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WATER AND RELATED LAND RESOURCES MANAGEMENT STUDY. VOLUME II. B--ETC(U)
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VOLUME II

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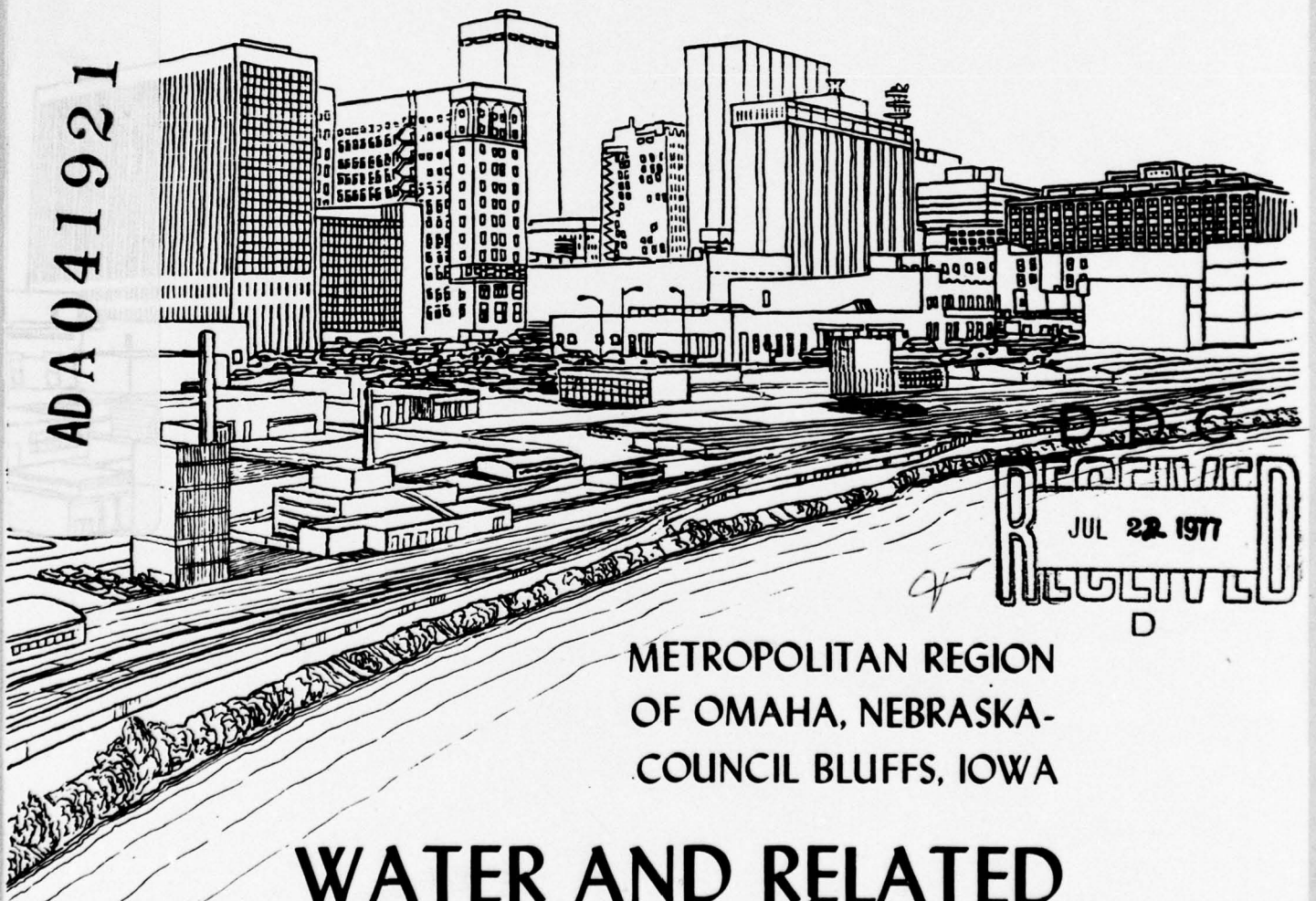
BACKGROUND INFORMATION APPENDIX

REVIEW REPORT ON THE MISSOURI RIVER AND TRIBUTARIES



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METROPOLITAN REGION
OF OMAHA, NEBRASKA-
COUNCIL BLUFFS, IOWA

WATER AND RELATED LAND RESOURCES MANAGEMENT STUDY

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WATER AND RELATED LAND
RESOURCES MANAGEMENT STUDY

Background Appendix

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BACKGROUND APPENDIX

Introduction

AUTHORITY FOR THE STUDY

This report is submitted in response to resolutions of the Committee on Public Works of the United States Senate, adopted on 6 May 1971 and the Committee on Public Works of the House of Representatives, adopted on 29 July 1971. Both resolutions are similarly worded and state, in part:

> " . . . that the Board of Engineers for Rivers and Harbors is hereby requested to review the reports of the Chief of Engineers on the Missouri River and Tributaries, published as House Document Number 238, Seventy-Third Congress, and other pertinent reports with a view to determining whether any modifications of the recommendations contained therein are advisable at the present time, with particular reference to providing a plan for the development, utilization, and conservation of

water and related land resources of the metropolitan region of Omaha, Nebraska-Council Bluffs, Iowa, with due consideration for the metropolitan planning activities in the seven-county area, consisting of Cass, Douglas, Sarpy, and Washington Counties in Nebraska, and Harrison, Mills, and Pottawattamie Counties in Iowa. Such study to include appropriate consideration of the needs for protection against floods, wise use of flood plain lands, navigation facilities, regional water supply and waste management facilities systems, general recreational facilities, enhancement and control of water quality, enhancement and conservation of fish and wildlife, and other measures for environmental enhancement, economic and human resources development, and shall be harmonious components of comprehensive development plans formulation by various planning agencies and other interested Federal agencies."

STUDY OBJECTIVES

from page 4 → The objectives of this study are: (1) development of a coordinated water and related land resource management program; and (2) provision of information and analyses tools to assist other agencies in their decisions regarding water resources.

STUDY SCOPE

This survey scope study attempts to assure that all water resources management programs consider the economic, social, institutional, and environmental impacts in conjunction with the technical aspects.

USE OF STUDY RESULTS

Results of this study will aid local agencies in their planning decisions. Specifically, the following outputs are expected to be realized as a product of this study.

- A regional wastewater management plan to guide local agencies in complying with the goals and objectives of PL 92-500;

- A regional water supply management plan which will guide local agencies in identifying the most cost-effective sources of water supply;

- A regional flood plain management plan which will identify opportunities for reducing potential flood hazards through a combination of structural and nonstructural measures;

- A regional recreation plan which identifies water-related recreation opportunities; and

- A discussion of the trade-offs associated with alternative growth policies and institutional strategies for managing the metropolitan region's water resources.

Geography of The Study Area

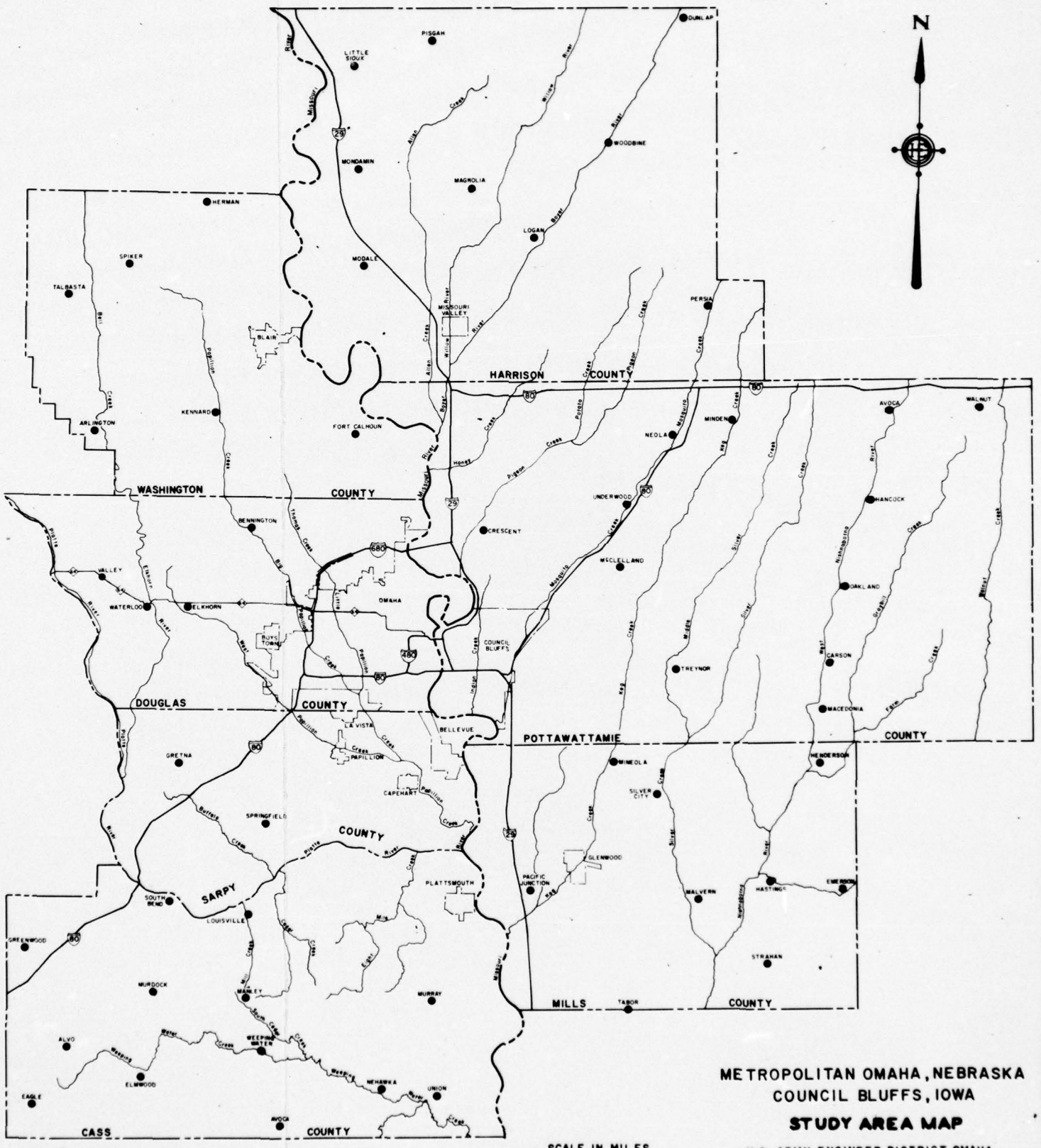
GENERAL

As defined in the Congressional Committee resolutions, the study area includes Washington, Douglas, Sarpy, and Cass Counties in Nebraska and Harrison, Pottawattamie, and Mills Counties in Iowa. A map of the study area is shown on figure B-1. The study area is located in Bureau of Economic Analysis Region 107 and in the Water Resources Council's Water Resources Subareas 1022 and 1023.

The seven-county study area includes the Missouri River and adjacent land areas, and contributing drainage areas of tributary streams which enter the Missouri River between Blair, Nebraska on the north and Plattsmouth, Nebraska on the south. page 2 Total area within the seven counties is about 3,600 square miles. Principal tributary streams are the Boyer, Nishnabotna, and Platte Rivers, and Indian, Mosquito, Keg, and Papillion Creeks.

The 1970 population of the seven-county area was about 602,000 with approximately 85 percent of this population located in urban areas. Major cities in the study area include Omaha, Council Bluffs, and Bellevue.

Minor cities include Papillion, La Vista, Ralston, Blair, Missouri Valley, Glenwood, and Plattsmouth.



METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA

STUDY AREA MAP

U.S. ARMY ENGINEER DISTRICT OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

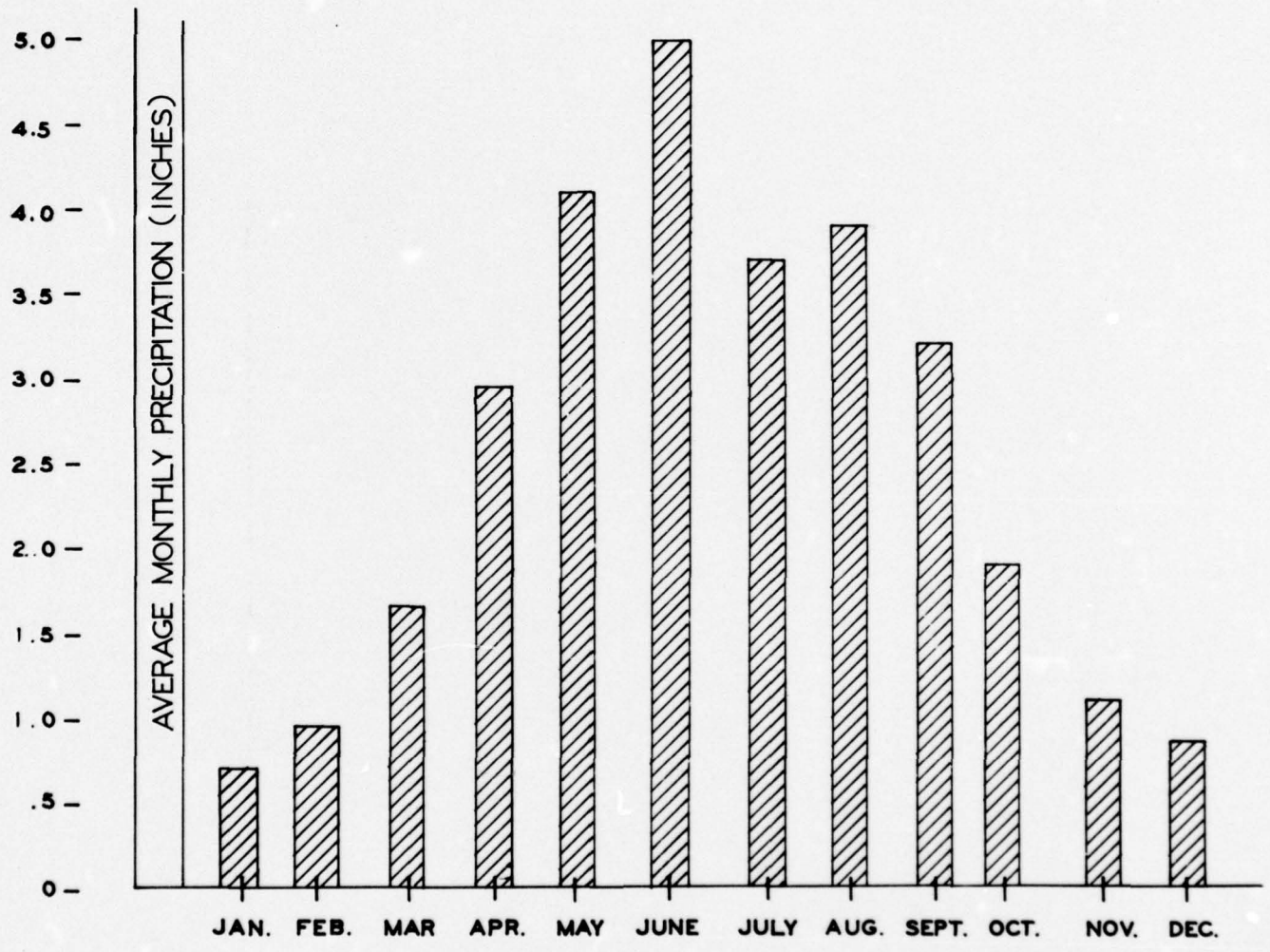
APPENDIX II FIGURE B-

CLIMATOLOGY

The climate of the study area is classified as subhumid. It is typical of the Great Plains Region, with warm summers and cold, dry winters. Rapid changes in temperature are characteristic of the area, with extreme variations in temperature, strong or gusty winds for short periods, and intense thunderstorm rainfall.

Temperature extremes range from -32°F. to 114°F. On 24 July 1974, the temperature reached 110°F. Three months, December through February, normally have temperatures below freezing. Two months, May and September, have normal monthly temperatures in the mid-60's. July and August average temperatures range from 85 to 87 degrees and the average minimum temperatures in the winter range from 14 to 19 degrees. A 90-degree or higher temperature can be expected about 28 days a year and an average year contains 123 days when the minimum temperature is 32° or lower. The mean monthly temperatures for the period from 1941 through 1970 are shown on figure B-2.

Monthly precipitation for the same period of record ranges from one inch or less to nearly 5 inches. During the 38 years through 1973, the maximum monthly precipitation occurring at Omaha was 13.75 inches in September 1965. Minimum monthly precipitation was a trace in October 1952 and in December 1943. Snow cover ranges from 30 to 60 days a year. The maximum accumulation of snow occurred during the winter of 1910-11 when 67.5 inches of snow was reported. The maximum snowfall in 24 hours was 18.3 inches in February 1965. Mean monthly precipitation for the period from 1941 through 1970 is shown on figure B-2.


AVERAGE MONTHLY PRECIPITATION (INCHES)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
.5
0
JAN.
FEB.
MAR
APR.
MAY
JUNE
JULY
AUG.
SEPT.
OCT.
NOV.
DEC.

2

JAN.	1.5" (1967)	Rain (Date)
	3.1" (1949)	Snow (Date)
FEB.	2.24" (1954)	
	18.3" (1965)	
MAR.	1.7" (1913)	
	16.4" (1923)	
APR.	2.6" (1938)	
	8.6" (1945)	
MAY	3.6" (1954)	Dates of Record Storms as expressed by 24 hr. maximums of Rain/Snow.
	2.0" (1945)	
JUNE	5.4" (1875)	
JULY	4.4" (1871)	
AUG.	7.0" (1903)	
SEP.	6.8" (1923)	
OCT.	3.7" (1884)	
	7.4" (1941)	
NOV.	2.5" (1948)	
	12.8" (1886)	
DEC.	2.1" (1931)	
	13.0" (1892)	

METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA

CLIMATOLOGICAL DATA

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

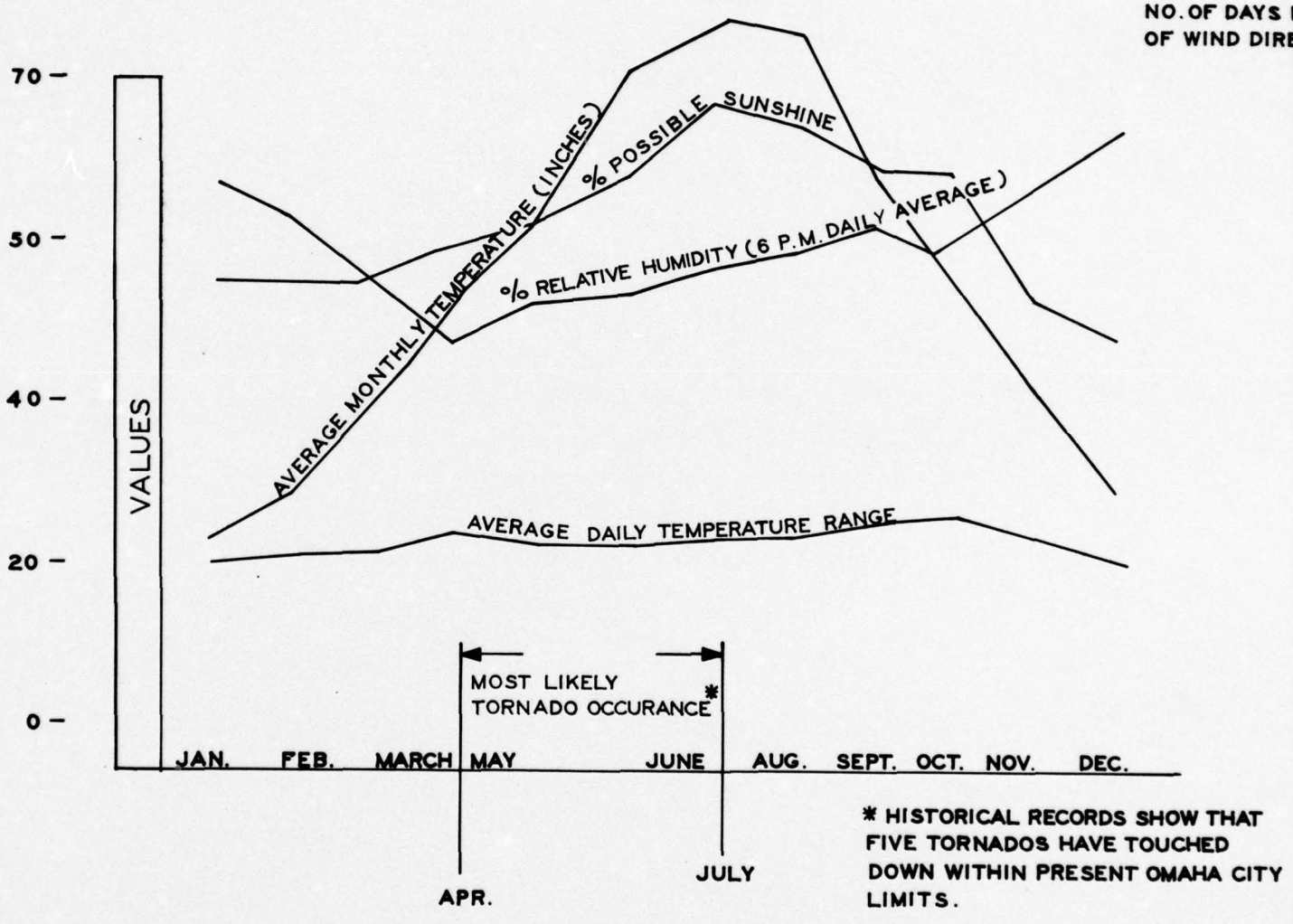
JUNE 1975

VOLUME II FIGURE B-2

Another characteristic of the climate in the study area is the wind. As shown in figure B-3, prevailing winds during the 1950's came primarily from two octants, north to northwest and south to southeast. About 19 percent of the time the wind was from the south-southeast. The mean speed of the wind for four representative months was 12 miles per hour in February, May, and November, and 10 miles per hour in August. The monthly percentages of possible sunshine in the area range from about 55 percent in December to about 75 percent in July. Mean relative humidity at noontime in Omaha during the late 1960's ranged from highs of about 65 percent in December and January to lows of about 50 percent in March and April. From June through August, the mean relative humidity at noon was about 60 percent. Mean relative humidity at this station ranged from 75 to 85 percent during all months of the year from the 6:00 a.m. reading.

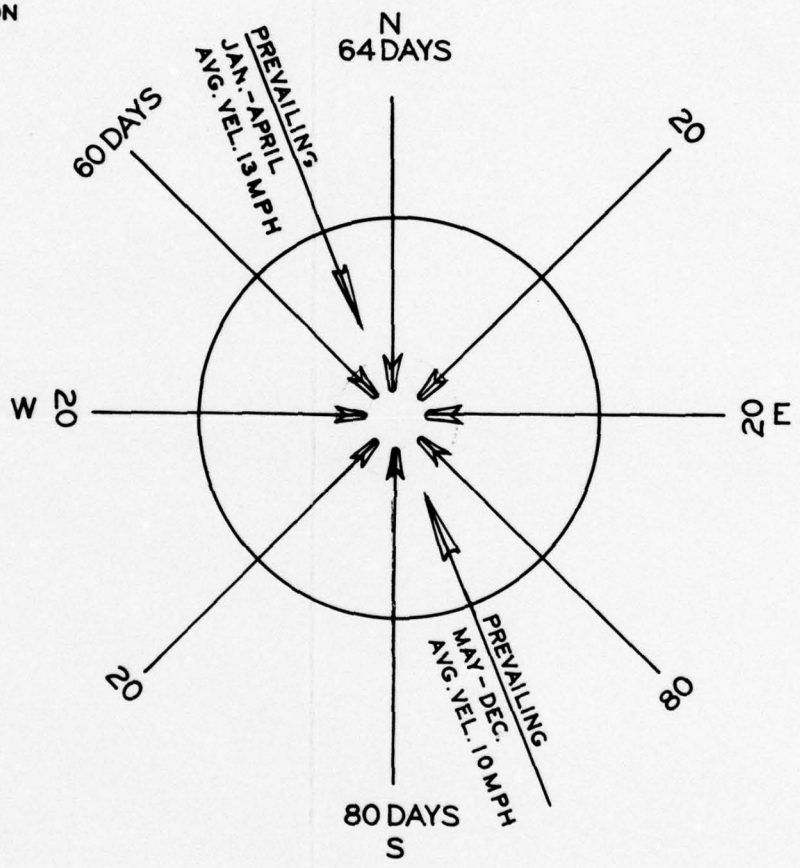
GEOLOGY AND TOPOGRAPHY

The seven-county study area is considered to be a transitional zone between the Central Lowland Province and the High Plains Province. More specifically, it is referred to as the Drift Hills or Dissected Till Plains Section. Surface topography is a reflection of an area's geologic history. The geologic history of the seven-county area is represented by overburden deposited during the Pleistocence Epoch and by bedrock deposited during the Pennsylvanian Period. The Pleistocene Epoch is the geologic time period during which fluvial and eolian deposits of glacial origin were deposited in the seven-county area. These deposits consist of wind-blown loess and stream alluvium.


NO. OF DAYS PER
OF WIND DIRECTIO
70 –
50 –
40 –
20 –
0 –
VALUES
AVERAGE MONTHLY TEMPERATURE (INCHES)
% POSSIBLE SUNSHINE
% RELATIVE HUMIDITY (6 P.M. DAILY AVERAGE)
AVERAGE DAILY TEMPERATURE RANGE
MOST LIKELY
TORNADO OCCURANCE *
JAN. FEB. MARCH MAY JUNE AUG. SEPT. OCT. NOV. DEC.
APR.
JULY
* HISTORICAL RECORDS SHOW THAT
FIVE TORNADOS HAVE TOUCHED
DOWN WITHIN PRESENT OMAHA CITY
LIMITS.

2

NO. OF DAYS PER YEAR
OF WIND DIRECTION



AVERAGE)

OCT. NOV. DEC.

ISTORICAL RECORDS SHOW THAT
VE TORNADOS HAVE TOUCHED
WN WITHIN PRESENT OMAHA CITY
MITS.

METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA

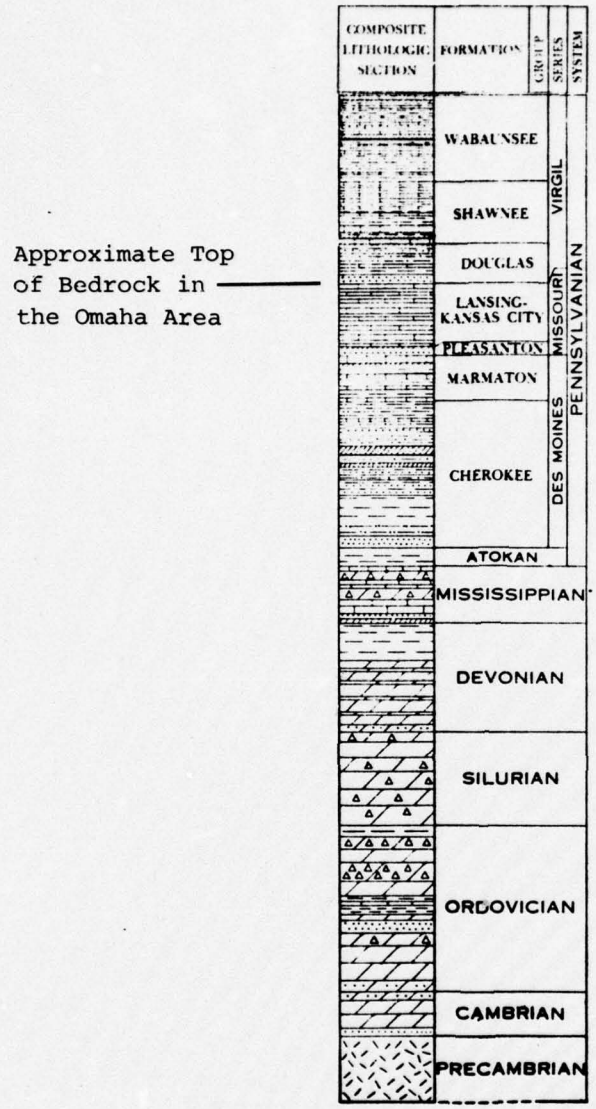
CLIMATOLOGICAL DATA

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

JUNE 1975

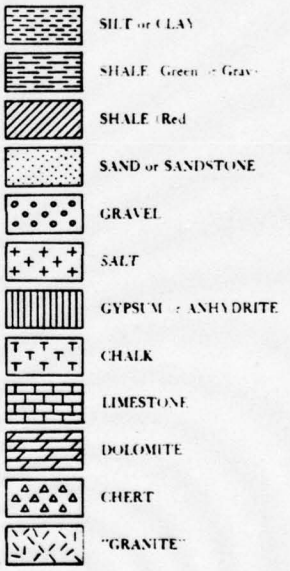
VOLUME II FIGURE B-3

Most glacial deposits are a result of the Kansas and Wisconsin ice ages. The most conspicuous Kansan deposit consists of till which is a mixture of clay, sand, and gravel. It was also during the Kansan ice age that the Missouri River began to entrench its present channel. During the last glacial stage, known as the Wisconsin (22,000-11,000 B.C.), winds blowing across the Platte, Elkhorn, and Missouri Flood Plains picked-up clay and silt and redeposited it locally as loess. The present landscape over a large portion of the seven-county area has been developed on these deposits. Loess deposits are 100 to 200 feet thick along the Missouri River bluffs and less than 12 feet thick in West Central Iowa. These deposits are reflected topographically by steep slopes and rugged tree-covered terrain along the Missouri bluffs. East and west of the Missouri River Valley, the loess topography consists of rolling farmland. The Missouri Flood Plain is the most prominent geomorphic feature in the study area and is 3 to 8 miles wide. Argillaceous limestones, calcareous shales, thin limestones and shales represent bedrock in the seven-county area and were deposited during the Pennsylvanian Period (280,000,000-310,000,000 B.C.). The environment under which these rocks accumulated was that of a shallow open sea with coastal swamps and lagoons. Limestone of the Pennsylvania system are a locally important source for construction aggregate and for manufacture of cement. Sands and gravels of glacial origin are also of economic value. Figure B-4 shows a geologic cross-section of the seven-county area.



Approximate Top of Bedrock in the Omaha Area

EXPLANATION OF SYMBOLS



Source :
From Bedrock Geologic Map of Nebraska,
Nebraska Geological Survey.

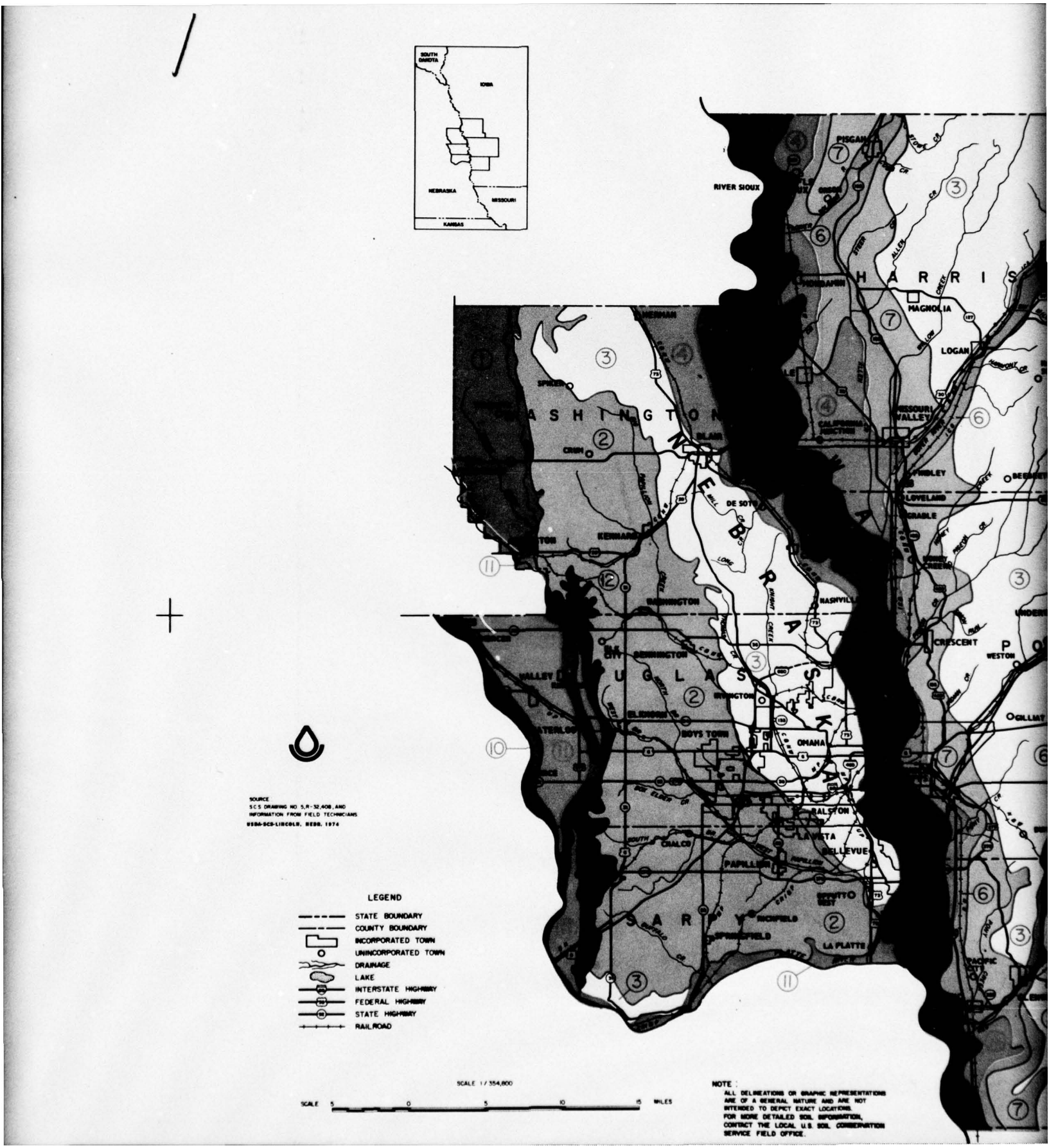
METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA

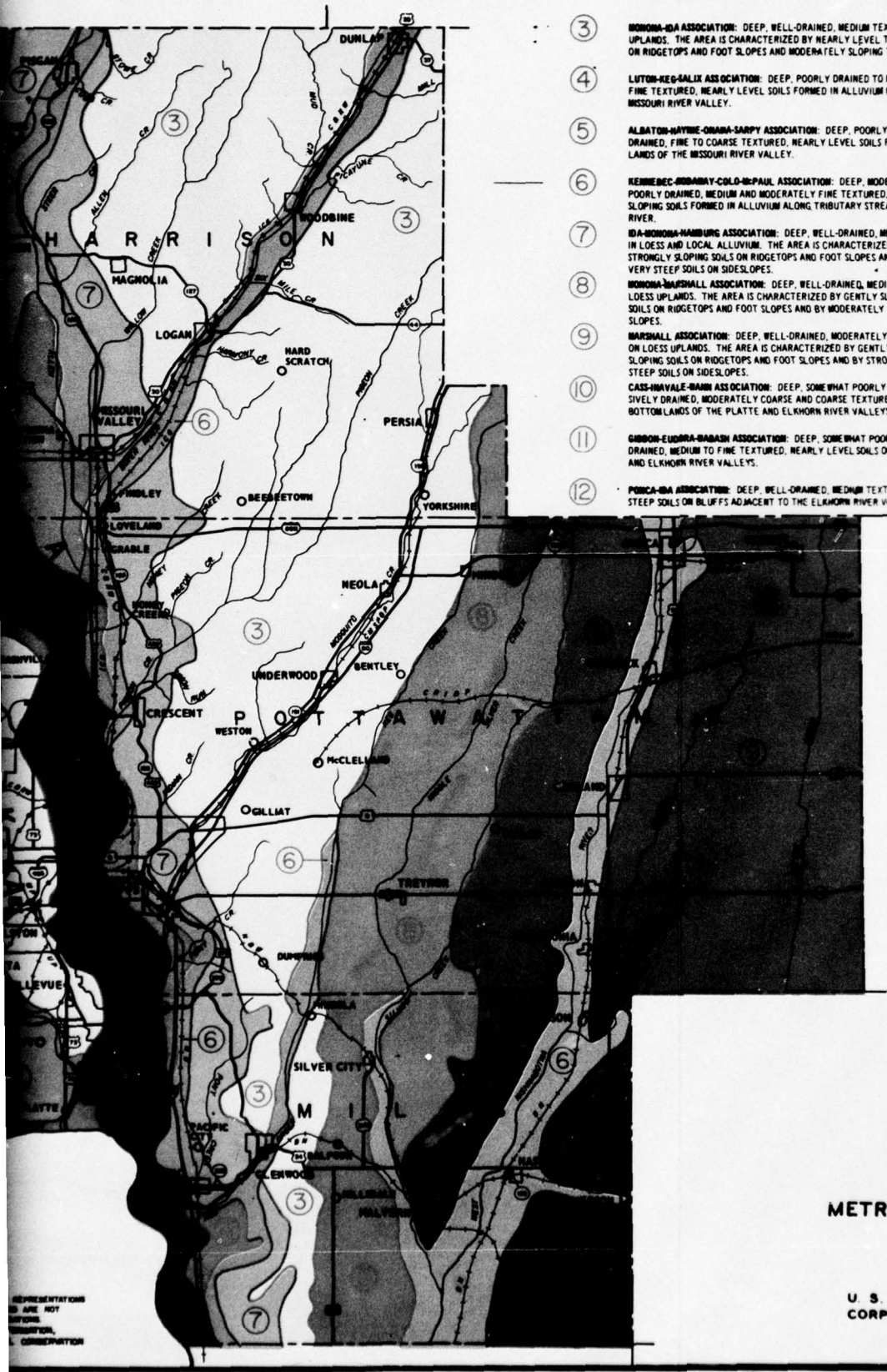
GEOLOGICAL CROSS SECTION

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

JUNE 1975

VOLUME II FIGURE B-4


SOUTH DAKOTA
IOWA
NEBRASKA
MISSOURI
KANSAS
RIVER SIOUX
PISGAH
HARRIS
MAGNOLIA
LOGAN
HERMAN
SPRIER
WASHINGTON
BLAIR
CRWN
KENNARD
DE SOTO
LOVELAND
CRABLE
RASHVILLE
CRESCENT
WESTON
GILLIAT
BURNINGTON
DOUGLAS
VALLEY
STERLING
ELKHORN
BOYS TOWN
OMAHA
BALSTON
LAVISTA
BELLEVUE
PAPILLION
GRETO WEST
SARPY
SPRINGFIELD
LA PLATTE
PACIFIC CITY
SOURCE
SCS DRAWING NO 5,R-32,408, AND
INFORMATION FROM FIELD TECHNICIANS
USDA-SCS-LINCOLN, NEBR. 1974
LEGEND
STATE BOUNDARY
COUNTY BOUNDARY
INCORPORATED TOWN
UNINCORPORATED TOWN
DRAINAGE
LAKE
INTERSTATE HIGHWAY
FEDERAL HIGHWAY
STATE HIGHWAY
RAILROAD
SCALE 1 / 354,800
SCALE 5 0 5 10 15 MILES
NOTE :
ALL DELINEATIONS OR GRAPHIC REPRESENTATIONS ARE OF A GENERAL NATURE AND ARE NOT INTENDED TO DEPICT EXACT LOCATIONS. FOR MORE DETAILED SOIL INFORMATION, CONTACT THE LOCAL U.S. SOIL CONSERVATION SERVICE FIELD OFFICE.



SOIL ASSOCIATIONS

1. **MOODY-BELFORE ASSOCIATION:** DEEP, WELL-DRAINED, MEDIUM AND MODERATELY FINE TEXTURED, NEARLY LEVEL TO STRONGLY SLOPING SOILS ON LOESS UPLANDS.
2. **MARSHALL-SHARPSBURG-PONCA ASSOCIATION:** DEEP, WELL-DRAINED, MODERATELY FINE TEXTURED, NEARLY LEVEL TO MODERATELY STEEP SOILS ON LOESS UPLANDS.
3. **MONONA-IDA ASSOCIATION:** DEEP, WELL-DRAINED, MEDIUM TEXTURED SOILS FORMED ON LOESS UPLANDS. THE AREA IS CHARACTERIZED BY NEARLY LEVEL TO MODERATELY SLOPING SOILS ON RIDGETOPS AND FOOT SLOPES AND MODERATELY SLOPING TO STEEP SOILS ON SIDESLOPES.
4. **LUTON-KEG-SALIX ASSOCIATION:** DEEP, POORLY DRAINED TO MODERATELY WELL-DRAINED, FINE TEXTURED, NEARLY LEVEL SOILS FORMED IN ALLUVIUM ON BOTTOM LANDS OF THE MISSOURI RIVER VALLEY.
5. **ALBATON-HAYNIE-OMAHA-SARPY ASSOCIATION:** DEEP, POORLY DRAINED TO EXCESSIVELY DRAINED, FINE TO COARSE TEXTURED, NEARLY LEVEL SOILS FORMED IN ALLUVIUM BOTTOM LANDS OF THE MISSOURI RIVER VALLEY.
6. **KENNEBEC-JUDDAY-COLO-McPAUL ASSOCIATION:** DEEP, MODERATELY WELL-DRAINED TO POORLY DRAINED, MEDIUM AND MODERATELY FINE TEXTURED, NEARLY LEVEL TO GENTLY SLOPING SOILS FORMED IN ALLUVIUM ALONG TRIBUTARY STREAMS LEADING TO THE MISSOURI RIVER.
7. **IDA-MONONA-HAMBURG ASSOCIATION:** DEEP, WELL-DRAINED, MEDIUM TEXTURED SOILS FORMED IN LOESS AND LOCAL ALLUVIUM. THE AREA IS CHARACTERIZED BY GENTLY SLOPING TO STRONGLY SLOPING SOILS ON RIDGETOPS AND FOOT SLOPES AND BY MODERATELY STEEP TO VERY STEEP SOILS ON SIDESLOPES.
8. **MONONA-MARSHALL ASSOCIATION:** DEEP, WELL-DRAINED, MEDIUM TEXTURED SOILS FORMED ON LOESS UPLANDS. THE AREA IS CHARACTERIZED BY GENTLY SLOPING TO STRONGLY SLOPING SOILS ON RIDGETOPS AND FOOT SLOPES AND BY MODERATELY STEEP TO STEEP SOILS ON SIDESLOPES.
9. **MARSHALL ASSOCIATION:** DEEP, WELL-DRAINED, MODERATELY FINE TEXTURED SOILS FORMED ON LOESS UPLANDS. THE AREA IS CHARACTERIZED BY GENTLY SLOPING TO MODERATELY SLOPING SOILS ON RIDGETOPS AND FOOT SLOPES AND BY STRONGLY SLOPING TO MODERATELY STEEP SOILS ON SIDESLOPES.
10. **CASS-HAVALE-BANO ASSOCIATION:** DEEP, SOMEWHAT POORLY DRAINED TO SOMEWHAT EXCESSIVELY DRAINED, MODERATELY COARSE AND COARSE TEXTURED, NEARLY LEVEL SOILS ON BOTTOM LANDS OF THE PLATTE AND ELKHORN RIVER VALLEYS.
11. **GIBBON-EUDORA-WABASH ASSOCIATION:** DEEP, SOMEWHAT POORLY DRAINED AND POORLY DRAINED, MEDIUM TO FINE TEXTURED, NEARLY LEVEL SOILS ON BOTTOM LANDS OF THE PLATTE AND ELKHORN RIVER VALLEYS.
12. **PONCA-IDA ASSOCIATION:** DEEP, WELL-DRAINED, MEDIUM TEXTURED, STRONGLY SLOPING TO STEEP SOILS ON BLUFFS ADJACENT TO THE ELKHORN RIVER VALLEY.

2

METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA

SOILS MAP

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

JUNE 1975

VOLUME II FIGURE B-5

★ U.S. GOVERNMENT PRINTING OFFICE: 1972-700-940

SOILS

The soils of the seven-county study area are partially classified according to the parent material upon which they occur. The classifications encompass soils developed on loess, till, and alluvium. These soils consist of a range of: silt loames, silty clays, sandy loames, clay loames, loamy sands, and fine sands. Soil series names, distribution, parent material, and permeability are summarized in table B-1. The locations of various soils are shown on figure B-5.

VEGETATIVE COVER

Almost three-fourths of the total land area is devoted to cropland. Douglas County at the time of the inventory was the most highly developed county with about 40 percent of the area developed, but even then about one-half of the total acreage of land and water was devoted to cropland. Pottawattamie County, with the second highest amount of developed acreage (36,500), also has the greatest relative and absolute amount of cropland, but this is because, in part, it is a large county having more than one-fourth of the total acreage of the whole region.

Close to one-half of the total cropland in each of the counties was harvested as corn for grain in 1973, when 805,200 acres produced nearly 80 million bushels of corn. About 22 percent of the cropland produced soybeans during the same year, yielding about 12.2 million bushels. Other important crops in the region include sorghum (grain) and alfalfa. Most of the cropland is in the flood plains and on the flat to gently-rolling uplands.

Less than one-tenth of the amount of land devoted to crops is in pasture or range. Other than Douglas County, with less than 2 percent, and Mills County with less than 5 percent, the other counties had from 7 to 8.6 percent of their total area in this primary land use as estimated in the inventory. Most of this land was used in part by nearly 82,000 beef and about 10,000 dairy cattle as of January 1973. Over one-fourth of the beef cattle were in Pottawattamie County and about one-fourth of the dairy cattle were in Washington County. About 190,000 head of other cattle were also located in the four Nebraska counties, which were not classified as either dairy or beef due to reporting procedures. During the year, nearly 640,000 head of cattle were fed in the region in isolated feedlots; 26 percent in Pottawattamie County, 22 percent in Sarpy County, 15 percent in Douglas County, and 12 percent in Washington County.

Woodland areas cover only about 6.7 percent of the total area in the region. Of three counties in the SMSA, only Sarpy has nearly 10 percent of its area in woodland, more than three times the relative amount in Douglas, and more than twice the amount in Pottawattamie. This is due to the juxtaposition of Sarpy County in relation to the two major rivers of the area, the Missouri and Platte. Being bounded on three sides by these rivers provides the county with a more adequate amount of natural habitat for wooded areas, normally found along water courses and bluffs in the region. Harrison and Mills Counties each have nearly 10 percent of their area in woodland. Indigenous trees in the area include: elm, linden, basswood, hickory, black walnut, poplar, green ash, box elder, hawthorne, locust, sycamore, sumac, bitter nut, black oak, and bur oak. Along the banks of smaller streams are willows and cottonwoods. Domestic plantings

of evergreens and ornamentals are common. A number of apple orchards were planted in the area; some were later subdivided into residential areas. Much of the wooded area is presently grazed and some is preserved in parks.

The Conservation Needs Inventory carried out under the direction of the respective State Soil Conservation Service offices provides estimates of the amount of conservation treatment needed. Additional contouring, terracing, diversions, and strip cropping are needed on about 75 percent of the cropland in the seven-county region. Adequate conservation treatment of cropland ranges from about 20 percent in Douglas County to 16 percent in Cass County in Nebraska, while adequate treatment was estimated to be from about 13 percent in Harrison County to nearly 19 percent in Mills County in Iowa. Pasture needs usually are concerned with overgrazing, thus adequate conservation needs for the most part require reestablishment of grass cover. Adequate conservation treatment of grasslands was adjudged to range from none in Sarpy County to about 43 percent in Douglas County, while it ranged from over 20 percent in Harrison County to about 34 percent in Pottawattamie County, Iowa. It was estimated over 75 percent of the grassland needed some conservation treatment. About two-thirds of the forest or woodland was estimated in need of conservation treatment. Adequate conservation treatment varies from establishment and reinforcement of plantings, timber-stand improvement, improvement of forage, and reduction or elimination of grazing. Adequate treatment was believed to range from 10 to 15 percent of the woodland acres among the Nebraska counties and from 38 to 55 percent among the Iowa counties.

Runoff and erosion are major problems on the upland soils, while poor drainage, high water tables and temporary ponding are common on the flood plains and bottomlands. The result is many areas with narrow, gently-sloping ridges and entrenched streams and gullys. The Missouri River bluffs have steep upland side slopes; where grass cover is found, erosion has occurred to form small natural benches called catsteps.

MARSHES

The only extensive bodies of water are in the streams of the area. The only natural lakes are oxbows or former river channels which have been cut off in the flood plain of the Missouri River. A number of artificial lakes have been formed in abandoned gravel pits in the Missouri, Platte, and Elkhorn flood plains. There are a small number of farm conservation ponds scattered throughout the area. A few borrow pits along the Interstate Highway have formed small lakes.

Stabilization of the Missouri River for navigation, bank erosion control, and the building of levees for flood protection have had a profound effect on the habitats and inhabitants of the river, shoreline, and flood plain. The most visual changes have been marked by the reduction and disappearance of marsh, backwaters, sandbars, dunes, reduced silt, and young and old forests. Some of the changes are due to project improvements while others are due to changes in adjacent land use. Reduction of shallow, quiet waters largely eliminated the habitat where the majority of aquatic organisms thrived. This, together with reduced turbidity and channelization and accompanied by increased stream velocity which

exposed the bottom of the channel has resulted in reduction of bottom-feeding fish. Loss of the bottom feeders, such as catfish, has not yet been replaced by the sight feeders such as sauger, walleye, and white bass. Thus, while the population of fish has been reduced, there is promise the quality of fishing may improve. The controlled river does offer the boater, fisherman, and hunter more and safer access to the river than they had when it was in the wild state where they had to traverse private land. Flood plain communities which normally developed in an uncontrolled river environment have largely been succeeded by agricultural land uses and casual residential development. L-head revetments, prone to trapping silt, initiate and accelerate a young vegetation succession, including cattail, willow, cottonwood, dogwood, elm, ash, and hackberry, in that order.

NATURAL RESOURCES

WATER RESOURCES

The Missouri River and the Platte River are the principal streams in the study area. Other important tributary streams of the Missouri River include the Boyer River, Indian and Mosquito Creeks, and Papillion Creek and its tributaries.

The Missouri River is the major surface source for water in the seven-county area. The Missouri River drains an area of about 322,800 square miles upstream from Omaha. Records of gage heights were kept from 1872 to 1899. The present gaging station was established in 1928 and has been in operation since that time. The maximum recorded discharge was 396,000 cubic feet per second on 18 April 1952, and the minimum was 2,200 cubic feet per second on

6 January 1937. Both extremes occurred before the main stem reservoir system was fully operational. The average annual volume of flow for the period of record is about 20,750,000 acre-feet.

The Platte River drains nearly 89,000 square miles upstream from Omaha. The maximum recorded discharge was 124,000 cubic feet per second on 30 March 1960. Minimum discharge was 240 cubic feet per second on 3 September 1955. The average volume of flow for a 19-year period was 3,989,000 acre-feet per year.

The Boyer River drains about 871 square miles. It flows in a southwesterly direction and is located in western Iowa. The river enters the Missouri River south of Missouri Valley, Iowa. The maximum discharge recorded was on 17 February 1971 when a peak of 25,000 cubic feet per second occurred. The minimum daily discharge of 1.5 cubic feet per second was recorded on 16 July 1938.

Indian Creek flows in a southerly direction through the city of Council Bluffs and enters the Missouri River south of the city. The creek drains an area of about 15 square miles. The downstream one-third of the basin is located within the city. On 19 and 20 June 1942, a flood having an estimated peak discharge of about 7,000 cubic feet per second occurred. During most years, no flow occurs in Indian Creek.

Mosquito Creek is located generally east of Council Bluffs and flows in a southwesterly direction, entering the Missouri River south of the city. It drains an area of about 240 square miles. Maximum discharge of record, about 12,000 cubic feet per

second, occurred on 11 September 1972. There are periods when no flow occurs for several days.

Papillion Creek is a right-bank tributary of the Missouri River, entering that stream south of Bellevue, Nebraska. Papillion Creek and its tributaries drain 402 square miles of land with uses ranging from agricultural in the upstream portions of the basin to urban development in the downstream portion of the basin. Maximum discharge of record of about 40,800 cubic feet per second occurred on the West Branch near Papillion on 16 June 1964. There are periods of little or no flow on the tributaries lasting for several days.

Historic records for the major rivers in the seven-county area indicate that the Missouri River has flows of at least 8,000 cubic feet per second 100 percent of the time, and the Platte River has flows of at least 800 cubic feet per second 100 percent of the time. Smaller streams in the area have experienced zero discharges for aslong as 10 days during dry weather. Indian Creek is representative of the smaller stream.

The upstream reaches of the smaller streams have relatively good water quality most of the time. The smaller streams in the metropolitan area are generally of poorer quality. All of the smaller streams are adversely affected by heavy runoff. The larger streams - West Nishnabotna, Platte, Elkhorn, and Missouri - all exhibit a greater buffering capacity to runoff or shock loads, and with the exception of bacterial limits, generally meet or exceed the adopted water quality criteria. The introduction of pollutants from various waste sources can, however, be detected even in rivers as large as the Missouri.

The entire seven-county study area is underlain with abundant ground water resources. The most desirable areas for ground water resource development are along the flood plains of the Platte, Elkhorn, Missouri, and Boyer Rivers and in the eastern portions of Pottawattamie and Mills Counties. Within the more desirable areas, differences in quality are significant. For example, dissolved solids range from less than 250 ppm to more than 4,000 ppm. Chlorides range from less than 150 to more than 600 ppm; and sulfates range from less than 250 ppm to more than 1,000 ppm.

Water table elevations along the Platte River are affected by the quantity of stream flow. Wells are generally placed near the river for greater capacity. Ground water levels along the Missouri River are influenced more by the character of the alluvium than by the streamflow.

The most significant quantities of ground water in the seven-county area occur at depths averaging 50-160 feet in sands and gravels of alluvial river valleys; especially in the Platte, Elkhorn, Boyer, and Missouri valleys. Water is also available from bedrock sources at depths of approximately 1,000 feet. In general, adequate supplies are obtained from the alluvial valleys.

BIOLOGICAL RESOURCES

The largest fishery, and perhaps the most underused, occurs in the major rivers of the area. This is probably due to the lack of the more popular game and pan fish. The species found locally in the rivers include: channel catfish, bullheads, bigmouth buffalo, carp, river carpsucker, quillback carpsucker, white sucker, gizzard shad, creek chub, silver chub, flathead chub, plains

suckermouth minnow, brassy minnow, flathead minnow, emerald shiner, red shiner, sand shiner, stonecat and various sandfishes. Some of the oxbows and sandpit lakes contain more popular species such as blue gills, sun fish, crappies, largemouth bass, and trout. These areas bear most of the local fishing pressure.

Wildlife remaining in the bottom lands and adjacent uplands depends on the habitat availability such as forests, marsh, backwater meadows, sandbar, and dune areas. Whitetail deer, fox, oppossum, cottontail rabbits, squirrels, skunk, coyote, and small rodents are the most common terrestrial wildlife inhabiting the wooded areas. The mink and raccoon also use marsh and stream habitats. Other small mammals in the area include the shrew, the thirteen-lined ground squirrel, plains pocket gopher, mice, and voles. Abandoned buildings, bluff caves, and forests provide habitat for bats, such as the red, evening, and silver-haired varieties.

Small mouthed and tiger salamanders are affected by pressure from the reduced amount of habitat following the removal of timber. The collared lizard, five-lined skink, great plains skink, northern prairie skink, slender glass lizard, and six-lined race runner, need damp, wooded areas since they feed primarily on insects. Similarly, the population of snakes continues to decline with the disappearance of woodlands. Most severely affected are the poisonous timber rattle snakes, and the non-poisonous worm snake and yellow-bellied racer. Less affected because they are not associated with the wet woodlands are the poisonous prairie rattler and western massasauga, and the non-poisonous prairie ring snake, black rat snake, western fox snake, prairie king snake, red milk

snake, speckled king snake, western smooth snake, bull snake, western ribbon snake, Texas brown snake, plains garter snake, red-sided garter snake, and northern lined snake.

