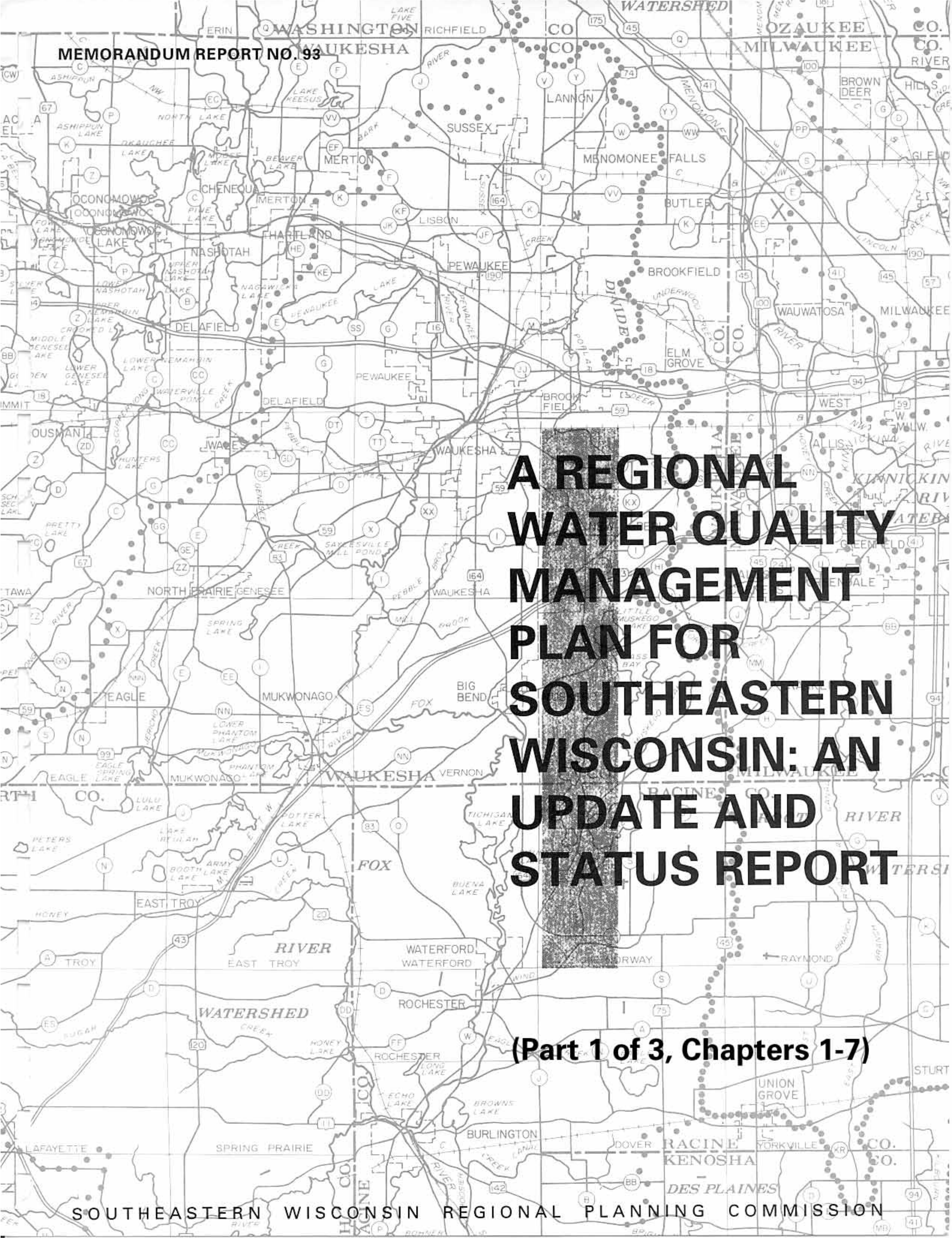

MEMORANDUM REPORT NO. 93

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

(Part 1 of 3, Chapters 1-7)

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

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Chapter I

INTRODUCTION

BACKGROUND

In 1979, the Commission completed and adopted a regional water quality management plan. The plan, designed in part to meet the Congressional mandate that the waters of the United States be made to the extent practicable "fishable and swimmable," is set forth in SEWRPC Planning Report No. 30, A Regional Water Quality Management Plan for Southeastern Wisconsin: 2000, Volume One, Inventory Findings, September 1978; Volume Two, Alternative Plans, February 1979; and Volume Three, Recommended Plan, June 1979. The plan provides recommendations for the control of water pollution from such point sources as sewage treatment plants, separate and combined sewer overflows, and industrial waste outfalls; and from such nonpoint sources as urban and rural stormwater runoff. The plan was subsequently endorsed by the Wisconsin Natural Resources Board and approved by the U. S. Environmental Protection Agency.

The regional water quality management plan is one of the more important plan elements adopted by the Commission since, in addition to providing clear and concise recommendations for the control of water pollution, it provides the basis for the continued eligibility of local units of government for Federal and State financial aids in partial support of sewerage system development and redevelopment; for the issuance of waste discharge permits by the Wisconsin Department of Natural Resources; for the review and approval of public sanitary sewer extensions by that Department; for the review and approval of private sanitary sewer extensions and large onsite sewage disposal systems and holding tanks by the Wisconsin Department of Industry, Labor and Human Relations; and for Federal and State financial assistance in support of local nonpoint source water pollution control projects.

Since adoption of the plan in 1979, the Commission has carried on a continuing regional water quality management planning program. That program is intended, to the extent that available fiscal resources permit, to meet the planning requirements set forth in Chapter NR 121 of the Wisconsin Administrative Code. Those rules envision periodic amendment, revision, and updating of the original plan as may be found necessary and desirable. This document is intended to help meet those planning requirements by providing for a restatement of the plan as updated over time through the amendment and revision process, by reporting on the extent to which the plan as amended has been implemented since its adoption, by identifying--to the extent that data are available--progress toward meeting the surface water quality objectives and supporting standards, and by identifying those issues which need to be addressed in the continuing planning process and which, therefore, may lead to further amendments, revisions, and updates of the plan.

PLAN REFINEMENT AND DETAILING EFFORTS SINCE PLAN ADOPTION

The adopted regional water quality management plan is a systems level plan intended to be refined, detailed, and, as necessary, amended through the following types of subregional planning and plan implementation efforts:

1. Sewer Service Area Plans
   The plan explicitly calls for the Commission to work with the designated management agencies to refine and detail the general sanitary sewer service areas identified in the original plan. These service areas are particularly important because they provide the basis for State regulatory approval of sanitary sewer extensions, and incorporate provisions attendant to the protection of environmentally sensitive lands. Since adoption of the original plan in 1979, such detailed sewer service area plans have been completed and adopted for 67 of the 85 initially identified sewer service areas.

2. Detailed Sewerage Facilities Plans
   The plan calls for the preparation on a case-by-case basis of detailed sewerage facility plans implementing the sewage treatment plant and trunk sewer improvements identified in the system plan. Responsibility for the preparation of these detailed plans lies with the designated management agency or agencies concerned. At times, these detailed facility planning efforts require reevaluation of system level recommendations and, therefore, may result in amendments to the system plan owing to changed circumstances.

3. Detailed Nonpoint Source Pollution Abatement Plans
   The plan recommends that the designated management agencies concerned prepare detailed nonpoint source pollution abatement plans to identify precisely how the quantitative nonpoint source pollution reduction goals set forth at the system level of planning can best be achieved. Since adoption of the original plan, the State of Wisconsin created a nonpoint source pollution abatement program that has served as the basis for carrying out this system plan recommendation. That program is overseen by the Wisconsin Department of Natural Resources and involves both detailed "second level" planning and funding of plan implementation efforts. In carrying out this program, the Department works closely with the designated nonpoint source pollution management agencies identified in the system plan, focusing its efforts in particular through the seven county land conservation committees.

4. Comprehensive Inland Lake Water Quality Management Plans
   The plan recommends that detailed inland land water quality management plans be prepared for the major lakes within the Region; that is, for those lakes having a surface water area of 50 acres or more. There are 101 such major lakes within the Region. Primary responsibility for carrying out this detailed planning lies with the designated management agencies concerned, primarily inland lake protection and rehabilitation districts.

5. Special Studies
   The plan also envisions that from time-to-time special in-depth studies would be undertaken to address unique water quality problems. One such major study has been completed since adoption of the original plan, that

being a comprehensive study of the Milwaukee Harbor estuary. This study had particularly important implications for the definition of the level of protection to be provided by abatement of combined sewer overflows in Milwaukee, and resulted in a recommendation to provide as well certain in-stream treatment measures.

Many of the foregoing plan refinement and detailing efforts have led over the years since adoption of the original plan to formal amendments of that plan by the Regional Planning Commission and the Wisconsin Department of Natural Resources. A list of those plan amendments, which were adopted only after public hearings and designated management agency approval, is set forth in Table I-1.

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

SCHEME OF PRESENTATION

As noted above, this report has as its basic purpose restating the regional water quality management plan as updated over time through the amendment and revision process, and identifying issues which remain to be addressed in the continuing planning process. Toward this end, the remainder of this report has been organized as follows:

1. <u>Chapter II</u>--<u>Surface Water Resources, Water Use Objectives and Standards, and Data Sources and Analytical Procedures</u>
   Chapter II provides an overview of the surface water resources in the Region and includes a discussion of the water use objectives and standards that apply to those resources. In addition, the chapter describes the procedures and data sources used to evaluate, to the extent possible given available data, the degree to which the water use objectives in the Region have been met since adoption of the original plan.

2. <u>Chapter III</u>--<u>Land Use Plan Element</u>
   Chapter III provides a brief description of the land use element of the regional water quality management plan, that element being the third generation regional land use plan.

3. <u>Chapters IV Through XV</u>--<u>Regional Water Quality Management Plan Status Report and Update for Each to the Twelve Watersheds in Southeastern Wisconsin</u>
   These 12 chapters provide, for each of the 12 major watersheds of the Region, the following information:

Table I-1

AMENDMENTS TO THE REGIONAL WATER QUALITY MANAGEMENT PLAN FOR SOUTHEASTERN WISCONSIN: 1979-1993

Plan Element	Plan Document	SEWRPC Date of Adoption	WDNR Date of Adoption
Regional Water Quality Management Plan	Planning Report No. 30, A Regional Water Quality Management Plan for Southeastern Wisconsin, Volume One, Inventory Findings; Volume Two, Alternative Plans; Volume Three, Recommended Plan	July 12, 1979	August 2, 1979
Amendment–Root River Watershed	Community Assistance Planning Report No. 37, A Nonpoint Source Water Pollution Control Plan for the Root River Watershed	March 6, 1980	March 5, 1980
Amendment–Walworth County Metropolitan Sewerage District	Community Assistance Planning Report No. 56 (2nd Edition), Sanitary Sewer Service Areas for the Walworth County Metropolitan Sewerage District, Walworth County, Wisconsin	December 4, 1991	--
Amendment–Cities of Brookfield and Waukesha	Amendment to the Regional Water Quality Management Plan–2000, Cities of Brookfield and Waukesha	December 3, 1981	February 2, 1982
Amendment–City of Muskego	Community Assistance Planning Report No. 64 (2nd Edition), Sanitary Sewer Service Area for the City of Muskego	March 3, 1986	March 20, 1987
Amendment–Ashippun Lake, Waukesha County	Community Assistance Planning Report No. 48, A Water Quality Management Plan for Ashippun Lake, Waukesha County, Wisconsin	September 9, 1982	February 3, 1983
Amendment–Okauchee Lake, Waukesha County	Community Assistance Planning Report No. 53, A Water Quality Management Plan for Okauchee Lake, Waukesha County, Wisconsin	September 9, 1982	February 3, 1983
Amendment–Lac La Belle, Waukesha County	Community Assistance Planning Report No. 47, A Water Quality Management Plan for Lac La Belle, Waukesha County, Wisconsin	September 9, 1982	February 3, 1983
Amendment–North Lake, Waukesha County	Community Assistance Planning Report No. 54, A Water Quality Management Plan for North Lake, Waukesha County, Wisconsin	December 2, 1982	February 3, 1983
Amendment–City of West Bend	Community Assistance Planning Report No. 35, Sanitary Sewer Service Area for the City of West Bend, Washington County, Wisconsin	December 2, 1982	June 5, 1984
Amendment–Village of Grafton	Amendment to the Regional Water Quality Management Plan–2000, Village of Grafton	December 2, 1982	February 7, 1983
Amendment–City of Brookfield	Amendment to the Regional Water Quality Management Plan–2000, City of Brookfield	December 2, 1982	September 13, 1984
Amendment–Village of Sussex	Community Assistance Planning Report No. 84, Sanitary Sewer Service Area for the Village of Sussex, Waukesha County, Wisconsin	June 16, 1983	March 12, 1984
Amendment–Village of Germantown	Community Assistance Planning Report No. 70, Sanitary Sewer Service Area for the Village of Germantown, Washington County, Wisconsin	September 8, 1983	March 19, 1984
Amendment–Village of Saukville	Community Assistance Planning Report No. 90, Sanitary Sewer Service Area for the Village of Saukville, Ozaukee County, Wisconsin	December 1, 1983	May 23, 1984
Amendment–City of Port Washington	Community Assistance Planning Report No. 95, Sanitary Sewer Service Area for the City of Port Washington, Ozaukee County, Wisconsin	December 1, 1983	June 7, 1984
Amendment–Belgium Area	Amendment to the Regional Water Quality Management Plan–2000, Onion River Priority Watershed Plan	December 1, 1983	January 18, 1984
Amendment–Geneva Lake Area	Amendment to the Regional Water Quality Management Plan–2000, Geneva Lake Area Communities	December 1, 1983	October 5, 1987
Amendment–Village of Butler	Community Assistance Planning Report No. 99, Sanitary Sewer Service Area for the Village of Butler, Waukesha County, Wisconsin	March 1, 1984	April 30, 1984
Amendment–City of Hartford	Community Assistance Planning Report No. 92, Sanitary Sewer Service Area for the City of Hartford, Washington County, Wisconsin	June 21, 1984	October 26, 1984
Amendment–Mukwonago Area	Amendment to the Regional Water Quality Management Plan–2000, Village of Mukwonago, Towns of East Troy and Mukwonago	June 21, 1984	August 30, 1984

Table 1 (continued)

Plan Element	Plan Document	SEWRPC Date of Adoption	WDNR Date of Adoption
Amendment–Village of Fredonia	Community Assistance Planning Report No. 96, Sanitary Sewer Service Area for the Village of Fredonia, Ozaukee County, Wisconsin	September 13, 1984	October 11, 1984
Amendment–Village of East Troy	Community Assistance Planning Report No. 112 (2nd Edition), Sanitary Sewer Service Area for the Village of East Troy and Environs, Walworth County, Wisconsin	June 16, 1993	October 20, 1993
Amendment–City of Milwaukee	Amendment to the Regional Water Quality Management Plan–2000, City of Milwaukee	September 13, 1984	December 19, 1984
Amendment–Town of Pleasant Prairie	Community Assistance Planning Report No. 88, A Land Use Management Plan for the Chiwaukee Prairie-Carol Beach Area of the Town of Pleasant Prairie, Kenosha County, Wisconsin	March 11, 1985	October 21, 1985
Amendment–Village of Belgium	Community Assistance Planning Report No. 97 (3rd Edition), Sanitary Sewer Service Area for the Village of Belgium, Ozaukee County, Wisconsin	September 15, 1993	October 15, 1993
Amendment–Town of Addison	Community Assistance Planning Report No. 103, Sanitary Sewer Service Area for the Allenton Area, Washington County, Wisconsin	March 11, 1985	August 8, 1985
Amendment–Town of Yorkville	Amendment to the Regional Water Quality Management Plan–2000, Town of Yorkville	March 11, 1985	August 8, 1985
Amendment–Village of Williams Bay	Amendment to the Regional Water Quality Management Plan–2000, Village of Williams Bay/Walworth County Metropolitan Sewerage District	March 11, 1985	September 30, 1985
Amendment–Town of Trenton City of West Bend	Amendment to the Regional Water Quality Management Plan–2000, City of West Bend/ Town of Trenton	March 11, 1985	July 10, 1985
Amendment–Village of Hartland	Community Assistance Planning Report No. 93, Sanitary Sewer Service Area for the Village of Hartland, Waukesha County, Wisconsin	June 17, 1985	July 11, 1986
Amendment–Village of Jackson	Community Assistance Planning Report No. 124, Sanitary Sewer Service Area for the Village of Jackson, Washington County, Wisconsin	June 17, 1985	July 11, 1986
Amendment–Pewaukee Area	Community Assistance Planning Report 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	June 17, 1985	July 11, 1986
Amendment–City of Waukesha	Community Assistance Planning Report No. 100, Sanitary Sewer Service Area for the City of Waukesha and Environs, Waukesha County, Wisconsin	December 2, 1985	November 20, 1987
Amendment–Village of Slinger	Community Assistance Planning Report No. 128 (2nd Edition), Sanitary Sewer Service Area for the Village of Slinger, Washington County, Wisconsin	September 15, 1993	April 26, 1994
Amendment–Kenosha Area	Community Assistance Planning Report No. 106, Sanitary Sewer Service Areas for the City of Kenosha and Environs, Kenosha County, Wisconsin	December 2, 1985	August 31, 1987
Amendment–Town of Eagle	Amendment to the Regional Water Quality Management Plan–2000, Eagle Spring Lake Sanitary District	December 2, 1985	November 2, 1987
Amendment–Town of Salem	Community Assistance Planning Report No. 143, Sanitary Sewer Service Area for the Town of Salem Utility District No. 2, Kenosha County, Wisconsin	March 3, 1986	December 11, 1986
Amendment–Friess Lake, Washington County	Community Assistance Planning Report No. 98, A Water Quality Management Plan for Friess Lake, Washington County, Wisconsin	March 3, 1986	October 5, 1987
Amendment–Geneva Lake, Walworth County	Community Assistance Planning Report No. 60, A Water Quality Management Plan for Geneva Lake, Walworth County, Wisconsin	March 3, 1986	October 5, 1987
Amendment–Pewaukee Lake, Waukesha County	Community Assistance Planning Report No. 58, A Water Quality Management Plan for Pewaukee Lake, Waukesha County, Wisconsin	March 3, 1986	October 5, 1987

Table 1 (continued)

Plan Element	Plan Document	SEWRPC Date of Adoption	WDNR Date of Adoption
Amendment—Waterford/ Rochester Area	Community Assistance Planning Report No. 141, Sanitary Sewer Service Area for the Waterford/ Rochester Area, Racine County, Wisconsin	June 16, 1986	December 9, 1986
Amendment—City of Burlington	Community Assistance Planning Report No. 78, Sanitary Sewer Service Area for the City of Burlington, Racine County, Wisconsin	June 16, 1986	July 13, 1987
Amendment—City of Waukesha/Town of Pewaukee	Amendment to the Regional Water Quality Management Plan—2000, City of Waukesha/ Town of Pewaukee	December 1, 1986	November 20, 1987
Amendment—Salem/Paddock Lake/Bristol Area	Community Assistance Planning Report No. 145, Sanitary Sewer Service Area for the Town of Salem Utility District No. 1, Village of Paddock Lake, and Town of Bristol Utility District Nos. 1 and 1B, Kenosha County, Wisconsin	December 1, 1986	January 13, 1988
Amendment—Racine Area	Community Assistance Planning Report No. 147, Sanitary Sewer Service Area for the City of Racine and Environs, Racine County, Wisconsin	December 1, 1986	January 13, 1988
Amendment—Town of Lyons	Amendment to the Regional Water Quality Management Plan—2000, Country Estates Sanitary District/Town of Lyons	March 2, 1987	August 25, 1987
Amendment—Village of Silver Lake	Community Assistance Planning Report No. 119, Sanitary Sewer Service Area, Village of Silver Lake, Kenosha County, Wisconsin	June 15, 1987	January 13, 1988
Amendment—Village of Twin Lakes	Community Assistance Planning Report No. 149, Sanitary Sewer Service Area, Village of Twin Lakes, Kenosha County, Wisconsin	June 15, 1987	March 23, 1988
Amendment—Cedarburg/ Grafton Area	Community Assistance Planning Report No. 91, Sanitary Sewer Service Area for the City of Cedarburg and the Village of Grafton, Ozaukee County, Wisconsin	June 15, 1987	December 23, 1987
Amendment—Town of Walworth	Amendment to the Regional Water Quality Management Plan—2000, Town of Walworth Utility District No. 1/Walworth County Metropolitan Sewerage District	June 15, 1987	November 2, 1987
Amendment—City of West Bend	Amendment to the Regional Water Quality Management Plan—2000, City of West Bend	June 15, 1987	January 13, 1988
Amendment—City of Whitewater	Community Assistance Planning Report No. 94, Sanitary Sewer Service Area for the City of Whitewater, Walworth County, Wisconsin	September 14, 1987	March 23, 1988
Amendment—Town of Lyons	Community Assistance Planning Report No. 158 (2nd Edition), Sanitary Sewer Service Area for the Town of Lyons Sanitary District No. 2, Walworth County, Wisconsin	September 15, 1993	April 28, 1994
Amendment—City of Hartford	Amendment to the Regional Water Quality Management Plan—2000, City of Hartford	September 14, 1987	January 29, 1988
Amendment—Milwaukee Harbor Estuary Plan	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 7, 1987	June 4, 1990
Amendment—City of New Berlin	Community Assistance Planning Report No. 157, Sanitary Sewer Service Area for the City of New Berlin, Waukesha County, Wisconsin	December 7, 1987	May 2, 1988
Amendment—Village of Sussex	Amendment to the Regional Water Quality Management Plan—2000, Village of Sussex	December 7, 1987	August 9, 1988
Amendment—Kenosha Area	Amendment to the Regional Water Quality Management Plan—2000, City of Kenosha and Environs	December 7, 1987	December 7, 1989
Amendment—Village of Kewaskum	Community Assistance Planning Report No. 161, Sanitary Sewer Service Area for the Village of Kewaskum, Washington County, Wisconsin	March 7, 1988	October 24, 1988
Amendment—Town of Darien	Amendment to the Regional Water Quality Management Plan—2000, Town of Darien/ Walworth County Metropolitan Sewerage District	June 20, 1988	October 24, 1988
Amendment—Village of Sussex	Amendment to the Regional Water Quality Management Plan—2000, Village of Sussex	June 20, 1988	January 14, 1993

Table 1 (continued)

Plan Element	Plan Document	SEWRPC Date of Adoption	WDNR Date of Adoption
Amendment–Village of Darien	Community Assistance Planning Report No. 123 (2nd Edition), Sanitary Sewer Service Area for the Village of Darien, Walworth County, Wisconsin	September 23, 1992	January 14, 1993
Amendment–West Bend Area	Amendment to the Regional Water Quality Management Plan–2000, City of West Bend/Town of West Bend	September 12, 1988	November 17, 1988
Amendment–Hartford Area	Amendment to the Regional Water Quality Management Plan–2000, City of Hartford	September 12, 1988	January 9, 1989
Amendment–Town of Waterford	Amendment to the Regional Water Quality Management Plan–2000, Western Racine County Sewerage District	September 12, 1988	December 16, 1988
Amendment–Hartford Area	Amendment to the Regional Water Quality Management Plan–2000, City of Hartford	December 5, 1988	April 18, 1989
Amendment–City of Waukesha	Amendment to the Regional Water Quality Management Plan–2000, City of Waukesha	December 5, 1988	April 5, 1989
Amendment–Oconomowoc Area	Community Assistance Planning Report No. 172, Sanitary Sewer Service Area for the City of Oconomowoc and Environs, Waukesha County, Wisconsin	March 6, 1989	October 17, 1989
Amendment–Village of Genoa City	Community Assistance Planning Report No. 175, Sanitary Sewer Service Area for the Village of Genoa City, Kenosha and Walworth Counties, Wisconsin	March 6, 1989	August 14, 1989
Amendment–Village of Germantown	Amendment to the Regional Water Quality Management Plan–2000, Village of Germantown	March 6, 1989	June 5, 1989
Amendment–Racine Area	Amendment to the Regional Water Quality Management Plan–2000, City of Racine and Environs	March 6, 1989	June 5, 1989
Amendment–Upper Fox River Watershed	Amendment to the Regional Water Quality Management Plan–2000, Upper Fox River Watershed–Brookfield and Sussex Sewage Treatment Plants	May 15, 1989	September 1989
Amendment–Racine Area	Amendment to the Regional Water Quality Management Plan–2000, City of Racine and Environs	June 19, 1989	August 14, 1989
Amendment–Lake Geneva Area	Amendment to the Regional Water Quality Management Plan–2000, City of Lake Geneva and Environs	June 19, 1989	July 19, 1989
Amendment–Town of Geneva	Amendment to the Regional Water Quality Management Plan–2000, Town of Geneva, Walworth County Metropolitan Sewerage District	November 6, 1989	August 9, 1991
Amendment–Town of Waterford	Amendment to the Regional Water Quality Management Plan–2000, Western Racine County Sewerage District	December 4, 1989	February 20, 1990
Amendment–Delavan Lake Area	Amendment to the Regional Water Quality Management Plan–2000, Delavan Lake Sanitary District/Walworth County Metropolitan Sewerage District	December 4, 1989	February 20, 1990
Amendment–East Troy Area	Amendment to the Regional Water Quality Management Plan–2000, Towns of East Troy, LaFayette, and Spring Prairie, and Village of East Troy	December 4, 1989	March 26, 1990
Amendment–Waukesha Area	Amendment to the Regional Water Quality Management Plan–2000, City of Waukesha and Town of Waukesha	June 20, 1990	October 12, 1990
Amendment–Village of Silver Lake	Amendment to the Regional Water Quality Management Plan–2000, Village of Silver Lake and Salem Utility District No. 2	June 20, 1990	October 12, 1990
Amendment–Village of Union Grove	Community Assistance Planning Report No. 180, Sanitary Sewer Service Area for the Village of Union Grove and Environs, Racine County, Wisconsin	September 12, 1990	August 19, 1991
Amendment–Town of Somers	Amendment to the Regional Water Quality Management Plan–2000, Kenosha and Racine Sanitary Sewer Service Areas	September 12, 1990	January 15, 1991

Table 1 (continued)

Plan Element	Plan Document	SEWRPC Date of Adoption	WDNR Date of Adoption
Amendment—City of Franklin	Community Assistance Planning Report No. 176, Sanitary Sewer Service Area for the City of Franklin, Milwaukee County, Wisconsin	December 5, 1990	July 31, 1991
Amendment—Village of Mukwonago	Community Assistance Planning Report No. 191, Sanitary Sewer Service Area for the Village of Mukwonago, Waukesha County, Wisconsin	December 5, 1990	August 19, 1991
Amendment—Village of Dousman	Community Assistance Planning Report No. 192, Sanitary Sewer Service Area for the Village of Dousman, Waukesha County, Wisconsin	December 5, 1990	July 31, 1991
Amendment—Towns of Yorkville and Mt. Pleasant	Amendment to the Regional Water Quality Management Plan—2000, Towns of Yorkville and Mt. Pleasant	December 5, 1990	February 15, 1991
Amendment—Town of Bristol	Amendment to the Regional Water Quality Management Plan—2000, Town of Bristol	March 6, 1991	July 22, 1991
Amendment—Village of Pewaukee	Amendment to the Regional Water Quality Management Plan—2000, Village of Pewaukee	March 6, 1991	July 22, 1991
Amendment—Town of Brookfield	Amendment to the Regional Water Quality Management Plan—2000, Brookfield and Waukesha Sanitary Sewer Service Areas	March 6, 1991	July 22, 1991
Amendment—Delavan Area	Amendment to the Regional Water Quality Management Plan—2000, Walworth County Metropolitan Sewerage District/Delavan-Delavan Lake Sanitary Sewer Service Area	March 6, 1991	July 22, 1991
Amendment—Oconomowoc Lake, Waukesha County	Community Assistance Planning Report No. 181, A Water Quality Management Plan for Oconomowoc Lake, Waukesha County, Wisconsin	June 19, 1991	--
Amendment—Town of Salem	Amendment to the Regional Water Quality Management Plan—2000, Town of Salem	June 19, 1991	September 30, 1991
Amendment—Town of Caledonia	Amendment to the Regional Water Quality Management Plan—2000, Town of Caledonia	June 19, 1991	--
Amendment—Village of Hartland	Amendment to the Regional Water Quality Management Plan—2000, Village of Hartland	June 19, 1991	September 30, 1991
Amendment—Town of Caledonia	Amendment to the Regional Water Quality Management Plan—2000, Town of Caledonia	September 11, 1991	December 11, 1991
Amendment—Town of Norway	Amendment to the Regional Water Quality Management Plan—2000, Town of Norway	September 11, 1991	December 11, 1991
Amendment—Town of Rochester	Amendment to the Regional Water Quality Management Plan—2000, Town of Rochester	September 11, 1991	November 26, 1991
Amendment—Town of Norway	Amendment to the Regional Water Quality Management Plan—2000, Town of Norway	September 11, 1991	--
Amendment—Brookfield/Elm Grove Area	Community Assistance Planning Report No. 109, Sanitary Sewer Service Area for the City and Town of Brookfield and the Village of Elm Grove, Waukesha County, Wisconsin	December 4, 1991	July 20, 1992
Amendment—Racine Area	Amendment to the Regional Water Quality Management Plan—2000, City of Racine and Environs	December 4, 1991	December 26, 1991
Amendment—Pewaukee Lake Area	Amendment to the Regional Water Quality Management Plan: 2000, Lake Pewaukee Sanitary District	December 4, 1991	April 7, 1992
Amendment—West Bend Area	Amendment to the Regional Water Quality Management Plan: 2000, City of West Bend/Town of West Bend	December 4, 1991	February 5, 1992
Amendment—Town of Salem	Amendment to the Regional Water Quality Management Plan: 2000, Town of Salem	December 4, 1991	March 27, 1992
Amendment—City of Mequon and Village of Thiensville	Community Assistance Planning Report No. 188, Sanitary Sewer Service Area for the City of Mequon and the Village of Thiensville, Ozaukee County, Wisconsin	January 15, 1992	September 23, 1992
Amendment—City of West Bend/Town of West Bend/Silver Lake Sanitary District	Amendment to the Regional Water Quality Management Plan—2000, City of West Bend/Town of West Bend/Silver Lake Sanitary District	March 4, 1992	September 11, 1992
Amendment—Town of Somers	Amendment to the Regional Water Quality Management Plan—2000, Town of Somers	June 17, 1992	September 11, 1992

Table 1 (continued)

Plan Element	Plan Document	SEWRPC Date of Adoption	WDNR Date of Adoption
Amendment—Delafield-Nashotah Area	Community Assistance Planning Report No. 127, Sanitary Sewer Service Area for the City of Delafield and the Village of Nashotah and Environs, Waukesha County, Wisconsin	January 18, 1993	April 29, 1993
Amendment—City of Lake Geneva and Environs	Community Assistance Planning Report No. 203, Sanitary Sewer Service Area for the City of Lake Geneva and Environs, Walworth County, Wisconsin	January 18, 1993	April 29, 1993
Amendment—Eagle Lake Sewer Utility District	Community Assistance Planning Report No. 206, Sanitary Sewer Service Area for the Eagle Lake Sewer Utility District, Racine County, Wisconsin	January 18, 1993	April 29, 1993
Amendment—Village of Hartland	Amendment to the Regional Water Quality Management Plan: 2000, Village of Hartland	January 18, 1993	May 14, 1993
Amendment—Village of Newburg	Community Assistance Planning Report No. 205, Sanitary Sewer Service Area for the Village of Newburg, Ozaukee and Washington Counties, Wisconsin	March 3, 1993	June 21, 1993
Amendment—Village of Twin Lakes	Amendment to the Regional Water Quality Management Plan—2000, Village of Twin Lakes	March 3, 1993	May 14, 1993
Amendment—City of Muskego	Amendment to the Regional Water Quality Management Plan: 2000, City of Muskego	March 3, 1993	April 29, 1993
Amendment—Villages of Lannon and Menomonee Falls	Community Assistance Planning Report No. 208, Sanitary Sewer Service Areas for the Villages of Lannon and Menomonee Falls, Waukesha County, Wisconsin	June 16, 1993	September 10, 1993
Amendment—City of New Berlin	Amendment to the Regional Water Quality Management Plan—2000, City of New Berlin	June 16, 1993	--
Amendment—Racine Area	Amendment to the Regional Water Quality Management Plan—2000, City of Racine and Environs	June 16, 1993	August 24, 1993
Amendment—Powers Lake, Kenosha and Walworth Counties	Community Assistance Planning Report No. 196, A Management Plan for Powers Lake, Kenosha and Walworth Counties, Wisconsin	September 15, 1993	--
Amendment—Wind Lake, Racine County	Community Assistance Planning Report No. 198, A Management Plan for Wind Lake, Racine County, Wisconsin	September 15, 1993	--
Amendment—Walworth County Metropolitan Sewerage District	Amendment to the Regional Water Quality Management Plan—2000, Town of Geneva, Walworth County Metropolitan Sewerage District	December 1, 1993	February 15, 1994

a. A description of the various elements of the regional water quality management plan as amended and as applied to the particular watershed concerned.

b. A description of the extent to which the key elements of the regional water quality management plan have been implemented since adoption of the original plan.

c. A description, based on the best available data, of the existing water quality conditions and of the extent to which the water quality objectives and standards in the watershed have been met.

d. A description of the substantive water quality management issues within the watershed that remain to be addressed in the continuing planning process.

4. Chapter XVI--Status of Groundwater Quality Management Plan Element
This chapter describes the status of the preparation of a proposed new element of a regional water quality management plan; namely, a groundwater management element.

5. Chapter XVII--Designated Management Agencies and Responsibilities
This chapter identifies, by plan element, all of the designated management agencies given responsibility for implementation of the regional water quality management plan.

6. Chapter XVIII--Summary and Recommendations
This chapter provides a summary of the information presented in the report, focusing in particular on the restatement of the regional water quality management plan as amended and updated; on the extent to which the water use objectives and supporting water quality standards have been met; and on the remaining water quality management issues to be addressed in the continuing planning effort.

Chapter II

SURFACE WATER RESOURCES--WATER USE OBJECTIVES AND STANDARDS, DATA SOURCES, AND ANALYTICAL PROCEDURES

This regional water quality management plan includes a collection of current data on which an assessment of the existing water quality conditions in the streams and lakes of the planning area, and an analysis of the ability of those conditions to support proposed water uses, has been made. In addition, such data are compared to historic data in order to assess the changes which have occurred in surface water quality since the preparation of the initial regional water quality management plan.

The initial water quality management plan presented a description of the existing surface water system along with existing and planned water use objectives and water quality data available through 1976. This chapter includes a general description of the existing surface water system; presents updated information on water use objectives and standards; and includes a general description of the data available and the procedures used to present the current state of surface water quality. Chapters IV through XV present for each of the 12 watersheds in the Region: available data on water quality and other surface water conditions for stream reaches and lakes; an assessment of the degree to which the water use objectives are currently being met; and, to the extent the data permit, an assessment of the changes which have occurred in water quality conditions since the initial regional water quality management planning effort was completed, thus providing a measure of the effect of plan implementation to date.

SURFACE WATER RESOURCE DESCRIPTION

Lakes and streams constitute an extremely valuable part of the natural resource base of Southeastern Wisconsin. Inasmuch as they are focal points for water-related recreational activities popular with the inhabitants of the Region, lakes and streams provide extremely attractive sites for properly planned residential development; and, when viewed in the context of open space areas, greatly enhance the aesthetic aspects of the environment. While highly valued by the urban and rural populations of the Region, lakes and streams are extremely susceptible to deterioration through the activities of those very populations. Water quality can degenerate as a result of pollutant loadings from malfunctioning or improperly placed septic tank systems, inadequate sewage treatment facilities, runoff from rural, urban, and urbanizing lands. Lakes and streams are also adversely affected by the excessive development of lacustrine and riverine areas in combination with the filling of peripheral wetlands, which removes valuable nutrient and sediment traps while adding nutrient and sediment sources. The regional surface water resources must be properly managed and land uses carefully located and designed to achieve a reasonable balance between public and private use and enjoyment of those surface water resources.

Streams

As shown on Map II-1, the surface drainage system of Southeastern Wisconsin may be viewed as existing within 11 individual watersheds. Five of these, the Root River, Menomonee River, Kinnickinnic River, Oak Creek, and Pike River watersheds, are contained entirely within the Region. In addition to the 11 watersheds, numerous small catchment areas immediately adjacent to the Lake Michigan shoreline drain directly to the Lake via local natural streams or artificial drainageways; these tributary areas together may be considered to comprise a twelfth watershed. The Region contains only a very small part of the Des Plaines and Fox River watersheds and of the Wisconsin portion of the large Rock River watershed. The streams of the Rock River watershed within the Region are limited to the headwater portions of such tributaries to the Rock River as the Bark and Oconomowoc Rivers and Turtle Creek.

Three of the 12 watersheds contained wholly or partly in Southeastern Wisconsin, the Fox, Rock, and Des Plaines River watersheds, with a combined area of 1,681 square miles, or 63 percent of the area of the Region, lie west of the subcontinental divide. As a result, the rivers and streams within these catchment areas flow in a generally southerly and southwesterly direction and are part of the Mississippi River drainage system. The rivers and streams in the nine watersheds comprising the remainder of Southeastern Wisconsin, with a combined area of 1,008 square miles, or 37 percent of the area of the Region, flow in a generally southerly and easterly direction and discharge into Lake Michigan and are a part of the Great Lakes-St. Lawrence River drainage system. A summary of the relative sizes of the watersheds within Southeastern Wisconsin is presented in Table II-1 and a graphical representation of the range of watershed sizes is shown in Figure II-1.

One of the most interesting, variable, and occasionally unpredictable features of each watershed is the ever changing, sometimes widely fluctuating, discharges and stages of its stream system. The stream systems of the Region generally receive a relatively uniform flow of groundwater from the shallow aquifers underlying the Region. This groundwater discharge constitutes the base flow of the streams. The streams also periodically intercept surface water runoff from rainfall and snowmelt which is superimposed on the base flow and sometimes causes the streams to leave their channels and occupy the adjacent floodlands. The volume of water drained annually from Southeastern Wisconsin by the stream system is equivalent to seven to eight inches of water spread over the seven-county Region, and amounts to about one-fourth of the average annual precipitation.

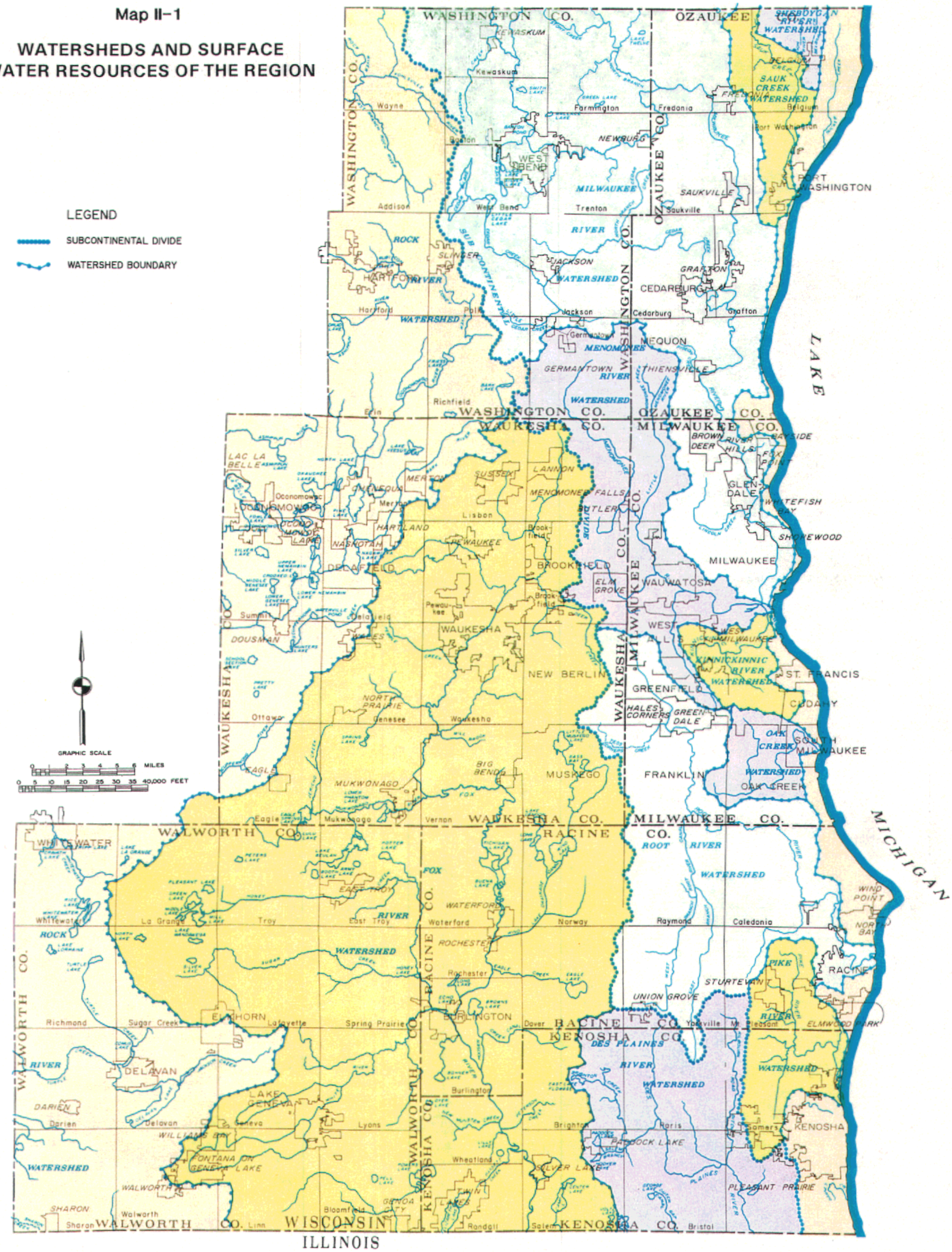
Major streams are defined herein as perennial streams which maintain, at a minimum, a small, continuous flow throughout the year except under unusual drought conditions. Within the Region, there are approximately 1,148 miles of such major streams, as summarized by county in Table II-2. The length of major streams per county ranges from a low of 101 linear miles in Racine County to a high of 333 linear miles in Waukesha County. The latter county also has the largest number of major lakes, and is therefore particularly well endowed with surface water resources.

Lakes

Major inland lakes are defined herein as those having 50 acres or more of surface water area, a size capable of supporting reasonable recreational use with relatively little degradation of the resource. There are 101 such major inland lakes within the Region, the location and relative sizes of which are

Map II-1

WATERSHEDS AND SURFACE WATER RESOURCES OF THE REGION



Source: SEWRPC.

Table II-1

WATERSHEDS IN THE REGION BY COUNTY

Watershed[a,b]	County														Total Watershed Area Within Region (square miles)	Percent of Region
	Kenosha		Milwaukee		Ozaukee		Racine		Walworth		Washington		Waukesha			
	Area (square miles)	Percent of Watershed	Area (square miles)	Percent of Watershed	Area (square miles)	Percent of Watershed	Area (square miles)	Percent of Watershed	Area (square miles)	Percent of Watershed	Area (square miles)	Percent of Watershed	Area (square miles)	Percent of Watershed		
Fox River[d,f]	96.06	10.28	0.26	0.03	- -	- -	164.78	17.63	337.06	36.06	0.25	0.02	336.30	35.98	934.71	34.76
Rock River[d]	- -	- -	- -	- -	- -	- -	- -	- -	239.43	39.21	177.65	29.10	193.51	31.69	610.59	22.71
Milwaukee River[e,f]	- -	- -	57.90	13.31	151.25	34.78	- -	- -	- -	- -	225.80	51.91	- -	- -	434.95	16.17
Root River[c,e,f]	1.99	1.02	57.75	29.47	- -	- -	123.16	62.85	- -	- -	- -	- -	13.06	6.66	195.96	7.29
Menomonee River[c,e,f]	- -	- -	56.34	40.92	11.63	8.45	- -	- -	- -	- -	31.98	23.22	37.74	27.41	137.69	5.12
Des Plaines River[d]	123.53	91.82	- -	- -	- -	- -	11.00	8.18	- -	- -	- -	- -	- -	- -	134.53	5.00
Minor Tributaries to Lake Michigan[c,e]	27.23	29.42	18.32	19.79	27.28	29.48	19.72	21.31	- -	- -	- -	- -	- -	- -	92.55	3.44
Pike River[c,e,f]	29.59	57.55	- -	- -	- -	- -	21.83	42.45	- -	- -	- -	- -	- -	- -	51.42	1.91
Sauk Creek[e]	- -	- -	- -	- -	34.09	100.00	- -	- -	- -	- -	- -	- -	- -	- -	34.09	1.27
Oak Creek[c,e,f]	- -	- -	27.74	100.00	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	27.74	1.03
Kinnickinnic River[c,e,f]	- -	- -	24.17	100.00	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	24.17	0.90
Sheboygan River[e]	- -	- -	- -	- -	10.84	100.00	- -	- -	- -	- -	- -	- -	- -	- -	10.84	0.40
Total	278.40	10.35	242.48	9.02	235.09	8.74	340.49	12.66	576.49	21.44	435.68	16.20	580.61	21.59	2,689.24	100.00

NOTE: Watershed areas are approximations based upon aggregations of U. S. Public Land Survey quarter sections.

[a]*Includes only that area of each watershed that lies within the Southeastern Wisconsin Region.*

[b]*Watersheds are listed in order of decreasing size within the Region.*

[c]*Indicates watershed wholly contained within the Region.*

[d]*Indicates watershed west of the subcontinental divide that is tributary to the Mississippi River basin. Three watersheds having a combined area of about 1,680 square miles, or about 62 percent of the Region, are in this category.*

[e]*Indicates watershed east of the subcontinental divide that is tributary to the Great Lakes-St. Lawrence River basin. Nine watersheds having a combined area of about 1,009 square miles, or about 38 percent of the Region are in this category.*

[f]*Indicates watershed for which comprehensive watershed plan has been prepared and adopted by the Regional Planning Commission.*

Source: SEWRPC.

Table II-2

MAJOR LAKES IN THE REGION BY COUNTY

County	Major Lakes[a]		
		Surface Area	
	Number[b]	Acres	Percent of Region
Kenosha	17	3,414	9.4
Milwaukee	- -	- -	- -
Ozaukee	3	358	1.0
Racine	11	3,516	9.6
Walworth	27	12,597	34.5
Washington	14	2,634	7.2
Waukesha	33	13,998	38.3
Region	101	36,517	100.0

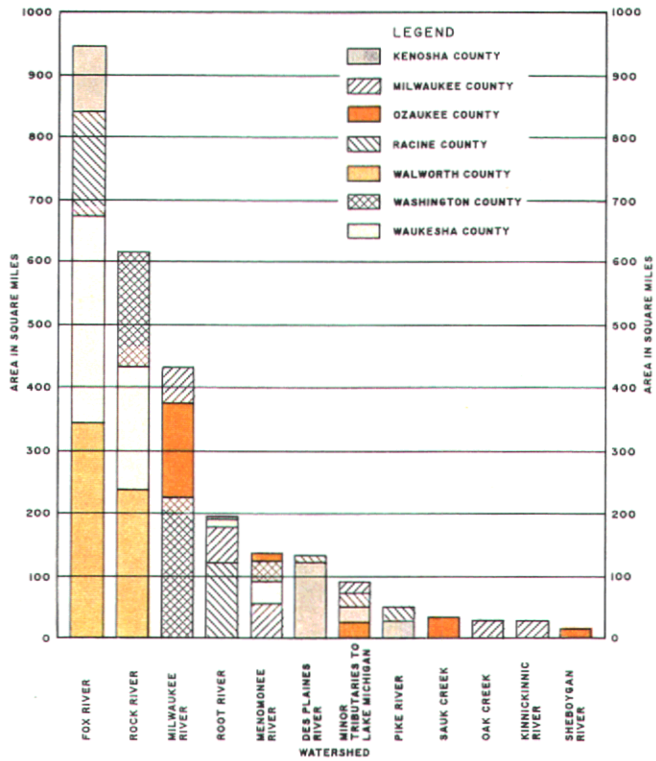
[a]*A major lake is defined as one having 50 acres or more of surface water.*

[b]*There are 101 major lakes in the Region. Four of these lakes lie in more than one county in the Region, including Benedict Lake and Powers Lake, which lie in Kenosha and Walworth Counties; Lake Denoon, which lies in Racine and Waukesha Counties; and Lake Five, which lies in Washington and Waukesha Counties. The number of lakes as reported by county in this table, therefore, adds up to more than 101.*

Source: Wisconsin Department of Natural Resources and SEWRPC.

Figure II-1

SIZE AND DISTRIBUTION OF WATERSHEDS IN THE REGION BY COUNTY



Source: SEWRPC.

shown on Map II-1.[1] Tabular summaries of selected physical characteristics of the major lakes of Southeastern Wisconsin are presented by watershed in the following chapters. The major lakes in the Region have a combined surface water area of about 36,500 acres, or about 2 percent of the total area of the Region. The number of major inland lakes per county ranges from none in Milwaukee County to 33 in Waukesha County; the combined surface water areas of the major lakes per county ranges from none in Milwaukee County to about 14,000 acres in Waukesha County. Lake Geneva is by far the largest inland lake in Southeastern Wisconsin, with an area of 5,262 acres, more than twice as large as Pewaukee Lake, which, with an area of 2,493 acres, is the second largest inland lake in the Region.

In addition to the major lakes, there are numerous "minor" lakes and ponds in the Region encompassing less than 50 acres of surface water area. These minor lakes have a combined surface area of about four square miles, or about 0.15 percent of the Region. These smaller lakes generally have few riparian owners and, in many cases, have marginal fisheries. In most cases, the primary values of the minor lakes are aesthetic. However, these lakes do provide a valuable resource and serve to provide an important ecological and recreational function. In some cases, these smaller lakes are located in highly urban areas, thus providing a readily available resource to large numbers of people. Minor lakes can be a fragile but important resource, and their ecological and aesthetic values may be lost unless properly managed.

The inland lakes of Southeastern Wisconsin are almost exclusively of glacial origin, formed by depressions in outwash deposits, terminal and interlobate moraines, and ground moraines. Some lakes, such as Green Lake in northeastern Washington County or Browns Lake in southwestern Racine County, owe their origins to kettles, that is, depressions formed in the glacial drift as a result of the melting of ice blocks that became separated from the melting continental ice sheet, and of the subsequent subsidence of sand and gravel contained on and within those blocks. By virtue of their origin, glacially formed lakes are fairly regular in shape, with their deepest points located predictably near the center of the basin, or near the center of each of several connected basins. The beaches are characteristically gravel or sand on the windswept north, east, and south shores, while fine sediments and encroaching vegetation are common on the protected west shores and in bays.

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[1]It should be noted that SEWRPC Planning Report No 30, A Regional Water Quality Management Plan for Southeastern Wisconsin--2000, reported the existence of 100 major lakes in the Region. Since the previous inventory, East Lake Flowage has been created as a major lake through an impoundment effort in the Bong State Recreation Area in the Town of Brighton, and an unnamed major lake has been created from an abandoned quarry in the Village of Pleasant Prairie. West Bend Pond in Washington County, classified as a major lake in previous inventory, is no longer a major lake due to the removal in 1987 of the dam which formed the pond. In addition, the classification of two other lakes has been changed on the basis of revised inventory data. Previously classified as a minor lake, Lac du Cours in Ozaukee County is now classified as a major lake on the basis of a revised area measurement of 56 acres. Previously classified as a major lake, Saylesville Mill Pond in Waukesha County is no longer classified as a major lake on the basis of a revised area measurement of 45 acres.

WATER USE OBJECTIVES AND SUPPORTING WATER QUALITY STANDARDS

The Wisconsin Department of Natural Resources (DNR) is required, under Section 144.025(2)(b) of the Wisconsin Statutes and the State Water Resources Act of 1965, to establish a set of water use objectives and supporting water quality standards applicable to all surface waters of the State. Under the Federal Water Pollution Control Act of 1965, the establishment of such objectives and standards is required for all navigable waters in the United States. The Federal Water Pollution Control Act further requires that these objectives and standards be periodically reviewed and revised as appropriate. Under the Wisconsin Resource Development Board, predecessor to the Wisconsin Natural Resources Board, a set of water use objectives and standards for Wisconsin surface waters was initially adopted for interstate waters on June 1, 1967, and for intrastate waters on September 1, 1968. These objectives and standards were then revised by the Wisconsin Natural Resources Board in 1977.

The initial regional water quality management plan included consideration of a set of water use objectives which were considered to be applicable for Southeastern Wisconsin and which were consistent with the water use objectives and standards for the State as they were revised by the Wisconsin Department of Natural Resources in 1977. In the initial regional plan, the following five combinations of water use objectives were formulated for application in Southeastern Wisconsin:

1. Salmon spawning fishery and aquatic life, recreational use, and minimum aesthetic standards

2. Trout fishery and aquatic life, recreational use, and minimum standards

3. Warmwater fishery and aquatic life, recreational use, and minimum standards

4. Warmwater fishery and aquatic life, limited recreational use, and minimum standards

5. Limited fishery and aquatic life, limited recreational use, and minimum standards

Of the five water use objective combinations, only the first three, providing for a full warmwater fishery and full body contact recreational use, are fully compatible with the national goal of "fishable and swimmable" waters, as set forth in Public Law 92-500.

The current Wisconsin Department of Natural Resources water use objectives and supporting standards, as of December 1992, are set forth in Chapters NR 102, 104, and 105 of the Wisconsin Administrative Code. In addition, Chapter NR 103, which became effective on August 1, 1991, establishes water quality-related rules for wetlands. The rules set forth in Chapter NR 103 consist of two parts: 1) a set of standards intended to protect water quality-related functions of wetlands including sediment and pollution control, stormwater and floodwater storage, hydrologic cycle maintenance, shoreline erosion protection, habitat protection for aquatic organisms and other wildlife species, and recreational uses; and 2) implementation procedures for application of the water quality standards. Because the application of the rules set forth in Chapter NR 103 are site specific and require consideration of the specific activity proposed within or adjacent to a wetland, wetland water quality objectives and standards are not specifically addressed in this report. Rather, it is assumed that the procedures documented in Chapter NR 103 will be applied by the Wisconsin Department of Natural Resources on a site-specific, case-by-case basis.

"Fishable" Waters

The revisions which have been made by the Wisconsin Department of Natural Resources to the surface water use objectives since the preparation of the regional water quality management plan consist primarily of combining the salmon and trout fishery categories into one coldwater fishery category, adding a new Great Lakes community category, and further subdividing the warmwater fishery and limited fishery biological use categories based upon the type of biological community which can be supported. Six biological use objectives have been developed by the Wisconsin Department of Natural Resources for application to all of the State surface waters, including both streams and lakes. These objectives are set forth in Chapter NR 102.04 (3) of the Wisconsin Administrative Code, and are based upon the type of aquatic life uses a particular water body should be able to safely and consistently support. Sub-section NR 102.04 (4) sets forth the applicable standards relating to these use objectives. Standards for recreational use, public health and welfare, and wild and domestic animals are set forth in Sub-sections NR 102.04 (5), (6) and (7), respectively, of the Wisconsin Administrative Code.

Each biological use objective represents the type of aquatic community a particular lake or stream reach is expected to be able to sustain. Because the existence of a particular aquatic community is dictated in large part by the level of water quality present in a particular water body, the assigned biological use serves as a measure of the water quality conditions, which are either currently being met or which could potentially be achieved under prescribed types and levels of management. The biological use objectives are detailed as follows:

Great Lakes Communities - Streams classified under this category are those waters which drain to Lake Michigan, and its bays, arms, and inlets, which serve as spawning areas for anadromous fishes.

Cold Water Communities - Streams classified under this category are capable of supporting a community of coldwater fish and other aquatic life, or serve as spawning areas for coldwater sport fish species. This category includes, but is not restricted to, surface waters identified as trout waters by the Wisconsin Department of Natural Resources. Also included in this classification are coldwater streams which, too small to support sport fish, are capable of supporting an abundant and diverse population of forage fish and macroinvertebrates which are intolerant of pollution.

Warmwater Sport Fish Communities - Under this classification, streams are capable of supporting a warmwater sport fishery or serve as spawning areas for warmwater sport fish species such as walleye, bluegill, largemouth bass, and smallmouth bass. Also present are aquatic macroinvertebrates which are relatively intolerant of pollution.

Warmwater Forage Fish Communities - This category includes surface waters with natural water quality and habitat capable of supporting an abundant, usually diverse, community of forage fish (shiners, minnows) and/or aquatic macroinvertebrates (insects, clams, crayfish) which are relatively intolerant of pollution. These streams are generally too small to support sport fish species. Streams capable of supporting valuable populations of pollution-tolerant forage fish are also included in this classification.

Limited Forage Fish Communities (Intermediate Surface Waters) - Streams within this classification are of limited capacity, naturally poor water quality and deficient habitat. These intermediate surface waters are capable of supporting only a limited community of pollution-tolerant forage fish and aquatic macroinvertebrates.

Limited Aquatic Life (Marginal Surface Waters) - Streams with this classification have a severely limited capacity, naturally poor water quality and deficient habitat. These marginal surface waters are only capable of supporting a limited community of aquatic life.

Those surface waters assigned a biological use objective as a Great Lakes community, coldwater community, warmwater sportfish community, or warmwater forage fish community, are characterized as surface waters which are considered in the Federal Water Pollution Control Act Amendment of 1972, Public Law 92-500, to be suitable for the protection and propagation of a balanced fish and other aquatic life community. These waters typically exhibit the highest degree of water quality and can be expected to meet the "fishable" criterion specified in Public Law 92-500. The remaining two biological use objectives are assigned when a particular surface water is unable to maintain the afore-described water quality conditions and resultant aquatic communities, or have been the subject of irretrievable physical alterations which limit uses. These water use objectives are described as supporting limited forage fish communities (intermediate surface waters) and limited aquatic life (marginal surface waters), respectively, in Sub-section NR 104.02 (3) of the Wisconsin Administrative Code.

"Swimmable" Waters

Two recreational use objectives considered applicable to surface waters in Southeastern Wisconsin for planning purposes in the initial regional plan were used in this updated report as a means of classifying surface waters according to varying degrees of human recreational use. For this purpose, the surface waters are divided into two categories: those waters that have a water quality which is considered safe and acceptable for full recreational use and those waters considered safe and acceptable for only limited recreational use. Surface waters classified as safe for full recreational use include those which have expected water quality conditions considered safe for human recreation where immersion of the head is expected and frequent. Recreational activities in this classification include swimming, waterskiing, windsurfing, and similar activities where significant contact with water is likely to occur. Limited recreational use waters include those used for human recreational use where immersion of the head is not frequent and contact is accidental or incidental and therefore less frequent, such as boating and sailing. As was done in preparing the initial water quality management plan, the Commission staff, when establishing the recreational use objectives for a particular water body or watercourse within the Region, in addition to giving consideration to potential bacterial contamination levels, gave consideration to both the degree of channelization and physical alteration, and physical attributes of the water body or watercourse, and to the nutrient levels within the waters, where known. Those streams and lakes which had excessive nutrient levels, which could not as a practical matter be sufficiently reduced, were placed in a limited recreational use category on the basis that the biological response to these conditions would result in a condition that would place limitations on the recreational uses.

Additionally, those streams which were found to have bacterial levels which could not be practically reduced to meet the standards described in the subsequent section, or which had physical characteristics which limited their use, were also placed in the limited recreation use category.

As was done in the initial regional water quality management plan, an attempt was made to assign all surface waters in the Region to an appropriate combination of those use objectives which would fully meet the national goal of "fishable and swimmable" waters. Consideration was given to the potential of each stream reach and of each major lake to meet objectives consistent with the national goal of "fishable and swimmable" waters. This consideration took into account the results of available inventories of the physical characteristics and conditions of the lakes and streams, existing water quality, sources of pollution in tributary drainage areas, characteristics of land uses in tributary drainage areas, and the locations and extent of in-place pollutants. This assessment was also based, in part, upon review of the analyses conducted under the initial regional water quality management planning program and subsequent field inspections and analyses conducted by the Wisconsin Department of Natural Resources staff, supplemented by inventory data collected by the U.S. Geological Survey, the Regional Planning Commission, and local agencies.

Water Use Objectives

In updating the initial regional water quality management plan, consistent with the objectives set forth in the initial regional water quality management plan refined to reflect the foregoing amended requirements of the Wisconsin Administrative Code and other considerations as set forth above, eight combinations of water use objectives were established by Commission staff for application to surface waters in the Region. These combinations of water use objectives are as follows:

- Coldwater biological community and full recreational use
- Warmwater sport fish community and full recreational use
- Warmwater sport fish community and limited recreational use
- Warmwater forage fish community and full recreational use
- Warmwater forage fish and limited recreational use
- Limited forage fish community and limited recreational use
- Limited aquatic life and limited recreational use

Waters supporting a limited forage fish community or limited aquatic life were deemed, by definition, to be incapable of supporting full recreational use, given that the conditions which impaired the survival of aquatic organisms would also be likely to impair human use of the system.

In addition to the above combinations of classifications, the Wisconsin Department of Natural Resources has two other special classifications used for the highest-quality lakes and streams. These classifications are Outstanding Resource Waters and Exceptional Resource Waters, as defined in Chapter NR 102 of the Wisconsin Administrative Code:

Outstanding Resource Waters have the highest value as a resource, excellent water quality and high-quality fisheries. They do not receive wastewater discharges and point source discharges will not be allowed in the future unless the quality of such a discharge meets or exceeds the quality of the receiving water. This classification includes national and State wild and scenic rivers and the highest quality, Class I trout streams in the State.

Exceptional Resource Waters have excellent water quality and valued fisheries but already receive wastewater discharges or may receive future discharges necessary to correct environmental or public health problems. This classification includes trout stream segments not classified as Outstanding Resource Waters.

The results of the application of the analysis of water use objectives for selected streams and for major lakes in the Region are graphically summarized on Map II-2 and are summarized below.

Streams: Of the seven water use objective combinations, only the three providing for the three highest biological uses, combined with the full recreational use, are fully compatible with the national goal of "fishable and swimmable" waters. Of the 1,223 stream miles analyzed in the updated planning program, 1,066 miles, or 87 percent, fall into one of these three categories: including 86 miles, or 7 percent, in the coldwater fishery, full recreational use category; 868 miles, or 71 percent, in the warmwater sport fishery, full recreational use category; and 112 miles, or 9 percent, in the warmwater forage fishery, full recreational use category. The remaining 157 stream miles, or about 13 percent, would not meet the national goal of "fishable and swimmable waters". These stream miles generally have excessive bacterial or nutrient levels which cannot as a practical matter be sufficiently reduced; or which have been significantly and permanently altered through concrete channelization; or have other physical alterations which limit their potential recreational use. Of these 157 stream miles, 59 miles, or 5 percent, have been placed into the warmwater sport fish and limited recreational use category; 27 stream miles, or 2 percent, have been placed into the warmwater forage fish and limited recreational use category; 35 stream miles, or 3 percent, have been placed into the limited forage fish and limited recreational use category; and 34 stream miles, or 3 percent, have been placed into the limited aquatic life and limited recreational use category.

The 1,223-mile stream network identified above does not include the Lake Michigan estuary portions of any of the regional streams that drain to Lake Michigan, except for the Milwaukee Harbor estuary which was included in the regional water quality management plan by means of a special estuary study completed in 1987.[2] No specific water use objectives for the remaining estuary reaches were assigned under the areawide water quality management planning program. 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.

Within Southeastern Wisconsin, Bluff, Potawatomi, and Van Slyke Creeks, all in Walworth County, totaling 5.0 stream miles, or 0.4 percent of all the perennial stream miles within the Region, are currently classified as Outstanding Resource Waters. The East Branch of the Milwaukee River from the Long Lake outlet to STH 28 in Washington County; and, Genesee Creek above STH 59, the Mukwonago River from Eagle Springs Lake to Upper Phantom Lake, and the Oconomowoc River below North Lake to Okauchee Lake, all in Waukesha County, totaling 21.4 miles, or

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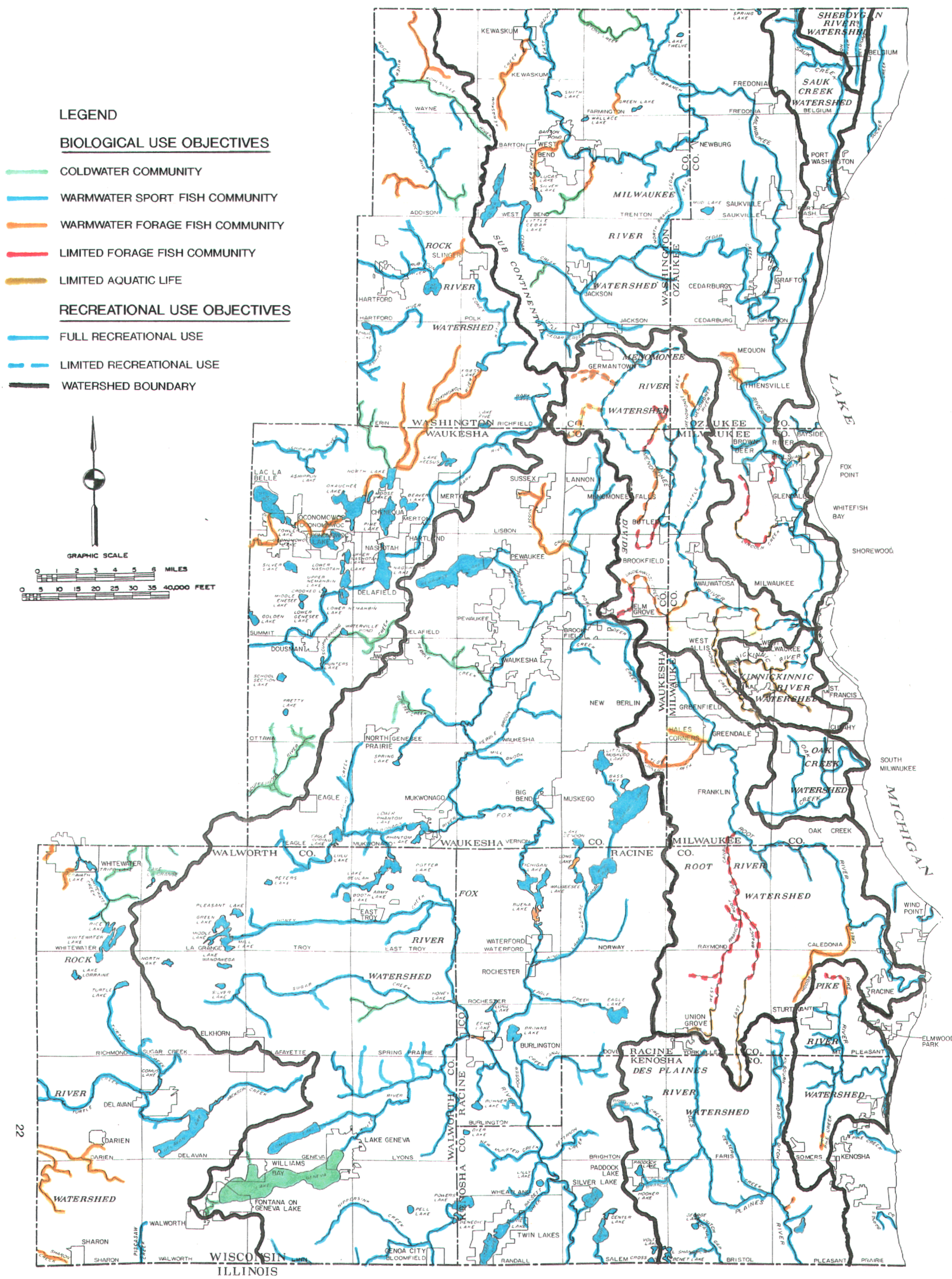
[2]SEWRPC Planning Report No. 37, A Water Resources Management Plan for the Milwaukee Harbor Estuary; Volume One, Inventory Findings; Volume Two, Alternative and Recommended Plans; December 1987.

Map II-2

RECOMMENDED WATER USE OBJECTIVES FOR LAKES AND STREAMS IN SOUTHEASTERN WISCONSIN: 2010



Source: SEWRPC.

1.8 percent of streams in the Region, are currently classified as Exceptional Resource Waters.

Lakes: Of the 101 major lakes in the Region, 98 lakes fall into water use objective categories that are deemed to be fully compatible with the national goal of "fishable and swimmable" waters. Of these 98 lakes, one--Geneva Lake--has been recommended for the maintenance of a coldwater biological community and full recreational use. The lake is the largest inland lake in the Region, with a surface area of 5,262 acres, or 14.5 percent of the total lake surface area of the Region. Within the Region, 97 lakes have been placed into the warmwater sport fish and full recreational use category, occupying a total area of 30,746 acres, or 84 percent of the lake area in Southeastern Wisconsin. The remaining three lakes--Echo Lake, Kee Nong Go Mong Lake, and the Buena Lake portion of the Waterford Impoundment in Racine County, together totaling 400 acres, or 1.1 percent of the lake surface area in the Region--have been placed into the warm-water forage fish and limited recreational use category because of estimated excessive nutrient loadings to the lakes which cannot, as a practical matter, be sufficiently reduced, resulting in accelerating rates of lake fertilization and attendant aquatic plant growth. Two lakes, Lulu Lake in Walworth County and Spring Lake in Waukesha County, are also classified as Outstanding Resource Waters, occupying 189 acres in surface area, or 0.5 percent of the combined surface area of all major lakes in the Region.

Water Quality Standards

In conjunction with the above stated water-use objectives, specific chemical and biological standards were developed for use in the plan updating process in order to quantitatively evaluate the water quality of specific surface waters. The standards are defined as characteristics of a water body which must be maintained to warrant it suitable for specific uses. When applied to specific waters, the standards serve to determine if, and to what extent, the water body is meeting its current water-use objectives. Additionally, standards are established and followed as a means for governing water management decisions.

The currently adopted standards were developed for planning purposes based upon consideration of those set forth in the initial areawide water quality management plan and the Wisconsin Administrative Code--Chapters NR 102, 104, and 105--as well as from additional sources, including U.S. Environmental Protection Agency (EPA) water quality criteria. These standards, as they apply to specific biological use objectives and recreational use objectives for the Southeastern Wisconsin Region, are set forth in Tables II-3 and II-4.

Historically, water quality standards were applied based upon the belief that water pollution was essentially a dry-weather, low-streamflow problem. This practice was based on analyses of stream water quality conditions affected by sewage treatment plant discharges. Such plants normally discharge sewage effluent at a relatively constant rate and quality, thereby causing the most severe water quality problems when receiving streamflows--and hence, dilution--are low. The Wisconsin Department of Natural Resources currently requires that all instream water quality standards be met during all but the very lowest flow conditions, such conditions being defined as flows less than the 7-day average, 1-in-10-year recurrence interval low flow.

Under the Commission's regional water quality management planning programs, however, it was determined that a probabilistic approach to the application of certain water quality standards, whereby the percent of time a given standard

Table II-3

APPLICABLE WATER USE OBJECTIVES AND WATER QUALITY STANDARDS FOR LAKES AND STREAMS WITHIN THE SOUTHEASTERN WISCONSIN REGION[a]

Water Quality Parameters	Combinations of Water Use Objectives Adopted for Southeastern Wisconsin Inland Lakes and Streams[b,c]						
	Coldwater Community and Full Body Recreational Use	Warmwater Sport fish Community and Full Recreational Use	Warmwater Sport fish Community and Limited Recreational Use	Warmwater Forage Fish Community and Full Recreational Use	Warmwater Forage Fish Community and Limited Recreational Use	Limited Forage Fish Community and Limited Recreational Use[d]	Limited Aquatic Life and Limited Recreational Use
Temperature[e,f,g] (°F)	Background	89.0 maximum	89.0 maximum	89.0 maximum	89.0 maximum	--	--
Dissolved Oxygen[g] (mg/l)	6.0 and 7.0[h] minimum	5.0 minimum[i]	5.0 minimum[i]	5.0 minimum[i]	5.0 minimum[i]	3.0 minimum[j]	3.0 minimum[j]
pH Range[k] (S.U.)	6.0 - 9.0	6.0 - 9.0	6.0 - 9.0	6.0 - 9.0	6.0 - 9.0	6.0 - 9.0	6.0 - 9.0
Total Phosphorous[l] (mg/l)	0.1, 0.02 maximum	0.1, 0.02 maximum	--	0.1, 0.02 maximum	--	--	--
Un-ionized Ammonia Nitrogen (mg/l)	0.02 maximum	0.04 maximum	0.04 maximum	0.04 maximum	0.04 maximum	3.0, 6.0 maximum[m]	--
Chloride[n] (mg/l)	1,000 maximum	1,000 maximum	1,000 maximum	1,000 maximum	1,000 maximum	1,000 maximum	--
Fecal Coliform (MFFCC)	200, 400 maximum[o]	200, 400 maximum[o]	1,000, 2,000 maximum[p]	200, 400 maximum[o]	1,000; 2,000 maximum[p]	1,000; 2,000 maximum[p]	1,000; 2,000 maximum[p]

[a] Includes SEWRPC interpretations of all basic water use categories established by the Wisconsin Department of Natural Resources and additional categories established under the areawide water quality management planning program, plus those combinations of water use categories applicable to the Southeastern Wisconsin Region. It is recognized that under both extremely high and extremely low flow conditions, instream water quality levels can be expected to violate the established water quality standards for short periods of time without damaging the overall health of the stream. It is important to note the critical differences between the official State and federally adopted water quality standards--composed of "use designations" and "water quality criteria"--and the water use objectives and supporting standards of the Regional Planning Commission described here. The U.S. Environmental Protection Agency and the Wisconsin Department of Natural Resources, being regulatory agencies, utilize water quality standards as a basis for enforcement actions and compliance monitoring. This requires that the standards have a rigid basis in research findings and in field experience. The Commission, by contrast,must forecast regulations and technology far into the future, documenting the assumptions used to analyze conditions and problems which may not currently exist anywhere, much less in or near Southeastern Wisconsin. As a result, more recent--and sometimes more controversial--study findings must sometimes be applied. This results from the Commission's use of the water quality standards as criteria to measure the relative merits of alternative plans.

[b] All waters shall meet the following minimum standards at all times and under all flow conditions: substances that will cause objectionable deposits on the shore or in the bed of a body of water, floating or submerged debris, oil, scum, or other material, and material producing color, odor, taste or unsightliness shall not be present in such amounts as to interfere with public rights in waters of the State. Substances in concentrations or combinations which are toxic or harmful to humans shall not be present in amounts found to be of public health significance, nor shall substances be present in amounts which are acutely harmful to animal, plant or aquatic life.

Footnotes continue.

Footnotes to Table II-3

[c] Standards presented in the table have been applied for planning purposes to lakes over 50 acres in surface area and to major streams of the Region.

[d] No un-ionized ammonia nitrogen standard has been established for streams or lakes classified as supporting limited forage fish communities. The maximum standard for total ammonia, as set forth in Chapter NR 104 of the Wisconsin Administrative Code, is included in the table.

[e] There shall be no temperature changes that may adversely affect aquatic life. Natural daily and seasonal temperature fluctuations shall be maintained. The maximum temperature rise at the edge of the mixing zone above the natural temperature shall not exceed 5°F for streams.

[f] There shall be no significant artificial increases in temperature where natural trout reproduction is to be maintained.

[g] Dissolved oxygen and temperature standards apply to continuous streams and the leeches of stratified lakes and to the unstratified lakes; the dissolved oxygen standard does not apply to the hypolimnion of stratified inland lakes. However, trends in the period of anaerobic conditions in the hypolimnion of deep inland lakes should be considered important to the maintenance of their natural water quality.

[h] Dissolved oxygen in classified trout streams shall not be artificially lowered to less than 6.0 mg/l at any time, nor shall the dissolved oxygen be lowered to less than 7.0 mg/l during the spawning season.

[i] Standard noted is applied using a probabilistic analyses approach as defined in this chapter; absolute minimum standard of 3.0 mg/l of dissolved oxygen also applies.

[j] Standard noted is applied using a probabilistic analyses approach as defined in this chapter; absolute minimum standard of 1.5 mg/l of dissolved oxygen also applies.

[k] The pH shall be within the stated range with no change greater than 0.5 units outside the estimated natural seasonal maximum and minimum.

[l] In streams classified for full recreational use, the total phosphorus concentration shall not exceed 0.1 mg/l. In lakes classified for full recreational use, the total phosphorus concentration shall not exceed 0.02 mg/l during spring when maximum mixing is underway. A phosphorus standard does not apply to streams and lakes classified for limited recreational use. Total phosphorus standards were developed by the Commission for use in the initial water quality management plan from U.S. Environmental Protection Agency recommendations set forth in Quality Criteria for Water, 1976.

[m] Standard is for total ammonia. Ammonia Nitrogen, expressed as N, at all points in the receiving water of Limited Forage Fish Communities should not be greater than 3 mg/l during warm temperature conditions (May - October), and 6 mg/l during cold temperatures (November - April), to minimize the zone of toxicity and to reduce dissolved oxygen depletion caused by oxidation of the ammonia.

[n] Threshold concentration for the propagation of freshwater fish above which the effects on aquatic life may become significant as determined by the California State Water Pollution Control Board, 1952.

[o] The fecal coliform count (MFFCC) should not exceed 200 per 100 ml as a geometric mean based on no less than 5 samples per month, nor exceed 400 per 100 ml in more than 10% of all samples during any month.

[p] The fecal coliform count (MFFCC) should not exceed 1000 per 100 ml as a geometric mean based on no less than 5 samples per month, nor exceed 2000 per 100 ml in more than 10% of all samples during any month.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table II-4

ACUTE AND CHRONIC TOXICITY CRITERIA[a]

Water Quality Parameters	Acute Toxicity ($\mu g/l$)						Chronic Toxicity ($\mu g/l$)		
	Water Use Objective						Water Use Objective		
	Coldwater			Others			All Water Use		
	Hardness ($mgCaCO_3/l$)			Hardness ($mgCaCO_3/l$)			Hardness ($mgCaCO_3/l$)		
	50	100	200	50	100	200	50	100	200
Cadmium	1.8	3.9	8.6	13.3	29.0	63.3	0.2	0.5	1.0
Copper	8.6	16.6	31.8	8.6	16.6	31.9	6.0	11.2	22.1
Lead	70.0	169.1	408.6	70.0	169.1	408.6	4.2	10.1	24.4
Zinc	57.4	103.3	185.8	62.7	112.8	202.9	27.6	49.6	89.2

[a]Values set forth in Chapter NR 105 of the Wisconsin Administrative Code.

Source: Wisconsin Department of Natural Resources.

should be allowed to be violated would be specified, would allow the assessment and resolution of water quality problems during high-flow as well as low-flow conditions. This approach is considered appropriate for planning, as opposed to regulatory, purposes as it allows the use of standards as criteria to measure the relative merits of alternative plans. Accordingly, analyses were conducted, under the initial regional water quality management plan, to determine the percentage of the time certain standards should be allowed to be violated except under specified conditions. A 95 percent compliance level was selected as the criterion for meeting the water quality standards for some parameters which directly affect desirable forms of aquatic life; namely, dissolved oxygen, temperature, un-ionized ammonia nitrogen, and pH. A 90 percent compliance level was selected as the criterion for parameters which do not directly affect desirable forms of aquatic life; namely, phosphorus, fecal coliform organisms, and chlorides. The analyses indicated that if these compliance levels were always met other than during periods of extreme low-flow conditions, the duration of the violation could be expected to be relatively short and the intensity of the violation to be relatively low, so that desirable uses and forms of aquatic life should not be adversely affected. Furthermore, the analyses indicated that even those surface waters which currently support full recreational uses and healthy fish and aquatic life communities often did not meet applicable water quality standards at all times. Thus, some level of violation of the standards was considered acceptable.

This probabilistic approach to water quality standards application was also used where applicable in the preparation of the regional water quality management plan update as a supplement to the current exemption in the standards for flow conditions lower than the 7-day average, 1-in-10-year recurrence interval low flow. This approach was generally used in considering the achievement of the water use objectives based upon modeling data developed in the initial plan for conditions arising from pollutant control levels which approximate current conditions. The probabilistic compliance level approach was not applied to those parameters for which seasonal standards--or standards based on acute and chronic toxicity criteria--were developed. For dissolved oxygen, an absolute minimum standard is also considered, as noted in Table II-3. For metals, values based on acute toxicity are presented and the application of such standards and criteria is specific and no probabilistic compliance level procedure is used. Chronic toxicity levels are also presented for metals and were considered based upon the 90 percent compliance level noted above.

Sediment Quality Standards

In addition to dissolved contaminants, contaminants also accumulate in lake and stream sediments. The Federal Water Resources Development Act of 1992 recognized the widespread existence of contaminated sediments and required that existing information on such sediments be compiled in a register. In response to this directive, the Wisconsin Department of Natural Resources (DNR) undertook a review of the existing data available in the State with a view toward developing statewide criteria for the identification and prioritization of contaminated sediment sites. The Department's draft report was published in mid-1994.[3] The criteria set forth in this report supersede previously published EPA criteria and, hence, have been adopted for use as an assessment tool in this plan.

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

The assessment criteria proposed in the draft DNR report are based on the potential for the contaminants present in the sediments at a particular site to create biological impacts. Two levels of potential impact are proposed: the lowest effect level (LEL) and the severe effect level (SEL) which represented the 5th and 95th percentiles, respectively, of a database compiled and analyzed in a comprehensive reference study prepared by the Ontario Ministry of the Environment. These values were considered by the DNR to be applicable within the State of Wisconsin. The lowest and severe effect levels for a selected set of parameters are shown in Table II-5.

Available data on the sediment quality were assembled for use in assessing the potential contamination of sediments within the Region. These data are presented in Chapters IV through XV for the major watersheds in the Region.

CURRENT SURFACE WATER QUALITY EVALUATION, DATA SOURCES AND PROCEDURES

Water quality data available for use in preparing the initial regional water quality management plan were collected during the 1964-65 Commission benchmark stream water quality study, the 1965-75 Commission stream water quality monitoring effort, the 1976 Commission sampling program for the regional water quality management plan, and the Wisconsin Department of Natural Resources sampling programs in 1973 and 1976.

The water quality biological condition and sediment quality data have been collected since the initial regional plan by sampling programs operated by other agencies and local units of government, including the Wisconsin Department of Natural Resources, the Milwaukee Metropolitan Sewerage District, the U. S. Geological Survey, the U. S. Environmental Protection Agency, and local lake organizations. In many cases, data have been collected for local or subregional purposes and thus do not represent a uniform data base comparable to that which was available for the initial regional plan, which included the results of modeling of the stream system. Therefore, the assessment of the probability of achieving the established water use objectives has relied in part upon the uniform areawide characterization of surface water conditions developed under the initial plan and expanded for the Milwaukee Harbor estuary study.[4] Simulation modeling conducted during the earlier planning programs,[5] in most cases, remains valid. Simulation of water quality conditions was carried out 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. While these modeling data cannot be used to precisely quantify the current 1990 water quality conditions, review of those data and a knowledge of the current status of the pollution control recommendations provides insight into the current water quality conditions and the potential for achieving the established water use objectives under current conditions.

Streams

Where data were available, various biotic and water quality indices were calculated for stream reaches within the Region. A water quality index value was

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

[5]SEWRPC Planning Report No. 30, A Regional Water Quality Management Plan for Southeastern Wisconsin--2000, Volume Two, Alternative Plans, February 1979.

Table II-5

LOWEST AND SEVERE EFFECT LEVELS OF CONTAMINANTS
PRESENT IN SEDIMENTS IN WISCONSIN

Chemicals	Lowest Effect Level[a]	Severe Effect Level[a]
As (Arsenic)	6	85
Cd (Cadmium)	1.1	9
Cr (Chromium)	31	145
Cu (Copper)	25	390
Hg (Mercury)	0.15	1.3
Ni (Nickel)	31	75
Pb (Lead)	31	250
Zn (Zinc)	120	820
Total PAH (Polycyclic Aromatic Hydrocarbons)	4	500
Total PCB (Polychlorinated Bi-phenyls)	0.07	26.4
Aldrin	0.002	0.4
Chlordane	0.007	0.3
Total DDT	0.007	0.6
op + pp DDT	0.008	3.6
pp DDD	0.008	0.3
pp DDE	0.005	1
Mirex	0.007	--
TCDD (dioxin) μg/kg	0.0003	--
NH_3-N	75	--
Oils and Grease	1,000	--
CN (Cyanide)	0.1	--

[a] Concentrations are in mg/kg dry sediment, with the exception of TCDD, which is in μg/kg.

Source: Wisconsin Department of Natural Resources and SEWRPC.

calculated for selected reaches. This index value was based upon six water quality parameters: fecal coliform counts, pH, and dissolved oxygen, chloride, nitrate-nitrogen, and total phosphorus concentrations. The same index was used in the initial regional water quality management plan.[6] For each water quality station where current data were available, the observed levels of each of the six selected parameters were assigned a score in the range of from 0 to 100. The parameter scores were then combined, through the use of selected weighing values, to prepare a general water quality index classification for each sampling station. Where the available data permit, the resulting ratings, based upon data obtained since the completion of the initial plan, are presented and compared to the 1964 and 1975 indices, along with descriptions of existing water quality conditions and trends, for each of the 12 major watersheds in the Region. These data are presented in Chapters IV through XV. Available water quality data collected since the completion of the initial plan are also summarized graphically in Chapters IV through XV.

Two biotic indices were also calculated where data were available. The Hilsenhoff Biotic Index (HBI) is the ratio of pollution-tolerant species or genera of arthropods--benthic animals--present in a stream sample population. Each species or genus is assigned a pollution tolerance value of between 0 and 5, with 0 representing the least tolerant species and 5 the most tolerant species. At each stream station, and for each species or genus present, the number of individual animals present is multiplied by the tolerance coefficient value for that species or genus, and a total score determined. The total score is divided by the total number of individuals present in the sample to derive the index value. HBI values of less than 2.75 were considered indicative of good water quality, while values in excess of 4.0 were considered indicative of poor water quality.[7] The resulting index values, based upon data obtained since the completion of the initial plan together with selected sampling data, are presented, along with descriptions of existing water quality conditions and trends, for each of the 12 major watersheds in the Region. These data are also presented in Chapters IV through XV.

Similarly, where data were available, an Index of Biotic Integrity (IBI) value was calculated. This index is a numerical description of the stream fishery, being comprised of the summation of ten scores and two correction factors. These scores are derived from metrics which reflect species richness and composition--rankings are given on the basis of the total number of native fish species, the number of darter species, the number of sucker species, the number of sunfish species, the number of pollution-intolerant species, and the percentage of pollution-tolerant species, their trophic and reproductive function--rankings are given on the basis of the percentage of omnivores, the percentage of insectivores, the percentage of top carnivores, and the percentage of simple lithophilous spawners, and fish abundance and condition--rankings are given on the basis of the number of pollution-intolerant individuals per 300 meters sampled and the percentage of deformities, eroded fins, lesions or tumors (DELT). Fish abundance and condition rankings, or the correction factors, are used only in cases where the IBI scores have extreme values--for example, where there are

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[6]See also: SEWRPC Technical Report No. 17, Water Quality of Lakes and Streams in Southeastern Wisconsin: 1964-1974, June 1978.

[7] Wisconsin Department of Natural Resources Technical Bulletin No. 132, Using A Biotic Index to Evaluate Water Quality in Streams, 1982.

very low numbers of fishes or a high percentage of DELT fishes. IBI values of close to 100 are considered indicative of good water quality, while values near zero are considered indicative of poor water quality.[8] Negative scores are rounded to zero. Scores differing by at least 25 points are considered to represent clear differences between sites. Where adequate data are available, the resulting index values, based upon data obtained since the completion of the initial plan, together with selected sampling data, are presented along with descriptions of existing water quality conditions and trends for each of the 12 major watersheds in the Region. These data are also presented in Chapters IV through XV.

Lakes

The 101 major lakes in the Region have been classified and are discussed according to trophic status where data exist. Trophic state classifications form a continuum from very nutrient poor lakes--classified as ultra-oligotrophic or oligotrophic--through mesotrophic to very nutrient rich lakes--classified as eutrophic or hypertrophic. The nutrient status of the lakes--generally assessed by means of their nitrogen and phosphorus concentrations and nitrogen to phosphorus ratios--is directly related to the nature and magnitude of plant growth that occurs in the lake. The relative proportions of nitrogen to phosphorus concentrations determines which of these essential plant nutrients controls plant growth--the "limiting nutrient"--as well as the type of algal growth that will occur--the lower the nitrogen to phosphorus ratio the more likely the lake is to be enriched and the more likely it is to have an algal flora dominated by nuisance, scum-forming blue-green algae. Eutrophic--or "well-fed"--lakes tend to have large numbers of few species of plants and animals, or unbalanced ecosystems dominated by the less desirable plants and animals; whereas, the oligotrophic--or nutrient poor--lakes tend to have small numbers of many species of plants and animals. The middle state--mesotrophy--contains moderate numbers of numerous species of plants and animals. Mesotrophy tends to be the most acceptable state for multiple use waterbodies and tends to be the natural state of most Southeastern Wisconsin waterbodies[9]--58 of the 101 major lakes in the Region have been assessed as mesotrophic using the trophic state classification described further below.

The trophic state classifications were assigned, where data were available, based on the phosphorus and chlorophyll concentrations and water clarity, with consideration being given to the levels of use impairment caused by algal and aquatic plant growth. The most commonly available data were water clarity data--determined as Secchi disc transparency--obtained through the Wisconsin Department of Natural Resources citizen-based Self-help Monitoring Program, the DNR Long-term Trends Monitoring Program, and specific lake studies conducted by the U. S. Geological Survey under the Chapter NR 119 Lake Management Planning Grant Program. These data were used to calculate the Carlson Trophic State Index

[8] United States Department of Agriculture, Forest Service General Technical Report No. NC-149, Using The Index of Biotic Integrity (IBI) to Measure Environmental Quality in Warmwater Streams of Wisconsin, April 1992.

[9] Lillie, R.A. and J.W. Mason, "Limnological Characteristics of Wisconsin Lakes," DNR Technical Bulletin No. 138, 1983.

(TSI) values and Wisconsin Trophic State Index (WTSI) values for these lakes.[10] These index values present numerical representations of water quality conditions in lakes based on a scale that ranges from 0 or ultra-oligotrophic to 100 or hypertrophic. Scores of about 50 are indicative of borderline eutrophy. The WTSI modifies the original Carlson TSI value to account for the greater humic--or tea-stained--coloration present in Wisconsin lake waters. Where data permit, both the Carlson and Wisconsin trophic state ratings are reported in the descriptions of water quality conditions in these lakes by watershed, as set forth in Chapters IV through XV.

The changes that have occurred in the water quality status of the lakes since 1975, as documented in the initial regional water quality management plan, are reported for the major lakes in each of the 12 major watersheds in the Region, as set forth in Chapters IV through XV, insofar as data exist. Assessment of change in water quality is based on a comparison of TSI values derived from 1981 survey based on satellite imagery and other available pre-1981 data sources, with index values calculated from post-1981 lake monitoring. The 1979-81 satellite imagery data[11], while tabulated, have limitations--the TSI was based only upon chlorophyll-a levels estimated from satellite imagery rather than upon chlorophyll-a and total phosphorus concentrations and water clarity observed in the lakes--which preclude their use in such assessments. The TSIs calculated from Wisconsin Department of Natural Resources Self-help monitoring data, while generally based solely on Secchi disc transparencies, in contrast, represent a readily available measured characterization of the status of the major lakes of Southeastern Wisconsin and likewise are presented in the following 12 chapters. However, because of these limitations in the data, as well as the inherently general nature of the Trophic State Index, the TSI values should be used with caution when comparing overall lake conditions. This is especially true when the variability inherent in the data is taken into account. For this reason, a change in TSI value of at least 10 units was required before a change in lake water quality was accepted as an assumed change. A change of 10 TSI units is equivalent to a change of approximately three to six feet in Secchi disc transparency in the mid-range mesotrophy. Even then, field data should be acquired before any lake management response, or alteration of existing lake management response, is contemplated. The WTSI values were not used in these assessments but are presented in order to facilitate future assessments when this refined index is brought into general use by the Wisconsin Department of Natural Resources.

SUMMARY

The assessment of water quality conditions requires a comparison of observed conditions to desired conditions. Thus, this plan update presents available

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[10]The two trophic state index schemes are described in detail in R.E. Carlson, "A Trophic State Index for Lakes," Limnology and Oceanography, Volume 22, pp. 361-368, 1977; and R.A. Lillie, S. Graham, and P. Rasmussen, "Trophic State Index Equations and Regional Predictive Equations for Wisconsin Lakes," DNR Research Management Findings, No. 35, May 1993. It should be noted that Wisconsin Trophic State Index values are currently being adopted by the DNR for future use in water quality assessments.

[11]Wisconsin Water Quality Assessment Report to Congress, 1992; and Wisconsin's Lakes-A Trophic Assessment, January 1983.

data upon which the assessment of current water quality and biological conditions can be made. Changes in water quality conditions which are apparent since preparation of the initial plan are also discussed where this data allow. In addition, a comparison of the water quality conditions of streams and lakes based upon available water quality sampling data obtained since 1975, or in some cases, estimated based upon modeling data developed in the initial plan, to the water use objectives and supporting standards described in this chapter. The resulting assessments are summarized by watershed in Chapters IV through XV. This approach was used to underpin the watershed-based approach to water quality management detailed in the following chapters.

Chapter III

LAND USE PLAN ELEMENT

INTRODUCTION

The most fundamental and basic element of the regional water quality management plan is the land use element. The future distribution of urban and rural land uses will determine to a large degree the character, magnitude, and distribution of point and nonpoint sources of pollution; the practicality of as well as the need for various lake, stream, and groundwater system management plans; and ultimately, the quality of the surface waters and the groundwater pollution potential of the Region. Accordingly, the selection and use of a regional land use plan is an essential element in synthesizing a regional water quality management plan.

The Southeastern Wisconsin Regional Planning Commission prepared and adopted on September 23, 1992, a new regional land use plan for the design year 2010. This plan is set forth in full in SEWRPC Planning Report No. 40, A Regional Land Use Plan for Southeastern Wisconsin - 2010. This land use plan was intended to update and revise as necessary the previously adopted SEWRPC regional land use plan for the year 2000, which was prepared and adopted by the Commission on December 19, 1977, and which served as the basis of the land use element of the 1979 regional water quality management plan. The year 2000 plan is documented in SEWRPC Planning Report No. 25, A Regional Land Use Plan and a Regional Transportation Plan for Southeastern Wisconsin: 2000. The design year 2010 plan is based upon the same basic concepts as the year 2000 plan, refining and detailing the previous plan as required with respect to changes in the levels and spatial distribution of population, households, and employment; land use patterns; and public facility and utility systems development.

