E. ROBERT BAUMANN
LEWIS M. NAYLOR
DEAN A. WILLIS

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SPECIAL REPORT
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DES MOINES—RACCOON RIVER BASIN CHARACTERISTICS RELATED TO RED ROCK AND SAYLORVILLE RESERVOIRS DES MOINES RIVER, IOWA

Contracts: DACW 25-75-C-0008 Red Rock
DACW 25-75-C-0007 Saylorville
Department of the Army
Rock Island District
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ERI Projects 1140 and 1141

ENGINEERING RESEARCH INSTITUTE
IOWA STATE UNIVERSITY
AMES, IOWA 50010 USA

SPECIAL REPORT

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RELATED TO RED ROCK AND SAYLORVILLE RESERVOIRS DES MOINES RIVER, IOWA

E. Robert Baumann
Anson Marston Distinguished Professor of Engineering
Professor of Civil Engineering

Lewis M. Naylor
Research Associate in Civil Engineering

Dean A. Willis
Research Trainee in Civil Engineering

Submitted to:
Department of the Army
Rock Island District
Corps of Engineers
Clock Tower Bldg.
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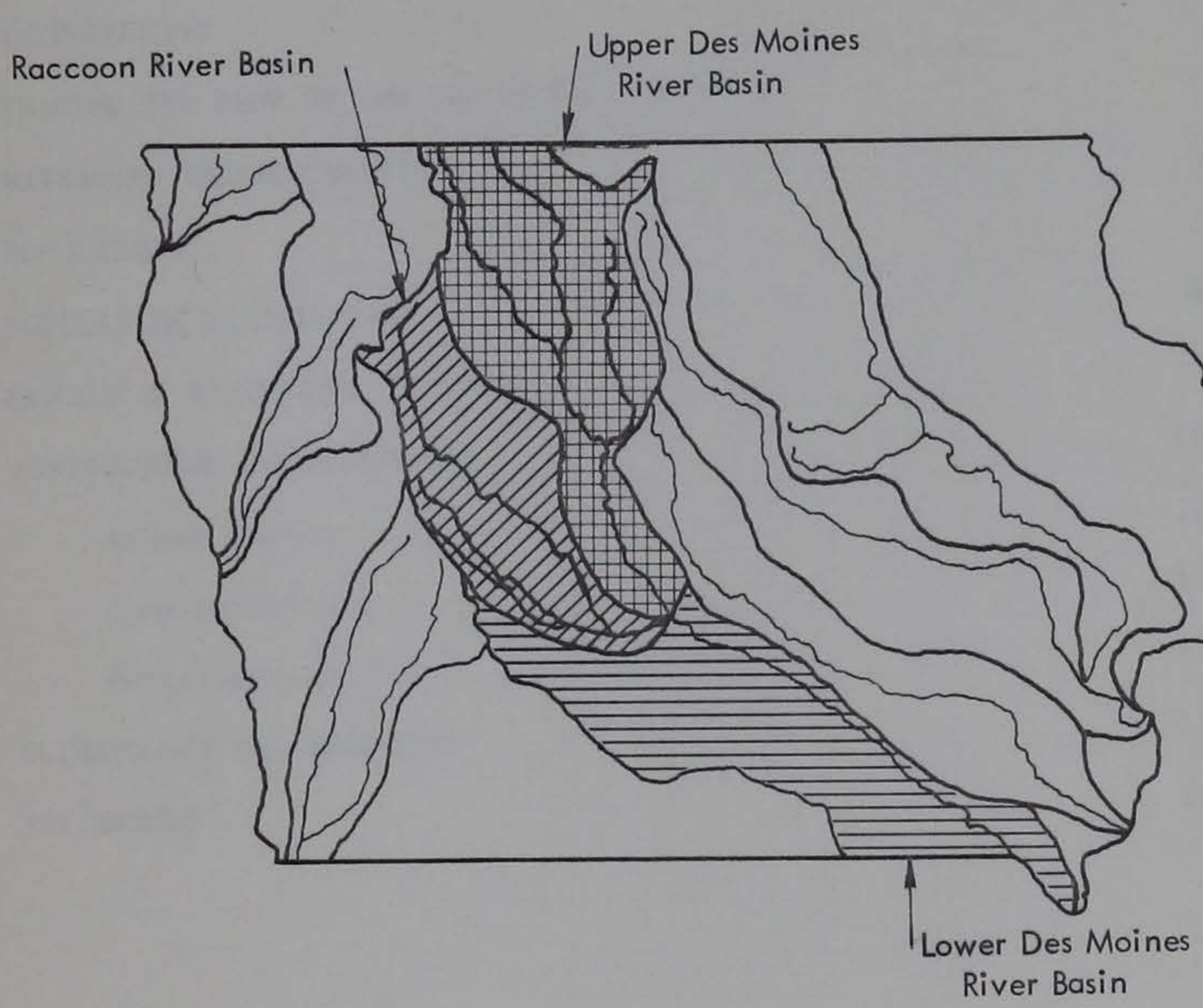

Location of sub-basins in the Des Moines River Basin.

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BASIN CHARACTERISTICS

DES MOINES-RACCOON RIVERS IN IOWA

INTRODUCTION

The river-lake water quality problems found within a basin are functions of the various activities of man that take place within that basin. Therefore, this Special Report has been prepared to provide a description of the Des Moines River basin in Iowa (Fig. 1) and the activities within the basin that influence or are influenced by the quality of water pertinent to determining lake water quality relationships in the Red Rock and Saylorville reservoirs.

In view of the very unique characteristics present in the Des Moines River, the basin characteristics are presented in three separate parts (Frontispiece):

- The upper Des Moines River in Iowa from the confluence of the Raccoon River to the headwaters of the river,
- The Raccoon River from its confluence with the Des Moines River in the City of Des Moines to the headwaters of the river, and
- The lower Des Moines River from the confluence of the Raccoon River to its confluence with the Mississippi River.

The unique characteristics of the Des Moines River are these:

- The upper Des Moines River flows through rich, Iowa farmland and ends in the Saylorville Reservoir (closure scheduled in summer of 1975) just a few miles above a major metropolitan

area – the City of Des Moines.

- The Raccoon River also flows through rich, Iowa farmland and joins the Des Moines River a few miles downstream of the Saylorville Reservoir and within the City of Des Moines.
- The lower Des Moines River thus has water inflow from two major basins draining farm land: one whose flow and water quality are to be influenced by the Saylorville Reservoir and one whose flow and water quality are not affected by reservoir construction. In Des Moines, water from these basins is combined, and into them are discharged the surface water runoff and municipal and industrial wastewater discharges of the major metropolitan area of the state.

This basin has importance because the water quality is being sampled on a long-term basis (starting in 1967) by personnel of the Sanitary Engineering Section of the Iowa State University Engineering Research Institute under contract with the Corps of Engineers, U.S. Army, Rock Island District. The study will provide the basic data needed for:

- An evaluation of the effect of man's activities within the basin on the water quality of both the upper Des Moines and Raccoon Rivers above the City of Des Moines,
- An evaluation of the effect of the Saylorville Reservoir on water quality in the upper Des Moines River just above the City of Des Moines,
- An evaluation of the effect of man's activities in a major metropolitan area on the river water quality in the lower Des Moines River, and

- An evaluation of the effect of the Red Rock Reservoir on water quality in the lower Des Moines River. The inflow to this reservoir represents the combined flow of the upper Des Moines River, the Raccoon River, and the lower river basin flow from the metropolitan area of the City of Des Moines.

This report is <u>not</u> designed to provide a detailed analysis of the above effects. It is designed to provide details of the basin characteristics which can be used in making such analyses. Pertinent river basin characteristics related to water quality which are included in this special report are:

- Characteristics of cities, towns, and major industrial operations in the basin:
  - location and population
  - wastewater treatment facilities
  - wastewater discharges and their quality
- Geological characteristics of the basin:
  - location of water quantity and quality gaging stations
  - hydrogeologic characteristics of the basin
- Agricultural and non-point sources of pollution:
  - animal production
  - crop production
    - corn-soy bean production
    - fertilizer applications

TRACING THE FLOW OF THE DES MOINES RIVER

The frontispiece shows the general locations of the upper Des Moines, lower Des Moines, and Raccoon River basins in Iowa. Figure 1 is a general plan of the entire Des Moines River basin. Figures 2, 3, and 4 are, respectively, hydrogeologic maps of the upper Des Moines, Raccoon, and lower Des Moines River basins.

The source of the West Fork of the Des Moines River is in the meadows of Murray and Lyon Counties in southwestern Minnesota at an altitude of 1800 to 1850 feet above sea level. The outlet of a large shallow lake, Lake Shetek, forms the initial stream in a flat plain area. Several small lakes drain to Lake Shetek. The northernmost of these is Long Lake in Lyon County, Minnesota, which lies less than 5 miles south of the Cottonwood River which flows into the Minnesota River at New Ulm, Minnesota, and ultimately into the Mississippi River at St. Paul, Minn.. The east Fork of the Des Moines River is formed by the outlet of Okamanpeden Lake near the Iowa-Minnesota border.

From Lake Shetek, approximately 40 miles north of the Iowa-Minnesota border, the West Fork of the Des Moines River flows in a southeasterly direction where it is joined by the East Fork a few miles below Humbolt, Iowa. The confluence of the Boone River and the Des Moines River is just above Stratford, Iowa, and the Raccoon River enters at Des Moines, Iowa. Below Des Moines, many smaller rivers flow into (Fig. 4) the major existing Des Moines River impoundment, the Red Rock Reservoir. The Des Moines River forms the boundary between Iowa and Missouri from Farmington, Iowa to Keokuk, Iowa, a distance of about 30 river miles. The total

length of Iowa's largest river from its source in Minnesota to its mouth immediately below Keokuk, Iowa, is about 535 miles. There, the river empties into the Mississippi River, 486 miles below St. Paul, Minnesota.

WATERSHED CHARACTERISTICS

More than 14,500 square miles of three states are drained by the Des Moines River, including 23 percent of Iowa. The watershed has a long and relatively narrow crescent shape averaging about 40 miles in width from southwestern Minnesota to the Iowa-Missouri border. Above the city of Des Moines at Saylorville, Iowa, the river drains 5841 square miles and above Boone, Iowa 5511 square miles (Fig. 2). Tables 1, 2, and 3 list and Figs. 5, 6, and 7 show the location of continuous-record stream gaging and water quality stations located, respectively, in the upper Des Moines, Raccoon, and lower Des Moines River basins. Stream flow records in this study were taken from the U.S.G.S. recording gage records at Saylorville, Iowa and Stratford, Iowa (Fig. 5). The river at the Stratford gaging station about 18 miles north of Boone drains 5,452 square miles.

From its source in Minnesota to its outlet at Keokuk on the Mississippi River, the Des Moines River falls nearly 1,370 feet. The stream slope averages 3.2 feet per mile from the source to river mile 300 near Fort Dodge, Iowa. The slope then becomes more gentle, about 1.6 feet per mile, from river mile 300 to the confluence with the Mississippi River. It is interesting to note that although the river is navigable only for small

boats at the present time, a steamboat was able to bring supplies to Des Moines from Keokuk in 1851. During still another highwater period of yesteryear, the river was navigable as far north as Fort Dodge.

The Des Moines River watershed lies in a glaciated plain in which the valley cut into the glaciated area does not generally exceed 200 feet. Many lakes and ponds dot the headwater area and a rather poorly defined drainage pattern exists in northern Iowa (Figs. 2 and 3). The stream has cut deeper near Humbolt, Iowa, exposing the limestone underlying the glacial till. In Boone County, the valley formed by the river is about 1/4 mile wide and 150 to 200 feet deep. Sandstone outcroppings in the Ledges State Park south of Boone, Iowa are a major scenic attraction in the area. The valley widens in Dallas and Polk Counties to about 1/2 mile where the river cuts through the drift in the vicinity of the Saylorville Reservoir.

Below Des Moines, where the valley is mature, the landscape changes dramatically, and the drainage pattern is well defined (Fig. 4). In the area between Des Moines and Knoxville, Iowa, the river meanders through a flood plain 2 to 4 miles wide bordered by rounded cliffs. Red Rock Reservoir covers much of this area at high water levels, but at the conservation pool level, river meanders are still visible. Downstream near the site of Red Rock Dam in Marion County, the valley width is reduced to 1 to 3 miles, forming a deep flat-bottomed valley. Near Tracey, Iowa the river has cut into the limestone, forming a flood plain 1/2 to 2 miles in width. The stream valley in Mahaska County and Van Buren County becomes constricted to a width ranging from 1/3 to 1 mile wide, but below this reach the flood plain again becomes wider and is bordered by rounded bluffs in the vicinity of its confluence with the

Mississippi River.

The soils found in the Upper Des Moines River watershed are moderately permeable. Pockets of sand and gravel are common, and these are highly permeable. Because of the moderate to high permeability, flooding problems during wet spring weather are localized. The areas flooded are generally confined to clay pan soils in pot hole areas and in places where the land is lower than the adjacent roads.

Large quantities of water percolate into the permeable soil and contribute to the groundwater supply rather than direct runoff into streams. In poorly-drained areas, however, tile drains and open ditches divert much of this excess water from fields into the stream. It has been estimated that as much as half of the Upper Des Moines River Basin is artificially drained.

POPULATION

Based on national census data, the state of Iowa is growing more slowly than the rest of the nation. In the 70 year interval between 1900 and 1970, the percentage of the U.S. population living in Iowa has steadily declined from 2.84 percent to 1.39 percent.

Many factors influence population growth and decline within the state. However, the fundamental factors are mortality, fertility, and migration. Mortality has not changed substantially for many years. Hence, fertility and net migration in effect control variations in the Iowa population. In Iowa, and throughout the rest of the nation, fertility is declining.

The peak number of births (66,123) in Iowa occurred in 1951 following World War II. In 1974, the number of births was less than 39,000, the lowest since 1917. This represents a current trend toward smaller families begun in 1959. Thus, if the population of Iowa is to grow, the dominant factor appears to be the net migration. Between 1900 and 1970 one million more people moved out of Iowa than moved into the state. This trend seems to be changing, however – for in the years 1970 to 1973 the net gain for the state was 38,000.

In the Upper Des Moines River basin, Iowa counties showing an increase in population of 1000 or more are Marion, Warren, Polk, Madison, Boone, and Hancock. The increase in population appears to be the result of attracting new industries into communities having populations that are less than 10,000. Based on 1973 population estimates and considering the population to be distributed uniformly throughout each county, the population of the Upper Des Moines River basin above Des Moines is approximately 150,000 including the non-municipal population. The only cities over 10,000 population in this area are Boone (pop., 12,468) and Fort Dodge (31,263).

POPULATION DISTRIBUTION

More than half a million people live in the cities and towns of the Des Moines River basin, including the Raccoon River basin according to the 1970 census records, and nearly 40 percent of these people live in the Des Moines metropolitan area. About 14 percent of those remaining live

in the Raccoon River basin, 23 percent live in the Upper Des Moines River basin, and 23 percent live in the Lower Des Moines River basin. Population data are summarized in Table 4.

Tables 5, 6, and 7 list the 1970 populations of municipalities in the upper Des Moines, Raccoon, and lower Des Moines River basins, respectively. Figures 8, 9, and 10 show the locations of these municipalities in their respective basins.

MUNICIPAL WASTEWATER TREATMENT

Tables 8, 9, and 10 list the point source wastewater discharge locations in, respectively, the upper Des Moines, Raccoon, and lower Des Moines River basins above the Red Rock Reservoir. Figures 11, 12, and 13 show pictorially the municipal populations and point source BOD loads in these basins. Tables 11 and 12, 13 and 14, and 15 list, respectively, the discharge quantities and the wastewater treatment facilities, respectively, in the upper Des Moines, Raccoon, and Lower Des Moines River basins. Table 16 lists the abbreviations used in Tables 12 and 14 to represent the different wastewater treatment facilities used.

The principal methods of treating municipal waste in the Des Moines River basin are trickling filters and waste stabilization ponds. Trickling filter plants serve the greatest population, including the Des Moines metropolitan area.

Communities above Red Rock Dam add about 20,349 lb BOD/day to the

rivers and streams of the basin (1974)(6). The Des Moines metropolitan area contributes nearly 48 percent of this amount, and only 10 percent of the cities and towns in the basin area produce more than 100 lb BOD/day. Eight cities contribute nearly 78 percent of the total BOD. One of these cities, Estherville, with a population just over 8,100, contributes nearly 2400 lb BOD/day. It has, however, submitted plans to the Iowa Department of Environmental Quality for polishing ponds and dual-media filters following secondary activated sludge treatment. Table 17 summarizes the BOD contributions to rivers and streams in the Des Moines River basin above Red Rock Dam.

AGRICULTURAL CONTRIBUTIONS

Animal Wastes

The State of Iowa is consistently among the nation's leaders in the production of cattle, hogs, poultry, and other livestock. Livestock production in Iowa contributes greatly to the state's economic development, but it also has great potential for polluting the surface water of the state.

Based on individual animal estimates for the period from 1971 to 1973, the equivalent of 2.4 million cows were raised in the Des Moines River basin (3). This figure was estimated by multiplying the number of each kind of animal by the factors given in Table 18 to give the number of equivalent 1000-lb cows.

For comparison, the BOD of the livestock waste produced in the basin is equivalent to a human population of at least 20 million people, far exceeding the human population of 500,000. The number of livestock and their density in number per square mile varies from one part of the Des Moines River basin to another, as shown in Table 19.

Tables 20, 21, and 22 list and Figs. 14, 15, and 16 show pictorially the equivalent 1000-lb cow densities in, respectively, the upper Des Moines, Raccoon, and lower Des Moines River basins.

Crop Production

The principal agricultural activity in the Des Moines River basin involves crop production – the production of corn and soy beans. The yearly acreage devoted to production of each grain will vary somewhat from year to year, depending on expected market conditions. The yield each year will depend principally on weather conditions.

In the last 25 years, corn production has increased from about 60 to 100 bushels per acre (statewide average). Soy bean acreage during this period has increased, and average yield (statewide average) now approximates 35 bushels per acre.

Tables 23, 24, and 25 list the total and unit production of corn and soy beans by county in, respectively, the upper Des Moines, Raccoon, and lower Des Moines River basins. Figures 17, 18, and 19 show pictorially the total acreage devoted to corn and soy bean production in, respectively, the upper Des Moines, Raccoon, and lower Des Moines River basins.

Corn and soy bean production respresent the most important cash grain crop in the State of Iowa. Its effect on river water quality is also the most significant. It does not, however, represent the only use of Iowa farm land. Table 26 summarizes the 1973 crop acreage devoted in Iowa to different farm uses.

Fertilizer Applied

Data concerning fertilizer applications by county or river basin are not readily available. The most important crops are corn and soy beans, and most fertilizer is used on these crops. Since the fertilizer applications are expected to be related to these crops, an estimate of fertilizer (and herbicide) application can be approximated, but such data are not included in this report.

CLIMATOLOGY AND HYDROLOGY

The State of Iowa receives an average of about 32 inches of rain each year. In the Des Moines River basin, this amount varies between 28 and 36 inches, with the greater amounts received in the southern part of the basin. During the period that the Des Moines River Water Quality Study has been in effect, from 1967 to 1973, the precipitation in the central part of Iowa has averaged 34.26 inches. This area includes most of the upper Des Moines River basin. The average annual precipitation for the central part was 31.36 inches prior to 1965. The range

for the 1967 to 1973 period was from 27.59 to 41.82 inches. One of Iowa's greatest assets is the timing of this rainfall. Nearly half of the annual precipitation occurs during the months of May, June, July, and August.

Streamflow in the upper Des Moines River has averaged 1,747 cfs for the 53-years period of record at Stratford. At Saylorville, Iowa, the average streamflow is 2.603 cfs, covering a shorter period of 12 years as shown in Table 27. The much higher streamflow at Saylorville reflects the higher than average precipitation during the past 12 years. During this same period, the streamflow has averaged 2,526 cfs and 2,749 cfs, respectively, at Stratford and Saylorville as given in Table 28.

ACKNOWLEDGMENT

Appreciation is expressed to the Iowa State Department of Environmental Quality and to Bob Kellogg, Environmental Specialist, for their cooperation in providing the extensive data necessary for compilation of many of the tables and figures in this report.

The assistance of the Iowa State University Department of Agricultural Engineering in providing agricultural data is gratefully acknowledged.

Thanks are also extended to the Engineering Research Institute's Editorial Office for help in editing and preparing this report.

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5. "Non-Point Pollution Sources," in Upper Des Moines River -- Waste Load Allocation Study, Iowa Department of Environmental Quality, Des Moines, Iowa, 1974.

6. "Point Source Wastewater Discharges," in Upper Des Moines River -- Waste Load Allocation Study, Iowa Department of Environmental Quality, Des Moines, Iowa, 1974.

Table 1. U.S.G.S. Gaging Stations in the Upper Des Moines River Basin.

Station* No.	Stream	Location	Drainage Area (sq.mi)
4765	W. F. Des Moines R.	Estherville	1,372
4767.5	W. F. Des Moines R.	Near Humbolt	2,256
4780	E. F. Des Moines R.	Near Burt	462
4785	E. F. Des Moines R.	Near Hardy	1,268
4790	E. F. Des Moines R.	Dakota City	1,308
4800	Lizard Creek	Near Clare	257
4805	Des Moines River	Near Fort Dodge	4,190
4810	Boone River	Near Webster City	844
4813	Des Moines River	Near Stratford	5,452
4815	Des Moines River	Near Boone	5,511
4816.5	Des Moines River	Near Saylorville	5,841
4819.5	Beaver Creek	Near Grimes	358
4820	Des Moines River	Des Moines	6,245

*From Water Resources Data for Iowa, USGS, 1973.

Table 2. U.S.G.S. Gaging Stations in the Raccoon River Basin.

Station* No.	Stream	Location	Drainage Area (sq.mi.)
4821.7	Big Cedar Creek	Near Varina	80.0
4823	North Raccoon River	Near Sac City	713
4825	North Raccoon River	Near Jefferson	1,619
4830	E. F. Hardin Creek	Near Churdan	24.0
4836	Middle Raccoon River	Panora	440
4840	South Raccoon River	Redfield	988
4845	Raccoon River	Van Meter	3,441
4848	Walnut Creek	Des Moines	80.9
4850	Raccoon River	Des Moines	3,590

*From Water Resources Data for Iowa, USGS, 1973.

Table 3. U.S.G.S. Gaging Stations in the Lower Des Moines River Basin.

Station* No.	Stream	Location	Drainage Area (sq.mi.)
4855	Des Moines River	Des Moines	9,879
4856.4	Four Mile Creek	Des Moines	92.7
4860	North River	Near Norwalk	349
4864.9	Middle River	Near Indianola	503
4874.7	South River	Near Ackworth	460
4879.8	White Breast Creek	Near Dallas	342
4880	White Breast Creek	New Knoxville	380
4885	Des Moines River	Near Tracy	12,479
4890	Cedar Creek	Near Bussey	374
4895	Des Moines River	Ottumwa	13,374
4905	Des Moines River	Keosauqua	14,038
4910	Sugar Creek	Near Keokuk	105
4745	Mississippi River	Keokuk	119,000

*From Water Resources Data for Iowa, USGS, 1973.

Table 4. Population Distribution in the Des Moines River Basin below the Confluence of the Des Moines and Raccoon Rivers.

Area	Municipal Population	Percent of Total
Des Moines River Basin	504,606	100.0
Des Moines River Basin above Red Rock Dam	436,241	86.5
Des Moines Metropolitan Area	201,404	40.0
Lower Des Moines River Basin	315,558	62.5
Upper Des Moines River Basin	116,647	23.1
Raccoon River Basin	72,401	14.4

Table 5. Population of Municipalities in the Upper Des Moines River Basin, 1970.

Boone County	1970 Population
Beaver	113
Berkley	56
Boone	12,468
Boxholm	242
Fraser	143
Luther	189
Madrid	2,448
Ogden	1,661
Pilot Mound	214
Dallas County	
Bouton	160
Granger	661
Woodward	1,010
Emmet County	
Armstrong	1,061
Dolliver	95
Estherville	8,108
Grover	135
Ringsted	509
Wallingford	249
Hamilton County	
Webster City	8,488

Hancock County	1970 Population
Britt	2,069
Corwith	407
Kanawha	705
Humbolt County	
Bode	372
Bradgate	130
Dakota City	746
Gilmore City	766
Hardy	73
Humbolt	4,665
Livermore	510
Ottosen	93
Pioneer	56
Renwick	429
Rutland	215
Thor	212
Kossuth County	
Algona	6,032
Bancroft	1,103
Burt	608
Fenton	403
Lone Rock	166

Table 5. Population of Municipalities in the Upper Des Moines River Basin, 1970 (continued).

Kossuth County	1970 Population
Lu Verne	380
Swea City	774
Titonka	599
Wesley	548
West Bend	865
Whittemore	658
Palo Alto County	
Ayrshire	243
Curlew	95
Cylinder	133
Emmetsburg	4,150
Graettinger	907
Mallard	384
Rodman	104
Pocahontas County	
Havelock	248
Palmer	264
Plover	129
Pocahontas	2,338
Rolfe	767
Polk County	
Grimes	834
Polk City	715

Webster County	1970 Population
Badger	465
Barnum	147
Clare	249
Dayton	909
Duncombe	418
Fort Dodge	31,263
Lehigh	739
Otho	581
Stratford	710
Vincent	204
Moorland	269
Wright County	
Clarion	2,972
Eagle Grove	4,489
Goldfield	722
Woolstock	222

Table 6. Population of Municipalities in the Racoon River Basin, 1970.

Adair County	1970 Population
Stuart	1,354
Buena Vista County	
Albert City	683
Lakeside	353
Marathon	447
Newell	877
Rembrandt	250
Storm Lake	8,591
Storm Lake Hygrade	-
Truesdale	132
Calhoun County	
Farnhamville	393
Jolley	112
Knieriem	131
Lake City - North	1,910
Lake City-Southwest	
Lohrville	553
Manson	1,993
Pomeroy	765
Rinard	88
Rockwell City	2,396
Somers	197
Yetter	47

Carroll County	1970 Population
Arcadia	414
Breda	518
Carroll	8,716
Coon Rapids	1,381
Dedham	325
Glidden	964
Halbur	235
Lanesboro	203
Lidderdale	173
Ralston	129
Willey	72
Dallas County	
Adel	2,419
Dallas Center	1,128
Dawson	232
DeSoto	369
Linden	278
Minburn	378
Perry	6,906
Redfield	921
Van Meter	464
Waukee	1,577

Table 6. Population of Municipalities in the Raccon River Basin, 1970 (continued).

Greene County	1970 Population
Churdan	598
Dana	118
Grand Junction	967
Jefferson	4,735
Paton	329
Rippey	270
Scranton	751
Guthrie County	
Bagley	365
Bayard	628
Guthrie Center	1,834
Jamaica	271
Panora	982
Yale	301
Madison County	
Earlham	974
Pocahontas County	
Fonda	980
Laurens	1,792
Varina	140
Polk County	
Clive	3,005

Polk County	1970 Population
Urbandale	14,434
West Des Moines	16,441
Windsor Heights	6,303
Sac County	
Auburn	329
Lake View	1,249
Lytton	378
Nemaha	117
Sac City	3,268
Webster County	
Callender	421
Gowrie	1,225
Harcourt	305

Table 7. Population of Municipalities in the Lower Des Moines River Basin, 1970.