Due to the geographic location of the area, near the western edge of the deciduous forests and the eastern edge of the plains, many eastern as well as western species of birds frequent the habitat of the flood plain and adjacent uplands. Many species of birds use the area but are being adversely affected by removal of the flood plain forests. Species which use this habitat for breeding include certain hawks, falcons, owls, goatsuckers, swifts, woodpeckers, flycatchers, jays, titmice, nuthatchers, wrens, mocking birds, thrashers, thrushes, gnatcatchers, waxwings, vireos, warblers, orioles, tanagers, grosbeaks, finches, towhees, juncos, and sparrows. Some species only use the area during their migration, including some species of hawks, falcons, eagles, ospreys, owls, flycatchers, thrushes, vireos, warblers, grosbeaks, juncos, and sparrows. Aquatic and semi-aquatic birds also live in or frequent the area. Breeding species most affected are certain grebes, ducks, mergansers, herons, bitterns, rails, coots, gallinules, plovers, sandpipers, woodcocks, snipes, terns, kingfishers, swallows, and blackbirds. Also affected to some degree are winter and summer residents which include certain ducks, mergansers, eagles, and herons. Least affected are the migrant grebes, pelicans, cormorants, swans, geese, ducks, mergansers, eagles, bitterns, cranes, rails, avocets, plovers, sandpipers, gulls, terns, and blackbirds.

Many species of waterfowl migrating through the Missouri River valley rest on the oxbow lakes and feed in adjacent fields. One such cutoff oxbow which has gained in popularity with waterfowl

as well as other wildlife is the DeSoto Bend National Wildlife Refuge where approximately 5,000,000 geese and 8,000,000 ducks annually stop over and rest before continuing their northward and southward migration.

Table B-1
Soils Of The Study Area

Soil Series Name	Distribution	Parent Material	Permeability (inches-hour)	Aerial Extent Percent
Albaton	Bottom lands	Alluvium	.05 - .02	2.2
Belfore	Uplands	Loess	.20 - 2.5	.7
Burchard	Uplands	Till	.20 - .80	1.3
Can	Bottom lands	Alluvium	2.5 - 5.0	.3
Cass	Bottom lands	Alluvium	2.5 -10.0	.6
Crafton	Uplands	Loess	.80 - 2.5	11.1
Haynie	Bottom lands	Alluvium	.80 - 2.5	1.8
Judson	Bottom lands-slopes	Alluvium	.80 - 2.5	7.7
Lancoure-Colo.	Bottom lands	Alluvium	.02 - .80	2.7
Leshara	Bottom lands	Alluvium	.80 - 5.0	1.5
Luton	Bottom lands	Alluvium	.05 - 5.0	6.2
McPaul	Bottom lands	Alluvium	.80 - 2.5	1.6
Monona	Uplands	Loess	.80 - 2.5	11.5
Moody - Marshall	Uplands	Loess	.20 - .80 - 2.5	7.8
Nora - Crafton	Uplands	Loess	.20 - .80 - 2.5	3.0
Onawa	Bottom lands	Alluvium	.05 -10.0	1.4
Rauville	Bottom lands	Alluvium	.05 - 2.5	.8
Sarpy	Bottom lands	Alluvium	5.0 -10.0	.6
Sharpsbury	Uplands	Loess	.20 - .80	21.8
Marshall	--	--	--	--
Steinauer	Uplands	Till	.17	.1

The Study Area Today

HUMAN RESOURCES

POPULATION DISTRIBUTION

Changes in population distribution between 1960 and 1970 among the seven counties comprising the study area, the States of Nebraska and Iowa, and the United States are presented in table B-2. Total population in the study area increased about 16 percent during the decade, compared to slightly over 13 percent for the Nation. The difference was due primarily to the gain in Douglas County, which increased at the same rate as the Nation and contains about two-thirds of the area's population, and in Sarpy County, which doubled in population during the decade. Pottawattamie County, second most populous county, gained population at less than a 5 percent rate; Washington County gained at a 10 percent rate; and Cass County gained at only a 1.4 percent rate. Population of Harrison and Mills Counties declined by over 7 and 9 percent, respectively. Iowa and Nebraska gained at rates of 2.4 and 5.1 percent, respectively with Nebraska gaining about five thousand persons more than Iowa. Densities of population in 1970 ranged from 1,163 per square mile in Douglas County to 267 in Sarpy County, and 90 for Pottawattamie County. Population densities in the four remaining counties range from 23 to 34 persons per square mile.

The proportion of the population living in urbanized areas continued to increase during the decade of the 1960's. By 1970, both Douglas and Sarpy Counties had appreciably greater proportions

of population in an urban area than either of the two States or the Nation. With a doubling of its population, Sarpy County experienced the greatest change. The smaller, more rural counties had from about one-fifth or less than one-half of their population in non-urban areas. More than one-third of the population in Harrison County and more than one-half of the total population in the other three smaller communities remained scattered in rural locations or lived in communities of 1,000 or less at the time of the 1970 Census.

Table B-2
Population Distribution

Areas	Population 1960	Population 1970	Urban-Percent 1960	Urban-Percent 1970	Places 1,000-2,499 in Percent 1960	Places 1,000-2,499 in Percent 1970	Other Rural in Percent 1960	Other Rural in Percent 1970
NEBRASKA								
Douglas Co.	343,490	389,455	94.2	95.8	4.8	0.7	1.0	3.5
Sarpy Co.	31,281	63,696	46.1	84.4	46.2	2.4	7.7	13.1
Cass Co.	17,821	18,076	35.0	35.2	36.2	12.1	28.4	52.7
Washington Co.	12,103	13,310	40.7	45.9	26.1	0.0	32.2	54.1
IOWA								
Pottawattamie Co.	83,102	86,991	72.9	74.7	14.9	3.6	12.2	21.8
Harrison Co.	17,600	16,240	20.3	21.7	40.9	52.7	55.3	35.6
Mills Co.	13,050	11,832	31.3	37.4	55.3	9.8	13.4	52.8
TOTALS								
Nebraska	1,411,330	1,483,493	54.3	62.0	23.8	7.3	21.9	31.2
Iowa	2,757,537	2,824,376	53.0	57.2	23.0	7.2	24.0	35.6
United States (1,000's)	179,323	203,212	69.9	73.5	3.6	3.3	26.5	23.2

Source: U.S. Department of Commerce, Bureau of Census, Census of Population

AGE CHARACTERISTICS

Reduction in birth rates and continued migration from the farm to the city contribute to dynamic changes in an area such as the seven counties under study. Table B-3 indicates percentages of oldest and youngest sectors of the population and median ages by sex for 1960 and 1970. Higher percentages in the younger age group, under 18 years, and lower median ages in the Sarpy County area may be attributed to settlement of younger married couples in newly-developed areas and the presence of Offutt Air Force Base. This also contributes to relatively smaller shares of the older age group, 65 years and over, found in Sarpy County. Higher median ages, larger proportions of older people, and smaller shares of younger people in the four smaller rural counties can be attributed to the decline of the number of farms and the movement of younger members of the labor force (and their families) to job opportunities in urban areas. It is interesting to note the median age for females had declined between 1960 and 1970 in six of the seven counties, Harrison excepted, as compared to an increase of 2.6 years for the United States. There was a net increase in the number of females in the oldest age group in both Harrison and Mills Counties, despite their loss of total population.

Table B-3
Age Characteristics
(in Percent)

Areas	Male						Female					
	Under 18 Years		65 Yrs & Over		Median Age		Under 18 Years		65 Yrs & Over		Median Age	
	1960	1970	1960	1970	1960	1970	1960	1970	1960	1970	1960	1970
NEBRASKA												
Douglas Co.	18.2	18.3	4.1	3.8	28.1	25.4	17.6	17.8	5.1	5.7	29.4	27.1
Sarpy Co.	20.7	22.6	1.9	1.3	23.2	21.9	19.5	21.4	2.1	1.5	23.4	21.9
Cass Co.	18.4	17.7	6.0	5.8	29.6	28.9	17.6	17.0	7.0	7.0	30.9	30.3
Washington Co.	17.8	17.0	5.7	5.8	30.0	28.0	16.5	15.4	7.1	7.3	32.3	30.7
IOWA												
Pottawattamie Co.	19.4	19.1	4.5	4.4	27.8	26.2	18.8	18.5	5.4	6.2	28.5	28.2
Harrison Co.	18.8	17.6	7.7	9.3	32.4	31.7	17.6	16.4	7.7	9.3	34.2	36.2
Mills Co.	18.5	17.3	5.5	5.7	30.3	29.1	16.5	15.5	6.0	7.0	32.6	32.3
TOTALS												
Nebraska	18.1	17.4	5.4	5.3	29.6	29.7	17.4	16.8	6.2	7.1	30.9	27.4
Iowa	18.3	17.7	5.4	5.2	29.5	27.5	17.5	16.9	6.5	7.2	31.1	30.2
United States	18.2	17.5	4.2	4.1	28.7	27.0	17.6	16.8	5.1	5.7	27.0	29.6

Source: U.S. Department of Commerce, Bureau of Census, Census of Population

RACIAL COMPOSITION

The distribution of nonwhite population among the counties in the study area and the ratio of this population in the two States and the Nation are compared on table B-4. Black population in Douglas County is the only nonwhite segment that exceeds the local (Nebraska) share, but even here it is somewhat less than the national ratio. The relative increase of this segment in Douglas and Sarpy Counties during the decade far exceeded increases in the State or Nation. While other nonwhite population doubled or more than doubled in all counties except Harrison during the last decade, the local county shares did not exceed the ratios for Nebraska and Iowa and fell far short of the mix attained at the national level. One-half or more of the local nonwhite population is American Indian.

Table B-4
Nonwhite Population

Areas	Black				Other Nonwhite			
	Number		Percent		Number		Percent	
	1960	1970	1960	1970	1960	1970	1960	1970
NEBRASKA								
Douglas Co.	25,269	34,722	7.3	8.9	1,191	2,452	0.3	0.6
Sarpy Co.	423	1,485	1.4	2.2	84	492	0.3	0.7
Cass Co.	6	14	*	*	30	57	0.2	0.3
Washington Co.	14	31	0.1	0.2	11	60	0.1	0.5
IOWA								
Pottawattamie Co.	593	600	0.7	0.7	94	250	0.1	0.3
Harrison Co.	9	6	*	*	9	11	*	*
Mills Co.	15	11	0.1	*	4	17	*	0.1
TOTALS								
Nebraska			2.1	2.7			0.5	0.7
Iowa			0.9	1.2			0.1	0.3
United States			10.5	11.2			0.9	1.4

* less than 0.1 percent share

Source: U.S. Department of Commerce, Bureau of Census, Census of Population

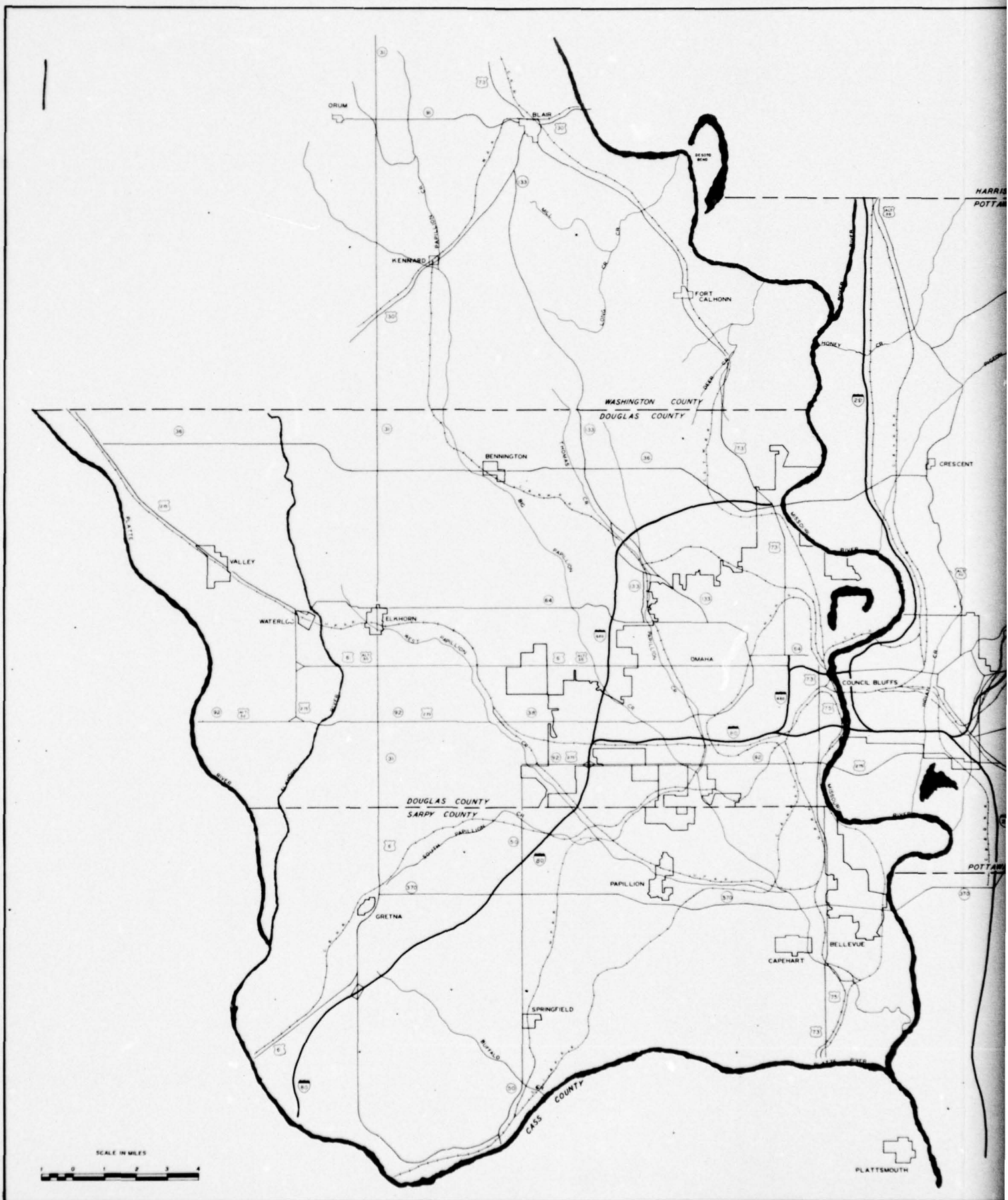
ECONOMIC BASE

TRANSPORTATION

The seven-county study area has a highly developed system of highways. Interstate Highways 29 (north-south) and 80 (east-west) intersect in Council Bluffs. Three Interstate Highway bridges cross the Missouri River. Washington County is the only county of the seven not directly served by the Interstate system. Other Federal highways serving the area include north-south routes U.S. 59, 73, 75, and 275; and east-west routes U.S. 6, 30, and 34. State routes in Iowa serving the area include 37, 41, 44, 83, 92, 127, 165, 166, 183, 191, 192, 242, 244, 300, 301, 347, 362, 370, and 385. Nebraska highways in the study area are 1, 31, 36, 38, 50, 64, 66, 85, 91, 92, 133, 370, and 634. Additional county and local roads serve local needs and feed the highway network. Locations of major transportation arteries are shown on figure B-6.

Two commercial scheduled national bus lines, Greyhound and Continental Trailways, operate bus terminals in Omaha. These and several other companies offer charter bus service. Many motor-freight common and contract carriers offer intrastate and interstate service in the area. Taxicab and limousine service is available in most communities.

Urban mass transit by motorbus is available primarily in Omaha, Council Bluffs, and in some of the adjacent communities. During the 1960's, the Omaha Transit Company suffered severe ridership decline from over 16 million annual revenue transit passengers to about one-half that number at the end of the decade.


ORUM
BLAIR
KENNARD
FORT CALHONN
HONEY CR.
WASHINGTON COUNTY
DOUGLAS COUNTY
BENNINGTON
CRESCENT
VALLEY
WATERLOO
ELKHORN
OMAHA
COUNCIL BLUFFS
DOUGLAS COUNTY
SARPY COUNTY
PAPILLION
GRETNA
BELLEVUE
CAPEHART
SPRINGFIELD
CASS COUNTY
PLATTSMOUTH
SCALE IN MILES
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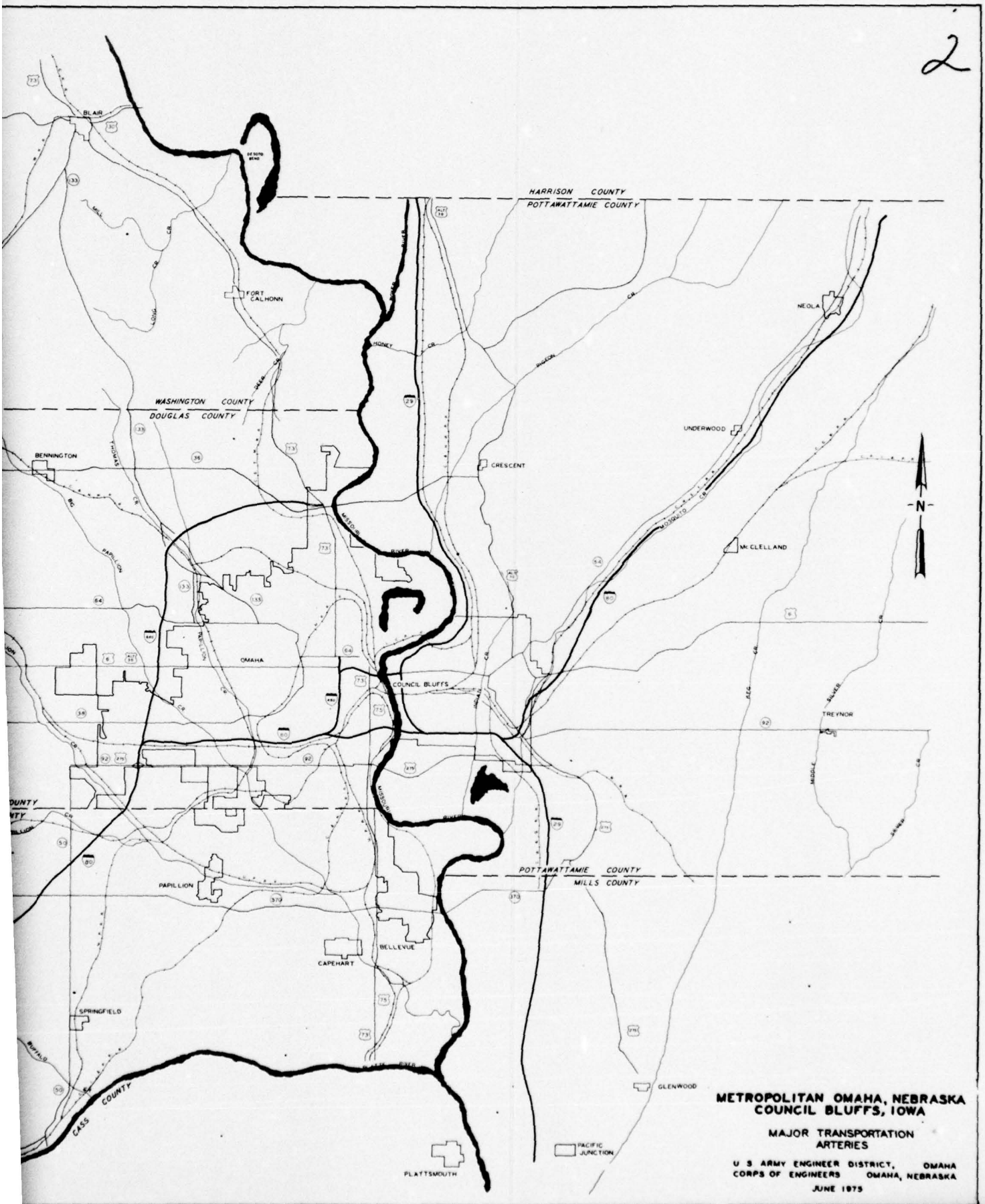


METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA

MAJOR TRANSPORTATION ARTERIES

U S ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

JUNE 1975

In the first half of the decade, passenger decline nearly followed national trends, but in the later half of the decade, it declined at an accelerated rate. Fares increased from 25 cents in 1966 in 5-cent increments to reach 45 cents by 1972. Similar trends were experienced in Council Bluffs which were served by the City Transit Lines, Inc. Public ownership of both lines occurred in July 1972 with the establishment of Metro Area Transit (MAT). Fares were maintained at the 1972 level but the 5-cent cost for transfers was dropped. Service has gradually been expanded to include commuter express service and the extension of some lines. Ultimately, a more complete grid-pattern service area will be established to replace some earlier lines which followed street-car tracks.

Recent estimates establish Omaha as the fourth largest rail center in the United States based on rail tonnage shipped, received, and passing through. Eight major railroads provide freight service to the area including the Burlington Northern Railway, the Chicago and North Western Railway, the Illinois Central Gulf Railroad, the Milwaukee Road, the Missouri Pacific Lines, the Norfolk and Western Railway, the Rock Island Lines, and the Union Pacific Railroad. The home office of the Union Pacific is located in Omaha. The South Omaha Terminal Railway Company operates locally. Seven other railroads maintain off-line offices in Omaha. For outbound freight service, first-day service is provided to Kansas City and Des Moines; second-day service reaches Chicago, Denver, Minneapolis-St. Paul, and St. Louis; third- and fourth-day service connects all points on the Pacific Coast, and fourth- and fifth-day service goes to the East Coast. Daily round-trip passenger service between Chicago and Denver was established in 1971 on AMTRAK.

Commercial air-passenger traffic leaving Eppley Airfield, the only commercial scheduled air terminal in the area, almost doubled during the 1960's, starting with about 300,000 annually. During the same period, commercial cargo more than tripled from a 1,400 ton annual base. Presently, the terminal at Eppley has 18 aircraft gate positions, seven of which are all-weather. Ultimately, some 50 gates will be provided. Currently, the longest runway is 8,500 feet, capable of handling the largest commercial aircraft. Plans call for lengthening this runway to 11,250 feet, the 4,300-foot runway to 9,600 feet, the 6,000-foot runway to 8,800 feet, and for building a new 8,800-foot runway. The Omaha Airport Authority also operates a 3,800-foot runway at Millard Airport. Council Bluffs has a general utility airport east of the city. Many other public and private airfields are located in the area. Offutt Air Force Base, headquarters of the Strategic Air Command, is located south of Bellevue.

Waterborne transport on the Missouri River extends from Sioux City, Iowa to St. Louis, Missouri. A few improvements remain to be completed on the nine-foot minimum depth channel. The navigation season lasts approximately nine months a year from March to November. For the entire river length, about 40 percent more traffic moved downstream than upstream in 1974. For the sector between Sioux City and Rulo, Nebraska, about 20 percent more commercial tonnage passed up the river than down. In this sector, about 20 percent of the tonnage was in the chemicals and related-products commodity classification group, about 16 percent in food and kindred products, 13 percent in stone, clay, cement and lime; 11 percent in nonmetallic minerals, and 3 percent in primary metal products - most of the aforementioned

in upstream traffic. To counter this, about 36 percent of the entire traffic movement consisted of farm products moving downstream. Total tonnage moving through this sector during 1974 was about 1.2 million. The Omaha Municipal Dock is the principal terminal with loading, unloading, warehousing, and transshipment facilities.

The Omaha-Council Bluffs area is served by natural gas and petroleum products pipelines. The Northern Natural Gas Company headquarters in Omaha, Hydrocarbon Transportation, Inc., the National Cooperative Refinery Association, and the Williams Brothers Pipe Line Company have facilities in the area.

LABOR FORCE

In recent years, the labor force has been defined as those people 16 years of age and older who are employed or actively seeking employment. Defining the labor or work force often involves reference to the participation rate, which is the number of people employed at a given time in relation to the total population. The participation rate at the time of the 1970 Census, April 1, 1970, along with other related information regarding the unemployment rate of the civilian labor force is shown in table B-5.

Table B-5

Employment And Unemployment Rates In 1970

	Douglas	Sarpy	Pottawattamie	Cass	Washington	Harrison	Mills
Population	389,455	66,200	86,911	18,076	13,310	16,220	12,517
Total Employment	159,337	24,968	33,677	6,573	5,245	6,016	4,333
Participation Rate	.409	.378	.387	.364	.395	.371	.348
Labor Force	164,291	25,495	34,753	6,819	5,345	6,176	4,378
Male	98,865	17,909	21,827	4,628	3,548	4,176	2,946
Female	65,326	7,586	12,926	2,191	1,797	2,000	1,432
Unemployment Rate	.030	.020	.031	.036	.019	.026	.010
Black Population	34,711	1,485	600				
Employment	11,255	154	199				
Participation Rate	.324	.103	.332				
Labor Force	12,182	167	218				
Male	6,239	39	123				
Female	5,943	128	95				
Unemployment Rate	.076	.078	.087				

Source: U.S. Department of Commerce, Bureau of Census, Census of Population.

Participation rates ranged from 35 to 41 percent of the total population. There was a slightly lower rate in Douglas and Pottawattamie Counties among Blacks. The extremely low participation rate in Sarpy County was due to 88 percent of the Black population (male) being in the Armed Forces. Unemployment rates were quite low in all of the counties at the time of the Census, but were considerably higher among Blacks in the three metropolitan counties.

Occupations among the major groups for the three county SMSA, the balance of the region, the States of Iowa and Nebraska, and the United States are presented in table B-6. Occupational groups are related to employment within the various industry groups to be discussed later. Other direct relationships are due to the relative amount of urban population in the different areas. Urban population ranges from 75 to 96 percent of the total in the SMSA counties, about 74 percent for the Nation, 62 percent for Nebraska, 57 percent for Iowa, and from 22 to 46 percent among the other four counties in the study region. There is a high degree of correlation between the degree of urbanization and the percentage of most occupational groups. The most notable exception of course is among those occupations associated with farming, where the relationship is inverse. Iowa slightly outranks Nebraska in the craftsmen...and operative...related occupations because it has more employment in the manufacturing group, despite having slightly less urban population in 1970.

Table B-6
Current Occupation Mix, Major Groups - 1969
(Percent)

Major Occupation Groups	Omaha, NE-IA SMSA	Regionless SMSA	Iowa	Nebraska	United States
Professional, technical, and kindred workers	14.8	9.5	12.7	12.9	13.8
Managers, administrators, and proprietors - nonfarm	9.2	7.7	8.7	9.1	10.3
Clerical and kindred workers	20.7	12.3	14.8	15.6	17.2
Sales workers	7.9	4.0	6.6	6.8	6.0
Craftsmen, foremen, and kindred workers	12.8	12.5	11.8	11.4	13.1
Operatives - manufacturing, trans. and nonmanufacturing	14.4	15.3	15.0	12.8	18.4
Laborers - except farm and mining	4.7	4.9	4.2	4.2	4.7
Service workers, including household workers	13.7	13.9	13.7	14.2	12.2
Farmers and farm managers	1.3	16.5	10.0	10.4	2.6
Farm laborers and farm foremen	0.5	3.4	2.5	2.6	1.7

Source: U.S. Dept. of Commerce, Bureau of Census, Census of Population

DISTRIBUTION OF EMPLOYMENT

Distribution of employment among 10 major industrial groups in 1969 for the Omaha SMSA, the seven-county region, Iowa, Nebraska, and for the United States is shown in table B-7. About 91 percent of the total employment in the seven-county area is within the three counties comprising the SMSA. Therefore, in those employment groups where the percentage is greater in the region than in the SMSA, these employment groups are relatively strong in the four rural counties. Employment is further displayed for each of the seven counties and the other larger geographic areas among 25 sectors of employment in table B-8. When comparing the individual counties, there is some lack of resolution because the census enumeration counts the individual according to his place of residence, which may or may not be in the county where he works. While this may be significant in some larger metropolitan areas, it is not viewed to be of great importance in the local area because relatively few people commute outside of the area for work.

Three-fourths of the local employment is found in the services, trade, manufacturing, and transportation - communications - utilities groups in that order. That portion of employment within the services group is almost identical among the five geographic areas observed. Almost as many people are employed in the wholesale-retail trade group as in the services. A slightly larger percentage of employment is in this sector at the State and local level than at the national level. While manufacturing employment is relatively important in the local area, it is more important for Iowa and the Nation. Almost the opposite could be said about the relative importance on an areal basis for employment in the transportation-communications-utilities group, where it is almost

Table B-7
Current Employment Mix, Major Groups - 1969
(Percent)

Major Employment Groups	Omaha, NE-IA SMSA	Seven County Region	Iowa	Nebraska	United States
Agriculture, Forestry, and Fisheries	2.2	3.9	13.2	8.4	3.7
Mining	0.2	0.3	0.2	0.3	0.8
Contract Construction	5.8	5.9	5.2	6.0	5.8
Manufacturing	16.2	16.0	20.0	15.9	25.0
Transportation, Communications, and Utilities	10.4	10.1	5.8	9.0	6.5
Trade	22.7	22.3	21.5	22.3	19.6
Finance, Insurance, and Real Estate	7.5	7.0	4.4	6.1	4.9
Services	25.9	25.6	26.0	24.5	25.9
Public Administration	4.0	4.0	3.6	3.7	5.3
Armed Forces	5.1	4.9	0.1	3.8	2.5

Source: U.S. Department of Commerce, Bureau of Census, Census of Population

twice as important on the local level as it is for Iowa and the United States. The relatively strong position of the finance, insurance, real estate group in the local area is primarily due to Omaha being the center for more than 30 insurance companies. The large percentage in the Armed Forces in the local area and in Nebraska is due to the location of Offutt Air Force Base, headquarters of the Strategic Air Command.

Table B-8
Seasonal Employment And Unemployment - 1971
(monthly indexes)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Avg. Ann.
Work Force													
Omaha SMSA	97	97	98	99	101	103	101	100	101	101	102	101	100
Region w/o SMSA	94	86	95	101	104	114	97	99	103	105	102	101	
Iowa	94	94	97	100	101	107	105	102	101	101	102	101	
Nebraska	95	95	97	100	102	106	106	102	101	100	99	97	
United States	98	98	98	99	99	101	102	102	100	100	101	101	
Unemployment Rate													
Omaha SMSA	4.2	4.0	4.1	3.8	3.9	5.2	4.8	4.3	3.8	3.3	3.5	3.4	4.0
Region w/o SMSA	19.4	15.1	14.2	11.0	10.3	12.1	14.7	11.9	8.5	4.0	3.6	3.8	10.6
Iowa	5.2	5.3	4.9	4.1	3.9	5.1	4.4	3.9	3.3	3.0	3.5	4.1	4.2
Nebraska	4.4	4.6	4.3	3.6	3.4	4.3	3.8	3.4	3.0	2.6	3.2	3.4	3.6
United States	6.6	6.6	6.3	5.7	5.3	6.5	6.2	5.9	5.8	5.4	5.7	5.5	5.9
Employment													
Omaha SMSA	97	97	98	100	100	101	100	99	101	102	102	102	100
Region w/o SMSA	91	91	93	100	105	110	108	104	103	102	98	94	
Iowa	93	94	96	100	102	106	105	103	103	103	99	97	
Nebraska	95	95	96	101	102	106	105	102	102	101	99	97	
United States	98	98	98	99	99	100	102	102	100	101	101	101	

Source: U.S. Department of Labor; Iowa and Nebraska Departments of Labor, Division of Employment.

SEASONALITY OF EMPLOYMENT

While the census provides useful employment data, it is only available and applicable to one week, the first week in April, once in a decade. The U.S. Department of Labor and its counterparts at the State level provide a continuous, month-to-month and year-to-year, source of data on employment estimates. This information indicates whether the level of work force, employment, and consequently the unemployment rate presented in the census is a valid observation for the entire year. Certain sectors of employment, such as agriculture and tourism, can be quite seasonal in their demands. They can also provide seasonal stimuli to transient labor for harvesting and processing crops. Monthly statistics can also indicate short-range trends and serve as the basis for making estimates of future employment and population levels. Small seasonal industries that use off-peak employment periods conceivably will be able to compete at lower wage levels, but if they compete for employment at peak periods they may stimulate the overall wage level.

Monthly index numbers for the work force and employment estimates for 1971 appear in table B-8. Indices for the year indicate overall growth among those employed and actively seeking work, i.e. the work force. It appears that the SMSA work force grew slightly faster than the national work force. Iowa and the region without the SMSA expanded the greatest during the year, and Nebraska the least. The four non-SMSA counties had the widest fluctuation in the size of the work force from a relative standpoint, ranging 14 percent above and below the annual average. The regional work force reached its peak in June whereas the Nation's work force peaked in July and August. These were the same

months in which employment in all areas, except in the SMSA reached a higher level from October through December. The slight employment sag during the July-August period was due to lower employment in the educational services sector. Unemployment rates were generally lower in the local area than in the Nation. The obvious exception is the four non-SMSA counties, but this is due to the unemployment being reported in the county of residence and would indicate many of these residents commute to the three metropolitan counties for work. Another contributing factor in this area may have been a contraction in construction employment.

Among the various major employment groups, agriculture and mining-construction are the most seasonal, as shown in table B-9. This table also presents monthly employment indices for three major commodity-producing industries. The three SMSA counties have smaller relative amounts of agricultural employment than any of the areas cited, therefore, they are least typical, ranging only 24 index points during 1971. In contrast, the other three areas have index ranges from 50 to 60 index points which illustrate the seasonal volatility of this employment group. The mining-construction group employment can be quite seasonal, at the same time, it is vulnerable to local work stoppages as well as local spurts of activity. Typically, the first quarter of the year is a low point of activity, but employment begins rising in late spring, peaks in summer, and then gradually declines in the last quarter of the year, as illustrated in the State and national indices. Of the three commodity-producing employment groups, manufacturing appears to be least susceptible to seasonal fluctuations in employment. In Iowa, but more particularly in Nebraska, gradually increasing indices through the year would seem to indicate overall growth in manufacturing

Table B-9
Seasonal Employment In Commodity Producing Industries - 1971
(Monthly Indexes)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave. Ann.
Agriculture													
Omaha SMSA	84	85	90	97	108	108	112	108	106	111	97	86	100
Region w/o SMSA	76	76	83	101	108	135	136	112	103	102	89	78	
Iowa	70	76	85	101	106	131	129	116	112	111	88	74	
Nebraska	80	79	87	110	114	130	136	111	105	94	83	72	
United States	NA												
Mining-Construction													
Omaha SMSA	85	84	87	102	108	91	94	103	111	110	117	103	100
Region w/o SMSA	81	88	85	89	126	106	67	103	103	115	121	118	
Iowa	79	77	82	98	103	111	113	115	113	109	104	94	
Nebraska	80	78	88	98	103	113	116	116	112	109	98	90	
United States	92	89	93	98	101	105	106	107	106	104	102	98	
Manufacturing													
Omaha SMSA	99	100	101	102	101	101	99	99	99	99	100	99	100
Region w/o SMSA	104	101	102	103	98	99	98	103	102	99	100	90	
Iowa	99	98	98	98	98	99	100	101	103	102	102	102	
Nebraska	97	97	97	97	98	101	100	102	102	103	103	104	
United States	100	100	99	99	100	101	99	100	101	101	100	100	

Source: U.S. Department of Labor, Iowa and Nebraska Departments of Labor, Divisions of Employment.

employment. Variations of only two index points in the SMSA and the Nation indicate that employment has held steady throughout the year and there has been little or no growth.

Seasonal employment in the noncommodity-producing industries is illustrated in table B-10. Most of the monthly index levels vary less than five percent from the annual average. The only exception for the year cited is in the four non-SMSA counties and even here it was only apparent in the transportation-communication-utilities group and in the finance, insurance, and real estate group. In the transportation group a moderate expansion in employment during the summer is probably due to annual maintenance activities. The absolute index growth during the year for the State of Nebraska may indicate an expansion of this industrial group activity. Seasonal variations in the wholesale-retail trade group are not unusual. Typically, the first quarter of the year is the low period of employment in this group and the last quarter is the peak period, characteristically associated with holiday season shopping activities. The travel and recreation industry promotes seasonal summer or fall peaks, depending on the area of the country, and it is more obvious in non-metropolitan areas. On an annual basis, the finance, insurance, and real estate group of industries is probably less vulnerable to seasonal fluctuations in employment than other groups. Nebraska and Iowa - having the headquarter offices of many insurance companies and to a lesser extent being centers, of the ever-changing activities in the farm real estate market - may have contributed to a small increase of this employment growth over the year. The services group employment has been expanding over the years and the gradual growth through the year is seen as a continuation of this trend. A very similar

trend has been taking place in the government group, particularly at the State and local level. The seasonal slump, July and August, proves to be in the educational services sector of this group.

Table B-10
Seasonal Employment In Noncommodity Producing Industries - 1971
(Monthly Indexes)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave. Ann.
Trans., Comm., & Utilities													
Omaha SMSA	99	99	99	100	100	102	102	100	101	100	100	99	100
Region w/o SMSA	91	88	93	92	99	103	102	106	104	108	100	95	
Iowa	97	97	97	99	100	102	102	102	102	101	101	101	
Nebraska	95	94	96	98	99	100	102	103	103	101	103	104	
United States	99	99	100	100	100	102	101	100	101	99	99	100	
Wholesale & Retail Trade													
Omaha SMSA	98	97	98	99	100	100	99	100	101	101	102	105	100
Region w/o SMSA	95	95	98	102	105	104	101	102	104	100	97	98	
Iowa	96	96	98	100	101	102	101	101	102	100	100	103	
Nebraska	95	94	96	98	99	100	102	103	103	101	103	104	
United States	98	97	97	99	99	100	100	100	100	101	102	106	
Finance, Insurance & Real Estate													
Omaha SMSA	100	101	101	100	100	101	101	101	99	99	99	99	100
Region w/o SMSA	87	87	84	110	110	101	114	114	114	97	97	98	
Iowa	98	98	98	99	99	101	101	102	101	101	101	102	
Nebraska	97	97	98	99	100	101	102	102	101	101	101	102	
United States	98	98	98	99	99	101	102	102	101	101	101	101	

Table B-10
(Cont)
Seasonal Employment In Noncommodity Producing Industries - 1971
(Monthly Indexes)

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Ave. Ann.
Services													
Omaha SMSA	97	98	99	99	102	102	100	100	101	101	101	101	100
Region w/o SMSA	100	99	100	99	99	96	98	99	102	102	102	105	
Iowa	97	97	99	100	100	102	101	101	101	101	101	101	
Nebraska	95	97	98	100	101	101	101	100	101	101	101	101	
United States	97	98	99	100	100	101	101	101	101	101	101	101	
Government													
Omaha SMSA	95	96	97	97	98	101	98	95	104	105	106	107	100
Region w/o SMSA	100	100	101	99	103	96	96	96	103	102	102	102	
Iowa	101	102	102	102	101	100	95	94	99	101	102	102	
Nebraska	99	100	101	100	100	100	97	95	101	102	102	103	
United States	99	100	101	101	101	101	96	95	99	101	102	103	

Source: U.S. Department of Labor; Iowa & Nebraska Departments of Labor, Divisions of Employment.

ESTIMATED RETAIL SALES

About 90 percent of the estimated retail sales in the seven-county area is in the SMSA according to "Sales Management in 1974", as presented in table B-11. On a per capita basis, retail sales were highest in Washington and Harrison Counties, and exceeded the State and National averages. This was due to high per capita expenditures in the food, automotive, and other categories; the later group includes sales of farm equipment. Estimated total and per capita sales for Sarpy County and the SMSA are not fully representative since they do not include military sales, those from post exchanges, commissaries, and officer's clubs. Nevertheless, general merchandise sales averages in Douglas and Sarpy Counties on a per capita basis were a great deal higher than State and National averages; sales in the five other counties were lower, suggesting the attraction to outlets in the two primary counties. Sales in the furniture and household appliance category were also dominated by Douglas County, whereas they were far below average in Sarpy, Cass, and Harrison Counties. Automotive sales were particularly strong in Washington County and quite weak in Sarpy County. As might be expected, drug sales are low in Sarpy County where a large number of persons obtain their needs from government facilities. With its numerous eating and drinking establishments, Douglas County excels in per capita sales in this category. Of the three SMSA counties, Douglas County comes close to the national average in apparel sales and far exceeds the other two counties. Gas station retail sales show well in Pottawattamie County, Iowa, probably due in part to its location as the junction of Interstate Highways 29 and 80. In addition to the sales of farm equipment and certain construction goods, the "other" category includes nonstore retailers such as

Table B-11
Estimated Reatil Sales - 1974

	SMSA Counties				Non-SMSA Counties						
	Douglas	Sarpy	Potta-wattamie	Total SMSA	Cass	Wash-ington	Harrison	Mills	Iowa	Nebraska	U.S.
Total Retail Sales (000,000)	959.5	76.1[1/]	157.9	1,193.5	36.0	38.8	40.8	25.1	6,809.7	3,701.8	514,053.5
Per Capita	2,320	1,045	1,766	2,073	1,864	2,677	2,427	1,991	2,335	2,391	2,437
Food	468	202	435	429	457	569	534	483	495	457	538
General Merchandise	525	397	137	448	56	126	89	65	315	365	346
Furniture & Hsld. Appl.	135	38	77	113	41	104	53	70	105	114	114
Automotive	416	90	374	368	431	731	472	303	477	445	471
Drug	78	19	78	71	52	68	68	62	66	72	78
Eating & Drink. Places	250	98	143	214					194	223	214
Apparel	129	58	68	111					101	122	130
Gas Station	173	83	236	172					236	239	189
Lumber, Bldg. & Hardware	59	35	90	61					150	161	122
Other	89	25	128	87	826	1,079	1,209	1,008	197	193	236
	(700)	(299)	(665)	(645)					(878)	(938)	(891)

[1/] Sarpy County does not include $29,691,000 estimated military sales; adjusted per capita $1,452.

Source: 1974 SURVEY OF BUYING POWER, Sales Management, July 8, 1974

mail order houses, vending machines and direct (house-to-house) sales.

PLACE OF WORK

Based on a 15 percent sample, the 1970 census estimated the place of work in relation to the place of residence, as shown in table B-12. Among the seven counties in the region, there were three levels of correlation among the percentage of workers who lived and worked in the same county. Douglas County, with the highest number of workers and employment opportunities, had the highest proportion of workers, 86 percent, who lived in the same county as their job. The three rural counties had the next highest percentages in this category ranging from 71.1 to 78.4 percent, consequently comparatively few workers commuted to other counties. The third level is represented among the counties, such as Sarpy, Pottawattamie, and Cass, where nearly half or more of the workers polled worked in their county of residence and only slightly fewer worked outside their county of residence. By comparison, approximately only one worker out of ten in Iowa and Nebraska was estimated to work outside the county of their residence.

TRANSPORTATION TO WORK

In 1970, the census estimated the means of transportation used to get to work. Information on persons 14 years of age and over for the SMSA was based on an area shown in table B-13. About 82 percent of the total relied on automobile transportation, either as driver or passenger. Relatively few, about 14 percent, reported being an automobile passenger - suggesting the existence of few car pools. Less that 7 percent reported using the bus as their principal means of getting to work. Since the "worked at home" category

Table B-12
Place of Work and Residence - 1970

Place	Total Workers	(Percent) Place of Work: County of Residence	Another County	Not Reported
Douglas	157,276	86.1	7.8	6.1
Omaha	141,327	86.1	7.6	6.3
Sarpy	24,702	54.0	40.9	5.1
Pottawattamie	33,051	55.8	38.6	5.6
Council Bluffs	23,234	51.3	43.6	5.1
SMSA	215,029	77.7	16.3	6.0
Cass	6,570	49.4	42.7	7.9
Washington	5,332	71.9	23.9	4.2
Harrison	6,161	71.1	22.2	6.6
Mills	4,348	78.4	18.3	3.3
Total	237,440	76.7	17.4	5.9
Iowa	1,082,869	83.2	11.3	5.5
Nebraska	583,341	84.4	10.1	5.5

Source: U.S. Dept. of Commerce, Bureau of Census, Census of Population

Table B-13
Transportation to Work
SMSA - 1970

	Total Workers	Private Driver	Automobile Passenger	Bus	Walked	Worked At Home	Other
Omaha-Council Bluffs SMSA	100%	67.9%	13.9%	6.8%	6.5%	2.9%	2.0%
Douglas & Sarpy Counties	84.6	68.2	14.0	7.1	6.6	2.2	1.9
Omaha	65.7	66.2	14.6	8.8	6.6	2.0	1.8
Urban Balance	14.3	75.9	11.5	1.7	7.7	1.4	1.8
Other	4.6	73.2	12.1	0.2	3.9	8.6	2.0
Pottawattamie County	15.4	65.9	13.7	4.9	5.9	6.6	3.0
Council Bluffs	10.8	68.4	15.3	6.7	5.9	1.7	2.0
Urban Balance	0.7	73.0	18.8	2.2	0.9	1.2	3.9
Other	3.9	57.7	8.3	0.4	6.8	21.4	5.4

Source: U.S. Dept. of Commerce, Bureau of Census, Census of Population

includes those who worked on farms where they lived, the non-urban areas reported relatively high numbers of persons in this category.

FAMILY INCOME LEVELS

The family income levels reported in the census and reflected in table B-14 represent dollar income only and should not be compared with total personal income. This is especially important to keep in mind when comparing areas with relatively large shares of farm families that may receive part of their income as "free" housing and goods produced and consumed on the farm. This is not to say that some nonfarm residents do not receive such nonmoney income, since they may receive similar benefits in the form of business expense accounts, use of business transportation and facilities, or partial compensation for medical and educational expenses. "Income in kind" is also received by many low income families through public welfare programs.

Table B-14
Family Income - 1969

	SMSA Counties				Non-SMSA Counties						
	Douglas	Sarpy	Potta-wattamie	Total SMSA	Cass	Wash-ington	Harrison	Mills	Iowa	Nebraska	U.S.
Number of Families	94,795	14,708	21,932	131,435	4,862	3,385	4,348	3,022	717,776	374,160	51,168,599
Percent of Families Less Than $3,000	6.8	5.0	8.4	6.9	11.6	9.8	14.0	10.1	10.1	11.0	9.3
$3,000 to $5,999	13.0	11.0	15.3	13.2	21.5	19.8	23.9	19.0	17.3	19.2	16.6
$6,000 to $9,999	27.2	32.5	31.4	28.5	33.8	30.0	30.9	28.4	29.7	30.5	28.1
$10,000 to $14,999	30.2	31.4	29.8	30.3	23.5	28.9	20.0	25.3	26.6	24.4	26.7
$15,000 to $24,999	17.4	18.0	12.3	16.6	8.7	9.4	8.1	11.6	12.8	11.7	
$25,000 or more	5.3	2.1	2.8	4.5	0.9	2.1	3.1	5.6	3.5	3.2	19.3
Median Income	$10,419	10,209	9,356	10,204	7,813	8,808	7,449	8,918	9,018	8,564	9,433
Mean Income	11,872	10,970	10,268	11,504	8,542	9,294	8,647	10,887	10,138	9,792	
Per Capita	3,316	2,801	2,836	3,178	2,511	2,711	2,510	3,129	2,894	2,814	3,119

Source: U.S. Department of Commerce, Bureau of Census, Census of Population

The numbers of families are distributed among the counties in the study area much like the population was distributed in 1970. Almost 64.5 percent of the families live in Douglas County and 89.4 percent live in the SMSA. Generally, family incomes are higher in the urban-oriented counties. This is illustrated by the four non-SMSA counties having higher percentages of their families in the lower income groups and the SMSA counties having higher percentages in the higher income groups. The only exception is in the highest family income group, $25,000 or more, where the three smallest counties are within the same range as the three largest counties. The distribution of families among income groups in Nebraska and Iowa is more like the rural counties and the National distribution is more like the SMSA counties. This is duplicated in the comparison of median and mean family incomes. The exception is Mills County because of the relatively great share of families in the two lowest groups. Deviations in rank order of median and mean incomes compared with per capita levels are probably due to a mixture of the number of individuals outside of family groups rather than to variations in the size of families. The largest and the smallest counties, Douglas and Mills, have per capita incomes above both the State and the National averages.

POVERTY LEVEL INCOME GROUPS

Poverty level statistics presented in the census and in table B-15 are based on a definition originated by the Social Security Administration and modified by a Federal Interagency Committee. The index provides for a range of weighted average thresholds based on family size, sex of head of the family, number of dependent children, farm, and nonfarm residence. Poverty thresholds are only computed on a National basis and there is no

Table B-15
Poverty Level Income Groups - 1969

	SMSA Counties				Non-SMSA Counties						
	Douglas	Sarpy	Potta-wattamie	Total SMSA	Cass	Wash-ington	Harrison	Mills	Iowa	Nebraska	U.S.
Number of Families	6,380	833	1,751	8,964	474	283	502	233	63,956	37,868	4,950,000
Percent of All Families	6.7	5.7	8.0	6.8	9.7	8.4	11.5	7.7	8.9	10.1	10.7
Mean Income ($)	1,964	1,613	2,024	1,943	1,928	1,726	2,065	1,756	1,865	1,834	
Mean Income Deficit ($)	1,594	1,985	1,358	1,585	1,137	1,137	1,058	1,055	1,242	1,328	1,283
Number of Unrelated Individuals	12,452	460	2,602	15,514	456	354	569	361	95,208	51,357	4,900,000
Percent of All	33.8	25.9	40.8	34.5	46.5	37.7	48.6	46.8	41.6	40.5	33.6
Mean Income ($)	878	757	874	874	854	843	980	921	943	913	
Mean Income Deficit ($)	943	1,025	928	943	904	938	756	819	849	883	759
Persons	37,512	3,806	9,037	50,355	2,062	1,216	2,325	1,039	318,605	188,235	24,654,000

Table B-15
Cont'd
Poverty Level Income Groups - 1969

	SMSA Counties				Non-SMSA Counties						
	Douglas	Sarpy	Potta-wattamie	Total SMSA	Cass	Wash-ington	Harrison	Mills	Iowa	Nebraska	U.S.
Percent of All Persons	9.8	6.2	10.5	9.5	11.6	9.7	14.5	9.7	11.6	13.1	12.3
Households	13,583	990	2,988	17,561	642	415	779	414	104,320	58,198	
Percent of All	11.8	6.8	13.4	11.5	16.8	15.4	22.7	18.3	15.4	15.7	

Source: U.S. Department of Commerce, Bureau of Census, Census of Population

attempt to adjust them for differences in the cost of living on a local, State, or regional basis. For 1969, the range varied from a low of $1,487 for an unrelated female individual, 65 years of age or older, living on a farm, to a high of $6,116 annually for a male head of a nonfarm family with seven or more persons.

When compared with the total number of families, poverty level families in the SMSA represented a smaller relative share of the total than the smaller rural counties, except for Mills County. Almost 86 percent of these low income families were in the SMSA, and almost 66 percent were in Douglas County. Of the counties cited, only Harrison had a larger share of its families at or below the poverty level than either of the States or the Nation. Sarpy, Washington, and Mills Counties had mean poverty level incomes lower than either of the State averages for families. The aggregate mean income deficit represents an estimate of the amount of money it would take to raise their respective incomes to the poverty threshold level. The amount is generally greater in the SMSA counties, while the amounts in the four rural counties are less than the State and National averages. About 90 percent of the unrelated individuals of the poverty level income, or below are in the SMSA counties; 72 percent are in Douglas County alone. From 25 percent to almost 50 percent of all unrelated individuals in the various counties were in this category. The mean income levels of the unrelated individuals ranged from $757 in Sarpy County to $980 in Harrison County. Except for Sarpy County, the other counties were within 10 percent of the State averages. The mean income deficits for unrelated individuals in all counties except Harrison and Mills were somewhat greater than both the State and National averages. Less than 10 percent of all persons in the SMSA were considered having less than poverty level incomes. Only

Harrison County, with 14.5 percent of all its population with less than poverty level incomes had a greater proportion than either State or National averages. When considering total number of households, there are relatively fewer with poverty level incomes in the SMSA. Harrison County, with more than 22.7 percent of its households at the poverty level, was highest among the counties and States cited.

ESTIMATED BUYING INCOME

Estimated "Effective Buying Income" for 1974 was adapted from "Sales Management, 1974 SURVEY OF BUYING POWER", and is presented in table B-16. Median household income less taxes ranged from $11,261 in Sarpy County to $7,232 in Harrison County. The three SMSA counties had the highest level of median household income, averaging $10,984, but all counties except Washington and Harrison were above the average of the two States and the Nation.

The SMSA had less than 10 percent of its households in the two lowest buying income categories, less than $3,000 and from $3,000 to $4,999. Harrison County had the greatest percent (22.1) in the lowest household category, the only county far exceeding the average for the two States and the Nation. Four counties had lower portions of their households in the next to the lowest category than the State and National average distributions. As the distribution moves to those households having over $8,000 estimated buying income, the SMSA counties generally have the greatest share.

Table B-16
Estimated Effective Buying Income - 1974

	SMSA Counties				Non-SMSA Counties						
	Douglas	Sarpy	Potta-wattamie	Total SMSA	Cass	Wash-ington	Harrison	Mills	Iowa	Nebraska	U.S.
Population (000)	413.5	72.8	89.4	575.7	19.3	14.5	16.8	12.6	2,916.3	1,548.2	210,908.3
Effective Buying Income[1/]											
Median per Household($)	11,164	11,261	9,965	10,984	9,577	8,546	7,232	9,570	9,499	9,419	9,544
Percent Hsld. less than $3,000	8.8	6.3	9.9	8.7	13.0	13.9	22.1	14.2	14.0	13.3	12.8
$3,000 to $4,999	6.8	5.8	7.9	6.9	9.0	11.5	13.7	10.0	9.4	9.6	9.1
$5,000 to $7,999	14.4	17.3	16.9	15.1	17.5	21.0	18.8	15.6	16.7	17.8	17.7
$8,000 to $9,999	13.8	13.8	15.7	14.1	13.3	13.0	11.7	13.1	13.1	13.1	13.4
$10,000 to $14,999	26.5	26.9	26.7	26.6	23.0	21.9	18.7	22.0	23.8	23.3	23.1
$15,000 or more	29.7	29.9	22.9	28.6	24.2	18.7	15.0	25.1	23.0	22.9	23.9

1/ Effective Buying Income - Personal income minus Federal, State, and local taxes.

