater Racine urban areas.[10] Inclusion of these plan recommendations by amendment to the updated areawide water quality management plan is pending intergovernmental agreement on the recommendations of these subregional system plans.

It is noted that there remains in service one relatively small public sewage treatment plant--the City of South Milwaukee plant--which is located immediately adjacent to and surrounded by the Milwaukee Metropolitan Sewerage District service area. It is recommended that facility planning reexamine the cost effectiveness of retaining this plant, or of abandoning the plant and connecting its tributary source area to the Milwaukee metropolitan system, at such time as upgrading or replacement needs require significant capital investment in the plant. The resultant sewerage facilities plan update would then, upon its adoption by all of the agencies concerned, form the basis of any needed amendment to the regional water quality management plan herein presented.

Private Sewage Treatment Plants

The regional water quality management plan, as amended, recommended the maintenance of 25 existing private sewage treatment plants; the abandonment of 43 private sewage treatment facilities; and the construction of one new private sewage treatment facility. These private sewage treatment plants serve isolated enclaves of urban land uses within the Region, including public and private recreational facilities, institutional facilities, commercial service facilities, isolated residential areas such as mobile home parks, and industries. As of 1993, 35 of the 43 private sewage treatment plants recommended to be abandoned were abandoned and the new facility proposed to serve the Bong Recreation Area facilities had been constructed. In addition, there were seven private sewage treatment plants which were no longer in operation due to industries or institutions ceasing operation, or were reclassified as industrial process treatment facilities. In 1993 there were a total of 27 private sewage treatment facilities within the Region. Under the amended plan, eight of the 27 existing private sewage treatment facilities would be abandoned and the land uses served connected to public sanitary sewerage systems as set forth in Table XVIII-5 and shown on Map XVIII-8.

In addition, there were in 1993 four private sewage treatment plants which generate wastewater with the same characteristics as typically treated by public sewage treatment plants and which were located in relatively close proximity to an established public sanitary sewer service area, or are located within or in close proximity to an area where public sanitary sewer service may be expected to be provided in the future. These plants serve the Fonk Mobile Home Park No. 2 in the Town of Dover, Racine County; the Grand Geneva Resort and Spa in the Town of Lyons, Walworth County; the Rainbow Lake Manor Mobile Home Park in the

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[10] Ruekert & Mielke, Inc., A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Kenosha Area, 1992, recommends abandonment of the two Village of Pleasant Prairie treatment plants, which service areas would subsequently be connected to the Kenosha Water Utility sewerage system for treatment purposes; Alvord, Burdick & Howson, A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Racine Area, 1992, recommends abandonment of the Town of Yorkville treatment plant, which service area would be connected to the Racine Water and Wastewater Utility sewerage system for treatment purposes.

Table XVIII-5

PRIVATE SEWAGE TREATMENT PLANTS RECOMMENDED TO BE ABANDONED UPON FULL IMPLEMENTATION OF THE RECOMMENDED REGIONAL WATER QUALITY MANAGEMENT PLAN: 2010

Private Sewage Treatment Plant to be Abandoned (by watershed)	Type of Wastewater	Civil Division Location	Current Effluent Discharge	Public Sewage Treatment Facility to Provide Service Following Abandonment
Fox River watershed				
Lake Geneva Interlaken Resort Village[a]	Sanitary	Town of Geneva	Soil Absorption	Walworth County Metropolitan Sewerage District
Willow Springs Mobile Home Park	Sanitary	Town of Lisbon	Soil Absorption	City of Brookfield
Rainbow Springs Resort	Sanitary	Town of Mukwonago	Tributary to Mukwonago River	Village of Mukwonago
New Berlin-West High School	Sanitary	City of New Berlin	Tributary to Poplar Creek	City of Brookfield
Packaging Corporation of America	Process and Sanitary	Town of Burlington	Tributary to Fox River	City of Burlington
Milwaukee River watershed				
Seneca Food Company[b]	Process	Town of Jackson	Soil Absorption and Cedar Creek	Village of Jackson
Watershed of Minor Streams and Direct Drainage Area Tributary to Lake Michigan				
Concordia University	Sanitary	City of Mequon	Lake Michigan	Milwaukee Metropolitan Sewerage District
Rock River watershed				
National Farmers Organization-Slinger Transfer Station	Process	Town of Polk	Soil Absorption	Village of Slinger
Root River watershed				
Southern Wisconsin Center for the Developmentally Disabled	Sanitary	Town of Dover	West Branch Root River Canal	Village of Union Grove

[a] The Lake Geneva Interlaken Resort Village sewage treatment plant was abandoned in 1993 with the resort connected to the Walworth County Metropolitan Sewerage District.

[b] Seneca Food Company private plant is currently used as a supplementary facility to the Village of Jackson sewage treatment plant.

Source: SEWRPC.

Town of Bristol, and the Wheatland Mobile Home Park in the Town of Wheatland, both in Kenosha County. It is recommended that detailed facility planning be undertaken for these four plants at such time as upgrading or replacement needs require significant capital investment to determine the most cost-effective means of providing sewage treatment. Such facility planning would consider alternatives to maintaining the existing private plant, as well as abandonment with connection to a public sanitary sewerage system. These four plants and the 15 private sewage treatment facilities proposed to be retained under the updated areawide water quality management plan are listed in Table XVIII-6.

It is further recommended that the need for upgrading and the level of treatment required for the private treatment plants that are to remain in service be formulated on a case-by-case basis during plan implementation as part of the Wisconsin Pollutant Discharge Elimination System (WPDES) permitting process.

It is important to recognize that additional private sewage treatment facilities may be needed during the plan implementation period to serve new enclaves of isolated land use development. Generally such new facilities may be expected to lie beyond the planned year 2010 sewer service areas set forth on Map XVIII-8. Each proposal for a new private sewage treatment facility must accordingly be individually evaluated in light of the current areawide plan and the objectives which that plan is intended to achieve.

It must also be recognized in this respect, that certain types of urban land uses are properly and logically located in the more rural reaches of the Region and at times may require the provision of a sewage treatment facility, as opposed to septic tank systems. The types of urban land uses that must of necessity often be located in rural areas, where public centralized sanitary sewer service is not available, include highway-oriented commercial service facilities, such as motels, restaurants, and certain types of truck service stations and terminals; certain transportation facilities, such as airports; park and outdoor recreational facilities, both public and private; certain institutional facilities; and industrial facilities directly related to the agricultural land use base. It is not possible within the context of an areawide system planning effort to identify the need for, or to locate all such potential land uses in the rural areas. Accordingly, each proposal for such land uses must be evaluated as it arises. Those additional private sewage treatment facilities found to be essential to accommodate such isolated urban enclaves must provide a type and level of treatment that will achieve the recommended water use objectives. Such facilities should not, however, be used to accommodate new urban residential development or new urban commercial or industrial development that can more rationally and efficiently be accommodated within the recommended year 2010 sanitary sewer service areas--areas where substantial public capital investment has in many cases already been made to accommodate future development.

Sewage Treatment Plant Sludge Management

Specific sludge management measures are set forth in the detailed plans for each individual sewage treatment facility required to be prepared pursuant to the Wisconsin Pollutant Discharge Elimination System (WPDES) permitting process. The permitting process requires designated management agencies to develop and submit to the Wisconsin Department of Natural Resources a sludge management plan, which, upon approval by the Department, requires the designated management agency to maintain records of sludge application sites and quantities and to monitor such

Table XVIII-6

PRIVATE SEWAGE TREATMENT PLANTS RECOMMENDED TO BE RETAINED OR REQUIRING FURTHER EVALUATION UPON FULL IMPLEMENTATION OF THE RECOMMENDED REGIONAL WATER QUALITY MANAGEMENT PLAN: 2010

Private Sewage Treatment Plant to be Retained (by watershed)	Type of Wastewater	Civil Division Location	Current Effluent Discharge
Des Plaines River watershed			
Brightondale County Park	Sanitary	Town of Brighton	Soil Absorption
Fonk's Mobile Home Park No. 2[a]	Sanitary	Town of Dover	Tributary to the Des Plaines River
Kenosha Beef International Company	Cooling, Process, and Sanitary	Town of Paris	Soil Absorption
Rainbow Lake Manor Mobile Home Park[a]	Sanitary	Town of Bristol	Soil Absorption
Fox River watershed			
Bong Recreational Area	Sanitary	Town of Brighton	Peterson Creek
Grand Geneva Resort and Spa[a]	Sanitary	Town of Lyons	White River
Downy Duck Company	Process	Town of Dover	Soil Absorption
East Troy Rest Area (IH 43)	Sanitary	Town of LaFayette	Tributary to Sugar Creek
Midwest Neurological Rehabilitation Center	Sanitary	Town of Dover	Tributary to Wind Lake Canal
Friday Canning Corporation-Mammoth Springs Division	Process	Town of Lisbon	Soil Absorption
Wheatland Estates Mobile Home Park[b]	Sanitary	Town of Wheatland	Minor Tributary to the Fox River
Milwaukee River watershed			
Level Valley Dairy	Process and Cooling	Town of Jackson	Cedar Creek
S&R Cheese Corporation	Process	Town of Saukville	Soil Absorption
Rock River watershed			
Ethan Allen School	Sanitary	Town of Delafield	Soil Absorption
Libby, McNeill, & Libby, Inc. (Walworth County)	Process	Town of Darien	Soil Absorption
Root River watershed			
C&D Foods Inc.	Process	Town of Yorkville	West Branch Root River Canal
Fonk's Mobile Home Park No. 1	Sanitary	Town of Yorkville	East Branch Root River Canal
Sauk Creek watershed			
Cedar Valley Cheese Factory	Process and Cooling	Town of Fredonia	Soil Absorption
Sheboygan River watershed			
Lakeside Packing Co.	Process	Town of Belgium	Soil Absorption and East Branch Belgium Creek

[a] Private sewage treatment plant to carry out facility planning to consider connection to a public sanitary sewer service area at such time as a major plant upgrading or modification is required.

[b] Private sewage treatment plant to be evaluated in the context of further subregional facility planning considering the best means of providing sanitary sewer service to the Town of Wheatland area.

Source: SEWRPC.

sites for adverse environmental, health, or social effects. At present, such reports have been prepared and submitted to the Department, or are under preparation, for all of the public and private sewage treatment plants currently within the Region. It is recommended that this plant-specific permitting process be maintained and that the sewage treatment plant sludge management facilities for the facilities noted in Tables XVIII-4 and XVIII-6 be expanded and upgraded as needed under the established permitting process.

Abatement of Pollution from Sewer System Flow Relief Devices

In 1975, there were 493 sanitary sewerage system flow relief devices in the Region which discharged sanitary sewage from separate sanitary sewer systems to surface water bodies. The initial regional water quality management plan recommended that each unit or agency of government responsible for the construction, operation, and maintenance of separate sanitary sewerage systems within the Region conduct detailed studies of local sewerage systems to identify all points of sewage flow relief and to ultimately eliminate all flow relief points through sewerage facility construction and infiltration and inflow reduction programs.

During the period since 1975, infiltration and inflow sewer system evaluations have been carried out for most of the sanitary sewer systems in the Region and, in many cases, flow reduction programs have been undertaken. However, as of 1990, releases of raw sanitary sewage from sanitary sewer system flow relief devices continued to occur throughout the Region. While the sewerage system upgrading which has occurred since the preparation of the initial regional water quality management plan has reduced the occurrences and the extent of discharges of untreated wastewater from flow relief devices in the Region; as of 1993 there still remained in existence within the Region about 330 sanitary sewer flow relief devices. These included 36 bypasses, 42 relief pumping stations, 52 portable pumping stations, and 200 sanitary to storm sewer crossovers.

During 1994, the Milwaukee Metropolitan Sewerage District completed work on the construction of the inline storage system, a major component of its water pollution abatement program as documented in the District facility plan.[11] Given the conveyance capacity now available in the inline storage deep tunnel system, bypassing from other sanitary sewer flow relief devices may be expected to be further reduced as additional sewerage system improvement upgrading is accomplished by the Milwaukee Metropolitan Sewerage District and other local units of government operating sewer systems. Currently, there are plans underway to further reduce the number of flow relief devices on the Milwaukee Metropolitan area sanitary sewer system.[12]

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[11]Milwaukee Metropolitan Sewerage District, MMSD Wastewater System Plan, June 1980.

[12]During 1994, the City of Milwaukee developed preliminary plans to specifically eliminate 52 of the 106 crossovers in the City's sanitary sewer system. In most cases, the crossovers were connected to other locations in the Milwaukee sewer system where adequate capacity was available. These plans were being refined and reviewed with the Milwaukee Metropolitan Sewerage District staff at the end of 1994.

Substantial progress has been made with regard to the elimination of the discharge to surface water courses of raw sanitary sewage from sanitary sewage flow relief devices. It is nevertheless recommended that all future planning for sewerage system expansion and improvement be conducted on the assumption that there will be no planned bypasses of raw sewage and that all flow relief devices in the systems will ultimately be eliminated, with the exception of bypasses at pumping stations and sewage treatment plants required to protect the public health and the treatment facilities in cases of unforeseen equipment or power failure. In the interim, it is recommended that the designated management agencies set forth in Chapter XVII continue to monitor sewerage system operations to ensure that the uses of the existing sewerage system flow relief devices are limited to periods of power or equipment failure, or to cases where infiltration and inflow due to wet weather conditions exceed the flows expected in the system design.

This recommendation is meant to preclude all bypassing which relies on the provisions of Section 110.05(2) of the Wisconsin Administrative Code relating to category 2 bypasses and overflows. These provisions presently permit bypassing and overflows resulting from a precipitation event having a recurrence interval of once in five years or less. The code presently presents such bypasses, as well as bypasses resulting from equipment damage and temporary power failure, and bypasses which are necessary to prevent the loss of life or severe property damage, without regard to the impact of extensions to the sewerage systems concerned.

In 1975, there were a total of 126 combined sewer overflow outfalls located within the Region. The initial plan recommended the eventual elimination of these combined sewer overflow outfalls through sewerage system construction and upgrading. Since the completion of the initial plan, those overflows which had existed in the Cities of Kenosha and Racine have since been eliminated through partial sewer separation programs. While overflows located in the Milwaukee metropolitan sewerage system continue to bypass raw sanitary sewage and storm water to surface waters during high flow events, the frequency of bypassing has been significantly reduced as a result of the completion of the inline storage deep tunnel system. Prior to the completion of the system, such bypassing occurred on an average of 52 times per year, discharging an estimated 3.0 to 4.0 billion gallons of mixed raw sewage and stormwater to surface waters. With the completion of the inline storage deep tunnel system, bypassing of raw sanitary sewage and storm water from the combined sewer overflows is expected to occur an average of about two times per year with the average duration of an overflow event being about 12 hours. The Milwaukee Harbor estuary study[13] documented that this level of reduction in combined sewer overflow discharges would be adequate to meet water quality standards in the estuary portion of the Milwaukee River, assuming other water quality improvement measures recommended were carried out.

Intercommunity Trunk Sewers

The regional water quality management plan, as amended, recommended the construction of 62 intercommunity trunk sewers in order to extend centralized sanitary sewer service throughout the proposed sewer service areas and to enable the

[13]SEWRPC Planning Report No. 37, op. cit.

abandonment of selected public and private sewage treatment plants. As of 1993, 49 of these intercommunity trunk sewers have been constructed. One trunk sewer, the Darien-Delavan trunk sewer, which will provide for the abandonment of the Village of Darien sewage treatment plant, was added to the plan in a 1994 plan amendment. Two trunk sewers were added to the plan also in a 1994 amendment to connect the Powers-Benedict-Tombeau Lakes area to a new sewage treatment plant located between these two lake areas. One additional trunk sewer--the Oak Creek Southeast trunk sewer--was recommended in the originally adopted plan but was estimated to not be needed until after the planning period. This trunk sewer has been included in this plan update based upon demonstrated need.

