SOUTHWEST OHIO RIVER BASIN

TYPE IV SURVEY REPORT
1979

United States Department of Agriculture
Soil Conservation Service
Economics, Statistics & Cooperatives Service
Forest Service

SOUTHWEST OHIO RIVER BASIN

PREPARED BY:

U.S. Department of Agriculture

IN COOPERATION WITH:

OHIO DEPARTMENT OF NATURAL RESOURCES

May 1979

ADDENDUM

This addendum reflects an interest rate change from 6 5/8 percent to 6 7/8 percent, and also the updating of costs and benefits current values. The updated tables in this addendum correspond to and were given the same number of tables in the main body of the report.

Table 8-8

ED Plan, 1990, for Recreation
Southwest Ohio River Basin

Location Area	Resource Area Purchased (Acres)	Resource Area Preserved	Basic Facilities Costs1/	Land Costs1/	Total Recreation Costs1/
Sidney to Tipp City Strip and Node Corridor	850	11,800	4,182,000	1,020,000	5,202,000
Mill Creek Strip and Node Corridor	1,160	5,800	5,707,200	1,392,000	7,099,200
Sidney Upground Reservoir	500	0	4,368,000	648,000	5,016,000
Piqua Upground Reservoir	770	0	6,384,000	972,000	7,356,000
Greenville Upground Reservoir	360	0	3,456,000	504,000	3,960,000
Mad River Strip and Node Corridor	600	8,500	2,952,000	720,000	3,672,000
Dayton Strip and Node Corridor	8,500	16,400	41,820,000	10,200,000	52,020,000
Lower Great Miami Strip and Node Corridor	550	7,700	2,760,000	660,000	3,420,000
Little Beaver Reservoir 2/	300	0	800,640	360,000	1,160,640
Massies Creek Reservoir 2/	350	0	1,709,136	630,000	2,339,136
Grand Total	13,940	50,200	74,138,976	17,106,000	91,244,976

1/ Updated to 1979 price base by a factor of 1.2.

2/ The method for economic analysis used precludes the reconstruction of annual structural costs from data presented in this table.

Table 8-9

Comparison of Annual Recreation Benefits to Costs (Dollars),
1990, ED Plan, For Recreation
Southwest Ohio River Basin1/

Location	Annual Recreation Benefits4/	Annual 2/3/ Structural Costs	Annual Operation & Maintenance Costs5/	Total Average Annual Costs	Benefit-Cost Ratio
Sidney to Tipp City Strip and Node Corridor	1,020,000	358,050	204,0000	562,050	1.8:1.0
Mill Creek Strip and Node Corridor	1,392,000	488,640	278,400	767,040	1.8:1.0
Sidney Upground Reservoir	600,000	345,240	120,000	465,240	1.3:1.0
Piqua Upground Reservoir	924,000	506,300	184,800	691,100	1.3:1.0
Greenville Upground Reservoir	432,000	272,570	86,400	358,970	1.2:1.0
Mad River Strip and Node Corridor	720,000	252,740	144,000	396,740	1.8:1.0
Dayton Strip and Node Corridor	10,200,000	3,580,540	2,040,000	5,620,540	1.8:1.0
Lower Great Miami Strip and Node Corridor	660,000	235,400	132,000	367,400	1.8:1.0
Little Beaver Reservoir (Mercer Co.)	285,060	182,620	48,000	230,620	1.2:1.0
Massies Creek Reservoir	515,470	364,160	88,200	452,360	1.1:1.0

1/ Price Base 1979.
2/ 6 7/8 percent interest, 100 years.
3/ Updated to 1979, example: 287,670 divided by .06636 times 1.2 times .06883 equal 358,050.
4/ Updated to 1979, example: 765,000 divided by 1.5 (benefit per visit) x 2.00 (benefit per visit 1979) equals 1,020,000.
5/ Updated to 1979, example: 170,000 times 1.2 (updated factor) equals 204,000.

Table 8-10

ED Plan, 2020, For Recreation
Southwest Ohio River Basin

Location or Area	Resource Areas Purchased (Acres)	Resource Area Preserved (Acres)	Basic Facilities Cost ($)1/	Land Cost ($)1/	Total Recreation Cost ($)1/
Indian Lake	400	0	2,976,000	480,000	3,456,000
Kiser Lake	300	0	2,232,000	360,000	2,592,000
Wabash River Strip and Node Corridor	90	1,200	442,800	108,000	550,800
Ohio River Strip and Node Corridor	520	5,400	2,558,400	624,000	3,182,400
Grand Lake St. Marys	1,200	0	7,728,000	1,440,000	9,168,000
Total	2,510	6,600	15,937,200	3,012,000	18,949,200

1/ Example Updating Costs: 1.2 times 2,880,000 equal 3,456,000.

Table 8-11

Comparison of Annual Recreation Benefits to Costs, 2020
ED Plan, for Recreation,
Southwest Ohio River Basin1/

Location	Annual Recreation Benefits3/ ($)	Annual 2/ Structural Costs ($)	Annual Operation & Maintenance Costs4/ ($)	Total Average Annual Costs ($)	Benefit-Cost Ratio
Indian Lake Expansion	480,000	237,880	96,000	333,880	1.4:1.0
Kiser Lake Expansion	360,000	178,400	72,000	250,400	1.4:1.0
Wabash River Strip and Node Corridor	108,000	37,910	21,600	59,510	1.8:1.0
Ohio River Strip and Node Corridor	624,000	219,040	124,800	343,840	1.8:1.0
Grand Lake St. Marys Expansion	1,440,000	631,030	288,000	919,030	1.6:1.0

1/ Price Base 1979

2/ 6 7/8 percent interest, amortized at 100-years (costs from Table 8-10).

3/ Example: 360,000 divided by $1.5 (benefit per unit 1976) x $2.00 (benefit per unit 1979).

4/ Example: 80,000 x 1.2 index factor for 1976 to 1979 equal 96,000.

Table 8-15

EQ Plan, 1990, For Recreation
Southwest Ohio River Basin 1/

Location or Area	Resource Area Purchased (Acres)	Resource Area Preserved (Acres)	Basic Facilities Cost ($)2/	Land Cost ($)2/	Total Recreation Cost ($)2/
Taylorsville Primitive Corridor	640	6,400	122,880	768,000	890,880
Stillwater River Valley Corridor	550	9,100	1,153,080	660,000	1,813,080
Miami-Whitewater Corridor	1,000	14,000	2,096,400	1,200,000	3,296,400
East Fork-Stonelick Primitive Corridor	3,300	33,000	633,600	3,960,000	4,593,600
Little Miami Scenic and Valley Corridor	4,000	33,000	8,400,000	4,800,000	13,200,000
Germantown Primitive Corridor	2,400	23,900	460,800	2,880,000	3,340,800
Upper Great Miami Valley Corridor	305	5,900	639,360	366,000	1,005,360
Upper Mad River Valley Corridor	220	15,000	461,160	264,000	725,160
Total	12,415	140,300	13,967,280	14,898,000	28,865,280

1/ Price Base 1979.

2/ Updated by a factor of 1.2.

Table 8-17

Comparison of Annual Recreation Benefits to Costs (Dollars 1/), 1990
EQ Plan, For Recreation
Southwest Ohio River Basin

Location	Annual 2/3/ Recreation Benefits	Annual 3/4/ Structural Costs	Annual 3/ Operation & Maintenance Costs	Total Average Annual Costs	Benefit-Cost Ratio
Taylorsville Primitive Corridor	128,000	61,320	770	62,090	2.1:1.0
Stillwater River Valley Corridor	256,670	124,790	33,000	157,790	1.6:1.0
Miami-Whitewater Corridor	466,670	226,890	60,000	286,890	1.6:1.0
East Fork-Stonelick Primitive Corridor	660,000	316,180	3,960	320,140	2.0:1.0
Little Miami Scenic and Valley Corridor	1,866,670	908,560	240,000	1,148,500	1.6:1.0
Germantown Primitive Corridor	480,000	229,950	2,880	232,830	2.0:1.0
Upper Great Miami Valley Corridor	142,400	69,200	18,360	87,560	1.6:1.0
Upper Mad River Valley Corridor	102,670	49,910	13,200	63,110	1.6:1.0

1/ Price Base 1979.
2/ Benefits are based on a value of $2.00 per visitor day.
3/ See Table 8-9 for example of calculations.
4/ 6 7/8 percent interest, 100-years.

Table 8-21

Economic Development Plan 1990
Economic Development Account
Southwest Ohio River Basin

Components	Measure of Effects (Average Annual) 1/
Beneficial Effects	
A. Value to users of increased outputs of goods and services.	
1. Flood prevention and improved drainage	$ 651,690
2. Recreation	16,748,530
3. Food and Fiber Output	26,262,030
Total Beneficial Effects	$43,662,250
B. Employment increases due to increased output.	
1. Agricultural employment	1,045 permanent jobs
2. Recreation employment	639 permanent jobs
3. Employment in Project Construction	1,743 man-years
4. Employment in project OM&R	5 permanent jobs

Components	Measures of Effects (Average Annual) 2/
Adverse Effects	
A. Value of resources required for the plan.	
1. Floodwater retarding structures and channels	
a. Installation Costs	$ 731,800
b. OM&R Costs	72,090
2. Recreation	
a. Installation Costs	6,586,280
b. OM&R Costs	3,449,590
3. Food and Fiber Output Cost of providing drainage measures and systems.	10,120,370
Total Adverse Effects	20,960,130
Net Beneficial Effects	22,702,110

1/ Agricultural benefits, current normalized; all other 1976.

2/ Price base 1979, amortized at 6 7/8 percent, 100-years.

Table 8-22

Environmental Quality Plan, 1990
Economic Development Account
Southwest Ohio River Basin

Components	Measures of Effects (Average Annual) 1/	Components	Measures of Effects (Average Annual) 2/
Beneficial Effects		Adverse Effects	
A. Value of users of increased output of goods and services		A. Value of resources required for the plan.	
1. Recreation	4,103,070	1. Recreation	
		a. Installation Costs	$ 1,979,360
		b. OM&R Costs	384,570
Total Beneficial Effects	$4,103,070	Total Adverse Effects	2,363,930
		Net Beneficial Effects	1,739,140
B. Employment increases due to increased output.			
1. Recreation employment	179 permanent jobs		
2. Employment in project construction	586 man-years		

1/ 1979 prices.

2/ 1979 price base, amortized at 6 7/8 percent, 100-years.

Table 9-18

Mixed Objective Plan, 1990
Economic Development Account
Southwest Ohio River Basin

Components (Benefits)	Measures of Effects (Average Annual) 1/
Beneficial Effects	
A. Value to users of increased output of goods and services.	
1. a. Flood Prevention and improved drainage on agricultural lands.	$ 317,570
b. Increased Food and Fiber Output	18,099,050
2. New recreation opportunities provided for the public.	15,833,460
Total Beneficial Effects	$34,250,080
B. Employment increases due to increased output of goods and services.	
1. Agricultural Employment	700 man-years
2. Recreation Employment	580 man-years
3. Employment in Project Construction	1,584 man-years
4. Employment for Project OM&R 3/	2 permanent semi-skilled jobs

Components (Costs)	Measures of Effects (Average Annual) 2/
Adverse Effects	
A. Value of labor, materials, & equipment required to implement a plan.	
1. Floodwater retarding dams and channels.	
a. Installation Costs	$ 335,050
b. OM&R Costs	23,900
2. New recreation facilities	
a. Installation Costs	6,112,460
b. OM&R Costs	3,051,470
c. Temporary loss of agricultural production from relatively small acreages of cropland converted to recreational facilities.	
3. Increased Food & Fiber Output Cost	5,857,400
Total Adverse Effects	15,380,280
Net Beneficial Effects	18,869,800

1/ Agricultural benefits, current normalized; all others 1976.

2/ 1979 price base, costs amortized at 6 7/8 percent, 100-years.

3/ OM&R - Operation, Maintenance, and Replacement.

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CHAPTER 1
SUMMARY

Purpose

The purpose of the Southwest Ohio River Basin Study is to provide a comprehensive analysis of problems and needs and to formulate alternatives for facilitating the coordinated and orderly conservation, development, utilization and management of the water and related land resources.

The study was prepared by the U.S. Department of Agriculture in cooperation with the Ohio Department of Natural Resources (ODNR). Principal USDA agencies in the Study were the Soil Conservation Service, Forest Service, and the Economics, Statistics and Cooperatives Service. Other federal, state, and local agencies participated in various phases of the Study. This study was coordinated with the Southwest Ohio Water Plan which was completed by ODNR.

Authority

The U.S. Department of Agriculture participated in this Study under the authority of Section 6 of the Watershed Protection and Flood Prevention Act (Public Law 83-566) as amended.

General Description

The Southwest Ohio River Basin includes all or portions of 20 counties in Southwest Ohio. The study area is 4,249,600 acres and about 120 miles long and 70 miles wide (Map 1-1).It includes the Great Miami River, Little Miami River, and the Wabash River portion in Ohio. Also included are Mill Creek, White Oak Creek, and direct drainage to the Ohio River between White Oak Creek and the Great Miami River.

Southwest Ohio is a rural-urban mixture. The northern part of the study area is agriculturally oriented and rural, while the central and southern parts are more commercial and industrially oriented and urban. In 1970 nearly 2.6 million people lived in southwest Ohio. Of this figure, approximately 2.0 million lived in the Cincinnati and Dayton metropolitan areas. Population is expected to increase in the rural and suburban areas reaching 3.1 million by 1990 and 3.7 million by 2020.

Per capita income is comparable to the state average in the study area. In 1970, per capita income was $3,291 as compared to $3,221 for the state of Ohio. Each was below the U.S. average of $3,685.

Problems and Objectives

Flooding of agricultural land in upstream watersheds is a major problem. Damage to crops, pasture, and farmsteads is most prevalent. Flooding occurs on about 135,000 acres of land. Average annual agricultural damages are estimated at $2.3 million in the upstream watersheds.

Wet agricultural soils exist on nearly 1.1 million acres of cropland. Of this, an estimated 175,000 acres have inadequate drainage outlets.

Recreation needs were determined through interpretations of the State Comprehensive Outdoor Recreation Plan for water and land based activities. With the population centers of Cincinnati and Dayton, present demand already exceeds existing supply for most activities. Additional boating, swimming, fishing, camping, picnicking, and canoeing facilities are needed to meet projected demands.

Excessive erosion exists on approximately 1.7 million acres of cropland, 238,000 acres of pastureland, and 145,000 acres of forest land.

Excessive erosion and resulting sedimentation are major problems in the study area. Erosion reduces crop yields, deteriorates visual quality, and decreases the valuable land resource base. Sediment yield, which is the result of erosion, increases the turbidity of streams, decreases the water quality, decreases reservoir and lake water holding capacity, blocks stream channels, and affects the fish and other stream habitat.

Annual gross erosion on cropland, pastureland, and forest land is estimated at 10.5 million tons. Annual sediment yield to southwest Ohio streams is estimated at approximately 2.0 million tons.

Pollution of lakes and streams and lack of proper management of stream corridors and natural areas for fish and wildlife is a major concern within the study area. Improving water quality through erosion reduction and sediment control and proper use of chemicals and fertilizers is needed. Preservation and proper management of streams, stream corridors, and natural areas is needed for fish and wildlife and recreational use.

Table 1-1 reflects the study concerns based on the problems identified. These study concerns were translated into specific components for both Economic Development and Environmental Quality as required by the Water Resource Council's Standards for Planning Water and Related Land Resources.

Needs

Needs were identified for the two major objectives, Economic Development and Environmental Quality. These needs reflect study concerns and desires and do not reflect potential project action as a result of this study. Not all needs can be reasonably met under existing programs and authorities. Table 1-2 lists the needs of the study area.

Agricultural Flooding: In 1975, there was an identified flooding problem on approximately 135,000 acres of agricultural land. The 1990 and 2020 projections show a need for flood reduction on 133,400 acres.

U S DEPARTMENT OF AGRICULTURE

LEGEND

- BASIN BOUNDARY
- SUBBASIN BOUNDARY
- STATE BOUNDARY
- COUNTY BOUNDARY
- COUNTY SEAT
- INCORPORATED TOWN OVER 25,000
- INCORPORATED TOWN 500-24,999*
- DRAINAGE
- LAKE

*NOTE
IN HAMILTON COUNTY, NOT ALL INCORPORATED TOWNS BETWEEN 500 AND 24,999 ARE SHOWN

MAP 1-1
SOUTHWEST OHIO RIVER BASIN STUDY AREA
OHIO

SCALE 1/633,600
0 5 10 15 20 25 MILES
0 5 10 15 20 25 30 35 40 KILOMETERS

SOURCE
FAMILY OF MAPS SCS DRAW NO. SJI-34,214(A-74)
TRANSVERSE MERCATOR PROJECTION

6-7-78
S,S-36,946

Table 1-1

Problems and Objectives
Southwest Ohio River Basin

Problems	Objectives
1. Frequent flooding on 135,000 acres of land in the upstream watersheds.	1. Reduce amount of flooding.
2. Wet Agricultural Soils	2. Improve agricultural production.
3. Excessive 1/ erosion occurs on 2.1 million acres of cropland 2/.	3. Reduce Erosion.
4. Insufficient recreation facilities.	4. Increased and more efficient use of recreational services.
5. Pollution of lakes and streams by sediment.	5. Reduce sediment pollution of lakes and streams.
6. Insufficient stream corridors and natural areas for public use.	6. Public acquisition and management of stream corridors and natural areas.
7. Pollution of water courses by fertilizers, chemicals, and pesticides.	7. Improve water quality.

1/ Excessive erosion as used in this study pertains to acreages on which the soil loss exceeds the tolerance limits defined by the Soil Conservation Service. "Soil Loss Tolerance" is used to denote the maximum rate of soil erosion that will permit a high level of crop productivity to be sustained economically and indefinitely.

2/ Includes pasture and forest land.

Table 1-2

Component Needs of the Economic and Environmental Quality Objectives, Under Present Programs and Funding
Southwest Ohio River Basin

Component Needs	Unit	Needs 1975	Needs 1990	Needs 2020
Reduce flooding in upstream watershed on agricultural land.	Acres	135,000	133,400	133,400 1/
Reduce erosion on cropland, pastureland, and forest land.	Acres	2,055,060	1,377,365	455,060
Reduce wetness problem on cropland.	Acres	1,088,000	985,200	793,400
Provide water and land based recreation.				
a. Boating	Acres	159,000	151,900	151,900 2/
b. Fishing	Acres	53,100	45,902	45,902
c. Canoeing	Miles	140	140	140
d. Picnicking	Tables	13,360	12,480	12,480
e. Camping	Sites	14,320	12,320	12,320
Preserve and manage stream corridors.	Acres	628,000	627,560	627,560
Provide adequate drainage outlets.	Acres	175,000	174,400	174,400

1/ Needs do not change from 1990 to 2020 because the public demand for change is low and environmental pressures opposing flood control are great.

2/ Needs do not change from 1990 to 2020 because the lack of public and private sector incentive to meet boating demands and ability to meet these demands.

Erosion Reduction on Agricultural Land: In 1975, erosion losses on 2,055,060 acres of cropland, pastureland, and forest land exceeded the tolerance 1/ limits. By 1990 and 2020 projections show that 1,377,365 and 455,060 acres, respectively, will still need erosion reduction.

Reduce Wetness Problems on Cropland: In 1975, there were 1,088,000 acres of cropland in the Basin with identified wetness problems. These problems are the result of inadequate soil drainage and result in depressed crop yields. Projections show that wetness will still be a problem on 901,200 acres in 1990 and 896,200 acres in 2020.

Provide Water and Land Based Recreation: Recreational needs presented in Table 1-2 were derived through interpretations of the State Comprehensive Outdoor Recreation Plan 2/. Needs have been identified and quantified for boating, fishing, canoeing, picnicking, and camping. Stream corridors have been utilized by local agencies in the basin as a solution to recreational demands. Additional acreages of stream corridors which could be used to satisfy recreational needs are presented in Table 1-2.

Provide Adequate Drainage Outlets: In 1975, there was a need for additional drainage outlets on 175,000 acres of cropland in the Basin. Providing adequate outlets entails the deepening of existing drains, ditches, streams, and rivers. Much of the needed, easily obtained, and economically profitable drainage outlet work has been accomplished through on-going programs and landowner initiative. The 1990 projections show a need for outlets for 174,400 acres. This need remains the same through 2020.

Mixed Objective Plan

The Mixed-Objective Plan (MO) is a combination of measures to satisfy specific components of both the Economic Development and Environmental Quality objectives.

The effects of the Mixed Objective Plan are displayed in Table 1-3 under the three accounts: Economic Development, Environmental Quality, and Social Well-Being. In the early action plan, 1990, average annual cost are $12.4 million. Average annual benefits accruing to flood prevention and improved drainage are $319,000, to recreation $11,900,000, and to increased food and fiber output $18,200,000 3/. Employment increases resulting from increased output are: agricultural employment, 700 man-years; recreation employment, 580 man-years; construction employment, 1,584 man-years. Two permanent semi-skilled jobs will result from operation and maintenance and recreation facility management demand.

1/ Soil Loss Tolerance: The maximum rate of soil erosion that will permit a high level of crop productivity to be sustained economically and indefinately.

2/ The 1975 Ohio Statewide Comprehensive Outdoor Recreation Plan, Ohio Department of Natural Resources, 1975.

3/ Figures are rounded.

Table 1-3

Mixed Objective Plan, 1990
Economic Development Account
Southwest Ohio River Basin

Components (Benefits)	Measures of Effects (Average Annual) 1/	Components (Costs)	Measures of Effects (Average Annual) 2/
Beneficial Effects		Adverse Effects	
A. Value to users of increased output of goods and services.		A. Value of labor, materials, & equipment required to implement a plan.	
1. a. Flood Prevention and improved drainage on agricultural lands.	$ 319,170	1. Floodwater retarding dams and channels.	
b. Increased Food and Fiber Output	18,190,000	a. Installation Costs	$ 269,190
2. New recreation opportunities provided for the public.	11,875,100	b. OM&R Costs	19,200
Total Beneficial Effects	$30,384,270	2. New recreation facilities	
B. Employment increases due to increased output of goods and services.		a. Installation Costs	4,910,930
1. Agricultural Employment	700 man-years	b. OM&R Costs	2,451,640
2. Recreation Employment	580 man-years	c. Temporary loss of agricultural production from relatively small acreages of cropland converted to recreational facilities.	
3. Employment in Project Construction	1,584 man-years	3. Increased Food & Fiber Output Cost	4,706,000
4. Employment for Project OM&R 3/	2 permanent semi-skilled jobs	Total Adverse Effects	$12,356,960
		Net Beneficial Effects	$18,027,310

1/ Agricultural benefits, current normalized; all others 1976.
2/ 1976 price base, costs amortized at 6 5/8 percent, 100-years.
3/ OM&R - Operation, Maintenance, and Replacement.

Table 1-3

Mixed Objective Plan, 1990
Environmental Quality Account
Southwest Ohio River Basin

Components	Measure of Effects
Beneficial and Adverse Effects	
A. Areas of Natural Beauty	1. Reduce erosion on 883,100 acres of cropland as a result of land treatment measures. 2. Develop three reservoirs. 3. Acquire 16,690 acres within stream corridors and preserve an additional 106,900 acres through zoning or easements. 4. Affect the natural vegetation on 21.6 miles of streams. 5.Apply conservation land treatment on 172,900 acres of pastureland and 35,000 acres of forest land to improve cover conditions, timber quality, and reduce erosion.
B. Quality considerations of water land, and air resources.	1. Reduce flooding on 5,914 acres of agricultural land. 2. Reduce erosion on 1,091,000 acres through land treatment measures. 3. Reduce average annual erosion 1,322,000 tons through increased use of conservation cropping and tillage measures. 4. Store 5,233 acre-feet of sediment. 5. Improve water quality by reducing sediment sources through land treatment measures, and conservation cropping and tillage measures 1/. 6. Create 340 acres of water impoundments for fisheries and wildlife habitat.
C. Biological resources and selected ecosystems.	1. Reduce stream sediment pollution to improve and protect fisheries habitat 1/. 2. Improve wildlife habitat through land treatment measures and floodwater retarding structures.

1/ Research has demonstrated on a qualitative bases that reductions in erosion cause reductions in sediment, transport, and deposition. Reliable predictive methodology for quantitative estimates does not exist at this time.

Components	Measures of Effects
C. Cont'd	3. Provide 340 acres of water impoundments for fisheries and waterfowl habitat.
	4. Maintain wildlife habitat on 123,590 acres located within stream corridors.
	5. Increase water temperature where channel work takes place.
D. Irreversible and Irretrievable Commitments of Resources.	1. Convert 340 acres of cropland, pastureland, and forest land to reservoir pools.
	2. Alter 21.6 miles of stream channels.
	3.Alter 17,040 acres for recreational developments.

Table 1-3

Mixed Objective Plan, 1990
Social Well-Being Account
Southwest Ohio River Basin

Components	Measures of Effects
Beneficial and Adverse Effects	
A. Real income distribution.	1. Create 1,282 low to medium income permanent jobs for residents in the study area. 2. Create 1,584 man-years of labor for project construction.
B. Life, Health, and Safety	1. Reduce flood damages on 5,900 acres. 2. Identify flood hazard areas on 75 miles of streams and for 13 communities.
C. Recreational Opportunities	1. Create facilities for 5,545,800 recreation visits in the region.

Adverse effects include temporary disturbance to riparian wildlife habitats during construction of water resource improvements and the expenditure of $12.4 million and loss or depreciation of associated construction labor, equipment, fuels, etc.

The Plan considers both economic development and preservation of the environment. Two flood control projects, Mud Creek and Massies Creek, and 11 flood hazard studies proposed in the MO Plan will reduce damages from flooding and protect the flood plain from new developments. Food and fiber output for 1990 will increase by three percent over the "Future Without" Plan and 9 percent over OBERS projections under future "with" Plan. Acceleration of subsurface drainage on 103,600 acres and use of more efficient tillage systems are the major factors. This alternative provides an opportunity to preserve 123,590 acres along major streams for recreational use. The demand is such that it would be feasible for private or governmental interests to purchase about 16,700 acres for this purpose. Acceleration of conservation treatment measures is proposed on 396,000 acres of cropland, pastureland, and forest land. Practices such as grassed waterways, contouring, stripcropping, critical planting, pasture and hayland management, and grazing control of forest land are methods to adequately treat the soil.

Program opportunities by USDA for implementation include: Public Law 566 Watershed Projects; Public Law 46; Resource, Conservation and Development (RC&D); Agricultural Conservation Program (ACP); Flood Hazard Studies; and Public Law 95-217 Section 208 of the Federal Water Pollution Control Act of 1977; and Cooperative Forest Management Programs. These programs provide opportunities for Basin residents to obtain technical and financial assistance in solving water and land resource problems.

CHAPTER 2
INTRODUCTION

The Southwest Ohio River Basin is in constant change. Changes such as increased use of intensive agricultural practices and increased use of land for commercial, industrial, and residential developments have put a burden on existing water, air, and land resources. As a result, deterioration of streams, lakes, agricultural and open lands, and the environment in general is continuing. A plan of action is needed by local and state agencies and citizens to correct the problems identified.

This Study was initiated at the request of Governor James A. Rhodes through the Ohio Department of Natural Resources (ODNR) and was done in conjunction with the Southwest Ohio Water Plan prepared by ODNR. The Southwest Ohio River Basin Study considers the rural water and land resource problems which include flooding of agricultural land, water quality, inadequate recreation, wet soils, forest related problems, and other rural land management.

Authority

Authority for the study is Section 6 of the Watershed Protection and Flood Prevention Act (Public Law 566) as amended. Section 6 authorizes the Secretary of Agriculture to cooperate with other federal, state, and local agencies in making investigations and surveys of watersheds, rivers, and other waterways as a basis for developing coordinated programs.

Objectives

The overall objective of the study is to develop a plan for the coordinated, and orderly conservation, development, use, and management of the basins' water and related land resources.

To accomplish this, the study was designed to investigate and analyze the total area in sufficient detail to:

1. Identify the existing water and land resources as to quantity, quality, availability, and distribution.

2. Evaluate, in relation to the demands for agricultural production, the ability of the available land and water resources to meet production needs.

3. Identify specific problems and needs related to flooding damage, soil erosion, wet agricultural soils, water quality, inadequate recreation, and forest related problems.

4. Identify and evaluate alternatives for alleviating resource problems and meeting projected agricultural, forestry, and recreational needs for selected target years.

5. Determine costs, benefits, and environmental effects of the alternatives in the study and the allocation of costs to purpose.

6. Determine the need for reducing erosion.

7. Reflect the economic and social conditions present in the basin.

General Description

The Southwest Ohio Study area includes the Great Miami, Little Miami, Mill Creek, White Oak Creek drainage areas and the portion of Upper Wabash River located in Ohio. Also included is the direct local drainage of the Ohio River between the points of confluence of White Oak Creek and the Great Miami River with the Ohio River. Table 2-1 and Map 2-1 shows the drainage area and location of hydrologic subbasins.

The hydrologic study area includes all or parts of twenty counties in Ohio. They are Auglaize, Brown, Butler, Champaign, Clark, Clermont, Clinton, Darke, Greene, Hamilton, Hardin, Highland, Logan, Madison, Mercer, Miami, Montgomery, Preble, Shelby, and Warren Counties. Total drainage area is 4,249,600 acres. Table 2-2 lists the percentage and amount of each county in the study area.

Of the 6,640 square miles in the basins, 59 percent is in cropland, 8 percent in pasture land, 10 percent in forest land, and 23 percent in other lands.

The majority (96 percent) of the study area is located in 16 counties. In the report these counties are referred to as the Southwest Ohio Economic Area (SWOEA). The counties included are: Brown, Butler, Champaign, Clark, Clermont, Clinton, Darke, Greene, Hamilton, Logan, Mercer, Miami, Montgomery, Preble, Shelby, and Warren. In 1970, these counties had a population of nearly 2.6 million people, which represented almost one-quarter of the total population in Ohio. Major concentrations are located in the metropolitan areas of Cincinnati, Dayton, and Springfield. These communities have shown a steady increase in population since 1930.

Industrial and commercial activities represent the major economic force within the study area. For example, in November 1976 the total employment in the Cincinnati and Dayton metropolitan areas was 900,700 people. The Cincinnati metropolitan area includes Clermont, Hamilton, and Warren Counties, Ohio; Dearborn County, Indiana; and Boone, Campbell, and Kenton Counties, Kentucky. The Dayton metropolitan area includes Greene, Miami, Montgomery, and Preble Counties, Ohio. Of this employment, 876,000 people or 97 percent were wage and salary employees in the nonagricultural sector and 24,700, or 3 percent, were employees in the agricultural sector. The breakdown for the nonagricultural sector is as follows: manufacturing, 30 percent; transportation and utilities, 5 percent; contract construction, 4 percent; wholesale and retail trade, 22 percent; government, 16 percent; services and other employment, 23 percent.

Despite a small work force agriculture plays a significant role in the economy of the Southwest Ohio region. It not only provides a direct source of employment but also serves as a base for agriculturally related industries, such as suppliers of farm inputs and processors of farm commodities. In 1976, cash receipts from farm production for 16 counties in Southwest Ohio represented nearly $706,000,000 or 26 percent, of the total farm production in the state. Darke and Mercer Counties

U. S DEPARTMENT OF AGRICULTURE

AUGLAIZE

HARDIN

CELINA

8

MERCER

AUGLAIZE

LOGAN

BELLEFONTAINE

SHELBY

SIDNEY

6

CHAMPAIGN

URBANA

7

OARKE

GREENVILLE

5

MIAMI

TROY

INDIANA

OHIO

SPRINGFIELD

CLARK

MONTGOMERY

FAIRBORN

MADISON

EATON

DAYTON

GREENE

KETTERING

XENIA

FAYETTE

PREBLE

4

3

MIDDLETOWN

BUTLER

WARREN

LEBANON

WILMINGTON

CLINTON

HAMILTON

1

HAMILTON

2

CLERMONT

HIGHLAND

CINCINNATI

BATAVIA

BROWN

OHIO

KENTUCKY

GEORGETOWN

OHIO

LEGEND

- BASIN BOUNDARY
- STATE BOUNDARY
- COUNTY BOUNDARY
- COUNTY SEAT
- INCORPORATED TOWN OVER 25,000
- DRAINAGE
- LAKE
- 3 HYDROLOGIC BOUNDARY AND NUMBER

SCALE
FAMILY OF MAPS SCS DRAW NO S,A-34,214(6-74)
AND INFORMATION FROM FIELD TECHNICIANS
TRANSVERSE MERCATOR PROJECTION

USDA-SCS-LINCOLN, NEB. 1978

1/633,600

SCALE 0 5 10 15 20 25 MILES
0 5 10 15 20 25 30 35 40 KILOMETERS

7-7-78
S,S-36,952

MAP 2-1

HYDROLOGIC TRIBUTARIES

SOUTHWEST OHIO RIVER BASIN STUDY AREA

OHIO

Table 2-1
Hydrologic Subbasins (Streams and Small Rivers)
Southwest Ohio River Basin

Hydrologic Tributary	Drainage Area Sq. Miles	General Description of Flow
1. Ohio River	652	Includes small drainage areas along Ohio River between the confluence of the Great Miami River and White Oak Creek with the Ohio River. Mill Creek and White Oak Creek are the major streams in this drainage area.
2. Lower Little Miami River	1100	Flows in a southerly direction through South Lebanon and Loveland and joins the Ohio River near Cincinnati. Includes Todd Fork and East Fork Little Miami.
3. Upper Little Miami River	657	Flows in a southwesterly direction from the headwaters located in Clark County through Greene County to the junction of Caesars Creek in Warren County. Includes Massies Creek and Caesars Creek.
4. Lower Miami River	1438	Flows in a southwesterly direction from Dayton through Middletown and Hamilton to the Indiana-Ohio State line where it empties into the Ohio River. Includes Twin, Fourmile, and Indian Creeks.
5. Stillwater River	676	Flows in a southeasterly direction from the headwaters west of Ansonia through Covington and Englewood and joins the Great Miami River at Dayton. Includes Greenville Creek.
6. Upper Miami River	1175	Flows south from Indian Lake to DeGraff, then westerly to Sidney, and generally south through Piqua and Troy to Dayton. Includes Loramie Creek.
7. Mad River	657	Flows in a southerly direction from Zanesfield through West Liberty to Springfield, then in a southwesterly direction to Dayton where it joins the Great Miami River.
8. Wabash River	285	Flows in a westerly direction to Fort Recovery, then northerly to the junction with Beaver Creek and westward into Indiana.

Table 2-2

Counties Within the Hydrologic Study by Percent and Area
Southwest Ohio River Basin

County	Percent	Square Miles
Auglaize	16.3	66
Brown	55.4	272
Butler	100.0	471
Champaign	78.3	339
Clark	96.8	389
Clermont	100.0	459
Clinton	86.2	355
Darke	100.0	605
Greene	92.8	386
Hamilton	100.0	415
Hardin	6.6	31
Highland	33.4	185
Logan	72.7	341
Madison	1.3	6
Mercer	49.0	231
Miami	100.0	407
Montgomery	100.0	465
Preble	100.0	428
Shelby	92.9	381
Warren	100.0	408
Total		6640

were the number one and two counties in the state for total cash receipts. This amounted to cash sales of over $96,000,000 and $83,000,000 respectively.

Procedure and Responsibilities

The study was carried out by personnel from three USDA agencies; Soil Conservation Service (SCS), Forest Service (FS), and Economics, Statistics, and Cooperatives Service (ESCS), along with the Ohio Department of Natural Resources (ODNR) utilizing an interdisciplinary approach in conducting the study. General direction came from the Field Advisory Committee composed of representatives from the three USDA agencies and ODNR. The Soil Conservation Service representative served as chairman of the committee. Each agency's staff had responsibility for specific technical phases within the study elements. The USDA agencies were responsible for studying flooding, erosion, wet agricultural soils, irrigation, and forest land problems and needs, plus evaluating the basins' ability to meet future food and fiber goals. ODNR was responsible for providing information relating to water supply, recreation, biological resource, and forest land needs. Water quality information relating to point and nonpoint source pollution was provided by either the Ohio Environental Protection Agency or designated 208 1/ planning agencies.

Acknowledgements

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USDA, Agricultural Research Service
USDA, Agricultural Stabilization and Conservation Service
U.S. Army Corps of Engineers
U.S. Bureau of Census
U.S. Bureau of Mines
U.S. Heritage Conservation and Recreation Service
U.S. Environmental Protection Agency
USDA, Farmers Home Administration
U.S. Fish and Wildlife Service
U.S. Geological Survey
Ohio Environmental Protection Agency
Miami Conservancy District
OKI Regional Planning Commission
Miami Valley Regional Planning Commission
Clark County Regional Planning Commission
Logan-Union-Champaign Regional Planning Commission
Local Soil and Water Conservation Districts

1/ Section 208 of PL 92-500, Areawide Waste Management (Nonpoint Source of Pollution).

CHAPTER 3
PROBLEMS AND OBJECTIVES

This chapter identifies the major water and land resource problems. The problems were determined through meetings with planning commissions, special interest groups, and state and federal agencies. From the identification of the problems, specific components of the two national objectives, Economic Development (ED) and Environmental Quality (EQ), were developed and addressed in this chapter.

PROBLEMS

Flooding

One of the major problems in the study area is flooding of agricultural land. Many of the major flood hazards in the Great Miami River Basin have been reduced by existing wet and dry dam systems and local protection works. However, a number of flood problems exist in the upstream watersheds of the Great Miami as well as the Little Miami, Wabash, Mill Creek, and White Oak Creek Basins. Flood damage to agricultural land is estimated at $2.3 million annually. Flooding occurs on about 135,000 acres of rural land. Flood damage to transportation facilities and rural communities also occurs. Damages to transportation in the upstream areas are estimated at $30,000 annually. Floodwater damage to communities were not evaluated. Table 3-1 lists the damages by subbasin.

Floodwater problems result when high intensity rains with a large runoff take place. Storms of this type occur more frequently during the winter and spring months when frozen ground or high soil moisture conditions are common. Floods during this time usually inundate large areas of land. The flood of January 1959 is an example of this type of flood condition. High intensity rains during the cropping season tend to be more localized and usually result in flooding less land but normally cause more serious crop and pasture damage. The flood on June 22, 1974 in Warren County illustrates this point clearly. Nearly eight inches of rain fell in a 13 to 14 hour period on the Clear Creek and Turtle Creek watershed areas. Considerable damage occurred to homes, businesses, utilities, roads and bridges, and agricultural land.

Floodwater damages to cropland and pastureland result in delayed plantings, replantings, plant injuries, weed infestations, additional tillage operations, increased production costs, and delayed harvests. This results in reduced crop yields and sometimes complete crop failure.

Damage to bottom land forests during flood periods is minimal in these basins. Although no monetary evaluation has been made for flooded forest land, floodwaters generally do not stay high for long enough periods to do lasting damage. Some streambank slumping or caving might occur, causing trees to fall in streams, but damages are generally light.

The tree species occurring naturally in the flood plains are adapted to that particular environment, and any changes in the soil-water relationship will have an impact on the existing species. While floods or high water of short duration have

Table 3-1

Rural Floodwater Damage
Southwest Ohio River Basin
(Dollars)

Subbasin	Average Annual Floodwater Damage 1/		
	Crop & Pasture	Other Agr. 2/	Nonagr. 3/
Upper Great Miami River	983,000	98,300	9,300
Lower Great Miami River	232,400	23,200	8,300
Stillwater River	218,700	21,900	3,700
Mad River	191,600	19,200	1,800
Upper Little Miami River	311,500	31,200	4,000
Lower Little Miami River	275,400	27,500	3,000
Total	2,212,600	221,300	30,100

1/ Direct damage only.

2/ Damages to fences, agricultural buildings, farm equipment, etc.

3/ Damages to transportation facilities.

Source: Soil Conservation Service (SCS)

very little impact, a permanent "drying out" of the areas would cause a change from bottom land species to drier site species. The opposite, of course, would be true if the sites become permanently wetter.