YEAR 2000 PLAN RECOMMENDATIONS

The year 2000 land use plan emphasized a compact, centralized regional settlement pattern, with the location, intensity, and character of urban development being largely controlled by the effects of the urban land market. However, the plan sought to influence the urban land market in three significant areas in an effort to achieve a more healthful, attractive, and more efficient regional settlement pattern.

First, the year 2000 plan recommended that intensive urban development occur only in those areas of the Region covered by soils suitable for such development; and not subject to special hazards, such as flooding and shoreline erosion; and furthermore, those areas which would be readily served by essential municipal facilities and services, including centralized public sanitary sewerage and water supply. The plan recommended that new residential development occur primarily in planned neighborhood units at medium densities. A total of 22 major industrial centers and 16 major commercial centers were envisioned to exist within existing or proposed urban areas by the plan year 2000.

Second, the plan recommended the protection of all of the remaining primary environmental corridors of the Region from intrusion by incompatible urban development. The preservation of the primary environmental corridors in essentially natural, open uses, was envisioned to contribute to an anticipated integrated system of park and related open spaces within the Region.

Third, the design year 2000 plan proposed the retention, in essentially rural use, of almost all the remaining prime agricultural lands. These prime agricultural lands consist of the most productive farm lands and farm units in the Region.

STATUS OF IMPLEMENTATION OF THE YEAR 2000 LAND USE PLAN

In many respects, actual growth and change within the Region between 1970, the base year of the year 2000 plan, and 1985, the base year of the year 2010 plan, occurred in close conformance with design year 2000 regional land use plan recommendations and forecasts. However, it should be noted that this period also experienced a continuation of certain trends which were at variance with the plan.

Between 1970 and 1985, residential development in the Region occurred at a rate somewhat higher than envisioned under the adopted regional land use plan. While more that 70 percent of all housing units were built at medium or high residential densities in accordance with plan recommendations, substantial development of residential land occurred at lower densities.

Additional land use development, with respect to major recreational, commercial, and industrial centers, proceeded in substantial conformance with regional land use plan recommendations. Between 1970 and 1985, continued development of the majority of the recommended major park sites occurred in accordance with specific recommendations. Two of five proposed commercial sites and three of five proposed industrial sites also achieved major regional commercial or industrial site status between 1970 and 1985.

Significant progress was made in the protection of primary environmental corridor lands in the Region between 1970 and 1985. In 1970, approximately 72 square miles of primary environmental corridor lands were protected through public ownership. By 1985, 147 square miles, or about 31 percent of primary corridor lands in the Region, were publicly owned and thereby permanently protected against inappropriate urban development. Urban development in other areas of the Region, however, was largely responsible for the loss of almost eight square miles, or approximately 2 percent of the total primary environmental corridor lands.

Substantial progress was also made in the protection of prime agricultural lands between 1970 and 1985 through the application of exclusive agricultural zoning. This zoning served to protect about 585 square miles of prime agricultural lands within the Region. While the regional land use plan recommended the preservation of most prime agricultural lands, the plan recognized that the loss of certain prime farmland would be necessary to accommodate continued urban growth and development within the Region. In total, about 160 square miles of prime farmland was lost to urban development in the Region between 1963 and 1985. About 27 square miles of this total was located in, or adjacent to, expanding urban areas, consistent with the year 2000 land use plan recommendations. The remaining 133 square miles were located in outlying rural areas generally recommended to remain in agricultural and related use under the year 2000 land use plan.

YEAR 2010 PLAN--ALTERNATIVE FUTURES

During periods of major change in social and economic conditions, there is great uncertainty as to whether or not historic trends will continue. In order to deal with this uncertainty, the Southeastern Wisconsin Regional Planning Commission incorporated the use of "alternative futures" into the preparation of the new year 2010 land use plan. Under this approach, the development and evaluation of alternative land use plans is based not upon a single most probable forecast of future socio-economic conditions, but rather upon a number of alternative futures chosen to represent a range of conditions which may occur over the plan design period. The alternative futures are intended to supplement the recommended plan by indicating a range of possible future conditions with respect to the level and distribution of population, households, economic activity, and attendant land use patterns in the Region. The purpose of the approach is to allow the evaluation of the performance of alternative plans over a variety of possible future conditions in order to identify those alternatives that perform well under a wide range of such conditions.

Under the alternative futures approach, three alternative future growth scenarios were postulated for Southeastern Wisconsin. The sets of conditions postulated for each "future" were intended to represent consistent, reasonable scenarios of future changes in resident population and economic activity levels in the Region through the year 2010. Two scenarios, the "high-growth" scenario and the "low-growth" scenario, were intended to represent reasonable extremes, while the third scenario, the "intermediate-growth" scenario, was intended to represent the most-likely future.

From these three growth scenarios, four individual alternative futures land use plans plus the recommended land use plan were developed for the design year 2010. Each plan was based upon different potential growth rates and development patterns. Three of these plans envision a decentralized regional settlement pattern. The "high-growth decentralized" plan was designed to accommodate the future population and economic activity levels that could be anticipated under a high-growth scenario. The "intermediate-growth decentralized" plan and the "low-growth decentralized plan were designed to accommodate the population and economic activity levels that would be anticipated under the intermediate- and low-growth scenarios, respectively. The fourth plan, the "high-growth centralized" plan, was designed to accommodate population and economic activity levels anticipated under the high-growth scenario, emphasizing a centralized, rather than a decentralized development pattern for the Region as did the other three alternative futures. Together, these four alternative futures land use plans were intended to conceptually bracket the new recommended year 2010 regional land use plan, which was based upon an intermediate-growth centralized scenario. While many variations of the four alternative futures plans are possible, it is believed that the four alternative futures plans, in conjunction with the recommended plan, provide a good representation of the range of possible future conditions with respect to the overall scale and distribution of land use development in the Region through the year 2010.

As might be expected, population and employment levels anticipated under the three growth scenarios vary considerably. Under the high-growth scenario, the resident population of the Region would increase by about 551,000 persons, or 31 percent, from about 1,765,000 persons in 1980 to about 2,316,000 persons by the year 2010. The intermediate-growth scenario envisions a population increase of about 107,000 persons, or 6 percent, to a level of about 1,872,000 persons by the year 2010. Conversely, the low-growth scenario envisions a decrease in the regional population of about 248,000 persons, or 14 percent, to a level of about 1,517,000 persons by the year 2010.

Under the high-growth scenario, total regional employment would increase by about 368,000 jobs, or 42 percent, from about 884,000 jobs in 1980 to about 1,252,000 jobs by 2010. Under the intermediate-growth scenario, employment would increase by about 167,000 jobs, or 19 percent, to about 1,051,000 jobs by 2010. Under the low-growth scenario, total employment would approximate 871,000 jobs by 2010, about 13,000 jobs, or about 2 percent, less than the 1980 level.

As a practical matter, the design of a regional land use plan must be targeted toward a single set of population and employment forecasts. It was the collective judgment of the Advisory Committee guiding the preparation of the design year 2010 plan that future population and employment levels in the Region would be most closely approximated by the intermediate-growth scenario. Accordingly, the Committee directed that the new land use plan be prepared to accommodate the population and employment forecasts attendant to that scenario, with some adjustments to reflect 1990 benchmark population and employment data. It was thus determined that the new regional land use plan should accommodate a design year population of 1,911,000 persons, and a design year employment level of about 1,095,000 jobs. While the new year 2010 regional land use plan is based upon the intermediate-growth scenario, potential land use patterns associated with population and economic activity levels under the low-growth and high-growth scenarios were also explored under the current planning program.

The new year 2010 regional land use plan, as described in the following sections, has been scaled to a carefully selected set of population, household, and employment forecasts for the Region. Consideration of these alternative future conditions is particularly important in local plan implementation activities associated with the regional water quality management plan. It is recommended that the local, detailed facility planning for both point and nonpoint source pollution abatement projects give consideration to the range of possible future conditions. As an example, the design of certain facilities which can readily be expanded in stages may be based initially on the recommended intermediate-growth centralized plan, or even on the low-growth stage of that recommended plan,, recognizing that the expansion of such facilities can be readily accommodated if a higher-growth future occurs. Examples of such a facility would be treatment plants designed for modular expansion or detention basins in areas where adequate open land is reserved. Conversely, certain facilities which cannot be readily expanded may be designed initially using the higher growth future condition. Such facilities might include gravity flow trunk sewers being built in areas where development is taking place, making replacement or reinforcement costly. Facilities crossing wetlands or other environmentally sensitive areas may also warrant design based upon a higher growth future in order to avoid future disruption. By considering the range of future conditions, the most robust as well as cost-effective and environmentally sound alternative design can be selected. To this end, design year 2010 population data under the recommended plan and under a high-growth decentralized land use scenario are provided herein for each sewer service area in the Region in order to provide a reasonable range of conditions to be considered in subsequent facility planning.

LAND USE PLAN ELEMENT

The adopted regional land use plan for design year 2010 for the Southeastern Wisconsin Region, as it was adopted on September 23, 1992, is shown in graphic summary on Map III-1. The regional land use plan recommends the promotion of compact, centralized land use development in the Region, with development generally occurring in concentric rings along the periphery of, and outward from, existing urban centers. While the plan continues to recognize the importance of market forces in determining the location, intensity, and character of urban development, it--like the two predecessor regional land use plans--seeks to influence the operation of the urban land market in order to promote a more orderly and economic settlement pattern. This settlement pattern would generally avoid further intensification of existing, and the creation of new, areawide developmental and environmental problems. In this regard, the plan recommends that new urban development occur either at densities consistent with the provision of public centralized sanitary sewer, water supply, and mass transit facilities and services, or in locations where such facilities and services can be readily and economically provided. Additionally, the plan seeks to encourage the location of new urban development primarily in those areas of the Region which are covered by soils suitable for such development and not subject to special hazards, such as flooding and erosion.

Urban Development and Density

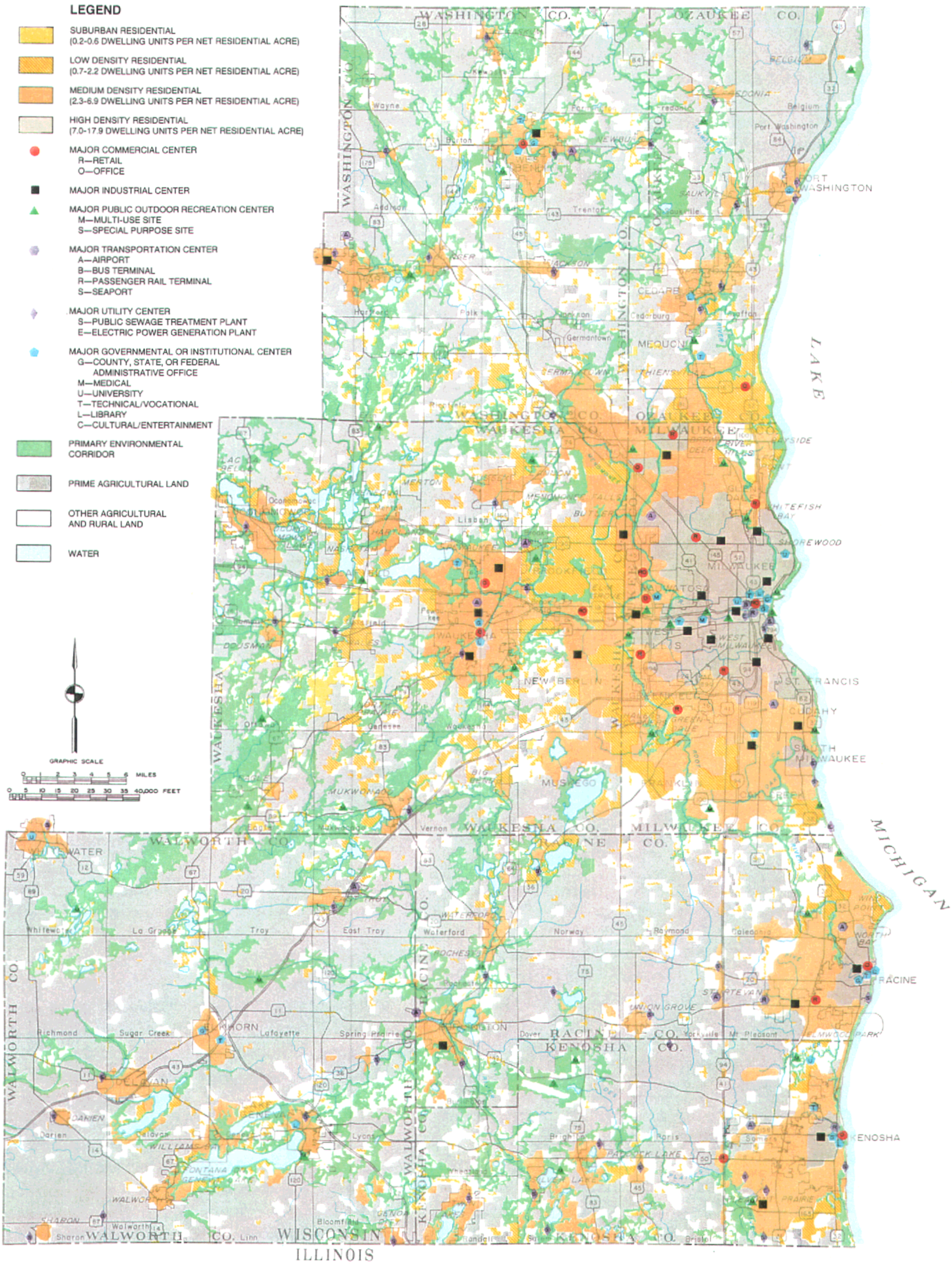
In order to accommodate the anticipated increases in population, households, and employment levels from 1985 to 2010, the year 2010 regional land use plan proposes to accommodate portions of this growth through the conversion of certain existing rural lands to urban land uses. In 1985, approximately 605 square miles, or about 22 percent of the Region, were devoted to urban land uses. The recommended land use plan anticipates a conversion of about 86 square miles of rural land to urban use by the year 2010, increasing the total stock of urban land to 691 square miles, or to about 26 percent of the total area of the Region.

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

The year 2010 land use plan seeks to discourage scattered, "leap frog" urban development--urban sprawl--in outlying areas of the Region, both through encouragement of higher density development in those areas of the Region that can be most readily served by essential urban services, and through the maintenance of rural development densities in these rural, outlying areas, that is, average lot sizes of at least five acres per dwelling unit. With proper attention to soil and other natural resource base limitations, such development can be sustained without public sanitary sewer, water supply, or urban storm drainage facilities; high-value woodland and wetland areas can be preserved; and wildlife can continue to sustain itself in the area.

Map III-1

RECOMMENDED LAND USE PLAN FOR THE SOUTHEASTERN WISCONSIN REGION: 2010



Source: SEWRPC.

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

Major Regional Commercial and Industrial Centers

In the Southeastern Wisconsin Region in 1985, there were 14 existing major commercial centers, encompassing a total of almost 1,100 acres of commercial land uses. The recommended land use plan proposes retaining all 14 existing sites as major commercial centers through the year 2010 and also proposes the expansion of certain of these centers. It is anticipated that with the expansion of the centers, 300 acres, in addition to the existing 1,100 acres, of commercial land would be occupied.

In addition to the proposed expansion of the centers, the plan recommends the development of five new major commercial centers in the Region. Four of the five centers are proposed as office centers and would include Park Place in northwestern Milwaukee County, development of which is currently underway; a strip office development along IH 43 in the City of Mequon, which is also under development; a new research park to be located near the Milwaukee County Institutions grounds in the City of Wauwatosa; and a new office center located near the intersection of IH 94 and CTH J in the Town of Pewaukee. The fifth proposed commercial center is a retail center located near the intersection of IH 94 and STH 50 in Kenosha County, development of which is underway.

In 1985, there were 22 major industrial centers identified in the Region. The recommended regional land use plan proposes to retain all of these sites as major industrial centers and further proposes to add three new major industrial centers by the year 2010. The three proposed new centers would be located in or near the Cities of Burlington and Hartford and the Village of Pleasant Prairie. Consideration has been given to these new industrial centers as sewer service area plans are being prepared for the individual service areas in the Region.

Park and Outdoor Recreation Area

Under the recommended year 2010 land use plan, about 4,100 acres of land for intensive, public recreational land use would be added to the existing 26,000 acres currently designated as recreational lands. The additional recreational areas called for under the plan are based in part on neighborhood development standards, which seek to provide adequate neighborhood park land in developing areas. The recreational land use recommendations of the regional land use plan also reflect specific park site acquisition and development proposals set forth in the county park and open space plans prepared by the Commission for each of the seven counties in the Region.

The year 2010 regional land use plan proposes a system of 31 major parks of regional size and significance to serve the needs of the Region through the year 2010. Such parks have an area of at least 250 acres and provide opportunities for a variety of resource-oriented outdoor recreational activities. Twenty-nine of the 31 sites were recommended as major park sites under the year 2000 regional land use plan. Of the 29 previously recommended sites, only two--Sugar Creek in

Walworth County and Paradise Valley in Washington County--have yet to be publicly acquired.

The year 2010 plan recognizes the development of two major parks not identified in the year 2000 plan, namely, Mitchell Park, an approximately 800-acre site located in the City and Town of Brookfield, and an approximately 400-acre unnamed site surrounding a major lake recently created from an abandoned quarry in the Village of Pleasant Prairie. Facility development at these sites as envisioned in local site plans would qualify both sites as major parks.

The development of a water quality management plan in accordance with proposed land use objectives for the design year 2010 will be important to the full and beneficial use of both resource and non-resource related outdoor recreation facilities.

Environmentally Sensitive Lands

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

As part of the regional land use planning program, each of these natural resource and resource-related elements was mapped on 1 inch equals 400 feet scale, ratioed and rectified aerial photographs. A point system for value rating the various elements of the resource base was established, as summarized in Table III-1. The primary environmental corridors were delineated using this rating system. To qualify for inclusion in a primary environmental corridor, an area must exhibit a point value of 10 or more. In addition, a primary environmental corridor must be at least 400 acres in size, be at least two miles long, and have a minimum width of 200 feet. This environmental corridor refinement process is more fully described in SEWRPC Technical Record, Volume 4, No. 2, in an article entitled, "Refining the Delineation of Environmental Corridors in Southeastern Wisconsin."

The primary environmental corridors encompassed about 468 square miles, or 17 percent of the Region in 1985. Under the recommended regional land use plan for the year 2010, these corridors, as shown on Map III-1, would be protected and preserved in essentially natural, open uses. In addition to the proposed retention of existing corridors, the year 2010 land use plan proposes that 3,600 acres of adjacent floodland areas currently in agricultural or other open use, be restored to a wetland condition, and thereby incorporated into the environmental corridor network. In accordance with the regional land use plan and the county park and open space plans for each of the individual seven counties, these lands are recommended for county or State acquisition for open space preservation purposes, or for protection through joint State, county-local zoning.

Table III-1

VALUES ASSIGNED TO NATURAL RESOURCE BASE AND RESOURCE BASE-RELATED ELEMENTS IN THE PROCESS OF DELINEATING PRIMARY AND SECONDARY ENVIRONMENTAL CORRIDORS

Resource Base or Related Element	Point Value
Natural Resource Base	
Lake	
Major (50 acres or more)	20
Minor (five to 49 acres)	20
Rivers or Streams (perennial)	10
Shoreland	
Lake or Perennial River or Stream	10
Intermittent Stream	5
Floodland (100-year recurrence interval)	3
Wetland	10
Wet, Poorly Drained, or Organic Soil	5
Woodland	10
Wildlife Habitat	
High-Value	10
Medium-Value	7
Low-Value	5
Steep Slope	
20 Percent or More	7
13-19 Percent	5
Prairie	10
Natural Resource Base-Related	
Existing Park or Open Space Site	
Rural Open Space Site	5
Other Park and Open Space Site	2
Potential Park Site	
High-Value	3
Medium-Value	2
Low-Value	1
Historic Site	
Structure	1
Other Cultural	1
Archaeological	2
Scenic Viewpoint	5
Scientific Area	
State Scientific Area	15
State Significance	15
County Significance	10
Local Significance	5

Source: SEWRPC.

The preservation of primary environmental corridors is considered essential to the protection and wise use of the natural resource base of the rapidly urbanizing Region. Preservation of these corridors in natural, open uses provides significant areas of habitat for wildlife, maintains the existence of high quality woodlands and wetlands, significantly contributes to the prevention of new and the intensification of existing environmental problems such as flooding and water pollution, and contributes to the preservation of the Region's cultural heritage and natural beauty.

It is recommended that lands identified as primary environmental corridors not be developed for intensive urban use. Accordingly, the plan further recommends that sanitary sewers not be extended into such corridors for the purpose of accommodating urban development in the corridors. It was, however, recognized in the plan that it would be necessary in some cases to construct sanitary sewers across and through primary environmental corridors, and that certain land uses requiring sanitary sewer service could be properly located in the corridors, including park and outdoor recreation facilities and certain institutional uses. In some cases very low density single-family residential development on five-acre lots, compatible with the preservation of the corridors in essentially natural open uses, may also be permitted to occupy corridor lands and it may be desirable to extend sewers into the corridors to serve such uses. Basically, however, the plan element seeks to ensure that the primary environmental corridor lands are not destroyed through conversion to intensive urban uses.

Secondary environmental corridors are also identified in the year 2010 regional land use plan. The secondary environmental corridors, while not as significant as the primary environmental corridors in terms of the overall resource values, should be considered for preservation as the process of urban development proceeds, because such corridors often provide economical drainageways, as well as needed "green space," through developing residential neighborhoods. To qualify for inclusion in a secondary environmental corridor, an area must exhibit a point value of 10 or more, with such a corridor having a minimum area of 100 acres and a minimum length of one mile.

Isolated natural areas are also identified in the year 2010 regional land use plan. Isolated natural areas generally consist of those natural resource base elements that have "inherent natural" value such as wetlands, woodlands, wildlife habitat areas, and surface water areas, but that are separated physically from the primary and secondary environmental corridors by intensive urban and agricultural land uses. Since isolated natural areas may provide the only available wildlife habitat in an area, provide good locations for local parks and nature study areas, and lend aesthetic character and natural diversity to an area, these areas should also be protected and preserved in a natural state to the extent practicable. An isolated natural area must be at least five acres in size.

As service area plans are developed for the individual sewer service areas in the Region, the primary environmental corridors, secondary environmental corridors, and isolated natural areas are documented, quantified, and mapped in order to assist the designated management agencies in the protection of the primary environmental corridors and in considering protection of other environmentally sensitive lands.

Prime Agricultural Lands

In an urbanizing area such as southeastern Wisconsin, the demands of a growing urban population typically require certain conversion of rural land to urban land use. While general agricultural lands are subject to this conversion, the year 2010 plan seeks to minimize the development of new urban uses on lands which have been designated as prime agricultural lands. Those areas, as shown on Map III-1, totaled just over 1,047 square miles, or 39 percent of the Region, in 1985. The recommended year 2010 land use plan proposes to convert to urban use only those prime agricultural lands which were already committed to urban development due to proximity to existing and expanding concentrations of urban uses and the prior commitment of heavy capital investment in utility extensions. The recommended plan proposes to convert only about 16 square miles, or just over 1 percent of the remaining prime agricultural lands to urban use by the year 2010.

The preservation of prime agricultural lands has important implications for water quality management planning. Prime agricultural land preservation will assist in the implementation of sound soil and water conservation practices and nonpoint source water pollution abatement measures, such as conservation tillage, crop rotation, contour plowing, cover crops, terracing, diversion structures and dikes, water and grade control structures, and grassed waterways, and will facilitate implementation of appropriate wind erosion measures, streambank erosion measures, and pesticide, fertilizer, and animal controls. Well-managed agricultural land contributes less pollutants to surface waters than urban land uses. Accordingly, implementation of the prime agricultural land component of the year 2010 regional land use plan element will be important to the implementation of the nonpoint source pollution abatement plan element and to the achievement of the recommended water use objectives and supporting water quality standards.

Chapter IV

DES PLAINES 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 Des Plaines 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 Des Plaines River watershed as part of the continuing water quality planning process. The status of the initial adopted 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 agencies for plan implementation are presented in Chapter XVII on a regional basis.

The Des Plaines River watershed is located in the southeasterly portion of the Region. That part of the watershed contained within the Region--about 134-square miles--is only a small part of a much larger watershed. The main stem of the Des Plaines River rises in Racine County south of the Village of Union Grove and flows approximately 22 miles southerly and easterly through Kenosha County before crossing the State line about 1.5 miles east of IH 94 into Illinois where it continues southerly to join the Kankakee River to form the Illinois River. 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, together with the locations of the main channels of the Des Plaines River and its principal tributaries, are shown on Map IV-1.

There are six major lakes in the watershed having a surface area of 50 acres or more: Benet/Shangrila Lakes, East Lake Flowage, George Lake, Hooker Lake, Paddock Lake, and an unnamed lake formed by an abandoned quarry in the Village of Pleasant Prairie. Physical characteristics of the major lakes in the Des Plaines River watershed are set forth in Table IV-1. The data indicate that major lakes in the watershed have a combined surface area of about 667 acres, or less than 1 percent of the total area of the watershed.

Map IV-1
DES PLAINES RIVER WATERSHED

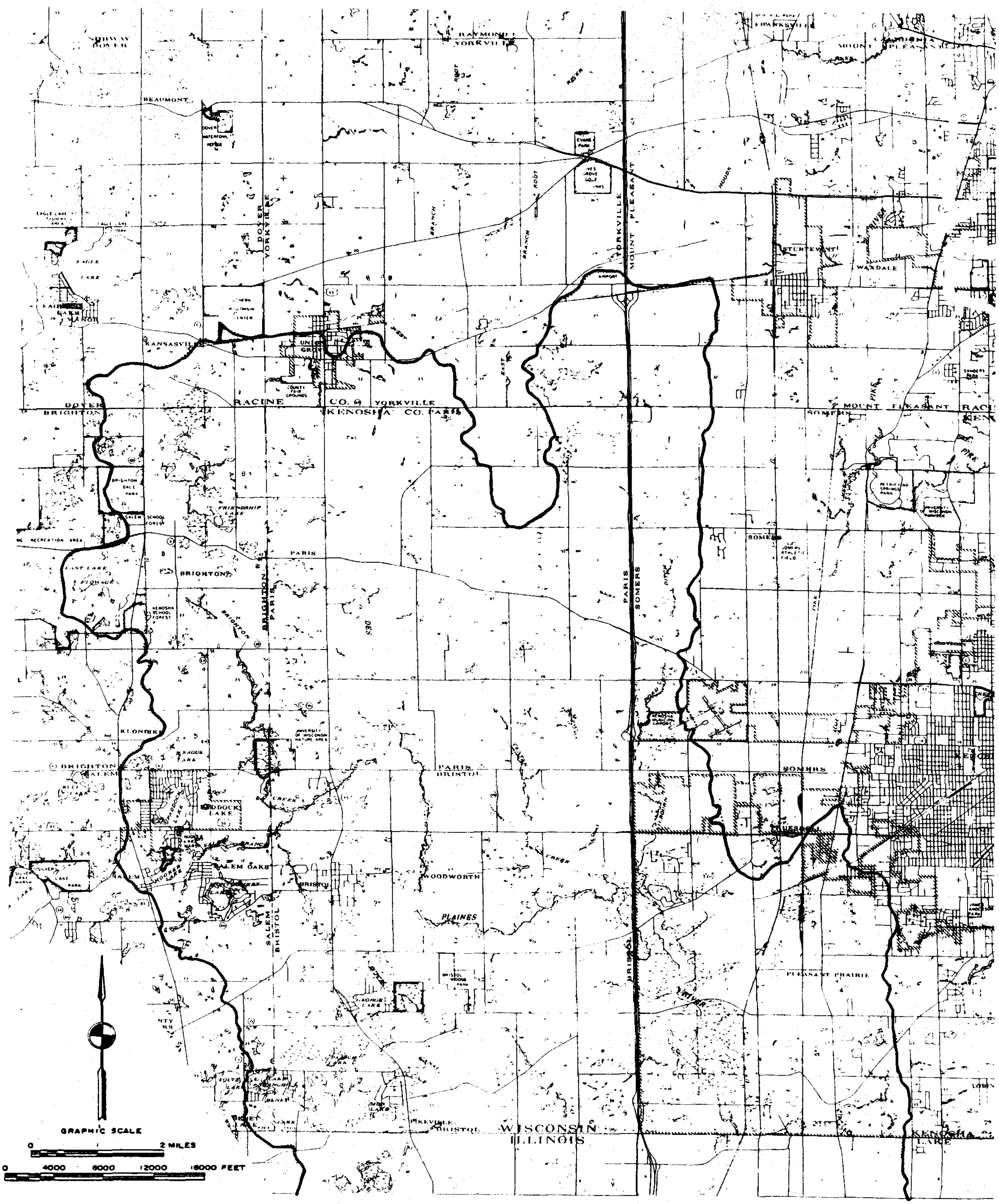


Table IV-1

PHYSICAL CHARACTERISTICS OF MAJOR LAKES IN THE DES PLAINES RIVER WATERSHED

WATERSHED Lake Name	Surface Area (acres)	Direct Tributary Drainage Area (acres)	Shoreline (miles)	Maximum Depth (feet)	Mean Depth (feet)	Volume (acre-feet)
DES PLAINES RIVER						
Benet/Shangrila Lake	186[a]	407	6.20	24	4.7	874
East Lake Flowage	123	850	3.07	N/A	N/A	N/A
George Lake	59	2,187	1.18	16	6.4	389.4
Hooker Lake	87	1,244	1.90	24	11.3	983
Paddock Lake	112	291	3.42	32	11.4	1,277
Unnamed Lake	100	68	2.10	N/A	N/A	N/A
Total	667	5,047	17.87	--	--	--

[a]Includes six acres in Illinois.

Source: SEWRPC

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 Des Plaines 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 IV-2 summarizes the existing land uses in the Des Plaines 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 is presently experiencing a relatively rapid conversion of land from rural to urban use in certain areas, about 88 percent of the watershed was still in rural and other open space land use in 1990. These uses included about 68 percent of the total watershed in agricultural and related rural uses, 6 percent in woodlands, about 9 percent in surface water and wetlands, and about 5 percent in other open lands. The remaining 12 percent of the total watershed was devoted to urban uses. Existing 1990 land uses within the watershed are shown on Map IV-2.

Within the Des Plaines River watershed, major concentrations of urban development have been rapidly taking place in the portion of the watershed east of IH 94 and just west of IH 94 at STH 50, the areas where public sanitary sewer service and water supply facilities are now available. Other urban-related land uses are located in the western portions of the watershed around Lakes Paddock, George, Hooker, Montgomery, and Benet/Shangrila; within the unincorporated Village of Bristol surrounding STH 45 south of STH 50; and within the corporate limits of Union Grove.

As shown in Table IV-2, from 1975 to 1990, urban land uses in the watershed increased from about 8,070 acres, or 12.6 square miles to about 10,030 acres, or 15.7 square miles, or by about 24 percent. Also, as shown in Table IV-2, residential land represents the largest urban land use in the watershed. Residential use has significantly increased within the watershed, from about 3,970 acres, or about 6.2 square miles in 1975 to 4,700 acres, or about 7.3 square miles in 1990, an 18 percent increase. Commercial and industrial lands increased from about 200 acres, or about 0.31 square mile, to 440 acres, or 0.69 square mile, an increase of 118 percent.

The 15.7 square miles of urban land uses in the watershed as of 1990 exceeded the approximated 1990 planned level of about 14.9 square miles set forth in the adopted year 2000 land use plan. The current status of development in the Des Plaines River watershed and adjacent portions of Kenosha County was considered

Table IV-2

LAND USE IN THE DES PLAINES RIVER WATERSHED: 1975 AND 1990[a]

Land Use Category	1975 Acres	1975 Percent	1990 Acres	1990 Percent	Change 1975-1990 Acres	Change 1975-1990 Percent
Urban						
Residential	3,971	4.6	4,695	5.5	724	18.2
Commercial	97	0.1	185	0.1	88	90.7
Industrial	104	0.1	254	0.3	150	144.2
Transportation, Communication, and Utilities[b]	3,174	3.7	3,915	4.5	741	23.3
Governmental and Institutional	233	0.3	248	0.3	15	6.4
Recreational	492	0.6	737	0.9	245	50.8
Subtotal	8,071	9.4	10,034	11.6	1,963	24.3
Rural						
Agricultural and Related	62,001	72.0	58,793	68.3	-3,200	- 5.2
Lakes, Rivers, Streams, and Wetlands	8,061	9.4	7,953	9.2	- 108	- 1.3
Woodlands	4,645	5.4	4,765	5.5	120	2.6
Open Lands,[c] Landfills, and Extractive	3,324	3.8	4,557	5.3	1,233	37.1
Subtotal	78,031	90.6	76,068	88.3	-1,963	- 2.5
Total	86,102	100.0	86,102	100.0	--	--

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

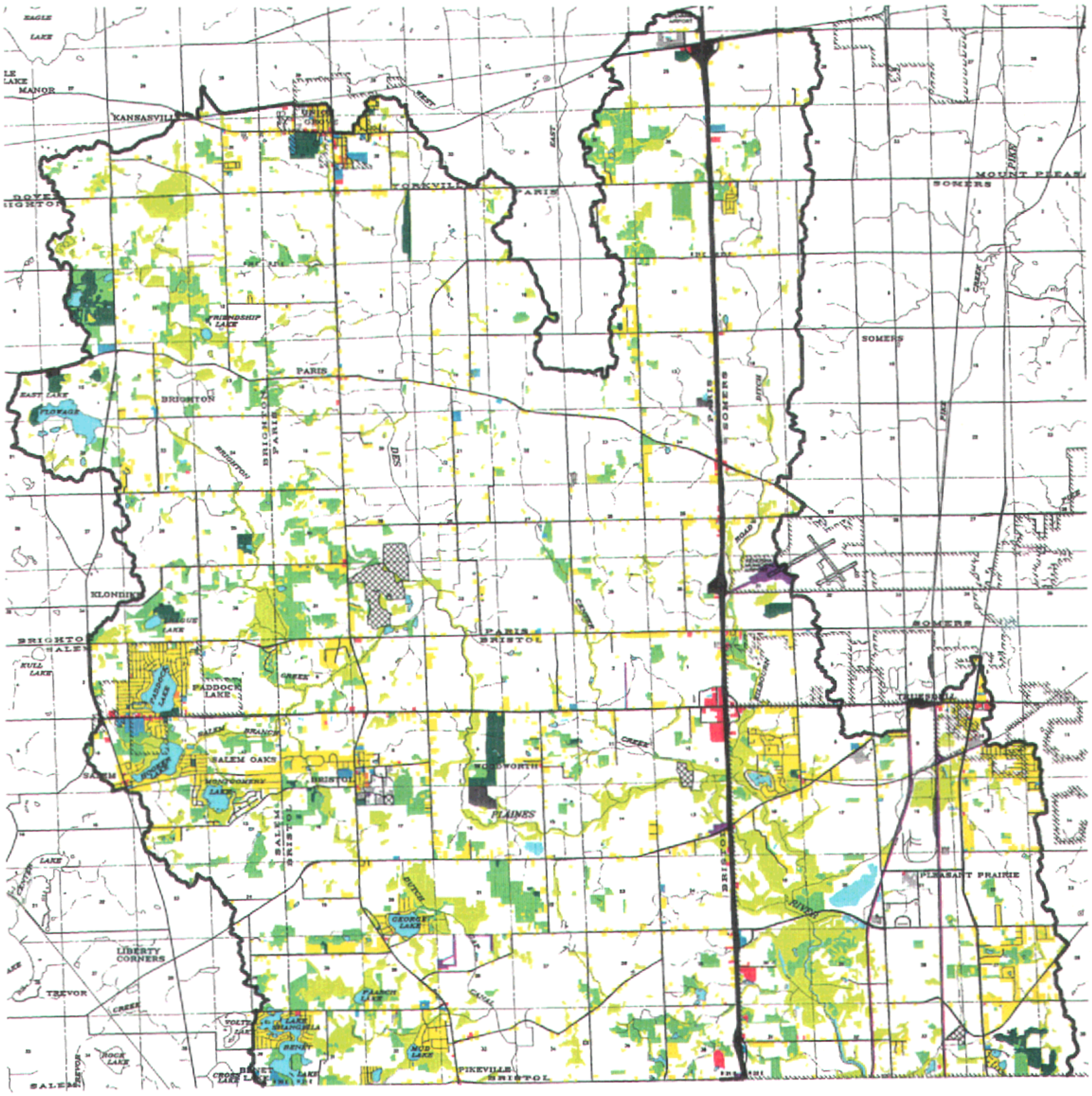
[b]Includes all off-street parking.

[c]Includes both rural and urban open lands.

Source: SEWRPC.

MAP IV-2

LAND USES IN THE DES PLAINES RIVER WATERSHED: 1990



—LEGEND—

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

0 1 2
GRAHIC SCALE IN MILES

The Des Plaines River watershed is about 134 square miles in areal extent, or about 5 percent of the total area of the Region. In 1990 about 16 square miles, or about 11 percent of the watershed, was in urban land uses.

Source: SEWRPC

in developing the new year 2010 land use plan element described in Chapter III for the Region.

Table IV-3 summarizes the year 2010 planned land use conditions recommended in the adopted year 2010 land use plan in the Des Plaines 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 along the IH 94 corridor in the City of Kenosha, the Village of Pleasant Prairie, and the Towns of Bristol and Somers; the STH 50 corridor in the City of Kenosha, the Village of Pleasant Prairie, and the Towns of Salem and Bristol; in an around the Villages of Paddock Lake and Union Grove; and in the unincorporated Village of Bristol. The year 2010 plan also proposes the addition of a major retail commercial center located near the intersection of IH 94 and STH 50, development of which was underway by 1985, and also the addition of a major industrial center located in the southwestern portion of the Village of Pleasant Prairie which was under development by 1990.

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 Des Plaines River watershed, as indicated in Table IV-3, is projected to increase from the 1990 total of about 15.7 square miles, or about 12 percent of the total area of the watershed, to about 20.3 square miles, or about 15 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 22.5 square miles, or about 17 percent of the total watershed by the year 2010. It is important to note that the 83 to 85 percent of the watershed remaining in rural use would be comprised, in part, 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 preserved in open space uses through joint State-local zoning or public acquisition. In addition, certain other lands classified as wetlands and floodlands outside the primary environmental corridor 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 119.0 square miles in 1990 to about 114.0 square miles in the year 2010 under the intermediate growth-centralized land use plan and to about 112.0 square miles under the high growth decentralized land use plan, decreases from about 4 to 6 percent between 1990 and 2010 for the two year-2010 plans considered.

POINT SOURCE POLLUTANT CONTROL PLAN ELEMENTS

This section describes the recommendations and status of implementation of the initial regional water quality management plan, as well as current plan recommendations updated by incorporating all amendments and implementation actions for the abatement of water pollution from point sources of pollution in the Des Plaines 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

Table IV-3

EXISTING AND PLANNED LAND USE IN THE DES PLAINES 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	4,695	5.5	6,171	7.2	1,476	31.4	6,496	7.6	1,801	38.4
Commercial	185	0.2	317	0.4	132	71.4	424	0.5	239	129.2
Industrial	254	0.3	634	0.7	380	149.6	1,155	1.3	901	354.7
Transportation, Communication, and Utilities[b]	3,915	4.6	4,625	5.4	710	18.1	5,040	5.8	1,125	28.7
Governmental and Institutional	248	0.3	290	0.3	42	16.9	301	0.4	53	21.3
Recreational	737	0.9	966	1.1	229	31.1	998	1.2	261	35.4
Subtotal	10,034	11.8	13,003	15.1	2,969	29.1	14,414	16.8	4,380	43.0
Rural										
Agricultural and Related	58,793	68.2	57,810	67.1	- 983	- 1.7	56,516	65.6	-2,277	- 3.9
Lakes, Rivers, Streams, and Wetlands	7,953	9.2	7,736	9.0	- 217	- 2.7	7,736	9.0	- 217	- 2.7
Woodlands	4,765	5.5	4,663	5.4	- 162	- 2.1	4,658	5.4	- 107	- 2.3
Open Lands,[c] Landfills, Dumps, and Extractive	4,557	5.3	2,890	3.4	-1,667	-36.6	2,778	3.2	-1,779	- 39.0
Subtotal	76,068	88.2	73,099	84.9	-2,969	- 3.9	71,688	83.2	-4,380	- 5.8
Total	86,102	100.0	86,102	100.0	0	--	86,102	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 unused lands.

Source: SEWRPC.

in the initial plan. This section also includes a status report on the public sanitary sewer service areas in the watershed.

Public and Private Wastewater Treatment Systems and Sewer Services Areas

Existing Conditions and Status of Plan Implementation: In 1975, there were five public sewage treatment facilities located in the Des Plaines River watershed, as shown on Map IV-3. The two plants which served the Town of Pleasant Prairie Sanitary District No. 73-1[1] and the Town of Pleasant Prairie Utility District "D"[1] discharged treated effluent directly to the main stem of the Des Plaines River via small tributaries; the two plants which served the Village of Paddock Lake and the Town of Salem Utility District No. 1 discharged to Brighton Creek and to the Salem Branch of Brighton Creek, respectively; and the plant which served the Town of Bristol Utility District No. 1 discharged treated effluent directly to a tributary of the Des Plaines River. No public sewage treatment plants have been abandoned since 1975. The status of implementation in regard to the abandonment, upgrading, and expansion of the public and private sewage treatment plants in the Des Plaines River watershed, as recommended in the initial regional water quality management plan, is summarized in Table IV-4.

As can be seen by review of Table IV-4, full implementation of the initial plan would provide for the upgrading and expansion of the Town of Bristol Utility District No. 1, the Village of Paddock Lake, and the Village of Pleasant Prairie Sewer Utility District "D" facilities. Implementation of these recommendations has been largely completed. The initial plan also included recommendations for the upgrading of the Village of Pleasant Prairie Sanitary District No. 73-1 plant and the abandonment of the Town of Salem Utility District No. 1 plant. The former recommendation has not yet been carried out. As recommended in an amendment to the initial plan, the Town of Salem Utility District No. 1 plant has been abandoned and connection of that service area to the Town of Salem Utility District No. 2 sewerage facilities has been completed. Three of the four public sewage treatment plants operating 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. To date, such procedures have not been implemented for plants in the Des Plaines River watershed with the exception of the Village of Pleasant Prairie Sanitary District No. 73-1 facility which does have facilities to provide a conventional level of phosphorus removal. As specific sewage treatment plant permits are issued for the remaining public sewage treatment plants, 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 IV-5.

In addition to the publicly owned sewage treatment facilities, eight private sewage treatment plants were in existence in 1975 in the Des Plaines River

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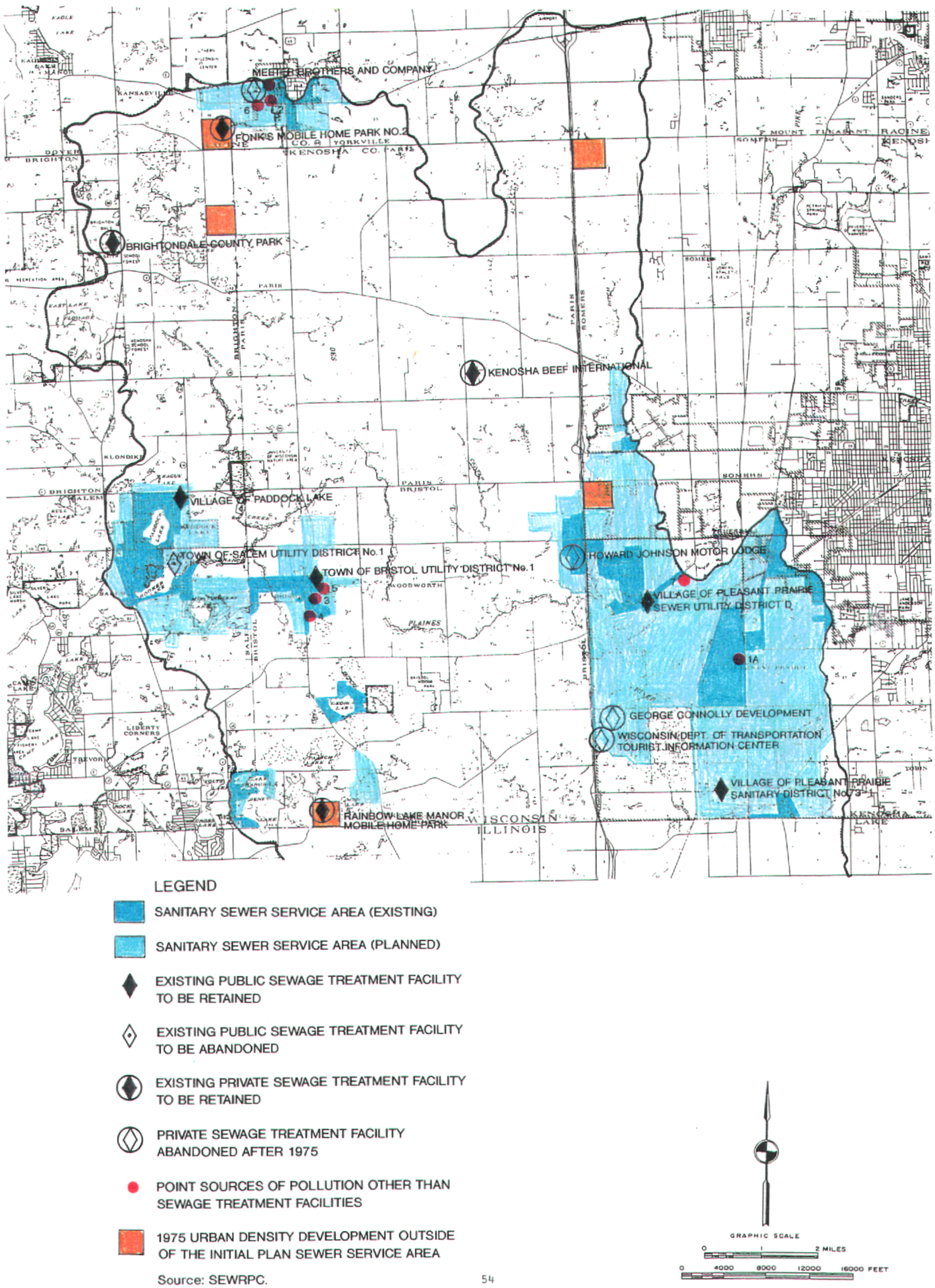
[1]In 1989, the Town of Pleasant Prairie was incorporated as a Village and the name of these special purpose units of government were changed to the Village of Pleasant Prairie Utility District "D" and the Village of Pleasant Prairie Sanitary District No. 73-1, respectively.

Map IV-3

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



Source: SEWRPC.

Table IV-4

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

Public Sewage Treatment Plants	Disposal of Effluent	Plan Recommendation	Implementation Status
Town of Bristol Utility District No. 1	Bristol Creek tributary of Des Plaines River	Upgrade and expand	Completed[a] (1988)
Village of Paddock Lake	Brighton Creek	Upgrade and expand	Completed[a] (1989)
Village of Pleasant Prairie Sanitary District No. 73-1	Tributary of Des Plaines River	Upgrade[b]	No action
Village of Pleasant Prairie Sewer Utility District "D"	Tributary of Des Plaines River	Upgrade and expand[b]	Completed[a] (1985)
Town of Salem Utility District No. 1	Salem Branch of Brighton Creek	Abandon plant[c]	No action[c]

Private Sewage Treatment Plants	Disposal of Effluent	Plan Recommendation	Implementation Status
Brightondale County Park	Soil Absorption	Maintain and Upgrade as needed	Plant maintained
Fonk's Mobile Home Park No. 2	Tributary to the Des Plaines River	Maintain and Upgrade as needed	Plant maintained
Kenosha Beef International Company[d]	Soil Absorption	Maintain and Upgrade as needed	Plant maintained
Meeter Brothers Company	Tributary to the Des Plaines River	Maintain and Upgrade as needed	Plant abandoned due to industry change (1987)
Rainbow Lake Manor Mobile Home Park[e]	Soil Absorption	Maintain and Upgrade as needed	Plant maintained
George Connolly Development[g]	Tributary to the Des Plaines River	Abandon plant[f]	Plant abandoned[g]
Howard Johnson Motor Lodge	Des Plaines River	Abandon plant	Plant abandoned (1989)
Wisconsin Tourist Information Center	Tributary to the Des Plaines River	Abandon plant[f]	Plant abandoned (1991)

[a] Plant upgrading and expansion was completed representing implementation of the plan recommendations, except for the provision of phosphorus removal facilities which have not yet been provided.

[b] A proposed revision to the initial regional water quality management plan, documented in A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Kenosha Area, recommends the abandonment of the Village of Pleasant Prairie Sanitary District No. 73-1 and of the Village of Pleasant Prairie Sewer Utility District"D" sewage treatment plants and for sanitary sewer needs to be provided for by the Kenosha Water Utility's sewage treatment plant.

[c] The Town of Salem Utility District No. 1 sewage treatment plant was recommended to be retained in the initial regional water quality management plan. A 1991 amendment to the regional water quality management plan-2000 for the Town of Salem recommended the plant to be abandoned and for the Town of Salem Utility District No. 1 sewer service area to be served by the Town of Salem Utility District No. 2 sewage treatment plant. The plant was abandoned in 1993.

[d]Formerly Kenosha Packing Company.

[e]Formerly Paramski Mobile Home Park.

[f]The George Connolly Development and Wisconsin Tourist Information Center sewage treatment plants were recommended to be retained in the initial regional water quality management plan. A 1987 amendment to the regional water quality management plan-2000 for the City of Kenosha and environs recommended the plants be abandoned that sewer service be provided for by the Village of Pleasant Prairie Sanitary District No. 73-1.

[g]The private treatment plant serving the George Connolly Development was never placed into operation.

Source: SEWRPC.

Table IV-5

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

Name of Public Sewage Treatment Plant	1990 Estimated Total Area Served (square miles)	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
Town of Bristol Utility District No. 1	0.8	1,200	1965, 1971, 1988	Contact stabilization activated sludge, clarification, chlorination	Des Plaines River via Bristol Creek tributary	12/31/93
Village of Paddock Lake	0.8	2,300	1958, 1967, 1988	Oxidation ditch, clarification, microscreen, chlorination, dechlorination, ultraviolet disinfection	Brighton Creek	12/31/99
Village of Pleasant Prairie Sanitary District No. 73-1	0.1	600	1975	Contact stabilization activated sludge, clarification, chemical phosphorus removal, sand filtration, chlorination	Des Plaines River via unnamed tributary	9/30/2000
Village of Pleasant Prairie Sewer Utility District D	1.2	1,700	1966, 1985	Oxidation ditch clarification, chlorination, post aeration	Des Plaines River via Pleasant Prairie tributary	6/30/99
Town of Salem Utility District No. 1[b]	0.4	1,100	1970	Activated sludge, clarification, chlorination, polishing pond, contact stabilization	Salem Branch	9/30/89

Table IV-5 (continued)

Name of Public Sewage Treatment Plant	Hydraulic Loading[c] (mgd)				BOD5 Loading[c] (pounds per day)				Suspended Solids Loading[c] (pounds per day)			
	Existing		Design Average Annual	Number of Months in 1990 in which the Monthly Average Loading Exceeded the Design Capacity	Existing		Design Average Annual	Number of Months in 1990 in which the Monthly Average Loadings Exceeded the Design Capacity	Existing		Design Average Annual	Number of Months in 1990 in which the Monthly Average Loadings Exceeded the Design Capacity
	Average Annual	Maximum Monthly Average			Average Annual	Maximum Monthly Average			Average Annual	Maximum Monthly Average		
Town of Bristol Utility District No. 1	0.34	0.49	0.48	1	366	501	860	0	450	615	729	0
Village of Paddock Lake	0.47	0.71	0.49	4	574	814	570	3	701	1,148	513	8
Village of Pleasant Prairie Sanitary District No. 73-1	0.21	0.26	0.40	0	145	192	800	0	167	317	--	--
Village of Pleasant Prairie Sewer Utility District D	0.50	0.75	0.50	4	407	499	602	0	814	1,424	--	--
Town of Salem Utility District No. 1	0.20	0.31	0.30	1	198	313	510	0	170	200	--	--

[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] The sewage treatment plant serving the Town of Salem Utility District No. 1 was abandoned in 1993 and its service area connected to the Town of Salem Utility District No. 2 sewerage system.

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

Source: Wisconsin Department of Natural Resources and SEWRPC.

watershed. These plants served the following land uses: Fonk's Mobile Home Park No. 2 in Racine County; and Brightondale County Park, George Connolly Development, Howard Johnson Motor Lodge, Kenosha Packing Company (currently Kenosha Beef International Company), Meeter Brothers Company, Wisconsin Tourist Information Center, and Paramski Mobil Home Park (currently Rainbow Lake Manor Mobile Home Park) in Kenosha County. As indicated in Table IV-4, one private sewage treatment plant in the watershed as of 1975 was recommended to be abandoned in the initial plan. A subsequent amendment to the plan recommended the abandonment of two additional plants. As of 1990, each of these three plants had been abandoned. In addition, the Meeter Brothers private plant had also ceased operation because the industry the plant supported is no longer in business at this location. 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).

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

The initial regional water quality management plan recommended that all of the sanitary sewer service areas identified in the plan be refined and detailed in cooperation with the local units of government concerned. There were nine sewer service areas identified within, or partially within, the Des Plaines River watershed: Bristol-George Lake, Bristol-IH 94 and Pleasant Prairie North, Cross Lake, Hooker-Montgomery Lakes, Kenosha, Paddock Lake, Pleasant Prairie South, and Union Grove. By 1990, all of these areas had undergone refinements as recommended. The boundaries of the sewer service areas, as currently refined, are shown on Map IV-3. Table IV-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 area names following the refinement process. The planned sewer service areas in the Des Plaines River watershed, as refined through 1993, total about 32 square miles, or about 24 percent of the total watershed area, as shown in Table IV-6.

Table IV-6

PLANNED SANITARY SEWER SERVICE AREAS IN THE DES PLAINES 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-George Lake	2.3	Bristol	December 1, 1986	SEWRPC CAPR No. 145, Sanitary Sewer Service Area for the Town of Salem Utility District No. 1, Village of Paddock Lake, and Town of Bristol Utility District Nos. 1 and 1B, Kenosha County, Wisconsin
Bristol-IH 94 Pleasant Prairie North	5.8	Bristol/ Pleasant Prairie	December 2, 1985	SEWRPC CAPR No. 106, Sanitary Sewer Service Areas for the City of Kenosha and Environs, Kenosha County, Wisconsin
Camp-Center Lakes Cross Lake Rock Lake Wilmot	0.5	Salem South	March 3, 1986	SEWRPC CAPR No. 143, Sanitary Sewer Service Area for the Town of Salem Utility District No. 2, Kenosha County, Wisconsin
Hooker-Montgomery Lakes	2.7	Salem North	December 1, 1986	SEWRPC CAPR No. 145 Sanitary Sewer Service Area for the Town of Salem Utility District No. 1, Village of Paddock Lake, and Town of Bristol Utility District Nos. 1 and 1B, Kenosha County, Wisconsin
Kenosha Pleasant Park Somers	13.8	Kenosha	December 2, 1985	SEWRPC CAPR No. 106, Sanitary Sewer Service Areas for the City of Kenosha and Environs, Kenosha County, Wisconsin
Paddock Lake	2.0	Paddock Lake	December 1, 1986	SEWRPC CAPR No. 145 Sanitary Sewer Service Area for the Town of Salem Utility District No. 1, Village of Paddock Lake, and Town of Bristol Utility District Nos. 1 and 1B, Kenosha County, Wisconsin
Pleasant Prairie South	3.4	Pleasant Prairie South	December 2, 1985	SEWRPC CAPR No. 106, Sanitary Sewer Service Areas for the City of Kenosha and Environs, Kenosha County, Wisconsin
Union Grove	1.6	Union Grove	September 12, 1990	SEWRPC CAPR No. 180, Sanitary Sewer Service Area for the Village of Union Grove and Environs, Racine County, Wisconsin
Total	32.1			

Note: CAPR - Community Assistance Planning Report

Source: SEWRPC

Current Plan Recommendations: The current point source plan element recommendations provide for the continued operation with expansion and upgrading, as necessary, of the Town of Bristol Utility District No. 1 and the Village of Paddock Lake sewage treatment plants, as well as the abandonment of the Town of Salem Utility District No. 1 sewage treatment plant and connection of that service area to the Town of Salem Utility District No. 2 sewerage system. The Town of Salem Utility District No. 1 sewage treatment plant in the process of being abandoned in 1993. Estimated approximate dates for beginning facility planning for the expansion and upgrading of existing sewage treatment plants are indicated in Table IV-7. This recommendation regarding plant facility upgrading and expansion, as needed, also applies to the treatment plant solids management element for the public sewage treatment plants recommended to be retained.

With regard to the two treatment plants operated by the Village of Pleasant Prairie Sanitary District No. 73-1 and the Village of Pleasant Prairie Sewer Utility District "D", further consideration should be given to evaluating a potential change in the recommendations set forth in the initial plan. That potential change is based upon the findings of a 1992 sanitary sewerage and water supply system plan which was completed for the greater Kenosha area. The findings and recommendations of the planning work 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. That report, which was prepared for a study area including all of Kenosha County extending from Lake Michigan to a distance of one mile west of IH 94, includes portions of the Des Plaines River watershed. The report identified the sanitary sewer and water supply needs of that planning area, and evaluated alternative means of meeting those needs; recommended a coordinated set of design year 2010 sewerage and water supply system plans for the area; identified the intergovernmental, administrative, legal, and fiscal issues inherent in the implementation of the system plans; and recommended an institutional structure for implementation of those plans. The recommended sewerage system and planned service area developed in this subregional system plan are shown on Map IV-4A. As of December 1994, the intergovernmental actions and approval needed to proceed with the attendant changes to the regional water quality management plan had not been put in place. Thus, the inclusion of these plan recommendations in the updated plan is pending intergovernmental agreement on the recommendations.

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

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

2. The Kenosha Water Utility sewage treatment plant is designated as the sole public sewage treatment plant to serve the area considered, as shown on Map IV-4; and the two public sewage treatment plants operated by the Village of Pleasant Prairie Sewer Utility District D and the Village of Pleasant Prairie Sanitary District No. 73-1 are recommended to be abandoned during the planning period.

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

Table IV-7

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

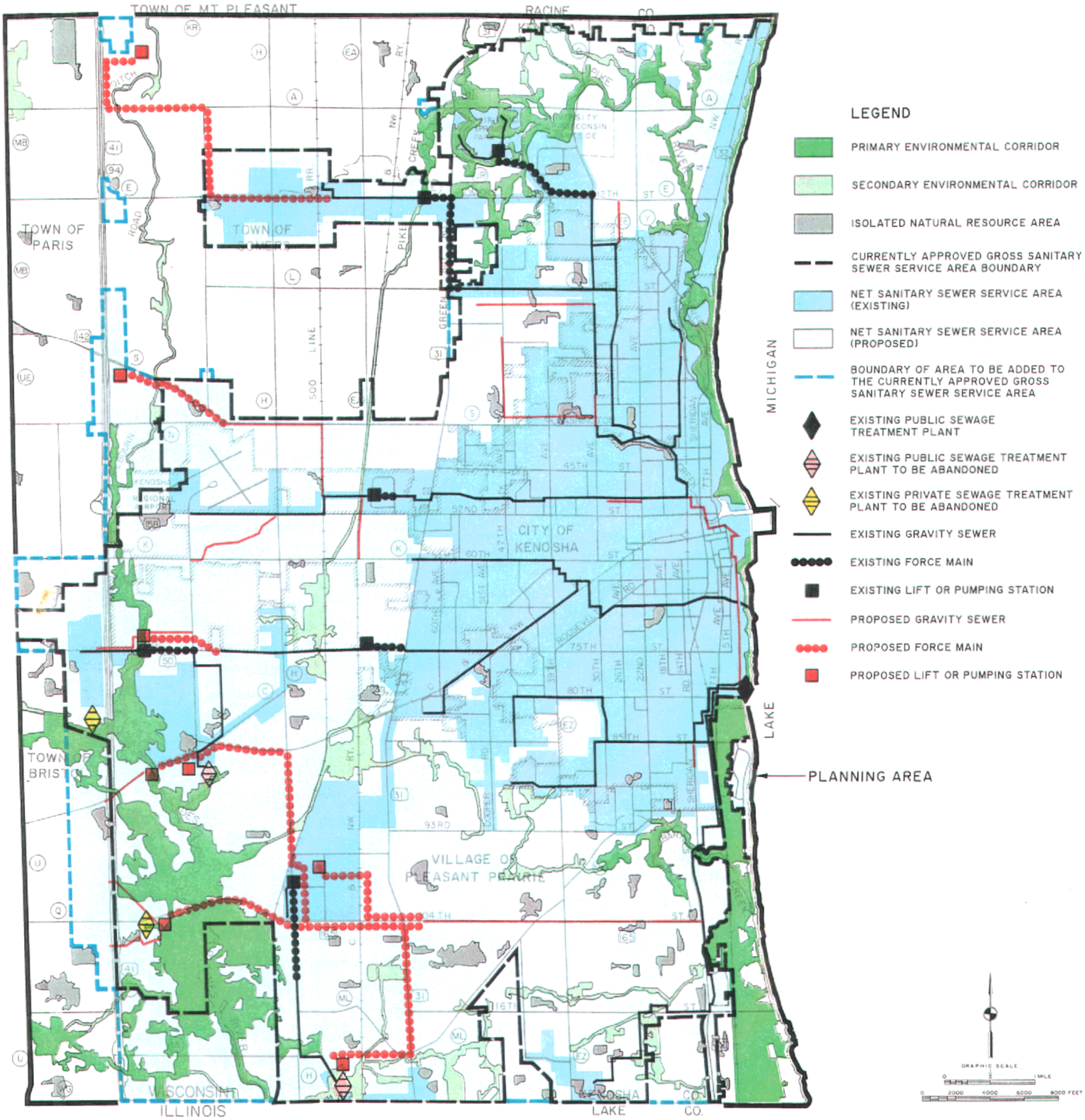
			Existing 1990			Planned Year 2010						
							Intermediate Growth-Centralized Land Use Plan			High Growth-Decentralized Land Use Plan		
Name of Public Sewage Treatment Plant	Sewer Service Areas	Design Capacity-Average Annual Hydraulic (mgd)	Average Hydraulic Loading (mgd)	Total Area Served (square mile)	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]
Town of Bristol Utility District No. 1	Bristol	0.48	0.34	0.8	1,300	2.3	2,500	0.49	1998	2,700	0.52	1996
Village of Paddock Lake	Paddock Lake	0.49	0.47	0.8	2,700	2.1	4,000	0.63	1995	4,300	0.67	1995
Village of Pleasant Prairie Sanitary District No. 73-1	Pleasant Prairie South	0.40	0.21	0.1	600	3.4	2,200	0.41	1998	3,100	0.52	1996
Village of Pleasant Prairie Sewer Utility District "D"	Bristol/ Pleasant Prairie	0.50	0.50	1.2	1,700	6.7	5,500	0.98	1995	6,500	1.1	1995

[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.

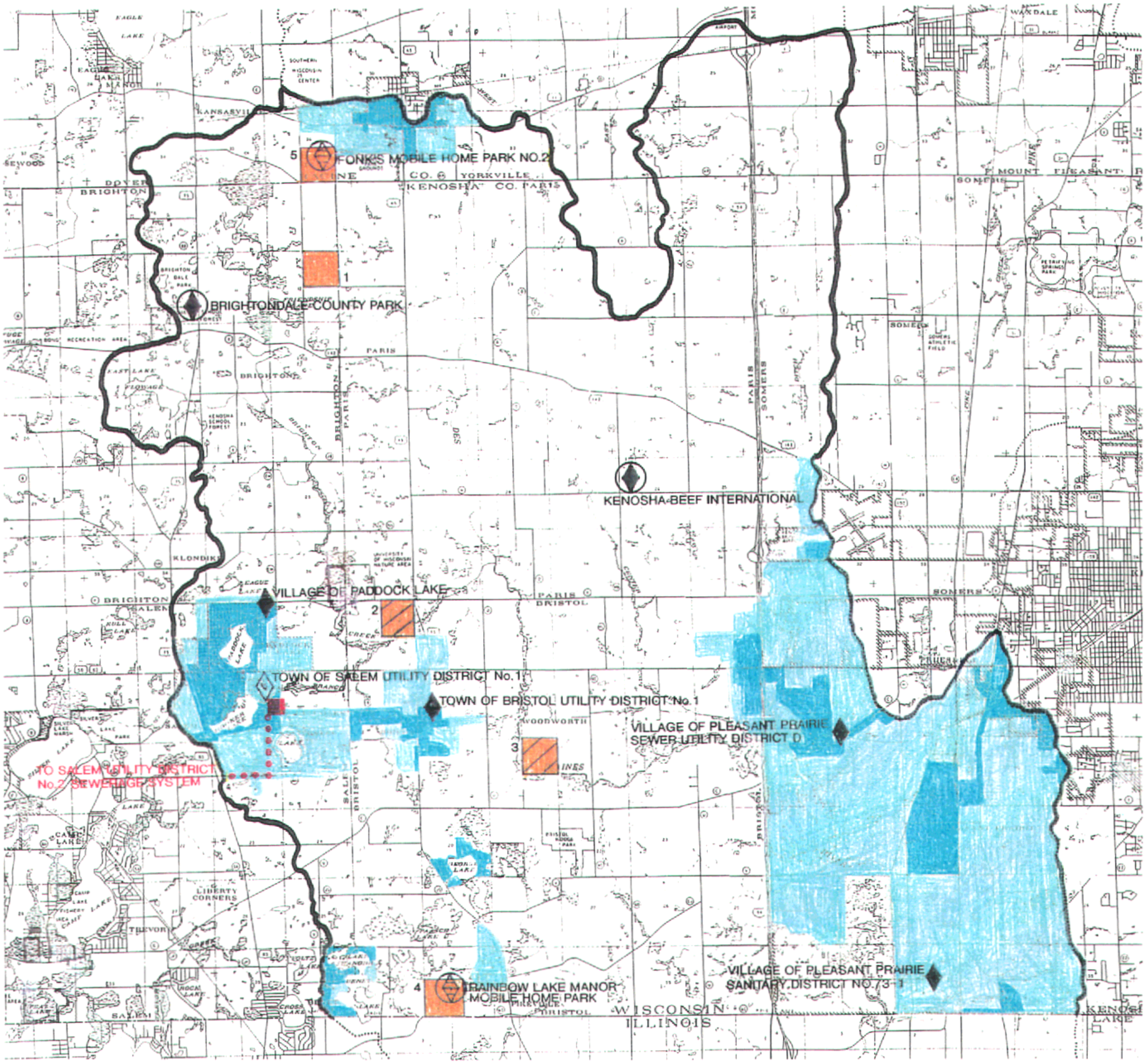
Source: SEWRPC.

Map IV-4A

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



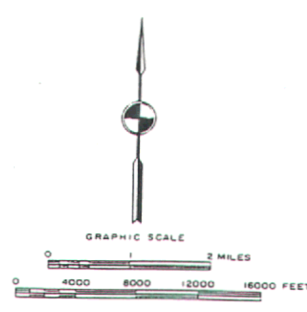
Map IV-4
UPDATED REGIONAL WATER QUALITY MANAGEMENT POINT SOURCE PLAN FOR THE DES PLAINES RIVER WATERSHED: 2010



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
- EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE RETAINED
- EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO BE ABANDONED
- EXISTING PRIVATE SEWAGE TREATMENT FACILITY TO EVALUATE CONNECTION TO PUBLIC SYSTEM
- PROPOSED LIFT OR PUMPING STATION
- PROPOSED FORCE MAIN
- 1975 URBAN DENSITY DEVELOPMENT OUTSIDE OF PLANNED SEWER SERVICE AREA
- ADDITIONAL URBAN DENSITY DEVELOPMENT SINCE 1975 OUTSIDE OF PLANNED SEWER SERVICE AREA

Source: SEWRPC.



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 by the City of Kenosha is summarized on Map IV-4. Table IV-7 presents selected design data for the public sewage treatment plants which are recommended to be maintained in the Des Plaines River watershed, including the two plants which are currently under consideration for abandonment. It is important to note that four of the five plants recorded monthly average hydraulic loadings during 1990 which equaled or exceeded the average design capacities of the plants, as shown in Table IV-5. Of these, two sewage treatment plants have recorded more than one month in 1990 in which the monthly average loadings exceeded the design capacity. The Town of Salem Utility District No. 1 has since been abandoned, with service currently being provided by the Town of Salem Sewer Utility District No. 2.

Table IV-7 shows expected increases in sewered populations and attendant increases in sewage hydraulic loading rates for two different year 2010 growth scenarios for the four public sewage treatment plants in the Des Plaines River watershed. Under both the intermediate growth-centralized and high growth-decentralized land use plans, all of the public plants are anticipated to have average annual hydraulic loading rates equal to or higher than the average annual design capacity. In addition, the Village of Pleasant Prairie Sewer Utility District "D" sewage treatment plant currently has average annual hydraulic loading rates that equal the average annual design capacity of the plant. Thus, there are expected to be expansions of existing plants to provide for increased capacities, or the abandonments of selected plants and the connection of existing service areas to plants with adequate capacity.

Based upon review and analysis of the data in Tables IV-5 and IV-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 within the next three years for all four public sewage treatment plants in the watershed, or, in the case of the two plants operated by the Village of Pleasant Prairie, plans for plant abandonment should be developed.

The current planned sanitary sewer service areas in the Des Plaines River watershed are shown on Map IV-4. The existing and planned year 2010 population data for each sewer service area is presented in Chapter XVIII on a regional basis. In the Des Plaines River watershed, these sewer service areas include: Bristol, Bristol/Pleasant Prairie, Salem South, Salem North, Kenosha, Paddock Lake, Pleasant Prairie South, and Union Grove sewer service areas.

As noted above, each of the sewer service areas in the watershed have been refined as part of the ongoing regional water quality management plan updating process. Thus, 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 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 four private sewage treatment plants in operation within the Des Plaines 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. It should be noted that while the private sewage treatment plant serving the Bong Recreation Area is physically located in the Des Plaines River watershed, the plant discharges effluent to Peterson Creek in the Fox River watershed. All four plants are recommended to be retained, with two exceptions. The relatively close proximity of the Fonk's Mobile Home Park No. 2 to the Union Grove sewer service area and the Rainbow Lake Manor Mobile Home Park to the Bristol service area indicate that there is the potential for consolidation of treatment facilities in these two instances. Thus, it is recommended that at the time each of these two private plants require significant upgrading or modification that detailed facility planning be conducted to evaluate the alternative of connecting these two land uses to the adjacent public sanitary sewer systems. For the two remaining private sewage treatment plants serving the Brightondale County Park and the Kenosha Beef International Company, 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 Flow Relief Devices

Existing Conditions and Status of Plan Implementation: In 1975, there were three known separate sewer system flow relief devices located in the Des Plaines River watershed: one bypass to Brighton Creek from the Village of Paddock Lake; and two bypasses to the Des Plaines River, one from the Town of Bristol and one from the Village of Pleasant Prairie. These bypasses have all been eliminated as the plants were upgraded, as recommended in the adopted regional water quality management plan. As of 1990, there were no known points of sanitary sewage flow relief in the Des Plaines River watershed. However, there were reported infrequent discharges of untreated sewage from the Town of Bristol Utility District No. 1 sewerage system resulting from structural pipe failures in the system between pumping station No. 1 and the sewage treatment plant.

Current Plan Recommendations: As noted above, there are currently no known points of sewage flow relief in the sanitary sewerage systems in the Des Plaines River watershed. However, there have been structural pipe fractures in the local sewer system in the Town of Bristol Utility District No. 1 which have resulted in infrequent bypasses from the tributary sanitary sewer system by overflowing due to pipe ruptures. Sewer system improvements, including upgrading of the pumping station, force main replacement, and a new trunk sewer, have been designed and are expected to be under construction late in 1993 to correct this problem.

Intercommunity Trunk Sewers

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 Des Plaines River watershed, as shown in Table IV-8. One trunk sewer would connect the urban development in the Town of Bristol in the vicinity of IH 94 and STH 50 to the Pleasant Prairie Sewer Utility District "D" sewerage system. Construction of the trunk sewer was completed in 1987. An additional trunk sewer connecting the Town of Salem Utility District No. 1 to the Town of Salem Utility District No. 2 sewerage system was added to the plan in 1991 to enable abandonment of the Town of Salem Utility District No. 1 plant. This trunk sewer was completed in 1993. In addition, a portion of the trunk sewer connecting Cross and Rock Lakes in the Fox River watershed to the Town of Salem Utility District No. 2 extends into the

Table IV-8

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

Intercommunity Trunk Sewer	Status of Implementation
Bristol-Pleasant Prairie	Completed (1987)
Benet/Shangrila Lake[a]	Completed (1983)
Salem[b]	No action[b]

[a] The Benet/Shangrila trunk sewer is part of the Cross-Rock Lakes trunk sewer located in the Fox River watershed.

[b] A trunk sewer providing for conveyance of sewage from the Town of Salem Utility District No. 1 sewer service area to the Town of Salem Utility District No. 2 sewerage system was added to the plan based upon a December 1991 amendment. Construction of the trunk sewer was completed in 1993.

Source: SEWRPC.

Des Plaines River watershed to connect urban development around Benet and Shangrila Lakes. This trunk sewer was completed in 1983.

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 Des Plaines River watershed. As of 1990, the intercommunity trunk sewers recommended to be constructed in the watershed under the initial plan had been constructed. Upon approval of two plan amendment documents, based upon the aforementioned 1992 sanitary sewer and water supply system plan for the greater Kenosha area and a sanitary sewer and water supply system plan for the greater Racine area[2], seven new trunk sewers would be added to the plan. Four of these new trunk sewers would convey wastewater from the Pleasant Prairie-Bristol portion of the service area to the City of Kenosha sewerage system, two would connect development in the Town of Somers along IH 94 to the City of Kenosha sewerage system, and one would connect development in Racine County along IH 94 in the northern portion of the watershed to the City of Racine sewerage system, as shown on Maps IV-4A and XIII-4A.

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

Existing Conditions and Status of Plan Implementation: In 1975, there were a total of six known point sources of pollution identified in the Des Plaines River watershed other than public and private sewage treatment plants. These sources consisted primarily of six outfalls through which industrial cooling, process, rinse, wash waters, and filter backwash waters were discharged directly or indirectly to the surface water system. Of these, three were identified as discharging only cooling water. The remaining three 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 eight such point sources of wastewater discharging to the Des Plaines River and its major tributaries directly through industrial waste outfalls or indirectly through drainage ditches and storm sewers. Table IV-9 summarizes selected characteristics of these other point sources and Map IV-3 shows their locations. Due to the dynamic nature of permitted point sources, it is recognized that the number of wastewater sources change as industries and other facilities change location or processes and as decisions are made with regard to the connection of such sources to public sanitary sewer systems.

Current Plan Recommendations: As of 1993, there were 14 known point sources of wastewater other than public and private sewage treatment plants discharging to surface waters in the Des Plaines River watershed. These other point sources of wastewater, primarily industrial cooling process, rinse, and wash water, discharge 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.

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

Table IV-9

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

Facility Name	County	Map ID #[b]	Permit Type	Permit Number	Expiration Date	Standard Industrial Classification Code	Industrial Activity	Receiving Water	Treatment System [c]
American Roller Co.	Racine	1	General	0044938-3	9-30-95	3069	Fabricated rubber products	Des Plaines River via storm sewer and unnamed tributary	--
Bardon Rubber Products Company, Inc.	Racine	2	General	0044938-3	9-30-95	3069	Fabricated rubber products	Des Plaines River via unnamed tributary	--
Bristol Water Utility	Kenosha	3	General	0045640-1	9-30-95	4941	Water supply	Des Plaines River via unnamed tributary	--
Contact Rubber Corp.	Kenosha	4	General	0044938-3	9-30-95	3069	Fabricated rubber products	Salem Branch Creek via unnamed tributary	--
I.T.O. Industries, Inc.	Kenosha	5	General	0046540-2	9-30-95	3679	Electrical components	Des Plaines River via unnamed tributary	--
Plastic Parts, Inc.	Racine	6	General	0044938-3	9-30-95	3089	Plastics products	Des Plaines River via storm sewer and unnamed tributary	--
Tri-Clover, Inc.	Kenosha	7	General	0044938-3	9-30-95	3494	Valves and pipe fittings	Des Plaines River via unnamed tributary	--
Wisconsin Electric Power-Pleasant Prairie	Kenosha	1A	Specific	0043583	3-31-93	4911	Electric services	Jerome Creek	1,2,3,4

[a] Table IV-9 includes eight known, permitted point sources of wastewater discharging to the Des Plaines River and its tributaries, or to the groundwater system in the Des Plaines River watershed. As of 1993, there were 14 known, permitted point sources of water pollution.

[b] See Map IV-3: "Sewer Service Areas and Point Sources of Pollution in the Des Plaines River Watershed: 1990."

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

1. Holding pond
2. Dechlorination
3. Chlorination
4. pH Control

Source: SEWRPC

Existing Unsewered Urban Development Outside the Proposed Sanitary Sewer Service Area

In 1975, there were five enclaves of unsewered urban development located outside of the then proposed year 2000 sewer service area. As of 1990, two of these areas have been added to the planned 2010 sewer service area. Two new enclaves of urban development have been created beyond the planned sewer service areas, as shown on Map IV-4. The corresponding urban enclave population and the distance to the nearest planned year 2010 sewer service area are listed in Table IV-10. Two of these areas are served by a private sewage treatment plants. The remaining three areas are covered by soils, and have lot sizes, which have a high probability of not meeting the criteria of Chapter ILHR 83 of the Wisconsin Administrative Code covering conventional onsite sewage disposal systems. Thus, for these three urban enclaves in the Des Plaines River watershed, the plan recommends that an inspection and maintenance program for the onsite sewage disposals system be instituted and that the conduct of further site-specific planning to determine the best wastewater management practice be conducted at such time as significant problems became evident. These areas should consider alternative methods of waste disposal and an intensive inspection and maintenance program for conventional systems, as well as the possibility of connection to the public sanitary sewer service areas.

Miscellaneous Potential Pollution Sources

Landfills: Landfills in the Des Plaines 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 two active landfills and 27 known abandoned landfills located in the Des Plaines River watershed. None of these landfills are known to be negatively affecting surface waters.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the Des Plaines 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 groundwater. Discharges from these sites are required to meet specified water quality discharge standards set forth by the Wisconsin Department of Natural Resources.

As of 1993, there were 11 leaking underground storage tanks in the Des Plaines River watershed identified by the Department of Natural Resources. None of these sites were permitted to discharge remediation wastewater directly to surface or ground waters. While there is little 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.

Table IV-10

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

Number[a]	Major Urban Concentration[b]	1990 Estimated Resident Population	Distance from Year 2010 Sewer Service Area (miles)
	Kenosha County		
1	Town of Brighton-Section 12[c]	240	2.0
2	Town of Bristol-Section 6[c]	101	2.0
3	Town of Bristol-Section 16[c]	109	0.6
4	Mud Lake[d]	200	0.5
	Racine County		
5	Town of Dover-Section 36[d]	270	0.4
	Total	920	--

[a]See Map IV-4.

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

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

[d] Served by a private sewage treatment plant.

Source: SEWRPC

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

NONPOINT SOURCE POLLUTION ABATEMENT PLAN ELEMENT

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

Existing Conditions and Status of Plan Implementation

For the Des Plaines River watershed, the adopted plan generally recommended nonpoint source 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, septic system management, and streambank erosion control. The plan also recommended that additional nonpoint source controls be provided within certain areas. Within the urban areas of the Hooker Lake and George Lake drainage areas, the plan recommends a reduction in nonpoint sources of pollution of about 50 percent. Within the rural areas of the Hooker Lake and George Lake drainage areas, the plan recommends reduction in nonpoint source pollutants of 75 and 50 percent, respectively.

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, 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 Des Plaines River watershed through local regulation and programs. The watershed has not yet been selected for inclusion in the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program. However, limited implementation has been achieved through programs which include the regulation of onsite sewage disposal systems under programs currently administered by Kenosha and Racine 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 program resolution of failing systems where they are identified. In addition, since the completion of the adopted regional water quality management plan, public sewer systems have been installed for the urban development surrounding Benet-Shangri-la Lake, as recommended in the regional plan, thereby reducing onsite system pollutant discharges to the surface water and groundwater systems in the watershed. Significant progress has been made in the area of construction site erosion control. As of January 1993, the City of Kenosha and Villages of Paddock Lake and 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.

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

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 cover all of the rural lands in the Des Plaines 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.

During 1994, work was initiated by the Regional Planning Commission on a comprehensive watershed plan[3] for the Des Plaines River watershed in cooperation with Kenosha and Racine Counties. This comprehensive plan will establish the necessary framework for the conduct of subsequent detailed stormwater management planning for the urban and urbanizing areas in the watershed. Such subsequent

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[3]See SEWRPC Prospectus, Des Plaines River Watershed Planning Prospectus, September 1991.

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

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.

Current Plan Recommendations

It is recommended that construction erosion controls, onsite sewage disposal systems management, and streambank erosion control measures, plus land management practices designed to provide about a 25 percent reduction in nonpoint source pollutant loadings from the urban and rural lands be carried out throughout the Des Plaines River watershed. Within the urban areas in the drainage areas of George Lake and Hooker Lake, it is recommended that additional practices providing for levels of control for about a 50 percent reduction in nonpoint source loadings be provided. Also, it is recommended that additional practices providing for about a 75 percent reduction in nonpoint source loading from rural lands be provided in the Hooker Lake drainage area. 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, the watershed should be included in the Wisconsin Nonpoint Source Water Pollution Abatement Program in order to make State cost-sharing programs available for nonpoint source pollution control measures. In addition, detailed stormwater management plans in urban areas and detailed farmland management plans in rural areas should be conducted to define the practices to be installed. The current priority ranking of watersheds for inclusion in that program is documented in a memorandum[4] prepared by the Regional Planning Commission using Wisconsin Department of Natural Resources procedures and is summarized in Chapter XVIII. That ranking included the Des Plaines River watershed in the medium category, indicating that inclusion in the program will likely be delayed until late in the planning period or beyond, unless the process of selection is changed and/or funding levels are increased. Because a comprehensive water resources planning program will be completed for the Des Plaines River watershed, the implementation of the nonpoint source pollution abatement component of that plan should be given a priority. Thus, it is recommended that further consideration be given to including the Des Plaines River watershed in the priority watershed program.

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.

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

As of 1993, long-term monitoring has been carried out in the Des Plaines River watershed on a sustained basis only by the U.S. Geological Survey at the station located at Russell Road on the Des Plaines River main stem about 0.5 miles downstream of the Wisconsin-Illinois State line, as shown on Map IV-5. After 1991, collection of water quality data at this station was terminated.

Currently, three of the six major lakes in the Des Plaines River watershed--Benet/Shangrila, George, and Hooker Lakes--are being monitored as part of the DNR Self-help Monitoring Program. In addition, limited additional water quality monitoring has been carried out by the U.S. Geological Survey, the Wisconsin Department of Natural Resources, and local lake management agencies.

The Wisconsin Department of Natural Resources has placed increased emphasis on monitoring and assessment of surface water quality[5] in all watersheds. The Department now envisions carrying out a one-year intensive monitoring program in the Des Plaines River watershed about once every five to seven years as part of the Fox-Illinois River Basin monitoring.

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 re-initiated by the U.S. Geological Survey at Station Dp-4 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 Dp-1, -2, and -3 and at five selected additional stations, with one station each on Brighton Creek, Dutch Gap Canal, Kilbourn Road Ditch, Center Creek, and Jerome Creek. It is recommended that this program be conducted within the next five years and repeated at approximately five- to seven-year intervals. These recommendations can be coordinated with and are consistent with the Department's current surface water monitoring strategy developed to conduct monitoring activities and perform basic assessments for each basin in the Region in an approximate five- to seven-year rotating cycle.

The lake monitoring program 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, three 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 two-year or more period of extensive 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 have been undertaken on Paddock Lake. 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.

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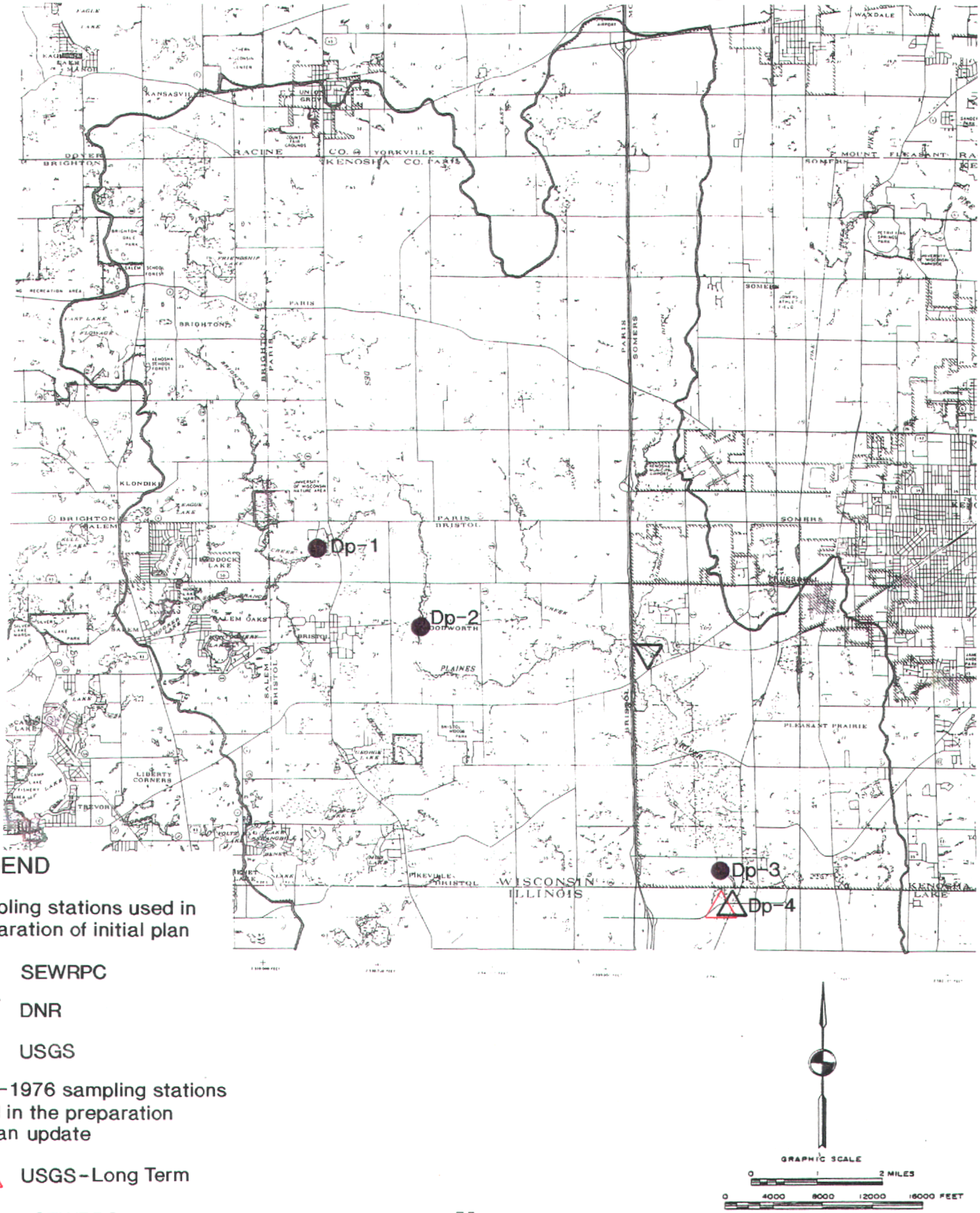
[5] Wisconsin Department of Natural Resources, Surface Water Monitoring Strategy, WR299-92, 1992.

Map IV-5

LOCATION OF WATER QUALITY SAMPLING STATIONS IN THE DES PLAINES RIVER WATERSHED



LEGEND

Sampling stations used in preparation of initial plan

● SEWRPC

▽ DNR

△ USGS

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

△ USGS-Long Term

Source: SEWRPC.

LAKES MANAGEMENT PLAN ELEMENT

Existing Conditions 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 Des Plaines 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 Des Plaines 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 Des Plaines River watershed is discussed for each major lake in the following paragraphs:

Benet/Shangrila Lake: Since preparation of the initial plan, the area has been included in the Town of Salem Utility District No. 2 and the urban development surrounding the lake has been provided with a public sanitary sewer system, as recommended in the initial plan. The lake has an approved aquatic plant management plan and has been involved in a herbicide-based aquatic plant management program. Shangrila Lake is included in the DNR Self-Help Monitoring Program and is subject to ongoing water clarity monitoring.

East Lake Flowage: The East Lake Flowage is managed by the Wisconsin Department of Natural Resources as part of the Bong Recreation Area. No specific plan implementation activities are documented as of 1993.

George Lake: An inland lake protection and rehabilitation district has been created at George Lake. The district has obtained a Chapter NR 119 Lake Management Planning Grant to assist in the preparation of components of a lake management plan.[6] An aquatic plant management plan has been prepared and approved for this lake, which has used herbicide-based aquatic plant controls; and an aquatic plant harvester has recently been purchased for use on this water body. The urban areas surrounding the lake is served by a public sanitary sewer system as recommended in the initial plan. Extensive nutrient, pest, and soils conservation management practices have been put into place in the western portions of the watershed. Both sediment and nutrient loads have been substantially reduced. The lake is included in the DNR Self-Help Monitoring Program.

Hooker Lake: An inland lake protection and rehabilitation district was recently formed around the lake. The district has received a Chapter NR 119 Lake Management Planning Grant to assist in the preparation of a lake management plan.[7] An aquatic plant management plan has been prepared and approved for this lake which has used herbicide-based aquatic plant control measures. This lake is

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[6]George Lake Rehabilitation and Protection District Planning Grant #1006-1, Updated Feasibility Study--Core Sample Results Water Usage Ordinance, June 1994.

[7]Aron & Associates, Hooker Lake Community Survey, 1991.

enrolled in the DNR Self-Help Monitoring Program and is subject to ongoing water clarity monitoring. The urban development around the lake is included in the Town of Salem Utility District No. 1 and is served by a public sanitary sewer system.

Paddock Lake: The lake has an inland lake protection and rehabilitation district and a Chapter NR 119 Lake Management Planning Grant was received to assist in preparing a lake management plan.[8] The district is seeking to resolve problems associated with organic lake sediment and nuisance aquatic plant growths. Paddock Lake has an approved aquatic plant management plan.[9] While not currently enrolled in the DNR Self-Help Monitoring Program, the lake water quality is being monitored under the Planning Grant Program. Urban development around the lake is served by a public sanitary sewer system. This lake has been the subject of an Office of Inland Lake Renewal feasibility study. Recent data suggest that the lake is now eutrophic.

Unnamed Quarry Lake in the Village of Pleasant Prairie: This lake is proposed to be managed as part of a new regional park recommended to be located on the property surrounding the lake. Currently, plans are being prepared by the Village of Pleasant Prairie to develop the site.

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 IV-11 for the six major lakes in the Des Plaines River watershed. The initial plan recommendations relating to the preparation of comprehensive lake management plans and the conduct of supporting water quality, biological condition, and water budget monitoring programs are reaffirmed in the updated plan recommendations for the Des Plaines River watershed. The management recommendations for the four lakes considered in detail in the initial plan--Benet/Shangrila, George, Hooker, and Paddock 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 and biological condition 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 Des Plaines 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, such as Montgomery Lake, 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

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[8]Woodward-Clyde, Inc., Paddock Lake Investigations and Management Plan, February 1994.

[9]Aron & Associates, Paddock Lake Plant Management Plan, August 1993.

Table IV-11

MANAGEMENT MEASURES RECOMMENDED FOR THE MAJOR LAKES IN THE DES PLAINES RIVER WATERSHED: 1993[a]

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 Inactivation	Dredge	Sediment Cover	Water Level Mgmt	Fish Mgmt
Benet/ Shangrila	186	0	+	0	-	-	+	+	-	+	-	+	+	+	-	+
East Lake Flowage	123	+	+	-	+	+	-	-	-	-	-	-	-	-	+	0
George	59	0	0	0	-	+	+	+	0	0	-	+	+	+	+	+
Hooker	87	0	0	0	-	+	+	+	-	+	-	+	+	+	-	+
Paddock	112	0	0	0	-	-	+	+	-	+	-	+	+	-	-	+
Unnamed Quarry Lake	100	+	+	+	-	+	+	+	-	-	-	-	-	-	-	+

0 = On-going 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 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.

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 U.S. Geological Survey sampling programs from 1964 to 1977; the Wisconsin Department of Natural Resources (DNR) sampling programs in 1973 and 1976; and the 1976 Commission monitoring program conducted under the regional water quality management planning effort. Available data collected in those programs for the Des Plaines River watershed included samplings at three Commission stations: one on Brighton Creek and two on the Des Plaines River; at one DNR station on the Des Plaines River; and at one U.S. Geological Survey station on the Des Plaines River in Lake County, Illinois, at Russell Road, about 0.5 mile downstream of the Wisconsin-Illinois State line. The sampling station locations are shown on Map IV-5.

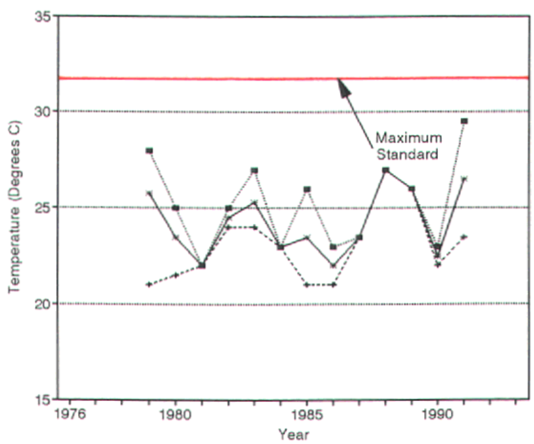
Long-term post-1976 comparable water quality data were collected at the U.S. Geological Survey sampling station Dp-4, located about 0.5 mile downstream of the Wisconsin-Illinois State line, as shown on Map IV-5. Biological condition data collected by the U.S. Environmental Protection Agency in 1979 through 1980 were also available for use in the assessment of current water quality conditions. In addition to the limited 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 Des Plaines River watershed.

