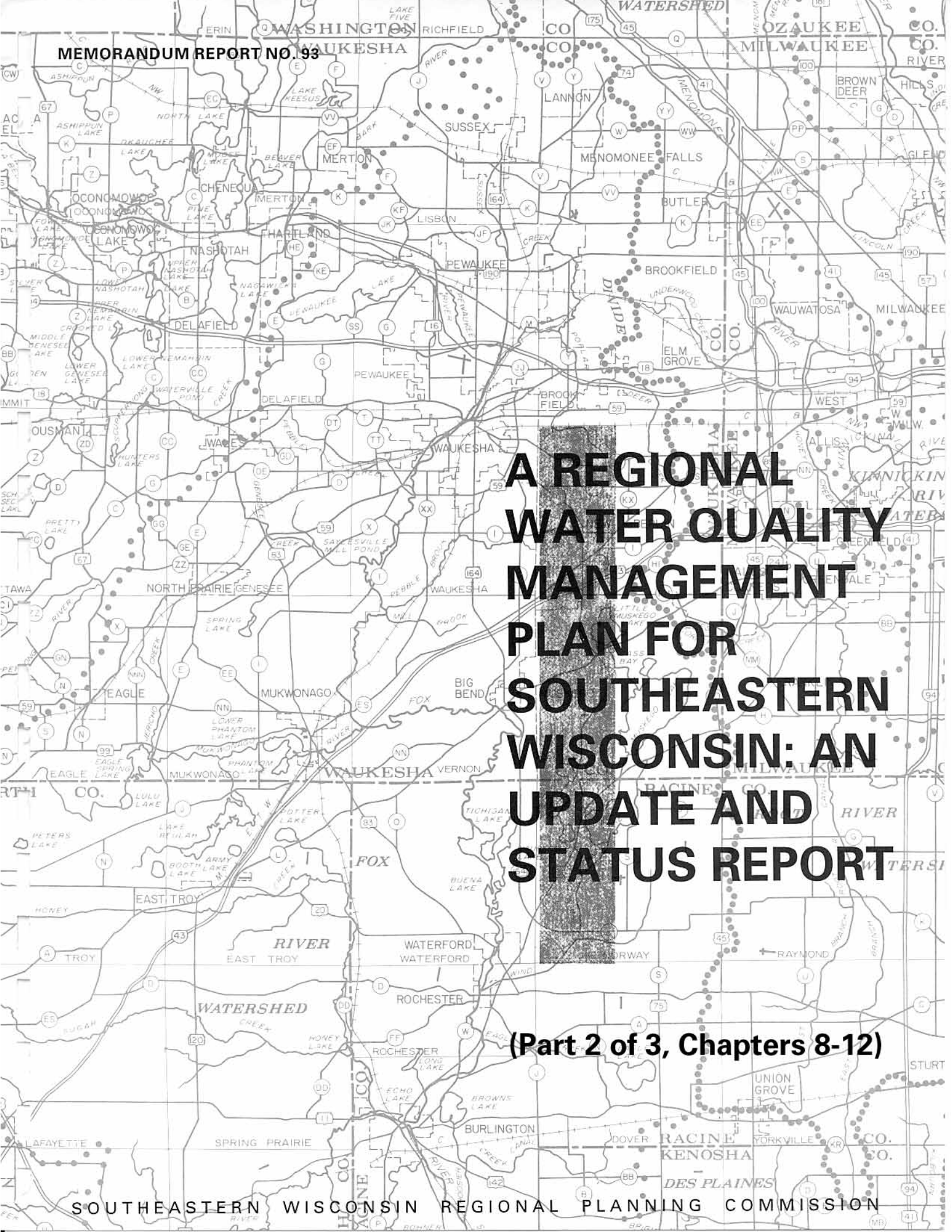

MEMORANDUM REPORT NO. 93

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

(Part 2 of 3, Chapters 8-12)

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

Special acknowledgement is due Dr. Jeffrey A. Thornton, SEWRPC Principal Planner, Ms. Tiffany G. Lyden, SEWRPC Research Analyst, and Messrs. Edward J. Schmidt, and Theodore C. Hikade, SEWRPC Research Aides for their contributions to the conduct of this study and the preparation of this report.

MEMORANDUM REPORT
NUMBER 93

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

Prepared by the

Southeastern Wisconsin Regional Planning Commission
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March 1995

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SEWRPC Memorandum Report No. 93

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

Table of Contents

Chapter VIII

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

INTRODUCTION

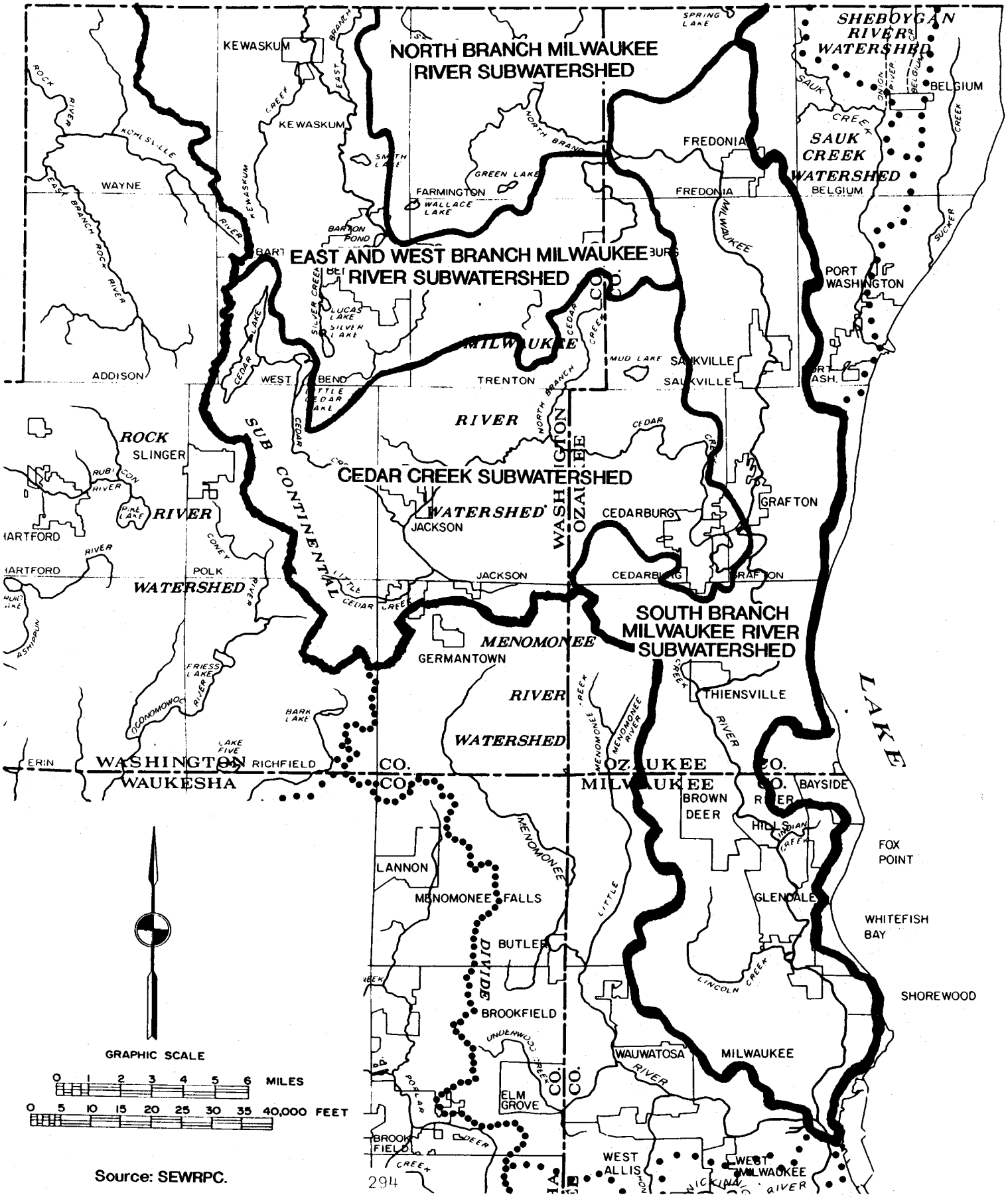
This chapter presents a description of the recommendations contained in the initial regional water quality management plan and amendments thereto and progress made toward plan implementation from 1975--the base year of the initial plan--through 1990--the base year of the plan update. In addition, this chapter presents information on water quality and biological conditions in the surface water system of the Milwaukee 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 Milwaukee 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. Designated management agency responsibilities for plan implementation are presented in Chapter XVII on a regional basis.

The Milwaukee River watershed is located in the northeastern and north-central portions of the Region. The portion of the watershed contained within the Region--about 433 square miles--is only a part of a larger--approximately 698-square-mile--watershed. The headwater portion of the watershed lies adjacent to the Region in Dodge, Fond du Lac, and Sheboygan Counties. 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 and its principal subwatersheds, together with the locations of the main channels of the Milwaukee River and its principal tributaries, are shown on Map VIII-1.

Within the Southeastern Wisconsin Region, the Milwaukee River watershed contains twelve major lakes having a surface area of 50 acres or more. These lakes are distributed within four subwatersheds: the Cedar Creek, the East/West Branch, and the South Branch subwatersheds. The major lakes in the Cedar Creek subwatershed are Big Cedar Lake, Little Cedar Lake, and Mud Lake. The major lakes in the East/West Branch subwatershed are Barton Pond, Lucas Lake, Silver Lake and Smith Lake. The major lakes in the North Branch subwatershed are Green Lake, Spring Lake, Lake Twelve, and Wallace Lake. The major lake in the South Branch subwatershed is Lac du Cours. Physical characteristics of the major lakes in the Milwaukee River watershed are set forth in Table VIII-1. The data indicate that the major lakes in the Southeastern Wisconsin portion of the watershed have a combined surface water area of about 2,070 acres, or less than 1 percent of the total area of the watershed within Southeastern Wisconsin.

Map VIII-1

SUBWATERSHEDS IN THE MILWAUKEE RIVER WATERSHED



Source: SEWRPC.

Table VIII-1

PHYSICAL CHARACTERISTICS OF MAJOR LAKES IN THE MILWAUKEE RIVER WATERSHED

SUBWATERSHED Lake Name	Surface Area (acres)	Direct Tributary Drainage Area (acres)	Shoreline (miles)	Maximum Depth (feet)	Mean Depth (feet)	Volume (acre-feet)
CEDAR CREEK						
Big Cedar Lake	932	5,495	3.8	105	34	31,983
Little Cedar Lake	246	1,718	4.4	56	13	3,153
Mud Lake (Ozaukee County)	245	4,233	3.9	4	2.5	645
MILWAUKEE RIVER-EAST/WEST						
Barton Pond	67	687	3.0	5	3	189
Lucas Lake	78	484	2.4	15	6	461
Silver Lake (Washington County)	118	602	2.7	47	20	2,306
Smith Lake	86	545	1.8	5	3	252
MILWAUKEE RIVER-NORTH						
Green Lake (Washington County)	71	505	3.8	37	17	1,195
Spring Lake (Ozaukee County)	66[a]	162	1.6	22	7	462
Lake Twelve	53	348	1.3	20	7	341
Wallace Lake	52	282	1.5	35	11	558
MILWAUKEE RIVER-SOUTH						
Lac du Cours	56	--	1.2	--	--	--
TOTAL	2,070	15,061	31.4	--	--	41,545

[a]Includes 9 acres in Sheboygan County.

Source: SEWRPC

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 Milwaukee 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 in stormwater, such as metals and chlorides, can also be expected to increase with urbanization.

Table VIII-2 summarizes the existing land uses in the Southeastern Wisconsin portion of the Milwaukee 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 number of urbanized areas, 75 percent of the watershed was still in rural and other open space land uses in 1990. These rural uses included about 48 percent of the total area of the watershed in agricultural and related rural uses, about 7 percent in woodlands, about 14 percent in surface water and wetlands, and about 6 percent in other open lands. The remaining 25 percent of the total watershed was devoted to urban uses. Existing land uses within the watershed are shown on Map VIII-2.

Within the Milwaukee River watershed, urban-related land uses are located primarily in Milwaukee County which is nearly fully developed, with limited concentrations of urban development located in Ozaukee and Washington Counties. In the portion of Washington County that lies within the Milwaukee River watershed, the Villages of Jackson and Kewaskum, the areas around both Big and Little Cedar Lakes and Silver Lake, and the City of West Bend all contain concentrations of urban-related land uses. In addition, a major commercial office center and a major industrial center are located in the City of West Bend. Within Ozaukee County, urban development has been rapidly taking place in the southern portion of the county, in and around the City of Cedarburg, the Village of Grafton, and north of Milwaukee County in the City of Mequon and the Village of Thiensville.

The portion of the watershed that lies within Milwaukee County contains, almost exclusively, urban-related land uses. While urban development is still taking place in limited amounts to the west of and in the Village of Brown Deer, high concentrations of already developed urban land are located in the Villages of Fox Point, Whitefish Bay, and Shorewood, and the Cities of Glendale, Wauwatosa, and Milwaukee. In addition, three major industrial centers, Milwaukee North, Milwaukee Glendale, and Milwaukee Near North; and four major commercial retail centers, Northridge, Capitol Court, Bay Shore, and the Milwaukee Central Business District, are located within or partially within the watershed.

Table VIII-2

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

Land Use Category	1975		1990		Change 1975-1990	
	Acres	Percent	Acres	Percent	Acres	Percent
Urban						
Residential	29,322	10.6	34,557	12.5	5,235	17.9
Commercial	1,653	0.6	2,028	0.7	375	22.7
Industrial	2,014	0.7	2,435	0.9	439	21.8
Transportation, Communication, and Utilities[b]	21,016	7.6	23,341	8.4	2,325	11.1
Governmental and Institutional	3,062	1.1	3,281	1.2	219	7.2
Recreational	4,136	1.5	4,684	1.7	548	13.3
Subtotal	61,203	22.1	70,326	25.4	9,123	14.92
Rural						
Agricultural and Related	147,177	53.2	132,990	48.0	-14,187	- 9.6
Lakes, Rivers, Streams and Wetlands	39,085	14.1	39,648	14.3	563	1.4
Woodlands	17,571	6.3	18,019	6.5	448	2.5
Open Lands,[c] Landfills, Dumps, and Extractive	11,940	4.3	15,993	5.8	4,053	33.9
Subtotal	215,773	77.9	206,650	74.6	- 9,123	- 4.2
Total	276,976	100.0	276,976	100.0	0	--

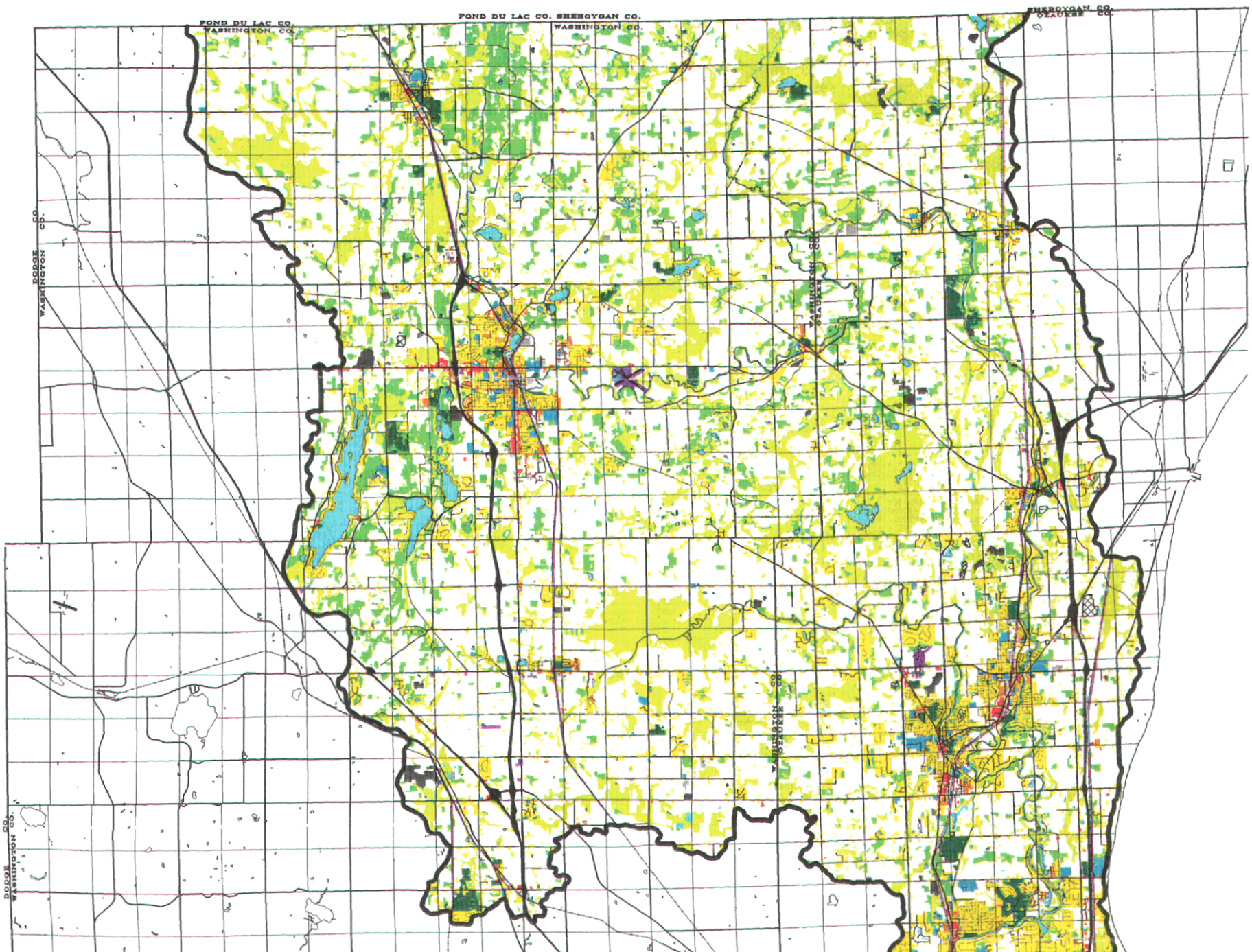
[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

MAP VIII–2
LAND USES IN THE MILWAUKEE 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 3 6
GRAPHIC SCALE IN MILES

The Milwaukee River watershed is about 433 square miles in areal extent, or 16 percent of the total Region. In 1990 about 110 square miles, or about 25 percent of the watershed, was in urban land uses.

Source: SEWRPC

As shown in Table VIII-2, from 1975 to 1990, urban land uses in the watershed increased from about 61,200 acres, or 96 square miles, to about 70,300 acres, or about 110 square miles, or by about 15 percent. As shown in Table VIII-2, residential land represents the largest urban land use in the watershed. Residential use has significantly increased within the watershed, from about 29,300 acres, or about 46 square miles in 1975, to about 34,600 acres, or about 54 square miles in 1990, an 18 percent increase. Commercial and industrial land uses increased from about 3,700 acres, or six square miles, to 4,500 acres, or seven square miles, an increase of 22 percent.

The 110 square miles of urban land uses in the watershed as of 1990 approximated the staged 1990 planned level of about 111 square miles envisioned in the adopted year 2000 land use plan. The current status of development in the Milwaukee River watershed and in adjacent portions of Milwaukee, Washington, and Ozaukee Counties was considered in developing the new year 2010 land use plan element described in Chapter III for the Region.

Table VIII-3 summarizes the year 2010 planned land use conditions recommended in the adopted year 2010 land use plan in the Milwaukee 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 Washington County in the Village of Jackson, in the Village of Kewaskum along USH 45, and in and around the City of West Bend. In Ozaukee County, increases in urban-related land uses are anticipated in and around the Cities of Cedarburg and Mequon, and in the Villages of Saukville, Grafton, and Thiensville. A major commercial office center has additionally been proposed for the City of Mequon in the year 2010 land use plan.

In the portion of the watershed contained within Milwaukee County, urban-related land uses are expected to increase in the northwestern corner of the county, with urban re-development occurring throughout the remainder of the county. Under year 2010 planned land use conditions, the entire portion of the watershed contained within Milwaukee County is expected to be developed as urban.

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 Milwaukee River watershed, as indicated in Table VIII-3, is projected to increase from the 1990 total of about 110 square miles, or about 25 percent of the total area of the watershed, to about 118 square miles, or about 27 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 136 square miles, or about 31 percent of the total watershed by year 2010. It is important to note that the 69 to 73 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 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 large portion of the remaining agricultural and other open lands of the watershed from rural to urban uses.

Table VIII-3

EXISTING AND PLANNED LAND USE IN THE MILWAUKEE 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	34,557	12.5	37,502	13.5	2,945	8.5	44,887	16.2	10,330	29.9
Commercial	2,028	0.7	2,005	0.7	- 23	- 1.1	2,133	0.8	105	5.2
Industrial	2,435	0.9	3,214	1.2	779	32.0	4,045	1.4	1,610	66.1
Transportation, Communication, and Utilities[b]	23,341	8.4	24,463	8.8	1,122	4.8	27,144	9.8	3,803	16.3
Governmental and Institutional	3,281	1.2	3,357	1.2	76	2.3	3,573	1.3	292	8.9
Recreational	4,684	1.7	4,899	1.8	215	4.6	5,150	1.9	466	10.0
Subtotal	70,326	25.4	75,440	27.2	5,114	7.3	86,932	31.4	16,606	23.6
Rural										
Agricultural and Related	132,990	48.0	135,238	48.8	2,248	1.7	125,304	45.2	-7,686	- 5.8
Lakes, Rivers, Streams, and Wetlands	39,648	14.3	38,893	14.1	- 755	- 1.9	38,893	14.1	- 755	- 1.9
Woodlands	18,019	6.5	17,374	6.3	- 645	- 3.6	17,236	6.2	- 783	- 4.4
Open Lands,[c] Landfills, Dumps, and Extractive	15,993	5.8	10,031	3.6	-5,962	-37.3	8,611	3.1	-7,382	- 46.2
Subtotal	206,650	74.6	201,536	72.8	-5,114	- 2.5	90,044	68.6	-16,606	- 8.0
Total	276,976	100.0	276,976	100.0	0	--	276,976	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.

Rural land uses may be expected to decline collectively from about 323 square miles in 1990 to about 315 square miles in the year 2010 under the intermediate growth-centralized land use plan and to about 297 square miles under the high growth-decentralized land use plan, decreases of about 2 to 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 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 Milwaukee River watershed--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 areas located in the watershed.

With regard to the point source plan element related to the Milwaukee River, the most significant recommendations in the initial plan and the most significant implementation actions are related to the Milwaukee Metropolitan Sewerage District's water pollution abatement program. This program includes: rehabilitation of the sanitary sewer system; construction of relief sewers; improvement and expansion of the Jones Island and South Shore sewage treatment plants; provision of large subterranean conveyance and storage-deep tunnel facilities to contain separate and combined sewer peak flows in excess of the capacity of the sewerage system; development of solids management program; and provision of trunk sewers to serve the various communities comprising the District area. As of 1993, the District pollution abatement program was nearing completion, with the deep tunnel system expected to be on line during 1994.

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 service 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 plant in the Milwaukee metropolitan area--the City of South Milwaukee plant. The resultant sewerage 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 Milwaukee River watershed.

---

[1]Milwaukee Metropolitan Sewerage District, MMSD Wastewater System Plan, June 1990.

Public and Private Wastewater Treatment Systems and Sewer Service Areas Existing Conditions and Status of Plan Implementation: In 1975, there were nine public sewage treatment facilities located in the portion of the Milwaukee River watershed within the Region, as shown on Map VIII-3. The Village of Fredonia, Village of Grafton, Village of Kewaskum, Village of Newburg, Village of Saukville, and the City of West Bend sewage treatment plants discharged to the main stem of the Milwaukee River. The City of Cedarburg and Village of Jackson sewage treatment plants discharged to Cedar Creek, and the Village of Thiensville sewage treatment plant discharged to the Milwaukee River. Of these plants, the plant operated by the Village of Thiensville was abandoned, and a new plant was constructed for the Village of Jackson 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 Milwaukee River watershed, as recommended in the initial regional water quality management plan, is summarized in Table VIII-4.

As can be seen by review of Table VIII-4, full implementation of the initial plan would provide for the upgrading and expansion, as needed, of six plants: the City of West Bend and City of Cedarburg plants, and the Village of Fredonia, Village of Grafton, Village of Newburg, and Village of Saukville sewage treatment plants. Implementation of these recommendations has been largely completed. The initial plan also included recommendations for the construction of a new plant for the Village of Jackson, and the upgrading of the Village of Kewaskum plant. The Village of Jackson plant has been constructed but currently requires further upgrading. Facility planning is currently being carried out for the upgrading of the Village of Jackson plant, and for the upgrading of the Village of Kewaskum and Village of Newburg plants.

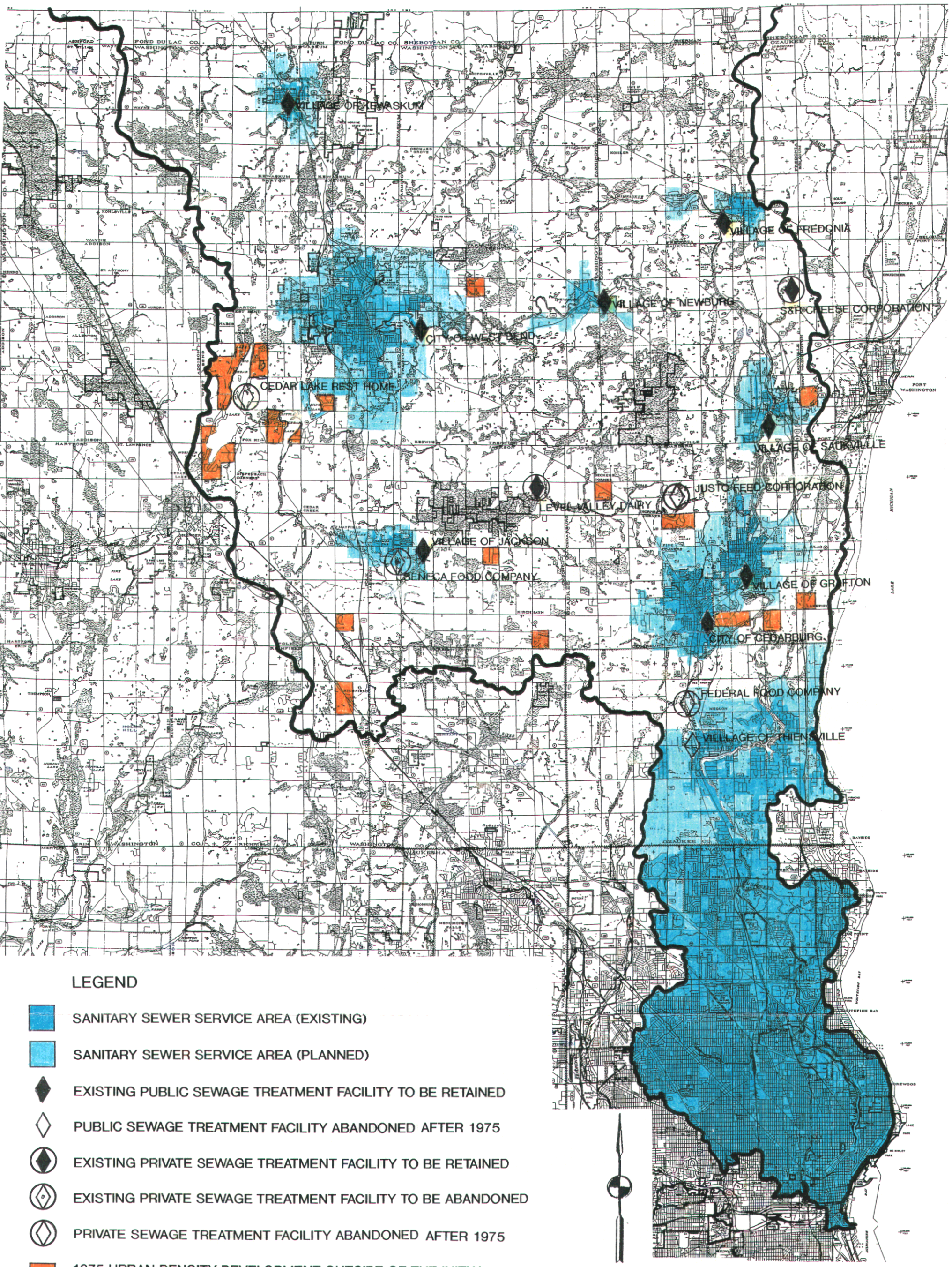
The plants in the watershed have not fully provided facilities to specifically reduce the phosphorus concentrations in plant effluent to the levels identified in the initial plan as being needed to fully meet the water use objectives. The steps needed to achieve the recommended level of phosphorus control 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 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. To date, all of the public plants in the watershed except for the Village of Newburg and Village of Fredonia plants have installed facilities to provide a conventional level of phosphorus removal. Selected characteristics of the public sewage treatment plants currently existing in the watershed are given in Table VIII-5.

In addition to the publicly-owned sewage treatment facilities, six private sewage treatment plants were in existence in 1975 in the portion of the Milwaukee River watershed contained within the Region. These plants served the following land uses: the Cedar Lake Home Campus, Federal Foods Company, Justo Feed Corporation, Level Valley Dairy, Libby, McNeill and Libby-Jackson facility (currently Seneca Food Company) and S & R Cheese Corporation..

As indicated in Table VIII-4, three of these private sewage treatment plants in the watershed were recommended to be abandoned in the initial plan. As of 1990,

Map VIII -3

SEWER SERVICE AREAS AND SEWAGE TREATMENT PLANTS IN THE MILWAUKEE RIVER WATERSHED: 1990



LEGEND

- SANITARY SEWER SERVICE AREA (EXISTING)
- SANITARY SEWER SERVICE AREA (PLANNED)
- EXISTING PUBLIC SEWAGE TREATMENT FACILITY TO BE RETAINED
- PUBLIC SEWAGE TREATMENT FACILITY ABANDONED AFTER 1975
- EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE RETAINED
- EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE ABANDONED
- PRIVATE SEWAGE TREATMENT FACILITY ABANDONED AFTER 1975
- 1975 URBAN DENSITY DEVELOPMENT OUTSIDE OF THE INITIAL PLAN SEWER SERVICE AREA

Source: SEWRPC.

Table VIII-4

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

Public Sewage Treatment Plants	Disposal of Effluent	Plan Recommendation	Implementation Status
City of Cedarburg	Cedar Creek	Upgrade and expand	Completed (1990)
Village of Fredonia	Milwaukee River	Upgrade and expand	Completed (1982)
Village of Grafton	Milwaukee River	Upgrade and expand	Completed (1984)
Village of Jackson	Cedar Creek	Construct new plant	Completed (1981), New upgrade required, facility planning underway
Village of Kewaskum	Milwaukee River	Upgrade	Facility planning underway
Village of Newburg	Milwaukee River	Upgrade and expand	Facility planning underway
Village of Saukville	Milwaukee River	Upgrade and expand	Completed (1981)
City of West Bend	Milwaukee River	Upgrade and expand	Completed (1980)
Village of Thiensville	Milwaukee River	Abandon plant	Plant abandoned (1987)
Private Sewage Treatment Plants	**Disposal of Effluent**	**Plan Recommendation**	**Implementation Status**
Justo Feed Corporation	Soil absorption	Maintain and upgrade as needed	Not in operation
Level Valley Dairy	Cedar Creek	Maintain and upgrade as needed	Plant maintained
S&R Cheese Corporation	Soil absorption	Maintain and upgrade as needed	Plant maintained
Cedar Lake Home Campus	Soil absorption	Abandon plant[a]	Plant abandoned with connection to West Bend sewerage system (1988)
Federal Food Company	Soil absorption	Abandon plant	Plant abandoned
Seneca Food Company[b]	Soil absorption and Cedar Creek	Abandon plant	Plant maintained[c]

[a] The Cedar Lake Home Campus private sewage treatment plant was recommended to be maintained in the initial regional water quality management plan. A 1988 amendment to the plan recommended the plant be abandoned, with connection to the City of West Bend sewerage system.

[b] Formerly Libby, McNeill, & Libby, Inc.-Jackson facility.

[c] Private plant is currently used as a supplementary facility to the Village of Jackson sewage treatment plant.

Source: SEWRPC

Table VIII-5

SELECTED CHARACTERISTICS OF EXISTING PUBLIC SEWAGE TREATMENT PLANTS
IN THE MILWAUKEE 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
City of Cedarburg	2.8	10,100	1925, 1935, 1960, 1973, 1979, 1990	Oxidation ditch, flocculation-clarification, phosphorus removal, chlorination/ dechlorination, post aeration	Cedar Creek	6/30/98
Village of Fredonia	0.8	1,800	1939, 1962, 1982	Flow equalization, activated biological filter, activated sludge clarification, chlorination	Milwaukee River	12/31/99
Village of Grafton	2.3	9,300	1934, 1960, 1970, 1984	Clarification, two-stage activated sludge system, clarification phosphorus removal, chlorination/ dechlorination, post aeration	Milwaukee River	6/30/97
Village of Jackson	0.5	2,500	1939, 1981	Clarification, rotating biological contactors, clarification, sand filtration, phosphorus removal, chlorination	Cedar Creek	9/30/89
Village of Kewaskum	0.7	2,500	1955, 1972, 1980	Activated sludge, clarification, phosphorus removal, chlorination/declorination	Milwaukee River	6/30/93
Village of Newburg	0.6	1,000	1966	Activated sludge, clarification, chlorination	Milwaukee River	6/30/87
Village of Saukville	0.7	3,700	1959, 1981	Activated sludge, phosphorus removal, chlorination/ dechlorination	Milwaukee River	12/31/98
City of West Bend	6.1	23,900	1967, 1973, 1980	Biotowers, clarification, activated sludge, clarification, chlorination, post aeration, nitrification, phosphorus removal, sand filters	Milwaukee River	3/31/95

Table VIII-5 (continued)

Name of Public Sewage Treatment Plant	Hydraulic Loading[b] (mgd)				BOD5 Loading[b] (pounds/day)				Suspended Solids Loading[b] (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
City of Cedarburg	1.58	2.435	2.75	0	2,068	2,566	4,590	0	1,826	2,185	3,670	0
Village of Fredonia	0.185	0.235	0.60	0	256	301	651	0	282	334	--	0
Village of Grafton	1.33	1.58	2.20	0	1,475	1,769	2,875	0	1,930	2,464	3,765	0
Village of Jackson	0.47	0.63	0.87	0	1,215	1,660	1,724	0	1,429	2,733	1,700	2
Village of Kewaskum	0.36	0.58	0.50	1	1,294	1,802	2,200	0	848	1,277	--	0
Village of Newburg	0.07	0.09	0.08	2	125	172	136	1	104	125	--	0
Village of Saukville	0.56	0.79	1.00	0	786	1,028	1,668	0	701	854	2,085	0
City of West Bend	3.45	4.09	9.00	0	4,818	6,306	13,000	0	6,272	7,828	15,250	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.

the Cedar Lake Home Campus and the Federal Foods Company plant had been abandoned and the Seneca Food Company plant is in limited use as a supplementary facility to the Village of Jackson sewage treatment plant. The Justo Feed Corporation plant has ceased operation. The two 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) permit program.

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 Milwaukee 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 Wisconsin 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. There were 12 sewer service areas identified in, or partially in, the Milwaukee River watershed: Cedarburg, Fredonia, Grafton, Jackson, Kewaskum, Mequon, Milwaukee Metropolitan Sewerage District, Newburg, Saukville, Thiensville, Waubeka, and West Bend. Currently, all of these areas, with the exception of the Milwaukee Metropolitan Sewerage District, had undergone refinements as recommended. The boundaries of the sewer service areas through 1993 are shown on Map VIII-3. Table VIII-6 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 area in the Milwaukee River watershed, as refined through 1993, totals about 72 square miles, or about 17 percent of the total watershed area within the Region, as shown in Table VIII-6.

Current Plan Recommendations: The current point source plan element recommendations provide for the continued operation, with expansion and upgrading as necessary, of the City of Cedarburg, Village of Fredonia, Village of Grafton, Village of Newburg, Village of Saukville, and City of West Bend sewage treatment plants, as well as the upgrading of the Village of Kewaskum and Village of Jackson plants. Estimated approximate dates for beginning facility planning for

Table VIII-6

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

Name of Initially Defined Sanitary Sewer Service Area(s)	Planned Sanitary Sewer Service Area (square mile)	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				
Cedarburg Grafton	14.3	Cedarburg Grafton	June 15, 1987	SEWRPC CAPR No. 91, Sanitary Sewer Service Area for the City of Cedarburg and the Village of Grafton, Ozaukee County, Wisconsin
Fredonia Waubeka	2.2	Fredonia Waubeka	September 13, 1984	SEWRPC CAPR No. 96, Sanitary Sewer Service Area for the Village of Fredonia, Ozaukee County, Wisconsin
Jackson	2.7	Jackson	June 17, 1984	SEWRPC CAPR No. 124, Sanitary Sewer Service Area for the Village of Jackson, Washington County, Wisconsin
Kewaskum	3.8	Kewaskum	March 7, 1988	SEWRPC CAPR No. 161, Sanitary Sewer Service Area for the Village of Kewaskum, Washington County, Wisconsin
Mequon Thiensville	20.9	Mequon Thiensville	January 15, 1992	SEWRPC CAPR No. 188, Sanitary Sewer Service Area for the City of Mequon and the Village of Thiensville, Ozaukee County, Wisconsin
Newburg	2.2	Newburg	March 3, 1993	SEWRPC CAPR No. 205, Sanitary Sewer Service Area for the Village of Newburg, Ozaukee and Washington Counties, Wisconsin
Saukville	4.3	Saukville	December 1, 1983	SEWRPC CAPR No. 90, Sanitary Sewer Service Area for the Village of Saukville, Ozaukee County, Wisconsin
West Bend	21.2	West Bend	December 2, 1982	SEWRPC CAPR No. 35, Sanitary Sewer Service Area for the City of West Bend, Washington County, Wisconsin
Subtotal	71.6			
Unrefined Sanitary Sewer Service Areas				
Milwaukee Metropolitan Sewerage District	57.9	- -	- -	- -
Subtotal	57.9			
Total	129.5			

NOTE: CAPR - Community Assistance Planning Report

Source: SEWRPC.

the expansion and upgrading of existing sewage treatment plans are indicated in Table VIII-7. This recommendation regarding plant facility upgrading and expansion, as needed, also applies to the treatment plant solids management element for the eight public sewage treatment plants recommended to be retained.

The current point source pollution abatement plan element, including the planned sewer service areas, is summarized on Map VIII-4. Table VIII-7 presents selected design data for the eight public sewage treatment plants which are recommended to be maintained in the Milwaukee River watershed. It is important to note that the Village of Newburg plant recorded monthly average flows during 1990 which equaled or exceeded the average design capacity of the plant, as shown in Table VIII-5.

Table VIII-7 shows expected increases in sewered populations and attendant increases in sewage hydraulic loading rates for two different year 2010 growth scenarios for the eight public sewage treatment plants in the Milwaukee River watershed. Under the intermediate growth-centralized land use plan, one plant is anticipated to have average annual hydraulic loading rates equal to or higher than the average annual design capacity. Under the high growth-decentralized land use plan, seven of the existing plants are anticipated to have loading rates equal to or higher than the average annual design capacity. Thus, there is expected to be significant additional treatment plant expansion and associated costs under the higher growth decentralized future scenario than would be expected under the intermediate growth-centralized land use plan.

Based upon review and analysis of the data in Tables VIII-5 and VIII-7, including estimates of future condition loadings on an annual average and maximum monthly basis, and based upon the age of the current facilities, estimates of timing of needed facility planning were made. It appears that facility planning should be initiated during the next three years by the Villages of Kewaskum, Newburg, and Jackson to consider the need for expansion and upgrading of their sewage treatment plants. It should be noted that the need for facility planning for the Kewaskum plant is dependent upon decisions to be made regarding the continued use of the treatment plant by a major dairy plant. No additional facility planning is expected to be needed until after the year 2000 for the plants operated by the Cities of Cedarburg and West Bend, and Villages of Fredonia, Grafton, Jackson, and Saukville, assuming that development occurs in accordance with the recommended year 2010 land use plan as described for the intermediate growth-centralized land use future condition. Should development occur as envisioned under the high growth-decentralized land use future scenario, facility planning for nearly all of the public sewage treatment plants in the Milwaukee River watershed should be initiated by the year 2000, except for the City of West Bend and City of Cedarburg which currently have adequate capacity until late in the planning period to provide service for development under the high growth-decentralized land use future scenario. Continued review of plant operations and State-required compliance maintenance reports for all plants will provide the basis for determining the timing for initiating facility planning programs to explore plant expansion alternatives.

The current planned sanitary sewer service areas in the Milwaukee River watershed are shown on Map VIII-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 following sewer service areas are located in the

Table VIII-7

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

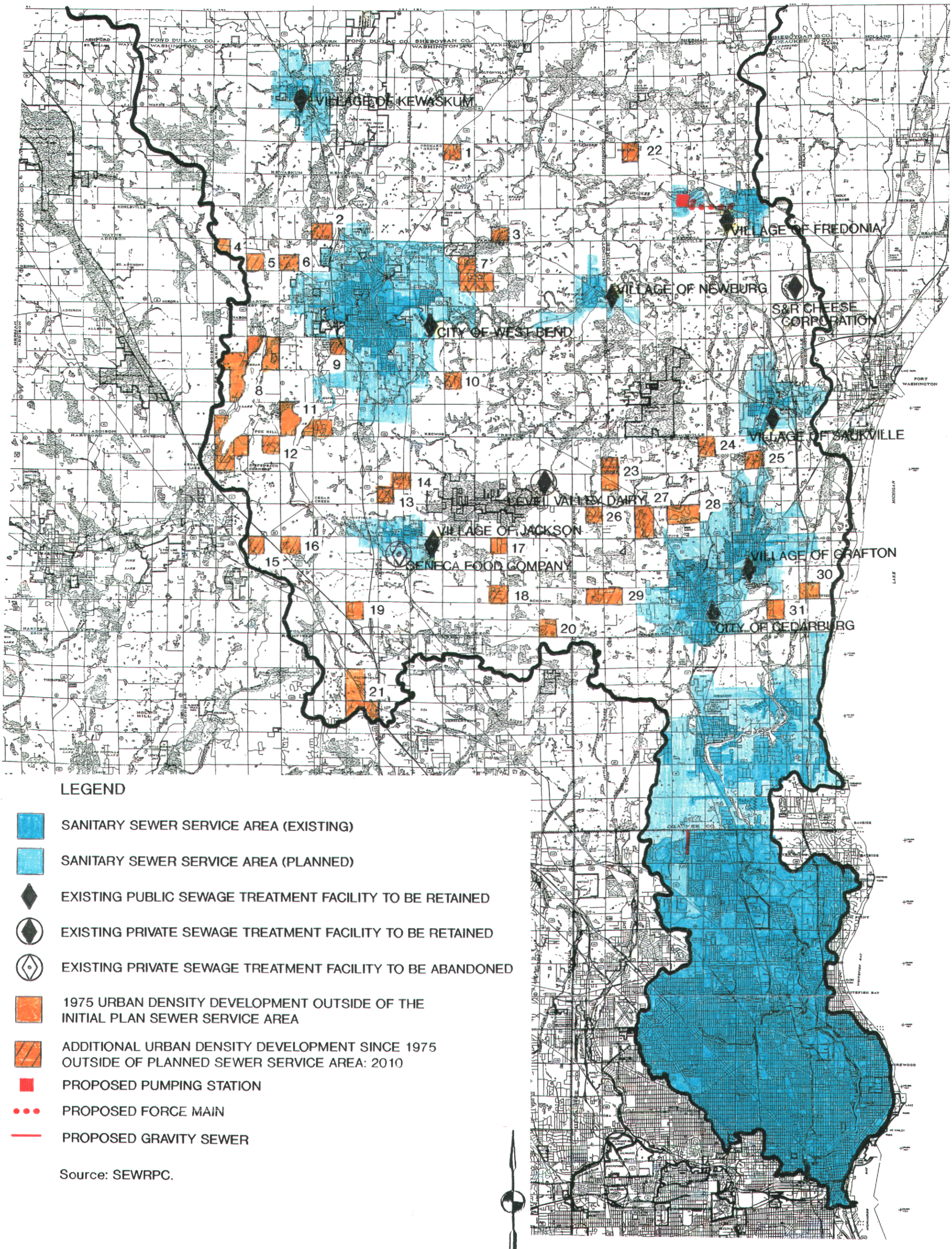
Name of Public Sewage Treatment Plant	Sewer Service Area	Design Capacity Average Annual Hydraulic (mgd)	Existing 1990			Planned Year 2010						
							Intermediate Growth Centralized Land Use Plan			High Growth Decentralized Land Use Plan		
			Average Hydraulic Loading (mgd)	Area Served (square mile)	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]
City of Cedarburg	Cedarburg	2.75	1.58	2.8	10,100	7.4	12,400	1.87	>2010	27,800	3.80	2005
Village of Fredonia	Fredonia, Waubeka	0.60	0.18	0.8	1,600	2.3	2,300	0.24	2005	6,500	0.76	2000
Village of Grafton	Grafton	2.20	1.33	2.3	9,300	6.9	11,500	1.60	>2010	24,100	3.18	2000
Village of Jackson	Jackson	0.87	0.47	0.5	2,500	2.7	3,500	0.59	1995	7,800	1.13	1995
Village of Kewaskum	Kewaskum	0.50	0.36	0.7	2,500	3.8	2,900	0.42	1996	7,100	0.94	1996
Village of Newburg	Newburg	0.08	0.07	0.6	1,000	2.2	1,100	0.08	1995	2,000	0.09	1995
Village of Saukville	Saukville	1.00	0.56	0.7	3,700	4.3	4,300	0.63	2005	8,600	1.17	2000
City of West Bend	West Bend	9.00	3.45	6.1	23,900	21.2	32,500	4.53	2005	53,800	7.18	2004

[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.

Source: SEWRPC

Map VIII-4

UPDATED REGIONAL WATER QUALITY MANAGEMENT POINT SOURCE PLAN FOR THE MILWAUKEE RIVER WATERSHED: 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
- EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE ABANDONED
- 1975 URBAN DENSITY DEVELOPMENT OUTSIDE OF THE INITIAL PLAN SEWER SERVICE AREA
- ADDITIONAL URBAN DENSITY DEVELOPMENT SINCE 1975 OUTSIDE OF PLANNED SEWER SERVICE AREA: 2010
- PROPOSED PUMPING STATION
- PROPOSED FORCE MAIN
- PROPOSED GRAVITY SEWER

Source: SEWRPC.

GRAPHIC SCALE

0 1 2 4 MILES

0 8000 16000 24000 32000 FEET

Milwaukee River watershed: Cedarburg, Fredonia, Grafton, Jackson, Kewaskum, Mequon, Newburg, Milwaukee Metropolitan Sewerage District, Saukville, Thiensville, Waubeka, and West Bend. Together, the planned service areas total about 130 square miles, or about 30 percent of the Milwaukee River watershed.

As noted above, most of the sewer 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 Newburg and the Milwaukee Metropolitan Sewerage District sewer service areas. These refinements are recommended to be conducted in 1995 and 1996. It is also 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 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.

In addition to the public plants, there were three private sewage treatment plants in operation within the Milwaukee River watershed in 1990. In 1990, of these three plants, the Seneca Food Company plant, formerly Libby, McNeill and Libby, was recommended for abandonment; however, to date, the plant remains in use as a supplementary facility to the Village of Jackson sewage treatment plant. The remaining two plants serve industrial facilities generating wastewater which requires special treatment considerations and generally are located beyond the current limits of the planned sanitary public sewer service areas. For the two plants serving the Level Valley Dairy and the S & R Cheese Corporation, 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 61 known combined sewer outfalls and 127 known separate sewer system flow relief devices located in the portion of the Milwaukee River watershed within the Southeastern Wisconsin Region. Of the combined sewer outfalls, 60 discharged to the Milwaukee River and one discharged to Lincoln Creek. Of the separate sewer system flow relief devices, 49 discharged to the main stem of the Milwaukee River, two from the City of Glendale, seven from the City of Mequon, 20 from the City of Milwaukee, eight from the Village of Shorewood; five from the Village of Whitefish Bay, and one each from the City of West Bend and the Villages of Brown Deer, Fredonia, Newburg, River Hills, Saukville, and Thiensville; four discharged to Cedar Creek, two each from the City of Cedarburg and the Village of Jackson; 54 discharged to Lincoln Creek from the City of Milwaukee; six discharged to Beaver Creek from the Village of Brown Deer; 13 discharged to Indian Creek, 11 from the Village of Fox Point and one each from the City of Glendale and the Village of River Hills; and one discharged to Pigeon Creek from the Village of Thiensville. The devices included 27 sanitary sewerage bypasses, seven pumping stations, 16 portable pumping stations, and 77 crossovers.

By 1993, work was completed by the Milwaukee Metropolitan Sewerage District on its Water Pollution Abatement Program, including construction of the Inline Storage System and major relief sewers. As a result of this project, many of the flow relief devices within the watershed have recently been eliminated.

Those which remain include combined sewer overflows, selected bypasses and crossovers, and portable pumping station sites which physically remain in the sewerage system but are expected to function only under conditions of power or equipment failure or excessive infiltration and inflow during extreme wet weather conditions. As shown in Table VIII-8, 186 points of sanitary sewer system flow relief--including 67 combined sewer overflows--were reported to exist as of 1993 in the Milwaukee River watershed. These flow relief points were located in 15 sewerage systems. The fact that the total number of relief devices is nearly the same as reported in 1975, even though a significant number of devices have been eliminated, is the result of additional field inventories conducted during the period after 1975, which revealed a larger number of such devices in existence. With the completion of the Inline Storage System, bypassing of sewage from the combined sewer overflows is expected to occur an average of about two times per year. The Milwaukee Harbor estuary study 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. Bypassing from other sanitary sewer flow relief devices is expected to be further reduced over time as additional sewerage system upgrading is accomplished by the Milwaukee Metropolitan Sewerage District and other local units of government operating sewer systems.[2]

Current Plan Recommendations: It is recommended that the Cities of Cedarburg, Mequon, Milwaukee, and West Bend; the Villages of Brown Deer, Fredonia, Grafton, Jackson, Kewaskum, Newburg, River Hills, Saukville, Shorewood, and Whitefish Bay; and the Milwaukee Metropolitan Sewerage District continue to monitor the sanitary sewer system operations to ensure that the use of the existing sanitary 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 be conducted with the assumption that there will be no planned bypasses of untreated sewage from the sanitary sewerage system and that the use of all flow relief devices within the sanitary sewerage system will ultimately be eliminated, with the only bypasses remaining designed to protect the public and treatment facilities from unforeseen equipment or power failure.

Intercommunity Trunk Sewers

Existing Conditions and Status of Plan Implementation: The initial regional water quality management plan, as updated, recommended the construction of eight intercommunity trunk sewers in the Milwaukee River watershed, as shown in Table VIII-9. Four of these trunk sewers would provide additional conveyance capacity in the Milwaukee Metropolitan sewer system; one trunk sewer would connect Thiensville to the Mequon sewerage system to permit the abandonment of the

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

Table VIII-8

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

Sewerage System	Sewage Treatment Flow Relief Device	Sewage Flow Relief Devices in the Sewer System						Comments
		Combined Sewer Overflow	Crossovers	Pumping Station Bypasses	Other Bypasses	Portable Pumping Systems	Total	
Village of Kewaskum	0	0	0	0	1	0	1	Used only in case of equipment failure
City of West Bend	0	0	0	1	0	0	1	Used only in case of equipment failure
Village of Jackson	0	0	0	0	1	0	1	Used only in case of extreme wet weather
Village of Newburg	0	0	0	1	0	0	1	Used only in case of extreme wet weather
Village of Fredonia	0	0	0	0	0	1	1	Used only in case of extreme wet weather
Village of Saukville	0	0	0	0	0	1	1	Used only in case of extreme wet weather
Village of Grafton	0	0	0	2	0	1	3	Used only in case of equipment failure or extreme wet weather
City of Cedarburg	0	0	0	1	0	0	1	Used only in case of extreme wet weather
City of Mequon	0	0	0	3	0	0	3	Used only in case of extreme wet weather
Village of Brown Deer	0	0	2	0	0	0	2	Crossovers are fitted with manually-operated gate valves
Village of River Hills	0	0	0	0	0	2	2	Used only in case of extreme wet weather
Village of Whitefish Bay	0	0	2	0	0	3	5	Used only in case of extreme wet weather
Village of Shorewood	0	0	5	0	0	0	5	Crossovers are fitted with manually-operated gate values
City of Milwaukee	0	1[a]	76[b]	0	0	0	77	Used only in case of extreme wet weather

Table VIII-8 (continued)

Sewerage System	Sewage Treatment Flow Relief Device	Sewage Flow Relief Devices in the Sewer System						Comments
		Combined Sewer Overflow	Crossovers	Pumping Station Bypasses	Other Bypasses	Portable Pumping Systems	Total	
Milwaukee Metropolitan Sewerage District	0	66	16	0	0	0	82	Crossovers used only in case of extreme wet weather; CSO bypassing expected about twice per year
Total	0	67	101	8	2	8	186	

[a] Proposed to be abandoned in 1995.

[b] Fifty-three of these crossovers are equipped with electric pumps to facilitate bypassing.

Source: SEWRPC.

Table VIII-9

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

Intercommunity Trunk Sewer	Status of Implementation
Northridge	Not Completed
Northeast Side Relief	
North Branch	Completed (1983)
East Branch	Completed (1983)
Milwaukee River Relief	No Action[a]
Thiensville-Mequon	Completed (1987)
Waubeka-Fredonia	Not Completed
Jackson	Completed (1981)
Silver Lake-West Bend Trunk Sewer[b]	Completed (1993)[b]

[a] Construction of this trunk sewer was completed in 1994.

[b] The Silver Lake-West Bend trunk sewer was added to the plan based upon a March 1992 plan amendment. Construction of this trunk sewer was completed in 1993.

Source: SEWRPC.

Village of Thiensville sewage treatment plant; one would connect the Waubeka sanitary sewer service area to the Village of Fredonia sewage treatment plant; one would permit the relocation of the Village of Jackson sewage treatment plant; and one would permit connection of the Silver Lake Sanitary District sewer system to the City of West Bend sewerage system. These trunk sewers have been fully constructed, with the exception of the Northridge and Waubeka-Fredonia trunk sewers.

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 Milwaukee River watershed within the Region, as shown on Map VIII-4. Two intercommunity trunk sewers in the Milwaukee River watershed are currently recommended to be constructed. These trunk sewers include the Northridge sewer, which would provide capacity for the northwestern portion of the service area tributary to the Sewerage District sewerage system; and the Waubeka-Fredonia sewer, which would connect urban development in the Waubeka area to the Village of Fredonia sewerage system.

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 68 known point sources of pollution identified in the Milwaukee River watershed other than public and private sewage treatment plants. These sources discharge industrial cooling, process, rinse, wash, and filter backwash waters through 118 outfalls directly or indirectly to the surface water system. Of these 118 point source outfalls, 45 discharged directly to the main stem of the Milwaukee River, 42 discharged indirectly to the main stem of the Milwaukee River, 31 discharged to other tributaries, and one outfall discharged to a soil absorption basin. Eighty-two--or about 70 percent--of the outfalls discharged cooling water only. 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 120 known such point sources of wastewater discharging to the Milwaukee River and its major tributaries or the groundwater system directly through industrial waste outfalls or indirectly through drainage ditches and storm sewers. Table VIII-10 summarizes selected characteristics of these other point sources and Map VIII-5 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 152 known, permitted point sources of wastewater other than public and private sewage treatment plants discharging to surface waters or groundwater in the Milwaukee 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 Milwaukee 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.

Table VIII-10

CHARACTERISTICS OF OTHER KNOWN POINT SOURCES OF
WATER POLLUTION IN THE MILWAUKEE 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]
American Landmark Management	Milwaukee	1	General	0044938-3	9/30/95	--	--	Milwaukee River	--
Amity Leather Products Company	Washington	2	General	0044938-3	9/30/95	3172	Personal leather goods	Milwaukee River via storm sewer	--
Amoco Oil Co. (Estabrook Apts.)	Milwaukee	--[d]	General	0046566-3	9/30/95	--	--	Milwaukee River	--
Aqua-Chem, Inc.	Milwaukee	4	General	0044938-3	9/30/95	3443	Fabricated plate work(boiler shops)	Lincoln Creek via storm sewer	--
Architectural Concrete Products, Inc.	Milwaukee	5	General	0046507-2	9/30/95	3272	Concrete products	Lincoln Creek via storm sewer	--
Autotrol Corporation	Milwaukee	6	General	0044938-3	9/30/95	3493	Steel springs except wire	Milwaukee River via storm sewer	--
Badger Middle School	Washington	7	General	0046523-2	9/30/95	8211	Secondary school	Milwaukee River via storm sewer	--
Bardes Plastics, Inc.	Milwaukee	8	General	0044938-3	9/30/95	3082	Unsupported plastics profile shapes	Lincoln Creek	--
Bend Industries, Inc.	Washington	9	General	0046507-2	9/30/95	3271	Concrete block and brick	Leach field	--
Brown Deer High School Pool	Milwaukee	10	General	0046523-2	9/30/95	8211	Secondary school	Milwaukee River via unnamed trib.	--
Cedarburg Swimming Pool	Ozaukee	11	General	0046523-2	9/30/95	--	Municipal pool	Cedar Creek via storm sewer	--
Cera-mite Corporation	Ozaukee	12	General	0044938-3	9/30/95	3675	Electronic capacitors	Milwaukee River via storm sewer	--
Charter Processing Inc.	Ozaukee	13	General	0044938-3	9/30/95	3452/3496	Bolts, nuts, rivets, misc. prod.	Milwaukee River via storm sewer	--
Continental Can Company	Milwaukee	14	General	0044938-3	9/30/95	3411	Metal cans	Milwaukee River via storm sewer	--
Crown Cork & Seal Company, Inc.	Milwaukee	15	General	0044938-3	9/30/95	3466	Crowns and closures	Lincoln Creek via storm sewer	--
Culligan Water Conditioning	Milwaukee	16	General	0046540-1	9/30/95	1711	Plumbing & soft water conditioners	Lincoln Creek via storm sewer	--
Culligan Water Conditioning-West Bend	Washington	17	General	0046540-1	9/30/95	1711	Plumbing & soft water conditioning	Milwaukee River via storm sewer	--
Dickmann Manufacturingg Co., Inc.	Ozaukee	18	General	NEW	--	3499/3496	Fabricated metals & wire products	Milwaukee River via storm sewer	--
E.R. Wagner Manufacturing Company	Milwaukee	19	General	0044938-3	9/30/95	3429/3469	Hardware; Metal stampings	Lincoln Creek	--
Eaton Corp.-Cutler Hammer Prod. Div.	Milwaukee	20	General	SPEC PERM	--	3812/3625	Search & navigation equipment, etc.	Lincoln Creek	--
Eaton Corp.-Oper. & Tech. Center	Milwaukee	21	General	0044938-3	9/30/95	3812/3625	Search & navigation equipment, etc.	Lincoln Creek via storm sewer	--
Federal Distributing, Inc.	Milwaukee	--[d]	General	0046566-2	9/30/95	--	--	Milwaukee River via Brown Deer Creek Tributary	--
Franchise Mailing Systems	Milwaukee	23	General	SPEC PERM	--	7331	Direct mail advertising services	Milwaukee River via storm sewer	--
Fred Usinger, Inc.	Milwaukee	24	General	0044938-3	9/39/95	2013	Sausages & other meat products	Milwaukee River	--
Gehl Company	Washington	25	General	0044938-3	9/30/95	3523	Farm machinery and equipment	Milwaukee River	--
Glen Hills Middle School (Pool)	Milwaukee	26	General	0046523-2	9/30/95	8211	Secondary schools	Milwaukee River via storm sewer	--
Grafton High School (Pool)	Ozaukee	27	General	0046523-2	9/30/95	8211	Secondary school	Milwaukee River via storm sewer	--
Great Lakes Biochemical Co., Inc.	Milwaukee	28	General	0044938-3	9/30/95	2835	Diagnostic substances	Milwaukee River	--
Henri's Food Products Co., Inc.	Milwaukee	29	General	0044938-3	9/30/95	2035	Pickles, sauces & salad dressings	Milwaukee River via storm sewer	--
Hercules, Incorporated	Milwaukee	30	General	0044938-3	9/30/95	2821	Plastics materials and resins	Milwaukee River	--
Homestead High School (Pool)	Ozaukee	31	General	0046523-2	9/30/95	8211	Secondary school	Lincoln Creek via storm sewer	--
Interstate Drop Forge, Inc.	Milwaukee	--[d]	General	0044938-3 & 0046566-2	9/30/95	3462	Iron and steel forgings	Lincoln Creek via storm sewer	--
Johnson Controls, Inc.-Civic Drive	Milwaukee	33	General	NPR-LET	--	3822/3561	Environmental cont.; Pumping equip.	Lincoln Creek via storm sewer	--
Johnson Controls, Inc.-Glen Park	Milwaukee	34	General	0044938-3	9/30/95	3822	Environmental controls	Milwaukee River	--
Kettle Moraine YMCA	Washington	35	General	0046523-2	9/30/95	7997	Membership sports & rec. club	Milwaukee River via Silver Creek	--
Kewaskum Frozen Foods, Inc.	Washington	36	General	0044938-3	9/30/95	2011	Meat packing plants	Milwaukee River	--
Le Club	Milwaukee	37	General	0046523-2	9/30/95	7997	Membership sports & recreation club	Milwaukee River	--
Leeson Electric Corp.	Ozaukee	38	General	0044938-3	9/30/95	3621/3546	Motors, generators, light fixtures	Lincoln Creek via storm sewer	--
Longview Fibre Company	Milwaukee	39	General	0044938-3	9/30/95	2653	Corrugated and solid fiber boxes	Milwaukee River via storm sewer	--
Marigold Foods, Inc.	Washington	40	General	0044938-3	9/30/95	2026	Fluid milk	Milwaukee River	--

Table VIII-10 (cont'd)

Facility Name	County	Map ID No.[b]	Permit Type	Permit No.	Expiration Date	Standard Industrial Classification Code	Industrial Activity	Receiving Water	Treatment System[c]
Marshall Fields - Grand Avenue	Milwaukee	41	General	0044938-3	9/30/95	5311	Department store	Milwaukee River	--
Meadow Brook Park Pool (Grafton)	Ozaukee	42	General	0046523-2	9/30/95	NA	Municipal pool	Milwaukee River via storm sewer	--
Mequon Swimming Pool	Ozaukee	43	General	0046523-2	9/30/95	NA	Municipal pool	Milwaukee River	--
Milw. Bd. Sch. Dir.: Custer H.S.	Milwaukee	44	General	0046523-2	9/30/95	8211	Secondary school	Lincoln Creek via storm sewer	--
Milw. Bd. Sch. Dir.: Madison H.S.	Milwaukee	45	General	0046523-2	9/30/95	8211	Secondary school	Lincoln Creek via storm sewer	--
Milw. Bd. Sch. Dir.: Marshall H.S.	Milwaukee	46	General	0046523-2	9/30/95	8211	Secondary school	Lincoln Creek via storm sewer	--
The Milwaukee Center	Milwaukee	47	General	SPEC PERM	9/30/95	6512	Non residential building operat.	Milwaukee River	--
Milwaukee Country Club	Milwaukee	48	General	0046523-2	9/30/95	7997	Membership sports & rec. club	Milwaukee River	--
Milwaukee County Dineen Park Pool	Milwaukee	49	General	0046523-2	9/30/95	NA	Municipal pool	Lincoln Creek via storm sewer	--
Milwaukee County Lincoln Park Pool	Milwaukee	50	General	0046523-2	9/30/95	N/A	Municipal pool	Milwaukee River via storm sewer	--
Milwaukee County McGovern Park Pool	Milwaukee	51	General	0046523-2	9/30/95	N/A	Municipal pool	Lincoln Creek via storm sewer	--
Milwaukee Gear Co., Inc.	Milwaukee	52	General	0044938-3	9/30/95	3398	Metal heat treating	Milwaukee River via storm sewer	--
Northridge Lakes	Milwaukee	53	General	0046523-2	9/30/95	6513	Apartment bldg. operators	Beaver Creek	--
North Shore Water Commission	Milwaukee	54	General	SPEC PERM	--	4941	Water supply	Groundwater discharge	--
North Suburban YMCA: Schroeder Pool	Milwaukee	55	General	0046523-1	9/30/95	7991	Physical fitness club	Milwaukee River	--
Oster - Sunbeam Joint Ventures	Milwaukee	56	General	SPEC PERM	9/30/95	3634	Electrical housewares and fans	Milwaukee River via storm sewer	--
Ozaukee Country Club	Ozaukee	57	General	0046523-2	9/30/95	7997	Membership sports & rec. club	Milwaukee River	--
Pereles Brothers, Inc.	Milwaukee	58	General	0044938-3	9/30/95	3089	Plastics products	Lincoln Creek via storm sewer	--
Perry Printing Co. - Milwaukee Div.	Milwaukee	59	General	0044938-3	9/30/95	2752	Commerical printing - lithographic	Beaver Creek via drainage ditch	--
Phoenix Products Company, Inc.	Milwaukee	60	General	0044938-3	9/30/95	2671	Paper & laminated packaging	Lincoln Creek via storm sewer	--
Pressure Cast, Div. Leggett & Platt	Ozaukee	61	General	0044938-3	9/30/95	3363	Aluminum die casting	Milwaukee River	--
Production Stamping Corp.	Milwaukee	62	General	0044938-3	9/30/95	3469	Metal stampings	Brown Deer Creek	--
Rexford Paper Company	Milwaukee	63	General	0044938-3	9/30/95	2672	Paper coated and laminated pkg.	Lincoln Creek via storm sewer	--
Rexnord Corp.-Plastics Division	Ozaukee	64	General	0044938-3	9/30/95	3714	Motor vehicle parts, relays, etc.	Milwaukee River	--
Rexnord Corp.-Stearns Division	Milwaukee	65	General	0044938-3	9/30/95	3625	Relays and industrial controls	Milwaukee River Canal	--
Riveredge Nature Center	Washington	66	General	0044938-3	9/30/95	9512	Nature conservancy	Milwaukee River	--
Rose Industries, Inc.	Milwaukee	67	General	0044938-3	9/30/95	3531	Construction machinery	Brown Deer Creek	--
Rostad Aluminum Corp.	Ozaukee	68	General	0044938-3	9/30/95	3363	Aluminum die casting	Milwaukee River via storm sewer	--
Rowe Sand & Gravel, Inc.	Ozaukee	69	General	0045615-2	9/30/95	3281	Cut stone & stone products	Cedar Creek	--
Schmitz Ready Mix-Mequon	Ozaukee	70	General	0046507-2	9/30/95	3273	Ready-mix concrete	Groundwater discharge	--
Sealcraft Packaging Corp.	Milwaukee	71	General	0044938-3	9/30/95	3089	Plastics	Milwaukee River via storm sewer	--
Sherwood Medical (Beatreme Foods)	Washington	72	General	SPEC PERM	--	3842	Surgical appl. & supplies	Cedar Creek	--
Shorewood High School (Pool)	Milwaukee	73	General	0046523-2	9/30/95	8211	Secondary school	Milwaukee River via storm sewer	--
Square D Co.-Richards Street Plant	Milwaukee	74	General	0044938-3	9/30/95	3625	Relays and industrial controls	Milwaukee River via storm sewer	--
Stainless Foundry & Engineering, Inc.	Milwaukee	75	General	0044938-3	9/30/95	3324/3325	Steel & steel investment found	Lincoln Creek via storm sewer	--
Super Steel Products Corp.-Calumet	Milwaukee	76	General	0044938-3	9/30/95	3499	Fabricated metal products	Lincoln Creek	--
Treat All Metals, Inc.	Milwaukee	77	General	0044938-3	9/30/95	3398	Metal heat treating	Milwaukee River via storm sewer	--
USEM/Doerr Electric Corp.	Ozaukee	78	General	0044938-3	9/30/95	3621	Motors and generators	Cedar Creek via unnamed trib.	--
United Division-Mid City Foundry Co.	Ozaukee	79	General	0044938-3	9/30/95	3321	Gray and ductile iron foundries	Milwaukee River via storm sewer	--
Universal Foods Corp.-Bioventures	Milwaukee	80	General	0044938-3	9/30/95	2022/2099	Cheese and Food preparation	Lincoln Creek via storm sewer	--

Table VIII-10 (cont'd)

Facility Name	County	Map ID No.[b]	Permit Type	Permit No.	Expiration Date	Standard Industrial Classification Code	Industrial Activity	Receiving Water	Treatment System[c]
Universal Strap, Inc.	Washington	81	General	0044938-3	9/30/95	2396	Automotive & apparel trim	Hasmer Creek	--
Vaporized Coatings, Inc.	Milwaukee	82	General	0044938-3	9/30/95	3471	Plating and polishing	Lincoln Creek via storm sewer	--
W. H. Brady Co.-Coated Products Div.	Milwaukee	83	General	0044938-3	9/30/95	2672	Papercoated and laminated prod.	Lincoln Creek via storm sewer	--
W. H. Brady Co.-Parkland Court	Milwaukee	84	General	0044938-3	9/30/95	3679	Electronic components	Lincoln Creek via storm sewer	--
West Bend High School (Pool)	Washington	85	General	0046523-2	9/30/95	8211	Secondary school	Milwaukee River via storm sewer	--
West Bend Water Utility	Washington	86	General	0046566-1	9/30/95	4941	Water supply	Milwaukee River	--
Wilke Dairy Company	Milwaukee	87	General	0044938-3	9/30/95	5143	Dairy products - wholesale	Milwaukee River via storm sewer	--
Wisconsin Color Press, Inc.	Milwaukee	88	General	0044938-3	9/30/95	2759/2752	Commercial printing: nec & litho.	Lincoln Creek via storm sewer	--
Wisconsin Paperboard Corp.-Newark	Milwaukee	89	General	0044938-3	9/30/95	2631	Paperboard mills	Milwaukee River	--
Wisconsin Thermoset Molding, Inc.	Milwaukee	90	General	0044938-3	9/30/95	3089	Plastic products	Milwaukee River via storm sewer	--
Wright Metal Processors, Inc.	Milwaukee	91	General	0044938-3	9/30/95	3479	Metal coating and allied services	Lincoln Creek via storm sewer	--
YMCA of Metro Milwaukee	Milwaukee	92	General	0046523-2	9/30/95	7991	Physical fitness facility	Milwaukee River via storm sewer	--
Yahrs Ready-Mix, Inc.	Washington	93	General	0046507-2	9/30/95	3273	Ready-mix concrete	Groundwater discharge	--
A. O. Smith Automotive Products Co.	Milwaukee	1A	Specific	0027278	12-31-94	3714	Motor vehicle parts & accessories	Lincoln Creek via storm sewer	None
Amcast Industrial Corp. Meta Mold Div	Ozaukee	2A	Specific	0000604	03-31-92	3363	Aluminum die casting	Cedar Creek	None
Aqua-Chem, Inc.-Cleaver Brooks	Milwaukee	3A	Specific	0043559	12-31-89	3443	Fabricated plate work	Milwaukee River via storm sewer	None
Aqua-Chem, Inc.-North Plant #2	Milwaukee	4A	Specific	0004502	12-31-89	3443	Fabricated plate work	Milwaukee River via storm sewer	None
Badger Meter, Inc.	Milwaukee	5A	Specific	0033529	12-31-89	3824	Fluid meters and counting devices	Milwaukee River via storm sewer	7
Beatreme Foods (Sherwood Medical)	Washington	6A	Specific	0046965	12-31-91	2022	Cheese-natural & processed	Hasmer Creek	None
Bieri's Cheese, Inc.	Washington	7A	Specific	0057355	09-30-92	2022	Cheese-natural & processed	Groundwater discharge	None
Brewery Works, Inc.	Milwaukee	8A	Specific	0046736	01-31-96	7699	Repair services	Milwaukee River via storm sewer	None
Briggs & Stratton Corp.-Glendale	Milwaukee	9A	Specific	0000621	12-31-89	3499	Fabricated metal products	Brown Deer Creek	7
Brookside Poultry Farms, Inc.	Washington	10A	Specific	0056677	12-31-93	0259	Poultry & eggs	Groundwater discharge	None
Cook Composites & Polymers	Ozaukee	11A	Specific	0027731	06-30-95	2821	Plastics materials and resins	Milwaukee River	7
Florence Eiseman, Inc.	Milwaukee	12A	Specific	0033901	03-31-90	2361	Girl & children's clothing	Milwaukee River	None
J. F. Shea Co., Inc. (NSW Dropshaft)	Milwaukee	13A	Specific	0047121	06-30-93	1622	Bridge, tunnel & elev. hwy. const.	Milwaukee River	6, 8
Johnson Brass & Mach. Foundry Inc.	Ozaukee	14A	Specific	0037923	06-30-89	3365/3366/3369	Aluminum, copper, nonferrous fndy.	Milwaukee River	6
Johnson Control Globe Battery	Milwaukee	15A	Specific	0000108	12-31-91	3625	Relays and industrial controls	Lincoln Creek via unnamed trib.	None
The Kelch Corp.	Ozaukee	16A	Specific	0044083	07-31-95	3545	Machine tool accessories	Milwaukee River	None
Morrison Knudsen Co., Inc.	Milwaukee	17A	Specific	0047139	04-30-90	1622	Bridge, tunnel and elev. hwy. const.	Lincoln Creek via storm sewer	None
OMC Milwaukee Plant 5	Milwaukee	18A	Specific	0000558	06-30-89	3519	Internal combustion engines	Lincoln Creek via storm sewer	None
Oster Division-Sunbeam	Milwaukee	19A	Specific	0001023	09-30-90	3634	Electric housewares and fans	Milwaukee River via storm sewer	None
Praefke Brake and Supply Corp.	Washington	20A	Specific	0025291	09-30-90	3714	Motor vehicles parts & accessories	Milwaukee River	None
Regal Ware, Inc.	Washington	21A	Specific	0000060	12-31-89	3631	Household cooking equipment	Milwaukee River	None
Schaefer Livestock Operation	Washington	22A	Specific	0056723	09/30/95	0219	General livestock	Milwaukee River	None
Terminal Storage Company	Milwaukee	23A	Specific	0042684	03-31-90	4225	General warehousing and storage	Milwaukee River Canal	None
West Bend Company	Washington	24A	Specific	0027294	09-30-92	3634	Electric housewares and fans	Milwaukee River	None
WI Electric Power Co.-Commerce Plant	Milwaukee	25A	Specific	0000892	09-30-90	4911	Electric services	Milwaukee River	5
WI Paperboard Corp.	Milwaukee	26A	Specific	0054984	09-30-90	2611	Pulp mills	Milwaukee River	None
WI University-Milwaukee Power Plant	Milwaukee	27A	Specific	0040282	08-31-95	4961	Steam and air-conditioning supply	Lake Michigan via storm sewer	None

Footnotes follow.

Table VIII-10 (cont'd)

[a] Table VIII-10 includes 120 known, permitted sources of wastewater discharging to the Milwaukee River and its tributaries, or to the groundwater systems in the Milwaukee River watershed. As of 1993, there were 152 known, permitted point sources of water pollution.

[b] See Map VII-5, "Point Sources of Pollution other than Sewage Treatment Facilities in the Milwaukee River Watershed: 1990."

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

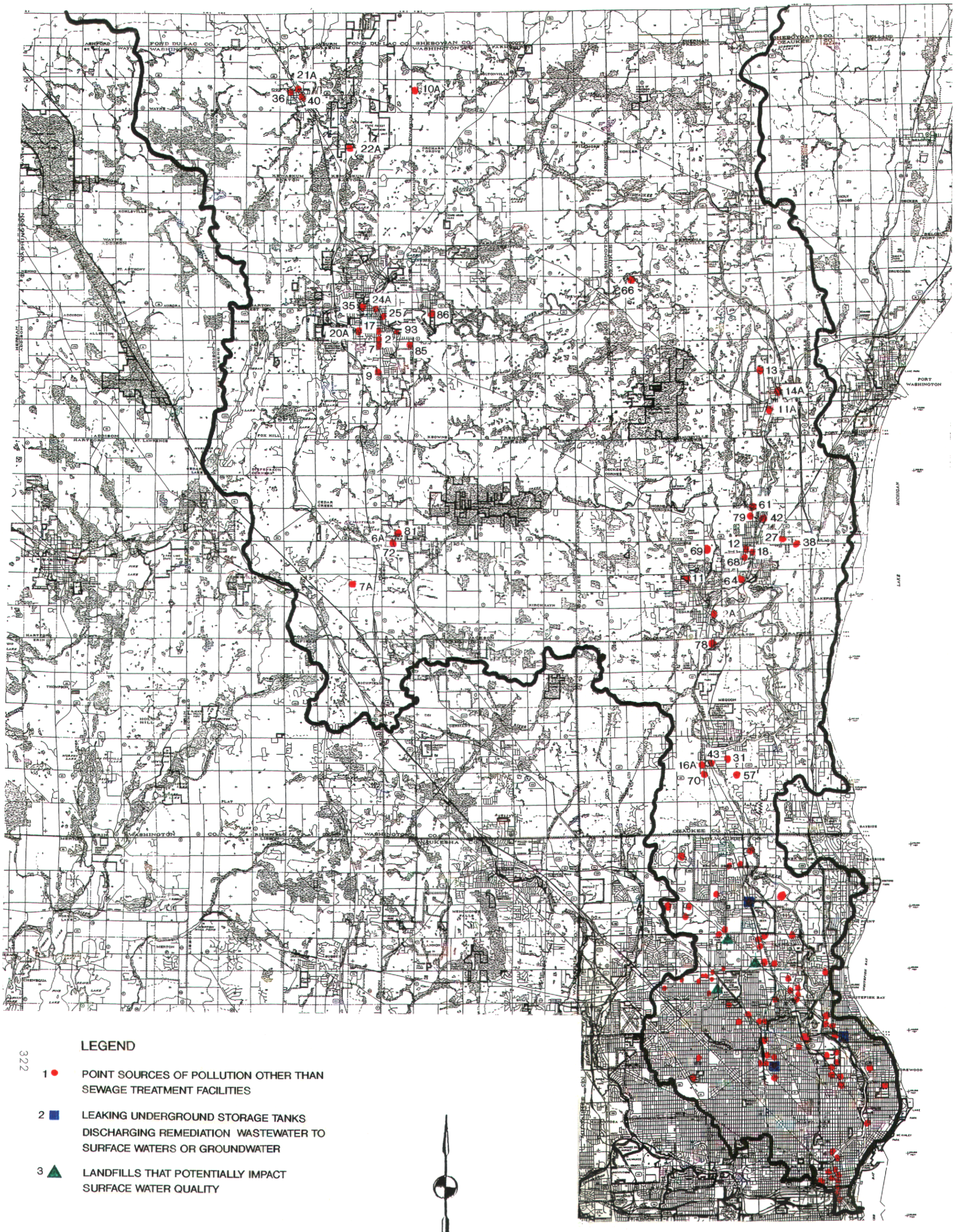
1. ACT sludge extended air
2. Absorption pond
3. Aerated lagoon
4. Anaerobic digestion
5. Filters- general
6. Gravity sedimentation
7. Holding pond
8. Oil and grease removal
9. Secondary clarification
10. Septic tanks
11. Spray irrigation
12. Stabilization lagoon

[d] Permitted as Leaking Underground Storage Tank (LUST) remediation site discharging to surface or groundwater as of 1990. As of 1993, there were seven additional LUST remediation sites discharging to surface or ground waters in the Milwaukee River watershed. See Table VIII-12, "Miscellaneous Potential Pollution Sources in the Milwaukee River Watershed: 1990", for map identification number.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Map VIII-5

POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES IN THE MILWAUKEE RIVER WATERSHED: 1990



LEGEND

1 ● POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES

2 ■ LEAKING UNDERGROUND STORAGE TANKS DISCHARGING REMEDIATION WASTEWATER TO SURFACE WATERS OR GROUNDWATER

3 ▲ LANDFILLS THAT POTENTIALLY IMPACT SURFACE WATER QUALITY

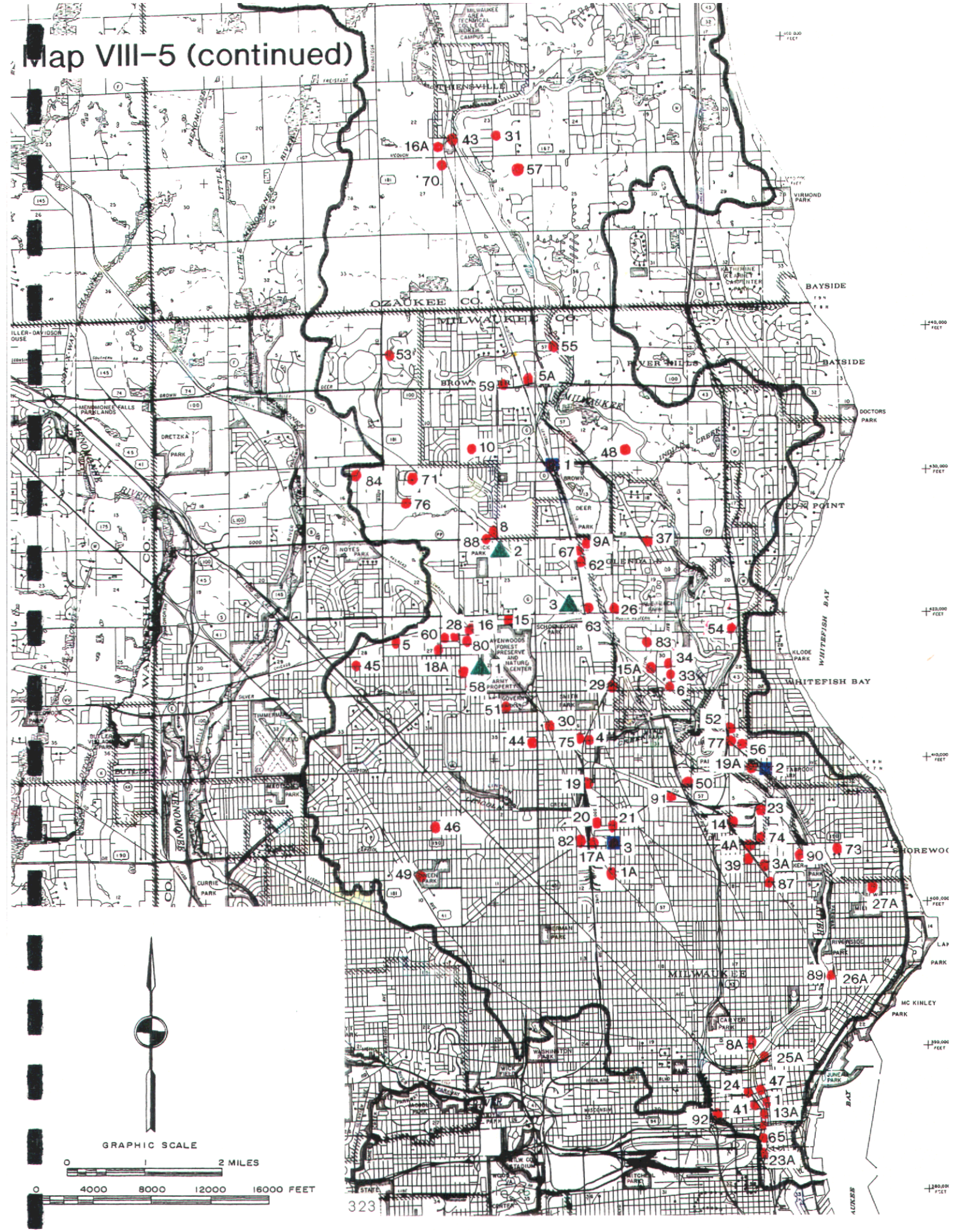
GRAPHIC SCALE

0 1 2 4 MILES

0 8000 16000 24000 32000 FEET

Source: SEWRPC.

Map VIII-5 (continued)



Existing Unsewered Urban Development Outside the Proposed Sanitary Sewer Service Area

As of 1975, there were 14 enclaves of unsewered urban development located outside of the then proposed year 2000 sewer service area. As of 1990, three of those areas had been added to the planned 2010 sewer service area. Due to increased urban growth within the watershed since 1975, twenty new enclaves of urban development have been created beyond the planned sewer service areas and three of the urban development enclaves identified in the original plan have been expanded, as shown on Map VIII-4. The corresponding urban enclave population and the distance to the nearest planned year 2010 sewer service area are listed in Table VIII-11. As shown in Table VIII-11, approximately one-half of these areas--17 of the 31 sites--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 alternative wastewater disposal methods should be considered. Two of these latter areas are located adjacent to Big and Little Cedar Lakes where alternative forms of wastewater management have been investigated during 1989[3] and 1991.[4] Based upon the studies completed, the installation of a public sanitary sewer system for these two lake areas was not recommended. However, it is recommended that this conclusion be reconsidered later in the planning period based upon the then current conditions of the onsite sewerage systems in the area. Thus, for these two areas and for the remaining enclaves located in areas where soils are not considered to meet current criteria for conventional onsite systems, it is recommended that an inspection and maintenance program for the onsite sewerage disposal system be initiated 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 Milwaukee 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, and, in the case of many of the abandoned landfills, the types and extent of these substances are sometimes unknown. In some instances, toxic and hazardous substances have begun to leach into surrounding soil and aquifers, and can be subsequently transported to surface waters.

There are currently three active landfills and 95 known abandoned landfills located in the Milwaukee River watershed. Three of the abandoned landfills in the Milwaukee River watershed have been reported to be potentially impacting Lincoln Creek. The location of these landfills are shown on Map VIII-5 and listed in Table VIII-12.

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[3]See Tri Lakes Sanitary Study, Ruekert & Mielke, Inc., November 1989.

[4]See Silver and Little Cedar Lake Sewerage Facility Plan, Ruekert & Mielke, Inc., August 1991.