Some damage also occurs to transportation facilities, residential and commercial properties, and agricultural facilities. In the upstream watersheds within the study area, 32 towns or communities have some flooding problems. Of these, 26 are within the Great Miami River Basin; 4 are within the Little Miami River; and 2 within the remaining study area.

Urban flood damages occur in scattered locations within the major flood plain areas. Assessment of these areas was determined to be too costly and beyond the scope of this study. Public support for such a study was minimal, and therefore, outside funding for urban flood studies could not be obtained.

Wet Agricultural Soils

Soil composition, slope, and characteristics which retard infiltration of water into the soil or the rate of surface runoff are causes of wet agricultural soils. This condition retards plant growth, delays land preparation, delays planting and harvesting, reduces crop yields, increases unit production costs, and affects the choice of crops.

This problem occurs on approximately 1.1 million acres of cropland in the study area. Nearly two-thirds of the acres having wet agricultural soils are located in the upper region of the Great Miami River Basin (Stillwater River, Upper Miami, and Mad River subbasins) and the portion of the Wabash River Basin located in Ohio. Table 3-2 lists the cropland acres by county which possess wet soils.

Insufficient Recreation Facilities

Adequate outdoor recreation opportunities are essential to human well-being. With the large population centers of Cincinnati and Dayton existing in the study area, there is a tremendous demand for recreational opportunities. Table 3-3 lists the major recreation facilities located in Southwest Ohio.

In addition, privately owned facilities provide about 30 percent of the total recreation space available in the study area. With all these facilities available, recreation demand is still not being met. The major demand is water related recreation facilities. Existing boating, camping, canoeing, picnicking, fishing, and swimming facilities cannot meet current demands. Table 3-4 illustrates the capacity of existing facilities.

Preservation of Stream Corridors and Natural Areas for Public Use

In this rapidly urbanizing agricultural river basin areas possessing natural appearance are rapidly disappearing. These areas are for man's enjoyment.

Table 3-2

Cropland Acreage with Wet Agricultural Soils and Inadequate Drainage Outlets by County Southwest Ohio River Basin

County	Wet Agricultural Soils (Acres)	Inadequate Outlets (Acres)
Brown	63,500	0
Butler	36,000	0
Champaign	52,600	9,500
Clark	52,000	1,300
Clermont	45,700	0
Clinton	41,000	20,000
Darke	178,100	80,000
Greene	47,000	20,800
Hamilton	8,000	5,000
Logan	80,100	9,000
Miami	62,300	3,700
Montgomery	35,400	300
Preble	77,000	6,000
Shelby	44,800	15,000
Warren	56,100	5,000

Source: Soil Conservation Service.

Table 3-3
Major Recreation Areas, In Acres
Southwest Ohio River Basin

	Area	County	Total Area	Land	Water
1.	Loramie Lake State Park	Auglaize and Shelby	2027	352	1675
2.	Grant Lake Wildlife Area	Brown	412	205	207
3.	Indian Creek Wildlife Area	Brown	1541	1485	56
4.	Lake Lorelei	Brown	1142	922	220
5.	Hueston Woods State Park	Butler and Preble	3596	2971	625
6.	Kiser Lake State Park	Champaign	860	475	385
7.	Clark Lake Wildlife Area	Clark	289	185	104
8.	Little Miami Scenic River Area	Clark, Clermont, Greene, Hamilton, and Warren	5666	0 1/	5666
9.	Stonelick Lake State Park	Clermont	1094	913	181
10.	Cowan State Park	Clinton	1775	1075	700
11.	Darke County Wildlife Area	Darke	316	295	21
12.	Huffman Reserve	Greene	400	355	45
13.	John Bryan State Park	Greene	899	899	0
14.	Spring Valley Wildlife Area	Greene and Warren	842	739	103
15.	Fish and Wildlife Conservation Area	Greene	2316	2254	62
16.	Sharon Woods	Hamilton	740	700	40
17.	Winton Woods	Hamilton	2012	1824	188
18.	Miami Whitewater Forest	Hamilton	1955	1870	85
19.	Oldaker Wildlife Area	Highland	140	135	5
20.	Lome Lodge	Highland	200	187	13
21.	Indian Lake State Park	Logan	6424	624	5800
22.	Valley Hi Ski Area	Logan	350	344	6
23.	Mercer County Waterfowl Refuge	Mercer	363	293	70
24.	Grand Lake State Park	Mercer	13,848	848	13,000
25.	Taylorsville Reserve	Miami and Montgomery	1192	1192	0
26.	Stillwater River Stream Easement	Miami	62	62	0
27.	Englewood Reserve	Montgomery	1149	1019	130

Area	County	Total Area	Land	Water
28. Germantown Reserve	Montgomery	634	634	0
29. Possum Creek Reserve	Montgomery	473	458	15
30. Rush Run Wildlife Area	Preble	1174	1120	54
31. Lakengren	Preble	230	30	200
32. Armco Association Club Park	Warren	818	798	20
33. Clarence J. Brown Reservoir	Clark	4200	2080	2120
34. Caesars Creek State Park 2/	Warren, Greene, and Clinton	13,950	11,420	2,530
35. East Fork State Park 2/	Clermont	11,000	8,840	2,160

1/ Land has recently been purchased but acreage figures are not available.
2/ Reservoirs are completed. Recreation facilities are still under construction.

Table 3-4

Existing Recreation Capacity - Sixteen Counties
Southwest Ohio River Basin

	Capacity 1973
Bicycling Paths(Miles)	115
Boating Areas(Acres)	57,356
Picnicking Areas(Tables)	16,026
Fishing Areas(Acres)	57,356
Camping Areas(Sites)	8,864
Canoeing Areas(Miles)	367
Swimming Areas(Sq. Ft.)	12,379,250

Source: Ohio - Statewide Comprehensive Outdoor Recreation Plan (SCORP).

Excessive Erosion

The erosion problem is moderate to severe in the Southwest Ohio area. Sheet erosion is the principal type of soil erosion. Some rill, gully, and landslide erosion occur when high intensity rainfall causes saturated soil conditions and surface runoff.

Sheet erosion is most prevalent in the upland reaches of the Great Miami and Little Miami River Basins where gently rolling plains and fine textured soils typify the area. Sheet erosion is the gradual removal of soil layer by layer, by overland sheet flow. Erosion occurs on most cropland, pastureland, and forest land in the study area with about 10,500,000 tons of soil loss occurring annually. Soil loss varies from an average of less than two tons per acre on Eldean soil to nearly 20 tons per acre on an Eden soil. Soil losses in the range of three to four tons/acre/year are considered allowable for most soils in the basin at these lower rates soil tilth is not depleted.

Gully erosion is more localized and is not as significant a problem as sheet erosion. It is in the southern part of the study area where the terrain is rolling to hilly that gully erosion is more prominent. Steepness of slope, shallowness to bedrock, and poor soil stability characterize the problem areas.

Flood plain scour is prevalent where high velocity out-of-bank flows occur. Flood plain scour results in damage to crops and cropland in the flood plain through removal of surface soils, nutrients and sometimes entire crops. Localized scouring exists in the study area but is not a major problem.

Streambank erosion results from high velocity water flow. Recession of streambanks, slumping, scour, and down cutting of the streambed are characteris-

tics of stream erosion. Problems exist where roads are built next to streams and roadbed and bridge abutments are being washed out. These problems are local and do not represent a significant problem throughout the study area.

Landslides occur in the southern part of the study area near the Ohio River where steepness of slope and soil instability exist. Landslides take place on land where the overlying soil becomes saturated and slips due to the wet surface of the underlying shale bedrock. Landslides are a hazard where highway construction and urban development have disturbed these soils. Again, the condition is local and does not represent a significant problem in the basins.

Approximately 70 percent of the area harvested annually is improperly treated from the standpoint of preventing erosion caused by logging activities. Most of the erosion occurs on the skid trails and logging roads, and could be minimized by proper location, maintenance during use, and proper rehabilitation after use.

Forest land grazing occurs on 26 percent of the forest land with almost two-thirds of this acreage moderately to heavily grazed.

Overall forest land erosion is slight in Southwest Ohio. Most of the area has rolling topography, with some steeper areas along major streams. The southeastern counties of Clermont and Brown have more steep topography than the other counties in the study area due to the breaks leading down to the Ohio River bottom. Sheet, rill, and gully erosion are found in some forested areas and occasionally some streambank erosion occurs along forested banks. Forest land erosion is classified as shown in Table 3-5.

Table 3-5
Forest Land Erosion Severity, Hydrologic Area
Southwest Ohio River Basin

Severity Rating	Acres	Percent of Total	Accum. Percent
None	95,260	21.5	21.5
Slight	202,480	45.7	67.2
Moderate	128,045	28.9	96.1
Severe	17,280	3.9	100.0
Total	443,065	100.0	

Source: U.S. Forest Service (FS)

Table 3-5 shows that comparatively few forested acres have a severe erosion problem. These problem areas are generally on the steeper slopes where grazing or logging occurs.

Slight erosion is where some light sheet erosion occurs without rilling or gullying. Moderate erosion is where rilling up to a depth of one inch occurs. Severe erosion consists of deep rilling or minor gullying into the subsoil layers.

Table 3-6 shows the forest land erosion and sediment yield rates for the Southwest Ohio Basin.

Erosion on nonagricultural land occurs along roads and railroads, new construction areas, and commercial and residential areas. Economic and aesthetic damages result where no corrective measures are applied. No estimate was made of erosion rates.

Sediment Pollution

Sources of sediment are erosion of streambanks, construction and development areas, agricultural cropland, forest land, residential and commercial areas, and roadbanks. Excessive sediment fills channels, damages flood plain land with infertile deposits, causes stream pollution, and decreases the storage capacity of reservoirs for water supply, flood control, and recreational uses.

The main sediment sources are from eroded cropland 1/ and forest land soils. The average annual sediment yield 2/ at the Ohio River from cropland and pastureland is estimated to be over 1,934,000 tons 3/. This amounts to an arithmatic mean of .8 tons per acre per year. Forest land contributes an annual estimated sediment yield of 38,000 tons or .10 tons per forest land acre.

Approximately 125,000 acres in the upstream watershed areas, or three percent of the study area, are affected annually by floodwater and sediment damages.

Pollution

Major pollutants to the streams within the study area are sediment, municipal and industrial waste, agricultural fertilizer, pesticides, and animal waste. Sediment pollution is a product of erosion and surface runoff. A majority of the sediment originates from rural land (cropland, pastureland, and forest land). It is estimated that 1,972,000 tons of sediment annually enter the Southwest Ohio stream systems from such land. Stream turbidity is increased where sediment pollution occurs. The sediment and attached nutrients and pesticides have an adverse impact on the aquatic environment.

Existing data on water quality within the basin is grossly inadequate for making subbasin comparisons and for identifying specific treatable point and nonpoint sources of pollution. Problems with water quality are reported to exist in segments of many of the major water courses but cause and effect relationships have not been well defined.

1/ Includes pastureland.

2/ Sediment yield is that portion of eroded material that enters the stream system and is transported downstream by flowing water.

3/ U.S. Geological Survey, 1979.

Table 3-6

Forest Land Erosion and Sedimentation in Acres
Hydrologic Area
Southwest Ohio River Basin

Item	Total	Undisturbed	Grazed				Logged		
			Total	Unmanaged	Moderate	Managed	Total	Unmanaged	Managed
EROSION									
Forest Land	443,065	305,490	130,135[1]	83,285[2]		46,850[2]	7,440[3]	5,210[2]	2,230[2]
Percent	100.0	68.9	29.4	18.8		10.6	1.7	1.2	0.5
Tons/Yr.	476,290	127,337			319,000			29,312	641
Tons/Ac./Yr.	1.0750								
SEDIMENT YIELDS[4]									
Tons/Yr.	38,169	6,367			30,305			1,465	32
Tons/Ac./Yr.	0.0861								
Accelerated Erosion									
Unmanaged logging areas = 5.6 T/A/yr.									
Grazed forest areas = 2.5 T/A/yr.[5]									

1/ Based on current CNI-ESCS data.

2/ Based on Table 2 percentages in "Development of Multiproduct Coefficients for Forest Resources in River Basin Studies."

3/ Based on percent of forest land cut per year as calculated from available field data.

4/ The portion of eroded soil which enters the stream system and is transported downstream by water. Most of this sediment is in suspension and is carried into the Ohio River.

5/ Weighted average of light and heavy grazing acreages and erosion rates.

OBJECTIVES

The document used for formulating and evaluating water and related land resource plans in this study is Principles and Standards for Water and Related Land Resource Planning prepared by the U.S. Water Resources Council and modified for use by the U.S. Department of Agriculture, Soil Conservation Service.

The primary objectives for water and land resource planning are defined as Economic Development (ED) and Environmental Quality (EQ). The ED objective reflects the increasing value of the nation's output of goods and services and improvement of the national economic efficiency. The EQ objective reflects the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resources and ecological systems.

With the problems and needs identified, a list of study elements was developed.

1. Reduce flood damages in upstream watersheds.
2. Reduce erosion and sediment.
3. Increase agricultural income and production.
4. Increase forest management.
5. Increase recreational areas.
6. Preserve and/or manage natural areas.
7. Improve water quality.

The study elements were translated into specific components of the two national objectives, ED and EQ, and are displayed in Table 3-7.

Table 3-7

Problems and Objectives
Southwest Ohio River Basin

Problems	Objectives
1. Frequent flooding on 135,000 acres of land in the upstream watersheds.	1. Reduce amount of flooding.
2. Wet Agricultural Soils	2. Improve agricultural production.
3. Excessive 1/ erosion occurs on 2.1 million acres of cropland 2/.	3. Reduce Erosion.
4. Insufficient recreation facilities.	4. Increased and more efficient use of recreational services.
5. Pollution of lakes and streams by sediment.	5. Reduce sediment pollution of lakes and streams.
6. Insufficient stream corridors and natural areas for public use.	6. Public acquisition and management of stream corridors and natural areas.
7. Pollution of water courses by fertilizers, chemicals, and pesticides.	7. Improve water quality.

1/ Excessive erosion as used in this study pertains to acreages on which the soil loss exceeds the tolerance limits defined by the Soil Conservation Service. "Soil Loss Tolerance" is used to denote the maximum rate of soil erosion that will permit a high level of crop productivity to be sustained economically and indefinitely.

2/ Includes pasture and forest land.

CHAPTER 4

ECONOMIC PROJECTIONS AND ENVIRONMENTAL PREFERENCES

This chapter presents historical and projected data to describe the magnitude of the population and its rate of growth, the economy and its rate of growth, and the associated environmental consequences of this expected growth.

ECONOMIC ACTIVITY INDICATORS

Population Characteristics

The 1970 Census of Population showed that the Southwest Ohio Economic Area (hereafter referred to as SWOEA)(Map 4-1) population grew at a more rapid rate than the state average. The SWOEA's population rose from 2.3 million in 1960 to about 2.6 million in 1970 (Table 4-1). This represents an increase of 12.4 percent over the last decade, compared to the state's 10.1 percent. The Southwest Ohio share of Ohio's population rose from 23.7 percent in 1960 to 24.3 percent in 1970. SWOEA population is projected to comprise 25 percent of the Ohio population by the year 1990.

Within the SWOEA, subarea 2 continued to grow at the most rapid rate, having increased by 17 percent since 1960 (Table 4-2). By contrast, subarea 3 grew by about 9.1 percent and subarea 1 by 9.3 percent over the past decade. Since 1940, subarea 2 has exceeded the state of Ohio population growth rate and subarea 3 was slightly above the state's rate until the past decade when it was slightly less.

The shift in population from rural to urban has continued in the SWOEA, although at a slower pace than in the past. Since 1940, the SWOEA as a whole had a higher proportion of urban dwellers than the state of Ohio. Within the study area, subarea 1 has consistently had a much lower proportion of urban residents than the other two subareas (Tables 4-3 and 4-4). Since 1950, the share of urban dwellers has been increasing at the same rate as in the state of Ohio.

The largest percentage increases in county urban population from 1960 to 1970 have occurred in four counties influenced by Cincinnati and Dayton (Table 4-2). These counties are Clermont, Clinton, Warren and Greene. Brown County also has experienced a large increase in urban population. (Information showing how much of the urban increase was due to expansion of city boundaries was not available as this report was prepared.) Shelby, Logan and Clark Counties showed small decreases in percent urban between 1960 and 1970.

Table 4-3 displays the distribution of the rural population between farm, nonfarm, and urban. Table 4-4 displays the absolute numbers. As would be expected, the urbanized counties have larger rural nonfarm populations than the less urban counties even though the percentage of total population is small. By definition, these people are not farmers but are either retired or work in the nearby cities.

Average population density is much lower in the northern part of SWOEA than in the southern part. The larger urban centers of Dayton and Cincinnati contribute to densities of about 530 people per square mile in subareas 2 and 3 compared to about 100 per square mile in subarea 1 (Table 4-5).

Table 4-1

Historical and Projected Population In Thousands
Southwest Ohio Economic Area and Ohio
Southwest Ohio River Basin

	1950	1960	1970	1990	2000	2020
Subarea 1						
Total Population	218.0	249.2	272.4			
Annual Rate*		1.4	.9			
Subarea 2						
Total Population	743.3	984.7	1,151.5			
Annual Rate		3.3	1.7			
Subarea 3						
Total Population	852.5	1,065.5	1,162.4			
Annual Rate		2.5	.9			
Southwest Ohio Economic Area 1/						
Total Population	1,813.8	2,299.4	2,586.3	3,089.3	3,305.4	3,691.8
Annual Rate		2.7	1.3	1.0	.7	.6
Southwest Ohio Economic Area 2/						
Total Population	1,813.8	2,299.4	2,586.3	3,679.7	4,237.4	5,182.2
Annual Rate		2.7	1.3	2.1	1.5	1.1
Ohio 1/						
Total Population	7,980.0	9,706.4	10,688.0	12,609.4	13,382.2	14,767.0
Annual Rate		2.2	1.0	.9	.6	.5

*Annual percent change for preceding period.
Source: Economics, Statistics, and Cooperatives Service (ESCS).
1/ Based on 1972 OBERS Projections prepared by the U.S. Department of Commerce and U.S. Department of Agriculture for the U.S. Water Resources Council.
2/ Battelle Memorial Institute, Columbus Laboratories, Demographic and Economic Projections for the Southwest Ohio Development Region, November 1970.

U. S. DEPARTMENT OF AGRICULTURE

LEGEND

- BASIN BOUNDARY
- STATE BOUNDARY
- COUNTY BOUNDARY
- COUNTY SEAT
- INCORPORATED TOWN OVER 25,000
- 3 ECONOMIC SUBAREA BOUNDARY AND NUMBER

MAP 4-1

SOUTHWEST OHIO ECONOMIC SUBAREAS (SWOEA)

SOUTHWEST OHIO RIVER BASIN STUDY AREA

OHIO

SOURCE:
FAMILY OF MAPS SCS DRAW. NO. 5,R-34,214(6-74) AND INFORMATION FROM FIELD TECHNICIANS.
TRANSVERSE MERCATOR PROJECTION

1/1,140,500

SCALE 0 10 20 MILES
0 10 20 30 KILOMETERS

6-28-78
5,0-36,956

USDA-SCS-LINCOLN, NEBR. 1978

Table 4-2

1970 Population and Percent Increase by County
Southwest Ohio Economic Area and Ohio
Southwest Ohio River Basin

	1970 Population	Percent Increase 1960-1970
Subarea 1		
Champaign	30,491	2.7
Darke	49,141	7.7
Logan	35,072	.9
Mercer	35,265	9.2
Miami	84,342	15.8
Shelby	37,748	12.2
Subarea 2		
Butler	226,207	13.6
Clark	157,115	20.0
Greene	125,057	32.2
Montgomery	606,148	15.4
Preble	34,719	6.8
Subarea 3		
Brown	26,635	5.6
Clinton	31,464	5.0
Clermont	95,725	18.8
Hamilton	924,018	6.8
Warren	84,925	30.1
State of Ohio	10,652,017	10.1

Source: 1970 Census of Population.

Table 4-3

1970 Distribution of Population by Percent Between Rural Farm, Rural Nonfarm, and Urban by County Southwest Ohio Economic Area and Ohio Southwest Ohio River Basin

	Rural Farm	Rural Nonfarm	Urban	Total
Subarea 1				
Champaign	16.6	46.4	37.0	100.0
Darke	23.6	51.2	25.2	100.0
Logan	14.7	54.6	30.7	100.0
Mercer	26.2	41.4	32.4	100.0
Miami	10.5	31.1	58.4	100.0
Shelby	17.4	40.0	42.6	100.0
Total	17.1	41.9	41.0	100.0
Subarea 2				
Butler	0.7	21.6	77.7	100.0
Clark	4.0	28.4	67.6	100.0
Greene	4.5	22.6	72.9	100.0
Montgomery	1.2	6.7	92.1	100.0
Preble	23.6	59.0	17.4	100.0
Total	2.5	16.0	81.5	100.0
Subarea 3				
Brown	25.7	53.9	20.4	100.0
Clinton	20.0	34.8	45.2	100.0
Clermont	8.5	60.9	30.6	100.0
Hamilton	.4	3.6	96.0	100.0
Warren	8.9	48.3	42.8	100.0
Total	2.5	13.9	83.6	100.0
SWOEA	4.0	17.8	78.2	100.0
State of Ohio	4.7	20.0	75.3	100.0

Source: 1970 Census of Population.

Table 4-4

1970 Distribution of Population Between
Rural Farm, Rural Nonfarm, and Urban by County
Southwest Ohio Economic Area and Ohio
Southwest Ohio River Basin

	Rural Farm	Rural Nonfarm	Urban
Subarea 1			
Champaign	5,100	14,200	11,200
Darke	11,600	25,100	12,400
Logan	5,000	19,000	11,300
Mercer	9,300	14,700	11,300
Miami	8,900	26,100	49,300
Shelby	6,600	15,100	16,300
Total	46,500	114,200	111,800
Subarea 2			
Butler	1,500	49,000	175,700
Clark	6,300	45,200	105,600
Greene	5,600	28,700	90,800
Montgomery	7,300	40,300	558,500
Preble	8,200	20,500	6,000
Total	28,900	183,700	936,600
Subarea 3			
Brown	6,800	14,100	5,700
Clinton	6,300	12,100	13,100
Clermont	8,100	58,200	28,800
Hamilton	3,700	32,300	888,000
Warren	4,000	44,700	36,200
Total	28,900	161,400	971,800
SWOEA	104,300	459,300	2,020,200
State of Ohio	502,000	2,124,000	8,026,000

Source: 1970 Census of Population.

Table 4-5

Population (1,000), Land Area, and Population Density by County
Southwest Ohio Economic Area and Ohio
Southwest Ohio River Basin

	1970 Population 1/	Land Area 2/ Sq. Mi.	Density 3/ Per Sq. Mi.
Subarea 1			
Champaign	30.5	432.1	71
Darke	49.1	604.9	81
Logan	35.1	460.1	76
Mercer	35.6	454.2	78
Miami	84.4	406.8	207
Shelby	37.7	407.9	92
Total	272.4	2,766.0	98
Subarea 2			
Clark	157.1	402.0	388
Butler	226.2	470.6	481
Greene	125.1	415.3	301
Montgomery	608.4	458.5	1,322
Preble	34.7	427.3	81
Total	1,151.5	2,173.7	529
Subarea 3			
Brown	26.6	490.4	54
Clinton	31.5	410.1	77
Clermont	95.6	458.3	209
Hamilton	923.2	414.3	2,230
Warren	85.5	408.0	208
Total	1,162.4	2,181.1	533
Southwest Ohio Economic Area	2586.3	6,620.8	390
State of Ohio	10,652.0	41,018.0	260

1/ U.S. Department of Commerce, Census of Population, 1970.

2/ U.S. Department of Commerce, Bureau of the Census, Area Measurement Reports, GE-20, No. 1, May 1970.

3/ Density obtained by dividing population by land area.

Employment and Economic Activity

Total employment in the 16 county SWO area increased at an average rate of 1.8 percent per year from 1950 to 1970 (Table 4-6). The state of Ohio rate for this period averaged 1.7 percent. The relative rates of growth of the major industry groups is displayed in Figure 4-1. (The total employment distribution is 10.7, 44.7, and 44.6 percent for subareas 1, 2, and 3, respectively.)

Employment in all industries except agriculture and forestry increased during the 1950 to 1970 period. Manufacturing continues to be the leading employer, accounting for 36.1 percent of the total employment in 1970 (Figure 4-1). The services sector had the largest percentage increase in employment from 1950 to 1970. The share of jobs attributed to services rose from 19.9 percent in 1950 to 27.5 percent in 1970.

Unemployment in the study area is comparable to the state average. In 1976 unemployment in the SWOEA was 7.7 percent compared to 7.8 percent for the state. Seven counties had unemployment higher than the state average. Generally, the industrialized counties experienced higher unemployment than the rural counties (Table 4-7).

Income

Median family income in the SWOEA has generally been lower than the state average for the majority of the counties during the past three census years. In 1950, only three of the sixteen SWOEA counties had median incomes which exceeded the Ohio average of $3,363 per family. In both 1960 and 1970, five counties (Butler, Greene, Hamilton, Montgomery and Warren) exceeded the Ohio average income per family (See Table 4-8).

None of the subarea 1 counties have exceeded the state of Ohio median family income level in the last three census years. Subarea 2 has had two counties exceed Ohio's median income in both the 1960 and 1970 censuses. Subarea 3 has had three counties exceed the state's median income level in the last two census years.

Brown County had the highest percentage of families below poverty level in 1970 with 14.8 percent while Greene County had the lowest with 5.2 percent. Six counties in SWOEA were above the state average of 7.6 percent (Table 4-9). Greene County also had the highest percentage of families with $15,000 or more income in 1970 (Table 4-9).

Urban Centers

There are three major urban centers within the SWOEA; Cincinnati, Dayton, and Springfield (Table 4-10). The Springfield Standard Metropolitan Statistical Area (SMSA) grew the most rapidly over the past decade at a rate of nearly 1.9 percent per year. The Cincinnati SMSA grew slightly less than 1 percent per year while Dayton SMSA grew nearly 1.7 percent per year. The central city portions of all

FIGURE 4-1
EMPLOYMENT IN MAJOR INDUSTRY GROUPS
SOUTHWEST OHIO ECONOMIC AREA 1950, 1960, 1970
SOUTHWEST OHIO RIVER BASIN

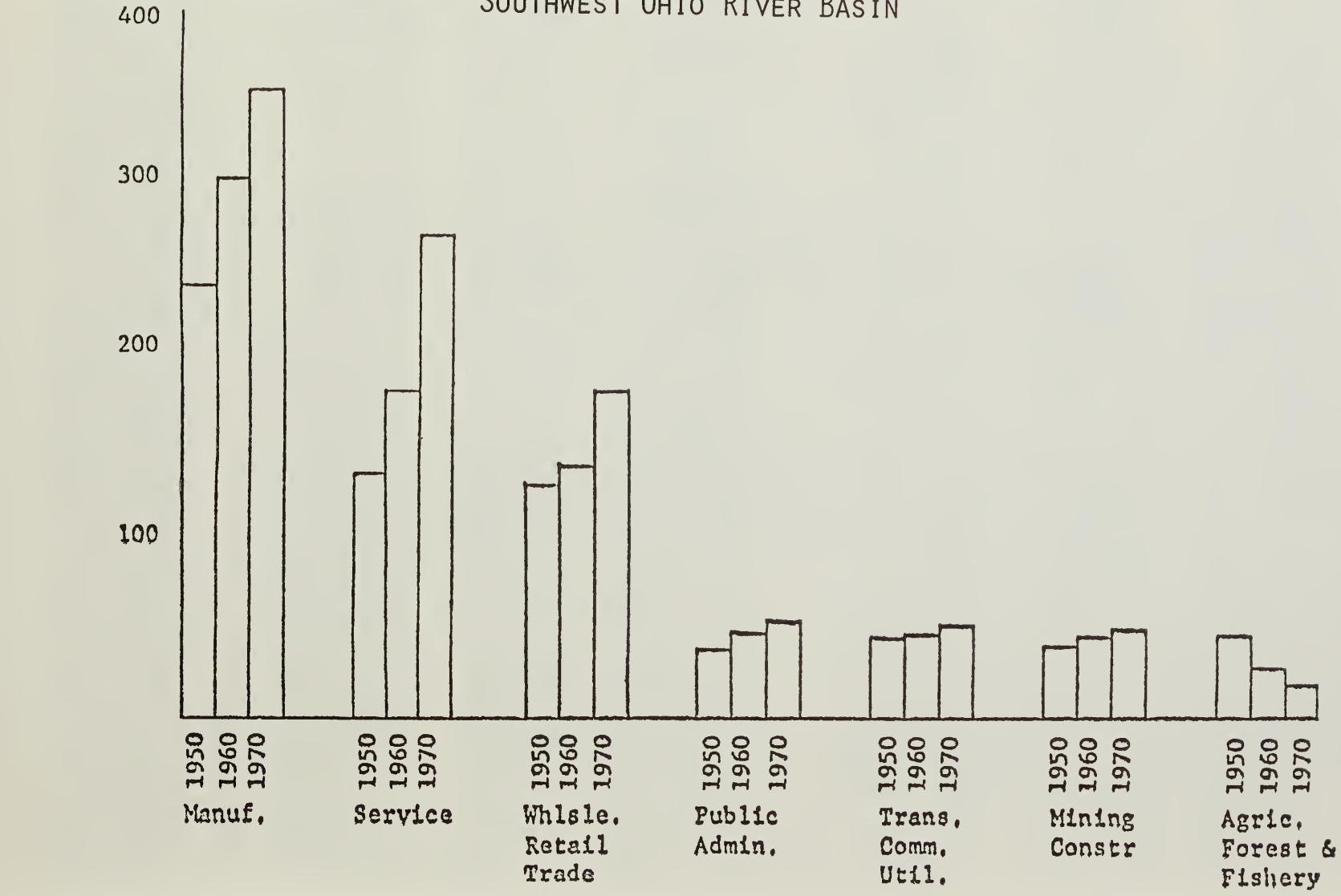


Table 4-6

Employment by Industry
Southwest Ohio Economic Area, 1950, 1960, and 1970
Southwest Ohio River Basin

	Subarea	Number of Employees 1950	1960	1970
Agriculture, Forestry and Fisheries	1	17,771	10,981	7,012
	2	12,418	8,565	6,361
	3	13,639	8,297	5,479
	SWOEA	43,828	27,843	18,852
Mining and Construction	1	4,938	5,222	6,166
	2	14,269	17,899	20,628
	3	20,093	22,603	22,351
	SWOEA	39,300	45,724	49,145
Manufacturing	1	24,189	33,163	43,456
	2	121,243	136,771	164,700
	3	109,717	133,721	148,119
	SWOEA	255,149	303,655	356,275
Transportation, Communication, and Utilities	1	4,844	4,452	5,031
	2	14,382	15,858	19,973
	3	26,350	25,920	26,333
	SWOEA	45,576	46,230	51,337
Wholesale and Retail Trade	1	13,598	15,094	19,091
	2	48,694	57,296	78,825
	3	68,031	69,561	88,063
	SWOEA	130,323	141,951	185,979
Services	1	12,249	15,983	21,772
	2	51,292	77,779	119,322
	3	10,169	91,119	130,659
	SWOEA	139,605	184,876	271,753
Public Administration	1	2,454	2,854	3,061
	2	23,472	30,044	31,592
	3	12,252	15,322	19,165
	SWOEA	38,178	48,220	53,818
Not Reported 1/	1	1,060	3,202	
	2	3,787	14,673	
	3	4,515	23,481	
	SWOEA	9,362	41,356	
Total Employment	1	81,103	90,951	105,589
	2	289,557	358,885	441,401
	3	330,661	390,019	440,169
	SWOEA	701,321	839,855	987,159

1/ This classification was not used in the 1970 enumeration.

Source: U.S. Department of Commerce, Office of Business Economics, Growth Patterns in Employment by County 1950-1960, Volume 3, Great Lakes U.S. Census of Population, 1970.

Table 4-7

Unemployment Rate by County and Subarea, SWOEA, and Ohio for 1976
Southwest Ohio River Basin

	Labor Force	Employed	Unemployed	Rate
Subarea 1				
Champaign	13,774	12,567	1,207	8.8
Darke	26,011	24,170	1,841	7.1
Logan	17,551	16,315	1,236	7.0
Mercer	17,918	16,819	1,099	6.1
Miami	35,817	33,885	1,932	5.4
Shelby	18,410	17,310	1,100	6.0
Total	129,481	121,066	8,415	6.5
Subarea 2				
Butler	102,834	93,658	9,176	8.9
Clark	66,535	61,096	5,439	8.2
Greene	49,787	46,804	2,983	6.0
Montgomery	261,993	244,063	17,930	6.8
Preble	14,257	13,426	831	5.8
Total	495,406	459,047	36,359	7.3
Subarea 3				
Brown	12,162	11,029	1,133	9.3
Clinton	15,312	14,191	1,121	7.3
Clermont	39,048	35,657	3,391	8.7
Hamilton	396,273	363,012	33,261	8.4
Warren	34,637	31,790	2,847	8.2
Total	497,432	455,679	41,753	8.4
Southwest Ohio Economic Area	1,122,319	1,035,792	86,527	7.7
State of Ohio	4,730,000	4,361,000	369,000	7.8

Source: Ohio Labor Market Information, Bureau of Employment Services.

Table 4-8

Family Income
Southwest Ohio Economic Area, Ohio and United States For 1949, 1959, and 1969
Southwest Ohio River Basin

	Median Family Income (Dollars)		
	1949	1959	1969
Subarea 1			
Champaign	2,661	4,997	9,354
Darke	2,727	5,069	9,130
Logan	2,521	4,919	8,399
Mercer	3,093	5,234	9,574
Miami	3,244	6,018	10,233
Shelby	2,868	5,205	9,439
Subarea 2			
Clark	3,342	5,825	9,996
Butler	3,487	6,566	10,388
Greene	3,504	6,520	11,694
Montgomery	3,795	6,821	11,413
Preble	2,921	5,279	9,612
Subarea 3			
Brown	1,759	4,103	7,674
Clinton	2,418	4,830	8,804
Clermont	2,657	6,174	10,204
Hamilton	3,304	6,451	10,486
Warren	3,085	6,142	10,679
State of Ohio	3,363	6,171	10,313
United States	3,073	5,660	9,586

Source: Census of Population for 1950, 1960 and 1970.

Table 4-9

Distribution and Percent of Family Income
Below Poverty Level and Above $15,000 Annually for 1970, By County
Southwest Ohio Economic Area and Ohio
Southwest Ohio River Basin

	Families Below Poverty Level	Percent	Families Above $15,000 Income	Percent
Subarea 1				
Champaign	545	6.8	1,170	14.6
Darke	1,077	8.4	1,849	14.5
Logan	894	9.6	1,136	12.2
Mercer	531	6.3	1,246	14.9
Miami	1,375	6.2	4,388	19.7
Shelby	738	7.9	1,403	15.0
Subarea 2				
Butler	3,945	7.0	11,890	21.1
Clark	2,945	7.3	7,679	19.1
Greene	1,611	5.2	8,999	29.2
Montgomery	9,445	6.1	43,619	28.1
Preble	579	6.3	1,450	15.8
Subarea 3				
Brown	1,015	14.8	599	8.7
Clinton	833	10.4	1,148	14.3
Clermont	1,675	7.0	4,453	18.7
Hamilton	19,006	8.3	55,241	24.1
Warren	1,272	6.0	4,368	20.6
State of Ohio	204,874	7.6	580,747	21.6

Source: 1970 Census of Population.

three urban centers declined in population in the past decade (Table 4-10). This indicates that the population growth associated with these SMSA's is occurring in their outlying suburban areas. Nine of the 16 SWOEA counties are included in the three SMSAs.

Agricultural Economy

In 1974 there were 22,539 farms in SWOEA, 10 percent fewer than in 1969 (Figure 4-2). About 45 percent of the area's farms were located in subarea 1 in 1974 with about 27 percent each in subareas 2 and 3. Eighty-three percent of the subarea 1 farms sold more than $2,500 worth of products in 1974 (Table 4-11). About 73 percent of subarea 2 and 66 percent of Subarea 3 farms reached that level of sales value.

In 1974 the average size farm in SWO was 144 acres, a three percent increase from 1969. The state average in 1974 was 170 acres (Table 4-12).

Average value of land and buildings increased from $495 per acre in 1969 to $875 in 1974 (Table 4-12). In 1977 good farm land in southwest Ohio was selling for over $2,200 per acre with some farm land selling for over $3,000 per acre.

The market value of all agricultural products sold in the SWOEA totaled over $575 million in 1974 (Table 4-13) or about $25,000 per farm on the average. This was an 8.7 percent increase over the 1969 agricultural products.

Crops and hay represented the largest source of sales in 1974 ($299.6 million) while in 1969 livestock and poultry products were the largest source ($199.3 million). Livestock and poultry combined made up 62 percent of the total SWOEA sales in 1969, but had dropped to 44 percent by 1974 (Table 4-14).

Table 4-15 shows production and value (based on 1976 current normalized prices) for major crops in 1964, 1969, and 1974. Computing value based on the same set of prices indicates that real crop production increased by about 40 percent from 1964 to 1974. (A large amount of this increased production was from bringing "conservation reserve" lands back into production. Also, additional production was obtained from drainage, technology, and from other practices which resulted in higher yields per acre.)

Both the number of farm operators and the number of full-time hired workers have been declining in recent years. Farm operators declined from 25,138 to 22,539 for SWOEA from 1964 to 1974. Full-time hired workers declined from 3,620 in 1964 to 2,242 in 1974 (Table 4-16). Farm operators employed off-the-farm increased from about 40 percent to 50 percent in all three subareas between 1964 and 1974 (Tables 4-16 and 4-17).

In 1974, 48 percent of the farmers did not work off their farms, 14 percent worked off less than 200 days, and 38 percent worked off 200 days or more (Table 4-17).

FIGURE 4-2

NUMBER OF FARMS IN SOUTHWEST OHIO ECONOMIC AREA, 1954-1974
SOUTHWEST OHIO RIVER BASIN

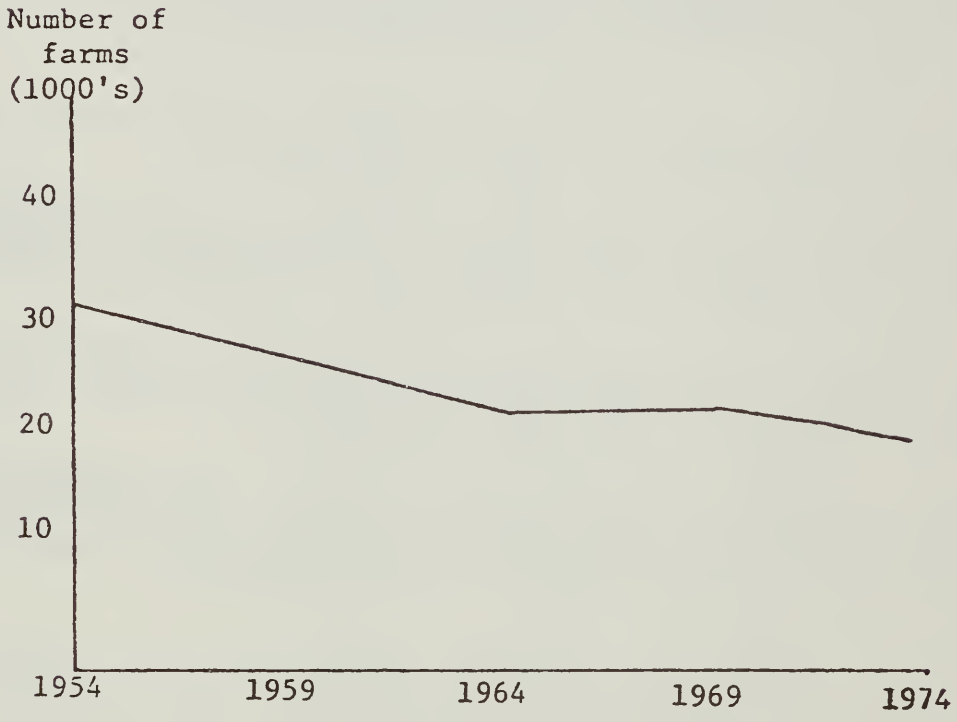


Table 4-10

Urban Center Population Changes by SMSA
Southwest Ohio Economic Area, 1960 and 1970
Southwest Ohio River Basin

SMSA[1/]	1960	1970	Differences	Percent Change
1. Cincinnati [2/]				
a. Total	1,268,479	1,384,842	116,363	+9.3
1. Ohio		1,104,659		
2. Kentucky		250,753		
3. Indiana		29,430		
b. Central City (Ohio Only)	502,550	452,524	-50,026	-10.0
2. Dayton [3/]				
a. Total	727,121	850,266	123,145	+16.9
b. Central City	262,332	243,601	-18,731	-7.1
3. Springfield [4/]				
a. Total	131,440	156,026	24,586	+18.7
b. Central City	82,723	81,870	-853	-1.0

1/ Standard Metropolitan Statistical Area as defined by the Bureau of the Census includes every city of 50,000 inhabitants or more.

