SEWRPC COMMUNITY ASSISTANCE
PLANNING REPORT NO. 37

A NONPOINT SOURCE WATER POLLUTION CONTROL PLAN FOR THE ROOT RIVER WATERSHED

LOCAL DESIGNATED WATER QUALITY MANAGEMENT AGENCIES: Kenosha County, Kenosha County Soil and Water Conservation District, Milwaukee County, Milwaukee County Soil and Water Conservation District, City of Franklin, City of Greenfield, City of Oak Creek, City of West Allis, Village of Greendale, Village of Hales Corners, Racine County, Racine County Soil and Water Conservation District, City of Racine, Village of Union Grove, Town of Caledonia, Town of Mt. Pleasant, Town of Yorkville Sanitary District No. 1, Town of Raymond, Waukesha County, Waukesha County Soil and Water Conservation District, Waukesha County Board of Health, City of Muskego, City of New Berlin.

COOPERATING AGENCIES: Southeastern Wisconsin Regional Planning Commission; Wisconsin Department of Natural Resources; State Board of Soil and Water Conservation Districts; University of Wisconsin-Extension Service; U. S. Department of Agriculture, Soil Conservation Service and Agricultural Stabilization and Conservation Service.

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Special acknowledgement is due Mr. David B. Kendziorski, SEWRPC Senior Planner, for his contribution to the preparation of this report.

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Special acknowledgement is due Mr. Lawrance C. Toney, District Conservationist, U.S. Soil Cconservation Service, Ms. Sharon L. Gayan, Program Manager, Racine County Soil and Water Conservation District, Ms. Jean E. Maddick, Technician, Racine County Soil and Water Conservation District, and Mr. Herbert C. Sims, Soil Conservation Technician, U.S. Soil Conservation Service, for their contribution to the preparation of this report.

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COMMUNITY ASSISTANCE PLANNING REPORT
NUMBER 37

A NONPOINT SOURCE WATER POLLUTION CONTROL PLAN

FOR THE

ROOT RIVER WATERSHED

Prepared by

LOCAL DESIGNATED WATER QUALITY MANAGEMENT AGENCIES:

Kenosha County
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COOPERATING AGENCIES:

Southeastern Wisconsin Regional Planning Commission
Wisconsin Department of Nautral Resources
State Board of Soil and Water Conservation Districts
University of Wisconsin-Extension Service
U.S.D.A. Soil Conservation Service
U.S.D.A. Agricultural Stabilization and Conservation Service

Preparation of this report was financed in part through a planning grant from the Wisconsin Department of Natural Resources under the provisions of the Wisconsin Nonpoint Source Pollution Abatement Program, and in part through a planning grant from the U. S. Environmental Protection Agency under the provisions of Section 208 of the Federal Water Pollution Control Act.

March 1980

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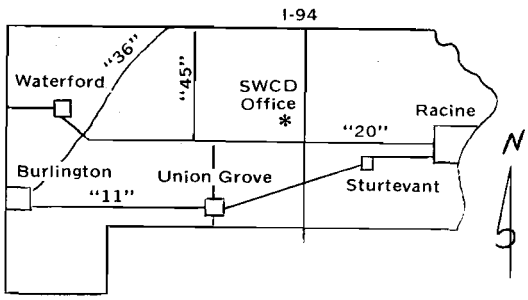
Racine County Soil and Water Conservation District

14200 WASHINGTON AVENUE STURTEVANT, WISCONSIN 53177 PHONE 886-4766



February 22, 1980

Anthony A. Earl
Department of Natural Resources
P.O. Box 7921
101 So. Webster Street
Madison, Wisconsin 53707

Dear Mr. Earl:

The Racine County Soil and Water Conservation District, functioning as the Designated Management Agency for the Root River Watershed, has reviewed and authorize approval of the Root River Watershed Water Quality Plan.

This agency will proceed with the implementation of the plan upon final Department of Natural Resources approval.

Sincerely,

David B. Yanny

David B. Yanny,
Chairman
Racine County SWCD

DY/lp

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State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Anthony S. Earl
Secretary

BOX 7921
MADISON, WISCONSIN 53707

March 5, 1980

IN REPLY REFER TO: 3200

The Root River Priority Watershed Plan and the Program for Implementation for the plan have been reviewed by the Department staff. They meet the intent and conditions of s. 144.25, Statutes, and NR 120, Wisconsin Administrative Code, and are hereby approved.

Sincerely,

Anthony S. Earl
Secretary

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SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

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March 21, 1980

TO: Local Designated Water Quality Management Agencies Involved in the Nonpoint Source Water Pollution Control Plan for the Root River Watershed

In 1979, the Root River watershed was selected by the Wisconsin Department of Natural Resources as a priority watershed for planning and plan implementation under the Wisconsin Fund Nonpoint Source Water Pollution Abatement Program. During the summer of 1979, a field inventory was conducted to identify nonpoint sources of pollution in the watershed and to determine control practice needs. Under the direction of the lead designated management agency, the Racine County Soil and Water Conservation District, and with the technical assistance of the Regional Planning Commission and the Wisconsin Department of Natural Resources, a detailed plan for the abatement of water pollution from nonpoint sources in the Root River watershed was cooperatively prepared. The Regional Planning Commission was asked to publish the report describing the plan, and is pleased to transmit herewith this nonpoint source pollution control plan for the Root River watershed.

This plan represents a refinement of the nonpoint source control plan element of the areawide water quality management plan adopted by the Regional Planning Commission in July 1979. The recommendations set forth in this plan relate to the control of pollution from both urban and rural nonpoint sources. The abatement of pollution from urban nonpoint sources, in particular, is a highly complex and technical problem which will require the dedicated efforts of all 23 local designated management agencies in the watershed. The abatement of pollution from rural nonpoint sources will require primarily the use of sound, basic soil and water conservation practices and livestock waste control measures proven by years of application by farmers.

The Root River nonpoint source water pollution control plan was approved by the Racine County Soil and Water Conservation District, as the lead designated management agency, on February 22, 1980, and by the Wisconsin Department of Natural Resources on March 5, 1980. The plan was formally adopted by the Regional Planning Commission on March 6, 1980, as an amendment to the areawide water quality management plan.

As established under the Wisconsin Fund Nonpoint Source Water Pollution Abatement Program, the nonpoint source control plan for the Root River watershed is advisory to the local, state, and federal units and agencies of government concerned. In its continuing role as a coordinator of water quality planning and plan implementation activities within southeastern Wisconsin, the Commission stands ready to work with the various units and agencies of government in implementing the recommendations contained herein.

Respectfully submitted,

Kurt W. Bauer
Executive Director

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INTRODUCTION

Two general categories of water pollution sources are point sources and nonpoint sources. Point sources of pollution are defined as concentrated discharges of wastewater from discrete, specific sites. Examples of point sources are sewage treatment plant outfalls, sewerage system flow relief device outfalls, and industrial waste outfalls. Nonpoint sources of water pollution are defined as diffuse discharges of pollutants which cannot be readily identified as a point source. Nonpoint sources include storm water and snowmelt runoff from urban and rural land surfaces, construction activities, and livestock operations.

The Wisconsin Fund program was enacted by the Wisconsin Legislature in 1978 to provide cost-sharing and technical assistance to local agencies to control point and nonpoint sources of water pollution. In 1979, $2.1 million was allocated for nonpoint source pollution abatement cost-sharing, and $57.9 million was designated for point source pollution control projects. Distribution of 70 percent of the nonpoint source pollution abatement funds was limited to five priority watersheds in the State. One of the priority watersheds selected was the Root River wastershed. The Root River watershed was selected because of the severity of water quality problems, the relative importance of nonpoint sources to the achievement of water quality standards, the expressed capability and willingness of local governmental agencies to carry out the planning and implementation program, and the interest shown by state and local elected representatives in cleaning up the Root River. The Wisconsin Fund program requires a detailed water pollution control plan to be prepared as a basis for the funding and implementation of nonpoint source pollution abatement measures. This report sets forth such a plan for the Root River watershed. It assesses the existing water quality conditions in the watershed, identifies and quantifies the existing pollution sources, recommends nonpoint source control measures, estimates associated costs, and sets forth an implementation program. The water pollution control plan set forth herein is within the framework of the adopted areawide water quality management plan prepared by the Southeastern Wisconsin Regional Planning Commission (SEWRPC) for the Southeastern Wisconsin Region. It is wholly consistent with that plan, and serves to implement it.

The water quality conditions in the Root River watershed have been the object of previous management efforts in the watershed. These efforts to protect the water resources in the watershed were considered in the development of this priority watershed plan. Historic and current management efforts include local floodplain and shoreland zoning programs, the development of extensive county park systems in Milwaukee and Racine Counties, the citizens' programs of the Root River Restoration Council, the preparation of a comprehensive watershed plan by the SEWRPC, and the point source pollution abatement programs conducted by the Wisconsin Department of Natural Resources (DNR). Also important are the collection and analysis of water quality data by the DNR, the Regional Planning Commission, and the City of Racine.[1] These programs were considered in, and provide one basis for, this priority watershed plan.

WATERSHED DESCRIPTION

The Root River watershed is a natural surface water drainage unit, 197 square miles in areal extent. The boundaries of the basin, together with the locations of the main channels of the Root River and its principal tributaries, are shown on Map 1. The main stem of the Root River originates in the City of New Berlin in Waukesha County and discharges to Lake Michigan through the City of Racine. About 77 percent of the watershed is occupied by rural land uses, with about 88 percent of these uses, or about 68 percent of the watershed

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[1] *Water quality data and analyses for the Root River watershed are set forth in the Root River drainage basin reports prepared by the Wisconsin Department of Natural Resources in 1954, 1955, 1967, and 1976; SEWRPC Technical Report No. 17, Water Quality of Lakes and Streams in Southeastern Wisconsin: 1964-1975; SEWRPC Technical Report No. 21, Sources of Water Pollution in Southeastern Wisconsin: 1975; SEWRPC Planning Report No. 30, A Regional Water Quality Management Plan for Southeastern Wisconsin: 2000; Combined Sewer Overflow Report, Racine, Wisconsin, prepared for the City of Racine in 1978; and in the files of the City of Racine Health Department.*

Map 1

THE ROOT RIVER WATERSHED

The Root River watershed is a natural drainage area about 197 square miles in areal extent, located within Racine, Milwaukee, Waukesha, and Kenosha Counties. The watershed is drained by a network of streams and watercourses totaling about 99 miles in length, but contains no lakes larger than 50 acres.

Source SEWRPC.

area, consisting of agricultural uses. Most of the agricultural-related land uses are located in the central and southwestern portion of the watershed. Map 2 sets forth the major land use categories and their spatial distributions within the Root River watershed as inventoried in 1975. Table 1 sets forth the extent of the major land use categories within the watershed as of 1975.

The watershed is bounded on the north by the Menomonee and Kinnickinnic River watersheds, on the west by the subcontinental divide which separates the Fox River watershed from the Root, on the south by the Des Plaines and Pike River watersheds, and on the east by the Oak Creek watershed and Lake Michigan. The named streams of the Root River watershed include the North Branch of the Root River (main stem), Upper Creek, Hales Corners Creek, Tess Corners-Whitnall Creek, Ryan Creek, South Branch or Root River Canal, East Branch of the Root River Canal, West Branch of the Root River Canal, Raymond Creek, Husher Creek, and Hoods Creek. Table 2 lists each perennial stream reach for the Root River watershed, together with the location of the source and the length of the stream in miles.

Superimposed upon the natural, meandering washershed boundaries is a rectilinear pattern of local political boundaries, as shown on Map 1. The Root River watershed lies within Kenosha, Milwaukee, Racine, and Waukesha Counties and in parts of 18 cities, villages, and towns. The area and proportion of the watershed lying within the jurisdiction of each local unit of government as of January 1, 1976, are shown in Table 3. The 1975 resident population of the watershed was estimated at 152,431 persons. Table 4 presents the population distribution of the Root River watershed by civil division.

Water and Soils

Surface water in the Root River watershed is comprised mostly of streamflow. Some small ponds, flooded gravel pits, and wetlands make up the remainder of the surface water.

The soils within the Root River watershed are deep to moderately deep. There are brown to black silt loams in the eastern parts of Racine, Kenosha, and Milwaukee Counties and brown to black prairie loam soils in the western areas of these counties. Soils in Waukesha County generally consist of grayish-brown loams. Parts of Milwaukee County are covered by clay-type soils. Most of the soils are relatively fertile and produce high crop yields if managed correctly. However, they also tend to produce high levels of nutrients in stream waters when soil particles are carried with precipitation runoff. The silt loams are formed on highly erosive loess, and range from well-drained to poorly drained soils. The soils are underlain by glacial till and the subsoils are somewhat poorly to poorly drained clay loams or silty-clay loams. When exposed, especially during urban development, the subsoils are highly erodible. To manage these soils, essentially all agricultural fields covered by row crops in the watershed are currently plowed in fall and disked in spring, prior to planting. Fall plowing is intended to allow the soil to dry out earlier in spring to facilitate planting. However, fall plowing exposes the soil to greater erosion, especially during runoff from late fall storms and during spring snowmelt runoff.

Particularly important to watershed planning are the soil suitability interpretations for specified types of urban development. Based upon the interpretations of the soils properties, much of the watershed area exhibits severe or very severe limitations for residential development with or without public sanitary sewer service.

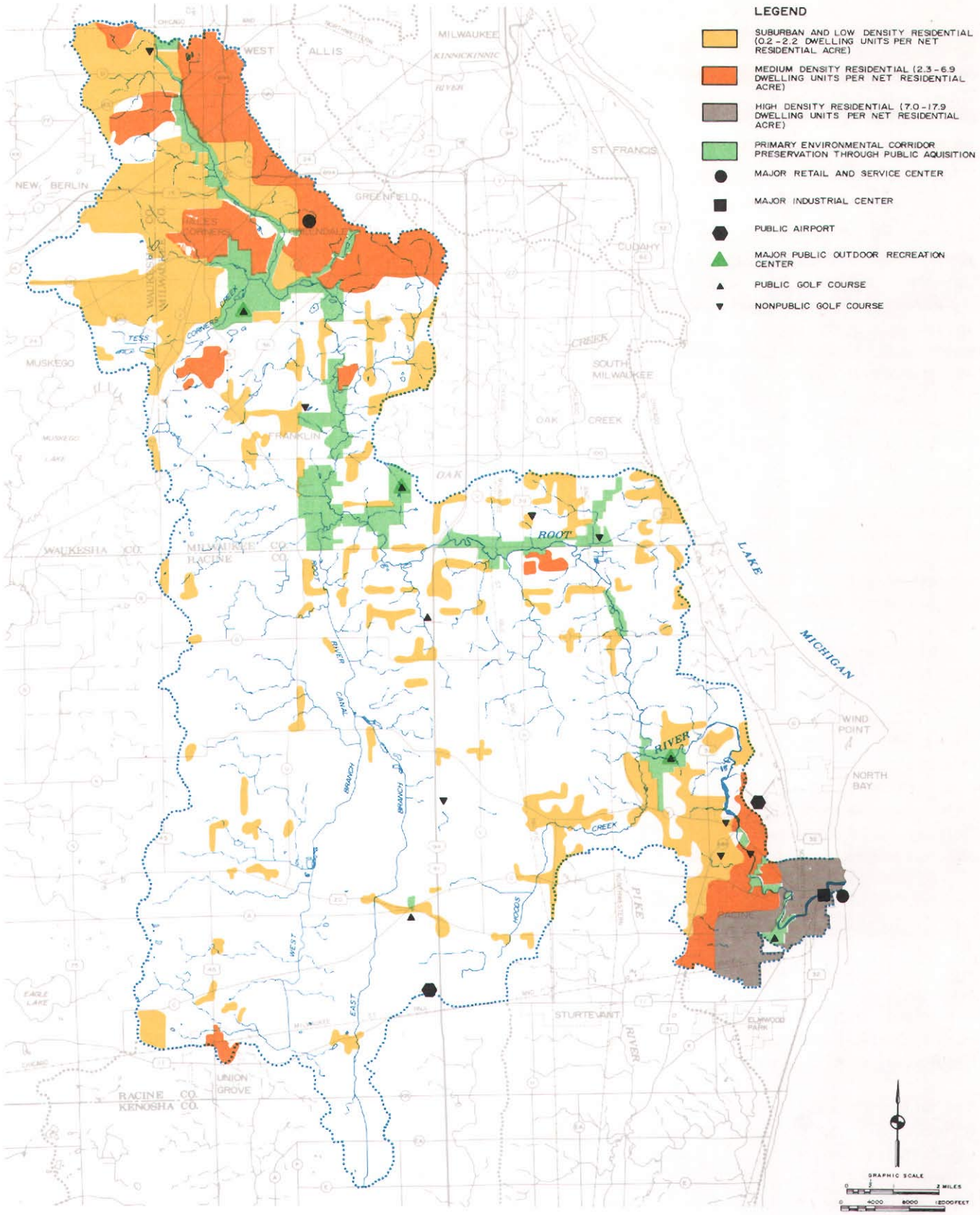
Climate

The Root River watershed has a continental climate characterized by a continuous progression of markedly different seasons and a large range in annual temperature. Distinct changes in weather conditions, particularly in the winter and spring, normally occur every two or three days. In addition to marked temporal weather changes, the watershed exhibits spatial weather differences, the most significant being the moderating effect of Lake Michigan on near-shore areas.

The monthly temperature range extends from an average of 20.0°F in January to 71.4°F in July. Precipitation within the watershed occurs as rain, sleet, hail, and snow. Precipitation events range in intensity, duration, and significance from gentle showers to destructive thunderstorms and major rainfall or rainfall-snowmelt events that result in property damage, inundation of poorly drained areas, and stream flooding. The annual total precipitation is 31.26 inches (water equivalent), with monthly averages ranging from a low of 1.19 inches in February to a high of 3.77 inches in June. Snow cover is most likely during the months of December, January, and February, and averages 44.5 inches annually.

Map 2

EXISTING LAND USE IN THE ROOT RIVER WATERSHED: 1975



As of 1975 more than 77 percent of the area of the Root River watershed was devoted to rural land uses. The dominant rural land use in the watershed was agriculture, occupying 68 percent of the watershed area. The overall spatial distribution of land use in the watershed was characterized by rural land use in the area drained by the South Branch or Root River Canal; medium-density urban development in the area drained by the North Branch; rural and suburban development along the middle reaches of the main stem; and an intensive concentration of urban development (the City of Racine) in the lower reaches of the basin.

Source: U. S. Department of Agriculture, Soil Conservation Service and Agricultural Stabilization and Conservation Service; County Soil and Water Conservation Districts; University of Wisconsin-Extension Service; and SEWRPC.

Table 1

AREAL EXTENT OF WATER QUALITY-RELATED LAND USES IN THE ROOT RIVER WATERSHED: 1975[a]

Land Use	Square Miles	Acres	Percent
Urban Land Use			
Residential	26.17	16,751	13.42
Commercial[b]	4.42	2,830	2.27
Industrial			
Manufacturing	0.10	580	0.47
Landfill and Dump	0.42	271	0.22
Extractive	0.69	441	0.35
Transportation			
Streets and Highways	2.05	1,309	1.05
Airfields	0.37	237	0.19
Railroad Yards and Terminals	0.00	1	0.00
Recreation			
Golf Courses	3.79	2,424	1.94
Parks and Other Recreation	2.54	1,628	1.30
Land Under Development			
Residential Land Under Development[c]	3.64	2,332	1.87
Commercial Land Under Development	0.06	41	0.03
Industrial Land Under Development	--	--	--
Transportation Land Under Development	--	--	--
Recreation Land Under Development	0.07	46	0.00
Subtotal	44.32	28,891	23.11
Rural Land Use			
Agricultural			
Grain Crops	9.78	6,259	5.02
Hay	10.34	6,618	5.30
Row Crops	83.50	53,438	42.82
Specialty Crops	3.61	2,313	1.85
Sod Farm	0.55	349	0.28
Other Open Space[d]	23.86	15,272	12.24
Silvicultural			
Woodlands	9.46	6,054	4.85
Orchards and Nurseries	0.86	553	0.44
Natural and Manmade Water Areas—Subject to Atmospheric Pollutant Contributions			
Ponds, Lakes & Streams	0.70	447	0.36
Wetlands, Swamps, and Marshes	7.17	4,590	3.68
Subtotal	149.83	95,893	76.89
Total	194.15	124,784	100.00

[a] *These special land use categories, defined primarily according to their land cover characteristics and effects on the quality of storm water runoff were delineated at a scale of 1" = 400' on aerial photographs taken in May 1975.*

[b] *Includes: retail, communication, utilities, administrative, and institutional.*

[c] *Based on 1975 total residential lands, adjusted by the 1970 ratio between residential lands and residential lands under development.*

[d] *Includes: pasture, unused urban, and rural lands.*

Source: U. S. Department of Agriculture, Soil Conservation Service and Agricultural Stabilization and Conservation Service; County Soil and Water Conservation Districts; University of Wisconsin-Extension Service; and SEWRPC.

Table 2

LENGTH OF STREAMS AND THEIR SOURCES IN THE ROOT RIVER WATERSHED

Stream or Watercourse	Source		Length[b] (in miles)
	By Civil Division	By U.S. Public Land Survey System	
North Branch of Root River (main stem)	City of West Allis	T 6N, R21E, Sec. 7, NW 1/4	44.8
Upper Creek[a]	City of New Berlin	T 6N, R20E, Sec. 13, SW 1/4	2.3
Hales Corners Creek	Village of Hales Corners	T 6N, R21E, Sec. 31, SE 1/4	0.8
Tess Corners - Whitnall Creek	City of Franklin	T 5N, R21E, Sec. 8, NW 1/4	3.3
Tributary (1) to West Branch of Root River[a]	City of Franklin	T 5N, R21E, Sec. 20, NW 1/4	1.6
Tributary to East Branch of Root River	City of Franklin	T 5N, R21E, Sec. 1, NE 1/4	2.4
Tributary (2) to West Branch of Root River[a]	City of Franklin	T 5N, R21E, Sec. 22, NW 1/4	0.6
Ryan Creek[a]	City of Franklin	T 5N, R21E, Sec. 28, NE 1/4	3.0
Root River Canal (south branch)	Town of Raymond	T 4N, R21E, Sec. 23, SW 1/4	2.9
West Branch of Root River Canal	Village of Union Grove	T 3N, R21W, Sec. 29, NW 1/4	10.6
Raymond Creek	Town of Raymond	T 4N, R21E, Sec. 22, NW 1/4	2.9
East Branch of Root River Canal	Town of Paris	T 2N, R21E, Sec. 11, SW 1/4	11.6
Husher Creek	Town of Caledonia	T 4N, R22E, Sec. 21, NW 1/4	3.4
Hoods Creek	Town of Mount Pleasant	T 3N, R22E, Sec. 19, NW 1/4	8.6

[a] *Portions of these streams are intermittent.*

[b] *Total perennial stream length as shown on U. S. Geological Survey quadrangle maps.*

Source: Wisconsin Department of Natural Resources and SEWRPC.

Ground frost or frozen ground during winter influences hydraulic processes, particularly the proportion of rainfall or snowmelt that will run off the land into surface waters. Livestock manure applied to frozen ground is susceptible to a high degree of runoff in spring under snowmelt conditions. Frozen ground exists throughout the watershed for approximately four months each winter season, extending from late November through March, with a frost depth of more than six inches occurring during January, February, and the first half of March. Historical data indicate that the most severe frost conditions normally occur in February, when a frost depth of 15 or more inches can be expected.

Topography

The surficial deposits left by the glaciers have determined the topography of the Root River watershed. The watershed is a rolling plain marked by broad asymmetrical ridges and glacial moraines controlling the slopes and patterns of the drainage network. Streams generally occupy northerly trending valleys between morainal ridges having relatively steep westward-facing slopes and gentle east-facing slopes. This pattern is particularly well developed in Racine County, where runoff, in order to reach the main stem of the Root River, must follow a long, circuitous route of easterly flow down the gentle side of moraines and northerly up the intermorainal valleys to the main stem of the Root River. Overall, the watershed has a flat to rolling topography with land slopes ranging from 0 to 5 percent. Main stream channel slopes are much flatter, however, with the average slope of all perennial waterways being about six feet per mile (0.114 percent).

Flooding

The Root River system has a history of frequent minor local flooding. Although the probability of intense rainfall within the watershed is much greater during the summer months than at any other time of year, summer floods have been less frequent and not as severe as spring floods. This is due to the greater capacity of the soil to retain moisture during summer conditions and to the absence of snowmelt contribution. The periods of

Table 3

AREAL EXTENT OF CIVIL DIVISIONS IN THE ROOT RIVER WATERSHED: 1976

Civil Division	Area Within Watershed (square miles)	Percent of Watershed Area Within Civil Division	Percent of Civil Division Area Within Watershed
Kenosha County			
Town			
Paris	2.18	1.11	6.06
County Subtotal	2.18	1.11	0.78
Milwaukee County			
Cities			
Franklin	31.70	16.10	91.38
Greenfield	6.25	3.17	53.74
Milwaukee	1.04	0.53	1.08
Oak Creek	8.08	4.10	28.44
West Allis	2.95	1.50	25.92
Villages			
Greendale	5.46	2.77	98.02
Hales Corners	3.17	1.61	100.00
County Subtotal	58.65	29.79	24.17
Racine County			
City			
Racine	6.27	3.18	46.62
Village			
Union Grove	0.44	0.22	47.83
Towns			
Caledonia	36.18	18.37	77.54
Dover	2.57	1.30	7.11
Mt. Pleasant	13.70	6.96	36.58
Norway	0.10	0.05	0.28
Raymond	33.93	17.23	14.99
Yorkville	29.75	15.11	84.28
County Subtotal	122.94	62.45	36.12
Waukesha County			
Cities			
Muskego	3.90	1.98	10.82
New Berlin	9.20	4.67	24.28
County Subtotal	13.10	6.65	2.26
Total	196.87	100.00	--

Source: SEWRPC.

Table 4

ESTIMATED POPULATION OF ROOT RIVER WATERSHED BY CIVIL DIVISION: 1975

Civil Division	1975 Population
Kenosha County	
Paris Town (Part)	62
Kenosha County (Part) Subtotal	62
Milwaukee County	
Franklin City (Part)	11,923
Greendale Village (Part)	16,349
Greenfield City (Part)	8,455
Hales Corners Village	8,773
Milwaukee City (Part)	8,376
Oak Creek City (Part)	3,014
West Allis City (Part)	13,254
Milwaukee County (Part) Subtotal	70,144
Racine County	
Caledonia Town (Part)	9,394
Dover Town (Part)	779
Mt. Pleasant Town (Part)	4,276
Norway Town (Part)	31
Racine City (Part)	43,286
Raymond Town (Part)	3,583
Union Grove Village (Part)	1,752
Yorkville Town (Part)	2,813
Racine County (Part) Subtotal	65,914
Waukesha County	
Muskego City (Part)	4,169
New Berlin City (Part)	12,142
Waukesha County (Part) Subtotal	16,311
Root River Watershed Total	152,431

Source: Wisconsin Department of Administration and SEWRPC.

greatest runoff are also the periods of greatest nonpoint source contribution. As urban development in the watershed increases in the future, changes in flood characteristics will occur. Although the major floods in the watershed have been associated with snowmelt conditions, urban development has its greatest influence on floods caused by summer rainfall because of the reduction in the high summer moisture retention capacity of the land surface. Thus, especially in summer, urban development increases both peak flood flows and the total volume of runoff. Historic flood damages in the Root River watershed have consisted primarily of basement flooding and minor damage to some parkway roads and bridges during very severe floods.

It is particularly important that the nonpoint source pollution control plan recognize the relationship between nonpoint source abatement and the flood damage abatement measures and floodland protection elements previously recommended or implemented. As discussed in Appendix A of this report, channel clearing and maintenance on the Root River Canal would serve to improve existing agricultural drainage and control flooding. Such activities should be coordinated with the implementation of nonpoint source controls in, and adjacent to, the affected canal reaches in order to maximize the effectiveness of nonpoint source control measures and to ensure that the nonpoint source control measures are properly designed to accommodate stabilized, drainage-efficient channels. The construction of an artificial, multiple-purpose reservoir at the confluence of the Root River Canal and the Root River main stem—as recommended in SEWRPC Planning Report No. 9, A Comprehensive Plan for the Root River Watershed, for flood abatement purposes, as well as for recreation, conservation, and low-flow augmentation purposes—would not have a substantial effect on either the recommended level of, or the effectiveness of, nonpoint source controls. The extensive public acquisition of parkway and other floodplain areas along the stream system in both Milwaukee and Racine Counties, along with the provisions of the floodplain-shoreland zoning ordinances, serves to stabilize eroding areas, to prevent excessive pollutant contributions from these environmentally sensitive and valuable areas, and to provide a "buffer zone" to trap a portion of the pollutant load generated from upland areas.

AREAWIDE WATER QUALITY MANAGEMENT PLAN RECOMMENDATIONS AND IMPLEMENTING AGENCIES

Plan Recommendations

The purpose of the areawide water quality management plan is to achieve recommended water use objectives and supporting water quality standards. Those objectives and standards, as they apply to the Root River watershed, are discussed below.

The areawide water quality management plan concluded that, in order to achieve the recommended water use objectives, both urban and rural

nonpoint source controls need to be implemented.[2] In urban areas, it was recommended that a 50 percent reduction in nonpoint source pollutant loads to the streams be achieved. In rural areas, it was recommended that a 25 percent reduction in nonpoint source loads be achieved, except in the Root River Canal drainage area, where a 50 percent reduction was recommended. The percent reductions refer to the level of reduction in nonpoint source pollutant loading required—as determined with the use of a water quality simulation model—to meet recommended water use objectives and supporting water quality standards. Nonpoint source pollutant loadings are those pollutant materials on the land surface which are available to be transported in storm water or snowmelt runoff. Although alternative nonpoint source control measures were identified, the actual selection of individual practices is to be accomplished through the priority watershed planning program, and through the selection—jointly with property owners—of necessary onsite measures.

Management Agencies

The local governmental management agencies designated in the areawide plan to implement urban nonpoint source pollution control practices are identified in Table 5 and depicted in Figure 1. All of the incorporated units of government in the watershed, together with selected unincorporated towns that have large urban populations, are designated agencies. No new agencies are recommended to be created for purposes of water pollution control in the Root River watershed. The various management responsibilities assigned to each agency are also set forth in Table 5. The designated urban agencies, rural agencies, and the lead agency are discussed below.

A total of 23 urban governmental agencies have responsibilities for urban nonpoint source pollution control in the watershed. Eight of these agencies are in Racine County, eight are in Milwaukee County, five are in Waukesha County, and two are in Kenosha County.

The rural management agencies designated to be responsible for rural nonpoint source pollution control, together with the assigned responsibilities of each agency, are given in Table 6. A total of eight governmental agencies have rural implementation responsibilities in the watershed. These eight agencies include each of the four counties and each of the four soil and water conservation districts which have jurisdiction over a portion of the watershed.

For the Root River watershed nonpoint source priority planning program, the Racine County Soil and Water Conservation District was designated as the lead management agency. As such, it is responsible for coordinating the activities of all other designated management agencies within the watershed. The Racine County Soil and Water Conservation District is responsible for the allocation of Wisconsin Fund and local cost-share funds.

Agricultural drainage districts, which have authority to plan, construct, and operate drainage and flood control facilities, were not designated for nonpoint source control responsibility. Drainage districts have not historically taken a role in nonpoint source control, and such a role would conflict with the responsibilities of the soil and water conservation districts. It is important, however, that soil and water conservation districts coordinate all nonpoint source control activities with the ongoing and proposed activities of the drainage districts. This will ensure that all implemented nonpoint source control measures are compatible with the objectives and actions of the drainage districts. The relationship of potential nonpoint source abatement measures to proposed drainage channel maintenance activities is discussed in Appendix A.

WATER QUALITY CONDITIONS

In the Root River watershed, the Regional Planning Commission conducted a water quality sampling program from 1964 to 1975 at six stations, shown on Map 3. As indicated in Tables 7 through 12, which summarize the data compiled between 1968 and 1975, the recommended water quality standards for fecal coliform, dissolved oxygen, and total phosphorus are frequently violated. For the entire watershed, measured fecal coliform levels averaged over 2,600 membrane filter fecal coliform counts per 100 milliliters (MFFCC/100 ml), well above the recommended standard of 400 MFFCC/100 ml. By count, 47, or 65 percent, of the 72 analyzed water samples

[2] *See SEWRPC Planning Report No. 30, A Regional Water Quality Management Plan for Southeastern Wisconsin: 2000, Volume One, Inventory Findings; Volume Two, Alternative Plans; and Volume Three, Recommended Plan.*

Table 5

LOCAL GOVERNMENTAL MANAGEMENT AGENCY DESIGNATIONS AND SELECTED RESPONSIBILITIES FOR URBAN NONPOINT SOURCE CONTROL IN THE ROOT RIVER WATERSHED

Urban Nonpoint Source Management Agency	Undertake Onsite Sanitary Disposal System Management Program	Undertake Construction Erosion Control Program	Develop and Implement Detailed Plan to Achieve 50 Percent Reduction in Pollutant Runoff	Conduct Informational and Educational Programs	Provide Technical Assistance	Provide Fiscal Support to Soil and Water Conservation Districts
Kenosha County	X	X	--	X	--	X
Kenosha County Soil and Water Conservation District	--	--	--	--	X	--
Milwaukee County	X[a]	X	--	X	--	X
Milwaukee County Soil and Water Conservation District	--	--	--	--	X	--
City of Franklin	X[a]	X	X	X	--	--
City of Greenfield	--	X	X	X	--	--
City of Oak Creek	X[a]	X	X	X	--	--
City of West Allis	--	X	X	X	--	--
Village of Greendale	--	X	X	X	--	--
Village of Hales Corners	--	X	X	X	--	--
Racine County	X	X	--	X	--	X
Racine County Soil and Water Conservation District	--	--	--	--	X	--
City of Racine	--	X	X	X	--	--
Village of Union Grove	--	X	X	X	--	--
Town of Caledonia	--	--	X	X	--	--
Town of Mt. Pleasant	--	--	X	X	--	--
Town of Yorkville Sanitary District No. 1	--	--	X	X	--	--
Town of Raymond	--	--	X	X	--	--
Waukesha County	--	X	--	X	--	X
Waukesha County Soil and Water Conservation District	--	--	--	--	X	--
Waukesha County Board of Health	X	--	--	X	--	--
City of Muskego	--	X	X	X	--	--
City of New Berlin	--	X	X	X	--	--

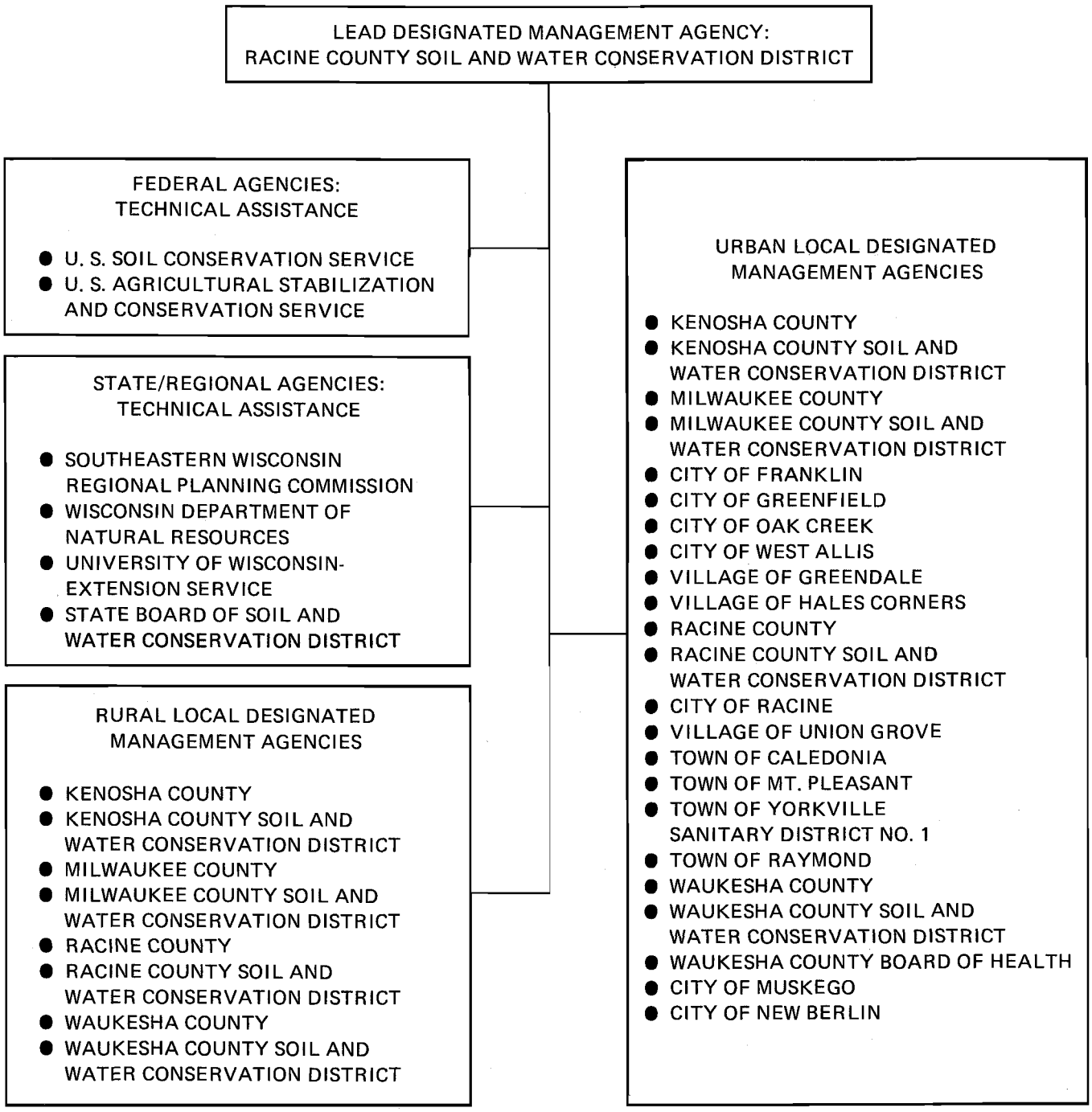
[a] *State law requires Milwaukee County to adopt a countywide sanitary ordinance by July 1980. Accordingly, the onsite sewage disposal system management functions required in the Cities of Franklin and Oak Creek can be performed by Milwaukee County. As of January 1980, local discussions had been initiated to consider the licensing and inspection in the program by these two cities under contract to Milwaukee County.*

Source: SEWRPC.

exceeded the fecal coliform standard. Dissolved oxygen levels for the watershed as a whole averaged 6.7 milligrams per liter (mg/l), or above the recommended standard of 5 mg/l for support of warmwater fish and aquatic life. Seventy, or 39 percent, of the 180 water samples analyzed violated the dissolved oxygen standards. The average total phosphorus concentration measured in the watershed was 0.58 mg/l, or nearly six times the standard of 0.1 mg/l recommended to support recreational use. All but two of the 48 samples analyzed exceeded the phosphorus standard. Occasional violations of the un-ionized ammonia-nitrogen standard were also recorded in the Root River watershed. Analyses conducted with the use of the Regional Planning Commission's water quality simulation model also indicated substantial violations of the fecal coliform, phosphorus, and dissolved oxygen standards, as set forth in Map 4. The analyses further indicated that future violations of the fecal coliform and phosphorus standards can be expected throughout the watershed,

Figure 1

GOVERNMENTAL AGENCIES INVOLVED IN THE ROOT RIVER WATERSHED NONPOINT SOURCE POLLUTION ABATEMENT PROGRAM



Source: Racine County Soil and Water Conservation District and SEWRPC.

Table 6

LOCAL GOVERNMENTAL MANAGEMENT AGENCY DESIGNATIONS AND SELECTED RESPONSIBILITIES FOR RURAL NONPOINT SOURCE CONTROL IN THE ROOT RIVER WATERSHED

Rural Nonpoint Source Management Agency	Undertake Livestock Waste Control Program	Develop and Implement Detailed Plan to Achieve 50 Percent Reduction in Pollutant Runoff	Conduct Informational and Educational Programs	Provide Technical Assistance	Provide Fiscal Support to Soil and Water Conservation District
Kenosha County	X	--	X	--	X
Kenosha County Soil and Water Conservation District	X	X	--	X	--
Milwaukee County	X	--	X	--	X
Milwaukee County Soil and Water Conservation District	X	X	--	X	--
Racine County	X	--	X	--	X
Racine County Soil and Water Conservation District	X	X	--	X	--
Waukesha County	X	--	X	--	X
Waukesha County Soil and Water Conservation District	X	X	--	X	--

Source: SEWRPC.

and that violations of the dissolved oxygen standard can be expected in the Root River Canal, if no nonpoint source control measures are implemented.

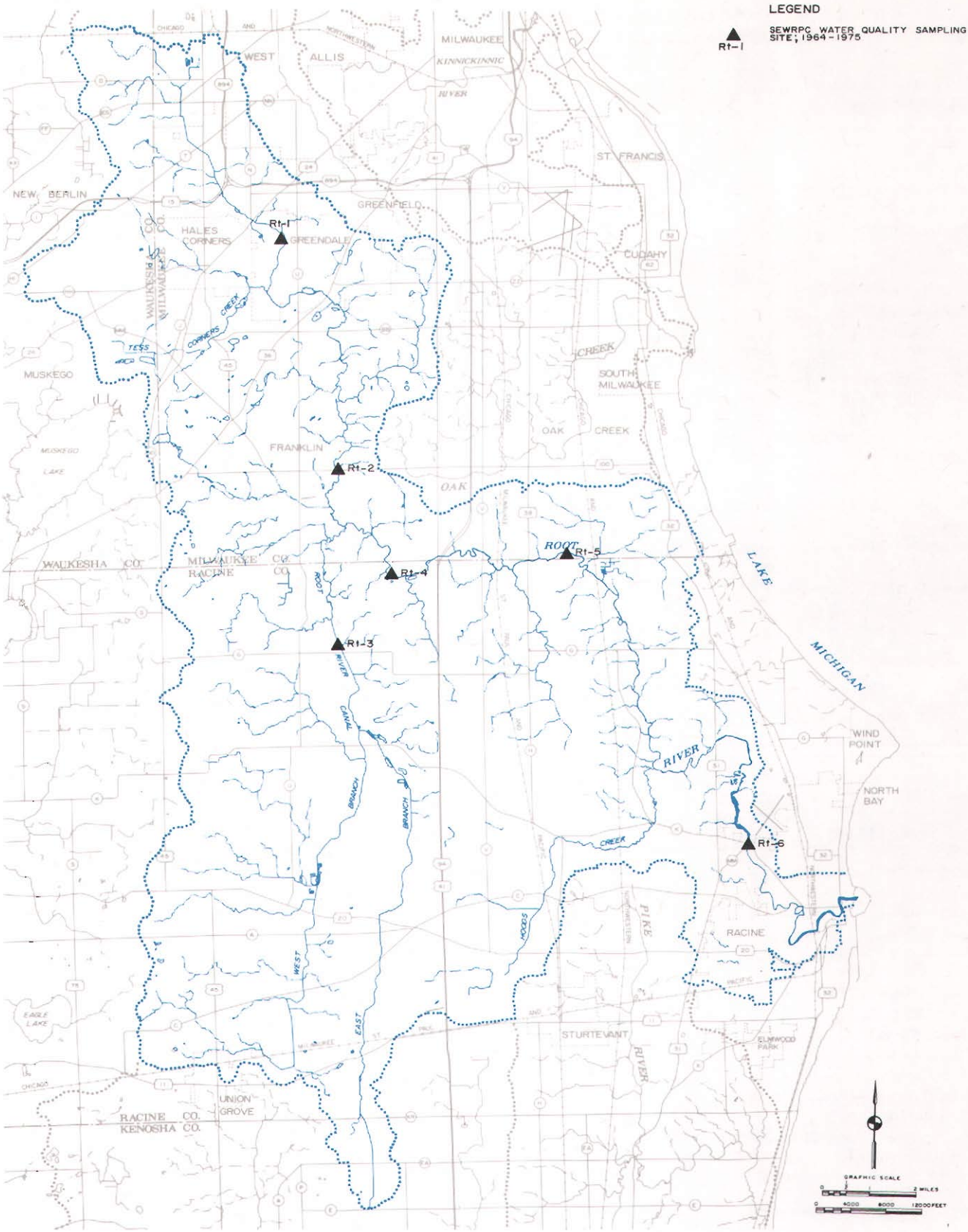
A simplified indicator of the bacteriological safety of water is the test for fecal coliform. Fecal coliform tests are used as an indicator of the presence of enteric bacteria and viruses, which cause serious diseases in humans and animals. Bacteria and viruses can be transmitted by drinking water, food, swimming, or other means of exposure. Water-borne diseases include typhoid fever, cholera, hepatitis-A, salmonellosis, giardiasis, and gastroenteritis.[3]

An especially offensive type of water pollution occurs when excessive amounts of putrescible organic materials, which require oxygen for decomposition, are contributed to waters. Since algae and other aquatic plants produce oxygen through photosynthesis during the daylight hours and consume oxygen by respiration at night, these plants may cause large daily fluctuations in the dissolved oxygen concentrations of surface waters. Oxygen consumption by the bottom sediments may be a very important, widespread cause of low dissolved oxygen levels in the Root River watershed. Organic bottom sediments, formed by the deposition of organic soils and solids and aquatic plant and animal remains, may exert significant oxygen demands on the overlying water column. Low dissolved oxygen concentrations in surface waters create an unsuitable environment for fish and other desirable forms of aquatic life, and the absence of dissolved oxygen leads to a septic or anaerobic condition with its associated

[3] *National Research Council, Drinking Water and Health, 1977.*

Map 3

SEWRPC WATER QUALITY SAMPLING SITES IN THE ROOT RIVER WATERSHED: 1964-1975



The Southeastern Wisconsin Regional Planning Commission conducted a water quality sampling program from 1964 to 1975 at these six stations. Measurements were taken for the following parameters: chloride, dissolved oxygen, ammonia-nitrogen, organic-nitrogen, nitrite-nitrogen, nitrate-nitrogen, total nitrogen, specific conductance, orthophosphate phosphorus, total phosphorus, fecal coliform, temperature, and pH. Water quality standards for fecal coliform, total phosphorus, and dissolved oxygen were frequently violated.