	1970 Population
Adair County	
Adair	750
Appanoose County	
Moravia	699
Clark County	
Osceola	3,124
Woodburn	186
Dallas County	
Dexter	652
Davis County	
Floris	145
Guthrie County	
Casey	561
Menlo	391
Jasper County	
Prairie City	1,141
Jefferson County	
Libertyville	329
Lee County	
Donnellson	798
Keokuk	14,631
Lucas County	
Lucas	247
Williamson	216
Madison County	
Bevington	53
East Peru	184
Patterson	120
St. Charles	443
Truro	359
Winterset	3,654
Mahaska County	
Beacon	431
Leighton	140
Oskaloosa	11,224
Marion County	
Bussey	498
Dallas	438
Hamilton	186
Harvey	217
Knoxville	7,755
Marysville	91
Melcher	913
Pella	6,784
Pleasantville	1,297

Table 7. Population of Municipalities in the Lower Des Moines River Basin, 1970 (continued).

Monroe County	1970 Population
Albia	4,151
Lovilia	640
Melrose	192
Polk County	
Altoona	2,883
Ankeny	6,700
Bondurant	462
Clive	3,005
Des Moines	201,404
Mitchellville	1,341
Pleasant Hill	1,536
Runnels	354
West Des Moines	16,441
Windsor Heights	6,303
Story County	
Slater	1,094
VanBuren County	
Bonaparte	517
Farmington	800
Keosauqua	1,018
Wapello County	
Blakesburg	403
Chillicothe	126
Eddyville	970
Eldon	1,319
Kirkville	222
Ottumwa	29,610
Warren County	
Ackworth	111
Carlisle	2,246
Cumming	189
Hartford	582
Indianola	8,976
Lacoma	424
Martensdale	306
Milo	561
New Virginia	452
Norwalk	1,745
Sandyville	89
Spring Hill	131
St. Mary's	105

Table 8. Point Source Wastewater Discharge Locations in the Upper Des Moines River Basin in Iowa.

Discharger	Reference Number	County	River* Mile	Discharge To	Page Reference: Quantity	Page Reference: Treatment
				MUNICIPAL		
Algona	M- 9	Kossuth	42	East Fork Des Moines River	51	64a
Armstrong	M-14	Emmet	90	East Fork Des Moines River	51	63
Ayrshire	M-62	Palo Alto			NEMTF	
Badger	M-22	Webster	326	Des Moines River (Badger Creek	52	64a
Bancroft	M-42	Kossuth	64	East Fork Des Moines River (Mud Creek)	51	63
Barnum	M-31	Webster			NEMTF	
Beaver	M-70	Boone		Beaver Creek	NEMTF	
Berkley	M-71	Boone		Beaver Creek	NEMTF	
Bode	M-63	Humboldt		Trulner Creek	52	64a
Boone	M-33	Boone	251	Des Moines River (Honey Creek)	60	69
Bouton	M-72	Dallas		Beaver Creek	NEMTF	
Boxholm	M-64	Boone			NEMTF	
Bradgate	M-34	Humboldt			NEMTF	
Britt	M-40	Hancock		East Branch Boone River	57	66
Burt	M- 1	Kossuth	61	East Fork Des Moines River	51	63

NEMTF: No Existing Municipal Treatment Facilities.

Table 8. Point Source Wastewater Discharge Locations in the Upper Des Moines River Basin in Iowa (continued).

Discharger	Reference Number	County	River* Mile	Discharge To	Page Reference: Quantity	Page Reference: Treatment
Clare	M-16	Webster			NEMTF	
Clarion	M-66	Wright		Eagle Creek	58	67
Corwith	M-51	Hancock	89	Boone River	57	65
Curlew	M-55	Palo Alto			NEMTF	
Cylinder	M-29	Palo Alto			NEMTF	
Dakota City	M- 6	Humboldt	5	East Fork Des Moines River	52	64a
Dayton	M-30	Webster	276	Des Moines River (Skillet Creek)	59	68
Dolliver	M- 8	Emmet			NEMTF	
Duncombe	M- 3	Webster		Brushy Creek	57	65
Eagle Grove	M-24	Wright	47	Boone River (Drainage Ditch 94)	58	67
Emmetsburg	M-43	Palo Alto	45	West Fork Des Moines River	50	62
Estherville	M-17	Emmet	73	West Fork Des Moines River	49	62
Fenton	M-59	Kossuth			NEMTF	
Fort Dodge	M-53	Webster	314	Des Moines River	53	64b
Fraser	M-38	Boone			NEMTF	

NEMTF: No Existing Municipal Treatment Facilities.

Table 8. Point Source Wastewater Discharge Locations in the Upper Des Moines River Basin in Iowa (continued).

Discharger	Reference Number	County	River* Mile	Discharge To	Page Reference: Quantity	Page Reference: Treatment
Gilmore City	M-56	Humboldt		North Branch Lizard Creek	53	64b
Goldfield	M-44	Wright	61	Boone River	57	66
Graettinger	M- 2	Palo Alto	61	West Fork Des Moines River	50	62
Granger	M-84	Dallas		Beaver Creek	60	70
Grimes	M-82	Polk		Beaver Creek	60	70
Gruver	M-67				NEMTF	
Hardy	M-47	Humboldt			NEMTF	
Havelock	M-21	Pocahontas			NEMTF	
Humboldt	M-10	Humboldt	4	West Fork Des Moines River	51	63
Kanawha	M-23	Hancock		West Otter Creek	57	66
Lehigh	M-41	Webster	295	Des Moines River (Crooked Creek)	57	65
Livermore	M-58	Humboldt	20	East Fork Des Moines River	51	64a
Lone Rock	M-20	Kossuth			NEMTF	
Luther	M-28	Boone			NEMTF	
Lu Verne	M-61	Kossuth			NEMTF	
Madrid	M-32	Boone		Little Creek	60	69

NEMTF: No Existing Municipal Treatment Facilities.

Table 8. Point Source Wastewater Discharge Locations in the Upper Des Moines River Basin in Iowa (continued).

Discharger	Reference Number	County	River* Mile	Discharge To	Page Reference: Quantity	Page Reference: Treatment
Mallard	M-49	Palo Alto				NEMTF
Moorland	M- 5	Webster				NEMTF
Ogden	M-86	Boone		Beaver Creek	60	70
Otho	M-57	Webster	305	Des Moines River (Dry Run)	56	65
Ottosen	M-27	Humboldt				NEMTF
Palmer	M-19	Pocahontas				NEMTF
Pilot Mound	M-35	Boone				NEMTF
Pioneer	M-52	Humboldt				NEMTF
Plover	M-13	Pocahontas				NEMTF
Pocahontas	M-50	Pocahontas	34	Lizard Creek	53	64b
Polk City	M-60	Polk	217	Des Moines River (Big Creek)	60	69
Renwick	M-15	Humboldt	67	Boone River (Joint Drainage Ditch 3, 47)	57	66
Ringsted	M-39	Emmet		Black Cat Creek	51	64a
Rodman	M-65	Palo Alto				NEMTF
Rolfe	M- 4	Pocahontas	18	West Fork Des Moines River (Pilot Creek)	50	63
Rutland	M-46	Humboldt				NEMTF

NEMTF: No Existing Municipal Treatment Facilities.

Table 8. Point Source Wastewater Discharge Locations in the Upper Des Moines River Basin in Iowa (continued).

Discharger	Reference Number	County	River* Mile	Discharge To	Page Reference: Quantity	Page Reference: Treatment
Stratford	M- 7	Webster	283	Des Moines River (Dry Run)	59	68
Swea City	M-11	Kossuth		Mud Creek	51	63
Thor	M-36	Humboldt			NEMTF	
Titonka	M-25	Kossuth		Buffalo Creek	51	63
Vincent	M-18	Webster		Brushy Creek	57	65
Wallingford	M-54	Emmet			NEMTF	
Webster City	M-45	Hamilton	24	Boone River	59	67
Wesley	M-37	Kossuth			NEMTF	
West Bend	M-26	Kossuth	24	West Fork Des Moines River (Prairie Creek)	50	62
Whittemore	M-48	Kossuth		Lotts Creek	51	64a
Woodward	M-81	Dallas		Beaver Creek	60	70
Woolstock	M-12	Wright			NEMTF	
			INDUSTRIAL			
American Can Co.	I-34	Polk		Des Moines River	61	71
American Can Co.	I- 4	Webster	314	Des Moines River	53	-
Armstrong Rubber Co.	I-35	Polk		Dean Lake	61	71

NEMTF: No Existing Municipal Treatment Facilities.

Table 8. Point Source Wastewater Discharge Locations in the Upper Des Moines River Basin in Iowa (continued).

Discharger	Reference Number	County	River* Mile	Discharge To	Page Reference: Quantity	Page Reference: Treatment
Beaver Valley Canning Co.	I-29	Polk		Dean Lake	-	70
Boone Valley Coop.	I-15	Wright	47	Boone River	57	-
Chicago Rock Island and Pacific RR.	I-36	Polk		Dean Lake	61	71
Coates Utility Co.	I-26	Webster	310	Des Moines River	55	64b
Cooperative Farm Chemicals Assn.	I-11	Webster		Des Moines River	56	65
Corn Belt Power Coop.	I-16	Humboldt	330	Des Moines River	52	-
Culligan Water Conditioning, Inc.	I- 2	Webster	312	Des Moines River	53	-
Deere and Co.	I-30	Polk		Rock Creek	60	69
Dickey Clay Mfg.	I-20	Webster	295	Des Moines River (Crooked Creek)	57	-
Emmetsburg Rendering Works	I- 6	Palo Alto	45	West Fork Des Moines River	50	-
Estherville Municipal Light Plant	I-27	Emmet	76	West Fork Des Moines River	49	-

Table 8. Point Source Wastewater Discharge Locations in the Upper Des Moines River Basin in Iowa (continued).

Discharger	Reference Number	County	River* Mile	Discharge To	Page Reference: Quantity	Page Reference: Treatment
Farmegg Production, Inc.	I-10	Webster		Des Moines River (Bass Creek)	52	64a
Farmland Industries	I-13	Webster	305	Des Moines River (Holiday Creek)	56	65
Firestone Tire and Rubber Co.	I-31	Polk		Wafley Creek	61	70
Ford Motor Co.	I-32	Polk		Des Moines River	61	70
Fort Dodge Creamery	I-24	Webster	314	Des Moines River	53	-
Franklin Mfg.	I- 5	Hamilton	24	Boone River	58	-
Frye Copy Systems	I-37	Polk		Des Moines River	61	71
Hallett Construction Co.	I-17	Pocahontas		North Branch Lizard Creek	53	-
Hormel and Co.	I-23	Webster	314	Soldier Creek	53	-
Iowa Beef Processors	I-19	Webster	311	Des Moines River	54	64b
Iowa Industrial Hydraulics, Inc.	I-21	Pocahontas	35	Lizard Creek	52	-
Iowa Power & Light Co.	I-39	Polk		Des Moines River	61	71

Table 8. Point Source Wastewater Discharge Locations in the Upper Des Moines River Basin in Iowa (continued).

Discharger	Reference Number	County	River* Mile	Discharge To	Page Reference: Quantity	Page Reference: Treatment
Iowa Public Service Co.	I- 1	Wright	47	Boone River (Drainage Ditch 94)	58	-
Land O'Lakes, Inc.	I- 9	Webster	312	Des Moines River	54	-
Lennox Industries	I-38	Polk		Des Moines River	61	71
Mid Continent Bottling Co.	I-33	Polk		Wafley Creek	61	71
Morrell and Co.	I-25	Emmet	73	West Fork Des Moines River	49	62
National Gypsum Co.	I- 7	Webster	309	Des Moines River (Gypsum Creek)	56	-
Northern Natural Gas Co.	I-18	Webster		Soldier Creek	53	-
P and M Stone Co., Inc.	I-12	Humboldt	14	West Fork Des Moines River	50	-
United States Gypsum Co.	I-22	Webster	310	Des Moines River	55	-
Wadco Foods, Inc.	I-14	Emmet	73	West Fork Des Moines River	49	-
Webster City Municipal Light & Power	I-28	Hamilton	23	Boone River	59	67
Webster Processing Co.	I- 3	Webster	309	Des Moines River	55	65

Table 8. Point Source Wastewater Discharge Locations in the Upper Des Moines River Basin in Iowa (continued).

Discharger	Reference Number	County	River* Mile	Discharge To	Page Reference Quantity	Page Reference Treatment
Welp and McCarter	I- 8	Webster	7	Lizard Creek	53	-
			SEMIPUBLIC			
Boone County Home	S- 3	Boone	265	Des Moines River (Poor Farm Creek)	60	68
Burr Oak Manor	S- 8	Kossuth		East Fork Des Moines River	51	64a
Camp Laurie	S- 1	Boone		Des Moines River	59	68
Dallas County Home	S-12	Dallas		Beaver Creek	60	-
Episcopal Center and Conference Camp	S- 4	Boone	265	Des Moines River (Poor Farm Creek)	60	68
Oak Lake Development	S- 7	Kossuth	52	East Fork Des Moines River	51	63
Regency Manor Mobile Home Park	S-11	Polk		Des Moines River	61	71
Savage Sanitary Sewer District Fort Dodge	S- 2	Webster	310	Des Moines River	55	65
Sentral Community School District	S- 5	Kossuth		Black Cat Creek	51	64a

Table 8. Point Source Wastewater Discharge Locations in the Upper Des Moines River Basin in Iowa (continued).

Discharger	Reference Number	County	River* Mile	Discharge To	Page Reference: Quantity	Page Reference: Treatment
Town and Country	S-10	Dallas		Beaver Creek	-	70
Woodward State Institution	S- 6	Boone	236	Des Moines River (Preston Branch)	60	69

* Main stem Des Moines River: 0 mile at confluence with Mississippi Rive River.

West Fork Des Moines River: 0 mile at confluence with East Fork Des Moines River.

East Fork Des Moines River: 0 mile at confluence with West Fork Des Moines River.

Boone River: 0 mile at confluence with Des Moines River.

Lizard Creek: 0 mile at confluence with Des Moines River.

Table 9. Point Source Wastewater Discharge Locations in the Raccoon River Basin.

Discharger	Reference Number	County	River* Mile	Discharge To	Page Reference: Quantity	Page Reference: Treatment
				MUNICIPAL		
Adel	M-1	Dallas	37.4	North Raccoon River	-	79
Albert City	M-2	Buena Vista		Lateral 2	72	76
Arcadia	M-6	Carroll		Brushy Creek	NEMTF	
Auburn	M-7	Sal			NEMTF	
Bagley	M-8	Guthrie		Mosquito Creek	74	81
Bayard	M-9	Guthrie		Willow Creek	NEMTF	
Breda	M-13	Carroll	75.5	Middle Raccoon River	-	80
Callender	M-14	Webster		West Butterick Creek	73	78
Carroll	M-15	Carroll	66.2	Middle Raccoon River	-	80
Churdan	M-16	Greene		Hardin Creek	73	78
Coon Rapids	M-17	Carroll	47.4	Middle Raccoon River	-	81
Dallas Center	M-18	Dallas		Walnut Creek	-	79
Dana	M-19	Greene			NEMTF	
Dawson	M-20	Dallas			NEMTF	
Dedham	M-21	Carroll			-	80
De Soto	M-24	Dallas		Bugler Creek	-	82
Earlham	M-25	Madison		Bear Creek	74	81

NEMTF: No Existing Municipal Treatment Facilities.

Table 9. Point Source Wastewater Discharge Locations in the Raccoon River Basin (continued).

Discharger	Reference Number	County	River* Mile	Discharge To	Page Reference: Quantity	Page Reference: Treatment
Farnhamville	M-26	Calhoun		Hardin Creek	-	78
Fonda	M-27	Pocahontas		Cedar Creek	72	77
Glidden	M-28	Carroll		Willow Creek	-	81
Gowrie	M-29	Webster		West Butterick Creek	73	78
Grand Junction	M-30	Greene		East Butterick Creek	73	79
Guthrie Center	M-33	Guthrie	43.4	South Raccoon River	-	80
Halbur	M-34	Carroll			NEMTF	
Harcourt	M-35	Webster		East Butterick Creek	NEMTF	
Jamaica	M-36	Guthrie			73	79
Jefferson	M-37	Greene		Drainage Ditch 132	73	78
Jolley	M-38	Calhoun			NEMTF	
Knierim	M-39	Calhoun			NEMTF	
Lake City - North	M-40	Calhoun		Lake Creek	73	77
Lake City - Southwest	M-41	Calhoun		Lake Creek	73	77
Lakeside	M-42	Buena Vista			-	76
Lakeview	M-43	Sac		Indian Creek	72	77
Lanesboro	M-44	Carroll			-	78

NEMTF: No Existing Municipal Treatment Facilities.

Table 9. Point Source Wastewater Discharge Locations in the Raccoon River Basin (continued).

Discharger	Reference Number	County	River* Mile	Discharge To	Page Reference: Quantity	Page Reference: Treatment
Laurens	M-45	Pocahontas			72	77
Lidderdale	M-46	Carroll		Storm Creek	-	80
Linden	M-47	Dallas			NEMTF	
Lohrville	M-48	Calhoun		Cedar Creek	73	78
Lytton	M-49	Sac		Camp Creek	72	77
Manson	M-50	Calhoun		Cedar Creek	73	78
Marathon	M-51	Buena Vista			NEMTF	
Menlow	M-52	Guthrie		South Raccon River	-	80
Minburn	M-53	Dallas	52.0	North Raccoon River	-	79
Nemaha	M-54	Sac			-	76
Newell	M-55	Buena Vista	154.0	North Raccoon River	72	77
Panora	M-57	Guthrie	16.3	Middle Raccoon River	74	81
Paton	M-58	Greene		East Butterick Creek	NEMTF	
Perry	M-59	Dallas	60.6	North Raccoon River	-	79
Pomeroy	M-61	Calhoun		Lake Creek	73	77
Ralston	M-62	Carroll			NEMTF	
Redfield	M-63	Dallas	16.4	Middle Raccoon River	74	81
Rembrandt	M-64	Buena Vista	196.0	North Raccoon River	72	76

NEMTF: No Existing Municipal Treatment Facilities.

Table 9. Point Source Wastewater Discharge Locations in the Raccoon River Basin (continued).

Discharger	Reference Number	County	River* Mile	Discharge To	Page Reference: Quantity	Page Reference: Treatment
Rinard	M-65	Calhoun		Cedar Creek	73	78
Rippey	M-66	Greene		Snake Creek	73	79
Rockwell City	M-67	Calhoun		Lake Creek	73	77
Sac City	M-68	Sac	156.3	North Raccoon River	72	76
Scranton	M-69	Greene		Drainage Ditch 171	73	78
Somers	M-71	Calhoun			NEMTF	
Storm Lake	M-72	Buena Vista		Boyer Creek	72	76
Storm Lake (Hy-Grade)	M-73	Buena Vista		Boyer Creek	72	76
Stuart	M-74	Adair		Long Branch Creek	NEMTF	
Truesdale	M-75	Buena Vista			NEMTF	
Van Meter	M-77	Dallas	29.2	South Raccoon River	74	82
Varina	M-78	Pocahontas			-	77
Waukee	M-79	Dallas		Sugar Creek	74	82
Willey	M-80	Carroll			NEMTF	
Yale	M-82	Guthrie			NEMTF	
Yetter	M-83	Calhoun			NEMTF	
INDUSTRIAL						
American Oil Co.	I-1	Polk		Walnut Creek		

NEMTF: No Existing Municipal Treatment Facilities.

Table 9. Point Source Wastewater Discharge Locations in the Raccoon River Basin (continued).

Discharger	Reference Number	County	River* Mile	Discharge To	Page Reference Quantity	Page Reference Treatment
Carroll Rendering Co.	I-5	Carroll		Middle Raccoon River	-	80
Gendler Stone Products Co., Inc.	I-11	Dallas		Bear Creek	74	81
Hormel	I-12	Dallas		North Raccoon River	-	79
Iowa Electric Light & Power Co.	I-13	Dallas		North Raccoon River	-	79
Iowa Public Service Co.	I-15	Buena Vista		Boyer Creek	72	76
Iowa Public Service Co. Carroll Station	I-16	Carroll		Middle Raccoon River	-	80
Mefferd Industries	I-18	Pocahontas		Cedar Creek	72	77
Meridith Corporation (Printing Division)	I-19	Polk		Raccoon River	74	82
Northern Iowa Natural Gas Co. (Redfield Compressor Station)	I-21	Dallas		South Raccoon River (Panther Creek)	74	81

Table 9. Point Source Wastewater Discharge Locations in the Raccoon River Basin (continued).

Discharger	Reference Number	County	River* Mile	Discharge To	Page Reference: Quantity	Page Reference: Treatment
Oscar Mayer & Co.	I-23	Dallas		North Raccoon River	-	81
Skelly Oil Company	I-24	Polk		Unnamed Tributary	74	82
Vilas & Company	I-25	Buena Vista		Storm Lake	72	76
Vista Products Co.	I-26	Buena Vista		Storm Lake	72	76
		SEMIPUBLIC			-	77
Country Village Mobile Home Park	S-2	Buena Vista		Storm Lake	72	76
Crossroads Enterprises	S-3	Sac		Indian Creek	73	78
KOA Campground	S-5	Polk		Raccoon River	-	82
Prairie Village Mobile Home Park	S-6	Dallas		Raccoon River	-	82
Rockwell City Women's Reformatory	S-8	Calhoun		Lake Creek	73	77
Twin Lakes Travel Park	S-11	Calhoun		Lake Creek	-	77

Table 9. Point Source Wastewater Discharge Locations in the Raccoon River Basin (continued).

* Des Moines River: 0 mile at confluence with Mississippi River.

Raccoon River and North Raccoon River: 0 mile at confluence with Des Moines River.

South Raccoon River: 0 mile at confluence with North Raccoon River.

Middle Raccoon River: 0 mile at confluence with South Raccoon River.

Table 10. Point Source Wastewater Discharge Locations in the Lower Des Moines River Above Red Rock Reservoir.

Discharger	Reference Number	County	Discharge To	Page Reference Treatment
		MUNICIPAL		
Ackworth	M-181	Warren	South River	87
Adair	M-164	Adair	S. Fork Middle R.	84
Altoona	M-155	Polk	Four Mile Creek	83
Ankeny E	M-153	Polk	Four Mile Creek	83
Bevington	M-168	Madison	Middle River	85
Bondurant	M-175	Polk	Mud Creek	86
Bussey	-	Marion		NEMTF
Carlisle	M-163	Warren	North River	84
Casey	M-165	Guthrie	Middle River	85
Clive	M-147	Polk	Des Moines River	83
Cumming	M-162	Warren	Middle Creek	84
Dallas	M-194	Marion	Tracy Creek	89
Des Moines	M-150	Polk	Des Moines River	83
Des Moines Highland Hills	M-151	Polk	Windmill Creek	84
Dexter	M-158	Dallas	N. Branch North R.	84
East Peru	M-170	Madison	Clanton Creek	85
Hamilton	-	Marion		NEMTF

NEMTF: No Existing Municipal Treatment Facilities.

Table 10. Point Source Wastewater Discharge Locations in the Lower Des Moines River Above Red Rock Reservoir (continued).

Discharger	Reference Number	County	Discharge To	Page Reference Treatment
Hartford	-	Warren		NEMTF
Harvey	-	Marion		NEMTF
Indianola	M-174	Warren	Middle River	86
Indianola	M-179	Warren	South River	86
Knoxville	M-191	Marion	Competine Creek	88
Lacoma	M-190	Warren	Mill Branch Creek	88
Lucas	M-188	Lucas	White Breast	88
Martensdale	M-169	Warren	Middle River	85
Marysville	-	Marion		NEMTF
Melcher	M-193	Marion	Tracy Creek	89
Menlo	M-157	Cuthrie	North River	83
Milo	M-180	Warren	Otter Creek	87
Mitchellville	M-184	Polk	Camp Creek	87
New Virginia	M-178	Warren	Squaw Creek	86
Norwalk	M-159	Warren	Windmill Creek	84
Osceola	M-186-1	Clark	White Breast	87
Osceola	M-186-2	Clark	White Breast	87
Patterson	M-167	Madison	Middle River	85
Pella	M-192	Marion	Sents Creek	88
Pleasant Hill	M-156	Polk	Des Moines River	83

NEMTF: No Existing Municipal Treatment Facilities.

Table 10. Point Source Wastewater Discharge Locations in the Lower Des Moines River Above Red Rock Reservoir (continued).

Discharger	Reference Number	County	Discharge To	Page Reference Treatment
Pleasantville	M-183	Marion	Coal Creek	87
Prairie City	M-185	Jasper	Calhoun Creek	87
Runnels	M-176	Polk	Mud Creek	86
Sandyville	M-182	Warren	South River	87
Slater	M-152	Story	Four Mile Creek	83
Spring Hill	M-173	Warren	Middle River	86
St. Charles	M-172	Madison	Middle River	85
St. Mary's	M-177	Warren	South River	86
Truro	M-171	Madison	Hay Br. Middle R.	85
West Des Moines	M-148	Polk	Des Moines River	83
Williamson	M-189	Lucas	White Breast	88
Windsor Heights	M-149	Polk	Des Moines River	83
Winterset	M-166	Madison	Middle River	85
Woodburn	M-187	Clark	White Breast	88
INDUSTRIAL				
Carlisle Sand & Gravel	I-77	Warren	North River	84
C.D. Hess and Son Rock	I-88	Marion	Winn Br., White Breast	88
Champlain Pet Co.	I-85	Clarke	White Breast	87

Table 10. Point Source Wastewater Discharge Locations in the Lower Des Moines River Above Red Rock Reservoir (continued).

Discharger	Reference Number	County	Discharge To	Page Reference Treatment
Concrete Materials	I-82	Clarke	South Squaw Creek	86
E.I. Sargent	I-75	Madison	Cedar Creek	84
E.I. Sargent	I-81	Madison	North Fork Clanton Creek	85
E.I. Sargent	I-83	Clarke	South Squaw Creek	86
Lacona Oil Co.	I-86	Warren	Mill Branch Creek	88
Nickerson Farms	I-78	Madison	Middle River	85
Pella Power Plant	I-89	Marion	Sents Creek	88
Schildberg Const. Co.	I-76	Madison	Cedar Creek	84
Schildberg Const. Co.	I-79	Madison	Middle River	85
Schildberg Const. Co.	I-80	Madison	Middle River	85
Stuckeys	I-84	Clarke	Squaw Creek	86
Vermeer Mfg. Co.	I-90	Marion	Sents Creek	88
SEMI PUBLIC				
Carlisle WTP	S-77	Warren	North River	84
Country Living MHP	S-72	Polk	Four Mile Creek	83
Des Moines Water Dev. Co.	S-76	Polk	Middle Creek	84

Table 10. Point Source Wastewater Discharge Locations in the Lower Des Moines River Above Red Rock Reservoir (continued).