2/ Includes Clermont, Hamilton, and Warren Counties, Ohio; Dearborn County, Indiana; and Boone, Campbell, and Kenton Counties, Kentucky.

3/ Includes Greene, Miami, Montgomery, and Preble Counties, Ohio.

4/ Includes Clark County, Ohio.

Table 4-11

Number of all Farms and Commercial Farms[1/]
Southwest Ohio Economic Area, 1969 and 1974
Southwest Ohio River Basin

	1974 No. Farms	No. Commercial Farms 1969	No. Commercial Farms 1974	Percent Farms Commercial 1974
Subarea 1				
Champaign	1,210	968	935	77
Darke	2,859	2,092	2,418	85
Logan	1,366	953	1,036	55
Mercer	1,872	1,591	1,662	89
Miami	1,422	1,070	1,127	79
Shelby	1,455	1,197	1,268	87
Total	10,184	7,871	8,446	83
Subarea 2				
Clark	1,068	795	835	78
Butler	1,218	792	828	68
Greene	1,008	791	774	77
Montgomery	1,370	729	939	69
Preble	1,600	1,091	1,210	76
Total	6,264	4,198	4,586	73
Subarea 3				
Brown	1,960	1,218	1,415	72
Clermont	1,144	645	669	58
Clinton	1,307	923	914	70
Hamilton	584	244	315	54
Warren	1,096	729	706	64
Total	6,091	3,759	4,019	66
Southwest Ohio Economic Area Total	22,539	15,828	17,051	76

1/ A commercial farm is one which sells products of $2,500 or greater value.
Source: Census of Agriculture.

Table 4-12

General Farm Characteristics
Southwest Ohio Economic Area, and Ohio 1969 and 1974
Southwest Ohio River Basin

	No. of Farms		Average No. of Acres Per Farm		Average Value of Land & Buildings Per Acre		Average Value Of Land & Buildings Per Farm ($1000)	
	1969	1974	1969	1974	1969	1974	1969	1974
Subarea 1	11,267	10,184	144	151	$452	$824	$65	$124
Subarea 2	6,928	6,264	144	147	$560	$960	$86	$141
Subarea 3	6,908	6,091	129	125	$499	$906	$69	$113
Southwest Ohio	25,103	22,539	140	144	$495	$875	$69	$126
State of Ohio	111,332	92,158	154	170	$399	$706	$61	$120

Source: Census of Agriculture, 1974.

Table 4-13

Percentage of Total Agricultural Production Value by Subarea and Commodity Group as Compared to Southwest Ohio Economic Area and Ohio Southwest Ohio River Basin 1/

	Total Value ($1000)	Crops and Hay	Nursery and Greenhouse	Forest	Livestock	Poultry and Eggs
Subarea 1 52 percent	301,199	53	1	*	36	10
Subarea 2 29.5 percent	168,517	51	5	*	43	1
Subarea 3 18.5 percent	105,456	55	10	*	32	3
Southwest Ohio Economic Area	575,172	52	4	*	38	6
State of Ohio	2,262,527	53	5	0.2	36	6

1/ Percent will not add to 100 due to rounding.

*Less than one-tenth of one percent.

Source: 1974 Census of Agriculture, 1973 data base.

Table 4-14

Value of Livestock and Poultry Products Sold ($1000) by Farmers for 1974, by County
Southwest Ohio Economic Area and Ohio
Southwest Ohio River Basin

	Total Value Of Livestock and Poultry	Cattle & Calves	Poultry and Products	Dairy Products	Hogs
Subarea 1					
Champaign	16,809	5,634	1,069	6,906	2,867
Darke	40,295	5,841	14,365	7,936	11,635
Logan	14,344	3,828	1,200	6,028	2,498
Mercer	39,136	4,655	12,125	12,347	9,474
Miami	13,342	5,739	1,465	2,125	3,708
Shelby	18,052	3,422	1,585	8,141	4,652
Total	141,978	29,119	31,809	43,483	34,834
Subarea 2					
Butler	11,938	3,602	166	4,037	3,549
Clark	23,583	15,934	835	2,688	3,556
Greene	14,175	4,537	135	1,576	7,468
Montgomery	8,539	4,078	497	1,278	2,150
Preble	16,180	4,415	414	2,921	8,046
Total	74,415	32,566	2,047	12,500	24,769
Subarea 3					
Brown	6,496	1,955	114	2,666	1,500
Clinton	16,850	3,960	776	1,635	10,054
Clermont	3,794	926	502	813	439
Hamilton	2,199	331	753	569	310
Warren	7,865	2,485	900	1,493	2,173
Total	37,204	9,657	3,045	7,176	14,476
Southwest Ohio Economic Area	253,597	71,342	36,901	63,159	74,079
State of Ohio	938,108	260,105	126,691	296,046	211,639
Percent	27	27	29	21	35

Source: Census of Agriculture, 1974.

Table 4-15

Production and Value of Major Field Crops for 1964, 1969, and 1974
Southwest Ohio Economic Area 1/
Southwest Ohio River Basin

		1964		1969		1974	
		Production (1000)	$Value 2/	Production (1000)	$Value 2/	Production (1000)	$Value 2/
Subarea 1							
Corn	Bu.	24,092	62,398	30,048	77,824	30,528	79,068
Corn Silage	Tons	386	4,999	442	5,724	0	0
Soybeans	Bu.	4,933	25,898	9,387	49,282	11,374	59,714
Wheat	Bu.	5,167	17,258	4,222	14,101	6,418	21,436
Oats	Bu.	4,281	6,464	5,164	7,798	3,578	5,403
Hay	Tons	331	15,183	294	13,486	251	11,513
Total Value			132,200		168,215		177,133
Subarea 2							
Corn	Bu.	16,760	43,408	22,024	57,042	22,528	58,348
Corn Silage	Tons	173	2,240	228	2,953	0	0
Soybeans	Bu.	1,187	6,232	3,311	17,383	6,024	31,626
Wheat	Bu.	2,936	9,806	2,459	8,213	3,089	10,317
Oats	Bu.	1,050	1,586	1,033	1,560	417	630
Hay	Tons	177	5,367	130	5,963	121	5,550
Total Value			68,639		93,113		106,470
Subarea 3							
Corn	Bu.	8,897	23,043	12,152	31,474	11,320	29,319
Corn Silage	Tons	98	1,269	103	1,334	0	0
Soybeans	Bu.	1,483	7,786	1,853	9,728	4,295	22,549
Wheat	Bu.	1,359	4,539	1,242	4,148	1,229	4,105
Oats	Bu.	250	378	367	554	142	214
Hay	Tons	101	4,633	82	3,761	88	4,037
Total Value			41,648		51,000		60,223

		1964		1969		1974	
		Production (1000)	$Value 2/	Production (1000)	$Value 2/	Production (1000)	$Value 2/
Southwest Ohio Economic Area							
Corn	Bu.	49,750	128,853	64,224	166,340	64,376	166,734
Corn Silage	Tons	657	8,508	773	10,010	0	0
Soybeans	Bu.	7,602	39,910	14,551	76,393	21,693	113,888
Wheat	Bu.	9,462	31,603	7,923	26,463	10,736	35,858
Oats	Bu.	5,581	8,427	6,564	9,912	4,136	6,245
Hay	Tons	609	27,935	506	23,210	460	21,100
Total Value			245,236		312,328		343,825

1/ The Southwest Ohio Economic Area includes 16 counties; data is from the Census of Agriculture for farms producing $2,500 or more of farm products.

2/ All values are based on 1976 current normalized prices; values are in the thousands of dollars (value times 1000).

Source: Census of Agriculture.

Table 4-16

Agricultural Employment in the Sixteen County
Southwest Ohio Economic Area 1964-1974
Southwest Ohio River Basin

	1964	1969	1974
Subarea 1			
Number of Farmers	10,947	11,267	10,184
Percent Employed off the farm 100 days or more 1/	36	49	
Percent employed off the farm less than 100 days 1/	14	14	
Number full-time hired workers	1,191	700	633
Total Workers	12,138	11,967	10,817
Subarea 2			
Number of Farmers	7,077	6,928	6,264
Percent employed off the farm 100 days or more	40	48	
Percent employed off the farm less than 100 days	12	13	
Number full-time hired workers	1,410	1,011	914
Total Workers	8,487	7,939	7,178
Subarea 3			
Number of Farmers	7,114	6,908	6,091
Percent employed off the farm 100 days or more	41	51	
Percent employed off the farm less than 100 days	10	11	
Number full-time hired workers	1,019	788	695
Total Workers	8,133	7,696	6,786
Southwest Ohio Economic Area			
Number of Farmers	25,138	25,103	22,539
Percent employed off the farm 100 days or more	39	49	
Percent employed off the farm less than 100 days	12	13	
Number full-time hired workers	3,620	2,499	2,242
Total Workers	28,758	27,602	24,781

1/ See Table 4-17 for 1974 data.

Source: Census of Agriculture 1969 and 1974.

Table 4-17

Number of Farm Operators Working Off-Farm
Percent by Number of Days, Southwest Ohio Economic Area and Ohio, 1974
Southwest Ohio River Basin

		Total Operators 1/	Full-Time Farmers	Total Off-Farm	200 + Days Off-Farm	100-199 Days Off-Farm	Less Then 100 Days Off-Farm
Subarea 1	No.	9,562	4,669	4,893	3,594	543	756
	Percent	100	49	51	(37)	(6)	(8)
Subarea 2	No.	5,688	2,731	2,957	2,241	309	407
	Percent	100	48	52	(40)	(5)	(7)
Subarea 3	No.	5,608	2,654	2,954	2,127	410	417
	Percent	100	47	53	(38)	(7)	(8)
Southwest Ohio Economic Area	No.	20,858	10,054	10,804	7,962	1,262	1,580
	Percent	100	48	52	(38)	(6)	(8)
State of Ohio	No.	91,237	42,142	49,095	35,261	6,512	7,322
	Percent	100	46	54	(39)	(7)	(8)

1/ Applies only to individual or family operations.

Source: Census of Agriculture 1974.

Throughout the SWOEA, an average of 46 percent of farmers earned over one-half their total income from nonfarm sources in 1974 (Table 4-18). Clinton and Montgomery Counties were highest in this regard with 63 and 57 percent, respectively. Proximity to industrial/urban areas, such as Dayton and Cincinnati, enables farmers to obtain off-farm employment more readily without giving up their farms.

The pattern of off-farm employment in SWO is somewhat similar to that for the state overall. Statewide, 39 percent of farmers had off-farm income greater than farm income. Fifty-four percent of state farmers worked off-the-farm at some time and 39 percent of them worked off-farm 200 days or more. Forty-six percent of the state's farmers did not work off-the-farm in 1974.

Forest Resources and Related Economic Activity

Of the 4.2 million acres in the study area, about 443,100 acres, or 10 percent, is forest land. Ninety-two percent of this area is classified as commercial forest land; land that is producing or is capable of producing crops of saleable wood and is not withdrawn from timber utilization. The remaining eight percent is classified as noncommercial forest land which has been withdrawn from timber utilization through statute, ordinance, or other administrative regulations.

Approximately 41 percent of the forest land is found in subarea 3, mostly in Clermont, Brown and Hamilton Counties. Subarea 2 contains 27 percent of the basins' forest land, while subarea 1 includes 32 percent.

Approximately 98 percent of the forested area is occupied by hardwood types (Table 4-19). The balance is in pine and other softwood types.

Forest stands capable of growing wood products are classified two ways; growing stock and sawtimber. Growing stock represents the whole forest and includes all the sawtimber, poletimber, and seedling and sapling size trees. Sawtimber includes only that portion of the forest harvestable as saw logs. Table 4-20 gives the volume of growing stock and sawtimber by species group for each hydrologic subarea.

The present volume of growing stock on commercial forest land is 281,200,000 cubic feet or 690 cubic feet per acre. Total sawtimber volume is about 178,172,000 cubic feet (1,033,400,000 board feet), an average of 437 cubic feet per acre. This includes the sawtimber size trees remaining in poletimber and sapling stands. About 38 percent of the forest land is in sawtimber stands: 4 percent in poletimber stands, and 58 percent in seedling-sapling stands. This unwieldy distribution of stand size classes presents a problem for timber production which can only be alleviated through a long-range program of effective forest management. The sawtimber stands average about 862 cubic feet (5,000 bd. ft.) per acre for the study area. Sawtimber stands are those in which more than half the trees per acre are of sawtimber size (hardwoods - 11 inches diameter breast height; softwoods - 9 inches diameter breast height).

Table 4-18

Number of all Farms and Number and Percent of Farms with Off-Farm Income Greater Than Farm Income
Southwest Ohio Economic Area and Ohio, 1974
Southwest Ohio River Basin

	1974	Off-Farm Income More Than Farm Income - 1974	
	No. Farms	No. Farms	Percent of Farms
Subarea 1			
Champaign	1,210	501	41
Darke	2,859	1,201	42
Logan	1,366	605	44
Mercer	1,872	712	38
Miami	1,422	673	47
Shelby	1,455	585	40
Total	10,184	4,277	42
Subarea 2			
Clark	1,068	483	45
Butler	1,218	601	49
Greene	1,008	382	38
Montgomery	1,370	787	57
Preble	1,600	746	47
Total	6,264	2,999	48
Subarea 3			
Brown	1,960	929	47
Clermont	1,144	413	36
Clinton	1,307	818	63
Hamilton	584	298	51
Warren	1,096	598	55
Total	6,091	3,056	50
Southwest Ohio Economic Area	22,539	10,332	46
State of Ohio	69,131	36,187	39

Source: Census of Agriculture.

Table 4-19

Commercial and Non-Commercial Forest Land (Acres) by Subbasin
Southwest Ohio River Basin

	Commercial Forest	Non-Commercial Forest	Percent Commercial Forest
Subbasin 1	136,149	6,261	95.6
Subbasin 2	96,748	21,012	82.2
Subbasin 3	174,405	8,490	95.4
Total	407,302	35,763	91.9

Above Acreages From Ohio CNI - 1971. Revised by ERS - 1976.

Table 4-20

Volume of Growing Stock and Sawtimber by Species Group
and Subbasins
Southwest Ohio River Basin

	Growing Stock (Mill.Cu.Ft.)			Sawtimber (Mill.Cu.Ft.)		
	Softwood	Hardwood	Total	Softwood	Hardwood	Total
Subbasin 1	0.2	69.1	69.3	0	46.5	46.5
Subbasin 2	0	53.3	53.3	0	35.5	35.5
Subbasin 3	5.0	153.6	158.6	2.8	93.3	96.1
Total	5.2	276.0	281.2	2.8	175.3	178.1

Source: U.S. Forest Service - Timber Resources of Ohio 1970.

Table 4-21 shows the inventory volume of growing stock timber in cubic feet by subarea for sawtimber and poletimber stands, and the projected volumes for 1980, 2000, and 2020.

There were approximately 3,600 persons engaged in primary wood-producing activities in 1970 (Census of Population figures). This includes logging and sawmilling jobs. The number of workers in secondary wood-using industries, such as pulp and paper products and furniture factories, were about 42,400. Allied wood product uses, (printing and publishing of books, magazines, newspapers, etc.), totaled 33,300 workers.

The adjusted average annual income per production worker in wood-using industries in 1973 was $7,650. This is projected to rise to $10,000 in 1980, $16,500 in 2000, and $27,500 in 2020. Table 4-22 shows average wages for workers in each type of wood-using industry for 1965 and 1973, the total wages by forest industry for production workers and all workers for 1965 and 1973, and the capital expenditures and added value of products for each industry type.

ENVIRONMENTAL CONSEQUENCES OF GROWTH

Urbanization and industrialization, with their attendant air pollution, erosion and sediment problems, and water pollution, keep expanding throughout the basin; thus making the area less attractive. Mining of mineral resources, such as gravel, is common and creates unsightly land sores.

A more modern threat to the forests is the effect of air pollution on trees in the vicinity of industrial areas. The chemicals can weaken trees and make them more susceptible to disease, insects, and fungi attacks.

PROJECTIONS OF FOOD AND FIBER PRODUCTION

The U.S. Department of Agriculture, in cooperation with the U.S. Department of Commerce, has prepared a set of projections which were published by the Water Resources Council. The agencies making the projections were the Bureau of Economic Analysis, formerly Office of Business Economics (OBE), and the Economics, Statistics, and Cooperatives Service (ESCS). Thus, the name OBERS has been applied to these projections. These projections are based on expected population and income growth.

The OBERS Series E prime projections provide a reasonable starting point for resource development planning for state and substate areas. They provide projections for small substate regions that are consistent with national projections. Even though the Water Resources Council suggests that federal planning agencies use these projections in evaluating development needs, planners may also use other projections which state or local agencies believe to be more realistic. These other projections can be analyzed for development needs by the same procedures used for the OBERS projections.

In deriving the Southwest Ohio projection data, the state of Ohio was divided into six areas along county boundaries approximating the state's major river basins (Map

Table 4-21

Inventory Volume of Growing Stock Timber with Projections
Hydrologic Area, Southwest Ohio River Basin
(In Millions of Cubic Feet)

	1968	1980	2000	2020
Subbasin 1				
Sawtimber	50.8	55.3	58.0	59.2
Pole Timber	18.5	20.1	21.2	21.6
Subtotal	69.3	75.4	79.2	80.8
Subbasin 2				
Sawtimber	39.1	42.7	45.0	46.0
Pole Timber	14.2	15.5	16.3	16.8
Subtotal	53.3	58.2	61.3	62.8
Subbasin 3				
Sawtimber	116.2	126.8	133.4	136.1
Pole Timber	42.4	46.2	48.6	49.6
Subtotal	158.6	173.0	182.0	185.7
Total	281.2	306.6	322.5	329.3

Source: U.S. Forest Service - Timber Resources of Ohio, 1970.

Table 4-22

Income of Forest Based Industrial Workers
Southwest Ohio River Basin

	1965	1973 1/	1965	1973 1/
	Production Workers		All Workers	
Average Wages				
Logging and Sawmilling	$4,100	$5,260	$4,610	$5,915
Furniture	5,205	6,680	5,830	7,485
Pulp and Paper Products	6,087	7,815	6,580	8,445
Printing and Publishing	6,542	8,400	6,620	8,500
Total Wages ($1,000,000)				
Logging and Sawmilling	$ 35.1	$ 45.0	$ 47.7	$ 61.3
Furniture	80.0	102.7	113.6	145.8
Pulp and Paper Products	188.2	241.5	259.4	332.9
Printing and Publishing	258.1	331.3	418.0	536.6
	Capital Expenditures		Products Added Value	
Logging and Sawmilling	$ 4.9	$ 6.3	$ 88.2	$113.2
Furniture	7.2	9.3	213.9	274.6
Pulp and Paper Products	38.3	49.2	491.6	631.0
Printing and Publishing	43.3	55.5	758.7	973.7

1/ Data derived by using Consumer Index for 1973. 1965 data from Statistical Abstract of Ohio, 1969.

4-3). The 1949-1969 Agriculture Censuses and 1972-1974 Statistical Reporting Service data were used as base data to determine the historical share the respective basins provided to the state's production by commodity. These historical trends were extended to 1990 linearly. The 1990 share was then held constant in 2000 and 2020. OBERS Series E Prime state production was allocated to the six areas.

The results of the trend procedure were reviewed and adjusted where it was deemed appropriate. Table 4-23 lists the production allocated to Southwest Ohio by crops and by time frame.

Table 4-24 illustrates the cropland acreage available under present conditions and projected cropland acreage for 1990 and 2020 plus acreage for other uses. The specialty crop acreage is minor, amounting to only about 20,000 acres in the current period and decreasing to about 11,400 acres in 2020 (Table 4-25). This acreage is set aside and held constant in the analysis of alternative plans.

A computer model was used in the analysis to help project land use patterns, effects on erosion, and production potential under alternative sets of assumptions. Inputs generated for the model included combining soils with similar characteristics and productive potential into Soil Resource Groups (SRG's), developing crop rotations representing the area, projecting yield increases under various rotations and tillage methods, developing soil loss information for rotations and tillage methods for each SRG, and budgets for each crop put in the model. The model uses this data to show the ability of the water and land resources in the study area to meet projected demand for food and fiber.

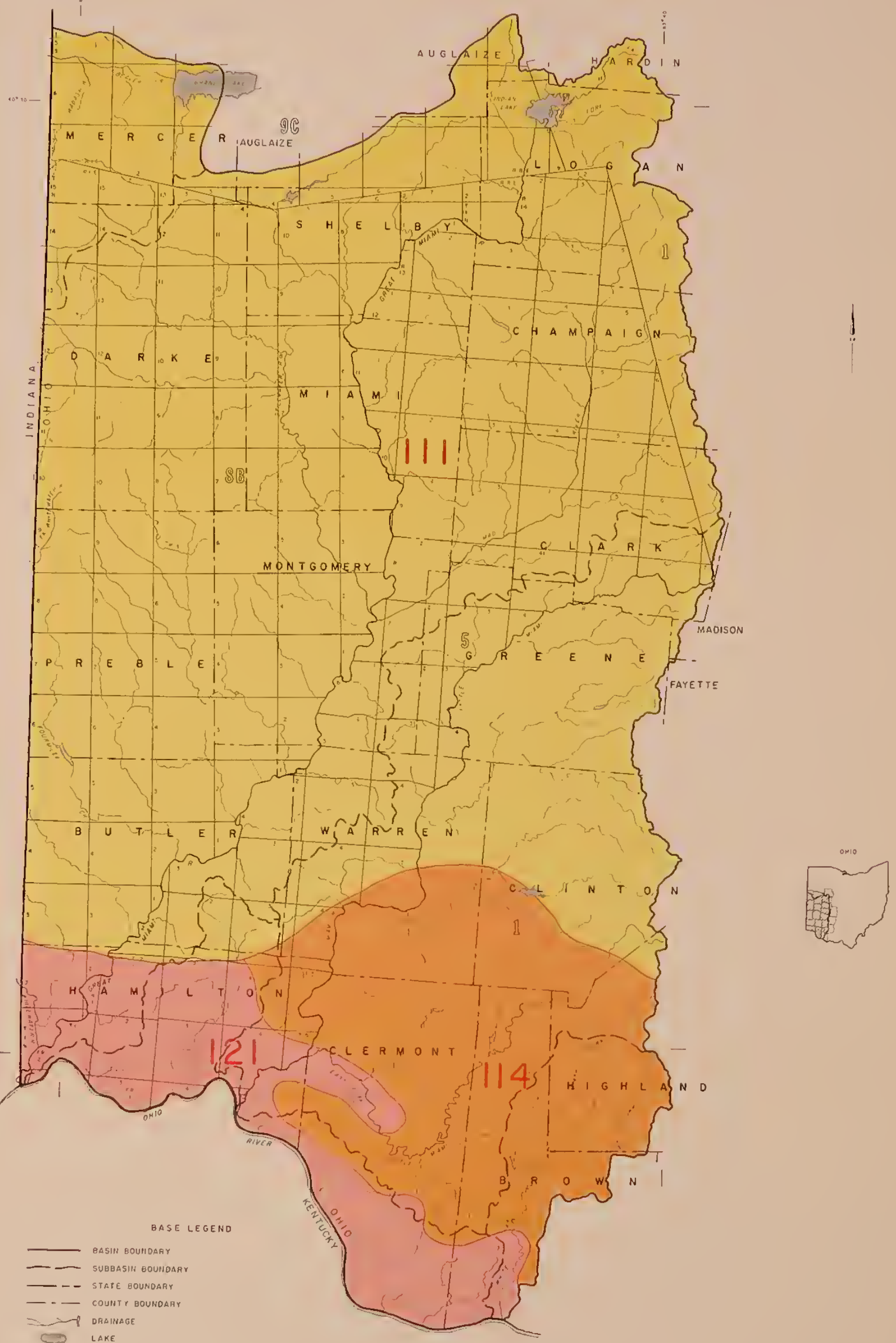
An examination of Tables 4-23 and 4-24 show a decrease in acreage with time and a corresponding increase in production. Increases in production result from the application of current and future agrarian technology to these decreasing acreages. This trend is already occurring in Southwest Ohio and should continue through the project life.

Livestock production used OBERS E Prime level under each alternative analyzed. Hay and pasture requirements shown in Table 4-23 are tied to the livestock projections in Table 4-26. The OBERS level of hay and pasture are requirements for the OBERS level of livestock production and, therefore, are used in the linear programming model to evaluate alternative plans.

Table 4-27 shows the projected annual growth rate of forest stands by Soil Resource Group (SRG) if "best" management practices were applied to all forested acres. The table also shows the present annual growth rate under "no" management or inadequate management. The final figures (assumed maximum under management) would not be realized until all acres were managed for a period of time ending beyond the 2020 deadline of this study.

The Southwest Ohio River Basin contains approximately one percent of Ohio's timber volume. Assuming a like percent for annual timber cut, the basin would provide about 825 thousand cubic feet of lumber per year. At current rates of growth, the cut in the Southwest Ohio is about 70 percent of annual growth.

U S DEPARTMENT OF AGRICULTURE



BASE LEGEND

- BASIN BOUNDARY
- SUBBASIN BOUNDARY
- STATE BOUNDARY
- COUNTY BOUNDARY
- DRAINAGE
- LAKE
- G.L.O. TOWNSHIP LINE
- 1 VIRGINIA MILITARY DISTRICT
- 5 BETWEEN THE MIAMIS
- SB CONGRESS LANDS WEST OF THE MIAMI RIVER BY GREENVILLE TREATY
- 9C NORTHWEST OHIO, SOUTH AND EAST GOVERNED BY THE FIRST PRINCIPAL MERIDIAN AND BASE LINE

LAND RESOURCE LEGEND

- 111 INDIANA-OHIO TILL PLAIN
- 114 SOUTHERN ILLINOIS AND INDIANA THIN LOESS AND TILL PLAIN
- 121 KENTUCKY BLUEGRASS

OHIO

MAP 4-2
MAJOR LAND RESOURCE AREAS
SOUTHWEST OHIO RIVER BASIN STUDY AREA
OHIO

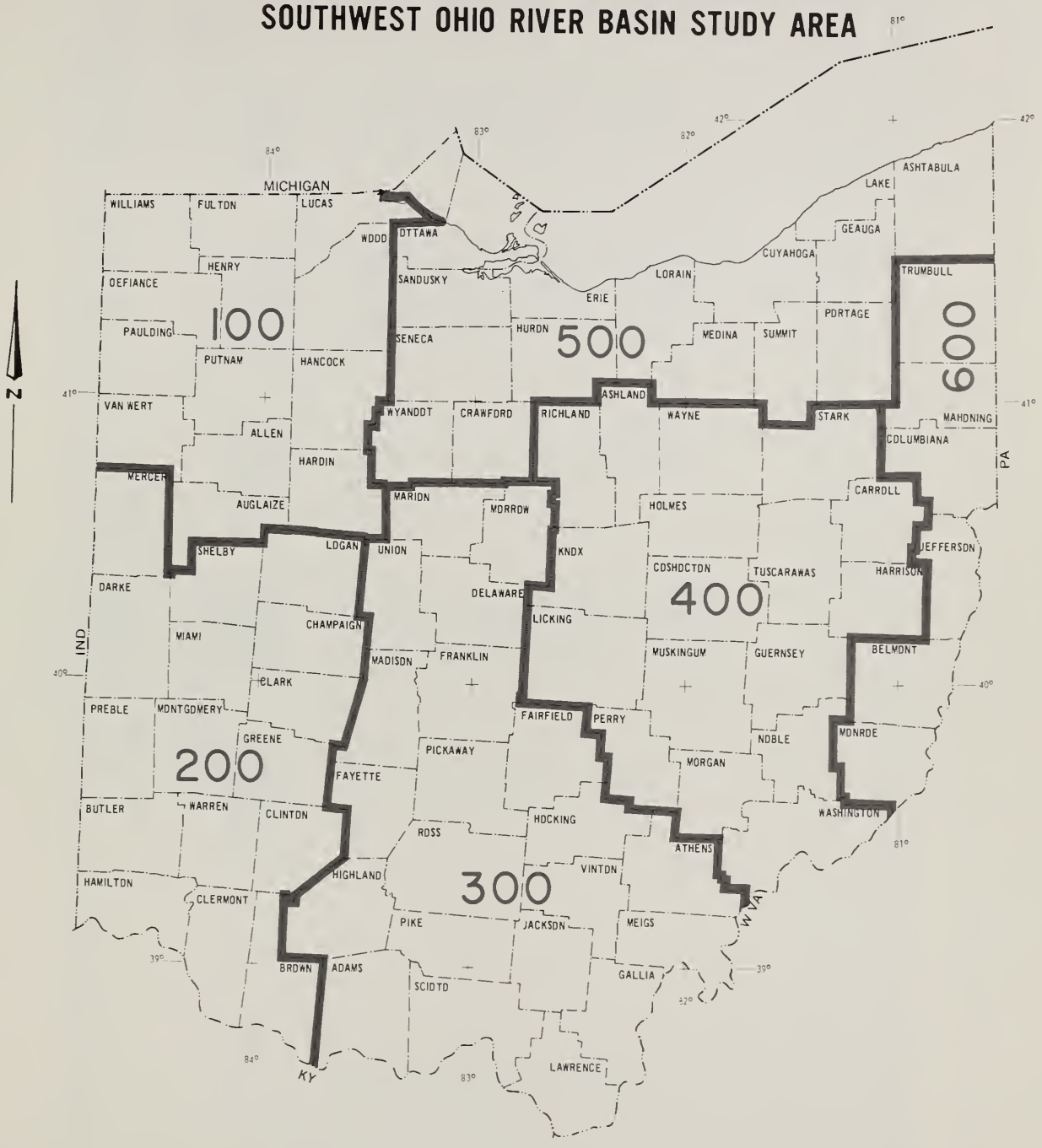
SCALE 1/633,600
0 5 10 15 20 25 MILES
0 5 10 15 20 25 30 35 40 KILOMETERS

SOURCE:
FAMILY OF MAPS SCS DRAW NO. U.S.- 34,214(6)-741
AND INFORMATION FROM FIELD TECHNICIANS.
TRANSVERSE MERCATOR PROJECTION

7-5-78
5,S-36,953

U. S. DEPARTMENT OF AGRICULTURE

MAP 4-3
STATE OF OHIO BY MAJOR SUBAREAS
SOUTHWEST OHIO RIVER BASIN STUDY AREA



LEGEND

- INTERNATIONAL BOUNDARY
- STATE BOUNDARY
- COUNTY BOUNDARY
- SUBAREA BOUNDARY

SOURCE
FAMILY OF MAPS SCS DRAWING NO 5-S-32 927 4-74
AND INFORMATION FROM FIELD TECHNICIANS
ALBERS EQUAL AREA PROJECTION
USDA SCS-LINCOLN NEBR 1978

SCALE 0 10 20 30 40 50 60 70 80 MILES
0 20 40 60 80 100 120 KILOMETERS
1/2,714,300

6-12-78
5,S-36,957

Table 4-23

Current Normal and Projected Crop Production Required from Southwest Ohio River Basin Land Resources for Consistency with National OBERS Series E Prime Agricultural Projections 1/ Southwest Ohio River Basins

	Unit	Current Normal Production (1000)	Current Normal Value2/ ($1000)	1990 Production (1000)	1990 Value2/ ($1000)	2020 Production (1000)	2020 Value2/ ($1000)
Cropland 3/							
Corn for Grain	BU.	66,554	172,375	90,844	235,286	116,853	302,647
Corn for Silage	Tons	715	9,259	954	12,354	1,209	15,659
Soybeans	BU.	17,093	89,738	32,174	168,914	45,546	239,116
Wheat	BU.	7,516	25,103	7,077	23,637	4,854	16,212
Oats	BU.	4,436	6,690	7,866	11,878	11,179	16,880
All Hay	Tons	547	25,091	554	25,412	505	23,164
Cropland Pasture	AUM	893	0	856	0	1,349	0
(Hay Equiv.)	(Tons)	447	20,504	428	19,632	675	30,962
Total Value		0	348,768	0	497,113	0	644,640
Percent Increase over Current Normal		0	0	0	42.5	0	84.8

1/ See 1972 OBERS Projections, Series E Prime Population Supplement, Agricultural Projections, May 1975.

2/ Prices used to estimate value are current normal prices from Water Resources Council dated 8-5-76; Corn - $2.59, Corn Silage - $12.95, soybeans - $5.25, wheat - $3.34, oats - $1.51, hay - $45.87. (Corn silage tons multiplied by 5 gives bushel of corn.)

3/ All crop requirements were allocated to soil resource groups by linear programming model.

Table 4-24

Present and Projected Land Use and Inventory Land (1,000 Acres)
By Time Frame, Hydrologic Area
Southwest Ohio River Basin

	Current Normal	1990	2020
Cropland	2,502	2,447	2,362
Pastureland	328	281	237
Forest Land	443	406	369
Other Land	183	175	166
Noninventory Land 1/	794	941	1,116

1/ Noninventory land includes federal land not used for crops, urban and built-up areas,and small water areas.
Source: ESCS and SCS.

Table 4-25

Current Normal and Projected Production Yield, Acreage and Value of Minor Crops
Southwest Ohio River Basin

Crops	Units	Current Normal	1990	2000	2020
Rye					
Production	1000 Bu.	57	55	44	24
Yield	Bu.	33.2	40.7	44.2	49.6
Acres	1000	1.7	1.3	1.0	.5
Value1/	$1000	131	126	101	55
Barley					
Production	1000 Bu.	74	78	66	37.5
Yield	Bu.	46.4	60.2	65.6	73.4
Acres	1000	1.6	1.3	1.0	.5
Value	$1000	138	145	123	71
Vegetables					
Production	cwt.	1,087	1,938	2,110	2,206
Yield	cwt.	160	240	269	313
Acres	1000	6.8	8.1	7.8	6.5
Value	$1000	10,870	19,384	21,101	22,064
Fruits and Nuts					
Production	Ton	12.7	7.1	6.4	5.3
Yield	Ton	4.0	4.3	4.6	4.8
Acres	1000	3.2	1.6	1.4	1.1
Value	$1000	1,676	937	845	700
Tobacco					
Production	1000 lbs.	9,785	10,050	9,146	8,661
Yield	Pounds	2,082	2,645	2,950	3,330
Acres	1000	4.7	3.8	3.1	2.6
Value	$1000	9,198	9,447	8,597	8,141
Irish Potatoes					
Production	1000 Bu.	404	232	160	61
Yield	Bu.	224	311	337	378
Acres	1000	1.8	.7	.5	.2
Value	$1000	2,165	1,244	858	327
Total Acres	1000	19.8	16.8	14.8	11.4
Total Value		24,178	31,283	31,625	31,358

1/ Product prices are for current normal as of 7-26-76: Vegetables - $10.00 per cwt., fruits and nuts - $132.00 per ton (using apple price as proxy for all fruit), Tobacco - $.94 per pound, irish potatoes - $5.36 cwt., rye - $2.29 per bu., barley - 1.86 per bushel.

Source: ESCS and SCS.

Table 4-26

Current Normal and Projected Livestock Production Required from Southwest Ohio River Basins Land Resources to Meet National OBERS Series E Prime Agricultural Projections 1/

		Current Normal		1990		2020	
Unit 2/		Production 1000	Value 3/ $1000	Production 1000	Value 3/ $1000	Production 1000	Value 3/ $1000
Cattle and Calves	Pounds	132,023	55,357	174,918	73,343	213,344	89,455
Pork	Pounds	249,576	97,684	273,341	106,986	237,801	93,075
Lamb and Mutton	Pounds	5,487	1,951	2,033	723	2,028	721
Milk	Pounds	859,750	68,608	880,205	70,240	807,237	64,418
Chickens	Pounds	6,444	1,076	6,259	1,045	3,368	562
Broilers	Pounds	1,672	400	365	87	71	17
Turkeys	Pounds	31,845	10,987	67,262	23,205	95,546	32,963
Eggs	Dozen	38,889	17,111	40,140	17,662	30,759	13,534
Total Value		0	253,174	0	293,291	0	294,745

1/ See 1972 OBERS Projections, Series E Prime Population Supplement (Data are for the hydrologic area.)

2/ Units apply to production columns.

3/ Prices used to estimate value are current normal prices as of 7-26-76. Prices are for the State of Ohio from unpublished ERS data: Cattle and calves - $41.93 per cwt., lamb and mutton - $35.56 per cwt., hogs - $39.14 per cwt., milk - $7.98 per cwt., broilers - $.239 per lb., turkeys - $.345 per lb., eggs - $.44 per dozen, chickens - $.167 per lb., (assumes chicken price is 70 percent of broiler price).

Table 4-27

Annual Forest Growth
Southwest Ohio River Basin

SRG	Class & Subclass	Forest Acres	Site Index	No Management M.A.I. 1/	No Management Total Increment M.B.F.	Good Management M.A.I. 2/	Good Management Total Increment M.B.F.
A	IIw	23,543	85	346	8,146	508	11,960
B	IIw	1,508	80	309	466	454	685
C	IIIw	7,293	80	309	2,254	454	3,311
D	IIIw	2,007	--	0	--	0	---
E	I	3,241	80	309	1,001	454	1,471
F	IIs	2,940	80	309	908	454	1,335
G	IIe	13,862	85	346	4,796	508	7,042
H	IIe	17,016	80	309	5,258	454	7,725
I	IIe	29,542	80	309	9,128	454	13,412
J	IIw	21,340	70	239	5,100	351	7,490
K	IIw	1,321	80	309	408	454	600
L	IIe	32,252	70	239	7,708	351	11,320
M	IIw	31,132	80	309	9,620	454	14,134
N	IIIe	16,606	80	309	5,131	454	7,539
O	IIIe	16,741	85	346	5,792	508	8,504
P	IIIe	5,701	80	309	1,762	454	2,588
R	IIIe	3,296	80	309	1,018	454	1,496
S	IIIw	23,323	80	309	7,207	454	10,589
T	IIIw	1,221	80	309	377	454	554
U	IIIw	10,522	80	309	3,251	454	4,777
V	IVe	25,568	80	309	7,900	454	11,608
W	IVe	9,074	70	239	2,169	351	3,185
X	VIe	111,264	70	239	26,592	351	39,054
Y	VIIe	32,752	70	239	7,828	351	11,496
Total		443,065			123,920		181,875
		Basin Average/Acre			279 b.f.		410 b.f. 3/

1/ M.A.I. = Mean Annual Increment in board feet per acre. Based on Ohio Soil Interpretations for Woodland Use - SCS Technical Guide Section, 11-F-1.

2/ Based on 80-year stands which have been thinned every 10 years, from Growth and Yield Predictions for Upland Oak Stands by Martin Dale. USFS Research Paper NE-241, 1972.

3/ A 47 percent improvement in growth under management.