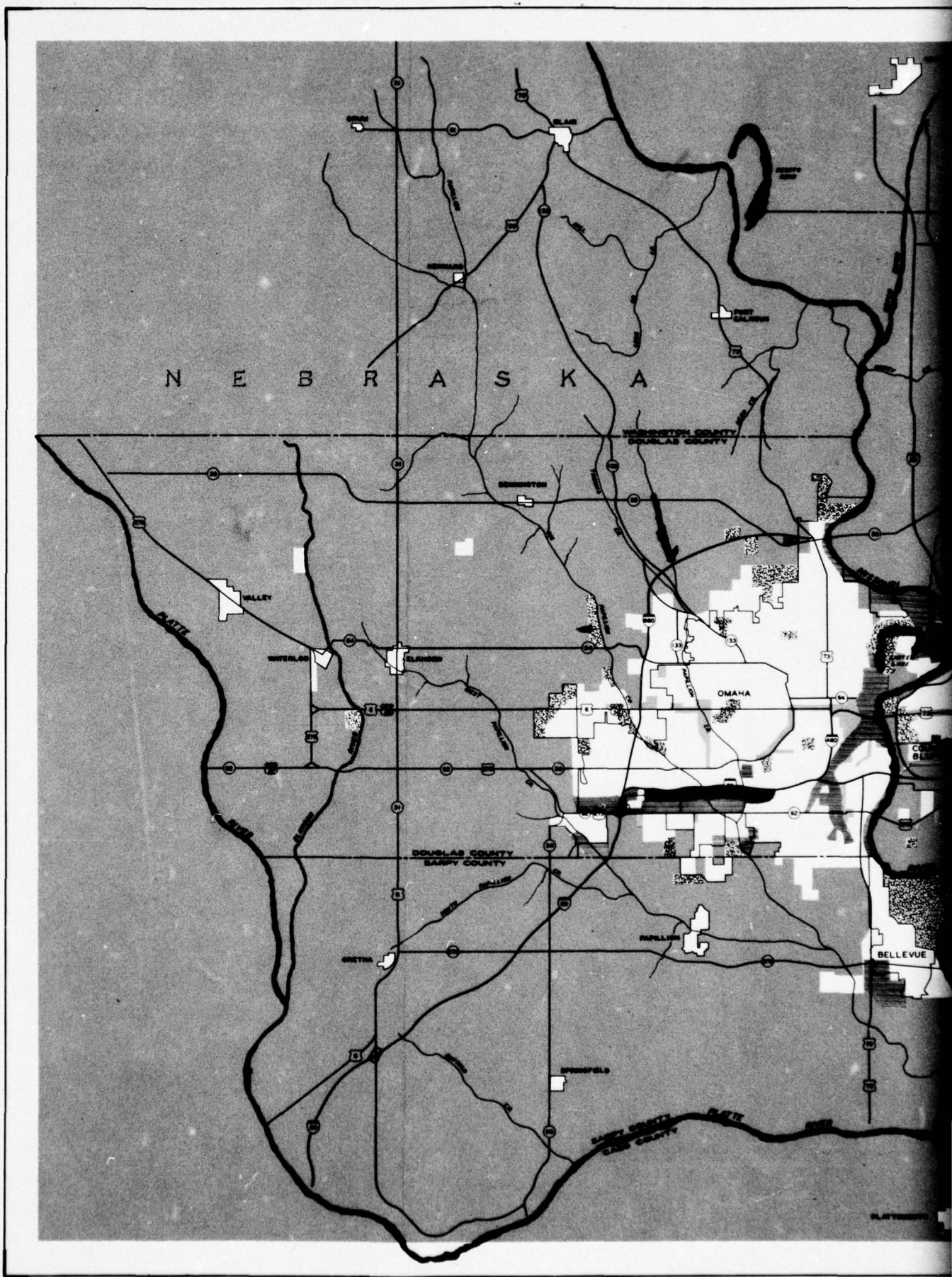
Source: 1974 SURVEY OF BUYING POWER, Sales Management, July 8, 1974

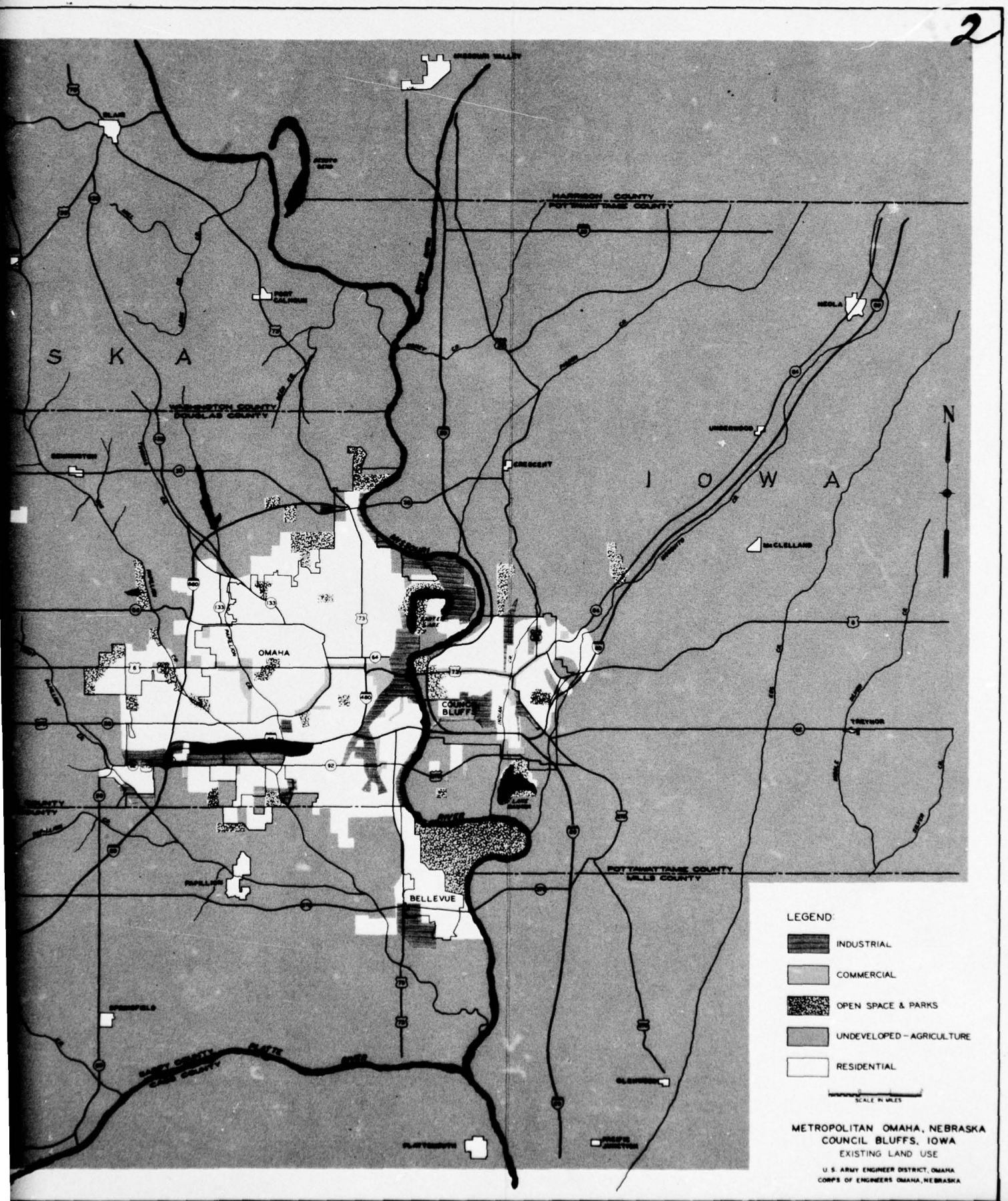
NATURAL RESOURCES

LAND USE

The seven-county study area is predominantly influenced by the agricultural activities occurring in the study area and in the market region served by the agri-business industry in the metropolitan area. Within the seven-county area, agriculture is the predominant land use, accounting for more than 74 percent of the 2.3 million acres of area. The second most important use is for urban development, which accounted for about 8 percent of the area in 1970. Primary land uses in the seven-county area are shown on table B-17.

Figure B-7 shows the location of major land use categories in the seven-county area.


NEBRASKA
WASHINGTON COUNTY
DOUGLAS COUNTY
DOUGLAS COUNTY
SARPY COUNTY
SARPY COUNTY
CASS COUNTY
BLAIR
KENNARD
WEST POINT
DECATUR
VALLEY
WATERLOO
ELKHORN
OMAHA
PAPILLION
GRETNA
SPRINGFIELD
BELLEVUE
PLATTSMOUTH
PLATTE RIVER



VOLUME II FIGURE 6-7

Table B-17
Primary Land Uses in 1970

County	Cropland		Grassland		Woodland		Other		Developed		Water		Total	
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent
Douglas	107,900	(50.6)	3,300	(1.6)	6,900	(3.2)	8,900	(4.2)	86,000	(40.4)	2,100	(1.0)	213,100	
Sarpy	103,445	(68.5)	11,200	(7.4)	14,716	(9.7)	9,700	(6.4)	11,600	(7.7)	400	(0.3)	151,061	
Washington	191,400	(77.3)	21,200	(8.6)	12,500	(5.0)	14,500	(5.9)	7,500	(3.0)	500	(0.2)	247,600	
Cass	277,500	(78.3)	24,800	(7.0)	24,200	(6.8)	7,700	(2.2)	18,300	(5.2)	2,000	(0.6)	354,500	
Pottawattamie	488,009	(79.1)	51,750	(8.4)	26,958	(4.4)	12,480	(2.0)	36,493	(5.9)	1,270	(0.2)	616,960	
Harrison	329,912	(74.2)	38,064	(8.6)	44,000	(9.9)	14,347	(3.2)	16,579	(3.7)	1,898	(0.4)	444,800	
Mills	210,939	(76.3)	13,242	(4.8)	25,000	(9.1)	16,242	(5.9)	9,647	(3.5)	977	(0.4)	276,047	
Region	1,709,105	(74.2)	163,556	(7.1)	154,274	(6.7)	83,869	(3.6)	186,119	(8.1)	7,145	(0.3)	2,304,068	

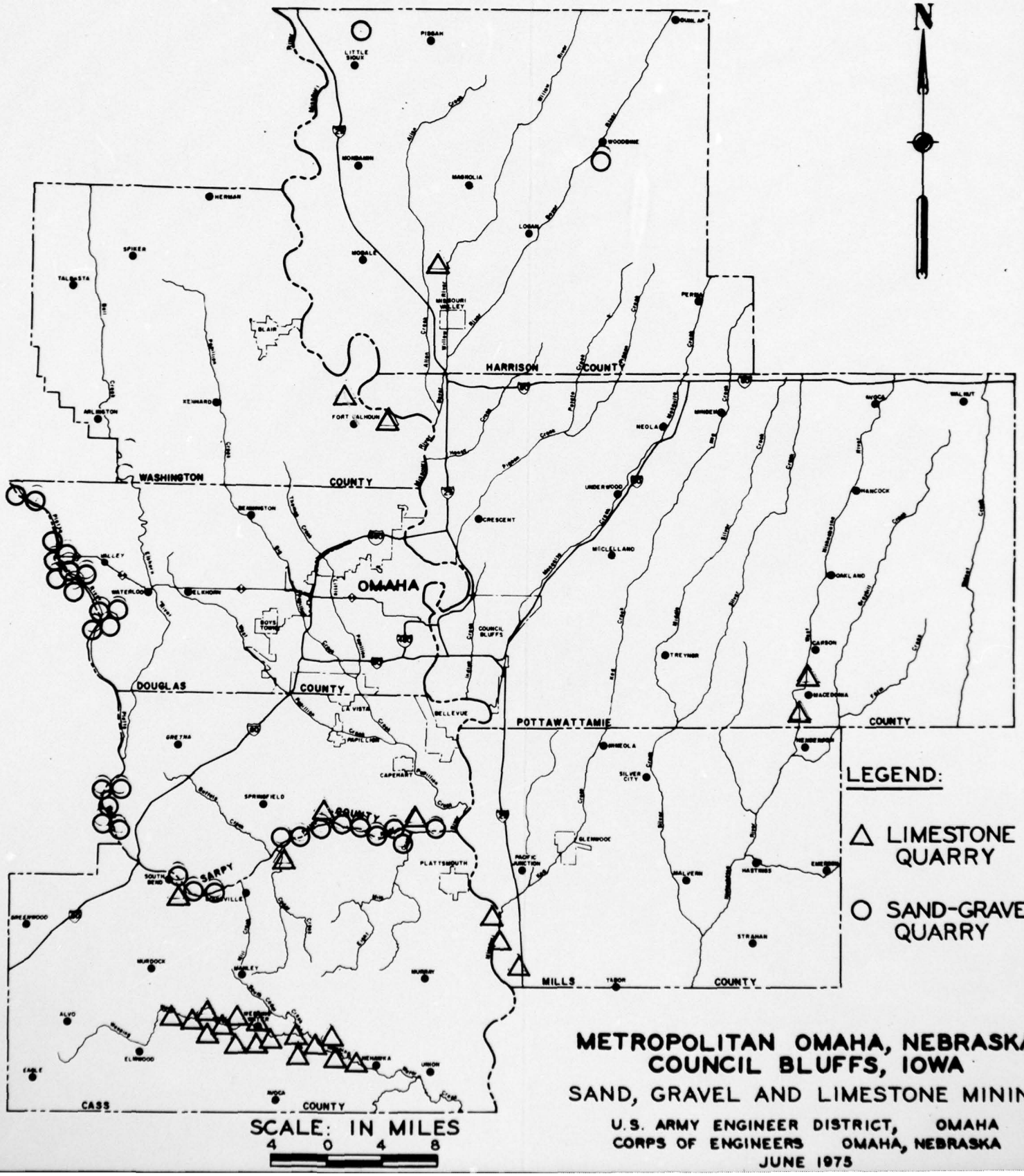
Source: U. S. Department of Agriculture, Soil Conservation Service, Conservation Needs Inventory, Nebraska (1969) and Iowa (1970).

MINERAL RESOURCES

The major mineral resources in the study area include sand, gravel, and limestone. Sand and gravel are generally mined along the Platte and Elkhorn River flood plains. Limestone is quarried in the Fort Calhoun and Plattsmouth areas along the Missouri River and in the Louisville and Weeping Water areas in Cass County. The locations of sand, gravel, and limestone mining operations are shown on figure B-8.

RECREATION

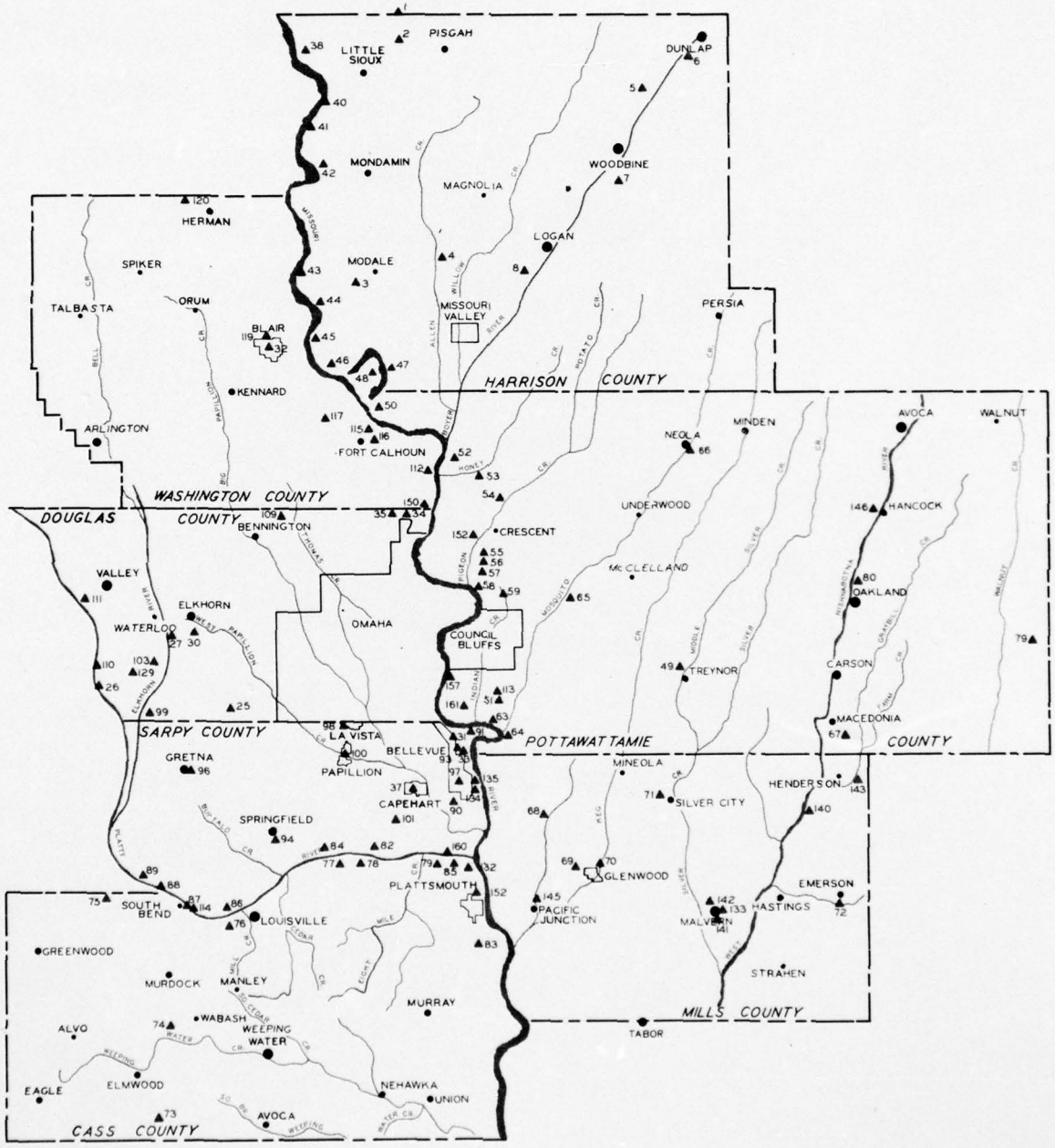
Existing recreational sites in the seven county area are listed in table B-18. The major use, land and water area, and total area for each site are also shown in the table. The locations of existing recreational sites are shown on figure B-9. Major recreational areas in the study region include DeSoto Bend National Wildlife Refuge, Carter Lake, Lake Manawa, and the Fontenelle Forest Nature Center. The latter is funded by private donations and memberships.

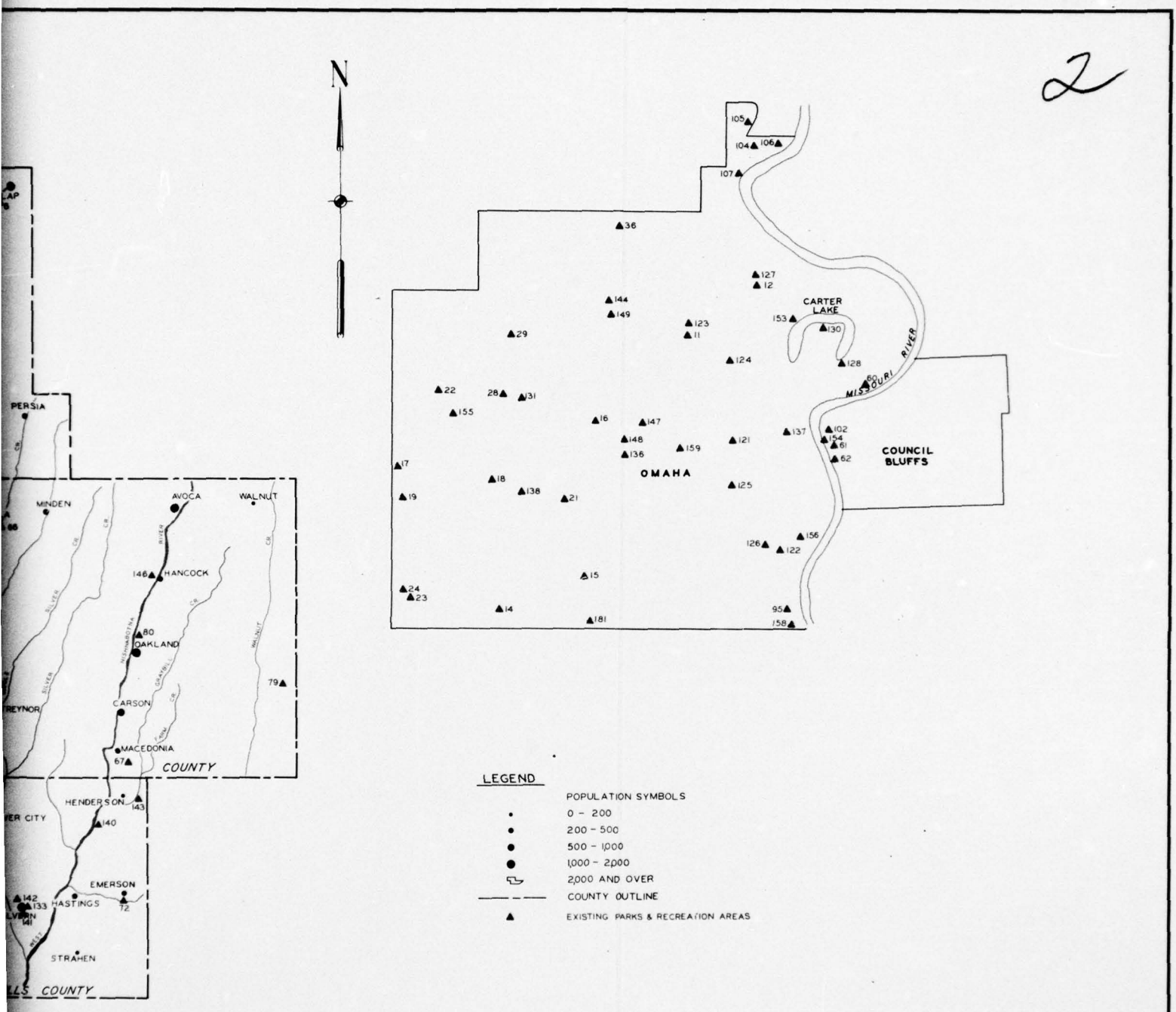


METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA

SAND, GRAVEL AND LIMESTONE MINING

U.S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA
JUNE 1975


N
PISGAH
LITTLE SIOUX
DUNLAP
MONDAMIN
WOODBINE
MAGNOLIA
HERMAN
LOGAN
SPIKER
MODALE
TALBASTA
ORUM
MISSOURI VALLEY
PERSIA
BLAIR
KENNARD
HARRISON COUNTY
ARLINGTON
FORT CALHOUN
NEOLA
MINDEN
AVOCA
WALNUT
WASHINGTON COUNTY
DOUGLAS COUNTY
BENNINGTON
UNDERWOOD
HANCOCK
CRESCENT
VALLEY
McCLELLAND
OAKLAND
ELKHORN
WATERLOO
OMAHA
COUNCIL BLUFFS
TREYNOR
CARSON
MACEDONIA
SARPY COUNTY
LA VISTA
BELLEVUE
POTTAWATTAMIE COUNTY
GRETNA
PAPILLION
MINEOLA
HENDERSON
CAPEHART
SILVER CITY
SPRINGFIELD
GLENWOOD
EMERSON
PLATTSMOUTH
SOUTH BEND
LOUISVILLE
PACIFIC JUNCTION
MALVERN
HASTINGS
GREENWOOD
MURDOCK
MANLEY
STRAHEN
MURRAY
MILLS COUNTY
ALVO
WABASH
WEEPING WATER
TABOR
EAGLE
ELMWOOD
NEHAWKA
UNION
CASS COUNTY
AVOCA



2

METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA

EXISTING RECREATION AREAS

U.S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA
JUNE 1975

Table B-18a
Existing Recreation Sites
Cass County, Nebraska

Map No.	Site Name	Type Area	Land (Acres)	Water (Acres)	Total (Acres)
73	Wilson Creek Watershed	Community Park	40*		40*
74	Grandpa Woods				
75	Scenic Overlook	Scenic Area			
76	Louisville State Recreation Area	Regional Park	142	50	192
77	Natural Area	Natural Area			
78	Timbered Bluff and Natural Area	Natural Area			
79	Buccaneer Bay	Private Development	1,750*		1,750*
83	Beaver Lake	Private Development	875	325	1,200
85	Merritt Beach	Community Park	20		20
132	Plattsmouth Water Fowl Mgt. Area	Fish and Game Area	1,465	35	1,500
151	Plattsmouth Wildlife Refuge	Fish and Game Area	500*		500*

* Includes land and water.

Table B-18b
Existing Recreation Sites
Douglas County, Nebraska

Map No.	Site Name	Type Area	Land (Acres)	Water (Acres)	Total (Acres)
11	Fontenelle Park Golf Course				
12	Miller Park Golf Course				
13	Dodge Park Golf Course				
14	Applewood Golf Course	Public	145		145
15	Lakeview Country Club	Private	63		63
16	Peony Park	Amusement Park			
17	Highland Country Club	Private	180		180
18	Happy Hollow Country Club	Private	180		180
19	Westwood Golf Course				
21	Cedar Hills Golf Course	Private	40		40
22	Miracle Hill Golf Course	Private	325		325
23	Oak Hills Golf Course (Millard)	Private	113		113
24	Oak Hills Country Club				
25	Walnut Grove Park	Community Park			
26	Two Rivers Scenic Recreation Area	Regional Park	644	320	964
27	Greenbriar Golf Course (Elkhorn)	Private	5		5
28	Brookhill Country Club				
29	Maple Village Golf Course				
30	Skyline Golf Course	Public	165		165
34	Ponca Hills Equestrial Club	Private			
35	Twin Brooks Bible Camp	Private			
36	Omaha Country Club	Private	210		210
95	Mount Vernon Gardens	Regional Park	52		52
99	Circle R Lutheran Bible Camp	Private	152		152
103	Native Prairie	Natural Site	40		40
104	N. P. Dodge Memorial Park	Regional Park	445		445

Table B-18b
Existing Recreation Sites
Douglas County, Nebraska
(Cont'd)

Map No.	Site Name	Type Area	Land (Acres)	Water (Acres)	Total (Acres)
105	Hummel Park	Regional Park	202		202
106	Boat Launch				
107	Florence Marina				
109	Native Prairie	Natural Site	40		40
110	Lake Platte View				
111	Ginger Cove	Private			
121	Turner Park	Community Park			
122	Spring Lake Golf Course				
123	Fontenelle Park	Regional Park	105	3	108
124	Adams Park	Community Park			
125	Hanscom Park	Community Park			
126	Spring Lake Park	Community Park	96		96
127	Miller Park	Community Park	78	2	80
128	Kiwanis Park	Community Park			
129	Sandridge	Natural Site			
131	Meadow Brook Golf Course	Private	17		17
136	Elmwood Golf Course				
137	Central Omaha Park Mall	Community Park	55		55
138	Sunset Valley Country Club	Private	50		50
144	Benson Park Golf Course				
147	Memorial Park	Regional Park			
148	Elmwood Park	Regional Park	216		216
149	Benson Park	Regional Park	215	2	217
153	Levi Carter Park	Regional Park	254		254
155	Tranquility Park	Regional Park	355		355
156	Henry Doorly Zoo	Regional Park & Zoo	155		155
158	Mandan Park	Regional Park	51		51

Table B-18c
Existing Recreation Sites
Harrison County, Iowa

Map No.	Site Name	Type Area	Land (Acres)	Water (Acres)	Total (Acres)
1	Fishing Access				
2	Hunting Area				
3	Hunting Area				
4	Hunting Area				
5	Hunting Area	Private	(7 areas)		2,149
6	Dunlap Golf Course	Public			
7	Vacation Farm	Private	(1 farm)		
8	Mo Valley Golf Course (Logan)	Public			
9	Roadside Park	Community Park			
10	Woodland Park	Community Park			
38	Deer Island	Natural Area	600		600
39	Little Sioux Access				
40	Small Boat Marina				
41	Little Sioux Delta				
42	Round Lake	Regional Park	262	131	393
43	Tyson Island State Wildlife Management Area	Regional Park	84		84
44	California Bend State Wildlife Refuge	Regional Park	190	360	550
45	Rand Access				
46	Rand Bar	Natural Area and Preserve	60		60
47	Nobles Lake	Regional Park	53	164	219
48	Desoto Bend Natural Wildlife Refuge	Natural Area	9,505	1,634	11,139

Table B-18d
Existing Recreation Sites
Mills County, Iowa

Map No.	Site Name	Type Area	Land (Acres)	Water (Acres)	Total (Acres)
68	Pony Creek Park	Regional Park	50		50
69	Glenwood Park	Community	15		15
70	Glenwood Golf Course	Public	45		45
71	Silver City Park	Community Park	3		3
72	Emerson City Park	Community Park	3		3
92	Boat Launch and Marina				
133	Fairview Golf Club				
140	Willow Slough	Natural Area	499		499
141	South Malvern Park	Community Park	3		3
142	North Malvern Park	Community Park	6		6
143	Hwy 59 Roadside Park				
145	Pacific Junction Park	Community Park	3		3

Table B-18e
Existing Recreation Sites
Pottawattamie County, Iowa

Map No.	Site Name	Type Area	Land (Acres)	Water (Acres)	Total (Acres)
49	Treynor Recreation Area	Public			
50	Wilson Island State Park	Regional Park	488	10	498
51	Lake Manawa State Park	Regional Park	453	660	1,113
52	Big Timber - KOA Campgrounds	Private			
53	Camp Hitchcock	Private			
54	Crescent Ski Hills	Private			
55	Camp Po-Ka-Mo-Ki	Private			
56	Quarry	Private			
57	Hamburg Bluffs	Private			
58	Lakeview Park	Community Park	300		300
59	Lewis and Clark Park	Regional Park	219		219
60	Marina				
61	Dodge Park (Council Bluffs)	Community Park	167		167
62	Dodge Park Golf Course				
63	Long's Landing Boat Launch	Regional Park	121	40	161
64	Pony Creek Watershed	Community Park	200	100	300
65	Smith Environmental Area	Natural Area			
66	Arrowhead Park	Regional Park	156	21	177
67	Old Towne	Community Park	5		5
79	Camp Wakonda	Private			
80	Oakland Country Club	Private			
102	Playland Park	Amusement Park			
113	Lakeshore Country Club	Private			
130	Levi Carter Lake and Park	Community Park	170	281	351
146	Botna Bend Park	Regional Park	114	7	121
152	YMCA Camp Pokamoke	Private			
154	Friendship Park				
157	Chain of Lakes Park				

Table B-18f
Existing Recreation Sites
Sarpy County, Nebraska

Map No.	Site Name	Type Area	Land (Acres)	Water (Acres)	Total (Acres)
31	Camp Brewster	Private			
33	Camp Wa-Kon-Da	Private			
37	Capehart Golf Course	Private	160		160
81	Seymour L. Smith Park	Community Park			
84	Quarry	Private			
86	Kiewite Quarry	Private			
87	Gretna Fish Hatchery	Fish and Game	60		60
88	Quarry	Private			
89	Linoma Beach	Private			
90	Offutt AFB Gold Course	Private	80		80
91	Fortenelle Forest	Natural Area	1,150	50	1,200
93	Fontenelle Hills Golf Course	Private	75		75
94	Springfield Parks	Community Parks	7		7
96	Gretna Parks	Community Parks	17		17
97	Bellevue Parks	Community Parks	168		168
98	La Vista Parks	Community Parks	38		38
100	Papillion Parks	Community Parks	125		125
101	Platteview Golf Course	Private			
114	Schramm Park	Regional Park	277		277
116	Gene Eppley Camp	Private			
134	Haworth Park	Community Park	75		75
135	Strategic Aerospace Museum	Regional Park	10		10

Table B-18g
Existing Recreation Sites
Washington County, Nebraska

Map No.	Site Name	Type Area	Land (Acres)	Water (Acres)	Total (Acres)
32	Blair Golf Club	Public	52		52
108	Environmental Institute	Natural Area	971		971
112	Scenic Area	General Park			
115	Omaha Boat Club	Private			
117	Scenic and Natural Area	General Park			
118	Blair Regional Park	Regional Park	500		500
119	Blair Park	Community Park	40		40
120	Scenic Area	General Park			
150	Neale Woods				

PUBLIC FINANCE

FEDERAL FUND DISTRIBUTION

In fiscal year 1973, 31 Federal departments and agencies distributed funds amounting to nearly $740 million among the seven counties in the study area. Allocation of 97.5 percent of these funds came from a dozen Federal sources, as illustrated in table B-19. The primary reason for a wide variation of expenditures in each county is to a great extent dependent on the type of services or facilities in each of the counties. The reason Sarpy County has the largest per capita level of expenditures associated with Offutt Air Force Base contributes 89 percent of the total expenditures. In fact, the Defense Department expenditures represent one-third of all Federal expenditures in the area. Due to the existence of health and educational facilities for servicemen and their families in Sarpy County, relatively few funds come from HEW. Large expenditures from the Agriculture Department among the different counties were due only in part to farming activities. The rather large amounts expended in Douglas and Pottawattamie Counties may be due to agricultural products processing, particularly livestock. The large amount of Postal Service expenditures in Douglas County is due to the Postal Service's divisional operations in Omaha. Large amounts of Railroad Retirement funds in Douglas and Pottawattamie Counties are probably due to the number of retired railway workers living there. While the distribution of Veterans Administration funds is probably due to the number of veterans living in the various counties, the Douglas County share is inflated because of the location of a Veterans Administration Hospital in the County.

Table B-19
Federal Fund Expenditure Distribution - Fiscal Year 1973
(by percent)

	SMSA Counties				Non-SMSA Counties							
	Douglas	Sarpy	Pottawattamie	Total SMSA	Cass	Washington	Harrison	Mills	Region	Iowa	Nebraska	U. S.
Federal Dept. or Agency												
Agriculture	5.2	1.2	36.0	8.3	34.4	26.8	45.1	32.5	10.9			
Commerce	1.4	.0	0.5	0.9	.0	.0	.0	.0	0.8			
Defense	17.5	89.3	8.2	35.5	6.2	34.1	0.4	1.4	33.1			
HEW	37.4	4.9	27.9	27.4	35.2	21.2	29.9	31.7	27.5			
HUD	1.8	.0	1/	1.1	.0	.0	.0	.0	0.9			
Labor	1.4	1/	0.5	0.9	0.1	1/	0.1	0.2	0.8			
Transportation	1.9	1/	5.9	2.0	0.3	6.1	8.9	17.5	2.5			
Treasury	7.7	1.8	7.2	6.1	7.3	3.9	6.0	6.7	6.1			
Civil Service	1.9	0.7	1.3	1.5	2.1	1.3	1.0	1.2	1.5			
Postal Service	7.2	0.5	2.5	4.8	4.7	2.6	3.3	3.2	4.7			
R.R. Retirement	3.3	0.1	4.9	2.7	3.6	0.6	1.7	1.8	2.6			
Veterans Admin.	9.1	1.2	4.4	6.4	5.5	3.2	2.6	3.7	6.1			
Other	4.2	0.3	0.7	2.4	0.6	0.2	0.1	0.1	2.5			
Total ($1,000,000)	$397.6	179.0	90.6	667.2	15.9	20.0	22.8	13.5	739.4			
Per Capita Expenditure 2/	1,021	2,703	1,043		880	1,499	1,408	1,078				

1/ Less than 0.1%.

2/ Based on 1970 population.

Source: Office of Economic Opportunity.

AD-A041 921 ARMY ENGINEER DISTRICT OMAHA NEBR F/G 8/6
WATER AND RELATED LAND RESOURCES MANAGEMENT STUDY. VOLUME II. B--ETC(U)
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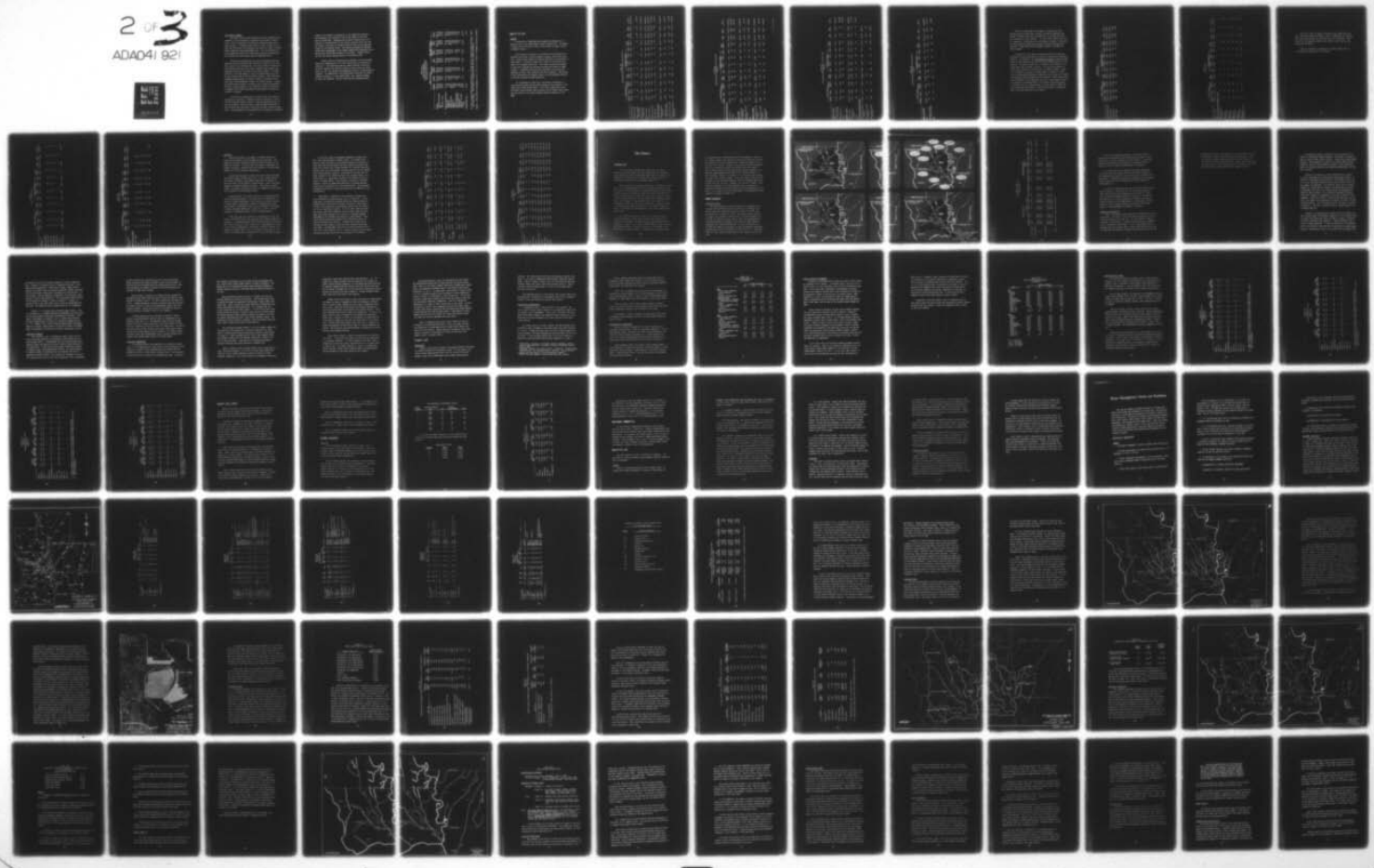

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NATIONAL BUREAU OF STANDARDS-1963-A

LOCAL PUBLIC FINANCE

Any study of local public finance has many limitations due primarily to the multitude of jurisdictions and public institutions. This is especially true when the study area spans more than one State. To simplify the review of public finance in the area, the 1972 Census of Governments was used as a source of information regarding county governments only. For the residents of local communities and cities, additional services and facilities are provided by those jurisdictions at additional costs.

Revenues and expenditures and their percentage allocation among the various categories are presented in table B-20 for the seven counties in the study area. The chief source of revenue for the counties comes from local taxes, primarily the property tax, providing from 40 to 59 percent of the total revenue. The three counties in the SMSA appear to rely less proportionately on the tax for revenue than do the more rural counties. The second most important general source of revenue, except for Douglas County, comes from intergovernmental, State, and Federal sources. Charges and miscellaneous sources of revenue, such as special assessments, licenses, special permits, are an important source, particularly in Douglas County where the greatest concentration of people and activity is located.

Allocation of expenditures is divided among eight general categories or functions. Education receives 1 percent or less in the four Nebraska counties, while it receives appreciably more in the Iowa counties, due to different organizational structures in the two States and the amount of services provided from the county level. The percentage of the expenditures for highways is inversely

related to the amount of population in the respective counties, and represents over one-half of the county budget in the four rural jurisdictions. Expenditures for public welfare have little relation to the population of the various counties other than that the largest county has the largest relative share and the smallest county has the smallest share. The remaining categories represent rather small percentages of the budget expenditures depending on the services and facilities available to the public. Douglas County was the only county paying interest on outstanding debt.

Another method of evaluating and comparing county government revenue and expenditures is on a per capita basis as presented in table B-21. The relatively high per capita revenues in Harrison and Mills Counties are directly related to their local tax effort which, in turn, has brought correspondingly greater intergovernmental response. An examination of the expenditures indicates the larger shares of revenue, on a per capita basis, went towards highways in these two counties. Only two counties had outstanding debts.

Table B-20
County Government
Revenue and Expenditures
Per Capita 1971-72 FY

	SMSA Counties			Non-SMSA Counties			
	Douglas	Sarpy	Pottawat-tamie	Cass	Washing-ton	Harri-son	Mills
Revenue	$91.90	$47.20	$81.80	$86.30	$79.80	$161.50	$140.10
Intergovernmental	25.60	19.80	29.80	22.90	26.80	56.60	54.20
Tax	37.90	19.00	40.10	50.80	39.80	90.00	74.90
Charges & Misc.	28.30	8.30	11.80	12.50	13.00	14.70	10.90
General Expenditures	91.30	36.50	78.30	90.00	81.50	150.10	137.60
Education	.30	.10	14.20	.80	.90	.80	9.00
Highways	5.70	14.50	24.20	49.50	42.20	80.10	76.70
Public Welfare	20.60	1.80	10.90	4.30	4.70	25.90	6.30
Hospitals	23.40	1.70	7.50	7.40	3.50	6.50	9.80
Health	8.90	.20	3.70	.20	-	3.50	1.40
Police Protection	1.90	2.40	1.70	2.80	2.80	1.90	2.70
Natural Resources	.70	1.60	1.70	2.10	3.70	2.40	8.10
Correction	1.90	.10	1.10	.30	.50	.50	.70
Interest on Debt	3.10						
Other 1/	24.40	1.37	12.90	22.40	22.80	19.80	22.50
Outstanding Debt	64.00						5.00

1/ Other includes Financial Administration, General Control, General Public Buildings, Other and Unallocable. 1970 Census of Population used for per capita allocation.

Source: 1972 Census of Governments, Vol. 4, No. 3, U. S. Dept. of Commerce, Bureau of Census.

QUALITY OF LIFE

HOUSING

Information on ownership and occupancy and facilities of housing units in the study area is shown on table B-21. The number of units varies from about 4,000 in Mills County to about 130,000 in Douglas County.

The condition of housing is indicated by the availability of household facilities, such as plumbing, heating, and kitchen services. Housing units lacking or sharing facilities is classified as sub-standard. As shown in table B-21, from 4 to 10 percent lack some or all plumbing facilities. The higher percents are located in the rural counties and the lower percents are located in SMSA counties. Household units with only cold water or no water are numerous in Sarpy, Cass, Harrison, and Mills Counties. Two percent of the housing units in Douglas, Sarpy, and Pottawattamie Counties do not have complete kitchen facilities.

As illustrated in table B-21, the percent distribution of owner-occupied houses has the same pattern for the counties in the study area, except Sarpy County. As of 1975, people that moved into their houses between 1965 and March 1970 in Sarpy County represent 54 percent of all owner-occupied versus 36 percent in the SMSA.

Table B-21
Housing Ownership, Occupancy, and Facilities

	SMSA Counties				Non-SMSA Counties							
	Douglas	Sarpy	Pottawat-tamie	Total SMSA	Cass	Washing-ton	Harri-son	Mills	Total Region	Iowa	Nebr.	U.S.
All housing units	129,837	16,810	28,121	174,768	6,496	4,397	5,793	3,922	195,376	964,060	514,617	68,671,920
Percent of total	67	9	14	90	3	2	3	2				
Vacant - seasonal and migratory	70	303	18	391	51	14	9	5	470	9,085	3,144	972,836
All year round housing units	129,767	16,507	28,103	174,377	6,445	4,383	5,784	3,917	194,906	954,975	511,473	67,699,084
Owner occupied	75,703	9,318	19,508	104,529	3,983	2,821	3,883	2,621	117,837	896,311	314,267	63,445,192
Renter occupied	46,757	6,662	7,268	60,687	1,700	1,278	1,532	1,036	66,233	253,641	152,108	23,559,647
Vacant yeer round	7,307	527	1,327	9,161	762	284	369	260	10,836	58,664	38,166	4,253,892
For sale only	894	75	219	1,188	35	27	32	24	1,306	7,893	4,468	501,322
PLUMBING FACILITIES												
With all plumbing facilities	125,505	16,147	26,902	168,554	5,980	4,128	5,256	3,628	187,546	891,470	483,653	63,301,323
Lacking some of all plumbing facilities	4,262	360	1,201	5,823	465	255	528	289	7,360	63,505	27,820	4,397,761
Lacking only hot water	532	63	170	765	10	21	59	10	865	5,660	3,377	551,260
Lacking other plumbing facilities	3,730	297	1,031	5,058	455	234	469	279	6,495	57,845	24,443	3,846,501

Table B-21
Housing Ownership, Occupancy, and Facilities
(Cont'd)

	SMSA Counties				Non-SMSA Counties							
	Douglas	Sarpy	Pottawat-tamie	Total SMSA	Cass	Washing-ton	Harri-son	Mills	Total Region	Iowa	Nebr.	U.S.
PIPED WATER IN STRUCTURE												
Hot and cold	128,961	2,719	27,530	159,210	6,072	4,231	5,421	3,696	178,630	917,802	494,654	64,590,071
Cold only	752	93	343	1,188	183	53	184	90	1,698	17,388	8,833	1,500,068
None	54	94	230	378	190	99	179	131	977	19,785	7,986	1,608,945
FLUSH TOILET												
For exclusive use of household	126,817	2,731	27,328	156,876	6,016	4,198	5,396	3,673	176,159	908,992	490,440	64,481,483
Also used by another household	2,713	4	407	3,124	10	14	54	40	3,242	13,887	5,757	604,128
None	237	171	368	776	419	171	334	204	1,700	32,096	15,276	2,613,473
BATHTUB OR SHOWER												
For exclusive use of household	126,146	2,714	27,112	155,972	6,078	4,174	5,350	3,659	175,233	900,461	488,838	64,038,910
Also used by another household	2,906	4	477	3,387	10	18	66	49	3,530	14,999	6,200	622,073
No complete bath facilities	715	188	514	1,417	357	191	368	209	2,542	39,515	16,435	3,038,101

Table B-21
Housing Ownership, Occupancy, and Facilities
(Cont'd)

	SMSA Counties				Non-SMSA Counties							
	Douglas	Sarpy	Pottawat-tamie	Total SMSA	Cass	Washing-ton	Harri-son	Mills	Total Region	Iowa	Nebr.	U.S.
SOURCE OF WATER												
Public system or private company	127,479	15,072	22,849	165,400	4,138	2,729	3,444	2,262	177,973	8,630	11,016	5,392,646
Individual well	2,226	1,331	5,189	8,746	2,219	1,638	2,318	1,604	16,525	162	57	640,788
Other	67	116	63	246	84	18	18	51	417	51	14	140,807
SEWAGE DISPOSAL												
Public sewer	123,745	14,320	21,788	159,853	3,660	2,571	2,930	1,914	170,920	8,482	10,900	4,980,714
Septic tank or cesspool	5,710	1,956	5,862	13,528	2,368	1,592	2,544	1,841	21,873	221	103	532,583
Other	317	243	451	1,011	413	222	306	162	2,114	140	84	660,944
COMPLETE KITCHEN FACILITIES												
For exclusive use of household	127,202	16,277	27,449	170,928	6,106	4,188	5,433	3,674	190,329	910,498	487,810	-
Also used by another household	211	14	43	268	-	-	-	-	268	1,472	484	-
No complete kitchen facilities	2,354	216	611	3,181	339	195	351	243	4,309	43,005	23,119	-

Table B-21
Housing Ownership, Occupancy, and Facilities
(Cont'd)

	SMSA Counties				Non-SMSA Counties							
	Douglas	Sarpy	Pottawat-tamie	Total SMSA	Cass	Washing-ton	Harri-son	Mills	Total Region	Iowa	Nebr.	U.S.
HEATING EQUIPMENT												
Total	129,767	16,507	28,103	174,377	6,445	4,383	5,784	3,917	194,906	954,975	511,446	6,174,353
Fireplaces, stoves, or portable heaters	502	95	161	758	188	54	69	113	1,182	6,319	4,266	612,779
None	85	72	53	210	18	25	28	69	350	3,473	3,412	39,384

Table B-22 shows data on the number of persons per room. Housing units with more than 1 person per room are generally considered "crowded", and units with more than 1.5 persons per room are classified as "most crowded". In other words, persons per room is a measure of living space or an indicator of comfort. Generally, the SMSA counties contain more crowded conditions than the rural counties. Sarpy County has the highest percent of "crowded" to "most crowded".

In table B-23, the "period constructed" refers to when the building was first constructed, not when the building was remodeled, added to, or converted. The 1970 Census of Housing contained county data for owner-occupied, but not for renter-occupied units for this category. As shown in table B-23, 46 percent of the houses in the region were built in 1939 or earlier. For the seven counties, a little under one-half of the houses are 36 years or older. There is a difference in the age of houses among the counties. Sarpy County demonstrates significant differences in the age of its houses in comparison with the urban and rural counties. Sarpy County shows that 15 percent of its houses are 36 years or older versus a range of 43 percent in Douglas County to 85 percent in Harrison County. In general there is a higher percent of older houses in SMSA counties, excluding Sarpy County, in the rural counties, in Nebraska, and in Iowa than there are in the Nation.

Table B-22
Persons Per Room

	SMSA Counties				Non-SMSA Counties						
	Douglas	Sarpy	Pottawat-tamie	Total SMSA	Cass	Washing-ton	Harri-son	Mills	Total Region	Iowa	Nebr.
All occupied units	122,460	15,980	26,776	165,216	5,083	4,099	5,415	3,657	183,980	642,670	314,267
1.00 or less	113,823	14,279	24,331	152,433	5,296	3,900	5,145	3,498	170,272	607,927	295,797
1.01 to 1.50	7,146	1,452	2,031	10,629	339	168	250	129	11,515	30,527	15,594
1.51 or more	1,491	249	414	2,154	48	31	20	30	2,283	5,216	2,876

Table B-23
Age of Housing

	SMSA Counties				Non-SMSA Counties							
	Douglas	Sarpy	Pottawat-tamie	Total SMSA	Cass	Washing-ton	Harri-son	Mills	Total Region	Iowa	Nebr.	U.S.
Owner occupied	129,767	16,507	28,103	157,336	6,445	4,383	5,784	3,917	194,906	642,670	314,267	39,885,545
PERIOD CONSTRUCTED IN PERCENT OF TOTAL												
1969-March 1970 6-5 years	4	5	1	4	4	5	1	2	4	2	3	3
1965-1968, 10-7 years	10	19	6	1	8	8	3	7	10	7	7	10
1960-1964, 15-11 years	13	30	12	16	8	9	4	6	12	8	12	13
1950-1959, 25-16 years	20	24	18	22	10	9	4	6	18	17	17	25
1940-1950, 35-24 years	10	7	7	10	5	5	3	4	10	8	7	12
1939-earlier, 36 years or older	43	15	57	47	65	64	85	75	46	58	54	37

Table B-24 shows the value of housing in the study area counties. The mean values for Douglas, Sarpy, Pottwattamie, and Washington Counties are higher than the mean values for the Nation. Mean values for the remaining counties are slightly lower than the mean values for the Nation.

Table B-25 presents a comparison of monthly rental costs in the study area counties and in the Nation.

Table B-24
Value of Housing Units

	SMSA Counties				Non-SMSA Counties							
	Douglas	Sarpy	Pottawat-tamie	Total SMSA	Cass	Washing-ton	Harri-son	Mills	Total Region	Iowa	Nebr.	U.S.
Specific owner occupies	69,461	8,259	16,005	93,725	2,614	1,711	2,404	1,657	102,111	478,456	236,920	2,078,940
VALUE IN PERCENT												
Less than $9,999	24	8	30	23	53	33	58	47	26	30	38	47
$10,000-$19,999	47	55	55	49	40	45	35	40	48	46	42	40
$20,000-$24,999	13	10	8	13	5	13	4	8	12	12	10	7
$25,000-$34,999	10	15	5	10	1	7	1	4	9	8	7	5
$35,000-more	6	2	2	5	-	2	-	1	5	4	3	1
Median Value ($)	15,300	18,000	12,800	NA	9,500	12,600	9,000	10,400	NA	13,900		10,700

Table B-25
Contract Rent

	SMSA Counties				Non-SMSA Counties							
	Douglas	Sarpy	Pottawat-tamie	Total SMSA	Cass	Washing-ton	Harri-son	Mills	Total Region	Iowa	Nebr.	U.S.
Specific renter occupied	46,045	6,338	6,226	58,609	1,201	944	1,006	580	62,340	199,543	132,920	22,333,580
MONTHLY RENT IN PERCENT												
Less than $30-$59	16	3	9	14	27	17	17	18	15	7	26	
$60-$99	37	9	39	34	48	34	39	43	36	13	37	
$100-$149	30	32	35	30	14	37	23	24	30	44	21	
$150 or more	14	22	10	15	1	5	3	3	13	29	8	
No cash rent	3	34	7	7	10	7	18	12	7	7	8	
Median monthly rent ($)	95	133	98	115	72	72	85	84	NA	99	78	108

EDUCATION

During recent years, the number of students enrolled in school has increased in both the SMSA and the study area. The change in the total enrollment during 1960-1970 increased in the SMSA by 52 percent. In this period, the region's enrollment increased 46 percent. Harrison and Mills Counties in Iowa declined, however, by 5 and 8 percent, respectively.

Significant increases in high school and college enrollment are shown in table B-26 and table B-27. For the seven counties, the percent increase in high school ranges from 15 percent in Harrison County to 201 percent in Sarpy County. Also, significant changes in college enrollment are shown: 794 percent in Sarpy County, 306 percent in Harrison County, 310 percent in Mills County, and 241 percent in Pottawattamie County.

There has been a 105 percent increase in college enrollment for the remaining counties. One reason for the substantial increase in college enrollment is the location of Bellevue College in Sarpy County; Iowa-Western College in Pottawattamie County, Dana College in Washington County; and the University of Nebraska at Omaha, Creighton University, College of St. Mary's, and the University of Nebraska Medical College in Douglas County.

There have been some increases in enrollments for some age groups, 3-34 years of age, over and above the compulsory ages of 6 through 15. As shown in table B-26, gains were noted in the enrollment level of youth, 16 and 17 years old, of approximately 10 percent in Sarpy, Pottawattamie, Washington, and Mills Counties; of 7 percent in Douglas County; and of 6 percent in Cass County. Also noted is a similar trend in enrollment of the 20-24 year old group.

In 1970 the census of population expanded to include the 3 and 4 year olds enrolled in nursery school. As of March 1974, almost 27 million children in the United States--or 42 percent of those under age 18--had mothers who were working or seeking work. About one of every four of these children (6.1 million) were below regular school age, and probably required some kind of care during their working mother's absence. Excluding Mills County, the six other counties in the study area follow the national trend. As a result there is a significant increase in the number of youth enrolled in nursery school. This increase is evident in the SMSA counties. Within the Omaha area there are 49 licensed day-care centers with the capacity for 2,236 pre-schoolers. Also dispersed throughout the area are 54 day-care homes with the capacity of 301 pre-schoolers.

"Head Start", sponsored by local agencies, provides pre-school education to young children, ages 3-5 years old. In the Omaha area, including the northern border and southern border of Douglas County, there are 690 students enrolled in "Head Start", of which 120 students are in home-based classes, and 570 students are in the "Head Start" centers. In Mills County there are four pre-schools where the students go once or twice a week for half-days, while their mothers are at work or in training programs. Approximately 100 students are enrolled in these schools. Sarpy County has seven day-care centers and 48 home-based centers in which 109 children are enrolled. Although Mills County has no licensed day-care centers, there are three licensed family day-care homes. Pottawattamie County has two profit day-care facilities with a total capacity of 101. Harrison County has one licensed non-profit day-care center with the capacity for 20 children.

