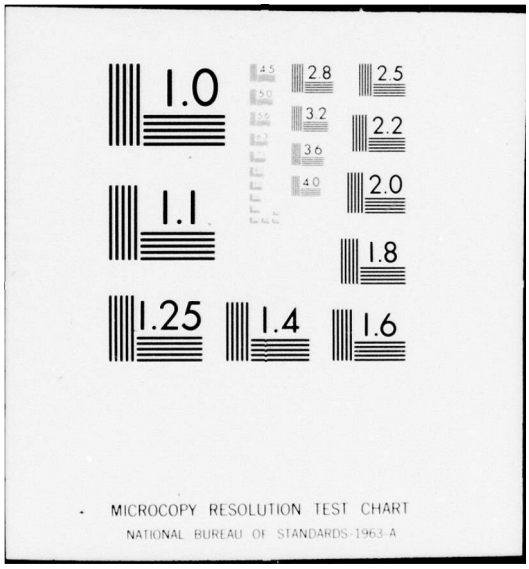
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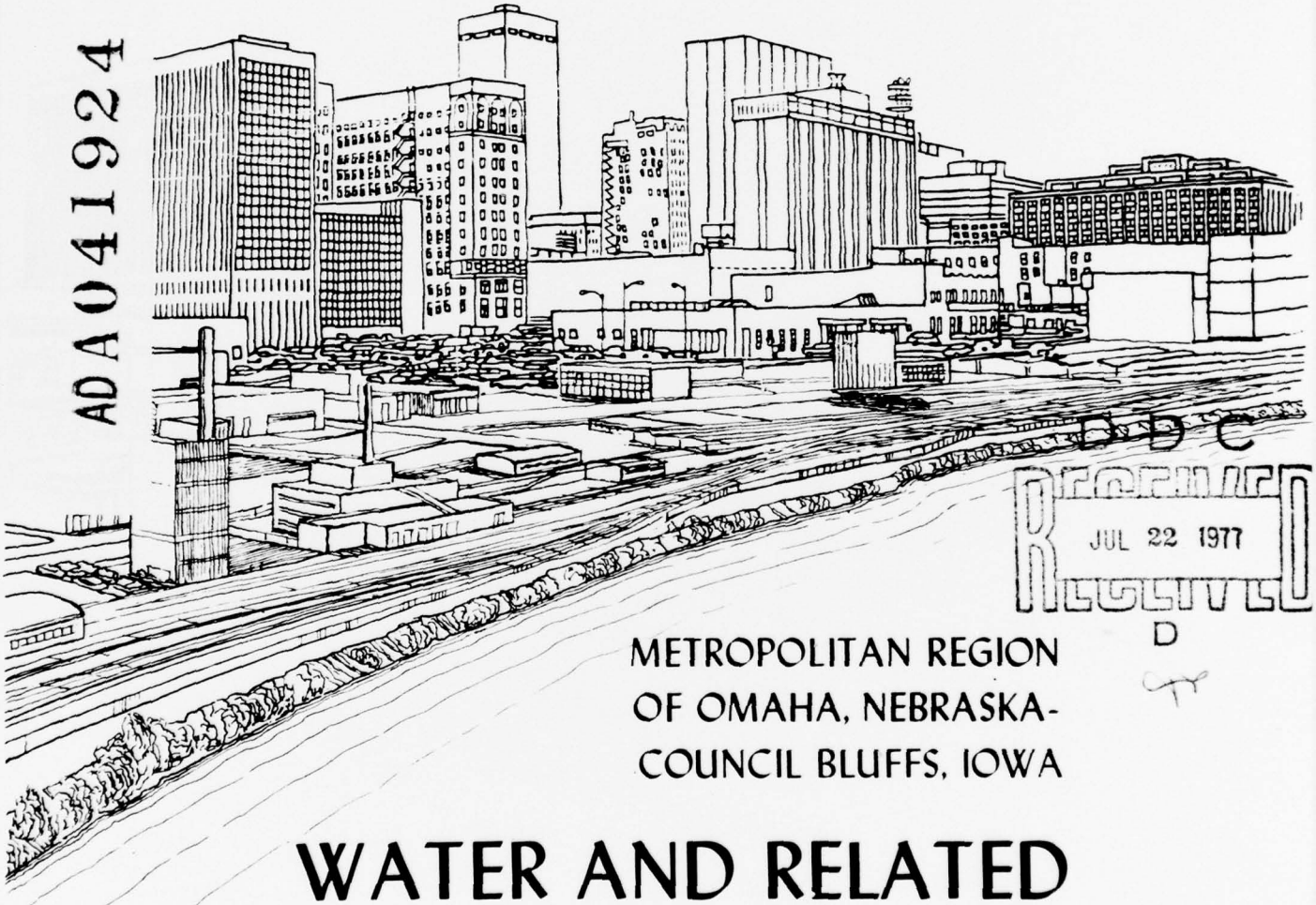
VOLUME III
PLAN FORMULATION APPENDIX

ANNEX C - WATER SUPPLY

REVIEW REPORT ON THE MISSOURI RIVER AND TRIBUTARIES

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OF OMAHA, NEBRASKA-
COUNCIL BLUFFS, IOWA

WATER AND RELATED LAND RESOURCES MANAGEMENT STUDY

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Volume III. Plan Formulation Appendix.
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REVIEW REPORT FOR
METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
WATER AND RELATED LAND
RESOURCES MANAGEMENT STUDY

Volume III Plan Formulation Appendix

ANNEX A	ALTERNATIVE FUTURES
ANNEX B	WASTEWATER
ANNEX C	WATER SUPPLY
ANNEX D	FLOOD CONTROL
ANNEX E	RECREATION

PREPARED BY THE

OMAHA DISTRICT CORPS OF ENGINEERS

DEPARTMENT OF THE ARMY

REVIEW REPORT FOR
METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
WATER AND RELATED LAND
RESOURCES MANAGEMENT STUDY

Plan Formulation Appendix

Annex C Water Supply

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SECTION B BACKGROUND FOR WATER SUPPLY PLANNING

SECTION C WATER SUPPLY PLANNING GOALS

SECTION D WATER SUPPLY PLANNING CRITERIA

SECTION E FORMULATING THE PLANS

SECTION F PLANS SELECTED FOR FURTHER CONSIDERATION

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PREPARED BY THE
OMAHA DISTRICT, CORPS OF ENGINEERS
DEPARTMENT OF THE ARMY

SECTION A

INTRODUCTION

INTRODUCTION

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SECTION A

INTRODUCTION

Purpose and Scope

1. The total study area includes Cass, Douglas, Sarpy, and Washington Counties in Nebraska, and Harrison, Mills, and Pottawattamie Counties in Iowa. The Regional Water Supply Study examined current and future water needs, the quality and quantity of water available to meet these needs, and methods of reducing water consumption. Water supply plans were developed to meet the needs and were tested for sensitivity to future uncertainties with regard to urban growth.

Study Participants

2. Henningson, Durham, and Richardson (HDR), an Omaha consulting firm, prepared the background work, developed the alternative

solutions and cost analyses in their report, prepared for the Urban Study entitled, "Regional Water Supply - Omaha, Nebraska - Council Bluffs, Iowa." The Corps of Engineers, Omaha District, performed the evaluation of the alternatives, based on alternative growth concepts, and on environmental, economic, and social factors. The results of this study will be helpful in guiding future planners and public officials in making water supply decisions for the communities and counties in the study area.

3. Many agencies and organizations contributed valuable information to the study effort including the following:

Metropolitan Utilities District

Council Bluffs Water Works

Papio Natural Resources District

Metropolitan Area Planning Agency

U. S. Environmental Protection Agency

Nebraska Department of Environmental Control

Iowa Department of Environmental Quality

Omaha Public Works Department

Area community public works and water works departments

SECTION B

BACKGROUND FOR WATER SUPPLY PLANNING

BACKGROUND FOR WATER SUPPLY PLANNING

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SECTION B

BACKGROUND FOR WATER SUPPLY PLANNING

Regional Water Supply Summary

1. Water supply systems in the study area are of three types: municipal, private, and rural water district.

2. Water users and usages in 1973 are shown on figure B-1 and in Table B-1. Municipal systems supplied more than 95 gallons on an average day (mgd) in 1973; 30 percent was supplied to industrial and large commercial users, and 70 percent to residential users. This use amounts to 172 gallons per person each day. An additional 28 mgd was used by industries with private supplies and 1,179 mgd was used by power generation plants primarily for nonconsumptive cooling purposes.

3. Agricultural usage amounted to 42 mgd for crop irrigation and 9 mgd for livestock watering.

4. Lawn watering accounts for about 20 percent of residential demand in the metropolitan area on an average day, and it accounts for up tc 38 percent of total system demand on peak days. In

smaller communities, lawn watering is estimated at about 10 percent of residential demand. Less than 10 percent of residential water use is for drinking or cooking.