Thus the current plan recommends the construction of 16 intercommunity trunk sewers and force mains. The general alignment of these trunk sewers are shown on Map XVIII-8 and the trunk sewers are listed in Table XVIII-7.

The trunk sewer recommendations summarized in Table XVIII-7 concern only those trunk sewers which are of an intercommunity nature. Also of importance to the attainment of the basic plan recommendation to provide centralized sanitary sewer service to the recommended future sewer service areas are local trunk sewer extensions, which generally involve only a single community and are not, therefore, of areawide significance. It should be understood that these locally proposed trunk sewers, while not shown on the recommended plan map, represent an important adjunct to the recommended regional water quality management plan and, as such, are required for full plan implementation.

Other Point Source Discharges

In 1975, there were 277 known point sources of wastewater, other than public and private sewage treatment plants, discharging wastewater to groundwater or surface waters in the Region. The initial areawide water quality management plan recommended that these "other" point sources be monitored, and discharges limited to levels which must be determined on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System permitting process.

As of 1993, there were 662 known point sources of wastewater, other than public and private sewage treatment plants, discharging wastewater to the ground water or to surface waters in the Region. These "other" point sources of wastewater discharge consist primarily of industrial cooling, process, rinse, and wash waters which were discharged directly, sometimes following treatment, to the surface waters or groundwaters of the Region, or to storm sewers tributary to the surface or groundwater system. The locations of these point sources, including the level of treatment applied and the receiving water for discharge, are provided by watershed in Chapters IV through XV. It is recommended that wastewater discharge from these "other" sources continue to be controlled and regulated on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System (WPDES) permitting process.

Existing Unsewered Urban Development Outside
the Proposed Sanitary Sewer Service Area

In 1975 there were 106 enclaves of unsewered urban development located outside of the then planned year 2000 sewer service areas. Since 1975, 16 of these areas have been incorporated into the planned year 2010 sanitary sewer service areas and 72 new areas have been created beyond the planned sewer service areas.

Table XVIII-7

INTERCOMMUNITY TRUNK SEWERS RECOMMENDED TO BE CONSTRUCTED
UPON FULL IMPLEMENTATION OF THE RECOMMENDED
REGIONAL WATER QUALITY MANAGEMENT PLAN: 2010

Intercommunity Trunk Sewer	Watershed Location
Salem[a]	Des Plaines River and Fox River watersheds
Lannon-Sussex	Fox River watershed
Eagle Spring-Mukwonago	Fox River watershed
Lake Geneva South	Fox River watershed
Como Lake North	Fox River watershed
Fontana-Linn	Fox River watershed
Pell Lake	Fox River watershed
Powers Lake	Fox River watershed
Northridge	Milwaukee River watershed
Waubeka-Fredonia	Milwaukee River watershed
Lake Church-Belgium	Watershed of Minor Streams and Direct Drainage Area Tributary to Lake Michigan
Oak Creek Southeast[b]	Oak Creek and Root River watersheds
Darien-Delavan	Rock River watershed
North Lake-Oconomowoc	Rock River watershed
Summit-Delafield	Rock River watershed
Center for the Developmentally Disabled-Union Grove	Root River watershed

[a] Trunk sewer was completed in 1993.

[b] Trunk sewer included in initial plan as needed beyond the year 2000 and included in the plan update based upon demonstrated needs.

Source: SEWRPC.

As of 1990, there were 162 enclaves of unsewered urban development located outside of the planned year 2010 sewer service areas. The location of these service areas and the corresponding urban enclave population and the distance to the nearest planned year 2010 sewer service area are provided in Chapters IV through XV. Four of these areas are served by private sewage treatment plants. Approximately one-half of the areas not served by private sewage treatment plants are covered by soils and have lot sizes which indicate a high probability of meeting the criteria of Chapter ILHR 83 of the Wisconsin Administrative Code covering conventional onsite sewage disposal systems. The remaining areas have soils and lot sizes having a high probability of not meeting these criteria, and consideration should be given to alternative methods of wastewater disposal. Many of these latter areas are located adjacent to inland lakes where alternative forms of wastewater management should be investigated during the planning period. Generally, for all of the remaining enclaves located in areas where soils are not considered to meet current criteria for onsite sewage disposal systems, it is recommended that an inspection and maintenance program be instituted and that further site-specific planning to determine the best wastewater management practices be conducted at such times as significant problems are anticipated.

Miscellaneous Point Source-Related Recommendations

Miscellaneous point sources of pollution including landfills and underground storage tanks are discussed and located on maps in Chapters IV through XV by watershed. As of 1990, there were 28 landfills in the Region that may potentially be impacting surface or ground waters. Seven of these landfills were designated as high priority sites for the U.S. Environmental Protection Agency Superfund program which provides for the identification, evaluation, and clean up of hazardous waste sites. Three of these landfills were identified for State clean-up actions. In addition, as of 1990, there were 14 leaking underground storage tanks and three other sites of groundwater contamination undergoing remediation in the Region which were discharging remediation wastewater to surface or ground waters under the Wisconsin Pollutant Discharge Elimination System (WPDES) permitting process. It is recommended that these miscellaneous point sources of wastewater, including operating and abandoned landfills, underground storage tanks, and other groundwater contamination sites continue to be monitored and appropriate remediation be carried out under the programs and regulations currently in place for that purpose.

NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT

The nonpoint source pollution abatement plan element includes recommendations relating to the control of diffuse sources of water pollution including urban sources--such as runoff from residential, commercial, industrial, transportation, and recreational land uses, construction activities, and private onsite sewage disposal systems--and from rural sources--such as runoff from cropland, pasture, and woodland, and livestock wastes and from streambank erosion sites. These nonpoint sources of pollutants discharge to surface waters by direct land drainage, by drainage through natural channels, by drainage through engineered storm water drainage systems, and by deep percolation into the ground and return flow to the surface waters. The water quality analyses developed in the initial plan demonstrated that a reduction in the transport of pollutants from nonpoint sources is essential, in combination with the point source pollutant abatement measures, to the achievement of the recommended water use objectives and

supporting water quality standards set forth in this regional water quality management plan update.

For planning purposes, measures for nonpoint source water pollution control were grouped into categories. The first category was defined as basic practices, which were recommended to be generally applied throughout the Region and included construction site erosion control, onsite sewage disposal system management, and streambank erosion controls. The effectiveness of such practices in reducing nonpoint source pollutant loadings varied by subwatershed and by pollutant. For conventional pollutants, these practices generally are expected to provide for a 5 to 30 percent reduction in nonpoint source pollutant loadings. Additional practices were then considered in incremental steps which would provide 25 and 50 percent reductions in nonpoint source pollutants from urban lands and 25, 50, and 75 percent reductions in nonpoint source pollutants from rural lands. The types of practices recommended to be considered for these various levels of nonpoint source control are summarized in Appendix A.

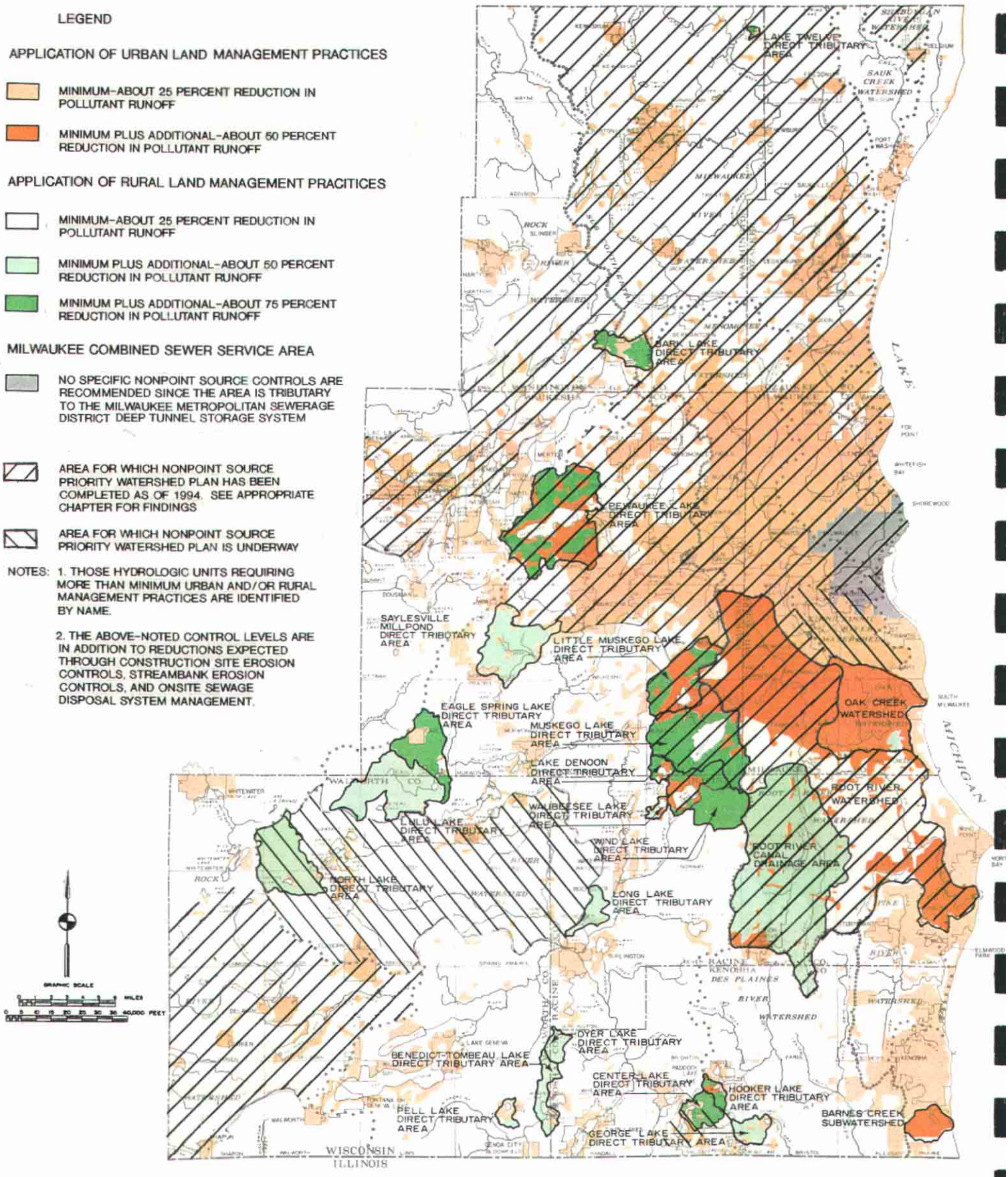
In the initial plan, water quality simulation modeling was conducted to determine the level of nonpoint source pollution control needed to meet the water quality standards associated with recommended water use objectives for each subwatershed area considered. The resulting recommendations of that analysis are shown on Map XVIII-9. For nearly all of the Southeastern Wisconsin Region, land management practices designed to achieve about a 25 percent reduction in nonpoint source pollutants, in addition to construction site erosion control, onsite sewage disposal system management, and streambank erosion controls were recommended to be implemented throughout the entire urban and rural areas. For these areas, the level of control expected to be achieved when considering the effectiveness of the basic practices, plus the land management practices designed to achieve the 25 percent reduction, varied, depending upon the specific subwatershed considered, ranging for specific subwatersheds from a 30 to 55 percent reduction overall.

The one exception to this recommendation was that no specific additional nonpoint source controls were recommended for the 21-square-mile area tributary to the Milwaukee Metropolitan Sewerage District inline storage deep tunnel system where stormwater runoff from storms with up to a recurrence interval of about one or two times per year is to be conveyed to the tunnel system and be stored and then treated at the District treatment plants, thus providing a high level of nonpoint source pollution control. In the area tributary to the combined sewer system, the discharge of stormwater to the surface water system will be reduced from an average of 50 times per year to 1.4 times per year. Accordingly, a level of control of nonpoint source pollutants exceeding 90 percent is expected. This is particularly important in that the area served by the combined sewer system represents the most highly urbanized area of the Region. This area contains concentrations of industrial, commercial, institutional, and transportation land uses which are expected to generate high nonpoint source loadings and where controls of nonpoint source pollutants using land management practices would be difficult and costly. The control of nonpoint sources in the combined sewer service area as provided by the inline storage deep tunnel system exceeds that which could practically be provided by any other practicable means.

Additional urban nonpoint source controls designed to provide about a 50 percent reduction in pollutant runoff were also recommended to be applied to a total of

Map XVIII-9

RECOMMENDED NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT IN THE REGION: 2010



Source: SEWRPC.

109 square miles of urban area. These areas lie largely in the Oak Creek and Root River watersheds, in the Barnes Creek subwatershed portion of the drainage area directly tributary to Lake Michigan, and in the direct drainage areas tributary to Pewaukee Lake, Big and Little Muskego Lakes, Lake Denoon, Waubeesee Lake, Wind Lake, and Hooker Lake. Additional rural nonpoint source pollution abatement measures designed to achieve an approximate 50 percent reduction in pollutant runoff were recommended in the plan to be applied to about 118 square miles of rural land. These lands lie largely in the Oak Creek watershed, in Root River Canal drainage area, and in the direct drainage areas tributary to GeorgeLake, Benedict/Tombeau Lakes, Waubeesee Lake, Long Lake, Dyer Lake, Pell Lake, North Lake (Walworth County), and Lulu Lake. In addition, additional rural nonpoint source pollution abatement measures designed to achieve an approximate 75 percent reduction in pollutant runoff were recommended to be applied to about 58 square miles of rural lands in the direct drainage areas tributary to Lake Twelve, Bark Lake, Pewaukee Lake, Big and Little Muskego Lakes, Eagle Spring Lake, Lake Denoon, Center Lake, Wind Lake, and Hooker Lake.

The initial regional plan also recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans. Such plans were to identify nonpoint source pollution control practices that should be applied to specific areas within the designated watersheds. Working with the individual county land conservation committees, local units of government, and the Commission, the Wisconsin Department of Natural Resources is carrying out the recommended detailed planning for nonpoint source water pollution abatement on a watershed by watershed basis. This detailed planning and subsequent plan implementation program is known as the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program. This planning program was established in 1978 by the Wisconsin State Legislature and provides cost-sharing funds for an individual project, or land management practice, to local governments and private landowners upon completion of the detailed plans. These funds are provided through nonpoint source local assistance grants administered by the DNR. Planning under the priority watershed program has been carried out, or is underway, for the Root River, Onion River, Turtle Creek, Oconomowoc River, Milwaukee River and Cedar Creek, Menomonee River, Upper Fox River, Kinnickinnic River, Honey and Sugar Creeks, Muskego-Wind Lakes, and Camp and Center Lakes watersheds and subwatersheds, as recommended in the initial areawide water quality management plan. The status of these projects are summarized in Table XVIII-8.

In those watersheds where nonpoint source pollution abatement priority watershed projects have been completed, the recommendations developed under the priority watershed projects now serve as the basis for nonpoint source project eligibility under the DNR priority watershed programs and must be taken into account along with the regional water quality management plan findings and recommendations in preparing subsequent detailed stormwater management plans, and for land management plans.