Table B-26
School Enrollment
(1960)

	SMSA Counties				Non-SMSA Counties						
	Douglas	Sarpy	Pottawat-tamie	Total SMSA	Cass	Washing-ton	Harri-son	Mills	Total Region	Iowa	Nebr.
Total enrolled, 5-34 years old	83,451	7,847	20,854	112,152	4,241	3,133	4,487	2,993	127,006	702,938	357,439
Kindergarten (number)	7,727	814	1,806	10,347	464	224	361	209	11,605	56,457	28,664
(percent)	9	10	9	9	11	7	8	7	9	8	8
Elementary 1-8 years (number)	52,603	5,285	14,632	72,520	2,795	1,889	3,010	2,024	82,238	444,712	220,892
(percent)	63	67	70	65	66	60	67	68	65	63	62
Public (number)	36,375	4,475	13,290	54,140	2,748	1,805	2,677	2,020	63,390	377,127	182,957
High School 1-4 years (number)	16,043	1,573	4,067	21,683	924	664	1,100	740	25,111	153,646	82,728
(percent)	20	21	19	19	22	22	25	24	20	22	23
Public (number)	11,935	1,413	3,829	17,177	917	664	1,036	729	20,523	135,932	73,653
College (number)	7,078	175	349	7,602	58	356	16	20	8,052	48,123	25,155
(percent)	8	2	2	7	1	11	-	1	6	7	7

Table B-27
School Enrollment
(1970)

	SMSA Counties				Non-SMSA Counties							
	Douglas	Sarpy	Pottawat-tamie	Total SMSA	Cass	Washing-ton	Harri-son	Mills	Total Region	Iowa	Nebr.	U.S.
3-34 years old	121,079	23,105	25,776	169,960	4,778	4,052	4,260	2,762	185,812	825,438	443,904	58,634,996
Nursery	3,104	487	281	3,872	21	46	22	6	5,041	9,920	6,375	953,912
Public	887	91	90	1,068	6	21	16	-	1,143	3,576	2,036	303,279
Kindergarten	8,182	1,726	1,990	11,898	373	238	263	209	12,981	52,224	27,230	3,024,398
Public	7,688	1,701	1,925	11,314	373	233	257	209	12,386	50,849	26,150	2,544,409
Elementary (1-8)	66,123	14,593	15,636	96,352	2,911	1,966	2,641	1,544	105,978	454,978	240,706	33,210,219
Public	50,797	12,511	14,212	77,520	2,759	1,897	2,479	1,544	86,209	404,074	204,625	29,375,178
High School	28,015	4,735	6,680	39,430	1,314	979	1,269	911	43,903	211,097	110,915	14,480,634
Public	21,287	4,304	5,823	31,414	1,300	960	1,233	891	35,798	191,404	97,666	13,063,465
College	15,655	1,564	1,189	18,408	159	823	65	82	19,537	97,219	58,678	6,966,033

The Future

INTRODUCTION

In this section, estimates and projections are used to describe the region twenty and fifty years from now. Variables were chosen that could be reasonably quantified or discussed. The forecasts are described at the seven-county region level, for individual counties, and for individual communities.

What is meant by "individual communities" is defined by levels. Level I is the area within the cities of Omaha and Council Bluffs and Level II are communities in the immediate vicinity of the metropolitan area such as Bellevue, Papillion, Gretna, and Bennington. Level III communities are those well beyond the 50-year boundaries of Omaha-Council Bluffs and include among others, Missouri Valley, Blair, and Glenwood. They are urban areas and probably will be influenced by Omaha but will remain independent. Level IV communities are agrarian towns and hamlets such as Persia, Pisgah, and Neola. They should not be affected by growth in the Omaha-Council Bluffs area.

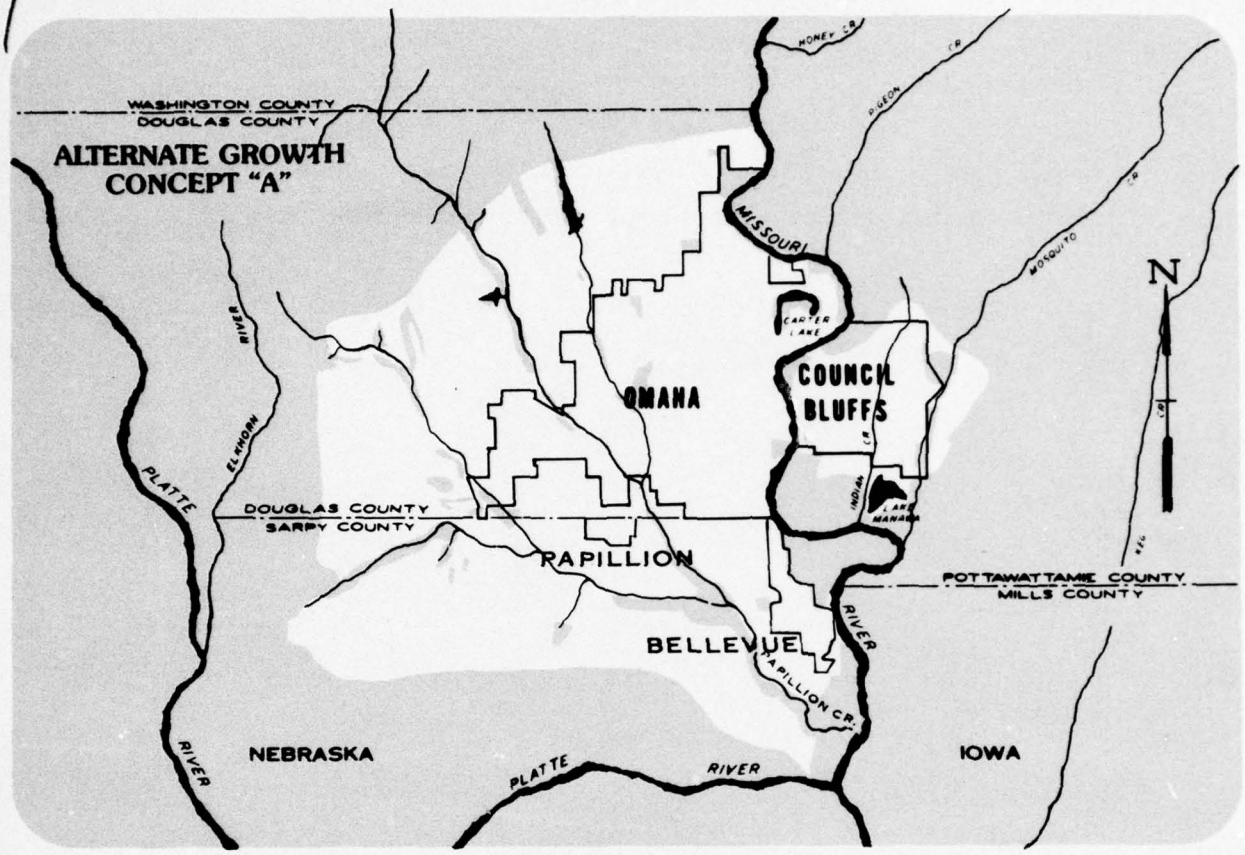
Four alternative growth concepts are described for each variable discussed. These growth concepts were derived from a study by Dana College. The concepts are listed alphabetically A through D. Concept A is a future scenario based on urban dispersal. The "American Dream" of owning a new home in the suburbs is the basis for this concept, which is a continuation of present trends

of suburbanization, scatteration, and skip development. Concept B is a planned compact city where city limits are arbitrarily defined, and satellite cities are encouraged in communities nearby such as Blair and Fort Calhoun. Concept B also assumes that city redevelopment is an important priority to the public and their leaders. Higher density housing, a new mass transit system, greenbelts, and downtown redevelopment are all part of the B growth concept. In many instances, Concept C is similar to B in restoring and preserving areas within the city limit. On the other hand, C does not have satellite cities, and new population growth is channeled away from suburbs back into the city. Concept D is similar to Concept A with the major exception of how the population will be distributed. D assumes that growth will sprawl along the major transportation corridors. In A, growth is much less structured. The alternative growth concepts are shown in figure B-10.

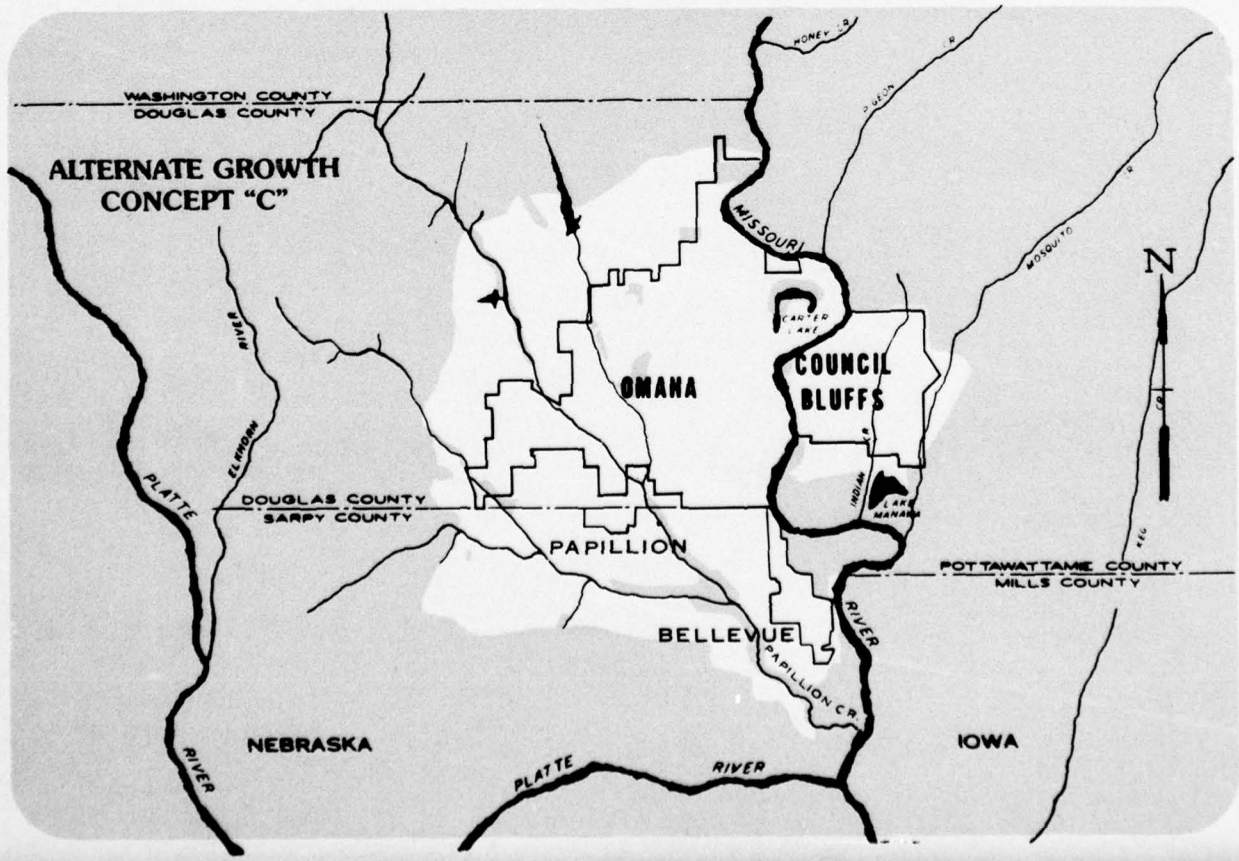
HUMAN RESOURCES

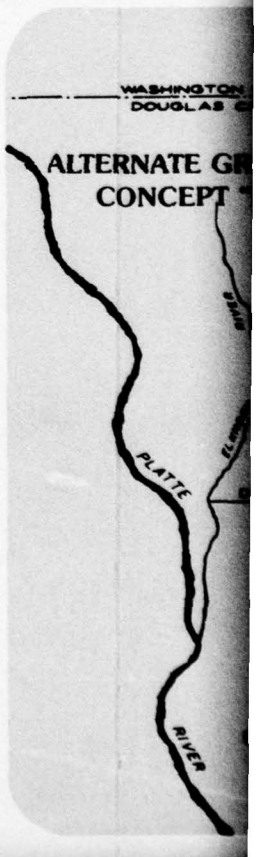
POPULATION GROWTH

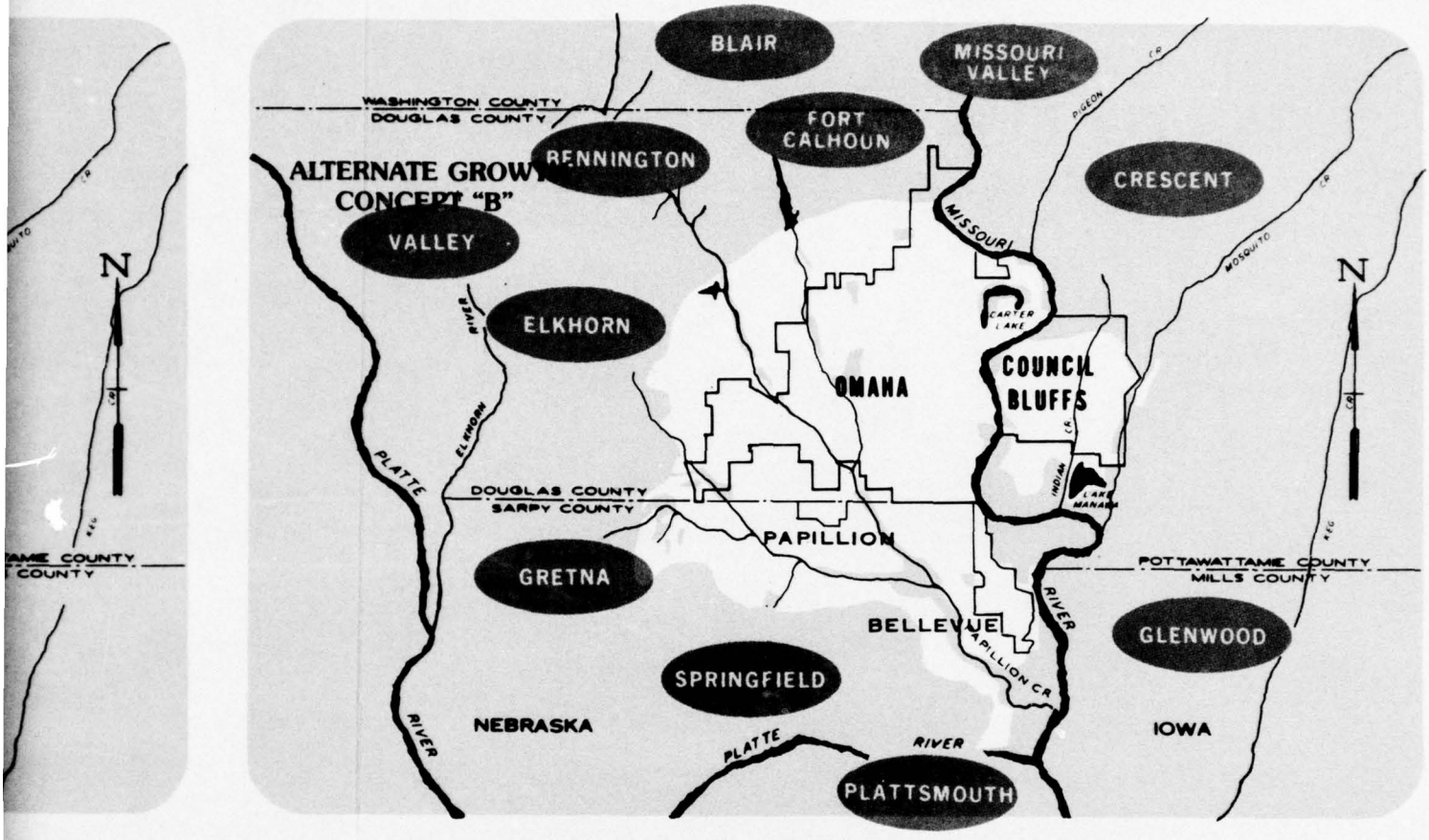
All four alternative growth concepts were formulated using the same 1995 and 2020 population projections. Available population projections range from 733,500 to 989,450 for 1995, and from 877,900 to 1,578,900 for 2020. Population figures selected by county, are indicated on table B-27a. The 1995 projection for the SMSA is identical to that used in MAPA's 1995 transportation plan and represents the Bureau of the Census or OBERS Series "C" projection with local modifications. The 2020 projections for the SMSA are based on an analysis of local and national projections approximating Bureau of the Census or OBERS Series "C". Available State or local projections were used for the counties outside the SMSA.

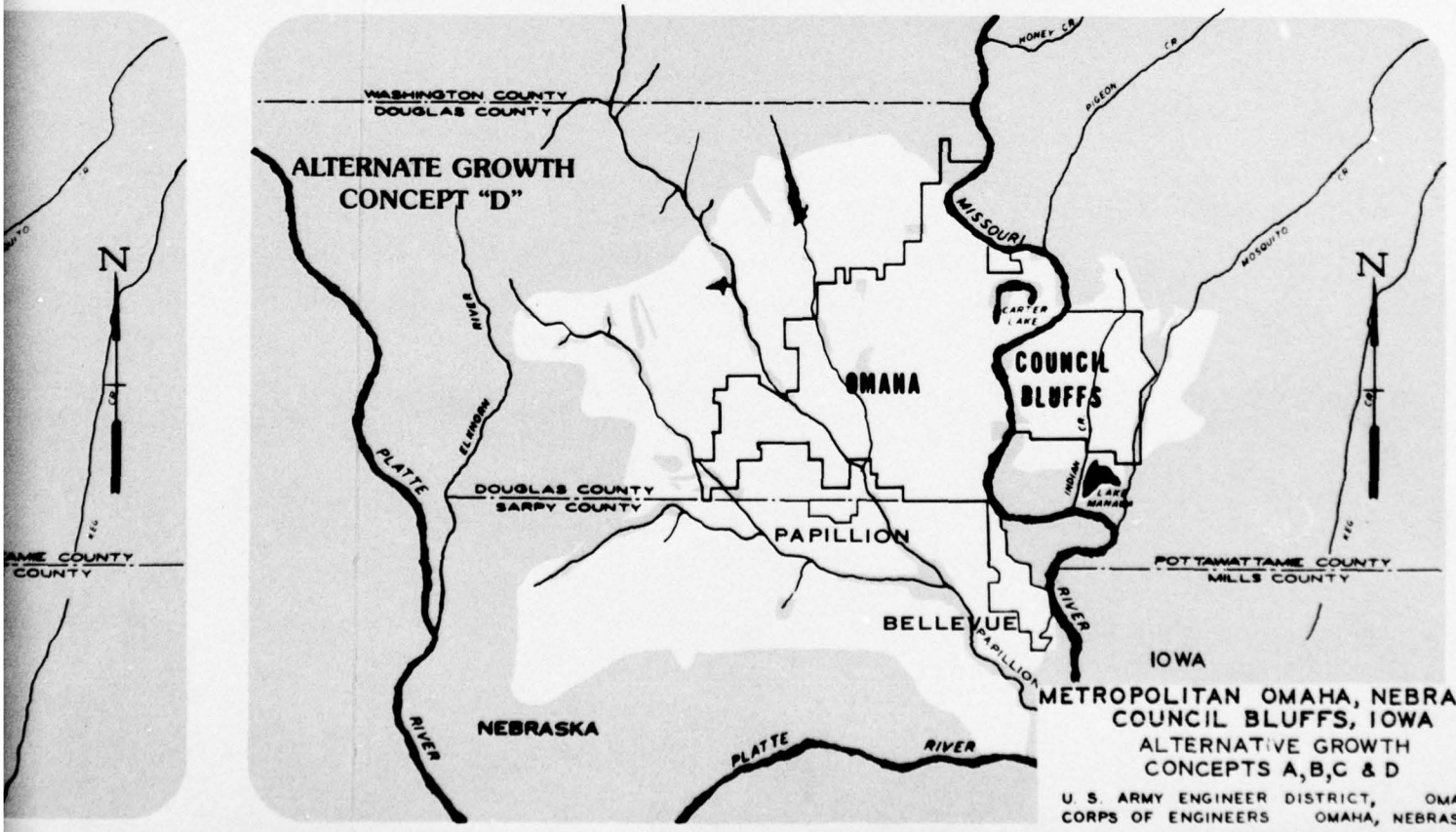

ALTERNATE GROWTH
CONCEPT "A"
WASHINGTON COUNTY
DOUGLAS COUNTY
MISSOURI
MOSQUITO
CARTER LAKE
OMAHA
COUNCIL BLUFFS
INDIAN
LAKE MANAWA
PLATTE
ELKHORN
RIVER
DOUGLAS COUNTY
SARPY COUNTY
PAPILLION
POTTAWATTAMIE COUNTY
MILLS COUNTY
BELLEVUE
PAPILLION CR.
NEBRASKA
IOWA
PLATTE RIVER
N

VALLEY


ALTERNATE GROWTH
CONCEPT "C"
WASHINGTON COUNTY
DOUGLAS COUNTY
MISSOURI
MOSQUITO
CARTER LAKE
OMAHA
COUNCIL BLUFFS
INDIAN
LAKE MANAWA
PLATTE
ELKHORN
RIVER
DOUGLAS COUNTY
SARPY COUNTY
PAPILLION
POTTAWATTAMIE COUNTY
MILLS COUNTY
BELLEVUE
PAPILLION CR.
NEBRASKA
IOWA
PLATTE RIVER
N







METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
ALTERNATIVE GROWTH
CONCEPTS A, B, C & D

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

JUNE 1975

VOLUME II FIGURE B-10

Table B-27a
Population Projections
(Thousands)

	SMSA Counties				Non-SMSA Counties							
	Douglas	Sarpy	Pottawat-tamie	SMSA Total	Cass	Washington	Harrison	Mills	Study Region Total	Iowa	Nebraska	U.S.
1970 Census	389.5	66.2	87.0	542.6	18.1	13.3	16.2	12.5	602.8	2,825.	1,483.	203,212.
1995 Concepts												
A	533.4	215.4	102.1	850.9	20.6	17.8	16.8	12.0	918.0	3,494.	1,818.	288,270.
B	515.8	176.8	102.6	795.1	32.9	42.1	22.9	24.9	918.0			
C	581.7	167.1	102.1	850.9	20.6	17.8	16.8	12.0	918.0			
D	523.5	225.3	102.1	850.9	20.6	17.8	16.8	12.0	918.0			
2020 Concepts												
A	650.2	260.7	123.5	1,034.5	21.5	19.3	17.7	11.4	1,104.5	4,672.	2,354.	399,013.
B	635.0	220.2	115.4	970.6	33.5	52.2	23.4	24.8	1,104.5			
C	686.5	228.5	119.5	1,034.5	21.5	19.3	17.7	11.4	1,104.5			
D	619.3	288.2	126.9	1,034.5	21.5	19.3	17.7	11.4	1,104.5			

Note: Totals may not add due to rounding.

For Cass and Washington Counties, the Nebraska Office of Planning and Programming's medium projections were used. These projections are based on Bureau of Census Series "E" projections. Additional population was allocated to the counties for the satellite cities of Blair and Plattsmouth for Concept B.

For Harrison and Mills Counties, population projections to the year 1990 were supplied by the Iowa Office of Planning and Programming and used as a guide to develop the 1995 and 2020 projections. Additional population was allocated to the counties for the satellite cities of Missouri Valley and Glenwood for Growth Concept B.

It should be recognized that while this study used a locally modified Series "C" projection for the urban area, there is a trend toward lowering the projection to the Series "E" level. MAPA has recently adopted a Series "E" projection for the SMSA and modified it to a 1995 projection of 772,862 or slightly in excess of Bureau of the Census Series "C" projections. Extrapolation of MAPA's current adopted projections to 2020 would result in a SMSA population in excess of 1,000,000.

POPULATION DISTRIBUTION

Under A, population should continue to increase in the seven-county area. The total for the seven-county region would be over 1,100,000 persons by the year 2020. As noted earlier, Concept A represents a continuation of recent trends of land use, characterized by low-density urban sprawl. It is a modification of the Metropolitan Area Planning Agency's (MAPA) 1969 land use plan, and it duplicates this agency's population allocations used in the 1995

transportation study. This concept is fairly consistent with the Metropolitan Utilities District's land use projections. Under this concept, Douglas County would retain about 58 percent of the total population projected for 1995, Sarpy County would attain 23 percent and the 3 SMSA counties almost 93 percent. Almost the same distribution would occur with this concept for 2020.

The median age should increase in the total region as the number of children per family decreases. The number of persons 62-years of age and older should increase. Income levels should remain constant. This assumption is based on the current market system. Though all levels of the economy have gained in real purchasing power, the income distribution has remained approximately the same over the years.

Concept B is referred to as the "Satellite City" concept. It can be classified as a noncontiguous urban growth pattern. It includes a constrained growth policy for urban Omaha, with satellite cities receiving spillover growth from the urban center, and open spaces are preserved. The satellite cities are not bedroom communities, rather they are largely self-sustaining with regard to employment and would, to a certain degree, be independent of Omaha for basic services. The Riverfront Development Program's "New Towns" concept is incorporated in the form of interior redevelopment. Under this concept, the SMSA would lose about six percent of its share of the population in 1995 and in 2020 to the four non-SMSA counties. The total population for the region is similar to Concept A. The area is reduced, however, because Concept B is a planned community.

Concept C is characterized by growth within the central city with limited growth in peripheral communities. This concept attains the same total population within the SMSA as Concept A; therefore, it does not represent zero expansion. Future development would occur in higher densities. It does not provide for the establishment of new towns but does provide for some interior redevelopment. Concept C particularly reflects the concerns for the energy crisis

and presents the need for further expansion of public transportation. Concept C is referred to as a "Restoration Society" in the Dana College presentation. Within this concept, Douglas County attains its highest level of projected population, almost two-thirds of the entire area's population as projected for 1995 and 2020. In this concept, land-use planning is emphasized with arbitrary limits defined to reduce suburbanization. The relationships among citizens in the society are similar to those in Concept B. Concept C is unique in that it has "New Towns" built within the established central city. The downtown central business district is refurbished.

Concept D is a transportation-oriented growth concept. Similar to Concept A, it assumes substantial development will take place in strip-like fashion along major transportation corridors. Eventually, development is assumed to fill in between the corridors. The main transportation corridors are Interstate Highways 80 and 29, U. S. Highway 73-75, and the proposed Omaha-Fremont expressway. Under this concept, Sarpy County is projected to obtain its highest level of population, 26 percent of the area's population, by 2020.

INDIVIDUAL COUNTIES

Under Concepts A and D, considerable growth should occur in Sarpy and Douglas Counties, but Washington County should only receive minimal growth. Pottawattamie and Cass Counties should have moderate growth and Harrison and Mills Counties should stabilize or lose population. Income levels should remain relatively constant in Douglas, Sarpy, and Pottawattamie Counties, but should diminish or remain constant in Washington and Cass Counties and drop in Harrison and Mills Counties. The income level decrease in the last two counties would occur as the active population (18-44) outmigrates

to more attractive job opportunities and as farms consolidate. Median age would also remain constant in most counties except in Harrison and Mills Counties where the median age would rise. Generally speaking, the number of elderly and retired persons will increase in these rural counties.

Under Concept C, population in Douglas County increases but Pottawattamie and Sarpy Counties would not have the growth as experienced in Concepts A and D. All other counties are the same as in A and D. Median age should increase in Harrison and Mills Counties and remain similar to A and D in Pottawattamie, Sarpy, Cass, and Douglas Counties. Income levels should be the same or similar to levels indicated in Concepts A and D in all counties.

If growth should occur as indicated in Concept B, Sarpy, Douglas, and Pottawattamie Counties shall not experience as much growth as under Concept A. The remaining rural counties (except Harrison and Mills) should experience considerable growth as "New Towns" or "Satellite Cities" are located in these areas. The median age should drop in rural counties and income levels should remain constant with levels shown for other concepts. The urban counties (Douglas, Sarpy, and Pottawattamie) should increase slightly and income levels should remain similar to current trends.

INDIVIDUAL COMMUNITIES

It was noted earlier that communities are defined by levels. Level I is the Omaha-Council Bluffs region, and the remaining levels increase in number as they geographically move outward from the metropolitan region. Under sprawl Concepts A and D, the population should scatter on the fringe of the metropolitan area. As A and D

also reflects continuation of the current social and economic system, income levels should remain similar to today's standards. The median age of the metropolitan region should slightly decrease as younger families continue to move away from the central portions of the city.

Under alternative growth Concept B, a compact city and surrounding satellite cities are envisioned. This concept should have a significant impact on population distribution, income levels, and median age. Level I should have higher densities of population positioned strategically around greenbelts. It is thought that the social system may be a bit more liberal. If this is the case, lower income groups may receive a slightly larger portion of total income. The median age may slightly increase because the number of children per family diminishes and Level I may reflect National trends. The populations should continue to urbanize, thus the National trend and local Level I should have similar characteristics.

With alternative growth Concept C, the city remains compact and the majority of the population is within an arbitrary city limit. Level I's median age and income distribution should be very similar to Concept B. This is assumed as both B and C have similar social and economic systems and city boundary limitations. Under C, the city is the most dense. High-rise units are mixed with smaller multiple dwellings and single dwellings on smaller lots.

Level II areas are near the Omaha region; and, in the years to come, they may be annexed. If this is the case, under sprawl concepts of A and D, these communities should be similar to other suburban communities. As in other suburbs, the changes in these now

independent towns would display these characteristics: (a) the income level should increase from this area with the infusion of middle income suburban commuters; (b) the median age should decrease as suburban commuter families dominate older and retired farm families in terms of numbers; and (c) the population distribution should scatter and encircle the older community. In many instances these small towns would lose their local identity.

Though B and C are similar in their constraint of urban growth, the impact on Level II communities should be strikingly different. Under B, some of these communities would remain independent satellite cities. Satellite cities differ from bedroom communities in that they contain their own industries and resource capital. Thus, local residents would work in their own communities. If this is the case, under B, Level II communities are renewed and revitalized. Median age is similar to A and D as outmigration is diminished and young families remain in the towns and participate in the communities. Income levels are slightly lower than A and D, however, because the population is more varied than in a typical suburban community. The low end of the income spectrum is reflected in retired farm and agri-business workers.

Under growth Concept C, Omaha is constrained by an arbitrary city limit. It may also occur that a use tax could be legislated to discourage commuters. If these assumptions are valid, Level II communities should have similar characteristics in the years ahead as they do now. This means relative to A and D, the median age should increase, income levels slightly lessen, and scatteration and encirclement of the towns should not be a factor.

As indicated earlier, Level III communities are well beyond the metropolitan region even if there was wide and varied dispersion. Thus, in this level, present conditions of median age, income level, and population dispersion may be very similar under growth Concepts A, D, and C. In these three, scatteration is either curbed or is not dispersed enough to have an impact on these communities; however, Concept B is important to these communities. In the ensuing years, these small rural-oriented towns may achieve higher density and become industrial communities. They are thriving and independent; no longer do they solely exist on farm trade. As growing satellite cities, those communities should see income levels increase from current conditions, and the median age should diminish as new families with youg children remain. Scatteration of these communities should not be evident for, under this growth concept (B), land use is both a National and local policy.

Level IV communities are those located beyond the reach or influence of the metropolitan region. Under all growth concepts, the populations of these hamlets and villages should remain constant with 1970 figures. Median age would increase as most young families continue to outmigrate and income distribution would remain similar to current levels.

ECONOMIC BASE

DESCRIPTION

Under all four growth concepts, the general nature of the means of production should not drastically change. For the region, production should remain agricultural, and the counties other than Douglas, Sarpy, and Pottawattamie should remain agriculturally

oriented. The urban regions should be agri-business oriented, and Level II, III, and IV communities should remain relatively agricultural. Under B, however, Levels II and III may become increasingly oriented toward more urban linked agri-business activity. Retail functions should increase under A, B, and D but decrease under C for Levels II and III.

The remaining portion of this section will discuss labor force occupation mix, distribution of employment, plan of work, transportation to work, and location of poverty level groups.

LABOR FORCE OCCUPATION MIX

In Concepts A and D, "white Collar"[1], "blue collar"[2], and "rural labor"[3] groups remain constant or will decrease slightly from the present rate of employment. Under B and C all labor force elements would remain constant with possible slight increases in rural labor and with minor decreases in the sales portion of the white collar sectors.

The urban counties of Sarpy, Douglas, and Pottawattamie would continue to show a decrease in the rural labor force under Concepts A, C, and D. Though the white collar work force should remain relatively constant, the rural outmigration should increase the blue collar force. If any increase should occur in the rural counties, it would be in the blue collar section under Concepts A, C, and D.

[1] Professional, technical, and kindred workers; managers, administrators, and proprietors - nonfarm; clerical and kindred workers; sales workers.

[2] Craftsmen, foremen, and kindred workers; operatives - manufacturing, transportation, and nonmanufacturing; laborers - except farm and mining; service workers, including household workers.

[3] Farmers and farm managers, farm laborers and farm foremen.

Under B however, Washington and Cass Counties may begin to experience similar labor force profiles as do the urban counties. On the other hand, Harrison and Mills Counties labor-force profiles should remain the same under all concepts.

Level I and IV communities should keep their occupational mix constant with present trends but with some decreases in rural labor force under Concepts A and D. Levels II and III should have marked decreases in rural labor forces and increases in blue collar forces.

Under B, Levels I and IV should remain similar to current trends but Levels II and III would increase in blue collar and white collar occupations because of the locations of New Towns.

For Concept C, Levels I through III communities would become increasingly urban oriented, but Level IV would remain constant to current trends.

DISTRIBUTION OF EMPLOYMENT

There is a lack of information for making projections of employment distribution by county or individual community. For the seven-county region, "services" and "trade" constitute nearly one-half the region's current employment mix. Figures presented in table B-28 indicate projections of distribution by percent in the seven-county region for 1995 and 2020 for Concepts A through D.

Under Concepts A and D, the service sector becomes larger in a "post industrial" economy and government increases slightly, as does the public security system. Trade continues to diminish; finance grows. Under Concepts B and C, the public security and government sectors increase slightly.

Table B-28
Future Employment Mix
(by percent)

	Growth Concepts			
	A	B	C	D
1995				
Agriculture, forestry, and fisheries	2.8	3.0	3.1	2.8
Mining	0.2	0.2	0.2	0.2
Contract construction	5.8	4.0	4.1	5.8
Manufacturing	14.0	12.0	12.8	14.0
Transportation, communications and utilities	9.0	8.7	8.6	9.0
Trade	18.0	18.0	18.0	18.0
Finance, insurance, and real estate	9.0	9.0	9.0	9.0
Services	29.0	25.0	25.2	29.0
Public administration	5.5	6.1	6.0	5.5
Security	7.0	7.1	7.2	7.0
2020				
Agriculture, forestry, and fisheries	2.8	3.0	3.2	2.8
Mining	0.2	0.2	0.2	0.2
Contract construction	5.8	4.0	4.5	5.8
Manufacturing	14.0	13.0	13.0	14.0
Transportation, communications, and utilities	9.0	7.8	8.0	9.0
Trade	18.0	18.0	18.0	18.0
Finance, insurance, and real estate	9.0	9.0	10.0	9.0
Services	28.0	25.0	25.0	28.0
Public administration	5.5	6.8	6.8	5.5
Security	8.0	8.1	8.1	8.0

PLACE OF WORK AND RESIDENCE

Currently, the average rate of people who work in their county of residence is 66.7 percent. In Douglas County, the rate is 86.1 percent; and it is also relatively high for Mills and Harrison Counties. On the other hand, Washington, Pottawattamie, and Sarpy Counties are commuter counties where from one-fourth to one-half of the population travel to and from work in another county. Under Concepts A, C, and D, the statistics should not change greatly. Under B, Washington and Cass Counties may change with the development of New Towns, but the rest of the counties should remain the same.

Under Concepts A through D, Douglas County remains constant. This also applies for Harrison and Mills Counties. Sarpy and Pottawattamie Counties increase under Concepts A and D, however, and remain constant under C and B. In the same fashion, Cass and Washington Counties would increase under A and D and decrease under B and C. There is logic to this flow of people to work. Under the sprawl concepts, commuters are encouraged. Under B, however, industries are attracted to the satellite cities and can sustain their own populations, thus reducing commuter traffic. Under C, it is quite possible that a use tax may be initiated along with the arbitrary boundary that is set at the edge of the city. In this way commuting is discouraged.

At the local level, out-of-county commuting remains similar under all concepts. There is an increase in commuting in all concepts because spread keeps commuters in the area and so do the redevelopment Concepts of B and C. On the other hand, Levels II and III are the most affected by place and work considerations.

Under Level II, Concepts A and D increase the intercounty activity, but B reduces it with onsite industrial and commercial activity which provide the necessary work for those who once commuted. With C, it is quite possible that if legislation was passed to draw an arbitrary city boundary line, other laws would be created which could require commuters from distant communities to help pay for the services in the metropolitan area. If this were the case, commuter activity from other counties could be reduced.

Regardless of what may happen, Level IV communities are in such remote areas that place of work and residential activity remains the same under all concepts. Table B-29 summarizes data on place of work and residence.

Table B-29
Place of Work and Residence
(in percent)

Area	Growth Concepts A	B	C	D
1995				
Region	66.7	72.1	67.2	66.7
Douglas	86.1	86.1	86.1	86.1
Cass	45.1	61.2	45.4	45.1
Sarpy	49.0	54.0	54.0	49.0
Washington	69.5	78.7	77.2	69.5
Pottawattamie	49.1	55.8	55.8	49.1
Harrison	71.1	71.1	71.1	71.1
Mills	78.4	78.4	78.4	78.4
Level I	88.5	86.5	87.2	88.5
Level II	I 1/	D 2/	D	I
Level III	I	D	D	I
Level IV	NC 3/	NC	NC	NC
2020				
Region	ND 4/	ND	ND	ND
Douglas	86.0	86.0	86.0	86.0
Cass	40.7	66.3	44.8	40.7
Sarpy	42.0	57.4	42.3	42.0
Washington	65.3	82.1	76.5	65.3
Pottawattamie	47.2	57.1	57.0	47.2
Harrison	70.2	70.2	70.2	70.2
Mills	77.6	77.6	77.6	77.6
Level I	88.8	85.3	86.1	88.7
Level II	I	D	D	I
Level III	I	D	D	I
Level IV	NC	NC	NC	NC

1/ I = Increase
2/ D = Decrease
3/ NC = No Change
4/ ND = No Data

TRANSPORTATION TO WORK

This section discusses how people travel to and from work. Concepts A and D are based on the dominance of the individual auto. Concepts B and C incorporate a mass transit system described in MAPA-COATS Alternative 2. This alternative uses a bus system with bus freeways, park and ride routes, feeder routes, and car pools.

For the entire region, the dominance of the automobile should prevail under Concepts A and D and the "private driver" rates should slightly increase from the year 1995 to 2020. For B and C, individual auto use should be reduced; however, these reductions may not be dramatic.

Under all concepts, current "private driver" rates should remain constant in Harrison and Mills Counties. Cass and Washington Counties should not be affected because no mass transit is envisioned for this area. None of the three urban counties should fluctuate, given differing alternative transportation modes. Under A and D, "private driver" ridership should increase. Under B and C, it should decrease. The transportation data are summarized in table B-30.

Though data are not available on a quantitative basis, Level I, III, and IV communities are not affected by differing transportation plans. Level II has an even higher "private driver" ridership under A and D but under B and C it declines. This decline is due to the effect of keeping workers in the community through on-site industrial activity under A, and the possibility of a use-tax to discourage commuting under Concept C.

Table B-30
Transportation to Work
1995-2020
Concept "A"

	Private Driver		Auto Passenger		Bus		Walked		Worked At Home		Other	
	1995	2020	1995	2020	1995	2020	1995	2020	1995	2020	1995	2020
Region	-	-	-	-	-	-	-	-	-	-	-	-
Douglas *	70.2	70.1	14.2	14.3	7.2	7.2	6.0	6.0	1.1	1.1	1.3	1.3
Sarpy *	70.2	70.1	14.2	14.3	7.2	7.2	6.0	6.0	1.1	1.1	1.3	1.3
Cass	-	-	-	-	-	-	-	-	-	-	-	-
Washington	-	-	-	-	-	-	-	-	-	-	-	-
Pottawattamie	68.9	69.8	14.3	15.2	6.7	6.6	5.2	5.1	2.8	1.3	2.1	2.0
Mills	-	-	-	-	-	-	-	-	-	-	-	-
Harrison	-	-	-	-	-	-	-	-	-	-	-	-
Level I **	71.2	71.2	15.0	15.0	7.0	7.0	5.4	5.6	.9	.7	.5	.5
Level II	-	-	-	-	-	-	-	-	-	-	-	-
Level III	-	-	-	-	-	-	-	-	-	-	-	-
Level IV	-	-	-	-	-	-	-	-	-	-	-	-

* Figure represents the average for both Douglas and Sarpy Counties.
** Figure represents the average for urban regions of Omaha and Council Bluffs.
\- Data not available.

Table B-30
(Cont'd)
Transportation to Work
1995-2020
Concept "B"

	Private Driver		Auto Passenger		Bus		Walked		Worked At Home		Other	
	1995	2020	1995	2020	1995	2020	1995	2020	1995	2020	1995	2020
Region	-	-	-	-	-	-	-	-	-	-	-	-
Douglas *	25.1	25.1	20.0	20.0	30.2	30.2	20.1	20.1	2.0	2.0	2.6	2.6
Sarpy *	25.1	25.1	20.0	20.0	30.2	30.2	20.1	20.1	2.0	2.0	2.6	2.6
Cass	-	-	-	-	-	-	-	-	-	-	-	-
Washington	-	-	-	-	-	-	-	-	-	-	-	-
Pottawattamie	25.4	25.4	20.0	20.0	30.1	30.1	20.1	20.1	2.0	2.0	2.4	2.4
Mills	-	-	-	-	-	-	-	-	-	-	-	-
Harrison	-	-	-	-	-	-	-	-	-	-	-	-
Level I **	23.2	23.2	18.0	18.0	33.1	33.1	22.3	22.3	1.1	1.1	2.3	2.3
Level II	-	-	-	-	-	-	-	-	-	-	-	-
Level III	-	-	-	-	-	-	-	-	-	-	-	-
Level IV	-	-	-	-	-	-	-	-	-	-	-	-

* Figure represents the average for both Douglas and Sarpy Counties.
** Figure represents the average for urban regions of Omaha and Council Bluffs.
\- Data not available.

Table B-30
(Cont'd)
Transportation to Work
1995-2020
Concept "C"

	Private Driver		Auto Passenger		Bus		Walked		Worked At Home		Other	
	1995	2020	1995	2020	1995	2020	1995	2020	1995	2020	1995	2020
Region	-	-	-	-	-	-	-	-	-	-	-	-
Douglas *	28.2	27.1	20.0	21.0	36.1	37.2	12.2	13.3	2.2	1.2	1.3	.2
Sarpy *	28.2	27.1	20.0	21.0	36.1	37.2	12.2	13.3	2.2	1.2	1.3	.2
Cass	-	-	-	-	-	-	-	-	-	-	-	-
Washington	-	-	-	-	-	-	-	-	-	-	-	-
Pottawattamie	29.1	27.5	20.8	21.0	37.2	39.1	.2	11.2	1.6	1.8	1.1	.4
Mills	-	-	-	-	-	-	-	-	-	-	-	-
Harrison	-	-	-	-	-	-	-	-	-	-	-	-
Level I **	21.8	20.8	21.7	20.8	39.3	42.2	14.0	14.0	1.7	1.7	1.5	.5
Level II	-	-	-	-	-	-	-	-	-	-	-	-
Level III	-	-	-	-	-	-	-	-	-	-	-	-
Level IV	-	-	-	-	-	-	-	-	-	-	-	-

* Figure represents the average for both Douglas and Sarpy Counties.
** Figure represents the average for urban regions of Omaha and Council Bluffs.
\- Data not available.

Table B-30
(Cont'd)
Transportation to Work
1995-2020
Concept "D"

	Private Driver		Auto Passenger		Bus		Walked		Worked At Home		Other	
	1995	2020	1995	2020	1995	2020	1995	2020	1995	2020	1995	2020
Region	-	-	-	-	-	-	-	-	-	-	-	-
Douglas *	70.2	70.1	14.2	14.3	7.2	7.2	6.0	6.0	1.1	1.1	1.3	1.3
Sarpy *	70.2	70.1	14.2	14.3	7.2	7.2	6.0	6.0	1.1	1.1	1.3	1.3
Cass	-	-	-	-	-	-	-	-	-	-	-	-
Washington	-	-	-	-	-	-	-	-	-	-	-	-
Pottawattamie	68.9	69.8	14.3	15.2	6.7	6.6	5.2	5.1	2.8	1.3	2.1	2.0
Mills	-	-	-	-	-	-	-	-	-	-	-	-
Harrison	-	-	-	-	-	-	-	-	-	-	-	-
Level I **	71.2	71.2	15.0	15.0	7.0	7.0	5.4	5.6	.9	.7	.5	.5
Level II	-	-	-	-	-	-	-	-	-	-	-	-
Level III	-	-	-	-	-	-	-	-	-	-	-	-
Level IV	-	-	-	-	-	-	-	-	-	-	-	-

* Figure represents the average for both Douglas and Sarpy Counties.
** Figure represents the average for urban regions of Omaha and Council Bluffs.
\- Data not available.

POVERTY LEVEL GROUPS

Numerous definitions are used for poverty; the one used here is adopted from the Social Security Administration. Though many categories describe poverty, this study will use the percent of persons who fall below the poverty line.

Presently, 12 percent of the Nation's population falls below the poverty line. Nebraska is just above this with 13.1 percent and Iowa is just below it with 11.6 percent. In the study area, all but Harrison County do not exceed the poverty level of the entire country. Currently, the seven-county study area has the same percentage below the poverty line as does the Nation. Under Concepts A and D, these projections should remain similar in the years ahead. The percentage of those below the poverty line should diminish.

Under A and D, the counties of Douglas, Sarpy, and Pottawattamie should not change drastically in reference to the poverty issue. Under B and C, all counties should show minor decreases for poverty as currently defined. The counties least affected by the social-economic changes may be Harrison and Mills. These two counties are primarily agricultural in their economic makeup and perhaps are least amenable to the economic influences of Omaha and Council Bluffs.

Level I areas should show some increase in poverty levels under Concepts A and D because of the steady out-migration of affluent citizens to suburbs beyond the city limits. Under B and C, these areas should decrease in poverty level because of welfare

policies that may occur with these concepts. It is assumed that a more liberal stance in terms of land use may also be reflected in a little more liberal stance in welfare policies.

Level II communities should have less poverty with migration of the prosperous middle class to its areas under Concepts A and D. Under Concept C, poverty levels should show some minor decreases.

Level III communities should show a decrease in poverty under Concepts A and D. Under B and C, minor decreases should occur.

Level IV community poverty levels should remain constant or increase slightly under all four concepts.

NATURAL RESOURCES

LAND USE

In the seven-county region, almost 74 percent of the 2.3 million acres of land is set aside for agriculture. This would probably change considerably depending upon the land-use policies adopted by local entities and upon population changes that occur in the years ahead (1995 through 2020).

The four growth concepts were formulated using alternative high, medium, and low-housing density arrangements. Low-density assumes less than 7 people per residential acre, medium density assumes 7 to 18 people per residential acre, and high-density assumes more than 18 people per residential acre. The following density mixes were assumed for each growth concept for Douglas and Sarpy Counties:

New Residential Development Density

Growth Concept	Relative Density Year	Low	Medium (Percentage)	High
A	1995	43	36	21
	2020	43	37	20
B	1995	22	35	43
	2020	15	38	47
C	1995	17	31	52
	2020	15	36	49
D	1995	37	39	24
	2020	42	38	20

For Douglas and Sarpy Counties, the four concepts would require the following additional developed acreages for 1995 and 2020.

Additional Acreage

Concept	1995	2020
A	49,000	72,000
B	22,000	30,000
C	29,000	43,000
D	45,000	71,000

Table B-31
Additional Developed Acreage
1995-2020

	Concept A		Concept B		Concept C		Concept D	
	1995	2020	1995	2020	1995	2020	1995	2020
Cass	932	1,294	1,850	1,927	245	340	932	1,295
Douglas	24,124	40,214	11,306	18,438	18,560	27,810	19,754	36,107
Sarpy	24,875	31,785	10,693	11,561	10,440	15,189	25,245	34,892
Washington	1,668	2,264	3,594	4,866	439	596	1,668	2,264
Harrison	230	565	836	896	61	149	230	565
Mills	0	0	1,553	1,553	0	0	0	0
Pottawattamie	5,656	13,690	1,954	3,550	1,491	3,208	5,656	14,982

Application of the four growth concepts to all counties in the study area, using the population allocations given in table B-27a results in the additional developed acreage requirements for each county given in table B-31. Densities used for the counties outside of Douglas and Sarpy were: A = 5.0 people/residential acre; B = 30.0 people/residential acre; C = 19.0 people/residential acre; and D = 5.0 people/residential acre.

INDIVIDUAL COMMUNITIES

For this section, quantitative projections are difficult beyond those for Level I communities. Numerous comprehensive plans have been developed; however, many plans assert caution about their projections. In a general view, under Concept B, Level II and III communities may increase, but Level IV communities should remain constant. Under Concepts A and D, Level II would be annexed, Level III would see minor increases, but Level IV should remain stable. For Concept C, Levels II and IV could stabilize.

QUALITY OF LIFE

The term "quality of life" is difficult to quantify. For this section, housing, education, and community cohesion indicators will be discussed.

HOUSING

Housing is generally defined by the following terms: (1) housing with complete plumbing; (2) percent of homes owned by

occupant, (30 crowding more than one person per room; (4) housing 25 years and older; and (5) poverty level housing. Each will be discussed in sequence.

(1) Complete plumbing. Under Concepts A through D, the current 4 to 10 percent of the housing which does not have complete plumbing should be almost entirely reduced.

(2) Home ownership. This should increase in all regions and levels under Concepts A and D. These concepts generally have more liberal credit policies in reference to home loans. Under B and C, however, home ownership should decrease slightly as multiple dwelling housing is encouraged.

(3) Crowding. Crowding can be described under at least two different criteria. The first criterion is the number of people per residential acre and the second is the number of people per room in a household. In the first criterion, none of the concepts (A-D) create such high densities as to be correlated with social problems. Even the most dense concept (C) allows for a mixture of high-rise and single-dwelling units. Numerous studies have been conducted which indicate that "residential crowding" is not related to social pathology. The issue is "room crowding" and when the number of people per room reach a certain number, neighborhoods are more likely to experience criminality and other related problems. Generally, "room crowding" is most likely to occur under Concepts A and D where low income groups are left behind in impacted areas. Poverty impacted, room crowded conditions are most likely to also occur in Levels I and IV, as these areas experience the most outmigration of more affluent groups.

(4) Older Housing. Housing that needs improvement and renovation is most likely to occur under the trend-line spread Concepts A and D. This happens as central city residences are abandoned for new suburban homes. In poverty-impacted areas, numerous homes are vacated and condemned. Under Concepts B and C, one of the major characteristics of the land-use program is preservation of the inner city. Thus, middle and upper income groups are discouraged from leaving the city and yet using it for their occupational income source. Through the discouragement of out-migration by the more affluent and through housing subsidy for the poor, the general aesthetic appearance of the central city should improve under Concepts B and C for all areas.

(5) Poverty Level Housing. Poverty level housing as currently defined should be significantly reduced under Concepts B and C. With an arbitrary city boundary, the middle class and upper income groups are less likely to leave the city, and poverty impacted areas are likely to be improved and upgraded. Under the spread concepts of A and D, poverty level housing is most likely to occur in poverty impacted areas from which the more affluent have moved. This is most pronounced in Level I and IV communities.

EDUCATION

The level of education should remain the highest under Concepts A and D. Here, "open mobility" is the cultural ideal. "Open mobility" means that all individuals would have the opportunity to receive liberal arts training assuming that many or most should strive for professional and upwardly mobile careers. Under Concepts B and C, however, "sponsored mobility" is generally related to regulated land use. Systems that have the regulated land-use policy are also likely

to have the other (sponsored mobility). Under this system, numerous careers of all sorts are highly valued and a vocational orientation is emphasized. In this system, youngsters at early age are familiarized with many different careers. By junior high, young adults receive training according to ability and interest. Though all receive basic liberal arts training, some receive more skilled and technical training than others.

Under Concepts A and D, educational levels in Sarpy County should increase dramatically. Other counties except the most rural (Mills) should also improve. With Concepts B and C, educational levels should move slightly downward for reasons discussed before.

With a continuation of present trends, Concepts A and D educational levels should be highest in Level II communities. Level I and IV communities should be lower, followed by Level III. Educational level is highly correlated with new suburban growth; under B and C, it is difficult to delineate by areas as the population is more heterogeneous.

COMMUNITY COHESION

The baseline data describe certain indicators (theaters, museums, churches, fraternal organizations, and other groups) to quantify cohesion. Sociologists have attitudinal measures as well as other indicators such as complete households, level of income, and incidence of crime. This section briefly describes cohesion and how it may occur under the various alternative growths. The general categories used previously, i.e., the seven-county region, individual counties, and the individual communities, will be omitted because of overlap in related areas.

It would appear that the issue here is social cohesion and land arrangement. If land use and its allocation act as a cause for cohesion, holding most everything else constant, compact, neatly-arranged urban and town areas should promote the most social harmony.

"Sprawl" as such fosters large tracts of houses without arranged limits to create smaller more easily defined areas for the individual to identify with and to get to know one's neighbor. At the base of the land-community relationship is the strength of the neighborhood. Under Concepts A and D, neighborhoods have difficulty stabilizing; there is a continual trickle of people as new homes turn old and as one social class invades the previous social strata.

Under Concepts B and C, neighborhoods are stabilized and the general aesthetic appearance should be upgraded. New towns and other land arrangements are encouraged. "Slums" are eradicated. Cross-cultural surveys of countries with community-regulated land use as opposed to scatter development generally indicate less civil strife, lower crime rates, lower infant mortality, and longer life span.

Water Management Needs and Problems

This section presents a general overview of the water and water-related needs and problems of the study area. The potential solutions to these needs and problems are discussed in Volume III, Plan Formulation. The factors discussed include wastewater management, water quality, water supply, flood control and flood plain management, and drainage and high ground water. Some of the needs and problems are readily visible. Others are potential and are revealed through projections of what may happen in the future. Still others are derived from legislation and standards or from changes in policy.

WASTEWATER MANAGEMENT

GENERAL

- Wastewater management concerns originate from three sources:

- Planning requirements of Federal Water Pollution Control Act Amendments of 1972, PL 92-500.

- Present management requirements to avoid violation of State water quality standards based on beneficial uses of the water resource.

- Future needs based on land use and waste load projections.

The main emphasis of this investigation is to fulfill the requirements of PL 92-500, which necessitated further study to extend the MAPA Comprehensive Water Pollution Control Plan completed in 1972. The MAPA Plan outlined the required steps to implement secondary treatment for most domestic wastes in the urban area. The Act (PL 92-500) states:

- It is the National goal that the discharge of pollutants into navigable waters be eliminated by 1985.

- It is the National goal that, wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and which provides for recreation in or on the water be achieved by 1 July 1983.

- By 1977, all publicly owned treatment works receive a minimum of secondary treatment; all nonpublicly owned treatment works to apply the best practical treatment available.

- The Act further requires that future wastewater management planning include the following factors:

- An evaluation of the integrity and reliability of sewer systems serving sewage treatment facilities.

- Implementation of areawide wastewater management.

- Integration of wastewater systems with land use policies.

Consideration of all wastewater sources including domestic, industrial, combined sewer overflows, and urban and agricultural runoff.

- Consideration of all available technologies including land irrigation of wastewater.