Better management, which would increase the growth rate, would in turn lead to larger amounts of timber available for the market. Present projections indicate that overall timber removal volume will equal growth rate volume by 1998, but that sawtimber removal will exceed sawtimber annual growth volume by 1978. Moreover, the maximum projected annual cut would be about six percent of the total inventory volume, which would indicate a complete cutover of merchantable timber in 16 to 20 years.

Environmental Preferences

The state of Ohio has identified desires and objectives that will serve as a guide to the future development of water and land resources in Southwest Ohio. The ones that relate to environmental quality are listed below:

1. Erosion - Encourage programs to reduce erosion on rural and urban lands with a problem.
2. Water Quality - Conserve and improve the quality of waters in the basins through reduction of sediment from agricultural land.
3. Fish and Wildlife - Encourage proper management of fish and wildlife resources and protect areas where rare and endangered species exist.
4. Stream Corridors - Encourage management and protection of major stream corridors for recreational use and for wildlife habitat preservation.
5. Land Use - Encourage efficient use of existing resources and insure proper land use and pollution control.

CHAPTER 5

RESOURCE BASE AND EXISTING PROGRAMS

RESOURCE BASE

Location

The study area is located in the Southwestern part of Ohio with the Indiana-Ohio state line being the western boundary line and the Ohio River being the southern boundary line. The total study area is 6,640 square miles in size. The Great Miami (3,946 square miles) and Little Miami (1,757 square miles) Rivers are the major drainage basins in the study. They account for nearly 86 percent of the total area. The remaining 937 square miles are broken down as follows: Upper Wabash River, 285 square miles; Mill Creek, 213 square miles; White Oak Creek, 235 square miles; and Ohio Direct Drainage, 204 square miles.

The Great Miami River originates in Hardin County and flows in a southwesterly direction for approximately 172 river miles to its confluence with the Ohio River near the Ohio-Indiana State boundary line. The Little Miami River starts in Clark County and flows in a general southwesterly direction for approximately 106 river miles to its confluence with the Ohio River in the eastern suburbs of the city of Cincinnati. The main tributaries of the Great Miami River are the Stillwater and Mad Rivers and Fourmile and Twin Creeks while the main tributaries of the Little Miami River are Caesars Creek, Todd Fork, and East Fork Little Miami River.

Climate

The study area is located in the temperate zone. The winters are moderately cold and summers are warm. Each season is distinct. Mean annual temperature is about 55 degrees F with average monthly temperatures ranging from 32 degrees F in January to 77 degrees F in July. Extreme temperatures may vary from minus 25 degrees F to 110 degrees F but are not common.

Annual precipitation ranges from 35 inches in the northern portion to 44 inches in the southeastern portion of the study area (Map 5-1). Precipitation is distributed fairly evenly with the largest amount occuring in the spring and the smallest amount in the fall. Snowfall varies throughout the area with an annual range of 16 inches at Cincinnati to 29 inches at Wilmington.

The frost-free or growing season begins in mid-April and extends to late October. The average length varies from 165 days in the northern portion to 190 days in the southern portion of the study area.

Land

The entire study area lies in one physiographic region, the Ohio Till Plains. The topography is typified by level to gently rolling plains in the upper and middle reaches of the basins which are broken by the wide valleys of the major streams. In the lower reaches, the topography changes to rolling and hilly terrain.

Glaciation by two major ice advances has affected the study area (Map 5-2). The Wisconsin glaciation which covered approximately 75 percent of the area reaching into northern Hamilton County and parts of Warren, Clinton and Highland Counties. Prior to that, the Illionian glaciation covered the entire study area. Upon recession of these ice advances, valleys were filled with deposits of glacial outwash material consisting primarily of coarse sand and gravel. Most of the upland areas are covered with till composed of clay, sand, silt and gravel. The entire area is underlain by consolidated rocks of sedimentary origin, including shale, dolomite, and limestone (Map 5-3).

The highest and lowest elevations within the state of Ohio are located within the study area. The highest elevation is located in Logan County on Campbell Hill. It is 1549 feet above sea level. The lowest elevation in the state is located at the mouth of the Great Miami River. It is 455 feet above sea level.

The soils in Southwest Ohio have been grouped into 19 soil associations. A soil association includes an aggregation of soils grouped according to location and related characteristics. Normally, a soil association consists of several extensive soils and one or more soils of lesser extent. Map 5-4 illustrates and identifies each soil association. Soil associations 9, 10, and 11 are the most productive in the study area. Each is located in the northern half of the study area where intensive agriculture is dominant. Table 5-1 gives interpretations by soil association of the limitations for a few major uses. It can be used as a guide for land use planning.

Land use within the study area is predominantly rural in nature. Approximately 67 percent is in crop and pasture lands, 10 percent in forest land, and 23 percent in other uses such as, residential, commercial, industrial, transportation facilities, water areas, and recreation.

Water

Average annual stream flow varies from 11 watershed inches in the northern extremity to 15 watershed inches in the southeastern extremity of the study area. The highest monthly stream flow occurs in the first part of the year, usually February, March, or April. The lowest monthly stream flow usually occurs during August, September, and October. Map 5-5 illustrates the stream flow characteristics for the southwestern Ohio area.

Surface water is a main source of municipal and industrial water supply in the Little Miami and Mill Creek Basins. The Ohio River is the main source for the City of Cincinnati with its industries being the major users. With the completion of East Fork and Caesars Creek Reservoirs, additional surface water will be available for municipal and industrial use. In 1969 over 2100 million gallon per day (mgd) of water were being used from surface water supplies. The largest user, power companies, accounted for nearly 1900 mgd of which the greatest amount was withdrawn from the Ohio River. 1/

1/ Southwest Ohio Water Plan, 1976, Ohio Department of Natural Resources.

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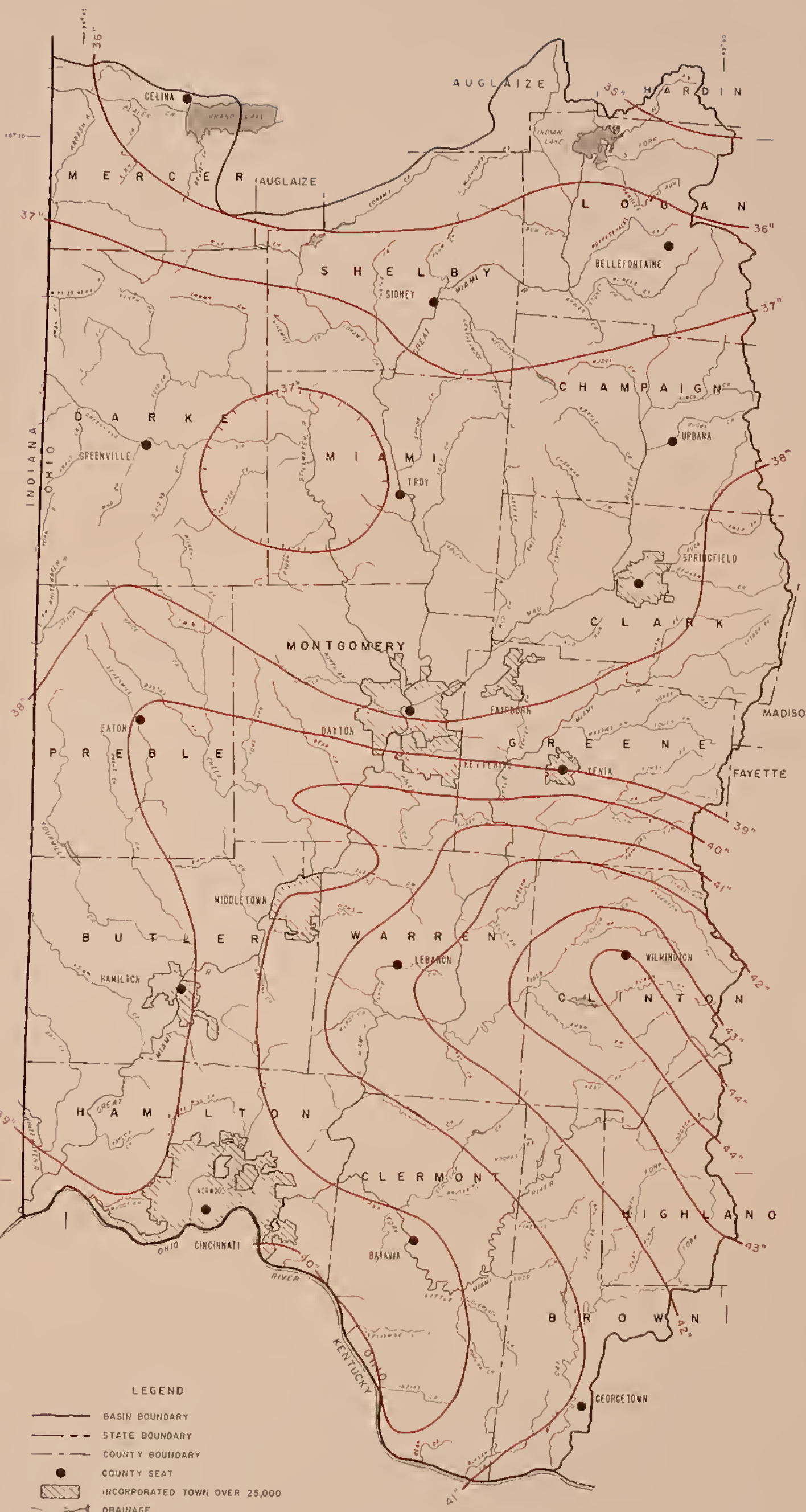


LEGEND

- BASIN BOUNDARY
- STATE BOUNDARY
- COUNTY BOUNDARY
- COUNTY SEAT
- INCORPORATED TOWN OVER 25,000
- DRAINAGE
- LAKE

MAP 5-1

AVERAGE ANNUAL PRECIPITATION IN INCHES
1931-60
SOUTHWEST OHIO RIVER BASIN STUDY AREA
OHIO

SCALE 1/633,600

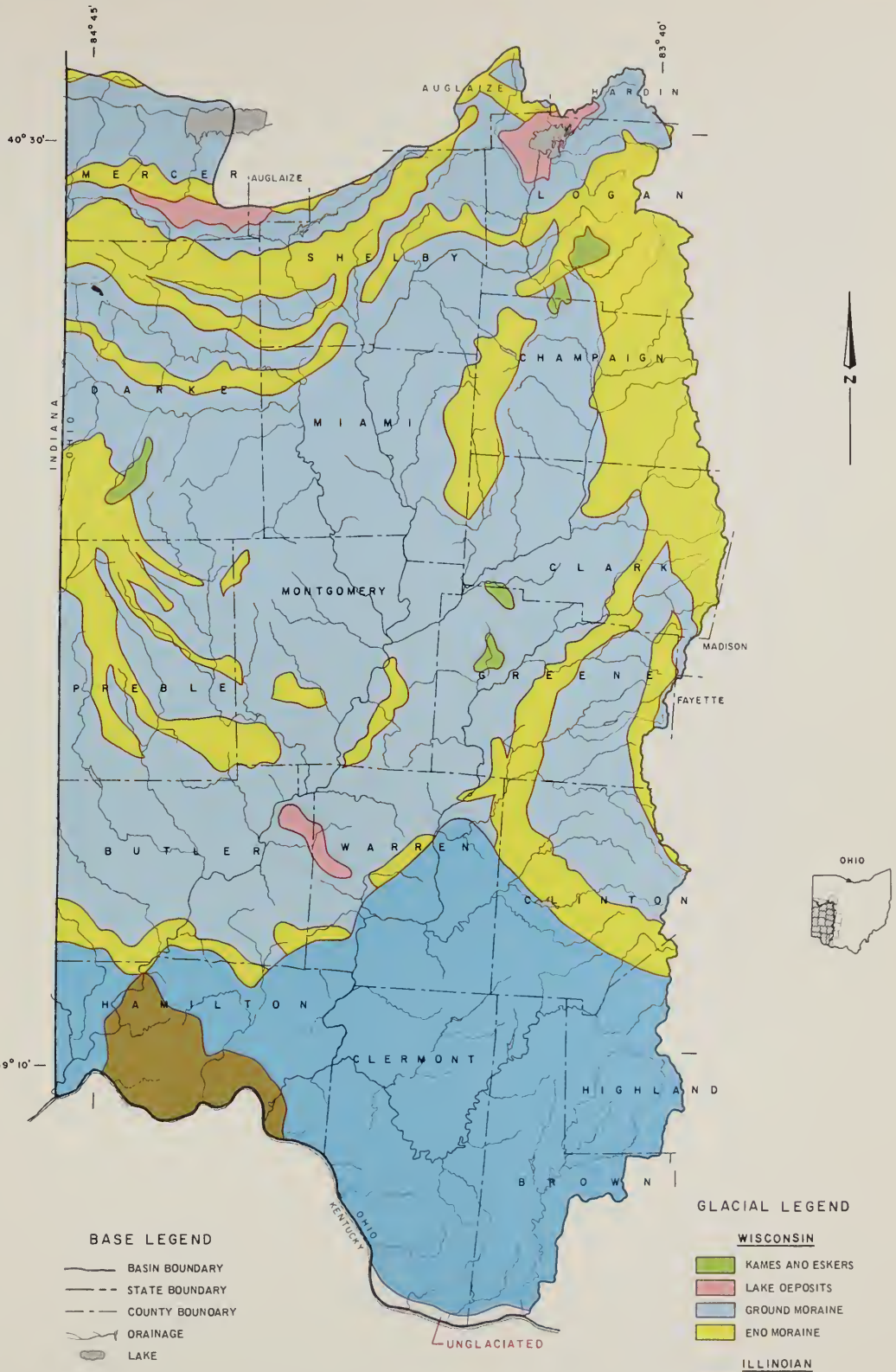
0 5 10 15 20 25 MILES

0 5 10 15 20 25 30 35 40 KILOMETERS

SOURCE
FAMILY OF MAPS SCS DRAW NO S(R-34,214)(C-74)
AND INFORMATION FROM FIELD TECHNICIANS
TRANSVERSE MERCATOR PROJECTION

7-1-78
5,S-36,951

U. S. DEPARTMENT OF AGRICULTURE



BASE LEGEND

- BASIN BOUNDARY
- STATE BOUNDARY
- COUNTY BOUNDARY
- DRAINAGE
- LAKE

GLACIAL LEGEND

WISCONSIN
- KAMES AND ESKERS
- LAKE DEPOSITS
- GROUND MORAINE
- END MORAINE

ILLINOIAN
- UNDIFFERENTIATED

KANSAN
- GROUND MORAINE

MAP 5-2
GLACIAL DEPOSITS
SOUTHWEST OHIO RIVER BASIN STUDY AREA
OHIO

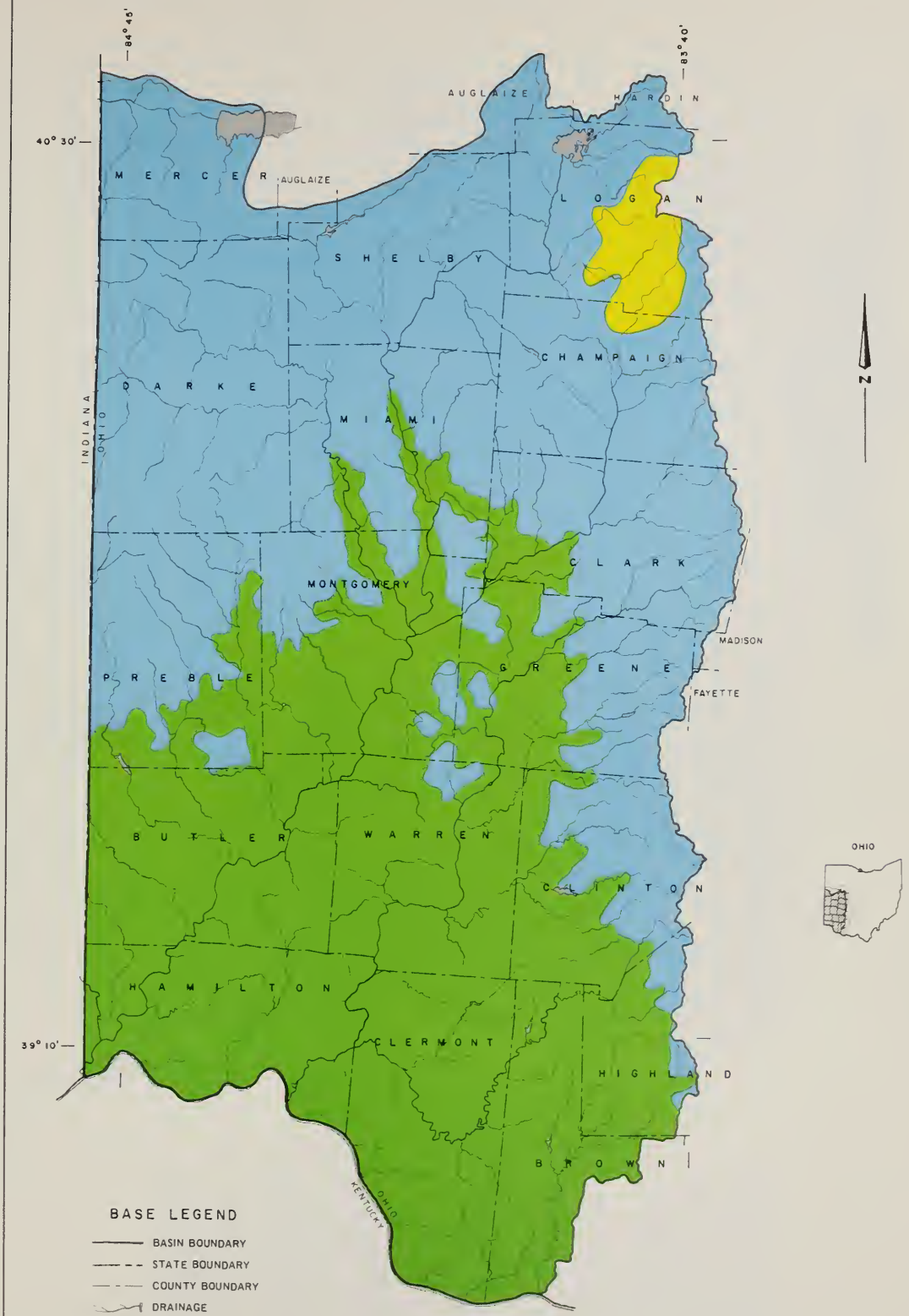
SOURCE
FAMILY OF MAPS SCS DRAW NO 5,R-34,214(5-74) AND OHIO DEPARTMENT OF NATURAL RESOURCES DIVISION OF GEOLOGICAL SURVEY.
TRANSVERSE MERCATOR PROJECTION

1/1,140,500
SCALE 0 10 20 MILES
0 10 20 30 KILOMETERS

7-14-78
5,0-36,955

USDA-SCS-LINCOLN, NEBR. 1978

U. S DEPARTMENT OF AGRICULTURE



BASE LEGEND

- BASIN BOUNDARY
- STATE BOUNDARY
- COUNTY BOUNDARY
- DRAINAGE
- LAKE

GEOLOGIC SYSTEM

- DEVONIAN
- SILURIAN
- ORDOVICIAN

MAP 5-3

GEOLOGIC MAP

SOUTHWEST OHIO RIVER BASIN STUDY AREA
OHIO

SOURCE
FAMILY OF MAPS SCS DRAW. NO 5,R-34,214(6-74) AND INFORMATION FROM FIELD TECHNICIANS.
TRANSVERSE MERCATOR PROJECTION

1/1,140,500
SCALE 0 10 20 MILES
0 10 20 30 KILOMETERS

6-30-78
5,0-36,954

USDA-SCS-LINCOLN, NEBR. 1978

U. S DEPARTMENT OF AGRICULTURE

SOIL ASSOCIATIONS

1 **MONTGOMERY – McGARY ASSOCIATION** Very poorly and somewhat poorly drained deep soils underlain by lacustrine clayey material and by thin layers of till and sand. These soils occur mostly on terraces having nearly level and low gently slopes.

2 **EEL – SLOAN ASSOCIATION** Soils on flood plains. These moderately well and very poorly drained alluvial soils are deep and underlain by silty alluvial material and by thin layers of sandy material. Nearly level.

3 **WESTLAND – SLEETH ASSOCIATION** Very poorly and somewhat poorly drained soils on a few broad terraces underlain by stratified calcareous sand and gravel material. These soils occur on terraces along the major streams and broad outwash areas associated with Wisconsin age glaciation. Level to nearly level slopes.

4 **OCKLEY – FOX – WESTLAND – SLOAN ASSOCIATION** Alluvial terraces and flood plains, mostly adjacent to the uplands and to glacial outwash valleys associated with Wisconsin age glaciation. The Ockley and Fox are deep and well drained, the Westland and Sloan soils are also deep, but very poorly drained. Nearly level to gently sloping.

5 **PEESVILLE – PATASDALE ASSOCIATION** Somewhat poorly drained deep soils on uplands covered with a thin to moderate mantle of silty material, underlain by calcareous Wisconsin age glacial till. Nearly level to level slopes.

6 **GENESEE – HUNTINGTON – WILLIAMSBURG – WHEELING ASSOCIATION** These well drained soils are on flood plains and alluvial terraces along the Ohio River and several tributaries. The Genesee and Huntington soils are underlain by silty material, whereas the Williamsburg and Wheeling soils are underlain by stratified sandy, gravelly, and silty material. Level to sloping.

7 **PATTON – KENSHAW ASSOCIATION** Very poorly and somewhat poorly drained, deep soils on lacustrine clayey and silty terraces. Level to nearly level slopes.

8 **BLOUNT – PEWAMO ASSOCIATION** Somewhat poorly and very poorly drained deep soils on uplands underlain by calcareous clay loam glacial till of Wisconsin age. Nearly level to gently sloping.

9 **BLOUNT – MORLEY – PEWAMO ASSOCIATION** Somewhat poorly, moderately well, and very poorly drained soils respectively. These deep soils are on uplands underlain by calcareous clay loam glacial till of Wisconsin age. Gently sloping to nearly level.

10 **BROOKSTON–CROSBY ASSOCIATION** Very poorly and somewhat poorly drained deep soils on uplands mostly covered by a thin mantle of silty material. These soils are underlain by Wisconsin age glacial till that is mostly loam to clay loam.

11 **MIAMIAN – CELINA ASSOCIATION** Well drained and moderately well drained, deep soils on uplands mostly covered by a thin mantle of silty material. These soils are underlain by Wisconsin age glacial till that is mostly loam to clay loam.

12 **MILTON – MILLSDALE – RANDOLPH ASSOCIATION** Soils underlain by limestone at depths mostly from 4 to 6 feet. These soils are well, very poorly, and somewhat poorly drained respectively. Nearly level to steep slopes.

13 **FINCASTLE – BROOKSTON ASSOCIATION** Somewhat poorly and very poorly drained deep soils on uplands covered with a moderately thick mantle of silty material, underlain by calcareous Wisconsin age glacial till that is mostly loam in texture. Nearly level to gently sloping.

14 **XENIA – RUSSELL ASSOCIATION** Moderately well and well drained soils moderately fine deep. These soils occur on uplands covered by a moderately thick mantle of silty material underlain by calcareous Wisconsin age glacial till that is mostly loam to clay loam. Nearly level to moderately steep.

15 **FINCASTLE – RUSSELL – WYNN ASSOCIATION** Fincastle and Russell soils are somewhat poorly and well drained soils respectively. They are deep and on uplands covered by a moderately thick mantle of silty material underlain by Wisconsin age glacial till that is mostly loam in texture. The well drained Wynn soils also occur on the upland but are underlain by limestone at 2 to 4 feet depth. Nearly level to moderately steep.

16 **RUSSELL – WYNN – XENIA ASSOCIATION** Russell and Xenia soils are well and moderately well drained respectively. These soils occur on the upland that is covered by a moderately thick mantle of silty material underlain by Wisconsin age glacial till that is mostly loam to clay loam. The well drained Wynn soils also occur on the uplands, but are underlain by limestone at 2 to 4 feet depth. Moderately steep to gently sloping.

17 **CLERMONT – AVONBURG ASSOCIATION** Poorly drained and somewhat poorly drained deep soils on uplands covered by a moderately thick mantle of silty material underlain by Illinoisan age glacial till. Nearly level to gently sloping.

18 **ROSSMOYNE – EDENTON – CINCINNATI – FAIRMOUNT ASSOCIATION** Rossmoyne and Cincinnati soils are moderately well and well drained respectively. They are deep soils occurring on gently sloping to moderately steep uplands underlain by Illinoisan age glacial till. The well drained Edenton and Fairmount soils occur on adjacent sloping to very steep areas along the flanks, and are underlain by limestone at 2 to 3 feet depth.

19 **EDEN – FAIRMOUNT – CINCINNATI ASSOCIATION** Well drained upland soils mostly on steep slopes including local areas that are sloping moderately steep, or very steep. The Eden and Fairmount soils are formed in residuum and local colluvium overlying interbedded calcareous shale and dolomitic limestone at 1 to 3 feet depth. The Cincinnati soils are deep and occur mostly on ridgetops that have a thin mantle of silty material and are underlain by Illinoisan age glacial till.

The generalized soil map and legend of Southwest Ohio Basin were compiled and published using the latest information available. Sources included published and unpublished soil survey reports, SCS data, Illinois Soil Conservation Service Soil Handbook information, generalized geologic material published by the Ohio Department of Natural Resources, and current practitioner knowledge of Soil Scientist working in the area.

LEGEND

- BASIN BOUNDARY
- SUBBASIN BOUNDARY
- STATE BOUNDARY
- COUNTY BOUNDARY
- COUNTY SEAT
- INCORPORATED TOWN OVER 25,000
- DRAINAGE
- LAKE

MAP 5-4
GENERAL SOIL MAP
SOUTHWEST OHIO RIVER BASIN STUDY AREA
OHIO

1/633,600

SCALE 0 5 10 15 20 25 MILES
0 5 10 15 20 25 30 35 40 KILOMETERS

SOURCE
FAMILY OF MAPS SCS DRAWING NO. S,H-34,214(6-81)
AND INFORMATION FROM FIELD TECHNICIANS
TRANSVERSE MERCATOR PROJECTION

8-4-78
S,S-36,950

Table 5-1

Soil Limitations for Specific Land Uses by Soil Association
Southwest Ohio River Basin

Association Number	Soil Series In Association	Estimated Degree and Kind of Limitation of Soils for Specific Land Uses: Septic Tanks, Filter Field	Homesite Location 1/	Parks, Play, and Picnic Areas	Campsites	Sanitary Landfill (Trench)
1	Montgomery	Severe: vpd, sp	Severe: vpd, ss	Severe: vpd	Severe: vpd, sp	Severe: vpd,cs
	McGary	Severe: spd, sp	Severe: spd, ss	Moderate: spd	Severe: spd, sp	Severe: spd, cs
2	Eel	Severe: stf,mwd	Severe: stf	Severe: stf 3/	Severe: stf	Severe: stf, mwd
	Sloan	Severe: stf,vpd	Severe: stf,vpd	Severe: stf,vpd	Severe: stf, vpd	Severe: stf, vpd
3	Westland	Severe: vpd, sp 2/	Severe: vpd	Severe: vpd	Severe: vpd	Severe: vpd
	Sleeth	Severe: spd, msp 2/	Moderate: spd	Moderate: spd	Moderate: spd, msp	Severe: spd, ps 2/
4	Ockley	Slight 2/	Slight	Slight	Slight	Severe: ps
	Eldean	Slight 2/	Slight	Slight	Slight	Severe:ps 2/
	Westland	Severe: vpd, sp 2/	Severe: vpd	Severe: vpd	Severe: vpd	Severe: vpd
	Sloan	Severe: stf, vpd	Severe: stf, vpd	Severe: stf, vpd	Severe: stf, vpd	Severe: stf, vpd
5	Reesville	Severe: msp, spd	Severe: spd	Moderate: spd, msp	Moderate: spd, msp	Severe: spd
	Ragsdale	Severe: vpd, msp	Severe: vpd	Severe: vpd	Severe: vpd	Severe: vpd
6	Genesee	Severe: stf	Severe: stf	Severe: stf 3/	Severe: stf	Severe: stf
	Huntington	Severe: stf	Severe: stf	Severe: stf 3/	Severe: stf	Severe: stf, pd
	Williamsburg	Slight	Slight	Slight	Slight	Severe: ps 2/
	Wheeling	Slight 2/	Slight	Slight	Slight	Severe: ps 2/
7	Patton	Severe: vpd	Severe: pd	Severe: pd	Severe: pd	Severe: pd
	Henshaw	Severe: spd, msp	Moderate: spd	Moderate: spd, msp	Moderate: msp, spd	Severe: spd
8	Blount	Severe: sp, spd	Severe: spd, ss	Moderate: spd, sp	Severe: sp, spd	Severe: spd
	Pewamo	Severe: msp, vpd	Severe: vpd	Severe: vpd	Severe: vpd	Severe: vpd, cs
9	Blount	Severe: sp, spd	Severe: spd, ss	Moderate: spd, msp	Severe: sp, spd	Moderate: clt, spd
	Morley	Severe: sp	Moderate: ss	Slight	Moderate: sp	Severe: cs
	Pewamo	Severe: msp, vpd	Severe: vpd	Severe: vpd	Severe: vpd	Severe: vpd, cs
10	Brookston	Severe: msp, vpd	Severe: vpd	Severe: vpd	Severe: vpd	Severe: vpd
	Crosby	Severe: msp, spd	Severe: spd	Moderate: spd	Severe: spd	Severe: spd
11	Miamian	Severe: msp, s	Moderate: s, ss	Moderate: s, slt	Moderate: msp, s	Moderate: s
	Celina	Severe: msp, mwd	Severe: mwd	Moderate: msp, mwd	Moderate: msp, mwd	Severe: mwd
12	Milton	Severe: Ldtb, msp, s	Severe: Ldtb, s	Moderate: Ldtb, s	Moderate: msp, s	Severe: Ldtb, s, cs
	Millsdale	Severe: msp, Ldtb	Severe: vpd, Ldtb	Severe: vpd	Severe: vpd	Severe: vpd, Ldtb
	Randolph	Severe: Ldtb, msp,spd	Severe: Ldtb, spd	Severe: spd	Severe: spd	Severe: Ldtb, spd
13	Fincastle	Severe: sp, spd	Severe: spd	Moderate: spd, sp	Moderate: spd, sp	Severe: spd
	Brookston	Severe: msp, vpd	Severe: vpd	Severe: vpd	Severe: vpd	Severe: vpd
14	Xenia	Severe: msp, mwd	Moderate: mwd, ss	Moderate: msp, mwd	Moderate: msp, mwd	Severe: mwd
	Russell	Severe: msp	Moderate: s, ss	Moderate: s	Moderate: s	Moderate: s, cs

Association Number	Soil Series In Association	Septic Tanks, Filter Field	Homesite Location 1/	Parks, Play, and Picnic Areas	Campsites	Sanitary Landfill (Trench)
		Estimated Degree and Kind of Limitation of Soils for Specific Land Uses				
15	Fincastle	Severe: sp, spd	Severe: spd	Moderate: spd, sp	Moderate: spd, sp	Severe: spd
	Russell	Severe: msp, s	Moderate: s, ss	Moderate: s	Moderate: s	Moderate: s, cs
	Wynn	Severe: Ldtb, sp	Severe: Ldtb, ss	Moderate: Ldtb, s	Moderate: s, sp	Severe: Ldtb, cs
16	Russell	Severe: msp, s	Severe: s	Severe: s	Severe: s	Moderate: s, cs
	Wynn	Severe: Ldtb, s	Severe: Ldtb, s, ss	Severe: s	Severe: s	Severe: Ldtb, s
	Xenia	Severe: msp, mwd	Moderate: S	Moderate: msp, mwd	Moderate: msp, mwd	Severe: mwd
17	Clermont	Severe: sp, pd	Severe: pd	Severe: pd, sp	Severe: pd, sp	Severe: pd
	Avonburg	Severe: sp, spd	Moderate: spd	Moderate: spd, sp	Severe: sp, spd	Moderate: spd
18	Rossmoyne	Severe: sp, mwd	Severe: mwd	Moderate: sp, mwd	Moderate: sp, mwd	Moderate: mwd, mft
	Edenton	Severe: Ldtb, s, sp	Severe: s, e	Severe: s, e	Severe: s, e	Severe: s, e, Ldtb, cs
	Cincinnati	Severe: sp, s	Moderate: s	Moderate: s	Moderate: s	Moderate: s, mft
	Fairmount	Severe: Ldtb, s	Severe: Ldtb, s	Severe: Ldtb, s	Severe: s	Severe: Ldtb, s
19	Eden	Severe: Ldtb, s, sp	Severe: Ldtb, s	Severe: ldtb, s, sp	Severe: s	Severe: Ldtb, s
	Fairmount	Severe: Ldtb, s	Severe: Ldtb, s	Severe: Ldtb, s	Severe: s	Severe: Ldtb, s
	Cincinnati	Severe: s, sp	Severe: s	Severe: s	Severe: s	Severe: s

1/ Rated for homes of three stories or less with basements.
2/ Pollution hazards to nearby streams, lakes, springs, or under ground water supply is very likely because of inadequate filtration of soil materials common to these soils.
3/ Actual rating dependent on on-site duration and frequency of flooding.

Table 5-1

Legend

Code Limitations

cs	Clayey subsoil
e	Erosion
Ldtb	Limited depth to bedrock
mft	Moderately fine textured
mp	Moderately permeable
msp	Moderately slow permeability
mwd	Moderately well drained
p	Ponding
pd	Poorly drained
ps	Pervious substrata
s	Slope
slt	Surface layer texture
sp	Slowly permeable
spd	Somewhat poorly drained
ss	Shrink--Swell
stf	Subject to flooding
tp	Permeable materials
vpd	Very poorly drained

The potential exists within the study area for the creation of additional small bodies of water (less than 1000 acres). Over 200 potential reservoir sites have been analyzed for possible use in flood control, water supply, water-based recreation, low flow augmentation or as multiple purpose sites. Majority of these sites are located in the southern half of the study area where steeper topography exists. The following map displays the potential reservoir sites inventoried and Map 5-5.5 gives each location.

Improvement in surface water quality is possible. At the present time, two water quality studies are in progress within the study area under Section 208 of the Water Pollution Control Act of 1972 (PL 92-500). The Act authorizes, on a regional basis, the coordination of activities of local governments in managing wastewater treatment and in controlling all sources of pollution which affect water quality. The two areas being studied are the Ohio-Kentucky-Indiana (OKI) Regional Planning Authority which include Hamilton, Butler, Warren, and Clermont Counties in Ohio and the Miami Valley Regional Planning Commission which includes Preble, Darke, Miami, Montgomery, and Greene Counties. Each is being done by respective regional planning agency. These are designated planning agencies. The nondesignated areas, which includes the remaining study area, are the responsibility of the Ohio Environmental Protection Agency (OEPA).These studies will consider both point and nonpoint source pollution. Upon there completion, the respective agencies will make recommendations for improvement to meet state standards. Data collections at present are inadequate to make any predictive analysis.

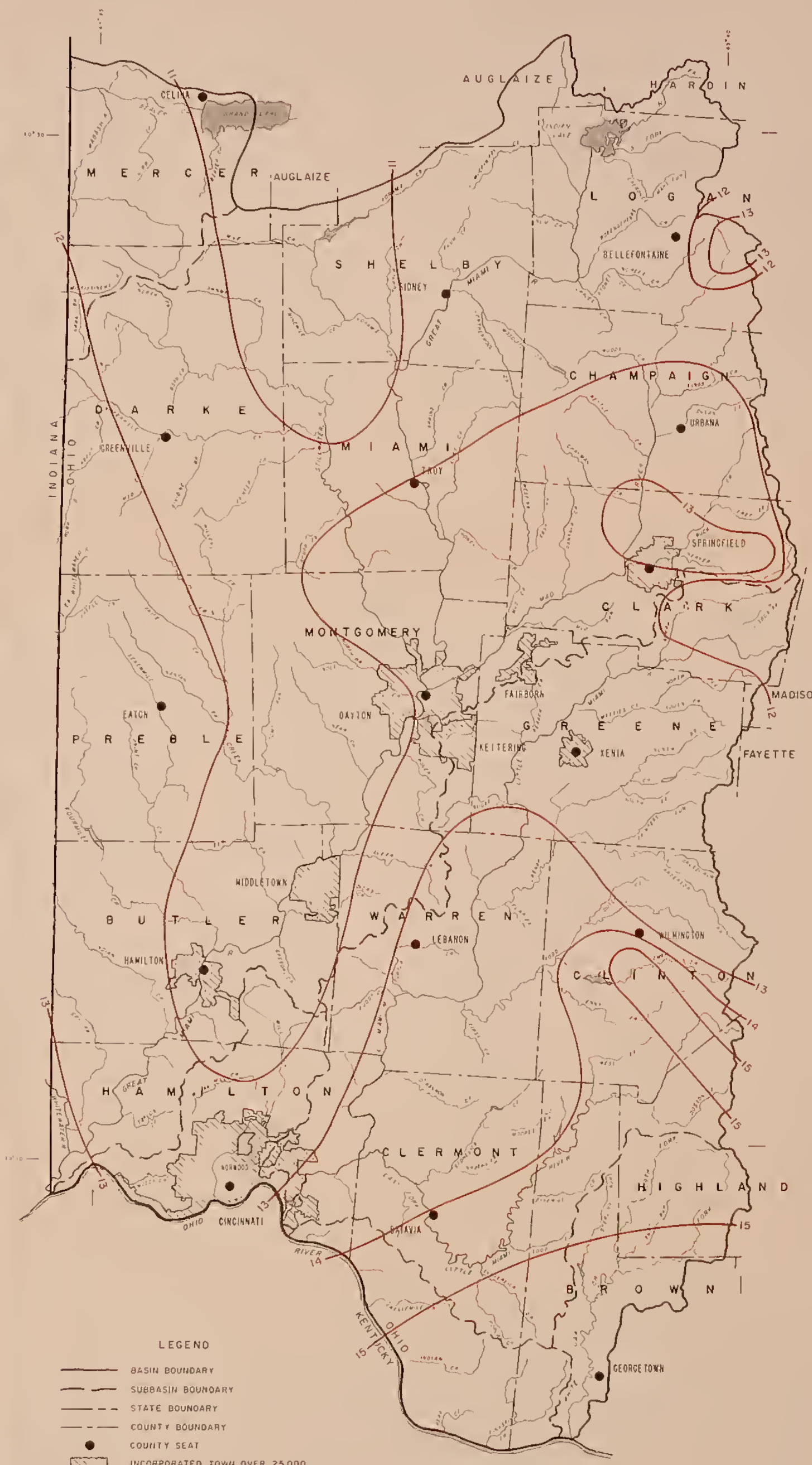
Ground water is a major water supply source in the Great Miami and Upper Wabash River Basins. An estimated 373.3 mgd of ground water were used in 1969 for all purposes in Southwest Ohio 1/. This represented 42 percent of the total ground water used in the state for that period. Most of the small communities and rural areas throughout the study area, obtain water from wells. Several cities in the Great Miami Basin, including Dayton and Springfield, obtain their supplies from ground water. Ground water furnishes most of the water supply for residential and industrial use throughout the region.

Within the Southwest Ohio Study area, ground water availability is provided through three main aquifer types: Buried Valley Deposits, Limestone, and Glacial Drift. Aquifers are recharged by precipitation percolating downward or by infiltration from a lake or stream. The amount of precipitation which ultimately recharges ground water aquifers is dependent upon soil properties, surface drainage characteristics and the vertical permeability of materials which may overlie the aquifer. The amount of infiltration which can be induced is controlled (among other parameters) by the stream bed area, average stream depth, and the stream bed permeability which varies with time as a result of siltation and scouring.

The Buried Valley aquifers located along the Great Miami and Ohio Rivers are the most proficient of the aquifers. Buried Valley deposits generally consist of permeable sand and gravel. Yields as high as 3,000 gallons per minute (gpm) may be developed.

1/ Information on ground water obtained from Report No. 23, Ohio Water Plan Inventory 1972, Ground Water for Planning in Southwest Ohio, Ohio Department of Natural Resources.

