



WAUKESHA COUNTY AGRICULTURAL SOIL EROSION CONTROL PLAN

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Special acknowledgement is due Mr. George L. Oncken, former Natural
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**COMMUNITY ASSISTANCE PLANNING REPORT
NUMBER 159**

**WAUKESHA COUNTY AGRICULTURAL
SOIL EROSION CONTROL PLAN**

Prepared by the
Southeastern Wisconsin Regional Planning Commission
P. O. Box 1607
Old Courthouse
916 N. East Avenue
Waukesha, Wisconsin 53187-1607

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June 1988

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SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

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June 6, 1988

Chairman and Members
Land Conservation Committee
Waukesha County Board
Waukesha County Courthouse
515 W. Moreland Boulevard
Waukesha, Wisconsin 53188

Dear Committee Members:

Recognizing the need to abate cropland soil erosion, and to comply with the erosion control planning requirements of Section 92.10 of the Wisconsin Statutes, the Waukesha County Board in 1985 determined to prepare a cropland soil erosion control plan. The County Board requested the assistance of the Southeastern Wisconsin Regional Planning Commission in the preparation of the plan. This report presents the requested plan.

The soil erosion control plan as documented in this report identifies the agricultural soil erosion control problems existing in the County; recommends a soil erosion control objective and related standards; recommends a rank ordering of areas of the County for the application of erosion control measures; identifies the types and amounts of soil erosion control practices needed to reduce agricultural soil erosion to tolerable levels within the County; and identifies the actions which should be taken by the various units and agencies of government concerned to carry out the plan.

Adoption and implementation of the plan presented in this report should result in the material abatement of excessive cropland soil erosion, reducing soil erosion to tolerable levels by the year 2000. This should contribute to the preservation and protection of the invaluable soil resource of the County for use by future generations, and minimize the environmental problems associated with cropland soil erosion.

The Regional Planning Commission is pleased to have been able to be of assistance to the County in the preparation of this plan. The Commission, of course, stands ready to assist the County on request with plan implementation.

Sincerely,



Kurt W. Bauer
Executive Director

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Chapter I

INTRODUCTION

The dust bowl experience of the 1930's generated a national interest in the wise use of the soil. Governmental agencies were created and cost-sharing programs developed to help farmers better manage the soil resource. Since that time, many agriculture landowners have practiced more responsible management aimed at the wise use and conservation of the invaluable soil resources of the nation. Others, however, have not. In addition, there has been a shift away from dairy farming and traditional crop rotation patterns generally compatible with long-term resource protection in favor of continuous row cropping that can lead to severe soil erosion and associated problems unless special precautions are taken.

Soil erosion takes place when water or wind carries away soil from inadequately protected land surfaces. When it occurs at a rapid rate, erosion can cause serious problems. The loss of topsoil from agricultural land, for example, means that the land loses part of its productive capacity. Eventually, no amount of fertilizer can, as a practical matter, replace this loss, and the ability of the land to produce crops may be jeopardized. Thus, the land and the people who occupy and work it may both become poorer. Downstream sites—the places to which the eroded soil is carried—experience a different but also very costly set of problems. These may include the clogging of culverts and drainageways and diminished water quality, and in some cases interference with commercial as well as recreational navigation. Soil erosion contributes to the water quality problems of lakes and streams, as the resulting sediment is volumetrically the greatest water pollutant, destroying fish and wildlife habitat and rendering recreational areas undesirable.

Because of the increasing concern over soil erosion, the Wisconsin Legislature in 1982 revised Chapter 92 of the Wisconsin Statutes, the state soil and water conservation law, to require the preparation of county soil erosion control plans focusing on the control of cropland soil erosion. A total of 55 counties located generally in the southern two-thirds of the State, including Waukesha County, are required to prepare such a plan. Chapter 92 requires that an erosion control plan: 1) specify maximum acceptable

rates of erosion; 2) identify the parcels where soil erosion standards are not being met; 3) identify the land use changes or management practices which would bring each area of land into compliance with standards adopted by the county land conservation committee; 4) specify procedures to be used to assist landowners and land users in controlling soil erosion; and 5) establish priorities for controlling soil erosion.

THE WAUKESHA COUNTY SOIL EROSION CONTROL PLAN

Recognizing the need for increased efforts to control soil erosion in Waukesha County, and in an effort to comply with the planning requirements of Chapter 92 of the Wisconsin Statutes, the Waukesha County Board in 1985 determined to prepare a county soil erosion control plan and requested the assistance of the Southeastern Wisconsin Regional Planning Commission in the preparation of such a plan. The County received a planning grant from the Wisconsin Department of Agriculture, Trade and Consumer Protection in partial support of the required work. The plan presented herein was prepared by the Regional Planning Commission in cooperation with the Waukesha County Land Conservation Department. The planning effort was carried out under the guidance of the Waukesha County Land Conservation Committee. The Land Conservation Department and the Commission staff were assisted in the preparation of the plan by a technical advisory committee consisting of county farmers, representatives of the Waukesha County Park and Planning Commission, and state and federal agency personnel assigned to the County. A full committee membership list is set forth on the inside front cover of this report.

The Waukesha County soil erosion control plan as documented in this report focuses on cropland soil erosion, although a general discussion of soil erosion attendant to other selected land uses is presented in Chapter III. It is important to note that there is a potential for serious construction site erosion problems in Waukesha County, given the rapid urbanization of the County. The development and redevelopment of land for residential, commercial, industrial, and other intensive ur-

ban uses may result in significant soil erosion, contributing to problems on the construction site itself and to offsite problems such as water quality degradation and the clogging of culverts and drainageways. Waukesha County, through the County Park and Planning Commission, has encouraged local units of government in the County to adopt construction site erosion control ordinances requiring appropriate erosion control practices in order to minimize soil erosion in developing areas.

SCHEME OF PRESENTATION

The Waukesha County soil erosion control plan is presented in seven chapters. Following this introductory chapter, Chapter II, "Description of the County," describes those aspects of the natural resource base and man-made environment of Waukesha County that are particularly relevant in any consideration of soil erosion problems and efforts to address those problems. Chapter III,

"Soil Erosion Inventory," describes the methodology and findings of a countywide inventory of cropland and related analysis of cropland soil erosion rates. Chapter IV, "Cropland Soil Erosion Control Objective, Principle, and Standards," presents a cropland soil erosion control objective, supporting principle, and related standards, establishing maximum acceptable erosion rates on cropland in the County. Chapter V, "Recommended Soil Erosion Control Plan," recommends priority areas for the application of cropland soil erosion control measures within the County and identifies conservation practices required to reduce cropland soil erosion problems. Chapter VI, "Plan Implementation," recommends measures that should be undertaken by the County and the concerned state and federal agencies to help achieve the objective and standards underlying the plan—focusing, in particular, on technical assistance activities. Chapter VII, "Summary," presents a summary of the major findings and recommendations of the planning program.

Chapter II

DESCRIPTION OF THE COUNTY

The preparation of a workable soil erosion control plan for Waukesha County requires an understanding of the natural resource base and of the pattern of human activities which have been superimposed on that resource base. Accordingly, this chapter describes those features of the natural resource base and of the man-made environment which are the most important in any consideration of soil erosion problems in the County. The first portion of the chapter describes salient elements of the natural resource base, including the topography, geology, soils, and surface water resources of the County. The second portion of the chapter describes trends in population, land use, and cropping patterns in Waukesha County.

NATURAL RESOURCE BASE

Topography and Physiography

Glaciation has largely determined the physiography, topography, and soils of Southeastern Wisconsin, including Waukesha County. The physiographic features, or surficial land forms, of southeastern Wisconsin are shown on Map 1, whereas regional topography or variation in elevation is depicted in a generalized manner on Map 2. There is evidence of four major stages of glaciation in the Region. The dominant physiographic and topographic feature is the Kettle Moraine, an interlobate glacial deposit, or moraine, formed between the Green Bay and Lake Michigan tongues, or lobes, of the continental glacier which moved in a generally southerly direction from its point of origin in what is now Canada. Topographically high points in the Kettle Moraine in Waukesha County include areas in southwestern Waukesha County north of Eagle and areas in central Waukesha County around Lapham Peak. The Kettle Moraine, which is oriented in a general northeast-southwest direction across western Washington, Waukesha, and Walworth Counties, is a complex system of kames, or crudely stratified conical hills; kettle holes marking the site of glacial ice blocks that became separated from the ice mass and melted to form depressions; and eskers, consisting of long, narrow ridges of drift deposited in abandoned drainageways. As indicated on Map 1, the remainder of Waukesha County is covered by a variety of glacial land forms and features, including gently sloping and

rolling ground moraine; drumlins, or elongated mounds of drift molded by and parallel to the advancing glacier; and outwash plains formed by the action of flowing glacial meltwater.

Topographic features—particularly slope length and slope steepness—have a direct bearing on soil erosion potential. Slope length and steepness affect the velocity and, accordingly, the erosive potential of runoff. In general, soil loss per unit area increases with the length and steepness of the slope.

Geology

The bedrock formations underlying the unconsolidated surficial deposits in the County consist of Cambrian through Devonian Period rocks of the Paleozoic Era, which are in turn underlain by older, predominantly crystalline rocks of the Precambrian Era. The bedrock geology of the County is shown in Figure 1 by means of a map of the surface of the bedrock supplemented with a representative vertical section.

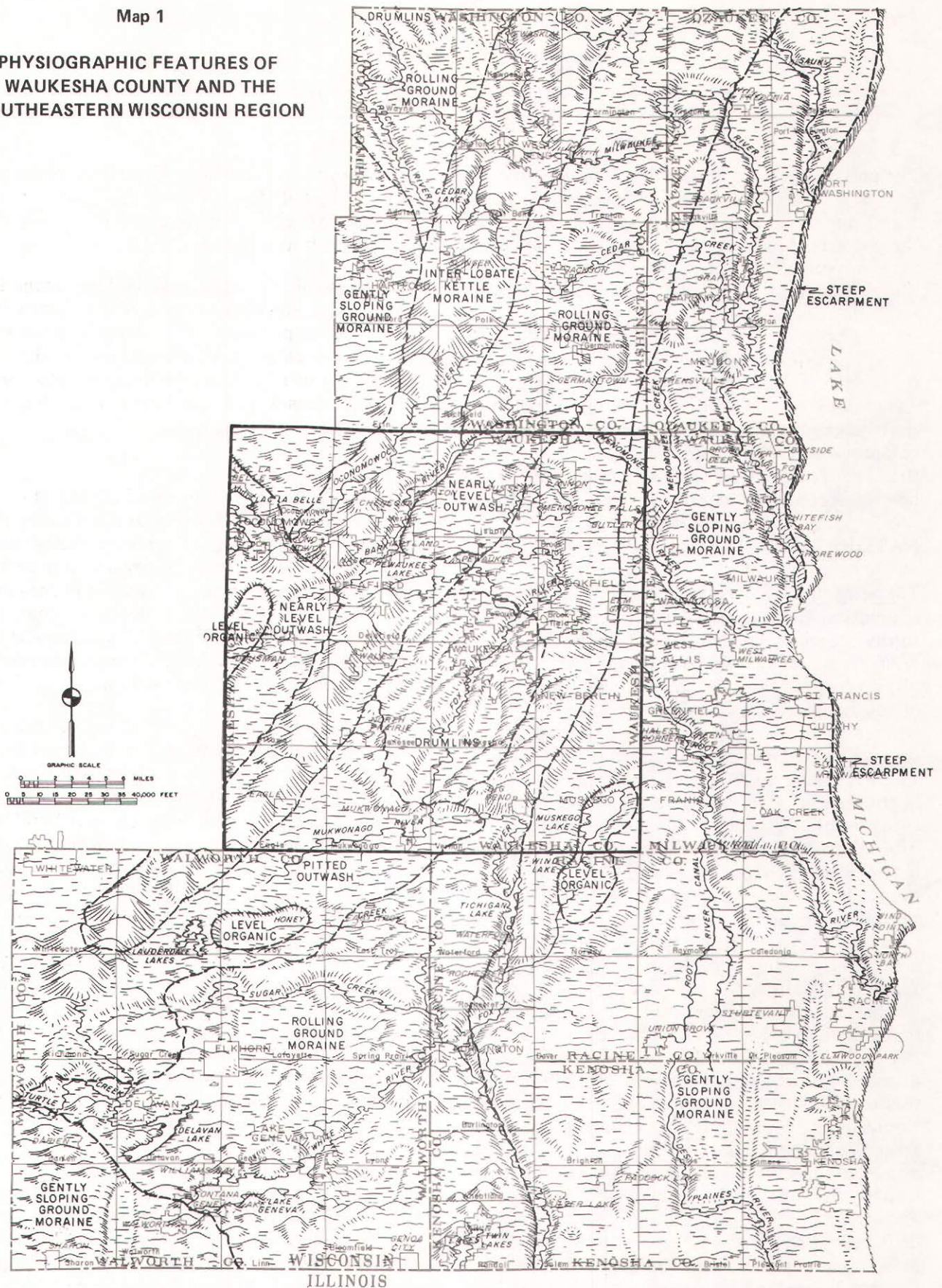
The bedrock of the County is, for the most part, covered by deep, unconsolidated glacial deposits, attaining a thickness in excess of 400 feet in some buried preglacial valleys. Bedrock lies within 20 feet of the ground surface in portions of the County, and a few localized areas exist where bedrock is actually exposed to the surface. These shallow drift areas and rock outcrops tend to occur in the County along a northeasterly-southwesterly alignment paralleling the interlobate Kettle Moraine, and reflect the presence of a preglacial ridge (see Map 3). Agricultural activities in such areas can lead to contamination of groundwater principally with nitrate and pesticides. The potential for groundwater contamination at a given location, however, depends upon site characteristics, characteristics of individual pollutants, and agronomic and management factors.

Soils

The soils in Waukesha County range from very poorly drained organic soils to excessively drained mineral soils. Nine soil associations are found in the County, as identified by the U. S. Department of Agriculture, Soil Conservation Service. A soil association is defined as a landscape having

Map 1

**PHYSIOGRAPHIC FEATURES OF
WAUKESHA COUNTY AND THE
SOUTHEASTERN WISCONSIN REGION**

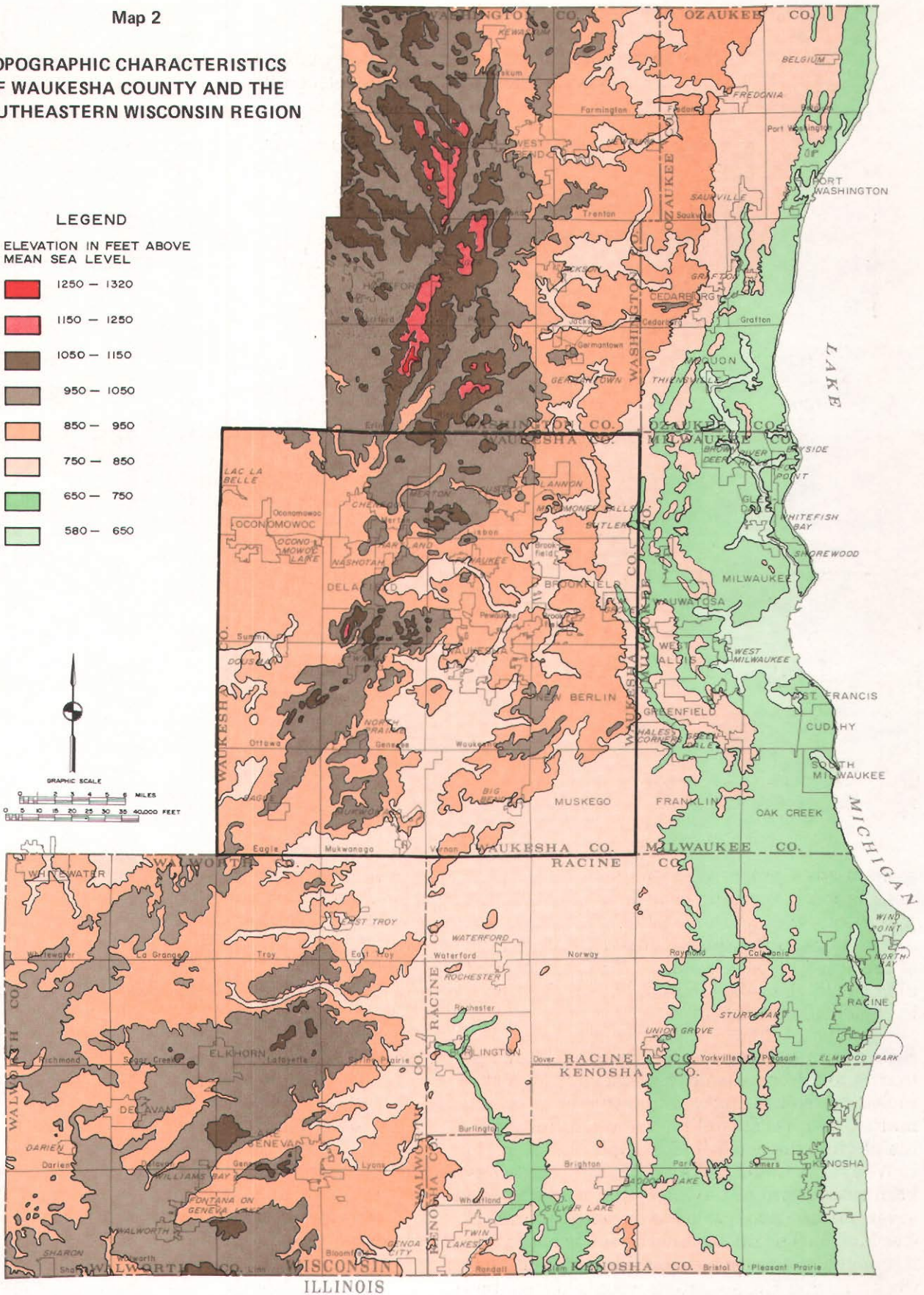
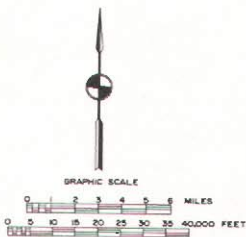
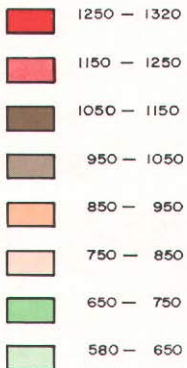


Source: SEWRPC.

Map 2

**TOPOGRAPHIC CHARACTERISTICS
OF WAUKESHA COUNTY AND THE
SOUTHEASTERN WISCONSIN REGION**

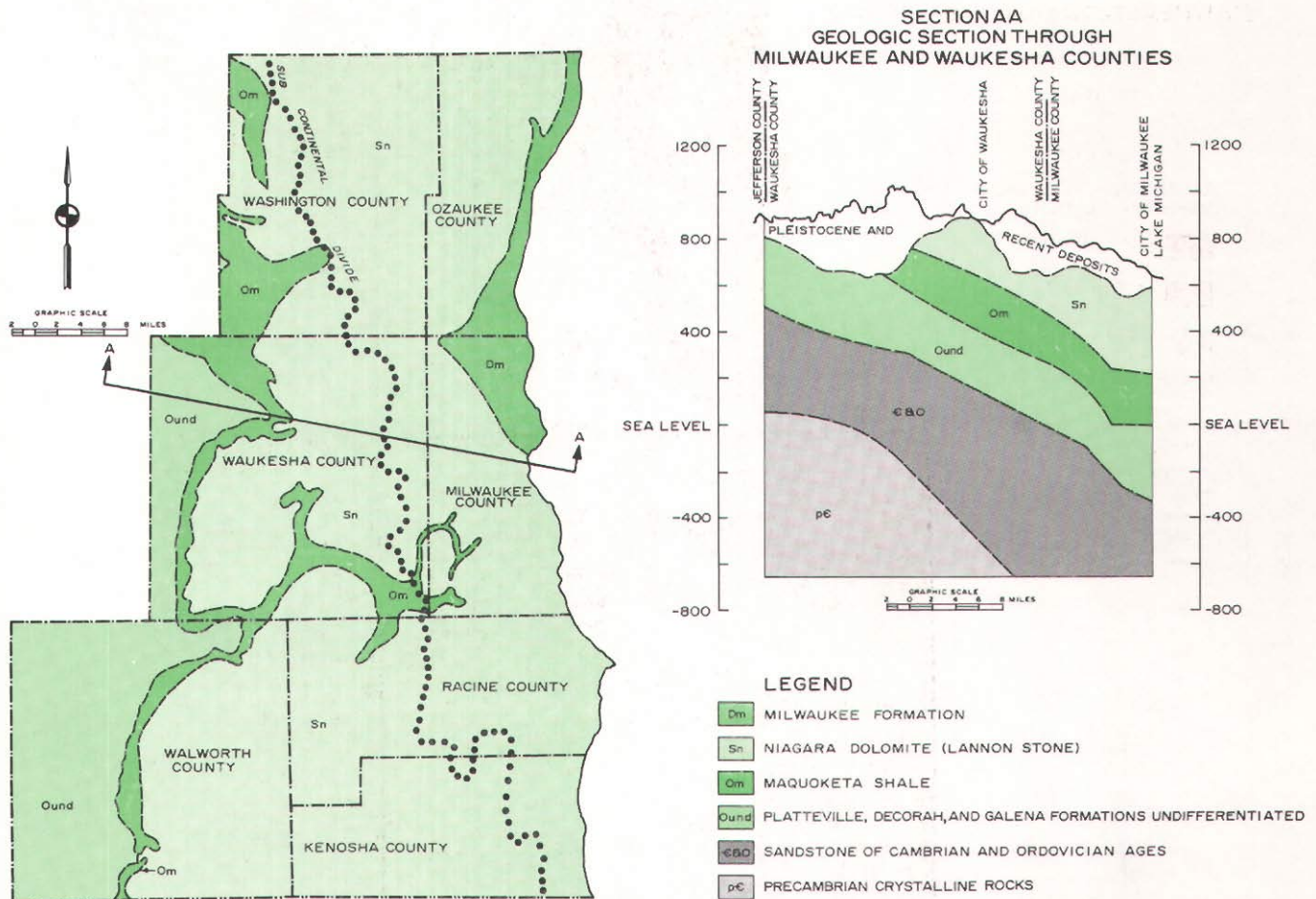
LEGEND
ELEVATION IN FEET ABOVE
MEAN SEA LEVEL



Source: SEWRPC.

Figure 1

MAP AND CROSS-SECTION OF BEDROCK GEOLOGY IN WAUKESHA COUNTY AND THE SOUTHEASTERN WISCONSIN REGION



Source: SEWRPC.

a distinctive proportional pattern of soils. An association is typically comprised of one or more major soil types and at least one minor soil type, and is named after the major soils. A description of the nine soil associations in Waukesha County along with their distribution within the County is presented on Map 4.

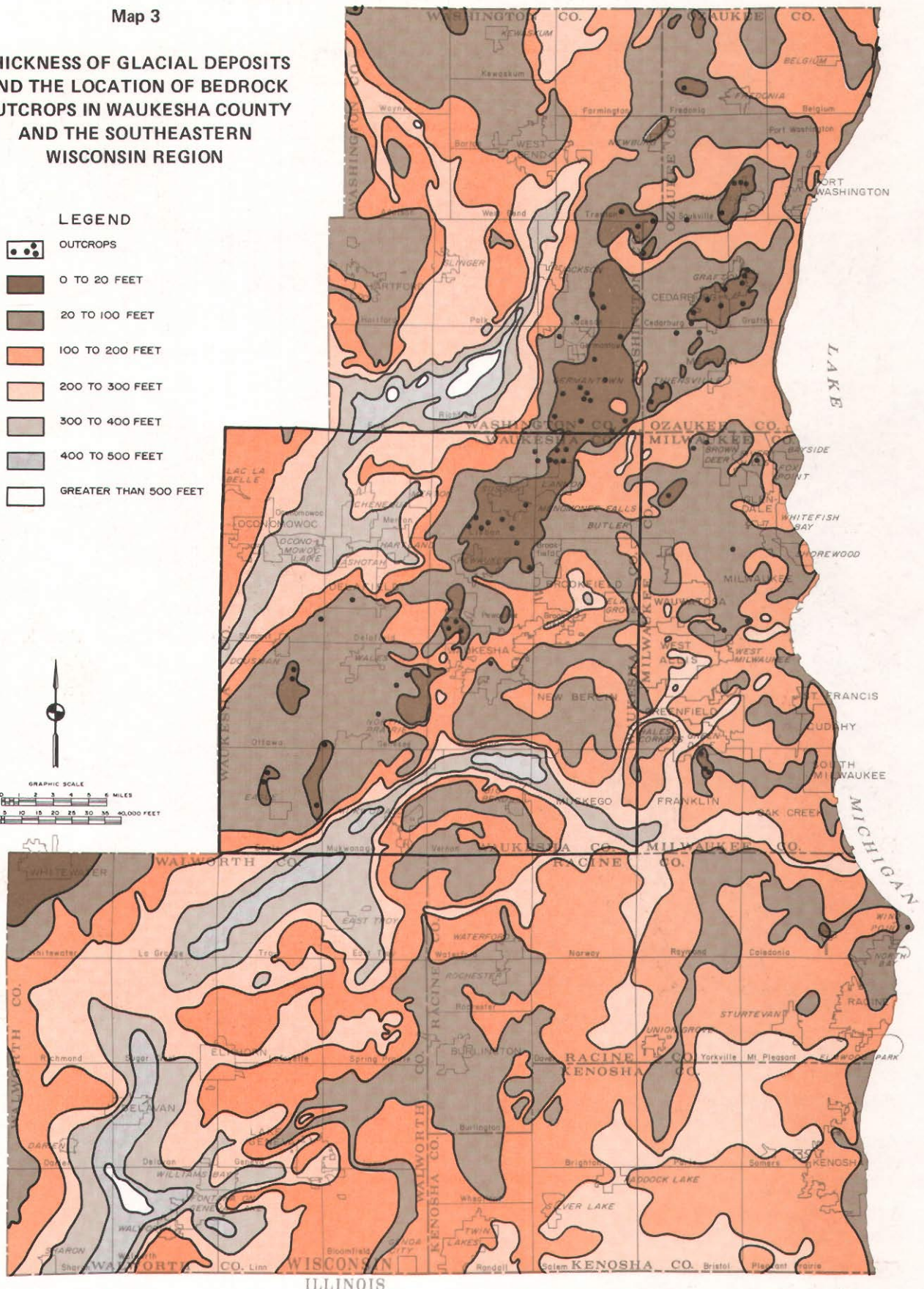
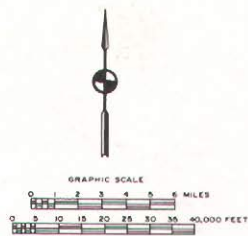
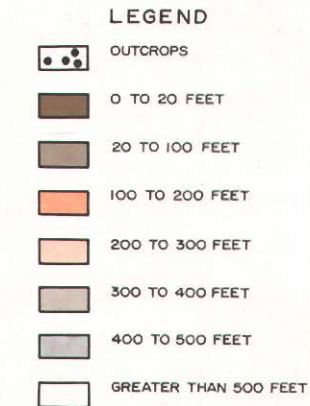
Soils vary in their potential erosiveness due primarily to differences in physical characteristics, including soil texture, soil structure, organic matter and permeability. In order to provide insight into the potential for cropland soil erosion in Waukesha County, the soils of the County have been categorized as having slight, moderate, and severe erosion potential, and mapped accordingly (see Map 5). The rating for each soil is based upon its capability class and subclass as assigned under the U. S. Soil Conservation Service agricultural

land capability system.¹ The rating indicates the potential for both water and wind erosion. It is emphasized that the rating is based solely on soil

¹ Following procedures set forth in *Soil Erosion Control Planning Manual*, prepared by the Wisconsin Department of Agriculture, Trade and Consumer Protection, soils in capability classes/subclasses I, IIw, IIIw, IVw, V, VIw, and VIIw have been classified as having slight soil erosion potential; soils in capability subclasses IIe, IIs, IIIs, IVs, VIs, and VIIs have been classified as having moderate soil erosion potential; and soils in capability subclasses IIIe, IVe, VIe, and VIIe have been classified as having severe erosion potential. The agricultural land capability system itself is described in U. S. Soil Conservation Handbook 210, entitled *Land Capability Classification*.