The nonpoint source priority watershed project implementation periods have now been completed for the Onion River, Oconomowoc River, Root River, and Turtle Creek watersheds. For each of these watersheds, it is recommended that the need for further nonpoint source controls be reevaluated based upon the level of plan implementation and additional water quality and biological monitoring data. This reevaluation should include adequate water quality and biological assessment and

Table XVIII-8

STATUS OF NONPOINT SOURCE POLLUTION ABATEMENT
PRIORITY WATERSHED PROJECTS: 1994

Watershed	Counties	Date Selected	Date Plan Completed	Project Sign-Up End Date	Project Implementation End Date
Root River	Racine Milwaukee Waukesha Kenosha	1979	1980	December 1984	December 1989
Onion River	Ozaukee Sheboygan	1980	1981	June 1984	June 1989
Turtle Creek	Walworth Rock	1982	1984	April 1987	April 1992
Oconomowoc River	Washington Waukesha Jefferson Dodge	1983	1986	April 1989	December 1994
East and West Branches of the Milwaukee River	Washington Ozaukee Sheboygan Dodge	1984	1989	December 1993[a]	June 1997
North Branch of the Milwaukee River	Washington Ozaukee Sheboygan Fond du Lac	1984	1989	December 1993[a]	July 1997
Menomonee River	Washington Waukesha Milwaukee Ozaukee	1984	1991	October 1994[a]	October 1999
Milwaukee River South	Ozaukee Milwaukee	1984	1991	October 1994[a]	October 1999
Cedar Creek	Ozaukee Washington	1984	1992	March 1995[a]	March 2000
Upper Fox	Waukesha	1990	1994	May 1994	May 1994
Muskego-Wind Lakes	Waukesha Racine	1991	1993	May 1994	May 1997
Kinnickinnic	Milwaukee	1990	1994	October 1994[a]	October 1997
Honey Sugar Creek	Walworth	1994	--	--	--
Camp-Center Lakes	Kenosha	1994	--	--	--

[a] Urban nonpoint source management practices can be signed up during the entire project implementation period.

Source: SEWRPC.

analyses to determine the current degree of achievement of the recommended water use objective for the stream reaches concerned. In some cases, this evaluation may indicate that the water use objective should be changed. For example, in the Root River watershed, the recommended point source pollution abatement measures have now been largely carried out, including the abandonment of seven public and seven private sewage treatment plants and the upgrading of the Village of Union Grove sewage treatment plant. Given that the nonpoint source priority watershed project implementation period has been completed and that the surface waters still do not fully meet the standards for the recommended water use objective, the achievability of the objective should be reevaluated along with the need for further nonpoint source controls.

For the Upper Fox River, Menomonee River, and Milwaukee River watersheds, the levels of control developed for the urban areas in the priority watershed plan are significantly higher than those developed in the initial regional water quality management plan. In this regard, it should be noted that the priority watershed plans included consideration of water quality implications of metals toxicity in stormwater. Such metal toxicity was not specifically considered in the development of the initial regional plan recommendations since metals toxicity standards were not available at the time of its preparation. However, levels of urban control developed under the priority watershed plans for these three areas are costly and full implementation will be difficult to achieve. Thus, it is recommended that the level of control for urban areas be refined based upon subsequent detailed stormwater management planning and based upon additional monitoring and quantitative analyses which are recommended to be conducted during the plan implementation period. These data and consideration of estimated costs and available funds for the urban practices are recommended to be evaluated to refine the recommended final level of control. Such refinement would include further consideration of toxics reduction requirements.

It is further recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans to identify the nonpoint source pollution control practices that should be applied to specific lands in the most cost-effective manner. In this regard, those areas of the Region not yet included under the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program should be enrolled in the program in order to make State cost-sharing funds and related programs available for nonpoint source pollution control measures. In addition, detailed stormwater management plans in urban areas and farmland management plans in rural areas should be conducted to determine the practices to be installed in the most cost-effective manner. The current priority ranking of watersheds for inclusion in that program is documented in a memorandum[14] prepared by the Regional Planning Commission using DNR procedures. That ranking is summarized on Map XVIII-10 and Table XVIII-9, and includes the Bark River, Middle Fox River, Lower Fox River, Oak Creek, Pike River, Pike Creek, Sauk Creek-Sucker Creek, East Branch Rock River, and Rubicon River in the high category, indicating that inclusion in the program will be possible in the future when the existing planning projects are completed, or additional funds and staff become available with the Department of Natural Resources. The Commission is

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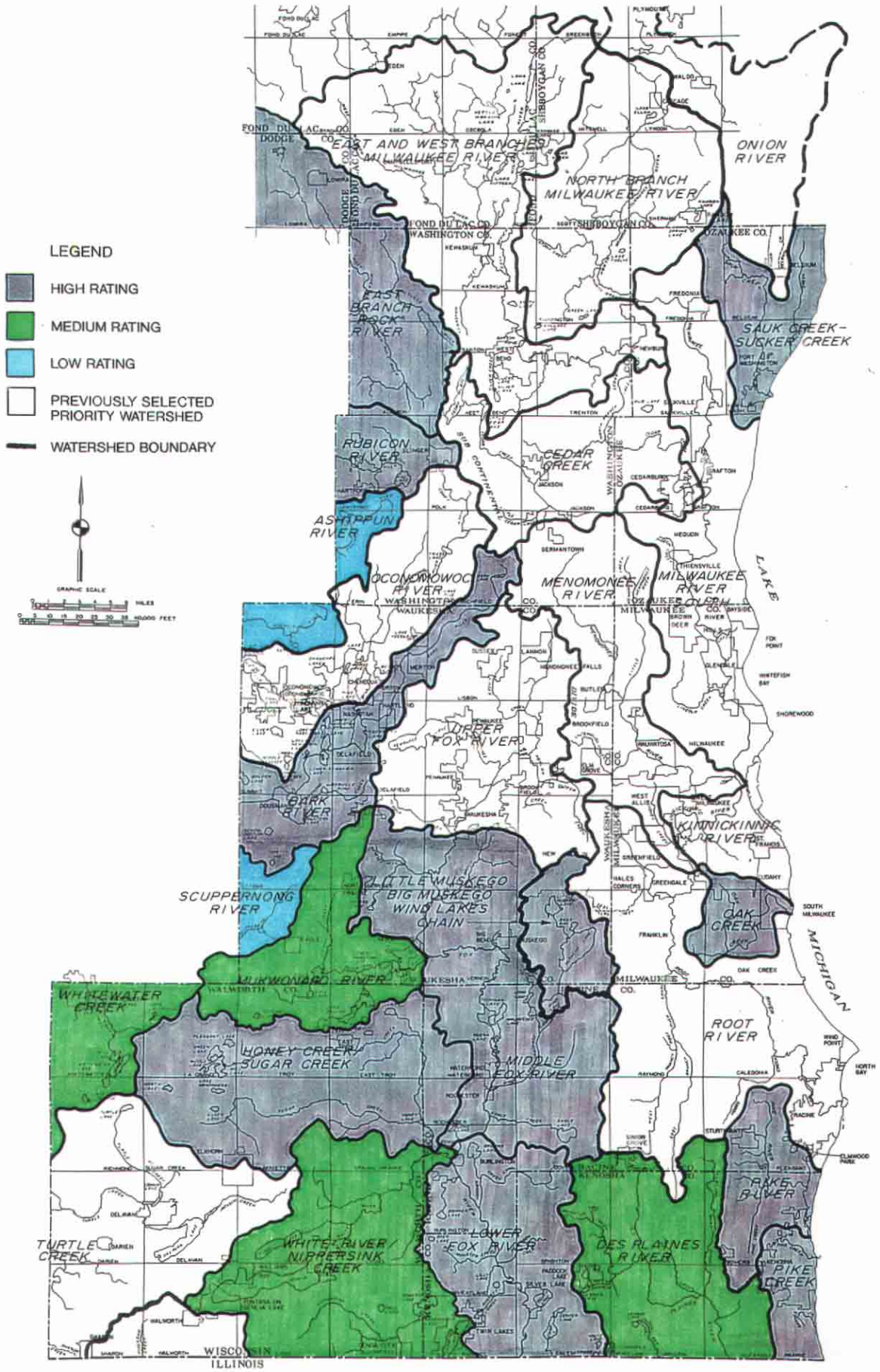
[14]See SEWRPC Memorandum entitled "Assessment and Ranking of Watersheds for Nonpoint Source Management Purposes in Southeastern Wisconsin: 1993."

Map XVIII-10

TOTAL NONPOINT SOURCE RATING ANALYSIS FOR
CANDIDATE WATERSHEDS WITHIN SOUTHEASTERN WISCONSIN



Source: SEWRPC.

Table XVIII-9

SUMMARY OF CANDIDATE PRIORITY WATERSHED RATINGS
FOR SOUTHEASTERN WISCONSIN

High Rating	Medium Rating	Low Rating
Bark River	Des Plaines River	Ashippun River
East Branch Rock River	Mukwonago River	Scuppernong River
Honey/Sugar Creeks[a]	White River/	
Lower Fox River	Nippersink Creek	
Middle Fox River	Whitewater Creek	
Oak Creek		
Pike Creek		
Pike River		
Rubicon River		
Sauk/Sucker Creeks		

[a] Since preparation of this priority watershed rating in 1993, the Honey/Sugar Creek watershed was selected in 1994 for inclusion in the Wisconsin Department of Natural Resources Nonpoint Source Pollution Abatement Priority Watershed Program.

Source: SEWRPC.

currently preparing a comprehensive watershed plan for the portion of the Des Plaines River watershed located in Southeastern Wisconsin.[15] That planning program will provide much of the information and data needed for the preparation of a nonpoint source priority watershed project. Because a comprehensive water resources planning program will be completed for the Des Plaines River watershed during 1995, the implementation of the nonpoint source pollution abatement in that watershed should be given special consideration since the comprehensive framework for the nonpoint source planning will be in place along with much of the inventory and analyses data needed to conduct priority watershed planning in a timely way. Thus, it is recommended that further consideration be given to including the Des Plaines River watershed under the State nonpoint source pollution abatement priority watershed program.

WATER QUALITY MONITORING PLAN ELEMENT

The updated regional water quality management plan recommends that steps be taken to ensure the establishment of a sound program for continuing water quality monitoring within the Region to determine the extent to which the recommended water use objectives and supporting water quality standards are being met over time. In particular, the plan recommends that the water quality data collection programs be continued at selected stations established by the Department of Natural Resources, the U.S. Geological Survey, and the Milwaukee Metropolitan Sewerage District as set forth in Chapters IV through XV and shown on Map XVIII-11, on a continuing long-term basis. In addition, it is recommended that an intensive water quality and biological condition monitoring program be conducted over a one-year period at selected additional locations as shown on Map XVIII-11, and that biological monitoring be conducted at selected continuing water quality monitoring stations during the same one-year period. The proper combination of water quality and biological monitoring should be determined during the development of monitoring programs for individual watersheds by the Department of Natural Resources in cooperation with the Regional Planning Commission. The data to be collected should be suitable for developing the necessary analyses, including modeling of future conditions, to reassess the levels of point and nonpoint source controls needed to achieve the recommended water use objectives, and to reexamine the practicality of achieving those objectives. It is recommended that this program be conducted within the next seven years and repeated at approximately five- to ten-year intervals. These recommendations are consistent with the Wisconsin Department of Natural Resources current conceptual surface water monitoring strategy developed to conduct monitoring activities and perform basic assessments for each watershed in the Region in an approximate five- to ten-year rotating cycle.

In addition, it is recommended that a lake water quality monitoring program be established on all lakes within the Region, consisting of, at a minimum, the enrollment of a citizen volunteer in the DNR Self-Help Monitoring Program. In addition, it is recommended that an intensive monitoring effort designed to establish baseline water quality conditions be undertaken on all major lakes within the Region, and on such smaller waterbodies as may be appropriate. For each lake, it is recommended that the monitoring program be such that current conditions be established during a two-year or more intensive monitoring program

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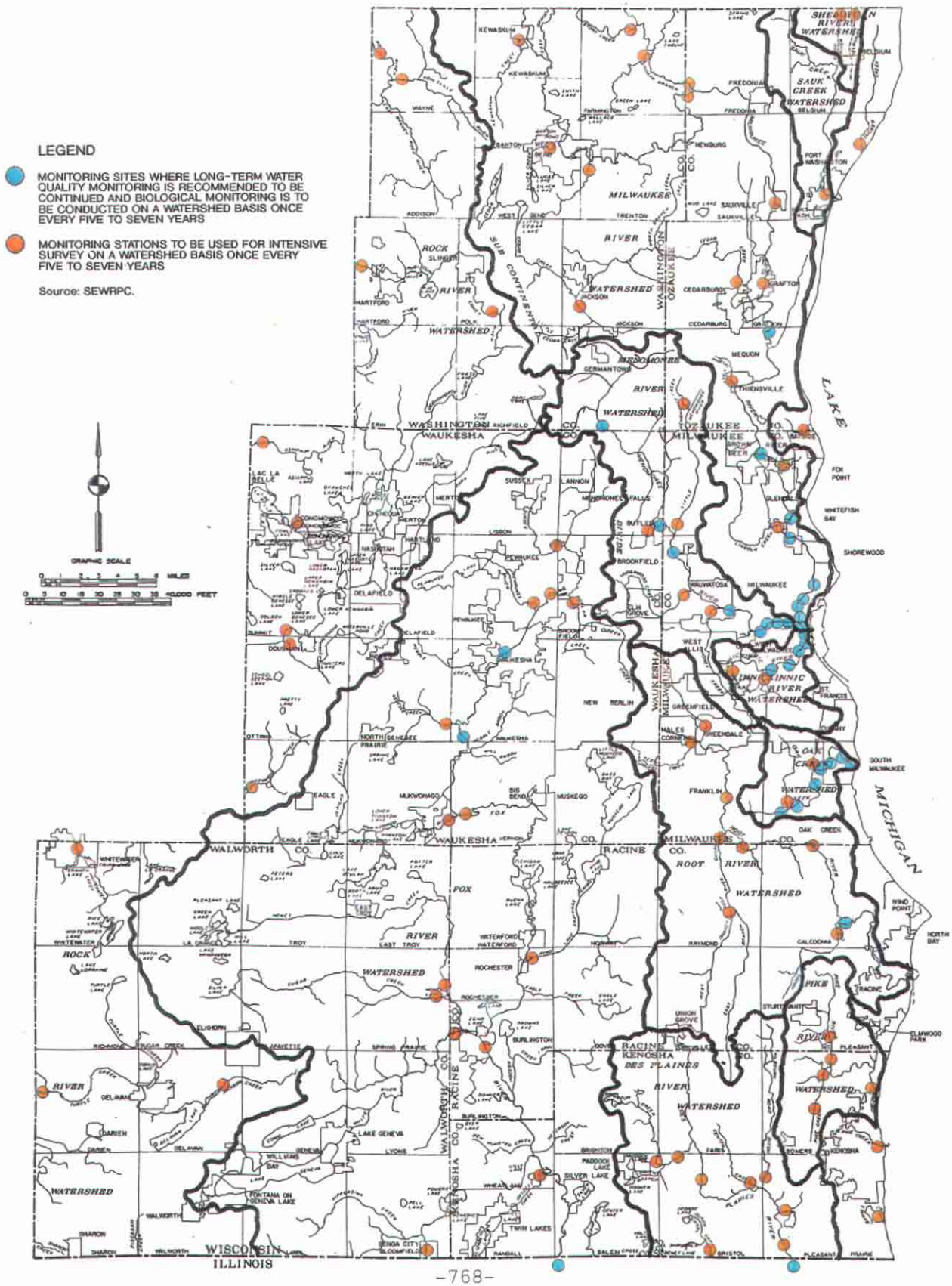
[15]Des Plaines River Watershed Planning Program Prospectus, September 1991.