Discharger	Reference Number	County	Discharge To	Page Reference Treatment
Greenwood WTP	S-70	Polk	Four Mile Creek	83
Hartford MHP	S-80	Warren	Butcher Creek	86
Ia. Highway Comm. Rest Area	S-78 A & B	Guthrie	Middle River	85
Ia. Highway Comm. Rest Stop	S-84	Polk	Ditch to Des Moines River	87
Ia. Highway Comm.	S-86	Clarke	White Breast	87
Ia. Promotional Man.	S-82	Clarke	Squaw Creek	86
Knoxville VA Hospital	S-90	Marion	Unnamed Tributary, Des Moines River	88
Knoxville VA W.T.P.	S-88	Marion	Competine Creek	88
Madison County Home	S-75	Madison	Cedar Creek	84
Marion County Home	S-91	Marion	Unnamed Tributary, Des Moines River	87
MBZ Mobile Home Park	S-83	Clarke	Squaw Creek	86
Menlo WTP	S-79	Guthrie	Middle River	85
Oakwood Heights MHP	S-69	Polk	Four Mile Creek	83
Pella WTP	S-92	Marion	Sents Creek	88
Red Rock Lave View Subdivision	S-89	Marion	Competine Creek	88
R & R Campground	S-87	Clarke	White Breast	88

Table 10. Point Source Wastewater Discharge Locations in the Lower Des Moines River Above Red Rock Reservoir (continued).

Discharger	Reference Number	County	Discharge To	Page Reference Treatment
S.E. Polk Comm. Sch.	S-73	Polk	Four Mile Creek	83
S.E. Polk High School	S-81	Polk	Mud Creek	86
Sunny Brook MHP	S-71	Polk	Four Mile Creek	83
Thomas Mitchell Park	S-85	Polk	Camp Creek	87
Winterset WTP	S-74	Madison	Cedar Creek	84

Table 11. Point Source Wastewater Discharge Quantities, Upper Des Moines River Basin (continued).

Ref. No.	Average Flow (mgd)	BOD_5 Summer (mg/l)	BOD_5 Summer (lb/day)	BOD_5 Winter (mg/l)	BOD_5 Winter (lb/day)	Suspended Solids (mg/l)	Suspended Solids (lb/day)	Ammonia Nitrogen (N) Summer (mg/l)	Ammonia Nitrogen (N) Summer (lb/day)	Ammonia Nitrogen (N) Winter (mg/l)	Ammonia Nitrogen (N) Winter (lb/day)	Phosphorus (Total P) (mg/l)	Phosphorus (Total P) (lb/day)	Total Dissolved Solids (mg/l)	Total Dissolved Solids (lb/day)	Temperature Summer (°F)	Temperature Winter (°F)	Other (mg/l unless noted otherwise)
West Fork Des Moines River (cont.)																		F Coli ≤ 10/100 T Coli ≤ 10/100 Surfactants = 0.08
M-2	0.185	28	43	40	61			2	3	10	15	4	6					
M-43	0.222	30	56	45	83			3	6	18	33	30	56					
I-6	0.0002	2,100	3.5			508	0.8	180	0.3					2268	3.8	195	175	pH = 6.0 units COD = 4420 TS = 1684 TVS = 1432 Oil = 14 F Coli = 559 x 10^9/100 ml T Coli = 757 x 10^6/100 ml
I-6	.00015	13,000	16			1176	1.5	1060	1.3					508	0.6			COD = 24,800 TS = 2776 TVS = 2068 Oil = 1070 F Coli = 600/100 ml T Coli < 1/100 ml
Prairie Creek																		
M-26	0.077	30	19	40	26			4	3	13	8	20	13					
Pilot Creek																		
M-4	0.032	30	8	45	12			6	2	15	4	15	4					
West Fork Des Moines River																		
I-12	5.04					160	6725									56	33	TS = 696

Table 11. Point Source Wastewater Discharge Quantities, Upper Des Moines River Basin (continued).

Ref. No.	Average Flow (mgd)	BOD_5 Summer (mg/l)	BOD_5 Summer (lb/day)	BOD_5 Winter (mg/l)	BOD_5 Winter (lb/day)	Suspended Solids (mg/l)	Suspended Solids (lb/day)	Ammonia Nitrogen (N) Summer (mg/l)	Ammonia Nitrogen (N) Summer (lb/day)	Ammonia Nitrogen (N) Winter (mg/l)	Ammonia Nitrogen (N) Winter (lb/day)	Phosphorus (Total P) (mg/l)	Phosphorus (Total P) (lb/day)	Total Dissolved Solids (mg/l)	Total Dissolved Solids (lb/day)	Temperature Summer (°F)	Temperature Winter (°F)	Other (mg/l unless noted otherwise)
West Fork Des Moines River																		pH = 6.8 units Alk as $CaCO_3$ = 320
M-10	0.683	20	114	30	171			10	57	5	28	20	114					
East Fork Des Moines River																		
M-14	0.089	25	19	40	30			1	1	12	9	4	3					
Mud Creek																		
M-11	0.047	30	12	60	24			4	2	20	8	15[b]	6					
M-42	0.099	50	41	100	83			10	8	22	18	20	17					
M-1	0.157	25	33	60	79			1	1	14	18	6	8					
Buffalo Creek																		
M-25	0.056	25	12	40	19			4	2	16	7	16	7					
East Fork Des Moines River																		
S-7	0.005[b]	25	1					6[b]	0.3			15[b]	1					
Black Cat Creek																		
M-39	0.043	25	9	25	9			2	1	8	3	10	4					
S-5	0.006[b]	25[b]	1					6[b]	0.3			15[b]	1					
East Fork Des Moines River																		
M-9	0.552	25	115	50	230			5	23	15	69	25	115					
S-8	0.011[b]	25[b]	2					6[b]	0.6			15[b]	1					
M-58	0.033	25	7	35	10			4	1	15	4	10	3					
Lotts Creek																		
M-48	0.151	25	31	115	145			2	3	10	13	18	23					

Table 11. Point Source Wastewater Discharge Quantities, Upper Des Moines River Basin (continued).

Ref. No.	Average Flow	BOD_5 Summer (mg/l)	BOD_5 Summer (lb/day)	BOD_5 Winter (mg/l)	BOD_5 Winter (lb/day)	Suspended Solids (mg/l)	Suspended Solids (lb/day)	Ammonia Nitrogen (N Summer (mg/l)	Ammonia Nitrogen (N Summer (lb/day)	Ammonia Nitrogen (N Winter (mg/l)	Ammonia Nitrogen (N Winter (lb/day)	Phosphorus (Total P) (mg/l)	Phosphorus (Total P) (lb/day)	Total Dissolved Solids (mg/l)	Total Dissolved Solids (lb/day)	Temperature Summer (°F)	Temperature Winter (°F)	Other (mg/l unless noted otherwise)
Trulner Creek																		
M-63	0.017	30	4	50	7			2	0.3	12	2	8	1					
East Fork Des Moines River																		
M-6	0.044	25	9	45	17			12	4	2	1	18	7					
Des Moines River																		
I-16	0.034	< 1	< 0.3			31	9	< .2	< 0.1			0.1	< 0.1	2178	618	85	76	pH = 6.95 units COD = 40 Kjel-N = 0.43 Alk as $CaCO_3$ = 16 TS = 2209 TVS = 322 Cr = 9.96 Cu = 0.02 Fe = 0.10 NO_3-N = 5.8
Bass Creek																		
I-10	0.0066[b]																	
Badger Creek																		
M-22	0.032[b]	30	8	36	10			2	0.5	12	3	10	3					
Lizard Creek																		
I-21	0.003	0	0			57	1	17.6	1			< .01	-	2515	63	68		pH = 6.74 units COD = 41.2 CN = 0.024 Cl = 280 Al = 0.51

Table 11. Point Source Wastewater Discharge Quantities, Upper Des Moines River Basin (continued)

Ref. No.	Average Flow	BOD_5 Summer (mg/l)	BOD_5 Summer (lb/day)	BOD_5 Winter (mg/l)	BOD_5 Winter (lb/day)	Suspended Solids (mg/l)	Suspended Solids (lb/day)	Ammonia Nitrogen (N) Summer (mg/l)	Ammonia Nitrogen (N) Summer (lb/day)	Ammonia Nitrogen (N) Winter (mg/l)	Ammonia Nitrogen (N) Winter (lb/day)	Phosphorus (Total P) (mg/l)	Phosphorus (Total P) (lb/day)	Total Dissolved Solids (mg/l)	Total Dissolved Solids (lb/day)	Temperature Summer (°F)	Temperature Winter (°F)	Other (mg/l unless noted otherwise)
																		Cd = 0.038
																		Cr = 0.058
																		Cu = 0.031
																		Hg < 0.05
																		Ni = 0.071, Ag = 0.051
																		NO_3-N = 35
M-50	0.236	30	59	45	89			1	2	7	14	18	35					
I-17	1.500					5	63							84	1051	76		pH = 7.8 units
																		Alk as $CaCO_3$ = 61
M-56	0.087	25	18	36	26			3	2	12	9	11	8					
I-8	0.123					0								640	657	54	52	pH = 8.2 units
																		TS = 640
I-8	0.05					14	6							566	236	68	70	pH = 8.5 units
																		TS = 580
I-8	0.210					42	74							469	821			pH = 8.2 units
																		TS = 511
Soldier Creek																		
I-18	0.090															65	40	pH = 8.0 units
I-23	0.158	< 5	< 7													120		pH = 7.2 units
																		Oil < 10
Des Moines River																		
I-24	0.200															80	80	
I-4	0.020															75		pH = 6.9 units
M-53	3.367	35	983	45	1264			7	197	31	871	26	730					
I-2	0.006	< 5	< 1			44	2	< 0.1	-			0.15	0.01	9188	460	62	62	pH = 7.2 units
																		COD < 10

Table 11. Point Source Wastewater Discharge Quantities, Upper Des Moines River Basin (continued).

Ref. No.	Average Flow	BOD_5 Summer (mg/l)	BOD_5 Summer (lb/day)	BOD_5 Winter (mg/l)	BOD_5 Winter (lb/day)	Suspended Solids (mg/l)	Suspended Solids (lb/day)	Ammonia Nitrogen (N) Summer (mg/l)	Ammonia Nitrogen (N) Summer (lb/day)	Ammonia Nitrogen (N) Winter (mg/l)	Ammonia Nitrogen (N) Winter (lb/day)	Phosphorus (Total P) (mg/l)	Phosphorus (Total P) (lb/day)	Total Dissolved Solids (mg/l)	Total Dissolved Solids (lb/day)	Summer (°F)	Winter (°F)	Other (mg/l unless noted otherwise)
																		SO_4 = 150
																		Cl = 360
																		Ca = 100
																		Fe = 0.2
																		Mg = 0.05
																		Na = 230
																		F Strep = 10/100 ml
																		F Coli = 10/100 ml
																		T Coli = 10/100 ml
S-2	0.050[b]	25[b]	10				6[b]	3			15[b]	6						
I-22	0.043	7.2	3			6	2				0.08	0.03	2778	996		60	40	pH = 7.9 units
																		COD = 27, NO_3-N = 0.4
																		NO_2 = 0.2
I-22	0.180	3.0	5			5	8				0.08	0.1	2709	4067		60	40	pH = 7.9 units
																		COD = 18
																		NO_3-N = 0.7
I-26	0.0095																	
I-3	No discharge																	
Gypsum Creek																		
I-7	0.00288	30	1			15	0.4	0.56	0.01		0.24	0.01	1381	33				COD = 42, NO_3-N = 2.00
																		Kjel-N = 12.26
I-7	0.0685	1	0.6			17	10	0.22	0.1		0.20	0.1	2575	1471				COD = 12, NO_3-N = 6.90
																		Kjel-N = 5.6

Table 11. Point Source Wastewater Discharge Quantities, Upper Des Moines River Basin (continued).

Ref. No.	Average Flow	BOD_5 Summer (mg/l)	BOD_5 Summer (lb/day)	BOD_5 Winter (mg/l)	BOD_5 Winter (lb/day)	Suspended Solids (mg/l)	Suspended Solids (lb/day)	Ammonia Nitrogen (N) Summer (mg/l)	Ammonia Nitrogen (N) Summer (lb/day)	Ammonia Nitrogen (N) Winter (mg/l)	Ammonia Nitrogen (N) Winter (lb/day)	Phosphorus (Total P) (mg/l)	Phosphorus (Total P) (lb/day)	Total Dissolved Solids (mg/l)	Total Dissolved Solids (lb/day)	Summer (°F)	Winter (°F)	Other (mg/l unless noted otherwise)
I-7	0.00216	10	0.2			28	0.5	0.22	-			0.38	0.01	1051	19			COD = 23, NO_3-N = 1.40 Kjel-N 3.08
I-7 ·	0.00432	10	0.4			28	1.0	0.22	0.01			0.38	0.01	1051	38			COD = 23, NO_3-N = 1.40 Kjel-N = 3.08
Des Moines River																		
M-57	0.057	25	12	41	19			2	1	8	4	8	4					
Holiday Creek																		
I-13									100		100							
Des Moines River																		
I-11	0.84	6	42			0		20	140			0.09	0.6	3000	21,017	75	40	COD = 32, NO_3-N = 2 Org-N = 3 Kjel-N = 22 Na = 450 Oil = 1 SO_4 = 2260 Cl = 320 Ca = 260 Al = 0.6 Mg = 0.07 Cr = 0.05 Cu = 0.05 Fe = 4.6 Pb = 0.01

Table 11. Point Source Wastewater Discharge Quentities, Upper Des Moines River Basin (continued).

Ref. No.	Average Flow	BOD_5 Summer (mg/l)	BOD_5 Summer (lb/day)	BOD_5 Winter (mg/l)	BOD_5 Winter (lb/day)	Suspended Solids (mg/l)	Suspended Solids (lb/day)	Ammonia Nitrogen (N) Summer (mg/l)	Ammonia Nitrogen (N) Summer (lb/day)	Ammonia Nitrogen (N) Winter (mg/l)	Ammonia Nitrogen (N) Winter (lb/day)	Phosphorus (Total P) (mg/l)	Phosphorus (Total P) (lb/day)	Total Dissolved Solids (mg/l)	Total Dissolved Solids (lb/day)	Temperature Summer (°F)	Temperature Winter (°F)	Other (mg/l unless noted otherwise)
I-11																		Mn = 0.29 Ni = 0.02 Zn = 0.16 F Coli = 76/100 ml T Coli = 7800/100 ml
Crooked Creek																		
M-41	0.047	25	10	40	16													
I-20	0.054					9	4					0.05	0.02	161[a]	729	65	57	pH = 7.9 units, NO_3-N = 0.12
Brushy Creek																		
M-18	0.02[b]	25[b]	5[b]															
M-3	0.022	25	5	35	6							2	0.4	8	1	10	2	
Boone River																		
M-51	0.023	28	5	40	8							2	0.4	12	2	6	1	
East Branch Boone River																		
M-40	0.242	27	54	50	101							2	4	14	28	10	20	
Joint Drainage Ditch 3, 47																		
M-15	0.040	25	8	35	12							1	0.3	12	4	15	5	
Otter Creek																		
M-23	0.083	31	21	46	32							1	0.7	14	10	10	7	
Boone River																		
M-44	0.024	31	6	80	16							1	0.2	17	2	25	5	
Drainage Ditch 94																		
I-15	0.720																	

Table 11. Point Source Wastewater Discharge Quantities, Upper Des Moines River Basin (continued).

Ref. No.	Average Flow	BOD_5 Summer (mg/l)	BOD_5 Summer (lb/day)	BOD_5 Winter (mg/l)	BOD_5 Winter (lb/day)	Suspended Solids (mg/l)	Suspended Solids (lb/day)	Ammonia Nitrogen (N) Summer (mg/l)	Ammonia Nitrogen (N) Summer (lb/day)	Ammonia Nitrogen (N) Winter (mg/l)	Ammonia Nitrogen (N) Winter (lb/day)	Phosphorus (Total P) (mg/l)	Phosphorus (Total P) (lb/day)	Total Dissolved Solids (mg/l)	Total Dissolved Solids (lb/day)	Temperature Summer (°F)	Temperature Winter (°F)	Other (mg/l unless noted otherwise)
I-1	0.016	3	0.4			4	0.5	1.1	0.2			0.5	0.07	495	66	84	71	pH = 7.6 units
																		COD = 4
																		Kjel-N = 1.54
																		Ortho-P = 1.6
																		TS = 499
																		NO_3-N = 0.07
																		TVS = 0.2
																		Alk as $CaCO_3$ = 280
																		SO_4 = 166
																		Cl = 4
																		Zn = 0.06
																		Phenols = 0.009
																		Ca = 179
																		Algal inhibitor = 0.08
M-24	0.652	45	245	75	408			4	22	14	76	11	60					
	Eagle Creek																	
M-66	0.261	35	76	70	152			4	9	16	35	9	20					
	Boone River																	
I-5	0.46	20	77			36	138	0.77	3			3.02	12	710	2724	73	73	pH = 9.5 units
																		Kjel-N = 1.13
																		Ortho-P = 3
																		TS = 734
																		TVS = 65

Table 11. Point Source Wastewater Discharge Quantities, Upper Des Moines River Basin (continued).

Ref. No.	Average Flow	BOD 5 Summer (mg/l)	BOD 5 Summer (lb/day)	BOD 5 Winter (mg/l)	BOD 5 Winter (lb/day)	Suspended Solids (mg/l)	Suspended Solids (lb/day)	Ammonia Nitrogen (N) Summer (mg/l)	Ammonia Nitrogen (N) Summer (lb/day)	Ammonia Nitrogen (N) Winter (mg/l)	Ammonia Nitrogen (N) Winter (lb/day)	Phosphorus (Total P) (mg/l)	Phosphorus (Total P) (lb/day)	Total Dissolved Solids (mg/l)	Total Dissolved Solids (lb/day)	Temperature Summer (°F)	Temperature Winter (°F)	Other (mg/l unless noted otherwise)
																		COD = 40
																		Alk as $CaCO_3$ = 102
																		SO_4 = 310
																		Cl = 56
																		Flouride = 0.92
																		Ca = 22.9
																		Cr = 0.86
																		Fe = 0.5
																		Pb < 0.1
																		Mg = 16.3
																		Mn = 0.03
																		Cu < 0.01
																		NO_3-N = 0.61
M-45	1.582	25	330			40	528	6	79			16	211	25	330			
I-28	11.52															80	45	
Des Moines River																		
M-7	0.042	25	9			25	9	8	3			19	7	19	7			
Skillet Creek																		
M-30	0.057	25	12			60	28	4	2			14	7	18	9			
Des Moines River																		
S-1	0.010[b]	25[b]	2					6[b]	0.5					15[b]	1			

Table 11. Point Source Wastewater Discharge Quantities, Upper Des Moines River Basin (continued).

Ref. No.	Average Flow	BOD_5 Summer (mg/l)	BOD_5 Summer (lb/day)	BOD_5 Winter (mg/l)	BOD_5 Winter (lb/day)	Suspended Solids (mg/l)	Suspended Solids (lb/day)	Ammonia Nitrogen (N) Summer (mg/l)	Ammonia Nitrogen (N) Summer (lb/day)	Ammonia Nitrogen (N) Winter (mg/l)	Ammonia Nitrogen (N) Winter (lb/day)	Phosphorus (Total P) (mg/l)	Phosphorus (Total P) (lb/day)	Total Dissolved Solids (mg/l)	Total Dissolved Solids (lb/day)	Temperature Summer (°F)	Temperature Winter (°F)	Other (mg/l unless noted otherwise)
Poor Farm Creek																		
S-3	0.07[b]	25[b]	15					6[b]	4			15[b]	9					
S-4	0.007[b]	25[b]	1					6[b]	0.4			15[b]	1					
Honey Creek																		
M-33	1.991	40	664	70	1162			4	66	16	266	18	299					
Preston Branch																		
S-6	0.2[b]	25[b]	42					6[b]	10			15[b]	25					
Big Creek																		
Little Creek																		
M-32	0.198	25	41	40	66			8	13	21	35	23	38					
Big Creek																		
M-60	0.070	35	20	50	29			10	6	20	12	20	12					
Beaver Creek																		
M-86	0.262	25	50					1	30			30						T Coli = 30 x 10^3/100ml
M-81	0.084	25	18	45	32			20	14	30	21	21	8					pH = 8.8
																		COD = 40
																		Grease = 9.8
M-84	0.057	25	40					1	1			30						
M-82	0.100	30	25	35	29			5	4	8	7	10	8					Org - N = 9
S-12	0.063	75	39	150	79			4	2	8	4							
Rock Creek																		
I-30	0.130																	

Table 11. Point Source Wastewater Discharge Quantities, Upper Des Moines River Basin (continued).

Ref. No.	Average Flow	BOD_5 Summer (mg/l)	BOD_5 Summer (lb/day)	BOD_5 Winter (mg/l)	BOD_5 Winter (lb/day)	Suspended Solids (mg/l)	Suspended Solids (lb/day)	Ammonia Nitrogen (N) Summer (mg/l)	Ammonia Nitrogen (N) Summer (lb/day)	Ammonia Nitrogen (N) Winter (mg/l)	Ammonia Nitrogen (N) Winter (lb/day)	Phosphorus (Total P) (mg/l)	Phosphorus (Total P) (lb/day)	Total Dissolved Solids (mg/l)	Total Dissolved Solids (lb/day)	Temperature Summer (°F)	Temperature Winter (°F)	Other (mg/l unless noted otherwise)
Des Moines River																		
I-31	1.270	5	53			20	212	0.30	3			1	11					TDS = 500
I-32	0.194															78		
I-33	0.50	25	10	65	271	30	125	4	17	1								
S-11																		
I-34																		
I-35	2.848	1	24	8	190	10	238	1	24	1	24	10	238					NO_2 - N = 1 TDS = 715
I-36	0.005																	
I-37	0.72							0.2	1			0.5	3			68	64	Org - N = 0.15 NO_3 - N = 0.16
I-38	0.038															75	45	
I-39	208.0																	
Total	240.403		6,422						1823.38				3017.06					

(208.0 mgd is from I-39)

b. Estimated: poor or no data available

Table 12. Wastewater Treatment Facilities, Upper Des Moines River Basin.

Discharge (Ref. No.)	Existing Design Average Day Capacity (mgd)	Present Average Day Flow (mgd)	BOD_5 Influent Conc. (mg/l)	BOD_5 Effluent Conc. (mg/l)	Suspended Solids Influent Conc. (mg/l)	Suspended Solids Effluent Conc. (mg/l)	Type of Treatment: Primary	Type of Treatment: Secondary	Type of Treatment: Solids Treatment	Comments
West Fork Des Moines River										
Estherville (M-17)	2.92	2.025	1128	135	1147	145	Gn Sm Cm	Fo Cm Ftr Cm	Dfh Ls Xl	Plans and specifications for new treatment facility are presently being reviewed by IDEQ. Proposed treatment processes include primary clarification, high rate trickling filters, activated sludge aeration, flow equalization and polishing ponds, dual-media filters, and chlorination.
Morrell & Co. (I-25) Wallingford (M-54)		0.37		150		230		Lo		No existing municipal treatment facility. Preliminary engineering report submitted to IDEQ during October, 1969.
Graettinger (M-2)	0.246	0.185		35				Lo		Plant put into operation during 1968.
Emmetsburg (M-43)	0.266	0.222		40			Ga Sch Cm Ftr Cp		Ga Sch Cm	Existing plant is organically overloaded. City is in the process of designing new treatment facility. Consent order issued by IDEQ requires final plans and specifications to be prepared by 1/1/74 with contract awarded by 6/1/74. Plant to be designed for effluent BOD_5 and ammonia concentrations of 10 mg/l and 2 mg/l, respectively.
Prairie Creek										
West Bend (M-26)	0.111	0.077		35			Ci	Ftr Cp	Bo	Existing treatment facility was constructed during the 1940's and is rather poor condition.
Beaver Creek										
Mallard (M-49)	0.054									No existing municipal treatment facility. Waste stabilization pond has been designed to replace private septic tanks. Construction permit was issued by IDEQ in September, 1973.

Table 12. Wastewater Treatment Facilities, Upper Des Moines River Basin (continued).

Discharge (Ref. No.)	Existing Design Average Day Capacity (mgd)	Present Average Day Flow (mgd)	BOD_5 Influent Conc. (mg/l)	BOD_5 Effluent Conc. (mg/l)	Suspended Solids Influent Conc. (mg/l)	Suspended Solids Effluent Conc. (mg/l)	Type of Treatment: Primary	Secondary	Solids Treatment	Comments
Pilot Creek										
Rolfe (M-4)	0.085	0.032		40				Lo		Waste stabilization pond was put into operation during May, 1970; replaced Imhoff tank and sand filters.
West Fork Des Moines River										
Rutland (M-46)										No existing municipal treatment system. Preliminary engineering report submitted to IDEQ during October, 1973.
Humboldt (M-10)	0.926	0.683	219	20	676	70	Sh Gw Cm	Ftr Cm	Dfr Bo Xl	
East Fork Des Moines River										
Armstrong (M-14)	0.175	0.089		30				Lo		Plant placed in operation during 1966.
Mud Creek										
Swea City (M-11)	0.063	0.047		45				Lo		Plant placed in operation during 1969.
Bancroft (M-42)		0.099		80			Ci	Fs	Bo	Presently designing new waste stabilization pond to replace existing plant.
East Fork Des Moines River										
Burt (M-1)	0.073	0.157		45					Lo	Plant placed in operation during 1964.
Buffalo Creek										
Titonka (M-25)	0.115	0.056		35			Cp Ftoc	Lo		
East Fork Des Moines River										
Oak Lake Development (S-7)										Construction of a one acre waste stabilization pond to treat the flow from 100 people was approved by IDEQ on February 14, 1973.

Table 12. Wastewater Treatment Facilities, Upper Des Moines River Basin (continued).

Discharge (Ref. No.)	Existing Design Average Day Capacity (mgd)	Present Average Day Flow (mgd)	BOD_5 Influent Conc. (mg/l)	BOD_5 Effluent Conc. (mg/l)	Suspended Solids Influent Conc. (mg/l)	Suspended Solids Effluent Conc (mg/l)	Type of Treatment: Primary	Secondary	Solids Treatment	Comments
Black Cat Creek										
Ringsted (M-39)	0.077	0.043		25				Lo		Plant placed in operation during 1969.
Sentral Community School (S-5)	0.006						Cm	Ft		Constructed in 1957.
Fenton (M-59)										No existing municipal treatment system. Preliminary engineering report submitted to IDEQ during January, 1967.
East Fork Des Moines River										
Algona (M-9)	0.655	0.552		40			Sg Gm (Km Cm)	Ftr Cm	Dfh Bo	Plant constructed during 1954.
Burr Oak Manor (S-8)	0.015							Aa	HA	
Livermore (M-58)	0.110	0.033		30				Lo		Plant placed in operation during 1968.
Lotts Creek										
Wittemore (M-48)	0.147	0.151		75			Sh Gh Cm	Ftr Cp	Dfh Bo	Plant constructed in 1960.
Trulner Creek										
Bode (M-63)	0.050	0.017		45				Lo		Plant placed in operation during 1968.
East Fork Des Moines River										
Dakota City (M-6)	0.10	0.044		35			Sh Cl	Ftr Cp	Bo	Plant constructed in 1958.
Bass Creek										
Farmegg Production, Inc. (I-10)	0.0066							Lo		Plant constructed in 1970.
Badger Creek										
Badger (M-22)	0.045	0.032		35				Lo		Two-cell waste stabilization pond with first cell constructed in 1961 and second cell constructed in 1968.