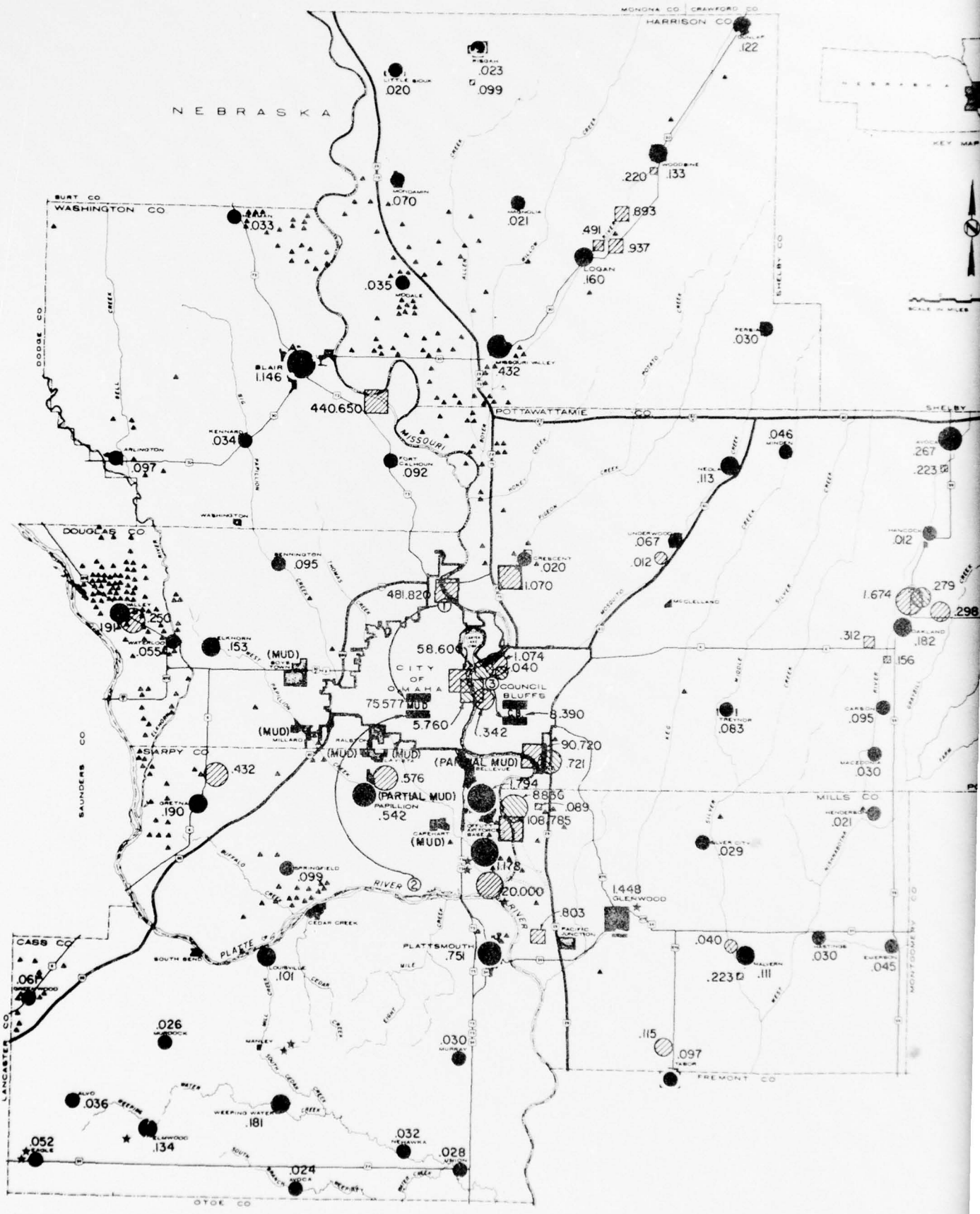
5. Powerplants and self-supplied industries use water primarily for cooling. Cooling water is generally returned to the source at nearly the same quality and quantity as which it is removed.

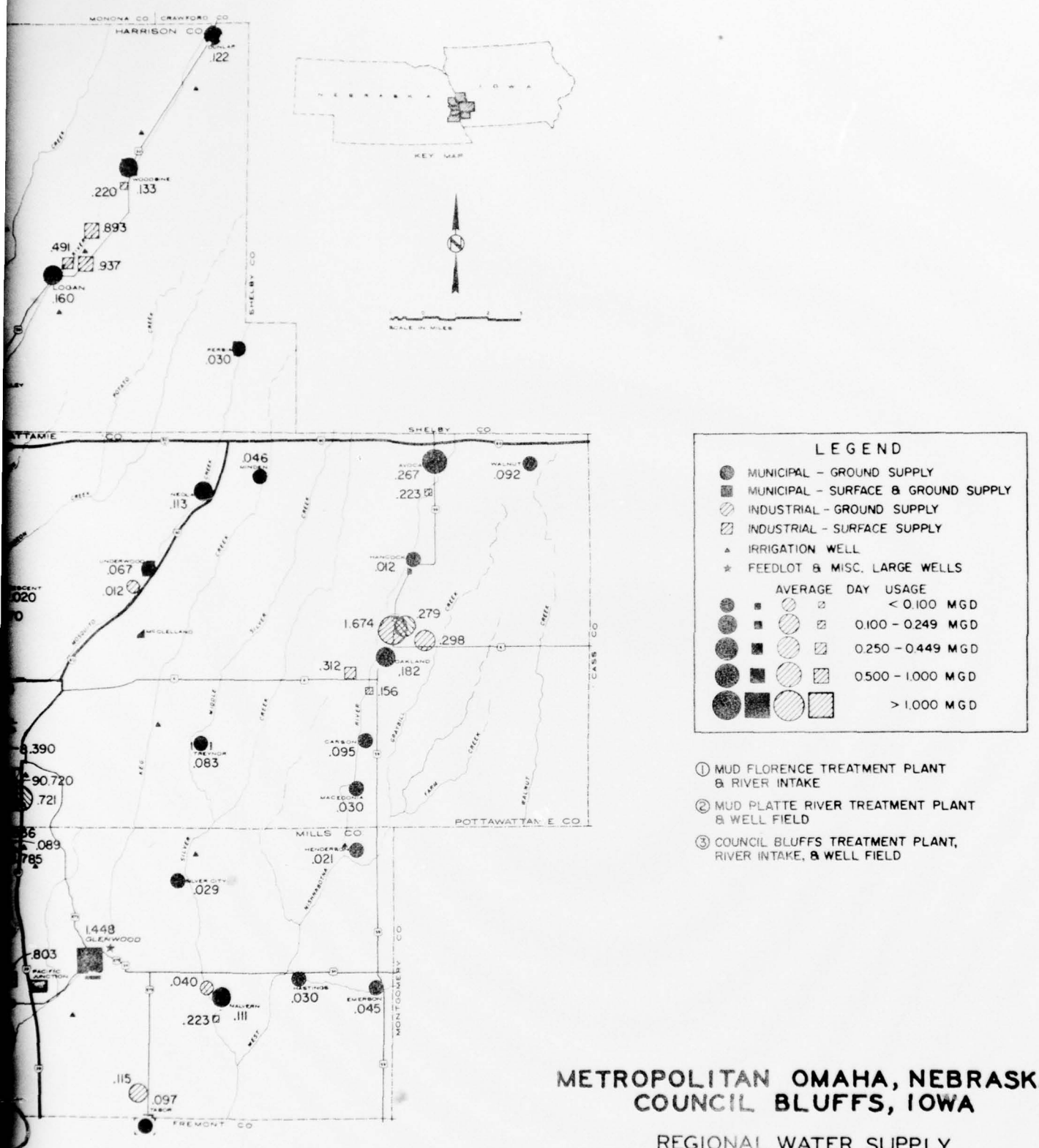
6. A total of 46,000 acres of agricultural land in the study area is currently irrigated. As indicated by irrigation-well locations on figure B-1, ground water withdrawal for crop irrigation is heaviest between the Elkhorn and Platte Rivers in western Douglas County and along the Missouri River in the northern portion of the study area.

7. Private residential supplies are located throughout the study area and account for less than 3 percent of the 1973 water supply. A majority of these systems are expected to be eliminated or relegated to a standby or alternative nonpotable source status upon implementation of rural water systems.

8. The largest water supplier is the Omaha Metropolitan Utilities District (MUD) which served 69 percent of the population and 77 percent of the demand in 1973. The other major municipal supplier in the study area is the Council Bluffs City Water Department which serves 9 percent of the demand. These two supplies are treated and meet the U. S. Public Health Service (USPHS) Drinking Water Standards.

9. There are 53 other municipal water supply systems in the study area, 42 or which do not meet the USPHS Drinking Water


NEBRASKA
HARRISON CO
MONONA CO
CRAWFORD CO
WASHINGTON CO
BURT CO
DODGE CO
SHELBY CO
POTTAWATTAMIE CO
DOUGLAS CO
SARPY CO
SAUNDERS CO
CASS CO
LANCASTER CO
OTOE CO
FREMONT CO
MILLS CO
MONTGOMERY CO
BLAIR
1.146
440.650
KENNARD
.034
ARLINGTON
.097
FORT CALHOUN
.092
MISSOURI RIVER
LOGAN
.160
.491
.937
.893
.220
.133
.035
.070
.033
.020
.023
.099
.122
.030
.432
.046
.113
.267
.223
.067
.012
.095
.020
1.070
481.820
1.674
279
.298
.312
.182
.156
.191
.250
.055
.153
(MUD)
58.606
CITY OF OMAHA
1.074
.040
COUNCIL BLUFFS
75.577 MUD
5.760
.342
8.390
90.720
.721
.083
.095
.030
.576
(PARTIAL MUD)
PAPILLION
.542
1.794
8.856
.089
108.785
.029
.021
.432
.190
.099
RIVER
20.000
1.178
1.448
GLENWOOD
.803
PACIFIC JUNCTION
PLATTSMOUTH
.751
SOUTH BEND
.101
.061
.026
.030
.036
WEEPING WATER
.181
ELMWOOD
.134
.052
.032
.028
.024
.040
.223
.111
.030
.045
.115
.097
KEY MAP
SCALE IN MILES



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 III ANNEX C FIGURE B-1

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Table B-1

PRESENT WATER DEMANDS – MILLION GALLONS PER DAY

TOTAL STUDY AREA

MUNICIPALITIES	1973 AVERAGE DAY	1973 MAX. DAY
SERVED BY MUNICIPAL SYSTEM		
RESIDENTIAL		
IN-HOUSE	53.459	69.495
LAWN IRRIGATION	12.572	69.457
INDUSTRIAL-COMMERCIAL	29.295	50.814
TOTAL	95.326	189.766
SERVED BY RURAL WATER DISTRICT		
RESIDENTIAL		
IN-HOUSE		
LAWN IRRIGATION		
INDUSTRIAL-COMMERCIAL		
TOTAL		
TOTAL MUNICIPAL	95.326	189.766
RURAL		
SERVED BY PRIVATE SYSTEM		
RESIDENTIAL		
IN-HOUSE	2.827	3.676
LAWN IRRIGATION	.501	2.980
TOTAL	3.328	6.657
SERVED BY RURAL WATER DISTRICT		
RESIDENTIAL		
IN-HOUSE		
LAWN IRRIGATION		
TOTAL		
LIVESTOCK WATERING BY PRIVATE SYSTEM	8.794	17.588
LIVESTOCK WATERING BY RURAL WATER DIST.		
TOTAL RURAL	12.122	24.245
TOTAL RURAL AND MUNICIPAL	107.448	214.011
CROP IRRIGATION	42.042	274.023
SELF SUPPLIED INDUSTRIES		
POWER PLANTS		
COOLING WATER	1178.567	1567.144
OTHER	2.732	4.058
OTHER INDUSTRIES	28.044	42.066
TOTAL INDUSTRIES	1209.343	1613.268
RECREATIONAL		
TOTAL	1358.833	2101.302

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. 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 have the desired system reliability and meet all USPHS Drinking Water Standards. An inventory of the municipal water systems is contained in Appendix A of the HDR Water Supply Study. A brief description of the water supply systems in each county follows.

CASS COUNTY

10. Cass County, Nebraska has one first-class city (Plattsmouth), two second-class cities, eleven villages, and four unincorporated communities. All of the incorporated areas are served by municipal water systems employing well sources with the exception of Manley and South Bend. Rural residents, the residents of South Bend and Manley, and the unincorporated communities use private well systems.