Table VIII-11

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

Number[a]	Major Urban Concentration[b]	1990 Estimated Resident Population	Distance from Year 2010 Sewer Service Area (miles)
Washington County			
1[c]	Town of Farmington-Section 20	129	2.5
2	Town of Barton-Section 4	118	0.3
3[c]	Town of Barton-Section 33	133	1.3
4[c]	Town of Barton-Section 6	113	2.1
5[c]	Town of Barton-Section 20	108	1.0
6[c]	Town of Barton-Section 33	113	--
7[c]	Town of Trenton-Sections 5, 8, and 9	457	--
8[c]	Big Cedar Lake	1,290	0.9
9	Town of West Bend-Section 22	194	--
10	Little Cedar Lake	220	0.5
11	Town of West Bend-Section 33 and 34	402	0.9
12	Town of Polk-Section 4	158	2.4
13	Town of Jackson-Section 7	129	0.5
14	Town of Jackson-Section 7	159	0.9
15[c]	Town of Polk-Section 21	109	2.5
16	Town of Polk-Section 22	115	1.5
17	Town of Jackson-Section 22	179	1.7
18[c]	Town of Jackson-Section 27	216	1.9
19	Town of Polk-Section 36	172	1.7
20	Town of Jackson-Section 36	214	3.0
21[c]	Town of Richfield-Sections 12 and 13	590	3.8
Ozaukee County			
22	Town of Fredonia-Section 19	128	1.3
23	Town of Cedarburg-Section 5 and 8	299	2.1

Table VIII-11 (Cont'd)

Number[a]	Major Urban Concentration[b]	1990 Estimated Resident Population	Distance from Year 2010 Sewer Service Area (miles)
24[c]	Town of Cedarburg-Section 2	142	0.8
25	Town of Cedarburg-Section 1	143	--
26	Town of Cedarburg-Section 18	239	2.1
27[c]	Town of Cedarburg-Section 16	242	0.4
28	Town of Cedarburg-Section 15	486	--
29	Town of Cedarburg-Sections 29 and 30	235	0.5
30[c]	Town of Grafton-Section 29	175	0.5
31[c]	Town of Grafton-Section 31	210	2.0
	Total	7,994	39

[a] See Map VIII-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.

Source: SEWRPC.

Table VIII-12

MISCELLANEOUS POTENTIAL POLLUTION SOURCES
IN THE MILWAUKEE RIVER WATERSHED: 1990

Map ID Number[a]	Landfills Indicated to be Potential Pollution Sources	Civil Division Location	Surface Water Potentially Impacted
1	U.S. Army Reserve Landfill-Havenwoods Park[b]	City of Milwaukee	Lincoln Creek
2	Village of Whitefish Bay[b]	City of Milwaukee	Lincoln Creek
3	City of Milwaukee Landfill[b]	City of Milwaukee	Lincoln Creek
	Leaking Underground Storage Tank Sites[c,d]		Receiving Water
1	Federal Distributing, Inc.	Village of Brown Deer	Milwaukee River
2	Amoco Oil Company	City of Milwaukee	Milwaukee River
3	Interstate Drop Forge, Inc.	City of Milwaukee	Lincoln Creek
	Additional Groundwater Contamination Sites[c,e]		
	None		

[a]Refers to Map VIII-5, "Point Sources of Pollution Other Than Sewage Treatment Facilities in the Milwaukee River Watershed: 1990."

[b]As indicated in Wisconsin Department of Natural Resources Milwaukee River South Branch Watershed Water Resource Appraisal and Stream Classification, 1989.

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

[d]As of 1993, there were seven additional leaking underground storage tank sites in the Milwaukee River watershed whose remediation discharges were permitted under the Wisconsin Pollutant Discharge Elimination System: Eddie's Service in the Village of Saukville, which is permitted to discharge to the Milwaukee River via a storm sewer; Herbst Service Station in the Village of Jackson, which is permitted to discharge to a tributary of Cedar Creek; Jacobus Company-West Bend Bulk Terminal in the City of West Bend, which is permitted to discharge to the Milwaukee River via a storm sewer; O'Connor Oil Company, Cooper Environmental, in the City of West Bend which is permitted to discharge into the Milwaukee River via a storm sewer; Ozaukee County Highway Department in the Town of Saukville, which is permitted to discharge to groundwater; TriPar Oil in the City of West Bend, which is permitted to discharge to the Milwaukee River via a storm sewer--all in Ozaukee County; and Milwaukee Gear Company in the City of Milwaukee, Milwaukee County, which is permitted to discharge to the Milwaukee River via a storm sewer.

[e]As of 1993, there was one groundwater contamination site whose remediation discharges were permitted under the Wisconsin Pollutant Discharge Elimination System: Moore Oil Company in the City of Milwaukee, which is permitted to discharge to Lincoln Creek.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the Milwaukee 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 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 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 1990, there were three known permitted leaking underground storage tank sites that were discharging remediation waters to surface waters in the Milwaukee River watershed, as indicated in Table VIII-12 and shown on Map VIII-5. As of 1993, there were seven additional leaking underground storage tanks in the Milwaukee River watershed whose remediation wastewaters were permitted to discharge to surface or ground waters, as shown in Table VIII-12.

As of 1993, there were 622 additional leaking underground storage tanks in the Milwaukee River watershed identified by the Wisconsin Department of Natural Resources 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 have 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 1993, there was one permitted site discharging to surface water in the Milwaukee River watershed, as indicated in Table VIII-12.

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, malfunctioning septic systems, and pollutant contributions from the atmosphere.

Existing Conditions and Status of Plan Implementation

For the Milwaukee River watershed, the adopted 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, onsite sewage disposal system management, and streambank erosion control. The plan also recommended that additional nonpoint source controls be provided in the Lake Twelve drainage area, which would reduce nonpoint sources of pollution by about 75 percent in the rural areas. No nonpoint source controls were recommended in

the southern portion of the watershed where the deep tunnel-combined sewer overflow abatement plan has been implemented.

In 1971, the Commission prepared a comprehensive plan[5] for the Milwaukee River watershed. This comprehensive plan established the necessary framework for the conduct of subsequent detailed stormwater management planning for the urban and urbanizing areas and for rural nonpoint source management planning in the watershed.

Implementation of the recommended nonpoint source control practices has been achieved on a limited basis in the Milwaukee 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 Washington, Ozaukee, and Milwaukee Counties in the unincorporated areas and by the local units of government in incorporated areas served by onsite systems. 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.

Significant progress has been made in the area of construction site erosion control. As of January 1993, the Cities of Cedarburg, Glendale, Mequon, and Milwaukee; the Villages of Fredonia, Germantown, Grafton, Jackson, Kewaskum, Newburg, and Saukville; and the Town of Cedarburg 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. In addition, Washington County, the City of West Bend, and the Villages of River Hills and Thiensville had ordinances which were developed independently from the model, while an ordinance based on the model is currently being drafted for the Town of Grafton. The Cities of Mequon and West Bend also have developed stormwater ordinances.

With regard to rural nonpoint source pollution 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 has been used in selected cases in the Milwaukee 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 being utilized in the Milwaukee River watershed 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

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[5]SEWRPC Planning Report No. 13, A Comprehensive Plan for the Milwaukee River Watershed, Volume One, Inventory Findings and Forecasts, 1969; Volume Two, Alternative Plans and Recommended Plan, 1970.

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 Washington and Ozaukee Counties. 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 local programs described above and the Wisconsin Department of Natural Resources priority watershed program described below have probably resulted in some reduction in the pollutant loadings from nonpoint sources. However, this element of the plan has only been partially implemented.

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 program was established in 1978 by the Wisconsin Legislature and provides cost-sharing funds for individual projects or land management practices 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. Four such programs are currently underway in the Milwaukee River watershed: the North Branch Milwaukee River Priority Watershed Project, the East and West Branch Milwaukee River Priority Watershed Project, the Milwaukee River South Priority Watershed Project, and the Cedar Creek Priority Watershed Project.[6]

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[6]Wisconsin Department of Natural Resources Publications No. WR-253-90, A Nonpoint Source Control Plan for the North Branch Milwaukee River Priority Watershed Project, June 1989; WR-255-90, A Nonpoint Source Control Plan for the East and West Branches of the Milwaukee River Priority Watershed Project, February 1989; WR-245-91, A Nonpoint Source Control Plan for the Milwaukee River South Priority Watershed Project, December 1991; and, A Nonpoint Source Control Plan for the Cedar Creek Priority Watershed Project, 1992.

North Branch Milwaukee River Priority Watershed Project: The North Branch Milwaukee River watershed was designated a "priority watershed" in 1984. Planning for the North Branch Milwaukee River priority watershed was completed in 1989 and implementation of practices will continue for about an eight-year period, to July 1997. Rural elements of the North Branch Milwaukee River priority watershed project are administered by the Fond du Lac, Ozaukee, Sheboygan, and Washington County Land Conservation Committees. Urban elements of project are being administered by the Villages of Adell, Cascade, and Random Lake.

The North Branch Milwaukee River priority watershed project established nonpoint source pollutant reduction goals to obtain loading reductions for sediment and phosphorus ranging from 10 to 40 percent for the subareas considered. Additional control recommendations were established for barnyards and livestock operations. These loading reductions were based primarily upon field inventories of the streams in the North Milwaukee River watershed. Observations were made of the sediment imbeddedness and biological conditions of each stream and a corresponding judgement was made with regard to the reductions needed in the stream sediment loading for restoring biological uses. The nonpoint source pollutant reductions set forth in the North Branch Milwaukee River priority watershed plan are generally consistent with the recommendations of the initial plan.

In order to achieve these objectives, the North Branch Milwaukee River priority watershed program includes recommendations and funding eligibility for the nonpoint source control measures presented below.

Rural Land Management--

- Provision of fencing and other streambank erosion control practices for about 65,000 feet of eroding streambank.

- Formation of detailed conservation plans to develop the best management practices for about 12,000 acres of cropland.

- Installation of management practice for 64-86 barnyards and the installation of improved practices for manure spreading on 1,600 acres.

Urban Land Management--

- Provision of construction site erosion control for new urban development which is expected in the watershed during the planning period.

- Preparation of detailed stormwater management plans to determine the best practices to be installed in the urban and urbanizing areas.

East and West Branches of the Milwaukee River Priority Watershed Program: The East and West branches of the Milwaukee River watershed was designated as a "priority watershed" in 1984. Planning for the watershed project was completed in 1989 and implementation of practices will continue for an eight-year period to July 1997. Rural elements of the East and West Branches of the Milwaukee River priority watershed project are administered by the Dodge, Fond du Lac, Ozaukee, Sheboygan, and Washington County Lake Conservation Committees. Urban elements of the project are being administered by the City of West Bend and the Villages of Kewaskum, Campbellsport, and Newburg.

The East and West Branches of the Milwaukee River priority watershed project established nonpoint source pollutant reduction goals to obtain loading reductions of from 10 to 50 percent for sediment and from 25 to 50 percent for phosphorus. These loading reductions were based primarily upon field inventories of the streams in the East and West Branches of the Milwaukee River watershed. Observations were made of the sediment imbeddedness and biological condition of each stream and a corresponding judgement was made with regard to the reductions needed in the stream sediment loading for restoring biological uses. The recommendations of the priority watershed plan for the rural areas are generally low in cost and are generally consistent with the County soil erosion control plans and other County land conservation programs. However, priority watershed plan recommendations for the urban areas are costly and full implementation will be difficult. The plan recommends that further detailed stormwater management planning and assessments of the levels of control required to meet the water use objectives be carried out as part of the subsequent plan implementation actions.

In order to achieve these objectives, the East and West Branch Milwaukee River priority watershed program includes recommendations and funding eligibility for the rural and urban nonpoint source control measures presented below.

Rural Land Management--

- The provision of fencing and other streambank erosion controls at 76 sites with a total of about 23,000 feet of eroding streambank.

- Preparation of detailed conservation plans to develop the best management practices for about 14,000 acres of cropland.

- Installation of facilities and management practices for 63 barnyards and improved practices for manure spreading on 1,200 acres.

Urban Land Management--

- Provision of construction erosion control for urban development which is expected in the watershed during the planning period.

- The preparation of detailed stormwater management plans to determine the best practices to be installed in the urban and urbanizing areas.

- Institution of public information and education programs on nonpoint source pollution abatement; and the institution of sound urban "housekeeping practices" such as pet litter regulation, proper yard waste management, and proper use of pesticides and fertilizers.

Milwaukee River South Priority Watershed Project: The Milwaukee River South watershed was designated as a "priority watershed" in 1984. Planning for the watershed project was completed in 1991 and implementation of practices will continue for an eight-year period ending in October 1999. Rural elements of the Milwaukee River South priority watershed project are administered by the Ozaukee County Land Conservation Committee. Urban elements of the project are being administered by the incorporated municipalities in the project area.

The Milwaukee River South priority watershed project established nonpoint source pollutant loading reduction goals of 50 percent for sediment, from 50 to 70 percent for phosphorus, and 50 percent for heavy metals. These loading reduc-

tions were based primarily upon field inventories of the streams in the Milwaukee River South watershed. Observations were made of the sediment imbeddedness and biological condition of each stream and a corresponding judgement was made with regard to the reductions needed in the stream sediment loading for restoring biological uses. In addition, the pollutant reduction goals were based upon a qualitative consideration of the toxicity of metals in urban runoff. The nonpoint source pollutant reductions set forth in the Milwaukee River South priority watershed plan for the rural areas are generally low in cost and are generally consistent with the County soil erosion control plans and other County land conservation programs. However, priority watershed plan recommendations for the urban areas are costly and full implementation will be difficult. The plan recommends that further detailed stormwater management planning and assessments of the levels of control required to meet the water use objectives be carried out as part of the subsequent plan implementation actions.

In order to achieve these objectives, the Milwaukee River South priority watershed program includes recommendations and funding eligibility for the rural and urban nonpoint source control measures presented below.

Rural Land Management--

- Provision of fencing and other streambank erosion control practices for about 36,000 feet of eroding streambank.

- Formation of detailed conservation plans to develop the best management practices for about 14,000 acres of cropland.

- Installation of management practices for 43 barnyards.

- The installation of facilities and management practices for 29 livestock operations to change manure spreading practices.

Urban Land Management--The plan generally recommends to municipalities the initial development of a "core program" of urban land management practices. This core program provides for implementation of construction erosion controls; the institution of a public information and education program on nonpoint source pollution abatement; and institution of sound urban "housekeeping practices" such as pet litter regulation, proper yard waste management, and proper use of pesticides and fertilizes. The plan further recommends the development of a "segmented program" providing for the stormwater management planning, possible stormwater ordinance requirements, streambank stabilization, street sweeping, and the design and construction of management practices is also recommended. Specific core and segmented programs include:

- Provision of construction erosion control for new urban development which is expected in the watershed during the planning period.

- Provision of nonpoint source control practices on about 16,000 to 35,000 acres of existing urban development and about 7,000 acres of new urban land targeted for nonpoint source control. Possible urban nonpoint source pollution control practices include wet detention ponds, infiltration devices, street sweeping, and public information and education programs to develop good housekeeping practices.

- Preparation of detailed stormwater management plans to determine the best practices to be installed in the urban and urbanizing areas.

- Provision of streambank erosion control measures at 16 sites, located primarily along Indian and Lincoln Creeks.

Cedar Creek Priority Watershed Project: The Cedar Creek watershed was designated as a priority watershed in 1984. Planning for the watershed project was completed in 1992 and implementation of practices will continue for an eight-year period ending in March 2000. Rural elements of the Cedar Creek priority watershed project are administered by the Ozaukee and Washington County Land Conservation Committees. Urban elements of the project are being administered by the City of Cedarburg, the Villages of Jackson and Grafton, and the Big Cedar Lake and Little Cedar Lake Protection and Rehabilitation Districts.

The Cedar Creek priority watershed project established nonpoint source pollutant loading reduction goals of from 50 to 75 percent for sediment. Additional reduction goals of 50 percent were established for urban stormwater pollutants, and of 60 percent for nutrient loadings to surface waters from animal waste sources and eroding uplands.

These loading reductions were based primarily upon field inventories of the streams in the Cedar Creek watershed. Observations were made of the sediment imbeddedness and biological condition of each stream and a corresponding judgement was made with regard to the reductions needed in the stream sediment loading for restoring biological uses. In addition, the pollutant reduction goals were based upon a qualitative consideration of the toxicity of metals in urban runoff. The recommendations of the priority watershed plan for the rural areas are generally low in cost and are generally consistent with the County soil erosion control plans and other County land conservation programs. However, priority watershed plan recommendations for the urban areas are costly and full implementation will be difficult. The plan recommends that further detailed stormwater management planning and assessments of the levels of control required to meet the water use objectives be carried out as part of the subsequent plan implementation actions.

In order to achieve these objectives, the Cedar Creek watershed program includes recommendations and funding eligibility for the rural and urban nonpoint source control measures presented below.

Rural Land Management:

- Provision of fencing and other streambank erosion control practices for 23 sites where cattle access is suspected to be causing degradation of habitat and/or water quality.

- Formation of detailed conservation plans to develop the best management practices for about 22,000 acres of cropland.

- Installation of management practices for 24 barnyards.

- Installation of facilities and management practices for 22 livestock operations to change manure spreading practices.

- Purchase of four conservation easements in selected areas of the watershed where it is demonstrated to be the least-cost practicable control alternative.

Urban Land Management--The plan generally recommends to municipalities the initial development of a "core program" of urban land management practices. This core program provides for implementation of construction erosion controls; the institution of a public information and education program on nonpoint source pollution abatement; and institution of sound urban "housekeeping practices" such as pet litter regulation, proper yard waste management, and proper use of pesticides and fertilizes. The plan further recommends the development of a "segmented program" providing for the stormwater management planning, possible stormwater ordinance requirements, streambank stabilization, street sweeping, and the design and construction of management practices is also recommended. Specific core and segmented programs include:

- Provision of construction erosion control for new urban development which is expected in the watershed during the planning period.

- Provision of nonpoint source control practices on existing urban and new urban land targeted for nonpoint source control. Possible urban nonpoint source pollution control practices include wet detention ponds, infiltration devices, street sweeping, and public information and education programs to develop good housekeeping practices.

- Preparation of detailed stormwater management plans to determine the best practices to be installed in the urban and urbanizing areas.

Current Plan Recommendations

It is recommended that construction site erosion control, onsite sewerage system management, and streambank erosion control, in addition to land management practices designed to provide about a 25 percent reduction in nonpoint source pollutant loadings are recommended to be carried out throughout the Milwaukee River watershed. Within the rural areas in the drainage area of Lake Twelve, it is recommended that additional practices providing for levels of control for about a 75 percent reduction in nonpoint source loadings be provided. It is further recommended that the levels of control set forth above as developed for the four priority watershed projects be utilized as the initial basis for subsequent stormwater management planning purposes and for project eligibility under the State priority watershed program. These levels of reduction are recommended to 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 define the recommended final level of control. 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 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, long-term monitoring has been carried out in the Milwaukee River watershed on a sustained basis by the U.S. Geological Survey at one station located on the Milwaukee River main stem and by the Milwaukee Metropolitan Sewerage District at nine stations located on the Milwaukee River main stem. Data from five of the Milwaukee Metropolitan Sewerage District sampling stations, as shown on Map VIII-6, were used to document current long-term water quality conditions in the watershed. Short-term monitoring has also been conducted at 13 sites by either the Department of Natural Resources or the U.S. Geological Survey during the period 1988 through 1993.

Currently, water quality monitoring is being carried out in several lakes as part of the DNR Self-help Monitoring Program, including Big Cedar Lake, Green Lake, Little Cedar Lake, Silver Lake (Washington County), and Wallace Lake. In addition, limited water quality monitoring has been carried out on the major lakes in the watershed by the U.S. Geological Survey, the Wisconsin Department of Natural Resources, and by local lake management agencies.

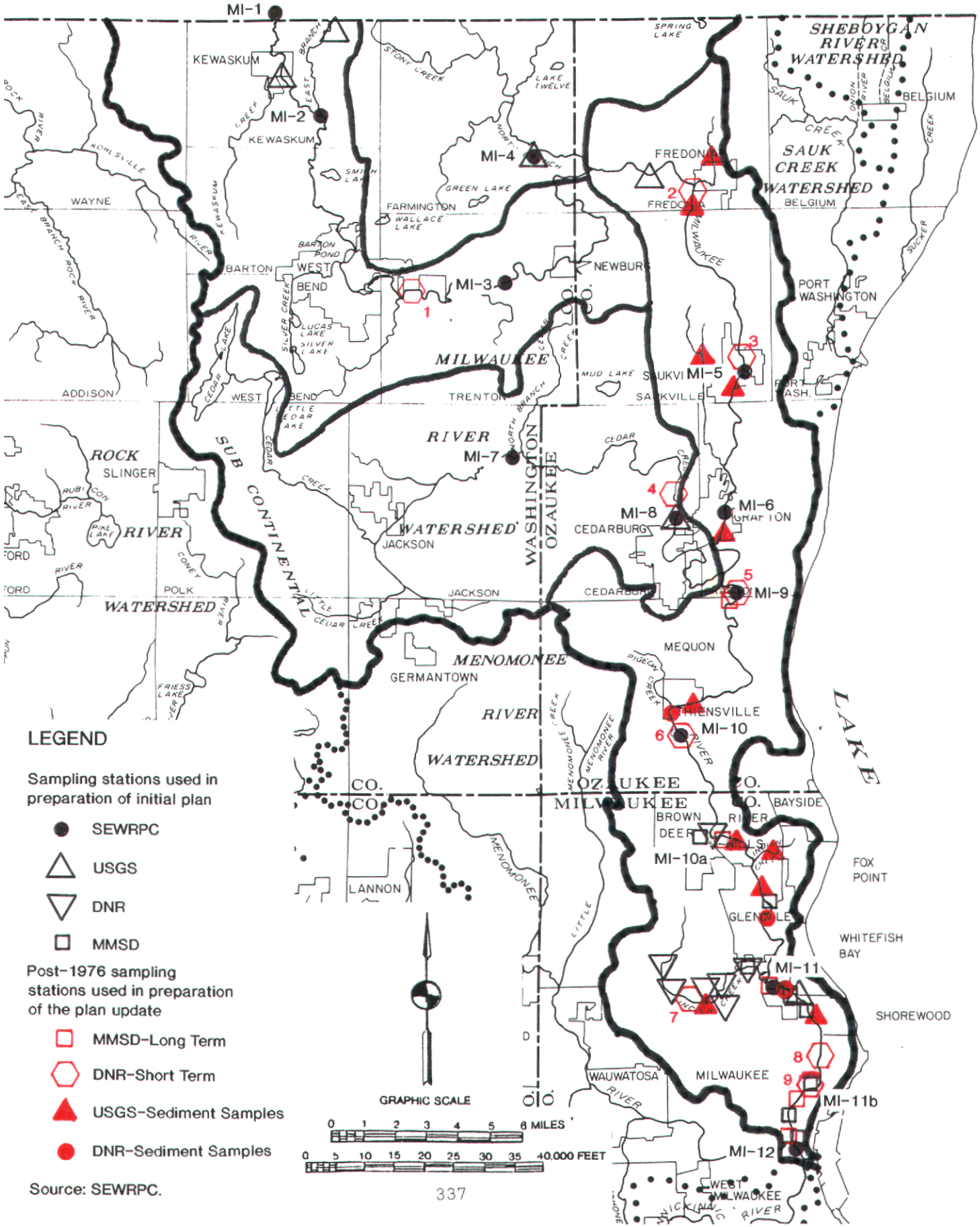
Current Plan Recommendation

Continued 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 U.S. Geological Survey and the Milwaukee Metropolitan Sewerage District on the Milwaukee River 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 M1-4, M1-5, M1-6, and M1-8, and at ten selected additional stations, with one station each on Silver, Kewaskum, Quaas, Stony, Wallace, Little Cedar, Indian, Pigeon, and Lincoln Creeks, and one on the Milwaukee River East Branch. During the same one-year period, it is recommended that biological monitoring be conducted on the stations which water quality data are collected by the Milwaukee Metropolitan Sewerage District. It is recommended that this program be conducted within the next five to seven years and repeated at 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 watershed in the Region in an approximate five- to seven-year rotating cycle.

The lake monitoring program for each lake should consist, at a minimum, of one intensive monitoring effort to establish baseline conditions and of long-term participation in the DNR Self-help Monitoring Program that can be conducted by citizen-volunteer residents on the lakes. As noted earlier, several lakes already participate in this program. For each lake, it is recommended that the monitoring program should be expanded to establish current conditions during a

Map VIII-6

LOCATIONS OF WATER QUALITY AND SEDIMENT SAMPLING SITES IN THE MILWAUKEE RIVER WATERSHED



LEGEND

Sampling stations used in preparation of initial plan

- SEWRPC
- USGS
- DNR
- MMSD

Post-1976 sampling stations used in preparation of the plan update

- MMSD-Long Term
- DNR-Short Term
- USGS-Sediment Samples
- DNR-Sediment Samples

GRAPHIC SCALE

0 1 2 3 4 5 6 MILES

0 5 10 15 20 25 30 35 40,000 FEET

Source: SEWRPC.

two-year or more period of intensive monitoring followed by a continual long-term monitoring program designed to detect changes in water quality conditions. In this regard, the monitoring program should be tailored to provide data needed for preparation or updating of comprehensive lake management plans for the major lakes in the watershed. Such programs are being undertaken by the Department of Natural Resources on Big Cedar Lake in Washington County as part of the Long-Term Trends Program. The water quality sampling program should be carried out at spring turnover (April) and during June, July, and August during two subsequent years with samples collected weekly.

LAKES MANAGEMENT PLAN ELEMENT

Existing Condition and Status of Plan Implementation

The initial regional water quality management plan included recommendations for reducing nonpoint sources of pollution in the tributary areas of the major lakes in the Milwaukee River watershed and for consideration of other lake management measures. Institutional recommendations were also made for the formation of new special purpose units of government where none exist to carry out the plan implementation measures. For each major lake in the Milwaukee River watershed, the initial plan recommended that a comprehensive lake management plan be prepared to consider in more detail the applicability and preliminary design of watershed and in-lake management measures. As noted in the previous sections, the preparation of such a comprehensive plan requires supporting water quality monitoring programs to be established.

The status of lake management, protection, and rehabilitation efforts on and around the major lakes in the Milwaukee River watershed is discussed for each major lake in the following paragraphs:

Barton Pond: Barton Pond is located within the East and West Branches of the Milwaukee River Priority watershed planning area. The urban development around the pond is within the City of West Bend sewer service area and is provided with a public sanitary sewer system. Water quality assessments of this pond have not been made. Enrollment of this waterbody in the DNR Self-help Monitoring Program is recommended.

Big Cedar Lake: Big Cedar Lake is located within the Cedar Creek priority watershed planning area. The lake is a DNR Long-term Trend Monitoring lake, and the Big Cedar Lake Protection and Rehabilitation District and Big Cedar Lake Sanitary District participate in the DNR Self-help Monitoring Program. An approved aquatic plant management plan has been prepared for this lake.[7]

Green Lake: Green Lake is located within the East and West Branch of the Milwaukee River priority watershed. The Green Lake Association participates in the DNR Self-help Monitoring Program.

Lac Du Cours: Lac Du Cours is located within the Milwaukee River South priority watershed planning area. No specific water quality data are available and no specific plan implementation activities have been documented on this lake as

[7]Aron & Associates, Big Cedar Lake Plant Management Plan, April 1993.

of 1993. Enrollment of this lake in the DNR Self-help Monitoring Program is recommended.

Little Cedar Lake: Little Cedar Lake is located within the Cedar Creek priority watershed planning area. The Little Cedar Lake Protection District participates in the DNR Self-help Monitoring Program. Sewerage services are provided by the Little Cedar Lake Protection District.

Lucas Lake: Lucas Lake is located within the East and West Branch of the Milwaukee River priority watershed planning area. Enrollment of this lake in the DNR Self-help Monitoring Program is recommended.

Mud Lake (Ozaukee County): Mud Lake is located within the Cedar Creek priority watershed. This lake has been assigned to the limited forage fish community and limited recreational use category due to its highly eutrophic character and shallow water depth in the initial plan but has been reassigned to the maintenance of warmwater sportfish and full recreational use as a result of detailed investigations carried out by the Wisconsin Department of Natural Resources during the Cedar Creek priority watershed project water resources appraisal process.[8]

Silver Lake (Washington County): Silver Lake is located within the current East and West Branch of the Milwaukee River Priority Watershed Program planning area. The Silver Lake District, Silver Lake Association, and the Silver Lake Sanitary District are participants in the DNR Self-help Monitoring Program. Jointly, these organizations have developed an aquatic plant management plan for the lake. The urban development around the lake is provided with a public sanitary sewer system.

Smith Lake: Smith Lake is located within the East and West Branch of the Milwaukee River priority watershed planning area. It is recommended that Smith Lake enroll in the DNR Self-help Monitoring Program.

Spring Lake: Spring Lake is located within the North Branch Milwaukee River priority watershed planning area. It is recommended that Spring Lake enroll in the DNR Self-help Monitoring Program.

Lake Twelve: Lake Twelve is located within the North Branch Milwaukee River priority watershed planning area. It is recommended that Lake Twelve enroll in the DNR Self-help Monitoring Program.

Wallace Lake: Wallace Lake is located within the North Branch Milwaukee River priority watershed planning area and within the West Bend sanitary sewer service area. The Wallace Lake Sanitary District provides sewerage services to the lakeshore area and conducts regular monitoring of the lake as a participant in the DNR Self-help Monitoring Program.

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[8]Wisconsin Department of Natural Resources Publication No. WR-336-93, Nonpoint Source Control Plan for the Cedar Creek Priority Watershed Project, August 1993.

Current Plan Recommendations

Management measures recommended and in-lake measures which are considered potentially applicable and should be considered in more detail are shown in Table VIII-13 for the twelve major lakes in the Milwaukee River watershed. The initial plan recommendations relating to the preparation of comprehensive lake management plans and the conduct of supporting water quality, biological conditions, and water budget monitoring programs are reaffirmed in the updated plan recommendations for the Milwaukee River watershed. The management recommendations for the lakes are based upon review of the lake planning set forth in the initial plan and the current status of implementation of the recommendations, as well as any subsequent local planning.

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, the water quality monitoring, aquatic plant management, and watershed protection measure planning and implementation are considered to be logical components 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 to the recommendations noted for the major lakes in the Milwaukee River watershed, it is recommended that water quality planning and supporting monitoring be conducted for those lakes and similar water bodies in the watershed which are less than 50 acres in size, where such activities are deemed to be important for water quality protection. In such cases, management techniques similar to those recommended to be applicable for consideration on the major lakes in the watershed can be considered for lake 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; the 1976 Commission monitoring program conducted under the regional water quality management planning effort; in addition to the U.S. Geological Survey (USGS), the Wisconsin Department of Natural Resources and the Milwaukee Metropolitan Sewerage District sampling programs. Available data collected in those programs for the Milwaukee River watershed included samplings at twelve Commission stations: nine on the Milwaukee River main stem and three on its tributaries; at seven DNR stations; at six USGS stations; and at eight Milwaukee Metropolitan Sewerage District stations. The sampling station locations are shown on Map VIII-6.

Long-term post-1976 water quality data have been collected by the Milwaukee Metropolitan Sewerage District for nine stations on the Milwaukee River. Water resource appraisal information, including biological condition and water quality data collected by the Wisconsin Department of Natural Resources for the Milwaukee River Nonpoint Source Priority Watershed Projects and the Milwaukee River

Table VIII-13

MANAGEMENT MEASURES TO BE CONSIDERED IN LOCAL MANAGEMENT PLANS FOR THE MAJOR LAKES IN THE MILWAUKEE RIVER WATERSHED: 1993[a]

SUBWATERSHED Lake Name	Area (acres)	Water Quality Monitoring	Prepare Comprehensive Management Plan	Watershed-based Measures						In-lake Management Measures						
				Public Sanitary Sewer Service	Onsite Sewage System Mgmt	Rural NPS Mgmt	Urban NPS Mgmt	Construction Site NPS Mgmt	Livestock Mgmt	Macrophyte Harvest	Aeration	Nutrient Inactivation	Dredge	Sediment Cover	Water Level Mgmt	Fish Mgmt
CEDAR CREEK																
Big Cedar Lake	932	o	+	-	+	o	o	o	+	o	-	+	-	-	-	+
Little Cedar Lake	246	o	+	-	+	o	o	o	+	-	-	+	+	+	-	+
Mud Lake (Ozaukee Co.)	245	+	+	-	-	o	-	-	+	-	-	-	-	-	-	-
MILWAUKEE RIVER-EAST/WEST																
Barton Pond	67	+	+	o	-	o	o	o	-	-	-	-	+	+	-	+
Lucas Lake	78	+	+	-	+	o	o	o	-	+	-	+	+	+	-	+
Silver Lake (Washington)	118	o	+	o	-	o	o	o	-	o	-	+	-	+	-	+
Smith Lake	86	+	+	-	+	o	o	-	+	+	-	+	+	+	-	+
MILWAUKEE RIVER-NORTH																
Green Lake (Washington)	71	o	+	-	+	o	o	-	-	-	-	+	-	+	-	+
Spring Lake (Ozaukee)	66	+	+	-	+	o	o	o	-	-	-	+	+	+	-	+
Lake Twelve	53	+	+	-	+	o	o	o	-	-	-	+	+	+	-	+
Wallace Lake	52	o	+	o	-	o	o	-	-	+	-	+	+	+	-	+
MILWAUKEE RIVER-SOUTH																
Lac du Cours	56	+	+	o	-	o	o	-	-	-	-	-	-	-	-	+

NOTE: o = on-going management measures; + = management measures proposed or recommended for further consideration; - = management measures not specifically recommended for further consideration

[a] Management measures recommended for further consideration in local management plan are summarizd from those adopted in SEWRPC Planning Report No. 30, modified as necessary as the results of subsequent implementation actions, monitoring programs, and planning studies.

Source: SEWRPC.

Basin Integrated Resource Management Plans,[9] were also available for use in the assessment of current water quality conditions. Water quality data have also been collected on a short-term basis at 13 locations in the Milwaukee River watershed. Data collected at nine sites from 1988 through 1993, along with long-term data from five Milwaukee Metropolitan Sewerage District stations, as shown on Map VIII-6, were used to assess current water quality conditions as discussed in the next section and, where appropriate, to make a generalized comparison to historic 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, 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 Milwaukee River watershed.

Long-term water quality data collected by the Milwaukee Metropolitan Sewerage District at five sampling stations on the main stem of the Milwaukee River--M1-9, at Pioneer Road; M1-10a, at Brown Deer Road; M1-11, at Port Washington Road; M1-11b, at Walnut Street; and M1-12, at the Chicago and North Western railway near the confluence of the Milwaukee and Menomonee Rivers--are summarized in Figures VIII-1 through VIII-5. The short-term data collected by the U.S. Geological Survey and the Wisconsin Department of Natural Resources during the period 1988 through 1993 are summarized in Figures VIII-6 through VIII-9 and in Table VIII-14. The water quality standards indicated in Figures VIII-1 through VIII-9 and in Table VIII-14 are those set forth for specific biological and recreational use objectives as described in Chapter II.

Review of those data for stations M1-9, 10a, 11, and 11b, indicates that following 1980, there appears to be improvements in water quality conditions as evidenced by reduced variabilities and, in some cases, reduced concentrations in BOD, volatile suspended solids, un-ionized ammonia nitrogen, fecal coliform, and nitrate. Improvements were also noted at stations M1-11a and M1-11b, with reduced levels of chlorophyll-a. These improvements may be attributed, in part, to the completion, after 1980, of plant upgradings for the Cities of Cedarburg and West Bend and Villages of Grafton, Fredonia, and Saukville; to the abandonments of the Village of Thiensville sewage treatment plant in 1984; to the reduction in the frequency of sanitary sewer flow bypassing due to the increased conveyance facilities installed under the Milwaukee Metropolitan Sewerage District water pollution abatement program; and to other sewer system rehabilitation actions. Water quality improvements may additionally be attributed, in part, to the reduction in pollutant loadings from industrial point sources and to the limited implementation of nonpoint source pollution abatement programs within the watershed as part of the Milwaukee River priority watershed program. Temperature, dissolved oxygen, and pH levels remained variable with no apparent

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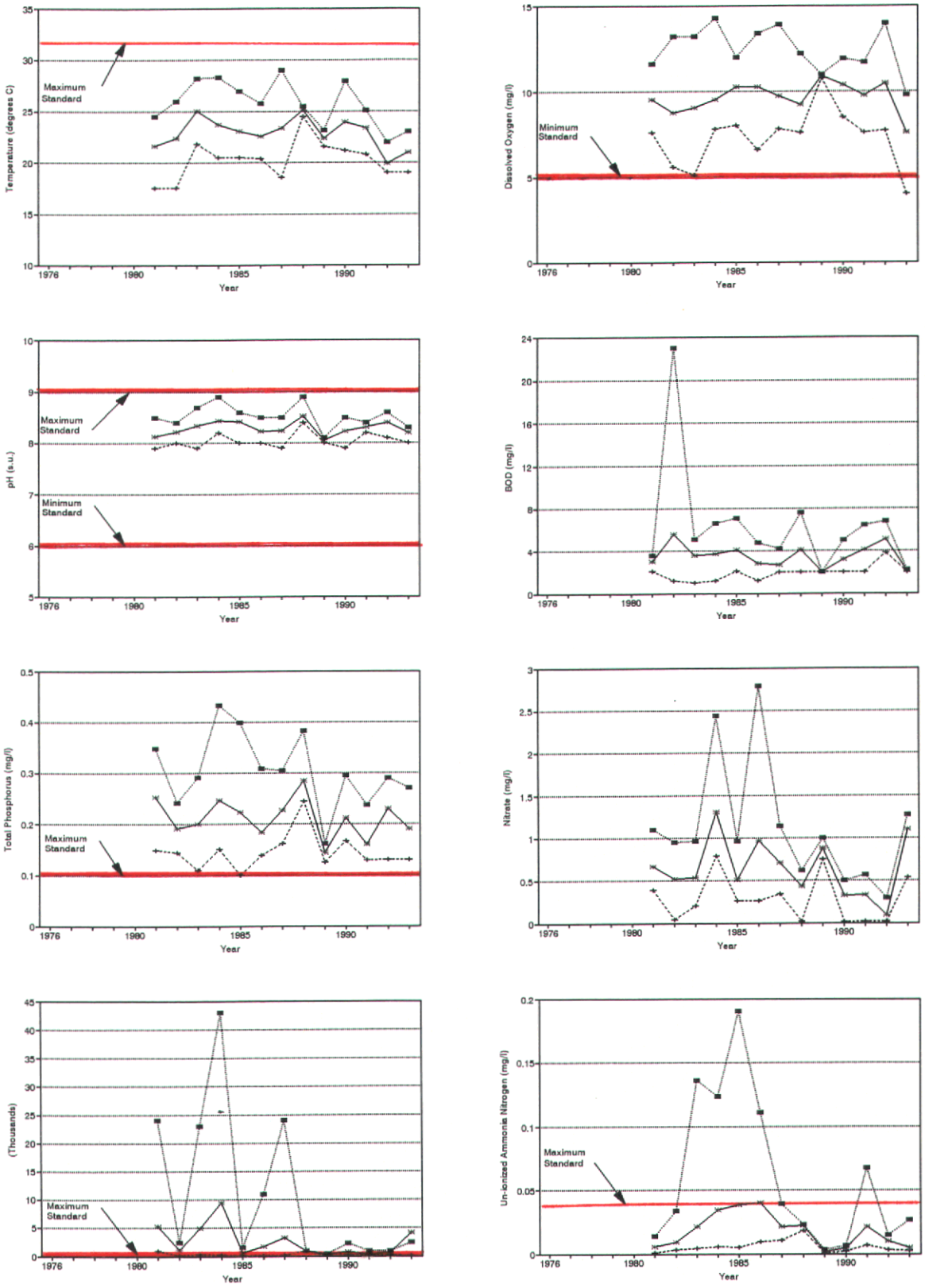
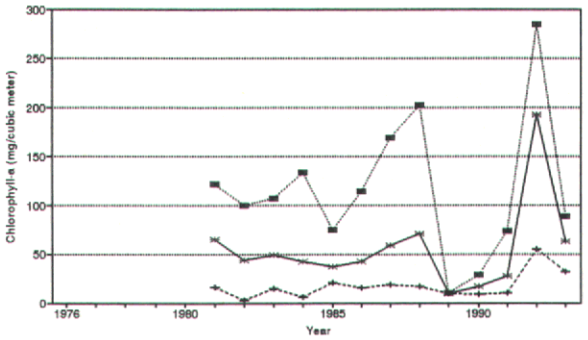
[9]Wisconsin Department of Natural Resources. "Milwaukee River Basin Integrated Management Plans-North Branch, 1990; South Branch, 1992."

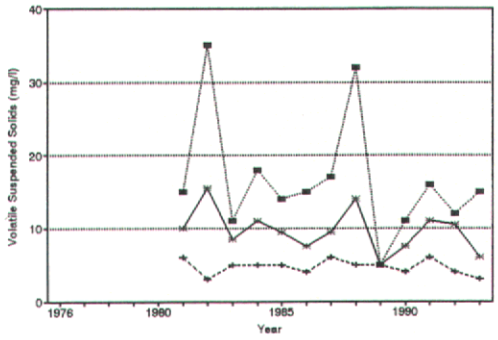
Figure VIII-1
WATER QUALITY DATA FOR THE MILWAUKEE RIVER AT STATION MI-9: 1976-1993

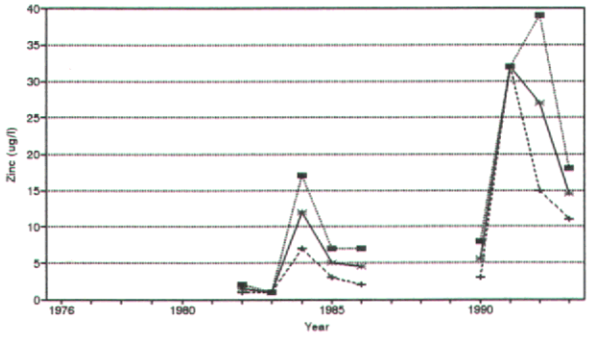


Note: The maximum standard of 200/400 colonies per 100 ml was violated in all years.

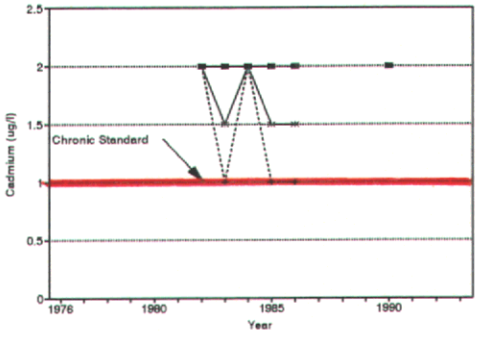
Figure VIII-1 (cont'd)



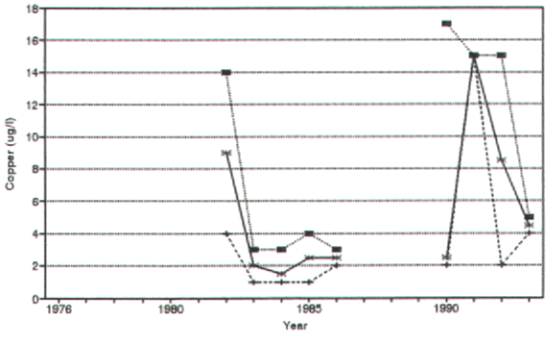




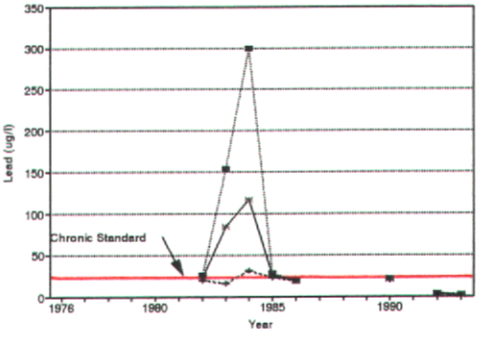
Note: The acute standard of 202.9 ug/l was not violated in any year.
The chronic standard of of 89.2 ug/l was not violated in any year.



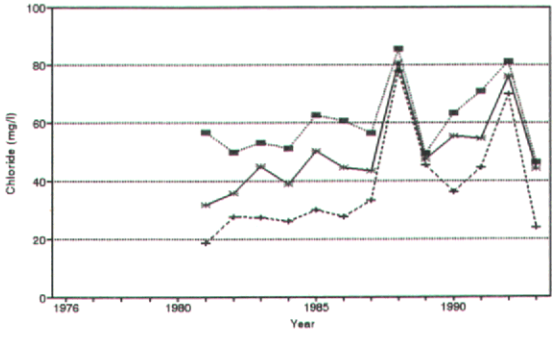
Note: The acute standard of 63.3 ug/l was not violated in any year.



Note: The acute standard of 31.9 ug/l was not violated in any year.
The chronic standard of 22.1 ug/l was not violated in any year.



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



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

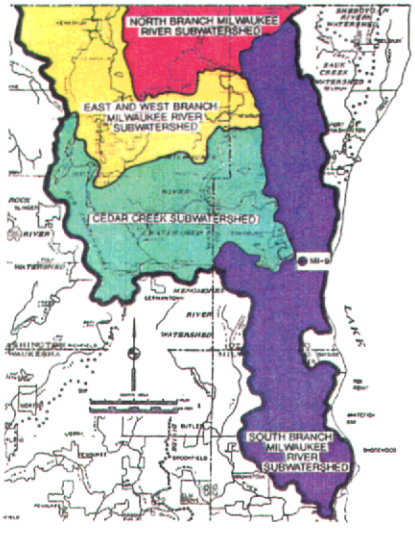
LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

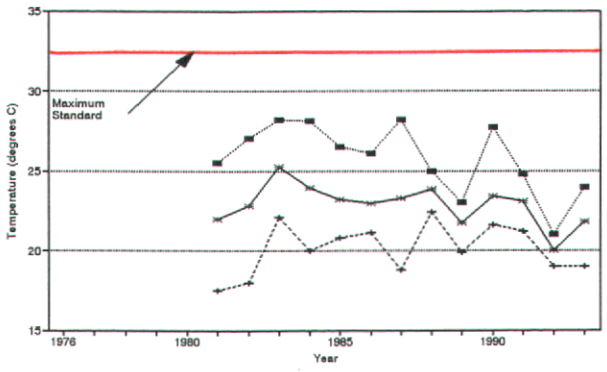
SUBWATERSHEDS IN THE MILWAUKEE RIVER WATERSHED

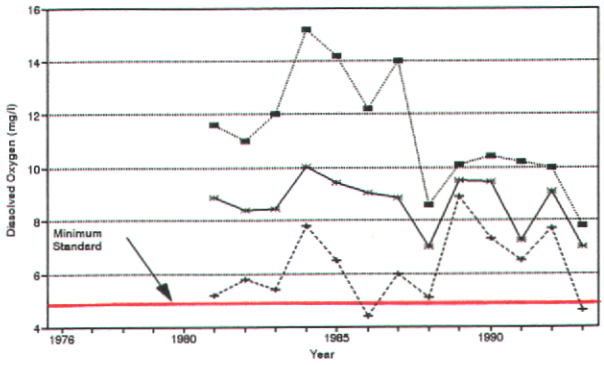


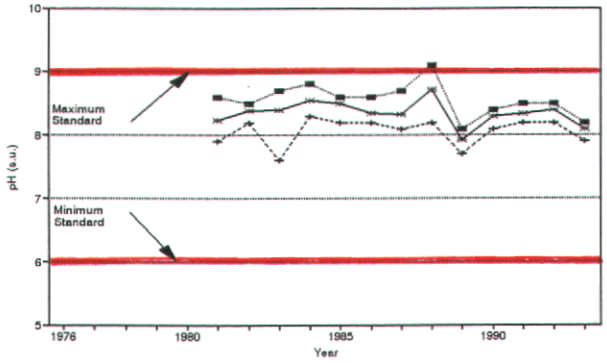
Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources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

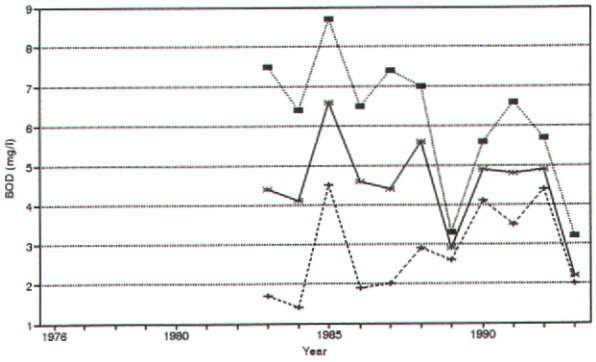
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

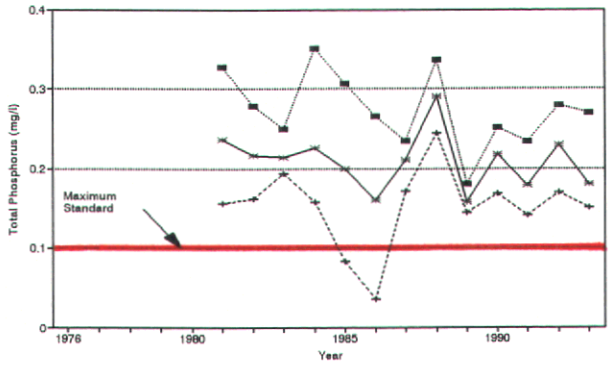
Figure VIII-2
WATER QUALITY DATA FOR THE MILWAUKEE RIVER AT STATION MI-10a: 1976-1993

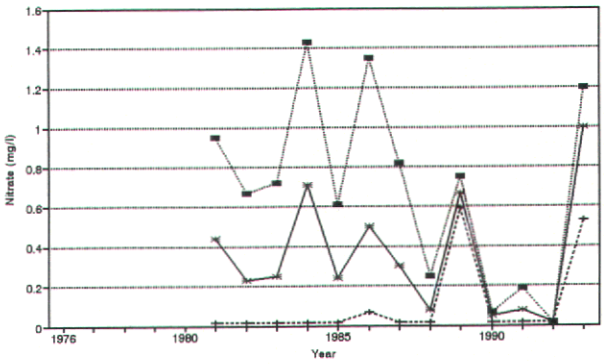




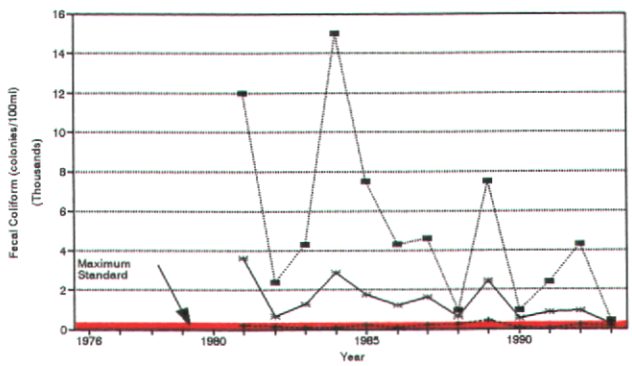


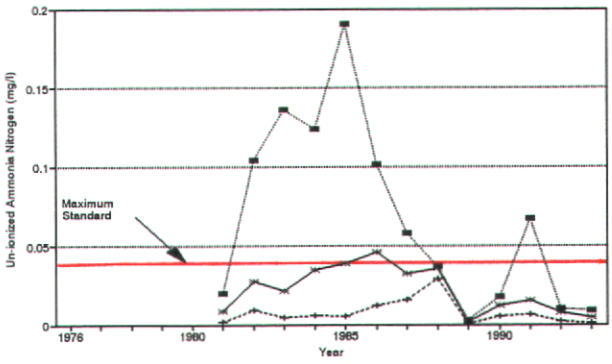






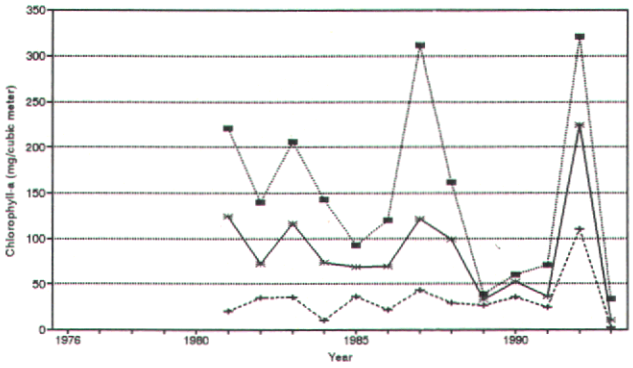
Note: The maximum standard of 0.1 mg/l was violated in all years.

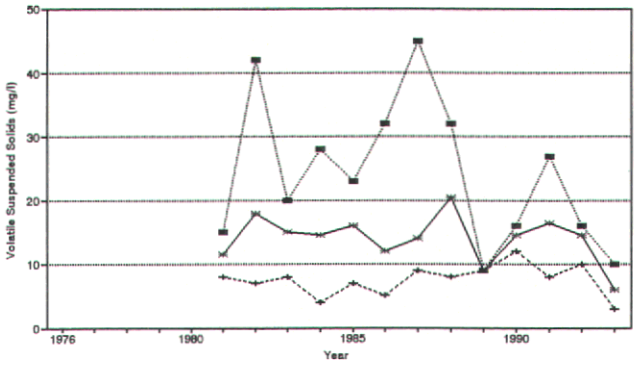


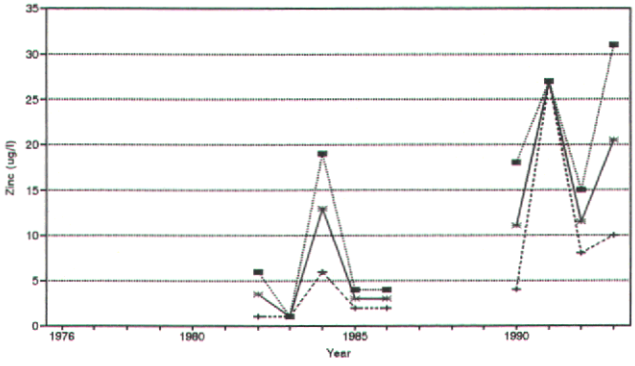


Note: The maximum standard of 200/400 colonies per 100 ml was violated in all years.

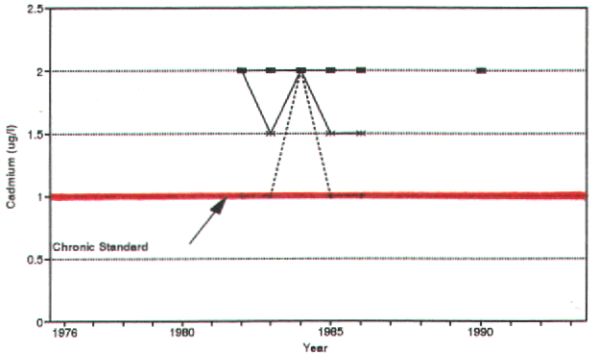
Figure VIII-2 (cont'd)



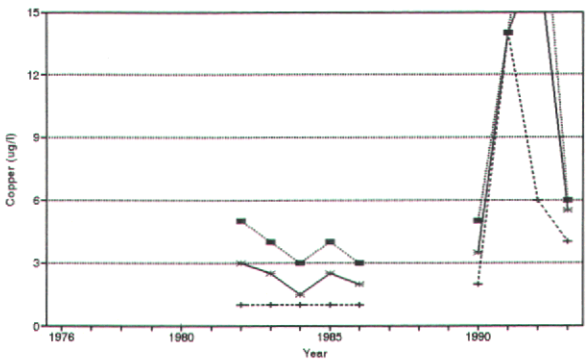




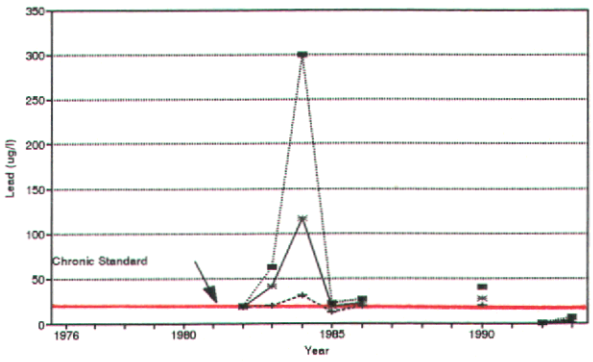
Note: The acute standard of 202.9 ug/l was not violated in any year.
The chronic standard of of 89.2 ug/l was not violated in any year.



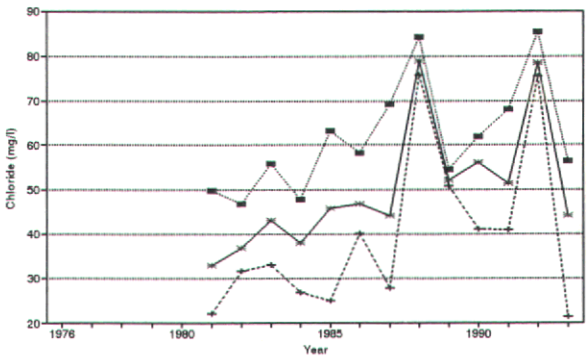
Note: The acute standard of 63.3 ug/l was not violated in any year.



Note: The acute standard of 31.9 ug/l was not violated in any year.
The chronic standard of 22.1 ug/l was not violated in any year.



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



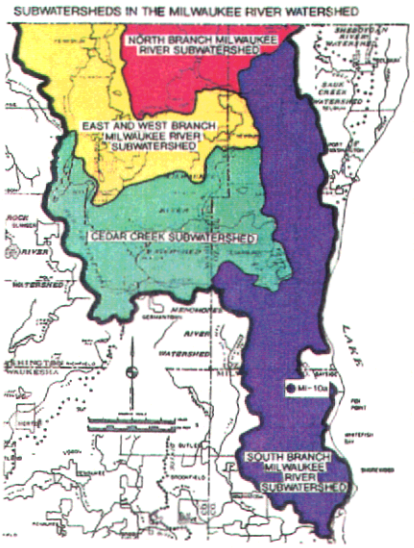
Note: The maximum standard of 1000 mg/l was not violated in any year.

LEGEND

MAXIMUM VALUE

MINIMUM VALUE

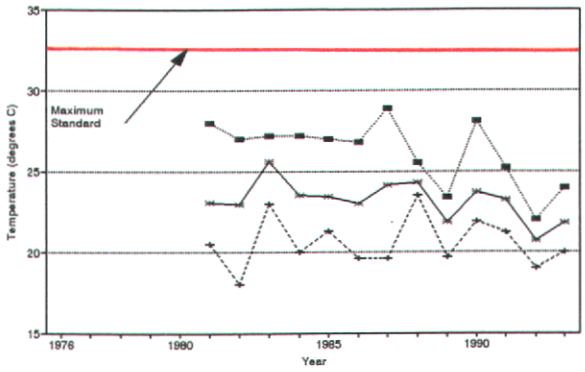
AVERAGE VALUE

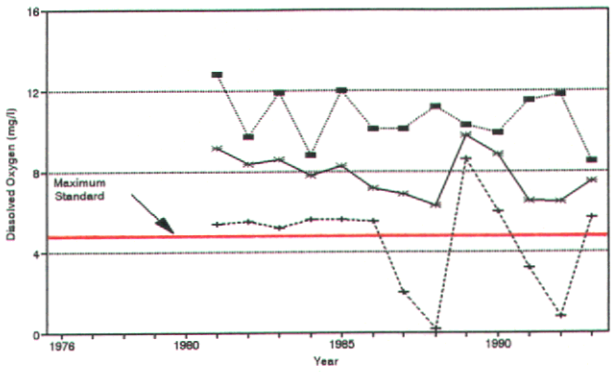


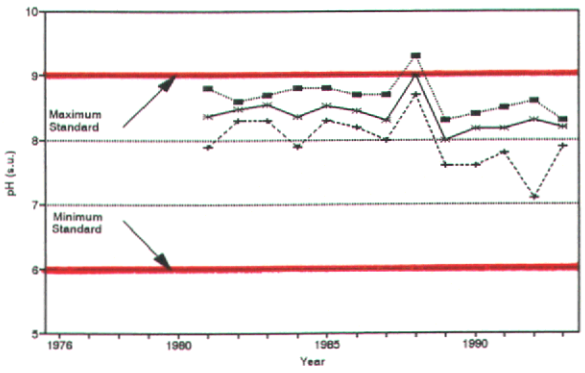
Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources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

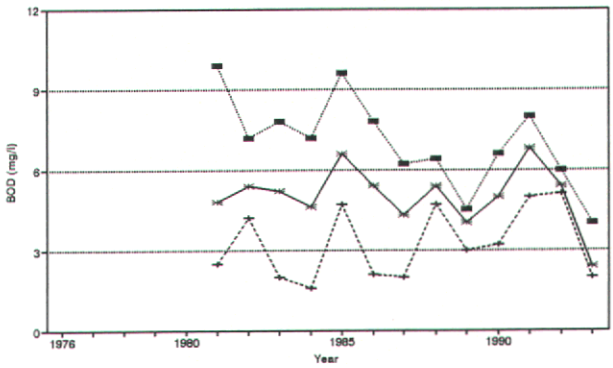
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

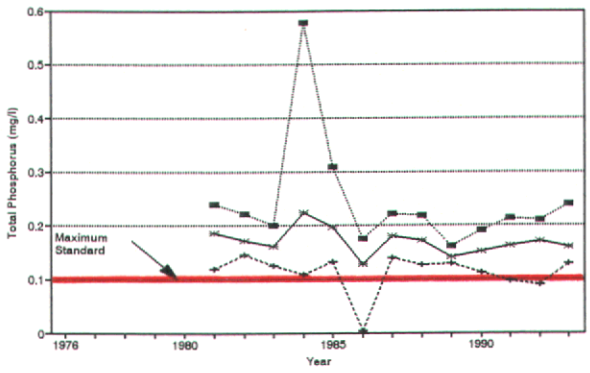
Figure VIII-3
WATER QUALITY DATA FOR THE MILWAUKEE RIVER AT STATION MI-11: 1976-1993

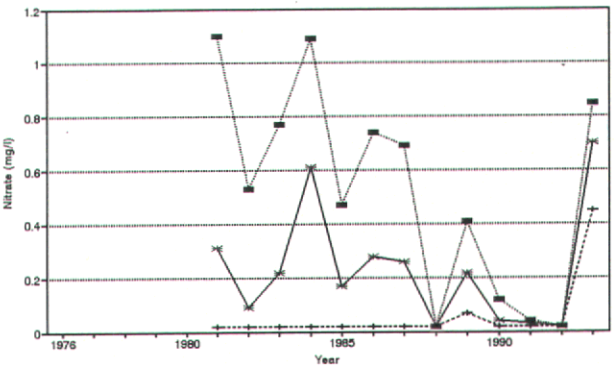


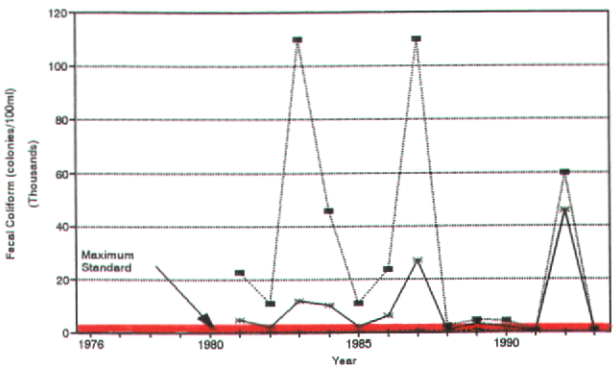


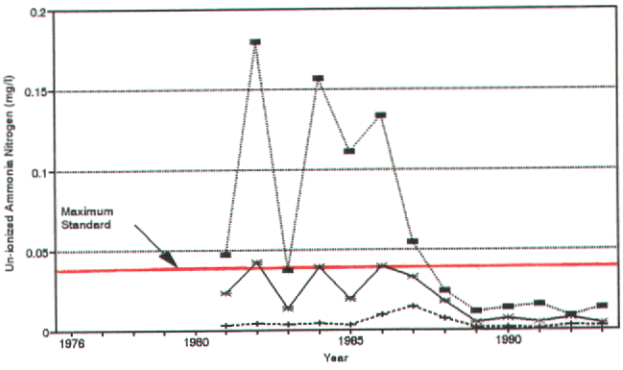






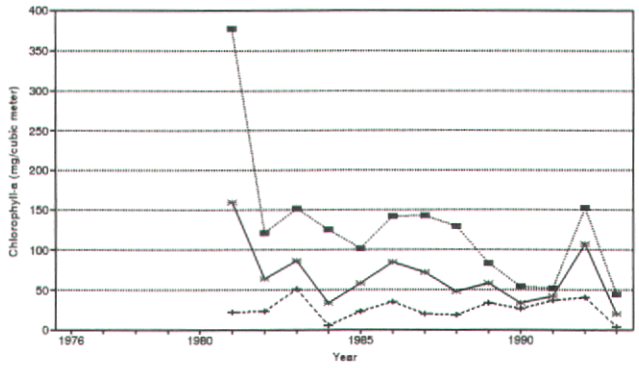


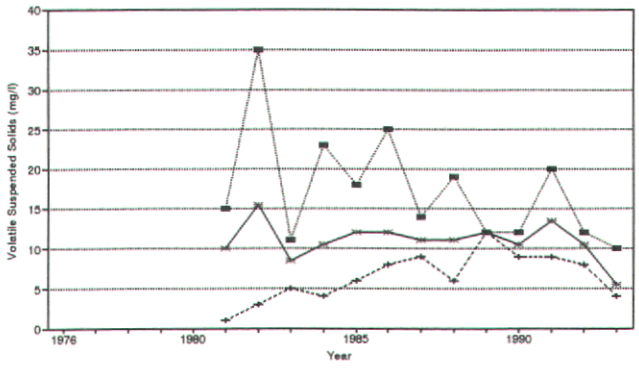


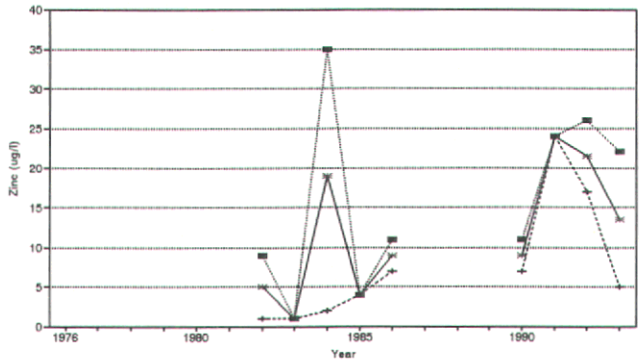


Note: The maximum standard of 200/400 colonies per 100 ml was violated in all years.

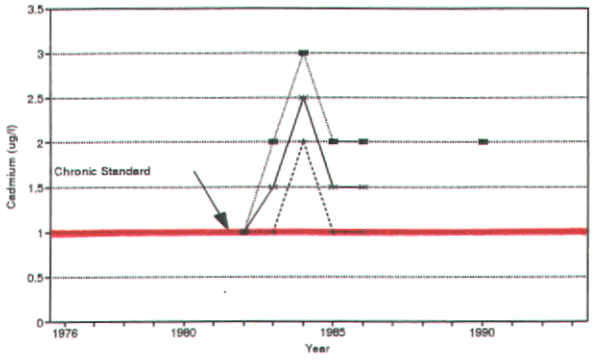
Figure VIII-3 (cont'd)



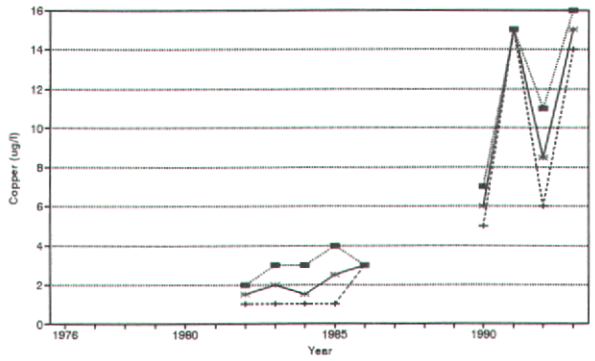




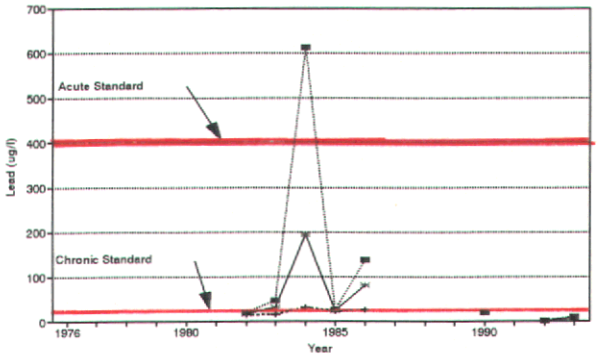
Note: The acute standard of 202.9 ug/l was not violated in any year.
The chronic standard of of 89.2 ug/l was not violated in any year.

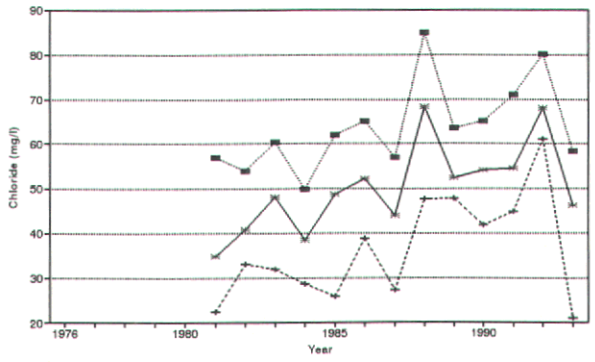


Note: The acute standard of 63.3 ug/l was not violated in any year.



Note: The acute standard of 31.9 ug/l was not violated in any year.
The chronic standard of 22.1 ug/l was not violated in any year.





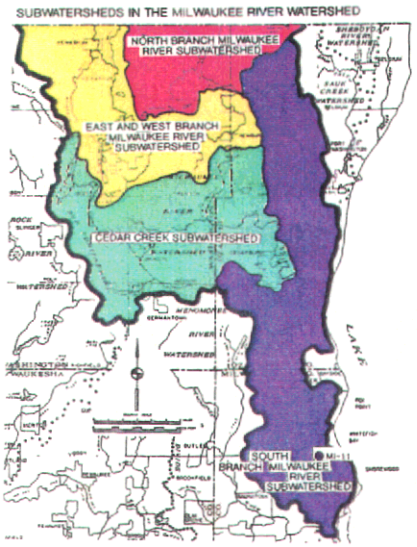
Note: The maximum standard of 1000 mg/l was not violated in any year.

LEGEND

MAXIMUM VALUE

MINIMUM VALUE

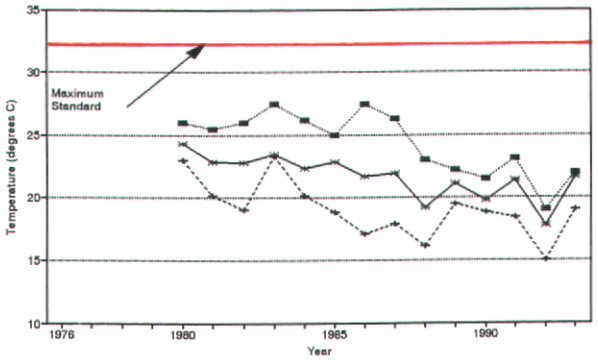
AVERAGE VALUE

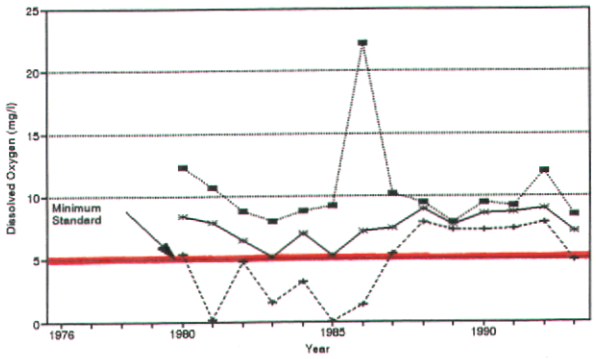


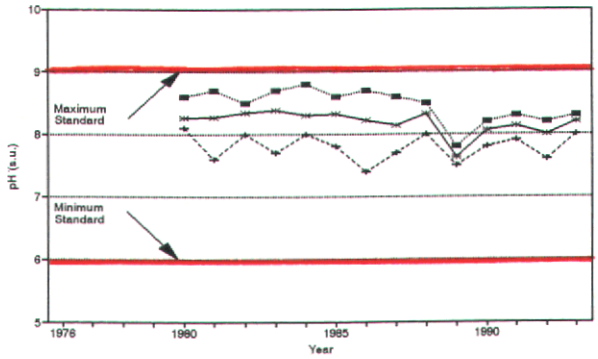
Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources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

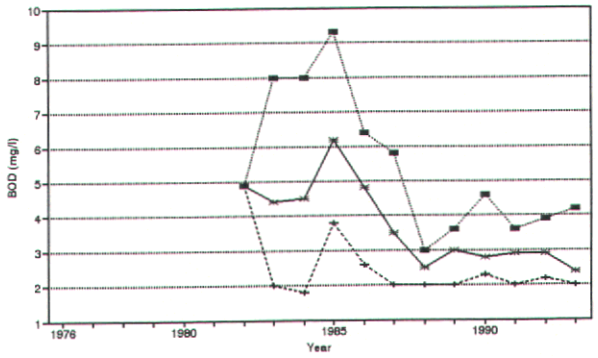
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

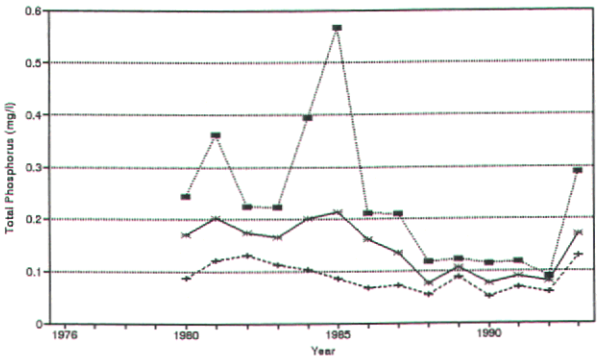
Figure VIII-4
WATER QUALITY DATA FOR THE MILWAUKEE RIVER AT STATION MI-11b: 1976-1993

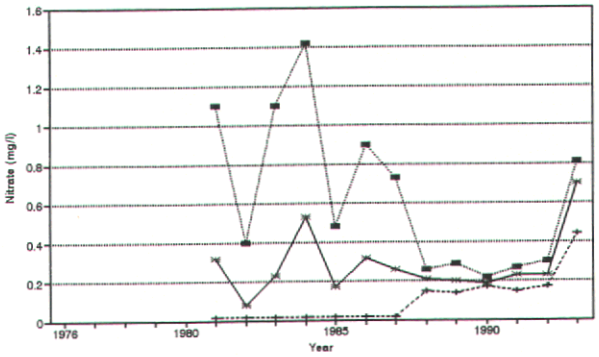




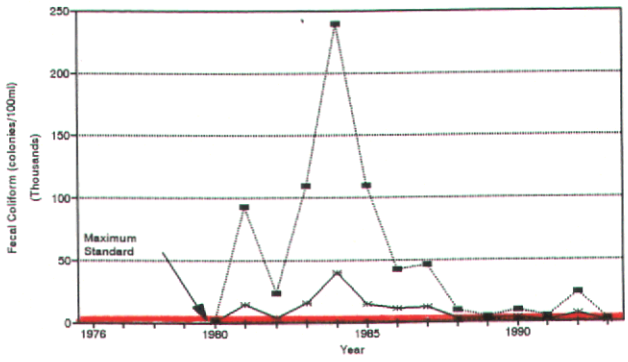


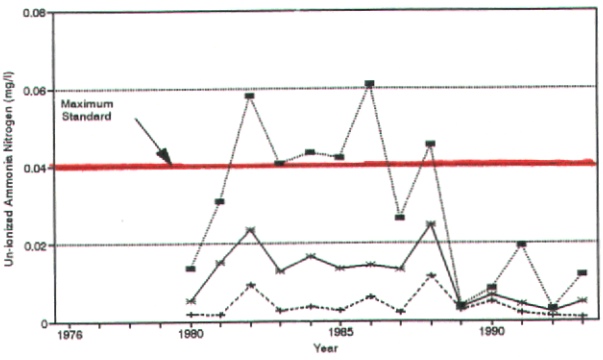






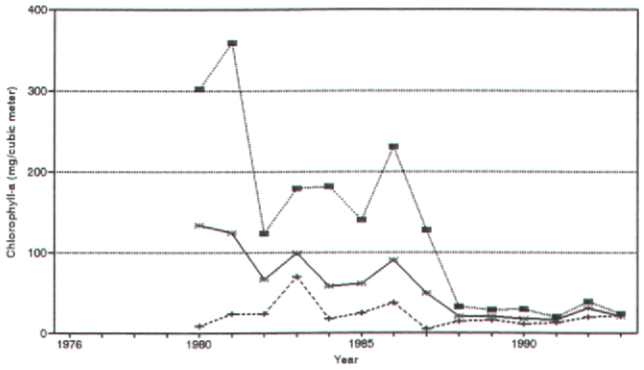
Note: No standard has been established for surface waters classified as limited recreational use.

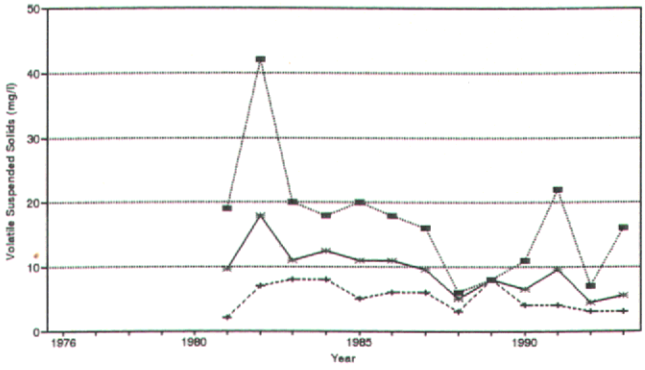


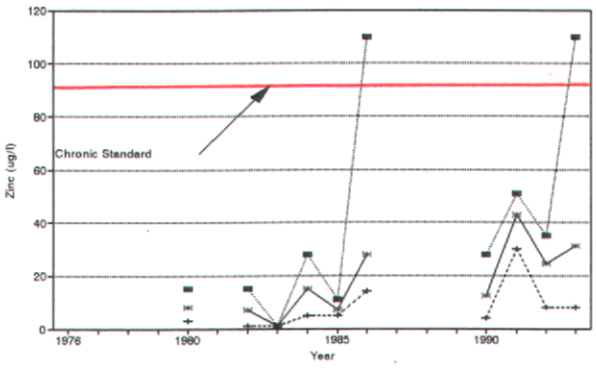


Note: The maximum standard of 1000/2000 colonies per 100 ml was violated in all years.

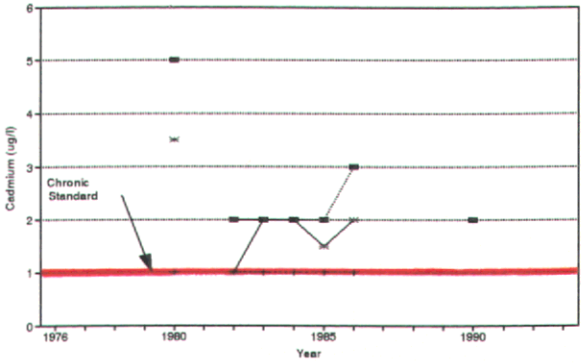
Figure VIII-4 (cont'd)



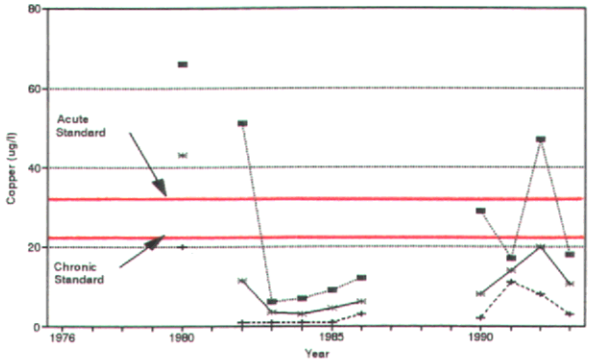


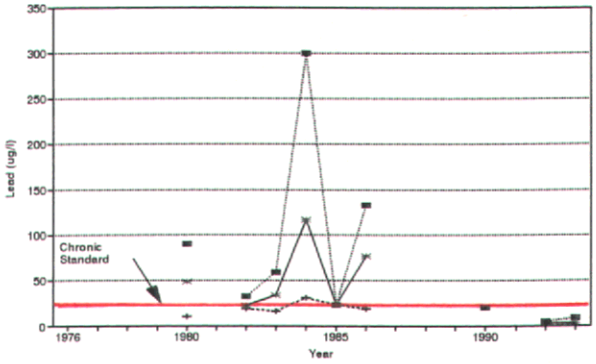


Note: The acute standard of 202.9 ug/l was not violated in any year.

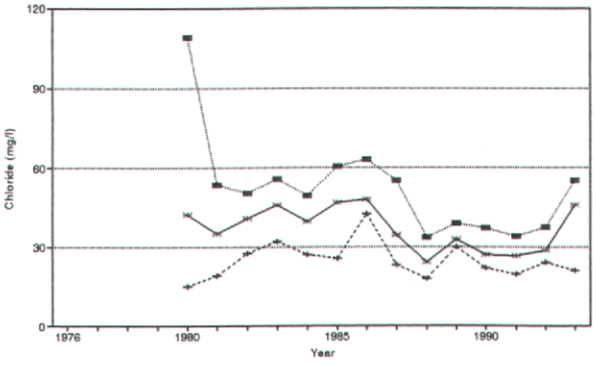


Note: The acute standard of 63.3 ug/l was not violated in any year.





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



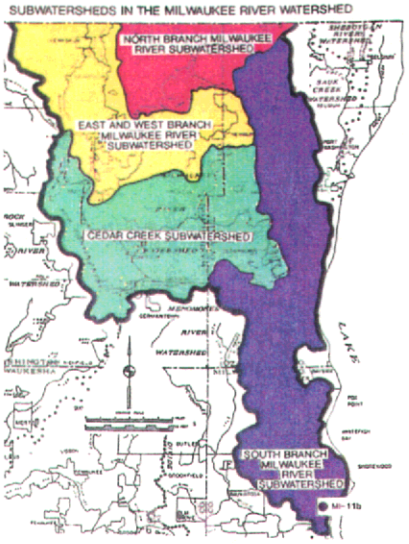
Note: The maximum standard of 1000 mg/l was not violated in any year.

LEGEND

MAXIMUM VALUE

MINIMUM VALUE

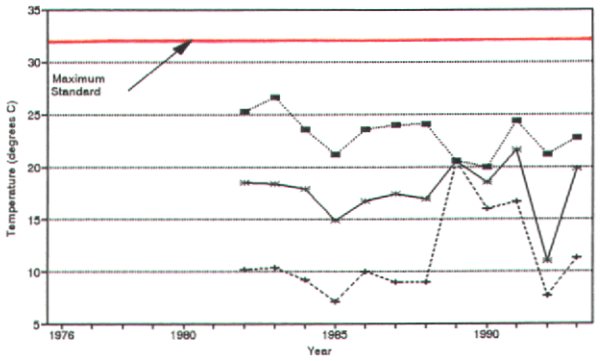
AVERAGE VALUE

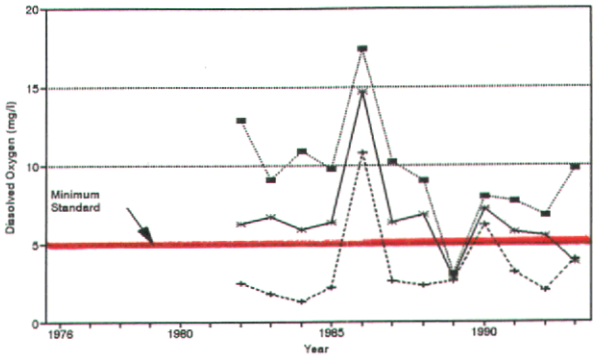


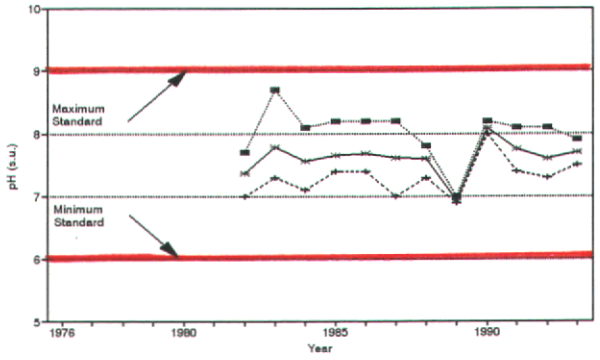
Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and limited recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural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

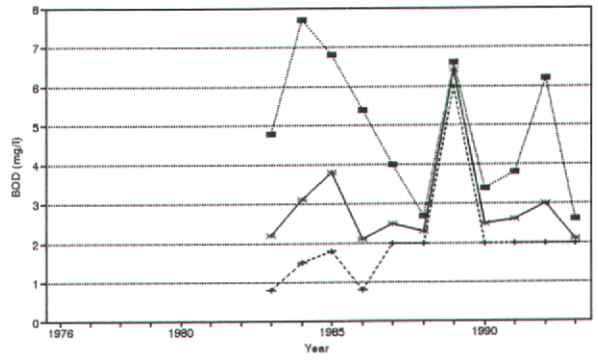
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

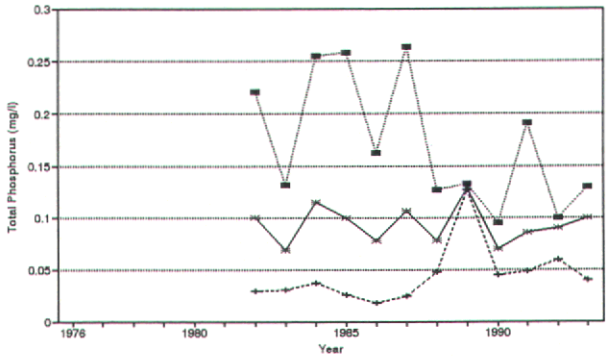
Figure VIII-5
WATER QUALITY DATA FOR THE MILWAUKEE RIVER AT STATION MI-12: 1976-1993

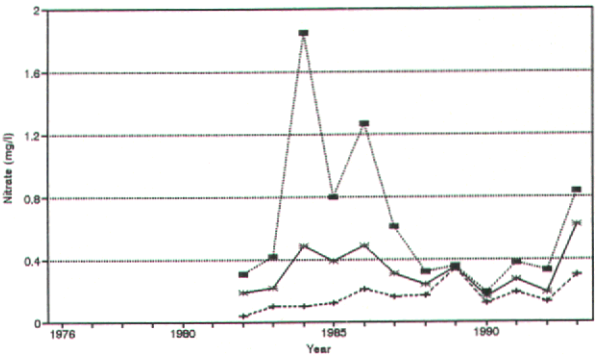




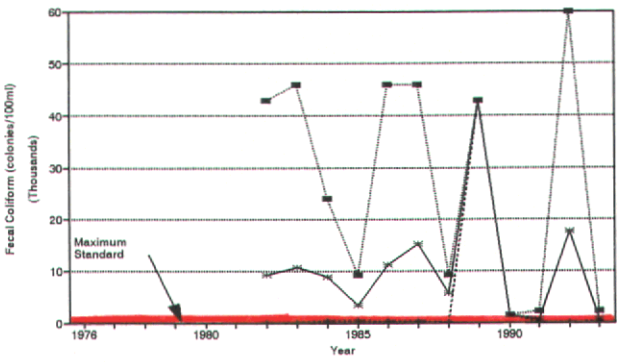




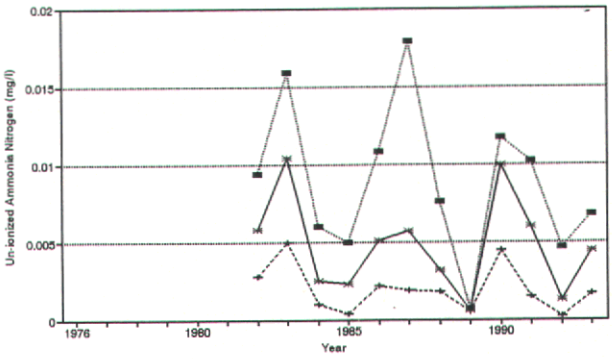




Note: No standard has been established for surface waters classified as limited recreational use.