Table 12. Wastewater Treatment Facilities, Upper Des Moines River Basin (continued).

Discharge (Ref. No.)	Existing Design Average Day Capacity (mgd)	Present Average Day Flow (mgd)	BOD_5 Influent Conc. (mg/l)	BOD_5 Effluent Conc. (mg/l)	Suspended Solids Influent Conc. (mg/l)	Suspended Solids Effluent Conc. (mg/l)	Type of Treatment: Primary	Secondary	Solids Treatment	Comments
Lizard Creek										
Pocahontas (M-50)	0.156	0.236		40			Sch Cm	Ftr	Dfh Bo	Plant constructed in 1951. Preliminary report is being prepared for new facilities.
Gilmore City (M-56)	0.100	0.087		30				Lo		Plant placed in operation during 1959.
Clare (M-16)										No existing municipal treatment facilities. Community has attempted to obtain grant assistance for waste stabilization pond since 1967 with active interest in August, 1973.
South Branch Lizard Creek										
Barnum (M-31)										No existing municipal treatment system. Preliminary engineering report submitted to IDEQ during May, 1973.
Spring Creek										
Moorland (M-5)										No existing municipal treatment system. Preliminary engineering report submitted to IDEQ during June, 1971.
Des Moines River										
Fort Dodge (M-53)	5.30	3.367	420	38	375	34	Sm Gm Oa Ka Cm	Fto Cm Eg Ftr Cm	Dfhemt Ds Bo Ls	Last plant expansion was completed in 1965.
Iowa Beed Processors (I-19)	1.20	1.00		30		120	O Af	Ln Lo	T Xl	Plant placed in operation during 1970. Waste stabilization pond covers about 40 acres. No discharge allowed when river flow is less than 32 cfs.
Coats Utility Co. (I-26)	0.0095							Lo		

Table 12. Wastewater Treatment Facilities, Upper Des Moines River Basin (continued).

Discharge (Ref. No.)	Existing Design Average Day Capacity (mgd)	Present Average Day Flow (mgd)	BOD 5 Influent Conc. (mg/l)	BOD 5 Effluent Conc. (mg/l)	Suspended Solids Influent Conc. (mg/l)	Suspended Solids Effluent Conc. (mg/l)	Type of Treatment: Primary	Type of Treatment: Secondary	Type of Treatment: Solids Treatment	Comments
Savage Sanitary Dist. (S-2)	0.05							La Lo		Plant constructed in 1970 to serve Webster County Home and new residential development.
Webster Processing Co. (I-3)	0.05							Lo		Treatment facility was constructed during 1967-68. In 1971, waste stabilization pond was being redesigned as a complete retention facility with no discharge.
Otho (M-57)	0.044	0.057		35				Lo		Plant placed in operation during 1968.
Holiday Creek										
Farmland Industries (I-13)								Lo		Plant placed in operation during 1966.
Des Moines River										
Cooperative Farm Chemical Assn. (I-11)		0.52		6		0		L		Package aeration plant is provided for sanitary flow. Chemical process water is also treated to reduce chromate and ammonia.
Crooked Creek										
Lehigh (M-41)	0.150	0.047		35				Lo		
Brushy Creek										
Vincent (M-18)								Lo		Plant placed in operation during October, 1972.
Duncombe (M-3)	0.034	0.022		30				Lo		Plant placed in operation during 1967.
Boone River										
Corwith (M-51)	0.091	0.023		35				Lo		Waste stabilization pond placed in operation during October, 1971; replaced Imhoff tank and sand filters.

Table 12. Wastewater Treatment Facilities, Upper Des Moines River Basin (continued).

Discharge (Ref. No.)	Existing Design Average Day Capacity (mgd)	Present Average Day Flow (mgd)	BOD_5 Influent Conc. (mg/l)	BOD_5 Effluent Conc. (mg/l)	Suspended Solids Influent Conc. (mg/l)	Suspended Solids Effluent Conc. (mg/l)	Type of Treatment: Primary	Secondary	Solids Treatment	Comments
East Branch Boone River										
Britt (M-40)	0.18	0.242		40			Sc Cm	Ftr Cm	Dch Bo Xl	Existing plant was constructed in 1935 and is in poor condition. A site has been approved for a new waste stabilization pond designed to replace the existing facility.
Prairie Creek										
Wesley (M-37)										No existing municipal treatment system. Preliminary engineering report submitted to IDEQ during December, 1967.
Lu Verne (M-61)										No existing municipal treatment facility. Preliminary plans have been prepared for three-cell waste stabilization pond.
Joint Drainage Ditch 3, 47										
Renwick (M-15)	0.096	0.040		30				Lo		Plant constructed in 1962.
Otter Creek										
Kanawha (M-23)	0.087	0.083		40				Lo		Waste stabilization pond placed in operation in March, 1970; replaced Imhoff tank and sand filters.
Boone River										
Goldfield (M-44)	0.219	0.024		50				Lo		Plant constructed in 1963.
Drainage Ditch 3										
Thor (M-36)										No existing municipal treatment facility. Plans and specifications are being prepared for waste stabilization pond system.

Table 12. Wastewater Treatment Facilities, Upper Des Moines River Basin (continued).

Discharge (Ref. No.)	Existing Design Average Day Capacity (mgd)	Present Average Day Flow (mgd)	BOD_5 Influent Conc. (mg/l)	BOD_5 Effluent Conc. (mg/l)	Suspended Solids Influent Conc. (mg/l)	Suspended Solids Effluent Conc. (mg/l)	Type of Treatment: Primary	Secondary	Solids Treatment	Comments
Drainage Ditch 94										
Eagle Grove (M-24)	0.504	0.652	106	52			Gm Sc Cm	Fth Cm	Dfht Dop Bo	Existing sewers have a large quantity of infiltration during periods of wet weather. Treatment plant is overloaded and raw sewage is by-passed frequently. City had preliminary report prepared which recommended construction of a large aerated lagoon and oxidation pond to treat by-pass flows.
Eagle Creek										
Clarion (M-66)	0.145	0.261		60			Sh Cm	Ftr Ctp	Dch Bo	Plant constructed in 1933-34. Presently making modifications to recirculate trickling filter effluent.
Woolstock (M-12)										No existing municipal treatment facility. Preliminary plans were made for sanitary sewers and waste stabilization pond system in 1967-68, and city made application for a loan from FHA. City is still served by individual septic tanks.
Boone River										
Webster City (M-45)	1.50	1.582	341	25	108	90	Sh Gw Cm	Ftr Cm	Dfh Bo Xl	Plant was built in 1939 and expanded in 1963. Preliminary report issued October 30, 1973, recommends adding another digestor, two more trickling filters, and final clarifiers.
Webster City Municipal Light & Power (I-28)	11.52	11.52					Lo			

Table 12. Wastewater Treatment Facilities, Upper Des Moines River Basin (continued).

Discharge (Ref. No.)	Existing Design Average Day Capacity (mgd)	Present Average Day Flow (mgd)	BOD_5 Influent Conc. (mg/l)	BOD_5 Effluent Conc. (mg/l)	Suspended Solids Influent Conc. (mg/l)	Suspended Solids Effluent Conc. (mg/l)	Type of Treatment: Primary	Secondary	Solids Treatment	Comments
Des Moines River										
Stratford (M-7)	0.070	0.042		25			Sh Ae	Ae Lp		Treatment plant was constructed in 1965. Existing sewers have a large quantity of infiltration during periods of wet weather. A compliance order was issued by IDEQ to correct the infiltration problem. The compliance order requires: preliminary report by 6/1/74, final plans and specifications by 12/1/74, construction contract be awarded by 4/1/75, and project completed by 12/1/74, construction contract be awarded by 4/1/75, and project completed by 12/31/75.
Skillet Creek										
Dayton (M-30)	0.084	0.057		40			Sh Ci	Ftr Cp	Bo	Plant was constructed in 1956 and is in poor condition. Compliance order issued by IDEQ requires in-plant and operation modifications to be completed by 6/1/74.
Des Moines River										
Camp Laurie (S-1)		0.010								Permit issued to construct waste stabilization pond in September, 1969.
Poor Farm Creek										
Boone Co. Home (S-3)		0.008					Lo			Plant constructed in 1967.
Episcopal Center and Conference Camp (S-4)		0.007								Permit issued 1/18/73 to construct waste stabilization pond to replace septic tank. No discharge allowed during summer low flow periods.
Bluff Creek										
Boxholm (M-64)										No existing municipal treatment system. Final plans and specifications received by IDEQ on 11/26/73 for waste stabilization pond.

Table 12. Wastewater Treatment Facilities, Upper Des Moines River Basin (continued).

Discharge (Ref. No.)	Existing Design Average Day Capacity (mgd)	Present Average Day Flow (mgd)	BOD_5 Influent Conc. (mg/l)	BOD_5 Effluent Conc. (mg/l)	Suspended Solids Influent Conc. (mg/l)	Suspended Solids Effluent Conc. (mg/l)	Type of Treatment: Primary	Secondary	Solids Treatment	Comments
Pilot Mound (M-35)										No existing municipal treatment system. Plans and specifications are being prepared for waste stabilization pond system.
Honey Creek										
Boone (M-33)	1.60	1.99	165	42	149	34	Sch Gam Ka Cm	Ftr Cm	Ho Zil Vv Xp	Plant constructed in 1958
Des Moines River										
Luther (M-28)										No existing municipal treatment system. Preliminary engineering report submitted to IDEQ during May, 1973.
Preston Branch										
Woodward State Institution (S-6)	0.213	0.20					Sm G Cm	Ft Cm E	D B	Plant constructed in 1941.
Big Creek										
Little Creek										
Madrid (M-32)	0.305	0.198	35				Sh Ga (Cp Do)	Ftr Cm	Xl	Plant constructed in 1967.
Big Creek										
Polk City (M-60)	0.080	0.070	40					Lo		Plant constructed in 1963.
Rock Creek										
Deere & Co. (I-30)		0.130								Deere & Co. plans to send all cooling and process wastes to city industrial sewer by end of 1974.

Table 12. Wastewater Treatment Facilities, Upper Des Moines River Basin (continued).

Discharge (Ref. No.)	Existing Design Average Day Capacity (mgd)	Present Average Day Flow (mgd)	BOD_5 Influent Conc. (mg/l)	BOD_5 Effluent Conc. (mg/l)	Suspended Solids Influent Conc. (mg/l)	Suspended Solids Effluent Conc. (mg/l)	Type of Treatment: Primary	Secondary	Solids Treatment	Comments
Beaver Creek										
Beaver (M-70)										
Ogden (M-86)	0.246	0.342		35			Sch Gm Cm	Ftr Cp	Dfp Bo	Plant placed in operation in 1958. Existing sewers have a large quantity of infiltration during period of wet weather.
Berkley (M-71)										
Woodward (M-81)	0.0965	0.084		30		45	Lo	Lo		Total surface area equals 8.52 acres.
Bouton (M-72)										
Town & Country, Inc. (S-10)	0.0065						Lo			Total surface area equals 0.58 acres.
Granger (M-84)										
Grimes (M-82)	0.080	0.100		30			Sh (Cp Do)	Ftr Cp	Bo	The City of Grimes is in the process of building a new treatment facility.
Beaver Valley Canning Co. (I-29)		0.063		850			Lo	Co ly		Plans are being made to connect into the city's new treatment facility when completed.
Urbandale Sanitary Sewer District (M-76)							G Sn	C FtC E	DB	Discharges are cooling water, curing water, and blowdown all other wastes are handled by the City of Des Moines Stp.
Des Moines River										
Firestone Tire & Rubber Co. (I-31)		1.270		5						
Ford Motor Co. (I-32)		0.194								0.01 mgd sanitary wastes to Des Moines STP. Cooling water and process water discharged to city storm sewer.

Table 12. Wastewater Treatment Facilities, Upper Des Moines River Basin (continued).

Discharge (Ref. No.)	Existing Design Average Day Capacity (mgd)	Present Average Day Flow (mgd)	BOD_5 Influent Conc. (mg/l)	BOD_5 Effluent Conc. (mg/l)	Suspended Solids Influent Conc. (mg/l)	Suspended Solids Effluent Conc. (mg/l)	Type of Treatment: Primary	Secondary	Solids Treatment	Comments
Mid Continent Bottling Co. (I-33)	0.050		31				Lo	Lo		They have NPDES Permit (11-73 to 11-78) which limits BOD_5 to 25 mg/l.
Regency Manor Mobile Home Park (S-11)							P	Lp		
American Can Co. (I-34)	0.202									Discharge is water for cooling, air conditioning, etc. MPDES permit issued 9-14-73 effective till 9-1-78.
Armstrong Rubber Co. (I-35)		2.85	8							
Chicago, Rock Island, and Pacific R.R. (I-36)		0.005								Cooling water discharged to city storm sewer.
Frye Copy Systems (I-37)		0.72								Sanitary wastes discharged to city sanitary sewer. Cooling water discharged to city storm sewer.
Lennox Industries (I-38)		0.038								
Iowa Power & Light Co. (I-39)		150-200 7.4								Three wastewater discharges - Condenser cooling water - Ash sluicing water (following ash settling pond) - Boiler blowdown and softening demineralizing flows.

Table 13. Point Source Wastewater Discharge Quantities, Raccoon River Basin.

Ref. No.	Average Flow (mgd)	BOD_5 Summer (mg/l)	BOD_5 Summer (lb/day)	BOD_5 Winter (mg/l)	BOD_5 Winter (lb/day)	Suspended Solids (mg/l)	Suspended Solids (lb/day)	Ammonia Nitrogen (N) Summer (mg/l)	Ammonia Nitrogen (N) Summer (lb/day)	Ammonia Nitrogen (N) Winter (mg/l)	Ammonia Nitrogen (N) Winter (lb/day)	Phosphorus (Total P) (mg/l)	Phosphorus (Total P) (lb/day)	Total Dissolved Solids (mg/l)	Total Dissolved Solids (lb/day)	Temperature Summer (°F)	Temperature Winter (°F)	Other (mg/l unless noted otherwise)
North Raccoon River																		
M-64	0.075	25	40					16										
Lateral 2																		
M-2	0.080	25	17	25	17			6	4	9	6	15	10					
North Raccoon River																		
Boyer Creek																		
I-15		3				4		0				0.6						TDS = 1,355
M-72	1.516	30	379	35	443			5	63	25	316							
M-73	1.045	30	261	30	261	60	523	17	148	90	784							
S-2																		
I-25	0.0986							3	2							48	43	
I-26	0.180	28	42					3	5							115		
North Raccoon River																		
M-68	0.270	25	56	50	113			8	18	17	38	38	86					
N Cedar Creek																		
M-45	0.198	30	50	95	157			2	3	24	40	13	21					
I-18	0.0082																	
M-27	0.088	40		100				5		10		30						
M-55	0.087	25	13	100	53			4	2	30	16	21	11					
Indian Creek																		
M-43	0.218	25	45	30	55													
Camp Creek																		
M-49	0.157	30		50				1	-	12		5						

Table 13. Point Source Wastewater Discharge Quantities, Raccoon River Basin (continued).

Ref. No.	Average Flow (mgd)	Summer (mg/l)	Summer (lb/day)	Winter (mg/l)	Winter (lb/day)	Suspended Solids (mg/l)	Suspended Solids (lb/day)	Ammonia Nitrogen (N) Summer (mg/l)	Ammonia Nitrogen (N) Summer (lb/day)	Ammonia Nitrogen (N) Winter (mg/l)	Ammonia Nitrogen (N) Winter (lb/day)	Phosphorus (Total P) (mg/l)	Phosphorus (Total P) (lb/day)	Total Dissolved Solids (mg/l)	Total Dissolved Solids (lb/day)	Temperature Summer (°F)	Temperature Winter (°F)	Other (mg/l unless noted otherwise
Lake Creek																		
M-61	0.073	50	30	25	15			1	1	18	11	7	4					
M-67	0.264	25	55	35	77			6	13	26	57	17	37					
S-8		25				25												
M-40	0.090	25	19	25	19					35	26							
M-41	0.080	25	17	45	30			2	1	18	12	17	11					
Cedar Creek																		
M-50	0.110	25	23	60	55			10	9	17	16	35	32					
M-65		25		25														
M-48	0.053	25	11	40	18			4	2	13	6	16	7					
Drainage Ditch 71																		
S-3																		
M-69	0.065	30	16	60	33			7	4	28	15	20	11					
Drainage Ditch 132																		
M-37	0.485	30	121	50	202			5	20	18	73	16	65					
Hardin Creek																		
M-36	0.110	25	23	25	23			4	4	1	1	25	23					
M-16	0.028	30	7	25	6			1	0			8	2					
Butterick Creek																		
M-14	0.020																	
M-29	0.070	25	15	50	29			12	7	2	1	15	4					
M-30	0.040	25	8	35	11			1	0	1	0	10	3					
Snake Creek																		
M-66	0.012	25	3					6	1			2	0					Org - N = 5 lb/day

Table 13. Point Source Wastewater Discharge Quantities, Raccoon River Basin (continued).

Ref. No.	Average Flow (mgd)	BOD_5 Summer (mg/l)	BOD_5 Summer (lb/day)	BOD_5 Winter (mg/l)	BOD_5 Winter (lb/day)	Suspended Solids (mg/l)	Suspended Solids (lb/day)	Ammonia Nitrogen (") Summer (mg/l)	Ammonia Nitrogen (") Summer (lb/day)	Ammonia Nitrogen (") Winter (mg/l)	Ammonia Nitrogen (") Winter (lb/day)	Phosphorus (Total P) (mg/l)	Phosphorus (Total P) (lb/day)	Total Dissolved Solids (mg/l)	Total Dissolved Solids (lb/day)	Temperature Summer (°F)	Temperature Winter (°F)	Other (mg/l unless noted otherwise)
North Raccoon River																		
M-59	1.052	25	219	30	263			3	26	10	88	16	140					
I-23		25		110				34		127								
I-12	1.233																	
I-13	0.002																	
M-53		25		25						4		6						
M-18	0.188	25	39	40	63			1	2	10	16	14	22					
M-1	0.069	25	14	35	20			1	1	13	7	21	12					NO_3 - N = 16 lb/day
South Raccoon River																		
M-33	0.186	25	39	40	62			1	2	16	25	35	54					
Long Branch																		
M-74	0.201	25	42	35	59			2	3	40	67	23	39					
Brushy Creek																		
M-21	0.009	25	2	40	3													
Middle Raccoon River																		
M-13	0.063	25	13	85	45					6	3	27	14					
M-15	0.805	25	168	25	168			1	7	14	94	30	201					Org - N = 141b/day
I-5																		
I-16		0	0			0.3		0.6				2						TDS = 157 NO_3 - N = 2 1b/day
Storm Creek																		
M-45																		
Middle Raccoon River																		
M-17	0.081	25	17	35	24			4	3	19	13							
Willow Creek																		
M-28	0.062	60	31	130	67			10	5	130	67	37	19					

Table 13. Point Source Wastewater Discharge Quantities, Raccoon River Basin (continued).

Ref. No.	Average Flow	BOD_5 Summer (mg/l)	BOD_5 Summer (lb/day)	BOD_5 Winter (mg/l)	BOD_5 Winter (lb/day)	Suspended Solids (mg/l)	Suspended Solids (lb/day)	Ammonia Nitrogen (N) Summer (mg/l)	Ammonia Nitrogen (N) Summer (lb/day)	Ammonia Nitrogen (N) Winter (mg/l)	Ammonia Nitrogen (N) Winter (lb/day)	Phosphorus (Total P) (mg/l)	Phosphorus (Total P) (lb/day)	Total Dissolved Solids (mg/l)	Total Dissolved Solids (lb/day)	Temperature Summer (°F)	Temperature Winter (°F)	Other (mg/l unless noted otherwise)
Middle Raccoon River																		
M-57	0.150	25	31	40	50													
Mosquito Creek																		
M-8																		
Middle Raccoon River																		
M-63	0.062	25	13	50	26			1	1	12	6	8	4					
I-21	0.0015																	
I-22	0.34 (based on 28 day/yr)	20	58															
Bear Creek																		
M-25	0.236	25	49	35	69			1	2	11	22	10	20					
I-11																		
Bugler Creek																		
M-77	0.033	25	7	95	26			1	0	56	15							
Sugar Creek																		
M-79		30		100														
Raccoon River																		
I-24	0.008															60	68	
I-19	0.85																	
Total	7.2013		1409						310				351					

Table 14. Wastewater Treatment Facilities, Raccoon River Basin.

Discharge (Ref. No.)	Existing Design Average Day Capacity (mgd)	Present Average Day Flow (mgd)	BOD_5 Influent Conc. (mg/l)	BOD_5 Effluent Conc. (mg/l)	Suspended Solids Influent Conc. (mg/l)	Suspended Solids Effluent Conc (mg/l)	Type of Treatment: Primary	Type of Treatment: Secondary	Type of Treatment: Solids Treatment	Comments
North Raccoon River										
Marathon (M-51)										
Rembrandt (M-64)		0.075		30			Lo	Lo		Lagoon.
Lateral 2										
Albert City (M-2)	0.048	0.080		25			Sh Cl	Ftrc Cp	Bo X	Plant put into operation during October, 1951. It is in good condition considering its age but is about due to be replaced.
Boyer Creek										
Iowa Public Service (I-15)		0.100		3	2	4	None			Discharge is cooling water.
Storm Lake (M-72)	2.40	1.516		40			Sc Gm Km Cm	Fo Cm Ftr Cm	Dm Fth Bo	IDEQ requires final plans for new STP by 1-1-75.
Storm Lake, Hy-Grade (M-73)	2.653	1.045		25			Ln La La	Lo Lo Lp		(Constructed in 1966).
Country Village Mobile Home Park (S-2)							Lo			Permit issued March, 1972.
Vilas and Co., Inc. (I-25)		0.0986		0						Sanitary wastes are sent to Storm Lake's STP. Discharge is defreeze water.
Vista Products Co. (I-26)		0.180		28						Discharge is cooling water.
Lakeside (M-42)										Lakeside discharges to Storm Lake's Industrial lagoon.
North Raccoon River										
Sac City (M-68)	0.220	0.270		40			Sch Cm	Ftr Cm	Dcm H	Preliminary plans were made for a new STP in 1973.
Nemaha (M-54)										City and school is served by industrial septic tanks.

Table 14. Wastewater Treatment Facilities, Raccoon River Basin (continued).

Discharge (Ref. No.)	Existing Design Average Day Capacity (mgd)	Present Average Day Flow (mgd)	BOD_5 Influent Conc. (mg/l)	BOD_5 Effluent Conc. (mg/l)	Suspended Solids Influent Conc. (mg/l)	Suspended Solids Effluent Conc. (mg/l)	Type of Treatment: Primary	Type of Treatment: Secondary	Type of Treatment: Solids Treatment	Comments
Cedar Creek										
Laurens (M-45)	0.198	0.150		40			Sh Cm	Ftr Cp	Dfh Bo	Plant constructed in 1953.
Mefferd Industries (I-18)		0.0082								Discharge is from the chrome rinse tank.
Varina (M-78)							Sh Cl	Ftr Cp	Dfp Bo	Plant originally built in 1919 with major modification in 1957. Needs updating. Large quantity of infiltration during wet weather.
Fonda (M-27)	0.111	0.088		54						
Newell (M-55)	0.110	0.087		35			Sh Cl	Ftr Cm	Bo	Plant constructed in 1964.
Indian Creek										
Lakeview (M-43)	0.060	0.218								Plant constructed in 1970.
North Raccoon River										
Auburn (M-7)										A waste stabilization pond is being considered.
Camp Creek										
Jolley (M-38)										
Lytton (M-49)	0.167	0.157		40			La	Lo Lo		
Yetter (M-83)										
Lake Creek										
Pomeroy (M-61)	0.062	0.073		35			Lo	Lo		
Rockwell City (M-67)	0.288	0.264		30			Sch Gh Cm	Ftr Cp	Dfh Bo	Sewers have large quantity of infiltration during wet weather.
Rockwell City Women's Reformatory (S-8)				25			Lo			Lagoon (0.68 acres) constructed in 1961.
Lake City N (M-40)	0.150	0.090		30			Sh Gh Cm	Ftr Cl Ftn	Do Bo	
Lake City SW (M-41)	0.20	0.80					Cl	Ftn	Bo	A new plant consisting of two mechanically equipped settling tanks, trickling filter, polishing lagoon, and digestor is proposed.
Twin Lakes Travel Park (S-11)										Permit issued November 15, 1967, for a complete retention lagoon.

Table 14. Wastewater Treatment Facilities, Raccoon River Basin (continued).

Discharge (Ref. No.)	Existing Design Average Day Capacity (mgd)	Present Average Day Flow (mgd)	BOD_5 Influent Conc. (mg/l)	BOD_5 Effluent Conc. (mg/l)	Suspended Solids Influent Conc. (mg/l)	Suspended Solids Effluent Conc. (mg/l)	Type of Treatment: Primary	Secondary	Solids Treatment	Comments
North Raccoon River										Individual septic tanks.
Lanesboro (M-44)										
Cedar Creek										
Manson (M-50)	0.190	0.110		35			Lo	Lo		Lagoons constructed in 1960.
Knierim (M-39)							None			
Somers (M-71)							None			
Rinard (M-65)				25			Cs	Fs		
Lohrville (M-48)	0.069	0.053		30			Sh Cl	Ftr E Cn	Bo X	Plant constructed in 1958.
Drainage Ditch 171										
Crossroads Enterprises (S-3)							Cs	Fs		
Scranton (M-69)	0.127	0.065		35						
Drainage Ditch 132										
Jefferson (M-37)	0.360	0.485		40			Sm Km Cm	Ftr Cm	Dfh Bo	Preliminary plans have been prepared for expansion, including nitrification.
Mardin Creek										
Farnhamville (M-26)	0.180	0.110		25			Lo	Lo		Total surface area equals 2.5 acres.
Churdan (M-16)	0.032	0.028		27			Lo	Lo		Lagoons built in 1962. Total surface area equals 2.9 acres.
Butterick Creek										
Callender (M-14)	0.050	0.020					Lo	Lo		Presently constructed two waste stabilization lagoons.
Gowrie (M-29)	0.081	0.070		26			Sh Cm	Ftr Cp	Do Bo	Excessive infiltration during wet weather.
Harcourt (M-35)	0.04									Proposed two-cell lagooon with total surface area of 3.2 acres.