11. Industrial water usage in the county is minimal, with no major self-supplied or municipally-supplied industries except for feedlots having private wells. About 2,500 acres of agricultural croplands were irrigated in 1973.

12. All municipal water supply and distribution systems are owned and operated by respective city or village governments. Of the cities for which water-rate pricing data were available, only one

(Weeping Water) had a flat rate schedule while all other municipalities had a declining unit-price billing with the lowest rate being in a range of 20 cents to 54 cents per 1,000 gallons.

13. The Plattsmouth and Nehawka municipal systems are the only water supplies in the county which furnish water treatment or disinfection. Iron and manganese removal, softening, and disinfection are provided at Plattsmouth and Nehawka water treatment plants. No water treatment is provided by the other municipalities prior to distribution. The untreated raw water supplies characteristically have high dissolved solids, iron, or manganese concentrations. The standard of quality is somewhat higher along the Platte and Missouri Rivers than in the rest of the county. Water supplied to the residents of Eagle, Alva, Murdock, Elmwood, Weeping Water, Avoca, Louisville, Nehawka, Plattsmouth, and Murray exceeds one or more of the suggested USPHS Drinking Water Standards for iron manganese, and total dissolved solids. Adequate sources of potentially fair quality ground water exist along the Platte and Missouri Rivers. The availability and quality of ground water diminishes in the rest of the county. Seasonal water shortages are prevalent and in some instances local farmers must haul water from nearby communities to meet their demands.

14. A comprehensive plan for developing and implementing rural water districts is currently being prepared by Bartlett and West, Consulting Engineers, of Topeka, Kansas. The Plan involves the development of three rural water districts. Rural Water District No. 1 (RWD 1) is in the construction stage and will serve the village of Murray and rural residents in the eastern sector of the county. This district will purchase water from the Plattsmouth Municipal System. A proposed district (RWD 2) in the southwestern

portion of the county would serve rural users with bulk purchases of water from Otoe County RWD 3. An expansion of Otoe County RWD 3 will serve the villages of Avoca and Manley, in addition to serving rural residents of central Cass County when completed. Otoe County RWD 3 will use a ground-water supply southeast of Burr, Nebraska in the Nemaha Valley as its water supply source. The Plattsmouth system currently employs a ground-water supply. Force main and storage improvements have recently been constructed at Plattsmouth, Nebraska. Municipalities not supplied from rural water districts will be required to expand their distribution systems and provide treatment as dictated by future demands.

DOUGLAS COUNTY

15. Douglas County, Nebraska has one metropolitan city (Omaha), three second-class cities, and two villages. Omaha and Ralston are served by the Omaha Metropolitan Utilities District. The other communities are served by municipal systems with well supplies. Rural residences not in the metro area are served by private water supplies, primarily wells.

16. The greater portion of the total seven-county industrial water use is concentrated in Omaha and supplied by MUD. Major self-supplied industrial users in the county include two electric power generation facilities using Missouri River water for cooling purposes, a manufacturing plant using a private well supply, and feed lots utilizing private wells or impoundments. About 9,800 acres of agricultural croplands in the county are irrigated. Nearly all of the irrigated land lies between the Platte and Elkhorn Rivers in western Douglas County with more than 90 percent of the irrigation water being supplied by wells.

17. The MUD system, which is summarized in a separate section, furnishes over 98 percent of the municipal water used in the county. All other municipal water supply systems are owned and operated by their respective city or village governments. Ralston owns its system, but water is purchased from and the system is managed by MUD. Boys Town and Carter Lake are served by MUD. Of the communities for which water-rate pricing information was available, all had declining unit pricing with increasing water consumption. The lowest rate was in a range of 20 cents to 30 cents per 1,000 gallons.

18. Bennington, Valley, and Waterloo pump raw well water, which exceeds one or more of the USPHS recommended limits for iron, manganese, and total dissolved solids, directly to their distribution systems without prior treatment or disinfection. Elkhorn also does not provide treatment or disinfection to its water. MUD provides extensive treatment and disinfection of raw water from the Platte River well field south of Omaha and from the Missouri River north of Omaha before distribution to the metropolitan Omaha area.

19. Based upon existing data the small municipal systems do not possess standby pumping or power capabilities.

20. The consulting firm of Kirkham, Michael and Associates of Omaha has recommended the construction of an elevated storage tank, distribution system extensions, and a new well at Bennington.

SARPY COUNTY

21. Sarpy County, Nebraska has one first-class city (Bellevue), six second-class cities, one village, and eight unincorporated

communities. La Vista and Capehart are supplied with water from the Omaha Metropolitan Utilities District (MUD). The other incorporated communities are served by municipal water systems with well supply sources. Papillion and Bellevue purchase additional water from MUD to meet peak demands. The unincorporated communities of Fort Crook, LaPlatte, Meadow, Portal, and Richfield, and the rural residents are primarily served from private well supplies.

22. Major self-supplied industrial users in the county include one electric power generating facility using Missouri River water for cooling, a chemical manufacturing plant with a well supply, and feedlots using private wells or impoundments. Municipally supplied industry is concentrated in the northeastern portion of the county, and is provided with water from the MUD and Bellevue systems.

23. The MUD system, which is summarized in a separate section, supplies approximately 70 percent of the county's municipal water demand. The remainder of this demand is provided by municipally owned and operated supply systems. Of the municipal supply systems from which water-rate pricing information was available, all had declining unit price schedules for increased consumption. The lowest rate was in a range of 45 cents to 50 cents per 1,000 gallons.

24. Gretna and Springfield do not provide water treatment or disinfection prior to distribution. Bellevue and Offutt provide iron and manganese removal, softening, disinfection, and fluoridation. MUD provides extensive treatment and disinfection of raw water from the Missouri River and from Platte River well fields.

The water supplied at Springfield exceeds USPHS Standards for iron and manganese and the water supplied at Papillion exceeds the iron standard.

25. Available information indicates that none of the municipal systems now owned or operated by MUD have standby pumping or power capabilities.

26. Future plans designed to meet the county's growing water demands involve extensions of MUD service into urbanized areas in north Sarpy County and the continued improvement of the municipal systems in Gretna and Springfield.

WASHINGTON COUNTY

27. Washington County, Nebraska has one first-class city (Blair), four villages and one unincorporated community. All of the incorporated areas are served by municipal water systems employing well supplies. The unincorporated community of Washington and the rural population are served from private well supplies.

28. The Fort Calhoun power plant and cattle feeding operations are the major industrial users in the county. The power plant is supplied from the Missouri River and the feedlots utilize wells or impoundments for their demands. Approximately 3,900 agricultural acres were irrigated in 1973.

29. All municipal water supply and distribution systems are owned and operated by respective city or village governments. Of the cities for which water-rate pricing data were available, Kennard

and Herman have flat rate schedules while all other municipalities had a declining unit price billing with the lowest rate being in a range of 15 cents to 30 cents per 1,000 gallons.

30. Arlington, Blair, and Fort Calhoun provide iron and manganese removal; and disinfection of their raw water supplies. In addition, the Blair treatment plant also provides softening and Herman chlorinates its raw water before distribution. Kennard and Washington do not have disinfection or treatment capabilities. The untreated raw water supplies characteristically have high concentrations of iron, manganese, and dissolved solids. Water supplied to the residents at Kennard exceeds USPHS recommended limits for iron, manganese, and is high in total hardness. Adequate sources of potentially fair quality ground water exist along the Missouri and Elkhorn Rivers. The availability and quality of ground water diminishes in the rest of the county.

31. In the Washington County Comprehensive Water and Sewer Study Kirkham, Michael, and Associates proposed that future county water needs be met through the formation of eight rural water districts. Supplying portions of Washington County, particularly the Fort Calhoun area, from the MUD system is currently being studied under the auspices of the Papio Natural Resources District.

METROPOLITAN UTILITIES DISTRICT

32. The Omaha Metropolitan Utilities District supplies by far the largest area, the largest number of users, and the greatest quantity of water of any municipal system in the study area. In addition to serving Omaha and the communities of Irvington,

Ralston, Millard, LaVista, and Capehart, MUD supplies part of the water needs of Bellevue and Papillion.

33. The existing water system has a supply and treatment capacity of 200 million gallons per day. MUD obtains its water from two supply sources. The existing Florence Treatment Plant was originally placed in operation in 1889, was expanded in 1923, and expanded further and modernized in the mid-fifties. Water is obtained from the Missouri River and is softened and disinfected prior to discharge to the water supply system. The Platte River Plant was placed in operation in 1968. Thirty-seven shallow wells having an average depth of 55 feet provide raw water at the Platte River Plant. This water is treated for iron and manganese removal, softened, and disinfected at the treatment plant.

HARRISON COUNTY

34. Harrison County, Iowa has four second-class cities, six villages, and six unincorporated communities. All of the incorporated areas are served by municipal water systems employing well supplies. The unincorporated communities and rural population are served by private well supplies.

35. Industrial water usage in the county is minimal with no major self-supplied or municipally supplied industries, except for feedlots having private well supplies. About 14,400 acres were irrigated in 1973.

36. All municipal water supply and distribution systems are owned and operated by their respective city or village governments.

Of the cities for which water-rate pricing information was available, all had a declining unit price billing, with the lowest rate being in a range of 12 cents to 35 cents per 1,000 gallons.

37. All of the municipal systems in the county, except those in Dunlap and Woodbine, have water treatment and disinfection facilities. Of the systems which provide treatment, all but one provide iron and manganese removal and two provide softening. Dunlap provides only water stabilization and Woodbine provides only disinfection. Pisgah pumps water directly into the distribution system without prior treatment or disinfection. The untreated raw water supplies characteristically have high total dissolved solids, iron and/or manganese concentrations. A few raw water supplies have excessive sulfate concentrations. With the exception of Pisgah, all the municipally treated water supplies exceed one or more of the suggested USPHS Drinking Water Standards for iron, manganese, total dissolved solids, and sulfates. Adequate supplies of fair quality ground water exist along the Boyer and Missouri Rivers. The availability of ground water diminishes in the rest of the county.

38. A plan exists for serving all rural and municipal residents of Harrison County from six rural water districts. Each district would be interconnected with the other districts and treatment facilities and well supplies would be located near the ten incorporated towns. Implementation of this plan would provide essentially all residents of the county with a good quality water supply.

39. There are currently no known pumping facilities with standby pumping or power capabilities.

40. Recommended improvements for the Missouri Valley municipal system listed in a 1968 Henningson, Durham, and Richardson report consisted of distribution system improvements, addition of an elevated storage tank, and improvement of the water treatment plant. The firm of Rieke, Carrol, Muller Associates has been recently retained to prepare an engineering study of Missouri Valley's water supply system.

MILLS COUNTY

41. There are eight incorporated municipalities in Mills County representing approximately 70 percent of the county's 11,800 residents. Seven of these communities have public water facilities. Pacific Junction, population 560, is not on a public system.