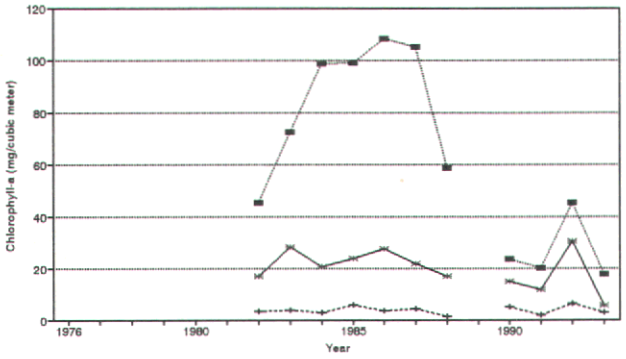


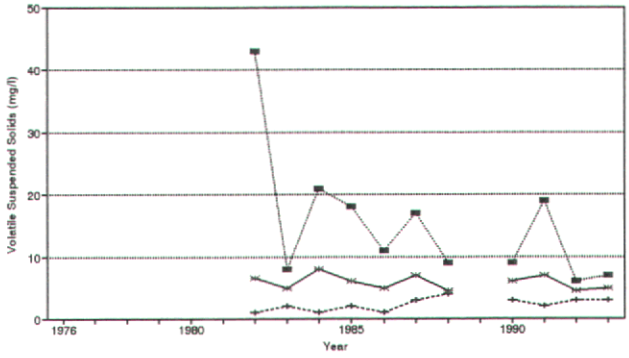
Note: The maximum standard of 1000/2000 colonies per 100 ml was violated in all years.

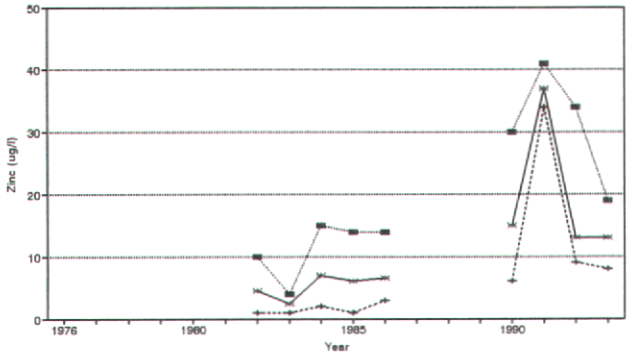


Note: The maximum standard of 0.04 mg/l was not violated in any year.

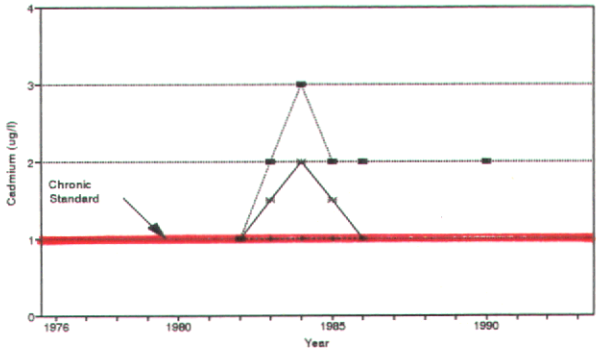
Figure VIII-5 (cont'd)



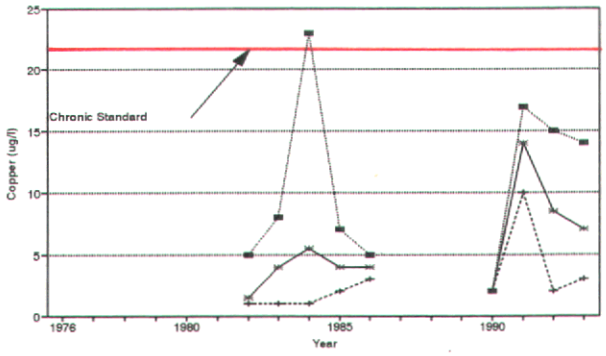




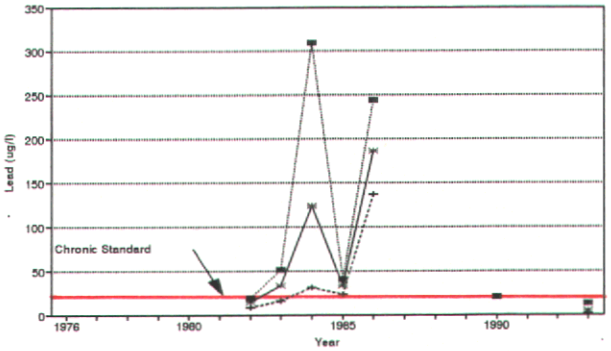
Note: The acute standard of 202.9 ug/l was not violated in any year.
The chronic standard of 89.2 ug/l was not violated in any year.



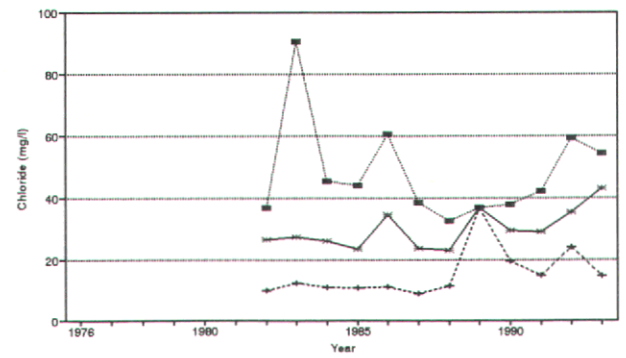
Note: The acute standard of 63.3 ug/l was not violated in any year.



Note: The acute standard of 31.9 ug/l was not violated in any year.



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



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

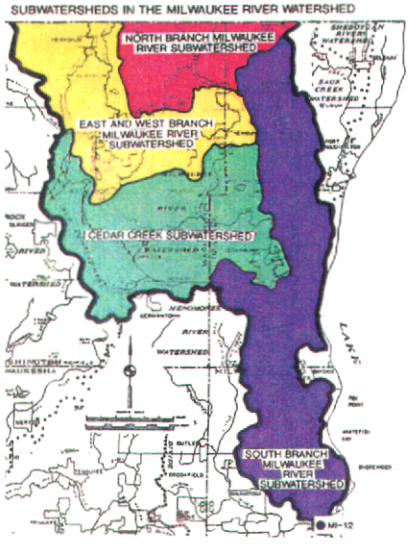
LEGEND

MAXIMUM VALUE

MINIMUM VALUE

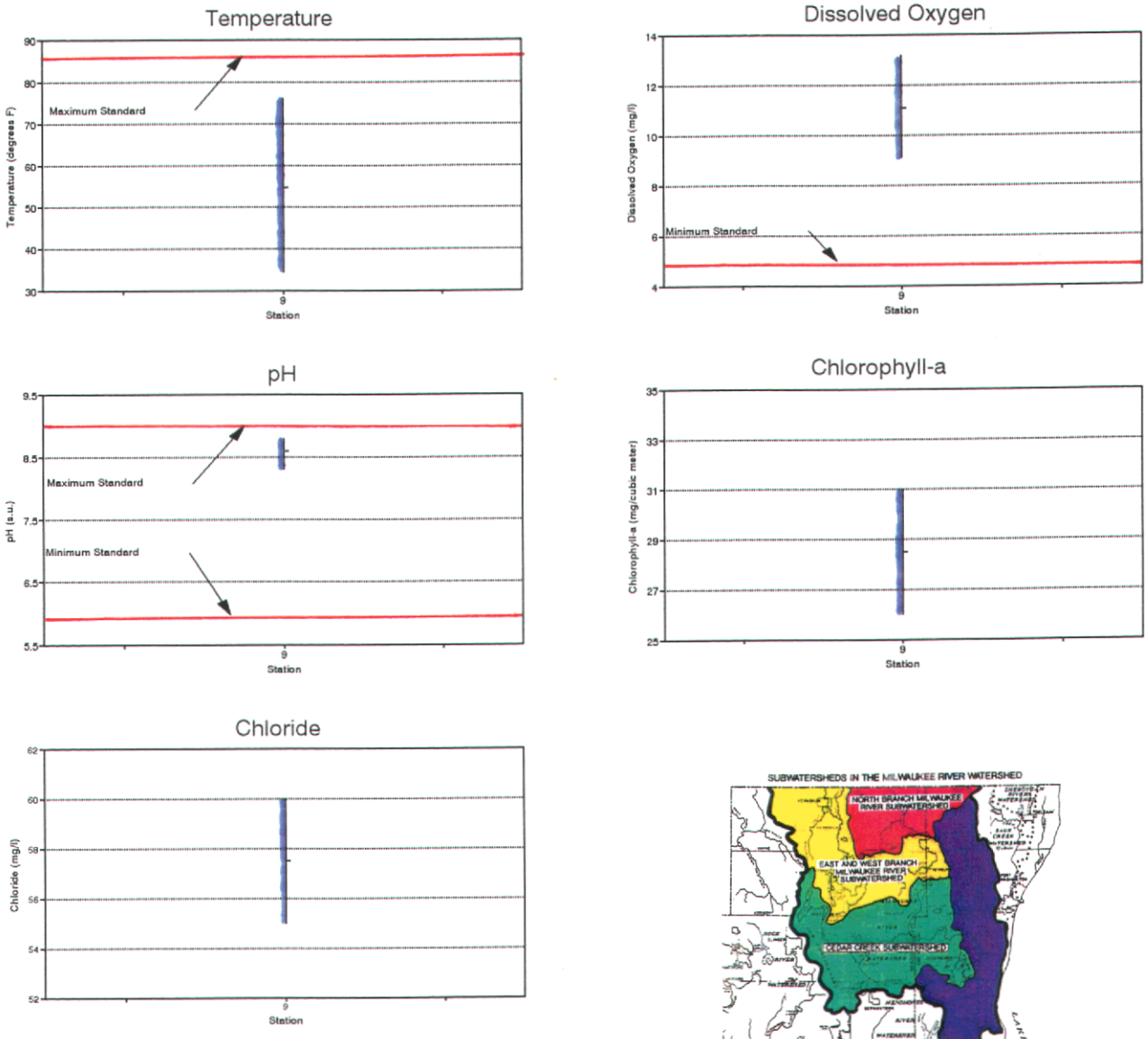
AVERAGE VALUE

SUBWATERSHEDS IN THE MILWAUKEE RIVER WATERSHED



Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport 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.

Figure VIII-6
Milwaukee River Watershed Short-Term Water Quality Sampling Data: 1990



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

LEGEND

Maximum

Average

Minimum

Milwaukee River Subwatershed Designation

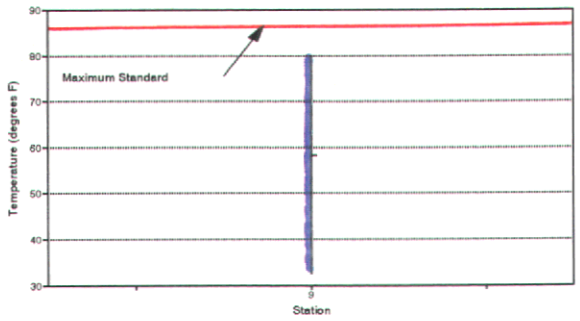
- East and West Branches
- North Branch
- Cedar Creek
- South Branch

Standards indicated are those established for warmwater sport fish and limited recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classification and water quality criteria. Refer to Table VIII-14 for summarized water quality data.

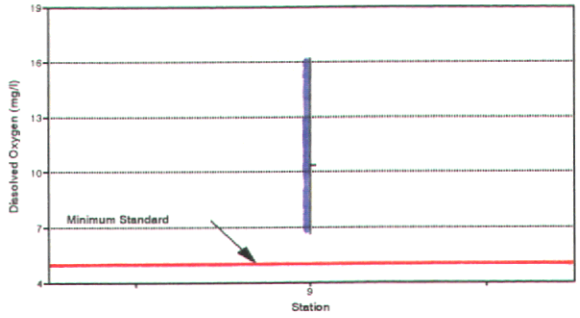
Source: Wisconsin Department of Natural Resources and SEWRPC.

Figure VIII-7
Milwaukee River Watershed Short-Term Water Quality Sampling Data: 1991

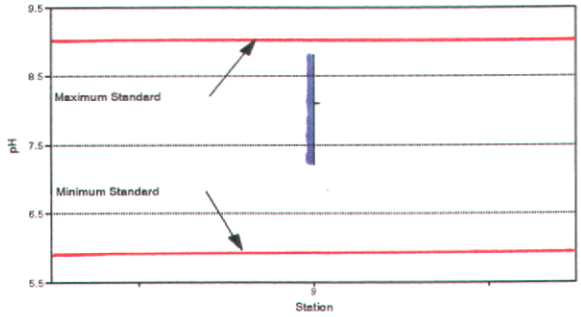
Temperature



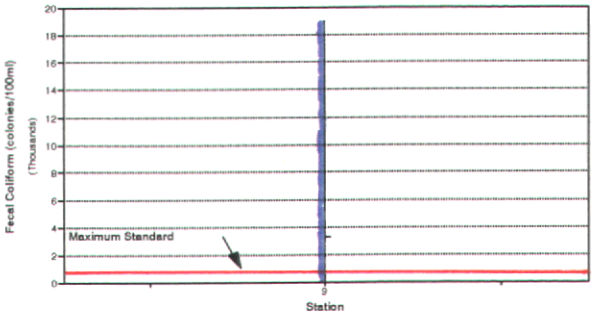
Dissolved Oxygen



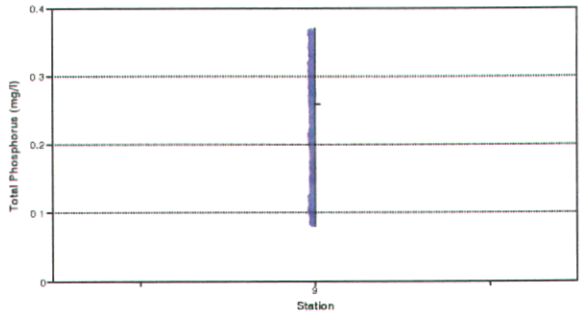
pH



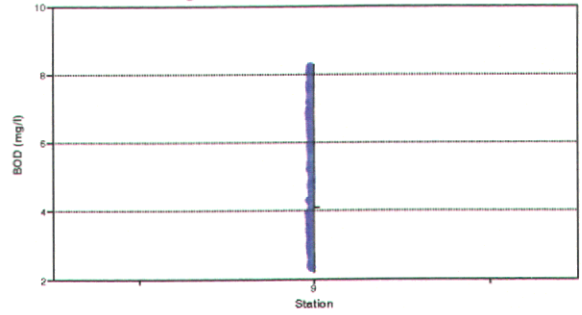
Fecal Coliform



Phosphorus

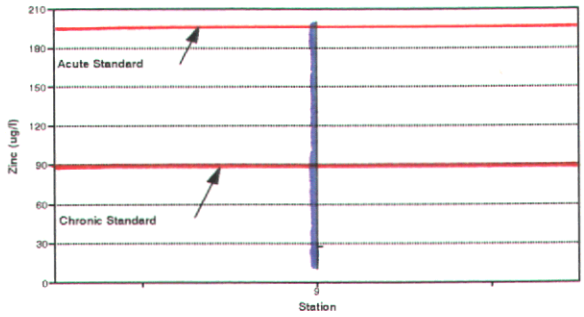


Biological Oxygen Demand

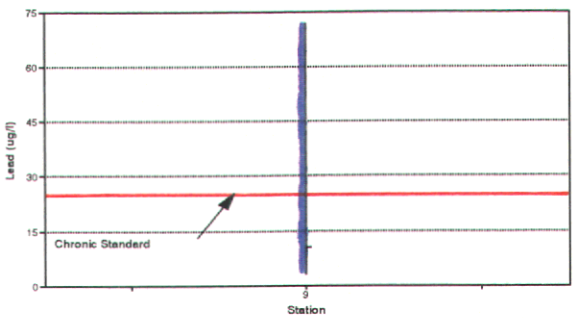


Note: No standard has been established for streams classified as limited recreational use.

Zinc

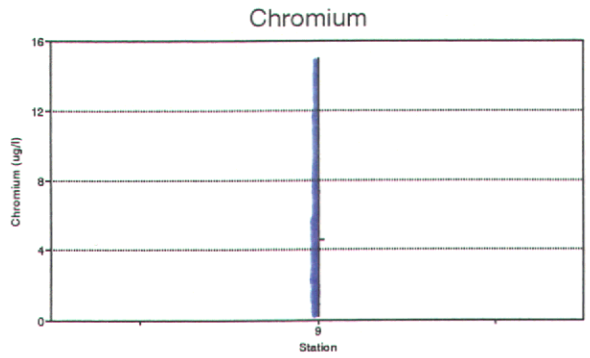


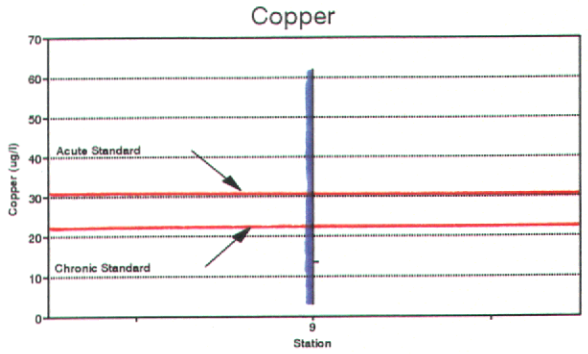
Lead

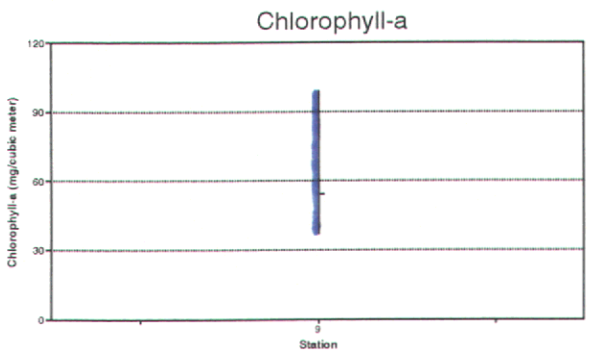


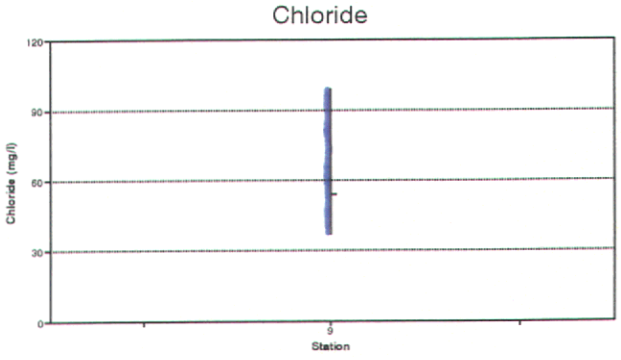
Note: The acute standard of 408.6 ug/l was not violated in any sample.

Figure VIII-7 (cont'd)









LEGEND

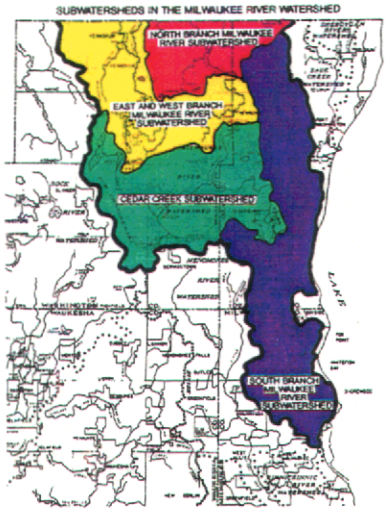
Maximum

Average

Minimum

Milwaukee River Subwatershed Designation

- East and West Branches
- North Branch
- Cedar Creek
- South Branch

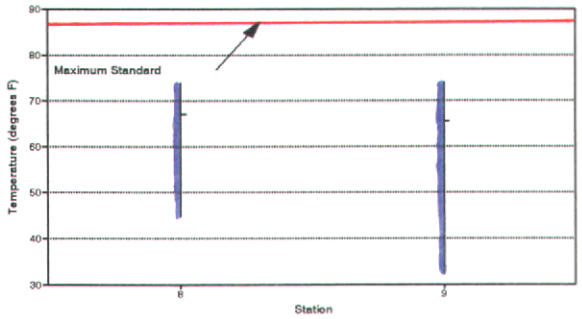


Standards indicated are those established for warmwater sport fish and limited recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria. Refer to Table VIII-14 for summarized water quality data.

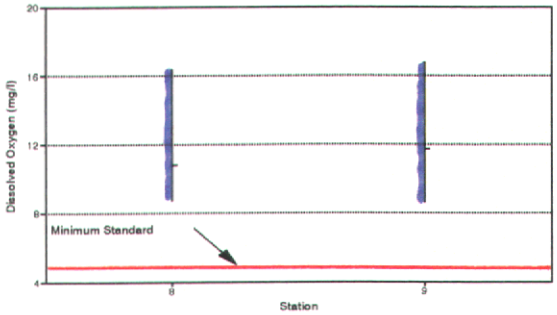
Source: Wisconsin Department of Natural Resources and SEWRPC.

Figure VIII-8
Milwaukee River Watershed Short-Term Water Quality Sampling Data: 1992

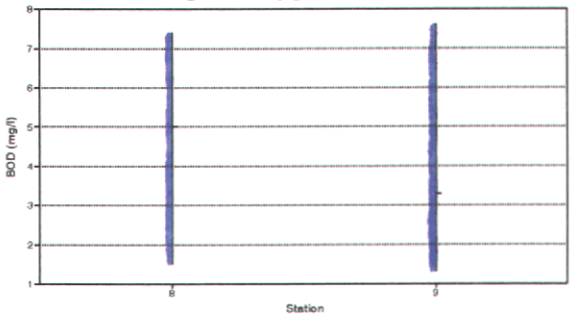
Temperature



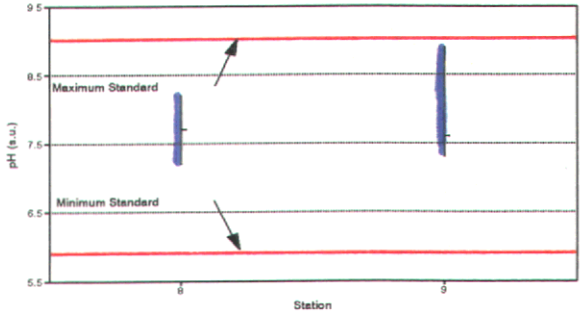
Dissolved Oxygen



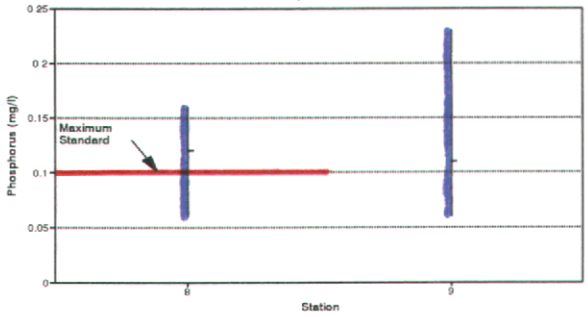
Biological Oxygen Demand



pH

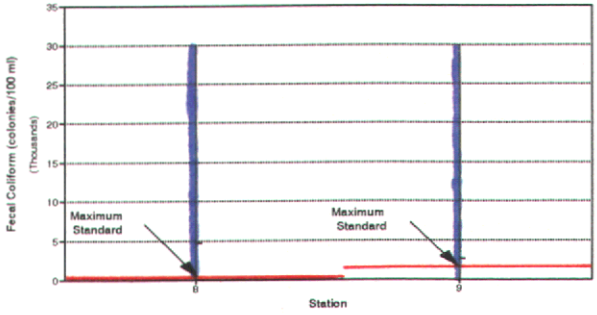


Phosphorus



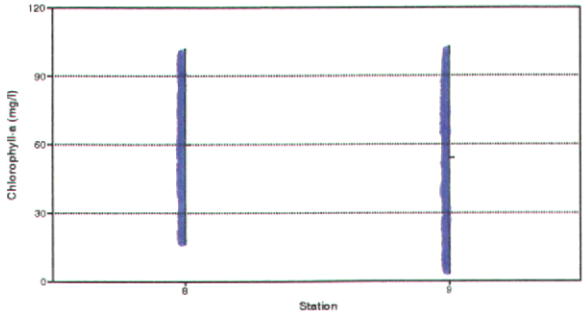
Note: No standard has been established for surface waters classified as limited recreational use.

Fecal Coliform

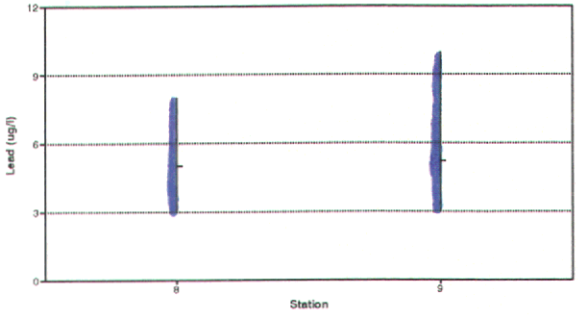


Note: The maximum standard for station 8 of 200/400 colonies per 100 ml was violated in all samples.

Chlorophyll-a

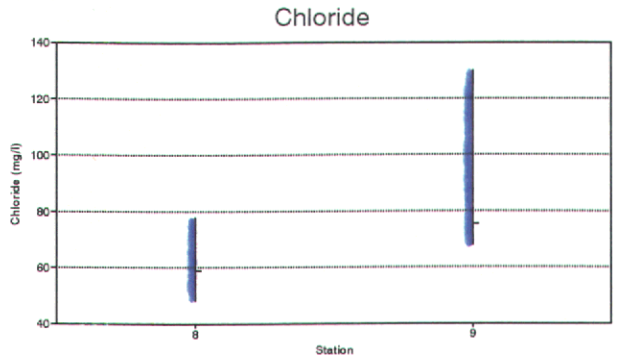


Lead

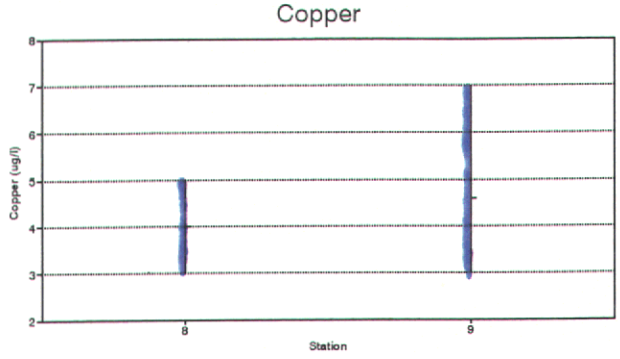


Note: The acute standard of 408.6 ug/l and the chronic standard of 24.4 ug/l was not violated in any sample.

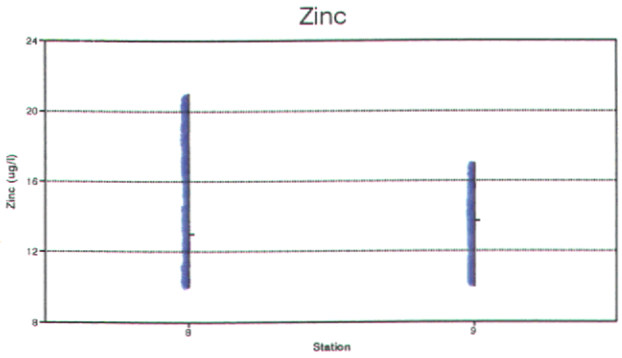
Figure VIII-8 (cont'd)



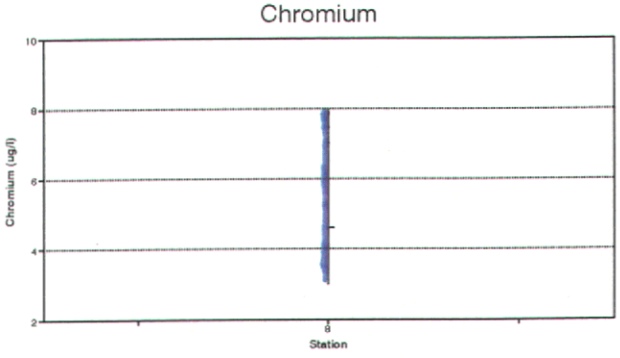
Note: The maximum standard of 1000 mg/l was not violated in any sample.

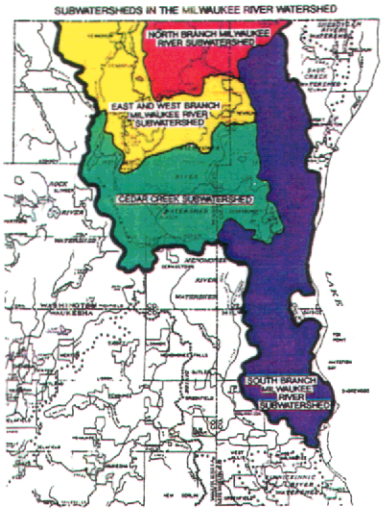


Note: The acute standard of 31.9 ug/l and the chronic standard of 22.1 ug/l were not violated in any sample.



Note: The acute standard of 202.9 ug/l and the chronic standard of 89.2 ug/l were not violated in any sample.



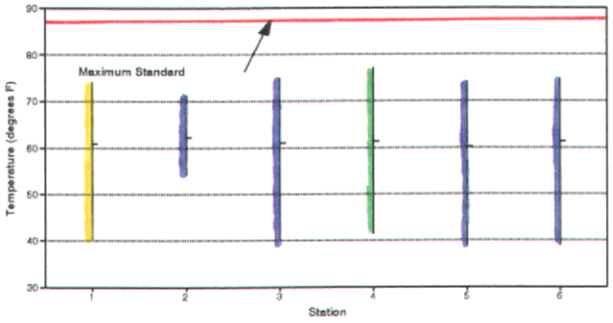


Standards indicated are those established for warmwater sport fish and full recreational use objectives, with the exception of station 9. Standards indicated for station 9 are those established for warmwater sportfish and limited recreational use. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classification and water quality criteria. Refer to Table VIII-14 for summarized water quality data.

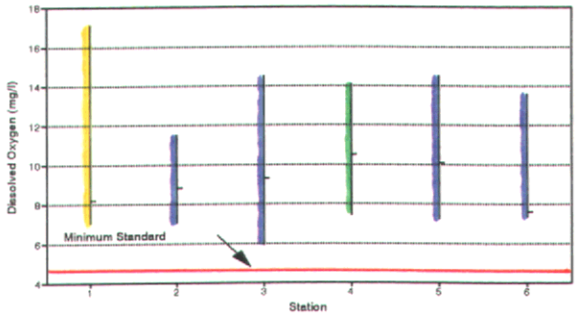
Source: Wisconsin Department of Natural Resources and SEWRPC.

Figure VIII-9
Milwaukee River Watershed Short-Term Water Quality Data: 1993

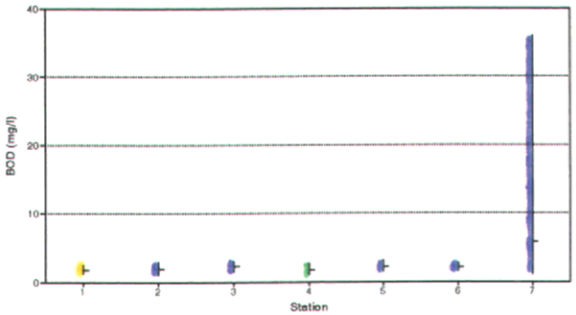
Temperature



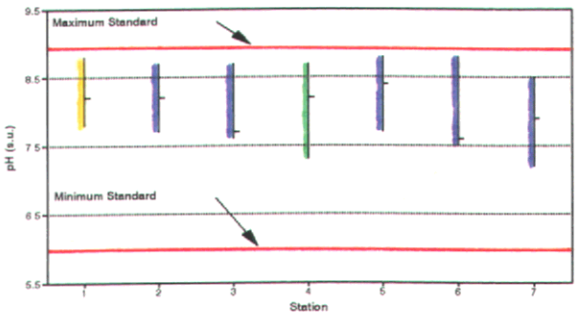
Dissolved Oxygen



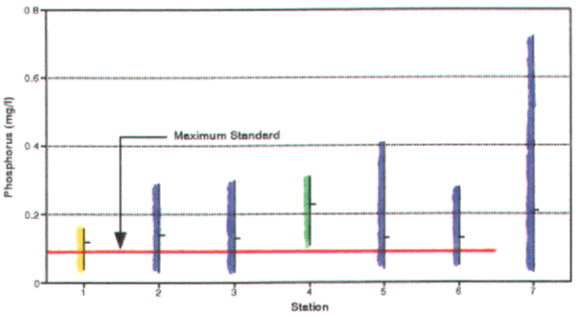
Biological Oxygen Demand



pH

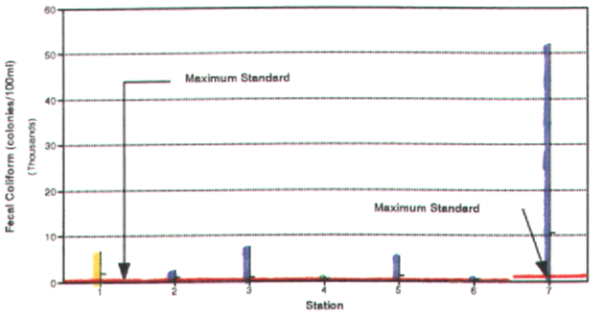


Phosphorus



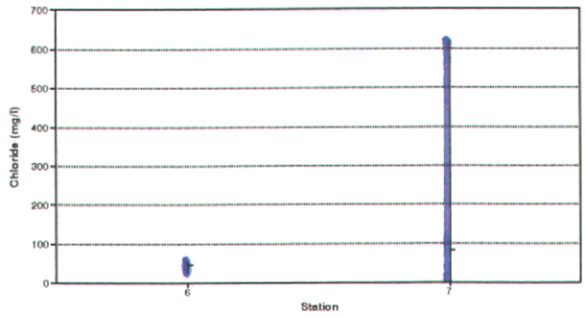
Note: No standard has been established for surface waters classified as limited recreational use.

Fecal Coliform



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

Chloride



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

Chlorophyll-a

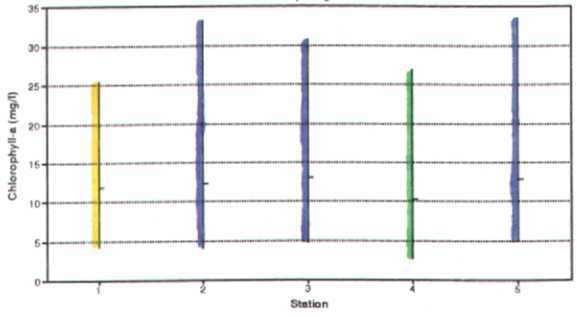
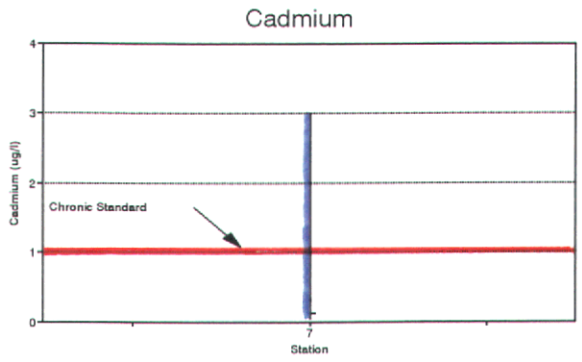
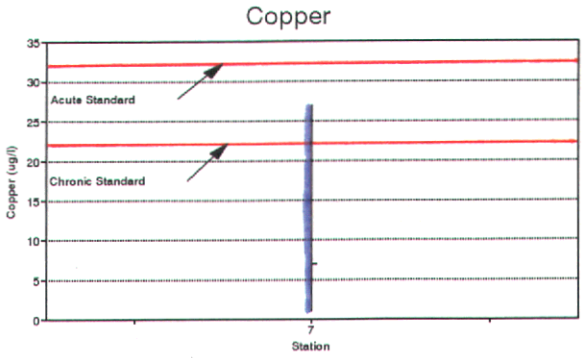
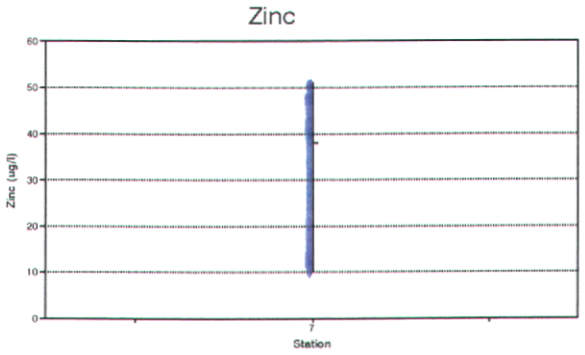


Figure VIII-9 (cont'd)

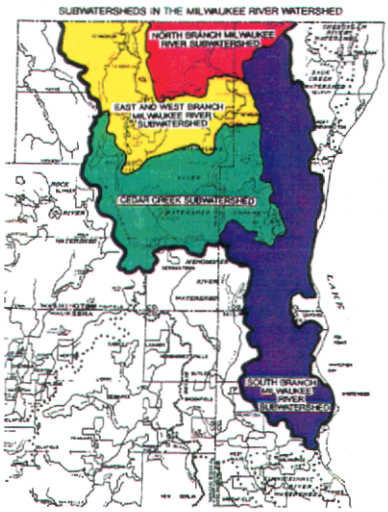




Note: The acute standard of 63.3 ug/l was not violated in any sample.



Note: The acute standard of 202.9 ug/l and the chronic standard of 89.2 ug/l were not violated in any sample.



LEGEND

Maximum

Average

Minimum

Milwaukee River Subwatershed Designation

- East and West Branches
- North Branch
- Cedar Creek
- South Branch

Standards indicated are those established for warmwater sport fish and full recreational use objectives, with the exception of station 7. Standards indicated for station 7 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 VIII-14 for summarized water quality data.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table VIII-14

MILWAUKEE RIVER WATERSHED SHORT-TERM STREAM WATER QUALITY
SAMPLING DATA: 1988-1993

Sampling Station Number and Subwatershed[a]	Parameter (units)	Applicable Standards[b]	Range	Violation of Accepted Standard	Sampling Dates	Total Number of Samples
1EW	Temperature (°F)	Maximum of 89.0	40.3-74.1	No	May-November 1993	11
	Dissolved Oxygen (mg/l)	Minimum of 5.0	7.0-17.1	No	May-November 1993	11
	Biological Oxygen Demand (mg/l)	--	1.2-2.6	--	May-November 1993	11
	pH (S.U.)	Maximum of 9.0, Minimum of 6.0	7.8-8.8	No	May-November 1993	11
	Phosphorus (mg/l)	Maximum of 0.1	0.04-0.16	Yes	May-November 1993	11
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	20-6,800	Yes	May-November 1993	10
	Chlorophyll-a (mg/l)	--	4.2-25.5	--	May-November 1993	11
2S	Temperature (°F)	Maximum of 89.0	54.1-71.2	No	March-December 1993	11
	Dissolved Oxygen (mg/l)	Minimum of 5.0	7.0-11.5	No	March-December 1993	11
	Biological Oxygen Demand (mg/l)	--	1.0-2.9	--	March-December 1993	10
	pH (S.U.)	Maximum of 9.0, Minimum of 6.0	7.7-8.7	No	March-December 1993	11
	Phosphorus (mg/l)	Maximum of 0.1	0.03-0.29	Yes	March-December 1993	11
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	40-2,500	Yes	March-December 1993	11
	Chlorophyll-a (mg/l)	--	4.0-33.2	--	March-December 1993	11
3S	Temperature (°F)	Maximum of 89.0	40.3-75.0	No	May-December 1993	11
	Dissolved Oxygen (mg/l)	Minimum of 5.0	5.9-14.5	No	May-December 1993	11
	Biological Oxygen Demand (mg/l)	--	1.5-3.0	--	May-December 1993	7
	pH (S.U.)	Maximum of 9.0, Minimum of 6.0	7.7-8.7	No	May-December 1993	12
	Phosphorus (mg/l)	Maximum of 0.1	0.03-0.30	Yes	May-December 1993	12
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	10-7,500	Yes	May-December 1993	11
	Chlorophyll-a (mg/l)	--	4.7-30.8	--	May-December 1993	12
4CC	Temperature (°F)	Maximum of 89.0	41.4-77.2	No	May-November 1993	11
	Dissolved Oxygen (mg/l)	Minimum of 5.0	7.4-14.1	No	May-November 1993	11
	Biological Oxygen Demand (mg/l)	--	1.0-2.7	--	May-November 1993	10
	pH (S.U.)	Maximum of 9.0, Minimum of 6.0	7.3-8.7	No	May-November 1993	11
	Phosphorus (mg/l)	Maximum of 0.1	0.11-0.31	Yes	May-November 1993	11
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	10-900	Yes	May-November 1993	11
	Chlorophyll-a (mg/l)	--	2.6-26.9	--	May-November 1993	11
5S	Temperature (°F)	Maximum of 89.0	38.8-74.1	No	May-November 1993	12
	Dissolved Oxygen (mg/l)	Minimum of 5.0	7.2-14.5	No	May-November 1993	12
	Biological Oxygen Demand (mg/l)	--	1.4-3.2	--	May-November 1993	7
	pH (S.U.)	Maximum of 9.0, Minimum of 6.0	7.7-8.8	No	May-November 1993	12
	Phosphorus (mg/l)	Maximum of 0.1	0.04-0.41	Yes	May-November 1993	12
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	10-5,500	Yes	May-November 1993	8
	Chlorophyll-a (mg/l)	--	4.9-33.5	--	May-November 1993	8

Table VIII-14 (continued)

Sampling Station Number and Subwatershed[a]	Parameter (units)	Applicable Standards[b]	Range	Violation of Accepted Standard	Sampling Dates	Total Number of Samples
6S	Temperature (°F)	Maximum of 89.0	39.0-74.7	No	May-December 1993	11
	Dissolved Oxygen (mg/l)	Minimum of 5.0	7.3-13.6	No	May-December 1993	11
	Biological Oxygen Demand (mg/l)	--	1.4-2.8	--	May-December 1993	6
	pH (S.U.)	Maximum of 9.0, Minimum of 6.0	7.5-8.8	No	May-December 1993	11
	Phosphorus (mg/l)	Maximum of 0.1	0.05-0.28	Yes	May-December 1993	11
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	20-670	Yes	May-December 1993	5
	Chloride (mg/l)	Maximum of 1,000	22-58	No	May-December 1993	4
7S	Biological Oxygen Demand (mg/l)	--	1.1-36.0	--	March-December 1993	46
	pH (S.U.)	Maximum of 9.0, Minimum of 6.0	7.2-8.5	--	March-December 1993	51
	Phosphorus (mg/l)	--	0.03-0.72	--	March-December 1993	50
	Fecal Coliform (colonies per 100 ml)	Maximum of 1,000/2,000	10-52,000	Yes	March-December 1993	44
	Chloride (mg/l)	Maximum of 1,000	2-620	No	March-December 1993	43
	Cadmium (µg/l)	Acute of 63.3, Chronic of 1.0	0.04-3.0	Yes-chronic	March-December 1993	64
	Copper (µg/l)	Acute of 31.9, Chronic of 22.1	1.0-27.0	Yes-chronic	March-December 1993	65
	Zinc (µg/l)	Acute of 202.9, Chronic of 89.2	10-51	No	March-December 1993	47
8S	Temperature (°F)	Maximum of 89.0	44.8-73.9	No	July-October 1992	9
	Dissolved Oxygen (mg/l)	Minimum of 5.0	8.7-16.4	No	July-October 1992	9
	Biological Oxygen Demand (mg/l)	--	1.5-7.4	--	July-October 1992	7
	pH (S.U.)	Maximum of 9.0, Minimum of 6.0	7.2-8.2	No	July-October 1992	8
	Phosphorus (mg/l)	Maximum of 0.1	0.06-0.16	Yes	July-October 1992	7
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	60-30,000	Yes	July-October 1992	9
	Chlorophyll-a (mg/l)	--	16-102	--	July-October 1992	9
	Chloride (mg/l)	Maximum of 1,000	48-78	No	July-October 1992	6
	Copper (µg/l)	Acute of 31.9, Chronic of 22.1	3-5	No	July-October 1992	3
	Zinc (µg/l)	Acute of 202.9, Chronic of 89.2	10-21	No	July-October 1992	3
	Lead (µg/l)	Acute of 408.6, Chronic of 24.4	3-8	No	July-October 1992	3

Table VIII-14 (continued)

Sampling Station Number and Subwatershed[a]	Parameter (units)	Applicable Standards[b]	Range	Violation of Accepted Standard	Sampling Dates	Total Number of Samples
9S	Temperature (°F)	Maximum of 89.0	34.3-76.1	No	August-December 1990	3
			32.4-80.1	No	January-December 1991	17
			32.2-474.1	No	January-October 1992	17
	Dissolved Oxygen (mg/l)	Minimum of 5.0	9.1-13.2	No	August-December 1990	3
			6.6-16.8	No	January-December 1991	17
			8.6-16.8	No	January-October 1992	17
	pH (S.U.)	Maximum of 9.0, Minimum of 6.0	8.3-8.8	No	August-December 1990	2
			7.2-8.8	No	January-December 1991	16
			7.3-8.9	No	January-October 1992	17
	Phosphorus (mg/l)	--	.08-.37	--	January-December 1991	16
			.06-.23	--	January-October 1992	17
	Fecal Coliform (colonies per 100 ml)	Maximum of 1,000/2,000	100-19,000	Yes	January-December 1991	12
			10-30,000	Yes	January-October 1992	14
	Biological Oxygen Demand (mg/l)	--	2.2-8.3	--	January-December 1991	13
		--	1.3-7.6	--	January-October 1992	17
	Chlorophyl-a (mg/l)	--	26-31	--	August-December 1990	2
			3-110	--	January-December 1991	16
			3-103	--	January-October 1992	13
	Chloride (mg/l)	Maximum of 1,000	55-60	No	August-December 1990	2
			37-92	No	January-December 1991	16
			68-130	No	January-October 1992	14
	Copper (µg/l)	Acute of 31.9, Chronic of 22.9	3-62	Yes-chronic & Acute	January-December 1991	15
			3-7	No	January-October 1992	7
	Zinc (µg/l)	Acute of 202.9, Chronic of 89.2	10-200	Yes-Chronic	January-December 1991	16
			10-17	No	January-October 1992	15
	Lead (µg/l)	Acute of 408.6, Chronic of 24.4	3-72	Yes-Chronic	January-December 1991	16
			3-10	No	January-October 1992	11
	Chromium (µg/l)	--	0.2-15	--	January-December 1991	16
		--	3-8	--	January-October 1992	5

[a]Subwatershed codes are as follows: EW - East-West Branch of the Milwaukee River; N = North Branch of the Milwaukee River; CC = Cedar Creek; S = South Branch of the Milwaukee River. See Map VIII-6 for detailed locations.

[b]Standards indicated are those established for warmwater sport fish and full recreational use objectives with the exception of Station 7S and 9S. Standards indicated for Station 7S are those established for limited forage fish and limited recreational use objectives. Standards indicated for Station 9S are those established for warmwater sport fish and limited recreational use objectives.

Source: Wisconsin Department of Natural Resources and SEWRPC.

trends, but generally met the standards, with limited exceedances of the dissolved oxygen standard. Phosphorus and fecal coliform levels generally exceeded the standards, while un-ionized ammonia nitrogen levels generally met but occasionally exceeded the standard.

Chloride levels appear to be increasing between 1981 and 1992 at stations, M1-9, 10a, and 11. However, the levels still meet the standards. The increase in chloride levels may be the result of new urban development which has occurred in the watershed in Ozaukee and northern Milwaukee Counties and the associated winter road maintenance.

Review of the data at station M1-12 indicates no apparent significant changes in water quality conditions. Temperature and pH levels remained variable with no apparent trends, but were generally within acceptable limits. Violations of the dissolved oxygen standard occurred some of the time and the fecal coliform levels exceeded the standards most of the time.

The remaining water quality data collected on a short-term basis throughout the watershed do not illustrate trends. However, these data do illustrate that fecal coliform and phosphorus standards are exceeded some of the time in the downstream portions of Cedar Creek, East and West Branch of the Milwaukee River, and in the upper reaches of the Milwaukee River main stem, while the dissolved oxygen standard is generally achieved.

As discussed in the subsequent section, chronic toxicity standards for some metals were exceeded in the lower reach of the Milwaukee River.

Toxic and Hazardous Substances: Available data on toxic pollutants gathered by the Wisconsin Department of Natural Resources during a three year period between 1973 and 1976, indicated that levels of mercury, polychlorinated biphenyls (PCBs) and various biocides--aldrin, heptachlor, heptachlor epoxide and phthalate--exceeded U.S. Environmental Protection Agency standards on at least one occasion from 1973 to 1976. Additional data indicated other heavy metals and toxicants--cadmium, chromium, copper, lead, mercury, nickel, zinc and PCBs--did not violate recommended U.S. Environmental Protection Agency standards. However, such were found to be in the stream sediments.

Recent data on water column toxic and hazardous substances in the Milwaukee River were collected by the U.S. Geological Survey (USGS) and the Milwaukee Metropolitan Sewerage District (MMSD). These data indicate that levels of cadmium and lead have violated chronic toxicity level standards for heavy metals, and that levels of copper occasionally violate chronic toxicity level standards in the lower stream reaches of the Milwaukee River. These metal standards were generally not exceeded at the two most upstream stations. Furthermore, only infrequent and small lead standard violations were reported after 1985.

Post-1976 data on toxic and hazardous substances present in stream sediments in the Milwaukee River were collected by the Wisconsin Department of Natural Resources (DNR), the Milwaukee Metropolitan Sewerage District, and the U.S. Geological Survey. Data collected between 1989 and 1993 by the DNR and USGS at seven stations on the Milwaukee River main stem, and four stations on tributary streams to the Milwaukee River indicated the presence of polycyclic aromatic

hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) at seven sites. Samples obtained from five of these sites exceeded the Lowest Effect Level (LEL) sediment quality screening criteria proposed by the DNR.[10] At Estabrook Park in the City of Milwaukee, the PAH concentration exceeded the Severe Effect Level (SEL) guidelines. Data on heavy metal concentrations in these sediments also generally exceeded the LEL guidelines, as set forth in Table VIII-15 and on Map VIII-6. Concentrations of other toxic substances, including some DDT-derivatives, also exceeded the SEL at five stations.

Data collected in 1990 by the MMSD at seven locations in the Milwaukee River main stem from Lincoln Creek downstream to the Milwaukee harbor indicated the presence of PCBs and PAHs at all sampling stations.[11] Higher levels of PCBs were recorded in those sediments sampled nearer to the harbor, while higher levels of PAHs were observed in those sediments sampled nearer to the confluence with Lincoln Creek. Concentrations of PCBs and PAHs exceeded the proposed LEL guidelines at all stations.

In 1991 and 1992, sediment sampling data were also collected in the Milwaukee River as part of the North Avenue Dam Feasibility Study[12] which was undertaken to analyze potential impacts of a change in the management of the North Avenue Dam. Data collected from mudflat and channel sediments upstream of the dam indicated that the majority of the chemicals sampled exceeded the LEL sediment quality guideline concentrations proposed by the DNR for the study area. Results indicated that higher concentrations of PCBs and PAHs had accumulated in the mudflat sediments than in the channel sediments of the river.

Additional sediment data were collected in Cedar Creek in 1991 by the DNR.[13] Sediments sampled above four dams within the City of Cedarburg were found to be highly contaminated with PCBs which exceeded the LEL guidelines at all stations sampled and the SEL guidelines in the Columbia, Wire & Nail, and Hamilton dams. These sediments were determined to have a high potential to contaminate large volumes of river sediment downstream, particularly during periods of high stream flow.

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

[11]Fan Ni, Michael F. Gin, and Erik R. Christensen, Toxic Organic Contaminants in the Sediments of the Milwaukee Harbor Estuary, Final Report, Milwaukee Metropolitan Sewerage District, 1992.

[12]Woodward-Clyde Consultants, North Avenue Dam Feasibility Study, Final Report, April 1994.

[13] Steve Westenbroek, Cedar Creek PCB Mass Balance, (draft) Wisconsin Department of Natural Resources, 1993.

Table VIII-15

CONCENTRATIONS OF TOXIC AND HAZARDOUS SUBSTANCES FOUND IN SEDIMENT SAMPLES IN THE MILWAUKEE RIVER WATERSHED: 1989-1993

Substances Sampled	Sampling Stations										
	Milwaukee River Main Stem							Milwaukee River Tributaries			
	STH 60	Fireman Park	Tennis Club	Kletzsch Park	Esta-brook Park	C&NW RR	Thiens-ville	Lincoln Creek	Fredonia Creek	Mole Creek	Indian Creek
Heavy Metals (mg/kg)											
Arsenic	1.0	6.0	4.0	7.0	--	3.0	--	4.0	7.0	5.0	4.0
Cadmium	5.0	6.0	3.0	5.0	--	3.0	--	2.0	1.0	1.0	1.0
Chromium	30.0	60.0	30.0	50.0	--	50.0	--	20.0	1.0	20.0	20.0
Copper	49.0	45.0	41.0	79.0	--	70.0	--	39.0	44.0	25.0	42.0
Lead	120.0	80.0	80.0	170.0	--	150.0	--	80.0	40.0	20.0	30.0
Mercury	0.1	0.3	0.2	0.2	--	0.2	--	0.07	0.06	0.07	0.06
Nickel	20.0	30.0	20.0	40.0	--	30.0	--	30.0	20.0	10.0	30.0
Zinc	200.0	220.0	180.0	380.0	--	280.0	--	160.0	140.0	76.0	97.0
Total Polycyclic Aromatic Hydrocarbons (mg/kg)	20.4	5.3	0.0	23.9	--	19.8	--	45.7	0.0	0.0	0.2
Total Polychlorinated Biphenyls (ug/kg)	--	--	--	10.0 (1989, USGS) 0.05 (1993, DNR)	36,000	--	0.05	--	10.0	10.0	10.0
Aldrin (µg/kg)	1.0	1.0	1.0	1.0	--	1.0	--	1.0	1.0	1.0	1.0
Chlordane	10.0	15.0	10.0	10.0	--	10.0	--	20.0	10.0	10.0	10.0
Total DDT	1.0	6.0	2.0	3.0	--	7.0	--	3.0	1.0	1.0	3.0
op+pp DDT	--	--	--	--	--	--	--	--	--	--	--
pp DDD	6.0	25.0	2.0	3.0	--	10.0	--	11.0	5.0	3.0	11.0
pp DDE	2.0	43.0	5.0	5.0	--	5.0	--	4.0	2.0	2.0	20.0
Mirex	1.0	1.0	1.0	1.0	--	1.0	--	1.0	1.0	1.0	1.0
TCDD	--	--	--	--	--	--	--	--	--	--	--
NH_3-N (mg/kg)	--	--	--	--	--	--	--	--	--	--	--
O&G (mg/kg)	--	--	--	--	--	--	--	--	--	--	--
CN (mg/kg)	0.5	0.5	0.9	4.4	--	0.7	--	0.5	0.5	0.8	0.5

NOTE: Values recorded as 0.0 are below the limit of detection.

Source: Wisconsin Department of Natural Resources, U.S. Geological Survey, and SEWRPC.

Data collected in 1992 for a DNR study of the impacts of stormwater runoff on urban streams in Milwaukee County[14] recorded high levels of pollutants within the water column and in bottom sediments of Lincoln Creek. Concentrations of oil and grease, PAHs, and heavy metals in Lincoln Creek all exceeded those concentrations recorded at a reference site located in a non-urbanized portion of the Milwaukee River. These pollutants were linked to stormwater discharges, accentuated during periods of high stream flow.

Since the completion of the initial regional water quality management plan, 63 spills of toxic substances into streams of known locations in the Milwaukee River watershed have been documented by the Wisconsin Department of Natural Resources. Of these spills, 39 have occurred in the main stem of the Milwaukee River and 20 have occurred in Lincoln Creek. The remaining spills have occurred in smaller tributaries of the Milwaukee River, including Beaver Creek and Pigeon Creek. The majority of the substances that were spilled into surface waters were gasoline or related petroleum products.

Water Quality Assessments: Based upon recent available data, the water quality and biological characteristics of the Milwaukee River and its major tributaries were assessed, with the results set forth in Table VIII-16. Where data were available, fish populations and diversity ranged from fair to good.

Fish kills were documented at eight locations in the Milwaukee River watershed--Lincoln Creek, Cedar Creek, Pigeon Creek, Brown Deer Creek, and in the Milwaukee River main stem in the Villages of Grafton and Kewaskum and in the Cities of West Bend and Milwaukee. Fish kills are generally related to seasonal fluctuations in water temperature and levels of dissolved oxygen as well as spawning activity, but can also be related to human activity such as the discharge of pollutants into surface water. Where known, the specific cause of each documented fish kill is shown in Table VIII-16.

Standards are not expected to be met for ammonia nitrogen and phosphorus concentrations, and for fecal coliform levels in the majority of the Milwaukee River main stem from about CTH C in Ozaukee County downstream to the Milwaukee Harbor estuary. Levels of fecal coliform are also not expected to fully meet the standards in Lincoln, Indian, Kewaskum, and Silver Creeks, in the North Branch of the Milwaukee River, and the lower portions of Cedar Creek. In addition, dissolved oxygen concentrations are estimated not to meet the standard in the lower reaches of Cedar Creek, Lincoln Creek, Pigeon Creek, and in the Milwaukee River main stem downstream of Wells Street.

As noted in Table VIII-16, available data on toxics indicate problems with water column toxic pollutants in the lower portions of the Milwaukee River and in Lincoln Creek, and in the lower portions of Cedar Creek. Data collected by the Milwaukee Metropolitan Sewerage District at five stations on the Milwaukee River main stem indicate that the standards for chronic toxicity for cadmium and lead have been exceeded and that violations of chronic toxicity standards for zinc and copper were reported at Station M1-11b. The standards for acute toxicity,

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[14]John P. Masterson and Roger T. Bannerman, Impacts of Stormwater Runoff on Urban Streams in Milwaukee County, Wisconsin, Wisconsin Department of Natural Resources, 1994.

Table VIII-16

CHARACTERISTICS OF STREAMS IN SUBWATERSHEDS WITHIN THE MILWAUKEE RIVER WATERSHED

SUBWATERSHED Stream Reach	Stream Length (miles)	Fish Population and Diversity[a]	Recorded Fish Kills[b]	Water Quality Problems[c]					Biotic Index Rating[d]	Streambed Sedimentation (substrate)	Physical Modifications to Channel[e]
				DO	NH_3	Total P	Fecal Coliform	Toxics			
CEDAR CREEK											
a. Cedar Creek u/s Little Cedar Creek inflow	8.0	Good	--	No	No	No	No	--	Good-fair	Moderate (sand,silt, gravel, rubble)	Moderate
b. Little Cedar Creek	7.2	Good	--	--	--	--	--	--	--	Moderate (sand and gravel)	Major
c. Cedar Creek d/s Little Cedar Creek inflow- CTH M	9.8	Good	--	Yes	No	No	Yes	--	Fair-poor	Moderate (silt,sand, gravel)	Major
d. Cedar Creek d/s CTH M to STH 60	9.5	Good	--	Yes	No	No	No	--	Fair	Moderate (silt,sand, gravel, rubble)	Low
e. Cedar Creek d/s STH 60	6.7	Good	Yes	No	No	Yes	Yes	Yes	--	Moderate	Low
f. North Branch	7.3	--	--	--	--	--	--	--	Very good-fair	Moderate (sand,silt, gravel, rubble)	--
g. Friedens Creek	3.2	--	--	--	--	--	--	--	Very good -good	Moderate (sand, silt)	Moderate
h. Lehner Creek	1.8	Good	--	--	--	--	--	--	Very good-good	--	--
TOTAL	53.5										
MILWAUKEE RIVER-EAST AND WEST BRANCHES											
a. Milwaukee River d/s North Washington Co line-CTH H	5.4	Good	Yes[f]	No	No	No	No	--	Excellent[g]	Moderate (sand, gravel, silt)	Low
b. Milwaukee River d/s CTH H to Woodford Drive	4.9	Poor	--	No	No	No	No	--	--	High (sand, gravel, silt, rubble)	--
c. Milwaukee River d/s Woodford Drive to STH 33	13.6	Fair	Yes[f]	No	No	Yes	No	--	Good-poor[g]	High (sand, gravel, rubble)	--
d. Milwaukee River d/s STH 33	9.9	--	--	No	No	Yes	No	--	Good[j]	High (sand, gravel, rubble)	--
e. Kewaskum Creek	6.4	Good	--	No	No	No	Yes	--	--	Moderate	--
f. Silver Creek	4.0	Fair	--	No	No	No	Yes	--	Good	High (silt, sand, gravel)	Major
g. Quaas Creek	4.9	Good	--	--	--	--	--	--	Very good-fair	Moderate (sand, silt, gravel, rubble)	Low
h. East Branch Milwaukee River d/s north Washington County Line	5.0	Fair	--	--	--	--	--	--	--	Low (gravel & sand)	Low
TOTAL	54.1										

Table VIII-16 (cont'd)

SUBWATERSHED Stream Reach	Stream Length (miles)	Fish Population and Diversity[a]	Recorded Fish Kills[b]	Water Quality Problems[c]					Biotic Index Rating[d]	Streambed Sedimentation (substrate)	Physical Modifications to Channel[e]
				DO	NH_3	Total P	Fecal Coliform	Toxics			
MILWAUKEE RIVER-NORTH											
a. North Branch of Milwaukee River	8.5	Good	--	No	No	No	Yes	--	Excellent[g] -good	Moderate-high	--
b. Stony Creek	10.0	--	--	--	--	--	--	--	--	Moderate (silt, gravel)	Moderate
c. Wallace Creek	8.6	Good	--	--	--	--	--	--	--	Low	--
TOTAL	27.1										
MILWAUKEE RIVER-SOUTH											
a. Milwaukee River Upstream STH 33	11.1	--	--	No	No	No	Yes	--	Good	Moderate (boulder, cobble, gravel)	--
b. Milwaukee River downstream STH 33 to STH 57	13.7	Good	--	No	No	Yes	Yes	Yes	Good	Moderate (boulder, cobble, gravel)	--
c. Milwaukee River downstream STH 57 to CTH C	4.5	Fair-good	Yes[h]	No	Yes	Yes	Yes	Yes	Good	Low to Moderate (cobble, gravel)	--
d. Milwaukee River downstream CTH C to Mequon Road	13.4	Good	--	No	Yes	Yes	Yes	Yes	Good	High (cobble, gravel)	--
e. Milwaukee River downstream Mequon Road to Brown Deer Rd	6.1	--	Yes	No	Yes	Yes	Yes	Yes	Good	High (cobble, gravel)	--
f. Milwaukee River d/s Brown Deer Rd.-Port Washington Rd.	10.4	--	--	No	Yes	Yes	Yes	Yes	--	High (cobble, gravel)	--
g. Milwaukee River d/s Port Wash. Road to North Avenue	3.8	--	Yes[i]	No	Yes	Yes	Yes	Yes	--	--	--
h. Milwaukee River downstream North Avenue to Walnut St.	0.9	--	--	No	Yes	--	Yes	Yes	--	--	Moderate
i. Milwaukee River downstream Walnut Street to Wells St.	0.8	--	--	No	Yes	--	Yes	Yes	--	--	Moderate
j. Milwaukee River downstream Wells Street to Water St.	0.6	--	--	Yes	Yes	--	Yes	Yes	--	--	Moderate
k. Milwaukee River downstream Water Street	0.8	--	--	Yes	Yes	--	Yes	Yes	--	--	Moderate
l. Lincoln Creek	9.4	Fair	Yes	Yes	No	--	Yes	Yes	Very poor	--	Major
m. Indian Creek	1.9	--	--	Yes	No	--	Yes	--	Very Poor	--	Major
n. Brown Deer Creek	1.9	--	Yes[j]	--	--	--	--	--	Very Poor	Moderate (sand, gravel, bubble)	Moderate
o. Pigeon Creek	2.4	Good	Yes[k]	Yes	No	No	No	--	Fair-Good	Low-moderate (gravel, cobble)	Low
TOTAL	80.7										

Footnotes follow.

Table VIII-16 (cont'd)

[a]Based upon stream appraisal documentation set forth in the DNR Water Resource Appraisals for the Cedar Creek, East/West Branch, North Branch, and South Branch Milwaukee River watershed.

[b]Unless otherwise noted, fish kills are assumed to be the result of natural fluctuations in water conditions.

[c]The most recent water quality data available as described in Figures VIII-1 through VIII-5 in addition to data available from DNR Water Resource Appraisals used to evaluate water quality in the Milwaukee 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 evaluate current water quality for Milwaukee River watershed stream reaches based upon year 2000 land use conditions, and current levels of pollution control, if appropriate.

[d]Except where otherwise indicated, 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.

[e]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 or 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.

[f]Reported to be due to a discharge of ammonia.

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

[h]Two fish kills were reported in this stream reach. A light fish kill recorded in 1980 was reported to be a result of cooling water discharge through a storm sewer. The cause of a moderate kill recorded in 1990 was undetermined.

[i]Undetermined source.

[j]Reported to be due to a discharge of lubricating and cutting oils.

[k]Reported to be due to a discharge of chlorine.

[l]Subsequent sampling in 1987 resulted in an Index of Biotic Integrity (IBI) rating of excellent.

Source: Wisconsin Department of Natural Resources and SEWRPC.

as defined in Chapter II, were exceeded only on very limited occurrences. Since 1985, no significant violations of the lead standard have been reported.

The biotic index ratings, which are biological indicators of water quality within a stream system, ranged from very poor to excellent in the watershed. Where data were available in the Milwaukee River South branch subwatershed, Milwaukee River tributaries generally received poorer biotic index ratings than main stem stream reaches. Moderate to high and high levels of streambed sedimentation were observed in the North Branch of the Milwaukee River and in the Milwaukee River from CTH C downstream to Port Washington Road, respectively. High levels were also noted in the Milwaukee River downstream of the north Washington County line to STH 33 and in Silver Creek. Elsewhere, the levels were generally low to moderate.

Table VIII-17 sets forth the water quality index classifications[15] 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 VIII-17, recent comparative water quality data were available for four stations on the Milwaukee River main stem; one in the Town of Grafton, M1-9; one at Brown Deer Road, M1-10a; one at Port Washington Road, M1-11; and one just upstream of the Milwaukee Harbor estuary, M1-12. These stations are shown on Map VIII-6. The limited comparative data available indicate that water quality conditions from 1974-75 and to 1990-92 have remained "fair" at Stations M1-9, M1-10, and M1-12. Water quality conditions at Station M1-11 have remained "good" from 1974-75 to 1990-92.

A summary of potential pollution sources in the Milwaukee River watershed by stream reach is shown in tabular summary in Table VIII-18. Review of the data indicate that the majority of the conversion of lands from rural to urban uses has occurred in the Milwaukee River South subwatershed and that much of this conversion occurred before the completion of the initial plan. As a result, a relatively small amount of new urban development has occurred in these areas, and much of the development occurs in the form of urban re-development. It should be noted that a majority of the documented spills of toxic substances and the majority of the permitted industrial discharges have also occurred in streams in the Milwaukee River South subwatershed. 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 VIII-18.

Lakes

Lake water quality data available for use in preparing the initial regional water quality management plan were obtained from the Wisconsin Department of Natural Resources quarterly lake monitoring program for selected lakes and Wisconsin Department of Natural Resources and Southeastern Wisconsin Regional Planning Commission lake use reports. Post-1976 data on phosphorus and chlorophyll concentrations and water clarity for major lakes in the Milwaukee River watershed, where available, are presented in Table VIII-19.

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[15]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 VIII-17

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATIONS OF THE MILWAUKEE RIVER WATERSHED 1964, 1974-1975, AND 1990-1992

Water Quality Sampling Stations[a]	July, August, September, and October of 1964	August of the Years 1974-1975	July and August 1990 and 1991
Main Stem Stations			
M1-1	Fair	Fair	N/A
M1-2	Fair	Fair	N/A
M1-3	Good	Fair	N/A
M1-5	Good	Good	N/A
M1-6	Good	Fair	N/A
M1-9	Good	Fair	Fair
M1-10	Fair	Fair	Fair[b]
M1-11	Fair	Good	Good
M1-11b	N/A	N/A	Good
M1-12	Fair	Fair	Fair
Tributary Stations			
M1-4	Fair	Fair	N/A
M1-7	Fair	Fair	N/A
M1-8	Fair	Fair	N/A
Watershed Average	Fair	Fair	Fair

[a] See Map VIII-6 for sampling station locations.

[b] Recent data collected from the Milwaukee River at Brown Deer Road (M1-10a) were used for comparison purposes with previous data collected from the Milwaukee River at CTH H (M1-10), located approximately 3.6 miles upstream from the Brown Deer Road station.

Source: SEWRPC.

Table VIII-18

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

SUBWATERSHED 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	
CEDAR CREEK											
Cedar Creek Upstream Little Cedar Creek Inflow	Significant	Insignificant	--	X	X	--	--	3	--		1,2,3
Little Cedar Creek	Insignificant	Insignificant	--	--	X	--	--	--	--		1,2,3
Cedar Creek Downstream Little Cedar Creek Inflow to CTH M	Insignificant	Insignificant	--	X	X	1	1	1	--	Seneca Food Company private sewage treatment plant recommended for abandonment	1,2,3,4
Cedar Creek Downtream CTH M to STH 60	Insignificant	Insignificant	--	--	X	--	1	--	--		2,3
Cedar Creek Downstream STH 60	Significant[d]	Insignificant[d]	--	X	X	1	--	5	--		1,2,3
North Branch Cedar Creek	Insignificant	Insignificant	--	--	X	--	--	1	--		1,2,3
Friedens Creek	Significant	Insignificant	--	--	X	--	--	--	--		1,2,3
Lehner Creek	Insignificant	Insignificant	--	--	X	--	--	--	--		1,2,3
MILWAUKEE RIVER-EAST/WEST											
Milwaukee River Downstream North Washington County Line to CTH H	Significant[e]	Moderate	--	X	X	1	--	3	--		1,2,3,4
Milwaukee River Downstream CTH H to Woodford Drive	Significant[e]	Insignificant	--	--	X	--	--	1	--		1,2,3
Milwaukee River Downstream Woodford Drive to STH 33	Significant[d]	Insignificant[d]	1985 - oil	X	X	1	--	7	--		1,2,3
Milwaukee River Downstream STH 33	Insignificant	Insignificant	--	X	X	1	--	1	--		1,2,3
Kewaskum Creek	Insignificant	Insignificant	--	--	X	--	--	--	--		1,2,3
Silver Creek	Moderate[e]	Insignificant	--	X	X	--	--	1	--		1,2,3
Quaas Creek	Significant[e]	Significant	--	--	X	--	--	1	--		1,2,3

Table VIII-18 (cont'd)

SUBWATERSHED 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	
East Branch Milwaukee River Downstream North Washington County Line	Insignificant	Insignificant	--	--	X	--	--	--	--		1,2,3
MILWAUKEE RIVER- NORTH											
North Branch Milwaukee River	Insignificant	Insignificant	--	--	X	--	--	--	--		1,2,3
Stony Creek	Insignificant	Insignificant	--	--	X	--	--	--	--		1,2,3
Wallace Creek	Significant	Insignificant	--	--	X	--	--	--	--		1,2,3
MILWAUKEE RIVER-SOUTH											
Milwaukee River Upstream STH 33	Insignificant	Insignificant	--	X	X	1	--	1	--		1,2,3
Milwaukee River Downstream STH 33 to STH 57	Significant	Insignficant	1989-petroleum	X	X	1	--	6	--		1,2,3
Milwaukee River Downstream STH 57 to CTH C	Significant[d]	Insignificant[d]	1989-dye lubricant mixture	X	X	1	--	2	--		1,2,3
Milwaukee River Downstream CTH C to Mequon Road	Moderate[d]	Significant[d]		X	X	--	--	5	--	Village of Thiensville public sewage treatment plant abandoned in 1987	1,2,3
Milwaukee River Downstream Mequon Road to Brown Deer Road	Moderate[d]	Significant[d]	1986-unknown 1989-drain oil	X	x	--	--	5	--		1,2,3
Milwaukee River Downstream Brown Deer Road to Port Washington Road	Insignificant[d]	Insignificant[d]	1978-gasoline 1980-oil 1985-oil 1987-petroleum 1989-oil 1990-copolymer #5S 1990-petroleum products	X	X	--	--	12	Leaking Underground Storage Tank permitted to discharge remediation wastewater to Milwaukee River		1,2,3

Table VIII-18 (cont'd)

SUBWATERSHED 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	
Milwaukee River Downstream Port Washington Road to North Avenue	Insignificant[d]	Insignificant[d]	1978-fuel oil 1983-fuel oil 1985-oil 1986-unknown 1986-chemicals 1987-red foamy stain	X	--	--	--	13	Leaking underground storage tank permitted to discharge remediation wastewater to Milwaukee River		1,2,3
Milwaukee River Downstream North Avenue to Walnut Street	Insignificant[d]	Insignificant[d]	1984-fuel oil 1986-oil/foam 1988-sewage 1988-unknown 1990-heavy material	X	--	--	--	2	--		1,2,3
Milwaukee River Downstream Walnut Street to Wells Street	Insignificant[d]	Insignificant[d]	1982-gasoline 1983-gasoline 1986-oil 1987-waste oil 1987-red substance 1988-old oil or fuel 1988-unknown 1989-sodium hydroxide	X	--	--	--	3	--		1,2,3
Milwaukee River Downstream Wells Street to Water Street	Insignificant[d]	Insignificant[d]	1980-oil 1983-unknown 1985-oil, waste 1986-unknown 1988-discharge from drain pipe	X	--	--	--	6	--		1,2,3
Milwaukee River Downstream Water Street	Insignificant[d]	Insignificant[d]	1982-fuel 1983-detergent 1987-sewage	X	--	--	--	--	--		1,2,3

Table VIII-18 (cont'd)

SUBWATERSHED 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	
Lincoln Creek	Insignificant[d]	Insignificant[d]	1979-oil (2) 1980-oil 1981-oil 1983-petroleum 1985-oil 1987-sheen 1987-oil (2) 1988-sheen 1988-unknown 1988-gas/oil 1988-oil 1989-petroleum products 1990-petroleum 1990-petroleum sheen (2) 1990-weathered oil 1990-black gritty silt 1990-oil	X	--	--	--	31	Leaking underground storage tank permitted to discharge remediation wastewater to Lincoln Creek Leachate seepage from U.S. Army Reserve Center/ Havenwoods Park landfill (abandoned) Village of Whitefish Bay landfill (abandoned) City of Milwaukee landfill (abandoned)		1,2,3
Indian Creek	Insignificant[d]	Insignificant[d]		X	X	--	--	--	--		1,2,3
Brown Deer Creek	Insignificant[d]	Insignificant[d]	1988-petroleum 1989-oil	X	X	--	--	3			1,2,3
Pigeon Creek	Inisgnificant	Insignificant	1986-paint thinner 1989-clay	X	X	--	--	--			1,2,3

Footnotes follow.

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

1. Construction Erosion Control Ordinances in place
2. Urban Nonpoint Source Controls Implemented
3. Rural Nonpoint Source Controls Implemented
4. Sewage Treatment Plant Upgrading Underway

[d] Considerable urban development existing pre-1976.

[e] The amount of post-1976 urban development has increased in comparison to pre-1976 urban development.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table VIII-19

WATER QUALITY OF THE MAJOR LAKES IN THE MILWAUKEE RIVER WATERSHED

SUBWATERSHED Lake Name	Area (acres)	Total Phosphorus (mg/l)					Chlorophyll-a (μg/l)					Secchi Disk (feet)				
		Maximum	Minimum	Average[a]	Date of Data	Source[b]	Maximum	Minimum	Average	Date of Data	Source[b]	Maximum	Minimum	Average	Date of Data	Source[b]
CEDAR CREEK																
Big Cedar Lake	932	0.15	0.01	0.01(187)	1985-89	LTT	46	2	24.0(64)	1985-89	LTT	17.1	4.3	9.8(148)	1985-89	LTT
Little Cedar Lake	246	0.34	0.01	0.11(33)	1973-86	STORET	17.0	5.0	9.4(5)	1985-86	STORET	23.0	11.75	15.8(7)	1991-92	SELF-HELP
Mud Lake (Ozaukee County)	245	0.08	0.01	0.04(20)	1973-75	LSF	--	--	--	--	--	5.5	2.0	3.2(7)	1973-75	LSF
MILWAUKEE RIVER-EAST/WEST																
Barton Pond	67	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lucas Lake	78	0.02	0.01	0.01(10)	1985-86	STORET	10.0	4.0	5.7(7)	1980-86	STORET	9.5	5.9	8.1(7)	1980-86	STORET
Silver Lake (Washington)	118	0.04	<0.01	0.01(14)	1985-86	STORET	5.0	2.0	3.0(3)	1985	STORET	6.25	21.5	11.5(30)	1988-91	SELF-HELP
Smith Lake	86	0.02	0.02	0.02(2)	1985-86	STORET	--	--	5.0(1)	1985	STORET	--	--	4.3(1)	1985	STORET
MILWAUKEE RIVER-NORTH																
Green Lake (Washington)	71	0.05	0.01	0.03(15)	1985-86	STORET	16.0	5.0	7.9(7)	1980-86	STORET	16.5	3.5	8.95(113)	1989-92	SELF-HELP
Spring Lake (Ozaukee)	66	0.02	0.01	0.01(13)	1985-89	STORET	5.0	3.0	4.5(6)	1980-86	STORET	9.0	6.25	7.6(5)	1987	SELF-HELP
Lake Twelve	53	0.02	0.01	0.01(7)	1985-86	STORET	8.0	5.0	7.0(3)	1985-86	STORET	6.9	4.6	5.9(3)	1985-86	STORET
Wallace Lake	52	0.05	0.01	0.03(12)	1985-86	STORET	23.0	5.0	10.2(6)	1980-86	STORET	9.5	6.5	7.78(9)	1991-92	SELF-HELP
MILWAUKEE RIVER-SOUTH																
Lac du Cours	57	--	--	0.05(1)	1979	LSF	--	--	25.0(1)	1979	LSF	--	--	1.5(1)	1979	LSF

[a] Number in parenthesis refers to the number of samples taken.

[b] The following sources were cited:
LSF.....Wisconsin Department of Natural Resources, Lake Survey Forms
LTT.....Long Term Trends Lake Monitoring Program Data: 1985-1987
SELF-HELP.....Wisconsin Self-Help Lake Monitoring Program Data: 1986-1988
STORET.....U.S. Environmental Protection Agency Water Information Storage and Retrieval System

Source: SEWRPC.

Toxic and Hazardous Substances: Since the preparation of the initial plan, there has only been one reported toxic spill on the major lakes in the Milwaukee River watershed. In 1986 a spill of an unknown substance was reported on Lac du Cours.

Water Quality Assessments: Data from Table VIII-19 were used in the calculation of trophic state indices for each of the major lakes where data were available. Trophic states, indicating degrees of nutrient enrichment in the lakes, were assigned using the Wisconsin Trophic State Index[16] for each major lake in the Milwaukee River watershed where data were available, as indicated in Table VIII-20. The available trophic state index values using the Carlson Trophic State Index are also provided for current and historic conditions, as shown in Table VIII-21. These data are presented using the Carlson Trophic State Index in order to present the newer data on a comparable basis to the historic data which used that Index.

The data available, as shown in Table VIII-20, indicate that all of the lakes may be classified in the mesotrophic to eutrophic range. Mesotrophic indicates lakes with moderate levels of nutrient enrichment whereas eutrophic lakes are nutrient-rich lakes. Big Cedar, Little Cedar, Green, Lucas, and Smith Lakes are all drainage lakes classified in the mesotrophic range. Lake Twelve and Wallace Lake are spring lakes classified as mesotrophic. Spring lake in Ozaukee County is a mesotrophic lake and Silver Lake in Washington County is a slightly mesotrophic lake, both of which are drained lakes. Mud Lake and Lac du Cours[17] are both eutrophic seepage lakes. No current data are available to make assessments of trophic status for Barton Pond, a drainage lake in Washington County. No conclusions regarding changes in water quality conditions can be drawn based upon the limited data available, although in the case of Little Cedar Lake the Carlson index values demonstrate some indication that their water quality has improved marginally during this period.

Fish kills, primarily related to seasonal fluctuations in water temperature and levels, dissolved oxygen or human activity, periodically occur in lakes in the Milwaukee River watershed. Since the initial plan, recorded fish kills in a major lake in the Milwaukee River watershed occurred in Silver Lake (Washington County) in 1984. However, these occurrences do not appear to be chronic. Thus, despite the obvious concern that those episodes create among lake users, they do not appear to warrant special planning considerations at this time.

Compliance with Water Use Objectives

As indicated in Chapter II, the majority of the stream reaches in the Milwaukee River watershed, as of 1993, are generally recommended for warm water sport fish and full recreational uses. Lehner Creek and portions of Quaas and Stony Creeks

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[16]The Wisconsin State Index is set forth in "Trophic State Index Equations and Regional Predictive Equations for Wisconsin Lakes," R.A. Lillie et al, Research Management Findings, No. 35, May 1993.

[17]Since the publication of the previous edition of this water quality management plan--SEWRPC Planning Report No. 30, the surface area of this lake has been revised to 56 acres; hence, it is included as a major lake in this edition.

Table VIII-20

TROPHIC STATE INDEX VALUES FOR MAJOR LAKES WITHIN THE MILWAUKEE RIVER WATERSHED[a]

Lake Name	Wisconsin Trophic State Index Values[b]			
	Total-P	Chlorophyll-a	Secchi	Mean
Barton Pond	--	--	--	--
Big Cedar Lake	47.5	48.4	43.9	46.6
Little Cedar Lake	64.7	51.6	35.0	50.4
Green Lake	54.6	50.3	43.2	49.4
Lac du Cours	58.6	58.9	71.4	63.0
Lucas Lake	46.1	47.8	47.1	47.0
Mud Lake	56.8	--	59.0	57.9
Silver Lake (Washington County)	46.1	43.0	42.0	43.7
Smith Lake	51.5	46.8	56.2	51.5
Spring Lake (Ozaukee County)	46.1	46.0	47.9	46.7
Lake Twelve	46.1	49.4	51.6	49.0
Wallace Lake	54.6	52.2	47.7	51.5

[a] Wisconsin Trophic State Index Values were calculated using water chemistry data shown in Table VIII-19.

[b] Wisconsin Trophic State Index ranges:
below 44 = oligotrophic
44 - 53 = mesotrophic
54 - 75 = eutrophic
above 75 = hypertrophic

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table VIII-21

COMPARISON OF TROPHIC STATE INDEX VALUES FOR MAJOR LAKES IN THE MILWAUKEE RIVER WATERSHED[a]

Lake Name	Carlson Trophic State Index Values[b]		
	Satellite Information 1979-1981	Water Chemistry pre-1981	Water Chemistry 1981-1991
Barton Pond	--	--	--
Big Cedar Lake	46	--	59
Little Cedar Lake	48	71	59
Green Lake	47	--	50
Lac du Cours	56	64	--
Lucas Lake	47	--	43
Mud Lake	--	56	--
Silver Lake (Washington County)	44	--	50
Smith Lake	--	--	49
Spring Lake (Ozaukee County)	47	--	43
Lake Twelve	49	--	45
Wallace Lake	47	--	59

[a] Carlson Trophic State Index values were calulated from available data from spring measurements for phosphorus and from summer measurements for chlorophyll-a and water clarity. Water chemistry values were determined from Wisconsin Lakes-A Trophic Assessment Using Landsat Digital Data, 1993.

[b] Carlson Trophic State Index Ranges:
below 40 = oligotrophic
40-50 = mesotrophic
50-60 = eutrophic
above 60 = hypertrophic

Source: Wisconsin Department of Natural Resources, U.S. Environmental Protection Agency, and SEWRPC.

are recommended for coldwater fish because of their potential to support trout populations, and are recommended for full recreational uses. Stream reaches recommended for warmwater sportfish and limited recreational uses include the Milwaukee River downstream of North Avenue, and portions of Lincoln and Indian Creeks. Kewaskum Creek, Silver Creek, Pigeon Creek, and portions of Quaas and Wallace Creeks have limitations for sport fish habitat and are recommended for warmwater forage fish and full recreational use. Brown Deer Creek and Lincoln Creek upstream of Silver Spring Drive and from Hampton Avenue to 32nd Street are recommended for limited forage fish and limited recreational uses, while Indian Creek upstream of IH-43 and Lincoln Creek from Silver Spring to Hampton and from 32nd Street to Teutonia Avenue are both recommended for limited aquatic life and limited recreational uses. The remaining streams are recommended for warmwater sport fish and full recreational uses. In addition, as noted in Chapter II, the East Branch of the Milwaukee River from the Fond du Lac-Washington County line downstream to STH 28 has been designated as an "Exceptional Resource Water."