Table 14. Wastewater Treatment Facilities, Raccoon River Basin (continued).

Discharge (Ref. No.)	Existing Design Average Day Capacity (mgd)	Present Average Day Flow (mgd)	BOD_5 Influent Conc. (mg/l)	BOD_5 Effluent Conc. (mg/l)	Suspended Solids Influent Conc. (mg/l)	Suspended Solids Effluent Conc. (mg/l)	Type of Treatment: Primary	Secondary	Solids Treatment	Comments
Paton (M-58)	0.048									Construction permit issued for a two-cell lagoon.
Dana (M-19)										
Grand Junction (M-30)	0.072	0.040		35			Sch Cl	Bo	Ftr Cp	Sewers have large quantity of infiltration during wet weather.
North Raccoon River										
Jamaica (M-36)										
Snake Creek										
Rippey (M-66)	0.040	0.012		25			Lo	Lo		One-cell lagoon (3.2 acres) constructed in 1969.
North Raccoon River										
Dawson (M-20)										Town with decreasing population. No treatment facility planned.
Perry (M-59)	1.545	1.052		35			Sch Ga Cm	Fto Cm Ftr Cm	Dfh Bo Ls	
Oscar Mayer Co. (I-23)	1.00			50			Ln	Ln	Lo	They have an odor problem from the lagoons and have had fish kills--probably NH_3.
Hormel & Perry (I-12)	1.625	1.233								No permit file.
Iowa Electric Light & Power Co. (I-13)	0.002									Discharges boiler, cooling tower blowdown, and water softener wash water.
Minburn (M-53)	0.048			25			Lo	Lo		Two-cell lagoon with total surface area of 5.2 acres, built in 1967.
Dallas Center (M-18)	0.066	0.188		30			Sh Cl	Ftr Cp	Bo	
Dallas County Home										In later 1972, they were about to build a lagoon sized for 110 people (one acre). No further information is available.
Adel (M-1)	0.224	0.069		30			Gnw Sm (Cp Do)	Ftr Cp	Bo	

Table 14. Wastewater Treatment Facilities, Raccoon River Basin (continued).

Discharge (Ref. No.)	Existing Design Average Day Capacity	Present Average Day Flow	BOD_5 Influent Conc.	BOD_5 Effluent Conc.	Suspended Solids Influent Conc.	Suspended Solids Effluent Conc.	Type of Treatment: Primary	Type of Treatment: Secondary	Type of Treatment: Solids Treatment	Comments
South Raccoon River										
Guthrie Center (M-33)	0.286	0.186		35			Sch (Gan Ka) Cm	Foc Cm Fth Cm	Dth Bo X	
Brushy Creek										
Arcadia (M-6)										
Halbur (M-34)										
Dedham (M-21)	0.035	0.009		30			Lo	Lo		
South Raccoon River										
Menlow (M-52)	0.150	0.201		35			Gm Sh Cm	Ftr Cp	Dop Bo X L	Sewers have a large quantity of infiltration during wet weather.
Long Branch										
Stuart (M-74)										
Middle Raccoon River										
Breda (M-13)	0.055	0.063		40			Ll	Fs	Bo	Permit issued 6-4-73 to build waste stabilization lagoon.
Carroll (M-15)	1.200	0.805		27			Sch Km Cm	Fth Cm Ftr	Dth Bo X L	Presently building a new plant.
Carroll Rendering Co. (I-5)		1.0*		40*						As of September 28, 1970, Carroll Rendering Co. was in the process of building a new sewage treatment facility.
Iowa Public Service Co. Carroll Station (I-16)			0	0	1	0.3				Discharge is cooling water. Submitted application for operating permit 2-27-74.
Storm Creek										
Lidderdale (M-46)							Lo	Lo		Lagoon constructed in 1973.

* Assumed value.

Table 14. Wastewater Treatment Facilities, Raccoon River Basin (continued).

Discharge (Ref. No.)	Existing Design Average Day Capacity (mgd)	Present Average Day Flow (mgd)	BOD_5 Influent Conc. (mg/l)	BOD_5 Effluent Conc. (mg/l)	Suspended Solids Influent Conc. (mg/l)	Suspended Solids Effluent Conc. (mg/l)	Type of Treatment: Primary	Secondary	Solids Treatment	Comments
Middle Raccoon River										
Willey (M-80)										
Coon Rapids (M-17)	0.120	0.081		25			Sh Km Cm	Ftr Cm	Dfr Bo	Plant constructed in 1942.
Willow Creek										
Glidden (M-28)	0.088	0.062		50			Sch Cl	Ftr Cp	Bo	Plant constructed in 1951.
Ralston (M-62)										
Bayard (M-9)										Permit issued 2-1-73 to construct a new treatment facility.
Middle Raccoon River										
Panora (M-57)	0.125	0.150		35			Lo	Lo		Total surface area equals 10 acres.
Linden (M-47)							None			
Mosquito Creek										
Bagley (M-8)							Cs	None	X	Inadequate treatment facility with no future plans. City has been decreasing in population.
Yale (M-82)										
South Raccoon River										
Redfield (M-63)	0.120	0.062		40			Lo	Lo		Lagoon constructed in 1968.
Northern Iowa Natural Gas Co., Redfield Compressor Station (I-21)		0.0015								Discharge is cooling water and effluent from three septic tanks.
Northern Iowa Natural Co., Redfield Storage Area (I-22)		0.35 (28 days/ year)								
Bear Creek										
Earlham (M-25)	0.093	0.236		30			Lo	Lo		Lagoons have wet weather problem but seem to be functioning properly
Gendler Stone Products Co., Inc. (I-11)	0.024									

Table 14. Wastewater Treatment Facilities, Raccoon River Basin (continued).

Discharge (Ref. No.)	Existing Design Average Day Capacity (mgd)	Present Average Day Flow (mgd)	BOD_5 Influent Conc. (mg/l)	BOD_5 Effluent Conc. (mg/l)	Suspended Solids Influent Conc. (mg/l)	Suspended Solids Effluent Conc. (mg/l)	Type of Treatment: Primary	Type of Treatment: Secondary	Solids Treatment	Comments
Bugler Creek										
De Soto (M-24)				31			Lo	Lo		Lagoon built in 1970.
Raccoon River										
Van Meter (M-77)	0.027	0.033		50			Lo	Lo		Plant built in 1963 and is having seepage problems. Total surface area equals 3.8 acres. Using only one cell.
Prairie Village Mobile Home part (S-6)										Lagoon is so oversized that there is no discharge. It is, in effect, an evaporation pond.
Sugar Creek										
Waukee (M-79)	0.083			50			La	Lo		Seems that lagoon is too small, aeration should help, but no results were actually given.
Raccoon River										
Skelly Oil Co. (I-24)		0.008					Lo			
Meridith Corporation (I-19)		0.85								NPDES permit issued 9-27-73 limits SS to 20 mg/l and pH to 6.5-9.0
ROA Campgrounds (S-5)										Permit issued 8-25-69 for a waste stabilization lagoon.

Table 15. Point Source Wastewater Treatment Facilities and Discharge Quantities, Lower Des Moines River Basin Above Red Rock Reservoir.

Discharger (Ref. No.)	Population 1970/Design	Effluent Flow(mgd) Average/Design	Effluent BOD_5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment	Comments
Des Moines River						
Clive M-147	3,005					To Des Moines STP
West Des Moines M-148	16,441					To Des Moines STP
Windsor Heights M-149	6,303					To Des Moines STP
Des Moines (*1) M-150	201,404/540,000	38.9/35.0	30/9,733	11/3,569	Trickling filter	
Yeader Creek						
Des Moines Area C Sanitary Lagoon M-222	NA/3,050	-/0.3			One cell lagoon	Under construction
Four Mile Creek						
Slater M-152	1,094/350	0.95/0.158	60/475	14/111	Two cell lagoon	16.81 acres
Ankeny E M-153	6,700/4,200	0.910/0.285	30/228	8/61	Trickling filter	New plant is planned to handle hydraulic and organic overloading.
Oakwood Heights MHP S-69		NA			Lagoon	164 spaces, total detention.
Greenwood STP S-70		NA				Iron backwash-1000 gal/week.
Sunny Brook MHP S-71		.025/NA	23/5	8	Lagoon	
Altoona M-155	2,883/500	0.534/0.5	30/134	8/36	Trickling filter, disinfection	Built 1961
Country Living MHP S-72		NA			Lagoon	
S.E. Polk Comm. Sch. S-73		0.013/0.026	25/2.7		Extended aeration	Built 1963
Des Moines River						
Pleasant Hill M-156	1,536/3,664	0.110/0.360	36/33	9/8	Trickling filter, disinfection	Built 1972
North River						
Menlo STP M-157	391				NEMTF	

Table 15. Point Source Wastewater Treatment Facilities and Discharge Quantities, Lower Des Moines River Basin Above Red Rock Reservoir.

Discharger (Ref. No.)	Population 1970/Design	Effluent Flow(mgd) Average/Design	Effluent BOD_5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment	Comments
North Branch						
Dexter STP M-158	652/750	NA/.075	44/28	11/7	Two cell lagoon	7.5 acres
Cedar Creek						
Winterset WTP S-74		0.720/NA				Filter backwash
Madison County Home S-75		NA/0.005	NA	NA	Aerated lagoon, polishing pond	
E. I. Sargent I-75		NA			Settling ponds	Quarry dewatering
Schildberg I-76		NA			None	Quarry dewatering
North River						
Middle Creek						
Cumming M-162	189				NEMTF	
Windmill Creek						
Ia. Metro Sewer M-160	NA/1,500	.100/.120	37/31	8/7	One cell lagoon	15 acres
Norwalk M-159	1,745					To Iowa Metro Sewer
Des Moines Highland Hills M-151	4,600/6,100	.525/.432	40/175	16/70	Trickling filter	
Des Moines Area B M-223	NA/3,050	NA/0.30			Single cell lagoon	Under construction
Middle Creek						
Des Moines Water Dev. Co. S-76		.216/NA				Iron filter backwash, pH 7.2
Greenfield Plaza M-161	NA/2,000	.350/.200	NA	NA	One cell lagoon	15.9 acres
North River						
Carlisle STP M-163	2,246/4,000	.104/.295	25/22	1/.9	Four cell lagoon	36.1 acres
Carlisle WTP S-77		.065/NA				Filter backwash pH 7.4
Carlisle Sand & Gravel I-77						
Middle River						
South Fork						
Adair M-164	750/1,000	.057/.100	45/19	8/3	Imhoff tank, trickling filter	Built 1962

Table 15. Point Source Wastewater Treatment Facilities and Discharge Quantities, Lower Des Moines River Basin Above Red Rock Reservoir.

Discharger (Ref. No.)	Population 1970/Design	Effluent Flow(mgd) Average/Design	Effluent BOD_5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment	Comments
Middle River						
Casey M-165	561/700	.022/.070	25/5	3/.6	Contact stabilization & polishing pond	
Menlo WTP S-79		.027/NA			Sludge lagoon	Filter backwash
Ia. Highway Comm. Rest Area S-78-A&B		.003	NA	NA	Lagoon	Direct discharge
Schildberg Const. Co. I-79		NA			Lagoon	Quarry dewatering NW¼, S17, T77, R31W
Schildberg Const. Co. I-80		NA				Dewatering quarry SE¼, S17, T77, R31W
Nickerson Farms I-78		.006	NA	NA	Lagoon	Total retention
Winterset M-166	3,685/5,300	.320/.500	28/75	6/16	Trickling filter	Built 1969
Patterson M-167	120				NEMTF	
Bevington M-168	54				NEMTF	
Martensadale M-169	306/400	NA/.04	26	5	Two cell lagoon	3.44 acres
Middle River						
Clanton Creek						
North Fork						
E.I. Sargent I-81					None	Quarry dewatering
East Peru M-170	184				NEMTF	
Hay Branch						
Truro M-171	359/450	.045/.040	25/9	NA	Two cell lagoon	3.5 acres
Unnamed Tributary						
St. Charles M-172	443				NEMTF	

Table 15. Point Source Wastewater Treatment Facilities and Discharge Quantities, Lower Des Moines River Basin Above Red Rock Reservoir.

Discharger (Ref. No.)	Population 1970/Design	Effluent Flow(mgd) Average/Design	Effluent BOD_5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment	Comments
Middle River						
Spring Hill M-173	131				NEMTF	
Unnamed Tributary						
Indianola M-174	4,976/5,500	.651/.463	25/136	3/16	Trickling filter	North plant built 1953
Butcher Creek						
Hartford MHP S-80		NA			Single cell lagoon	
Des Moines River						
Mud Creek						
Bondurant M-175	462/486	.047/.049	48/19	12/4.7	Two cell lagoon	4.16 acres, constructed 1960
S.E. Polk High School S-81		.020	25/.7	1	Extended aeration	
Runnells M-176	354				NEMTF	To build extended aeration activated sludge facility
South River						
St. Mary's M-177	105				NEMTF	
Squaw Creek						
South Squaw Creek						
Concrete Materials I-82		NA			None	Quarry operations
E. I. Sargent I-83		NA			None	Quarry operations
Squaw Creek						
Ia. Promotional Man. S-82		NA			Lagoon	System in poor conditions
MBZ Mobil Home Park S-83		NA			Single cell lagoon	
New Virginia M-178	450/462	.028/.028	25/5.8		Two cell lagoon	4 acres
Stuckeys I-84		NA/.003			Aeration to soil absorption pit	
South River						
Indianola M-179	4,000/4,000	.045/.40	25/9	3/1.1	Contact stabilization & polishing pond	South plant

Table 15. Point Source Wastewater Treatment Facilities and Discharge Quantities, Lower Des Moines River Basin Above Red Rock Reservoir.

Discharger (Ref. No.)	Population 1970/Design	Effluent Flow(mgd) Average/Design	Effluent BOD_5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment	Comments
South River						
Otter Creek						
Milo M-180	561/480	NA/.048	54	3	Two cell lagoon	Const. 1968 4 acres
South River						
Ackworth M-181	111				NEMTF	
Sandyville M-182	89				NEMTF	
Coal Creek						
Pleasantville M-183	1,297/1,300	.047/.120	33/13	7/2.7	Three cell lagoon	10.7 acres
Des Moines River						
Camp Creek						
Mitchellville M-184	1,341/1,500	.085/.150	35/25	6/4.3	Imhoff tank & trickling filter	Built 1954
Ditch						
Ia. Highway Comm. Rest Stop S-S4		NA			Lagoon	Seasonal discharge
Camp Creek						
Thomas Mitchell Park S-85		NA			Lagoon	Seasonal discharge
Des Moines River						
Calhoun Creek						
Prairie City M-185	1,141/2,400	NA/.208	NA	NA	Two cell lagoon	3.2 acres
White Breast						
Ia. Highway Comm. S-86		NA/.004			Lagoon	
Osceola M-186-1	1,900/400	.22/.19	51/94		Aerated lagoon	S. plant 20 acres, plant overloaded by industrial wastes, new plant plans submitted
Osceola M-186-2	3,120/19,470	.19/.225	46/73	23/36	Trickling filter	E. plant
Champlain Pet. Co. I-85		NA			Lagoon	Total retention

Table 15. Point Source Wastewater Treatment Facilities and Discharge Quantities, Lower Des Moines River Basin Above Red Rock Reservoir.

Discharger (Ref. No.)	Population 1970/Design	Effluent Flow(mgd) Average/Design	Effluent BOD_5 (mg/l)/(lb/day)	Effluent Ammonia-N (mg/l)/(lb/day)	Treatment	Comments
R & R Campground S-87		NA			Lagoon	
Woodburn M-187	186				NEMTF	
Lucas M-188	247				NEMTF	
Williamson M-189	216				NEMTF	
Mill Branch Creek						
Lacona Oil Co. I-86					None	Car wash-oil and grease
Lacona STP M-190	424/540	.034/.081	25/7	2/.6	Two cell lagoon	7.61 acres - D.T. = 82 days, Const. 1964
White Breast						
Winn Branch						
C. D. Hess & Son Rock I-88		NA			None	Quarry dewatering
Competine Creek						
Knoxville STP M-191	7,755/12,500	.606/1.25	25/126	10/50	Trickling filter & disinfection	East plant
Knoxville WTP S-88		NA				Filter backwash water
Red Rock Lake View Subdivision S-89		NA			Lagoon	81 lots
Unnamed Tributary						
Knoxville V.A. Hospital S-90		.186/.250			Trickling filter & disinfection	Plant to be abandoned, sewage to go to municipal plant
Marion County Home S-91		NA			Lagoon	No discharge
Sents Creek						
Pella STP M-192	NA	.054/.043	31/14	3/1.35	Imhoff tank & trickling filter	South west plant const. 1949
Pella STP S-92		0.028				Filter backwash water
Pella Power Plant I-89		0.07				Cooling tower & boiler blowdown - 4.5 ppm chromium
Vermeer Mfg. Co. I-90		NA			Septic tank to holding pond	Lagoon planned for future

Table 15. Point Source Wastewater Treatment Facilities and Discharge Quantities, Lower Des Moines River Basin Above Red Rock Reservoir.

Discharger (Ref. No.)	Population	Effluent			Treatment	Comments
		Flow(mgd)	BOD_5	Ammonia-N		
	1970/Design	Average/Design	(mg/l)/(lb/day)	(mg/l)/(lb/day)		
English Creek						
Tracy Creek						
Melcher M-193	913/1,259	.10/.1259	33/28	5/4	Two cell lagoon	10.7 acres
Dallas M-194	438					To Melcher lagoon

Table 16. Table Abbreviations for Wastewater Treatment Facilities.

A-----Aeration (in tanks or basins)
Aa----Activated sludge, diffused air aeration
Ac----Contact stabilization
Ad----Aerobic digestion
Ae----Extended aeration
Af----Air flotation
Am----Activated sludge, mechanical aeration
Ao----Oxidation ditch
Ap----Aeration, plain, without sludge return

B-----Sludge beds
Bo----Open
Bc----Glass covered

C-----Settling tanks
Ci----Two-story (Imhoff)
Cm----Mechanically equipped
Cp----Plain, hopper bottom, or intermittently drained for cleaning
Cs----Septic tank
Ct----Multiple tray, mechanically equipped
CmDm--Two-story "Clarigester"
CpDo--Two-story "Spiragester"

D-----Digesters, separate sludge
Dc----With cover (fixed if not otherwise specified)
D(cg)-Gasometer in fixed cover
De----Gas used in engines (heat usually recovered)
Df----With floating cover
Dg----With gasometer cover
Dh----Gas used in heating
Dm----Mixing
Do----Open top
Dp----Unheated
Dr----Heated
Ds----Gas storage in separate holder
Dt----Stage digestion

E-----Chlorination
Ec----With contact tank
Eg----By chlorine gas
Eh----By hypochlorite

F-----Filters
Fc----Covered filter
Fo----Roughing filter
Fr----Rapid sand or other sand straining
Fs----Intermittent sand
Ft----Trickling (no further details)
Fth---High capacity
Ft2H--High capacity, two-stage
Ftn---Fixed nozzle, standard capacity
Ftr---Rotary distributor, standard capacity
Ftt---Traveling distributor, standard capacity

G-----Grit chambers
Ga----Aerated grit removal
Gh----Without continuous removal mechanism
Gm----With continuous removal mechanism
Gp----Grit pocket at screen chamber
Gw----Separate grit washing device

H----Sludge storage tanks (not second-stage digestion units)
Ha----Aerated
Hc----Covered
Hm----With stirring or concentrating mechanism
Ho----Open

I-----Sewage application to land
If----Ridge and furrow irrigation
Is----Subsurface application
lu----Land underdrained
ly----Spray irrigation

K-----Chemical treatment-flocculation. Chemical treatment-type units or equipment not necessarily complete or

Table 16. Table of Abbreviations for Wastewater Treatment Facilities. (continued).

operated as chemical treatment.
Ka----Flocculation tank, air agitation
Kc----Chemicals used
Km----Flocculation tank, mechanical agitation
Kx----No chemicals used

L-----Lagoons
La----Aerated lagoon
Le----Evaporation lagoon
Ln----Anaerobic lagoon
Lo----Waste stabilization lagoon
Lp----Polishing lagoon
Ls----Sludge lagoon - not for treatment of sewage

O-----Grease removal or skimming tanks - not incidental to settling tanks
Oa----Aerated tank (diffused air)
Om----Mechanically equipped tank
Ov----Vacuum type

S-----Screens
Sc----Comminutor (screenings ground in sewage stream)
Sf----Fine screen (less than 1/8" opening)
Sh----Bar rack, hand cleaned 1/2" to 2" openings
Si----Intermediate screen 1/8" to 1/2" openings
Sm----Bar rack mechanically cleaned 1/2" to 2" openings
Sr----Coarse rack (openings over 2")
St----Garbage ground at plant and returned to sewage flow

T-----Sludge thickener
Tc----Covered
Tm----Stirring mechanism
Tp----Open top

V-----Mechanical sludge dewatering
Vc----Sludge centrifuge
Vp----Pressure filter
Vv----Rotary vacuum filter
Vo----Other

X-----Sludge drying or incineration
Xd----Used for fertilizer
Xf----Sludge burned for fuel
Xl----Disposal to land
Xn----Incinerated
Xp----Used for fill

Z-----Sludge conditioning
Za----Chemicals used, alum
Zc----Chemical used (unidentified)
Zi----Chemicals used, iron salts
Zl----Chemicals used, lime
Zp----Polyelectrolytes used
Zx----No chemicals used
Zy----Elutriation

Table 17. Point Source BOD Contributions to Rivers and Streams in the Des Moines River Basin Above Red Rock Dam.

Area	Average Daily BOD, lb/day	Percent of Total
Lower Des Moines River Basin	11,394 (9,733)*	56.0 (47.8)*
Upper Des Moines River Basin	6,563	32.3
Raccoon River Basin	2,392	11.7
Total in Des Moines River Basin	20,349	100.0

*(Des Moines Metropolitan Area)

Table 18. Livestock Waste Production Equivalents.

Animal	Conversion Factor +
All Cattle and Calves	0.8
Swine	0.4
Poultry	0.02

+ Number of animals times conversion factor gives waste production equivalent to that of a 1000 lb cow (2, 3, 4).

Table 19. Livestock Distribution in the Des Moines River Basin.

River Basin	Numbers of Equivalent Cows in Thousands	Drainage Area sq mi	Density, Animals per sq mi
Raccoon River Basin	941	3680	256
Upper Des Moines River Basin	715	6200	115
Lower Des Moines River Basin	744	4172	178
Des Moines River Basin	2400	14052	171

Table 20. Livestock Production Estimates for the Upper Des Moines River Basin in Iowa, 1972

County	All Cattle and Calves, in Thousands	Swine in Thousands	Poultry, in Thousands	Equivalent 1000-lb Cows	
				Density Animals per sq mi	In Thousands
Boone	48.6	83.4	254.2	167	77.3
Clay	2.5	3.0	4.1	191	3.3
Dallas	15.0	81.0	146.5	153	22.9
Dickinson	3.0	3.8	4.1	175	4.0
Emmet	49.0	59.5	90.3	171	64.8
Green	6.8	10.3	3.1	170	9.6
Hamilton	13.8	51.5	20.1	173	32.0
Hancock	16.8	62.9	46.1	177	39.5
Humbolt	38.0	72.0	67.0	139	60.5
Kossuth	58.5	171.7	171.0	164	118.9
Palo Alto	50.6	113.0	105.8	163	83.8
Pocahontas	39.5	91.8	147.7	183	71.2
Polk	8.4	12.2	15.3	86	11.9
Webster	31.2	74.1	516.0	116	64.9
Winnebago	6.0	26.3	14.3	149	15.6
Wright	24.0	74.7	53.3	134	50.2

Table 21. Livestock Production Estimates for the Raccoon River Basin, 1972

County	All Cattle and Calves, in Thousands	Swine, in Thousands	Poultry, in Thousands	Equivalent 1000-lb Cows	
				Density Animals per sq mi	In Thousands
Audubon	5.3	7.1	6.9	322	7.2
Buena Vista	46.0	129.2	51.7	248	89.5
Calhoun	64.7	102.9	62.7	168	94.2
Carroll	110.1	207.5	87.4	358	172.8
Crawford	7.0	11.5	9.0	289	10.4
Dallas	45.0	75.0	135.7	153	68.7
Greene	61.2	93.6	27.9	170	87.0
Guthrie	72.1	99.5	124.4	202	100.0
Pocahontas	19.5	45.3	70.4	183	35.1
Polk	14.1	20.5	25.8	86	20.0
Sac	73.0	95.6	54.9	341	96.5
Webster	8.8	20.9	145.5	116	18.3

Table 22. Livestock Production Estimates for the Lower Des Moines River Basin, 1972.

County	All Cattle and Calves, in Thousands	Swine, in Thousands	Poultry, in Thousands	Equivalent 1000-lb Cows Density Animals per sq mi	Equivalent 1000-lb Cows In Thousands
Adair	28.8	43.4	18.9	231	40.8
Appanoose	4.1	2.6	0.6	113	6.5
Clarke	32.2	35.3	6.8	151	40.0
Davis	21.3	23.2	4.9	137	26.4
Guthrie	6.1	8.4	10.4	202	8.4
Jasper	9.3	19.6	10.9	235	15.5
Jefferson	3.5	8.9	1.4	163	6.4
Lee	21.6	47.3	20.3	154	36.6
Lucus	40.6	46.2	23.1	169	51.5
Madison	65.2	84.4	51.3	177	87.0
Mahaska	28.1	80.2	43.6	293	55.4
Marion	59.0	142.6	72.2	241	105.6
Monroe	52.4	49.5	10.7	147	61.9
Polk	19.6	28.5	35.8	86	27.8
Union	1.3	1.4	0.3	183	1.6
Van Buren	34.1	52.3	8.9	135	48.5
Wapello	25.7	42.2	15.2	131	37.8
Warren	61.0	94.0	45.0	155	86.7

Table 23. Corn and Soy Bean Production in the Upper Des Moines River Basin - 1973.

County	Percent County in Basin*	Total Land in Farms in 1000 Acres	Approximate % of County in Farmland	Corn		Soy Beans		Percent of Farmland in Corn and Soy Beans	Total Corn and Soy Bean Acreage in 1000 Acres
				Harvested for All Purposes in 1000 Acres	Grain Yield Per Acre Bu	Harvested for Grain in 1000 Acres	Grain Yield Per Acre Bu		
Boone	81	278.1	93.6	110.2	117.3	90.8	37.3	72	201.0
Clay	3	10.4	94.7	4.1	105.2	3.5	35.0	73	7.6
Dallas	25	88.1	92.3	34.5	106.3	25.1	33.1	68	59.6
Dickinson	6	13.5	92.8	5.6	103.9	4.3	34.9	73	9.9
Emmet	96	231.2	95.5	92.9	115.2	91.6	37.6	80	184.5
Green	10	35.7	98.2	14.8	109.1	12.9	33.8	78	27.7
Hamilton	32	115.2	97.5	47.7	112.7	44.3	36.6	80	92.0
Hancock	39	136.8	96.2	54.5	103.9	54.6	31.5	80	109.1
Humbolt	100	272.4	97.8	114.7	111.1	111.8	36.7	83	226.5
Kossuth	74	451.3	97.3	181.0	112.3	191.1	36.2	82	372.1
Palo Alto	92	322.2	97.5	126.1	109.6	125.8	35.6	78	251.9
Pocahontas	67	242.5	97.3	93.4	114.9	106.5	36.0	82	199.9
Polk	24	67.6	76.1	25.0	108.5	20.0	34.0	67	45.0
Webster	78	333.8	93.1	125.4	116.5	135.3	36.9	78	260.7
Winnebago	26	65.3	97.9	24.5	107.1	26.5	35.1	78	51.0
Wright	65	236.9	98.7	98.0	110.8	98.2	35.0	83	196.2
								Mean = 77.2	

* By planimeter measurement.