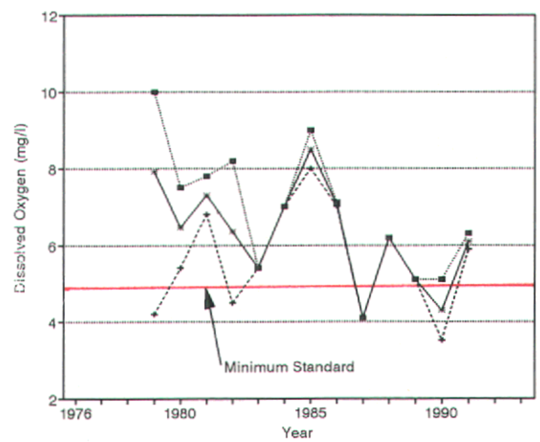
The water quality data obtained at the U.S. Geological Survey sampling station Dp-4 on the main stem of the Des Plaines River at Russell Road in Illinois, for the period 1976 through 1991, are summarized in Figure IV-1. The data have been used to assess current water quality conditions to evaluate water quality trends and the occurrence of change over time, and to evaluate current conditions with respect to water quality standards. The water quality standards indicated in Figure IV-1 are those set forth for specific biological and recreational use objectives as described in Chapter II.

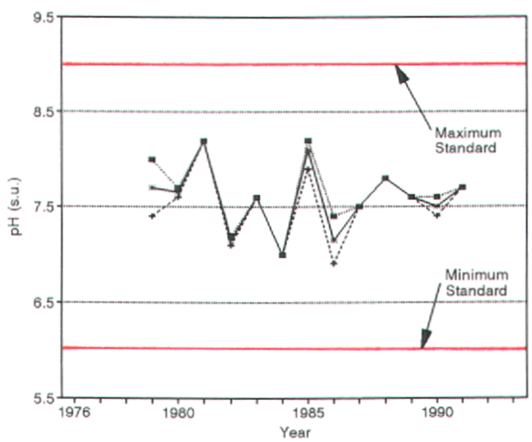
Review of those data for station Dp-4 indicates that there were no apparent significant changes in water quality conditions from 1979 to 1988, with a possible improvement following 1988 as evidenced by reduced volatile solids and phosphorus and less variability in dissolved oxygen levels. This improvement may be attributed, in part, to the improvements which were made between 1985 and 1989 to the Paddock Lake, Bristol, and Pleasant Prairie Sewer Utility District "D" sewage treatment plants. Although phosphorus levels have appeared to decline over the sampling period, it should be noted that these levels still exceed the standard established for streams with full recreational water use

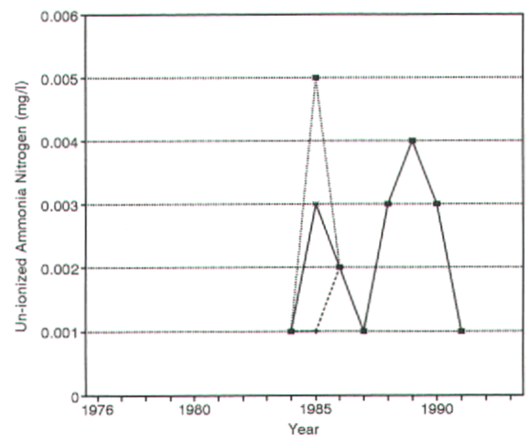
Figure IV-1

WATER QUALITY DATA FOR THE DES PLAINES RIVER AT STATION Dp-4: 1976-1993

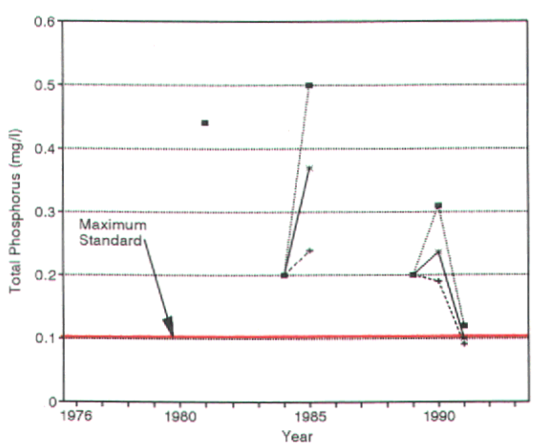


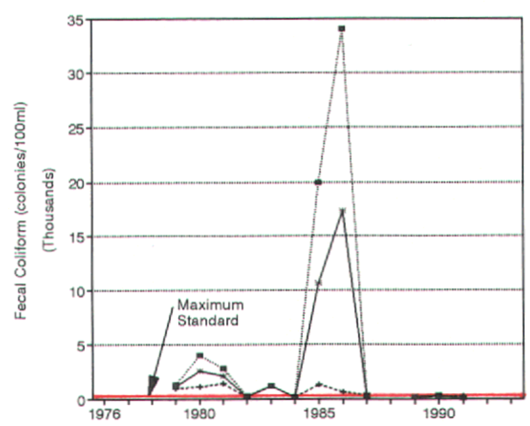






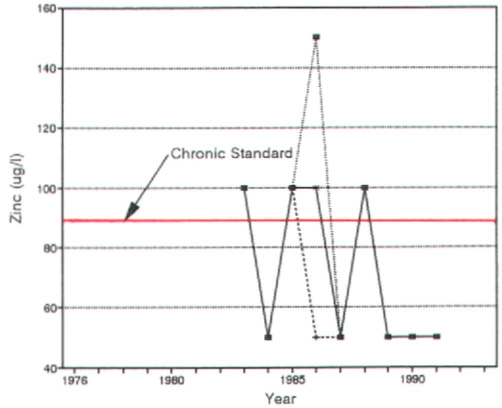
Note: The maximum standard of 0.04 mg/l was not violated in any year.

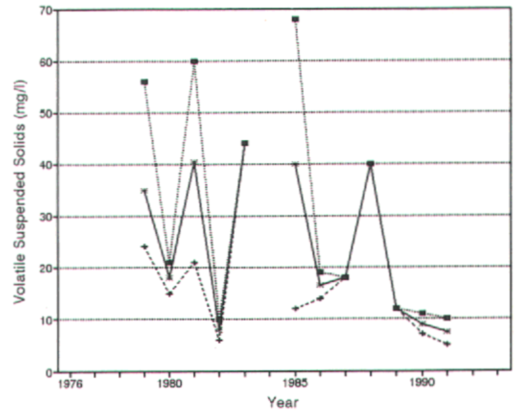




Note: The maximum standard of 200/400 colonies per 100 ml was violated in all years.

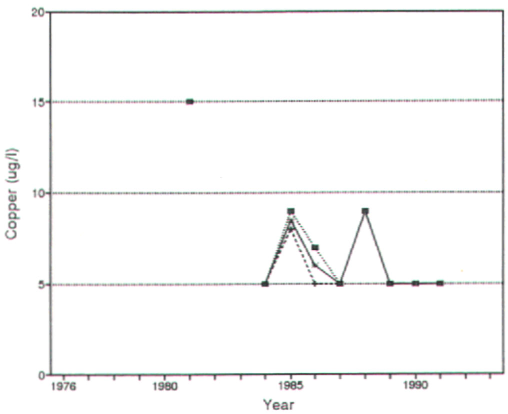
Figure IV-1 (cont'd)

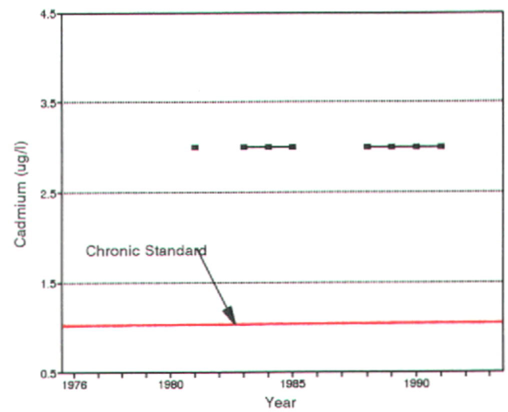




Note: The acute standard of 202.9 ug/l was not violated in any year.

Values graphed at 50 ug/l were indicated to be less than 50 ug/l.





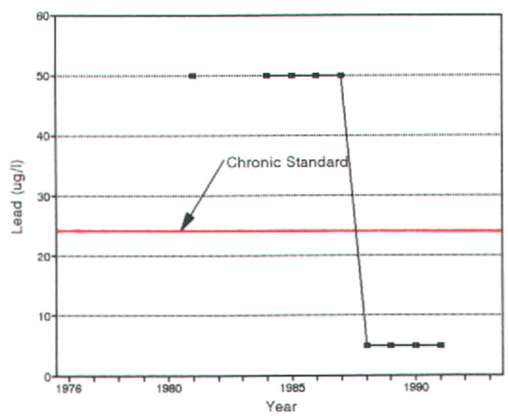
Note: The acute standard of 31.9 ug/l was not violated in any year.

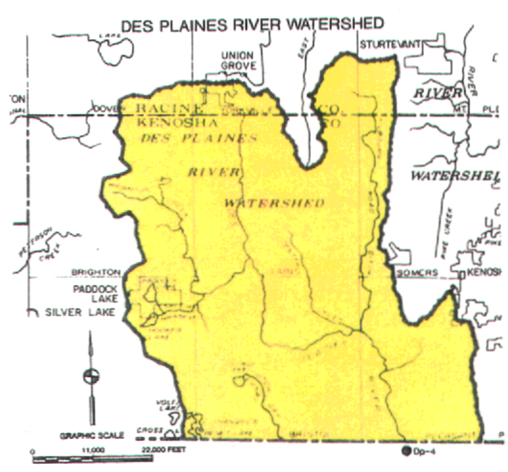
The chronic standard of 22.1 ug/l was not violated in any year.

Values graphed at 3 ug/l were indicated to be less than 3 ug/l.

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

Values graphed at 3 ug/l were indicated to be less than 3 ug/l.





Note: The acute standard of 408.6 ug/l 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 ug/l from 1988 to 1991 were indicated to be less than 5 ug/l.

Source: U.S. Geological Survey and SEWRPC.

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

objectives, as set forth in Chapter II. Temperature, pH, and un-ionized ammonia nitrogen levels remained variable with no apparent trends, but were within acceptable limits as defined by the water quality standards for the Des Plaines River main stem set forth in Chapter II. Fecal coliform levels exceed the standards. Chronic standards for some metals are 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 Des Plaines River watershed from 1973 through 1977. In the three in-stream water quality samples for which toxic and hazardous substances were tested, levels of heptachlor epoxide, a persistent pesticide, were exceeded only once. Sample analyses for cadmium, chromium, copper, lead, mercury, nickel, zinc, PCBs, and DDT, DDE, DDD, aldrin, heptachlor, lindane, dieldrin, methoxychlor, and phthalate uncovered no violations of U.S. Environmental Protection Agency recommended levels.

Recent sampling of metals were collected by the U.S. Geological Survey from 1981 through 1991 at Station Dp-4 on the Des Plaines River, as shown in Figure IV-1. The data indicate that chronic toxicity level standards were exceeded for selected metals. However, the acute toxicity standards were not violated. It should be noted that the chronic standard for lead was not exceeded after 1988. No recent stream or lake bottom sediment analyses were conducted for toxic and hazardous substances.

Since the completion of the initial regional water quality management plan, one spill of a toxic substance into a stream within the Des Plaines River watershed has been documented by the Wisconsin Department of Natural Resources. The spill occurred in the Kilbourn Road Ditch as a result of a fuel storage accident.

Water Quality Assessments: Based upon recent available data, the water quality and biological characteristics of the Des Plaines River and its major tributaries were assessed with the results set forth in Table IV-12. Fish population and diversity was recorded as fair in the mainstem of the Des Plaines River and in Kilbourn Road Ditch, and as poor in Dutch Gap Canal, Center Creek, and the Salem Branch of Brighton Creek. An assessment of a good to fair fish population and diversity was reported for Brighton Creek. There were no recorded fish kills documented in any of the stream reaches in the Des Plaines River watershed.

Standards are not expected to be fully met for dissolved oxygen concentrations, phosphorus, and fecal coliforms in most streams of the Des Plaines River watershed. Ammonia nitrogen levels did appear to meet standards. No comprehensive data were available on water column toxic pollutants. However, limited data collected by the U.S. Geological Survey at Station Dp-4 suggest that the standards for chronic toxicity for zinc and cadmium have been occasionally exceeded, with the other metal concentrations generally within the acceptable levels, as defined in Chapter II.

No recent data were available on biotic index ratings, which are biological indicators of water quality within a stream system. High levels of streambed sedimentation were noted in the Kilbourn Road Ditch, the Des Plaines River, and Center Creek. Moderate to high levels of streambed sedimentation were noted in the remaining stream reaches of the Des Plaines River watershed.

Table IV-12

CHARACTERISTICS OF STREAMS IN THE DES PLAINES RIVER WATERSHED

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			
Brighton Creek and Salem Branch	17.5	Good to fair--Brighton Creek Poor--Salem Branch	No	Yes	No	Yes	Yes	--	--	Moderate to High (silt)	Moderate
Dutch Gap Canal	5.8	Poor	No	Yes	No	Yes	Yes	--	--	Moderate to High (silt)	Major
Kilbourn Road Ditch	14.8	Poor	No	--	No	Yes	Yes	--	--	High (silt)	Major
Des Plaines River Upstream STH 50	8.8	Poor	No	Yes	No	Yes	Yes	--	--	High (silt)	Major
Des Plaines River Downstream STH 50	15.7	Poor	No	Yes	No	Yes	Yes	Yes	--	High (silt)	Major
Center Creek	5.8	Poor	No	Yes	No	Yes	Yes	--	--	High (silt)	Major

[a] Based upon a 1994 SEWRPC fishery survey of the Des Plaines River watershed.

[b] The most recent water quality data available as described in Figure IV-1 were used to evaluate water quality in the Des Plaines 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 the Des Plaines River watershed stream reaches based upon simulated year 2000 land use conditions and current level of pollutant control, if appropriate.

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

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table IV-13 sets forth the water quality index classifications[10] used in the initial plan for 1964, 1974-1975, and for 1990-1991 conditions for selected sampling stations in the watershed. The use of the index is discussed in Chapter II. As indicated in Table IV-13, recent comparative data were available only for station Dp-4, located on the Des Plaines River at Russell Road in Illinois. This station is shown on Map IV-5. The data were used for comparative purposes with earlier data from station Dp-4. The limited data available indicate that water quality conditions in 1964 and 1974-75 have improved from "fair" to "fair to good" based on 1990-91 data. This improvement can be attributed, in part, to upgrading of the Town of Bristol and Village of Pleasant Prairie Sewer Utility District "D" sewage treatment plants.

A summary of potential pollution sources in the Des Plaines River watershed by stream reach is shown in tabular summary in Table IV-14. Review of the data indicate that the only notable conversion of lands from rural to urban uses has occurred in the area tributary to the Des Plaines River in the vicinity of and downstream of STH 50 and in the area tributary to the Kilbourn Road Ditch. It should also be noted that the majority of the permitted industrial discharges in the watershed discharge to the Des Plaines River. 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 IV-14.

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 Southeastern Wisconsin Regional Planning Commission and Wisconsin Department of Natural Resources lake use reports. Post-1975 data on phosphorus and chlorophyll-a concentrations and Secchi disc measurements for major lakes in the Des Plaines River watershed, where available, are presented in Table IV-15.

Toxic and Hazardous Substances: There have been no reported substance spills in lakes in this watershed as reported up to 1993.

Water Quality Assessments: Data from Table IV-15 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[11] for each major lake in the Des Plaines River watershed where data were available, as indicated in Table IV-16. The available trophic state index values using the Carlson Trophic State Index[12] are also provided for current and historic conditions, as shown in Table IV-17.

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[10]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.

[11]R.A. Lillie et al, "Trophic State Index Equations and Regional Predictive Equations for Wisconsin Lakes," Research Management Findings, No. 35, May 1993.

[12]Robert E. Carlson, "A Trophic State Index for Lakes," Limnology and Oceanography, Vol. 22(2), March 1977.

Table IV-13

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATIONS OF THE DES PLAINES RIVER WATERSHED 1964, 1974-75, AND 1990-91

Main Stem Stations[a]	July, August, September, and October of 1964	August of the Years 1974-1975	July and August 1990-1991
Dp-2	Fair	Fair	--
Dp-3	Fair	Fair	--
Dp-4	Fair	Fair	Fair to Good
Tributary Station[a]			
Dp-1	Excellent	Fair	--
Watershed Average	Fair	Fair	--

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

Source: U.S. Geological Survey and SEWRPC.

Table IV-14

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

	Extent of Conversion of Lands from Rural to Urban[b]			Remaining Potential Surface Water Pollution Sources							
Stream Reach[a]	Historical 1976-1990	Expected 1990-2010	Documented Toxic Spills 1976-1990	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	Ongoing Pollution Abatement Efforts[c]
Brighton Creek and Salem Branch	insignificant	insignificant	--	x	x	2	--	1	--	Town of Salem Utility District No. 1 public sewage treatment plant recommended for abandonment	1,2
Dutch Gap Canal	insignificant	insignificant	--	--	x	--	--	--	--	--	--
Kilbourn Road Ditch	insignificant	moderate	1990-fuel spill	x	x	--	--	--	--	--	--
Des Plaines River Upstream of STH 50	insignificant	insignificant	--	--	x	1	1	5	--	Meeter Brothers and Company private sewage treatment plant abandoned in 1981. Fonk's Mobile Home Park No. 2 private sewage treatment plant to evaluate connection to public system	1 --
Des Plaines River downstream of STH 50	insignificant	major	--	x	x	2	--	2	--	Wisconsin Tourist Information Center private sewage treatment plant abandoned in 1991 Village of Pleasant Prairie Sewer Utility District "D" and Village of Pleasant Prairie Sanitary District No. 73-1 public sewage treatment plants are recommended for abandonment pending approval of plan amendment by the City of Kenosha	1 --
Center Creek	insignificant	insignificant	--	--	x	--	--	--	--	Howard Johnson Motor Lodge private sewage treatment plant abandoned in 1989	--

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

[b] Extent of urban land conversions were determined as a percentage of the watershed as follows:
- major > 20%
- moderate 10 - 20%
- significant 5 - 10%
- insignificant 0 - 5%

[c] Number codes refer to the following ongoing pollution abatement efforts:
1. Construction Erosion Control Ordinances in place
2. Abandonment of Sewage Treatment Plant Underway

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table IV-15

WATER QUALITY OF THE MAJOR LAKES IN THE DES PLAINES RIVER WATERSHED

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]
Benet/ Shangrila Lake	188	0.54	0.01	0.17(16)	1977-78	LSF	--	--	--	--	--	3.0	1.5	2.25(2)	1991	Self-Help
East Lake Flowage	123	0.24	0.10	0.15(3)	1977	LSF	--	--	--	--	--	1.0	1.0	1.0(1)	1977	LSF
George Lake	59	0.22	0.03	0.08(38)	1976-80	LSF	--	--	--	--	--	7.0	1.25	2.7(35)	1988-92	Self-Help
Hooker Lake	87	0.18	0.02	0.05(17)	1977-92	LSF/USGS	19.00	9.00	13.00(4)	1992	USGS	7.2	2.6	5.4(10)	1991-92	Self-Help
Paddock Lake	112	--	--	--	--	--	8.37	0.54	2.2(15)	1977	ERA	6.25	--	--	--	--
Unnamed Lake/ Pleasant Prairie	100	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

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

[b] The following sources were cited:
LSF.........Wisconsin Department of Natural Resources, Lake Survey Forms
SELF-HELP...Wisconsin Self-Help Lake Monitoring Program Data, 1986-1988
ERA ....Environmental Resource Assessment Report
USGS .......U.S. Geological Survey, Water Resources Data-Wisconsin (annual)

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table IV-16

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

Lake Name	Wisconsin Trophic State Index Values[b]			
	Total-P	Chlorophyll-a	Secchi	Mean
Benet/Shangrila	68.0	--	65.6	66.8
East Lake Flowage	67.0	--	67.0	67.0
George Lake	62.1	--	57.1	59.6
Hooker Lake	58.9	54.1	51.7	54.9
Paddock Lake	72.8	40.7	56.2	56.6
Unnamed Lake/ Pleasant Prairie	--	--	--	--

[a] Wisconsin Trophic State Index values were calculated using water chemistry data shown in Table IV-15.

[b] Wisconsin Trophic State Index ranges:
- Below 44 = oligotrophic
- 45 - 53 = mesotrophic
- 54 - 75 = eutrophic
- Above 75 = hypertrophic

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table IV-17

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

Lake Name	Carlson Trophic State Index Values[b]		
	Satellite Information 1979-1981	Water Chemistry pre-1981	Water Chemistry 1981-1991
Benet/Shangrila	51	70	67
East Lake Flowage	--	77	--
George Lake	57	62	64
Hooker Lake	51	58	54
Paddock Lake	49	57	--
Unnamed Lake/ Pleasant Prairie	--	--	--

[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 IV-15. Satellite information values were determined from Wisconsin's 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

The data available indicate all of the lakes may be classified as in the eutrophic, or nutrient-enriched, range. Two of these lakes--Benet/Shangrila and Paddock--are classified as drained lakes. George, Hooker, and East Lake Flowage are drainage lakes. East Lake Flowage is part of the Wisconsin Department of Natural Resources Bong Recreation Area and is managed by the Department for a variety of wildlife and recreational uses. There are no water quality data available for the unnamed lake in U.S. Public Survey Section 20, Township 1 North, Range 23 East, in the Village of Pleasant Prairie which was created in the late 1980s at a now abandoned quarry site. No conclusions regarding changes in water quality conditions between 1976 and 1991 can be drawn based upon the limited data available.

Fish kills, primarily related to seasonal fluctuations in water temperature and dissolved oxygen levels, as well as spawning activities, do not normally occur in the lakes in the Des Plaines River watershed. Since the initial plan, one recorded fish kill occurred in Hooker Lake in June 1984. However, this occurrence does not appear to be chronic. Thus, despite the obvious concerns that this episode creates among lake users, it does not appear to warrant special consideration at this time.

Compliance with Water Use Objectives

As indicated in Chapter II, all of the stream reaches studied in the Des Plaines River watershed, as of 1993, are recommended for warmwater sportfish and full recreational uses, except for the tributary extending from the main stem to the Village of Pleasant Prairie sewage treatment plant, which is recommended for a warmwater forage fish and limited recreational use. These water use objectives and 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 Des Plaines River downstream of STH 50 did not fully meet the water quality standards associated with the recommended water use objectives during and prior to 1975, the base year of the initial plan. More recent data available for the period of 1979 through 1991 and analyses indicate that there has been some modest improvement in water quality conditions. However, some of the standards associated with the recommended water use objectives continue to not be fully achieved. As shown in Figure IV-1, violations of the dissolved oxygen, total phosphorus, and fecal coliform levels occurred at station Dp-4 on the main stem of the Des Plaines River just south of the Wisconsin-Illinois border. Based upon a review of the water quality sampling and water quality simulation data developed in the initial plan and the status of plan implementation, it is likely that violations of the dissolved oxygen, fecal coliform, and phosphorus standards also occur at upstream stations.

There are currently two stream reaches for which the water use objectives set forth herein are higher than the objectives set forth in Chapter NR 104 of the Wisconsin Administrative Code. Chapter NR 104 classifies a portion of Salem Branch downstream of the now abandoned Town of Salem Utility District No. 1 sewage treatment plant as capable of supporting a limited forage fish community, while the objectives set forth herein recommend a warmwater sport fish objective. Chapter NR 104 classifies the tributary of the Des Plaines River to the Village of Pleasant Prairie sewage treatment plant as a limited forage fishery, while the recommended objectives set forth herein provide for a warmwater forage fishery and limited recreational use. It is recommended that stream appraisals to further assess the potential for a higher use objective be conducted for Salem Branch and the Pleasant Prairie tributary. These appraisals are recommended to be carried out as part of the next one-year monitoring period envisioned to be carried out in the Des Plaines River watershed.

The waters of Benet/Shangrila Lakes, East Lake Flowage, George Lake, Hooker Lake, Paddock Lake, and the unnamed quarry lake in Pleasant Prairie are recommended for the maintenance of a warmwater sport fishery and full recreational use. George and Paddock Lakes, for which complete water quality data were available between 1965 and 1975, violated the standards for total phosphorus of 0.02 mg/l recommended by the Commission. In addition, George Lake and Benet/-Shangrila Lake violated the dissolved oxygen standard on at least one occasion between 1965 and 1975. Modeling data developed in the initial plan indicates that Lakes George, Paddock, Benet/Shangrila, and Hooker did not meet the phosphorus standard.

As shown in Table IV-15, recent monitoring data are available for Benet/Shangrila, George, and Hooker Lakes to assess the current compliance with water quality standards for the major lakes in the Des Plaines River watershed. Based upon that data as summarized in the Carlson Trophic State Index values set forth in Table IV-17, most lakes in the watershed could be expected to have an annual average total phosphorus concentration in excess of the 0.02 mg/l standard, which is represented by a TSI value in excess of approximately 47. All of the lakes in the watershed for which data were available had TSI values in excess of this value and hence would not be expected to meet the standard. No data were available for the unnamed quarry lake in the Village of Pleasant Prairie.

WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

There are three water quality-related issues remaining to be resolved in the Des Plaines River watershed. The only major issue remaining to be resolved with regard to point sources of pollution deals with the implementation of the findings and recommendations set forth in the system level plan documented in the report prepared by Ruekert & Mielke, Inc., entitled A Coordinated Sanitary Sewer and Water Supply System Plan for the Greater Kenosha Area, October 1991. The recommendations of that plan include revisions to the planned sewer service areas in the greater Kenosha area and provisions to abandon the two existing sewage treatment plants operated by the Village of Pleasant Prairie, with the areas served by these plants being connected to the City of Kenosha sewage system for treatment plant purposes. As of December 1994, the intergovernmental agreements needed to proceed with an amendment of the regional water quality management plan to incorporate the findings of the 1991 system plan had not been forthcoming. An amendment to the plan continues to be needed in this regard.

The second issue relates to the need for a second level nonpoint source pollution abatement program to be carried out in the watershed. It is recommended that the Wisconsin Department of Natural Resources and Racine and Kenosha Counties undertake the preparation of a detailed planning program as part of, or as a follow-up to the ongoing Des Plaines River comprehensive planning program being carried out by the Southeastern Wisconsin Regional Planning Commission for Kenosha and Racine Counties.

In addition to these two major issues, it is also recommended that the Wisconsin Department of Natural Resources conduct a water quality and biological condition survey of Salem Branch and the Pleasant Prairie tributary, in order to reevaluate the current water use objectives during the next monitoring period when the

Department will be devoting its efforts in the Des Plaines River watershed as is envisioned within the next five to seven years.

Chapter V

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

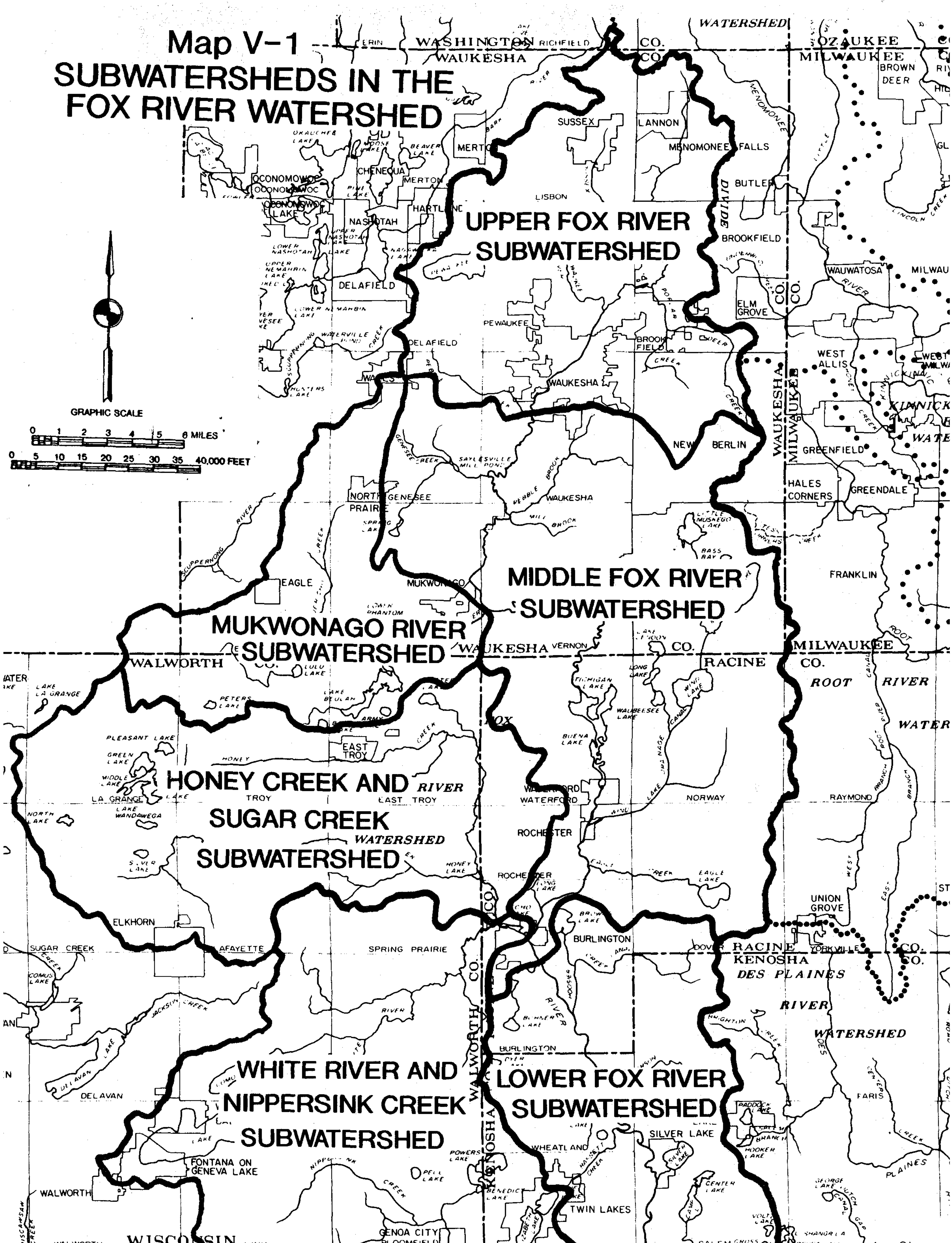
INTRODUCTION

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 Fox 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 Fox 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. Plan implementation setting forth designated management agency responsibilities is presented in Chapter XVII on a regional basis.

The Fox River watershed is located in the south central portion of the Region. That part of the watershed contained within the Region--about 934 square miles--is only a small part of a much larger watershed. The main stem of the Fox River rises in Waukesha County near the Village of Lannon and flows approximately 81 miles south through Racine and Kenosha Counties before crossing the State line just east of the Salem-Randall Town line. The river continues to flow in a southerly direction to its confluence with the Illinois River. 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 its principal subwatersheds, together with the locations of the main channels of the Fox River and its principal tributaries, are shown on Map V-1.

Within the Southeastern Wisconsin Region, the Fox River watershed contains 45 major lakes having a surface area of 50 acres or more. These lakes are distributed within six subwatersheds: the Lower Fox River, Middle Fox River, Upper Fox River, Honey/Sugar Creeks, Mukwonago River, and White River/Nippersink Creek subwatersheds. The major lakes in the Lower Fox River subwatershed are Bohner Lake, Browns Lake, Camp Lake, Center Lake, Cross Lake, Dyer Lake, Lilly Lake, Silver Lake-Kenosha, and Voltz Lake. The major lakes in the Middle Fox River watershed are Big Muskego Lake, Lake Denoon, Eagle Lake, Kee Nong Go Mong Lake, Little Muskego Lake, Long Lake, Spring Lake-Waukesha, the Waterford Impoundment comprised of Buena and Tichigan Lakes, Waubeesee Lake, and Wind Lake. The major lake in the Upper Fox River subwatershed is Pewaukee Lake. The major lakes in the Honey/Sugar Creeks subwatershed are the three Lauderdale Lakes-Green, Middle, and Mill Lakes, North Lake-Walworth, Pleasant Lake, Potter Lake, Silver

Map V-1
SUBWATERSHEDS IN THE FOX RIVER WATERSHED



Lake-Walworth, and Wandawega Lake. The major lakes in the Mukwonago River subwatershed are Army Lake, Lake Beulah, Booth Lake, Eagle Spring Lake, Lower Phantom Lake, Lulu Lake, Peters Lake, and Upper Phantom Lake. The major lakes in the White River/Nippersink Creek subwatershed are Benedict/Tombeau Lake, Lake Como, Echo Lake, Elizabeth Lake, Geneva Lake, Lake Mary, Pell Lake, and Powers Lake. Physical characteristics of the major lakes in the Fox River watershed are set forth in Table V-1. The data indicate that major lakes in the watershed have a combined surface water area of about 21,872 acres, or about 4 percent of the total area of the watershed.

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 use which have occurred within the Fox 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 V-2 summarizes the existing land uses in the Fox River watershed in 1990 and indicates the changes in such land uses since 1975--the base year of the initial regional water quality management plan. Although the watershed contains numerous urbanized areas, 83 percent of the watershed was still in rural and other open land uses in 1990. These rural uses included about 52 percent of the total watershed in agricultural and related rural uses, about 9 percent in woodlands, about 16 percent in surface water and wetlands, and about 6 percent in other open lands. The remaining 17 percent of the total watershed was devoted to urban uses. Existing land uses within the watershed are shown on Map V-2.

Within the Fox River watershed, major concentrations of urban development exist in all four counties, with the majority of urban development increases since 1975 occurring in Waukesha County. Urban development has been taking place rapidly in and around the Cities of Muskego, New Berlin, and Waukesha, and the Town of Pewaukee, and along the Blue Mound Road corridor in the City and Town of Brookfield. Other concentrations of urban-related land uses within Waukesha County are located in the Village of Pewaukee and around Pewaukee Lake; in the Village and the Town of Mukwonago; and within the Towns of Vernon and Genesee. In addition, scattered urban development has occurred throughout the watershed in Waukesha County. The Fox River watershed contains two major commercial centers, the Waukesha Central Business District in downtown Waukesha and the Blue Mound Road corridor in Brookfield; and four major industrial centers, Pewaukee, Waukesha North and South, and New Berlin, all in Waukesha County.

Table V-1

PHYSICAL CHARACTERISTICS OF MAJOR LAKES IN THE FOX RIVER WATERSHED

SUBWATERSHED Lake Name	Surface Area (acres)	Direct Tributary Drainage Area (acres)	Shoreline (miles)	Maximum Depth (feet)	Mean Depth (feet)	Volume (acre-feet)
FOX RIVER UPPER						
Pewaukee Lake	2,493	14,819	13.7	45.0	10.0	24,930
FOX RIVER MIDDLE						
Big Muskego Lake	2,177	12,150	26.13	4.0	2.5	5,469
Denoon Lake	162	1,013	2.4	55	18	2,940
Eagle Lake	520	2,910	4.37	15	7.0	3,640
Kee Nong Go Mong Lake	88	1,337	2.5	25	8.7	770
Little Muskego Lake	506	7,067	5.7	65	15	7,170
Long Lake	102	1,858	3.4	5	2.5	259
Spring Lake (Waukesha County)	105	3,096	2.2	22	5	553
Waterford Impoundment (Buena & Tichigan Lakes)	1,133	14,375	28	63	6	8,244
Waubeesee Lake	129	553	3.1	73	19	2,450
Wind Lake	936	8,381	9.3	47	9.6	8,995
FOX RIVER LOWER						
Bohner Lake	135	1,098	1.9	30	9.2	1,243
Browns Lake	396	526	5.7	44	8	3,135
Camp Lake	461	2,566	4.8	19	5	2,328
Center Lake	129	2,243	6.5	28	8	1,136
Cross Lake	87	436	2.2	35	11.8	1,027
Dyer Lake	56	1,353	1.16	13	5	275
Lilly Lake	88	307	1.3	6	4.7	415
Silver Lake (Kenosha Co)	464	3,191	4.1	44	10	4,819
Voltz Lake	52	257	2.3	24	7	362

Table V-1 (cont'd)

SUBWATERSHED Lake Name	Surface Area (acres)	Direct Tributary Drainage Area (acres)	Shoreline (miles)	Maximum Depth (feet)	Mean Depth (feet)	Volume (acre-feet)
HONEY/SUGAR CREEKS						
Lauderdale Lakes (Green, Middle, Mill)	841	5,429	16	57	15	12,591
North Lake (Walworth County)	191	9,131	4.8	2.8	2.0	382
Pleasant Lake	155	1,216	2.7	29	12.5	1,910
Potter Lake	162	380	2.2	26	8	1,296
Silver Lake (Walworth County)	85	270	1.5	3.0	2.8	211
Wandawega Lake	119	910	2.25	8	4	476
MUKWONAGO RIVER						
Army Lake	78	356	1.5	17	8	625
Beulah Lake	834	5,283	15.3	58	17	14,279
Booth Lake	113	146	1.79	24	12.2	1,396
Eagle Spring Lake	311	5,859	4.0	8	3.6	1,127
Lulu Lake	84	10,317	2.4	40	24	2,009
Peters Lake	64	1,295	1.51	8	3	215
Upper/Lower Phantom Lake	540	20,178	3.91	29	5.1	2,750
WHITE RIVER/ NIPPERSINK CREEK						
Benedict Lake	78	2,589	3.7	37	15.4	1,888
Lake Como	946	4,058	8.0	9	4.3	4,033
Echo Lake	71	3,476	2.46	11	1.8	129
Elizabeth Lake	865	5,029	5.4	32	11	6,900
Geneva Lake	5,262	12,750	20.2	135	61	320,982
Lake Mary	315	1,143	3.5	33	9	1,957
Pell Lake	86	1,011	1.8	13	3.6	314
Powers Lake	459	2,426	5.3	33	16.2	7,453
TOTAL	21,872	172,788	240.98	--	--	463,067

Source: SEWRPC

Table V-2

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

Land Use Category	1975		1990		Change 1975-1990	
	Acres	Percent	Acres	Percent	Acres	Percent
Urban						
Residential	43,658	7.3	56,783	9.5	13,125	30.1
Commercial	1,558	0.3	2,147	0.4	589	37.8
Industrial	1,674	0.3	2,580	0.4	906	54.1
Transportation, Communication, and Utilities[b]	27,958	4.7	31,469	5.2	3,511	12.6
Governmental and Institutional	3,015	0.5	3,185	5.3	170	5.6
Recreational	7,336	1.2	8,068	1.4	732	10.0
Subtotal	85,199	14.3	104,232	17.4	19,033	22.3
Rural						
Agricultural and Related	341,385	57.0	313,435	52.3	-27,950	- 8.2
Lakes, Rivers, Streams and Wetlands	94,570	15.8	94,342	15.8	- 228	- 0.4
Woodlands	51,542	8.6	51,183	8.6	- 359	- 0.7
Open Lands[c], Landfills, Dumps, and Extractive	26,004	4.3	35,508	5.9	9,504	99.4
Subtotal	513,501	85.7	494,468	82.6	-19,033	- 3.7
Total	598,700	100.0	598,700	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.

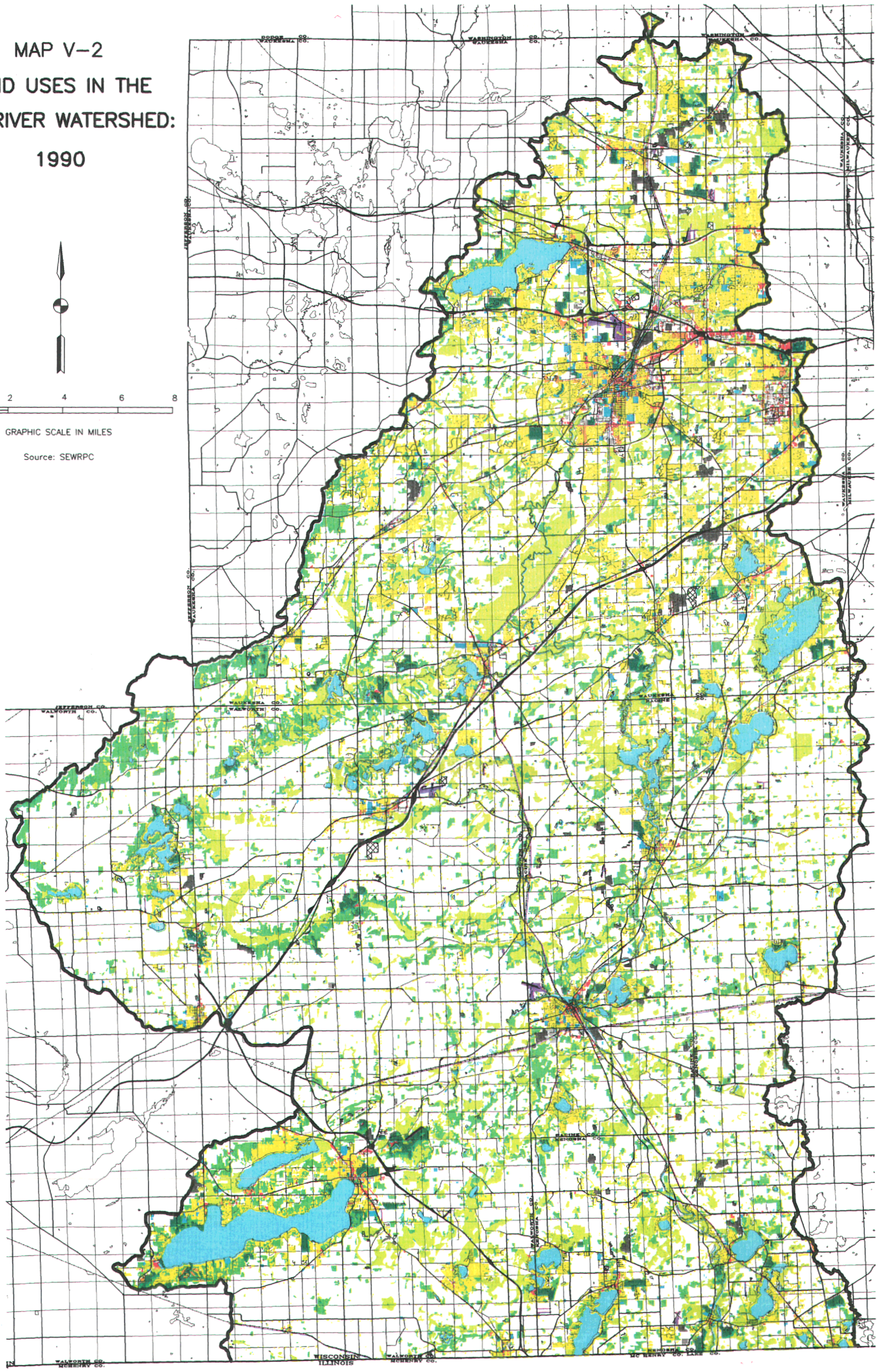
Source: SEWRPC.

MAP V-2
LAND USES IN THE FOX RIVER WATERSHED: 1990

0 2 4 6 8

GRAPHIC SCALE IN MILES

Source: SEWRPC



-LEGEND-

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

Source: SEWRPC.

The Fox River watershed is about 935 square miles in areal extent, or about 35 percent of the total Region. In 1990 about 163 square miles, or about 17 percent of the watershed, was in urban land uses.

In the portion of the watershed contained in Walworth County, urban-related land uses are located primarily in and around the City of Lake Geneva, the Villages of Williams Bay, Fontana on Geneva Lake, East Troy, and Genoa City, and in unincorporated areas around Geneva Lake and the Lauderdale Lakes. Other urban-related land uses occur to the north of Lake Como, around Pell Lake, and within the City of Elkhorn. In the portion of the watershed located within Racine County, urban development is concentrated in the City of Burlington and the Villages of Rochester and Waterford, and around Tichigan Lake, the Waterford Impoundment, Browns and Bohner Lakes. In Kenosha County, urban-related land uses within the watershed are concentrated around Powers, Camp, Center, Silver, Elizabeth, and Mary Lakes.

As shown in Table V-2, from 1975 to 1990, urban land uses in the watershed increased from about 85,200 acres, or 133 square miles, to about 104,200 acres, or 163 square miles, or by about 22 percent. As shown in Table V-2, residential land represents the largest urban land use in the watershed. Residential use has significantly increased within the watershed, from about 43,600 acres, or about 68 square miles in 1975 to about 56,800 acres, or about 89 square miles in 1990, a 30 percent increase. Commercial and industrial land uses increased from 3,200 acres, or about 5.0 square miles, to 4,700 acres, or about 7.3 square miles, an increase of 47 percent.

The 163 square miles of urban land uses in the watershed as of 1990 approximated, but exceeded somewhat, the staged 1990 planned increase in urban land of about 153 square miles envisioned in the adopted year 2000 land use plan. The current status of development in the Fox River watershed and in adjacent portions of Waukesha, Walworth, 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 V-3 summarizes the year 2010 planned land use conditions set forth in the adopted year 2010 land use plan in the Fox 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 Waukesha County within and around the Cities of Brookfield, New Berlin, and Waukesha; in and around the Villages of Sussex and Lannon; east of Little Muskego Lake within the City of Muskego; and in the Town of Pewaukee, between IH-94 and STH 190, just east of Pewaukee Lake. The adopted year 2010 land use plan also proposes the addition of a major commercial office center in Waukesha County, to be located near the intersection of I-94 and CTH J in the Town of Pewaukee.

In Walworth County, the adopted year 2010 land use plan anticipates increased urbanization in the Village of Fontana, and limited urban growth in the City of Elkhorn, the Village of Genoa City, and the Village and Town of East Troy. Additional urban development is expected for Racine County in the Village and Town of Waterford and the City of Burlington. In Kenosha County, additional urban development is envisioned in and around the Villages of Silver Lake and Twin Lakes. The adopted year 2010 land use plan also proposes the development of a major industrial center, to be located in Burlington.

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 Fox River watershed, as indicated in Table V-3, is projected to increase from the 1990

Table V-3

EXISTING AND PLANNED LAND USE IN THE FOX 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	56,783	9.5	65,226	10.9	8,443	14.8	78,497	13.1	21,714	38.2
Commercial	2,147	0.4	2,267	0.4	120	5.6	2,516	0.4	360	17.2
Industrial	2,580	0.4	3,350	0.6	770	29.8	4,316	0.7	1,736	67.3
Transportation, Communication, and Utilities[b]	31,469	5.2	34,705	5.8	3,236	10.3	38,939	6.5	7,470	23.7
Governmental and Institutional	3,185	0.5	3,489	0.6	304	9.5	3,813	0.7	628	19.7
Recreational	8,068	1.4	9,227	1.5	1,159	14.4	9,730	1.6	1,662	20.6
Subtotal	104,232	17.4	118,264	19.8	14,032	13.5	137,811	23.0	33,579	32.2
Rural										
Agricultural and Related	313,435[d]	52.3	314,135	52.5	700[d]	0.2[d]	297,445	49.7	- 15,990	- 5.1
Lakes, Rivers, Streams, and Wetlands	94,342	15.8	93,116	15.5	- 1,226	- 1.3	93,116	15.6	- 1,226	- 1.3
Woodlands	51,183	8.6	50,202	8.4	- 981	- 1.9	49,783	8.3	- 1,400	- 2.7
Open Lands,[c] Landfills, Dumps, and Extractive	35,508	5.9	22,983	3.8	- 12,525	- 34.3	20,545	3.4	- 14,963	- 42.1
Subtotal	494,468	82.6	480,436	80.2	- 5,351	- 4.15	460,889	77.0	- 33,579	- 6.8
Total	598,700	100.0	598,700	100.0	0	--	598,700	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.

[d] Existing 1990 agricultural and related land uses are at about the same level as projected 2010 levels under the intermediate growth-centralized land use plan.

Source: SEWRPC.

total of about 163 square miles, or about 17 percent of the total area of the watershed, to about 185 square miles, or about 20 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 215 square miles, or about 23 percent of the total watershed by year 2010. It is important to note that the 83 percent of the watershed remaining in rural uses is partly comprised of primary environmental corridor lands consisting of the best remaining natural resource features, and as recommended in the year 2010 regional land use plan, is proposed to be preserved largely in open space use through joint 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 773 square miles in 1990 to about 751 square miles in the year 2010 under the intermediate growth-centralized land use plan and to about 721 square miles under the high growth-decentralized land use plan, decreases of about 3 and 7 percent between 1990 and 2010 for the two year 2010 plans considered.

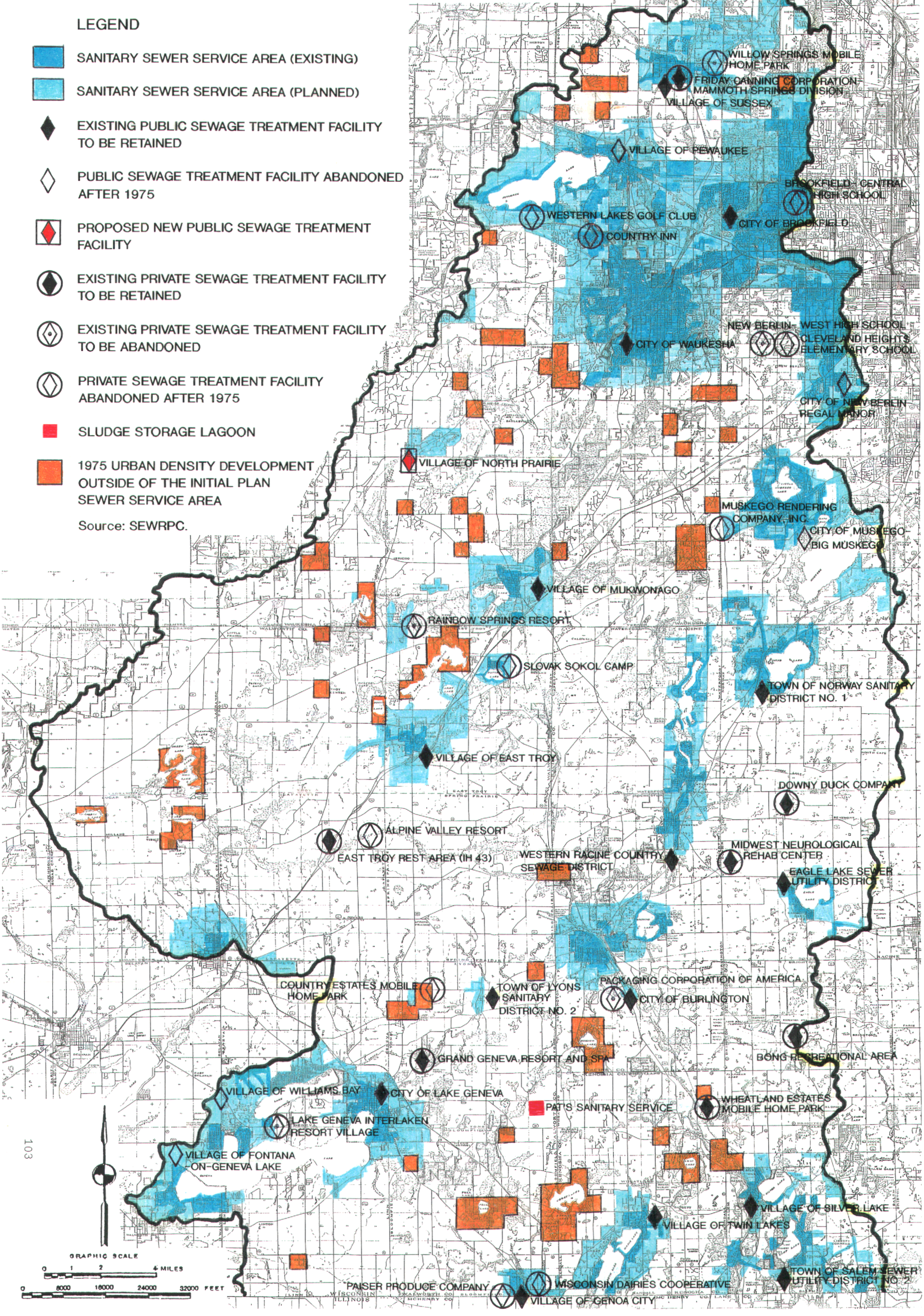
POINT SOURCE POLLUTANT CONTROL PLAN ELEMENTS

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 Fox 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 Service Areas

Existing Conditions and Status of Plan Implementation: In 1975, there were sixteen public sewage treatment facilities located in the Fox River watershed, as shown on Map V-3. The City of Waukesha, City of Burlington, City of Brookfield, Village of Silver Lake, and the Western Racine County Sewerage District sewage treatment plants discharged directly to the main stem of the Fox River. The Village of Fontana on Geneva Lake and the Village of Williams Bay treatment plants utilized soil absorption for the discharge of treated effluent; the Village of Twin Lakes treatment plant discharged to Bassett Creek; the City of Lake Geneva treatment plant discharged to the White River; the City of Muskego treatment plant discharged to Big Muskego Lake; the City of New Berlin Regal Manor plant discharged to Deer Creek; the Village of East Troy plant discharged to Honey Creek; the Village of Genoa City plant discharged to Nippersink Creek; the Village of Mukwonago plant discharged to the Mukwonago River; the Village of Pewaukee plant discharged to the Pewaukee River; and the Village of Sussex plant discharged to Sussex Creek. Of these sixteen plants, the plants operated by the Cities of Muskego and New Berlin, and the Villages of Pewaukee, Williams Bay, and Fontana on Geneva Lake were abandoned after 1975, as recommended in the initial plan. The status of implementation in regard to the abandonment, Map V-3

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



upgrading and expansion, and construction of the public and private sewage treatment plants in the Fox River watershed, as recommended in the initial regional water quality management plan, is summarized in Table V-4.

As can be seen by review of Table V-4, full implementation of the initial plan would provide for the upgrading and expansion, as needed, of eight plants: the City of Brookfield, City of Waukesha, City of Lake Geneva, Village of East Troy, Village of Genoa City, Village of Sussex, Village of Twin Lakes, and Western Racine County Sewerage District No. 2 sewage treatment plants. Implementation of these recommendations has been largely completed. The initial plan also included recommendations for the upgrading of the City of Burlington and Village of Silver Lake plants and for the construction of six new plants, five of which have been constructed. Construction of the Village of North Prairie plant and the upgrading of the Village of Silver Lake plant has not yet been completed. Upgrading and expansion of the Village of Twin Lakes plant has been partially completed. The plants in the watershed have not fully provided facilities to specifically reduce the phosphorus concentrations in plant effluents to the levels identified in the initial plan as being needed to fully meet the water use objectives. The steps needed to achieve the recommended level of phosphorus 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, 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 V-5.

In addition to the publicly-owned sewage treatment facilities, 22 private sewage treatment plants were in existence in 1975 in the Fox River watershed. These plants served the following land uses: Alpine Valley Resort (two plants), Brookfield Central High School, Cleveland Heights Elementary School, Country Estates Mobile Home Park, Downy Duck Company, East Troy Rest Area, Holy Redeemer College (currently the Midwest Neurological Rehabilitation Center), Lake Geneva Interlaken Resort Village, Friday Canning Corporation-Mammoth Springs Division, Muskego Rendering Company, Inc., New Berlin-West High School, Oakton Manor-Tumblebrook Golf Course (currently the Western Lakes Golf Club), Packaging Corporation of America, Americana Resort (currently the Grand Geneva Resort and Spa), Paiser Produce Company, Rainbow Springs Resort, Sloval Sokol Camp, Steeplechase Inn-Waukesha (currently the Country Inn), Wheatland Estates Mobile Home Park, Willow Springs Mobile Home Park, and Wisconsin Dairies Cooperative. In addition, the initial plan recommended the construction of a new private sewage treatment plant to serve the Bong Recreation Area.

As indicated in Table V-4, 12 of the 22 private sewage treatment plants in the watershed were recommended to be abandoned in the initial plan. Subsequent amendments to the plan recommended the abandonment of three additional plants. As of 1990, eleven of the 15 plants had been abandoned. Of the remaining four plants recommended for abandonment, capacity was provided for in the City of Burlington sewerage system for connection of the Packaging Corporation of America plant, and the Lake Geneva Interlaken Resort Village has completed

Table V-4

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

Public Sewage Treatment Plants	Disposal of Effluent	Plan Recommendation	Implementation Status
City of Brookfield	Fox River	Upgrade and expand	Completed first of two phases (1985)[a]
City of Burlington	Fox River	Upgrade	Local facility plan completed (1990)[b]
Eagle Lake Sewer Utility District	Eagle Creek	Construct new plant	Completed[c] (1978)
Village of East Troy	Honey Creek	Upgrade and expand	Completed (1982)
City of Lake Geneva	White River	Upgrade and expand	Completed (1986)
Village of Genoa City	Nippersink Creek	Upgrade and expand	Completed[c] (1985)
Town of Lyons Sanitary District No. 2	White River	Construct new plant	Completed[c] (1981)
Village of Mukwonago	Mukwonago River[d]	Construct new plant	Completed (1980)
Village of North Prairie	Soil Absorption	Construct new plant	Facility plan completed (1989)
Town of Norway Sanitary District No. 1	Wind Lake Drainage Canal	Construct new plant	Completed[c] (1978)
Town of Salem Sewer Utility District No. 2	Fox River	Construct new plant	Completed (1981)
Village of Silver Lake	Fox River	Upgrade	No action
Village of Sussex	Sussex Creek	Upgrade and expand[e]	Facility plan underway[e]
Village of Twin Lakes	Bassett Creek	Upgrade and expand	Partially completed (1988)
City of Waukesha	Fox River	Upgrade and expand	Construction completed (1979)[f]
Western Racine County Sewerage District	Fox River	Upgrade and expand	Completed (1987)
Village of Fontana-on-Geneva Lake	Soil Absorption	Abandon plant-connection to new Fontana-Walworth plant	Plant abandoned (1986)
City of Muskego-Big Muskego	Big Muskego Lake	Abandon plant	Plant abandoned (1984)
City of New Berlin-Regal Manor	Deer Creek	Abandon plant	Plant abandoned (1984)
Village of Pewaukee	Pewaukee River	Abandon plant	Plant abandoned (1981)
Village of Williams Bay	Soil Absorption	Abandon plant	Plant abandoned (1986)

Private Sewage Treatment Plants	Disposal of Effluent	Plan Recommendation	Implementation Status
Bong Recreational Area	Peterson Creek	Construct new plant	Plant constructed (1980)
Grand Geneva Resort and Spa[g]	White River	Maintain and upgrade as needed	Plant maintained
Downy Duck Company	Soil Absorption	Maintain and upgrade as needed	Plant maintained
East Troy Rest Area (IH 43)	Tributary to Sugar Creek	Maintain and upgrade as needed	Plant maintained and upgraded
Midwest Neurological Rehabilitation Center[h]	Tributary to Wind Lake Canal	Maintain and upgrade as needed	Plant maintained
Friday Canning Corporation-Mammoth Springs Division	Soil Absorption	Maintain and upgrade as needed	Plant maintained
Wheatland Estates Mobile Home Park	Minor Tributary to the Fox River	Maintain and upgrade as needed	No action
Lake Geneva Interlaken Resort Village	Soil Absorption	Abandon plant	Facility planning underway to enable abandonment[i]
Willow Springs Mobile Home Park	Soil Absorption	Abandon plant	No action
Rainbow Springs Resort	Tributary to Mukwonago River	Abandon plant[j]	Not in operation
New Berlin-West High School	Tributary to Poplar Creek	Abandon plant	No action
Packaging Corporation of America	Tributary to Fox River	Abandon plant	No action; Capacity provided in Burlington sewerage system for connection

Table V-4 (cont'd)

Public Sewage Treatment Plants	Disposal of Effluent	Plan Recommendation	Implementation Status
Alpine Valley Resort (two plants)	Soil Absorption	Abandon plants[k]	Plants abandoned (1990)
Brookfield Central High School	Soil Absorption	Abandon plant	Plant abandoned (1980)
Cleveland Heights Elementary School	Tributary to Poplar Creek	Abandon plant	Plant abandoned (1986)
Country Estates Mobile Home Park	Tributary to Ore Creek	Abandon plant[l]	Plant abandoned with connection to Town of Lyons Sanitary District No. 2 (1988)
Muskego Rendering Company, Inc.	Soil absorption	Abandon plant	Plant abandoned (1981)
Western Lakes Golf Club[m]	Pewaukee Lake	Abandon plant	Plant abandoned (1980)
Paiser Produce Company	Soil Absorption	Abandon plant	Plant abandoned (1978)
Slovak Sokol Camp	Soil Absorption	Abandon plant	Plant abandoned (1982)
Country Inn-Waukesha[n]	Soil Absorption	Abandon plant	Plant abandoned (1984)
Wisconsin Dairies Cooperative	Nippersink Creek	Abandon plant	Plant abandoned (1979)

[a] Facility planning for a second phase expansion and upgrading was under preparation as of 1993.

[b] New plant was placed into service May 1992.

[c] Plant upgrading and expansion was completed representing implementation of the plan recommendations, excepting for the provision of phosphorus removal facilities which have not yet been provided.

[d] New plant discharge recommended to be conveyed to the Fox River mainstem in an outfall sewer.

[e] The Sussex plant was recommended for abandonment in the initial regional water quality management plan. A 1989 amendment to the Regional Water Quality Management Plan-2000 for the Upper Fox River Watershed Brookfield and Sussex Sewage Treatment Plants provided for the plant to be a permanent facility after upgrading and expansion. The permanent facility was under construction during 1994.

[f] A major expansion and upgrading of the Waukesha sewage treatment plant was under construction during 1993.

[g] Formerly the Americana Resort.

[h] Formerly Holy Redeemer College.

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

[j] The Rainbow Springs Resort sewage treatment plant was recommended to be retained in the initial regional water quality management plan. A 1987 amendment to the regional water quality management plan for the Village of Mukwonago, Towns of East Troy and Mukwonago recommended the plant to be abandoned and for the Rainbow Springs Resort sewer service area to be served by the Village of Mukwonago sewage treatment plant.

[k] The Alpine Valley Resort sewage treatment plants were recommended to be retained in the initial regional water quality management plan. A 1989 amendment to the Regional Water Quality Management Plan-2000 for the Towns of East Troy, LaFayette, and Spring Prairie, and Village of East Troy recommended the plants to be abandoned and for the Alpine Valley Resort sewer service area to be served by the Village of East Troy sewage treatment plant.

[l] The Country Estates Mobile Home Park sewage treatment plant was recommended to be retained in the initial regional water quality management plan. A 1987 amendment to the Regional Water Quality Management Plan-2000 for the Country Estates Sanitary District, Town of Lyons recommended the plant to be abandoned and for the Country Estates sewer service area to be served by the Town of Lyons Sanitary District No. 2 sewage treatment plant.

[m] Formerly Oakton Manor - Tumblebrook Golf Course.

[n] Formerly Steeplechase Inn.

Source: SEWRPC.

Table V-5

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

Name of Public Sewage Treatment Plant	1990 Estimated Total Area Served (square miles)	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 Brookfield	14.8	33,800	1973, 1982, 1988[c]	Phosphorus removal, activated sludge, clarification sand filtration, chlorination, dechlorination, post aeration	Fox River	6/30/98
City of Burlington	3.3	10,400	1934, 1938, 1962, 1972, 1975[d]	Activated sludge (contact stabilization), clarification, phosphorus removal, chlorination, post aeration	Fox River	3//31/99
Eagle Lake Sewer Utility District	0.6	1,200	1978	Activated sludge, rotating biological contactor, clarification, chlorination, sand filters	Eagle Creek	9/30/98
Village of East Troy	1.1	3,600	1960, 1982	Activated sludge, clarification, phosphorus removal, sand filtration, chlorination	Honey Creek	6/30/98
City of Lake Geneva	2.6	6,400	1930, 1966, 1986	Oxidation ditch, clarification, seepage cell system	Groundwater system and the White River	6/30/99
Village of Genoa City	0.6	1,200	1923, 1959, 1985	Oxidation ditch, clarification, chlorination	Nippersink Creek	6/30/98
Town of Lyons Sanitary District No. 2	0.3	1,000	1981	Oxidation ditch, clarification, ultraviolet disinfection	White River	6/30/98
Village of Mukwonago	1.0	4,400	1950, 1971, 1980	Activated sludge, clarification, phosphorus removal, chlorination basin	Fox River	6/30/98
Town of Norway Sanitary District No. 1	3.5	4,900	1978	Activated sludge, clarification, phosphorus removal, sand filtration, chlorination	Wind Lake Drainage Canal	3/31/92
Town of Salem Sewer Utility District No. 2	2.6	4,900	1981	Activated sludge, clarification, phosphorus removal, chlorination, dechlorination	Fox River	3/31/97
Village of Silver Lake	0.6	1,800	1967, 1987, 1988	Activated sludge, clarification, chlorination, dechlorination	Fox River	12/31/98
Village of Sussex	1.7	4,400	1960, 1975, 1978[e]	Activated sludge (contact stabilization), clarification, filtration, phosphorus removal, chlorination	Sussex Creek	6/30/96
Village of Twin Lakes	2.3	4,000	1958, 1972, 1975, 1988	Activated sludge (contact stabilization), trickling filter, clarification, phosphorus removal, chlorination, polishing pond	Bassett Creek via unnamed tributary	12/31/93
City of Waukesha	14.6	57,000	1949, 1967, 1979[f]	Primary trickling filter, clarification, secondary trickling filters, clarification, sand filters, phosphorus removal, chlorination	Fox River	12/31/93
Western Racine County Sewerage District	3.7	6,400	1968, 1987	Activated sludge (contact stabilization), clarification, phosphorus removal, chlorination	Fox River	12/31/99

Table V-5 (cont'd)

Name of Public Sewage Treatment Plant	Hydraulic Loading[b] (mgd)				BOD_5 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 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 Brookfield	6.74	10.36	10.0[c]	1	8,332	9,422	15,200	0	7,885	9,163	22,500	0
City of Burlington	2.15	2.57	2.5[d]	1	5,754	6,792	5,000	12	4,091	5,260	--	0
Eagle Lake Sewer Utility District	0.19	0.34	0.4	0	160	220	680	0	153	243	--	0
Village of East Troy	0.27	0.30	0.70	0	562	642	1,197	0	625	705	1,408	0
City of Lake Geneva	1.24	1.56	1.74	0	2,154	2,597	2,221	4	1,818	2,189	2,605	0
Village of Genoa City	0.07	0.09	0.22	0	85	140	494	0	67	100	--	0
Town of Lyons Sanitary District No. 2	0.08	0.12	0.10	2	142	161	282	0	81	93	--	0
Village of Mukwonago	0.51	0.68	1.5	0	606	698	2,502	0	605	796	3,129	0
Town of Norway Sanitary District No. 1	0.67	1.03	0.75	5	798	1,109	1,275	0	1,076	2,463	1,500	1
Town of Salem Sewer Utility District No. 2	0.78	1.09	1.57	0	698	1,021	2,550	0	3,000	1,563	3,000	0
Village of Silver Lake	0.22	0.29	0.36	0	197	247	510	0	275	356	--	0
Village of Sussex	0.98	1.46	1.00[e]	3	1,092	1,168	1,580	0	1,025	1,195	2,000	0
Village of Twin Lakes	0.37	0.43	0.71	0	474	600	1,390	0	533	673	--	0
City of Waukesha	8.74	11.74	16.0[f]	0	14,956	31,168	20,000	2	27,727	79,042	--	0
Western Racine County Sewerage District	0.71	0.99	1.00	0	1,212	1,858	1,700	1	1,319	1,843	2,080	0

[a]In addition, plants typical 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 unless noted.
[c]As of 1994, the City of Brookfield had completed facility planning for a sewage treatment plant expansion to provide for a capacity of 12.5 mgd on an average annual basis.
[d]In May of 1992, the City of Burlington completed construction of a new sewage treatment plant with a design capacity of 3.5 mgd on an average annual basis.
[e]As of 1994, the Village of Sussex plant was under construction providing for a design capacity of 3.2 mgd on an average annual basis and 4.0 on a maximum monthly basis.
[f]As of 1994, the City of Waukesha plant was under construction providing for an upgrading and expansion project with a design capacity of 14.0 mgd on an average dry weather basis and 18.5 mgd on an average wet weather basis.

Source: Wisconsin Department of Natural Resources and SEWRPC.

facility planning to enable its abandonment.[1] In addition, capacity is being provided in the Village of Sussex sewage treatment plant, presently under construction, for the Willow Springs Mobile Home Park. No action has been taken with regard to the abandonment of New Berlin-West High School sewage treatment plant. The remaining private plants were recommended to be maintained and upgraded to provide effluent quality which would be determined on a case-by-case basis as part of the Wisconsin Pollutant Discharge Elimination System (WPDES) permit.

In addition to these private sewage treatment plants, there is also a sludge storage lagoon operated by Pat's Sanitary Service in the northwest one-quarter of U.S. Public Land Survey Section 36, Township 21 North, Range 18 East, Town of Lyons, as shown on Map V-3. This lagoon is permitted under the WPDES.

The initial regional water quality management plan included a set of specific options to be considered in facilities planning for management of solids generated at the public and private sewage treatment plants in the Fox 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 affects 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 35 sewer service areas identified within, or partially within, the Fox River watershed: Brookfield West, Burlington, Camp-Center Lakes, Cross Lake, Rock Lake, Wilmot, Elkhorn, Walworth County Institutions, Lake Como, Williams Bay, Fontana, Walworth, Eagle Lake, East Troy, Potter Lake, Genoa City, Hartland, Lake Geneva, Lyons, Menomonee Falls, Mukwonago, Muskego, New Berlin, Paddock Lake, North Prairie, Pewaukee, Silver Lake, Sussex-Lannon, Tichigan Lake, Twin Lakes, Waterford/Rochester, Wales, Waukesha, and Wind Lake. Currently, all of these areas, with the exception of North Prairie, Wales, Fontana, Walworth, and Wind

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[1]The Lake Geneva Interlaken Resort Village plant was abandoned in 1993 and the resort was connected to the Walworth County Metropolitan Sewerage District sewerage system.

Lake, have undergone refinements as recommended[2]. The boundaries of the sewer service areas through 1993 are shown on Map V-3. Table V-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 Fox River watershed, as refined through 1993, totals about 188 square miles, or about 20 percent of the total watershed area, as shown in Table V-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 Brookfield, City of Burlington, City of Waukesha, City of Lake Geneva, Village of East Troy, Village of Genoa City, Village of Silver Lake, Village of Twin Lakes and Western Racine County Sewerage District sewage treatment plants. This same recommendation applies to the plants constructed or reconstructed since the initial plan in accordance with the plan recommendations, including the Village of Mukwonago, the Eagle Lake Sewer Utility, Town of Lyons Sanitary District No. 2, Town of Norway Sanitary District No. 1, and the Town of Salem Sewer Utility District No. 2 sewage treatment plants. Estimated approximate dates for beginning facility planning for the expansion and upgrading of existing sewage treatment plants are indicated in Table V-7. This recommendation regarding plant facility upgrading and expansion, as needed, also applies to the treatment plant solids management element for the 15 public sewage treatment plants recommended to be retained.

With regard to the Village of Sussex plant, an amendment to the regional water quality management plan[3] served to change the initial recommendation which recommended the abandonment of the Sussex sewage treatment plant and the subsequent connection of its tributary service area to the City of Brookfield sewage treatment plant. This amendment was based upon an evaluation of a formal request for a plan amendment by a joint sewer study committee comprised of the following four communities, Sussex, Lisbon, Menomonee Falls, and Lannon, and of a facility plan prepared by Strand Associates, Inc. for the committee.[4] The amendment identified the sanitary sewer needs of the area, and evaluated alternative means of meeting those needs; evaluated the alternatives set forth in the facility plan; and set forth a recommendation as an amendment to the initial water quality plan. The amendment recommended expansion and reconstruction of the Sussex sewage treatment plant and recommended designation of the plant as a permanent facility to serve the Villages of Lannon and Sussex, and portions of the Village of Menomonee Falls and Town of Lisbon.

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[2]In addition, as of June 1994, the sewer service area for Bohner Lake was identified and refined as set forth in the Amendment to the Regional Water Quality Management Plan-2000, City of Burlington/Bohner Lake Sanitary Sewer Service Areas.

[3]Amendment to the Regional Water Quality Management Plan - 2000 for the Upper Fox River Watershed Brookfield and Sussex Sewage Treatment Plants, May 1989.

[4]Reevaluation of Regional Wastewater Treatment for Upper Fox River Watershed, Strand Associates, Inc., August 1988.

Table V-6

PLANNED SANITARY SEWER SERVICE AREAS IN THE FOX RIVER WATERSHED: 1993[a,b]

Name of Initially Refined Sanitary Sewer Service Area(s)	Planned Sewer Service Area in Fox River Watershed (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				
--	0.1	Alpine Valley	December 4, 1989	Amendment to the Regional Water Quality Management Plan-2000, Towns of East Troy, LaFayette, and Spring Prairie, and Village of East Troy
Brookfield East Elm Grove Brookfield West	13.4	Brookfield East Brookfield West	December 4, 1991	SEWRPC CAPR No. 109, Sanitary Sewer Service Area for the City and Town of Brookfield and the Village of Elm Grove, Waukesha County, Wisconsin
Burlington	10.3	Burlington	June 16, 1986	SEWRPC CAPR No. 78, Sanitary Sewer Service Area for the City of Burlington, Racine County, Wisconsin
Camp-Center Lakes Cross Lake Rock Lake Wilmot	6.7	Salem South	March 3, 1986	SEWRPC CAPR No. 143, Sanitary Sewer Service Area for the Town of Salem Utility District No. 2, Kenosha County, Wisconsin
Delavan Delavan Lake Elkhorn Walworth County Institutions Lake Como Williams Bay --	14.8	Delavan-Delavan Lake Elkhorn Lake Como Williams Bay Geneva National-Interlaken	December 4, 1991	SEWRPC CAPR No. 56, 2nd Edition, Sanitary Sewer Service Areas for the Walworth County Metropolitan Sewerage District
Eagle Lake	2.2	Eagle Lake	January 18, 1993	SEWRPC CAPR No. 206, Sanitary Sewer Service Area for the Eagle Lake Sewer Utility District, Racine County, Wisconsin
--	0.9	Eagle Spring Lake	December 2, 1985	Amendment to the Regional Water Quality Management Plan-2000, Eagle Spring Lake Sanitary District
East Troy Potter Lake	8.1	East Troy Potter Lake Army Lake	June 16, 1993	SEWRPC CAPR No. 112, 2nd Edition, Sanitary Sewer Service Area for the Village of East Troy and Environs, Walworth County, Wisconsin
Genoa City	1.6	Genoa City	March 6, 1989	SEWRPC CAPR No. 175, Sanitary Sewer Service Area for the Village of Genoa City, Kenosha and Walworth Counties, Wisconsin
Hartland	0.8	Hartland	June 17, 1985	SEWRPC CAPR No. 93, Sanitary Sewer Service Area for the Village of Hartland, Waukesha County, Wisconsin

Table V-6 (cont'd)

Name of Initially Refined Sanitary Sewer Service Area(s)	Planned Sewer Service Area in Fox River Watershed (square miles)	Name of Refined and Detailed Sanitary Sewer Service Area(s)	Date of SEWRPC Adoption of Plan Amendment	Plan Amendment Document
Hooker-Montgomery Lakes	0.8	Salem North	December 1, 1986	SEWRPC CAPR No. 145, Sanitary Sewer Service Area for the Town of Salem Utility District No. 2, Kenosha County, Wisconsin
Lake Geneva	8.3	Lake Geneva	January 18, 1993	SEWRPC CAPR No. 203, Sanitary Sewer Service Area for the City of Lake Geneva and Environs, Walworth County, Wisconsin
Lyons	1.5	Lyons Country Estates Sanitary District	September 15, 1993	SEWRPC CAPR No. 158, 2nd Edition, Sanitary Sewer Service Area for the Town of Lyons Sanitary District No. 2, Walworth County, Wisconsin
Menomonee Falls	7.4	Lannon Menomonee Falls	June 16, 1993	SEWRPC CAPR No. 208, Sanitary Sewer Service Area for the Villages of Lannon and Menomonee Falls, Waukesha County, Wisconsin
Mukwonago	7.8	Mukwonago	December 5, 1990	SEWRPC CAPR No. 191, Sanitary Sewer Service Area for the Village of Mukwonago, Waukesha County, Wisconsin
--	0.3	Mukwonago County Park	June 21, 1984	Amendment to the Regional Water Quality Management Plan-2000, Village of Mukwonago, Towns of East Troy and Mukwonago
Muskego	12.0	Muskego	March 3, 1986	SEWRPC CAPR No. 64, Sanitary Sewer Service Area for the City of Muskego, Waukesha County, Wisconsin
New Berlin	8.5	New Berlin	December 7, 1987	SEWRPC CAPR No. 157, Sanitary Sewer Service Area for the City of New Berlin, Waukesha County, Wisconsin
Paddock Lake	0.1	Paddock Lake	December 1, 1986	SEWRPC CAPR No. 145, Sanitary Sewer Service Area of the Town of Salem Utility District No. 1, Village of Paddock Lake, and Town of Bristol Utility District Nos. 1 and 1B, Kenosha County, Wisconsin
Pewaukee	26.1	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
--	1.4	Rainbow Springs	June 21, 1984	Amendment to the Regional Water Quality Management Plan-2000, Village of Mukwonago, Towns of East Troy and Mukwonago

Table V-6 (cont'd)

Name of Initially Refined Sanitary Sewer Service Area(s)	Planned Sewer Service Area in Fox River Watershed (square miles)	Name of Refined and Detailed Sanitary Sewer Service Area(s)	Date of SEWRPC Adoption of Plan Amendment	Plan Amendment Document
Silver Lake	1.9	Silver Lake	June 15, 1987	SEWRPC CAPR No. 119, Sanitary Sewer Service Area for the Village of Silver Lake, Kenosha County, Wisconsin
Sussex-Lannon[b]	4.8	Sussex	June 16, 1983	SEWRPC CAPR No. 84, Sanitary Sewer Service Area for the Village of Sussex, Waukesha County, Wisconsin
Twin Lakes	7.8	Twin Lakes	June 15, 1987	SEWRPC CAPR No. 149, Sanitary Sewer Service Area for the Village of Twin Lakes, Kenosha County, Wisconsin
Waterford/Rochester Tichigan Lake	9.3	Waterford/ Rochester	June 16, 1986	SEWRPC CAPR No. 141, Sanitary Sewer Service Area for the Waterford/Rochester Area, Racine County, Wisconsin
Waukesha	30.6	Waukesha	December 2, 1985	SEWRPC CAPR No. 100, Sanitary Sewer Service Area for the City of Waukesha and Environs, Waukesha County, Wisconsin
Subtotal	187.5			
Unrefined Sanitary Sewer Service Areas				
Denoon Lake Fontana North Prairie Sussex (part)[b] Wales Walworth Wind Lake	1.4 4.3 1.9 2.6 1.3 0.3 5.3			
Subtotal	17.1			
Total	204.6			

[a]As of June 1994, the sewer service area for Bohner Lake was identified and refined as set forth in the Amendment to the Regional Water Quality Management Plan--2000, City of Burlington/Bohner Lake Sanitary Sewer Service Areas. The refined sanitary sewer service area encompasses 1.5 square miles.

[b]As of September 1994, the Sussex sewer service area was amended as set forth in SEWRPC Community Assistance Planning Report No. 84, 2nd Edition, Sanitary Sewer Service Area for the Village of Sussex, Waukesha County, Wisconsin. The refined sanitary sewer service area encompasses 7.4 square miles.

Note: CAPR - Community Assistance Planning Report

Source: SEWRPC.

Table V-7

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

			Existing 1990			Planned Year 2010						
							Intermediate Growth Centralized Land Use Plan			High Growth Decentralized Land Use Plan		
Name of Public Sewage Treatment Plant	Sewer Service Area	Design Capacity-Average Annual Hydraulic (mgd)	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 Brookfield	Brookfield West, Pewaukee	10.00[b]	6.74	14.8	33,800	47.7	52,100	12.50[b]	>2010[b]	78,800	15.5	2010[b]
City of Burlington	Burlington, Bohner Lake	3.50[c]	2.15	3.3	10,400	11.8	13,500	2.54	>2010[c]	18,800	3.20	2000[c]
Eagle Lake Sewer Utility District	Eagle Lake	0.40	0.19	0.6	1,200	2.2	1,200	0.19	1998	1,800	0.27	1996
Village of East Troy	East Troy, Potter Lake, Army Lake, Alpine Valley	0.70	0.27	1.1	3,600	8.2	5,500	0.51	2002	9,200	0.97	1996
City of Lake Geneva	Lake Geneva	1.74	1.24	2.6	6,400	8.3	9,200	1.59	2000	16,800	2.54	1996
Village of Genoa City	Genoa City	0.22	0.10	0.6	1,200	1.6	1,800	0.18	2005	3,000	0.32	2000
Town of Lyons Sanitary District No.2	Lyons	0.10	0.08	0.3	1,000	1.5	1,500	0.14	1997	2,400	0.26	1995
Village of Mukwonago	Mukwonago, Eagle Spring Lake, Mukwonago County Park, Rainbow Springs	1.50	0.51	1.0	4,400	10.4	7,500	1.0	2000	19,200	2.46	1998
Village of North Prairie (proposed plant)[d]	North Prairie	--	--	--	--	1.9	--	--	--	3,600	0.45	--
Town of Norway Sanitary District No. 1	Wind Lake Lake Denoon	0.75	0.67	3.5	4,900	6.7	5,900	0.80	1995	6,800	0.91	1995
Town of Salem Sewer Utility District No. 2	Salem South Salem North	1.57	0.78	2.6	4,900	10.7[e]	9,300[e]	1.33[e]	2000	10,200[e]	1.44[e]	1998
Village of Silver Lake	Silver Lake	0.36	0.22	0.6	1,800	1.9	2,900	0.36	1995	3,200	0.40	1995
Village of Sussex	Sussex, Lannon, Menomonee Falls	3.2[f]	0.98	1.7	4,400	13.7	19,800	2.91	>2010	33,100	4.57	2000
Village of Twin Lakes	Twin Lakes	0.50	0.37	2.3	4,000	7.8	7,000	0.70	1995	7,400	0.80	1995

Table V-7 (continued)

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 Waukesha	Waukesha	14.0[g]	8.74	13.4	57,000	30.6	74,300	14.00[g]	2003	105,900	15.0	2000
Western Racine County Sewerage District	Waterford, Rochester	1.00	0.71	3.7	6,400	9.3	8,700	1.00	2007	10,600	1.24	1998

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

[b] Facility planning for plant expansion and upgrading completed. Design flows based upon design year 2014 as documented in a May 1993 facility plan.

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

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

[e] Includes Salem North sewer service area. As of 1993, Town of Salem Utility District No. 1 sewage treatment plan was abandoned and service area was served by Town of Salem Utility District No. 2.

[f] During 1993, the Village of Sussex sewage treatment plant was under construction providing for an upgraded and expanded plant with a hydraulic design capacity of 3.2 mgd on an average annual basis and 4.0 mgd on a maximum monthly basis.

[g] Based upon March 1990 facility plan. During 1993, an addition and expansion of the City of Waukesha sewage treatment plant was under construction providing for a hydraulic capacity of 14.0 mgd on an average annual basis and 18.5 mgd on a wet weather average basis.

Source: SEWRPC.

With regard to the proposed Village of North Prairie sewage treatment plant, a facility plan[5] was prepared in two phases during 1986 through 1989 which concluded that the lowest cost alternative means of providing for sanitary sewage disposal was the continued reliance of onsite systems, including replacement as needed using conventional, mound type, or other special soil absorption systems or holding tanks. It was also recommended in the facility plan that the Village continue to periodically monitor the groundwater system in the Village for potential degradation from onsite sewage disposal systems. This facility planning effort was the subject of public informational meetings held during 1988 and 1989. Based upon the findings of the facility plan, the plan includes a recommendation for future periodic groundwater monitoring and onsite sewage disposal system surveillance to be conducted to assess the viability of onsite systems. It is further recommended that at such time as there is evidence that onsite sewage systems are not a viable long-term solution for all or portions of the Village, then additional subregional planning should be conducted to determine the most cost-effective means of providing sanitary sewer service. Such evaluations should include alternatives providing for the connection of the Village to the Village of Mukwonago, or alternatively, the City of Waukesha sewerage system, as well as the potential construction of a new plant.

The current point source pollution abatement plan element, including the planned sewer service areas, is summarized on Map V-4. Table V-7 presents selected design data for the 15 public sewage treatment plants which are recommended to be maintained in the Fox River watershed. It is important to note that five plants recorded monthly average hydraulic loadings during 1990 which equaled or exceeded the average design capacities of the plants, as shown in Table V-5. Of these, three sewage treatment plants have recorded more than one month in 1990 in which the monthly average loadings exceeded the design capacity. One of these plants--the City of Burlington--has since been reconstructed at a new site with an increased capacity. Thus, no further capacity problems exist at that plant. The Village of Sussex sewage treatment plant is currently under construction to provide for increased capacity, and the City of Brookfield has completed facility planning for a plant expansion. Other plants which are currently approaching their design capacities are the Town of Norway Sanitary District No. 1 and the Town of Lyons Sanitary District No. 2 sewage treatment plants. In addition, facility planning should be initiated in the near future for the Village of Silver Lake and the Village of Twin Lakes sewage treatment plants due to the age of major portions of the plant facilities.

Table V-7 shows expected increases in sewered populations and attendant increases in sewage hydraulic loading rates for two different year 2010 growth scenarios for the 15 public sewage treatment plants in the Fox River watershed. Under the intermediate growth-centralized land use plan, seven of the 16 public plants are 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, 12 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.

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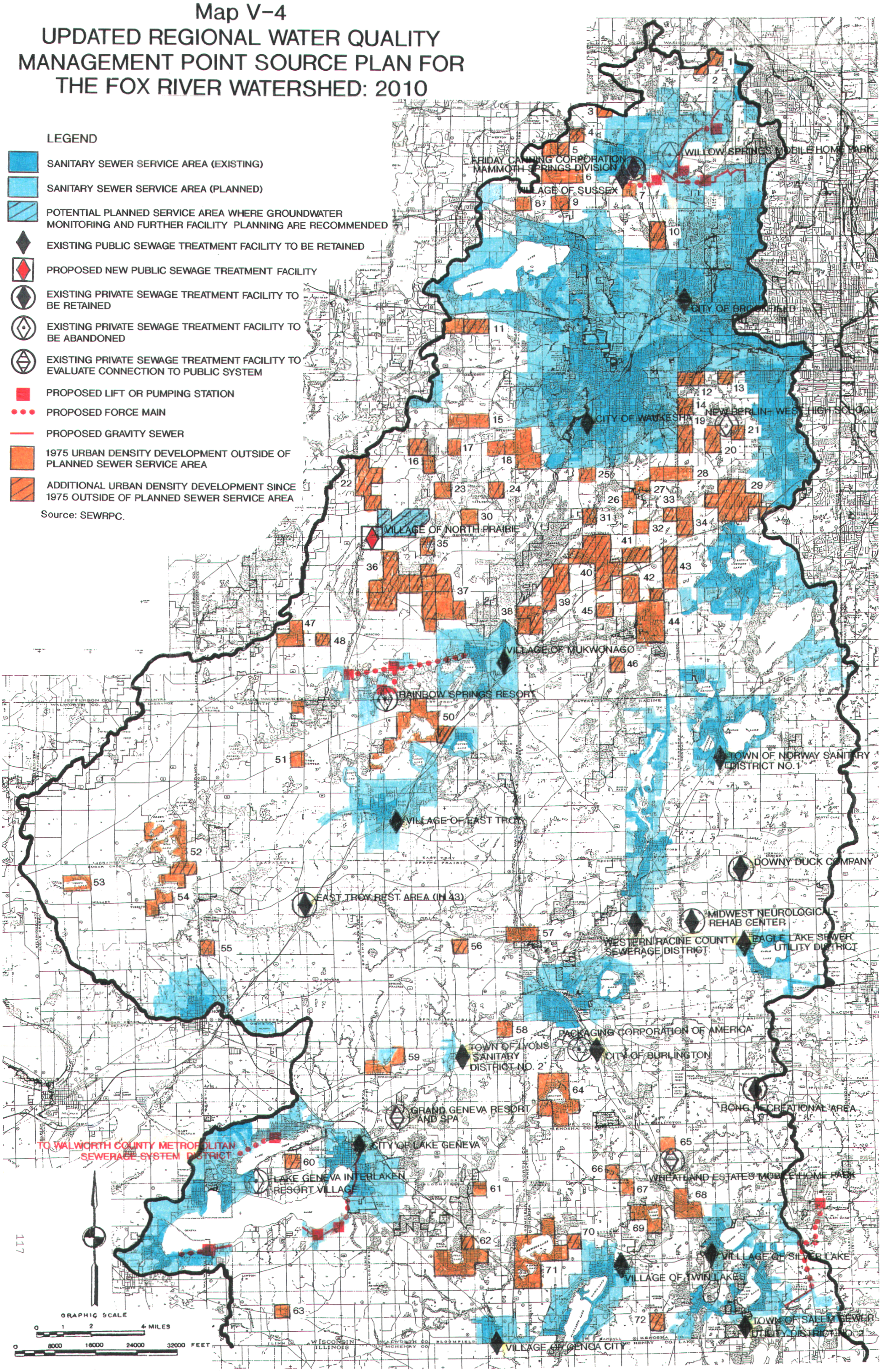
[5]Ruekert & Mielke, Inc., Village of North Prairie Wastewater Facility Plan, Phase One, July 1986; Phase Two, December 1989.

Map V-4
UPDATED REGIONAL WATER QUALITY MANAGEMENT POINT SOURCE PLAN FOR THE FOX RIVER WATERSHED: 2010



Based upon review and analysis of the data in Tables V-5 and V-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 Village of Silver Lake, the Village of Twin Lakes, the Town of Norway Sanitary District No. 1, the Town of Lyons Sanitary District No. 2, and the Western Racine County Sewerage District to consider the need for expansion and upgrading of their sewage treatment plants. As noted earlier, four plants have recently undergone facility planning and/or construction, and no additional facility planning is expected to be needed for the plants operated by the Cities of Brookfield, Burlington, and Waukesha, and the Village of Sussex. The remaining five sewage treatment plants are expected to begin facility planning to consider the need for plant expansions later in the planning period, 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 Fox River watershed should be initiated within the next three years, except for the Brookfield, Burlington, Genoa City, Sussex, and Waukesha plants which recently completed facility planning or construction programs. 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 Fox River watershed are shown on Map V-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 Fox River watershed: Alpine Valley, Brookfield West, Burlington, Salem South, Country Estates Sanitary District, Denoon Lake, Elkhorn, Fontana, Lake Como, Williams Bay, Eagle Lake, Eagle Spring Lake, East Troy, Potter Lake, Army Lake, Walworth, Geneva National-Interlaken, Genoa City, Hartland, Salem North, Lake Geneva, Lyons, Lannon, Menomonee Falls, Mukwonago, Mukwonago County Park, Muskego, New Berlin, North Prairie, Paddock Lake, Pewaukee, Rainbow Springs, Silver Lake, Sussex, Twin Lakes, Waterford/Rochester, Wales, Waukesha, and Wind Lake. Together, the planned service areas within the watershed total about 205 square miles, or about 22 percent of the Fox 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 Denoon Lake, Fontana, Walworth, and Wind Lake sewer service areas. It is recommended that these refinements be conducted in 1995 and 1996. In addition, the North Prairie and Wales sewer service areas will have to be refined at such time as public sanitary sewer services are implemented in those areas. 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 ten private sewage treatment plants in operation within the Fox River watershed in 1990, plus the plant serving the

Bong Recreation Area which is located in the Des Plaines River watershed but discharges effluent through a drainage system to Peterson Creek, a tributary of the Fox River. 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. The updated plan recommends that four of the 11 plants in operation, be abandoned: the Lake Geneva Interlaken Resort,[6] the Packaging Corporation of America, the New Berlin West High School, and the Willow Springs Mobile Home Park. A 1987 amendment to the initial water quality plan recommended that the Rainbow Springs Resort also be abandoned, with service provided for by the Village of Mukwonago sewage treatment plant. In addition, the relatively close proximity of the Grand Geneva Resort and Spa to the Lake Geneva sewer service area indicates that there is potential for the consolidation of treatment facilities in this instance. Thus, it is recommended that at the time this private plants require significant upgrading or modification, that detailed facility planning be conducted to evaluate the alternative of connecting the land uses to the City of Lake Geneva public sanitary sewer systems. For the remaining five private sewage treatment plants serving the Bong Recreation Area, the Downy Duck Farm, the Friday Canning Company, the Midwest Neurological Rehabilitation Center, the East Troy Rest Area IH 43, and the Wheatland Mobile Home Park, 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. The Wheatland Mobile Home Park plant recommendations would be reevaluated as part of the subregional evaluation for the Town of Wheatland area as recommended in the last section of this chapter.

Sewer System Flow Relief Devices

Existing Conditions and Status of Plan Implementation: In 1975, there were 20 known separate sewer system flow relief devices located in the Fox River watershed: one bypass discharging to the White River from the City of Lake Geneva; one bypass discharging to Honey Creek from the Village of East Troy; one bypass to Nippersink Creek from the Village of Genoa City; one bypass to the Silver Lake Outlet Canal from the Village of Silver Lake; one bypass into Big Muskego Lake from the City of Muskego; and eight bypasses discharging into the Fox River from the City of Waukesha. In addition, as of 1975, the City of Waukesha also maintained two portable pumping locations which discharged to the Fox River, while the City of Brookfield maintained two portable pumping locations discharging to Deer Creek and Fox Creek. The Village of Sussex maintained one portable pumping station that discharged to Sussex Creek, while the Village of Menomonee Falls had two portable pumping stations discharging to the Fox River. 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 V-8, 41 reported points of sanitary sewer system flow relief were reported during 1988 through 1993 in the Fox River watershed. These flow relief points are located in ten 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 five years per flow relief location. This equates to an average of about eight isolated overflow occurrences per year considering all the reported bypassing.

[6]The Lake Geneva Interlaken Resort Village plant was abandoned in 1993.