Based upon the available data for sampling stations in the watershed, the main stem of the Milwaukee River and many of its tributaries 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. As part of the Milwaukee River priority watershed planning program, the DNR staff conducted field inspections and limited sampling in order to assess the water quality and biological conditions on all of the streams in the Milwaukee River watershed. Those investigations indicated that the majority of the streams in the watershed did not fully meet the recommended water use objectives. Based upon a review of the data summarized in Figures VIII-1 through 9 and in Table VIII-14 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 fecal coliform and phosphorus standards occur in the majority of the stream reaches in the watershed. However, the recommended water use objectives may potentially be met in Lehner Creek and in portions of Quaas and Stony Creeks, based upon the observed uses in those streams. In addition, it is expected that portions of the upper reaches of the East and West Branches of the Milwaukee River and some of their tributaries likely do meets the standards associated with the recommended water use objectives.

The waters of lakes in the Milwaukee River watershed are recommended for the maintenance of a warm water sport fishery and full recreational use. Mud Lake is recommended for limited aquatic life and limited recreational use. All of the lakes for which complete water quality data were available between 1965 and 1975 violated the standards for all parameters--total phosphorus of 0.02 mg/l, dissolved oxygen and fecal coliform--recommended by the Commission. Modeling data developed in the initial plan indicates that none of the lakes fully met the phosphorus standard.

As shown in Table VIII-19, recent monitoring data are available for Big Cedar Lake, Little Cedar Lake, Lucas Lake, Silver Lake (Washington County), Smith Lake, Green Lake (Washington County), Spring Lake (Ozaukee County), Lake Twelve, Wallace Lake, and Lac du Cours to assess the current compliance with water quality standards for the major lakes in the Milwaukee River watershed. Based upon those data as summarized in the Carlson Trophic State Index values set forth in Table VIII-6, it may be expected that Big Cedar Lake, Little Cedar Lake, Green Lake, Mud Lake, Silver Lake, and Wallace Lake would have total

phosphorus levels exceeding the 0.02 mg/l standard, which is represented by a TSI value in excess of approximately 47.

WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

Based upon local nonpoint source pollution abatement planning and land use decisions, the only significant water quality management issue which remains to be addressed is the level of control which is needed and which is achievable for urban nonpoint source pollution abatement. It is recommended that this issue be examined further following a period of implementation of the ongoing nonpoint source pollution priority watershed program, taking into account subsequent monitoring data and levels of funding available and anticipated.

A future amendment to the regional plan for the Milwaukee 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.

Chapter IX

WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

INTRODUCTION

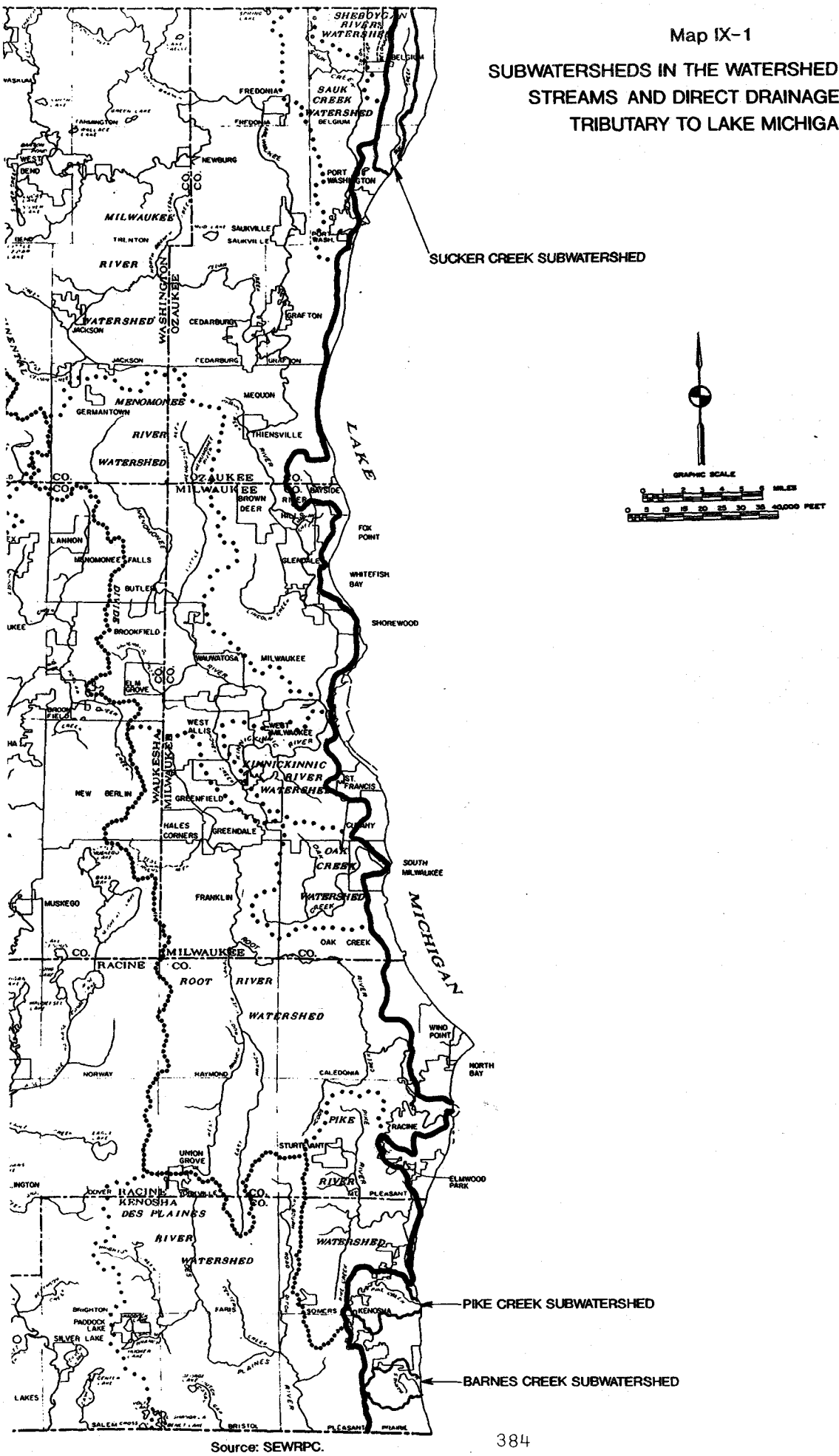
This chapter presents a description of the recommendations contained in the initial regional water quality management plan and amendments thereto and progress made toward plan implementation from 1975--the base year of the initial plan--through 1990--the base year of the plan update. In addition, this chapter presents information on water quality and biological conditions in the surface water system of the minor streams and direct drainage area tributary to Lake Michigan through 1993, where available. Finally, this chapter presents a description of the substantive water quality management issues that remain to be addressed in the watershed of minor streams and direct drainage area tributary to Lake Michigan 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. Designated management agency responsibilities for plan implementation are presented in Chapter XVII on a regional basis.

The watersheds of numerous small creeks and streams in the extreme eastern portion of the Region, as well as the watersheds of the Milwaukee, Menomonee, Kinnickinnic, Root, and Pike Rivers, and Oak and Sauk Creeks, drain directly to Lake Michigan. For convenience, the group of small watersheds which are directly tributary or tributary through small streams to Lake Michigan is considered as a single unit in this plan update--the watershed of minor streams and direct drainage area tributary to Lake Michigan. The Milwaukee, Menomonee, Kinnickinnic, Root, and Pike River watersheds, and Oak and Sauk Creek watersheds are covered in separate chapters of this plan.

The watershed of minor streams and direct drainage area tributary to Lake Michigan encompasses the watersheds of Sucker Creek in the northern portion of the Region and Pike Creek and Barnes Creek in the south, as well as the direct drainage riparian lands to Lake Michigan in Kenosha, Milwaukee, Ozaukee and Racine Counties. The portion of this composite watershed contained within the Region--about 93-square miles--is only a small part of a much larger Lake Michigan watershed. Rivers and streams within this watershed are part of the St. Lawrence River drainage system which lies east of the subcontinental divide. The boundaries of the watershed of minor streams and direct drainage area tributary to Lake Michigan, together with the locations of the main surface water courses draining to Lake Michigan, are shown on Map IX-1.

Map IX-1

SUBWATERSHEDS IN THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN



Source: SEWRPC.

Within the Southeastern Wisconsin Region, the watershed of minor streams and direct drainage area tributary to Lake Michigan 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 watershed of minor streams and direct drainage area tributary to Lake Michigan 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 uses has the potential to impact on water quality as a result of increased point source 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 in stormwater, such as metals and chlorides, can also be expected to increase with urbanization.

Table IX-1 summarizes the existing land uses in the watershed of minor streams and direct drainage area tributary to Lake Michigan 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, 48 percent of the watershed was still in rural and other open space land uses in 1990. These rural uses included about 29 percent of the total area of the watershed in agricultural and related rural uses, about 4 percent in woodlands, about 4 percent in water and wetlands, and about 11 percent in other open lands. The remaining 52 percent of the total watershed was devoted to urban uses. Existing land uses within the watershed are shown on Map IX-2.

Within the watershed of minor streams and direct drainage area tributary to Lake Michigan, major concentrations of urban development exist in all four Lake Michigan shoreline counties. Since 1975, only limited development has been occurring in the direct drainage area, primarily within the City of Mequon in Ozaukee County, the Towns of Caledonia and Mount Pleasant in Racine County, and the Village of Pleasant Prairie in Kenosha County.

Within the Barnes Creek subwatershed, urban-related land uses are located in the northern portion of the subwatershed, in and adjacent to the City of Kenosha. Small concentrations of residential land uses are also located in the southeastern portion of the subwatershed, along STH 174 and CTH Q.

The Pike Creek subwatershed, which lies almost entirely within the City of Kenosha, is highly urbanized, with only some remaining open space and scattered urban development located in the northwest portion of the subwatershed, north of STH 142, in the Town of Somers. One major industrial center, located just west of the downtown area between CTH K and STH 158, lies within the subwatershed.

Table IX-1

LAND USE IN THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 1975 and 1990[a]

Land Use Category	1975		1990		Change 1975-1990	
	Acres	Percent	Acres	Percent	Acres	Percent
Urban						
Residential	14,948	25.0	16,107	26.9	1,159	7.8
Commercial	700	1.2	827	1.4	127	18.1
Industrial	1,275	2.1	1,225	2.0	- 50	3.9
Transportation, Communication, and Utilities[b]	8,756	14.6	9,509	15.9	753	8.6
Governmental and Institutional	1,629	2.7	1,666	2.8	37	2,3
Recreational	1,553	2.6	1,869	3.1	316	20.3
Subtotal	28,861	48.2	31,203	52.1	2,342	8.1
Rural						
Agricultural and Related	19,879	33.3	17,110	28.6	-2,769	-13.9
Lakes, Rivers, Streams and Wetlands	2,402	4.0	2,352	3.9	- 50	- 2.1
Woodlands	2,301	3.9	2,350	3.9	49	2.1
Open Lands[c], Landfills, Dumps, and Extractive	6,349	10.6	6,876	11.5	527	8.3
Subtotal	30,931	51.8	28,688	47.98	-2,243	- 7.3
Total	59,792	100.0	59,891	100.0	99[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 is the net effect of Lake Michigan shoreline erosion and accretion and of landfill activities.

Source: SEWRPC.

MAP IX–2

LAND USES FOR THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 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 3 6

GRAPHIC SCALE IN MILES

Source: SEWRPC

The watershed of minor streams and direct area tributary to Lake Michigan is about 93 square miles in areal extent, or about 4 percent of the total Region. In 1990, about 49 square miles, or about 52 percent of the watershed, was in urban land uses.

Within the Sucker Creek subwatershed, only limited urban development has occurred in the Village of Belgium and in and around the unincorporated place of Lake Church, as the subwatershed is primarily an agricultural area. Scattered urban-related land uses are additionally located along the CTH LL corridor in the Towns of Belgium and Port Washington.

As shown in Table IX-1, from 1975 to 1990, urban land uses in the watershed increased from about 28,900 acres, or 45 square miles to about 31,200 acres, or 49 square miles, or by about 8 percent. Residential use has increased within the watershed from about 15,000 acres, or 23 square miles in 1975, to about 16,100 acres, or 25 square miles in 1990, an increase of 8 percent. Commercial and industrial land uses increased only slightly, from about 1,980 acres, or three square miles, to about 2,050 acres, an increase of about 4 percent.

The 49 square miles of urban land uses in the watershed as of 1990 can be compared to the staged 1990 planned level of about 52.7 square miles envisioned in the year 2000 land use plan. The current status of development in the watershed of minor streams and direct drainage area tributary to Lake Michigan and in adjacent portions of Milwaukee, Ozaukee, Racine, and Kenosha Counties was considered in developing the new year 2010 land use plan element described in Chapter III for the Region as a whole.

Table IX-2 summarizes the year 2010 planned land use conditions set forth in the adopted year 2010 land use plan in the minor stream and direct drainage area watershed tributary to Lake Michigan and compares the recommended land use conditions to the 1990 conditions. Under planned land use conditions, as described in Chapter III, urban redevelopment is anticipated to occur in the already urbanized portions of the watershed of Milwaukee County and the Cities of Mequon, Kenosha, and Racine. Within the Barnes Creek subwatershed, urban land uses are expected to increase within the entire subwatershed, with more concentrated development to the north and west of Barnes Creek, adjacent to the City of Kenosha. Within the Pike Creek subwatershed, urban land uses are expected to increase in the northwestern portion of the subwatershed and urban redevelopment is anticipated in the already urbanized portions. Within the less urbanized Sucker Creek subwatershed, urban land uses are anticipated to increase in 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 watershed of minor streams and direct drainage area tributary to Lake Michigan, as indicated in Table IX-2, is projected to increase from the 1990 total of about 49 square miles, or about 52 percent of the total area of the watershed, to about 54 square miles, or about 58 percent of the total area of the watershed, by the year 2010. Under the high growth-decentralized land use plan future scenario, the land devoted to urban uses is projected to increase to about 56 square miles, or about 60 percent of the total area of the subwatershed, by the year 2010. It is important to note that the 40 to 42 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 the primary environmental corridors are, in some cases, precluded from being developed by State and Federal regulations. Thus, the demand for urban

Table IX-2

EXISTING AND PLANNED LAND USE IN THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 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	16,107	26.9	18,137	30.3	2,031	12.6	19,108	31.9	3,001	18.6
Commercial	827	1.4	815	1.4	- 12	- 1.5	841	1.4	14	1.7
Industrial	1,225	2.0	1,410	2.4	185	15.1	1,527	2.6	302	24.7
Transportation, Communication, and Utilities[b]	9,509	15.9	10,123	16.9	614	6.5	10,495	17.5	986	10.4
Governmental and Institutional	1,666	2.8	1,755	2.9	89	5.3	1,786	3.0	120	7.2
Recreational	1,869	3.1	2,338	3.9	469	25.1	2,403	4.0	534	28.6
Subtotal	31,203	52.1	34,578	57.8	3,375	10.8	36,160	60.4	4,957	15.9
Rural										
Agricultural and Related	17,110	28.6	16,196	27.0	- 914	- 5.3	14,985	25.0	-2,125	-12.4
Lakes, Rivers, Streams, and Wetlands	2,352	3.9	2,249	3.8	- 103	- 4.4	2,249	3.8	- 103	- 4.4
Woodlands	2,350	3.9	2,292	3.8	- 58	- 2.5	2,282	3.8	- 68	- 2.9
Open Lands[c], Landfills, Dumps, and Extractive	6,876	11.5	4,576	7.6	-2,300	-33.4	4,215	7.0	-2,661	-38.7
Subtotal	28,688	47.9	25,313	42.2	-3,375	-11.8	23,731	39.6	-4,957	-17.3
Total	59,891	100.0	59,891	100.0	0	--	59,891	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 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 45 square miles in 1990 to about 40 square miles in the year 2010 under the intermediate growth-centralized land use plan and to about 37 square miles under the high growth-decentralized land use plan, decreases of about 12 and 17 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 watershed of minor streams and direct drainage area tributary to Lake Michigan--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 areas located within the watershed of minor streams and direct drainage area tributary to Lake Michigan.

With regard to the point source plan element related to the watershed of minor streams and direct drainage area to Lake Michigan, the most significant recommendations in the initial plan and the most significant implementation actions are related to the Milwaukee Metropolitan Sewerage District's water pollution abatement program. This program includes: rehabilitation of the sanitary sewer system; construction of relief sewers; improvement and expansion of the Jones Island and South Shore sewage treatment plants; provision of large subterranean conveyance and storage-deep tunnel facilities to contain separate and combined sewer peak flows in excess of the capacity of the sewerage system; development of a solids management program; and provision of trunk sewers to serve the various communities comprising the District service area. As of 1993, the District's pollution abatement program was nearing completion, with the deep tunnel system expected to be online during 1994.

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 service area. The update will have a plan year 2010, the same as the update of the regional plan. It is recommended that the facility plan re-examine certain system level decisions that were made in the past including trunk sewer needs, and the cost-effectiveness of retaining the one remaining small sewage treatment plant in the Milwaukee metropolitan area--the City of South Milwaukee plant. The resultant sewerage 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 herein

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

presented. Such an amendment could impact on the facilities within the watershed of minor streams and direct drainage area tributary to the Lake Michigan watershed.

Public and Private Wastewater Treatment Systems and Sewer Service Areas Existing Conditions and Status of Plan Implementation: In 1975, there were eight public sewage treatment plants located in the watershed of minor streams and direct drainage area tributary to Lake Michigan, as shown on Map IX-3. The Milwaukee Metropolitan Sewerage District (MMSD) Jones Island and South Shore plants, the Cities of Port Washington, South Milwaukee, Racine, and Kenosha sewage treatment plants, and the North Park Sanitary District sewage treatment plants discharged directly or indirectly through harbors to the coastal waters of Lake Michigan. The Pleasant Park Utility Company plant discharged to Lake Michigan via a drainage ditch. Of these eight plants, the plants operated by the North Park Sanitary District and Pleasant Park Utility Company 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 watershed of minor streams and direct drainage area tributary to Lake Michigan, as recommended in the initial regional water quality management plan, is summarized in Table IX-3.

As can be seen by review of Table IX-3, full implementation of the initial plan would provide for the upgrading, as needed, of three plants--the Milwaukee Metropolitan Sewerage District Jones Island and South Shore Plants, and the City of South Milwaukee plant. The initial plan also included recommendations for the expansion of the City of Kenosha, City of Racine, and City of Port Washington sewage treatment plants, as well as the abandonment of the North Park Sanitary District and Pleasant Park Utility Company plants. Implementation of these recommendations has been largely completed with the exception of the upgrading of the City of South Milwaukee plant. No action has yet been taken with regard to this plant. Selected characteristics of the public sewage treatment plants currently existing in the watershed are given in Table IX-4.

In addition to the publicly-owned sewage treatment facilities, five private sewage treatment plants were in existence in 1975 in the watershed of minor streams and direct drainage area tributary to Lake Michigan. These five plants served the following land uses: the Chalet-on-the-Lake Restaurant, the Port Country Club, the Siennadale Motherhouse, the Sisters of Notre Dame Academy (currently Concordia College), and the Wisconsin Electric Power Company Oak Creek Plant.

As indicated in Table IX-3, all five of the private sewage treatment plants in the watershed were recommended to be abandoned in the initial plan. As of 1990, four of the five plants had been abandoned. As of 1994, the Concordia College sewage treatment plant was continuing operations.

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 watershed of minor streams and direct drainage area tributary to Lake Michigan. 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

Table IX-3

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN FOR PUBLIC AND PRIVATE SEWAGE TREATMENT PLANTS IN THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 1990

Public Sewage Treatment Plants	Disposal of Effluent	Plan Recommendation	Implementation Status
City of Kenosha	Lake Michigan	Expand	Partially competed[a]
Milwaukee Metropolitan Sewerage District-Jones Island Plant	Lake Michigan via Milwaukee outer harbor	Upgrade	Construction underway
Milwaukee Metropolitan Sewerage District-South Shore Plant	Lake Michigan	Upgrade	Construction underway
City of Port Washington	Lake Michigan	Expand	Construction underway
City of Racine	Lake Michigan	Expand	Partially completed, construction underway for additional plant improvements, including equalization basin[b]
City of South Milwaukee	Lake Michigan	Upgrade	No action
North Park Sanitary District	Lake Michigan	Abandon plant	Plant abandoned (1988)
Pleasant Park Utility Company	Lake Michigan via drainage ditch	Abandon plant	Plant abandoned (1990)
Private Sewage Treatment Plants			
Chalet-on-the-Lake Restaurant	Lake Michigan	Abandon plant	Plant abandoned (1981)
Port Country Club[c]	Soil absorption	Abandon plant	Plant abandoned (1980)
Siennadale Motherhouse	Bartlett Creek	Abandon plant	Plant abandoned (1990)
Concordia University[d]	Lake Michigan	Abandon plant	No action
Wisconsin Electric Power Company-Oak Creek Plant	Lake Michigan	Abandon plant	Plant abandoned (1986)

[a] Plant expansion was completed in 1994.

[b] Plant expansion was completed in 1991.

[c] Most recently known as the Squires Country Club.

[d] Formerly Sisters of Notre Dame Academy.

Source: SEWRPC.

Table IX-4

SELECTED CHARACTERISTICS OF EXISTING PUBLIC SEWAGE
TREATMENT PLANTS IN THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 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
City of Kenosha	20.0	88,800	1941, 1967, 1984	Clarification, phosphorus removal, activated sludge, clarification, chlorination, dechlorination	Lake Michigan	6/30/98
Milwaukee Metropolitan Sewrage District-Jones Island Plant	255.4	1,036,000	1925, 1935, 1969, 1970, 1990	Phosphorus removal, activated sludge, clarification, chlorination, dechlorination	Lake Michigan via Milwaukee outer harbor	3/31/99
Milwaukee Metropolitan Sewerage District-South Shore Plant			1969, 1974, 1990	Clarification, activated sludge, clarification, phosphorus removal, chlorination, dechlorination	Lake Michigan	3/31/99
City of Port Washington	2.5	9,300	1956, 1972, 1990	Activated sludge, contact stabilization, clarification, phosphorus removal, ultraviolet disinfection	Lake Michigan	6/30/97
City of Racine	32.25	124,400	1938, 1967, 1977, 1989	Equalized basin, clarification, phosphorus removal, activated sludge, chlorination	Lake Michigan	6/30/96
City of South Milwaukee	4.8	21,000	1937, 1952, 1962, 1972, 1985	Activated sludge, clarification, phosphorus removal, chlorination	Lake Michigan	6/30/97

Table IX-4 (continued)

Name of Public Sewage Treatment Plant	Hydraulic Loading (mgd)				BOD5 Loading (pounds per day)				Suspended Solids Loading (pounds per day)			
	Existing				Existing				Existing			
	Average Annual	Maximum Monthly Average	Design Average Annual	Number of Months in 1990 in Which the Monthly Average Flow Exceeded the Design Capacity	Average Annual	Maximum Monthly Average	Design Average Annual	Number of Months in 1990 in Which the Monthly Average Flow Exceeded the Design Capacity	Average Annual	Maximum Monthly Average	Design Average Annual	Number of Months in 1990 in Which the Monthly Average Flow Exceeded the Design Capacity
City of Kenosha	23.02	35.09	28.6[c]	1	16,907	20,474	29,700	0	24,647	34,445	34,300	1
Milwaukee Metropolitan Sewerage District-Jones Island Plant	123.00	139.30	200.0	0	268,757	307,551	323,600	0	273,760	388,564	332,000	2
Milwaukee Metropolitan Sewerage District-South Shore Plant	101.00	158.00	150.0	1	118,66	141,987	265,000	0	152,089	196,434	265,000	0
City of Port Washington	1.42	1.72	3.1	0	1,803	2,231	4,315	0	2,237	2,737	5,386	0
City of Racine	28.80	43.90	30.0[d]	3	23,212	26,374	61,300	0	32,887	41,275	50,000	0
City of South Milwaukee	3.45	5.10	6.0	0	3,995	5,642	11,000	0	5,850	9,836	--	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.

[c] In 1994, the City of Kenosha completed a sewerage system upgrading and expansion project, including 30.0-million gallon equalization and wastewater storage facilities for its sewerage system, resulting in a hydraulic design capacity of 28.6 mgd on an average annual basis and 68 mgd on a wet weather average basis.

[d] In 1994, the City of Racine was preparing facility planning for sewerage system upgrading and expansion.

Source: Wisconsin Department of Natural Resources and SEWRPC.

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. There were nine sewer service areas identified within, or partially within, the watershed of minor streams and direct drainage area tributary to Lake Michigan: Belgium, Lake Church, Port Washington, Mequon, Milwaukee Metropolitan Sewerage District (MMSD), South Milwaukee, Racine, Kenosha, and Pleasant Park. Currently, all of these areas, with the exception of the Milwaukee Metropolitan Sewerage District[2] and the Lake Church sewer service areas, have undergone refinements as recommended. The boundaries of the sewer service areas as refined through 1993 are shown on Map IX-3. Table IX-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 area in the, as refined through 1993, totals about 49 square miles, or about 53 percent of the total watershed area, as shown in Table IX-5.

Current Plan Recommendations: The current point source plan element recommendations provide for the continued operation with expansion and upgrading, as necessary, of the City of Kenosha, City of Port Washington, City of Racine, City of South Milwaukee, and MMSD Jones Island and South Shore sewage treatment plants. Estimated approximate dates for beginning facility planning for the expansion and upgrading of existing sewage treatment plants are indicated in Table IX-6. This recommendation regarding plant facility upgrading and expansion as needed, also applies to the treatment plant solids management element for the six public sewage treatment plants recommended to be retained.

With regard to the two treatment plants operated by the Cities of Racine and Kenosha, further consideration should be given to evaluating a potential change in the recommendations set forth in the initial plan. That potential change is proposed based upon the findings of 1992 sanitary sewerage and water supply system plans which were completed for the greater Racine and greater Kenosha areas. The findings and recommendations of the planning work for the former 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,

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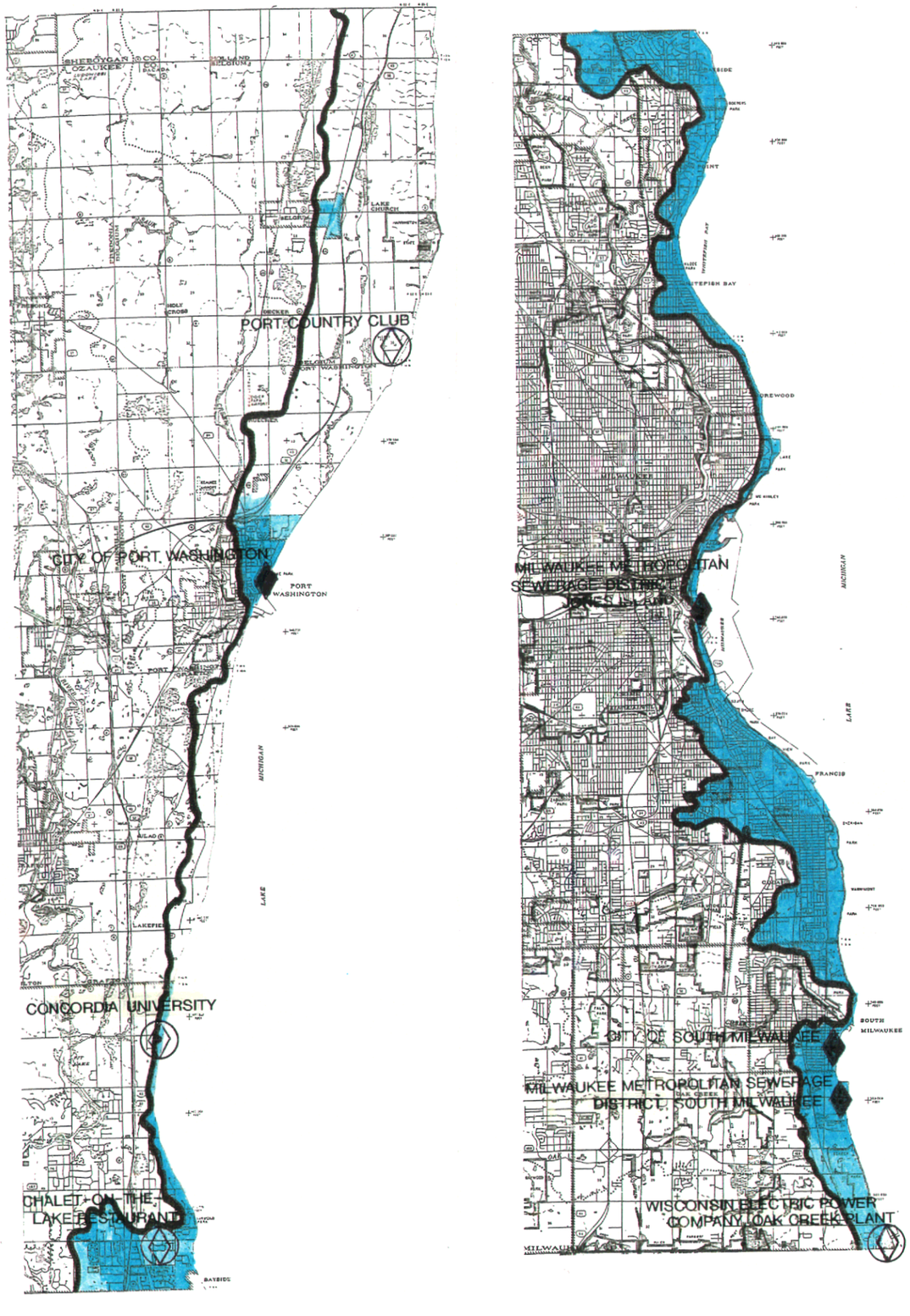
[2]As of September 1994, the sewer service areas for the City of Oak Creek portion of the MMSD sewer service area was refined as set forth in SEWRPC Community Assistance Planning Report No. 213, Sanitary Sewer Service Area Plan for the City of Oak Creek, Milwaukee County, Wisconsin.

Map IX-3

SEWER SERVICE AREAS AND SEWAGE TREATMENT PLANTS IN THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 1990



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
- EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE ABANDONED
- PRIVATE SEWAGE TREATMENT FACILITY ABANDONED AFTER 1975
- 1975 URBAN DENSITY DEVELOPMENT OUTSIDE OF THE INITIAL PLAN SEWER SERVICE AREA

Source: SEWRPC.

GRAPHIC SCALE

0 1 2 3 4 5 6 MILES

0 8000 16000 24000 32000 FEET

Table IX-5

PLANNED SANITARY SEWER SERVICE AREAS IN
THE MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 1993

Name of Initially Defined Sanitary Sewer Service Area(s)	Planned 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				
Belgium	1.3	Belgium	June 15, 1987	SEWRPC CAPR No.97, 2nd Edition, Sanitary Sewer Service Area for the Village of Belgium, Ozaukee County, Wisconsin
Kenosha Pleasant Park Somers	22.7	Kenosha	December 2, 1985	SEWRPC CAPR No. 106, Sanitary Sewer Service Areas for the City of Kenosha and Environs, Kenosha County, Wisconsin
Mequon Thiensville	4.0	Mequon Thiensville	January 15, 1992	SEWRPC CAPR No. 188, Sanitary Sewer Service Area for the City of Mequon and the Village of Thiensville, Ozaukee County, Wisconsin
Port Washington	1.8	Port Washington	December 1, 1983	SEWRPC CAPR No. 95, Sanitary Sewer Service Area for the City of Port Washington, Ozaukee County, Wisconsin
Racine Caddy Vista	19.2	Racine Caddy Vista	December 1, 1986	SEWRPC CAPR No. 147, Sanitary Sewer Service Area for the City of Racine and Environs, Racine County, Wisconsin
Subtotal	49.0			
Unrefined Sanitary Sewer Service Areas				
Milwaukee Metropolitan Sewerage District (portion)[a]	16.9	--	--	--
Lake Church	1.1	--	--	--
South Milwaukee	1.4	--	--	--
Subtotal	19.4	--	--	--
Total	68.4	--	--	--

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 3.0 miles within the minor streams and direct drainage area tributary to Lake Michigan.

while the findings and recommendations of the planning work for the latter are contained in a report prepared by Ruekert & Mielke, Inc., entitled A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Kenosha Area. Those reports, which were prepared for study areas including all of the eastern portion Racine County extending from Lake Michigan to a distance of about two miles west of IH 94 and all of Kenosha County extending from Lake Michigan to a distance of one mile west of IH 94 include portions of the watershed of minor streams and direct drainage area tributary to Lake Michigan. The reports identified the sanitary sewer and water supply needs of those planning areas, and evaluated alternative means of meeting those needs; recommended coordinated design year 2010 sewerage and water supply system plans for the areas; identified intergovernmental, administrative, legal, and fiscal issues inherent in the implementation of the system plans; and recommended institutional structures for implementation of those plans. The recommended sewerage system and planned service areas developed in this subregional system plan are shown on Maps IV-4A and XIII-4A. As of December 1994, the needed intergovernmental agreement and approvals of the system plan or the attendant changes to the regional water quality management plan had not been achieved. Thus, the inclusion of these plan recommendations in the updated plan are pending intergovernmental agreement on the recommendations.

The current point source pollution abatement plan element, including the planned sewer service areas, and including the components noted above to be held in abeyance pending approval of the Cities of Racine and Kenosha, is summarized on Map IX-4. Table IX-6 presents selected design data for the six public sewage treatment plants which are recommended to be maintained in the watershed of minor streams and direct drainage area tributary to Lake Michigan. It is important to note that three plants recorded monthly average hydraulic loadings which equaled or exceeded the average design capacities of the plants, as shown on Table IX-4. It should be noted that the City of Kenosha completed a sewerage system upgrading and expansion in 1994, and that facility planning was underway for sewerage system upgrading and expansion for the City of Racine in 1994, and the Milwaukee Metropolitan Sewerage District facility planning was initiated in 1995.

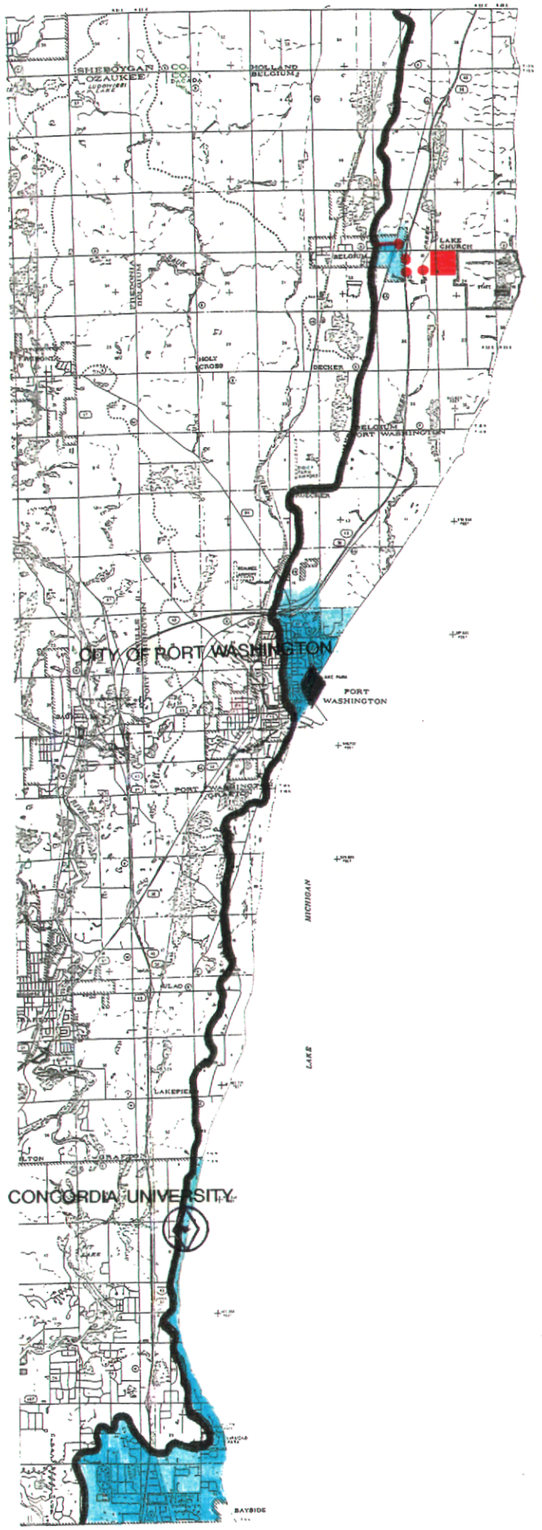
Table IX-6 shows expected increases in sewered populations and attendant increases in sewage hydraulic loading rates for two different year 2010 growth scenarios for the six public sewage treatment plants in the watershed of minor streams and direct drainage area tributary to Lake Michigan.

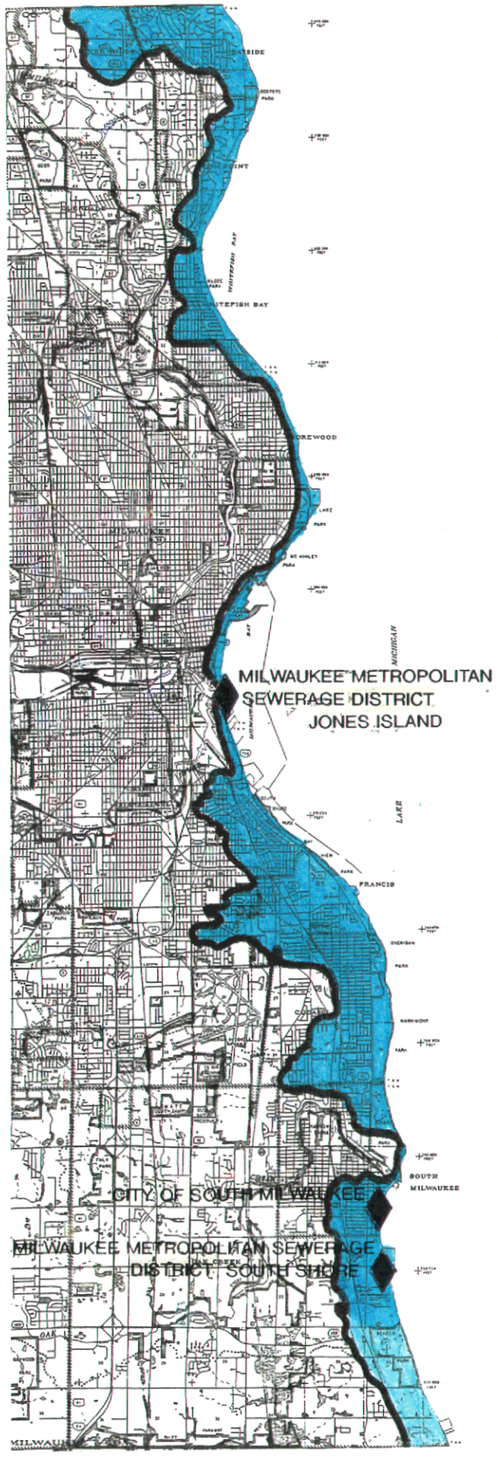
The current planned sanitary sewer service areas in the watershed of minor streams and direct drainage area tributary to Lake Michigan are shown on Map IX-4. The existing and planned year 2010 population data for each sewer service area is presented in Chapter XVIII on a regional basis. All or portions of the following sewer service areas are located in the watershed of minor streams and direct drainage area tributary to Lake Michigan: Kenosha, Racine, South Milwaukee, Milwaukee Metropolitan Sewerage District, and Port Washington. Together, the planned service areas within the watershed total about 68 square miles, or about 73 percent of the watershed of minor streams and direct drainage area tributary to Lake Michigan.

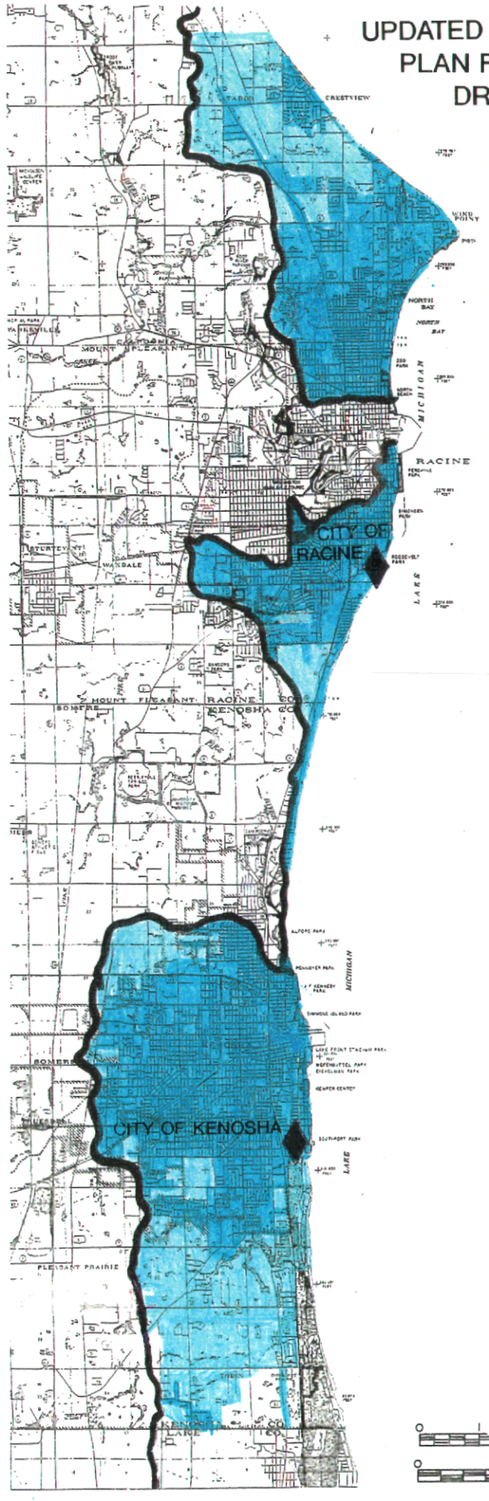
As noted above, most of the sewer service areas in the watershed have been refined as part of the ongoing regional water quality management plan updating process. Additional refinements are envisioned to be needed for the Lake Church and remaining portion of the Milwaukee Metropolitan Sewerage District sewer

Map IX-4

UPDATED REGIONAL WATER QUALITY MANAGEMENT POINT SOURCE PLAN FOR THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 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 ABANDONED
- PROPOSED GRAVITY SEWER
- PROPOSED FORCE MAIN
- PROPOSED PUMPING STATION

Source: SEWRPC.

GRAPHIC SCALE

0 1 2 3 4 5 6 MILES

0 8000 16000 24000 32000 FEET

Table IX-6

SELECTED DESIGN DATA FOR PUBLIC SEWAGE TREATMENT PLANTS
IN THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 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]
City of Kenosha[b]	Kenosha	28.6[b]	23.02	20.0	83,800	53.2	100,900	25.0	2010	118,400	27.3	2010
Milwaukee Metropolitan Sewerage District-Jones Island Plant	Milwaukee Metropolitan Sewerage District, Franklin, Mequon, Thiensville, Germantown, Butler, Brookfield East, New Berlin, Muskego, Caddy Vista, Menomonee Falls, Oak Creek	200	123.20	250.6	1,036,000	335.7	1,060,000	125.0	1995[c]	1,134,000	128.0	1995[c]
Milwaukee Metropolitan Sewerage District-South Shore Plant		120	100.01					105.0	1995[c]		110.0	1995[c]
City of Port Washington	Port Washington	3.1	1.42	2.5	9,300	5.7	9,900	1.5	2010	19,000	2.6	2000
City of Racine	Racine	30.0[d]	28.8	32.3	124,400	60.4	133,400	30.0	--[d]	167,800	34.2	--[d]
City of South Milwaukee	South Milwaukee	6.0	3.45	4.8	21,000	4.8	19,800	3.3	2005	20,300	3.4	2005

[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 and monthly design flows compared to average expected annual and maximum monthly flows and the age of facilities based upon data of last major construction.

[b] In 1994, the City of Kenosha completed an upgrading and expansion, including 30.0 million gallon equalization and wastewater storage facilities for its sewerage system, resulting in a hydraulic design capacity of 28.6 mgd on an average annual basis and 68 mgd on a wet weather average basis.

[c] Facility planning for Milwaukee Metropolitan Sewerage District sewage treatment plants was underway in 1995.

[d] Local facility plan was underway in 1994 for sewerage system upgrading and expansion.

Source: SEWRPC

service area. 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 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.

In addition to the public plants, there was one private sewage treatment plant in operation within the watershed of minor streams and direct drainage area tributary to Lake Michigan in 1990. This facility serves Concordia College. This private plant is recommended to be abandoned during the planning period with connection to the Milwaukee Metropolitan Sewerage District system through the City of Mequon sewerage system. It is recommended that at such time as the Concordia College sewage treatment plant requires a major upgrading and/or expansion, that an evaluation be conducted of the cost effectiveness of the alternative of abandoning the plant with connection to the Mequon public sewerage system.

Sewer Flow Relief Devices

Existing Conditions and Status of Plan Implementation: As shown in Table IX-7, 63 points of sanitary sewer system flow relief--including two combined sewer overflows--were reported to exist during 1993 in the watershed of minor streams and direct drainage area tributary to Lake Michigan. These flow relief points are located in nine sewerage systems and include, in addition to the two combined sewer overflows, selected bypasses which physically remain in the sewerage system but are expected to function only under conditions of power or equipment failure or excessive infiltration and inflow during extreme wet weather conditions. These flow relief points, except for the combined sewer overflows, have only been in operation infrequently, with the average discharge occurrence frequency over this five-year period being less than once per year per flow relief location. This equates to an average of about six isolated overflow occurrences per year considering all reported bypassing. With the completion of the Inline Storage System, bypassing of sewage from the combined sewer overflows is expected to occur an average of about one to two times per year. The Milwaukee Harbor estuary study[3] documented that this level of reduction in combined sewer overflow discharges would be adequate to meet water quality standards within the Milwaukee outer harbor, assuming the other water quality improvement measures recommended are carried out. Bypassing from the other sanitary sewer flow relief devices is expected to be further eliminated over time as sewerage system upgrading is completed.[4]

Current Plan Recommendations: It is recommended that the Cities of Cudahy, Milwaukee, and Racine; the Villages of Bayside, North Bay, and Whitefish Bay; the Milwaukee Metropolitan Sewerage District, the Crestview Sanitary District,

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

[4]In 1994, the City of Racine was planning a sewer rehabilitation program, including upgrading of lift stations and construction of relief sewers. This project should result in the elimination of many of the bypasses in that system.

Table IX-7

KNOWN SEWAGE FLOW RELIEF DEVICES IN THE WATERSHED
OF THE MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIAGAN: 1988-1993

Sewerage System	Sewage Treatment Plant Flow Relief Device	Sewage Flow Relief Devices in the Sewer System						Comments
		Combined Sewer Overflow	Cross-overs	Pumping Station Bypasses	Other Bypasses	Portable Pumping Systems	Total	
Village of Bayside	--	--	5	1	--	--	6	Used only in case of extreme wet weather
Village of Whitefish Bay	--	--	19	--	--	1	20	Used only in case of extreme wet weather
City of Milwaukee	--	--	1	--	--	--	1	Used only in case of extreme wet weather
Milwaukee Metropolitan Sewerage District	--	2	2	--	--	--	4	Used only in case of extreme wet weather
City of Cudahy	--	--	19	--	--	--	19	Used only in case of extreme wet weather
North Park Sanitary District	--	--	--	2	--	--	2	Used only in case of equipment failure
Crestview Sanitary District	--	--	--	--	1	--	1	Used only in case of extreme wet weather
Village of North Bay	--	--	--	--	2	--	2	Used only in case of extreme wet weather
City of Racine	--	--	5	1	2	--	8	Used only in case of equipment failure or extreme wet weather
TOTAL	--	2	51	4	5	1	63	

Source: SEWRPC.

and the North Park Sanitary District continue to monitor the 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 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.

Intercommunity Trunk Sewer

Existing Conditions and Status of Plan Implementation: The initial regional water quality management plan as updated, recommended the construction of three intercommunity trunk sewers in the watershed of minor streams and direct drainage area tributary to Lake Michigan, as shown in Table IX-8. One trunk sewer would connect anticipated urban development in the unincorporated Village of Lake Church to the Village of Belgium sewerage system. This trunk sewer has not yet been constructed. The second trunk sewer would connect the North Park Sanitary District service area and other portions of the Town of Caledonia to the City of Racine sewerage system. The construction of this trunk sewer was completed in 1988, and the North Park Sanitary District facility was subsequently abandoned as recommended in the initial plan. A further intercommunity trunk sewer would connect the Pleasant Park Utility Company service area and portions of the Village of Pleasant Prairie to the City of Kenosha sewerage system. The construction of this trunk sewer was completed in 1990 and the Pleasant Park Utility Company sewage treatment plant abandoned as recommended in the initial plan.

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 watershed of minor streams and direct drainage area tributary to Lake Michigan. Two of the three intercommunity trunk sewers recommended to be constructed in the watershed under the initial plan have been completed. The remaining trunk sewer to connect the unincorporated Village of Lake Church to the Village of Belgium sewerage system is recommended to be constructed at such time as the provision of sanitary sewer service to Lake Church is considered further and implemented.

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

Existing Conditions and Status of Plan Implementation: As of 1990, there were 47 point sources of wastewater discharging cooling water and other types of wastewater to the watershed of minor streams and direct drainage area tributary to Lake Michigan through industrial waste outfalls or indirectly through drainage ditches and storm sewers. Table IX-9 summarizes selected characteristics of these other point sources and Map IX-5 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 65 known permitted point sources of wastewater other than public and private sewage treatment plants discharging to surface waters in the watershed of minor streams and direct

Table IX-8

IMPLEMENTATION STATUS OF THE INITIAL REGIONAL WATER QUALITY MANAGEMENT PLAN FOR INTERCOMMUNITY TRUNK SEWERS IN THE MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 1990

Intercommunity Trunk Sewer	Status of Implementation
Lake Church-Belgium	Not completed
Caledonia-Crestview and North Park-Racine	Completed (1988)
Pleasant Prairie-Kenosha	Completed (1990)

Source: SEWRPC.

Table IX-9

CHARACTERISTICS OF OTHER KNOWN POINT SOURCES OF WATER POLLUTION
IN THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 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]
Ametek Lamb Electric Division	Racine	1	General	0044938-3	9-30-95	3564/3621	Blowers, fans, mtrs., generators	Lake Michigan via storm sewer	--
Anderson Park Pool	Kenosha	2	General	0046523-2	9-30-95	--	Municipal pool	Barnes Creek via storm sewer	--
Arneson Foundry, Inc.	Kenosha	3	General	0044938-3	9-30-95	3321/3325	Gray & ductile iron, steel foundry	Lake Michigan via storm sewer	--
Benjamin Air Rifle Company	Racine	4	General	0044938-3	9-30-95	3484	Small arms	Lake Michigan via storm sewer	--
Best Western Harborside Inn	Ozaukee	5	General	0046523-2	9-30-95	7011	Hotels and motels	Lake Michigan via harbor	--
Boliden-Allis Inc.: Res. & Test Ctr.	Milwaukee	6	General	0044938-3	9-30-95	8732	Commercial nonphysical research	Lake Michigan	--
Bostrom Seating, Inc.	Milwaukee	7	General	0044938-3	9-30-95	2531	Public bldg. and related furniture	Lake Michigan via storm sewer	--
Bradford High School Pool	Kenosha	8	General	0046523-2	9-30-95	8211	Secondary school	Pike Creek	--
City of Cudahy Water Utility	Milwaukee	9	General	0046540-1	9-30-95	4941	Water supply	Lake Michigan	--
City of Racine: Gaslight Point Prjt.	Racine	10	General	0046558-1	9-30-95	--	N/A	Lake Michigan	--
EZ Paintr. Corp.	Milwaukee	11	General	SPEC PERM	9-30-95	3991	Brooms and brushes	Lake Michigan	--
Fox Point Municipal Pool	Milwaukee	12	General	0046523-2	9-30-95	--	Municipal pool	Lake Michigan via storm sewer	--
Gleason Ready Mix	Racine	13	General	0046507-2	9-30-95	3273	Ready-mix concrete	Groundwater discharge	--
In-Sink-Erator. -Emerson, Inc.	Racine	14	General	0044938-3	9-30-95	3639	Household appliances	Lake Michigan via storm sewer	--
Jacobsen Div. -Textron Industries	Racine	16	General	0044938-3	9-30-95	3524	Lawn & garden equipment	Lake Michigan via storm sewer	--
Milw. Water Works-Linwood Purif. Plt.	Milwaukee	17	General	0046540-1	9-30-95	4941	Water supply	Lake Michigan	--
North Shore Cement & Burial Vault Inc	Kenosha	18	General	0046507-2	9-30-95	3272	Concrete products	Groundwater discharge	--
West Point Raquet & Fitness Club	Racine	19	General	0046523-2	9-30-95	7997	Membership sports & rec. club	Lake Michigan via unnamed trib.	--
Port Washington Water Utility	Ozaukee	20	General	0046540-1	9-30-95	4941	Water supply	Lake Michigan	--
Quality Concrete Steps & Porches	Milwaukee	21	General	0046507-2	9-30-95	3272	Concrete products	Groundwater discharge	--
Racine School Dist.: Horlick H.S.	Racine	22	General	0046523-1	9-30-95	8211	Secondary school	Lake Michigan via storm sewer	--
Racine School Dist.: Wachwitz Elem.	Racine	23	General	0046523-1	9-30-95	8211	Elementary school	Lake Michigan via storm sewer	--
Rainfair, Inc.-Memorial Drive	Racine	24	General	0044938-3	9-30-95	2385	Waterproof outerwear	Lake Michigan via storm sewer	--
Reuther High School (pool)	Kenosha	25	General	0046523-2	9-30-95	8211	Secondary school	Pike Creek via storm sewer	--
S.C.Johnson & Son- R & D Center	Racine	26	General	0044938-3	9-30-95	2842/2879	Polishes, sanitation, ag. chems.	Lake Michigan via storm sewer	--
St. Francis High School (pool)	Milwaukee	27	General	0046523-2	9-30-95	8211	Secondary school	Lake Michigan via storm sewer	--
Snap-on Tools Corp.	Kenosha	28	General	0044938-3	9-30-95	3425/3429	Saw blades, saws & hardware	Lake Michigan via storm sewer	--
Surgitek, Inc.	Racine	29	General	0044938-3	9-30-95	3069	Fabricated rubber products	Lake Michigan via storm sewer	--
Tremper High School (pool)	Kenosha	30	General	0046523-2	9-30-95	8211	Secondary school	Lake Michigan via storm sewer	--
Twin Disc, Inc. -21st St. Factory	Racine	31	General	0044938-3	9-30-95	3566/3568	Speed changers, drivers,etc.	Lake Michigan via storm sewer	--
Vulcan Materials Co.- Racine Plant	Racine	32	General	0046515-2	9-30-95	3281/3274	Cut stone; stone products; lime	Lake Michigan via storm sewer	--
Washington Park Pool- Kenosha	Kenosha	33	General	0046523-2	9-30-95	--	Municipal pool	Pike Creek	--
Whitefish Bay High School (pool)	Milwaukee	34	General	0046523-2	9-30-95	8211	Secondary school	Lake Michigan via storm sewer	--
Wire & Metal Specialties Co.	Milwaukee	35	General	0044983-3		3443	Fabricated plate work	Lake Michigan via storm sewer	--
YWCA of Racine	Racine	36	General	0046523-2		7991	Physical fitness facility	Lake Michigan via storm sewer	--

Table IX-9 (cont'd)

Facility Name	County	Map ID No.[b]	Permit Type	Permit No.	Expiration Date	Standard Industrial Classification Code	Industrial Activity	Receiving Water	Treatment System[c]
Chrysler Corp -Engineering Division	Kenosha	1A	Specific	0000833	06-03-92	3714	Motor vehicles, parts & accessor.	Pike Creek via storm sewer	5
Everbrite, Inc.	Milwaukee	2A	Specific	0045764	06-30-88	3646	Commercial lighting fixtures	Lake Michigan via storm sewer	None
J.I. Case Company (24th & Mead)	Racine	3A	Specific	0000311	06-30-93	3523	Farm machinery & equipment	Lake Michigan via storm sewer	3, 5, 1, 2
Kenosha City Harbor Conf. Disp. Fac.	Kenosha	4A	Specific	0045390	06-30-93	4432	Freight transportation on L. Mich.	Lake Michigan	None
Ladish Company, Inc. -Cudahy	Milwaukee	5A	Specific	0000728	06-30-90	3462	Iron & steel forgings	Lake Michigan via storm sewer	None
Lakeshore Towers of Racine	Racine	6A	Specific	0048470	--	--	--	Lake Michigan	None
Outokumpu American Brass, Inc.	Kenosha	7A	Specific	0000299	09-30-87	3351	Copper rolling and drawing	Lake Michigan via storm sewer	5, 3, 1
Solvay Animal Health, Inc.	Ozaukee	8A	Specific	0033294	08-31-90	8731	Commercial physical research	Lake Michigan	3
Twin Disc, Inc.	Racine	9A	Specific	0038199	08-31-94	3566	Speed changers, drivers, etc.	Lake Michigan via storm sewer	None
Wisconsin Elec. Power Co. -Oak Creek	Milwaukee	10A	Specific	0000914	06-30-90	4911	Electric services	Lake Michigan	6, 8
Wisconsin Nat. Gas Co. -Oak Creek	Milwaukee	11A	Specific	0054372	03-31-90	4923	Gas transmission & distribution	Lake Michigan via storm sewer	None
Young Radiator Company	Racine	12A	Specific	0039748	12-31-86	3714	Motor vehicle parts	Lake MIchigan via ditch	6, 2, 7, 4

[a] Table IX-9 includes 47 known, permitted point sources of wastewater discharging to the surface or groundwater of the watershed of the minor streams and direct drainage area tributary to Lake Michigan.

[b] See Map IX-5, "Point Sources of Pollution Other than Sewage Treatment Plants in the Watershed of the Minor Streams and Direct Tributary Area to Lake Michigan: 1990."

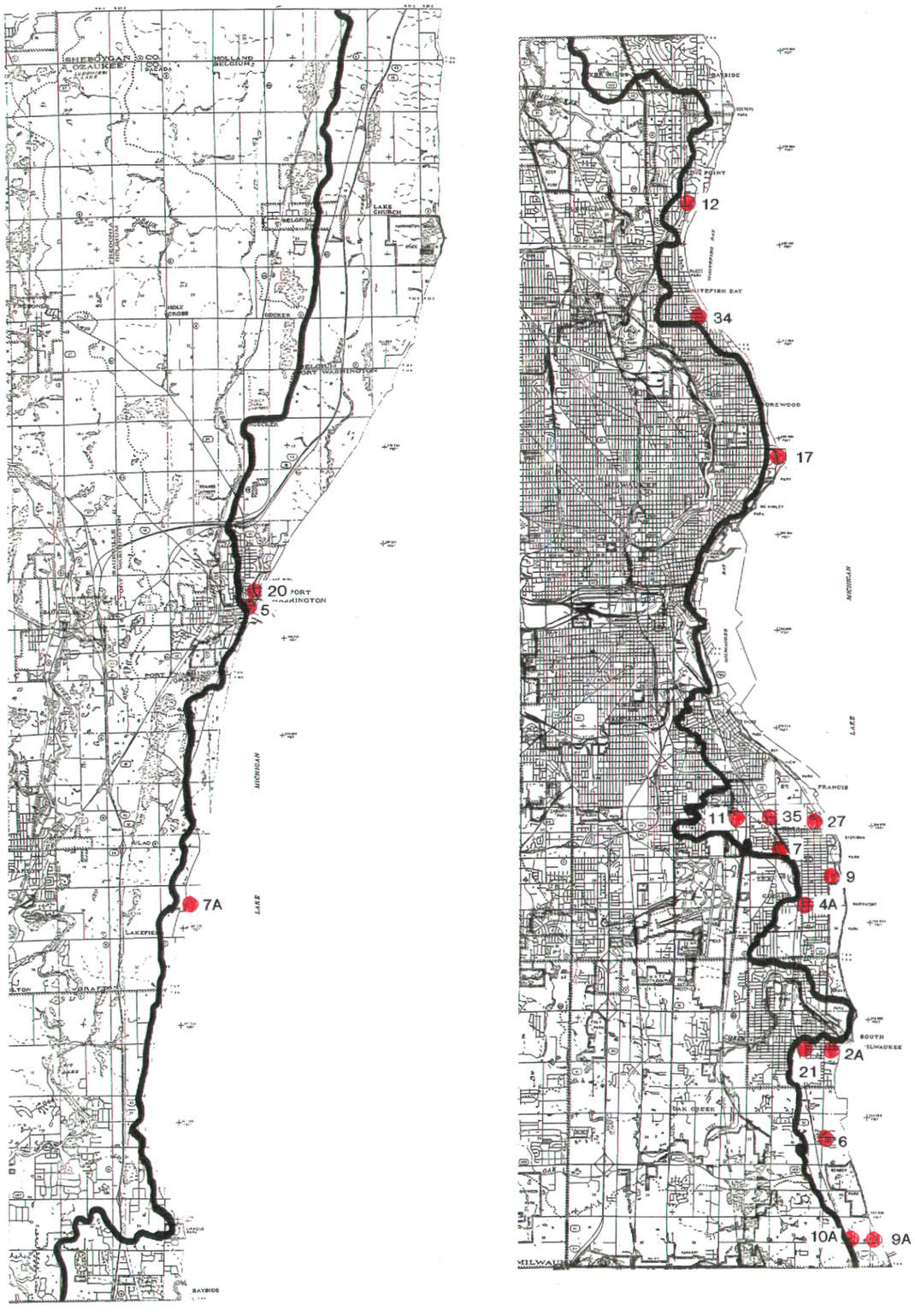
[c] The number code refers to the following treatment systems:

1. Chemical conversion/addition
2. Coagulation flocculation
3. Gravity sedimentation
4. Gravity thickening
5. Oil and grease removal
6. pH control
7. Secondary clarification
8. Tube/Plate settlers

Source: Wisconsin Department of Natural Resources and SEWRPC.

Map IX-5

POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES IN THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN: 1990



LEGEND

- POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES

Source: SEWRPC.

GRAPHIC SCALE

0 1 2 3 4 5 6 MILES

0 8000 16000 24000 32000 FEET

drainage area tributary to Lake Michigan. These point sources of wastewater discharge primarily industrial cooling, process, rinse, and wash water directly, or following treatment, to surface waters or groundwater system of the watershed of minor streams and direct drainage area tributary to Lake Michigan, or directly to Lake Michigan. 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 was one enclave of unsewered urban development located outside of the then proposed year 2000 sewer service area, as shown on Map IX-3. As of 1990, this area has been added to the planned 2010 sewer service area as part of the plan amendment process. No new enclaves of urban development have been created beyond these planned sewer service areas.

Miscellaneous Potential Pollution Sources

Landfills: Landfills in the watershed of minor streams and direct drainage area tributary to Lake Michigan, 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, and, in the case of many of the abandoned landfills, the types and extent of these substances are sometimes unknown. In some instances, toxic and hazardous substances have begun to leach into surrounding soils and aquifers, and can be subsequently transported to surface waters.

There is currently one active landfill and 46 known abandoned landfills located in the watershed of minor streams and direct drainage area tributary to Lake Michigan. None of these landfills are known to be negatively impacting surrounding surface waters.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the watershed of minor streams and direct drainage area tributary to Lake Michigan have the potential to affect water quality through the release of substances into the surrounding soils 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 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 231 known leaking underground storage tanks in the watershed of minor streams and direct drainage area tributary to Lake Michigan. 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 (WPDES) 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 watershed of minor streams and direct drainage area tributary to Lake Michigan.

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 watershed of minor streams and direct drainage area tributary to Lake Michigan, the initial 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 erosion control, streambank erosion control, and onsite sewage disposal system management. The plan recommended that additional nonpoint source controls be provided in certain areas. Within the Barnes Creek subwatershed, the plan recommends a reduction of about 50 percent in the urban areas. No nonpoint source control practices were recommended in the portion of Milwaukee County where the deep tunnel combined sewer overflow abatement plan has been implemented and where a relatively high level of nonpoint source control will be achieved by the conveyance of most of the stormwater to the Milwaukee Metropolitan Sewerage District sewerage system.

Implementation of the recommended nonpoint source control practices has been achieved on a limited basis in the watershed of minor streams and direct drainage area tributary to Lake Michigan through local and State regulation and programs. In the area of construction site erosion control, significant progress has been made. As of January 1993, the Cities of Kenosha, Oak Creek, Cudahy, Milwaukee, and Mequon, and the Village of Pleasant Prairie 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. The ordinance adopted by the City of Cudahy applies only to subdivisions, and the ordinance adopted by the City of Mequon includes stormwater management requirements. In addition, the City of Port Washington had adopted a construction site erosion control ordinance that predates the model ordinance which applies to commercial developments and subdivisions; and the Village of River Hills has an ordinance which was developed independently from the model. As of 1994, an ordinance is being drafted for the Town of Grafton.

While new development is largely being served by sanitary sewer, the existing unsewered development and some additional new unsewered development within the watershed is regulated by onsite sewage disposal system programs administered by Kenosha, Racine, and Ozaukee Counties. These programs provide for the system installation requirements as set forth in Chapter ILHR 83 of the Wisconsin Administrative Code, for ongoing maintenance of new systems, and for problem resolution of failing systems where they are identified.

Rural nonpoint source control implementation actions, 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, respectively, 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 Ozaukee Counties. Those plans identify priority areas for 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 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 program was established in 1978 by the Wisconsin Legislature and provides cost-sharing funds for the cost of an individual project or land management practice to local governments and private landowners upon completion of the detailed plans. The funds are provided through nonpoint source local assistance grants administered by the Wisconsin Department of Natural Resources. A portion of the watershed of minor streams and direct drainage area tributary to Lake Michigan is being proposed to be included within the study area for the Milwaukee River South priority watershed project. The area proposed to be added to the Milwaukee River South priority watershed project area includes about 14.4 square miles of the Lake Michigan direct drainage area extending from the northern limits of the Town of Grafton in Ozaukee County to the Milwaukee Harbor estuary. A description of the Milwaukee River South priority watershed project is included in Chapter VIII. Planning for the Milwaukee River South priority watershed pro-

ject[5] and was completed in 1991, and implementation of practices began in October 1991 and will continue for eight years.

Because of the situation of the watershed within the Lake Michigan coastal zone, and because of community concerns relating to the extensive erosion of shorelands due to storms, ice-cover and high water conditions existing with the Laurentian Great Lakes System, the Commission has prepared coastal erosion control plans for Milwaukee[6] and Racine[7] Counties. The plans identify priority actions required to control and reduce the erosion of shorelands as well as providing for longer term protection of the shorelands, and, additionally, recommend shoreland management practices intended to minimize coastal zone erosion and its consequences for economic activities within the watershed of minor streams and direct drainage area tributary to Lake Michigan.

While the 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.

Current Plan Recommendations: It is recommended that construction site erosion control, onsite sewerage system management, and streambank erosion control, in addition to land management, would provide at least a 25 percent reduction in loadings to the watershed of minor streams and direct drainage area tributary to Lake Michigan. Within the Barnes Creek subwatershed, it is recommended that additional practices providing for levels of control for about a 50 percent reduction in nonpoint source loadings be provided.

The types of practices recommended to be considered for these various levels 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, additional portions of the watershed of minor streams and direct drainage area tributary to Lake Michigan 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

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[5]Wisconsin Department of Natural Resources, Publication No. WR-245-91, A Nonpoint Source Control Plan for the Milwaukee River South Priority Watershed Project, December 1991.

[6] SEWRPC Community Assistance Planning Report No. 110, A Lake Michigan Coastal Erosion and Related Land Use Management Study for the City of St. Francis, Wisconsin, August 1984; SEWRPC Community Assistance Planning Report No. 155, A Lake Michigan Shoreline Erosion Control Plan for Northern Milwaukee County, Wisconsin, December 1988; SEWRPC Community Assistance Planning Report No. 163, A Lake Michigan Shoreline Erosion Control Plan for Milwaukee County, Wisconsin, October 1989.

[7] SEWRPC Community Assistance Planning Report No. 86, A Lake Michigan Coastal Erosion Management Study for Racine County, Wisconsin, October 1982.

watersheds for inclusion in that program is documented in a memorandum[8] prepared by the Regional Planning Commission using Wisconsin Department of Natural Resources procedures and is summarized in Chapter XVIII. That ranking included portions of the watershed of minor streams and direct drainage area tributary to Lake Michigan--the Pike Creek and Sucker Creek subwatersheds--in the high category, indicating that inclusion in the program will be possible within the near future, when the existing planning projects are completed or as additional funds and staff become available within the Department of Natural Resources. In addition, Barnes Creek subwatershed could be considered for a small scale priority watershed project.

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 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 known monitoring has been carried out on a sustained basis in the watershed of minor streams and direct drainage area tributary to Lake Michigan. Off-shore, long-term monitoring has been carried out in Lake Michigan in the vicinity of Milwaukee Harbor by the Milwaukee Metropolitan Sewerage District at fifteen stations in the Milwaukee Outer Harbor, twelve stations along the south shore in the vicinity of the South Shore Wastewater Treatment Plant, and at fourteen stations in the nearshore zone between Wind Point and Fox Point adjacent to Milwaukee County. Physical, chemical, and biological data are typically collected from these 41 stations at bi-weekly--Outer Harbor and South Shore stations--or monthly--nearshore stations--intervals. These data collected through 1984, as well as additional supplementary water quality data collected during runoff events, was used in the preparation of the Milwaukee Harbor estuary study. A description of water quality conditions based upon that data and upon water quality modeling is documented in that study report.[9]

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 Metropolitan Milwaukee Sewerage District at their offshore stations on a continuing long-term basis. That data provide an adequate basis for water quality assessments. In addition, it is recommended that an intensive water quality and biological condition monitoring program be conducted over a one-year period at four stations, with one station each being located on Barnes Creek, Fish Creek, Pike Creek and Sucker Creek. It is recommended that this program be conducted within the next five to seven years and repeated at 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

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

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

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 or 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 watershed of minor streams and direct drainage area tributary to Lake Michigan. 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.

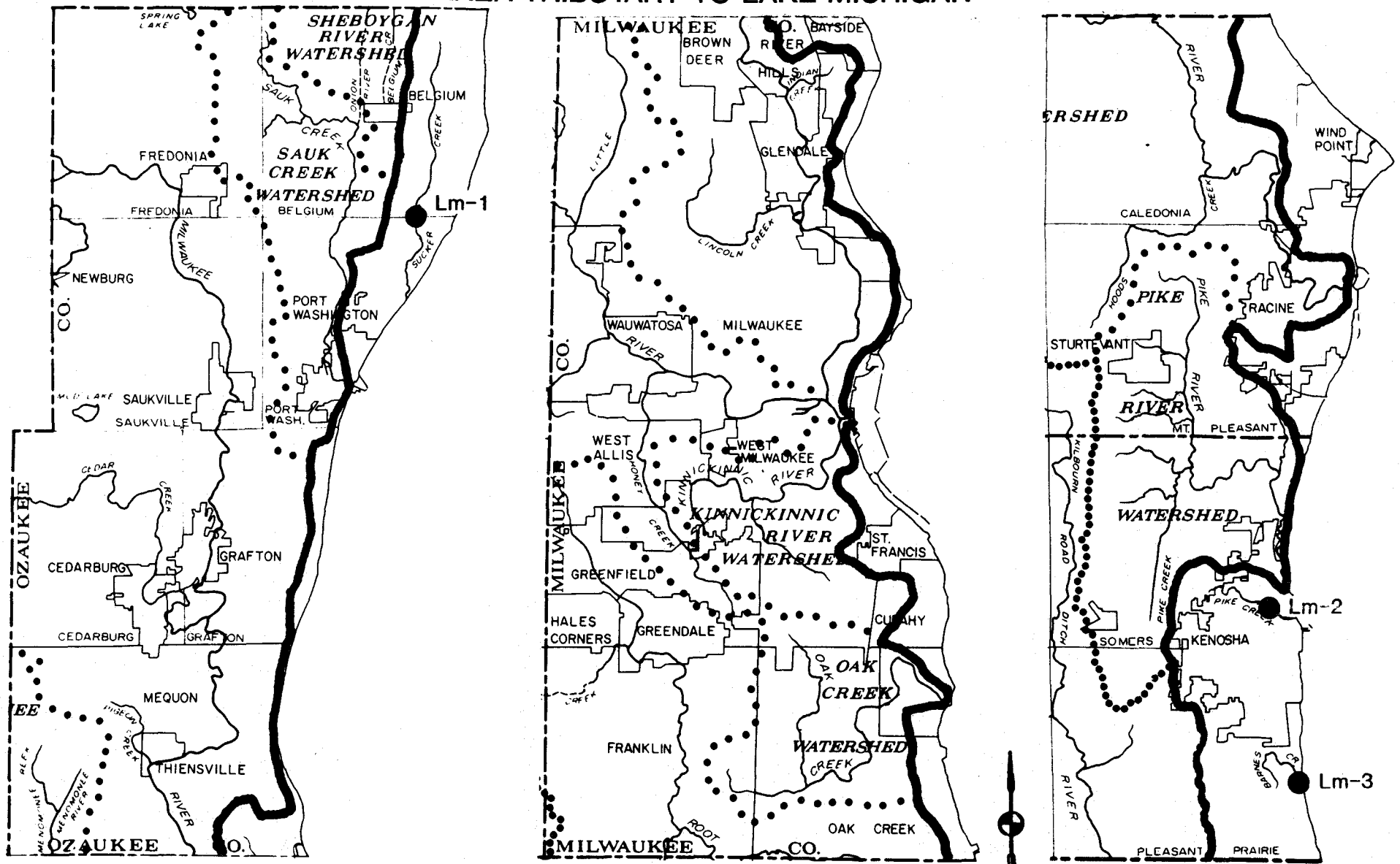
WATER QUALITY AND BIOLOGICAL CONDITIONS

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 watershed of minor streams and direct drainage area tributary to Lake Michigan included samplings at three Commission stations shown on Map IX-6: one each on Sucker Creek, Pike Creek, and Barnes Creek.

No known post-1976 comparable water quality data were available for the streams in the Lake Michigan direct drainage watershed. Limited biological condition data collected by the Wisconsin Department of Natural Resources were available for use in the assessment of current water quality conditions. In addition, 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 potential for currently achieving the established water use objectives in the watershed of minor streams and direct drainage area tributary to Lake Michigan.

Map IX-6
LOCATION OF WATER QUALITY SAMPLING STATIONS IN THE WATERSHED OF MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN



LEGEND

Sampling stations used in preparation of initial plan

● SEWRPC

Source: SEWRPC.

GRAPHIC SCALE

0 1 2 3 4 5 6 MILES

0 5 10 15 20 25 30 35 40,000 FEET

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

Since completion of the initial plan, few analyses of the chemical composition of the sediments of the streams directly tributary to Lake Michigan have been conducted. Most studies of sediment chemistry that have been carried out have been related to the Milwaukee Harbor Estuary and are reported in Chapters VI, VII, and VIII on the Kinnickinnic, Menomonee, and Milwaukee River watersheds, respectively, and in the Milwaukee Harbor Estuary Study.[10] Sediment quality data for the offshore portions of Milwaukee Harbor are reported by Palmer[11] and Ni, Gin and Christensen.[12] In the latter study, polychlorinated biphenyl (PCB) concentrations exceeded the Lowest Effect Level (LEL) proposed by the Wisconsin Department of Natural Resources[13] as screening criteria for contaminated sediments at one of the 15 sampling sites in the Outer Harbor. Polycyclic Aromatic Hydrocarbon (PAH) LELs were exceeded at 14 of the 15 stations sampled during this study. Palmer reported similar results from her study; the PCB LEL was exceeded at both stations in the Outer Harbor and the total PAH LEL was exceeded at one of the two stations. Sediment quality data for the Port Washington Harbor are reported in SEWRPC Memorandum Report No. 16, Unpolluted Dredge Materials Disposal Plan for the Port Washington Harbor, City of Port Washington, Ozaukee County, Wisconsin, published in May 1987. Concentrations of arsenic, cadmium, chromium, copper, lead and mercury exceeded the LEL for those metals at two of the four stations sampled. Oil and grease concentrations exceeded the LEL guideline at one site. Additional data for the offshore portion of Kenosha Harbor were collected by the Wisconsin Department of Natural Resources during 1991. Concentrations of the metals--arsenic, cadmium, chromium, copper, lead, and mercury--exceeded the LEL guidelines in this estuary, as did the total PAH concentration.

Since the completion of the initial regional water quality management plan, nine spills of toxic substances into streams within the watershed of minor streams and direct drainage area tributary to Lake Michigan have been documented by the Wisconsin Department of Natural Resources. Of these spills, eight have occurred in Pike Creek and one in Sucker Creek.

Water Quality Assessments: Based upon available data, the water quality and biological characteristics of the watershed of minor streams and direct drainage area tributary to Lake Michigan were assessed, with the results set forth in Table IX-10. Where data were available, fish populations and diversity range

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[10]Ibid.

[11] Lauran Palmer, Evaluation of Polychlorinated Biphenyls and Polycyclic Aromatic Hydrocarbons in the Menomonee River, Canals, and Milwaukee Harbor, Final Report, University of Wisconsin-Stevens Point, August 1993.

[12] Fan Ni, Michael F. Gin & Erik R. Christensen, Toxic Organic Contaminants in the Sediments of the Milwaukee Harbor Estuary, Final Report, Milwaukee Metropolitan Sewerage District, March 1992.

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

Table IX-10

CHARACTERISTICS OF STREAMS IN THE MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN

Stream Reach	Stream Length (miles)	Fish Population and Diversity[a]	Recorded Fish Kills	Water Quality Problems[b]					Biotic Index Rating	Streambed Sedimentation (substrate)	Physical Modifications to Channel[c]
				DO	NH_3	Total P	Fecal Coliform	Toxics			
Barnes Creek	3.0	Fair	No	Yes	No	Yes	Yes	--	--	Moderate (silt, clay, sand, gravel)	Major
Pike Creek	3.7	Poor	No	No	No	No	Yes	--	--	Moderate to high (silt)	Major
Sucker Creek	8.2	Fair	No	No	No	No	No	--	--	High (clay, silt, gravel, muck)	Major
Fish Creek	3.4	--	No	--	--	--	--	--	--	--	--
Unnamed Stream in T4N, R23E, Sections 21 and 22	0.9	--	No	--	--	--	--	--	--	--	--
Unnamed Stream in T4N, R23E, Sections 17 and 20	1.7	--	No	--	--	--	--	--	--	--	--

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

[b] Simulation modeling analyses data developed in the initial plan were used to evaluate current water quality for stream reaches in the watershed of the minor streams and direct drainage area tributary to Lake Michigan based upon year 2000 land use conditions and current level of pollutant control.

[c] Physical modifcations 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.

from poor to fair: Pike Creek has been rated as poor, and Barnes Creek and Sucker Creek have been rated as fair. Standards were not expected to be fully met for dissolved oxygen concentrations and phosphorus levels in Barnes Creek. In addition, fecal coliform levels were expected to be outside of acceptable limits in both Barnes and Pike Creeks. Ammonia nitrogen levels did not appear to pose problems in any of the three major streams in the watershed. No data were available on water column toxic pollutants.

No recent data on biotic index ratings, which are biological indicators of water quality within a stream system, were available for streams within the watershed. Moderate to high levels of streambed sedimentation were noted in all three Creeks, with the highest level of siltation being recorded in Sucker Creek.

Table IX-11 sets forth the water quality index classifications[14] used in the initial plan for three sampling stations in the watershed. The use of that index is discussed in Chapter II. The limited data indicate that water quality conditions remained "fair" from 1964 to 1974 and 1975, but no recent data were available to assess the water quality conditions in 1990 and 1991.

A summary of potential pollution sources in the watershed of minor streams and direct drainage area tributary to Lake Michigan by stream reach is shown in tabular summary in Table IX-12. Review of the data indicate the majority of the conversion of lands from rural to urban uses has occurred historically in the Greater Racine and Kenosha urban areas, and more recently in the Fish Creek subwatershed on the border of Milwaukee and Ozaukee Counties. It should also be noted that a majority of the documented spills of toxic substances and the majority of the permitted industrial discharges occur in Pike Creek in the City of Kenosha. Data on nonpoint source pollution are included in Table IX-12.

Compliance with Water Use Objectives

As indicated in Chapter II, the major stream reaches in the watershed of minor streams and direct drainage area tributary to Lake Michigan 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 sampling stations in the watershed, Barnes, Pike, and Sucker Creeks 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 water quality simulation data developed in the initial plan and the status of plan implementation, it is likely that violations of the dissolved oxygen, fecal coliform, and phosphorus standards continue to occur in Barnes and Pike Creeks and in the two unnamed streams in Racine County. However, the recommended water use objectives may potentially be met in Sucker Creek and in Fish Creek.

WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

There are three major water quality issues remaining to be resolved in the watershed of minor streams and direct drainage area tributary to Lake Michigan.

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[14] 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 IX-11

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATIONS OF THE WATERSHED OF THE MINOR STREAMS AND DIRECT DRAINAGE AREA TRIBUTARY TO LAKE MICHIGAN 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
Lm-1 (Sucker Cr)	Fair	Fair	--
Lm-2 (Pike Cr)	Fair	Fair	--
Lm-3 (Barnes Cr)	Fair	Fair	--
Watershed Average	Fair	Fair	--

[a] See Map IX-6 for sampling station locations.

Source: SEWRPC.

Table IX-12

SUMMARY OF POTENTIAL SURFACE WATER POLLUTION SOURCES IN THE MINOR STREAMS TRIBUTARY TO LAKE MICHIGAN: 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	
Barnes Creek	Insignificant[d]	Major[e]	--	X	--	--	--	1	--		1
Pike Creek	Insignificant[d]	Moderate	81-unknown 83-unknown 86-unknown 86-unknown 87-paint thinner 88-Cutting fluid 90-milk-white substance	X	--	--	--	4	--		1
Sucker Creek	Insignificant	Insignificant	84-diesel fuel	--	X	--	--	0	--		--
Fish Creek	Moderate	Significant	--	X	--	--	--	0	--		1
Unnamed stream in T4N R23E, Sections 21 & 22	Significant[d]	Moderate	--	X	--	--	--	1	--		--
Unnamed stream in T4N R23E, Sections 17 & 20	Significant	Moderate	--	X	X	--	--	1	--		--

[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] Letter codes refer to the following ongoing pollution abatement efforts:
1. Construction Erosion Control Ordinances in place

[d] Considerable urban development existing pre-1976.

[e] The amount of post-1990 urban development is anticipated to increase significantly in comparison to pre-1990 urban development.

Source: Wisconsin Department of Natural Resources and SEWRPC.

There are three major water quality issues remaining to be resolved in the watershed of minor streams and direct drainage area tributary to Lake Michigan. These issues relate to the implementation of subregional sewerage system plans; the need for more detailed study of the estuary; and the monitoring and planning related to biological invasives.

Subregional Sewerage System Plan Implementation

The first issue relates to implementation of the sewer service area and treatment plant recommendations set forth in subregional system plans[15] for the greater Racine and greater Kenosha areas. The recommendations of those plans include revisions to the planned sewer service areas in the greater Kenosha area and the greater Racine area and call for the City of Kenosha and City of Racine sewage treatment plants to serve additional areas. These recommendations are described in more detail in Chapters IV and XIII.

Lake Michigan Estuary Water Quality Planning

The estuary reaches of the Milwaukee, Menomonee, and Kinnickinnic Rivers have been specifically considered in the initial plan through the Milwaukee Harbor Estuary Study.[16] The estuary reaches of the Pike and Root Rivers and of Oak Creek, Pike Creek, and Sauk Creek have not been specifically addressed in the initial plan or in this update because of the complexity of the estuaries. It is envisioned that supplemental estuary studies will have to be undertaken to fully assess the water quality related problems of these estuaries and to intelligently assign appropriate water use objectives to all the estuaries. Recommendations in this regard have been developed in an earlier prospectus.[17]

Monitoring of Biological Invasives

The confirmed presence of the zebra mussel, Dreissena polymorpha, in the Laurentian Great Lakes, and specifically within that portion of Lake Michigan coastal zone falling within the Southeastern Wisconsin Region, has specific implications for the management of the coastal zone within this watershed and for the management of other water resources in the Region. These animals have been known to interfere with the beneficial uses of water resources throughout the Great Lakes by blocking inlet pipes and encrusting other structures, causing both nuisance and economic damage to these structures. It is recommended that their distribution within the coastal waters of the Region be monitored on a long-term continuous basis by the Wisconsin Department of Natural Resources (DNR), University of Wisconsin-Sea Grant, and other agencies--especially power generation and water supply utilities--as appropriate. In addition, it is recommended that these agencies also conduct regular reviews of appropriate control measures reported in technical publications and apply such measures when and where necessary. It is further recommended that the DNR and University of Wisconsin-Extension continue public awareness campaigns and that the DNR provide the necessary means for cleaning boats being transported from public boating access points in the

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[15]Alvord Burdick & Howson and Applied Technologies, Inc., A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Racine Area; and Ruekert & Mielke, Inc., A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Kenosha Area.

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

[17]SEWRPC Prospectus, Lake Michigan Estuary and Direct Drainage Area Subwatershed Planning Program, 1978.

coastal zone to access sites on inland lakes. The confirmed presence of zebra mussels in inland lakes suggests the potential for this animal to rapidly spread throughout the Region. It is expected that there may be a similar need over time to monitor the presence and impacts of other exotic species.

A potential future amendment to the regional plan for the watershed of minor streams and direct drainage areas to Lake Michigan 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.

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Chapter X

OAK 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 Oak Creek watershed through 1993, where available. Finally, this chapter presents a description of the substantive issues that remain to be addressed in the Oak 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 in the Oak Creek watershed as there are no major lakes located within the watershed. Designated management agency responsibilities for plan implementation are presented in Chapter XVII on a regional basis.