Source: SEWRPC.

Table 7

WATER QUALITY CONDITIONS OF THE ROOT RIVER AT SAMPLING STATION RT-1: 1968-1975

Parameter	SEWRPC Recommended Level/Standard	Numerical Value			Number of Analyses	Number of Times the Recommended Level/Standard Was Not Met
		Maximum	Average	Minimum		
Chloride (mg/l)	--	395	147	48	22	--
Dissolved Oxygen (mg/l)	5.0	9.9	5.2	2.2	30	16[b]
Ammonia-N (mg/l)	0.02[a]	0.44	0.25	0.03	8	0
Organic-N (mg/l)	--	1.19	0.80	0.10	8	--
Total-N (mg/l)	--	2.89	1.62	0.22	8	--
Specific Conductance (µmhos/cm at 25°C)	--	1,733	1,103	464	30	--
Nitrite-N (mg/l)	--	0.28	0.11	0.00	12	--
Nitrate-N (mg/l)	--	1.08	0.44	0.12	12	--
Soluble Orthophosphate-P (mg/l)	--	0.58	0.32	0.05	12	--
Total Phosphorus (mg/l)	0.1	0.53	0.18	0.07	8	6
Fecal Coliform (MFFCC/100 ml)	400	32,000	3,253	140	12	8
Temperature (°F)	89.0	77.0	69.9	59.5	30	0
Hydrogen Ion Concentrations (pH) (standard units)	6-9	8.3	7.9	7.6	22	0

[a] *The recommended standard applies to un-ionized ammonia-nitrogen. The numerical values shown are total ammonia-nitrogen.*

[b] *The concentrations were below the water quality standard of 5.0 mg/l for dissolved oxygen.*

Source: SEWRPC.

Table 8

WATER QUALITY CONDITIONS OF THE ROOT RIVER AT SAMPLING STATION RT-2: 1968-1975

Parameter	SEWRPC Recommended Level/Standard	Numerical Value			Number of Analyses	Number of Times the Recommended Level/Standard Was Not Met
		Maximum	Average	Minimum		
Chloride (mg/l)	--	158	93	58	22	--
Dissolved Oxygen (mg/l)	5.0	11.6	7.0	2.3	30	4[b]
Ammonia-N (mg/l)	0.02[a]	0.23	0.16	0.03	8	0
Organic-N (mg/l)	--	1.57	1.12	0.63	8	--
Total-N (mg/l)	--	2.70	1.98	0.97	8	--
Specific Conductance (µmhos/cm at 25°C)	--	1,188	961	752	30	--
Nitrite-N (mg/l)	--	0.12	0.07	0.01	12	--
Nitrate-N (mg/l)	--	0.81	0.56	0.12	12	--
Soluble Orthophosphate-P (mg/l)	--	0.80	0.41	0.16	12	--
Total Phosphorus (mg/l)	0.1	0.55	0.43	0.07	8	8
Fecal Coliform (MFFCC/100 ml)	400	13,000	2,069	80	12	6
Temperature (°F)	89.0	82.0	74.6	67.0	30	0
Hydrogen Ion Concentrations (pH) (standard units)	6-9	8.8	8.2	7.6	22	0

[a] *The recommended standard applies to un-ionized ammonia-nitrogen. The numerical values shown are total ammonia-nitrogen.*

[b] *The concentrations were below the water quality standard of 5.0 mg/l for dissolved oxygen.*

Source: SEWRPC.

Table 9

WATER QUALITY CONDITIONS OF THE ROOT RIVER AT SAMPLING STATION RT-3: 1968-1975

Parameter	SEWRPC Recommended Level/Standard	Numerical Value			Number of Analyses	Number of Times the Recommended Level/Standard Was Not Met
		Maximum	Average	Minimum		
Chloride (mg/l)	--	194	85	40	22	--
Dissolved Oxygen (mg/l)	3.0	12.4	3.8	0.5	30	14[c]
Ammonia-N (mg/l)	0.2[a]	4.09	1.65	0.15	8	0
Organic-N (mg/l)	--	2.73	2.10	1.70	8	--
Total-N (mg/l)	--	7.58	5.47	3.00	8	--
Specific Conductance (µmhos/cm at 25°C)	--	1,347	841	775	30	--
Nitrite-N (mg/l)	--	0.40	0.24	0.04	12	--
Nitrate-N (mg/l)	--	2.86	1.48	0.21	12	--
Soluble Orthophosphate-P (mg/l)	--	4.72	1.41	0.33	12	--
Total Phosphorus (mg/l)	--[b]	3.28	1.35	0.61	8	8
Fecal Coliform (MFFCC/100 ml)	400	25,000	2,900	40	12	7
Temperature (°F)	89.0	83.5	73.3	67.0	30	0
Hydrogen Ion Concentrations (pH) (standard units)	6-9	8.4	7.8	7.6	22	0

[a] *The recommended standard applies to un-ionized ammonia-nitrogen. The numeric values shown are total ammonia-nitrogen.*

[b] *No total phosphorus standard applies to the Root River Canal which is classified for limited recreational use and limited fishery and aquatic life.*

[c] *The concentrations were below the water quality standard of 3.0 mg/l for dissolved oxygen.*

Source: SEWRPC.

Table 10

WATER QUALITY CONDITIONS OF THE ROOT RIVER AT SAMPLING STATION RT-4: 1968-1975

Parameter	SEWRPC Recommended Level/Standard	Numerical Value			Number of Analyses	Number of Times the Recommended Level/Standard Was Not Met
		Maximum	Average	Minimum		
Chloride (mg/l)	--	114	84	42	22	--
Dissolved Oxygen (mg/l)	5.0	23.0	8.4	4.1	30	21[b]
Ammonia-N (mg/l)	0.02[a]	1.73	0.32	0.03	8	1
Organic-N (mg/l)	--	2.02	1.44	0.72	8	--
Total-N (mg/l)	--	6.01	3.45	1.09	8	--
Specific Conductance (µmhos/cm at 25°C)	--	1,180	956	688	30	--
Nitrite-N (mg/l)	--	0.38	0.16	0.01	12	--
Nitrate-N (mg/l)	--	3.43	1.54	0.36	12	--
Soluble Orthophosphate-P (mg/l)	--	1.94	0.63	0.19	12	--
Total Phosphorus (mg/l)	0.1	0.67	0.59	0.45	8	8
Fecal Coliform (MFFCC/100 ml)	400	3,400	843	90	12	9
Temperature (°F)	89.0	86.0	75.6	67.0	30	0
Hydrogen Ion Concentrations (pH) (standard units)	6-9	9.0	8.1	7.8	22	0

[a] *The recommended standard applies to un-ionized ammonia-nitrogen. The numeric values shown are total ammonia-nitrogen.*

[b] *The concentrations were below the water quality standard of 5.0 mg/l for dissolved oxygen.*

Source: SEWRPC.

Table 11

WATER QUALITY CONDITIONS OF THE ROOT RIVER AT SAMPLING STATION RT-5: 1968-1975

Parameter	SEWRPC Recommended Level/Standard	Numerical Value			Number of Analyses	Number of Times the Recommended Level/Standard Was Not Met
		Maximum	Average	Minimum		
Chloride (mg/l)	--	134	89	39	22	--
Dissolved Oxygen (mg/l)	5.0	23.0	8.4	2.2	30	6[b]
Ammonia-N (mg/l)	0.02[a]	0.43	0.21	0.00	8	1
Organic-N (mg/l)	--	1.92	1.45	0.70	8	--
Total-N (mg/l)	--	5.02	3.22	1.14	8	--
Specific Conductance (μmhos/cm at 25°C)	--	1,065	896	591	30	--
Nitrite-N (mg/l)	--	0.19	0.11	0.02	12	--
Nitrate-N (mg/l)	--	2.86	1.32	0.34	12	--
Soluble Orthophosphate-P (mg/l)	--	0.94	0.58	0.30	12	--
Total Phosphorus (mg/l)	0.1	0.61	0.48	0.30	8	8
Fecal Coliform (MFFCC/100 ml)	400	36,000	6,144	530	12	12
Temperature (°F)	89.0	87.0	76.9	70.0	30	0
Hydrogen Ion Concentrations (pH) (standard units)	6-9	9.3	8.5	7.8	22	4

[a] *The recommended standard applies to un-ionized ammonia-nitrogen. The numeric values shown are total ammonia-nitrogen.*

[b] *The concentrations were below the water quality standard of 5.0 mg/l for dissolved oxygen.*

Source: SEWRPC.

Table 12

WATER QUALITY CONDITIONS OF THE ROOT RIVER AT SAMPLING STATION RT-6: 1968-1975

Parameter	SEWRPC Recommended Level/Standard	Numerical Value			Number of Analyses	Number of Times the Recommended Level/Standard Was Not Met
		Maximum	Average	Minimum		
Chloride (mg/l)	--	150	89	38	22	--
Dissolved Oxygen (mg/l)	5.0	9.2	7.6	5.4	30	0[b]
Ammonia-N (mg/l)	0.02[a]	2.23	0.38	0.03	8	1
Organic-N (mg/l)	--	2.50	1.42	0.79	8	--
Total-N (mg/l)	--	6.03	2.95	1.32	8	--
Specific Conductance (μmhos/cm at 25°C)	--	1,133	940	585	30	--
Nitrite-N (mg/l)	--	0.15	0.07	0.03	12	--
Nitrate-N (mg/l)	--	3.21	1.17	0.17	12	--
Soluble Orthophosphate-P (mg/l)	--	0.67	0.36	0.21	12	--
Total Phosphorus (mg/l)	0.1	0.61	0.43	0.30	8	8
Fecal Coliform (MFFCC/100 ml)	400	1,700	528	30	12	5
Temperature (°F)	89.0	83.0	73.4	62.0	30	0
Hydrogen Ion Concentrations (pH) (standard units)	6-9	8.7	8.3	7.8	22	0

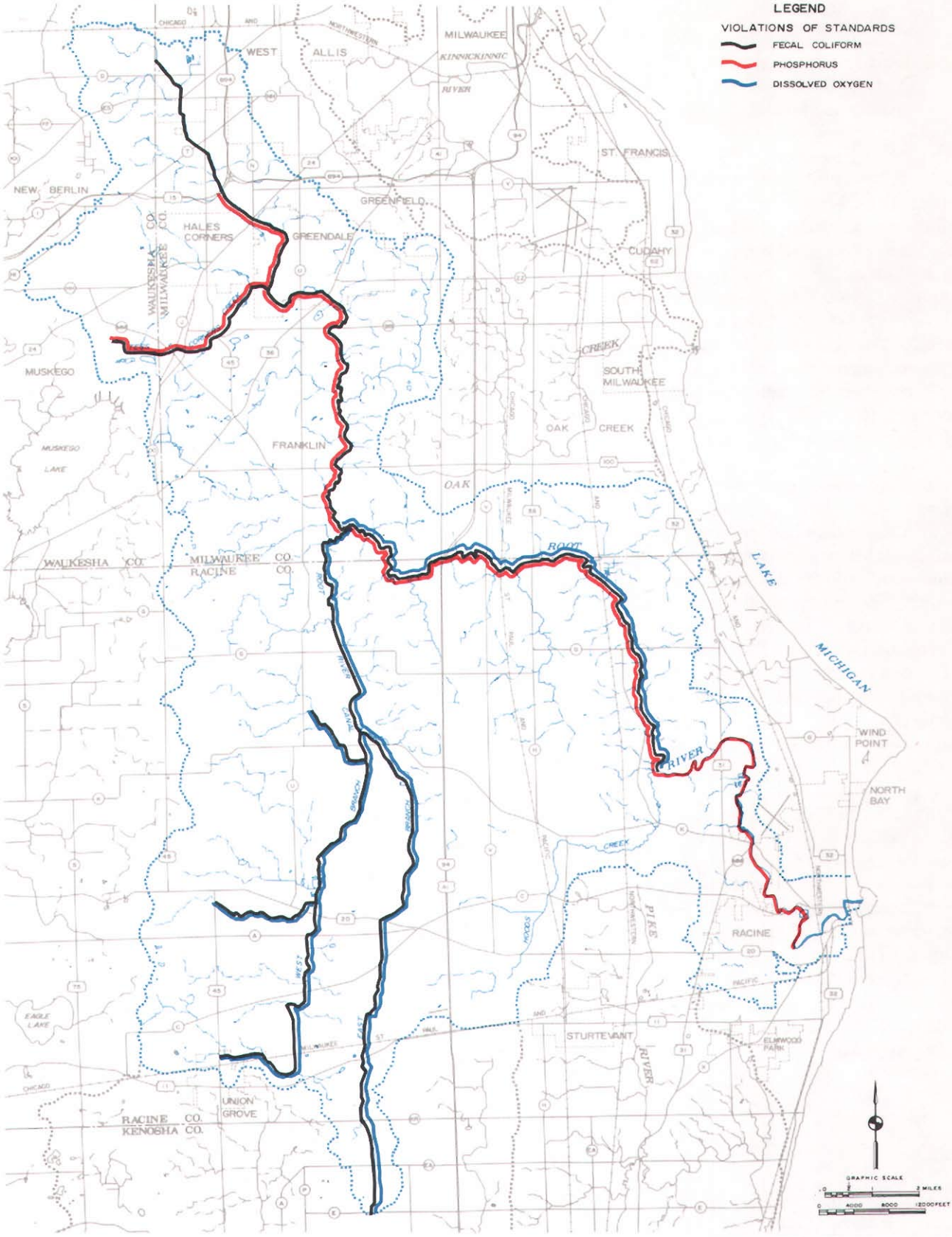
[a] *The recommended standard applies to un-ionized ammonia-nitrogen. The numeric values shown are total ammonia-nitrogen.*

[b] *The concentrations were below the water quality standard of 5.0 mg/l for dissolved oxygen.*

Source: SEWRPC.

Map 4

COMPARISON OF SIMULATED WATER QUALITY DATA TO THE RECOMMENDED WATER QUALITY STANDARDS FOR FECAL COLIFORM, PHOSPHORUS, AND DISSOLVED OXYGEN: 1975



The water quality of streams in the Root River watershed was analyzed using available water quality sampling data and a water quality simulation model developed under the Regional Planning Commission's areawide water quality management planning program. Substantial violations of existing fecal coliform and dissolved oxygen standards and of the recommended phosphorus standard are estimated to occur under existing conditions. These violations are expected to continue in the future if no action is taken to control both point and nonpoint sources of pollution. No phosphorus standard applies to the Root River Canal because of the limited-use objectives established for that stream.

Source: SEWRPC.

foul odors and unpleasant appearance. Anaerobic conditions also increase the rate of release of toxic materials and nutrients from the sediments and increase denitrification rates.

High phosphorus levels in surface waters can stimulate excessive algae and other aquatic plant growths. The Regional Planning Commission's water quality simulation modeling analyses indicate that algae growth within the Root River and its tributaries is usually limited by phosphorus—as opposed to other nutrients—during those periods of time when nuisance growth conditions are likely to occur. Algae can be responsible for unpleasant visual and odor conditions and reduced light penetration, and can color the water. Excessive growths of algae and other aquatic plants can destroy the recreational and aesthetic values of waters. Macrophytes (rooted water weeds) can interfere with swimming, boating, and fishing.

Water quality researchers have developed a method of using aquatic insects as an indicator of water quality. This technique, referred to as the Biotic Index, is a measure of overall water quality based on the type and number of aquatic insects in a stream.[4] The Biotic Index assumes that certain species of insect larvae can tolerate only relatively low levels of pollution. The most important water quality parameter which determines the insect types and populations in a stream is dissolved oxygen. The condition of the stream bottom substrate also influences the types and amount of insect types present.

To calculate the Biotic Index, each species collected is assigned a numeric value ranging from zero to five. Species intolerant of pollution receive a low number, while pollution-tolerant species are assigned a higher value. About 100 organisms are collected at each site; the organisms are identified and quantified; and the individual values are averaged to determine the Biotic Index value. The ranges of Biotic Index values are classified according to various levels of water quality, as set forth in Table 13.

Table 14 and Map 5 present the Biotic Index ratings for 20 sites in the watershed sampled in 1979. Portions of the Root River main stem within Milwaukee County, Raymond Creek, the Yorkville Tributary, Hoods Creek, Husher Creek, Whitnall Park Creek, and the East Branch of the Root River Canal were classified as having very poor water quality. The remaining stream sites were classified as having poor water quality, with the exception of one site on the Root River near the Milwaukee-Racine County line, which was classified as having fair water quality. The average Biotic Index value for the entire watershed was 3.86, which indicates very poor water quality.

The quantity of pollutants transported in the Root River at State Trunk Highway (STH) 38 in the City of Racine was estimated based on streamflow and pollutant concentration measurements. Streamflow data were available for the Root River at Racine from the U. S. Geological Survey for the years 1963 to 1975. Pollutant concentration measurements were available from the Regional Planning Commission and from the Wisconsin Department of Natural Resources. At the Root River at Racine, it is estimated from these in-stream measurements that about 1.1 million pounds of nitrogen, 90,000 pounds of phosphorus, 1.9 million pounds of biochemical oxygen demand, and 38,100 tons of sediment are transported annually.

POLLUTION SOURCES AND MANAGEMENT NEEDS

The Regional Planning Commission estimated that, as of 1975, nonpoint sources contributed the majority of the pollutants discharged to the streams in the Root River watershed, based on annual mass loadings.[5] However, the Commission's water quality simulation modeling analyses indicated that point sources are also important contributors of pollution. These include 4 public and 10 private sewage treatment plants, 13 industrial wastewater outfalls, and 61 sanitary and combined sewage flow relief devices which discharge raw,

[4] *William L. Hilsenhoff, Use of Arthropods to Evaluate Water Quality of Streams, Wisconsin Department of Natural Resources, Technical Bulletin No. 100, 1977.*

[5] *See SEWRPC Technical Report No. 21, Sources of Water Pollution in Southeastern Wisconsin: 1975, 1978.*

Table 13

WATER QUALITY CLASSIFICATION BASED ON THE BIOTIC INDEX

Biotic Index	Water Quality Classification	Typical Description of Stream
0.00-1.75	Excellent	Clean, undisturbed
1.76-2.25	Good	Slight organic enrichment or disturbance
2.26-3.00	Fair	Moderate organic enrichment or disturbance
3.01-3.75	Poor	High organic enrichment or disturbance
3.76-5.00	Very Poor	Very high organic enrichment or disturbance

Source: Wisconsin Department of Natural Resources.

partially treated, and treated wastewaters to the stream system. In particular, point sources cause substantial violations of the phosphorus and dissolved oxygen standards during low flow conditions. Point source pollution also contributes to the accumulation of organic material on the stream bottom. Point sources of pollution adversely affect about 87 stream miles in the watershed, or about 88 percent of the approximately 99 total stream miles in the watershed, as shown on Map 6.

Nonpoint source pollutant loads are contributed to the streams within the watershed by both urban and rural sources. Although there is substantial urban development within the upstream areas in Milwaukee County and near the river's mouth in the City of Racine, about 77 percent of the watershed remains in rural land uses, with about 88 percent of this area still in agricultural use as of 1975. A description of the extent of specific nonpoint sources inventoried in the summer of 1979 under the priority watershed planning program, together with an assessment of nonpoint source control needs in the watershed, is discussed below.

Urban Nonpoint Sources of Pollution

Urban nonpoint sources in the Root River watershed include 1) runoff from residential, commercial, industrial, transportation, and recreational land uses; 2) recreational activities; 3) roadside and stream bank erosion; 4) landfill sites; 5) malfunctioning onsite sanitary waste disposal systems; and 6) construction site erosion.

Urban Land Runoff: Since there are 28,900 acres of developed urban land in the watershed, there is a great potential for the discharge of pollutants into the stream system.[6] The primary responsibility for management of urban areas lies with the public works departments of the municipalities. The public works activities of each incorporated and unincorporated municipality in the watershed are listed in Table 15 and shown on Map 7.

Citizens are encouraged by all municipalities, except the Cities of New Berlin and Muskego, the Towns of Raymond and Caledonia, and the Town of Yorkville Sanitary District No. 1, to bag their leaves for pickup. Bagged leaves are picked up by municipal collection crews. Solid waste collection is done on a weekly basis in residential areas, except in the Cities of New Berlin and Muskego, the Towns of Caledonia and Raymond, and the Town of Yorkville Sanitary District No. 1, which do not provide a solid waste collection service. Large apartment dwellings and industrial plants in most cases contract for solid waste collection services.

All municipalities, except the Town of Yorkville Sanitary District No. 1, use salt on their roads for ice control during the winter months. Some municipalities use a sand-salt mixture, and some use salt alone. Salt and sand are applied heavily on major arterial streets and at dangerous intersections.

Street sweeping can be an effective method of nonpoint source control in urban areas. Table 16 gives the frequency of street sweeping practiced by each municipality. Generally, the larger municipalities sweep their streets more often, while many of the smaller communities do not sweep at all.

Automobile Sales and Service Facilities: Within the watershed, automobile sales and service facilities are significant sources of nonpoint source pollution. Sales and service facility personnel—and many private citizens—often dispose of lubricants, transmission fluid, oil, and antifreeze in storm

[6] *Urban land uses include residential, commercial, industrial, transportation, and recreational land uses and land under construction in both the incorporated and unincorporated areas of the watershed.*

Table 14

BIOTIC INDEX RATINGS IN THE ROOT RIVER WATERSHED: 1979

Site Number	Stream	U. S. Public Land Survey Designation	Biotic Index Value	Water Quality Classification
1	Root River	T6N-R21E, Section 18, SE 1/4	4.81	Very poor
2	Root River	T5N-R21E, Section 3, SE 1/4	3.91	Very poor
3	Root River	T5N-R21E, Section 35, NW 1/4	3.18	Poor
4	Root River	T4N-R22E, Section 4, NW 1/4	2.81	Fair
5	Root River	T4N-R22E, Section 14, NW 1/4	3.06	Poor
6	Root River	T4N-R22E, Section 25, SW 1/4	3.38	Poor
7	Root River	T3N-R23E, Section 8, SW 1/4	3.01	Poor
8	Raymond Creek	T4N-R21E, Section 3, SE 1/4	3.90	Very poor
9	Yorkville Tributary	T3N-R21E, Section 9, NE 1/4	4.58	Very poor
10	Hoods Creek	T3N-R22E, Section 17, NE 1/4	4.95	Very poor
11	Hoods Creek	T3N-R22E, Section 4, NE 1/4	4.69	Very poor
12	Hoods Creek	T4N-R22E, Section 26, SW 1/4	4.10	Very poor
13	Hoods Creek	T4N-R22E, Section 25, SE 1/4	3.55	Poor
14	Husher Creek	T4N-R22E, Section 5, NE 1/4	4.04	Very poor
15	Whitnall Park Creek	T5N-R21E, Section 5, NE 1/4	3.78	Very poor
16	Franklin Tributary	T5N-R21E, Section 14, NW 1/4	3.33	Poor
17	Kilbournville Tributary	T4N-R21E, Section 1, SE 1/4	3.54	Poor
18	West Branch, Root River Canal	T4N-R21E, Section 3, SE 1/4	3.71	Poor
19	East Branch, Root River Canal	T3N-R21E, Section 11, SE 1/4	3.98	Very poor
20	East Branch, Root River Canal	T4N-R21E, Section 23, SE 1/4	4.81	Very poor

Source: Wisconsin Department of Natural Resources.

sewers. Detergent, wax, grease, and debris are flushed into storm sewers by the washing of automobiles outside the service buildings.

Recreation-Related Activities: Recreation-related activities affecting water quality are shown on Map 8 and include the use of recreational vehicles (including four-wheel-drive automobiles, motorcycles, and snowmobiles), motor boating, and equestrian trail use.

Recreational vehicles cause severe stream bank erosion and gullies, especially when trails are adjacent to, or cross, the stream. Erosion by recreational vehicles is most common in the City of Greenfield and in the Town of Caledonia. Most recreational vehicle use found to cause erosion problems involves trespassing on public or private lands. There are no designated trails for recreational vehicle use in the watershed.

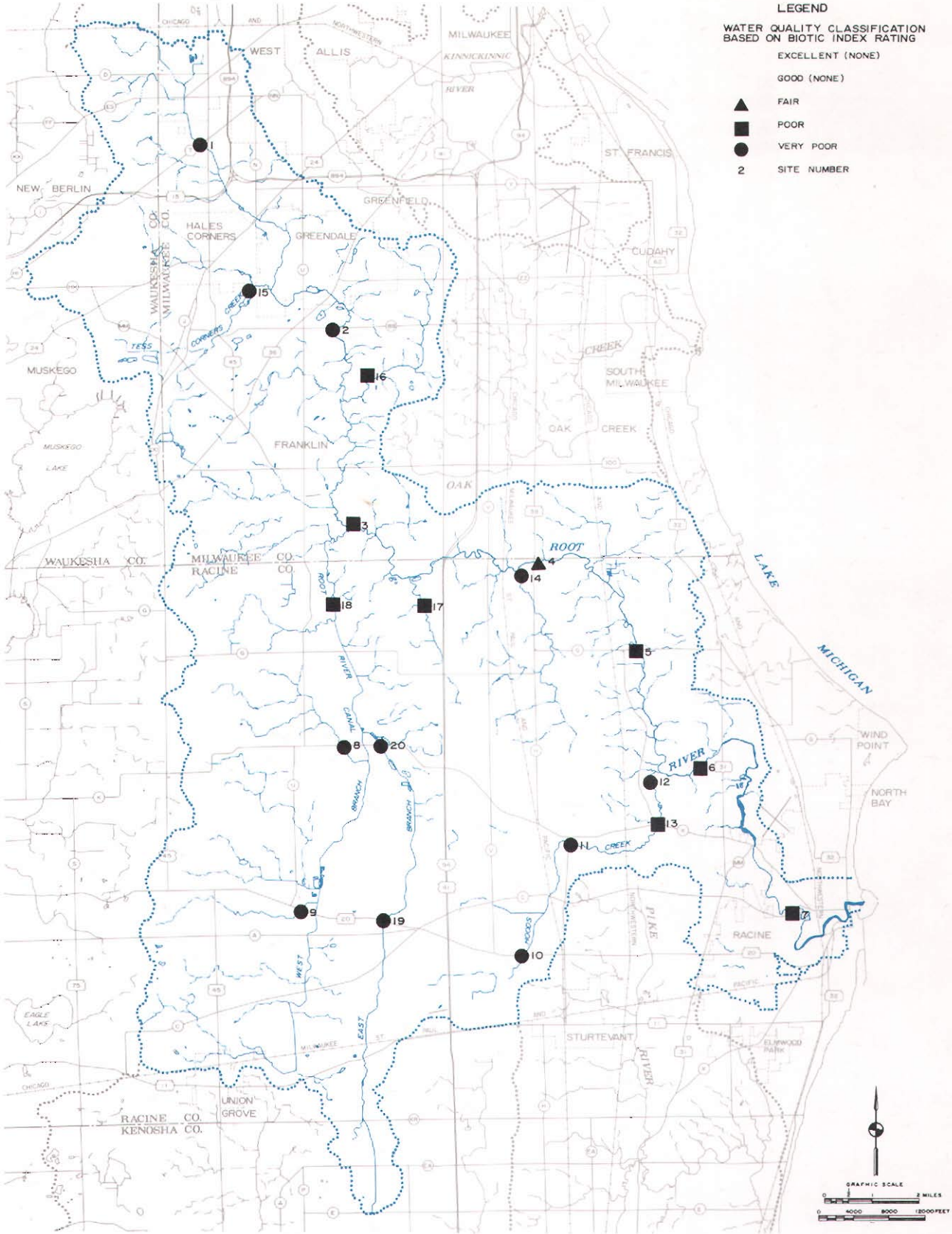
Hiking on unmarked trails along the river is a small contributor to gully erosion. The highest concentration of hiking trails is found in Johnson's Park in the Town of Caledonia. Eroded banks are found where people fish. Most of the eroded areas are adjacent to, or under, bridges.

In recent years, the increased use of motor boats has become a problem in the lower Root River within the Town of Caledonia, just upstream of the Horlick Dam. Wave action from motor boats is causing the banks to slowly erode, and an oil film is often apparent after the heavy use of motor boats.

Equestrian trails along the river were observed to be causing problems where trails are adjacent to streams and where streams are crossed. Properly constructed trails and animal crossings are needed to prevent gullies. Heavy equestrian use was found

Map 5

WATER QUALITY CLASSIFICATION OF THE ROOT RIVER WATERSHED: 1979

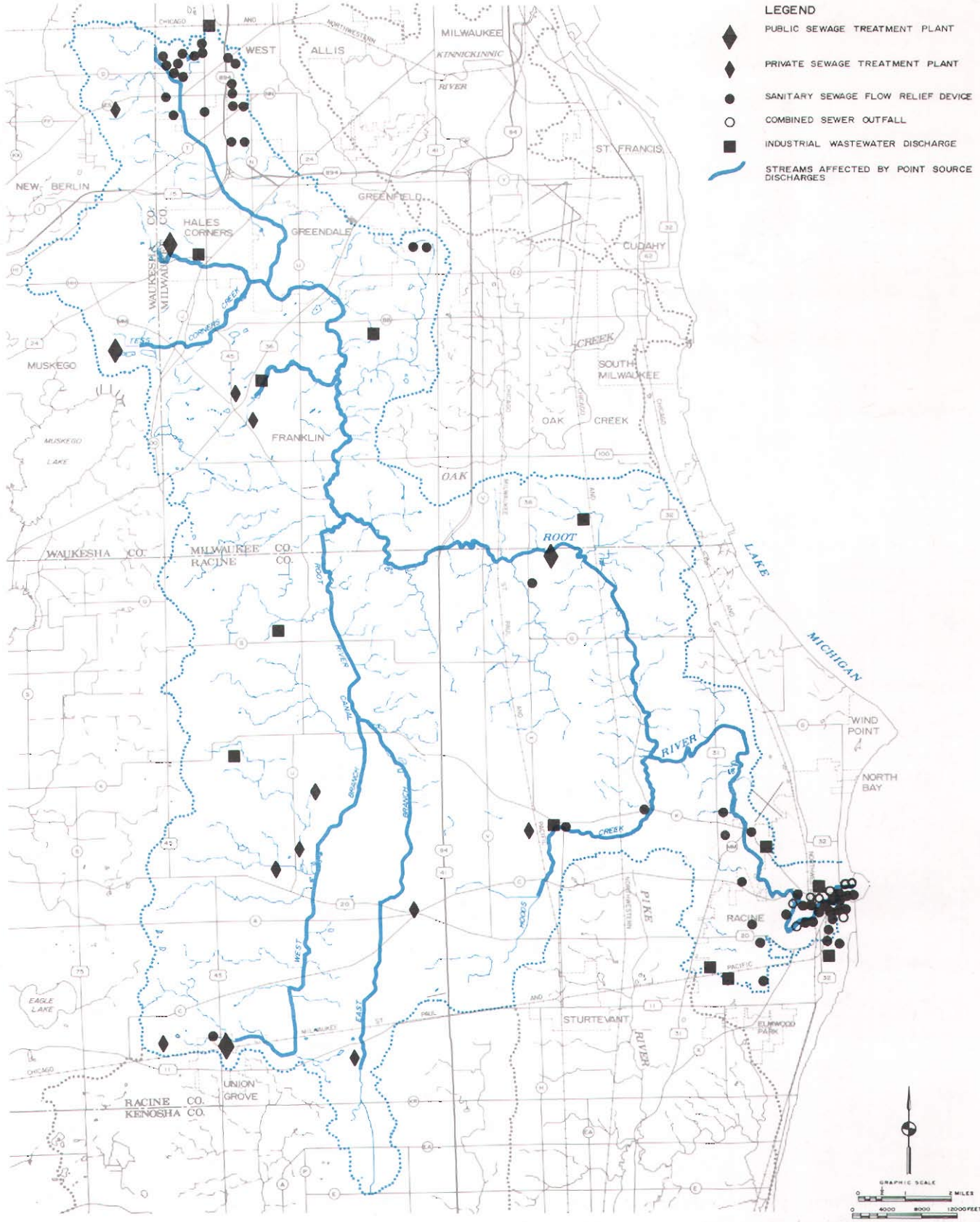


The water quality of the Root River watershed was classified with the use of a Biotic Index. The Biotic Index is a measure of overall water quality based on the type and number of aquatic insects in a stream. Portions of the Root River main stem within Milwaukee County, Raymond Creek, the Yorkville Tributary, Hoods Creek, Husher Creek, Whitnall Park Creek, and the East Branch of the Root River Canal were classified as having very poor water quality. The remaining sites were classified as having poor water quality, with the exception of one site of the Root River near the Milwaukee/Racine County line which was classified as having fair water quality. The average Biotic Index for the entire watershed indicated very poor water quality conditions.

Source: Wisconsin Department of Natural Resources.

Map 6

LOCATION OF POINT SOURCES OF WATER POLLUTION AND POINT SOURCE-AFFECTED STREAM REACHES IN THE ROOT RIVER WATERSHED: 1979



Four public and 10 private sewage treatment plants discharge treated wastewaters to the Root River system. As shown on this map, there are also 61 sewage flow relief devices and 13 industrial wastewater outfalls that discharge raw, partially treated, and treated wastewaters to the stream system. These point sources of discharge already affect about 87 stream miles, or about 88 percent of the total stream miles in the watershed.

Source: SEWRPC.

within parts of the Milwaukee County park system and in the tributaries to the Root River Canal and the lower Root River.

Roadside and Stream Bank Erosion: Roadside and stream bank erosion are common in the urban areas within the watershed. Over 13,000 feet of eroded stream bank were observed in the urban areas, most of which was located in the Cities of Greenfield and West Allis, and in the Village of Greendale. Most roadside erosion is associated with newly developed subdivisions. Approximately 40 roadside erosion sites were found in Milwaukee and Waukesha Counties. As shown on Map 8, the stream bank erosion sites were classified as slight, moderate, or severe, according to the condition of the stream banks, the extent of erosion, and the erodibility of the soils. Also shown on Map 8 are similar classifications of roadside erosion sites, based on the extent of erosion, the distance from a stream, and the condition and amount of vegetation along the roadside.

Landfill and Dump Sites: Landfill and dump sites can be a significant source of both surface water and groundwater pollution. The inventory indicated that four active dumps or landfills, five inactive (abandoned) dumps or landfills, and four unlicensed dumps are located in the watershed, as shown on Map 8. All of the active landfill and dump sites are located in Milwaukee County. One site is immediately adjacent to the Root River. The other sites have direct drainage through intermittent tributaries. Runoff from all active landfill and dump sites either directly or indirectly enters the Root River. Most active landfill and dump sites do not have a berm around them to prevent runoff from entering the river. A leaching problem was apparent in the landfill sites in the City of Franklin. There are two inactive landfill and dump sites immediately adjacent to the lower Root River. One is a slag dump and the other is an abandoned landfill site. Another inactive landfill site, located in the City of West Allis, was reportedly used to dispose of incinerator ashes up until about 10 years ago.

There are four unlicensed dumps within the watershed. An unlicensed dump located along the West Branch of the Root River Canal is currently being used by a farmer. The types of debris found there were household garbage, old lumber, and old machinery. A dump site along the East Branch of the Root River Canal, where gullies and uplands were covered with old furniture, tires, and metal scraps, is associated with Funk's Mobile Home Park. A dump site along Hoods Creek contains household garbage and filling debris. On the West Branch of the Root River Canal, there is an abandoned (closed) dump. However, when the area was surveyed, there was active dumping of household items. An abandoned site in the Town of Raymond, immediately adjacent to the Root River, is being used as a transfer station and is already being managed in accordance with site reclamation requirements developed through the Racine County zoning program. On the basis of the floodland-shoreland regulatory program, a design for riprapping about two-thirds of the stream bank along the Root River near this site had been prepared, while about one-third of the stream bank area has already been stabilized.

Onsite Sewage Disposal Systems: As of 1975, the sanitary and household wastewater from an estimated 27,530 persons, or about 18 percent of the total resident population of the watershed, was treated and disposed of through the use of onsite systems. The location and extent of urban development, as of 1975, which relies on such onsite sewage disposal systems, together with the suitability of soils for the use of such systems on lots one acre or less in size, is shown on Map 9. An onsite sewage disposal system may be a conventional septic tank system, a mound system, or a holding tank. As of 1975, there were 6,686 septic tank systems, 21 holding tanks, and 5 mound systems known to exist in the watershed.

When the soil surrounding the seepage area will no longer accept or properly stabilize the effluent, failure of the onsite sewage disposal system occurs. Malfunctioning is caused either by the groundwater rising to levels which will no longer allow for uptake of liquid effluent by the soils, age, or lack of proper maintenance. Hence, onsite sewage disposal system failure may result from 1) installation in soils with severe limitations for system use, 2) improper design or installation of the system, or 3) inadequate maintenance. In many older, improper installations, the effluent may not receive the benefit of soil filtration, but may discharge directly to a drain tile or culvert.

A precise identification of onsite sewage disposal system problems requires a sanitary survey. Malfunctioning septic systems would normally be expected to be observable only under conditions of high groundwater, or when directly connected to a drainage ditch or stream. At the time the inven-

Table 15

PUBLIC WORKS ACTIVITIES AND EROSION CONTROL ORDINANCES IN THE ROOT RIVER WATERSHED: 1979

Civil Division	Leaf Collection	Solid Waste Collection	Street Salting/Sanding for Ice Control	Snow Removal and Dumping	De-icing Salt Storage	Subdivision Erosion Control Ordinance	Street Sweeping
City of West Allis	X	X	X	X[a]	--	--	X
Village of Greendale	X	X	X	--	X	--[b]	X
City of Greenfield	X	X	X	X	--	--	--
Village of Hales Corners	X	X	X	--	--	--	--
City of New Berlin	--	--	X	--	--	--	--
City of Muskego	--	--	X	--	--	X	--
City of Racine	X	X	X	X	X	--[b]	X
Village of Union Grove	X	X	X	X	--	--	X
City of Oak Creek	X	X	X	--	--	--	X
City of Franklin	X	X	X	--	X	--[b]	--
Town of Caledonia	--	--	X	X	--	--	--
Town of Mt. Pleasant	X	X	X	--	X	--	X
Town of Yorkville Sanitary District No. 1	--	--	--	--	--	--	--
Town of Raymond	--	--	X	--	X	--	--

[a] *Snow is removed, but is not placed in watershed.*

[b] *Although the Cities of Racine and Franklin and the Village of Greendale do not have specific construction erosion control ordinances, these municipalities may, through special use agreements, require the use of erosion control measures by developers.*

Source: Racine County Soil and Water Conservation District and SEWRPC.

tory was conducted (during a dry period) there were only 10 noticeably malfunctioning septic systems, as shown on Map 8. Three of the malfunctioning septic systems had outlets into a road ditch. Seven of the malfunctioning septic systems had tile outlets leading directly to a stream.

Construction Activities: Construction activities generally involve soil disturbance and destruction of stable vegetative cover; changes in the physical and biological character of the land surface; and the discharge of large amounts of pollutants to surface waters. In 1975 there were about 2,860 acres of land undergoing construction activity in the watershed. In 1979, 35 developing subdivisions—ranging from four lots to about 200 lots—were noted. Eighteen of these subdivisions were located in Milwaukee County, 12 in Racine County, and five in Waukesha County.

Based on the size of the subdivision, the amount of soil exposed, the estimated soil loss, the soil conservation practices implemented, and the distance from stream or drainageway, the 35 subdivisions were classified as severe, moderate, or slight nonpoint pollution sources. As shown on Map 8, 17 of the subdivisions were classified as severe, 5 were rated as moderate, and 13 were classified as slight contributors of pollution.

Urban Nonpoint Source Controls: Alternative urban nonpoint source control practices to be considered by the urban designated management agencies are listed in Table 17. The appropriateness and acceptability of any practice to any specific municipality is dependent on the particular pollution sources which need to be controlled, existing land management activities, costs, public acceptance, and the physical characteristics of the land surface.

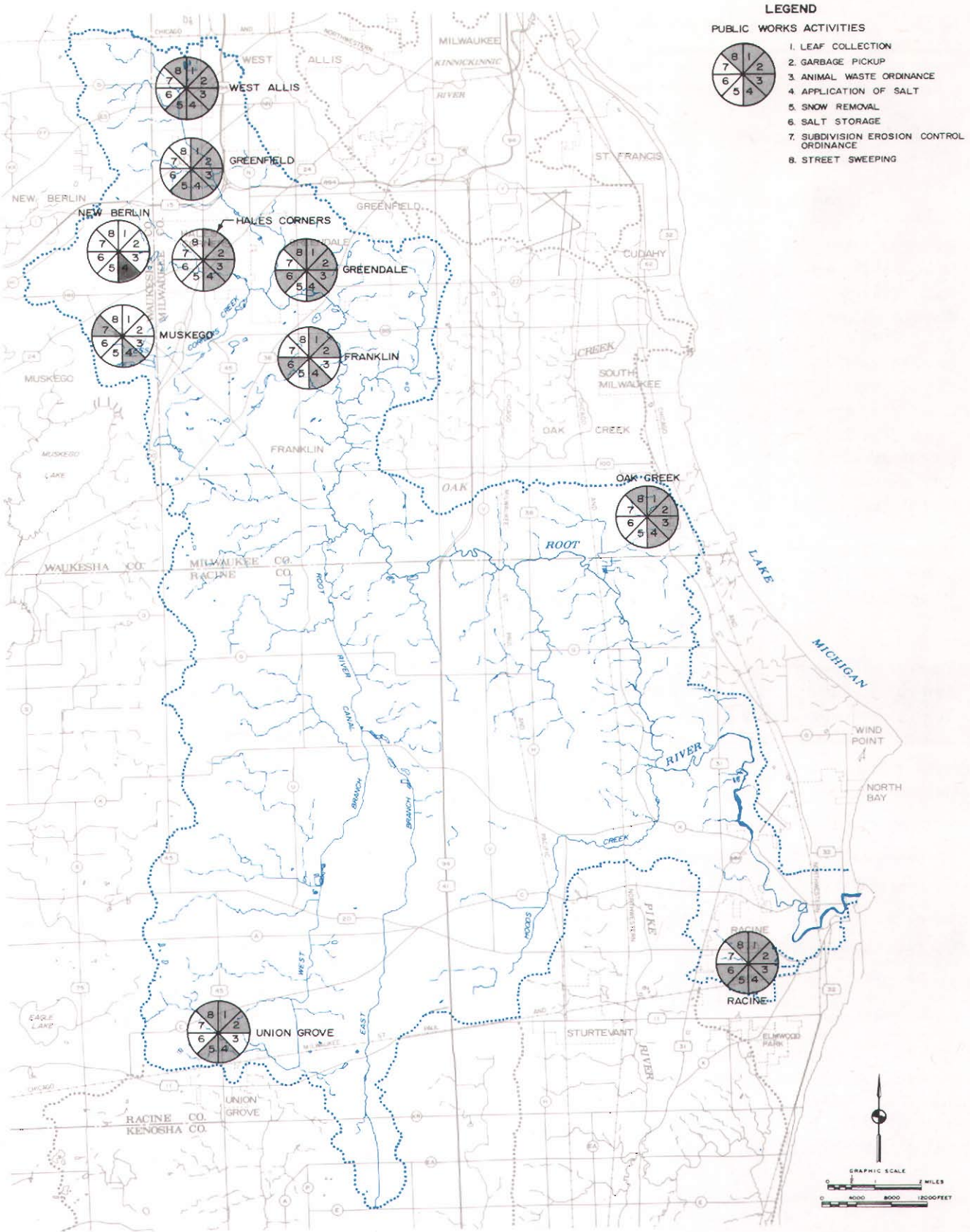
Rural Nonpoint Sources of Pollution

Rural nonpoint sources of water pollution include livestock operations, cropland storm water runoff, and stream bank and roadside erosion in rural areas.