42. The city of Glenwood obtains a portion of its water from Keg Creek. All other communities and rural areas utilize ground water with pumping capacities ranging from 40 gpm to 300 gpm. Irrigation wells in the alluvial aquifer along the Missouri River's plain are capable of producing up to 1,500 gallons per minute.

43. Three of the county's six municipal water systems are supplied totally from wells and provide no treatment. The town of Tabor provides only disinfection. Three communities provide iron and manganese removal and disinfection. Glenwood's Pacific Junction well field provides softening, iron, and manganese removal and disinfection.

44. The cities which provided water-pricing information all have metered sales with declining block rates. The high quantity rates range from 25 cents to 50 cents per 1,000 gallons.

45. The greatest use of water in the county is for agriculture. A total of 3,900 acres of cropland are irrigated. It is estimated that hogs and cattle alone consume 500,000 gallons per day (gpd) in Mills County.

46. There are two major industrial water users in the county. The Swift Company in Glenwood uses over 600,000 gpd, and Henningson Foods in Malvern uses about 50,000 gpd from the municipal system. Henningson Foods also has a private supply well of about 40,000 gpd. There is only one major commercial water user in the county; the State School in Glenwood uses approximately 100,000 gallons per day.

47. A water system plan was prepared for Mills County in 1970 by Anderson Engineering Company. The basic features of this plan, which divided the county into three water service areas, are: (1) greater use of ground water sources through the construction of new wells; (2) placement of additional storage facilities; and (3) interconnection of municipal water systems with 8-inch mains.

48. A 1971 report by Kirkham, Michael & Associates on the Glenwood water system recommended immediate construction of additional water storage and pumping facilities. Future improvement recommendations include abandonment of the surface water supply and treatment plant and expansion of the Pacific Junction well field capacity and treatment to 5.5 mgd by 1998.

49. Recommended improvements for the Malvern system listed in a 1967 report by Kirkham, Michael & Associates consisted principally of expansion and updating of the existing system.

POTTAWATTAMIE COUNTY

50. Pottawattamie County, Iowa has one first-class city (Council Bluffs), three second-class cities, ten villages, and seven unincorporated communities. All of the incorporated areas, except McClelland, are served by municipal water systems employing well supplies. McClelland, the unincorporated communities, and the rural population are served by private well supplies. The Council Bluffs system will be summarized in a separate section.

51. Industrial water usage in the county is concentrated in the Council Bluffs area, with minimal industrial usage in the remainder of the county. There are three major self-supplied industries located near Council Bluffs, with the remainder of the major industries being supplied from the Council Bluffs water system. About 3,900 acres were irrigated in 1973. The remaining irrigated acreage is concentrated in northwest Pottawattamie County and is irrigated from wells.

52. All municipal water supply distribution systems are owned and operated by their respective city or village governments. Of the cities for which water-rate pricing information was available, all had declining unit pricing with increasing water consumption. The lowest unit price ranged from 20 cents per 1,000 gallons at Treynor to 70 cents per 1,000 gallons at Macedonia.

53. Four municipal systems, Hancock, Macedonia, Treynor, and Underwood; pump water directly from well supplies to their distribution system without prior treatment or disinfection. Three municipal systems Crescent, Neola, and Oakland, provide only

disinfection, and four systems, Avoca, Carson, Minden, and Walnut, provide both treatment and disinfection. Of the four systems providing treatment, all provide iron and manganese removal with Avoca and Minden providing additional softening. The finished waters from all four municipal treatment facilities are characteristically hard. Untreated raw-water supplies within the county have concentrations of total solids, iron, and manganese. Well water supplies at Crescent, Hancock, Macedonia, Minden, Neola, Oakland, Treynor, Underwood, and Walnut exceed one or more of the recommended limits for total dissolved solids, sulfates, fluoride, iron, and manganese. Adequate supplies of fair quality ground water exist along the Missouri River. A large variance in water availability and quality exists in the remainder of the county.

54. A plan exists for serving rural and municipal residents of Pottawattamie County, exclusive of the Council Bluffs area, from eight rural water districts. Each rural district would be interconnected with the other districts. District water supply sources and treatment facilities would be located near existing towns in each district and would supply both municipal and rural residents in the district. Implementation of this plan would supply rural residents of the county with a good quality water supply and improve existing municipal systems.

55. There are currently no known pumping facilities with standby pumping or power capabilities.

56. Recommended improvements for the Avoca municipal system as listed in a 1971 Kirkham, Michael & Associates' study and report, consisted mainly of distribution system improvements and the addition of another elevated storage facility.

COUNCIL BLUFFS

57. All of the Council Bluffs' municipal water supply is treated by the Narrows Station Treatment Plant which has a capacity of 17 mgd. Raw water supply is primarily from the Missouri River with some supplemental well water used during the winter months to raise the water temperature to lessen icing problems. The treatment plant provides clarification, softening, filtration, and chlorination of the raw water.

58. Council Bluffs' 1972 Water Distribution System Master Plan basically recommends expansion of treatment, distribution, and storage facilities to accommodate increasing water demands and growth of the service area.

59. Probable supply source is the Missouri River at the existing Narrows Station site.

Water Supply Problems and Needs

PRESENT

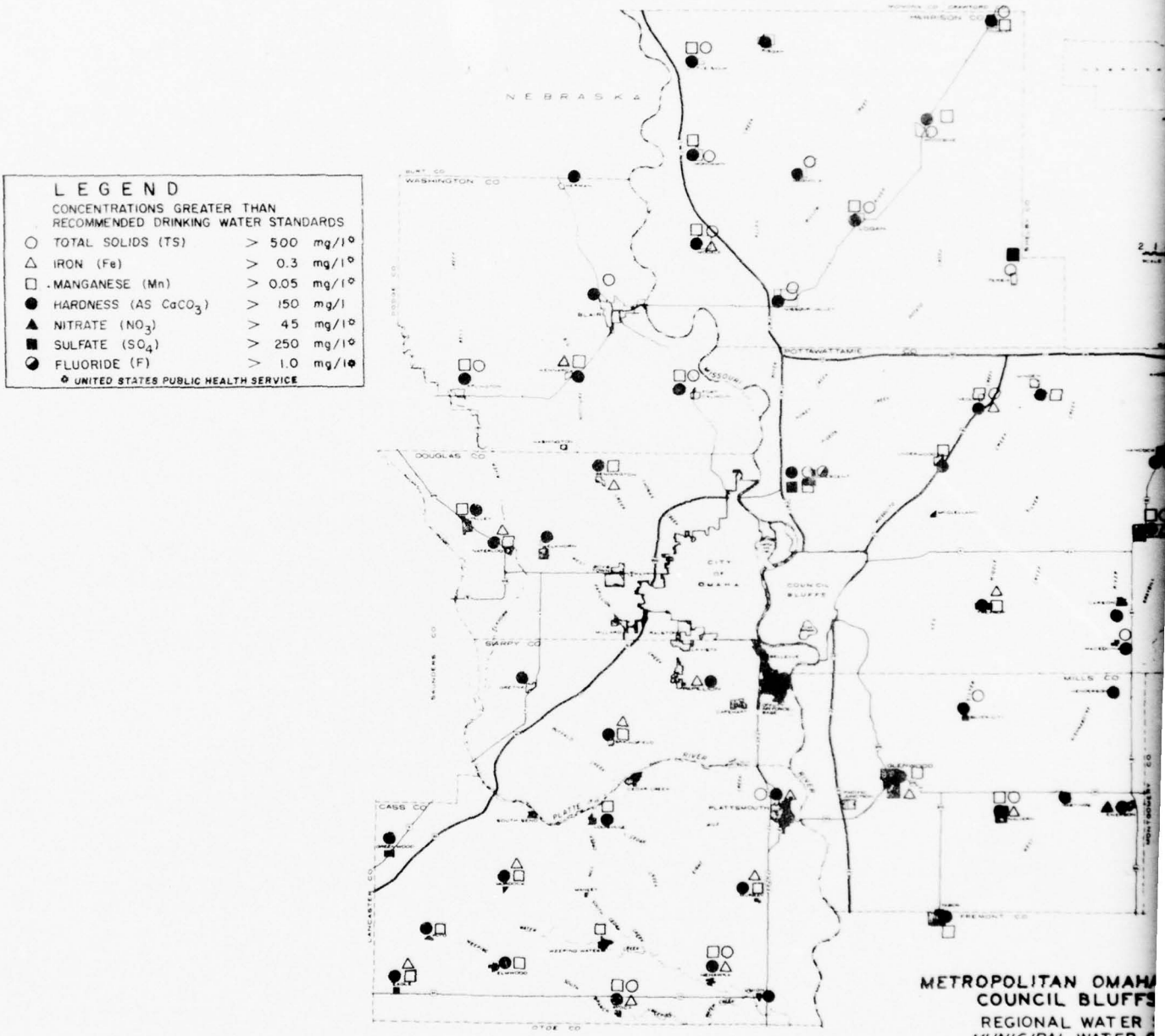
60. The 1962 United States Public Health Service (USPHS) recommended Drinking Water Standards are generally accepted as

guidelines for municipal water quality. These standards were used in this study as a basis for comparing the quality of water supplies to residents of the study area. Some of the recommended standards are related to public health whereas many are aesthetic in nature. Most communities that exceed the USPHS recommendations exceed standards that are not related to health. Table B-2 indicates the USPHS recommended maximum concentrations of constituents and their signficance. Limits on the constituents shown are recommended USPHS standards and are not mandatory.

61. The 1974 Safe Drinking Water Act contains provisions for the establishment and enforcement of municipal drinking water quality standards. Interim Primary Standards were issued on 14 March 1975. The Act adopted the USPHS recommendations related to public health. Final provisions in the Safe Drinking Water Act are still being determined. It is important to note that the Act did not include the USPHS recommendation for iron, manganese, total dissolved solids, or sulfates but did establish requirements for nitrates, florides, bacteria, and a host of other chemicals which are not now normally monitored in water supplies.

62. Figure B-2 compares the quality of water supplied to each municipality in the study area with five USPHS recommended standards, a non-standard hardness criteria, and the nitrate and flouride Interim Standards of the Safe Drinking Water Act. The map was constructed from other data sources including questionnaires returned by some communities.