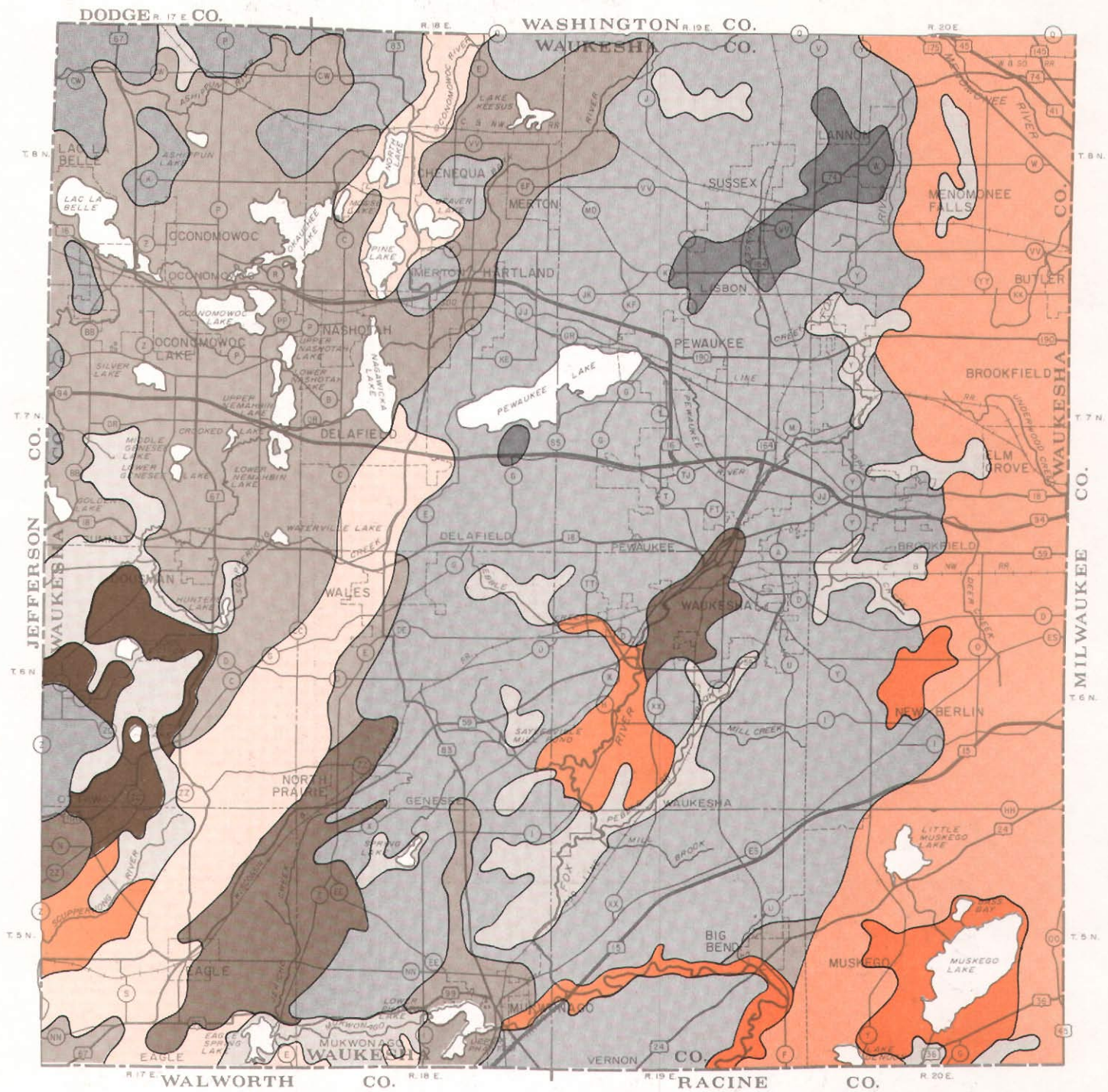
Map 3

**THICKNESS OF GLACIAL DEPOSITS
AND THE LOCATION OF BEDROCK
OUTCROPS IN WAUKESHA COUNTY
AND THE SOUTHEASTERN
WISCONSIN REGION**



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

GENERAL SOIL ASSOCIATIONS IN WAUKESHA COUNTY



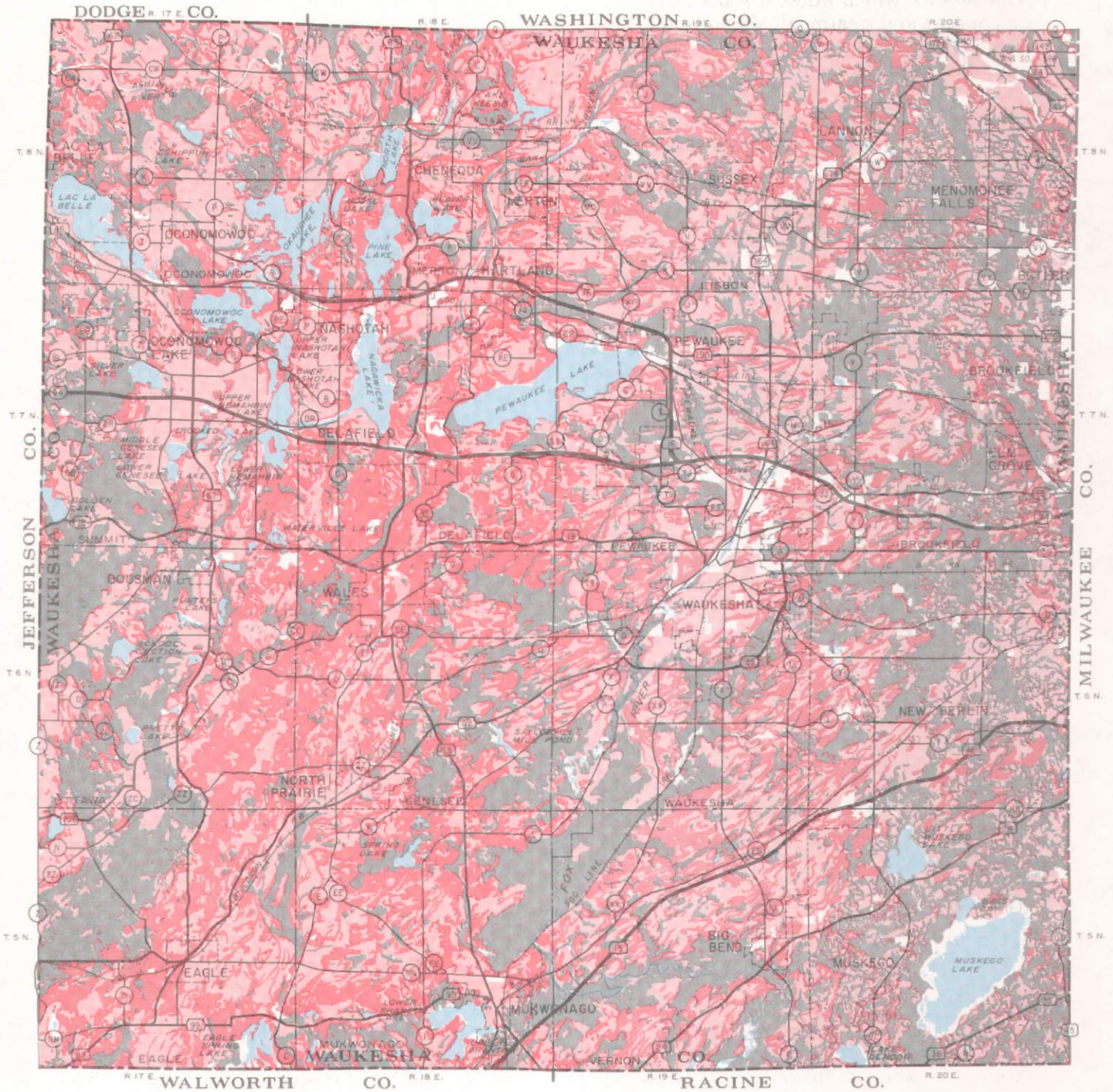
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- | | | |
|--|--|--|
| HOUGHTON-PALMS-ADRIAN ASSOCIATION: VERY POORLY DRAINED ORGANIC SOILS IN DEPRESSIONS ON OLD LAKEBEDS AND ON FLOODPLAINS | RODMAN-CASCO ASSOCIATION: EXCESSIVELY DRAINED TO WELL-DRAINED SOILS THAT HAVE A SUBSOIL OF GRAVELLY SANDY LOAM AND CLAY LOAM; SHALLOW OVER GRAVEL AND SAND, ON THE KETTLE MORAINES | HOCHHEIM-THERESA ASSOCIATION: WELL-DRAINED SOILS THAT HAVE A SUBSOIL OF CLAY LOAM AND SILTY CLAY LOAM; FORMED IN THIN LOESS AND LOAM GLACIAL TILL, ON GROUND MORAINES |
| FOX-CASCO ASSOCIATION: WELL-DRAINED SOILS THAT HAVE A SUBSOIL OF CLAY LOAM, MODERATELY DEEP TO SHALLOW OVER SAND AND GRAVEL, ON OUTWASH PLAINS AND STREAM TERRACES | OZAUKEE-MORLEY-MEQUON ASSOCIATION: WELL-DRAINED TO SOMEWHAT POORLY DRAINED SOILS THAT HAVE A SUBSOIL OF SILTY CLAY LOAM AND SILTY CLAY, FORMED IN THIN LOESS AND SILTY CLAY LOAM GLACIAL TILL, ON MORAINES | PELLA, MODERATELY SHALLOW VARIANT-KNOWLES ASSOCIATION: POORLY DRAINED AND WELL-DRAINED SOILS THAT HAVE A SUBSOIL OF SILTY CLAY LOAM OR CLAY LOAM; MODERATELY SHALLOW OVER DOLOMITE BEDROCK |
| WARSAW-LORENZO ASSOCIATION: WELL-DRAINED SOILS THAT HAVE A SUBSOIL OF CLAY LOAM; MODERATELY DEEP OVER SAND AND GRAVEL, ON OUTWASH PLAINS AND RIVER TERRACES | MONTGOMERY-MARTINTON-HEBRON-SAYLESVILLE ASSOCIATION: POORLY DRAINED TO WELL DRAINED SOILS THAT HAVE A SUBSOIL OF CLAY TO CLAY LOAM; FORMED IN SILTY CLAY OR SILTY CLAY LOAM SEDIMENTS, IN OLD LAKEBEDS | |
| BOYER-OSHTIMO ASSOCIATION: WELL-DRAINED SOILS THAT HAVE A SUBSURFACE OF SANDY LOAM AND SANDY CLAY LOAM, UNDERLAIN BY SANDY MATERIAL, ON OUTWASH PLAINS | | |

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

Map 5

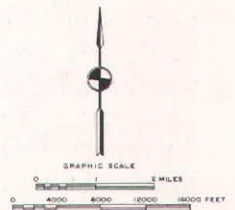
CROPLAND SOIL EROSION POTENTIAL IN WAUKESHA COUNTY



LEGEND

- SLIGHT EROSION POTENTIAL
- MODERATE EROSION POTENTIAL
- SEVERE EROSION POTENTIAL
- EROSION POTENTIAL NOT CLASSIFIED

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



characteristics which affect a soil's response to management and treatment. Farming practices, which have a direct bearing on the rate of erosion, are not taken into account.

Surface Water Resources

Lakes and streams constitute an extremely valuable part of the natural resource base of Waukesha County. They constitute a focal point of water-related recreational activities; provide an attractive setting for properly planned residential development; and have immeasurable environmental value. The major lakes and streams in the Waukesha County area shown on Map 6.

Soil erosion can create serious surface water problems. The resulting sediment is volumetrically the major pollutant entering surface waters. Sediment tends to damage fish and wildlife habitat, diminish the desirability of recreational areas, decrease the capacity of farm ponds and reservoirs, and increase the need for dredging of waterways. Agricultural chemicals carried by eroded soil particles may be toxic to aquatic life and harmful to man. Nutrients carried on eroded soil particles accelerate the eutrophication of lakes.

For water quality planning purposes, the Wisconsin Department of Natural Resources has divided the Southeastern Wisconsin Region into 27 watersheds, nine of these being located wholly or partially within Waukesha County. As shown on Map 6, two of these nine watersheds—the Menomonee River and the Root River watersheds—are located east of the subcontinental divide and are part of the Great Lakes-St. Lawrence River drainage area. The other seven watersheds—the Ashippun River, Bark River, Middle Fox River, Mukwonago River, Oconomowoc River, Scuppernong River, and Upper Fox River watersheds—are located west of the subcontinental divide and are part of the Mississippi River drainage area.

Primary Environmental Corridors

Primary environmental corridors are linear areas in the landscape which encompass the most important elements of the natural resource base, including lakes, rivers, streams and their associated floodlands and shorelands; wetlands; woodlands; prairies; wildlife habitat areas; and rugged terrain and high-relief topography. Such corridors have been identified throughout southeastern Wisconsin, including Waukesha County, by the Regional Planning Commission by overlaying all

of the appropriate land use and natural resource data to determine the location of significant concentrations of such resources.

The preservation of these corridors is important to the maintenance of a high level of environmental quality in the Region, to the protection of its natural beauty, and to the provision of opportunities for certain scientific, educational, and recreational activities. The exclusion of urban development from these corridors will also prevent the creation of serious and costly developmental problems such as wet and flooded basements, foundation failures, and excessive clearwater infiltration and inflow into sanitary sewerage systems.

Map 7 shows the pattern of primary environmental corridors in Waukesha County in 1985. These corridors encompass a total of 92,223 acres, or about 25 percent of the area of Waukesha County. Of this total, 16,233 acres, or about 18 percent, consist of surface water; 45,776 acres, or about 50 percent, consist of wetlands; 21,108 acres, or about 23 percent, consist of upland woodlands; 6,951 acres, or about 7 percent, consist of other open lands; and 2,155 acres, or about 2 percent, consist of isolated urban enclaves within the corridor configuration.

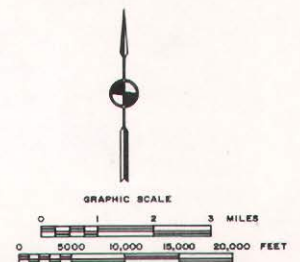
MAN-MADE ENVIRONMENT

Historic Population Trends

The population of Waukesha County stood at about 85,900 persons in 1950, having increased from about 19,300 persons in 1850 and 35,200 persons in 1900 (see Table 1). During each of the three decades after 1950, the county population increased substantially—by about 72,300 persons, or 84 percent, during the 1950's; about 73,100 persons, or 46 percent, during the 1960's; and about 49,000 persons, or 21 percent, during the 1970's—so that by 1980, the county population had reached about 280,300 persons. In comparison to the three preceding decades, growth in the county population has been comparatively modest since 1980. The 1987 county population estimate of 288,900 persons represents an increase of about 8,600 persons since 1980.

Population projections for Waukesha County and the Southeastern Wisconsin Region through the year 2010 have been prepared by the Regional Planning Commission and are presented in SEWRPC Technical Report No. 11 (2nd Edition),

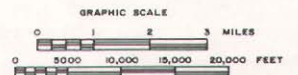
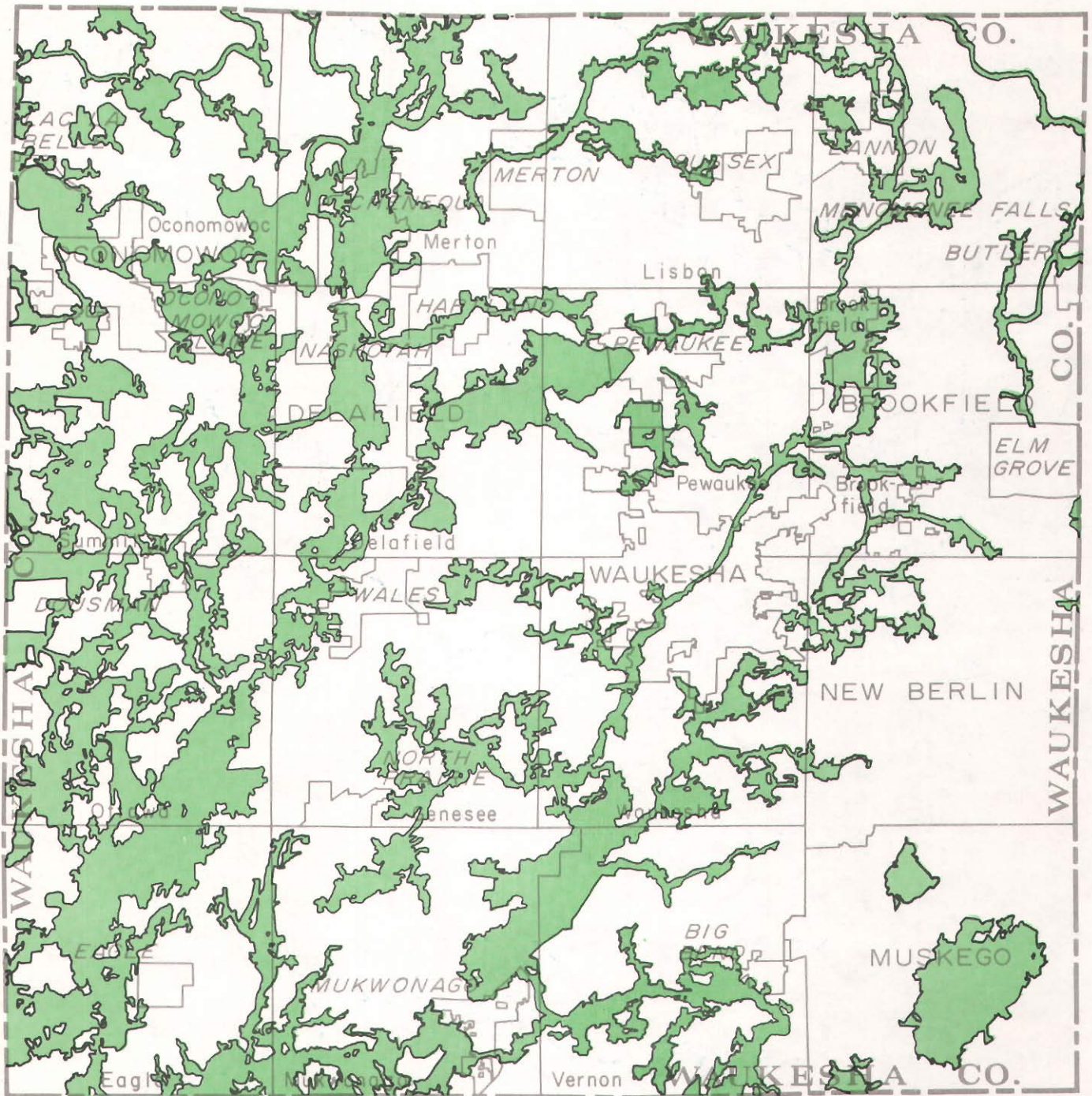
SURFACE WATER RESOURCES IN WAUKESHA COUNTY



11

Map 7

PRIMARY ENVIRONMENTAL CORRIDORS IN WAUKESHA COUNTY



Source: SEWRPC.

Table 1

**POPULATION IN WAUKESHA COUNTY:
CENSUS YEARS 1850-1980, AND ESTIMATED 1987**

Year	Total Population		
	Number	Change from Preceding Time Period	
		Absolute	Percent
1850	19,258	--	--
1860	26,831	7,573	39.3
1870	28,274	1,443	5.4
1880	28,957	683	2.4
1890	33,270	4,313	14.9
1900	35,229	1,959	5.9
1910	37,100	1,871	5.3
1920	42,612	5,512	14.9
1930	52,358	9,746	22.9
1940	62,744	10,386	19.8
1950	85,901	23,157	36.9
1960	158,249	72,348	84.2
1970	231,335	73,086	46.2
1980	280,326	48,991	21.2
1987	288,903	8,577	3.1

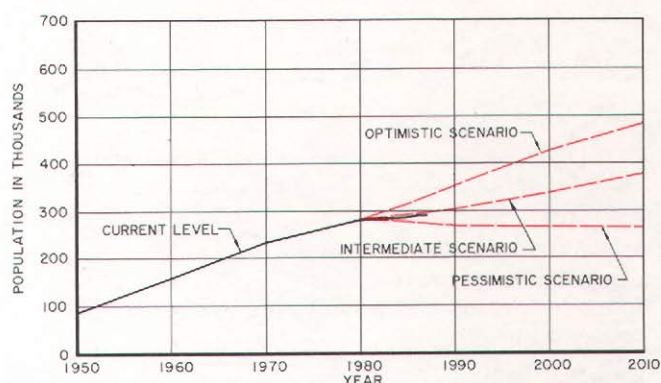
Source: U. S. Bureau of the Census, Wisconsin Department of Administration, and SEWRPC.

The Population of Southeastern Wisconsin. Because of the uncertainty entailed in any projection of future population levels in times of great social and economic change, such as are being presently experienced, the Commission has postulated three alternative future scenarios as a basis for population projection—two intended to identify extremes and one intended to identify an intermediate, or most probable, future. Critical social and economic factors that could be expected to have an impact upon future mortality, fertility, and migration rates within the United States, the State, and the Southeastern Wisconsin Region were examined, and a reasonably extreme range of values was established for each component of population change. The “most reasonably optimistic” scenario of population change was provided by combining all factors that were internally consistent to create favorable conditions for population growth in the Region, and the “most reasonably pessimistic” scenario was provided by similarly combining all factors that would create unfavorable conditions for population growth in the Region.

As indicated in Figure 2, under an intermediate growth scenario, the population of Waukesha County would increase from 280,300 persons in 1980 to about 378,000 persons in the year 2010—an increase of about 97,700 persons, or 35 percent. Under an optimistic growth scenario, the county population would increase to about 481,700 persons in the year 2010, an increase of about 201,400, or 72 percent, over 1980. Conversely, under a

Figure 2

**CURRENT AND ALTERNATIVE
FUTURE POPULATION LEVELS
FOR WAUKESHA COUNTY: 1950-2010**



Source: U. S. Bureau of the Census; Wisconsin Department of Administration; and SEWRPC.

pessimistic scenario, the county population would decrease by about 18,500 persons, or 7 percent, from the 1980 level. As further indicated in Figure 2, population levels in Waukesha County between 1980 and 1987 closely approximate the trend envisioned under the intermediate growth scenario.

Land Use

Although Waukesha County is considered to be a relatively urbanized county, almost three-fourths of the area of the County was devoted to rural uses in 1985, and just slightly more than one-fourth was devoted to urban uses. As indicated in Table 2, in 1985 urban lands—consisting of lands devoted to residential, commercial, industrial, recreational, governmental and institutional, and transportation, communication, and utility uses—encompassed about 99,500 acres, or about 27 percent of the total area of Waukesha County. Lands in residential use comprised the largest share of the urban land area—about 55,600 acres—representing about 56 percent of the urban land area and about 15 percent of the total area of the County. As shown on Map 8, much of the urban development has occurred in scattered fashion in outlying areas of the County.

As further indicated in Table 2, in 1985 rural land uses accounted for about 272,100 acres, or 73 percent of the area of the County. Agricultural lands encompassed about 157,000 acres, about 58 percent of all rural land and 42 percent of the

Table 2

LAND USE IN WAUKESHA COUNTY: 1963 AND 1985

Land Use Category	1963		1985		Change: 1963-1985	
	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent
<u>Urban</u>						
Residential.	30,421	8.2	55,598	15.0	25,177	82.8
Commercial	945	0.3	1,946	0.5	1,001	105.9
Industrial.	782	0.2	2,426	0.7	1,644	210.2
Transportation, Communication, and Utilities	16,836	4.5	24,963	6.7	8,127	48.3
Governmental and Institutional	2,326	0.6	3,588	1.0	1,262	54.3
Recreational.	3,423	0.9	5,994	1.6	2,571	75.1
Unused Urban.	6,144	1.7	5,003	1.3	-1,141	-18.6
Subtotal	60,877	16.4	99,518	26.8	38,641	63.5
<u>Rural</u>						
Agricultural						
Cropland	137,245	36.9	115,772	31.2	-21,473	-15.6
Orchards and Nurseries	978	0.3	1,054	0.3	76	7.8
Pasture and Other	62,018	16.7	40,177	10.8	-21,841	-35.2
Subtotal	200,241	53.9	157,003	42.3	-43,238	-21.6
Wetlands	52,588	14.1	50,791	13.7	-1,797	-3.4
Woodlands	31,181	8.4	29,166	7.8	-2,015	-6.5
Extractive and Landfill Sites	2,610	0.7	3,777	1.0	1,167	44.7
Unused Rural and Other Open Lands	8,017	2.2	14,582	3.9	6,565	81.9
Surface Water	16,076	4.3	16,753	4.5	677	4.2
Subtotal	310,713	83.6	272,072	73.2	-38,641	-12.4
Total	371,590	100.0	371,590	100.0	--	--

Source: SEWRPC.

total area of the County. The agricultural acreage included about 115,800 acres of cropland, 40,200 acres of pasture and unused agricultural land, and just over 1,000 acres of orchards and nurseries. Other major rural land use categories in Waukesha County include wetlands—which in 1985 encompassed about 50,800 acres, or about 14 percent of the total area of the County—and woodlands—which encompassed about 29,200 acres, or about 8 percent of the total area of the County.

The previously described rapid growth in the county population has been accompanied by a substantial increase in the area within the County

devoted to urban land uses, and a corresponding decrease in open space lands. Between 1963—the base year for the Regional Planning Commission's initial land use inventory—and 1985, the urban land area of Waukesha County increased by about 38,600 acres, or 64 percent. Most of this increase consisted of lands developed for residential and transportation use. As indicated in Table 2, much of the new development occurred in areas formerly in agricultural use.

Land subdivision records provide an indication of recent development activity in the County. From 1985 through 1987, a total of 2,500 residential lots

EXISTING LAND USE IN WAUKESHA COUNTY: 1985

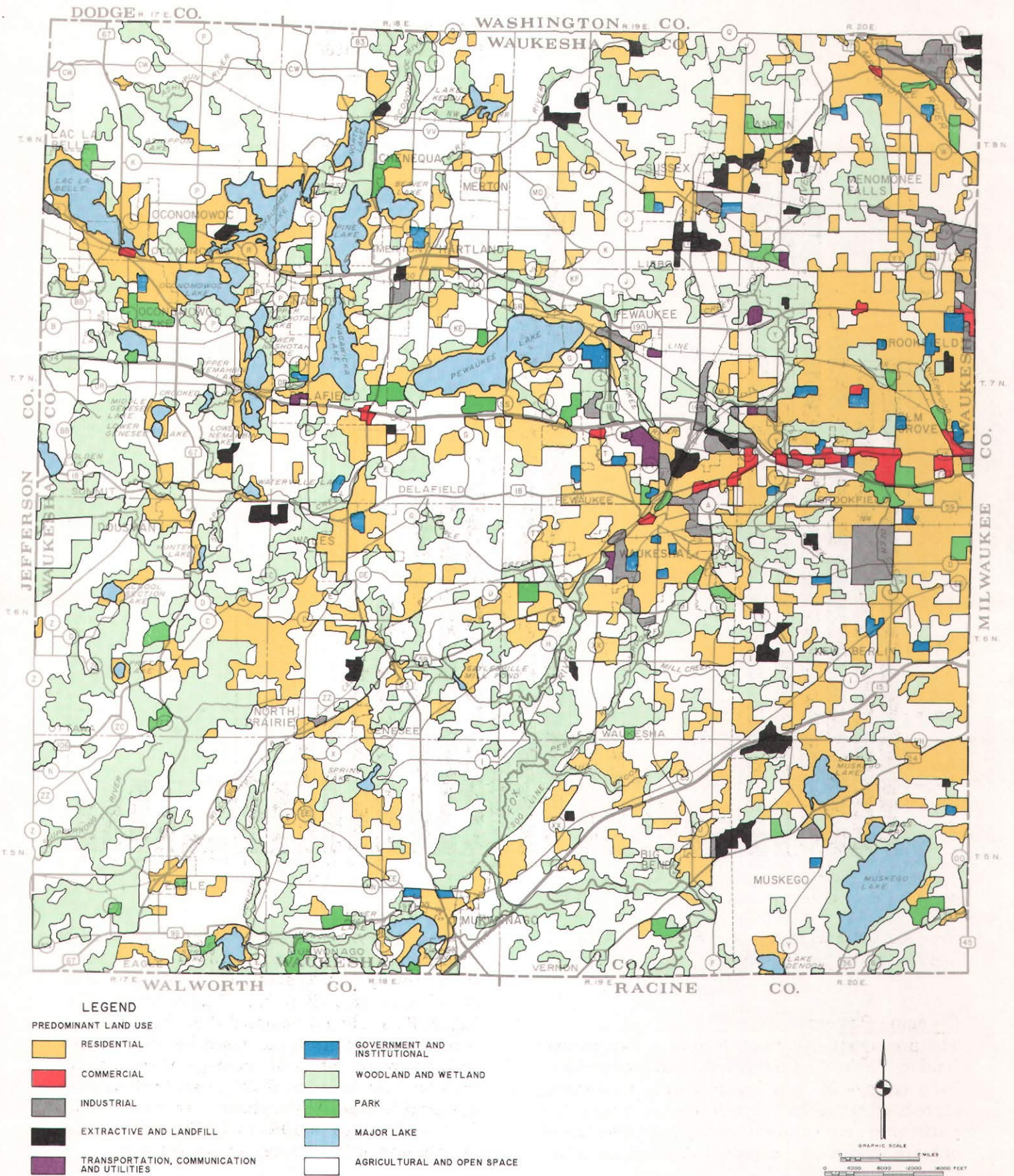
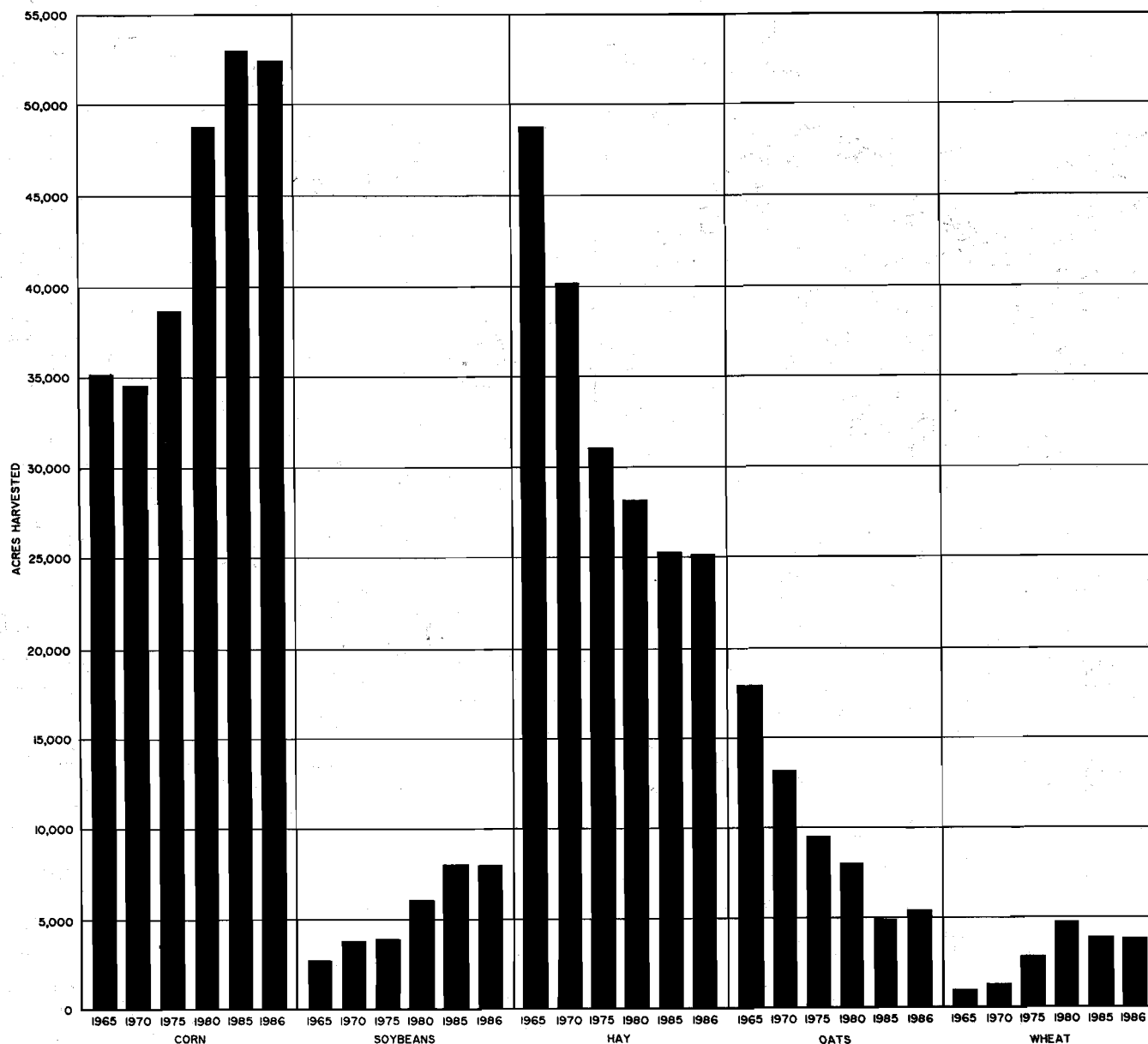


Figure 3

ACREAGES FOR MAJOR CROPS IN WAUKESHA
COUNTY: 1965, 1970, 1975, 1980, 1985, AND 1986



Source: Wisconsin Agricultural Reporting Service and SEWRPC.

were platted, including 414 lots in 1985, 853 lots in 1986, and 1,233 lots in 1987.