Table V-8

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

Sewerage System	Sewage Treatment Plant Flow Relief Device	Sewage Flow Relief Devices in the Sewer System					Comments
		Cross-overs	Pumping Station Bypasses	Other Bypasses	Portable Pumping System Locations	Total	
City of Brookfield	--	--	2	--	14	16	Used only in case of equipment failure or extreme wet weather conditions
Village of Twin Lakes	--	--	1	--	--	1	Used only in case of severe wet weather conditions
Town of Linn Sanitary District	1	--	--	--	--	1	Used only in case of equipment failure
Village of Pewaukee	--	--	2	--	--	2	Used only in case of extreme wet weather
City of Waukesha	1	--	5	--	--	6	Bypasses are used infrequently, only when unanticipated equipment failure occurs
Town of Norway Sanitary District No. 1	1	--	2	--	--	3	Used only in the case of equipment failure or extreme wet weather conditions
Village of Waterford	--	--	1	--	--	1	Used only in case of equipment failure
Village of Sussex	1	--	--	--	4	5	Portable pumps used at pumping stations and used only in cases of extreme wet weather or equipment failure conditions
Fontana-Walworth Water Pollution Control Commission	--	--	3	--	--	3	Used only in case of equipment failure or extreme wet weather conditions
Walworth County Metropolitan Sewerage District	--	--	3	--	--	3	Used only in case of equipment failure or extreme wet weather conditions
TOTAL	4	--	19	--	18	41	

Source: SEWRPC.

Current Plan Recommendations: It is recommended that the Cities of Brookfield and Waukesha; the Villages of Pewaukee, Sussex, Twin Lakes, and Waterford; the Town of Norway Sanitary District No. 1 and the Town of Lyons Sanitary District No. 2 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 25 intercommunity trunk sewers in the Fox River watershed, as shown in Table V-9. Five of these trunk sewers would connect outlying communities to the City of Brookfield sewage treatment plant. These trunk sewers have been fully constructed except for the Poplar Creek and River Road trunk sewers. The Poplar Creek trunk sewer is only partially completed to near the southern limits of the City of Brookfield and has not been extended into the City of New Berlin due to a change in the New Berlin sewer service area, which would defer the remaining portion of this sewer until after the year 2000. In addition, the westerly portion of the River Road trunk sewer in the City of Brookfield has not yet been constructed. Construction of the New Berlin-Hales Corners and Franklin-Muskego trunk sewers to enable the abandonment of the City of New Berlin Regal Manor and the City of Muskego-Northeast and Big Muskego sewage treatment plants have been completed. The trunk sewer connecting the Village of Lannon and portions of the Village of Menomonee Falls to the Village of Sussex sewerage system has not yet been completed. The two trunk sewers providing for the relocation of the Mukwonago sewage treatment plant and the connection of the Potter Lake community to the East Troy sewerage system have been completed. The trunk sewers to connect the Lake Denoon area to the Town of Norway Sanitary District No. 1 sewerage system and the Tichigan Lake area to the Western Racine County Sewerage District sewerage system have been constructed. Three trunk sewers connecting the Town of Salem Sewer Utility District No 2 service area have also been completed. The trunk sewer to connect the urban development south of Geneva Lake in the Town of Linn to the City of Lake Geneva sewerage system has not yet been constructed. Connections of the Geneva National Sanitary District and the Village of Williams Bay to the Walworth County Metropolitan sewerage system have been completed. However, the connection of the Como Lake North area has not yet been constructed. The trunk sewer connecting urban development along the southwest shore of Geneva Lake to the Village of Fontana on Geneva Lake sewerage system has not been implemented, while the trunk sewer needed to connect Fontana on Geneva Lake to the Fontana-Walworth Water Pollution Control Commission has been completed. It should also be noted that a portion of the trunk sewer connecting the Town of Salem Utility District No. 1 in the Des Plaines River watershed to the Town of Salem Utility District No. 2 sewerage system is located in the Fox River watershed and that trunk sewer has been completed.

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 Fox River watershed, as shown on Map V-4.

Table V-9

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

Intercommunity Trunk Sewer	Status of Implementation
Northwest-River Road	Partially completed (1987)
Springdale	Completed (1979 and 1990)
Pewaukee Lake-Pewaukee	Completed (1979)
Pewaukee-Brookfield	Completed (1980)
Poplar Creek	Partially completed
Lannon-Sussex[a]	No action[a]
New Berlin-Hales Corners	Completed (1984)
Franklin-Muskego	Completed (1984)
Mukwonago	Completed (1980)
Potter Lake-East Troy	Completed (1982)
Eagle Spring-Mukwonago	No Action
Muskego-Norway	Completed (1978)
Tichigan Lake-Rochester	Completed (1988)
Silver Lake-Camp Lake	Completed (1981)
Wilmot	Completed (1983)
Cross-Rock Lakes	Completed (1983)
Lake Geneva South	No action
Como Lake North[b]	No action
Geneva Lake National to WalcoMet[c]	Completed (1990)
Williams Bay-Delavan Lake[d]	Completed (1986)
Fontana-Linn	No action
Fontana-Walworth	Completed (1986)

[a]Lannon-Sussex trunk sewer added to the plan based upon a May 1989 plan amendment. Facility planning was completed in 1994.

[b]Como Lake North trunk sewer connecting the north shore of Como Lake to the City of Lake Geneva sewage treatment plant was deleted from the plan and a new trunk sewer connecting the north shore of Como Lake to the Walworth County Metropolitan sewerage system was added to the plan based upon a December 1991 plan amendment.

[c]Geneva National-WalCoMet trunk sewer added to plan based upon a November 1989 plan amendment.

[d]Williams Bay-Delavan Lake trunk sewer added to plan based upon a March 1985 plan amendment.

Source: SEWRPC.

Four intercommunity trunk sewers in the Fox River watershed are currently recommended to be constructed. These trunk sewers include connections from Menomonee Falls and Lannon to the Sussex sewerage system; from the south shore of Geneva Lake to the City of Lake Geneva sewerage system; from the north shore of Lake Como to the Walworth County Metropolitan Sewerage District sewerage system via the Geneva National Sanitary District sewerage system; and a trunk sewer connecting Eagle Spring Lake, Mukwonago County Park, and Rainbow Springs Resort to the Village of Mukwonago sewerage system. In addition, the remaining portion of the River Road trunk sewer connecting portions of the Town of Pewaukee and the Town and City of Brookfield to the City of Brookfield sewerage system is recommended to be completed.

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 37 known point sources of pollution identified in the Fox River watershed other than public and private sewage treatment plants. These sources discharge industrial cooling, process, rinse, wash, and filter backwash waters through 54 outfalls directly or indirectly to the surface water or groundwater system. Of these point source outfalls, three were identified as minor or intermittent discharges. The remaining 34 were other types of wastewater discharges, predominantly--24, or about 71 percent of those remaining--cooling water. 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 84 such known point sources of wastewater discharging to the Fox River and its major tributaries or to the groundwater system directly through industrial waste outfalls or indirectly through drainage ditches and storm sewers. Table V-10 summarizes selected characteristics of these other point sources and Map V-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 116 known point sources of wastewater other than public and private sewage treatment plants discharging to surface waters or groundwater in the Fox 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 42 enclaves of unsewered urban development located outside of the then proposed year 2000 sewer service area. As of 1990, four of these areas had been added to the planned 2010 sewer service area as part of the plan amendment process. Due to increased urban growth within the watershed since 1975, 34 new enclaves of urban development have been created beyond the planned sewer service areas, and 16 of the urban development enclaves identified in the initial plan have been expanded, as shown on Map V-4. The corresponding

Table V-10

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

Facility Name	County	Map ID#[b]	Permit Type	Permit Number	Expiration Date	Standard Industrial Classification Code	Industrial Activity	Receiving Water	Treatment System[c]
APS Industries	Waukesha	1	General	0046507-2	9-30-95	--	--	Groundwater discharge	--
Ace Redi-Mix, Inc.	Waukesha	2	General	0046507-2	9-30-95	3273	Ready-mix concrete	Groundwater discharge	--
Alby Block Co.	Racine	3	General	0046507-2	9-30-95	3271	Concrete block and brick	Groundwater discharge	--
Basset Ready Mix	Kenosha	4	General	0046507-2	9-30-95	3273	Ready-mix concrete	Absorption pit	--
Burlington Swimming Pool	Racine	5	General	0046523-2	9-30-95	--	Municipal pool	Echo Lake via storm sewer	--
Carroll College Van Male Pool	Waukesha	6	General	0046523-2	9-30-95	8221	College/University	Fox River via storm sewer	--
East Troy Ready Mix	Walworth	7	General	0046507-2	9-30-95	3273	Ready-mix concrete	Groundwater discharge	--
Echo Lake Farm Produce Co., Inc.	Racine	8	General	0044938-3	9-30-95	2015	Poultry slaughtering & processing	Echo Lake	--
Elmbrook Memorial Hospital	Waukesha	9	General	0044938-3	9-30-95	8062	General med. & surgical hospital	Fox River via storm sewer	--
GE Medical Systems - C.T.	Waukesha	10	General	0044938-3	9-30-95	3844/3845	Electro. med. equip, etc.	Poplar Creek via unnamed trib.	--
Hales Corners Block Co.	Racine	11	General	0046507-2	9-30-95	3271	Concrete block and brick	Groundwater discharge	--
Halquist Stone Co., Inc.	Waukesha	12	General	0046515-2	9-30-95	3281	Cut stone & stone products	Sussex Creek	--
Herb's Service	Walworth	--[d]	General	0046566-1	9-30-95	5541	Gasoline service station	Lake Geneva	--
J.W. Peter & Sons	Racine	14	General	0046507-2	9-30-95	3272	Concrete products	Groundwater discharge	--
Jacob's Ready-Mix	Walworth	15	General	0046507-2	9-30-95	3273	Ready-mix concrete	Groundwater discharge	--
Lake Geneva Culligan Water Cond.	Racine	16	General	0046540-1	9-30-95	1711	Plumbing: water conditioning	Fox River via storm sewer	--
Lake Geneva Water Treatment Plant	Walworth	17	General	0046540-1	9-30-95	4941	Water supply	White River	--
Lanson Industries, Inc.	Waukesha	18	General	0044938-3	9-30-95	3699	Electric equipment & supplies	Muskego Canal via unnamed trib.	--
Lavelle Industries, Inc.	Racine	19	General	0044938-3	9-30-95	3069	Fabricated rubber products	Fox River via storm sewer	--
Maple Leaf Farms-Burlington Feed Mill	Racine	20	General	0044938-3	9-30-95	2048	Prepared animal feeds	Fox River via storm sewer	--
Meyer Material Co. KD Pit	Kenosha	21	General	0046515-2	9-30-95	1442	Construction sand & gravel	Groundwater discharge	--
Milupa Company	Walworth	22	General	0044938-3	9-30-95	2023	Dry/condensed/evap. products	Honey Creek via storm sewer	--
Milwaukee Chaplet & Mfg. Co. Inc.	Waukesha	23	General	0044938-3	9-30-95	3559	Special industry machinery	Deer Creek	--
Muskego H.S. (Pool)	Waukesha	24	General	0046523-2	9-30-95	8211	Secondary school	Muskego Canal via unnamed trib.	--
New Berlin Public Schools	Waukesha	25	General	0046523-2	9-30-95	8299	Schools/educational serv.	Deer Creek via drainage ditch	--
N. B. Public Schools: Eisenhower H.S.	Waukesha	26	General	0046523-2	9-30-95	8211	Secondary school	Deer Creek via drainage ditch	--
N. B. Public Schools: N.B. West H.S.	Waukesha	27	General	0046523-2	9-30-95	8211	Secondary school	Poplar Creek via unnamed trib.	--
New Berlin Redi-Mix Inc.	Waukesha	28	General	0046507-2	9-30-95	3273	Ready-mix concrete	Mill Creek via unnamed trib.	--
Outboard Marine Corp. Research Ctr.	Waukesha	29	General	0044938-3	9-30-95	3733	Commercial nonphysical research	Pewaukee River via storm sewer	--
Park & Rec.: Eisenhower Pool	Waukesha	30	General	0046523-2	9-30-95	--	Municipal pool	Deer Creek via drainage ditch	--
Quality Aluminum Casting Co.	Waukesha	31	General	SPEC PERM	9-30-95	3363	Copper foundry	Fox River via storm sewer	--
Quality Concrete Products Co., Inc.	Waukesha	32	General	0046507-2	9-30-95	3271	Concrete block & brick	Groundwater discharge	--
R. Frederick Redi-Mix	Waukesha	33	General	0046507-2	9-30-95	3273	Ready-mix concrete	Groundwater discharge	--
Recreation Ctr. Pool - Genoa City	Walworth	34	General	0046523-2	9-30-95	7999	Amusement & recreation	Nippersink Creek via storm sewer	--
Rubber Products Inc.	Waukesha	35	General	0044938-3	9-30-95	3069	Fabricated rubber products	Pewaukee River	--
S & M Rotogravure Service Inc.	Waukesha	36	General	0044938-3	9-30-95	2754	Commercial printing-gravure	Deer Creek via drainage ditch	--
Sanofi Bio Ingredients Inc.	Waukesha	37	General	0044938-3	9-30-95	2022	Cheese-natural & processed	Fox River via storm sewer	--
Spancrete Industries, Inc.	Waukesha	38	General	0046507-2	9-30-95	3272	Concrete products	Groundwater discharge	--
Stanek Tool Corp.	Waukesha	39	General	0044938-3	9-30-95	3544	Special dies, tools, jigs, etc.	Deer Creek via drainage ditch	--
Taylor Dynamometer & Mach. Co. Inc.	Waukesha	40	General	0044938-3	9-30-95	3829	Measuring & control devices	Deer Creek	--

Table V-10 (cont'd)

Facility Name	County	Map ID#[b]	Permit Type	Permit Number	Expiration Date	Standard Industrial Classification Code	Industrial Activity	Receiving Water	Treatment System[c]
Trent Tube Div.-Crucible Materials	Walworth	--[d]	General	0046566-2	9-30-95	3317	Steel pipe and tubes	Honey Creek via storm sewer	--
Trent Tube Inc.-Plant #1	Walworth	42	General	0044938-3	9-30-95	3317	Steel pipe and tubes	Honey Creek via storm sewer	--
Uhen's Garage	Kenosha	--[d]	General	0046566-2	9-30-95	5541	Gasoline service station	Groundwater discharge	--
Waukesha Block Co., Inc.	Waukesha	44	General	0046507-2	9-30-95	3271	Concrete block & brick	Groundwater discharge	--
Waukesha Board of Education	Waukesha	45	General	0046523-2	9-30-95	8299	School/educational serv.	Fox River via storm sewer	--
Wauk. Bd. of Ed.: Central Middle Sch.	Waukesha	46	General	0046523-2	9-30-95	8211	Secondary school	Fox River via storm sewer	--
Wauk. Bd. of Ed.: North H.S. Pool	Waukesha	47	General	0046523-2	9-30-95	8211	Secondary school	Brandy Brook via unnamed trib.	--
Waukesha Bd. of Ed: South H.S. Pool	Waukesha	48	General	0046523-2	9-30-95	8211	Secondary school	Fox River via storm sewer	--
Waukesha Concrete Products Co., Inc.	Waukesha	49	General	0046507-2	9-30-95	3272	Concrete products	Groundwater discharge	--
Wauk. Cty. Trans. Dept.: Crites Field	Waukesha	50	General	0046531-1	9-30-90	4581	Airports/field services	Fox River via storm sewer	--
Waukesha Foundry, Inc.	Waukesha	51	General	SPEC PERM	9-30-95	3325	Steel foundry	Fox River via storm sewer	--
Waukesha Lime & Stone Co., Inc.	Waukesha	52	General	0046515-2	9-30-95	3295/3274	Lime/ground/treat. minerals	Fox River	--
Waukesha Park & Rec. Dept (WPR)	Waukesha	53	General	0046523-2	9-30-95	9199	General government	Fox River via storm sewer	--
Waukesha P&R Dept.: Buchner Pool	Waukesha	54	General	0046523-2	9-30-95	--	Municipal pool	Fox River via storm sewer	--
Waukesha P&R Dept.: Horeb Pool	Waukesha	55	General	0046523-2	9-30-95	--	Municipal pool	Fox River via storm sewer	--
Waukesha YMCA	Waukesha	56	General	0046523-2	9-30-95	7991	Physical fitness facility	Fox River via storm sewer	--
West Shore Pipeline Co.	Racine	--[e]	General	0046566-1	9-30-95	5171	Petroleum bulk stations, term.	Goose Lk Branch Canal via ditch	--
Western Bituminous Co.	Waukesha	58	General	0046515-2	9-30-95	2951	Asphalt paving, mixtures, blocks	Groundwater discharge	--
Williams Bay Water Utility	Walworth	59	General	0046540-1	9-30-95	4941	Water supply	Lake Geneva	--
Wilmot Ready Mix Inc.	Kenosha	60	General	0046507-2	9-30-95	3272	Concrete products	Groundwater discharge	--
Wislanco Stone Co.	Waukesha	61	General	0046501-1	9-30-95	3281	Cut stone & stone products	Groundwater discharge	--
YWCA of Waukesha	Waukesha	62	General	0046523-2	9-30-95	7991	Physical fitness facility	Fox River via storm sewer	--
AT&T (Switching Center-Waukesha)	Waukesha	1A	Specific	0023132	06-30-92	4812	Radio/phone communications	Fox River via unnamed trib.	None
Akerman, Inc.	Waukesha	2A	Specific	0043206	06-30-91	3499	Fabricated metals products	Fox River via unnamed trib.	None
American National Can Co.	Racine	3A	Specific	0027251	03-31-91	3221	Glass containers	Fox River via storm sewer	1, 2
Amron Corp.	Waukesha	4A	Specific	0026417	12-31-91	3479	Metal coating & allied services	Fox River via storm sewer	2, 3, 4, 5
Beatrice Cheese, Inc.	Waukesha	5A	Specific	0070891	06-30-92	5143	Dairy prod. exc. dried or canned	Groundwater discharge	None
Continental Plastic Containers	Racine	6A	Specific	0052710	12-31-88	3081	Unsupported plastics film & sheet	Groundwater discharge	6
Cooper Power Systems, RTE Division	Waukesha	7A	Specific	0001350	03-31-93	3612	Transformers - exc. electric	Fox River	2
Melson Meat Co, Inc.	Waukesha	10A	Specific	0048097	--	2011	Meat packing plant	Groundwater discharge	None
Navistar International Trans. Corp.	Waukesha	11A	Specific	0000566	06-30-91	3321	Gray & ductile iron foundry	Fox River via storm sewer	None
Packaging Corp. of America	Racine	12A	Specific	0027073	12-31-92	2653	Corrugated & solid fiber boxes	Fox River via unnamed tributary	11, 12, 13
Plastic Molded Concepts, Inc.-Eagle	Waukesha	13A	Specific	0047015	03-31-95	3444	Special dies, tools, jigs, fixt.	Eagle Spring Lk. via unnamed trib.	None
QuadGraphics - Pewaukee	Waukesha	14A	Specific	0043800	09-30-91	2752	Commerical printing - lithographic	Fox River via drainage ditch	None
S & M Rotogravure Service, Inc.	Waukesha	15A	Specific	0042188	06-30-89	2754	Commercial printing - gravure	Deer Creek via drainage ditch	None
S & R Egg Farms, Inc. - Genesee	Waukesha	16A	Specific	0056600	06-30-91	6252	Chicken eggs	Groundwater discharge	None
S & R Egg Farms, Inc. - LaGrange	Walworth	17A	Specific	0056537	06-30-91	0252	Chicken eggs	Groundwater discharge	None
Trent Tube Div.-Crucible Materials	Walworth	18A	Specific	0038938	03-31-92	3317	Steel pipe and tubes	Honey Creek via storm sewer	2, 4, 5, 14
Vulcan Materials Co. - Sussex	Waukesha	19A	Specific	0001198	12-31-91	1442	Construction sand and gravel	Sussex Creek	8
Waste Mgmt. of WI: Metro Landfill	Milwaukee	20A	Specific	0045250	12-31-90	4953	Refuse systems	Muskego Lake via unnamed trib.	1, 8
Wauk. County Trans. Dept.-Emissions	Waukesha	21A	Specific	0047953	--	9512	Air, water, solid waste management	Pewaukee River	None
Waukesha Engine Div. - Dresser Ind.	Waukesha	22A	Specific	0027227	06-30-92	3519	Internal combustion engines	Fox River	None
WI Electric, Hwy. 59 Landfill 918	Waukesha	23A	Specific	0047686	--	--	--	Groundwater discharge	None
Wisconsin Precision Casting Corp.	Walworth	24A	Specific	0048038	--	3324	Steel investment foundries	Honey Creek via drainage ditch	None

Footnotes follow.

Table V-10 (cont'd)

[a] Table V-10 includes 84 known, permitted sources of wastewater discharging to the Fox River and its tributaries, or to the groundwater system in the Fox River watershed. As of 1993, there were 116 known, permitted point sources of water pollution.

[b] See Map V-5, Point Sources of Pollution Other Than Sewage Treatment Facilities in the Fox River Watershed: 1990.

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

1. Gravity sedimentation
2. Oil and grease removal
3. Multimedia filters
4. Pressure filters
5. Tube/Plate settlers
6. Land disposal - general
7. Stabilization lagoon
8. Holding pond
9. Spray Irrigation
10. Absorption pond
11. ACT sludge extended air
12. Sand filters
13. Chlorination
14. Chemical conversion/addition

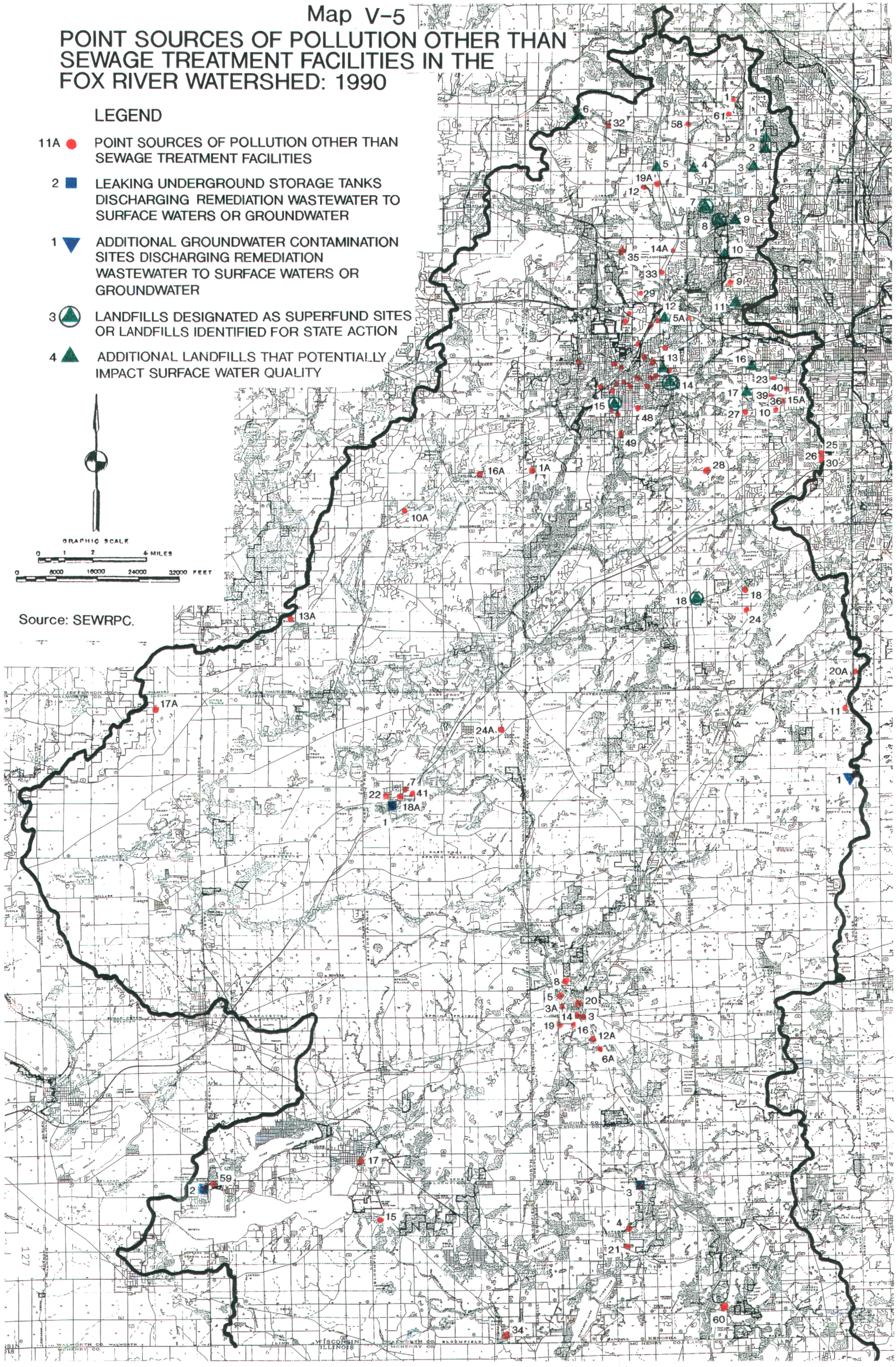
[d] Permitted as Leaking Underground Storage Tank (LUST) remediation sites discharging to surface or ground waters as of 1990. As of 1993, there were four additional Leaking Underground Storge Tank remediation sites discharging to surface or ground waters in the Fox River Watershed. See Table V-12, "Miscellaneous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

[e] Reported as a ground water contamination site as of 1990. Remediation waste water from site is permitted to discharge to surface water. See Table V-12, "Miscellaneous Potential Pollution Sources in the Fox River Watershed: 1990", for map identification number.

Source: Wisconsin Department of Natural Resources and SEWRPC.

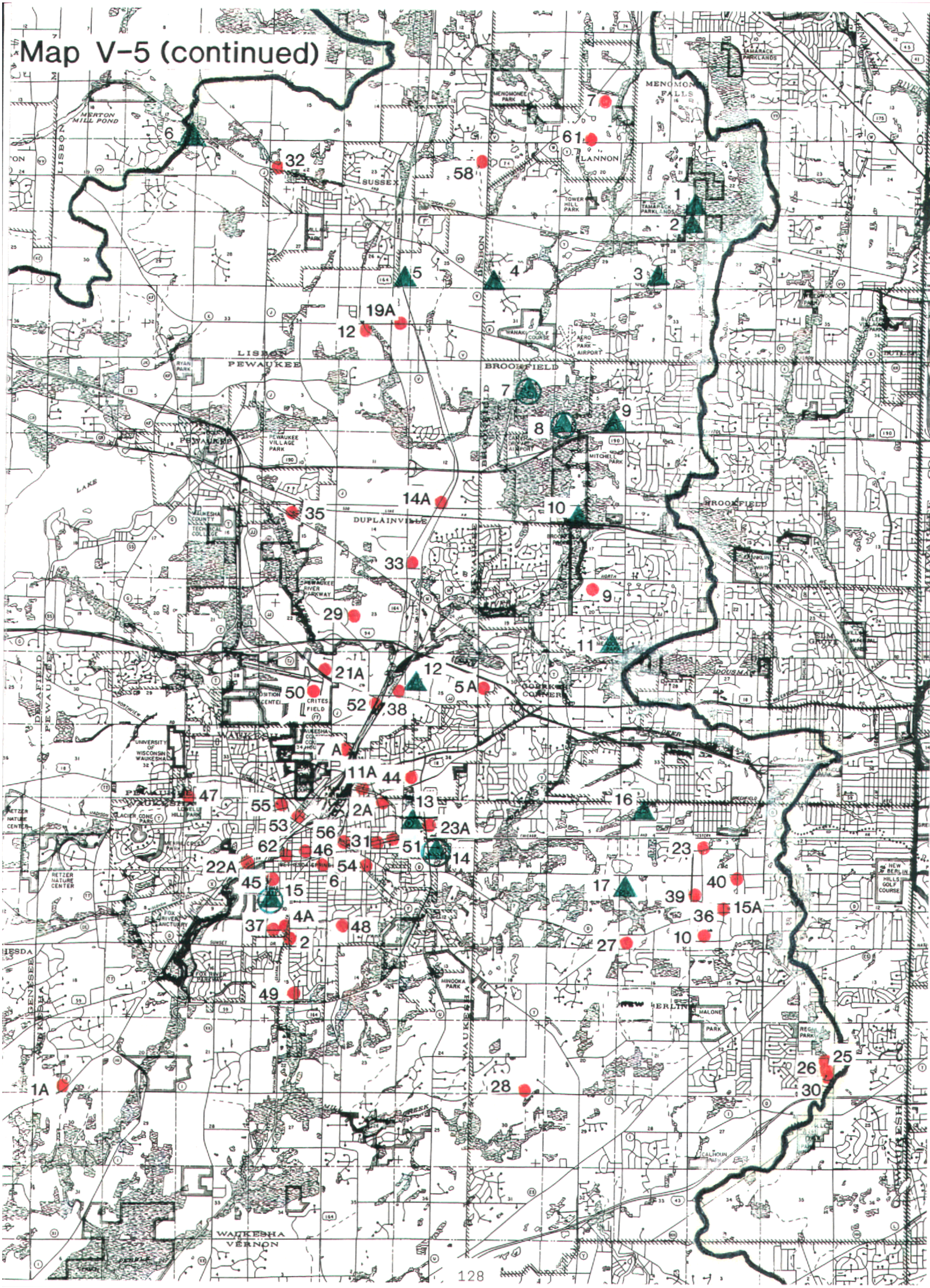
Map V-5

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



Source: SEWRPC.

Map V-5 (continued)



urban enclave population and the distance to the nearest planned year 2010 sewer service area are listed in Table V-11. One of these areas is served by a private sewage treatment plant. As shown in Table V-11, approximately one-half of these areas--37 of the 72 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 for incorporation into public sanitary sewer service areas. 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 Genesee Lakes, Lilly Lake, Powers Lake, Benedict-Tombeau Lake, Pell Lake, Booth Lake, Beulah Lake, North Lake, and Honey Lake. Generally, for all of the remaining enclaves located in areas where soils are not considered to meet current criteria, it is recommended that an inspection and maintenance program for the onsite sewage disposal system be instituted and that further site-specific planning to determine the best wastewater management practices be conducted at such time as significant problems become evident.

Miscellaneous Potential Pollution Sources

Landfills: Landfills in the Fox River watershed, including those currently abandoned, have the potential to affect water quality through 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 seven active landfills and 170 known abandoned landfills located in the Fox River watershed. Two of the abandoned landfills, the Master Disposal Service Landfill in the Town of Brookfield and the Muskego Sanitary Landfill located in the City of Muskego, were designated as high priority sites for the U.S. Environmental Protection Agency Superfund program which provides for the identification, evaluation, and clean up of hazardous waste sites. Three of the abandoned landfills, the City of Waukesha Sanitary Landfill located in the City of Waukesha, the Anchor Coatings, Inc. Landfill and the Martha Zaretzke Landfill, both located in the Town of Brookfield, have been identified for consideration under State programs for possible clean-up action due to the potential for groundwater and/or surface water contamination. The location of these and other landfills which are potentially impacting surface or groundwater in the Fox River watershed are shown on Map V-5 and listed in Table V-12.

In August 1984, the Master Disposal Service Landfill was designated as a high priority site for the Superfund program. The landfill, operational from 1962 until 1983, received various municipal and industrial wastes, including hazardous waste. Oil and other debris were reportedly released into channels at the site which drain into the Fox River. Analyses conducted in 1990 and 1991 to determine impacts of the landfill on surface water found significantly elevated levels of iron downstream of the site in the main drainage channel and in the Fox River. Levels of cadmium exceeding Federal and State ambient water quality criteria were also detected downstream of the site, while no cadmium was detected upstream of the site. Elevated levels of some volatile organic compounds and

Table V-11

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

Number[a]	Major Urban Concentration[b]	1990 Estimated Resident Population	Distance from Year 2010 Sewer Service Area (miles)
	Waukesha County		
1	Village of Menomonee Falls-Section 5[c]	310	0.5
2	Village of Menomonee Falls-Section 6[c]	115	0.5
3	Town of Lisbon-Section 15	134	--
4	Town of Lisbon-Section 21	169	0.5
5	Town of Lisbon-Section 20	347	1.0
6	Town of Lisbon-Sections 28 and 29	717	0.5
7	Town of Lisbon-Section 35[c]	138	0.3
8	Town of Lisbon-Section 31[c]	309	0.3
9	Town of Lisbon-Section 32[c]	238	0.5
10	Town of Pewaukee-Sections 1 and 12[c]	258	--
11	Town of Delafield-Sections 26 and 27[c]	423	--
12	City of New Berlin-Section 6[c]	486	--
13	City of New Berlin-Section 5[c]	225	--
14	City of New Berlin-Section 7[c]	113	--
15	Town of Genesee-Sections 10 and 11[c]	917	0.5
16	Town of Genesee-Sections 16 and 21	298	1.1
17	Town of Genesee-Section 15	130	1.2
18	Town of Genesee and Town of Waukesha Sections 13, 18, and 19	1398	--
19	City of New Berlin-Section 18	312	--
20	City of New Berlin-Section 17[c]	389	1.0
21	City of New Berlin-Section 16[c]	323	0.5

Table V-11 (cont'd)

Number[a]	Major Urban Concentration[b]	1990 Estimated Resident Population	Distance from Year 2010 Sewer Service Area (miles)
22	Town of Genesee-Sections 19 and 30[c]	566	2.7
23	Town of Genesee-Section 27	177	2.8
24	Town of Genesee-Section 25[c]	102	1.7
25	Town of Waukesha-Section 21	447	--
26	Town of Waukesha-Section 26	378	1.0
27	Town of Waukesha-Section 26	150	1.0
28	City of New Berlin and Town of Waukesha-Sections 19 and 24[c]	698	0.5
29	City of New Berlin-Sections 28, 29, 32, 33, and 34	1973	--
30	Town of Genesee-Section 35	330	3.0
31	Town of Waukesha-Section 33	100	1.6
32	Town of Waukesha-Section 35[c]	121	2.5
33	Town of Waukesha-Section 36	138	1.6
34	City of New Berlin-Section 31	774	1.0
35	Town of Mukwonago-Section 4[c]	113	3.0
36	Town of Mukwonago-Sections 5, 7, 8, 17, and 18	1545	1.7
37	Town of Mukwonago-Sections 9, 10, 15, 16, and 21	1791	0.5
38	Town of Vernon-Sections 18 and 19[c]	732	--
39	Town of Vernon-Sections 8 and 17	719	1.3
40	Town of Vernon-Sections 3, 4, and 10[c]	1725	2.6
41	Town of Vernon-Section 2[c]	302	2.2
42	Town of Vernon-Sections 11 and 14	331	1.6
43	Town of Vernon-Sections 1 and 12	667	--
44	Town of Vernon-Sections 13, 14, 23, and 24	1852	0.7
45	Town of Vernon-Section 15[c]	124	2.6

Table V-11 (cont'd)

Number[a]	Major Urban Concentration[b]	1990 Estimated Resident Population	Distance from Year 2010 Sewer Service Area (miles)
46	Town of Vernon-Section 27	176	2.0
47	Village of Eagle-Section 22	1130	1.3
48	Town of Eagle-Section 23	153	0.8
	Walworth County		
49	Town of Troy-Section 3[c]	133	1.0
50	Town of East Troy-Sections 4, 5, 8, 9, 10, and 18[c]	817	--
51	Town of Troy-Section 15	122	1.5
52	Town of Sugar Creek and Town of LaGrange-Sections 1, 25, 26, 35, 36[c]	595	3.5
53	Town of Sugar Creek-Section 5[c]	118	4.2
54	Town of Sugar Creek-Sections 1, 2, and 11	736	2.1
55	Town of Lafayette-Section 19	190	0.5
56	Town of Spring Prairie-Section 22	114	2.3
57	Town of Spring Prairie and Town of Rochester-Sections 13 and 18[c]	499	1.0
58	Town of Lyons-Section 1[c]	62	0.5
59	Town of Lyons-Sections 7 and 8[c]	534	--
60	Town of Geneva-Section 34	180	1.0
61	Town of Bloomfield-Section 2[c]	118	2.6
62	Town of Bloomfield-Sections 14, 15, 16, 21, and 22	1894	1.5
63	Town of Linn-Section 28	115	2.3
	Racine County		
64	Town of Burlington-Sections 17, 18, 19, and 20[c]	1651	1.7
	Kenosha County		
65	Town of Wheatland-Section 25[d]	516	2.5

Table V-11 (cont'd)

Number[a]	Major Urban Concentration[b]	1990 Estimated Resident Population	Distance from Year 2010 Sewer Service Area (miles)
66	Town of Wheatland-Section 34[c]	131	2.3
67	Town of Wheatland-Section 3[c]	132	2.0
68	Town of Wheatland and Town of Salem-Sections 1, 7, and 12[c]	579	--
69	Town of Wheatland-Section 11[c]	561	1.3
70	Town of Randall-Section 17	158	--
71	Town of Randall and Town of Wheatland and Town of Bloomfield-Sections 7, 13, 17, 18, 19, and 24	1068	0.5
72	Town of Randall-Section 35	256	0.2
	Total	36,689	--

[a] See Map V-4

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

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

[d] Served by a private sewage treatment plant.

Source: SEWRPC.

Table V-12

MISCELLANEOUS POTENTIAL POLLUTION SOURCES IN THE FOX RIVER WATERSHED: 1990

Map ID Number[a]	Landfills Indicated to Be Potential Pollution Sources	Civil Division Location	Surface Water Potentially Impacted
		Waukesha County:	
1	Industrial Waste Corp. Landfill[b]	Village of Menomonee Falls	Fox River
2	Mill Lands, Inc. Landfill[b]	Village of Menomonee Falls	Fox River
3	Unnamed landfill - Village of Menomonee Falls Section 28[b]	Village of Menomonee Falls	Fox River
4	Unnamed landfill - Village of Menomonee Falls Section 30[b]	Village of Menomonee Falls	Fox River
5	Vulcan Materials Landfill[b]	Town of Lisbon	Sussex Creek
6	Milwaukee Road Landfill[b]	Town of Lisbon	Sussex Creek
7[c]	Martha Zaretzke Landfill	Town of Brookfield	Fox River
8[d]	Master Disposal Sanitary Landfill	Town of Brookfield	Fox River
9	Fly ash disposal site[b]	City of Brookfield	Fox River
10	Unnamed landfill-City of Brookfield Section 17[b]	City of Brookfield	Fox River
11	United Waste Systems Landfill[b]	City of Brookfield	Poplar Creek
12	Johnson Sand and Gravel Landfill[b]	Town of Pewaukee	Fox River
13	Unnamed landfill-Town of Waukesha Sec. 1[b]	Town of Waukesha	Fox River
14[c]	Anchor Coatings, Inc. Landfill	City of Waukesha	--
15[c]	City of Waukesha Sanitary Landfill	City of Waukesha	Fox River
16	Industrial Waste Corp. Landfill[b]	City of New Berlin	Poplar Creek
17	Bodus Landfill[b,e]	City of New Berlin	Poplar Creek
18[d]	Muskego Sanitary Landfill	City of Muskego	--
	Leaking Underground Storage Tank Sites[f,g]		Receiving Water
1	Trent Tube-Division of Crucible Materials	Village of East Troy, Walworth County	Honey Creek
2	Herb's Service	Village of Williams Bay, Walworth County	Lake Geneva
3	Uhen's Garage	Town of Wheatland, Kenosha County	groundwater
	Additional Groundwater Contamination Sites[f,h]		Receiving Water
1	West Shore Pipeline Company	Town of Norway, Racine County	Wind Lake Drainage Canal tributary

[a] Refers to Map V-5, Point Sources of Pollution other than Sewage Treatment facilities in the Fox River Watershed: 1990.

[b] As indicated in Wisconsin Department of Natural Resources, Upper Fox River Priority Watershed Stream Appraisals, February 1993.

[c] Identified for State action.

[d] Superfund site.

[e] Bodus Landfill was determined to have collected mixed industrial wastes during its operation and is considered by the U.S. Environmental Protection Agency to have potentially accepted hazardous wastes. A comprehensive site assessment has not yet been completed.

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

[g] As of 1993, there were three additional leaking underground storage tank sites in the Fox River watershed whose remediation discharges were permitted under the Wisconsin Pollutant Discharge Elimination System: Horn Oil Company in the Village of Mukwonago, Waukesha County which is permitted to discharge to Vernon Marsh via a drainage ditch; Burlington Consumer Cooperative in the City of Burlington, Racine County which is permitted to discharge to the Fox River; and Genesee Aggregate Corporation in the Village of Sussex, Waukesha County which is permitted to discharge to groundwater.

[h] As of 1993, there was one additional groundwater contamination site whose remediation discharges were permitted under the Wisconsin Pollutant Discharge Elimination System: STS Consultants LTD-Waukesha Foods Warehouse in the City of Waukesha, Waukesha County which is permitted to discharge to the Fox River.

Source: Wisconsin Department of Natural Resources and SEWRPC.

inorganic compounds were also found in groundwater downgradient of the site. Remedial actions are currently underway at this landfill site.

The Muskego Sanitary Landfill was designated as a Superfund site in September 1985. During its operation from 1954 to 1981, household, municipal, industrial, and commercial wastes were accepted at the site, including waste oils and paint products. Samples taken from on-site monitoring wells and residential wells near the site indicated contamination of groundwater from volatile organic compounds and other chemical contaminants. As permanent surface water features are not present on or near the site, impacts to surface water are considered minimal. Remediation efforts for the Muskego Sanitary Landfill are currently underway.

<u>Leaking Underground Storage Tanks</u>: Leaking Underground Storage Tanks in the Fox 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 (WPDES) to discharge remediation wastewater to surface or ground water. Discharges from these sites are required to meet specified water quality discharge standards set forth by the Wisconsin Department of Natural Resources.

As of 1990, there were three known, permitted leaking underground storage tank sites that were discharging remediation waters to surface waters and one known, permitted leaking underground storage tank discharging remediation waters to groundwater in the Fox River watershed, as indicated in Table V-12 and shown on Map V-5. As of 1993, there were three additional leaking underground storage tanks in the Fox River watershed whose remediation wastewaters were permitted to discharge to surface or ground waters, as shown in Table V-12.

As of 1993, there were 365 additional leaking underground storage tanks in the Fox River watershed identified by the DNR that were not discharging remediation wastewater directly to surface or ground waters. While there is little evidence to document the impact of these individual point sources on water quality within the watershed, it can reasonably be assumed that the cumulative effect of multiple leaking underground storage tanks has the potential to result in detrimental effects on water quality over time.

<u>Additional Groundwater Contamination Sites:</u> 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, as indicated in Table V-12. As of 1993, there was one additional such site known to be discharging to surface water, as indicated in Table V-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, wastes from livestock operations, malfunctioning septic systems, and pollutant contributions from the atmosphere.

Existing Conditions and Status of Plan Implementation

For the Fox 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, onsite sewage disposal system management, and streambank erosion control. The plan recommended that additional nonpoint source controls be provided in certain areas. Within the urban areas of the Big Muskego, Denoon, Little Muskego, Pewaukee, Waubeesee, and Wind Lake drainage areas, the plan recommends a reduction of nonpoint source pollution by about 50 percent. Within the rural areas of the Big Muskego, Center, Denoon, Eagle Spring, Little Muskego, Pewaukee, and Wind Lake drainage areas, the plan recommends a reduction of about 75 percent. Finally, in the rural areas of the Benedict/Tombeau, Dyer, Kee Nong Go Mong, Lulu, North-Walworth, Pell, Powers, and Waubeesee Lake drainage areas, the plan recommends a reduction in nonpoint source pollution of about 50 percent.

In 1970, the Commission prepared a comprehensive plan[7] for the Fox 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 Fox 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, Racine, Walworth, and Waukesha 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 also been made in the area of construction site erosion control. As of January 1993, Waukesha and Walworth Counties; the Cities of Brookfield, Muskego, New Berlin, and Waukesha; the Villages of Fontana on Geneva Lake and Williams Bay; and the Town of Delafield 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 Villages of Big Bend, North Prairie, Silver Lake, and Sussex, and the Towns of Lisbon, Norway, Mukwonago, and Salem also had ordinances providing for construction site erosion control requirements which were developed independently from the model.

With regard to rural nonpoint source pollution controls, Chapter NR 243 of the Wisconsin Administrative Code sets forth design standards and accepted animal waste management practices for large animal feeding operations. This program is administered by the Wisconsin Department of Natural Resources, which works with the County Land Conservation Departments to resolve identified significant animal waste problems. This program has been used in a few selected cases in

[7]SEWRPC Planning Report No. 12, A Comprehensive Plan for the Fox River Watershed, February 1970.

the Fox River watershed. Other programs, such as the Conservation Reserve Program administered by the U.S. Department of Agriculture, Soil Conservation Service, and wetland restoration programs administered by the Wisconsin Department of Natural Resources and others are utilized primarily for cropland soil erosion control and wildlife habitat purposes and will have positive water quality impacts.

Chapter ATCP 50 of the Wisconsin Administrative Code requires that soil erosion on all croplands be reduced to tolerable levels by the year 2000. Tolerable levels are defined as soil loss tolerances or T-values, which are the maximum annual average rates of soil loss for each soil type that can be sustained economically and indefinitely without impairing the productivity of the soil. These values have been determined for each soil type by the U.S. Soil Conservation Service. Chapter 92 of the Wisconsin State Statutes requires that soil erosion control plans be prepared and maintained for counties identified by the Wisconsin Department of Agriculture, Trade and Consumer Protection as priority counties for soil erosion control. The Commission has prepared agricultural soil erosion control plans for Kenosha, Racine and Waukesha Counties. In addition, an agricultural soil erosion control plan for Walworth County was prepared by a consultant. Thus, these plans have been prepared for all rural areas of the Fox River watershed in Southeastern Wisconsin. 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 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.

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.

As of 1993, there were two priority watershed projects[8] underway in the Fox River watershed. These projects are the Upper Fox River priority watershed project[9] and the Little Muskego, Big Muskego, and Wind Lakes priority watershed project.[10]

Little Muskego, Big Muskego, and Wind Lake Priority Watershed Project: The Little Muskego, Big Muskego, and Wind Lakes Priority Watershed Project was designated a "priority watershed" in 1991. Planning for the Little Muskego, Big Muskego, and Wind Lakes priority watershed project was completed in 1993, and implementation of practices began in January 1994 and will continue for eight years. Rural elements of the Little Muskego, Big Muskego, Wind Lake priority watershed project are administered by both the Waukesha and Racine County Land Conservation Committees. Urban elements of the project are being implemented by other local units of government including the Cities of Muskego and New Berlin, the Town of Norway, the Big Muskego/Bass Bay Lake District, the Little Muskego Lake District, and the Wind Lake Management District.

The Little Muskego, Big Muskego, and Wind Lake priority watershed project established pollutant reduction goals of 55 percent for sediment and 60 percent for phosphorus. The program had no specific reduction goal for metals and other toxic materials from urban runoff. However, the plan indicated that controls of these materials would be achieved by the practices needed to meet reductions for sediment and phosphorus. The loading reductions noted above were based upon further lake modeling analyses work conducted by the Wisconsin Department of Natural Resources staff for Big Muskego and Little Muskego Lakes and upon the completed modeling work conducted by the Regional Planning Commission for Wind Lake. The nonpoint source pollutant reduction goals set forth in the Little Muskego, Big Muskego, and Wind lakes priority watershed project are similar to those established in the initial regional water quality management plan.

To achieve the recommended pollutant reduction goals, the Little Muskego, Big Muskego, and Wind Lakes priority watershed plan included recommendations and funding eligibility for the following projects:

Rural Land Management--

- Provision of streambank erosion control practices for fourteen specific sites with a total of about 6,900 feet of eroding streambank. Upon full implementation, the installation of erosion control measures would reduce the sediment loading from streambanks in the study subwatershed by about 60 percent.

- Preparation of detailed conservation plans to develop the best management practices for about 2,000 acres of cropland. Upon full implementation, these practices would reduce the sediment loading from croplands in the study subwatershed by about 60 percent.

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[8]During 1994, a third priority watershed project was initiated for the Camp-Center Lakes subwatershed.

[9]Wisconsin Department of Natural Resources, A Nonpoint Source Pollution Control Plan for the Upper Fox River Priority Watershed Project, November 1993.

[10]Wisconsin Department of Natural Resources, A Nonpoint source Pollution Control Plan for the Muskego/Wind Lakes Priority Watershed Project, October 1993.

- Installation of facilities and management practices for two barnyards representing a reduction of about 87 percent of the phosphorus loading from barnyards in the study subwatershed.

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 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. The plan further recommends the development of a "segmented program" providing for stormwater management planning, possible stormwater ordinance requirements, streambank stabilization, street sweeping, and the design and construction of management practices. Specific core and segmented program elements include:

- Provision of construction site erosion control for about 900 acres of new urban development which is expected in the watershed during the planning period. Implementation of such controls should reduce the sediment and phosphorus loading from construction sites up to 75 percent.

- Conduct information and education programs to educate policy makers, elected officials, and citizens about urban and rural nonpoint pollution.

- The preparation of detailed stormwater management plans to determine the best practices to be installed in the urban areas. These plans address water quantity and quality problems in developed and developing urban areas.

Upper Fox River Priority Watershed Project: The Upper Fox River priority watershed project was designated a "priority watershed" in 1990. Planning for the Upper Fox River priority watershed project was completed in 1993, and implementation of practices began in January 1994 and will continue for eight years.

Rural elements of the Upper Fox River priority watershed project are administered by the Waukesha County Land Conservation Committee. Urban elements of the project are being administered by the Cities of Brookfield, New Berlin, and Waukesha; the Villages of Hartland, Lannon, Menomonee Falls, Pewaukee, Sussex, and Wales; the Towns of Brookfield and Pewaukee; and the Pewaukee Lake Sanitary District.

The Upper Fox River priority watershed project established nonpoint source pollutant reduction goals to obtain sediment loading reductions and phosphorus reductions ranging from 49 to 75 percent for the subareas considered. These loading reductions were based primarily upon field inventories of the streams in the Upper Fox 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. 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 Upper Fox River priority watershed plan are consistent with the recommendations of the initial plan for the area tributary to Pewaukee Lake. For the remaining areas of the Upper Fox River watershed, the priority watershed project reduction goals exceed those of the initial areawide water quality management plan.

The recommendations of the priority watershed plan for the rural areas are plans generally low in cost and are generally consistent with the County soil erosion control plans and other County land conservation programs. Certain components of the plan recommendations for the urban and urbanizing areas such as construction erosion control, are expected to be readily implemented. However, other components of the recommended plan such as retrofitting urban land management practices in developed areas are costly and full implementation will be difficult.

To achieve these pollutant reduction goals, the Upper Fox River priority watershed project includes recommendations and funding eligibility for the following rural and urban nonpoint source control measures. The levels of nonpoint source reduction used to develop the cost-eligible practices are generally similar to those recommended in the initial plan for the area tributary to Pewaukee Lake. However, higher levels of reduction are used in the priority watershed plan than were recommended in the initial plan for the remainder of the Upper Fox River subwatershed. The plan also recommended that further detailed stormwater management planning and assessments be carried out as part of the subsequent plan implementation actions.

Rural Land Management--

- Provision of fencing and other streambank erosion control practices for about 36,000 feet of eroding streambank. Upon full implementation, the installation of erosion control measures would reduce the sediment loading from streambanks in the study subwatershed by about 75 percent.

- Formation of detailed conservation plans to develop the best management practices for about 1,300 acres of cropland. Upon full implementation, these practices would reduce the sediment loading from croplands in the study subwatershed by about 50 to 70 percent.

- Installation of management practices for 17 barnyards representing a reduction of about 69 percent of the phosphorus loading from barnyards in the study subwatershed.

- Installation of facilities and management practices for 16 livestock operations to change manure spreading practices. This will reduce the phosphorus loading from such operations by about 70 percent.

- Improved nutrient and pesticide management for eligible cropland.

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 fertilizers. 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 site erosion control for about 6,000 acres of new urban development which is expected in the watershed during the planning period. Implementation of such controls should reduce the sediment and phosphorus loading from construction sites by about 70 percent.

- Provision of nonpoint source control practices on about 5,400 acres of existing urban land and about 6,000 acres of new urban land are 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 areas. These plans address water quantity and water quality problems in developed and developing urban areas.

<u>Current Plan Recommendations</u>: It is recommended that construction site erosion control, onsite sewage system management, and streambank erosion controls, plus land management practices designed to provide about a 25 percent reduction in nonpoint source pollutant loadings be carried out throughout the Fox River watershed. Additional nonpoint source controls are recommended to be provided in certain areas to provide from about 50 to 75 percent reduction in nonpoint source pollution. Within the urban areas in the drainage areas of Denoon, Little Muskego, Pewaukee, Waubeesee, and Wind Lakes, it is recommended that additional practices providing for levels of control for about a 50 percent reduction in nonpoint source loadings be provided. Also, it is recommended that additional practices providing for about a 50 percent reduction in nonpoint source pollutant loadings be provided in the Benedict/Tombeau, Dyer, Kee Nong Go Mong, Lulu, North-Walworth, Pell, Powers, and Waubeesee Lake drainage areas and about a 75 percent reduction in nonpoint source loading from rural lands be provided in the Center, Denoon, Eagle Spring, and Pewaukee drainage areas. In addition, it is recommended that nonpoint source control measures to achieve a 55 percent reduction in sediment and a 60 percent reduction in phosphorus be carried out in the Big Muskego, Little Muskego, and Wind Lakes drainage area. It is further recommended that the levels of control set forth above as developed for the urban and urbanizing areas under the Upper Fox River priority watershed project, be utilized as the initial basis for stormwater management planning and 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.

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 Fox River 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 plans in rural areas should be conducted to determine the practices to be installed. The current priority ranking of watersheds for inclusion in that program is documented in a memorandum[11] prepared by the Regional Planning Commission using Wisconsin Department of Natural Resources procedures and is summarized in Chapter XVIII. That ranking included the Fox River watersheds in the high category, indicating that inclusion in the program will be possible in the future, when the existing planning projects are completed, or additional funds and staff become available 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 Fox River watershed on a sustained basis by the Wisconsin Department of Natural Resources (DNR) at two stations located on the Fox River main stem, one at CTH I just south of the City of Waukesha and one at Prairie Avenue in the City of Waukesha; and by the U.S. Geological Survey at one station located on the Fox River main stem at Russell Road about 1.5 miles south of the Wisconsin-Illinois State line, as shown on Map V-6. In addition, during 1991 and 1992, water quality and biological assessment monitoring has been carried out in the Upper Fox River subwatershed by the Wisconsin Department of Natural Resources. Short-term monitoring has also been conducted at 27 sites by the DNR during the period 1988 through 1993, as described later in this chapter. Some of these water quality sampling surveys were limited to one sample and only a few basic parameters were analyzed as dictated by the specific intended use of the surveys. However, data collected at about 25 sites, as shown on Map V-6, was considered to be potentially useful for review along with the long-term monitoring data to characterize the water quality.

Currently, water quality monitoring is being carried out on several lakes as part of the DNR Self-help Program, including Benedict/Tombeau, Beulah, Big Muskego, Bohner, Booth, Camp, Center, Cross, Eagle, Eagle Spring, Elizabeth, Geneva, Lilly, Little Muskego, Mary, Pell, Pleasant, Powers, Silver Lakes (Kenosha County), Spring Lake (Waukesha County), Upper Phantom and Waubeesee Lakes and the Waterford Impoundment (Racine County). In addition, limited additional water quality monitoring has been carried out on some of the major

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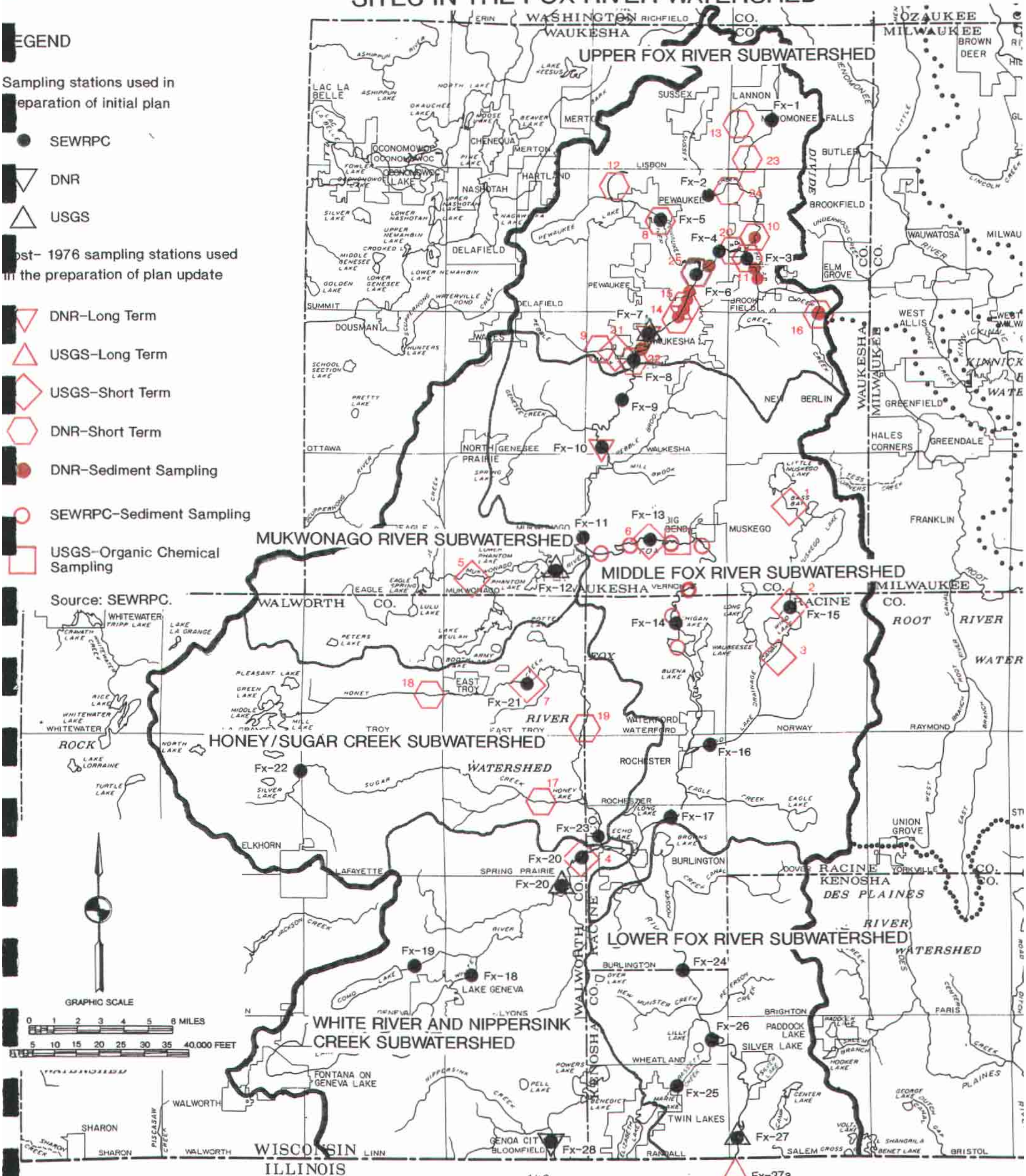
[11]See SEWRPC Memorandum entitled "Assessment and Ranking of Watersheds for Nonpoint Source Management Purposes in Southeastern Wisconsin: 1993."

Map V-6

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



lakes in the watershed by the U.S. Geological Survey, the Wisconsin Department of Natural Resources, local lake management agencies, and the Southeastern Wisconsin Regional Planning Commission.

Water resource appraisal monitoring was conducted in 1990 for the Upper Fox River watershed as part of the Upper Fox River Priority Watershed Project. Future evaluation monitoring is anticipated to be conducted for the Upper Fox River watershed as part of the evaluation phase of the priority watershed project. The Department has placed increased emphasis on monitoring and assessment of surface water quality[12] in all watersheds and now envisions carrying out a one-year intensive monitoring program in the Fox River watershed about once every five to seven years.

As part of the process of reviewing and evaluating public sewage treatment plant effluent requirements for meeting water quality standards, the DNR is currently conducting a study to assess the total maximum daily pollutant loadings from both point source and nonpoint sources which would desirably be discharged to the Upper Fox River in the reaches of the River most directly affected by the Sussex, Brookfield, and Waukesha sewage treatment plants. The analysis is being conducted to estimate the total allowable loadings to the Upper Fox River system based upon established dissolved oxygen and phosphorus standards. The total maximum daily loads calculated are anticipated to potentially affect the permitting of point sources of pollution and the level of control recommended to be achieved through nonpoint source pollution abatement programs in the watershed.

<u>Current Plan Recommendation</u>

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 U.S. Geological Survey at stations Fx-7, Fx-10, and Fx-27a 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 three stations and at 14 selected additional stations, with three stations located on the main stem of the Fox River and one station each located on Sussex Creek, Genesee Creek, Poplar Creek, Honey Creek, Sugar Creek, the Pewaukee River, the Mukwonago River, the White River, the Wind Lake Drainage Canal, Nippersink Creek, and Bassett Creek. It is recommended that this program be conducted within the next five to seven years and repeated at approximately five- to seven-year intervals. These recommendations can be coordinated with and are consistent with the Wisconsin Department of Natural Resources current surface water monitoring strategy developed to conduct monitoring activities and perform basic assessments for each 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 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 should be expanded to establish current conditions during a

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[12]Wisconsin Department of Natural Resources, <u>Surface Water Monitoring Strategy</u>, WR299-92, 1992.

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 Lakes Denoon, Waubeesee, Powers, Big Muskego, Kee Nong Go Mong, Eagle Spring, Little Muskego, Eagle and Potter, and the DNR under the Long-Term Trends Program on Browns and Pewaukee 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 Fox 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 Fox 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 section, 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 Fox River watershed is discussed for each major lake in the following paragraphs:

Army Lake: No specific plan implementation activities are documented for this lake as of 1993. The urban development surrounding the lake is recommended to be provided with a public sanitary sewer system.

Benedict/Tombeau Lakes: Both lakes are enrolled in the DNR Self-help Monitoring Program and are subject to on-going water clarity monitoring by citizen volunteers.

Beulah Lake: The Town of East Troy Sanitary District No. 1 is actively involved in operating an aquatic plant harvesting program on the lake. Incipient growths of *Myriophyllum spicatum*, Eurasian water milfoil, have been observed and were targeted for specific control measures including manual controls, sediment covering, and site specific chemical treatments beginning in 1993 when a Eurasian Water Milfoil Plan was completed for the Lake. The Sanitary District also participates in the DNR Self-help Monitoring Program and maintains dissolved oxygen and temperature profiles for five sample sites on the Lake.

Big Muskego Lake: The Big Muskego/Bass Bay Protection and Rehabilitation District was formed of properties around the Lake and has conducted lake water quality studies with the assistance of a Chapter NR 119 Lake Management Planning Grant. Water level manipulations have been recommended in the Wind Lake Management Plan which is currently being implemented.[13] The District is participating in the DNR Self-help Monitoring Program and has an active public information role. The lake is included in the Muskego-Wind Lakes Priority Watershed Project planning area[14] and, together with Wind Lake, is the subject of a U.S. Environmental Protection Agency Clean Lakes grant to partially fund the costs of an anticipated drawdown pursuant to the Big Muskego Lake management elements of the Wind Lake Management Plan.[15] The area adjacent to Bass Bay on the northern shore of the Lake is currently provided with a public sanitary sewer system with that system being connected to the Milwaukee Metropolitan sewerage system; the local sewage treatment plant which historically discharged to the lake was abandoned in 1984, as was recommended in the initial plan.

Bohner Lake: The Bohners Lake Improvement Association obtained an NR 119 Lake Management Planning Grant and has completed a plan addressing nonpoint source pollution-related problems at its inlet.[16] This study recommended application of watershed-based soil loss control measures or use of a sediment control structure at the lake inlet. The Association is a participant in the DNR Self-help Monitoring Program. An approved aquatic plant management plan has been prepared for the Lake and serves as the basis for aquatic plant management activities on the Lake. A sanitary district was formed of properties around the lake and facility planning recommending a public sanitary sewer system for the urban development around the lake was completed.[17]

Booth Lake: A portion of the urban development surrounding the lake is recommended to be provided with a public sanitary sewer system. The Booth Lake Property Owners Association participates in the DNR Self-help Monitoring Program. Booth Lake has recently been included in a DNR sensitive areas survey which determined that the entire waterbody was potentially sensitive to habitat disturbances.

Browns Lake: This is a DNR Long-term Trend Monitoring lake, the lakeshore of which has been provided with a public sanitary sewer system by the Browns Lake Sanitary District. The District also conducts aquatic plant management activities on the Lake in accordance with an approved aquatic plant management plan.[18]

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[13] SEWRPC Community Assistance Plan No. 198, A Management Plan for Wind Lake, Racine County, Wisconsin, December 1991.

[14] Wisconsin Department of Natural Resources, Publication No. WR-340-93, A Nonpoint Source Control Plan for the Muskego-Wind Lakes Priority Watershed Project, October 1993.

[15] Muskego-Wind Lakes Priority Watershed Newsletter, Big Muskego Lake-Bass Bay Management Alternatives, March 1994.

[16] R.A. Smith & Associates, Inc., Bohners Lake Inlet Watershed Study, March 1993.

[17] Crispell-Snyder, Inc., Bohners Lake Facilities Plan, May 1992.

[18] Aron & Associates, Browns Lake Plant Management Plan, 1992.

Camp Lake: Lake management actions on Camp Lake are conducted under the auspices of the Camp and Center Lake Rehabilitation District, which is preparing a lake management plan with the assistance of funding provided under the Chapter NR 119 Lake Management Planning Grant Program. The present studies are being conducted to develop a proposed dam improvement project. Camp Lake has an approved aquatic plant management plan. Camp and Center Lakes are also included in the nonpoint source pollution abatement priority lakes watershed planning program initiated during 1993. On-going water clarity monitoring is conducted through the DNR Self-help Monitoring Program. All of the urban development around the lake is provided with a public sanitary sewer system, as was recommended in the initial plan.

Center Lake: Adjoining Camp Lake, the Camp and Center Lake Rehabilitation District conducts regular monitoring of this Lake under the DNR Self-help Monitoring Program. The District is also undertaking preparation of a lake management plan with assistance of funding provided by the Chapter NR 119 Lake Management Planning Grant Program and is participating with other governmental units in the nonpoint source pollution abatement priority watershed planning program initiated on Camp and Center Lakes during 1993. This lake also has an approved aquatic plant management plan. All of the urban development of the lakeshore is provided with a public sanitary sewer system, as was recommended in the initial plan.

Lake Como: The Town of Geneva conducts an aquatic plant management program on the lake and has an approved aquatic plant management plan. Small portions of the developed areas on the southwestern shore of the Lake, including the Interlaken Resort, are connected to a public sanitary sewer system operated by the Geneva National Sanitary District. The Town of Geneva has received a Chapter NR 119 Lake Management Planning Grant to assist in completing a sewerage system facilities study to evaluate the best means to extend sewer services to the urban development around this lake. The urban development around this lake is recommended to be provided with a public sanitary sewer system.

Cross Lake: This lake has a property owners association which participates in the DNR Self-help Monitoring Program. The urban development of the lakeshore is provided with a public sanitary sewer system, as was recommended in the initial plan.

Lake Denoon: The Lake Denoon Advancement Association has received a Chapter NR 119 Lake Management Planning Grant to assist in preparing water quality elements of a lake management plan for the lake. Water quality studies are being carried out by Tri-Lakes Conservation Inc., which serves Lake Denoon and its neighbors Waubeesee and Kee Nong Go Mong Lakes. A stormwater detention pond system has been proposed, and partially implemented by the Association, to reduce nonpoint source loads on the Lake. The urban development of the lakeshore and areas north of the lake are provided with a public sanitary sewer system, as was recommended in the initial plan.

Dyer Lake: No recent data are available and no specific plan implementation activities have been documented for this lake as of 1993.

Eagle Lake: A watershed-wide lake user survey was completed in 1991.[19] This survey documented the continued decline of the lake's water quality as perceived by the surrounding community, a decline supported by the monitoring data. In conjunction with this perceived decline in water quality, a fish eradication project was conducted on the Lake during 1992. The Eagle Lake Property Owners Improvement Association have received a Chapter NR 119 Lake Management Planning Grant to assist in the preparation of a lake management plan, the aquatic plant management portion of which has been completed.[20] The Association participates in the DNR Self-help Monitoring Program. The urban areas of the lake have been provided with a public sanitary sewer system as recommended in the initial plan. Dam and dike modifications were undertaken during 1992.

Eagle Spring Lake: A management plan for the lake is being prepared with financial assistance being awarded to the Eagle Spring Lake District under the Chapter NR 119 Lake Management Planning Grant Program. This program is also financing in part water quality studies being carried out by the USGS. The District also participates in on-going monitoring under the DNR Self-help Monitoring Program. The urban development around the lake is recommended to be provided with a public sanitary sewer system.

Echo Lake: The southern and eastern shores of the Echo Lake have been provided with a public sanitary sewer system.

Elizabeth Lake: Refinement of the lake management proposals developed for this lake under the earlier lake management plan has been undertaken with the financial assistance of a Chapter NR 119 Lake Management Planning Grant awarded to the Twin Lakes Protection and Rehabilitation District. Both watershed and in-lake management measures were recommended in this plan refinement.[21] Specifically, adoption of construction site erosion ordinances, preparation of a stormwater plan, and close liaison with government units in the watershed was recommended. In the lake, limited dredging was suggested. The District undertakes regular water clarity monitoring of the lake under the DNR Self-help Monitoring Program. The urban development of the lakeshore is provided with a public sanitary sewer system.

Geneva Lake: Geneva Lake was the first of Wisconsin's lakes to have a lake association, and several local associations continue to be active around the lake. The Geneva Lake Environmental Agency, created by intergovernmental agreement between the lakeshore municipalities, is actively involved in lake management activities both on the lake and in the immediate watershed. One of the lake associations, The Geneva Lake Conservancy, Inc., has received funding to permit the Geneva Lake Environmental Agency to undertake watershed nonpoint source contaminant modelling with assistance from the Chapter NR 119 Lake Management Planning Grant Program. In addition, the DNR conducts an ongoing monitoring program of the wetlands located in Big Foot Beach State Park. An

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[19]Michael J. Losik & Associates, Inc., Eagle Lake Lake Management Planning Grant, October 1992.

[20]Aron & Associates, Eagle Lake Plant Management Plan, May 1995.

[21]Discovery Group Ltd and Blue Water Science, Lake Management Plan: Twin Lakes Protective and Rehabilitation District, Twin Lakes, Wisconsin, February 1993; Aron & Associates, Twin Lakes Plant Management Plan, May 1995.

approved aquatic plant management plan has been prepared for Geneva Lake, and the lake is monitored regularly under the DNR Self-help Monitoring Program. A lake management plan for the Lake was prepared and approved in 1985.[22] The incorporated communities, including the City of Lake Geneva and the Villages of Williams Bay and Fontana on Geneva Lake, are provided with public sanitary sewer systems.

Kee Nong Go Mong Lake (Long Lake): Water quality studies are currently being carried out by Tri-Lakes Conservation, Inc. with partial funding provided under the Chapter NR 119 Lake Management Planning Grant Program. Tri-Lakes Conservation Inc. serves Kee Nong Go Mong Lake, Lake Denoon and Waubeesee Lake. Enrollment of this lake in the DNR Self-help Monitoring Program is recommended. A water use management plan for the lake's outlet channel, the Anderson Canal, is being implemented.[23]

Lauderdale Lakes: Lauderdale Lakes comprise the three interconnected lake basins of Green, Middle and Mill Lakes. The lakes are currently being monitored as part of the planning program being undertaken by the Lauderdale Lakes Improvement Association, Lauderdale Lakes Protection and Rehabilitation District, and Town of LaGrange, with partial funding provided under the Chapter NR 119 Lake Management Planning Grant Program. The District is evaluating several options for the treatment of sanitary sewerage/septage generated by surrounding households. Continued reliance on onsite and clustered sewage disposal systems is currently the District's preferred alternative.[24] Lauderdale Lakes have an approved aquatic plant management plan.

Lilly Lake: The Lilly Lake Rehabilitation District participates in the DNR Self-help Monitoring Program.

Little Muskego Lake: Both the Little Muskego Lake Association and Little Muskego Lake Protection and Rehabilitation District are actively involved with lake management issues, including the installation and maintenance of a controversial aeration system. As a result of investigations conducted with the financial assistance of Phase I and Phase II Chapter NR 119 Lake Management Planning Grants, the effectiveness of the aeration system in the lake was assessed and the system was shut down in 1991. Under a Phase III Lake Management Planning Grant, a lake management plan is being prepared in which aeration will again be evaluated as a management option for the Lake. The lake organizations also have an approved aquatic plant management plan. The DNR also recently completed a sensitive area survey of the Lake. The Lake is included in the

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[22] SEWRPC Community Assistance Planning Report No. 60, A Water Quality Management Plan for Geneva Lake, Walworth County, Wisconsin, October 1985.

[23] SEWRPC Community Assistance Planning Report No. 182, A Water Use Management Plan for Waubeesee Lake and the Anderson Canal, Racine County, Wisconsin, December 1990.

[24] R.A. Smith & Associates, Inc. Final Report for the Lauderdale Lakes Area and Wastewater Feasibility Study for the Lauderdale Lakes Management District, March 1992; and RUST Environment and Infrastructure, Inc., Facilities Plan for Wastewater Collection and Treatment Facilities, Lauderdale Lakes, Wisconsin, 1994.

Muskego-Wind Lakes Priority Watershed planning area[25] under whose auspices an appraisal of lake water quality was recently completed. Monitoring of the lake is undertaken as part of the DNR Self-help Monitoring Program. The lakeshore is provided with a public sanitary sewer system.

Long Lake (Burlington/Rochester, Racine County): No recent data are available on this lake, and no specific plan implementation activities have been documented as of 1993.

Lulu Lake: No specific plan implementation activities have been documented for this lake as of 1993 but it is currently classified by the DNR as an "Outstanding Resource Water." Some aspects of the management of the lake are being addressed in the water quality management plan being prepared for Eagle Spring Lake which is located immediately downstream.

Lake Mary (Marie Lake): Refinement of the proposals relating to the Twin Lakes--Lakes Elizabeth and Mary--contained in the previous lake management plan for the lakes was undertaken with the financial assistance through a Chapter NR 119 Lake Management Planning Grant awarded to the Twin Lakes Protection and Rehabilitation District. The refined plan has been summarized above and recommends both in-lake and watershed-based protection actions be implemented by the District and surrounding units of government. The District undertakes regular water clarity monitoring of the lakes under the DNR Self-help Monitoring Program. All of the urban development around the lake is provided with a public sanitary sewer system.

North Lake (Walworth County): No recent data are available and no specific plan implementation activities have been documented for this lake as of 1993.

Pell Lake: A previously inactive lake association has been recently resurrected by lakeshore residents in response to growing concerns over aquatic plant growth in the waterbody. The Association has enrolled in the DNR Self-help Monitoring Program and is initiating the collection of Secchi disc transparency readings as of 1994. A sanitary district was formed of properties around the Lake and facility planning recommending a public sanitary sewer system for the urban development around the lake is completed.[26]

Peters Lake: No specific plan implementation activities have been documented for this Lake as of 1993.

Pewaukee Lake: This lake is a DNR Long-term Trends Monitoring Lake. The Lake Pewaukee Sanitary District conducts an aquatic plant harvesting operation in accordance with an approved aquatic plant management plan, and conducts lake-related environmental education outreach programs throughout the District. This District, and the Village and Town of Pewaukee, provide sewerage services to the larger part of the lakeshore as was recommended in the initial plan. The Lake Pewaukee Sanitary District also participates in the DNR Self-help Monitoring Program, and has received Chapter NR 119 Lake Management Planning Grant funding to assist in conducting studies of nutrient loading and boat traffic effects on

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[25]Wisconsin Department of Natural Resources Publication No. WR-340-93, op.cit.

[26]Baxter and Woodman, Inc., Pell Lake Sanitary District No. 1 Facilities Planning Report, June 1993.

the lake. A lake management plan for Pewaukee Lake has been prepared.[27] The lake is included in the Upper Fox River priority watershed planning area.

Pleasant Lake: Recently concerns have been raised about the presence of Myriophyllum spicatum, Eurasian water milfoil, in this lake, and the Wisconsin Department of Natural Resources has assisted residents in controlling this plant, including limiting its spread to other waterbodies. The Pleasant Lake Protection and Rehabilitation District conducts regular water clarity monitoring of the lake as part of the DNR Self-help Monitoring Program.

Potter Lake: The lakeshore area of Potter Lake is sewered by the Town of East Troy Sanitary District No. 2. Water quality monitoring in the lake is being conducted by the Potter Lake Protection and Rehabilitation District with funding assistance provided under Chapter NR 119. Compilation of an aquatic plant management plan has been completed, and a lake management plan will probably also be prepared as a result of these studies.[28] On-going water clarity monitoring through participation of the District in the DNR Self-help Monitoring Program is recommended.

Powers Lake: A recently completed lake management plan for Powers Lake[29] has been adopted and is being implemented. The plan recommended public acquisition and protection of environmentally valuable areas in the watershed, which is currently being carried out by the Powers Lake Management District. In addition, the plan includes recreational use management measures such as ordinance revisions and dissemination of information to the public. An approved aquatic plant management plan has also been prepared for this lake.[30] The Powers Lake Management District has received a Chapter NR 119 Lake Management Planning Grant to partially fund water quality studies on the lake; on-going water clarity monitoring is also being conducted under the DNR Self-help Monitoring Program. A detailed facility plan[31] was prepared considering alternatives for sewage disposal for the Powers, Benedict, and Tombeau Lakes area. That plan recommends the development of a public sanitary sewer system to serve the urban development around the Lake.

Silver Lake (Kenosha County): The eastern and western shores of the Lake are sewered. The Lake is enrolled in the DNR Self-help Monitoring Program.

Silver Lake (Walworth County): No specific plan implementation activities have been reported for the lake as of 1993.

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[27] SEWRPC Community Assistance Planning Report No. 58, A Water Quality Management Plan for Pewaukee Lake, Waukesha County, Wisconsin, March 1984.

[28] Aron & Associates, Potters Lake Plant Management Plan, 1992; Aron & Associates, Potters Lake Community Survey, March 1992.

[29] SEWRPC Community Assistance Planning Report No. 196, A Management Plan for Powers Lake, Kenosha and Walworth Counties, Wisconsin, November 1991.

[30] Aron & Associates, Powers Lake Plant Management Plan, March 1994.

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

Spring Lake (Waukesha County): Ongoing water clarity monitoring under the DNR Self-help Monitoring Program is being conducted. This lake is currently classified by the DNR as an "Outstanding Resource Water."

Upper and Lower Phantom Lakes: The Phantom Lakes Management District is considering preparation of a lake management plan and applying for funding under Chapter NR 119. The District has completed an aquatic plant management plan for these lakes.[32] The District is also enrolled in the DNR Self-help Monitoring Program for Upper Phantom Lake and is beginning to develop a water clarity data base. Lower Phantom lake was formerly enrolled in the program but is not currently participating. Re-enrollment is recommended. The eastern portion of the Lower Phantom Lake lakeshore is provided with a public sanitary sewer system which is part of the Village of Mukwonago sewerage system. Urban development around the remaining shoreline is recommended to be provided with a public sanitary sewer system.

Voltz Lake: Lake management plan elements being prepared for this lake with the assistance of Chapter NR 119 Lake Management Planning Grant funds provided to the Voltz Lake Management District include assessments of the lake's watershed and sediment characteristics. Watershed management measures aimed at reducing soil and contaminant losses were recommended, including the control of aquatic plants in the lake and watershed; mechanical and manual aquatic plan control was recommended for use within the lake.[33] Urban development on the lakeshore is provided with a public sanitary sewer system.

Wandawega Lake: No specific plan implementation activities have been reported for this lake as of 1993.

Waterford Impoundment: The Waterford Impoundment is made up of two waterbodies; namely, Buena Lake and Tichigan Lake. On-going involvement in the DNR Self-help Monitoring Program is conducted on Tichigan Lake. The Town of Waterford received a Chapter NR 119 Lake Management Planning Grant to partially fund regular monitoring of the lake's water quality and to prepare an aquatic plant management plan for the impoundment.[34] Urban development on the lakeshore is provided with a public sanitary sewer system as was recommended in the initial plan.

Waubeesee Lake: Waubeesee Lake is situated downstream from Kee Nong Go Mong Lake, and connected to that lake by the Anderson Canal. The recommended water use management plan prepared for the Canal and Waubeesee Lake[35] adopted many of the measures proposed in the 1979 plan, adding recreational use management and protection of environmentally sensitive areas. Urban development around the lake is provided with public sanitary sewer service by the Town of Norway Sanitary District No. 1, as was recommended in the initial plan. Tri-Lakes

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[32] SEWRPC Memorandum Report No. 81, An Aquatic Plant Management Plan for the Phantom Lakes, Waukesha County, Wisconsin, July 1993.

[33] Applied Ecological Services, Inc., Lake and Watershed Assessment and Management Recommendations Report: Voltz Lake Near Trevor, Wisconsin, May 1992.

[34] Aron & Associates, Waterford Impoundment Aquatic Plant Survey, May 1995; Aron & Associates, Town of Waterford Community Survey, 1994.

[35] SEWRPC Community Assistance Planning Report No. 182, op.cit.

Conservation, Inc, the lake organization covering Waubeesee Lake, Lake Denoon, and Kee Nong Go Mong Lake, is enrolled in the DNR Self-help Monitoring Program and conducts regular water clarity monitoring of the lake. The lake association is also conducting additional water quality studies on the lake with partial funding provided under the Chapter NR 119 Lake Management Planning Grant Program.

Wind Lake: Wind Lake is located downstream of Little Muskego and Big Muskego Lakes. The Muskego Canal discharges into Wind Lake on the north and is drained to the south by the Wind Lake Drainage Canal. It was recommended in the initial plan that additional urban nonpoint source contaminant control measures be employed together with livestock waste and construction erosion controls. This recommendation was reenforced by the recently completed lake management plan prepared for Wind Lake, which emphasized a watershed-based approach combined with in-lake measures, including nutrient inactivation, macrophytes harvesting, limited dredging and protection of environmentally sensitive areas.[36] This Lake, together with Big and Little Muskego Lakes, has been included in the Muskego-Wind Lakes Priority Watershed planning area.[37] The urban development along the Wind Lake shoreline has been provided with a public sanitary sewer system as recommended in the initial plan. While the Wind Lake Management District has previously been enrolled in the DNR Self-help Monitoring Program, on-going monitoring of the Lake is being conducted by the U.S. Geological Survey. Currently, the District has received Chapter NR 119 Lake Management Planning grants and U.S. Environmental Protection Agency grants for water quality restoration activities. An aquatic plant management plan has also been prepared and approved.

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 V-13 for the 42 major lakes in the Fox River watershed. The initial plan recommendations relating to the preparation of comprehensive lake management plans and the conduct of supporting water quality and water budget monitoring programs for each lake are reaffirmed in the updated plan recommendations for the Fox 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, biological condition, 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 and biological condition 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 Fox River watershed, it is recommended that water quality planning and supporting

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[36] SEWRPC Community Assistance Planning Report No. 198, A Management Plan for Wind Lake, Racine County, Wisconsin, December 1991.

[37] Wisconsin Department of Natural Resources Publication No. WR-340-93, op.cit.

Table V-13

MANAGEMENT MEASURES TO BE CONSIDERED IN LOCAL MANAGEMENT PLANS FOR THE MAJOR LAKES IN THE FOX 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 Mgmt	Live-Stock Mgmt	Macro-phyte Harvest	Aeration	Nutrient Inactivation	Dredge	Sediment Cover	Water Level Mgmt	Fish Mgmt
FOX RIVER-UPPER																
Pewaukee Lake	2,493	0	0	0	-	0	0	+	+	0	-	+	0	-	+	+
FOX RIVER-MIDDLE																
Big Muskego Lake	2,177	0	0	0	-	0	0	0	+	-	-	-	+	+	-	0
Denoon Lake	162	+	0	0	-	+	+	0	+	+	-	+	+	+	-	+
Eagle Lake	520	0	0	0	-	+	+	+	+	0	-	-	-	+	-	+
Kee Nong Go Mong Lake	88	+	0	0	-	+	+	0	+	+	-	+	+	+	-	+
Little Muskego Lake	506	0	0	0	-	0	0	0	+	0	-	+	+	+	0	+
Long Lake (Racine Co.)	102	+	+	-	+	+	+	-	+	+	-	-	+	+	-	+
Spring Lake (Waukesha)	105	0	+	-	-	+	+	0	-	-	-	-	-	-	-	+
Waterford Impoundment	1,233	+	+	0	-	+	+	+	+	-	-	-	+	-	+	+
Waubeesee Lake	129	0	0	0	-	+	+	0	+	+	-	+	-	+	-	+
Wind Lake	936	+	0	0	-	0	0	0	+	0	-	+	0	-	-	+
FOX RIVER-LOWER																
Bohner Lake	135	0	0	0	+	+	+	-	+	0	-	+	+	+	-	+
Browns Lake	396	0	+	0	-	+	+	+	+	+	-	+	+	+	-	+
Camp Lake	461	0	0	0	-	0	0	0	-	+	-	-	+	+	-	+
Center Lake	129	0	0	0	-	0	0	0	+	+	-	+	+	+	-	+
Cross Lake	87	0	+	0	-	+	+	0	-	-	-	+	-	+	-	+
Dyer Lake	56	+	+	-	+	+	-	-	+	+	-	-	+	+	-	+
Lilly Lake	88	0	+	+	+	+	+	-	-	-	-	+	+	+	-	+
Silver Lake (Kenosha)	464	+	0	0	-	+	+	0	+	+	-	+	+	+	-	+
Voltz Lake	52	0	0	0	-	+	+	0	-	+	-	+	+	+	-	+
HONEY/SUGAR CREEKS																
Lauderdale Lakes	841	0	0	+	+	+	+	-	-	0	-	+	-	+	-	+
North Lake (Walworth)	191	+	+	-	+	+	+	-	+	+	-	-	+	+	-	+
Pleasant Lake	155	0	+	-	+	+	+	-	-	+	-	+	+	-	-	+
Potters Lake	162	0	0	0	-	-	+	+	-	0	-	+	+	+	-	+
Silver Lake (Walw)	85	+	+	-	+	+	+	-	-	-	-	-	+	+	-	+
Wandawega Lake	119	+	+	-	+	+	+	-	-	+	-	-	+	+	-	+

Table V-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 Mgmt	Live-Stock Mgmt	Macro-phyte Harvest	Aeration	Nutrient Inactiva-tion	Dredge	Sediment Cover	Water Level Mgmt	Fish Mgmt
MUKWONAGO RIVER																
Army Lake	78	+	+	+	+	+	+	-	-	-	-	+	+	+	-	+
Beulah Lake	834	0	+	-	+	+	+	-	-	0	-	+	-	+	-	+
Booth Lake	113	0	+	+	+	+	+	-	+	-	-	+	-	+	-	+
Eagle Spring Lake	311	0	0	+	+	0	0	-	+	0	-	+	+	+	-	+
Lower Phantom Lake	433	+	0	+	+	+	+	0	-	0	-	+	+	+	-	+
Lulu Lake	84	+	0	-	-	0	0	-	+	+	-	+	-	+	-	+
Peters Lake	64	+	+	-	-	+	+	-	+	+	-	+	+	+	-	+
Upper Phantom Lake	107	0	0	+	+	+	-	-	-	0	-	-	-	-	-	+
WHITE RIVER/ NIPPERSINK CREEK																
Benedict Lake	78	0	+	+	+	+	+	-	-	+	-	+	-	+	-	+
Como Lake	946	+	+	0	-	+	+	-	+	0	-	-	+	+	+	+
Echo Lake	71	+	+	0	-	+	+	+	+	-	-	-	-	-	+	+
Elizabeth Lake	865	0	0	0	-	+	+	+	+	-	-	+	-	+	-	+
Geneva Lake	5,262	0	0	0	-	+	+	+	-	-	-	-	-	-	-	+
Lake Mary	315	0	0	0	-	+	+	+	+	-	-	-	-	+	-	+
Pell Lake	86	+	+	0	-	+	+	-	+	-	-	+	-	-	-	+
Powers Lake	459	0	0	+	+	+	+	-	+	-	-	+	-	-	-	+

0 = 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 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 text of this report.

Source: SEWRPC

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 1966 through 1968 Commission and Wisconsin Department of Natural Resources (DNR) monitoring program for the Fox River watershed planning program; and the 1976 Commission monitoring program conducted under the regional water quality management planning effort. Available data collected in those programs for the Fox River watershed included samplings at twenty-eight Commission stations--twelve on the Fox River main stem and sixteen on its tributaries; at one DNR station on the Nippersink Creek; and at four U.S. Geological Survey (USGS) stations--two on the Fox River main stem and one each on the Mukwonago and White Rivers tributary to the Fox River. One additional USGS sampling site was located on the Fox River in Lake County, Illinois, near Channel Lake, about 1.2 miles south of the Wisconsin-Illinois State line. The sampling station locations are shown on Map V-6.

Long-term post-1976 comparable water quality data have been collected at the current DNR sampling stations Fx-10 on the Fox River at CTH I and Fx-7 on the Fox River at Prairie Street just north of the City of Waukesha sewage treatment plant, and USGS sampling station Fx-27a on the Fox River just south of the Wisconsin-Illinois State line near Channel Lake, as shown on Map V-6. Water resource appraisal information including biological condition and water quality data collected by the DNR during 1991 through 1992 were also available for use in the assessment of current water quality conditions in the Upper Fox River watershed.[38] The DNR has collected water quality data on a short-term basis at 30 locations in the Fox River watershed. Some of these water quality sampling surveys were limited to one sample and in the number of parameters analyzed due to the specific purpose of the survey. Data collected at 25 sites from 1988 through 1993 were used, along with the long-term data previously noted, to characterize water quality conditions. These 25 sites are shown on Map V-6. Those data 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. Data on water quality and biological conditions were also collected for the Fox River main stem between the Village of Rochester and the Wilmot Dam for a University of Wisconsin-Stevens Point study in the summer of 1983. 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

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[38]Wisconsin Department of Natural Resources, Upper Fox River Priority Watershed Appraisal, February 1993.

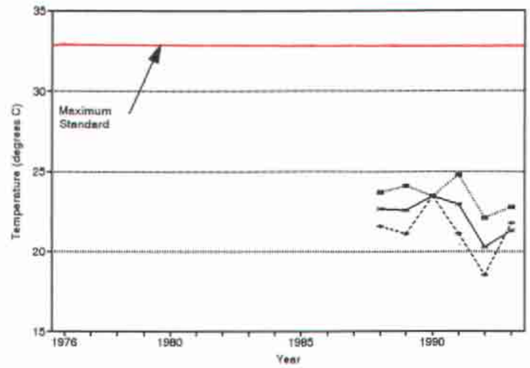
land use conditions, as discussed in Chapter II. Review of these data can provide insight into the current water quality conditions and the current potential for achieving the established water use objectives in the Fox River watershed.

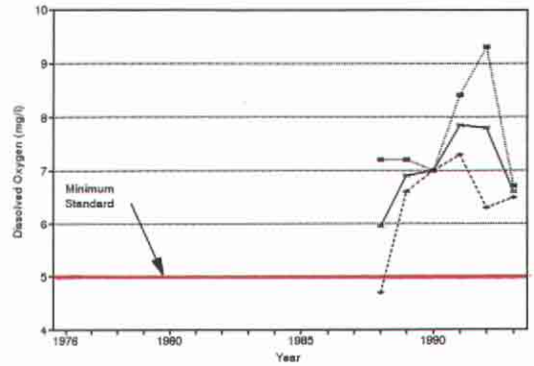
The long-term water quality data obtained at DNR stations Fx-7 and Fx-10 on the main stem of the Fox River at Prairie Street and CTH I, respectively, and at the USGS sampling station Fx-27a on the main stem of the Fox River near Channel Lake in Illinois, for the period 1976 through 1993, are summarized in Figures V-1 through V-3. The short-term data collected by the DNR and local units of government during the period 1988 through 1993 are summarized in Figures V-4 through V-8 and in Table V-14. Both the long-term and short-term sampling data have been used to assess 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. The water quality standards indicated in Figures V-1 through V-3 and in Table V-14 are those set forth for specific biological and recreational use objectives as described in Chapter II. The relationship of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria is discussed in detail in Chapter II.

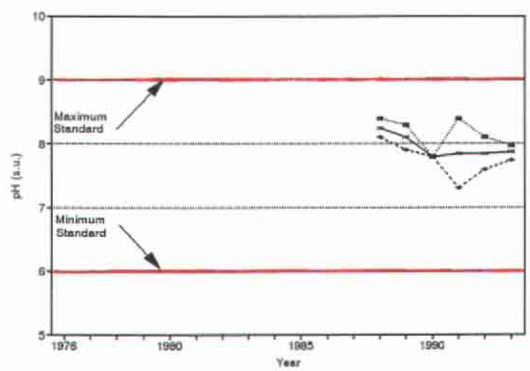
Review of those data for station Fx-7 and Fx-10 indicates that there appears to be an increase in dissolved oxygen levels at both stations since 1985; a decrease in phosphorus levels at station Fx-10 since 1982; and an improvement in un-ionized ammonia nitrogen levels at Fx-10 since 1979. No other significant changes in water quality conditions can be identified. These improvements may be attributed, in part, to the upgrading of the City of Waukesha sewage treatment plant in 1979; to the completion in 1985 of a major plant upgrading at the City of Brookfield sewage treatment plant; the abandonment of smaller existing public sewage treatment plants, including the Village of Pewaukee and the City of New Berlin Regal Manors plants between 1981 and 1985; and to the reduction in pollutant loadings from industrial point sources. Although phosphorus levels have declined over the sampling period, it should be noted that these levels still exceed the standard for streams with full recreational water use objectives, as set forth in Chapter II. Temperature, dissolved oxygen, pH, and chloride levels remained variable with no apparent trends, but were within the acceptable limits as defined by the water quality standards for the Fox River main stem set forth in Chapter II.