U S DEPARTMENT OF AGRICULTURE



LEGEND

- BASIN BOUNDARY
- SUBBASIN BOUNDARY
- STATE BOUNDARY
- COUNTY BOUNDARY
- COUNTY SEAT
- INCORPORATED TOWN OVER 25,000
- DRAINAGE
- LAKE

MAP 5-5

AVERAGE ANNUAL STREAM FLOW IN INCHES 1931-60

SOUTHWEST OHIO RIVER BASIN STUDY AREA

OHIO

SCALE 1/633,000

0 5 10 15 20 25 MILES

0 5 10 15 20 25 30 35 40 KILOMETERS

SOURCE
FAMILY OF MAPS SCS DRAWING NO. S.R. 34,214 (6-74)
AND INFORMATION FROM FIELD TECHNICIANS
TRANSVERSE MERCATOR PROJECTION

5-27-76
5,S-36,949

U S DEPARTMENT OF AGRICULTURE

LEGEND

- BASIN BOUNDARY
- SUBBASIN BOUNDARY
- STATE BOUNDARY
- COUNTY BOUNDARY
- COUNTY SEAT
- INCORPORATED TOWN OVER 25,000
- DRAINAGE
- LAKE
- PROPOSED LAKE
- LAKE UNDER CONSTRUCTION
- RESERVOIR SITES

MAP 5 – 5.5

WATER DEVELOPMENT PLAN

SOUTHWEST OHIO RIVER BASIN STUDY AREA
OHIO

SOURCE
FAMILY OF MAPS, S.C.S. DRAWING NO
DEPARTMENT OF NATURAL RESOURCES,
DIVISION OF WATER
TRANSVERSE MERCATOR PROJECTION

SCALE 0 5 10 15 20 25 30 35 40 KILOMETERS

8-21-79
5,0-37,495

USDA-SCS LINCOLN, NEBR. 1979

The northern portion of the study area is underlain by devonian and silurian strata consisting of limestone and dolomite. Individual well yields from limestone and dolomite aquifers located in Darke, Mercer, and Shelby counties generally range from 100 to 200 gpm, where as wells may yield as high as 1000 gpm in some parts of Champaign and Logan counties.

The middle portion of the study area is underlain by glacial drift. Aquifers in this region occur as discontinuous lenses of sand and gravel. Yields in the northern portion of the region range between 25 to 100 gpm. In the southern part, yields of 5 to 25 gpm are more common.

The Shale aquifers in the southern part of the study area are poor producers of ground water even in small quantities. Normal well yields are barely adequate for domestic and limited agricultural use. Yields of five gpm or less is the general range but in some areas, dry holes are common. Map 5-6 illustrates the location and extent of these aquifers for ground water availability.

The quality of ground water is governed primarily by the concentrations of soluble minerals in the surrounding rock material. In most instances ground water is virtually free of suspended matter and microorganisms.

Relationship of Resource Base to Objectives

Over 135,000 acres of cropland, forest land, and other land in the upstream areas of the Southwest Ohio study area are subject to flooding. Nearly 92,000 acres or 66 percent of these flood plain acres are located in the upper drainage areas of the Great Miami and Little Miami Rivers. Some flooding occurs annually and is a hazard to transportation facilities, residents, wildlife, and agricultural production.

Wet agricultural soils exist in the northern and central portions of the study area because of low hydraulic gradients, flat topography, slowly permeable soils, and abundant rainfall.

Because of the urban centers of Cincinnati, Dayton, and Springfield, tremendous pressures are put on existing recreational facilities. To meet the future demands for boating is difficult. Topographically, the southeastern part of the study area offers the most opportunity to provide large enough bodies of water for boating purposes. Large lake sites (1,000 surface acres) are limited and are not sufficient to meet the projected needs. Other portions of the study area are not conducive to new water-based recreation and are not close to the large urban centers.

Topographically, small stream impoundments for fishing purposes can be developed throughout most of the study area. Wetlands and stream corridors which possess desirable natural attributes exist throughout the study area.

The fact that nearly 70 percent of the Southwest Ohio Study area is either open or agricultural land indicates to some extent the magnitude of the erosion problem. Such practices as continuous row crops, conventional tillage, and fall plowing are the major contributors to excessive erosion and resulting sedimentation. The potential exists to improve the quality of water in streams and lakes without a major loss in crop production.

EXISTING PROGRAMS AND AGENCIES

Soil Conservation Service

The main purpose of the Soil Conservation Service (SCS), under Public Law 46 of the 74th Congress, as amended, is to assist individuals, groups, organizations, cities and towns, and county and state governments in planning, applying and maintaining soil and water conservation measures on the land. Technical assistance is provided by SCS through soil and water conservation district programs. All counties within the Southwest Ohio Study area have organized soil and water conservation districts. SCS provides technical assistance in preparing conservation plans, determining where conservation practices are practical and necessary, designing, laying out, and supervising installation of the practices, and checking and certifying performance of the practices. Table 5-2 lists the practices applied as of July 1, 1976, to reduce erosion and sedimentation production, control surface runoff, and preserve water and land resources.

The U.S. Department of Agriculture through the Soil Conservation Service provides technical and financial assistance for the development of small watershed projects under Public Law 566. Federal assistance can be provided to rural and urban residents in helping to reduce flooding, erosion, and siltation; improve fish and wildlife resources; provide for recreation; provide for agricultural water management; supply water for growing domestic and industrial needs; recharge groundwater reservoirs; and provide for water quality management. SCS administers the watershed program for USDA.

Under Public Law 566, the Upper Wabash River and East Fork Buck Creek projects are completed. A total of eight structures and nearly 42 miles of channel work was installed under the two projects. Currently, the East Fork Whitewater River project is authorized and under construction.

Expected accomplishments under Public Law 566 by 1990 include the completion of the East Fork Whitewater River project. This will involve 19.6 miles of channel work in Darke and Preble counties. Map 5-7 shows the status of PL-566 watershed programs in Southwest Ohio.

A Resource Conservation and Development (RC&D) project, Top of Ohio, includes Champaign and Logan Counties located in the Southwest Ohio Study area. USDA provides technical and financial help in carrying out measures called for in the plans which SCS helps local sponsors to develop and for helping to coordinate the assistance of other federal and state agencies in meeting project objectives. At the present time, one federal financial assistance under RC&D has taken place in the area and others are being planned.

Agricultural Stabilization and Conservation Service

The Agricultural Stabilization and Conservation Service (ASCS) administers the Agricultural Conservation Program (ACP) which allows land users to share with USDA the cost of applying certain soil and water conservation measures. This program provides cost-sharing assistance in implementing soil, water, woodland, and

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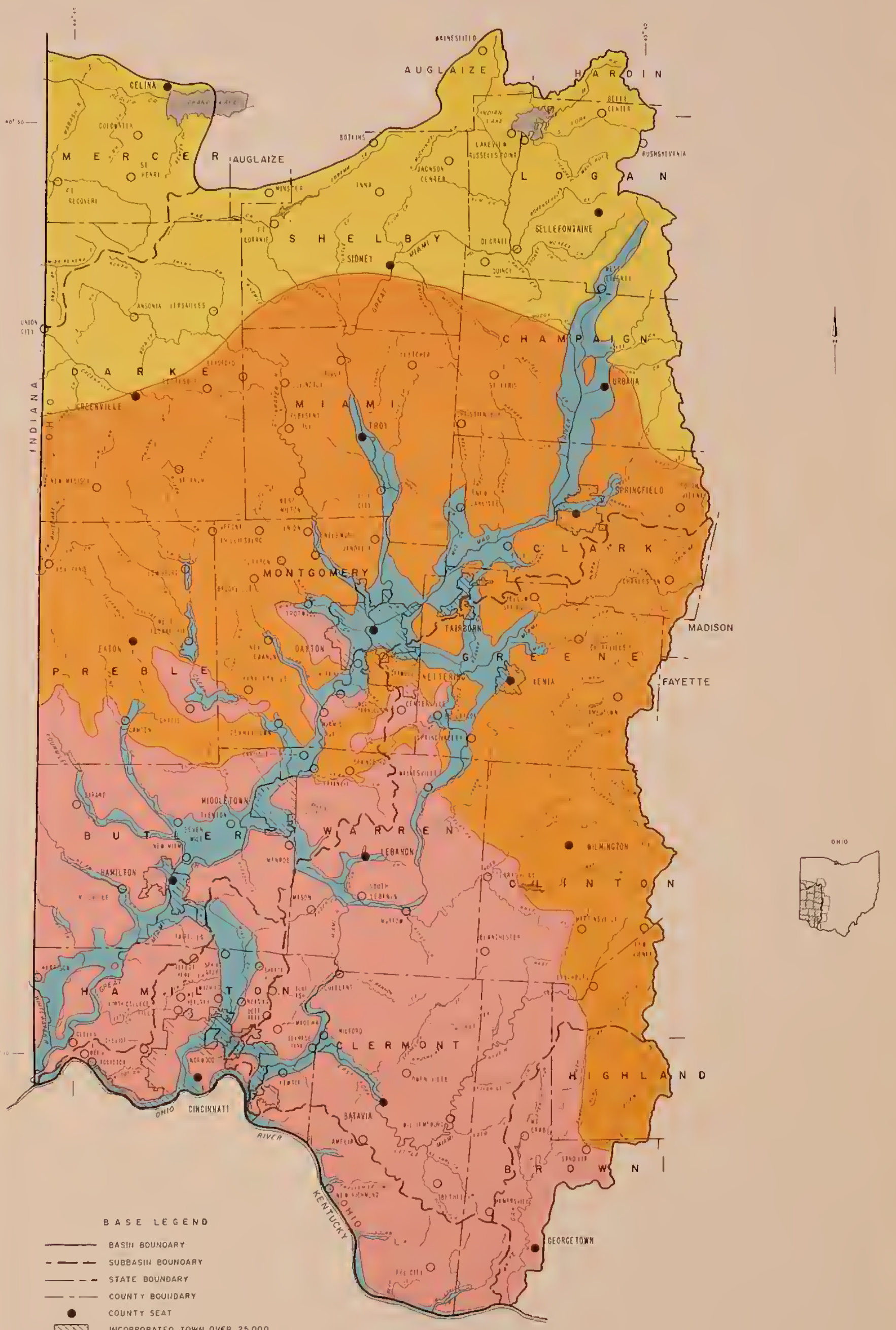


BASE LEGEND

- BASIN BOUNDARY
- SUBBASIN BOUNDARY
- STATE BOUNDARY
- COUNTY BOUNDARY
- COUNTY SEAT
- INCORPORATED TOWN OVER 25,000
- INCORPORATED TOWN 500-24,999 *
- DRAINAGE
- LAKE

AQUIFER TYPES

- BURIED VALLEY AQUIFERS (LESS THAN 0.4-20 MGD PER VALLEY MILE)
- LIMESTONE AQUIFERS (.5-3 MGD PER WELL FIELD)
- GLACIAL AQUIFERS (5-100 GPM PER WELL FIELD)
- SHALE AQUIFERS (5 GPM OR LESS PER WELL FIELD)

* NOTE
IN HAMILTON COUNTY, NOT ALL INCORPORATED TOWNS BETWEEN 500 AND 24,999 ARE SHOWN

OHIO

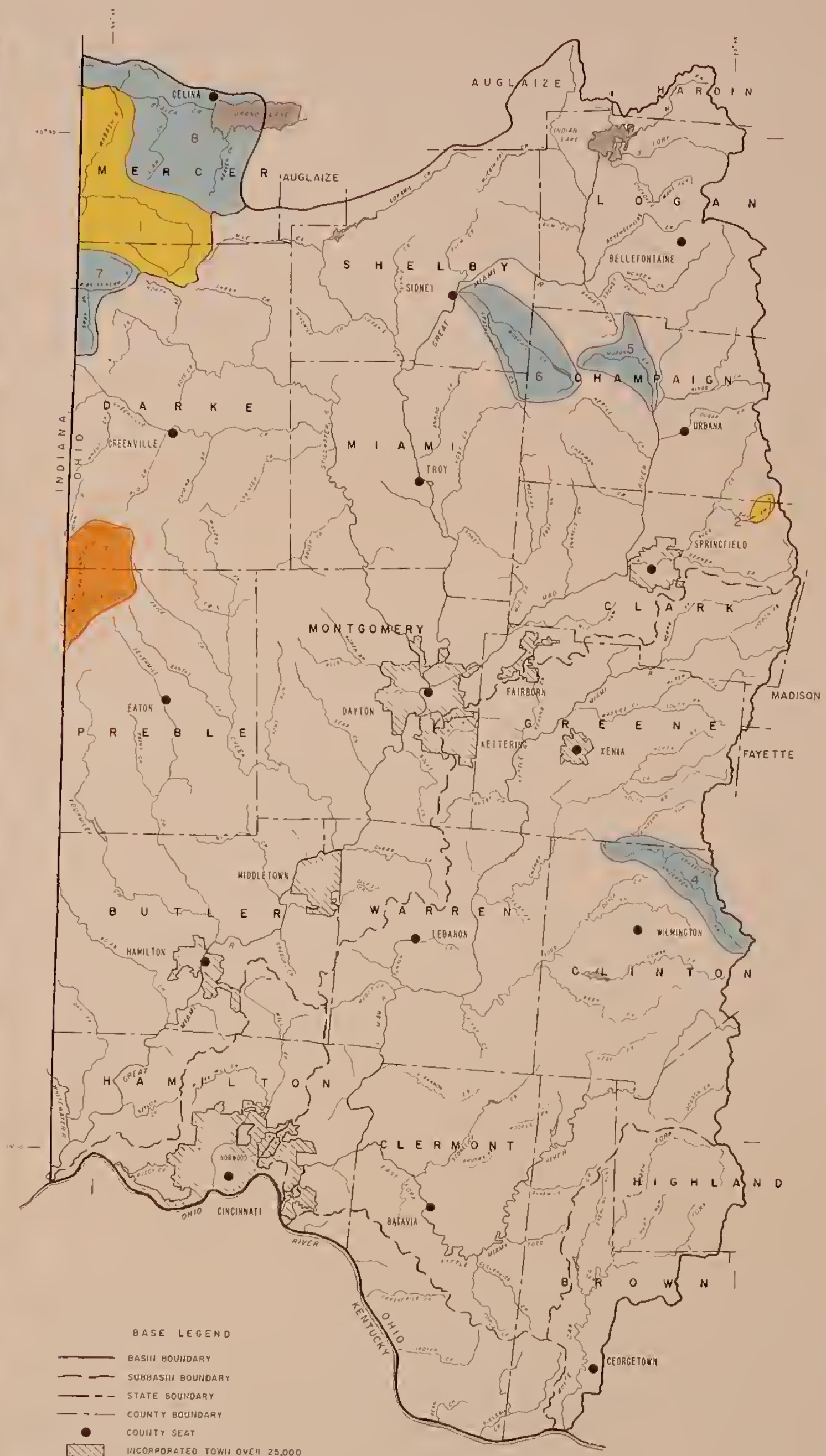
MAP 5-6
GROUNDWATER AVAILABILITY
SOUTHWEST OHIO RIVER BASIN STUDY AREA
OHIO

SCALE 1/633,600
0 5 10 15 20 25 MILES
0 5 10 15 20 25 30 35 40 KILOMETERS

SOURCE
TABLE OF MAPS, SCS DRAW NO 5,R-34,214 (1-74)
AND INFORMATION FROM FIELD TECHNICIANS
TRANSVERSE MERCATOR PROJECTION

6-6-75
5,S-36,947

U. S. DEPARTMENT OF AGRICULTURE



BASE LEGEND

- BASIN BOUNDARY
- SUBBASIN BOUNDARY
- STATE BOUNDARY
- COUNTY BOUNDARY
- COUNTY SEAT
- INCORPORATED TOWN OVER 25,000
- DRAINAGE
- LAKE

PL-566 WATERSHED STATUS

CONSTRUCTION COMPLETED
1. UPPER WABASH
2. EAST FORK BUCK CREEK

AUTHORIZED FOR CONSTRUCTION
3. EAST FORK WHITEWATER RIVER

APPLICATION
4. ANDERSON FORK
5. MUDDY-GLADY CREEK
6. TAWAWA CREEK
7. UPPER MISSISSINEWA RIVER
8. BUCKEYE-HOOSIER WABASH

MAP 5-7
P.L. 566 WATERSHED STATUS
SOUTHWEST OHIO RIVER BASIN STUDY AREA
OHIO

SCALE 1/633,600
0 5 10 15 20 25 MILES
0 5 10 15 20 25 30 35 40 KILOMETERS

SOURCE
FAMILY OF MAPS SCS DRAWING NO. S,R-34,214 (6-74)
AND INFORMATION FROM FIELD TECHNICIANS
TRANSVERSE MERCATOR PROJECTION

6-6-78
S,S-36,948

Table 5-2

Practices Applied July 1, 1976 (16 Counties)
Southwest Ohio Economic Area
Southwest Ohio River Basin

Practice	Unit	Amount
Conservation Cropping	Acres	1,406,100
Critical Area Planting	Acres	6,700
Contour Farming	Acres	59,200
Strip Cropping	Acres	11,500
Minimum Tillage	Acres	208,000
Grass Waterways or Outlets	Acres	8,000
Pasture and Hayland Management	Acres	144,500
Pasture and Hayland Planting	Acres	132,300
Terrace Gradient	Feet	1,234,700
Diversion	Feet	1,943,700
Drainage Main Lateral	Feet	4,054,300
Drainage Field Ditch	Feet	7,935,400
Drainage Subsurface	Feet	174,023,500
Farm Ponds	No.	12,100
Fish Pond Management	No.	8,200
Wildlife Upland Management	Acres	57,800
Cropland to Wildlife Recreation	Acres	23,400
Tree Planting	Acres	21,700
Woodland Improvement	Acres	20,000
Land Adequately Protected	Acres	2,092,600

wildlife conservation practices on land now in agricultural production. SCS provides technical assistance in certain phases of the program. The conservation practices must be applied satisfactorily by the landowner before cost-sharing assistance can be administered. Table 5-3 lists the acres needing to be treated.

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers, under the Department of Defense, is authorized by Congress to carryout major civil engineering work involving water management and navigational improvement.

The U.S. Army Corps of Engineers, Louisville District, has completed West Fork Mill Creek and Clarence J. Brown Reservoirs. Caesar Creek and East Fork Little Miami Reservoirs are currently under construction and scheduled for completion in fiscal year 1979. West Fork Mill Creek Lake is a single purpose recreation lake, whereas, the other three reservoirs are multiple purpose and will provide 7,100 acres toward water based recreation.

The Corps of Engineers has been authorized to initiate construction of the Mill Creek local protection project. The project consists of approximately 18 miles of channel work, 11 miles of levees, 8 pumping plants and regulation of 2000 undeveloped flood plain acres. Completion is to take place by 1990.

U.S. Forest Service

Cooperative Forest Management Program - This program was authorized under Public Law 81-729 (64 Stat. 73), as amended, to improve the management of small private forest and the operation of loggers and small plants processing primary forest products with special attention to maintaining and improving the quality of the environment. The program is administered by the U.S. Forest Service through the state forestry agencies who provide on-site technical assistance in such activities as preparing forest management plans for the production of timber, wildlife habitat, water recreation, forage, and other forest sources.

Tree Seedling Production - Assistance is authorized under Section 4 of the Clark McNary Act of June 1924, as amended, Public Law 69-270 (43 Stat. 653). Both financial and technical assistance are provided to cooperating states for seed or seedling production to be used in multiple-use forest, wind barrier, and watershed plantings on private and non-federal public lands.

Forestry Incentives Program - This program was authorized under Title X, Section 1009 of the Agriculture and Consumer Protection Act of 1973, Public Law 93-86, to provide for the production of timber and related benefits. FIP is administered jointly at the national, state, and county levels by the Agriculture Stabilization and Conservation Service (ASCS). ASCS handles the program administration and the Forest Service, in cooperation with the state forestry agencies, develops and recommends fund allocation procedures, practice specifications, and on-the-ground application.

Table 5-3

Conservation Treatment Needs (Acres)
Adjusted CNI Sample Data, 1975
Southwest Ohio River Basin

Cropland	
Treatment Adequate	183,599
Residue and Annual Cover	280,724
Sod In Rotation	568,593
Contouring Only	124,749
Strip Cropping, Terraces, and Diversions	210,806
Permanent Cover	38,933
Drainage System	1,088,819
Pastureland	
Treatment Adequate	80,049
No Treatment Feasible	8,062
Need Protection Only	58,921
Need Improvement Only	87,068
Brush Control and Improvement	24,486
Reestablishment Vegetative Cover	23,661
Reestablishment with Brush Control	36,163
Change in Land Use	9,642

Forest Products Utilization - The objective of the Forest Products Utilization Program is to extend the supply of our nation's forest resources and protect and enhance the environment through more efficient utilization of forest products. Both Forest Service and State Forest Products Utilization personnel provide technical assistance of a highly specialized nature to timber harvesters and processors throughout the nation.

General Forestry Assistance - This program provides highly specialized forestry services to support state forestry organizations and others in their efforts to enhance rural community development and increase the production of forest products under sound principles of resource management. Assistance provided under the GFA Program includes resource management advice to other federal, state, and local government land holding agencies; large private owners, forestry consultants and other individuals and groups; loggers and processors; local and state groups; and regional planning and development groups.

The Forest Service also participates with other USDA agencies in planning and operation activities of the PL-566, RC&D, and river basin programs.

Rural Commumity Fire Protection Program - Title IV of the Rural Development Act of 1972 - Authorized and directed the Secretary of Agriculture to provide financial, technical, and other assistance to State Foresters to organize, train, and equip fire departments in rural areas and communities under 10,000 population to prevent and suppress fires.

Farmers Home Administration

The Farmers Home Administration (FmHA) is authorized to make loans to local sponsors to assist in implementing watershed and RC&D projects. Loans are used to finance the local cost-sharing items as required by the project. Loans to individual landowners for installation of conservation practices are eligible. The FmHA is also authorized to make loans to develop domestic water supply and waste disposal systems for farmers and rural residents. Interest rates are usually favorable for community development loans.

Ohio Department of Natural Resources

The Ohio Department of Natural Resources (ODNR) was established in 1949 to bring together the various state agencies engaged in conservation of natural resources. The director is appointed by the governor and coordinates the activities of eleven divisions. Most of them are directly concerned with water. They are: forestry, geological survey, lands and soils, natural areas and preserves, oil and gas, parks and recreation, reclamation, soil and water districts, water watercraft, and wildlife. The Division of Water conducts major water management and planning programs for water supply, flood control, dam inspection and design, and stream management. It serves as the governor's agent to administer state relationships with the Soil Conservation and Corps of Engineers.

Soil and Water Conservation Districts

Soil and Water Conservation Districts are delineated by county boundaries and are organized under provisions passed by the State Legislature to promote conservation, improvement, and development of water and land resources.

Each district is concerned with water, land, and associated resource problems. The main objectives are to have complete soil and water conservation programs established on all lands and to assist in the solution of water problems throughout the district. Districts enter into cooperative agreements with landowners or operators and provide assistance to those who wish to participate in district programs.

CHAPTER 6
FUTURE CONDITIONS WITHOUT ADDITIONAL PROJECTS

A base against which to compare selected variables is necessary if the impacts of alternative plans are to be projected and evaluated. The base developed for this analysis is referred to as the "future without" condition. This chapter shows the magnitude which selected variables are expected to attain if current programs are continued and no new projects are installed.

Assumptions

General

Two general assumptions that were made are: Existing USDA programs will continue at present levels over projected time frames and that technological development and adoption rates will be nearly the same in the future as over the past 15 to 20 years. In addition to these general assumptions, the following specific assumptions were used in preparing the future without situation:

Yield Projections

There were county soil surveys for 6 of the 16 counties in the Southwest Ohio Study area. These gave sufficient data for establishing relative yields for each major crop for the 24 Soil Resource Groups (SRG) (Table 6-1). The soil survey yield data was for different years, therefore, it was necessary to adjust the different county yield data to a common base year, 1975. The resulting common base year yields were then normalized, i.e., adjusted further to insure that the sum of each SRG crop yield multiplied by acres in that crop in 1975 for each SRG totaled to the Economics, Statistics, and Cooperatives Service (ESCS) production estimates 1/. The current normal yields resulting from these procedures are shown in Table 6-2.

A basic assumption underlying the yield projections is that the rapid rate of increase in research and development in agriculture that occurred in 1947-70 will slow down slightly during the period 1970-2020. However, the casual relationship between research and resource development and land use shifts and crop yields has not been adequately quantified. As a result, general assumptions have been made concerning these relationships. The projected increases are due to continued investment in production, research and resource development, a lagged implementation of current knowledge and technologies, more extensive use of fertilizers and pesticides, improved varieties, and improved management practices. The yield projection procedure is consistent with these baseline assumptions and is directly related to historical yield data 1/. The projection factors developed by OBERS for

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1/ Volume 1, "Concepts Methodology and Summary Data," 1972 OBERS Projections, prepared by the U.S. Department of Commerce and the U.S. Department of Agriculture for the Water Resources Council, September 1972, pages 30-31.

Table 6-1

Composition and Area of Each Soil Resource Group
Southwest Ohio River Basin

Soil Group	Class Sub-Class	Approximate Area (Acres)	Significant Soil Series*				
A	IIw	126,176	Genesee	Eel	Ross		Medway
B	IIw	28,990	Shoals	Algiers	Wallkill		
C	IIIw	52,313	Sloan				
D	IIIw	17,731	Carlisle	Linwood	Edwards		
E	I	89,073	Celina	Ockley	Xenia	Miamian	Thackery
F	IIs	41,582	Fox	Warsaw			
G	IIe	301,901	Russell	Xenia	Eldean	Ockley	Dana
H	IIe	152,028	Rossmoyne	Wynn	Milton		
I	IIe	423,890	Miamian	Celina	Morley		
J	IIw	362,634	Crosby	Blount	Fincastle	Reesville	
K	IIw	21,243	Rossmoyne	Weinbach			
L	IIe	450,038	Blount	Crosby	Fincastle		
M	IIw	759,040	Brookston	Pewamo	Westland	Patton	Abington
N	IIIe	154,427	Miamian	Cincinnati	Kendallville	St. Clair	
O	IIIe	128,587	Russell	Eldean	Wynn	Edenton	Maddox
P	IIIe	32,129	Rossmoyne				
R	IIIe	35,397	Morley				
S	IIIw	134,601	Clermont				
T	IIIw	17,304	Montgomery	Hoytville	Kings		
U	IIIw	96,289	Arenburg				
V	IVe	136,523	Miamian	Cincinnati	Eldean	Kendallville	
W	IVe	49,558	Edenton	Wynn	Milton	Eden	
X	VIe	250,076	Eden	Edenton	Miamian		
Y	VIIe	45,415	Eden				

* The first named soil is the dominant soil of the SRG on which the soil loss assumptions are based. All soils are in order of decreasing importance from left to right.

Table 6-2

Current Normal Per Acre Yields by Soil Resource Groups
Southwest Ohio River Basin

Soil Group	Corn Grain Bushel	Corn Silage Ton	Soybeans Bushel	Wheat Bushel	Oats Bushel	All Hay Ton	Cropland Pasture AUM
A	99.5	15.9	34.4	43.2	62.2	2.50	6.00
B	96.5	15.4	31.7	42.8	68.6	2.46	5.92
C	97.0	15.5	33.6	42.4	62.4	2.63	6.26
D	104.7	16.8	35.0	-	-	2.40	5.80
E	89.9	14.4	33.3	43.7	64.2	2.32	5.46
F	81.6	13.1	26.6	42.1	65.7	2.80	6.60
G	87.2	14.0	28.8	42.2	59.5	2.08	5.16
H	77.6	12.4	25.4	36.1	52.2	1.87	4.74
I	81.7	13.1	31.1	41.5	60.4	2.23	5.46
J	86.3	13.8	32.1	40.2	59.2	2.06	5.12
K	80.3	12.8	24.6	35.0	53.3	1.92	4.84
L	83.2	13.3	29.4	41.3	65.7	2.12	5.24
M	101.0	16.2	35.6	43.9	64.1	3.25	7.50
N	70.3	11.2	22.0	35.0	54.0	2.00	5.00
O	74.1	11.9	24.2	37.5	55.8	1.91	4.82
P	70.9	11.3	20.6	32.8	49.9	1.76	4.52
R	63.0	10.1	25.1	36.3	55.2	1.50	4.00
S	76.4	12.2	23.4	29.7	45.2	1.64	4.28
T	100.0	16.0	37.4	42.8	62.9	2.28	5.56
U	76.2	12.2	23.8	35.0	53.3	1.67	4.34
V	49.0	7.8	19.3	27.3	43.0	1.60	4.20
W	50.5	8.1	21.2	29.7	39.4	1.46	3.92
X	86.6	13.8	30.4	40.4	60.0	1.97	4.94

the State of Ohio are shown in Table 6-3. Table 6-4 shows the effect of projections on yields for selected SRG's by time frame. Additional assumptions and procedures underlying these yield factors are explained in detail in Volume 1 of 1972 OBERS Reports 1/.

Yield Differentials

Yield differentials were estimated for each treatment need and under each combination or rotation and tillage (Tables 6-5 and 6-6). Table 6-5 shows typical differentials for "e" soils (SRG's G and I are shown as examples) and Table 6-6 shows typical differentials for "w" soils (SRG's J, L, and M are shown as examples).

The "w" soils not having adequate drainage generally have lower yields under no-till than under conventional tillage. These soils tend to warm and drain more slowly in the spring due to the organic material and growth left on the surface under no-till. In contrast, adequately drained "w" soils shows both increases and decreases in yields under no-till versus conventional tillage.

The "e" soils generally show a yield response to conservation tillage versus conventional tillage. Since "e" soils are on slopes, wetness is usually not a problem but droughtiness and soil loss are. Conservation tillage keeps more soil in place and reduces droughtiness thus increasing yields. Conservation tillage requires, however, better management skills to obtain comparable or higher yields. Table 6-7 shows the effects of conservation tillage versus conventional tillage on yields and soil loss for "e" soils.

Tillage

The rate of use for various tillage methods were assumed to vary between erosive "e" soils and wet "w" soils. This was based on possible economic gains going to minimum and no-till versus conventional tillage on "e" soils and little economic gain or a decrease on "w" soils. Table 6-8 shows the percent of "e" and "w" cropland soils expected to be tilled by each of the tillage systems for each target year.

Land Treatment

In Chapter 5, the past accomplishments in applying conservation treatment measures for the Southwest Ohio area were illustrated. The programs to implement these measures are expected to continue in reducing erosion and sedimentation. Table 6-9 show the measures and the amounts projected to be applied by 1990, under present programs.

1/ 1972 OBERS Projections of Regional Activity in the U.S. (Series E Population), Volume 1, Concepts, Methodology, and Summary Data, U.S. Water Resources Council, 1974.

Table 6-3

Yield Projection Factors for the State of Ohio 1/
Southwest Ohio River Basin

Crop	1990	2020
Corn for Grain	1.39	1.68
Corn Silage	1.25	1.49
Soybeans	1.18	1.35
Wheat	1.21	1.48
Oats	1.32	1.60
All Hay	1.12	1.30
Crop Pasture	1.12	1.30

1/ The projection factors are to be multiplied by the current normal yield for each SRG (See Table 6-2).

Table 6-4

Projected Yields for Adequately Drained and
Treated Land for Selected Soil Resource Groups
Southwest Ohio River Basin

Soil Group	Target Year	Corn For Grain (Bu.)	Corn Silage (Ton)	Soybeans For Beans (Bu.)	Wheat (Bu.)	Oats (Bu.)	All Hay (Ton)	Crop Pasture AUM
A (Class I)	1974	100	15.9	34	43	62	2.5	6.0
	1990	138	19.9	41	52	82	2.8	6.7
	2000	149	21.3	43	57	89	3.0	7.1
	2020	167	23.7	46	64	99	3.3	7.8
G (Class IIe)	1974	87	14.0	29	42	60	2.1	5.2
	1990	121	17.5	34	51	79	2.4	5.8
	2000	131	18.8	36	55	86	2.5	6.2
	2020	146	20.9	39	62	96	2.8	6.8
M (Class IIw)	1974	101	16.2	36	44	64	3.3	7.5
	1990	140	20.3	42	53	84	3.7	8.4
	2000	152	21.7	45	58	92	3.9	8.9
	2020	170	24.1	49	65	102	4.3	10.0

Table 6-5
Current Normal Corn Yields by Treatment Need and Rotation for Major "e" Soil Resource Groups
Southwest Ohio River Basin

Soil Resource Group	Rotation 1/	Adequate for Contouring				Needs Contouring and/or Stripping			
		CF	CS	M	N-T	CF	CS	M	N-T
G	RRR	81	86	95	95	72	72	86	-
(Subclass IIe)	RRRGX	86	91	95	95	76	81	86	-
(9 percent of all cropland)	RRRGM	95	95	95	95	86	91	91	-
	RRGMM	95	95	95	95	95	95	95	-
(189,282 a)	RGMMMM	95	95	95	95	95	95	95	-
I	RRR	80	80	84	84	71	71	80	-
(Subclass IIe)	RRRGX	84	84	84	84	71	71	80	-
(11 percent of all cropland)	RRRGM	84	84	84	84	80	84	84	-
	RRGMM	84	84	84	84	84	84	84	-
(226,662 a)	RGMMMM	84	84	84	84	84	84	84	-

1/ R - row crops, corn or soybeans; G - Small grains, wheat or oats; X - Green Manure Crop; M - Hay.
Note: CF - Conventional Fall Plow; CS - Conventional Spring Plow; M - Conservation Tillage;
N-T - No Tillage.

Table 6-6

Current Normal Corn Yields by Treatment Need and Rotations for Major "w" Soil Resource Groups
Southwest Ohio River Basin

Soil Resource Group	Rotation	Adequate Drainage (AD)				Needs Partial Drainage (PD)				Needs Full Drainage (FD)			
		CF	CS	M	N -T	CF	CS	M	N -T	CS	CF	M	N-T
J	RRR	104	104	109	109	93	93	88	88	77	77	71	66
(Subclass IIw)	RRRGX	104	104	109	109	99	99	88	88	77	77	71	66
(12 percent of	RRRGM	109	109	109	109	99	99	88	88	77	77	66	66
all cropland)	RRGMM	109	109	109	109	99	99	88	88	77	77	71	66
(238,686 a)	RGMMMM	109	109	109	109	99	99	88	88	77	77	71	66
L	RRR	85	85	97	111	78	78	89	89	72	72	72	67
(Subclass IIw)	RRRGX	89	89	97	111	85	85	89	89	78	78	72	67
(13 percent of	RRRGM	97	199	199	111	89	97	89	89	78	78	72	67
all cropland)	RRGMM	100	106	111	111	97	100	89	89	78	78	72	67
(259,248 a)	RGMMMM	111	111	111	111	100	100	89	89	78	78	72	67
M	RRR	128	128	115	109	115	115	90	83	90	90	77	77
(Subclass IIw)	RRRGX	128	128	115	109	115	115	90	83	90	90	77	77
(25 percent of	RRRGM	128	128	115	109	115	115	90	83	90	90	83	77
all cropland)	RRGMM	128	128	115	109	115	115	90	83	90	90	77	77
(500,383 a)	RGMMMM	128	128	115	109	115	115	90	83	90	90	77	77

Note: CF- Conventional Fall Plow; CS - Conventional Spring Plow; M - Conservation Tillage; N-T - No Tillage. R - Row Crops; G - Small Grains; X - Green Manure Crop; M - Hay.

Table 6-7

Soil Characteristics, Yield and Erosion Rates by Tillage Method, By Soil Resource Group for Corn Grown Continuously and in a RRRGM Rotation
Southwest Ohio River Basin

Soil Resource Group	Subclass	Major Soil	Dominant Slope		Continuous Corn Not Contoured				Corn in Rotation:RRRGM			
					Conv. Fall Tillage	Conv. Spring Tillage	Minimum Tillage	No Tillage	Conv. Fall Tillage	Conv. Spring Tillage	Minimum Tillage	No Tillage
G	IIe	Russell	4	Yield	72	72	86	95	86	91	91	95
				"C" factor	.42	.38	.19	.03	.16	.14	.12	.05
				soil loss	14.1	12.8	6.4	.5	5.4	4.7	4.0	.4
H	IIe	Rossmoyne	4	Yield	57	57	70	82	70	74	78	82
				"C" factor	.42	.38	.19	.03	.16	.14	.12	.05
				soil loss	14.4	13.0	6.5	.5	5.5	4.8	4.1	.4
I	IIe	Miamian	4	Yield	71	71	80	84	80	84	84	84
				"C" factor	.42	.38	.19	.03	.16	.14	.12	.05
				soil loss	9.4	8.5	4.3	.3	3.6	3.1	2.7	.3
N	IIIe	Miamian	6	Yield	58	58	69	76	69	73	73	76
				"C" factor	.42	.38	.19	.03	.16	.14	.12	.05
				soil loss	15.8	14.3	7.1	.6	.6	5.3	4.5	.5
O	IIIe	Russell	8	Yield	58	58	63	78	73	78	78	97
				"C" factor	.42	.38	.19	.08	.16	.14	.12	.05
				soil loss	33.7	30.5	15.3	1.5	12.9	11.2	9.6	1.2
P	IIIe	Rossmoyne	8	Yield	49	49	58	82	62	62	66	79
				"C" factor	.42	.38	.19	.03	.16	.14	.12	.05
				soil loss	32.6	29.5	14.8	1.4	12.4	10.9	9.3	1.2
R	IIIe	Morley	10	Yield	50	50	58	83	63	63	67	83
				"C" factor	.42	.38	.19	.03	.16	.14	.12	.05
				soil loss	37.9	34.3	17.2	1.6	14.5	12.6	10.8	1.4
V	IVe	Miamian	10	Yield	38	38	48	64	48	51	54	64
				"C" factor	.42	.38	.19	.03	.16	.14	.12	.05
				soil loss	28.2	25.5	12.8	1.2	10.8	9.4	8.1	1.0
W	IVe	Edenton	10	Yield	44	44	50	63	50	50	50	63
				"C" factor	.42	.38	.19	.03	.16	.14	.12	.05
				soil loss	32.6	29.5	14.8	1.2	12.4	10.9	9.3	1.0

Table 6-8
Tillage Method Used in Percent and By Target Year,
Future Without Condition
Southwest Ohio River Basin

Target Year	Conv. Fall	Conv. Spring	Minimum	No-Till
Current Normal				
"e" Soils				
1990	30	30	30	10
2020	18	17	45	20
"w" Soils				
1990	44	43	10	3
2020	38	37	20	5

Flood Reduction

Flooding will continue to reduce average annual agricultural production by about 20 percent on about 135,000 acres of cropland. Under the "future without" situation, there will be no flood prevention or protection measures installed other than those underway or approved for construction by 1977.

Under the existing PL 566 program, the East Fork Whitewater River is approved for construction. Flooding will be reduced on over 1600 acres of agricultural land and improved drainage of cropland will take place on 2,200 acres. Flood damage reduction benefits of $5,352, more intensive use benefits of $9,261, and drainage benefits of $677 will occur from the project plus secondary benefits of $3,629. The benefits are based on 1966 prices and include only those benefits accruing to the channel work portion of the project.

The Corps of Engineers plan to complete the East Fork and Caesars Creek Reservoirs by 1979. Flood control benefits of nearly $6.1 million will be realized when the structures are completed. Recreation benefits approaching $3.8 million will also result from the sites. The Corps is also authorized to construct a local protection project along Mill Creek in Hamilton County. Flood control benefits of $1.7 million and recreation benefits of $57,000 are expected from the project. Completion of this project is expected by 1990.

Drainage of Wet Agricultural Soils

Drainage improvements in the "future without" situation will be limited to that which farmers are expected to do under existing programs and no new government projects. Table 6-10 lists the percentages and acreages of wet land which is adequately drained by farmers by the indicated target years.