Cropping Patterns

The previously described decline in agricultural land in Waukesha County has been accompanied by a change in cropping patterns. In general, there has been an increase in erosion-prone crops, particularly corn and soybeans, and a decrease in crops that are less susceptible to erosion, including

oats and hay. Thus, the combined acreage of corn grown for grain and corn grown for silage increased by 17,200 acres, or 49 percent—from 35,100 acres in 1965 to 52,300 acres in 1986 (see Figure 3). It should be noted that the acreage of corn grown for grain increased by 25,700 acres, or 124 percent, while the acreage of corn grown for silage decreased by 8,500 acres, or 59 percent, during this time. The soybean acreage increased from 2,600 acres in 1965 to 7,900 acres in 1986, an increase of 5,300 acres, or 204 percent.

As further indicated in Figure 3, the acreage in hay decreased by 23,600 acres, or 48 percent—from 48,800 acres in 1965 to 25,200 acres in 1986. The acreage in oats also decreased substantially, from 17,800 acres in 1965 to 5,400 acres in 1986—a decrease of 12,400 acres, or 70 percent.

The foregoing trends undoubtedly reflect a general shift away from dairy farming and traditional crop rotations, which may include several years of hay, toward continuous row cropping. While traditional crop rotations are generally compatible with long-term resource protection, continuous row cropping can lead to severe soil erosion unless special precautions are taken.

CONCLUDING REMARKS

This chapter has described those features of the natural resource base and the man-made envi-

ronment of Waukesha County that are important in any consideration of soil erosion problems in the County. Natural resource base features considered in this chapter include the topography, physiography, geology, soils, and surface water resources. Aspects of the man-made environment considered include population, land use, and cropping patterns. Among the most important trends observed in this chapter is the increase in erosion-prone crops, particularly corn and soybeans, and a decrease in crops that are less susceptible to erosion, including oats and hay—undoubtedly a reflection of a general shift away from dairy farming and traditional crop rotations toward continuous row cropping. The next chapter of this report presents the results of data collection and analysis work undertaken as part of the county soil erosion control planning program to identify the extent and severity of soil erosion attendant to current farming practices in Waukesha County.

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Chapter III

SOIL EROSION INVENTORY

The rate of soil erosion on cropland for any given set of climatic conditions varies considerably, depending upon the cropping system, management practices, soil characteristics, and topographic features of the individual farm fields. Under the Waukesha County soil erosion control planning program, an inventory and analysis of existing cropland was undertaken in order to determine the extent and severity of cropland soil erosion problems within the County. This chapter describes the methodology and findings of that inventory and analysis work. In addition, this chapter presents a general description of soil erosion for other selected land uses.

SOIL EROSION PROCESSES

The primary agents of soil erosion are wind and water. It is estimated that, for cultivated cropland in Wisconsin, water erosion is about three times that caused by wind, although in the Central Sands area of the State, wind erosion is estimated to be more than twice that caused by water. Water erosion is considered to be the primary cropland soil erosion problem in Waukesha County.

Water erosion on cropland can be characterized as raindrop or splash erosion, sheet erosion, rill erosion, and gully erosion. Raindrop or splash erosion, the initial phase of water erosion, is the result of the impact of raindrops falling on soil particles, dislodging and splashing them about so that they can be readily transported by surface runoff. Sheet erosion is characterized by the removal of a relatively uniform, thin layer of soil from the land surface, the result of runoff in the form of shallow sheets of water flowing over the ground. Such shallow surface flow typically does not move more than a few feet before collecting in surface depressions. Rill erosion occurs when sheet runoff begins to concentrate in surface depressions and, gaining in velocity, cuts small but well-defined channels termed "rills." Rills are at most a few inches deep and are easily obliterated by ordinary tillage. Gully erosion is an advanced form of soil erosion. Gullies may result when concentrated runoff widens and deepens rills, or when flows from several rills combine and form a larger channel. In contrast to rills, gullies are not obliterated by normal tillage.

Under certain conditions, soils may also be removed and transported by the wind. Extensive areas of unprotected sandy soils and drained and cultivated organic soils are susceptible to wind erosion in the absence of effective wind breaks. In Waukesha County, areas covered by soils considered to be highly susceptible to wind erosion encompass about 41,200 acres, or 11 percent of the total area of the County. About 9,700 acres, or 24 percent of this total, are in agricultural use.

The inventory and analysis work conducted as part of the Waukesha County soil erosion control planning program focused on water erosion—specifically, sheet and rill erosion. Sheet and rill erosion is a widespread problem causing massive amounts of soil to be moved about on—and in many cases completely off—inadequately protected cropland. Though often not perceived as a problem by the farm operator, sheet and rill erosion can seriously impair soil productivity in the long term and can cause serious and costly offsite damages and environmental problems. Gully and wind erosion problems, which may occur in localized areas in Waukesha County, should be addressed along with sheet and rill erosion as the county soil erosion control plan is implemented and detailed farm conservation plans are prepared.

CROPLAND SHEET AND RILL EROSION

Universal Soil Loss Equation

Estimates of the amount of sheet and rill erosion may be developed through application of a mathematical model known as the universal soil loss equation. The universal soil loss equation is used to estimate the average soil loss from sheet and rill erosion. The equation may be written as:

$$A = R \cdot K \cdot LS \cdot C \cdot P$$

where:

A = soil loss, expressed in tons of soil per acre per year;

R = rainfall erosion index, expressed in hundreds of foot-tons per acre, times the

maximum 30-minute rainfall intensity, in inches per hour, for all significant storms on an average annual basis;

K = soil erodibility factor, or the average soil loss, expressed in tons per acre per unit of R, from a particular soil in cultivated continuous fallow condition—that is, tilled continuously so as to be maintained free of vegetation and surface crusting—with a standard plot length of 72.6 feet and slope of 9 percent;

LS = slope length and steepness factor, a dimensionless ratio of soil loss expected on the subject field to the soil loss expected from a plot 72.6 feet in length, with a slope of 9 percent;

C = vegetative cover factor, a dimensionless ratio of soil loss expected on the subject field to the soil loss from a site in cultivated continuous fallow; and

P = erosion control practice factor, a dimensionless ratio of soil loss expected on the subject field to the soil loss from a site with no erosion control practices.

A detailed description of the universal soil loss equation can be found in Agriculture Handbook Number 537, issued by the U. S. Department of Agriculture.¹ It should be recognized that the soil “loss” estimated by the equation refers to soil dislodged and moved from place to place. The equation does not indicate the distance moved, nor does it indicate whether the movement is to a waterway, a neighboring farm field, or a different location on the same field.

In order to provide perspective on the severity of the soil erosion problem, soil loss as estimated by the universal soil loss equation is often compared to the soil loss tolerance, or “T-value.” The term “T-value” refers to the maximum annual average rate of soil loss that can be sustained without impairing the productivity of the soil. T-values have been determined for each soil type by the U. S. Soil Conservation Service. For soils in Waukesha County, T-values generally range between two and

five tons per acre per year. While comparisons to T-values are relied upon to provide insight into the severity of soil erosion problems and are widely used in conservation planning, a number of questions have developed regarding the concept of soil loss tolerances. Soil loss tolerances are considered further in the next chapter of this report.

Inventory Procedures

As part of the soil erosion control planning program, each cropland field in Waukesha County was identified on Commission 1985 one inch equals 400 feet scale ratioed and rectified vertical aerial photographs. In an effort to include the most current information on Waukesha County croplands in the report, a “drive-by” survey of all cropland fields identified on the 1985 aerial photographs was conducted in the spring of 1986. The 1985 farm field inventory was thus updated to both exclude those fields identified as cropland in 1985 but not cropped in 1986, and include fields in cropland use in 1986 that were not cropped in 1985. Data were then developed for each farm field to facilitate the estimation of soil erosion through application of the universal soil loss equation. Cropland fields were delineated so as to have a relatively homogeneous slope, soil type, and cropping pattern.² A total of 8,464 cropland

¹ U. S. Department of Agriculture, *Agricultural Handbook Number 537, Predicting Rainfall Erosion Losses, A Guide to Conservation Planning*, 1978.

² Cropland fields were delineated on Commission 1985 aerial photographs based upon a consideration of soil types, as shown on U. S. Soil Conservation Service soil survey maps; cropping patterns as shown on vertical aerial photographs, developed as color transparencies, taken by the U. S. Agricultural Stabilization and Conservation Service; and topographic characteristics—including importantly, the percent slope—as shown on U. S. Soil Conservation Service soil survey maps and one inch equals 100 feet and one inch equals 200 feet scale, five-foot contour interval topographic maps on file at the Waukesha County Park and Planning Department offices. The one inch equals 100 feet and one inch equals 200 feet scale, five-foot contour interval topographic maps were used in the interest of uniformity throughout the County. In this regard, it should be noted that the one inch equals 100 feet scale and one inch equals 200 feet scale, two-foot contour interval topographic maps recommended by the Regional Planning Commission were available for only portions of the County.

fields were identified—having a combined area of 107,091 acres, or an average of 12.7 acres per field. The data required for application of the universal soil loss equation were developed as described below.

Rainfall Erosion Index (R): The rainfall erosion index is an indicator of the erosive force of rainfall for an area during a normal year. At the time of the Waukesha County soil erosion inventory, the rainfall index established by the U. S. Soil Conservation Service for Waukesha County was 125, and that value was used in the determination of soil loss rates presented later in this chapter.³

Soil Erodibility Factor (K): The soil erodibility factor is an indicator of the susceptibility of soil to erosion, being a reflection of soil texture, structure, organic matter, and permeability. Soil erodibility factors have been determined by the U. S. Soil Conservation Service for each soil type. Under the Waukesha County cropland soil erosion inventory, the soil erodibility factor for each farm field was determined from U. S. Soil Conservation soil survey data. Where a farm field was covered by soils having different erodibility factors, a weighted average erodibility factor was assigned, based upon the proportionate areas covered by each of the various soil types.

Slope Length-Steepness Factor (LS): The steepness and length of slope have a direct bearing on the rate of soil loss. In general, soil loss per unit area increases as the slope gets longer and steeper. The LS-factor is a reflection of both the length and steepness of slope.

The following procedures were followed in developing LS-factors for farm fields under the Waukesha County cropland soil erosion inventory:

1. The steepness of slope was determined for each farm field from the detailed operational soil survey completed in 1965 by the Regional Planning Commission in cooperation with Waukesha County and the U. S. Soil Conservation Service, each farm field being assigned the percent slope indicated on the soil survey maps. Where

a farm field was covered by soil mapping units having different slopes, a weighted average percent slope was assigned to the farm field based upon the proportionate area covered by each of the mapping units.

2. Within each watershed in Waukesha County, representative slope lengths were developed for given percent slopes, based upon an analysis of slope steepness and corresponding slope lengths recorded on farm plans on file at the Waukesha County office of the U. S. Soil Conservation Service; and upon consultation with Waukesha County Land Conservation Department and U. S. Soil Conservation Service staff members with extensive experience in farm planning in Waukesha County, and therefore knowledgeable about the topographic characteristics of the County.
3. For each slope length-steepness combination developed in Step 2 above, an LS-factor was calculated according to the formula set forth in Agriculture Handbook Number 537.⁴
4. Each farm field was then assigned an LS-factor based upon its percent slope and watershed location.

Vegetative Cover Factor (C): The effects of cropping and management practices on soil erosion are taken into account in the universal soil loss equation through the vegetative cover factor, or "C-factor." The C-factor for a particular cropland field is a reflection of its particular crop sequence and management practices. The C-factor is equal to 1.0 for cultivated continuous fallow ground—that is, tilled ground continuously maintained free of vegetation and surface crusting. The C-factors assigned to farm fields under the Waukesha County cropland soil erosion inventory generally ranged between 0.006 and 0.5.

The following procedures were utilized in determining C-factors for cropland fields in Waukesha County:

1. Crop rotations were determined for each cropland field through inspection of verti-

³ Subsequent to the completion of the cropland soil erosion inventory, the rainfall index for Waukesha County was changed to 130. The effect of this change is to increase soil loss rates estimated through the universal soil loss equation by 4 percent.

⁴ U. S. Department of Agriculture, *Agricultural Handbook Number 537, Predicting Rainfall Erosion Losses, A Guide to Conservation Planning*, 1978.

cal aerial photographs, developed as color transparencies, of cropland areas taken in five consecutive years—1981 through 1985—by the U. S. Agricultural Stabilization and Conservation Service.

2. C-factors were subsequently assigned to each farm field based upon the rotation pattern indicated by the aerial photographs, using C-factors set forth in the U. S. Soil Conservation Service technical guide. Except for those farm fields known to be under conservation tillage, it was assumed that conventional moldboard plowing was utilized; that fields were fall plowed if the plow layer consisted of fine- and medium-textured soils such as clays, clay loams, silty clays, silty clay loams, loams, silt loams, and silts; and that fields were spring plowed if the plow layer consisted of coarse-textured soils such as sands, loamy sands, sandy loams, sandy clay loams, and sandy clays.
3. For farm fields known to be under conservation tillage, the C-factor was adjusted to take into account the reduction in soil loss inherent in such tillage practices. Farm operators receiving cost-share assistance in support of conservation tillage under the Agricultural Conservation Program (ACP) were identified by reviewing ACP files for the years 1983 through 1986. Based upon this review, about 4,600 acres, representing 4 percent of all cropland in the County, were identified as being under conservation tillage. It is important to note that farm operators who utilized conservation tillage without the benefit of cost-share assistance were not identified in the inventory.

Erosion Control Practice Factor (P): The effects of conservation practices such as contour cropping, contour strip-cropping, and terracing are taken into account in the universal soil loss equation through the erosion control practice factor, or "P-factor."⁵ The following procedures were utilized in determining P-factors for cropland fields in Waukesha County:

⁵ *The effects of terracing are also reflected in the universal soil loss equation in the LS-factor.*

1. Farm fields on which contour cropping, contour strip-cropping, and terracing have been implemented were identified by reviewing Agricultural Conservation Program files for the period 1983 through 1986, which identify those farm operators who received cost-share assistance for such practices under the Agricultural Conservation Program; by reviewing progress reports for the years 1981 through 1986 documenting the activities of the U. S. Soil Conservation Service staff in designing such practices for farms in the County; and by inspecting farm fields as shown on Commission 1985 one inch equals 400 feet scale, vertical aerial photographs for evidence of such practices. It should be noted that this inventory indicated that contour cropping, contour strip-cropping, and terracing were practiced on a very limited basis in Waukesha County. Contour cropping was identified on farm fields encompassing a total area of only 774 acres, or about 0.7 percent of all cropland in Waukesha County, in 1986. Contour strip-cropping was identified on farm fields encompassing a total area of only 135 acres, or about 0.1 percent of all cropland. Only two farm fields were known to be terraced in 1986, and these totaled only 45 acres in area.
2. A P-factor value of less than 1.0 was subsequently assigned to each farm field for which contour cropping, contour strip-cropping, or terracing was identified, in accordance with the methodology set forth in the U. S. Soil Conservation Service technical guide. The large balance of cropland fields in the County were assigned a P-factor of 1.0.

Cropland Soil Erosion Rates

The rate of sheet and rill erosion was calculated for cropland fields in Waukesha County through application of the universal soil loss equation, using the data developed under the cropland inventory. The resulting soil loss rates expressed in tons per acre per year are presented for the County overall, for U. S. Public Land Survey townships, and for U. S. Public Land Survey sections in Tables 3 and 4, and on Map 9.

As indicated in Table 3, the average rate of sheet and rill erosion in Waukesha County in 1986 was 4.9 tons per acre per year. The soil loss rate was

Table 3

**CROPLAND SOIL EROSION RATES
IN WAUKESHA COUNTY: 1986**

Soil Loss Rate (tons per acre per year)	Cropland		
	Number of Fields	Acres	
		Number	Percent of Total
Less than 3.0	3,828	48,805	45.6
3.0 - 3.9	718	9,942	9.3
4.0 - 4.9	587	8,381	7.8
5.0 - 5.9	653	8,441	7.9
6.0 - 6.9	399	5,138	4.8
7.0 - 7.9	344	4,333	4.0
8.0 - 8.9	409	5,241	4.9
9.0 - 9.9	178	2,193	2.0
10.0 - 14.9	807	9,614	9.0
15.0 - 19.9	327	3,272	3.1
20.0 or More	214	1,731	1.6
Total	8,464	107,091	100.0
Average Soil Loss Rate	4.9 Tons/Acre/Year		

Source: SEWRPC.

less than 3.0 tons per acre per year on about 48,800 acres of cropland, representing about 46 percent of all cropland. At the other extreme, the soil loss rate was 10 tons or more per acre per year on about 14,600 acres, representing 14 percent of all cropland. As shown on Map 9, there was considerable variation in the rate of cropland soil erosion within the County. While areas having relatively high soil loss rates are located throughout the County, the most extensive areas are located in the central and southeastern portions of the County. Relatively high soil loss rates were also identified in the northeastern portion of the County.

Actual soil loss rates within the County relative to "tolerable" soil loss rates, or "T-value," are presented in Tables 5 and 6 and on Map 10. As indicated in Table 5, for about 61,800 acres of

Table 4

CROPLAND SOIL EROSION RATES IN WAUKESHA COUNTY BY TOWNSHIP: 1986

U. S. Public Land Survey Township	Cropland Eroding at Less than 3.0 Tons/Acre/Year		Cropland Eroding at 3.0 - 4.9 Tons/Acre/Year		Cropland Eroding at 5.0 - 6.9 Tons/Acre/Year		Cropland Eroding at 7.0 - 8.9 Tons/Acre/Year		Cropland Eroding at 9.0 Tons/Acre/ Year or More		Total Cropland		Average Soil Loss Rate: Tons/Acre/Year
	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	
5 North, 17 East (Eagle)	5,249	69.3	1,492	19.7	432	5.7	147	1.9	258	3.4	7,578	100.0	2.5
5 North, 18 East (Mukwonago)	3,427	43.6	1,458	18.6	1,054	13.4	678	8.6	1,242	15.8	7,859	100.0	5.0
5 North, 19 East (Vernon)	2,920	36.4	1,394	17.4	1,145	14.3	811	10.1	1,743	21.8	8,013	100.0	5.7
5 North, 20 East (Muskego)	2,396	32.0	1,863	24.9	1,540	20.5	542	7.2	1,151	15.4	7,492	100.0	5.0
6 North, 17 East (Ottawa)	4,765	72.6	710	10.8	441	6.7	263	4.0	383	5.9	6,562	100.0	2.6
6 North, 18 East (Genesee)	2,967	44.0	921	13.7	674	10.0	389	5.8	1,783	26.5	6,734	100.0	6.2
6 North, 19 East (Waukesha)	1,885	32.7	1,126	19.6	608	10.6	720	12.5	1,419	24.6	5,758	100.0	6.3
6 North, 20 East (New Berlin)	1,612	32.4	721	14.5	685	13.8	833	16.8	1,119	22.5	4,970	100.0	6.2
7 North, 17 East (Summit)	4,402	60.7	932	12.9	996	13.7	454	6.3	463	6.4	7,247	100.0	3.6
7 North, 18 East (Delafield)	1,835	33.7	954	17.5	406	7.4	804	14.7	1,454	26.7	5,453	100.0	6.8
7 North, 19 East (Pewaukee)	2,399	50.0	767	16.0	557	11.6	486	10.1	592	12.3	4,801	100.0	4.2
7 North, 20 East (Brookfield)	470	31.6	175	11.8	374	25.2	157	10.6	309	20.8	1,485	100.0	5.6
8 North, 17 East (Oconomowoc)	4,587	45.2	2,036	20.1	1,209	11.9	1,064	10.5	1,252	12.3	10,148	100.0	4.8
8 North, 18 East (Merton)	4,682	55.2	1,547	18.2	1,014	11.9	540	6.4	704	8.3	8,487	100.0	3.8
8 North, 19 East (Lisbon)	4,146	44.5	1,688	18.1	1,378	14.8	681	7.3	1,423	15.3	9,316	100.0	5.0
8 North, 20 East (Menomonee Falls)	1,063	20.5	539	10.4	1,066	20.5	1,005	19.4	1,515	29.2	5,188	100.0	7.1
County Total	48,805	45.6	18,323	17.1	13,579	12.7	9,574	8.9	16,810	15.7	107,091	100.0	4.9

Source: SEWRPC.

Map 9

CROPLAND SOIL EROSION RATES IN WAUKESHA COUNTY: 1986



LEGEND

AVERAGE SOIL LOSS RATE IN TONS PER ACRE PER YEAR FOR U.S. PUBLIC LAND SURVEY SECTIONS HAVING AT LEAST 100 ACRES OF CROPLAND:



Source: SEWRPC.

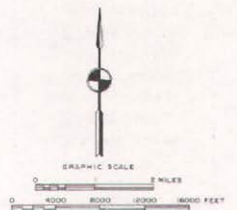


Table 5

CROPLAND SOIL EROSION RELATIVE TO T-VALUE IN WAUKESHA COUNTY: 1986

Soil Loss Rate in Multiples of T-Value	Cropland		
	Number of Fields	Acres	
		Number	Percent of Total
1.0 or Less	4,744	61,770	57.7
1.1 - 1.5	1,081	14,355	13.4
1.6 - 2.0	683	8,820	8.2
2.1 - 3.0	858	10,430	9.7
3.1 - 4.0	470	5,650	5.3
4.1 - 5.0	276	2,938	2.8
5.1 - 10.0	323	2,918	2.7
10.1 or More	29	210	0.2
Total	8,464	107,091	100.0

Source: SEWRPC.

cropland, or almost 58 percent of all cropland in Waukesha County, the soil loss rate was less than or equal to T-value. Conversely, about 23,200 acres, or almost 22 percent of all cropland, was eroding at rates between 1.1 and 2.0 times T-value; about 10,400 acres, or almost 10 percent, was eroding at rates between 2.1 and 3.0 times T-value; and the balance—about 11,700 acres, or about 11 percent—was eroding at rates of more than 3.0 times T-value.

NONCROPLAND SOIL EROSION

As already noted, under the county soil erosion control planning program, primary data collection activity focused on cropland soil erosion. A

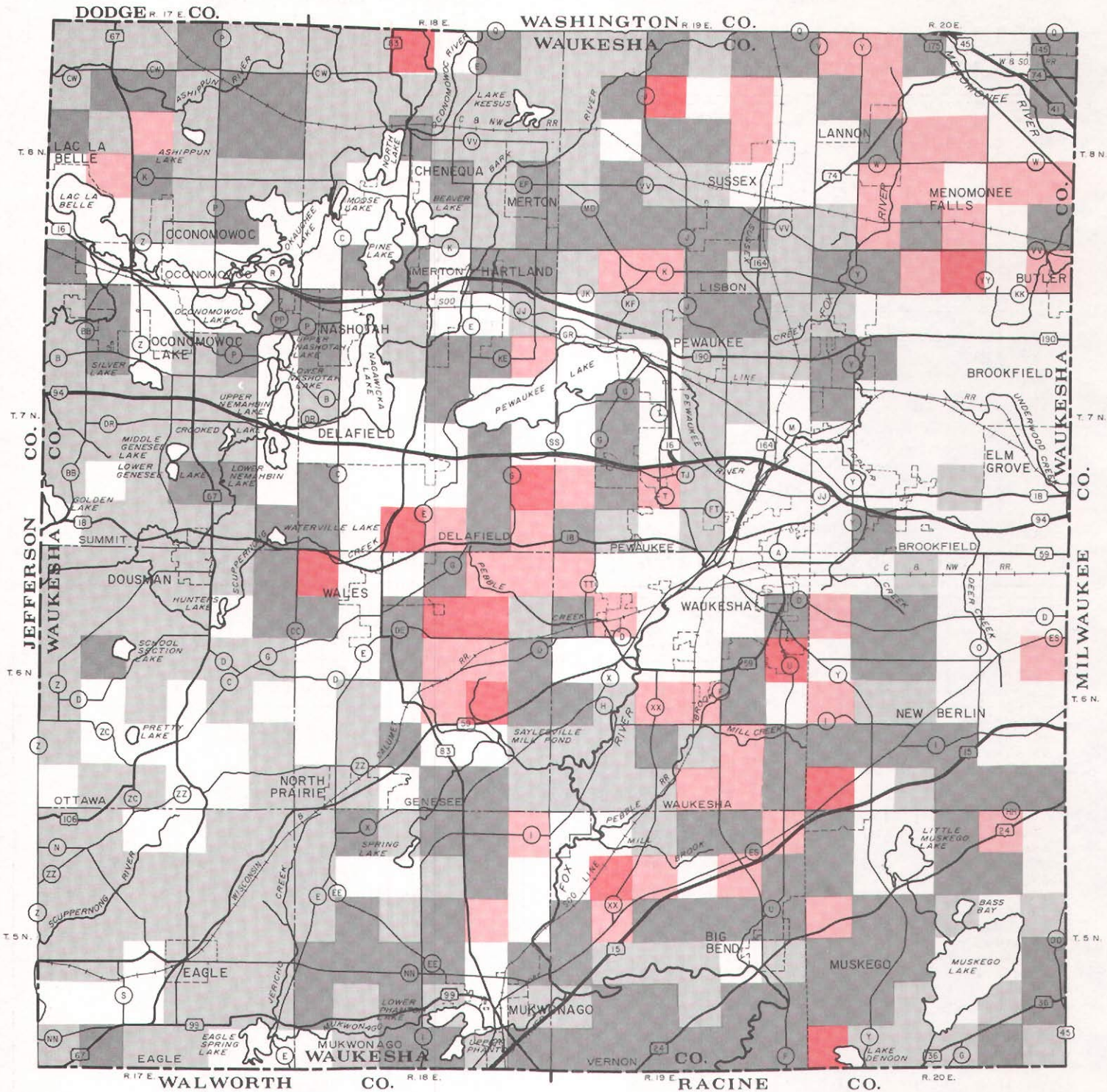
Table 6

CROPLAND SOIL EROSION RELATIVE TO T-VALUE IN WAUKESHA COUNTY BY TOWNSHIP: 1986

U. S. Public Land Survey Township	Cropland Eroding at 1.0 Times T-Value or Less		Cropland Eroding at 1.1 - 2.0 Times T-Value		Cropland Eroding at 2.1 - 3.0 Times T-Value		Cropland Eroding at More than 3.0 Times T-Value		Total Cropland		Average Soil Loss Rates in Multiples of T-Value
	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	
5 North, 17 East (Eagle)	6,382	84.2	855	11.3	237	3.1	104	1.4	7,578	100.0	0.6
5 North, 18 East (Mukwonago)	4,650	59.2	1,865	23.7	663	8.4	681	8.7	7,859	100.0	1.2
5 North, 19 East (Vernon)	3,797	47.4	1,946	24.3	999	12.5	1,271	15.8	8,013	100.0	1.5
5 North, 20 East (Muskego)	3,587	47.9	2,288	30.5	783	10.5	834	11.1	7,492	100.0	1.3
6 North, 17 East (Ottawa)	5,396	82.2	716	10.9	283	4.3	167	2.6	6,562	100.0	0.7
6 North, 18 East (Genesee)	3,683	54.7	1,042	15.5	576	8.5	1,433	21.3	6,734	100.0	1.7
6 North, 19 East (Waukesha)	2,669	46.3	1,478	25.7	606	10.5	1,005	17.5	5,758	100.0	1.6
6 North, 20 East (New Berlin)	2,214	44.5	1,287	25.9	689	13.9	780	15.7	4,970	100.0	1.6
7 North, 17 East (Summit)	4,801	66.3	1,648	22.7	515	7.1	283	3.9	7,247	100.0	0.9
7 North, 18 East (Delafield)	2,390	43.8	1,062	19.5	801	14.7	1,200	22.0	5,453	100.0	1.7
7 North, 19 East (Pewaukee)	2,916	60.7	983	20.5	582	12.1	320	6.7	4,801	100.0	1.1
7 North, 20 East (Brookfield)	600	40.4	475	32.0	249	16.8	161	10.8	1,485	100.0	1.5
8 North, 17 East (Oconomowoc)	6,199	61.1	2,223	21.9	1,028	10.1	698	6.9	10,148	100.0	1.2
8 North, 18 East (Merton)	5,892	69.4	1,680	19.8	501	5.9	414	4.9	8,487	100.0	0.9
8 North, 19 East (Lisbon)	5,304	56.9	2,251	24.2	720	7.7	1,041	11.2	9,316	100.0	1.2
8 North, 20 East (Menomonee Falls)	1,290	24.9	1,376	26.5	1,198	23.1	1,324	25.5	5,188	100.0	2.1
County Total	61,770	57.7	23,175	21.6	10,430	9.7	11,716	11.0	107,091	100.0	1.3

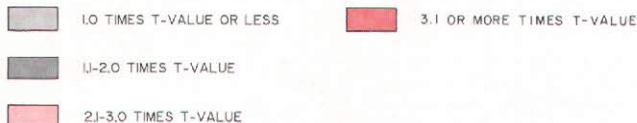
Source: SEWRPC.

CROPLAND SOIL EROSION RELATIVE TO T-VALUE IN WAUKESHA COUNTY: 1986

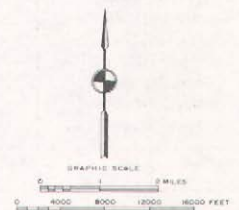


LEGEND

AVERAGE SOIL LOSS RATE IN MULTIPLES OF T-VALUES
FOR U.S. PUBLIC LAND SURVEY SECTIONS HAVING
AT LEAST 100 ACRES OF CROPLAND:



Source: SEWRPC.



general description of soil erosion attendant to other selected land uses is presented below.

Erosion on Pastureland and Grazed Woodland

Pastureland and grazed woodlands are susceptible to excessive erosion under certain circumstances, particularly when overgrazing occurs on steep slopes. Data regarding the rate of soil erosion on pastureland and grazed woodlands specific for Waukesha County are not available. However, the 1982 National Resources Inventory (NRI) conducted by the U. S. Soil Conservation Service indicated that within the reporting area that includes Waukesha County, the estimated average rate of water erosion on pastureland was 0.4 ton per acre per year.⁶ The National Resources Inventory further indicated that, within this area, 2 percent of all pastureland was eroding at rates exceeding T-value. The estimated average rate of water erosion on grazed woodlands in this area, as estimated by the National Resources Inventory, was 0.6 ton per acre per year. An estimate of the percent of grazed woodlands eroding at rates exceeding T-value is not available.

While an analysis of erosion on pastureland and grazed woodlands was not conducted as part of the soil erosion control planning program, it is envisioned that the detailed farm planning activities required to address the cropland soil erosion problems identified in this report would also address any apparent erosion problems on pastureland and grazed woodlands.

⁶ *The 1982 National Resources Inventory was a sample survey conducted by the U. S. Soil Conservation Service intended to provide statistically valid natural resource data for "major land resource areas." Major land resource areas are regions having similar soils, topography, and climate, as well as many similar resource-related opportunities and problems. Almost all of Waukesha County is located within major land resource area 95B. Within Wisconsin, major land resource area 95B also includes portions or all of Calumet, Columbia, Dane, Dodge, Fond du Lac, Green, Green Lake, Jefferson, Kenosha, Manitowoc, Marquette, Milwaukee, Racine, Rock, Sheboygan, Walworth, Waushara, and Winnebago Counties. Additional documentation of the National Resources Inventory is presented in National Resources Inventory-Wisconsin-1982, prepared by the U. S. Soil Conservation Service.*

Stream Bank Erosion

Erosion of stream banks in rural areas may be promoted by livestock disturbance, cropping activity immediately adjacent to a stream, and certain recreational activities. Increased stormwater runoff from urbanizing areas may also contribute to increased stream bank erosion in downstream rural areas. Stream bank erosion is not considered to be a significant problem in Waukesha County, and such problems as may exist are considered to be localized in nature. Although an analysis of stream bank erosion was not conducted as part of the soil erosion control planning program, it is envisioned that the detailed farm planning activities required to address cropland soil erosion problems would also address any apparent stream bank erosion problems.