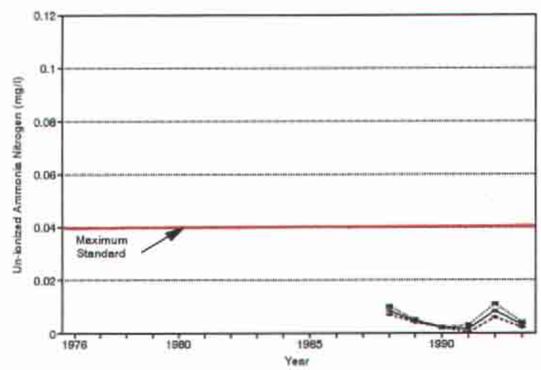
Review of the data at the USGS station Fx-27a, near Channel Lake just south of the Wisconsin-Illinois State Line, indicates no apparent significant changes in water quality conditions from 1976 through 1991 at that location, with the exception of chloride levels and the possible slight improvement in dissolved oxygen and phosphorus levels and a slight increase in un-ionized ammonia nitrogen levels. Chloride levels appear to have increased continuously. However, the levels are still within acceptable limits as defined by the standards associated with the water use objectives for the Fox River main stem 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 slight improvement in dissolved oxygen and phosphorus levels is likely due to the upstream treatment plant improvements noted above. The un-ionized ammonia nitrogen levels are still within acceptable limits. Chronic standards for some metals were also exceeded, as discussed in the next section.

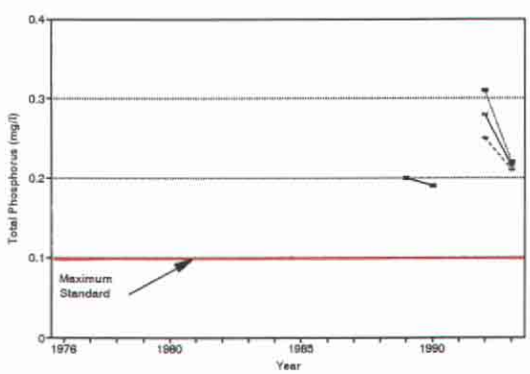
Figure V-1
WATER QUALITY DATA FOR THE FOX RIVER AT STATION Fx-7: 1976-1993

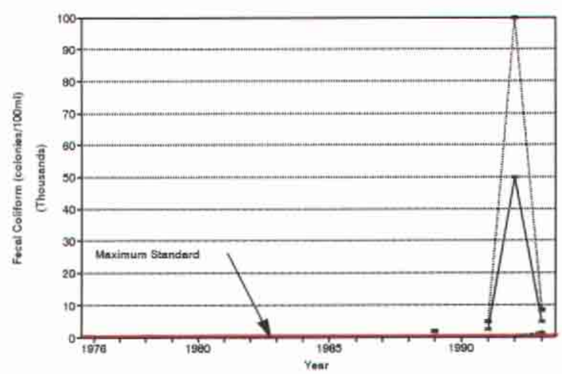




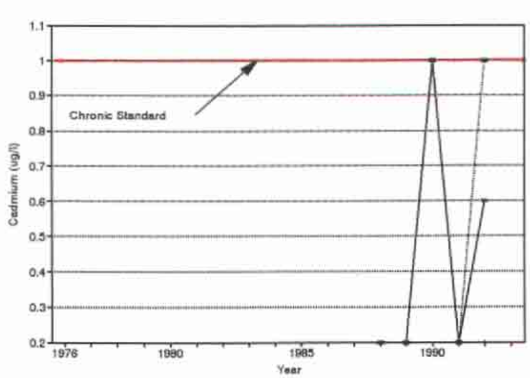




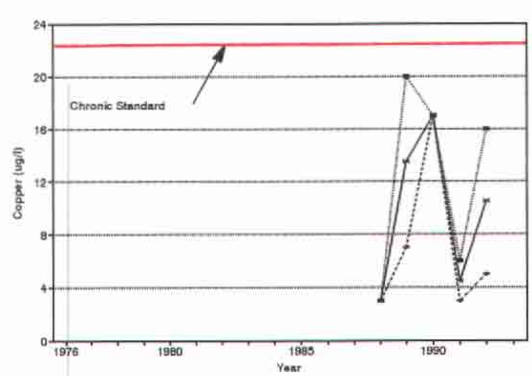




Note: The maximum standard of 200/400 colonies per 100 ml was violated in all years.

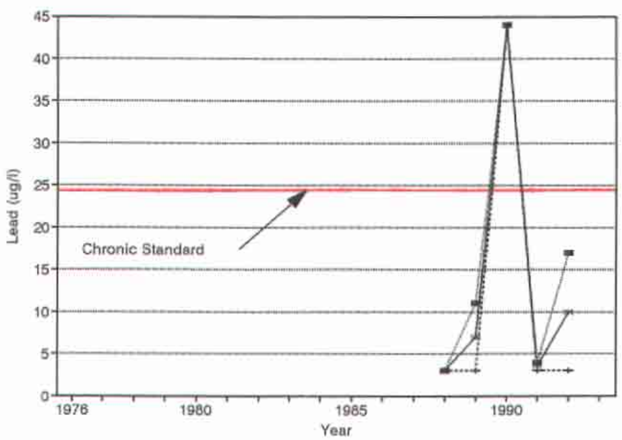


Note: The acute standard of 63.3 ug/l was not violated in any year.

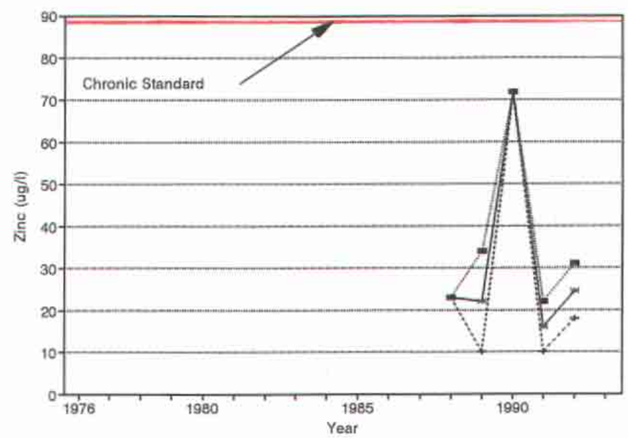


Note: The acute standard of 31.9 ug/l was not violated in any year.

Figure V-1 (cont'd)



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



Note: The acute standard of 202.9 ug/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 relationship 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.

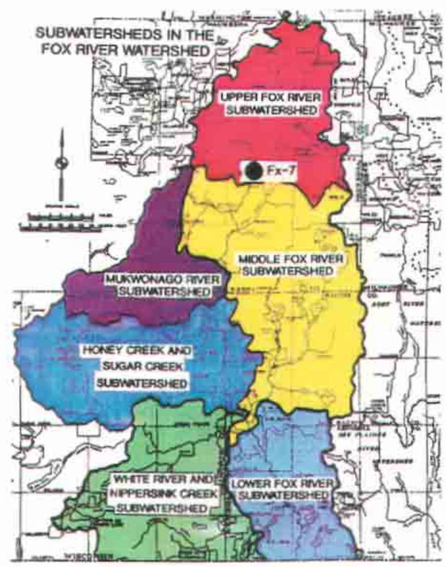
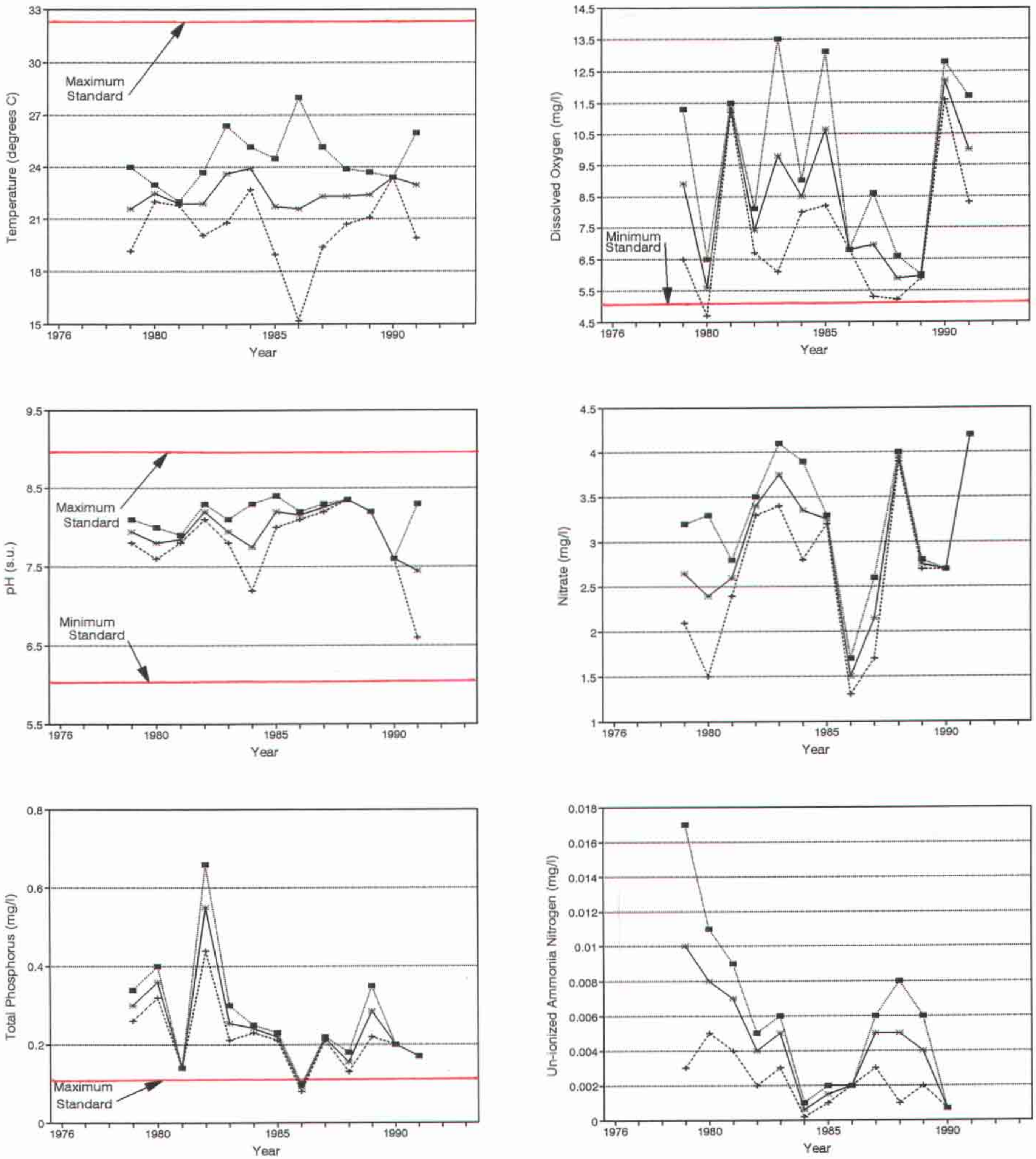
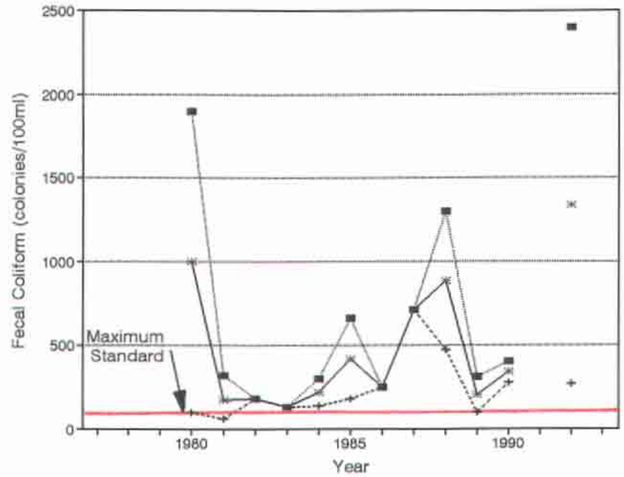


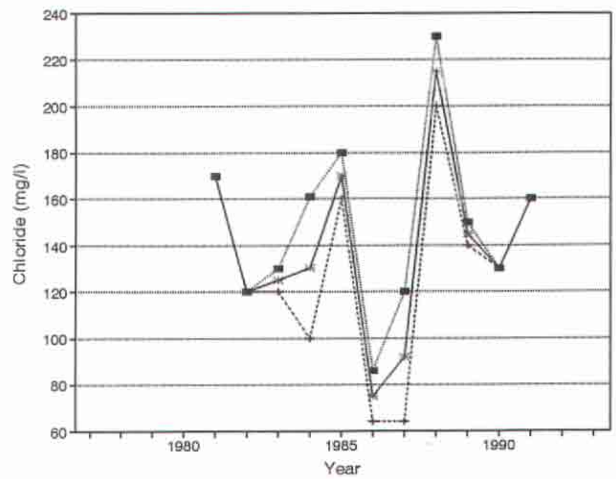
Figure V-2
WATER QUALITY DATA FOR THE FOX RIVER
AT STATION Fx-10: 1976-1993



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

Figure V-2 (Cont'd)





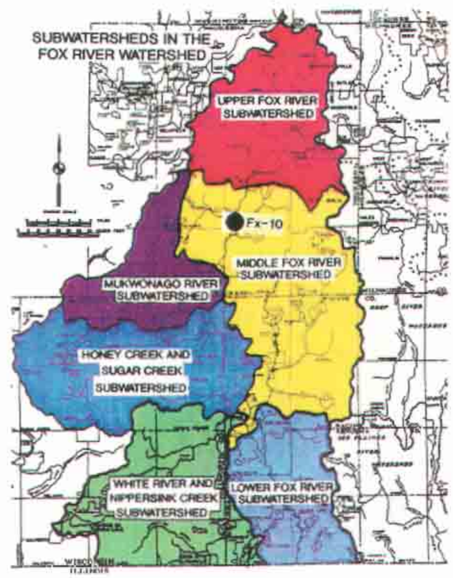
Note: The maximum standard of 1000 mg/l was not violated in any year.

LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

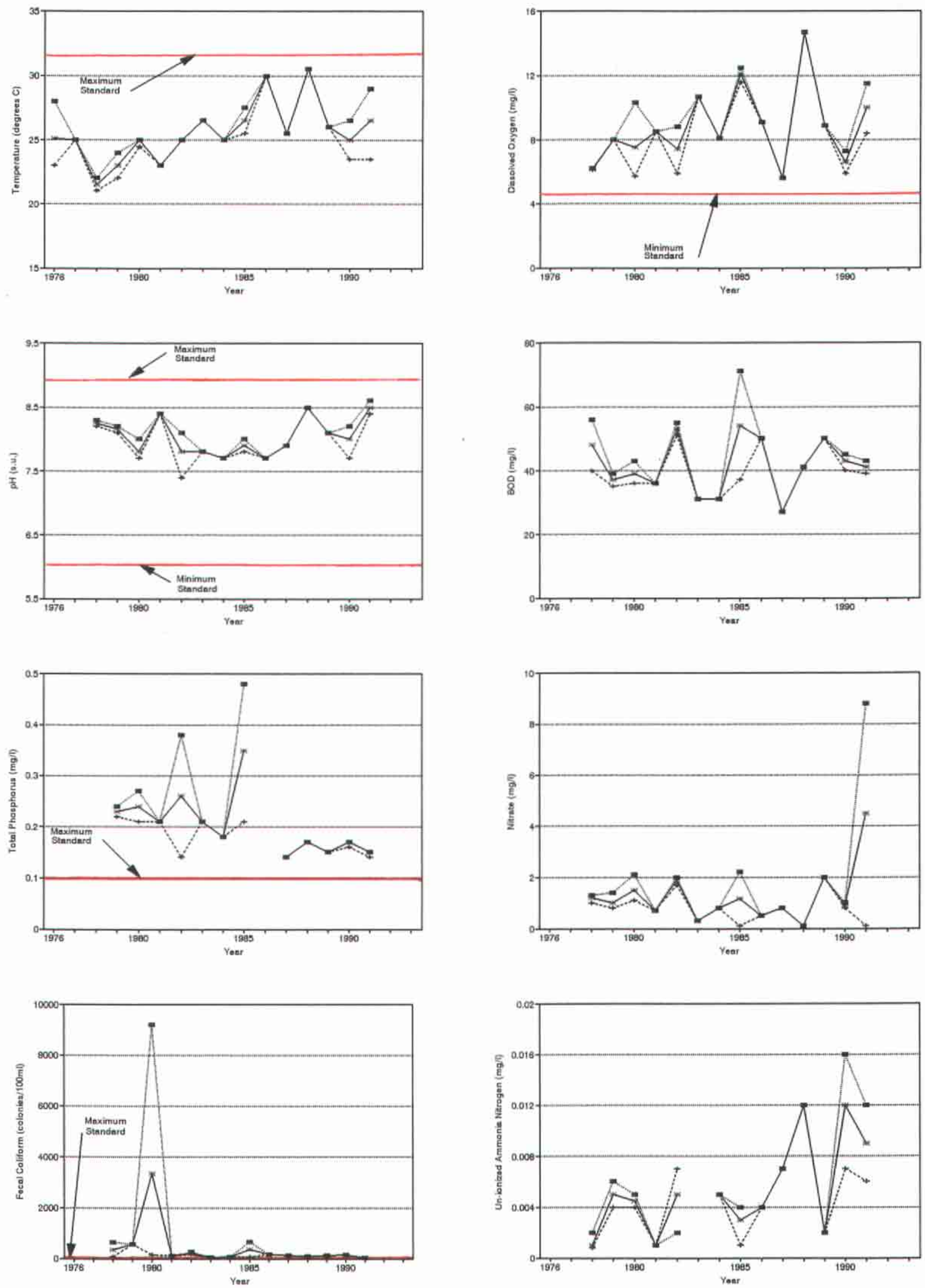


Note: Graphs indicate maximum, minimum and average values for July and August data.

Standards indicated are those established for warm water sport fish and full recreational use objectives. See chapter II for relationships to 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.

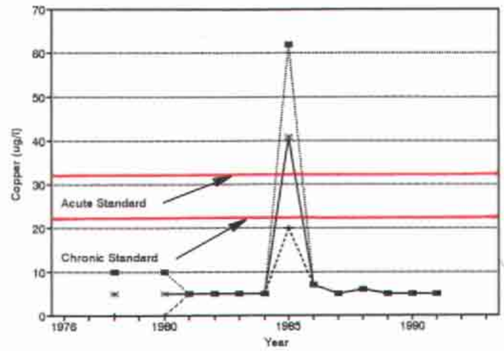
Figure V-3
WATER QUALITY DATA FOR THE FOX RIVER AT STATION Fx-27a: 1976-1993

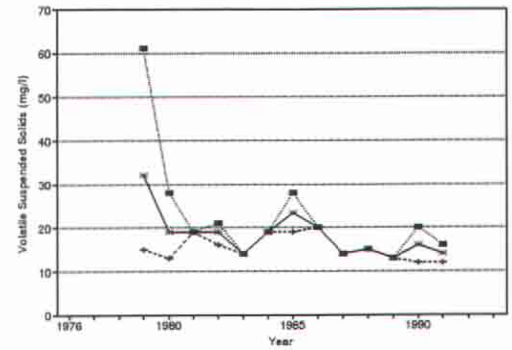


Note: The maximum standard of 200/400 colonies per 100 ml was violated in all years.

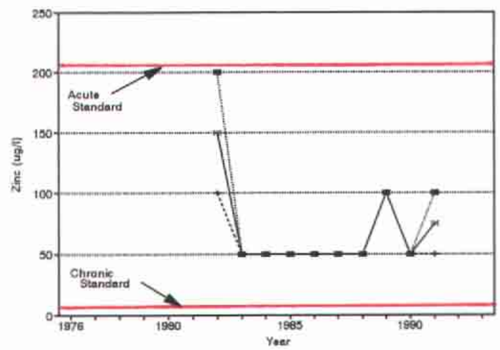
Note: The maximum standard of 0.04 mg/l was not violated in any year.

Figure V-3 (cont'd)

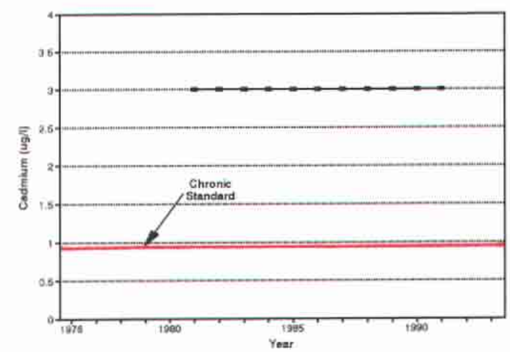




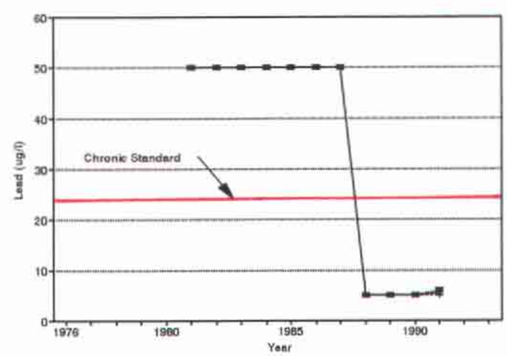
Note: Values graphed at 5.0 ug/l were indicated to be less than 5.0 ug/l.



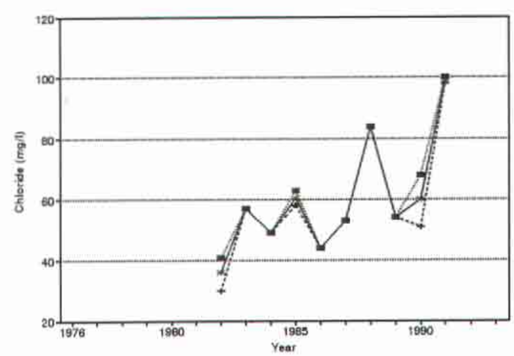
Note: Values graphed at 50 ug/l were indicated to be less than 50 ug/l.



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 409 ug/l 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 from 1988 to 1991 were indicated to be less than 5.0 ug/l.



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: U.S. Geological Survey and SEWRPC.

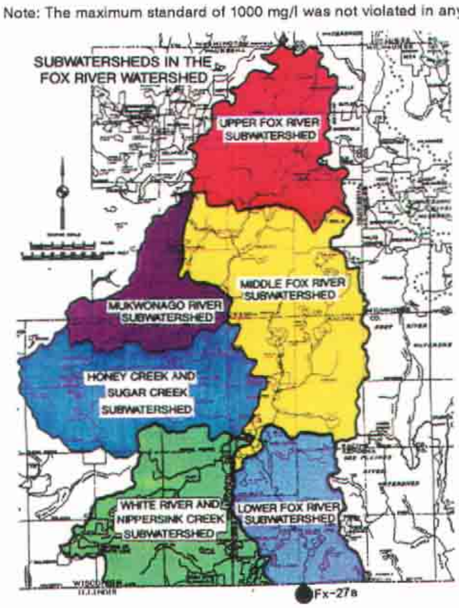
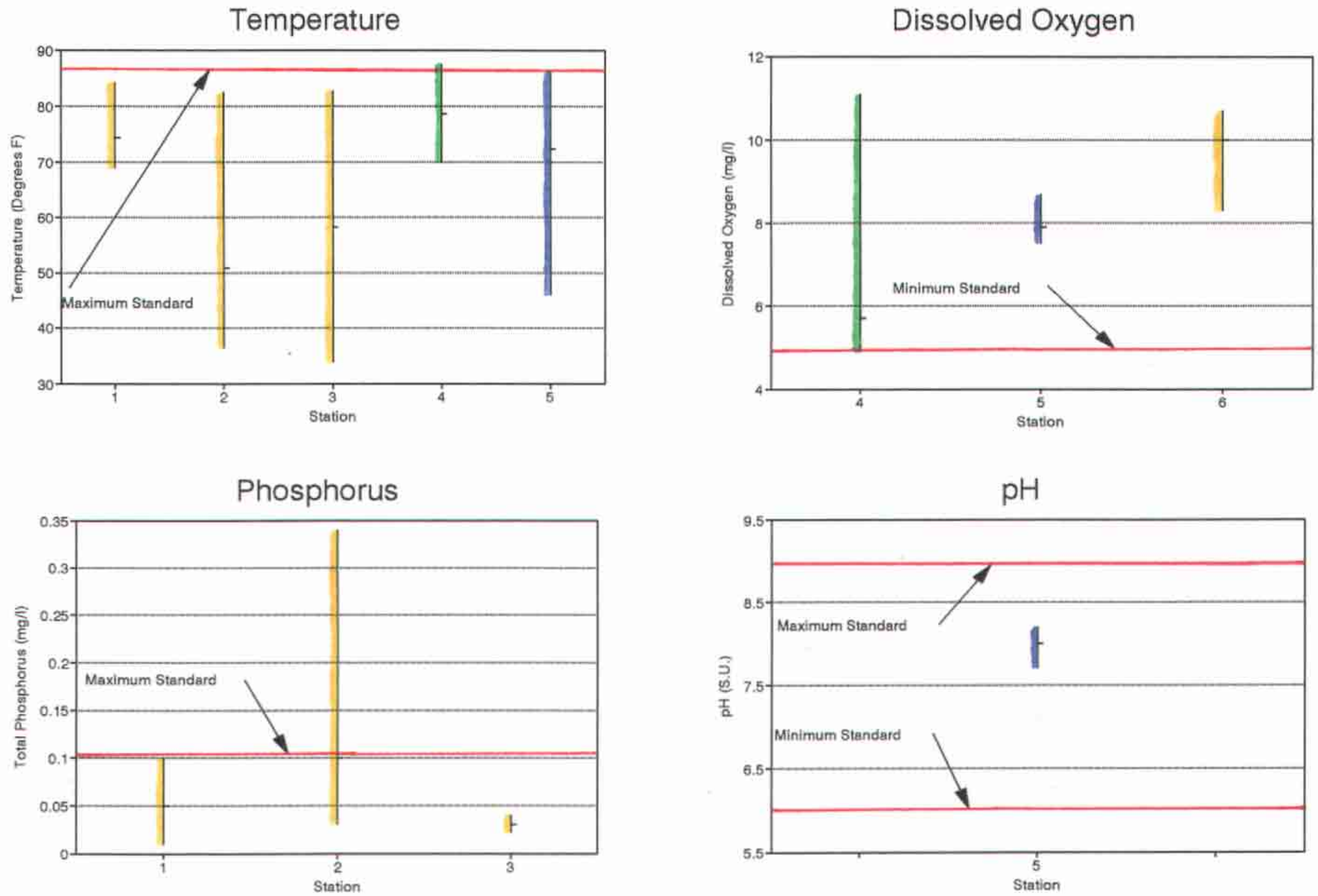


Figure V-4
Fox River Watershed Short-Term Water Quality Sampling Data: 1988



LEGEND

Maximum

Average

Minimum

Subwatershed Designation

Upper Fox

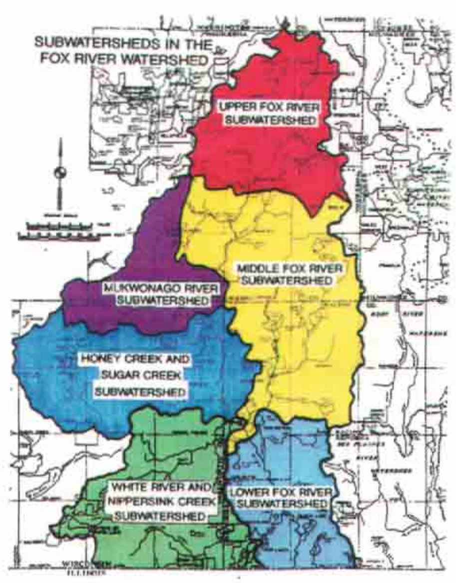
Middle Fox

Lower Fox

Honey/Sugar Creek

Mukwonago River

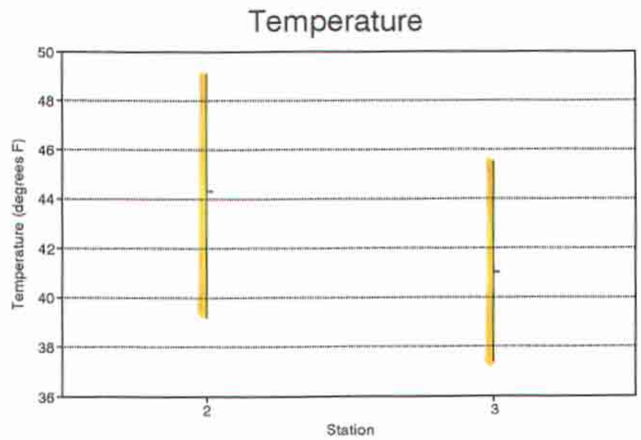
White/Nippersink Creek

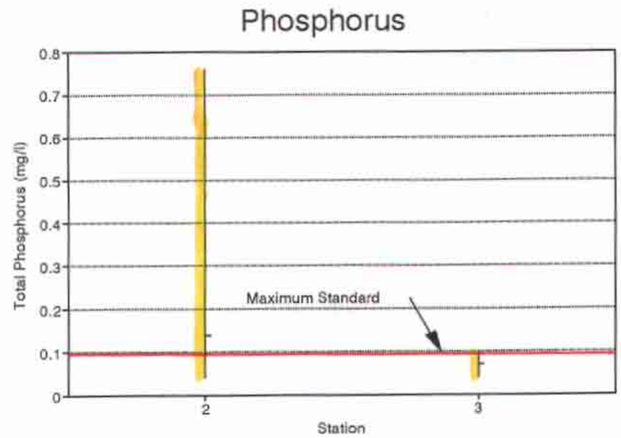


Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria. Refer to Table V-14 for summarized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

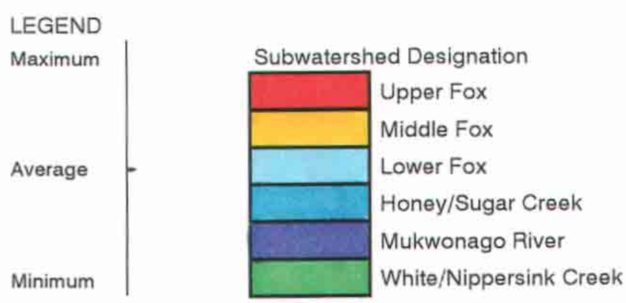
Source: Wisconsin Department of Natural Resources and SEWRPC.

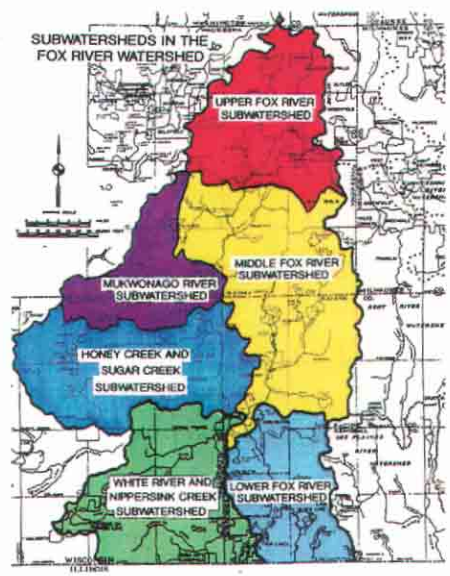
Figure V-5
Fox River Watershed Short-Term Water Quality Sampling Data: 1989





Note: The maximum standard of 89 degrees F was not violated in any sample





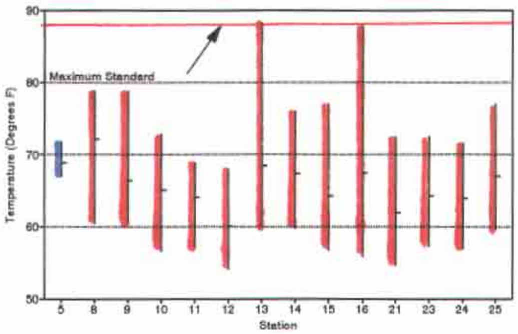
Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria. Refer to Table V-14 for summarized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

Source: Wisconsin Department of Natural Resources and SEWRPC.

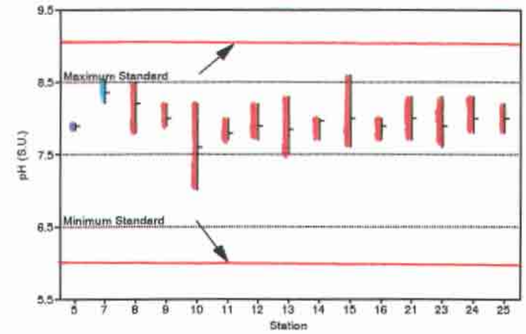
Figure V-6

Fox River Watershed Short-Term Water Quality Sampling Data: 1990

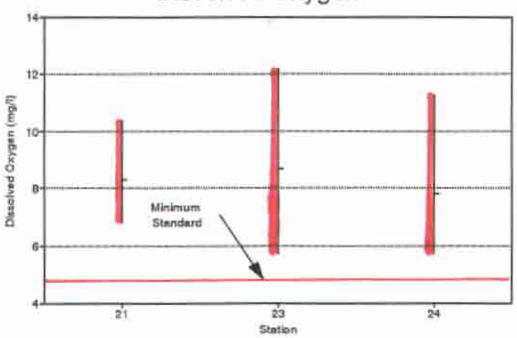
Temperature



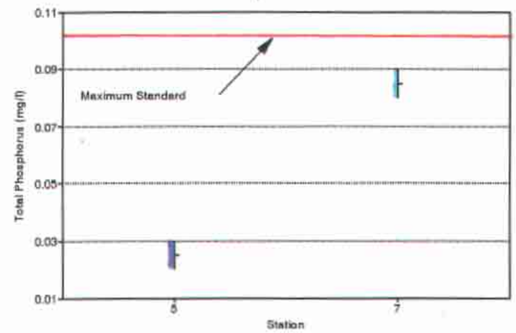
pH



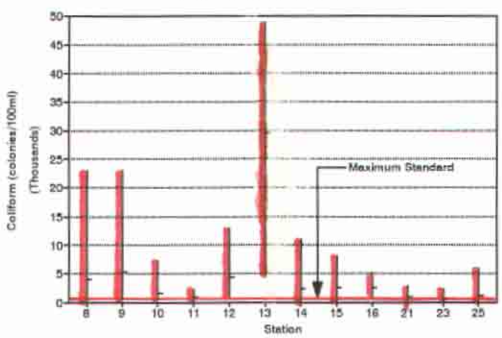
Dissolved Oxygen



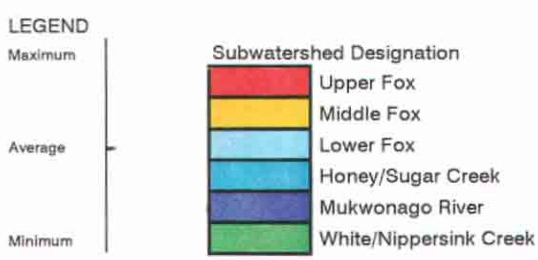
Phosphorus

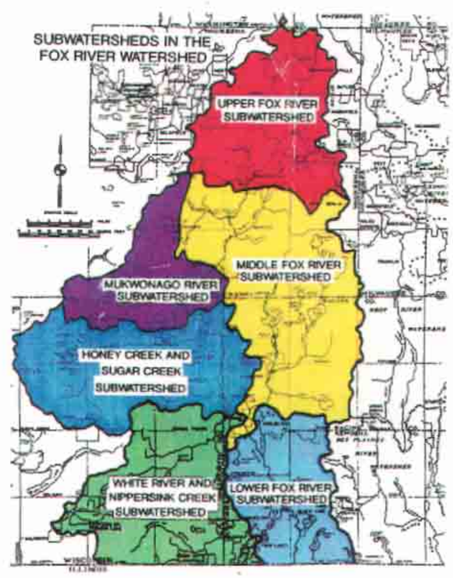


Fecal Coliform



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



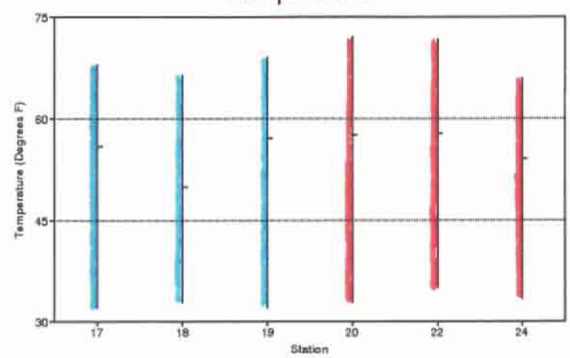


Standards indicated are those established for warmwater sport fish and full recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural Resources stream classifications and water quality criteria. Refer to Table V-14 for summarized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

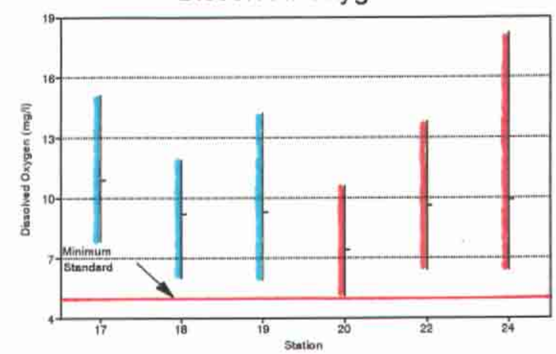
Source: Wisconsin Department of Natural Resources and SEWRPC.

Figure V-7
Fox River Watershed Short-Term Water Quality Sampling Data: 1992

Temperature

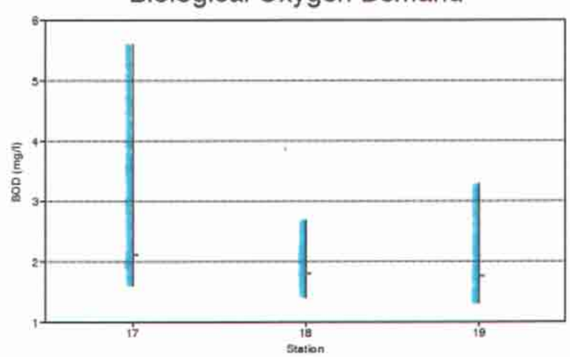


Dissolved Oxygen

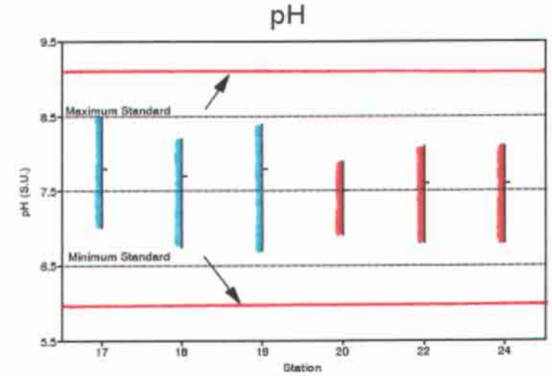


Note: The maximum standard of 89 degrees F was not violated in any sample.

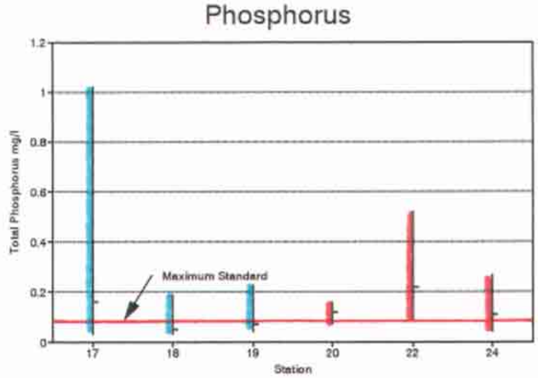
Biological Oxygen Demand



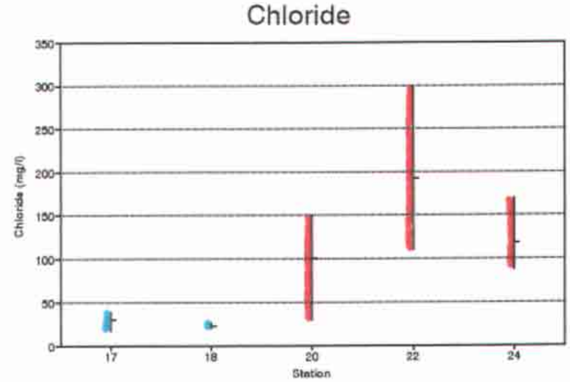
pH



Phosphorus

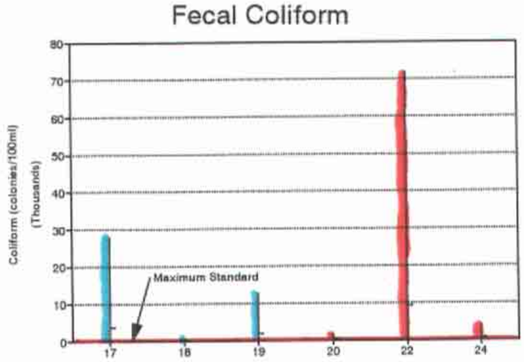


Chloride

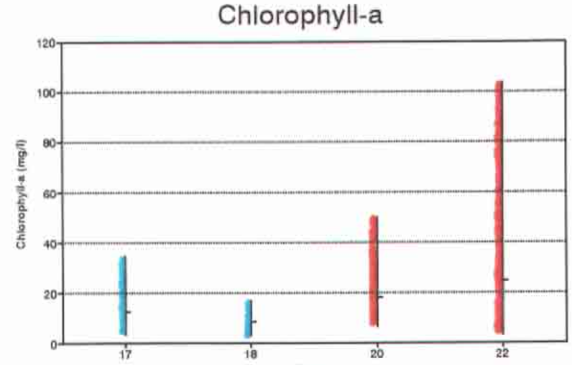


Note: The maximum standard of 1000 mg/l was not violated in any sample.

Fecal Coliform

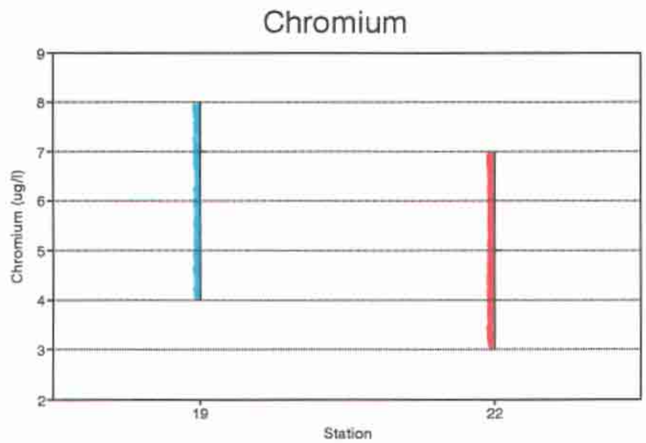


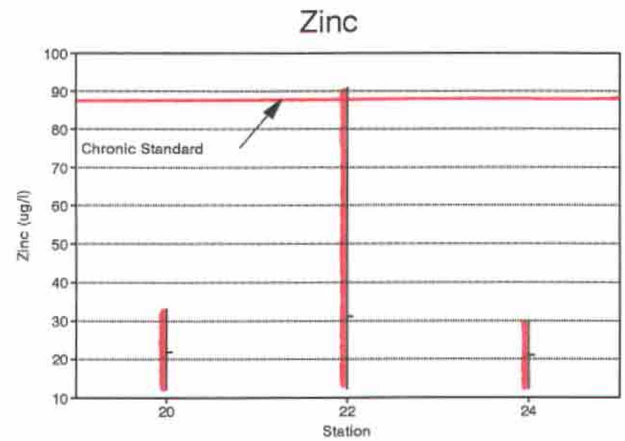
Chlorophyll-a



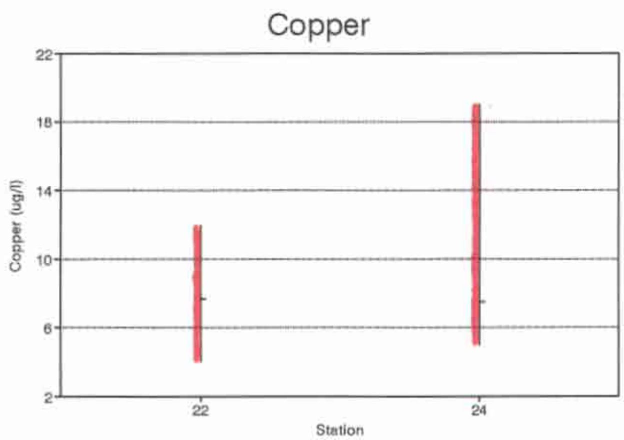
Note: The maximum standard of 200/400 colonies per 100ml was violated in all samples.

Figure V-7 (cont'd)





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



Note: The chronic standard of 22.1 ug/l was not violated in any sample.
The acute standard of 31.9 ug/l was 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 classifications and water quality criteria. Refer to Table V-14 for summarized water quality data.

Source: Wisconsin Department of Natural Resources and SEWRPC.

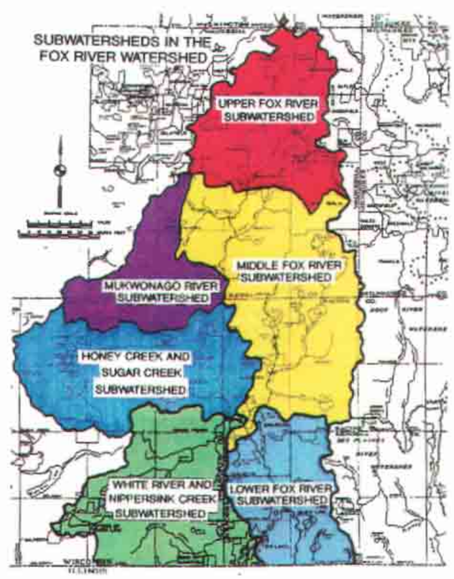
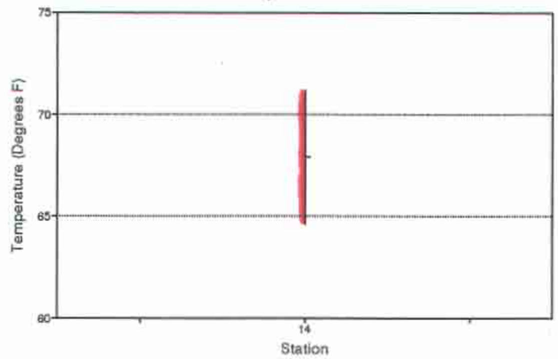
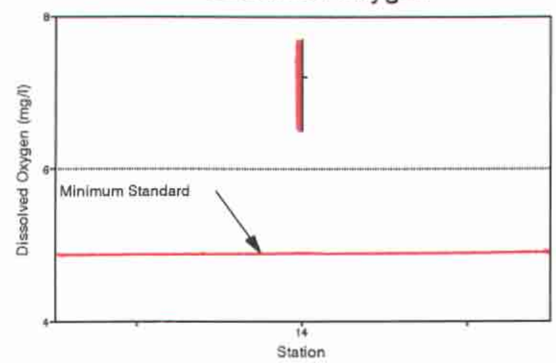


Figure V-8
Fox River Watershed Short-Term Water Quality Sampling Data: 1993

Temperature

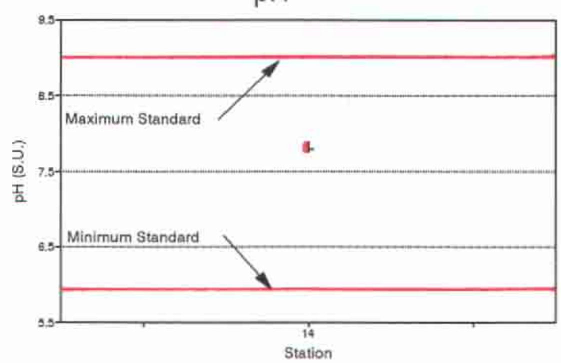


Dissolved Oxygen

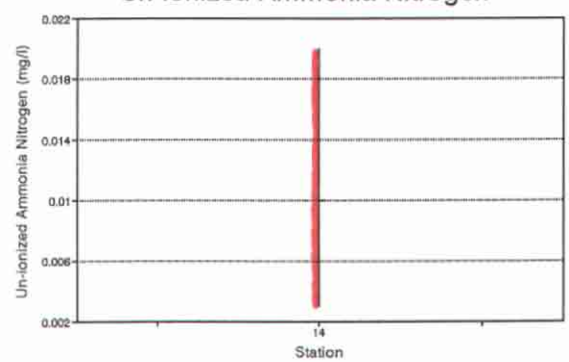


Note: The maximum standard of 89 degrees F was not violated in any year.

pH

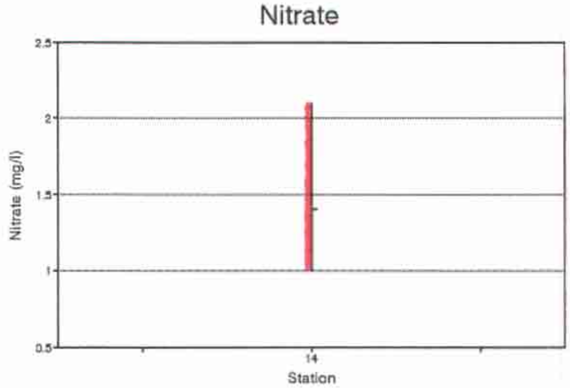


Un-ionized Ammonia Nitrogen

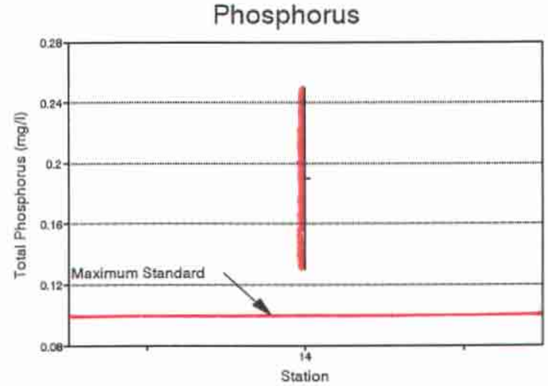


Note: The maximum standard of .04 mg/l was not violated in any sample.

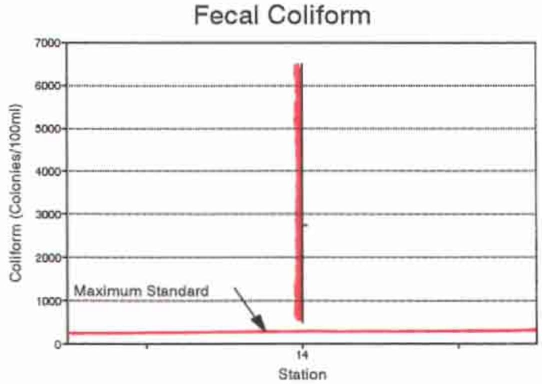
Nitrate



Phosphorus



Fecal Coliform



Chlorophyll-a

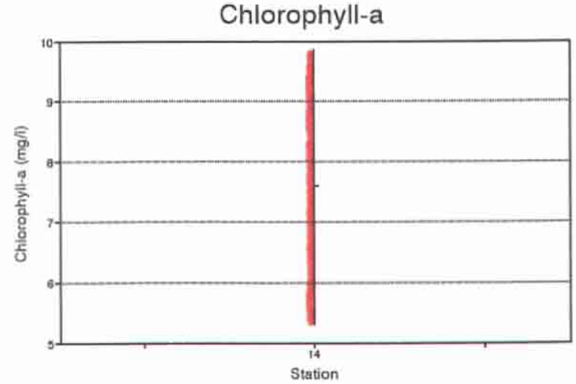


Figure V-8 (Cont'd)

LEGEND

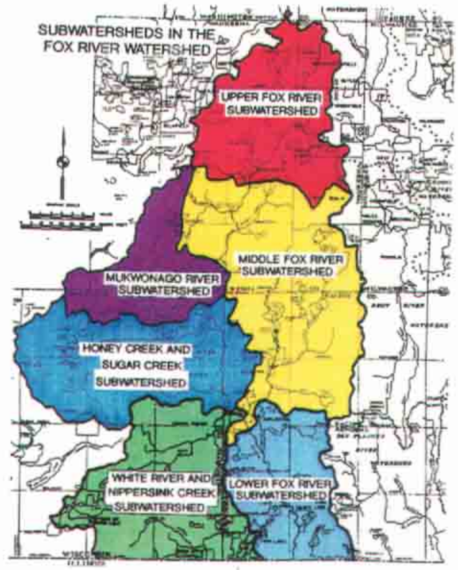
Maximum

Average

Minimum

Subwatershed Designation

- Upper Fox
- Middle Fox
- Lower Fox
- Honey/Sugar Creek
- Mukwonago River
- White/Nippersink Creek



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. Refer to Table V-14 for summarized water quality data.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table V-14

FOX 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
1 MF	Temperature (°F)	Maximum of 89.0	68.9-84.2	No	May-June 1988	3
	Phosphorus (mg/l)	Maximum of 0.1	0.09-0.15	Yes	January-September 1988	13
2 MF	Temperature (°F)	Maximum of 89.0	36.5-82.6 39.2-49.1	No No	February-December 1988 February-April 1989	7 3
	Phosphorus (mg/l)	Maximum of 0.1	0.03-0.34 0.04-0.76	Yes Yes	January-December 1988 January-October 1989	31 20
3 MF	Temperature (°F)	Maximum of 89.0	33.8-82.8 37.4-45.5	No No	July-December 1988 February-April 1989	2 3
	Phosphorus (mg/l)	Maximum of 0.1	0.022-0.04 0.04-0.10	No Yes	January-December 1988 January-August 1989	8 9
4 WN	Temperature (°F)	Maximum of 89.0	70.0-87.4	No	July 1988	2
	Dissolved Oxygen (mg/l)	Minimum of 5.0	4.9-11.1	Yes	July 1988	2
5 MK	Temperature (°F)	Maximum of 89.0	45.9-86.2 66.9-71.8	No No	August 1988 July 1990	6 2
	Dissolved Oxygen (mg/l)	Minimum of 5.0	7.5-8.7	No	August 1988	2
	Phosphorus (mg/l)	Maximum of 0.1	0.02-0.03	No	June-July 1990	2
	pH (s.u)	Maximum of 9.0; Minimum of 6.0	7.7-8.2 7.83-7.93	No No	August 1988 June-July 1990	2 22
6 MF	Dissolved Oxygen (mg/l)	Minimum of 5.0	8.3-10.7	No	July-August 1988	2
7 HS	pH (s.u.)	Maximum of 9.0; Minimum of 6.0	8.2-8.54	No	June-July 1990	22
	Ammonia (mg/l)	Maximum of 0.04	0.04-0.28	Yes	June-July 1990	2
	Phosphorus (mg/l)	Maximum of 0.1	0.08-0.09	No	June-July 1990	2
8 UF	Temperature (°F)	Maximum of 89.0	60.4-78.8	No	August-September 1990	6
	pH (s.u.)	Maximum of 9.0; Minimum of 6.0	7.8-8.5	No	August-September 1990	6

Table V-14 (continued)

Sampling Station Number and Subwatershed[a]	Parameter (Units)	Applicable Standards[b]	Range	Violation of Accepted Standard	Sampling Dates	Total Number of Samples
8 UF	Fecal Coliform (colonies per 100ml)	Maximum of 200/400	250-23,000	Yes	August 1990	5
9 UF	Temperature (°F)	Maximum of 89.0	60.4-78.8	No	August-September 1990	6
	pH (s.u)	Maximum of 9.0; minimum of 6.0	7.9-8.2	No	August-September 1990	6
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	370-23,000	Yes	August-September 1990	5
10 UF	Temperature (°F)	Maximum of 89.0	56.5-72.9	No	August-September 1990	6
	pH (s.u)	Maximum of 9.0; minimum of 6.0	7.0-8.2	No	August-September 1990	6
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	360-7,400	Yes	August-September 1990	5
11 UF	Temperature (°F)	Maximum of 89.0	57.0-68.9	No	August-September 1990	6
	pH (s.u)	Maximum of 9.0; minimum of 6.0	7.7-8.2	No	August-September 1990	6
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	170-2,300	Yes	August-September 1990	5
12 UF	Temperature (°F)	Maximum of 89.0	54.0-68.0	No	August-September 1990	6
	pH (s.u)	Maximum of 9.0; minimum of 6.0	7.7-8.2	No	August-September 1990	6
	Fecal Coliform (colonies per 100ml)	Maximum of 200/400	820-13,000	Yes	August-September 1990	6
13 UF	Temperature (°F)	Maximum of 89.0	59.7-88.3	No	August-September 1990	6
	pH (s.u.)	Maximum of 9.0; minimum of 6.0	7.5-8.3	No	August-September 1990	6
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	4,200-49,000	Yes	August-September 1990	5
14 UF	Temperature (°F)	Maximum of 89.0	59.7-76.1 64.6-71.2	No No	August-September 1990 August-September 1993	6 2
	pH (s.u.)	Maximum of 9.0; Minimum of 6.0	7.70-8.00 7.75-7.90	No No	August-September 1990 August-September 1993	6 2

Table V-14 (continued)

Sampling Station Number and Subwatershed[a]	Parameter (Units)	Applicable Standards[b]	Range	Violation of Accepted Standard	Sampling Dates	Total Number of Samples
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	40-11,000 49-6,500	Yes Yes	August-September 1990 August-September 1993	6 2
	Nitrate (mg/l)	--	1.2-2.1	--	August-September 1993	3
	Dissolved Oxygen (mg/l)	Minimum of 5.0	6.5-7.7	No	August-September 1993	2
	Chlorophyll-a (mg/l)	--	5.3-9.8	--	August-September 1993	2
	Un-ionized Ammonia Nitrogen (mg/l)	Maximum of 0.04	0.003-0.020	No	August-September 1993	3
	Phosphorus (mg/l)	Maximum of 0.1	0.13-0.25	Yes	August-September 1993	3
15 UF	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	160-8,200	Yes	August-September 1990	5
	Temperature (°F)	Maximum of 89.0	56.7-77.0	No	August-September 1990	7
	pH (s.u.)	Maximum of 9.0; minimum of 6.0	7.6-8.6	No	August-September 1990	7
16 UF	Temperature (°F)	Maximum of 89.0	55.8-87.8	No	August-September 1990	6
	pH (s.u.)	Maximum of 9.0; minimum of 6.0	7.7-8.0	No	August-September 1990	6
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	650-5,200	Yes	August-September 1990	5
17 HS	Temperature (°F)	Maximum of 89.0	32.0-68.0	No	May-October 1992	10
	Dissolved Oxygen (mg/l)	Minimum of 5.0	7.8-15.1	No	May-December 1992	10
	Biological Oxygen Demand (mg/l)	--	1.6-5.6	--	May-December 1992	8
	pH (s.u.)	Maximum of 9.0; minimum of 6.0	7.0-8.5	No	May-December 1992	10
	Phosphorus (mg/l)	Maximum of 0.1	0.03-1.02	Yes	May-December 1992	9
	Chloride (mg/l)	Maximum of 1000.0	17.0-40.0	No	May-December 1992	9
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	10-28,000	Yes	May-December 1992	8
	Chlorophyll-a (mg/l)	--	3.39-35.0	--	May-October 1992	7

Table V-14 (continued)

Sampling Station Number and Subwatershed[a]	Parameter (Units)	Applicable Standards[b]	Range	Violation of Accepted Standard	Sampling Dates	Total Number of Samples
18 HS	Temperature (°F)	Maximum of 89.0	32.7-66.4	No	May-December 1992	7
	Dissolved Oxygen (mg/l)	Minimum of 5.0	6.0-11.9	No	May-December 1992	7
	Biological Oxygen Demand (mg/l)	--	1.4-2.7	--	May-December 1992	6
	pH (s.u.)	Maximum of 9.0; minimum of 6.0	6.74-8.2	No	May-December 1992	7
	Phosphorus (mg/l)	Maximum of 0.1	0.03-0.19	Yes	May-December 1992	7
	Chloride (mg/l)	Maximum of 1000.0	20.0-27.0	No	May-December 1992	7
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	20-320	No	May-December 1992	6
	Chlorophyll-a (mg/l)	--	3.0-17.0	--	May-December 1992	7
19 HS	Temperature (°F)	Maximum of 89.0	32.0-69.1	No	May-December 1992	11
	Dissolved Oxygen (mg/l)	Minimum of 5.0	5.9-14.2	No	May-December 1992	11
	Biological Oxygen Demand (mg/l)	--	1.3-3.3	--	May-October 1992	7
	pH (s.u.)	Maximum of 9.0; Minimum of 6.0	6.7-8.4	No	May-December 1992	9
	Phosphorus (mg/l)	Maximum of 0.1	0.04-0.23	Yes	May-October 1992	7
	Fecal Coliform (colonies per 100 ml)	Maximum of200/400	30-13,000	Yes	May-October 1992	8
	Chromium (ug/l)	--	4.0-8.0	--	May-October 1992	7
20 UF	Temperature (°F)	Maximum of 89.0	32.7-71.8	No	May-October 1992	11
	Dissolved Oxygen (mg/l)	Minimum of 5.0	5.1-10.6	No	May-October 1992	11
	pH (s.u.)	Maximum of 9.0; Minimum of 6.0	6.90-7.90	No	June-December 1992	10
	Phosphorus (mg/l)	Maximum of 0.1	0.07-0.16 0.10-0.25	Yes Yes	June-November 1992 August-September 1993	7
	Chloride (mg/l)	Maximum of 1000.0	30.0-150.0	No	June-November 1992	7

Table V-14 (continued)

Sampling Station Number and Subwatershed[a]	Parameter (Units)	Applicable Standards[b]	Range	Violation of Accepted Standard	Sampling Dates	Total Number of Samples
20 UF	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	100-1,800	Yes	June-November 1992	8
	Chlorophyll-a (mg/l)	--	6.3-50.0	--	July-November 1992	7
	Zinc (ug/l)	Chronic maximum of 89.2; acute maximum of 202.9	12.0-33.0	No	July-November 1992	7
21 UF	Temperature (°F)	Maximum of 89.0	54.5-72.5	No	August-September 1990	6
	pH (s.u.)	Maximum of 9.0; Minimum of 6.0	7.7-8.3	No	August-September 1990	6
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	260-2,900	Yes	August-September 1990	6
	Dissolved Oxygen (mg/l)	Minimum of 5.0	6.8-10.4	No	August-September 1990	6
22 UF	Temperature (°F)	Maximum of 89.0	34.9-71.8	No	May-December 1992	12
	Dissolved Oxygen (mg/l)	Minimum of 5.0	6.4-13.8	No	May-December 1992	12
	pH (s.u.)	Maximum of 9.0; Minimum of 6.0	6.8-8.1	No	May-December 1992	10
	Phosphorus (mg/l)	Maximum of 0.1	0.09-0.52	Yes	May-December 1992	9
	Chloride (mg/l)	Maximum of 1000.0	110.0-300.0	No	May-December 1992	9
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	50-72,000	Yes	May-December 1992	5
	Chlorophyll-a (mg/l)	--	3.39-104.00	--	May-December 1992	9
	Chromium (ug/l)	--	3.0-7.0	--	May-December 1992	9
	Zinc (ug/l)	Chronic maximum of 89.2; acute maximum of 202.9	12.0-91.0	Yes (chronic)	May-December 1992	9
	Copper (ug/l)	Chronic maximum of 22.1; acute maximum of 31.9	4.0-12.0	No	May-December 1992	9
23 UF	Temperature (°F)	Maximum of 89.0	57.2-72.5	No	August-September 1990	6
	pH (s.u.)	Maximum of 9.0; minimum of 6.0	7.6-8.3	No	August-September 1990	6
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	110-2,300	Yes	August-September 1990	6

Table V-14 (continued)

Sampling Station Number and Subwatershed[a]	Parameter (Units)	Applicable Standards[b]	Range	Violation of Accepted Standard	Sampling Dates	Total Number of Samples
23 UF	Dissolved Oxygen (mg/l)	Minimum of 5.0	5.7-12.2	No	August-September 1990	6
24 UF	Temperature (°F)	Maximum of 89.0	56.9-71.6 33.3-66.0	No No	August-September 1990 May-December 1992	6 10
	pH (s.u.)	Maximum of 9.0; minimum of 6.0	7.8-8.3 6.8-8.1	No No	August-September 1990 May-December 1992	6 10
	Dissolved Oxygen (mg/l)	Minimum of 5.0	5.7-11.3 6.4-18.2	No No	August-September 1990 May-December 1992	6 10
	Phosphorus (mg/l)	Maximum of 0.1	0.04-0.27	Yes	May-December 1992	9
	Chloride (mg/l)	Maximum of 1000.0	88.0-170.0	No	May-December 1992	8
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	100-4,300	Yes	May-December 1992	9
	Zinc (ug/l)	Chronic maximum of 89.2; acute maximum of 202.9	12.0-30.0	No	May-December 1992	9
	Copper (ug/l)	Chronic maximum of 22.1; acute maximum of 31.9	5.0-19.0	No	May-December 1992	9
25 UF	Temperature (°F)	Maximum of 89.0	59.5-77.0	No	August-September 1990	6
	pH (s.u.)	Maximum of 9.0; minimum of 6.0	7.8-8.2	No	August-September 1990	6
	Fecal Coliform (colonies per 100 ml)	Maximum of 200/400	140-5,900	Yes	August-September 1990	6

[a]Subwatershed codes are as follows: UF=Upper Fox, MF= Middle Fox, LF=Lower Fox, MK=Mukwonago River, HS=Honey/Sugar Creek, WN=White/Nippersink Creeks; see map V-6 for detailed locations.

[b]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.

The remaining water quality data collected on a short-term basis throughout the watershed do not illustrate trends. However, these data do illustrate that the phosphorus standards are exceeded in the Upper and Middle Fox River and Honey/ Sugar Creek systems.

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. Recent data on toxic and hazardous substances in the Fox River were collected by the Wisconsin Department of Natural Resources and the U.S. Geological Survey at stations Fx-7 and Fx-27a, respectively, as shown in Figures V-1 and V-3. These data indicate that levels of lead occasionally violated chronic toxicity level standards as established by the Wisconsin Department of Natural Resources for stations Fx-7 and Fx-27a. Levels of zinc and cadmium occasionally violated chronic toxicity level standards for station Fx-27a and levels of copper violated chronic and acute toxicity standards at station Fx-27a on one occasion.

In 1979, bottom sediment sampling was conducted by the Wisconsin Department of Natural Resources for three locations in the Fox River watershed. Results indicated that sediments within Honey Creek downstream of East Troy were moderately polluted by iron and heavily polluted by chromium and nickel. Fox River sediments in the City of Waukesha were moderately polluted by lead, zinc, iron, and nickel, and heavily polluted by copper.

Post-1976 data on toxic and hazardous substances present in stream sediments in the Fox River were collected by the Wisconsin Department of Natural Resources as part of the water quality appraisals for the Upper Fox River priority watershed plan and by the Regional Planning Commission in the Middle Fox River as part of a water level management plan refinement.[39] Data collected in 1993 at ten locations in the Upper Fox River subwatershed and seven locations in the Middle Fox River subwatershed indicated the presence of polycyclic aromatic hydrocarbons (PAHs) at 14 of the sampling stations, and polychlorinated biphenyls (PCBs) at six of the sampling stations as set forth in Table V-15. Higher levels of PAHs than stated in the lowest effect level (LEL) guidelines set forth in the draft screening criteria proposed by the Wisconsin Department of Natural Resources[40] were recorded in those sediments sampled in the Fox River downstream of IH 94, while higher levels of PCBs were observed in those sediments sampled in the Fox River and tributaries in the City of Waukesha. The data also indicated higher levels of heavy metals in the aforementioned river and tributary reaches than those levels recorded at other sampling stations. Concentrations of most metals included in the screening criteria also exceeded the Lowest Effect Level guidelines downstream of IH-94. Oil and grease concentrations also exceeded the LEL at four locations in the Middle Fox River downstream of IH 43, as set forth in Table 15. Copper concentrations exceeded the Severe Effect Level (SEL) guidelines at the Barstow Impoundment Recreational Center, Main Street and River Avenue, and in the Waterford Impoundment. Chromium concentrations exceeded the

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[39]SEWRPC Community Assistance Planning Report No. 5, Drainage and Water Level Control Plan for the Waterford-Rochester-Wind Lake Area of the Lower Fox River Watershed, May 1975.

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

Table V-15

CONCENTRATIONS OF TOXIC AND HAZARDOUS SUBSTANCES FOUND IN SEDIMENT SAMPLES
IN THE FOX RIVER WATERSHED: 1993-1994

	Sampling Stations-Upper Fox River Subwatershed									
	Fox River Main Stem					Fox River Tributaries at Frame Park		Fox River Tributaries		
Substances Sampled	CTH Y	Springdale Road	Sunset Drive	Barstow Impoundment-Boat Landing	Barstow Impoundment-Recreation Center	Arcadian Avenue	Main Street	Deer Creek at IH 94	Poplar Creek at Barker Road	Poplar Creek Tributary at CTH Y
Heavy Metals (mg/kg)										
Arsenic	2.76	5.66	10.0	12.3	14.7	9.73	8.63	5.15	9.02	7.06
Cadmium	0.73	1.01	1.11	1.45	1.07	1.92	4.49	1.38	0.77	0.59
Chromium	19.0	15.0	32.0	26.0	24.0	74.0	150.0	39.0	13.0	9.0
Copper	20.0	20.0	50.0	66.0	160.0	93.0	110.0	61.0	19.0	19.0
Lead	17.0	19.0	26.0	68.0	46.0	110.0	290.0	53.0	23.0	24.0
Mercury	0.08	0.12	0.31	0.19	0.18	0.06	1.1	0.22	0.05	0.05
Nickel	13.0	12.0	15.0	19.0	22.0	120.0	150.0	22.0	12.0	10.0
Zinc	120.0	94.0	170.0	200.0	180.0	280.0	350.0	260.0	96.0	120.0
Total Polycyclic Aromatic Hydrocarbons (μg/kg)	0.70	1.12	59.2	28.7	17.6	--	11.0	34.5	1.6	--
Total Polychlorinated Biphenyls (μg/kg)	--	--	150	50	--	630	740	--	240	160

Source: Wisconsin Department of Natural Resources

Table V-15 (continued)

CONCENTRATIONS OF TOXIC AND HAZARDOUS SUBSTANCES FOUND IN SEDIMENT SAMPLES
IN THE FOX RIVER WATERSHED: 1993-1994

Substances Sampled	Sampling Stations-Middle Fox River Subwatershed: Fox River Main Stem						
	IH 43	Center Road	East Troy Railroad	CTH LL	River Avenue	Edgewood Golf Course	Waterford Impoundment
Heavy Metals (mg/kg)							
Arsenic	1.7	5.66	10.0	12.3	14.7	9.73	8.63
Cadmium	2.0	1.01	1.11	1.45	1.07	1.92	4.49
Chromium	10.0	15.0	32.0	26.0	24.0	74.0	150.0
Copper	6.0	20.0	50.0	66.0	160.0	93.0	110.0
Lead	13.0	19.0	26.0	68.0	46.0	110.0	290.0
Mercury	0.0	0.12	0.31	0.19	0.18	0.06	1.1
Nickel	6.0	12.0	15.0	19.0	22.0	120.0	150.0
Zinc	26.0	94.0	170.0	200.0	180.0	280.0	350.0
Total Polycyclic Aromatic Hydrocarbons (μg/kg)	45	48	148	50	7	0.0	80
Total Polychlorinated Biphenyls (mg/kg)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aldrin (μg/kg)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chlordane	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total DDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0
op+pp DDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0
pp DDD	--	--	--	--	--	--	--
pp DDE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mirex	--	--	--	--	--	--	--
TCDD	--	--	--	--	--	--	--
NH_3-N (mg/kg)	--	--	--	--	--	--	--
O&G (mg/kg)	15,900.0	360.0	1100.0	850.0	1,200.0	560.0	1,400.0
CN (mg/kg)	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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

Source: Wisconsin Department of Natural Resources and SEWRPC.

SEL at Main Street and in the Waterford Impoundment. Lead and nickel concentrations exceeded the SEL in the Fox River Tributary at Frame Park and in the Waterford Impoundment. Sampling station locations are shown on Map V-6.

Surface water quality sampling data of non-agricultural volatile and semivolatile organic chemicals in the Fox River were collected by the U.S. Geological Survey in 1988.[41] The data were collected from one station on the Fox River near the Village of Big Bend, as indicated on Map V-6. Results of the analysis indicated that all of the chemicals sampled for were at concentrations below the minimum detection levels established for each chemical. Where toxicity criteria had been developed by the U.S. Environmental Protection Agency for selected chemicals, it should be noted that sampled concentrations were well below the levels of toxicity.

Since the completion of the initial regional water quality management plan, 15 spills of toxic substances into streams within the Fox River watershed have been documented by the Wisconsin Department of Natural Resources. Of these spills, nine have occurred in the main stem of the Fox River, five in the City of Waukesha, two in the City of Burlington, and two in the Village of Waterford. The remaining spills have occurred in tributaries of the Fox River, including the White and Pewaukee Rivers, and Honey, Deer, Pebble, and Spring Creeks. The majority of the substances that were spilled into surface waters were gasoline or related petroleum products.

Water Quality Assessments: Based upon the recent available data, the water quality and biological characteristics of the Fox River and its major tributaries were assessed, with the results set forth in Table V-16. Fish populations and diversity range from fair to good throughout. The portions of Genesee Creek above STH 59, and Potawatomi and Van Slyke Creeks support Class I trout fisheries. A 2.5-mile reach of Genesee Creek immediately downstream of STH 59, and Southwick and Spring Brook Creeks support Class II trout fisheries.

Fish kills were documented in three streams in the Fox River watershed - Muskego Canal, Pebble Brook, and the Fox River main stem in the City of Waukesha. Fish kills are primarily related to seasonal fluctuations in water temperature and levels of dissolved oxygen as well as spawning activity. The specific causes and severity of each documented fish kill is shown in Table V-16.

Standards were not fully met for dissolved oxygen concentrations and fecal coliforms in the majority of the streams in the Upper Fox River subwatershed and in the Honey/Sugar Creeks subwatershed. In addition, fecal coliform levels exceeded the standard in the Fox River from the confluence with Pebble Creek to IH 43 and from Echo Lake to the State line; and in the majority of the stream reaches in the White River/Nippersink Creek subwatershed. Problems with phosphorus concentrations were also estimated to exceed standards in parts of the Upper Fox River subwatershed, in the Lower Fox River, and in Honey Creek.

Metals concentrations which exceeded standards set forth in Chapter II were identified during a 1989 sampling survey conducted by consultants for the City

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[41]U.S. Geological Survey, "Surface Water Quality Assessment of the Upper Illinois River Basin in Illinois, Indiana, and Wisconsin: Data on Man-made Non-agricultural Volatile and Semivolatile Organic Chemicals in Water, May 1988 through March 1990," Open-File Report 92-46F, 1993.

Table V-16

CHARACTERISTICS OF STREAMS IN SUBWATERSHEDS WITHIN THE FOX 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[1]
				DO	NH_3	Total P	Fecal Coliform	Toxics			
FOX RIVER UPPER											
a. Fox River u/s Mill Road	5.2	Fair	No	Yes	No	No	Yes	--	Fair	Moderate (sand and silt)	Major
b. Fox River d/s Mill Road to Sussex Creek inflow	4.7	Fair	No	Yes	No	No	Yes	--	Fair	Moderate (sand and silt)	Major
c. Sussex Creek	7.7	Fair	No	Yes	No	Yes	Yes	--	Very poor	High (cobble, gravel, sand)	Moderate
d. Fox River d/s Sussex Creek to Watertown Road	6.8	Fair	No	Yes	No	Yes	Yes	--	Fair	Moderate (cobble, gravel, silt)	Moderate
e. Fox River d/s Watertown Road to Prairie Avenue	4.4	Fair	Yes[e]	Yes	No	Yes	Yes	Yes	Fair[f]	Moderate (boulders, rubble, gravel, sand)	Major
f. Fox River d/s Prairie Ave. to Pebble Creek inflow	2.7	Fair	No	Yes	No	Yes	Yes	--	Fair[f]	Moderate (boulders, rubble, gravel, sand)	Moderate
g. Deer Creek	7.0	Fair	No	Yes	No	Yes	Yes	--	Fair	High (clay, silt and concrete)	Moderate
h. Pebble Creek and Brandy Brook)	6.8	Fair	No	Yes	No	No	Yes	--	Fair	Moderate (sand, cobble, gravel, and silt)	High
i. Poplar Creek	7.0	Fair	No	Yes	No	Yes	Yes	No	Fair[f]	High (sand and gravel)	Moderate
j. Pewaukee River	7.5	Good	No	Yes	No	No	Yes	No	Poor	High (cobble and gravel)	Moderate
TOTAL	59.8										

Table V-16 (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[1]
				DO	NH_3	Total P	Fecal Coliform	Toxics			
FOX RIVER MIDDLE											
a. Fox River d/s Pebble Creek inflow to I-43	13.3	Fair to good	No	No	No	Yes	Yes	--	--	Moderate (silt and sand)	None
b. Fox River d/s I-43 to Waterford Impoundment	13.7	Fair to good	No	No	No	No	No	--	--	Moderate (silt and sand)	Moderate
c. Fox River d/s Waterford Impoundment to Echo Lake inflow	10.6	Fair to good	No	Yes	No	No	No	--	--	Low to moderate (silt and sand)	Moderate
d. Fox River d/s Echo Lake inflow to Spring Brook inflow	1.3	Fair	No	No	No	No	No	--	--	Moderate (sand and silt)	Low
e. Muskego Canal	2.4	--	Yes[g]	No	No	Yes	No	--	--	High (silt and sand)	Major
f. Wind Lake Drainage Canal	12.8	--	No	No	No	No	No	--	--	High (silt and sand)	Major
g. Genesee Creek and Spring Creek	11.2	Good[h]	No	No	No	No	No	--	--	Low to moderate (silt)	Low
h. Eagle Creek	5.5	--	No	No	No	No	Yes	--	--	Low to moderate (silt)	Low
i. Pebble Brook, Mill Brook, and Mill Creek	13.7	Good	Yes	Yes	No	No	Yes	--	--	Low to moderate (silt, gravel, sand)	Low
TOTAL	84.5										
FOX RIVER LOWER											
a. Fox River d/s Spring Brook Creek inflow to CTH JB	9.8	Fair	No	No	No	Yes	Yes	--	--	Moderate (sand and silt)	Low
b. Fox River d/s CTH JB to State Line	14.1	Fair	No	No	No	Yes	Yes	Yes	--	Moderate (sand and silt)	Low
c. Hoosier, Palmer, and Peterson Creeks	21.8	Fair[i]	No	--	--	--	--	--	--	Moderate (silt)	Moderate
d. Bassett Creek	5.1	Fair	No	No	No	No	No	--	--	Moderate (silt and sand)	Low
e. New Munster Creek	4.7	--	No	No	No	No	No	--	--	Moderate (sand and silt)	Low
TOTAL	55.5										
HONEY/SUGAR CREEKS											
a. Honey Creek and Spring Creek	34.8	Honey Creek -fair	No	Yes	No	Yes	Yes	--	--	High (silt)	Moderate
b. Sugar Creek and Spring Brook Creek	34.1	Fair[j]	No	Yes	No	Yes	Yes	--	--	Moderate (sand and silt)	Moderate
TOTAL	68.9										

Table V-16 (continued)

SUBWATERSHED Stream Reach	Stream Length (miles)	Fish Population and Diversity[a]	Recorded Fish Kills[b]	Water Quality Problems[c] DO	NH_3	Total P	Fecal Coliform	Toxics	Biotic Index Rating[d]	Streambed Sedimentation (substrate)	Physical Modifications to Channel[l]
MUKWONAGO RIVER											
a. Mukwonago River u/s Eagle Spring Lake	6.3	Good	No	No	No	No	No	--	--	Moderate (silt and sand)	None
b. Mukwonago River d/s Eagle Spring L. to Phantom Lakes	9.7	Good	No	No	No	No	No	--	--	Low (sand and silt)	None
c. Mukwonago River d/s Phantom Lakes	2.3	Good	No	No	No	No	No	No	Excellent	Low (sand, silt)	None
d. Jericho Creek	6.9	Fair	No	No	No	No	No	--	--	Low (silt, sand)	None
TOTAL	25.2										
WHITE RIVER/NIPPERSINK CREEK											
a. White River	22.5	Fair to good	No	No	No	No	Yes	--	--	Low to moderate (sand and silt)	Moderate
b. Como Creek	3.6	--	No	No	No	No	Yes	--	--	--	Moderate
c. Ore Creek	11.5	--	No	No	No	No	Yes	--	--	Moderate (sand, silt)	Moderate
d. Lake Ivanhoe outlet	8.4	--	No	No	No	No	Yes	--	--	Light (sand)	Low
e. Nippersink Creek	21.6	--	No	No	No	No	Yes	--	--	Moderate (sand and silt)	Moderate
f. Potawatomi, Van Slyke, and Southwick Creeks	3.1	Good[k]	No	--	--	--	--	--	--	Moderate (sand and silt)	None
TOTAL	70.7										

[a]Based upon stream appraisal documentation set forth in the November 1993 Upper Fox River Priority Watershed Plan 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]The most recent water quality data available as described in Figures V-1 through V-10 were used to evaluate water quality in the Fox 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 Fox River watershed stream reaches based upon simulated year 2000 land use conditions and current level of pollutant control, if appropriate.

[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]Undetermined cause.

[f]Biotic index rating is 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]Due to decreased water discharge from dam.
[h]Genesee Creek is a Class I trout stream upstream of STH 59, and a Class II trout stream downstream of STH 59.
[i]Palmer Creek is a Class III trout stream.
[j]Spring Brook Creek is a Class II trout stream.
[k]Potawatomi and Van Slyke Creeks are Class I trout streams. Southwick Creek is a Class II trout stream.
[l]Physical modifications to the channel were defined as: major if 50 percent or more of the stream reach was modified by structural measures or was deepened and straightened; moderate if 25 to 50 percent of the stream reach was modified; and low if up to 25 percent of the reach was modified.

Source: Wisconsin Department of Natural Resources and SEWRPC.

of Waukesha at locations both upstream and downstream of the Waukesha sewage treatment plant. The metals concentrations were variable and exceeded the standards for chromium, lead, and zinc on occasions. Only limited data were available on water column toxic pollutants at additional locations in the watershed, as noted in Table V-16. Additional data collected by the U. S. Geological Survey at station Fx-27a suggest that the standards for toxicity for copper and zinc have been occasionally exceeded only on very limited occurrences and generally metal concentrations appear to be within the acceptable levels, as defined in Chapter II.

The biotic index ratings, which are biological indicators of water quality within a stream system, were fair except for Pewaukee River which had a poor rating, Sussex Creek which had a very poor rating, and Mukwonago River downstream of Phantom Lakes which had an excellent rating. High levels of streambed sedimentation were noted in selected sections of the Fox River between IH 43 and the Waterford Impoundment, the upper reaches of the Pewaukee River, Poplar Creek, Honey Creek, Sussex Creek, Deer Creek, and in the Wind Lake and Muskego Canals. Elsewhere, the levels were generally low to moderate.

Table V-17 sets forth water quality index classifications[42] used in the initial plan for 1964, 1974-75, and for 1990-92 conditions for selected sampling stations in the watershed. The use of the index is discussed in Chapter II. As indicated in Table V-17, recent comparative water quality data were available for four stations on the Fox River main stem; one in the City of Waukesha, Fx-7; one just downstream of the City of Waukesha, Fx-10; one just upstream of the Village of Big Bend, Fx-13; and one just downstream of the Wisconsin-Illinois State Line, Fx-27a; and for four stations on tributaries of the Fox River: two on the Pewaukee River, one on Poplar Creek, and one on Honey Creek. These stations and additional locations where water quality data were collected by the Wisconsin Department of Natural Resources are shown on Map V-6. The data obtained for USGS sampling station Fx-27a, just downstream of the Wisconsin-Illinois State Line, were used for comparative purposes in conjunction with earlier data from station Fx-27, located on the Fox River just upstream of the State line. The limited data available indicate that water quality conditions from 1974-75 through 1990-92 have remained "fair" at stations Fx-6, Fx-7, and Fx-10, and have remained "good" at stations Fx-13 and Fx-27. Improvements in water quality conditions were indicated at station Fx-5 from where the classification was "poor" in 1974-75 and was "fair" in 1990-92. These improvements can be attributed, in part, to the abandonment of the Village of Pewaukee sewage treatment plant which occurred in 1981. Water quality improvements from a classification of "fair" in 1974-75 to "good" in 1990-92 were also noted at station Fx-21, located downstream of the Village of East Troy sewage treatment plant which was upgraded in 1982. Water quality conditions at station Fx-3 on Poplar Creek decreased from "fair" to "poor" from 1974-75 to 1990-92, most likely as a result of increased urban development and associated construction site erosion in the tributary area.

A summary of potential pollution sources in the Fox River watershed by stream reach is shown in tabular summary in Table V-18. Review of the data indicate the majority of the conversion of lands from rural to urban uses has occurred in

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[42]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 V-17

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATIONS OF THE FOX RIVER WATERSHED 1964, 1974-1975, AND 1990-92

Water Quality Sampling Stations[a]	July, August, September, and October of 1964	August of the Years 1974-1975	July, August, and September 1990-1992
Main Stem Stations			
Fx-1	Fair	Fair	--
Fx-4	Poor	Fair	--
Fx-7	Fair	Fair	Fair
Fx-8	Poor	Fair	--
Fx-9	Poor	Fair	--
Fx-10	Poor	Fair	Fair
Fx-11	Fair	Fair	--
Fx-13	Good	Good	Good[b]
Fx-14	Good	Good	--
Fx-17	Good	Good	--
Fx-24	Fair	Fair	--
Fx-27	Good	Good	Good
Tributary Stations			
Fx-2	Fair	Fair	--
Fx-3	Fair	Fair	Poor
Fx-5	Poor	Poor	Fair
Fx-6	Good	Fair	Fair
Fx-12	Excellent	Excellent	--
Fx-15	Poor	Fair	--
Fx-16	Good	Good	--
Fx-18	Fair	Fair	--
Fx-19	Fair	Fair	--
Fx-20	Fair	Fair	--
Fx-21	Good	Fair	Good
Fx-22	Good	Good	--
Fx-23	Good	Fair	--
Fx-25	Poor	Fair	--
Fx-26	Fair	Fair	--
Fx-28	Good	Fair	--
Watershed Average	Fair	Fair	Fair

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

[b]Recent short-term water quality data available for these stations were used to calculate 1990-1992 water quality indices.

Source: SEWRPC.

Table V-18

SUMMARY OF POTENTIAL SURFACE WATER POLLUTION SOURCES IN THE FOX 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	
UPPER FOX RIVER Fox River upstream Mill Road	insignificant	insignificant	--	x	x	--	--	--	Industrial Waste Corp. landfill (abandoned)		1,2
Fox River downstream Mill Road to Sussex Creek inflow	insignificant	insignificant	--	x	x	--	--	--	Martha Zaretzke landfill[e] (inactive) Mill Lands, Inc. landfill (abandoned) Unnamed landfills in Village of Menomonee Falls, Sec. 30 (inactive) and Sec. 28 (inactive)	Willow Springs Mobile Home Park private sewage treatment plant recommended for abandonment	1,2
Sussex Creek	significant	insignificant	--	x	x	1	--	2	Milwaukee Road landfill (inactive) Vulcan Materials landfill (inactive)		1,2
Fox River d/s Sussex Creek to Watertown Road	moderate	moderate	--	x	x	1	--	3	Unnamed landfill in City of Brookfield Sec. 17 (inactive) Master Disposal Sanitary Landfill[f] (inactive) Fly ash disposal site in City of Brookfield Sec. 5 (inactive)		1,2,3
Fox River d/s Watertown Road to Prairie Avenue (Waukesha)	moderate[d]	moderate[d]	1978 - gasoline 1984 - petroleum product 1986 - unknown 1988 - unknown 1988 - petroleum	x	--	1	--	14	Johnson Sand and Gravel landfill (abandoned) Unnamed Landfill Town of Waukesha, Sec. 1 (abandoned)		1,2
Fox River d/s Prairie Avenue to Pebble Creek inflow	moderate[d]	moderate[d]	--	x	--	--	--	3	City of Waukesha sanitary landfill (abandoned)		1,2,3
Deer Creek	moderate[d]	significant[d]	--	x	--	--	--	5	--	City of New Berlin-Regal Manor private sewage treatment plant abandoned in 1984.	1,2

Table V-18 (continued)

Subwatershed Stream Reach[a]	Extent of Conversion of Lands from Rural to Urban[b]: Historical 1976-1990	Expected 1990-2010	Documented Toxic Spills 1976-1990	Remaining Potential Surface Water Pollution Sources: 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	Ongoing Pollution Abatement Efforts[c]
Pebble Creek and Brandy Brook	significant	moderate	--	x	x	--	--	1	--		1,2
Poplar Creek	significant	moderate	--	x	x	--	1	2	United Waste Systems Landfill (abandoned) Bodus Landfill (abandoned)[h] Industrial Waste Corp. landfill (active)	Cleveland Heights Elementary School private sewage treatment plant abandoned in 1986 New Berlin-West High School private sewage treatment plant recommended for abandonment	1,2
Pewaukee River	significant	moderate	1984 - unknown 1986 - oil	x	x	--	--	4	--	Village of Pewaukee public sewage treatment plant abandoned in 1981	1,2
MIDDLE FOX RIVER Fox River d/s Pebbel Creek inflow	moderate	significant	--	x	x	--	--	3			2
Fox River d/s IH 43-Waterford Impoundment	insignificant	significant	--	--	x	--	--	--			2
Fox River d/s Waterford Impoundment to Echo Lake inflow	insignificant	significant	1978-Kerosene Solvent 1990-Diesel Fuel	x	x	--	--	--			--
Fox River d/s Echo Lake Inflow to Spring Brook inflow	insignificant[d]		1978-Oil 1990-Petroleum Product	x	x	1	1	4		Packaging Corporation of America private sewage treatment plant recommended for abandonment	--
Muskego Canal	moderate	significant	--	--	x	--	--	2			2,4
Wind Lake Drainage Canal	insignificant	insignificant	--	--	x	1	1	1	West Shore Pipeline Company-Broken pipeline remediation efforts permitted to discharge treated wastewater to Wind Lake Drainage Canal Tributary		2,4

Table V-18 (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	
Genesee Creek and Spring Creek	major	moderate	--	--	x	--	--	--			2
Eagle Creek	insignificant	insignificant	--	--	x	1	--	--			--
Pebble Brook, Mill Brook, and Mill Creek	major	moderate	--	x	x	--	--	1			2
LOWER FOX RIVER Fox River d/s Spring Brook Creek to CTH JB	insignificant	significant	--	x	x	--	--	2			2
Fox River d/s CTH JB to State Line	insignificant	moderate	--	--	x	2	1	--			2
Hoosier, Palmer and Peterson Creeks	insignificant	insignificant	--	--	x	--	1[g]	2			2
Bassett Creek	significant	significant	--	--	x	1	--	--			2
New Munster Creek	insignificant	insignificant	--	--	x	--	--	--			2
MUKWONAGO RIVER Mukwonago River u/s of Eagle Spring Lake	insignificant	insignificant	--	--	x	--	--	--			2
Mukwonago River Eagle Spring Lake to Phantom Lakes	significant	significant	--	--	x	--	1	--		Classified as an Exceptional Resource Water Rainbow Springs private sewage treatment is currently not in operation	2
Mukwonago River d/s Phantom Lakes	significant	significant	--	x	x	1	--	--			2
Jericho Creek	major	significant	--	--	x	--	--	--			2

Table V-18 (continued)

Subwatershed Stream Reach[a]	Extent of Conversion of Lands from Rural to Urban[b] Historical 1976-1990	Expected 1990-2010	Documented Toxic Spills 1976-1990	Remaining Potential Surface Water Pollution Sources: 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	Ongoing Pollution Abatement Efforts[c]
HONEY/SUGAR CREEKS Honey Creek	insignificant	significant	--	x	x	1	--	4	Leaking Underground Storage Tank site permitted to discharge remediation wastewater to Honey Creek		2
Sugar Creek and Spring Brook Creek	insignificant	insignificant	--	--	x	--	1	--			2
WHITE RIVER / NIPPERSINK CREEK White River	insignificant	significant	1984-Gas-oil mixture 1988-Diesel fuel 1986-Gasoline	x	x	2	1	1			2
Como Creek	insignificant	significant	--	x	x	--	--	--			2
Ore Creek	insignificant	significant	--	--	x	--	--	--		Country Estates mobile home park private sewage treatment plant abandoned in 1988	2
Lake Ivanhoe Outlet	insignificant	insignificant	--	--	x	--	--	--			2
Nippersink Creek	insignificant	significant	--	--	x	1	1	1		Wisconsin Dairies Cooperative private sewage treatment plant was abandoned in 1979	2
Potawatomi, Van Slyke and Southwick Creeks	significant	significant	--	x	x	--	--	1			2

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

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

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

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

1. Upper Fox River Priority Watershed Nonpoint Source Plan Implementation Underway
2. Construction Erosion Control Ordinances in place
3. Sewage Treatment Plant Upgrading Underway
4. Muskego-Wind Lakes Priority Watershed Nonpoint Source Plan Implementation Underway

Footnotes continue.

Table V-18 (continued)

[d] Considerable urban development existing pre-1976.

[e] Landfill identified for State action.

[f] Superfund site

[g] The private sewage treatment plant serving the Bong Recreational Area is located in the Des Plaines River watershed. Treated effluent from the plant is discharged to Peterson Creek in the Fox River watershed.

[h] Bodus landfill was determined to have collected mixed industrial wastes during its operation and is considered by the U.S. Environmental Protection Agency to have potentially accepted hazardous wastes.

Source: Wisconsin Department of Natural Resources and SEWRPC.

the Upper Fox River and Mukwonago River subwatersheds. It should also be noted that a majority of the documented spills of toxic substances and the majority of the permitted industrial discharges have occurred in streams in the Upper Fox and Middle Fox River subwatersheds. 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 V-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; U.S. Environmental Protection Agency (EPA) national eutrophication survey--reports on Browns Lake, Como Lake, Geneva Lake, Middle Lake, Pewaukee Lake, and Tichigan Lake; and Southeastern Wisconsin Regional Planning Commission and Wisconsin Department of Natural Resources lake use reports. Post-1975 data on phosphorus and chlorophyll concentrations and water clarity for major lakes in the Fox River watershed, where available, are presented in Table V-19.

Toxic and Hazardous Substances: A number of the lakes in this watershed were subjected to substance spills. These include Big Muskego Lake, Lake Como, Geneva Lake, Powers Lake, Pewaukee Lake, and Phantom Lakes. The majority of the substances that were spilled into these surface waters were gasoline or related petroleum products.

Water Quality Assessments: Data from Table V-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[43] for each major lake in the Fox River watershed where data were available, as indicated in Table V-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 V-21. These data are presented using the Carlson Trophic State Index[44] 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 V-20 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. Beulah, Bohner, Eagle Spring, Geneva, the three Lauderdale Lakes, Pewaukee, Powers, Silver-Kenosha, Spring, Lower Phantom, and Waubeesee Lakes are all drainage lakes classified in the mesotrophic range. Booth, Peters, and Pleasant Lakes are mesotrophic seepage lakes and Browns, Center, and Upper Phantom Lakes are mesotrophic spring lakes. Benedict/Tombeau Lake and Lake Mary are also mesotrophic, and are classified as drained lakes. Elizabeth and Wandawega Lakes, drainage and seepage lakes respectively, are currently classified as meso-eutrophic lakes.