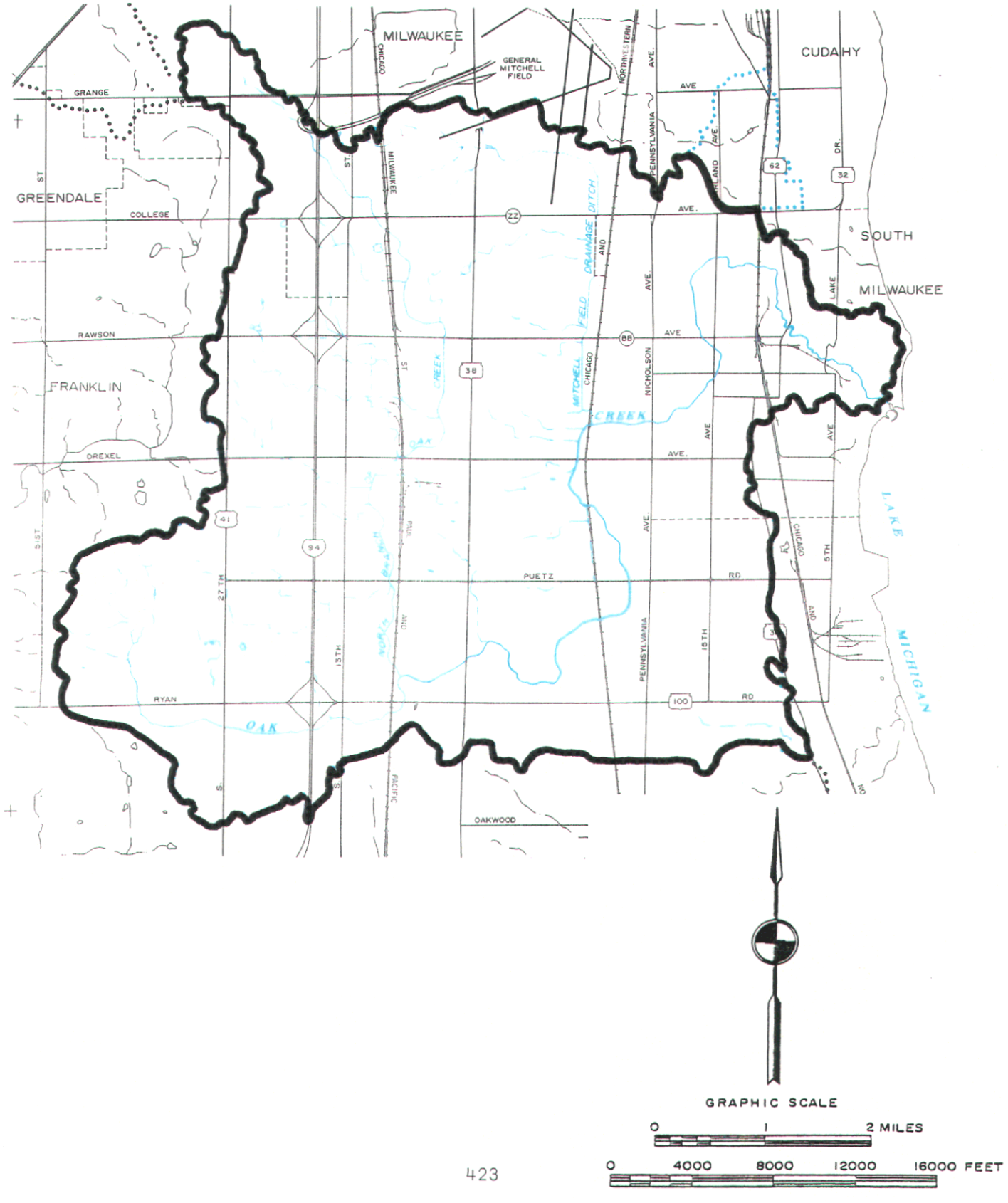
The Oak Creek watershed is located in the east central portion of the Region and covers an area of approximately 28 square miles. The main stem of Oak Creek rises in Milwaukee County and flows easterly and northerly within the County for approximately 13 miles before emptying into Lake Michigan on the eastern border of the watershed. 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 Oak Creek and its principal tributaries, are shown on Map X-1. The Oak 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 Oak 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 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

Map X-1

OAK CREEK WATERSHED



source pollutants in stormwater, such as metals and chlorides, can also be expected to increase with urbanization.

Table X-1 summarizes the existing land uses in the Oak 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. Although the watershed contains numerous urbanized areas, 49 percent of the watershed was still in rural land and other open space uses in 1990. These rural uses included about 27 percent of the total area of the watershed in agricultural and related rural uses, about 5 percent of the total area of the watershed in woodlands, about 3 percent in surface water and wetlands, and about 14 percent in open lands. The remaining 51 percent of the total watershed was devoted to urban uses. Existing land uses within the watershed are shown on Map X-2.

Major concentrations of urban development exist largely in the northern far western and far eastern portions of the Oak Creek Watershed. Urban development is located in the northern portion of the Oak Creek watershed, along IH 94 and STH 38, near the General Mitchell International Airport. Other urban-related land uses are located throughout the City of South Milwaukee, along STH 32, and in the City of Franklin portion of the watershed west IH 94. Two of the 22 major industrial centers of the Region are located in the northern portion of the watershed: the Oak Creek industrial center, which is located along Rawson Road, between IH 94 and STH 38; and the Cudahy-South Milwaukee industrial center located just north of the City of South Milwaukee.

As shown in Table X-1, from 1975 to 1990, urban land uses in the watershed increased from about 7,700 acres, or 12 square miles, to about 9,000 acres, or 14 square miles, or by about 17 percent. As shown in Table X-1, residential land represents the largest urban land use in the watershed. Residential use has significantly increased within the watershed, from about 3,300 acres, or five square miles, in 1975 to about 3,800 acres, or six square miles, in 1990, a 14 percent increase. Commercial and industrial lands increased from about 600 acres, or one square mile, to 900 acres, or 1.4 square miles, an increase of about 42 percent.

The 14 square miles of urban land use in the watershed as of 1990 approximated the staged 1990 planned level of about 14.2 square miles envisioned in the adopted 2000 land use plan. The current status of development in the Oak Creek watershed and in adjacent portions of Milwaukee County was considered in developing the new year 2010 land use plan element described in Chapter III for the Region as a whole.

Table X-2 summarizes the year 2010 planned land use conditions set forth in the adopted year 2010 land use plan in the Oak 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 and along the IH 94 and STH 38 corridors in the Cities of Oak Creek and Milwaukee; in and around the City of Franklin; and in the already urbanized Cities of Cudahy and South Milwaukee.

In order to meet the needs of the expected resident population and employment envisioned under both the intermediate growth-centralized and high growth-decentralized land use plan future conditions, the amount of land devoted to urban use within the Oak Creek watershed, as indicated in Table X-2, is projected to increase from the 1990 total of about 14 square miles, or about 51 percent of

Table X-1

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

Land Use Category	1975		1990		Change 1975-1990	
	Acres	Percent	Acres	Percent	Acres	Percent
Urban						
Residential	3,328	18.7	3,795	21.4	467	14.0
Commercial	190	1.1	279	1.6	89	46.8
Industrial	438	2.4	616	3.5	178	40.6
Transportation, Communication, and Utilities[b]	2,842	16.0	3,374	19.0	532	18.7
Governmental and Institutional	405	2.3	453	2.5	48	11.9
Recreational	509	2.9	519	2.9	10	2.0
Subtotal	7,712	43.4	9,036	50.9	1,324	17.2
Rural						
Agricultural and Related	6,400	36.1	4,754	26.8	- 1,646	- 25.7
Lakes, Rivers, Streams and Wetlands	517	2.9	564	3.2	47	9.1
Woodlands	852	4.8	842	4.7	- 10	- 1.2
Open Lands,[c] Landfills, Dumps, and Extractive	2,271	12.8	2,556	14.4	285	12.5
Subtotal	10,040	56.6	8,716	49.1	- 1,324	- 13.2
Total	17,752	100.00	17,752	100.0	0	--

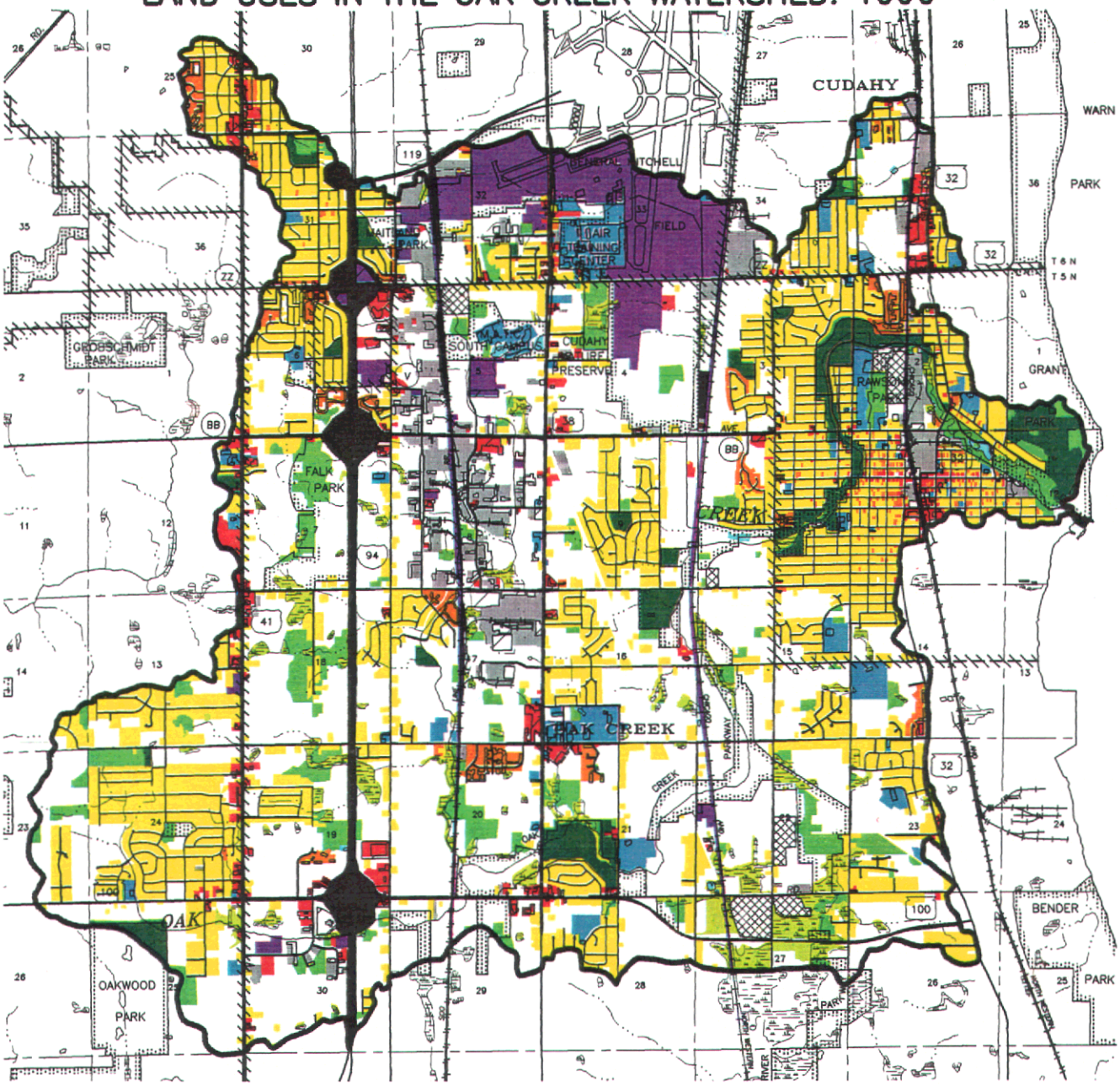
[a] As approximated by whole U.S. Public Land Survey one-quarter sections.

[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

MAP X-2
LAND USES IN THE OAK 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 1
GRAPHIC SCALE IN MILES

The Oak Creek watershed is about 28 square miles in areal extent, or about 1 percent of the total Region. In 1990, about 14 square miles, or 51 percent of the watershed, was in urban land uses.

Source: SEWRPC

Table X-2

EXISTING AND PLANNED LAND USE IN THE OAK 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	3,795	21.4	5,137	28.9	1,342	35.4	5,023	28.3	1,228	32.4
Commercial	279	1.6	297	1.7	18	6.5	338	1.9	59	21.1
Industrial	616	3.5	894	5.0	278	45.1	976	5.5	360	58.4
Transportation, Communication, and Utilities[b]	3,374	19.0	3,890	21.9	516	15.3	3,944	22.2	570	16.9
Governmental and Institutional	453	2.5	490	2.8	37	8.2	485	2.7	32	7.1
Recreational	519	2.9	625	3.5	106	20.4	626	3.5	107	20.6
Subtotal	9,036	50.90	11,333	63.8	2,297	25.4	11,392	64.1	2,356	26.1
Rural										
Agricultural and Related	4,754	26.8	3,817	21.5	- 937	-19.7	3,682	20.7	-1,072	-22.5
Lakes, Rivers, Streams, and Wetlands	564	3.2	525	3.0	- 39	6.9	525	3.0	- 39	- 6.9
Woodlands	842	4.7	815	4.6	- 27	- 3.2	812	4.6	- 30	- 3.6
Open Lands,[c] Landfills, dumps, and Extractive	2,556	14.4	1,262	7.1	-1,294	-50.6	1,341	7.6	-1,215	-47.5
Subtotal	8,716	49.1	6,419	36.2	-2,297	-26.3	6,360	35.9	-2,356	-27.0
Total	17,752	100.0	17,752	100.0	0	--	17,752	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.

the total area of the watershed, to about 18 square miles, or about 64 percent of the total area of the watershed, by year 2010. It is important to note that the 36 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 the primary environmental corridors are, in some cases, precluded from being developed by State and Federal regulation. 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 14 square miles in 1990 to about 10 square miles in the year 2010 under the intermediate growth-centralized and high growth-decentralized conditions, a decrease of about 10 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 Oak Creek watershed--including consideration of points of public sewage collection system overflows, intercommunity trunk sewers, and industrial wastewater treatment systems and discharges. This section also includes a status report on the public sanitary sewer service areas within the watershed.

With regard to the point source plan element related to the Oak Creek Watershed, the most significant recommendations in the initial plan and the most significant implementation actions are related to the Milwaukee Metropolitan Sewerage District's water pollution abatement program. This program includes: rehabilitation of the sanitary sewer system; construction of relief sewers; improvement and expansion of the Jones Island and South Shore sewage treatment plants; provision of large subterranean conveyance and storage-deep tunnel facilities to contain separate and combined sewer peak flows in excess of the capacity of the sewerage system; development of a solids management program; and provision of trunk sewers to serve the various communities comprising the District service area. As of 1993, the District's pollution abatement program was nearing completion, with the deep tunnel system expected to be online during 1994.

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 service 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 plant in the Milwaukee metropolitan area--the City of South Milwaukee plant. The resultant sewerage facilities plan update is intended, then, upon its adoption by all of the agencies concerned, to constitute

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

an amendment to the regional water quality management plan update herein presented. Such an amendment could impact on the facilities within the Oak Creek watershed.

Public and Private Wastewater Treatment Systems and Sewer Services Areas Existing Conditions and Status of Plan Implementation: In 1975, there were no public or private sewage treatment facilities located in the Oak Creek watershed. The sewage treatment plants serving the watershed, including the Milwaukee Metropolitan Sewerage District South Shore plant and the City of South Milwaukee plant, are located in the Lake Michigan direct drainage area and are discussed in Chapter IX. As of 1990, no new sewage treatment plants had been constructed.

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 Oak Creek watershed: South Milwaukee and the Milwaukee Metropolitan Sewerage District. As of 1993, the City of Franklin portion of Milwaukee Metropolitan Sewerage District service area had been refined and the refinement of the City of Oak Creek portion of the service area was underway.[2] The boundaries of the sewer service areas through 1993 are shown on Map X-3. Table X-3 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 service area names and the relationship of the service areas to the service area names following the refinement process. The planned sewer service area in the Oak Creek watershed, as refined through 1993, totals about 2.4 square miles, or about 9 percent of the total watershed area, as shown in Table X-3.

Current Plan Recommendations: No public or private sewage treatment facilities are envisioned for this watershed. The current planned sanitary sewer service areas in the Oak Creek watershed are shown on Map X-3. 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 following sewer service areas are located in the Oak Creek watershed: Franklin, Oak Creek, South Milwaukee, and the Milwaukee Metropolitan Sewerage District. Together, the planned service areas within the watershed total about 28 square miles, or the entire area of the Oak Creek watershed.

As noted above, two of the sewer service areas in the watershed have been refined as part of the on-going regional water quality management plan updating process. Additional refinements are envisioned to be needed for South Milwaukee and the remaining portion of the Milwaukee Metropolitan Sewerage District sewer service areas. These refinements are recommended to be conducted in 1995 and 1996. It is also 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 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.

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[2]As of September 1994, the sewer service area for the City of Oak Creek was identified and 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.

Table X-3

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

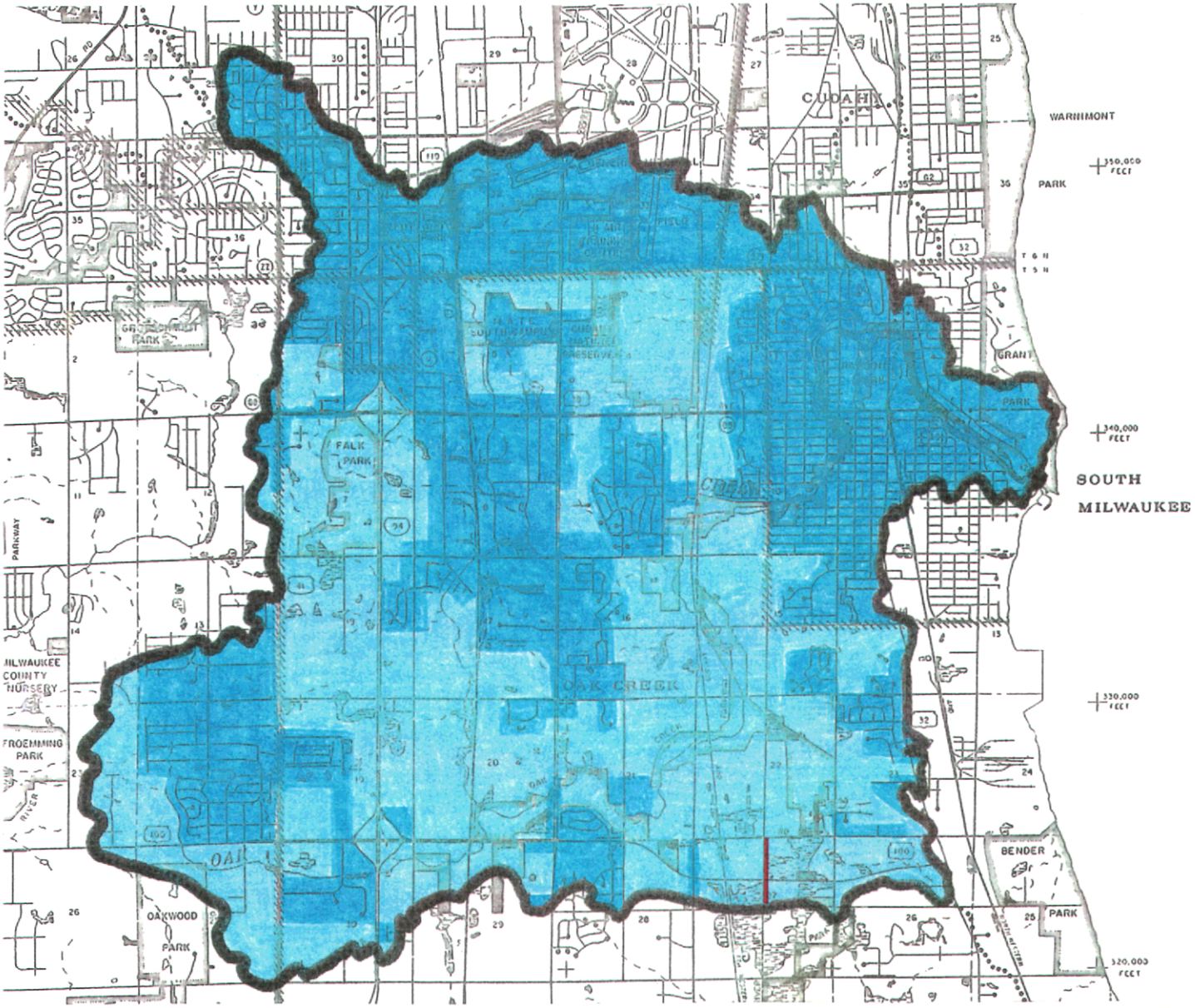
Name of Initially Defined Sanitary Sewer Service Area(s)	Planned Sewer Service Area (square miles)	Name of Refined and Detailed Sanitary Sewer Service Area(s)	Date of SEWRPC Adoption of Plan Amendment	Plan Amendment Document
Refined Sanitary Sewer Service Areas				
Milwaukee Metropolitan Sewerage District (portion)	2.4	Franklin	December 5, 1990	SEWRPC CAPR No. 176, Sanitary Sewer Service Area for the City of Franklin, Milwaukee County, Wisconsin
Unrefined Sanitary Sewer Service Areas				
Milwaukee Metropolitan Sewerage District[a] (portion)	21.9	--	--	--
South Milwaukee	3.4	--	--	--
Subtotal	25.3			
Total	27.7			

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 service area was refined as set forth in SEWRPC Community Assistance Planning Report No. 213, Sanitary Sewer Service Area for the City of Oak Creek, Milwaukee County, Wisconsin. This refined Oak Creek sewer service area encompasses 17.3 miles within the Oak Creek watershed.

Source: SEWRPC.

Map X-3
SANITARY SEWER SERVICE AREAS IN THE OAK CREEK WATERSHED: 1990 AND 2010



LEGEND

- SANITARY SEWER SERVICE AREA (EXISTING)
- SANITARY SEWER SERVICE AREA (PLANNED)
- PROPOSED TRUNK SEWER

Source: SEWRPC.

GRAPHIC SCALE

0 1 2 MILES

0 4000 8000 12000 16000 FEET

Table X-3a

KNOWN SEWAGE FLOW RELIEF DEVICES IN THE OAK CREEK WATERSHED: 1988-93

Sewerage Systems	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 South Milwaukee	--	--	2	--	--	2	Used only in case of major equipment failure
Total	--	--	2	--	--	2	

Source: SEWRPC.

Sewer Flow Relief Devices

Existing Conditions and Status of Plan Implementation: In 1975, there were two known separate sewer system flow relief devices located in the Oak Creek watershed, both of which discharged directly to the main stem of the Oak Creek in the City of South Milwaukee. In 1993 these two devices remained, as shown in Table X-3a. However, as a result of a sanitary sewer system rehabilitation program completed by the City of South Milwaukee in 1984, these two pumping station bypasses are now used only in the event of a major equipment failure, as recommended in the adopted regional water quality management plan.

Current Plan Recommendations: It is recommended that the City of South Milwaukee continue to monitor the 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. 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 untreated sewage, with the only bypasses remaining designed to protect the public and treatment facilities from unforeseen equipment or power failure.

Intercommunity Trunk Sewers

Existing Conditions and Status of Plan Implementation: The initial regional water quality management plan, as updated, recommended the construction of two intercommunity trunk sewers in the Oak Creek watershed, as shown in Table X-4. One trunk sewer would provide additional conveyance capacity for areas west and south of the Mitchell Field Airport to the Milwaukee Metropolitan sewerage system and one trunk sewer would connect development in the City of Oak Creek to the Milwaukee Metropolitan sewerage system. These trunk sewers have both been constructed.

Current Plan Recommendations: The current regional water quality management plan included recommendations for those trunk sewers necessary to extend centralized sanitary sewer service to the Oak Creek watershed. As noted above, both trunk sewers recommended in the initial plan have been constructed. However, one other trunk sewer was considered in the initial plan but was estimated not to be needed until after the planning period, based upon the development expected. This trunk sewer--the Oak Creek Southeast trunk sewer--would generally extend from the existing trunk sewer at Ryan Road and Pennsylvania Avenue south to Elm Road and then west to Nicholson Road. The Caddy Vista Sanitary District connection, as well as major areas in the southern portion of the City Oak Creek, are tributary to existing sewers for which the proposed Oak Creek Southeast trunk sewer will provide relief capacity. Surveillance of the current flows in the existing system, as well as projected needs for development currently approved by the City of Oak Creek, indicates that the existing sewer capacity will be reached. The City of Oak Creek therefore established, in 1994, a moratorium on new land development activities which have not been previously approved. Thus, the Oak Creek Southeast trunk sewer is now included in the updated plan based upon demonstrated needs.

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 eight known point sources of pollution identified in the Oak Creek watershed other than public and private sewage treatment plants. These sources discharged industrial cooling, process, rinse, wash, and filter backwash waters through 13 outfalls directly or indirectly to the surface water or groundwater

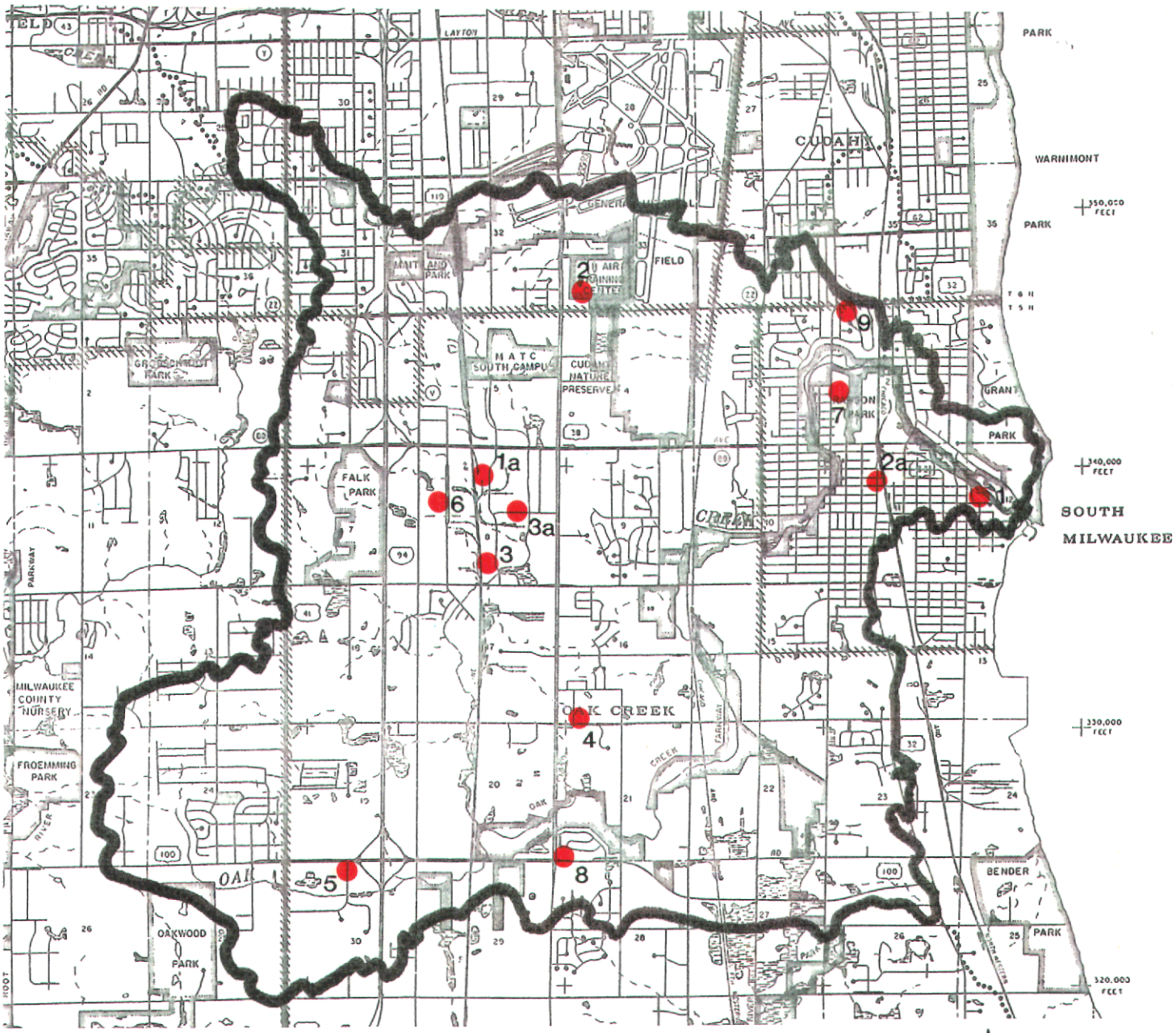
Table X-4

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

Intercommunity Trunk Sewer	Status of Implementation
Oak Creek	Completed (1985)
Mitchell Field-South	Completed (1986)

Source: SEWRPC.

Map X-4
POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES IN THE OAK CREEK WATERSHED: 1990



LEGEND

- POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES

Source: SEWRPC.

GRAPHIC SCALE

0 1 2 MILES

0 4000 8000 12000 16000 FEET

Table X-5

CHARACTERISTICS OF OTHER KNOWN POINT SOURCES OF WATER POLLUTION IN THE OAK CREEK WATERSHED: 1990

Facility Name	County	Map ID No.[a]	Permit Type	Permit No.	Expiration Date	Standard Industrial Classification Code	Industrial Activity	Receiving Water	Treatment System[b]
Oak Creek Watershed									
Appleton Electric Co. - Foundry Div.	Milwaukee	1	General	0044938-3	9-30-95	3369	Non-ferrous foundries	Oak Creek	--
General Mitchell IAP (440th AF Resv.)	Milwaukee	2	General	SPEC PERM	9-30-95	4581	Airports, flying fields, services	Mitchell Field Drainage Ditch	--
Henkel Corporation	Milwaukee	3	General	0044938-3	9-30-95	2843	Surface active agents	North Branch Oak Creek	--
Oak Creek Senior H.S. (Pool)	Milwaukee	4	General	0046523-2	9-30-95	8211	Secondary school	Oak Creek via unnamed trib.	--
Oak Creek Services-Milw. Truck Stop	Milwaukee	5	General	0046531-1	9-30-90	5541	Gasoline service station	Oak Creek	--
Phillip Orth Company	Milwaukee	6	General	0044938-3	9-30-95	--	--	North Branch Oak Creek	--
South Milwaukee-Senior H.S. Pool	Milwaukee	7	General	0046523-2	9-30-95	8211	Secondary school	Oak Creek via storm sewer	--
Vilter Manufacturing, Inc.	Milwaukee	8	General	0044938-3	9-30-95	3443/3585	Fabr. plate work; Ref. & hyg. equip.	Oak Creek	--
YMCA of Milwaukee-South Shore Branch	Milwaukee	9	General	0046523-2	9-30-95	7991	Physical fitness facility	Oak Creek via storm sewer	--
Applied Plastics Company, Inc.	Milwaukee	1A	Specific	0041700	3-31-90	3081	Unsupported plastics, film & sheet	North Branch Oak Creek via storm sewer	None
Bucyrus Erie Company	Milwaukee	2A	Specific	0001058	12-31-89	3599	Industrial machinery	Oak Creek via storm sewer	1
Thiem Corp. National Starch & Chem.	Milwaukee	3A	Specific	0047643	--	2891	Adhesives and sealants	North Branch Oak Creek via storm sewer	None

[a] See Map X-4, Point Sources of Pollution in the Oak Creek Watershed: 1990.

[b] The number code refers to the following treatment system:

1. Gravity sedimentation

Source: Wisconsin Department of Natural Resources and SEWRPC.

system. Of these point source outfalls, six were identified as discharging only cooling water. The remaining seven were identified as discharging other types of wastewater. Four of these outfalls discharged directly to the Oak Creek, seven discharged indirectly to the Oak Creek, and two discharged indirectly to the North Branch of Oak Creek. The initial regional water quality management 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 12 such known point sources of wastewater discharging to the Oak Creek and its major tributaries directly through industrial waste outfalls or indirectly through drainage ditches and storm sewers. Table X-5 summarizes selected characteristics of these other point sources and Map X-4 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 eight known point sources of wastewater other than public and private sewage treatment plants discharging to surface or ground waters in the Oak Creek watershed. These point sources of wastewater discharge, primarily industrial cooling, process, rinse, and wash water, directly or following treatment to the groundwater or the surface waters of the Oak 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

Because the entire Oak Creek watershed is included in the planned public sanitary sewer service area, there were no enclaves of unsewered urban development located outside of the then recommended year 2000, or currently recommended year 2010, sewer service area.

Miscellaneous Potential Pollution Sources

Landfills: Landfills in the Oak 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, and, in the case of many of the abandoned landfills, the types and extent of these substances are sometimes unknown. In some instances, toxic and hazardous substances have begun to leach into surrounding soils and aquifers, and can potentially be transported to surface waters.

There are currently three active landfills and 23 known abandoned landfills located in the Oak Creek watershed. None of these landfills are known to be negatively impacting surrounding surface or groundwater.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the Oak Creek watershed have the potential to affect water quality through the release of substances into the surrounding soils 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 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 60 known leaking underground storage tank sites in the Oak Creek watershed. None of these involved the discharging of remediation wastewaters 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 permitted sites discharging to surface or ground waters in the Oak Creek 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 Oak Creek watershed, the initial 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, onsite sewage disposal system management, and streambank erosion control. In addition, the plan recommended that additional nonpoint source controls be provided which would reduce nonpoint sources of pollution by about 50 percent in the urban areas.

In 1986, the Commission prepared a comprehensive watershed plan[3] for the Oak Creek watershed 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 continue to be directed toward reducing nonpoint source pollutant loadings, as well as providing for local drainage needs in the watershed.

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

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[3]See SEWRPC Planning Report No. 36, A Comprehensive Plan for the Oak Creek Watershed, August 1986.

specific lands. Working with the individual county land conservation committees, the 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 currently provides funds for individual projects or land management practices to local governments and private landowners upon completion of the detailed plans. The funds are provided through local assistance grants administered by the Wisconsin Department of Natural Resources.

Implementation of the recommended nonpoint source control practices has been achieved on a limited basis in the Oak Creek 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, Oak Creek, and Cudahy 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. The ordinance adopted by the City of Cudahy is applicable only to subdivisions.

Rural nonpoint source control implementation actions, 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, respectively, 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. Milwaukee County was not identified as one of these priority counties, and soil erosion control plans have not been prepared for any areas of the Oak Creek watershed. Nevertheless, 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 the pollutant loadings from nonpoint sources, this element of the plan remains largely unimplemented.

Current Plan Recommendations

It is recommended that construction site erosion control, onsite sewerage system management, and streambank erosion control, plus land management practices, designed to provide about a 50 percent reduction in nonpoint source pollutant loadings in the urban areas and 25 percent reduction in nonpoint source pollutant

loadings in the rural areas be carried out throughout the watershed. The type of practices 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 programs available for nonpoint source pollution control measures. The current priority ranking of watersheds for inclusion in that program is documented in a memorandum report[4] prepared by the Regional Planning Commission using Wisconsin Department of Natural Resources procedures and is summarized in Chapter XVIII. That ranking included the Oak Creek watershed in the high category, indicating that inclusion in the program will be possible within a reasonable time from when the existing planning projects are completed, or additional funds and staff become available within the Department of Natural Resources.

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.

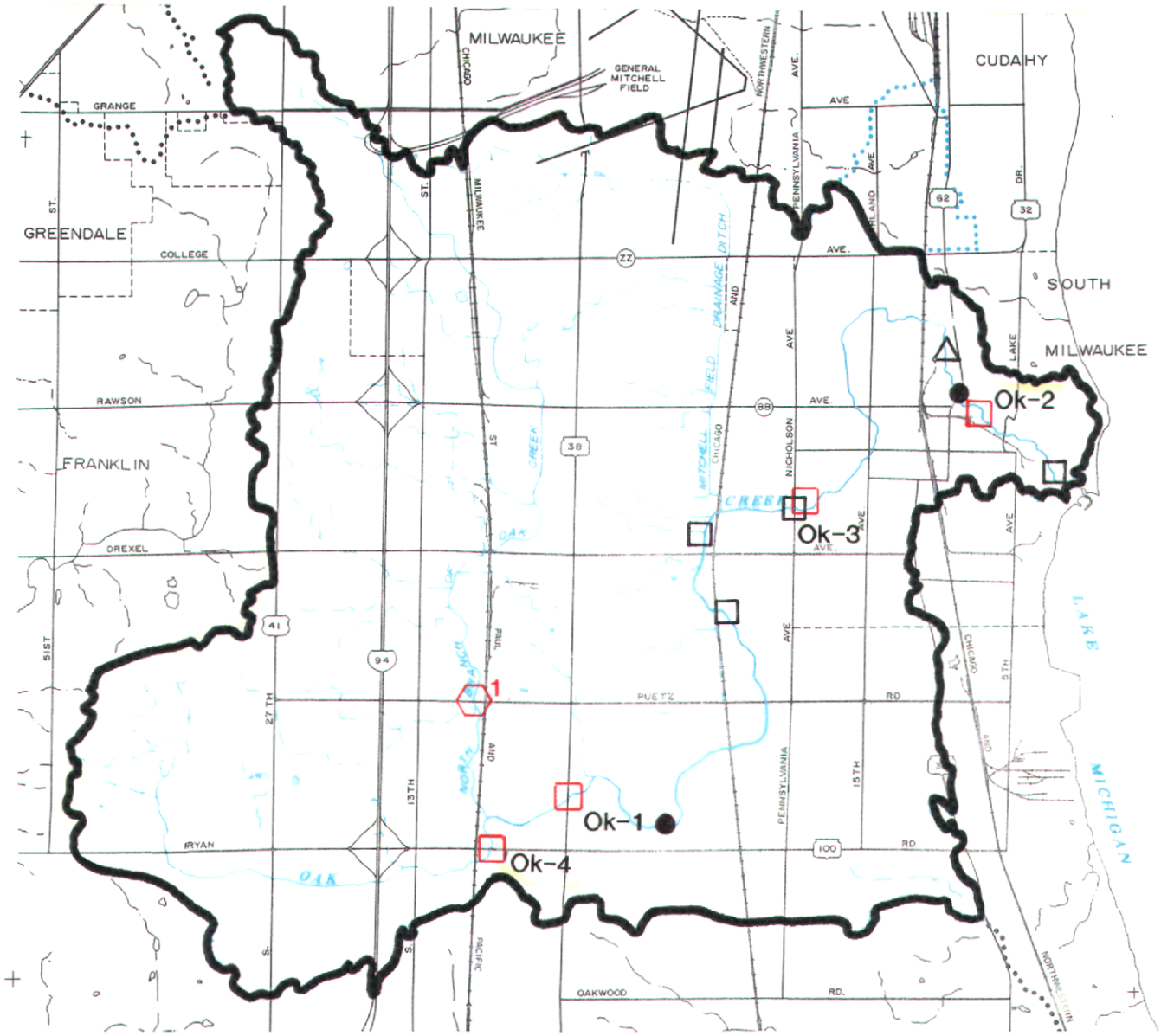
As of 1993, long-term monitoring has been carried out in the Oak Creek watershed on a sustained basis by the Milwaukee Metropolitan Sewerage District (MMSD) at seven stations located on the Oak Creek main stem. Data from four of these stations were used to document current long-term water quality conditions in the watershed, as shown on Map X-5. Short-term monitoring was also conducted at one site on the North Branch of Oak Creek in this watershed by the Wisconsin Department of Natural Resources during the period 1988 through 1993, as shown on Map X-5 and described later in this chapter.

Current Plan Recommendation

Increased water quality and biological condition 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 Milwaukee Metropolitan Sewerage District at the current stations on Oak Creek on a continuing basis. This program is considered adequate for the assessment of water quality conditions on the main stem of Oak Creek. In addition, it is recommended that an intensive water quality and biological condition monitoring program be conducted over a one-year period at two selected additional stations located on the major tributaries of Oak Creek, with one station each being located on the North Branch of Oak Creek and the Mitchell Field Drainage Ditch. During this one-year period, it is recommended that biological monitoring also be conducted at the sites for which water quality data

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

Map X-5
LOCATIONS OF WATER QUALITY SAMPLING STATIONS IN THE OAK CREEK WATERSHED



LEGEND

Sampling stations used in preparation of initial plan

- ● SEWRPC
- △ USGS
- □ MMSD

Post-1976 sampling stations used in preparation of plan update

- □ MMSD-Long Term
- ⬡ DNR-Short Term

Source: SEWRPC.

GRAPHIC SCALE

0 1 2 MILES

0 4000 8000 12000 16000 FEET

is currently being collected. 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.

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 measure such 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 Oak 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

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 (USGS) and Milwaukee Metropolitan Sewerage District (MMSD) sampling programs. Available data collected in those programs for the Oak Creek watershed included samplings at three Commission stations; at four MMSD stations; and at one USGS station, all on the main stem of the Oak Creek. The sampling station locations are shown on Map X-5.

Long-term post-1976 comparable water quality data have been collected by the Milwaukee Metropolitan Sewerage District at seven stations on the Oak Creek. The DNR has also collected water quality data on a short-term basis at one location in the Oak Creek watershed on the North Branch of Oak Creek at Puetz Road. Data from four of the MMSD stations and from the DNR station were used to characterize water quality conditions in the watershed. These sites are shown on Map X-5. The data obtained from the sampling stations were used in this chapter to assess current water quality conditions as discussed in the next section and, where appropriate, to make a generalized comparison to historic 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, 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 Oak Creek watershed.

Long-term water quality data collected by the Milwaukee Metropolitan Sewerage District at four sampling stations on the main stem of Oak Creek, at Ok-1 at STH 38, Ok-2 at the Oak Creek Parkway east of STH 32, Ok-3 at Nicholson Avenue, and Ok-4 on Ryan Road, are summarized in Figures X-1 through X-4. The short-term data collected by the DNR is summarized in Figure X-5 and in Table X-6. Both the long-term and short-term sampling data have been used to assess current water quality conditions and to evaluate conditions with respect to water quality standards. The water quality standards indicated in Figures X-1 through X-5 and in Table X-6 are those set forth for specific biological and recreational use objectives as described in Chapter II.

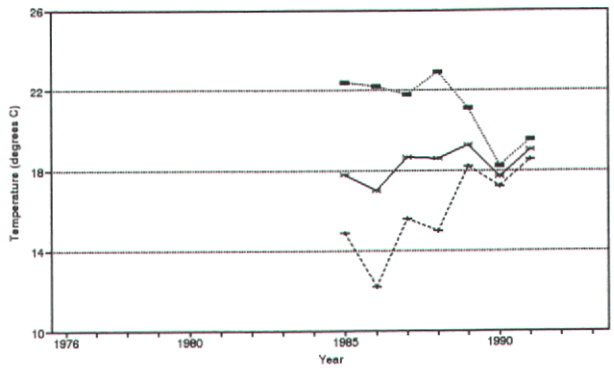
Review of those data for stations Ok-1 through Ok-4 indicate no apparent significant changes in water quality conditions from 1985 through 1993. The only possible trend which can be seen is that the variability of most parameters was reduced with the range of values indicated becoming less in more recent years. Data from all four stations indicate frequent violations of the standards established for total phosphorus, and fecal coliform, as set forth in Chapter II. Violations of the standard dissolved oxygen concentrations occurred at stations Ok-1, Ok-3, and Ok-4. Temperature and levels of pH remained variable, but within standards at all stations. The water quality data collected on a short-term basis on the North Branch of Oak Creek indicate violations of the fecal coliform standard at that location. Chronic toxicity standards for certain metals were also exceeded as discussed in the next section.

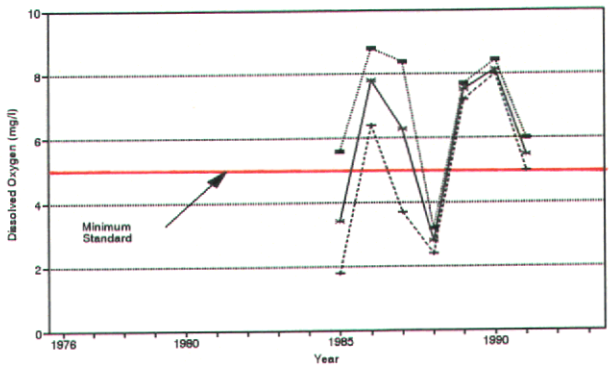
Toxic and Hazardous Substances: Sampling and analysis for pesticides, polychlorinated biphenyls (PCBs), and heavy metals were conducted by the Wisconsin Department of Natural Resources in the Oak Creek watershed from 1975 through 1976. The analyses indicated that recommended levels of mercury were exceeded in two of 48 samples, while recommended levels for PCBs were exceeded in one of ten samples. Sample analyses for cadmium, chromium, copper, lead, nickel, zinc, DDT, DDE, DDD, aldrin, heptachlor, lindane, dieldrin, heptachlor epoxide, methoxychlor, and phthalate uncovered no violations of U.S. Environmental Protection Agency (EPA) recommended levels.

Sampling and analysis of the bottom sediments conducted on Oak Creek for pesticides, polychlorinated biphenyls (PCBs), and heavy metals were conducted by the Wisconsin Department of Natural Resources in the Oak Creek watershed from 1975 through 1976. The analyses resulted in detectable concentrations of cadmium, chromium, copper, lead, mercury, nickel, zinc, and PCBs being recorded from the sediments.

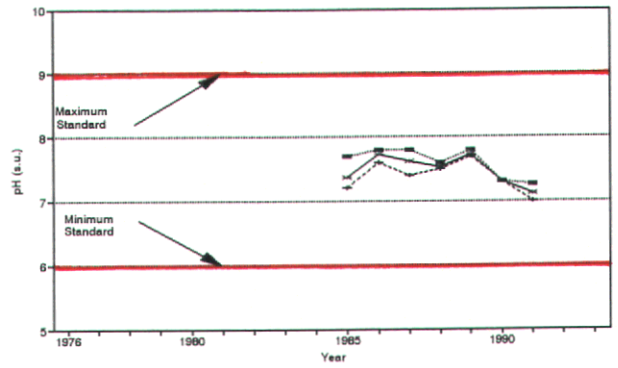
Recent data on toxic and hazardous substances in Oak Creek were collected by the Milwaukee Metropolitan Sewerage District, and are shown in Figures X-1 through X-4. These data indicate that lead and cadmium concentrations at all four stations exceeded the chronic toxicity standards established by the Wisconsin

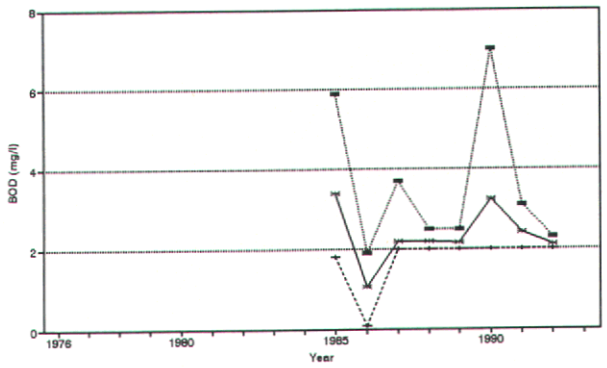
Figure X-1
WATER QUALITY DATA FOR THE OAK CREEK AT STATION Ok-4: 1976-1993

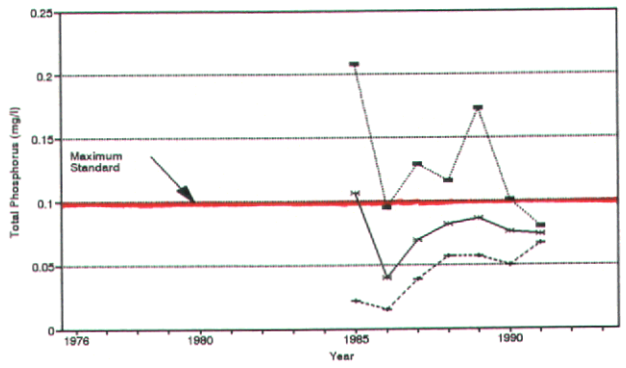


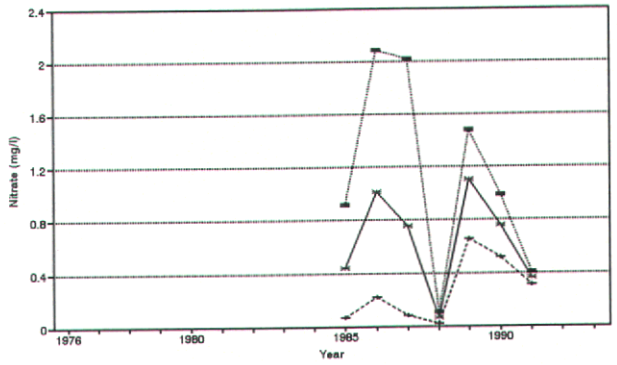


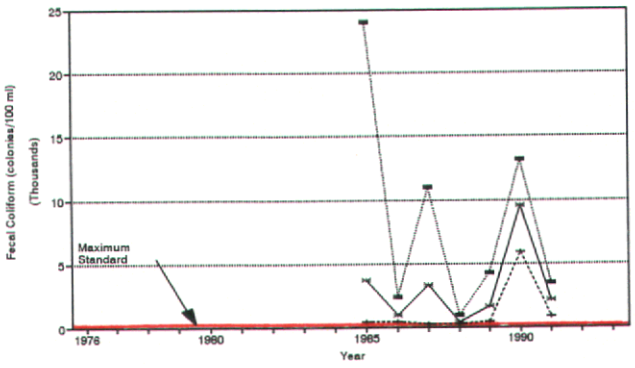
Note: The maximum standard of 31.7 degrees C was not violated in any year.

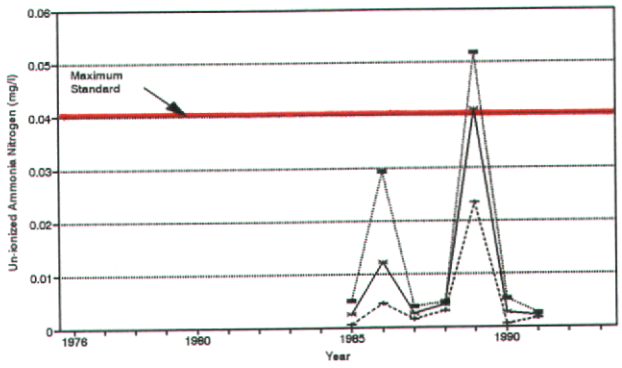






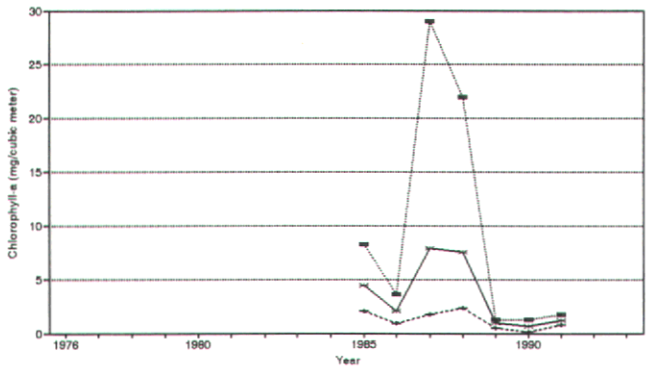


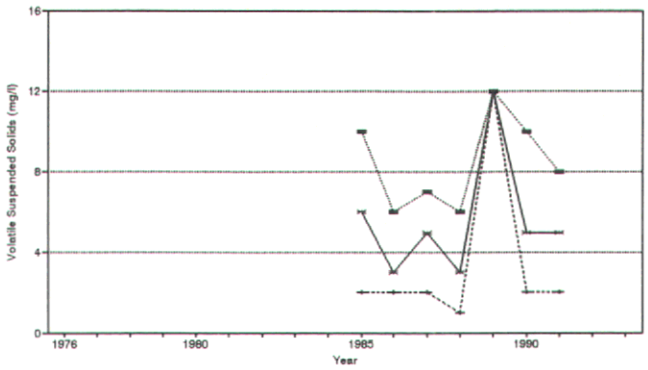


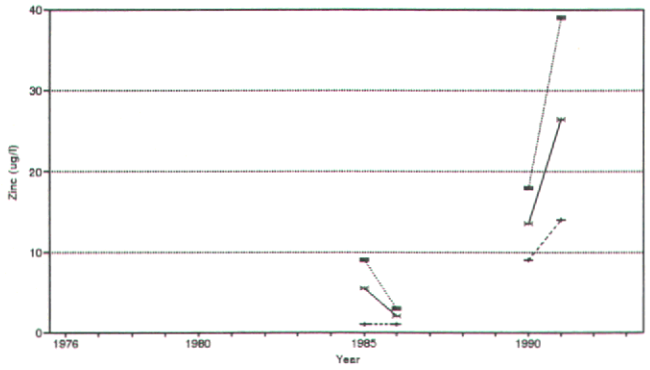


Note: The maximum standard of 200/400 colonies per 100 ml was violated in all years.

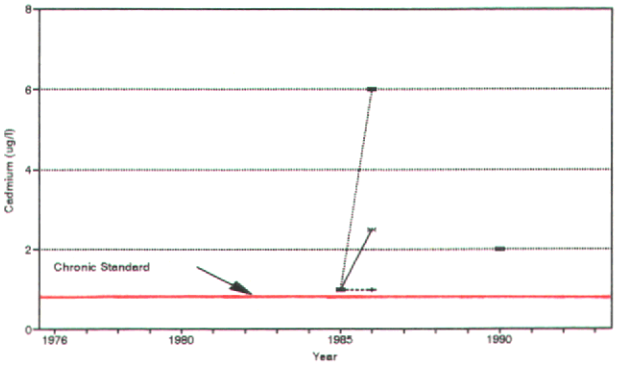
Figure X-1 (cont'd)



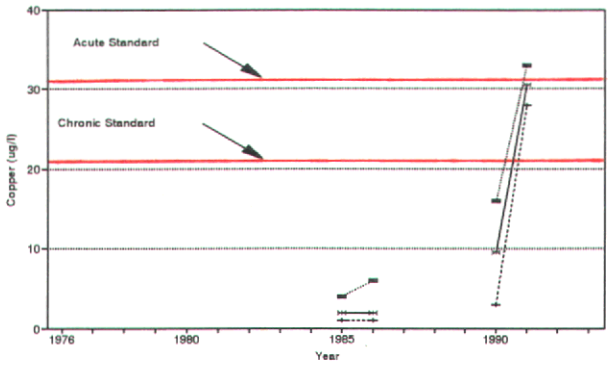


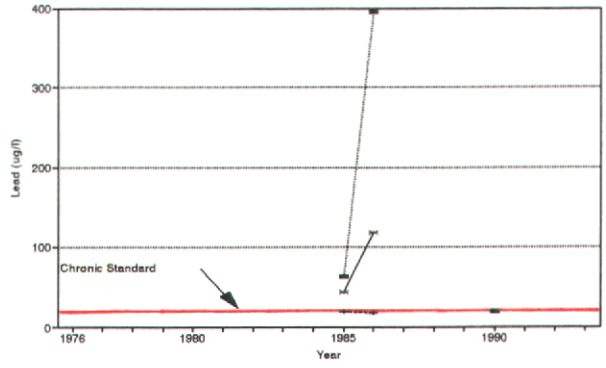


Note: The acute standard of 202.9 ug/l was not violated in any year.
The chronic standard of 89.2 ug/l was not violated in any year.

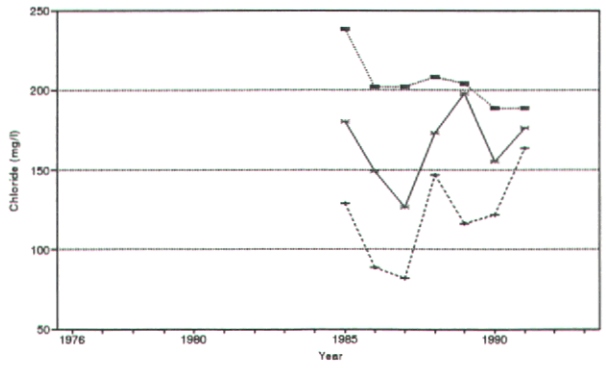


Note: The acute standard of 63.3 ug/l was not violated in any year.





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



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

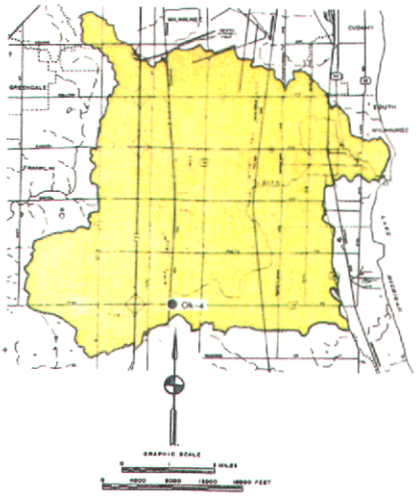
LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

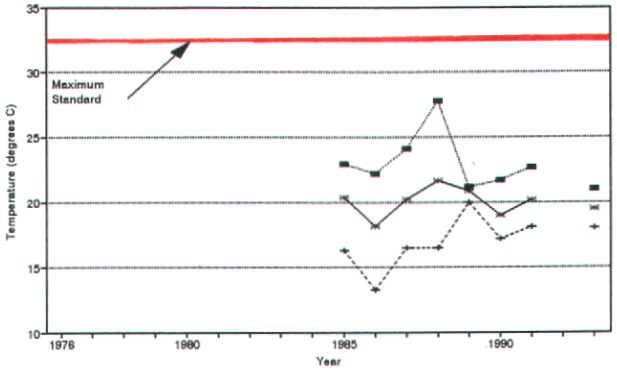
OAK CREEK WATERSHED

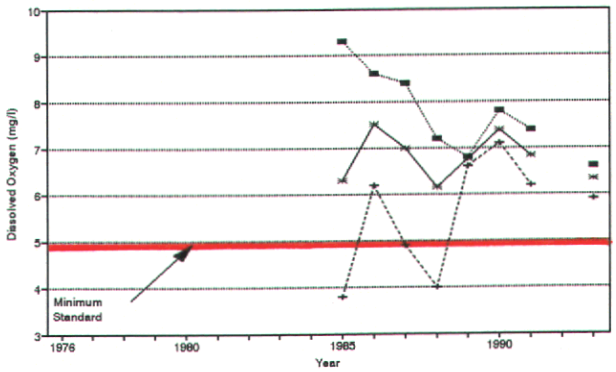


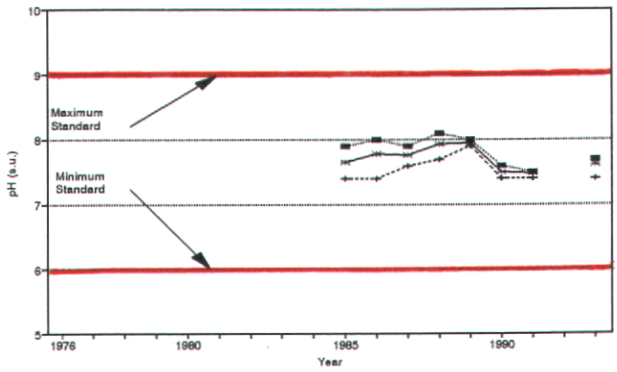
Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources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

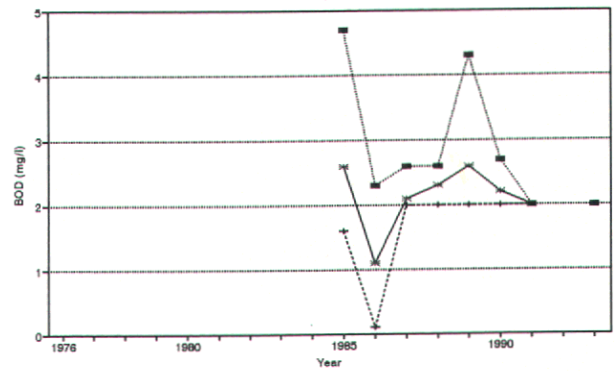
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

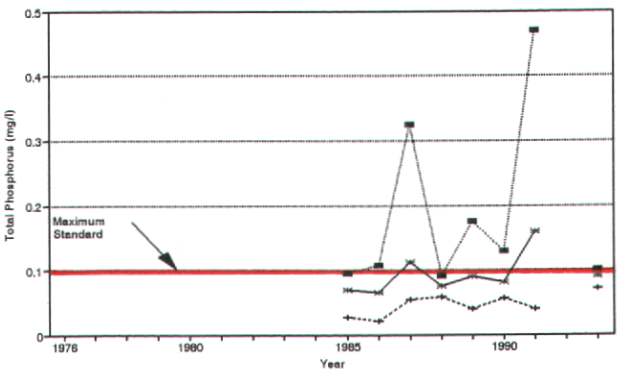
Figure X-2
WATER QUALITY DATA FOR THE OAK CREEK AT STATION Ok-1: 1976-1993

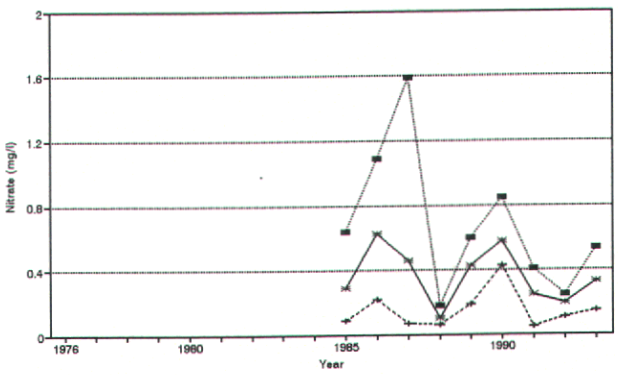


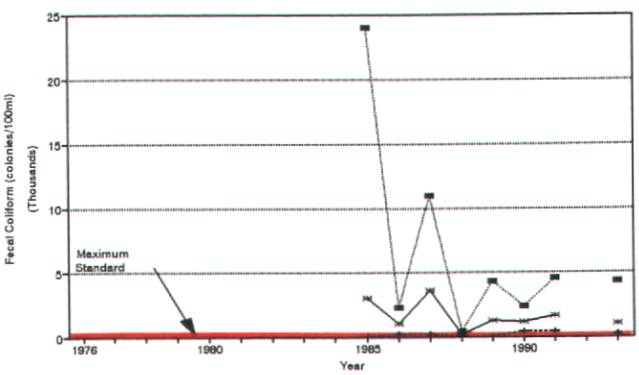


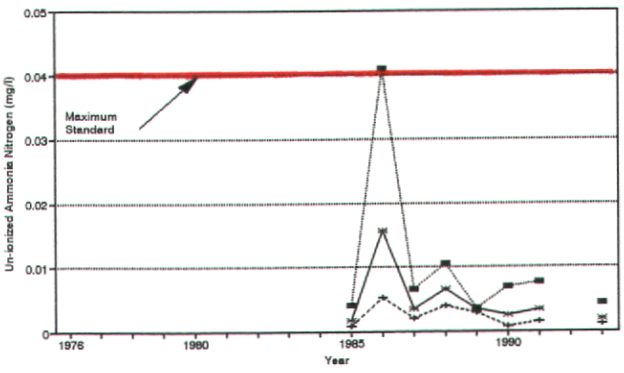






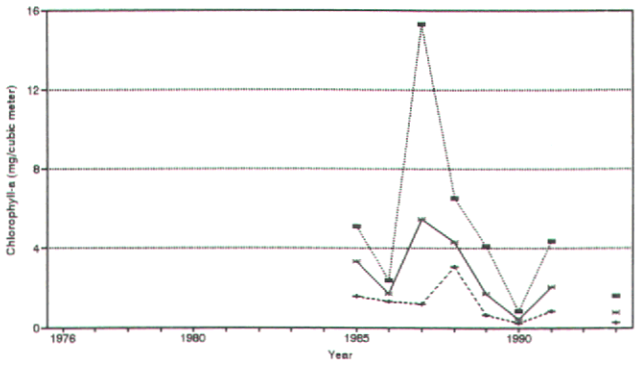


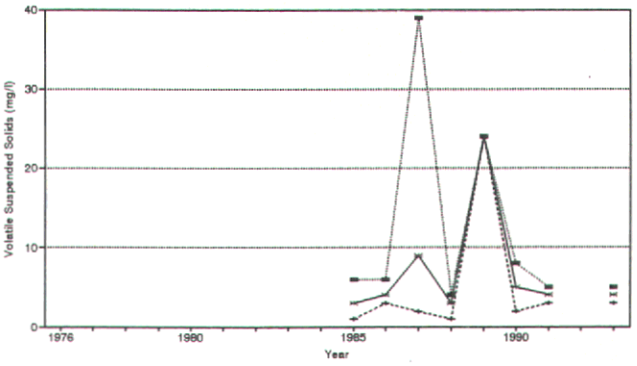


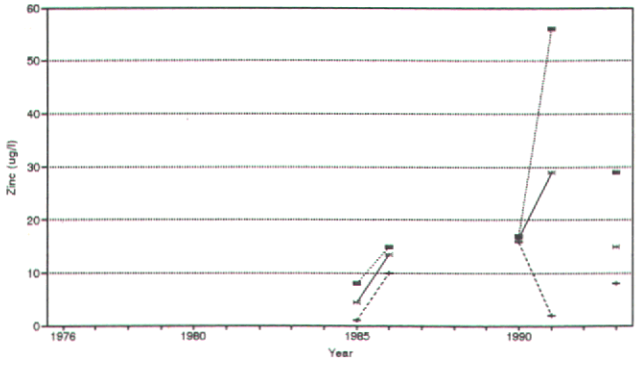


Note: The maximum standard of 200/400 colonies per 100 ml was violated in all years.

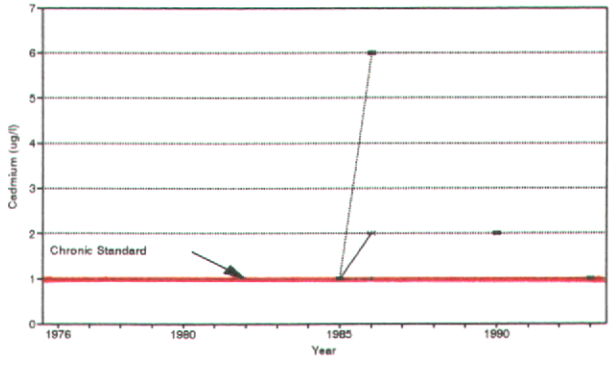
Figure X-2 (cont'd)



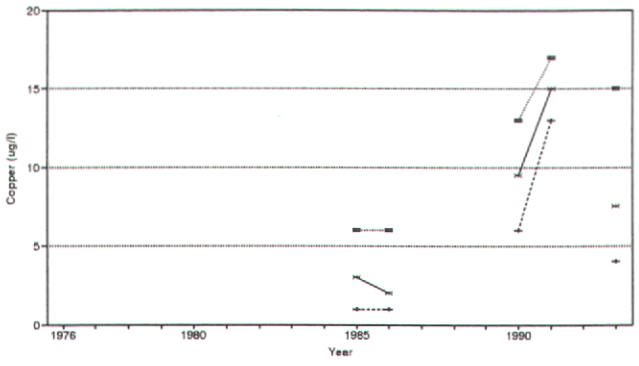




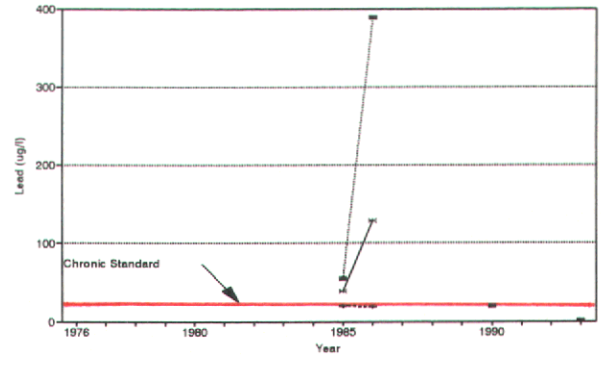
Note: The acute standard of 202.9 ug/l was not violated in any year.
The chronic standard of 89.2 ug/l was not violated in any year.



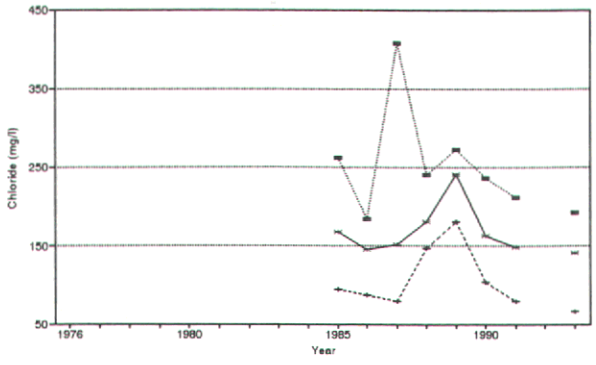
Note: The acute standard of 63.3 ug/l was not violated in any year.



Note: The acute standard of 31.9 ug/l was not violated in any year.
The chronic standard of 22.1 ug/l was not violated in any year.



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



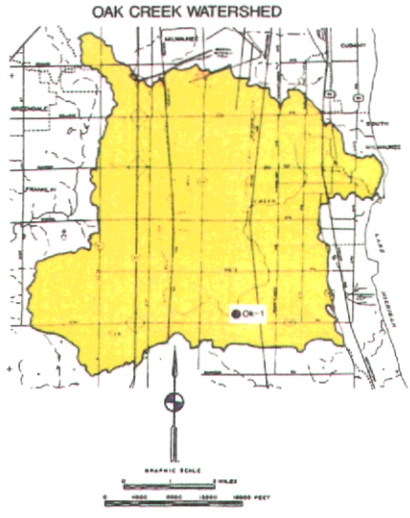
Note: The maximum standard of 1000 mg/l was not violated in any year.

LEGEND

MAXIMUM VALUE

MINIMUM VALUE

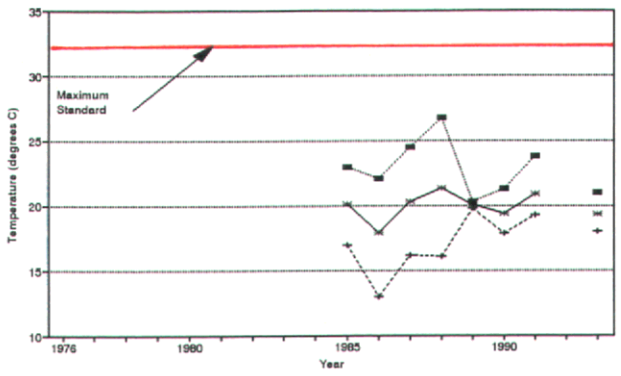
AVERAGE VALUE

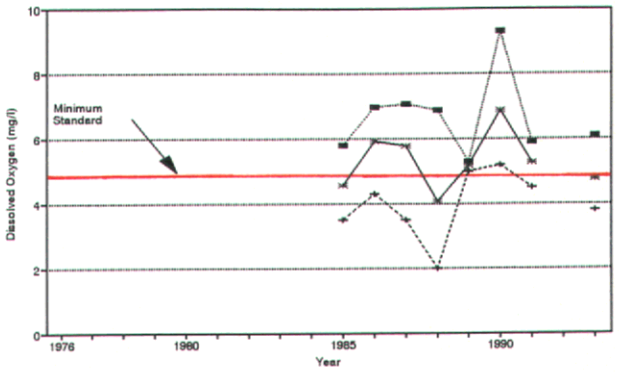


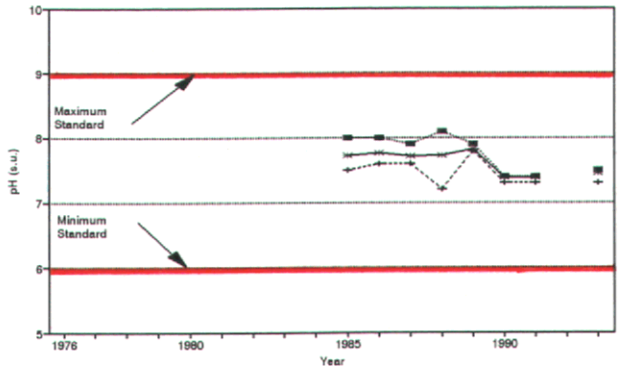
Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources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

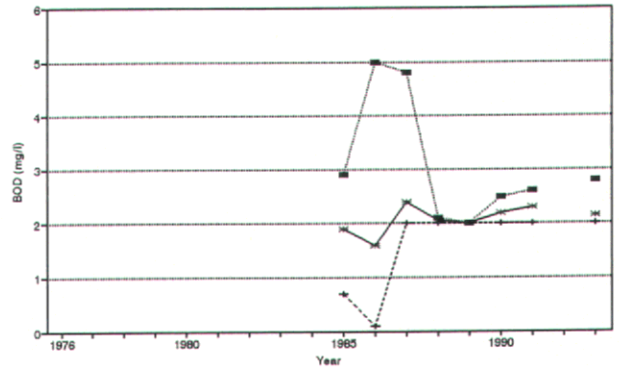
Source: Milwaukee Metropolitan Sewerage District and SEWRPC

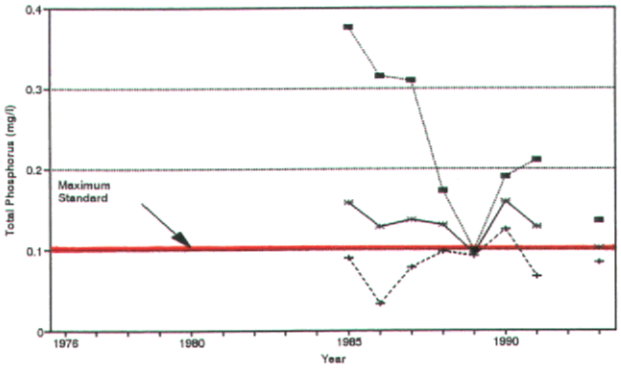
Figure X-3
WATER QUALITY DATA FOR THE OAK CREEK AT STATION Ok-3: 1976-1993

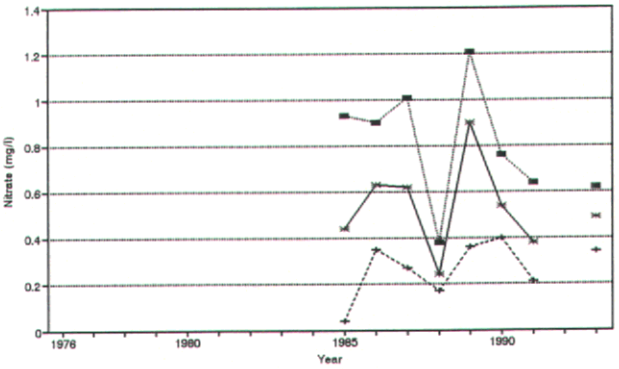


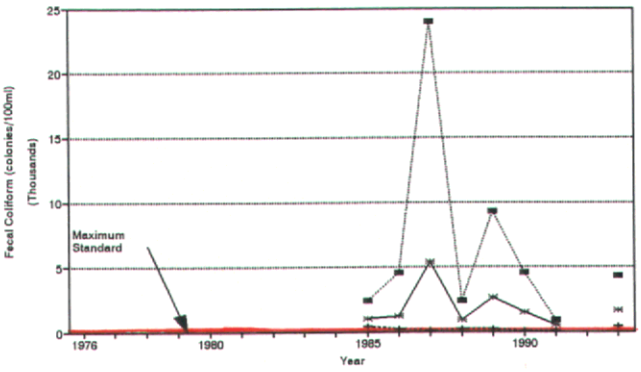


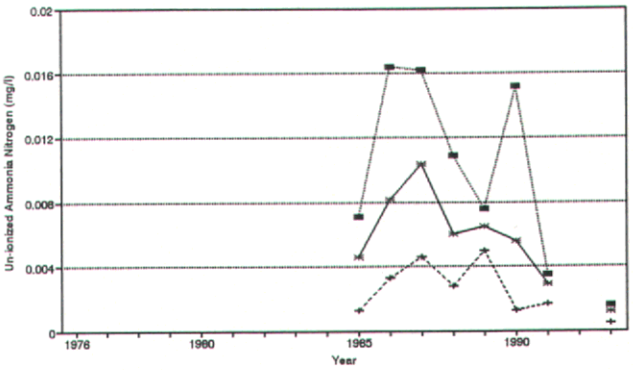








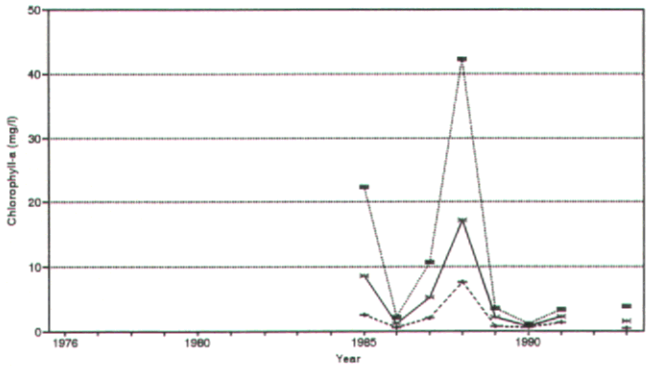


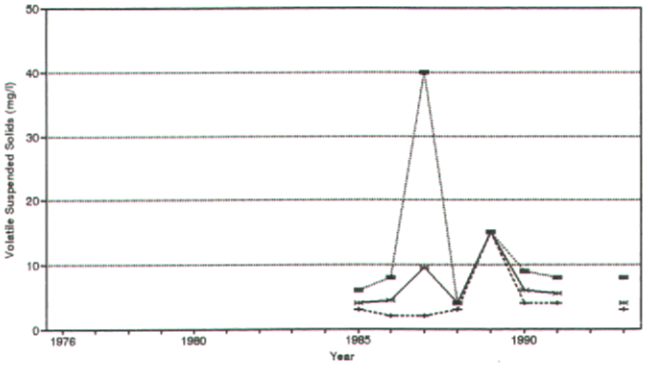


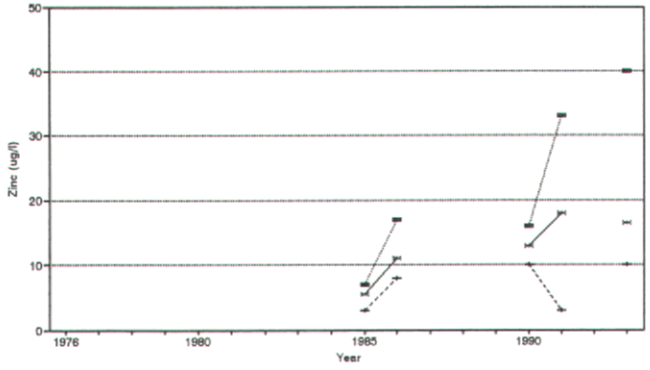
Note: The maximum standard of 200/400 colonies per 100 ml was violated in all years.

Note: The maximum standard of 0.04 mg/l was not violated in any year.

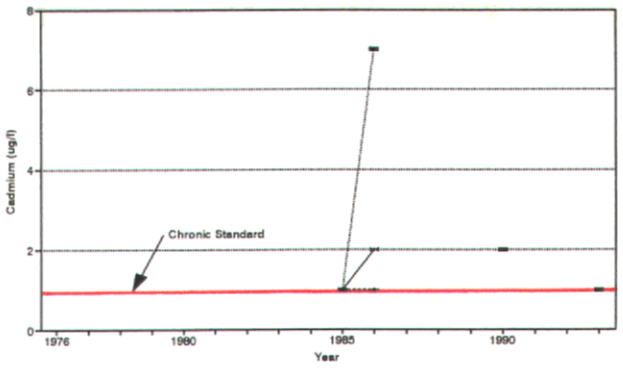
Figure X-3 (cont'd)



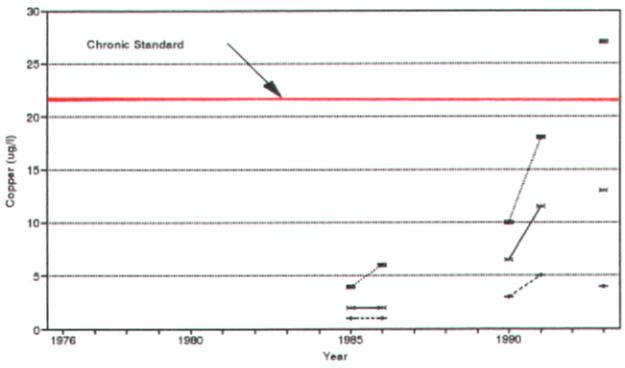




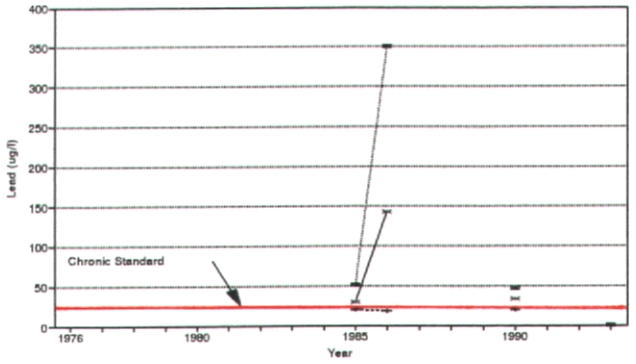
Note: The acute standard of 202.9 ug/l was not violated in any year.
The chronic standard of 89.2 ug/l was not violated in any year.



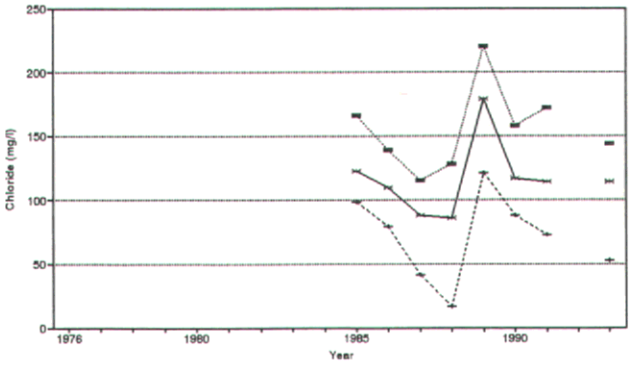
Note: The acute standard of 63.3 ug/l was not violated in any year.



Note: The acute standard of 31.9 ug/l was not violated in any year.