Table 6-9

Conservation Land Treatment
Existing Policies and Program, 1990
Southwest Ohio River Basin

Conservation Treatment Practices	Present Need (Acres)	Expected Accom-plishments (Acres)	Remaining Needs (Acres)	Federal Funds	Other Funds	Total Cost
Cropland						
Annual Cover	280,700	126,300	154,400		1,263,000	1,263,000
Sod in Rotation	568,600	255,900	312,700		25,590,000	25,590,000
Contouring Only	124,700	56,100	68,600		14,000	14,000
Strip Crop and Diversions	210,800	94,900	115,900		949,000	949,000
Permanent Cover	38,900	17,500	21,400		1,750,000	1,750,000
Pastureland						
Need Protection Only	58,900	26,500	32,400		927,500	927,500
Need Improvement Only	87,100	39,200	47,900		1,960,000	1,960,000
Brush Control and Improvement	24,500	11,000	13,500		550,000	550,000
Reestablishment Vegetative Cover	23,700	10,700	13,000		1,070,000	1,070,000
Reestablishment with Brush Control	36,200	16,300	19,900		2,445,000	2,445,000
No Treatment Feasible	8,062	0	8,062			
SCS Technical Assistance				9,816,000		9,816,000
Total				9,816,000	36,518,500	46,334,500
Forest Land						
Planting	115,300	2,300	113,000	0	113,700	113,700
Stand Improvement	238,200	2,500	235,700	0	75,300	75,300
Grazing Control	115,800	3,600	112,200	0	54,000	54,000
Erosion Control	17,300	2,480	14,820	0	6,200	6,200
Harvest Cutting	106,300	12,415	93,885	0	62,100	62,100

Recreation Facilities

The East Fork and Caesars Creek developments, when completed, will provide approximately $5.8 million in recreation benefits. At the present time, no additional state parks or expansion of existing parks are expected by 1990 for the Southwest Ohio River Basin. No new reservoirs are planned other than scheduled completion of East Fork and Caesars Creek which will provide 2,160 and 2,830 acres of surface water, respectively. There is a plan by the Ohio Department of Natural Resources (ODNR) to purchase portions of the Mad River Canopy in Champaign County. This would provide an estimated 220 acres of fishing.

Table 6-10
Acres Drained Under Existing Programs
Future Without Project Conditions by Time Periods
Southwest Ohio River Basin

Time Periods	1975-1990	1990-2020
Land Needing a Complete Subsurface System 1/		
At the start of the period (acres)	892,160	807,678
Area drained during the period (acres)	84,482	158,324
Percentage of total needing drainage during period (percent)	9	20
Land Needing Less than a Complete Subsurface System 2/		
At the start of the period (acres)	195,840	177,545
Area drained during the period (acres)	18,295	33,538
Percentage of total needing drainage during period (percent)	9	19

1/ Needing subsurface drains, drainage mains, and perhaps outlet modification.

2/ Needing only certain parts of the total drainage system such as additional tile, additional or replacement mains, and perhaps outlet modification.

Management and Protection of Stream Corridors, and Natural Areas

Both preservation and recreational use of stream corridors is possible when development limits are set within site limitations and capabilities. Acquisition of land by the Miami Conservancy District along the Great Miami River and by Little Miami Inc. and other public interests along the Little Miami River has helped in restricting development and is expected to continue. However, most unique natural areas and streams are located on or adjacent to privately owned land. The Ohio Department of Natural Resources, through their scenic rivers, natural areas, and wildlife programs, have acquired and preserved land along rivers and corridors in the Southwest Ohio Basin. Acquisition of these areas by public agencies preserves them against urban development and protects the quality of the resource. Once a natural area is destroyed, it is not likely to be replaced.

Land Use

The agricultural resource base was presented in Chapter 5. Certain shifts of acreage between the major land uses will occur over time due to population growth, productive land presently in forest land shifting to cropland, and marginal cropland changing to pasture or forest land. Land will also be shifted from agriculture to urban and other nonagricultural uses.

Assumptions about such shifts were made by OBERS analysts for each state. The OBERS assumptions were adopted for this study. While there is much attention being given to identifying and preserving prime agricultural lands, market forces continue to prevail at present. Without measures designed to preserve prime agricultural lands, it must be assumed that the land use shifts will occur. If dollar returns from land used in agriculture are less than that from other sources, even prime agricultural land will be diverted.

OBERS projections estimate that the State of Ohio will lose approximately 278,000 acres from cropland between 1969 and 1980, 426,000 from 1980 to 2000 and 290,000 from 2000 to 2020. Estimated losses in the Southwest Ohio Study area are based on an assumption that each person added to the population will remove three-tenths of an acre from the agricultural land base (Table 6-11).

Forest land is projected to decrease from 443,000 acres in 1975 to 368,700 acres in 2020. As previously stated in the assumptions, forest land is regarded as a residual use after other competitive uses are met. Table 6-12 illustrates the projected land use for each major category, by target year, under the "future without" condition. (This table is a representation of Table 4-25 for comparison purposes within this chapter.)

In setting aside land for nonagricultural uses by 1990, 2000, and 2020, it was assumed that land would be drawn from each SRG proportionately in the study area.

Table 6-11
Population Change and Acreage Lost (1,000) from Agricultural Use
Southwest Ohio River Basin

	1990	2020
Population Change	492.2	1,075.4
Acreage Lost From Agricultural Land 1/	147.7	322.6

1/ Assumes .3 acre per capita population increase.

The soil series of the study area were placed in homogeneous groups according to production capabilities and treatment needs. Figure 6-1 is a graphical display of the acreage by major land use by SRG. Six SRGs (G, I, J, L, M, and S) account for 74 percent of all the cropland.

Table 6-12
Land Use for Future Without Plan Condition
Southwest Ohio River Basin

	Projected		
	1975	1990	2020
Cropland	2,501,950	2,446,537	2,361,933
Pastureland	328,501	280,559	236,966
Forest Land	443,065	405,813	368,661
Other	976,534	1,116,691	1,282,040
Total	4,249,600	4,249,600	4,249,600

Agricultural Production

OBERS 1/ projections on agricultural production were presented in Chapter 4. This section presents the production levels of agricultural products under the assumptions shown.

The value of potential agricultural production is expected to be greater in 1990 than the basin's share of the OBERS projections. As shown in Table 6-13, the future without production value in 1990 is six percent greater than the value of the OBERS projection of production. However in 2020, potential production level is estimated to be about 95 percent of the OBERS projection. Note that the "future without" projection is based on the land resource expected to be available (combined with yield projections) while the OBERS projections are based on extensions of historical trends and national production needs. The OBERS is a projection based on demand while the "future without" is a projection based on production potential of the agricultural land. OBERS projections are not a limiting factor in future development.

The projections show that the Southwest Ohio River Basin can meet its OBERS share of future United States agricultural needs through 1990 without additional government financial assistance for development such as drainage and flood control.

Livestock production under "future without" conditions is assumed to be the same as the OBERS projections presented in Chapter 4. The OBERS projections of livestock are assumed to be as good as any that could be projected for this study.

1/ OBERS - An analytical system which projects personal income, employment and population through the year 2020.

Figure 6-1
Major Land Use by Soil Resource Group
Southwest Ohio River Basin

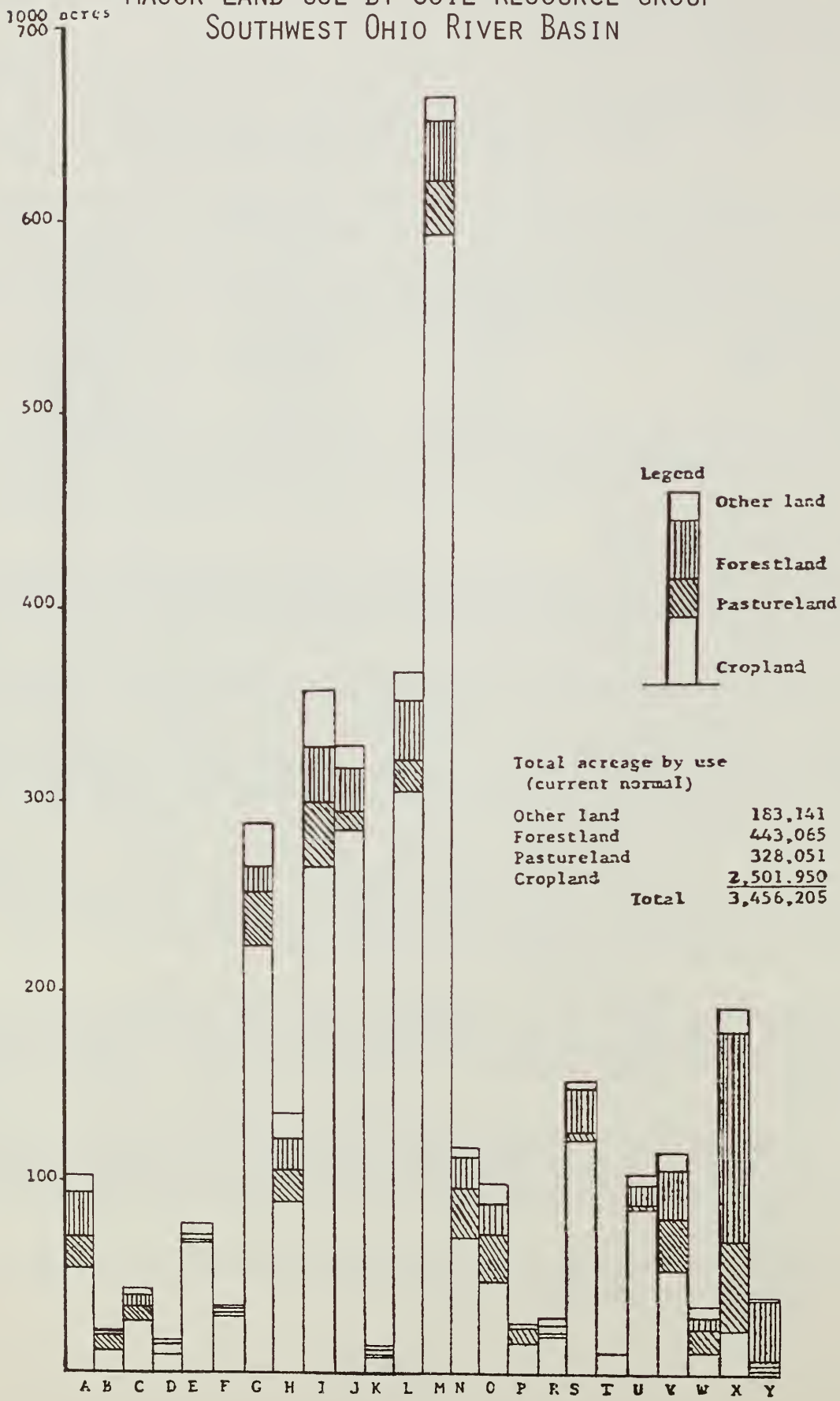


Table 6-13

Production of Major Crops as Projected In OBERS and
As Estimated for the Future Without Condition, By Time Frame,
Southwest Ohio River Basin

			1990		2020	
		1974-76	WO 1/	OBERS	WO 1/	OBERS
Corn	1000 Bu.	84,189	97,670	90,844	100,425	116,853
Silage	1000 Tons	756	954	954	1,209	1,209
Soybeans	1000 Bu.	21,124	32,174	32,174	38,714	45,546
Wheat	1000 Bu.	12,068	9,418	7,077	10,281	4,854
Oats	1000 Bu.	3,385	9,950	7,866	11,179	11,179
Hay	1000 Tons	576	554	554	505	505
Crop Pasture	1000 AUM	929	856	856	1,349	1,349
Total Value	$1000	431,901	525,761	497,113	610,207	644,640
Index of Value 2/		100	122	115	141	149
WO as percent of OBERS			106		95	

1/ Future without condition.

2/ 1974-76 = 100.

To conform with the livestock production assumption, the projection model for major crops was to insure that adequate feed for the OBERS level of livestock production would be available. Thus, in the linear programming model for major crop production, the supply of hay, pasture and silage necessary to support the OBERS livestock projection were set as minimums.

Specialty crop production was assumed to be the same under all plans. This production was displayed in Chapter 4 for the OBERS projections. This acreage is minor and was not included in the model. Yield projections were made for speciality crops, however, as was explained in Chapter 4.

Forestry Production

Projected demand for forestry products is expected to exceed projected supply by 2020 under future without plan conditions.

Annual growth of all growing stock is projected to increase from 28 cubic feet per acre in 1968 to 77 cubic feet in 2020. As a result, the supply of forest products will increase from 12 million cubic feet in 1975 to 28 million cubic feet in 2020, based on annual growth. This supply will fall short of meeting projected cut (demands), with a deficit of 30 million cubic feet in 2020 (Figure 6-2). The deficit could be cut from the inventory volume, but such action would eventually deplete the forest resource.

The production and value of the basic product is illustrated in Table 6-14 for sawtimber, veneer logs, industrial wood, pulpwood, and fuel wood by target year. Table 6-15 represents the added value of the finished products manufactured from the raw products under the "future without" condition by target year.

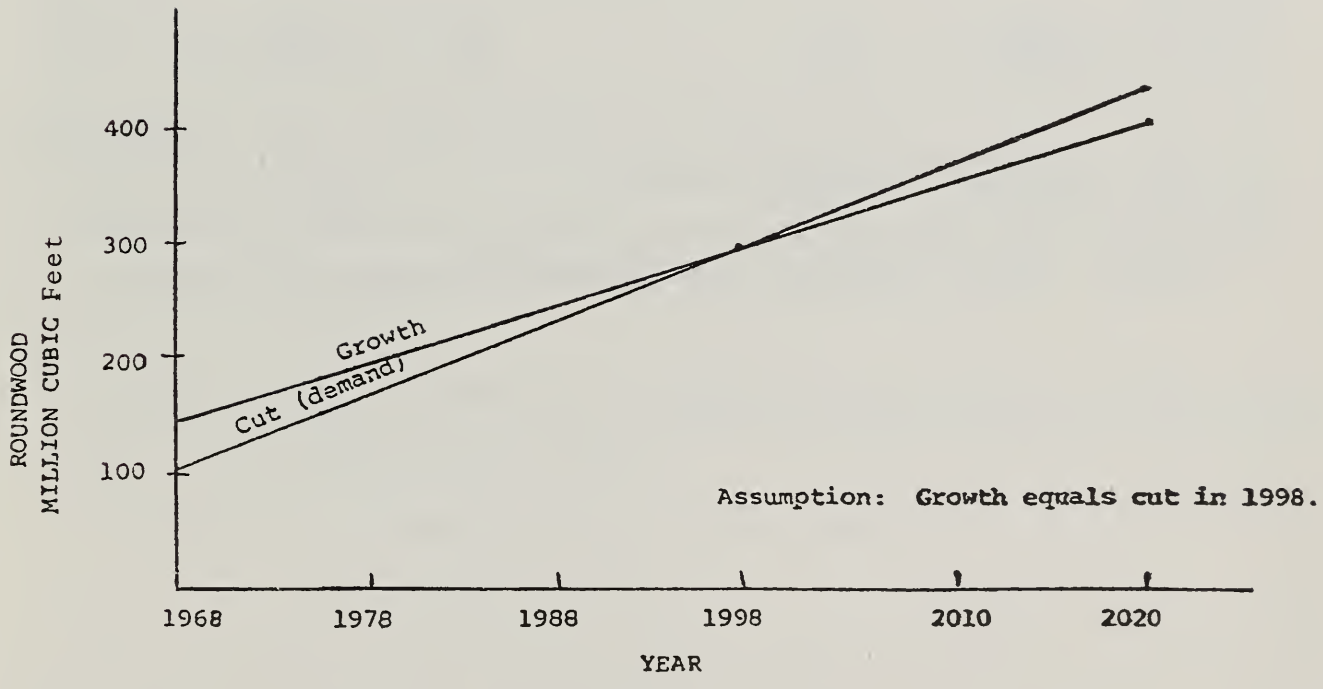
Employment Impacts

Over the years, the trend has been toward fewer farm workers with higher and higher rates of output per worker as farmers adopted labor saving technology. In the 40's and even into the 50's, the labor released from agriculture by on-farm technology adoption was readily absorbed by the non-farm economy. But in recent years, problems have arisen in urban areas due to the influx of people from rural areas who cannot find satisfactory employment opportunities.

One factor in the solution to the urban employment problem is to stimulate employment opportunities in rural areas. In recent years, many small and large industries have located plants in rural areas to take advantage of the labor supply. These industries have had beneficial effects on rural communities as they provide off-farm jobs for rural people.

An estimated 26,783,000 hours of labor would be required to meet current levels of agricultural production. Assuming that 2000 hours represents a full man-year, this would imply 13,400 full-time people producing output valued at about $709 million. Thus, the average output per man-hour is $26.48.

FIGURE 6-2
ROUNDWOOD DEMAND AND SUPPLY FOR
FUTURE WITHOUT CONDITION FOR 1968 AND PROJECTED TO 2020
SOUTHWEST OHIO RIVER BASIN



Source: Forest Service, USDA-Timber Resources of Ohio.

Table 6-14
Production and Value of Products
Under Present Management System
Southwest Ohio River Basin

	1977	1990	2020
Sawtimber, Veneer logs, Misc. Industrial Wood 1/			
Volume (Million c.f.)	6.75	10.02	12.10
Value ($1000) 2/	3,028	4,495	5,428
Pulpwood			
Volume (Million c.f.)	1.85	2.95	6.66
Value ($1000)	543	865	1,954
Fuelwood			
Volume (Million c.f.)	.50	.46	.46
Value ($1000)	190	175	175

1/ Misc. Industrial wood includes: cooperage logs, poles, piling, mine timbers, posts, box bolts, and pallet material.

2/ Based on 1976 dollars and The Timber Resources of Ohio, U.S. Forest Service, 1970. Assumption: Cut (production) equals annual growth.

Table 6-15
Added Value of Timber Cut
Under Present Management System
Southwest Ohio River Basin

	1977	1990	2020
Sawtimber			
Volume cut 1/ (Million c.f.)	6.40	9.50	11.47
Added value 2/ ($1000)	19,800 3/	29,393	35,488
Veneer Logs			
Volume cut (Million c.f.)	.35	.52	.63
Added Value ($1000)	2,457	3,650	4,423
Pulpwood			
Volume cut (Million c.f.)	1.85	2.95	6.66
Added value ($1000)	4,098	6,534	14,752
Fuelwood			
Volume cut (Million c.f.)	.50	.46	.46
Added Value ($1000)	1,821	1,675	1,675

1/ Based on the Timber Resources of Ohio, U.S.F.S., 1970.

2/ Based on 1976 dollars.

3/ Computed at 25 x stumpage value, using 1976 dollar values for future values. Added value means the value of the delivered finished products manufactured from the raw material listed above.

Assumption: Cut (production) equals annual growth.

An analysis of 1974 Census of Agriculture data indicates about 9,340 full-time farm operators in the Southwest Ohio River Basin. In addition, there were about 8,860 operators who worked off-farm, with almost 8,000 working over 200 days per year off-the-farm. Also, a significant amount of the farm labor requirement is provided by members of the farm operators family. With the data limitations it is impossible to determine exactly how many man-hours are used in farm work.

Plan analyses in Chapters 8 and 9 will show the change in man-years of labor associated with the changes in value of output from the "future without". These estimates will be based on employment and earnings ratio supplied by the Bureau of Economics Analysis of the U.S. Department of Commerce 1/.

1/ See "Guidelines 5 - Regional Multipliers," U.S. Water Resources Council, Washington, D.C., January 1977.

CHAPTER 7

NEEDS

Introduction

In the planning process, specific components are expressed in terms of needs. The component needs reflect the desires of the public as interpreted from the study concerns. The needs presented in this chapter are the difference between the problems presented in Chapter 3 and the accomplishments that can be expected under the "future without" condition in Chapter 6. Table 7-1 lists the needs by study objective.

The objectives and component needs, with information on resource capability and the broad outline of opportunities for management, development, and other actions, provide the basis to undertake the development of alternative plans. All alternatives are tested for acceptability, effectiveness, efficiency, and completeness. The number of alternatives are usually governed by consideration of the complementary or competitive aspects of the stated objectives.

COMPONENT NEEDS

Flood Damage Reduction

With over 135,000 acres of land subject to flooding, the potential for flood control development exists on 97,000 acres of the flood plain. Floodwater damage to crop and pasture amount to approximately $2.3 million annually. Planned structural measures will reduce flooding on 1,600 acres and floodwater damages by $5,300.

Drainage of Wet Agricultural Soils

Approximately 1,088,000 acres of cropland still need some type of drainage improvement measures to improve agricultural production. Under existing programs an estimated 10,000 acres of cropland per year will be drained adequately. This amounts to 102,800 acres by the year 1990, and 294,600 acres by 2020.

Over 175,000 acres of cropland that have impaired drainage problem do not have adequate outlets for drainage. Only project type measures will solve the problem. Under existing programs no new projects are planned to improve channels or outlets for drainage except for East Fork of Whitewater River Watershed presently under construction.

Recreation

Projected recreational needs are significant for Southwest Ohio (See Table 7-1). Many of the projected needs will have to be met in adjacent regions. Under existing projects and programs an estimated 7,100 acres of water based and 22,300 acres of land based recreation facilities will become available.

Table 7-1

Component Needs of the National Economic and Environmental Quality Objectives, by Time Frame, Southwest Ohio River Basin

Component Need	Unit	1990 Desired Future Condition	1990 Future W/O* Plan Accomplishment	1990 Remaining Needs to be Addressed by Plan	2020 Desired Future Condition	2020 Future W/O* Plan Accomplishment	2020 Remaining Needs to be Addressed by Plan
REDUCED BY:							
Reduce flooding in upstream watersheds on agricultural land.	Acres	135,000	1,600	133,400	135,000	1,600	133,400
	($)	2,300,000	5,300	2,294,700	2,300,000	5,300	2,294,700
Reduce erosion on agricultural land (cropland, pastureland, and forest land).	Acres	2,055,060	677,695	1,377,365	2,055,060	1,600,000	455,060
Reduce wetness problem on cropland.	Acres	1,088,000	102,800	985,200	1,088,000	294,600	793,400
INCREASED BY:							
Provide water and land based recreations.							
a. Boating Areas	Acres	159,000	7,100	151,900	159,000	7,100	151,900
b. Fishing Areas	Acres	53,100	98	53,002	53,100	98	53,002
c. Canoeing Areas	Miles	140	0	140	140	0	140
d. Picnicking Areas	Tables	13,360	880	12,480	13,360	880	12,480
e. Camping Areas	Sites	14,320	2,000	12,320	14,320	2,000	12,320
Preserve and manage stream corridors.	Acres	628,000	440	627,560	628,000	440	627,560
Provide adequate drainage outlets.	Acres	175,000	600	174,400	175,000	600	174,400

*Without

Erosion and Sedimentation Reduction

Over 2.0 million acres of agricultural land 1/ have some type of erosion problem. Average annual soil loss from these acres is approximately 10.5 million tons, or approximately 5 tons per acre per year. Under existing programs, conservation treatment measures on an estimated 695,000 acres will be applied by the year 1990, and 1.6 million acres by 2020.

Of the total acreage of agricultural land having erosion problems approximately 145,000 acres is forest land. Slightly over 17,000 acres are considered as having severe erosion. Annual soil loss from forest land is estimated at 476,000 tons. Under existing programs and funding, conservation treatment measures on an estimated 23,000 acres will be applied by the year 1990, and 77,000 acres by 2020.

Preservation and Management of Stream Corridors and Natural Areas for Public Use

Lands along and adjacent to streams and rivers are commonly referred to as stream corridors. In Southwest Ohio the streams and rivers are the most significant remaining recreational resource. Preservation and management for fish and wildlife enhancement plus recreational use is of prime importance.

Management of Forest Land For Timber Production and Erosion Reduction

Present component needs for forest land include improvement of hydrologic soil conditions, improvement of timber growth rate and quality, and a decrease in erosion and sedimentation rates on disturbed forest land.

Hydrologic conditions can be improved by treating severely eroding areas in the basins. There is opportunity to treat these areas by regrading, installing drainage measures, tree planting, reestablishing other vegetative cover, and eliminating forest land grazing.

Establishment of reinforcement plantings in timber stands is needed on approximately 115,300 acres. Change over from pasture and cropland to forest should occur on an additional 34,465 acres. The opportunity for supervised stand improvement exists on about 238,200 acres. Reduction of forest land grazing through actual animal withdrawal or fencing should be accomplished on 115,800 acres and erosion control on 17,300 acres. Since several of these treatments may occur on the same land (stand improvement on forest land protected from grazing), it is difficult to state what percent of the total forest area has potential need for development. It probably ranges between 50 and 85 percent of the total forest area.

1/ Includes 1.7 million acres of cropland, 0.23 million acres of pastureland, and 0.145 million acres of forest land.

CHAPTER 8

ALTERNATIVE PLANS

The plans developed are directed toward improving the quality of life by meeting current and projected needs as identified. Each alternative plan formulated for the Southwest Ohio varies depending on the level of contribution to the specified components of the Economic Development (ED) and Environmental Quality (EQ) objectives. In this chapter, two plans are presented; the ED plan and the EQ plan. Alternatives were analyzed in formulating these two plans.

ECONOMIC DEVELOPMENT PLAN

The ED plan is directed toward increasing the value of the nation's output of goods and services. Increased crop yields, expanding recreational use, and reduction in floodwater damages are examples of direct increases in the nation's output which result from water and land resources development.

Under the ED plan for 1990 the value of agricultural production can potentially be increased by 5 percent over the "future without" condition which was presented in Chapter 6, and 11 percent over OBERS projections (Tables 8-1 and 8-2). The increased output is due primarily to yield increases from acceleration of subsurface drainage installation, flood control measures, and more use of conservation tillage methods on sloping farm land (Tables 8-3 and 8-12).

Forest production for 1990 under the ED Plan can be increased 50 percent over the "future without" condition. This increased output can be accomplished by accelerating growth rates through increased and more intensive management treatments. Tables 8-4 and 8-5 illustrate the production and value of timber products by time frame for alternative plans.

To achieve the production level suggested in the ED plan, additional public support and funding are needed. Cost sharing on drainage installation and flood control is recommended with informational and technical assistance to farmers promoting conservation tillage on erosive soils.

Flood Damage Reduction

Even with the existing local protection projects, dry dams system, and reservoirs, flood hazards still exist in the upstream watersheds in Southwest Ohio. Agricultural and transportation are the major flood problem areas.

In the ED plan, five watersheds are recommended for implementation. These include the Upper Great Miami River, Beaver Creek (Mercer County), Mud Creek (Darke County), Upper Little Miami River (Clark County), and Massies Creek. Table 8-6 gives a summation of the benefits and costs for these projects. Total annual benefits are estimated at nearly $1,260,000 with total average annual cost, operation, maintenance and replacement of nearly $1,190,000. Flood damage reduction and agricultural enhancement benefits would be realized from all five projects.

Table 8-1

Production and Value of Major Crops for Economic Development and Environmental Quality Plans, Compared to OBERS Projections
Southwest Ohio River Basin

		1974-76	1990 OBERS	1990 EQ	1990 ED	2020 OBERS	2020 EQ	2020 ED
Corn	1000 bu.	84,189	90,844	96,696	106,863	116,853	105,168	127,775
Silage	1000 tons	756	954	954	954	1,209	1,209	1,209
Soybeans	1000 bu.	21,124	32,174	32,171	32,174	45,546	40,991	40,991
Wheat	1000 bu.	12, 068	7,077	9,650	9,734	4,854	11,375	11,645
Oats	1000 bu.	3,385	7,866	9,250	10,621	11,179	11,179	11,245
Hay	1000 tons	576	554	554	554	505	505	505
Crop Pasture	1000 AUM	929	856	909	879	1,349	1,348	1,348
Total Value	$1000	431,901	497,113	524,149	552,155	644,640	612,199	671,755
Index of Value 1/		100	115	121	128	149	142	155
ED and EQ as a percent of OBERS Value			0	105	111	0	95	104

1/ 1974-76 = 100

Table 8-2

Production and Value of Major Crops Under the Economic Development and Environmental Quality Plans Compared to the Future Without Condition
Southwest Ohio River Basin

			1990			2020		
		1974-76	WO	ED	EQ	WO	ED	EQ
Corn	1000 bu.	84,189	97,670	106,863	96,696	100,425	127,775	105,168
Silage	1000 tons	756	954	954	954	1,209	1,209	1,209
Soybeans	1000 bu.	21,124	32,174	32,174	32,171	38,714	40,991	40,991
Wheat	1000 bu.	12,068	9,418	9,734	9,650	10,281	11,645	11,375
Oats	1000 bu.	3,385	9,950	10,621	9,250	11,179	11,245	11,179
Hay	1000 tons	576	554	554	554	505	505	505
Crop Pasture	1000 AUM	929	856	879	909	1,349	1,348	1,348
Total Value	$1000	431,901	525,761	552,155	524,149	610,207	671,755	612,199
Index of Value 1/		100	122	128	121	141	155	142
ED and EQ as a percent of WO Value				105	100		110	100

1/ 1974-76 = 100

Table 8-3

Distribution of Cropland Acreage, by Tillage Method and Time Frame
Southwest Ohio River Basin

Type of Tillage	1974-76 Average	1990			2020		
		WO	ED	EQ	WO	ED	EQ
Conventional Tillage	2,065,800	1,962,000	1,380,300	941,000	1,599,400	891,700	837,600
Conservation Tillage	264,200	305,900	796,600	630,700	498,400	1,033,600	531,900
No Tillage	64,800	99,700	190,600	740,700	193,100	365,700	908,100

Table 8-4
Production and Value of Forestry Products for Alternative Plans
Southwest Ohio River Basin

			1990			2020		
		1977	WO	ED	EQ	WO	ED	EQ
Sawtimber, Veneer logs, Misc. Industrial Wood 1/	Million cu.ft.	6.75	10.02	15.03	10.02	12.10	18.15	12.10
	$1000	3,028	4,495	6,738	4,495	5,428	8,138	5,428
Pulpwood	Million cu.ft.	1.85	2.95	4.43	2.95	6.66	9.99	6.66
	$1000	543	865	1298	865	1954	2931	1954
Fuelwood	Million cu.ft.	.50	.46	.69	.46	.46	.69	.46
	$1000	190	175	262	175	175	262	175

1/ Misc. industrial wood includes: Cooperage logs, poles, piling, mine timber, posts, box bolts, and pallet material.

Source: Price Base 1976, The Timber Resources of Ohio, U.S. Forest Service, 1970. Assumption: Cut (production) equals annual growth.

Table 8-5
Added Value 1/ of Timber Cut for Alternative Plans
Southwest Ohio River Basin

			1990			2020		
		1977	WO	ED	EQ	WO	ED	EQ
Sawtimber Cut	Million cu.ft.	6.40	9.5	14.25	9.5	11.47	17.21	11.47
	$1000	19,800	29,393	44,090	29,393	35,488	53,232	35,488
Veneer Logs	Million cu.ft.	.35	.52	.78	.52	.63	.95	.63
	$1000	2457	3650	5475	3650	4423	6634	4423
Pulpwood	Million cu.ft.	1.85	2.95	4.43	7.95	6.66	9.99	6.66
	$1000	4098	6534	9800	6534	14,752	27,128	14,752
Fuelwood	Million cu.ft.	.50	.46	.69	.46	.46	.69	.46
	$1000	1821	1675	2512	1675	1675	2512	1675

1/ Added value means the value of the delivered finished products manufactured from the raw material listed above.

Source: Price Base 1976, The Timber Resources of Ohio, U.S. Forest Service, 1970.

Table 8-6

Comparison of Benefits to Costs, by Watershed, for 1990, ED Plan
Southwest Ohio River Basin1/
(Dollars)

Watershed	Flood-water Reduction Benefits	Agricultural Enhance-ment	Recreation	Total Average Annual Benefits	Total Average 2/ Annual Cost Plus OM&R	Benefit-Cost Ratio
Upper Great Miami River	105,700	83,700	0	189,400	186,260	1.02:1.0
Mud Creek (Darke Co.)	46,300	10,970	0	57,270	54,250	1.06:1.0
Upper Little Miami River (Clark Co.)	78,820	26,800	0	105,620	105,010	1.02:1.0
Beaver Creek (Mercer Co.)	40,700	0	213,800	254,500	244,000	1.04:1.0
Massies Creek	228,300	33,620	386,600	648,520	600,220	1.08:1.0
Total	499,820	155,090	600,400	1,255,310	1,189,740	1.06:1.0

1/ Price Base 1976.

2/ Average Annual Costs plus annual operation and maintenance at 6 5/8 percent interest, 100-years.

The Upper Great Miami Watershed is located in the northeastern part of the study area in Logan County. The drainage area is approximately 190 square miles, or 121,600 acres. Indian Lake is located within the drainage area. Proposed is approximately 14 miles of channel work along North and South Forks above Indian Lake, and 17 miles of clearing and snagging below Indian Lake along the main channel of the Great Miami. Total average annual cost and operation, maintenance and replacement are estimated at 186,000. An estimated $189,400 in benefits will annually accrue from the project.

The Beaver Creek Watershed located in the northwestern part of the study area in Mercer County is another watershed considered for implementation. The watershed is within the Wabash River Basin and is approximately 125 square miles, or 80,000 acres. Grand Lake-St. Marys, a 13,000 acre canal lake, is located within the watershed. Proposed is 13.3 miles of channel work along Beaver Creek, and one multiple purpose flood control-recreation structure on Little Beaver Creek. Total average annual cost and operation, maintenance and replacement costs are over $244,000 with average annual benefits over $254,500.

Mud Creek is also located in the northwestern part of the Southwest Ohio study area in Darke County. Total drainage area is nearly 30 square miles, or 19,000 acres. is approximately 5.3 miles of channel work on the main stem of Mud Creek for agricultural protection and drainage. Estimated average annual cost and operation, maintenance, and replacement are over $54,000 with annual benefits over $57,200.

The Upper Little Miami River Watershed which is located in the east central portion of the study area in Clark County is another watershed suggested for implementation. Like the other proposed watershed projects intensive agriculture prevails. Total drainage area is estimated at 93 square miles, or 59,500 acres. The North Fork of the Little Miami River and the Little Miami are part of the Little Miami River designated by the state of Ohio and the nation as a wild and scenic river. Major policy changes would have to take place before the project could be implemented 1/. Proposed in this project is nearly 19 miles of channel work on North Fork and the Little Miami average annual cost and operation, maintenance, and replacement is approximately $105,000. Annual benefits to agriculture are estimated at $105,620.

The final project considered is Massies Creek Watershed which is located adjacent to the Upper Little Miami River Watershed in Clark, Greene, Fayette, and Madison Counties. Total drainage area is approximately 84 square miles, or 53,800 acres. Total average annual cost and operation, maintenance, and replacement is estimated to be over $600,000 for 16.3 miles of channel work along the North and South Forks, three single-purpose flood control structures, and one multiple purpose flood control-recreation structure. Annual benefits are nearly $650,000.

Table 8-7 gives a summary of each project proposed and the respective costs.

1/ This project could not presently be endorsed by the Ohio Department of Natural Resources because of commitments to the Wild and Scenic River Program.

Table 8-7

Distribution of Structural Costs (Dollars), by Watershed, for 1990, ED Plan
Southwest Ohio River Basin 1/

Watershed	Construction Costs	Installation Services & Project Administration	Land Rights	Total Installation Costs	Average Annual Costs 2/
Upper Great Miami River	1,703,100	567,400	170,200	2,440,700	161,960
Mud Creek (Darke Co.)	458,000	192,000	50,000	700,000	46,450
Upper Little Miami River (Clark Co.)	1,040,600	312,300	206,900	1,559,800	103,510
Beaver Creek (Mercer Co.)	1,420,800	471,400	1,121,700	3,013,900	200,000
Massies Creek	3,314,970	1,108,080	3,342,510	7,765,560	515,320
Total	7,937,470	2,651,180	4,891,310	15,479,960	1,027,240

1/ Price Base 1976.

2/ 6 5/8 percent interest rate, 100-years.

Map 8-1 illustrates the location of each proposed watershed project.

Recreation Facilities

The topography in the Southwest Ohio Study area does not offer many opportunities to store large bodies of water (1000 surface acres for recreation pool) for water-based recreation. Therefore, it is suggested the ED plan contain provisions to develop the river corridors and associated natural areas for recreation and intensify the use of existing lakes within the study area.

The demands for the type of recreation facilities which are projected in the State Comprehensive Outdoor Recreation Plan cannot be met by the creation of recreation facilities by existing authorities and under existing land use conditions. The availability of land and capitol in the basin for this type of development is insignificant when compared with the total recreation demand. This will always be true of intensively urbanized regions. Recreation demands are probably satisfied by private and local governmental facilities which address diversified demands not considered by state and federal agencies. Examples are: school programs, which in this basin are highly developed and diversified; industrial athletic programs, which are usually highly sophisticated; community baseball, softball, tennis, golf, etc., programs; church oriented athletic programs including the YMCA, YWCA, and the Catholic Youth Organization programs; scout organizations; private bowling facilities which cator to individuals and organized leagues; private amusement facilities such as King's Island which provide recreation for tremendous numbers of local, regional, and interstate participants; and the farm oriented organizations such as 4-H, and Future Farmers of America, and preparation for and participation in local fairs.

Table 8-8 lists the recreation areas considered for the 1990 evaluation. Included are the number of acres to be acquired for development and the respective costs. Also included are estimates the total facilities cost for each development and the number of acres in each resource area to be preserved in its natural condition either through zoning regulations or some form of scenic or recreation use easement. Map 8-2 illustrates the possible location of the strip and node corridors.

Three possible upground reservoirs 1/ considered for water supply were also included for recreational use by 1990. These upground reservoirs would be located at Greenville, Piqua, and Sidney and provide both water-based and land-based activities. Water-based activities would include boating, shoreline fishing, and a swimming beach. Camping, picnicking, open areas for field games, walking paths, and multiple use shelters are some land-based activities suggested for each reservoir. Table 8-8 shows the acres for acquisition and the respective costs. Total estimated basic facilities cost are also shown. Map 8-1 illustrates the location of each upground reservoir.

1/ Upground Reservoir: A storage basin for water supply which is constructed adjacent to and at a higher elevation than a respective watercourse. Water is pumped up and into the basin from the stream or from wells. This type of reservoir is utilized in areas of low topographic relief.