[43]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.

[44]The Carlson Trophic State Index is set forth in "A Trophic State Index for Lakes," Robert E. Carlson, Limnology and Oceanography, Vol. 22(2), March 1977.

Table V-19

WATER QUALITY OF THE MAJOR LAKES IN THE FOX RIVER WATERSHED

SUBWATERSHED Lake Name	Area (acre)	Total Phosphorus (mg/l) Maximum	Minimum	Average[a]	Date of Data	Source[b]	Chlorophyll-a (µg/l) Maximum	Minimum	Average[a]	Date of Data	Source[b]	Secchi Disk (feet) Maximum	Minimum	Average[a]	Date of Data	Source[b]
FOX RIVER-UPPER																
Pewaukee Lake	2,439	0.36	0.016	0.058(67)	1986-87	LTT	15.0	2.0	9.95(22)	1986-87	LTT	19.7	2.8	6.64(33)	1986-87	LTT
FOX RIVER-MIDDLE																
Big Muskego Lake	2,177	0.31	0.03	0.11(30)	1989-93	USGS	100.0	31.0	48.7(15)	1989-93	USGS	5.5	1.0	2.18(61)	1989-93	SELF-HELP
Denoon Lake	162	0.35	0.01	0.11(16)	1991-92	USGS	22.0	4.0	9.4(8)	1991-92	USGS	8.9	4.9	6.5(8)	1991-92	USGS
Eagle Lake	520	0.12	<0.01	0.06(41)	1975-92	LSF	44.0	1.0	14.8(73)	1976-92	SEWRPC	11.0	1.75	4.66(18)	1991-92	SELF-HELP
Kee Nong Go Mong	88	0.55	0.01	0.07(33)	1989-92	USGS	31.0	5.9	12.5(24)	1988-92	USGS	7.2	2.0	5.1(25)	1988-92	USGS
Little Muskego Lake	506	0.99	0.01	0.09(132)	1987-90	USGS	81.0	3.0	23.8(53)	1987-90	USGS	7.0	3.5	4.39(7)	1991	SELF-HELP
Long Lake (Racine Co.)	102	0.07	0.03	0.05(8)	1977-78	LSF	--	--	--	--	--	4.0	1.3	2.5(4)	1977-78	LSF
Spring Lake (Waukesha County)	105	--	--	--	--	--	--	--	6.0(1)	1980	STORET	10.0	4.5	7.0(23)	1980	SELF-HELP
Waterford Impoundment																
Buena Lake	241	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tichigan Lake	892	1.33	0.05	0.28(41)	1973-80	LSF	--	--	--	--	--	9.0	2.5	4.88(33)	1986-89	SELF-HELP
Waubeesee Lake	129	0.19	<0.01	0.43(32)	1988-92	USGS	5.0	1.0	2.9(16)	1988-92	USGS	19.5	7.5	12.3(31)	1989-92	SELF-HELP
Wind Lake	936	0.87	0.01	0.18(119)	1985-90	USGS	65.0	1.8	22.7(40)	1985-90	USGS	10.25	2.0	5.49(20)	1988-89	SELF-HELP
FOX RIVER-LOWER																
Bohner Lake	135	0.09	0.01	0.04(14)	1977-78	LSF	5.2	1.0	3.1(2)	1977-78	LSF	10.0	4.75	7.65(23)	1989-91	SELF-HELP
Browns Lake	396	0.23	0.012	0.033(53)	1986-87	LTT	1.00	2.0	5.18(18)	1986-87	LTT	16.4	1.7	6.88(33)	1986-87	LTT
Camp Lake	461	0.07	<0.01	0.04(20)	1975-78	LSF	--	--	--	--	--	5.0	5.0	5.0(1)	1989	SELF-HELP
Center Lake	129	0.75	0.03	0.08(3)	1977	LSF	--	--	--	--	--	30.0	1.0	14.0(10)	1989-92	SELF-HELP
Cross Lake	87	0.16	0.01	0.07(3)	1977	LSF	--	--	--	--	--	11.5	4.0	5.94(26)	1989-92	SELF-HELP
Dyer Lake	56	0.11	0.04	0.06(3)	1977	LSF	--	--	--	--	--	--	--	10.0(1)	1977	LSF
Lilly Lake	88	4.76	<0.01	0.11(358)	1978-82	STORET	33.0	2.0	7.9(139)	1978-81	STORET	6.0	3.0	5.5(11)	1975-78	LSF
Silver Lake (Kenosha)	464	0.07	<0.01	0.03(28)	1973-77	LSF	--	--	--	--	--	11.25	5.0	8.4(33)	1987-91	SELF-HELP
Voltz Lake	52	0.37	0.09	0.20(3)	1977	LSF	--	--	--	--	--	5.5	2.5	4.06(4)	1989	SELF-HELP
HONEY/SUGAR CREEKS																
Lauderdale Lakes																
Green	311	--	--	--	--	--	11.0	3.0	6.3(3)	1980-81	STORET	27.9	6.9	14.3(3)	1980-81	STORET
Middle	259	--	--	--	--	--	6.0	5.0	5.3(3)	1980-81	STORET	18.4	6.9	12.0(3)	1980-81	STORET
Mill	271	--	--	--	--	--	6.0	5.0	5.5(2)	1980-81	STORET	--	--	--	--	--
North Lake (Walworth)	191	--	--	0.33(1)	1978	STORET	--	--	--	--	--	--	--	--	--	--
Pleasant Lake	155	0.02	0.01	0.02(3)	1978	LSF	--	--	5.0(2)	1980-81	STORET	19.25	4.25	9.7(130)	1986-92	SELF-HELP
Potter Lake	162	0.34	0.05	0.27(3)	1975-78	LSF	20.00	10.0	15.0(2)	1980-81	STORET	3.9	2.3	3.1(2)	1980-81	STORET
Silver Lake (Walworth)	85	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Wandawega Lake	119	0.07	<0.01	0.03(10)	1978-79	LSF	--	--	--	--	--	7.0	2.9	4.8(5)	1978-79	LSF

Table V-19 (continued)

SUBWATERSHED Lake Name	Area (acre)	Total Phosphorus (mg/l) Maximum	Minimum	Average[a]	Date of Data	Source[b]	Chlorophyll-a (µg/l) Maximum	Minimum	Average[a]	Date of Data	Source[b]	Secchi Disk (feet) Maximum	Minimum	Average[a]	Date of Data	Source[b]
MUKWONAGO RIVER																
Army Lake	78	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Beulah Lake	834	--	--	--	--	--	--	--	<5.0(1)	1980	STORET	14.0	4.5	8.43(26)	1991	SELF-HELP
Booth Lake	113	0.01	<0.01	0.01(3)	1978	LSF	--	--	5.0(1)	1980	STORET	10.5	7.5	9.31(4)	1991	SELF-HELP
Eagle Spring Lake	311	0.09	<0.01	0.02(27)	1975-92	LSF/USGS	10.0	4.0	6.6(9)	1980-92	USGS	6.2	3.9	4.8(9)	1980-92	USGS
Lulu Lake	84	--	--	--	--	N/A	--	--	--	--	--	--	--	--	--	--
Peters Lake	64	0.18	0.03	0.08(3)	1978	LSF	--	--	16.1(1)	1978	LSF	--	--	5.0(1)	1978	LSF
Upper Phantom Lake	107	0.03	<0.01	0.02(14)	1977-80	LSF	9.8	9.8	5.5(3)	1977-80	LSF	17.5	7.0	11.7(5)	1991-92	SELF-HELP
Lower Phantom lake	433	0.14	<0.01	0.03(15)	1975-80	LSF	--	--	3.9(1)	1980	LSF	11.0	11.0	11.0(8)	1986	SELF-HELP
WHITE RIVER/ NIPPERSINK CREEK																
Benedict Lake	78	0.04	0.03	0.037(3)	1977	LSF	--	--	--	--	--	4.0	14.0	8.63(43)	1989-92	SELF-HELP
Lake Como	946	0.15	0.01	0.062(30)	1975-79	LSF	62.48	61.0	61.7(2)	1976-77	LSF	6.0	0.85	2.25(13)	1975-79	LSF
Echo Lake	71	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Elizabeth Lake	865	0.10	<0.01	0.03(76)	1973-91	LSF	14.7	4.0	8.6(11)	1976-78	LSF	9.0	4.5	6.28(35)	1991-92	SELF-HELP
Geneva Lake	5262	0.127	0.007	0.023(129)	1975-90	STORET	8.0	2.0	4.2(20)	1988-90	STORET	27.89	6.56	14.2(50)	1986-89	SELF-HELP
Lake Mary	315	0.09	<0.01	0.021(69)	1973-91	LSF	6.06	3.0	4.7(7)	1976-78	LSF	8.5	5.5	7.3(20)	1987-91	SELF-HELP
Pell Lake	86	--	--	--	--	--	--	--	--	--	--	4.0	2.0	3.16(3)	1988	SELF-HELP
Powers Lake	459	0.055	<0.005	0.02(56)	1986-92	USGS	13.0	1.0	3.3(26)	1986-92	USGS	18.0	5.5	10.31(94)	1986-92	SELF-HELP

[a] Number in parentheses refers to 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: 1986-1987
SELF-HELP.....Wisconsin Self-Help Lake Monitoring Program Data: 1986-1992
SEWRPC........SEWRPC Planning Report No. 30, A Regional Water Quality Management Plan for Southeastern Wisconsin: 2000, 1978
STORET........U.S. Environmental Protection Agency, Water Inforamtion Storage and Retrieval System
USGS..........U.S. Geological Survey, Water Resources Data - Wisconsin (annual)

Source: SEWRPC.

Table V-20

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

Subwatershed Lake Name	Wisconsin Trophic State Index Values[b]			
	Total-P	Chlorophyll-a	Secchi	Mean
FOX RIVER UPPER				
Pewaukee Lake	57.4	50.1	51.8	53.1
FOX RIVER MIDDLE				
Big Muskego Lake	64.7	64.1	50.4	59.7
Lake Denoon	64.5	51.7	50.1	55.5
Eagle Lake	61.0	60.8	54.9	58.9
Kee Nong Go Mong Lake	63.5	53.9	53.6	57.0
Little Muskego Lake	63.2	58.5	55.8	59.2
Long Lake	58.6	--	--	58.6
Spring Lake (Waukesha County)	--	45.2	44.1	44.7
Waterford Impoundment				
Buena Lake	--	--	--	--
Tichigan Lake	72.0	--	54.3	63.2
Waubeesee Lake	64.8	42.8	40.9	49.5
Wind Lake	68.6	58.2	60.0	62.3
FOX RIVER LOWER				
Bohner Lake	56.8	43.3	44.7	48.3
Browns Lake	54.3	47.1	44.4	48.6
Camp Lake	56.8	--	54.2	55.5
Center Lake	62.2	--	39.1	50.7
Cross Lake	61.2	--	52.4	56.8
Dyer Lake	60.0	--	--	60.0
Lilly Lake	64.7	50.3	52.6	55.9
Silver Lake (Kenosha County)	54.6	--	48.8	51.7
Voltz Lake	69.4	--	56.9	63.2
HONEY/SUGAR CREEK				
Lauderdale Lakes				
Green Lake	--	48.6	38.9	43.8
Middle Lake	--	47.3	41.4	44.4
Mill Lake	--	47.5	--	47.5
North Lake (Walworth County)	73.3	--	--	73.3
Pleasant Lake	51.5	46.8	42.4	46.9
Potter Lake	71.7	55.1	43.7	56.8
Silver Lake (Walworth County)	--	--	--	--
Wandawega Lake	56.4	--	54.6	55.5

Table V-20 (continued)

Subwatershed Lake Name	Wisconsin Trophic State Index Values[b]			
	Total-P	Chlorophyll-a	Secchi	Mean
MUKWONAGO RIVER				
Army Lake	--	--	--	--
Beulah Lake	--	<46.8	46.5	46.7
Booth Lake	46.1	46.8	44.9	45.9
Eagle Spring Lake	52.9	49.7	54.5	52.3
Lulu Lake	--	--	--	--
Peters Lake	62.2	55.6	36.8	51.5
Lower Phantom Lake	54.6	45.0	42.6	47.4
Upper Phantom Lake	51.5	47.5	44.7	47.9
WHITE RIVER/NIPPERSINK CREEK				
Benedict Lake	56.2	--	45.9	51.1
Lake Como	60.3	65.7	65.6	63.9
Echo Lake	--	--	--	--
Elizabeth Lake	55.6	51.9	50.6	52.7
Geneva Lake	52.5	45.5	39.2	45.7
Lake Mary	52.5	46.6	48.5	49.2
Pell Lake	--	--	60.4	60.4
Powers Lake	51.5	43.8	43.5	46.8

[a] Wisconsin Trophic State Index Values were calculated using water chemistry data shown in Table V-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 V-21

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

SUBWATERSHED Lake Name	Carlson Trophic State Index Values[b]		
	Satellite Information 1979-1981	Water Chemistry Pre - 1981	Water Chemistry 1981-1991
FOX RIVER UPPER			
Pewaukee Lake	49	--	59
FOX RIVER MIDDLE			
Big Muskego Lake	59	--	70
Lake Denoon	47	--	49
Eagle Lake	55	65	52
Kee Nong Go Mong Lake	50	--	55
Little Muskego Lake	48	--	62
Long Lake	--	61	--
Spring Lake (Waukesha County)	51	--	51
Waterford Impoundment			
Buena Lake	56	85	--
Tichigan Lake	54	72	54
Waubeesee Lake	50	--	46
Wind Lake	55	--	69
FOX RIVER LOWER			
Bohner Lake	52	49	45
Browns Lake	49	53	51
Camp Lake	52	54	54
Center Lake	50	61	35
Cross Lake	49	57	52
Dyer Lake	50	53	--
Lilly Lake	--	57	--
Silver Lake (Kenosha County)	50	48	50
Voltz Lake	51	73	57
HONEY/SUGAR CREEK			
Lauderdale Lakes			
Green Lake	48	53	49
Middle Lake	46	53	51
Mill Lake	48	52	--
North Lake (Walworth County)	56	88	--
Pleasant Lake	48	46	45
Potter Lake	52	85	78
Silver Lake (Walworth County)	--	--	--
Wandawega Lake	50	61	--

Table V-21 (continued)

SUBWATERSHED Lake Name	Carlson Trophic State Index Values[b] Satellite Information 1979-1981	 Water Chemistry Pre - 1981	 Water Chemistry 1981-1991
MUKWONAGO RIVER			
Army Lake	48	--	--
Beulah Lake	46	52	46
Booth Lake	47	48	45
Eagle Spring Lake	49	56	49
Lulu Lake	48	--	--
Peters Lake	48	--	--
Lower Phantom Lake	46	50	43
Upper Phantom Lake	48	50	44
WHITE RIVER/NIPPERSINK CREEK			
Benedict Lake	46	59	44
Lake Como	62	73	--
Echo Lake	55	--	--
Elizabeth Lake	50	56	52
Geneva Lake	50	--	48
Lake Mary	48	55	47
Pell Lake	53	--	60
Powers Lake	48	--	45

[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 V-19. Satellite Information Values were determined from Wisconsin's 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.

Big Muskego, Camp, Como, Cross, Dyer, Eagle, Kee Nong Go Mong, Little Muskego, Long, Buena, Tichigan, Voltz, and Wind Lakes are all drainage lakes classified in the eutrophic range. Lilly, Pell, and Potter Lakes are classified as eutrophic seepage lakes. North Lake (Walworth County), also a seepage lake, is considered very eutrophic or slightly hypertrophic. No current data are available to make assessments of trophic status for Echo and Lulu Lake, drainage and drained lakes respectively, or for Army, Denoon, and Silver (Walworth County) Lakes, classified as seepage lakes. Based upon a comparison of available TSI data, few conclusions regarding changes in water quality conditions between 1976 and 1991 can be drawn based upon the limited data available, although slight improvements in water quality may have occurred in the Waterford Impoundment--Tichigan and Buena Lakes; Eagle Lake, Center Lake, Voltz Lake, and Benedict Lake.

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 Beulah Lake in 1985, Lake Como in 1991, Geneva Lake in 1981 and 1985, Little Muskego Lake in 1981, Wandawega Lake in 1988, and Wind Lake in 1981 and 1987. 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 consideration at this time.

Compliance with Water Use Objectives

As indicated in Chapter II, the majority of the stream reaches studied in the Fox River watershed are generally recommended for warmwater sport fish and full recreational uses. These water use objectives and the associated water quality standards are discussed in Chapter II. Potawatomi, Van Slyke, Southwick, Pebble, Brandy, and Spring Brook Creeks, and Genesee Creek upstream of Spring Creek are recommended for coldwater communities and full recreational uses because of their potential to support trout populations. Van Slyke and Potawatomi Creeks and a portion of Genesee Creek have been designated as Class I trout streams, and Southwick Creek and portions of Genesee and Spring Brook Creeks are designated as Class II trout streams. The remaining portion of Spring Brook Creek is designated as a Class III trout stream.[45] Sussex Creek has limitations for sport fish habitat and is recommended for warmwater forage fish and full recreational use. However, Sculpins, a coldwater fish species, have been found in the stream, indicating the potential for upgrading--perhaps through habitat reconstruction projects. The remaining streams are recommended for warmwater sport fish and full recreational uses. In addition, as noted in Chapter II, special designations as "Outstanding Resource Waters" have been given to Potawatomi and Van Slyke Creeks in Walworth County. In addition, Genesee Creek above STH 59 and the Mukwonago River from Eagle Springs Lake to Upper Phantom Lake, both in Waukesha County, have been designated as "Exceptional Resource Waters".

Based upon the available data for sampling stations in the watershed, the main stem of the Fox River and most of its major tributaries 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. As part of the Upper Fox 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 Upper Fox River subwatershed. Those

[45]Wisconsin Department of Natural Resources Publication No. FM-213-72, reissued as Publication No. 6-3600(80), Wisconsin Trout Streams, 1980.

investigations indicated that during 1990 and 1991 none of the streams in the Upper Fox River watershed fully met the recommended water use objectives. Based upon a review of the data summarized in Figures V-1 through V-10 and in Table V-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 the fecal coliform and phosphorus standards also occur along the entire main stem of the Fox River and the recommended water use objectives continue to be partially met in the majority of the major streams in the watershed. However, the recommended water use objectives are likely to be met in the Mukwonago River where the only significant source of pollution which existed in 1975--the Village of Mukwonago sewage treatment plant discharge--has been removed and now discharges to the Fox River downstream of the Mukwonago River. In addition, Genesee, Spring, Potawatomi, Van Slyke, Southwick, and Palmer Creeks may also potentially be meeting the water use objectives based upon the observed uses in those streams. It is also expected that selected tributaries of the Middle and Lower Fox subwatersheds may largely meet the standards associated with the recommended water use objectives.

There are currently three stream reaches for which the water use objectives set forth herein are higher than the objectives set forth in Chapter NR 104 of the Wisconsin Administrative Code. These include Eagle Creek, Deer Creek, and Poplar Creek. Chapter NR 104 classifies portions of Poplar and Eagle Creeks as capable of supporting limited forage fish communities and Deer Creek and the remaining portions of Poplar and Eagle Creeks as capable of supporting only limited aquatic life communities, while the objectives set forth herein recommend a warmwater sport fish objective for all three streams. Under the Upper Fox River Priority Watershed Planning Program, the necessary stream appraisals have been conducted by the DNR staff to support upgrading the objectives for Deer Creek and Poplar Creek. It is recommended that a stream appraisal to further assess the potential for a higher use objective be conducted for Eagle Creek. It is further recommended that a stream appraisal to evaluate the potential for a higher use objective be conducted for Sussex Creek, due to the recording of Sculpins, a coldwater species, in the creek. Sussex Creek is currently recommended for warmwater forage fish. These stream appraisals are recommended to be part of the next one-year monitoring period envisioned to be carried out in the Fox River watershed.

The waters of the lakes in the Fox River watershed--excepting Lakes Geneva, Echo, Kee Nong Go Mong, and the Waterford Impoundment--are recommended for the maintenance of a warmwater sport fishery and full recreational use. Geneva Lake is recommended for maintenance of coldwater sport fish and full recreational use. Echo Lake, Lake Kee Nong Go Mong, and the Waterford Impoundment--only the Buena Lake portion--are recommended for maintenance of a warmwater sport fishery and limited recreational use as a result of high levels of fecal coliform or total phosphorus. In addition, as discussed in Chapter II, special designation as "Outstanding Resource Waters" has been given to Lulu Lake in Walworth County and Spring Lake in Waukesha County. All of the lakes for which water quality data were available between 1965 and 1975, except for Booth and Browns Lakes, violated the standards for total phosphorus of 0.02 mg/l recommended by the Commission. Pleasant and Silver (Walworth County) Lakes were also estimated to meet the standard based upon modeling data developed in the initial plan. In addition, over half of the lakes for which data were available during this period--13, or 59 percent--violated the dissolved oxygen standard on at least one occasion between 1965 and 1975.

As shown in Table V-19, recent monitoring data were available for most lakes in this watershed from the DNR Self-help Monitoring Program data base or from monitoring studies conducted under the auspices of the Chapter NR 119 Lake Management Planning Grant Program. These data were used to assess compliance with water quality standards for the major lakes in the Fox River watershed. Based upon these data, as summarized in the Carlson TSI values set forth in Table V-21, most lakes in the watershed could be expected to have average total phosphorus concentration in excess of the 0.02 mg/l standard, which is represented by a TSI value in excess of approximately 47. Waubeesee, Bohner, Center, Pleasant, Beulah, Booth, Lower Phantom, Upper Phantom, Benedict, and Powers Lakes have TSI values of less than 47, based upon water quality monitoring data obtained between 1981 and 1991, and thus, would be expected to meet the standard.

WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

Based upon local facility planning, land use decisions, and identified onsite sewerage system problems, there is a need to conduct subsequent subregional sewerage system evaluations for six specific areas in the Fox River watershed. These areas include the Village of North Prairie and environs in Waukesha County; the Benedict, Tombeau, and Powers Lakes area in Kenosha County; the Pell Lake area in Walworth County; the Village of Big Bend and Town of Vernon areas in Waukesha County; and the Town of Wheatland-Silver Lake area in Kenosha County. Subregional studies potentially leading to formal amendments to the regional water quality management plan are recommended to be conducted as budgeting and local support becomes available. In addition, an amendment to the regional water quality management plan for the Bohner Lake area was under preparation early in 1994. That amendment would add the urban development around Bohner Lake to the planned sewer service area of the City of Burlington based upon local facility planning studies.

In addition to the issues noted above relating to sewerage system planning, it is also recommended that the Wisconsin Department of Natural Resources conduct a water quality and biological condition survey of Eagle Creek and Sussex Creek in order to reevaluate the current water use objectives.

Village of North Prairie Sewage Treatment Plant Evaluation

Based upon the findings of a facility plan prepared for the Village of North Prairie,[46] it is recommended that the public sewer service recommendation for the Village of North Prairie be reevaluated in a subsequent planning study which would include the connection of the Village to the Village of Mukwonago or City of Waukesha sewerage systems.

Powers, Benedict, and Tombeau Lakes Area and Pell Lake Area Sewerage System Evaluation

Recommendations for new sewerage systems to serve the Powers, Benedict, and Tombeau Lakes area, and the Pell Lake area were documented in local facility plans.[47,48] The facility plans recommended that these areas be served by a

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

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

new public sewage treatment plant to be located in the Town of Bloomfield west of the Powers, Benedict, and Tombeau Lakes area and east of Pell Lake. A regional plan amendment evaluation of these recommendations, as well as the potential for interconnection to existing plants is required and will be documented in a separate plan amendment. The amendment would include cost effectiveness analyses.

Town of Wheatland Sewerage System Evaluation

A local facility plan prepared for the Town of Wheatland[49] recommends the installation of a public sanitary sewerage system for a portion of the Town. A regional plan amendment evaluation is needed to determine the best means of providing treatment plant capacity for the area.

Town of Vernon-Big Bend Sewerage System Evaluation

Land use developments and local initiatives have indicated a need to consider further the potential need for a public sanitary sewerage system to serve the Village of Big Bend and portions of the Town of Vernon. The alternatives to be considered would include the use of a public sanitary sewer system and the continued use of onsite systems. If a public sanitary sewerage systems is found to be the best alternative for all or portions of the study area, construction of a new treatment plant as well as connection to the Village of Mukwonago and/or to the City of Waukesha sewerage system would be considered in this subsequent subregional study. That subsequent study would include a cost-effectiveness analysis of the alternatives.

Bohner Lake Sewerage System

Recommendations have been made in a local facility plan[50] for a new sewerage system to serve the Bohner Lake area in Racine County. The facility plan recommended the development of a public sanitary sewerage system for the urban development surrounding Bohner Lake and the connection of that system to the City of Burlington sewerage system for treatment purposes. Review of the facility plan indicates no new cost-effectiveness issue will have to be explored and the recommendations of the facility plan are proposed to be incorporated into an amendment to the regional plan.

Stream Reclassification Evaluations

Eagle Creek, Deer Creek, and Poplar Creek 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 objective for these streams be upgraded to provide for a warmwater sport fish classification. The necessary surveys and stream appraisals needed to support this change have been conducted by the Wisconsin Department of Natural Resources for Deer Creek and Poplar Creek as part of the Upper Fox River Priority Watershed Planning Program. It is recommended that the Department include further stream appraisals for Eagle Creek as part of the monitoring program for the Fox River watershed during the next period when the Department is devoting its monitoring efforts in the Fox River watershed as is envisioned within the next five years.

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

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

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

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Chapter VI

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

INTRODUCTION

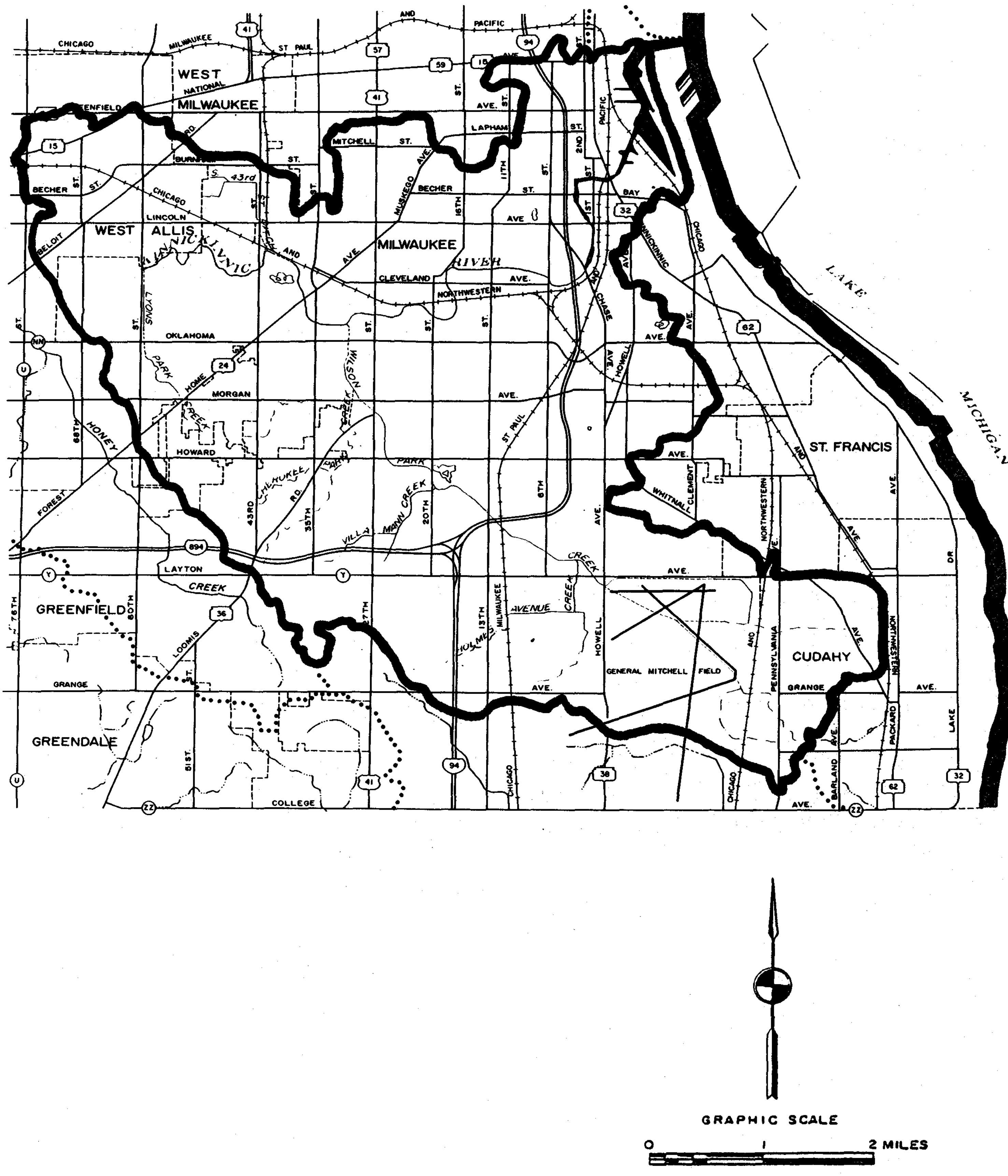
This chapter presents a description of the recommendations contained in the initial regional water quality management plan and amendments thereto and progress made toward plan implementation from 1975--the base year of the initial plan--to 1990--the base year of the plan update. In addition, this chapter presents information on water quality and biological conditions in the surface water system of the Kinnickinnic River watershed through 1993, where available. Finally, this chapter presents a description of any substantive water quality management issues that remain to be addressed in the Kinnickinnic 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 brief separate section on lake management is included, which is limited for the Kinnickinnic 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 Kinnickinnic River watershed is located in the south central portion of Milwaukee County and covers an area of approximately 26 square miles. The Kinnickinnic River, approximately 8.0 miles in length and receiving discharge from approximately 8.2 miles of perennial stream tributaries, discharges into Lake Michigan through the Milwaukee Harbor estuary. 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 Kinnickinnic River and its principal tributaries, are shown on Map VI-1. The Kinnickinnic 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 implementation, 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 Kinnickinnic 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

Map VI-1
KINNICKINNIC RIVER WATERSHED



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 VI-1 summarizes the existing land uses in the Kinnickinnic 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. The watershed is almost completely developed for urban uses, with 8 percent of the watershed in open space uses in 1990. Existing land uses in the Kinnickinnic River watershed are shown in graphic summary on Map VI-2.

The Kinnickinnic River watershed lies completely within Milwaukee County and includes lands located in the Cities of Cudahy, Greenfield, Milwaukee, Oak Creek, St. Francis, West Allis, and West Milwaukee. There are four major industrial centers, Milwaukee South, Milwaukee Near South, West Milwaukee, and West Allis, a major commercial retail center, the Southgate-Point Loomis centers, and the General Mitchell International Airport are all located within the watershed.

As shown in Table VI-1, from 1975 to 1990, urban land uses in the watershed increased from about 14,700 acres, or 23.0 square miles, to about 15,100 acres or 23.6 square miles, or by less than 3 percent. As shown in Table VI-1, urban-residential and urban-transportation lands represent the largest urban land use in the watershed. Residential use has increased within the watershed, from about 5,600 acres in 1975 to about 5,700 acres in 1990, an increase of about 1 percent. Commercial land uses increased from about 500 acres to about 570 acres, an increase of 13 percent.

Table VI-2 summarizes the year 2010 planned land use conditions recommended in the adopted year 2010 land use plan in the Kinnickinnic River watershed and compares the recommended land use conditions to the 1990 conditions. Under planned land use conditions, as described in Chapter III, urban lands are anticipated to remain relatively constant, with some urban redevelopment expected to occur in the already urbanized portions of the watershed.

It is important to note that a portion of the watershed is comprised of primary environmental corridor lands consisting of the best remaining natural resource features and, as recommended in the year 2010 land use plan, is proposed to be preserved through joint State-local zoning or public acquisition.

POINT SOURCE POLLUTION 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 Kinnickinnic River watershed--including points of public sanitary sewage

Table VI-1

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

Land Use Category	1975		1990		Change 1975-1990	
	Acres	Percent	Acres	Percent	Acres	Percent
Urban						
Residential	5,608	34.2	5,676	34.6	68	1.2
Commercial	505	3.1	569	3.5	64	12.6
Industrial	988	6.0	977	5.9	- 11	- 1.1
Transportation, Communication, and Utilities[b]	5,757	35.1	6,010	36.6	253	4.4
Governmental and Institutional	1,199	7.3	1,152	7.0	- 47	- 3.9
Recreational	678	4.1	699	4.2	21	3.1
Subtotal	14,735	89.8	15,083	91.9	348	2.4
Rural						
Agricultural and Related	131	0.8	111	0.7	- 20	- 15.3
Lakes, Rivers, Streams and Wetlands	194	1.2	192	1.2	- 2	- 1.0
Woodlands	83	0.5	92	0.6	9	10.8
Open Lands,[c] Landfills, Dumps, and Extractive	1,266	7.7	931	5.7	- 335	- 26.5
Subtotal	1,674	10.2	1,326	8.1	- 348	- 20.8
Total	16,409	100.0	16,409	100.0	0	--

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

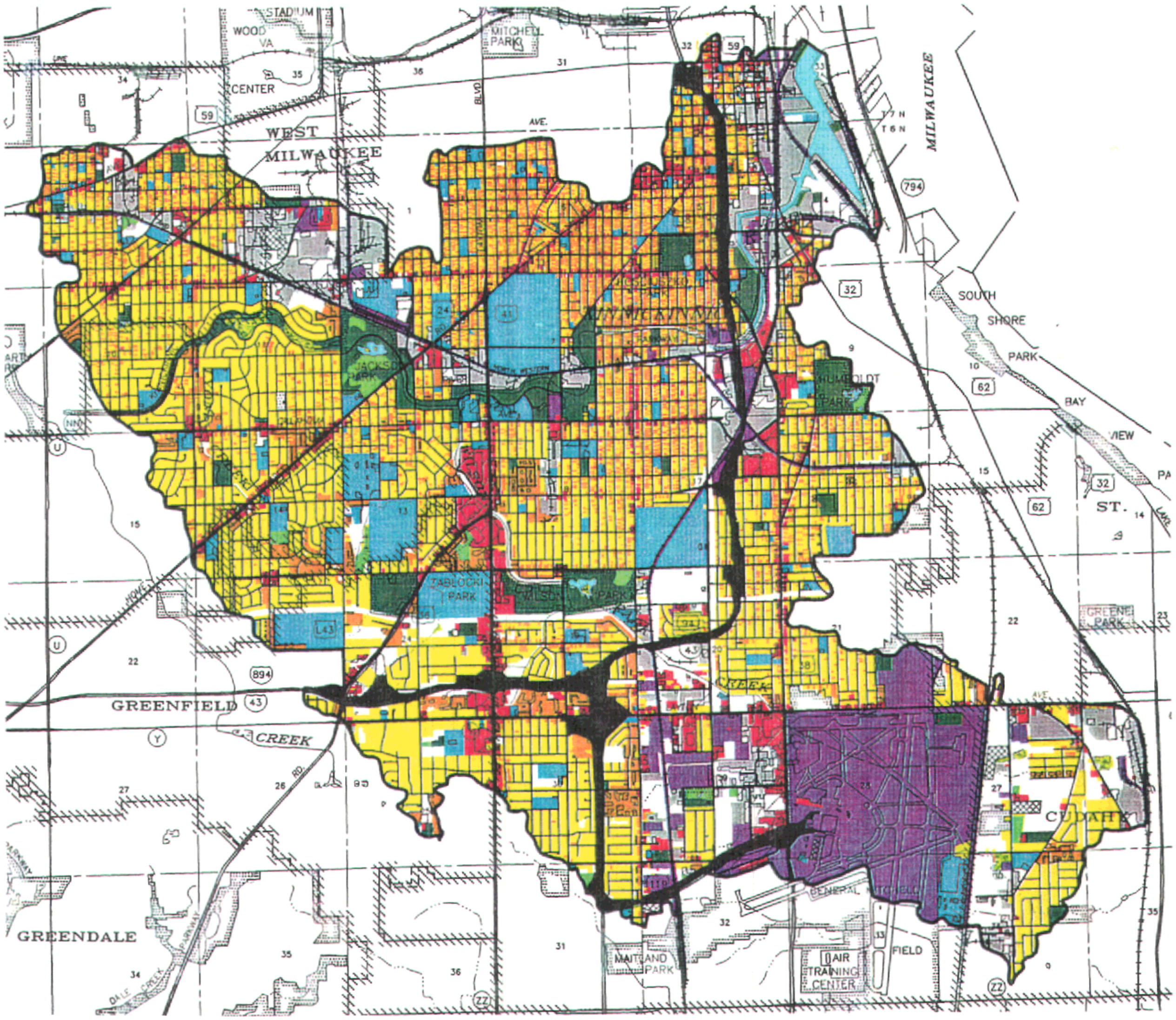
[b] Includes all off-street parking.

[c] Includes both rural and urban open lands.

Source: SEWRPC.

MAP VI–2

LAND USES IN THE KINNICKINNIC 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

The Kinnickinnic River watershed is about 26 square miles in areal extent, or about 1 percent of the total Region.

In 1990, the watershed was almost entirely in urban land uses.

Source: SEWRPC

Table VI-2

EXISTING AND PLANNED LAND USE IN THE KINNICKINNIC 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	5,676	34.6	5,699	34.7	23	0.4	5,659	34.5	- 17	- 0.3
Commercial	569	3.5	537	3.3	- 32	- 5.6	540	3.3	- 29	- 5.1
Industrial	977	5.9	1,039	6.3	62	6.3	1,074	6.5	97	9.9
Transportation, Communication, and Utilities[b]	6,010	36.6	5,958	36.3	- 52	- 0.9	5,961	36.3	- 49	- 0.8
Governmental and Institutional	1,152	7.0	1,213	7.4	61	5.3	1,211	7.4	59	5.1
Recreational	699	4.2	690	4.2	- 9	- 1.3	688	4.2	- 11	- 1.6
Subtotal	15,083	91.9	15,136	92.2	53	0.4	15,133	92.2	50	0.3
Rural										
Agricultural and Related	111	0.7	116	0.7	5	4.5	116	0.7	5	4.5
Lakes, Rivers, Streams, and Wetlands	192	1.2	191	1.2	- 1	- 0.5	191	1.2	- 1	- 0.5
Woodlands	92	0.6	83	0.5	- 9	- 9.8	83	0.5	- 9	- 9.8
Open Lands,[c] Landfills, Dumps, Extractive	931	5.7	883	5.4	- 48	- 5.2	886	5.4	- 45	- 4.8
Subtotal	1,326	8.1	1,273	7.8	- 53	- 4.0	1,276	7.8	- 50	- 3.8
Total	16,409	100.0	16,409	100.0	0	--	16,409	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.

collection system overflows 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 Kinnickinnic 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 a 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 plan in the Milwaukee metropolitan area--the City of South Milwaukee plant. The resultant 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 Kinnickinnic River 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 plants located in or discharging into the Kinnickinnic River watershed. 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. As indicated on Map VI-3, the entire Kinnickinnic River watershed, approximately 26 square miles, is served by sanitary sewer and is part of the larger Milwaukee Metropolitan Sewerage District service area which is currently unrefined.

Current Plan Recommendations: The current point source plan element includes the recommendation to prepare a refinement of the Milwaukee Metropolitan Sewerage District sewer service area.

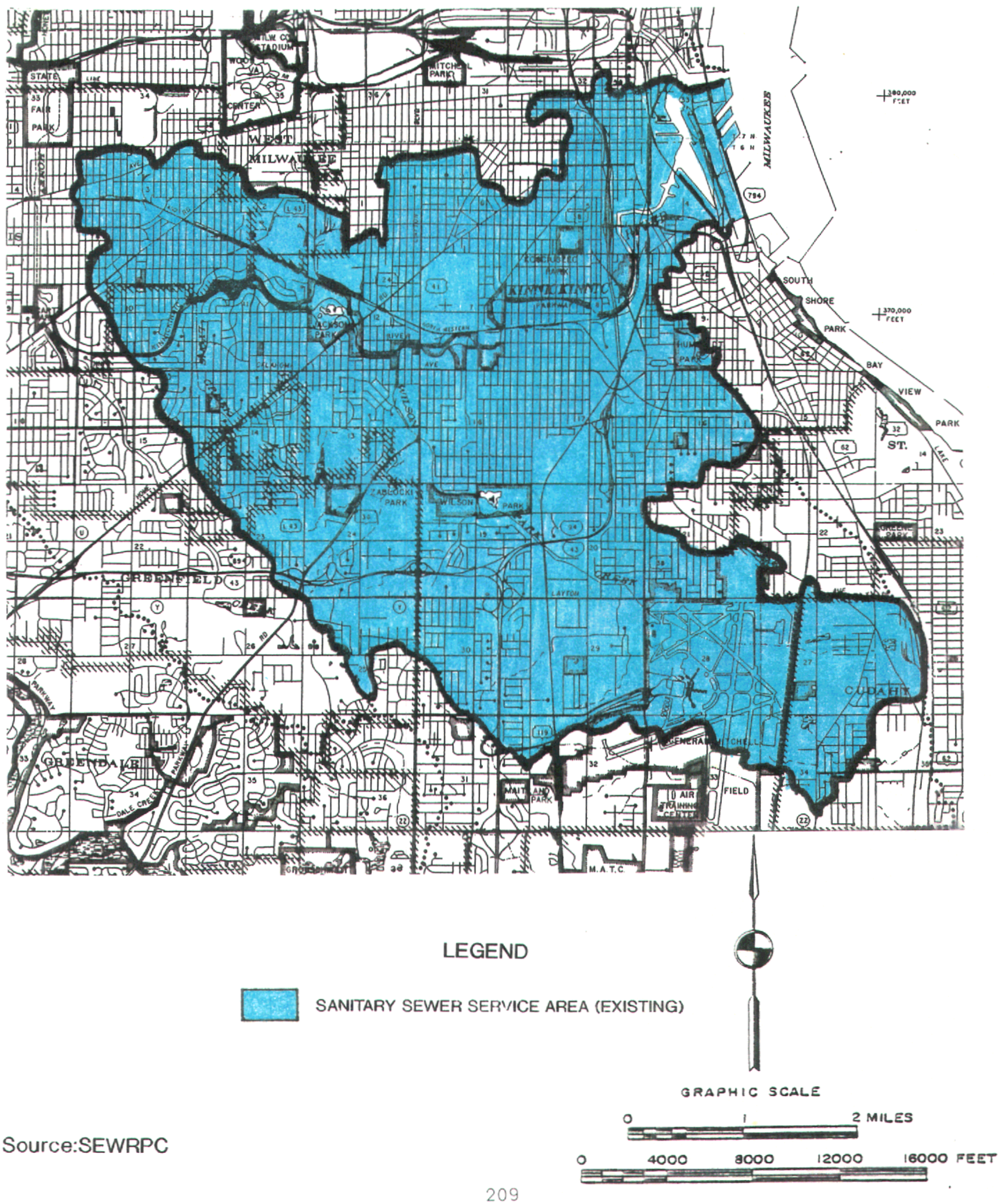
Sewer System Flow Relief Devices

Existing Conditions and Status of Plan Implementation: In 1975, there were 23 combined sewer outfalls and 29 known sanitary sewer flow relief devices located

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

Map VI-3

SEWER SERVICE AREAS IN THE KINNICKINNIC RIVER WATERSHED: 1990 AND 2010



Source:SEWRPC

in the Kinnickinnic River watershed. Of the latter, four were sanitary sewerage system bypasses; two were relief pumping stations; four were portable pumping stations; and the remaining 19 were crossovers. Of the total 52 flow relief devices and combined sewer outfalls, 40 discharged directly to the main stem of the Kinnickinnic River; seven discharged directly to Wilson Park Creek; two discharged directly to the S. 43rd Street ditch; two discharged directly to Lyons Park Creek; and one discharged directly to Cherokee Park Creek.

By 1993, work was completed by the Milwaukee Metropolitan Sewerage District on a system-wide upgrade of its sewerage conveyance and storage facilities, including completion of the Inline Storage System and major relief sewers. As a result of this work, many of the flow relief devices within the watershed have 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 VI-3, 39 points of sanitary sewer system flow relief--including 24 combined sewer overflows--were reported to exist during 1993 in the Kinnickinnic River watershed. These flow relief points were located in three sewerage systems. 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[2] 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 Kinnickinnic River, assuming other water quality improvement measures recommended were carried out. Bypassing from the other sanitary sewer flow relief devices is expected to be further eliminated over time as additional sewerage system upgrading is completed by the Cities of Milwaukee[3] and West Allis and the Milwaukee Metropolitan Sewerage District.

Current Plan Recommendations: It is recommended that the Cities of Milwaukee and West Allis and the Milwaukee Metropolitan Sewerage District continue to monitor the sewerage system operations to ensure that the use of the existing sanitary sewer 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 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

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

[3]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 VI-3

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

Sewerage System	Sewage Treatment Plant Flow Relief Device	Sewage Flow Relief Devices in the Sewer System					Total	Comments
		Combined Sewer Overflow	Crossovers	Pumping Station Bypasses	Other Bypasses	Portable Pumping Systems		
City of Milwaukee	--	--	10[a]	--	--	--	10	Used only in case of extreme wet weather
City of West Allis	--	--	--	--	--	1	1	Used only in case of extreme wet weather
Milwaukee Metropolitan Sewerage District	--	24	1	--	3	--	28	Used only in case of extreme wet weather, CSO bypassing expected about one to two times per year
TOTAL	--	24	11	--	3	1	39	

[a] Nine of these crossovers are equipped with electric pumps to facilitate bypassing.

Source: SEWRPC.

protect the public and treatment facilities from unforeseen equipment or power failure.

Intercommunity Trunk Sewers

Existing Conditions and Status of Plan Implementation: No intercommunity trunk sewers were recommended for construction in the initial regional water quality management plan.

Current Plan Recommendations: The current regional water quality management plan recommends the continued maintenance of existing intercommunity trunk sewers in the Kinnickinnic River watershed. No additional trunk sewers are recommended for construction.

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 30 known point sources of pollution identified in the Kinnickinnic River watershed other than public and private sewage treatment plants. These sources discharged industrial cooling, process, rinse, wash, and filter backwash waters through 60 outfalls directly or indirectly to the surface water system. Of these point source outfalls, 30 were identified as discharging only cooling water and 30 were identified as discharging other types of wastewaters. The initial regional 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 (WPDES) permit process.

As of 1990, there were 50 such point sources of wastewater discharging to the Kinnickinnic River and its major tributaries or to the groundwater system directly through industrial waste outfalls or indirectly through drainage ditches and storm sewers. Table VI-4 summarizes selected characteristics of these other point sources and Map VI-4 shows their locations. Due to the dynamic nature of permitted point sources, it is recognized that the number of such 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 43 known point sources of wastewater other than public and private sewage treatment plants discharging to surface waters in the Kinnickinnic 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 of the Kinnickinnic 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

Because the entire Kinnickinnic watershed was served by sanitary sewer prior to 1975, there were no enclaves of unsewered urban development located outside of the then recommended year 2000 or currently recommended year 2010 sewer service area.

Table VI-4

CHARACTERISTICS OF OTHER KNOWN POINT SOURCES OF
WATER POLLUTION IN THE KINNICKINNIC 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]
Acme Galvanizing, Inc.	Milwaukee	1	General	0044938-3	9-30-95	3471	Plating and polishing metal	Kinnickinnic River	--
Advance Boiler & Tank Co.	Milwaukee	2	General	0044938-3	9-30-95	3443	Fabricated plate work	Kinnickinnic River Canal	--
Behmke Residence	Milwaukee	3	General	HEAT PUMP	--	8811	Private household	Holmes Avenue Creek	--
Columns Tennis & Swim Club	Milwaukee	4	General	0046523-2	9-30-95	7997	Membership sports & rec. club	Villa Mann Creek via storm sewer	--
The Grand Hotel	Milwaukee	5	General	0046523-2	9-30-95	7011	Hotels and motels	Wilson Park Creek	--
Grebe Bakeries, Inc.	Milwaukee	6	General	0044938-3	9-30-95	2051	Bread, cake, etc. products	West Milwaukee Ditch	--
Howard Johnson's Motor Lodge	Milwaukee	7	General	0046523-1	9-30-95	7011	Hotels & motels	Wilson Park Cr. via storm sewer	--
Joy-Mark, Inc.	Milwaukee	8	General	0044938-3	9-30-95	3297	Nonclay refractories	Wilson Park Cr. via storm sewer	--
Magnetek, Inc.-Louis Allis Division	Milwaukee	9	General	0044938-3	9-30-95	3621/3625	Motors, generators, relays, etc.	Kinnickinnic River	--
Maynard Steel Casting Co.	Milwaukee	10	General	0044938-3	9-30-95	3325	Steel foundry	Kinnickinnic River	--
Midway Motor Lodge Airport	Milwaukee	11	General	0046523-2	9-30-95	7011	Hotels and motels	Holmes Avenue Creek	--
Milwaukee School Dist: Pulaski H.S.	Milwaukee	12	General	0046523-2	9-30-95	8211	Secondary school	Kinnickinnic River	--
Milwaukee Boys and Girls Club	Milwaukee	13	General	0046523-2	9-30-95	7999	Amusement & Recreation	Kinnickinnic River via storm sewer	--
Milw. Cty. PR&C: Pulaski Pool	Milwaukee	14	General	0046523-1	9-30-95	--	Municipal pool	Kinnickinnic River	--
Milw. Cty. PR&C: Holler Park Pool	Milwaukee	15	General	0046523-2	9-30-95	--	Municipal pool	Holmes Ave. Creek via storm sewer	--
Milw. Cty. PR&C: Jackson Park Pool	Milwaukee	16	General	0046523-2	9-30-95	--	Municipal pool	Kinnickinnic River	--
Milw. Cty. PR&C: Kosciuszko Pk. Pool	Milwaukee	17	General	0046523-2	9-30-95	--	Municipal pool	Kinnickinnic River via storm sewer	--
Milw. Cty. PR&C: Wilson Park Pools	Milwaukee	18	General	0046523-2	9-30-95	--	Municipal pool	Wilson Park Creek	--
Milw. Malleable & Gray Iron Works	Milwaukee	19	General	0044938-2	9-30-95	3321/3322	Iron foundries	Kinnickinnic River via storm sewer	--
Milwaukee Marble Company	Milwaukee	20	General	0046515-1	9-30-95	3281	Cut stone and stone products	West Milw. Ditch via storm sewer	--
Milwaukee Metro. Sewerage District	Milwaukee	21	General	0046566-1	9-30-95	4952	Sewerage systems	Kinnickinnic River Canal	--
Milwaukee Wilbert Vault Co.	Milwaukee	22	General	0046507-2	9-30-95	3272	Concrete products	Groundwater discharge	--
Moore Oil Container Corp.	Milwaukee	23	General	0044938-2	9-30-95	--	--	Edgerton Channel via ditch	--
Pelton Casteel, Inc.	Milwaukee	24	General	SPEC PERM	--	3325	Steel foundry	Kinnickinnic River via ditch	--
Raytec (Bruner) Corp.	Milwaukee	25	General	0044938-2	9-30-95	3589	Service industry machinery	Kinnickinnic R. via storm sewer	--
Rex Works, Inc.	Milwaukee	26	General	0044938-3	9-30-95	3531	Construction machinery	Kinnickinnic R. via storm sewer	--
St. Lukes Medical Center	Milwaukee	--[d]	General	0044938-3	9-30-95	8062	General med. & surgical hospital	Wilson Park Creek	--
Southeastern Wisconsin Products Co.	Milwaukee	28	General	0044938-3	9-30-95	2099	Food preparation	Holmes Ave. Creek via storm sewer	--
Spinweld Division-Coating, Inc.	Milwaukee	29	General	0044938-3	9-30-95	3471/3479	Plating, polishing, coating, etc.	West Milw. Ditch via storm sewer	--
Super America, Inc.	Milwaukee	--[d]	General	0046566-1	9-30-95	5541	Gasoline service station	West Milw. Ditch via storm sewer	--

Table VI-4 (continued)

Facility Name	County	Map ID No.[b]	Permit Type	Permit Number	Expiration Date	Standard Industrial Classification Code	Industrial Activity	Receiving Water	Treatment System[c]
Support Terminal Services, Inc.	Milwaukee	31	General	0046531-1	9-30-95	--	--	Lake Michigan	--
Teledyne Wisc. Motors-Plant No. 1	Milwaukee	32	General	0044938-3	9-30-95	3519	Internal combustion engines	West Milw. Ditch via storm sewer	--
Uno-ven Co.-Mitchell Field	Milwaukee	33	General	0046531-1	9-30-95	5171	Petroleum bulk stations & term.	Wilson Park Creek via storm sewer	--
West Shore Pipeline Co.-Jones Island	Milwaukee	34	General	0046531-1	9-30-95	5171	Petroleum bulk stations & term.	Lake Michigan	--
Wisconsin Gas Co.-35th Street Plant	Milwaukee	35	General	SPEC PERM	--	4923	Gas transmission & distribution	Kinnickinnic R. via storm sewer	--
Briggs & Stratton Corp. W. Allis/68th	Milwaukee	1A	Specific	0000493	03-31-92	3519	Internal combustion engines	West Milw. Ditch via storm sewer	None
Chrysler Motors Corp.	Milwaukee	2A	Specific	0026557	06-30-92	3714	Motor vehicle parts	Kinnickinnic R. via storm sewer	None
Dillingham Construction - KK-2 NA	Milwaukee	3A	Specific	0047414	08-31-94	1622	Bridge, tunnel, elevated hwys.	Kinnickinnic River	1, 2, 3, 4
Dillingham Const. - KK-3 NA Inc.	Milwaukee	4A	Specific	0047406	08-31-94	1622	Bridge, tunnel, elevated hwys.	Kinnickinnic River	1, 2, 3, 4
Fleischmann Kurth Malting Co.	Milwaukee	5A	Specific	0027693	03-31-89	2083	Malt	West Milwaukee Ditch	None
Froedtert Malting Corp. FMC	Milwaukee	6A	Specific	0026166	12-31-89	2083	Malt	West Milwaukee Ditch	None
General Electric Co. - Hotpoint	Milwaukee	7A	Specific	0027499	03-31-90	3639	Household appliances	West Milwaukee Ditch	None
General Electric Co. - Med. Sys.	Milwaukee	8A	Specific	0027791	12-31-89	3829	Measuring & controlling devices	West Milw. Ditch via storm sewer	4
JF Shea Co., Inc. - KK LM Tunnel	Milwaukee	9A	Specific	0047601	01-31-95	1422	Crushed and broken limestone	Kinnickinnic River	5, 6
Motor Casting Co. - Plt. 2 Milw.	Milwaukee	10A	Specific	0001431	09-30-88	3321	Grey & ductile iron foundry	West Milw. Ditch via storm sewer	None
Patrick Cudahy Inc.	Milwaukee	11A	Specific	0001660	06-30-94	2011	Meat packing plants	Edgerton Channel	None
Pelton Casteel Inc.	Milwaukee	12A	Specific	0001481	09-30-90	3325	Steel foundries	Kinnickinnic River via ditch	None
Rexworks Inc.	Milwaukee	13A	Specific	0001627	06-30-90	3531	Construction machinery	Kinnickinnic R. via storm sewer	None
Unit Drop Forge Co., Inc.	Milwaukee	14A	Specific	0026484	12-31-89	3312	Blast furnaces and steel mills	West Milw. Ditch via storm sewer	4
WI University Great Lakes Research	Milwaukee	15A	Specific	0045942	03-31-89	0921	Fish hatcheries and preserves	Kinnickinnic R. via storm sewer	None

[a] Table VI-4 includes 50 known, permitted sources of wastewater discharging to the Milwaukee River and its tributaries, or to the groundwater system in the Kinnickinnic River watershed. As of 1993, there were 43 known, permitted point sources of pollution.

[b] See Map VI-4, Point Sources of Pollution Other Than Sewage Treatment Facilities in the Kinnickinnic River Watershed: 1990.

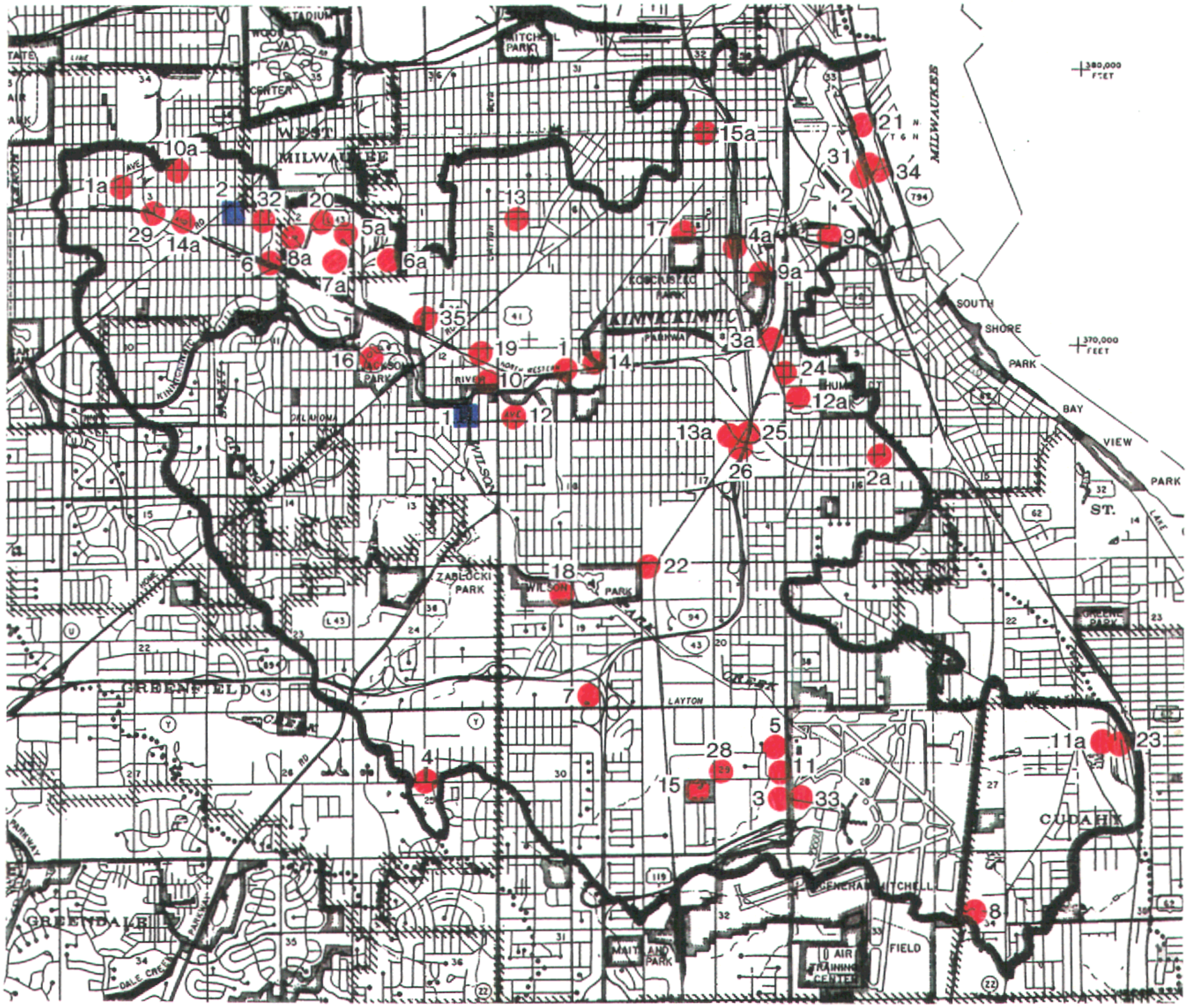
[c] The number code refers to the following treatment systems:

1. Chemical conversion/addition
2. Coagulation flocculation
3. Gravity sedimentation
4. Oil and grease removal
5. Solids Treatment/Removal
6. Tube/Plate settlers

[d] Permitted as Leaking Underground Storage Tank (LUST) remediation sites discharging to surface waters as of 1990. As of 1993, there was one addition LUST remediation site discharging to a surface water in the Kinnickinnic River watershed. See Table VI-5, "Miscellaneous Potential Pollution Sources in the Kinnickinnic River Watershed: 1990", for map identification numbers.

Source: Wisconsin Department of Natural Resources and SEWRPC.

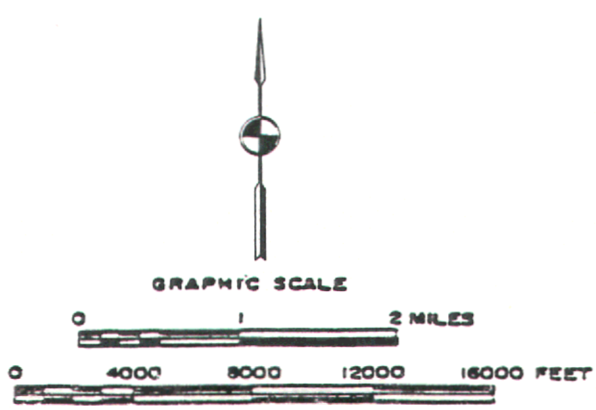
Map VI-4
POINT SOURCES OF POLLUTION OTHER THAN SEWAGE
TREATMENT FACILITIES IN THE KINNICKINNIC RIVER WATERSHED: 1990



LEGEND

POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES

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



Miscellaneous Potential Pollution Sources

Landfills: Landfills in the Kinnickinnic 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 generally 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 no active landfills and ten abandoned landfills located in the Kinnickinnic River watershed. None of the abandoned landfills in the Kinnickinnic River watershed, through 1993, have been reported as negatively impacting surrounding surface waters.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the Kinnickinnic 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 water. Discharges from these sites are required to meet specified water quality discharge standards set forth by the Wisconsin Department of Natural Resources.

As of 1990, there were two known, permitted leaking underground storage tank sites that were discharging remediation waters to surface waters in the Kinnickinnic River watershed, as indicated in Table VI-5 and shown on Map VI-4. As of 1993, there was one additional leaking underground storage tank in the Kinnickinnic River watershed whose remediation wastewaters were permitted to discharge to a surface water, as shown in Table VI-5.

As of 1993, there were 222 additional leaking underground storage tanks in the Kinnickinnic River watershed identified by the DNR that were not discharging remediation wastewater directly to surface or ground waters. While there is no specific evidence to document the impact of these individual point sources on water quality within the watershed, it can be reasonably assumed that the cumulative effect of multiple leading underground storage tanks may 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 wastewater to surface or ground waters. As of 1993, there were no permitted sites discharging to surface or ground waters.

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

Table VI-5

MISCELLANEOUS POTENTIAL POLLUTION SOURCES IN THE
KINNICKINNIC RIVER WATERSHED: 1990

Map Identification Number[a]	Landfills Indicated to be Potential Pollution Sources	Civil Division Location	Surface Water Potentially Impacted
	None		
	Leaking Underground Storage Tank Sites[b,c]		
1	St. Luke's Medical Center	City of Milwaukee	Kinnickinnic River
2	SuperAmerica, Inc.	City of West Allis	Kinnickinnic River
	Additional Groundwater Contamination Sites[b]		
	None		

[a] Refers to Map VI-4, "Point Sources of Pollution Other than Sewage Treatment Facilities in the Kinnickinnic River Watershed: 1990"

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

[c] As of 1993, there was one additional leaking underground storage tank site in the Kinnickinnic River watershed whose remediation discharges were permitted under the Wisconsin Pollutant Discharge Elimination System: Industrial Refrigeration in the City of Greenfield, Milwaukee County, which is permitted to discharge to the Kinnickinnic River.

Source: Wisconsin Department of Natural Resources and SEWRPC.

sources of water pollution. Nonpoint sources of water pollution include runoff from urban and rural land uses, runoff from construction sites, and pollutant contributions from the atmosphere.

Existing Conditions and Status of Plan Implementation

For the Kinnickinnic River watershed, the adopted plan generally recommended urban nonpoint source pollution control practices designed to reduce the pollutant loadings from nonpoint sources by about 25 percent, in addition to urban construction erosion control and streambank erosion control. However, the plan did not specifically recommend the application of control practices in the northern portion of the watershed 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.

In 1978 the Commission prepared a comprehensive watershed plan[4] for the Kinnickinnic River 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.

Implementation of the recommended nonpoint source control practices has been achieved in the Kinnickinnic River watershed on a limited basis 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 Cudahy, Greenfield, Milwaukee, and West Allis, and the Village of West Milwaukee had adopted construction erosion control ordinances based upon the model ordinance developed cooperatively by the Wisconsin Department of Natural Resources and League of Wisconsin Municipalities. It should be noted that the ordinance for the City of Cudahy applies only to subdivisions.

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.

The initial regional plan also recommended that local agencies charged with responsibility for nonpoint source pollution control prepare refined and detailed local-level nonpoint source pollution control plans. Such plans are to identify the nonpoint source pollution control practices that should be applied to specific lands. Working with the individual county land conservation committees, local units of government, and the Commission, the Wisconsin Department of Natural Resources is carrying out the recommended detailed planning for nonpoint source water pollution abatement on a watershed-by-watershed basis. This detailed planning and subsequent plan implementation program, is known as the Wisconsin Nonpoint Source Priority Watershed Pollution Abatement Program. This planning program was established in 1978 by the Wisconsin Legislature and provides cost-sharing funds for the cost of an individual project or land management

[4]See SEWRPC Planning Report No. 32, A Comprehensive Plan for the Kinnickinnic River Watershed, December 1978.

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.

The Kinnickinnic River watershed was designated a "priority watershed" in 1990. Planning for the Kinnickinnic River Priority watershed project was completed in 1994, and implementation of practices began in September 1994 and will continue for eight years.

The Kinnickinnic River priority watershed project established nonpoint source pollutant reduction goals to obtain an overall nonpoint source pollutant loading reduction of 25 percent for the subareas considered, and to achieve a high level of nonpoint source sediment and toxic pollution reduction in areas deemed "critical," such as older, highly industrialized lands. The nonpoint source pollutant reductions set forth in the Kinnickinnic River priority watershed plan are consistent with the recommendations of the initial plan and of the Milwaukee Harbor estuary study.

To achieve these pollutant reduction goals, the Kinnickinnic River priority water shed project includes recommendations and funding eligibility for the following urban nonpoint source control measures. 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 fertilizers. 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 site erosion control practices for all new urban development and redevelopment in the watershed.

- The installation of erosion control measures for 4,200 feet of eroding streambank.

- Provision of nonpoint source control practices on about 4,600 acres of urban land targeted for nonpoint source control. Possible urban nonpoint source pollution control practices including wet detention ponds, infiltration devices, street sweeping, and public information and education programs to develop good housekeeping practices.

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

Current Plan Recommendations

It is recommended that construction site erosion control and streambank erosion control, plus land management practices, designed to provide about a 25 percent reduction in nonpoint source pollutant loadings, and the implementation of construction site erosion control be carried out throughout the Kinnickinnic River watershed, as was recommended in the initial plan and in the Kinnickinnic River priority watershed plan. In addition, the recommendations regarding critical area nonpoint source controls directed toward toxic pollutants be implemented as set forth in the Kinnickinnic River priority watershed plan noted above. The type of practices recommended to be considered for this level 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 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 Kinnickinnic River watershed on a sustained basis by the Milwaukee Metropolitan Sewerage District for five stations along the main stem of the Kinnickinnic River. Data from three of these stations were used to document current long-term water quality conditions in the watershed, as shown on Map VI-5.

Short-term monitoring was also conducted at one site in the Kinnickinnic River watershed by the Wisconsin Department of Natural Resources during the period 1988 through 1993, as described later in this chapter.

Current Plan Recommendation

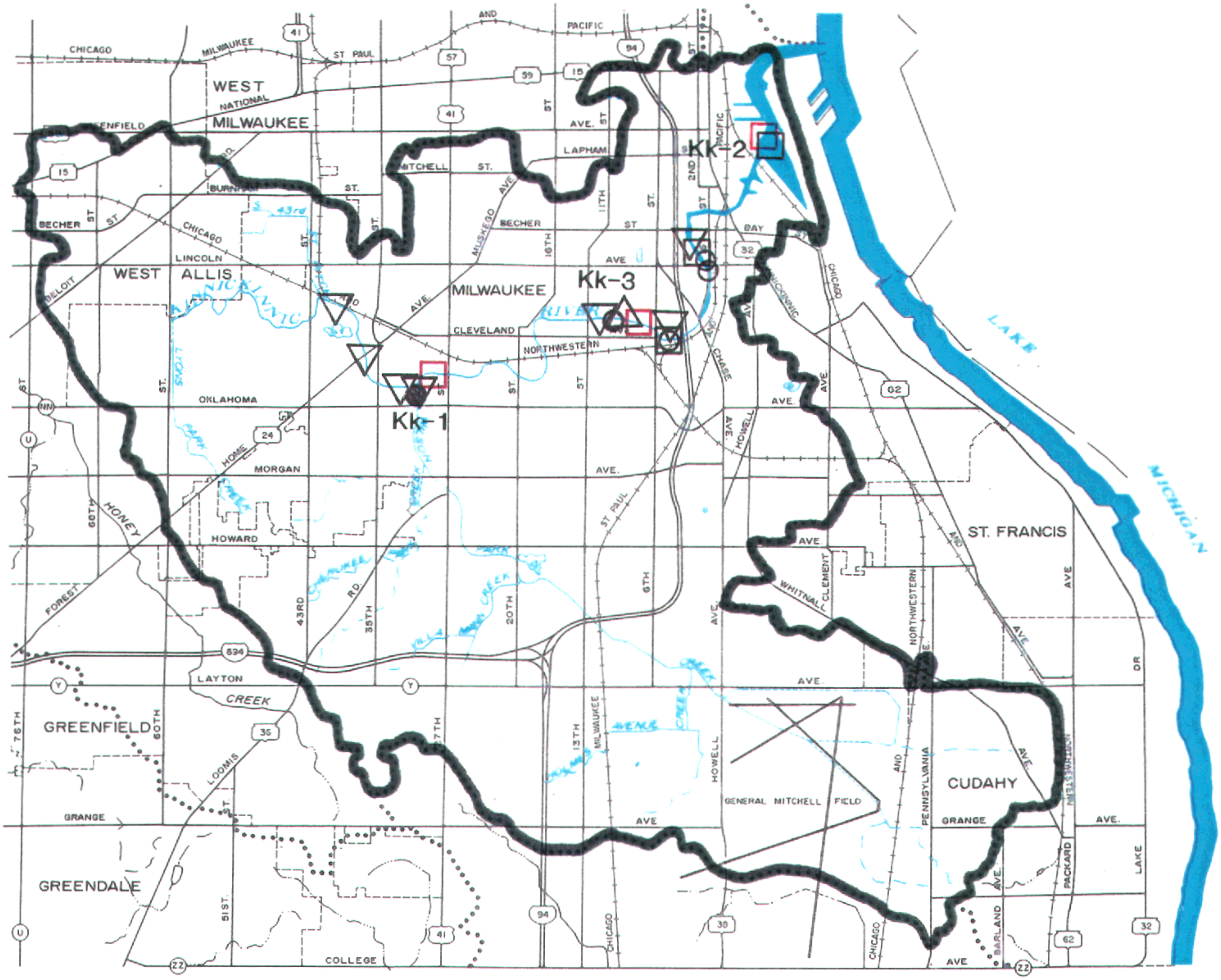
Continued water quality and biological conditions monitoring will be needed in the watershed to document current conditions and to demonstrate water quality condition changes over time. It is recommended that present water quality data collection be continued by the Milwaukee Metropolitan Sewerage District at the current stations on the Kinnickinnic River. Such data represents an adequate program for purposes of characterizing water quality conditions and assessing changes in those conditions. It is also recommended that an intensive biological conditions monitoring survey be conducted by the Wisconsin Department of Natural Resources as part of its next survey period focusing on the Kinnickinnic River, which is expected in the next five to seven years. This program should include monitoring at one station each on Wilson Park Creek and Lyons Creek.

LAKES MANAGEMENT PLAN ELEMENT

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

As noted above, there are no major lakes in the Kinnickinnic River watershed. However, there are smaller water bodies such as park-oriented ponds 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

Map VI-5
LOCATION OF WATER QUALITY SAMPLING STATIONS IN THE KINNICKINNIC RIVER WATERSHED



LEGEND

Sampling stations used in preparation of initial plan

- △ USGS
- ▽ DNR
- □ MMSD
- ● SEWRPC
- ○ CITY OF MILWAUKEE HEALTH DEPARTMENT

Post-1976 sampling stations

- □ MMSD Long Term

Source: SEWRPC.

GRAPHIC SCALE

0 1 2 MILES

0 4000 8000 12000 16000 FEET

protection. In such cases, the management techniques similar to those recommended to be applicable for consideration on the major lakes in the Region are 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 management planning 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 Kinnickinnic River watershed included samplings at two Commission stations, both on the main stem of the Kinnickinnic River; at seven DNR stations; at one U.S. Geological Survey (USGS) station; and at four City of Milwaukee Health Department stations. The sampling station locations are shown on Map VI-5.

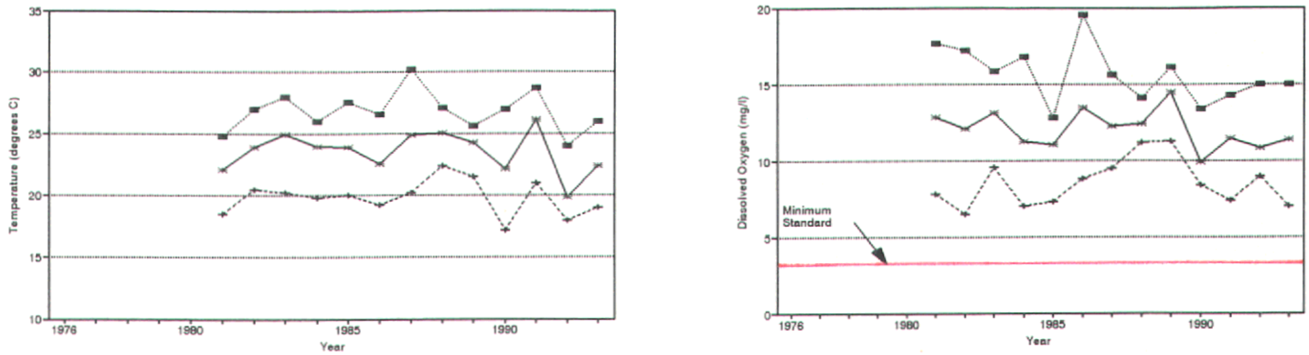
Long-term post-1976 comparable water quality data were collected by the Milwaukee Metropolitan Sewerage District for five stations on the Kinnickinnic River. The DNR has also collected water quality data on a short-term basis at one location in the Kinnickinnic River watershed on the main stem at 7th Street. Water resource appraisal information including biological condition and water quality data collected by the DNR were also available for use in the assessment of current water quality conditions in the Kinnickinnic River watershed.[5] 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, 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 Kinnickinnic River watershed.

Long-term water quality data collected by the Milwaukee Metropolitan Sewerage District at three sampling stations on the Kinnickinnic River--at Kk-1 on the main stem of the Kinnickinnic River at 27th Street, at Kk-2 in the inner harbor at Greenfield Avenue, and at Kk-3 on the main stem at 7th Street, for the period 1976 through 1993, are summarized in Figures VI-1 through VI-3. The data have been used to assess current water quality trends and the occurrence of changes over time, and to evaluate current conditions with respect to water quality standards. Review of those data indicates that there were no apparent trends in water quality conditions. The water quality standard for dissolved oxygen was generally met at stations Kk-1 and Kk-3 in the free flowing reaches of the river, and the standard for pH was achieved at stations Kk-1 and Kk-2, but violations were reported at station Kk-3. The dissolved oxygen standard was violated at

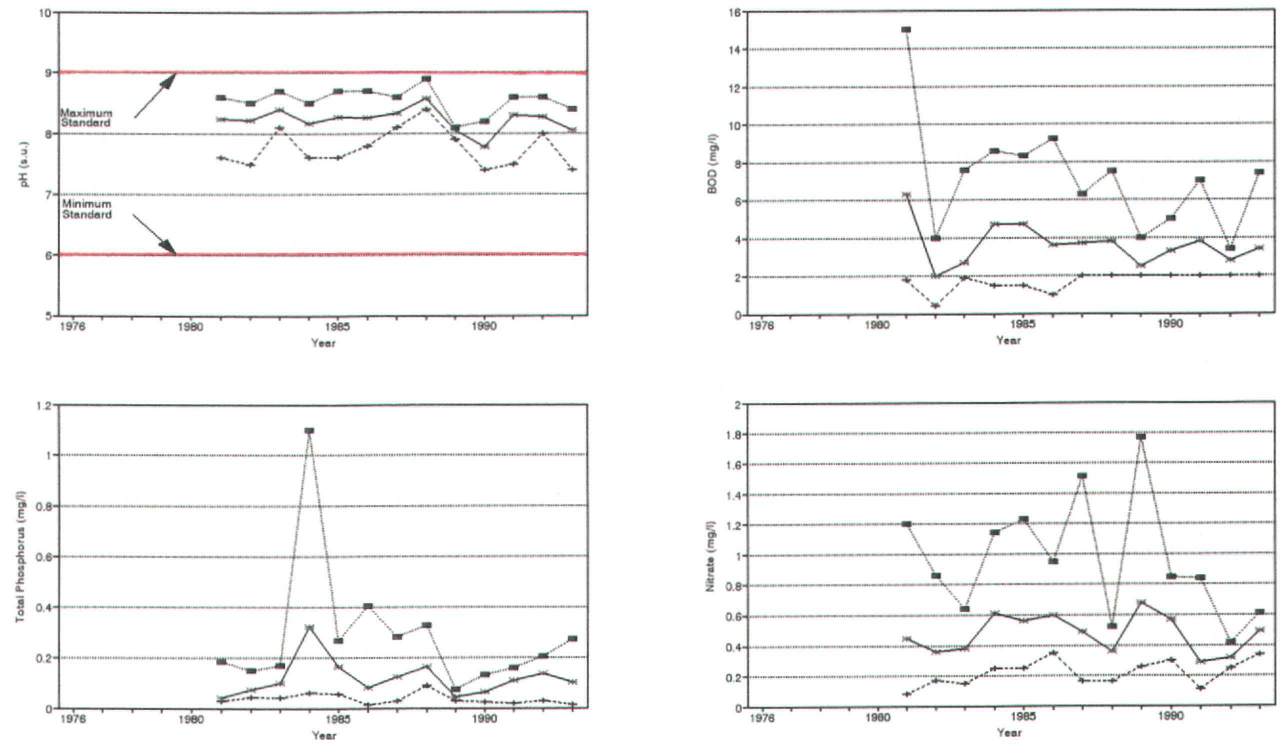
---

[5]Wisconsin Department of Natural Resources, Kinnickinnic River Stream Appraisals, November 1984.

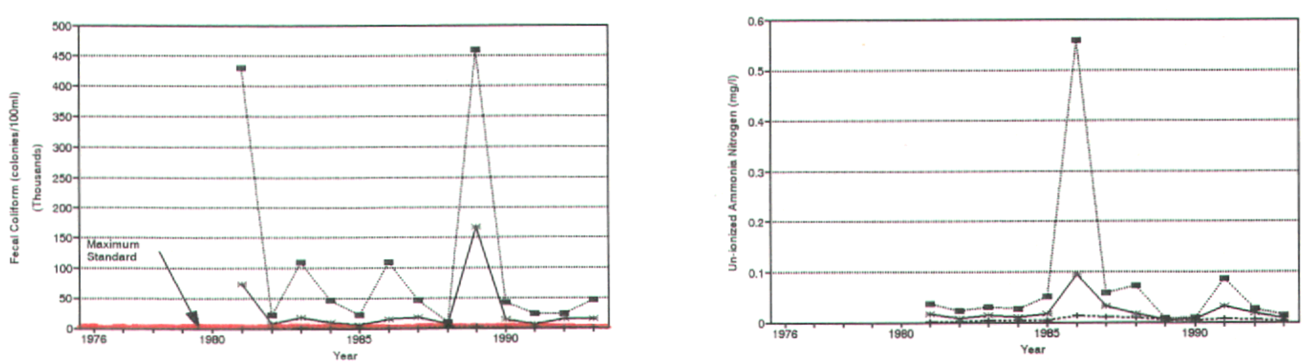
Figure VI-1
WATER QUALITY DATA FOR THE KINNICKINNIC RIVER
AT STATION Kk-1: 1976-1993



Note: No standard has been established for surface waters classified as limited aquatic life.



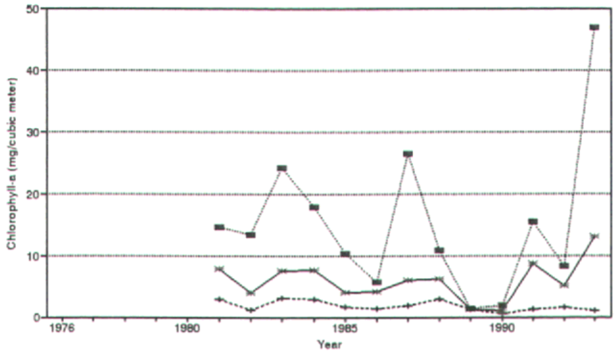
Note: No standard has been established for surface waters classified as limited aquatic life.

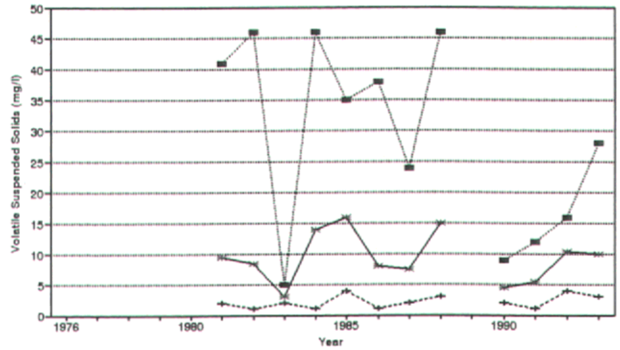


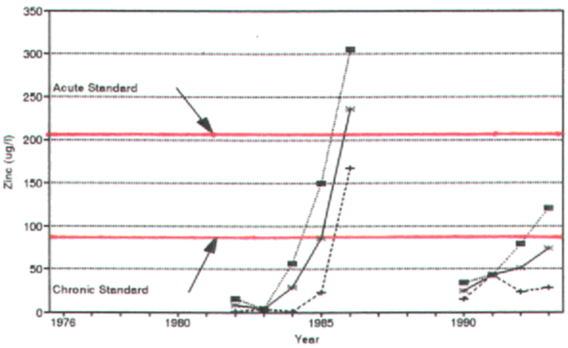
Note: The maximum standard of 1000/2000 colonies per 100 ml was violated in all years.

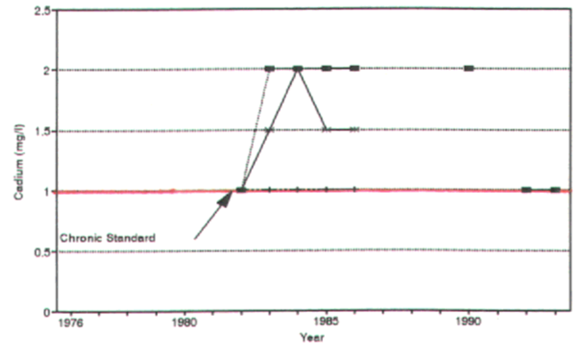
Note: No standard has been established for surface waters classified as limited aquatic life.

Figure VI-1 (cont'd)

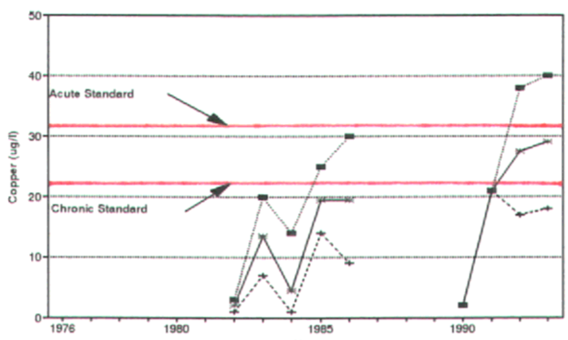


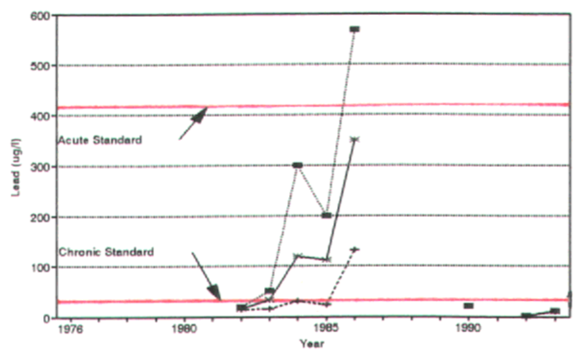


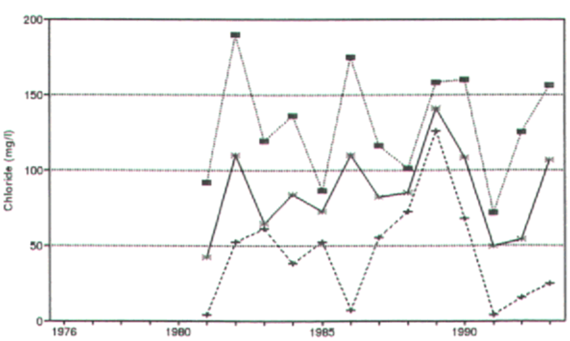




Note: The acute standard of 63.3 ug/l was not violated in any year.

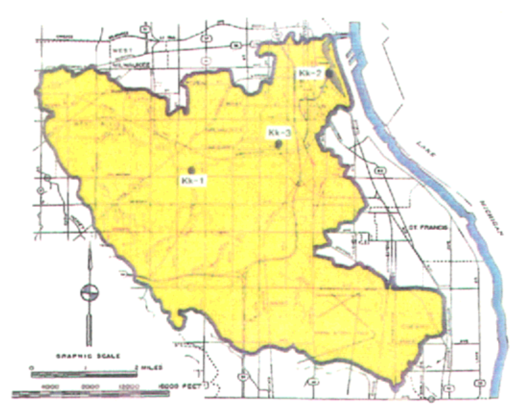






Note: No standard has been established for surface waters classified as limited aquatic life.

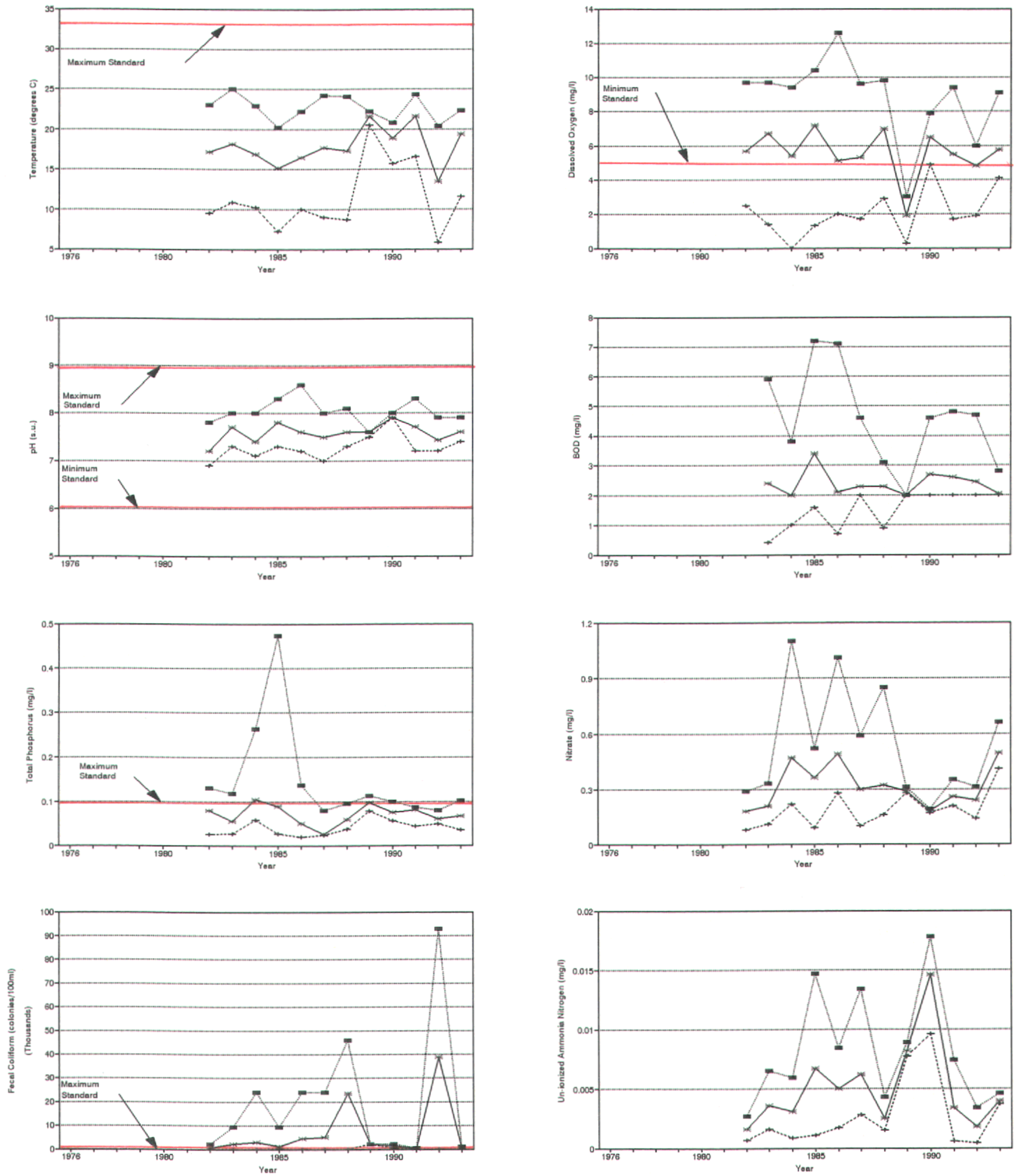
KINNICKINNIC RIVER WATERSHED



Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

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

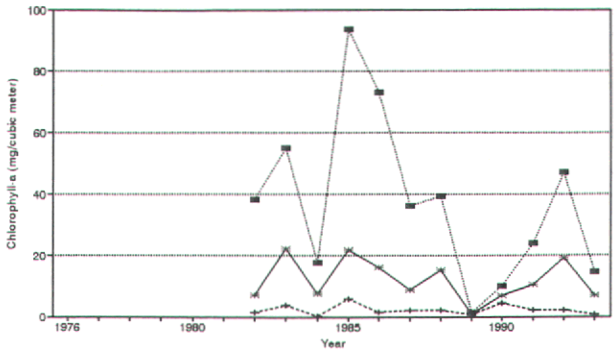
Figure VI-2
WATER QUALITY DATA FOR THE KINNICKINNIC RIVER AT STATION Kk-2: 1976-1993

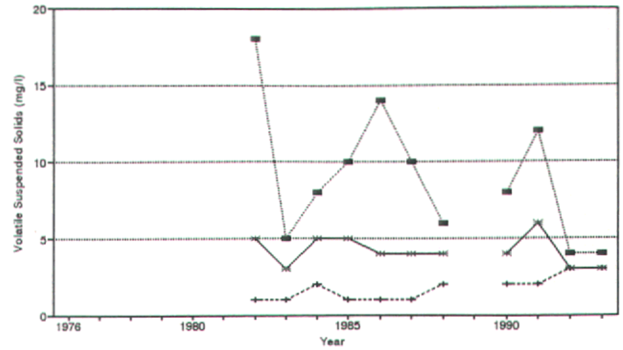


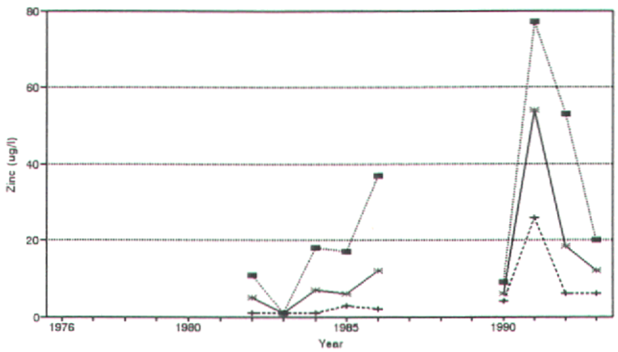
Note: The maximum standard of 200/400 colonies per 100ml was violated in all years.

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

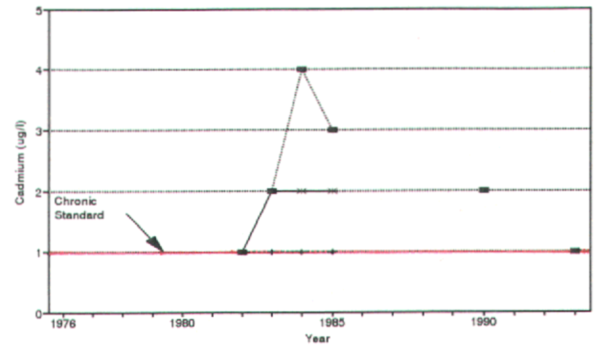
Figure VI-2 (cont'd)



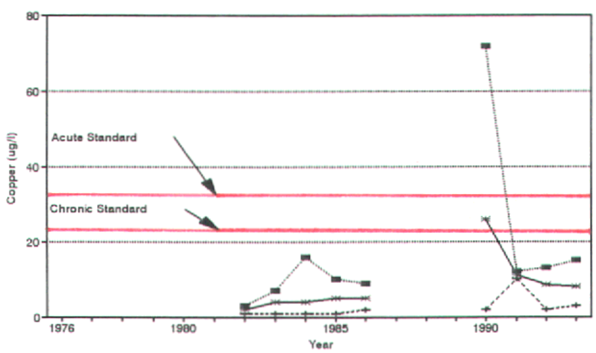


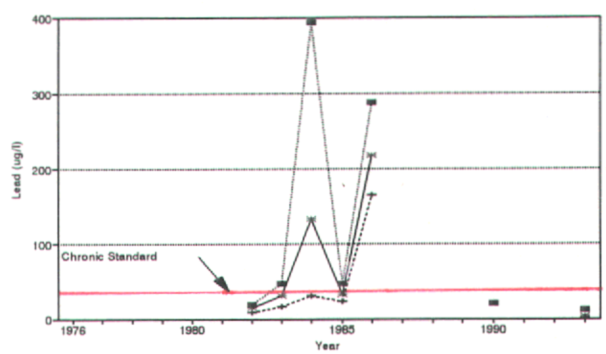


Note: The acute standard of 202.9 ug/l was not violated in any year.
The chronic standard of 89.2 ug/l was not violated in any year.