63. The available data indicate that 42 communities have water that exceeds one or more of the USPHS recommendations. In addition,

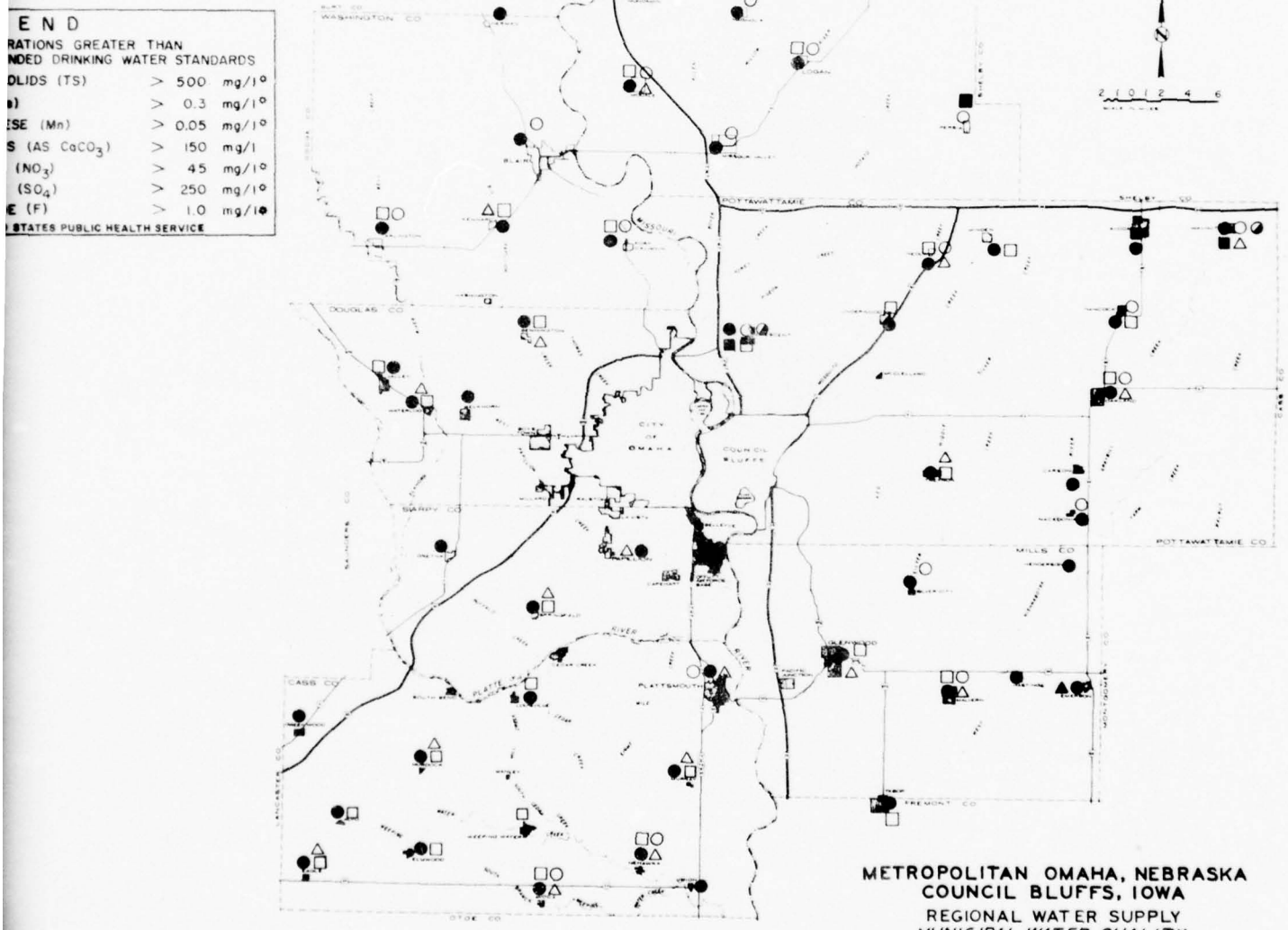


METROPOLITAN OMAHA
COUNCIL BLUFFS
REGIONAL WATER
MUNICIPAL WATER

U. S. ARMY ENGINEER DISTRI
CORPS OF ENGINEERS OM

JUNE 1975

VOLUME III ANNEX C | F



END

RATIONS GREATER THAN
NDED DRINKING WATER STANDARDS

OLIDS (TS)	>	500	mg/l*
a)	>	0.3	mg/l*
ESE (Mn)	>	0.05	mg/l*
S (AS $CaCO_3$)	>	150	mg/l
(NO_3)	>	45	mg/l*
(SO_4)	>	250	mg/l*
E (F)	>	1.0	mg/l*

STATES PUBLIC 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 III ANNEX C | FIGURE B-2

Table B-2
Water Constituent Standards and Significance

Constituent or Property	Maximum Recommended Concentration	Significance
Iron	0.3 mg/l	Causes discoloration of clothes and plumbing fixtures, incrustations in water mains, hardness, and disagreeable taste.
Manganese	0.05 mg/l	May clog pipes and discolor fabrics.
Chloride	250 mg/l	Large amounts may cause salty taste and excessive amounts may indicate sewage pollution.
Sulfate	250 mg/l	A sulfate content in excess of 500-700 ppm usually imparts a bitter taste and may have a laxative effect on persons not accustomed to the water.
Fluoride	2.0 mg/l	A fluoride content of 1.2 mg/l has been found to reduce tooth decay in children. Excess fluorides have been found to cause pitting and staining of tooth enamel.
Nitrate	45.0 mg/l	Waters with high nitrates may cause methemoglobinemia (blue babies). High concentrations may indicate pollution from sewage.
Total Dissolved Solids	500 mg/l	Refers to all material in water that is in solution. Amounts in excess affect water taste. Amounts in excess of 1000 mg/l may have detrimental effect in crops.
Hardness		
Soft	0-60 mg/l	Defined as the soap consuming capacity of water.
Moderate Hard	61-120 mg/l	
Hard	121-180 mg/l	
Very Hard	181- mg/l	

one community has excessive nitrates and three communities have wells with excessive flourides based on the Safe Drinking Water Act Interim Standards.

64. In addition to quality, the supply adequacy, amount of storage, and disinfection capabilities were assessed for each community. Supply adequacy was determined by comparing the well capacity with the 1973 maximum day demand for each community. Adequate storage was based on whether or not a community had an average day's water demand stored in case of fire or pump and well breakdown. The capability of municipal systems to provide disinfection as a safeguard against health hazards was also examined.

65. Table B-3 shows the result of the above assessments for each community in the study area.

66. The majority of the municipal systems will need comprehensive management and planning in order to rectify present deficiencies and to provide reliable service in the future. Table B-3 indicates cities having or currently formulating some type of water supply plan. The systems exhibiting some type of reliableness and a lack of planning are potential problem areas.

67. The MUD and Council Bluffs systems provide reliable service to the metro area through efficient operation and maintenance of their systems. Both systems have formulated Master Plans to govern future expansions which will be required to meet the growing water requirements in Metropolitan Omaha and Council Bluffs.

Table B-3
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		I	N/A	X	X	
	MURRAY			N/A	X	X	
	NEHAWKA	X		N/A	I		
	PLATTSMOUTH				I		X
	UNION			N/A		X	
	WEEPING WATER	X		X	X	X	
DOUGLAS							
	BENNINGTON			I	X	X	X
	ELKHORN					X	X
	VALLEY		X	N/A	X	X	
	WATERLOO		X	N/A	X	X	
SARPY							
	BELLEVUE						X
	PAPILLION		X		I		X
	SPRINGFIELD		X	N/A	X	X	X
	GRETNA		X	N/A		X	X
WASHINGTON							X
	ARLINGTON		X	N/A	I	X	X
	BLAIR				I		X
	FORT CALHOUN	X		N/A	X		X
	HERMAN			N/A			
	KENNARD	X	X	X	X	X	

N/A NOT AVAILABLE

Table B-3 (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

FUTURE

INTERNAL TO THE STUDY AREA

68. Present and future water demands are compared in figure B-3. Per capita water use is expected to increase 37 percent by 2020. This increase, coupled with population projections, results in a 2020 water usage equal to 2.5 times the 1973 usage.

69. This increase will create additional demands on the resources of the region and the use of chemicals and energy. Rising costs of labor materials, energy, and chemicals indicate that the costs of water will increase along with the costs of all other public utilities. Eighty percent of the water that is used ends up at the sewage treatment plant for treatment before discharge to the river. Rising costs in conjunction with stricter pollution control standards will cause sewage treatment costs to rise in the future.

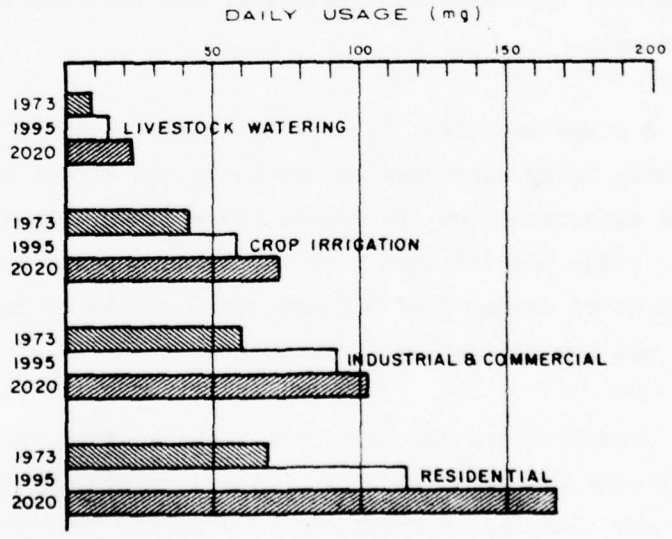


Figure B-3

PRESENT AND FUTURE WATER DEMANDS

70. For the study area water availability will not be a problem. Uses of water outside the study area and the location of water supply sources within the study area are the primary water supply problems.

EXTERNAL TO THE STUDY AREA

71. Water resource development outside the study area, in the Platte and Missouri River Basins, will have an impact on water supply planning in the Omaha-Council Bluffs area.

72. As Omaha expands westward, the desirability for additional well field development in the Platte River Valley has increased. Use of this resource instead of additional supplies from the Missouri River would save MUD customers about $400,000 to $1,000,000 annually in energy and chemical costs by 1995. Further use of the Platte River ground and surface waters is desired by the city of Lincoln, by irrigation interests, and for fish and wildlife maintenance.

73. A study entitled, "The Platte River Level 'B' Study", is currently being conducted to determine the effect of future upstream withdrawals on the Platte River flows. Preliminary results of the study predict zero flow in the downstream reach of the Platte River during 3 of 5 consecutive months by 2020 in dry years under maximum irrigation development.

74. Ground waters fed by direct recharge from the Platte River are already tapped by major well fields supplying the cities of Omaha and Lincoln. Development of a second well field as contemplated by the Metropolitan Utilities District, expansion of

Lincoln's withdrawal to meet future needs, increasing irrigation usage, and concern for fish life will result in competition for a limited amount of water.