Table 24. Corn and Soy Bean Production in the Raccoon River Basin - 1973.

County	Percent County in Basin*	Total Land in Farms in 1000 Acres	Approximate % of County in Farmland	Corn		Soy Beans		Percent of Farmland in Corn and Soy Beans	Total Corn and Soy Bean Acreage in 1000 Acres
				Harvested for All Purposes in 1000 Acres	Grain Yield Per Acre Bu	Harvested for Grain in 1000 Acres	Grain Yield Per Acre Bu		
Audubon	5	13.8	96.4	5.2	99.9	2.1	31.0	53	7.3
Buena Vista	63	220.5	95.6	95.6	109.5	76.5	36.5	78	172.1
Calhoun	98	348.2	97.2	137.9	103.2	144.1	30.6	81	282.0
Carroll	84	302.7	98.1	135.9	103.9	72.0	33.6	69	207.9
Crawford	5	22.0	96.1	8.6	102.0	2.9	33.6	52	11.5
Dallas	75	264.4	92.3	103.4	106.3	75.4	33.1	68	178.8
Greene	90	321.7	98.2	133.0	109.1	116.2	33.8	77	249.2
Guthrie	83	298.3	94.2	82.6	101.7	55.5	31.0	46	138.1
Pocahontas	33	119.4	97.3	46.0	114.9	52.5	36.0	82	98.5
Polk	14	39.4	76.1	14.6	108.5	11.6	34.0	66	26.2
Sac	49	178.1	98.3	81.7	107.6	44.3	34.0	71	126.0
Webster	22	94.1	93.1	35.4	116.5	38.1	36.9	78	73.5

Mean = 68.4

* By planimeter measurement.

Table 25. Corn and Soy Bean Production in the Lower Des Moines River Basin - 1973.

County	Percent County in Basin*	Total Land in Farms in 1000 Acres	Approximate % of County in Farmland	Corn		Soy Beans		Percent of Farmland in Corn and Soy Beans	Total Corn and Soy Bean Acreage in 1000 Acres
				Harvested for All Purposes in 1000 Acres	Grain Yield Per Acre Bu	Harvested for Grain in 1000 Acres	Grain Yield Per Acre Bu		
Adair	31	111.5	98.7	28.1	100.7	16.5	31.7	40	44.6
Appanoose	11	32.4	87.9	3.8	88.6	4.6	26.8	26	8.4
Clarke	62	157.4	92.5	22.0	90.2	17.4	29.6	25	39.4
Davis	38	117.9	95.2	17.0	91.0	15.5	29.4	28	32.5
Guthrie	7	25.2	94.2	7.0	101.7	4.7	31.0	46	11.7
Jasper	9	39.6	94.0	13.7	109.3	7.7	36.8	54	21.4
Jefferson	9	23.3	92.9	5.8	97.1	5.2	29.3	47	11.0
Lee	45	134.4	88.6	39.1	98.0	24.2	29.9	47	63.3
Lucas	70	178.2	91.2	28.2	84.1	21.6	26.7	28	49.8
Madison	87	306.1	97.5	71.6	100.9	50.7	32.0	40	122.3
Mahaska	33	113.4	93.9	38.1	102.3	25.7	33.9	56	63.8
Marion	88	274.6	97.9	69.7	100.7	45.2	31.7	42	114.9
Monroe	97	241.8	89.5	32.6	79.2	23.2	24.5	23	55.8
Polk	56	152.0	76.1	58.3	108.5	46.6	34.0	69	104.9
Union	2	5.2	95.3	1.0	94.2	0.6	32.1	31	1.6
Van Buren	74	215.2	93.3	39.5	95.9	33.0	29.4	34	72.5
Wapello	66	161.1	87.3	34.4	101.1	31.3	31.1	41	65.7
Warren	100	334.9	93.8	76.6	104.7	50.3	31.0	38	126.9

Mean = 39.7

*By planimeter measurement.

Table 26. Statewide Average Crop Acreage Distribution in Iowa, 1973.

Crop	Acreage	Percent of Farmland
Total Farm Land	33,705,189	100.00
Corn (field)	11,883,148	35.26
Oats	1,244,300	3.69
Soy Beans	7,588,192	22.51
Sorghum	13,414	0.04
Wheat	26,724	0.08
Rye	2,752	0.008
Timothy Seed	1,684	0.005
Red Clover Seed	2,487	0.007
White Corn	9,304	0.03
Popcorn	31,496	0.09
Hay	2,465,313	7.31
Other Crop	38,767	0.12
Pasture	6,465,709	19.18
All other land	3,933,948	11.67

Table 27. Discharge Records in the Upper Des Moines River Basin for Period of Record+.

	Stratford	Saylorville
Average Annual Flow, cfs	1747	2603
Minimum Daily Flow	17	44
Maximum Flow	57,400 (June 22, 1954)	47,700 (April 10, 1965)

+Period of record: Stratford -- 1920 to 1973
Saylorville -- 1961 to 1973

Table 28. Discharge Records in the Upper Des Moines River Basin for Period from 1967 to 1973.

	Stratford	Saylorville
Average Annual Flow, cfs	2,526	2,749
Minimum Average Annual Flow	409	466
Maximum Average Annual Flow	4,962	5,175
Minimum Average Monthly Flow	75	75
Maximum Average Monthly Flow	15,770	15,830
Minimum Daily Flow	46	44
Maximum Daily Flow	24,600	23,800

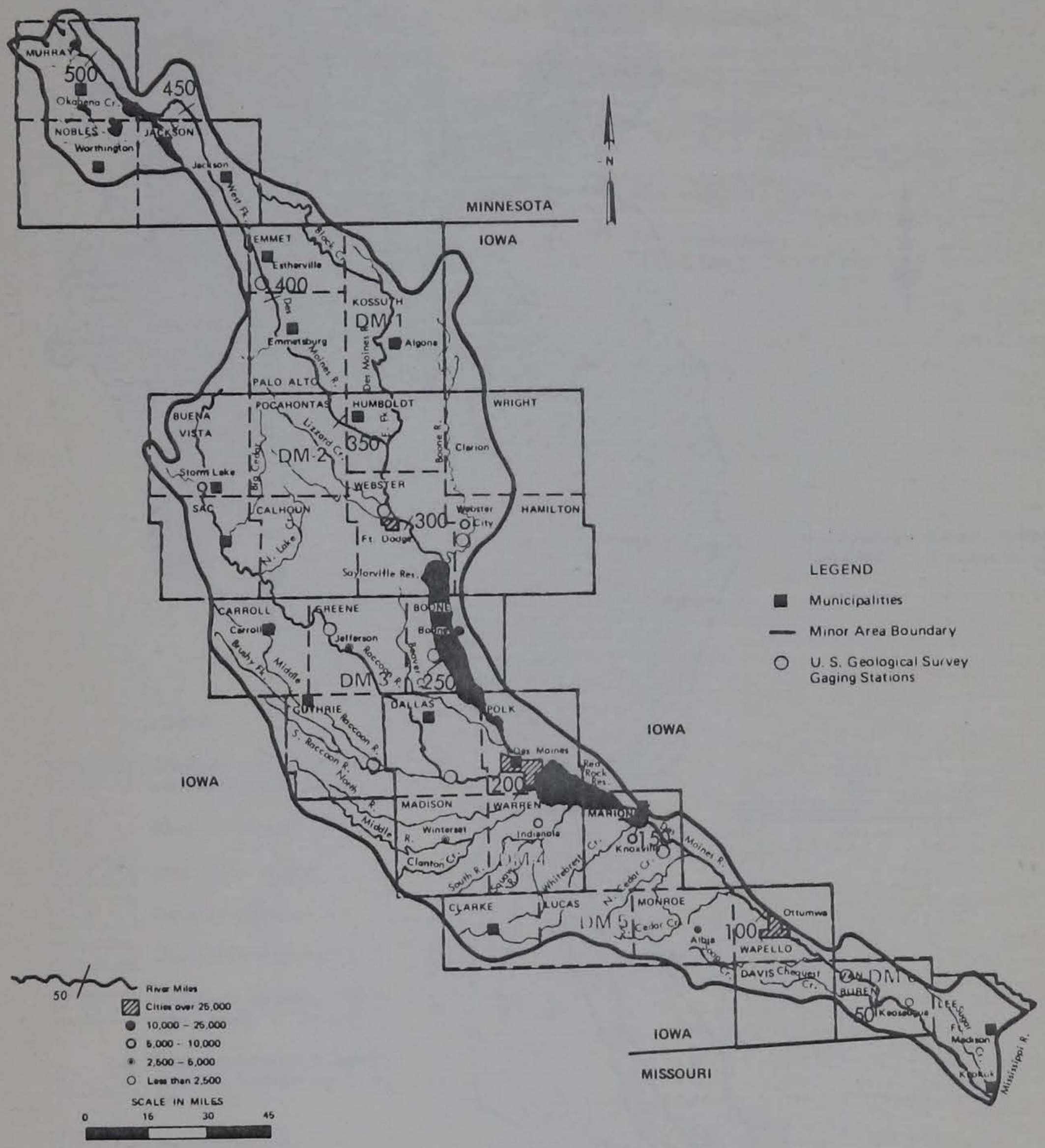


Figure 1. General Plan of Des Moines River basin.

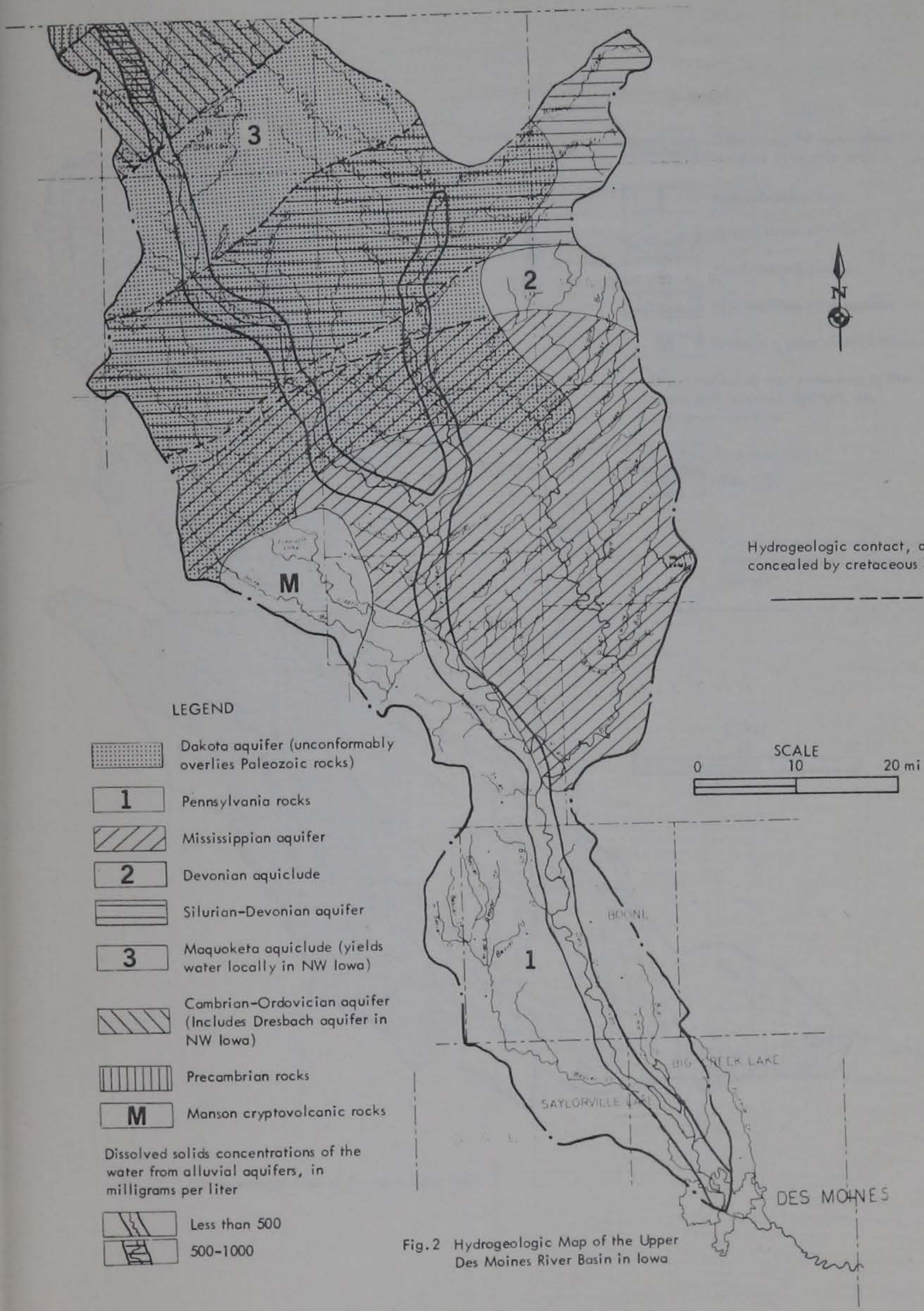


Fig. 2 Hydrogeologic Map of the Upper Des Moines River Basin in Iowa

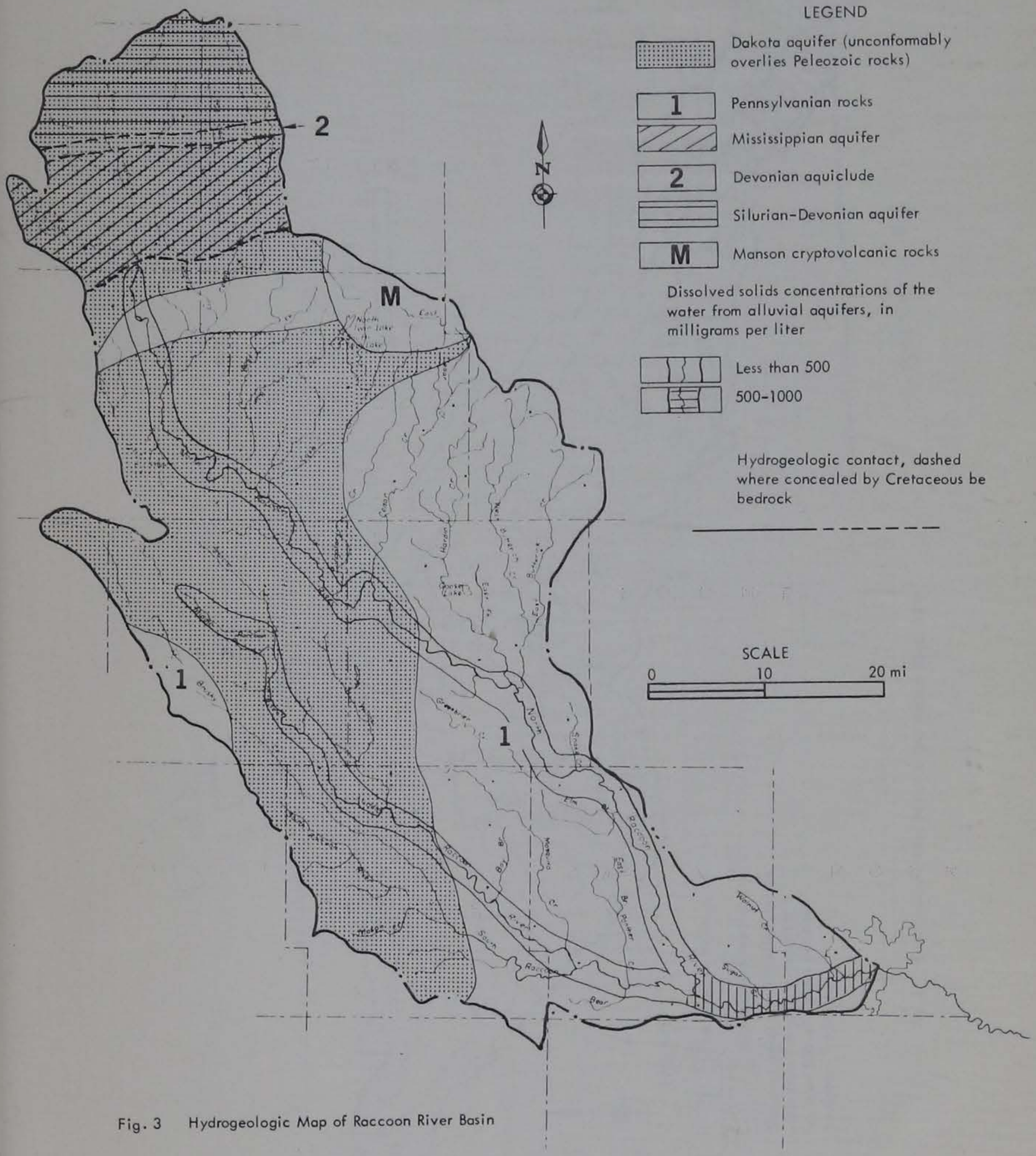


Fig. 3 Hydrogeologic Map of Raccoon River Basin

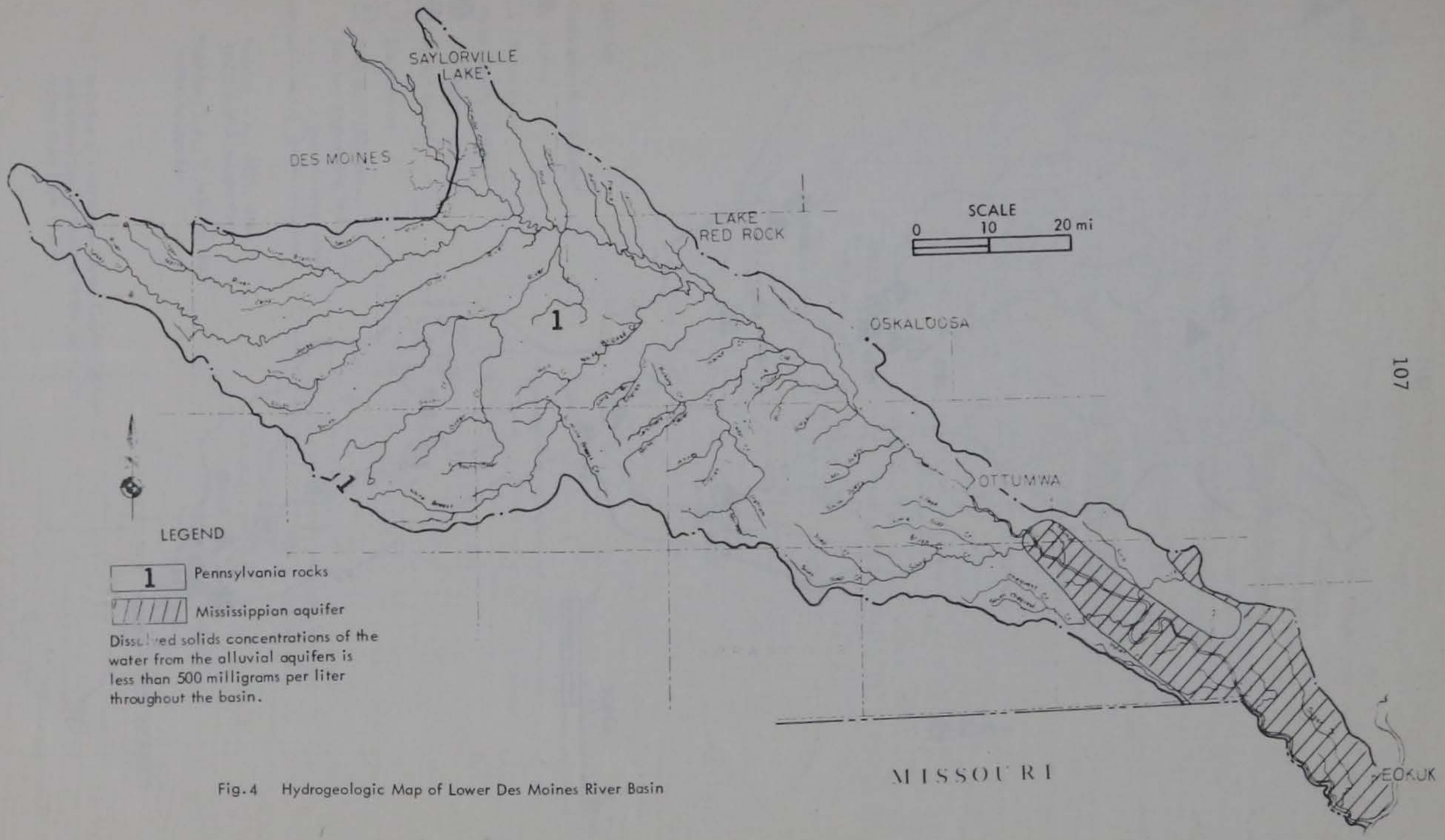


Fig. 4 Hydrogeologic Map of Lower Des Moines River Basin

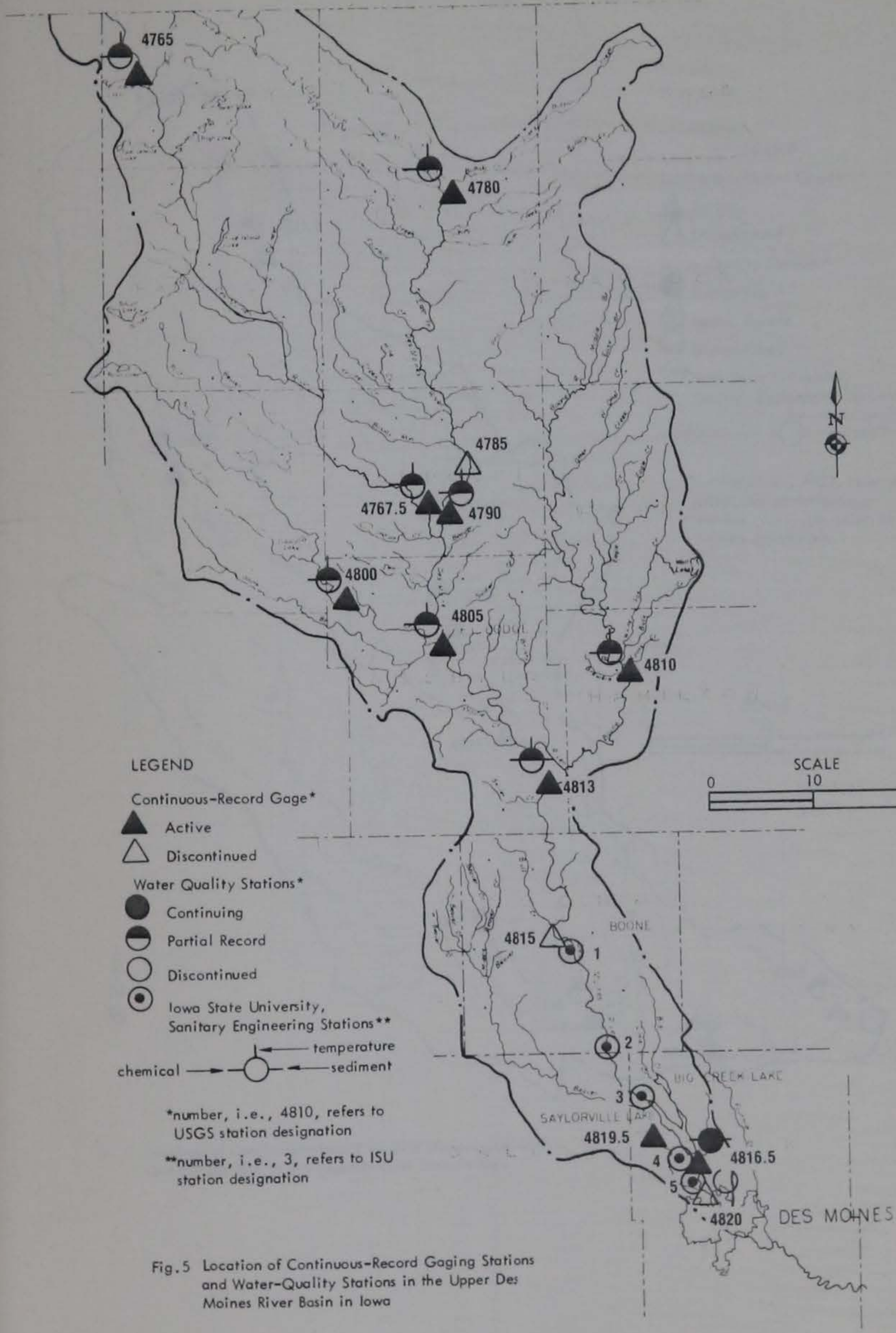
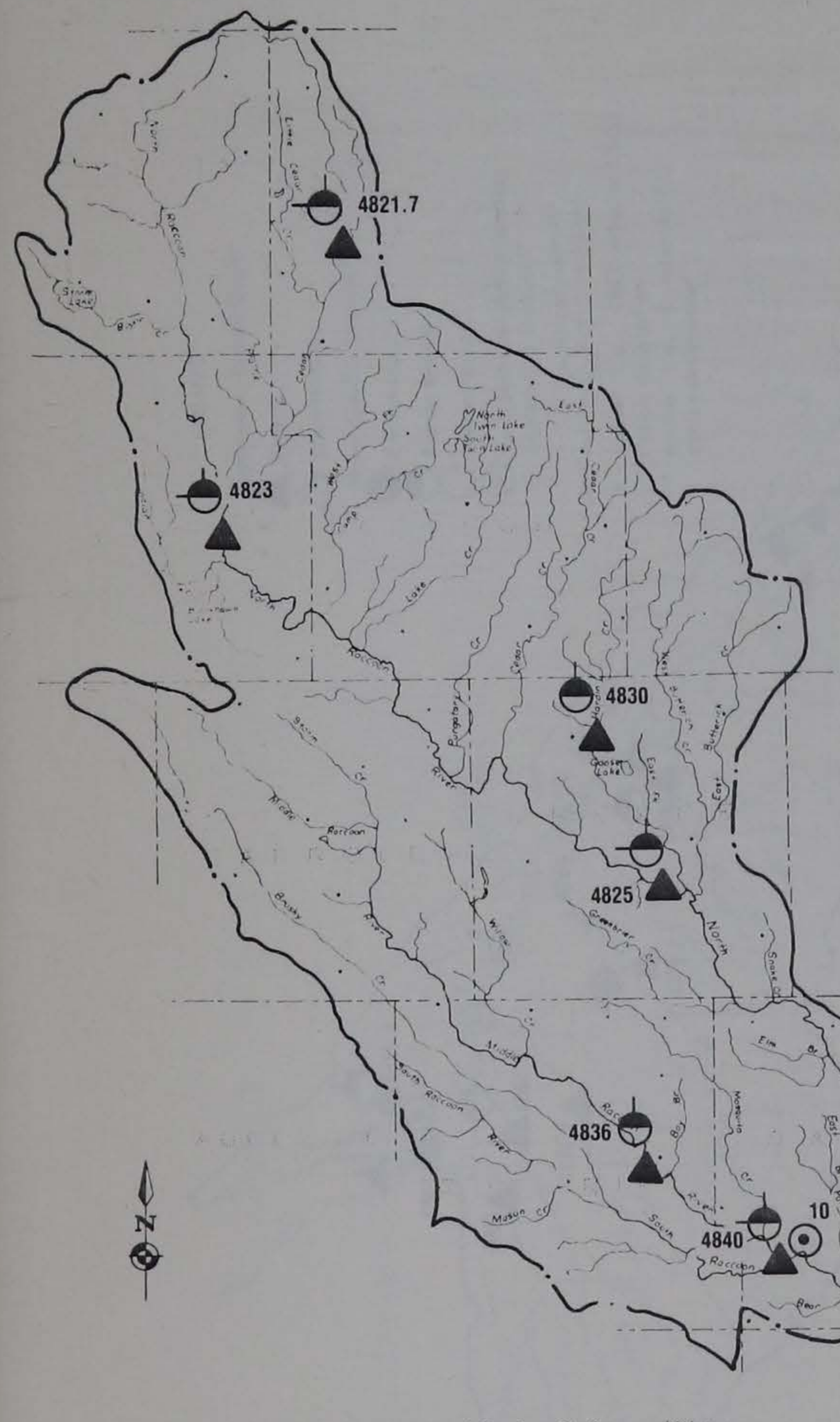