Livestock Operations: If animal manure is transported by storm water runoff from a barnyard or from agricultural fields to which manure has been applied, or is directly deposited into a stream, it

Map 7

PUBLIC WORKS ACTIVITIES AND EROSION CONTROL ORDINANCES IN THE ROOT RIVER WATERSHED: 1979



The primary responsibility for the management of urban areas lies with the public works departments of the civil divisions. Leaf collection, solid waste collection, and street salting are the most common public works activities in the watershed. Snow removal and street sweeping are generally conducted by only the large municipalities. Only the City of Muskego has a subdivision erosion control ordinance.

Source: Racine County Soil and Water Conservation District and SEWRPC.

Table 16

STREET SWEEPING PRACTICES IN THE ROOT RIVER WATERSHED: 1979

Urban Management Agency	No Streets Are Swept	Street Sweeping Frequency During the Sweeping Season[c,d]		
		Once Every Month or Less	Once Every Two Weeks	Once Every Week
Kenosha County	X	--	--	--
Milwaukee County	--	X[a]	--	--
Racine County	--	X[b]	--	--
Waukesha County	--	X	--	--
City of Franklin[a]	X	--	--	--
City of Greenfield[a]	X	--	--	--
City of Muskego	X	--	--	--
City of New Berlin	X	--	--	--
City of Oak Creek[a]	--	X	--	--
City of Racine	--	--	X	--
City of West Allis[a]	--	--	X[e]	--
Village of Greendale[a]	--	--	--	X
Village of Hales Corners[a]	X	--	--	--
Village of Union Grove[b]	--	--	--	X[f]
Town of Caledonia	X	--	--	--
Town of Mt. Pleasant	--	X	--	--
Town of Raymond	X	--	--	--
Town of Yorkville Sanitary District No. 1	X	--	--	--

[a] *County highways A, BB, H, MM, OO, U, V, and Y, together with the state trunk highways and freeways, are swept by Milwaukee County.*

[b] *Portions of county highways C, G, H, K, MM, U, and Y are swept by Racine County.*

[c] *The sweeping season is approximately from April through November.*

[d] *Only streets with curb and gutter are swept.*

[e] *Business district streets are swept once every week.*

[f] *Main Street is swept once every week during the sweeping season; all other streets are swept twice per sweeping season.*

Source: Racine County Soil and Water Conservation District and SEWRPC.

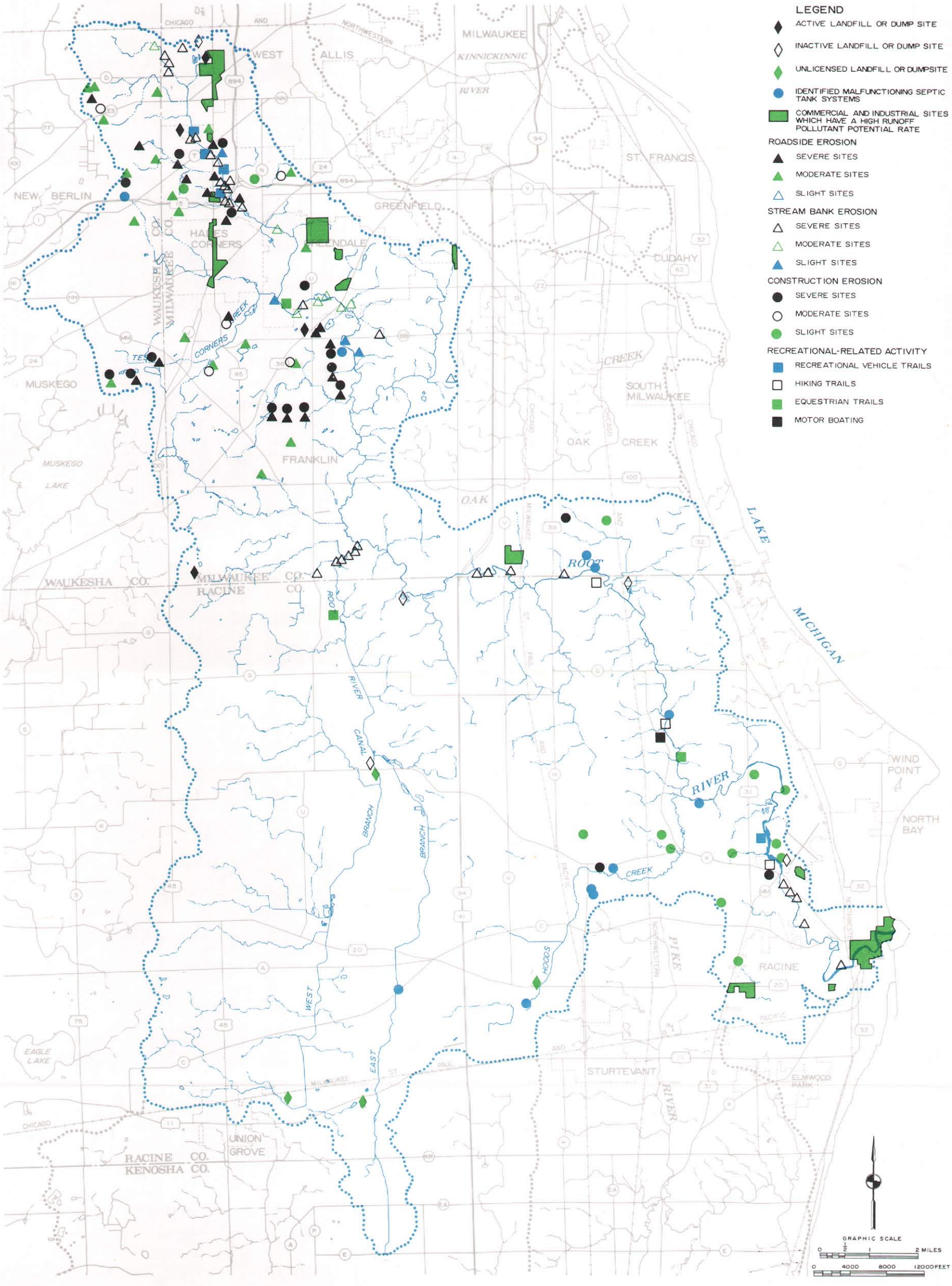
contributes nutrients, solids, oxygen-demanding substances, bacteria, and viruses to surface waters. Within the watershed, there were 82 livestock operations noted in the 1979 field inventory.[7] The largest livestock herd (excluding duck farms) in the watershed contains about 300 animal units. Each operation was classified as a very severe, severe, moderate, or slight pollution source, depending on distance to the stream, the number of animal units, and the slope of the barnyard. Table 18 sets forth the critieria used to classify livestock operations.

Within the watershed, 21, or 26 percent, of the 82 operations were rated as potentially being a very severe source for contributing pollutants to surface

[7] *Each animal unit represents the equivalent waste production of a 1,000-pound cow.*

Map 8

URBAN NONPOINT SOURCES OF POLLUTION IN THE ROOT RIVER WATERSHED: 1979

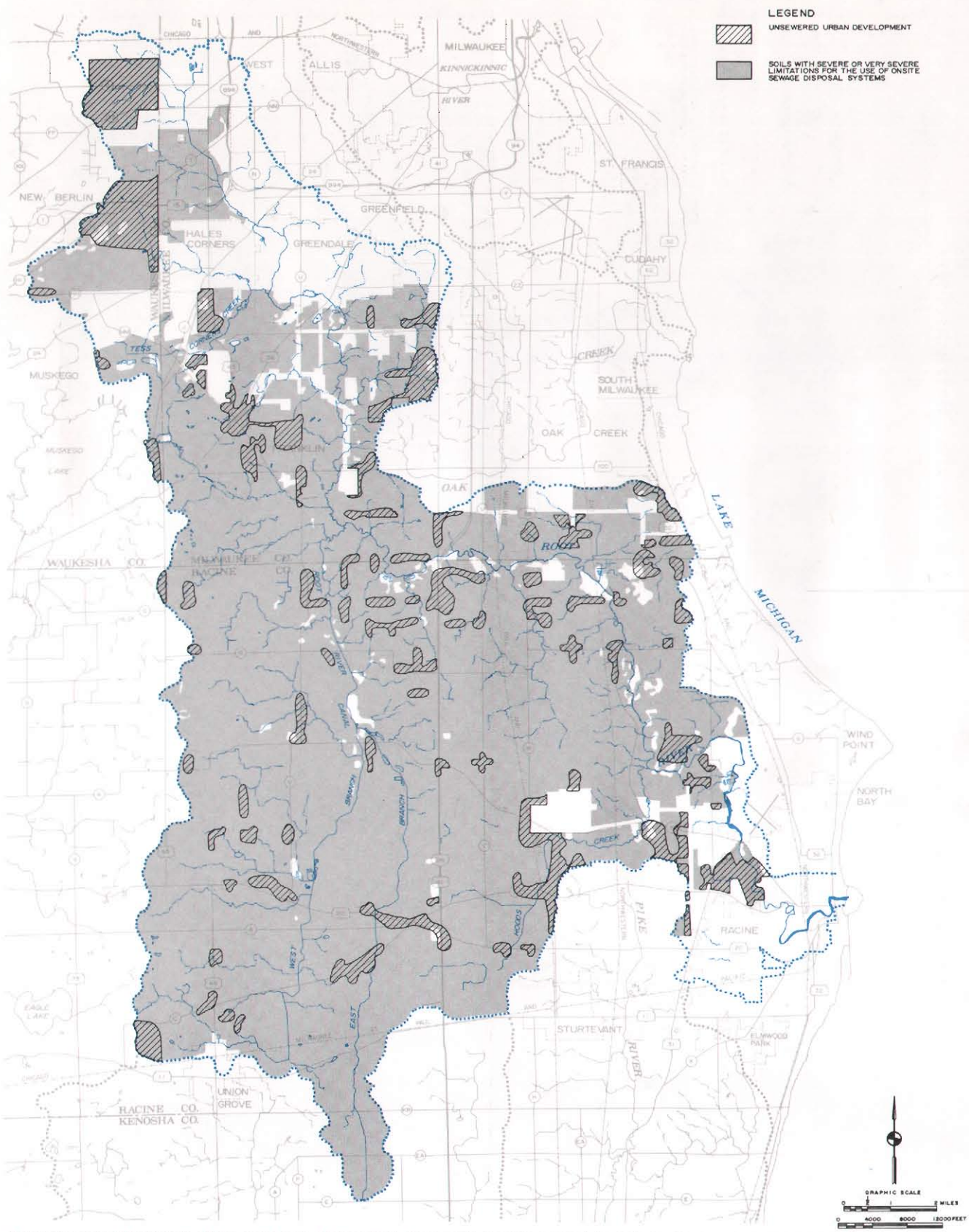


A variety of urban nonpoint sources were identified in the field inventory conducted in the summer of 1979. These sources include soil erosion on undesignated recreational vehicle trails, hiking trails, and equestrian trails; stream bank erosion and oil film caused by motor-boating activities in the lower reaches of the Root River; 13,000 feet of eroded stream banks; 40 roadside erosion sites; four active dumps or landfills; five inactive dumps or landfills; four unlicensed dumps; 10 noticeably malfunctioning septic tank systems; and 35 subdivisions under construction.

Source: Racine County Soil and Water Conservation District

Map 9

LOCATION AND EXTENT OF UNSEWERED URBAN DEVELOPMENT AND SUITABILITY OF SOILS FOR ONSITE SEWAGE DISPOSAL IN THE ROOT RIVER WATERSHED: 1975



Approximately 94 percent of the total area of the Root River watershed is covered by soils having severe or very severe limitations for the use of onsite sewage disposal systems. Relying on septic tank systems in these areas, which are covered by relatively impervious soils or are subject to seasonally high water tables, may result in eventual malfunctioning of such systems and consequently increased water pollution.

Source: U. S. Department of Agriculture, Soil Conservation Service; and SEWRPC.

Table 17

ALTERNATIVE URBAN NONPOINT SOURCE CONTROL PRACTICES FOR THE ROOT RIVER WATERSHED

Urban Nonpoint Source Control Practice	Practice Description
Street Sweeping	Sweep residential areas at least once a week; commercial and industrial areas at least twice a week. Implement alternate side parking restrictions. Improve scheduling, work habits, and equipment maintenance
Leaf and Vegetative Debris Collection	Improve frequency and effectiveness of leaf collection. Have leaves, clippings, and other organic debris mulched or bagged for pickup. Encourage mulching by property owners
Construction Erosion Control	Establish effective construction erosion controls on all construction sites
Litter and Pet Waste Control	Prevent the accumulation of litter and pet wastes on streets and other impervious areas and near streams
Oil and Chemical Disposal Station	Provide disposal containers for oil, grease, transmission fluid, anti-freeze, and other chemicals
Settling and Infiltration Basins	Use settling and infiltration basins to treat runoff from automobile sales facilities, parking lots, other commercial establishments, industrial sites, and some residential areas
Roadside Erosion Control	Stabilize roadsides and drainage ditches along roads in both urban and rural areas
Stream Bank Stabilization	Stabilize stream banks and shoreland areas. Establish vegetative filter strips along streams
Onsite Sewage Disposal Management	Routinely inspect and maintain onsite sewage disposal systems
Public Education Programs	Conduct public education programs to encourage proper urban "housekeeping" practices and appropriate local ordinances, provide technical information and inform the public of the status of the plan and the effects of practices
Reduced Use of Street De-icing Salt	Reduce use of de-icing salt on streets. Salt only intersections and problem areas. Prevent excessive use of sand and other abrasives. Control runoff at salt storage sites
Increased Catch Basin Cleaning	Increase frequency and efficiency of catch basin cleaning. Clean each catch basin at least twice a year
Improved Street Maintenance and Refuse Collection and Disposal	Increase street maintenance and repairs. Increase the provision of solid waste receptacles in public areas. Improve solid waste collection schedules

Table 17 (continued)

Urban Nonpoint Source Control Practice	Practice Description
Storm Water Storage Facilities	Store storm water runoff from urban land in surface or subsurface storage basins. Construct onsite storm water storage facilities such as a dutch drain storage basin. Construct basins or trenches to store runoff from parking lots or roof tops
Proper Use of Fertilizers and Pesticides	Match application rate to need. Eliminate applications in or near surface water drainageways
Critical Area Protection	Emphasize control of areas bordering streams. Provide seeding and other erosion control measures
Control of Recreational Activities	Stabilize and control erosion along hiking, equestrian, and snow-mobile trails. Provide adequate stream crossings. Provide restricted areas for recreational vehicle use. Restrict motor boating to areas not susceptible to stream bank erosion by wave action, or control such erosion
Diversions and Grass Waterways	Use diversions and grass waterways to control runoff and prevent gully erosion in urban areas, as well as in rural areas
Landfill Site Runoff Control	Use diversions or other measures to prevent runoff from landfill sites from reaching streams. Properly maintain and operate landfills. Use proper construction and operation to control leachate
Development and Application of Local Ordinances	Control erosion and sedimentation through local subdivision, zoning, building construction, and other erosion control ordinances

Source: SEWRPC.

Table 18

NONPOINT SOURCE SEVERITY RATING CRITERIA FOR LIVESTOCK OPERATIONS

Distance to Stream (miles)	Number of Animal Units								
	0-25			26-75			More Than 75		
	Percent of Slope on Feedlot			Percent of Slope on Feedlot			Percent of Slope on Feedlot		
	0.0-2.0	2.1-6.0	More Than 6.0	0.0-2.0	2.1-6.0	More Than 6.0	0.0-2.0	2.1-6.0	More Than 6.0
0-1/8	Very Severe	Very Severe	Very Severe	Very Severe	Very Severe	Very Severe	Very Severe	Very Severe	Very Severe
1/8-1/4	Moderate	Moderate	Moderate	Moderate	Severe	Severe	Severe	Severe	Severe
1/4-1/2	Slight	Slight	Slight	Slight	Slight	Moderate	Moderate	Moderate	Moderate
More Than 1/2	Slight	Slight	Slight	Slight	Slight	Slight	Slight	Slight	Slight

[a] *All operations were rated as a slight nonpoint source contributor if located within an internally drained basin.*

Source: Wisconsin Department of Natural Resources, Racine County Soil and Water Conservation District, and SEWRPC.

waters, and 24, or 29 percent, of the operations were rated as potentially being a servere source. Nineteen, or 23 percent, of the operations were classified as moderate pollution sources, and 18, or 22 percent, were rated as slight pollution sources. As shown on Map 10, the highest concentration of operations classified as very severe or severe pollution sources was located in the area drained by the West Branch of the Root River Canal. Most of the smaller operations located in Waukesha or Milwaukee Counties were rated as slight pollution sources.

Cropland Runoff: Storm water runoff from cropland can contribute sediment, nutrients, organic matter, and pesticides to streams. The extent and severity of water pollution from cropping activities varies considerably, depending on the topography, hydrology, soils, slopes, specific crops grown, conservation practices, and methods of tillage, planting, fertilization, and pesticide treatment.

In 1975 there were 84,250 acres of agricultural land in the watershed, two-thirds of which were in row or vegetable crop. Row crop production usually contributes relatively high pollutant loads of surface waters. The proportion of agricultural land in row crop production has continued to increase since 1975. In 1979 the cropland of the watershed was inventoried; the soil loss was estimated; conservation practices were selected; crop fields were classified according to the severity of nonpoint source pollution contributed; and cost estimates of conservation practices were prepared.

The estimated soil loss from agricultural lands, as determined from the application of the Universal Soil Loss Equation, is given in Table 19 and shown on Map 16 on page 53. The soil losses shown are gross soil losses from individual farm fields and overestimate the amount of soil which is actually contributed to a stream. Generally, soil losses greater than five tons per acre per year can be considered excessive. About 71,520 acres, or 78 percent of the agricultural land areas surveyed, have an estimated soil loss exceeding five tons per acre per year. The East Branch, West Branch, and main stem of the Root River Canal subwatersheds have the highest annual average soil losses. These losses are due to erodible soils, extensive row crop production, and relatively steep slopes.

The extent, unit cost, and total capital cost of the conservation practices—including livestock waste control practices—identified as needed to reduce agricultural nonpoint source pollutant loads are listed in Table 20. Of the total capital cost of $7,227,000, about $3,586,000, or 50 percent, is for terraces, and $1,577,000, or 22 percent, is for livestock waste control. All other practices each account for less than 10 percent of the total capital cost.

Conservation tillage, contour strip cropping, and terraces are effective alternatives for reducing erosion in many instances. The field inventory indicates a need for conservation tillage on 25,630 acres of land, contour strip cropping on 890 acres, and terraces on 6,870 acres.

Landowner acceptance of any practice depends on total capital costs, present farming operations, technical assistance available, personal landowner opinion of each practice, and managerial skills. Each varies considerably as indicated below:

1. The estimated average capital cost per acre for terraces is 35 times that of conservation tillage and 40 times that of contour strip cropping. The operation and maintenance costs of conservation tillage and of contour strip cropping are roughly double the operation and maintenance cost of terraces.

2. Most farmers in the watershed do not raise livestock. At least one-half of the crop produced in contour strip cropping is hay. With little need for hay, contour strip cropping is not a practical alternative for many farmers in the watershed. Remaining alternatives include conservation tillage and terraces, of which conservation tillage may be the more cost-effective.

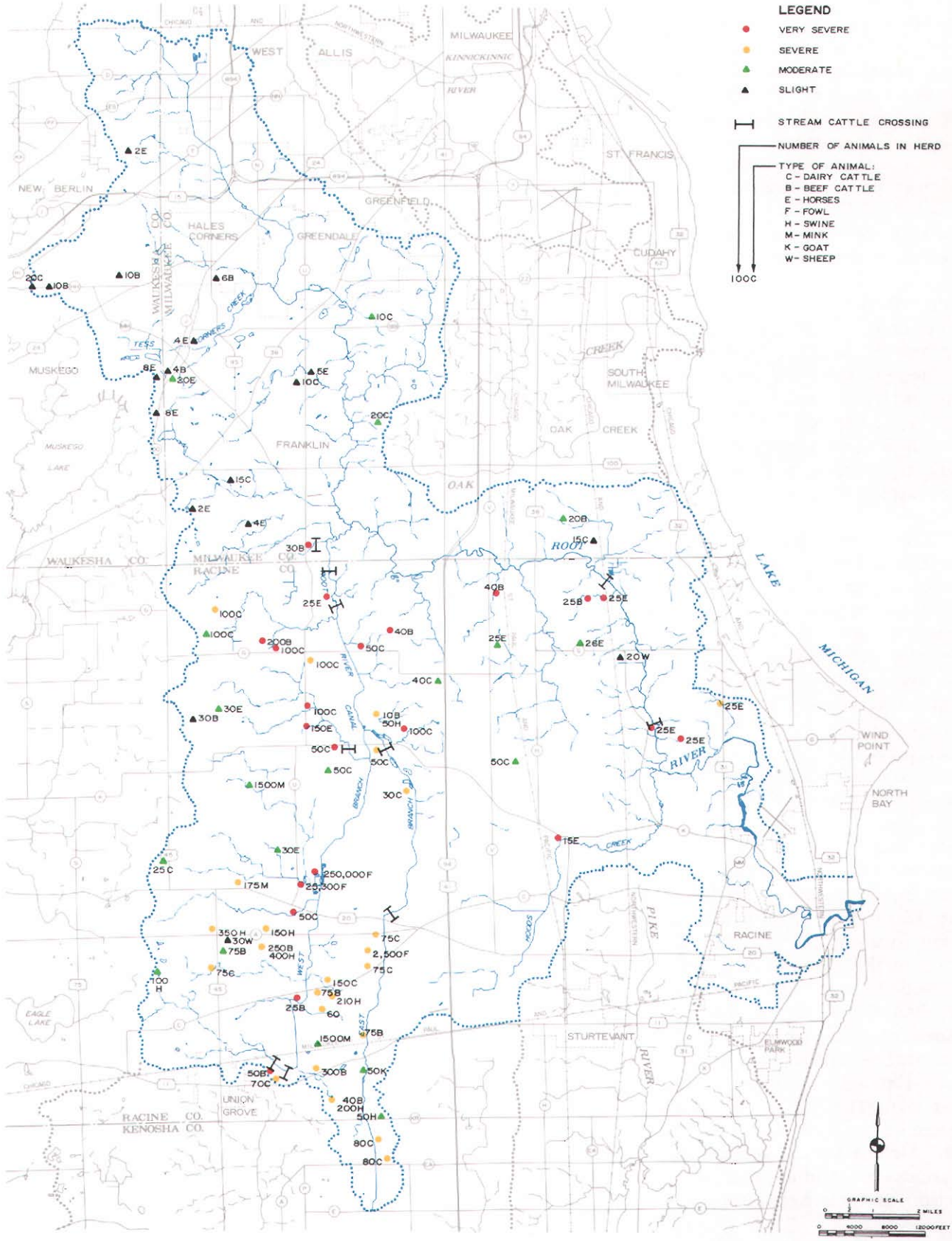
3. Technical assistance requirements for these alternatives vary considerably, and are estimated at: 1.25 man-hours per acre for terraces; 0.1 man-hour per acre for contour strip cropping; and 0.02 man-hour per acre for conservation tillage.

4. Landowner acceptance of each alternative would require a major information and education program plus personal contact by management agency technical staff.

5. Managerial skills are important to implementation of a conservation tillage system. Weed, insect, and disease control is

Map 10

NONPOINT SOURCE SEVERITY CLASSIFICATION OF LIVESTOCK OPERATIONS IN THE ROOT RIVER WATERSHED: 1979



There were 82 livestock operations noted in the watershed during the field inventory of 1979. Each operation was classified as a very severe, severe, moderate, or slight nonpoint pollution source, depending on distance to the stream, the number of animal units present, and the slope of the barnyard. Twenty-one, or 26 percent, of the operations were rated as having a very severe pollution potential; 24, or 29 percent, were rated as having a severe potential; 19, or 23 percent, were classified as moderate pollution sources; and 18, or 22 percent, were rated as slight pollution sources.

Source: Racine County Soil and Water Conservation District.

Table 19

EXISTING SOIL LOSS IN THE RURAL AREAS OF THE ROOT RIVER WATERSHED: 1979

Subwatershed	Rural Area (acres)[a]	Soil Loss (tons per year)[b]	Unit-Area Soil Loss (tons per acre per year)
West Branch, Root River Canal	24,480	277,470	11.3
East Branch, Root River Canal	9,600	101,600	10.6
Root River Canal	7,680	78,400	10.2
Whitnall Park Creek	2,080	19.040	9.1
Lower Root River	25,440	224,800	8.8
Middle Root River	11,840	85,920	7.3
Hoods Creek	9,120	62,400	6.8
East Branch, Root River	1,760	9,280	5.3
Total	92,000	858,910	9.3

[a] *The rural area shown is larger than the actual rural area of the watershed because the areas represent quarter-section approximations.*

[b] *The soil loss is estimated by the application of the Universal Soil Loss Equation.*

Source: Racine County Soil and Water Conservation District.

essential. Depending on the managerial skills of the landowner and on the physical characteristics of the land, crop production yields could be increased or decreased. Compared to conventional tillage, the reduced labor requirements allow flexibility of planting time, and thus farmers can plant at optimum times. Yields and production costs will depend on all of the stated management factors.

6. In a voluntary program, a number of technical problems with regard to conservation tillage are perceived locally. These perceived problems include a potential delay in spring planting due to colder soil temperatures and higher soil moistures; higher production costs; and a potential reduction in yields.

Each agricultural field requiring conservation treatment was classified as a very severe, severe, moderate, or slight pollution source. The criteria used in the classification were distance to stream and soil loss, as set forth in Table 21. The location of the proposed soil conservation practices and the nonpoint source severity ratings of the agricultural fields to be treated are shown on Map 11. Most severe and very severe agricultural sites are located along the Root River main stem and along the Root River Canal.

Stream Bank and Roadside Erosion: Erosion of both stream banks and roadsides occurs in rural, as well as urban, areas. In rural areas, stream bank erosion is usually caused by livestock disturbance, cropping immediately adjacent to a stream, recreational activities, and increased storm water discharges from upstream urbanizing areas. As in urban areas, roadside erosion in rural areas is usually associated with construction activities. Map 12 shows 15 roadside erosion sites, and about 44,000 feet of eroded stream bank in the rural areas of the watershed. As with the urban roadside and stream bank crossing sites, these rural sources were classified as slight, moderate, or severe pollution sources, according to the physical characteristics of the site and the extent and severity of erosion.

Table 20

RURAL NONPOINT SOURCE CONTROL PRACTICES NEEDED IN THE ROOT RIVER WATERSHED: 1979

Soil Conservation Practice[a]	Extent	Estimated Average Capital Cost per Unit	Total Cost
Conservation Tillage	25,630 acres	$ 16 per acre	$ 410,240
Contour Strip Cropping	890 acres	14 per acre	12,460
Crop Rotation	2,720 acres	–	–
Diversions	60,000 feet	1.75 per foot	105,000
Terraces	1,593,900 feet	2.25 per foot	3,586,300
Grass Waterways	234 acres	2,100 per acre	491,400
Grade Stabilization Structure	111 units	6,000 each	666,000
Vegetative Buffer Strips	170 acres	150 per acre	25,500
Critical Area Seeding[b]	20.8 acres	550 per acre	11,440
Roadside Erosion Control	5.2 acres	550 per acre	2,860
Livestock Waste			
Runoff Control	82 units	6,000 each	492,000
Storage	31 units	35,000 each	1,085,000
Stream Bank Fencing[b]	3,350 feet	0.85 per foot	2,850
Stream Bank Shaping and Seeding	41,170 feet	2 per foot	82,340
Stream Livestock Crossing	10 units	1,000 each	10,000
Riprap[b]	16,250 feet	15 per foot	243,750
Total	–	–	$7,227,140

[a] *This table lists all of the practices which were identified in the inventory as needed to prevent excessive soil erosion and to control livestock waste runoff. In order for the recommended water use objectives and water quality standards to be met, it is not necessary that all of these practices be implemented.*

[b] *Includes roadside and stream bank erosion control in urban areas.*

Source: Racine County Soil and Water Conservation District.

WATER USE OBJECTIVES AND WATER QUALITY STANDARDS

The adopted areawide water quality management plan, as set forth in SEWRPC Planning Report No. 30, A Regional Water Quality Management Plan for Southeastern Wisconsin: 2000, contains recommended water use objectives and supporting water quality standards for all major lakes and streams in the Region. The water use objectives established for the Root River Canal and the Root River main stem upstream of Layton Avenue are limited recreational use, limited fishery, and limited aquatic life. The limited classification for the Root River Canal is due to in-place pollutants and drainage from naturally organic soils. For portions of the Root River main stem, the limitation is due to committed channelization with concrete lining. The mouth of the Root River is classified for recreational use, salmon spawning fishery, and aquatic life. The water use objectives recommended in the remainder of the stream system are recreational use, warmwater fishery, and aquatic life, as shown on Map 13. The water quality standards which support these objectives are given in Table 22. Standards were established for temperature, pH, dissolved oxygen, fecal coliform, residual chlorine, un-ionized ammonia-nitrogen, and total phosphorus. It is recommended that all standards be met for a specified proportion

Table 21

NONPOINT SOURCE SEVERITY RATING CRITERIA FOR CROPLAND

Soil Loss (tons per acre per year)[a]	Distance to Stream (miles)[a]			
	0-1/8	1/8-1/4	1/4-1/2	>1/2
>14	Very Severe	Severe	Moderate	Slight
6-14	Severe	Severe	Moderate	Slight
0-5	Moderate	Moderate	Slight	Slight

[a] *All cropland was rated as a slight nonpoint source contributor if located within an internally drained basin.*

Source: Wisconsin Department of Natural Resources, Racine County Soil and Water Conservation District, and SEWRPC.

of the time during both low streamflow and high streamflow conditions.[8] As previously discussed, the water quality standards for dissolved oxygen, fecal coliform, and total phosphorus are generally not satisfied under existing conditions. The achievement of applicable standards in the Root River Canal and in the Root River main stem upstream of Layton Avenue would provide water quality suitable for limited body-contact recreational use and for some pollution-tolerant fish species such as carp, catfish, and suckers. Achievement of the recommended standards in the remainder of the watershed would provide water quality suitable for a full range of recreational use activities and for the support of healthy warmwater (or salmonid) fish and aquatic life species.

RECOMMENDATIONS

The development of a recommended plan must focus primarily upon the degree to which the established water use objectives are satisfied and upon the accompanying costs. Analyses of the sources of water pollution and a comparison of measured water quality data to adopted and recommended quality standards, as summarized in the preceding sections of this report, indicated that a reduction in the transport of pollutants from nonpoint sources through the implementation of land management practices, in combination with point source abatement measures, will be necessary if the established water use objectives for the watershed are to be met. Accordingly, this section sets forth recommended measures for abating nonpoint source water pollution in the Root River watershed, together with the estimated costs of the recommended pollution abatement measures.

The selection of the individual nonpoint practices to be implemented from among the alternative practices indentified in the plan requires detailed, specific analyses of the physical characteristics of each pollutant-contributing site and of the fiscal position and managerial capabilities of the landowner involved. Although these factors cannot be considered in this report, the U. S. Soil Conservation Service has historically conducted site-specific analyses and developed detailed soil and water conservation plans on a farm-by-farm basis through its conservation planning program. Accordingly, the rural nonpoint source pollution abatement measures recommended herein can be further refined and detailed during the development and implementation of individual farm plans. Urban nonpoint source pollution abatement measures are also recommended herein. Because of the variety of practices available, the varying local conditions, and the varying capabilities and preferences of each urban management agency, these recommendations must be further evaluated, refined, and detailed by each designated local management agency throughout plan implementation.

Abatement of Pollution from Urban Nonpoint Sources

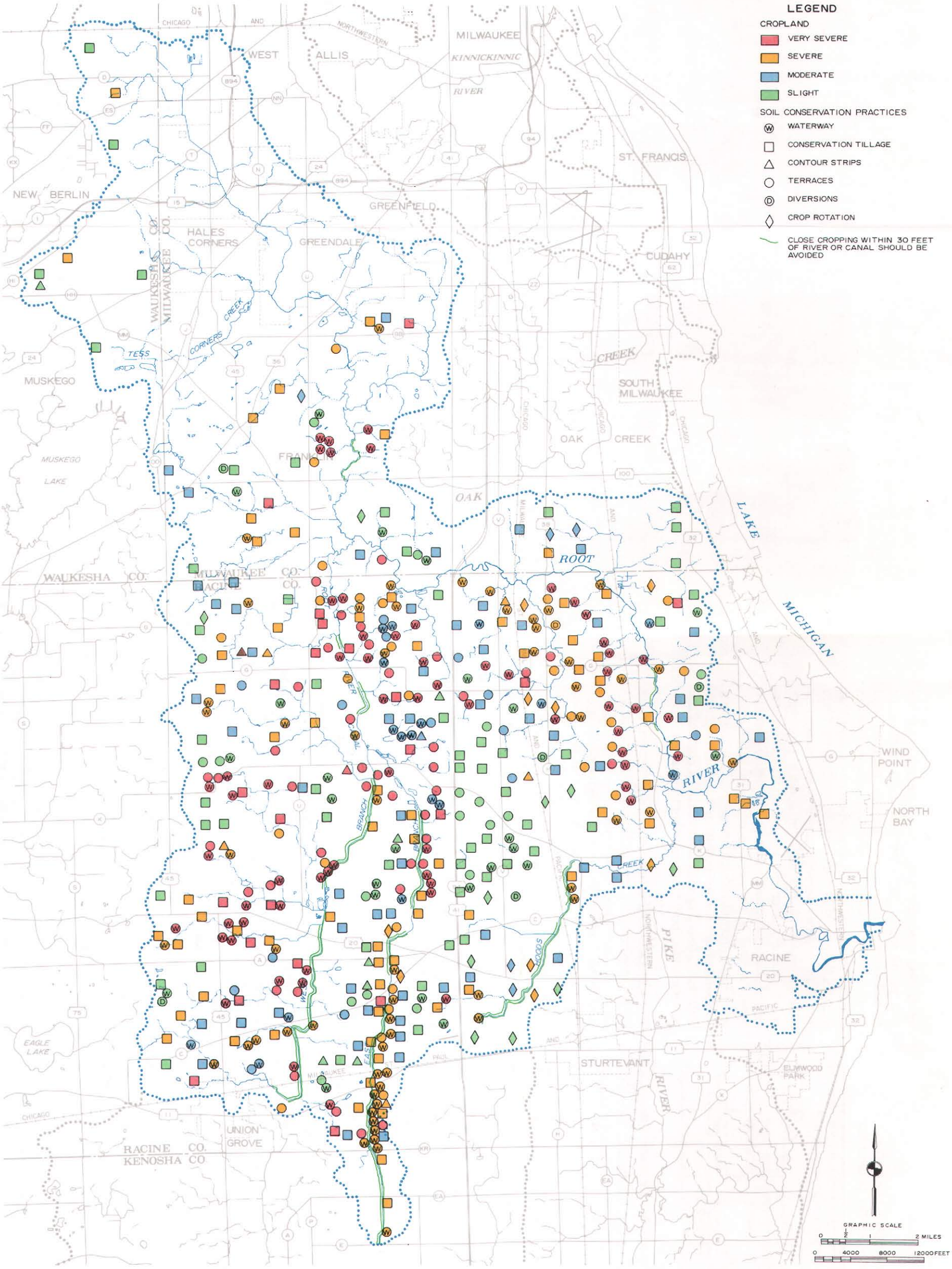
In urban areas, it is recommended that septic tank system management programs, construction erosion control programs, and other additional management practices be undertaken by the designated management agencies to reduce pollutant loads in urban storm water runoff by about 50 percent. These recommendations are presented in more detail in the following sections.

In addition to the recommendations set forth below, it is essential that the existing local regulatory programs—including zoning, sanitary, and

[8] *See SEWRPC Planning Report No. 30, A Regional Water Quality Management Plan for Southeastern Wisconsin: 2000, Volume Two, Alternative Plans.*

Map 11

NONPOINT SOURCE SEVERITY CLASSIFICATION OF CROPLAND AND PROPOSED SOIL CONSERVATION PRACTICES IN THE ROOT RIVER WATERSHED: 1979

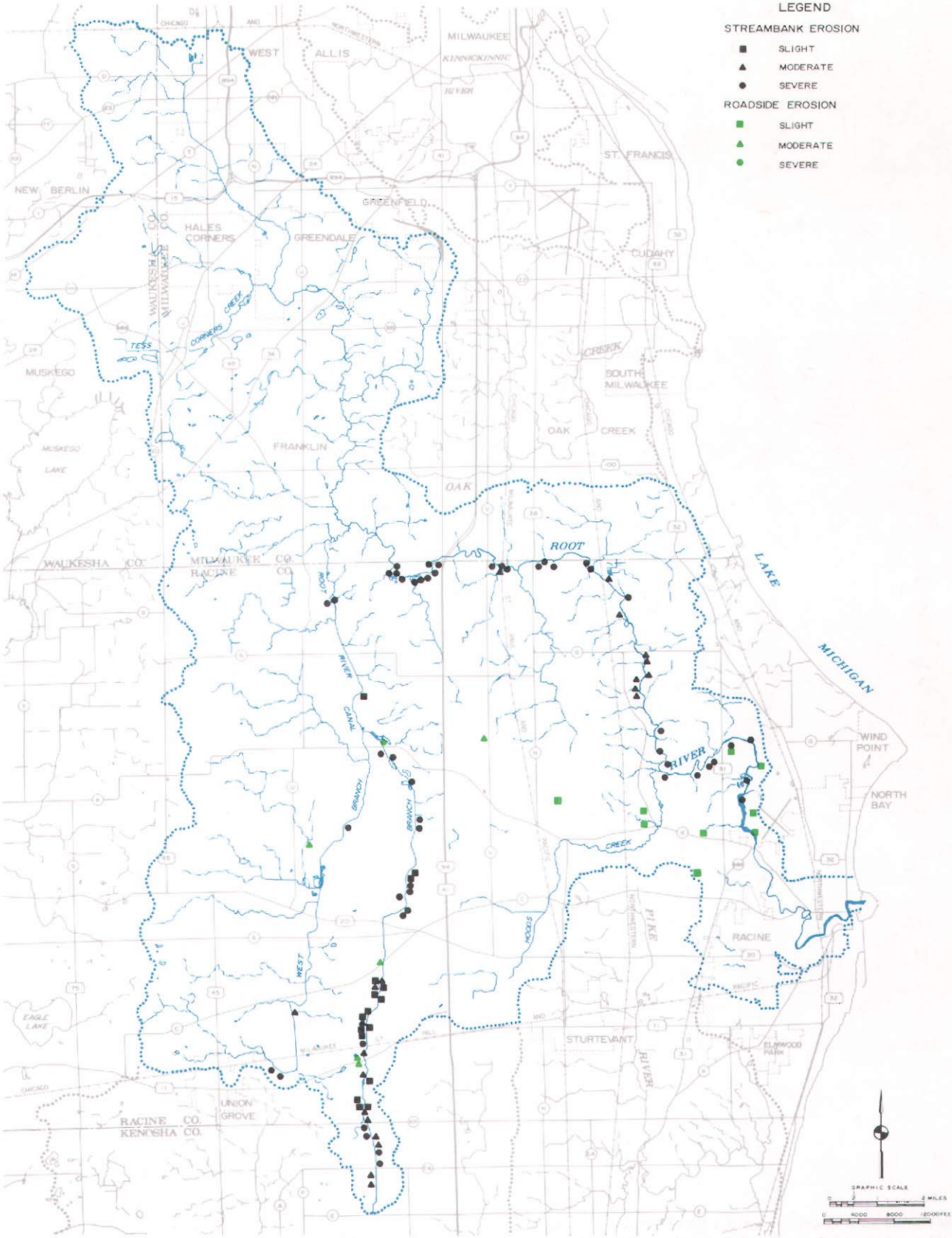


In 1975 there were 84,250 acres of agricultural land in the watershed, two-thirds of which were in row or vegetable crops. In 1979 the cropland was inventoried, soil loss was estimated, conservation practices were selected, crop fields were classified according to the severity of nonpoint source pollution contributed, and cost estimates of conservation practices were prepared. These practices, together with the livestock waste controls set forth on Map 10, would involve a total cost of $7.2 million, of which $3.6 million, or 50 percent, is for terraces. Agricultural sites rated as severe and very severe pollution sources are located along the Root River main stem and along the Root River Canal.

Source: Wisconsin Department of Natural Resources, Racine County Soil and Water Conservation District, and SEWRPC.

Map 12

NONPOINT SOURCE SEVERITY CLASSIFICATION OF RURAL ROADSIDE EROSION AND STREAM BANK EROSION IN THE ROOT RIVER WATERSHED: 1979

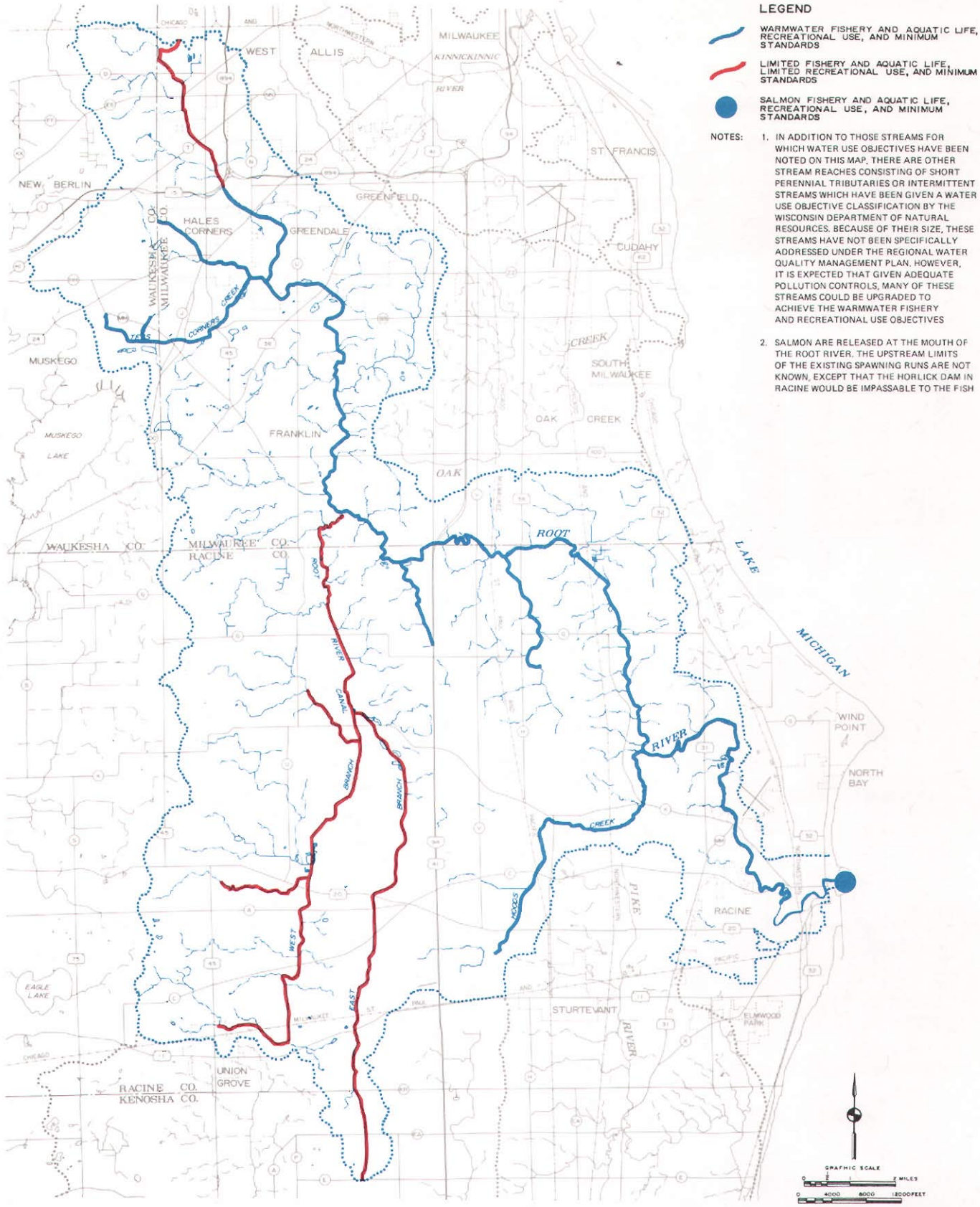


The 1979 inventory identified about 15 roadside erosion sites and about 44,000 feet of eroded stream bank in the rural areas of the watershed. These erosion sites were classified as slight, moderate, or severe pollution sources, according to the physical characteristics of the site and the extent and severity of erosion.