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



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

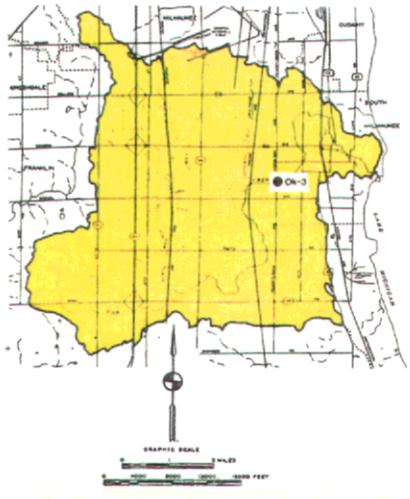
LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

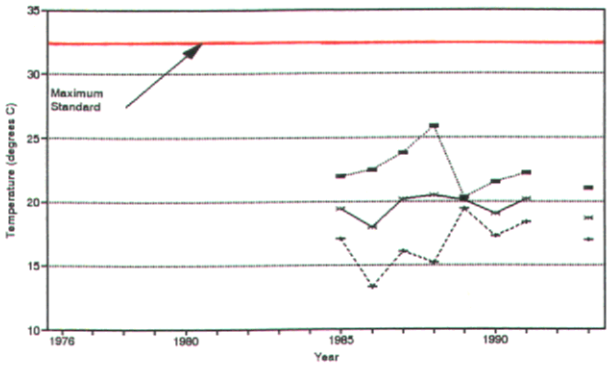
OAK CREEK WATERSHED

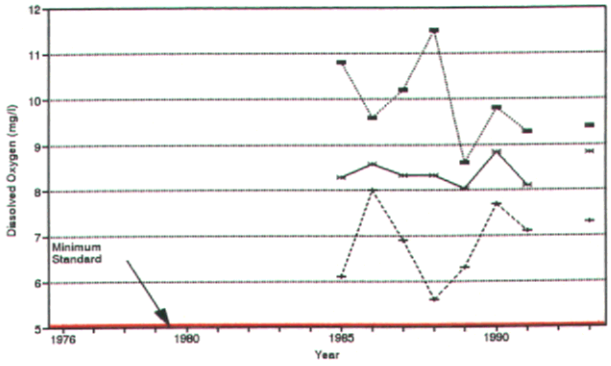


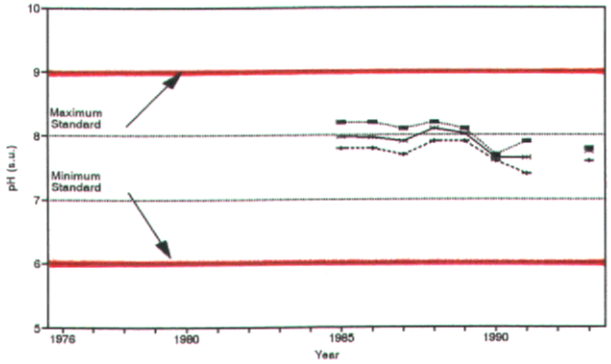
Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources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

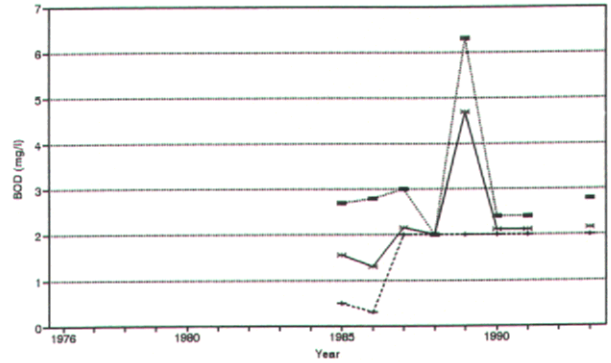
Source: Milwaukee Metropolitan Sewerage District and SEWRPC

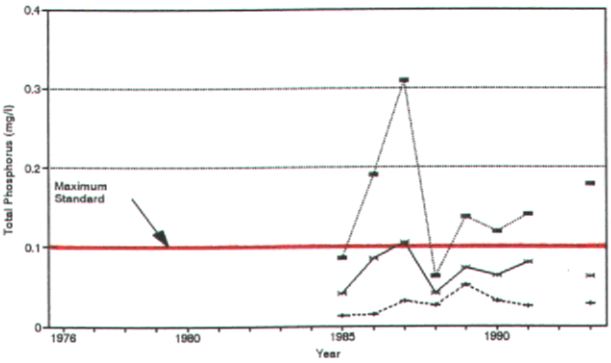
Figure X-4
WATER QUALITY DATA FOR THE OAK CREEK AT STATION Ok-2: 1976-1993

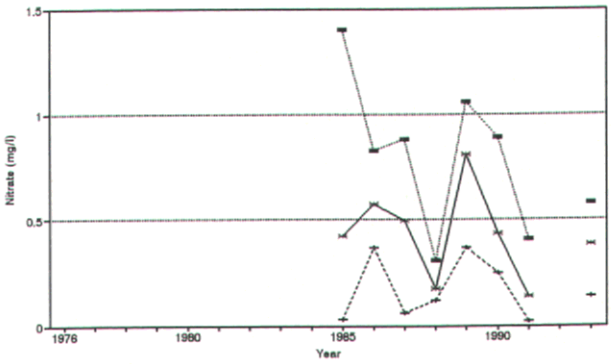


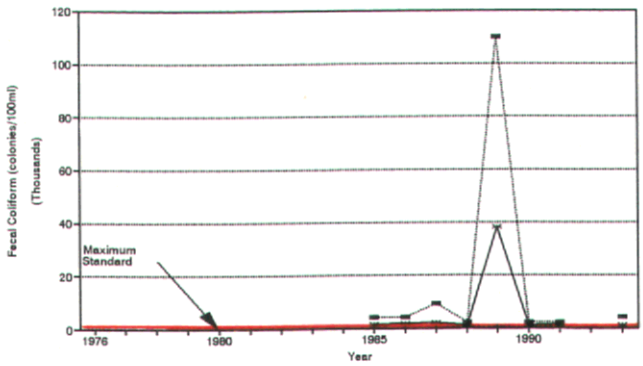


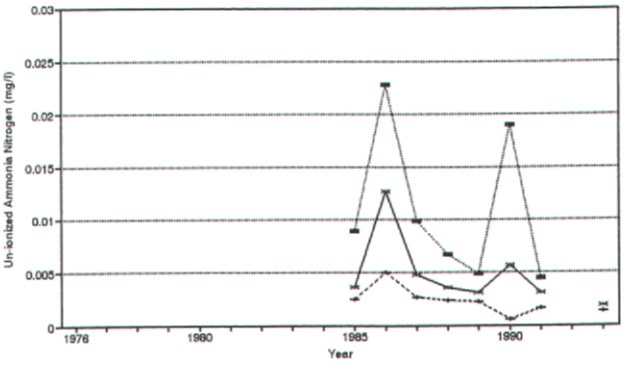








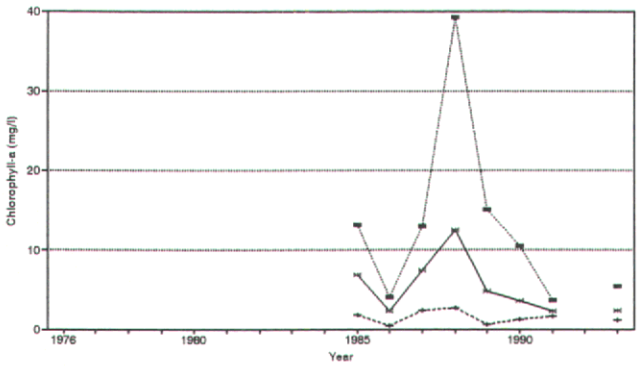


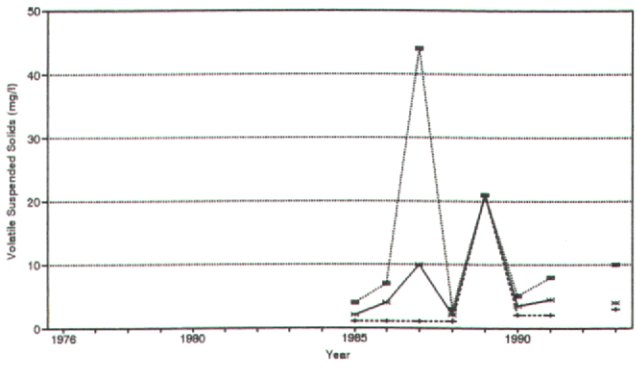


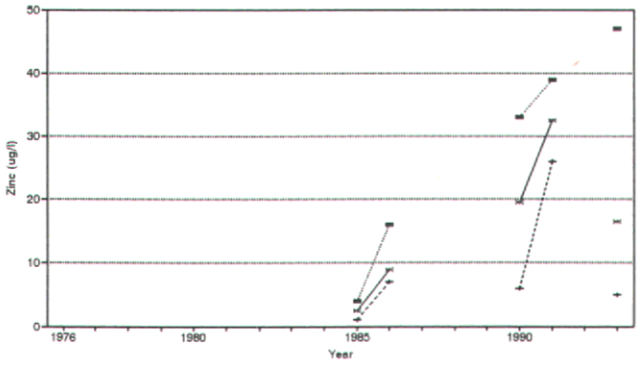
Note: The maximum standard of 200/400 colonies per 100 ml was violated in all years.

Note: The maximum standard of 0.04 mg/l was not violated in any year.

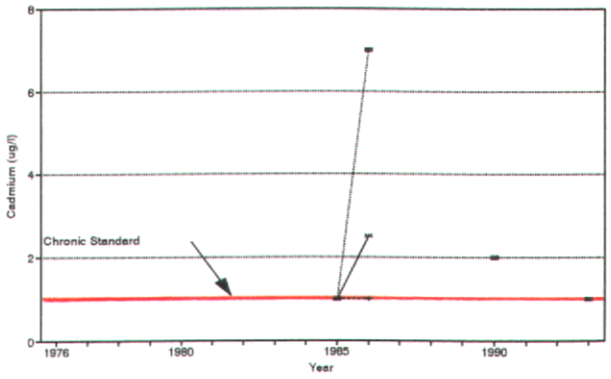
Figure X-4 (cont'd)



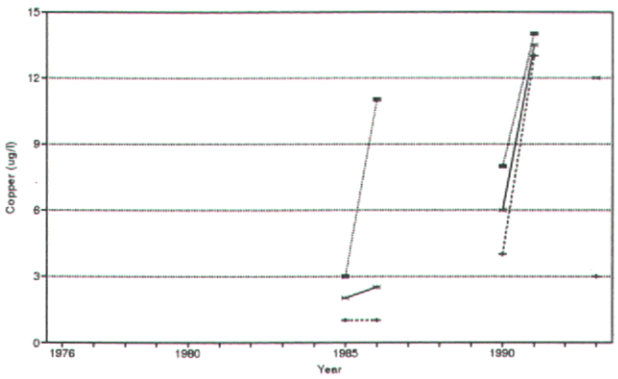




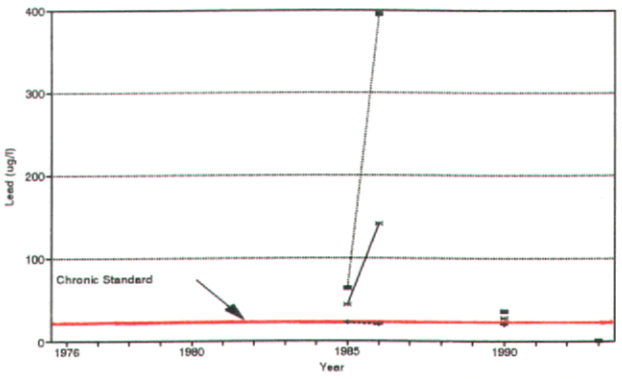
Note: The acute standard of 202.9 ug/l was not violated in any year.
The chronic standard of 89.2 ug/l was not violated in any year.



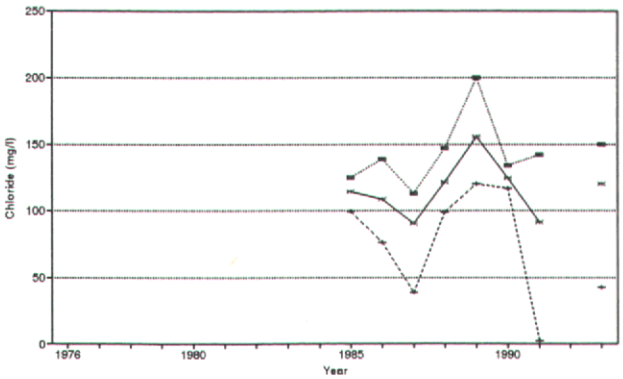
Note: The acute standard of 63.3 ug/l was not violated in any year.



Note: The acute standard of 31.9 ug/l was not violated in any year.
The chronic standard of 22.1 ug/l was not violated in any year.



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



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

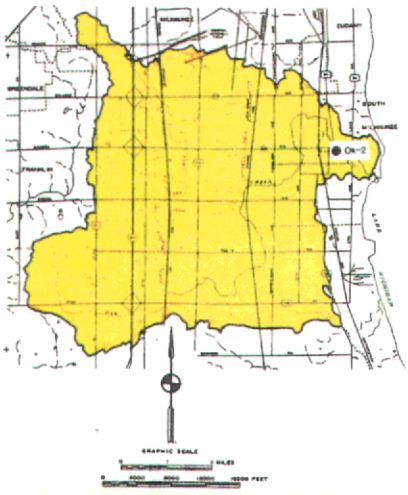
LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

OAK CREEK WATERSHED

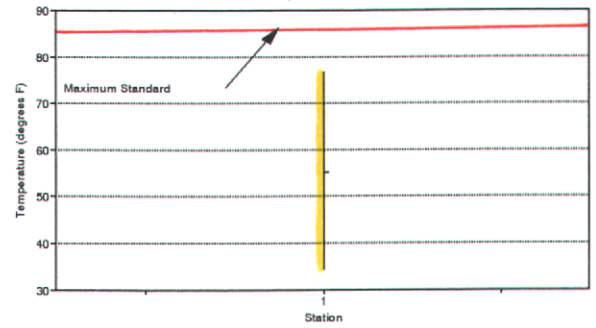


Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources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

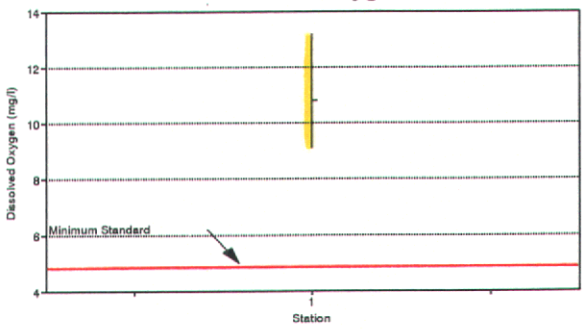
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

Figure X-5
Oak Creek Watershed Short-Term Water Quality Sampling Data: 1990

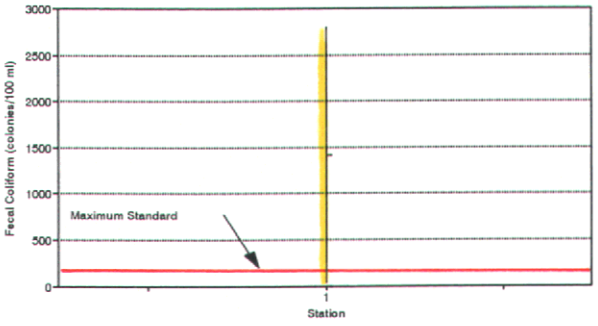
Temperature



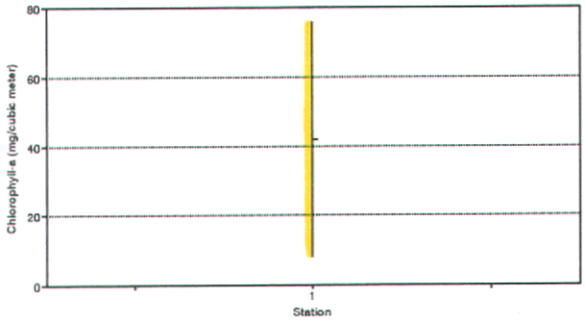
Dissolved Oxygen



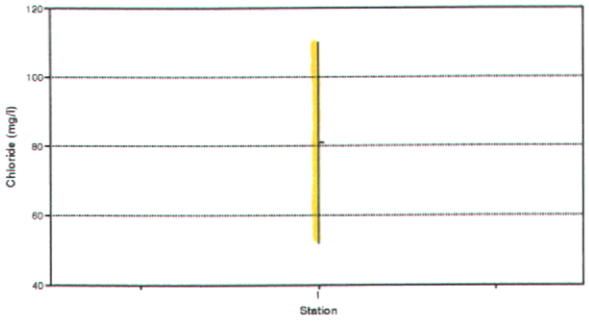
Fecal Coliform



Chlorophyll-a

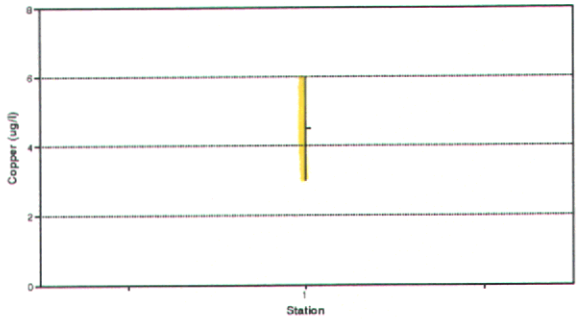


Chloride



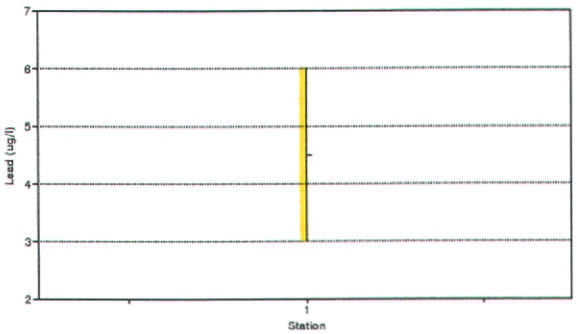
Note: The maximum standard of 1000 mg/l was not violated in any sample.

Copper



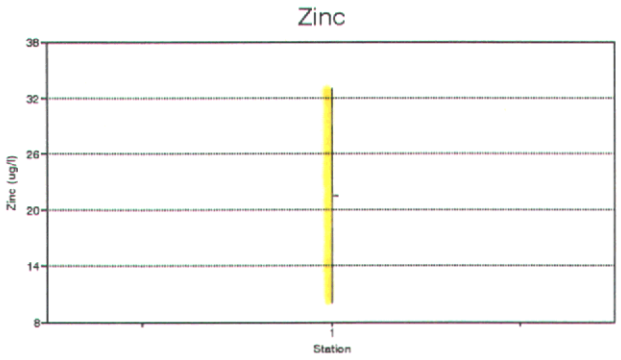
Note: The acute standard of 31.9 ug/l and the chronic standard of 22.1 ug/l were not violated in any sample.

Lead

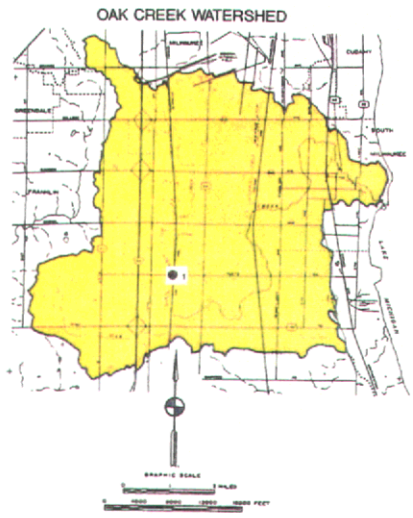


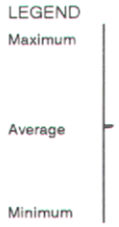
Note: The acute standard of 408.6 ug/l and the chronic standard of 24.4 ug/l were not violated in any sample.

Figure X-5 (cont'd)



Note: The acute standard of 202.9 ug/l and the chronic standard of 89.2 ug/l were not violated in any sample.





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 classification and water quality criteria. Refer to Table X-6 for summarized water quality data.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table X-6

OAK CREEK WATERSHED SHORT-TERM STREAM WATER QUALITY SAMPLING DATA: 1988-1993

Sampling Station Number	Parameter (Units)	Applicable Standards[a]	Range	Violation of Accepted Standard	Sampling Dates	Total Number of Samples
1	Temperature (°F)	Maximum of 89.0	34.3-76.8	No	September-December 1990	3
	Dissolved Oxygen (mg/l)	Minimum of 5.0	9.1-13.2	No	September-December 1990	3
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	40-2800	Yes	September-December 1990	2
	Chlorophyll-a (mg/cubic meter)	--	8.0-76.0	--	September-December 1990	2
	Chloride (mg/l)	Maximum of 1000	52-110	No	September-December 1990	2
	Copper (ug/l)	Chronic maximum of 22.1; acute maximum of 31.9	3-6	No	September-December 1990	2
	Lead (ug/l)	Chronic maximum of 24.4; acute maximum of 408.6	3-6	No	September-December 1990	2

[a]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.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Department of Natural Resources. However, the limited data which were available for lead indicate improved levels after 1985.

Since the completion of the initial regional water quality management plan, nine spills of toxic substances into streams within the Oak Creek watershed have been documented by the Wisconsin Department of Natural Resources. All of these spills have occurred in the main stem of Oak Creek, one in the City of Oak Creek and eight in the City of South Milwaukee.

Water Quality Assessments: Based upon recent available data, the water quality and biological characteristics of the Oak Creek and its major tributaries were assessed with the results set forth in Table X-7. Fish population and diversity were poor throughout. No recent fish kills have been recorded in the watershed.

Standards were not fully met for fecal coliform counts, and un-ionized ammonia and total phosphorus concentrations along the main stem of the Oak Creek or in Mitchell Field Ditch or the North Branch of Oak Creek. Problems with toxic substances were indicated in all stream reaches where data were available.

In general, the biotic index ratings, which are biological indicators of water quality within a stream system, were poor to fair, except for Oak Creek upstream of STH 100, which a poor to very poor rating. Moderate to high levels of stream bed sedimentation were noted throughout the watershed.

Table X-8 sets forth the water quality index classifications[5] 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 X-8, recent data were available for four stations on the Oak Creek main stem; one at STH 38, one at the Oak Creek Parkway east of STH 32, one at Pennsylvania/Nicholson Avenue, and one on Ryan Road/STH 100. These stations and additional locations where water quality data were collected by the Milwaukee Metropolitan Sewerage District are shown on Map X-5. The limited data available indicate that water quality conditions at two of the four stations for which data were available in 1964 decreased from "good" to "fair" in 1974-75 and remained "fair" in 1990-91. Data from the two additional stations assessed during 1990-91 also resulted in a classification of the waters of Oak Creek as "fair" as set forth in Table X-8.

A summary of potential pollution sources in the Oak Creek watershed by stream reach is shown in tabular summary in Table X-9. Review of the data indicate that the majority of the conversion of lands from rural to urban uses is anticipated to occur within the portion of the watershed upstream of Pennsylvania Avenue and in the areas tributary to Mitchell Field Ditch and the North Branch of Oak Creek. It should be noted that the majority of the documented spills of toxic substances and the majority of the permitted industrial discharges occur in the Oak Creek main stem downstream of 15th Avenue in the City of South Milwaukee. Data on nonpoint source pollution and additional potential impacts to surface water quality are included in Table X-9.

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[5] 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 X-7

CHARACTERISTICS OF STREAM REACHES IN THE OAK CREEK 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			
a. Oak Creek upstream STH 100	2.8	Poor	No	No	Yes	Yes	Yes	Yes	Poor-very poor	Moderate (rocks, sand, gravel)	Moderate
b. Oak Creek downstream STH 100 to Drexel Avenue	4.5	Poor	No	No	Yes	Yes	Yes	Yes	Poor	High (sand, silt, gravel, organics)	Major
c. Oak Creek d/s Drexel Ave. to Pennsylvania Avenue	0.9	Poor	No	No	Yes	Yes	Yes	Yes	--	High (sand, silt, slimes, organics)	Major
d. Oak Creek d/s Pennsylvania Avenue to 15th Avenue	1.9	Poor	No	No	Yes	Yes	Yes	Yes	--	High (sand, gravel, rubble)	Major
e. Oak Creek d/s 15th Avenue	2.8	Poor	No	No	Yes	Yes	Yes	Yes	Fair-poor	High (sand, gravel,organics)	Major
f. Mitchell Field Drainage Ditch	2.3	Poor	No	No	Yes	Yes	Yes	--	--	Moderate (sand, silt, clay, fine gravel)	Major
g. North Branch, Oak Creek	5.7	Poor	No	No	Yes	Yes	Yes	--	Fair	Moderate (sand, silt, clay)	Major
TOTAL	20.9										

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

[b] The most recent water quality data available as described in Figures X-1 through X-5 were used to evaluate water quality in the Oak Creek 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 evaluate current water quality for Oak Creek watershed stream reaches based upon year 2000 land use conditions and current levels of pollutant 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.

[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.

Table X-8

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATIONS OF THE OAK 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			
Ok-1	Good	Fair	Fair
Ok-2	Good	Fair	Fair
Ok-3	--	--	Fair
Ok-4	--	--	Fair
Watershed Average	Good	Fair	Fair

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

Source: SEWRPC.

Table X-9

SUMMARY OF POTENTIAL SURFACE WATER POLLUTION SOURCES IN THE OAK 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	
Oak Creek upstream STH 100	Significant	Major	--	X	X	--	--	1	--		1
Oak Creek downstream STH 100 to Drexel Avenue	Insignificant	Major[d]	--	X	X	--	--	2	--		1
Oak Creek downstream Drexel Avenue to Pennsylvania Ave.	Significant	Major	1986-antifreeze	X	--	--	--	0	--		1
Oak Creek downstream Pennsylvania Ave. to 15th Avenue	Insignificant[e]	Insignificant[e]	--	X	--	--	--	0	--		--
Oak Creek downstream 15th Avenue	Insignificant[e]	Insignificant[e]	1980-water glycol 1985-diesel fuel 1986-ferric chloride 1988-sheen on Oak Creek Lagoon 1991-oily sheen 1991-10W-20 oil 1992foundry sand	X	--	--	--	4	--		--
Mitchell Field Drainage Ditch	Signifiant	Major	--	X	X	--	--	1	--		1
North Branch, Oak Creek	Significant	Major	--	--	X	--	--	4	--		1

[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 code refers to the following ongoing pollution abatement efforts:
1. Construction Erosion Control Ordinances in place

[d] The amount of post-1990 urban development is antidicpated to increase significantly in comparison to pre-1990 urban development.

[e] Considerable urban development existing pre-1976.

Compliance with Water Use Objectives

As indicated in Chapter II, all of the stream reaches in the Oak Creek watershed as of 1993 are recommended for warmwater sportfish 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 sampling stations in the watershed, the main stem of the Oak Creek 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. Stream water quality data collected by the Milwaukee Metropolitan Sewerage District on the main stem of Oak Creek from 1985 to 1993, as shown in Figures X-1 through X-4, indicated that the main stem of the Oak Creek did not fully meet the recommended water use objectives. Based upon a review of the data summarized in Figure X-5 and Table X-6, 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 may also occur along the tributaries of the Oak Creek, and the recommended water use objectives continue not to be achieved in the majority of the major streams in the watershed.

WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

Based upon the current status of plan implementation, there are no major water quality issues remaining to be evaluated and addressed specific to the Oak Creek watershed. There remains a need to implement the nonpoint source pollution abatement recommendations set forth herein. A potential future amendment to the regional plan for the Oak Creek 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 institute an amendment to the regional plan once it is adopted by all of the agencies involved.

Chapter XI

PIKE 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 Pike 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 Pike 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 Pike River watershed as there are no major lakes located within the watershed. Designated management agency responsibilities for plan implementation are presented in Chapter XVII on a regional basis.

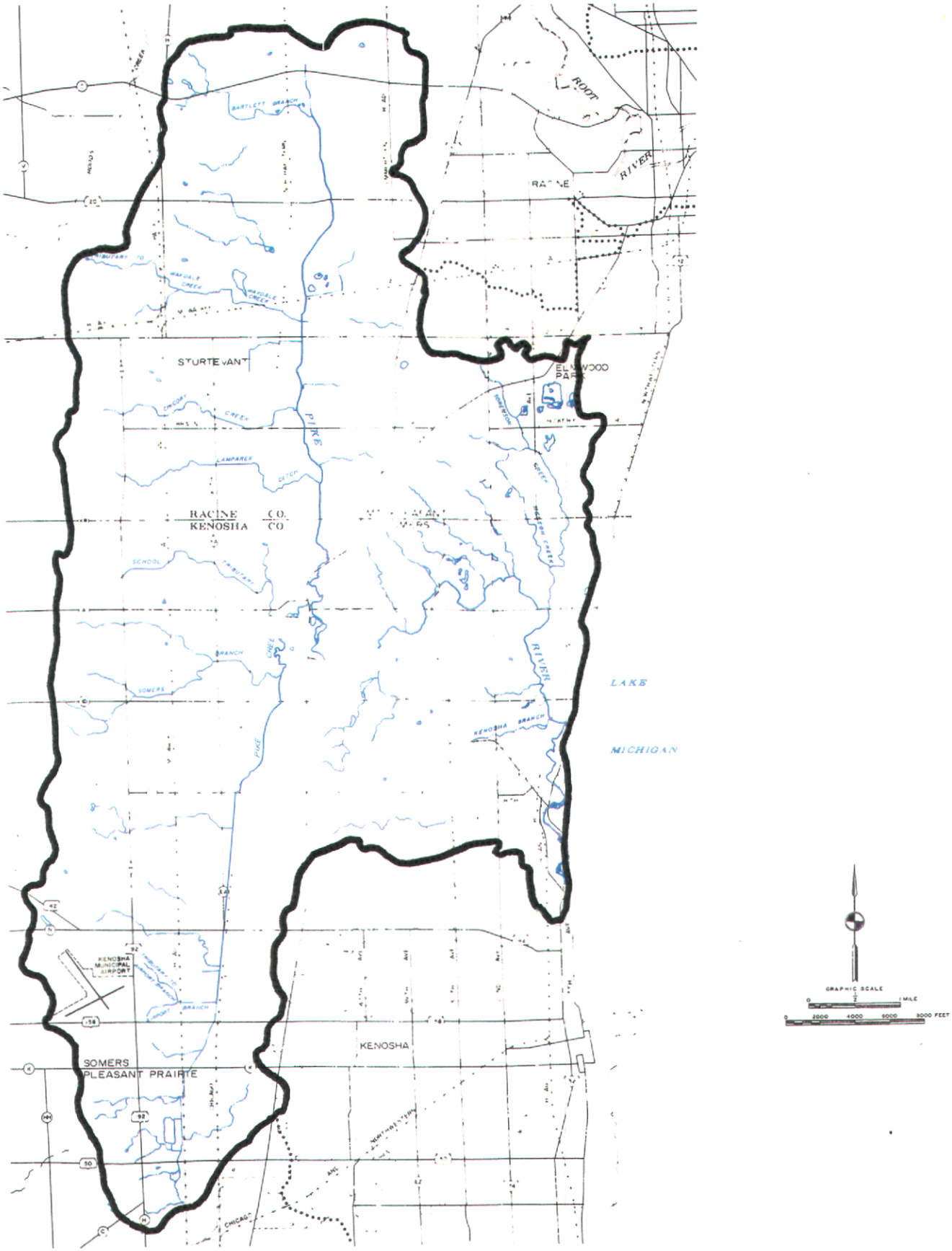
The Pike River watershed is located in the southeast portion of the Region and covers an area of approximately 51 square miles. The main stem of the Pike River rises in Racine County and flows approximately 16 miles southerly and easterly to enter Lake Michigan in the City of Kenosha in Kenosha County. 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 Pike River and its principal tributaries, are shown on Map XI-1. The Pike 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 uses which have occurred within the Pike 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 source 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

Map XI-1

PIKE RIVER WATERSHED



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 XI-1 summarizes the existing land uses in the Pike 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 Pike River watershed contains numerous urbanized areas, 71 percent of the watershed was still in rural and other open space land uses in 1990. These rural uses included about 57 percent of the total area of the watershed in agricultural and related rural uses, about 3 percent in woodlands, about 3 percent in surface water and wetlands, and about 8 percent in open lands. The remaining 29 percent of the total watershed was devoted to urban uses. Existing land uses within the watershed are shown on Map XI-2.

Within the Pike River watershed, major concentrations of urban development exist in both Kenosha and Racine Counties, with the majority of urban development increases since 1975 occurring in Racine County. Urban development has been rapidly taking place in and around the City of Racine; in the Village of Mount Pleasant, along STH 20 and STH 31, and along STH 11; adjacent to and within the Village of Sturtevant; and in the southern portion of the watershed in the City of Kenosha and Village of Pleasant Prairie--the area generally between STH 50 and STH 142. The Pike River watershed contains a major industrial center, located just east of the Village of Sturtevant along STH 11, and a portion of the Regency Mall commercial center, located east of STH 31 in the City of Racine.

As shown in Table XI-1, from 1975 to 1990, urban land uses in the watershed increased from about 8,100 acres, or 13 square miles, to about 9,500 acres, or 15 square miles, or by about 17 percent. As shown in Table XI-1, residential land represents the largest urban land use in the watershed. Residential use increased within the watershed, from about 3,800 acres, or about six square miles in 1975, to about 4,400 acres, or about seven square miles in 1990, a 15 percent increase. Commercial lands increased significantly, from 120 acres, or about 0.2 square mile, to 252 acres, or about 0.4 square mile, an increase of 110 percent.

The 15 square miles of urban land uses in the watershed as of 1990 approximated the staged 1990 planned level of about 14.7 square miles envisioned in the adopted year 2000 land use plan. The current status of development in the Pike River watershed and in adjacent portions of Racine and Kenosha Counties was considered in developing the new year 2010 land use plan element described in Chapter III for the Region as a whole.

Table XI-2 summarizes the year 2010 planned land use conditions set forth in the adopted year 2010 land use plan in the Pike 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 Racine County in the vicinity of STH 11 and STH 20 in the Town of Mount Pleasant, and along STH 31 in the Town of Mount Pleasant and the City of Racine; and in Kenosha County in the vicinity of STH 142 and STH 50 in the City of Kenosha and Village of Pleasant Prairie.

In order to meet the needs of the expected resident population and employment envisioned under the intermediate growth-centralized land use plan future

Table XI-1

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

Land Use Category	1975		1990		Change 1975-1990	
	Acres	Percent	Acres	Percent	Acres	Percent
Urban						
Residential	3,795	11.5	4,373	13.3	578	15.2
Commercial	120	0.4	252	0.7	132	110.0
Industrial	447	1.4	438	1.3	- 9	- 2.0
Transportation, Communication, and Utilities[b]	2,416	7.3	3,053	9.3	637	26.4
Governmental and Institutional	698	2.1	712	2.2	14	2.0
Recreational	634	1.9	654	2.0	20	3.2
Subtotal	8,110	24.6	9,482	28.8	1,372	16.9
Rural						
Agricultural and Related	21,169	64.3	18,764	57.0	- 2,405	- 11.4
Lakes, Rivers, Streams and Wetlands	878	2.7	944	2.9	66	7.5
Woodlands	945	2.9	919	2.8	- 26	- 2.8
Open Lands[c], Landfills, Dumps, and Extractive	1,807	5.5	2,800	8.5	993	55.0
Subtotal	24,799	75.4	23,427	71.2	- 1,372	- 5.5
Total	32,909	100.0	32,909	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.

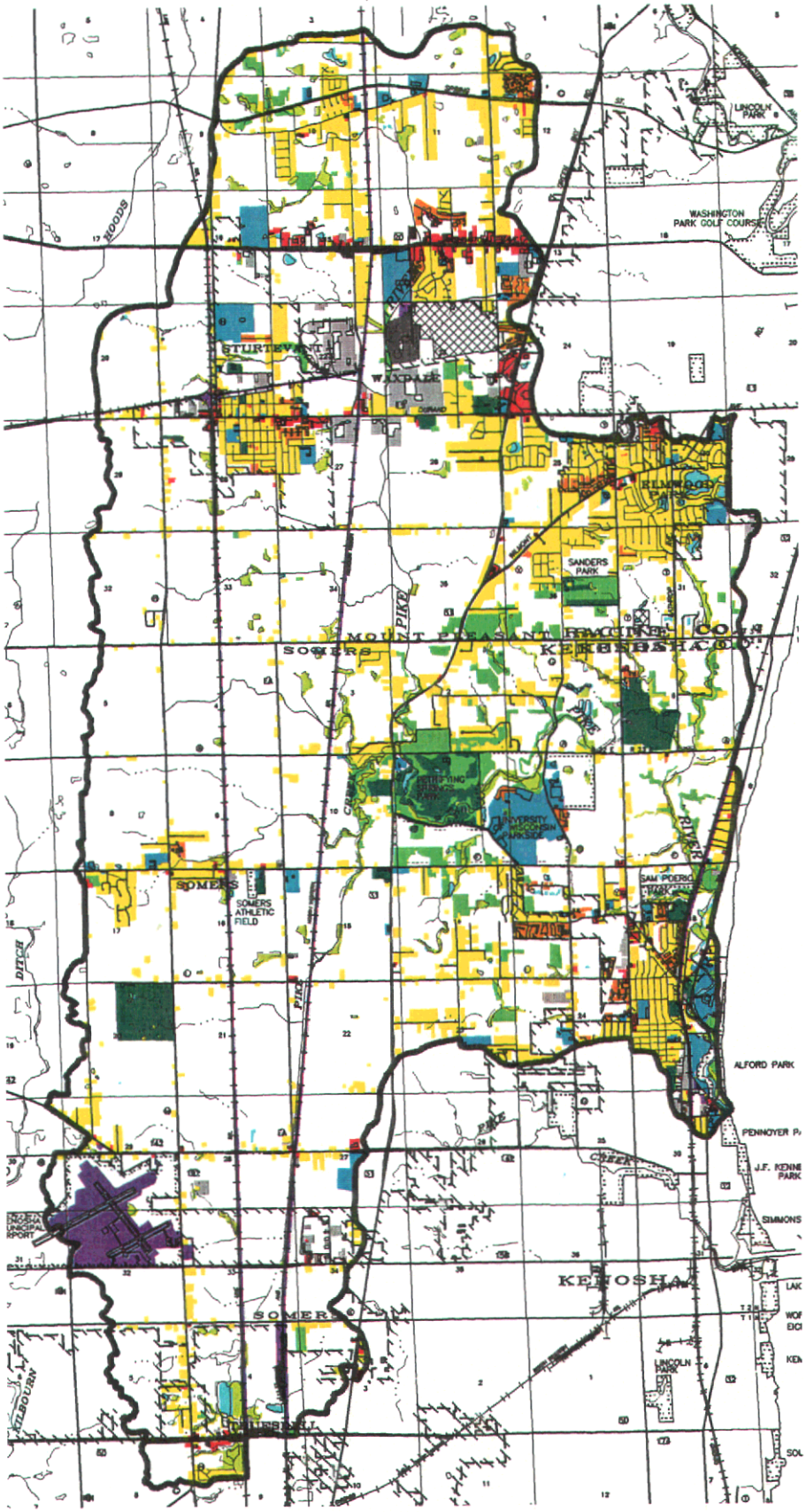
Source: SEWRPC.

MAP XI–2

LAND USES IN THE PIKE 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



The Pike River watershed is about 51 square miles in areal extent, or about 2 percent of the total Regic In 1990, about 15 square miles, or about 29 percent of the watershed, was in urban land uses.

Source: SEWRPC.

Table XI-2

EXISTING AND PLANNED LAND USE IN THE PIKE 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	4,373	13.3	5,912	18.0	1,539	35.2	6,759	20.5	2,386	54.6
Commercial	252	0.7	283	0.9	31	12.3	316	0.9	64	25.4
Industrial	438	1.3	757	2.3	319	72.8	942	2.9	504	115.1
Transportation, Communication, and Utilities[b]	3,053	9.3	3,581	10.9	528	17.3	3,939	12.0	886	29.0
Governmental and Institutional	712	2.2	754	2.3	42	5.9	783	2.4	71	10.0
Recreational	654	2.0	842	2.5	188	28.7	893	2.7	239	36.5
Subtotal	9,482	28.8	12,129	36.9	2,647	27.9	13,632	41.4	4,150	43.8
Rural										
Agricultural and Related	18,764	57.0	17,843	54.2	- 921	- 4.9	16,558	50.3	-2,206	- 11.8
Lakes, Rivers, Streams, and Wetlands	944	2.9	894	2.7	- 50	- 5.3	894	2.7	- 50	- 5.3
Woodlands	919	2.8	905	2.7	- 14	- 1.5	882	2.7	- 37	- 4.0
Open Lands,[c] Landfills, Dumps, and Extractive	2,800	8.5	1,140	3.5	-1,660	- 59.3	943	2.9	-1,857	- 66.3
Subtotal	23,427	71.2	20,780	63.1	-2,647	- 11.3	19,277	58.6	-4,150	- 17.7
Total	32,909	100.0	32,909	100.0	0	--	32,909	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.

conditions, the amount of land devoted to urban use within the Pike River watershed, as indicated in Table XI-2, is projected to increase from the 1990 total of about 15 square miles, or about 29 percent of the total area of the watershed, to about 19 square miles, or about 37 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 21 square miles, or about 41 percent of the total watershed by year 2010. It is important to note that the 59 to 63 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 largely in open space uses, preserved 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 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 36 square miles in 1990 to about 32 square miles in the year 2010 under the intermediate growth-centralized land use plan and to about 30 square miles under the high growth-decentralized land use plan, decreases of about 11 and 18 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 Pike River watershed--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. 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 two public sewage treatment facilities located in the Pike River watershed, as shown on Map XI-3. The Village of Sturtevant and Town of Somers sewage treatment plants discharged indirectly to the main stem of the Pike River via small tributaries. Both of these plants were abandoned after 1975, as recommended in the initial plan. The status of implementation with regard to the initial plan recommendations for public and private sewage treatment plants in the Pike River watershed is summarized in Table XI-3.

In addition to the publicly-owned sewage treatment facilities, two private sewage treatment plants were in existence in 1975 in the Pike River watershed. These plants served the American Motors Corporation-Transportation Division in the Town of Somers and St. Bonaventure Seminary in the Town of Mount Pleasant. As indicated in Table XI-3, both of the private sewage treatment plants in the watershed were recommended to be abandoned. As of 1990, both of these plants had been abandoned.

Map XI-3

SEWER SERVICE AREAS AND SEWAGE TREATMENT PLANTS IN THE PIKE RIVER WATERSHED: 1990 AND 2010

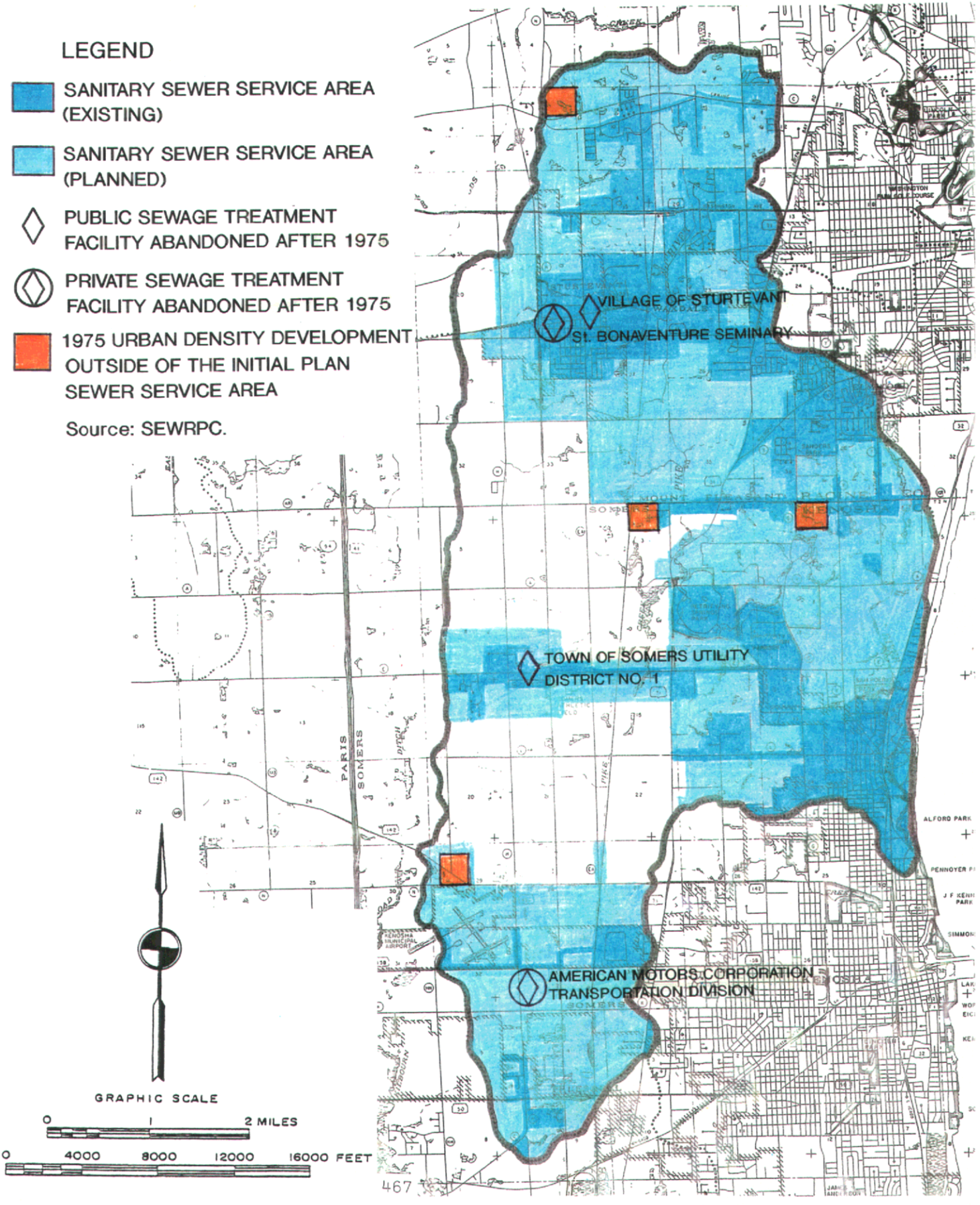


Table XI-3

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

Public Sewage Treatment Plants	Disposal of Effluent	Plan Recommendation	Implementation Status
Town of Somers Utility District No. 1	Tributary of Pike Creek	Abandon Plant	Plant Abandoned (1986)
Village of Sturtevant	Tributary of Pike River	Abandon Plant	Plant Abandoned (1980)
Private Sewage Treatment Plants	**Disposal of Effluent**	**Plan Recommendation**	**Implementation Status**
American Motors Corporation Transportation Division	Tributary of Pike Creek	Abandon Plant	Plant Abandoned (1977)
St. Bonaventure Seminary	Tributary of Pike River	Abandon Plant	Plant Abandoned (1979)

Source: 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 four sewer service areas identified within, or partially within, the Pike River watershed: Racine, Somers, Pleasant Prairie North, and Kenosha. Currently, all of these areas have undergone refinements as recommended. The boundaries of the sewer service areas through 1993 are shown on Map XI-3. Table XI-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 service area in the Pike River watershed, as refined through 1993, totals about 36 square miles, or about 71 percent of the total watershed area, as shown in Table XI-4.

Current Plan Recommendations: The current point source pollution abatement plan element, including the planned sanitary sewer service areas in the Pike River watershed are shown on Map XI-3. 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 Bristol/Pleasant Prairie, Kenosha, and Racine sewer service areas are located in the Pike River watershed. Together, the planned service areas total about 36 square miles, or about 71 percent of the Pike River 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. However, additional changes to the planned sewer service areas, as well as to the trunk sewer system in the Pike River watershed have been recommended in two subregional sewerage system plans.[1] The recommendations of these two system plans are described in Chapter IV for the greater Kenosha area and in Chapter XIII for the greater Racine Area. Formally amending the regional water quality management plan is being held in abeyance until such time as intergovernmental agreements on the system plans is achieved by the local units involved, including the City of Racine for the greater Racine area plan recommendations and the City of Kenosha for the greater Kenosha area. No specific additional refinements are envisioned to be needed for the currently planned sewer service areas at this time. 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.

Sewer System Flow Relief Devices

Existing Conditions and Status of Plan Implementation: In 1975, there were eight known separate sewer flow relief devices located in the Pike River watershed: five crossovers to storm sewers discharging to the Pike River from the City of Kenosha; two bypasses to the Pike River, one from the Village of Sturtevant and one from the Town of Mount Pleasant; and one bypass to Pike Creek from the Town

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[1]Alvord, Burdick & Howson and Applied Technologies,Inc., A Coordinated Sanitary Sewerage and Water Supply System Plan for the Greater Racine Area, September 1992; and Ruekert & Mielke, Inc., A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Kenosha Area, October 1991.

Table XI-4

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

Name of Initially Defined Sanitary Sewer Service Area(s)	Planned 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
Bristol IH 94 Pleasant Prairie North	0.9	Bristol/Pleasant Prairie	December 2, 1985	SEWRPC CAPR No. 106, Sanitary Sewer Service Area for the City of Kenosha and Environs, Kenosha County, Wisconsin
Kenosha Pleasant Park Somers	16.7	Kenosha	December 2, 1985	SEWRPC CAPR No. 106, Sanitary Sewer Service Area for the City of Kenosha and Environs, Kenosha County, Wisconsin
Racine Caddy Vista	18.4	Racine Caddy Vista	December 1, 1986	SEWRPC CAPR No. 147, Sanitary Sewer Service Area for the City of Racine and Environs, Racine County, Wisconsin
Total	36.0			

Note: CAPR - Community Assistance Planning Report

Source: SEWRPC.

of Somers. These flow relief devices have all been eliminated, as recommended in the initial regional water quality management plan. As shown in Table XI-5, two points of sanitary sewer system flow relief were reported during 1988 through 1993 in the Pike River watershed. One incident of bypassing was reported at the County Line Road lift station in the Town of Mount Pleasant Sewer Utility District No. 1 sewerage system due to a mechanical failure which was subsequently repaired. One incident of bypassing was reported at the Hulda Street lift station in the Village of Sturtevant due to excessive rainfall.

Current Plan Recommendations: It is recommended that the Village of Sturtevant and the Town of Mount Pleasant Sewer Utility District No. 1 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 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.

Intercommunity Trunk Sewer

Existing Conditions and Status of Plan Implementation: The initial regional water quality management plan, as updated, recommended the construction of two intercommunity trunk sewers in the Pike River watershed, as shown in Table XI-6. One trunk sewer would connect urban development in the Village of Sturtevant and in portions of the Town of Mount Pleasant to the City of Racine sewerage system, enabling the abandonment of the Village of Sturtevant sewage treatment plant, while the other would connect urban development in the Town of Somers to the City of Kenosha sewerage system, enabling the abandonment of the Town of Somers Utility District No. 1 sewage treatment plant. The trunk sewer connecting the Village of Sturtevant and portions of the Town of Mount Pleasant has been constructed. An interim connection of the Town of Somers Utility District No. 1 to the Kenosha sewerage system was also completed and the permanent Somers-Kenosha trunk sewer was partially completed by extension to CTH E.

Current Plan Recommendations: As noted earlier, there are now pending recommendations for additional trunk sewers to serve the service areas in the watershed as were recommended in separate subregional system plans for the greater Kenosha area and the greater Racine area. Amendment of the regional water quality management plan is being held in abeyance until such time as local agreement on the system plans is reached. Details regarding the trunk sewers recommended in those plans are shown in Chapter IV for the greater Kenosha area and Chapter XIII for the greater Racine area.

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 four known point sources of pollution identified in the Pike River watershed other than public and private sewage treatment plants. All six of these outfalls were identified as discharging only cooling water to the surface water system. The initial regional water quality management 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.

Table XI-5

KNOWN SEWAGE FLOW RELIEF DEVICES IN
THE PIKE RIVER 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	
Town of Mount Pleasant Utility District No. 1	--	--	1	--	--	1	Used only in case of equipment failure
Village of Sturtevant	--	--	1	--	--	1	Used only in case of equipment failure or extreme wet weather conditions
Total	--	--	2	--	--	2	

Source: SEWRPC.

Table XI-6

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

Intercommunity Trunk Sewer	Status of Implementation
Sturtevant-Mt. Pleasant	Completed (1980)
Somers-Kenosha	Interim Connection Completed (1986) Portion of permanent trunk sewer completed to CTH E (1993)

Source: SEWRPC.

As of 1990, there were ten such known point sources of wastewater discharging to the Pike River and its major tributaries and the groundwater system. Table XI-7 summarizes selected characteristics of these other point sources and Map XI-4 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 14 known point sources of wastewater other than public and private sewage treatment plants discharging to surface waters in the Pike River watershed. These point sources of wastewater discharge, primarily industrial cooling, process, rinse, and wash water directly or following treatment to the groundwater or the surface waters. 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 four enclaves of unsewered urban development located outside of the then proposed year 2000 sewer service area. As of 1990, all of these areas had been added to the planned 2010 sewer service area as part of the plan amendment process. No new enclaves of urban development have been created beyond the planned sewer service areas, as shown on Map XI-3.

Miscellaneous Potential Pollution Sources

Landfills: Landfills in the Pike 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 two active and nine known abandoned landfills located in the Pike River watershed. None of the active or abandoned landfills are known to be negatively impacting surrounding surface waters.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the Pike 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 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 32 known leaking underground storage tank sites in the Pike River watershed. None of these involved the discharging of remediation wastewater directly to surface water 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

Table XI-7

CHARACTERISTICS OF OTHER KNOWN POINT SOURCES OF WATER POLLUTION IN THE PIKE 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]
Pike River Watershed									
Eaton Corporation - Elec. Drives Div.	Kenosha	1	General	0044938-3	9-30-95	3566	Speed changers, drives & gears	Pike River via storm sewer	--
Ken-Crete Products Co., Inc.	Kenosha	2	General	0046507-2	9-30-95	3271/3273	Concrete block, brick & ready-mix	Absorption pit	--
Metal-lab, Inc.	Kenosha	3	General	0044938-3	9-30-95	3398	Metal heat treating	Pike River via unnamed tributary	--
Racine Fluid Power	Kenosha	4	General	0044938-3	9-30-95	3561	Pumps & equip., valves & pipe fit.	Pike River	--
Racine School Dist: J.I. Case H.S.	Kenosha	5	General	0046523-1	9-30-95	3494	Secondary school	Pike River via drainage ditch	--
Spencer Residence	Kenosha	6	General	HEAT PUMP	9-30-95	8811	Private residence	Pike River via storm sewer	--
UW Parkside Pool	Kenosha	7	General	0046523-2	9-30-95	8221	College or university	Pike River via drainage ditch	--
J. I. Case Company-Transmission Plant	Racine	1A	Specific	0039691	8-31-94	3523	Farm machinery & equipment	Lake Michigan via storm sewer	None
Land Reclamation Company	Racine	2A	Specific	0045420	12-31-94	4953	Refuse systems	Pike River via drainage ditch	1, 2
S. C. Johnson & Son, Inc. - Waxdale	Racine	3A	Specific	0027758	12-31-93	2842	Polishes and sanitation goods	Pike River via unnamed tributary	None

[a] Table XI-7 includes 10 known, permitted point sources of wastewater discharging to the Pike River and its tributaries, or to the groundwater system in the Pike River watershed. As of 1993, there were 14 known, permitted point sources of pollution.

[b] See Map XI-4, Point sources of pollution other than sewage treatment facilities in the Pike River Watershed: 1990 and 2010.

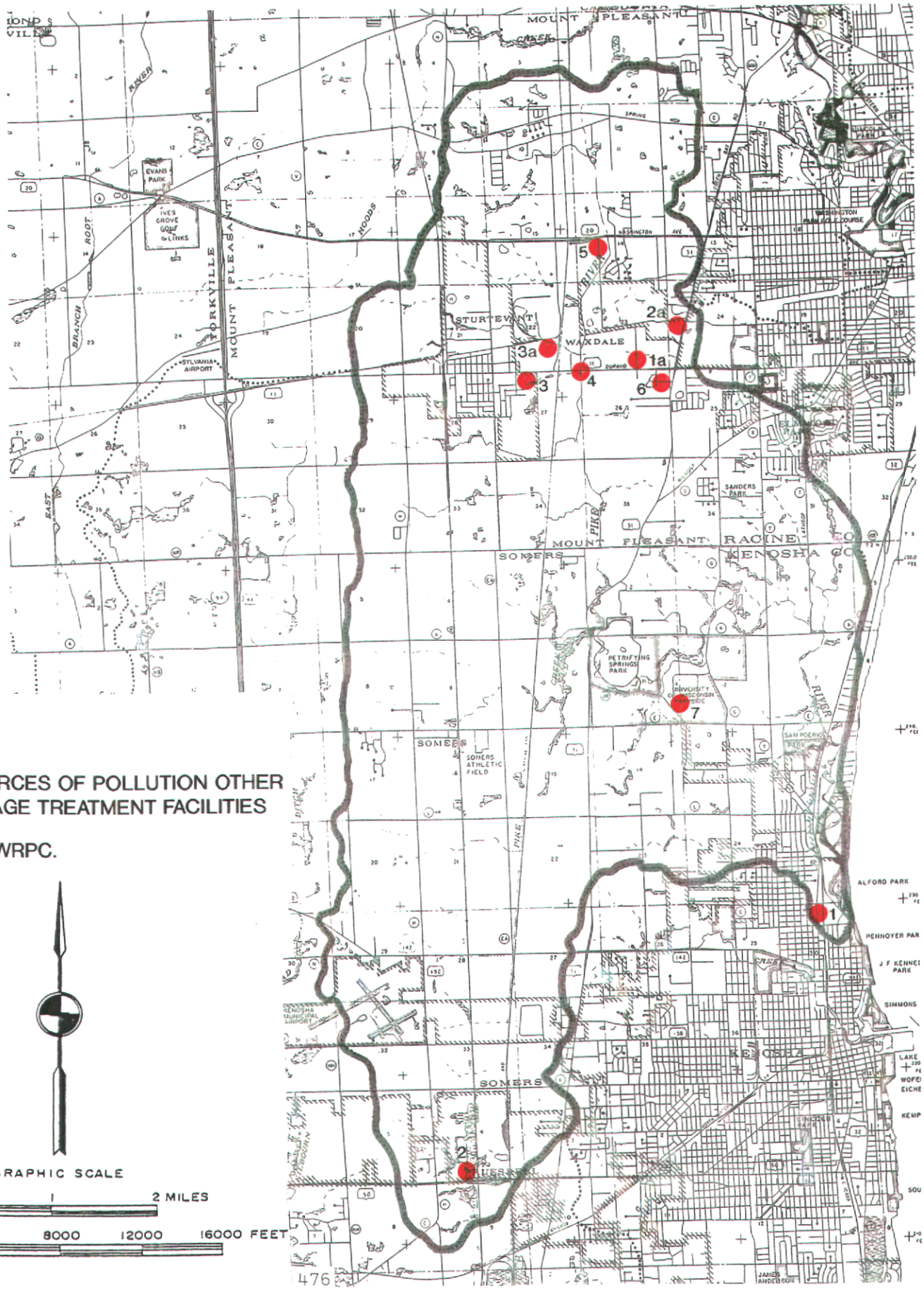
[c] The number code refers to the following treatment systems:

1. Gravity sedimentation
2. Holding pond

Source: Wisconsin Department of Natural Resources and SEWRPC.

Map XI-4

POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES IN THE PIKE RIVER WATERSHED: 1990



LEGEND

- POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES

Source: SEWRPC.

GRAPHIC SCALE

0 1 2 MILES

0 4000 8000 12000 16000 FEET

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 1993, there were no known such sites in the Pike 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 Pike River watershed, the initial 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 construction site erosion control, onsite sewage disposal system management, and streambank erosion control.

In 1983, the Commission prepared a comprehensive plan[2] for the Pike River watershed. This comprehensive plan established the necessary framework for the conduct of subsequent detailed stormwater management planning for the urban and urbanizing areas and for rural nonpoint source management planning in the watershed.

Implementation of the recommended nonpoint source control practices has been achieved on a very limited basis in the Pike 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 Kenosha and Racine Counties in the unincorporated areas and by the local units of government in incorporated areas served by onsite systems. 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. In addition, significant progress has also been made in the area of construction site erosion control. As of January 1993, the City of Kenosha and Village of Pleasant Prairie had adopted construction erosion control ordinances which are based upon the model ordinance developed cooperatively by the Wisconsin Department of Natural Resources and the League of Wisconsin Municipalities.

With regard to rural nonpoint source control, 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 being utilized primarily for cropland soil erosion control and wildlife habitat purposes and will have

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[2]SEWRPC Planning Report No. 35, A Comprehensive Plan for the Pike River Watershed, June 1983.

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 and Racine Counties. Thus, these plans have been prepared for all rural areas of the Pike 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.

While these local programs described above have 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 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 Wisconsin Department of Natural Resources. To date, the Pike River watershed has not been selected for inclusion in the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program.

Current Plan Recommendations

It is recommended that construction site erosion control, onsite sewage system management, and streambank erosion controls plus land management be carried out throughout the Pike River watershed. The types of practices 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. In addition, detailed stormwater management plans in urban areas and farmland management practices in rural areas should be conducted to define 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[3] prepared by the Regional Planning Commission using Wisconsin Department of Natural Resources procedures and is summarized in Chapter XVIII. That ranking included the Pike River watershed in the high category, indicating that inclusion in the program will be possible when existing planning projects are completed and funds and staff become available within the Department of Natural Resources.

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 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 known monitoring has been carried out in the Pike River watershed on a sustained basis. However, the Wisconsin Department of Natural Resources conducted extensive stream habitat and fish community surveys in the watershed in June of 1990 and again in June of 1993.

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 biological condition monitoring program be conducted over a one-year period at four stations located on the main stem of the Pike River--at stations Pk-1, Pk-2, Pk-4, and at a location upstream of Pk-1 on the Pike River in Racine County, as shown on Map XI-5. 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

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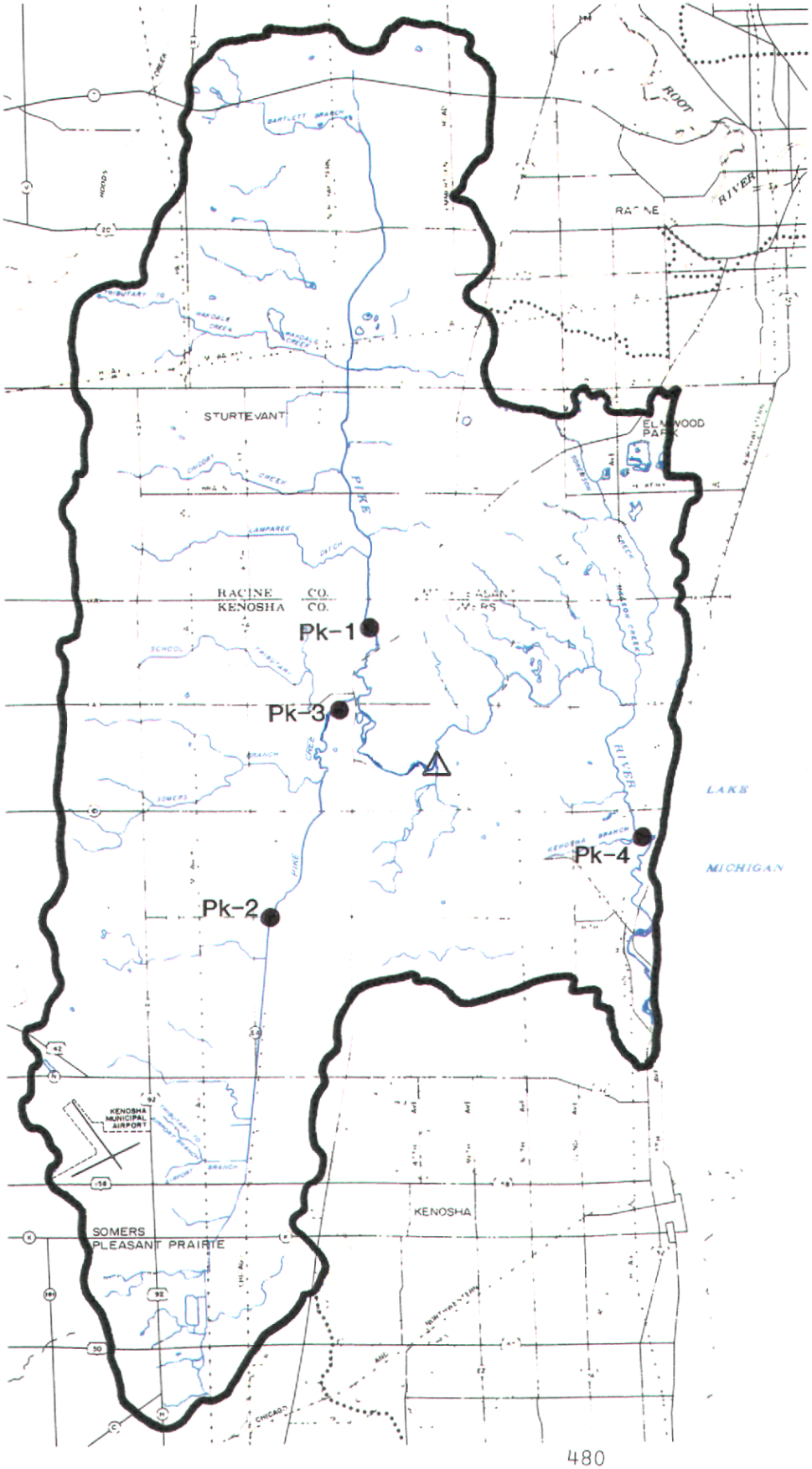
[3]See SEWRPC Memorandum entitled "Assessment and Ranking of Watersheds for Nonpoint Source Management Purposes in Southwestern Wisconsin: 1993."

Map XI-5
LOCATIONS OF WATER QUALITY SAMPLING STATIONS IN THE PIKE RIVER WATERSHED



LEGEND

Sampling stations used in preparation of initial plan

- ● SEWRPC
- △ USGS

Source: SEWRPC.

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 Pike 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; the 1976 Commission monitoring program conducted under the regional water quality management planning effort; and the Wisconsin Department of Natural Resources (DNR) sampling programs in 1973 and 1976. Available data collected in those programs for the Pike River watershed included samplings at four Commission stations--two on the Pike Creek Tributary of the Pike River and two on the main stem of the Pike River--and at one USGS station on the Pike River main stem. The sampling station locations are shown on Map XI-5.

No post-1976 comparable water quality data were available for streams in the Pike River watershed. However, the Wisconsin Department of Natural Resources has conducted biological condition monitoring in the watershed, including stream habitat and biological community surveys conducted in June 1990 and June 1993 which were available for use in the assessment of current water quality conditions. In addition, 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 Pike River watershed.

Based upon review of the available current data, it is not possible to determine current conditions, or if any significant changes have occurred in the water quality conditions since the preparation of the initial plan.

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 Pike River watershed from 1973 through 1977. In the in-stream water quality samples for which toxic and hazardous substances were tested, levels of heptachlor epoxide, DDT, lindane and dieldrin, and persistent pesticides were exceeded in two of nine, one of nine, one of eight, and three of eight samples, respectively. Sample analyses for cadmium, chromium, copper, lead, mercury, nickel, zinc, PCBs, and DDE, DDD, aldrin,

heptachlor, and phthalate uncovered no violations of U.S. Environmental Protection Agency recommended levels.

Since the completion of the initial plan, no known water column or sediment sampling for toxic and hazardous substances in streams within the Pike River watershed has been conducted.

The Wisconsin Department of Natural Resources has documented 12 spills of toxic substances into streams within the Pike River watershed since the completion of the initial regional water quality management plan. All of these spills have occurred in the Pike River main stem, upstream of Pike Creek in Racine County.

Water Quality Assessments: Based upon the available data, the water quality and biological characteristics of the Pike River and its major tributaries were assessed with the results set forth in Table XI-8. Fish sampling and habitat evaluations were conducted by the Wisconsin Department of Natural Resources in the Pike River watershed during June of 1990. Results indicated that fish population and diversity are poor, except for Pike Creek where the population and diversity are fair. One fish kill incident has been documented in the Pike River watershed. This incident occurred in the main stem of the Pike River and its cause has not fully been determined.

Standards were not fully met for dissolved oxygen concentrations in the main stem of the Pike River both upstream and downstream of the Pike Creek confluence. Downstream of the Pike Creek confluence,and in Pike Creek, standards were not fully met for fecal coliform levels.

In general, the biotic index ratings, which are biological indicators of water quality within a stream system, were very poor to fair, except for Pike Creek which had a poor rating. High levels of streambed sedimentation were noted throughout the watershed.

Table XI-9 sets forth the water quality index classifications[4] 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. The limited data available indicate that water quality conditions have generally improved from "poor" in 1964 to "fair" in 1974-75, but no recent data were available to assess water quality conditions in 1990 and 1991.

A summary of potential pollution sources in the Pike River watershed by stream reach is shown in tabular summary in Table XI-10. 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 Pike River main stem downstream of the Pike Creek confluence. It should be noted that the majority of the documented spills of toxic substances and the majority of the permitted industrial discharges occur in the Pike River main stem in Racine County, in and around an area of industrial land uses. Data on nonpoint source pollution and additional potential impacts to surface water quality are included in Table XI-10.

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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.

Table XI-8

CHARACTERISTICS OF STREAMS IN THE PIKE RIVER WATERSHED

SUBWATERSHED Stream Reach	Stream Length (miles)	Fish Population and Diversity[a]	Recorded Fish Kills	Water Quality Problems[b]					Biotic Index Rating[c]	Streambed Sedimentation (substrate)	Physical Modifications to Channel[d]
				DO	NH_3	Total P	Fecal Coliform	Toxics			
a. Pike River upstream Pike Creek	14.2	Poor	Yes[e]	Yes	No	No	Yes	--	Very poor-fair	High (cobble, gravel, sand, clay)	Major
b. Pike River downstream Pike Creek	13.8	Poor	No	Yes	No	No	Yes	--	Very poor-fair	High (cobble, gravel, sand, clay)	Moderate
c. Pike Creek	10.5	Fair	No	No	No	No	Yes	--	Poor	High (gravel, sand, clay)	Major
TOTAL	38.5										

[a] Based upon 1990 Wisconsin Department of Natural Resources fishery survey.

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

[c] Biotic index ratings are based upon the Index of Biotic Integrity (IBI) discussed in U.S. Department of Agriculture, Forest Service, General Technical Report NC-149, "Using the Index of Biotic Integrity (IBI) To Measure Environmental Quality in Warmwater Streams of Wisconsin," Lyons, April 1992. Data provided in Wisconsin Department of Natural Resources Report A Resource Assessment for the Pike River Watershed, July 1994.

[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] Potentially related to a chemical discharge. Source unknown.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table XI-9

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATIONS OF THE PIKE RIVER WATERSHED 1964, 1974-1975, AND 1990-1991

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			
Pk-1	Poor	Fair	--
Pk-4	Fair	Fair	--
Tributary Stations			
Pk-2	Poor	Fair	--
Pk-3	Poor	Fair	--
Watershed Average	Poor	Fair	--

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

Source: SEWRPC.

Table XI-10

SUMMARY OF POTENTIAL SURFACE WATER POLLUTION SOURCES IN THE PIKE 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
	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	
Pike River upstream Pike Creek	Insignificant	Major[c]	83-chlorine 86-soap suds 89-diesel fuel 90-emulsified wax 90-76 polymers-emulsion 90-hydraulic fluid 91-isopropyl alcohol 91-light oil 92-polymer wastewaters 92-glycol ether 92-diesel fuel 92-diesel fuel	X	X	--	--	6	--	Village of Sturtevant public sewage treatment plant abandoned in 1980. St. Bonaventure Seminary private sewage treatment plant abandoned in 1979.	--
Pike River downstream Pike Creek	Significant	Moderate	--	--	X	--	--	3	--		X[d]
Pike Creek	Insignificant	Significant	--	X	X	--	--	1	--	Town of Somers Utility District No. 1 public sewage treatment plant abandoned in 1986. American Motors Corporation-Transportation Division private sewage treatment plant abandoned in 1977.	--

[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] The amount of post-1990 urban development is anticipated to increase significantly in comparison to pre-1990 urban development.

[d] Construction Erosion Control Ordinances in place

Source: Wisconsin Department of Natural Resources and SEWRPC.

Compliance with Water Use Objectives

As indicated in Chapter II, the main stem of the Pike River and Pike Creek downstream of STH 142 are recommended for warmwater sport fish and full recreational uses. The portion of the Pike Creek upstream of STH 142 has limitations for sport fish habitat and is recommended for warmwater forage fish and limited recreational use. The Bartlett Branch tributary to the Pike River is recommended for limited forage fish and limited recreational use due to its depth and channel characteristics. 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 streams in the Pike River watershed did not meet water quality standards associated with the recommended water use objectives during and prior to 1975, the base year of the initial plan. Based upon review of the water quality simulation data developed in the initial plan and the status of plan implementation, it is likely that violations of dissolved oxygen and fecal coliform standards continue to occur in most of the major streams in the watershed and the water use objectives are being partially met.

WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

Based upon the current status of plan implementation, there are no major water quality issues remaining to be evaluated and addressed specific to the Pike River watershed. There remains a need to implement the nonpoint source pollution abatement recommendations set forth herein.

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Chapter XII

ROCK 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 Rock 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 Rock 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 plan element and sludge management 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. Designated management agency responsibilities for plan implementation are presented in Chapter XVII on a regional basis.

The Rock River watershed is located in the westerly portion of the Region. The portion of the watershed contained within the Region--about 612 square miles--is only a small part of a much larger watershed. The main stem of the Rock River arises and flows outside of the Region. Seventeen tributaries of the Rock River originate in the Region. Rivers and streams in the watershed are part of the Mississippi River drainage system as the watershed lies west of the subcontinental divide. The boundaries of the basin and the principal tributaries of the Rock River are shown on Map XII-1.

Within the Southeastern Wisconsin Region, the Rock River watershed contains 38 major lakes having a surface area of 50 acres or more. These lakes are distributed within seven subwatersheds: the Ashippun River, Bark River, Oconomowoc River, Rubicon River, Scuppernong River, Turtle Creek, and Whitewater Creek subwatersheds. The major lakes in the Ashippun River subwatershed are Ashippun Lake and Druid Lake. The major lakes in the Bark River subwatershed are Bark Lake, Crooked Lake, Lake Five, Golden Lake, Hunters Lake, Lower Nashotah Lake, Lower Nemahbin Lake, Nagawicka Lake, Pretty Lake, School Section Lake, Upper Nashotah Lake, Upper Nemahbin Lake, and Waterville Pond. The major lakes in the Oconomowoc River subwatershed are Beaver Lake, Fowler Lake, Friess Lake, Lake Keesus, Lac La Belle, Lower Genesee Lake, Middle Genesee Lake, Moose Lake, North Lake, Oconomowoc Lake, Okauchee Lake, Pine Lake, and Silver Lake. The major lake in the Rubicon River subwatershed is Pike Lake and, in the Scuppernong River subwatershed, La Grange Lake. The major lakes in the Turtle Creek subwatershed are Comus Lake, Delavan Lake, and Turtle Lake. The major lakes in the Whitewater Creek subwatershed are Cravath Lake, Lake Lorraine, Rice Lake, Tripp Lake, and Whitewater Lake. Physical characteristics of the major lakes of the Rock River watershed are set forth in Table XII-1. The data indicate that major

Map XII-1

SUBWATERSHEDS IN THE ROCK RIVER WATERSHED

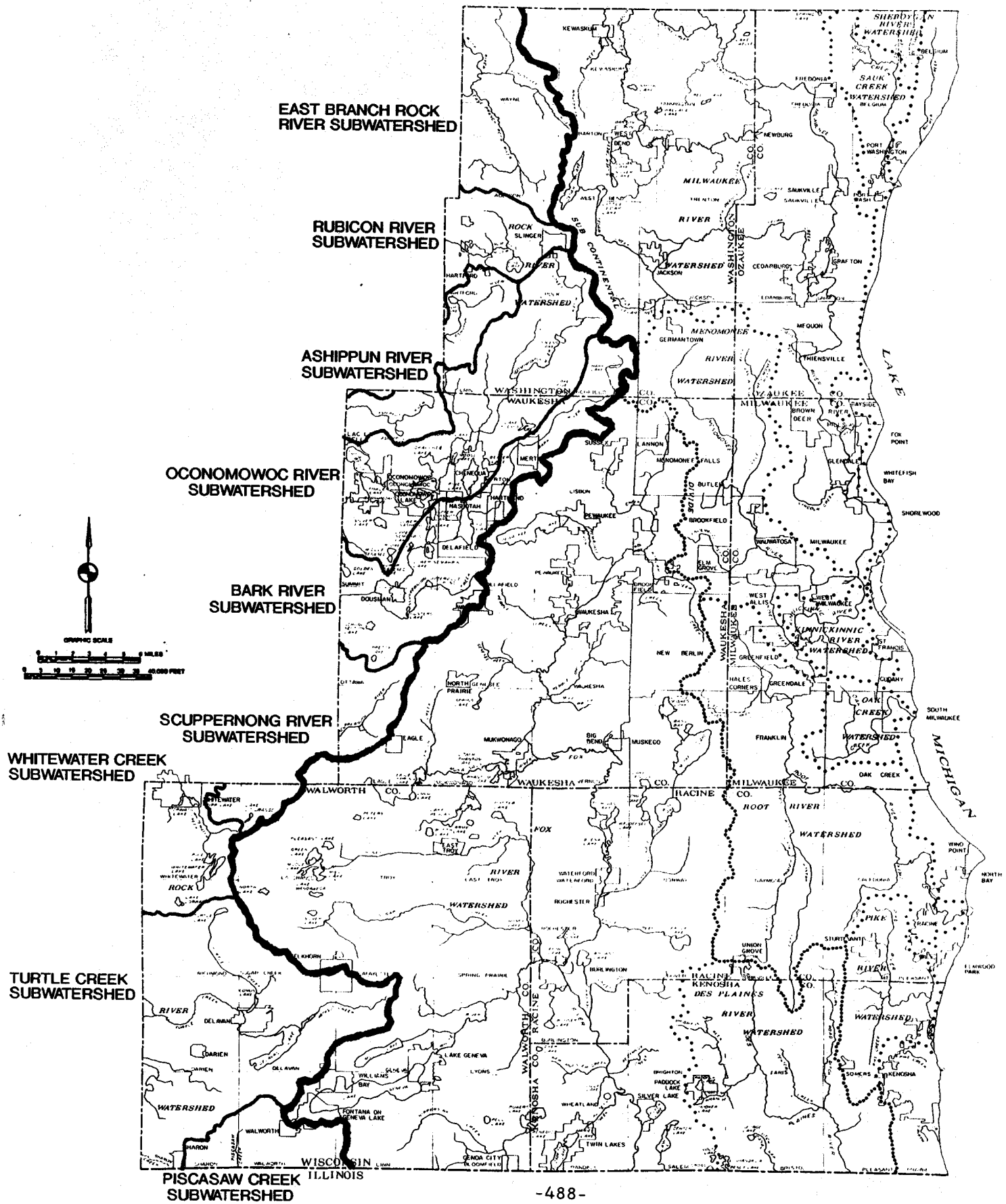


Table XII-1

PHYSICAL CHARACTERISTICS OF MAJOR LAKES IN THE ROCK RIVER WATERSHED

WATERSHED Lake Name	Surface Area (acres)	Direct Tributary Drainage Area (acres)	Shoreline (miles)	Maximum Depth (feet)	Mean Depth (feet)	Volume (acre-feet)
ROCK RIVER						
Ashippun Lake	84	347	1.5	35.0	17.1	1,436
Bark Lake	65	3,315	1.8	34	12.9	838
Beaver Lake	316	1,119	3.6	46	16	5,056
Comus Lake	117	1,107	5.1	6	5.2	608
Cravath Lake	65	546	2.5	10	2.7	176
Crooked Lake	58	794	2.3	16	7	406
Delavan Lake	2,072	12,357	10.1	56	25	51,800
Druid Lake	124	481	2.5	45	15	3,150
Lake Five	102	823	1.9	22	10.9	1,112
Fowler Lake	78	1,478	1.7	50	12.9	1,006
Friess Lake	119	843	2.3	48	26.1	3,105
Lower Genesee Lake	66	273	1.4	44	18.3	1,208
Middle Genesee Lake	102	529	1.8	38	14.4	1,469
Golden Lake	250[a]	476	3.4	44	13.8	3,450
Hunters Lake	65	1,222	1.87	36	20.0	1,300
Lake Keesus	237	2,321	5.0	42	16.7	3,958
Lac La Belle	1,117	6,447	8.7	38	11.6	12,957
La Grange Lake	55	586	1.8	4.0	2.0	110
Lake Lorraine	133	1,415	3.2	7.5	3.0	399
Moose Lake	81	553	2.3	61	28.7	2,325

Table XII-1 (cont'd)

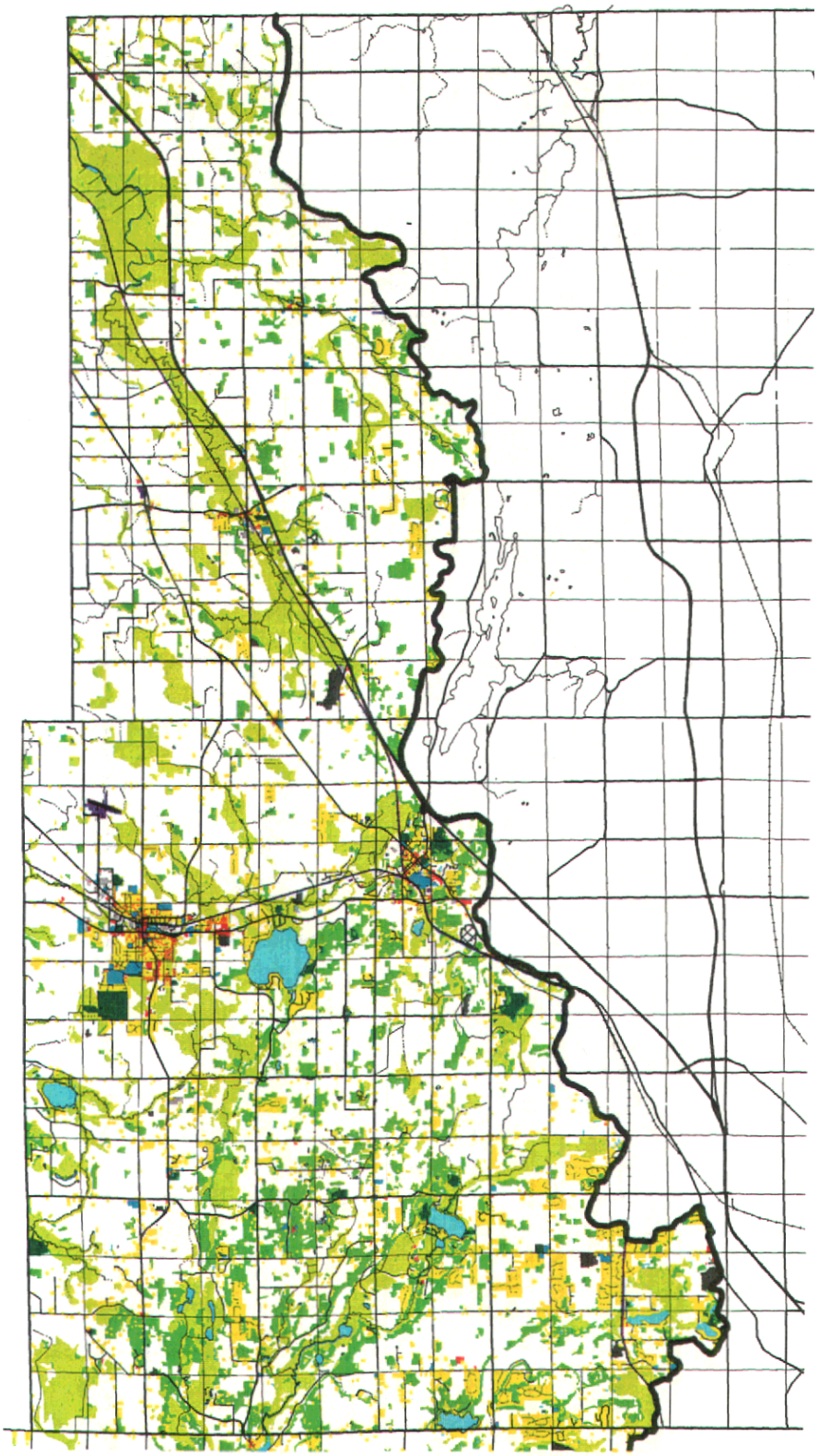
WATERSHED Lake Name	Surface Area (acres)	Direct Tributary Drainage Area (acres)	Shoreline (miles)	Maximum Depth (feet)	Mean Depth (feet)	Volume (acre-feet)
ROCK RIVER (con't)						
Nagawicka Lake	957	5,352	8.6	90	48	45,936
Lower Nashotah Lake	90	185	2.3	43	20	1,800
Upper Nashotah Lake	133	1,257	2.3	53	21	2,820
Lower Nemahbin Lake	271	595	3.3	36	10.1	2,737
Upper Nemahbin Lake	283	1,208	2.9	60	29.6	8,377
North Lake (Wauk. Co.)	437	1,648	5.3	70	40	17,480
Oconomowoc Lake	767	1,934	7.0	60	32	24,697
Okauchee Lake	1,187	4,757	15.0	90	27.5	32,642
Pike Lake	522	2,455	3.8	45	13.3	6,942
Pine Lake	703	1,528	7.3	85	38.4	26,995
Pretty Lake	64	106	1.25	31	9.2	589
Rice Lake	137	348	3.0	10	4	548
School Section Lake	125	135	1.9	8.0	2.5	312
Silver Lake (Wauk.Co.)	222	1,161	2.7	44	31.5	6,993
Tripp Lake	115	554	2.9	8	3.3	380
Turtle Lake	140	748	2.3	35	14.4	2,016
Waterville Pond	68	1,357	1.87	12.0	4.0	274
Whitewater Lake	640	3,735	9.8	38.0	7.8	5,003
TOTAL	12,167	66,095	148.29	-----	-----	282,410

[a]Includes 52 acres in Jefferson County.

Source: SEWRPC

MAP XII–2
LAND USES IN THE ROCK RIVER WATERSHED: 1990

WASHINGTON COUNTY



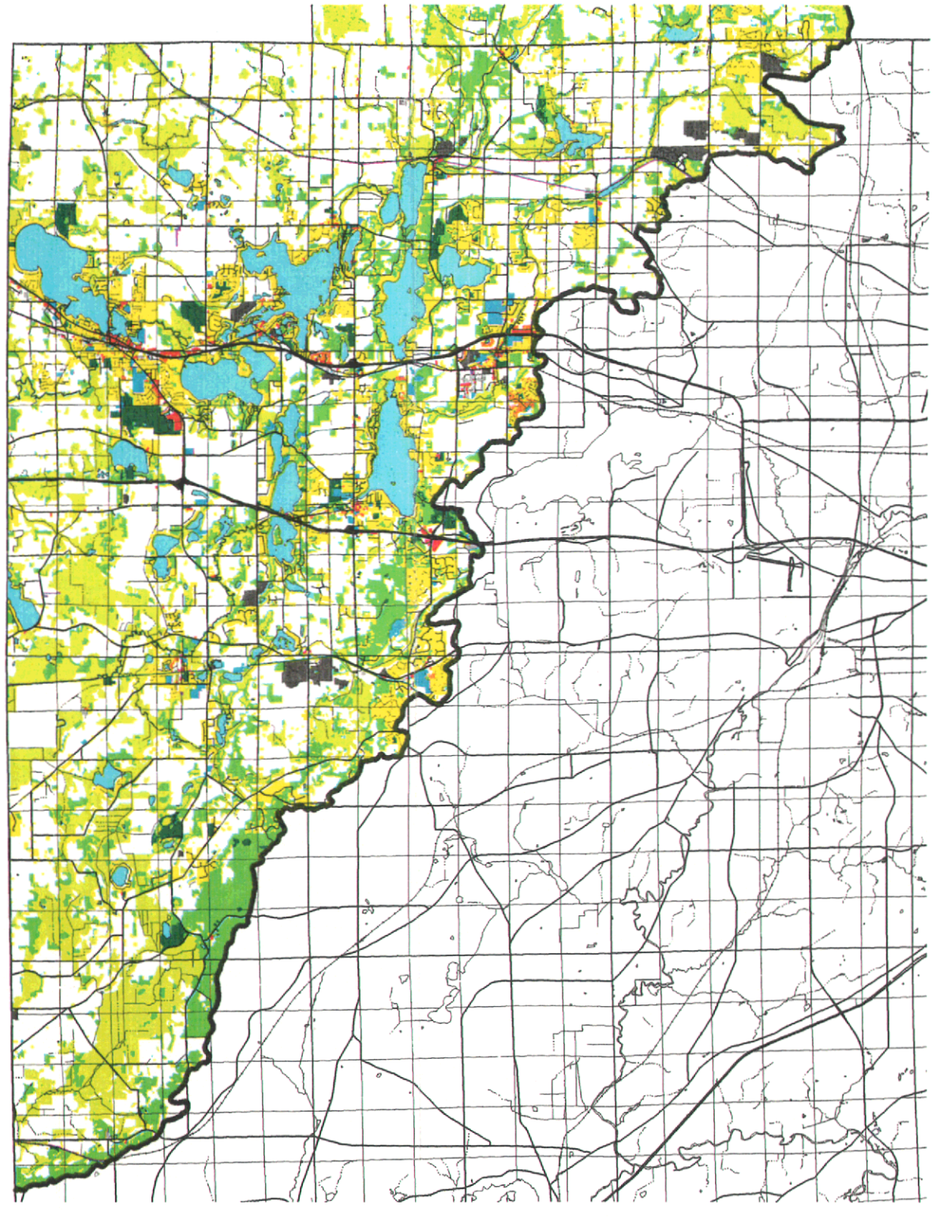
–LEGEND–

- 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

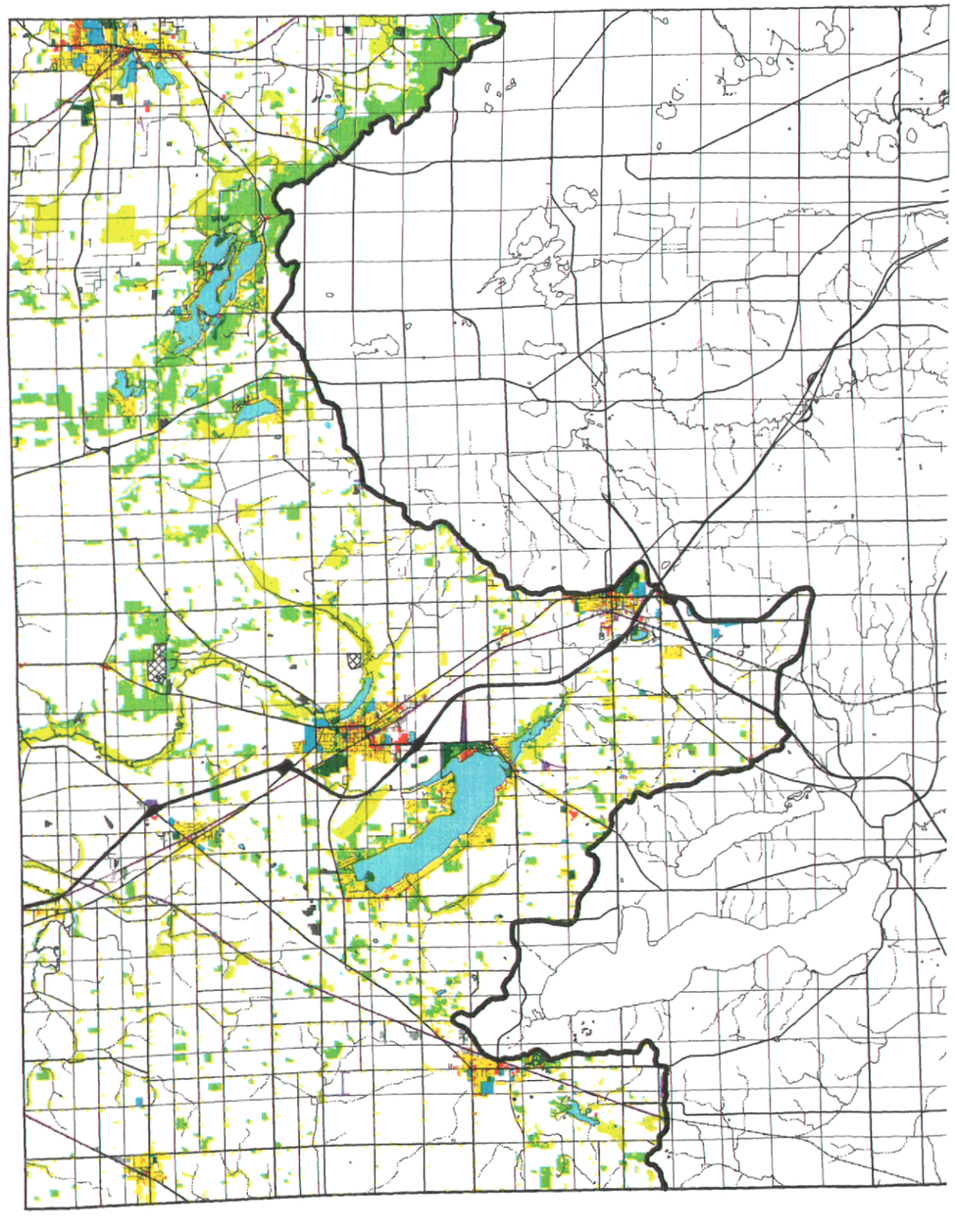
The Rock River watershed is about 612 square miles in areal extent, or about 23 percent of the total Region. In 1990, about 78 square miles, or about 13 percent of the watershed, is in urban land uses.