Fig. 5 Location of Continuous-Record Gaging Stations and Water-Quality Stations in the Upper Des Moines River Basin in Iowa



LEGEND

Continuous-Record Gage*

▲ Active

△ Discontinued

Water Quality Stations*

● Continuing

◒ Partial Record

○ Discontinued

⊙ Iowa State University, Sanitary Engineering Stations**

chemicals ← ⊙ → temperature, sediment

*number, i.e., 4823, refers to USGS station designation

**number, i.e., 10, refers to ISU station designation

Fig. 6 Location of Continuous-Record Gaging Stations and Water-Quality Stations in the Raccoon River Basin in Iowa

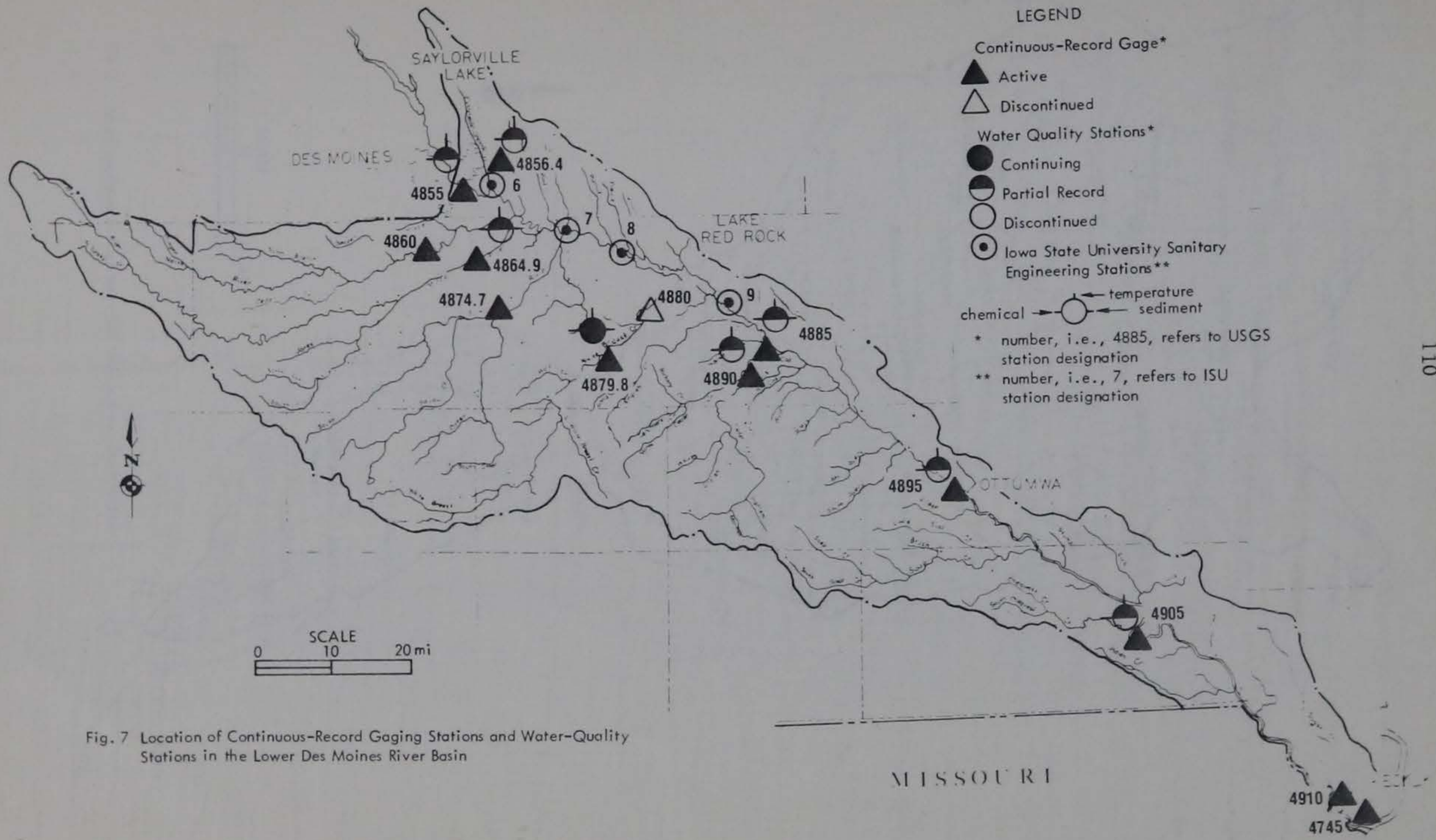


Fig. 7 Location of Continuous-Record Gaging Stations and Water-Quality Stations in the Lower Des Moines River Basin

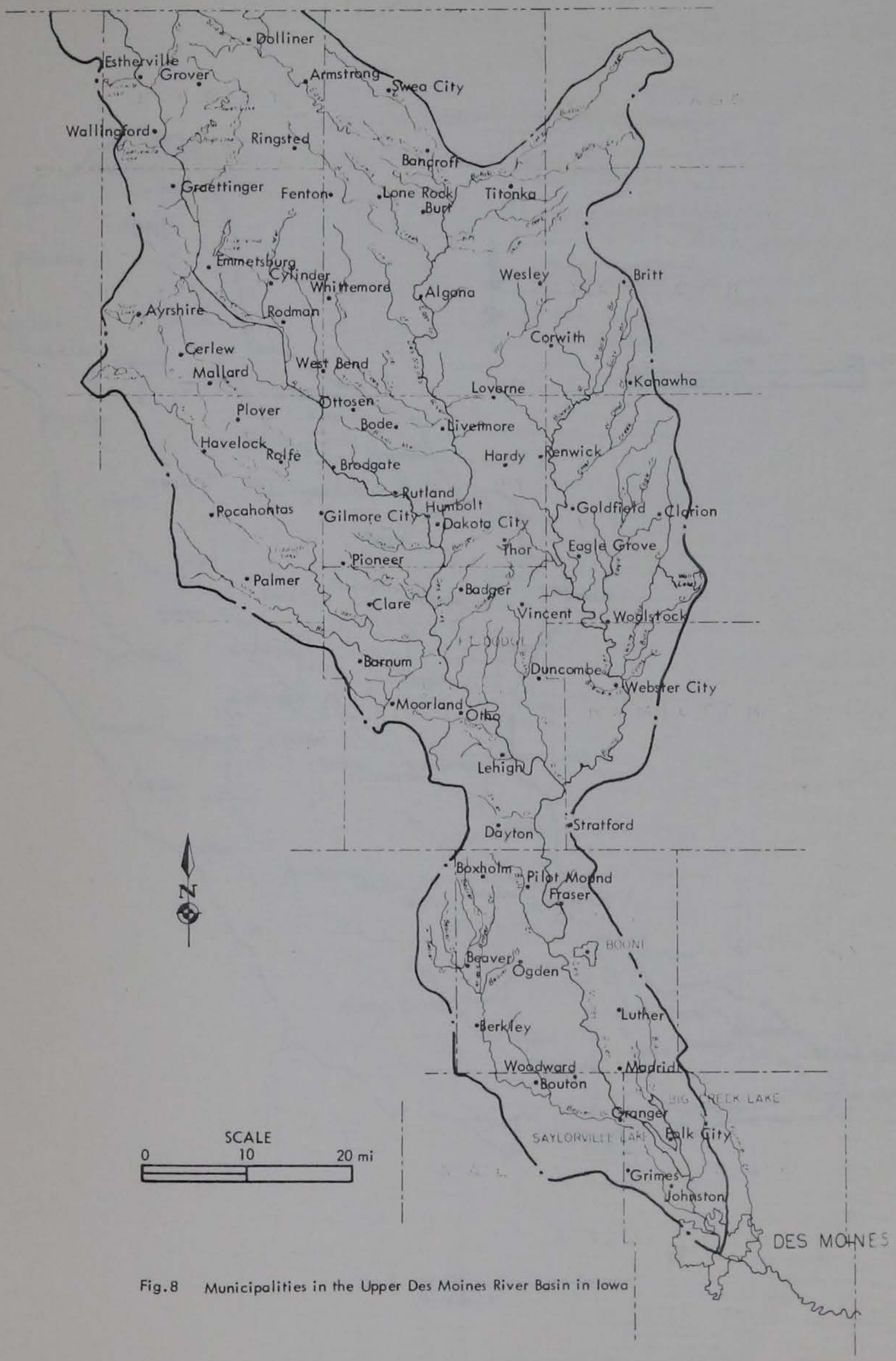


Fig.8 Municipalities in the Upper Des Moines River Basin in Iowa

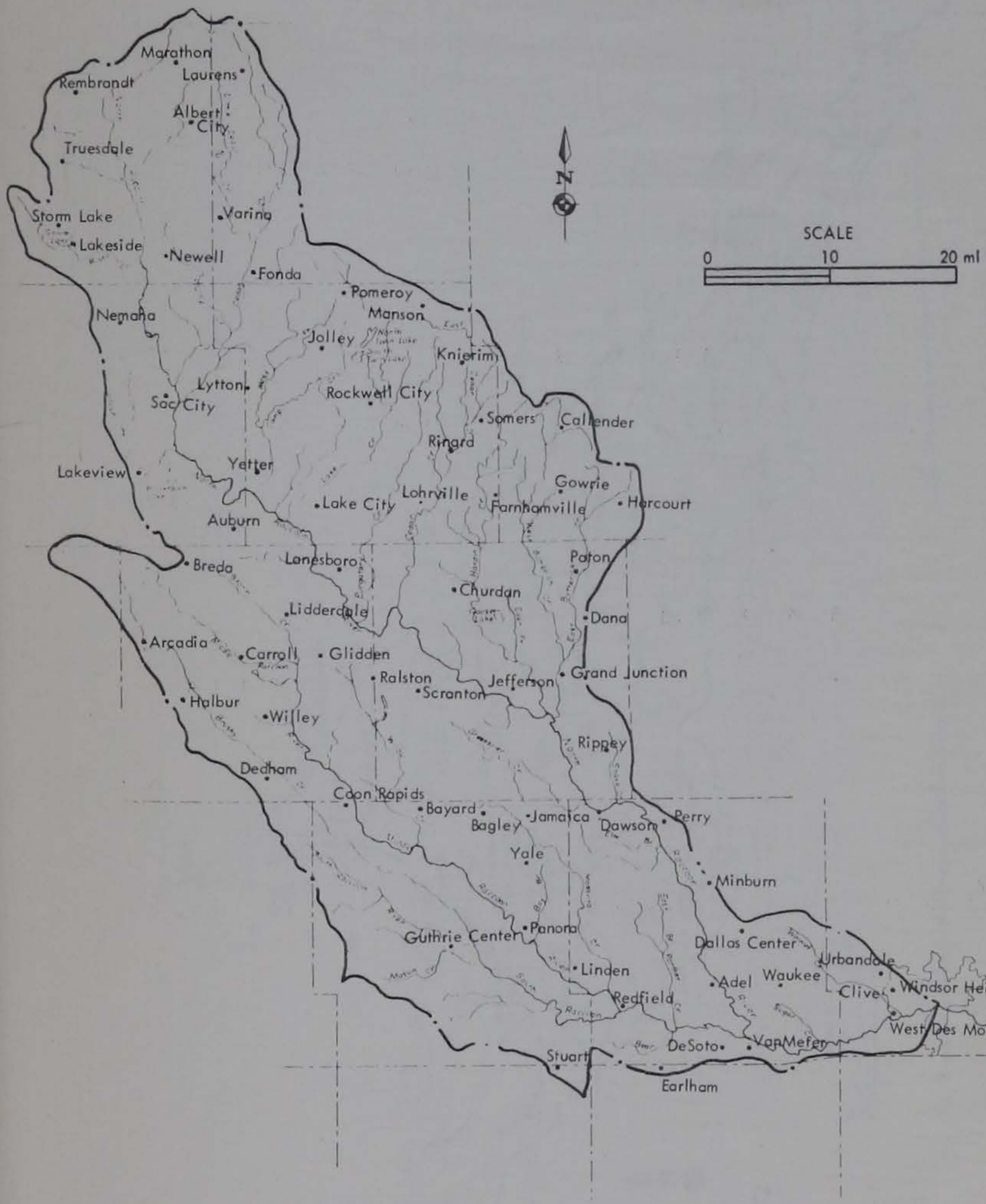


Fig. 9 Municipalities in the Raccoon River Basin

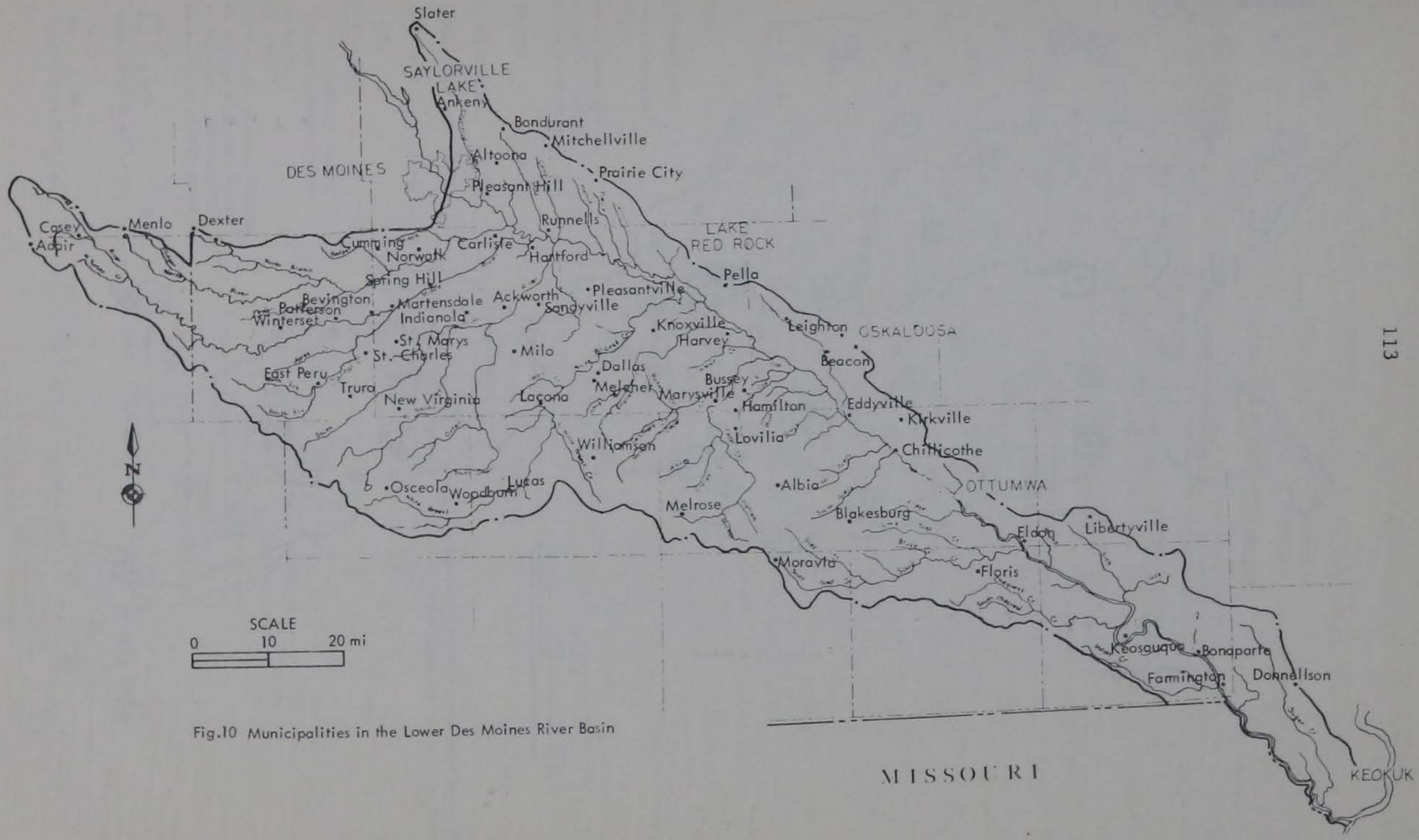


Fig.10 Municipalities in the Lower Des Moines River Basin

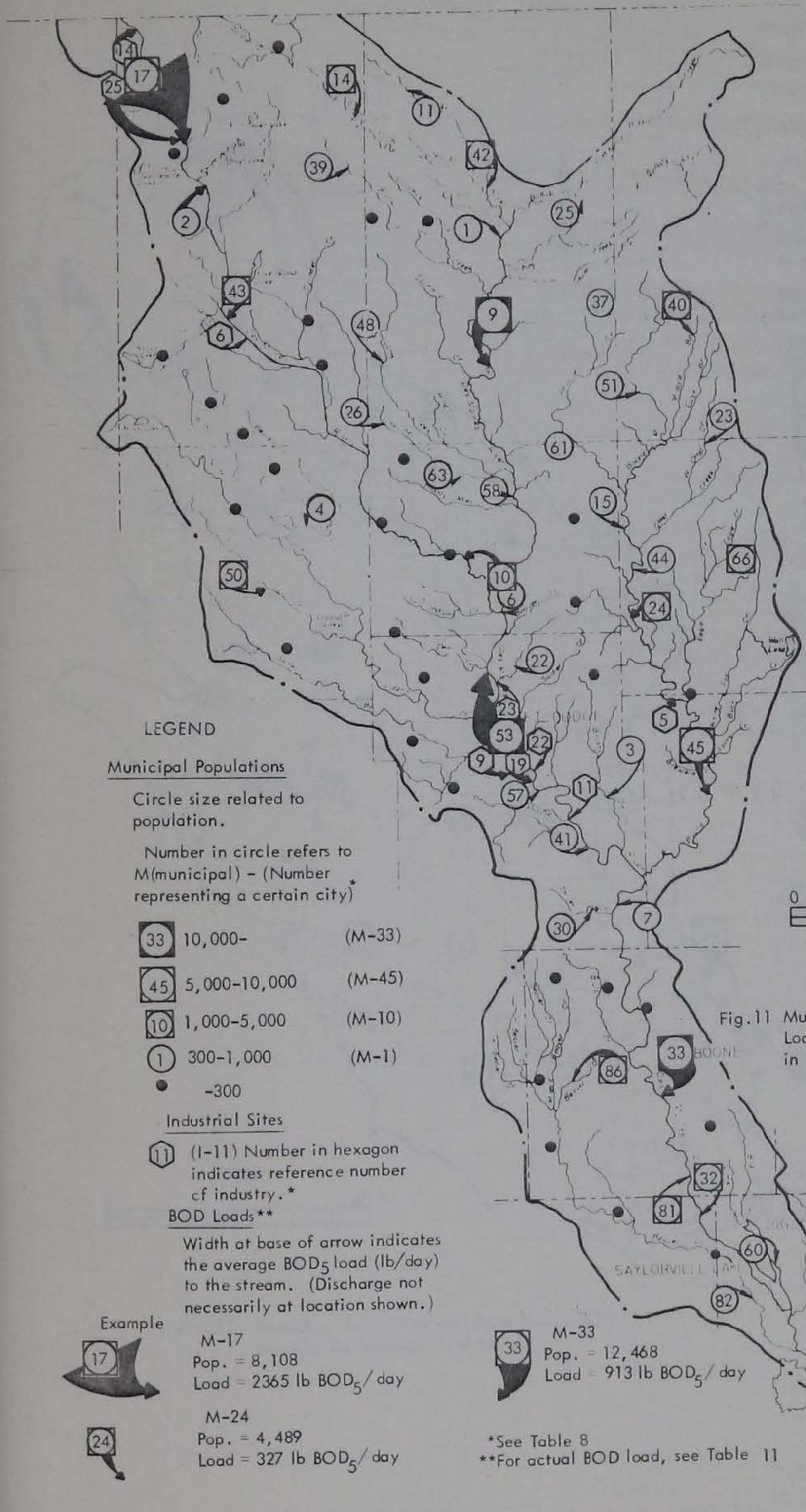
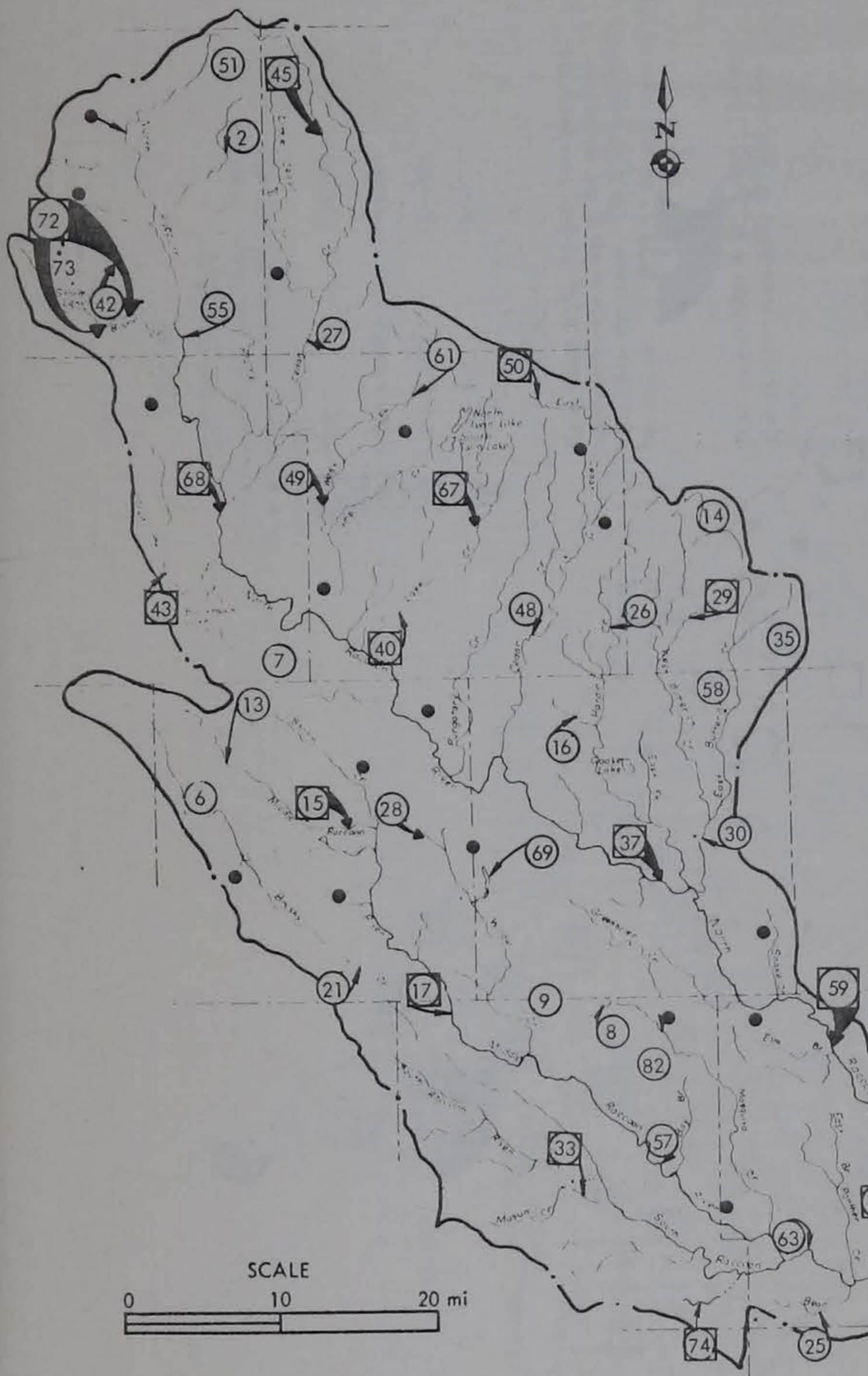


Fig. 11 Municipal Populations and Point Source BOD Loads in the Upper Des Moines River Basin in Iowa



LEGEND

Municipal Population

Circle size is related to population.

Number in circle refers to M (Municipal) - (Number representing a certain city)*

76	10,000-	(M-76)
15	5,000-10,000	(M-15)
1	1,000-5,000	(M-1)
14	300-1,000	(M-14)
●	-300	

**BOD Loads

Width at base of arrow indicates the average BOD_5 load (lb/day) to the stream. (Discharge not necessarily at location shown.)