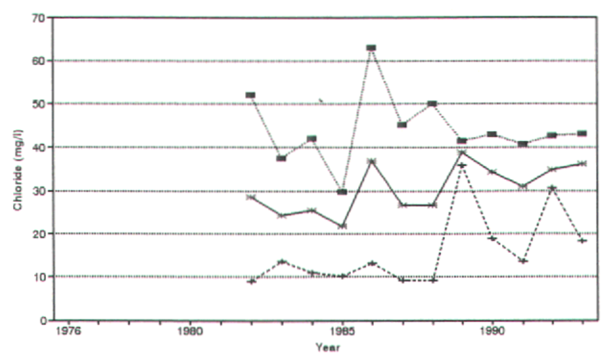


Note: The acute standard of 63.3 ug/l was not violated in any year.

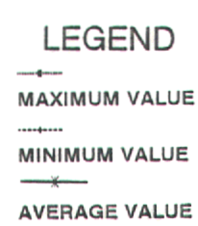




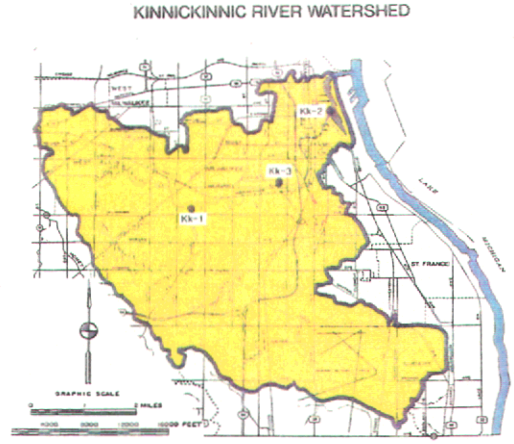
Note: The acute standard of 408.6 ug/l was not violated in any year.



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



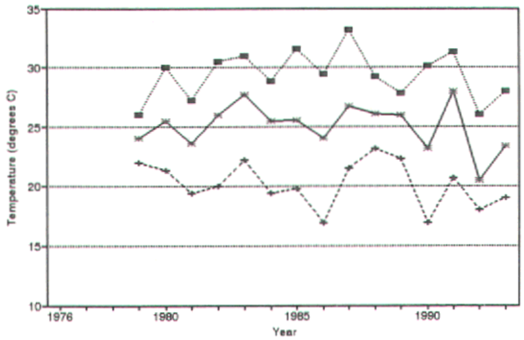
KINNICKINNIC RIVER WATERSHED



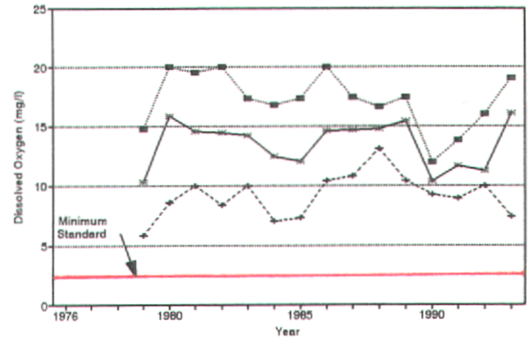
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

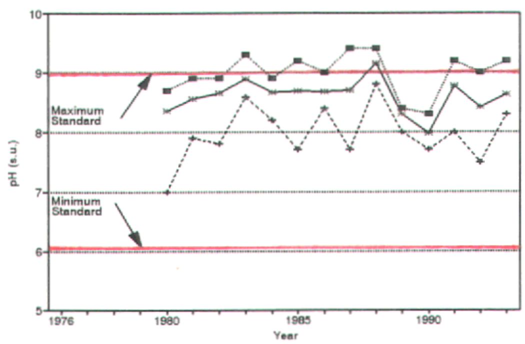
Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and limited recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural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

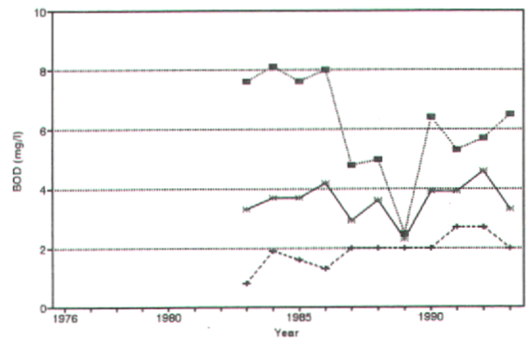
Figure VI-3
WATER QUALITY DATA FOR THE KINNICKINNIC RIVER AT STATION Kk-3: 1976-1993

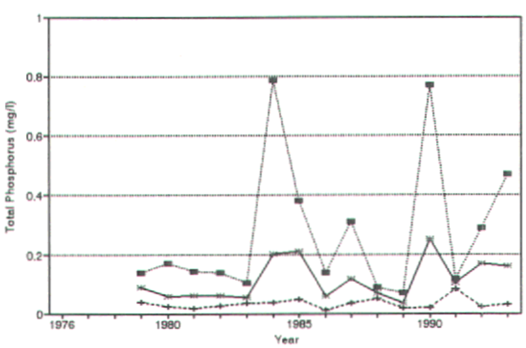


Note: No standard has been established for surface waters classified as limited aquatic life.

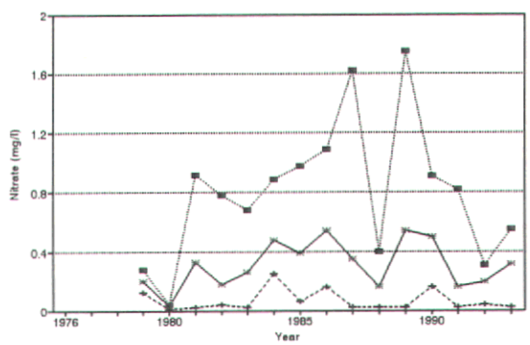


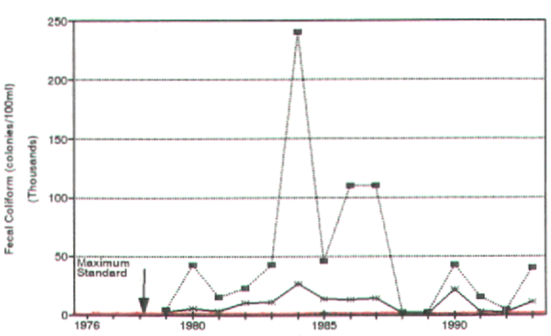




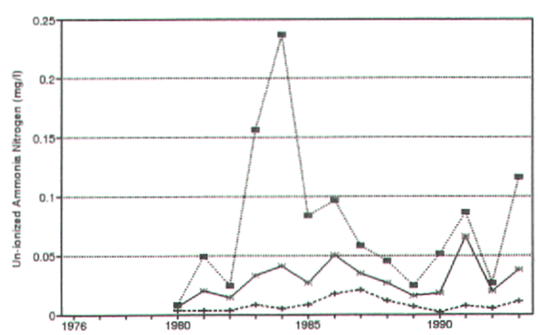


Note: No standard has been established for surface waters classified as limited aquatic life.



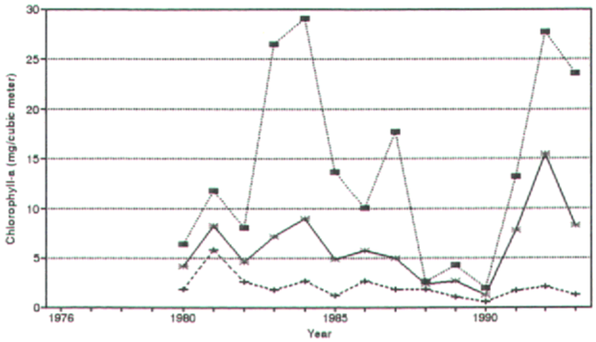


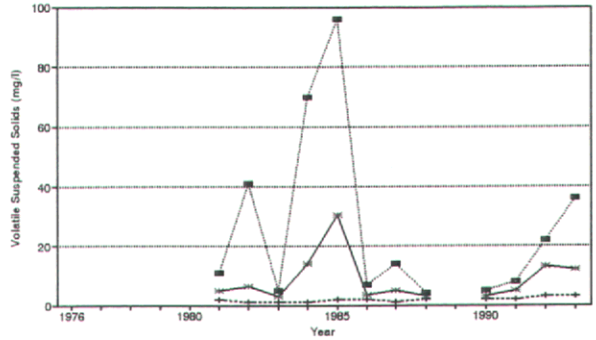
Note: The maximum standard of 1000/2000 colonies per 100ml was violated in all years.

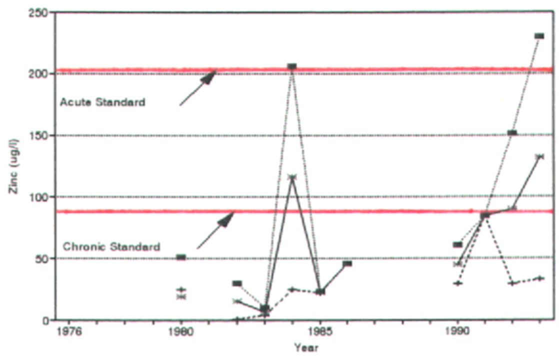


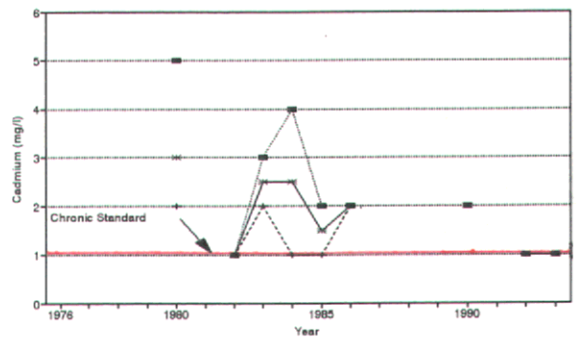
Note: No standard has been established for surface waters classified as limited aquatic life.

Figure VI-3 (cont'd)

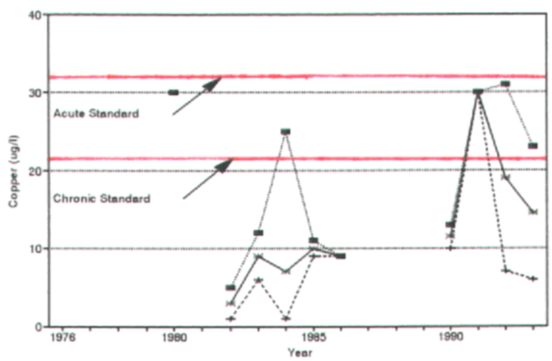


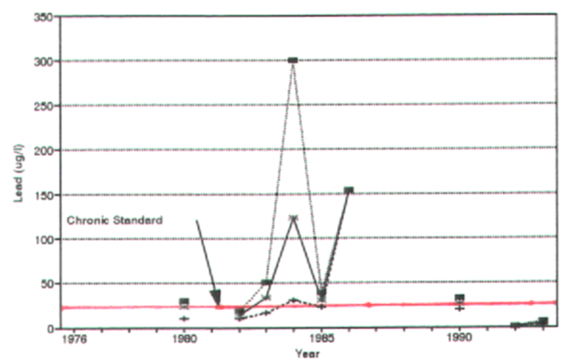




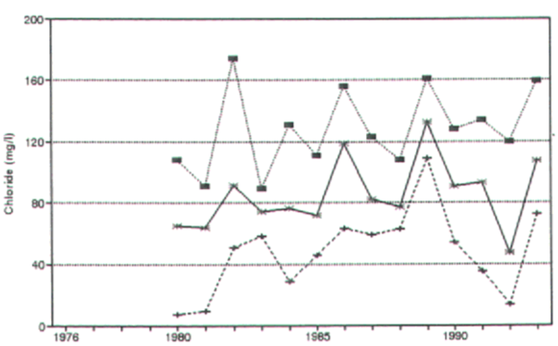


Note: The acute standard of 63.9 ug/l was not violated in any year.





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



Note: No standard has been established for surface waters classified as limited aquatic life.

LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

KINNICKINNIC RIVER WATERSHED

Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

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

station Kk-2 in the inner harbor. Fecal coliform levels exceeded the standard at all three locations. As noted in the subsequent section, standards for metals are also exceeded at all stations.

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 Kinnickinnic River watershed from 1973 through 1977. The analyses indicated that recommended levels of mercury were exceeded in four of 73 samples, and that recommended PCB levels were exceeded in one out of 12 water quality samples. Sample analyses for cadmium, chromium, copper, lead, nickel, zinc, DDT, DDE, DDD, aldrin, heptachlor, heptachlor epoxide, lindane, dieldrin, methoxychlor, and phthalate uncovered no violations of U.S. Environmental Protection Agency (EPA) recommended levels. Sampling and analyses of bottom sediments were conducted on the Kinnickinnic River, and detectable levels of cadmium, chromium, copper, lead, mercury, nickel, zinc, and PCBs were observed; however, no criteria were established to assess the recorded concentrations.

Recent data on metals in the Kinnickinnic River watershed were collected by the Milwaukee Metropolitan Sewerage District, as shown in Figures VI-1 through VI-3. Available data collected from stations Kk-1, 2, and 3 from 1976 to 1993 indicated that lead, copper, and cadmium concentrations at all stations violated chronic toxicity level standards as established by the Wisconsin Department of Natural Resources. Levels of zinc also violated chronic toxicity standards at two stations, Kk-1 and Kk-3.

Sediment contamination with PAHs is a general problem in the sediments of the Kinnickinnic River portions of the Milwaukee Harbor estuary, as documented in the Milwaukee Harbor estuary study[6] and the remedial action plan for the Milwaukee Harbor estuary.[7] Additional data on the sediment chemistry of the Kinnickinnic River are reported by Ni, Gun, and Christensen[8] and by Masterson and Bannerman.[9] Both studies report PAH concentrations that exceed the Lowest Effect Level (LEL) guidelines proposed as screening criteria for contaminated sediments by the Wisconsin Department of Natural Resources.[10] In addition, data on copper and oil

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

[7]Wisconsin Department of Natural Resources, Milwaukee Estuary, Remedial Action Plan, March 1991.

[8]Fay Ni, Michael F. Gun, and Erik R. Christensen, Toxic Organic Contaminants in the Sediments of the Milwaukee Harbor Estuary; Final Report, Milwaukee Metropolitan Sewerage District, March 1992.

[9]John P. Masterson and Roger T. Bannerman, "Impacts of Stormwater Runoff on Urban Streams in Milwaukee County, Wisconsin;" in Proceedings of the National Symposium on Water Quality, AWRA, November 1994; pp. 123-133.

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

and grease concentrations in the Kinnickinnic River sediments reported by Masterson and Bannerman also exceeded the proposed LEL guidelines.

Since the completion of the initial regional water quality management plan, 34 spills of toxic substances into streams within the Kinnickinnic River watershed have been documented by the Wisconsin Department of Natural Resources. Of these spills, 29 have occurred in the main stem of the Kinnickinnic River, all within the City of Milwaukee. The remaining five spills occurred in the Wilson Park Creek tributary. The majority of the substances that were spilled into surface waters were oil or related petroleum products.

Water Quality Assessments: Based upon the available data, the water quality and biological characteristics of the Kinnickinnic River and its major tributaries were assessed with the results set forth in Table VI-6. Fish populations and diversity are poor throughout much of the watershed due largely to the conversion of the natural stream channel to a concrete channel. Downstream of the location where the concrete channel ends on the Kinnickinnic River downstream of 5th Street, the fish population and diversity are rated as good. No reported fish kills have been recorded in the Kinnickinnic River watershed.

Standards were not expected to be fully met for fecal coliform for all stations considered in the Kinnickinnic River watershed. Problems with dissolved oxygen concentrations occurred in the Kinnickinnic River downstream of First Street. For those stream reaches recommended for warmwater sport fish and limited recreational uses, standards were not met for concentrations of un-ionized ammonia nitrogen or total phosphorus. Problems with water column toxic pollutants were noted in the Kinnickinnic River downstream of 27th Street and in Wilson Park Creek. Where data were available, the biotic index ratings, which are biological indicators of water quality within a stream system, were poor. High levels of streambed sedimentation were noted in Wilson Park Creek and the Kinnickinnic River upstream of 27th Street. Moderate levels of streambed sedimentation were noted in the Kinnickinnic River downstream of First Street.

Table VI-7 sets forth the water quality index classifications[11] 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 VI-7, recent data were used from the Milwaukee Metropolitan Sewerage District for three stations on the Kinnickinnic River: at 27th Street, at 7th Street, and at Greenfield Avenue. These stations are shown on Map VI-5. The data from the station at 27th Street were used for comparative purposes in conjunction with earlier data from station Kk-1, located on the Kinnickinnic River at 29th Street. The limited comparative data available indicate that water quality conditions have generally remained "fair" from 1964 to 1974-75 and to 1990-91.

A summary of potential pollution sources in the Kinnickinnic River watershed by stream reach is shown in tabular summary in Table VI-8. Review of the data indicate the majority of the conversion of lands from rural to urban uses

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[11]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 VI-6

CHARACTERISTICS OF STREAMS IN THE KINNICKINNIC RIVER WATERSHED

Stream Reach	Stream Length (miles)	Fish Population and Diversity[a]	Recorded Fish Kills	Water Quality Problems[b]					Biotic Index Rating[c]	Streambed Sedimentation (substrate)	Physical Modifications to Channel[d]
				DO	NH_3	Total P	Fecal Coliform	Toxics			
a. Kinnickinnic River upstream 27th Street	3.9	Poor	No	No	--	--	Yes	--	Poor	High (gravel, sand, silt, concrete)	Major
b. Kinnickinnic River downstream 27th Street to 5th Street	2.2	Poor	No	No	--	--	Yes	Yes	--	-- (concrete)	Major
c. Kinnickinnic River downstream 5th Street to 1st Street	1.3	Good	No	No	Yes	Yes	Yes	Yes	Poor	-- (gravel, sand)	Major
d. Kinnickinnic River downstream 1st Street	1.4	Good	No	Yes	Yes	Yes	Yes	Yes	Poor	Moderate (gravel, sand)	Major
e. Lyons Creek	1.4	--	No	No	--	--	Yes	--	--	--	Major
f. Wilson Park Creek	5.1	Poor	No	No	--	--	Yes	Yes	Poor	High (gravel, sand, silt)	Major
TOTAL	15.3										

[a] Based upon stream appraisal documentation set forth in Wisconsin Department of Natural Resources Kinnickinnic River Stream Appraisals, November 1984, and professional judgement of area fish managers.

[b] The most recent water quality data available as described in Figures VI-1 through VI-3 were used to evaluate water quality in the Kinnickinnic 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 Kinnickinnic River watershed stream reaches based upon simulated year 2000 land use conditions and current level of pollutant control, if appropriate.

[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.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table VI-7

WATER QUALITY INDEX CLASSIFICATIONS FOR THE SAMPLING STATIONS OF THE KINNICKINNIC 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			
Kk-1	Fair	Fair	Fair
Kk-2	--	--	Fair/Good
Kk-3	--	--	Fair
Watershed Average	Fair	Fair	Fair

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

Source: SEWRPC.

Table VI-8

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

Stream Reach[a]	Extent of Conversion of Lands from Rural to Urban[b]		Documented Toxic Spills 1976-1990	Remaining Potential Surface Water Pollution Sources						Ongoing Pollution Abatement Efforts[c]
	Historical 1976-1990	Expected 1990-2010		Urban Nonpoint Source Pollution	Rural Nonpoint Source Pollution	Public Sewage Treatment Plants	Private Sewage Treatment Plants	Number of Permitted Industrial Discharges	Other Known Potential Impacts to Surface Water Quality	
Kinnickinnic River upstream 27th Street	Insignificant[d]	Insignificant[d]	1978-oil 1983-unknown 1983-gelatinous scum 1986-unknown	X	--	--	--	15	Leaking Underground Storage Tank (LUST) site permitted to discharge remediation waste-water to the Kinnickinnic River	1,2
Kinnickinnic River downstream 27th Street to 5th Street	Insignificant[d]	Insignificant[d]	1978-foundary sand 1982-green liquid 1983-unknown 1983-gelatinous scum 1984-oil 1984-oil 1986-oil 1986-milky substance 1991-Water with cement floor grindings	X	--	--	--	4	--	1,2
Kinnickinnic River downstream 5th Street to 1st Street	Insignificant[d]	Insignificant[d]	1985-fuel oil 1992-diesel fuel	X	--	--	--	10	--	1,2
Kinnickinnic River downstream 1st Street to Jones Island Ferry	Insignificant[d]	Insignificant[d]	1978-oil 1982-light oil 1985-oil cutting 1985-coal dust 1987-waste oil 1987-hydraulic oil 1987-gasoline 1987-waste oil 1988-heavy dark oil residue 1988-ground seepage 1989-lube oil 1989-oil-based paint 1990-oil-based paint 1991-diesel fuel	X	--	--	--	6	--	1,2
Lyons Creek	Insignificant[d]	Insignificant[d]	--	X	--	--	--	0	--	1,2

Table VI-8 (continued)

Stream Reach[a]	Extent of Conversion of Lands from Rural to Urban[b] Historical 1976-1990	Expected 1990-2010	Documented Toxic Spills 1976-1990	Remaining Potential Surface Water Pollution Sources: 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	Ongoing Pollution Abatement Efforts[c]
Wilson Park Creek	Insignificant[d]	Insignificnt[d]	1986-oil substance 1990-diesel fuel 1990-petroleum product 1990-petroleum product 1991-petroleum (sheen)	X	--	--	--	12	LUST site permitted to discharge remediation wastewater to the Kinnickinnic River	1,2

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

[b] Extent of urban land conversions were determined as a percentage of the watershed as follows:
major > 20%
moderate 10 - 20%
significant 5 - 10%
insignificant 0 - 5%

[c] Number codes refer to the following ongoing pollution abatement efforts:
1. Construction Erosion Control Ordinances in place
2. Kinnickinnic Priority Watershed Nonpoint Source Plan implementation underway.

[d] Considerable urban development existing pre-1976.

Source: Wisconsin Department of Natural Resources and SEWRPC.

occurred prior to 1976. It should be noted that the majority of the documented spills of toxic substances occurred in the Kinnickinnic River main stem from 27th Street to 5th Street and downstream of 1st Street. The majority of the permitted industrial discharges occur in the Kinnickinnic River upstream of 27th Street and in Wilson Park Creek. Data on nonpoint source pollution and additional potential impacts to surface water quality are included in Table VI-8.

Compliance with Water Use Objectives

As indicated in Chapter II, the majority of the stream reaches in the Kinnickinnic River watershed, as of 1993, are generally recommended for limited aquatic life and limited recreational uses. These water use objectives and the associated water quality standards are discussed in Chapter II. The Kinnickinnic River downstream of 5th Street, which is not concrete-lined, is recommended for warmwater sport fish and limited recreational uses.

Based upon the available data for sampling stations in the watershed, the main stem of the Kinnickinnic River did not fully meet the water quality standards associated with the recommended water use objectives during and prior to 1975, the base year of the initial plan. More recent data available for the period of 1976 through 1991 indicate that the dissolved oxygen standards associated with the recommended water use objective are largely met, while the fecal coliform standards continue to be violated. As shown in Figures VI-1 through VI-3, 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 levels also occur along the entire main stem of the Kinnickinnic River and in Wilson Park and Lyons Creeks. In addition, metals standards were noted to be violated for all stations except for the main stem above 27th Street and for Lyons Park Creek.

WATER QUALITY MANAGEMENT ISSUES REMAINING TO BE ADDRESSED

Based upon the current status of pollution abatement planning and land use decisions, there are no major water quality issues remaining to be addressed specific to the Kinnickinnic River watershed. A potential future amendment to the regional plan for the Kinnickinnic 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 institute an amendment to the regional plan once it is adopted by all of the agencies involved.

Chapter VII

MENOMONEE RIVER WATERSHED REGIONAL WATER QUALITY MANAGEMENT PLAN UPDATE AND STATUS REPORT

INTRODUCTION

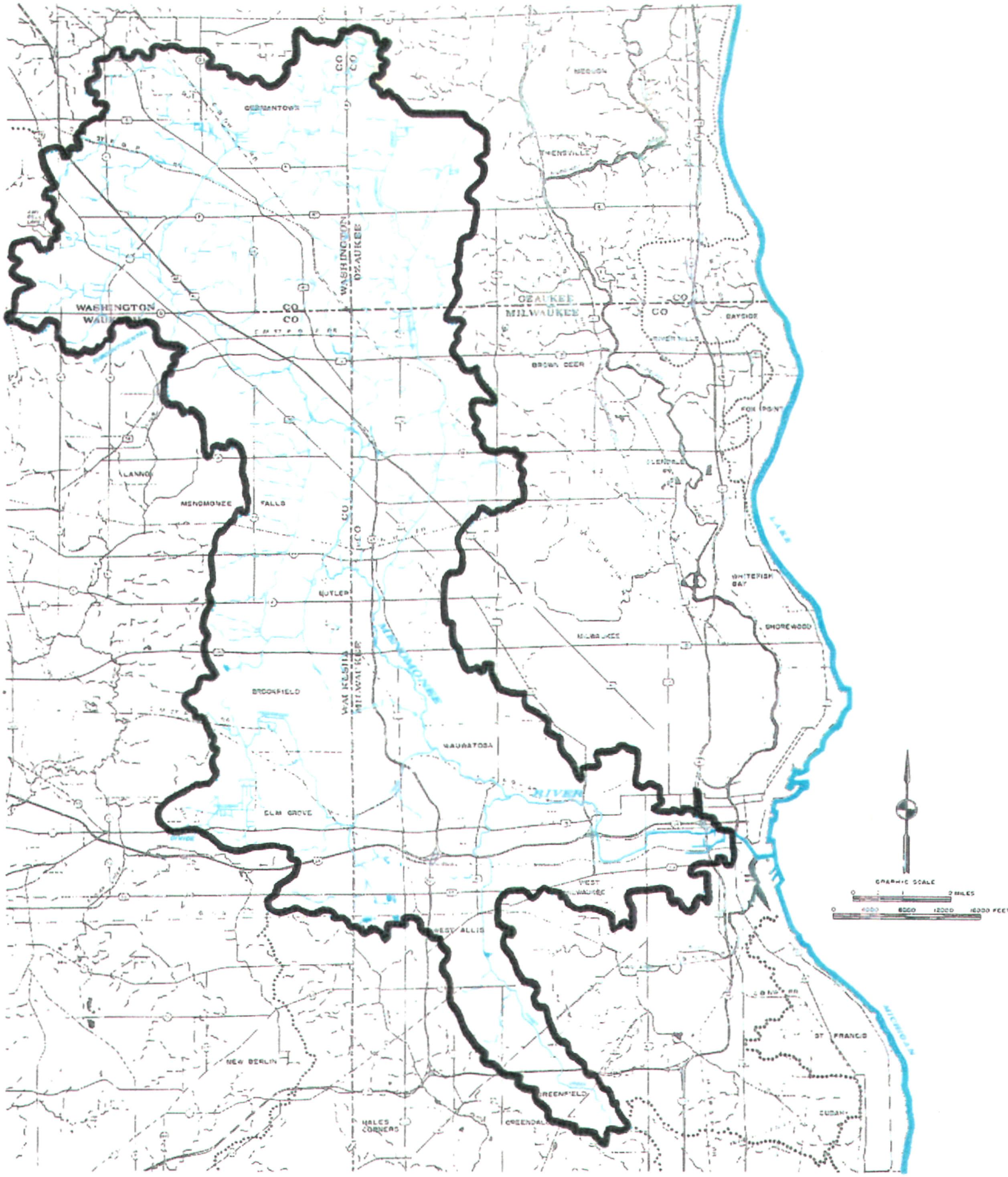
This chapter presents a description of the recommendations contained in the initial regional water quality management plan and amendments thereto, and progress made toward plan implementation from 1975--the base year of the initial plan--through 1990--the base year of the plant update. In addition, this chapter presents information on water quality and biological conditions in the surface water system of the Menomonee River watershed through 1993, where available. Finally, this chapter presents a description of any substantive water quality management issues that remain to be addressed in the Menomonee 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 the water quality monitoring plan elements. In addition, a brief separate section on lake management is included which is limited for the Menomonee River watershed as there are no major lakes in the watershed. Designated management agency responsibilities for plan implementation are presented in Chapter XVII on a regional basis.

The Menomonee River watershed is located in the east central portion of the Region and covers an area of approximately 135 square miles. The Menomonee River originates in southeastern Washington County, and flows approximately 28 miles through the northeastern corner of Waukesha County and through western and central Milwaukee County to its confluence with the Milwaukee River. Rivers and streams in the watershed are part of the Lake Michigan drainage system as the watershed lies east of the subcontinental divide. The boundaries of the basin, together with the locations of the main channels of the Menomonee River watershed and its principal tributaries, are shown on Map VII-1. The Menomonee 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 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 use which have occurred within the Menomonee 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

Map VII-1
MENOMONEE RIVER WATERSHED



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 VII-1 summarizes the existing land uses in the Menomonee 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 is largely urbanized, 41 percent of the watershed was still in rural and other open space land uses in 1990. These rural and open space uses included about 22 percent of the total area of the watershed in agricultural and related rural uses, about 2 percent in woodlands, about 8 percent in surface water and wetlands, and about 9 percent in other open lands. The remaining approximately 59 percent of the total watershed was devoted to urban uses. Existing land uses within the watershed are shown on Map VII-2.

Urban development exists in much of the Menomonee River watershed, with concentrated development generally occurring in portions of Milwaukee, Washington, and Waukesha Counties. Concentrations of urban-related land use are located in and around the Village of Menomonee Falls, particularly along the STH 175 corridor, in the Villages of Elm Grove and Germantown, and in the Cities of Brookfield, Greenfield, Wauwatosa, West Allis, and Milwaukee. The watershed contains two major commercial centers, Blue Mound Road and Mayfair, and five major industrial centers, Milwaukee Granville, Butler, West Allis West, Menomonee Valley East, and Menomonee Valley West.

As shown in Table VII-1, from 1975 to 1990, urban land uses in the watershed increased from about 46,000 acres, or about 72 square miles, to about 51,000 acres, or 79 square miles, or by about 10 percent. As shown in Table VII-1, residential land represents the largest urban land use in the watershed. Residential use has increased within the watershed, from about 22,000 acres, or about 34 square miles in 1975 to about 24,000 acres, or about 38 square miles in 1990, a 10 percent increase. Commercial and industrial land uses increased significantly, from about 3,400 acres, or about 5.3 square miles, to about 4,300 acres, or about 6.8 square miles, an increase of 28 percent.

The 79-square miles of urban land uses in the watershed as of 1990 approximate the same amount under the staged 1990 planned urban land envisioned in the adopted year 2000 land use plan. The current status of development in the Menomonee River watershed and in adjacent portions of Milwaukee, Ozaukee, Washington, and Waukesha Counties was considered in developing the new, year 2010 land use plan element described in Chapter III for the Region as a whole.

Table VII-2 summarizes the year 2010 planned land use conditions set forth in the adopted year 2010 land use plan in the Menomonee 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 the Villages of Butler and Menomonee Falls, in the southern portion of the Village of Germantown, and in the northwestern portion of Milwaukee County. In addition, some urban re-development is anticipated to occur in portions of the already urbanized areas in and around Milwaukee County. The year 2010 land use plan additionally proposes two major commercial centers to be located in the

Table VII-1

LAND USE IN THE MENOMONEE RIVER WATERSHED: 1975 AND 1990[a]

Land Use Category	1975		1990		Change 1975-1990	
	Acres	Percent	Acres	Percent	Acres	Percent
Urban						
Residential	22,139	25.6	24,247	29.1	2,108	9.5
Commercial	1,314	1.5	1,618	1.9	304	23.1
Industrial	2,072	2.4	2,719	3.2	647	31.25
Transportation, Communication, and Utilities[b]	14,423	16.7	15,835	18.3	1,412	9.8
Governmental and Institutional	3,198	3.7	3,220	3.7	22	0.7
Recreational	2,861	3.3	2,966	3.4	105	3.7
Subtotal	46,007	53.2	50,605	58.6	4,598	10.0
Rural						
Agricultural and Related	24,528	28.4	19,035	22.0	-5,493	- 22.4
Lakes, Rivers, Streams and Wetlands	6,720	7.8	7,077	8.2	357	5.3
Woodlands	2,326	2.7	2,185	2.5	- 141	- 6.1
Open Lands, Landfills, Dumps, and Extractive[c]	6,798	7.9	7,477	8.7	679	- 10.1
Subtotal	40,372	46.8	35,774	41.4	-4,598	- 11.4
Total	86,379	100.0	86,379	100.0	0	--

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

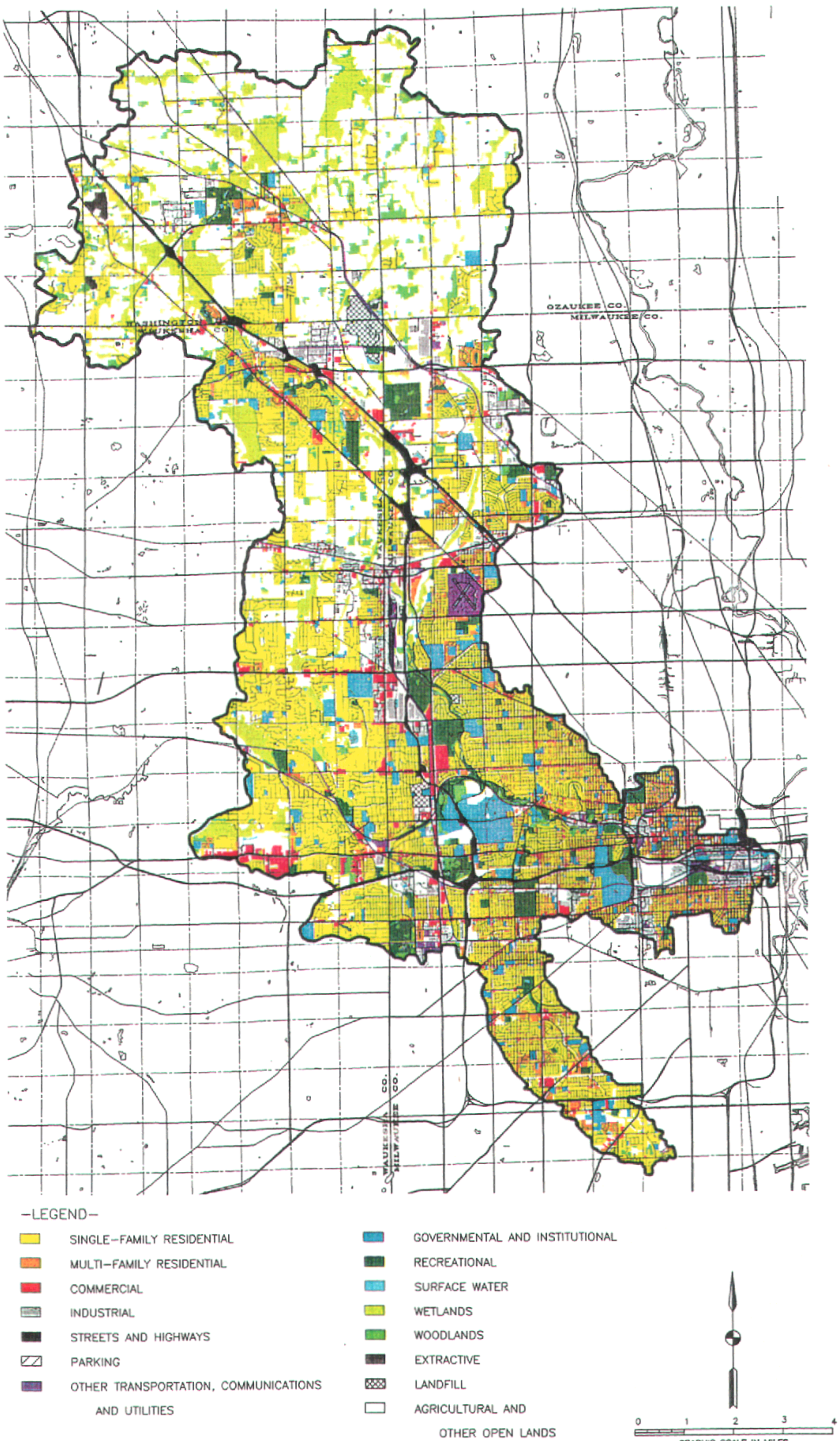
[b] Includes all off-street parking.

[c] Includes both rural and urban lands.

Source: SEWRPC.

MAP VII-2

LAND USES IN THE MENOMONEE RIVER WATERSHED: 1990



The Menomonee River watershed is about 135 square miles in areal extent, or about 5 percent of the total Region. In 1990 about 79 square miles, or about 59 percent of the watershed, was in urban land uses.

Source: SEWRPC

Table VII-2

EXISTING AND PLANNED LAND USE IN THE MENOMONEE 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	24,247	28.1	26,529	30.7	2,282	9.4	30,177	34.9	5,930	24.5
Commercial	1,618	1.9	1,677	2.0	59	3.6	1,788	2.1	170	10.5
Industrial	2,719	3.2	3,109	3.6	390	14.3	3,381	3.9	662	24.3
Transportation, Communication, and Utilities[b]	15,835	18.3	16,707	19.3	872	5.5	18,048	20.9	2,213	14.0
Governmental and Institutional	3,220	3.7	3,374	3.9	154	5.2	3,486	4.0	266	8.3
Recreational	2,966	3.4	3,450	4.0	484	16.3	3,563	4.1	597	20.1
Subtotal	50,605	58.6	54,846	63.5	4,241	8.4	60,443	69.9	9,838	19.4
Rural										
Agricultural and Related	19,035	22.0	18,156	21.0	- 879	- 4.6	13,431	15.6	-5,604	- 29.4
Lakes, Rivers, Streams, and Wetlands	7,077	8.2	6,531	7.6	- 546	- 7.7	6,531	7.6	- 546	- 7.7
Woodlands	2,185	2.5	2,184	2.5	- 1	0.0	2,111	2.4	- 74	- 3.4
Open Lands,[c] Landfills, Dumps and Extractive	7,477	8.7	4,662	5.4	-2,815	-37.6	3,863	4.5	-3,614	- 48.3
Subtotal	35,774	41.4	31,533	36.5	-4,241	-11.8	25,936	30.1	-9,838	- 27.5
Total	86,379	100.0	86,379	100.0	0	--	86,379	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.

Menomonee River watershed. The plan proposes a research park to be located in the southwestern portion of the City of Wauwatosa in the vicinity of the Milwaukee County Institutions grounds, and a major commercial office center--Park Place--which was largely completed as of 1990 and is located in the northwestern portion of Milwaukee 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 Menomonee River watershed, as indicated in Table VII-2, is projected to increase from the 1990 total of about 79 square miles, or about 59 percent of the total area of the watershed, to about 86 square miles, or about 64 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 94 square miles, or about 70 percent of the total watershed by year 2010. It is important to note that the 30 to 37 percent of the watershed remaining in rural and other open space 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 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 56 square miles in 1990 to about 49 square miles in the year 2010 under the intermediate growth-centralized land use plan and to about 41 square miles under the high growth-decentralized land use plan, decreases of about 13 to 25 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 Menomonee River watershed--including consideration of public and private sewage treatment plants, points of public sanitary 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 Menomonee River, the most significant recommendations in the initial plan and the most significant implementation actions are related to the Milwaukee Metropolitan Sewerage District 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 completing, 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 an amendment to the regional water quality management plan update herein presented. Such an amendment could impact on the facilities within the Menomonee River watershed

Public and Private Wastewater Treatment Systems and Sewer Service Areas

Existing Conditions and Status of Plan Implementation: In 1975, there were three public sewage treatment facilities located in the Menomonee River watershed, as shown on Map VII-3. All three plants, the Village of Germantown Old Village Plant and the Village of Menomonee Falls Pilgrim Road and Lilly Road plants, discharged treated effluent directly to the main stem of the Menomonee River. All three plants were abandoned after 1975 and the attendant service areas were connected to the Milwaukee metropolitan sewerage system for treatment purposes, as recommended in the initial water quality plan. The status of implementation in regard to the abandonment of public and private sewage treatment plants in the Menomonee River watershed, as recommended in the initial regional water quality management plan, is summarized in Table VII-3. Currently, the Milwaukee Metropolitan Sewerage District's Jones Island and South Shore plants serve the existing sewered portions of the Menomonee River watershed. It should be noted that in 1975, the base year of the initial plan, and in 1990, there were no privately owned sewage treatment plants discharging to the stream system of the Menomonee River 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 eight sewer service areas identified within, or partially within, the Menomonee River watershed: Mequon, Germantown, Menomonee Falls, Butler, Brookfield East, Elm Grove, New Berlin, and the Milwaukee Metropolitan Sewerage District. Currently, all of the sewer service areas within the watershed have undergone refinements as recommended, with the exception of the Milwaukee Metropolitan Sewerage District which is currently almost entirely served by sewer. The boundaries of the sewer service areas in the watershed, through 1993, are shown on Map VII-3. Table VII-4 lists the plan amendment prepared for each refinement and the date the Commission

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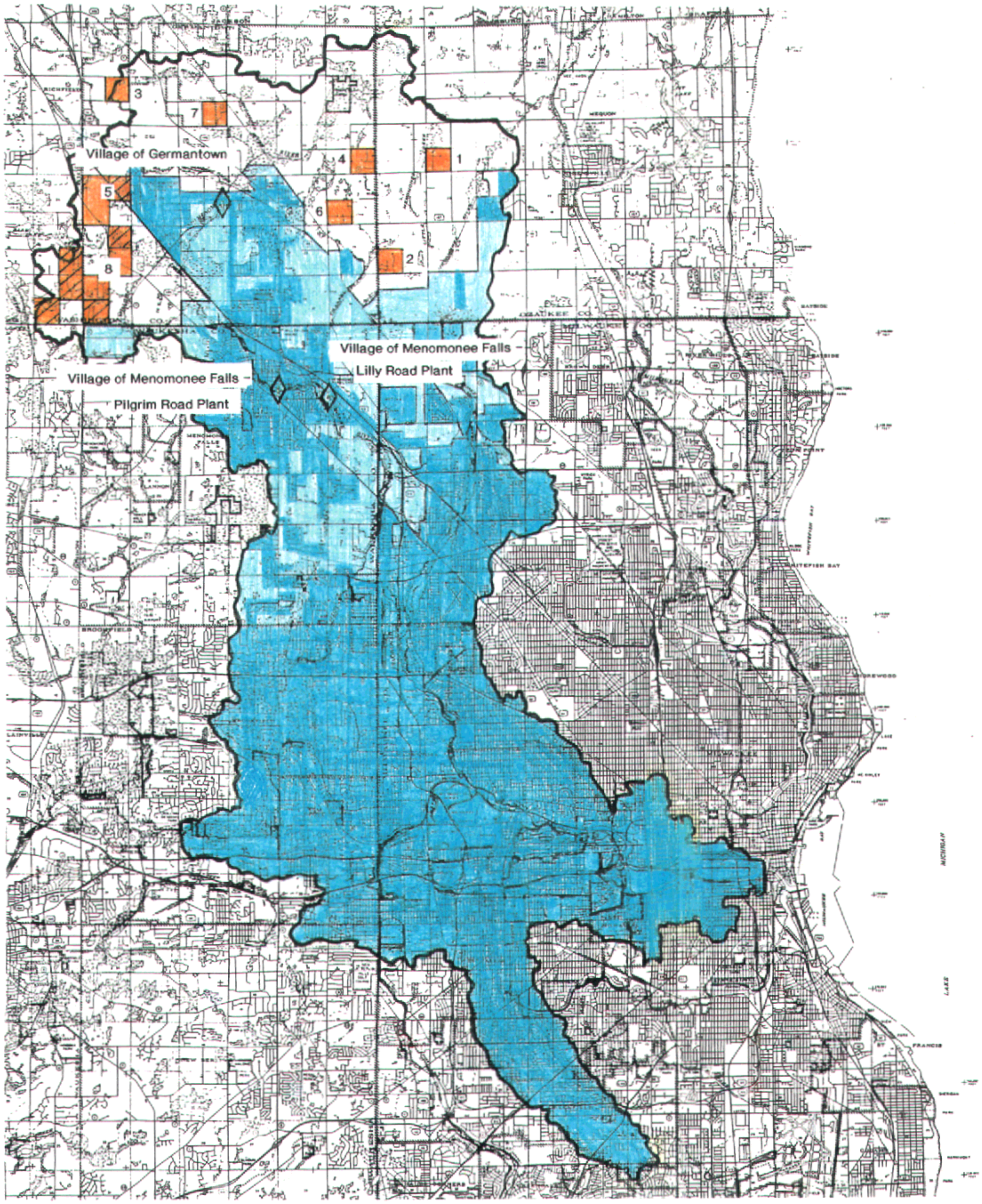
[1]Milwaukee Metropolitan Sewerage District, MMSD Wastewater System Plan, June 1990.

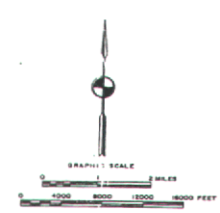
Map VII-3

SEWER SERVICE AREAS IN THE MENOMONEE RIVER WATERSHED: 1990 AND 2010



LEGEND

- SANITARY SEWER SERVICE AREA (EXISTING)
- SANITARY SEWER SERVICE AREA (PLANNED)
- PUBLIC SEWAGE TREATMENT FACILITY ABANDONED AFTER 1975
- 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



Source: SEWRPC

Table VII-3

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

Public Sewage Treatment Plants	Disposal of Effluent	Plan Recommendation	Implementation Status
Village of Germantown	Menomonee River	Abandon plant	Plant abandoned (1986)
Village of Menomonee Falls-Pilgrim Road	Menomonee River	Abandon plant	Plant abandoned (1981)
Village of Menomonee Falls-Lilly Road	Menomonee River	Abandon plant	Plant abandoned (1981)

Source: SEWRPC.

Table VII-4

PLANNED SANITARY SEWER SERVICE AREAS IN THE MENOMONEE 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
Refined Sanitary Sewer Service Area				
Brookfield East Elm Grove Brookfield West	22.6	Brookfield East Brookfield West	December 4, 1991	SEWRPC CAPR No. 109, Sanitary Sewer Service Area for the City and Town of Brookfield and the Village of Elm Grove, Waukesha County, Wisconsin
Butler	0.8	Butler	March 1, 1984	SEWRPC CAPR No. 99, Sanitary Sewer Service Area for the Village of Butler, Waukesha County, Wisconsin
Germantown	8.0	Germantown	September 8, 1983	SEWRPC CAPR No. 70, Sanitary Sewer Service Area for the Village of Germantown, Washington County, Wisconsin
Menomonee Falls	17.3	Menomonee Falls Lannon	June 16, 1993	SEWRPC CAPR No. 208, Sanitary Sewer Service Areas for the Villages of Lannon and Menomonee Falls
Mequon Thiensville	3.3	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
New Berlin	0.7	New Berlin	December 7, 1989	SEWRPC CAPR No. 157, Sanitary Sewer Service Area for the City of New Berlin, Waukesha County, Wisconsin
Subtotal	52.7			
Unrefined Sanitary Sewer Service Areas				
Milwaukee Metropolitan Sewerage District	56.3	--	--	--
Subtotal	56.3			
Total	109.0			

Note: CAPR - Community Assistance Planning Report

Source: SEWRPC.

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 area names following the refinement process. The planned sewer service area in the Menomonee River watershed, as refined through 1993, totals about 53 square miles, or about 39 percent of the total watershed area, as shown in Table VII-4.

Current Plan Recommendations: The current planned sanitary sewer service areas in the Menomonee River watershed are shown on Map VII-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 these sewer service areas are located in the Menomonee River watershed: Brookfield East and West, Butler, Germantown, Menomonee Falls, Mequon, the Milwaukee Metropolitan Sewerage District, and New Berlin. Together, the planned service areas within the watershed total about 109 square miles, or about 81 percent of the Menomonee River watershed.

As noted above, all of the service areas within the watershed have been refined as part of the ongoing regional water quality management plan updating process, with the exception of the Milwaukee Metropolitan Sewerage District sewer service area. The refinement of the Milwaukee Metropolitan Sewerage District service area is recommended to be conducted during 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.

Sewer Flow Relief Devices

Existing Conditions and Status of Plan Implementation: In 1975, there were 26 combined sewer outfalls and 140 known separate sewer system flow relief devices located in the Menomonee River watershed. Of the latter, 73 were crossovers, seven were bypasses, 28 were relief pumping stations, and 32 were portable pumping stations. Of the total of 166 flow relief devices, six discharged to the Burnham Canal from the City of Milwaukee; two discharged to the South Menomonee Canal Branch from the City of Milwaukee; 106 discharged to the Menomonee River, 45 from the City of Milwaukee, 41 from the City of Wauwatosa, two from the Village of Butler, and 18 from the Village of Menomonee Falls; one discharged to Butler Ditch from the City of Brookfield; 15 discharged to Underwood Creek, two from the City of Brookfield, five from the City of West Allis, and eight from the City of Wauwatosa; and 36 discharged to Honey Creek, 18 from the City of West Allis, 12 from the City of Wauwatosa, and six from the City of Milwaukee.

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 VII-5, 89 points of sanitary sewer system flow relief--including

Table VII-5

KNOWN SEWAGE FLOW RELIEF DEVICES IN THE MENOMONEE RIVER WATERSHED: 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 Germantown	--	--	--	--	--	3	3	Used only in case of equipment failure or extreme wet weather conditions
Village of Menomonee Falls	--	--	--	--	--	3	3	Used only in case of extreme wet weather conditions
City of Milwaukee	--	--	18[a]	--	--	--	18	Used only in case of extreme wet weather conditions
City of Brookfield	--	--	--	--	1	8	9	Used only in case of equipment failure or extreme wet weather conditions
City of Wauwatosa	--	--	9	--	--	--	9	Used only in case of extreme wet weater conditions
Village of Elm Grove	--	--	--	--	--	2	2	Used only in case of extreme wet weather conditions
City of West Allis	--	--	--	--	--	6	6	Used only in case of extreme wet weather conditions
Milwaukee Metropolitan Sewerage District	--	30	4	--	5	--	39	Used only in cases of extreme wet weather, CSO bypassing expected about twice per year
TOTAL	--	30	31	--	6	22	89	

[a] Ten of these crossovers are equipped with electric pumps to facilitate bypassing.

Source: SEWRPC.

30 combined sewer overflows--were reported to exist as of 1993 in the Menomonee River watershed. These flow relief points were located in eight sewerage systems. 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[2] 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 Menomonee River, assuming the other water quality improvement measures recommended are carried out. Bypassing from other sanitary sewer flow relief devices is expected to be further reduced over time as additional system upgrading is completed by the Milwaukee Metropolitan Sewerage District and the other local units of government operating sanitary sewer systems.[3]

Current Plan Recommendations: It is recommended that the Cities of Brookfield, Milwaukee, Wauwatosa, and West Allis; the Villages of Elm Grove, Germantown, and Menomonee Falls; and the Milwaukee Metropolitan Sewerage District continue to monitor the sewerage system operations to ensure that the use of the existing sanitary sewer 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 Sewer

Existing Conditions and Status of Plan Implementation: The initial regional water quality management plan as updated, recommended the construction of four intercommunity trunk sewers in the Menomonee River watershed, as shown in Table VII-6. One trunk sewer would connect portions of the City of Brookfield and Village of Menomonee Falls to the Milwaukee Metropolitan sewerage system. One trunk sewer would connect the Village of Germantown to the Milwaukee Metropolitan Sewerage system, permitting the abandonment of the Germantown sewage treatment plant. The Menomonee River and the Underwood Creek sewers would provide needed additional capacity to convey wastewater from the Villages of Menomonee Falls and Elm Grove, and the Cities of Brookfield and Wauwatosa to the Milwaukee Metropolitan sewerage system.

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

[3]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.

Current Plan Recommendations: As noted in Table VI-6, all four trunk sewers recommended in the initial plan have been constructed. No new intercommunity trunk sewers are planned for construction.

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 48 known point sources of pollution identified in the Menomonee River watershed other than public and private sewage treatment plants. These sources discharged industrial cooling, process, rinse, and wash waters through 78 outfalls directly, or indirectly, to the surface water system. Of these point sources outfalls, 37 were identified as discharging only cooling water. The remaining 41 were discharging other types of wastewater. The initial regional water quality plan includes a recommendation that these industrial sources of wastewater be monitored, and discharges limited to levels which must be determined on a case-by-case basis under the Wisconsin Pollutant Discharge Elimination System permit process.

As of 1990, there were 132 such point sources of wastewater discharging to the Menomonee River and its major tributaries or to the groundwater system directly through industrial waste outfalls or indirectly through drainage ditches and storm sewers. Table VII-7 summarizes selected characteristics of these other point sources and Map VII-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 120 known point sources of wastewater discharging to surface waters other than public and private sewage treatment plants in the Menomonee 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 of the Menomonee 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

In 1975, there were eight enclaves of unsewered urban development located outside of the then proposed year 2000 sewer service area in the Menomonee River watershed. As of 1990, none of these areas had been added to the planned 2010 sewer service area. Due to increased urban growth within the watershed since 1975, two of the urban development enclaves identified in the initial plan have been expanded, as indicated on Map VII-3. The corresponding urban enclave population and the distance to the nearest planned year 2010 sewer service area are listed in Table VII-8. As shown in Table VII-8, three of the eight 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 five areas have soils and lot sizes having a high probability of not meeting these criteria and alternative wastewater disposal methods should be considered. Thus, for these five areas,

Table VII-6

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

Intercommunity Trunk Sewer	Status of Implementation
Brookfield-Menomonee Falls	Completed (1981)
Germantown	Completed (1986)
Menomonee River	Completed (1977)
Underwood Creek	Completed (1983)

Source: SEWRPC

Table VII-7

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

Facility Name	County	Map ID No.[b]	Permit Type	Permit No.	Expiration Date	Standard Industrial Classification	Industrial Activity	Receiving Water	Treatment System[c]
Advance Metal Treating, Inc.	Waukesha	1	General	0044938-3	9-30-95	3398	Metal heat treating	Menomonee River via storm sewer	--
Aldrich Chemical Co. - St. Paul	Milwaukee	2	General	0044938-3	9-30-95	2819	Industrial inorganic chemicals	Menomonee River Canal	--
Aldrich Chemical Co. - Ember	Milwaukee	3	General	0044938-3	9-30-95	2819	Industrial inorganic chemicals	Menomonee River Canal	--
Amoco Oil Company - Milwaukee Term.	Milwaukee	4	General	0046531-1	9-30-95	5171	Petroleum bulk stations & terminals	Lt. Menomonee R. via unnamed trib.	--
Ampco Metal Manufacturing, Inc.	Milwaukee	5	General	0044938-3	9-30-95	3351	Copper rolling and drawing	Groundwater discharge	--
APITECH/Division of Applied Power	Waukesha	6	General	0044938-3	9-30-95	3531	Construction machinery	Menomonee River	--
Arcron Ltd. - Menomonee Falls	Waukesha	7	General	0044938-3	9-30-95	3499	Fabricated metal products	Nor-X-Way Channel	--
Borden Dairy Div. - Borden, Inc.	Milwaukee	8	General	0044938-3	9-30-95	2021-26	Dairy products	Underwood Creek via storm sewer	--
Briggs & Stratton	Waukesha	9	General	0044938-3	9-30-95	3519	Internal combustion engines	Menomonee River via storm sewer	--
C&NW Transportation Co., Butler Yd.	Milwaukee	10	General	0046531-1	9-30-90	4013	Switching & terminal services	Menomonee River	--
Chris Hansen's Lab., Inc.	Milwaukee	11	General	SPEC PERM	9-30-95	2869	Industrial inorganic chemicals	Honey Creek via storm sewer	--
Citgo Petroleum Corp. - Granville	Milwaukee	12	General	0046531-1	9-30-90	5171	Petroleum bulk stations & term.	Lt. Menomonee R. via unnamed trib.	--
Clark Oil & Refining Corp.-Granville	Milwaukee	13	General	0046531-1	9-30-90	5171	Petroleum bulk stations & term.	Lt. Menomonee R. via unnamed trib.	--
Concrete Molded Products, Inc.	Washington	14	General	0046507-2	9-30-95	3272	Concrete products	Groundwater discharge	--
Continental Equipment Corp.	Milwaukee	15	General	0044938-3	9-30-95	3452	Bolts, nuts, rivets, & washers	Noyes Creek via storm sewer	--
Cronin Enterprises - Cronin Oil Term.	Milwaukee	16	General	0046531-1	9-30-90	5171	Petroleum bulk stations & term.	Underwood Creek via unnamed trib.	--
Eaton Corp. - Controls Div.	Milwaukee	17	General	0044938-3	9-30-95	3494	Valves and pipe fittings	Menomonee River via storm sewer	--
Elite Fitness & Racquet Club	Milwaukee	18	General	0046523-2	9-30-95	7991	Physical fitness facility	Underwood Creek via unnamed trib.	--
Elm Grove Municipal Pool	Waukesha	19	General	0046523-2	9-30-95	--	Municipal pool	Underwood Creek	--
Empire Level Mfg. Corp.	Milwaukee	20	General	0044938-3	9-30-95	3423	Hand and edge tools	Underwood Creek	--
Enerpac Group Applied Power, Inc.	Waukesha	21	General	0044938-3	9-30-95	3492/3714	Fluid power valves/mtr. parts	Menomonee River	--
Falk Corp. R&D Center	Milwaukee	22	General	0044938-3	9-30-95	3566	Speed changers, drives & gears	Menomonee River Canal	--
Falk Corp. - Plant #2	Milwaukee	23	General	0044938-3	9-30-95	3566	Speed changers, drives & gears	Menomonee River via storm sewer	--
Fulton Manufacturing Corp.	Milwaukee	24	General	0044938-3	9-30-95	3568	Power transmission equipment	Honey Creek via storm sewer	--
Gebhardt-Vogel Tanning Co.	Milwaukee	25	General	0044938-3	9-30-95	3111	Leather tanning and finishing	Menomonee River Canal	--
Germantown Sewage Utility	Washington	--[d]	General	0046566-2	9-30-95	4952	Sewerage systems	Menomonee River	--
The Godfrey Company	Milwaukee	27	General	0046566-1	9-30-95	2033	Canned fruits/vegetables, etc.	Menomonee River via storm sewer	--
Great Lakes Concrete Products	Waukesha	28	General	0046507-2	9-30-95	3272	Concrete products	Nor-X-Way Channel	--
Grede Foundries, Inc. - Wauwatosa	Milwaukee	29	General	0044938-3	9-30-95	3321/3325	Gray & ductile iron, steel foundry	Menomonee River	--
Greenfield High School (Pool)	Milwaukee	30	General	0046523-2	9-30-95	8211	Secondary school	Honey Creek	--
Handschy Ind.	Waukesha	31	General	0044938-3	9-30-95	2893	Printing ink	Menomonee River	--
Harley Davidson Motors	Milwaukee	32	General	0044938-3	9-30-95	3751	Motorcycles, bicycles, parts	Menomonee R. via storm sewer	--
Hentzen Coatings, Inc.	Milwaukee	33	General	0044938-3	9-30-95	2851	Paints and allied products	Noyes Ck. via storm sewer	--
Inland Diesel, Inc.	Waukesha	34	General	0044938-3	9-30-95	3519	Internal compustion engines	Menomonee River	--
J. W. Speaker Corp.	Washington	35	General	0044938-3	9-30-95	3647	Vehicular lighting equipment	Menomonee River	--
James Mews Companies, Inc.	Milwaukee	36	General	0046507-2	9-30-95	--		Groundwater discharge	--
John's Oil Company	Milwaukee	37	General	0046566-2	9-30-95	5171	Petroleum bulk stations & term.	Underwood Ck. via unnamed trib.	--
Koch Refining Company	Milwaukee	38	General	0046531-1	9-30-90	5171	Petroleum bulk stations & term.	Lt. Menomonee R. via unnamed trib.	--
Kraft Food Service Corp.	Waukesha	--[a]	General	SPEC PERM	9-30-95	--	--	Nor-X-Way Channel	--
L. T. Hampel Corp.	Washington	40	General	0044938-3	9-30-95	3089	Plastics products	West Branch Menomonee River	--

Table VII-7 (continued)

Facility Name	County	Map ID No.[b]	Permit Type	Permit No.	Expiration Date	Standard Industrial Classification	Industrial Activity	Receiving Water	Treatment System[c]
Longfellow Jr. High School	Milwaukee	41	General	0046523-2	9-30-95	8211	Secondary School	Menomonee R. via storm sewer	--
M. A. Gerett Div. of Western Ind.	Waukesha	42	General	0044938-3	9-30-95	3469	Metal stampings	Menomonee R. via storm sewer	--
Marathon Oil Company	Milwaukee	43	General	0046531-1	9-30-90	5171	Petroleum bulk stations & term.	Ltl. Meno. R. via unnamed trib.	--
Materson Company	Milwaukee	44	General	SPEC PERM	9-30-95	--	--	Menomonee R. via storm sewer	--
McCarty Park Pool	Milwaukee	45	General	0046523-2	9-30-95	--	Municipal pool	Honey Creek	--
Menomonee Falls School District	Waukesha	46	General	0046523-2	9-30-95	8299	Schools & educational services	Menomonee River via storm sewer	--
Meno. Falls Sch. Dist.: South H.S.	Waukesha	47	General	0046523-2	9-30-95	8211	Secondary school	Menomonee River via storm sewer	--
Meno. Falls Sch. Dist.: Middle Sc.	Waukesha	48	General	0046523-2	9-30-95	8211	Secondary school	Menomonee River	--
Mid City Foundry Co.	Milwaukee	49	General	0044938-2	9-30-95	3321	Gray & ductile iron foundry	Meno.R. Canal v/ Burnhams Canal	--
Milwaukee Board of Schools	Milwaukee	50	General	0046523-2	9-30-95	8299	Schools & educational services	Menomonee River via storm sewer	--
Milw. Bd. of Sch.: Hamilton H.S.	Milwaukee	51	General	0046523-2	9-30-95	8211	Secondary school	Honey Creek	--
Milw. Bd. of Sch.: Juneau Jr/Sr. H.S.	Milwaukee	52	General	0046523-2	9-30-95	8211	Secondary school	Menomonee River via storm sewer	--
Milw. Bd. of Sch.: Vincent Harold	Milwaukee	53	General	0046523-2	9-30-95	8211	Secondary school	Lt. Menomonee River	--
Milwaukee Brush Mfg. Co.	Waukesha	54	General	0044938-3	9-30-95	3496/3991	Fabricated wire prod., brushes	Nor-X-Way Channel	--
Milwaukee Cold Storage Co.	Milwaukee	55	General	0044938-3	9-30-95	5142	Packaged frozen foods	Meno. R. Canal via Burnham Canal	--
Milwaukee County Parks, Rec.& Culture	Milwaukee	56	General	0046523-2	9-30-95	9199	General government	Menomonee River	--
Milwaukee Co. PR&C: Noyes Park Pool	Milwaukee	57	General	0046523-2	9-30-95	--	Municipal pool	Noyes Creek	--
Milw. Co. PR&C: Washington Park Pool	Milwaukee	58	General	0046523-2	9-30-95	--	Municipal pool	Menomonee River via storm sewer	--
Milwaukee Electric Tool Corp.	Waukesha	59	General	0044938-3	9-30-95	3546	Power driven hand tools	Menomonee R. via unnamed trib.	--
Milwaukee Faucets, Inc.	Milwaukee	60	General	0044938-3	9-30-95	3432	Plumbing fixtures fittings & trim	Menomonee R. via storm sewer	--
Milwaukee Lutheran H.S.	Milwaukee	61	General	0045623-2	9-30-95	8211	Secondary school	Menomonee River via storm sewer	--
Mobil Oil Corp.	Milwaukee	--[a]	General	0046566-2	9-30-95	5171	Petroleum bulk station & terminal	Honey Creek via storm sewer	--
Mohawk Cold Storage Div.-Wiscold Inc.	Milwaukee	63	General	0044938-3	9-30-95	5142	Packaged frozen foods	Menomonee River via unnamed trib.	--
The Neilson Wheel Company	Milwaukee	64	General	0044938-3	9-30-95	3499	Fabricated metal products	Little Menomonee River	--
Orchard Business Park	Milwaukee	65	General	0046531-1	9-30-90	6512	Non-residential bldg. operators	Menomonee River via storm sewer	--
Perlick Corporation	Milwaukee	66	General	0044938-3	9-30-95	3585	Refrigeration & heating equipment	Noyes Creek	--
Rainbow Park Pool	Milwaukee	67	General	0046523-2	9-30-95	--	Municipal pool	Underwood Creek via unnamed trib.	--
Reuben Residence	Waukesha	68	General	HEAT PUMP	9-30-95	8811	Private household	Underwood Creek via storm sewer	--
Safer Drycleaning Center	Waukesha	69	General	0044938-3	9-30-95	7216	Drycleaning, exc. rugs	Butler Ditch	--
School District of Elmbrook	Waukesha	70	General	0046523-2	9-30-95	8299	Schools & educational services	Butler Ditch	--
Sch. Dist. Elmbrook: Brkfd.Central HS	Waukesha	71	General	0046523-2	9-30-95	8211	Secondary school	Dousman Ditch via storm sewer	--
Sch. Dist. Elmbrook: Brkfd.East HS	Waukesha	72	General	0046523-2	9-30-95	8211	Secondary school	Underwood Creek via drainage ditch	--
Service Heat Treating Inc.	Milwaukee	73	General	0044938-3	9-30-95	--	--	Little Meno. R. via unnamed trib.	--
Silgan Containers Corp.	Waukesha	74	General	0044938-3	9-30-95	3411	Metal cans	Nor-X-Way Channel	--
Smith & Nephew Roylan Inc.	Waukesha	75	General	0044938-3	9-30-95	3086/3089	Plastics, foam products	Nor-X-Way Channel	--
Stone Container Corp.	Washington	76	General	0044938-2	9-30-95	2653	Corrugated and solid fiber boxes	Groundwater discharge	--
Super Excavators	Waukesha	77	General	0046531-1	9-30-90	1794	Excavation work	Lilly Creek	--
Super Steel Products Corp.-Tower Ave.	Milwaukee	78	General	0044983-3	9-30-95	3441/3499	Fab. struc. metal & products	Little Meno. R. via storm sewer	--
Tews Lime & Cement Co.	Milwaukee	79	General	0046507-1	9-30-95	3274/3273	Lime and Ready-mix concrete	Menomonee River via storm sewer	--
Thiele Tanning Company	Milwaukee	80	General	0044938-3	9-30-95	3111	Leather tanning and finishing	Menomonee River Canal	--

Table VII-7 (continued)

Facility Name	County	Map ID No.[b]	Permit Type	Permit No.	Expiration Date	Standard Industrial Classification	Industrial Activity	Receiving Water	Treatment System[c]
U.S. Oil Co.-Milw. Petro. Prod. Term.	Milwaukee	81	General	0046531-1	9-30-90	2992/2911/2899	Chem preps., petro. refining, etc.	Little Meno. R. via unnamed trib.	--
USA Concrete	Waukesha	82	General	0046507-1	9-30-95	3273	Ready-mix concrete	Lilly Creek	--
Uno-ven Company-Granville Term	Milwaukee	83	General	0046531-1	9-30-90	5171	Petroleum bulk stations & term.	Little Meno. R. via unnamed trib.	--
Waco Oil Company	Milwaukee	--[d]	General	0046566-1	9-30-95	5171	Petroleum bulk station & term.	Menomonee River	--
Washington High School (Pool)	Washington	85	General	0046523-2	9-30-95	8211	Secondary school	Menomonee River	--
Wauwatosa School District	Milwaukee	86	General	0046523-2	9-30-95	8299	Schools & educational services	Underwood Creek via unnamed trib.	--
Wauwatosa Sch. Dist. East HS Pool	Milwaukee	87	General	0046523-2	9-30-95	8211	Secondary school	Menomonee River via storm sewer	--
Wauwatosa Sch. Dist. West HS Pool	Milwaukee	88	General	0046523-2	9-30-95	8211	Secondary school	Menomonee River via storm sewer	--
Wauwatosa Sch. Dist. Whitman Jr. HS	Milwaukee	89	General	0046523-2	9-30-95	8211	Secondary school	Menomonee River via storm sewer	--
West Allis Central H.S. (Pool)	Milwaukee	90	General	0046523-2	9-30-95	8211	Secondary school	Honey Creek via storm sewer	--
West Milwaukee H.S. (Pool)	Milwaukee	--[d]	General	0046523-2	9-30-95	8211	Secondary school	Menomonee River via storm sewer	--
West Shore Pipeline Co.	Milwaukee	--[e]	General	0046566-2	9-30-95	5171	Petroleum bulk station & terminal	Underwood Creek	--
West Shore Pipeline Co., Granville	Milwaukee	93	General	0046531-1	9-30-90	5171	Petroleum bulk station & terminal	Little Meno. R. via unnamed trib.	--
West Surburban Branch YMCA	Milwaukee	94	General	0046523-2	9-30-95	7991	Physical fitness facility	Underwood Creek via unnamed trib.	--
Wirth Park Swimming Pool	Waukesha	95	General	0046523-2	9-30-95	--	Municipal pool	Dousman Ditch	--
Wisconsin Lintel Company	Washington	96	General	0046507-2	9-30-95	3272	Concrete products	Absorption-gravel driveway	--
Wright Junior H.S. (Pool)	Milwaukee	97	General	0046523-2	9-30-95	8211	Secondary schools	Honey Creek via storm sewer	--
YMCA of of Metro Milw. Tri-Co. Branch	Waukesha	98	General	0046523-2	9-30-95	7991	Physical fitness facility	Menomonee River via storm sewer	--
A-C Reorganization Trust	Milwaukee	1A	Specific	0026778	9-30-89	3523	Farm machinery & equipment	Honey Creek via storm sewer	3,6
American Concrete Pipe Co., Inc.	Milwaukee	2A	Specific	0044181	3-31-85	3272	Concrete products	Menomonee River via storm sewer	None
Aqua-Tech, Inc. (Thiem-Beazer East)	Milwaukee	3A	Specific	0041688	9-30-87	2891	Adhesives and sealants	Underwood Creek via storm sewer	None
Bradley Corp.	Waukesha	4A	Specific	0041734	9-30-87	3432	Plumbing fixtures, fittings, trim	Nor-X-Way Channel	None
Briggs & Stratton Corp-Wauwatosa	Milwaukee	5A	Specific	0026514	12-31-89	3519	Internal combustion engines	Menomonee River via storm sewer	5
Briggs & Stratton Corp-W Allis/83rd	Milwaukee	6A	Specific	0000507	6-30-92	3321	Gray and ductile iron foundries	Honey Creek	None
Chicago Milwaukee Corp.	Milwaukee	7A	Specific	0027057	3-31-90	4013	Switching and terminal services	Menomonee River	6, 2, 4
Falk Corporation	Milwaukee	8A	Specific	0001139	9-30-86	3566	Speed changers, drives, and gears	Menomonee River	7, 3, 4
Gehl Guernsey Farms, Inc.	Washington	9A	Specific	0033219	12-31-90	2022/2023/2099	Cheese, dry/evap prod., food prep.	Menomonee River	None
Harnischfeger Corp.	Milwaukee	10A	Specific	0025321	9-30-86	3536	Hoists, cranes, and monorails	Menomonee River via storm sewer	None
J.F.Shea Co. Inc.:Crosstown Coll 5/6	Milwaukee	11A	Specific	0047155	6-30-93	1622	Bridge, tunnel & elev. hwy. const.	Menomonee River Canal	3,6
J.F.Shea Co. Inc.:Crosstown Coll 7	Milwaukee	12A	Specific	0047163	6-30-93	1622	Bridge, tunnel & elev. hwy. const.	Menomonee River Canal	3,6
Kearney & Trecker Corp.	Milwaukee	13A	Specific	0033146	3-31-89	3541	Machine tools, metal cutting types	Underwood Creek via storm sewer	None
Lakeview Hospital	Milwaukee	14A	Specific	0044105	3-31-90	8069	Specialty hosp, exc. psychiatric	Underwood Creek via unnamed trib.	None
Masterson Company	Milwaukee	15A	Specific	0068951	9-30-90	--	--	Menomonee River via storm sewer	None
Miller Brewing Company	Milwaukee	16A	Specific	0000744	3-31-91	2082	Malt beverage	Menomonee River via storm sewer	None
The Neilson Wheel Co., Inc.	Milwaukee	17A	Specific	0048542	--	3499	Fabricated metal products	Little Meno. R. via storm sewer	None
Pressed Steel Tank Co., Inc.	Milwaukee	18A	Specific	0045705	1-31-96	3443	Fabricated plate work(boiler shops)	Menomonee River via storm sewer	6
Rexnord Corp. - Milwaukee Factory	Milwaukee	19A	Specific	0026573	9-30-89	3714	Motor vehicle parts, accessories	Menomonee River via storm sewer	None
Sears Roebuck & Co. (Brookfield Sq.)	Waukesha	20A	Specific	0048178	--	5311	Department store	Dousman Ditch via drainage ditch	None
Soo Line Railroad Co.	Milwaukee	21A	Specific	0045993	3-31-88	4013	Switching and terminal services	Menomonee River	6
Stroh Die Casting Co., Inc.	Milwaukee	22A	Specific	0042285	9-30-92	3364	Nonferrous die casting excl. alum.	Menomonee River via unnamed trib.	None

Table VII-7 (continued)

Facility Name	County	Map ID No.[b]	Permit Type	Permit No.	Expiration Date	Standard Industrial Classification	Industrial Activity	Receiving Water	Treatment System[c]
Sunlite Plastics, Inc.	Washington	23A	Specific	0047465	--	3089	Plastics products	Menomonee River via Willow Creek	None
United Parcel Service, Inc.	Waukesha	24A	Specific	0042030	3-31-96	4212	Local trucking without storage	Underwood Creek	8
Universal Foods Corp.	Milwaukee	25A	Specific	0042137	9-30-89	2022/2099	Cheese and Food preparation	Menomonee River via storm sewer	9
Veterans Administration Med. Center	Milwaukee	26A	Specific	0044199	12-31-89	8069	Specialty hosp exc. psychiatric	Menomonee River via storm sewer	None
Waste Mgmt. of WI - Controlled Basin	Waukesha	27A	Specific	0047635	--	4953	Refuse systems	Menomonee River via unnamed trib.	None
Waste Mgmt. of WI - MF/N.Am.Reg./EMD	Waukesha	28A	Specific	0044440	12-31-90	4953	Refuse systems	Menomonee River via unnamed trib.	3
Waste Mgmt. of WI - Omega Hills	Washington	29A	Specific	0045381	12-31-90	4953	Refuse systems	Menomonee River via unnamed trib.	3
Western Metal Spec. Div.	Milwaukee	30A	Specific	0039004	3-31-90	344	Sheet metal work	Menomonee River	None
WI Electric Power Co. - Germantown	Washington	31A	Specific	0042757	6-30-93	4911	Electric services	Menomonee River via unnamed trib.	6
WI Electric Power Co. - Milw Htg.Plt.	Milwaukee	32A	Specific	0001686	12-31-92	4961	Steam and air conditioning supply	Menomonee River Canal	None
WI Elec. Power Co. - Valley Pwr. Plt.	Milwaukee	33A	Specific	0000931	12-31-91	4911	Electric services	Menomonee River Canal	3, 1, 7, 10
Zignego Ready-mix: West Allis Plant	Milwaukee	34A	Specific	0057185	12-31-93	3273	Ready-mix concrete	Underwood Creek via unnamed trib.	None

[a] Table VII-7 includes 132 such point sources of waste water discharging to the Menomonee River and its tributaries, or to the groundwater system in the Menomonee River watershed. As of 1993, there were 120 known, permitted point sources of water pollution.

[b] See Map VII-4, "Point Sources of Pollution Other Than Sewage Treatment Facilities in the Menomonee River Watershed: 1990".

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

1. Chemical conversion/addition
2. Dissolved air flotation
3. Gravity sedimentation
4. Gravity thickening
5. Holding pond
6. Oil and grease removal
7. pH control
8. Screening
9. Spray Irrigation
10. Tube/Plate settlers

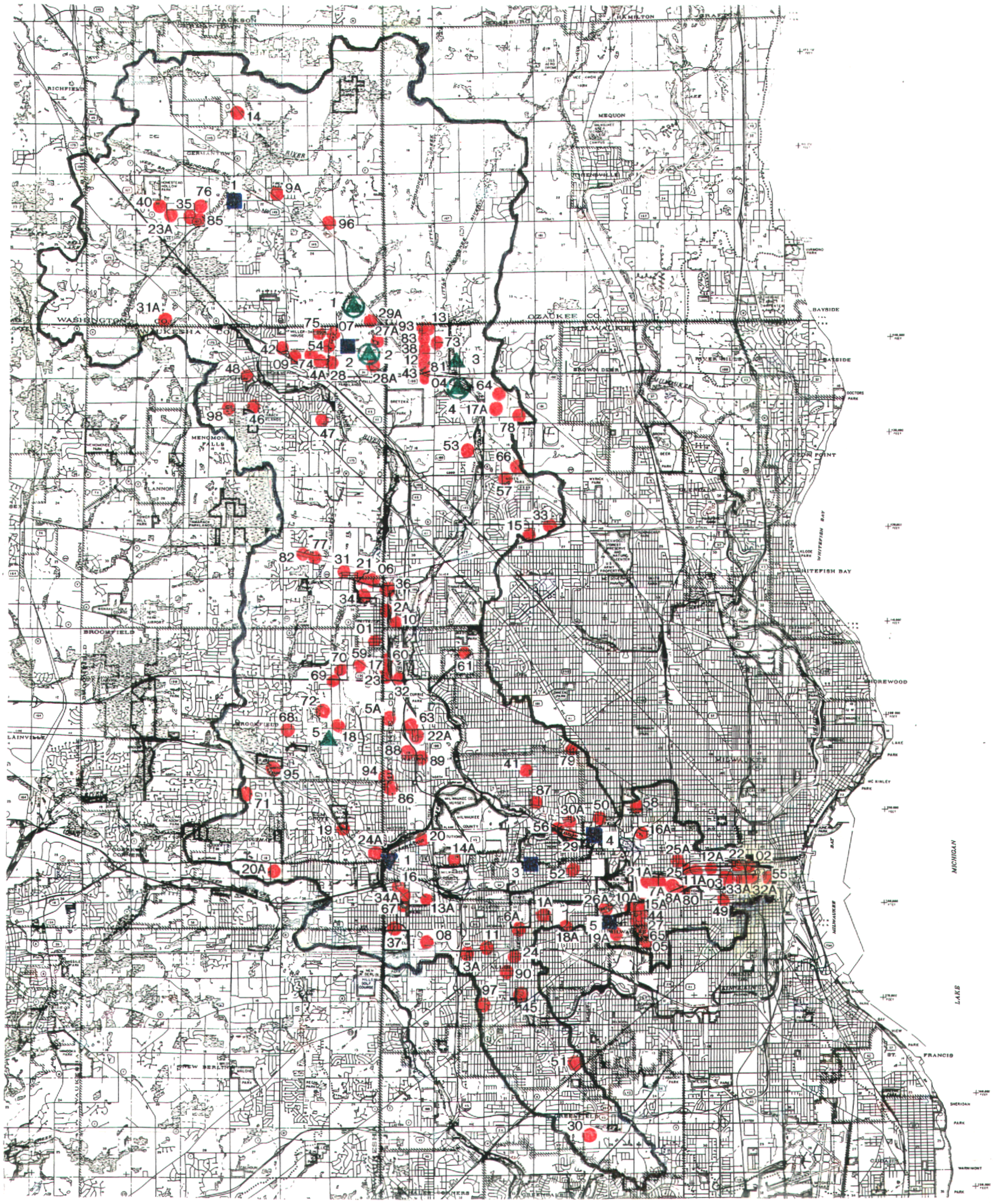
[d] Permitted as Leaking Underground Storage Tanks (LUST) remediation site discharging to surface or ground waters as of 1990. As of 1993, there were 11 additional LUST remediation sites discharging to surface or ground waters in the Menomonee River watershed. See Table VII-9, "Miscellaneous Potential Pollution Sources in the Menomonee River Watershed: 1990" for map identification numbers.

[e] Reported as a groundwater contamination site as of 1990. Remediation wastewater from site is permitted to discharge to surface waters. As of 1993, there was one additional LUST remediation site discharging to surface or ground waters in the Menomonee River watershed. See Table VII-9 for map identification number.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Map VII-4

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



LEGEND

- POINT SOURCES OF POLLUTION OTHER THAN SEWAGE TREATMENT FACILITIES
- LEAKING UNDERGROUND STORAGE TANKS DISCHARGING REMEDIATION WASTEWATER TO SURFACE WATERS OR GROUNDWATER
- ADDITIONAL GROUNDWATER CONTAMINATION SITES DISCHARGING REMEDIATION WASTEWATER TO SURFACE WATERS OR GROUNDWATER
- LANDFILLS DESIGNATED AS SUPERFUND SITES LANDFILLS IDENTIFIED FOR STATE ACTION
- ADDITIONAL LANDFILLS THAT POTENTIALLY IMPACT SURFACE WATER QUALITY

GRAPHIC SCALE

0 1 2 MILES

0 4000 8000 12000 16000 FEET

Source: SEWRPC.

Table VII-8

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

Number[a]	Major Urban Concentration[b]	1990 Estimated Resident Population	Distance from Year 2010 Sewer Service Area (miles)
	Ozaukee County		
1[c]	City of Mequon - Section 17	127	1.0
2[c]	City of Mequon - Section 30	163	1.0
	Washington County		
3	Village of Germantown - Section 7	152	1.3
4	Village of Germantown - Section 13	154	1.1
5[c]	Village of Germantown - Section 19	453	0.1
6	Village of Germantown - Section 24	120	0.5
7[c]	Dhiensville-Rockfield	148	0.8
8[c]	Willow Creek	1155	0.4
	Total	2472	--

[a] See Map VII-3

[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.

it is recommended an inspection and maintenance program for the onsite sewage disposal systems 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.

<u>Miscellaneous Potential Pollution Sources</u>
<u>Landfills</u>: Landfills in the Menomonee 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 two active landfills and 55 abandoned landfills located in the Menomonee River watershed. Two of the abandoned landfills--the Boundary Road landfill (formerly known as Lauer I sanitary landfill) in the Village of Menomonee Falls and the Omega Hills North landfill in the Village of Germantown--were designated as high priority sites for the U.S. Environmental Protection Agency Superfund program which provides for the identification, evaluation, and clean-up of hazardous waste sites. The location of these sites and other landfills which are potentially impacting surface or groundwater in the Menomonee River watershed are shown on Map VII-4 and listed in Table VII-9. In addition, the Moss American Company, a former creosote treatment facility site located in the City of Milwaukee adjacent to the Little Menomonee River, is designated as a high priority Superfund site.

The Boundary Road landfill is located west of the Milwaukee-Waukesha County line and south of the Wisconsin Southern Railroad Company railway in the northeast corner of the Village of Menomonee Falls. The 58-acre landfill site was in operation from 1959 to 1972. Waste Management of Wisconsin, Inc. is the site owner. Surface water may run off the site by way of drainage ditches located immediately to the west of the site and to the east across Boundary Road. A pond and wetland are located immediately to the south of the site. The surface drainage of the lands in the vicinity of the landfill is to the south and east to the Dretzka Park tributary of the Menomonee River. Contaminants detected in the groundwater include chlorinated and non-chlorinated volatile organic compounds. Surface water samples taken in the vicinity show low levels of contaminants. Further feasibility studies have been prepared to evaluate cleanup alternatives. The preliminary recommended plan provides for regrading of the landfill cover, the addition of a new composite cover system, installing a landfill gas extraction system, continuing and expanding the leachate extraction system, and continued monitoring.

The Omega Hills North landfill is located in the southeast corner of the Village of Germantown just north of the Waukesha-Washington County line and just west of the Wisconsin and Southern Railroad Company railway. The site covers 83 acres and was licensed to accept hazardous wastes from 1977 until 1982. The site stopped accepting hazardous wastes in 1982 and liquid wastes in 1983. In 1989, the site stopped accepting all wastes and a clay cover was installed. The surface drainage in the vicinity of the landfill drains largely to the south and

Table VII-9

MISCELLANEOUS POTENTIAL POLLUTION SOURCES IN THE MENOMONEE RIVER WATERSHED: 1990

Map Identification Number[a]	Landfills Indicated to be Potential Pollution Sources	Civil Division Location	Surface Water Potentially Impacted
1[b]	Omega Hills North	Village of Germantown	Little Menomonee River
2[b]	Lauer I Sanitary Landfill[c]	Village of Menomonee Falls	Tributary to Menomonee River
3	Geipel Landfill[d]	City of Milwaukee	Little Menomonee River
4[b]	Moss American	City of Milwaukee	Little Menomonee River
5	City of Brookfield[d]	City of Brookfield	Underwood Creek
	Leaking Underground Storage Tank Sites[e,f]		Receiving Water
1	Germantown Sewage Utility	Village of Germantown	Menomonee River
2	Kraft Food Service Corp.	Village of Menomonee Falls	Nor-X-Way Channel
3	Mobil Oil Corporation	City of Wauwatosa	Honey Creek
4	Waco Oil Company	City of Milwaukee	Menomonee River
5	West Milwaukee High School	Village of West Milwaukee	Menomonee River
	Additional Groundwater Contamination Sites[e,g]		Receiving Water
1	West Shore Pipeline Company	City of Wauwatosa	Underwood Creek

[a] Refers to Map VII-4, "Point Sources of Pollution Other Than Sewage Treatment Facilities in the Menomonee River Watershed: 1990."
[b] SuperFund site.
[c] Also referred to as Boundary Road Landfill.
[d] Indicated to be potential pollution source in DNR Water Resource Appraisal for the Menomonee River Watershed dated August 1992.
[e] Includes those sites which are permitted under the Wisconsin Pollutant Discharge Elimination System to discharge remediation wastewater to surface or ground waters.
[f] As of 1993, there were 11 additional LUST sites in the Menomonee River watershed whose remediation discharges were permitted under the WPDES: Auto Service Association in City of Brookfield discharges to Dousman Ditch; CDS Investments in the City of New Berlin discharges to the Menomonee River, Speedy Lube gas station in the City of Wauwatosa discharges to Underwood Creek; Fleming Companies, Inc. in the City of Milwaukee discharges to the Menomonee River; John's Oil Company in the City of West Allis discharges to Underwood Creek, M & I Northern Bank in the City of Brookfield discharges to the Menomonee River; Moser's Automotive in the Village of Menomonee Falls discharges to Butler Ditch; Murphy Oil USA, Inc. in the Village of Menomonee Falls discharges to the Little Menomonee River; Sprinkman Sons Corp. in the City of Milwaukee discharges to the Little Menomonee River; and Tenley Automotive in the City of Milwaukee discharges to the Little Menomonee River.

Source: Wisconsin Department of Natural Resources and SEWRPC.

east to the Dretzka Park tributary of the Menomonee River, with the area west of the landfill draining to the Nor-X-Way Channel tributary of the Menomonee River. Currently, leachate at the site is being collected and treated, while investigations leading to the selection of final cleanup remedies for the landfill are taking place.

In 1984, the Moss-American site was designated as a high-priority site for the Superfund program. During its operation--from 1921 to 1976, the Moss-American factory treated railroad ties with a creosote and fuel oil mixture. Various analyses which have been conducted over the years since the operation ceased, have indicated the presence of creosote and other chemicals in the area soil and groundwater, and in the Little Menomonee River. There have been documented cases of chemical skin burns by persons from the sediments in the Little Menomonee River. Alternative and recommended plans were set forth in the Menomonee River watershed plan[4] for resolving the identified problem. That plan recommended that the residual creosote pollution problem in the Little Menomonee River within Milwaukee County be resolved by excavating a new parallel channel, filling the existing channel, and restoring the site. The recommended pollution abatement measure would be applied along a 3.46-mile-long reach of the Little Menomonee River and would result in a significant reduction in creosote exposure hazard. Following additional site investigations and feasibility studies, the previous site operator, under U.S. Environmental Protection Agency and Wisconsin Department of Natural Resources supervision, is in the initial phases of designing the pollution abatement program for the site. The project, which was identified by the Superfund remedial action plans after evaluation of alternatives, includes:

- Rerouting of the Little Menomonee River from the Moss-American site to its mouth.

- Removal and biological treatment of highly contaminated soil and river sediment using an onsite treatment system.

- Burial of remaining sediments in the current streambed with soil excavated from the new channel.

- Burial of the untreated soil and the treated material from the treatment system onsite under a soil cover.

- Collection and treatment of contaminated groundwater with discharge to the sanitary sewerage system.

- Treatment of the landfilled soil onsite and disposal of it onsite in a specially designed landfill.

The recommended remedial action plan is consistent with recommendations contained in the adopted Menomonee River watershed plan.

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[4]SEWRPC Planning Report No. 26, A Comprehensive Plan for the Menomonee River Watershed, Volume 1, Inventory Findings, Volume 2, Alternative Plans and Recommended Plan, October 1976.

Leaking Underground Storage Tanks: Leaking underground storage tanks in the Menomonee 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 (WPDES) to discharge remediation wastewater to surface or ground water. Discharges from these sites are required to meet specified water quality discharge standards set forth by the Wisconsin Department of Natural Resources.

As of 1990, there were five known, permitted leaking underground storage tank sites that were discharging remediation waters to surface waters, as indicated in Table VII-9 and shown on Map VII-4. As of 1993, there were 11 additional leaking underground storage tanks in the Menomonee River watershed whose remediation wastewaters were permitted to discharge to surface or ground waters, as shown in Table VII-9.

As of 1993, there were 526 additional leaking underground storage tanks in the Menomonee River watershed identified by the DNR that were not discharging remediation wastewater directly to surface or ground waters. While there is no specific evidence to document the impact of these individual point sources on water quality within the watershed, it can be reasonably assumed that the cumulative effect of multiple leaking underground storage tanks may have detrimental effects on water quality.

Additional Groundwater Contamination Sites: Additional groundwater contamination sites which are undergoing remediation may also be permitted under the WPDES program to discharge remediation wastewater to surface or ground waters. As of 1990, there was one permitted site discharging to surface water. As of 1993, there was one additional such site known to be discharging to surface water in the Menomonee River watershed, as indicated in Table VII-9.

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 Menomonee River watershed, the adopted plan generally recommended nonpoint source controls for both rural and urban lands designed to reduce the pollutant loadings from nonpoint sources by 25 percent, in addition to construction erosion control, septic system management, and streambank erosion control. No nonpoint source controls were recommended in the portion of the watershed 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.

In 1976, the Commission prepared a comprehensive watershed plan[5] for the Menomonee River 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.

Implementation of the recommended nonpoint source control practices has been achieved on a limited basis in the Menomonee River watershed through local regulation and programs. In the area of construction site erosion control measures, significant progress has been made. As of January 1993, Waukesha County; the Cities of Brookfield, Mequon, Milwaukee, and New Berlin; and the Villages of Germantown, Elm Grove, Menomonee Falls, and West Milwaukee had adopted construction erosion control ordinances based upon the model ordinance developed cooperatively by the Wisconsin Department of Natural Resources and the League of Wisconsin Municipalities. In addition, Washington County and the Village of Butler had ordinances which pre-dated the model.

While new development is largely being served by sanitary sewer, the existing unsewered development within the watershed is regulated by onsite sewage disposal system programs administered by the City of Mequon and the Villages of Germantown and Menomonee Falls. 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. Since the completion of the adopted regional water quality management plan, public sewer systems have been installed for the urban development within portions of the Village of Menomonee Falls and Germantown, as recommended in the regional plan, thereby reducing onsite system pollutant discharges to the surface water and groundwater systems in the watershed.

With regard to rural nonpoint source control implementation actions, programs such as the Conservation Reserve Program administered by the U.S. Department of Agriculture, Soil Conservation Service, and wetland restoration programs administered by the Wisconsin Department of Natural Resources and others are utilized primarily for cropland soil erosion control and wildlife habitat purposes and will have positive water quality impacts. Chapter ATCP 50 of the Wisconsin Administrative Code requires that soil erosion on all croplands be reduced to tolerable levels by the year 2000. Tolerable levels are defined as soil loss tolerances, or T-values, which are the maximum 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.

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[5]See SEWRPC Planning Report No. 26, A Comprehensive Plan for the Menomonee River Watershed, Volume One: Inventory Findings and Forecast, Volume Two: Alternative Plans and Recommended Plan.

The Commission has prepared agricultural soil erosion control plans for Washington, Ozaukee, and Waukesha Counties. Thus, all of the rural areas in the Menomonee River watershed have been addressed through such planning. 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 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. The Menomonee River watershed was designated a "priority watershed" in 1984. Planning for the Menomonee River priority watershed project[6] was completed in 1991, and implementation of practices began in October 1991 and will continue for eight years.

The Menomonee River priority watershed program established nonpoint source pollutant control reduction goals of 50 percent for sediment and 50 to 70 percent for phosphorus for the subareas considered. Additional goals of 50 percent for heavy metal nonpoint source pollutant loadings were also established. These loading reductions were based primarily upon field inventories of the streams in the Menomonee 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. 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. Certain components of the plan

[6]Wisconsin Department of Natural Resources, Publication No. WR-300-92, A Nonpoint Source Control Plan for the Menomonee River Priority Watershed Project, March 1992.

recommendations for the urban and urbanizing areas, such as construction erosion control, are expected to be readily implemented. However, other components of the recommended plan, such as retrofitting urban land management practices in developed areas are costly and full implementation will be difficult. The plan also recommends that further detailed stormwater management planning and assessments be carried out as part of the subsequent plan implementation actions in order to refine the recommendations.

To achieve these objectives, the Menomonee River priority watershed program includes recommendations and funding eligibility for the rural and urban nonpoint source control measures presented below.

Rural Land Management:

- Provision of streambank erosion control practices for about 1,200 feet of eroding streambank.
- Development of detailed conservation plans to develop best management practices for about 5,300 acres of cropland.
- Installation of management practices for six barnyards.
- Installation of facilities and management practices for ten livestock operations in the watershed.
- Obtaining easements along streams in selected areas.