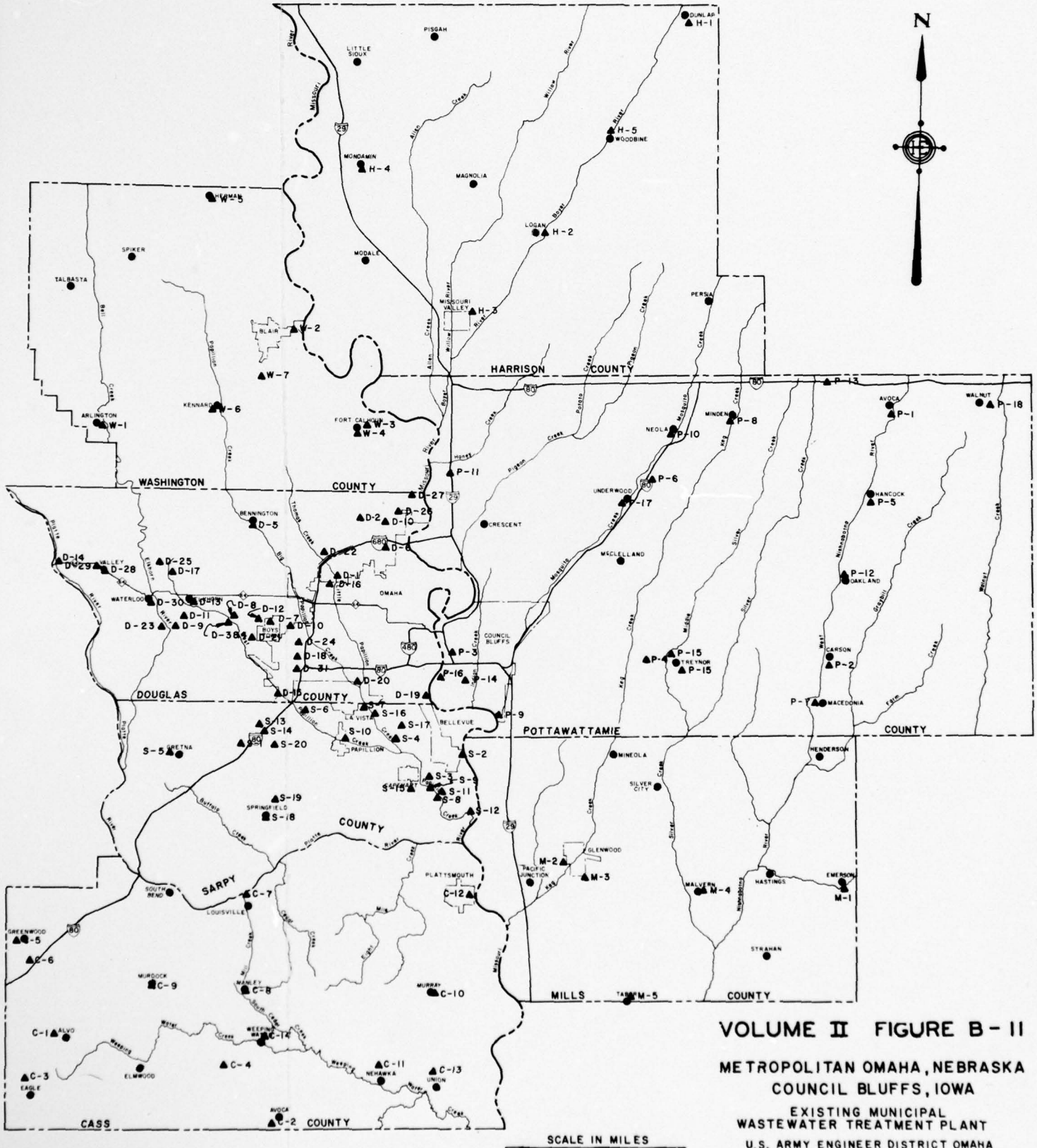
- Incorporation of reuse/recycle technology.

- Consideration of environmental and social impacts.

The significant sources of wastes in the study area include treatment plant discharges; combined sewer overflows; storm runoff; agricultural runoff, including feedlots; and industrial wastes.

TREATMENT FACILITIES

A map of existing municipal wastewater treatment facilities is shown in figure B-11. Table B-32, which is coded to correspond to figure B-11, presents basic data on each plant. There are some 100 municipal wastewater treatment plants of varying size in the study area, 72 in the four Nebraska counties, and 28 in the three Iowa counties. Most of the existing plants are very small and are destined to be phased out in accordance with the MAPA plan. Three major urban plants are the largest wastewater management plants. These are the Missouri River and the Papillion Creek plants of the city of Omaha, and the Council Bluffs plant. Table B-33 shows the average daily flow and load information for the major urban plants. This table illustrates the sustained effect of industrial wastewater on the operation and design of these facilities. These three plants serve a population of 506,000 and handle a combined average



VOLUME II FIGURE B-11

METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA

EXISTING MUNICIPAL
WASTEWATER TREATMENT PLANT

U.S. ARMY ENGINEER DISTRICT OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

Table B-32

WASTEWATER TREATMENT PLANTS

Ref. No.	Treatment Plant	Type* of Plant	Design Flow (mgd)	Current Flow (mgd)	Data Year	Influent		Effluent		Receiving Stream	Remarks
						Suspended Solids (mg/l)	5-Day BOD (mg/l)	Suspended Solids (mg/l)	5-Day BOD (mg/l)		
Cass County, Nebraska											
C1	Alvo	WSL-1 Cell	0.012	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Dee Creek	Satisfactory operation
C2	Avoca	E	0.025	N.D.	1974	N.D.	N.D.	N.D.	N.D.	S. Branch Weeping Water Creek	Good plant operation
C3	Eagle	A-D	0.040	0.06	1973	N.D.	N.D.	N.D.	N.D.	Hooper Cr. to Little Nemaha Riv.	Poor performance; new plant being designed
C4	Elmwood	**	0.050	N.D.	1974	N.D.	N.D.	N.D.	N.D.	N. Branch Weeping Water Creek	Overloaded
C5	Greenwood	WSL-1 Cell	0.028	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Salt Creek	Good performance
C6	Greenwood (Sid #2)	E	0.009	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Platte River	
C7	Louisville	A-D	0.20	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Platte River	
C8	Manley	ARL	0.011	N.D.	1974	N.D.	N.D.	N.D.	N.D.	S. Cedar Creek	
C9	Murdock	WSL	0.017	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Farm Pond to Weeping Water Cr.	
C10	Murray	I	0.04	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Rock Creek	
C11	Nehawka	A	0.025	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Weeping Water Cr.	Good performance
C12	Plattsmouth	P-D	0.70	0.558	1973	166	181	91	163	Missouri River	Good performance
C13	Union	WSL-2 Cell	0.037	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Dry Ditch to Weeping Water Cr.	Good performance
C14	Weeping Water	P	0.20	0.075	1974	N.D.	N.D.	N.D.	N.D.	Weeping Water Cr.	Fair performance

N.D. - No Data Available
* - See Key following last page of table.

Table B-32
(Cont'd)

WASTEWATER TREATMENT PLANTS

Ref. No.	Treatment Plant	Type of Plant	Design Flow (mgd)	Current Flow (mgd)	Data Year	Influent Suspended Solids (mg/l)	Influent 5-Day BOD (mg/l)	Effluent Suspended Solids (mg/l)	Effluent 5-Day BOD (mg/l)	Receiving Stream	Remarks
Douglas County, Nebraska											
D1	AAA Mobile Homes	-	N.D.	N.D.	1974	N.D.	N.D.	N.D.	N.D.	-	*Septic tanks, treatment plant proposed*
D2	AF Radar Station	WSL	N.D.	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Little Papillion	Very little flow
D3	Atkins Mobil Homes	E	0.018	0.048	1970	237	202	167	142	West Papillion	Overloaded
D4	Atkins New Plant	E	N.D.	N.D.	1974	N.D.	N.D.	N.D.	N.D.	West Papillion	Poor operation
D5	Bennington	E	0.100	0.078	1970	241	204	37	32	Big Papillion	Good operation
D6	Bonniwell Estates	WSL-1 Cell	0.007	0.013	1970	N.D.	253	N.D.	37	Little Papillion	0.59 Acres; unsatisfactory operation
D7	Boystown	TF-D	0.200	0.100(.15)	1970(1971)	240	204	36	31	Hell Creek to West Papillion	Good operation
D8	Carat Homes	E	0.015	0.021	1970	245	205	171	143	West Papillion	Overloaded; unsatisfactory operation
D9	Chapel Hill (Sid #57)	WSL-2 Cell	0.067	0.022	1970	240	201	38	33	Boxelder Creek to West Papillion	
D10	County Squire (Sid #135)	WSL-1 Cell	0.007	0.0064	1970	299	261	37	37	Ponca Creek to Missouri River	Is to enter Omaha system in 1975
D11	Crest Mobile Homes	E	0.050	0.040	1970	240	204	36	30	Elkhorn River	Fair performance
D12	Eldorado (Sid #206)	WSL-3 Cell	0.085	(0.12)	1970(1971)	N.D.	200	N.D.	30	N. Branch of West Papillion	Good operation
D13	Elkhorn	A-D-DB	0.085	0.118	1970	240	204	37	30	West Papillion	Proposed sewage treatment plant
D14	Ginger Cove (Sid #196)	WSL-1 Cell	0.012	0.008	1970	240	210	30	30	Platte River	1.28 acre lagoon
D15	Holling Heights	CS	1.250	1.01(1.25)	1973(1974)	305	183	54	31	West Papillion	Good overall treatment; owned by City of Omaha
D16	Knolls (Sid #229)	TF	N.D.	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Little Papillion	
D17	Mt. Michael & Benedictine High School	A-D	0.025	N.D.	1974	N.D.	N.D.	N.D.	N.D.	West Papillion	Good operation
D18	Oak Hills	TF-D	0.21	0.12(0.31)	1970(1974)	174(475)	185(124)	28(79)	20(42)	West Papillion	50% Western Electric domestic + 50% residential; owned by City of Omaha. To be abandoned when new Papillion plant is in operation.
D19	Omaha-Missouri	P-D-VF	72	38.4(21.9)	1970(1973)	510(837)	563(789)	201(343)	347(659)	Missouri River	Secondary treatment by 1975; owned by City of Omaha
D20	Omaha-Papillion	S-(18 mgd) P-(26 mgd)	76	24.1(24.8)	1970(1974)	260(271)	250(195)	112(172)	63(108)	Big Papillion	Plant effluent was tied to Papillion interceptor in 1974; overloaded; owned by City of Omaha
D21	Pacific Heights (Sid #126)	WSL-2 Cell	0.024	0.04	1970	240	204	168	143	West Papillion	Satisfactory operation
D22	Peaceful Valley Mobile Homes	WSL-1 Cell	N.D.	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Thomas Creek to Little Papillion	
D23	Riverside Lake	E	0.01	0.01	1970	240	204	36	36	Elkhorn River	Poor performance
D24	Signal Hill (Sid #124)	WSL-1 Cell	0.008	0.01	1970	N.D.	200	N.D.	N.D.	Hell Creek to West Papillion	0.7 acre cell
D25	St. John Seminary	A	N.D.	N.D.	1974	N.D.	N.D	N.D.	N.D.	West Papillion	Effluent to pond
D26	Twilight Hills (Sid #128)	E	0.050	0.045	1970	240	200	35	29	Ponca Creek to Missouri River	To enter Omaha system in 1975
D27	Ura Hafee Omaha Home For Girls	E	0.01	0.003	1970	240	200	40	40	Missouri River	Expected to enter Papillion system when service is extended.
D28	Valley	TF-DB	0.30	0.160	1970	239	202	36	31	Elkhorn River	
D29	Valmont Industries	E	0.014	0.014	1970	376	316	60	51	Platte River	Domestic waste only
D30	Waterloo	I-A-DB	0.075	0.059(0.060)	1970(1974)	254	233	101	164	Elkhorn River	Good operation
D31	Westwood (Sid #31)	TF-D	0.70	1.10(1.40)	1970(1973-4)	154(289)	173(150)	54(123)	35(59)	Hell Creek to West Papillion	Owned by City of Omaha. Overloaded; plant to be abandoned when interceptor is completed

N.D. - No Data Available
* - See Key following last page of table.

Table B-32
(Cont'd)

WASTEWATER TREATMENT PLANTS

Ref. No.	Treatment Plant	Type* of Plant	Design Flow (mgd)	Current Flow (mgd)	Data Year	Influent Suspended Solids (mg/l)	Influent 5-Day BOD (mg/l)	Effluent Suspended Solids (mg/l)	Effluent 5-Day BOD (mg/l)	Receiving Stream	Remarks
Sarpy County, Nebraska											
S1	Antilles Corp. (Sid #51)	WSL-2 Cell	N.D.	N.D.	1974	N.D.	N.D.	N.D.	N.D.	South Papillion	Fair operation
S2	Bellevue #1	P-D	0.90	0.74	1970	189	235	66	160	Missouri River	Secondary by 1975
S3	Bellevue #2	TF-VF	1.0 Sec. 2.0 Prim.	0.6 Sec. 1.25 Prim.	1970(1974) (1.20)	240	204	107	76	Big Papillion	Has option to go to Papillion system
S4	Blue Ridge (Sid #14)	A	0.062	0.063	1970	186	490	29	25	Squaw Creek to Big Papillion	Good operation
S5	Gretna	CS	0.250	0.160	1970	234	198	35	30	Elkhorn River	Good operation; to be abandoned when Papio Creek plant is completed
S6	Jacobson	P-RBD	1.5	(0.45)	1973(1974)	712	193	99	39	West Papillion	Overloaded; only 50% of plant is in operation; owned by City of Omaha
S7	La Vista	CS	0.50	0.576(.72)	1970(1974)	200	170	30	51	Big Papillion	To be abandoned when Papio Creek plant is completed
S8	Normandy Hills #67	WSL-2 Cell	N.D.	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Papillion	Good operation
S9	Offut A.F.B.	TF-D	1.00	1.115	1970	206	174	31	26	Big Papillion	To Papillion interceptor (1973)
S10	Offut A.F.B. Lab	Z	0.085	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Storm Sewer to Papillion	Silver recovery unit
S11	Papillion	CS	0.500	0.498(0.75)	1970(1974)	200	180	30	27	West Papillion	Overloaded; interceptor may be used to divert some of load
S12	Papillion Creek Plant	P	50	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Missouri River	Bids have been received
S13	Sapp Brothers Lagoon (Sid #48)	WSL	0.024	N.D.	1974	N.D.	N.D.	N.D.	N.D.	South Papillion	
S14	Sid #52	WSL	N.D.	N.D.	1974	N.D.	N.D.	N.D.	N.D.	South Papillion	
S15	Southdale (Sid #25)	A	0.032	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Papillion Creek	1973 - Good operation; to go into proposed Papillion interceptor
S16	Southern Park (Sid #83)	WSL-1 Cell	0.120	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Big Papillion	Poor operation; at present complete retention
S17	Southern View (Sid #20)	E	0.065	0.065	1970	240	138	37	20	Squaw Creek to Big Papillion	
S18	Springfield	I-TF	0.059	0.061	1970	167	206	26	31	Springfield Creek to Platte River	Fair operation; secondary by 1974
S19	School District #46	WSL	0.007	0.01	1970	204	204	36	36	Springfield Creek to Platte River	
S20	Westmont (Sid #23)	E	0.01	0.012	1970	230	200	40	30	South Papillion	Good performance

N.D. - No Data Available
* - See Key following last page of table.

Table B-32
(Cont'd)

WASTEWATER TREATMENT PLANTS

Ref. No.	Treatment Plant	Type* of Plant	Design Flow (mgd)	Current Flow (mgd)	Data Year	Influent Suspended Solids (mg/l)	Influent 5-Day BOD (mg/l)	Effluent Suspended Solids (mg/l)	Effluent 5-Day BOD (mg/l)	Receiving Stream	Remarks
Washington County, Nebraska											
W1	Arlington	TF-DB	0.040	0.090	1973	N.D.	N.D.	160	174	Bell Creek to Elkhorn River	Overloaded
W2	Blair	A-D-DB	0.008	0.243	1973	280	170	266	200	Blair Creek	To be replaced with new plant under construction
W3	Ft. Calhoun	WSL	0.022	0.042	1970	N.D.	90	N.D.	54	Drainage Ditch to Missouri River	3.5 acre surface area; fair operation
W4	Ft. Calhoun Power Plant	E	0.007	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Missouri River	Fair performance
W5	Herman	WSL	0.036	0.034	1970	N.D.	N.D.	N.D.	N.D.	Peterson Drainage Ditch to Missouri River	2.5 acre surface area; fair performance
W6	Kennard	WSL-2 Cell	0.052	0.030	1972	N.D.	N.D.	N.D.	N.D.	Big Papillion	Good performance
W7	Rose Ann Mobile Home Park	WSL-2 Cell	0.027	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Hinz Creek	Good performance
Harrison County, Iowa											
H1	Dunlap	WSL	N.D.	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Boyer River	12 acre surface area
H2	Logan	E	N.D.	.1196	1974	N.D.	N.D.	14	N.D.	Boyer River	
H3	Missouri Valley	WSL	N.D.	.111	1974	N.D.	N.D.	N.D.	N.D.	Willow River	39 acre surface area
H4	Mondamin	WSL	N.D.	.044	1974	N.D.	N.D.	N.D.	N.D.	Spooner Drainage Ditch	
H5	Pisgah	WSL	N.D.	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Soldier River	
H6	Woodbine	WSL-2 Cell	N.D.	.084	1974	N.D.	N.D.	N.D.	N.D.	Boyer River	22 acre surface area
Mills County, Iowa											
M1	Emerson	I-P	N.D.	0.059	1974	N.D.	N.D.	N.D.	N.D.	Nishnobotna	
M2	Glenwood	TF-D	N.D.	0.458	1974	N.D.	N.D.	N.D.	121	Keg Creek	Packing plant and state school have separate treatment facilities.
M3	Glenwood State Hospital	TF	N.D.	0.130	1974	N.D.	N.D.	N.D.	N.D.	Keg Creek	To be phased out into Town of Glenwood
M4	Malvern	L	N.D.	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Silver Creek	
M5	Tabor	E	N.D.	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Plum Creek	Treatment system is in Fremont County

N.D. - No data available
* - See Key following page.

Table B-32
(Cont'd)

WASTEWATER TREATMENT PLANTS

Ref. No.	Treatment Plant	Type* of Plant	Design Flow (mgd)	Current Flow (mgd)	Data Year	Influent Suspended Solids (mg/l)	Influent 5-Day BOD (mg/l)	Effluent Suspended Solids (mg/l)	Effluent 5-Day BOD (mg/l)	Receiving Stream	Remarks
Pottawattamie County, Iowa											
P1	Avoca	WSL-2 Cell	0.131	0.121(0.144)	1970(1974)	300	257	45	39	West Nishnobotna	
P2	Carson	TF	0.049	0.060(0.070)	1970(1974)	299	253	45	37	West Nishnobotna	
P3	Council Bluffs	F-D	10.4	6.60(6.86)	1970(1974)	233(684)	288(668)	133(130)	230(264)	Missouri River	Plant to be replaced with new Mosquito Plant when completed
P4	Malvern Center for Education	WSL-2 Cell	N.D.	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Middle Silver Creek	No Discharge
P5	Hancock	WSL-2 Cell	0.025	0.018(0.07)	1970(1974)	292	252	47	40	West Nishnobotna	
P-6	I-80 Rest Area	WSL-2 Cell	0.120	0.120	1970	60	50	10	9	Middle Silver Creek	
P-7	Macedonia	WSL-2 Cell	0.031	0.031(0.012)	1970(1974)	254	216	39	31	West Nishnobotna	Sealing problems
P-8	Minden	WSL-2 Cell	0.045	0.034	1970	444	380	46	39	Keg Creek	Some short circuiting
P-9	Mosquito	TF	14.71	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Missouri River	
P-10	Neola	TF	0.100	0.076	1970	301	255	121	180	Mosquito Creek	
P-11	Nickerson Farms	WSL	0.006	0.006	1970	2,395	2,235	359	339	Dry Run to Missouri River	
P-12	Oakland	WSL-2 Cell	0.150	0.126	1970	298	253	45	38	West Nishnobotna	
P-13	Skelly Station	WSL-2 Cell	0.003	0.003	1970	599	479	80	80	Silver Creek	
P-14	Trailer City	E	0.037	N.D.	1974	N.D.	N.D.	N.D.	N.D.	Indian Creek	Will connect to Council Bluffs
P-15	Treynor	2 Separate WSL-1 Cell	0.054	0.037	1970	301	256	45	39	Middle Silver Creek	S.E. Lagoon - 1.25 acres; N.W. Lagoon - 4.00 acres town served by two separate collection systems
P-16	Twin Cities Plaza	F	0.22	0.26	1970	239	203	92	143	Missouri River	Will connect to Council Bluffs in 1974
P-17	Underwood	WSL-2 Cell	0.077	0.058(0.018)	1970(1974)	301	258	43	34	Mosquito Creek	Sealing problems
P-18	Walnut	WSL-2 Cell	0.104	0.104(.07)	1970(1974)	196	175	30	26	Walnut Creek	6.82 acres

N.D. - No Data Available
* - See Key following last page of table.

Wastewater Treatment Plant Designation Key
(For Preceding Table)

Symbol	Type of Treatment
A	Activated Sludge
ARL	Aerated Lagoon
CS	Contact Stabilization
D	Digester
DB	Drying Beds
E	Extended Aeration
I	Imhoff Tank
P	Primary
RBD	Rotating Biological Disks
TF	Trickling Filter
VF	Vacuum Filter
WSL	Waste Stabilization Pond
Z	Advanced Treatment
**	Spragester and Facultative Lagoon

Table B-33
Existing Major Urban Wastewater Treatment Plant
Average Daily Flows and Loads

Plant	Population	Type of Waste	Flow (mgd)	BOD_5 (lbs/day)	SS (lbs/day)	N (lbs/day)	P (lbs/day)
Council Bluffs	64,005	Domestic	6.0	11,521	13,441	1,920	576
		Industrial	2.4	10,509	2,988	1,051	105
		Total	8.4	22,030	16,429	2,971	681
Missouri River	189,536	Domestic	17.8	34,116	39,803	5,686	1,706
		Industrial	18.6	189,997	157,172	18,998	1,900
		Total	36.4	224,113	196,975	24,684	3,606
Papillion Creek*	252,670	Domestic	23.8	45,479	53,061	7,581	2,382
		Industrial	2.3	10,509	2,988	1,051	105
		Total	26.1	56,088	56,049	8,632	2,487

* The entire Papillion sanitary district is assumed to contribute to this plant by 1975.

daily flow of about 71 mgd. By comparison, treatment plants for 12 communities adjacent to the Omaha-Council Bluffs urban area serve a population of only 36,176 and handle a combined average daily flow of 3.9 mgd. The existing Omaha-Papillion Creek plant has a design capacity of 18 mgd for primary treatment and 12 mgd for secondary treatment, but in 1973 it received an average flow of 25 mgd. Due to the hydraulic overload, with resulting poor treatment performance, its operation was changed to primary treatment only.

The Omaha-Missouri River plant has a design capacity of 72 mgd and provides primary treatment of municipal and pretreated industrial wastes from the eastern part of the city. The plant treated an average of 38.4 mgd in 1973. It has been receiving an abnormally high strength of industrial flow which has caused operation problems. The existing Council Bluffs 23rd Avenue plant was designed to provide primary treatment for an average flow of 6.6 mgd. Due to excessive strength of industrial meatpacking wastes, overall treatment has been only fair. Odors have been a constant nuisance.

By 1975, three facilities will be providing secondary treatment of most of the study area's municipal sewage effluent. These plants are being designed to handle projected waste through 1995. This will implement the MAPA plan of September 1972. The city of Omaha is replacing 25 separate plants by two major plants, the Missouri River plant and a new Papillion Creek plant. The new Omaha-Papillion Creek plant will be located at the confluence of Papillion Creek and the Missouri River. This facility will initially provide a 50 mgd primary treatment capacity with expansion planned for a 70 mgd secondary treatment capacity. Construction of site development

has started. Planned expansion of the Missouri River plant will include 65 mgd secondary treatment. Council Bluffs has completed the Mosquito Creek treatment plant, which is to replace the 23rd Avenue facility. This plant, located at a remote site near the south city limits, will provide secondary treatment for a design capacity of 12.85 mgd.

In addition to urban treatment plants, there are numerous treatment plants in the seven-county area serving incorporated communities, sanitary and improvement districts (SID's), and miscellaneous housing subdivisions. While the waste load from each facility is small, individual plant performance is generally not good and may cause localized water quality problems. Of eight plants serving incorporated communities surrounding the Omaha area, seven received unsatisfactory ratings from the Nebraska Department of Environmental Control. These ratings stem more from poor operation than from lack of facilities. Facilities installed by developers of SID's have, for the majority, one common characteristic; they are operating either at or above design capacity. There is inadequate planning for future capacity in relation to the ultimate population load.

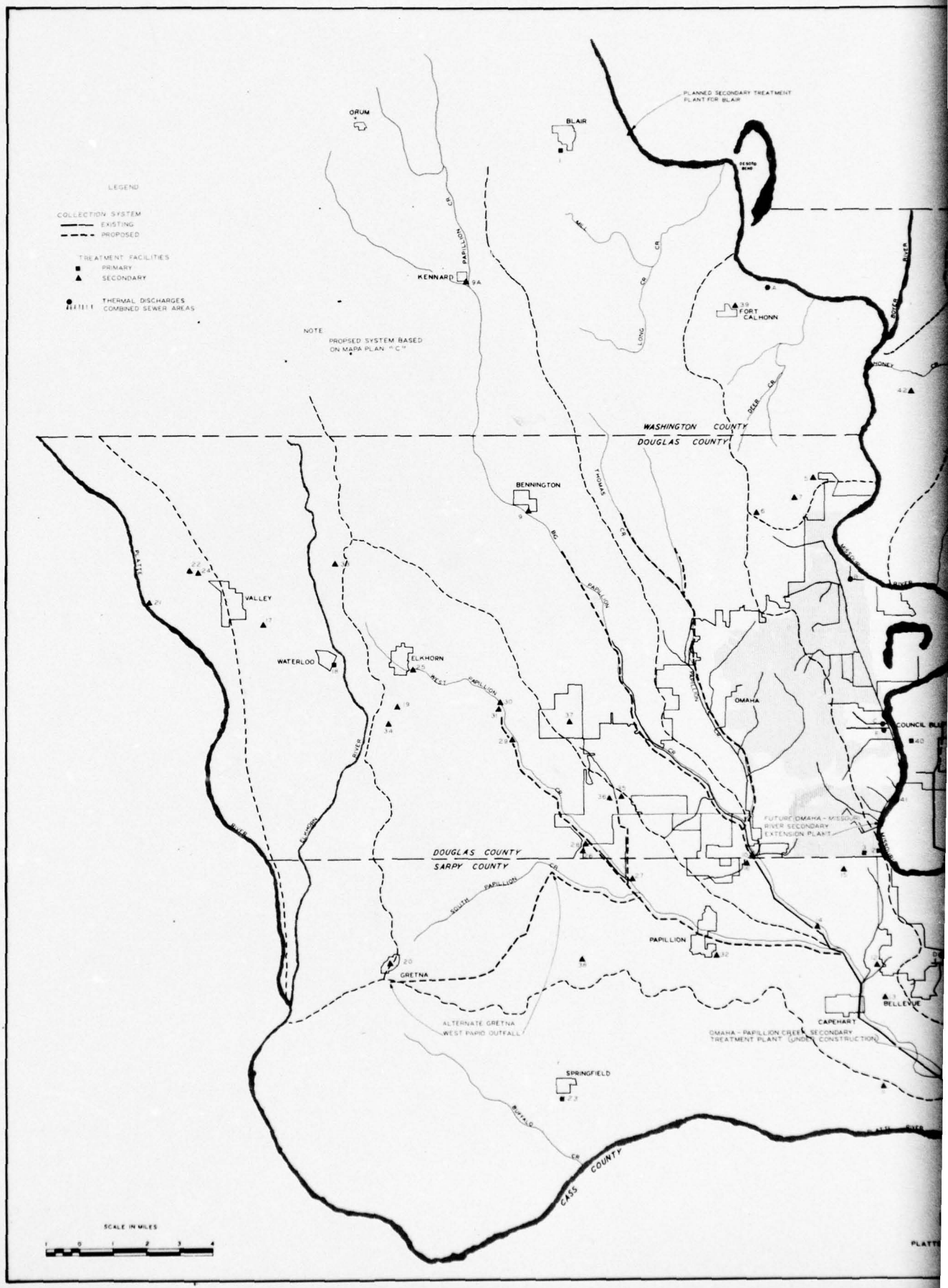
COMBINED SEWERS

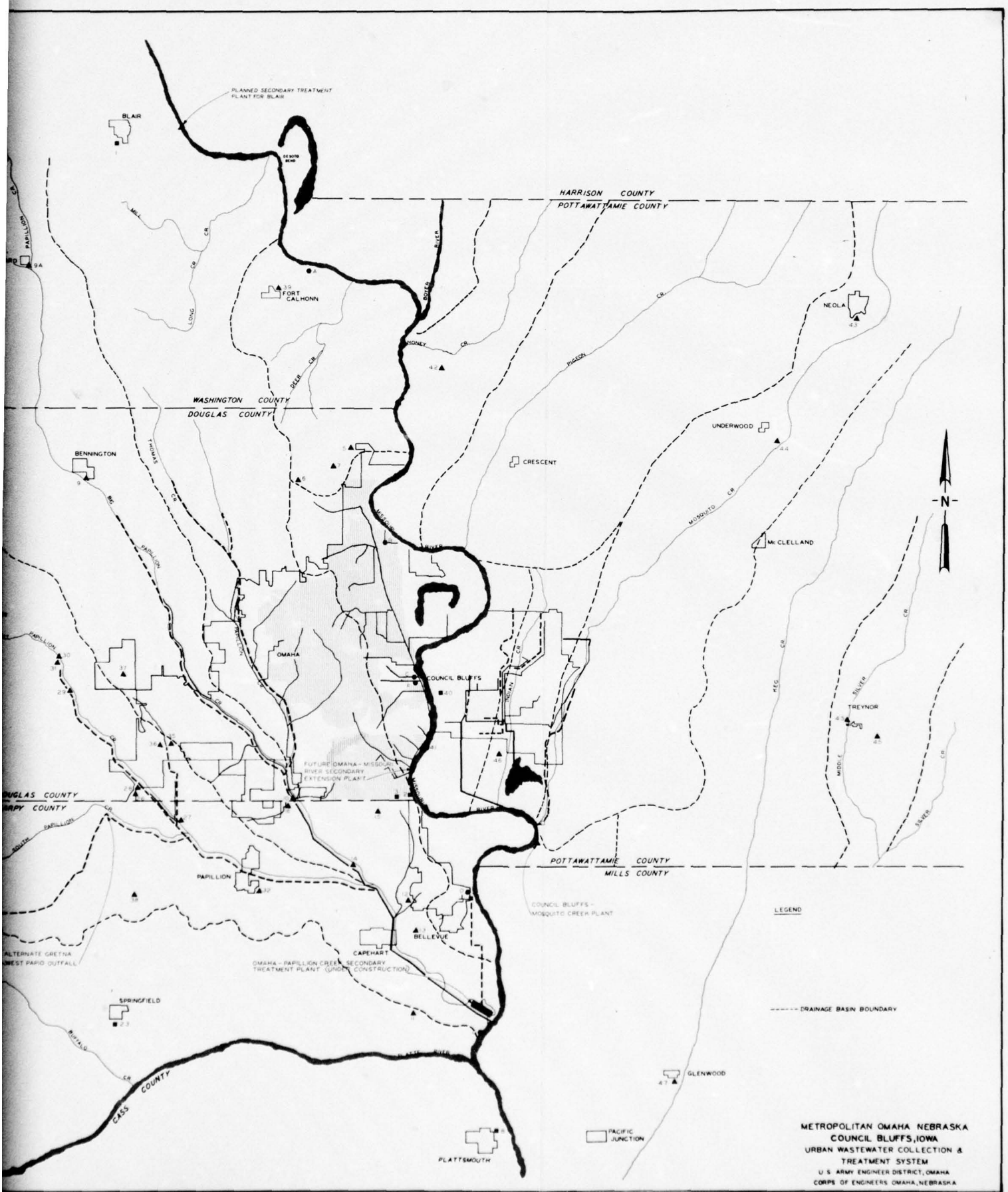
The existing wastewater collection systems in the study area are generally of the separate type and carry sanitary flows only. Extensive combined storm and sanitary sewers exist, however, in the older urban sections of Omaha, Council Bluffs, and Plattsmouth. In the city of Omaha, this area lies in the eastern half of the city and includes about 20,000 acres mainly in the area draining into the Missouri River. The western portion of the city is served by

the Papillion Creek sewer system. Figure B-12 shows the area served by combined sewers and also shows the major sewer lines in the Omaha-Council Bluffs urban area.

The major combined sewer problems and flows originate in Omaha. The existing collection system is a combined sewer system initiated near the turn of the century. Many of the trunk sewers, built between 1900 and 1930, are of brick construction and are in need of repair. These trunk sewers originally conveyed sanitary sewage and storm runoff directly eastward to the Missouri River. In 1964 a north-south interceptor was constructed to divert sanitary sewage and some of the storm runoff to the Missouri River Treatment Plant south of Omaha.

Sewer system rehabilitation is the most critical need in the above system. Mechanical failures along the South Omaha Interceptor have caused bypassing of raw sewage directly to the Missouri River. The city of Omaha estimates that the dry-weather bypasses totalled 4.5 billion gallons in 1973. Grit is removed from all wastewater pumped to the South Omaha Interceptor. During periods of high runoff, large, heavy objects are carried by the wastewater, such as bricks from the sewer lining, and tree branches. The grit removal facilities and pump stations are frequently damaged by these objects. While these facilities are under repair, sewage must be diverted directly to the river. The city has plans to correct these deficiencies. Implementation of the required facilities would be very cost-effective in reducing pollutant loads to the Missouri River.


LEGEND
COLLECTION SYSTEM
EXISTING
PROPOSED
TREATMENT FACILITIES
PRIMARY
SECONDARY
THERMAL DISCHARGES
COMBINED SEWER AREAS
NOTE
PROPSED SYSTEM BASED ON MAPA PLAN "C"
PLANNED SECONDARY TREATMENT PLANT FOR BLAIR
ORUM
BLAIR
KENNARD
FORT CALHONN
WASHINGTON COUNTY
DOUGLAS COUNTY
BENNINGTON
VALLEY
WATERLOO
ELKHORN
OMAHA
COUNCIL BLUFFS
FUTURE OMAHA - MISSOURI RIVER SECONDARY EXTENSION PLANT
DOUGLAS COUNTY
SARPY COUNTY
PAPILLION
GRETNA
ALTERNATE GRETNA WEST PAPIO OUTFALL
BELLEVUE
CAPEHART
OMAHA - PAPILLION CREEK SECONDARY TREATMENT PLANT (UNDER CONSTRUCTION)
SPRINGFIELD
CASS COUNTY
SCALE IN MILES
PLATTE



METROPOLITAN OMAHA NEBRASKA
COUNCIL BLUFFS, IOWA
URBAN WASTEWATER COLLECTION & TREATMENT SYSTEM
U S ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS, OMAHA, NEBRASKA

VOLUME II FIGURE 8-12

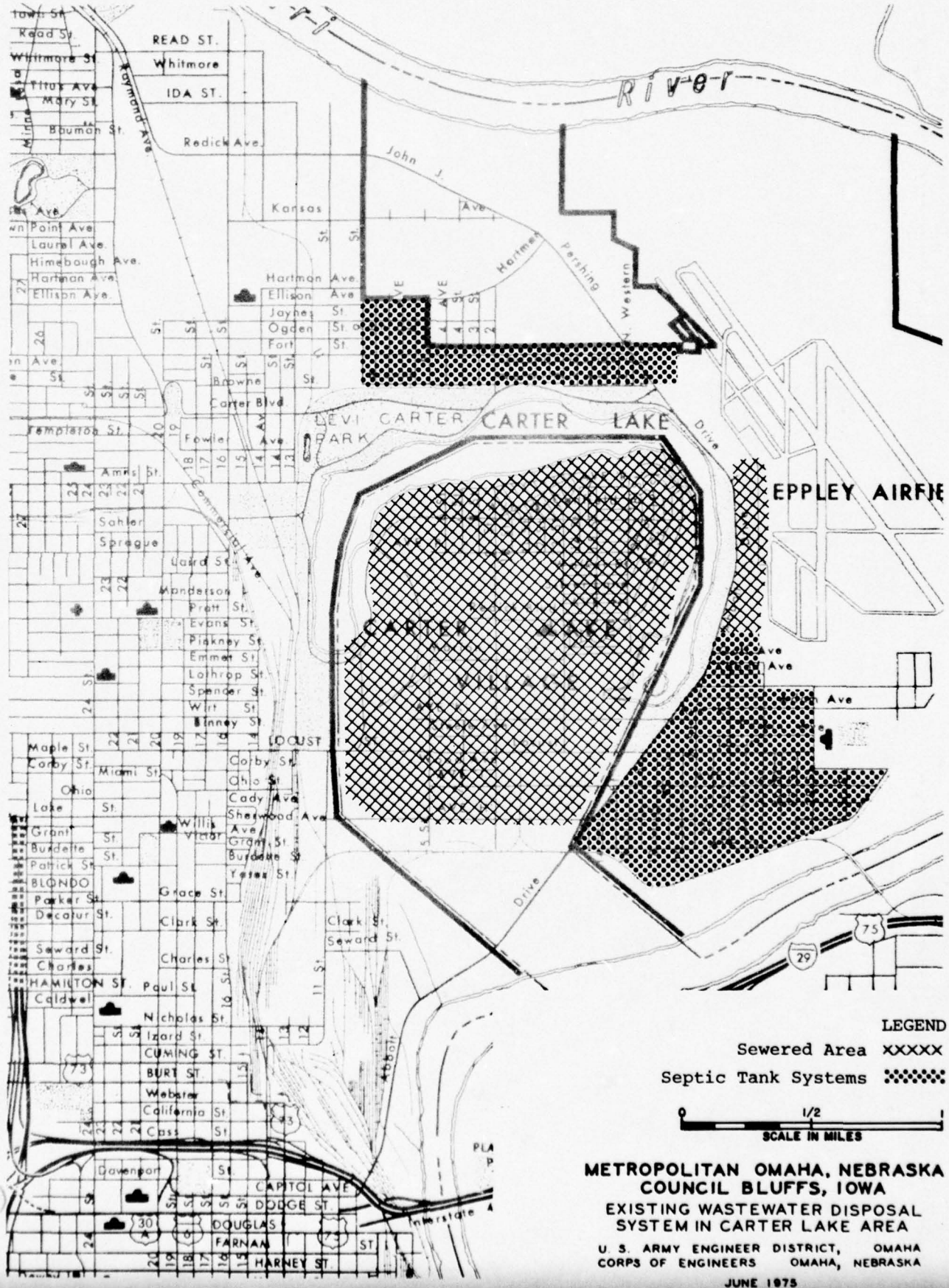
Diversion structures control the quantity of flow allowed into the interceptors. The interceptor system was designed to convey all wastewater to the Missouri River plant so long as the proportion of the stormwater flow to the design dry-weather flow does not exceed a prescribed ratio. The ratio is either 5 to 1 or 3 to 1 depending upon the location of the overflow point. Flows causing this ratio to be exceeded are not diverted to the interceptor system and are discharged without treatment to the Missouri River.

When the capacity of the interceptor is exceeded, gates on the structures automatically close and divert combined storm and sanitary wastes to the river. This occurs only during storm runoff periods; however, the gates must be manually reopened. During the period between automatic gate closing and manual gate resetting, raw sewage is diverted directly to the river. A system of automatic gate controls should be installed to effectively improve the sewer system performance. Overflows occur at 22 points along the riverfront. Overflows occur about 50 times a year and result in an annual discharge to the river of about 5 billion gallons of mixed sanitary sewage and stormwater, 8 million pounds of suspended solids, and 4 million pounds of BOD. Additionally, frequent overflows of sanitary sewage are caused by mechanical breakdowns in the interceptor system. Reduction or elimination of this pollution source is required under Federal law and these discharges of untreated combined sewage will be in violation of Nebraska State law after December 31, 1975.

The Benson-Westside area of Omaha, an older urban section of the city, also contains a concentration of combined sewers and

separate sewers. This system contributes raw wastewater to the several local streams and, ultimately, to the Little Papillion Creek during storm events. The Council Bluffs collection system generally consists of separate storm and sanitary sewers. The old section of the city has combined sewers, however, and there are areas where certain interceptors are suspected to contain overflow relief points.

The Environmental Protection Agency requires a sewer system evaluation to determine whether or not a sewer system receives an excessive amount of extraneous flow caused by infiltration/inflow. Flow records (November 1972 to November 1973) show that 40 to 50 percent of the wastewater generated within the eastern Omaha system was bypassed to the Missouri River because of system malfunctions. The bypass situation required setting up 24-hour, 7-day, dry-flow measurements for each sewer service area. Data on estimated water consumption and industrial discharges were compared to the dry-weather flow measurements for each sewer service area. The comparisons indicated that infiltration is not evident in the sewer system. The Plattsmouth collection system is almost totally combined and, according to a current study, it receives very little infiltration. The north-south interceptor in the Omaha-Missouri River system also drains storm runoff from service areas east of the interceptor system. Only one service area located east of the interceptor system has separate storm and sanitary sewers. This area is the Carter Lake-Eppley Airfield-East Omaha service area. Residents of the areas east and north of Carter Lake use septic tank and tile field wastewater disposal systems. The city of Omaha has extended sewerage service to Carter Lake, Iowa, Eppley Airfield, and to several homes in East Omaha. The location of the existing wastewater disposal systems are shown in figure B-13.



METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA

EXISTING WASTEWATER DISPOSAL SYSTEM IN CARTER LAKE AREA

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

JUNE 1975

VOLUME I FIGURE B-13

As indicated by a survey of the residences in the unsewered areas, by the Douglas County sanitarian, many of the septic tanks are undersized. The systems are 20 to 50 years old, and it is doubtful whether many of them have tile fields. Most of these systems were installed without having a percolation test made to determine the capability of the soil for a tile field. About half of the residents using septic tanks in this area reported various degrees of difficulty with these septic tank systems during 1973.

Septic tanks, used for residential wastewater disposal in most of the Carter Lake area, function poorly, supposedly because of a high water table in the area. It was concluded in a study by Harza Engineering Company that the soils in the area are unsuitable for septic tanks, irrespective of ground-water levels, and that the area should be served by separate sanitary sewers.

STORMWATER RUNOFF

Wastewater treatment plant effluents are point sources of pollution. Stormwater runoff is a non-point pollution source. It may consist of a mixture of combined sewer overflows, urban runoff, or agricultural runoff. The volume and quality characteristics of overland runoff for each watershed are highly dependent on the type of land use. The annual runoff volumes and accompanying pollution loads were derived from data obtained from monitoring runoff events in the past. In general, unit runoff volumes increase with increasing density of urban development, due to a greater percentage of impervious area. Feedlot runoff is primarily a function of rainfall only and varies little with respect to slope, cattle density, or other factors. Rural runoff volumes were developed by comparing annual rainfall data with annual runoff data for major streams. A summary of runoff volumes per acres for various land use is given in Table B-34.

Table B-34
Mean Annual Runoff by Land Usage

Type of Land Use	Annual Volume (cubic feet/acre)
Residential (2-5 people/acre)	17,500
Residential (5-8 people/acre)	21,000
Residential (8-12 people/acre)	24,500
Residential (12-15 people/acre)	28,000
Residential (15-18 people/acre)	31,500
Residential (18-20 people/acre)	35,000
Industrial and Commercial	52,500
Feedlots	33,500
Rural (Iowa)	15,000
Rural (Eastern Nebraska)	10,000
Rural (East-Central Nebraska)	4,000

Pollutant concentrations in residential area stormwater runoff vary with the population density. Overflows from combined sewers are characterized by greater nutrient concentrations and oxygen demand, but slightly lower concentrations of suspended solids. Commercial and industrial stormwater runoff quality is similar to that of dense residential runoff. Table B-35 indicates the relative water quality for various types of land use. A large variation in agricultural runoff can exist, depending on whether adequate soil conservation practices are followed. Annual soil loss rates have been shown to vary from 1 to 7 tons/acre/year for land possessing adequate soil conservation treatment to 70 to 90 tons/acre/year and 5 to 20 tons/acre/year for cropland and other rural areas respectively that need conservation treatment. Runoff from feedlots is generally lower in concentrations of suspended solids but is high in nutrient-laden, oxygen-demanding organic wastes.

Table B-35
Average Annual Stormwater Runoff Concentrations of Pollutant Parameters

Land Use	Suspended Solids (mg/l)	BOD_5 (mg/l)	COD (mg/l)	Phosphorus as P (mg/l)	Nitrogen as N (mg/l)
Residential (2-5 ppa)[1]	300	20	150	0.70	3.1
Residential (5-8 ppa)	340	22	160	0.66	2.9
Residential (8-12 ppa)	380	24	170	0.62	2.7
Residential (12-15 ppa)	420	26	180	0.58	2.5
Residential (15-18 ppa)	460	28	190	0.54	2.3
Residential (18-20 ppa)	500	30	200	0.50	2.2
Residential Combined Sewer Overflows	250	100	400	4.00	10.0
Commercial and Industrial	500	30	200	0.50	2.2
Feedlots[2]	7,000	5,000	20,000	30.00	300.0
Iowa Agricultural (Adequate Controls)	3,000	20	30	.20	5.0
Iowa Agricultural (Needing Control)	40,000	25	350	2.80	65.0
Iowa Rural (Adequate Controls)	500	0.3	5	.002	1.0
Iowa Rural (Needing Control)	5,000	3.5	50	.04	8.0
Nebraska Agricultural (Adequate Controls)	4,000	3	40	.30	7.0
Nebraska Agricultural (Needing Control)	40,000	25	350	2.60	65.0

Table B-35
(Cont'd)
Average Annual Stormwater Runoff Concentrations of Pollutant Parameters

Land Use	Suspended Solids (mg/l)	BOD_5 (mg/l)	COD (mg/l)	Phosphorus as P (mg/l)	Nitrogen as N (mg/l)
Nebraska Rural (Adequate Controls)	700	0.6	8	.001	1.0
Nebraska Rural (Needing Control)	4,000	2.5	20	.020	5.0
Open/Public	200	3.0	50	.200	2.0

(1) ppa = people/acre

(2) Concentrations for runoff directly off feedlots.

Using the concentrations developed in table B-35 and the annual runoff volume from table B-34, both based on the land use for the watershed, the flows and loads per watershed were calculated and are shown in table B-36. Figure B-14 illustrates the extent of these watersheds.

Table B-37 summarizes the existing annual pollutant loads for the study area. It provides a comparison of the total wastewater loads to the total stormwater loads from the defined watersheds, as discussed in the previous section. Stormwater runoff provides about 60 percent of the volume of pollutant loads.

The table also shows the influent loadings and relative impacts of the major, minor, and nonurban wastewater treatment plants. The major plants receive about 92 percent of the volume of total wastewater pollutant loads.

As would be expected, the solids loading from the stormwater runoff (due largely from the agricultural lands) are much more significant than the solids loading from the wastewater treatment plants. The BOD and nutrient loadings to the wastewater treatment plants are, however, more significant than the loads from the stormwater runoff. Stormwater runoff carries 97 percent of the suspended solids, but wastewater influent to the treatment plants carries 92 percent of the BOD load and most of the nutrient load.

Combined sewer overflows and urban storm runoff are precipitation-related events. MAPA studies indicate that as much as 15 to 20 percent of annual waste quantities may be discharged during one 24-hour period. These quantities are compared to daily treatment plant discharges in table B-38.

Table B-36
Existing Annual Runoff and Pollutant Loads Per Watershed

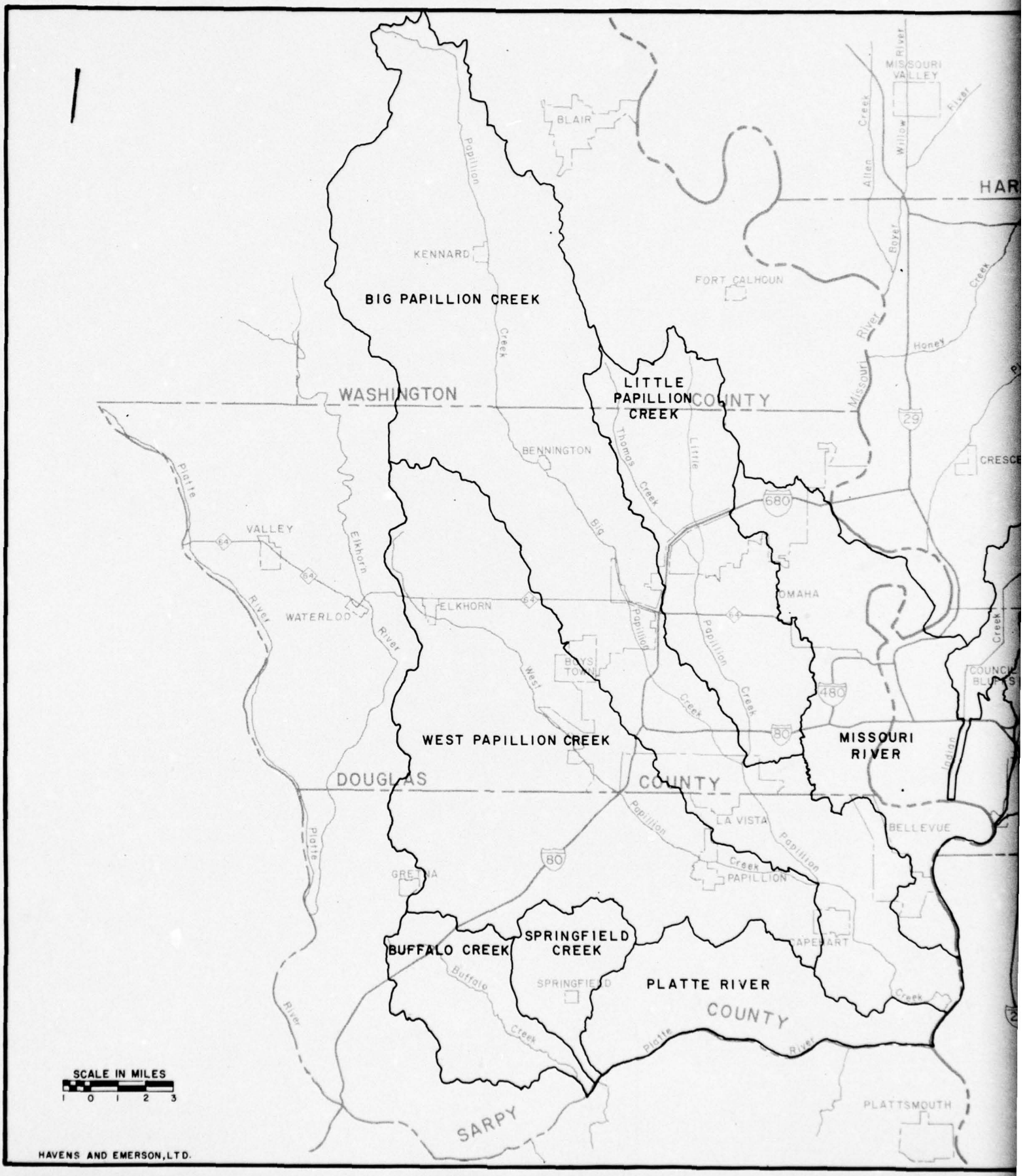
Watershed	Runoff (MG)	Suspended Solids (tons/yr)	BOD (tons/yr)	COD (tons/yr)	Phosphorus (tons/yr)	Nitrogen (tons/yr)
Big Papillion Creek	12,360	570,460	1,010	8,702	45	959
Buffalo Creek	1,331	100,329	367	2,078	8	179
Indian Creek	1,256	24,449	179	965	7	54
Little Papillion Creek	4,819	134,731	765	4,483	32	280
Missouri River	7,229	44,451	1,473	7,061	52	196
Mosquito & Keg Creeks	3,830	182,190	206	2,029	15	307
Platte River	1,831	132,412	114	1,254	8	214
Satellite Cities	1,092	9,594	62	455	2	18
Springfield Creek	824	65,032	143	976	5	111
West Papillion Creek	7,808	545,953	739	6,859	39	905
	42,380	1,809,601	5,058	34,862	213	3,223

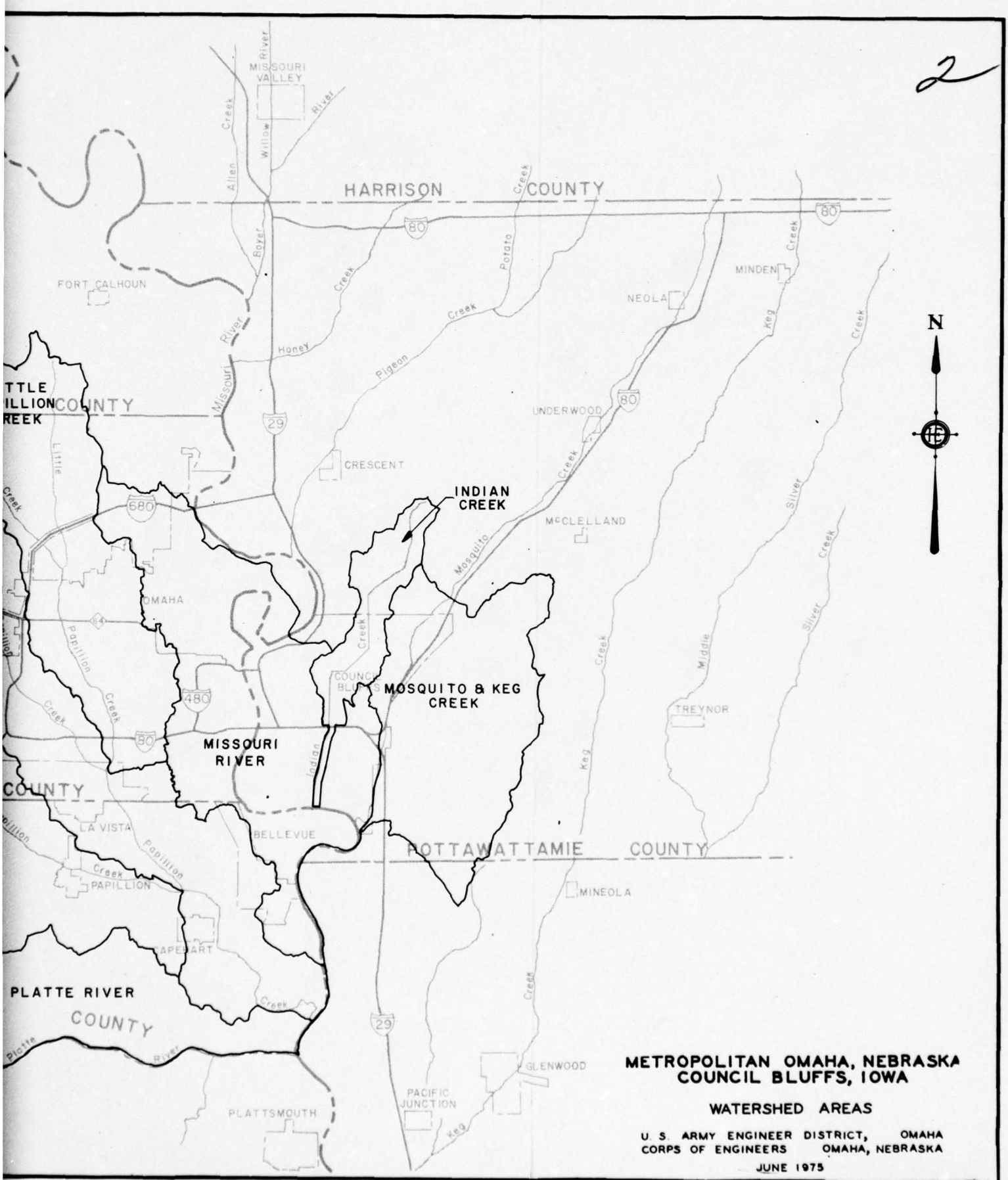
Table B-37
Existing Annual Pollutant Loads Summary

Source	Volume (MG)	Suspended Solids (tons)	BOD (tons)	Phosphorus (tons)	Nitrogen (tons)
Wastewater*					
Major Urban	25,879	49,166	55,152	1,241	6,607
Minor Urban	1,424	1,543	1,366	50	208
Non-Urban	803	876	767	37	110
Total Wastewater	28,106	51,585	57,285	1,328	6,925
Total Stormwater**	42,380	1,809,601	5,058	213	3,223
Total Loads	70,486	1,861,186	62,343	1,541	10,148

* Influent Flows and Loads to Municipal Plants

** Total Runoff Volumes and Loads from 9 Watersheds and Satellite Cities


BIG PAPILLION CREEK
LITTLE PAPILLION CREEK
WEST PAPILLION CREEK
MISSOURI RIVER
BUFFALO CREEK
SPRINGFIELD CREEK
PLATTE RIVER
WASHINGTON COUNTY
DOUGLAS COUNTY
SARPY COUNTY
BLAIR
KENNARD
FORT CALHOUN
MISSOURI VALLEY
BENNINGTON
VALLEY
WATERLOO
ELKHORN
OMAHA
LA VISTA
BELLEVUE
PAPILLION
GRETNA
SPRINGFIELD
PLATTSMOUTH
SCALE IN MILES
1 0 1 2 3
HAVENS AND EMERSON, LTD.