Source: Wisconsin Department of Natural Resources, Racine County Soil and Water Conservation District, and SEWRPC.

Map 13

RECOMMENDED WATER USE OBJECTIVES FOR THE ROOT RIVER WATERSHED



Under the regional water quality management planning program, analyses were conducted to determine the feasibility of achieving a level of water quality that would make all surface waters "fishable and swimmable" as envisioned by the U. S. Congress in Public Law 92-500. The results of these analyses for the Root River watershed indicated that the Root River Canal and the Root River main stem upstream of Layton Avenue could not be expected to achieve "fishable and swimmable" water quality through the year 2000. These reaches were therefore classified for limited recreational use and for the support of a limited fishery and aquatic life. The limited classification for the Root River Canal is due to in-place pollutants and to drainage from naturally organic soils. Portions of the Root River main stem are limited due to committed channelization with concrete lining. The mouth of the Root River is classified for recreational use, salmon spawning fishery, and aquatic life, with the water use objectives recommended in the remainder of the steam system being recreational use, warmwater fishery, and aquatic life.

Source: SEWRPC.

Table 22

RECOMMENDED WATER QUALITY STANDARDS FOR THE ROOT RIVER WATERSHED

Parameter	Recreational Use, Warmwater Fishery, and Aquatic Life	Recreational Use, Salmon Spawning Fishery, and Aquatic Life	Limited Recreational Use, Limited Fishery, and Aquatic Life
Maximum Temperature (F^o)	89[a]	_[a,e]	89[a]
pH Range (standard units)	6.0-9.0	6.0-9.0	6.0-9.0
Minimum Dissolved Oxygen (mg/l)	5.0	5.0[f]	3.0
Maximum Fecal Coliform (MFFCC/100 ml)	200/400[b]	200/400[b]	200/400[b]
Maximum Residual Chlorine (mg/l)	0.01	0.002	0.5
Maximum Un-ionized Ammonia-Nitrogen (mg/l)	0.02	0.02	0.2
Maximum Total Phosphorus (mg/l)	0.1	0.1	–
Other	_[c,d]	_[c,d]	_[c,d]

[a] *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.*

[b] *Shall not exceed a monthly geometric mean of 200 per 100 ml based on not less than five samples per month, nor a monthly geometric mean of 400 per 100 ml in more than 10 percent of all samples during any month.*

[c] *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 shall not be present in such amounts as to interfere with public rights in waters of the State. Floating or submerged debris, oil, scum, or other material shall not be present in such amounts as to interfere with public rights in the waters of the State. Materials producing color, odor, taste, or unsightliness shall not be present in amounts which are acutely harmful to animal, plant, or aquatic life.*

[d] *Unauthorized concentrations of substances that alone or in combination with other materials present are toxic to fish or other aquatic life are not permitted. The determination of the toxicity of a substance shall be based upon the available scientific data base. References to be used in determining the toxicity of a substance shall include, but not be limited to, Quality Criteria for Water, EPA-440/9-76-003, U. S. Environmental Protection Agency, Washington, D. C., 1976, and Water Quality Criteria 1972, EPA R3-73-003. National Academy of Engineering, U. S. Government Printing Office, Washington, D. C., 1974. Questions concerning the permissible levels, or changes in the same, of a substance, or combination of substances, or undefined toxicity to fish and other biota, shall be resolved in accordance with the methods specified in Water Quality Criteria 1972 and Standard Methods for the Examination of Water and Wastewater, 14th Edition, American Public Health Association, New York, 1975, or other methods approved by the Department of Natural Resources.*

[e] *There shall be no significant artificial increases in temperature where stocked salmon reproduction is to be protected.*

[f] *The dissolved oxygen in streams used by stocked salmonids for spawning runs shall not be lowered below natural levels during the period of habitation.*

Source: SEWRPC.

construction erosion programs—pertaining to nonpoint source water pollution control be maintained and enforced.

Onsite Sewage Disposal Systems Management Programs: The onsite sewage disposal systems management programs are intended to ensure the proper operation and maintenance of existing septic tank and other onsite waste disposal systems, and to ensure the proper installation, operation, and maintenance of any new private systems that may be required to serve urban development in those portions of the watershed where centralized sanitary sewer service is not provided. The recommended onsite sewage disposal system management programs should include at least the following actions:

1. The adoption, where appropriate, of ordinances governing the installation, operation, and maintenance of onsite sewage disposal systems, including septic tanks, holding tanks, and mound systems or other systems approved by the Wisconsin Department of Health and Social Services. In accordance with the provisions of Chapter 59 of the Wisconsin Statutes, such ordinances can be developed only by the counties. Accordingly, changes in the designated management agency responsibilities set forth in the areawide water quality management plan must be recognized.

2. The establishment, through such sanitary ordinances, of programs of regular inspection of onsite sewage disposal systems, including septic tanks, holding tanks, and mound systems. The programs would include the visual inspection of each onsite sewage disposal system by individuals trained in evaluation and would include the dye-testing of the system if necessary. The purpose of the inspection would be to identify any malfunctioning sewage disposal system. It is envisioned that each system would be inspected once every five years, and that each management agency would thereby inspect one-fifth of all such systems annually. The inspection program would result, as necessary, in the issuance of orders to abate improper practices and take appropriate corrective measures.

3. The conduct of a supporting educational program whereby homeowners would be advised of the provisions of the ordinances, rules, and regulations governing onsite sewage disposal systems, and would be encouraged to undertake preventive maintenance measures. These preventive measures should also be described in the educational program. It is further recommended that each management agency responsible for onsite sewage disposal system management prepare a detailed facilities plan for each area not recommended to be served by sanitary sewers. Such a facility plan should explore alternatives to the use of the septic tank systems, including mound systems, holding tanks, and community systems involving low-pressure sewers and a common treatment facility such as a large soil absorption system. Since centralized sanitary sewers are recommended for virtually all of the existing and planned urban land within the Milwaukee County and Waukesha County portions of the watershed by the year 2000, and since essentially no urban land exists in the portion of the watershed in Kenosha County, this sanitary engineering study would be conducted only for a portion of Racine County.

It is recommended that each public sewage treatment plant include provisions for the discharge of septage and holding-tank wastes. The septage and holding-tank wastes should be discharged from tank trucks directly into aerated holding tanks or other appurtenances within sanitary sewerage systems. This gradual release to the plant influent will minimize the "shock load" effects which can be especially detrimental to the operation of smaller treatment plants. It is recommended that the counties, through their sludge management programs, require that septage and holding-tank wastes be discharged to sewage treatment plants, rather than to the land surface as sometimes occurs in the less populous portions of the counties.

The onsite sewage disposal system management functions as currently conducted and as recommended for each designated agency are presented in Table 23. Only Waukesha County currently has a countywide ordinance governing the installation, operation, and maintenance of septic tank systems.

Table 23

EXISTING AND RECOMMENDED ONSITE SEWAGE DISPOSAL SYSTEM MANAGEMENT FUNCTIONS FOR DESIGNATED MANAGEMENT AGENCIES IN THE ROOT RIVER WATERSHED

Designated Management Agency	Adopt Ordinance Governing Onsite Sewage Disposal System Installation, Operation, and Maintenance	Incorporate Into an Existing or New Sanitary Ordinance the Provision for a Regular Onsite Sewage Disposal System Inspection Program	Supplement the Ordinances with a Suitable Public Education Program	Supplement the Regulatory Program with a Sanitary Engineering Analysis to Evaluate Other Small-Scale Alternatives for Onsite Sewage Disposal
Kenosha County	X[a]	X	X	--
Racine County	X[a]	X	X	X
Waukesha County Board of Health	O	X	X	--
Milwaukee County	X[a,b]	X	X	--

NOTE: O - Existing function; X - Recommended function.

[a] *Kenosha, Milwaukee, and Racine Counties are in the process of preparing countywide sanitary ordinances, in accordance with recent State Statutes. Kenosha County currently regulates onsite sewage disposal system installation in floodland and shoreland areas.*

[b] *State law requires Milwaukee County to adopt a countywide sanitary ordinance by July 1980. Accordingly, the onsite sewage disposal system management functions required in the Cities of Franklin and Oak Creek can be performed by Milwaukee County. As of January 1980, local discussion has also been initiated to consider the licensing and inspection in the program of these two cities under contract to Milwaukee County.*

Source: SEWRPC.

No agencies currently have regular inspection programs or specific educational programs. As of 1979, no facilities plans had been prepared to assess septic system performance or to evaluate alternative methods of onsite sewage disposal where conventional systems were found inadequate.

At the present time, Kenosha County regulates the installation of onsite sewage disposal systems in the floodland and shoreland area. A new Kenosha County Sanitary Ordinance is scheduled to be developed in 1980, in accordance with recent State Statutes. The new ordinance would apply throughout the entire County, and would fully regulate the installation, operation, and maintenance of onsite sewage disposal systems. It is recommended that Kenosha County adopt such a countywide sanitary ordinance, that the ordinance incorporate provisions for regular inspection of private onsite sewage disposal systems, and that the sanitary program be supplemented with a suitable public education program.

In Milwaukee County, only the Cities of Franklin and Oak Creek have any significant number of onsite sewage disposal systems. Thus, the areawide plan designated responsibility for onsite sewage disposal system management only to these two cities in Milwaukee County. Because of the recent statutory requirements that all counties adopt a countywide sanitary ordinance by July 1980, it is recommended that the onsite sewage disposal system management functions of these two cities be transferred to the Milwaukee County Department of Environmental Services and that Milwaukee County adopt a countywide sanitary ordinance. The ordinance should incorporate provisions for the regular inspection of private onsite sewage

disposal systems, and the sanitary program should be supplemented with a suitable public education program.

Racine County does not at the present time regulate the installation of onsite sewage disposal systems in the floodland and shoreland areas, relying instead upon town sanitary ordinances, and town enforcement of the state plumbing code. A new Racine County Sanitary Ordinance is scheduled to be developed in 1980, in accordance with recent State Statutes. The new ordinance would apply throughout the entire County, and would fully regulate the installation, operation, and maintenance of onsite sewage disposal systems. It is recommended that 1) Racine County adopt such a countywide sanitary ordinance; 2) the ordinance incorporate provisions for the regular inspection of private onsite sewage disposal systems; 3) the sanitary program be supplemented with a suitable public education program; and 4) the sanitary program be supplemented with sanitary engineering (facilities plan) analyses of private onsite sewage disposal systems as one step in attaining state or federal financial assistance for rehabilitation of the systems.

In Waukesha County, the County Board of Health regulates onsite sewage disposal systems through a countywide ordinance that is applicable within the incorporated, as well as the unincorporated, areas of the County. It is recommended that this ordinance be supplemented to provide for regular inspection of private onsite sewage disposal systems and a public education program.

Construction Erosion Control Program: It is recommended that all of the counties and municipalities in the watershed, take steps to ensure the reduction of water pollution from erosion of land under construction.

It is recommended that the designated urban management agencies establish formal construction erosion control programs and review their subdivision regulations, zoning ordinances, and building codes to assure that, taken together, they address the functions noted in Table 24. An effective construction erosion control program should address administrative procedures, erosion control performance standards, and enforcement provisions. It is recommended that each designated agency adopt the appropriate ordinances; require the submittal of erosion control plans for all construction projects; review the plans with technical assistance from the soil and water conservation districts, and were appropriate, in conjunction with local staff engineers; and provide for enforcement through inspection of the erosion control measures to be implemented. The review and evaluation of the plans and control measures implemented should be based on criteria set forth in the U. S. Soil Conservation Service Soil and Water Technical Guide. Enforcement of the ordinances would be through the subdivision, zoning, and building approval authority of the designated management agency. The Regional Planning Commission can assist in the development of the ordinances.

The City of Muskego has adopted a construction erosion control ordinance which requires the subdivision developers to submit erosion control plans to the city plan commission for review. It is recommended that provisions be added to these ordinances to require plan review by the soil and water conservation district, and inspection of implementation measures. Model construction erosion control ordinances for land division controls, zoning ordinances, and building codes are set forth in Appendix B.

Selection and Implementation of Priority Management Practices: It is recommended that each municipality review this plan, and select and implement those nonpoint source control measures which are compatible with the physical, managerial, social, and fiscal characteristics of the municipality, and which may be expected together to achieve approximately a 50 percent reduction in pollutant loads transported in urban storm water runoff.

Urban nonpoint source control practices recommended for the Root River watershed are discussed below. Table 25 presents the practices recommended for each designated urban management agency in the watershed.

Increased street sweeping is one way to control nonpoint source pollutant loads from developed urban areas within the Root River watershed. The Cities of Racine, Oak Creek, and West Allis; the Villages of Greendale and Union Grove; and Milwaukee, Racine, and Waukesha Counties should consider increasing the frequency of their street sweeping programs so that all streets are swept at least once a week during the sweeping season, generally assumed to be that period from the last snowfall in spring to the first snowfall in fall and

Table 24

EXISTING AND RECOMMENDED CONSTRUCTION EROSION CONTROL FUNCTIONS FOR DESIGNATED MANAGEMENT AGENCIES IN THE ROOT RIVER WATERSHED

Designated Management Agency	Construction Erosion Control Ordinance Adopted	Erosion Control Plan for Subdivisions Required by Ordinance	Soil and Water Conservation District Review of Plan for Subdivisions Required by Ordinance	Periodic Inspection of Control Measures and Provision of Enforcement Measures Required by Ordinance
Kenosha County	X	X	X	X
Milwaukee County	X	X	X	X
Racine County	X	X	X	X
Waukesha County	X	X	X	X
City of Franklin	X	X	X	X
City of Greenfield	X	X	X	X
City of Muskego	O	O	X	X
City of New Berlin	X	X	X	X
City of Oak Creek	X	X	X	X
City of Racine	X	X	X	X
City of West Allis	X	X	X	X
Village of Greendale	X	X	X	X
Village of Hales Corners	X	X	X	X
Village of Union Grove	X	X	X	X

NOTE: O - Existing function
X - Recommended function

Source: SEWRPC.

lasting from about April through November.[9] The Cities of Franklin, New Berlin, Greenfield, and Muskego should consider developing new street sweeping programs and should sweep all streets at least once a week during the sweeping season. Few streets—most notably some county and state trunk highways—in the Village of Hales Corners, in the Towns of Caledonia, Mt. Pleasant, and Raymond, and in the Town of Yorkville Sanitary District No. 1 have curbs and gutters; hence, sweeping would not be an effective nonpoint source control measure for these communities. It is recommended that all designated management agencies implement parking restrictions as required to ensure complete curb access by the sweeping equipment. Alternate side parking and prohibition of street

[9] *Under the Nationwide Urban Runoff Program (NURP) funded by the U. S. Environmental Protection Agency, SEWRPC and the DNR are currently studying the water quality effects of different frequencies of street sweeping at select study sites in Milwaukee County. Although a street sweeping frequency of once a week is recommended herein and used for cost purposes in this plan, it is recommended that actual implementation of increased street sweeping programs not occur until 1983, when the NURP study is scheduled for completion, and the appropriate frequency of sweeping which would provide for an adequate level of nonpoint source control can be specified.*

Table 25

RECOMMENDED URBAN NONPOINT SOURCE CONTROL MEASURES FOR THE ROOT RIVER WATERSHED

Urban Nonpoint Source Management Agency	Onsite Sewage Disposal Management Program	Construction Erosion Control Program	Technical Assistance	Increased Street Sweeping Program[a]	New Street Sweeping Program[a]	Improved Leaf Collection	Oil and Chemical Disposal Stations	Industrial and Commercial Site Housekeeping Practices	Roadside Erosion Control[a]	Stream Bank Erosion Control[a]	Recreational Activity Erosion Control[a]	Landfill Site Runoff Control[a]	Public Education Program[b]
Kenosha County	X	X	--	--	--	--	--	--	--	X	--	--	X
Kenosha County Soil and Water Conservation District	--	--	X	--	--	--	--	--	--	--	--	--	--
Milwaukee County	X	X	--	X	--	X	X	X	--	X	X	--	X
Milwaukee County Soil and Water Conservation District	--	--	X	--	--	--	--	--	--	--	--	--	--
City of Franklin	--	X	--	--	X	X	X	X	X	X	--	X	X
City of Greenfield	--	X	--	--	X	X	X	X	X	X	--	X	X
City of Oak Creek	--	X	--	X	--	X	X	X	X	X	--	--	X
City of West Allis	--	X	--	X	--	X	X	X	X	X	--	X	X
Village of Greendale	--	X	--	X	--	X	X	X	--	X	--	--	X
Village of Hales Corners	--	X	--	--	--	X	X	X	--	--	--	--	X
Racine County	X	X	--	X	--	X	X	X	--	X	X	--	X
Racine County Soil and Water Conservation District	--	--	X	--	--	--	--	--	--	--	--	--	--
City of Racine	--	X	--	X	--	X	X	X	--	X	--	--	X
Village of Union Grove	--	X	--	X	--	X	X	X	--	--	--	--	X
Town of Caledonia	--	--	--	--	--	X	X	X	--	X	--	--	X
Town of Mt. Pleasant	--	--	--	--	--	X	X	X	--	X	--	--	X
Town of Yorkville Sanitary District No. 1	--	--	--	--	--	X	X	X	--	--	--	--	X
Town of Raymond	--	--	--	--	--	X	X	X	X	X	--	--	X
Waukesha County	--	X	--	X	--	X	X	X	--	--	--	--	X
Waukesha County Soil and Water Conservation District	--	--	X	--	--	--	--	--	--	--	--	--	--
Waukesha County Board of Health	X	--	--	--	--	--	--	--	--	--	--	--	X
City of Muskego	--	X	--	--	X	X	X	X	X	--	--	--	X
City of New Berlin	--	X	--	--	X	X	X	X	X	--	--	--	X

[a] *These practices are recommended only for those communities where the field inventory indicated that they were appropriate and necessary control measures.*

[b] *In addition to assisting in the implementation of the other practices shown on this table, public education programs would encourage litter and pet waste control, proper use of fertilizers and pesticides, and critical area protection.*

Source: Racine County Soil and Water Conservation District and SEWRPC.

parking are restrictions that can facilitate street sweeping. The Cities of Greenfield, Racine, and West Allis currently have alternative side parking restrictions on some streets. All cities and villages, except the City of Muskego, prohibit parking on some streets during a portion of the day and during a portion of the year. The street sweeping programs should include improved scheduling and equipment maintenance, further training of sweeper personnel on the use of the sweepers to minimize water pollution loadings, and increased street sweeping during the fall when leaf fall occurs and during the spring when snowmelt occurs.

All counties, cities, villages, and towns identified in Table 25 should consider instituting or improving leaf collection operations. All leaves and other vegetative debris should be bagged, mulched, or placed to avoid transport to surface drainage systems. Street sweeping and leaf collection by solid waste collection vehicles should be accelerated during periods of leaf fall to prevent the accumulation of leaves in streets. It is recommended that leaves be removed from the portions of parklands and golf courses bordering streams and then disposed of properly. Public education programs should encourage the proper collection and disposal of leaves.

It is recommended that all municipalities—as identified in Table 25—consider providing one or more oil and chemical disposal containers at municipal garages and public parking lots for oil, grease, transmission fluid, and other petroleum-based chemicals. A waste oil and chemical collection site may consist of a 250-gallon tank, curb

stop abutments, and signs. The collected oil and chemicals could be sold to petroleum refiners and processors. Public education programs should encourage the proper disposal of oil and other hazardous chemicals by private individuals and by business establishments.

Storm water runoff from large impervious areas—primarily parking lots, commercial establishments, and industrial sites—often contains substantial amounts of contaminants: toxic chemicals and metals, oil and grease, litter, and sediment. The high storm water runoff rates from such areas, together with the intense land use activities and accumulation of litter, debris, and stored materials attendant to such areas, can result in the generation of substantial pollutant loads. Pollutant loads from these sources can be controlled by implementing improved housekeeping practices or by storing and treating storm water runoff.

Review and analysis were conducted of the location, type, extent, and storm drainage characteristics of the parking lots and commercial and industrial sites shown on Map 14. This analysis indicated that improved housekeeping practices would be the most practical and cost-effective means of water pollution control for such sites. As part of this analysis, a screening of potential sites was conducted. In the City of Racine, storage and treatment of storm water runoff from large impervious areas has been determined to be unnecessary for water quality protection in a previous study.[10] Elsewhere in the Root River watershed in Racine County, runoff from large impervious areas was not identified as having significant water quality impacts. However, in Milwaukee County along STH 100, the field inventory analyses indicated that storm water runoff from some sites—particularly the commercial areas shown on Map 14—could have significant water quality impacts on the receiving stream. Hence, storm water storage was considered as an alternative to improved housekeeping practices for these sites.

To evaluate the feasibility of storm water storage, and to compare the relative cost and effectiveness of storage and housekeeping practices, cost estimates and effectiveness evaluations for 1) a storm water storage system, and 2) housekeeping practices were prepared for a storm sewer drainage area of 101 acres in size. The site, as shown on Map 14, is located along STH 100 just south of Lincoln Avenue, and drains commercial establishments—primarily department stores and their parking lots and automobile sales facilities—and was observed to be contributing a substantial amount of pollutants to the main stem of the Root River. Implementing improved housekeeping practices in this drainage area would involve an estimated capital cost of about $12,000, with an annual operation and maintenance cost of about $12,000. The total worth of construction and operation of improved housekeeping practices over a 50-year analysis period using a 6 percent interest rate is about $208,000. Such housekeeping practices should provide about a 25 percent reduction in pollutant loads to the stream. Thus, the present worth of each percentage point of reduction in pollutant loads is about $8,300.

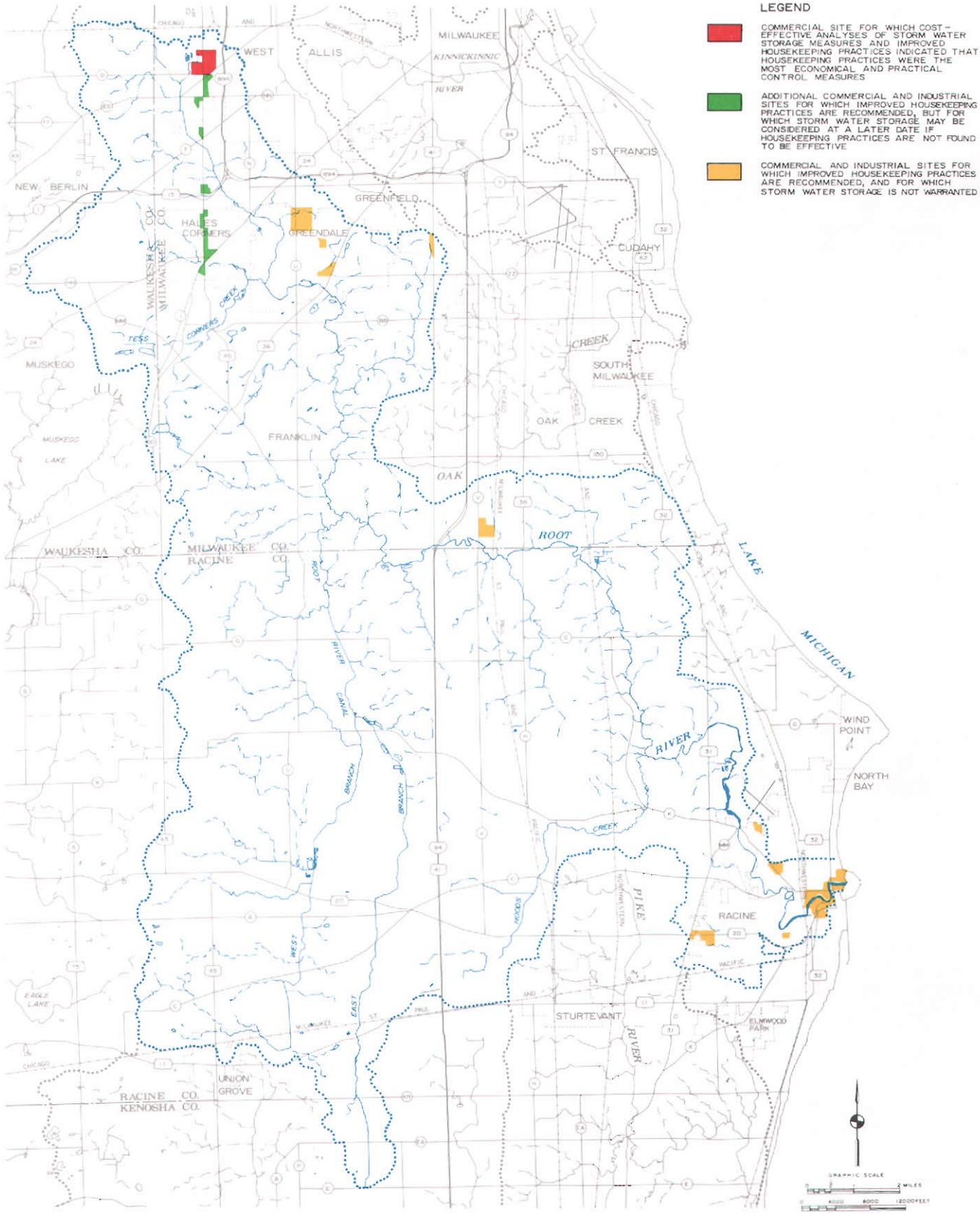
By comparison, constructing an earthen surface storm water storage basin with a pipe outlet at the storm sewer outfall would involve a capital cost of $460,000 and an annual operation and maintenance cost of $3,200. The total worth of construction and operation of the storm water storage basin over a 50-year analysis period using a 6 percent interest rate is about $510,000. The storm water storage basin would remove from the runoff about 75 percent of the suspended solids, about 40 percent of the organic matter, and about 20 percent of the phosphorus. The present worth of each percentage point of reduction achieved in pollutant load is about $6,800 for suspended solids, $12,800 for organic matter, and about $25,500 for phosphorus. Hence, while storm water storage is a comparatively cost-effective means of reducing suspended solids loads to streams, it is not a cost-effective means of reducing organic matter or phosphorus loads.

The total cost of housekeeping practices is substantially less than that of storm water storage. Moreover, there are no state-promulgated water quality standards for suspended solids in the surface waters of Wisconsin. Improved housekeeping practices can provide a sufficient level of nonpoint source control to satisfy the applicable water quality standards, and are generally more implementable in a voluntary program than are storm water storage facilities. The study site for which the above analyses were conducted is the largest single site in the Root River watershed,

[10] *Donohue and Associates, Inc., Combined Sewer Overflow Report, Racine, Wisconsin. 1978.*

Map 14

HIGHLY IMPERVIOUS COMMERCIAL AND INDUSTRIAL SITES GREATER THAN 10 ACRES IN SIZE WHICH MAY CONTRIBUTE SUBSTANTIAL NONPOINT SOURCE POLLUTANT LOADS

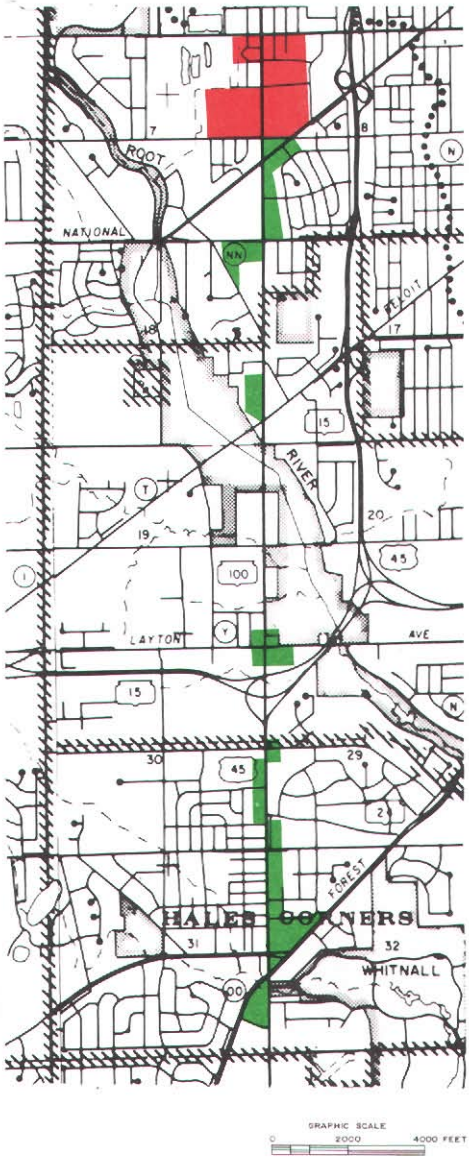


Large impervious areas often generate high storm water runoff rates and high nonpoint source pollutant loadings. Review and analysis of the characteristics, location, type, and extent of the storm drainage, as well as consideration of the pollution abatement effectiveness and cost of alternative pollution control measures, indicate improved housekeeping practices to be the most practical and cost-effective means of water pollution control for such sites. Improved housekeeping practices may be expected to provide a sufficient level of nonpoint source control in terms of satisfying applicable water quality standards. Improved housekeeping practices are generally more implementable in a voluntary program than are more costly structural control measures.

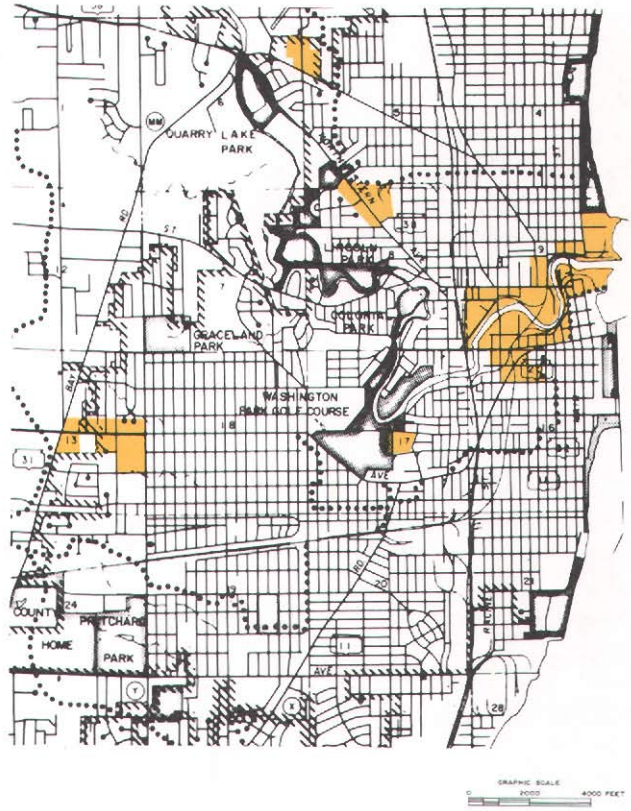
Source: SEWRPC.

Map 14 (continued)

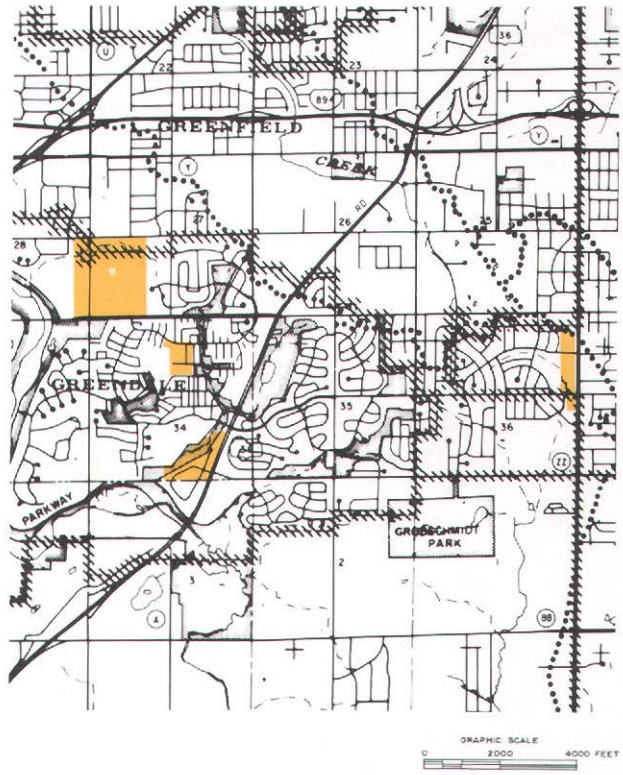
GREENFIELD-HALES CORNERS
WEST ALLIS SITE



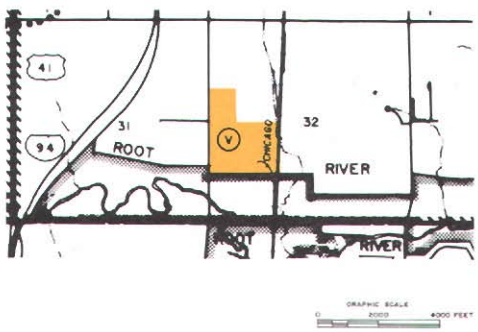
RACINE SITE



GREENDALE SITE



OAK CREEK SITE



and has the greatest observable water quality impact of any such sites. Therefore, it was concluded that housekeeping practices are the most practical and economical means of controlling nonpoint source pollutant loads for all such commercial and industrial sites in the watershed. Accordingly, it is recommended that improved housekeeping practices be implemented at all commercial and industrial areas greater than 10 acres in size that are shown on Map 14. Improved housekeeping practices recommended for these sites include the washing of all automobiles inside (instead of outside) service buildings at sales and service facilities so that the washwater will be discharged properly to sanitary sewers, rather than to storm sewers. Also recommended are the proper disposal of oil and other chemicals, improved litter control, the sweeping of parking lots at least twice a week, the diversion of roof top runoff to grassed or other pervious areas, and improved maintenance and cleaning of material storage areas.

It is therefore recommended that, before further consideration is given to storm water storage and treatment measures, the specified housekeeping practices be implemented at all sites shown on Map 14. If the housekeeping practices are not implemented, or if they do not provide a satisfactory level of pollution control, then storage and treatment should be considered in a revision to this nonpoint source abatement plan.

It is recommended that all severe roadside and stream bank erosion sites identified in urban areas from the field inventory data and shown on Map 8 be controlled by the application of erosion controls, riprap, stream bank seeding and shaping, and vegetative buffer strips. It is recommended that the Milwaukee and Racine County park commissions take steps to prevent and control erosion from the recreational activities identified on Map 8. Eroding trails and stream crossings should be stabilized. If necessary, access areas for certain recreational activities should be restricted. It is further recommended that Milwaukee County, acting through the County Park Commission and the Milwaukee Metropolitan Sewerage District, control stream bank erosion in the Root River Parkway.

It is recommended that all communities review the use of ice control materials, street maintenance, and refuse collection and disposal operations, and modify these operations to conform to those set forth in Table 17 to reduce pollutants entering the stream system. All landfills and dumps shown on Map 8 should be properly operated and maintained. Landfill and dump site operators should construct adequate diversions or other runoff controls to prevent contaminated surface runoff from landfill or dump sites from reaching streams.

It is recommended that the Town of Raymond dump site abandonment continue as envisioned in the local arrangements, and that a commitment to long-term site maintenance be honored. Similarly, sound operation and well-planned abandonment procedures, with long-term maintenance commitments, are recommended where appropriate for all landfill or dump sites in the watershed.

As set forth in Table 25, it is recommended that each county, city, village, and designated town in the watershed develop, with the assistance of the University of Wisconsin-Extension Service, a public education program. The program should encourage proper urban housekeeping practices, encourage the proper use of fertilizers and pesticides on lawns and gardens, support the proper collection and disposal of leaves, promote proper oil and chemical disposal, encourage improved industrial and commercial site housekeeping practices, demonstrate the use and effectiveness of specific nonpoint source control practices, encourage pet waste control and litter control, provide technical assistance to individual landowners, and inform the public of the status of the plan implementation and water quality improvements which are observed. A list of activities to be included in a public education program is set forth in Appendix C.

Abatementof Pollution from Rural Nonpoint Sources

In the rural areas those management practices identified in the field inventory as necessary to control the severe and very severe rural nonpoint sources of pollution are expected to sufficiently control rural nonpoint source pollution in the Root River watershed, and should therefore be implemented. Measures to control pollution from the severe and very severe nonpoint sources are presented in Table 26 and shown on Map 15. These practices are expected to result in the minimum level of rural nonpoint source control needed to satisfy the adopted water use objectives and supporting water quality standards.

The estimated soil loss from the rural land surfaces is one measure of pollutant loads from nonpoint sources. Table 27 and Maps 16, 17, and 18 show

the existing soil loss, the expected soil loss if all land management practices identified as desirable in the field inventory are implemented, and the expected soil loss if practices are applied only to the severe and very severe nonpoint sources. Implementation of practices to control the severe and very severe nonpoint sources is expected to achieve about a 37 percent reduction in the existing soil loss for the watershed as a whole. This is about 54 percent of the maximum reduction of about 68 percent achievable by implementing all desirable rural nonpoint source control practices identified in the field inventory of the watershed. Furthermore, the severe and very severe pollution sources, all of which are recommended to be controlled, are generally located close to streams and therefore are more likely to contribute pollutants to streams than are those sources which are farther from streams. Therefore, a reduction somewhat greater than 37 percent in sediment load to a stream may be possible through control of the severe and very severe sources alone. In addition, control of livestock waste may be expected to substantially reduce phosphorus and fecal coliform levels in the surface waters.

In the drainage areas tributary to the East Branch, West Branch, and main stem of the Root River Canal, a 50 percent reduction in pollutant loads, including fecal coliform, from rural nonpoint sources is required to satisfy the recommended water quality standards. The implementation of those practices needed to control only the severe and very severe nonpoint sources of pollution to the Root River Canal and its branches would result in a 45 percent reduction in soil loss from cropland in this drainage area. In addition, analyses conducted under the areawide water quality management plan indicated that control of stream bank erosion and livestock waste runoff would reduce sediment, phosphorus, and fecal coliform loads to the stream system by an estimated 10, 20, and 40 percent, respectively.

In the remaining portions of the watershed, which do not drain to the Root River Canal or its branches, a 25 percent reduction in rural nonpoint source pollutant loads is required to satisfy the water quality standards. However, more than a 50 percent reduction in fecal coliform loads is necessary. The implementation of only those practices needed to control the severe and very severe rural nonpoint sources in the remainder of the watershed would result in approximately a 30 percent reduction in soil loss from cropland. As with the Root River Canal drainage area, control of stream bank erosion and livestock waste runoff would further reduce sediment, phosphorus, and fecal coliform loads to the stream system by an estimated 10, 20, and 40 percent, respectively. Hence, a sufficient level of rural nonpoint source control is expected to be achieved by those practices needed to control only the severe and very severe rural nonpoint sources. It is therefore not necessary that pollution from all sources identified in the field inventory be abated in order to meet the water quality standards. The specific practices selected to be implemented to control the severe and very severe rural nonpoint sources shown on Map 15 will depend on the acceptability of the alternative practices to individual farmers.[11] Implementation of the recommended control measures summarized in Table 26 and on Map 15 may be expected to result in the attainment of the desired reduction in rural nonpoint source pollutant loads to the streams.

The stream bottom sediments in the watershed, particularly in the Root River Canal, have been identified as potentially important sources of nutrients and oxygen demand. Further studies—as set forth in SEWRPC Technical Memorandum No. 3, Priority Watershed Plan for Control of Nonpoint Sources of Water Pollution in the Root River Watershed: Water Quality Sampling and Monitoring Program (see Appendix D), a memorandum prepared under the Root River priority planning

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[11] *Under the Wisconsin Fund nonpoint source abatement program, cost-sharing is available only to those portions of the watershed having the greatest potential to be affected by pollutants transported in storm water runoff or reaching the stream by other means. Through the designation of these portions of the watershed, referred to as "priority management areas," it is intended that the limited available funds will be used to abate pollution from the severe and very severe nonpoint source contributors. Since this plan recommends that only the severe and very severe pollution sources be controlled, and since essentially complete implementation of the recommended practices will be necessary to achieve the adopted water use objectives and supporting water quality standards, it is recommended that all qualified practices identified in the recommended plan be considered eligible for cost-sharing under the program.*

Table 26

MEASURES TO CONTROL THE SEVERE AND VERY SEVERE RURAL NONPOINT SOURCES OF POLLUTION IN THE ROOT RIVER WATERSHED: 1979

Rural Nonpoint Source Abatement Measure	Nonpoint Source Severity Classification[a]	Extent
Crop Rotation	Very severe, severe	750 acres
Contour Strip Cropping	Very severe, severe	490 acres
Conservation Tillage	Very severe, severe	11,500 acres
Diversions	Very severe, severe	50,000 feet
Terraces	Very severe, severe	1,225,200 feet
Grass Waterways	Very severe, severe	182 acres
Grade Stabilization Structures	All	111 structures
Stream Fencing for Livestock Exclusion	Severe	3,350 feet
Stream Bank Riprap	Severe	13,650 feet
Stream Bank Shaping and Seeding	Severe	26,370 feet
Stream Cattle Crossings	All	10 crossings
Critical Area Planting	Severe	18 acres
Vegetative Buffer Strips	Severe	170 acres
Livestock Waste Runoff Management	Very severe, severe	44 systems
Livestock Waste Storage	Very severe, severe	23 systems

[a] *The nonpoint source severity classifications are set forth in the "Pollution Sources and Management Needs" section of this report.*

Source: Racine County Soil and Water Conservation District and SEWRPC.

program—are needed to determine the need for removing these potentially nutrient-rich, oxygen-demanding sediments by dredging or other means. This activity, if needed, could be coordinated with drainage channel maintenance activities, as set forth in Appendix A. Because channel maintenance activities may interfere with in-stream pollution control measures, it is important that the implementation of nonpoint source controls be coordinated with drainage channel maintenance activities. Changing the depth or side-slope of channels could affect the performance of grass waterways and grade stabilization structures adjacent to the stream. Furthermore, some channel maintenance activities, such as the removal of in-place pollutants and the shaping and stabilization of side slopes, could have significant water quality benefits.

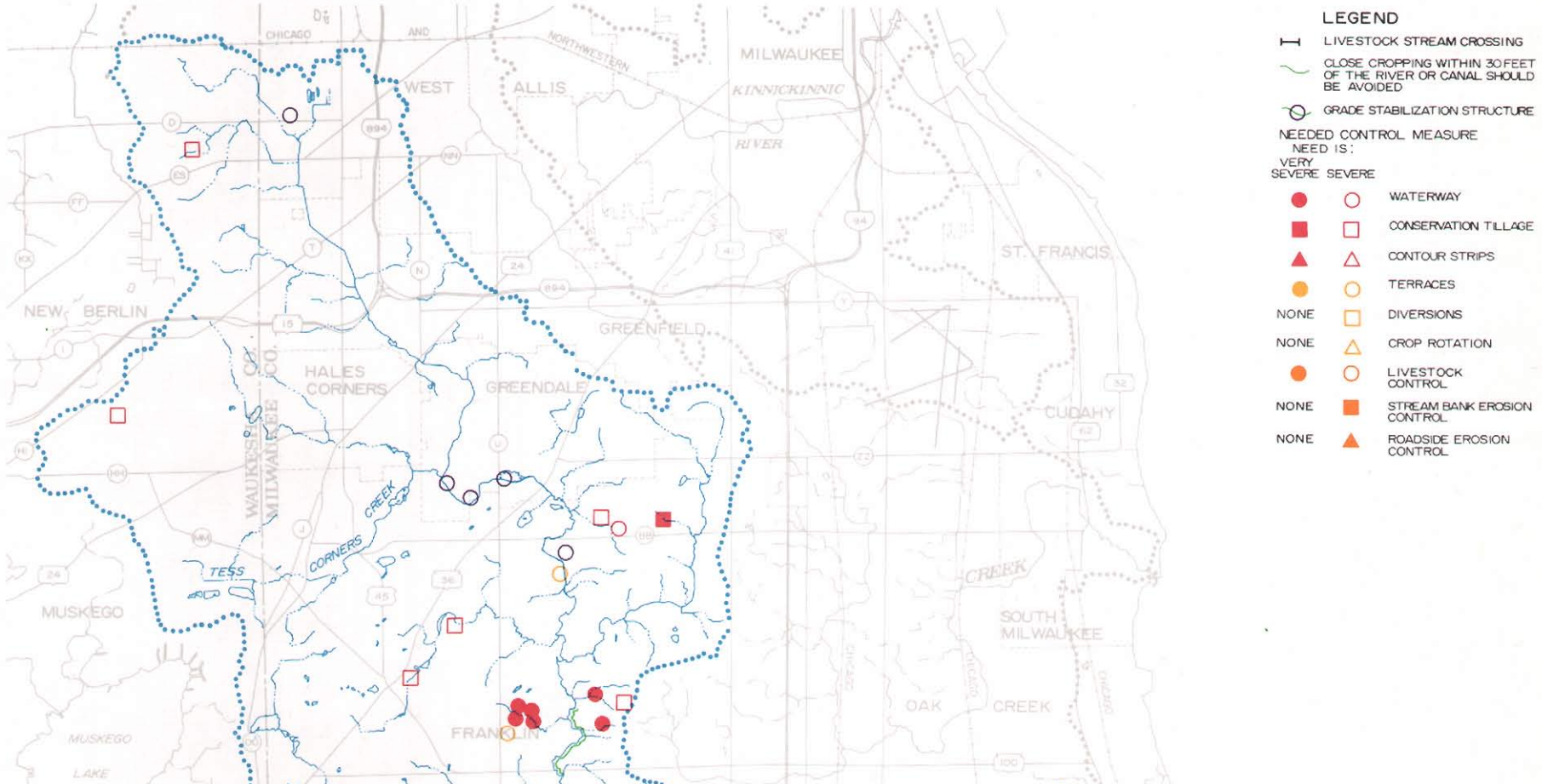
Racine County currently regulates land use, land management, erosion control, storm water drainage, and other activities in the floodplain and shoreland areas under the adopted floodplain and shoreland ordinance. It is recommended that the Racine County Planning and Zoning Department, in cooperation with the Racine County Soil and Water Conservation District staff and responsible landowners, prepare specific conservation standards as called for in the adopted floodplain and shoreland provisions of the zoning ordinance of Racine County. These standards should be applied in evaluating the environmental effects of land use and management activity in the floodplain and shoreland areas of the County.