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 fertilizers. 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 site erosion control ordinances and implementation actions for control of about 7,000 acres of new urban development which is expected in the watershed during the planning period.
- Provision of nonpoint source control practices on about 32,000 acres of existing urban land and about 7,400 acres of new urban land are 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.
- Provision of erosion control measures for about 7,300 lineal feet of streambank.

- Preparation of detailed stormwater management plans to determine the best practices to be installed in the urban areas. These plans address water quantity and water quality problems in developed and developing urban 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 that would provide at least a 25 percent reduction in nonpoint source loadings be carried out throughout the Menomonee River watershed. It is further recommended that rural land management measures needed to achieve the levels of control set forth in the Menomonee River priority watershed study for sediment control from rural areas be carried out. It is also recommended that the urban land management practices set forth in the Menomonee River priority watershed plan be utilized as the initial basis for stormwater management planning and project eligibility under the State priority watershed program. These levels of reduction in the urban areas 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 refine 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

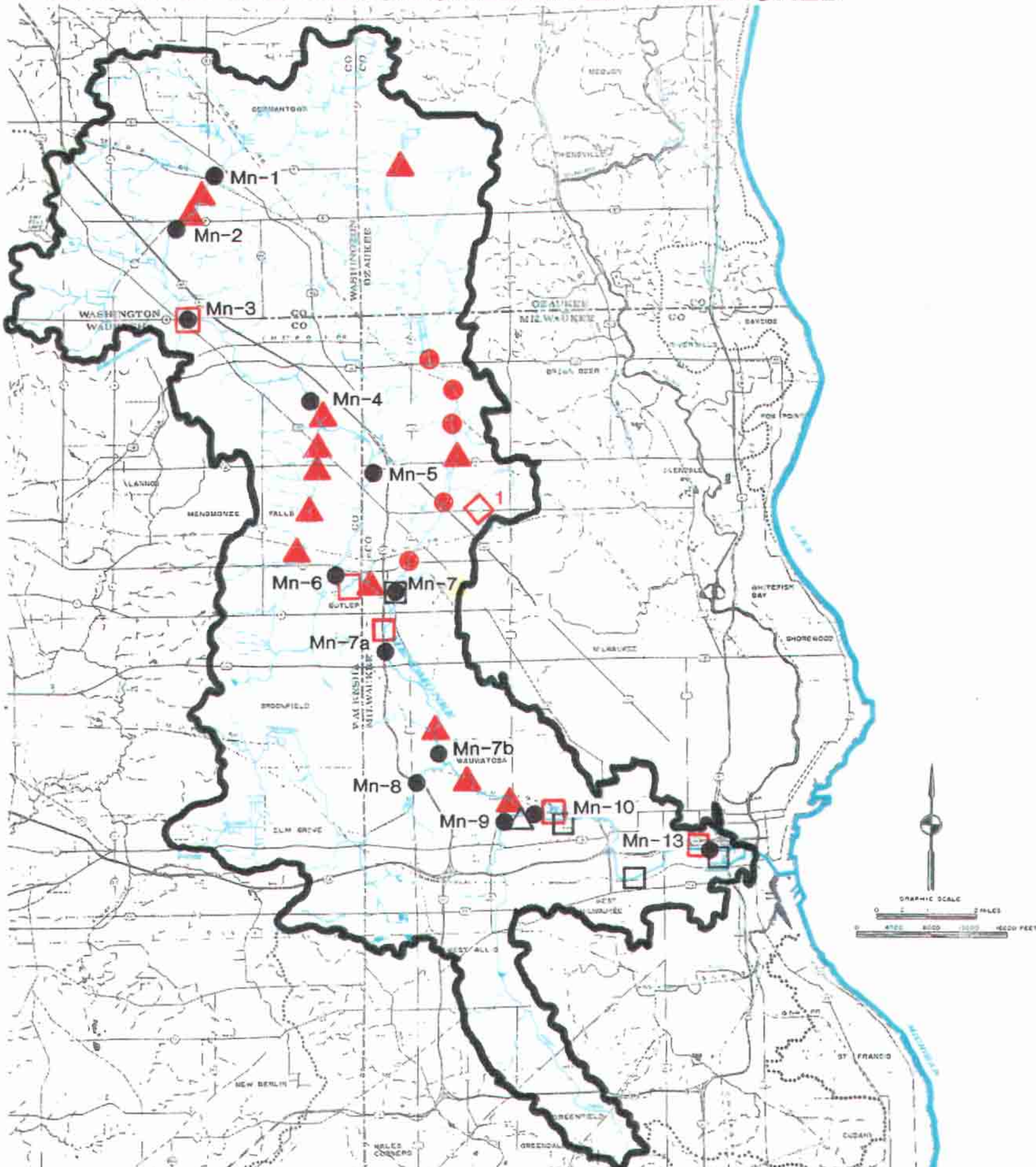
Existing Conditions and Status of Implementation

While substantial progress has been made in the regional water quality management plan elements described in the previous 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 Menomonee River watershed on a sustained basis by the Milwaukee Metropolitan Sewerage District for eight stations located on the Menomonee River main stem. Data from five of these stations were used to document current long-term water quality conditions in the watershed, as shown on Map VII-5. Short-term monitoring has also been conducted at one site by the Wisconsin Department of Natural Resources and at one site by the U.S. Geological Survey during the period 1988 through 1993, as described later in this chapter.

Current Plan Recommendations

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 Milwaukee Metropolitan Sewerage District for all current stations on the Menomonee River on a continuing long-term basis. In addition, it is recommended an intensive water quality and biological condition monitoring program be conducted over a one-year period at five selected additional stations, with one station each located on Little Menomonee River, Little Menomonee Creek, Butler Ditch, Underwood Creek, and Honey Creek. This monitoring program would

Map VII-5
LOCATIONS OF WATER QUALITY SAMPLING STATIONS IN THE MENOMONEE RIVER WATERSHED



LEGEND

Sampling station used in preparation of initial plan

- ● SEWRPC
- △ USGS
- □ MMSD

Post-1976 sampling stations used in preparation of plan update

- ◇ USGS-Short Term
- □ MMSD-Long Term
- ● DNR-Sediment Samples
- ▲ USGS-Sediment Samples

Source: SEWRPC.

also include biological monitoring at stations on the Menomonee River main stem at locations currently being sampled by the Milwaukee Metropolitan Sewerage District. It is recommended that this program be conducted within the next five to seven years and repeated at approximately five- to seven-year intervals. These recommendations can be coordinated with, and are consistent with, the Wisconsin Department of Natural Resources current surface water monitoring strategy developed to conduct monitoring activities and perform basic assessments for each watershed in the Region in an approximate five- to seven-year rotating cycle.

LAKES MANAGEMENT PLAN ELEMENT

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

As noted above, there are no major lakes in the Menomonee 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 1964 through 1974 U.S. Geological Survey (USGS) and Milwaukee Metropolitan Sewerage District (MMSD) sampling programs. Available data collected in those programs for the Menomonee River watershed included samplings at 14 Commission stations: 11 on the main stem of the Menomonee River, one on Underwood Creek, one on Honey Creek, and one on the Little Menomonee River; and at one USGS station and four MMSD sampling stations, all on the main stem of the Menomonee River. The sampling station locations are shown on Map VII-5.

Long-term 1976 comparable water quality data have been collected by the Milwaukee Metropolitan Sewerage District for eight stations on the Menomonee River. Water resource appraisal information including biological condition and water quality data collected by the Wisconsin Department of Natural Resources (DNR) for the Menomonee River Nonpoint Source Priority Watershed Project were also available for use in the assessment of current water quality conditions. Water quality data has also been collected on a short-term basis at two locations in the Menomonee

River watershed. Data collected at one short-term site, along with long-term data from five MMSD stations, are shown on Map VII-5. These data 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 area-wide 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 Menomonee River watershed.

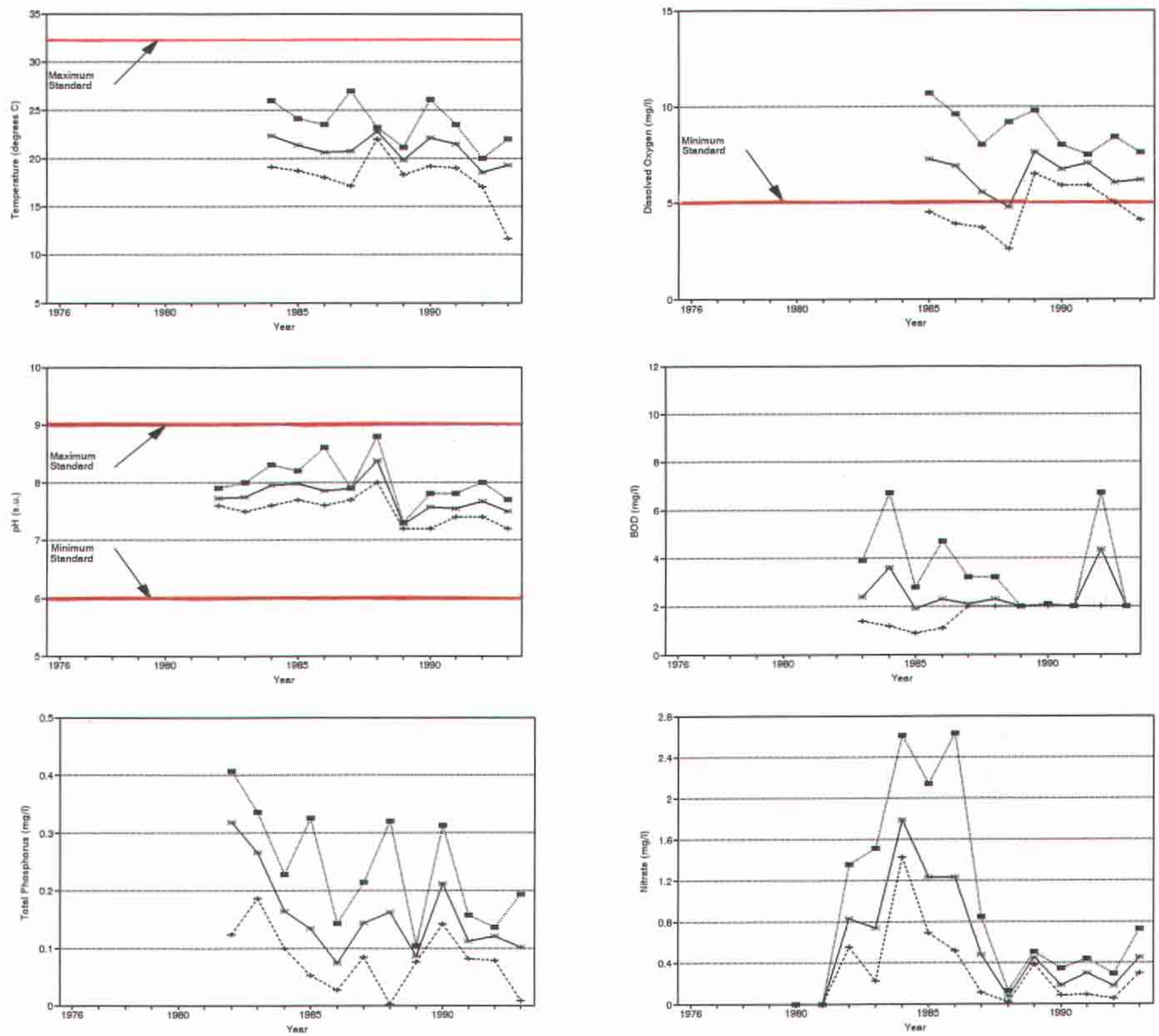
Long-term water quality data collected by the MMSD at five sampling stations on the main stem of the Menomonee River--Mn-3, at County Line Road; Mn-6, at 127th Street; Mn-7a, at Hampton Avenue; Mn-10, at N. 70th Street; and Mn-13, at Muskego Avenue--are summarized in Figures VII-1 through VII-5. The short-term data collected by the USGS in 1990 are summarized in Figure VII-1 through VII-6 and in Table VII-10. The water quality standards indicated in Figures VII-1 through VII-6 and in Table VII-10 are those set forth for specific biological and recreational use objectives as described in Chapter II. The relations of these objectives and standards to current DNR stream classifications and water quality criteria is discussed in detail in Chapter II.

Review of those data indicate general decreases in levels of chlorophyll-a for all five stations. Both stations Mn-3 and Mn-6 indicate decreases in phosphorus, un-ionized ammonia nitrogen, nitrate nitrogen, and chlorides. In addition, the variability of most of the measured constituents at these two stations was reduced. These improvements are likely due at least in part to the abandonment of the three public sewage treatment plants operated by the Villages of Menomonee Falls and Germantown and to the reduction in the bypassing of sewage through flow relief devices. Levels of dissolved oxygen, un-ionized ammonia nitrogen, and fecal coliform remained variable at all stations, with occasional violations of the dissolved oxygen and un-ionized ammonia nitrogen water quality standards, and frequent violations of the fecal coliform water quality standards associated with the water use objectives for the Menomonee River main stem set forth in Chapter II. Temperature and pH levels remained variable with no apparent trends, but were generally within acceptable limits at all stations. As noted in the subsequent section, the levels of most metals exceeded chronic toxicity standards at all stations.

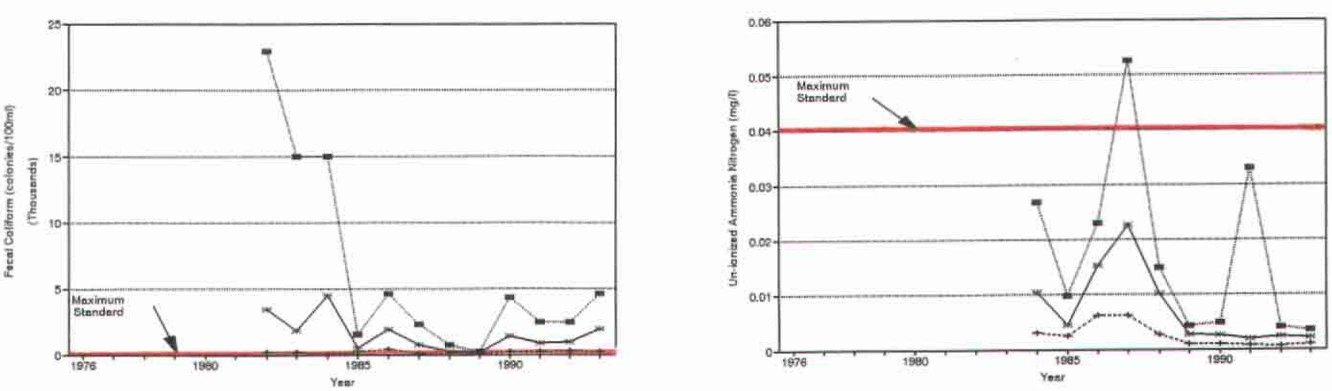
Toxic and Hazardous Substances

Sampling and analysis for pesticides, polychlorinated biphenyls (PCBs), and heavy metals were conducted by the Commission and the Wisconsin Department of Natural Resources at three sampling stations in the Menomonee River from 1973 through 1974. Specifically, 21 of 105, or 20 percent, of the samples collected violated the recommended criteria for lead. Sample analyses for cadmium, cobalt, copper, mercury, nickel, and zinc uncovered no violations of U.S. Environmental Protection Agency (EPA) recommended levels.

Figure VII-1
WATER QUALITY DATA FOR THE MENOMONEE RIVER AT STATION Mn-3: 1976-1993

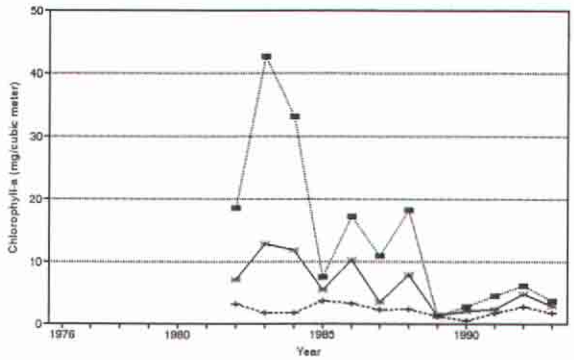


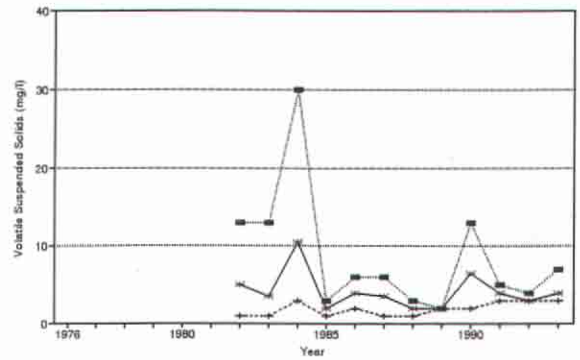
Note: No standard has been established for surface waters classified as limited recreational use.

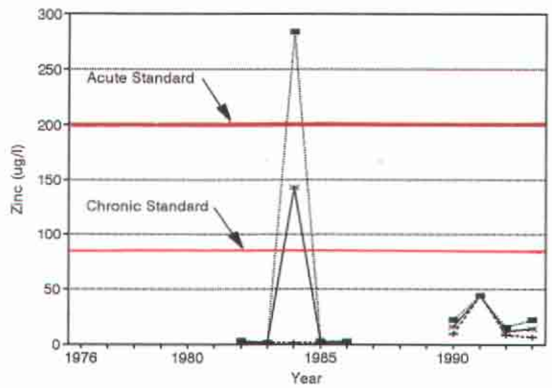


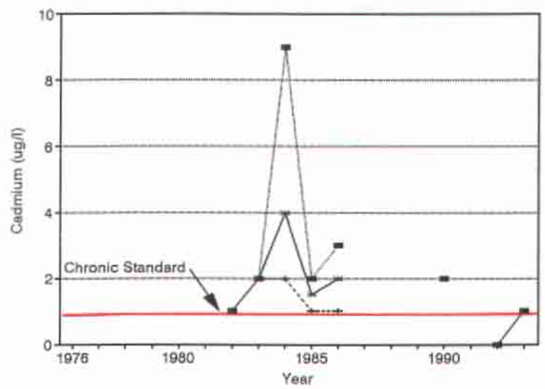
Note: The maximum standard of 1000/2000 colonies per 100 ml was violated in all years.

Figure VII-1 (cont'd)

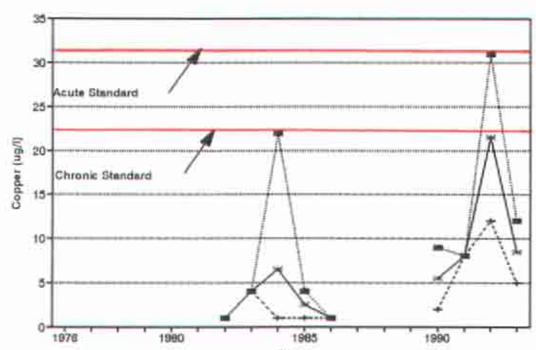


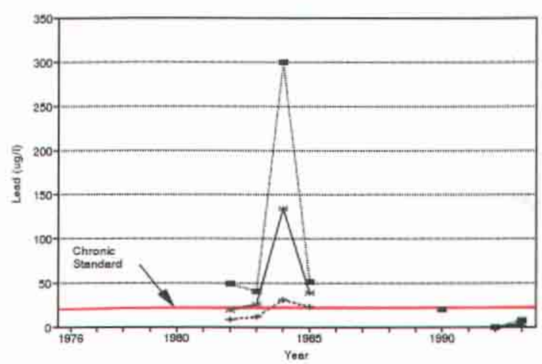




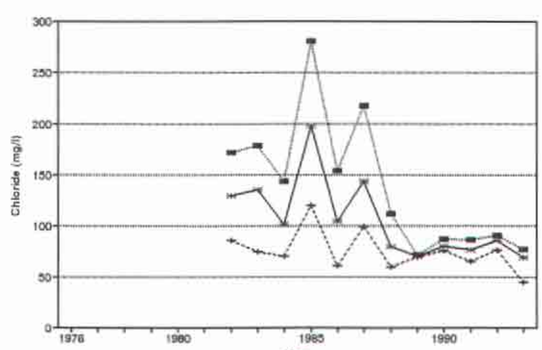


Note: The acute standard of 63.3 was not violated in any year.





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



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

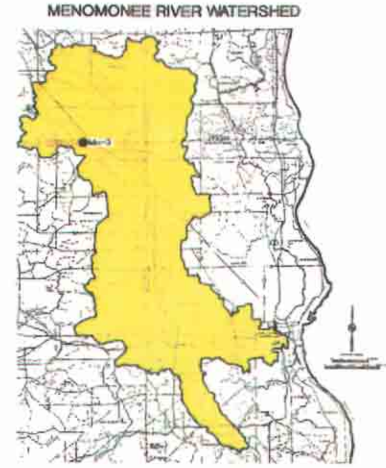
LEGEND

MAXIMUM VALUE

MINIMUM VALUE

AVERAGE VALUE

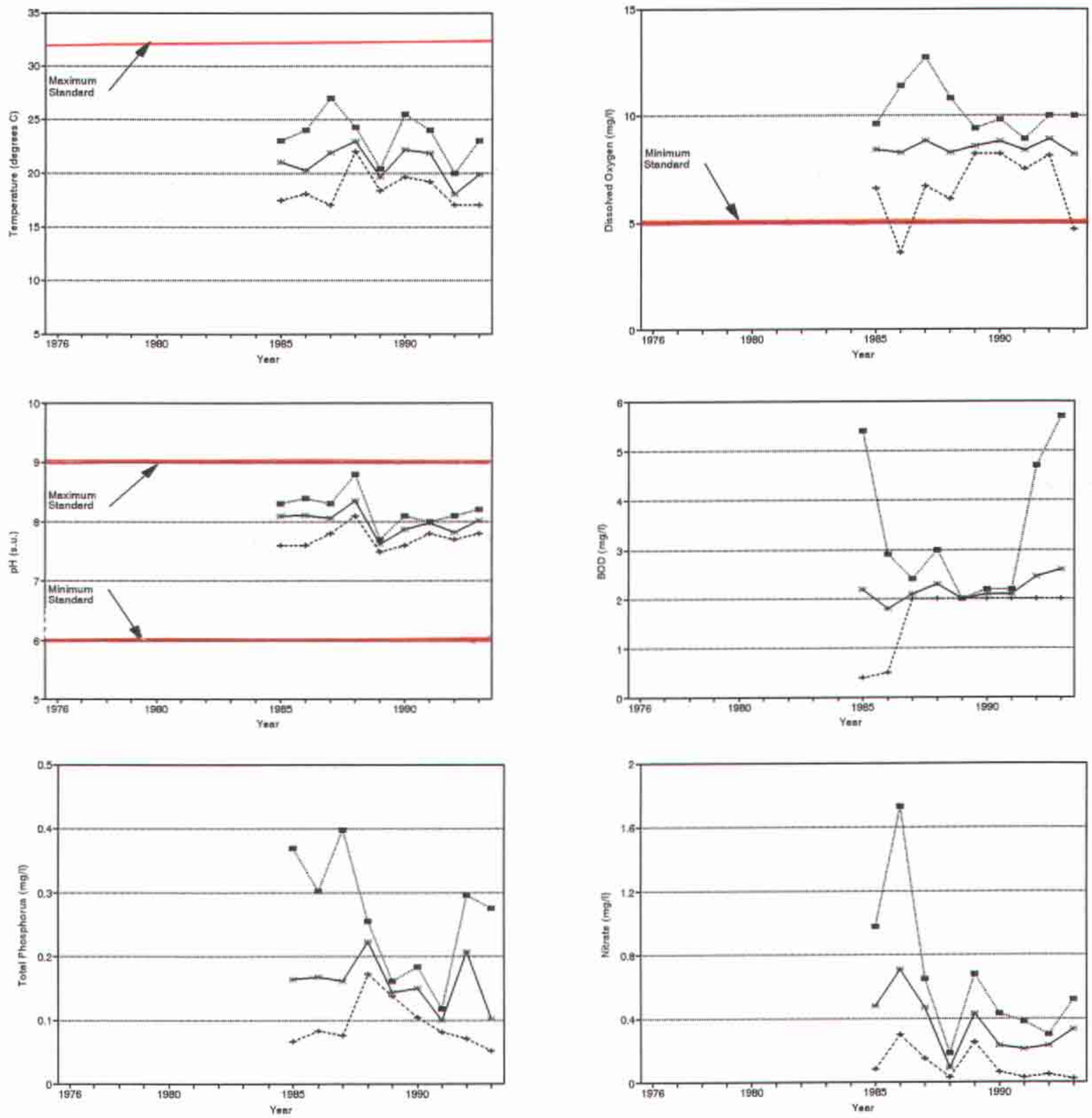
MENOMONEE RIVER WATERSHED



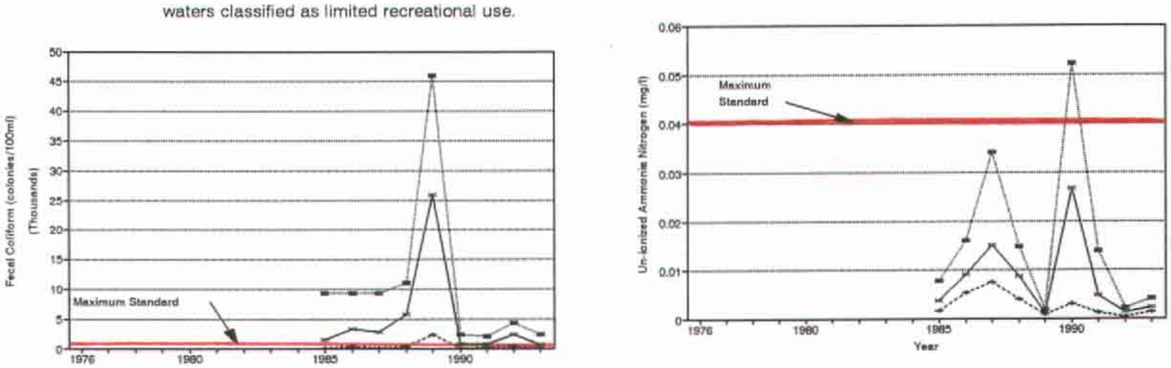
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and 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 VII-2
WATER QUALITY DATA FOR THE MENOMONEE RIVER AT STATION Mn-6: 1976-1993

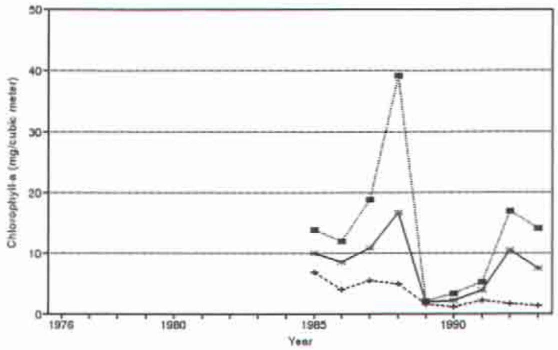


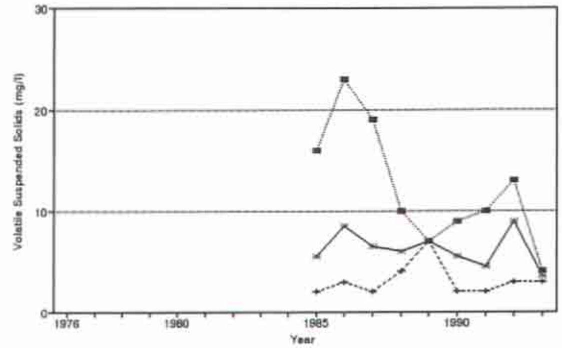
Note: No standard has been established for surface waters classified as limited recreational use.

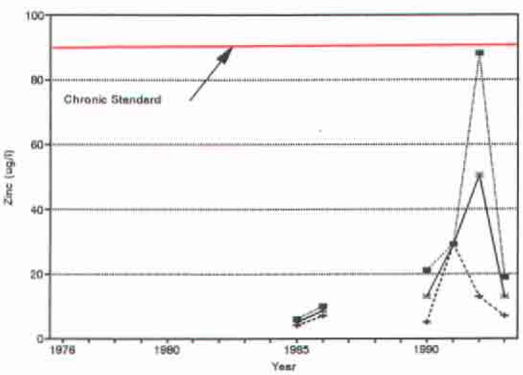


Note: The maximum standard of 1000/2000 colonies per 100 ml was violated in all years.

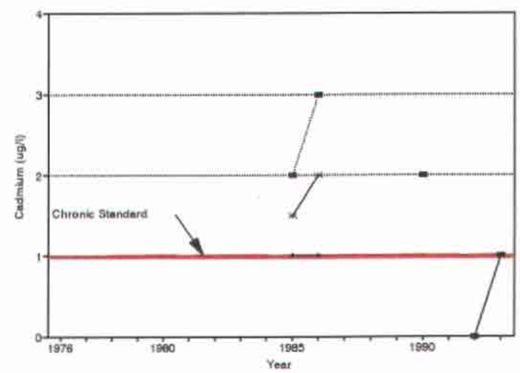
Figure VII-2 (cont'd)



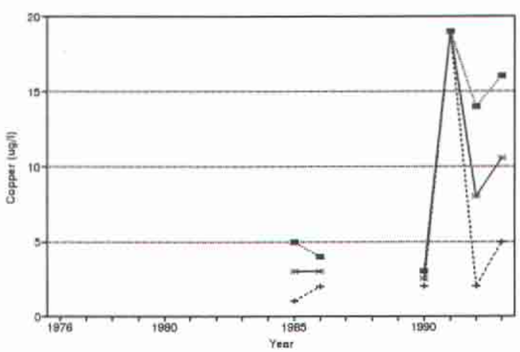




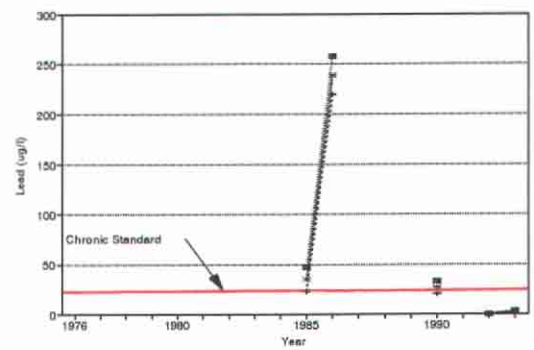
Note: The acute standard of 202.9 was not violated in any year.



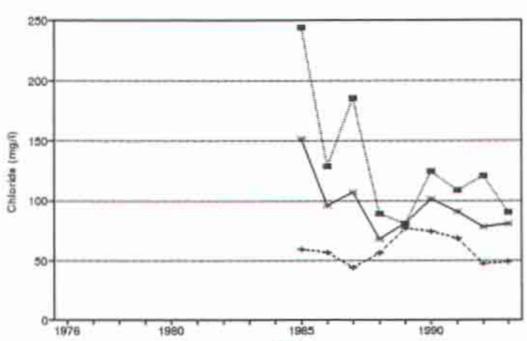
Note: The acute standard of 63.3 was not violated in any year.



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

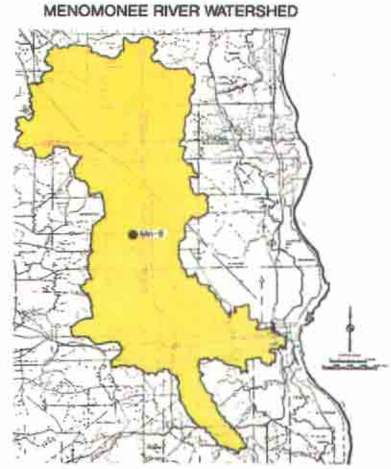


Note: The acute standard of 408.6 was not violated in any year.



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

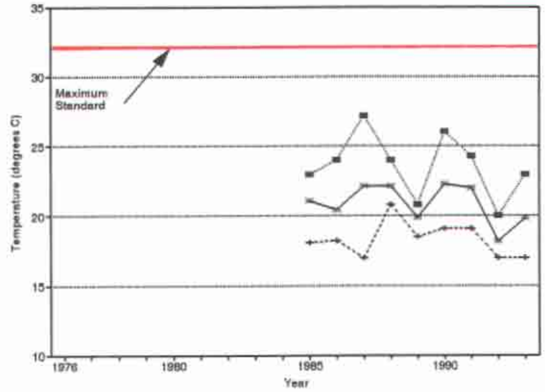
MENOMONEE RIVER WATERSHED

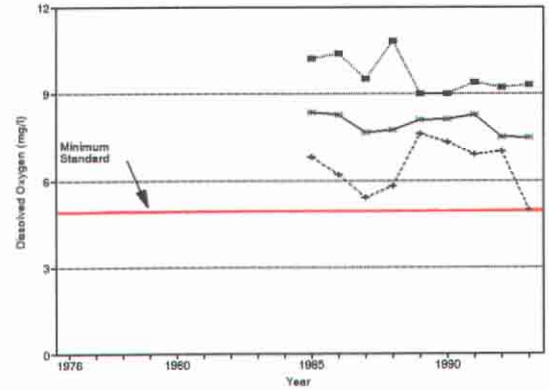


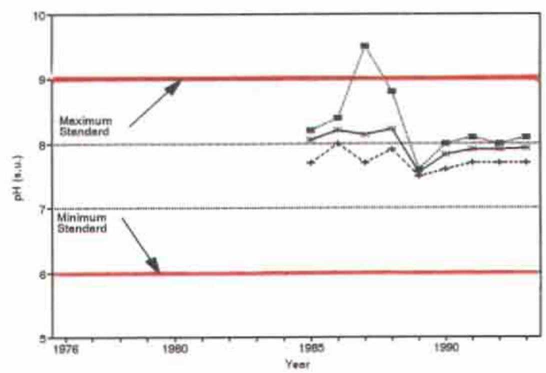
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

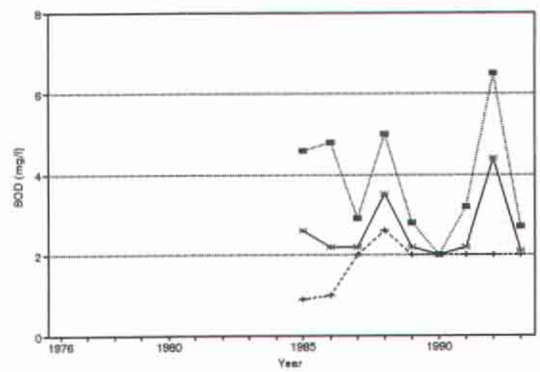
Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and limited recreational use objectives. See chapter II for relationships of these objectives and standards to current Wisconsin Department of Natural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

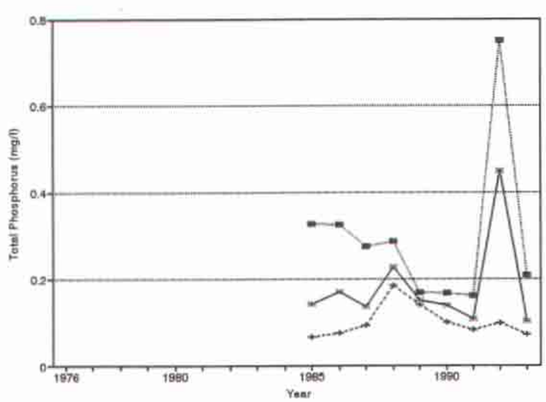
Figure VII-3
WATER QUALITY DATA FOR THE MENOMONEE RIVER AT STATION Mn-7a: 1976-1993



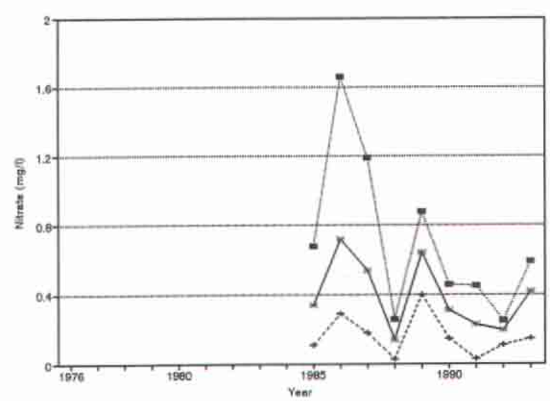


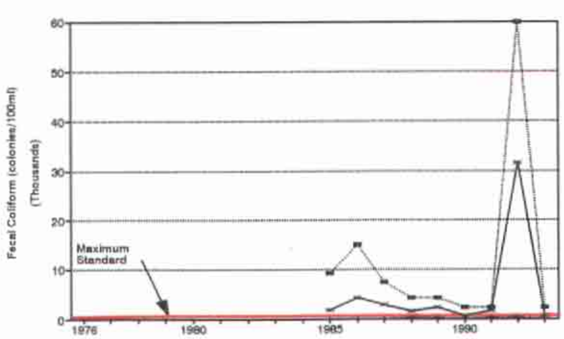




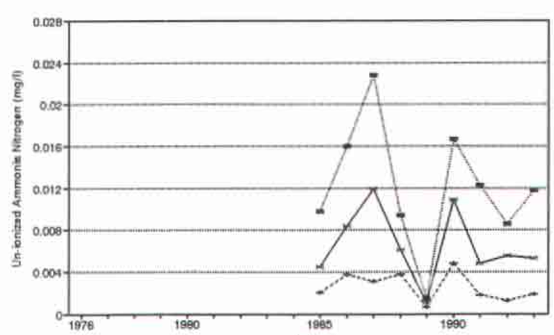


Note: No standard has been established for surface waters classified as limited recreational use.



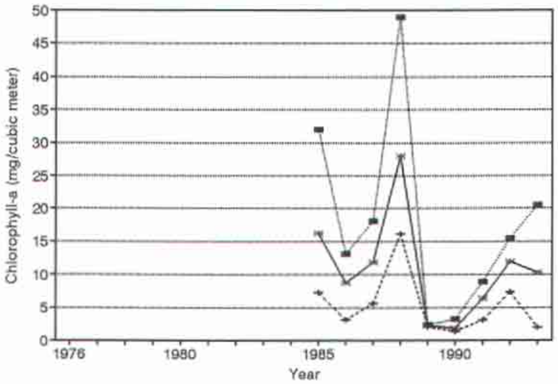


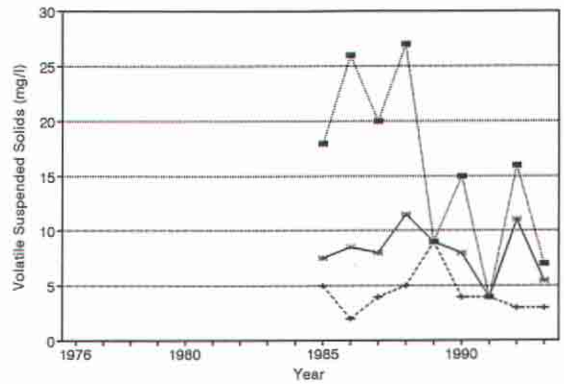
Note: The maximum standard of 1000/2000 colonies per 100 ml was violated in all years.

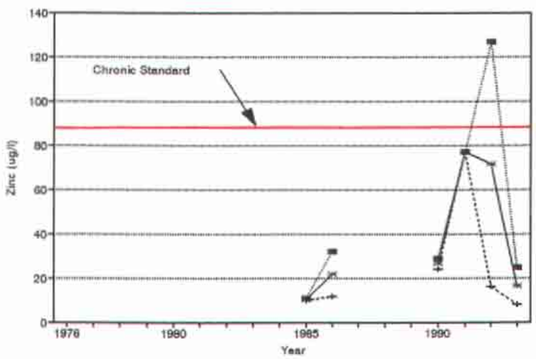


Note: The maximum standard of 0.04 mg/l was not violated in any year.

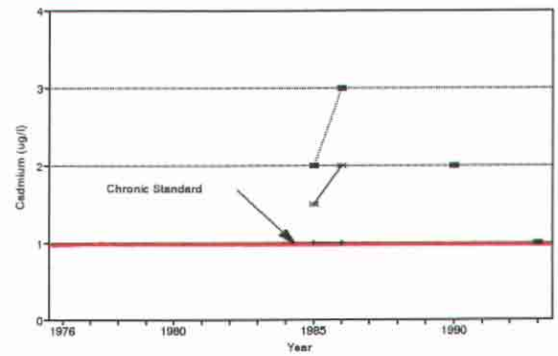
Figure VII-3 (cont'd)



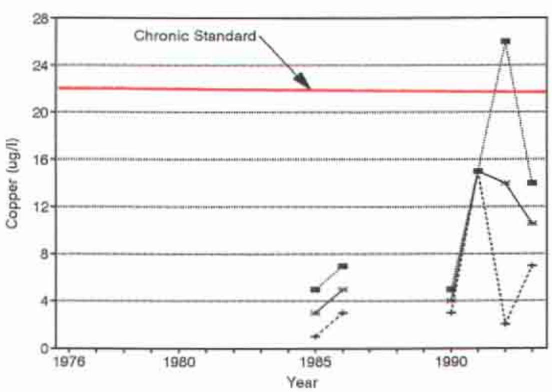




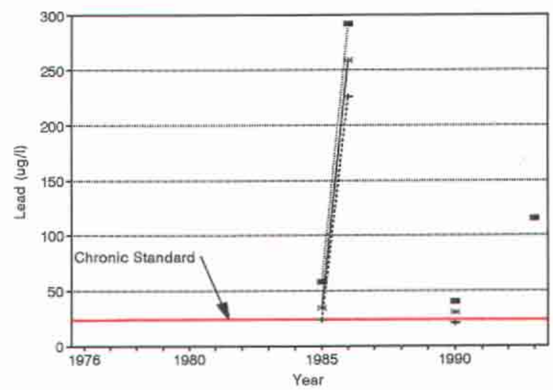
Note: The acute standard of 202.9 ug/l was not violated in any year.



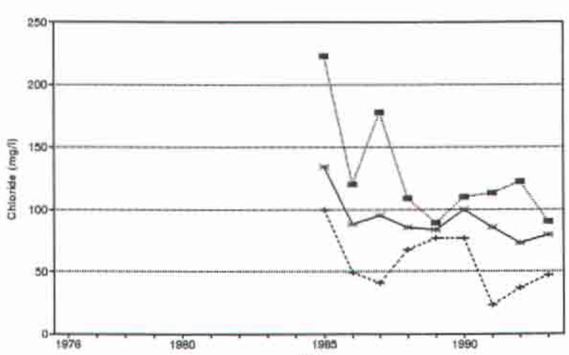
Note: The acute standard of 63.3 ug/l was not violated in any year.



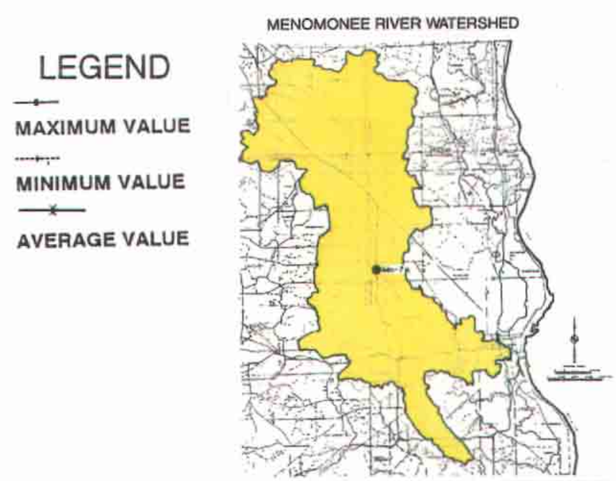
Note: The acute standard of 31.9 ug/l was not violated in any year.



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



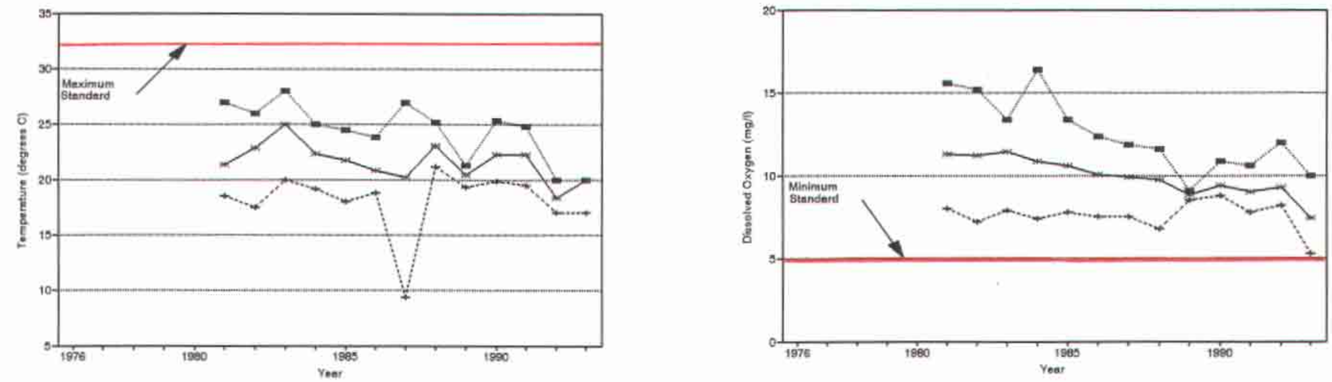
Note: The standard of 1000 mg/l was not violated in any year.

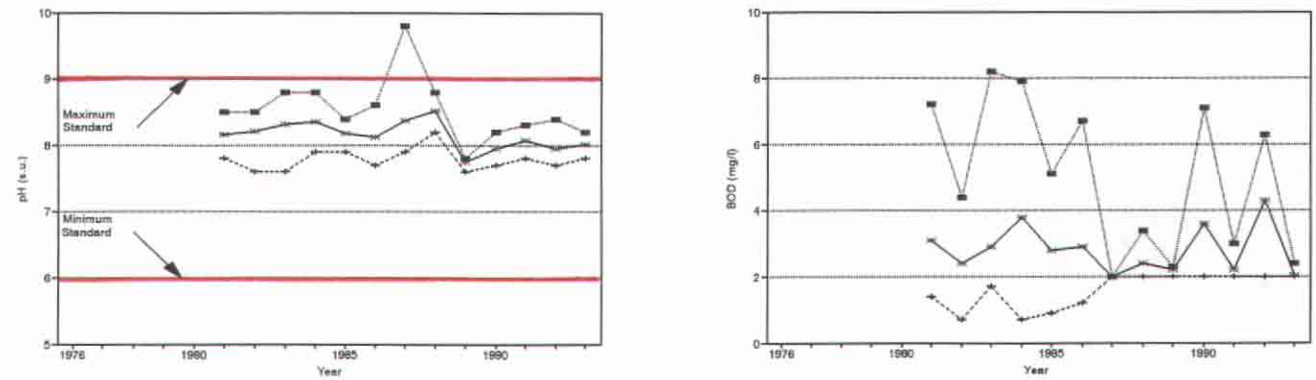


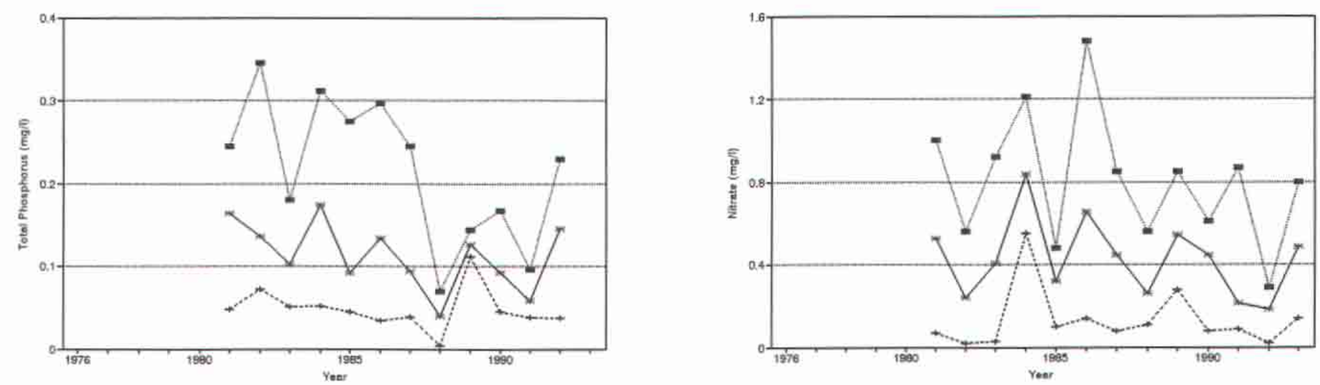
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

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

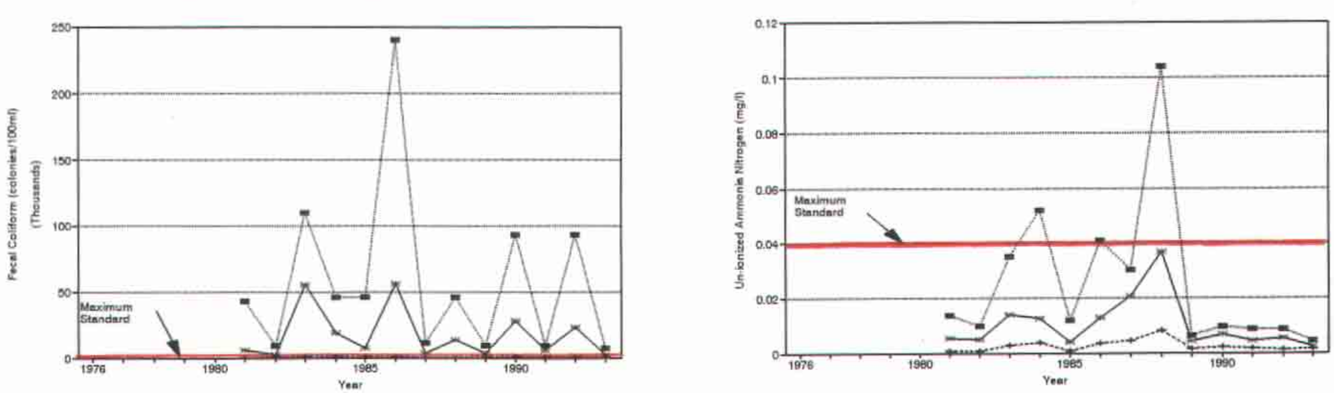
Figure VII-4
WATER QUALITY DATA FOR THE MENOMONEE RIVER AT STATION Mn-10: 1976-1993





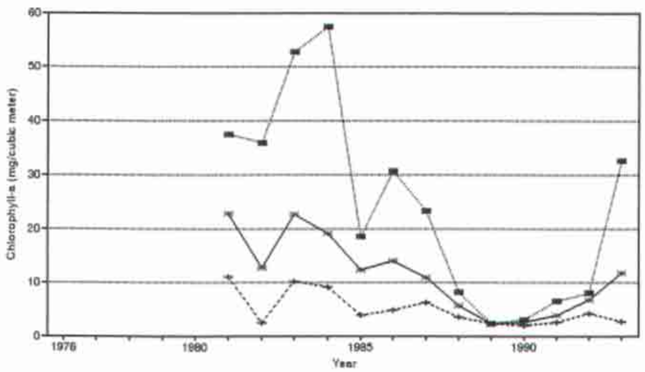


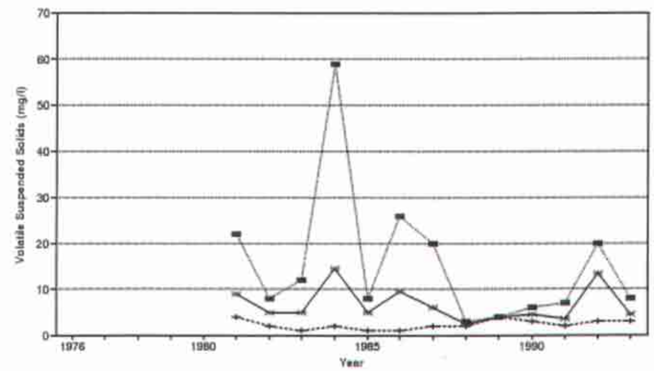
Note: No standard has been established for streams classified as limited recreational use.

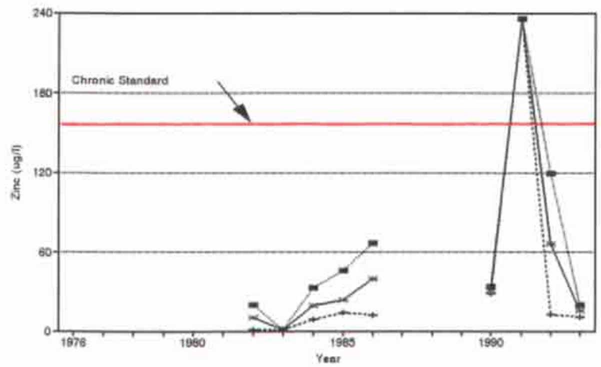


Note: The maximum standard of 1000/2000 colonies per 100 ml was violated in all years.

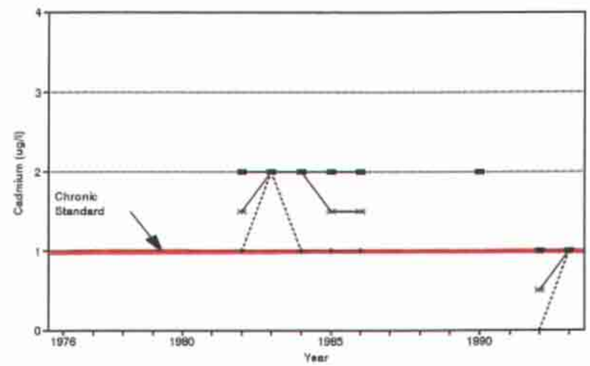
Figure VII-4 (cont'd)



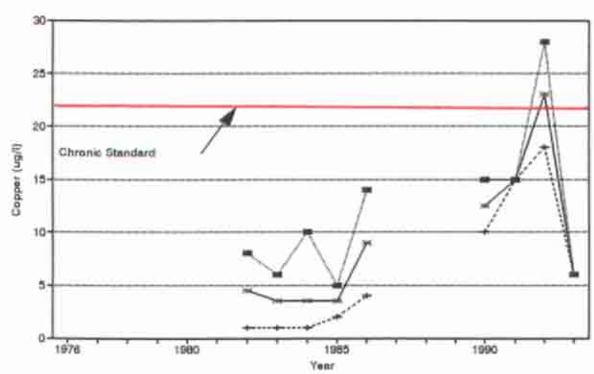




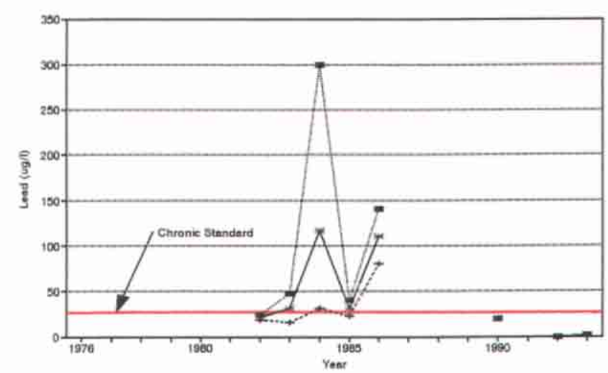
Note: The acute standard of 202.9 was not violated in any year.



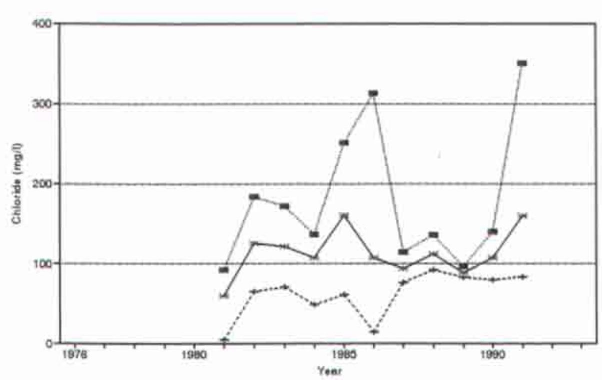
Note: The acute standard of 63.3 was not violated in any year.



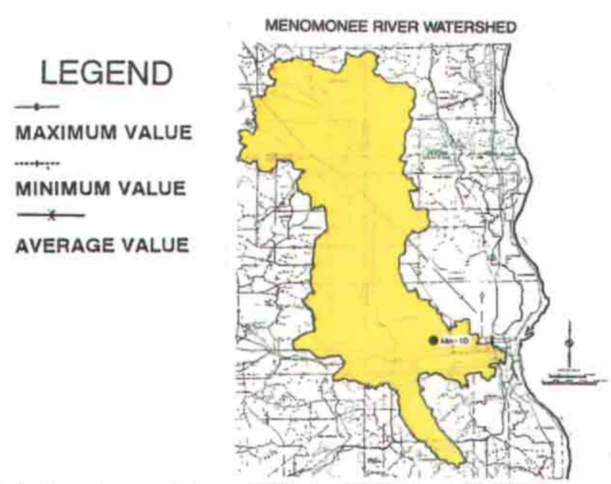
Note: The acute standard of 31.9 ug/l was not violated in any year.



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



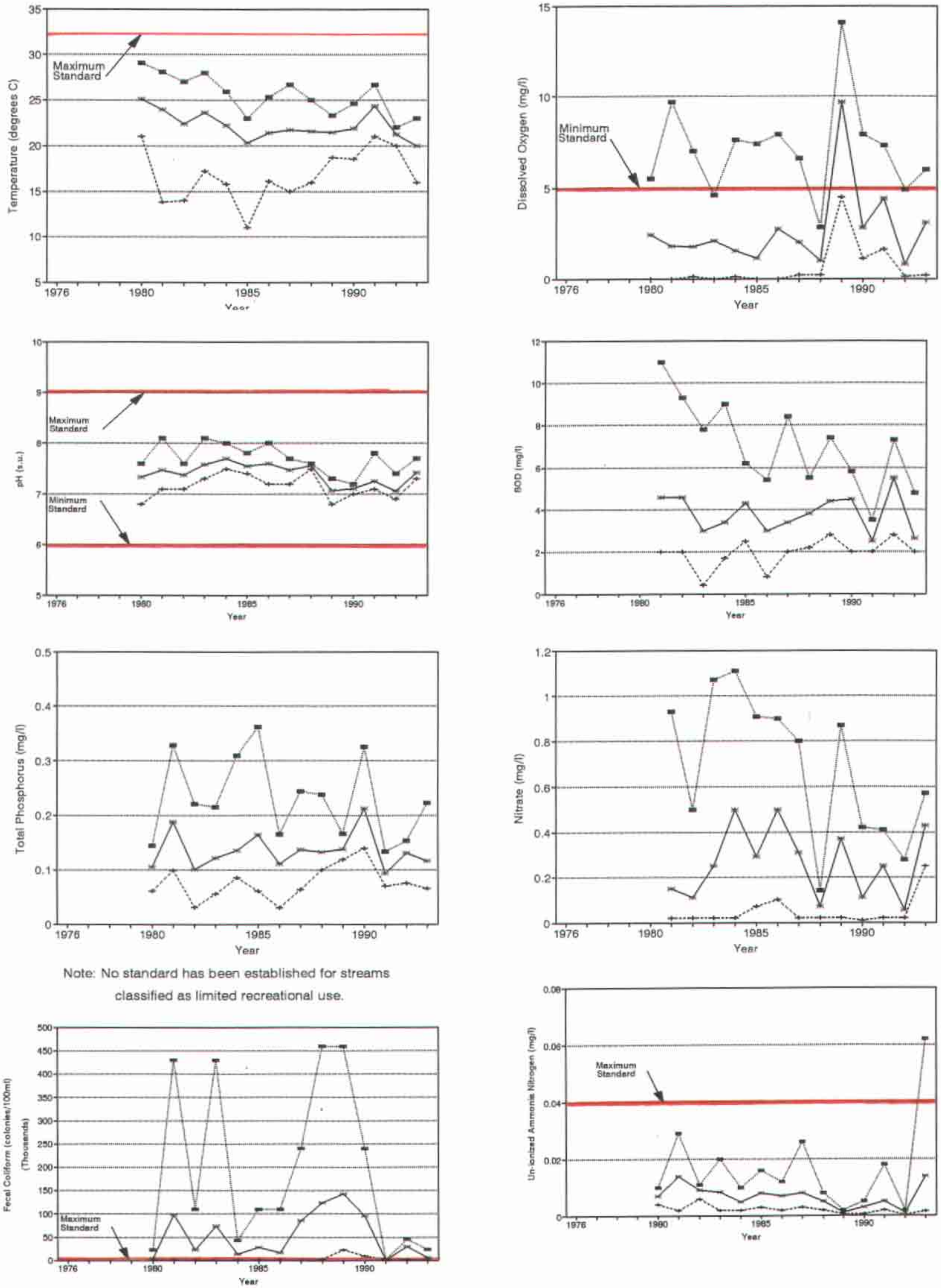
Note: The maximum standard of 1000 mg/l was not violated in any year.



Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

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

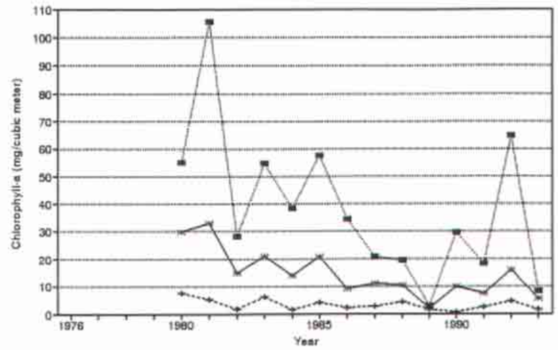
Figure VII-5
WATER QUALITY DATA FOR THE MENOMONEE RIVER AT STATION Mn-13: 1976-1993

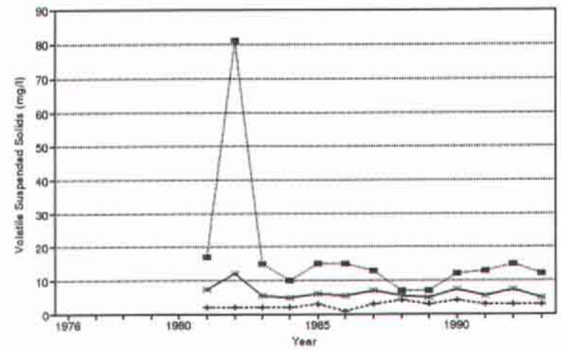


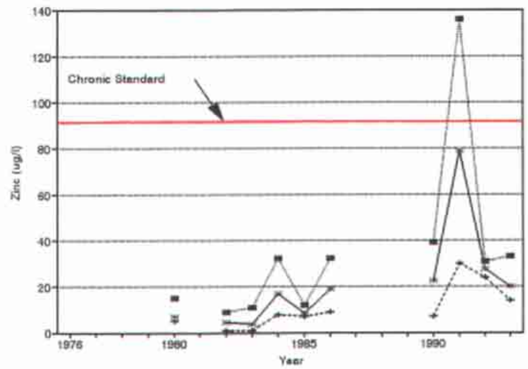
Note: No standard has been established for streams classified as limited recreational use.

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

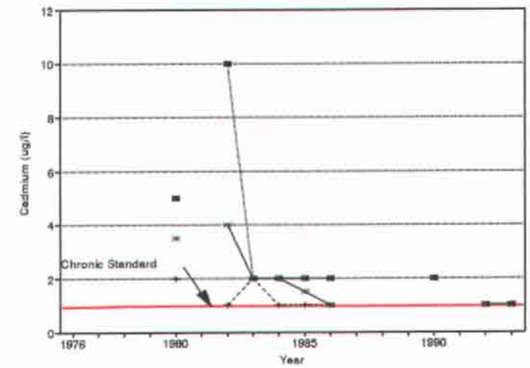
Figure VII-5 (Cont'd)



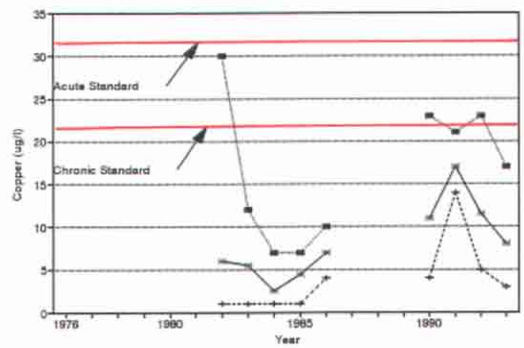


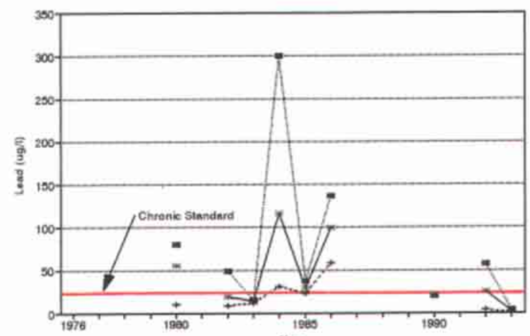


Note: The acute standard of 202.9 was not violated in any year.

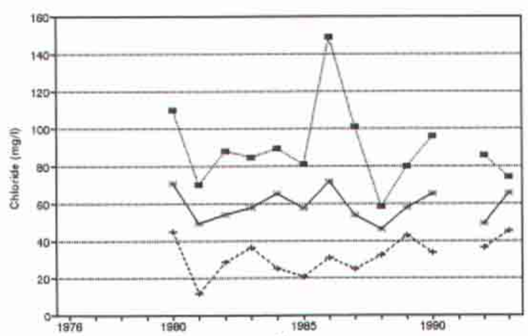


Note: The acute standard of 63.3 was not violated in any year.

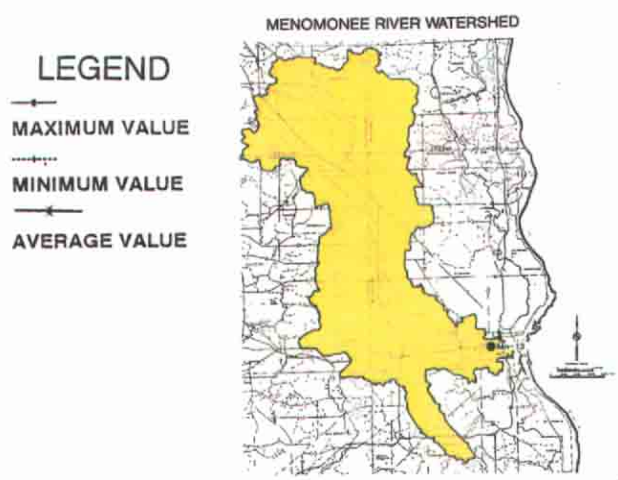




Note: The acute standard of 408.6 was not violated in any year.



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



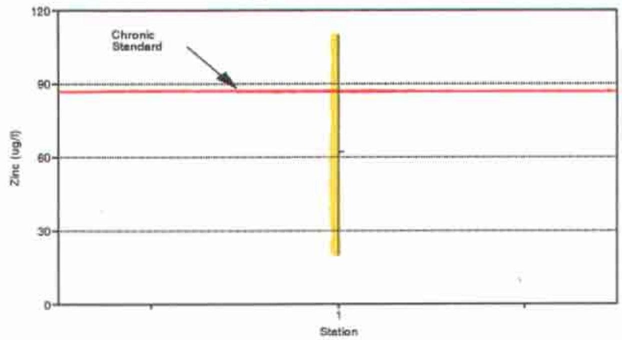
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

Note: Graphs indicate maximum, minimum, and average values for July and August data. Standards indicated are those established for warmwater sport fish and 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 VII-6

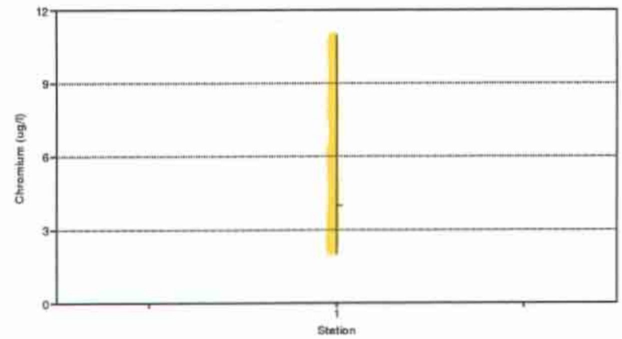
Menomonee River Watershed Short-Term Water Quality Sampling Data: 1990

Zinc

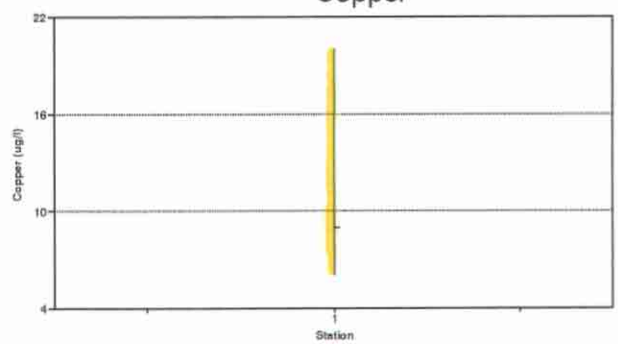


Note: The acute standard of 202.9 ug/l was not violated in any year.

Chromium



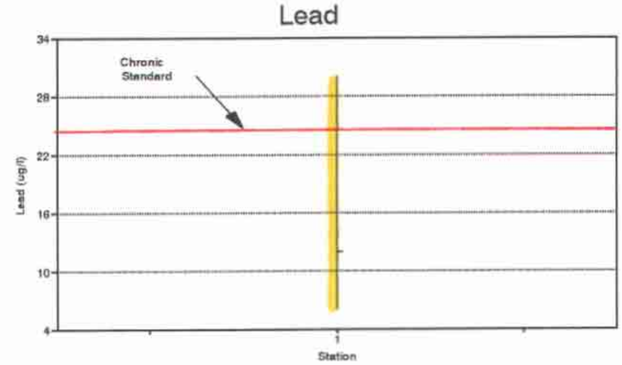
Copper



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

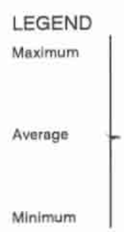
Note: The acute standard of 31.9 ug/l was not violated in any year.

Lead

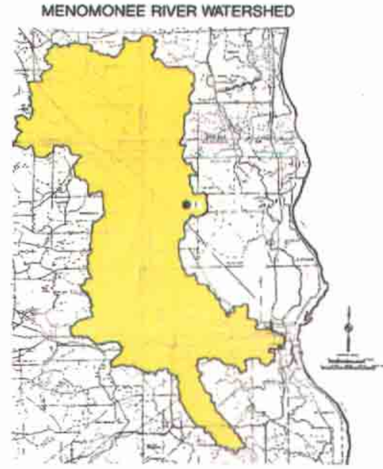


Note: The acute standard of 408.6 ug/l was not violated in any year.

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 VII-10 for summarized water quality data.



MENOMONEE RIVER WATERSHED



Source: U.S. Geological Survey and SEWRPC.

Table VII-10

MENOMONEE RIVER WATERSHED SHORT-TERM
STREAM WATER QUALITY SAMPLING DATA: 1990

Sampling Station Number	Parameter (Units)	Applicable Standards[a]	Range	Violation of Accepted Standard	Sampling Dates	Total Number of Samples
1	Zinc (ug/l)	Chronic maximum of 89.2; Acute maximum of 202.9	20 - 110	Yes No	May - June 1990	7
	Chromiumm (ug/l)	--	2 - 11	--	May - June 1990	7
	Copper (ug/l)	Chronic maximum of 22.1; Acute maximum of 31.9	6 - 20	No No	May - June 1990	7
	Lead (ug/l)	Chronic maximum of 24.4; Acute maximum of 408.6	6 - 30	Yes No	May - June 1990	7

[a] 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: U.S. Geological Survery, Wisconsin Department of Natural Resources and SEWRPC.

Recent data on metals substances in the Menomonee River were collected by the Milwaukee Metropolitan Sewerage District at stations Mn-3, Mn-6, Mn-7a, Mn-10, and Mn-13; and by the Wisconsin Department of Natural Resources at a station inthe Little Menomonee River, as shown in Figures VII-1 through VII-6. These data indicate that levels of zinc, cadmium, copper, and lead consistently violated chronic toxicity level standards as established by Department of Natural Resources for all stations on the Menomonee River main stem, with the exception of zinc and copper levels at station Mn-6, which remained within the acceptable limits. Short-term data collected in a tributary to the Little Menomonee River in 1990 indicated that levels of zinc and lead violated the chronic toxicity level standards.

Post-1976 data on toxic and hazardous substances present in stream sediments were collected in the Menomonee River portion of the Milwaukee Harbor estuary as part of the Milwaukee Harbor estuary study[7] and the remedial action plan for the Milwaukee Harbor estuary,[8] reported sediments contaminated with organics and metals. Sediment concentrations of ammonia, lead, zinc, and cadmium exceeded the proposed DNR Severe Effect Level (SEL) guidelines[9] at most sites sampled; copper concentrations exceeded the Lowest Effect Level guidelines. Further studies of sediment chemistry have been reported by Palmer,[10] and Ni, Gin, and Christensen.[11] In these studies, total PCB concentrations in the sediments of the Lower Menomonee River exceeded the Lowest Effect Level (LEL) guidelines proposed by the Department of Natural Resources at both stations, with extremely high values being reported from the two additional Menomonee Canal stations. Similarly, PAH concentrations exceeded the LEL guidelines, with the most severe contamination being reported from the Lower Menomonee River.

Additional data collection by the U.S. Geological Survey and the Wisconsin Department of Natural Resources between 1989 and 1992, and set forth in Table VII-11, show that the proposed screening criteria were exceeded at most sites. The LEL criteria were exceeded at all 18 sampling sites on the Menomonee River main stem, Little Menomonee River, and Lilly Creek. Severe Effect Level guidelines for selected heavy metals were exceeded at Hoyt Park--copper and lead--and

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

[8]Wisconsin Department of Natural Resources, Remedial Action Plan, Milwaukee Harbor Estuary, 1991.

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

[10]Lauran Palmer, Evaluation of Polychlorinated Biphenyls and Polycyclic Aromatic Hydrocarbons in the Menomonee River, Canals, and Milwaukee Harbor, UW-SP Report, August 1993.

[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.

Table VII-11

CONCENTRATIONS OF TOXIC AND HAZARDOUS SUBSTANCES FOUND IN SEDIMENT SAMPLES
IN THE MENOMONEE RIVER WATERSHED: 1989-1992

	Sampling Stations																		
	Menomonee River Main Stem							Little Menomonee River								Lilly Creek			
Substances Sampled	CTH F	Germantown	Mount Mary College	Lilly Road	C&NW Railway	Hoyt Park	Wauwa-tosa	Friestadt Road	Brown Road	C&NW Railway	Calumet Road	Good Hope Road	Good Hope Road	Mill Road	STH 100	Mill Road	Silver Spring Road	Nicolet Avenue	Mouth
Heavy Metals (mg/kg)												1989	1992						
Arsenic	5.0	1.0	6.0	3.0	4.0	6.0	7.0	38.0	2.9	5.8	4.5	7.0	4.0	5.5	3.5	10.0	2.0	12.0	5.0
Cadmium	2.0	2.0	3.0	1.0	2.0	4.0	5.0	1.0	1.0	7.0	1.0	1.0	1.0	1.0	1.0	2.0	1.0	1.0	2.0
Chromium	30.0	40.0	30.0	30.0	30.0	70.0	70.0	20.0	--	--	--	--	20.0	--	--	30.0	20.0	20.0	20.0
Copper	33.0	48.0	49.0	41.0	50.0	140.0	130.0	29.0	--	--	--	--	2.0	--	--	41.0	40.0	23.0	26.0
Lead	30.0	40.0	80.0	90.0	60.0	260.0	40.0	20.0	95.0	56.0	29.0	37.0	10.0	22.0	69.0	50.0	30.0	20.0	50.0
Mercury	0.06	0.2	0.4	0.2	0.08	0.2	0.2	0.06	--	--	--	--	0.2	--	--	0.04	0.04	0.04	0.06
Nickel	20.0	30.0	20.0	20.0	30.0	40.0	40.0	20.0	--	--	--	--	10.0	--	--	20.0	30.0	20.0	20.0
Zinc	140.0	140.0	280.0	260.0	250.0	540.0	850.0	93.0	190.0	2,100.0	220.0	160.0	93.0	100.0	180.0	190.0	130.0	77.0	120.0
Total Polycyclic Aromatic Hydrocarbons (mg/kg)	0.0	0.0	21.7	50.6	48.1	114.5	42.5	0.3	46.7	61.8	119.4	10.5	2,262.9	118.5	35.2	25.1	5.4	0.0	36.6
Total Polychlorinated Biphenyls (μg/kg)	10.0	10.0	--	20.0	10.0	--	--	10.0	--	--	--	--	--	--	--	--	10.0	10.0	10.0
Aldrin	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	--	--	--	1.0	--	--	--	1.0	1.0	1.0	1.0
Chlordane	10.0	10.0	20.0	--	10.0	20.0	20.0	10.0	--	--	--	--	--	--	--	10.0	10.0	20.0	10.0
Total DDT	3.0	1.0	18.0	7.0	10.0	17.0	--	1.0	--	--	--	--	--	--	--	1.0	1.0	4.0	6.0
op+pp DDT	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pp DDD	7.0	1.0	34.0	12.0	30.0	30.0	13.0	6.0	--	--	--	21.0	--	--	--	4.0	1.0	2.0	8.0
pp DDE	8.0	1.0	22.0	7.0	5.0	11.0	13.0	13.0	--	--	--	16.0	--	--	--	3.0	1.0	5.0	19.0
Mirex	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	--	--	--	1.0	--	--	--	1.0	1.0	1.0	1.0
TCDD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
NH_3-N (mg/l)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
O&G (mg/l)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CN (mg/l)	0.5	0.6	0.5	0.5	0.5	0.5	2.5	0.5	2.9	5.8	4.5	0.5	7.0	5.6	3.5	0.5	0.5	0.5	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.

Wauwatosa--copper and zinc--on the Menomonee River main stem, and at Friestadt Road--arsenic--and the Chicago & North Western railroad crossing--zinc--on the Little Menomonee River. PAH SEL guidelines were exceeded at Good Hope Road on the Little Menomonee River during 1992. This latter exceedance may be related to a chemical spill within the Little Menomonee River watershed on Good Hope Road immediately prior to the date the sample was obtained and is unlikely to reflect the normal condition of the river sediments at this location.

Since the completion of the initial regional water quality management plan, 62 spills of toxic substances into streams within the Menomonee River watershed have been documented by the Wisconsin Department of Natural Resources. Of these spills, 27 have occurred in the main stem of the Menomonee River, 20 in the City of Milwaukee, three in the Village of Menomonee Falls, two in the City of Wauwatosa, and one each in the Villages of Germantown and Butler. The remaining spills have occurred in tributaries of the Menomonee River, including Honey Creek, Underwood Creek, the Little Menomonee River, Butler Ditch, Lilly Creek, and South Menomonee and Burnham Canals. The majority of the substances that were spilled into surface waters were oil or related petroleum products.

Water Quality Assessments: Based upon the available data, the water quality and biological characteristics of the Menomonee River and its major tributaries were assessed, with the results set forth in Table VII-12. Fish populations and diversity ranged from poor to good in stream reaches where data were available.

Fish kills were documented in five streams in the Menomonee River watershed--Honey Creek, Underwood Creek, the Nor-X-Way Channel, Burnham Canal, and the Menomonee River main stem in the Cities of Wauwatosa and Milwaukee. Where known, the specific cause of each documented fish kill is shown in Table VII-12.

Standards were not fully met for fecal coliform levels in the majority of the Menomonee River watershed. Dissolved oxygen concentrations exceeded the standards in the Menomonee River main stem from CTH Q to Lilly Road and downstream of 25th Street, as well as in South Menomonee and Burnham Canals. In addition, un-ionized ammonia nitrogen levels exceeded the standards in the Menomonee River from STH 145 to Lilly Road, from Silver Spring Drive to Capitol Drive, and downstream of 70th Street. Metals concentrations exceeded chronic toxicity standards set forth in Chapter II at all sampling stations.

In general, the biotic index ratings, which are biological indicators of water quality within a stream system, were fair to very poor, except for the Menomonee River West Branch which had a good rating and Little Menomonee Creek which had a good to fair rating. Moderate levels of streambed sedimentation were noted throughout much of the watershed.

Table VII-12 sets forth the water quality index classifications[12] 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

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[12]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 VII-12

CHARACTERISTICS OF STREAMS IN THE MENOMONEE RIVER WATERSHED

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	NH3	Total P	Fecal Coliform	Toxics			
North Branch of Menomonee River upstream STH 145	10.0	--	No	No	No	--	Yes	--	--	Moderate	--
Menomonee River West Branch	4.2	Good	No	No	No	--	Yes	Yes	Good	Low (gravel, rubble)	Low
Menomonee River Downstream STH 145 to CTH Q	3.8	--	No	No	Yes	--	Yes	Yes	Fair	Moderate	--
Menomonee River Downstream CTH Q to Lilly Road	3.8	--	No	Yes	Yes	--	Yes	Yes	Fair	Moderate	--
Menomonee River Downstream Lilly Road to Good Hope Road	7.1	--	No	No	No	--	Yes	Yes	Fair	Moderate (sand, gravel, rubble)	--
Menomonee River Downstream Good Hope Road to Silver Spring	2.7	--	No	No	No	--	Yes	Yes	Fair	Moderate	--
Menomonee River Downstream Silver Spring to Hampton Avenue	2.1	--	No	No	Yes	--	Yes	Yes	Poor	Moderate	--
Menomonee River Downstream Hampton Avenue to Capitol Drive	1.3	--	Yes[f]	No	Yes	--	Yes	Yes	Poor	--	--
Menomonee River Downstream Capitol Drive to North Avenue	2.7	--	No	No	No	--	Yes	Yes	Poor	Moderate	--
Menomonee River Downstream North Avenue to 70th Street	2.4	Poor	No	No	No	--	Yes	Yes	Poor	Moderate (rubble, sand, silt)	--
Menomonee River Downstream 70th Street to 25th Street	4.4	Poor	Yes[g]	No	Yes	--	Yes	Yes	Very poor	Moderate (rubble, sand, silt)	Major
Menomonee River Downstream 25th Street to 2nd Street	1.7	Good	Yes[h]	Yes	Yes	--	Yes	Yes	--	--	--
South Menomonee and Burnham Canals	1.5	Good	Yes	Yes	--	--	Yes	Yes	--	Moderate	Major
Honey Creek	8.4	Poor	Yes[f]	No	No	--	Yes	Yes	Fair-very poor	Moderate (concrete, rubble, gravel)	Major

Table VII-12 (continued)

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			
Underwood Creek	8.9	Poor	Yes[i]	No	No	--	Yes	Yes	Fair-poor	Moderate (concrete)	Major
Little Menomonee Creek	2.3	Fair	No	No	No	--	Yes	--	Good-fair	Moderate (silt, clay, sand, gravel, rubble)	Low
Little Menomonee River	9.7	Fair	No	No	No	--	Yes	Yes	Fair-Poor	Moderate	--
Butler Ditch	2.4	Poor	No	No	No	--	Yes	--	Poor	Moderate (sand, gravel, rubble)	--
Dousman Ditch	2.5	Poor	No	No	No	--	Yes	Yes	--	--	Major
Lilly Creek	3.4	Good	No	No	No	--	Yes	Yes	Poor	Moderate	Major
Nor-X-Way Channel	4.5	Good	Yes[f]	No	No	--	Yes	--	Fair-poor	Low (clay, silt, sand, gravel, rubble)	Moderate
Willow Creek	3.2	Fair	No	No	No	--	Yes	--	Fair	Moderate (sand)	Moderate

[a] Based upon stream appraisal documentation set forth in the 1992 Water Resource Appraisals for the Menomonee River watershed 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] The most recent water quality data available as described in Figures VII-1 through VII-5 were used to evaluate water quality in the Menomonee 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 Menomonee River watershed stream reaches based upon simulated year 2000 land use conditions and current levels of pollutant control.

[d] Biotic index ratings are based upon the Hilsenhoff Biotic Index (HBI) discussed in DNR 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 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] Undetermined cause.

[g] Due to a spill of spent pickle liquor.

[h] Due to suspected industrial discharge.

[i] Due to a spill of #2 heating oil from a petroleum pipeline.

Source: SEWRPC.

indicated in Table VII-13, recent comparative data were available for five stations along the main stem of the Menomonee River. These stations and an additional station where water quality data was collected by the Department of Natural Resources are shown on Map VII-5. The data obtained for MMSD sampling station Mn-7a, the Menomonee River at Hampton Avenue, were used for comparative purposes in conjunction with earlier data from the Menomonee River at Capitol Drive. The data indicate that at stations Mn-6, Mn-7a, and Mn-10, water quality conditions have remained "fair" in 1964, 1974-75, and in 1990-91. In the upper reaches of the Menomonee River at station Mn-3, water quality conditions declined from "good" in 1964 to "fair" in 1974-75, and have remained "fair" based on 1990-91 data.

A summary of potential pollution sources in the Menomonee River watershed by stream reach is shown in tabular summary in Table VII-14. Review of the data indicate that the majority of the conversion of lands from rural to urban uses has occurred within Milwaukee County, with much of the conversion having occurred prior to 1976. More recent conversion of lands to urban uses has occurred in the Villages of Menomonee Falls and Germantown. 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 Menomonee River main stem, from 70th Street downstream to 25th Street, and in the South Menomonee and Burnham Canals, Honey Creek, Underwood Creek, and the Little Menomonee River. It should also be noted that three abandoned landfills are indicated to be potentially impacting the Little Menomonee River, two of these were designated as high priority sites for the U.S. Environmental Protection Agency Superfund program.

Compliance with Water Use Objectives

As indicated in Chapter II, the major stream reaches in the Menomonee River watershed as of 1993, are generally recommended for warmwater sport fish and limited recreational uses. These water use objectives and the associated water quality standards are discussed in Chapter II. The West Branch of the Menomonee River, the Menomonee River main stem from USH 41 to the Falk Corporation Dam, Honey Creek downstream of Wisconsin Avenue, Underwood Creek upstream of Watertown Plank Road, Little Menomonee Creek, Lilly Creek, Willow Creek, and the Nor-X-Way Channel from Donges Bay Road to Warren Street have limitations for sport fish habitat and are therefore recommended for warmwater forage fish and limited recreational uses. Butler Ditch, Dousman Ditch, and the remaining portions of the Nor-X-Way Channel are recommended for limited forage fish and limited recreational uses. Stream reaches recommended for limited aquatic life and limited recreational uses include portions of Honey Creek and portions of Underwood Creek. The Menomonee River portion of the Milwaukee Harbor estuary is recommended for warmwater sport fish and limited recreational use.

Based upon the available data for sampling stations in the watershed, the main stem of the Menomonee River and its major tributaries did not fully meet the water quality standards associated with the recommended water use objectives during and prior to 1975, the base year of the initial plan. As part of the Menomonee River priority watershed planning program the Wisconsin Department of Natural Resources staff conducted field inspections and limited sampling in order to assess the water quality and biological conditions on all of the streams in the Menomonee 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 VII-1 through

Table VII-13

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

Main Stem Stations[a]	July, August, September, and October of 1964	August of the Years 1974-1975	July, August, 1990 and 1991
Mn-1	Fair	Fair	--
Mn-2	Poor	Fair	--
Mn-3	Good	Fair	Fair
Mn-4	Poor	Fair	--
Mn-5	Poor	Poor	--
Mn-6	Fair	Fair	Fair
Mn-7a	Fair	Fair	Fair[b]
Mn-7b	Fair	Fair	--
Mn-10	Fair	Fair	Fair
Mn-13	--	--	Fair
Tributary Stations			
Mn-7	Fair	Fair	--
Mn-8	Fair	Fair	--
Mn-9	Fair	Fair	--
Watershed Average	Fair	Fair	Fair

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

[b] Recent data collected from the Menomonee River at Hampton Avenue were used for comparison purposes with previous data from the Menomonee River at Capitol Drive, located approximately 1.1 miles downstream from the Hampton Avenue station.

Source: SEWRPC.

Table VII-14

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

Stream Reach[a]	Extent of Conversion of Lands from Rural to Urban[b]		Documented Toxic Spills 1976-1990	Remaining Potential Surface Water Pollution Sources							Ongoing Pollution Abatement Efforts[c]
	Historical 1976-1990	Expected 1990-2010		Urban Nonpoint Source Pollution	Rural Nonpoint Source Pollution	Public Sewage Treatment Plants	Private Sewage Treatment Plants	Number of Permitted Industrial Discharges	Other Known Potential Impacts to Surface Water Quality	Comments	
North Branch Menomonee River Upstream STH 145	Insignificant	Insignificant	--	--	X	--	--	--	--	--	1,3
Menomonee River West Branch	Insignificant	Insignificant	--	--	X	--	--	1	--	--	1,3
Menomonee River Downstream STH 145 to CTH Q	Major[d]	Major[e]	--	X	X	--	--	4	Leaking underground storage tank site permitted to discharge remediation wastewater to Menomonee River	Village of Germantown public sewage treatment plant abandoned in 1986	1,2,3
Menomonee River Downstream CTH Q to Lilly Road	Moderate	Moderate	1982-gasoline 1991-fuel oil	X	--	--	--	6	--	Village of Menomonee Falls-Pilgrim Road public STP abandoned in 1981	1,2
Menomonee River Downstream Lilly Road to Good Hope Road	Significant[d]	Major[e]	1989-white liquid 1987-oil	X	--	--	--	3	Lauer I sanitary landfill[g] (abandoned)	Village of Menomonee Falls-Lilly Road public STP abandoned in 1981	1,2
Menomonee River Downstream Good Hope Road to Silver Spring	Insignificant	Major[e]	--	X	--	--	--	3	--	--	1,2
Menomonee River Downstream Silver Spring to Hampton Avenue	Moderate	Insignificant[f]	1983-fuel oil 1983-oil 1987-petroleum	X	--	--	--	3	--	--	1,2
Menomonee River Downstream Hampton Avenue to Capitol Drive	Significant[f]	Insignificant[f]	1987-gasoline	X	--	--	--	6	--	--	1,2
Menomonee River Downstream Capitol Drive to North Avenue	Insignificant[f]	Insignificant[f]	1984-unknown 1986-unknown 1992-diesel fuel	X	--	--	--	7	--	--	1,2

Table VII-14 (continued)

Stream Reach[a]	Extent of Conversion of Lands from Rural to Urban[b]		Documented Toxic Spills 1976-1990	Remaining Potential Surface Water Pollution Sources							Ongoing Pollution Abatement Efforts[c]
	Historical 1976-1990	Expected 1990-2010		Urban Nonpoint Source Pollution	Rural Nonpoint Source Pollution	Public Sewage Treatment Plants	Private Sewage Treatment Plants	Number of Permitted Industrial Discharges	Other Known Potential Impacts to Surface Water Quality	Comments	
Menomonee River Downstream North Avenue to 70th Street	Insignificant[f]	Insignificant[f]	1990-vegetable oil	X	--	--	--	1	--	--	2
Menomonee River Downstream 70th Street to 25th Street	Insignificant[f]	Insignificant[f]	1979-waste oil 1980-oil 1980-oil 1981-oil 1982-sewage 1984-oil 1985-oil 1986-fuel oil 1988-light sheen only 1991-cutting oil 1992-gasoline	X	--	--	--	20	Two leaking underground storage tank sites permitted to discharge remediation wastewater to Menomonee River	--	1,2
Menomonee River Downstream 25th Street to Milwaukee River	Insignificant[f]	Insignificant[f]	1985-oil 1986-refrigeration lube oil 1991-ethylene glycol 1992-dye	X	--	--	--	--	--	--	1,2
South Menomonee and Burnham Canals	Insignificant[f]	Insignificant[f]	1980-sewage water 1982-diesel fuel 1985-oil 1985-oil 1986-lube oil 1986-waste soil 1987-blue powder 1989-petroleum product (sheen)	X	--	--	--	11	--	--	1,2
Honey Creek	Insignificant[f]	Insignificant[f]	1984-gasoline 1984-unknown 1986-unknown 1986-gasoline 1986-oil or gas 1987-sludge 1988-oily scum 1989-petroleum product (sheen) 1990-unknown red substance	X	--	--	--	9	Leaking underground storage tank site permitted to discharge remediation wastewater to Honey Creek	--	1,2

Table VII-14 (continued)

Stream Reach[a]	Extent of Conversion of Lands from Rural to Urban[b]		Documented Toxic Spills 1976-1990	Remaining Potential Surface Water Pollution Sources							Ongoing Pollution Abatement Efforts[c]
	Historical 1976-1990	Expected 1990-2010		Urban Nonpoint Source Pollution	Rural Nonpoint Source Pollution	Public Sewage Treatment Plants	Private Sewage Treatment Plants	Number of Permitted Industrial Discharges	Other Known Potential Impacts to Surface Water Quality	Comments	
Underwood Creek	Significant[f]	Significant[f]	1986-unknown 1987-oil sheen 1987-concrete wash water 1988-oil 1992-gasoline 1992-oil	X	--	--	--	16	Leaking underground storage tank site permitted to discharge remediation wastewater to Underwood Creek City of Brookfield landfill (abandoned)	--	1,2
Little Menomonee Creek	Insignificant	Insignificant	--	--	X	--	--	--	--	--	1,3
Little Menomonee River	significant	Significant	1986-oil 1987-gasoline 1987-oily substance 1988-petroleum product 1989-unknown 1989-oil or gas 1991-oil sheen	X	X	--	--	17	Omega Hills North landfill[g] (abandoned) Geipel landfill (abandoned) Moss American landfill[g] (abandoned)	--	1,2,3
Butler Ditch	Moderate[f]	Insignificant[f]	1978-oil 1978-fuel oil 1979-oil	X	--	--	--	2	--	--	1,2
Dousman Ditch	Significant[f]	Insignificant[f]	--	X	--	--	--	3	--	--	1,2
Lilly Creek	Significant	Major[e]	1988-oil	X	--	--	--	2	--	--	1,2
Nor-X-Way Channel	Moderate	Moderate	--	X	X	--	--	6	Leaking underground storage tank site permitted to discharge remediation wastewater to Nor-X-Way channel	--	1,2,3
Willow Creek	Significant	Insignificant	--	X	X	--	--	1	--	--	1,2,3

Footnotes follow.

Table VII-14 (continued)

[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

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

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

[f] Considerable urban development existing pre-1976.

[g] Superfund site

Source: Wisconsin Department of Natural Resources and SEWRPC.

VII-5, 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 expected that violations of the fecal coliform standards occur in the main stem of the Menomonee River and in most of its tributaries. Dissolved oxygen and ammonia nitrogen levels do not meet the standards in the reaches of the Menomonee River main stem downstream of 25th Street. Thus, the recommended water use objectives are only partially being achieved in the majority of the major streams in the watershed.

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 final 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 potential future amendment to the regional plan for the Menomonee 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.