VOLUME II FIGURE B-14

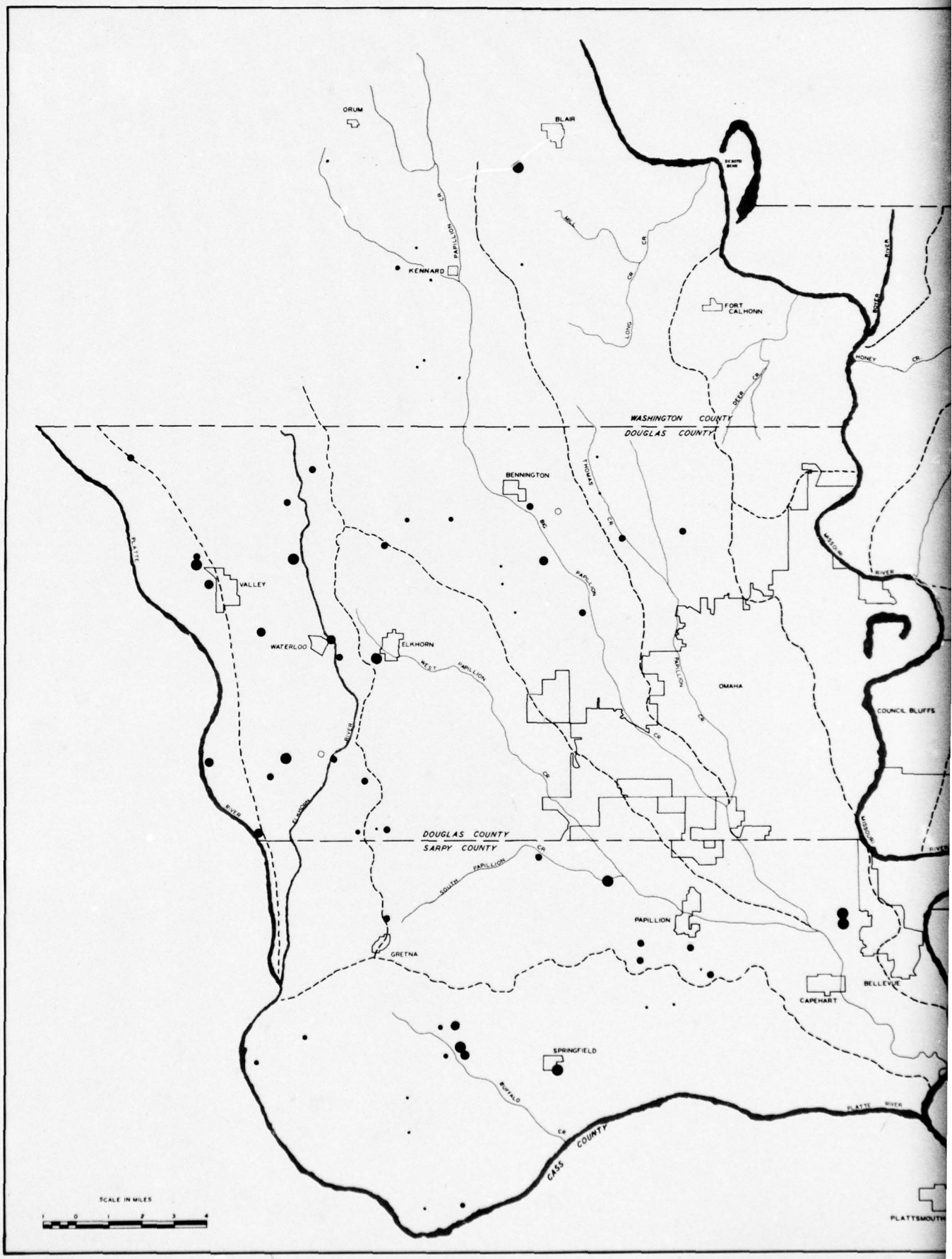
Table B-38
Comparison of Storm Runoff to Treatment Plant Flows

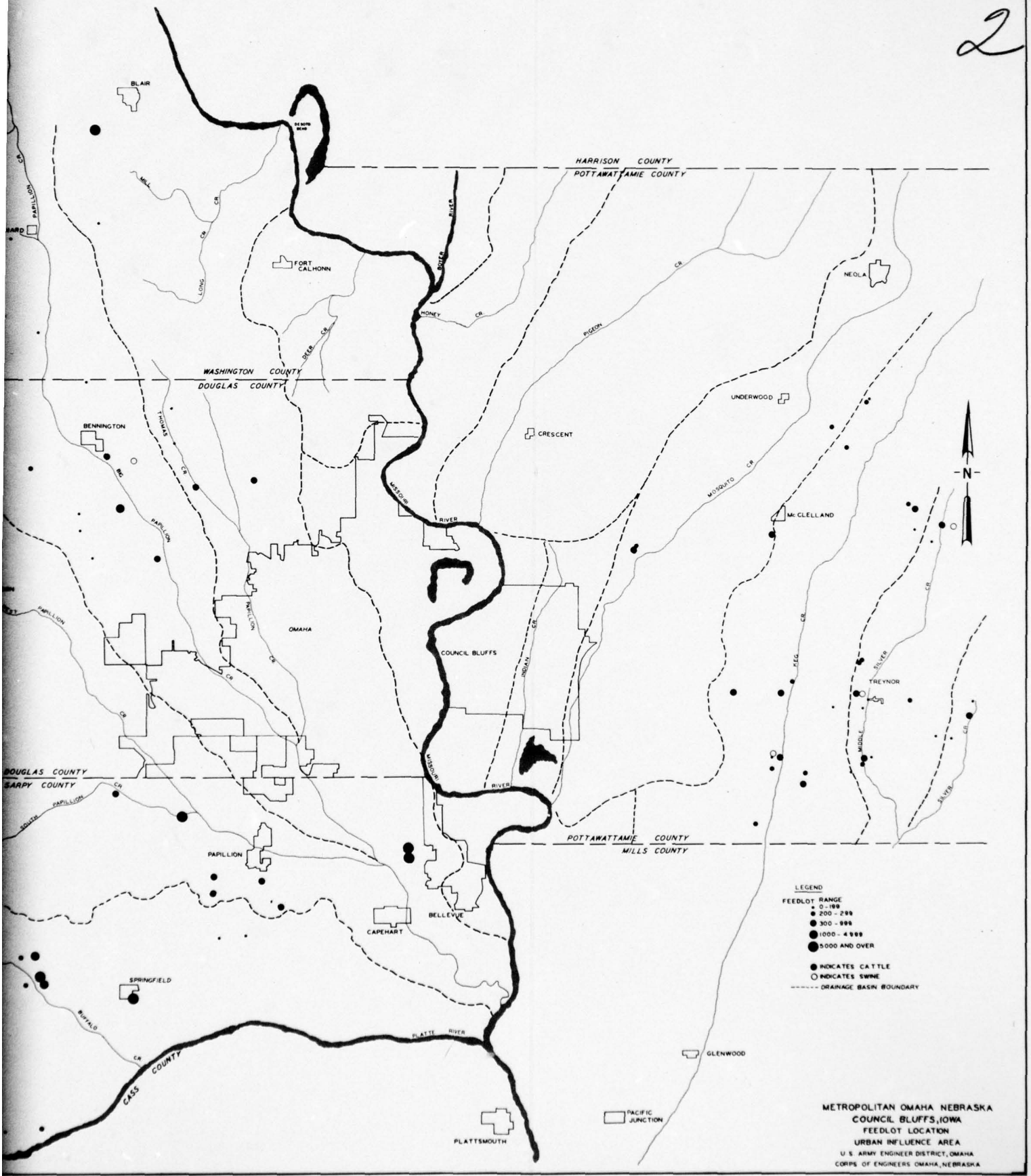
	Flow (MGD)	BOD (lbs)	Suspended Solids (lbs)
Present Average Daily Wastewater Discharge	77	141,000	98,000
2.5 Inch Storm; Combined Sewer Overflow	450	310,000	1,700,000
2.5 Inch Storm; Urban Runoff	900	380,000	3,300,000

Due to the rural nature of most of the drainage basins in the study area, agricultural waste quantities play a significant role in the total wasteload of a receiving stream. Waste sources include general rural runoff and feedlot runoff. Locations of area feedlots are shown in figure B-15. Like urban runoff, a significant percentage of this loading may occur during a short period.

INDUSTRIAL WASTEWATER

The industrial wastewater process flows of the study area are summarized in table B-39. It can be seen that 64 percent of this flow originates in the Omaha-Missouri River Sanitary District. About 60 percent of the total industrial process flows originated with the meat packing and food processing industry. About 70 percent of the BOD load, 86 percent of the TSS load, and 95 percent of the oil and grease load originate with the industries. Another significant contributor to BOD is an agri-chemical plant in the Omaha-Missouri River Sanitary District. The industrial wastes have caused some problems at the existing wastewater treatment plants. With the exception of meat processing wastes, industrial wastes are not critical problems in the study region.


ORUM
BLAIR
KENNARD
PAPILLION CR.
MILL CR.
LONG CR.
FORT CALHOUN
DEER CR.
MONEY CR.
WASHINGTON COUNTY
DOUGLAS COUNTY
BENNINGTON
THOMAS CR.
BIG PAPILLION
VALLEY
PLATTE RIVER
WATERLOO
ELKHORN
WEST PAPILLION CR.
OMAHA
COUNCIL BLUFFS
MISSOURI RIVER
LAKE CR.
DOUGLAS COUNTY
SARPY COUNTY
SOUTH PAPILLION CR.
PAPILLION
GRETNA
BELLEVUE
CAPEHART
SPRINGFIELD
BUFFALO CR.
PLATTE RIVER
CASS COUNTY
PLATTSMOUTH
SCALE IN MILES
1 0 1 2 3 4



METROPOLITAN OMAHA NEBRASKA
COUNCIL BLUFFS, IOWA
FEEDLOT LOCATION
URBAN INFLUENCE AREA
U.S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

VOLUME II FIGURE B-15

Table B-39
Significant Industrial Wastewater Processing Flows
in the Study Area
(millions gallons per day)

Papillion Sanitary District	2.760
Council Bluffs Sanitary District	4.421
Missouri River Sanitary District	18.943
Rivers and Streams	3.570
Rural City Sewers	0.100
Seven-County Area	29.664

SUMMARY

A summary of wastewater management needs and problems is given below:

- The largest volume of domestic wastes does not receive secondary treatment; plans are available to implement secondary treatment but implementation will go beyond the 1977 deadline.

- After most of the domestic and compatible industrial wastes are given secondary treatment, waste sources will exist that negate partially the beneficial effects of providing secondary treatment - particularly in streams with low assimilative capacity such as the Papillion Creek. This is particularly true during storm-related events.

- Portions of the sewer systems are mechanically unreliable and allow the discharge of raw sewage into the receiving waters.

- Portions of Omaha's and Council Bluffs' systems contain combined sewers. During storm periods, these systems are overloaded and contaminated wastewater is discharged to receiving waters.

- Urban and agricultural runoff degrades stream quality during storm periods.

- Storm runoff, both urban and agricultural, may introduce large quantities of wastes into receiving waters in shock-loading condition.

- Industrial wastes, particularly from meat processing, have caused problems in the operation of municipal treatment plants.

- Rural treatment facilities generally lack proper operation and maintenance and will have difficulty meeting the 1977 requirements.

Urbanization of the Papillion Creek basin, combined with treatment plant discharge and agricultural runoff, may produce a questionable water quality in the Papillion Creek Lake system.

Projected waste loadings in terms of BOD and suspended solids reveal that overall removal effectiveness will be limited if treatment continues to be addressed only to treatment plant discharges.

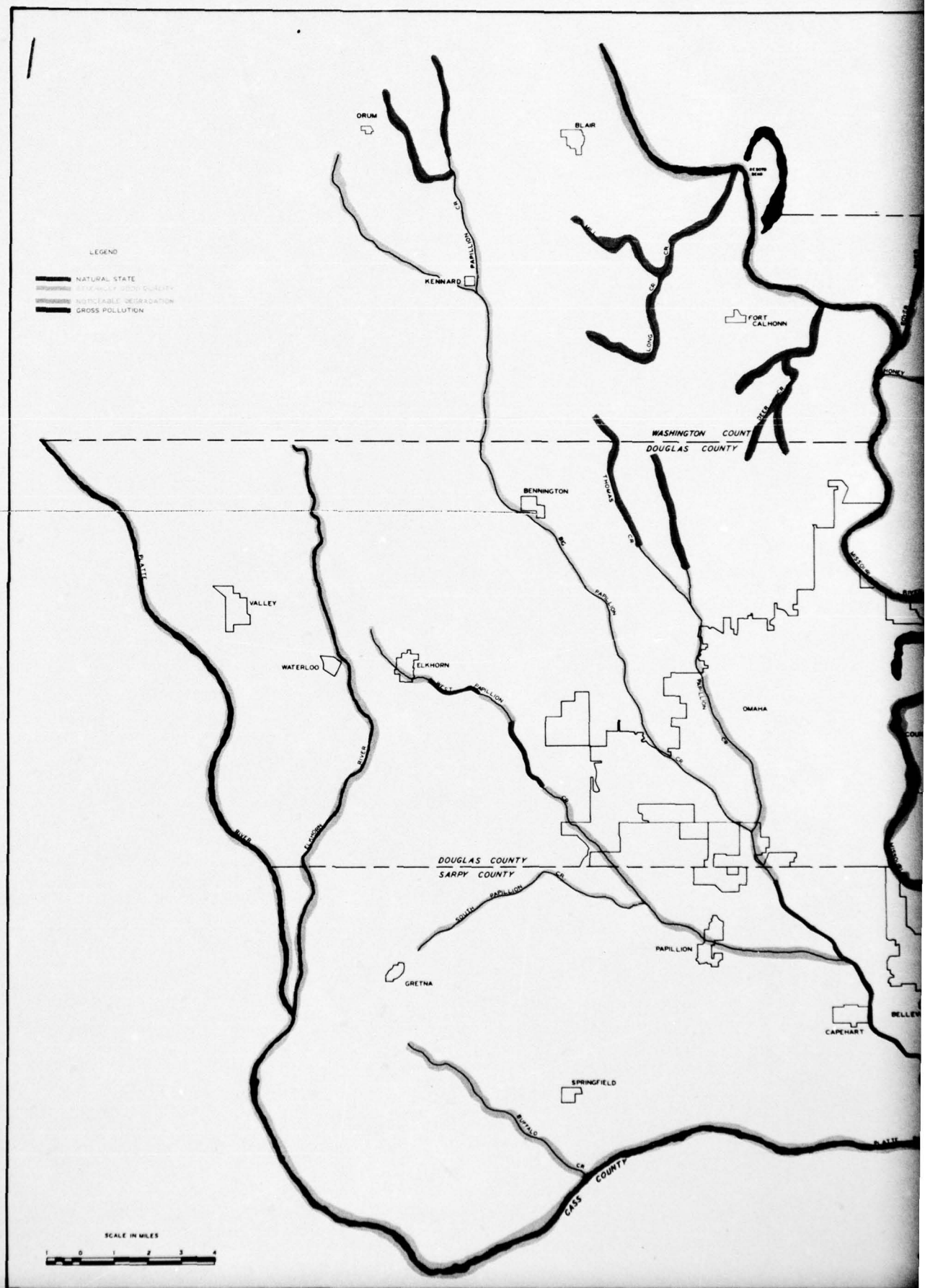
Alternatives for the future must address the possible elimination of all waste sources. Attention to only treatment plant discharges may not result in cost-effective solutions.

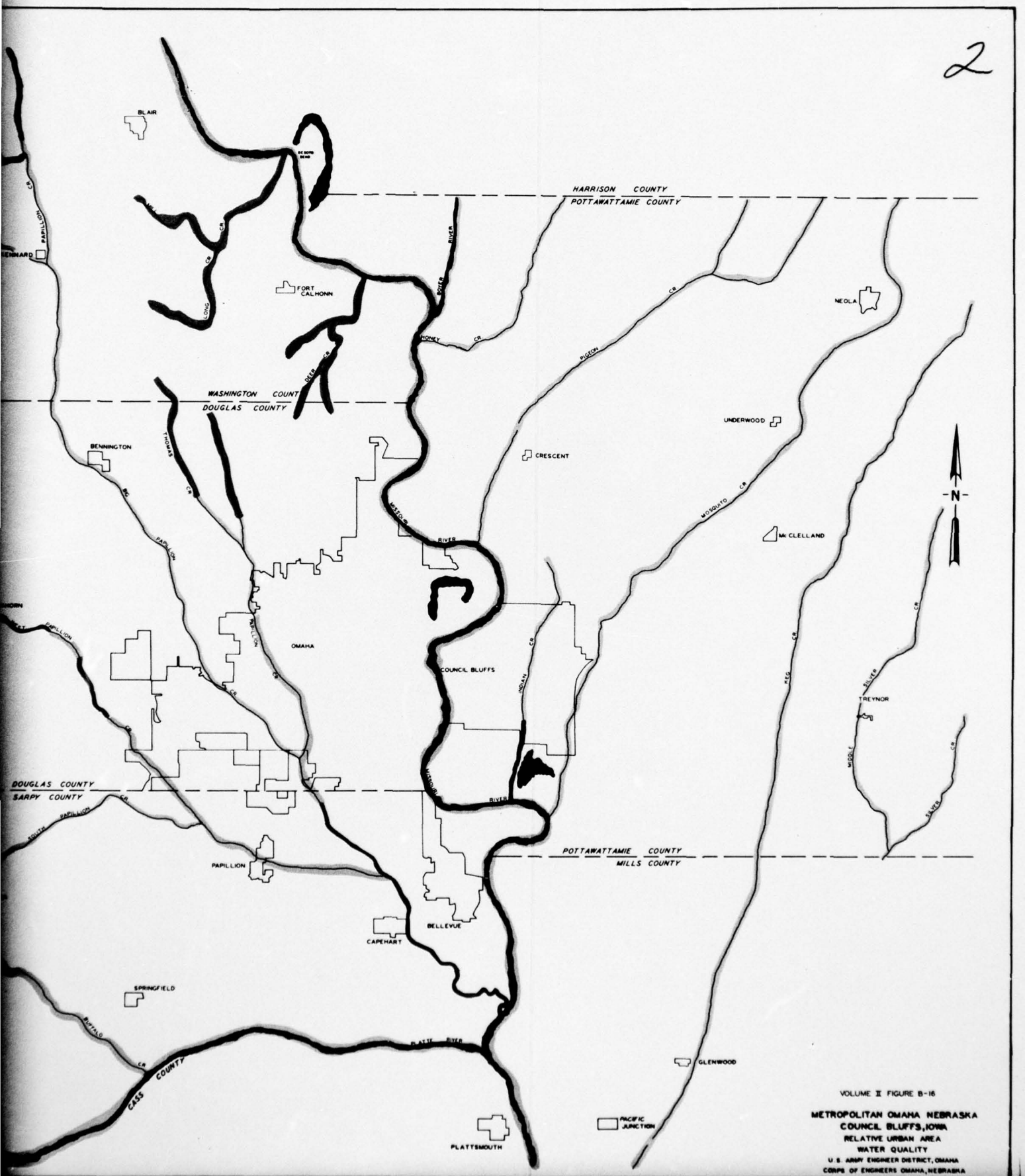
WATER QUALITY

The water quality of the Missouri River, the Papillion Creek basin, the Iowa tributaries, the Platte River, and the Elkhorn River and Buffalo Creek tributaries has been variously monitored

for several years. The data accumulated are stored in files and computer banks of both Nebraska and Iowa and are available on STORET, from U. S. EPA Region VII, Kansas City, Missouri and from the State of Iowa Department of Environmental Quality. Based on an analysis of available data, it appears that the upstream reaches of the smaller streams are relatively clean most of the time. The smaller streams in the metropolitan urban area are generally of poorer quality. All of the smaller streams are adversely affected from heavy runoff. The larger streams, i.e., the West Nishnabotna, Platte, Elkhorn, and Missouri Rivers, all exhibit a greater buffering capacity to runoff or shock loads and, with the exception of bacterial limits, generally always meet or exceed the adopted water quality criteria. The introduction of pollutants from various waste sources can, however, be detected even in rivers as large as the Missouri. Figure B-16 indicates the relative water quality of streams in the region.

Table B-40 shows the classification of the streams in the study area according to the States of Nebraska and Iowa.


LEGEND
NATURAL STATE
NOTICEABLE DEGRADATION
GROSS POLLUTION
ORUM
BLAIR
KENNARD
PAPILLION CR
FORT CALHOUN
LONG CR
WASHINGTON COUNTY
DOUGLAS COUNTY
BENNINGTON
THOMAS CR
BIG PAPILLION
VALLEY
WATERLOO
PLATTE RIVER
ELKHORN
ELKHORN RIVER
WEST PAPILLION CR
PAPILLION CR
OMAHA
DOUGLAS COUNTY
SARPY COUNTY
SOUTH PAPILLION CR
PAPILLION
GRETNA
SPRINGFIELD
BUFFALO CR
CASS COUNTY
SCALE IN MILES
1 0 1 2 3 4



VOLUME II FIGURE B-16

METROPOLITAN OMAHA NEBRASKA
COUNCIL BLUFFS, IOWA
RELATIVE URBAN AREA
WATER QUALITY
U.S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

Table B-40
State Stream Classifications

Classification of Waters:

Missouri River Class A (Nebraska), Class C (Iowa)
All Other Streams - Class B (exception: see Keg Creek, Iowa), or intermittent streams - Iowa (see note).

Categories of Waters; Uses:

Nebraska: Category I - (Class A and Class B)

Class "A" - full body (primary) contact, domestic water supply, fish and wildlife, and other aquatic and semi-aquatic life.

Iowa: Class "A" - primary (full body) contact recreation.

Class "B" - secondary (partial body) contact, wildlife, fish, and aquatic and semi-aquatic life.

Class "C" - raw water source of potable water supply.

NOTE: Iowa Water Quality Standards, 1974, do not designate intermittent streams or set quality standards for them. However, Section 16.2 (455B), General Considerations, and Section 16.3 (455B), Surface Water Quality Criteria, include all surface waters under general policy protection, the "four freedoms" clauses, and the turbidity limit.

A brief evaluation of the water quality of streams in the study area is given in the following paragraphs. The streams are grouped into the Papillion Creek System, the Platte-Elkhorn System, the Iowa Tributaries, and the Missouri River.

PAPILLION CREEK BASIN

The problems in the Papillion Creek basin are readily apparent upon review of the data presented by MAPA and Havens and Emerson, Ltd. Papillion Creek has the highest concentrations of pollution of the

study area's streams. Concentrations and unit contributions in the downstream areas are the highest recorded under normal conditions and they increase during runoff. Upstream areas are characteristic of the "natural" streams in the study area. Information on some of the basin streamflows are summarized below:

- On West Papillion Creek, fecal coliforms exceed standards throughout the stream in all seasons. BOD is excessive at times during all seasons. Ammonia nitrogen violates standards frequently in the middle and upper reaches but has been reported excessive in the downstream reach only in the winter. Occasional to frequent DO deficiencies are reported for the upstream and downstream sampling stations in all but the spring season, and for the middle station only in summer.

South Papillion Creek, a tributary of West Papillion Creek, shows fecal coliform violations and excessive BOD for all seasons except winter. Its ammonia nitrogen and dissolved oxygen are within standards during all seasons at the sampling point.

Both streams equal or exceed minimum nutrient requirements of phosphorus on all sampling dates. The nutrient level is sufficient to support heavy aquatic plant growths.

West Papillion Creek and its tributary South Papillion Creek do not meet public health partial-contact standards much of the year. The nutrient condition of the water is at all times above minimum requirements for excessive growth, and the organic load is often high. Both streams are moderately to excessively polluted, with the West Papillion Creek condition worsened by the presence of ammonia at toxic levels.

• The Little Papillion Creek headwaters are lacking in complete data for some parameters. Fecal coliform standards were exceeded whenever samples (spring and winter) were taken. This is true of the Thomas Creek tributary also. After the creek enters the city, dissolved oxygen deficiencies occur occasionally in summer and phosphorus is present in nutrient sufficiency in all seasons.

The stream further deteriorates to the point that just above its confluence with the Big Papillion Creek, dissolved oxygen is deficient part of the time in summer and fall, BOD is excessive frequently in all seasons, and ammmonia nitrogen is at toxic levels occasionally in fall and winter.

In its headwaters, the stream is unsafe for contact, and phosphorus concentration is sufficient to support nuisance algal growths. The middle reaches of Thomas Creek are rapidly degraded upon entering the city -- to the point of severe pollution for much of the time near its confluence with Big Papillion Creek.

• On Big Papillion Creek, fecal colfirm bacteria exceed standards throughout the course of the stream and for all seasons of the year. Phosphorus concentrations also indicate a year-round nutrient surplus. In the upstream reaches of the creek, ammonia nitrogen is an occasional problem in the fall. It is a frequent problem in all seasons in the downstream one-third reach, below the confluence with the Little Papillion Creek. Dissolved oxygen falls below standards frequently, in all seasons, in this same reach.

The upper Big Papillion Creek is enriched and is not safe for contact, while the downstream one-third to one-half of the stream is grossly polluted in all seasons of the year.

PLATTE-ELKHORN BASIN

• The Platte River has the best water quality of the five major rivers in the area. The Platte's high quality is most severely affected by the Elkhorn River and Salt Creek. The Elkhorn River is characterized by high coliform counts and a turbid flow caused by a combination of urban and agricultural wastes. Salt Creek is located outside the study region but has the potential of affecting the Platte River with high salt concentrations. Other streams in this basin are characteristic of the agricultural streams such as those found in Pottawattamie County.

• The Platte River from Schuyler to Plattsmouth has sustained occasional violations of water quality standards for PH, fecal coliforms, dissolved oxygen, ammonia, and temperature. The violations of standards occur in organic pollutants. Fecal coliforms exceed limits in all seasons, but not in all samples at all stations. Dissolved oxygen deficiency occurs at the downstream station occasionally. The BOD results show a moderate level of organic load. Phosphorus is sufficient to support heavy algal growths.

• For the Elkhorn River, fecal coliform standards are exceeded in the downstream and middle reaches of the river segment traversing the western MAPA area. The upstream sampling point, located just west of the Washington County-Dodge County line, was in standard violation the one time it was sampled for fecal coliforms. Phosphorus was analyzed in most of the samples and always exceeded minimum nutrient levels. Organic load was generally moderate in the upstream and middle reaches, and increased somewhat in the downstream reach. The downstream station reported excessive BOD occasionally in all seasons. The Elkhorn River is moderately polluted by organic

wastes throughout its downstream (MAPA) segment. By the health standard it is unsafe for partial body contact during all periods reported.

• Buffalo Creek, a tributary of the Platte River in Sarpy County, has exceeded the water quality standards for fecal coliforms and dissolved oxygen. Buffalo Creek is heavily polluted, organically, in its downstream reach. In that reach, fecal coliform criteria are violated in all seasons of the year, while DO violations are frequent in summer, fall, and winter. Ammonia nitrogen toxicity is an occasional problem, particularly in the fall. The BOD data indicate moderate to excessive organic load.

IOWA TRIBUTARIES

These tributaries include the Boyer River, and Pigeon, Indian, Mosquito, Keg, and Silver Creeks. With the exception of Indian Creek, the predominant influence on each stream is the rural-agricultural area through which it courses. All except the Boyer River are low flow or intermittent streams. Indian Creek is influenced in its downstream reach by the Council Bluffs urbanized area.

A review of MAPA's sampling program shows that, with the exception of Indian Creek, all of the Iowa tributaries have comparable minimum pollutant values, indicating all of the streams are high-quality waters during non-runoff periods. Upstream sampling stations continue to have low unit contribution values even during periods of runoff. Downstream stations show significant increases in pollutant values as the stream passes through the study area.

• On the Boyer River, summer, fall, and winter data show violation of fecal coliform standards, one winter sample with ammonia

nitrogen violation, and moderate organic load. Phosphorus is sufficient to promote abundant algal growth. Other parameters are within standards and, except for the health criteria, the Boyer River is a slightly polluted, though nutrient rich, stream at the sample station.

• Analyses of spring, fall, and winter sampling of Pigeon Creek indicate moderate organic pollution. Low quality in fecal coliforms and dissolved oxygen at high flows indicate occasional storm flushes that deliver slug quantities of very poor water.

• Violations have occurred on Indian Creek, but do not apply to the Intermittent Stream Category in Iowa. There is as yet no set of water quality standards for this category.

A generally polluted water quality for Indian Creek can be ascertained from the available data. Because of the impact of some of the data on the one or few dates of collection (one sample, specific conductance = 4,100 micromhos), a more thorough sampling program should be undertaken. Also, it is likely that the urban reach of this stream carries a polluted flow at all times, and its effects should be monitored. Stream characteristics at the upstream end of the covered reach as of 1 August 1974 were: estimated width 2.0 feet, maximum depth 0.2 feet, and slight color.

• The only violation of standards at two sampling points on Mosquito Creek is in the category of fecal coliform bacteria. Standards are exceeded during all seasons at the downstream station and in all seasons but spring at the upstream station. Organic load is moderate and nutrient level is in excess of the minimum requirement for algal growths at both sample points.

• Keg Creek upstream from Glenwood is designated Class C (Iowa Water Quality Standards, raw source for potable water supply). Glenwood is converting to a ground-water supply. The chemical constituent standards for Class C waters are met, but violation of the fecal coliform standard of Class B waters occurs in all seasons for which there are recent data, except during winter. Keg Creek is relatively unpolluted chemically but has frequently high fecal coliform counts and it is nutrient rich.

• Silver Creek, a tributary of the West Nishnabotna River, violates the fecal coliform standards in all seasons except winter. It carries a moderate organic load as measured in BOD and nutrients are sufficient to support an abundant algal growth. Silver Creek was sampled eight times in two recent years. The analyses indicate that it is moderately organically polluted.

MISSOURI RIVER

MAPA data collected at three Missouri River sampling sites show relatively good water quality from Blair to Plattsmouth. The MAPA data did not show any appreciable change in water quality for most parameters between these sites, except for total and fecal coliform densities. Data from the Plattsmouth sampling site demonstrated higher fecal and total coliform counts than data from the Blair sampling site. A prior study of the Missouri River, done as part of the Water Quality Standards Conference of Iowa, 1969, states the following:

> "Below the Omaha-Council Bluffs metropolitan area, the (Missouri) river quality again reflects the impact of waste discharges. The aquatic habitat for a distance of 54 miles downstream supports members of pollution tolerant organisms. Densities of bacterial indicator organisms increase sharply. The concentrations of dissolved organics as measured by BOD and the nutrient concentrations are significantly higher."

This study showed that the effects of pollutants can be detected in the Missouri River even though the effects are small.

In the reaches of the study area the Missouri River does not meet fecal coliform standards. Occasionally in summer and winter the water falls below oxygen standards and carries a sufficient phosphorus nutrient concentration to support nuisance growth.

WATER SUPPLY

Problems and needs regarding water supply are related to both existing conditions and projected future demands. This section discusses the present water use and supply, the present problems, and the future, or projected problems.

PRESENT WATER USE AND SUPPLY

The major water supply sources in the study area are the Missouri and Platte Rivers. Minor supply sources are the Elkhorn, Boyer, and Nishnabotna Rivers. Omaha and Council Bluffs both use Missouri River surface sources as their primary water supply. The remaining major supply sources are from ground-water wells located in sands and gravels along the major water courses. Ground water availability is limited in the remaining portions of the study area

although adequate supplies could be found to service minor water supply development. Omaha's second water supply source is from wells along the Platte River. Most other communities use ground water for their supplies.

An outline of available ground water sources in the study region, which identifies estimated ground water in storage and net changes in ground-water levels, is shown on figure B-17. The conditions shown are gross estimates for both confined storage and net change in ground-water levels.

The figures shown in each area are the estimated minimum acre-feet of ground water in storage. The figures do not include the very large quantities of ground water in storage underlying the Missouri River basin at depths greater than 1,000 feet. The quantity of ground water in storage in these deep aquifers is believed to be much greater than the minimums shown. The figures shown include the entire confined storage volume which, in most cases, extends outside the study area.

Areas, where properly constructed and located wells capable of yielding more than 300-gallons per minute, are in the net change of "rise of 10 feet to decline of 10 feet" range.

Areas, where wells are less than 500-feet deep generally, will yield less than 300-gallons per minute in the net change of "rise of 50 feet to a decline of 50 feet" range.

Relative quality of ground-water sources in the study area is shown in figure B-18. The qualify of ground water produced from the

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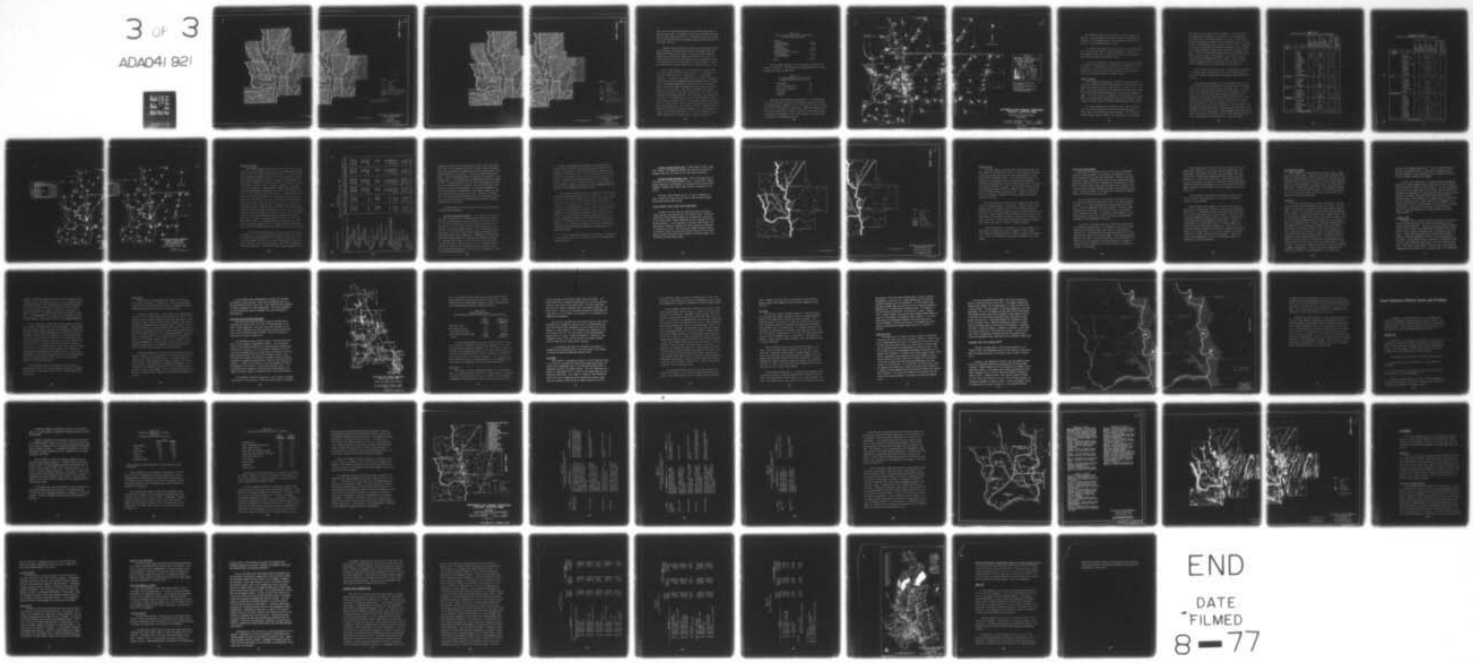

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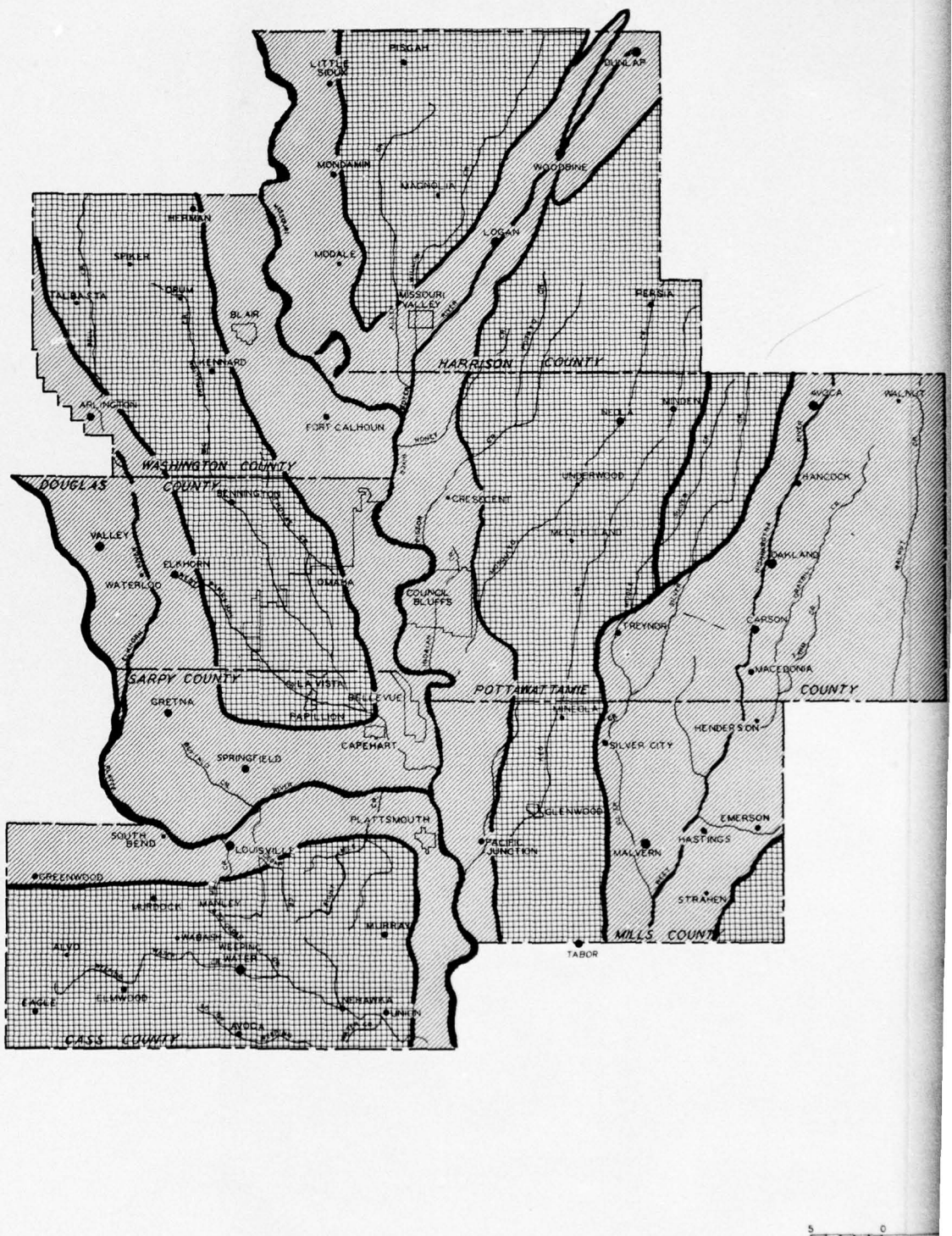
NATIONAL BUREAU OF STANDARDS-1963-A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DUNLAP
MONDAMIN
WOODBINE
MAGNOLIA
HERMAN
LOGAN
SPIKER
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PERSIA
BLAIR
HARRISON COUNTY
ARLINGTON
FORT CALHOUN
WASHINGTON COUNTY
DOUGLAS COUNTY
MODALE
WOOCA
WALNUT
HANCOCK
CRESCENT
OAKLAND
VALLEY
WATERLOO
ELKHORN
OMAHA
COUNCIL BLUFFS
TREYNOR
CARSON
MACEDONIA
SARPY COUNTY
POTTAWATTAMIE COUNTY
GRETNA
BELLEVUE
PAPILLION
CAPEHART
SILVER CITY
HENDERSON
SPRINGFIELD
PLATTSMOUTH
GLENWOOD
EMERSON
SOUTH BEND
LOUISVILLE
PACIFIC JUNCTION
MALVERN
HASTINGS
GREENWOOD
MANLEY
STRAHAN
MURRAY
ALVO
WAVERLY
WEEPING WATER
TABOR
EAGLE
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CASS COUNTY
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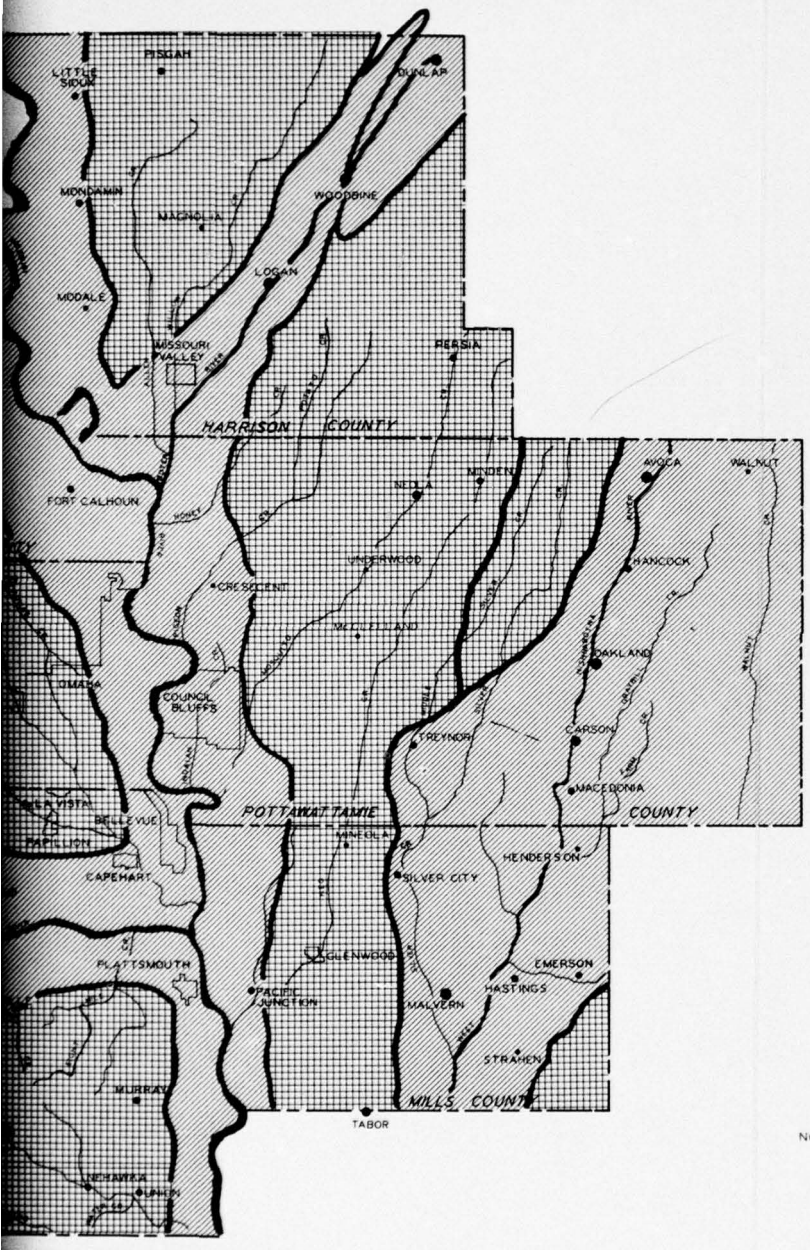
SCALE IN MI



2

N

LEGEND

POPULATION SYMBOLS

- 0 - 200
- 200 - 500
- 500 - 1,000
- 1,000 - 2,000
- 2,000 AND OVER

COUNTY OUTLINE

QUATERNARY SAND AND/OR GRAVEL WATER MAY BE CONFINED OR UNCONFINED RISE OF 10 FEET TO DECLINE OF 10 FEET

DOMINATLY SILT, CLAY, AND SHALE GENERALLY UNCONFINED RISE OF 50 FEET TO DECLINE OF 50 FEET

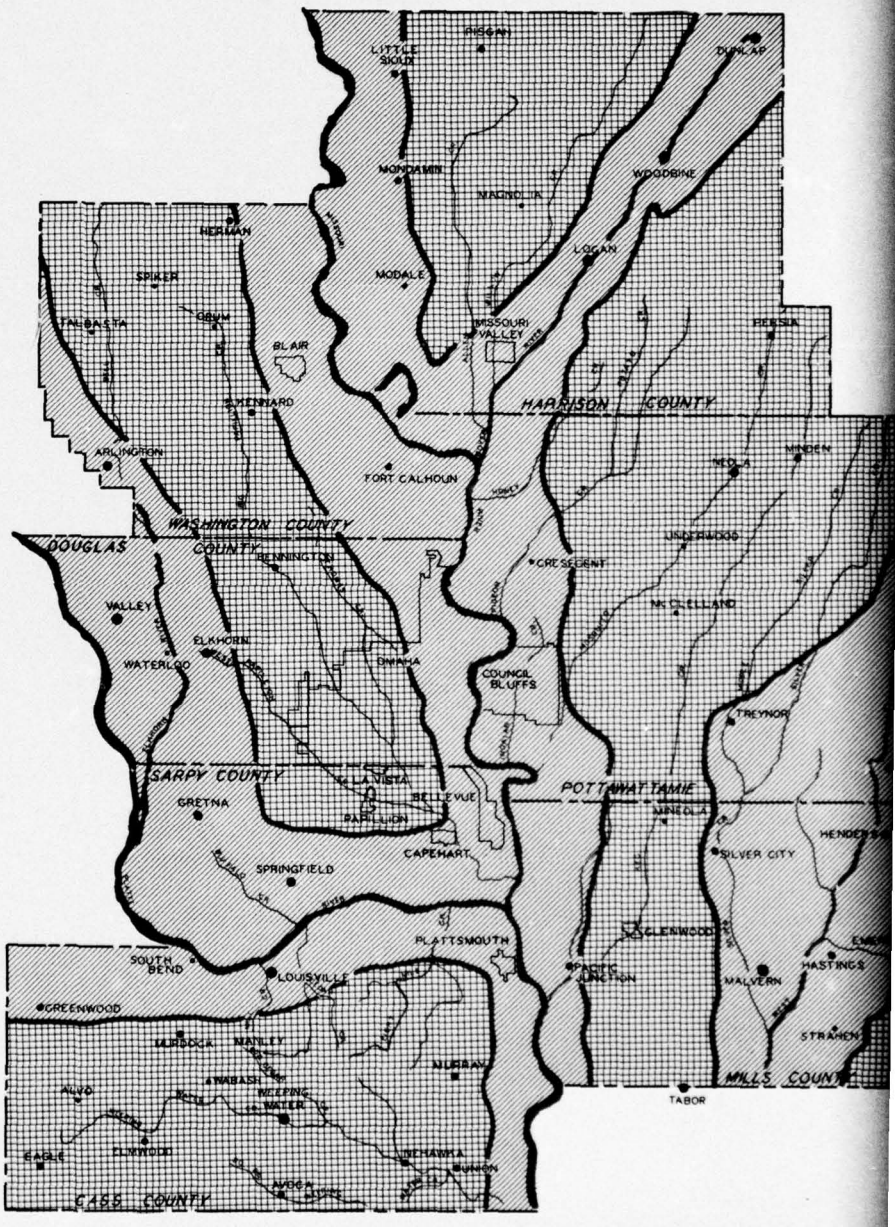
NOTE

THE ESTIMATED TOTAL STORAGE CAPACITY OF THE CONFINED AQUIFERS IS 280,300 ACRE - FEET AQUIFERS EXTEND BEYOND THE STUDY AREA.

5 0 5 10
SCALE IN MILES

METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
GROUND WATER
QUANTITY

U.S. ARMY ENGINEER DISTRIST OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA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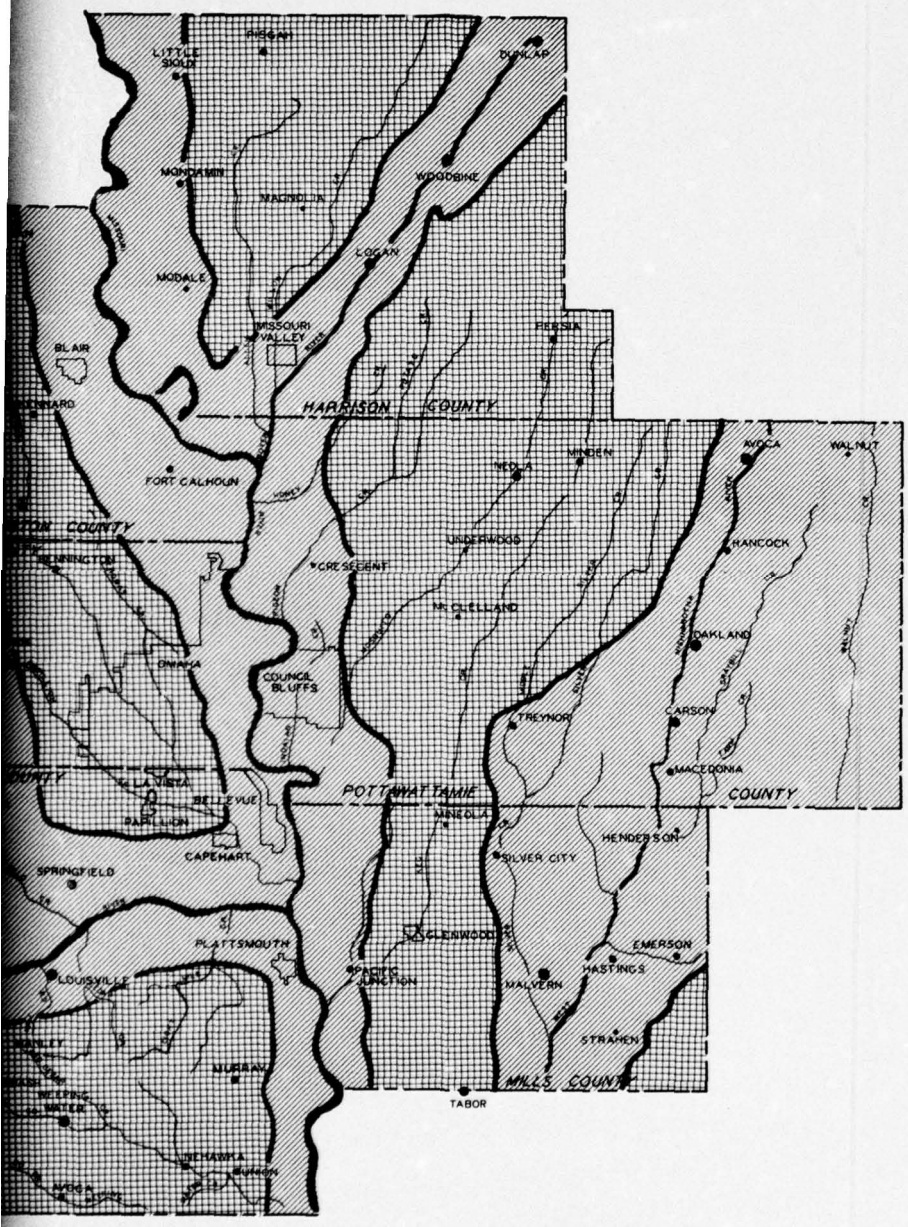
PERSIA
DUNLAP
WOODBINE
MONDAMIN
MAGNOLIA
HERMAN
LOGAN
MODALE
SPIKER
TABASTA
BLAIR
MISSOURI VALLEY
HARRISON COUNTY
ARLINGTON
FORT CALHOUN
WASHINGTON COUNTY
DOUGLAS COUNTY
BENNINGTON
CRESCENT
VALLEY
ELKHORN
WATERLOO
OMAHA
COUNCIL BLUFFS
TREYNOR
SARPY COUNTY
GRETNA
BELLEVUE
PAPILLION
CAPEHART
SPRINGFIELD
POTTAWATTAMIE
SILVER CITY
PLATTSMOUTH
SOUTH BEND
LOUISVILLE
GREENWOOD
MURDOCK
MURRAY
NEHAWKA
EAGLE
ELMWOOD
CASS COUNTY
PACIFIC JUNCTION
MALVERN
HASTINGS
TABOR
MILLS COUNTY



2

N

LEGEND

POPULATION SYMBOLS

- 0 - 200
- 200 - 500
- 500 - 1,000
- 1,000 - 2,000
- 2,000 AND OVER

COUNTY OUTLINE

250-500 PPM TOTAL DISSOLVED SOLIDS; LESS THAN 150 PPM CLORIDES; LESS THAN 250 PPM SULPHATES.

LESS THAN 250 TO GREATER THAN 4,000 PPM TOTAL DISSOLVED SOLIDS; LESS THAN 150 TO GREATER THAN 600 PPM CLORIDES, LESS THAN 250 TO GREATER THAN 1000 PPM SULPHATES.

5 0 5 10
SCALE IN MILES

VOLUME II FIGURE B-18

METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
GROUND WATER QUALITY

U.S. ARMY ENGINEER DISTRICT OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

very thick and extensive sandstones and limestones underlying the Missouri River basin is variable; dissolved solids range from less than 250 ppm to more than 4,000 ppm, chlorides range from less than 150 to more than 600 ppm, and sulfates range from less than 250 to more than 1,000 ppm.

Although the entire region is underlain with abundant ground-water resources, the quantity and quality differences make some areas more desirable than others. The most desirable areas for ground-water resource development would appear to be along the Platte, Elkhorn, Missouri, and Boyer Rivers flood plains and along the eastern portions of Pottawattamie and Mills Counties. Within the more desirable areas, differences in quality are insignificant.

Water supply systems in the study area are of three types: municipal, private, and rural water districts. At present, only one rural water district is in operation; it is Cass County, Nebraska. In general, incorporated areas are served by municipal well systems, with unincorporated areas and farms served by private wells. The Omaha Metropolitan Utilities District (MUD) and the Council Bluffs City Water Department are the two major water suppliers in the study area. They supply 86 percent of the area's present municipal and rural water requirements. There are 53 other municipal water-supply systems in the study area. The current supply sources of the Omaha system are the Florence Treatment Plant, which uses the Missouri River for a raw water source and has a capacity of 170 mgd, and the Platte River South Plant which uses Platte River ground water and has a capacity of 60 mgd. Council Bluffs obtains its water from the Narrows Treatment Plant on the Missouri River. The existing plant capacity is 17 mgd. The existing water supply capability in the study area is shown in table B-41.