Map XVIII-11

RECOMMENED WATER QUALITY AND BIOLOGICAL

CONDITION MONITORING PROGRAM SITE LOCATIONS



followed by continual long-term monitoring designed to detect changes in water quality conditions. In this regard, the monitoring program should be designed to provide data needed to prepare or update comprehensive lake management plans for the major lakes in each watershed and such smaller lakes as may be appropriate. The water quality sampling program should be carried out at spring turnover--usually in April--and during June, July, and August, during two subsequent years, with samples collected weekly.

LAKE MANAGEMENT PLAN ELEMENT

Lake management measures recommended to be considered in more detail are set forth in Table XVIII-10 for the 101 major lakes in the Southeastern Wisconsin Region. It is recognized that the preparation of comprehensive lake management plans may need to be conducted in a staged manner in order to best utilize available resources. In this regard, water quality monitoring, aquatic plant management, and watershed protection measures planning and implementation are considered to be logical components, among others, of the comprehensive plans which can be conducted under separate planning programs, if designed to be integrated into a comprehensive lake management plan. In addition, it is recommended that water quality planning and supporting monitoring be conducted for those lakes and similar waterbodies of both greater and lesser than 50 acres in size, where such activities are deemed to be important for water quality protection. In cases where such planning and monitoring is conducted on waterbodies of less than 50 acres in size, management techniques similar to those recommended to be applicable for consideration on the major lakes can be considered for lake management purposes. Currently, such activities are underway on about half of the 101 major lakes in the Region, as shown in Table XVIII-10.

MILWAUKEE HARBOR ESTUARY PLAN RECOMMENDATIONS

The water quality management recommendations developed in the Milwaukee Harbor estuary study[16] are incorporated into the regional water quality management plan update. In addition to those recommendations set forth above for the tributary area to the Milwaukee Harbor estuary, the plan recommends the continued operation of the existing flushing tunnels which discharge to the upstream end of the Milwaukee and Kinnickinnic River watersheds, and the installation and operation of an instream aeration system in the Menomonee River estuary. In addition, the updated plan incorporates the recommendations to implement measures to prevent contamination of surface water by stormwater runoff from scrap metal, salt, and other material storage sites located within the estuary direct drainage area and the development and continued operation of a water quality, sediment quality, and biological conditions monitoring program to document the extent to which desired water use objectives are being met over time.

STATUS OF GROUNDWATER MANAGEMENT PLAN ELEMENT

A groundwater management plan element of the regional water quality management plan is currently under preparation under a cooperative program being carried out

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[16]SEWRPC Planning Report No. 37, A Water Resources Management Plan for the Milwaukee Harbor Estuary, Vol. One, Inventory Findings, Vol. Two, Alternative and Recommended Plans, December 1987.

Table XVIII-10

SUMMARY OF LAKE MANAGEMENT PLAN ELEMENT RECOMMENDATIONS

COUNTY WATERSHED Lake	Area acres	TSI[a]	Form of Lake Organi-zation	Provide Public Sanitary Sewerage	Manage Onsite Sewage Disposal	Monitor Water Quality	Manage Aquatic Plants	Manage Fish/ In-lake Habitat	Manage Access and Recreation	Manage Watershed NPS	Public Infor-mation	Comprehen-sive Plan
KENOSHA COUNTY												
DES PLAINES RIVER												
Benet/Shangrila	186	67	--[d]	o	-	o	x	x	x	x	x	o
East Lake Flowage	123	--	State[b]	-	x	x	-	o	x	x	x	x
George Lake	59	64	District[c]	o	-	o	o	x	o	x	o	o
Hooker Lake	87	54	District[c]	o	-	o	x	x	o	x	x	o
Paddock Lake	112	--	District[c]	o	-	o	x	x	o	x	x	o
Unnamed Quarry Lake	100	--	--[d]	x	-	x	-	x	x	-	x	x
FOX RIVER												
Benedict Lake	78	44	--[d]	x	x	o	x	x	x	x	x	x
Camp Lake	461	54	District[c]	o	-	o	x	x	o	o	x	o
Center Lake	129	35	District[c]	o	-	o	x	x	o	o	x	o
Cross Lake	87	52	Assn[e]	o	-	x	x	x	x	x	x	o
Dyer Lake	56	--	--[d]	-	x	x	x	x	x	x	x	x
Elizabeth Lake	865	52	District[c]	o	-	o	-	x	o	x	x	o
Lilly Lake	88	--	District[c]	x	x	o	-	x	o	x	x	o
Marie Lake	315	47	District[c]	o	-	o	-	x	o	x	x	o
Powers Lake	459	45	District[c]	x	x	o	x	x	o	x	x	o
Silver Lake	464	50	Assn[e]	o	-	x	x	x	o	x	x	o
Voltz Lake	52	57	District[c]	o	-	o	x	x	x	x	x	o
OZAUKEE COUNTY												
MILWAUKEE RIVER												
Lac du Cours	56	--	--[d]	o	-	x	-	x	x	o	x	x
Mud Lake	245	--	--[d]	-	-	x	-	-	x	o	x	x
Spring Lake	66	43	--[d]	-	x	x	-	x	x	o	x	x
RACINE COUNTY												
FOX RIVER												
Bohner Lake	135	45	Assn[e]	o	x	o	o	x	o	x	x	o
Browns Lake	396	51	District[c]	o	-	o	x	x	o	x	x	o
Buena Lake	241	--	--[d]	o	-	x	-	x	x	x	x	x
Eagle Lake	520	52	Assn[e]	o	-	o	o	x	o	x	x	o
Echo Lake	71	--	--[d]	o	-	x	-	x	x	x	x	x
KeeNongGoMong Lake	88	55	Assn[e]	o	-	o	x	x	o	x	x	o
Long Lake	102	--	--[d]	-	x	x	x	x	x	x	x	x
Tichigan Lake	892	54	Assn[e]	o	-	o	-	x	o	x	x	x
Waubeesee Lake	129	46	Assn[e]	o	-	o	x	x	o	x	x	o
Wind Lake	936	69	District[c]	o	-	o	o	x	o	o	o	o

Table XVIII-10 (cont'd.)

COUNTY WATERSHED Lake	Area acres	TSI[a]	Form of Lake Organi-zation	Provide Public Sanitary Sewerage	Manage Onsite Sewage Disposal	Monitor Water Quality	Manage Aquatic Plants	Manage Fish/ In-lake Habitat	Manage Access and Recreation	Manage Watershed NPS	Public Infor-mation	Comprehen-sive Plan
WALWORTH COUNTY												
FOX RIVER												
Army Lake	78	--	--[d]	x	x	x	-	x	x	x	x	x
Booth Lake	113	45	Assn[e]	x	x	o	-	x	x	x	x	x
Lake Beulah	834	46	District[c]	-	x	o	o	x	o	x	x	x
Lake Como	946	--	District[c]	o	-	o	o	x	x	x	x	x
Lake Geneva	5,262	48	Agency[f]	o	-	o	-	x	o	x	o	o
Lauderdale Lakes[g]	841	50	District[c]	-	x	o	x	x	o	x	x	o
Lulu Lake	84	--	--[d]	-	-	x	x	x	o	x	x	o
North Lake	191	--	--[d]	-	x	x	x	x	x	x	x	x
Pell Lake	86	60	Assn[e]	o	-	x	-	x	x	x	x	x
Peters Lake	64	--	--[d]	-	-	x	x	x	x	x	x	x
Pleasant Lake	155	45	District[c]	-	x	o	x	x	o	x	x	x
Potters Lake	162	78	District[c]	o	-	o	x	x	x	x	x	o
Silver Lake	85	--	--[d]	-	x	x	-	x	x	x	x	x
Wandawega Lake	119	--	--[d]	-	x	x	x	x	x	x	x	x
ROCK RIVER												
Comus Lake	117	--	District[c]	o	-	x	x	x	x	o	x	x
Cravath Lake	65	--	--[d]	o	-	x	x	x	x	x	x	x
Delavan Lake	2,072	64	District[c]	o	-	o	o	x	o	o	o	o
La Grange Lake	55	--	--[d]	-	x	x	-	x	x	x	x	x
Lake Lorraine	133	--	Assn[e]	-	x	x	x	x	x	x	x	x
Rice Lake	137	60	District[c]	-	x	o	o	x	x	x	o	o
Tripp Lake	115	--	--[d]	o	x	x	x	x	x	x	x	x
Turtle Lake	140	--	Assn[e]	-	x	x	x	x	x	o	x	x
Whitewater Lake	640	61	District[c]	-	x	o	o	x	o	x	o	x
WASHINGTON COUNTY												
MILWAUKEE RIVER												
Barton Pond	67	--	--[d]	o	-	x	-	x	x	o	x	x
Big Cedar Lake	932	59	District[c]	-	x	o	o	x	o	o	x	x
Green Lake	71	50	Assn[e]	-	x	o	-	x	o	o	x	x
Lake Twelve	53	45	Assn[e]	-	x	x	-	x	x	o	x	x
Little Cedar Lake	246	59	District[c]	-	x	o	-	x	o	o	x	x
Lucas Lake	78	43	--[d]	-	x	x	x	x	x	o	x	x
Silver Lake	118	50	District[c]	o	-	o	o	x	o	o	x	x
Smith Lake	86	49	--[d]	-	x	x	x	x	x	o	x	x
Wallace Lake	52	59	District[c]	o	-	o	x	x	o	o	x	x
ROCK RIVER												
Bark Lake	65	--	District[c]	-	x	x	x	x	x	x	x	x
Druid Lake	124	47	District[c]	-	x	o	x	x	o	x	x	o
Friess Lake	119	59	Assn[e]	-	x	o	-	x	x	x	x	o
Lake Five	102	47	Assn[e]	-	x	o	x	x	x	x	x	x
Pike Lake	522	52	Assn[e]	-	x	o	-	x	o	x	x	x

Table XVIII-10 (cont'd.)

COUNTY WATERSHED Lake	Area acres	TSI[a]	Form of Lake Organization	Provide Public Sanitary Sewerage	Manage Onsite Sewage Disposal	Monitor Water Quality	Manage Aquatic Plants	Manage Fish/ In-lake Habitat	Manage Access and Recreation	Manage Watershed NPS	Public Information	Comprehensive Plan
WAUKESHA COUNTY												
FOX RIVER												
Big Muskego Lake	2,177	70	District[c]	o	-	o	-	o	o	o	o	o
Eagle Spring Lake	311	49	District[c]	x	x	o	o	x	x	x	x	o
Lake Denoon	162	49	Assn[e]	o	-	o	x	x	x	x	x	x
Little Muskego Lake	506	62	District[c]	o	-	o	o	x	o	o	o	o
Lower Phantom Lake	433	43	District[c]	x	x	x	o	x	o	x	o	x
Pewaukee Lake	2,493	59	District[c]	o	-	o	o	x	x	o	o	o
Spring Lake	105	51	--[d]	-	-	o	-	x	x	x	x	x
Upper Phantom Lake	107	44	District[c]	x	x	o	o	x	o	x	o	x
ROCK RIVER												
Ashippun Lake	84	49	District[c]	-	x	o	x	x	o	x	x	o
Beaver Lake	316	--	Assn[e]	x	x	x	x	x	o	o	x	x
Crooked Lake	58	51	--[d]	-	x	x	x	x	x	x	x	x
Fowler Lake	78	43	District[c]	o	-	o	o	x	o	o	x	-
Golden Lake	250	42	Assn[e]	-	x	o	x	x	o	x	x	x
Hunters Lake	65	--	Assn[e]	-	x	x	x	x	x	x	x	x
Lac La Belle	1,117	54	District[c]	o	-	o	o	x	o	o	o	o
Lake Keesus	237	50	District[c]	-	x	o	o	x	o	o	x	o
Lower Genesee Lake	66	41	Assn[e]	-	x	o	x	x	x	x	x	x
Lower Nashotah Lake	90	51	Assn[e]	x	x	x	x	x	x	x	x	x
Lower Nemahbin Lake	271	54	Assn[e]	x	x	o	x	x	x	x	x	x
Middle Genesee Lake	102	--	District[c]	-	x	o	x	x	o	x	x	x
Moose Lake	81	--	Assn[e]	x	x	x	x	x	x	o	x	x
Nagawicka Lake	957	60	Assn[e]	o	-	o	o	x	x	x	x	x
North Lake	437	54	District[c]	x	x	o	o	x	x	o	x	o
Oconomowoc Lake	767	44	--[d]	x	x	o	o	x	x	o	x	o
Okauchee Lake	1,187	58	District[c]	x	x	o	o	x	o	o	x	o
Pine Lake	703	--	Assn[d]	x	x	x	x	x	o	o	x	x
Pretty Lake	64	42	District[c]	-	x	o	x	x	x	x	x	o
School Section Lake	125	53	District[c]	-	x	o	o	x	x	x	x	o
Silver Lake	222	43	Assn[e]	x	x	o	x	x	x	o	x	o
Upper Nashotah Lake	133	45	--[d]	x	x	x	x	x	x	x	x	x
Upper Nemahbin Lake	283	45	District[c]	x	x	o	x	x	o	x	x	o
Waterville Pond	68	--	--[d]	-	x	x	x	x	x	x	x	x

[a] Carlson Trophic State Index (TSI) classification based on water chemistry data collected between 1981 and 1994.

[b] The East Lake Flowage is totally contained within the Bong State Recreational Area administered by the Wisconsin Department of Natural Resources.

[c] An inland lake protection and rehabilitation district, sanitary district or utility district is known to exist. These organizations may be eligible for State financial assistance in the preparation and implementation of lake management plans under Chapters NR 119 and NR 191 of the Wisconsin Administrative Code.

Footnotes continue.

Table XVIII-10 (cont'd.)

[d] No known lake organization exists. It is recommended that some type of local lake management organization be formed around each of the major lakes in the Region. These organizations may be eligible for State financial assistance in the preparation and implementation of lake management plans under Chapters NR 119 and NR 191 of the Wisconsin Administrative Code. Management actions may also be taken by the responsible local unit of government. Recognized lake management organizations include: cities, villages, towns, public inland lake protection and rehabilitation districts, and qualified lake associations, as well as sanitary districts and tribes under certain grant programs.

[e] A lake association, property owner's association, or similar organization is known to exist. Qualified lake associations, which are incorporated under Chapter 181 of the Wisconsin Statutes--and which meet other specified criteria--may be eligible for State financial assistance in the preparation and implementation of lake management plans under Chapters NR 119 and NR 191 of the Wisconsin Administrative Code.

[f] A Section 66.30, Stats., intergovernmental agreement exists between riparian municipalities and has created the Geneva Lake Environmental Agency to oversee planning and research into the water quality of Geneva Lake.

[g] Lauderdale Lake incorporates Green Lake, Middle Lake, and Mill Lake.

KEY:

o = Ongoing water quality monitoring, planning program or management activity.

x = Water quality monitoring recommended; development and implementation of detailed plan element recommended.

- = No action necessary at this time; detailed plan element completed--implement, update and refine as necessary.