Source: SEWRPC

MAP XII–2 continued



WAUKESHA COUNTY



WALWORTH COUNTY

Source: SEWRPC

The Wisconsin Department of Natural Resources has prepared two basin plans which have included consideration of the portion of the Rock River in Southeastern Wisconsin as part of plans for the entire Lower Rock River Basin[1] and the Upper Rock River Basin.[2] The study area for these two planning efforts extends to the entire Rock River basin. The preparation of these two plans was coordinated with the preparation of this plan update and it is intended that this plan update refine and update the information regarding the portion of the watershed in Southeastern Wisconsin set forth in these earlier documents.

LAND USE PLAN ELEMENT

The land use plan element of the initial plan, the status of the initial plan recommendation, 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 uses which have occurred within the Rock 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 is presented for the watershed in order to permit consideration of the relationship of the changes in land use to 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 in stormwater, such as metals and chlorides, is also expected to increase with urbanization.

Table XII-2 summarizes the existing land uses in the watershed in 1990 and indicates the changes in such land uses since 1975. Although the watershed contains a number of urbanized areas, 87 percent of the watershed was still in rural and other open space land uses in 1990. These rural uses included about 60 percent of the total watershed area in agricultural and related rural uses, about 8 percent in woodlands, about 15 percent in surface water and wetlands, and about 4 percent in other open lands. The remaining 13 percent of the total watershed was devoted to urban uses. Existing land uses for 1990 in the Rock River watershed are shown in graphic summary on Map XII-2.

Within the Rock River watershed, urban development has occurred in portions of all three counties, with the majority of new development taking place in Waukesha County concentrated in the Village of Oconomowoc south and east of Lac La Belle. Other urban-related land use is generally located around the larger lakes in the northwest portion of the Waukesha County, including Lac La Belle, Oconomowoc, Okauchee, Nagawicka, Beaver, Upper and Lower Nemahbin Lakes, and Upper and Lower Nashotah Lakes. In the portion of Walworth County contained within the watershed, urban-related development is located in and around the Cities of Delavan, Elkhorn, and Whitewater, as well as additional urban develop-

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[1]Wisconsin Department of Natural Resources, Publication No. WR 280-91, Lower Rock River Basin, Water Quality Management Plan, November 1991.

[2]Wisconsin Department of Natural Resources, Publication No. WR 190-88, Upper Rock River Basin, Areawide Water Quality Management Plan, May 1989.

ment around Delavan Lake. In Washington County, urban development has occurred primarily in and around the City of Hartford and the Village of Slinger and in the Town of Richfield.

As shown in Table XII-2, from 1975 to 1990, urban land uses in the watershed increased from about 40,100 acres, or about 63 square miles to about 50,000 acres, or about 78 square miles, or by about 25 percent. As shown in Table XII-2, residential land represents the largest urban land use in the watershed. Residential use has significantly increased within the watershed, from about 19,100 acres, or about 30 square miles in 1975 to about 26,500 acres, or about 41 square miles in 1990, a 39 percent increase, with commercial and industrial lands increasing from about 1,300 acres, or about 2.1 square miles to about 1,800 acres, or about 2.8 square miles, an increase of 38 percent.

The 78 square miles of urban land uses in the watershed as of 1990 approximate the planned level of about 80 square miles for the year 1990 stage of the year 2000 planned conditions set forth in the adopted regional water quality management plan. The current status of development in the Rock River watershed and in adjacent portions of Washington, Waukesha, and Walworth Counties was considered in developing the new year 2010 land use plan element described in Chapter III for the Region.

Table XII-3 summarizes the year 2010 planned land use conditions recommended in the adopted year 2010 land use plan in the Rock 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 within and around the Cities of Delavan, Whitewater and Elkhorn, in the Village of Darien in Walworth County, within and around the City of Hartford and Village of Slinger in Washington County. The adopted year 2010 land use plan also proposes the addition of a major industrial center to be located within or near the City of Hartford. Additional urban uses within the watershed are expected to increase within and around the Cities of Delafield and Oconomowoc and the Village of Hartland. Commercial, industrial, and residential urban development is also anticipated to increase along the IH-94 corridor in Waukesha County.

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 Rock River watershed, as indicated in Table XII-3, is projected to increase from the 1990 total of about 78 square miles, or about 13 percent of the total area of the watershed, to about 85 square miles, or about 14 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 104.6 square miles, or about 17 percent of the total watershed by year 2010. It is important to note that the 83 to 86 percent of the watershed remaining in rural use is partly comprised of primary environmental corridor lands consisting of the best remaining natural resource features 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 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 large 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 534 square miles in 1990 to about 527 square miles in

Table XII-3

EXISTING AND PLANNED LAND USE IN THE ROCK 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.....	26,481	6.0	28,311	7.2	1,830	6.9	36,401	9.3	9,920	37.5
Commercial.....	824	0.2	822	0.2	- 2	- 0.2	998	0.3	174	21.1
Industrial.....	1,002	0.3	1,692	0.4	690	68.9	2,594	0.7	1,592	158.9
Transportation, Communication, and Utilities[b] ...	16,691	4.3	17,973	4.6	1,282	7.7	20,892	5.3	4,201	25.2
Governmental and Institutional.....	1,793	0.5	1,868	0.5	75	4.2	2,088	0.5	295	16.5
Recreational	3,173	0.8	3,582	0.9	409	12.9	3,965	1.0	792	25.0
Subtotal	49,964	12.8	54,248	13.9	4,284	8.6	66,938	17.1	16,974	34.0
Rural										
Agricultural and Related.....	234,053	59.8	236,022	60.3	1,969	0.8	224,698	57.4	- 9,355	- 4.0
Lakes, Rivers, Streams, and Wetlands.....	58,919	15.1	58,861	15.0	- 58	- 0.1	58,861	15.0	- 58	- 0.1
Woodlands.....	32,957	8.4	32,068	8.2	- 889	- 2.7	31,976	8.2	- 981	- 3.0
Open Lands,[c] Landfills, Dumps, and Extractive.....	15,514	4.0	10,208	2.6	- 5,306	- 34.2	8,934	2.3	- 6,580	- 42.4
Subtotal	341,443	87.2	337,159	86.1	- 4,284	- 1.3	324,469	82.9	- 16,974	- 5.0
Total	391,407	100.0	391,407	100.0	0	--	391,407	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.

the year 2010 under the intermediate growth-centralized land use plan and to about 507 square miles under the high growth-decentralized land use plan, decreases of about 1 to 5 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 Rock River watershed--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 areas located in the watershed.

Public and Private Wastewater Treatment Systems and Sewer Services Areas Existing Conditions and Status of Plan Implementation: In 1975, there were twelve public sewage treatment facilities located in the Rock River watershed, as shown on Map XII-3. The City of Delavan plant discharged directly to Turtle Creek; the Village of Sharon plant discharged to Little Turtle Creek; the Village of Darien plant discharged to a tributary of Darien Creek; the City of Elkhorn plant discharged to a tributary of Jackson Creek; the two plants serving the Villages of Dousman and Hartland discharged to the Bark River; the City of Whitewater plant discharged to Whitewater Creek; the City of Hartford plant discharged to the Rubicon River while the Village of Slinger plant discharged indirectly to the Rubicon River; the Allenton Sanitary District plant discharged to the East Branch of the Rock River; the City of Oconomowoc plant discharged to the Oconomowoc River; and the Village of Walworth plant discharged to a tributary of Piscasaw Creek. Of these 12 plants, the plants operated by the Cities of Delavan and Elkhorn and the Villages of Hartland and Walworth 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 Rock River watershed, as recommended in the initial regional water quality management plan, is shown in Table XII-4.

As can be seen by review of Table XII-4, full implementation of the initial plan would provide for the upgrading and expansion, as needed, of four plants: the Village of Sharon, Village of Darien,[3] Village of Dousman, and Allenton Sanitary District No. 1 sewage treatment plants. Implementation of these recommendations has been largely completed. The initial plan also included recommendations for the upgrading of the City of Hartford plant and the construction of seven new plants, six of which have been constructed. Facility planning to

[3]Based upon a September 1994 amendment, the Village of Darien sewage treatment plant is recommended to be abandoned and the Village's sewerage system is recommended to be connected to the WalCoMet sewerage system for sewage treatment purposes.

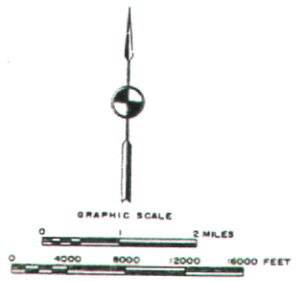
Map XII-3

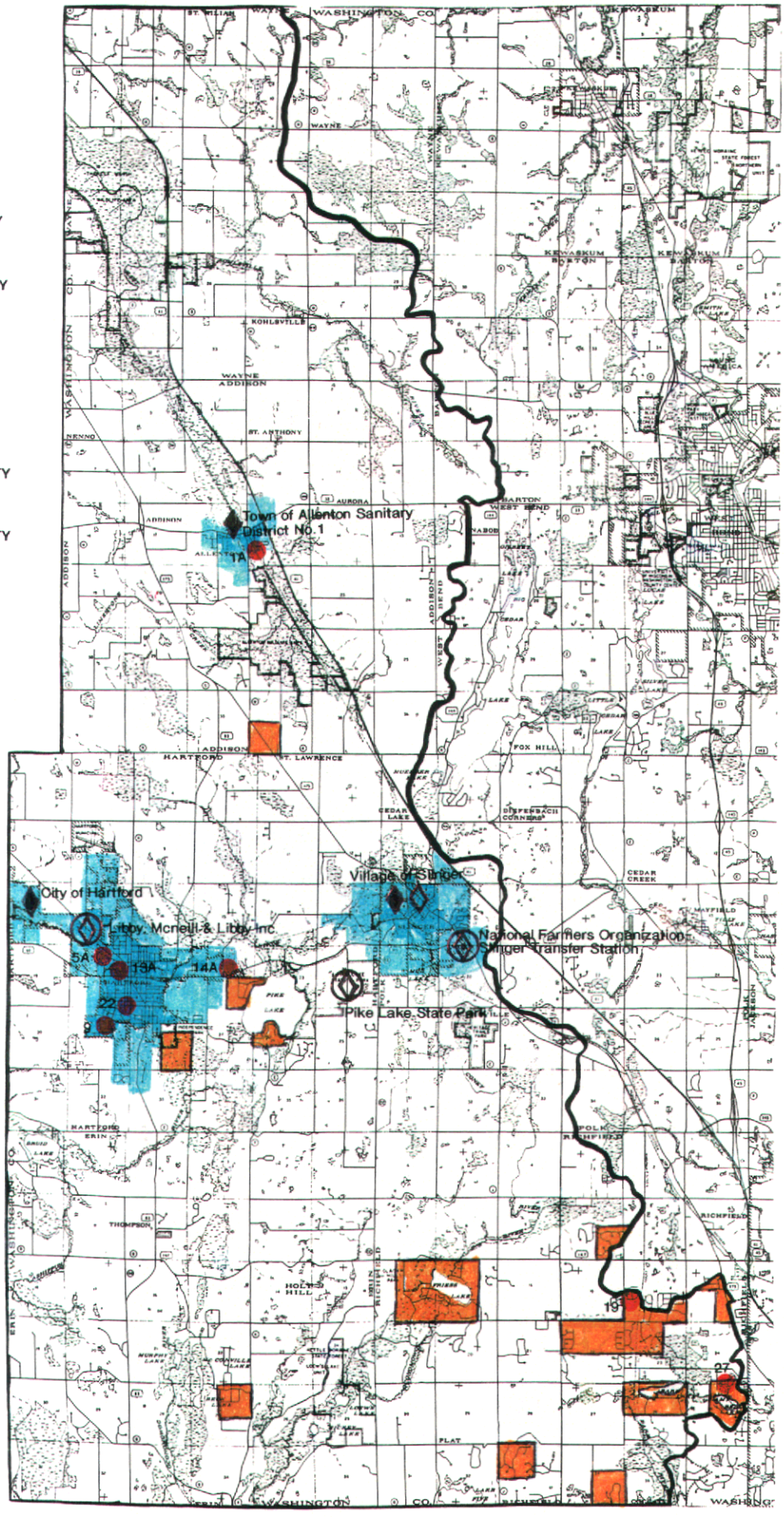
SEWER SERVICE AREAS, SEWAGE TREATMENT PLANTS AND OTHER POINT SOURCES OF POLLUTION IN THE ROCK RIVER WATERSHED: 1990

LEGEND

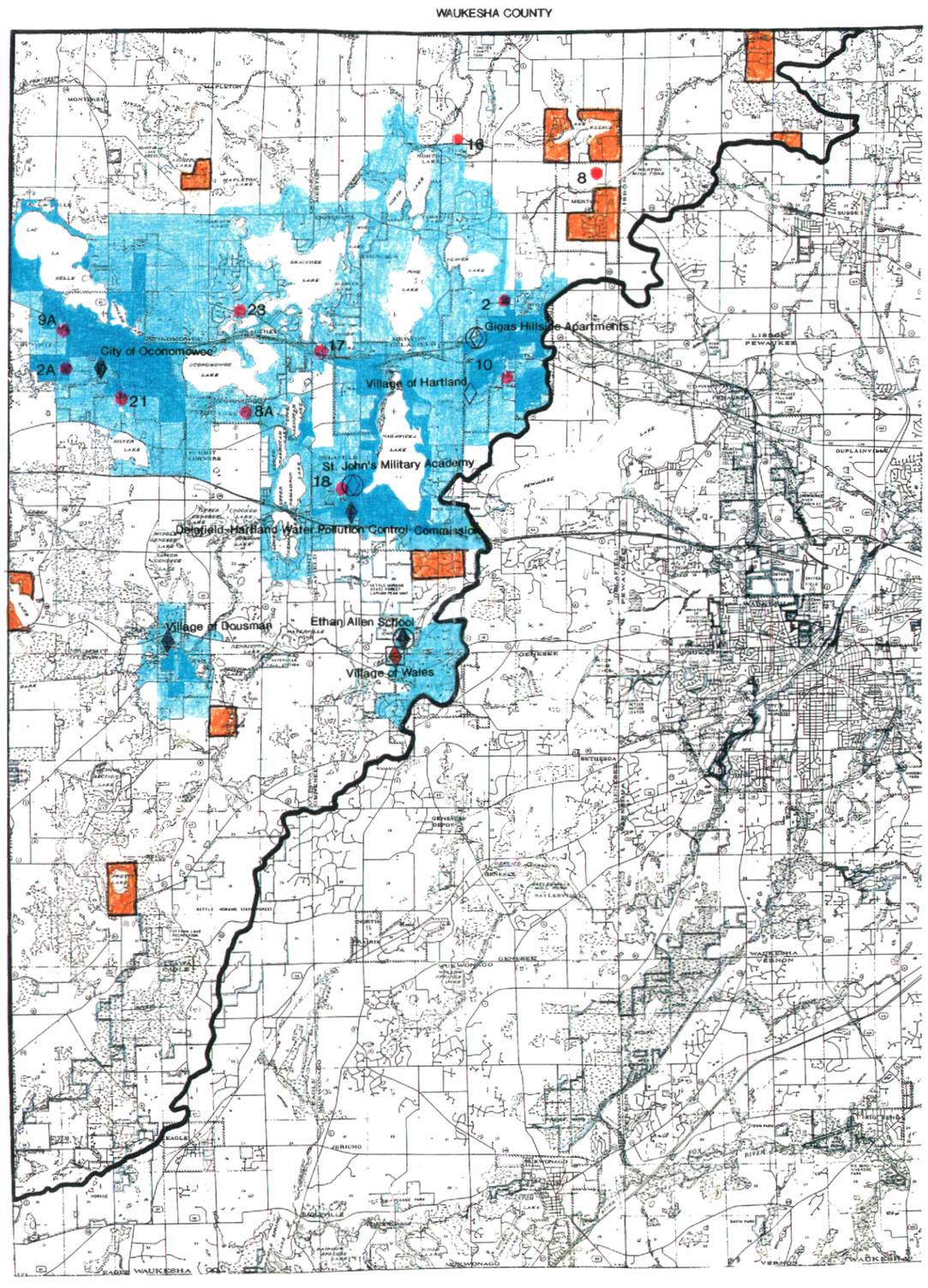
- SANITARY SEWER SERVICE AREA (EXISTING)
- SANITARY SEWER SERVICE AREA (PLANNED)
- EXISTING PUBLIC SEWAGE TREATMENT FACILITY TO BE RETAINED
- EXISTING PUBLIC SEWAGE TREATMENT FACILITY TO BE ABANDONED
- PUBLIC SEWAGE TREATMENT FACILITY ABANDONED AFTER 1975
- PROPOSED NEW PUBLIC SEWAGE TREATMENT FACILITY
- EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE RETAINED
- EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE ABANDONED
- PRIVATE SEWAGE TREATMENT FACILITY ABANDONED AFTER 1975
- POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES
- LEAKING UNDERGROUND STORAGE TANKS DISCHARGING REMEDIATION WASTEWATER TO SURFACE WATERS OR GROUND WATER
- ADDITIONAL GROUNDWATER CONTAMINATION SITES DISCHARGING REMEDIATION WASTEWATER TO SURFACE WATERS OR GROUNDWATER
- 1975 URBAN DENSITY DEVELOPMENT OUTSIDE OF THE INITIAL PLAN SEWER SERVICE AREA

Source: SEWRPC.





Map XII-3 Continued



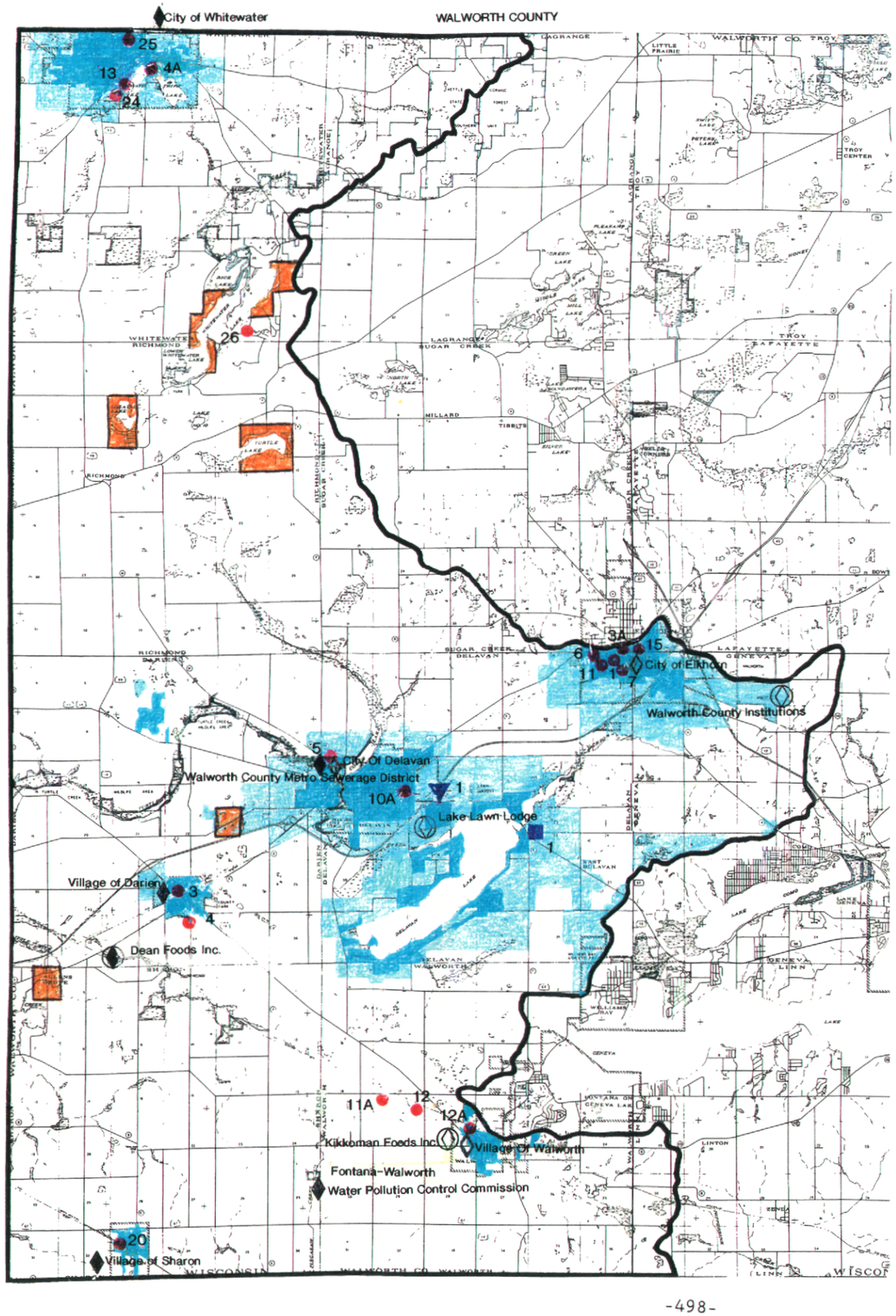


Table XII-4

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

Public Sewage Treatment Plants	Disposal of Effluent	Plan Recommendation	Implementation Status
Allenton Sanitary District No. 1	Rock River - East Branch	Upgrade and expand	Completed (1987)
Village of Darien	Tributary of Darien Creek	Upgrade and expand[a]	Local facility plan completed (1988)
Delafield-Hartland Water Pollution Control Commission	Bark River	Construct new plant	Plant in operation (1980)
Village of Dousman	Bark River	Upgrade and expand	Completed (1983)
Fontana-Walworth Water Pollution Control Commission	Tributary of Piscasaw Creek	Construct new plant	Plant in operation (1986)
City of Hartford	Rubicon River	Upgrade	Facility plan underway
City of Oconomowoc	Oconomowoc River	Construct new plant	Plant in operation (1976)
Village of Sharon	Little Turtle Creek	Upgrade and expand	Completed (1984)
Village of Slinger	Rubicon River	Construct new plant	Plant in operation (1981)
Village of Wales	Soil Absorption	Construct new plant	No action
Walworth County Metropolitan Sewerage District	Turtle Creek	Construct new plant	Plant in operation (1981)
City of Whitewater	Whitewater Creek	Construct new plant	Plant in operation (1982)
City of Delavan	Turtle Creek	Abandon plant-connection to new WalCoMet plant	Plant abandoned (1981)
City of Elkhorn	Tributary of Jackson Creek	Abandon plant-connection to new WalCoMet plant	Plant abandoned
Village of Hartland	Bark River	Abandon plant-connection to Delafield-Hartland plant	Plant abandoned (1980)
Village of Walworth	Tributary of Piscasaw Creek	Abandon plant-connection to new Fontana-Walworth plant	Plant abandoned (1986)
Private Sewage Treatment Plants			
Ethan Allen School	Soil Absorption	Maintain and upgrade as needed	Plant maintained
Libby, McNeill, & Libby, Inc. (Washington County)	Soil Absorption	Maintain and upgrade as needed	Not in operation
Dean Foods, Inc.[d]	Soil Absorption	Maintain and upgrade as needed	Plant maintained
Walworth County Correctional Center	Soil Absorption	Maintain and upgrade as needed	Not in operation
Gigas Hillside Apartments	Soil Absorption	Abandon plant	Plant abandoned (1980)
Kikkoman Foods, Inc.	Soil Absorption	Abandon plant	Plant abandoned
Lake Lawn Lodge	Delavan Lake	Abandon plant	Plant abandoned (1982)
National Farmers Organization-Slinger Transfer Station	Soil Absorption	Abandon plant	No action
Pike Lake State Park	Soil Absorption	Abandon plant[b]	Plant abandoned (1990)
St. John's Military Academy	Bark River and Soil Absorption	Abandon plant	Plant abandoned (1980)
Walworth County Institutions[c]	Jackson Creek	Abandon plant	Plant abandoned (1981)

[a] Based upon a September 1994 amendment, the Village of Darien sewage treatment plant is recommended to be abandoned and connected to the WalCoMet sewerage system.

[b] The Pike Lake State Park sewage treatment plant was recommended to be abandoned in the initial plan. A 1988 amendment to the regional water quality management plan recommended that the plant be abandoned and the park connected to the City of Hartford sewerage system.

[c] Formerly Lakeland Nursing Home.

[d] Formerly Libby, McNeill, & Libby, Inc. (Walworth County)

Source: SEWRPC

upgrade the City of Hartford plant has been completed. No action has been taken with regard to the construction of the plant for the Village of Wales. The plants in the watershed have not fully provided facilities to specifically reduce the phosphorus concentrations in plant effluent 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 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 plants currently existing in the watershed are given in Table XII-5 and their locations are shown on Map XII-3.

In addition to the publicly owned sewage treatment facilities, 11 private wastewater treatment plants were in existence in 1975 in the Rock River watershed. These plants served the following land uses: Kikkoman Foods, Inc., Lakeland Nursing Home (currently Walworth County Institutions), Lake Lawn Lodge, Libby, McNeill and Libby, Inc., and Walworth County Correction Center in Walworth County; Libby, McNeill and Libby, Inc. (currently Dean Foods, Inc.), National Farmers Organization-Slinger Transfer Station, Pike Lake State Park in Washington County; and Ethan Allen School, Gigas Hillside Apartments, and St. John's Military Academy in Waukesha County.

As indicated in Table XII-4, seven of the eleven private sewage treatment plants in the watershed were recommended to be abandoned in the initial plan as amended. As of 1990, six of these plants have been abandoned. No action has been taken with regard to the abandonment of the National Farmers Organization-Slinger Transfer Station facility. The remaining four 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) permitting process. With the exception of Walworth County Correctional Center and the Libby, McNeill & Libby Hartford plant, which have ceased operation, the plants are continuing to operate in this manner.

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 Rock 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 Wisconsin 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

Table XII-5

SELECTED CHARACTERISTICS OF EXISTING PUBLIC SEWAGE TREATMENT PLANTS IN THE ROCK WATERSHED

Name of Public Sewage Treatment Plants	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
Allenton Sanitary District No. 1	0.2	800	1961, 1987	Activated sludge, clarification, chlorination, dechlorination	Rock River-East Branch	3/31/94
Village of Darien	0.6	1,200	1969	Activated sludge-contact stabilization, clarification, seepage lagoon-holding pond	Soil absorption and tributary of Darien Creek	3/31/94
Delafield-Hartland Water Pollution Control Commission	4.1	10,200	1980	Rotating biological contact process, clarification, sand filtration, chlorination, nitrification, post aeration	Bark River	3/31/97
Village of Dousman	0.5	1,300	1961, 1972, 1983	Oxidation ditch, clarification, micro screen filtration, chlorination	Bark River	3/31/2000
Fontana-Walworth Water Pollution Control Commission	2.5	3,500	1986	Oxidation ditch, clarification, chlorination, dechlorination, holding pond	Piscasaw Creek	6/30/96
City of Hartford	2.1	8,200	1973	Activated sludge, clarification, phosphorus removal, polishing pond, micro screen filtration, chlorination	Rubicon River	9/30/98
City of Oconomowoc	5.5	11,500	1936, 1976	Clarification, activated sludge, clarification, sand filtration, aeration basins, chlorination	Oconomowoc River	6/30/97
Village of Sharon	0.5	1,300	1959, 1984	Activated sludge contact stabilization, clarification	Little Turtle Creek	3/31/99
Village of Slinger	1.2	2,300	1950, 1981	Oxidation ditch, clarification, chlorination	Rubicon River	9/30/98
Walworth County Metropolitan Sewerage District	6.8	19,100	1981	Clarification, trickling filter, clarification, nitrification aeration basin, activated sludge, clarification, post aeration, sand filter, chlorination	Turtle Creek	6/30/97
City of Whitewater	2.3	12,600	1937, 1956, 1968, 1982	Rotating biological contactor, clarification, polishing lagoons, sand filter, chlorination	Whitewater Creek	12/30/98

Table XII-5 (continued)

Name of Public Sewage Treatment Plants	Hydraulic Loading[b] (mg/d)				BOD5 Loading[b] (pounds/day)				Suspended Solids Loading[b] (pounds/day)			
	Existing				Existing				Existing			
	Average Annual	Maximum Monthly Average	Design Average Annual	Number of Months in 1990 in which the Monthly Average Flow Exceeded the Design Capacity	Average Annual	Maximum Monthly Average	Design Average Annual	Number of Months in 1990 in which the Monthly Average Flow Exceeded the Design Capacity	Average Annual	Maximum Monthly Average	Design Average Annual	Number of Months in 1990 in which the Monthly Average Flow Exceeded the Design Capacity
Allenton Sanitary District No. 1	0.15	0.18	0.36	--	295	354	390	--	240	296	--	--
Village of Darien	0.11	0.14	0.15	--	167	275	255	1	151	374	--	--
Delafield-Hartland Water Pollution Control Commission	1.39	1.50	2.20	--	2,252	2,466	3,740	--	2,456	2,779	4,590	--
Village of Dousman	0.22	0.26	0.35	--	317	352	584	--	228	283	730	--
Fontana-Walworth Water Pollution Control Commission	1.02	1.27	1.71	--	1,104	1,305	2,620	--	1,594	1,906	--	--
City of Hartford	1.46	1.87	2.00	--	2,449	3,050	10,000	--	1,891	3,109	--	--
City of Oconomowoc	2.33	2.74	4.00	--	3,930	5,164	8,340	--	2,517	2,929	6,672	--
Village of Sharon	0.16	0.32	0.26	2	244	547	360	2	246	555	--	--
Village of Slinger	0.33	0.45	0.76	--	419	698	1,268	--	660	1,311	1,585	--
Walworth County Metropolitan Sewerage District	2.92	3.68	3.60	1	3,107	3,776	6,260	--	3,283	3,826	6,515	--
City of Whitewater	1.43	1.66	3.65	--	5,644	7,132	11,500	--	2,845	3,886	10,800	--

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

Source: Wisconsin Department of Natural Resources and SEWRPC.

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. There were 24 sewer service areas identified in, or partially in, the Rock River watershed--Allenton, Hartford, Slinger, Oconomowoc-Lac La Belle, Oconomowoc Lake, Okauchee Lake, North Lake, Pine Lake, Beaver Lake, Hartland, Delafield-Nashotah, Nashotah-Nemahbin Lakes, Silver Lake, Dousman, Wales, Williams Bay, Whitewater, Elkhorn, Delavan, Delavan Lake, Darien, Fontana, Walworth, Sharon and Walworth County Institutions. Currently, many of these areas have undergone refinements as recommended. North Lake, Okauchee Lake, Beaver Lake, Pine Lake, Oconomowoc Lake, Wales, Fontana, Walworth, and Sharon sewer service areas have currently not been refined. The boundaries of the sewer service areas as refined through 1993 are shown on Map XII-3. Table XII-6 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 area in the Rock River watershed, as refined through 1993, totals about 90 square miles, or about 15 percent of the total watershed area, as shown in Table XII-6.

Current Plan Recommendations: The current point source plan element recommendations provide for the continued operation with expansion and upgrading, as necessary, of the Allenton Sanitary District No. 1, Village of Dousman, City of Hartford, and Village of Sharon sewage treatment plants, as well as the construction of a plant for the Village of Wales. This same recommendation applies to the plants constructed since the initial plan in accordance with the plan recommendations, including the Delafield-Hartland Water Pollution Control Commission, Fontana-Walworth Water Pollution Control Commission, City of Oconomowoc, Village of Slinger, Walworth County Metropolitan Sewerage District, and the City of Whitewater sewage treatment plants. Estimated approximate dates for beginning facility planning for the expansion and upgrading of existing sewage treatment plants are indicated in Table XII-7. This recommendation regarding plant facility upgrading and expansion as needed, also applies to the treatment plant solids management element for the 11 public sewage treatment plants recommended to be retained.

The current point source pollution abatement plan element, including the planned sewer service areas, is summarized on Map XII-4. Table XII-7 presents selected design data for the 11 public sewage treatment plants which are recommended to be maintained in the Rock River watershed and for one new sewage treatment plant. It is important to note that two of these plants recorded monthly average flows during 1990 which equaled or exceeded the average design capacities of the plants, as shown in Table XII-5. The WalCoMet sewage treatment plant is, as of 1994, under construction to expand its capacity.

Table XII-7 shows expected increases in sewered populations and attendant increases in sewage hydraulic loading rates for two different year 2010 growth scenarios for the 11 public sewage treatment plants in the Rock River watershed. Under the intermediate growth-centralized land use plan, two plants are anticipated to have loading rates equal to or higher than the average annual design

Table XII-6

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

Name of Initially Defined Sanitary Sewer Service Area	Planned Sewer Service Area (square miles)	Name of Refined and Detailed Sanitary Sewer Service Area	Date of SEWRPC Adoption of Plan Amendment	Plan Amendment Document
Refined Sanitary Sewer Services Areas				
Allenton	0.8	Allenton	March 11, 1985	SEWRPC CAPR No. 103, Sanitary Sewer Service Area for the Allenton Area, Washington County, Wisconsin
Darien	1.2	Darien	September 23, 1992	SEWRPC CAPR No. 123, 2nd Edition, Sanitary Sewer Service Area for the Village of Darien, Walworth County, Wisconsin
Delafield-Nashotah Nashotah-Nemahbin Lakes	13.8	Delafield-Nashotah	January 18, 1993	SEWRPC CAPR No. 127, Sanitary Sewer Service Area for the City of Delafield and the Village of Nashotah and Environs,Waukesha County, Wisconsin
Delavan Delavan Lake Elkhorn Walworth County Institutions Lake Como Williams Bay --	27.8	Delavan-Delavan Lake Elkhorn Lake Como Williams Bay Geneva National-Interlaken	December 4, 1991	SEWRPC CAPR No. 56, 2nd Edition, Sanitary Sewer Service Area for the Walworth County Metropolitan Sewerage District, Walworth County, Wisconsin
Dousman	2.4	Dousman	December 5, 1990	SEWRPC CAPR No. 192, Sanitary Sewer Service Area for the Village of Dousman, Waukesha County, Wisconsin
Hartford	10.5[a]	Hartford	June 21, 1984	SEWRPC CAPR No. 92, Sanitary Sewer Service Area for the City of Hartford, Washington County, Wisconsin
Hartland	4.5	Hartland	June 17, 1985	SEWRPC CAPR No. 93, Sanitary Sewer Service Area for the Village of Hartland, Waukesha County, Wisconsin
Oconomowoc-Lac La Belle Silver Lake	16.7	Oconomowoc	March 6, 1989	SEWRPC CAPR No. 172, Sanitary Sewer Service Area for the City of Oconomowoc and Environs, Waukesha County, Wisconsin

Table XII-6 (continued)

Name of Initially Defined Sanitary Sewer Service Area	Planned Sewer Service Area (square miles)	Name of Refined and Detailed Sanitary Sewer Service Area	Date of SEWRPC Adoption of Plan Amendment	Plan Amendment Document
Pewaukee	0.4	Pewaukee	June 17, 1985	SEWRPC CAPR No. 113, Sanitary Sewer Service Area for the Town of Pewaukee Sanitary District No. 3, Lake Pewaukee Sanitary District, and Village of Pewaukee, Waukesha County, Wisconsin
Slinger	3.6	Slinger	December 2, 1985	SEWRPC CAPR No. 128, 2nd Edition, Sanitary Sewer Service Area for the Village of Slinger, Washington County, Wisconsin
Whitewater	8.3[b]	Whitewater	September 14, 1987	SEWRPC CAPR No. 94, Sanitary Sewer Service Area for the City of Whitewater, Walworth County, Wisconsin
Subtotal	90.0			
Unrefined Sanitary Sewer Service Areas				
Beaver Lake	2.5	--	--	--
Fontana	0.2	--	--	--
North Lake	1.2	--	--	--
Oconomowoc Lake	1.5	--	--	--
Okauchee Lake	4.8	--	--	--
Pine Lake	1.2	--	--	--
Sharon	1.2	--	--	--
Wales	1.5	--	--	--
Walworth	1.5	--	--	--
Subtotal	15.6			
Total	105.6			

[a] Includes 1.3 square miles in Dodge County.

[b] Indludes 2.2 square miles in Jefferson County.

Note: CAPR - Community Assistance Planning Report

Source: SEWRPC.

Table XII-7

SELECTED DESIGN DATA FOR PUBLIC SEWAGE TREATMENT PLANTS IN THE ROCK 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]
Allenton Sanitary District No. 1	Allenton	0.36	0.15	0.2	800	0.8	1,200	0.20	>2010	2,400	0.36	2000
Delafield-Hartland Water Pollution Control Commission	Delafield, Nashotah, Hartland	2.20	1.39	4.1	10,200	19.1	18,200	2.40	1998	28,500	3.70	1997
Village of Dousman	Dousman	0.35	0.22	0.5	1,300	2.4	3,100	0.44	1997	5,600	0.76	1995
Fontana-Walworth Water Pollution Control Commission	Fontana, Walworth	1.71	1.02	2.5	3,500	6.3	4,600	1.16	2000	7,400	1.51	1997
City of Hartford	Hartford	2.00	1.46	2.1	8,200	10.5	12,400	2.00	1995	24,000	3.44	1995
City of Oconomowoc	Oconomowoc, Oconomowoc Lake, Okauchee Lake, Beaver Lake, North Lake, Pine Lake	4.00	2.33	5.5	11,500	27.9	23,600	3.84	2010	42,000	6.14	2000
Village of Sharon	Sharon	0.26	0.16	0.5	1,300	1.2	1,800	0.23	1997	2,900	0.37	1996
Village of Slinger	Slinger (Proposed Plant[b])	0.76	0.33	1.2	2,300	3.6	2,700	0.38	2000	4,400	0.60	2000
Village of Wales	Wales	--	--	--	--	2.8	3,600	0.45	--	7,900	0.98	--
Walworth County Metropolitan Sewerage District	Delavan, Delavan Lake, Elkhorn, Lake Como, Geneva National, Williams Bay	5.60[c]	2.92	6.8	19,100	43.8[d]	24,200[d]	3.53[d]	2010	46,400[d]	6.33[d]	2003
City of Whitewater	Whitewater	3.65	1.43	2.3	12,600[e]	8.3	13,100[e]	1.50	2000	21,600[e]	2.56	2000

[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 and monthly design flows compared to average expected annual and maximum monthly flows and the age of facilities based upon data of last major construction.

[b] Alterantive 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.

[c] As of 1994, WalCoMet sewage treatment plant was undergoing expansion and upgrading which will provide a capacity of 5.60 mgd.

[d] Including Village of Darien sewer service area.

[e] Includes portion of Whitewater sewer service area in Jefferson County.

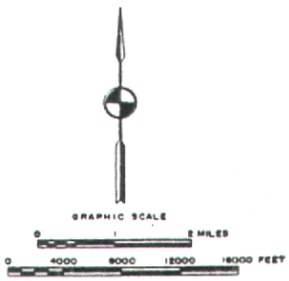
Source: SEWRPC.

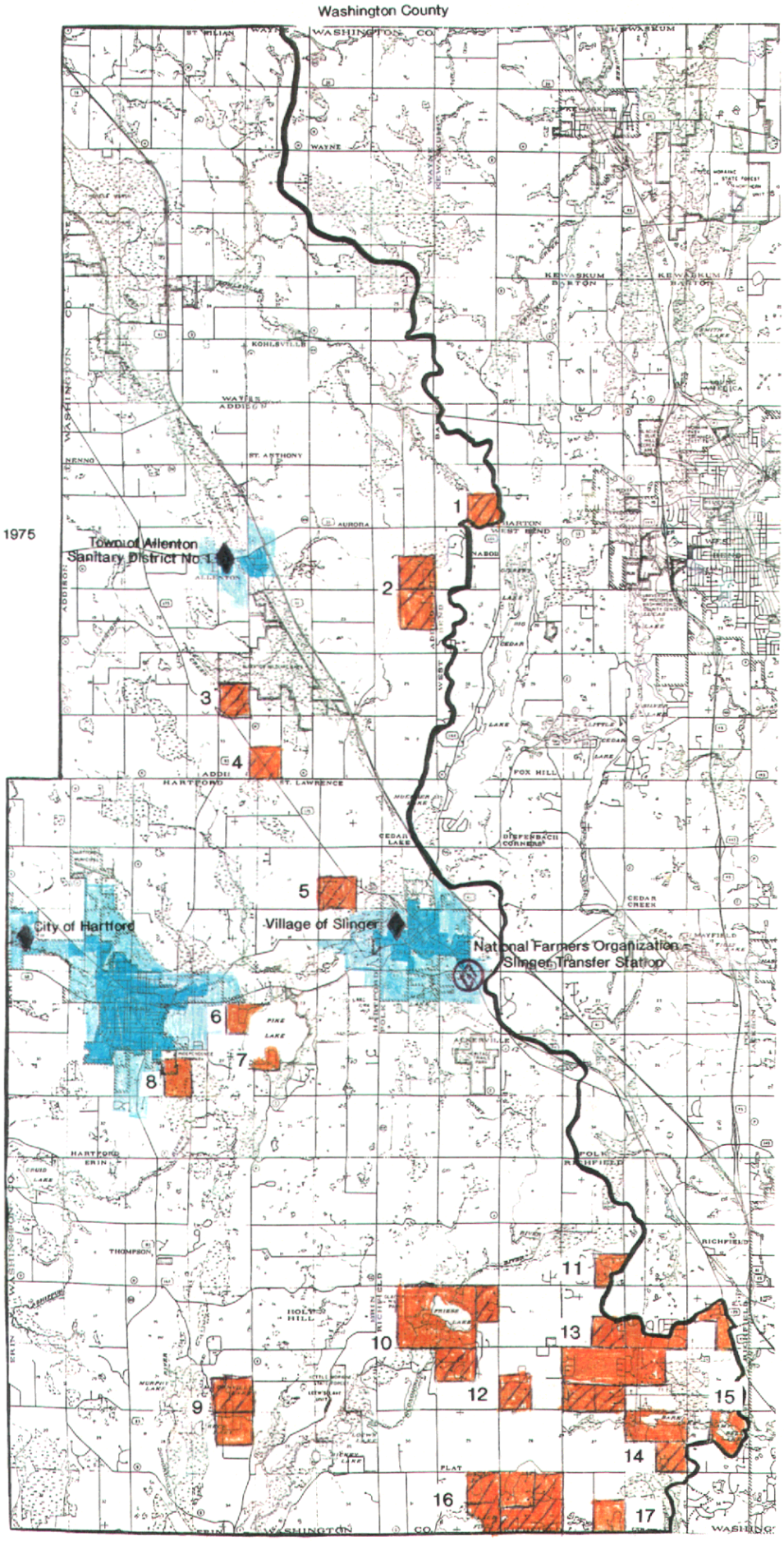
Map XII-4
UPDATED REGIONAL WATER QUALITY MANAGEMENT PLAN FOR THE ROCK RIVER WATERSHED: 2010

LEGEND

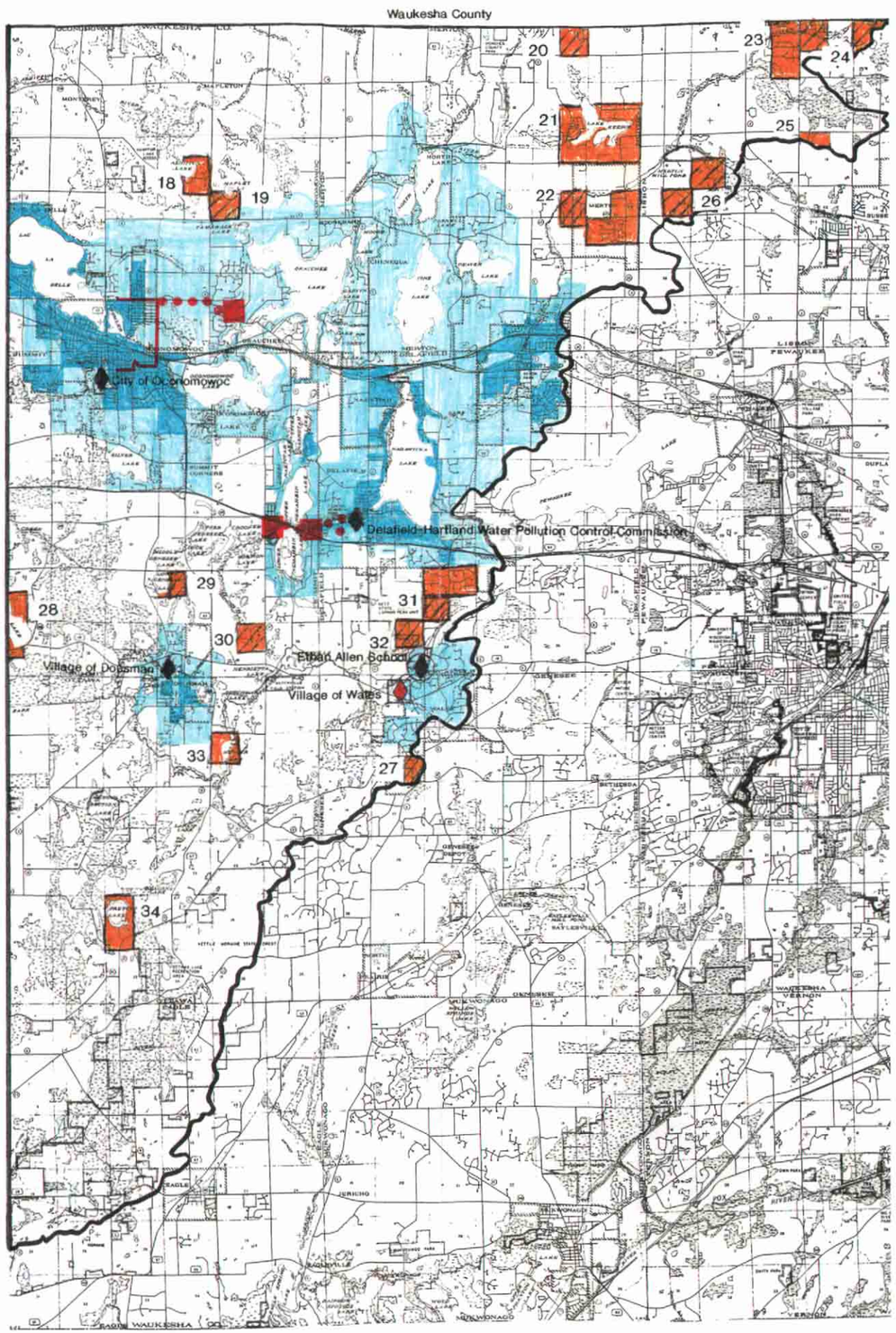
- SANITARY SEWER SERVICE AREA (EXISTING)
- SANITARY SEWER SERVICE AREA (PLANNED)
- EXISTING PUBLIC SEWAGE TREATMENT FACILITY TO BE RETAINED
- PROPOSED NEW PUBLIC SEWAGE TREATMENT FACILITY
- EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE RETAINED
- EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE ABANDONED
- 1975 URBAN DENSITY DEVELOPMENT OUTSIDE OF THE INITIAL PLAN SEWER SERVICE AREA
- ADDITIONAL URBAN DENSITY DEVELOPMENT SINCE 1975 OUTSIDE OF PLANNED SEWER SERVIVE AREA: 2010
- PROPOSED TRUNK SEWER
- PROPOSED FORCE MAIN
- PROPOSED PUMPING STATION

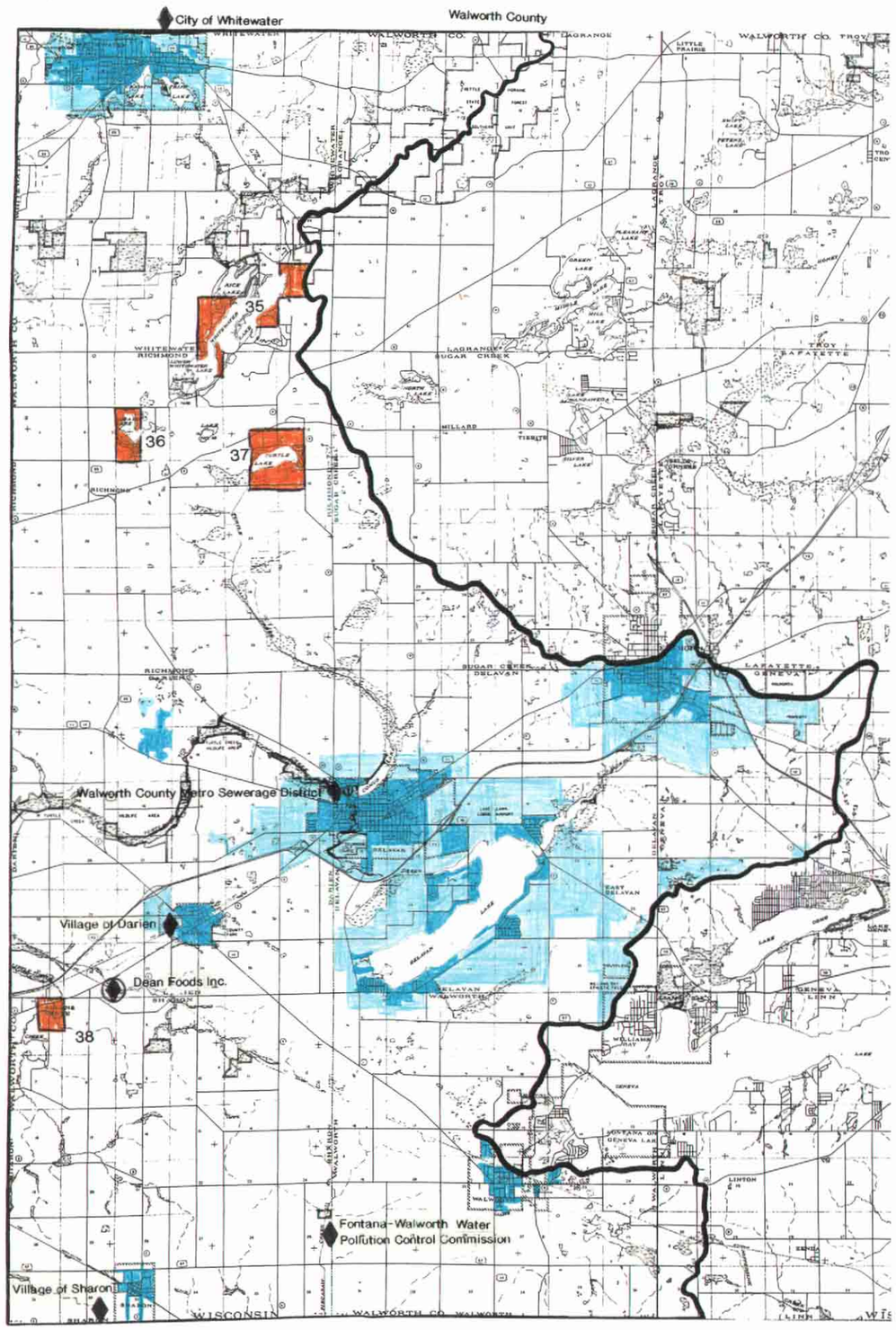
Source: SEWRPC.





Map XII-4 Continued





capacity. Under the high growth-decentralized land use plan, seven of the existing plants are anticipated to have loading rates equal to or higher than the average annual design capacity. Thus, there is expected to be significant additional sewage treatment plant expansion and associated costs under the higher growth decentralized future scenario than would be expected under the intermediate growth-centralized land use plan.

Based upon review and analysis of the data in Tables XII-5 and XII-7, including estimates of future condition loadings on an annual average and maximum monthly basis, and based upon the age of the current facilities, estimates of the timing of needed facility planning were made. It appears that facility planning should be initiated during the next three years by the Delafield-Hartland Water Pollution Control Commission, the Village of Dousman, the City of Hartford, and the Village of Sharon to consider the need for expansion and upgrading of their sewage treatment plants. The remaining six sewage treatment plants are expected to begin facility planning to consider the need for plant expansion after the year 1997, assuming that development occurs in accordance with the recommended year 2010 land use plan as described for the intermediate growth-centralized land use future condition. Should development occur as envisioned under the high growth-decentralized land use future scenario, facility planning for nearly all of the public sewage treatment plants in the Rock River watershed should be initiated within the next three years, except for the Allenton Sanitary District No. 1, the City of Oconomowoc, the Village of Slinger, the City of Whitewater plants, and the Walworth County Metropolitan Sewerage District. Continued review of plant operations and State required compliance maintenance reports for all plants will provide the basis for determining the timing for initiating facility planning programs to explore plant expansion alternatives.

The current planned sanitary sewer service areas in the Rock River watershed are shown on Map XII-4. The existing and planned year 2010 population data for each sewer service area is presented in Chapter XVIII on a regional basis. All or portions of the following sewer service areas are located in the Rock River watershed: Allenton, Beaver Lake, Darien, Delafield-Nashotah, Delavan-Delavan Lake, Elkhorn, Williams Bay, Dousman, Geneva National-Interlaken, Fontana, Hartford, Hartland, Oconomowoc, Oconomowoc Lake, Okauchee Lake, North Lake, Pewaukee, Pine Lake, Sharon, Slinger, Wales, Walworth, and Whitewater. Together, the planned service areas within the watershed total about 106 square miles, or about 17 percent of the Rock River watershed.

As noted above, most of the sewer 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 North Lake, Okauchee Lake, Beaver Lake, Pine Lake, Oconomowoc Lake, Wales, Fontana, Walworth, and Sharon sewer service areas identified in the initial plan. It is recommended that these refinements be conducted through the year 2010, with the currently sewered areas being refined during 1995 and 1996, and the unsewered areas being refined at such time as sewer service is envisioned to be provided. 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 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.

In addition to the public plants, there were three private sewage treatment plants in operation within the Rock 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, one plant was recommended for abandonment--the National Farmers Organization-Slinger Transfer Station. Due to the relatively close proximity of this plant to the Village of Slinger sewer service area, abandonment of the plant and connection to the public sanitary sewer system is recommended. For the remaining two private sewage treatment plants serving the Ethan Allen School and the Dean Foods, Inc. plant (formerly Libby, McNeill, and Libby, 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 16 known sanitary sewer system flow relief devices located in the Rock River watershed: two bypasses draining to Turtle Creek; one bypass to Little Turtle Creek from the Village of Sharon; one bypass to Piscasaw Creek from the Village of Walworth; one bypass to Jackson Creek from the City of Elkhorn; five bypasses to Whitewater Creek from the City of Whitewater; two bypasses to the Bark River, one from the Village of Hartland and one from the Village of Dousman; and three bypasses from the City of Oconomowoc, one to the Oconomowoc River, one to Lac La Belle, and one to Fowler Lake. During the period of 1988 through 1993, the only flow relief devices which existed in the sanitary sewer systems were selected bypasses and portable pumping station sites 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 XII-8, seven reported points of sanitary sewer system flow relief were reported during 1988 through 1993 in the Rock River watershed. These flow relief points are located in four 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 four years per flow relief location. This equates to an average of about two isolated overflow occurrences per year considering all reported bypassing.

Current Plan Recommendations: It is recommended that the Cities of Hartford and Whitewater, the Village of Dousman, and the Walworth County Metropolitan Sewerage District continue to monitor the 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 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 bypasses remaining designed to protect the public and treatment facilities from unforeseen equipment or power failure.

Intercommunity Trunk Sewers

Existing Conditions and Status of Plan Implementation: The initial regional water quality management plan as updated, recommended the construction of 13 intercommunity trunk sewers in the Rock River watershed, as shown in Table XII-9. One trunk sewer would permit the relocation of the Slinger wastewater treatment plant; two would extend the service from the City of Oconomowoc sewerage system along the Lac La Belle shoreline to the Town of Oconomowoc and

Table XII-8

KNOWN SEWAGE FLOW RELIEF DEVICES IN
THE ROCK RIVER 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	
Village of Dousman	--	--	--	--	1	1	No reported by-passing occurred in 1988 through 1993
City of Hartford	1	--	--	--	--	1	Used only in case of equipment failure or extreme wet weather conditions
Walworth County Metropolitan Sewerage District	1	--	1	2	--	4	Used only in case of equipment failure or extreme wet weather conditions
City of Whitewater	--	--	--	1	--	1	Used only in case of extreme wet weather
Total	2	--	1	3	1	7	

Source: SEWRPC.

Table XII-9

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

Intercommunity Trunk Sewer	Status of Implementation
Slinger	Completed (1981)
Lac La Belle-Oconomowoc East	Completed (1989)
Lac La Belle-Oconomowoc West	Completed (1988)
North Lake-Oconomowoc	Facility Planning Completed for Initial Port of Sewer (1989)
Silver Lake-Oconomowoc (Oconomowoc-South)	Completed (1990)
Hartland-Delafield	Completed (1980)
Nashotah-Delafield	Completed (1980)
Summit-Delafield	No Action
Whitewater	Completed (1982)
Walworth County Institutions	Completed (1981)
Elkhorn	Completed (1981)
Delavan Lake	Completed (1981)
Walworth	Completed (1986)

Source: SEWRPC.

Village of Lac La Belle; one would extend the service from Oconomowoc to connect the urban development along the shorelines of Oconomowoc, Okauchee, North, Pine and Beaver Lakes; one would extend the service from Oconomowoc to the south of the City of Oconomowoc including the Silver Lake shorelands; one would extend service from the Delafield-Hartland sewerage system to portions of the City of Delafield and Village of Hartland and permit the abandonment of the Village of Hartland plant; one would connect the portions of the City of Delafield and Village of Nashotah; one would extend service from the Delafield-Hartland sewerage system to the shorelands of Nashotah and Nemahbin Lakes; one would permit the relocation of the Whitewater treatment plant; three would connect the Walworth County Institutions, City of Elkhorn and Delavan Sanitary District to the Walworth County Metropolitan sewage treatment plant, thus permitting the abandonment of the City of Elkhorn and City of Delavan sewage treatment plants; and one would connect the Walworth sewer service area to the Fontana-Walworth Water Pollution Control Commission, thus permitting the abandonment of the Walworth and Fontana sewage treatment plants. The only recommended trunk sewers that remain to be constructed as of 1990 are those connecting the shorelands of Nashotah and Nemahbin Lakes to the Delafield-Hartland sewerage system, and urban development along the shorelines of Oconomowoc, Okauchee, North, Pine, and Beaver Lakes to the City of Oconomowoc sewerage system. It should also be noted that portions of the trunk sewers connecting urban development in the Como Lake South area and the Village of Williams Bay to the Walworth County Metropolitan sewerage system and a portion of the trunk sewer connecting the Village of Fontana on Geneva Lake to the Fontana-Walworth Water Pollution Control Commission sewerage system are located in the Rock River watershed.

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 Rock River watershed. Two intercommunity trunk sewers in the Rock River watershed are currently recommended to be constructed. These trunk sewers include connections from the shorelands of Nashotah and Nemahbin Lakes to the Delafield-Hartland plant and from urban development along the shorelines of Oconomowoc, Okauchee, North, Pine, and Beaver Lakes to the City of Oconomowoc plant, as shown on Map XII-4.

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

Current Conditions and Status of Plan Implementation: In 1975, there were a total of 24 known point sources of pollution identified in the Rock River watershed other than public and private sewage treatment plants. These other point sources discharged industrial cooling, process, rinse, wash waters, and filter backwash waters through 26 outfalls directly or indirectly to the surface water or groundwater systems. Of these, 12 were identified as discharging only cooling water. The remaining 12 were discharging other types of wastewater. The initial regional water quality management 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 39 such point sources of wastewater discharging to the Rock River and its major tributaries or the groundwater system directly through industrial waste outfalls or indirectly through drainage ditches and storm sewers. Table XII-10 summarizes selected characteristics of these other point sources and Map XII-3 shows their locations. Due to the dynamic nature of permitted point sources, it is recognized that the number of wastewater sources

Table XII-10

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

Facility Name	County	Map ID No.[b]	Permit Type	Permit Number	Expiration Date	Standard Industrial Classification Code	Industrial Activity	Receiving Water	Treatment System[c]
A.K. Rubber Products Company	Walworth	1	General	0044938-3	9-30-95	3069	Fabricated rubber products	Jackson Creek via unnamed tributary	--
Arrowhead High School	Waukesha	2	General	0046523-2	9-30-95	8211	Secondary school	Bark River	--
Darien Water Treatment Plant: Well #1	Walworth	3	General	0046540-1	9-30-95	4941	Water supply	Warner Creek via Darien Creek	--
Darien Water Treatment Plant: Well #2	Walworth	4	General	0046540-1	9-30-95	4941	Water supply	Warner Creek via Darien Creek	--
Delavan PWD: Well #5 Iron Filter	Walworth	5	General	0046540-1	9-30-95	4941	Water supply	Wetland discharge to Turtle Creek	--
Elkhorn City Swimming Pool	Walworth	6	General	0046523-2	9-30-95	--	Municipal pool	Jackson Creek via unnamed tributary	--
Elkhorn Water Treatment Plant	Walworth	7	General	SPEC PERM	--	4941	Water supply	Jackson Creek via unnamed tributary	--
Essential Industries, Inc.	Waukesha	8	General	0044938-3	9-30-95	2841	Soap and other detergents	Bark River	--
Hartford Union High School	Washington	9	General	0046523-2	9-30-95	8211	Secondary school	Groundwater discharge	--
Hasslinger Crushing Company	Waukesha	10	General	0046515-1	9-30-95	1429	Crushed and broken stone	Groundwater discharge	--
J.W. Reichel & Sons, Inc.	Walworth	11	General	0044938-2	9-30-95	3363/3364	Aluminum & nonferrous die castings	Jackson Creek via unnamed tributary	--
Kikkoman Foods, Inc.	Walworth	12	General	0044938-3	9-30-95	2035	Pickles, sauces, and salad dressing	Groundwater discharge	--
Lycon, Inc. - Whitewater	Walworth	13	General	0046507-2	9-30-95	3273	Ready-mix concrete	Groundwater discharge	--
Maxi-One, Inc.	Walworth	14	General	0046566-2	9-30-95	--	N/A	Delavan Lake via storm sewer	--
Mesa Industries, Inc.	Walworth	15	General	0044938-3	9-30-95	--	N/A	Jackson Creek via unnamed tributary	--
North Lake Sand & Gravel	Waukesha	16	General	0046515-2	9-30-95	3281	Cut stone and stone products	Oconomowoc River	--
Okauchee Redi-Mix	Waukesha	17	General	0046507-2	9-30-95	3273	Ready-mix concrete	Groundwater discharge	--
St. Johns Military Academy	Waukesha	18	General	0046523-1	9-30-95	8211	Secondary school	Bark River	--
Schmitz Ready Mix - Richfield	Washington	19	General	0046507-2	9-30-95	3273	Ready-mixed concrete	Groundwater discharge	--
Sharon Foundry	Walworth	20	General	0044938-3 & 0046531-1	9-30-95	3321	Gray and ductile iron foundry	Little Turtle Creek via unnamed tributary	--
Town & Country YMCA	Waukesha	21	General	0046523-2	9-30-95	7991	Physical fitness facility	Oconomowoc River via unnamed tributary	--
Veterans Memorial Pool	Washington	22	General	0046523-2	9-30-95	--	Municipal pool	Rubicon River via storm sewer	--
Vogt, Inc.	Waukesha	23	General	0046507-2	9-30-95	3273	Ready-mix concrete	Groundwater discharge	--
Whitewater Limestone, Inc.	Walworth	24	General	0046515-2	9-30-95	3281	Cut stone & stone products	Cravath Lake	--
Whitewater Water Utility Well #6 & #8	Walworth	25	General	0046540-1	9-30-95	4941	Water supply	Whitewater Creek	--
Witte Residence	Walworth	26	General	HEAT PUMP	--	8811	Private household	Whitewater Lake	--
YMCA Camp Minikani	Washington	27	General	0046523-2	9-30-95	7032	Sporting & recreational camps	Amy Belle Lake	--
Allcast, Inc.	Washington	1A	Specific	0041378	12-31-90	3363	Aluminum die casting	East Branch Rock River	None
Carnation Company Instant Products	Waukesha	2A	Specific	0002500	9-30-92	2023	Dry, condensed, evap. products	Oconomowoc River via storm sewer	None
Elkhorn Water Treatment Plant	Walworth	3A	Specific	0048500	9-30-95	4941	Water supply	Jackson Creek via unnamed tributary	None
Hawthorn Melody Farms Dairy of WI	Walworth	4A	Specific	0002461	3-31-95	2024	Ice cream & frozen desserts	Whitewater Creek	None
International Stamping Co., Inc.	Washington	5A	Specific	0002691	6-30-92	3714	Motor vehicle parts & accessories	Rubicon River	9
Pabst Farms, Inc.	Waukesha	8A	Specific	0053627	12-31-93	2026	Fluid milk	Groundwater discharge	3, 2, 5
Silgan Containers, Inc.	Waukesha	9A	Specific	0047058	9-30-92	3411	Metal cans	Oconomowoc River	None
Sta-Rite Industries, Inc.	Walworth	10A	Specific	0055816	7-31-95	3648	Lighting equipment	Swan Creek via storm sewer	None
Tankcraft Corporation	Walworth	11A	Specific	0057614	9-30-95	3443	Fabricated plate work	Piscasaw Creek via unnamed tributary	None
U.S.G. Interiors, Inc.	Walworth	12A	Specific	0050601	12-31-89	3081	Unsupported plastics film & sheet	Groundwater discharge	1, 2, 3
W. B. Place Company	Washington	13A	Specific	0057258	6-30-92	3111	Leather tanning and finishing	Groundwater discharge	7, 4
Zunker Contractors	Washington	14A	Specific	0047805	9-30-95	--	N/A	Rubicon River	None

Footnotes follow.

Table XII-10 (continued)

[a] Table XII-10 includes 39 known, permitted sources of wastewater discharging to the Rock River and its tributaries, or to groundwater systems in the Rock River watershed. As of 1993, there were 69 known, permitted point sources of water pollution.

[b] See Map XII-3, Sewer Service Areas and Point Sources of Pollution in the Fox River Watershed: 1990.

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

1. ACT sludge extended air
2. Absorption pond
3. Holding pond
4. Land spreading
5. Ridge & furrow
6. Screening
7. Solids Treatment/Removal
8. Spray Irrigation
9. Stabilization lagoon

[d] Permitted as Leaking Underground Storage Tank (LUST) remediation site discharging to surface or groundwater as of 1990. As of 1993, there were five additional LUST remediation sites discharging to surface or groundwaters in the Rock River watershed. See Table XII-11, "Miscellaneous Potential Pollution Sources in the Rock River Watershed: 1990" for map identification number.

Source: Wisconsin Department of Natural Resources and SEWRPC.

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 69 known point sources of wastewater other than public and private sewage treatment plants discharging to surface waters in the Rock 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 Rock 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 25 enclaves of unsewered urban development located outside of the then proposed year 2000 sewer service area. As of 1990, one of these areas had been added to the planned 2010 sewer service area as part of the plan amendment process. Due to increased unsewered urban growth within the watershed since 1975, 14 new enclaves of urban development have been created beyond the planned sewer service areas and eight of the urban development enclaves identified in the initial plan have been expanded, as shown on Map XII-4. The corresponding urban enclave population and the distance to the nearest planned year 2010 sewer service area are listed in Table XII-11. As shown in Table XII-11, approximately one-half of these areas--16 of the 38 areas--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 alternative wastewater disposal methods should be considered. Many of these latter areas are located adjacent to lakes where alternative forms of wastewater management should be investigated during the planning period including the urban enclaves around Lake Keesus, Golden Lake, Lower Genesee Lake, Hunters Lake, Pretty Lake, Whitewater Lake, Lake Lorraine, and Turtle Lake. Generally, for all of the enclaves located in areas where soils and lot sizes are not considered to meet current criteria, it is recommended that an inspection and maintenance plan be instituted 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 Rock 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, and, in the case of many of the abandoned landfills, the types and extent of these substances are sometimes unknown. In some instances, toxic and hazardous substances have begun to leach into surrounding soil and aquifers, and potentially can be subsequently transported to surface waters.

There are four active landfills and 78 known abandoned landfills located in the Rock River watershed. None of the landfills in the Rock River watershed, through 1993, have been reported as negatively impacting surrounding surface waters.

Table XII-11

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

Number[a]	Major Urban Concentration[b]	1990 Estimated Resident Population	Distance from Year 2010 Sewer Service Area (miles)
	Washington County		
1[c]	Town of Barton-Section 7	104	3.0
2	Town of Addison-Sections 13, 24	250	2.0
3[c]	Town of Addison-Section 28	153	1.5
4	Town of Addison-St. Lawrence	174	2.0
5[c]	Town of Hartford-Section 12	136	--
6	Pike Lake	194	--
7	Pike Lake - South	151	0.7
8[c]	City of Hartford	33	--
9	Town of Erin-Sections 22, 27	269	5.0
10[c]	Friess Lake	723	4.5
11[c]	Town of Richfield-Section 10	228	4.25
12	Town of Richfield-Section 21	113	5.75
13	Town of Richfield-Sections 13, 14, 15, 22, 23	2274	5.25
14[c]	Bark Lake	497	7.0
15[c]	Amy Bell Lake	125	7.25
16[c]	Town of Richfield-Sections 32, 33	980	7.25
17[c]	Town of Richfield-Section 34	160	8.0
	Waukesha County		
18[c]	Ashippun Lake	196	0.5
19	Town of Oconomowoc-Section 23	131	--
20	Town of Merton-Section 2	169	2.0

Table XII-11 (continued)

Number[a]	Major Urban Concentration[b]	1990 Estimated Resident Population	Distance from Year 2010 Sewer Service Area (miles)
21[c]	Lake Keesus	708	1.5
22	Village of Merton	1076	0.75
23	Town of Lisbon-Sections 3,4	722	5.5
24	Town of Lisbon-Section 2	234	6.75
25	Town of Lisbon-Section 15	134	6.0
26[c]	Town of Lisbon-Sections 17, 19	327	2.65
27	Town of Genesee-Section 8	258	0.2
28[c]	Golden Lake	121	2.5
29[c]	Lower Genesee Lake	107	0.5
30	Town of Summit-Section 35	139	0.5
31[c]	Town of Delafield-Section 28	744	--
32[c]	Town of Delafield-Section 32	313	--
33[c]	Hunters Lake	59	--
34[c]	Pretty Lake	270	2.75
	Walworth County		
35[c]	Whitewater Lake	404	3.5
36[c]	Lorraine Lake	210	5.5
37[c]	Turtle Lake	208	5.0
38	Allens Grove	55	2.0
	Total	13,149	--

[a] See Map XII-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, area which should, during the planning period, conduct further site specific planning to determine the best means of providing for wastewater management.

Source: SEWRPC.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the Rock 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 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 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 was one known permitted leaking underground storage tank site that was discharging remediation waters to surface water, as indicated in Table XII-12 and shown on Map XII-3. As of 1993, there were five additional leaking underground storage tanks in the Rock River watershed whose remediation wastewaters were permitted to discharge to surface or ground waters, as shown in Table XII-12.

As of 1993, there were 183 additional leaking underground storage tanks in the Rock River watershed identified by the Department of Natural Resources 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 have 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 was one permitted site discharging to surface water in the Rock River watershed, as indicated in Table XII-12 and shown on Map XII-3. This site was the Delavan Municipal Well No. 4, which was designated as a high priority site for the U.S. Environmental Protection Superfund program in 1984 which provides for the identification and cleanup of hazardous waste sites. Contamination of soil and groundwater by Volatile Organic Compounds (VOCs) were detected at the well in 1982, resulting from a discharge of cleaning solvents by Sta-Rite, Inc. Remediation efforts are currently underway at this site.

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 septic systems, and pollutant contributions from the atmosphere.

Existing Conditions and Status of Plan Implementation

For the Rock River watershed, the initial 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 disposal system management. In addition, the plan recommended

Table XII-12

MISCELLANEOUS POTENTIAL POLLUTION SOURCES
IN THE ROCK RIVER WATERSHED: 1990

Map Identification No.[a]	Landfills Indicated to be Potential Pollution Sources	Civil Division Location	Surface Water Potentially Impacted
	None		
	Leaking Underground Storage Tank Sites[b],[c]		
1	Maxi-One, Inc.	Town of Delavan	Delavan Lake
	Additional Groundwater Contamination Sites[b]		
1	Delavan Municipal Well No. 4[d]	City of Delavan	Turtle Creek

[a]Refers to Map XII-3, "Sewer Service Areas and Point Sources of Pollution in the Rock River Watershed: 1990."

[b]Includes those sites which are permitted under the Wisconsin Pollutant Discharge Elimination System (WPDES) to discharge remediation wastewater to surface or groundwaters.

[c]As of 1993, there were five additional leaking underground storage tank sites in the Rock River watershed whose remediation discharges were permitted under the WPDES: Dairyland Fuels in the City of Delafield, Waukesha County,which is permitted to discharge to the Bark River; The Holiday Company in the Village of Williams Bay, Walworth County, which is permitted to discharge to Swan Creek via a storm sewer; the Holiday Company in the City of Oconomowoc, Waukesha County, which is permitted to discharge to Fowler Lake via a storm sewer; Silver Lake Service Station in the City of Oconomowoc, Waukesha County, which is permitted to discharge to Fowler Lake via a storm sewer; and Theresa State Bank in the Town of Wayne, Washington County, is permitted to discharge to Theresa Marsh.

[d]Superfund site.

Source: Wisconsin Department of Natural Resources and SEWRPC.

that additional rural nonpoint source controls be provided in the Bark Lake drainage area, which would reduce nonpoint sources of pollution by about 75 percent.

Implementation of the recommended nonpoint source control practices has been achieved on a limited basis in the Rock 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 Walworth, Washington, and Waukesha Counties. These programs provide for the system installation requirements 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. Significant progress has also been made in the area of construction site erosion control. As of January 1993, Walworth and Waukesha Counties had erosion control ordinances based on the model ordinance developed cooperatively by the Wisconsin Department of Natural Resources and League of Wisconsin Municipalities, while Washington County had an ordinance that pre-dated the model ordinance. In addition, the Cities of Delafield, Elkhorn, Oconomowoc and Whitewater, and Towns of Delafield and Delavan had adopted construction erosion control ordinances which are based upon the model ordinance developed by the League of Wisconsin Municipalities. The Village of Hartland and the Towns of Oconomowoc and Lisbon had ordinances which were not based on the model, while the City of Hartford was in the process of drafting an ordinance based on the model ordinance. In addition, Waukesha County and Walworth County have adopted erosion control ordinances applicable in the unincorporated areas to certain developments.

With regard to rural nonpoint sources of pollution, Chapter NR 243 of the Wisconsin Administrative Code sets forth design standards and accepted animal waste management practices for large animal feeding operations and sets forth criteria whereby the Wisconsin Department of Natural Resources may issue permits for 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 program administered by the Wisconsin Department of Natural Resources and others, are being utilized in the Rock River watershed primarily for cropland soil erosion control and wildlife habitat purposes, respectively, 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 Waukesha and Washington Counties. In addition, an agricultural soil erosion control plan for Walworth County was prepared by a consultant. 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 program was established in 1978 by the Wisconsin Legislature and provides cost-sharing funds for the cost of an individual project or land management practice to local governments and private landowners upon completion of the detailed plans. The funds are provided through nonpoint source local assistance grants administered by the Wisconsin Department of Natural Resources. As of 1993, two priority watershed projects shave been conducted in the Rock River watershed--the Turtle Creek Priority Watershed Project[4] and the Oconomowoc River Priority Watershed Project.[5]

The Turtle Creek Priority Watershed Plan: The Turtle Creek watershed was selected for inclusion in the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program in 1982, and the watershed plan was completed in 1984. The project implementation phase was carried out from 1984 until April 1992 and included the following recommended components:

- Provision of streambank erosion control practices for selected sites.
- Provision of wind erosion controls on lands in the Comus Lake subwatershed.
- Preparation of detailed conservation plans to develop management practices on about 21,000 acres of cropland which are estimated to have soil losses of greater than six tons per acre per year. The target soil loss for these lands was established at five tons per acre per year which was estimated to result in a reduction in total sediment losses from cropland by about 53 percent.
- Installation of facilities and management practices for 75 barnyards representing a reduction of about 80 percent of the phosphorus loading from barnyards in the study subwatershed.

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[4] Wisconsin Department of Natural Resources Publication, Turtle Creek Priority Watershed Plan, March 1984.

[5] Wisconsin Department of Natural Resources Publication No. WR-194-86, A Nonpoint Source Control Plan for the Oconomowoc River Priority Watershed Project, March 1986.

- Installation of facilities and management practices for selected livestock operations to change manure spreading practices.

- In urban and urbanizing areas, the implementation of construction erosion controls; the institution of public information and education programs on nonpoint source pollution abatement; and the institution of sound urban "housekeeping practices" such as pet litter regulation, proper yard waste management, and proper use of pesticides and fertilizers.

A final report and evaluation of the Turtle Creek priority watershed project are currently being prepared by the Wisconsin Department of Natural Resources.

The Oconomowoc River Priority Watershed Program: The Oconomowoc watershed was selected for inclusion in the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program in 1983, and the plan was completed in 1986. The project implementation phase began in 1986 and is currently scheduled for completion in December 1994. The program established pollutant reduction goals of between 30 and 50 percent for sediment loadings and between 28 and 76 percent for phosphorus loadings. Generally, the higher phosphorus load reductions were proposed for the more urban, lower portions of the watershed--below Okauchee Lake--while the higher sediment load reductions were proposed for the upper, more rural portions of the watershed--upstream of Oconomowoc Lake. The recommendations varied with each subwatershed and generally included the following:

- Provision of fencing and other streambank erosion control practices for selected reaches of eroding streambank.

- Formation of detailed conservation plans to develop the best management practices for cropland areas identified as having excessive erosion.

- Installation of facilities and management practices for selected barnyards identified to be contributing significant phosphorus loadings.

- Installation of facilities and management practices for selected livestock operations to change manure spreading practices.

- In urban and urbanizing areas, the implementation of construction erosion controls; the institution of public information and education programs on nonpoint source pollution abatement; and the institution of sound urban "housekeeping practices" such as pet litter regulation, proper yard waste management, and proper use of pesticides and fertilizers.

Current Plan Recommendations

It is recommended that construction site erosion control, onsite sewerage system management, and streambank erosion control in addition to land management, to provide about a 25 percent reduction in nonpoint source pollutant loadings are recommended to be carried out throughout the watershed. Additional practices providing for about a 75 percent reduction in rural nonpoint source pollutant loadings are recommended to be provided in the Bark Lake drainage area. In addition, it is recommended that the need for further nonpoint source pollution abatement efforts in the Turtle Creek and Oconomowoc River watersheds be reviewed and reevaluated following preparation of a project final report and evaluation for the priority watershed projects prepared for those subwatersheds.

The types of practices recommended to be considered for these various levels 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, additional portions of the watershed should be included in the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program in order to make State cost-sharing programs available for nonpoint source pollution control measures. In addition, it is recommended that stormwater management plans be carried out in urban areas and farmland management plans be carried out in rural areas to define the practices to be installed. The current priority ranking of watersheds for inclusion in that program is documented in a memorandum[6] prepared by the Regional Planning Commission using Wisconsin Department of Natural Resources procedures and is summarized in Chapter XVIII. That ranking included portions of the Rock River watershed--including the Bark River, East Branch Rock River and Rubicon River--in the high rating category, indicating that their inclusion in the program will be possible in the near future, when the existing planning projects are completed, or additional funds and staff become available with the Department of Natural Resources and its sister agencies. The inclusion of the remaining portions of the watershed--including Whitewater Creek, which was ranked as having a medium rating, and the Ashippun and Scuppernong Rivers, which were ranked as low--will probably be delayed until late in the planning period or beyond unless the process of selection is changed and/or funding levels are increased.

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 Rock River watershed on a sustained basis only by the U.S. Geological Survey at one station located at Rockton, Illinois, on the Rock River main stem about 4.0 miles downstream of the Wisconsin-Illinois State line, and by the Wisconsin Department of Natural Resources at one station on the Rock River at Afton, about 4.0 miles downstream of Janesville, in Rock County, as shown on Map XII-5. Only limited significant short-term monitoring data has been carried out on the stream system in the watershed since the completion of the initial plan. This data was primarily used to evaluate lake phosphorus water quality conditions and pollutant loadings at Delavan Lake and in the Oconomowoc River lake chain.

Currently, water quality monitoring is being carried out on several lakes as part of the WDNR Self-help Monitoring Program, including Ashippun, Delavan, Druid, Lake Five, Friess, Golden, Green, Hunters, Keesus, Lac La Belle, Lower Genesee, Nagawicka, Lower Nashotah, Lower Nemahbin, Upper Nemahbin, North, Oconomowoc, Pike, Pretty, Rice, School Section, Silver (Waukesha County) Silver (Washington County), Turtle, and Whitewater. In addition, limited additional

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

water quality monitoring has been carried out on some of the major lakes in the watershed by the U.S. Geological Survey, the Department of Natural Resources, local lake management agencies, and the Commission.

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 and the U.S. Geological Survey at stations Rk-14 and Rk-15 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 these two stations and at 12 selected additional stations, with one station each located on Jackson Creek, Turtle Creek, Whitewater Creek, Scuppernong River, Scuppernong Creek, Bark River, Ashippun River, Oconomowoc River, Coney River, Rubicon River, East Branch of Rock River, and Kohlsville River. It is recommended that this program be conducted within the next five to seven years and repeated at five-to seven-year intervals. These recommendations can be coordinated with and are consistent with the 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 approximately five- to seven-year rotating cycle.

The lake monitoring program for each lake should consist, at a minimum, of one intensive monitoring effort to establish baseline conditions and of the long-term participation in the DNR Self-help Monitoring Program that can be conducted by citizen-volunteer residents on the lakes. As noted earlier, several lakes already participate in this program. For each lake, it is recommended that the monitoring program be expanded to establish current conditions during a two-year or more period of intensive monitoring followed by a continual long-term monitoring program designed to detect changes in water quality conditions. In this regard, the monitoring program should be tailored to provide data needed for preparation or updating of comprehensive lake management plans for the major lakes in the watershed. Such programs are being undertaken by the U.S. Geological Survey on Druid, Keesus, Okauchee, Oconomowoc, Fowler, Silver (Waukesha County), Upper Nemahbin, and Delavan Lake; and the Department of Natural Resources under the Long-Term Trends Program on Friess, Lac La Belle, Nagawicka, Pike, and Whitewater Lakes. The water quality sampling program should be carried out at spring turnover (April) and during June, July, and August, during two subsequent years, with samples collected weekly.

LAKES MANAGEMENT PLAN ELEMENT

Existing Condition and Status of Plan Implementation

The initial regional water quality management plan included recommendations for reducing nonpoint sources of pollution in the tributary areas of the major lakes in the Rock River watershed and for consideration of other lake management measures. Institutional recommendations were also made for the formation of new special purpose units of government where none exist to carry out the plan implementation measures. For each major lake in the Rock River watershed, the initial plan recommended that a comprehensive lake management plan be prepared to consider in more detail the applicability and preliminary design of watershed and in-lake management measures. As noted in the previous sections, the preparation of such a comprehensive plan requires that supporting water quality monitoring programs be established.

The status of lake management, protection, and rehabilitation efforts on and around the major lakes in the Rock River watershed is discussed for each major lake in the following paragraphs:

Ashippun Lake: The Ashippun Lake Protection and Rehabilitation District conducts regular water clarity monitoring under the DNR Self-help Monitoring Program. A comprehensive lake management plan has been prepared for this lake.[7]

Bark Lake: No data were available from which to assess the present conditions in Bark Lake. The Bark Lake Sanitary District which was formed of the properties around the lake is currently inactive. It is recommended that the Bark Lake Association enroll in the DNR Self-help Monitoring Program.