Cost Analysis of Recommended Nonpoint Source Control Practices

In order to assist public officials and citizens in evaluating the financial feasibility of the recommended nonpoint source control practices, capital cost estimates were prepared. Capital cost estimates for both the urban- and rural-recommended nonpoint source control practices are presented in Table 28. All costs are in August 1979 dollars. It is proposed that the plan be implemented over

Map 15

LOCATION OF MANAGEMENT PRACTICES TO CONTROL THE SEVERE AND VERY SEVERE RURAL NONPOINT SOURCES OF POLLUTION IN THE ROOT RIVER WATERSHED: 1979



Management practices needed to control the severe and very severe rural nonpoint sources of pollution, as identified in the field inventory, are expected to sufficiently control rural nonpoint source pollution in the Root River watershed. It is recommended that these practices be implemented. The implementation of these practices to control the severe and very severe rural nonpoint sources would involve a total capital cost of about $5.5 million.

Source: Racine County Soil and Water Conservation District and SEWRPC.

Table 27

EXISTING AND EXPECTED SOIL LOSS FROM THE RURAL AREAS OF THE ROOT RIVER WATERSHED

Subwatershed	Existing Conditions			Practices Applied to Only the Severe and Very Severe Rural Nonpoint Sources			Practices Applied to all Rural Nonpoint Sources Identified		
	Rural Area (acres)[a]	Soil Loss (tons per year)[b]	Unit-Area Soil Loss (tons per acre per year)	Soil Loss (tons per year)[b]	Unit-Area Soil Loss (tons per acre per year)	Percent Reduction from Existing	Soil Loss (tons per year)[b]	Unit-Area Soil Loss (tons per acre per year)	Percent Reduction from Existing
West Branch, Root River Canal	24,480	277,470	11.3	157,600	6.4	43	74,240	3.0	73
East Branch, Root River Canal	9,600	101,600	10.6	59,360	6.2	42	28,800	3.0	72
Root River Canal	7,680	78,400	10.2	37,440	4.9	52	23,040	3.0	71
Whitnall Park Creek	2,080	19,040	9.1	12,640	6.1	34	6,240	3.0	67
Lower Root River	25,440	224,800	8.8	159,680	6.3	29	80,320	3.2	64
Middle Root River	11,840	85,920	7.2	57,920	4.9	33	39,520	3.3	54
Hoods Creek	9,120	62,400	6.8	46,080	5.0	26	27,360	3.0	56
East Branch, Root River	1,760	9,280	5.3	7,680	4.4	17	7,680	5.3	17
Total	92,000	858,910	9.3	538,400	5.8	37	287,200	3.1	68

[a] *The rural area shown is larger than the actual rural area of the watershed because the areas represent quarter-section approximations.*

[b] *The soil loss is estimated by the application of the Universal Soil Loss Equation. The soil loss represents gross soil erosion from an agricultural farm field. Only a portion of the eroded soil would actually reach a stream.*

Source: Racine County Soil and Water Conservation District and SEWRPC.

a nine-year period from 1980 through 1988. In addition to the capital costs presented, many practices have operation and maintenance costs associated with them, although a portion of the associated operation and maintenance efforts would be conducted routinely under normal urban land management and farming operations.

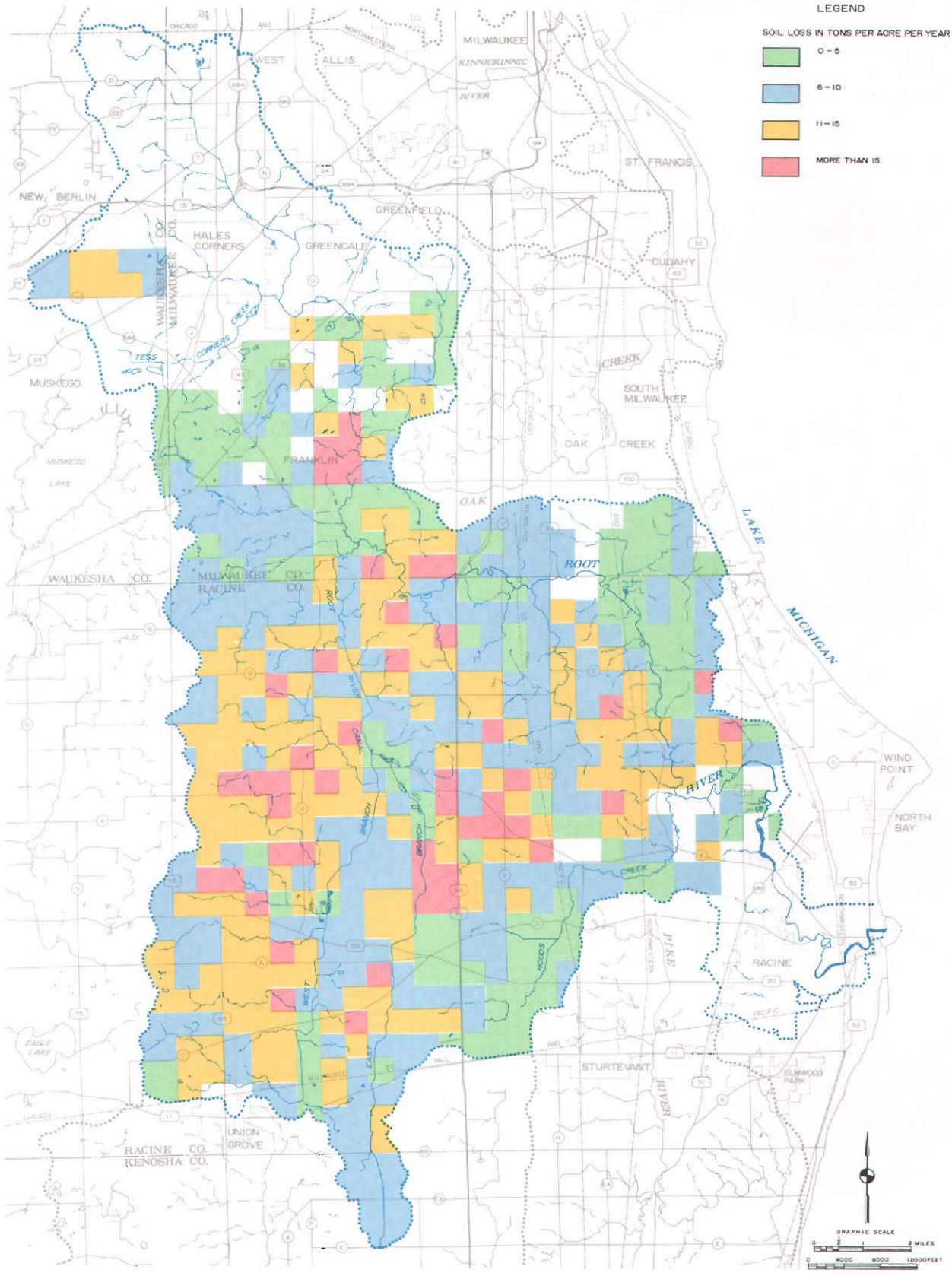
Table 28 also sets forth the expected cost-sharing rate from the Wisconsin Fund and total amount of money which could be expected to be provided by the Wisconsin Fund. Of the total plan cost of $6.8 million, about $5.5 million, or about 81 percent, would be required for the recommended rural practices, and about $1.4 million, or about 19 percent, for the recommended urban practices. About $3.4 million, or about 61 percent of the rural plan cost, about $0.37 million, or 27 percent of the urban plan cost, and about $3.7 million, or about 54 percent of the total plan cost, may be expected to be provided by the Wisconsin Fund. The capital costs and Wisconsin Fund cost-share requirements are set forth for each subwatershed in Table 29, and for each county in Table 30.

The total plan cost represents about $45 per capita distributed over the nine-year implementation period, or about $5.00 per capita per year, based on the 1975 resident population of the watershed. This cost does not include operation and maintenance costs for soil conservation practices, or any incremental operation and maintenance costs which may be incurred for street sweeping practices beyond the first year of implementation, during which operation and maintenance costs are eligible for cost-sharing. The local portion of the cost (that portion not provided by the Wisconsin Fund) is equivalent to about $20 per capita over the nine-year period, or about $2.22 per capita per year. The local portion of the cost of the recommended urban nonpoint source pollution control measures is estimated to total $1.0 million. Of this total, about $0.76 million, or 76 percent, would be provided by the concerned local units of government, with the remaining 24 percent being provided by the private sector.

The local portion of the cost of the recommended rural nonpoint source pollution control measures is estimated to total $2.1 million. Of this total,

Map 16

EXISTING SOIL LOSS FROM RURAL LAND SURFACES: 1979

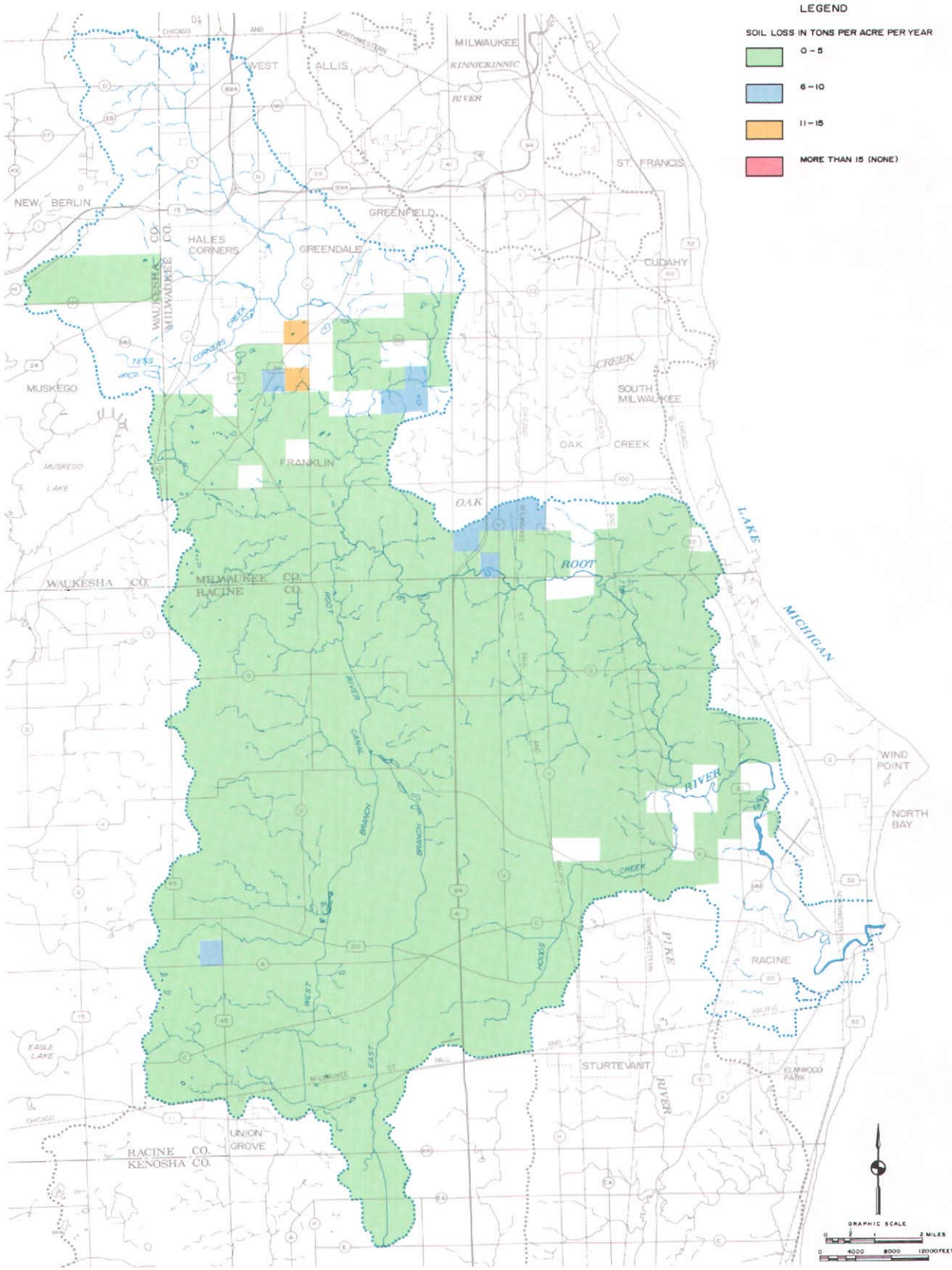


The estimated soil loss from all agricultural land in the watershed averaged 9.3 tons per acre per year. The soil loss, as determined by the application of the Universal Soil Loss Equation, represents gross soil losses from individual farm fields and overestimates the amount of soil which is actually contributed to a stream. About 71,520 acres, or 78 percent, of the agricultural land areas surveyed had an estimated soil loss exceeding five tons per acre per year. The East Branch of the Root River Canal, West Branch of the Root River Canal, and Root River Canal main stem subwatersheds have the highest estimated soil losses, due to erodible soils, extensive row crop production, and relatively steep slopes.

Source: Racine County Soil and Water Conservation District and SEWRPC.

Map 17

EXPECTED SOIL LOSS FROM RURAL LAND SURFACES IF ALL LAND MANAGEMENT PRACTICES IDENTIFIED IN THE FIELD INVENTORY ARE IMPLEMENTED

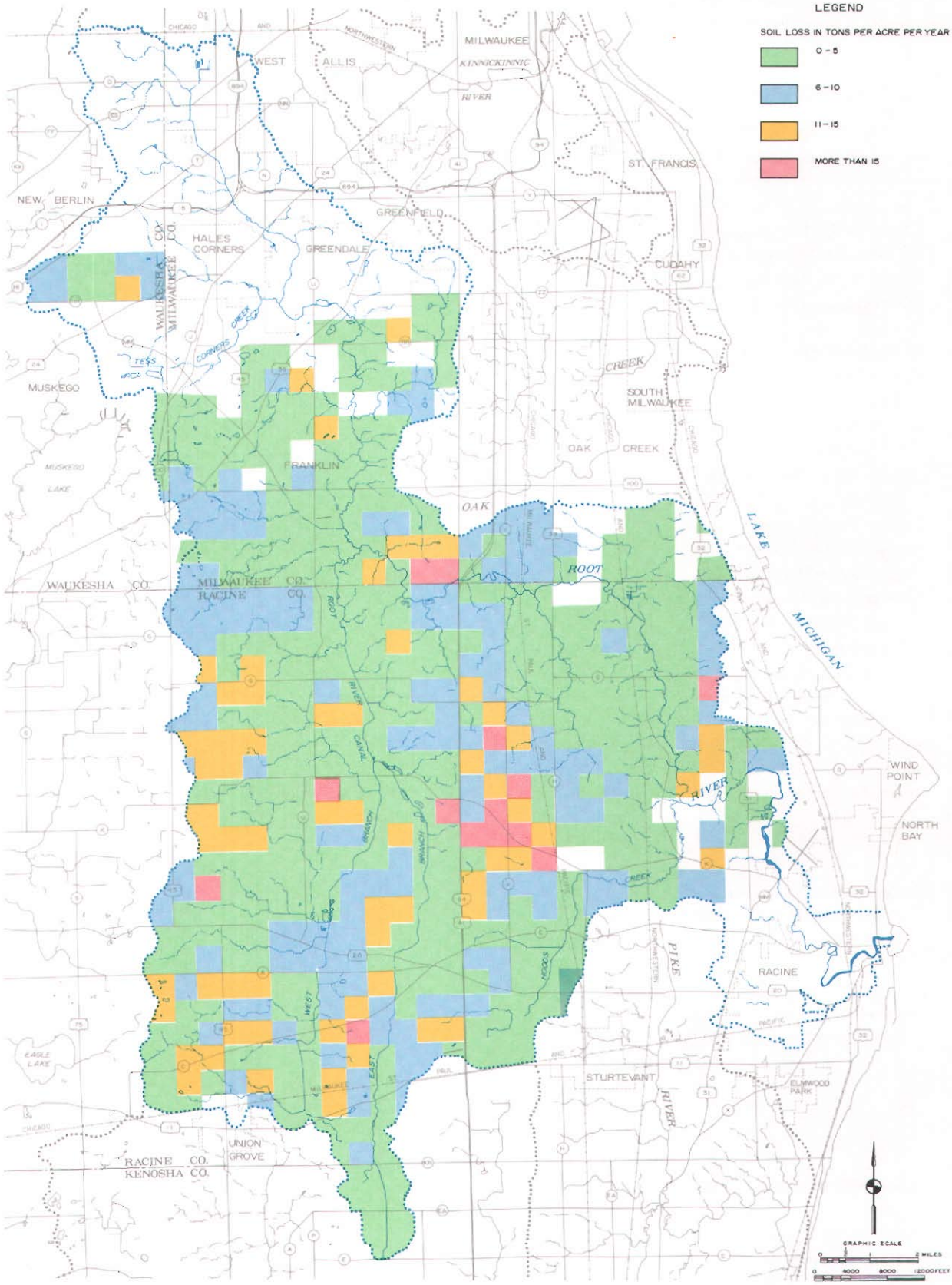


If all rural nonpoint source control practices identified in the inventory were implemented, the average soil loss from rural land surfaces would be reduced to about 3.1 tons per acre per year—a 68 percent reduction in the existing soil loss level.

Source: Racine County Soil and Water Conservation District and SEWRPC.

Map 18

EXPECTED SOIL LOSS FROM RURAL LAND SURFACES IF LAND MANAGEMENT PRACTICES ARE APPLIED ONLY TO THE SEVERE AND VERY SEVERE NONPOINT SOURCES



If only the severe and very severe rural nonpoint sources are controlled, average soil loss from rural land surfaces would be reduced to about 5.8 tons per acre per year, for about a 37 percent reduction in the existing soil loss level. However, this is only 54 percent of the total reduction achievable by implementing all rural nonpoint source controls. This level of reduction, though, is expected to satisfy the recommended water use objectives. The reduction in soil particles actually reaching a stream is expected to be somewhat greater than 37 percent because the severe and very severe sources are generally located closer to streams, and any pollutants from these sites are more likely to reach a stream. Additional reductions in phosphorus and fecal coliform levels are expected to result from the control of livestock waste.

Source: Racine County Soil and Water Conservation District and SEWRPC.

Table 28

CAPITAL COST AND WISCONSIN FUND COST-SHARE REQUIREMENTS FOR THE RECOMMENDED NONPOINT SOURCE ABATEMENT PLAN FOR THE ROOT RIVER WATERSHED

Nonpoint Source Abatement Measure	Extent	Wisconsin Fund Cost-Share Rate (percent)	Total Capital Cost[h]	Percent Total Capital Cost	Wisconsin Fund Cost-Share	Percent Total Wisconsin Fund Cost-Share
Rural						
Crop Rotation	750 acres	–	$ –	–	$ –	–
Contour Strip Cropping	490 acres	50	6,860	0.1	3,430	0.1
Conservation Tillage	11,500 acres	50	184,000	2.8	92,000	2.5
Diversions	50,000 feet	70	87,500	1.3	61,250	1.6
Terraces	1,225,200 feet	70	2,756,700	40.0	1,929,690	51.8
Grass Waterways	182 acres	70	382,200	5.6	267,540	7.2
Grade Stabilization Structures	111 structures	70	666,000	9.7	466,200	12.5
Stream Fencing for Livestock Exclusion	3,350 feet	50	2,850	–	1,430	–
Stream Bank Shaping and Seeding	26,370 feet	70	52,740	0.8	36,920	1.0
Stream Bank Riprap[a]	13,650 feet	70	204,750	3.0	143,320	3.9
Stream Cattle Crossings	10 crossings	70	10,000	0.1	7,000	0.2
Critical Area Planting	18 acres	70	9,900	0.1	6,930	0.2
Vegetative Buffer Strips	170 acres	70	25,500	0.4	17,850	0.5
Livestock Waste Runoff Management	44 systems	70[d]	264,000	3.9	184,800	5.0
Livestock Waste Storage	23 systems	70[d]	805,000	11.8	138,000	3.7
Subtotal	–	–	$5,458,000	79.8	$3,356,360	90.2
Urban						
Increased Street Sweeping	Assume the cost and operation of 10 new sweepers	50	$ 900,000[i]	13.2	$ 283,000	7.6
Improved Commercial and Industrial Site Housekeeping Practices	3,851 acres of commercial and industrial land	50	100,000[j]	1.5	50,000	1.3
Improved Leaf and Vegetative Debris Collection	Assume a 50 percent increase in existing collected leaves and debris	50	10,000	0.1	5,000	0.1
Construction Erosion Control	Assume 150 acres per year	50[d]	150,000	2.2	18,750[e]	0.5
Septic Tank System Management[b]	–	–[f]	–	–	–	–

Table 28 (continued)

Nonpoint Source Abatement Measure	Extent	Wisconsin Fund Cost-Share Rate (percent)	Total Capital Cost[h]	Percent Total Capital Cost	Wisconsin Fund Cost-Share	Percent Total Wisconsin Fund Cost-Share
Recreational Activities Erosion Control	About 2,400 feet of fencing, and about 20 signs restricting access	50	2,500[k]	–	1,250	–
Landfill and Dump Site Runoff Control	Four landfills in dumps require runoff control	50	8,400	0.2	4,200	0.2
Oil and Chemical Disposal Stations	Assume 20 stations	50	6,000[l]	0.1	3,000	0.1
Roadside Erosion Control[a]	3.2 acres	70	1,760	–	1,230	–
Public Education Program [a, c]	–	–[g]	200,000[m]	2.9	–	–
Subtotal	–	–	$1,378,660	20.2	$ 366,430	9.8
Total	–	–	$6,836,660	100.0	$3,722,790	100.0

[a] *For cost summary purposes, roadside erosion control and public education programs are assumed to be urban practices and stream bank erosion control is assumed to be a rural practice.*

[b] *The proper maintenance and replacement, if necessary, of septic tank systems is recommended to help abate pollution in the Root River watershed. However, because septic tank system management is an existing function necessary for the preservation of public health and the maintenance of drinking water supplies, the cost is not included in this nonpoint source abatement plan. The estimated expenditures for septic system management for the Root River watershed include a capital cost over the period of 1975-2000 of $6,764,000, and an average annual operation and maintenance cost of $178,000.*

[c] *Includes the encouragement of litter and pet waste control, proper use of fertilizer and pesticides, and critical area protection.*

[d] *The cost-share for any single livestock waste storage system cannot exceed $6,000.*

[e] *Construction activities on publicly owned land (highways, schools, etc.) are eligible for cost-sharing. It was estimated for costing purposes that about 25 percent of the new urban development in the watershed would be on public land.*

[f] *Cost-share funds for the replacement of malfunctioning septic tank systems are available under a separate provision of the Wisconsin Fund.*

[g] *No direct Wisconsin Fund monies are available to local units of government for educational purposes. However, the Board of Soil and Water Conservation Districts is providing some funds which may be used for education.*

[h] *All costs are in August 1979 dollars.*

[i] *This cost includes both capital and operation and maintenance for a one-year period since both the capital and operation and maintenance costs for a one-year period of increased street sweeping are eligible for Wisconsin Fund cost-sharing. The annual operation and maintenance costs of increased street sweeping are estimated at $500,000. The capital cost of purchasing new sweepers is estimated at $400,000.*

[j] *In estimating the costs of improved housekeeping practices on commercial and industrial lands, it was assumed that most practices would involve little or no cost, and would primarily require changes in the management and operation of the sites.*

[k] *The cost of erosion control along recreational trails is included in the stream bank erosion control cost.*

[l] *The cost of oil and chemical disposal stations is often readily reimbursed through the sale of the collected oil and chemicals for recycling. In such cases, Wisconsin Fund cost-share funds may not be needed.*

[m] *Of the total public education cost, about $90,000 would be for University of Wisconsin-Extension Service programs. The remaining costs would be for the education programs developed by each designated management agency.*

Source: Racine County Soil and Water Conservation District and SEWRPC.

Table 29

ESTIMATED CAPITAL COSTS AND WISCONSIN FUND COST-SHARE REQUIREMENTS BY SUBWATERSHED

Subwatershed	Total Capital Cost	Percent Total Capital Cost	Wisconsin Fund Cost-Share	Percent Total Wisconsin Fund Cost-Share
West Branch, Root River Canal	$1,457,790	21.3	$ 804,080	21.6
East Branch, Root River Canal	1,206,620	17.6	716,370	19.2
Lower Root River	1,950,270	28.5	1,132,650	30.4
Root River Canal	853,870	12.5	533,510	14.3
Hoods Creek	306,200	4.5	179,300	4.8
Middle Root River	344,660	5.1	138,690	3.8
Whitnall Park Creek	244,880	3.6	67,570	1.8
Upper Root River	416,520	6.1	136,030	3.7
East Branch, Root River	55,850	0.8	14,590	0.4
Total	$6,836,660	100.0	$3,722,790	100.0

Source: Racine County Soil and Water Conservation District and SEWRPC.

Table 30

ESTIMATED CAPITAL COSTS AND WISCONSIN FUND COST-SHARE REQUIREMENTS BY COUNTY

County	Total Capital Cost	Percent Total Capital Cost	Wisconsin Fund Cost-Share	Percent Total Wisconsin Fund Cost-Share
Kenosha	$ 110,500	1.6	$ 57,100	1.5
Milwaukee	876,300	12.8	359,400	9.7
Racine	5,690,760	83.3	3,267,090	87.8
Waukesha	159,100	2.3	39,200	1.0
Total	$6,836,660	100.0	$3,722,790	100.0

Source: Racine County Soil and Water Conservation District and SEWRPC.

only about $43,000, or about 2 percent, would be provided by the concerned local units of government, essentially for stream bank erosion control and grade stabilization structures on publicly owned lands, and over $2.0 million, or about 98 percent, would be provided by the private sector.

Comparison of the Root River Watershed Nonpoint Source Abatement Plan to the Areawide Water Quality Management Plan

The Root River watershed second-level nonpoint source pollution abatement plan is a refinement and extension of the areawide water quality management plan for the Root River watershed. As described below, the findings of this second-level plan are generally consistent with the assessment of nonpoint sources presented in the areawide plan.

The nonpoint source field inventory data collected in support of this detailed plan indicate observable pollution sources such as construction erosion sites, eroded roadsides, commercial and industrial site runoff, eroded stream banks, and malfunctioning septic tank systems in urban areas. In addition, the streams draining urban areas were observed to be turbid, occasionally covered by

algae growths, and generally unsuitable for recreational use or for the support of healthy populations of fish and other aquatic life. These findings are consistent with the areawide plan findings, which indicated that urban areas contribute a significant pollutant load to the Root River system and that a relatively high-level (50 percent) reduction in urban nonpoint pollution loads to the stream system would be necessary to satisfy water quality standards.

For rural areas, the field inventory of the detailed plan addressed agricultural cropland and estimated soil loss through the application of the Universal Soil Loss Equation. These studies indicated that the Root River Canal drainage area has the highest estimated soil loss in the watershed, and that application of soil conservation practices to the Root River Canal drainage area would achieve the highest percent reduction in soil loss within the watershed. In addition, about 84 percent of the livestock operations recommended to be controlled within the watershed are located within the Root River Canal drainage area. The areawide plan also highlighted the Root River Canal drainage area as the most significant area of rural nonpoint source pollution. The areawide study concluded that a relatively high-level (approximately 50 percent) reduction in nonpoint source pollutant loads to the Root River Canal would be required and that relatively low-cost practices—practices which would achieve approximately a 25 percent reduction in rural nonpoint source loads to the remaining portions of the watershed—would be needed in order for water quality standards to be met.

The nonpoint source control practices for urban areas recommended in this detailed nonpoint source abatement plan are similar to the urban practices recommended in the areawide plan. Specific urban nonpoint source pollution control practices recommended in the areawide plan to be considered for implementation in the Root River watershed include landfill and dump site runoff control, increased street sweeping, modified leaf and vegetative debris collection and disposal, improved industrial and commercial site housekeeping practices, and the provision of oil and chemical disposal stations. In addition, the detailed plan appropriately identifies certain site-specific urban area needs which were noted in the areawide plan as identifiable only in a site-specific study.

The capital cost of urban practices set forth in this detailed nonpoint source abatement plan is $1,379,000. The corresponding capital cost of urban practices set forth in the areawide plan is $2,884,000. All costs are expressed in August 1979 dollars. The cost of the detailed plan is somewhat less because detailed investigations indicated that housekeeping practices would provide the necessary level of storm water runoff control at industrial and commercial material storage facilities, thereby eliminating the need for relatively expensive storm water storage measures.

Both the detailed and areawide plans recommend that livestock waste control (either runoff control or waste storage) be implemented at a large number of operations in the watershed. The estimated capital cost of the livestock waste control recommended in this detailed nonpoint source plan is $1,069,000. The capital cost of the livestock waste control set forth in the areawide plan is $1,325,000.

The recommendations of the detailed plan and the areawide plan are similar with regard to the nonpoint source practices which should be implemented in the rural areas of the Root River Canal subwatersheds. Both plans envision practices that would provide for a relatively high level of pollutant control and that would represent a relatively high cost for this area. Such practices include the construction of grassed waterways, of terraces, and of diversions and grade stabilization structures. The detailed plan also recommends that similar practices be implemented in the other rural areas of the watershed besides the Root River Canal drainage area, although to a lesser extent. For the areas outside the Root River Canal drainage area, the areawide plan concluded that the widespread application of relatively low-cost conservation practices, such as conservation tillage, residue management, proper use of fertilizers and pesticides, and contour plowing, would sufficiently reduce pollutant loads from cropland. However, in the detailed study it was found that many of these low-cost practices are not fully compatible with the agricultural methods now used in the watershed and, therefore, are not fully acceptable to many farmers. Local management agency personnel found that the relatively wet soils in the watershed preclude the implementation in many areas of some low-cost practices, such as spring plowing or conservation tillage. Such practices are locally perceived to result in delayed crop planting and harvest. Hence, more locally acceptable (although more expensive) capital-intensive practices such as terraces are recommended for large portions of the rural areas of the watershed in the detailed nonpoint source plan.

The capital cost of all soil conservation practices recommended in the areawide plan is about $870,000 based upon generalized regionwide unit costs applied to the rural areas of the watershed.

The capital cost of the soil conservation practices recommended in the detailed nonpoint source plan is $4,389,000, of which $2,757,000, or 63 percent, is for terraces. This difference is due in part to the higher-cost practices assumed in the watershed as a result of local management agency conclusions regarding the soil conservation practices implementable in the watershed on a voluntary basis.

The difference in cost is also attributable to the higher number of practices needed and to the higher unit costs utilized in estimating the cost of terraces in the plan. The detailed plan indicates that more practices than were identified in the areawide plan will need to be implemented to sufficiently reduce cropland pollutant loads. This is attributable to the more intensive nature of the farming operations in the Root River watershed, compared to those in other parts of the Region, and to the historic character of the Soil Conservation Service farm plans, which are based on practices which farmers have agreed to implement, which provided the basis for the areawide plan analyses. In addition, the unit costs of practices used in the detailed nonpoint source plan are sometimes substantially higher than those used in the areawide plan. For example, a unit cost of $2.25 per foot was used in determining the cost of terraces in the detailed plan, while a unit cost (updated to 1979) of about $0.90 per foot was used in the areawide plan.

The total costs (including the capital costs and annual operation and maintenance costs of soil conservation practices) of this nonpoint source abatement plan and the areawide plan are consistent. The average annual operation and maintenance cost of the conservation practices recommended in this plan to control pollution from only the severe and very severe sources is $197,000. The areawide plan estimated an average annual operation and maintenance cost of $281,000 for soil conservation practices needed to control all agricultural nonpoint source pollution. Assuming an average soil conservation practice life of 25 years, this nonpoint source abatement plan proposes an average annual cost—including capital and operation and maintenance—of $373,000. The average annual cost of the soil conservation practices recommended in the areawide plan is $316,000. Therefore, this detailed nonpoint source abatement plan represents proper local refinement of the recommendations set forth in the areawide plan and serves to implement that plan.

PLAN IMPLEMENTATION

Introduction

The recommended plan described in this report provides a design for the achievement of the level of nonpoint source water pollution control necessary to attain established water use objectives and supporting water quality standards in the Root River watershed. In a practical sense, however, the plan is not complete until the steps required to implement it are set forth. After formal adoption of this plan by the designated management agencies, realization of the recommendations will require the support of local officials concerned with its implementation. The preparation and adoption of the plan is only the first of a series of required actions necessary to achieve the objectives expressed in this report. Adjustments to the plan must be made from time to time as required by changing conditions. Thus, plan implementation includes the periodic reevaluation of the plan to maintain its validity and effectiveness.

Nonpoint source pollution control involves: 1) changes in management techniques and implementation of soil conservation practices by agricultural landowners; 2) the adoption of effective land disturbance and onsite sewage disposal control ordinances by municipalities; 3) the improvement of public works operations by municipalities; and 4) the improvement of housekeeping practices by individual citizens and commercial and industrial establishments. This report indicates that these actions are necessary water pollution control measures and that failure to implement these actions will result in the continued degradation of the water quality of the stream system of the Root River watershed.

The following section describes the role and responsibilities of each of the units and agencies of government that have plan implementation powers, specifies actions desired for formal plan adoption, and sets forth implementation schedules for each of the designated management agencies. Finally, financial and technical assistance programs available to the implementing agencies are discussed and a time schedule for implementation is set forth.

Designated Local Management Agencies

Designated management agencies are agencies identified as having responsibilities for implementing specific plan recommendations. These agencies are legally responsible for the abatement of water pollution from nonpoint sources, and for

the protection of the surface waters of the Root River watershed. There are 23 designated nonpoint source pollution control management agencies in the Root River watershed. All 23 agencies are responsible for implementing urban nonpoint source controls, as set forth in Table 25. Eight of these agencies (each county and each soil and water conservation district) are also responsible for implementing rural nonpoint source controls.

The lead management agency for the Root River watershed priority planning program is the Racine County Soil and Water Conservation District. The lead agency is responsible for plan preparation and for coordinating activities among all other management agencies. Since planning at its best is a continuing function, it is recommended that a committee composed of representatives of each designated management agency advance the implementation of the nonpoint source priority watershed plan, and undertake plan updating and renovation as necessitated by changing conditions.

Other Agencies Providing Technical or Financial Assistance

Although primary responsibility for implementing land management practices lies with the local designated management agencies, there are other agencies which can provide assistance. Identified below are the federal, state, and regional governmental agencies that can assist the local agencies in the implementation of the plan. Each agency's role and responsibilities in the Root River watershed are specified.

Agricultural Stabilization and Conservation Service: Under contract to the lead designated management agency, the Agricultural Stabilization and Conservation Service (ASCS) of the U. S. Department of Agriculture can provide technical assistance for fiscal management of the Wisconsin Fund-supported projects which are undertaken within the framework of this nonpoint source pollution abatement plan. In addition, cost-sharing provided by the ongoing federal Agricultural Conservation Program (ACP) can be coordinated with the Wisconsin Fund projects in all rural areas in the watershed to maximize the financial assistance available to property owners for soil conservation practices. The ASCS can also provide assistance in the fiscal management of urban nonpoint source control abatement practices.

Soil Conservation Service: The Soil Conservation Service (SCS) of the U. S. Department of Agriculture can assist the soil and water conservation districts as stated in the memoranda of understanding maintained between the Service and the four soil and water conservation districts. The District Conservationist assigned to each county by the SCS can ensure that management practices meet applicable technical specifications. The SCS staff can assist in the design and development of individual practices on privately owned land, and can provide designated urban nonpoint source pollution control agencies with information on ways to control urban nonpoint source pollution. Finally, the SCS can provide staff specialists for technical and engineering assistance.

Wisconsin Department of Natural Resources: The Wisconsin Department of Natural Resources (DNR) is designated by the Wisconsin State Legislature as the cognizant state agency for administration of nonpoint source pollution abatement cost-sharing funds available through the Wisconsin Fund. The DNR can monitor the progress and goal achievement of projects, as well as the resulting water quality improvements, through the conduct of appropriate water quality monitoring throughout the watershed.

The Wisconsin State Board of Soil and Water Conservation Districts: Under the provisions of Section 144.25(5) of the Wisconsin Statutes, the State Board of Soil and Water Conservation Districts (BSWCD) is responsible for providing technical and educational assistance to the designated management agencies, as well as financial assistance in the management of records.

University of Wisconsin-Extension Service: The University of Wisconsin-Extension Service (UWEX) can provide technical and educational personnel to assist in the development and conduct of an educational program for the general public, landowners, and appropriate public officials. It can also assist the designated management agencies in the development of appropriate educational programs, tours, workshops, newsletters, and bulletins.

Southeastern Wisconsin Regional Planning Commission: The Southeastern Wisconsin Regional Planning Commission (SEWRPC) can provide technical assistance in the monitoring of progress in plan implementation, and can review and comment on the annual update of the plan, which will include an evaluation of the progress in implementation and water quality impacts associated therewith. SEWRPC can also assist in the development of selected ordinances for the control of pollution from nonpoint sources. As the officially

designated areawide water quality planning agency, SEWRPC will also be responsible for certifying the conformance of the Root River priority watershed plan with the recommendations of the adopted areawide water quality management plan.

PLAN ADOPTION

Upon completion of this nonpoint source abatement plan, a copy of the plan will be transmitted by the Racine County Soil and Water Conservation District (the lead designated management agency) to each designated management agency and to the DNR. Adoption of the plan by the designated management agencies and the DNR is highly desirable, if not essential, to ensure that the agencies understand the plan, and to enable their staffs to program the necessary plan implementation work. As part of the adopting action, the policy-making body or individual of each agency should direct its staff to fully integrate the nonpoint source abatement plan elements into the existing plans and programs of that agency. Plan adoption by a designated management agency does not commit that agency to implementing any nonpoint source control practices. Participation in the plan by local units of government is strictly voluntary. Before Wisconsin Fund monies can be appropriated, however, it is necessary that the plan be approved by the Racine County Soil and Water Conservation District and the Wisconsin Department of Natural Resources.

Evaluation and Subsequent Adjustment of the Plan

As already noted, periodic reevaluation of the adopted plan, and revision as necessary, is essential, and is required under the provisions of Chapter NR 121 of the Wisconsin Administrative Code. It is recommended that the plan be reevaluated on an annual basis. Plan reevaluation should include an assessment of the degree of participation in implementing the plan, a quantification of the management practices installed, and a description of the water quality effects noted.

The committee of designated management agencies should meet annually to 1) discuss the implementation status of the plan, 2) evaluate cost-share rates and eligible practices, 3) direct the administration of the program, and 4) make adjustments to the plan necessitated by changing conditions. An annual report on the status of the plan should be prepared by the lead management agency (the Racine County Soil and Water Conservation District). The annual report should include an audit of each contractual agreement signed and each practice implemented; an identification of funds expended for technical assistance, program administration, and educational programs; an identification of funds expended for management practices; and the unencumbered balance of the allotment from the Wisconsin Fund to the Root River project.

It is recommended that water quality monitoring be conducted by the DNR, as set forth in Technical Memorandum No. 3, Priority Watershed Plan for Control of Nonpoint Sources of Water Pollution in the Root River Watershed: Water Quality Sampling and Monitoring Program (see Appendix D), a memorandum prepared as part of the Root River priority planning program.

Implementation Schedules

In order to provide a basis for local, state, and federal agency programming and for the allocation of cost-sharing funds, implementation schedules were prepared. These schedules include recommended dates for the implementation of each rural and urban nonpoint source abatement measure. The schedules are intended to serve as a guide for the designated management agencies. Under the schedules, complete implementation of the recommended plan would be accomplished in a nine-year, 1980 through 1988, period.

Table 31 presents the recommended implementation schedule for urban nonpoint source abatement measures. Table 32 sets forth a schedule of costs for urban nonpoint source control. The schedule for urban measures must be regarded as flexible and should be reviewed and revised annually to reflect the programs and policies of the local management agencies involved. For urban areas, it was not deemed necessary to present an implementation schedule setting forth different implementation dates for each management agency. Rather, it is recommended that the urban practices be implemented within the framework of the implementation schedule for all urban areas of the watershed. It is further recommended that increased street sweeping programs not be implemented until 1983, upon completion of the Nationwide Urban Runoff Program (NURP) studies. These studies will quantify the water quality effects of street sweeping at different sweeping frequencies.

A schedule for the implementation of each rural nonpoint source control measure is set forth in Table 33. Because of the substantial technical assistance requirements associated with imple-

Table 31

IMPLEMENTATION SCHEDULE FOR URBAN NONPOINT SOURCE ABATEMENT MEASURES

Urban Nonpoint Source Abatement Measure	Implementation Schedule[a]								
	1980	1981	1982	1983	1984	1985	1986	1987	1988
Septic Tank System Management Program	X	X	--	--	--	--	--	--	--
Construction Site Erosion Control Program	X	X	--	--	--	--	--	--	--
New and Increased Street Sweeping Programs	--	--	--	X	X	X	--	--	--
Improved Leaf Collection	X	X	--	--	--	--	--	--	--
Oil and Chemical Disposal Stations	X	X	--	--	--	--	--	--	--
Improved Industrial and Commercial Site Housekeeping Practices	X	X	--	--	--	--	--	--	--
Roadside Erosion Control	X	X	--	--	--	--	--	--	--
Stream Bank Erosion Control	X	X	X	--	--	--	--	--	--
Recreational Activity Erosion Control	X	X	X	--	--	--	--	--	--
Landfill and Dump Site Runoff Control	X	--	--	--	--	--	--	--	--
Public Education Program	X	--	--	--	--	--	--	--	--

[a] *Implementation date represents the initial development of the practice or program. Most programs involve efforts on a continuing yearly basis.*

Source: Racine County Soil and Water Conservation District and SEWRPC.

Table 32

SCHEDULE OF WISCONSIN FUND-RELATED COSTS FOR URBAN NONPOINT SOURCE ABATEMENT MEASURES

Urban Nonpoint Source Abatement Measure	1980	1981	1982	1983	1984	1985	1986	1987	1988	Total
Construction Site Erosion Control	$ 30,000	$ 20,000	$20,000	$ 20,000	$ 20,000	$ 10,000	$10,000	$10,000	$10,000	$ 150,000
Increased Street Sweeping Program	–	–	–	100,000	300,000	300,000	–	–	–	700,000
New Street Sweeping Program	–	–	–	100,000	50,000	50,000	–	–	–	200,000
Improved Leaf Collection	5,000	5,000	–	–	–	–	–	–	–	10,000
Oil and Chemical Disposal Stations	3,000	3,000	–	–	–	–	–	–	–	6,000
Roadside Erosion Control	880	880	–	–	–	–	–	–	–	1,760
Improved Industrial and Commercial Site Housekeeping Practices	50,000	50,000	–	–	–	–	–	–	–	100,000
Recreational Activity Erosion Control	1,000	1,000	500	–	–	–	–	–	–	2,500
Landfill and Dump Site Runoff Control	8,400	–	–	–	–	–	–	–	–	8,400
Public Education Program	80,000	60,000	20,000	10,000	10,000	5,000	5,000	5,000	5,000	200,000
Total	$178,280	$139,880	$40,500	$230,000	$380,000	$365,000	$15,000	$15,000	$15,000	$1,378,660

[a] *The Wisconsin Fund-related cost represents only the capital cost for all practices. However, the increased and new street sweeping program costs also include operation and maintenance costs for a one-year period, which are eligible for cost-sharing. Only a portion of these costs would be provided by the Wisconsin Fund.*

Source: Racine County Soil and Water Conservation District and SEWRPC.