Construction Site Erosion

The development and redevelopment of land for residential, commercial, industrial, institutional, transportation, and other intensive urban uses may result in significant soil erosion. Such erosion can contribute to problems on the construction site itself, such as rilled and gullied slopes and washed out roads, and to offsite problems such as water quality degradation and the clogging of culverts, roadside ditches, channels, and bays. Upon completion, increased runoff from impervious pavements, building roofs, and compacted soil at the developed site may cause erosion on adjacent lands and may increase the potential for flooding.

Soil erosion rates attendant to construction activities are extremely variable. The amount of erosion depends upon the time period and areal extent of the construction operation; the topography of the site; the soil characteristics; the construction methods utilized; and the ameliorative measures taken to control soil erosion. Erosion rates on land under construction may be very high, ranging up to 200 tons per acre per year.

As indicated in Chapter II, Waukesha County has experienced a substantial increase in lands devoted to intensive urban uses. Such lands increased by about 38,600 acres, or 64 percent, between 1963 and 1985, with residential lands accounting for about 25,200 acres, or two-thirds of the total increase. A total of 26,960 residential lots were platted during this time period, an average of 1,225 lots per year. From 1985 through 1987, a total of 2,500 residential lots were platted, an average of 833 lots per year. Within Waukesha County, urban land development—and the atten-

dant potential for construction site erosion—has occurred both within expanding urban centers and within isolated enclaves in outlying areas of the County (see Map 8 in Chapter II).

Soil erosion from construction sites can be minimized through appropriate soil erosion control practices. The Wisconsin Department of Natural Resources, in conjunction with the League of Wisconsin Municipalities, recently prepared a model ordinance which local units of government may adopt to control construction site erosion.⁷ The model ordinance requires erosion control practices which reduce the amount of sediment and other pollutants leaving construction sites during the development process. The ordinance sets forth requirements with regard to seeding, sodding, mulching, and other means of stabilizing disturbed ground; use of sedimentation basins and filter fences to minimize the amount of sediment leaving the site; diversion of runoff from upland areas away from the construction site; and other erosion control practices.

The Waukesha County Park and Planning Commission has encouraged local units of government in Waukesha County to adopt the model construction site erosion control ordinance, and has offered technical assistance in adapting that ordinance to the individual communities. Widespread use of the model ordinance would have the advantage of creating a relatively uniform set of construction site erosion control regulations within the County. To date, one community, the City of Muskego, is known to have adopted a construction site erosion control ordinance based upon the model ordinance. Two other communities—the City of Oconomowoc and the Village of Sussex—had adopted construction site erosion control ordinances prior to the preparation of the model ordinance.

CONCLUDING REMARKS

This chapter has described the methodology and findings of an inventory and analysis of cropland soil erosion in Waukesha County. That work indicated that the average rate of sheet and rill erosion on cropland in Waukesha County was 4.9 tons per acre per year in 1986. The soil loss was less than 3.0 tons per acre per year on about 48,800 acres of cropland, representing about 46 percent of all cropland in the County. At the other extreme, the soil loss rate was 10

tons per acre per year or more on about 14,600 acres, representing 14 percent of all cropland. About 45,300 acres, or just over 42 percent of all cropland in the County, were identified as having a soil loss rate in excess of soil loss tolerance, or “T-value,” as established by the U. S. Soil Conservation Service. Specifically, about 23,200 acres, or almost 22 percent of all cropland, was eroding at rates between 1.1 and 2.0 times T-value; about 10,400 acres, or almost 10 percent, was eroding at rates between 2.1 and 3.0 times T-value; and the balance—11,700 acres, or about 11 percent—was eroding at rates greater than 3.0 times T-value. While areas having relatively high soil loss rates are located throughout the County, the most extensive areas are located in the central, southeastern, and northeastern portions. Subsequent chapters of this report establish a cropland soil erosion control objective and related standards and set forth a plan for the abatement of the identified cropland soil erosion problems.

Data regarding the rate of soil erosion on pastureland and grazed woodlands specific for Waukesha County are not available. However, the 1982 National Resources Inventory (NRI) conducted by the U. S. Soil Conservation Service indicated that within the reporting area that includes Waukesha County, the estimated average rate of water erosion on pastureland was 0.4 ton per acre per year. The estimated average rate of water erosion on grazed woodlands in this area, as estimated by the National Resources Inventory, was 0.6 ton per acre per year. It is envisioned that such erosion problems would be identified and addressed as part of the detailed farm planning activities required to address cropland soil erosion problems. It is further envisioned that stream bank erosion problems—generally considered to be localized in nature in Waukesha County—would also be identified and addressed as part of the detailed farm planning activities.

This chapter has also pointed out the potential for serious construction site erosion problems, given the rapid urbanization of Waukesha County. Erosion rates on land under construction may be very high—up to 200 tons per acre per year. Construction site erosion can, however, be minimized through appropriate erosion control practices. Adoption and enforcement of construction site erosion control ordinances by local units of government in Waukesha County, based upon a model ordinance recently prepared by the Wisconsin Department of Natural Resources, would significantly reduce construction site erosion problems in the County.

⁷ “A Model Ordinance,” *The Municipality*, Volume 82, No. 1, January 1987.

Chapter IV

CROPLAND SOIL EROSION CONTROL OBJECTIVE, PRINCIPLE, AND STANDARDS

Planning is a rational process for formulating and meeting objectives. The formulation of objectives, therefore, is an essential task which must be undertaken before plans can be properly prepared. This chapter presents a cropland soil erosion objective for Waukesha County together with a supporting principle and related standards, all as recommended for adoption by the Technical Advisory Committee as part of the county soil erosion control plan.¹

BACKGROUND

Central to the formulation of cropland soil erosion objectives and standards is a consideration of what constitutes excessive erosion. Traditionally in conservation planning, excessive erosion has been defined as erosion in excess of the specific soil loss tolerance for a given soil. A soil loss tolerance, or "T-value," has been established by the U. S. Soil Conservation Service for each soil type. Soil loss tolerance is defined by the Soil Conservation Service as the maximum level of soil erosion

that will permit a high level of crop productivity to be sustained economically and indefinitely. Considered in the establishment of soil loss tolerances, or T-values, are soil depth, including depth to a restrictive layer, permeability, and other factors. For soils in Waukesha County, T-values range from two to five tons per acre per year (see Appendix A).

Chapter Ag 160 of the Wisconsin Administration Code, which governs the preparation of county soil erosion control plans, requires that every county soil erosion control plan establish maximum acceptable rates of cropland soil erosion and that these rates be expressed in terms of T-value, or multiples or fractions of T-value. Chapter Ag 160 further requires that these rates meet certain minimum statewide goals, including an ultimate goal that erosion on all cropland be reduced to no more than T-value by the year 2000. Several interim goals are also prescribed.

Attainment of T-value on all cropland would represent a substantial reduction in cropland soil erosion in Waukesha County, and would contribute significantly to the long-term maintenance of soil productivity. It should be recognized in this respect that while T-values enjoy a widespread use as a basis for soil conservation planning, they are not universally accepted as goals for cropland soil erosion control. There is growing concern that T-values have been set too high to adequately protect the long-term productivity of the soil. If the actual topsoil formation rate is less than the assigned T-value, topsoil may be gradually depleted even though erosion would appear to be at tolerable levels. It should also be recognized in this respect that the established T-values do not take into account offsite impacts attendant to cropland soil erosion. Controlling erosion at T-value does not ensure the prevention of erosion-related water quality problems or other offsite damages, such as the clogging of culverts and ditches. Nevertheless, a reduction of cropland soil erosion to T-value throughout Waukesha County would contribute significantly to the abatement of such offsite problems.

¹ For purposes of this report, the following definitions of these terms will be employed: 1) objective—a goal or end toward the attainment of which plans and policies are directed; 2) principle—a fundamental, primary, or generally accepted tenet used to assert the validity of objectives and to prepare standards and plans; 3) standard—a criterion used as a basis of comparison to determine the adequacy of alternative and recommended plan proposals to attain objectives; 4) plan—a design which seeks to achieve the agreed-upon objectives; 5) policy—a rule or course of action used to ensure plan implementation; and 6) program—a coordinated series of policies and actions to carry out a plan. Although this chapter discusses only the first three of these terms, an understanding of the interrelationship of the basic concepts which the foregoing terms represent is essential to the discussion of objectives, principles, and standards.

Some conservationists argue for more aggressive control of cropland erosion, calling for the prevention of all "accelerated" erosion. Accelerated erosion refers to erosion induced by man, as opposed to "normal" erosion caused by geological processes under natural environmental conditions. This position was espoused by the Ad Hoc Committee on Land Resources, created by the Wisconsin Chapter of the Soil and Water Conservation Society, in a report entitled "Soil Conservation Policies for the 1980's."² That report notes that soil productivity in terms of crop yield is declining at about 2 percent annually and that increased use of fertilizer and cultural technology has been relied on to offset this decline. The report cautions that there is no assurance that technological advances can indefinitely counter the losses in natural soil productivity. While there are practical impediments to achieving zero accelerated erosion on a widespread basis, there may come a time when soil erosion control beyond currently established soil loss tolerance levels will be required.

RECOMMENDED SOIL EROSION CONTROL OBJECTIVE, PRINCIPLE, AND STANDARDS

After careful deliberation, the Technical Advisory Committee recommended the adoption of the cropland soil erosion control objective, supporting principle, and related standards set forth in Table 7. It should be noted that the standards set forth in Table 7 incorporate the minimum standards for erosion control prescribed in Chapter Ag 160 of the Wisconsin Administrative Code—including,

² *Wisconsin Chapter, Soil Conservation Society of America (now Soil and Water Conservation Society), "Soil Conservation Policies for the 1980's," Report of the Ad Hoc Committee on Land Resources, November 1984.*

importantly, the reduction of soil erosion on all cropland to no more than T-value by the year 2000.

The recommended objective and related standards are based upon the following conclusions drawn by the Advisory Committee during its deliberation on this matter:

- That despite their limitations, soil loss tolerances, or T-values, established by the U. S. Soil Conservation Service, currently provide the best available basis for establishing cropland soil erosion objectives and standards—although continuing research into the validity of those tolerances is required.
- That the attainment of the recommended standards would result in a substantial reduction in cropland soil erosion in Waukesha County, contributing significantly to the maintenance of the long-term productivity of soil resources and to the abatement of erosion-related water quality problems and other offsite damages.
- That given the amount of cropland—about 45,300 acres, or about 42 percent of all cropland in the County—eroding at rates in excess of T-value, and given the trend toward production of erosion-prone crops, the reduction of soil loss to tolerable levels throughout the County by the year 2000 represents a major challenge to the County's agricultural sector.
- That in the long term, the County may wish to explore more aggressive erosion control objectives and standards as warranted by continuing erosion research.

Table 7

CROPLAND SOIL EROSION CONTROL OBJECTIVE, PRINCIPLE, AND STANDARDS

OBJECTIVE

The maintenance of the long-term productivity of soils through the prevention of excessive cropland soil erosion.

PRINCIPLE

Erosion can diminish soil productivity by degrading the physical, biological, and chemical properties of the topsoil and by decreasing the depth of soil that is suitable for plant rooting. Prevention of excessive cropland soil erosion is necessary to ensure soil productivity for future generations. Prevention of excessive cropland soil erosion would also contribute to the abatement of erosion-related water quality problems and other offsite damages, including the clogging of culverts and drainageways.

STANDARDS

A. Standards for Individual Fields

1. The soil erosion rate on individual cropland fields should not exceed T-value on or after January 1, 2000.
2. The soil erosion rate on individual cropland fields should not exceed three times T-value on or after July 1, 1990.
3. The soil erosion rate on individual cropland fields should not exceed two times T-value on or after July 1, 1995.
4. The soil erosion rate on individual cropland fields on farms owned by any department or agency of state government should not exceed T-value on or after July 1, 1990.

B. Standards for the County

1. The average soil erosion rate for all cropland in the County should not exceed 1.5 times T-value on or after July 1, 1990.
2. The average soil erosion rate for all cropland in the County should not exceed T-value on or after July 1, 1993.

NOTE: "T-value" is the tolerable soil loss rate—the maximum level of soil erosion that will permit a high level of crop productivity to be sustained economically and indefinitely, as determined by the U. S. Soil Conservation Service. "Excessive" cropland erosion refers to erosion in excess of the tolerable rate, or T-value.

Source: SEWRPC.

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Chapter V

RECOMMENDED SOIL EROSION CONTROL PLAN

A variety of conservation practices are available to farmers for the control of cropland soil erosion. These practices range from structural approaches, such as the installation of terraces and construction of grassed waterways, to management approaches, such as conservation tillage and contour plowing. An important objective of the county soil erosion control planning program was the identification of those practices that would be the most effective in addressing the soil erosion problems identified within the County. Accordingly, this chapter identifies the types and amounts of conservation practices believed to have the greatest potential for reducing cropland soil erosion to tolerable levels in Waukesha County. This chapter also identifies the farm conservation planning activities that would be required to implement the recommended practices.

While the responsibility for implementation of soil erosion control practices ultimately rests with the individual farmer, various county, state, and federal agencies can help to increase the awareness of cropland soil erosion problems and promote implementation of soil erosion control practices through technical assistance, financial assistance, and informational and educational activities. Because cropland soil erosion problems are widespread, and because the public resources available to address such problems are limited, it is important that the available resources be appropriately directed, or targeted, to ensure the maximum resulting benefit. Accordingly, this chapter also recommends a rank ordering of areas of the County for application of soil erosion control measures, and provides a general time frame to help guide the use of the available soil erosion control resources. A description of county, state, and federal technical and financial programs which can be used to assist in the implementation of soil erosion control measures is provided in the next chapter of this report, together with recommendations regarding the use of those programs in Waukesha County.

This chapter consists of four sections. The first section describes the recommended priority areas for the application of soil erosion control measures in Waukesha County. The second section describes the various types of soil erosion control

practices available, and identifies those types and amounts needed to abate the soil erosion problems in the County. The third section identifies the farm conservation planning activities required to implement the recommended practices. The fourth section establishes a time frame for addressing the identified soil erosion problems within the respective priority areas.

EROSION CONTROL PRIORITY AREAS

The rank ordering of subareas of the County for soil erosion control purposes is a key aspect of the county soil erosion control plan. Such a rank ordering could be accomplished in a number of ways. The Waukesha County Soil Erosion Control Planning Program Technical Advisory Committee determined that the rank ordering of areas for erosion control should be based primarily upon the soil loss rate and the amount of excessive soil erosion occurring, with those areas having the highest soil loss rate and greatest amount of excessive soil loss assigned the highest priority for erosion control. The Committee further determined that U. S. Public Land Survey sections, each approximating 640 acres in area, should serve as the basic geographic units for the rank ordering, and that the U. S. Public Land Survey sections should be classified into priority categories based upon the average soil loss rate and the amount of excessive erosion occurring. The approach recommended by the Advisory Committee was intended to address the most serious soil erosion problems first, and to achieve the maximum reduction in soil erosion as quickly as possible with the limited resources available.

The specific criteria for grouping and ranking U. S. Public Land Survey sections for erosion control, developed under the guidance of the Technical Advisory Committee, are set forth in Table 8. Based upon those criteria, each U. S. Public Land Survey section containing cropland eroding at excessive rates was assigned to one of four priority categories, as shown on Map 11. Summary information regarding cropland soil erosion rates for each of the priority areas is presented in Tables 9 and 10. As indicated in Table 10, Priority Area A—the highest priority

area for erosion control—contained 108 U. S. Public Land Survey sections, which together encompassed about 26,128 acres of cropland in 1987. On the average, cropland in Priority Area A was eroding at 2.1 times T-value, and about 18,226 acres, or about 70 percent of all cropland in the 108 sections concerned, was eroding at rates exceeding T-value. Conversely, Priority Area D—the lowest priority area for erosion control—contained 158 U. S. Public Land Survey sections, which together encompassed about 21,045 acres of cropland. On the average, cropland in Priority Area D was eroding at 0.8 times T-value, and about 3,985 acres, or about 19 percent of all cropland in the 158 sections concerned, was eroding at rates exceeding T-value. Priority area data summarized for U. S. Public Land Survey Townships is presented in Appendix B.

Water Quality Considerations

The county soil erosion control planning program included an identification of farm fields within Priority Area A having potential adverse impacts on surface water or groundwater as a result of excessive soil erosion. The identification of potential surface water problems was based upon an analysis of the existing drainage pattern, the proximity of the eroding field to the surface water network, and the extent of effective buffering between the eroding field and the surface water, as determined from a review of topographic maps and aerial photographs, and from field inspection. The identification of potential groundwater impacts was based upon analysis of drainage patterns as well as the types of soils, depth to bedrock, and vegetative cover for internally drained areas, as determined from a review of topographic maps, aerial photographs, and soil survey maps, as well as from field inspection. Table 11 sets forth the criteria utilized to identify farm fields having potential adverse impacts on surface- or groundwater as a result of excessive soil erosion. This analysis indicated that of the 18,226 acres of excessively eroding cropland in Priority Area A, about 10,300 acres, or just under 57 percent, have a potential to contribute significantly to surface- or groundwater pollution. In addressing soil erosion problems within Priority Area A, first priority should be given to those areas containing concentrations of excessively eroding cropland identified as having potential adverse water quality impacts.

SOIL EROSION CONTROL PRACTICES

The major conservation practices that may be utilized in efforts to control cropland soil erosion

Table 8

CRITERIA FOR THE GROUPING AND RANKING OF U. S. PUBLIC LAND SURVEY SECTIONS FOR EROSION CONTROL UNDER THE WAUKESHA COUNTY SOIL EROSION CONTROL PLAN

Priority Area	Priority Area Criteria
A	U. S. Public Land Survey sections having an average soil loss rate of at least 1.5 times T-value and at least 100 acres of cropland with a soil loss rate exceeding T-value
B	Other U. S. Public Land Survey sections having at least 100 acres of cropland with a soil loss rate exceeding T-value
C	U. S. Public Land Survey sections having 50 to 99 acres of cropland with a soil loss rate exceeding T-value
D	U. S. Public Land Survey sections having 1 to 49 acres of cropland with a soil loss rate exceeding T-value

NOTE: The cropland acreage referred to herein is the total area of all cropland fields in each U. S. Public Land Survey section having a soil loss rate greater than T-value.

Source: SEWRPC.

include conservation tillage, changes in crop rotations, contouring, contour strip-cropping, terraces, grassed waterways, cover crops, and permanent vegetative cover. The first part of this section describes these practices; the second part identifies the types and amounts of such practices recommended for the abatement of cropland soil erosion problems in Waukesha County.

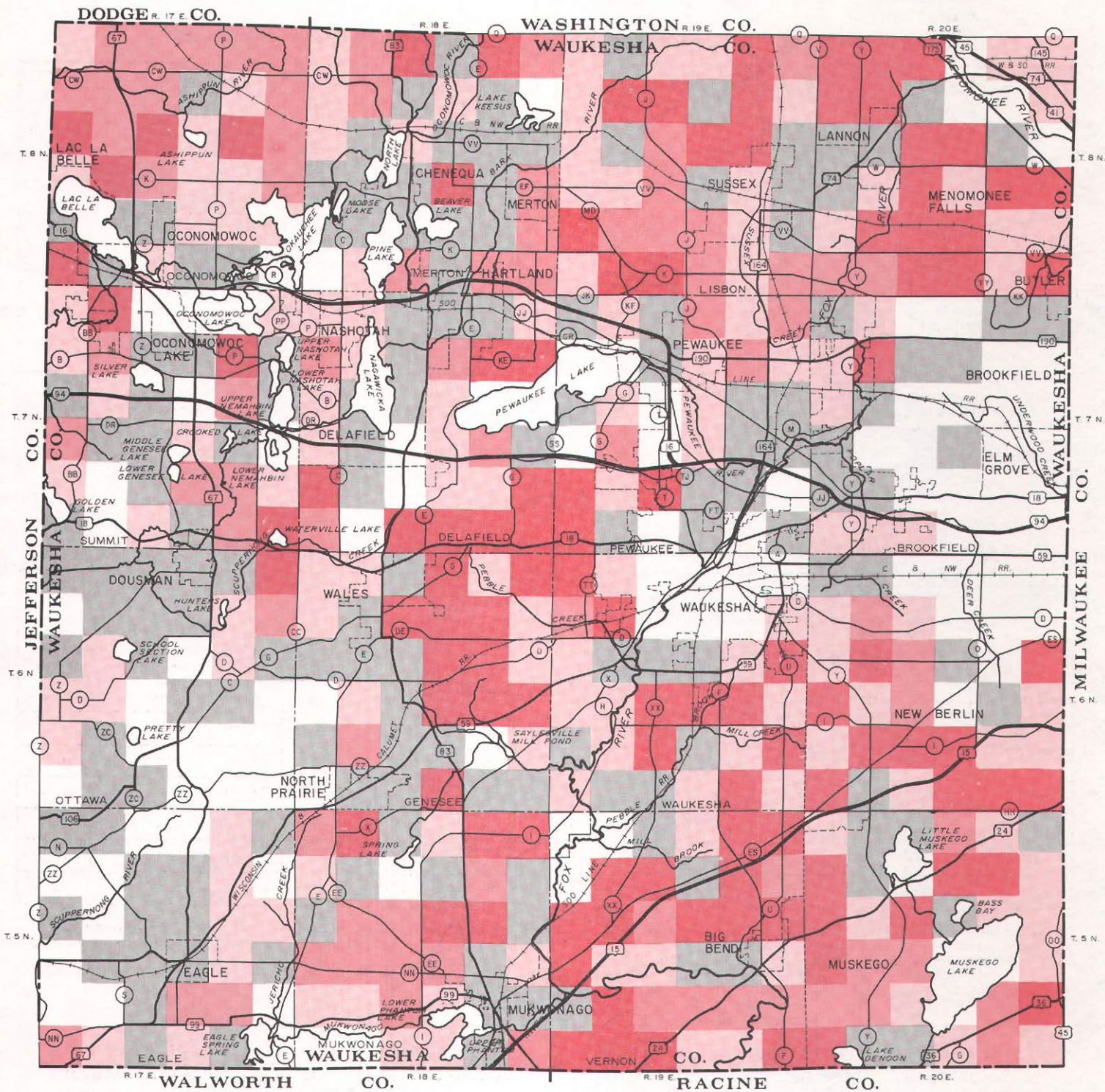
Description of Soil

Erosion Control Practices

Conservation Tillage: The term conservation tillage refers to any tillage and planting system that maintains a crop residue on at least 30 percent of the soil surface after planting to reduce soil erosion by water.¹ There are many conservation tillage systems. Major types of conservation systems include mulch till systems, no-till systems, and variations of no-till systems, including ridge-till and strip-till systems.

¹ Where soil erosion by wind is the primary concern, a conservation tillage system is defined as one which maintains at least 1,000 pounds of flat small grain residue equivalent on the surface during the critical erosion period.

RECOMMENDED PRIORITY AREAS FOR CROPLAND SOIL EROSION CONTROL IN WAUKESHA COUNTY



LEGEND

- PRIORITY AREA A
- PRIORITY AREA B
- PRIORITY AREA C
- PRIORITY AREA D

Source: SEWRPC.

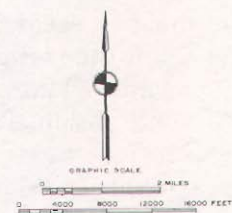


Table 9

CROPLAND SOIL EROSION RATES IN WAUKESHA COUNTY BY PRIORITY AREA: 1987

Priority Area (See Map 11)	Cropland Eroding at Less than 3.0 Tons/Acre/Year		Cropland Eroding at 3.0-4.9 Tons/Acre/Year		Cropland Eroding at 5.0-6.9 Tons/Acre/Year		Cropland Eroding at 7.0-8.9 Tons/Acre/Year		Cropland Eroding at 9.0 Tons/Acre/Year or More		Total Cropland		Average Soil Loss Rate: Tons/Acre/Year
	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	
A	5,706	21.8	3,611	13.8	4,131	15.8	4,091	15.7	8,589	32.9	26,128	100.0	7.7
B	11,260	42.2	5,621	21.1	4,545	17.0	2,491	9.3	2,767	10.4	26,684	100.0	4.5
C	13,104	49.1	5,202	19.5	3,294	12.4	1,771	6.6	3,318	12.4	26,689	100.0	4.4
D	13,988	66.5	3,603	17.1	1,403	6.7	862	4.1	1,189	5.6	21,045	100.0	3.1
Other	4,747	95.5	222	4.5	0	--	0	--	0	--	4,969	100.0	1.1
County Total	48,805	46.3	18,259	17.3	13,373	12.7	9,215	8.7	15,863	15.0	105,515	100.0	4.8

NOTE: The data in this table reflect updates to the cropland soil erosion inventory, based upon field inspection of cropland in Priority Area A conducted in late spring and early summer of 1987 for the purpose of identifying appropriate erosion control practices. The data in this table, therefore, differ slightly from the cropland soil erosion inventory data, dated 1986, and presented in Tables 3 and 4 of Chapter III of this report.

Source: SEWRPC.

Table 10

CROPLAND SOIL EROSION RELATIVE TO T-VALUE IN WAUKESHA COUNTY BY PRIORITY AREA: 1987

Priority Area (See Map 11)	Cropland Eroding at 1.0 Times T-Value or Less		Cropland Eroding at More than 1.0 Times T-Value								Total Cropland		Average Soil Loss Rate in Multiples of T-Value
			Cropland Eroding at 1.1-2.0 Times T-Value		Cropland Eroding at 2.1-3.0 Times T-Value		Cropland Eroding at More than 3.0 Times T-Value		Subtotal				
	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	
A	7,902	30.3	6,906	26.4	4,991	19.1	6,329	24.2	18,226	69.7	26,128	100.0	2.1
B	14,901	55.8	7,810	29.3	2,343	8.8	1,630	6.1	11,783	44.2	26,684	100.0	1.1
C	16,921	63.4	5,727	21.5	1,746	6.5	2,295	8.6	9,768	36.6	26,689	100.0	1.1
D	17,060	81.1	2,287	10.9	939	4.4	759	3.6	3,985	18.9	21,045	100.0	0.8
Other	4,969	100.0	0	--	0	--	0	--	0	--	4,969	100.0	0.3
County Total	61,753	58.5	22,730	21.6	10,019	9.5	11,013	10.4	43,762	41.5	105,515	100.0	1.2

NOTE: The data in this table reflect updates to the cropland soil erosion inventory, based upon field inspection of cropland in Priority Area A conducted in late spring and early summer of 1987 for the purpose of identifying appropriate erosion control practices. The data in this table, therefore, differ slightly from the cropland soil erosion inventory data, dated 1986, and presented in Tables 5 and 6 of Chapter III of this report.

Source: SEWRPC.

Under mulch-till systems, the entire soil surface is disturbed by tillage before planting. Tillage implements may include chisel plows, disks, and field cultivators, with one primary pass and one or two secondary passes typically made. Chisel plowing is illustrated in Figure 4. Weed control is achieved through a combination of herbicides and cultivation. To be considered conservation tillage, residue cover should be at least 30 percent after planting. Mulch-till systems are also referred to as minimum- or reduced-till systems.

Under no-till systems, the soil is left essentially undisturbed from harvesting through planting (see Figure 5). Planting is done in a narrow seedbed about one to three inches wide. Weed control is achieved primarily through application of herbicides. Residue cover at planting is usually between 60 and 70 percent of the surface area, but may be as high as 80 to 90 percent.

A ridge-till system is a variation of no-till, under which about one-third of the soil surface is

Table 11

**CRITERIA UTILIZED TO IDENTIFY FARM FIELDS HAVING POTENTIAL ADVERSE IMPACTS
ON SURFACE- OR GROUNDWATER AS A RESULT OF EXCESSIVE SOIL EROSION**

Farm Fields Having Potential Adverse Impact on Surface Water	Farm Fields Having Potential Adverse Impact on Groundwater
<ol style="list-style-type: none"> 1. The runoff from the farm field enters a lake, stream, or pond—with an outlet—or a wetland bordering same, directly or through a channelized flow such as a gully, ditch, or natural swale 2. The runoff from the farm field ultimately drains to a lake, stream, or pond—with an outlet—or a wetland bordering same, but first travels by overland flow through other lands which do not adequately buffer the water resource^a 	<ol style="list-style-type: none"> 1. The runoff from the farm field drains to a depression or flat area with mineral soils less than two feet to bedrock or groundwater 2. The runoff from the farm field drains to a depression or flat area with organic soils 3. The runoff from the farm field drains to an internally drained wetland 4. The runoff from the farm field drains to a small pond with no outlet

^aThe determination of adequate buffer included a consideration of the type of lands that the runoff flowed through—meadow, woodland, cropland, and land slope. On slopes of 0 to 2 percent, adequate buffer consists of 100 feet of meadow, 150 feet of woodland, or 300 feet of cropland with hay rotation; on slopes of 2 to 6 percent adequate buffer consists of 150 feet of meadow or 250 feet of woodland; and on slopes of 6 to 12 percent adequate buffer consists of 200 feet of meadow or 300 feet of woodland. These buffer lengths apply to runoff from a watershed area of less than 40 acres. For watershed area greater than 40 acres, the minimum buffer length should be increased by 50 percent.

Source: Washington County Land Conservation Department and SEWRPC.

Figure 4

CHISEL TILLAGE PLOWING



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

Figure 5

ZERO TILLAGE PLANTING



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

Table 12

**COMPARISON OF MOLDBOARD PLOW AND CONSERVATION TILLAGE SYSTEMS
TYPICAL FIELD OPERATION, RESIDUE, AND MAJOR ADVANTAGES AND DISADVANTAGES**

System	Typical Field Operations	Percent Residue	Major Advantages	Major Disadvantages
Moldboard Plow	Fall or spring plow; two spring diskings; plant; cultivate	0-10	Prepares a fine seedbed Excellent pesticide and fertilizer incorporation opportunities Adaptable for poorly drained soils Full range of management options	Minimal erosion control High field costs and horsepower requirements Timeliness problems Can cause soil damage
Mulch-Till Chisel Plow	Fall or spring primary tillage; spring disk; plant; cultivate	30 or more	Very good erosion control Good pesticide and fertilizer incorporation opportunities Adaptable to many soil types High field efficiency capacity Wide range of management options	Easy to overtill soil High horsepower requirements Not suggested for rocky soils Rapid moisture loss possible in spring
Offset Disk	Fall or spring disk; spring disk; plant; cultivate	30 or more	Very good erosion control Good pesticide and fertilizer incorporation opportunities One-pass tillage possible on coarse soils Wide range of management options	Only tills 4-6 inches deep High horsepower requirements Not suggested for rocky soils Rapid moisture loss possible in spring
Ridge-Plant	Stalk chopping; planting on ridges; cultivate to maintain ridges	35-65	Good erosion control on contour Offers controlled traffic farming opportunities Suitable for more poorly drained soils Lower fuel/labor costs Lower horsepower requirements	Rotation options are limited Not recommended for slopes over 6-8 percent No pesticide or fertilizer incorporation opportunities Special equipment needed Requires special ridge maintenance and operation
No-Till	Spray; plant into undisturbed surface; postemergent spraying necessary	65-90	Maximum erosion control Low fuel/labor costs Low horsepower requirements Well suited for coarse-textured soils Improved soil structure	No pesticide or fertilizer incorporation opportunities Not suited to poorly drained soils More management skills required Increased dependence on chemicals

NOTE: This table pertains primarily to growing of corn.