Source: Wisconsin Department of Natural Resources and SEWRPC.

by the Regional Planning Commission and the University of Wisconsin-Extension, Wisconsin Geologic and Natural History Survey.

The purpose of the groundwater management plan element is to complete a comprehensive groundwater resource data inventory and analysis, including a series of groundwater resource maps of the Region; to complete a groundwater pollution source inventory and supporting mapping; to development groundwater protection and management recommendations for the Region; and to document the inventory,analysis, and recommendations in a separate report expected to be completed in 1997. The planning program is intended to form the basis for a groundwater management element of the regional water quality management plan. In addition, the planning program will provide, on a regional basis, valuable hydrogeologic information for use in parallel and subsequent groundwater planning programs, such as well head protection planning.

A more detailed description and status of the work to be conducted and a schedule for its completed is set forth in Chapter XVI.

DESIGNATED MANAGEMENT AGENCIES

While the recommended plan described above is designed to achieve the water use objectives and the supporting water quality standards, the plan is not complete in a practical sense until the steps required to implement the plan--that is, to convert the plan into action policies and programs--are specified. In addition, Federal and State regulations require that specific designations be made of the water quality management agencies required to implement the plan and that the plan implementation responsibilities of such agencies be identified. Accordingly, the plan includes recommendations for management agency designations and sets forth the various actions that must be taken by these agencies in order for the recommended plan to be fully carried out by the plan design year 2010. The plan also includes a series of proposed implementation schedules, with particular regard to the point source pollution abatement element of the recommended plan, including proposed dates for sewage treatment plant upgrading and expansion.

In total, it is proposed that 228 management agencies be designated for plan implementation purposes as set forth in Chapter XVII. All but 44 of these agencies currently exist. The 44 new agencies would be sanitary, utility, and/or lake protection and rehabilitation districts required to carry out a variety of plan implementation responsibilities in direct drainage areas to lakes or, in a few instances, to isolated enclaves of urban development within unincorporated towns. A total of 139 management agencies are proposed to be designated for point source pollution abatement purposes, while 194 management agencies are proposed to be designated for nonpoint source pollution abatement purposes, and 124 management agencies for lake management purposes. These designated management agencies are set forth in Table XVIII-11.

The plan implementation program includes the establishment of a continuing areawide water quality management planning effort. As the designated Section 208 water quality management planning agency, the Commission would bear primary responsibility for the conduct of that effort under a program conducted cooperatively with the Wisconsin Department of Natural Resources. The plan recommends that, since such areawide water quality management planning must be carried on throughout the entire State of Wisconsin, funding for such continuing efforts be

Table XVIII-11

SUMMARY OF LOCAL GOVERNMENTAL MANAGEMENT AGENCY DESIGNATIONS FOR IMPLEMENTATION OF THE RECOMMENDED AREAWIDE WATER QUALITY MANAGEMENT PLAN FOR THE REGION

Designated Management Agency	Plan Implementation Responsibilities			
	Point Source Pollution Abatement	Urban Nonpoint Source Pollution Abatement	Rural Nonpoint Source Pollution Abatement	Lake Management
KENOSHA COUNTY				
Kenosha County	--	X	X	--
City of Kenosha	X	X	--	--
Village of Paddock Lake	X	X	--	--
Paddock Lake Inland Lake Protection and Rehabilitation District	--	X	--	X
Village of Pleasant Prairie	--	X	--	--
Sewer Utility District No. 1	X	--	--	--
Sewer Utility District D	X	--	--	--
Sewer Utility District F	X	--	--	--
Sanitary District No. 73-1	X	--	--	--
New District--Unnamed Quarry Lake	--	--	X	X
Village of Silver Lake	X	X	--	--
Village of Twin lakes	X	X	--	--
Twin Lakes Protection and Rehabilitation District	--	X	--	X
Town of Brighton				
Wisconsin Department of Natural Resources (East Lake Flowage)	--	--	X	X
Town of Bristol				
Utility District No. 1	X	X	--	--
Utility District No. 3	X	--	--	--
Utility District No. 4	X	--	--	--
George Lake Protection and Rehabilitation District	--	X	X	X
New District--Bennett/Shangrila Lakes	--	X	X	X
Town of Randall				
The Powers Lake Management District	--	X	X	X
New District--Powers-Benedict-Tombeau Lakes	X	--	--	--
New District--Benedict Lake	--	X	X	X
Town of Salem				
Sewer Utility District No. 1	X	X	X	--
Sewer Utility District No. 2	X	X	X	--
Camp and Center Lakes Rehabilitation District	--	X	--	X
Hooker Lake Management District	--	X	--	X
Voltz Lake Management District	--	X	--	X
Town of Somers	--	X	--	--
Sanitary District No. 1	X	--	--	--
Utility District No. 1	X	--	--	--
Town of Wheatland				
Lilly Lake Protection and Rehabilitation District	--	X	X	X
New District--Dyer Lake	--	--	X	X
MILWAUKEE COUNTY				
Milwaukee County	--	X	X	--
Milwaukee Metropolitan Sewerage District	X	--	--	--
City of Cudahy	X	X	--	--
City of Franklin	X	X	--	--
City of Glendale	X	X	--	--
City of Greenfield	X	X	--	--
City of Milwaukee	X	X	--	--
City of Oak Creek	X	X	--	--
City of St. Francis	X	X	--	--
City of South Milwaukee	X	X	--	--
City of Wauwatosa	X	X	--	--
City of West Allis	X	X	--	--
Village of Bayside	X	X	--	--
Village of Brown Deer	X	X	--	--
Village of Fox Point	X	X	--	--
Village of Greendale	X	X	--	--
Village of Hales Corners	X	X	--	--
Village of River Hills	X	X	--	--
Village of Shorewood	X	X	--	--
Village of West Milwaukee	X	X	--	--
Village of Whitefish Bay	X	X	--	--

Table XVIII-11 (cont'd)

Designated Management Agency	Plan Implementation Responsibilities			
	Point Source Pollution Abatement	Urban Nonpoint Source Pollution Abatement	Rural Nonpoint Source Pollution Abatement	Lake Management
OZAUKEE COUNTY				
Ozaukee County	--	X	X	--
City of Cedarburg	X	X	--	--
City of Mequon	X	X	--	--
New District--Lac du Cours	--	X	X	X
City of Port Washington	X	X	--	--
Village of Belgium	X	X	--	--
Village of Fredonia	X	X	--	--
New District--Spring Lake	--	X	X	X
Village of Grafton	X	X	--	--
Village of Saukville	X	X	--	--
Village of Thiensville	X	X	--	--
Town of Belgium				
New District--Lake Church	X	--	--	--
Town of Fredonia				
Waubeka Area Sanitary District	X	--	--	--
Town of Saukville				
New District--Mud Lake	--	--	X	X
RACINE COUNTY				
Wisconsin Department of Health and Social Services	X	--	--	--
Racine County	--	X	X	X
Western Racine County Sewerage District	X	--	--	--
City of Burlington	X	X	--	--
City of Racine	X	X	--	--
Village of Elmwood Park	X	X	--	--
Village of North Bay	X	X	--	--
Village of Rochester	X	X	--	--
Village of Sturtevant	X	X	--	--
Village of Union Grove	X	X	--	--
Village of Waterford	X	X	--	--
Village of Wind Point	--	X	--	
Town of Burlington				X
Browns Lake Sanitary District	X	X	X	X
Bohner Lake Sanitary District	X	X	X	X
New District--Long Lake	--	X	X	X
New District--Echo Lake	--	X	X	--
Town of Caledonia	--	X	--	--
Sewer Utility District No. 1	X	--	--	--
Caddy Vista Sanitary District	X	--	--	--
Crestview Sanitary District	X	--	--	--
North Park Sanitary District	X	--	--	
Town of Dover				X
Eagle Lake Sewer Utility District	X	X	X	--
Town of Mt. Pleasant	--	X	--	--
Sewer Utility District No. 1	X	--	--	--
Town of Norway				
Sanitary District No. 1	X	X	X	--
Wind Lake Management District	--	X	--	X
Town of Rochester				
Sewer Utility District No. 1	X	X	--	--
Town of Waterford				
Sanitary District No. 1	X	X	X	--
New District--Buena Lake	--	X	X	X
Town of Yorkville				
Sanitary District No. 1	X	X	--	--

Table XVIII-11 (cont'd)

Designated Management Agency	Plan Implementation Responsibilities			
	Point Source Pollution Abatement	Urban Nonpoint Source Pollution Abatement	Rural Nonpoint Source Pollution Abatement	Lake Management
WALWORTH COUNTY				
Walworth County	X	X	X	--
Walworth County Metropolitan Sewerage District	X	--	--	--
Fontana-Walworth Water Pollution Control Commission	X	--	--	--
Geneva Lake Environmental Agency	--	X	X	X
City of Delavan	X	X	--	--
City of Elkhorn	X	X	--	--
City of Lake Geneva	X	X	--	--
City of Whitewater	X	X	--	--
New District--Tripp Lake	--	X	X	X
Village of Darien	X	X	--	--
Village of East Troy	X	X	--	--
Village of Fontana	X	X	--	--
Village of Genoa City	X	X	--	--
Village of Sharon	X	X	--	--
Village of Walworth	X	X	--	--
Village of Williams Bay	X	X	--	--
Town of Bloomfield				
Pell Lake Sanitary District	X	X	X	X
Town of Delavan				
Delavan Lake Sanitary District	X	X	X	X
Geneva National Sanitary District	X	--	--	--
Town of East Troy				
Sanitary District No. 1	--	X	X	--
Sanitary District No. 2	X	X	X	--
Beulah Lake Sanitary District	--	X	X	X
Pattens Lake Protection and Rehabilitation District	--	X	X	X
New District--Army Lake	X	X	X	X
Town of Geneva				
New District--Como Lake	X	X	X	X
Town of La Grange				
Lauderdale Lakes Management District	--	X	X	X
Pleasant Lake Protection and Rehabilitation District	--	X	X	X
New District--LaGrange Lake	--	X	X	X
Town of Linn				
Sanitary District	X	X	X	--
Town of Lyons				
Sanitary District No. 2	X	--	--	--
Town of Richmond				
New District--Lake Loraine	--	X	X	X
New District--Turtle Lake	--	X	X	X
Town of Spring Prairie				
Honey Lake Protection and Rehabilitation District	--	X	X	X
Town of Sugar Creek				
New District--North Lake	--	X	X	X
New District--Silver Lake	--	X	X	X
New District--Wandawega Lake	--	X	X	X
Town of Troy				
New District--Booth Lake	X	X	X	X
New District--Lulu Lake	--	X	X	X
New District--Peters Lake	--	X	X	X
Town of Walworth				
Utility District No. 1	X	--	--	--
Town of Whitewater				
Whitewater-Rice Lakes Management District	--	X	X	X
New District--Cravath Lake	--	X	X	X

Table XVIII-11 (cont'd)

Designated Management Agency	Plan Implementation Responsibilities			
	Point Source Pollution Abatement	Urban Nonpoint Source Pollution Abatement	Rural Nonpoint Source Pollution Abatement	Lake Management
WASHINGTON COUNTY				
Washington County	--	X	X	--
City of Hartford	X	X	--	--
City of West Bend	X	X	--	--
New District--Barton Pond	--	X	X	X
Village of Germantown	X	X	--	--
Village of Jackson	X	X	--	--
Village of Kewaskum	X	X	--	--
Village of Newburg	X	X	--	--
Village of Slinger	X	X	--	--
Town of Addison				
Allenton Sanitary District No. 1	X	X	--	--
Town of Barton				
New District--Smith Lake	--	X	X	X
Town of Erin				
Druid Lake Protection and Rehabilitation District	--	X	X	X
Town of Farmington				
New District--Green Lake	--	X	X	X
New District--Lake Twelve	--	X	X	X
Town of Hartford				
Pike Lake Sanitary District	X	--	--	--
New District--Pike Lake	--	X	X	X
Town of Richfield				
Richfield Sanitary District	--	X	X	--
New District--Bark Lake	--	X	X	X
New District--Freiss Lake	--	X	X	X
New District--Lake Five	--	X	X	X
Town of Trenton				
Wallace Lake Sanitary District	X	X	X	X
Town of West Bend				
Big Cedar Lake Sanitary District	--	X	X	--
Big Cedar Lake District	--	X	X	X
Little Cedar Lake District	--	X	X	X
Silver Lake District	X	X	X	X
New District--Lucas Lake	--	X	X	X
WAUKESHA COUNTY				
Waukesha County	X	X	X	--
Delafield-Hartland Water Pollution Control Commission	X	--	--	--
City of Brookfield	X	X	--	--
City of Delafield	X	X	--	--
City of Muskego	X	X	--	--
Big Muskego Lake-Bass Bay Protection and Rehabilitation District	--	X	X	X
Little Muskego Lake Protection and Rehabilitation District	--	X	--	X
City of New Berlin	X	X	--	--
City of Oconomowoc	X	X	--	--
Fowler Lake Management District	--	X	--	X
City of Waukesha	X	X	--	--
Village of Big Bend	--	X	--	--
Village of Butler	X	X	--	--
Village of Chenequa	X	X	--	--
Village of Dousman	X	X	--	--
Village of Eagle	--	X	--	--
Village of Elm Grove	X	X	--	--
Village of Hartland	X	X	--	--

Table XVIII-11 (cont'd)

Designated Management Agency	Plan Implementation Responsibilities			
	Point Source Pollution Abatement	Urban Nonpoint Source Pollution Abatement	Rural Nonpoint Source Pollution Abatement	Lake Management
WAUKESHA COUNTY (continued)				
Village of Lac La Belle	X	X	--	--
Village of Lannon	X	X	--	--
Village of Menomonee Falls	X	X	--	--
Village of Merton	--	X	--	--
Village of Mukwonago	X	X	--	--
Village of Nashotah	X	X	--	--
Village of North Prairie	X	X	--	--
Village of Oconomowoc Lake	X	X	--	--
Village of Pewaukee	X	X	--	--
Village of Sussex	X	X	--	--
Village of Wales	X	X	--	--
Town of Brookfield	X	X	--	--
Town of Delafield	--	X	--	--
Town of Eagle				
Eagle Spring Lake Rehabilitation & Protection District	X	X	X	X
Town of Genesee	--	X	--	--
Town of Lisbon	--	X	--	--
Sanitary District No. 1	X	--	--	--
Town of Merton				
North Lake Management District	--	X	X	X
New District--North Lake	X	--	--	--
New District--Beaver Lake	X	X	X	X
New District--Moose Lake	X	X	X	X
Lake Keesus Management District	--	X	X	X
Town of Mukwonago				
Phantom Lakes Protection and Rehabilitation District	--	X	X	X
New District--Spring Lake	--	X	X	X
Town of Oconomowoc				
Mary Lane Sanitary District	X	--	--	--
Blackhawk Drive Sanitary District	X	--	--	--
Lac La Belle Management District	--	X	X	X
New District--Oconomowoc Lake	--	X	X	X
Okauchee Lake Management District	--	X	X	X
New District--Okauchee Lake	X	--	--	--
Ashippun Lake Protection and Rehabilitation District	--	X	X	X
Town of Ottawa				
Pretty Lake Protection and Rehabilitation District	--	X	X	X
School Section Lake Protection and Rehabilitation District	--	X	X	X
Town of Pewaukee	--	X	--	X
Sanitary District No. 3	X	--	--	--
Pewaukee Lake Sanitary District	X	X	--	X
Town of Summit	--	X	--	--
Middle Genesee Lake Management District	--	X	X	X
Upper Nemahbin Lake Management District	--	X	--	X
New District--Upper Nashotah Lake	--	X	X	X
New District--Crooked Lake	--	X	X	X
New District--Nashotah-Nemahbin Lakes	X	--	--	--
New District--Silver Lake	X	--	--	--
Town of Vernon	--	X	--	--
Town of Waukesha	--	X	--	--

Source: SEWRPC.

provided directly by the State of Wisconsin through the Department of Natural Resources.