Table B-41
1973 Study Area Water Supply Capabilities
(million gallons per day)

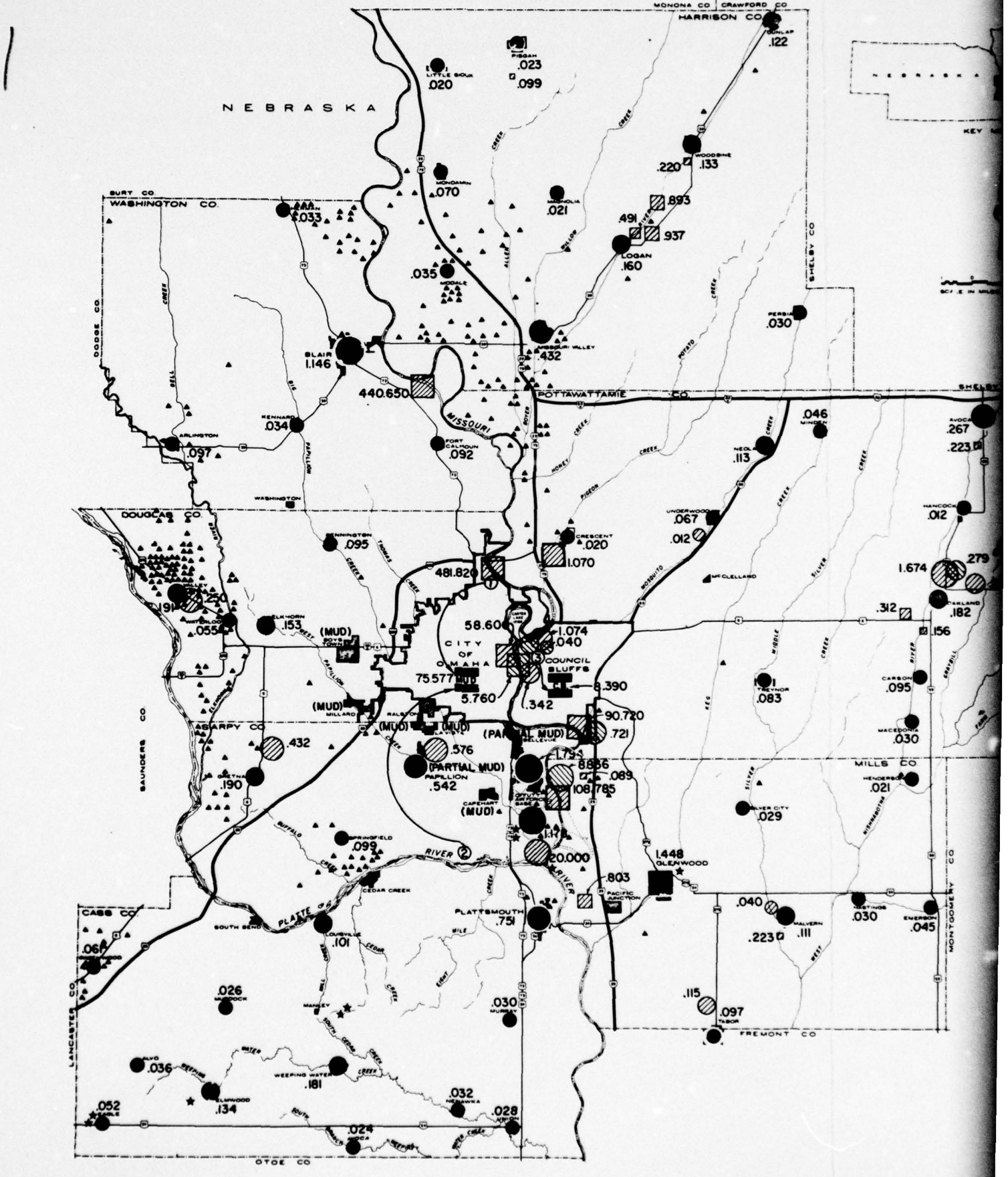
Municipal	
Well Supplies	100.06
Surface Supplies	158.00
Industrial	
Well Supplies	43.23
Surface Supplies	1,647.14
Agricultural Crop Irrigation	
Well Supplies	525.23
Surface Supplies	83.14
Total	2,556.80

The total water demands in the seven-county study area are shown in table B-42. The location and relative magnitude of water demands are shown on figure B-19.

Table B-42
1973 Water Demands in the Study Area
(average million gallons per day)

Residential	69
Industrial/commercial	57
Power plant (cooling)	1,179
Irrigation	42
Livestock	9

Municipal systems supplied approximately, on an average day, 95 million gallons, 70 percent for residential use and 30 percent for industrial and commercial use. An additional 28 million gallons per day was self-supplied by industries. Water for powerplant cooling and for agriculture is largely supplied by individual systems. Approximately 90 percent of total water demands in the study area is generated in Omaha-Council Bluffs.


NEBRASKA
MONONA CO
CRAWFORD CO
HARRISON CO
SHELBY CO
WASHINGTON CO
BURT CO
DODGE CO
SAUNDERS CO
DOUGLAS CO
SARPY CO
POTTAWATTAMIE CO
MILLS CO
MONTGOMERY CO
FREMONT CO
CASS CO
LANCASTER CO
OTOE CO
CITY OF OMAHA
COUNCIL BLUFFS
PLATTSMOUTH
GLENWOOD
BLAIR
1.146
440.650
481.820
58.600
1.074
.040
75.577
5.760
.342
8.390
90.720
.721
1.793
8.896
.089
108.785
20.000
1.448
.803
.751
.542
.576
.432
.190
.099
.101
.026
.030
.036
.181
.134
.052
.024
.032
.028
.055
.191
.250
.153
.095
.034
.097
.092
.020
.070
.033
.035
.023
.099
.122
.133
.220
.893
.491
.937
.160
.021
.030
.432
.046
.267
.223
.113
.067
.012
.020
1.070
.279
1.674
.182
.312
.156
.083
.095
.030
.021
.029
.040
.223
.111
.030
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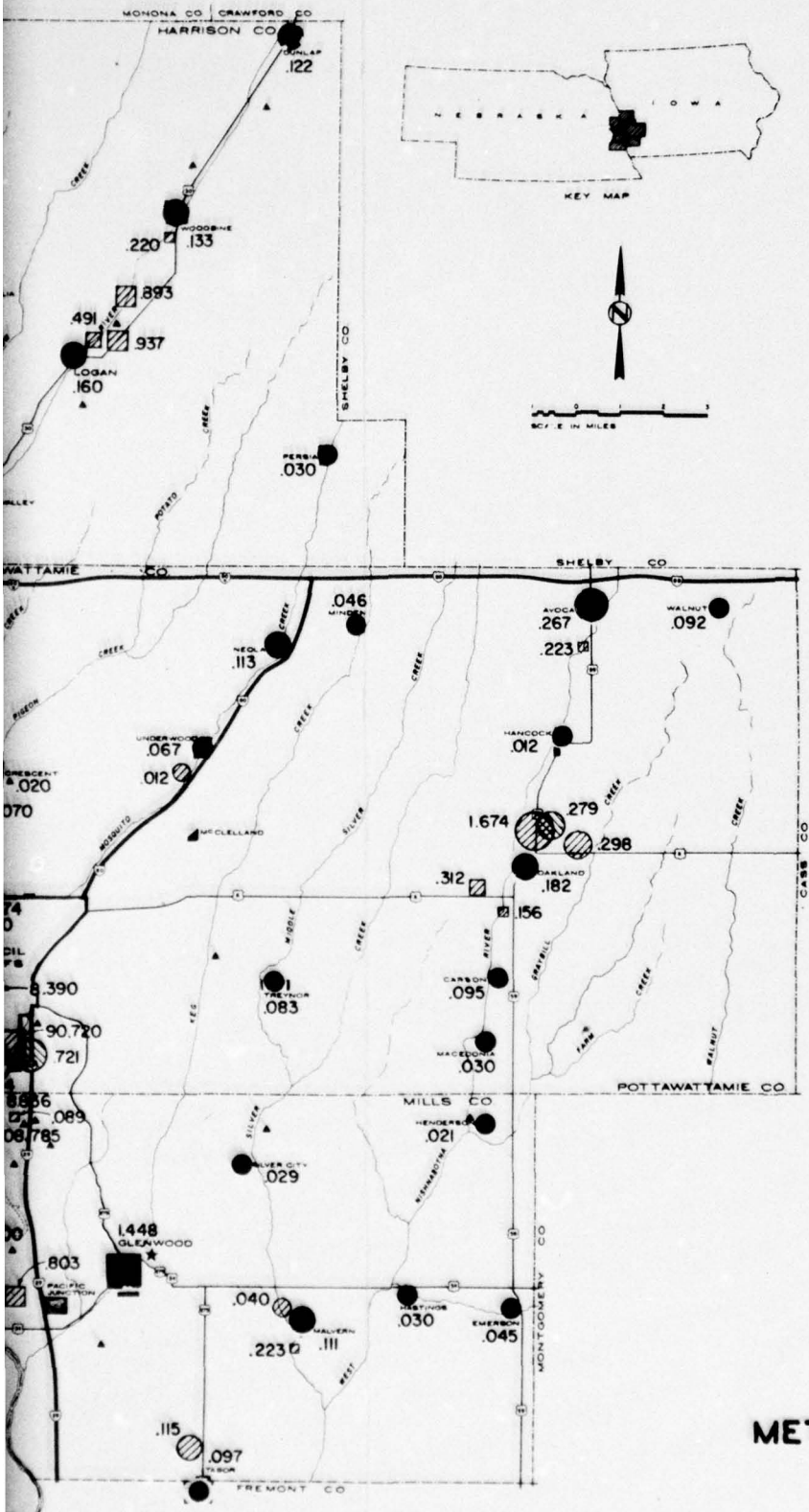
.115
.097
.012
.117



LEGEND

- MUNICIPAL - GROUND SUPPLY
- MUNICIPAL - SURFACE & GROUND SUPPLY
- INDUSTRIAL - GROUND SUPPLY
- INDUSTRIAL - SURFACE SUPPLY
- IRRIGATION WELL
- FEEDLOT & MISC. LARGE WELLS

AVERAGE DAY USAGE

- < 0.100 MGD
- 0.100 - 0.249 MGD
- 0.250 - 0.449 MGD
- 0.500 - 1.000 MGD
- > 1.000 MGD

① MUD FLORENCE TREATMENT PLANT & RIVER INTAKE

② MUD PLATTE RIVER TREATMENT PLANT & WELL FIELD

③ COUNCIL BLUFFS TREATMENT PLANT, RIVER INTAKE, & WELL FIELD

METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA

REGIONAL WATER SUPPLY
USER MAP

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

JUNE 1975

VOLUME II FIGURE B-19

Of residential water use, 10 percent is used for human consumption. Lawn irrigation constitutes 20 percent of residential water use. On peak demand days, lawn irrigation accounts for 38 percent of the total water used in Omaha.

The largest self-supplied industrial use is for cooling water. Most of the cooling water is used by powerplants. Cooling is a non-consumptive use, with no significant reduction in the amount of water being returned to the resource base.

A total of 46,000 acres of agricultural land in the study area is irrigated. Average yearly irrigation use is estimated at 47,000 acre-feet or 15.275 billion gallons of water per year. Use of ground water for crop irrigation is heaviest at the confluence of the Platte and Elkhorn Rivers in Douglas County.

PRESENT PROBLEMS

From a regional consideration, quantity of water available is not critical except for some rural locations in the study area. The absolute minimum flow for the Missouri River is 5,000 c.f.s. (3,250 mgd). This supply would more than adequately serve the entire needs of the region and would be adequate for all study area projected needs. In order to provide an adequate and safe supply to all residents of the study area, location and quality of alternative supply sources for future use are the major considerations in this study.

The Omaha Metropolitan Utilities District (MUD) and Council Bluffs City Water Department supplies are treated and meet U. S. Public Health Service Drinking Water Standards. Of the 53 other municipal water supply systems in the study area, 36 do not meet

the Health Service Drinking Water Standards. In most instances, the standards are exceeded in the amounts of iron and manganese that are found in the ground waters of the region. These ground-water well supplies are found to be from moderately hard to extremely hard. Some wells are high in total dissolved solids. Some areas have potential problems with sufficient quantities of water especially during periods of drought when ground-water supplies are reduced. There are 26 municipal systems that do not disinfect their water supplies; however, this amounts to only about 6 percent of the present total municipal and rural demand. Of the municipal systems evaluated, only four, including MUD and Council Bluffs, have the desired system reliability and are safe supplies.

Table B-43 and figure B-20 indicate deficiencies by community in the study area. Unfortunately, most of the rural communities are not in locations where supplies of adequate quantity and quality exist.

The Missouri River water is of good quality with the exception of fecal coliform concentrations, indicating that other parameters, such as viruses, may be above acceptable limits. No transmission of disease through this source has been reported. Treatment of this Missouri River water becomes more difficult when sediment loads are high, particularly during spring runoff. Estimated costs for treating the Missouri's surface water are $15.50 per million gallons. This cost compares to $9.10 for treating a million gallons of Platte River ground water. It is estimated that treatment of ground water from the Missouri River flood plain would cost $22.00 per million gallons. Urban expansion away from the river and the lower cost of treating the Platte River ground water have led to development of this resource as a supply for Omaha.

Table B-43
MUNICIPAL WATER SUPPLY RELIABILITY ASSESSMENT

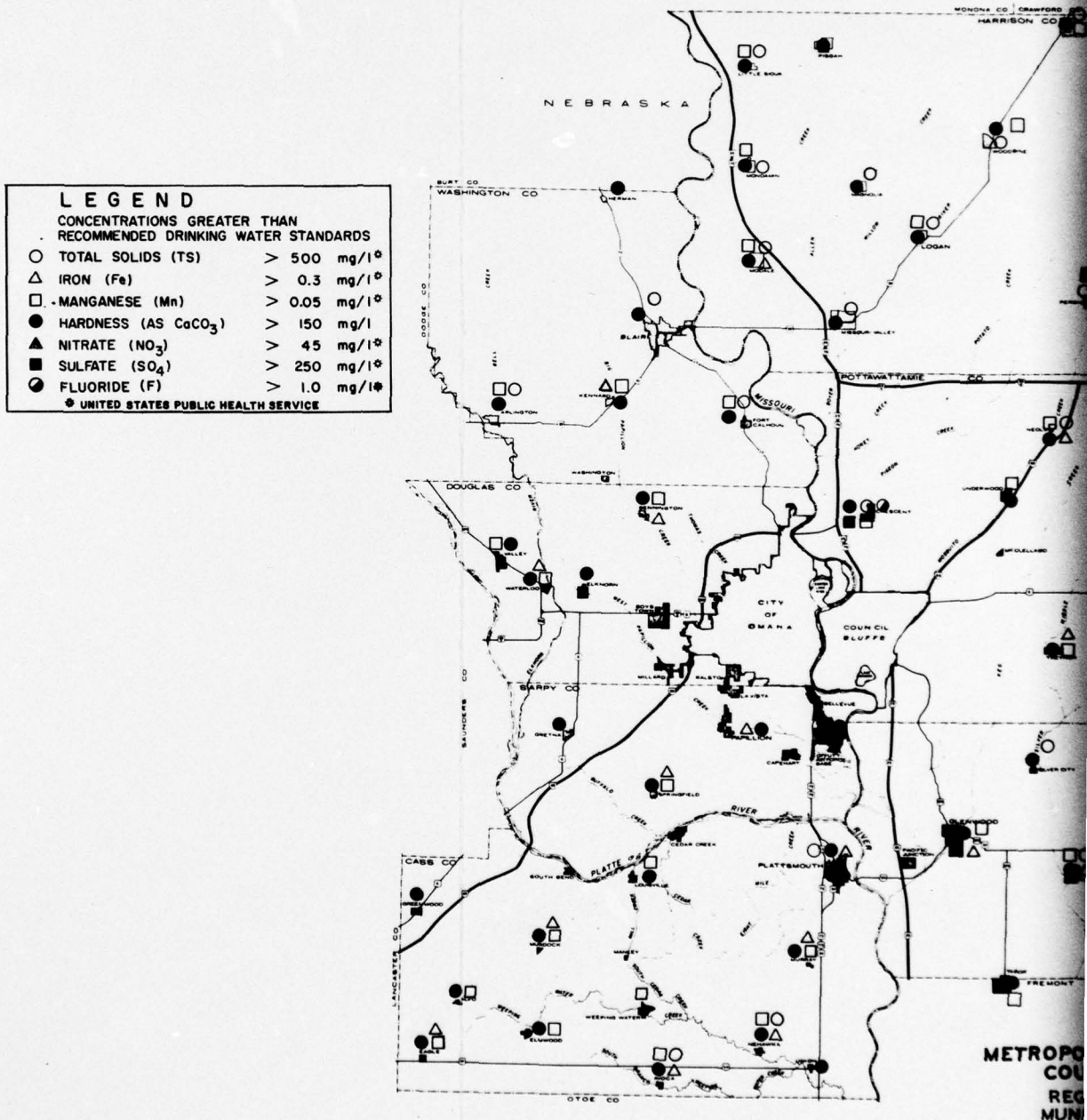
COUNTY	CITY	INADEQUATE SUPPLY CAPACITY	INADEQUATE STORAGE CAPACITY	NO AUXILIARY STAND-BY FACILITIES	INADEQUATE WATER QUALITY	NO DISINFECTION	EXISTING PLAN OR WATER SUPPLY STUDY
CASS							X
	ALVO	X	X	X	X	X	X
	AVOCA	X		N/A	X	X	
	EAGLE	N/A	X	N/A	X	X	
	ELMWOOD	X	X	X	X	X	
	GREENWOOD		X			X	
	LOUISVILLE		X	X	X	X	
	MURDOCK		X	N/A	X	X	
	MURRAY			N/A	X	X	
	NEHAWKA	X		N/A	X		
	PLATTSMOUTH				X		X
	UNION			N/A		X	
	WEEPING WATER	X		X	X	X	
DOUGLAS							
	BENNINGTON			X	X	X	X
	ELKHORN					X	X
	VALLEY		X	N/A	X	X	
	WATERLOO		X	N/A	X	X	
SARPY							
	BELLEVUE						X
	PAPILLION		X		X		X
	SPRINGFIELD		X	N/A	X	X	X
	GRETNA		X	N/A		X	X
WASHINGTON							X
	ARLINGTON		X	N/A	X	X	X
	BLAIR				X		X
	FORT CALHOUN	X		N/A	X		X
	HERMAN			N/A			
	KENNARD	X	X	X	X	X	

N/A NOT AVAILABLE

Table B-43 (Cont'd)
MUNICIPAL WATER SUPPLY RELIABILITY ASSESSMENT

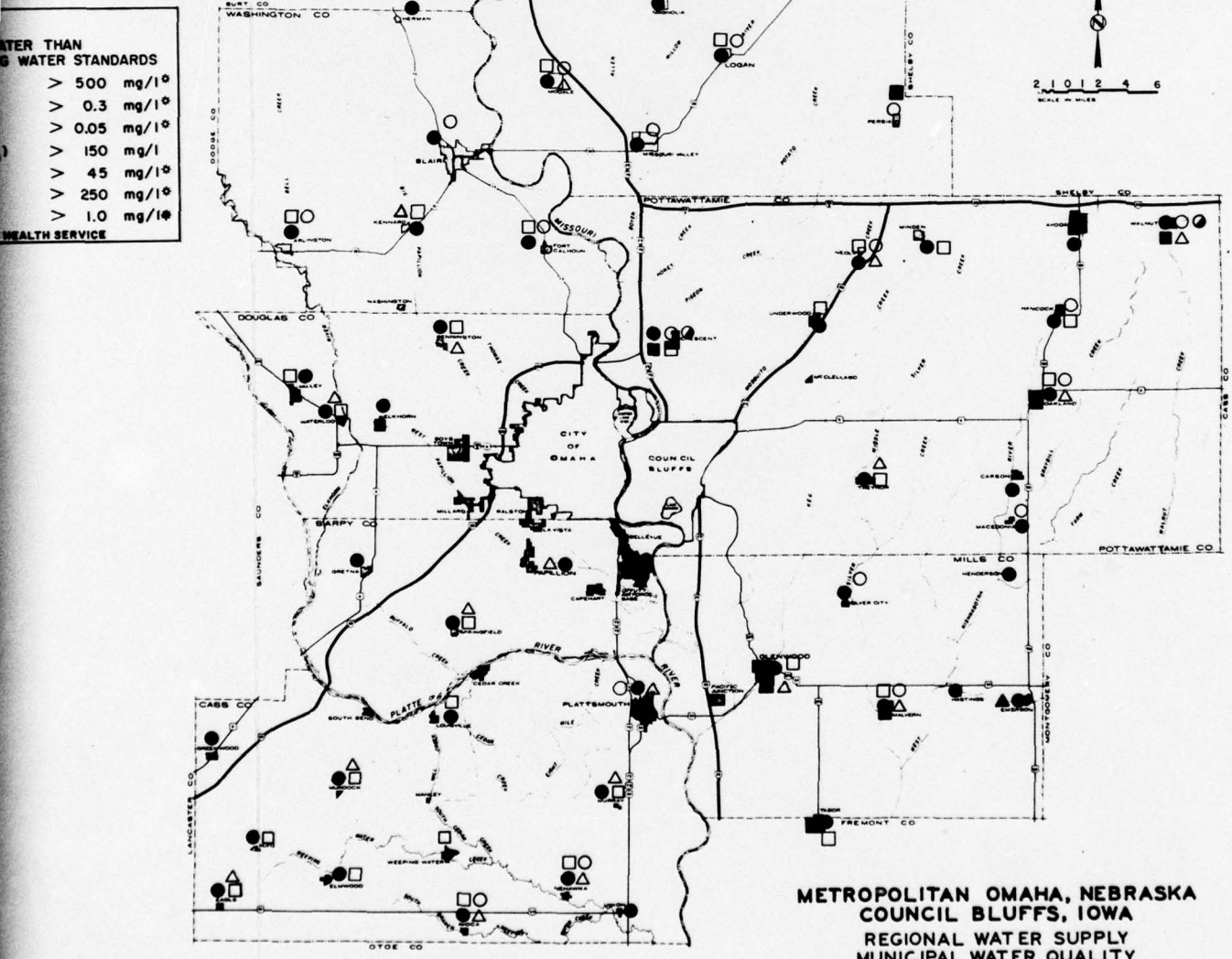
COUNTY	CITY	INADEQUATE SUPPLY CAPACITY	INADEQUATE STORAGE CAPACITY	NO AUXILIARY STAND-BY FACILITIES	INADEQUATE WATER QUALITY	NO DISINFECTION	EXISTING PLAN OR WATER SUPPLY STUDY
HARRISON							X
	DUNLAP		X	N/A	X	X	X
	LITTLE SIOUX	X		N/A	X		
	LOGAN			X	X		
	MAGNOLIA	X	X	N/A	X		
	MISSOURI VALLEY		X	X	X		
	MODALE		X	N/A	X		
	MONDAMIN			N/A	X		
	PERSIA			X	X		
	PISGAH			N/A		X	
	WOODBINE		X	X	X		
MILLS							X
	EMERSON			X	X	X	
	GLENWOOD		X	N/A	X		X
	HASTINGS	X		N/A		X	
	HENDERSON	X		X		X	
	MALVERN		X	N/A	X		X
	SILVER CITY		X	N/A	X		
	TABOR			N/A	X		
POTTAWATTAMIE							X
	AVOCA		X	N/A			X
	CARSON	X	X	N/A			
	CRESCENT	X		X	X		
	HANCOCK			N/A	X	X	
	MACEDONIA			X	X	X	
	MINDEN			N/A	X		
	NEOLA		X	N/A	X		
	OAKLAND		X	N/A	X		X
	TREYNOR		X	X	X	X	
	UNDERWOOD	X	X	N/A	X	X	
	WALNUT		X	X	X		

N/A NOT AVAILABLE



METROPO
COU
REG
MUN

U. S. ARM
CORPS OF



ATER THAN
G WATER STANDARDS

>	500	mg/l*
>	0.3	mg/l*
>	0.05	mg/l*
>	150	mg/l
>	45	mg/l*
>	250	mg/l*
>	1.0	mg/l*

HEALTH SERVICE

METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
REGIONAL WATER SUPPLY
MUNICIPAL WATER QUALITY

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

JUNE 1975

VOLUME II FIGURE B-20

PROJECTED PROBLEMS

Future water demands were projected on the basis of the population projections discussed earlier and on increased demands developed for MUD's and Council Bluffs' master plans. The 1995 and 2020 water demands are indicated in table B-44. Water usage is expected to increase 250 percent by 2020 and municipal water demands of the study area are expected to increase by 2020 to an average of 238 mgd. The increase is due not only to a growing population, but also to rising per capita use. Future municipal water usage is expected to be 31 percent industrial-commercial, 31 percent out-of-house residential, and 56 percent in-house residential. Nonagricultural rural demands will increase somewhat with the introduction of safe reliable rural water district service. Agricultural livestock watering demand will nearly triple, reaching 23 mgd by 2020. Quantities of water used for crop irrigation will be dependent upon State regulatory agency policy in granting new irrigation well and surface water diversion permits and based upon available data. Major self-supplied industries that use substantial quantities of water which may affect future regional water availability are power generation and coal gasification. Alternative growth concepts substantially influence water demand centers. Although metropolitan area per capita new-growth residential demand varies 6.5 percent between two growth concepts, total metro-system water requirements vary less than 1 percent.

To meet these increased demands, Omaha (MUD) plans to increase the capacity of the two existing treatment plants and, with continued westward population expansion, to construct an additional well field and treatment facility on the Platte River west of Omaha near Valley, Nebraska. The Florence Treatment Plant will be increased to 190 mgd in about 1982. The new Platte River valley Treatment Plant

TOTAL STUDY AREA

Table B-44

PRESENT AND FUTURE WATER DEMANDS, MGD

MUNICIPALITIES	1973		1995		2020	
	AVERAGE DAY	MAX. DAY	AVERAGE DAY	MAX. DAY	AVERAGE DAY	MAX. DAY
SERVED BY MUNICIPAL SYSTEM						
RESIDENTIAL						
IN-HOUSE	53.459	69.495	89.398	116.216	127.072	165.192
LAWN IRRIGATION	12.572	69.457	21.522	144.402	30.651	210.166
INDUSTRIAL-COMMERCIAL	29.295	50.814	55.376	101.933	71.654	125.197
TOTAL	95.326	189.766	166.296	362.551	229.377	500.555
SERVED BY RURAL WATER DISTRICT						
RESIDENTIAL						
IN-HOUSE			3.512	4.565	4.155	5.401
LAWN IRRIGATION			.622	4.226	.740	4.873
INDUSTRIAL-COMMERCIAL			2.754	4.133	3.572	5.359
TOTAL			6.888	12.924	8.467	15.633
TOTAL MUNICIPAL	95.326	189.766	173.184	375.475	237.844	516.188
RURAL						
SERVED BY PRIVATE SYSTEM						
RESIDENTIAL						
IN-HOUSE	2.827	3.676	1.262	1.640	.778	1.012
LAWN IRRIGATION	.501	2.980	.224	1.333	.138	.820
TOTAL	3.328	6.657	1.486	2.973	.916	1.832
SERVED BY RURAL WATER DISTRICT						
RESIDENTIAL						
IN-HOUSE			2.815	3.659	2.815	3.659
LAWN IRRIGATION			.497	2.965	.497	2.965
TOTAL			3.312	6.624	3.312	6.624
LIVESTOCK WATERING BY PRIVATE SYSTEM	8.794	17.588	7.875	15.750	15.340	30.680
LIVESTOCK WATERING BY RURAL WATER DIST.			7.525	15.050	7.525	15.050
TOTAL RURAL	12.122	24.245	20.198	40.397	27.093	54.186
TOTAL RURAL AND MUNICIPAL	107.448	214.011	193.382	415.872	264.937	570.374
CROP IRRIGATION	42.042	274.023	58.019	378.152	72.577	493.243
SELF SUPPLIED INDUSTRIES						
POWER PLANTS						
COOLING WATER	1178.567	1567.144	2007.720	2499.944	N.A.	N.A.
OTHER	2.732	4.053	2.36	8.018	N.A.	N.A.
OTHER INDUSTRIES	28.044	42.066	28.044	42.066	28.044	42.066
TOTAL INDUSTRIES	1209.343	1613.268	2038.124	2550.028	28.044	42.066
RECREATIONAL						
TOTAL	1358.833	2101.302	2289.525	3344.052	365.558	1105.683

scheduled for 1993 will be 50 mgd and the Platte River South Treatment Plant will be increased to 80 mgd in 1995. Late in the planning period, additions are planned for the Florence and Platte River Valley locations of 50 mgd each. The Council Bluffs Water Works plans to provide additional supply and treatment by expansion of the Narrows Plant. It is expected the increased capacity will be needed by 1980. To correct deficiencies, all the counties have water supply and distribution plans. Harrison, Mills, and Washington Counties have plans for the development of county-wide treatment and distribution systems, interconnecting the smaller communities, and for providing service to most rural areas. Although few communities have a large projected population growth, these plans can provide a sufficient quantity of acceptable quality water to smaller communities and rural areas.

Increased population and consumption will tend to create the following future problems.

Conflicts Over Water Resources. This applies particularly in the lower Platte Valley. As Omaha expanded westward, the desirability for additional well field development on the Platte River has increased. Platte River ground and surface flows are also desired by the city of Lincoln, by irrigation interests, and for fish and wildlife maintenance purposes. The city of Lincoln presently has its well field located near Ashland, northwest of the Salt Creek-Platte River intersection. According to Lincoln's long range water system master plan, maximum daily demands at Ashland will increase from 55 mgd in 1970 to 90 mgd by 1985, 130 mgd by the year 2000, and as high as 190 mgd by 2020. The seven-county study area, including the Metropolitan Utilities District will have an additional average day municipal supply requirement of over 100 mgd to meet 2020 demands.

Taking into consideration Lincoln's projected water needs, the low river flows, and the available storage of water in the aquifer, a new supply of 136 mgd for Metropolitan Omaha could be developed at the Valley site. This new supply would have to rely on both river flow and on Platte River ground-water aquifers that depend on surface flow for direct recharge. Water taken from a westerly supply along the Platte River would be lost, however, so far as Lincoln's supply is concerned, as the unconsumed water from Omaha will be returned to the Missouri River.

Of particular significance are the tentative findings regarding the available water supply from the Platte River. The Missouri River Basin Commission's Platte River Level "B" Study, while not completed, does indicate that the lower Platte River would be "dried-up" by additional irrigation development for periods of one or more months during future dry years. Aquatic life and riparian habitat are also affected when flows are reduced below a certain quantity. The 1973 fish-kill emergency exemplified this effect. If even the existing Platte River water supply sources for the cities of Omaha and Lincoln are to be protected, an affective management and "protected flow" system for Nebraska is an absolute necessity. This system could determine surface and ground water amounts allocated to municipal/industrial, irrigation, and fish and wildlife uses.

The 1973 drought highlighted this competition. Flow maintenance problems in the Platte River are projected to worsen without adequate controls.

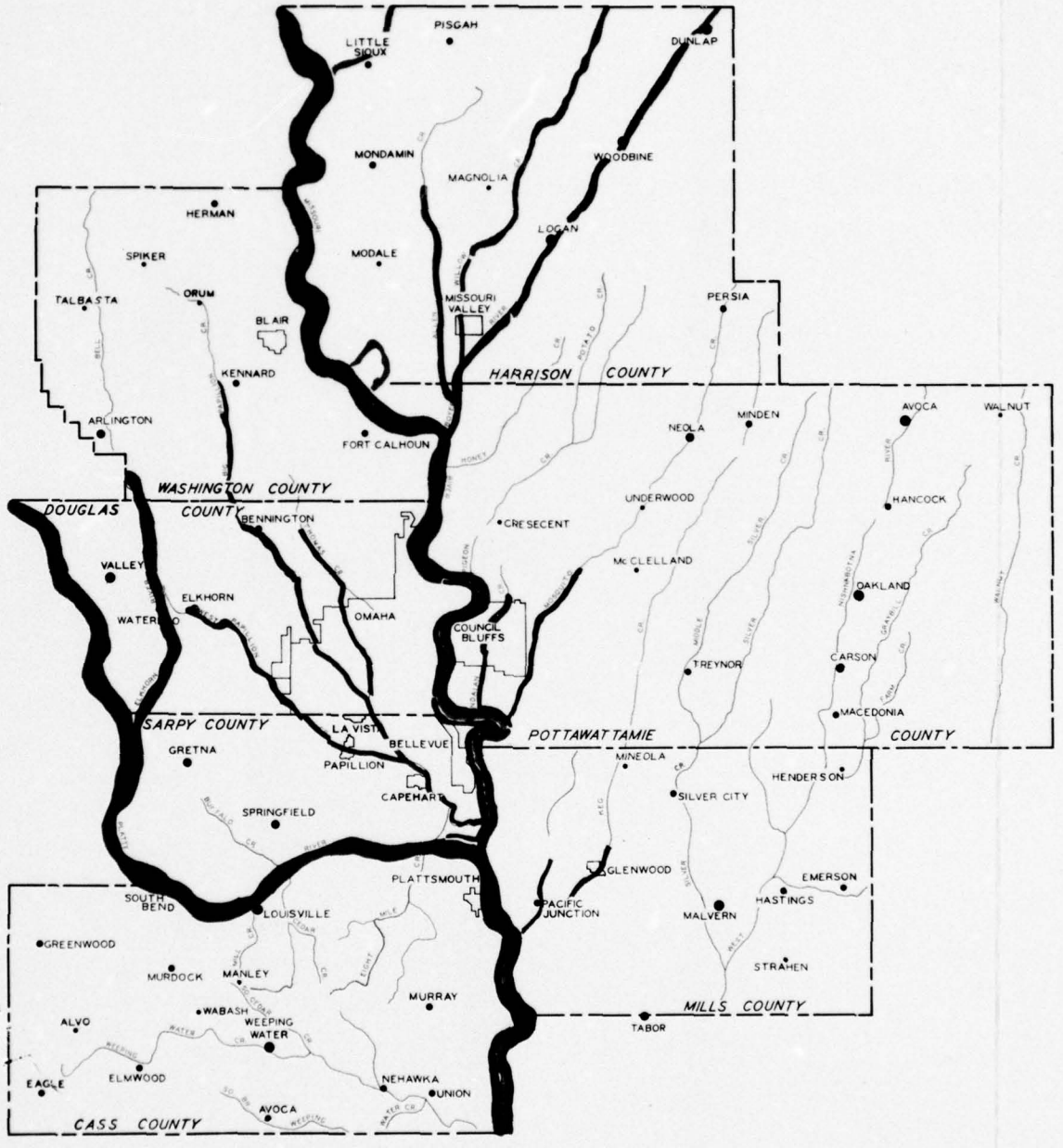
Increased Consumer Water Costs. Rising costs of labor, materials, energy, and chemicals indicate that the cost of water will increase along with the costs of all other public utilities.

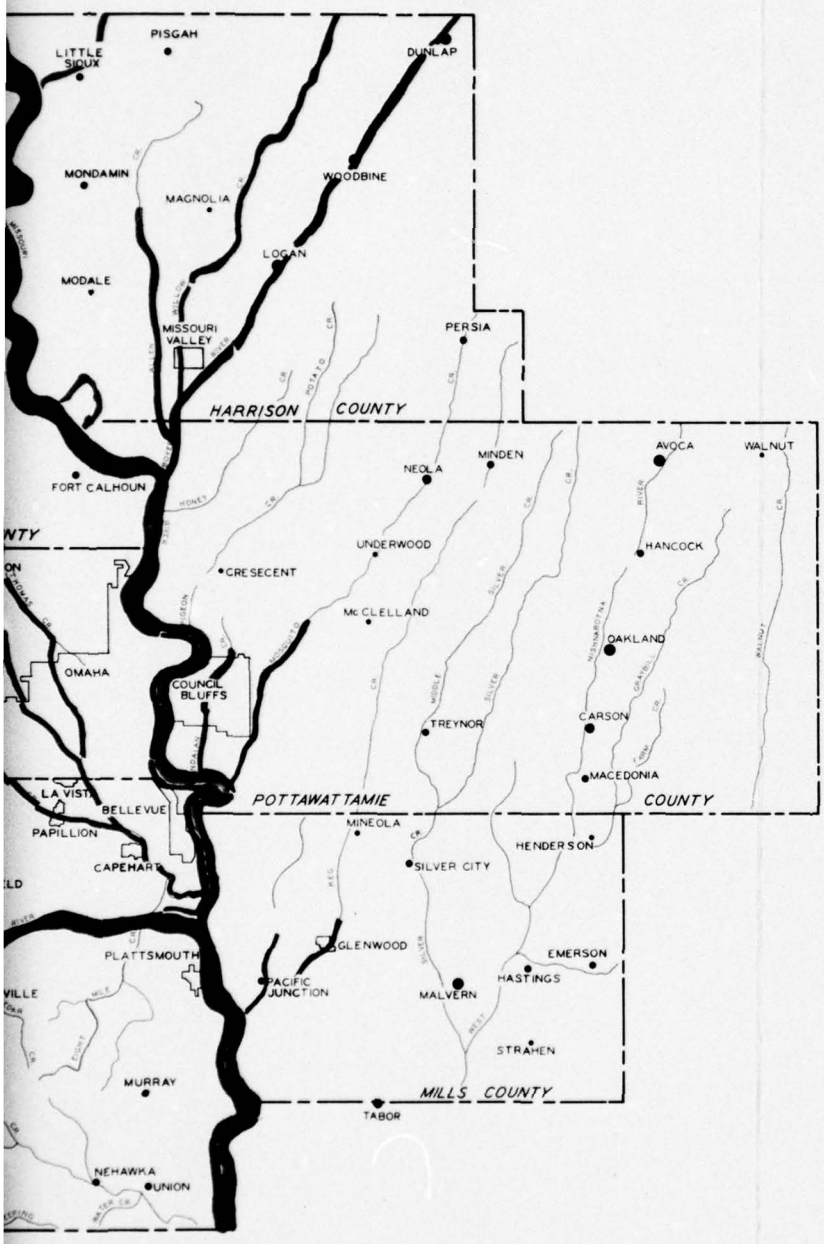
Increased Sewage Treatment Costs. Much of the water that is used ends up at the sewage treatment plant. Rising costs of labor, energy, materials, and chemicals in conjunction with stricter environmental standards will cause sewer use fees to increase in the future.

The above items indicate that it is time to reanalyze our water consumption trends with the idea of reducing water demands particularly during peak periods.

FLOOD CONTROL AND FLOOD PLAIN MANAGEMENT

Flooding can occur near the urban area along the Missouri, Platte, Elkhorn, and Boyer Rivers, and Mosquito Creek. Within the urban area, flood hazards originate in the Papillion Creek basin and on Indian Creek. Future urbanization would increase the flood hazard potential. As an indication of relative flood hazard, the map shown on figure B-21 defines the flood potential by frequency of occurrence in years. The study area streams discussed include the Missouri River, the Platte and Elkhorn Rivers, the Iowa tributaries including the Boyer River, Mosquito and Indian Creeks, and the Papillion Creek basin system.


PISGAH
LITTLE SIOUX
DUNLAP
MONDAMIN
MAGNOLIA
WOODBINE
HERMAN
LOGAN
SPIKER
MODALE
TALBASTA
ORUM
MISSOURI VALLEY
PERSIA
BLAIR
KENNARD
HARRISON COUNTY
ARLINGTON
FORT CALHOUN
NEOLA
MINDEN
AVOCA
WALNUT
WASHINGTON COUNTY
DOUGLAS COUNTY
BENNINGTON
UNDERWOOD
HANCOCK
CRESECENT
VALLEY
McCLELLAND
ELKHORN
OAKLAND
WATERLOO
OMAHA
COUNCIL BLUFFS
TREYNOR
CARSON
SARPY COUNTY
LA VISTA
POTTAWATTAMIE COUNTY
MACEDONIA
GRETNA
BELLEVUE
PAPILLION
MINEOLA
HENDERSON
CAPEHART
SILVER CITY
SPRINGFIELD
GLENWOOD
EMERSON
PLATTSMOUTH
SOUTH BEND
LOUISVILLE
PACIFIC JUNCTION
MALVERN
HASTINGS
GREENWOOD
MURDOCK
MANLEY
STRAHEN
MURRAY
WABASH
ALVO
WEEPING WATER
MILLS COUNTY
TABOR
EAGLE
ELMWOOD
NEHAWKA
UNION
AVOCA
CASS COUNTY
5 0 5 10
SCALE IN MILES



N

LEGEND

POPULATION SYMBOLS
- 0 - 200
- 200 - 500
- 500 - 1,000
- 1,000 - 2,000
- 2,000 AND OVER

COUNTY OUTLINE

HIGH FLOOD RISK (10 YR. PROBABILITY)

MEDIUM FLOOD RISK (10 YR. - 100 YR. PROBABILITY)

LOW FLOOD RISK (LESS THAN 100 YR. PROBABILITY)

5 0 5 10
SCALE IN MILES

METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
URBAN AREA FLOOD HAZARD

U.S. ARMY ENGINEER DISTRIST OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

MISSOURI RIVER

The flood hazard on the main stem of the Missouri River has been dramatically reduced as a result of the constructed projects, including the main stem reservoirs, bank stabilization, and the agricultural and Federal levees. The flood problem varies on the Missouri River according to the flood generating potential of tributaries downstream from the main stem reservoirs and the degree of protection afforded by levees. The flood area through the presently urbanized areas of Omaha and Council Bluffs is confined between the levees protecting these cities. Outside of the leveed areas, the potential flood area from major floods could extend from bluff to bluff.

The river extends to about 20 miles through the urban reach, with the remainder devoted to agriculture. Federal levees, where completed, provide standard project flood protection along the Missouri River. There are numerous locally-constructed levees along the river. Some of these provide significant flood protection, but many provide a relatively low degree of protection or receive inadequate maintenance. Local levees immediately upstream from Omaha, for instance, may fail in a flood of 10-year frequency.

Increased intensity of development in the flood plain, or upward shifts in rating curves due to changes in stream regimen, could produce a greater potential of damage in areas of low protection. Some of the remaining flood hazard is caused by the tributaries.

PLATTE AND ELKHORN RIVERS

The Platte River valley is wide and flat, with considerable overbank storage available. This results in attenuation of overbank discharges as the flows move downstream. Floods in the Platte River basin occur primarily from runoff from the contributing drainage areas between North Platte, Nebraska and the mouth of the Platte River. Records over the past years indicate that 22 percent of the flow that passes Ashland, Nebraska originates from the Elkhorn River basin. The flood history of the Platte River study area includes 22 floods on the Platte River since 1930.

The most severe flood of recent years on the Platte River in the study area occurred in March-April 1960. This flood inundated an area 1.5 to 3 miles wide upstream from Interstate 80 and averaged 1 mile wide downstream from the interstate. The area flooded covered about 50,000 acres. The flood of record on the Elkhorn River occurred in June 1944; it flooded an area averaging 1.5 miles wide through the study area. About 15,000 acres were inundated. Flooding is often compounded by ice jams.

Land use in the Platte River and Elkhorn River flood plains is predominantly agricultural. The remainder of the area contains gravel pits, recreation lands, urban lands, and transportation rights-of-way. The communities of Valley and Waterloo lie in this area and are flooded by the larger floods. The unincorporated community of King Lake is flooded by overflows from the Elkhorn River. The flood plain is traversed by several railroads, by numerous Federal and State highways, and by county roads, all of which are subject to flood damage.

Three primary factors, the construction of Interstate 80, the recreational potential of the Platte River and Elkhorn River, and urban growth, have caused significant land use changes within the flood plain. Omaha has been expanding westward towards the common Elkhorn River - Platte River flood plain. Recent urban expansion into the flood plain in the form of recreational and scenic-oriented suburban residential developments, such as the Riverside Lake Development, Buccaneer Bay, and Ginger Cove, has increased the threat to human life.

In the absence of suitable flood protection of flood plain zoning measures, flood-prone areas will continue to experience severe and costly damages.

Average annual flood damages on the lower Platte River are relatively low, having been estimated in terms of unit damage per acre as $4.07. The overall existing flood problems are relatively minor, even though floods occur almost annually. The flood plain is rapidly developing, however, due to its obvious economic locational advantage and environmental attractiveness. Continued development in this area would result in potential damages far greater than those historically experienced. Although the four alternative growth concepts do not delineate extensive urban development in this flood plain, it is strongly suspected that uncontrolled urban sprawl would allow such development. The several recent urban developments along the Platte-Elkhorn Rivers are indicative of such an occurrence.

IOWA TRIBUTARY STREAMS

These streams are the Boyer River and Honey, Pigeon, Indian, Mosquito, and Keg Creeks. Flooding in these basins has been infrequent and confined mainly to agricultural lands. Frequency and damage caused would not justify construction of flood control measures. There is a real opportunity to implement flood plain regulations in these areas. Proper zoning would reduce future damages and eliminate the need for any structural solutions. The principal problems are on the Boyer River, and on Indian and Mosquito Creeks, due to existing or potential urbanization.

BOYER RIVER

The major flood problem in the Boyer River basin is ice jam flooding in the reach from Missouri Valley to the mouth. Missouri Valley is located at the confluence of the Boyer River and Willow Creek. Floods in the vicinity of Missouri Valley are most frequently the result of ice jams during early spring snowmelt runoff. During this period of annual ice breakup, iceflows from the Boyer River and Willow Creek accumulate against unbroken ice in the backwater areas of the Missouri River. Locally constructed levees often fail and large areas in and adjacent to Missouri Valley are flooded. Flood depths in the town of Missouri Valley have reached up to 5 feet. Approximately 19,000 acres of land, mostly agricultural, in the Missouri River flood plain are subject to frequent inundation caused by ice jams along the Boyer River. An additional 14,000 acres of land are subject to flooding from ice jams upstream from Missouri Valley on both Willow Creek and the Boyer River. In 1949 and 1965, ice jam floods caused an estimated $2,270,000 and $850,000 in damages, respectively. Average annual flood damages are estimated to be $200,000. Future development in the basin would

increase these damages significantly. The flood hazard potential has been a limiting influence on the growth of Missouri Valley. Future development in the area would require measures for controlling or reducing potential flood damages.

A total of 324 residences, 105 business places, the municipal powerplant, sewage treatment lagoon, water works, and local government buildings are located in the flood plain. The age of residences in the flood plain ranges from 30 to 100 years, and the condition of residences and businesses is deteriorating and many are being vacated. Residents of Missouri Valley are either lower income persons or retired persons. Local officials are convinced that the flood problem has contributed to the overall decline of the community. Our studies confirm that the flood problem is a major factor in limiting the location of new houses and businesses in Missouri Valley. Missouri Valley was projected as a future satellite city under growth concept B.

MOSQUITO CREEK

Mosquito Creek is a minor left-bank tributary of the Missouri River and drains an area of 234 square miles upstream from the Missouri River flood plain. The basin is long and narrow, averages about 5 miles in width, and extends from the Missouri River southeast of Council Bluffs to Crawford County, a distance of about 55 miles. Flooding along Mosquito Creek is apparently infrequent. A moderate flood was recorded in June 1947 at the downstream end of the creek. At the present time, the land use in the Mosquito Creek valley is practically all agricultural, with little urban development. The Mosquito Creek channel is fairly large, with capacities ranging from the 5-percent to the 7-percent flood in the downstream

reaches. The channel capacity is about half the discharge of the 1-percent flood. In a major flood, such as the 1-percent flood or the standard project flood, the Mosquito Creek valley, averaging 1,000 to 2,000 feet wide, could be included in the flood area. Topographic surveys are required to define the flood areas and depth of flooding. No previous studies have been made on Mosquito Creek. High floodwater in the past has had an erosive effect on bridge abutments, and on levee, railroad, and highway embankments.

In the flood plain upstream from Council Bluffs, the principal land use is cropland, with very few farmsteads. Other damageable developments include State and local highways and bridges and railroads. Minor urban encroachment has occurred at the towns of Portsmouth, Persia, Neola, and Underwood. In the downstream half of the basin, from the town of Neola to the Missouri River flood plain, preliminary estimates indicate more than 3,000 acres lie in the flood plain. A major flood could cause damages in excess of $1,000,000. In the immediate Council Bluffs area, from the Missouri River flood plain to about 6 miles upstream, about 800 acres of predominately undeveloped land could be subject to a major flood. Development in this area has been confined to the hilly areas adjacent to the Mosquito Creek valley, with only a few residences located in the lower flood plain.

The downstream 4 miles of Mosquito Creek flow across the Missouri River flood plain, where 1-percent protection is provided by the Mosquito Creek levee, which is part of the Missouri River levee system.

INDIAN CREEK

Indian Creek, a minor left-bank tributary of the Missouri River, drains an area of 15 square miles. The stream rises about 4 miles north of Council Bluffs and flows in a southerly direction through the center of the city to the Missouri River.

Flooding on Indian Creek is caused entirely by high intensity rainfall of short duration and rapid concentration of runoff. The main problem is a covered concrete channel which runs for 1.4 miles through the Council Bluffs central business district. The slope of the channel downstream from the covered conduit is about 2.9 feet per mile compared to an average upstream slope of 21.5 feet per mile. This change in gradient can result in heavy sediment deposits which reduce the channel capacities in the downstream reaches. The topographic characteristics of the drainage area and the inadequate capacity of the channel through Council Bluffs can lead to potentially high damages to a major portion of the city from the more infrequent storm event. The 1-percent discharge through Council Bluffs is about twice as large as the channel capacity.

Topographic mapping is required to determine the magnitude of flooding; however, it is suspected that 2,250 acres of the city are located in the Indian Creek flood plain. The Indian Creek flood plain contains 3,500 residences, 225 acres of streets, 20 acres of railroad yards, and commercial and industrial development. It is estimated that a standard project flood would cause more than $20 million in direct flood damages. When a new shopping center is completed, the damages from a standard project flood could exceed $50 million.

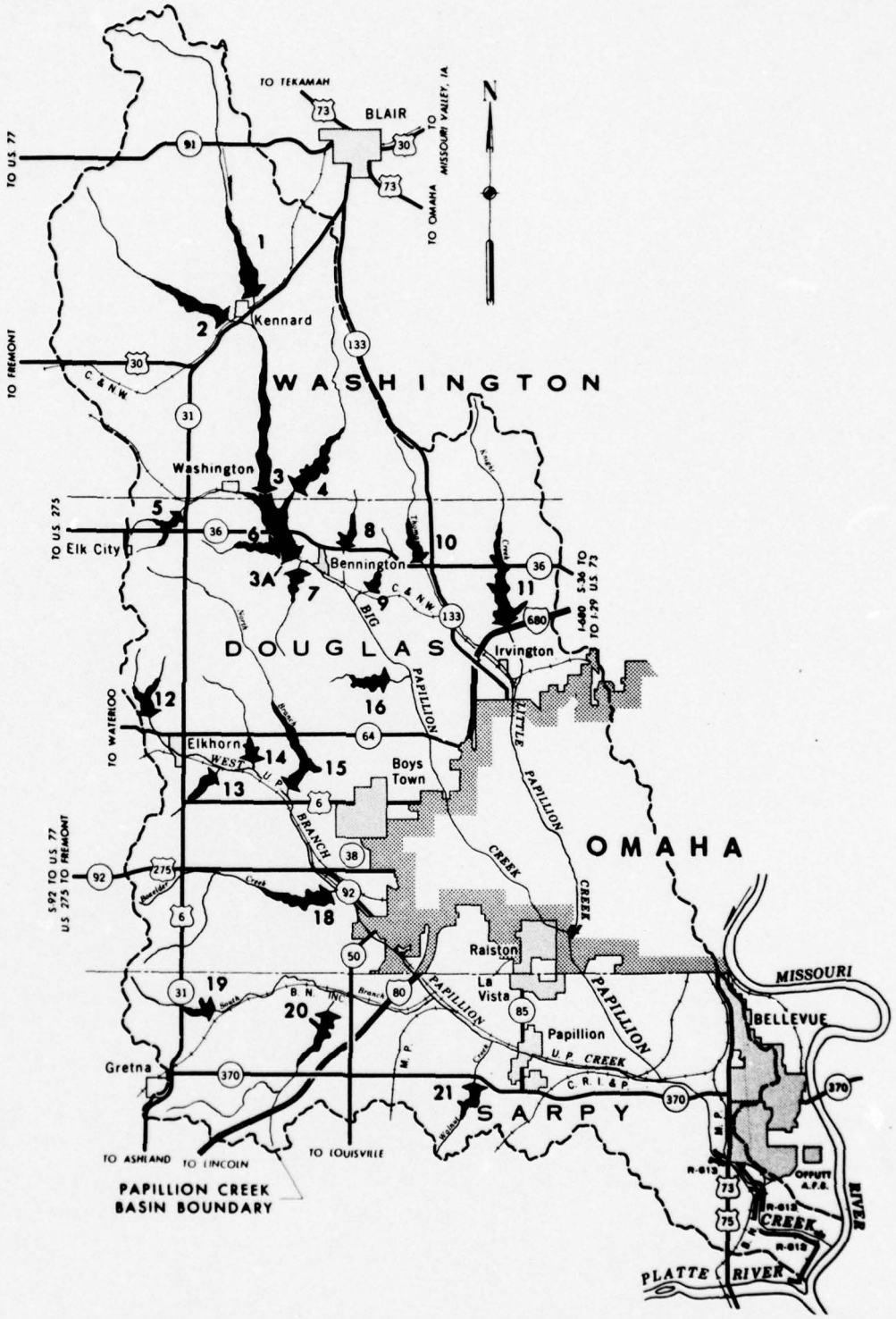
At the present time, approximately 60 percent of the basin is devoted to urban land use. There was an authorized plan for a dam and reservoir north of the city. Local interests were requested to furnish assurances of local cooperation. The 5-year limitation on the authorization ended in December 1973, and the project is de-authorized.

PAPILLION CREEK AND MAJOR TRIBUTARIES

Papillion Creek drains an area of about 402 square miles, including the western part of the city of Omaha and areas in the path of urban expansion to the south, west, and northwest of the city. Major tributaries are Little Papillion Creek, Big Papillion Creek, and West Branch Papillion Creek. A map of the Papillion Creek basin is shown on figure B-22.

The predominant factor causing floods in the Papillion Creek basin is high intensity thunderstorm rainfall. The flood plain areas of the principal streams in the basin generally average about one-half mile in width. In a few locations, usually at the junction of two streams such as the Little and Big Papillion Creeks and along Papillion Creek, the flood plain broadens to about 1 mile. The flood plain covers the spectrum of economic activity including residential, commercial, agricultural, industrial, and military components. A threat to life exists in the urban areas of the basin, as evidenced by the loss of 7 lives during the 1964 flood. It is anticipated that as Omaha and the surrounding areas develop, the number of persons subject to potential loss of life would increase.

The aggregate flooded area adjacent to the 86 miles of streams in the basin is 22,600 acres. Flood plain areas subject to flooding



METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA

PAPILLION CREEK LAKES PROJECT

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

OCTOBER 1975

VOLUME II FIGURE B-22

up to the standard project flood and existing estimated average annual damages on each stream are shown in table B-45. The damages indicated are approximate based on a current reevaluation of the 20-dam Papillion Creek and Tributaries Project.

Table B-45
Papillion Creek Basin
Flood Damages and Areas Flooded Without Reservoir Control

	Area Flooded in acres	Exis ing Average Annual Damages
Papillion Creek	6,500	$ 235,000
Big Papillion Creek	8,500	1,596,000
Little Papillion Creek	1,600	774,000
West Branch Papillion Creek	6,000	280,000
Total	22,600	$2,885,000

The authorized Papillion Creek Lakes Project, shown on figure B-22, includes 20 lakes for flood control, recreation, water quality, and fish and wildlife recreation. Of the 20 lakes, 2 would be located on Little Papillion Creek, 10 on Big Papillion Creek, and 8 on West Branch Papillion Creek. Site 16, located on a tributary of Big Papillion Creek, is essentially complete. Site 11, located on Little Papillion Creek, is nearing completion. The Papillion Creek Lakes Project is discussed in the Plan Formulation Appendix.

HELL CREEK

Hell Creek is a small left-bank tributary of the West Branch Papillion Creek and drains an area of 5.7 square miles in a suburban area near the western edge of the city of Omaha. The stream flows southeasterly for about 6 miles from its origin north of Boys Town

to its confluence with the West Branch near 114th Street. The entire basin lies in Douglas County except the first mile upstream from the mouth, which is in Sarpy County. The Hell Creek basin has been only recently urbanized, with development beginning in the early 1960's. Except for the extreme upstream and downstream ends, practically all of the basin is now covered by new residential and commercial developments.

The flood of June 1964 was particularly severe on Hell Creek, exceeding the intermediate regional flood in estimated magnitude. Due to the steep slopes, floodwater velocities were high, as evidenced by a house moved off its foundation and a garage with two of its walls torn off. The flood plain of Hell Creek averages about 500 feet in width. Urban encroachment is limited to a few residential areas in the central portion of the basin between Pacific Street and the Union Pacific Railroad.

It is estimated that about 150 residences are subject to flooding from the standard project flood and about 50 are subject to flooding from the intermediate regional flood.

COLE CREEK

Cole Creek is a left-bank tributary of Little Papillion Creek. It is a part of the Papillion Creek basin system which drains the western and southwestern parts of the Omaha metropolitan area in Washington, Douglas, and Sarpy Counties. The Cole Creek basin contains 6.1 square miles out of a total of 394 square miles for the Papillion Creek basin. Cole Creek is located in the northwestern part of the city of Omaha and flows southwesterly about 5 miles from the vicinity of 60th Street and Redick Avenue to join the

Little Papillion Creek just north of Dodge Street at 78th Street. The basin is practically all urbanized, predominantly with residential neighborhoods, except for commercial areas along major streets.