Table 33

IMPLEMENTATION SCHEDULE AND CAPITAL COST SCHEDULE FOR RURAL NONPOINT SOURCE ABATEMENT PRACTICES

Rural Nonpoint Source Abatement Measure	1980		1981		1982		1983		1984	
	Units	Capital Cost	Units	Capital Cost	Units	Capital Cost	Units	Capital Cost	Units	Capital Cost
Crop Rotation (acres)	250	$ –	250	$ –	250	$ –	–	$ –	–	$ –
Contour Strip Cropping (acres)	–	–	75	1,050	75	1,050	75	1,050	75	1,050
Conservation Tillage (acres)	1,000	16,000	2,000	32,000	2,000	32,000	2,000	32,000	2,000	32,000
Diversions (feet)	4,000	7,000	5,000	8,750	5,000	8,750	–	–	8,000	14,000
Terraces (feet)	–	–	150,000	337,500	100,000	225,000	100,000	225,000	200,000	450,000
Grass Waterways (acres)	–	–	35	73,500	35	73,500	35	73,500	12	25,200
Grade Stabilization Structures (number)	3	18,000	9	54,000	16	96,000	24	144,000	25	150,000
Stream Fencing (feet)	500	425	700	595	1,000	850	700	595	450	385
Stream Bank Shaping and Seeding (feet)	–	–	4,000	8,000	6,500	13,000	6,650	13,300	4,000	8,000
Stream Bank Riprap (feet)	–	–	1,300	19,500	1,300	19,500	4,300	64,500	4,000	60,000
Stream Cattle Crossings (number)	6	3,300	6	3,300	6	3,300	–	–	–	–
Critical Area Planting (acres)	1	1,000	2	2,000	4	4,000	2	2,000	1	1,000
Vegetative Buffer Strips (acres)	–	–	33	4,950	–	–	–	–	56	8,400
Livestock Waste Runoff Management (system)	4	24,000	5	30,000	11	66,000	9	54,000	4	24,000
Livestock Waste Storage (system)	2	70,000	4	140,000	5	175,000	5	175,000	3	105,000
Total	–	$139,725	–	$715,145	–	$717,950	–	$784,945	–	$879,035

menting rural practices, the implementation procedures are concentrated initially in those subwatersheds with the most severe nonpoint source problems and where implementation of management practices would receive the most acceptance. Map 19 sets forth a priority ranking of subwatersheds for rural practice implementation in the Root River watershed. During the first two or three years of the implementation program, the soil and water conservation district staffs should place emphasis on carrying out the practices recommended for the West Branch of the Root River Canal, Lower Root River, Whitnall Park Creek, and Middle Root River subwatersheds. Practices recommended for the rural portions of the Root River Canal, East Branch of the Root River, and Upper Root River subwatersheds should receive the next highest priority for technical assistance, and practices recommended for the East Branch of the Root River Canal and Hoods Creek should be implemented toward the end of the nine-year implementation period. Appendix E sets forth an implementation schedule for rural practices for each subwatershed.

Technical Assistance by the Soil and Water Conservation Districts

Technical assistance in carrying out the recommendations of this plan will primarily be provided by the U. S. Department of Agriculture, Soil Con-

Table 33 (continued)

Rural Nonpoint Source Abatement Measure	1985		1986		1987		1988		Total	
	Units	Capital Cost	Units	Capital Cost	Units	Capital Cost	Units	Capital Cost	Units	Capital Cost
Crop Rotation (acres)	–	$ –	–	$ –	–	$ –	–	$ –	750	$ –
Contour Strip Cropping (acres)	75	1,050	75	1,050	40	560	–	–	490	6,860
Conservation Tillage (acres)	1,000	16,000	1,000	16,000	500	8,000	–	–	11,500	184,000
Diversions (feet)	6,000	10,500	12,000	21,000	10,000	17,500	–	–	50,000	87,500
Terraces (feet)	200,000	450,000	200,000	450,000	275,200	619,200	–	–	1,225,200	2,756,700
Grass Waterways (acres)	17,000	35,700	28	58,800	20	42,000	–	–	182	382,200
Grade Stabilization Structures (number)	21	126,000	13	78,000	–	–	–	–	111	666,000
Stream Fencing (feet)	–	–	–	–	–	–	–	–	3,350	2,850
Stream Bank Shaping and Seeding (feet)	2,900	5,800	2,000	4,000	320	640	–	–	26,370	52,740
Stream Bank Riprap (feet)	2,750	41,250	–	–	–	–	–	–	13,650	204,750
Stream Cattle Crossings (number)	–	–	–	–	–	–	–	–	10	10,000
Critical Area Planting (acres)	–	–	–	–	–	–	–	–	18	9,900
Vegetative Buffer Strips (acres)	17	2,550	64	9,600	–	–	–	$ –	170	25,500
Livestock Waste Runoff Management (system)	7	42,000	4	24,000	–	–	–	–	44	264,000
Livestock Waste Storage (system)	3	105,000	1	35,000	–	–	–	–	23	805,000
Total	–	$835,850	–	$697,450	–	$687,900	–	–	–	$5,458,000

Source: Racine County Soil and Water Conservation District and SEWRPC.

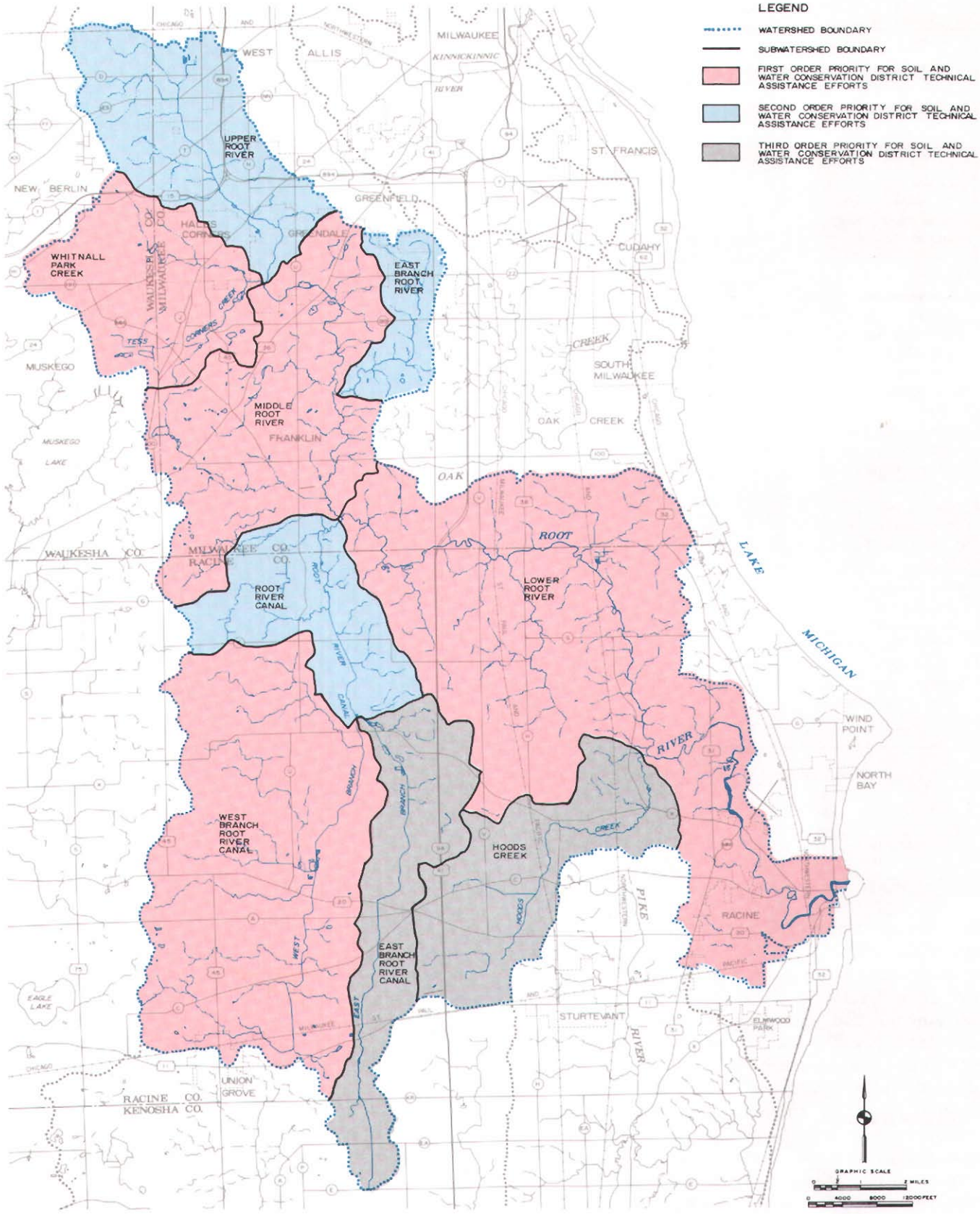
servation Service, working through the county soil and water conservation districts. The soil and water conservation districts have primary responsibility for the development of individual cooperator agreements and individual contract agreements, and for the design and layout of soil conservation practices. Personnel of the Soil Conservation Service and soil and water conservation districts should assist in implementing erosion control measures in urban areas, in the review of construction erosion control plans, and in the inspection of implemented measures. Present staffing levels of the soil and water conservation districts indicate the availability of about 1.4 equivalent employees per year for implementation of the program. Remaining technical assistance needs will have to be met through increased local or state funding or through the re-allocation of existing staff. Technical assistance requirements for each management practice and for each of the subwatersheds are set forth in Appendix E, and such requirements are summarized by year in Table 34.

Financial Assistance

The majority of the financial assistance funds to be used in implementing nonpoint source controls will be provided by the Wisconsin Fund. Generally, only capital costs are eligible for cost-sharing, and some practices do not require cost-sharing because

Map 19

PRIORITY RANKING OF SUBWATERSHEDS FOR SOIL AND WATER CONSERVATION DISTRICT TECHNICAL ASSISTANCE EFFORTS



The implementation of the recommended urban and rural nonpoint source control practices would require substantial technical assistance by the soil and water conservation districts. Implementation procedures and technical assistance efforts are therefore concentrated initially in those subwatersheds with the most severe nonpoint source problems and where implementation of management practices is expected to receive the most acceptance. Accordingly, during the first two or three years of the implementation program, the SWCD staffs are to place emphasis on carrying out practices recommended for the West Branch of the Root River Canal, Lower Root River, Whitnall Park Creek, and Middle Root River subwatersheds.

Source: Racine County Soil and Water Conservation District and SEWRPC.

Table 34

ESTIMATED SOIL AND WATER CONSERVATION DISTRICT PERSONNEL REQUIREMENTS FOR IMPLEMENTATION OF THE ROOT RIVER NONPOINT SOURCE CONTROL PLAN

Work Effort	Personnel Requirements (person - years)									
	1980	1981	1982	1983	1984	1985	1986	1987	1988	Total
Technical Assistance[a]	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.0	20.0
Education[b]	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	2.0
Program Management[c]	0.6	0.6	0.4	0.4	0.2	0.2	0.2	0.2	0.2	3.0
Total Program Needs	3.5	3.3	3.1	3.1	2.9	2.9	2.9	2.9	0.4	25.0
Locally Supported	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	12.6
State Supported	2.1	1.9	1.7	1.7	1.5	1.5	1.5	1.5	0.0	13.4

[a] *The technical assistance needs shown are required to implement the plan according to the implementation schedule. Technical assistance includes conservation planning, planning with other local designated management agencies, and the selection, design, layout, and construction supervision of conservation practices. Though the 20 man-years of effort have been equally distributed over eight years, evaluation of the program at the end of the first and subsequent years may indicate a need for an increased commitment in the early years and decreased staff needs near the end of the project. The Racine County SWCD will be responsible for evaluating changes in personnel needs.*

[b] *A multiple-agency education program has been developed to provide nonpoint source pollution abatement information to landowners and the general public. The urban education program will be supported by the soil and water conservation districts, the University of Wisconsin-Extension Service, and the designated urban management agencies. In the rural areas, the University of Wisconsin-Extension Service, the counties, and the SWCD's will be responsible for adequately developing and presenting the technical aspects of the conservation measures. Participation in these activities includes personal contacts with landowners. Public involvement is a vital part of a successful implementation program. This involves presenting the Root River plan to various groups as well as listening to their concerns. Soil and water conservation district staff serve as a necessary link between the public and the SWCD supervisors.*

[c] *The Racine County SWCD is responsible for the program management of the Root River watershed nonpoint source control plan. Program management includes, but is not limited to, the following activities: 1) coordinating activities of all designated management agencies; 2) serving as a liaison between state and regional level agencies such as SEWRPC, DNR, BSWCD, and University of Wisconsin-Extension Service; 3) coordinating other priority watershed planning programs with this program; 4) monitoring subcontracts; 5) preparing and filing reports; 6) providing assistance to district supervisors; 7) annual program review; and 8) budget preparation.*

Source: Racine County Soil and Water Conservation District.

of their low capital cost.[12] Section 144.25 of the Wisconsin Statutes states that Wisconsin Fund cost-share payments shall not exceed 50 percent of the cost of implementing the recommended management practices except as follows:

1. The maximum rate may be increased to as much as 70 percent where the practice produces benefits for the landowner but the main benefits to be derived are related to improving water quality and where limiting the cost-sharing to 50 percent would place an unreasonable cost burden on landowners.

2. The maximum rate may be increased above 70 percent where the practice produces negligible benefits to the landowner but the main benefits to be derived are related to improving water quality and

[12] *Wisconsin Fund cost-sharing is also not available for silvicultural activities (excluding farm woodlots), mining activities, dredging activities, practices installed primarily for flood control purposes, and practices normally used in the growing of crops.*

where limiting the cost-sharing to 70 percent would place an unreasonable cost burden on landowners. In order for a specific practice to receive cost-sharing above 70 percent, county cost-sharing must be provided. The county cost-sharing may be matched by supplemental state cost-sharing up to 10 percent. For example, a stream bank protection practice could receive 80 percent state cost-sharing if the county provides 10 percent cost-sharing. As of March 1980, no county cost-share programs had been established in the Root River watershed.

Wisconsin Fund monies may provide the major source of cost-sharing or may be used together with federal cost-sharing programs such as the Agricultural Conservation Program (ACP), up to 70 percent. The remaining costs must be met by county cost-sharing or be borne by the landowner. The specific cost-share guidelines for individual practices are set forth in Appendix F.

The management of the Root River watershed nonpoint source abatement program is primarily the responsibility of the Racine County Soil and Water Conservation District and the U. S. Department of Agriculture, Agricultural Stabilization and Conservation Service. Each designated management agency, however, is required by state administrative rules to maintain files of practices implemented within its own jurisdictional area. The recommended record-keeping program, cost-share application and payment procedures, and guidelines for the maintenance of management practices are set forth in Appendix G.

SUMMARY

This report sets forth a detailed plan for the abatement of nonpoint source water pollution in the Root River watershed located in southeastern Wisconsin. The plan assesses the water quality conditions in the watershed, identifies and quantifies the pollution sources, recommends nonpoint source control measures, estimates associated costs, and sets forth an implementation program. The plan is a refinement and extension of the adopted areawide water quality management plan for southeastern Wisconsin, which was prepared to provide for the achievement of "fishable and swimmable" water quality wherever practical within the Southeastern Wisconsin Region. The preparation of this detailed plan was funded under the Wisconsin Fund nonpoint source pollution abatement program.

The watershed drains 197 square miles of land, an area influenced by glacial effects, with ridges and glacial moraines which control the slope and pattern of the drainage network. The surface water is comprised almost entirely of streamflow, with the perennial streams totaling about 99 miles in length. These streams include the North Branch of the Root River (main stem), Upper Creek, Hales Corners Creek, Tess Corners-Whitnall Creek, Ryan Creek, South Branch or Root River Canal, East Branch of the Root River Canal, West Branch of the Root River Canal, Raymond Creek, Husher Creek, and Hoods Creek. The soils covering the watershed are relatively deep loams or clay-type soils. The watershed has a continental climate characterized by a continuous progression of different seasons and a large range in temperature. The temperature ranges from a monthly average of 20.0°F in January to 71.4°F in July. The annual precipitation totals about 31 inches of water equivalent. As of 1975, about 23 percent of the watershed area was in urban land use, 68 percent in agricultural use, and the remainder in open uses such as streams, wetlands, or woodlands. As of 1975, an estimated 152,400 persons were residing in the watershed. The watershed lies within Kenosha, Milwaukee, Racine, and Waukesha Counties, and includes parts of 18 cities, villages, and towns, as well as numerous special-purpose units of government.

The areawide water quality management plan concluded that, in order for the recommended water use objectives to be achieved, both urban and rural nonpoint source controls, as well as point source controls, need to be implemented within the watershed. In urban areas, a 50 percent reduction in nonpoint source pollutant loads to the streams was recommended. In rural areas, a 25 percent reduction in nonpoint source loads was recommended, except in the Root River Canal drainage area, where a 50 percent reduction was recommended.

A total of 23 government agencies were designated in the areawide plan for urban nonpoint source control responsibility. Eight of these agencies were also designated for rural nonpoint source control responsibility. The recommended water use objectives for the Root River Canal and for the Root River main stem upstream of Layton Avenue in the City of Greenfield are limited recreational use and the support of a limited fishery and aquatic life. The recommended use objectives for the remaining portions of the watershed are full recreational use and the support of a warmwater (or salmonid-spawning) fishery and aquatic life.

Water quality analyses indicate that substantial violations of the fecal coliform and dissolved oxygen standards and of the recommended phosphorus standard occur throughout most of the watershed. Similar violations may be expected in the future if no action is taken to control point and nonpoint sources of pollution. Hence, the water quality of the Root River stream system is presently unsuitable for recreational use or for the support of desired fish and aquatic life populations. The application of a biological index to measure water quality in the watershed indicated that the water quality of most of the streams in the watershed is very poor.

The areawide water quality management plan indicated that point sources are an important contributor of pollutants, currently affecting about 88 percent of the stream miles in the watershed. The plan recommended measures for the abatement of pollution from these point sources. The areawide plan also indicated—and the inventory analyses conducted under this planning program confirmed—that nonpoint source pollutant loads are substantial. Important urban nonpoint sources include: 1) runoff of leaf and other vegetative debris; 2) storm water runoff from streets and large imperviously surfaced areas such as parking lots with the attendant discharge of oil, transmission fluid, and antifreeze; 3) runoff from recreational-related activities, including unstabilized recreational vehicle, hiking, and equestrian trails, and, in the lower reaches of the main channel, motor boats; 4) roadside and stream bank erosion; 5) construction site erosion; 6) uncontrolled runoff from land fill sites; and 7) malfunctioning septic tank systems. Important rural nonpoint sources include: 1) runoff from livestock operations; 2) improper manure application to cropland; 3) excessive cattle access to streams; 4) cropland runoff; and 5) stream bank erosion.

The recommended plan focuses primarily on the degree to which the established water use objectives can be satisfied by alternative control measures and on the accompanying costs. Recommendations are made to effectively control pollution from both urban and rural nonpoint sources. Recommended urban and rural practices are summarized on Map 20. Recommended urban nonpoint source control measures include: 1) onsite sewage disposal system management programs; 2) construction erosion control programs; 3) new or increased street sweeping programs; 4) improved leaf collection and disposal; 5) the provision of oil and chemical disposal containers; 6) improved industrial and commercial site housekeeping practices; 7) roadside and stream bank erosion control; 8) recreational activity erosion control; 9) landfill site runoff control; and 10) public education programs. The implementation of the recommended practices may be expected to reduce pollutant loads from urban nonpoint sources by about 50 percent, thereby assisting in meeting the water use objectives.

Practices recommended to abate pollution from nonpoint sources include: 1) crop rotation; 2) contour strip cropping; 3) conservation or minimum tillage; 4) diversions; 5) terraces; 6) grass waterways; 7) grade stabilization structures; 8) stream fencing for livestock exclusion; 9) stream bank riprap; 10) stream cattle crossings; 11) critical area planting; 12) vegetative buffer strips; 13) livestock waste runoff control systems; and 14) livestock waste storage systems. The plan recommends control of only the severe and very severe rural nonpoint sources. Control of such sources would reduce the average soil loss from erosion by about 40 percent, with additional reductions in sediment, phosphorus, and bacteriological pollutant loads resulting from the control of livestock waste and stream bank erosion. It is not necessary that all rural sources of pollution identified in the field inventory be abated in order to meet the water quality standards; controlling only the severe and very severe sources, as recommended in the plan, is expected to achieve the desired reduction in rural nonpoint source pollutant loads.

To determine the financial feasibility of the recommended nonpoint source abatement plan, capital cost estimates were prepared. The capital cost of the plan is estimated to total $6.8 million, of which $5.5 million, or 81 percent, is required for rural nonpoint source control practices, and $1.4 million, or 19 percent, for urban nonpoint source control practices. About $3.4 million, or about 61 percent of the cost of the rural control measures, about $0.37 million, or 27 percent of the cost of the urban control measures, and about $3.7 million, or about 54 percent of the total plan cost, may be expected to be provided by the Wisconsin Fund. The total plan cost represents about $5.00 per capita per year over a nine-year plan implementation period, based on the 1975 resident population of the watershed. The local portion of the cost—that portion not provided by the Wisconsin Fund—represents about $2.22 per capita per year.

The local portion of the cost of the urban nonpoint source control measures is estimated to total $1.0 million. Of this total, about $0.76 million, or 76 percent, will be provided by the concerned local units of government, with the remaining 24 percent being provided by the private sector. The local portion of the cost of the rural nonpoint source control measures is estimated to total $2.1 million. Of this total, about $43,000, or about 2 percent, will be provided by the concerned local units of government, and over $2.0 million, or about 98 percent, will be provided by the private sector.

The plan cost includes capital costs and an operation and maintenance cost of $500,000 for one year of street sweeping, which is eligible for cost-sharing under the Wisconsin Fund. This nonpoint source control plan involves a total average annual operation and maintenance cost of about $893,000, including street sweeping. Of this total, $249,500, or 28 percent, is required for rural control measures and $643,500, or 72 percent, is required for urban control measures. The operation and maintenance cost of the plan is about $5.86 per capita per year.

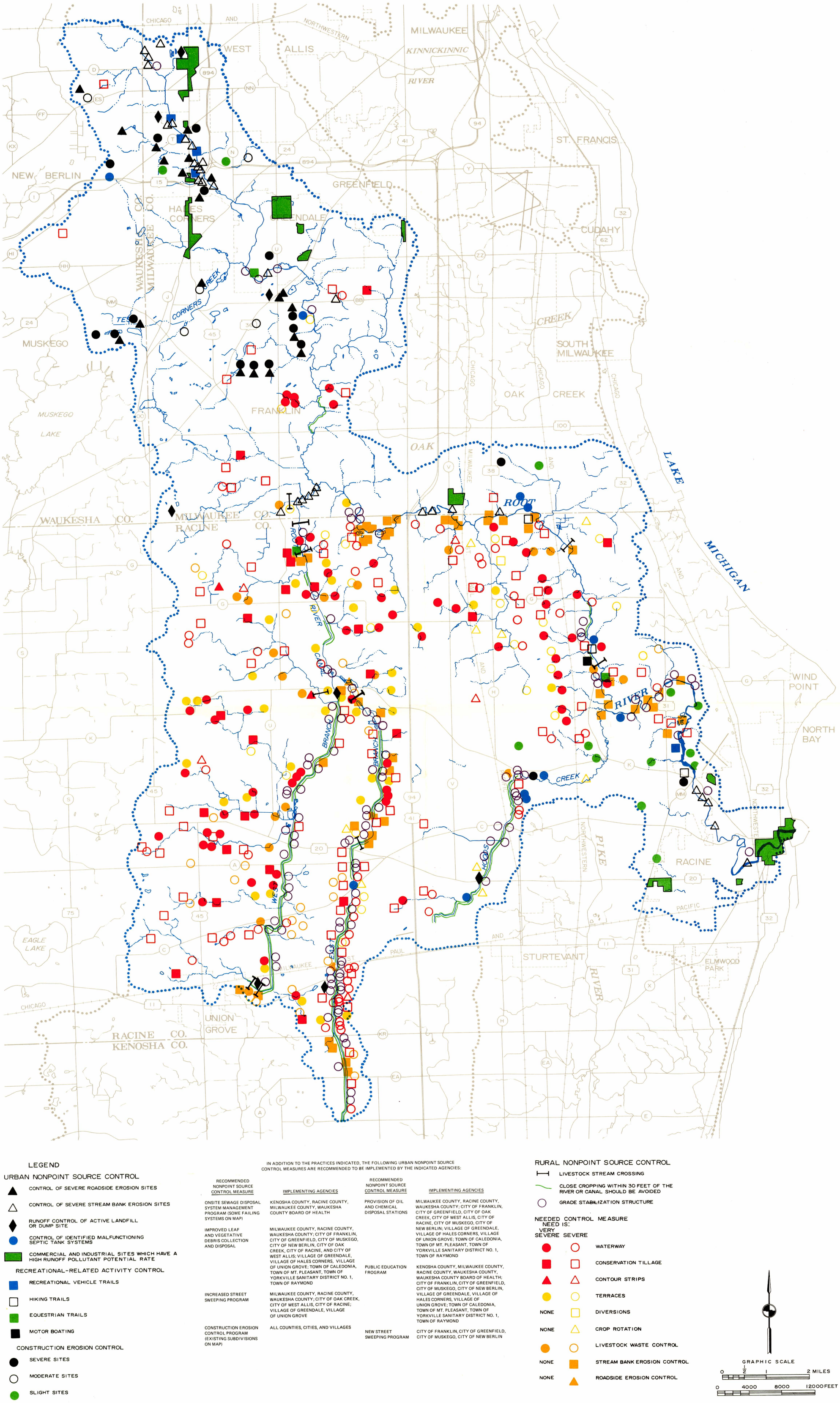
Based on the foregoing findings, it is recommended that the plan be implemented over a nine-year period—from 1980 through 1988. The Racine County Soil and Water Conservation District, as the lead designated management agency, would have primary responsibility for administering the implementation of the plan. In addition to requiring the efforts of the designated local management agencies, implementation of the plan will require the dedicated efforts of the U. S. Department of Agriculture, Agricultural Stabilization and Conservation Service and Soil Conservation Service; the Wisconsin Department of Nautral Resources; the State Board of Soil and Water Conservation Districts; the University of Wisconsin-Extension Service; and the Southeastern Wisconsin Regional Planning Commission.

It is recommended that the plan be formally adopted by each designated management agency, and that the plan be periodically evaluated and revised. Most urban practices should be implemented early in the implementation program, except for increased street sweeping. Sweeping should not be implemented until 1983, upon completion of the Nationwide Urban Runoff Program studies. Implementation of the rural practices should occur uniformly over the nine-year implementation period to allow allocation of sufficient personnel for technical assistance, as well as to provide stability in funding levels. In the rural areas, it is recommended that the subwatersheds with the most severe nonpoint sources be treated first, and that subwatersheds with less severe nonpoint sources be treated toward the end of the implementation period.

This nonpoint source abatement plan for the Root River watershed represents a refinement of the adopted areawide water quality management plan. This plan identifies the practices needed to abate pollution from both urban and rural nonpoint sources, and sets forth the location, extent, and costs of such practices. The recommended nonpoint source abatement measures would—in combination with the point source controls recommended in the areawide plan—serve to achieve the established water use objectives and supporting water quality standards. This implementation of the plan will contribute toward the enhancement of the overall quality of the environment in the watershed, and thereby make the watershed a safer, more healthful, and more attractive area in which to live and work.

Map 20

RECOMMENDED URBAN AND RURAL NONPOINT SOURCE CONTROL PRACTICES FOR THE ROOT RIVER WATERSHED



LEGEND

URBAN NONPOINT SOURCE CONTROL

- ▲ CONTROL OF SEVERE ROADSIDE EROSION SITES
- △ CONTROL OF SEVERE STREAM BANK EROSION SITES
- ◆ RUNOFF CONTROL OF ACTIVE LANDFILL OR DUMP SITE
- ● CONTROL OF IDENTIFIED MALFUNCTIONING SEPTIC TANK SYSTEMS
- ▬ COMMERCIAL AND INDUSTRIAL SITES WHICH HAVE A HIGH RUNOFF POLLUTANT POTENTIAL RATE

RECREATIONAL-RELATED ACTIVITY CONTROL

- ■ RECREATIONAL VEHICLE TRAILS
- □ HIKING TRAILS
- ■ EQUESTRIAN TRAILS
- ■ MOTOR BOATING

CONSTRUCTION EROSION CONTROL

- ● SEVERE SITES
- ○ MODERATE SITES
- ● SLIGHT SITES

IN ADDITION TO THE PRACTICES INDICATED, THE FOLLOWING URBAN NONPOINT SOURCE CONTROL MEASURES ARE RECOMMENDED TO BE IMPLEMENTED BY THE INDICATED AGENCIES:

RECOMMENDED NONPOINT SOURCE CONTROL MEASURE	IMPLEMENTING AGENCIES
ONSITE SEWAGE DISPOSAL SYSTEM MANAGEMENT PROGRAM (SOME FAILING SYSTEMS ON MAP)	KENOSHA COUNTY, RACINE COUNTY, MILWAUKEE COUNTY, WAUKESHA COUNTY BOARD OF HEALTH
IMPROVED LEAF AND VEGETATIVE DEBRIS COLLECTION AND DISPOSAL	MILWAUKEE COUNTY, RACINE COUNTY, WAUKESHA COUNTY; CITY OF FRANKLIN, CITY OF GREENFIELD, CITY OF MUSKEGO, CITY OF NEW BERLIN, CITY OF OAK CREEK, CITY OF RACINE, AND CITY OF WEST ALLIS; VILLAGE OF GREENDALE, VILLAGE OF HALES CORNERS, VILLAGE OF UNION GROVE; TOWN OF CALEDONIA, TOWN OF MT. PLEASANT, TOWN OF YORKVILLE SANITARY DISTRICT NO. 1, TOWN OF RAYMOND
INCREASED STREET SWEEPING PROGRAM	MILWAUKEE COUNTY, RACINE COUNTY, WAUKESHA COUNTY; CITY OF OAK CREEK, CITY OF WEST ALLIS, CITY OF RACINE; VILLAGE OF GREENDALE, VILLAGE OF UNION GROVE
CONSTRUCTION EROSION CONTROL PROGRAM (EXISTING SUBDIVISIONS ON MAP)	ALL COUNTIES, CITIES, AND VILLAGES

RECOMMENDED NONPOINT SOURCE CONTROL MEASURE	IMPLEMENTING AGENCIES
PROVISION OF OIL AND CHEMICAL DISPOSAL STATIONS	MILWAUKEE COUNTY, RACINE COUNTY, WAUKESHA COUNTY; CITY OF FRANKLIN, CITY OF GREENFIELD, CITY OF OAK CREEK, CITY OF WEST ALLIS, CITY OF RACINE, CITY OF MUSKEGO, CITY OF NEW BERLIN; VILLAGE OF GREENDALE, VILLAGE OF HALES CORNERS, VILLAGE OF UNION GROVE; TOWN OF CALEDONIA, TOWN OF MT. PLEASANT, TOWN OF YORKVILLE SANITARY DISTRICT NO. 1, TOWN OF RAYMOND
PUBLIC EDUCATION FROGRAM	KENOSHA COUNTY, MILWAUKEE COUNTY, RACINE COUNTY, WAUKESHA COUNTY, WAUKESHA COUNTY BOARD OF HEALTH; CITY OF FRANKLIN, CITY OF GREENFIELD, CITY OF MUSKEGO, CITY OF NEW BERLIN, VILLAGE OF HALES CORNERS, VILLAGE OF GREENDALE, VILLAGE OF UNION GROVE; TOWN OF CALEDONIA, TOWN OF MT. PLEASANT, TOWN OF YORKVILLE SANITARY DISTRICT NO. 1, TOWN OF RAYMOND
NEW STREET SWEEPING PROGRAM	CITY OF FRANKLIN, CITY OF GREENFIELD, CITY OF MUSKEGO, CITY OF NEW BERLIN

RURAL NONPOINT SOURCE CONTROL

- ⊢ LIVESTOCK STREAM CROSSING
- ~ CLOSE CROPPING WITHIN 30 FEET OF THE RIVER OR CANAL SHOULD BE AVOIDED
- ○ GRADE STABILIZATION STRUCTURE

NEEDED CONTROL MEASURE NEED IS: VERY SEVERE / SEVERE

VERY SEVERE	SEVERE	
●	○	WATERWAY
■	□	CONSERVATION TILLAGE
▲	△	CONTOUR STRIPS
●	○	TERRACES
NONE	□	DIVERSIONS
NONE	△	CROP ROTATION
●	○	LIVESTOCK WASTE CONTROL
NONE	■	STREAM BANK EROSION CONTROL
NONE	▲	ROADSIDE EROSION CONTROL

GRAPHIC SCALE
0 1/2 1 2 MILES
0 4000 8000 12000 FEET

The implementation of the recommended urban practices may be expected to reduce pollutant loads from urban nonpoint sources by about 50 percent. The plan also recommends control of only the severe and very severe rural nonpoint sources. Control of the severe sources may be expected to reduce the average soil loss from erosion by about 40 percent, with additional reductions in sediment, phosphorus, and bacteriological pollutants resulting from the control of livestock waste and stream bank erosion. The capital cost of the plan is estimated at $6.8 million, of which $5.5 million, or 81 percent, is required for rural nonpoint source control practices, and $1.4 million, or 19 percent, for urban nonpoint source control practices. About $3.7 million, or about 54 percent of the total plan cost, may be expected to be provided by the Wisconsin Fund. The total plan cost represents an equivalent of about $5.00 per capita per year over the nine-year plan implementation period (1980-1988). The local portion of the cost—that portion not provided by the Wisconsin Fund—represents about $2.22 per capita per year.

Source: Racine County Soil and Water Conservation District and SEWRPC.

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APPENDICES

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Appendix A

POTENTIAL DRAINAGE CHANNEL MAINTENANCE ACTIVITIES AND RELATIONSHIP TO NONPOINT SOURCE CONTROLS

The functional maintenance of agricultural drainage systems is necessary to sustain productive agricultural use of a large portion of the land in the Root River watershed, particularly that area drained by the Root River canals. As shown on Map A-1, there are two active agricultural drainage districts in the watershed which have legal authority to plan, construct, and operate drainage and flood control facilities: the Yorkville-Raymond Drainage District and the Hoods Creek Drainage District.[1] These active drainage districts together encompass a total area of 21.2 square miles, or about 11 percent of the total area of the watershed. In addition, there are four inactive drainage districts in the watershed: Milwaukee Drainage Districts No. 5 and No. 6, located primarily within the City of Franklin, Husher Drainage District No. 2, and Racine Drainage District No. 3. The inactive drainage districts together encompass a total area of 5.5 square miles, or about 3 percent of the total area of the watershed. Agricultural drainage districts have played an important historic role in the management of the land and water resources of the watershed.

In order to achieve the maximum benefit from nonpoint source water pollution controls, it is necessary to properly relate these measures to ongoing and proposed drainage channel maintenance and improvement activities. This coordination will ensure that all implemented nonpoint source control measures are compatible with the objectives and actions of the drainage districts.

The coordination of such drainage and nonpoint source control activities can also serve to maximize the effectiveness of some nonpoint source control measures. Gully erosion control measures such as grass waterways and grade stabilization structures which are often located adjacent to streams are designed to discharge storm water runoff to a specific stream bank slope and channel-bottom elevation. Therefore, the coordination of channel maintenance activities and erosion control measures will ensure that the erosion control measures are properly designed for stabilized, drainage-efficient channels, and that the maximum water quality benefits are thereby achieved. In some stream reaches, maintenance on the bottom and side slopes of channels to improve drainage could also be conducted in such a way as to stabilize eroding stream banks. Stream bank stabilization is an integral and essential function of both drainage channel maintenance and nonpoint source pollution control.

Some drainage maintenance activities may directly benefit water quality. Stream bottom sediments in the watershed—particularly in the Root River canals—have been identified as a significant source of nutrients and oxygen demand to the overlying water. Removal of nutrient-rich, oxygen-demanding sediments by dredging activities intended primarily for drainage channel maintenance could have substantial water quality benefits if the newly exposed sediments are less organic and nutrient rich, and if the dredging methods are conducted so as to minimize the downstream effects on water quality.

The proposed water quality montoring and sampling program set forth in Appendix D includes an analysis of the physical and chemical characteristics of the bottom sediments. The results of this analysis could be used to refine the delineation of stream reaches where dredging or other maintenance activities would be expected to enhance stream water quality. Stabilizing and reducing the slope of stream banks to maintain drain tile outlets can also serve as a stream bank erosion control measure, if the new bank slopes are properly vegetated. Therefore, the proper coordination of drainage channel maintenance activities and nonpoint source pollution control measures could serve to maximize the water quality benefits of such activities, while not hindering the completion of necessary drainage maintenance activities.

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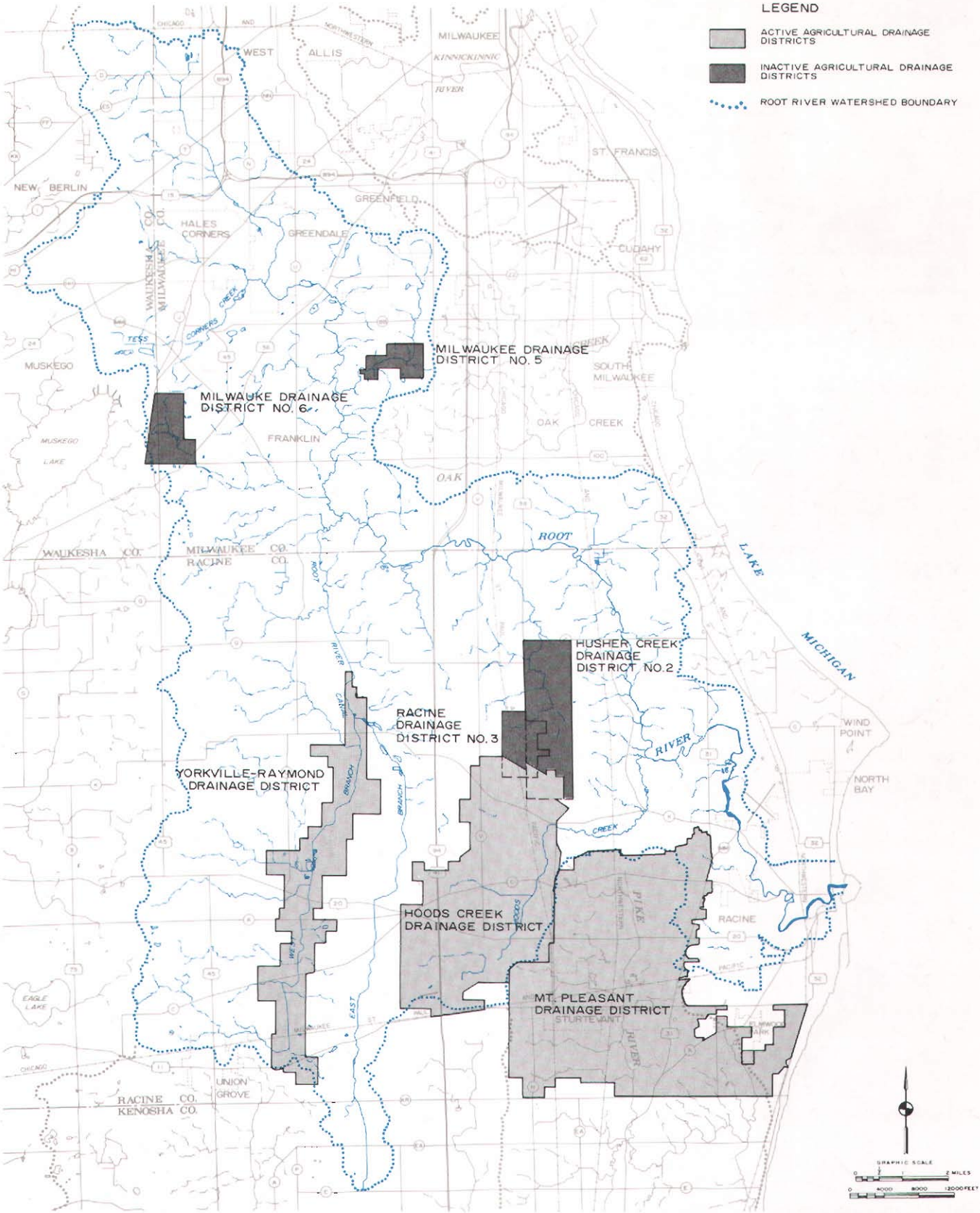
[1] *A small portion of the active Mt. Pleasant Drainage District also extends into the Root River watershed. However, no perennial or intermittent reaches of the Root River stream system are located within the district, and the amount of agricultural land in that portion of the district is minimal.*

Map A-1

ACTIVE AND INACTIVE AGRICULTURAL DRAINAGE DISTRICTS IN THE ROOT RIVER WATERSHED: 1980



Source: Racine County Soil and Water Conservation District and SEWRPC.

Large portions of the drainage areas of the Root River Canal and of Hoods Creek were so poorly drained under natural conditions that farm operators found it necessary to deepen and straighten the main stream channels and to install tile underdrains to provide for more efficient agricultural operations. Because of the piecemeal manner in which, and the long period of time over which, such drain tile installation took place, it is not possible to precisely delineate the total tile-drained areas. The greatest proportion of the tile-drained lands are believed to be tributary to the Root River Canal. The main channels of the canal were deepened and straightened by a floating dredge around 1905, with occasional debrushing and clearing thereafter. However, portions of the canal area are still poorly drained, especially in the spring when small surface drainage courses are blocked by ice and snow with attendant flow impediments.

The main channels of the Root River Canal system are relatively small, having low banks. Along most of the canal length, the floodplains are relatively level and wide, ranging in width up to one mile. The relatively flat channel bottom slopes result in low velocities of flow. The channel and floodplain roughness coefficients are strongly influenced by the seasonal variation in the vegetation, which reaches a maximum growth in summer. Winter and spring flows, however, are often obstructed by ice and snow.

All but about four miles of the perennial channels of the Root River Canal system have been deepened, widened, and straightened by dredging. The dredged channels have generally uniform cross-sections with bed widths varying from 10 to 20 feet, and side slopes generally ranging from 1 on 1 to 1 on 2. Channel depths initially ranged from 4 to 12 feet, being primarily a function of the amount of channel deepening required to achieve suitable bed slopes in the dredged sections. Spoil banks placed many years ago along the streams remain visible in some of the dredged reaches.

The beds and banks of most of the dredged sections are contributing to poor drainage conditions. In many places, bank material has sloughed into the bed as a result of the unstable bank conditions. Although subsurface seepage and livestock have contributed to this problem, such sloughing is also attributable in part to the basic soil characteristics and to the fact that portions of the stream bank do not conform to the currently recommended technical standards for stable slopes. As set forth in Table A-1, the muck, peat, and loam soils present in the Root River Canal should normally have slopes lower than 1 on 1 to 1 on 2. Upland materials have also been contributed by sheet erosion, a problem exacerbated by cropping too close to the banks. The most significant obstruction to flow in the Root River Canal channels is, reportedly, the profuse growth of vegetation in and adjacent to most of the channel length. Some types of vegetation flex under high flows and, therefore, have a modest effect upon channel friction. However, along much of their length, the channels are lined with cattails, reeds, bushes, willows, and other trees—some over three inches in diameter—which are rigid and seriously impede flow.

Restricted flow in the channel can result in submerged tile outlets, with decreased hydraulic efficiency of the tributary drain tile systems. Silt accumulation may obstruct tile outlets if the stream water flows slowly enough to deposit soil particles.

In a comprehensive plan for the Root River watershed adopted in 1966, the Southeastern Wisconsin Regional Planning Commission recommended channel maintenance for the West Branch and East Branch of the Root River Canal, primarily for drainage and flood control purposes.[2] The plan recommendations included channel debrushing and cleaning. The cost of this initial channel cleaning, expressed in 1979 dollars, is estimated at $39,500, with an additional annual cleaning cost of about $2,200. Major channel deepening, widening, or reconstruction was not recommended. The channel debrushing and cleaning was recommended to be undertaken by the Yorkville-Raymond Farm Drainage Board. Channel deepening and widening were not identified in the 1966 plan as being required for flood control purposes. Nonetheless, it has been the contention of local farmers in 1980 that such deepening and widening have become necessary to maintain the effectiveness of subsurface drainage tiles for agricultural lands in portions of the watershed.