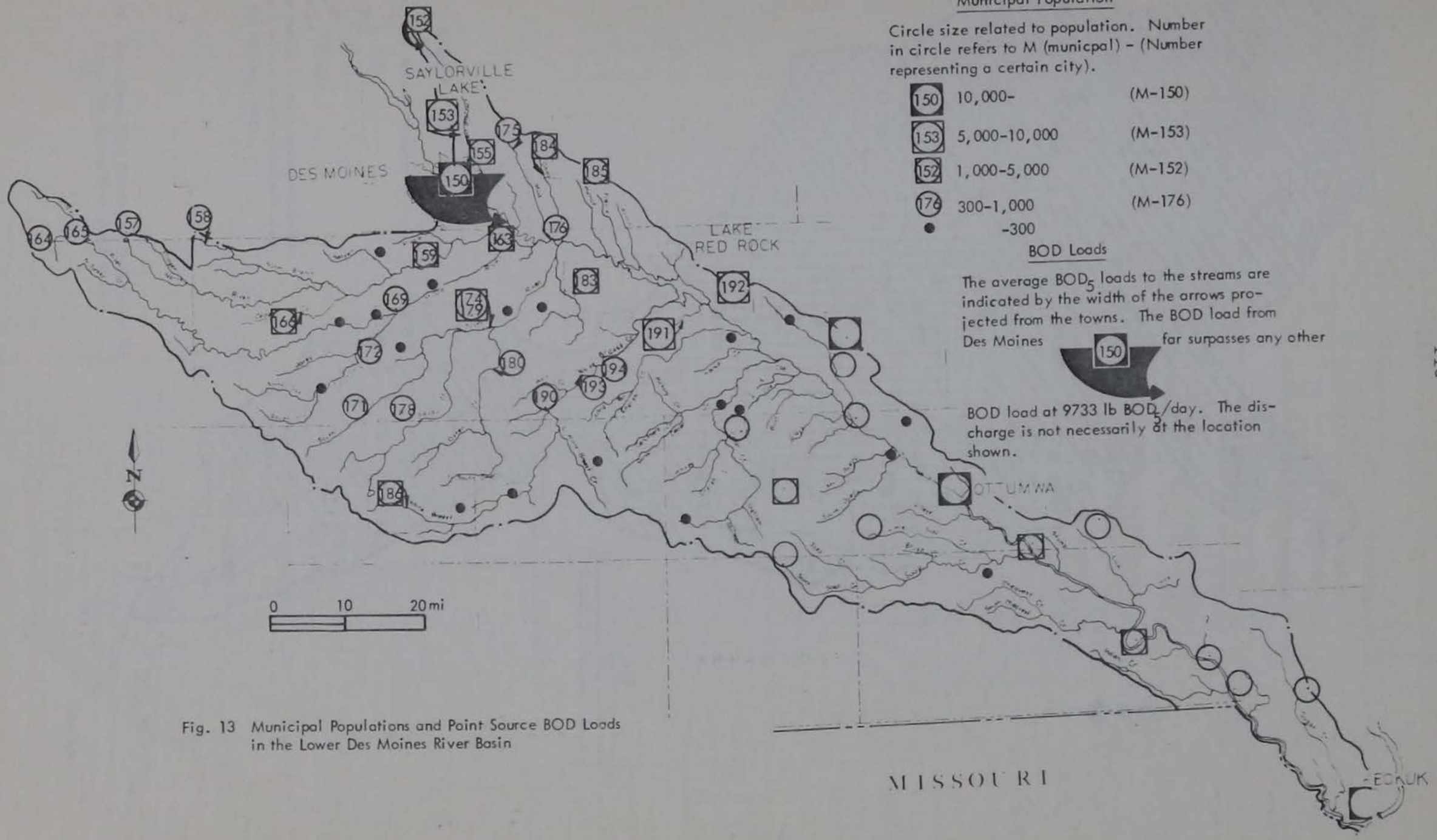
Example

M-59
Pop = 6,906
Load = 241 lb/BOD_5/day

M-16
Pop = 598
Load = 7 lb BOD_5/day

*See Table 9
**For actual BOD loads, see Table 13

Fig. 12 Municipal Populations and Point Source BOD Loads in the Raccoon River Basin



LEGEND

Municipal Population

Circle size related to population. Number in circle refers to M (municpal) - (Number representing a certain city).

150	10,000-	(M-150)
153	5,000-10,000	(M-153)
152	1,000-5,000	(M-152)
176	300-1,000	(M-176)
●	-300	

BOD Loads

The average BOD_5 loads to the streams are indicated by the width of the arrows projected from the towns. The BOD load from Des Moines far surpasses any other BOD load at 9733 lb BOD_5/day. The discharge is not necessarily at the location shown.

Fig. 13 Municipal Populations and Point Source BOD Loads in the Lower Des Moines River Basin

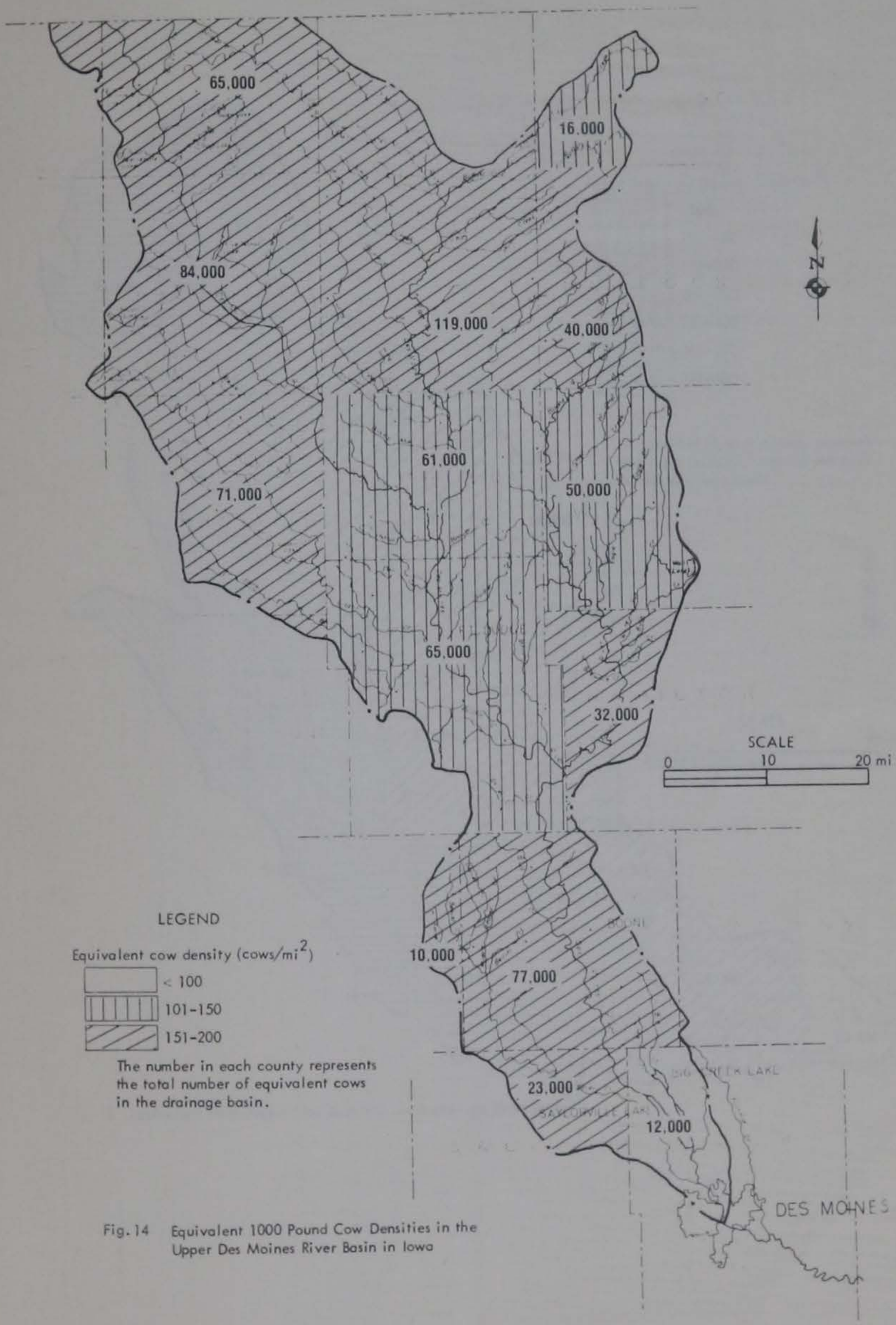


Fig. 14 Equivalent 1000 Pound Cow Densities in the Upper Des Moines River Basin in Iowa

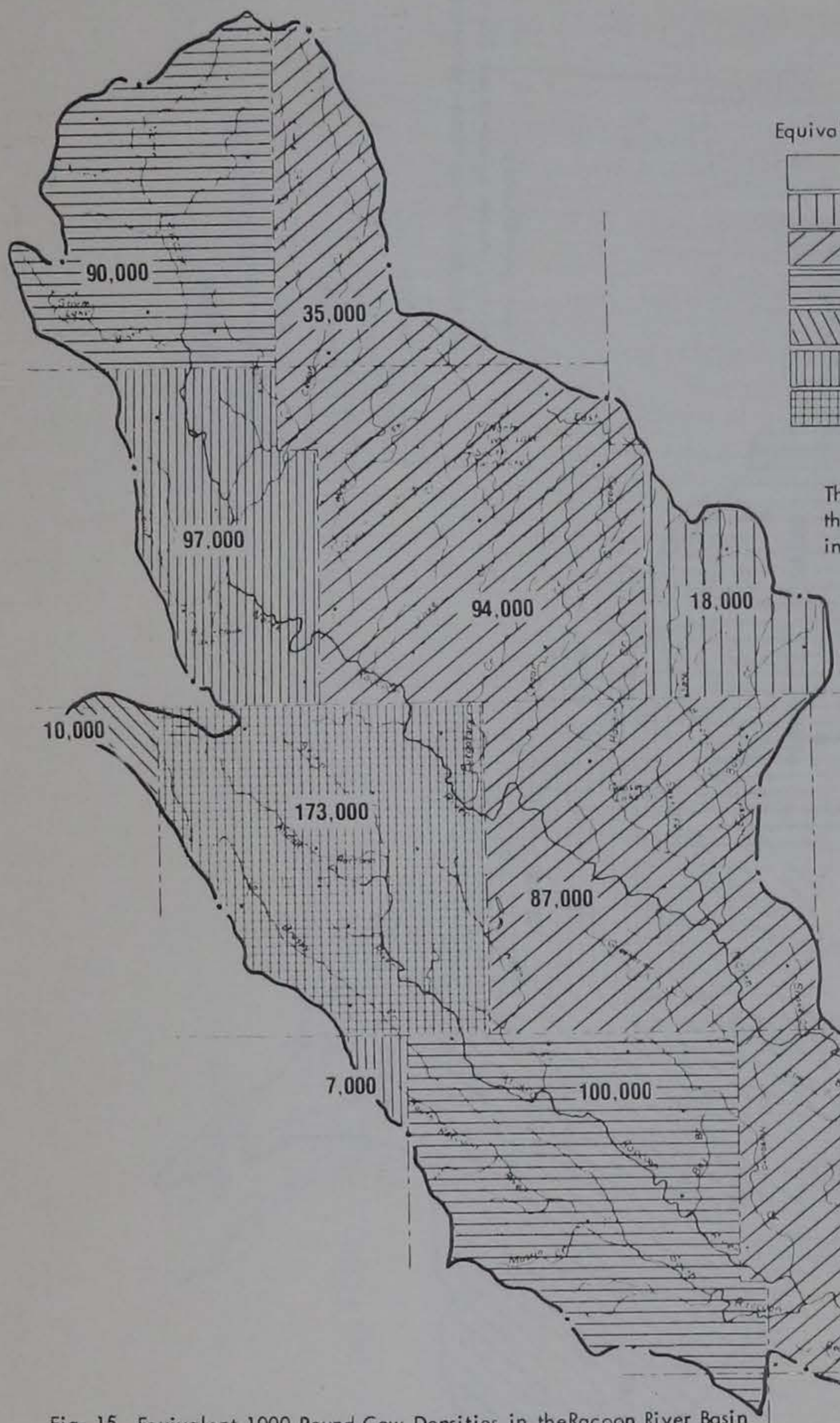


Fig. 15 Equivalent 1000 Pound Cow Densities in theRacoon River Basin

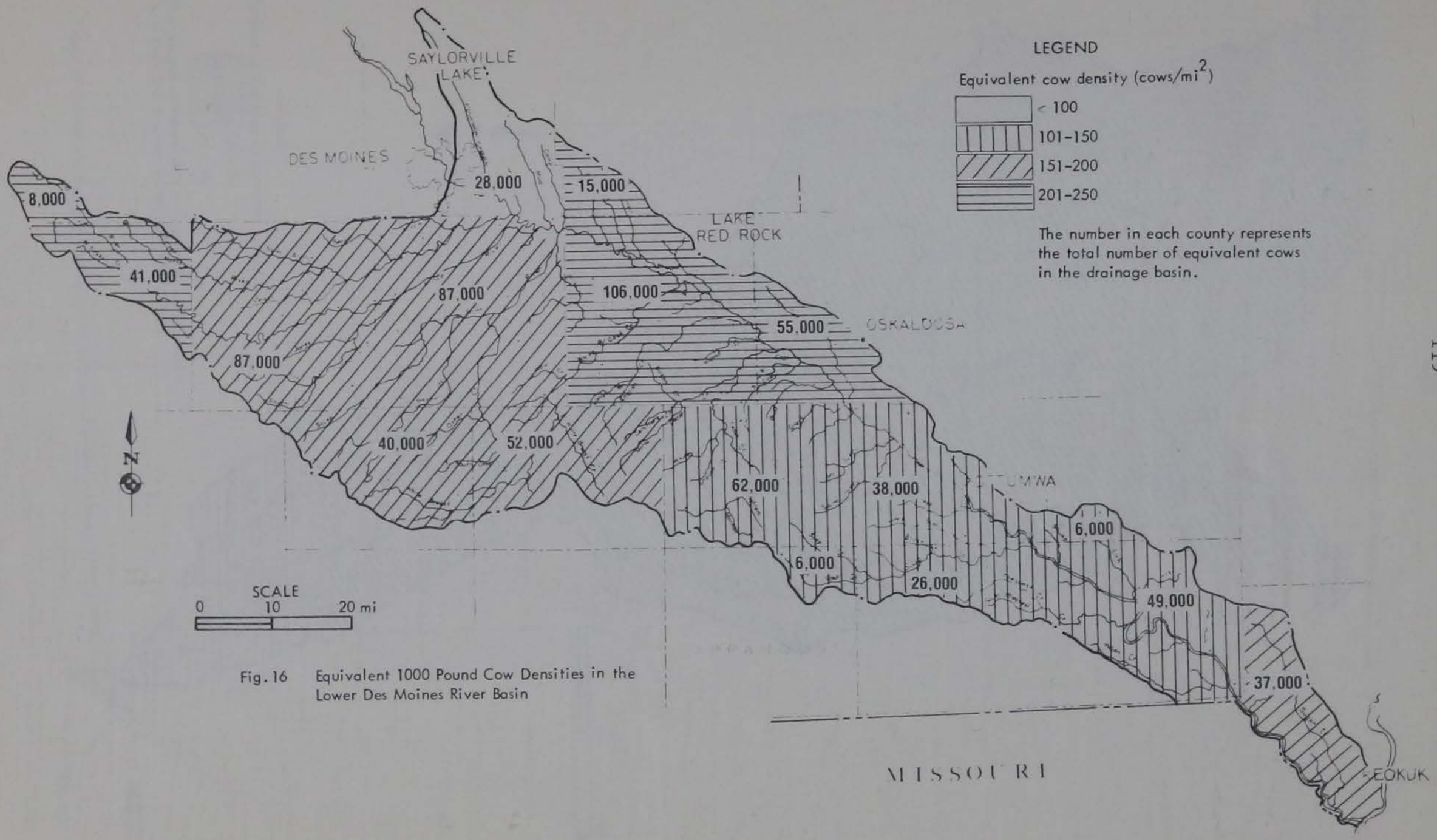
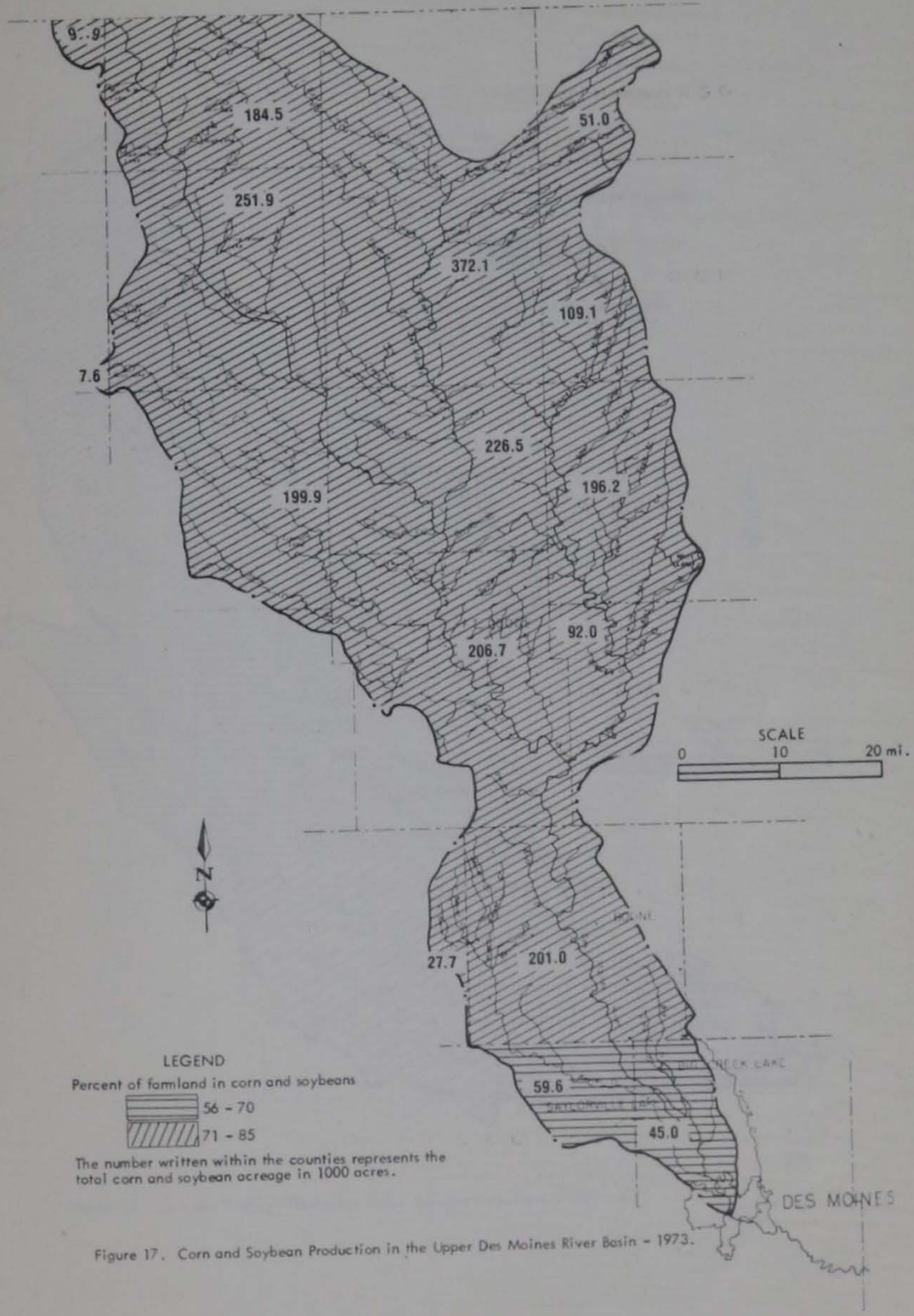


Fig. 16 Equivalent 1000 Pound Cow Densities in the Lower Des Moines River Basin



LEGEND

Percent of farmland in corn and soybeans

56 - 70

71 - 85

The number written within the counties represents the total corn and soybean acreage in 1000 acres.

Figure 17. Corn and Soybean Production in the Upper Des Moines River Basin - 1973.

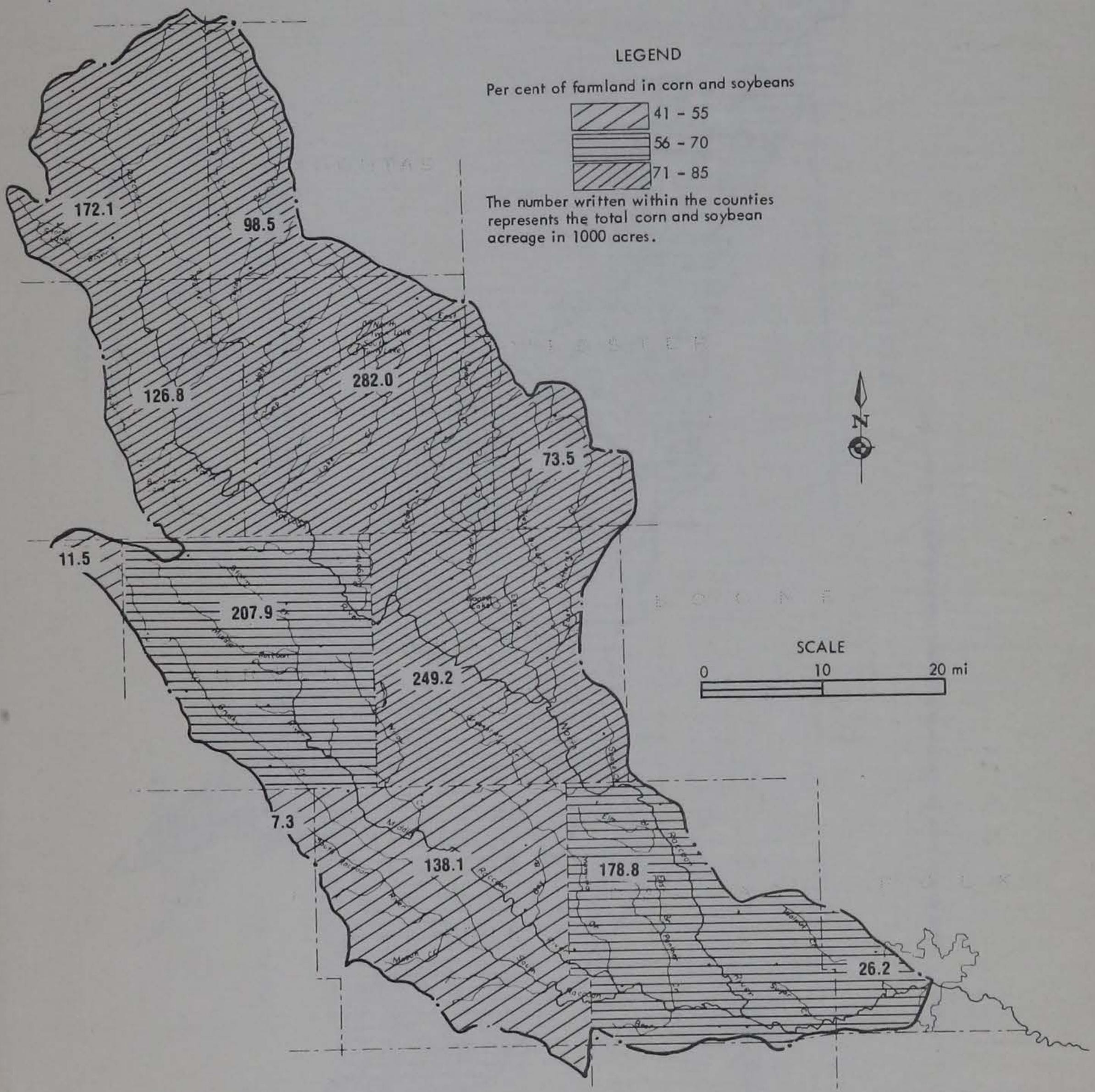


Figure 18. Corn and Soybean Production in the Raccoon River Basin - 1973.

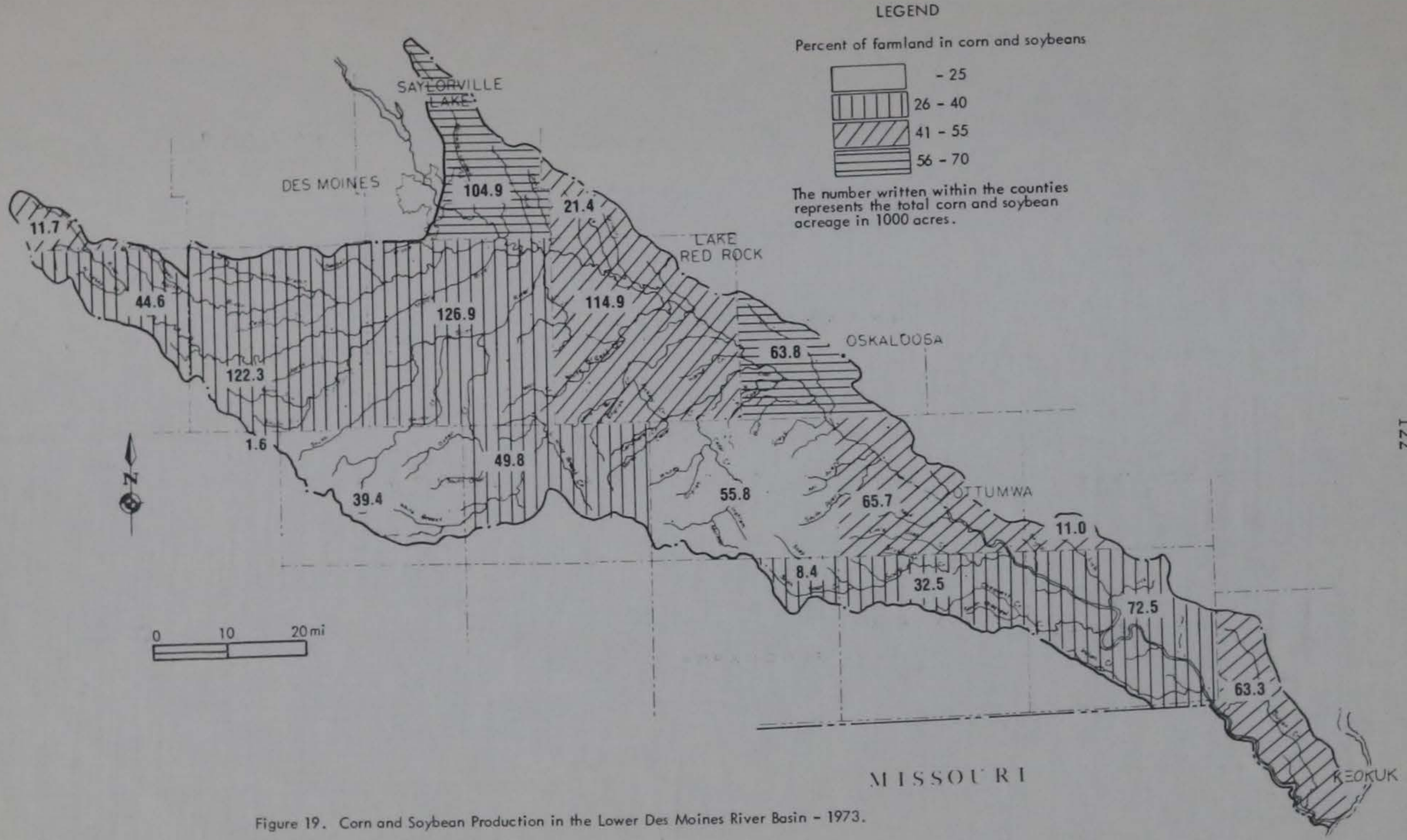


Figure 19. Corn and Soybean Production in the Lower Des Moines River Basin - 1973.