MAJOR WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

Several major issues relating to water quality management policies and programs were raised and highlighted during the conduct of the areawide water quality management plan updating program for Southeastern Wisconsin. These issues relateto the need for further subregional sewer service area sewerage system plans; the evaluation of water use objectives in specific stream reaches; and the evaluation of specific water quality trends. These issues could not be specifically addressed in the updating process since the data collection and analyses required could only be accomplished under a subsequent subregional planning effort; because of the need for the collection of extensive water quality and biological monitoring data; and because local intergovernmental agreements on the issue had not yet been achieved to allow for incorporation of an amendment into the regional plan to address the issues. It is recommended that these issues be addressed on a case-by-case basis under the continuing water quality management planning program for Southeastern Wisconsin. Amendments to the plan relating to these issues would then be developed, as appropriate, following the public hearing process. These issues are summarized below.

Sewer Service Areas and Sewerage System Evaluations

In the greater Kenosha area, the implementation of the findings and recommendations set forth in the system level plan documented in the report prepared by Ruekert & Mielke, Inc., entitled A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Kenosha Area, October 1991, remains to be resolved. The recommendations of that plan include revisions to the planned sewer service areas in the greater Kenosha area and provisions to abandon the two existing sewage treatment plants operated by the Village of Pleasant Prairie, with the areas served by these plants being connected to the City of Kenosha sewerage system for treatment purposes, as described in Chapter IV. As of December 1994, the intergovernmental agreements needed to proceed with an amendment of the regional water quality management plan to incorporate the findings of the 1991 system plan had not been forthcoming. An amendment to the plan continues to be needed in this regard.

In the greater Racine area, the implementation of the findings and recommendations set forth in the system level plan documented in the report prepared by Alvord, Burdick, and Howson, entitled A Coordinated Sanitary Sewerage and Water Supply System Plan, Greater Racine Area, September 1992, remains to be resolved. The recommendations of that plan include revisions to the planned sewer service areas in the greater Racine area and provisions to abandon the existing sewage treatment plant operated by the Town of Yorkville Utility District No. 1, with the area served by this plant being connected to the City of Racine sewerage system for treatment purposes, as described in Chapter XII. As of December 1994, the intergovernmental agreements needed to proceed with an amendment of the regional water quality management plan to incorporate the findings of the 1992 system plan had not been forthcoming. An amendment to the plan continues to be needed in this regard.

In the Fox River watershed, based upon local facility planning, land use decisions, and identified onsite sewerage system problems, there is a need to

conduct subsequent subregional sewerage system evaluations for five specific areas: the Village of North Prairie and environs in Waukesha County;[17] the Benedict, Tombeau, and Powers Lakes area in Kenosha County;[18] the Pell Lake area in Walworth County;[19] the Village of Big Bend and Town of Vernon areas in Waukesha County; and the Town of Wheatland-Silver Lake area in Kenosha County.[20] Subregional studies potentially leading to formal amendments to the regional water quality management plan are recommended to be conducted as budgeting and local support becomes available. The subregional planning program for the Powers-Benedict-Tombeau Lakes area and the Pell Lake area has been completed and an amendment[21] has been incorporated into the plan to reflect the findings of that planning program, following public information meetings and a public hearing on the matter. The results of that amendment are reflected in the plan update as summarized in this chapter. In addition, an amendment to the regional water quality management plan for the Bohner Lake area was completed in June 1994.[22] That amendment serves to add the urban development around Bohner Lake to the planned sewer service area of the City of Burlington based upon local facility planning studies.

In the Rock River watershed, the Regional Planning Commission has, at the request of and in cooperation with local units of government in northwestern Waukesha County, prepared a Prospectus for the Preparation of A Sanitary Sewerage System Plan for the Northwestern Waukesha County Area. The prospectus documents the need for conducting a system level sewerage system planning program for the northwestern Waukesha County area. In addition, the prospectus sets forth the planning program required to prepare a coordinated sanitary sewerage system plan for the area concerned. The plan is intended to address the intergovernmental, administrative, legal, and fiscal problems inherent in the development of the planned sewerage system, or systems, as well as to identify the configuration, capacity, and level of treatment to be provided by the planned sewerage system, or systems. Work is expected to be initiated on this subregional system during the first half of 1995.

Evaluation of Water Use Objectives

Based upon the inventory and analyses conducted, there are a number of stream reaches within the Region where it is recommended that the Wisconsin Department of Natural Resources consider changing the current adopted State stream classifi-

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[17]Ruekert & Mielke, Inc., Village of North Prairie Wastewater Facility Plan, Phase One, July 1986; Phase Two, December 1989.

[18]Crispell-Snyder, Inc., Powers, Benedict, and Tombeau Lakes Facility Plan, May 1992.

[19]Baxter & Woodman, Inc., Pell Lake Sanitary Facilities Planning Report, June 1993.

[20]Ruekert & Mielke, Inc., Town of Wheatland Facility Plan, September 1992.

[21]SEWRPC Amendment, Pell Lake Area and Powers-Benedict-Tombeau Lakes Area, Kenosha and Walworth Counties, December 1994.

[22]Crispell-Snyder, Inc., Bohner Lake Facilities Plan, May 1992.

cations. In some cases, the recommendation for upgrading has been to either a warmwater sport fish community or warmwater forage fish community. In these cases, detailed field inventories of the physical characteristics of the stream channel are required to make the distinction. The stream reaches for which it is recommended that a reevaluation of the current adopted stream classifications be reconsidered are listed in Table XVIII-12.

Evaluation of Specific Water Quality Trends

Increases in levels of chloride over the period of 1976 to 1993 were noted in selected stream reaches within the Region, including the lower reaches of the Fox River and the free-flowing portion of the Milwaukee River. These apparent increases in chloride levels may potentially be a result of increased urban development within the Region. The construction of additional streets and highways associated with increased urban development has the potential to contribute a greater amount of runoff from winter road maintenance to surface waters. While none of the chloride levels observed at the long-term monitoring stations violated the standard as set forth in Chapter II, it is recommended that chloride levels continue to be monitored on a long-term continual basis to assess the extent of further increases.

SUMMARY AND CONCLUSION

The areawide water quality management plan provides another important element of the evolving comprehensive plan for the physical development of the seven-county Southeastern Wisconsin Region, and thereby provides a sound basis for the social and economic development of the Region. Together with the adopted regional land use and regional park and open space plans, the areawide water quality management plan provides the Region and its public officials and citizens with a sound coordinated guide to land use development and pollution abatement.

Of the 1,223 stream miles assessed under this planning effort, 148 miles, or 12 percent, are estimated to currently be fully meeting the recommended water use objectives. The majority of the streams studied--773 miles, or 63 percent--are estimated to be partially meeting the recommended water use objectives. About 50 stream miles, or 4 percent, are estimated to be not meeting the water use objectives. For 252 stream miles, or 21 percent of the total stream miles, no data were available to assess the potential level of achievement of the water use objectives. For those streams which are not estimated to be meeting the recommended water use objectives, it was generally found that the phosphorus and fecal coliform levels exceeded the water quality standards. In some limited reaches, it was found that dissolved oxygen, un-ionized ammonia nitrogen, and metals levels also did not meet the standards some of the time. Chloride levels were generally found to meet the standards but were noted to be increasing over time in the lower reaches of some of the major streams.

Adequate water quality and biological condition data to evaluate long-term trends in water quality conditions were available for about 105 miles, or 9 percent of the stream miles in the Region. The available data indicate that water quality conditions have improved for selected stream reaches in the Region, totaling 60 stream miles, or about 57 percent of those streams for which data were available. The data also indicate that water quality conditions have deteriorated in short reaches, totaling about four miles, or 4 percent of the stream miles for which data were available. For 41 miles of stream, or 39 percent of the stream miles

Table XVIII-12

STREAM REACHES FOR WHICH REVISIONS TO THE WISCONSIN DEPARTMENT OF NATURAL RESOURCES WATER USE OBJECTIVES ARE RECOMMENDED TO BE CONSIDERED

Watershed	Stream Reach	Wisconsin Department of Natural Resources Water Use Objective	SEWRPC-Recommended Water Use Objective	Rationale for Change Recommended by SEWRPC
Des Plaines River	Salem Branch	Limited Forage Fish Community	Warmwater Sport Fish or Warmwater Forage Fish Community	Town of Salem Utility District No. 1 sewage treatment plant abandoned
	Pleasant Prairie tributary	Limited Forage Fish Community	Warmwater Forage Fish Community	Upgrading or abandonment of the Village of Pleasant Prairie Sewer Utility District 'D' sewage treatment plant is expected to result in a water quality sufficient to permit the assignment of a higher water use objective
Fox River	Eagle Creek d/s CTH J	Limited Forage Fish Community	Warmwater Sport Fish Community	Implementation of the planned water pollution abatement measures is expected to result in a water quality sufficient to permit the assignment of a higher water use objective
	Eagle Creek u/s CTH J	Limited Aquatic Life	Warmwater Sport Fish Community	Implementation of the planned water pollution abatement measures is expected to result in a water quality sufficient to permit the assignment of a higher water use objective
	Deer Creek	Limited Aquatic Life	Warmwater Sport Fish Community	Stream appraisals and surveys support the assignment of a higher water use objective
	Poplar Creek d/s C&NW Railroad	Limited Forage Fish Community	Warmwater Sport Fish Community	Stream appraisals and surveys support the assignment of a higher water use objective
	Poplar Creek u/s C&NW Railroad	Limited Aquatic Life	Warmwater Sport Fish Community	Stream appraisals and surveys support the assignment of a higher water use objective
Rock River	Sharon Creek	Limited Forage Fish Community	Warmwater Forage Fish Community	Implementation of the planned water pollution abatement measures is expected to result in a water quality sufficient to permit the assignment of a higher water use objective
	Darien Creek	Limited Forage Fish Community	Warmwater Forage Fish Community	Abandonment of the Village of Darien sewage treatment plant is expected to result in a water quality sufficient to permit the assignment of a higher water use objective
	Rubicon River d/s tributary confluence in NE ¼ Section 13	Limited Forage Fish Community	Rubicon River d/s Hilldale Road: Warmwater Sport Fish Community	Implementation of the planned water pollution abatement measures is expected to result in a water quality sufficient to permit the assignment of a higher water use objective
	Rubicon River u/s tributary confluence in NE ¼ Section 13	Limited Aquatic Life	Rubicon River u/s Hilldale Road: Warmwater Forage Fish Community	Implementation of the planned water pollution abatement measures is expected to result in a water quality sufficient to permit the assignment of a higher water use objective

Table XVIII-12 (cont'd)

Watershed	Stream Reach	Wisconsin Department of Natural Resources Water Use Objective	SEWRPC-Recommended Water Use Objective	Rationale for Change Recommended by SEWRPC
Root River	Hoods Creek	Limited Forage Fish Community	Warmwater Forage Fish Community	Implementation of the planned water pollution abatement measures is expected to result in a water quality sufficient to permit the assignment of a higher water use objective
	Tess Corners Creek	Limited Forage Fish Community	Warmwater Forage Fish Community	Implementation of the planned water pollution abatement measures is expected to result in a water quality sufficient to permit the assignment of a higher water use objective
Sheboygan River	East Branch Belgium Creek	Limited Aquatic Life	Warmwater Sport Fish Community	Upgrading of the Village of Belgium sewage treatment plant is expected to result in a water quality sufficient to permit the assignment of a higher water use objective

Source: Wisconsin Department of Natural Resources and SEWRPC.

for which data were available, the data indicate that no significant changes in water quality conditions have occurred. For 1,118 miles of stream, or 91 percent of the stream miles in the Region, the available data were not adequate to characterize the long-term trends in water quality conditions. It should benoted that adequate long-term data were available for only a relatively small percentage of the stream mileage within the Region. The streams for which data did exist included the main stem reaches of the major rivers which traverse the most highly urbanized areas of the Region and thus are the most susceptible to water pollution from urban sources, and for which a knowledge of current conditions and trends within the Region is most important.

Current available lake water quality data were compared with available lake monitoring data collected prior to 1981 to determine any potential changes in lake water quality over time. Comparative data were available for 44 of the 101 major lakes in the Region. The data indicate that 10 of the 44 major lakes for which comparative data were available exhibited an improvement in lake water quality since the initial plan. For 34 lakes where comparative water chemistry data are available, water quality conditions appeared to be unchanged. Comparative water quality data was not available for the remaining 57 major lakes in the Region.

Available current water quality indicate that about 24, or about 35 percent, of the 69 lakes for which data were available have an estimated water quality which indicates that the recommended water use objectives are likely to be met. The available data indicate that 45 lakes, or 65 percent of the lakes for which data were available, do not fully meet the recommended water use objectives. No data were available for 32 of the major lakes in the Region.

The water quality management analyses conducted by the Commission under the plan update have indicated the recommendations for control at the major point sources of pollution in the Region developed in the initial plan have been largely implemented. However, only limited implementation has been achieved with regard to the nonpoint source pollution recommendations included in the initial plan. Significant additional effort will have to be mounted to abate pollution from nonpoint sources in both rural and urban areas. Such pollution control efforts are likely to be more difficult to bring about than point source pollution control measures, and will require an enlightened public for implementation. In addition, in order to assess water quality conditions in the Region and to measure the degree of improvement in those conditions, and in order to provide a sound basis to refine the recommendations contained herein in the future, it will be necessary to carry out a long-term water quality and biological monitoring program throughout the Region.

The updated water quality management plan includes definitive recommendations for land use development; for the establishment of sewer service areas; for the configuration and sizing of major trunk sewers; for the number and location of sewage treatment plants; for the abatement of pollution from sanitary sewer flow relief devices; and for reduction levels in nonpoint source pollutants from both urban and rural land. Within the context of the overall regional program, the updated recommended regional water quality management plan should meet all applicable Federal and State planning requirements and thereby should be able to continue to serve as the official regional water quality management plan of the Region. As such, the plan should serve as a sound basis for the approval of

waste discharge permits and State and Federal grants-in-aid. It is recognized that the plan recommendations will need to be further refined and detailed through preparation at the local governmental level of specific facilities and practices plans. In this respect, the plan should serve as a sound point of departure for the necessary local studies. Most importantly, implementation of the plan will contribute toward enhancing the overall quality of the environment in the Region and thereby contribute toward making the Region a safer, more healthful, and more attractive area in which to live and work.

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APPENDICES

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Appendix A

NONPOINT SOURCE POLLUTION CONTROL, STREAM CHANNEL REHABILITATION AND LAKE REHABILITATION MEASURES--REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

NONPOINT SOURCE POLLUTION CONTROL MEASURES

Nonpoint, or diffuse, sources of water pollution include urban sources such as runoff from residential, commercial, industrial, transportation, and recreational land uses; construction activities; and onsite sewage disposal systems and rural sources such as runoff from cropland, pasture, and woodland, atmospheric contributions, and livestock wastes. These sources of pollutants discharge to surface waters by direct overland drainage, by drainage through natural channels, by drainage through engineered stormwater drainage systems, and by deep percolation into the ground and subsequent return flow to the surface waters.