Source: University of Wisconsin-Extension, "Conservation Tillage for Corn Handbook," 1986.

tilled at planting with sweeps or row cleaners. Planting is done on four- to six-inch-high ridges formed the previous year. Weed control is achieved through a combination of herbicides and cultivation. Residue cover after planting is between 35 and 65 percent of the soil surface. Strip-till systems are similar to ridge-till systems in that about one-third of the soil surface is tilled at planting. Planting, however, is done on a level surface rather than on ridges.

Typical field operations, percent residues, and major advantages and disadvantages for major types of conservation tillage systems and the conventional moldboard plow system are set forth in Table 12.

Conservation tillage systems result in a significant reduction in soil erosion. For continuous corn, for example, conservation tillage may reduce soil loss by 55 to 85 percent, compared to moldboard plowing (see Table 13). The potential for controlling soil erosion depends upon the amount of tillage, the type and amount of crop residue, and the roughness of the soil. While the various conservation tillage systems share certain common features—for example, increased residue levels over conventional tillage—the systems differ in regard to how they function. Mulch-till systems using chisel plowing create a roughened surface with residue on and in the surface. Much of the aggregate structure of the soil remains. The residue on the surface, the depression storage

caused by the rough surface, and the infiltration capability provided by the soil structure and residue in the surface combine to reduce soil erosion. No-till, in contrast, results in a smooth surface and almost complete retention of the soil structure, and possibly increased earthworm channels. The very high amounts of residue with no-till and the generally increased infiltration capacity combine to reduce the soil erosion.

While conservation tillage systems are effective in reducing soil erosion and sediment delivery to streams, there are concerns about the impacts of such systems—particularly no-till systems—on water quality. No-till systems typically utilize greater amounts of herbicides than do conventional systems. Moreover, no-till systems and other very high residue systems rely on surface application of pesticides. Sprayed on the surface, pesticides can more readily move with runoff during the weeks after application. Thus, there is a conflict between efforts to leave high residue levels for erosion control and the need to incorporate agricultural chemicals to lessen runoff losses. In contrast to no-till systems, mulch-till systems provide better opportunities for the incorporation of pesticides and fertilizers.

There is also concern regarding the potential impacts of conservation tillage on groundwater, although those impacts are not entirely clear. Increased surface roughness and crop residues tend to hold moisture on the field and may contribute to increased leaching. Moreover, “macropores” which carry water through structured soils are generally more continuous when soils are less disturbed. Thus, reducing tillage may enhance the movement of chemical solutes, particularly through soils having a strong structure. It can be reasonably concluded that no-till systems present a greater potential for groundwater contamination and accordingly require more careful management. It is recommended that use of no-till systems on a widespread basis be avoided within areas having a moderate or severe potential for groundwater contamination based upon the depth to bedrock, soil permeability, and depth to water table.

Conservation tillage systems are relatively new and the systems are still evolving. The environmental impacts of these systems are not fully understood. Given the water quality concerns noted above, it is essential that the use of conservation tillage systems to control cropland soil erosion be accompanied by careful management of agri-chemical inputs.

Table 13

ESTIMATED EFFECTIVENESS OF EROSION CONTROL PRACTICES

Primary Practices	Approximate Soil Loss Reduction ^a (percent)
Conservation Tillage (up and down the slope)	55 - 85
Contouring (moldboard plow)	10 - 50
Contour Strip-Cropping (moldboard plow)	75 - 95
Terracing (moldboard plow)	60 - 80
Crop Rotation (moldboard plow, up and down the slope)	Variable ^b
Grassed Waterways	Up to 99 in grassed channel
Permanent Vegetative Cover	Up to 99

^aIn comparison to soil loss assuming continuous corn and moldboard plowing up and down the slope.

^bDepends upon type and sequence of crops grown.

Source: U. S. Soil Conservation Service, Waukesha County Land Conservation Department, and SEWRPC.

Crop Rotation: Crop rotation is a cropping system in which row crops, small grains, and legumes are grown in a planned sequence to reduce soil erosion. This sequence may be used on an entire field or as strips on one field. Forage-based rotations reduce soil erosion and direct runoff. Soil loss from a good-quality grass and legume meadow is negligible. When the sod is plowed, residual effects improve infiltration, leaving the soil less erodible. The effects of the sod are greatest during the first year, but are also significant during the second year. Rotating two kinds of row crop or row crop and small grain is not as effective as including forage crops in the rotation, but may aid in control of some diseases and pests, and usually reduces the amount of herbicides required, a particularly important consideration. The impact of crop rotations on soil erosion thus depends on the type and sequence of crops grown. For example, changing from continuous corn to a rotation of three years of corn, one year of oats,

and three years of hay would reduce average annual soil loss by about 57 percent. Changing from continuous corn to a rotation of one year of corn, one year of oats, and four years of hay would reduce average annual soil loss by about 83 percent.

Advantages of this system include:

1. Reduced pesticide, herbicide, and fertilizer use.
2. The system is easy to implement.

Disadvantages of the system include:

1. The major reason for the long-term soil loss reduction is reduced erosion from the periods of legume or small grain cover, and the erosion from row crops is only slightly reduced during the years when row crops are grown.
2. The system is most applicable on farms where both row crops and legumes are needed in the farming operation.

Contouring: Contouring is a planting practice in which the crop rows follow the land contours across the slope. The average soil loss reduction from contouring is about 50 percent on moderate slopes, but less on steeper slopes.

The advantages of contouring are:

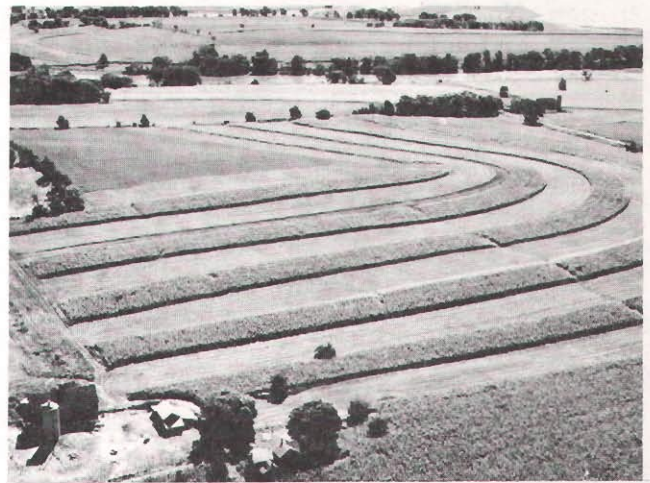
1. Erosion control is provided for storms with up to moderate levels of rainfall.
2. The greatest effectiveness is on 3 to 8 percent slopes.

The disadvantages of contouring are:

1. The practice is ineffective for severe rainstorms.
2. On long slopes, the practice needs to be supported by terraces or runoff diversions.
3. Following field contour lines with large equipment is time-consuming, and point rows are often encountered.
4. With poorly drained soils, contouring may aggravate wetness problems.

Figure 6

CONTOUR STRIP-CROPPING



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

Contour Strip-Cropping: Contour strip-cropping is a method of growing crops in a systematic arrangement of alternating strips or bands of hay and crops which follow the land contours across the slope (see Figure 6). High-quality hay strips 100 to 125 feet in width may filter 75 percent or more of the suspended soil from the runoff from the cultivated strips. Strip-crop systems using a four-year rotation—two years of meadow, one of row crop, and one of small grain in which new meadow is established—reduce soil loss to about half of the average for the same rotation contour farmed without the alternating strips, or about 25 percent of the rotation average with the rows up and down a moderate slope. The soil loss reduction from contour strip-cropping ranges from 75 percent to 95 percent.

Contour strip-cropping is most applicable for farmers who need both row crops and hay in their farming operations.

Cover Crops: Cover crops are crops of close growing grasses, legumes, or small grain used primarily for seasonal protection and for soil improvement. The crop usually occupies land for a period of one year or less. The purposes of the cover crop are to provide vegetative protection from soil erosion by wind and water during periods when the major crops do not furnish adequate cover; to add organic material to the soil; and to improve infiltration, aeration, and tilth.

Depending on weather conditions in any given year, a cover crop may be a help or a hindrance. If the soil wetness in the spring is a problem, the early growth of a wheat cover crop can enable earlier corn planting by removing excess water from the soil. Conversely, if soil moisture supplies are critical, water used for growth of the winter cover crop may reduce the amount of water available to the primary crop later in the growing season and thereby lower crop yields. An example of a cover crop is spring oats planted in the fall after harvesting a row crop. The growing oats freeze, but the tops protect the soil during the winter. The soil loss reduction from cover crops will vary depending upon that crop which preceded the cover crop, the time that the cover crop was planted, and the type of cover crop used.

Terracing: A terrace system is a series of earth embankments or ridges and channels constructed across the slope at a prescribed spacing. Terraces reduce the slope length by dividing the overall slope into segments. The soil loss reduction from terracing can range from 60 percent to 80 percent.

The most common types of terraces used in southeastern Wisconsin are the farmable terrace and the vegetated ridge terrace. The selection of the type of terrace system is determined by the inherent soil and slope conditions and the crop management practices employed on the field. Farmable terraces are used on gently sloping land. The ridges of these terraces have relatively flat front and back slopes and are entirely farmable (see Figure 7).

The vegetated ridge terrace is used on steep land. The ridges of this type of terrace system have steep front and back slopes. The ridges and channels are not farmable and are maintained in erosion-resistant vegetation (see Figure 8).

Terraces may use underground outlets or channels to collect and transport runoff water from the field.

Grassed Waterways: Grassed waterways and outlets are natural drainageways or constructed channels shaped to required dimensions and maintained in erosion-resistant perennial vegetation (see Figure 9). Grassed waterways collect and transport runoff water from fields, diversions, terraces, or other structures. A grass-lined waterway reduces erosion by lowering water flow velocity over the soil surface and binding the surface soil particles with grass roots. The soil loss reduction

from grassed waterways ranges up to 99 percent in the grassed channel.

Although periodic mowing is required, grassed waterways are aesthetically pleasing and offer cover for wildlife, especially when mowing is delayed until mid-summer.

Permanent Vegetative Cover: Permanent vegetative cover refers to the conversion of very erodible cropland to a less intensive use, involving the establishment of a permanent vegetative cover, such as perennial grasses, legumes, forbs, shrubs, or trees. The soil loss reduction from permanent vegetative cover ranges up to 99 percent.

Recommended Soil Erosion Control Practices

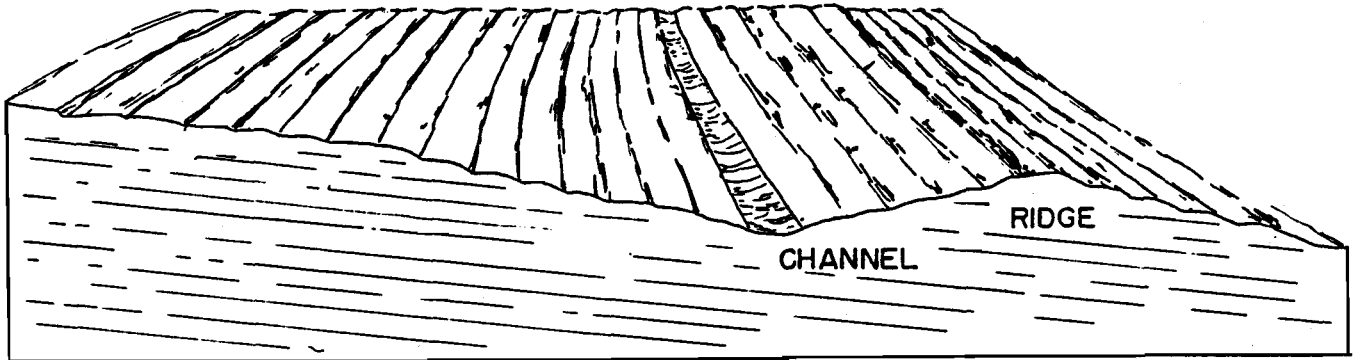
Under the soil erosion control planning program, a determination was made of the types of soil erosion control practices that would be the most effective in addressing the soil erosion problems identified in Waukesha County as described in Chapter III. The plan emphasizes solutions involving changes in management practices rather than solutions involving structural practices such as terracing, which typically have high installation costs. Moreover, in identifying potential management practices, the plan emphasizes those practices that allow farmers to continue to raise essentially the same types of crops as in the recent past.

**Recommended Soil Erosion Control Practices—
Priority Area A:** Under the soil erosion control planning program, a specific erosion control practice or set of practices was identified for each farm field in Priority Area A which had been identified as experiencing excessive soil erosion—that is, erosion in excess of T-value. Such fields were inspected in late spring and early summer of 1987 in an effort to identify appropriate erosion control practices. The universal soil loss equation was utilized to ensure the identification of practices which would reduce soil loss to tolerable levels. The types and amounts of practices recommended to be applied to excessively eroding cropland in Priority Area A are summarized in Table 14.

As indicated in Table 14, the plan recommends that some form of conservation tillage be utilized on most of the excessively eroded croplands in the area. More specifically, reduced tillage systems leaving between 30 and 40 percent of the surface area covered by crop residue after planting are recommended for 11,586 acres, or 63.6 percent of

Figure 7

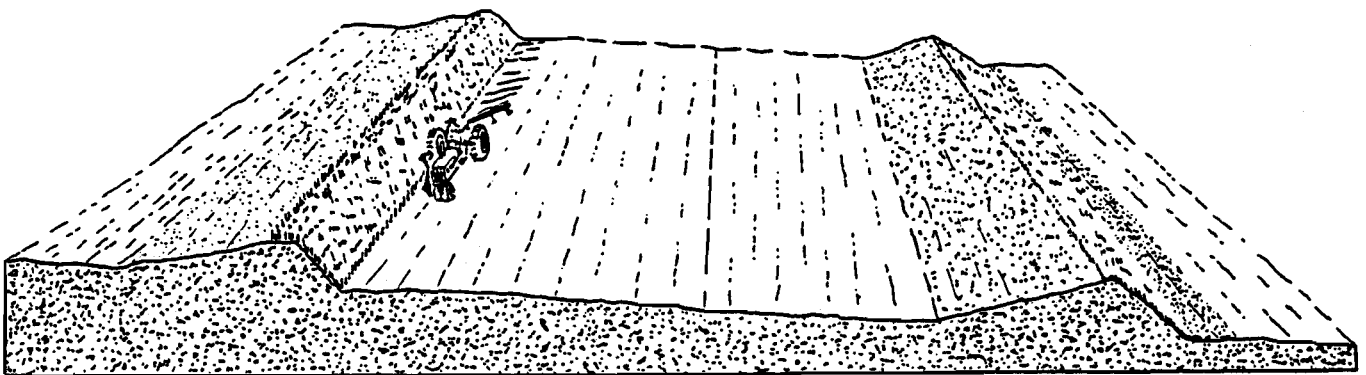
FARMABLE TERRACE



Source: U. S. Department of Agriculture, Soil Conservation Service; and Waukesha County Land Conservation Department.

Figure 8

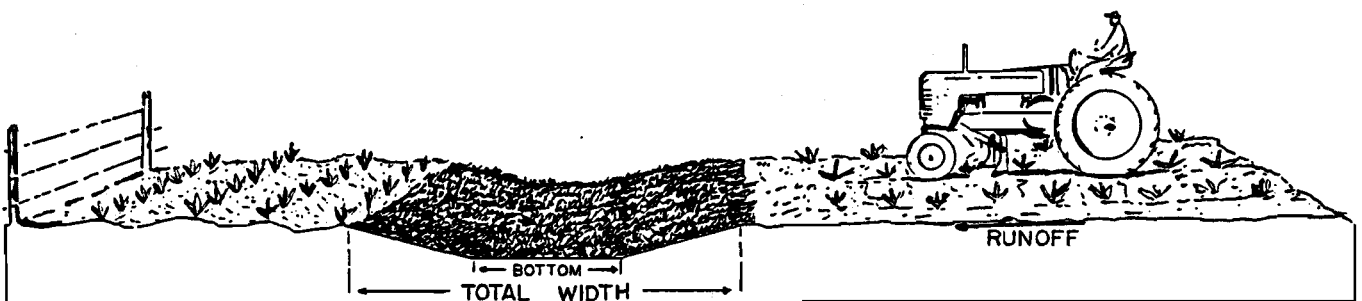
VEGETATED RIDGE TERRACE



Source: U. S. Department of Agriculture, Soil Conservation Service; and Waukesha County Land Conservation Department.

Figure 9

GRASSED WATERWAY



Source: U. S. Department of Agriculture, Soil Conservation Service; and Waukesha County Land Conservation Department.

the excessively eroding cropland; reduced tillage systems leaving between 40 and 60 percent of the surface area covered by crop residue after planting are recommended for 3,779 acres, or 20.7 percent of the excessively eroding cropland; and no-till systems leaving between 60 and 70 percent of the surface area covered by crop residue after planting are recommended for 2,778 acres, or 15.2 percent of the excessively eroding cropland.² Under the plan, the remainder of the excessively eroding cropland in Priority Area A—83 acres, or about 0.5 percent of the total—would be taken out of production and permanent vegetative cover established, owing to the steepness and complexity of the slope.³

² *There are many forms of conservation tillage, having varying potential for controlling soil erosion. For purposes of the county soil erosion control plan, three forms of conservation tillage, intended to be representative of the range of conservation tillage systems available, were hypothesized. Two of these are referred to as reduced tillage systems, and the third is referred to as a zero tillage, or no-till, system. The first of the reduced tillage systems assumes a combination of chisel tillage and disk tillage so that between 30 and 40 percent of the soil surface is covered by crop residue after planting. The second reduced tillage system assumes a single pass—either chisel tillage or disk tillage—so that between 40 and 60 percent of the soil surface is covered by crop residue after planting. The zero tillage system assumes the elimination of almost all tillage and no seedbed preparation before planting, with between 60 and 70 percent of the soil surface covered by crop residue after planting.*

³ *Under the county soil erosion control planning program, permanent vegetative cover was recommended on a limited basis—primarily for small, isolated, very erodible portions of fields that would otherwise require management systems markedly different from that of the remainder of the field. It should be noted that in addition to the limited acreage specifically recommended herein for permanent vegetative cover, considerable additional cropland identified by the U. S. Soil Conservation Service as “highly erodible” may be placed in permanent vegetative cover under the federal Conservation Reserve Program, which is described in Chapter VI of this report.*

Some of the excessively eroding cropland in Priority Area A would require other management changes, in addition to the use of conservation tillage, in order to reduce soil erosion to tolerable levels. As indicated in Table 14, contour plowing is recommended for 1,134 acres, or 6 percent of the excessively eroding cropland; and changes in rotation—generally by replacing one or two years of a row crop with one or two years of hay—have been recommended for 374 acres, representing about 2 percent of the excessively eroding cropland.

In addition to the management practices described above, grassed waterways would be required on some fields to help convey concentrated runoff from the fields, thereby preventing gully erosion. The need for 14,950 feet of such waterways on cropland within Priority Area A has been identified.

The reliance on conservation tillage as the primary method to reduce cropland soil erosion in Waukesha County to a tolerable level requires a concomitant effort to judiciously manage agri-chemical inputs. The need for such management is borne out of both economic and environmental necessities. On the environmental side, there is increasing public concern over the excessive use of not only pesticides—insecticides, herbicides, and fungicides—but also fertilizers which may pollute surface- and groundwaters. Concerns regarding the long-term adverse effects of widespread chemical usage on human and animal life are becoming as real among rural land operators as they are among the rest of society. On the economic side, judicious chemical usage can help ensure farm profitability. For these reasons, the careful monitoring of all agricultural inputs is important.

Conservation tillage systems may require lesser fuel and man-hour inputs, and greater pesticide inputs. The levels of pesticides and fertilizers used in some conventionally tilled fields, however, would allow some operators to successfully convert to forms of conservation tillage without an increase in chemical usage. In some instances, in fact, careful monitoring and management of a conservation tillage operation may actually permit a decrease in chemical usage. Sometimes called “low- or reduced-input agriculture,” this approach seeks to retain farm profitability while protecting the environment. Under such a program, the savings to the farm operator in reduced chemical usage offsets any yield declines that may result.

Table 14

**RECOMMENDED SOIL EROSION CONTROL PRACTICES FOR CROPLAND HAVING A
SOIL LOSS RATE GREATER THAN T-VALUE BY PRIORITY AREA IN WAUKESHA COUNTY**

Management Practice	Priority Area A	Priority Area B	Priority Area C	Priority Area D	County Total
Conservation Tillage					
Reduced Tillage: 30-40 Percent Residue (acres)	11,586	8,021	6,441	2,645	28,693
Reduced Tillage: 40-60 Percent Residue (acres)	3,779	2,284	1,967	780	8,810
Zero Tillage: 60-70 Percent Residue (acres)	2,778	1,455	1,343	538	6,114
Subtotal	18,143	11,760	9,751	3,963	43,617
Permanent Vegetative Cover (acres)	83	23	17	22	145
Contour Plowing (acres)	1,134	466	481	213	2,294
Rotation Change (acres)	374	148	149	73	744
Grassed Waterways (feet)	14,950	9,660	8,010	3,270	35,890

NOTE: Within Priority Area A, excessively eroding farm fields were inspected in late spring and early summer of 1987 in an effort to identify appropriate erosion control practices, using the universal soil loss equation to ensure the identification of practices that would reduce soil loss to tolerable levels. Estimates of the conservation practices required to address identified cropland soil erosion control problems in Priority Areas B, C, and D were subsequently developed based upon the proportional relationships between the practice levels and the excessively eroding cropland acreage for Priority Area A.

Source: SEWRPC.

Thus, static or even fewer bushels-per-acre may translate into equal or greater net proceeds—and the environmental gains are clearly apparent.

Embodying these concepts are integrated pest management programs. Here, pest infestation levels—typically insects or weeds—are monitored closely throughout the growing season. Random locations within fields are sampled for the presence and relative abundance of pests, their developmental stages with respect to the crop grown, and their potential for adversely affecting yields. In some locations, spot treatment may be prescribed to keep pest population levels in check. More often, infestations are evaluated against their potential to significantly lower yields. In some cases, no pesticide application is made as the cost of treatment is found to equal or

exceed the cost of projected yield reductions. In other cases, the pests are brought under control to ensure profitability, but application is timed and measured so as to work most effectively. Through such programs, the conventional or routine application of chemicals is minimized. The same type of approach can be used to ensure the judicious application of fertilizers.

With respect to potential environmental problems, there is also the matter of selecting the most appropriate conservation tillage system for a given site. Where possible, this plan recommends using the least chemically intensive system possible to achieve erosion control objectives. The chisel plow and/or offset disk systems providing for 30 to 40 percent surface residue—the conservation tillage method recommended for 65 percent of

cropland eroding in excess of tolerable levels—as previously noted, may require relatively modest changes in chemical inputs compared to their moldboard plowed counterpart. However, it is clear that proper management and conservative use of inputs are keys for any tillage systems—conservation and conventional.

In addition, during implementation of the soil erosion control plan, as detailed farm conservation plans are prepared, an effort should be made to substitute other management measures such as contour plowing, contour strip-cropping, and changes in rotations for conservation tillage, where applicable, in order to reduce the need for chemicals. Indeed, some farm operators may choose to utilize management solutions other than conservation tillage. Decisions regarding management practices, to a great extent, are based on economics, but should also consider other variables, including perceived risks; uncertainty; farmer attitudes, preferences, and education; size of operation; and tenure—as well as potential environmental impacts. Farm operators should be encouraged to utilize conservation practices other than conservation tillage when the operator exhibits a general lack of sensitivity concerning potential surface- or groundwater pollution. Use of no-till systems in particular should be discouraged on farmlands located in areas susceptible to groundwater contamination.

Recommended Soil Erosion Control Practices—Balance of County: Under the county soil erosion control planning program, determinations of the conservation practices required to address identified problems in Priority Areas B, C, and D were made based upon the proportional relationships between the practice levels and the excessively eroding cropland acreage for Priority Area A. The resulting estimates for Priority Areas B, C, and D as well as for the County overall are also set forth in Table 14. As indicated in that table, reduced tillage systems leaving between 30 and 40 percent crop residue after planting would be required for 28,693 acres, or 65.6 percent of the excessively eroding cropland in the County; reduced tillage systems leaving 40 to 60 percent residue would be required for 8,810 acres, or 20.1 percent of the excessively eroding cropland; and zero tillage systems leaving between 60 and 70 percent residue would be required for 6,114 acres, or 14.0 percent of the excessively eroding cropland. Under the plan, about 145 acres, or about 0.3 percent of the

excessively eroding cropland, would be taken out of production and placed in permanent vegetative cover.

In addition to conservation tillage, contour plowing and rotation changes would be implemented on 2,294 acres and 744 acres, respectively, of excessively eroding cropland. Approximately 35,890 feet of grassed waterway would be required within the County.

Costs of Recommended Practices

Of the soil erosion control practices specified in Table 14, implementation costs may be readily estimated for two practices—namely, grassed waterways and permanent vegetative cover. The cost of installing grassed waterways without tiles, including a 10 percent allowance for required design work, would approximate \$118,400 for the County overall, including \$49,300 in Priority Area A, \$31,900 in Priority Area B, \$26,400 in Priority Area C, and \$10,800 in Priority Area D. The cost of establishing permanent vegetative cover would approximate \$9,400 countywide, including \$5,400 in Priority Area A, \$1,500 in Priority Area B, \$1,100 in Priority Area C, and \$1,400 in Priority Area D.

The costs of implementing the other recommended practices—including, importantly, conservation tillage systems—are far more difficult to specify. Of concern to the farmer is the difference in net return as the farmer shifts from conventional cropping to a form of conservation tillage. On one hand, net return may be adversely affected by potentially decreased yields, although in some cases yields could actually increase; by potentially greater use of pesticides; and by a potential initial capital outlay for specialized equipment used in some conservation tillage systems. On the other hand, net return may be positively affected by lower fuel consumption and lower operation and maintenance costs because conservation tillage systems involve fewer tillage operations. Moreover, in the long term, net return may be positively affected owing to the maintenance of natural soil productivity. The impacts on net return of shifting from conventional to conservation tillage may be expected to vary from farm to farm, depending upon the size of operation; the physical characteristics of the farm, including soil and topographic characteristics; the types of crops grown; and the type and condition of existing farm machinery.

CONSERVATION PLANNING REQUIREMENTS

While the county soil erosion control plan identifies the general types of practices which may be utilized to control soil erosion, detailed farm conservation plans will be required to adapt and refine those recommendations for individual farm units. Conservation plans are detailed plans, generally prepared with the assistance of the U. S. Soil Conservation Service or County Land Conservation Department staffs, intended to guide agricultural activity in a manner which conserves soil and water resources. The conservation plan indicates desirable tillage practices, cropping patterns, and rotation cycles, considering the specific topography, hydrology, and soil characteristics of the farm, together with the specific resources of the farm operator and the operator's objectives as owner or manager of the land. Farm conservation plans have been prepared in the recent past for about 110 farms, or about 11 percent of the total of 980 farm operations in Waukesha County. This includes about 60 plans recently completed by the Waukesha County Land Conservation Department and the U. S. Soil Conservation Service to assist farmers in meeting the soil erosion compliance requirements of the Wisconsin Farmland Preservation Program, and about 50 plans recently completed by the U. S. Soil Conservation Service to assist farmers in meeting the federal conservation compliance requirements established under the Food Security Act of 1985.⁴ No additional conservation planning would be required for these farms during implementation of the county soil erosion control plan.

Plans for an estimated 200 farms, or just over 20 percent of all farms in Waukesha County, prepared in the more distant past under the U. S. Soil Conservation Service continuing technical assistance program remain substantially intact, but would require review and updating during implementation of the county soil erosion control plan.

The remaining 670 farms, representing just over 68 percent of all farms in the County, have

⁴ *The soil erosion compliance requirements of the Wisconsin Farmland Preservation Program and the federal conservation compliance requirements of the Food Security Act of 1985 are described in Chapter VI of this report.*

Table 15

ANTICIPATED FARM CONSERVATION PLANNING ACTIVITY UNDER THE WAUKESHA COUNTY SOIL EROSION CONTROL PLAN

Priority Area	Farms with Conservation Plans Requiring Review and Updating	Farms Requiring the Preparation of New Conservation Plans
A	52	165
B	53	169
C	53	169
D	42	133
Total	200	636

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

conservation plans that are outdated or have no farm conservation plans whatsoever. It is estimated that at least 5 percent, or 34, of these farms are not experiencing any excessive cropland soil erosion and, accordingly, would not require a farm conservation plan. It is anticipated that farm plans would be prepared for the balance—about 636 farms—during implementation of the county soil erosion control plan.

Estimates of the farm conservation planning activity required within the four erosion control priority areas are set forth in Table 15. In developing these estimates, it was assumed that the number of farms requiring preparation or revision of farm conservation plans is proportional to the total cropland acreage of each priority area.

As indicated in Chapter III of this report, wind erosion and stream bank erosion are not considered to be significant problems in Waukesha County, and such problems that may exist are considered to be localized in nature. The detailed farm conservation planning described above will address any apparent wind erosion or stream bank erosion problems.

PROPOSED TIME FRAME

As indicated in Chapter IV, the long-range objective of the county soil erosion control plan is the reduction of soil erosion on all cropland in Waukesha County to tolerable levels by the year 2000. In order to meet this objective, it is recommended that, to the extent practicable, available public soil erosion control resources be directed toward the resolution of soil erosion problems in Priority Area A during the years 1988 through 1990; in Priority Area B from 1991 through 1993; in Priority Area C from 1994 through 1996; and in Priority Area D from 1997 through 1999. This arrangement, it should be noted, would provide a very uniform work load for the concerned county and federal agency staff, particularly in terms of preparing and updating farm conservation plans.

A summary of cropland soil erosion rates in Waukesha County, assuming that soil erosion problems in Priority Areas A, B, C, and D are addressed sequentially according to the time frame described above, is set forth in Tables 16 and 17. As shown in Table 17, adherence to the proposed time frame would reduce the acreage of excessively eroding cropland from 43,762 acres, or 41.5 percent of all cropland in the County in 1987, to 25,536 acres, or 24.2 percent of all cropland by the end of 1990; to 13,753 acres, or 13 percent of all cropland by the end of 1993; to 3,985 acres, or 3.8 percent of all cropland by the end of 1996; and to zero acres by the end of 1999.