Several damaging floods have occurred on Cole Creek. Under existing conditions, varying degrees of overbank flows are likely to occur once every year. Available records indicate that floods occurred on Cole Creek in 1946, 1947, 1948, 1950, 1951, 1960, and 1965. In the flood of 6 September 1965, after a heavy thunderstorm, Cole Creek was out of its bank along much of the reach downstream from Military Avenue; this reach is the downstream 3 miles of the creek. Lawns, sidewalks, and driveways were eroded and undercut, and a considerable amount of fencing was damaged. Several basements were flooded and sewers and streets were seriously damaged. In the Cole Creek basin, intense thunderstorm rainfall during the summer months produces flash-type floods. The Cole Creek channel is lined with numerous dead or dying trees and debris. As these trees fall into the Creek, they create channel obstructions. In addition, the channel area serves as a dumping ground for refuse. Various types of street crossings also restrict the channel capacity, and these are further restricted by debris during floods. High velocity flows create erosion problems and produce deep holes downstream from culverts. These deep holes remain during normal flows and create a hazard to human life. In 1970, two children drowned in one of these deep holes.

The principal problem area lies downstream from Military Avenue to the mouth. The flood plain averages about 500 feet in width. Over 200 homes are subject to damage from the 100-year

flood. Damages from this flood are estimated at about $500,000. Average annual flood damages on Cole Creek are estimated at about $450,000.

MUD CREEK

Mud Creek is a small left-bank tributary of Papillion Creek. The Mud Creek basin begins in Douglas County in a highly developed area of South Omaha which includes the Omaha stockyards. The southern portion of the basin, in Sarpy County, has mostly residential development except for industrial and commercial developments along Highway 73-75. Mud Creek flows in a southerly direction from northwest of Bellevue to its confluence with Papillion Creek to the west of Bellevue. Through most of its length, Mud Creek flows along the west edge of Bellevue close to Highway 73-75. The basin has a length of about 4 miles, a width of about 1 mile, and drains an area of about 1,600 acres.

Local interests indicate that flooding occurs every 3 to 5 years. The most recent floods occurred in 1967 and 1971. On 20 June 1967, floodwaters flowed across and along Highway 73-75 for about 4,000 feet and caused an estimated $83,000 damage to six commercial and industrial properties and three residences. Indirect damages were caused by traffic delays and detours. The 1971 flood occurred on 10 May. This flood flowed over Highway 73-75 at Childs Road but did very little property damage.

The principal problem area is a commercial and industrial area at the western edge of Bellevue extending along Highway 73-75 from Childs Road downstream to County Highway 370, a reach of about 7,500 feet. The potential flood area ranges from 200 to 800 feet in width.

Development in the flood area includes motels, service stations, restaurants, a used car lot, a large manufacturer of reinforced concrete products, and a few residences. In this problem reach, the Creek crosses under both the Union Pacific Railroad tracks and Highway 73-75, in three double 90-degree bends. The channel is also obstructed by brush and a thick growth of weeds. Highway 73-75, a major traffic route and the main highway between Omaha and Offutt Air Force Base, is inundated during flooding. It is estimated that the intermediate regional flood would cause about $100,000 damage at current price levels, and average annual damages to structures and highway traffic would be in excess of $10,000.

BETZ ROAD DITCH

Betz Road Ditch is a small left-bank tributary of Papillion Creek and lies within the city of Bellevue, except for a short reach at the downstream end which lies in the Papillion Creek flood plain. The Betz Road Ditch basin drains 1.8 square miles in the northwest part of Bellevue and flows southwesterly to Papillion Creek. Most of the basin lies in a predominantly residential urban area and is almost fully developed. Increased runoff from urbanized areas, steep slopes, inadequate bridge openings, and greater damage potential from building in the flood plain have increased the flood hazard. In the past 7 years, Betz Road Ditch has experienced two large floods, in 1967 and 1971. On 20 June 1967, one life was lost when an automobile was swept off a street by high velocity floodwaters. A number of other automobiles were stalled when streets and highways were inundated. On 11 May 1971, another flood occurred and automobiles were again stranded in high water on streets and parking lots.

The Corps of Engineers published a Flood Plain Information Report on Betz Road Ditch in June 1972. The primary problem reach extends from Highway 73-75 upstream about 1.6 miles to the vicinity of Lincoln Road. The flood plain is partially urbanized, with some development close to the channel, and has some areas of open space. The standard project flood could inundate an area ranging from 100 to 800 feet in width and the 1-percent flood could cover an area nearly the same size. Significant damages are estimated to begin at the 4-percent flood. Existing developments subject to damage from the standard project flood include 20 residences, 7 apartment buildings, a multiunit garage, a commercial building, a large shopping center parking lot, and streets and bridges. Potential damages from an intermediate regional flood and a standard project flood are estimated at more than $240,000 and $460,000, respectively.

DRAINAGE AND HIGH GROUND WATER

Potential problems exist on the lowlands adjacent to the Missouri River, the downstream portion of the Papillion Creek basin, and the downstream portion of the Platte River as shown on figure B-23.

Currently, the communities of Carter Lake and Western Council Bluffs are adversely affected by drainage and high ground-water problems. Surface ponding in the two communities is evident during high water periods. High ground water during these periods causes septic systems to fail in Carter Lake and foundation failures in Council Bluffs. Combined sewers in the eastern portion of Omaha not only cause water pollution but also cause problems relating to inadequate drainage of domestic sewage. Further development in any of these areas will require solutions to the problems mentioned.

ORUM
BLAIR
KENNARD
PAPILLION CR.
MILL CR.
LONG CR.
FORT CALHONN
DE SOTO BEND
MISSOURI RIVER
SIDNEY CR.
OYER CR.
WASHINGTON COUNTY
DOUGLAS COUNTY
BENNINGTON
THOMAS CR.
BIG PAPILLION
CRESCENT
VALLEY
WATERLOO
ELKHORN
WEST PAPILLION
PAPILLION CR.
OMAHA
COUNCIL BLUFFS
PLATTE RIVER
DOUGLAS COUNTY
SARPY COUNTY
SOUTH PAPILLION CR.
PAPILLION
GRETNA
BELLEVUE
CAPEHART
SPRINGFIELD
BUFFALO CR.
CASS COUNTY
PLATTSMOUTH
SCALE IN MILES
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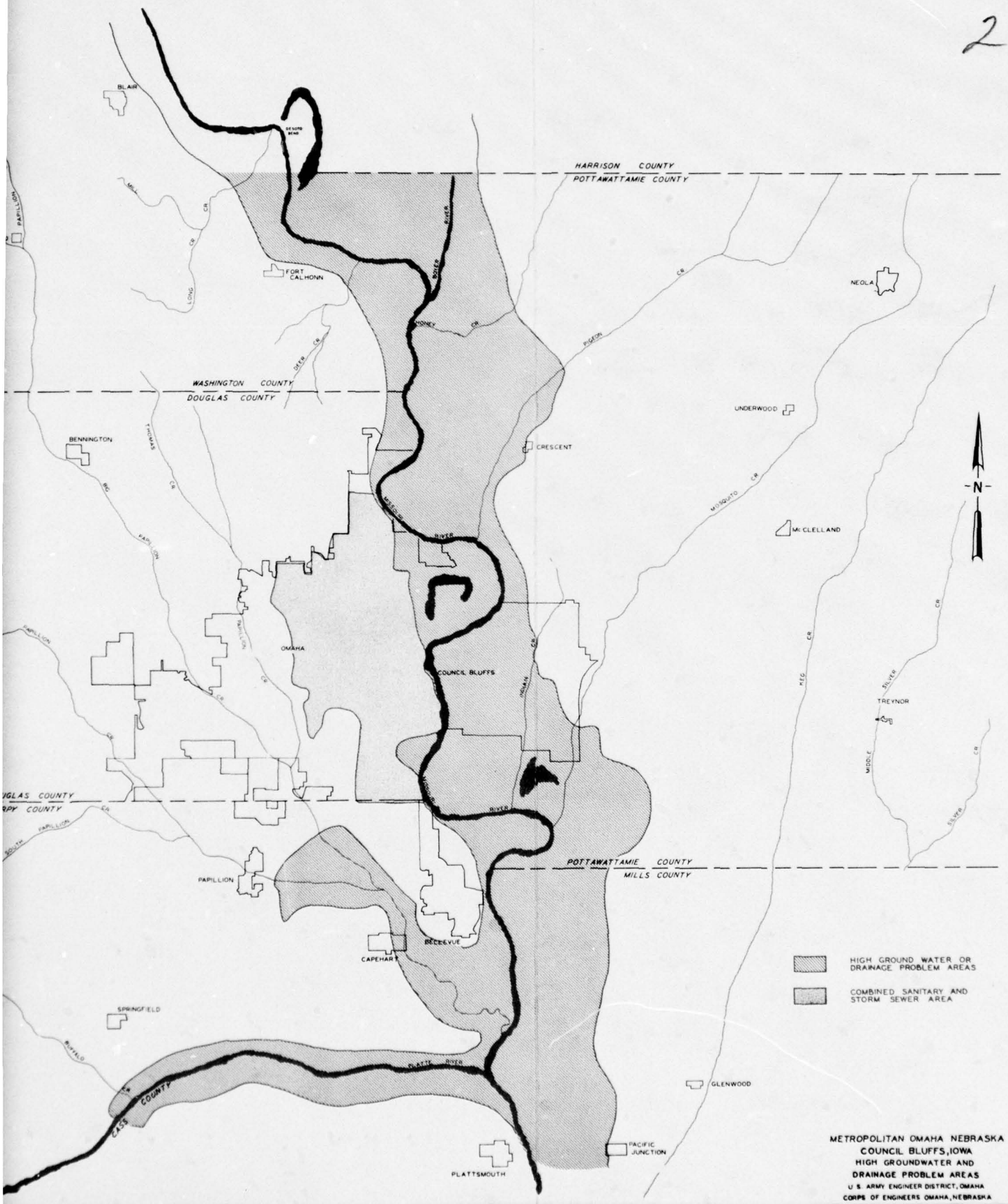


METROPOLITAN OMAHA NEBRASKA
COUNCIL BLUFFS, IOWA
HIGH GROUNDWATER AND
DRAINAGE PROBLEM AREAS
U.S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

VOLUME I FIGURE B-23

In addition to the flood hazards in the vicinity of the city of Missouri Valley, high ground-water levels and poor drainage during high stages along the Boyer River, Missouri River, and Willow Creek could have an influence on future development in the flood plain areas. These related problems would have to be considered in the formulation of any flood protection for the city.

Sediment from the tributaries, derived from gully erosion in the loess areas upstream, increases the maintenance cost of the improved channel of the Missouri River and decreases channel capacity of these tributaries as they cross the Missouri River flood plain. The terrain of the Missouri River flood plain is relatively flat and floods on tributaries may flow downstream for long distances through old channels or be diverted by road grades and other flood plain irregularities. Areas to be flooded cannot be precisely determined. High ground-water problems in some areas of the flood plain have been ascertained to be caused, in part, by the maintenance of navigation flows on the Missouri River.

Water Resources Related Needs and Problems

The previous section dealt with needs and problems encompassing the management of the quantity and quality of water. This section discusses other needs and problems which can be related to water resources. These include recreation, the environment, fish and wildlife, erosion and sedimentation, and land use.

RECREATION

Recreation is tied closely to the quality of urban life. Recreation within urban areas frequently represents a high priority need on which urban water resource systems can have a significant impact. The study area has abundant water resources for supply purposes but lacks adequate water related recreation.

Two categories of activities are considered water related:

- Activities which are only possible if a body of water is available.

- Activities which are enhanced by the presence of a body of water but are not strictly dependent on it.

Swiming, fishing, boating, and water skiing are examples of the first category while picnicking, camping, hiking, and nature enjoyment are examples of the second category.

Determining demand for recreation facilities is difficult. There is no single answer or generally acceptable method for determining demand.

Demand is influenced by socioeconomic factors and availability of opportunities. There are, however, certain indicators that can be used to determine need for additional recreation development. These indicators include: (1) expressed preferences of the public, determined by survey techniques; and (2) observed use of existing recreation facilities.

Recent attempts to quantify recreation demand include the Nebraska Game and Parks Commission - Nebraska Outdoor Recreation Activity Survey, the North Omaha Recreation Needs Survey, and the Council Bluffs League of Women Voters Recreation Study. A fourth activity survey is nearing completion. This survey is being undertaken through the Riverfront Development Program and is intended to complement the other recreation needs surveys. The Riverfront Survey is the first to cover the majority of the Omaha Urban Study seven-county region.

The Nebraska Game and Parks Commission Survey indicated that existing recreation land deficiencies in the Omaha area total 27,700 acres, with deficiency predicted to increase to 57,800 acres by 1990. Table B-46 indicates existing and 1990 deficiencies by activity.

Table B-46
Recreation Deficiency by Activity
Omaha Area
(Nebraska Game and Parks Commission)

	Acres	
	1972	1990*
Power Boating	8,082	9,887
Fishing	6,303	4,169
Water Skiing	4,380	5,450
Camping	599	989
Picnicking	410	578
Swimming (beach)	32	44

* 1990 statistics assume completion of the 20 Papillion Creek Reservoirs.

MAPA requirements are not divided by activity but are estimated in terms of recreational open space requirements. These requirements were determined using relationships of National and SMSA population and recreational participation increases. MAPA's projections indicate a 2020 recreational open space deficiency in the SMSA of 64,438 acres.

The Council Bluffs League of Women Voters Recreation Study indicated that 78 percent of the households interviewed felt that recreational facilities in Council Bluffs are inadequate. Respondents were requested to indicate what type facilities were most needed and least needed in Council Bluffs. The percentage of respondents and "most" and "least" desires by facility are indicated in table B-47.

Table B-47
Council Bluffs Recreation Facility Indicators

	Most Desired (percent)	Least Desired (percent)
Swimming Pools	74.5	1.9
Small Neighborhood Play Areas	30.8	6.3
Sport Vehicle Trails	14.9	33.9
Open Space for Sports and Games	76.0	11.5
Areas for Water Related Activities	14.9	22.6
Picnic-Park Facilities	13.5	24.5
Golf Courses	6.7	44.2
Hiking Trails	3.8	19.2
Campsites	14.9	21.2
Bicycle Lanes	37.0	9.6

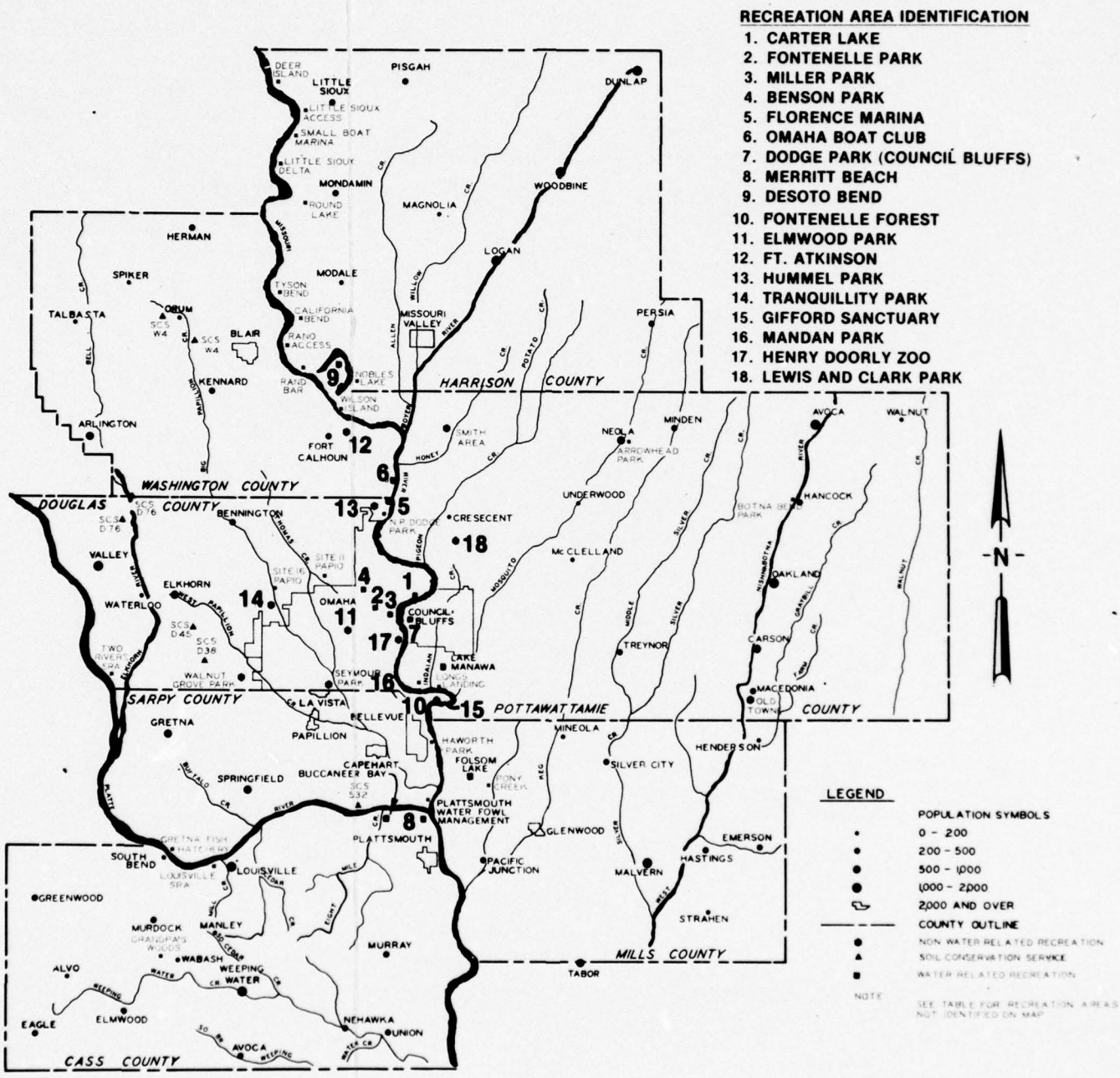
The results of the above surveys would indicate that demand for outdoor recreation activities is greatest in the Nebraska portion of the study area. The one exception is the need for additional swimming pools in Council Bluffs.

A second indicator of demand for additional outdoor recreation facilities is the amount of use of existing facilities. Again, there is no definitive standard to indicate when a facility is overused or when the carrying capacity of a facility is exceeded. Information presented by Clawson, Held, and Stoddard in "Land for the Future" indicates that use of camping and picnic areas at popular lakes and streamsides is considered heavy with 50 to 100 uses per acre per year while the use of municipal parks is considered very heavy when the park experiences 1,500 visits per acre per year. Currently, overuse of existing major recreation areas is defined

when recreation visits exceed 500 per acre per year. Existing recreation facilities in the study area are shown in figure B-24. Use at major outdoor recreation facilities in the Omaha area varies from 906 to 3,401 visits per acre per year. Visitation at all sites exceeds the carrying capacity of the site. Table B-48 describes characteristics and use of major existing water recreation areas. Outside the study region, but also a good indicator of recreational use, are the Salt Creek reservoirs near Lincoln. Use rates range as high as 1,400 visits per acre per season.

There are recreation resource potentials in the area to help satisfy demands. Currently, major opportunities to increase the amount of water related recreation are the Papio flood control and recreation project, the Riverfront Development Program, and the MAPA Open Space Plan and Program.

The authorized Papillion Creek Lakes Project consists of 20 reservoirs with water surface per reservoir ranging from 40 to 650 acres. If completed, this system would add 3,980 surface acres of water in close proximity to Omaha. An issue concerning the reservoir system is water quality and conflicting future land uses in close proximity to recreational areas. Currently, controversy exists over the Papio flood control project with regard to the project itself and the additional lands being contemplated for recreation development. According to the demand statistics, the recreation around the reservoirs would add much needed water related recreation for the Omaha area. If this project is not implemented, alternatives to the recreation potential should be investigated.



METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA

MAJOR
EXISTING RECREATION AREAS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

JUNE 1975

VOLUME II FIGURE B-24

Table B-48
Existing Water Oriented Recreation Areas
Characteristics and Capacity

Area	Characteristics	Capacity
Desoto National Wildlife Refuge	Historic site of Riverboat Bertrand. Water area available for use. Heavily used on weekends. Popular for boating, skiing, and fishing. Natural wooded area with most of land used for crops to feed wildlife or wildlife resting area.	With emphasis on wildlife oriented visitation; 1,000,000 visitors annually is the capacity as estimated by the Bureau of Sport Fisheries and Wildlife.
Wilson Island	Missouri River access. Naturally wooded area. Facilities for picnicking and camping (50 camp pads). Much of area low and swampy and not suitable for development.	Capacity has been reached for facilities available.
Longs Landing	Missouri River access site. Naturally timbered area. Camping and picnic facilities.	3,481 uses per acre exceeds capacity.
Haward Park	Missouri River access in natural timbered area. Facilities for picnicking and camping. Playground, fishing lagoon, restaurant, and marina available.	40,000 ultimate capacity.

Table B-48
(Cont'd)
Existing Water-Oriented Recreation Areas
Characteristics and Capacity

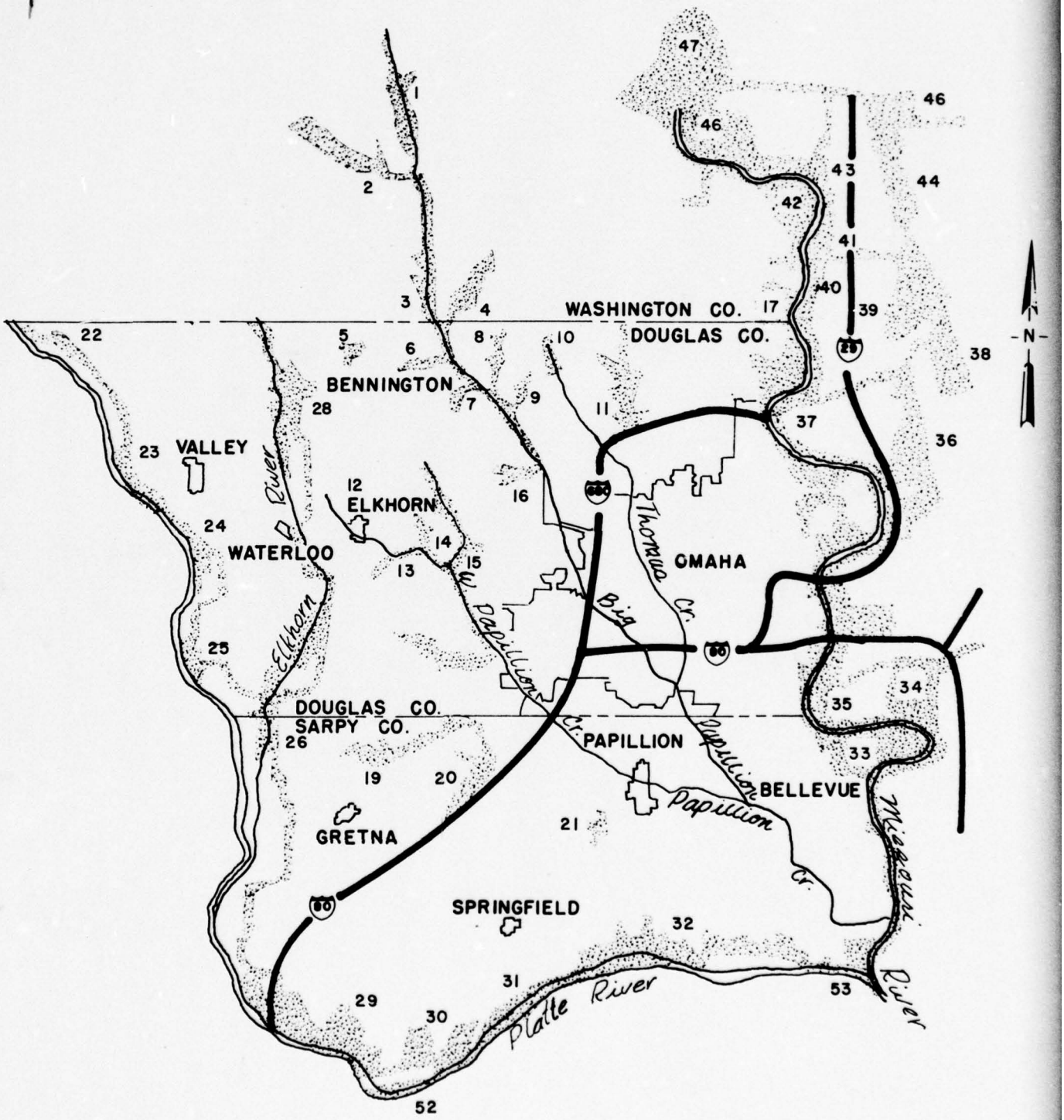
Area	Characteristics	Capacity
Two Rivers Recreation Area	"Put and Take" fishery, camping and picnicking facilities. Periodically closed due to flooding.	Exceeds capacity with 322,000 annual visitation.
Memphis State	Naturally timbered public use areas. Fishing listed as primary activity with picnicking and camping.	Capacity 80,000.
Arrowhead Park	16-acre lake. Fishing, no power boating permitted. Camping and picnic facilities.	1,431 uses per acre exceeds capacity.
Lake Manawa	Shallow lake, very popular area for boating, skiing, swimming, fishing, and picnicking. Camping recently added.	With 705,230 actual uses or 2,661 uses per acre exceeds capacity.
Louisville State	Sandpit lakes, where picnicking is primary activity with swimming, fishing, and camping facilities. Also available are nature study, hiking, bicycling, and sightseeing.	Recreation use exceeds capacity with 906 uses per acre.

Table B-48
(Cont'd)
Existing Water-Oriented Recreation Areas
Characteristics and Capacity

Area	Characteristics	Capacity
N.P. Dodge Park	River access site which is still under development. Facilities are provided for picnicking and camping.	Capacity of site 222,500.
Levi Carter Park	Polluted water, swimming not allowed; used by boaters. Recreation use has been declining.	Heavily used; no actual counts taken.

The major goal of the MAPA Open Space Plan and Program is to provide open space in sufficient quantity and at such locations as is necessary to create a quality environment and to satisfy the requirements. This program identified lands best suited for natural or recreational use including surface waters, flood plains, timbered areas, and lands with excessive slopes and erosion problems. This program, if all recommendations are implemented, could satisfy MAPA's open space demand calculations. The lands that MAPA selected for recreational open space are shown on figure B-25. Phase I of this study has identified additional "best suited" recreational open space lands in the remaining four counties. These are shown on figure B-26.

Future lifestyles, innovative changes in work patterns, housing styles, and personal habits will have a great effect on projected recreation needs. Necessary resource conservation requires that multiple use be made wherever possible of a resource and that the resource be recycled if possible. Development of recreation should be integrated with other resource management measures, such as flood control. Recreation will tend to become polarized into two areas: immediate, short-term, after-school type of activities; and extended weekend activities. These extended weekends will come to include many mental as well as physical activites, not presently considered as recreation. Other recreation concerns include: (1) the needs, desires, and mobility of different socioeconomic groups; (2) environmental impacts; (3) preservation vs. recreation development; (4) agriculture vs. recreation development; and (5) private vs. public acquisition of prime recreation lands.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DOUGLAS CO.
SARPY CO.
BENNINGTON
VALLEY
WATERLOO
ELKHORN
OMAHA
PAPILLION
BELLEVUE
GRETNA
SPRINGFIELD
Elkhorn River
W. Papillion Cr.
Big Papillion Cr.
Thorne Cr.
Papillion Cr.
Missouri River
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Priority I, by 1980

Nos. 1-16 and 18-21. The 20 proposed Papillion Creek flood control-general recreation areas, ranging in size from 300 to 2,245 acres northwest of Omaha. No. 16 already is under construction.

No. 17. An 1,800-acre natural environment area 2 1/2 miles northwest of the Mormon Bridge.

No. 29. A 4,500-acre general recreation area seven miles south of Gretna.

No. 31. A 600-acre sandpit-lake recreation area 2 1/2 miles south of Springfield.

No. 32. A 3,800 acre general recreation area five miles south of Papillion.

No. 34. A 534-acre expansion of the recreation area south of Lake Manawa, Ia.

No. 35. A 450-acre public access area west of Lake Manawa to the Missouri River.

No. 48. A 235-acre general recreation area two miles south of Neola, Ia., expanding Arrowhead Park.

No. 50. A 1,200-acre general recreation area two miles east of Macedonia, Ia.

Priority II, by 1990

No. 27. A 700-acre natural environment area at the intersection of U.S. Highway 30A and the Elkhorn River south of Elk Horn.

No. 28. A 4,000-acre natural environment area one mile west of Elk City.

No. 20. A 2,600-acre natural environment area three miles east of the Gretna Fish Hatchery.

No. 36. A 2,240-acre general recreation and scenic drive along the bluff between Crescent, Ia., and Council Bluffs, including the present Lewis and Clark Monument.

No. 37. A 1,000-acre public access area to the Missouri River east of the Mormon Bridge.

Nos. 40, 41, 43. Three 100-acre public access areas to the Missouri west of Honey Creek, Ia.

No. 24. A 600-acre general recreation area along the Platte 1 1/2 miles south of Valley.

Priority III, by 2000

No. 22. A 1,000-acre natural environment area five miles northwest of Valley.

No. 23. A 600-acre public access area 2 1/2 miles west of Valley.

No. 26. A 2,000-acre general recreation area near the Douglas-Sarpy County line along the Elkhorn River.

No. 38. An 1,800-acre general recreation area and scenic drive in the bluff area east of Crescent, Ia.

No. 39. A 1,630-acre natural environment area south of Honey Creek, Ia.

No. 42. A 2,000-acre primitive (wilderness) area along the Missouri 2 1/2 miles west of Honey Creek, Ia.

No. 44. A 2,420-acre natural environment area two miles north of Honey Creek.

No. 45. A 700-acre general recreation area one mile north of Loveland, Ia.

No. 49. A 320-acre public access area to the Nishnabotna River a half-mile south of Hancock, Ia.

No. 51. A 1,000-acre natural environment area 12 miles east of Carson, Ia.

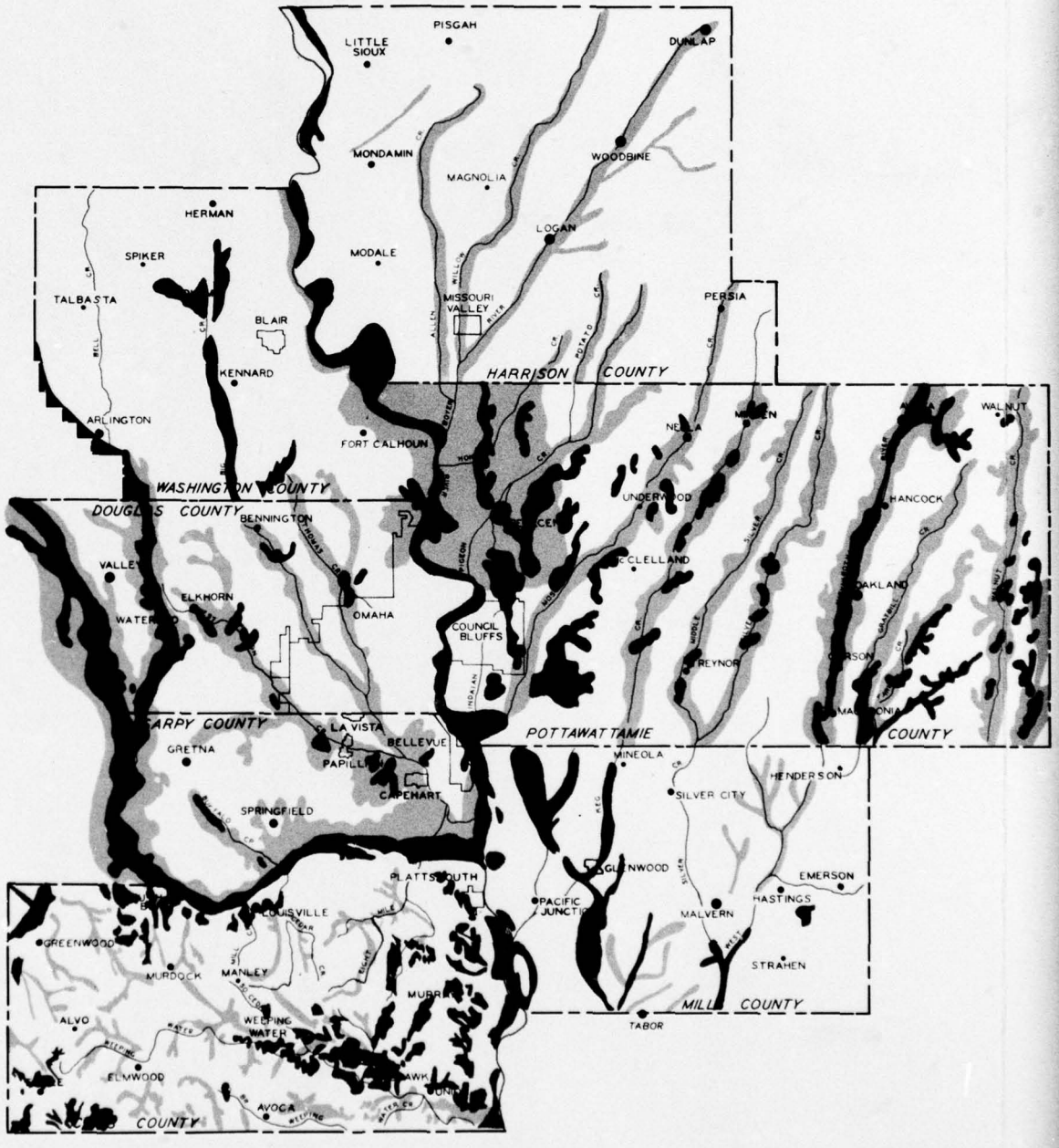
METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA

MAPA OPEN SPACE PLAN

U.S. ARMY ENGINEER DISTRICT OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

VOLUME II FIGURE B-25

U.S. GOVERNMENT PRINTING OFFICE: 1979 788-848


PISGAH
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DUNLAP
MONDAMIN
WOODBINE
MAGNOLIA
HERMAN
LOGAN
SPIKER
MODALE
TALBASTA
MISSOURI VALLEY
PERSIA
BLAIR
KENNARD
HARRISON COUNTY
ARLINGTON
FORT CALHOUN
WALNUT
WASHINGTON COUNTY
DOUGLAS COUNTY
BENNINGTON
HANCOCK
OMAHA
COUNCIL BLUFFS
OAKLAND
REYNOR
LA VISTA
BELLEVUE
PAPILLION
CAPEHART
SPRINGFIELD
POTTAWATTAMIE COUNTY
MINEOLA
HENDERSON
SILVER CITY
GLENWOOD
EMERSON
HASTINGS
MALVERN
STRAHEN
TABOR
MILLS COUNTY
PLATTSMOUTH
LOUISVILLE
GREENWOOD
MURDOCK
MANLEY
ALVO
WEEPING WATER
ELMWOOD
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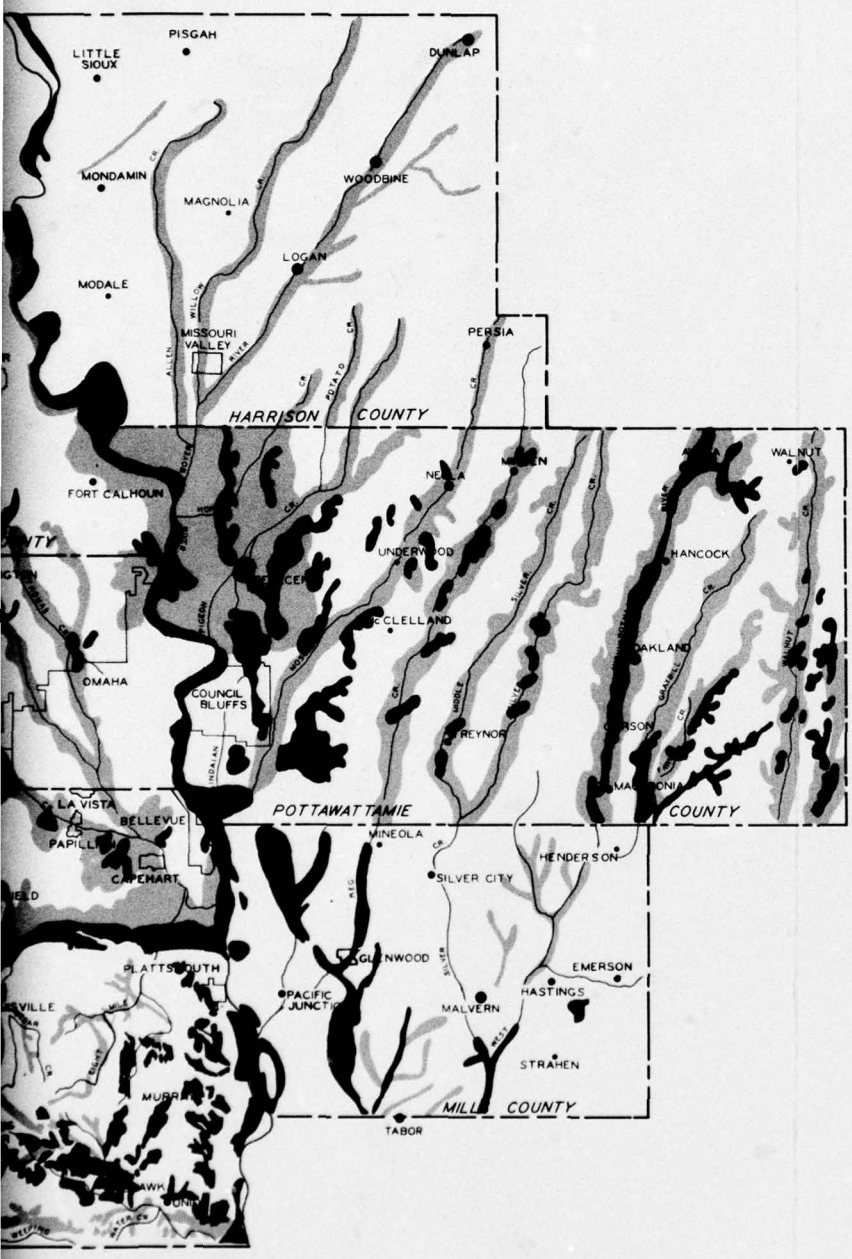
5 0 5
SCALE IN MILES



N

2

LEGEND

POPULATION SYMBOLS

- 0 - 200
- 200 - 500
- 500 - 1,000
- 1,000 - 2,000
- 2,000 AND OVER
- COUNTY OUTLINE
- PRIMARY CORRIDOR
- SECONDARY CORRIDOR

NOTE: ADOPTED IN PART FROM MAPA OPEN SPACE PLAN

5 0 5 10
SCALE IN MILES

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
STUDY REGION
POTENTIAL OPEN SPACE AREAS

U.S. ARMY ENGINEER DISTRICT OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

ENVIRONMENT

This section summarizes some of the environmental issues related to water resource planning in the study area. Factors discussed include population, land use and growth patterns, fish and wildlife, water quality, recreation and open space, and flood control.

POPULATION

Concerns have recently surfaced over what should be the ultimate population of the area. Some regional and local spokesmen have stated that the area would have no trouble supporting a population of 1 million, others are concerned with any additional increase, others would like a study made to determine how many people the area can support and still retain a high quality of life. Some citizens would promote growth while others would discourage it. Hopefully, this study can help to resolve these concerns at least from the water resource viewpoint.

LAND USE AND GROWTH PATTERNS

How and where future development will take place is a regional concern brought on partly by the Riverfront Development Program. Concerns under this category include the services and the environmental and social implications of particular density or growth patterns. Generally, a more compact pattern is less costly to service but can either have negative or positive environmental and social implications. Redevelopment of the blighted areas of the cities generally would have a positive environmental impact while leaving both positive and negative social and economic implications. Soil types, topography, lack of vegetation, and current land investments favor westward expansion but increasingly convert prime agricultural

land to urban uses. Development along the riverfront may have social and economic advantage but may take place in some of the most unique natural areas of the region.

FISH AND WILDLIFE

The study region is not well known for its wildlife, yet it contains a variety of fish, fowl, and small animals. Urbanization, intensive agricultural activity, and some water resource development have encroached upon wildlife's natural habitat. Preservation of lands along the Platte, Elkhorn, and Missouri Rivers and other streams is essential. Man's desire to live closer to nature has, however, resulted in residential development in these areas. Weekend cottages along these rivers have increased private recreation at the expense of natural protective habitat. As the population grows and leisure time increases, the conflicts will increase.

WATER QUALITY

National and State laws prescribe that water bodies cannot be used as sewers to carry away waste materials. Historically, water quality has decreased with urbanization, industrialization, and use of modern chemicals for both urban and rural purposes. An overview of the study region's water quality was presented earlier. Generally, a decline of water quality reduces its usefulness as a resource for aquatic habitat, aesthetic, and economic purposes. The social value of recreation is reduced. It costs money to preserve and enhance water quality. Dollars for water quality must compete with dollars for other human needs. Trade-offs between the costs and benefits for water quality versus other concerns are necessary.

RECREATION AND OPEN SPACE

Provision of open space and related recreational opportunities in an urban setting plays a major role in man's environment. Provision of open space can be complementary to proper land use, flood plain management, recreation, and fish and wildlife preservation. Current concerns include the difficulty of preserving lands for open space usage because of rising land prices and the urban expansion and development of recreation areas.

OTHER ENVIRONMENTAL CONCERNS

This study recognizes other significant aspects of man's environment such as transportation, air quality, housing, economic development, and community services. While noting their importance, there is little impact that water resource planning can have on solving environmental needs in these areas. By displaying the costs of solutions to water related problems, the costs of growth policies, and by planning wisely for the future, trade-offs can be made as to future public investments.

FISH AND WILDLIFE

The study area contains a broad variety of fish and wildlife; however, intensive agriculture and urbanization have greatly reduced wildlife populations; also, the majority of fish are non-game species. In general, the study area is not known for its wildlife.

The study area contains some excellent small game populations. Wetland areas support large numbers of ducks and geese during spring and fall. Whitetailed deer is the only large game animal in the area. Habitat for deer is found along the Platte, Elkhorn, and Missouri Rivers. Upland game habitat is provided by an interspersion

of grain fields, brushy areas, and pastures of varying sizes. Croplands adjacent to the Platte, Elkhorn, and Missouri Rivers provide feeding areas for migratory waterfowl.

Fish in the study region are almost entirely warm-water species although a few areas do support bass, pike, and trout fishing. The warm-water species include catfish, carp, bluegill, crappies, and bullheads. While some fishing is done in the Platte, Elkhorn, and Missouri Rivers, and in other streams and rivers, the major portion of fishing efforts is on manmade lakes such as DeSoto Bend and Two Rivers State Recreation Area. All fishing areas are heavily used during weekend periods. The most heavily used resource is a 7-acre trout pond at Two Rivers State Recreation Area; it averages 60,000 user fee-paying fisherman days during a season. The main concern is preserving the natural habitat of fish and wildlife. This includes the water and land habitat. Intensive agriculture, clearing, and stream modification have all had detrimental effects. Urbanization is beginning to take place in some of the "natural habitat" areas of the Platte, Elkhorn, and Missouri Rivers and will continue to endanger some wildlife species. Particularly susceptible are habitat for deer and wintering and migration areas for waterfowl. Pollution from municipal, industrial, and agricultural sources, combined with stream modification, have seriously degraded fish habitat.

Preservation of fish and wildlife requires preservation of the habitat. Preservation is not only necessary to meet hunting and fishing demands but also for the natural enjoyment of man. Conservation measures must be stressed. Management strategies that provide recreation development on the one hand, and conservation on the other, must be developed.

Fortunately, lands that are best suited for open space, and least suited for development, are the lands best suited for wildlife habitat in the study region. These prime areas are along the Platte, Elkhorn, and Missouri Rivers. MAPA studies have identified many of these areas and have recommended that they not be used for urban development. These lands are generally heavily wooded, have steep slopes, or are subject to floods and have high ground water and drainage problems. The locations of recommended open space areas are shown on figures B-25 and B-26.

EROSION AND SEDIMENTATION

The soils of the region along the Missouri River in eastern Nebraska and western Iowa, including the study area, are derived from a parent material of windblown silt or loess. These soils are susceptible to gully and sheet erosion. This erosion is ordinarily most severe in cultivated areas of rolling and rough topography where there is insufficient vegetative cover. For example, in the Mosquito Creek watershed in Harrison County, Iowa, sheet erosion in the upland areas was estimated by the Soil Conservation Service at 9.6 tons per acre per year. In the 7 square mile Indian Creek basin upstream from Council Bluffs, sheet erosion was estimated at 14 tons per square mile per year. Gully erosion for this basin was estimated to result in average annual rates of land voiding and land depreciation of 11.6 acres and 11.1 acres, respectively. Preliminary studies of the Twin Ponies watershed, of about a 34 square mile area south of Council Bluffs, estimated that gully erosion damaged approximately 34 acres each year. In Nebraska, the Papio Natural Resources District, which covers Washington, Douglas, and Sarpy Counties, has given erosion prevention and control the highest priority among its authorized activities. Streambank erosion from

time to time threatens local improvements along the Platte and Elkhorn Rivers. On major streams, accretion tends to balance erosion so that the net channel area remains fairly constant. But the value and productive ability of lands within the resulting meander belt are adversely affected. More critical problems occur where streambank erosion threatens to destroy transportation facilities or other structures. Stabilization of the channel has effectively controlled erosion on the Missouri River main stem, and no serious problems are anticipated if the channel improvements are maintained to design standards. Bank protection works along the Platte and Elkhorn Rivers have been primarily of an emergency nature to protect critical local large-scale bank protection works. Recent studies for Corps of Engineers flood control dams in the Papillion Creek basin indicate a sediment load of about 3,000 tons per square mile per year. During a period of construction and urbanization, these values could rise to 35,000 tons per square mile per year. The primary gully and sheet erosion problems in the study area occur on the minor branching tributaries which drain from the upland areas to the principal Missouri River tributaries. Land treatment measures have been installed in recent years and erosion problems have been corrected in portions of the study area. The principal sediment cleanout problems occur where the minor tributaries enter the flood plains and where the principal tributaries enter the Missouri River flood plain. The silt from these areas, in addition to damaging local flood plain lands and improvements, increases the maintenance cost of the improved channel of the Missouri River. Table B-49 indicates the erosion problems in most of the drainage basins in the study area; these basins are shown on figure B-27. The 1967 Conservation Needs Inventory for Watersheds is the source used to determine the extent of major land erosion problems. For each

Table B-49
Erosion Problem Areas

Watershed	Drainage Area (acres)	Erosion Damage	
		Acres w/ Problems	Acres Needing Project Action
Iowa			
Missouri River Direct Tributaries			
03 Soldier River*	74,870	56,630	37,000
04 Rush Creek*	5,820	5,120	3,580
05 Skunk Creek*	3,710	3,710	2,600
06 Unnamed Creek	3,520	3,520	2,820
07 Emigrant Creek	8,700	7,000	5,000
08 Middle Soldier River*	54,270	39,160	23,200
09 Skinner Creek	3,260	3,280	2,620
10 Davis-Battle Creek Watershed 4/	4,770	3,400	3,400
11 Norway Creek	10,690	10,690	8,000
12 Elk Creek 3/	17,020	16,975	10,500
13 Jordan Creek	19,390	18,390	15,500
14 Jones Creek Watershed	1,400	0	0
15 Main Stem - Direct Tributaries	32,960	21,000	12,600
16 Stowe Creek	9,220	8,500	8,100
17 Cobb Creek 3/	3,970	3,000	2,500
18 Lower Soldier River	31,230	5,700	5,000
19 Direct Tributaries	75,310	50	0
20 Honey Creek	17,340	13,500	9,200
21 North Pigeon Watershed 1/	4,510	4,100	4,100
22 Pigeon Creek Watershed	101,190	81,750	64,750

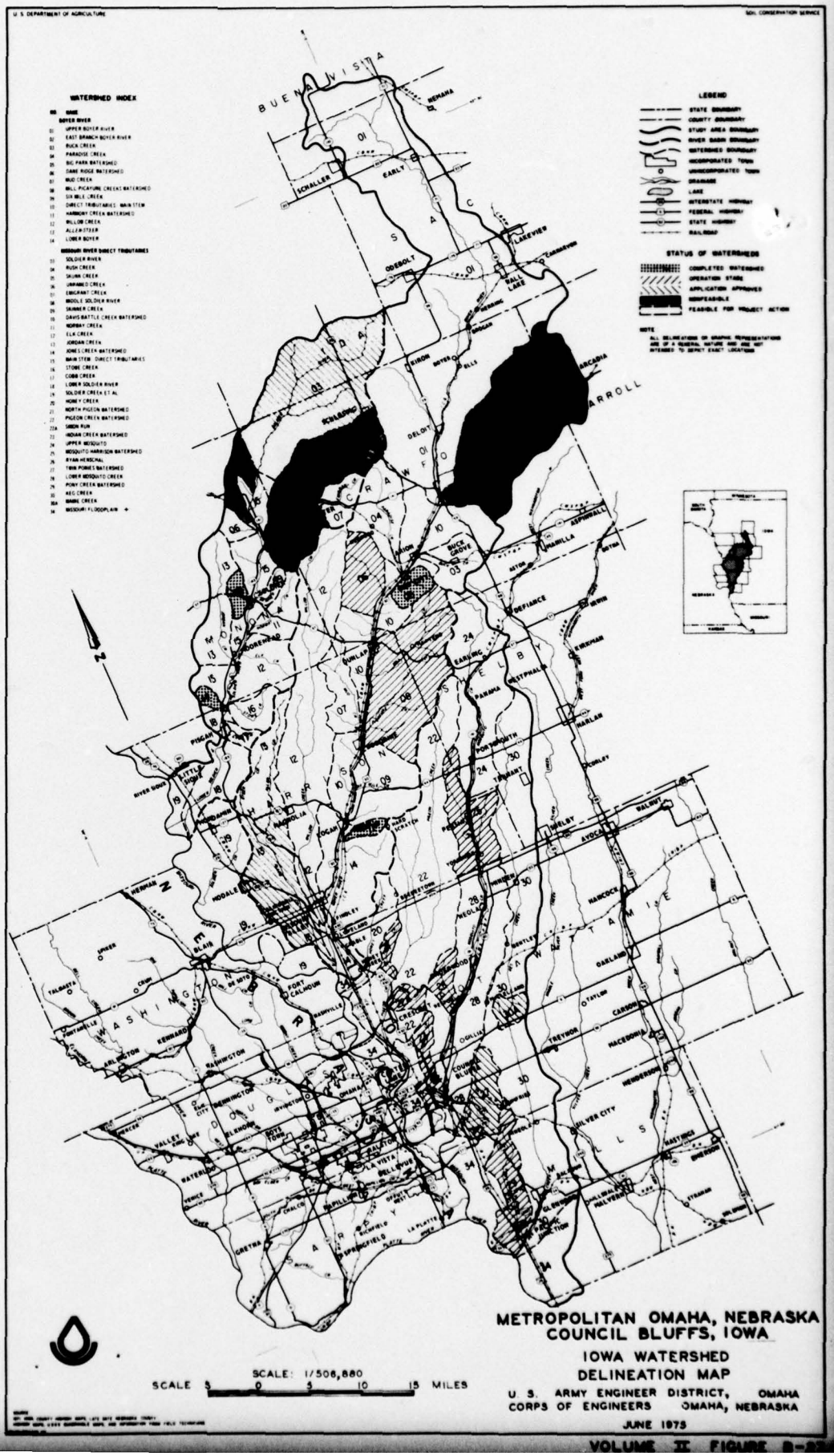
Table B-49
(Cont'd)
Erosion Problem Areas

Watershed	Drainage Area (acres)	Erosion Damage	
		Acres w/ Problems	Acres Needing Project Action
22A Simon Run Watershed[1/]	4,150	904	904
23 Indian Creek Watershed[1/]	9,790	3,350	3,350
24 Upper Mosquito	51,710	27,050	19,500
25 Mosquito-Harrison Watershed[1/]	24,510	22,650	19,850
26 Ryan-Henschal[1/]	9,410	7,300	7,300
27 Twin Ponies Watershed[2/]	21,640	12,475	8,475
28 Lower Mosquito Creek	63,610	26,700	19,600
29 Pony Creek Watershed[1/]	19,330	5,039	5,039
30 Keg Creek	124,800	83,593	55,610
34 Missouri Flood Plain	81,550	3,450	3,000
Boyer River Boyer-34			
01 Upper Boyer River	247,040	165,160	131,050
02 East Branch, Boyer River*	83,840	47,800	29,300
03 Buck Creek	13,310	10,000	6,700
04 Paradise Creek	24,260	18,000	14,000
05 Big Park Watershed[4/]	7,680	5,500	5,500
06 Dane Ridge Watershed[1/]	17,860	10,000	7,000
07 Mud Creek	13,440	13,140	11,820
08 Mill-Picayune Creek Watershed[1/]	62,990	44,860	38,460

Table B-49
(Cont'd)
Erosion Problem Areas

	Watershed	Drainage Area (acres)	Erosion Damage: Acres w/ Problems	Erosion Damage: Acres Needing Project Action
09	Six Mile Creek	13,630	10,000	9,000
10	Direct Tribs. - Main Stem	73,390	50,000	39,800
11	Harmony Creek Watershed 4/	3,070	2,000	0
12	Willow Creek	93,440	74,560	63,720
13	Allen-Steer 3/	59,010	28,000	25,000
14	Lower Boyer	47,360	38,980	31,200
Nebraska				
	Papillion Creek 1/	246,000	95,000	36,000
	Missouri River Direct Tributaries	62,200	7,500	5,000

* Non-feasible
1/ P.L. 566 Project - Construction
2/ P.L. 566 Project - Planning
3/ P.L. 566 Application
4/ P.L. 566 Project - Construction completed


U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WATERSHED INDEX
LEGEND
STATUS OF WATERSHEDS
NOTE
BUENA VISTA
SCHALLER
EARLY
SACAC
ODEBOLT
LAKEVIEW
CAMANCHE
BALL LAKE
SCHLESING
DELOIT
CRAWFORD
CARROLL
ARCADIA
MANILLA
DEFIANCE
EARLING
EUBY
PANAMA
WESTPHALIA
MARLAR
FORTHWORTH
TENNANT
HARRISON
LITTLE SIOUX
MAGNOLIA
LOCAN
PERSIA
MISSION HILLS
WELSH
AVOCA
HANCOCK
OAKLAND
HODALE
MINDEN
REGLO
WASHINGTON
BLAIR
FORT CALHOUN
KENNARD
ARLINGTON
WAHOO
OTOCHE
TAYLOR
CARSON
TREYNOR
MACEDONIA
HENDERSON
OMAHA
COUNCIL BLUFFS
SILVER CITY
MILLS
DOUGLAS
SARPY
VALLEY
WATERLOO
BOYS TOWN
LA VISTA
BELLEVUE
PAPILLION
GRETNA
SPRINGFIELD
LA PLATTE
MISSOURI FLOODPLAIN
SCALE: 1/506,880
SCALE 0 5 10 15 MILES
METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
IOWA WATERSHED
DELINEATION MAP
U.S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA
JUNE 1975

identified watershed, estimates were made of the total acreage with erosion damage; these problem acreages constituted limits within which needs for project action were determined. Project action is defined as that cooperative action which can be effected only through formal organizations which have a legal status under State or Federal law with the power to negotiate contracts, or raise funds for the installation, operation, and maintenance of works of improvement.

LAND USE

A basic concept in the study is that water resource planning and land use are inseparable. Land use has ramifications that extend to all phases of water resources planning. For example, increased development in flood plains would increase flood damages. Larger areas of urban development would mean greater wastewater discharges and degraded quality of overland runoff. Rapidly urbanizing areas can greatly increase the runoff of sediment from a drainage basin. The conversion of rural lands to cities will displace wildlife and reduce agricultural production.

Resource demand in a given area is directly related to population and lifestyles. Historically, water resource system design is based on a selected land-use plan and population projection. The ultimate result is that the planned system frequently determines land use.

Historically, the major change in land use in the seven-county study area has been the conversion of agricultural lands to urban uses. Associated with this change has been the lowering of population densities in the older portions of the urbanized areas.

Population increases coupled with lowered population densities have had the effect of accelerating changes in land forms from agricultural to urban uses.