75. Priority of claims to use of Platte River Valley water resources or streamflow regulation or augmentation must be considered to resolve this competition. Planning at the State level must be accomplished in the immediate future to determine legal claim to water by Platte River basin entities and to ascertain the feasibility of streamflow maintenance by water control structures or interbasin transfer.

76. Upstream withdrawals for irrigation and possibly for development of coal deposits could diminish Missouri River flows, although not enough to affect the quantity required for area users according to present predictions. The annual flow of the Missouri River could be reduced by as much as 50 percent by 2020 if many of the planned irrigation and energy-related projects are implemented.

77. The level of quality would also be reduced. For instance, total dissolved solids (salt content) would rise from 470 mg/l (miligrams per liter) to 790 mg/l if the flow is depleted by 50 percent. It is generally agreed by water quality experts that the salt concentration of good palatable water and good irrigation water should not exceed 500 mg/l but that significant adverse effects do not occur until concentrations exceed 1,000 mg/l. Total dissolved solids (TDS) are extremely difficult to remove from water.

78. Irrigation return flow problems could become significant in both the Platte River and Missouri River Basins. Part of the

water withdrawn dissipates via evapotranspiration while the remainder of the flow is returned carrying essentially all of the dissolved solids contained in the total flow withdrawn. Excess flow and leaching are necessary in irrigation to prevent salt build-up in soils to a point where crops are adversely affected. Washout of artifically applied or naturally occurring chemicals in the soil and use of groundwaters high in dissolved solids are also factors affecting stream quality through irrigation return flow.

79. Increases in magnesium and calcium salts (hardness) from irrigation return flows will increase treatment costs to maintain a desirable potable water quality. Continued surveillance of other potentially harmful constituents will be required to insure public health. A tremendous treatment cost will be incurred should TDS reduction become necessary. No TDS limit for drinking water is made by the proposed Interim Primary Drinking Water Standards.

80. Careful planning and management of the Missouri River resources, coordinated through the Missouri River Basin Commission will be necessary to avert future problems.

SECTION C

WATER SUPPLY PLANNING GOALS

SECTION C

WATER SUPPLY PLANNING GOALS

1. The purpose of the water supply study is to provide a plan, or set of plans, which can be used by planners and government officials in the urban study area as they work to solve water supply problems during the next 50 years. Goals of the study are to:

- Develop plans which provide a reliable water supply to the majority of the seven-county residents that meets USPHS and 1974 Safe Drinking Water Act standards;

- Develop plans which provide for future residential, industrial, and commercial water demands through the year 2020;

- Determine measures to minimize potential conflicts over water resource use and environmental protection;

- Determine measures to reduce water consumption;

- Evaluate economic, social, and environmental impacts of the plans;

- Determine institutional arrangements required to implement the plans; and

- Integrate water supply planning with comprehensive water and related land resource management.

SECTION D

WATER SUPPLY PLANNING CRITERIA

WATER SUPPLY PLANNING CRITERIA

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SECTION D

WATER SUPPLY PLANNING CRITERIA

Population and Land Use

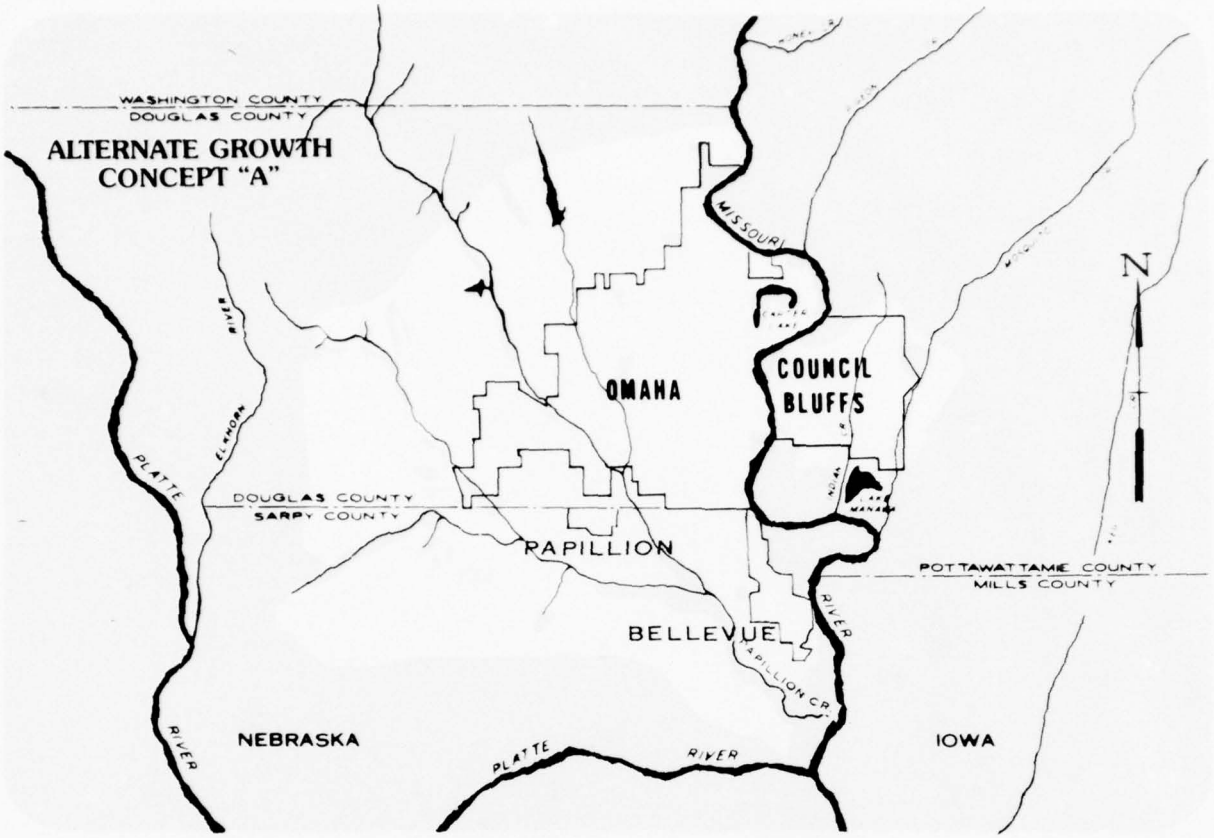
1. The 1970 population of the seven-county study area was approximately 600,000. The future growth of the area is not entirely predictable, but future population growth projections are necessary for water supply planning. By 1995 the population of the study area is predicted to be over 900,000; by 2020, it is projected to be over 1,100,000.

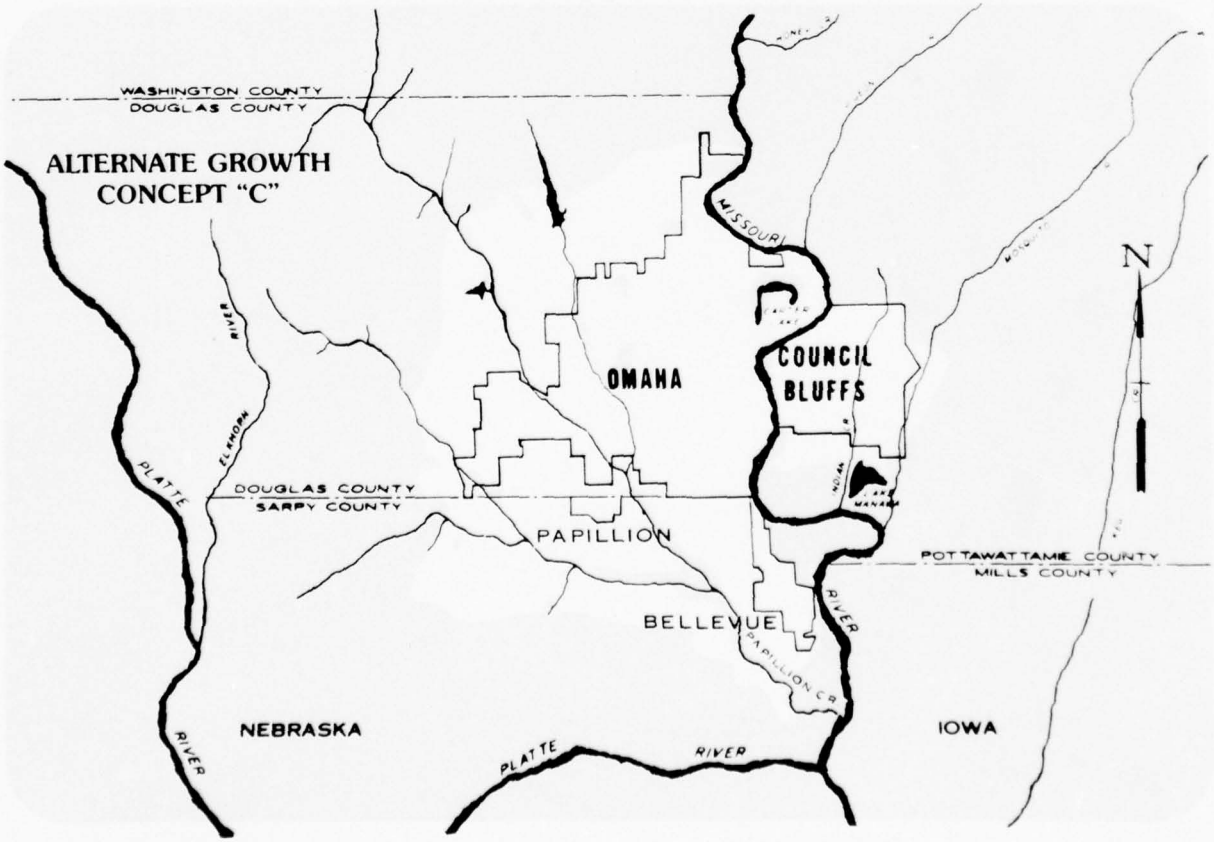
2. The distribution of this population throughout the study area is important in water supply planning. In order to develop plans for water supply, an expected growth pattern is usually developed. In the case of the Omaha, Nebraska - Council Bluffs, Iowa urban area, no general consensus could be arrived at for a future growth pattern. In their analysis of the growth, the Corps of Engineers has examined input from various other planning agencies in the study area and used not one but four alternative growth patterns for future urban growth in the metropolitan area.