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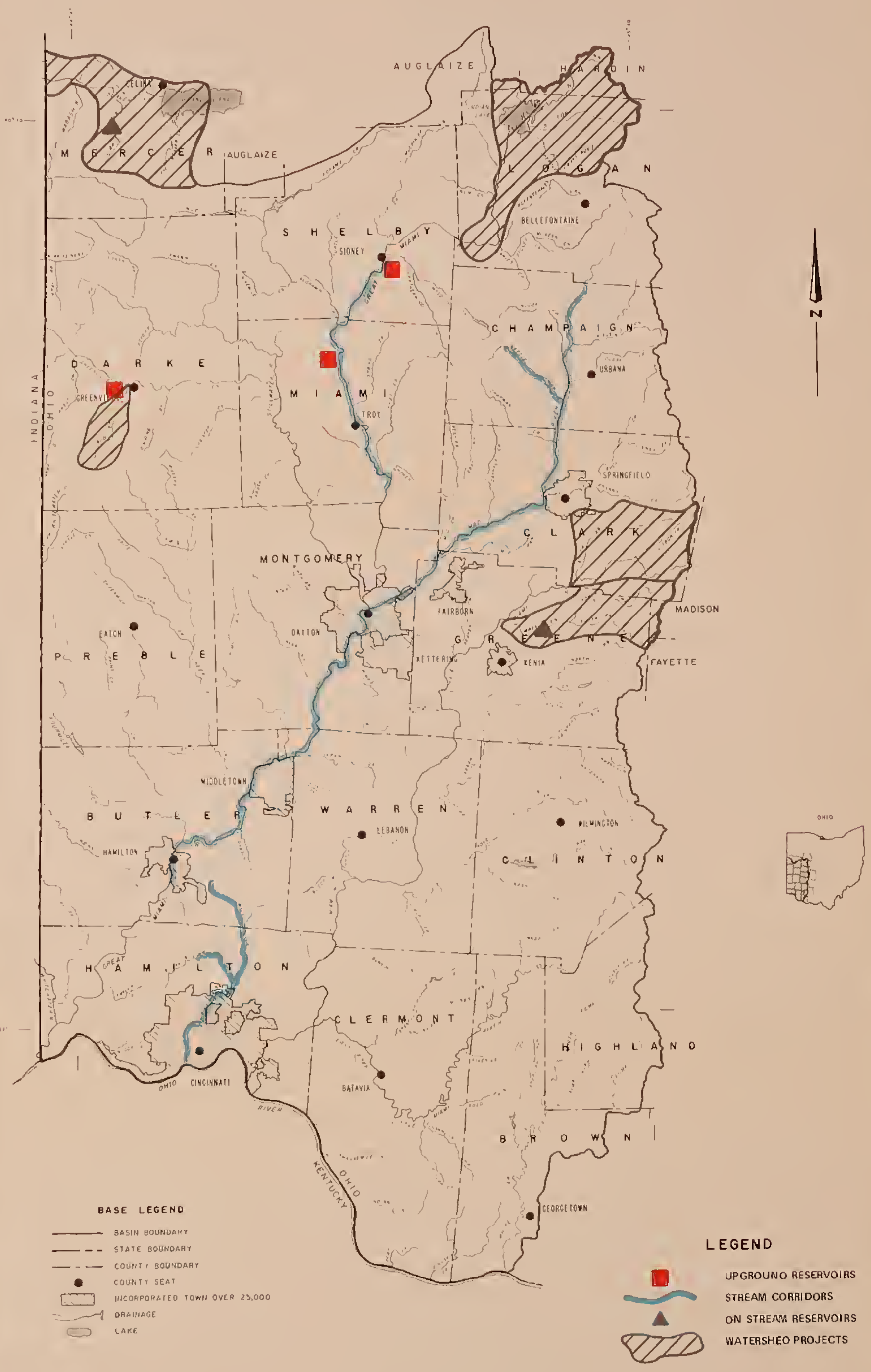

BASE LEGEND

- BASIN BOUNDARY
- STATE BOUNDARY
- COUNTY BOUNDARY
- COUNTY SEAT
- INCORPORATED TOWN OVER 25,000
- DRAINAGE
- LAKE

LEGEND

- UPGROUND RESERVOIRS
- STREAM CORRIDORS
- ON STREAM RESERVOIRS
- WATERSHED PROJECTS

MAP 8 - 1

ECONOMIC DEVELOPMENT PLAN

SOUTHWEST OHIO RIVER BASIN STUDY AREA
OHIO

SOURCE:
FAMILY OF MAPS SCS DRAW. NO. 5,R-34,214(6-74) AND INFORMATION FROM SCS FIELD PERSONNEL
TRANSVERSE MERCATOR PROJECTION

USDA-SCS-LINCOLN, NEBR. 1979

SCALE 0 5 10 15 20 25 MILES
0 5 10 15 20 25 30 35 40 KILOMETERS

8-21-79
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Table 8-8

ED Plan, 1990, for Recreation
Southwest Ohio River Basin

Location Area	Resource Area Purchased (Acres)	Resource Area Preserved	Basic Facilities Costs	Land Costs	Total Recreation Costs
Sidney to Tipp City Strip and Node Corridor	850	11,800	3,485,000	850,000	4,335,000
Mill Creek Strip and Node Corridor	1,160	5,800	4,756,000	1,160,000	5,916,000
Sidney Upground Reservoir	500	0	3,640,000	540,000	4,180,000
Piqua Upground Reservoir	770	0	5,320,000	810,000	6,130,000
Greenville Upground Reservoir	360	0	2,880,000	420,000	3,300,000
Mad River Strip and Node Corridor	600	8,500	2,460,000	600,000	3,060,000
Dayton Strip and Node Corridor	8,500	16,400	34,850,000	8,500,000	43,350,000
Lower Great Miami Strip and Node Corridor	550	7,700	2,300,000	550,000	2,850,000
Little Beaver Reservoir 1/	300	0	667,200	300,000	967,200
Massies Creek Reservoir 1/	350	0	1,424,280	525,000	1,949,280
Grand Total	13,940	50,200	61,782,480	14,255,000	76,037,480

1/ The method for economic analysis used precludes the reconstruction of annual structural costs from data presented in this table.

Table 8-9 shows the estimated annual recreation benefits to accrue from the recreation phase of the Economic Development Plan. The average annual costs plus estimated operation and maintenance costs (O&M) for each development are also shown.

The total cost for the recreation phase of the Economic Development plan is estimated at $76,037,480. Annual operation and maintenance cost is estimated at $2,771,500. This includes $14,255,000 for 13,940 acres needed for development and $61,782,480 for the basic recreation facilities. The estimated annual recreation benefits are $12,561,400. If this is capitalized at 6 5/8 percent interest for 100-years, it would be $189,291,740. The benefits would exceed the costs to install and maintain these facilities. Table 8-10 lists the proposed recreation areas recommended for implementation by 2020 and Table 8-11 shows the annual benefits and costs associated with each development.

Drainage of Wet Agricultural Soils

As mentioned in Chapter 3 over 1,088,000 acres of cropland have a wetness problem. Under existing programs, an estimated 102,800 of these acres will be drained by the year 1990, and 191,800 acres by 2020. This leaves an estimated 793,400 acres of cropland to be drained after 2020. Because of the projected food and fiber requirements, pressure will be put on existing cropland to achieve optimum production.

Acceleration in installation of subsurface drainage systems is included in the ED Plan. Under the accelerated program, an estimated 300,000 acres would be drained by 1990, and 704,000 acres by 2020. The total estimated cost for the accelerated program to 1990 would be $104,700,000. Assuming cost-sharing took place on a 50-50 ratio, the costs to the public and landowner would be $52,350,000 each. Table 8-12 shows the acres drained under existing and accelerated programs, and the distribution of costs by time frame.

Excessive Erosion

Within the Economic Development Plan profit maximization and maximizing food and fiber production are major concerns. Also of concern are protecting the soil resource base, permitting more effective and efficient water management, and improving environmental conditions.

The estimated average annual soil loss from cropland in the ED Plan is 7.9 million tons compared to 9.3 million tons for the "future without" condition (Tables 8-19 and 8-20). This soil loss is tied to the projected tillage distribution as shown in Table 8-13. These tillage assumptions are based on projected yield responses and increased net returns from conservation and no tillage methods on "e" soils, and yield responses and increased net returns from conservation and no tillage methods on certain adequately drained "w" soils.

An accelerated land treatment program is also part of the ED Plan. Table 8-14 shows the breakdown by cropland, pastureland, and forest land. It is a program where federal or state subsidy is needed for accomplishment. Resource

Table 8-9

Comparison of Annual Recreation Benefits to Costs (Dollars),
1990, ED Plan, For Recreation
Southwest Ohio River Basin1/

Location	Annual Recreation Benefits	Annual 2/ Structural Costs	Annual Operation & Maintenance Costs	Total Average Annual Costs	Benefit-Cost Ratio
Sidney to Tipp City Strip and Node Corridor	765,000	287,670	170,000	457,670	1.7:1.0
Mill Creek Strip and Node Corridor	1,044,000	392,590	232,000	624,590	1.7:1.0
Sidney Upground Reservoir	450,000	277,380	100,000	377,380	1.2:1.0
Piqua Upground Reservoir	693,000	406,790	154,000	560,790	1.2:1.0
Greenville Upground Reservoir	324,000	218,990	72,000	290,990	1.1:1.0
Mad River Strip and Node Corridor	540,000	203,060	120,000	323,060	1.7:1.0
Dayton Strip and Node Corridor	7,650,000	2,876,710	1,700,000	4,576,710	1.7:1.0
Lower Great Miami Strip and Node Corridor	495,000	189,130	110,000	299,130	1.7:1.0
Little Beaver Reservoir (Mercer Co.)	213,800	146,720	40,000	186,720	1.1:1.0
Massies Creek Reservoir	386,600	292,580	73,500	366,080	1.1:1.0

1/ Price Base 1976.

2/ 6 5/8 percent interest, 100 years.

Table 8-10

ED Plan, 2020, For Recreation
Southwest Ohio River Basin

Location or Area	Resource Areas Purchased (Acres)	Resource Area Preserved (Acres)	Basic Facilities Cost ($)	Land Cost ($)	Total Recreation Cost ($)
Indian Lake	400	0	2,480,000	400,000	2,880,000
Kiser Lake	300	0	1,860,000	300,000	2,160,000
Wabash River Strip and Node Corridor	90	1,200	369,000	90,000	459,000
Ohio River Strip and Node Corridor	520	5,400	2,132,000	520,000	2,652,000
Grand Lake St. Marys	1,200	0	6,440,000	1,200,000	7,640,000
Total	2,510	6,600	13,281,000	2,510,000	15,791,000

Table 8-11

Comparison of Annual Recreation Benefits to Costs, 2020
ED Plan, for Recreation,
Southwest Ohio River Basin1/

Location	Annual Recreation Benefits ($)	Annual 2/ Structural Costs ($)	Annual Operation & Maintenance Costs ($)	Total Average Annual Costs ($)	Benefit-Cost Ratio
Indian Lake Expansion	360,000	191,120	80,000	271,120	1.3:1.0
Kiser Lake Expansion	270,000	143,340	60,000	203,340	1.3:1.0
Wabash River Strip and Node Corridor	81,000	30,460	18,000	48,460	1.7:1.0
Ohio River Strip and Node Corridor	468,000	175,990	104,000	279,990	1.7:1.0
Grand Lake St. Marys Expansion	1,080,000	506,990	240,000	746,990	1.4:1.0

1/ Price Base 1976

2/ 6 5/8 percent interest, amortized at 100-years.

Table 8-12

Acres Drained and Total Costs Under an Accelerated Program, ED Plan, by Time Frame
Southwest Ohio River Basin

	Time Frame	
	1990	2020
Total Cropland Acreage Needing Drainage	1,004,000	964,000
Total Acres Drained Under Existing Program	102,800	294,600
Total Acres Drained Under Accelerated Program	198,000	512,000
Total Acres Drained ED Plan	300,000	704,000
Distribution of Costs		
Private Costs	52,350,000	124,250,000
State or Federal Costs	52,350,000	124,250,000
Total Installation Costs	104,700,000	248,500,000

Table 8-13

Percent of Cropland Under Each Tillage Method in the Economic Development Plan by Target Year Compared to the 1974-76 Current Normal Situation
Southwest Ohio River Basin

	Conventional Fall	Conventional Spring	Conservation	No-Till
1974-76 Current Normal	46	40	11	3
Erosive "e" Soils				
1990	5	5	70	20
2020	1	1	63	35
Wet "w" Soils Group 1 1/				
1990	45	45	8	2
2020	40	40	15	5
Wet "w" Soils Group 2 2/				
1990	25	25	45	5
2020	8	7	75	10

1/ Group 1 is those "w" soils which show no or negative yield response to reduced tillage compared to conventional tillage.

2/ Group 2 is those "w" soils which show positive yield response to reduced tillage compared to conventional tillage.

Table 8-14

Conservation Land Treatment, Economic Development Plan
Southwest Ohio River Basin

	Present Needs (Acres)	Economic Development Quantities (Acres) 1990	2020	Remaining Needs (Acres) 1990	2020
Cropland	1,223,700	883,100	1,223,700	340,600	0
Pastureland	238,460	172,900	230,400	65,560	8,060
Forest Land	592,900 1/	23,280	115,700	569,620	477,200
Total	2,055,060	1,079,280	1,569,800	975,780	485,260

1/ Present needs for forest land exceeds total forest land acres because of certain acres requiring more than one practice for adequate treatment.

management systems may include crop residue management, cover crops, diversions, grassed waterways, contouring or stripcropping, sod in rotation, or permanent grass cover. The ED Plan shows about 883,000 acres of cropland, 173,000 acres of pastureland, and 23,280 acres of forest land would be adequately treated if the accelerated program would be implemented.

The land treatment measures and conservation tillage systems would help reduce erosion damage and help protect the land base and soil productivity. Water quality would improve through reduced sediment loading and nutrient pollution.

ENVIRONMENTAL QUALITY PLAN

The EQ Plan reflects man's concern and emphasis for the natural environment and its maintenance and enhancement as a source of present and future enjoyment. Recognition is given to the desirability of diverting a portion of the nation's resources from production of more conventional market-oriented goods and services in order to conserve, preserve, restore, or improve certain natural and cultural resources.

Under the EQ plan for 1990, the value of agricultural production is essentially unchanged as compared to the "future without" condition and five percent over the OBERS projections. More emphasis on conservation tillage versus conventional tillage and restricting soil loss to under the "t" (tolerable soil loss) value are the major differences in the EQ plan versus the "future without" alternative.

Flood Damage Reduction

The EQ Plan proposes nonstructural measures in addressing the flood situation. Land use and zoning regulations should be considered for adoption to cope with future population and economic expansion. Responsibility for implementation lies with county, township, and municipal governments. Assistance may be provided by state and regional planning commissions. Zoning boards organized should include representatives of county, township, and municipal governments, soil and water conservation districts, planning commissions, conservation groups, and other organizations interested in resource development in the study area.

An accurate determination of the flood prone area is needed before local land use and zoning regulations can be effectively implemented. Flood hazard studies are suggested for 13 communities in the study area where flooding is a problem and future development is expected (Map 8-2). This is in addition to the studies that are presently planned in the study area. A flood hazard study involves the evaluation of various frequency storms so as to determine the extent of flooding that can occur along a given stream. This information, can assist planners in determining: 1. Areas for industrial growth; 2. Location of highways; 3. Areas for home sites; 4. Future use of bottomland; 5. Location of schools and municipal facilities; 6. Location of recreation sites; 7. Preservation of land for agricultural use; and 8. Preservation of historical and natural beauty areas. The estimated cost for these studies would be $150,000.

In addition to the nonstructural measures, two projects that are currently authorized for construction, are recommended for completion. The East Fork Whitewater Watershed project and the Mill Creek Local Protection Project are funded and should be completed by 1990.

Insufficient Recreation Facilities

As mentioned before, a large unmet demand still exists for water and land-based recreation. Within the Environmental Quality Plan, concern is to meet part of this demand and at the same time preserve unique natural and aesthetically pleasing areas. Preserving stream and river corridors for fish and wildlife and for human enjoyment with limited recreational development is suggested. These developments are referred to as either primitive or valley corridors.

Primitive corridors emphasize preservation of wildlife habitat and unusual or natural resources with access provided through hiking trail systems. Primitive pack-in campsites would be scattered throughout the corridor. All facilities would be compatible with the wilderness setting. The limited development concept could be useful in linking existing or future recreation oriented reservoir complexes.

Valley corridors are suited more for an intermediate level of development over extensive areas. Facilities on larger streams may be oriented toward water-based activities with supporting land-based facilities. Smaller streams and tributaries may, on the other hand, be utilized more for fishing and aesthetic setting. The main concern would be little or no modifications to the natural character of the corridor. Development of picnicking and camping areas would be scattered along ridge tops and valley floors. Extensive hiking, riding, and cycling trails would connect all activity areas. Emphasis is on natural quality of the area rather than facility development.

Tables 8-15 and 8-16 list, by time frame, the corridors considered for preservation, acres needing purchasing, acres to preserve, and the total costs for land and basic facilities for each corridor. Table 8-17 compares the benefits to annual costs for the early action plan. Map 8-2 shows the location of each corridor.

Total estimated cost for the recreation phase of the Environmental Quality Plan would be $24,054,400. Total average benefits would amount to $3,077,300. If capitalized at 6 5/8 percent, interest for 100-year benefits would be $46,372,800.

Excessive Erosion

The Environmental Quality Plan is concerned with improving water quality, improving environmental conditions, and protecting the natural resource base. On cropland soil loss is reduced by accelerating the use of conservation and no-till over conventional tillage and restricting soil loss on cropland to within the "t" value (tolerable soil loss). Table 8-18 shows the projected tillage distribution by time frame. The estimated average annual soil loss rate from cropland in the EQ Plan by 2020 is 1.9 ton/acre/year, a reduction of over 50 percent over the present condition (Tables 8-19 and 8-20).

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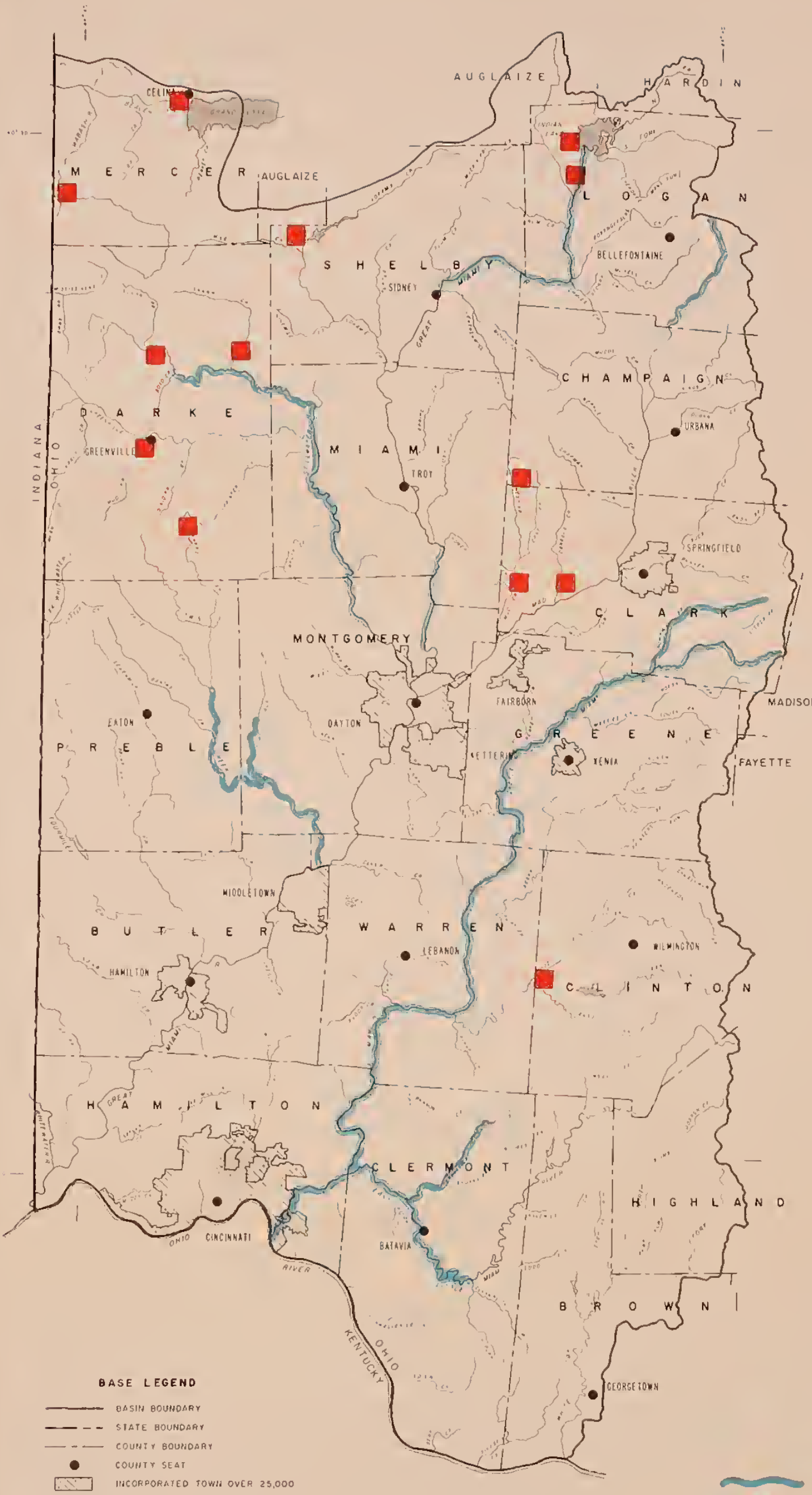

BASE LEGEND

- BASIN BOUNDARY
- STATE BOUNDARY
- COUNTY BOUNDARY
- COUNTY SEAT
- INCORPORATED TOWN OVER 25,000
- DRAINAGE
- LAKE

LEGEND

- STREAM CORRIDORS
- FLOOD HAZARD STUDIES

MAP 8 - 2

ENVIRONMENTAL QUALITY PLAN

SOUTHWEST OHIO RIVER BASIN STUDY AREA
OHIO

SOURCE:
FAMILY OF MAPS SCS DRAW. NO.
5,R-34,214 (6-74) AND INFORMATION
FROM SCS FIELD PERSONNEL
TRANSVERSE MERCATOR PROJECTION

USDA-SCS-LINCOLN, NEBR. 1979

SCALE 0 5 10 15 20 25 MILES
0 5 10 15 20 25 30 35 40 KILOMETERS

8-21-79
5,0-37,497

Table 8-15

EQ Plan, 1990, For Recreation
Southwest Ohio River Basin

Location or Area	Resource Area Purchased (Acres)	Resource Area Preserved (Acres)	Basic Facilities Cost ($)	Land Cost ($)	Total 1/ Recreation Cost ($)
Taylorsville Primitive Corridor	640	6,400	102,400	640,000	742,400
Stillwater River Valley Corridor	550	9,100	960,900	550,000	1,510,900
Miami-Whitewater Corridor	1,000	14,000	1,747,000	1,000,000	2,747,000
East Fork-Stonelick Primitive Corridor	3,300	33,000	528,000	3,300,000	3,828,000
Little Miami Scenic and Valley Corridor	4,000	33,000	7,000,000	4,000,000	11,000,000
Germantown Primitive Corridor	2,400	23,900	384,000	2,400,000	2,784,000
Upper Great Miami Valley Corridor	305	5,900	532,800	305,000	837,800
Upper Mad River Valley Corridor	220	15,000	384,300	220,000	604,300
Total	12,415	140,300	11,639,400	12,415,000	24,054,400

1/ Price Base 1976.

Table 8-16

EQ Plan, 2020, For Recreation
Southwest Ohio River Basin

Location or Area	Resource Area Purchased (Acres)	Resource Area Preserved (Acres)	Basic Facilities Cost ($)	Land Cost ($)	Total 1/ Recreation Cost ($)
Loramie Creek Valley Corridor	380	6,400	663,900	380,000	1,043,900
Four and Seven Mile Creek Valley Corridor	1,500	25,000	2,620,500	1,500,000	4,120,500
Indian Creek Valley Corridor	260	4,400	454,200	260,000	714,200
Todd Fork Primitive Corridor	2,900	29,400	464,000	2,900,000	3,364,000
Whiteoak Valley Corridor	310	5,100	541,600	310,000	851,600
Ohio River and Tributaries Corridor	1,570	10,900	2,742,800	1,570,000	4,312,800
Total	6,920	75,440	7,487,000	6,920,000	14,407,000

1/ Price Base 1976.

Table 8-17

Comparison of Annual Recreation Benefits to Costs (Dollars 1/), 1990
EQ Plan, For Recreation
Southwest Ohio River Basin

Location	Annual 2/ Recreation Benefits	Annual 3/ Structural Costs	Annual Operation & Maintenance Costs	Total Average Annual Costs	Benefit-Cost Ratio
Taylorsville Primitive Corridor	96,000	49,270	640	49,910	1.9:1.0
Stillwater River Valley Corridor	192,500	100,260	27,500	127,760	1.5:1.0
Miami-Whitewater Corridor	350,000	182,290	50,000	232,290	1.5:1.0
East Fork-Stonelick Primitive Corridor	495,000	254,030	3,300	257,330	1.9:1.0
Little Miami Scenic and Valley Corridor	1,400,000	729,960	200,000	929,960	1.5:1.0
Germantown Primitive Corridor	360,000	184,750	2,400	187,150	1.9:1.0
Upper Great Miami Valley Corridor	106,800	55,600	15,300	70,900	1.5:1.0
Upper Mad River Valley Corridor	77,000	40,100	11,000	51,100	1.5:1.0

1/ Price Base 1976.

2/ Benefits are based on a value of $1.50 per visitor day.

3/ 6 5/8 percent interest, 100-years.

Table 8-18

Percent of Cropland Under Each Tillage Method in Environmental Quality by Target Year Compared to the 1974-76 Current Normal Situation Southwest Ohio River Basin

	Conventional Fall	Conventional Spring	Conservation	No-Till
1974-76 Current Normal	46	40	11	3
Erosive "e" Soils				
1990	3	2	30	65
2020	1	1	10	88
Wet "w" Soils				
1990	5	5	80	10
2020	5	5	80	10

Table 8-19

Cropland Acreage and Average Annual Soil Loss by Tillage Methods and by Alternatives for 1990
Southwest Ohio River Basin

	Units	1974-76	WO	ED	EQ
Conventional Tillage	Acres	2,065,815	1,961,996	1,380,322	941,034
	Tons Soil Loss	8,877,000	8,358,000	5,330,000	3,132,000
	Tons/Acre	4.3	4.3	3.9	3.3
Conservation Tillage	Acres	264,232	305,852	796,623	630,705
	Tons Soil Loss	747,000	937,000	2,509,000	1,517,000
	Tons/Acre	2.8	3.1	3.2	2.4
No-Till Tillage	Acres	64,759	99,747	190,646	740,663
	Tons Soil Loss	48,000	45,000	88,000	369,000
	Tons/Acre	0.8	0.4	0.5	0.5
Total Tillage Acre		2,394,806	2,367,595	2,367,591	2,312,402
Total Soil Loss		9,672,000	9,340,000	7,927,000	5,017,000
Tons/Acre		4.0	3.9	3.4	2.2

Table 8-20

Cropland Acreage and Average Annual Soil Loss By Tillage Methods and Alternatives for 2020
Southwest Ohio River Basin

	Unit	1974-76	WO	ED	EQ
Conventional Tillage	Acres	2,065,815	1,599,364	891,656	837,582
	Tons Soil Loss	8,877,000	6,705,000	3,237,000	2,834,000
	Tons/Acre	4.3	4.2	3.6	3.4
Conservation Tillage	Acres	264,232	498,403	1,033,561	531,871
	Tons Soil Loss	747,000	1,422,000	3,057,000	1,084,000
	Tons/Acre	2.8	2.9	3.0	2.0
No Tillage	Acres	64,759	193,119	365,668	908,050
	Tons Soil Loss	48,000	85,000	167,000	452,000
	Tons/Acre	0.8	0.4	0.5	0.5
Total Tillage Acres		2,394,806	2,290,886	2,290,885	2,277,503
Total Soil Loss (Tons)		9,672,000	8,212,000	6,460,000	4,370,000
Tons/Acre		4.0	3.6	2.8	1.9

An accelerated land treatment program is also a part of the EQ Plan to reduce erosion and sedimentation. Federal or state subsidy is needed for implementation. This could be 50-50 cost-sharing on some practices and 100 percent on others. Resource management systems would vary but would be similar to practices used in the ED Plan.

The EQ Plan shows 1,223,700 acres of cropland, 230,400 acres of pastureland, and 206,765 acres of forest land being treated by 2020. This along with conservation tillage systems will reduce erosion by more than 50 percent. Suspended sediment yield to rivers and streams will be reduced by an estimated 50 percent over present levels.

PLAN EFFECTS

Economic Development Plan

The ED Plan emphasized maximizing economic output. This is reflected in the value of food and fiber output which increases nearly $26.4 million over the "future without" condition for 1990. This is possible by accelerating installation of subsurface drainage and using the most efficient tillage system. The multiplier effect on the Southwest Ohio economy from the increased food and fiber output is an estimated $62.7 million. This total dollar effect could support about 1,045 permanent jobs1/.

Increased recreational opportunities will be a stimulus to the Southwest Ohio economy. The value to users of additional recreational facilities will increase an estimated $12.6 million by 1990. This will generate about $29.7 million in the Southwest Ohio economic structure and support nearly 639 permanent jobs. An estimated 12,300 acres of land will be altered due to recreational developments and 50,200 acres of land along stream corridors will be preserved for public recreation use.

The five proposed watershed projects will reduce flooding on 21,600 acres of land and provide annual benefits of nearly $655,000. The projects will permanently alter 674 acres of land and temporarily disturb 84 miles of stream channels. Sediment storage of 5,700 acre-feet will also be available at four reservoirs.

Other aspects of environmental quality will be affected by the ED Plan. Average soil loss from cropland can be reduced from 4.0 tons per acre under the present condition to 2.8 tons per acre under the ED Plan in the year 2020. Sediment yield to rivers and streams will be reduced by an estimated 30 percent by 2020 compared to present rates.

Table 8-21 displays the beneficial and adverse effects of the ED Plan in the three account system.

1/ These estimates were developed using the multiplier and earnings data published by the Water Resources Council. See "Guidelines 5 - Regional Multiplier," U.S. Water Resources Council, Washington, D.C., January 1977. Use of this procedure implies the assumption that the multiplier will be essentially the same as in 1977 when developed.

Environmental Quality Plan

The EQ Plan emphasizes enhancement of environmental quality. This is reflected in soil loss on cropland decreasing from 4.0 tons per acre under present conditions to 1.9 tons per acre under the EQ Plan in the year 2020. Sediment yield to rivers and streams would be reduced by an estimated 50 percent by 2020 under this plan.

To accomplish these results all soil loss was restricted to within the "t" value or tolerable soil loss limit. This accounted for the lower soil loss per acre. To maintain the level of production as in the "future without" condition only the most productive land was used with the most efficient tillage and cropping systems. No additional jobs were generated within the food and fiber sector.

The additional recreation facilities in the EQ Plan will provide about $3.0 million in benefits annually to users. The recreation facilities, if installed, will generate an additional $8.3 million in the Southwest Ohio economy which will support 175 permanent jobs over the "future without" condition. An estimated 12,400 acres will be altered by recreation developments and 326,000 acres will be preserved for use by the public.

Eleven flood hazard studies will be made. Each study will delineate the flood plain acres along stream and in total will define the flood prone areas for communities.

Land treatment measures will take place on 1,223,700 acres of cropland, 230,400 acres of pastureland, and 75,000 acres of forest land. Reduced erosion and improved cover conditions will enhance the water quality and environmental conditions.

Table 8-22 summarizes the EQ Plan in the three account display.

Table 8-21

Economic Development Plan 1990
Economic Development Account
Southwest Ohio River Basin

Components	Measure of Effects (Average Annual) 1/	Components	Measures of Effects (Average Annual) 2/
Beneficial Effects		Adverse Effects	
A. Value to users of increased outputs of goods and services.		A. Value of resources required for the plan.	
1. Flood prevention and improved drainage	$ 654,970	1. Floodwater retarding structures and channels	
		a. Installation Costs	$ 587,950
		b. OM&R Costs	57,920
2. Recreation	12,561,400	2. Recreation	
		a. Installation Costs	5,291,610
		b. OM&R Costs	2,771,500
3. Food and Fiber Output	26,394,000	3. Food and Fiber Output Cost of providing drainage measures and systems.	8,131,000
Total Beneficial Effects	$39,610,370	Total Adverse Effects	$ 16,839,980
		Net Beneficial Effects	$22,770,390
B. Employment increases due to increased output.			
1. Agricultural employment	1,045 permanent jobs		
2. Recreation employment	639 permanent jobs		
3. Employment in Project Construction	1,743 man-years		
4. Employment in project OM&R	5 permanent jobs		

1/ Agricultural benefits, current normalized; all other 1976.

2/ Price base 1976, amortized at 6 5/8 percent, 100-years.

Table 8-21

Economic Development Plan, 1990
Environmental Quality Account
Southwest Ohio River Basin

Components	Measure of Effects
Beneficial and Adverse Effects	
A. Areas of Natural Beauty	1. Reduce erosion on 883,100 acres of cropland as a result of land treatment measures. 2. Develop seven reservoirs. 3. Acquire 11,660 acres along stream corridors and preserve an additional 50,200 acres through zoning or easements. 4. Channel work on 67.9 miles of streams and 17 miles of clearing and snagging will affect the natural vegetation along these streams. 5. Improve cover conditions, timber quality, and reduce erosion on 172,900 acres of pastureland and 23,280 acres of forest land.
B. Quality considerations of water, land and air resources.	1. Reduce flooding on 21,600 acres of land. 2. Reduce erosion on 1,079,280 acres through land treatment measures. 3. Reduce erosion by 1,413,000 tons annually through increased use of conservation cropping and tillage measures. 4. Store 5,713 acre feet of sediment. 5. Improve water quality by reducing sediment sources through land treatment, and conservation tillage measures. 1/ 6. Create 674 acres of water impoundments for fisheries and water fowl habitat.
C. Biological resources and selected ecosystems.	1. Reduce erosion and store sediment to reduce stream sediment pollution to improve and protect fishery habitat.

Components	Measure of Effects
C. Cont'd	2. Improve wildlife habitat through land treatment measures and floodwater retarding structures. 3. Provide 674 acres of water impoundments for fisheries and water fowl habitat. 4. Maintain the natural resource base on 61,860 acres located within stream corridors. 5. Increase water temperature where channel work takes place. 6. Disrupt stream corridors through more intensive use.
D. Irreversible and irretrievable commitments of resources.	1. Convert 674 acres of cropland, pastureland, and forest land into reservoir pools. 2. Alter 67.9 miles of stream by channel work. 3. Alter 17 miles of streams by clearing and snagging. 4. Alter 12,310 acres for recreational developments.

Table 8-21

Economic Development Plan, 1990
Social Well-Being Account
Southwest Ohio River Basin

Components	Measures of Effects
Beneficial and Adverse Effects	
A. Real income distribution.	1. Create 1,684 low to medium income permanent jobs for residents in the area.
	2. Create 1,743 man-years of employment for project construction.
B. Life, Health and Safety	1. Reduce flood damages on 21,600 acres.
C. Recreational opportunities.	1. Create 5,582,800 recreation visits for the region.

Table 8-22

Environmental Quality Plan, 1990
Economic Development Account
Southwest Ohio River Basin

Components	Measures of Effects (Average Annual) 1/	Components	Measures of Effects (Average Annual) 2/
Beneficial Effects		Adverse Effects	
A. Value of users of increased output of goods and services		A. Value of resources required for the plan.	
1. Recreation	$3,077,300	1. Recreation	
		a. Installation Costs	$ 1,596,260
		b. OM&R Costs	310,140
Total Beneficial Effects	$3,077,300	Total Adverse Effects	$ 1,906,400
		Net Beneficial Effects	$ 1,170,900
B. Employment increases due to increased output.			
1. Recreation employment	179 permanent jobs		
2. Employment in project construction	586 man-years		

1/ 1976 prices.

2/ 1976 price base, amortized at 6 5/8 percent, 100-years.

Table 8-22

Environmental Quality Plan, 1990
Environmental Quality Account
Southwest Ohio River Basin

Components	Measure of Effects
Beneficial and Adverse Effects	
A. Areas of Natural Beauty	1. Reduce erosion on 1,223,700 acres of cropland as a result of land treatment measures. 2. Acquire 12,420 acres along stream corridors and preserve an additional 326,100 acres through zoning or easements. 3. Improve timber cover conditions, timber quality, and reduce erosion on 230,400 acres of pastureland, and 75,505 acres of forest land.
B. Quality considerations of water, land and air resources.	1. Reduce erosion on 1,529,605 acres through application of adequate land treatment measures. 2. Reduce average annual erosion by 4,286,000 tons on cropland through accelerated use of conservation cropping and tillage measures.
C. Biological resources and selected ecosystems.	1. Reduce erosion and store sediment to reduce stream sediment pollution to improve and protect fisheries habitat. 2. Improve wildlife habitat through land treatment measures and improved cover conditions from use of conservation cropping and tillage measures. 3. Protect wildlife and fisheries habitat on 338,520 acres located within stream corridors.
D. Irreversible and irretrievable commitments of resources.	1. Alter 12,420 acres for recreational development.

Table 8-22

Environmental Quality Plan, 1990
Social Well-Being Account
Southwest Ohio River Basin

Components	Measure of Effects
Beneficial and Adverse Effects	
A. Real income distribution.	1. Create 175 low to medium income permanent jobs for residents in the area.
	2. Create 586 man-years of employment from project construction.
B. Life, Health, and Safety	1. Identify flood hazard areas for 75 miles of streams and 13 communities.
C. Recreational Opportunities	1. Create 1,849,000 recreation visits for the region.

CHAPTER 9

MIXED OBJECTIVE PLAN

The Mixed-Objective Plan (MO) is based on selected components of the Economic Development and Environmental Quality Plans. The plan was prepared based on inputs from the Ohio Department of Natural Resources, district conservationists within the study area, and regional planning commissions. Also, water quality laws, especially PL 92-500, have influenced the MO Plan. From their input, the Mixed-Objective Plan was prepared taking into consideration the economic, environmental and social concerns.

Public involvement in selecting the Mixed-Objective Plan was instrumented through the regional planning agencies. The decision to utilize the regional planning agencies was made because of their broad experience in resource planning and their direct "grass roots" involvement with the public. It is fortunate that most of the Southwest Ohio River Basin is represented by regional planning agencies. The following agencies provided input during plan formulation:

Miami Valley Regional Planning Commission - A designated 208 planning agency (6-12-74) in Darke, Greene, Miami, Montgomery, and Preble Counties. Miami Valley provided useful information concerning rural soil and water resource problems. Their 208 plan is still in the draft stage.

Ohio-Kentucky-Indiana (OKI) Regional Council of Governments - A designated 208 planning agency (6-12-74) in Clermont and Hamilton Counties, Ohio. The region covered also includes portions of Kentucky and Indiana. OKI is concerned with the soil and water resource needs of Cincinnati and the rapidly expanding urban and suburban environs of that city. OKI has a draft final 208 plan which is currently undergoing the 208 review process.

Little Miami Incorporated - This agency is actively involved in preserving flood plain corridors along the Little Miami River. They provided guidance concerning the feasibility of and public attitudes toward greenbelt development.

Miami Conservancy District - This agency of the Ohio state government is concerned with flood control and soil and water resource development along the main stem of the Great Miami River. They provided information concerning flood control needs and other public environmental concerns within the Great Miami River drainage.

Clark County Regional Planning Commission - This agency is responsible for urban and rural planning activities within Clark County which encompasses the city of Springfield, Ohio.

Logan-Union-Champaign Regional Planning Commission (LUC) - This agency has been responsible for rural and urban planning in Logan, Union, and Champaign Counties, in the upper reaches of the Southwest Ohio River Basin. Their experience has been predominantly in rural areas. They are avid supporters of the Top of Ohio RC&D project. They provided assistance in identifying soil and water resource needs in their three-county area.

The Mixed-Objective Plan is a combination of structural and nonstructural measures. The plan is directed mainly at the rural portion of the study area. The larger metropolitan areas were not addressed.

The MO Plan for 1990 can potentially increase the value of agricultural production by three percent over the "future without" condition and nine percent over OBERS projections while decreasing total gross soil loss by 14 percent. Output is less than the ED Plan and greater than the EQ Plan (Tables 9-1, 9-2, and 9-3). The major differences between the MO Plan versus the other two plans is the amount of subsurface drainage installed, flood control measures, and the emphasis on conservation and no-tillage (Table 9-3).

Forestry production for 1990 under the MO Plan can be increased 25 percent over the "future without" condition. Tables 9-4 and 9-5 illustrate the production by time frame under the Mixed-Objective Plan as compared to the other alternative plans.

Flood Damage Reduction

The Mixed-Objective Plan proposes structural measures in the Mud Creek and Massies Creek Watersheds. Mud Creek Watershed, which is located in central Darke County, is approximately 19,000 acres in size. Proposed for construction is approximately 5.3 miles of channel work for agricultural flood protection. Agricultural enhancement benefits would also be realized. Estimated total installation costs are $700,000, with annual benefits over $57,000. Tables 9-6 and 9-7 further describe the proposed project, and Map 9-1 shows the location in Darke County.

The other proposed watershed project is Massies Creek located mainly in Greene County with smaller portions in Clark, Madison, and Fayette Counties. The watershed drainage area is approximately 53,700 acres in size, and is roughly rectangular in shape with the longest dimension lying east and west.