CONCLUDING REMARKS

The soil erosion control plan set forth in this chapter identifies the amounts and types of soil erosion control practices necessary to reduce cropland soil erosion in Waukesha County to tolerable levels; identifies priority areas for cropland soil erosion within the County; identifies the detailed farm conservation planning activities required to help implement the recommended practices; and identifies the time frame for addressing identified soil erosion control problems within the priority areas.

The plan recommends shifting from conventional cropping systems to conservation tillage systems as the primary means of controlling cropland soil erosion in the County. Thus, under the recommended plan, reduced tillage systems leaving between 30 and 40 percent crop residue after planting would be required on 28,693 acres, or 65.6

percent of the excessively eroding cropland in the County; reduced tillage systems leaving 40 to 60 percent residue would be required on 8,810 acres, or 20.1 percent of the excessively eroding cropland; and zero tillage systems leaving between 60 and 70 percent residue would be required on 6,114 acres, or 14 percent of the excessively eroding cropland. Under the plan, about 145 acres, or about 0.3 percent of the excessively eroding cropland, would be taken out of production and placed in permanent vegetative cover. In addition to conservation tillage, contour plowing and rotation changes would be implemented on 2,294 acres and 744 acres, respectively, of excessively eroding cropland. Approximately 35,890 feet of grassed waterway would be required within the County.

The reliance on conservation tillage as the primary method to reduce cropland soil erosion in Waukesha County to a tolerable level requires a concomitant effort to judiciously manage agri-chemical inputs. The need for such management is borne out by both economic and environmental necessities. On the environmental side, there is increasing public concern over the excessive use of not only pesticides—insecticides, herbicides, and fungicides—but also fertilizers which may pollute surface- and groundwaters. Concerns regarding the long-term adverse effects of widespread chemical usage on human and animal life are becoming as real among rural farm operators as they are among the rest of society. On the economic side, judicious chemical usage can help ensure farm profitability. For these reasons, the careful monitoring of all agricultural inputs is important. Farmers should be encouraged to adopt integrated pest management systems to keep pest problems below economically damaging levels, while at the same time minimizing undesirable impacts on the environment. Farmers should be encouraged to use management practices such as contour plowing and changes in rotations, where feasible, instead of conservation tillage when the operator exhibits a general lack of sensitivity concerning potential surface- or groundwater pollution. Use of no-till systems in particular should be discouraged on farmland located in areas susceptible to groundwater contamination.

While the county soil erosion control plan identifies the general types of practices that may be utilized to control soil erosion, detailed farm conservation plans will be required to adapt and refine those recommendations for individual farm units. Farm conservation plans are detailed

Table 16

**CROPLAND SOIL EROSION RATES IN WAUKESHA COUNTY UPON
IMPLEMENTATION OF RECOMMENDED SOIL EROSION CONTROL PRACTICES**

Condition	Cropland Eroding at Less than 3.0 Tons/Acre/Year		Cropland Eroding at 3.0-4.9 Tons/Acre/Year		Cropland Eroding at 5.0-6.9 Tons/Acre/Year		Cropland Eroding at 7.0-8.9 Tons/Acre/Year		Cropland Eroding at 9.0 Tons/Acre/ Year or More		Total Cropland		Average Soil Loss Rate: Tons/Acre/Year
	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	
Existing Conditions: 1987	48,805	46.3	18,259	17.3	13,373	12.7	9,215	8.7	15,863	15.0	105,515	100.0	4.8
Conditions upon Implemen- tation of Soil Erosion Control Practices in Priority Area A—by 1990	49,433	46.8	33,638	31.9	10,046	9.5	5,124	4.9	7,274	6.9	105,515	100.0	3.7
Conditions upon Implemen- tation of Soil Erosion Control Practices in Priority Areas A and B—by 1993	49,523	46.9	42,118	39.9	6,734	6.4	2,633	2.5	4,507	4.3	105,515	100.0	3.3
Conditions upon Implemen- tation of Soil Erosion Control Practices in Priority Areas A, B, and C—by 1996	49,611	47.0	49,628	47.1	4,225	4.0	862	0.8	1,189	1.1	105,515	100.0	2.8
Conditions upon Implemen- tation of Soil Erosion Control Practices in Priority Areas A, B, C, and D—by 1999	49,633	47.0	52,633	49.9	3,249	3.1	0	--	0	--	105,515	100.0	2.6

Source: SEWRPC.

Table 17

**CROPLAND SOIL EROSION RELATIVE TO T-VALUE IN WAUKESHA COUNTY
UPON IMPLEMENTATION OF RECOMMENDED SOIL EROSION CONTROL PRACTICES**

Condition	Cropland Eroding at 1.0 Times T-Value or Less		Cropland Eroding at More than 1.0 Times T-Value								Total Cropland		Average Soil Loss Rate in Multiples of T-Value
			Cropland Eroding at 1.1-2.0 Times T-Value		Cropland Eroding at 2.1-3.0 Times T-Value		Cropland Eroding at More than 3.0 Times T-Value		Subtotal				
	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	
Existing Conditions: 1987	61,753	58.5	22,730	21.6	10,019	9.5	11,013	10.4	43,762	41.5	105,515	100.0	1.2
Conditions upon Implemen- tation of Soil Erosion Control Practices in Priority Area A—by 1990	79,979	75.8	15,824	15.0	5,028	4.8	4,684	4.4	25,536	24.2	105,515	100.0	0.9
Conditions upon Implemen- tation of Soil Erosion Control Practices in Priority Areas A and B—by 1993	91,762	87.0	8,014	7.6	2,685	2.5	3,054	2.9	13,753	13.0	105,515	100.0	0.8
Conditions upon Implemen- tation of Soil Erosion Control Practices in Priority Areas A, B, and C—by 1996	101,530	96.2	2,287	2.2	939	0.9	759	0.7	3,985	3.8	105,515	100.0	0.7
Conditions upon Implemen- tation of Soil Erosion Control Practices in Priority Areas A, B, C, and D—by 1999	105,515	100.0	0	--	0	--	0	--	0	--	105,515	100.0	0.7

Source: SEWRPC.

plans, generally prepared with the assistance of the U. S. Soil Conservation Service or County Land Conservation Department staffs, indicating desirable tillage practices, cropping patterns, and rotation cycles, considering the specific topography, hydrology, and soil characteristics of the farm, together with the specific resources of the farm operator and the operator's objective as owner and manager of the land. It is anticipated that existing farm conservation plans for an estimated 200 farms will require review and updating during implementation of the county soil erosion plan. It is further anticipated that farm plans will be prepared for about 636 farms that have outdated plans or no plans whatsoever.

The soil erosion control plan also recommends a rank ordering of areas of the County for erosion control, providing a general framework to guide the concerned county, state, and federal agencies in efforts to address soil erosion problems in the County. Four priority areas, each consisting of groups of U. S. Public Land Survey sections, have been identified based upon soil erosion rates and the amount of excessive erosion occurring (see Map 11). Priority Area A consists of those U. S. Public Land Survey sections having an average

soil loss rate of at least 1.5 times T-value and at least 100 acres of cropland with a soil loss rate exceeding T-value. Priority Area B consists of those other U. S. Public Land Survey sections having at least 100 acres of cropland with a soil loss rate exceeding T-value. Priority Area C consists of those U. S. Public Land Survey sections having between 50 and 99 acres of cropland with a soil loss rate exceeding T-value. Priority Area D consists of those U. S. Public Land Survey sections having between 1 and 49 acres of cropland with a soil loss rate exceeding T-value. The plan recommends that in order to meet the long-range objective of reducing soil erosion on all cropland in Waukesha County to tolerable levels by the year 2000, available public soil erosion control resources be directed toward the resolution of soil erosion problems in Priority Area A during the years 1988 through 1990; in Priority Area B during the years 1991 through 1993; in Priority Area C during the years 1994 through 1996; and in Priority Area D during the years 1997 through 1999. A description of the technical assistance and financial assistance programs of the concerned county, state, and federal agencies, along with specific recommendations regarding the use of those programs in Waukesha County, is set forth in the next chapter of this report.

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Chapter VI

PLAN IMPLEMENTATION

The recommended soil erosion control plan described in the previous chapter of this report provides a guide for addressing cropland soil erosion control problems in Waukesha County in an effort to reduce such erosion throughout the County to tolerable levels by the year 2000. In a practical sense, however, the plan is not complete until the steps required to implement the plan have been specified. Accordingly, this chapter outlines the actions which must be taken by the various units and agencies of government concerned if the recommended plan is to be carried out. Those units and agencies of government which have plan adoption and plan implementation responsibilities applicable to the soil erosion control plan are identified; desirable plan adoption actions are specified; and specific implementation activities are recommended.

PLAN IMPLEMENTATION AGENCIES

Implementation of the soil erosion control plan depends on the cooperative actions of a number of county, state, and federal units or agencies of government. Those units or agencies of government whose actions will have a significant effect, either directly or indirectly, upon the successful implementation of the recommended soil erosion control plan include, at the county level, the Waukesha County Board, the Waukesha County Land Conservation Committee, and the Waukesha County Park and Planning Commission; at the state level, the Wisconsin Department of Agriculture, Trade and Consumer Protection, the Wisconsin Department of Natural Resources, and the University of Wisconsin-Extension; and at the federal level, the U. S. Department of Agriculture—Agricultural Stabilization and Conservation Service, Soil Conservation Service, and Farmers Home Administration. The powers and programs of these agencies and units of government which may be brought to bear on soil erosion problems in the County are summarized below.

County Level

Waukesha County Land Conservation Committee: Created under Chapter 92 of the Wisconsin Statutes, the Waukesha County Land Conservation Committee has broad authority and responsibilities for the conservation and protection of

the soil and water resources of Waukesha County. The Land Conservation Committee has authority to engage in technical assistance activities intended to facilitate implementation of resource conservation operations and works of improvement for flood prevention and for the conservation, development, utilization, and protection of soil and water resources. The Land Conservation Committee may conduct information and education programs and assist other agencies, including the University of Wisconsin system, in implementing educational programs. The Land Conservation Committee is responsible for administering the soil erosion control requirements of the Wisconsin Farmland Preservation Program in the County. The Land Conservation Committee has the authority to administer cost-sharing programs, such as the Wisconsin Department of Natural Resources Priority Watersheds Program, and other incentive programs for improvements and practices relating to soil and water conservation.

Waukesha County Board: The Waukesha County Board determines the level of county funding of the Land Conservation Committee in carrying out its various responsibilities as described above. The County Board thus has ultimate authority over the types and levels of county-sponsored activities for the conservation and protection of the soil and water resources of Waukesha County. The Waukesha County Board also has authority under Section 92.11 of the Wisconsin Statutes to adopt ordinances for the regulation of land use and land management practices—including, potentially, ordinances controlling excessive soil erosion.

Waukesha County Park and Planning Commission: The Waukesha County Park and Planning Commission has important park and land use planning and land use regulatory responsibilities in Waukesha County. The general county zoning ordinance—administered by the Waukesha County Park and Planning Commission through its staff in the County Park and Planning Department—is in effect in the Towns of Eagle, Genesee, Oconomowoc, Ottawa, and Vernon. The shoreland and floodland protection ordinance

administered by the Park and Planning Commission is in effect within shoreland areas throughout the unincorporated area of Waukesha County. General zoning powers and floodland-shoreland regulatory powers are used on a limited basis to prevent excessive cropland soil erosion in Waukesha County.

State Level

Wisconsin Department of Agriculture, Trade and Consumer Protection: The Wisconsin Department of Agriculture, Trade and Consumer Protection has a wide range of responsibilities with regard to the conservation and protection of soil and water resources in the State. The Department is responsible for administration of the recently created state Soil and Water Resources Management Program. That program, created as part of the 1987-1989 State Budget Bill, represents a consolidation and restructuring of several previous programs—namely, the Wisconsin Farmers Fund, the Erosion Control Program, and the Conservation Aids Program—into a single program intended to more effectively address soil and water conservation problems in the State. The consolidation represents a general shift away from direct financial assistance to landowners for implementation of soil and water conservation practices, with greater emphasis placed upon the financial support of county technical assistance activities. During the 1987-1989 biennium, first priority for the use of available soil and water resources management program funds is the continued provision of financial support to counties for the maintenance of county conservationist positions. A second priority is the provision of financial support for additional county staff working to implement key state soil and water conservation programs—including, in particular, county staff retained to assist farmers in their efforts to comply with the soil conservation requirements of the Wisconsin Farmland Preservation Program.

The Wisconsin Department of Agriculture, Trade and Consumer Protection is also the lead agency responsible for administering the Wisconsin Farmland Preservation Program in the State. That program combines planning and zoning provisions with tax incentives for the purpose of ensuring the long-term preservation of agricultural lands. Farmers in southeastern Wisconsin seeking a Farmland Preservation Program tax credit must have their lands zoned for agricultural use under a state-certified exclusive agricultural

zoning district. In addition, to be eligible, farmers must also comply with county-adopted soil conservation standards, so that soil erosion is kept at or below tolerable levels.

Finally, the Wisconsin Department of Agriculture, Trade and Consumer Protection is responsible for administering the soil erosion control planning program established under Section 92.10 of the Wisconsin Statutes. Under that section of the Statutes, each “priority” county in the State, including Waukesha County, is required to prepare a countywide soil erosion control plan, focusing on cropland soil erosion. The plan documented in this report is intended to fulfill that planning requirement for Waukesha County. All such plans must be submitted for review to the Wisconsin Land Conservation Board and the Department of Agriculture, Trade and Consumer Protection. The Department must act to approve or disapprove the plans after reviewing the recommendations of the Land Conservation Board.

Wisconsin Department of Natural Resources: The Wisconsin Department of Natural Resources has broad authority and responsibility in the areas of natural resource protection and water quality control. The priority watershed program administered by the Department is designed to maintain and improve the quality of lakes and streams by reducing nonpoint sources of pollution, including cropland soil erosion. Many of the land management practices which the priority watershed program supports for improved water quality are aimed at reducing soil erosion.

In addition, the Department of Natural Resources is the lead agency in the State carrying out the nonpoint source pollution abatement program established under Section 319 of the Water Quality Act of 1987 and administered at the federal level by the U. S. Environmental Protection Agency. In accordance with the Water Quality Act, the Department in 1988 must prepare an assessment report describing nonpoint source problems in the State and a management report setting forth a four-year program addressing the nonpoint source problems. The management program would establish priorities for addressing nonpoint source pollution problems on a watershed-by-watershed basis in the State. Upon review and approval of the required reports by the U. S. Environmental Protection Agency, the Department of Natural Resources may apply for federal financial assistance to support

implementation of the nonpoint source management program. Implementation activities which may be funded include technical assistance, information and education programs, and demonstration projects. Implementation funds are expected to be made available in federal fiscal year 1989.

University of Wisconsin-Extension: The Extension Service operates on a contractual basis with counties to provide technical and educational assistance within the counties. The Extension Service is well equipped to assist the County Land Conservation Committee in developing and implementing an educational program designed to increase the awareness among landowners of soil erosion problems and of the measures available to remedy those problems.

Federal Level

U. S. Department of Agriculture, Agricultural Stabilization and Conservation Service: The U. S. Department of Agriculture, Agricultural Stabilization and Conservation Service, administers two programs—the Agricultural Conservation Program and the Conservation Reserve Program—which can contribute directly to the reduction of cropland soil erosion problems in Waukesha County. The Agricultural Conservation Program provides grants to rural landowners throughout the County in partial support of carrying out approved soil, water, woodland, wildlife, and other conservation practices. Agricultural Conservation Program grants may be used in support of a variety of soil erosion control measures.

The Conservation Reserve Program provides annual payments to farmers for converting highly erodible land from cropland to a less intensive use by establishing a permanent vegetative cover. The program also provides grants to farmers in partial support of establishing such cover.

U. S. Department of Agriculture, Soil Conservation Service: The U. S. Department of Agriculture, Soil Conservation Service, maintains an extensive technical assistance program involving the provision of technical assistance—including the preparation of farm conservation plans and assistance in design and application of conservation practices—to landowners and the provision of soil and water conservation resource information to units of government.

The Soil Conservation Service, in conjunction with the Agricultural Stabilization and Conservation Service, is responsible for implementing

the conservation compliance provisions of the Food Security Act of 1985. Under those provisions, farmers who produce crops on highly erodible land without an approved conservation plan may be ineligible for certain U. S. Department of Agriculture farm programs. The Soil Conservation Service, in conjunction with the Agricultural Stabilization and Conservation Service, is also responsible for administering related “sodbuster” and “swampbuster” provisions of the Food Security Act. The various conservation requirements of the Food Security Act of 1985 are described in more detail later in this chapter.

The Soil Conservation Service also conducts detailed soil surveys and provides interpretations as a guide to the use of the soil survey data. Within the Southeastern Wisconsin Region, including Waukesha County, detailed operational soil surveys were completed under a cooperative agreement between the Regional Planning Commission and the Soil Conservation Service negotiated in 1963, thereby providing modern standard soil surveys for the entire Region together with interpretations for a wide range of rural and urban planning activities.

U. S. Department of Agriculture, Farmers Home Administration: The U. S. Department of Agriculture, Farmers Home Administration, administers a number of loan programs for farm and nonfarm enterprises in rural areas that are unable to obtain credit from other sources. One such program, the Soil and Water Loan Program, represents a potential source of credit for a variety of soil and water conservation improvements, including soil erosion control improvements.

PLAN ADOPTION

Adoption, endorsement, and formal integration of the county soil erosion control plan by the County Board of Supervisors and the state and federal agencies concerned is highly desirable, if not absolutely essential, to ensure a common understanding among the several government levels and to enable their staffs to program the necessary plan implementation work. Recommendations regarding adoption and endorsement of the soil erosion control plan are presented here.

County Level

1. It is recommended that the Waukesha County Board of Supervisors, upon the recommendation of the Waukesha County

Land Conservation Committee, formally adopt the erosion control plan set forth in this report as a guide for addressing cropland soil erosion problems in the County, and direct the Waukesha County Land Conservation Department to integrate the plan into the various county conservation programs and activities.

2. It is recommended that the Waukesha County Park and Planning Commission adopt the county soil erosion control plan and direct the staff in the County Park and Planning Department to consider the objectives of that plan in administering the general county zoning ordinance and the shoreland and floodland protection ordinance.

State Level

1. It is recommended that the Wisconsin Department of Agriculture, Trade and Consumer Protection endorse the soil erosion control plan and utilize it in carrying out the Soil and Water Resources Management Program and its other soil and water conservation responsibilities, after review and certification by the Wisconsin Land Conservation Board that the plan meets the standards of Section 92.10 of the Wisconsin Statutes and Chapter Ag 160 of the Wisconsin Administrative Code.
2. It is recommended that the Wisconsin Department of Natural Resources endorse the soil erosion control plan and integrate the plan into its broad range of agency responsibilities, including, importantly, administration of the state priority watershed program, and of the federal nonpoint source pollution abatement program—established under Section 319 of the Water Quality Act of 1987—within Wisconsin.
3. It is recommended that the University of Wisconsin-Extension Service endorse the soil erosion control plan and utilize the plan recommendations, as appropriate, in the development and direction of its work program.

Federal Level

1. It is recommended that the U. S. Depart-

ment of Agriculture, Agricultural Stabilization and Conservation Service, formally acknowledge the soil erosion control plan and utilize the plan recommendations in its administration of the Agricultural Conservation Program and the Conservation Reserve Program. It should be noted that all U. S. Agricultural Stabilization and Conservation Service county offices in Wisconsin have been directed to consider county soil erosion control plans, where available, in the administration of their conservation programs (see Appendix C).

2. It is recommended that the U. S. Department of Agriculture, Soil Conservation Service, formally acknowledge the soil erosion control plan and utilize the plan recommendations in carrying out its continuing technical assistance program, as well as in the administration of the conservation compliance provisions of the federal Food Security Act of 1985.
3. It is recommended that the U. S. Department of Agriculture, Farmers Home Administration, formally acknowledge the soil erosion control plan and utilize the plan recommendations in its administration of the Soil and Water Loan Program.

PLAN IMPLEMENTATION MEASURES

It is envisioned that the major programs and activities to be carried out by the concerned county, state, and federal agencies in an effort to implement the county soil erosion control plan would include the provision of financial and technical assistance to farmers; the administration of state and federal conservation compliance requirements; and the conduct of information and education programs. Recommendations regarding these programs and activities, developed to foster implementation of the county soil erosion control plan, are set forth in this section. Also discussed are land management regulations, although such regulations are not herein recommended for adoption in Waukesha County. Finally, this section includes recommendations for a system to help monitor progress in the overall effort to reduce cropland soil erosion in Waukesha County.

Financial Assistance

Financial assistance is available to farmers under certain state and federal "cost-sharing" programs

and under the recently created federal Conservation Reserve Program. A description of those programs, along with recommendations for the administration of those programs, is set forth herein.

State Financial Assistance Programs: Financial assistance in support of management practices addressing soil erosion problems that adversely affect water quality is available to certain farmers under the Wisconsin Department of Natural Resources Priority Watersheds Program. Assistance is currently available under that program in support of such management practices in the Oconomowoc River watershed, located in the northwestern portion of Waukesha County (see Map 6 in Chapter II). Such assistance will be available to farmers within the Menomonee River watershed, located in the northeastern portion of Waukesha County, beginning in 1989 after completion of a detailed nonpoint source pollution abatement plan. It should be noted that the Upper Fox River watershed had been included on a list of watersheds in the State that are eligible for priority watershed programs in the future. At the same time, it should be noted that the Wisconsin Department of Natural Resources and Department of Agriculture, Trade and Consumer Protection are in the process of re-evaluating the criteria used in the selection of eligible watersheds, and there is a possibility that the current eligibility list will be changed.

The priority watershed program provides financial assistance in an amount of up to 70 percent of the cost of installing such improvements as terrace systems, grassed waterways, and grade stabilization structures, and provides financial assistance on a per-acre basis for the adoption of such practices as contour farming, contour strip-cropping, and conservation tillage. The assistance rate is \$6.00 per acre for contour farming and \$12 per acre for contour strip-cropping. For conservation tillage, the assistance rate is \$45 per acre, over a three-year period, for continuous row crop fields, and \$15 per acre, for one year, for fields with hay rotations.

In addition to the priority watershed program, limited financial assistance in support of needed land management practices may eventually be available under the "innovative project" provisions of the Soil and Water Resource Management Program administered by the Wisconsin Department of Agriculture, Trade and Consumer Protection. Under those provisions, a county

land conservation committee may seek state funding in support of innovative approaches to implementation of county soil erosion plans and animal waste management plans. State funds in support of such innovative projects are expected to be made available for the first time in 1988.

Federal Financial Assistance Programs: Financial assistance is available to farmers throughout Waukesha County for soil erosion control practices and other conservation practices under the Agricultural Conservation Program administered by the U. S. Department of Agriculture, Agricultural Stabilization and Conservation Service. Under that program, a farmer may receive assistance in partial support of the cost of installing such improvements as terrace systems and grassed waterways, up to a maximum of \$3,500. Assistance to individual farmers may exceed \$3,500 under certain circumstances as provided for in long-term agreements between the Agricultural Stabilization and Conservation Service and the farmer. Under the Agricultural Conservation Program, financial assistance is available in support of no-till systems, on a per-acre basis, for up to a maximum of 40 acres of cropland. The rate of assistance for no till was \$26.25 per acre in Waukesha County in 1988.

As previously noted, the Conservation Reserve Program, administered by the U. S. Department of Agriculture, Agricultural Stabilization and Conservation Service, provides financial assistance to farmers as incentive to retire highly erodible farm fields from crop production. Under this program, a field is considered to be highly erodible if at least two-thirds of the field is covered by soils having the potential to erode at a rate of more than eight times T-value. Under the Conservation Reserve Program, annual payments are made to the farmer over a period of 10 years on a per-acre basis for highly erodible cropland taken out of production. The program also provides financial assistance in support of up to 50 percent of the normal costs of establishing permanent vegetative cover.

As also previously noted, the Soil and Water Loan Program administered by the U. S. Department of Agriculture, Farmers Home Administration, represents a potential source of credit to farmers in financing the installation of grassed waterways, terraces, and other soil erosion control improvements. Applicants must be unable to obtain credit from other sources under reasonable terms and conditions. Loans may be repaid over a period of up to 40 years.

Recommendations for Use of Financial Assistance Programs: It is recommended that, to the extent possible given existing program regulations, the financial assistance programs described above, and other financial assistance programs which may become available, be used to address soil erosion problems in Waukesha County in general conformance with the priority area recommendations and related time frame proposed under the county soil erosion control plan, as documented in Chapter V of this report. In this manner, emphasis would be placed on the use of available financial assistance programs to address soil erosion control problems in Priority Area A from 1988 through 1990; in Priority Area B from 1991 through 1993; in Priority Area C from 1994 through 1996; and in Priority Area D from 1997 through 1999. Administration of the federal Agricultural Conservation Program and Conservation Reserve Program could be readily adapted to conform with this priority system. Because it is directed at water quality problems in watersheds encompassing only portions of the County, the Wisconsin Department of Natural Resources Priority Watersheds Program is less adaptable to this priority system. That program, however, remains an important potential source of financial assistance for addressing certain soil erosion-related water quality problems.

It is also recommended that the Wisconsin Department of Natural Resources and the Wisconsin Department of Agriculture, Trade and Consumer Protection give due consideration to the designation of the Upper Fox River watershed for funding under the priority watershed program, and, upon such designation, undertake a nonpoint source pollution abatement plan for that watershed, appropriately coordinating the recommendations of that plan with the county soil erosion control plan.

Technical Assistance Programs

As previously indicated, the U. S. Department of Agriculture, Soil Conservation Service, maintains an extensive program of technical assistance to farmers, as well as to governmental units. The Waukesha County Land Conservation Department also provides technical assistance to farm operators in an effort to promote land management practices. Technical assistance to farmers provided by the Soil Conservation Service and the County Land Conservation Department includes the preparation of farm conservation plans—which indicate desirable tillage practices and cropping patterns, considering the char-

acteristics of the land and the resources and objectives of the farm operator—and the design of conservation measures.

Recommendations for Technical Assistance Programs: As indicated in Chapter V, the reduction of cropland soil erosion to tolerable levels throughout Waukesha County will require the revision of, or the preparation of new, farm conservation plans for a majority of farms in the County. In this regard, it was estimated that farm conservation plans will have to be revised, or new plans prepared, for more than 830 farms. In planning their respective work programs, the County Land Conservation Department and the Soil Conservation Service should, to the extent practicable, allocate staff time for preparing farm conservation plans in accordance with the priority area recommendations and related time frame proposed under the county soil erosion control plan.¹ Estimated staff requirements attendant to the proposed farm conservation planning work within each priority area and for the county overall are set forth in Table 18. As indicated in that table, the conservation planning envisioned under the county soil erosion control plan would require a commitment of time by conservation technicians of an estimated 18,400 man-hours, or about nine man-years. Total salary and fringe-benefit costs attendant to such conservation planning, expressed in 1987 dollars, would approximate \$220,800 through the year 1999, or an average of \$18,400 per year for 12 years.

Conservation Compliance Requirements

In recent years both the state and federal governments have added conservation compliance requirements for participation in certain government-sponsored farm programs to encourage sound land management. Such conservation requirements, as described below, provide additional incentive for many farmers to control cropland soil erosion within tolerable levels.

¹ *It is recognized that the Land Conservation Committee and Soil Conservation Service will not be able to adhere strictly to the recommended time frame for addressing priority areas in Waukesha County because of other agency responsibilities, including implementation of the soil conservation requirements of the Wisconsin Farmland Preservation Program and the conservation compliance requirements of the Food Security Act of 1985.*

Table 18

FARM CONSERVATION PLANNING REQUIREMENTS UNDER THE WAUKESHA COUNTY SOIL EROSION CONTROL PLAN

Priority Area	Time Period	Review and Updating of Existing Farm Conservation Plans			Preparation of New Farm Conservation Plans			Total Staff Requirements	
		Number of Plans	Staff Requirements		Number of Plans	Staff Requirements			
			Hours (Conservation Technician)	Costs ^a		Hours (Conservation Technician)	Costs ^a	Hours (Conservation Technician)	Costs ^a
A	1988-1990	52	650	\$ 7,800	165	4,125	\$ 49,500	4,775	\$ 57,300
B	1991-1993	53	663	7,960	169	4,225	50,700	4,888	58,660
C	1994-1996	53	663	7,960	169	4,225	50,700	4,888	58,660
D	1997-1999	42	524	6,280	133	3,325	39,900	3,849	46,180
Total	--	200	2,500	\$30,000	636	15,900	\$190,800	18,400	\$220,800

^a Includes salary and fringe benefits, based upon 1987 salary levels.

Source: U. S. Soil Conservation Service, Waukesha County Land Conservation Department, and SEWRPC.

Wisconsin Farmland Preservation Program Soil Conservation Requirements: Created in 1977, the Wisconsin Farmland Preservation Program provides property tax relief in the form of state income tax credits to eligible owners of farmland who decide to participate. In southeastern Wisconsin, owners of farmland are eligible to participate in the program only if their land has been placed in a state-certified exclusive agricultural zoning district and if certain other requirements are met. As a result of legislation contained in the 1985-1987 State Budget Bill, all participants in the Farmland Preservation Program are required to adhere to sound soil conservation practices so that cropland soil erosion is kept at or below tolerable levels. The soil conservation compliance requirements first applied to "new" participants—landowners who had not claimed a farmland preservation tax credit for tax year 1984 or any prior year—in tax year 1986. The requirements first apply to past participants—landowners who have claimed a farmland preservation tax credit for tax year 1984 or any prior year—in tax year 1988.

Since the enactment of the soil conservation requirements of the Wisconsin Farmland Preservation Program, the Waukesha County Land Conservation Department and the U. S. Department of Agriculture, Soil Conservation Service, have developed soil conservation plans for about 60 farms, or about one-half of the 119 farms in Waukesha County that participate in the Farmland Preservation Program. The Land Conservation Department and the Soil Conservation Service

are scheduled to prepare farm conservation plans for the remainder of the participating farmers in 1988.

Conservation Requirements of the Food Security Act of 1985: The Food Security Act of 1985 established "conservation compliance" requirements for farmers participating in a number of U. S. Department of Agriculture farm programs, including price and income support programs, crop insurance programs, Farmers Home Administration loan programs, the Conservation Reserve Program, and others. The conservation compliance provisions require that producers farming highly erodible fields must develop and be applying a conservation plan for such fields by 1990, and that such plan be fully implemented by 1995. Under the conservation compliance provisions, a field is considered to be highly erodible if at least one-third of the field is covered by soil having the potential to erode at a rate of more than eight times tolerable levels. The U. S. Department of Agriculture, Soil Conservation Service, is responsible for identifying highly erodible lands in Waukesha County. The required conservation plans may be prepared by specialists in the Soil Conservation Service, the County Land Conservation Department, the Extension Service, vocational agriculture instructors, and other qualified technicians. As a practical matter, it is anticipated that most of the required plans will be prepared by the U. S. Soil Conservation Service or County Land Conservation Department.