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[2] *See SEWRPC Planning Report No. 9, A Comprehensive Plan for the Root River Watershed, July 1966.*

Table A-1

MAXIMUM SIDE SLOPES RECOMMENDED TO PROVIDE STABLE BANK SLOPE CONDITIONS

Soil Texture	Maximum Side Slope
Loam	1 on 2
Clay	1 on 1.5
Sand, Peat and Muck	1 on 1

Source: U.S. Department of Agriculture, Soil Conservation Service, Engineering Field Manual.

The continuation of agricultural production at the current levels within the Root River watershed is dependent on the maintenance of the drainage channels. A sound drainage channel maintenance project must be properly planned and engineered, identifying the locations, nature, and extent of drainage problems; identifying alternative solutions to these problems; determining the costs and benefits of these solutions; recommending solutions from among the alternatives; and assessing the environmental impacts of the proposed actions. It should be noted that none of the drainage district representatives have indicated a need to drain any existing wetlands, although it is recognized by all parties that wetland drainage has occurred in the evolution and development of farming in the Root River canals and other parts of the watershed.

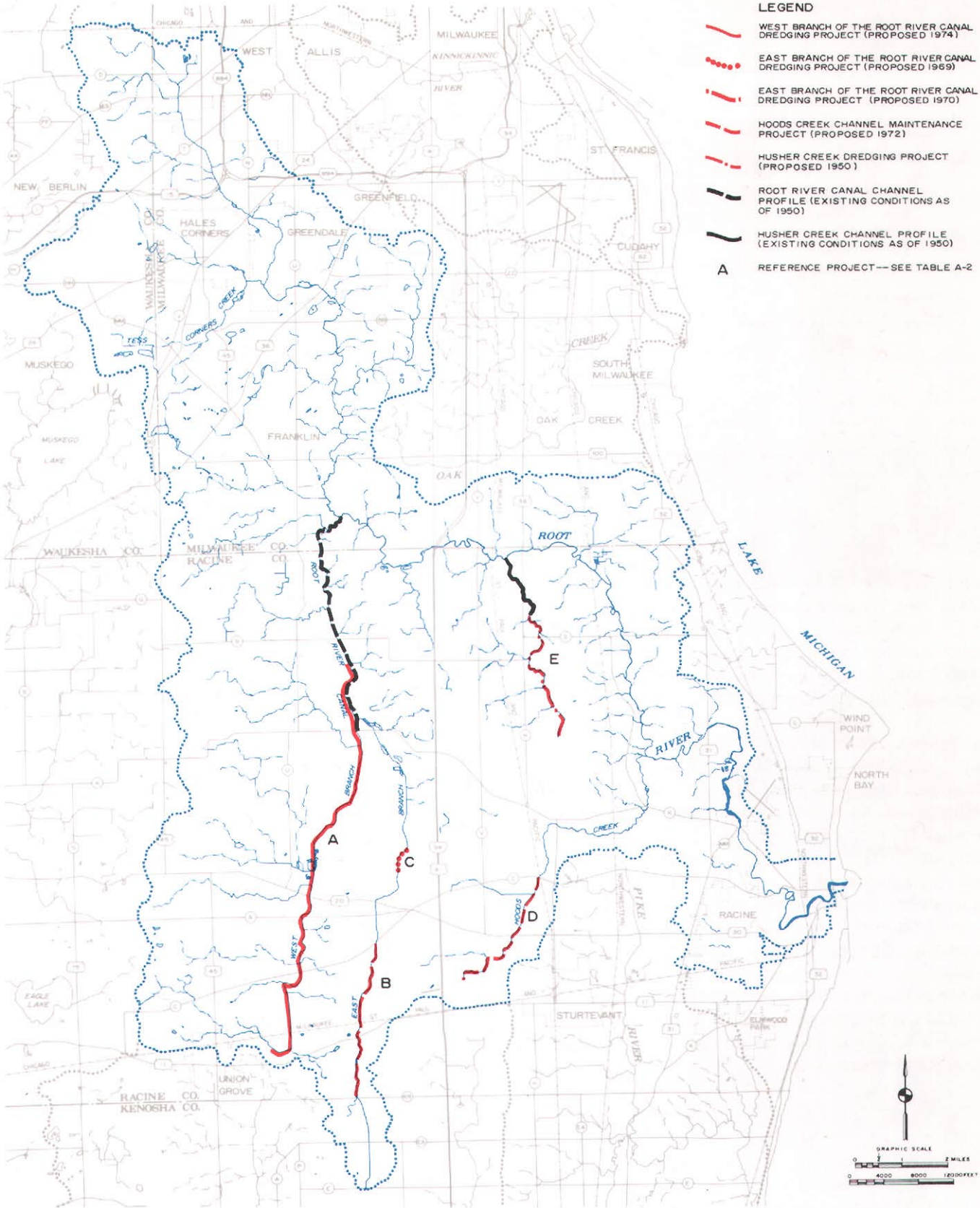
Locally proposed channel maintenance activities for the Root River watershed are set forth on Map A-2. These proposals were developed by the agricultural drainage districts in the watershed and by the U. S. Soil Conservation Service in 1950, 1969, 1970, 1972, and 1974. As set forth in Table A-2, channel improvement plans have been prepared for about 17.8 miles of stream in the watershed, or about 18 percent of the total perennial stream miles in the watershed. Proposed channel improvement activities would involve primarily the deepening of channels and the shaping of side slopes. Such activities for the East and West Branches of the Root River Canal would involve the removal of about 78,200 cubic yards of earth at an estimated total cost of $229,000. These proposed activities would maintain existing drained areas. It is important to note that no additional lands are proposed to be artificially drained.

Deepening or widening streams or drainage channels requires permits from the Wisconsin Department of Natural Resources. Specifically, a permit under the provisions of Chapter 30.19 of the Wisconsin Statutes would be needed for channel widening or enlarging and a permit under the provisions of Chapter 30.20 of the Wisconsin Statutes would be required for the deepening of channels. In applying for such permits, it is necessary to submit information concerning the proposed projects. Such information would include the extent, location, and description of the proposed maintenance activity; the existing condition of the drainage channel; the proposed design characteristics of the drainage channel following maintenance, including the cross-sections and bottom elevations of the existing and proposed channels; the side slopes, vegetative cover, and other stabilization measures; and the proposed locations of spoils materials disposal. The Wisconsin Department of Natural Resources would conduct an onsite inspection, analyze the hydraulic effects of the proposed activity, and determine whether other significant environmental impacts, such as damage to existing wetlands or endangered plant or animal species, are likely to occur.

In addition to requiring the necessary permits from the Wisconsin Department of Natural Resources, any such channel deepening and widening would require amendment of the Commission-adopted Root River watershed plan. This would be required because the proposed channel improvement activities are significantly more extensive than the simple maintenance activities recommended in the watershed plan. Accordingly, such amendment would have to be preceded by systemwide flow simulation modeling to

Map A-2

LOCALLY PROPOSED DRAINAGE CHANNEL MAINTENANCE ACTIVITIES AND CHANNEL PROFILE DATA FOR THE ROOT RIVER WATERSHED



Source: Racine County Soil and Water Conservation District and SEWRPC.

Table A-2

LOCALLY PLANNED DRAINAGE CHANNEL MAINTENANCE ACTIVITIES IN THE ROOT RIVER WATERSHED

Project Symbol on Map A-2	Affected Stream Reach	Proposed Project Extent	Plan Preparation Date	Source of Plan	Maintenance Activity Description	Stream Length Affected (miles)	Planned Specifications				Cost
							Average Additional Channel Depth (feet)	New Side Slopes	New Channel Width (feet)	Amount of Material to Be Removed (cubic yards)	
A	West Branch, Root River Canal	From 1.2 miles upstream of Chicago, Milwaukee, St. Paul & Pacific railroad tracks, Town of Yorkville, to 0.8 mile downstream of Five Mile Road, Town of Raymond	1974	Yorkville-Raymond Drainage District	Deepening and widening of channel	10.4	2.1	1 on 1.5	Variable	45,200	$137,000
B	East Branch, Root River Canal[a]	From County Line Road to CTH C, Town of Yorkville	November 1969	U.S. Department of Agriculture, Soil Conservation Service	Deepening and widening of channel	3.6	1.8	1 on 2	4-6	21,300	59,600
C	East Branch, Root River Canal	From 50th Road to 0.6 mile downstream of 50th Road, Town of Yorkville	February 1970	U.S. Department of Agriculture, Soil Conservation Service	Deepening and widening of channel	0.6	2.7	1 on 2	9	11,700	32,400
D	Hoods Creek	From CTH C to STH 11, Town of Mt. Pleasant	1972	Nielson and Madsen Civil Engineers, Racine, Wisconsin	Deepening of channel	3.0	0.7	N/A	N/A	N/A	N/A
E	Husher Creek	From Four Mile Road to 0.6 mile downstream of STH 38, Town of Caledonia	1950	Nielson and Madsen Civil Engineers, Racine, Wisconsin	Deepening of channel	3.2	4.1	N/A	N/A	N/A	N/A
Total	--	--	--	--	--	17.8	--	--	--	78,200[b]	$229,000[b]

NOTE: N/A indicates data not available.

[a] *In the early 1970's, the east bank of a portion of the East Branch of the Root River Canal was dredged to the original channel profile. Additional dredging would be needed, however, to achieve the planned specifications shown above.*

[b] *Excludes amount of material to be removed and cost of maintenance activities for the Hoods Creek and Husher Creek project proposals.*

Source: U.S. Soil Conservation Service, Yorkville-Raymond Drainage District, Nielson and Madsen Civil Engineers, and SEWRPC.

determine the effects of the proposed widening and deepening on upstream and downstream flows and stages, and by a benefit-cost analysis to determine the economic viability of the proposed improvements. Preliminary analyses by the Regional Planning Commission staff indicate that the proposed drainage channel improvement activities could have significant effects on downstream flood flows and stages. Such amendment would have to be approved by action of the Root River Watershed Committee and the Regional Planning Commission.

In order to advance any maintenance dredging projects, the active drainage districts, the Racine County Soil and Water Conservation District, the Racine County Planning and Zoning Department, and the Wisconsin Department of Natural Resources would need to discuss further the potential means of financing drainage channel maintenance activities and the specific procedures necessary to obtain the required permits from the Department of Natural Resources, and would have to determine whether local or county governmental agencies or the drainage districts should actually carry out the maintenance activities. Alternative methods of financing could also be explored including, but not limited to, assessment of all landowners within a drainage district, the selective assessment of only those farmers who would directly benefit from drainage maintenance, special county appropriations, and federal funding through the U. S. Department of Agriculture, Agricultural Stabilization and Conservation Service.

The careful planning and coordination of all agricultural drainage activities and nonpoint source control activities will serve to maximize both agricultural production and water quality improvement in the Root River watershed. This coordination is an integral part of the nonpoint source abatement plan for the Root River watershed.

Appendix B

MODEL ORDINANCES FOR CONSTRUCTION AND RELATED EROSION CONTROL

As a procedural matter, the control of construction-related soil erosion and the attendant impacts on water quality can be approached from two perspectives. First, such a program can be initiated through a regulatory ordinance established for the sole purpose of erosion control. The second alternative—and the one recommended by the Southeastern Wisconsin Regional Planning Commission—provides for the integration of erosion control measures into the broader comprehensive framework of other land use regulatory ordinances. The SEWRPC has recommended in SEWRPC Planning Guide No. 6, Soils Development Guide, that, rather than establishing an entirely new ordinance, the objectives for construction erosion control be integrated into existing municipal land division, zoning, and building ordinances. This approach would serve to avoid the duplication of various ordinances or regulatory structures, the attendant confusion regarding multiple ordinance requirements which face a private or public land development effort, and the additional administrative efforts required of a local unit of government. The educational value of a free-standing erosion control ordinance is recognized, but there is greater practical utility to an integrated approach whereby erosion control is set within the framework of the existing ordinance structures of various local units of government.

This appendix includes model erosion control regulations designed to be integrated into a land division ordinance, which pertains to the subdivision of land for specified uses; a building ordinance, which addresses the construction of facilities and modifications of the land surface itself for the intended use of the land; and a zoning ordinance, which provides for proper uses of the land itself and guides the decisions which prompt the building and land division decisions. It should be noted that a sanitary or health code could also be amended to incorporate control of erosion from the construction of sanitary and related facilities. For the sake of brevity, such an example ordinance has not been included in this appendix, but the provisions would be quite similar to the building ordinance provisions proposed herein.

Appendix B-1

GUIDES FOR EROSION CONTROL

The following technical guides deal with several practices designed to control erosion and sedimentation and to preserve existing vegetation in the urban development process. These guides were prepared by the Milwaukee and Waukesha Soil and Water Conservation Districts, cooperating with the U. S. Department of Agriculture, Soil Conservation Service and are reproduced verbatim herein.

STANDARDS AND SPECIFICATIONS FOR TOPSOILING (URBAN AREAS)

Definition: Stripping the upper five to seven inches of surface soil from areas to be disturbed by construction, stockpiling for later use, and top dressing the exposed surface of completed outs and fills after land grading.

Purpose: To provide for a better quality of fill material and to ensure that exposed surfaces of graded areas will provide a favorable environment for plant growth.

Conditions Where Practice Applies: This practice is applicable to areas that are to be disturbed by land grading.

Specifications

The topsoils shall be stripped from areas to be disturbed and stockpiled (uncompacted). Upon completion of grading, the exposed soil material surface shall be top dressed with a minimum of four inches of topsoil. All roots larger than three inches in diameter shall be removed from the topsoil layer in order to leave it in suitable condition for the establishment of vegetation.

STANDARDS AND SPECIFICATIONS GUIDE FOR PROTECTION OF EXISTING TREES DURING URBAN DEVELOPMENT

Definition: Protection of desirable trees from physical and mechanical injury while land is being converted from rural to urban use.

Purpose: To employ the necessary protective measures and to ensure the survival of desirable trees for shade, beautification, and erosion control.

Conditions Where Practice Applies: On areas now containing single specimen trees or groups of trees.

Specifications

1. Criteria for protecting trees:

   a. Where existing ground levels are raised, drainage tile will be placed at the old ground level and open into a well built around the base of the tree. The well will be left open or can be filled with coarse stones or gravel. Tile may be installed in a radiating pattern or laid in parallel lines.

   b. Trees within 25 feet of a building site will be ''boxed in'' to prevent mechanical injury.

   c. Nailing of boards to trees during building operations will not be tolerated.

d. Heavy equipment operators will be warned to avoid damages to existing tree trunks and roots during land leveling operations. Major feeder roots shall not be cut.

e. Tree trunks and exposed roots damaged during above operations will be painted immediately with a good grade of tree paint.

f. All tree limbs damaged during building or land leveling will be sawed flush at tree trunks or large branches and painted with tree paint.

g. The use of heavy equipment near desirable trees should be avoided as much as possible to minimize soil compaction.

h. Waste concrete should be removed from the area and not dumped around the base of trees. This practice will kill trees and new landscape materials.

i. All limbs removed from trees should be cut flush at trunks and painted with a good grade of tree paint.

2. Trees to be left:

a. Trees that are relatively free from disease, that have relatively long life, and that have aesthetic beauty shall be preserved. Experienced builders and developers consider that having desirable shade trees on a residential home site frequently enhances the market value by $500 or more. By careful planning and development, desirable trees can often be saved at little or no cost to the developer.

STANDARDS AND SPECIFICATIONS GUIDE FOR ESTABLISHING TEMPORARY VEGETATIVE COVER ON CRITICAL AREAS

Definition: Establishing temporary vegetative cover on high silt-producing areas created during urban construction activities. This includes the seeding of annual grasses, legumes, small grain, or the use of anchored straw mulch.

Purpose: To afford rapid cover for the control of accelerated runoff and erosion during periods of construction on disturbed areas and until permanent vegetation or other stabilization material can be established. (This practice is expected to give protection for a period of 6 to 12 months.)

Conditions Where Practice Applies: On areas of land that are being converted from agricultural or related uses to urban development and when the period of exposure will be at least 60 days but generally less than 12 months.

Technical Specifications for Establishment of Temporary Vegetative Cover

1. Apply 500 lbs. per acre of 20-10-10 or equivalent fertilizer.

2. Incorporate fertilizer into the top four inches of surface soil by disking or other suitable means.

3. Seed one of the following mixtures at the rate shown per acre:

a. July 1 to September 15
2 bu. of Rye (small grain)

b. April 1 to July 1
3 bu. of oats

STANDARDS AND SPECIFICATIONS FOR ESTABLISHING PERMANENT VEGETATION ON CRITICAL AREAS

Definition: Stabilizing silt-producing and highly erodible areas resulting from construction activities by the establishment of permanent vegetative cover. This includes grass and legumes established by seeding or sodding to provide long-term ground cover.

Purpose: To stabilize the area so as to protect it from accelerated erosion and/or minimize damages from sediment and runoff to downstream areas.

Conditions Where Practice Applies: On critical erodible areas disturbed by construction activities where vegetation is difficult to establish with normal seeding methods and where appearance and heavy use are considerations.

Technical Specifications for Establishment of Grasses and Legumes Other Than Lawns

1. Site preparation:

Where practical and economical, cover exposed subsoil areas with topsoil. A four-inch covering is usually adequate.

2. Supporting practices:

Where possible and practical, use diversions to carry runoff water away from the areas until cover is established.

3. Fertilization:

Apply 400 to 800 lbs. of 20-10-10 or 16-8-8 fertilizer (or equivalent) per acre, and work into top three or four inches of soil.

4. Seed to one of the following mixtures:

a. All soils except drouthy sands.

15 lbs. Southern Type Smooth Brome Grass)
10 lbs. Tall Fescue) per acre
5 lbs. Birdsfoot Trefoil)
or
15 lbs. Southern Type Smooth Brome Grass
15 lbs. Tall Fescue

b. Drouth sands and gravel.

20 lbs. Southern Type Brome Grass)
8 lbs. Vernal Alfalfa) per acre

5. Time of seeding:

April 1 to September 15 where mulch is used. Seeding is normally not recommended without mulching. Seedings should not be made during late September and October.

6. Mulching:

a. Straw or meadowgrass 1 to 1 1/2 tons per acre spread evenly. Straw or meadowgrass mulch should be anchored either by 1) asphalt at a minimum of 200 gallons per acre, 2) a straight disc, or 3) fiber netting secured with wire staples.

b. Wood fiber materials - 1000 lbs. per acre.

c. Jute netting - 43,560 sq. ft. per acre.

d. Other protective materials as developed by industry.

7. Stabilizing crop:

a. If mulching is not practicable, use stabilizing crop instead of mulch.

b. Seeding rate - 1 1/2 bushels of rye or 3 lbs. of ryegrass not to exceed 10 percent of mixture.

c. Mow stabilizing crop when it has started to head out. If stabilizing crop will not be mowed, use oats in fall and rye in spring.

d. Plant stabilizing crops April 1 to July 1 or August 1 to September 1 and make grass seeding at one time. (Use mulch during July.)

STANDARDS AND SPECIFICATIONS GUIDE FOR ESTABLISHING COVER BY SODDING IN URBAN DEVELOPMENT

Definition: The placement of suitable grasses removed from another site under growing conditions, containing a sufficient thickness of soil to hold in place and to temporarily support the existing plant growth.

Where Applicable: This practice is applicable where it is desirable to get quick permanent cover for protection against hazardous erosion conditions and/or where steepness of slope or other conditions makes establishment of vegetation by other methods questionable or impossible.

Site Preparation: The area where sod is to be placed should be prepared as for seeding. Soil preparation should be 3 inches deep. All nonarable areas should be resoiled with topsoil. Apply 500 lbs. of 20-10-10 fertilizer or equivalent per acre. This should be applied on site during soil preparation and mixed thoroughly with the top 3 inches of soil prior to placement of sod.

Sod Requirements: Grass sod shall be freshly cut and of good quality, having a clean growth of acceptable grasses free from weeds and harmful insects. It shall be cut 2 inches thick in strips with straight side and square ends. Sod selected should contain a minimum of 1 inch of soil material that adheres to the root system.

Sod Placement: Sod shall be placed uniformly on a well-prepared site; the strips will be tightly compacted together and smoothed down with a roller where possible. When placement on slopes greater than 2 1/2:1, sufficient staking should be done to ensure stabilization. On extremely sloping land (1:1) fine mesh wire or other suitable material will be employed to prevent slippage. On sloping areas, the sod strips should be placed so that the cracks will lie perpendicular to the slope. Sod strips should also be staggered so that the cracks between the strips are not continuous from the top to the bottom of the slope.

Supplemental Irrigation: Irrigation is often desirable and sometimes necessary for use when unfavorable weather or other conditions prevail. Employment of this practice both on areas where the sod is being produced and on the areas where sod has been placed, will ensure successful growth and establishment during most of the growing season. Application rates should be such as to minimize runoff.

Maintenance: Top dress with 500 lbs. of 20-10-10 fertilizer or equivalent per acre each year. Remove undesirable growth by clipping or the use of a recommended chemical weed killer.

JUTE THATCHING USE IN WATERWAYS

Definition: Jute thatching is a coarse, open mesh, web-like material woven of heavy jute twine. It comes in rolls 225 feet long and about 4 feet wide.

Purpose: Jute thatching is used as a mechanical aid to protect the soil from erosion during the critical period of vegetative establishment. It serves better all the purposes of mulch. It is easier to lay and hold in place against wind. It has the tensile strength and weight to resist water flow and erosion.

How Used: Used in place of mulch or sod.

1. Preparing the channel:

   To prevent meandering, grade center to a slight V-shaped channel to confine low flows to the channel where thatching will be laid.

2. Fertilization:

   Lime and fertilize to standard recommendations.

   Disk as needed but do not cultipack.

3. Vegetative spriggings:

   Plant grass sprigs or similar material before the thatching is put down. Spacings for planting may vary. Suggested maximum: 18 x 36 inches.

4. Seedings:

   Split the application. Sow half the seed before placing the thatching. Plant the remaining half after the thatching is laid.

5. Laying the thatching:
   (If instructions have been followed, the thatching will be laid in loose soil.)

   Start laying the thatching from the top of the channel and unroll downgrade so that one edge of the strip coincides with the channel center. Lay a second strip parallel to the first on the other side of the channel and allow a two-inch overlap. If one roll of thatching does not extend the length of the channel, continue downhill with additional rolls.

6. Securing the thatching:

   Bury the top end of the jute strip in a trench four inches or more deep. Tamp the trench full of soil. Reinforce with a row of staples driven through the jute about four inches downhill from the trench. These staples should be about ten inches apart. Then staple the overlap in the channel center. These staples should be four to ten feet apart. The outside edges may be stapled similarly at any time after the center has been stapled. Closer stapling along the sides is required where concentrated water may flow into the channel.

   Succeeding strips of thatching farther down the channel are secured in a similar manner.

   Where one roll of thatching ends and another roll begins, the end of the top strip overlaps the trench where the upper end of the lower strip is buried. Make the overlap at least four inches and staple securely. If the ends and edges of the strips of thatching are securely stapled, stapling in the strip middles may be ten feet apart or omitted entirely.

7. Erosion stops:

   At any point the thatching may be folded for burying in slit trenches and secured as were the upper ends. This checks water flow and erosion that may begin under the matting. It also gives improved tie-down. The procedure is recommended on the steeper slopes of sandy soil and gentler slopes subject to seepage. Spacing may vary from 25 to 100 feet.

STANDARDS AND SPECIFICATIONS FOR OPEN AND CLOSED STORM DRAINS

(URBAN AREAS)

Definition: Installing open or closed conduits with fixed linings of materials, such as concrete, metal, or other durable material.

Purpose: To provide for the disposal of excess water without damage by erosion.

Conditions Where the Practice Applies: This practice is applicable at sites where there is a constant flow of water that prohibits growth of vegetative protection or at other locations which prohibit use of grassed waterways or outlets.

Specifications

Capacity: The minimum capacity shall be that required to confine the peak runoff expected from a storm of 25-year frequency, based on recognized procedures for the particular type of installation planned.

Design and Installation: Design and installation will be in accordance with a plan approved by a qualified engineer.

STANDARDS AND SPECIFICATIONS GUIDE FOR TEMPORARY DEBRIS BASIN

(URBAN DEVELOPMENT)

Definition: Constructing a barrier or dam across a waterway or at other suitable locations to form a silt or sediment basin.

Scope: This guide is applicable to impoundment heights of 15 feet or less.

Purpose: To provide for trapping and storing sediment from the drainage area above during the development period and until the area can be stabilized to a point where erosion and sedimentation are reduced to a safe level.

Conditions Where the Practice Applies: This practice is applicable where sites for small impoundments can be located below high sediment source areas, and the trapping of sediment at key points will protect areas and installations below. This is a temporary measure since the goal will be to permanently stabilize sediment source areas when development of the area is completed.

Specifications

Capacity: Adequate sediment storage capacity, where possible, shall be provided for the estimated volume of sediment that will be moved from the drainage area during the development period.

Spillways: All debris basins created by the construction of a dam shall be provided with a spillway or a combination of spillways and temporary storage capacity to handle safely the peak runoff expected from a storm of 25-year frequency.

1. Pipe Spillways:

   Each structure will be provided with a pipe drawdown or trickle tube to handle normal flow and to drain flood runoff from the sediment pool. The drawdown structure will consist of a horizontal pipe under the dam with a vertical riser at the upstream end. The crest elevation of the riser shall be set at the top of the sediment pool, and the riser shall be perforated to prohibit permanent storage of water.

   a. Size of horizontal pipe and riser--The drawdown pipe shall have a capacity adequate to discharge the flow from seeps and springs plus sufficient capacity to empty the sediment pool within a period of five days following storm flow. The minimum diameter of pipe that will be used shall be eight inches. The cross-sectional area of the riser pipe shall be at least 1.5 times the cross-sectional area of the horizontal pipe.

   b. At least one anti-seep collar at the centerline of the dam will be required on smooth pipe exceeding eight inches in diameter and on corrugated pipe exceeding twelve inches in diameter.

   c. Where a drawdown pipe is not provided, the accumulated storm water may be drawn out by pumping.

2. Vegetated Spillway:

   The elevation of the control section of the vegetated spillway shall be a minimum of one foot above the elevation of the crest of the riser pipe. Additional temporary storage obtained by increasing the minimum is desirable to reduce frequency of emergency spillway flow.

   a. The length of the control section shall be not less than the crest width of the dam or more than twenty feet in length.

   b. The entrance to the vegetated spillway shall be at least 25 percent wider than the control section. The grade of the vegetated spillway from the control section to the entrance shall be not less than 3 percent.

Earth Embankment:

1. Side slopes:

   The side slopes for settled embankments shall be not steeper than 2 1/2: 1 on both sides.

2. Top Width:

   The width of the embankment shall be not less than 8.0 feet for fill heights of ten feet or less, and not less than ten feet for fill heights of ten feet to fifteen feet.

3. Freeboard:

   The settled top elevation of the embankment shall be a minimum of one foot higher than the maximum flood water level in the pool.

4. Site Preparation:

   The embankment site and borrow area shall be cleared of trees, stumps, sod, and other undesirable material.

   a. The area below sediment pool level shall be cleared of all trees, brush, and fallen timber.

   b. A core cutoff trench, where required by soil conditions, shall be excavated to a layer of slowly permeable material.

   c. The core cutoff trench and all steep or overhanging banks in or on which fill material will be placed shall be sloped to a 1:1 or flatter slope.

5. Embankment Construction:

   The fill material shall be obtained from designated areas. It shall be free of roots, limbs, sod, or other objectionable material. Frozen material shall not be placed in the fill nor shall fill material be placed on a frozen foundation.

   a. Fill material shall be placed in the embankment in layers not exceeding six inches in thickness and with suitable moisture content for obtaining desired compaction. Each layer shall be kept as near level as practicable and be completed over the entire fill area before the next layer is started.

   b. Fill around pipe shall be placed in approximate four inch layers and compacted with hand operated equipment. The hand tamped material will be brought at least two feet above the top of the pipe before heavy equipment is operated over it.

Vegetative Protection: All exposed areas of the embankment and spillway shall be protected by establishment of suitable vegetation.

Safety: Adequate safety signs will be displayed to warn the public of the hazards from soft silt and flooding.

Final Disposal: After the structure has served the desired purpose and the drainage area is stabilized against erosion, the embankment and resulting silt deposits will be leveled or otherwise disposed of.

References:

1. "Engineering Handbook for Soil Conservationist," U. S. Department of Agriculture, Soil Conservation Service.

Appendix B-2

SPECIAL REGULATIONS TO BE INCORPORATED INTO LAND DIVISION ORDINANCES

The following sections and subsections have been designed to replace or be added to those regulations found in the Model Land Division Ordinance set forth in Appendix A of SEWRPC Planning Guide No. 1, Land Development Guide, 1963, or to other properly prepared subdivision control ordinances.

SECTION 1.0 INTRODUCTION

SECTION 1.3 Intent (Addition)

Prevent and Control Erosion, sedimentation, and other pollution of surface and subsurface waters.

Obtain the Wise Use, conservation, development, and protection of the *Village's* soil, water, wetland, woodland, and wildlife resources and attain an adjustment of land use and development to the supporting and sustaining natural resource base.

Preserve Growth and Cover and promote the natural beauty of the *Village* and its environs.

Prohibit the Creation of Building Sites in those areas poorly suited for development.

Implement those municipal, county, watershed, or regional comprehensive plans or components of such plans adopted by the *Village*.

SECTION 1.6 Severability and Non-Liability (Addition)

The *Village* does not guarantee, warrant, or represent that those soils listed as being unsuited for specific uses are the only unsuited soils within the *Village* and hereby asserts that there is no liability on the part of the *Village Board of Trustees*, its agencies, or employees for sanitation problems or structural damages that may occur as a result of reliance upon, and conformance with, this Ordinance.

SECTION 2.0 GENERAL PROVISIONS

SECTION 2.6 Land Suitability (Addition)

Lands Made, Altered, or Filled with non-earth materials within the last ten (10) years shall not be divided into building sites which are to be served by soil absorption waste disposal systems.

Lands Having a Slope of twelve (12) percent or more shall be maintained in permanent open space use. No lot shall have more than fifty (50) percent of its minimum required area in slopes of ten (10) percent or greater.

Lands Having Bedrock within eight (8) feet of the natural undisturbed surface shall not be divided into building sites to be served by soil absorption sewage disposal systems.

Lands Having Ground Water within eight (8) feet of the natural undisturbed surface shall not be divided into building sites to be served by soil absorption sewage disposal systems.

Soils Having a Percolation Rate slower than sixty (60) minutes per inch or faster than ten (10) minutes per inch in shoreland areas shall not be divided into building sites to be served by soil absorption sewage disposal systems.

The Following Soil Types, which have very severe limitations, shall not be divided into building sites:

2	5	10	217	451	455	458
3	7	11	218	452	456	459
4	9	13	302	453	457	460

Lands Drained by farm drainage tile or farm ditch systems shall not be divided into building sites to be served by on-site soil absorption sewage disposal systems.

SECTION 4.0 PRELIMINARY PLAT

SECTION 4.2 Plat Data (Addition)

Soil Type, Slope, and Boundaries as shown on the detailed operational soil survey maps prepared by the U. S. Soil Conservation Service.

Location and Results of Soil Boring Tests made to a depth of eight (8) feet, or five (5) feet below the bottom of a proposed deep absorption system, whichever is greater. The number of such tests shall be adequate to portray the character of the soil and the depths of bedrock and ground water from the natural undisturbed surface but no less than two (2) tests per acre shall be made.

Location, Depth, Area, and Type of all soil absorption waste disposal facilities.

Location and Results of Percolation Tests conducted in accordance with Section H 65.06 of the Wisconsin Administrative Code, taken at the location and depth in which the soil absorption waste disposal system is to be installed. The number of such tests shall not be less than three (3) tests per disposal system area.

SECTION 4.7 Soil and Water Conservation (Addition)

The *Village Engineer*, upon determining from a review of the preliminary plat that the soil, slope, vegetation, and drainage characteristics of the site are such as to require substantial cutting, clearing, grading, and other earthmoving operations in the development of the subdivision or otherwise entail a severe erosion hazard, may require the subdivider to provide soil erosion and sedimentation control plans and specifications.

Tree Cutting and Shrubbery Clearing shall not exceed thirty (30) percent of the lot or tract and shall be so conducted as to prevent erosion and sedimentation; preserve and improve scenic qualities; and, during foliation, substantially screen any development from stream or lake users.

Paths and Trails shall not exceed ten (10) feet in width and shall be so designed and constructed as to result in the least removal and disruption of trees and shrubs and the minimum impairment of natural beauty.

Earth Movements, such as grading, topsoil removal, mineral extraction, stream course changing, road cutting, waterway construction or enlargement, removal of stream or lake bed materials, excavation, channel clearing, ditching, drain tile laying, dredging, and lagooning, shall be so conducted as to prevent erosion and sedimentation and to least disturb the natural fauna, flora, watercourse, water regimen, and topography.

Review of Such Cutting, Clearing, and Movement may be requested of the County Soil and Water Conservation District Supervisors, the State District Fish and Game Managers, and the State District Forester by the *Village Engineer* or *Village Plan Commission* as they deem appropriate.

SECTION 7.0 DESIGN STANDARDS

SECTION 7.1 Street Arrangement (Addition)

Street, Block, and Lot Layouts shall be adjusted to the capability of the soil and water resources and shall be designed so as to least disturb the existing terrain, flora, fauna, and water regimen and to meet all the use, site, sanitary, floodland, and shoreland regulations contained in the *Village* Zoning, Sanitary, and Building Ordinances.

SECTION 8.0 REQUIRED IMPROVEMENTS

SECTION 8.2 Grading (Addition)

Cut and Filled Lands shall be graded to a maximum slope of *one on four* or the soils angle of repose, whichever is the lesser, and covered with permanent vegetation.

SECTION 8.8 Storm Water Drainage Facilities (Replacement)

The subdivider shall construct storm water drainage facilities, which may include curbs and gutters, catch basins and inlets, storm sewers, road ditches, and open channels, as required by the *Village Engineer*. All such facilities shall be of adequate size and grade to hydraulically accommodate the maximum potential volumes of flow. The type of facility required, the design criteria, and the sizes and grades shall be determined by the *Village Engineer*.

Storm Drainage Facilities shall be so designed as to prevent and control soil erosion and sedimentation and to present no hazard to life or property; and the size, type, and installation of all storm water drains and sewers proposed to be constructed shall be in accordance with the plans and standard specifications approved by the *Village Engineer*. Such facilities may at the request of the *Village Engineer* include water retention structures and settling basins so as to prevent erosion and sedimentation.

Unpaved Road Ditches and street gutters shall be shaped and seeded or sodded as grassed waterways. Where the velocity of flow is in excess of four (4) feet per second on soils having a severe or very severe erosion hazard and in excess of six (6) feet per second on soils having moderate, slight, or very slight erosion hazard, the subdivider shall install a paved invert or check dams, flumes, or other energy dissipating devices in accordance with plans and specifications approved by the *Village Engineer*.

SECTION 8.14 Sediment Control (Addition)

The subdivider shall plant those grasses, trees, and vines, a species and size specified by the *Village*

Engineer or the *Village Plan Commission, necessary* to prevent soil erosion and sedimentation.

In Addition, the *Village Plan Commission* may require the subdivider to provide or install certain protection and rehabilitation measures, such as fencing, sloping, seeding, riprap, revetments, jetties, clearing, dredging, snagging, drop structures, brush mats, willow poles, and grade stabilization structures.

SECTION 9.0 CONSTRUCTION

SECTION 9.1 Commencement (Replacement)
No construction or installation of improvements shall commence in a proposed subdivision until the preliminary plat or map has been approved and the *Village Engineer* has given written authorization.

SECTION 9.2 Permits (Replacement)
No building, zoning, or sanitary permits shall be issued for erection of a structure on any lot not of record until all the requirements of this Ordinance have been met.

SECTION 9.3 Plans (Addition)
The following plans and accompanying construction specifications may be required by the *Village Engineer* before construction or installation of improvements is authorized.

Erosion and Sedimentation Control Plans showing those structures required to retard the rate of runoff water and those grading and excavating practices that will prevent erosion and sedimentation.

Planting Plans showing the locations, age, caliper, and species of any required grasses, vines, shrubs, and trees.

SECTION 9.5 Erosion Control (Addition)
The subdivider shall cause all grading, excavations, open cuts, side slopes, and other land surface disturbances to be so mulched, seeded, sodded, or otherwise protected that erosion, siltation, sedimentation, and washing are prevented, in accordance with the plans and specifications approved by the *Village Engineer*.

Sod Shall be Laid in strips at those intervals necessary to prevent erosion and at right angles to the direction of drainage.

Temporary Vegetation and mulching shall be used to protect critical areas, and permanent vegetation shall be installed as soon as practical.

Construction at any given time shall be confined to the smallest practical area and for the shortest practical period of time.

Sediment Basins shall be installed and maintained at all drainageways to trap, remove, and prevent sediment and debris from being washed outside the area being developed.

SECTION 9.6 Existing Flora (Addition)
The subdivider shall make every effort to protect and retain all existing trees, shrubbery, vines, and grasses not actually lying in public roadways, drainageways, building foundation sites, private driveways, soil absorption waste disposal areas, paths, and trails.

Such Trees are to be protected and preserved during construction in accordance with sound conservation practices, including the preservation of trees by well islands or retaining walls whenever abutting grades are altered.

SECTION 11.0 DEFINITIONS (Addition)

Deep Absorption System
A soil absorption sewage system for disposal of effluent through the bottom and sides of a hole or trench at a depth of more than three (3) feet below the natural undisturbed surface.

Soil Mapping Unit
Soil types, slopes, and erosion factors delineated on detailed operational soil survey maps prepared by the U. S. Soil Conservation Service.

Wisconsin Administrative Code
The rules of administrative agencies having rule-making authority in Wisconsin, published in a loose-leaf, continual revision system as directed by Section 35.93 and Chapter 227 of the Wisconsin Statutes, including subsequent amendments to those rules.

Appendix B-3

SPECIAL SOIL REGULATIONS TO BE INCORPORATED INTO ZONING ORDINANCES

The following sections and subsections have been designed to replace or be added to those regulations found in the Model Zoning Ordinance set forth in Appendix A of SEWRPC Planning Guide No. 3, Zoning Guide, 1964, or to other properly prepared zoning ordinances.

SECTION 1.0 INTRODUCTION

SECTION 1.3 Intent (Addition)
Obtain the Wise Use, conservation, development, and protection of the *Village's* soil, water, wetland, woodland, and wildlife resources and attain a balance between land uses and the ability of the natural resource base to support and sustain such uses.

Prevent and Control Erosion and sedimentation.

Preserve Natural Growth and Cover and promote the natural beauty of the *Village*.

Implement those municipal, county, watershed, or regional comprehensive plans or their components adopted by the *Village*.

SECTION 1.6 Severability and Non-Liability (Addition)
The *Village* does not guarantee, warrant, or represent that those soils listed as being unsuited for specific uses are the only unsuitable soils within the *Village* and hereby asserts that there is no liability on the part of the *Village Board of Trustees*, its agencies, or employees for sanitation problems or structural damages that may occur as a result of reliance upon, and conformance with, this Ordinance.

SECTION 2.0 GENERAL PROVISIONS

SECTION 2.2 Compliance (Replacement)
No structure, land, or water shall hereafter be used and no structure or part thereof shall hereafter be located, erected, moved, reconstructed, extended, enlarged, converted, or structurally altered without a *Zoning Permit*, except minor structures, and without full compliance with the provisions of this Ordinance and all other applicable local, county, and state regulations.

SECTION 2.3 Zoning Permit (Addition)
Plat of Survey prepared by a land surveyor registered in Wisconsin, showing. . . and the type, slope, erosion factor, and boundaries of each soil mapping unit.

SECTION 2.4 Land Suitability (Addition)
No land shall be used or structure erected where the *Village Plan Commission* finds that the land has severe or very severe limitations for such use or structure by reason of flooding, concentrated runoff, inadequate drainage, adverse soil or rock formation, unfavorable topography, low percolation rate or bearing strength, erosion susceptibility, or any other feature likely to be harmful to the health, safety, prosperity, aesthetics, and general welfare of this community. The *Village Plan Commission*, in applying the provisions of this section,

shall in writing recite the particular facts upon which it bases its conclusions that the land is not suitable for certain uses.

SECTION 2.5 Sanitary Regulation

Certain soil types lying in the *Village* of_____, as shown on the operational soil survey maps prepared by the U. S. Department of Agriculture, Soil Conservation Service, have severe or very severe limitations for soil absorption sewage disposal facilities because of one or more of the following reasons: high or fluctuating ground water table, flooding, ground water contamination, silting, slow permeability, steep slopes, or proximity to bedrock. Therefore, the *Village Plan Commission* finds the following:

Soils with Very Severe Limitations. All soil absorption sewage disposal facilities are prohibited on the following soil types:

4	*76*	*179*	*231*	*327*	*451*
11W	*87*	*203*	*233*	*328*	*452*
29	*124*	*212*	*278*	*364*	*454*

Soils with Severe Limitations. All soil absorption sewage disposal facilities are prohibited on the following soil types and on those soil types having slopes in excess of twelve (12) percent, unless their severe limitations are overcome by the elimination or avoidance of bedrock, provision of larger lot and soil absorption areas, or the terracing and reduction of steep slopes:

16	*24*	*39*	*82*	*170Z*	*325*
21	*31*	*40*	*99*	*172Z*	*336*
22	*32*	*44*	*100*	*295*	*397*

An Applicant desiring to use the above soils that have severe limitations for soil absorption sewage disposal facilities shall: have additional on-site soil investigations made, including percolation tests; obtain a certification from a soils scientist or soils engineer stating that specific areas lying within these soils are suitable for the proposed soil absorption sewage disposal facility; meet the State Division of Health regulations; and obtain the *Village Plan Commission's* finding that the proposed soil absorption sewage disposal facility has overcome the severe limitations.

SECTION 2.6 Steep Land Regulations (Addition)

In addition to any other applicable use, site, or sanitary regulations, the following restrictions and regulations shall apply to all lands having slopes of twelve (12) percent or greater, as shown on the operational soil survey maps prepared by the U. S. Department of Agriculture, Soil Conservation Service, and which are on file with the *Zoning Inspector*.

All Construction and Private Roads shall be of sc· ıd engineering design with footings and roadbeds designed by a registered professional engineer and shall be so treated so as to prevent erosion.

Tillage and Grazing are prohibited except as conducted in accordance with the County Conservation Standards.

Tree Cutting and Shrubbery Clearing for the purpose of changing land use from wildlife or woodlot management are conditional uses requiring review, public hearing, and approval by the *Village Plan Commission* and shall be so regulated so as to completely prevent erosion and sedimentation and promote preservation of its scenic qualities. The *Board of Zoning Appeals* shall request the review of the State District Forester, State Fish and Game Manager, and the County Soil and Water Conservation District Supervisors and await their recommendations before final action is taken, but not to exceed sixty (60) days.

SECTION 2.7 Erodible Land Regulations (Addition)

In addition to any other applicable use, site, or sanitary regulations, the following restrictions and regulations shall apply to the following lands as shown on the operational soil survey maps prepared by the U. S. Department of Agriculture, Soil Conservation Service, and which are on file with the *Zoning Inspector*.

Lands Having Slopes of Six (6) Percent or more shall be prohibited from intensive farming, such as cash grains, nurseries, orchards, horticulture, truck farming, viticulture, seed cropping, vegetables, tree fruits, nuts, and berries, except as conducted in accordance with the County Conservation Standards.

Land Subject to Soil Blowing (Wind Erosion), such as the following muck and peat soil types, shall have all tillage and grazing prohibited except as conducted in accordance with the County Conservation Standards:

452 453 458 459 460 461

Lands Having an Erosion Factor of 3 shall have all tillage and grazing prohibited except as conducted in accordance with the County Conservation Standards.

SECTION 2.8 Soil Capability Regulations

In addition to any other applicable use, site, or sanitary regulations, the following restrictions and regulations shall apply to the following soil types as shown on the operational soil survey maps prepared by the U. S. Department of Agriculture, Soil Conservation Service, and which are on file with the *Zoning Inspector*.

Tillage is prohibited on the following rough, broken, sandy, stoney, or escarpment soils because of their erodibility and very low agricultural capabilities:

1 75 303 416 431 462

Farm Drainage Systems shall not be installed on the following soils because of flooding hazard and generally unsuitable soil characteristics for an operative drainage system, unless installed in accordance with the County Conservation Standards:

4 10W 11W 11WY 462

Grazing is prohibited on the following soil types because of their very severe limitations for pasturing:

1 4 416 419 462

SECTION 3.0 ZONING DISTRICTS

SECTION 3.1 Establishment (Addition)

Boundaries of These Districts shall be construed to follow: . . . soil mapping unit boundaries.