A summary of the methods and estimated effectiveness of nonpoint source water pollution control measures is set forth in Table A-1. These measures have been grouped for planning purposes into two categories: basic practices and additional. Application of the basic practices will have a variable effectiveness in terms of control level of pollution control depending upon the subwatershed area characteristics and the pollutant considered. The additional category of nonpoint source control measures has been subdivided into four subcategories based upon the relative effectiveness and costs of the measures. The first subcategory of practices can be expected to generally result in an about 25 percent reduction in pollutant runoff. The second and third subcategory of practices, when applied in combination with the minimum and additional practices, can be expected to generally result in up to a to and 75 percent reduction in pollutant runoff, respectively. The fourth subcategory would consist of all of the preceding practices, plus those additional practices that would be required to achieve a reduction in ultimate runoff of more than 75 percent.

Table A-1 sets forth the diffuse source control measures applicable to general land uses and diffuse source activities, along with the estimated maximum level of pollution reduction which may be expected upon implementation of the applicable measures. The Table also includes information pertaining to the costs of developing the alternatives set forth in this chapter.[1] These various individual nonpoint source control practices are summarized by group in Table A-2.

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[1] Costs are presented in more detail in the following SEWRPC Technical Reports: No. 18, State of the Art of Water Pollution Control in Southeastern Wisconsin, Volume three: Urban Storm Water Runoff, July 1977; No. 18, State of the Art of Water Pollution Control in Southeastern Wisconsin, Volume four: Rural Storm Water Runoff, December 1976; and No. 31, Costs of Urban Nonpoint Source Water Pollution Control Measures, June 1991.

Table A-1

GENERALIZED SUMMARY OF METHODS AND EFFECTIVENESS OF DIFFUSE SOURCE WATER POLLUTION CONTROL MEASURES

Applicable Land Use	Control Measures[a]	Summary Description	Approximate Percent Reduction of Released Pollutants[b]	Assumptions for Costing Purposes
Urban	Litter and pet waste control ordinance	Prevent the accumulation of litter and pet waste on streets and residential, commercial, industrial, and recreational areas	2-5	Ordinance administration and enforcement costs are expected to be funded by violation penalties and related revenues
	Improved timing and efficiency of street sweeping, leaf collection and disposal, and catch basin cleaning	Improve the scheduling of these public works activities, modify work habits of personnel, and select equipment to maximize the effectiveness of these existing pollution control measures	2-5	No significant increase in current expenditures is expected
	Management of onsite sewage treatment systems	Regulate septic system installation, monitoring, location, and performance; replace failing systems with new septic systems or alternative treatment facilities; develop alternatives to septic systems; eliminate direct connections to drain tiles or ditches; dispose of septage at sewage treatment facility	10-30	Replace one-half of estimated existing failing septic systems with properly located and installed systems and replace one-half with alternative systems, such as mound systems or holding tanks; all existing and proposed onsite sewage treatment systems are assumed to be properly maintained; assume system life of 25 years. The estimated cost of a septic tank system is $5,000-$6,000 and the cost of an alternative system is $10,000. The annual maintenance cost of a disposal system is $250. An in-ground pressure system is estimated to cost $6,000-$10,000 with an annual operation and maintenance cost of $250. A holding tank would cost $5,500-$6,500 with an annual operation and maintenance cost of $1,800.
	Increased street sweeping	On the average, sweep all streets in urban areas an equivalent of once or twice a week with vacuum street sweepers; require parking restrictions to permit access to curb areas; sweep all streets at least eight months per year; sweep commercial and industrial areas with greater frequency than residential areas	30-50	Estimate curb miles based on land use, estimated street acreage, and Commission transportation planning standards; assume one street sweeper can sweep 2,000 curb miles per year; assume sweeper life of 10 years; assume residential areas swept once weekly, commercial and industrial areas swept twice weekly. The cost of a vacuum street sweeper is approximately $120,000. The cost of the operation and maintenance of a sweeper is about $25 per curb/mile swept.

Table A-1 (continued)

Applicable Land Use	Control Measures[a]	Summary Description	Approximate Percent Reduction of Released Pollutants[b]	Assumptions for Costing Purposes
Urban (continued)	Increased leaf and clippings collection and disposal	Increase the frequency and efficiency of leaf collection procedures in fall; use vacuum cleaners to collect leaves; implement ordinances for leaves, clippings, and other organic debris to be mulched, composted, or bagged for pickup	2-5	Assume one equivalent mature tree per residence plus five trees per acre in recreational areas; 75 pounds of leaves per tree; 20 percent of leaves in urban areas not currently disposed of properly. The cost of the collection of leaves in a vacuum sweeper and disposal is estimated at $180-$200 per ton of leaves
	Increased catch basin cleaning	Increase frequency and efficiency of catch basin cleaning; clean at least twice per year using vacuum cleaners; catch basin installation in new urban development not recommended as a cost-effective practice for water quality improvement	2-5	Determine curb miles for street sweeping; vary percent of urban area served by catch basins by watershed from Commission inventory data; assume density of 10 catch basins per curb mile; clean each basin twice annually by vacuum cleaner. The cost of cleaning a catch basin is approximately $10.
	Reduced use of deicing salt	Reduce use of deicing salt on streets; salt only intersections and problem areas; prevent excessive use of sand and other abrasives	Negligible for pollutants addressed in this plan but helpful for reducing chlorides and associated damage to vegetation	Increased costs, such as for slower transportation movement, are expected to be offset by benefits such as reduced automobile corrosion and damage to vegetation
	Improved street maintenance and refuse collection and disposal	Increase street maintenance and repairs; increase provision of trash receptacles in public areas; improve trash collection schedule; increase cleanup of parks and commercial centers	2-5	Increase current expenditures by approximately 15 percent
	Parking lot stormwater temporary storage and treatment measures	Construct gravel-filled trenches, sediment basins, or similar measures to store temporarily the runoff from parking lots, rooftops, and other large impervious areas; if treatment is necessary, use a physical-chemical treatment measure such as screens, dissolved air flotation, or a swirl concentrator	5-10	Design gravel-filled trenches for 24-hour, five year recurrence interval storm; apply to off-street parking acreages. For treatment--assume four-hour detention time. The capital cost of stormwater detention and treatment facilities is estimated at $40,000-$80,000 per acre of parking lot area, with an annual operation and maintenance cost of about $200 per acre
	Onsite storage--residential	Remove connections to sewer systems; construction onsite stormwater storage measures for subdivisions	5-10	Remove roof drains and other connections from sewer system wherever needed; use lawn aeration if applicable; apply dutch drain storage facilities to 15 percent of residences. The capital cost would approximate $500 per house, with an annual maintenance cost of about $25

Table A-1 (continued)

Applicable Land Use	Control Measures[a]	Summary Description	Approximate Percent Reduction of Released Pollutants[b]	Assumptions for Costing Purposes
Urban (continued)	Stormwater infiltration--urban	Construct gravel-filled trenches for areas of less than 10 acres or basins to collect and store temporarily stormwater runoff to reduce volume, provide groundwater recharge and augment low stream flows	45-90	Design gravel-filled trenches or basins to store the first 0.5 inch of runoff; provide at least a 25-foot grass buffer strip to reduce sediment loadings. The capital cost of a stormwater infiltration is estimated at $12,000 for a six-foot deep, 10-foot wide trench, and at $70,000 for a one-acre basin, with an annual maintenance cost of about $10-$350 for the trench, and of about $2,500 for the basin
	Stormwater storage--urban	Store stormwater runoff from urban land in surface storage basins or, where necessary, subsurface storage basins	10-35	Design all storage facilities for a 1.5 inch of runoff event, which corresponds approximately to a five-year recurrence interval event with a storm event being defined as a period of precipitation with a minimum antecedent and subsequent dry period of from 12 to 24 hours; apply subsurface storage tanks to intensively developed existing urban areas where suitable open land for surface storage is unavailable; design surface storage basins for proposed new urban land, existing urban land not storm sewered, and existing urban land where adequate open space is available at the storm sewer discharge site. The capital cost for stormwater storage would range from $35,000 to $110,000 per acre of basin, with an annual operation and maintenance cost of about $40-$60 per acre
	Stormwater treatment	Provide physical-chemical treatment which includes screens, microstrainers, dissolved air flotation, swirl concentrator, or high-rate filtration, and/or disinfection, which may include chlorination, high-rate disinfection, or ozonation to stormwater following storage	10-50	To be applied only in combination with stormwater storage facilities above; general cost estimates for microstrainer treatment and ozonation were used; same costs were applied to existing urban land and proposed new urban development. Stormwater treatment has an estimated capital cost of from $900-$7,000 per acre of tributary drainage area, with an average annual operation and maintenance cost of about $35-$100 per acre

Table A-1 (continued)

Applicable Land Use	Control Measures[a]	Summary Description	Approximate Percent Reduction of Released Pollutants[b]	Assumptions for Costing Purposes
Rural	Conservation practices	Includes such practices as strip cropping, contour plowing, crop rotation, pasture management, critical area protection, grading and terracing, grassed waterways, diversions, wood for management, fertilization and pesticide management, and chisel tillage	Up to 50	Costs for Natural Resources Conservation Service (NRCS)-recommended practices are applied to agricultural and related rural land; the distribution and extent of the various practices were determined from an examination of 56 existing farm plan designs within the Region. The capital cost of conservation practices ranges from $3,000-$5,000 per acre of rural land, with an average annual operation and maintenance cost of from $5-$10 per rural acre
	Animal waste control system	Construct stream bank fencing and crossovers to prevent access of all livestock to waterways; construct a runoff control system or a manure storage facility, as needed, for major livestock operations; prevent improper applications of manure on frozen ground, near surface drainageways, and on steep slopes; incorporate manure into soil	50-75	Cost estimated per animal unit; animal waste storage (liquid and slurry tank for costing purposes) facilities are recommended for all major animal operations within 500 feet of surface water and located in areas identified as having relatively high potential for severe pollution problems. Runoff control systems recommended for all other major animal operations. It is recognized that dry manure stacking facilities are significantly less expensive than liquid and slurry storage tanks and may be adequate waste storage systems in many instances. The estimated capital cost and average operation and maintenance cost of a runoff control system is $100 per animal unit and $25 per animal unit, respectively. The capital cost of a liquid and slurry storage facility is about $1,000 per animal unit, with an annual operation and maintenance cost of about $75 per unit. An animal unit is the weight equivalent of a 1,000-pound cow

Table A-1 (continued)

Applicable Land Use	Control Measures[a]	Summary Description	Approximate Percent Reduction of Released Pollutants[b]	Assumptions for Costing Purposes
Rural (continued)	Base-of-slope detention storage	Store runoff from agricultural land to allow solids to settle out and reduce peak runoff rates. Berms could be constructed parallel to streams	50-75	Construct a low earthen berm at the base of agricultural fields, along the edge of a floodplain, wetland, or other sensitive area; design for 24-hour, 10-year recurrence interval storm; berm height about four feet. Apply where needed in addition to basic conservation practices; repair berm every 10 years and remove sediment and spread on land. The estimated capital cost of base-of-slope detention storage would be about $500 per tributary acre, with an annual operation and maintenance cost of $25 per acre.
	Bench terraces	Construct bench terraces, thereby reducing the need for many other conservation practices on sloping agricultural land	75-90	Apply to all appropriate agricultural lands for a maximum level of pollution control. Utilization of this practice would exclude installation of many basic conservation practices and base-of-slope detention storage. The capital cost of bench terraces is estimated at $1,500 per acre, with an annual operation and maintenance cost of $100 per acre
Urban and Rural	Public education programs	Conduct regional- and county-level public education programs to inform the public and provide technical information on the need for proper land management practices on private land, the recommendations of management programs, and the effects of implemented measures; develop local awareness programs for citizens and public works officials; develop local contact and education efforts	Intermediate	For first 10 years includes cost of one person, materials, and support for each 25,000 population. Thereafter, the same cost can be applied to for every 50,000 population. The cost of one person, materials, and support is estimated at $55,000 per year
	Construction erosion control practices	Construct temporary sediment basins; install straw bale dikes; use fiber mats, mulching and seeding; install slope drains to stabilize steep slopes; construct temporary diversion swales or berms upslope from the project	20-40	Assume acreage under construction is the average annual incremental increase in urban acreage; apply costs for a typical erosion control program for a construction site. The estimated capital cost and operation and maintenance cost for construction erosion control is $250-$5,500 and $250-$1,500 per acre under construction, respectively.

Table A-1 (continued)

Applicable Land Use	Control Measures[a]	Summary Description	Approximate Percent Reduction of Released Pollutants[b]	Assumptions for Costing Purposes
Urban and Rural (continued)	Materials storage and runoff control facilities	Enclose industrial storage sites with diversions; divert runoff to acceptable outlet or storage facility; enclose salt piles and other large storage sites in crib and dome structures	5-10	Assume 40 percent of industrial areas are used for storage and to be enclosed by diversions; assume existing salt storage piles enclosed by cribs and dome structures. The estimated capital cost of industrial runoff control is $2,500 per acre of industrial land. Material storage control costs are estimated at $75 per ton of material
	Stream protection measures	Provide vegetative buffer zones along streams to filter direct pollutant runoff to the streams; construct stream bank protection measures, such as rock riprap, brush mats, tree revetment, jacks, and jetted willow poles where needed	5-10	Apply a 50-foot-wide vegetative buffer zone on each side of 15 percent of the stream length; apply stream bank protection measures to 5 percent of the stream length. Vegetative buffer zones are estimated to cost $21,200 per mile of stream, and streambank protection measures cost about $37,000 per stream mile
	Pesticide and fertilizer application restrictions	Match application rate to need; eliminate excessive applications and applications near or into surface water drainageways	0-3	Cost included in public education program
	Critical area protection	Emphasize control of areas bordering lakes and streams; correct obvious erosion and other pollution source problems	Intermediate	Intermediate

[a] Not all control measures are required for each subwatershed. The characteristics of the watershed, the estimated required level of pollution reduction needed to meet the applicable water quality standards, and other factors will influence the selection and estimation of costs of specific practices for any one subwatershed. Although the control measures costed represent the recommended practices developed at the regional level on the basis of the best available information, the local implementation process should provide more detailed data and identify more efficient and effective sets of practices to apply to local conditions.

[b] The approximate effectiveness refers to the estimated amount of pollution produced by the contributing category (urban or rural)that could be expected to be reduced by the implementation of the practice. The effectiveness rates would vary greatly depending on the characteristics of the watershed and individual diffuse sources. It should be further noted that practices can have only a "sequential" effect, since the percent pollution reduction of a second practice can only be applied against the residual pollutant load which is not controlled by the first practice. For example, two practices of 50 percent effectiveness would achieve a theoretical total effectiveness of only 75 percent control of the initial load. Further, the general levels of effectiveness reported in the table are not necessarily the same for all pollutants associated with each source. Some pollutants are transported by dissolving in water and others by attaching to solids in the water; the methods summarized here reflect typical pollutant removal levels.

[c] For highly urbanized areas which require retrofitting of facilities into developed areas, the costs can range from $400,000 to $1,000,000 per acre of storage.

Source: SEWRPC.