The Food Security Act of 1985 also included "sodbuster" provisions intended to discourage the conversion of highly erodible land from grassland or woodland to cropland. The sodbuster provisions apply, in particular, to highly erodible land, as defined above, which was not planted to annually tilled crops during the period 1981-1985. Under the Food Security Act, farmers desiring to remain eligible for basic U. S. Department of Agriculture programs may convert such land to cropland only by developing and applying a conservation plan, in cooperation with the U. S. Department of Agriculture, Soil Conservation Service.

In addition to the foregoing, the Food Security Act of 1985 included "swampbuster" provisions intended to discourage the conversion of wetland areas to cropland. Under the swampbuster provisions, a farmer who converts a wetland to cropland use generally loses eligibility for basic U. S. Department of Agriculture programs, although certain exceptions are provided.

Recommendations Regarding Conservation Compliance Requirements: As indicated above, it is anticipated that in 1988 the County Land Conservation Department, in cooperation with the U. S. Department of Agriculture, Soil Conservation Service, will complete farm conservation plans for the balance of farms currently requiring such plans under the soil conservation requirements of the Wisconsin Farmland Preservation Program. A total of 59 farm plans would thus be prepared in 1988. Also, it is anticipated that the Land Conservation Department will prepare farm conservation plans for additional participants in the Wisconsin Farmland Preservation Program as participation in that program increases over time. It is recognized that the farm conservation planning activities required for compliance with the Wisconsin Farmland Preservation Program may not be able to be undertaken in strict conformance with the priority area recommendations and related time frame proposed under the county soil erosion control plan.

It is also anticipated that by 1990 the U. S. Department of Agriculture, Soil Conservation Service, possibly assisted by other agencies, will prepare conservation plans for highly erodible cropland for farmers participating in U. S. Department of Agriculture programs, in accordance with the provisions of the Food Security Act of 1985. While the Food Security Act requires the preparation of a

conservation plan for highly erodible farm fields, it is recommended that, to the extent practicable, the Soil Conservation Service and cooperating agencies prepare comprehensive plans for the entire farm concerned, rather than exclusively for highly erodible farm fields. At a minimum, this approach should be followed in implementing the conservation planning requirements of the Food Security Act within Priority Area A.

Information and Education Program

An effective information and education program can increase the awareness among farmers of soil erosion problems, of the types of practices that may be used to address those problems, and of the public financial and technical resources that are available to help in implementing those practices.

Recommendations for an Information and Education Program: It is recommended that the Waukesha County Land Conservation Department take the lead role in developing and implementing an information and education program focusing on cropland soil erosion in Waukesha County. In developing and implementing this program, the Land Conservation Department should draw upon the expertise and resources of the University of Wisconsin-Extension and the U. S. Department of Agriculture, Soil Conservation Service.

It is recommended that the information and education program be developed and carried out under the guidance of a committee comprised of individuals who are familiar with existing soil erosion control problems and the resources available to address those problems, as well as with farming practices and the attitudes and preferences of farmers in Waukesha County. The newly created Food Security Act Information and Education Committee—consisting of representatives of the County Land Conservation Department, the University of Wisconsin-Extension, and the concerned federal agencies, and established for the purpose of promoting an understanding of the conservation compliance provisions of the Food Security Act of 1985—could perform the functions of the recommended information and education committee.

The Waukesha County Land Conservation Department, working cooperatively with the University of Wisconsin-Extension and the U. S. Department of Agriculture, Soil Conservation Service, would be responsible for identifying the specific activities to be pursued and the

type of resource materials to be prepared under the information and education program. The following general guidelines should be followed in developing that program:

1. The information and education program should be carried out with the involvement of the existing farm organizations, including, importantly, the Waukesha County Farm Bureau. Moreover, the information and education program should include programs addressed at future farmers, including school groups and youth-oriented organizations such as 4-H and Future Farmers of America.
2. The information and education program should foster an awareness of the environmental impacts of all forms of cropping practices—including both conventional practices and alternative practices intended to reduce soil erosion. In particular, the program should emphasize the dissemination of information on the judicious use of agricultural chemicals, particularly when conservation tillage systems are adopted to reduce cropland soil erosion. In this regard, information and education programs should promote an awareness of integrated pest management programs which attempt to minimize the application of pesticides, as well as similar programs intended to minimize the application of fertilizers.
3. It is recommended that the information and education program be undertaken in general conformance with the priority area recommendations and related time frame proposed under the county soil erosion control plan, as documented in Chapter V of this report. In this manner, information and education activities would be directed primarily toward farmers in Priority Area A from 1988 through 1990; in Priority Area B from 1991 through 1993; in Priority Area C from 1994 through 1996; and in Priority Area D from 1997 through 1999. Focusing on the priority areas in this manner, however, should not preclude countywide activities, such as the preparation and dissemination of fact sheets and other informational materials intended to increase the understanding of soil erosion problems in the County and solutions to those problems.

4. It is recommended that as a first step in the information and education program, a meeting be held for farmers in Priority Area A—the highest priority area for cropland soil erosion control—in order to explain the findings and recommendations of the soil erosion control plan, to describe soil loss rates within that area, and to describe the types of practices that are recommended for adoption by the farmers concerned to remedy soil erosion problems. Written notice of the meeting should be sent to each farmer within Priority Area A. It is anticipated that such a meeting will be held in the fall of 1988. Additional meetings could be held with Priority Area A farmers over the next three years, as deemed appropriate by the Land Conservation Department.

While the staff requirements attendant to the county soil erosion control information and education program depend on the types of activities undertaken, such a program would probably require an annual commitment of time of about 300 man-hours by the Land Conservation Department, 200 man-hours by the University of Wisconsin-Extension, and 100 man-hours by the U. S. Department of Agriculture, Soil Conservation Service. Attendant salary and fringe-benefit costs, expressed in 1987 dollars, would approximate \$3,600 for Land Conservation Department staff, \$2,400 for the University of Wisconsin-Extension staff, and \$1,200 for Soil Conservation Service staff. Miscellaneous costs for supplies, printing, and postage may be expected to total an additional \$4,500.

Regulatory Measures for Erosion Control

Government activities intended to achieve a reduction in cropland soil erosion have traditionally relied upon voluntary cooperation by the farmer, with financial and technical assistance programs and educational programs used to promote farmer cooperation. As indicated above, both the state and federal governments have recently established certain conservation requirements for participation in basic farm programs. Other than those program compliance requirements, regulatory approaches for controlling cropland soil erosion have not gained legislative support.

It should be noted, however, that counties as well as cities and villages in Wisconsin have been granted the authority under Section 92.11 of the Wisconsin Statutes to adopt ordinances prohibiting land uses and land management practices

which cause excessive soil erosion, sedimentation, nonpoint source water pollution, or stormwater runoff. Upon adoption of such an ordinance by the governing body, the ordinance provisions become effective only upon approval by a majority of voters in a referendum in the affected area. As of December 1987, regulations governing cropland soil erosion adopted under Section 92.11 of the Wisconsin Statutes were in effect in only one municipality in Wisconsin—the Town of Sterling in Vernon County.

It should be noted that the general county zoning ordinance and county shoreland and floodland protection ordinance, administered by the Waukesha County Park and Planning Commission through its staff in the County Park and Planning Department, have been used on a limited basis to control cropland soil erosion within the County. In this regard, farm operators seeking a general or shoreland-floodland zoning permit for an intensive agricultural use—such as egg operations, boarding stables, feedlots, and nurseries—are required as a matter of policy to prepare a conservation plan for the sound management of soil and water resources for their entire farm unit. Moreover, nuisance provisions of these ordinances have been used on a limited basis to require farmers to control cropland soil erosion where such erosion has resulted in serious offsite problems. As part of its activities in assisting local units of government in Waukesha County in developing or amending zoning ordinances, the Waukesha County Park and Planning Department encourages local units of government to incorporate similar provisions providing for the control of cropland soil erosion in special cases.

After deliberating on this matter, the Waukesha County Soil Erosion Control Planning Program Technical Advisory Committee determined that efforts to address cropland soil erosion in Waukesha County should continue to emphasize a basically voluntary approach, supported by available technical and financial assistance and information and education programs, by the conservation compliance provisions of state and federal farm programs, and by limited control of cropland soil erosion in special cases through county and local zoning ordinances, as noted above. If that combination of programs can be made to succeed, mandatory approaches will not be necessary. Only if the proposed voluntary approach fails should consideration be given to the enactment of mandatory requirements.

Program Monitoring and Evaluation

Chapter Ag 160 of the Wisconsin Administrative Code, which governs the preparation of county soil control plans, requires that such plans set forth a method by which the County Land Conservation Committee can evaluate the effectiveness of the county soil erosion control program. In this regard, the Wisconsin Department of Agriculture, Trade and Consumer Protection recommends a structured evaluation system providing for an annual evaluation of erosion control efforts within the County.

Recommendations for Monitoring and Evaluation: The following recommendations are intended to assist the Waukesha County Land Conservation Committee in a structured evaluation of the effectiveness of soil control efforts within the County:

1. It is recommended that the County Land Conservation Department routinely update the field-by-field soil erosion inventory file created during the preparation of the county soil erosion control plan to reflect additional conservation practices as they are implemented. With the file updated in this matter, average cropland soil erosion rates could be re-calculated for the County overall and for appropriate subareas of the County. This procedure could be used to estimate the effect on the overall soil loss rate of conservation practices implemented each year—assuming that there is no change in the rate of soil erosion on other cropland in the County.
2. It is recommended that each year the County Land Conservation Department prepare a report briefly summarizing the types and levels of soil erosion control activities undertaken by that Department, as well as by cooperating agencies, including the U. S. Department of Agriculture, Soil Conservation Service, and the University of Wisconsin-Extension. The report should appropriately document technical assistance activities, information and education activities, and any other activities undertaken to achieve a reduction in cropland soil erosion in the County.
3. It is recommended that each year the County Land Conservation Committee evaluate the soil erosion control activities as

documented above, considering, among other factors, the estimated impact on soil loss rates in the County, in order to identify any areas in which the soil erosion control efforts might be improved.

STAFF AND COST-SHARE ASSISTANCE NEEDS

Staff Needs

The staff requirements for the farm conservation planning activities and the informational and educational activities envisioned under the soil erosion control plan, presented in previous sections of this chapter, are summarized in Table 19 along with related administrative staff requirements. As indicated in that table, the soil erosion control plan envisions that farm conservation planning activities would involve the commitment of about 18,400 man-hours; that the informational and educational activities would involve the commitment of about 7,200 man-hours; and that administrative activities would involve the commitment of about 2,560 man-hours through the year 2000.

At the present time, there are five staff members—three in the Land Conservation Department and two in the Waukesha County office of the U. S. Soil Conservation Service office—available on a part-time basis for farm conservation planning work. It should be noted that one of the present Land Conservation Department staff members is retained through funding available under the Oconomowoc River Priority Watershed Program. It is anticipated that additional staff will not be required for the farm conservation planning activities envisioned in the county soil erosion control plan. However, should the Land Conservation Department position presently funded through the priority watershed program be discontinued, additional staff may be required.

It is further anticipated that existing staff in the Waukesha County Land Conservation Department, assisted by U. S. Soil Conservation Service staff and University of Wisconsin-Extension staff assigned to Waukesha County, will be able to undertake the information and education program envisioned in the soil erosion control plan. It is also anticipated that the existing Waukesha County Land Conservation Department staff will be able to carry out all of the administrative functions attendant to implementation of the soil erosion control plan.

Cost-Share Assistance Needs

Previous sections of this chapter have described the types of cost-share assistance programs available to farmers for use in reducing cropland soil erosion, the primary cost-share assistance programs being the Federal Agricultural Conservation Program and the state priority watershed program. This section presents an estimate of the amount of cost-share assistance required to reduce cropland soil erosion to tolerable levels, assuming that all farm operators with excessively eroding cropland are eligible for, and amenable to, such assistance.

Cost-share assistance requirements attendant to the management practices recommended in the soil erosion control plan are set forth in Table 20. As indicated in that table, cost-share assistance requirements through the year 2000 total about \$2,272,100—including \$955,200 in Priority Area A, \$604,300 in Priority Area B, \$506,300 in Priority Area C, and \$206,300 in Priority Area D. As indicated in Table 21, the amount of cost-share assistance required is substantially greater than the amount which may be expected to be provided through the existing major cost-share assistance programs. The additional amount of cost-share funds required—beyond the amounts which may be expected to be provided through existing programs—approximates \$1,703,000.² Additional

² *This analysis is based upon the levels of cost-share assistance which may be expected to be available under the federal Agricultural Conservation Program and the state priority watershed programs for the Menomonee and Oconomowoc River watersheds. Payments to farmers under the federal Conservation Reserve Program were not taken into account. As noted in Chapter V, under the county soil erosion control plan, permanent vegetative cover was recommended on a limited basis—primarily for small, isolated, very erodible portions of fields that would otherwise require management systems markedly different from that of the remainder of the field. It should be noted that, in addition to the limited acreage specifically recommended under the county soil erosion control plan for permanent vegetative cover, considerable additional cropland identified by the U. S. Soil Conservation Service as “highly erodible” may be placed in permanent vegetative cover under the Conservation Reserve Program.*

Table 19

**STAFFING REQUIREMENTS FOR IMPLEMENTATION OF
THE WAUKESHA COUNTY SOIL EROSION CONTROL PLAN**

Priority Area	Time Period	Farm Conservation Planning		Information and Education Activities		Administration		Total	
		Hours	Costs ^a	Hours	Costs ^a	Hours	Costs ^a	Hours	Costs
A	1988-1990	4,775	\$ 57,300	1,800	\$21,600	657	\$ 7,880	7,232	\$ 86,780
B	1991-1993	4,888	58,660	1,800	21,600	669	8,030	7,357	88,290
C	1994-1996	4,888	58,660	1,800	21,600	669	8,030	7,357	88,290
D	1997-1999	3,849	46,180	1,800	21,600	565	6,780	6,214	74,560
Total	--	18,400	\$220,800	7,200	\$86,400	2,560	\$30,720	28,160	\$337,920

^aIncludes salary and fringe benefits, based upon 1987 salary levels.

Source: U. S. Soil Conservation Service, Waukesha County Land Conservation Department, and SEWRPC.

Table 20

COST-SHARE REQUIREMENTS FOR IMPLEMENTATION OF THE WAUKESHA COUNTY SOIL EROSION CONTROL PLAN

Management Practice	Units/Cost-Share Requirement	Priority Area A (1988-1990)	Priority Area B (1991-1993)	Priority Area C (1994-1996)	Priority Area D (1997-1999)	Total
Reduced Tillage	Acres required	15,365	10,305	8,408	3,425	37,503
	Cost-share funds required ^a	\$691,400	\$463,700	\$378,400	\$154,100	\$1,687,600
Zero Tillage	Acres required	2,778	1,455	1,343	538	6,114
	Cost-share funds required ^b	\$218,800	\$114,600	\$105,800	\$ 42,400	\$ 481,600
Contour Plowing	Acres required	1,134	466	481	213	2,294
	Cost-share funds required ^c	\$ 6,800	\$ 2,800	\$ 2,900	\$ 1,300	\$ 13,800
Permanent Vegetative Cover	Acres required	83	23	17	22	145
	Cost-share funds required ^d	\$ 3,800	\$ 1,000	\$ 800	\$ 1,000	\$ 6,600
Grassed Waterways	Linear feet required	14,950	9,660	8,010	3,270	35,890
	Cost-share funds required ^e	\$ 34,400	\$ 22,200	\$ 18,400	\$ 7,500	\$ 82,500
Total Cost-Share Required		\$955,200	\$604,300	\$506,300	\$206,300	\$2,272,100

^aAssumes a cost-share rate of \$45 per acre over three years as provided under the state priority watershed program. This would apply to reduced tillage on continuous row croplands. Assistance levels for reduced tillage for crop rotations involving hay would be lower.

^bAssumes a cost-share rate of \$78.75 per acre over three years as provided under the federal Agricultural Conservation Program.

^cAssumes a cost-share rate of \$6.00 per acre as provided under the state priority watershed program.

^dAssumes cost sharing at 70 percent of the cost as provided under the state priority watershed program, with the cost assumed to be \$65 per acre.

^eAssumes cost sharing at 70 percent of the cost as provided under the state priority watershed program, with the cost assumed to be \$3.00 per foot plus 10 percent for required design work.

Source: Waukesha County Land Conservation Department and SEWRPC.

Table 21

COMPARISON OF COST-SHARE FUNDS REQUIRED AND COST-SHARE FUNDS WHICH MAY BE PROVIDED THROUGH EXISTING COST-SHARE ASSISTANCE PROGRAMS IN WAUKESHA COUNTY

	Priority Area A (1988-1990)	Priority Area B (1991-1993)	Priority Area C (1994-1996)	Priority Area D (1997-1999)	Total
Cost-Share Funds Required	\$955,200	\$604,300	\$506,300	\$206,300	\$2,272,100
Cost-Share Funds Which May be Provided Through Existing Programs:					
Wisconsin Department of Natural Resources Priority Watershed Programs for the Menomonee River and Oconomowoc River Watersheds	\$ 51,600	\$ 34,400	\$ 36,200	\$ 14,800	\$ 137,000
Federal Agricultural Conservation Program	108,000	108,000	108,000	108,000	432,000
Total	\$159,600	\$142,400	\$144,200	\$122,800	\$569,000
Additional Cost-Share Funds Needed—Beyond the Amounts Which May be Provided Through Existing Programs	\$795,600	\$461,900	\$362,100	\$ 83,500	\$1,703,100

Source: Waukesha County Land Conservation Department and SEWRPC.

cost-share funds may eventually be available within Waukesha County under the innovative projects provisions of the state Soil and Water Resources Management Program. Additional cost-share assistance may also become available under the state priority watershed program should the Middle Fox River watershed be designated as a priority watershed.

SUMMARY

This chapter has recommended the actions that should be taken by various units and agencies of government in order to implement the Waukesha County soil erosion control plan. The most important recommendations are summarized below by agency or unit government.

County Level

Waukesha County Board of Supervisors: It is recommended that upon the recommendation of the Waukesha County Land Conservation Committee, the Waukesha County Board of Supervisors:

1. Formally adopt the erosion control plan set forth in this report as a guide for addressing cropland soil erosion problems

in the County, and direct the Waukesha County Land Conservation Department to integrate the plan into various county conservation programs and activities.

Waukesha County Land Conservation Committee: It is recommended that the Waukesha County Land Conservation Committee, through its staff in the County Land Conservation Department:

1. In conjunction with the U. S. Department of Agriculture, Soil Conservation Service, maintain a technical assistance program for farmers in Waukesha County emphasizing, in particular, the preparation or revision of farm conservation plans to identify field-specific measures for addressing cropland soil erosion in Waukesha County.
2. In cooperation with the University of Wisconsin-Extension, develop and carry out an information and education program to foster an awareness of soil erosion problems, of the types of practices which may be used to address those problems, and of the public financial and technical resources available to help in implementing those practices.

3. Conduct an annual evaluation of erosion control efforts in the County, considering, among other factors, the estimated impact on soil loss rates in the County, in order to identify any areas in which the soil erosion control efforts might be improved.

Waukesha County Park and Planning Commission: It is recommended that the Waukesha County Park and Planning Commission:

1. Adopt the county soil erosion control plan and direct the staff in the County Park and Planning Department to consider the objectives of that plan in administering the general county zoning ordinance and shoreland-floodland protection ordinance.

State Level Agencies

Wisconsin Department of Agriculture, Trade and Consumer Protection: It is recommended that the Wisconsin Department of Agriculture, Trade and Consumer Protection:

1. Endorse the Waukesha County soil erosion control plan, and utilize it in carrying out the Soil and Water Resources Management Program and its other soil and conservation responsibilities, after review and certification by the Wisconsin Land Conservation Board that the plan meets the standards of Section 92.10 of the Wisconsin Statutes and Chapter Ag 160 of the Wisconsin Administrative Code.

Wisconsin Department of Natural Resources: It is recommended that the Wisconsin Department of Natural Resources:

1. Endorse the soil erosion control plan and integrate the plan into its broad range of agency responsibilities in the area of natural resource protection and water quality control.
2. Appropriately coordinate the administration of the priority watershed program, particularly in the Menomonee and Oconomowoc River watersheds, with the county soil erosion control plan.
3. Give due consideration to the designation of the Upper Fox River watershed for funding under the priority watershed program, and,

upon such designation, undertake a non-point source pollution abatement plan for that watershed, appropriately coordinating the recommendations of that plan with the county soil erosion control plan.

4. Give due consideration to the county soil erosion control plan in the administration of the federal nonpoint source water pollution abatement program—established under Section 319 of the Water Quality Act of 1987—within Wisconsin.

University of Wisconsin-Extension: It is recommended that the University of Wisconsin-Extension:

1. Endorse the soil erosion control plan, and utilize the plan recommendations as appropriate in the development and direction of its work program.
2. Assist the Waukesha County Land Conservation Department in developing and carrying out an effective erosion control information and education program for farmers in Waukesha County.

Federal Level Agencies

U. S. Department of Agriculture, Agricultural Stabilization and Conservation Service: It is recommended that the U. S. Department of Agriculture, Agricultural Stabilization and Conservation Service:

1. Formally acknowledge the soil erosion control plan, and consider the plan recommendations in its administration of related federal financial assistance programs. In particular, it is recommended that in the administration of the Agricultural Conservation Program and the Conservation Reserve Program, the Agricultural Stabilization and Conservation Service, to the extent practicable, allocate financial assistance in accordance with the priority area recommendations and related time frame proposed under the county soil erosion control plan.

U. S. Department of Agriculture, Soil Conservation Service: It is recommended that the U. S. Department of Agriculture, Soil Conservation Service:

1. Formally acknowledge the soil erosion control plan, and work cooperatively with the Waukesha County Land Conservation Department in efforts to implement that plan.
2. In cooperation with the Waukesha County Land Conservation Department, maintain a technical assistance program for farmers in Waukesha County, emphasizing, in particular, the preparation of detailed farm conservation plans addressing cropland soil erosion problems.
3. Coordinate its activities in carrying out the conservation compliance provisions of the Food Security Act of 1985 with the county soil erosion control plan. In this regard, conservation planning activity undertaken by the Soil Conservation Service in conjunction with the conservation compliance

provisions should, to the extent practicable, address entire farm operations, rather than highly erodible farm fields exclusively—particularly within Priority Area A.

4. Assist the Waukesha County Land Conservation Department in developing and carrying out an effective erosion control information and education program for farmers in Waukesha County.

U. S. Department of Agriculture, Farmers Home Administration: It is recommended that the U. S. Department of Agriculture, Farmers Home Administration:

1. Formally acknowledge the soil erosion control plan, and consider the plan recommendations in its administration of the Soil and Water Loan Program.

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Chapter VII

SUMMARY

Soil erosion takes place when water or wind carries soil away from inadequately protected land surfaces. Erosion causes serious problems. The loss of topsoil from agricultural land means that the land loses part of its productive capacity. Eventually, no amount of fertilizer can, as a practical matter, replace this loss, and the ability of the land to produce crops may be jeopardized. Thus, the land and the people who occupy and work it both become poorer. Downstream sites—the places to which the eroded soil is carried—experience a different but also very costly set of problems. These include the clogging of culverts and drainageways, and diminished water quality, and in some cases interference with commercial as well as recreational navigation. Soil erosion contributes to water quality problems of lakes and streams, the soil particles constituting a form of pollution per se being directly injurious to various desirable forms of aquatic life, destroying fish and wildlife habitat, and rendering recreational areas undesirable, and carrying adsorbed conventional and toxic pollutants.

The dust bowl experience of the 1930's generated a national interest in the wise use of soil. More recently, concern about soil erosion has increased in southeastern Wisconsin owing in part to a shift away from dairy farming and traditional crop rotation patterns generally compatible with long-term resource protection, in favor of continuous row cropping that tends to exacerbate soil erosion and associated problems. Such a shift is occurring in Waukesha County. In general, there has been an increase in erosion-prone crops, particularly corn and soybeans, and a decrease in crops that are less susceptible to erosion, such as oats and hay. The combined acreage in corn grown for grain and silage increased by 17,200 acres, or 49 percent—from about 35,100 acres in 1965 to about 52,300 acres in 1986. The combined acreage in soybeans increased by 5,300 acres, or 204 percent—from about 2,600 acres in 1965 to about 7,900 acres in 1986. Conversely, the combined acreage in hay decreased by 23,600 acres, or 48 percent—from about 48,800 acres in 1965 to about 25,200 acres in 1986. The acreage in oats also decreased substantially—from about 17,800 acres in 1965 to about 5,400 acres in 1986, a decrease of 12,400 acres, or 70 percent.

Because of the increasing concern over soil erosion, the Wisconsin Legislature in 1982 revised Chapter 92 of the Wisconsin Statutes, the state soil and water conservation law, to require the preparation of county soil erosion control plans focusing on the control of cropland soil erosion. A total of 55 counties located generally in the southern two-thirds of the State, including Waukesha County, are required to prepare such a plan.

Recognizing the need for soil erosion control, and in an effort to comply with the requirements of Chapter 92 of the Wisconsin Statutes, the Waukesha County Board in 1985 determined to prepare a county soil erosion control plan. The Board requested the assistance of the Southeastern Wisconsin Regional Planning Commission in the preparation of such a plan. The County received a planning grant from the Wisconsin Department of Agriculture, Trade and Consumer Protection in partial support of the required work. The plan presented herein was prepared by the Regional Planning Commission in cooperation with the Waukesha County Land Conservation Department. The planning effort was carried out under the guidance of the Waukesha County Land Conservation Committee. The Land Conservation Department and the Commission staff were assisted in the preparation of the plan by a technical advisory committee consisting of county farmers, representatives of the Waukesha County Park and Planning Commission, and state and federal agency personnel assigned to the County.

The soil erosion control plan presented herein is intended to serve as a guide for use in controlling cropland soil erosion in Waukesha County. The plan recommends a cropland soil erosion control objective and related erosion control standards; recommends a rank ordering of areas of the County for the application of erosion control measures; identifies the types and amounts of soil erosion control practices which may be used to reduce soil erosion to tolerable levels; and identifies the actions which should be taken by the various units and agencies of government concerned in implementing the plan. The major findings and recommendations of the plan are summarized below.

SOIL EROSION CONTROL OBJECTIVE

The primary objective of the cropland soil erosion control plan, as recommended by the Technical Advisory Committee, is the maintenance of the long-term productivity of soils within the County through the prevention of "excessive" cropland soil erosion. "Excessive" erosion is defined as erosion in excess of soil tolerances—or T-value—as determined by the U. S. Department of Agriculture, Soil Conservation Service. The related standards recommended by the Technical Advisory Committee incorporate the minimum standards for erosion control prescribed in Chapter Ag 160 of the Wisconsin Administrative Code—including, importantly, the reduction of soil erosion on all cropland to no more than T-value by the year 2000 (see Table 7 in Chapter IV of this report).

Soil loss tolerance, or T-value, refers to the maximum level of soil erosion that will permit a high level of crop productivity to be sustained economically and indefinitely. For soils in Waukesha County, T-values generally range between two and five tons per acre per year. It should be noted that while the concept of the T-value enjoys widespread use as a basis for soil conservation planning, T-values are not universally accepted as goals for cropland soil erosion control. There is some concern that T-values have been set too high to adequately protect the long-term productivity of the soil. It should also be recognized, in this respect, that the established T-values do not take into account offsite impacts attendant to cropland soil erosion. Nevertheless, in developing the soil erosion control plan, the Technical Advisory Committee determined that despite limitations, soil loss tolerances, or T-values, established by the U. S. Soil Conservation Service currently provide the best available basis for establishing cropland soil erosion objectives and standards—although continuing research into the validity of those tolerances is required.

SOIL EROSION INVENTORY AND ANALYSIS

The rate of soil erosion on cropland for any given set of climatic conditions varies considerably, depending upon the cropping system, management practices, soil characteristics, and topographic features of the individual farm fields. Under the Waukesha County soil erosion control planning program, an inventory and analysis of existing cropland was undertaken in order to determine the extent and severity of cropland soil erosion problems within the County, focusing, in

particular, on "sheet" and "rill" erosion. Sheet erosion is characterized by the removal of a relatively uniform, thin layer of soil from the land surface, the result of runoff in the form of shallow sheets of water flowing over the ground. Such shallow surface flow typically does not move more than a few feet before collecting in surface depressions. Rill erosion occurs when sheet runoff begins to concentrate in surface depressions and, gaining in velocity, cuts small, but well-defined channels termed "rills." Sheet and rill erosion is a widespread problem causing massive amounts of soil to be moved about on and, in many cases, completely off inadequately protected cropland. Though often not perceived as a problem by the farm operator, sheet and rill erosion can seriously impair soil productivity in the long term, and can cause serious and costly offsite damages and environmental problems.

Estimates of the amount of sheet and rill erosion on individual farm fields in Waukesha County were developed through application of the universal soil loss equation. This equation, the attendant data requirements, and the manner in which the required data were developed for individual farm fields in Waukesha County are described in Chapter III of this report.

The inventories conducted under the planning program indicated that the average rate of sheet and rill erosion in Waukesha County in 1987 was 4.8 tons per acre per year. The soil loss rate was less than 3.0 tons per acre per year on about 48,800 acres of cropland, representing about 46 percent of all cropland in the County in 1987. At the other extreme, the soil loss rate was nine tons per acre per year on about 15,900 acres, representing about 15 percent of all cropland. Considerable variation was found in the rate of cropland soil erosion within the County. While areas having relatively high soil loss rates occur throughout the County, the most extensive areas occur in the central and southeastern portions of the County. Relatively high soil loss rates were also identified in the northeastern portion of the County.

In order to provide perspective on the severity of the soil erosion problem, soil loss rates, as estimated by the universal soil loss equation, are frequently expressed in multiples or fractions of T-value. More than 43,700 acres of cropland, representing just over 41 percent of all cropland in Waukesha County, was found to be eroding at rates exceeding T-value in 1987—including about

22,700 acres, or 22 percent of all cropland, eroding at rates between 1.1 and 2.0 times T-value; about 10,000 acres, or just over 9 percent, eroding at rates between 2.1 and 3.0 times T-value; and about 11,000 acres, or just over 10 percent, eroding at rates of more than 3.0 times T-value. The remaining cropland—totaling about 61,800 acres, or just over 58 percent of all cropland in the County—was eroding at rates less than T-value.

RECOMMENDED SOIL EROSION CONTROL PRACTICES

A variety of conservation practices are available to farmers for the control of cropland soil erosion. These practices range from structural approaches, such as the installation of terraces and the construction of grassed waterways, to management approaches, such as conservation tillage and contour plowing. An important objective of the county soil erosion control planning program was the identification of those practices that would most effectively address soil erosion problems within the County. In identifying recommended management practices, preference was given to those practices that allow farmers to continue to raise essentially the same types of crops as in the recent past.

The plan recommends that some form of conservation tillage be utilized on most of the excessively eroding cropland in the County. More specifically, reduced tillage systems leaving between 30 and 40 percent of the surface area covered by crop residue after planting are recommended for about 28,700 acres, or 66 percent of the excessively eroding cropland in the County; reduced tillage systems leaving between 40 and 60 percent of the surface area covered by crop residue after planting are recommended for about 8,800 acres, or 20 percent of the excessively eroding cropland; and no-till systems leaving between 60 and 70 percent of the surface area covered by crop residue after planting are recommended for about 6,100 acres, or 14 percent of the excessively eroding cropland. Under the plan, the remainder of the excessively eroding cropland in the County, about 145 acres, or less than 1 percent of the total, would be taken out of production and permanent vegetative cover established, owing to the steepness and complexity of the slopes concerned. In addition to conservation tillage, contour plowing and crop rotation changes would be implemented on about 2,300 acres and 700 acres, respectively, of excessively eroding cropland.