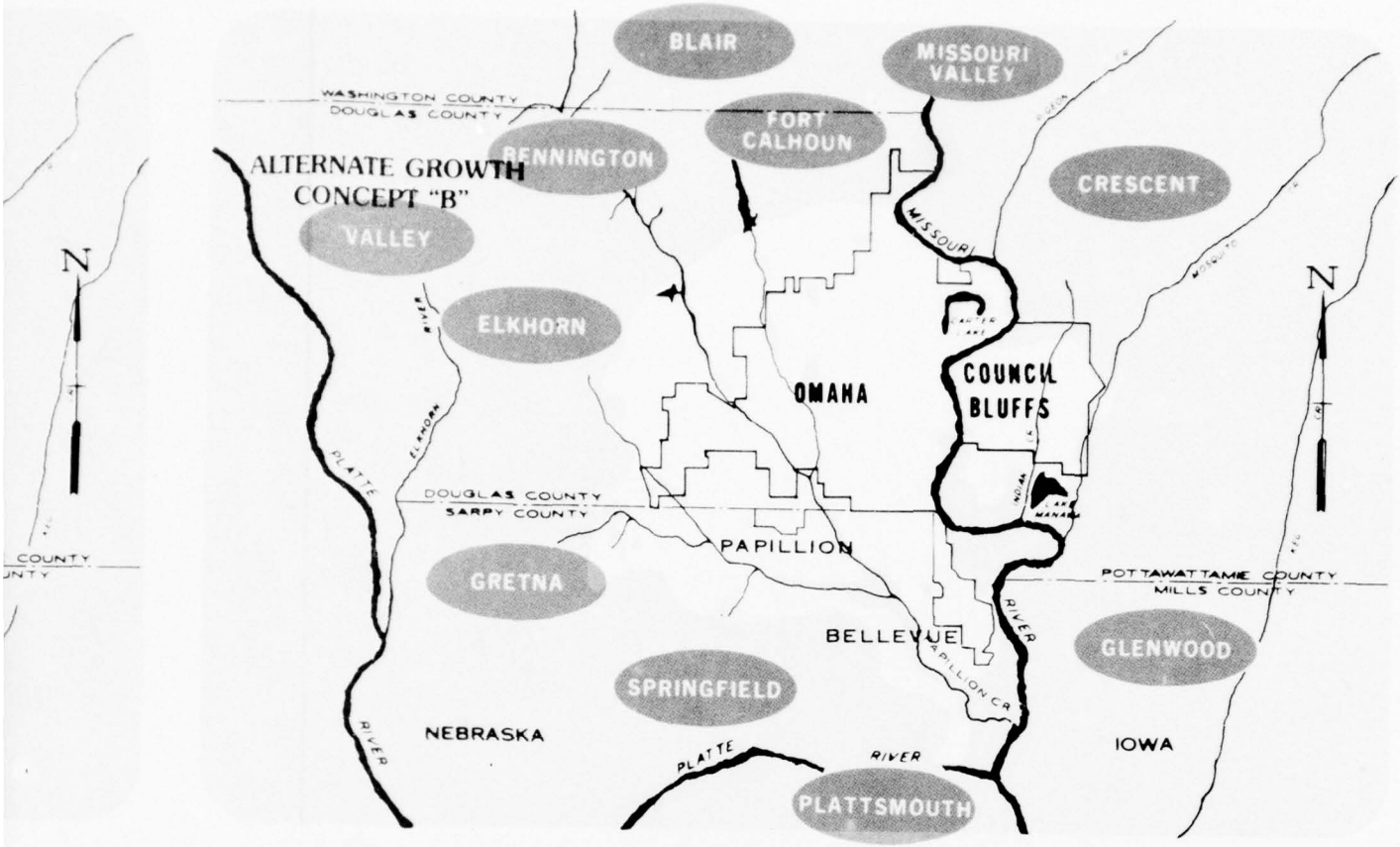
3. A set of four possible patterns of urban growth exist for the area (Concept A, B, C, and D). Concept A assumes a continuation of present land use and represents low density urban sprawl. Concept B involves a higher density growth consisting of controlled growth for urban Omaha with separate, self-sustaining satellite cities separated from urban Omaha by open space. Concept C also envisions a high density pattern for Omaha, but with expanding boundaries rather than separate satellite cities. Concept D assumes low density development, as in Concept A, but presumes the development will occur as a secondary effect of the existing transportation routes.

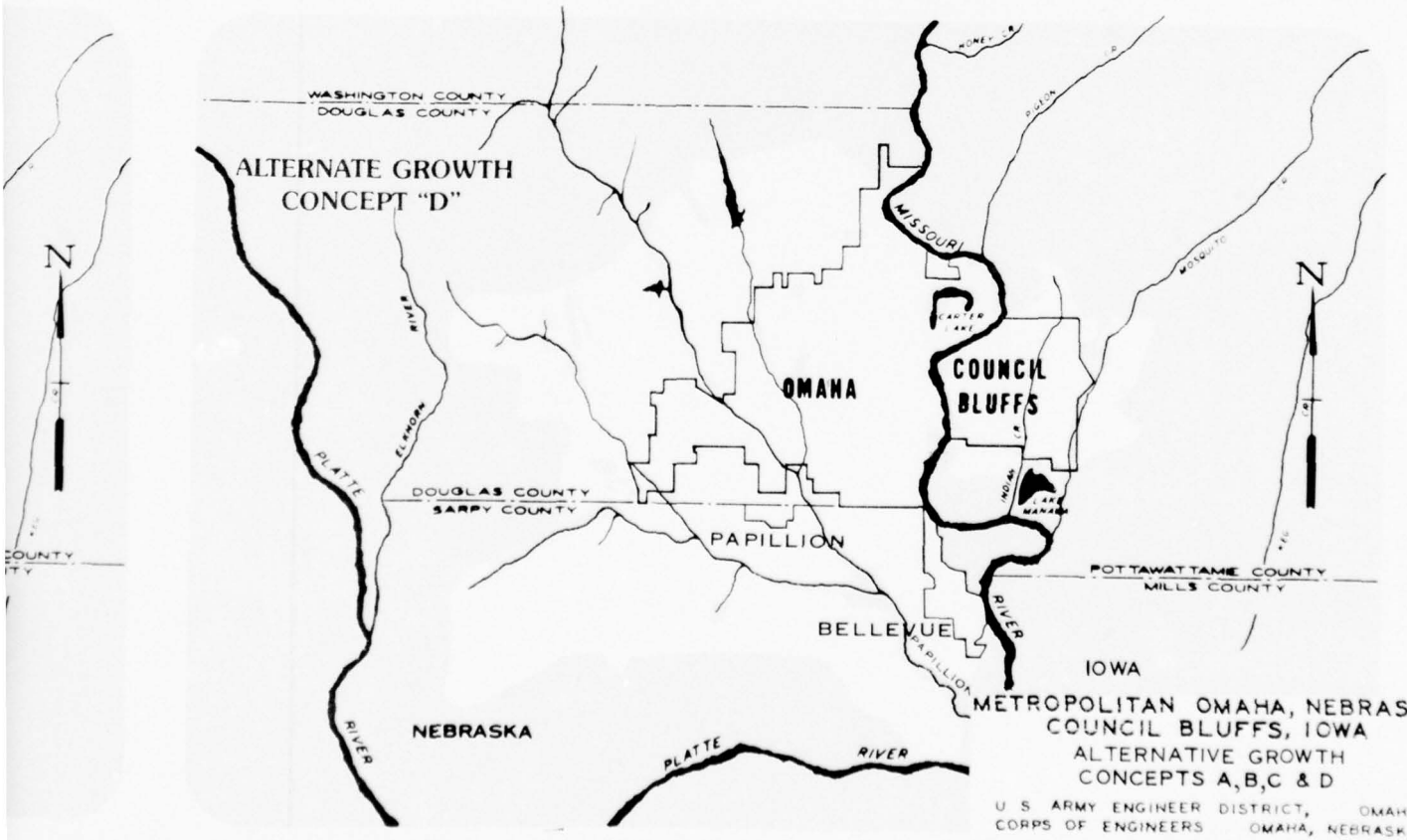
4. Figure D-1 illustrates the four growth concepts. A more detailed discussion of the growth concepts is contained in the Alternative Futures Plan Formulation Annex. Alternative Futures permit determination of water resource system sensitivity to changing growth policies, permit an analysis of the role of water resource systems in shaping urban growth, provide an effective tool for citizen communication concerning water and related land resource management, provide opportunities for multiple-objective planning, and allow the Corps of Engineers to assume a non-advocacy position with regard to land use.

5. Table D-1 contains existing and future population projections by county for four growth concepts. The 1995 projections for the three county SMSA (Douglas, Sarpy, and Pottawattamie Counties) were adopted by the Metropolitan Area Planning Agency Council of Elected Officials for use in their 1995 transportation study. The SMSA projection resembles OBERS Series "C" as modified locally. Projections for the other counties were obtained from State or local projections with the exception of Growth Concept B where


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


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





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 III ANNEX C FIGURE D-1

Table D-1
1970 Population With Future Projections For Seven-County Area

County	1970 Census Data	1995 Growth Concepts A	1995 Growth Concepts B	1995 Growth Concepts C	1995 Growth Concepts D	2020 Growth Concepts A	2020 Growth Concepts B	2020 Growth Concepts C	2020 Growth Concepts D
Nebraska									
Cass	18,076	20,562	32,879	20,562	20,562	21,526	33,491	21,526	21,526
Douglas	389,455	533,378	515,791	581,667	523,502	650,241	634,989	686,483	619,346
Sarpy	66,200	215,442	176,800	167,113	225,278	260,743	220,200	228,501	288,193
Washington	13,310	17,759	42,063	17,759	17,759	19,348	52,242	19,348	19,348
Nebraska Total	487,041	787,141	767,533	787,101	787,101	951,858	940,922	955,858	948,413
Iowa									
Harrison	16,220	16,834	22,904	16,834	16,834	17,727	23,386	17,727	17,727
Mills	12,517	11,961	24,939	11,961	11,961	11,418	24,795	11,418	11,418
Pottawattamie	86,991	102,074	102,624	102,104	102,104	123,497	115,397	119,497	126,942
Iowa Total	115,728	130,869	150,467	130,899	130,899	152,642	163,578	148,692	156,087
7-County Total	602,769	918,000	918,000	918,000	918,000	1,104,500	1,104,500	1,104,500	1,104,500

urban population growth was dispersed to rural communities. The year 2020 projections were based on analysis of 13 different population projections. The selected 2020 projections approximate OBERS Series "C".

Water Quality Criteria

6. The 1962 USPHS recommended drinking-water standards were used as a basis for the quality of water to be supplied to citizens of the study area. The 1974 Safe Drinking Water Act contains provisions for the extablishment and enforcement of municipal drinking-water quality standards. Interim Primary Standards were issued on 14 March 1975. The Primary Standards are those related to public health and are similar to those recommended by the USPHS. Secondary standards are to be issued at a later date for non-health related conditions. Table D-2 lists the USPHS Standards and the Interim Standards of the Safe Drinking Water Act. Water quality required for various industries and agricultural operations was determined during the study. These quality requirements are contained in the Supporting Technical Reports Appendix. Basically all raw water supplies in the study area are usable for domestic water supplies and suitable for direct use for livestock watering, irrigation, and industrial cooling. Industrial process water requires a quality similar to that required for domestic consumption. Boiler feed waters in the study area generally require at least potable water quality plus additional hardness reduction.