Beaver Lake: The lake is within the Oconomowoc River priority watershed project area. No plan data have been recorded to assess water quality conditions for this lake as of 1993. It is recommended that Beaver Lake be enrolled in the DNR Self-help Monitoring Program. The urban development around this lake is recommended to be provided with public sanitary sewer service, which would be connected to the Oconomowoc sewerage system. The implementation of this recommendation may not occur until late in the planning period.

Comus Lake: The southern portions of the lakeshore are provided with a public sanitary sewer system, and sewer extensions are planned for most of the remaining lake shore. Lake Comus is in the Turtle Creek priority project area. It is recommended that the Comus Lake Protection and Rehabilitation District enroll in the DNR Self-help Monitoring Program.

Cravath Lake: The northwestern lakeshore lies within the current public sanitary sewer service area of the City of Whitewater, and extensions are planned to encompass the entire lakeshore. It is recommended that Cravath Lake enroll in the DNR Self-help Monitoring Program.

Crooked Lake: The lake was formerly enrolled in the DNR Self-help Monitoring Program but does not appear on the most recent list of participants. Re-enrollment is recommended.

Delavan Lake: A comprehensive program of lake management was carried out on the lake during the early 1990s by the Delavan Lake Sanitary District in cooperation with State and Federal agencies, and extensive water quality data have been collected. Lake rehabilitation measures including drawdown and alum treatment, wetland creation at the lake inlet area, lake inflow control routing structures, and fishery stocking has been carried out. The urban development around this lake has been provided with a public sanitary sewer system as recommended in the initial plan. Delavan Lake is within the Turtle Creek priority watershed project area. An aquatic plant management plan has been completed for the lake,[8] and the Delavan Lake Sanitary District maintains an on-going water clarity monitoring program under the DNR Self-help Monitoring Program.

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[7] SEWRPC Community Assistance Planning Report No. 48, A Water Quality Management Plan for Ashippun Lake, Waukesha County, Wisconsin, January 1982.

[8]Aron & Associates, Delavan Lake Aquatic Plant Management Plan, 1993.

Druid Lake: The Druid Lake Property Owners Association is enrolled in the DNR Self-help Monitoring Program and maintains an on-going water clarity monitoring program. The Druid Lake Protection and Rehabilitation District has also conducted water quality investigations with partial funding provided under the Chapter NR 119 Lake Management Planning Grant Program.

Lake Five: Water clarity monitoring is conducted by the Lake Five Advancement Association under the DNR Self-help Monitoring Program.

Fowler Lake: An aquatic plant management plan has been prepared for the lake, and a lake management plan has been prepared.[9] The lake lies within the City of Oconomowoc public sanitary sewer service area and is in the Oconomowoc River priority watershed project area. Further water quality investigations are being conducted with partial funding provided under the Chapter NR 119 Lake Management Planning Grant Program. Enrollment of the Fowler Lake Management District in the DNR Self-help Monitoring Program is recommended. The District operates an aquatic plant management program including harvesting and limited spraying.

Friess Lake: The lake lies within the Oconomowoc River priority watershed, and is a WDNR Long-term Trends Monitoring lake. The Friess Lake Association participated in the DNR Self-help Monitoring Program. Friess Lake has an approved aquatic plant management plan, and has been the subject of a comprehensive lake management plan prepared by the Commission.[10] During 1995, this plan is being updated, with partial funding under the Chapter NR 119 Lake Planning Grant Program.

Golden Lake: The Golden Lake Association is enrolled in the DNR Self-help Monitoring Program. The Association is investigating possible actions necessary to control purple loosestrife, Lythrum sp., in the vicinity of the lake.

Hunters Lake: Data with which to re-assess the water quality conditions in Hunters Lake were not available as of 1993. As of 1994, however, Hunters Lake Association participates in the DNR Self-help Monitoring Program and is in the planning stage of developing a public access site and lake protection plan.

Lake Keesus: Water quality and use data for Lake Keesus had been developed under water quality investigations conducted with financial assistance from the Chapter NR 119 Lake Management Planning Grant Program, a UW-Stevens Point lake resident questionnaire survey, and on-going water clarity monitoring conducted by the Lake Keesus Advancement Association and Lake Keesus Management District under the DNR Self-help Monitoring Program. Lake Keesus is within the Oconomowoc River priority watershed project area. An aquatic plant management plan has been prepared for the lake.[11]

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[9]SEWRPC Community Assistance Planning Report No. 187, A Management Plan for Fowler Lake, Waukesha County, Wisconsin, March 1994.

[10] SEWRPC Community Assistance Planning Report No. 98, A Water Quality Management Plan for Friess Lake, Washington County, Wisconsin, August 1983.

[11]Aron & Associates, Lake Keesus Plant Management Plan, October 1994.

Lac La Belle: A water quality management plan has been prepared for Lac La Belle.[12] There is also an approved aquatic plant management plan for this lake, which is being used to experimentally assess the effects of aquascaping to manipulate the growth of more desirable aquatic plant species. Large-leaf pondweed, Potamogeton amplifolius, was planted in the lake during 1991 by the Lac La Belle Management District. The District has also received a Chapter NR 119 lake management planning grant to partially fund conducting recreational use surveys, water quality data analyses, and public information campaigns.[13] On-going water clarity monitoring is done by the District through the DNR Self-help Monitoring Program, and the Department's Long-term Trends Monitoring Program. Lac La Belle lies within the Oconomowoc River priority watershed project area and the City of Oconomowoc public sanitary sewer service area. Most of the urban development around the lake is provided with public sewers, except for portions of the Town of Oconomowoc on the eastern and northeastern shoreline.

La Grange Lake: There are no records of water quality data or other plan implementation activities on this lake as of 1993.

Lake Lorraine: There are no records of water quality data or other plan implementation action as of 1993. It is recommended that the Lorraine Lake Property Owners Association enroll in the DNR Self-help Monitoring Program.

Genesee Lakes: The three Genesee lakes--Upper, Middle, and Lower--are located in the Town of Summit, Waukesha County. Lower and Middle Genesee Lakes are participants in the DNR Self-help Monitoring Program. A lake management district was created around Middle Genesee Lake during 1994. The District plans to develop a comprehensive lake management plan for that Lake which could ultimately be extended to the entire lake chain.

Nashotah Lakes: Lower Nashotah Lake is actively enrolled in the DNR Self-help Monitoring Program. Upper Nashotah Lake was formerly enrolled in the program but does not appear on the most recent list of participants. Re-enrollment is recommended. The urban development around these lakes is recommended to be provided with a public sanitary sewer system which would be connected to the Delafield-Hartland Water Pollution Control Commission sewerage system.

Upper and Lower Nemahbin Lakes: The Nemahbin Lakes have active lake organizations that are enrolled in the DNR Self-help Monitoring Program. Additional nonpoint source contaminant investigations have been proposed by the Upper Nemahbin Lake District. This project has been funded through the Chapter NR 119 Lake Management Planning Grant Program.[14] The urban development around these lakes is recommended to be provided with a public sanitary sewerage system which would be connected to the Delafield-Hartland Water Pollution Control Commission sewerage system.

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[12] SEWRPC Community Assistance Planning Report No. 47, A Water Quality Management Plan for Lac La Belle, Waukesha County, Wisconsin, December 1980.

[13]Aron & Associates, Lac La Belle Planning Grant Developed for the Lac La Belle Management District, 1993

[14]SEWRPC Memorandum Report No. 101, Upper Nemahbin Lake Watershed Inventory Findings, Waukesha County, Wisconsin, December 1994.

Moose Lake: The Moose Lake Association currently participates in the DNR Self-help Monitoring Program. Aquatic plant problems continue to occur within the littoral zone of Moose Lake. The urban development around this lake is recommended to be provided with a public sanitary sewer system which would be connected to the Oconomowoc sewerage system.

Nagawicka Lake: Nagawicka Lake has been included as a DNR Long-term Trends Monitoring lake, and on-going water quality monitoring is conducted by the Nagawicka Lake Improvement Association under the DNR Self-help Monitoring Program. The developed portions of the lakeshore are provided with a public sanitary sewer system as recommended in the initial plan. Nagawicka Lake has an approved aquatic plant management plan.[15]

North Lake (Waukesha County): An approved aquatic plant management plan has been prepared for the Lake, as has a water quality management plan.[16] The North Lake Management District undertakes regular water clarity measurements under the DNR Self-help Monitoring Program. North Lake is located within the Oconomowoc River priority watershed project area. The District has also undertaken paleolimnological investigations with financial assistance provided by a Chapter NR 119 lake management planning grant.[17] Following the removal of the upstream Funk's Dam in 1991, additional engineering studies are being designed to address the potential impacts on North Lake.[18] The urban development around this lake is recommended to be provided with a public sanitary sewer system which would be connected to the Oconomowoc sewerage system. Implementation of this recommendation may not occur until late in the planning period.

Oconomowoc Lake: On-going water quality monitoring is conducted under the DNR Self-help Monitoring Program. The eastern embayment, Upper Oconomowoc Lake, has been the subject of an aquatic plant management plan. A water quality management plan has been prepared for the lake.[19] The Village of Oconomowoc, in cooperation with the Oconomowoc-Waukesha Lake Association, has conducted water quality studies on the lake with partial funding provided under the Chapter NR 119 Lake Management Planning Grant Program. Oconomowoc Lake is located within the Oconomowoc River priority watershed project area. The urban development around this lake is recommended to be provided with a public sanitary sewer system which would be connected to the Oconomowoc sewerage system.

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[15]Aron & Associates, Nagawicka Lake Plant Management Plan, August 1993.

[16] SEWRPC Community Assistance Planning Report No. 54, A Water Quality Management Plan for North Lake, Waukesha County, Wisconsin, July 1982.

[17]Aquatic Environmental Consulting, Inc., North Lake Project: Paleolimnology, Geochronology, Sediment Size Fractionation, and Suspended Sediment Load, sine datum.

[18]R.A. Smith & Associates, Inc., (Draft Report) Former Funk's Dam Impoundment Study, January 1995.

[19] SEWRPC Community Assistance Planning Report No. 181, A Water Quality Management Plan for Oconomowoc Lake, Waukesha County, Wisconsin, March 1990.

Okauchee Lake: A water quality management plan was developed for this lake in 1981.[20] An approved aquatic plant management plan has also been prepared for this Lake.[21] Okauchee Lake is also located within the Oconomowoc River priority watershed project area. The lake has developed an approved aquatic plant management plant with funding provided under the Chapter NR 119 Lake Management Planning Grant Program. Water clarity monitoring by the lake organizations established on this lake and conducted under the DNR Self-help Monitoring Program is recommended. The urban development around this lake is recommended to be provided with a public sanitary sewer system which would be connected to the Oconomowoc sewerage system.

Pike Lake: Pike Lake is monitored by the Wisconsin Department of Natural Resources under the Long-term Trends Monitoring Program and by the Pike Lake Protection District under the DNR Self-help Monitoring Program. Most of the urban development around the lake has been provided with a public sanitary sewer system which is connected to the City of Hartford sewerage system.

Pine Lake: As the lake has not been retained in any State monitoring programs, enrollment of the lake in the DNR Self-help Monitoring Program is recommended. Pine Lake is located within the Oconomowoc River priority watershed project area. The urban development around this lake is recommended to be provided with a public sanitary sewer system which would be connected to the Oconomowoc sewerage system. Implementation of this recommendation may not occur until late in the planning period.

Pretty Lake: The Pretty Lake Management District is continuing to monitor water clarity in the Lake through the DNR Self-help Monitoring Program. The district has received Chapter NR 119 planning grant funding to partially fund conducting more intensive water quality monitoring of the lake. The district is presently exploring the possibility of purchasing specific properties for lake protection purposes using NR 50-51 Stewardship or NR 191 Lake Protection Grant Program cost-shared funding.

Rice Lake: The lake is regularly monitored for water clarity by the Whitewater-Rice Lakes Management District, which is also undertaking more extensive lake management-related water quality investigations with partial funding provided under the Chapter NR 119 Lake Management Planning Grant Program.[22] The District also undertakes aquatic plant harvesting and management operations and has an approved aquatic plant management plan.

School Section Lake: The School Section Lake Management District is a participant in the DNR Self-help Monitoring Program. The District has recently received an Inland Waterways Commission grant to undertake limited dredging

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[20] SEWRPC Community Assistance Planning Report No. 53, A Water Quality Management Plan for Okauchee Lake, Waukesha County, Wisconsin, August 1981.

[21] Aron & Associates, Okauchee Lake Plant Management Plan, June 1993.

[22] USGS Water Resources Investigations Report, (draft) Hydrology and Water Quality of Whitewater and Rice Lakes in Southeastern Wisconsin, 1990-91, June 1993.

within the lake basin to improve boat access. An approved aquatic plant management plan has been completed for this lake.[23]

Silver Lake (Waukesha County): The Silver Lake Association is a participant in the DNR Self-help Monitoring Program. Through the Town of Summit, the Association has received a Chapter NR 119 Lake Management Planning Grant to undertake watershed-based lake quality-related investigations which have resulted in the publication of a lake protection plan for Silver Lake.[24] The lake is located within the Oconomowoc River priority watershed project area, and has limited areas which are provided with a public sewer system along the northern lakeshore. The remaining urban development around this lake is recommended to be provided with a public sanitary sewer system which would be connected to the Oconomowoc sewerage system.

Tripp Lake: The northern lakeshore is provided with a public sanitary sewer system, and extensions are planned along most of the remainder of the lake shoreline. Enrollment of this lake in the DNR Self-help Monitoring Program is recommended.

Turtle Lake: The lake is situated in the Turtle Creek priority watershed project area. Enrollment of the Turtle Lake Improvement Association in the DNR Self-help Monitoring Program is recommended.

Waterville Pond: Data with which to assess the water quality condition and other plan implementation actions for this waterbody were not available as of 1993. Enrollment in the DNR Self-help Monitoring Program is recommended for Waterville Pond.

Whitewater Lake: Whitewater Lake is situated upstream of Rice Lake (see above). The Whitewater-Rice Lakes Management District also has an approved aquatic plant management plan, and the Wisconsin Department of Natural Resources has recently completed a sensitive areas investigation of the lake. Whitewater Lake is both a DNR Self-help Monitoring Program lake and a Long-term Trends Monitoring Lake. The District has recently conducted even more intensive monitoring of the lake using cost-shared funding provided under the Chapter NR 119 Lake Management Planning Grant Program.[25]

Current Plan Recommendations

Management measures recommended and in-lake measures which are considered potentially applicable and should be considered in more detail are shown in Table XII-13 for the 38 major lakes in the Rock River watershed. The initial plan recommendations relating to the preparation of comprehensive lake management plans and the conduct of supporting water quality, biological conditions,

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[23]Aron & Associates, School Section Lake Plant Management Plan, October 1994.

[24] SEWRPC Memorandum Report No. 82, A Lake Protection Plan for Silver Lake, Waukesha County, Wisconsin, July 1993.

[25]USGS Water Resources Investigations Report, (Draft) Hydrology and Water Quality of Whitewater and Rice Lakes in Southeastern Wisconsin, 1990-91, June 1993.

Table XII-13

MANAGEMENT MEASURES TO BE CONSIDERED IN LOCAL MANAGEMENT PLANS FOR THE MAJOR LAKES IN THE ROCK RIVER WATERSHED: 1993[a]

SUBWATERSHED Lake Name	Area (acre)	Water Quality Monitoring	Prepare Comprehensive Management Plan	Watershed-based Measures						In-lake Management Measures						
				Public Sanitary Sewer Service	Onsite Sewage System Mgmt	Rural NPS Mgmt	Urban NPS Mgmt	Construction Site NPS Management	Live-stock Mgmt	Macro-phyte Harvest	Aeration	Nutrient Inactiva-tion	Dredge	Sediment Cover	Water Level Mgmt	Fish Management
ASHIPPUN RIVER																
Ashippun Lake	84	0	+	-	+	+	+	-	-	+	-	-	+	-	-	+
Druid Lake	124	0	0	-	+	+	+	-	+	+	-	+	-	+	-	+
BARK RIVER																
Bark Lake	65	+	+	-	+	+	+	-	+	+	-	+	+	+	-	+
Crooked Lake	58	+	+	-	+	+	+	-	-	+	-	+	+	+	-	+
Golden Lake	250	0	+	-	+	+	+	-	-	+	-	-	+	-	-	+
Hunters Lake	65	+	+	-	+	+	+	-	+	+	-	+	-	+	-	+
Lower Nashotah Lake	90	0	+	+	+	+	+	+	-	+	-	+	-	+	-	+
Lower Nemahbin Lake	271	0	+	+	+	+	+	+	-	+	-	+	+	+	-	+
Nagawicka Lake	957	0	+	0	-	+	+	0	+	0	-	+	-	+	-	+
Pretty Lake	64	0	0	-	+	+	+	-	-	+	-	+	+	+	-	+
School Section Lake	125	0	0	-	+	+	+	-	-	0	-	-	0	+	-	+
Upper Nashotah Lake	133	+	+	+	+	+	+	+	+	+	-	+	-	+	-	+
Upper Nemahbin Lake	283	0	0	+	+	+	+	+	+	+	-	+	-	+	-	+
Waterville Pond	68	+	+	-	+	+	+	-	+	+	-	-	+	+	-	+
OCONOMOWOC RIVER																
Beaver Lake	316	+	+	+	+	0	0	+	-	+	-	+	-	+	-	+
Lake Five	102	0	+	-	+	+	+	-	-	+	-	+	+	+	-	+
Fowler Lake	78	0	0	0	-	-	0	0	-	0	-	+	+	+	-	+
Friess Lake	119	0	+	-	+	0	0	-	+	-	-	+	-	-	-	+
Keesus Lake	237	0	0	-	+	0	0	-	+	0	-	+	-	+	-	+
Lac La Belle	1117	0	0	0	-	0	0	0	+	0	-	-	-	+	-	+
Lower Genesee Lake	66	0	+	-	+	+	+	-	-	+	-	-	-	-	+	+
Middle Genesee Lake	102	+	+	-	+	+	+	-	-	+	-	-	-	-	-	+
Moose Lake	81	+	+	+	+	0	0	+	-	+	-	+	-	+	-	+
North Lake (Wauk)	437	0	0	+	+	0	0	+	-	0	-	-	-	-	+	+
Oconomowoc Lake	767	0	0	+	+	0	0	+	-	0	-	-	-	+	-	+
Okauchee Lake	1187	+	0	+	+	0	0	0	-	0	-	+	-	+	-	+
Pine Lake	703	0	+	+	+	0	0	+	-	+	-	-	-	+	-	+
Silver Lake (Wauk.)	222	0	0	+	+	0	0	+	-	+	-	+	-	+	-	+
RUBICON RIVER																
Pike Lake	522	0	+	+	+	+	+	0	+	-	-	-	-	-	-	+
SCUPPERNONG RIVER																
La Grange Lake	55	+	+	-	+	+	+	-	+	-	-	+	+	-	-	+

Table XII-13 (continued)

SUBWATERSHED Lake Name	Area (acre)	Water Quality Monitoring	Prepare Comprehensive Management Plan	Watershed-based Measures						In-lake Management Measures						
				Public Sanitary Sewer Service	Onsite Sewage System Mgmt	Rural NPS Mgmt	Urban NPS Mgmt	Construction Site NPS Management	Live-stock Mgmt	Macro-phyte Harvest	Aeration	Nutrient Inactiva-tion	Dredge	Sediment Cover	Water Level Mgmt	Fish Management
TURTLE CREEK																
Comus Lake	117	+	+	0	-	0	0	-	+	+	-	-	+	+	-	+
Delavan Lake	2072	0	0	0	-	+	+	+	+	0	-	0	0	+	-	+
Turtle Lake	140	+	+	-	+	0	0	-	+	+	-	+	-	+	-	+
WHITEWATER CREEK																
Cravath Lake	65	+	+	0	-	+	+	0	-	+	-	+	+	+	+	+
Lake Lorraine	133	+	+	-	+	+	+	-	+	+	-	+	+	-	-	+
Rice Lake	137	0	0	-	+	+	+	-	+	+	-	+	+	+	-	+
Tripp Lake	115	+	+	0	+	+	+	0	-	+	-	+	+	+	+	+
Whitewater Lake	640	0	0	-	+	+	+	-	+	o	-	+	+	+	-	+

0 = completed or on-going management measures

+ = management measures proposed or recommended for further consideration

- = management measures not specifically recommended for future consideration

[a] Management Measures recommended for further consideration in local management plans are summarized from those adopted in SEWRPC Planning Report No. 30, modified, as necessary, as the result of subsequent implementation actions, monitoring programs, and planning studies referenced in the previous section of the text.

Source: SEWRPC.

and water budget monitoring programs are reaffirmed in the updated plan recommendations for the Rock River watershed. The management recommendations for the lakes are based upon review of the lake planning set forth in the initial plan and the current status of implementation of recommendations, as well as any subsequent local planning.

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, the water quality monitoring, aquatic plant management, and lake watershed protection measure planning and implementation are considered to be logical components 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 to the recommendations noted for the major lakes in the Rock River watershed, it is recommended that water quality planning and supporting monitoring be conducted for those lakes and similar water bodies in the watershed which are less than 50 acres in size, where such activities 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 watershed can be considered for lake management purposes.

WATER QUALITY AND BIOLOGICAL CONDITIONS

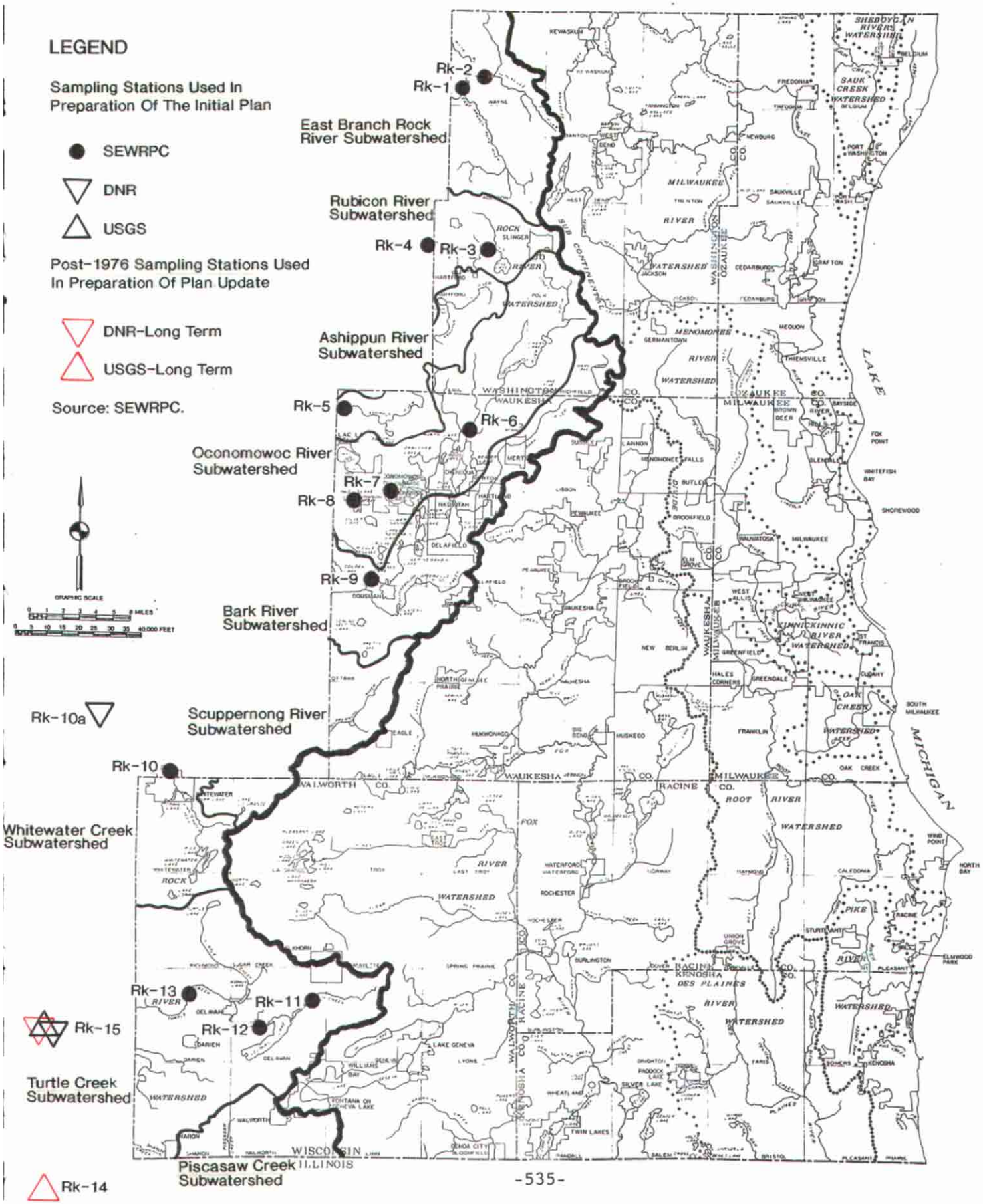
Streams

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, the 1976 Commission monitoring program conducted under the regional water quality management plan, and the Wisconsin Department of Natural Resources and U.S. Geological Survey sampling programs. Available data collected in those programs for the Rock River watershed included samplings at 13 Commission stations in the Region; at two Department of Natural Resources stations on the Rock River--one in Jefferson County and one in Rock County; and one U.S. Geological Survey station on the Rock River in Rock County. The sampling station locations are shown on Map XII-5.

No long-term post-1976 water quality data were available for stations within the Region; however, for comparative purposes, available water quality data collected at a DNR station on the main stem of the Rock River at Afton in Rock County, Rk-15, about 4.0 miles downstream of the City of Janesville, and at a U.S. Geological Survey sampling station on the Rock River at Rockton, Illinois, Rk-14, about 4.0 miles south of the Wisconsin-Illinois State line were used in the preparation of the plan update. Water quality data collected by the U.S. Geological Survey and biological condition data collected by the Department of Natural Resources were also available for use in the assessment of current water quality conditions. In addition to the data obtained since the 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

Map XII-5

LOCATIONS OF WATER QUALITY SAMPLING STATIONS IN THE ROCK RIVER WATERSHED



water quality conditions and the current potential for achieving the established water use objectives in the Rock River watershed.The long-term water quality data obtained at the U.S. Geological Survey sampling station Rk-14 at Rockton, Illinois, and at the Department of Natural Resources sampling station Rk-15 at Afton, in Rock County, for the period 1976 through 1991, are summarized in Figure XII-1 and Figure XII-2. The sampling data have been used, to the extent the data permits, to present a measure of current water quality conditions to evaluate water quality trends and the occurrence of changes over time, and to evaluate current conditions with respect to water quality standards. Because of the large tributary area above these two stations from subwatersheds located outside the Southeastern Wisconsin Region, the data are not considered to necessarily represent conditions for the portion of the watershed within the Region. However, the data are presented for information purposes. The water quality standards indicated in Figure XII-1 and Figure XII-2 are those set forth for specific biological and recreational use objectives as described in Chapter II.

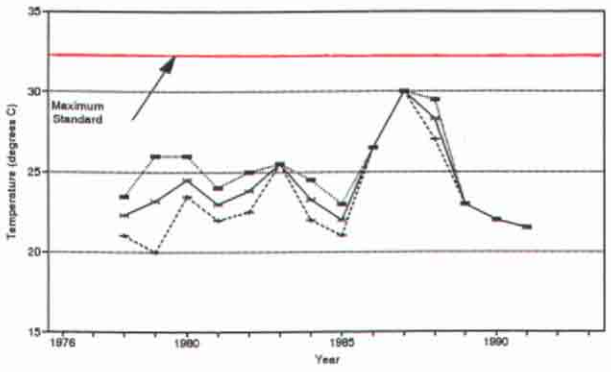
Review of the data for station Rk-14 indicates that, with the exception of dissolved oxygen and phosphorus levels, there were no apparent significant changes in water quality conditions from 1976 to 1991. Sampling data of dissolved oxygen and total phosphorus showed improvements in overall concentrations. The sampling data indicate that the standards for temperature and dissolved oxygen are generally met. Fecal coliform and phosphorus standards are frequently not met. Chronic toxicity standards for selected metals were exceeded some of the time, as discussed in the following section.

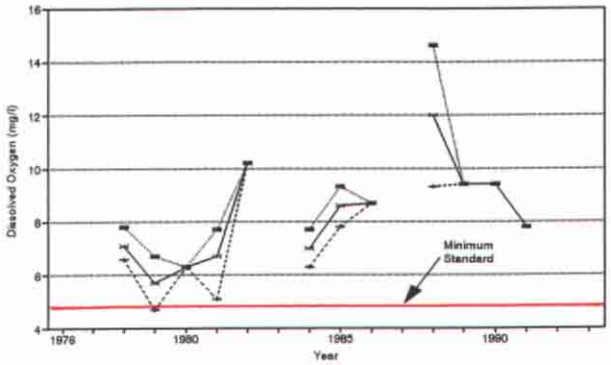
Review of the available data for station Rk-15 indicates no apparent significant changes in water quality conditions from 1976 to 1991, with the exception of chloride levels which appear to be increasing. However, the levels of chloride are still within acceptable limits as defined by the standards associated with the water use objectives for the Rock River set forth in Chapter II. The increase in chlorides may be the result of new urban development which has occurred in the watershed and the impacts of increased winter road maintenance salt-spreading operations associated with urban development. The sampling data indicate that the standards for temperature, dissolved oxygen, and ammonia nitrogen are generally met, while fecal coliform and phosphorus standards are frequently not met.

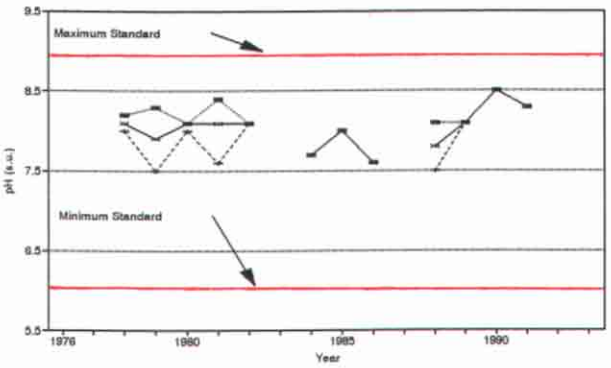
Toxic and Hazardous Substances: Sampling and analysis for pesticides, polychlorinated biphenyls (PCB's), and heavy metals were conducted by the Wisconsin Department of Natural Resources in the Rock River watershed between 1973 and 1978. In the in-stream water quality samples for which toxic and hazardous substances were tested, recommended levels of mercury were exceeded in approximately four of 78 samples, and for the persistent pesticides of heptachlor, heptachlor epoxide, lindane, metholychlor, and phthalate recommended levels were exceeded in one of 77, one of 76, one of 76, and three of 62 samples collected, respectively. Sample analyses for cadmium, chromium, copper, lead, nickel, zinc, PCB's, DDT, DDE, DDD, aldrin, and dieldrin showed no violations of U.S. Environmental Protection Agency recommended levels.

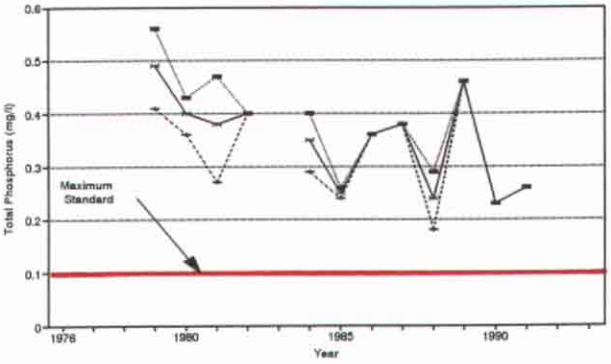
No analyses were conducted for toxic and hazardous substances in the bottom sediments of the Rock River watershed. Recent data on toxic and hazardous substances were collected by the U.S. Geological Survey at station Rk-14, as shown in Figure XII-1. These data indicatestation Rk-14. Lead levels have not violated the standard since 1987. Prior to 1987, the exceedances of the lead

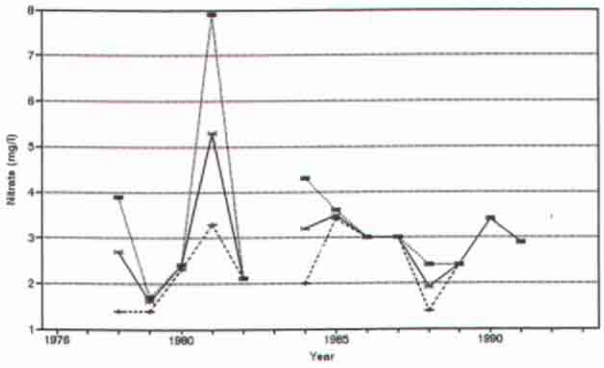
Figure XII-1
WATER QUALITY DATA FOR THE ROCK RIVER
AT STATION Rk-14: 1976-1993

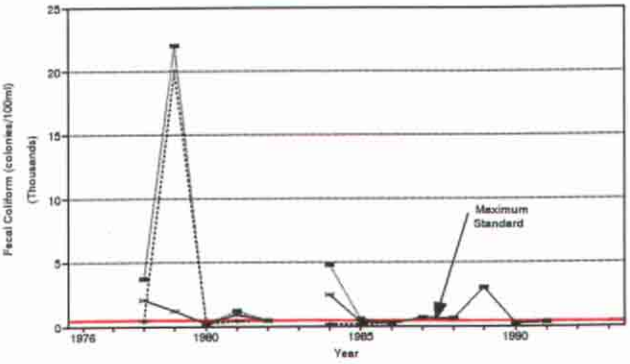




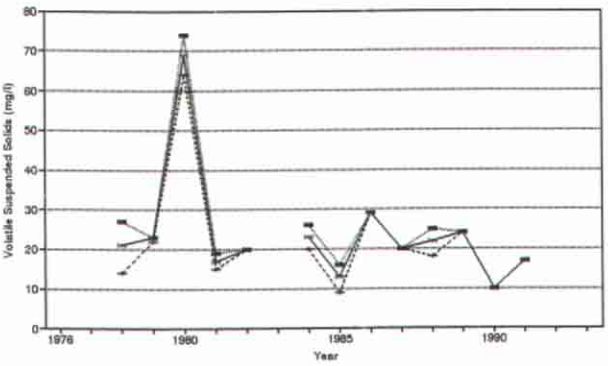


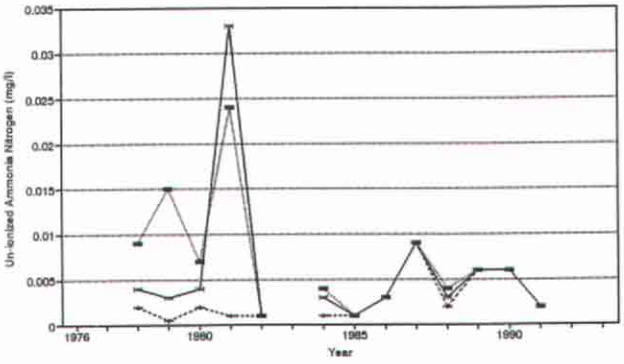






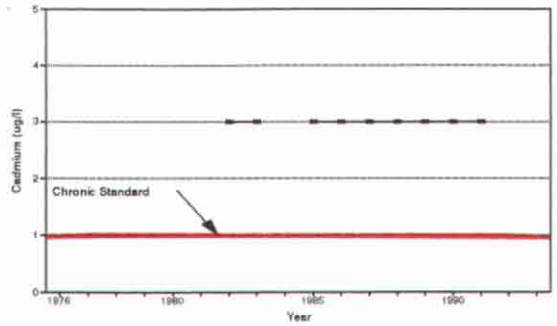
Note: The maximum standard of 200/400 colonies per 100ml was violated in all years.



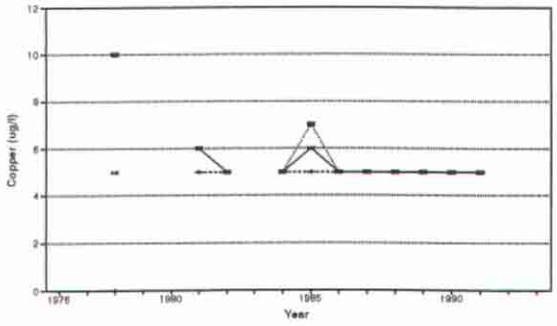


Note: The maximum standard of 0.04 mg/l was not violated in any year.

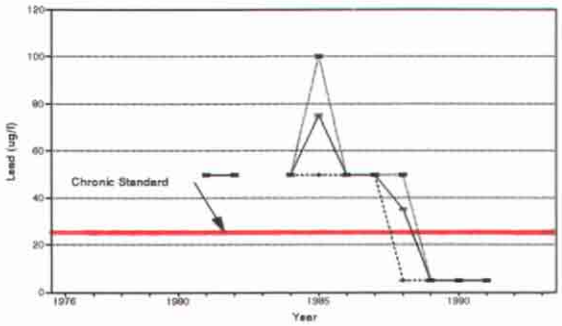
Figure XII-1 (cont'd)



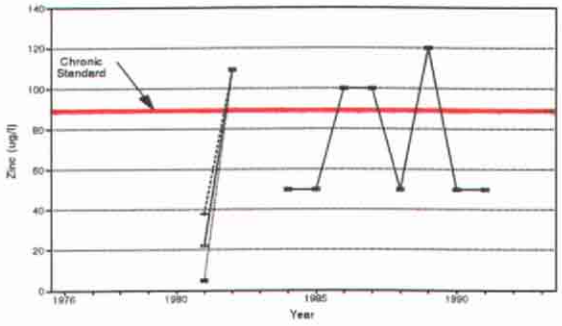
Note: The acute standard of 63.3 ug/l was not violated in any year.
Values graphed at 3.0 ug/l were indicated to be less than 3.0 ug/l.



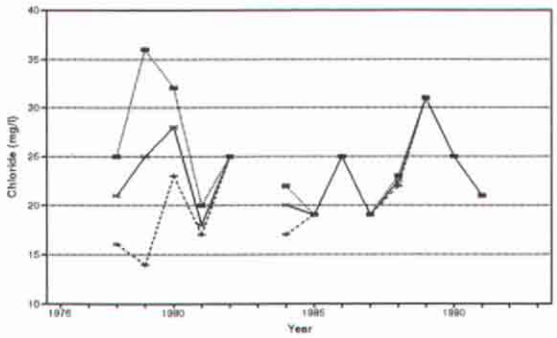
Note: The acute standard of 31.9 ug/l was not violated in any year.
The chronic standard of 22.1 ug/l was not violated in any year.
Values graphed at 5.0 ug/l were indicated to be less than 5.0 ug/l.



Note: The acute standard of 406.6 was not violated in any year.
Values graphed at 50 ug/l prior to 1988 were indicated to
be less than 50 ug/l and values graphed at 5.0 ug/l
after 1988 were indicated to be less than 5.0 ug/l.



Note: The acute standard of 202.9 ug/l was not violated in any year.



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

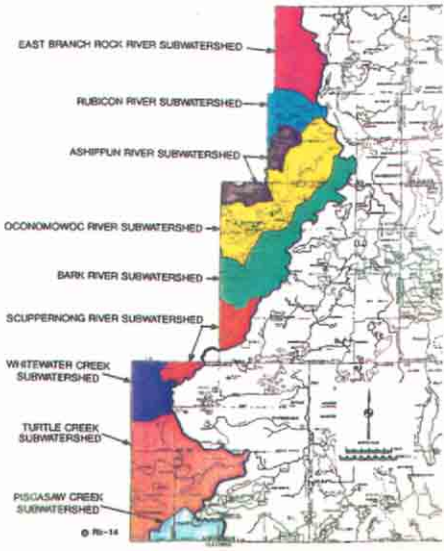
LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

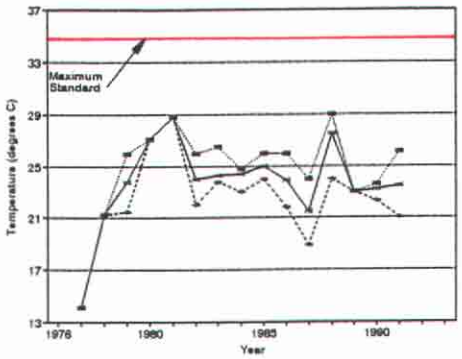
SUBWATERSHEDS IN THE ROCK RIVER WATERSHED

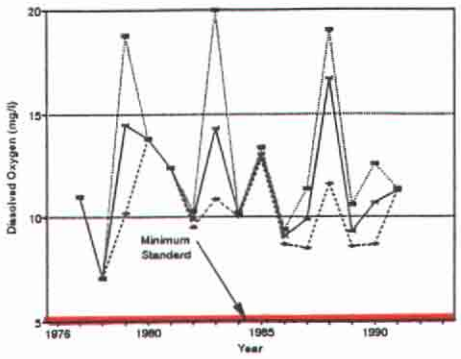


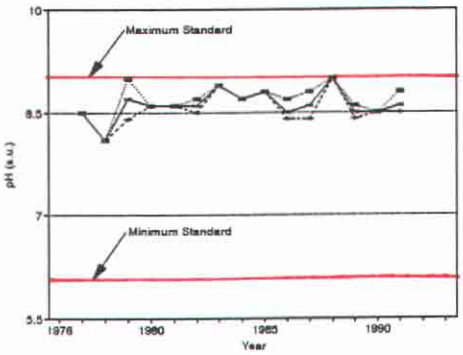
Note: Graphs indicate maximum, minimum and average values for July and August data. Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources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

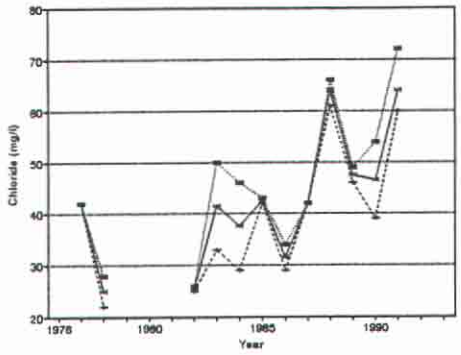
Source: U.S. Geological Survey and SEWRPC.

Figure XII-2
WATER QUALITY DATA FOR THE ROCK RIVER AT STATION Rk-15: 1976-1993

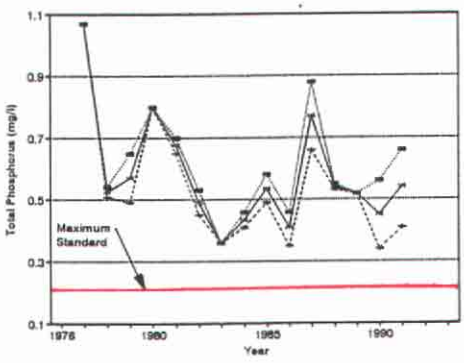


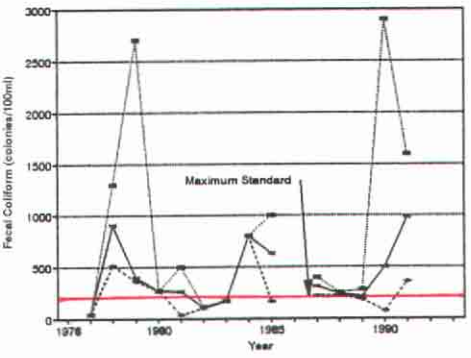


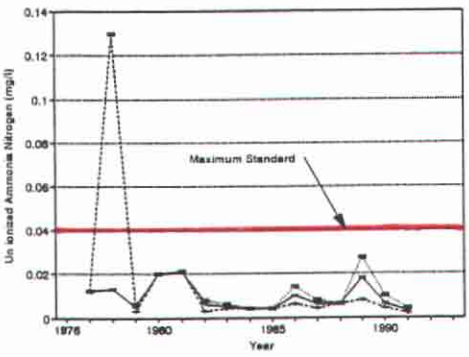




Note: The maximum standard of 1000 mg/l was not violated in any year.







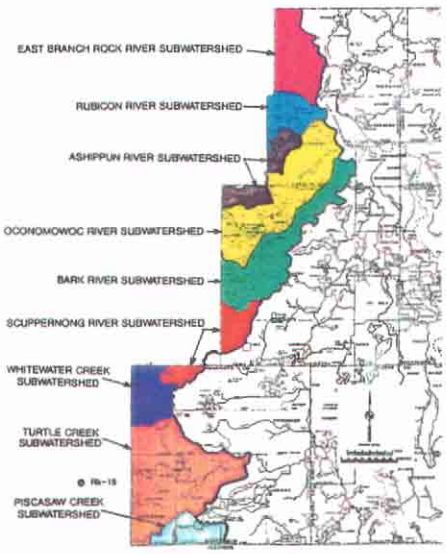
LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

SUBWATERSHEDS IN THE ROCK RIVER WATERSHED



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.

Source: Wisconsin Department of Natural Resources and SEWRPC.

standard was reported. No recent data were available on toxic and hazardous substances for station Rk-15.

Since the completion of the initial water quality management plan, seven spills of toxic substances into streams within the Rock River watershed have been documented by the Wisconsin Department of Natural Resources. Of these spills, three have occurred in the Bark River, two in the Ashippun River, and one each in the East Branch of the Rock River and the Rubicon River. The majority of the spills were of oil or diesel fuel.

Water Quality Assessments: Based upon recent available data, the water quality and biological characteristics of the Rock River and its major tributaries were assessed, with the results set forth in Table XII-14. Where data were available, fish populations and diversity range from poor in the Kohlsville River to generally good elsewhere, except for Whitewater Creek, Jackson Creek, Swan Creek, and Turtle Creek upstream of Comus Lake, where the populations and diversities are fair. Bluff Creek upstream of CTH P supports a Class I trout fishery; and the remaining portion of Bluff Creek and portions of Allenton Creek, Steel Brook Creek, and the Scuppernong River support Class II trout fisheries. Class III trout fisheries are supported by portions of the Scuppernong River and Steel Brook Creek.

Fish kills were documented in four streams in the Rock River watershed--Scuppernong River, Steel Brook Creek, Darien Creek, and the East Branch of the Rock River. The specific cause of each documented fish kill is shown in Table XII-14.

Standards were not fully met for dissolved oxygen concentrations in the Rubicon River, the East Branch of the Rock River, Kohlsville River, Whitewater Creek, the Oconomowoc River downstream of US 16, and along portions of the Bark and Ashippun Rivers. Ammonia nitrogen levels were within acceptable limits in those streams of the watershed for which data were available, except for portions of the Rubicon River downstream of Pike Lake and in the Oconomowoc River downstream of US 16 to Fowler Lake. For all streams where data were available, phosphorus levels did not appear to pose problems in any of the stream reaches, while fecal coliform levels appeared to generally exceed the standard.

No comprehensive data were available on toxic pollutants, with the exception of some evidence of nonpoint source toxic pollutants occurring in the Ashippun River downstream of the Waukesha County Line, in two tributaries of the Oconomowoc River, and in portions of the Rubicon River. Additional data collected by the U.S. Geological Survey at station Rk-14 on the Rock River at Rockton, Illinois, indicate that the standards for chronic toxicity, as defined in Chapter II, for zinc, and cadmium were consistently violated.

The biotic index ratings, which are biological indicators of water quality within a stream system, ranged from good to excellent within the Oconomowoc River subwatershed, except for the Oconomowoc River upstream of Friess Lake, which had a good to fair rating. In the rest of the watershed, no data were available to determine biotic index ratings. Low to moderate levels of streambed sedimentation were observed throughout the watershed, with moderate to high and high levels of streambed sedimentation occurring in Turtle Creek.

Table XII-14

CHARACTERISTICS OF STREAMS IN SUBWATERSHEDS WITHIN THE ROCK RIVER WATERSHED

SUBWATERSHED Stream Reach	Stream Length (miles)	Fish Population and Diversity[a]	Recorded Fish Kills[b]	Water Quality Problems[c]					Biotic Index Rating[d]	Streambed Sedimentation Substrate	Physical Modifications to Channel[e]
				DO	NH_3	Total P	Fecal Coliform	Toxics			
ASHIPPUN RIVER											
a. Ashippun River upstream Druid Lake	4.3	--	No	--	--	--	--	--	--	--	--
b. Ashippun River downstream Druid Lake to Washington County Line	5.2	--	No	--	--	--	--	--	--	--	--
c. Ashippun River downstream Waukesha County Line to Ashippun Lake inflow	7.2	--	No	Yes	No	--	--	Yes	--	--	Moderate
d. Ashippun River downstream Ashippun Lake inflow	4.2	--	No	--	--	--	--	--	--	--	Moderate
TOTAL	20.9										
BARK RIVER											
a. Bark River upstream Nagawicka Lake	19.3	Good	No	No	--	No	No	--	--	Moderate (sand, gravel, silt)	Moderate
b. Bark River downstream Nagawicka Lake	12.3	Good	No	Yes	No	No	No	--	--	Unkown deposition (sand, gravel,rubble)	Moderate
c. Scuppernong Creek	12.5	Good	No	No	No	No	No	--	--	Low to Moderate (sand, gravel, silt)	Major
TOTAL	44.1										
OCONOMOWOC RIVER											
a. Coney River	6.2	--	--	No	No	--	--	Yes	--	--	Major
b. Oconomowoc River u/s Friess Lake	2.8	--	No	No	No	--	--	--	Good to Fair	--	--
c. Oconomowoc River d/s Friess Lake to North Lake	15.2	--	No	No	No	--	--	--	Good	--	Moderate
d. Oconomowoc River d/s North Lake to Okauchee Lake	1.8	--	No	No	No	--	--	--	Good	--	--
e. Oconomowoc R. d/s Okauchee Lake to Oconomowoc Lake	0.4	--	No	No	No	--	--	--	--	--	--
f. Oconomowoc River d/s US 16 to Fowler Lake	1.7	--	--	Yes	Yes	--	--	--	--	--	--
g. Oconomowoc R. d/s Lac La Belle to Waukesha Co. Line	5.0	--	--	Yes	No	--	--	--	--	--	--
h. Little Oconomowoc River	5.7	--	--	No	No	--	--	--	Excellent	--	--
i. Mason Creek	6.5	--	--	--	--	--		Yes	Very good to good	--	--
TOTAL	45.3										
PISCASAW CREEK	2.5	--	No	--	--	--	--	--	--	--	Moderate
a. Piscasaw Creek											

Table XII-14 (continued)

SUBWATERSHED Stream Reach	Stream Length (miles)	Fish Population and Diversity[a]	Recorded Fish Kills[b]	Water Quality Problems[c]					Biotic Index Rating[d]	Streambed Sedimentation Substrate	Physical Modifications to Channel[e]
				DO	NH_3	Total P	Fecal Coliform	Toxics			
ROCK RIVER EAST BRANCH											
a. East Branch Rock River downstream CTH D	4.4	--	No	Yes	No	--	--	--	--	--	--
b. Limestone Creek	5.8	Good	No	Yes	--	--	Yes	--	--	--	Low
c. East Branch Rock River upstream CTH D	14.3	--	Yes	Yes	No	--	--	--	--	Moderate	--
d. Allenton Creek	3.4	Good[g]	No	No	No	--	--	--	--	Moderate	Moderate
e. Kohlsville River	10.2	Poor	No	Yes	--	--	--	--	--	--	--
f. Wayne Creek	6.5	Good	No	--	--	--	--	--		Low (gravel)	Moderate
TOTAL	44.6										
RUBICON RIVER											
a. Rubicon River upstream Pike Lake	2.8	--	No	Yes	No	No	No	--	--	Moderate	Major
b. Rubicon River d/s Pike Lake	5.0	--	No	Yes	Yes	No	No	Yes	--	Moderate	Moderate
TOTAL	12.6										
SCUPPERNONG RIVER											
a. Scuppernong River	14.9	Good[h]	Yes	No	No	--	--	--	--	Low to moderate (sand, gravel, silt)	Moderate (upper)
b. Steel Brook Creek	7.1	Good[i]	Yes[j]	--	--	--	--	--	--	--	--
TOTAL	22.0										
TURTLE CREEK											
a. Jackson Creek	5.7	Fair	No	No	No	No	Yes	--	--	Moderate	--
b. Swan Creek	4.2	Fair	No	No	No	No	No	--	--	Low	--
c. Turtle Creek upstream Comus Lake	10.2	Fair	No	No	No	No	No	--	--	High	Moderate
d. Turtle Creek downstream Comus Lake to STH 11	3.3	Fair-good	No	No	No	No	No	--	--	Moderate to high	--
e. Turtle Creek downstream STH 11 to Walworth County Border	7.1	Fair-good	No	No	No	No	No	--	--	Moderate to high	--
f. Little Turtle Creek + Ladd Creek	8.6	Fair	No	No	No	No	Yes	--	--	--	Moderate
g. Darien Creek	8.8	--	Yes[k]	No	No	No	Yes	--	--	Unknown Deposition	--
h. Sharon Creek	2.1	--	No	--	--	--	--	--	--	--	--
TOTAL	50.0										

Table XII-14 (continued)

SUBWATERSHED Stream Reach	Stream Length (miles)	Fish Population and Diversity[a]	Recorded Fish Kills[b]	Water Quality Problems[c]					Biotic Index Rating[d]	Streambed Sedimentation Substrate	Physical Modifications to Channel[e]
				DO	NH_3	Total P	Fecal Coliform	Toxics			
WHITEWATER CREEK											
a. Whitewater Creek	10.2	Fair	No	Yes	No	--	--	--	--	--	--
b. Bluff Creek	1.9	Good[l]	No	--	--	--	--	--	--	--	--
c. Galloway Creek	1.4	--	No	--	--	--	--	--	--	--	--
TOTAL	13.5										

[a]Based upon available dates and professional judgement of area fish managers.

[b]Unless otherwise noted, fish kills are assumed to be the result of natural fluctuations in water conditions.

[c]Estimated 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 evaluate current water quality for Rock River watershed stream reaches based upon year 2000 land use conditions, and if data developed in the initial plan were used to evaluate current water quality for Rock River watershed stream reaches based upon year 2000 land use conditions, and if appropriate, were applied using less than a 95 percent compliance level of the dissolved oxygen and un-ionzed ammonia nitrogen standards and less than a 90 percent compliance level for the fecal coliform and phosphorus standards as an indication of water quality problems.

[d]Except where otherwise indicated, biotic index ratings are based upon the Index of Biotic Integrity (IBI) discussed in U.S. Department of Agriculture, Forest Service, General Technical Report NC-149, "Using the Index of Biotic Integrity (IBI) To Measure Environmental Quality in Warmwater Streams of Wisconsin," Lyons, April 1992.

[e]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.

[f]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.

[g]Allenton Creek is a Class II trout stream.

[h]Scuppernong River from above CTH N downstream to Scuppernong Springs Pond is a Class II trout stream. Scuppernong River downstream of Scuppernong Springs Pond is a Class III trout stream.

[i]Steel Brook Creek is a Class II trout stream upstream of Bluff Road and a Class III trout stream downstream of Bluff Road.

[j]Spill potentially related to a fertilizer spill.

[k]Due to point source discharge from canning plant.

[l]Bluff Creek is a Class I trout stream upstream of CTH P and a Class II trout stream downstream of CTH P.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table XII-15 sets forth the water quality index classifications[26] 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 XII-14, recent data were available only for stations Rk-14 and Rk-15. These stations are shown on Map XII-5. The limited data available indicate that at station Rk-14, water quality conditions have improved from "fair" to "good" from 1978-79 to 1990-91 and at station Rk-15, water quality conditions have maintained a "fair" rating from 1977-78 to 1990-91. As noted earlier, these stations may not be representative of water quality conditions in the subwatersheds located within Southeastern Wisconsin since relatively large subwatersheds from outside the Region are tributary to the station locations. However, the data and the quality indices are presented for information purposes.

A summary of potential pollution sources in the Rock River watershed by stream reach is shown in tabular summary in Table XII-16. Review of the data indicate a majority of the conversion of lands from rural to urban uses has occurred in the Oconomowoc and Bark River subwatersheds, primarily in the northwest portion of Waukesha County. It should also be noted that the majority of the permitted industrial discharges occur in streams in the Turtle Creek subwatershed. 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 XII-16.

Lakes

Lake water quality data available for use in preparing the initial regional water quality management plan were obtained from the Wisconsin Department of Natural Resources' quarterly lake monitoring program for selected lakes; U.S. Environmental Protection Agency (EPA) National Eutrophication Survey and Southeastern Wisconsin Regional Planning Commission and Wisconsin Department of Natural Resources lake use reports. Post-1975 data on phosphorus and chlorophyll-a concentrations and water clarity for major lakes in the Rock River watershed, where available are presented in Table XII-17.

Toxic and Hazardous Substances: A number of lakes in this watershed were subject to substance spills. These included an hydraulic fluid spill into Fowler Lake in 1982, two diesel oil spills into Lower Nemahbin Lake in 1982 and 1990; two oil and one diesel fuel spills into Okauchee Lake in 1983 and 1991, respectively; a spill of an unknown substance into North Lake in 1984; and a gasoline and hydraulic oil spill in Pretty Lake in 1982 and 1986, respectively--but these appear to be isolated incidences that do not warrant special planning consideration at this time.

Fish kills, primarily related to seasonal fluctuations in water temperature and levels of dissolved oxygen, as well as spawning activity periodically occur in lakes in the Rock River watershed. Since the initial plan, recorded fish kills in major lakes in the Rock River watershed occurred in Okauchee Lake in 1981 and 1985, Delavan Lake in 1990, and Pine Lake in 1984. However, these occurrences do not appear to be chronic. Thus, despite the obvious concern that these

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[26]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 XII-15

WATER QUALITY INDEX CLASSIFICATIONS[a] FOR THE SAMPLING STATIONS OF THE ROCK RIVER 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
Rk-1	Excellent	Fair	--
Rk-2	Excellent	Fair	--
Rk-3	Excellent	Fair	--
Rk-4	Fair	Fair	--
Rk-5	Good	Fair	--
Rk-6	Excellent	Fair	--
Rk-7	Good	Excellent	--
Rk-8	Fair	Fair	--
Rk-9	Good	Fair	--
Rk-10	Fair	Fair	--
Rk-11	Poor	Poor	--
Rk-12	Good	Fair	--
Rk-13	Fair	Fair	--
Watershed Average	Good	Fair	--
Sampling Stations Outside of Region			
Rk-14	--	Fair[b]	Good
Rk-15	--	Fair[c]	Fair

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

[b]Water quality index calculated from July and August 1978-1979.

[c]Water quality index calculated from July and August 1977-1978.

Source: SEWRPC.

Table XII-16

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

SUBWATERSHED 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	
ASHIPPUN RIVER Ashippun River upstream Druid Lake	Insignificant	Insignificant	1987-blue chemical	--	X	--	--	--	--		1
Ashippun River downstream Druid Lake	Moderate	Insignificant	--	--	X	--	--	--	--	--	1
Ashippun River downstream Waukesha County Line to Ashippun Lake inflow	Insignificant	Insignificant	1986-diesel fuel	--	X	--	--	--	--	--	1
Ashippun River downstream Ashippun Lake inflow	Insignificant	Insignificant	--	--	X	--	--	--	--	--	1
BARK RIVER Bark River upstream Nagawicka Lake	Moderate	Significant	1984-oil 1984-waste oil	X	X	--	--	1	--	Village of Hartland public sewage treatment plant abandoned in 1980.	1
Bark River downstream Nagawicka Lake	Significant	Insignificant	1986-drums	X	X	2	--	1	--	St John's private sewage treatment plant abandoned in 1980.	1
Scuppernong Creek	Moderate[d]	Significant	--	X	X	--	--	--	--	--	1
OCONOMOWOC RIVER Coney River	Insignificant	Insignificant	--	--	X	--	--	--	--	--	2,3
Oconomowoc River Upstream Friess Lake	Moderate[d]	Insignificant	--	--	X	--	--	--	--	--	2,3
Oconomowoc River Downstream Friess Lake to North Lake	Significant	Insignificant	--	--	X	--	--	1	--	--	2,3
Oconomowoc River Downstream North Lake to Okauchee Lake	Insignificant	Significant	--	X	X	--	--	--	--	--	1,2,3

Table V-16 (continued)

SUBWATERSHED 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	
Oconomowoc River Downstream Okauchee Lake to Oconomowoc Lake	Significant[e]	Insignificant[e]	--	X	X	--	--	--	--	--	1,2,3
Oconomowoc River Downstream US 16 to Fowler Lake	Insignificant	Significant	--	X	X	--	--	--	--	--	1,2,3
Oconomowoc River Downstream Lac La Belle to Waukesha County Line	Significant	Significant	--	X	X	1	--	3	--	--	1,2,3
Little Oconomowoc River	Significant[d]	Insignificant	--	X	X	--	--	--	--	--	1,2,3
Mason Creek	Significant[d]	Insignificant	--	X	X	--	--	--	--	--	1,2,3
PISCASAW CREEK Piscasaw Creek	Insignificant	Insignificant	--	--	X	1	--	1	--	Village of Walworth public sewage treatment plant replaced in 1986	1
ROCK RIVER EAST BRANCH East Branch Rock River Downstream CTH D	Insignificant	Insignificant	--	--	X	--	--	--	--	--	1
Limestone Creek	Insignificant	Insignificant	--	--	X	--	--	--	--	--	1
East Branch Rock River Upstream CTH D	Insignificant	Insignificant	1991-diesel fuel	X	X	1	--	1	--	--	1
Allenton Creek	Insignificant	Insignificant	--	--	X	--	--	--	--	--	1
Kohlsville River	Insignificant	Insignificant	--	--	X	--	--	--	--	--	1
Wayne Creek	Insignificant	Insignificant	--	--	X	--	--	--	--	--	1
RUBICON RIVER Rubicon River Upstream Pike Lake	Moderate	Significant	--	X	X	1	--	--	--	--	1
Rubicon River Downstream Pike Lake	Insignificant	Significant	1991-hydraulic oil	X	X	1	--	3	--	--	1,4
SCUPPERNONG RIVER Scuppernong River	Insignificant	Insignificant	--	--	X	--	--	--	--	--	1
Steel Brook Creek	Insignificant	Insignificant	--	--	X	--	--	--	--	--	1

Table V-16 (continued)

SUBWATERSHED 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	
TURTLE CREEK											
Jackson Creek	Insignificant	Insignificant	--	--	X	--	--	6	--	City of Elkhorn public sewage treatment plant abandoned in 1981 Walworth County Institutions private sewage treatment plant abandoned in 1981	1,2,3
Swan Creek	Significant	Significant	--	X	X	--	--	1	--	--	1,2,3
Turtle Creek Upstream Comus Lake	Insignificant	Insignificant	--	--	X	--	--	--	--		1,2,3
Turtle Creek Downstream Comus Lake to STH 11	Insignificant	Insignificant	--	X	X	1	--	1	Delavan Municipal Well No. 4	City of Delavan public sewage treatment plant abandoned in 1981	1,2,3
Turtle Creek Downstream STH 11	Insignificant	Insignificant	--	--	X	--	--	--	--	--	1,2,3
Little Turtle Creek and Ladd Creek	Insignificant	Insignificant	--	--	X	--	--	--	--	--	1
Darien Creek	Insignificant	Insignificant	--	X	X	1	--	3	--	--	1,4
Sharon Creek	Insignificant	Insignificant	--	--	X	1	--	1	--	--	1
WHITEWATER CREEK											
Whitewater Creek	Insignificant	Insignificant	--	X	X	1	--	2	--	--	1
Bluff Creek	Insignificant	Insignificant	--	--	X	--	--	--	--	--	1
Galloway Creek	Insignificant	Insignificant	--	X	X	--	--	--	--	--	1

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

1. Construction Erosion Control Ordinances in place; 2 - Urban Nonpoint Source Controls Implemented; 3 - Rural Nonpoint Source Controls Implemented; 4 - Sewage Treatment Plant Upgrading or Abandonment Underway

[d] Considerable urban development existing pre-1976.

[e] The amount of post-1976 urban development has increased significantly in comparison to pre-1976 urban development.

Source: Wisconsin Department of Natural Resources and SEWRPC.

episodes create among lake users, they do not appear to warrant special planning considerations at this time.

Water Quality Assessments: Data from Table XII-17 were used in the calculation of trophic state indices for each of the major lakes where data were available. Trophic states, indicating degrees of nutrient enrichment in the lakes, were assigned using the Wisconsin Trophic State Index[27] for each major lake in the Rock River watershed where data were available, as indicated in Table XII-18. The available trophic state index values using the Carlson Trophic State Index are also provided for current and historic conditions, as shown in Table XII-19. These data are presented using the Carlson Trophic State Index in order to present the newer data on a comparable basis to the historic data which used that Index.

The data available, as shown in Table XII-18, indicate that all of the lakes may be classified in the mesotrophic to eutrophic range. Mesotrophic lakes have moderate levels of nutrient enrichment, whereas, eutrophic lakes are nutrient-rich lakes. Crooked, Lower Nashotah, Lower Nemahbin, Nagawicka, Upper Nemahbin, Fowler, Keesus, Lac La Belle, North, Oconomowoc, and Okauchee Lakes are all drainage lakes in the mesotrophic range. Golden, Pretty, Beaver, Lower Genesee, Middle Genesee, Moose, Pine, and Silver Lakes and Lake Five are mesotrophic seepage lakes; and Ashippun, Bark, School Section, Upper Nashotah, Pike, and Turtle Lakes are mesotrophic drained lakes.

Druid, Friess, Comus, Delavan, Cravath, Rice, and Tripp Lakes are all drainage lakes classified in the eutrophic range. Whitewater Lake is classified as an eutrophic drained lake. No current data are available to make assessments of trophic status for Hunters Lake, La Grange Lake, or Lake Lorraine, all seepage lakes, or for Waterville Pond, a drainage lake.

No conclusions regarding changes in water quality conditions between 1976 and 1991 can be drawn based on the limited data available. However, based upon the data set forth in Table XII-19, water quality does not appear to have changed significantly despite considerable urbanization in this watershed. Slight improvements in water quality in fact may have occurred in Druid Lake, Golden Lake, Upper Nashotah Lake, and Lake Keesus.

In addition, periodic fish kills primarily related to seasonal fluctuations in water temperature and levels of dissolved oxygen, as well as spawning activity, have occurred on Pine Lake in 1984, Okauchee Lake in 1985, and Whitewater Lake in 1986. A fish kill related to an herbicide application occurred on Okauchee Lake in 1981. A fish kill related to lake management activities on Delavan Lake occurred in August 1990. These occurrences do not appear to be chronic. Thus, despite the obvious concern that these episodes create among lake users, they do not appear to warrant special planning considerations at this time.

Compliance with Water Use Objectives

As indicated in Chapter II, the majority of the stream reaches in the Rock River watershed as of 1993, are generally recommended for warmwater sport fish and full recreational uses. These water use objectives and associated water quality

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[27]The Wisconsin State Index is set forth in "Trophic State Index Equations and Regional Predictive Equations for Wisconsin Lakes," R.A. Lillie et al, Research Management Findings, No. 35, May 1993.

Table XII-17

WATER QUALITY OF THE MAJOR LAKES IN THE ROCK RIVER WATERSHED

SUBWATERSHED Lake Name	Area (acre)	Total Phosphorus (mg/l)					Chlorophyll-a (µg/l)					Secchi Disk (feet)				
		Maximum	Minimum	Average[a]	Date of Data	Source[b]	Maximum	Minimum	Average[a]	Date of Data	Source[b]	Maximum	Minimum	Average[a]	Date of Data	Source[b]
ASHIPPUN RIVER																
Ashippun Lake	84	0.13	0.01	0.03(140)	1973-79	LSF,ERA	28.26	5.28	16.77(2)	1976	LSF	14.25	3.25	6.97(30)	1989-92	SELF-HELP
Druid Lake	124	0.44	0.02	0.13(24)	1973-75	LSF	--	--	--	--	--	10.25	8.75	9.5(6)	1992	SELF-HELP
BARK RIVER																
Bark Lake	65	0.16	0.03	0.07(3)	1979	LSF	8.0	5.4	6.7(2)	1980	LSF	--	--	9.5(1)	1980	LSF
Crooked Lake	58	--	--	--	--	--	--	--	--	--		12.0	4.0	7.6(20)	1988-89	SELF-HELP
Golden Lake	250	0.10	<0.01	0.03(26)	1973-75	LSF	--	--	3.0(1)	1980	LSF	14	9.5	11.7(13)	1989,92	SELF-HELP
Hunter's Lake	65	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lower Nashotah Lake	90	0.12	<0.01	0.04(9)	1980	AquaTech	5.8	2.8	4.6(7)	1980-81	AquaTech	22	4.75	11.8(8)	1987-89	SELF-HELP
Lower Nemahbin Lake	271	0.85	<0.01	0.09(26)	1973-75	LSF	--	--	6.0(1)	1980	LSF	12	8.2	8.2(21)	1988-89	SELF-HELP
Nagawicka Lake	957	0.20	0.01	0.04(75)	1986-87	LTT	17.0	2.0	8.6(22)	1986-87	LTT	19.7	4.9	10.1(49)	1986-87	LTT
Pretty Lake	64	0.03	<0.01	0.02(13)	1974-80	LSF	5.2	1.6	3.4(2)	1979-80	LSF	23.0	6.0	11.71(7)	1989	SELF-HELP
School Section Lake	125	0.04	0.01	0.02(10)	1979-80	LSF	--	--	7.0(1)	1980	STORET	8.0	4.5	5.37(33)	1987-91	SELF-HELP
Upper Nashotah Lake	133	0.31	<0.01	0.03(25)	1973-75	LSF	--	--	--	--	--	11.0	4.25	8.75(3)	1988-89	SELF-HELP
Upper Nemahbin Lake	283	0.49	<0.01	0.07(35)	1973-79	LSF	--	--	4.0(1)	1980	STORET	14.0	3.75	8.73(23)	1986-88	SELF-HELP
Waterville Pond	68	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
OCONOMOWOC RIVER																
Beaver Lake	316	0.06	0.01	0.03(26)	1973-75	LSF	--	--	--	--	--	12.5	5.0	9.2(10)	1973-75	LSF
Lake Five	102	--	--	--	--	--	--	--	--	--	--	13.75	5.25	8.18(15)	1991-92	SELF-HELP
Fowler Lake	78	0.23	0.003	0.03(89)	1984-91	USGS	6.0	<0.10	1.85(31)	1984-90	USGS	24.9	5.9	12.2(18)	1987-90	USGS
Friess Lake	119	0.40	0.015	0.105(69)	1986-87	LTT	69.0	2.0	22.0(22)	1986-87	LTT	16.1	1.8	6.5(70)	1986-87	LTT
Lake Keesus	237	0.49	0.01	0.045(8)	1991-92	USGS	9.0	3.0	6.0(8)	1991-92	USGS	10.5	6.6	8.4(8)	1991-92	USGS
Lac La Belle	1117	0.40	0.01	0.015(43)	1986-89	LTT	12.0	2.0	6.0(40)	1986-89	LTT	16.4	4.5	7.7(127)	1986-89	LTT
Lower Genesee Lake	66	0.05	0.02	0.035(2)	1974	LSF	--	--	3.0(1)	1980	STORET	20.25	6.5	12.2(4)	1987	STORET
Middle Genesee Lake	102	0.03	0.02	0.025(2)	1974	LSF	--	--	3.0(1)	1980	STORET	--	--	7.2(1)	1980	STORET
Moose Lake	81	0.04	0.01	0.018(4)	1979	LSF	--	--	--	--	--	9.0	7.0	8.0(2)	1979	DNR
North Lake (Waukesha)	437	0.26	0.01	0.06(55)	1973-75	LSF	14.0	6.0	10.0(2)	1980	STORET	21.5	4.0	11.48(119)	1986-92	SELF-HELP
Oconomowoc Lake	767	0.12	<0.001	0.02(82)	1986-92	USGS	6.0	1.0	2.67(33)	1986-90	USGS	22.25	5.0	10.64(181)	1986-92	SELF-HELP
Okauchee Lake	1187	0.23	<0.005	0.02(123)	1986-91	USGS	15.0	3.0	5.68(77)	1986-90	USGS	14.11	3.94	6.92(91)	1986-90	USGS
Pine Lake	703	0.36	0.017	0.076(39)	1978-81	STORET	13.0	3.0	5.0(32)	1978-81	STORET	18.0	5.91	10.21(45)	1979-81	STORET
Silver Lake (Wauk.)	222	0.12	<0.01	0.02(36)	1973-92	LSF	--	--	4.0(1)	1980	STORET	--	--	10.54(6)	1991	SELF-HELP
RUBICON RIVER																
Pike Lake	522	0.83	0.01	0.052(96)	1985-87	LTT	22	4.8	11.3(26)	1985-87	LTT	33	2.6	7.5(67)	1985-87	LTT
SCUPPERNONG RIVER																
La Grange Lake	55	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table XII-17 (continued)

SUBWATERSHED Lake Name	Area (acre)	Total Phosphorus (mg/l)					Chlorophyll-a (µg/l)					Secchi Disk (feet)				
		Maximum	Minimum	Average[a]	Date of Data	Source[b]	Maximum	Minimum	Average[a]	Date of Data	Source[b]	Maximum	Minimum	Average[a]	Date of Data	Source[b]
TURTLE CREEK																
Comus Lake	117	0.24	0.04	0.10(11)	1977-79	LSF	--	--	95(1)	1977	LSF	2.7	0.5	1.7(6)	1977-79	LSF
Delavan Lake	2072	3.30	0.007	0.16(641)	1983-89	USGS	300	0.2	24.33(91)	1987-90	USGS	27.5	0.5	7.73(114)	1986-92	SELF-HELP
Turtle Lake	140	0.19	<0.01	0.06(5)	1974-78	LSF	--	--	6(1)	1980	STORET	--	--	33.47(1)	1980	STORET
WHITEWATER CREEK																
Cravath Lake	65	0.61	0.24	0.45(3)	1966-73	UWW,LSF	--	--	--	--	--	--	--	1.05(--)	1973	UWW
Lake Lorraine	133	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Rice Lake	137	0.05	0.04	0.045(2)	1974	LSF	170.0	57.0	113.5(2)	1980-81	STORET	10.5	1.0	3.82(28)	1988-92	SELF-HELP
Tripp Lake	115	0.15	0.15	0.15(3)	1966-73	UWW,LSF	--	--	--	--	--	--	--	3.21(--)	1973	UWW
Whitewater Lake	640	0.15	0.018	0.039(51)	1986-87	LTT	67.0	12	29.3(16)	1986-87	LTT	6.6	1.5	3.2(63)	1986-87	LTT

[a] Number in parentheses refers to number of samples taken.

[b] The following sources were cited:

AquaTech.....Water Quality Monitoring Reports by AquaTech Inc.
DNR.....Department of Natural Resources
LSF.....WI Department of Natural Resources, Lake Survey Forms
LTT.....Long Term Trends Lake Monitoring Program Data: 1985-1987
SELF-HELP.....Wisconsin Self-Help Lake Monitoring Program Data: 1986-1988
STORET.....U.S. EPA Water Information Storage and Retrieval System
USGS.....U.S. Geological Survey, Water Resources Data - Wisconsin (annual)
UWW.....UW-Whitewater, W.L. Gross et al., "The Ecology of Tripp and Cravath Lakes with Recommendations for Management", 1974

Source: SEWRPC.

standards are discussed in Chapter II. The Scuppernong River, Steel Brook Creek, Bluff Creek, Mason Creek, Allenton Creek, and portions of the Kohlsville River, Scuppernong Creek, and Whitewater Creek are recommended for coldwater fish and full recreational uses because of their potential to support trout populations. Bluff Creek upstream of CTH P has been designated as a Class I trout stream, and the remaining portion of Bluff Creek and portions of Allenton Creek, Steel Brook Creek, and Scuppernong River are designated as Class II trout streams. Class III trout stream designations have been given to portions of the Scuppernong River and Steel Brook Creek. Wayne, Little Turtle, Spring Brook, Galloway, Ladd Creek, Darien Creek, Sharon Creek, a portion of Limestone Creek, and the Rubicon River, in addition to the Little Oconomowoc River and the Oconomowoc River downstream of Friess Lake, have limitations for sport fish habitat and are recommended for warmwater forage fish and full recreational uses. The remaining streams are recommended for warmwater sport fish and full recreational uses. In addition, as noted in Chapter II, Bluff Creek in Walworth county is designated as an "Outstanding Resource Water" and the Oconomowoc River from North Lake to Okauchee Lake, in Waukesha County, is designated as an "Exceptional Resource Water".

Based upon the available data for sampling stations in the watershed, the majority of the Rock River tributaries in the Region 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. Based upon a review of the water quality data available 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 some water quality improvements have been made in most of the stream reaches. However, it is likely that, in general, fecal coliform and phosphorus standards are not met in most stream reaches and the dissolved oxygen standards are not met in a limited number of stream reaches. However, the recommended water use objectives are likely to be met in the Scuppernong and Kohlsville Rivers, and in Allenton, Steel Brook, Mason, and Bluff Creeks, based upon the observed uses in those streams. The recommended water use objectives may potentially also be met in portions of the Bark River, Turtle Creek, and Oconomowoc River systems downstream of major lakes since the only major point sources have been removed and since the lakes serve to remove pollutants by sedimentation.

There are currently three stream 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. Chapter NR 104 classifies the Rubicon River upstream of the confluence with a tributary in U. S. Public Land Survey Section 13, Township 10 North, Range 18 East, Town of Hartford, as capable of supporting only a limited aquatic life community and downstream of the tributary as supporting a limited forage fish community. The objectives set forth herein recommend a warmwater forage fish community upstream of Hilldale Road, about 0.4 mile downstream of the aforementioned tributary confluence, and a warmwater sport fish community downstream of Hilldale Road. Darien Creek and Sharon Creek in Walworth County are classified as capable of supporting a limited forage fish community and limited aquatic life community, respectively. The objectives set forth herein recommend a warmwater forage fish objective for both streams. All

three streams are recommended for upgrading in the Upper Rock River Basin Plan.[28] It is recommended that further stream appraisals for the Rubicon River, Darien Creek, and Sharon Creek be conducted by the DNR staff as part of the next one-year monitoring period envisioned to be carried out in the Rock River watershed.

The waters of the lakes in the Rock River watershed are all recommended for the maintenance of a warmwater sport fishery and full recreational use. The twenty-one lakes for which complete water quality data were available between 1965 and 1975--Ashippun, Beaver, Delavan, Druid, Fowler, Friess, Golden, Keesus, La Belle, Upper and Lower Nashotah, Upper and Lower Nemahbin, Nagawicka, North, Oconomowoc, Okauchee, Pike, Pine, Silver-Waukesha, and Whitewater Lakes--violated the 0.02 mg/l standard for total phosphorus, and Nagawicka Lake violated the 5 mg/l dissolved oxygen standard, recommended by the Commission, on at least one occasion between 1965 and 1975. Modeling data developed in the initial plan indicated that most of the other lakes also failed to meet the phosphorus standard.

As shown in Table XII-17, recent monitoring data are available for Lower Nashotah, Nagawicka, Pretty, School Section, Upper Nemahbin, Fowler, Friess, Keesus, Lac La Belle, Oconomowoc, Okauchee, Pine, Silver, Delavan, and Whitewater Lakes to assess the current compliance with water quality standards for the major lakes in the Rock River watershed. All of these lakes exceeded the total phosphorus standard on at least one occasion and Delavan Lake had phosphorus concentrations constantly in excess of the recommended standard. Based upon these data and review of the previous modeling data and the status of plan implementation, it may be expected that the majority of the lakes in the watershed would, at some times, have total phosphorus levels exceeding the 0.02 mg/l standard, which is represented by a TSI value in excess of approximately 47.

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 and abatement and sewerage system planning, there are three major issues which remain to be addressed in the Rock River watershed. One issue relates to the need for system level sewerage system planning in the northwestern Waukesha County area and one relates to the nonpoint source pollution control which should be carried out in the Turtle Creek and Oconomowoc River watersheds. In addition, it is also recommended that the Wisconsin Department of Natural Resources conduct a water quality and biological conditions survey on the upstream reaches of the Rubicon River to reassess the water use objectives currently set forth in the Wisconsin Administrative Code.

Northwestern Waukesha County Sewerage System Evaluation

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

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[28]Wisconsin Department of Natural Resources, Upper Rock River Basin Areawide Water Quality Management Plan, Publication No. WR-190-88, May 1989.

Table XII-18

TROPHIC STATE INDEX VALUES FOR MAJOR LAKES WITHIN THE ROCK RIVER WATERSHED[a]

Lake Name	Wisconsin Trophic State Index Values[b]			
	Total-P	Chlorophyll-a	Secchi	Mean
Ashippun Lake	54.6	55.9	47.8	52.8
Bark Lake	61.2	49.0	44.8	51.7
Beaver Lake	54.6	--	43.9	49.3
Comus Lake	64.0	68.9	69.4	67.4
Cravath Lake	75.7	--	76.4	76.0
Crooked Lake	--	--	47.8	47.8
Delavan lake	67.7	58.7	40.2	55.5
Druid Lake	66.0	50.4	46.0	54.0
Lake Five	--	--	45.3	45.3
Fowler Lake	54.6	41.4	42.4	46.1
Friess Lake	61.7	57.9	50.1	56.6
Lower Genesee Lake	55.8	43.0	41.1	46.6
Middle Genesee Lake	53.2	43.0	48.8	48.3
Golden Lake	54.6	43.0	40.3	46.0
Hunters Lake	--	--	--	--
Lake Keesus	64.0	48.2	47.4	53.2
Lac La Belle	49.3+	48.2+	47.9	48.5
La Grange Lake	--	--	--	--
Lake Lorraine	--	--	--	--
Moose Lake	50.6	--	47.3	49.0
Nagawicka Lake	54.0	50.9	43.9	49.6
Lower Nashotah Lake	56.8	46.2	41.5	48.2
Upper Nashotah Lake	54.6	--	45.8	50.2
Lower Nemahbin Lake	63.2	48.2	46.8	52.7
Upper Nemahbin Lake	61.2	45.2	45.9	50.7

Table XII-18 (continued)

Lake Name	Wisconsin Trophic State Index Values[b]			
	Total-P	Chlorophyll-a	Secchi	Mean
North Lake (Waukesha)	60.0	52.0	40.4	50.8
Oconomowoc Lake	50.7	41.9	43.3	45.3
Okauchee Lake	51.3	47.5	49.6	49.5
Pike Lake	57.2	52.9	48.7	52.9
Pine Lake	61.8	46.8	43.7	50.8
Pretty Lake	51.5	43.9	41.6	45.7
Rice Lake	57.8	70.2	61.2	63.1
School Section Lake	51.5	49.4	51.9	50.9
Silver Lake (Waukesha)	52.9	44.1	44.1	47.0
Tripp Lake	67.1	--	60.4	63.8
Turtle Lake	60.0	48.2	26.7	45.0
Waterville Pond	--	--	--	--
Whitewater Lake	56.4	60.1	59.6	58.7

[a]Wisconsin Trophic State Index values were calculated using water chemistry data shown in Table XII-17.

[b] Wisconsin Trophic State Index ranges:

below 44 = oligotrophic
44 - 53 = mesotrophic
54 - 75 = eutrophic
above 75 = hypertrophic

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table XII-19

COMPARISON OF TROPHIC STATE INDEX VALUES FOR MAJOR LAKES IN THE ROCK RIVER WATERSHED[a]

Subwatershed Lake Name	Carlson Trophic State Index Values[b]		
	Satellite Information 1979 - 1981	Water Chemistry pre - 1981	Water Chemistry 1981 - 1991
ASHIPPUN RIVER			
Ashippun Lake	49	51	49
Druid Lake	52	72	47
BARK RIVER			
Bark Lake	50	53	--
Crooked Lake	48	--	51
Golden Lake	46	56	42
Hunters Lake	50	--	--
Nagawicka Lake	48	65	60
Lower Nashotah Lake	44	48	51
Upper Nashotah Lake	44	56	45
Lower Nemahbin Lake	47	55	54
Upper Nemahbin Lake	47	53	45
Pretty Lake	47	46	42
School Section Lake	50	58	53
Waterville Pond	50	--	--
OCONOMOWOC RIVER			
Beaver Lake	44	56	--
Lake Five	48	--	47
Fowler Lake	47	--	43
Friess Lake	49	54	59
Lower Genesee Lake	45	48	41
Middle Genesee Lake	45	46	--
Lake Keesus	47	70	50
Lac La Belle	51	49	54
Moose Lake	44	60	--
North Lake (Wauk. Co.)	49	58	54
Oconomowoc Lake	46	--	44
Okauchee Lake	47	--	58
Pine Lake	46	53	--
Silver Lake (Wauk. Co.)	47	50	43
SCUPPERNONG RIVER			
La Grange Lake	--	--	--
RUBICON RIVER			
Pike Lake	54	60	52

Table XII-19 (continued)

Subwatershed Lake Name	Carlson Trophic State Index Values[b]		
	Satellite Information 1979 - 1981	Water Chemistry pre - 1981	Water Chemistry 1981 - 1991
TURTLE CREEK			
Comus Lake	--	71	--
Delavan Lake	55	--	64
Turtle Lake	48	66	--
WHITEWATER CREEK			
Cravath Lake	56	89	--
Lake Lorraine	48	--	--
Rice Lake	55	67	60
Tripp Lake	--	71	--
Whitewater Lake	52	69	61

[a] Carlson TSI values were calculated from available data from spring measurements for phosphorus and from summer measurements for chlorophyll-a and water clarity. Water chemistry values were calculated from data shown in Table XII-17. Satellite information values were determined from Wisconsin Lakes - A Trophic Assessment Using Landsat Digital Data, 1983.

[b] Carlson Trophic State Index ranges:

below 40 = oligotrophic
40 - 50 = mesotrophic
50 - 60 = eutrophic
above 60 = hypertrophic

Source: Wisconsin Department of Natural Resources, U.S. Environmental Protection Agency, and SEWRPC.

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.

Reassessment of the Future Needs for Nonpoint Source Controls in the Oconomowoc and Turtle Creek Watershed Areas

Nonpoint source priority watershed program implementation periods have now been completed for the Turtle Creek and Oconomowoc River watersheds. The Wisconsin Department of Natural Resources is currently preparing project finalization and evaluation reports. Following completion of those reports and following the conduct of water quality and biological condition monitoring in the Rock 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

Sharon Creek, Darien Creek, and portions of the upper Rubicon River are currently included under the limited forage fish or limited aquatic life 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 warmwater sport fish and warmwater forage fish classifications. It is recommended that the Wisconsin Department of Natural Resources include further stream appraisals for the upper Rubicon River and Darien Creek as part of the monitoring program during the next period when the Department is conducting monitoring efforts in the Rock River watershed as is envisioned within the next five to seven years.