Included in the proposed project is 16.3 miles of channel work, two single-purpose flood control structures, and one multiple-purpose flood control-recreation structure. Total estimated cost exceeds $7.7 million. Annual benefits are nearly $650,000. Tables 9-6 and 9-7 show the breakdown of costs and benefits. Map 9-1 illustrates the location and relative size of the watershed.

Nonstructurally, the Mixed-Objective Plan emphasizes flood hazard or flood insurance studies with flood plain delineation. Planned are eleven separate flood hazard studies involving 13 communities and adjoining streams. Total estimated cost is $150,000. Table 9-8 lists the communities and the river or stream to be studied. Map 9-1 shows the location of each community and the stream area affected.

The two watersheds will protect 5,900 acres of land from flooding and provide 340 acres of water for water-based recreation and 350 acres for land-based recreation.

Table 9-1

Production and Value of Major Crops Under the Mixed Objective Plan Compared to Alternatives and Future Without Condition
Southwest Ohio River Basin

		1990				2020			
		WO	ED	MO	EQ	WO	ED	MO	EQ
Corn	1000 bu.	97,670	106,863	104,245	96,696	100,425	127,775	127,387	105,168
Silage	1000 tons	954	954	954	954	1,209	1,209	1,209	1,209
Soybeans	1000 bu.	32,174	32,174	32,174	32,171	38,714	40,991	40,991	40,991
Wheat	1000 bu.	9,418	9,734	9,621	9,650	10,281	11,645	11,649	11,375
Oats	1000 bu.	9,950	10,621	10,272	9,250	11,179	11,245	11,179	11,179
Hay	1000 tons	554	554	554	554	505	505	505	505
Crop Pasture	1000 AUM	856	879	856	909	1,349	1,348	1,348	1,348
Total Value	$1000	525,761	552,155	543,951	524,149	610,207	671,755	670,661	612,199
As a percent of WO Value 1/			105	103	100		110	110	100

1/ WO = 100.

Table 9-2

Production and Value of Major Crops Under the Mixed Objective (MO) Plan Compared to Alternatives and OBERS (WO) Projections
Southwest Ohio River Basin

		1990				2020			
		OBERS	ED	MO	EQ	OBERS	ED	MO	EQ
Corn	1000 bu.	90,844	106,863	104,245	96,696	116,853	127,775	127,387	105,168
Silage	1000 tons	954	954	954	954	1,209	1,209	1,209	1,209
Soybeans	1000 bu.	32,174	32,174	32,174	32,171	45,546	40,991	40,991	40,991
Wheat	1000 bu.	7,077	9,734	9,621	9,650	4,854	11,645	11,649	11,375
Oats	1000 bu.	7,866	10,621	10,272	9,250	11,179	11,245	11,179	11,179
Hay	1000 tons	554	554	554	554	505	505	505	505
Crop Pasture	1000 AUM	856	879	856	909	1,349	1,348	1,348	1,348
Total Value	$1000	497,113	552,155	543,951	524,149	644,640	671,755	670,661	612,199
As a percent of OBERS value 1/			111	109	105		105	105	95

1/ OBERS = 100.

Table 9-3

Distribution of Cropland Acreage by Tillage Method and Time Frame for WO, ED, EQ, and MO Plans
Southwest Ohio River Basin

Type of Tillage	1974-76 Average	1990				2020			
		WO	ED	MO	EQ	WO	ED	MO	EQ
Conventional Tillage	2,065,800	1,962,000	1,380,300	1,506,600	941,000	1,599,400	891,700	980,100	837,600
Conservation Tillage	264,200	305,900	796,600	602,000	630,700	498,400	1,033,600	866,800	531,900
No-Tillage	64,800	99,700	190,600	259,000	740,700	193,100	365,700	444,000	908,100

Table 9-4
Added Value 1/ of Timber Cut for Mixed-Objective Plan
Compared to Alternative Plans and Future Without Plan
Southwest Ohio River Basin

		1990				2020			
		WO	ED	MO	EQ	WO	ED	MO	EQ
Sawtimber Cut	Million cu.ft.	9.5	14.25	11.88	9.5	11.47	17.21	14.34	11.47
	$1000	29,393	44,090	36,741	29,393	35,488	53,232	44,360	35,488
Veneer Logs	Million cu.ft.	.52	.78	.65	.52	.63	.95	.79	.63
	$1000	3650	5475	4562	3650	4423	6634	5529	4423
Pulpwood	Million cu.ft.	2.95	4.43	3.69	2.95	6.66	9.99	8.33	6.66
	$1000	6534	9800	8168	6534	14,752	27,128	18,440	14,752
Fuelwood	Million cu.ft.	.46	.69	.58	.46	.46	.69	.58	.46
	$1000	1675	2512	2094	1675	1675	2512	2094	1675

1/ Added value means the value of the delivered finished products manufactured from the raw material listed above.

Source: Price Base 1976, The Timber Resources of Ohio, U.S. Forest Service, 1970.

Table 9-5
Forest Production and Value for Mixed Objective Plan Compared to Alternative Plans and the Future Without Plan
Southwest Ohio River Basin

		1990				2020			
		WO	ED	MO	EQ	WO	ED	MO	EQ
Sawtimber, Veneer logs, Misc. Industrial Wood 1/	Million cu.ft.	10.02	15.03	12.53	10.02	12.10	18.15	15.13	12.10
	$1000	4495	6738	5615	4495	5428	8138	6781	5428
Pulpwood	Million cu.ft.	2.95	4.43	3.69	2.95	6.66	9.99	8.33	6.66
	$1000	865	1298	1081	865	1954	2931	2442	1954
Fuelwood	Million cu.ft.	.46	.69	.58	.46	.46	.69	.58	.46
	$1000	175	262	219	175	175	262	219	175

1/ Misc. industrial wood includes: cooperage logs, poles, piling, mine timbers, posts, box bolts, and pallet material.

Source: Price Base 1976, The Timber Resources of Ohio, U.S. Forest Service, 1970.
Assumption: Cut (production) equals annual growth.

Table 9-6
Comparison of Benefits to Costs, by Watershed, for 1990, Mixed Objective Plan
Southwest Ohio River Basin
(Dollars) 1/

	Mud Creek (Darke Co.)	Massies Creek
Floodwater Reduction Benefits	46,300	228,300
Agricultural Enhancement	10,970	33,620
Recreation	0	386,600
Total Average Annual Benefits	57,270	648,520
Total Average Annual Costs 2/	54,250	600,220
Benefit-Cost Ratio	1.1:1.0	1.1:1.0

1/ Price Base 1976

2/ Average annual costs plus annual operation and maintenance; 6 5/8 percent interest, 100-years.

Table 9-7

Distribution of Structural Costs, by Watershed, for 1990, Mixed Objective Plan
Southwest Ohio River Basin
(Dollars) 1/

	Mud Creek (Darke Co.)	Massies Creek
Construction Costs	458,000	3,314,970
Installation Services and Project Administration	192,000	1,108,080
Land Rights	50,000	3,342,510
Total Installation Costs	700,000	7,765,560
Average Annual Costs 2/	46,450	515,320

1/ Price Base 1976.

2/ 6 5/8 percent interest, 100-years.

Table 9-8

Proposed Flood Hazard Studies by Stream and
Communities Affected, Mixed Objective Plan, 1990
Southwest Ohio River Basin

Stream	Community(s)
Beaver Creek	Celina
Donnels Creek	Donnelsville
Greenville Creek	Greenville
Honey Creek	Christiansburg and New Carlisle
Loramie Creek	Ft. Loramie
Painter Creek	Arcanum
Swamp Creek	Versailles
Todd Fork	Clarksville
Upper Great Miami	Lakeview and Russells Point
Upper Stillwater River	Ansonia
Wabash River	Ft. Recovery

U S DEPARTMENT OF AGRICULTURE

BASE LEGEND

- BASIN BOUNDARY
- STATE BOUNDARY
- COUNTY BOUNDARY
- COUNTY SEAT
- INCORPORATED TOWN OVER 25,000
- DRAINAGE
- LAKE

LEGEND

- A — ON STREAM RESERVOIR
- A — MUD CREEK WATERSHED PROJECT
- B — MASSIES CREEK WATERSHED PROJECT
- FLOOD INSURANCE STUDIES
  - 1 SIDNEY TO TIPP CITY
  - 2 TAYLORSVILLE
  - 3 DAYTON
  - 4 LOWER GREAT MIAMI
  - 5 MIAMI–WHITEWATER
  - 6 STILLWATER
  - 7 MAD
  - 8 LITTLE MIAMI

MAP 9 - 1

MIXED OBJECTIVE PLAN

SOUTHWEST OHIO RIVER BASIN STUDY AREA
OHIO

SOURCE:
FAMILY OF MAPS SCS DRAW. NO.
S,R-34,214(6-74) AND INFORMATION
FROM SCS FIELD PERSONNEL
TRANSVERSE MERCATOR PROJECTION
USDA-SCS-LINCOLN, NEBR 1979

SCALE 0 5 10 15 20 25 MILES
0 5 10 15 20 25 30 35 40 KILOMETERS

8-21-79
5,0-37,498

Drainage of Wet Agricultural Soils

The Mixed-Objective Plan shows an acceleration in the installation of subsurface drainage systems. The accelerated program would have to be subsidized through state or federal funding. Assuming project installation an estimated 206,400 acres are to be drained by 1990 and 703,800 acres of cropland by 2020. Under the early action plan total estimated drainage cost would be $71,300,000. Assuming a 50-50 cost share program, the public and landowner would bear $35,650,000 of the cost each. Table 9-9 lists the acres drained by time frame and the allocated costs.

Recreation

The recreation component of the Mixed-Objective Plan proposes preservation and more intensive use of stream corridors for recreation. For the purpose of evaluation, preservation and development was assumed for the Great Miami River corridor from Sidney to its confluence with the Ohio River, the Mad River corridor from the Champaign-Logan County line to its confluence with the Great Miami River, and the Stillwater River corridor from Covington to its confluence with the Great Miami River. Primitive to intensive development was considered along the Great Miami River corridor with limited development along the Stillwater River and intensive development along sections of the Mad River. It is estimated that 12,690 acres are needed for the recreation facilities. An additional 73,900 acres would be available for preservation in its natural condition. These areas could be used to connect the various recreation facilities located along the river and still be preserved for wildlife habitat. This land would stay in private ownership. Total estimated costs for the recreation facilties and land is $58,595,300. The annual recreation benefits from these developments are estimated at $10,088,500. Tables 9-10 and 9-11 give a breakdown of the costs and benefits for the various corridors.

Also considered was preservation of the Little Miami River corridor from the Greene-Clark County line to its confluence with the Ohio River. Involved would be acquisition of 4,000 acres for some form of development and preserving 33,000 acres in its natural condition. The Little Miami River is the first river in the state designated as a scenic river. Proposed development would vary from intensive recreation facilities in the lower portions near the Ohio River to more primitive nature area in the upper reaches of the Little Miami River. Overall, development would be compatible with the character of the area. Total cost is estimated at $11,000,000. Annual recreation benefits are estimated at $1,400,000. Tables 9-10 and 9-11 show the breakdown of the costs and benefits with Map 9-1 illustrating the location.

A multipurpose flood prevention recreation structure is proposed for the Massies Creek Watershed. Involved would be acquisition of 350 acres for recreation development. Basic facilities cost are estimated at $1,424,280 and landrights at $525,000.

Erosion and Sedimentation Reduction

The Mixed Objective Plan is concerned with maintaining food and fiber productivity and still protecting the soil resource base and environmental conditions.

Table 9-9

Acres Drained and Total Costs under an Accelerated Program
MO Plan, by Time Frame
Southwest Ohio River Basin1/

	1990	2020
Total Cropland Acreage Needing Drainage	1,088,000	985,200
Total Acres Drained Under Existing Programs	102,800	191,800
Total Acres Drained Under MO Plan	103,600	512,000
Total Acres Drained	206,400	703,800
Distribution of Cost		
Private Costs	$35,650,000	$124,250,000
State or Federal Costs	35,650,000	124,250,000
Total Installation Cost	$71,300,000	$248,500,000

1/ Price Base 1976.

Table 9-10

Mixed Objective Plan, 1990, Recreation
Southwest Ohio River Basin
(Dollars) 1/

Location or Area	Resource Area Purchased (Acres)	Resource Area Preserved (Acres)	Basic Facilities Costs ($)	Land Costs ($)	Total Recreation Costs ($)
Sidney to Tipp City Strip and Node Corridor	850	11,800	3,485,000	850,000	4,335,000
Mad River Strip and Node Corridor	600	8,500	2,460,000	600,000	3,060,000
Dayton Strip and Node Corridor	8,500	16,400	16,400,000	8,500,000	24,900,000
Lower Great Miami Strip and Node Corridor	550	7,700	2,300,000	550,000	2,850,000
Taylorsville Primitive Corridor	640	6,400	102,400	640,000	742,400
Stillwater River Valley Corridor	550	9,100	960,900	550,000	1,510,900
Miami-Whitewater Corridor	1,000	14,000	1,747,000	1,000,000	2,747,000
Little Miami Scenic and Valley Corridor	4,000	33,000	7,000,000	4,000,000	11,000,000
Massies Creek Reservoir	350	0	1,424,280	525,000	1,949,280

1/ Price Base 1976.

Table 9-11

Comparison of Annual Recreation Benefits to Costs (Dollars), 1990,
Mixed Objective Plan, for Recreation
Southwest Ohio River Basin
(Dollars) 1/

Location	Annual Recreation Benefits	Annual 2/ Structural Costs	Annual Operation & Maintenance Costs	Total Average Annual Costs	Benefit-Cost Ratio
Sidney to Tipp City Strip and Node Corridor	765,000	287,670	170,000	457,670	1.7:1.0
Mad River Strip and Node Corridor	540,000	203,060	120,000	323,060	1.7:1.0
Dayton Strip and Node Corridor	7,650,000	2,876,710	1,700,000	4,576,710	1.7:1.0
Lower Great Miami River Strip & Node Corridor	495,000	189,130	110,000	299,130	1.7:1.0
Taylorsville Primitive Corridor	96,000	49,270	640	49,910	1.9:1.0
Stillwater River Valley Corridor	192,500	100,260	27,500	127,760	1.5:1.0
Miami-Whitewater Corridor	350,000	182,290	50,000	232,290	1.5:1.0
Little Miami River Scenic and Valley Corridor	1,400,000	729,960	200,000	929,960	1.5:1.0
Massies Creek Reservoir	386,600	292,580	73,500	366,080	1.1:1.0

1/ Price Base 1976.

2/ 6 5/8 percent interest, 100-years.

The estimated soil loss from cropland is 8.0 million tons in the MO Plan or a decrease of 1.3 million tons from the "future without" condition. This decrease in soil loss is tied to the projected tillage distribution as shown in Tables 9-12, 9-13, and 9-14. These tillage assumptions are based on what is expected if an informational program on conservation tillage and accelerated installation of subsurface drainage would occur.

An accelerated land treatment program is also part of the MO Plan to reduce the erosion problem. Table 9-15 shows the breakdown by cropland, pastureland, and forest land. For 1990, an estimated 883,100 acres of cropland, 172,900 acres of pastureland, and 35,000 acres of forest land would be adequately treated under the Plan.

Both the land treatment measures and conservation tillage systems would help reduce erosion, protect the land base, preserve the environmental quality, and still maintain agricultural productivity.

Plan Effects

Economic and Social: The Mixed Objective Plan (MO) can produce an additional $18.2 million in agricultural products in 1990 as compared to the "future without" condition for 1990. When the multiplier effect from this increased production is considered, an additional $41.2 million can be generated in the Southwest Ohio economy. This increase in production has the potential for supporting about 700 permanent jobs over the "future without" condition 1/.

The Mixed Objective Plan will also support about 1,300 low to medium income jobs on a permanent basis. In addition, nearly 1,600 man-years of labor will be generated by construction of the recreation and flood prevention facilities. This would all be realized by 1990.

In addition to increased employment from higher agricultural output the MO Plan will provide more jobs in the recreation sector. The increased value to recreation from the proposed recreation developments is about $11.8 million in 1990. The multiplier effect from recreation on the Southwest Ohio economy would be an additional $32 million and about 580 permanent jobs above the "future without" condition.

Environmental: The MO Plan will also affect certain aspects of environmental quality. Average soil loss from cropland in 1990 can be reduced from nearly 3.9 tons per acre under the "future without" plan to about 3.4 tons per acre with the MO plan. Three reservoirs will be constructed altering 340 acres of cropland, pastureland, and forest land. In addition, 350 acres will be altered for recreation development plus nearly 124,000 acres along stream corridors will be acquired or

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1/ These estimates were developed using the multiplier and earnings data published by the Water Resources Council. See "Guidelines 5 - Regional Multiplier," U.S. Water Resources Council, Washington, D.C., January 1975. Use of this procedure implies the assumption that the multiplier will be essentially the same in 1990 as in 1977 when developed.

Table 9-12

Percent of Cropland Under Each Tillage Method in the Mixed Objective Plan by Target Year Compared to the 1974-76 Current Normal Situation Southwest Ohio River Basin

	Conventional Fall	Conventional Spring	Conservation	No-Till
1974-76 Current Normal	46	40	11	3
Erosive "e" Soils				
1990	8	7	60	25
2020	1	1	53	45
Wet "w" Soils Group 1 1/				
1990	45	45	5	5
2020	40	40	15	5
Wet "w" Soils Group 2 2/				
1990	33	32	25	10
2020	15	15	60	10

1/ Group 1 is those "w" soils which show no or negative yield response to reduced tillage compared to conventional tillage.

2/ Group 2 is those "w" soils which show a positive yield response to reduced tillage compared to conventional tillage.

Table 9-13

Cropland Acreage and Average Annual Soil Loss by Tillage Methods and Alternatives for 1990
Southwest Ohio River Basin

	Units	1974-76	WO	ED	EQ	MO
Conventional Tillage	Acres	2,065,815	1,961,996	1,380,322	941,034	1,506,590
	Tons Soil Loss	8,877,000	8,358,000	5,330,000	3,132,000	5,973,000
	Tons/Acre	4.3	4.3	3.9	3.3	4.0
Conservation Tillage	Acres	264,232	305,852	796,623	630,705	601,954
	Tons Soil Loss	747,000	937,000	2,509,000	1,517,000	1,926,000
	Tons/Acre	2.8	3.1	3.2	2.4	3.2
No-Till Tillage	Acres	64,759	99,747	190,646	740,663	259,048
	Tons Soil Loss	48,000	45,000	88,000	369,000	119,000
	Tons/Acre	0.8	0.4	0.5	0.5	0.5
Total Tillage Acres		2,394,806	2,367,595	2,367,591	2,312,402	2,367,592
Total Soil Loss (Tons)		9,672,000	9,340,000	7,927,000	5,017,000	8,017,800
Tons/Acres		4.0	3.9	3.4	2.2	3.4

Table 9-14

Cropland Acreage and Average Annual Soil Loss by Tillage Methods and Alternatives for 2020
Southwest Ohio River Basin

	Units	1974-76	WO	ED	EQ	MO
Conventional Tillage	Acres	2,065,815	1,599,364	891,656	837,582	980,138
	Tons Soil Loss	8,877,000	6,705,000	3,237,000	2,834,000	3,670,000
	Tons/Acre	4.3	4.2	3.6	3.4	3.7
Conservation Tillage	Acres	264,232	498,403	1,033,561	531,871	866,774
	Tons Soil Loss	747,000	1,422,000	3,057,000	1,084,000	2,552,000
	Tons/Acre	2.8	2.9	3.0	2.0	2.9
No Tillage	Acres	64,759	193,119	365,668	908,050	444,000
	Tons Soil Loss	48,000	85,000	167,000	452,000	203,000
	Tons/Acre	0.8	0.4	0.5	0.5	0.5
Total Tillage Acres		2,394,806	2,290,886	2,290,885	2,277,503	2,290,886
Total Soil Loss (Tons)		9,672,000	8,212,000	6,460,000	4,370,000	6,424,000
Tons/Acres		4.0	3.6	2.8	1.9	2.8

Table 9-15

Conservation Land Treatment
Mixed Objective Plan
Southwest Ohio River Basin

	Present Needs (Acres)	Mixed Objective Quantities (Acres) 1990	2020	Remaining Needs (Acres) 1990	2020
Cropland	1,223,700	883,100	1,223,700	340,600	0
Pastureland	238,460	172,900	230,400	65,560	8,060
Forest Land	592,900 1/	35,000	115,700	557,900	477,200
Total	2,055,060	1,091,000	1,569,800	964,060	485,260

1/ Present needs for forest land exceeds total forest land acres because of certain acres requiring more than one practice for adequate treatment.

preserved for public enjoyment. Nearly 22 miles of channel work to facilitate drainage outlets and flood prevention will temporarily alter fish and wildlife habitat.

Land treatment measures will be applied on about 883,000 acres of cropland, 173,000 acres of pastureland, and 35,000 acres of forest land to improve cover conditions and reduce the erosion hazard. Thirteen rural communities will have flood plain studies completed for use in community planning.

Table 9-16 shows the effect of the MO Plan in meeting component needs. Table 9-17 compares the MO Plan to the alternative plans, ED and EQ. Table 9-18 displays the beneficial and adverse effects of the MO Plan in the three account system.

Table 9-16

Effectiveness of Plan Elements to Satisfy Component Needs
Mixed Objective Plan by 1990
Southwest Ohio River Basin

	Unit	Needs	Plan 1/ Effectiveness
Reduce Flooding	Acres	133,400	5,900
(Average Annual Damage)	Dollars	2,194,700	274,600
Reduce Erosion	Acres	1,377,365	413,305
Reduce Wetness	Acres	985,200	103,600
Provide Drainage Outlets	Acres	174,400	3,100
Preserve Stream Corridors	Acres	627,560	123,600
Provide Recreation			
a. Boating	Acres	151,900	545
b. Fishing	Acres	53,002	1,890
c. Canoeing	Miles	140	2/
d. Picnicking	Tables	12,480	3,680
e. Camping	Sites	12,320	1,622

1/ Accomplishments with project does not include accomplishments which would occur normally without project installation.

2/ Streams within planned corridors already used for canoeing. More intensive use is possible.

Table 9-17

Summary Comparison Between Alternative Plans for 1990 1/
Southwest Ohio River Basin

Accounts	Economic Development	Environmental Quality	Mixed Objective
1. Economic Development			
Beneficial Effects	$39,610,370	3,077,300	30,384,270
Adverse Effects	$16,839,980	1,906,400	12,356,960
Net Beneficial Effects	$22,770,390	1,170,900	18,027,310
Employment Net Beneficial Effects	1,743 man-year of semi-skilled jobs. 1,689 permanent semi-skilled jobs.	586 man-years of semi-skilled jobs. 179 permanent semi-skilled jobs.	1,584 man-years of semi-skilled jobs. 1,282 permanent semi-skilled jobs.
2. Environmental Quality			
Beneficial and Adverse Effects			
A. Create Reservoirs	674 surface acres	0	340 acres
B. Protect and Manage Stream Corridors	Purchase 11,660 acres and preserve 50,200 acres along streams.	Purchase 12,415 acres and preserve 326,100 acres along streams.	Acquire 16,690 acres and preserve 106,900 acres along streams.
C. Disrupt aquatic ecosystem	67.9 miles of natural streams disrupted.	0	21.6 miles of natural streams disrupted.
D. Improve water quality and environmental conditions through land treatment.	1,091,000 acres	1,587,660 acres	1,091,000 acres

Accounts	Economic Development	Environmental Quality	Mixed Objective
3. Social Well-Being			
A. Create low to medium permanent income jobs.	1,689	175	1,282
B. Identify flood prone urban areas.	-	13 communities	13 communities
C. Provide flood protection to rural areas.	2 percent to Mud, Massies, and Beaver Creeks and Upper Great and Upper Little Miami Rivers.	--	2 percent protection to Mud and Massies Creeks.
D. Provide Recreational Opportunities	5,582,800	1,849,000	5,545,800 recreation visits.

1/ All effects are in addition to the "Future Without" Plan.

Table 9-18

Mixed Objective Plan, 1990
Economic Development Account
Southwest Ohio River Basin

Components (Benefits)	Measures of Effects (Average Annual) 1/	Components (Costs)	Measures of Effects (Average Annual) 2/
Beneficial Effects		Adverse Effects	
A. Value to users of increased output of goods and services.		A. Value of labor, materials, & equipment required to implement a plan.	
1. a. Flood Prevention and improved drainage on agricultural lands.	$ 319,170	1. Floodwater retarding dams and channels.	
b. Increased Food and Fiber Output	18,190,000	a. Installation Costs	$ 269,190
2. New recreation opportunities provided for the public.	11,875,100	b. OM&R Costs	19,200
Total Beneficial Effects	$30,384,270	2. New recreation facilities	
B. Employment increases due to increased output of goods and services.		a. Installation Costs	4,910,930
1. Agricultural Employment	700 man-years	b. OM&R Costs	2,451,640
2. Recreation Employment	580 man-years	c. Temporary loss of agricultural production from relatively small acreages of cropland converted to recreational facilities.	
3. Employment in Project Construction	1,584 man-years	3. Increased Food & Fiber Output Cost	4,706,000
4. Employment for Project OM&R 3/	2 permanent semi-skilled jobs	Total Adverse Effects	$12,356,960
		Net Beneficial Effects	$18,027,310

1/ Agricultural benefits, current normalized; all others 1976.

2/ 1976 price base, costs amortized at 6 5/8 percent, 100-years.

3/ OM&R - Operation, Maintenance, and Replacement.

Table 9-18

Mixed Objective Plan, 1990
Environmental Quality Account
Southwest Ohio River Basin

Components	Measure of Effects
Beneficial and Adverse Effects	
A. Areas of Natural Beauty	1. Reduce erosion on 883,100 acres of cropland as a result of land treatment measures. 2. Develop three reservoirs. 3. Acquire 16,690 acres within stream corridors and preserve an additional 106,900 acres through zoning or easements. 4. Affect the natural vegetation on 21.6 miles of streams. 5. Apply conservation land treatment on 172,900 acres of pastureland and 35,000 acres of forest land to improve cover conditions, timber quality, and reduce erosion.
B. Quality considerations of water land, and air resources.	1. Reduce flooding on 5,914 acres of agricultural land. 2. Reduce erosion on 1,091,000 acres through land treatment measures. 3. Reduce average annual erosion 1,322,000 tons through increased use of conservation cropping and tillage measures. 4. Store 5,233 acre-feet of sediment. 5. Improve water quality by reducing sediment sources through land treatment measures, and conservation cropping and tillage measures 1/. 6. Create 340 acres of water impoundments for fisheries and wildlife habitat.
C. Biological resources and selected ecosystems.	1. Reduce stream sediment pollution to improve and protect fisheries habitat 1/. 2. Improve wildlife habitat through land treatment measures and floodwater retarding structures.

1/ Research has demonstrated on a qualitative bases that reductions in erosion cause reductions in sediment, transport, and deposition. Reliable predictive methodology for quantitative estimates does not exist at this time.

Components	Measures of Effects
C. Cont'd	3. Provide 340 acres of water impoundments for fisheries and waterfowl habitat. 4. Maintain wildlife habitat on 123,590 acres located within stream corridors. 5. Increase water temperature where channel work takes place.
D. Irreversible and Irretrievable Commitments of Resources.	1. Convert 340 acres of cropland, pastureland, and forest land to reservoir pools. 2. Alter 21.6 miles of stream channels. 3. Alter 17,040 acres for recreational developments.

Table 9-18

Mixed Objective Plan, 1990
Social Well-Being Account
Southwest Ohio River Basin

Components	Measures of Effects
Beneficial and Adverse Effects	
A. Real income distribution.	1. Create 1,282 low to medium income permanent jobs for residents in the study area. 2. Create 1,584 man-years of labor for project construction.
B. Life, Health, and Safety	1. Reduce flood damages on 5,900 acres. 2. Identify flood hazard areas on 75 miles of streams and for 13 communities.
C. Recreational Opportunities	1. Create facilities for 5,545,800 recreation visits in the region.

CHAPTER 10

OPPORTUNITIES FOR USDA PROGRAMS IN THE MIXED-OBJECTIVE PLAN

Many USDA programs exist that provide technical and financial assistance to state and local sponsors and basin residents. This chapter describes the components of the Mixed-Objective Plan that can be accomplished under USDA programs. All USDA programs depend on the leadership, interest, and financial ability of the local people. Each USDA program is discussed below and its role in accomplishing the Mixed-Objective Plan.

Public Law 566

Public Law 566, the Watershed Protection and Flood Prevention Act, provides technical and financial assistance mainly for flood control and drainage. It is administered by the Soil Conservation Service and sponsored by local soil and water conservation districts. In the Mixed-Objective Plan, two watersheds are planned for implementation under PL-566. Table 10-1 shows a possible cost-share distribution between federal funds and other funds. The bulk of project benefits, according to Congressional Policy, must accrue to flood prevention or agricultural water management. For this reason, it does not appear feasible to promote recreational corridors adjacent to water courses under PL-566 unless flood control or agricultural water management are identified as needs also. Recreation as a part of the Massies Creek Watershed qualified under this policy due to associated flood prevention measures.

Flood hazard studies for the thirteen communities in the plan may receive assistance from the USDA. The amount will vary with each study depending on local participation. The studies will assist communities in preventing future increases in flood damages by identifying flood prone areas. Total estimated cost for the studies is $150,000.

Public Law 46

The Soil Conservation Service under Public Law 46 provides technical assistance to landowners and operators in the planning and application of conservation practices through soil and water conservation districts. Financial assistance for these programs is provided by the Agricultural Stabilization and Conservation Service and the Farmers Home Administration. Application of conservation practices on 883,000 acres of cropland, 173,000 acres of pastureland, and 35,000 acres of forest land throughout the basin could be facilitated through PL-46 assistance. These measures would reduce erosion and resulting sedimentation throughout the Basin. Application of these measures would also increase the quality of recreational facilities and corridors.

Agricultural Conservation Program

The Agricultural Conservation Program (ACP) provides financial assistance to landowners and operators for the installation of conservation practices. The cost-sharing program is administered by the Agricultural Stabilization and Conservation

Table 10-1

Cost-Sharing by Watershed, PL-566 Projects, Mixed-Objective Plan
Southwest Ohio River Basin
(Dollars) 1/

Watershed	PL-566 Funds	Other Funds	Total
Mud Creek	650,000	50,000	700,000
Massies Creek	4,155,440	3,610,120	7,765,560
Total	4,805,440	3,660,120	8,465,560

1/ Price Base 1976.

Service (ASCS). The ACP may cost-share up to fifty percent of the cost for certain practices. ACP practices are designed for erosion control, conservation of water, development of wildlife habitat, pollution reduction, and improved farm income. Some of the practices are: establishing grasses, surface and subsurface drainage, diversions, ponds, grade stabilization structures, tree planting, and wildlife habitat development.

The Mixed-Objective Plan includes an accelerated installation of conservation practices with appropriate federal or state funding for technical and financial assistance.

Resource Conservation and Development (RC&D)

Technical and financial assistance is also provided through the RC&D Program administered by the Soil Conservation Service. The RC&D program is designed to accelerate the installation of measures through group action in addition to actions by individual landowners in other USDA programs. Presently, Champaign and Logan Counties are the only counties in Southwest Ohio within a RC&D area. Plans for the RC&D program include flood hazard analysis, flood prevention and drainage measures in rural communities, critical area treatment, recreation development, and others. Funding is no longer available for new RC&D starts. For this reason, the potential for RC&D to solve water resources, conservation, and recreational demands of the remaining portions of the basin remains doubtful.

Farmers Home Administration Loan Program

The Farmers Home Administration (FmHA) is authorized to make loans to local sponsors to assist in implementing watershed and RC&D plans. Loans are used to finance local cost-sharing items. Loans to individual landowners for installation of conservation practices are eligible. The FmHA is also authorized to make loans to develop domestic water supply and waste disposal systems for farmers and rural residents in towns of up to 10,000 people. Interest rates are usually favorable for community development loans.

Forestry Incentive Program

The Forestry Incentive Program (FIP) offers cost-sharing for tree planting and improving a stand of forest. It is administered by the Agricultural Stabilization and Conservation Service. The program's main purpose is to assist small forest landowners on a cost-share basis to produce marketable timber crops.

Forest Service Programs

Within the Forest Service many programs provide technical assistance to landowners and operators. The major programs are: Cooperative Forest Management Program (CFM), Forest Products Utilization Program (FPU), General Forestry Assistance Program (GFA), Rural Community Fire Protection Program (CFPP) and the Watershed Protection and Flood Prevention Program (PL-566 Small Watershed Program). These were explained earlier in Chapter V. Other programs involving Forest Service assistance are Forest Insect and Disease Management,

which can cost-share on projects where insect or disease infestations are to be suppressed chemically or biologically; and the Resource Conservation and Development Program (RC&D), which furnishes specific forest land technical assistance and cost-shares with landowners for forestry measures installed for conservation purposes.

Environmental Impact

The probable impacts of the Mixed-Objective Plan were discussed in Chapter 9 which include impacts from USDA programs. Land treatment measures are primarily concerned with erosion damage reduction and preserving the natural resource base. Management systems for cropland, forest land, and pastureland are part of the land treatment program. Structural measures affecting environmental conditions include floodwater retarding structures, channel work, multiple-purpose structure, or a combination of these structural measures.

Favorable Environmental Effects

Floodwater reduction and drainage improvement will occur on 5,900 acres of agricultural land. An estimated $319,170 in benefits will be realized. With the implementation of flood hazard studies potential increases in urban floodwater damage will be halted.

Soil erosion will be reduced by an estimated 1,322,000 tons annually on agricultural land and sediment delivery to stream courses will be reduced by an estimated 50 percent.

Fish and wildlife habitat will be improved with the installation of agricultural and forestry conservation practices.

Recreational opportunities will increase through development of the water based recreation reservoir on Massies Creek and along stream corridors. This plan will provide opportunities for 5,545,800 recreation visits.

Preserve and maintain 140,630 acres along stream corridors for fish and wildlife habitat and recreational use.

Adverse Environmental Effects

Installation of the three structures will disturb 580 acres of land. An estimated 22 miles of stream channels will be disturbed from construction. Noise and dust pollution will increase during construction. Traffic congestion will increase around the recreation site.

Alternatives

Two alternative plans were formulated: ED and EQ. As discussed in Chapter 8, the ED plan includes more structural measures for flood control, drainage, and recreation causing greater impact on the environment. The EQ Plan alternative includes fewer structural measures and emphasizes more of a nonstructural approach. The impact on the environment will be less than the ED Plan.

Relationship Between Local Short-Term Uses of Man's Environment and the Maintenance of Long-Term Productivity

Implementation of plan elements affected by USDA programs will promote more effective utilization of land in Southwest Ohio. Installation of the flood control and drainage measures proposed will encourage more intensive use of low lands and wetlands. Environmental losses will occur for increased agricultural output. With the emphasis toward conservation treatment measures and reduced tillage methods on erosive soils, any reduction in erosion and sedimentation will benefit the short-term effects of the environment while maintaining the resource base and long-term productivity.

Irreversible or Irretrievable Commitment of Resources

Installation of channel work and reservoirs will permanently alter 850 acres of land. Forest land, pastureland, and cropland will be converted to other uses. The construction of the structural measures will commit materials, labor, and other resources to various measures and cannot be retrieved.

CHAPTER 11

COORDINATION OF PROGRAMS FOR FUTURE DEVELOPMENT

Programs other than those available within USDA are available to state and local sponsors, plus basin residents, to implement parts of the Mixed-Objective Plan. Cooperation and coordination is essential among all agencies involved. Chapter 10 describes the programs under USDA which can help implement the plan. This chapter describes the measures that may be used by basin residents, local governments, state agencies, and federal agencies other than USDA in accomplishing the Mixed-Objective Plan.

Flood Damage Reduction

The U.S. Army Corps of Engineers flood control program utilizes structural measures to control and alleviate flood damage. East Fork, Caesar Creek, and Clarence J. Brown Reservoirs are examples of their efforts to reduce flood problems. Recent efforts have concentrated on solving local flood problems along the Great Miami and Little Miami Rivers. The study includes all urban areas along these rivers and upstream areas identified as having flood problems.

Where structural measures are not feasible, a nonstructural approach is a possibility.

Federal agencies such as the Army Corps of Engineers, the Soil Conservation Service, and the Geological Survey all make flood hazard studies that can assist in the flood insurance program. Private consulting firms also make flood hazard studies. The overall responsibility in making and assigning these studies lies with a state coordinating agency. In Ohio, the Ohio Department of Natural Resources (ODNR), is the coordinating agency. The thirteen new flood hazard studies shown in the Mixed-Objective Plan would be coordinated through them.

Drainage of Wet Agricultural Soils

The Mixed-Objective Plan shows installation of a larger acreage of cropland with subsurface drainage. The local soil and water conservation districts can provide technical assitance to landowners and groups of landowners in reducing the wetness problem. Costs of installing and maintaining the systems are usually financed by the landowner. However, as shown in Chapter 9, cost-sharing on a fifty-fifty basis is suggested with half the costs financed by state or federal funds.

Increased Recreation Facilities

The stream corridors included in the Mixed-Objective Plan depend largely on impetus from local groups and organizations for implementation. The U.S. Department of the Interior also can assist in recreational programs. The U.S. Heritage Conservation and Recreation Service provides funds for cost-sharing with the state for recreation. However, local interest has the leadership role in development of future recreation areas.

At the local level, River Corridor committees exists in several counties along the Great Miami River. The committees are made up of people from city government, villages, chambers of commerce, park districts, regional planning commissions, and other interested individuals. The role of the committees is to discover the potential of the Great Miami Corridor and restore awareness to the rivers natural features. Each committee is concerned with orderly development and satisfying the needs of the citizens. Three corridor plans have been developed which encompass the Great Miami from the Logan-Shelby County line to the Butler-Hamilton County line.

Along similar lines, efforts to preserve the Little Miami River Corridor have been taken up by ODNR and Little Miami Inc. Established in 1967, the Little Miami Inc. is a non-profit citizens' organization endeavoring to preserve the Little Miami for the enjoyment of man and his fellow beings. Their goal is to achieve protection for the entire river on a national basis. Presently, the entire river is designated scenic with the upper portion as part of the national wild and scenic rivers system.

The interest for preservation of major stream corridors at the local level is real. Proper coordination by ODNR between local, state, and federal officials is necessary if the recreation phase is to be implemented. The private sector is generally not equiped to obtain landrights and develop extensive corridor type recreational facilities. The power of dominant eminent domain which is entrusted to some public agencies is necessary for obtaining riparian properities. Funding for endeavors of this magnitude is usually not available through the private sector.

Reduced Erosion and Sedimentation

The Environmental Protection Agency (EPA) administers the Water Pollution Control Act Amendments of 1972 (PL 92-500). Section 208 of the Act authorizes the EPA to make studies on a region basis relating to point and nonpoint source pollution. Point source relates to industry and wastewater facilities where pollution can be identified and monitored. Nonpoint source pollution relates mainly to open and agricultural lands where the source cannot be directly identified. Sediment is the major nonpoint source pollutant. The "208" plans are geared toward locating and controlling sources of pollution, such as erosion, on all lands. State and local soil and water conservation districts, plus other state agencies, will have major inputs into the plans. Presently, OKI Planning Region has completed a 208 water quality plan for their region. Miami Valley Planning Regions' 208 water quality plan is still in progress.

The remainder of the Southwest Ohio Study area is underway but not completed.

The local soil and water conservation districts provide technical assistance to landowners in treating erosion hazards. A possibility exists at the state level for cost-sharing assistance along with more emphasis on conservation tillage on erosive soil. Whatever the outcome, the ultimate responsibility for erosion control and sediment reduction is with the landowner.

Technical assistance is also provided to manage and reduce erosion from forest land. The Division of Forestry, which is part of ODNR, provides assistance to landowners for timber stand improvement and tree planting. Federal cost-sharing may also be available.