Table A-2

ALTERNATIVE GROUPS OF DIFFUSE SOURCE WATER POLLUTION CONTROL MEASURES PROPOSED FOR STREAMS AND LAKE WATER QUALITY MANAGEMENT

Pollution Control Category	Level of Pollution[b] Control	Practices to Control Diffuse Source Pollution from Urban Areas[c]	Practices to Control Diffuse Source Pollution from Rural Areas[b]
Basic Practices	Variable	Construction erosion control; onsite sewage disposal system management; streambank erosion control	Streambank erosion control
	25 percent	Public education programs; litter and pet waste control; restricted use of fertilizers and pesticides; construction erosion control; critical areas protection; improved timing and efficiency of street sweeping, leaf collection, and catch basin cleaning; material storage facilities and runoff control	Public education programs; fertilizer and pesticide management; critical area protection; crop residue management; chisel tillage; pasture management; contour plowing; livestock waste control
Additional Diffuse Source Control Practices[a]	50 percent	Above, plus: Increased street sweeping; improved street maintenance and refuse collection and disposal; increased catch basin cleaning; stream protection; increased leaf and vegetation debris collection and disposal; stormwater storage; stormwater infiltration	Above, plus: Crop rotation; contour strip-cropping; grass waterways; diversions; wind erosion controls; terraces; stream protection
	75 percent	Above, plus: An additional increase in street sweeping, stormwater storage and infiltration; additional parking lot stormwater runoff storage and treatment	Above, plus: Base-of-slope detention storage
	More than 75 percent	Above, plus: Urban stormwater treatment with physical-chemical and/or disinfection treatment measures	Bench terraces[c]

[a] In addition to diffuse source control measures, lake rehabilitation techniques may be required to satisfy lake water quality standards - see Table A-4.

[b] Groups of practices are presented here for general analysis purposes only. Not all practices are applicable to, or recommended for, all lake and stream tributary watersheds. For costing purposes, construction erosion control practices, public education programs, and material storage facilities and runoff controls are considered urban control measures and stream protection is considered a rural control measure.

[c] The provision of bench terraces would exclude most basic conversation practices and base-of-slope detention storage facilities.

Source: SEWRPC.

Of the sets of practices recommended for various levels of diffuse source pollution control presented in Table A-2, not all practices are needed, applicable, or cost-effective for all watersheds, due to variations in pollutant loadings and land use and natural conditions among the watersheds. Therefore, it is recommended that the practices indicated as needed for nonpoint source pollutant control be refined by local level nonpoint source control practices planning, which would be analogous to sewerage facilities planning for point source pollution abatement. A locally prepared plan for nonpoint abatement measures should be better able to blend knowledge of current problems and practices with a quickly evolving technology to achieve a suitable, site specific approach to pollution abatement.

STREAM CHANNEL REHABILITATION MEASURES

The ability of streams in southeastern Wisconsin to satisfy desired water use objectives is contingent on the tributary pollution loads to the stream and the instream characteristics. In recognizing the need to harmonize these two management aspects within a comprehensive water quality plan, the Commission proposes stream bank protection measures as a best management practice, in addition to land management measures. Stream bank protection measures--primarily designed to prevent erosion and preserve stream side vegetation--are most applicable to natural stream channels. However, portions of streams which flow through the highly urbanized areas of the Region--such as the Menomonee and Kinnickinnic River watersheds--have undergone major channel modifications. These channelized stream reaches require specialized management techniques to provide a suitable habitat for fish and other aquatic life which serve as important indicators of the chemical and biological condition of a stream.

Channel modifications--more commonly called channelization--may include one or more of the following major changes to the natural stream channel, all designed to increase the capacity of the channel: straightening, widening, and deepening; placement of a concrete invert and concrete sidewalls; and construction of culverts to carry the stream under roads and railroads as needed. In some instances, a completely new length of channel may be constructed so as to bypass a natural channel reach, as has been done for a portion of Underwood Creek in the City of Wauwatosa. The function of channel modifications or enclosures are to yield a lower, hydraulically more efficient waterway through which a given flood discharge can be conveyed at a much lower flood stage relative to that which would exist under natural or prechannelization conditions. However, modified channels are detrimental to the support of fish and aquatic life for the following reasons:

1. They eliminate habitat areas needed by fish, aquatic insects, and benthic organisms. These habitat areas provide food, shelter, and spawning substrate necessary for the support of fish and other aquatic animals.

2. They eliminate plant substrate. Besides providing food, shelter, and spawning substrate for aquatic animals, aquatic plants provide oxygen to the water, remove nutrients, and trap sediments and other pollutants. Plants also provide shade, thereby lowering the temperature of the stream.

3. Some structures and dams provide barriers to the migration of fish and other aquatic animals, often necessary for feeding, spawning, and colonization purposes.

In addition, the aesthetic qualities of modified channels are generally poor, thereby reducing recreational use potential. Temporary storage of pollutants within the stream channel is also minimized, thereby increasing the first flush pollutant load effects on downstream receiving waters. These factors indicate that habitat improvement techniques, in addition to water pollution control measures, may need to be implemented to satisfy fish and aquatic life objectives within these channelized stream reaches.

The basic approach to improving the biological potential of a modified stream channel is to: 1) provide protective areas where a suitable sediment substrate may at least temporarily accumulate; 2) increase vegetative growth; and 3) eliminate barriers to aquatic animal migration. Table A-3 presents a description of selected measures which could be used to increase the biological potential of existing and future modified channels. In addition to providing suitable habitat for aquatic life, stream channel rehabilitation enhances the aesthetic qualities of the stream and--through temporary sediment storage, aeration, increased shading, and biological nutrient uptake--improves the water quality of the stream. It is recognized that most of these rehabilitation measures by their nature decrease the hydraulic efficiency of the stream channel. However, in many cases the hydraulic efficiency could be maintained at a level which would not preclude achievement of flood control design. A site-specific study would be required to determine the potential of each stream reach to provide biological habitat and at the same time be acceptable for flood control purposes.

LAKE REHABILITATION MEASURES

The reduction of nutrient inputs to lakes in southeastern Wisconsin, while preventing further water quality deterioration, may not necessarily result in the elimination of existing water quality problems. The indicated water quality improvements expected from a reduced nutrient input will be inhibited or prevented by conditions which include, for example, in eutrophic lakes, the presence of continued mixing or an anaerobic hypolimnion (the lower layer of a stratified lake), which may release significant amounts of phosphorus from the sediments to the overlying water column. Similarly, rooted aquatic plants may continue to grow prolifically in nutrient-rich bottom sediments, regardless of the nutrient content of the overlying water. If this occurs, or if other characteristics of a lake result in a restricted water use potential, the application of lake rehabilitation techniques should be considered.

Lake rehabilitation techniques that are applicable to southeastern Wisconsin include dredging, sediment covering or consolidation, nutrient inactivation, hypolimnetic aeration, and total aeration. Other techniques, perhaps more properly classified as lake management practices, would include macrophyte harvesting or chemical control, algae chemical control, and fish management. The applicability of experimental techniques, such as biological control, selective discharge, algal harvesting, dilution/flushing, and inflow treatment, requires additional study. Many of these techniques require federal and/or state permits to be issued prior to implementation. A brief description of lake rehabilitation techniques is set forth in Table A-4.

Table A-3

SELECTED BIOLOGICAL LIFE HABITAT REHABILITATION MEASURES
FOR EXISTING AND PLANNED CHANNEL MODIFICATIONS

Rehabilitation Measure		Description and Application
Existing Modified Channels	Riffle and Pool Development	Use various methods below to create riffle-pool sequences. Riffles are sections of streams containing rocks, gravel, or other coarse substrate in which the current is swift enough to remove silt and sand. Riffles should occur at intervals equal to five to seven channel widths. A water depth of six inches is desirable. Riffles help aerate the stream and provide ideal biological habitat. Pools are deeper, slower sections of streams and provide valuable food and resting and refuge areas for fish. Pools ideally should be designed so that the sediments are not completely flushed out during storm events
	Installation of Low Gabion, Rock, or Concrete Check Dams	Low dams provide a pooling effect and accumulate sediment for biological habitat. Dams should be low enough to provide for fish migration
	Installation of Gabion or Rock Wing Deflectors	Wing deflectors provide a riffle-pool effect and accumulate sediment. They provide cover for fish and other aquatic life
	Use of Scattered Rocks	Installation of rocks create a riffle effect and provide cover for fish and other aquatic life. They also temporarily trap some sediment
	Vegetation Improvement	Plant erosion-resistant native grasses, shrubs, and trees as close as practical to the stream channel to provide cover, food supply, and shade. Provide buffer strip along channel
	Removal of Barriers to Migrating Species	Remove dams, drop structures, chutes, and steep grades which cannot be crossed by migrating fish and other aquatic life. Construct alternative grade control structures
Planned Modified Channels	Channel Section and Grade Design	The low flow channel cross-section should approach a natural stream condition. The bottom width of the channel and the channel grade can be varied to create a riffle-pool sequence
	Avoidance of Straight Channels	Constructed channels should be aligned as much as possible with the natural stream curvature
	Vegetation and Wetland Preservation	Preserve native vegetation and wetlands as much as possible to provide shade trees and shrubs and maintain the water quality, environmental, and aesthetic benefits of wetlands
	Installation of Channel Bank Reservoirs	Various storage measures may be incorporated into the channel bank design to temporarily store runoff, reduce size requirements for downstream channels, and accumulate sediment, thereby providing suitable biological habitat
	Avoidance of Barriers to Migrating Species	Do not construct steep drop structures which cannot be crossed by fish or other aquatic life
	Use of Construction Erosion Controls	Construction erosion controls are essential for channel modification projects. Stabilize the exposed surface, control runoff, and prevent sediment delivery to the stream

Source: SEWRPC.

Table A-4

DESCRIPTION OF LAKE REHABILITATION TECHNIQUES APPLICABLE TO SOUTHEASTERN WISCONSIN

Technique	Description and Effectiveness	Disadvantages
Dredging	Dredging is effective in deepening lakes. A hydraulic dredge is often used. Benefits are an increased depth, possible induced lake stratification, and reduced mixing of the sediments and water layers; removal of a suitable bottom substrata for macrophytes; improved navigation; and, if nutrient-poor sediments can be exposed, reduced nutrient release from sediments	Possible adverse environmental effects,[a] increased turbidity during operation, nutrient release from disturbed sediments, and high costs
Sediment Covering	Covering lake sediments may prevent release of nutrients and organic material from the sediments, prevent continued resuspension of the sediments, inhibit macrophyte growth by elimination of suitable bottom stabilization of sediments, and minimization of water loss via infiltration. Several cover materials have been proposed, including sand, clay, plastic, rubber, fly ash, and gels	Unknown ecological and environmental impacts, possible return of macrophytes if an organic layer is deposited above the covering, possible algal problems if macrophytes are eliminated, and questionable long-term effectiveness
Sediment Consolidation	This technique involves lake drawdown and sediment drying. The dewatering reduces the volume of sediments which are highly organic, and increases the lake depth. The effects are irreversible; the sediments will not expand upon lake refilling	Sediment chemical changes may occur, increasing nutrient release to the water
Nutrient Inactivation	This technique has worked effectively for stratified lakes. The treatment may convert nutrients into a form unavailable for plant uptake, remove nutrients from the water column, and prevent release of nutrients from the sediments. The most commonly used material is alum (an aluminum compound), although iron compounds, calcium compounds, ion exchange resins, fly ash, and clay have also been used. Application may be on ice surfaces or under ice cover, or through water surface broadcast or subsurface manifold injection. This technique is effective in reducing algal problems	Limited applicability
Hypolimnetic (bottom) Aeration	The intent of this technique is to increase the dissolved oxygen content in the hypolimnion of stratified lakes without destroying the stratification. Typically, bottom water is lifted to the surface via a vertical tube and oxygenated water is returned to the hypolimnion. The decomposition of organic matter is increased and nutrient release is decreased. Available habitat for desirable fish species may be increased	The ecological effects of aeration need to be more thoroughly addressed. The practice is too expensive to be feasible in lakes larger than one or two hundred acres in size

Table A-4 (continued)

Technique	Description and Effectiveness	Disadvantages
Total Aeration/Circulation	The prevention of fish winterkill and the destratification of lakes to provide oxygen to bottom layers are the primary intents of this technique. The general approach has been to circulate and thereby destratify lakes by pumping or injecting compressed air to the bottom water. The effect of destratification during winter is the maintenance of an open water area, which increases photosynthesis and oxygen diffusion from the air	Destratification could eliminate cold water areas during summer required for some fish species
Macrophyte (weed) Harvesting	Harvesting macrophytes with mechanical harvesters increases the recreational use potential of lakes subject to with excessive plant growth	The macrophytes must be harvested every year and disposal may be a problem. Some nutrients are removed from the lake but the amounts are usually minimal in terms of the total nutrient content of the lake
Chemical Control	Excessive macrophyte growths, algal blooms, and undesirable fish populations may be controlled by chemical treatment. It is most applicable in highly eutrophic lakes where nutrient loads cannot be sufficiently reduced and where severe water use restrictions occur	Because of the potential adverse effects of adding poisonous chemicals to lakes, this technique requires cautious use in only the most extreme circumstances
Inflow Treatment	It is possible to treat inflowing surface runoff by many of the same procedures recommended for treatment of urban runoff	Required high levels of sophisticated equipment and technical expertise and high costs have prevented the adequate demonstration of this technique
Dilution/Flushing	This technique involves the replacement of nutrient-rich lake water with nutrient-poor water from a stream or the groundwater. The method may be effective in reducing algal blooms	Long-term effects are questionable. Dilution/Flushing is probably not applicable to most lakes in the Region, which are characteristically shallow and contain nutrient-rich sediments
Selective Discharge	Selective discharge involves the release of nutrient-rich, anaerobic water from the hypolimnion of a eutrophic lake. Nutrient levels are reduced and dissolved oxygen in the hypolimnion is increased	Further research on the overall effectiveness of this technique is needed, and it appears that the water quality of downstream reaches would be adversely affected
Biological Controls	This technique is a highly desirable approach and is inexpensive. Techniques are generally categorized into predatory-prey relationships; species manipulation; and pathological reactions. Control organisms being evaluated include the white amur (grass carp), walleye, northern pike, snails, crayfish, waterfowl, insects, aquatic mammals, plant viruses, and fish parasites	This technique is still in the experimental stage and possible adverse environmental impacts could be substantial; grass carp are prohibited from being imported into Wisconsin

Source: Wisconsin Department of Natural Resources and SEWRPC.

The applicability of specific lake rehabilitation techniques is highly dependent on the characteristics of an individual lake. As most techniques available have a relatively high cost, and as the state-of-the-art of lake management, for the most part, is still in its early stages of development, a cautious approach to implementing lake rehabilitation techniques is desirable. Application of any lake rehabilitation technique, therefore, should be contingent upon the completion of detailed, local, lake-specific management plans, which would be analogous to sewerage facilities planning for point source pollution abatement, and upon the actual experiences with the proposed technique in similar waterbodies in the Region, if possible. For these reasons, it is recommended that lake rehabilitation techniques be applied first to lakes in which: 1) nutrient inputs to the lake have been reduced to below the critical level on the basis of watershed point and nonpoint source pollution control measures; 2) there is the greatest probability of success based upon the results of in-lake studies to be conducted prior to implementing a lake rehabilitation program; and 3) the possibility of adverse environmental impacts is minimal. Proper technical support and monitoring programs, together with additional research and development, should maximize the chance of successful lake management and minimize adverse environmental impacts, and provide a range of management experiences that can be transferred to other situations as appropriate.