SECTION 11.0 *BOARD OF ZONING APPEALS*

SECTION 11.4 Powers (Addition)

Errors. To hear and decide appeals where it is alleged that there is an error in the soil type, slope, erosion factor, or mapping unit boundaries shown on the operational soil survey maps or the analyses of such soils prepared by the U. S. Department of Agriculture, Soil Conservation Service The Board may request the County Soil and Water Conservation District to provide expert assistance from regional, state, or federal agencies which are assisting the District under a ''Memorandum of Understanding.''

SECTION 13.0 DEFINITIONS (Addition)

Conservation Standards

Guidelines and specifications for soil and water conservation practices and management enumerated in the Technical Guide prepared by the U. S. Department of Agriculture, Soil Conservation Service, for the County, adopted by the County Soil and Water Conservation District Supervisors, and containing suitable alternatives for the use and treatment of land based upon its capabilities from which the landowner selects that alternative which best meets his needs in developing his soil and water conservation plan.

Erosion Factor
An index of soil erosion or of the detachment and movement of the solid material of the land surface by wind, moving water, or ice, and by such processes as landslides and creep. The digits 1, 2, and 3 are used by the U. S. Department of Agriculture, Soil Conservation Service, to indicate the degree of such erosion as follows:

1 - None to one-fourth of the original surface soil has been removed by erosion.
2 - one-fourth to three-fourths of the original surface soil has been removed by erosion.
3 - three-fourths of the original surface soil to one-fourth of the subsoil has been removed by erosion.

Soil Mapping Units
The boundaries of soil types, slopes, and erosion factors shown on the operational soil survey maps prepared by the U S Department of Agriculture, Soil Conservation Service.

Appendix B-4

SPECIAL SOIL REGULATIONS TO BE INCORPORATED INTO BUILDING ORDINANCES

The following sections and subsections have been designed to replace or be added to those regulations found in properly prepared local building ordinances so as to assist in effectively and efficiently preventing and controlling erosion and sedimentation.

SECTION 1.0 INTRODUCTION

SECTION 1.3 Intent (Addition)
Prevent and Control Erosion, sedimentation, and other pollution of surface and subsurface waters.
Preserve Growth and Cover and promote the natural beauty of the *Village*.
Provide for the Least Disturbance of existing terrain, flora, fauna, and water regimen.

SECTION 1.8 Non-Liability (Addition)
The *Village* does not guarantee, warrant, or represent that those soils listed as being unsuited for specific uses are the only unsuitable soils within the *Village* and hereby asserts that there is no liability on the part of the *Village Board of Trustees*, its agencies, or employees for sanitation problems or structural damages that may occur as a result of reliance upon, and conformance with, this Ordinance.

SECTION 2.0 GENERAL PROVISIONS

SECTION 2.2 Compliance (Replacement)
No structure shall be erected, constructed, altered, repaired, relocated, reconstructed, extended, converted, enlarged, demolished, occupied, or maintained without a *Building Permit* and without full compliance with the provisions of this Ordinance; the Wisconsin Statutes; the National Board of Fire Underwriters standards; and all other applicable local, county, and state regulations.

SECTION 2.3 *Building Permit* (Addition)
Plat of Survey prepared by a land surveyor registered in Wisconsin, showing the type, slope, erosion factor, and boundaries of these soils as shown on the detailed operational soil survey maps prepared by the U. S. Soil Conservation Service.

SECTION 2.6 Land Suitability (Addition)
No structure shall be erected where the *Village Building Board* finds that the land has severe or very severe limitations for such structure by reason of flooding, concentrated runoff, inadequate drainage, adverse soil or rock formation, unfavorable topography, low percolation rate or bearing strength, erosion susceptibility, or any other feature likely to be harmful to the health, safety, prosperity, aesthetics, and general welfare of this community. The *Village Building Board*, in applying the provisions of this section, shall in writing recite the particular facts upon which it bases its conclusions that the land is not suitable for certain uses.

SECTION 2.7 Unbuildable Soils (Addition)
Certain soil types lying in the *Village* of _____, as shown on the operational soil survey maps prepared by the U. S. Soil Conservation Service, have very severe limitations for residential development because of low-bearing capacity, high shrink-swell potential, high water table, frequent overflow, steepness, or erosiveness. Therefore, the erection or construction of residential structures is prohibited on the following soil types:

2	*5w*	*11w*	*327*	*451*	*461*
4	*11*	*54*	*416*	*458*	*462*

An Applicant shall have an opportunity to present evidence to the *Village Building Board* contesting the soil classifications, slope, boundaries, and analyses if he so desires.
The Village Building Board may request the County Soil and Water Conservation District to provide expert assistance from regional, state, or federal agencies which are assisting such District under a Memorandum of Understanding.

SECTION 2.8 Steep Lands (Addition)
Certain soil types lying in the *Village* of _____, as shown on the operational soil survey maps prepared by the U. S. Soil Conservation Service, have severe limitations for development because they occur on slopes of twelve (12) percent or greater; and the following restrictions shall be complied with:
All Construction and Private Roads shall be of sound engineering design with earthworks and roadbeds designed by a registered professional engineer and shall be so treated so as to prevent erosion.

SECTION 3.0 SITE IMPROVEMENT

SECTION 3.1 General (Addition)
Building Sites shall be so designed, developed, and improved as to result in the minimum disruption of the natural terrain, flora, fauna, and water regimen; excavation, grading, cutting, and filling shall be directly related to the construction of public rights-of-way, private driveways, and building foundations; and natural drainage patterns shall not be altered so as to divert water onto adjoining properties.

SECTION 3.2 Erosion Control (Addition)
All grading, excavations, open cuts, and other land surface and subsurface disturbances shall be so mulched, seeded, sodded, or otherwise protected that erosion, siltation, sedimentation, and washing are prevented during and after site development.

SECTION 3.3 Existing Flora (Addition)
Every effort shall be made to protect all existing trees, shrubbery, and grasses not actually lying in public roadways, drainageways, building foundation sites, private driveways, soil absorption waste disposal areas, pathways, and trails.
Such Trees are to be protected and preserved during construction in accordance with sound conservation practices, including the preservation of trees by well islands or retaining walls whenever abutting grades are altered.

SECTION 3.4 Drainage (Addition)

All Excavations or changes in the natural terrain shall be provided with adequate drainage so as to prevent ponding.

SECTION 4.0 FOUNDATIONS

SECTION 4.2 Disturbed Soils (Addition)

Lands filled with non-earth materials over five (5) feet in depth within the last ten (10) years shall not have structures erected thereon unless designed, constructed, and supervised in accordance with plans and specifications approved by a professional engineer registered in Wisconsin who is experienced in foundation engineering; and such engineer shall certify that such structures are designed and were constructed in accordance with such plans and specifications.

SECTION 10.0 DEFINITIONS

Words used in the present tense include the future; the singular number, the plural; the plural number, the singular; and the word ''shall'' is mandatory and not directory.

Building

Any structure having a roof supported by columns or walls designed, used, or intended to be used for human occupancy or for the permanent, year-round sheltering, enclosure, or storage of animals, equipment, machinery, or other materials.

Building Inspector

A person recommended by the *Village Building Board* and appointed by the *Village Board of Trustees* to administer and enforce this Ordinance. References to the *Building Inspector* shall be construed to include duly appointed *deputy inspectors*.

Foundation

A substructure, including masonry walls, piers, footings, piles, grillage, and similar construction, which is designed to transmit the load of any superimposed structure to natural soil or bedrock.

Soil Mapping Unit

Soil types, slopes, and erosion factors delineated on operational soil survey maps prepared by the U. S. Soil Conservation Service.

Structure

Any erection or construction, such as boons, bridges, buildings, bulkheads, carports, cribs, decorations, machinery, masts, piers, poles, posts, signs, towers, and walls.

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Appendix C

EDUCATIONAL PROGRAM

An intensive educational program will be necessary if the goals of the Wisconsin Fund program are to be met in the Root River watershed. The program will require the cooperation of a number of agencies to reach varied clientele. The list of activities below was developed by representatives of the University of Wisconsin-Extension, the Agricultural Stabilization and Conservation Service, the Soil and Water Conservation Districts, the Young Adult Conservation Corp, the Cooperative Educational Service Agency, the Board of Soil and Water Conservation Districts, the U. S. Sea Grant Advisory Service, the Wisconsin Department of Natural Resources, and the Milwaukee Public School System.

1. Educational Tours—Canoe, cross country ski, and bike trips are planned to provide an attractive educational program designed to create awareness of the nonpoint source pollution problem in the Root River watershed. Clientele: youth, environmental groups, general public.

2. Tillage Demonstration—Plot and program demonstrations will be set up showing various conservation tillage practices. Clientele: farmers, youth, rural officials, environmental groups.

3. Soil Management Series—An 18-hour educational program will be presented on soil management. Clientele: farmers, rural officials, youth, environmental groups.

4. Animal Waste Management Series—An educational program will be presented on manure-handling alternatives. Clientele: farmers, youth groups, rural officials, environmental groups.

5. Newsletter—A quarterly newsletter will be provided to property owners and governments in the watershed.

6. Intense Informational Campaign in Priority Areas—An intensive effort is planned to acquaint landowners with the program to achieve the sign-up goals. Clientele: farmers, municipal officials, homeowners, businesses, rural officials, planners.

7. Urban Housekeeping—Educational materials and programs will be developed for homeowners covering such topics as lawn fertilizers, leaf handling, and pet wastes. Clientele: farmers, schools, youth, homeowners, environmental groups.

8. Automobile Dealers—Consultation will be conducted with a number of auto dealerships whose car- and garage-washing practices contribute pollutants to the Root River.

9. Urban Field Trips—Field trips will be developed for schools emphasizing urban nonpoint source pollution problems. Clientele: youth, teachers.

10. Government Officials—Meetings will be held with government officials to acquaint them with the Wisconsin Fund program and techniques for reducing nonpoint source water pollution. Clientele: municipal officials, rural officials.

11. Erosion Control Ordinances—Sessions will be held with individual municipalities to develop construction-erosion control ordinances and policies. Clientele: municipal officials, contractors, developers, homeowners.

12. Septic Systems—Educational materials and programs will be developed on proper septic system management. Clientele: farmers, homeowners, businesses, municipal officials.

13. Booths/Exhibits—Displays will be developed and exhibited at county and community fairs and expositions. Clientele: farmers, youth, schools, homeowners, general public.

14. Media Announcements—A coordinated media campaign will be undertaken to create awareness of the nonpoint source pollution abatement program, activities, and progress. Clientele: news media, general public.

15. School Projects—Class and individual student projects will be developed for area elementary and secondary schools. Clientele: teachers, youth.

Appendix D

TECHNICAL MEMORANDUM NO. 3[1]

PRIORITY WATERSHED PLAN FOR CONTROL OF NONPOINT SOURCES OF WATER POLLUTION IN THE ROOT RIVER WATERSHED

WATER QUALITY SAMPLING AND MONITORING PROGRAM

INTRODUCTION

Technical Memorandum No. 1 for the Root River watershed set forth proposals for collecting inventory data and outlined the responsibilities of the designated management agencies. Technical Memorandum No. 2 discussed the development of the priority plan. This memorandum is intended to review the extent of the available water quality data and determine whether additional data are necessary. For any additional data needed, the memorandum identifies the locations, parameters, and methods of water quality sampling needed to properly assess the stream water quality conditions in the watershed and to evaluate the effectiveness of the nonpoint source control measures which are implemented. Unlike the proposals set forth in the first two memoranda, which are primarily the responsibility of the local designated management agencies, the water quality monitoring program is recommended to be conducted by the Wisconsin Department of Natural Resources. This memorandum was prepared jointly by the staffs of the Southeastern Wisconsin Regional Planning Commission (SEWRPC) and the Wisconsin Department of Natural Resources (DNR), Southeast District.

OBJECTIVES

The specific objectives of a monitoring program to support priority watershed planning are to assess "baseline" water quality conditions prior to the implementation of pollution control measures, to identify stream reaches severely polluted by nonpoint sources, to identify the specific pollutants which affect the different stream reaches, and to support documentation of the improvement in water quality expected to occur upon implementation of the control measures. In addition to recommending that a water quality monitoring effort be conducted under the priority watershed planning program, the areawide water quality management plan prepared by the Regional Planning Commission recommends that long-term water quality monitoring programs and programs for special-purpose water quality surveys be developed. The special-purpose monitoring programs should demonstrate the effects of point and nonpoint source pollution abatement measures, support the establishment of appropriate discharge permit limitations for point sources, assign the proper water use objectives and supporting water quality standards to stream reaches, determine the precise in-stream phosphorus standard to be applied to each stream, and assess the effects of sediment oxygen demand on in-stream dissolved oxygen levels. Thus, the objectives of the priority watershed planning program are compatible with the objectives of the areawide water quality management plan.

EXISTING DATA

The Regional Planning Commission sampled water quality at six sites in the watershed between 1964 and 1975 under its water quality trends analysis set forth in SEWRPC Technical Report No. 17, Water Quality of Lakes and Streams in Southeastern Wisconsin: 1964-1975. The location of these sites—along with a proposed new sampling site—are shown on Map D-1. These samples—which were taken mostly during

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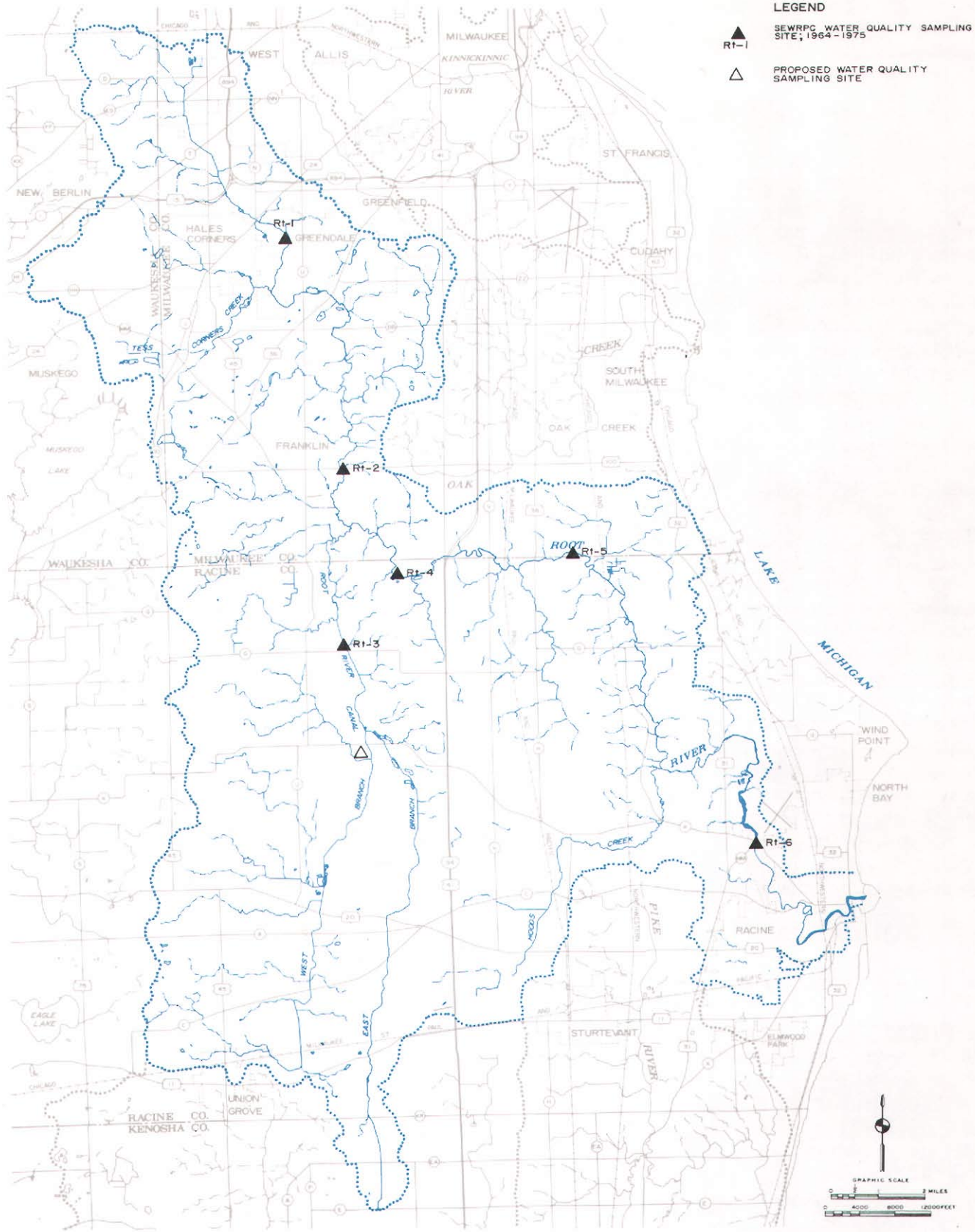
[1] *Prepared in September 1979 by the Southeastern Wisconsin Regional Planning Commission at the request of the local designated management agencies in the Root River watershed at their meeting of June 13, 1979.*

Map D-1

EXISTING AND PROPOSED WATER QUALITY SAMPLING SITES IN THE ROOT RIVER WATERSHED



Source: SEWRPC.

summer low-flow periods—were analyzed for temperature, dissolved oxygen, conductivity, nitrite, nitrate, ammonia, organic nitrogen, total nitrogen, dissolved phosphorus, total phosphorus, pH, chloride, fecal coliform, and total coliform. In addition, three of these sites were also sampled under the Commission Section 208 planning program in order to calibrate the water quality simulation model. This sampling occurred in the fall of 1976. These samples were analyzed for temperature, dissolved oxygen, conductivity, nitrite, nitrate, ammonia, organic nitrogen, total nitrogen, phosphate-phosphorus, soluble reactive phosphorus, total phosphorus, biochemical oxygen demand, fecal coliform, and chloride.

The Wisconsin Department of Natural Resources studied the Root River, its tributaries, and the wastewater discharges in the watershed in 1954, 1955, 1967, and 1976 under the drainage basin investigation report program. Chemical analyses, biological surveys, and observations were conducted at several sites within the watershed. In the 1976 report, water samples from 77 in-stream sites and 35 wastewater effluent sites were analyzed for temperature, dissolved oxygen, pH, fecal coliform, biochemical oxygen demand, total solids, suspended solids, volatile solids, organic nitrogen, ammonia, nitrite, nitrate, total phosphorus, soluble phosphorus, and chloride. The 1976 report also included biological survey data and observations for 23 sites within the watershed. In the summer of 1979, benthic invertebrates were surveyed at 20 sites and a biotic index was used to classify the streams in the watershed with regard to the degree of pollution.

RECOMMENDATIONS

In developing a water quality monitoring program it is necessary to identify the location of the sampling sites, determine when and under what conditions sampling should occur, estimate the frequency of sampling, identify the water quality parameters to be analyzed, and discuss the methods of sampling.

A drainage basin investigation report for the Root River, Pike River, and Des Plaines River watersheds is scheduled by the Wisconsin Department of Natural Resources to begin in the summer of 1980. The drainage basin reports are periodically and routinely conducted to assess the surface water quality, and to focus attention on basin water quality problems. It is recommended that the drainage basin survey to be conducted for the Root River in 1980 be designed in such a way as to satisfy the objectives of the nonpoint source priority planning program. It is assumed that few—if any—additional management practices will actually be installed prior to the summer of 1980. Therefore, sampling data collected at that time would represent a reasonable characterization of water quality conditions prior to the implementation of nonpoint source control practices.

Recommendations for a sampling program are set forth below for consideration by the DNR in program design. These recommendations are subject to change as the techniques of water quality survey change and as further investigation by the DNR and the Commission indicates further refinement to be appropriate.

1. Field surveys should be conducted by the DNR to identify appropriate sites to assess nonpoint sources of pollution. The SEWRPC sites shown on Map D-1 should be included in order to assess long-term trends in water quality. Additional sites will serve to identify reaches of streams severely polluted by nonpoint sources. Additional sites should be located on streams which receive runoff from intensive agricultural land, agricultural ditches, feedlots, urban drainage ditches, failing septic systems, industrial sites, urban land under construction, developed urban land, landfills, or other areas of significant nonpoint source loadings observed during the priority watershed planning data inventory process.

2. Wet weather surveys conducted over the rise, peak, and fall of a series of storm event hydrographs should be conducted to define water quality response during wet weather conditions. Each survey should be accomplished in coordination with appropriate dye studies or other analyses of the time-of-travel of the storm flows. The Regional Planning Commission's water quality simulation model may be used to provide additional data for the wet weather surveys. These data should be used to identify severely polluted stream reaches and high source areas.

3. Automatic "continuous" water quality samplers should be installed if possible at the three U. S. Geological Survey gage sites located in the watershed. Selected grab samples could be collected at other sites.

4. Water quality samples should be analyzed for temperature, pH, dissolved oxygen, biochemical oxygen demand, total solids, volatile total solids, suspended solids, volatile solids, fecal coliform, fecal streptococcus, total phosphorus, soluble phosphorus, total organic nitrogen, ammonia-nitrogen, nitrite- and nitrate-nitrogen, chlorides, turbidity, cadmium, chromium, copper, lead, nickel, mercury, and zinc.

5. Bottom sediment oxygen demand studies should be conducted. These studies should address the specific oxygen demand levels in the sediments; the physical and biological character of the sediments; the metals, pesticides, and nutrients contained in the sediments; the probable sources of the sediments; the effects of sediment oxygen demand on stream water use classification; and the depth and densities of the bottom sediments.

6. Field surveys should be conducted to verify the water use objectives established by the Regional Planning Commission under its areawide water quality management planning program, especially wherever a difference with current DNR objectives exists. The specific levels of phosphorus required to satisfy the recommended water use objectives should be investigated.

7. Based upon field survey observations, it is recommended that selected sites of water quality degradation be field checked and that grab-samples be taken by DNR field personnel even prior to the undertaking of the full basin survey effort described above.

Following the implementation of nonpoint source controls under the priority watershed planning program, similar studies should be conducted to assess the effects of these controls. These should include both an overall assessment of the watershed's water quality conditions and an evaluation of the effectiveness of the specific types of nonpoint source control measures.

SUMMARY

A great amount of water quality data is currently available for the Root River watershed. A water quality monitoring program should be conducted in the Root River watershed by the Wisconsin Department of Natural Resources, in support of the priority watershed planning and implementation program. This program should document the current condition of the streams, identify severely polluted stream reaches, identify specific pollutants, and document the improvement in water quality expected to occur upon implementation of the nonpoint source control measures. Recommendations for specific sampling sites, distribution and frequency of sampling, parameters to be analyzed, and methods of analysis should be determined by the Wisconsin Department of Natural Resources as part of its drainage basin report.

Appendix E

IMPLEMENTATION SCHEDULE AND SOIL AND WATER CONSERVATION DISTRICT TECHNICAL ASSISTANCE REQUIREMENTS FOR RURAL NONPOINT SOURCE ABATEMENT PRACTICES BY SUBWATERSHED

Table E-1

CONSERVATION FARM PLANS AND IMPLEMENTATION OF RURAL NONPOINT SOURCE POLLUTION CONTROL PRACTICES BY SUBWATERSHED IN THE ROOT RIVER WATERSHED

Rural Nonpoint Source Pollution Control Practice	Units	Subwatershed									
		West Branch, Root River Canal	Lower Root River	Whitnall Park Creek	Middle Root River	Upper Root River	Root River Canal	East Branch, Root River	East Branch, Root River Canal	Hoods Creek	Total
Conservation Farm Plans	Number	49	75	7	23	–	19	–	26	37	236
Crop Rotation	Acres	–	150	–	–	–	75	–	45	293	563
Contour Strip Cropping	Acres	180	50	–	–	–	110	–	30	–	370
Conservation Tillage	Acres	3,190	1,760	225	490	110	750	–	1,240	860	8,625
Diversions	Feet	7,500	7,500	–	1,900	–	5,650	–	13,150	1,900	37,600
Terraces	Feet	195,900	310,200	–	18,750	–	189,750	–	174,300	30,000	918,900
Grass Waterways	Feet	34,150	61,050	–	5,950	–	13,650	–	25,850	8,100	148,750
Grade Stabilization Structures	Number	18	16	–	3	1	4	–	32	10	84
Stream Fencing for Livestock Exclusion	Feet	1,100	400	–	900	–	–	–	200	–	2,600
Stream Bank Shaping and Seeding	Feet	850	9,400	–	200	4,400	1,700	–	2,400	1,000	19,950
Stream Bank Riprap	Feet	225	6,750	–	–	975	1,688	–	150	450	10,238
Stream Cattle Crossings	Number	2	1	1	–	–	2	–	1	–	7
Critical Area Planting	Acres	–	–	3	3	9	–	–	–	–	15
Vegetative Buffer Strips	Acres	41	3	–	5	–	6	–	52	21	128
Livestock Waste Runoff Management Systems	Number	15	6	–	–	–	6	–	6	–	33
Livestock Waste Storage Systems	Number	8	3	–	–	–	4	–	3	–	18

NOTE: These numbers represent implementation of 75 percent of the recommended practices, which is the goal of the Wisconsin Fund Nonpoint Source Water Pollution Abatement Program.

Source: Wisconsin Department of Natural Resources and Racine County Soil and Water Conservation District.

Table E-2

TECHNICAL ASSISTANCE REQUIREMENTS FOR INDIVIDUAL TYPES OF RURAL NONPOINT SOURCE POLLUTION CONTROL PRACTICES IN THE ROOT RIVER WATERSHED: 1980-1987

Rural Nonpoint Source Pollution Control Practice	Units of Technical Assistance Required	Number of Hours								Total Hours 1980-1987
		1980	1981	1982	1983	1984	1985	1986	1987	
Conservation Farm Plans	40 hours	3,160	2,080	1,680	1,840	680	–	–	–	9,440
Planning With Other Designated Management Agencies	–	975	425	600	400	100	–	–	–	2,500
Crop Rotation	–	–	–	–	–	–	–	–	–	–
Contour Strip Cropping	0.1 hour per acre	–	8	15	–	5	9	–	–	37
Conservation Tillage	0.02 hour per acre	–	–	20	40	57	19	20	17	173
Diversions	50 feet per hour	60	80	80	–	150	130	252	–	752
Terraces	110 feet per hour	–	637	546	455	1,273	1,682	1,666	2,091	8,350
Grass Waterways	50 feet per hour	–	600	600	600	184	257	419	315	2,975
Grade Stabilization Structures	80 hours each	–	–	–	240	1,200	1,520	1,760	2,000	6,720
Road Side Stabilization	10 hours per acre	–	–	–	–	30	10	–	–	40
Stream Fencing for Livestock Exclusion	100 feet per hour	–	–	–	–	15	11	–	–	26
Stream Bank Shaping and Seeding	50 feet per hour	–	60	97	100	60	44	30	8	399
Stream Bank Riprap	39 feet per hour	–	25	25	80	75	51	–	–	256
Stream Cattle Crossings	20 hours each	–	–	–	–	60	80	–	–	140
Critical Area Planting	10 hours per acre	–	–	–	–	90	60	–	–	150
Vegetative Buffer Strips	2 hours per acre	10	50	–	–	84	26	86	–	256
Livestock Waste Runoff Management Systems	50 hours each	150	200	400	350	150	250	150	–	1,650
Livestock Waste Storage Systems	100 hours each	100	300	400	400	200	300	100	–	1,800
Total	–	4,455	4,465	4,463	4,505	4,413	4,449	4,483	4,431	35,664

NOTE: These numbers represent implementation of 75 percent of the recommended practices, which is the goal of the Wisconsin Fund Nonpoint Source Water Pollution Abatement Program.

Source: Wisconsin Department of Natural Resources and Racine County Soil and Water Conservation District.

Table E-3

TECHNICAL ASSISTANCE REQUIREMENT SCHEDULE BY SUBWATERSHED IN THE ROOT RIVER WATERSHED: 1980-1987

Subwatershed	Number of Hours								Total Hours
	1980	1981	1982	1983	1984	1985	1986	1987	
West Branch, Root River Canal	2,225	1,128	1,201	1,189	950	1,155	–	–	7,848
Lower Root River	1,230	3,057	962	902	1,749	1,578	456	–	9,934
Whitnall Park Creek	600	180	–	–	62	–	–	–	842
Middle Root River	–	–	1,170	100	96	172	208	164	1,910
Upper Root River	400	100	20	24	34	140	–	–	718
Root River Canal	–	–	910	200	330	928	692	1,185	4,245
East Branch, Root River	–	–	200	100	–	–	–	–	300
East Branch, Root River Canal	–	–	–	1,090	385	441	2,583	2,322	6,821
Hoods Creek	–	–	–	900	807	35	544	760	3,046
Total	4,455	4,465	4,463	4,505	4,413	4,449	4,483	4,431	35,664

NOTE: These numbers represent the technical assistance required to implement 75 percent of the recommended practices, which is the goal of the Wisconsin Fund Nonpoint Source Water Pollution Abatement Program.

Source: Wisconsin Department of Natural Resources and Racine County Soil and Water Conservation District.

Appendix F

COST-SHARING FOR BEST MANAGEMENT PRACTICES[1]

INTRODUCTION

The overall goal of the Wisconsin Fund Nonpoint Source Water Pollution Abatement Program is to make the State's lakes and streams swimmable and fishable. In order to help meet this goal, the program offers financial assistance to landowners, operators, and municipalities for installing or applying best management practices. Best management practices are defined as:

> Practices, techniques or measures which are determined to be most effective, practicable means of preventing or reducing pollutants generated from nonpoint sources to a level compatible with water quality goals. They are identified in the areawide water quality management plans and priority watershed plans.

The purposes of this appendix are to identify: 1) the rural and urban best management practices and the components of those practices eligible for cost-sharing; 2) the state maximum cost-share rates for each eligible practice; 3) the cost-sharing conditions designated management agencies must certify are being met by land users; and 4) the minimum cost-sharing conditions the land user must meet to comply with the cost-sharing agreement. Some best management practices do not require cost-sharing because they are low cost or no cost or provide a high degree of benefit to the land user. Efforts have been made to make the cost-sharing under this program as compatible as possible with the Agricultural Conservation Program (ACP), administered by the Agricultural Stabilization and Conservation Service.

COST-SHARE RATES

The Wisconsin Department of Natural Resources, in consultation with the State Board of Soil and Water Conservation Districts, is required to identify a maximum cost-sharing rate for each best management practice. The maximum cost-sharing rate identified in this appendix represents a ceiling. Local designated management agencies may use any rate at or below the ceiling.

Section 144.25 of the Wisconsin Statutes states cost-share payments shall not exceed 50 percent of the cost of implementing the best management practice except as follows:

1. The maximum rate may be increased to as much as 70 percent where: a) the practice produces benefits for the applicant but the main benefits to be derived are related to improving offsite water quality, and b) limiting the cost-sharing to 50 percent would place an unreasonable cost burden on applicants.

2. The maximum rate may be increased above 70 percent for certain practices where: a) the practice produces negligible benefit to the applicant, with the benefits to be derived related to improving offsite water quality, and b) limiting the cost-sharing payment to 70 percent would place unreasonable cost burden on applicants.

In order for a specific practice to receive cost-sharing above 70 percent, county cost-sharing must be provided. The county cost-sharing may be matched by supplemental state cost-sharing up to 10 percent. For example, a stream bank protection practice could have 80 percent state cost-sharing if the county provides 10 percent cost-sharing.

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[1] *Source: Wisconsin Department of Natural Resources, Guidelines for Nonpoint Source Water Pollution Abatement Program: A Part of the Wisconsin Fund, December 1978.*

State funds may be the sole source of cost-sharing or may be used together with federal cost-sharing, such as ACP, up to 70 percent. The remaining costs must be met by county cost-sharing or be borne by the landowner. For example, a manure storage facility could receive 70 percent cost-sharing in state funds or 35 percent federal funds and 35 percent state funds. In either case, the cost to the land user is the remaining 30 percent.

Additional guidelines for determining cost-share rates are provided in Chapter NR 120 of the Wisconsin Administrative Code. They are:

1. Practices which are very effective for pollution control and which have high capital costs should have higher rates.

2. Practices normally used for crop or livestock production or street sweeping should have lower rates.

Table F-1 provides an evaluation of the cost-share-eligible practices in relation to four major criteria and identifies the State's maximum cost-share rate.

GENERAL POLICIES

1. Only best management practices installed at specific locations necessary to improve or protect water quality are eligible.

2. Rural and urban areas are eligible.

3. Cost-sharing is limited to areas of the State with approved areawide water quality management plans.

4. Cost-sharing is limited to priority management areas in priority watersheds or areas likely to be within a priority management area in other watersheds.

5. Cost-sharing is not available for the following:

   a. mining activities;
   b. construction activities[2] on privately owned lands (e. g. erosion control practices for construction of subdivisions);
   c. silviculture activities (excluding farm woodlots);
   d. septic systems (small-scale onsite human domestic waste disposal systems);
   e. dredging activities; and
   f. practices installed primarily for flood control purposes.

6. When two or more practices are of equal pollution control effectiveness and compatible with the use and management of the land, the maximum cost-share will be based on the least-cost practice. For example, a manure storage tank ($50,000) and a solid stacking pad ($8,000) may provide equal pollution control of manure. While the farmer may desire to install the more expensive manure storage facility in order to enhance his operation, cost-sharing will be based on the least-cost alternative.

7. Cost-sharing is not available for practices which:

   a. are normally and routinely used in growing crops;
   b. are normally and customarily used in the cleaning of streets and roads;
   c. have drainage of land as the primary objective; and
   d. have installation costs that can reasonably be passed on to potential consumers.

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[2] *This does not include construction of best management practices.*

Table F-1

EVALUATION OF COST-SHARE-ELIGIBLE PRACTICES

Nonpoint Source Control Practice	Effectiveness	Capital Cost	Private Onsite Benefit	Relationship to Customary Operating Practices	Maximum State Cost-sharing (percent)
C1 – Contour Cropping	High	Low	Moderate	Moderate	50[c]
C2 – Strip Cropping	High	Low	Moderate	Moderate	50[c]
C3 – Diversions	High	Moderate	Moderate	Low	70
C4 – Terraces	High	Moderate	Moderate	Low	70
C5 – Waterways	High	Moderate	Moderate	Moderate	70
C6 – Minimum Tillage	High	Low	Moderate	High	50[c]
C7 – No-till	High	Low	Moderate	High	50[c]
M1 – Critical Area Stabilization	High	High	Low	Low	70[a]
M2 – Grade Stabilization Structure	High	High	Low	Low	70[a]
M3 – Shoreline Protection	High	High	Low	Low	70[a]
M4 – Settling Basins	High	High	Low	Low	70[a]
L1 – Barnyard Runoff Management	High	Moderate	Moderate	Low	70
L2 – Manure Storage Facilities	High	High	Moderate	Moderate	70[b]
L3 – Livestock Exclusion From Woodlots	High	Low	Low	Moderate	50
U1 – Leaf Collection	High	Low	Low	High	50
U2 – Street Sweeping	Moderate	Low	Low	High	50
U3 – Infiltration System	Moderate to High	Moderate	Low	Low	70

C: Generally used in cropland but may be applicable in urban areas as well.
M: Applicable in both rural and urban areas.
L: Livestock.
U: Urban.

[a] *May be increased to 80 percent according to the conditions set forth in the "Cost-Share Rates" section of this appendix.*

[b] *A dollar ceiling of $6,000 is set for priority watershed projects and $4,000 is set for local priority projects.*

[c] *A flat rate per acre equal to the cost-share rate applied to an average installation may be used.*

Source: Wisconsin Department of Natural Resources.

BEST MANAGEMENT PRACTICES ELIGIBLE FOR COST-SHARING

Guidelines for Nonpoint Source Water Pollution Abatement Program: A Part of the Wisconsin Fund, prepared by the Wisconsin Department of Agriculture in 1978, identifies the best management practices and their components eligible for cost-sharing and conditions the land user must meet to comply with the cost-sharing agreement. The conditions represent a statewide minimum. Designated management agencies may make the conditions more stringent.

Designated management agencies are encouraged to coordinate local adjustments to cost-share rates and conditions with the county Agricultural Stabilization and Conservation committees.

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Appendix G

RECORD KEEPING PROGRAM, WISCONSIN FUND COST-SHARE APPLICATION AND PAYMENT PROCEDURES, AND GUIDELINES FOR THE MAINTENANCE OF MANAGEMENT PRACTICES

RECORD KEEPING PROGRAM

The Racine County Soil and Water Conservation District shall maintain all records of correspondence, landowner agreements, and contract arrangements at the Racine County Soil and Water Conservation District office. Other designated management agencies shall maintain their own implemented practice files for their respective jurisdictional areas. Copies of landowner agreements and management practice certification and progress reports will be maintained by both the responsible designated management agency and the Racine County Soil and Water Conservation District. The Racine County Soil and Water Conservation District is responsible for filing financial reports with the State Board of Soil and Water Conservation Districts and the Wisconsin Department of Natural Resources.

WISCONSIN FUND COST-SHARE APPLICATION AND PAYMENT PROCEDURES

It is recommended that the following agency functions provide for the acceptance and processing of cost-share applications:

1. The Racine County Agricultural Stabilization and Conservation Service (ASCS) office is responsible for accepting and processing cost-share applications. Applications shall be accepted at the Racine County or Waukesha County ASCS offices. The federal Agricultural Conservation Program (ACP) forms should be used for applications.

2. The Racine County ASCS office shall forward cost-share applications to the responsible designated management agency for approval.

3. The Racine County ASCS office, along with each designated management agency, is responsible for following up on approved applications to ensure the timely implementation of all approved practices.

4. The Racine County ASCS office is fully responsible for the maintenance of program financial records. These records include all funding applications, ledgers, annual and final reports, and individual landowner files, including any long-term agreements which are established.

5. The Wisconsin Department of Natural Resources will transfer an initial sum of money from the Wisconsin Fund to the Racine County Soil and Water Conservation District. This advance payment will equal up to 20 percent of the maximum grant amount as detailed in the grant award. Money is to be deposited in the Racine County treasury in a separate Root River account. This initial sum of money will be drawn from for reimbursement to landowners for installation of management practices. The Wisconsin Department of Natural Resources will reimburse the Racine County Soil and Water Conservation District upon confirmation of installations of the management practices.

The Agricultural Stabilization and Conservation Service shall be reimbursed by the Racine County Soil and Water Conservation District for administrative services performed in the implementation of the plan. The reimbursement amount is a rate of 1 percent of project funds available for cost-sharing assistance. Reimbursement to the ASCS shall be made as follows:

1. At the beginning of each fiscal year, one-half of 1 percent of the funds estimated to be expended to participants during the fiscal year shall be transmitted. Estimates are to be based on projected cost-sharing assistance.

2. At the end of the fiscal year, the balance due to equal 1 percent of cost-sharing assistance paid during that fiscal year shall be transmitted.

The following procedure is recommended to facilitate the payment of Wisconsin Fund cost-share monies:

1. A cost-share agreement or contract between the Racine County Soil and Water Conservation District and the landowner shall be prepared which specifies the management practices to be installed and provides a general cost estimate. Upon completion of the cost-share agreement and approval by the responsible designated management agency and by the lead designated management agency, a copy of the agreement shall be forwarded to the Racine County ASCS office.

2. On receipt of the approved agreement by the Racine County ASCS office, funds shall be appropriated. ASCS Form RE 247, Referral for Technical Determination, should be completed for those practices for that particular year as determined by the agreement.

3. The Racine County ASCS office shall transmit Form 247 to the responsible designated management agency, which will prepare a detailed cost estimate and arrange for implementation of the practice. Upon certifying the installation of the practice, the responsible designated management agency shall return Form 247 to the Racine County ASCS office.

4. On receipt of Form 247, with certification of the practice installed, the Racine County ASCS office shall complete Form 245, Request for Cost-Sharing. This form and an attached letter advising the landowner of practice approval, rate of cost-sharing, and amount of eligible funds shall be transmitted to the landowner by the Racine County ASCS office.

5. Following construction of the management practice, the landowner shall submit itemized payment receipts and construction costs to the Racine County ASCS office.

6. The responsible designated management agency shall complete a performance report and, if the practice is included in the U. S. Soil Conservation Service (SCS) Technical Guide, certify that the practice meets SCS Technical Guide specifications. This information shall be transmitted to the Racine County Soil and Water Conservation District and to the Racine County ASCS office.

7. Upon receipt of practice construction costs and designated management agency certification reports, the cost-share payment shall be made to the landowner by the Racine County Clerk.

MAINTENANCE OF MANAGEMENT PRACTICES

The Wisconsin Department of Natural Resource's Guidelines for the Nonpoint Source Water Pollution Abatement Program sets forth requirements for the maintenance of management practices and describes penalties for failure by the landowner to carry out obligations. Maintenance requirements are also set forth in Chapter NR 120 of the Wisconsin Administrative Code.

The following steps shall be taken to evaluate the proper maintenance of management practices:

1. Identification of violations of the required maintenance measures shall be obtained through annual status reviews of implemented management practices by the Racine County Soil and Water Conservation District.

2. Where violations are identified, the Racine County Soil and Water Conservation District shall contact the landowner/operator in control of the management practice in violation. Contact will be followed with a formal letter explaining details of the violation and possible alternatives that may be followed to bring the violation into compliance.

3. Final action shall be to submit violations to the Racine County Corporation Counsel for further action and proceedings.

Appendix H

MODEL RESOLUTION FOR ADOPTION OF THE AMENDMENT TO THE REGIONAL WATER QUALITY MANAGEMENT PLAN FOR SOUTHEASTERN WISCONSIN

WHEREAS, the seven-county Southeastern Wisconsin Region was designated by the Governor of the State of Wisconsin as an areawide water quality planning area, pursuant to the provisions of Section 208 of the Federal Water Pollution Control Act, as amended; and

WHEREAS, the Southeastern Wisconsin Regional Planning Commission was designated by the Governor of the State of Wisconsin as the official water quality management planning agency for the Southeastern Wisconsin Region; and

WHEREAS, pursuant to Section 208 of the Federal Water Pollution Control Act, as amended, and Section 66.945(10) of the Wisconsin Statutes, a regional water quality management plan was duly adopted at a meeting of the Southeastern Wisconsin Regional Planning Commission held on the 12th day of July 1979, as part of the master plan for the physical development of the Region; and

WHEREAS, the regional water quality management plan was duly adopted at a meeting of the (name of local governing body) held on the_____day of_____, 19__; and

WHEREAS, the adopted regional water quality management plan for Southeastern Wisconsin contains recommendations relating to the abatement of water pollution from nonpoint sources located in urban and rural lands by a process of local action with state and federal financial and technical assistance, and incorporating a local plan refinement process; and

WHEREAS, the Root River watershed was identified as a "priority watershed" under the Wisconsin Fund Nonpoint Source Water Pollution Abatement Program by the Secretary of the Wisconsin Department of Natural Resources on March 6, 1979; and

WHEREAS, the management agencies designated in the regional water quality management plan, working in cooperation with the Regional Planning Commission and the Wisconsin Department of Natural Resources and through a Committee of Designated Water Quality Management Agencies created for this purpose, have completed a nonpoint source pollution control plan for the Root River watershed and set forth their findings and recommendations in SEWRPC Community Assistance Planning Report No. 37, A Nonpoint Source Water Pollution Control Plan for the Root River Watershed, dated March 1980; and

WHEREAS, the Committee of Designated Water Quality Management Agencies for the Root River watershed on January 30, 1980, unanimously endorsed the nonpoint source water pollution control plan for the Root River watershed, set forth in SEWRPC Community Assistance Planning Report No. 37, and recommended that the Regional Planning Commission amend the adopted regional water quality management plan to incorporate the Root River nonpoint source water pollution control plan.

NOW, THEREFORE, BE IT HEREBY RESOLVED that, pursuant to Section 66.945(12) of the Wisconsin Statutes, the (name of local governing body) on the_____day of_____19__, hereby adopts the nonpoint source water pollution control plan for the Root River watershed as an amendment to the regional water quality management plan previously adopted by the (name of local governing body) and by the Southeastern Wisconsin Regional Planning Commission as set forth in SEWRPC Planning Report No. 30 as a guide for regional and community development.

BE IT FURTHER HEREBY RESOLVED that the_____clerk transmit a certified copy of this resolution to the Southeastern Wisconsin Regional Planning Commission and to the Secretary of the Wisconsin Department of Natural Resources.

ATTESTATION

_____
(President, Mayor, or Chairman of the Local Governing Body)

_____
(Clerk of Local Governing Body)