Approximately 35,900 feet of grassed waterway would be constructed within the County.

It is important to note that conservation tillage systems may require greater pesticide inputs than conventional tillage. Accordingly, the reliance on conservation tillage as the primary method to reduce cropland soil erosion in Waukesha County to a tolerable level requires a concomitant effort to judiciously manage agri-chemical inputs. The need for such management is borne out by both economic and environmental necessities. On the environmental side, there is increasing public concern over the excessive use of not only pesticides—insecticides, herbicides, and fungicides—but also of fertilizers which may pollute surface- and groundwaters. Concerns regarding the long-term adverse effects of widespread chemical usage on human and animal life are becoming as real among rural farm operators as they are among the rest of society. On the economic side, judicious chemical usage can help ensure farm profitability. For these reasons, the careful monitoring of all agricultural inputs is important.

Integrated pest management systems provide a sound approach to the minimization of agri-chemical inputs and should be encouraged, particularly as farms shift to conservation tillage. Under such systems, pest infestation levels—typically insects or weeds—are monitored closely throughout the growing season. Random locations within fields are sampled for the presence and relative abundance of pests, their developmental stages with respect to the crop grown, and their potential for adversely affecting yields. In some locations, spot treatment may be prescribed to keep pest population levels in check. More often, infestations are evaluated against their potential to significantly lower yields. In some cases, no pesticide is applied, as the cost of treatment is found to equal or exceed the cost of projected yield reductions. In other cases, the pests are brought under control to ensure profitability, but application is carefully timed and measured so as to work most cost effectively. Through such programs, the conventional or routine application of chemicals is minimized. The same type of approach can be used to ensure the judicious application of fertilizers.

When helping farmers address soil erosion problems, agricultural technicians should encourage farmers to utilize conservation practices other than conservation tillage when the operator exhibits a general lack of sensitivity concerning

surface water or groundwater pollution. Use of no-till systems, in particular, should be discouraged on farmlands located in areas susceptible to groundwater contamination.

Costs of Recommended Practices

Of the soil erosion control practices recommended herein, implementation costs may be readily estimated for two practices—namely, grassed waterways and permanent vegetative cover. The cost of installing grassed waterways without tiles—including a 10 percent allowance for engineering—would approximate \$118,400 for the entire County. The establishment of a permanent vegetative cover would similarly cost about \$9,400.

The costs of implementing the other recommended practices—including the conservation tillage systems—are more difficult to estimate. Of concern to the farmer is the difference in net return as the farmer shifts from conventional cropping to a form of conservation tillage. Net return may be adversely affected by potentially decreased yields; by greater use of pesticides; and by the capital outlay required for the specialized equipment used in some conservation tillage systems. Net return may also be positively affected by lower fuel consumption and lower operation and maintenance costs, because conservation tillage systems involve fewer tillage operations. The impacts on net return of shifting from conventional to conservation tillage may be expected to vary from farm to farm, depending upon the size of operation; the physical characteristics of the farm, including soil and topographic characteristics; the types of crops grown; and the type and condition of existing farm machinery.

CONSERVATION PLANNING REQUIREMENTS

While the county soil erosion control plan identifies the general types of practices which may be utilized to control soil erosion, detailed farm conservation plans will be required to adapt and refine those recommendations for individual farm units. Conservation plans are detailed plans, generally prepared with the assistance of the U. S. Soil Conservation Service or County Land Conservation Department staffs, intended to guide agricultural activity in a manner which conserves soil and water resources. The conservation plan recommends site-specific desirable tillage practices, cropping patterns, and rotation cycles, considering the topography, hydrology,

and soil characteristics of the farm, together with the resources of the farm operator and the operator's objectives as owner or manager of the land. Farm conservation plans have been prepared in the recent past for about 110 farms, or about 11 percent of the total of 980 farm operations in Waukesha County. This includes about 60 plans recently completed by the Waukesha County Land Conservation Department and the U. S. Soil Conservation Service to assist farmers in meeting the soil erosion compliance requirements of the Wisconsin Farmland Preservation Program; and about 50 plans recently completed by the U. S. Soil Conservation Service to assist farmers in meeting the federal conservation compliance requirements established under the Food Security Act of 1985. No additional conservation planning would be required for these farms during implementation of the county soil erosion control plan.

Plans for an estimated 200 farms, or just over 20 percent of all farms in Waukesha County, prepared in the more distant past under the U. S. Soil Conservation Service continuing technical assistance program should remain substantially valid, but would require review and updating during implementation of the county soil erosion control plan.

The remaining 670 farms, representing just over 68 percent of all farms in the County, have conservation plans that are outdated, or have no conservation plans whatsoever. It is estimated that at least 5 percent, or about 34, of these farms are not experiencing any excessive cropland soil erosion, and accordingly would not require a farm conservation plan. It is anticipated that farm plans would be prepared for the balance—about 636 farms—during implementation of the county soil erosion control plan.

The conservation planning requirements envisioned under the county soil erosion control plan would require a commitment of time by conservation technicians of an estimated 18,400 man-hours, or about nine man-years. Total salary and fringe-benefit costs attendant to such conservation planning, expressed in 1987 dollars, would approximate \$220,800 through the year 1999, or an average of \$18,400 per year for 12 years. Most of the farm conservation planning work would be cooperatively undertaken by the Waukesha County Land Conservation Department and the U. S. Department of Agriculture, Soil Conservation Service.

It is anticipated that the detailed farm conservation planning described above would address any apparent wind erosion or stream bank erosion problems, as well as cropland sheet and rill erosion and gully erosion. Wind erosion and stream bank erosion are not considered to be significant problems in Waukesha County, and such problems as may exist are localized in nature.

EROSION CONTROL PRIORITY AREAS

The rank ordering of subareas of the County for soil erosion control purposes is a key aspect of the county soil erosion control plan. Such a rank ordering could be accomplished in a number of ways. The Waukesha County Soil Erosion Control Planning Program Technical Advisory Committee determined that the rank ordering of areas for erosion control should be based primarily upon the soil loss rate and the amount of excessive soil erosion occurring, with those areas having the highest soil loss rate and greatest amount of excessive soil loss assigned the highest priority for erosion control. The Committee further determined that U. S. Public Land Survey sections, each approximating 640 acres in area, should serve as the basic geographic units for the rank ordering, and that the U. S. Public Land Survey sections should be classified into priority categories based upon the average soil loss rate and the amount of excessive erosion occurring. The approach recommended by the Advisory Committee was intended to address the most serious soil erosion problems first and to achieve the maximum reduction in soil erosion as quickly as possible with the limited resources available.

The specific criteria for grouping and ranking U. S. Public Land Survey sections for erosion control, developed under the guidance of the Technical Advisory Committee, are set forth in Table 8 in Chapter V of this report. Based upon those criteria, each U. S. Public Land Survey section containing cropland eroding at excessive rates was assigned to one of four priority categories, as shown on Map 11 in Chapter V. Priority Area A—the highest priority area for erosion control—includes 108 U. S. Public Land Survey sections, which together encompassed about 26,128 acres of cropland in 1987. On the average, cropland in Priority Area A was eroding at 2.1 times T-value, and about 18,226 acres, or about 70 percent of all cropland in the 108 sections concerned, was eroding at rates exceeding T-value. Conversely, Priority Area D—the lowest priority area for erosion control—contains 158

U. S. Public Land Survey sections, which together encompassed about 21,045 acres of cropland. On the average, cropland in Priority Area D was eroding at 0.8 times T-value, and about 3,985 acres, or about 19 percent of all cropland in the 158 sections concerned, was eroding at rates exceeding T-value.

As previously indicated, the long-range objective of the county soil erosion control plan is the reduction of soil erosion on all cropland in Waukesha County to tolerable levels by the year 2000. In order to meet this objective, it is recommended that, to the extent practicable, available public soil erosion control resources be directed toward the resolution of soil erosion problems in Priority Area A during the years 1988 through 1990; in Priority Area B during the years 1991 through 1993; in Priority Area C during the years 1994 through 1996; and in Priority Area D during the years 1997 through 1999.

Water Quality Considerations

The county soil erosion control planning program identified farm fields within Priority Area A having potential adverse impacts on surface water or groundwater as a result of excessive soil erosion. The identification of potential surface water problems was based upon an analysis of the existing drainage pattern, the proximity of the eroding field to the surface water network, and the extent of effective buffering between the eroding field and the surface water, as determined from a review of topographic maps and aerial photographs, and from field inspection. The identification of potential groundwater impacts was based upon analysis of drainage patterns as well as the types of soils, the depth to bedrock, and the vegetative cover of internally drained areas, as determined from a review of topographic maps, aerial photographs, and soil survey maps, as well as from field inspection. This analysis indicated that of the 18,226 acres of excessively eroding cropland in Priority Area A, about 10,300 acres, or just under 57 percent, have a potential for contributing significantly to surface- or groundwater pollution. In addressing soil erosion problems within Priority Area A, first priority should be given to those areas containing concentrations of excessively eroding cropland identified as having potential adverse water quality impacts.

PLAN IMPLEMENTATION

Implementation of the soil erosion control plan depends on the cooperative actions of a number

of county, state, and federal units or agencies of government. Those units or agencies of government whose actions will have a significant effect, directly or indirectly, upon the successful implementation of the recommended soil erosion control plan include, at the county level, the Waukesha County Board, the Waukesha County Land Conservation Committee, and the Waukesha Park and Planning Commission; at the state level, the Wisconsin Department of Agriculture, Trade and Consumer Protection, the Wisconsin Department of Natural Resources, and the University of Wisconsin-Extension; and at the federal level, the U. S. Department of Agriculture—Agricultural Stabilization and Conservation Service, Soil Conservation Service, and Farmers Home Administration. It is very important that the powers and programs of these agencies and units of government which bear on soil erosion problems be coordinated to achieve the maximum reduction in cropland soil erosion in Waukesha County.

It is envisioned that the major programs and activities to be carried out by the concerned county, state, and federal agencies in an effort to implement the county soil erosion control plan will include the provision of technical assistance to farmers, particularly in the preparation of farm conservation plans, as well as assistance in the design of soil erosion control improvements, as appropriate; financial assistance to farmers in the application of needed practices; and information and education programs to increase the awareness among farmers of soil erosion problems, of the types of practices which may be used to address those problems, and of the public financial and technical resources that are available to help in implementing those practices. The plan recommends that, to the extent possible given existing program regulations, available technical, financial, and educational resources be used to address soil erosion problems in Waukesha County in general conformance with the priority area recommendations and related time frame as described above. Major plan implementation responsibilities are set forth by agency in Table 22.

Table 22

SUMMARY OF PLAN IMPLEMENTATION RESPONSIBILITIES FOR THE WAUKESHA COUNTY SOIL EROSION CONTROL PLAN

Plan Implementation Activity	Waukesha County Board of Supervisors	Waukesha County Land Conservation Committee/Land Conservation Department	Waukesha County Park and Planning Commission/Park and Planning Department	Wisconsin Department of Agriculture, Trade and Consumer Protection	Wisconsin Department of Natural Resources	University of Wisconsin Extension	U. S. Department of Agriculture, Agricultural Stabilization and Conservation Service	U. S. Department of Agriculture, Soil Conservation Service	U. S. Department of Agriculture, Farmers Home Administration
Plan Adoption/Endorsement	X	X	X	X	X	X	X	X	X
Provision of Technical Assistance to Farmers in Preparation of Farm Conservation Plans and Design of Soil Erosion Control Practices.		X						X	
Administration of Conservation Compliance Requirements of State and Federal Farm Programs		X					X	X	
Administration of Financial Assistance Programs to Assist Farmers in the Implementation of Erosion Control Practices		X		X	X		X		X
Coordination of State Nonpoint Source Pollution Abatement Program (Priority Watershed Program) with the County Soil Erosion Control Plan					X				
Development and Implementation of a Soil Erosion Control Information and Education Program for Farmers in Waukesha County		X				X		X	
Integration of County Soil Erosion Control Plan Objectives into Administration of the General Zoning Ordinance and Shoreland Protection Ordinance			X						

Source: SEWRPC.

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APPENDICES

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Appendix A

SOIL LOSS TOLERANCES OR "T-VALUES" FOR SOILS IN WAUKESHA COUNTY

Soil Symbol	Soil Name	Soil Loss Tolerance (T-Value) in Tons per Acre per Year
Ac	Adrain muck	4
AsA	Ashkum silty clay loam, 0 to 3 percent slopes.	5
AzA	Aztalan loam, 0 to 2 percent slopes.	5
AzB	Aztalan loam, 2 to 6 percent slopes.	5
BIA	Blount silt loam, 1 to 3 percent slopes.	3
BmB	Boyer loamy sand, 1 to 6 percent slopes	3-4
BmC2	Boyer loamy sand, 6 to 12 percent slopes, eroded	3-4
BnB	Boyer sandy loam, 1 to 6 percent slopes	3-4
BsA	Brookston silt loam, 0 to 3 percent slopes	5
CcB	Casco sandy loam, 2 to 6 percent slopes.	3
CcC2	Casco sandy loam, 6 to 12 percent slopes, eroded	3
CcD2	Casco sandy loam, 12 to 20 percent slopes, eroded	3
CeB	Casco loam, 2 to 6 percent slopes	3
CeC2	Casco loam, 6 to 12 percent slopes, eroded.	3
CeD2	Casco loam, 12 to 20 percent slopes, eroded.	3
CfC3	Casco soils, 6 to 12 percent slopes, severely eroded	2
CrC2	Casco-Rodman complex, 6 to 12 percent slopes, eroded	3
CrD	Casco-Rodman complex, 12 to 20 percent slopes.	3
CrE	Casco-Rodman complex, 20 to 30 percent slopes.	3
CrF	Casco-Rodman complex, 30 to 45 percent slopes.	3
CtB	Chelsea fine sand, 1 to 6 percent slopes	5
CtD	Chelsea fine sand, 6 to 20 percent slopes	5
Cw	Colwood silt loam	5
DdA	Dodge silt loam, 0 to 2 percent slopes	5
DdB	Dodge silt loam, 2 to 6 percent slopes	5
Dt	Drummer silt loam, gravelly substratum.	5
EsA	Elliott silt loam, 1 to 3 percent slopes	4
FaA	Fabius loam, 1 to 3 percent slopes	3
FmA	Fox sandy loam, 0 to 2 percent slopes.	4
FmB	Fox sandy loam, 2 to 6 percent slopes.	4
FmC2	Fox sandy loam, 6 to 12 percent slopes, eroded	4
FnB	Fox sandy loam, loamy substratum, 2 to 6 percent slopes	4
FoA	Fox loam, 0 to 2 percent slopes	4
FoB	Fox loam, 2 to 6 percent slopes	4
FoC2	Fox loam, 6 to 12 percent slopes, eroded.	4

Appendix A (continued)

Soil Symbol	Soil Name	Soil Loss Tolerance (T-Value) in Tons per Acre per Year
FsA	Fox silt loam, 0 to 2 percent slopes.	4
FsB	Fox silt loam, 2 to 6 percent slopes.	4
FsC2	Fox silt loam, 6 to 12 percent slopes, eroded	4
FtB	Fox silt loam, loamy substratum, 2 to 6 percent slopes	4
Gd	Gilford loam.	4
Gf	Granby fine sandy loam	5
GrA	Grays silt loam, 0 to 2 percent slopes	5
GrB	Grays silt loam, 2 to 6 percent slopes	5
GtB	Griswold silt loam, 2 to 6 percent slopes	5
GtC2	Griswold silt loam, 6 to 12 percent slopes, eroded	5
GwB	Griswold silt loam, mottled subsoil variant, 2 to 6 percent slopes	5
HeA	Hebron loam, 0 to 2 percent slopes.	5
HeB	Hebron loam, 2 to 6 percent slopes.	5
HeC2	Hebron loam, 6 to 12 percent slopes, eroded	5
HmB	Hochheim loam, 2 to 6 percent slopes.	3
HmB2	Hochheim loam, 2 to 6 percent slopes, eroded	3
HmC2	Hochheim loam, 6 to 12 percent slopes, eroded.	3
HmD2	Hochheim loam, 12 to 20 percent slopes, eroded.	3
HmE2	Hochheim loam, 20 to 30 percent slopes, eroded.	3
HoC3	Hochheim soils, 6 to 12 percent slopes, severely eroded	2
HoD3	Hochheim soils, 12 to 20 percent slopes, severely eroded	2
HoE3	Hochheim soils, 20 to 30 percent slopes, severely eroded	2
HtA	Houghton muck, 0 to 2 percent slopes.	5
HtB	Houghton muck, 2 to 6 percent slopes.	5
JuA	Juneau silt loam, 1 to 3 percent slopes.	5
KeA	Kane silt loam, 1 to 3 percent slopes.	4
KIA	Kendall silt loam, 1 to 3 percent slopes	5
KnB	Kewaunee silt loam, 2 to 6 percent slopes	3
KnC2	Kewaunee silt loam, 6 to 12 percent slopes, eroded	2
KwA	Knowles silt loam, 0 to 2 percent slopes.	4
KwB	Knowles silt loam, 2 to 6 percent slopes.	4
LmB	Lamartine silt loam, 1 to 4 percent slopes	5
Lo	Lawson silt loam	5
LyB2	Lorenzo loam, 2 to 6 percent slopes, eroded.	3
LyC2	Lorenzo loam, 6 to 12 percent slopes, eroded	3
LyD2	Lorenzo loam, 12 to 20 percent slopes, eroded	3

Appendix A (continued)

Soil Symbol	Soil Name	Soil Loss Tolerance (T-Value) in Tons per Acre per Year
MaA	Manawa silt loam, 1 to 3 percent slopes	3
MeB	Markham silt loam, 2 to 6 percent slopes	3
MgA	Martinton silt loam, 1 to 3 percent slopes	3
MhA	Matherton sandy loam, 1 to 3 percent slopes	4
MmA	Matherton silt loam, 1 to 3 percent slopes	4
MoA	Mayville silt loam, 0 to 2 percent slopes	5
MoB	Mayville silt loam, 2 to 6 percent slopes	5
MtA	Mequon silt loam, 1 to 3 percent slopes	5
MvB	Kidder sandy loam, sandy loam substratum, 2 to 6 percent slopes	5
MvC2	Kidder sandy loam, sandy loam substratum, 6 to 12 percent slopes, eroded	5
MxB	Kidder loam, sandy loam substratum 2 to 6 percent slopes	5
MxC2	Kidder loam, sandy loam substratum, 6 to 12 percent slopes, eroded	5
MxD2	Kidder loam, sandy loam substratum, 12 to 20 percent slopes, eroded	5
MxE	Kidder loam, sandy loam substratum, 20 to 30 percent slopes	5
Mzb	Montgomery silty clay loam	5
MzdB	Morley silt loam, 2 to 6 percent slopes	4
MzdB2	Morley silt loam, 2 to 6 percent slopes, eroded	4
MzdC2	Morley silt loam, 6 to 12 percent slopes, eroded	4
MzdD2	Morley silt loam, 12 to 20 percent slopes, eroded	4
MzfA	Mundelein silt loam, 1 to 3 percent slopes	5
Mzg	Muskego muck	4
Mzk	Mussey loam.	3
Na	Navan silt loam	3
Oc	Willetta muck	4
OmB	Oshtemo loamy sand, 1 to 6 percent slopes	5
OnB	Oshtemo sandy loam, 1 to 6 percent slopes	5
OuB	Ozaukee silt loam, 2 to 6 percent slopes	3
OuB2	Ozaukee silt loam, 2 to 6 percent slopes, eroded	3
OuC2	Ozaukee silt loam, 6 to 12 percent slopes, eroded	3
OuD2	Ozaukee silt loam, 12 to 20 percent slopes, eroded	3
Pa	Palms muck	5
Ph	Pella silt loam	5
Pm	Pella silt loam, moderately shallow variant	4
PrA	Pistakee silt loam, 1 to 3 percent slopes	5
RkB	Ritchey silt loam, 1 to 6 percent slopes	2
RkC2	Ritchey silt loam, 6 to 12 percent slopes, eroded	2
RkE	Ritchey silt loam, 12 to 30 percent slopes	2

Appendix A (continued)

Soil Symbol	Soil Name	Soil Loss Tolerance (T-Value) in Tons per Acre per Year
RIA	Ritchey silt loam, mottled subsoil variant, 1 to 3 percent slopes	3-4
Ru	Edwards muck, deep	4
Rv	Edwards muck, shallow	4
SaA	St. Charles sandy loam, gravelly substratum, 1 to 3 percent slopes	5
ScA	St. Charles silt loam, 0 to 2 percent slopes	4-5
ScB	St. Charles silt loam, 2 to 6 percent slopes	4-5
SeA	St. Charles silt loam, gravelly substratum, 0 to 2 percent slopes	5
SeB	St. Charles silt loam, gravelly substratum, 2 to 6 percent slopes	5
Sg	Sawmill silt loam, calcareous variant	5
ShA	Saylesville silt loam, 0 to 2 percent slopes	5
ShB	Saylesville silt loam, 2 to 6 percent slopes	5
ShB2	Saylesville silt loam, 2 to 6 percent slopes, eroded	5
ShC2	Saylesville silt loam, 6 to 12 percent slopes, eroded	5
Sm	Sebewa silt loam	4
ThA	Theresa silt loam, 0 to 2 percent slopes	4
ThB	Theresa silt loam, 2 to 6 percent slopes	4
ThB2	Theresa silt loam, 2 to 6 percent slopes, eroded	4
ThC2	Theresa silt loam, 6 to 12 percent slopes, eroded	4
VsA	Virgil silt loam, gravelly substratum, 0 to 3 percent slopes	5
Wa	Wallkill silt loam	5
WdB	Warsaw sandy loam, 2 to 6 percent slopes	4
WeA	Warsaw loam, 0 to 2 percent slopes	3-4
WeB	Warsaw loam, 2 to 6 percent slopes	3-4
WeC2	Warsaw loam, 6 to 12 percent slopes, eroded	3-4
WhA	Warsaw silt loam, 0 to 2 percent slopes	3-4
WmA	Wasepi sandy loam, 1 to 3 percent slopes	4

Source: U. S. Soil Conservation Service.

Appendix B

CROPLAND ERODING IN EXCESS OF T-VALUE BY PRIORITY AREA FOR U. S. PUBLIC LAND SURVEY TOWNSHIPS IN WAUKESHA COUNTY: 1987

U. S. Public Land Survey Township	Priority Area A		Priority Area B		Priority Area C		Priority Area D	
	Number of U. S. Public Land Survey Sections	Acres of Cropland Eroding in Excess of T-Value	Number of U. S. Public Land Survey Sections	Acres of Cropland Eroding in Excess of T-Value	Number of U. S. Public Land Survey Sections	Acres of Cropland Eroding in Excess of T-Value	Number of U. S. Public Land Survey Sections	Acres of Cropland Eroding in Excess of T-Value
5 North, 17 East (Eagle)	0	0	3	388	7	523	15	285
5 North, 18 East (Mukwonago)	5	896	10	1,489	8	551	10	273
5 North, 19 East (Vernon)	16	2,651	6	787	6	478	5	85
5 North, 20 East (Muskego)	8	1,600	7	1,261	10	809	7	147
6 North, 17 East (Ottawa)	1	190	1	145	6	443	16	388
6 North, 18 East (Genesee)	11	1,528	1	114	8	590	13	374
6 North, 19 East (Waukesha)	9	1,403	1	101	12	912	7	227
6 North, 20 East (New Berlin)	10	1,535	3	407	9	640	5	99
7 North, 17 East (Summit)	3	471	6	1,121	8	544	12	310
7 North, 18 East (Delafield)	8	1,480	4	634	10	688	9	256
7 North, 19 East (Pewaukee)	3	411	4	496	8	633	13	345
7 North, 20 East (Brookfield)	1	198	0	0	6	412	10	228
8 North, 17 East (Oconomowoc)	5	1,057	13	2,065	10	673	7	136
8 North, 18 East (Merton)	3	479	8	1,251	6	409	17	439
8 North, 19 East (Lisbon)	9	1,733	8	1,248	12	785	7	222
8 North, 20 East (Menomonee Falls)	16	2,594	2	276	9	678	5	171
County Total	108	18,226	77	11,783	135	9,768	158	3,985

Source: SEWRPC.

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Appendix C

USDA AGRICULTURAL STABILIZATION AND CONSERVATION SERVICE
MEMORANDUM REGARDING USE OF COUNTY SOIL EROSION CONTROL PLANS

UNITED STATES
DEPARTMENT OF
AGRICULTURE

AGRICULTURAL
STABILIZATION AND
CONSERVATION SERVICE

WISCONSIN STATE ASCS OFFICE
4601 HAMMERSLEY ROAD
MADISON, WISCONSIN 53711

Date: 7-9-87
WI CONS. MEMO-154

To: All County ASCS Offices

From: Donald I. Wachter, Specialist
Conservation and Environmental Protection Programs

Subject: Use of County Soil Erosion Control Plans.

USDA is dead serious about halting excessive soil erosion. Farmers who continue to cause serious soil erosion while farming will soon lose many USDA program benefits.

The CRP attacks the erosion problem by removing highly erodible cropland from production and returning it to protective cover.

The ACP assists in solving erosion problems by sharing in the cost of installing needed conservation practices.

A perennial dilemma is identifying serious erosion problems so we can effectively target our program to solving them.

Erosion Control Plans are being compiled by 55 county Land Conservation Departments. Data supporting these Plans show the location of most critically eroding sites. These Plans will be useful to you in targeting your conservation programs.

Plans will not be developed for the following counties:

Ashland	Bayfield	Burnett	Douglas
Florence	Forest	Iron	Langlade
Marinette	Menominee	Oneida	Price
Rusk	Sawyer	Taylor	Vilas
Washburn			

Plans have been completed and approved for the following counties:

Adams	Buffalo	Calumet	Dunn
Green	Lafayette	Lincoln	Marquette
Oconto	Pepin	Pierce	Portage
Rock	Shawano	Trempealeau	Vernon

Plans are in various stages of development in many other counties. Even though a county's plan may not yet be approved, background data will be useful to you.

Contact your county Land Conservation Department to become acquainted with the Erosion Control Plan and its supporting data. It is expected that County ASCS Offices will use the Plan to further its conservation programs objective, where such Plan is available.

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Appendix D

PUBLIC INFORMATIONAL MEETING ON THE WAUKESHA COUNTY SOIL EROSION CONTROL PLANNING PROGRAM

A countywide meeting was held on June 19, 1986, at the Waukesha County office building to provide information to the public concerning the county soil erosion control planning program, as well as the county animal waste management planning program. The meeting was announced in area newspapers and in the U. S. Agricultural Stabilization and Conservation Service (ASCS) newsletter. A copy of the meeting agenda, along with a copy of the press release and of the meeting announcement in the ASCS newsletter, are included in this appendix. Although it was well publicized, the meeting was attended by just one farmer, a member of the Soil Erosion Control Planning Program Technical Advisory Committee. It is anticipated that, as a first step in the information and education program recommended in the county soil erosion control plan, a meeting will be held for farmers in Priority Area A—the highest priority area for cropland soil erosion control—to explain the findings and recommendations of the plan, to describe soil loss rates within that area, and to describe the types of practices that are recommended for adoption by the farmers concerned to remedy soil erosion problems. Written notice of the meeting would be sent to each farmer within Priority Area A. It is anticipated that additional meetings will be held with Priority Area A farmers over the next three years, as deemed appropriate by the Land Conservation Department.

AGENDA FOR MEETING ON WAUKESHA COUNTY SOIL EROSION CONTROL

NOTICE OF MEETING AND AGENDA

PUBLIC INFORMATIONAL MEETING ON THE
WAUKESHA COUNTY SOIL EROSION CONTROL PLAN AND
ANIMAL WASTE MANAGEMENT PLAN

Date: June 19, 1986

Time: 8:00 p.m.

Place: Brookfield Room
Waukesha County Office Building
500 Riverview Avenue
Waukesha, Wisconsin

1. Introductory Remarks (George L. Oncken, Natural Resource Agent, University of Wisconsin-Extension)
2. Soil Erosion Control Planning Program (Regional Planning Commission Staff)
 - a. Program Origin and Objectives
 - State Soil Erosion Control Program
 - Waukesha County Soil Erosion Control Planning Program
 - b. County Soil Erosion Control Planning Process
3. Animal Waste Management Planning Program (Regional Planning Commission Staff)
 - a. Program Origin and Objectives
 - State Animal Waste Water Pollution Grant Program
 - Waukesha County Animal Waste Management Planning Program
 - b. County Animal Waste Management Planning Process

NEWS RELEASE ANNOUNCING WAUKESHA COUNTY SOIL EROSION CONTROL MEETING

Waukesha County Land
Conservation Committee
500 Riverview Avenue
Waukesha, WI 53188

George L. Oncken
Natural Resource Agent
UWEX

FOR IMMEDIATE RELEASE

May 21, 1986

SOIL EROSION MEETING SCHEDULED

The Waukesha County Advisory Committee, created to provide guidance in developing an Erosion Control Plan and Animal Waste Plan for Waukesha County, would like to invite all interested farmers to participate in an informational meeting on June 19, 1986 at 8:00 p.m. in the Brookfield Room, Waukesha County Office Building, 500 Riverview Avenue, Waukesha.

Items for public discussion will include an overview of the Animal Waste and Soil Erosion Plan, progress of inventory, and the cost/benefit ratios to the farmers once the plan is completed and adopted.

Presenting information on the development of the plan will be George Oncken, Natural Resource Agent, UWEX; Tom Littwin, Land Conservationist, LCC; and Southeastern Wisconsin Regional Planning Commission.

* * * * *

ANNOUNCEMENT OF SOIL EROSION CONTROL MEETING IN ASCS NEWSLETTER

SOIL EROSION MEETING SCHEDULED

The Waukesha County Advisory Committee, created to provide guidance in developing an Erosion Control Plan and Animal Waste Plan for Waukesha County, would like to invite all interested farmers to participate in an informatinal meeting on June 19, 1986 at 8:00 p.m. in the Brookfield Room, Waukesha County Office Building, 500 Riverview Avenue, Waukesha.

Items for public discussion will include an overview of the Animal Waste and Soil Erosion Plan, progress of inventory, and the cost/benefit ratios to the farmers once the plan is completed and adopted.

Presenting information on the development of the plan will be George Oncken, Natural Resource Agent, UWEX; Tom Littwin, Land Conservationist, LCC; and Southeastern Wisconsin Regional Planning Commission.

SINCERELY,

MAX HORWATICH JR.
COUNTY EXECUTIVE DIRECTOR

ASCS PROGRAMS ARE OPEN TO ALL ELIGIBLE FARMERS REGARDLESS OF RACE, COLOR, RELIGION, SEX, HANDICAP, OR NATIONAL ORIGIN.