Table D-2
Drinking Water Quality Standards

Chemical Substance	U.S.P.H. 1962 Recommended Limit	U.S.P.H. 1962 Mandatory Limit	S.D.W.A. 1974 Proposed Interim Standard
Alkyl Benzene Sulfonate	0.5 mg/l		
Arsenic	0.01 mg/l	0.05 mg/l	0.05 mg/l
Barium		1.0 mg/l	1.0 mg/l
Cadium		0.1 mg/l	0.01 mg/l
Carbon-Chloroform Extract	0.2 mg/l		
Chloride	250. mg/l		
Chromium (hexavalent)		0.05 mg/l	0.05 mg/l
Color	15. mg/l		
Copper	1. mg/l		
Cyanide	0.01 mg/l	0.2 mg/l	0.2 mg/l
Fluoride (Annual average of max. daily air temperatures of)			
50.0 - 53.7	1.2 mg/l		2.4 mg/l
53.8 - 58.3	1.2 mg/l		2.2 mg/l
58.4 - 63.8	1.0 mg/l		2.0 mg/l
63.9 - 70.6	0.9 mg/l		1.8 mg/l
70.7 - 79.2	0.8 mg/l		1.6 mg/l
79.3 - 90.5	0.7 mg/l		1.4 mg/l
Iron	0.3 mg/l		
Lead		0.05 mg/l	0.05 mg/l
Manganese	0.05 mg/l		
Mercury			0.002 mg/l
Nitrates	45. mg/l		10. mg/l*
Odor	3 T.C.N.		
Phenols	0.003 mg/l		
Selenium		0.01 mg/l	0.01 mg/l
Silver		0.05 mg/l	0.05 mg/l
Sulfates	250. mg/l		
Total dissolved solids	500. mg/l		
Turbidity	5. FTU		1 FTU
Zinc	5. mg/l		

* as N equals 44.3 mg/l as NO_3

Table D-2 (cont'd)
Drinking Water Quality Standards

Radiologic	U.S.P.H. 1962 Recommended Standard	Safe Drinking Water Act Proposed Interim Std.
Alpha Activity		
Gross		Radiological maximum contaminant levels will be established in the near future
Radium	3 pc/l	
Beta Activity		
Gross	1000 pc/l in absence of strontium	
Strontium	10 pc/l	

Pesticide/Herbicide	U.S.P.H. Guidelines	Safe Drinking Water Act Proposed Interim Std.
Chlorinated Hydrocarbons		
Aldrin	0.017 mg/l	*
Chlordane	0.003 mg/l	0.003 mg/l
DDT	0.042 mg/l	*
Dieldrin	0.017 mg/l	*
Endrin	0.001 mg/l	0.0002 mg/l
Heptachlor	0.018 mg/l	0.0001 mg/l
Heptachlor Epoxide	0.018 mg/l	0.0001 mg/l
Lindane	0.056 mg/l	0.004 mg/l
Methoxychlor	0.035 mg/l	0.1 mg/l
Toxaphene	0.005 mg/l	0.005 mg/l
Chlorophenoxy Herbicides		
2,4-D	0.1 mg/l	0.1 mg/l
2,4,5-TP	0.1 mg/l	0.01 mg/l
2,4,5-T	0.1 mg/l	
Organophosphate and Carbamate (total)	(parathion)	

* To be established in the near future

Table D-2 (cont'd)
Proposed Interim Primary Standards
For Microbiological And Organic Contaminants

Microbiological	Standard
Coliforms *	1 per 100 ml (membrane filter technique) <10 percent positive per month (fermentation tube method)
or	
Residual Chlorine *	Substitute for 75 percent of coliform tests and maintain residual of 0.2 mg/l free chlorine.
* Number of tests depends on population served.	If population served $\leq$ 4900, can use only residual chlorine and must maintain a residual of 0.3 mg/l free chlorine

Organic Chemicals	Standard
Total Concentration	0.7 mg/l as determined by the carbon chloroform extract method.

Water Quantity Criteria

7. Residential and municipally supplied industrial water consumption projections are shown for 1995 and 2020 in table D-3 based upon Growth Concept A population allocations. Future per capita usages are derived from report data, municipal water supply records, and engineering estimates.

8. Historically, water consumption in most area systems has shown a steady rise due to both population and per capita usage increases, Reports on area systems project a continued increase in per capita consumption. Usage in the MUD and Council Bluffs systems, as shown in respective planning reports, is expected to increase at the rate of one gallon per capita per day (gpcd) per year. A one gpcd per year increase is applied from 1973 to 1995 for all municipalities except where specific municipal report predictions differ. Municipalities for which planning reports and water use records are not available are assumed to have rates increasing from 100 gpcd in 1973 to 122 gpcd in 1995. Per capita consumption is assumed to remain constant from 1995 or report target level, whichever is higher, to 2020; except in Council Bluffs where the one gallon per year increase is continued to 2020.

9. Rural and non-municipally supplied villages are assigned a daily consumption rate of 100 gallons per capita in both 1995 and 2020, up from 60 gpcd in 1973.

10. Increasing per capita use is caused by an increase in the standard of living and a predominance of "wet" food-related

Table D-3

RESIDENTIAL AND MUNICIPALLY
SUPPLIED INDUSTRIAL WATER USAGE

COUNTY	1973			1995			2020		
	POPULATION SERVED	AVE DAY (MGD)	MAX. DAY (MGD)	POPULATION SERVED	AVE DAY (MGD)	MAX. DAY (MGD)	POPULATION SERVED	AVE DAY (MGD)	MAX. DAY (MGD)
CASS	18,792	1.839	3.678	20,562	2.618	5.236	21,526	2.778	5.556
DOUGLAS									
MUD	387,000	68.638	140.328	515,950	105.586	236.167	634,473	147.082	329.104
OTHER	12,930	1.014	2.028	17,428	2.006	4.012	15,768	2.181	4.362
TOTAL COUNTY	399,930	69.652	142.356	533,378	107.592	240.179	650,241	149.263	333.466
SARPY									
MUD	43,000	7.795	16.740	200,056	40.924	91.541	237,600	54.774	123.244
OTHER	31,480	3.905	7.810	15,386	1.965	3.930	23,143	3.014	6.028
TOTAL COUNTY	74,480	11.700	24.582	215,442	42.889	95.471	260,743	57.788	129.272
WASHINGTON	13,833	1.700	3.401	17,759	2.794	5.587	19,348	3.043	6.087
HARRISON	16,366	1.451	3.060	16,834	2.068	4.424	17,727	2.155	4.605
MILLS	12,758	2.087	3.508	11,961	3.137	5.448	11,418	3.483	5.967
POTTAWATTAMIE									
COUNCIL BLUFFS	62,103	8.390	12.315	75,350	12.207	19.373	94,570	18.611	30.097
OTHER	21,807	1.835	3.523	26,724	4.337	8.705	28,927	4.861	9.295
TOTAL COUNTY	83,910	10.225	15.838	102,074	16.155	27.461	123,497	21.955	36.938
TOTAL	620,069	98.654	196.423	918,000	.642	384.423	1,104,500	241.982	.344

industries in the study area. The provision of good quality water in the rural areas is expected to cause an increase in use.

11. Because of quantity and quality requirements, some industries find it more feasible to develop their own source of supply. Self-supplied industrial users tend to use large quantities of water. Future growth of self-supplied industry as a whole is very unpredictable and likely will not grossly affect total water availability in the study area with the exception of out-of-area usage as discussed under Section B.

Design Criteria

TREATMENT FACILITIES

12. All supply, treatment, and sludge-handling components are sized based upon maximum-day water demands in the area served. Plants of less than 2 mgd capacity are designed to meet maximum-day requirements in less than 24 hour operation. Plants larger than 2 mgd are sized to provide an adequate maximum-day supply in 24 hours of operation.

13. Treatment plants using a surface water source are to have an intake structure, screening, and low-lift pumps. Treatment will consist of presedimentation with polyeletrolyte treatment and prechlorination, sedimentation and softening using lime, soda ash, and alum, and rapid sand filtration. Well fields for small

treatment facilities have wells sized from available geologic information including size of existing wells in the area. A sufficient number of wells is developed to supply maximum plant capacity with a minimum of one well out of service. Ground water treatment will consist of oxidation of iron and manganese, lime softening, and rapid sand filtration.

14. All waste sludges and filter backwash from treatment plants of less than 2 mgd capacity will be lagooned with lagoon supernatant returned to the head of the treatment plant. Softening and iron and manganese sludges from large treatement facilities will be mechanically dewatered and trucked to landfill or land reclamation sites. Filter backwash from all plants and presedimentation sludges from plants having a surface water source are lagooned. All dewatering waste streams and supernatant are returned to the start of the water treatment process.

BOOSTER PUMPING STATIONS

15. Rural and major metropolitan booster stations are sized to pump 1.25 times maximum-day service area water demand with a pressure increase of up to 80 psi, normally from about 40 psi to 100 psi.

STORAGE FACILITIES

16. Rural water district and rural community storage facilities are sized to store an average day's water requirement for the area of service. Type of storage (elevated, standpipe, or ground level steel or concrete) is chosen based upon type of existing storage, size required, and topography.

17. Storage requirements to provide first-class fire protection determine storage facility capacity for cities with a population exceeding 10,000.

PIPELINES

18. Supply of design, for year 2020, maximum-day demand at a velocity of less than 3 fps is the design criterion for rural transmission and major distribution pipelines. From existing reports and designs, four miles of minor mains and service lines for each mile of major distribution main was determined as a ratio to be used for costing purposes.

19. For the metropolitan area, piping networks and sizes basically follow the MUD and Council Bluffs Master Plans. They are adjusted based upon supply and growth variations of the four growth concepts. Pipelines of less than 24-inch size are shown only when they serve as a transmission main to some area or city.

20. Expansion and improvement of rural community piping networks and distribution pipelines of less than 24-inch diameter in the metropolitan area are not addressed specifically in this report. For purposes of economic analysis, a per capita cost was derived from engineering reports to cover minor distribution mains, service lines, and meters in metropolitan areas and all in-city pipelines, meters, and booster pumping stations in rural communities.

21. Interconnection of the pipelines between water supply service areas will improve the reliability of the water supply systems.

STAGING

22. Rural water districts not currently in final planning or implementation stages are assumed to be constructed and operational in 1985. Initial installation of pipelines need to be capable of carrying 2020 design loads to rural areas. Rural booster pumping stations and storage facilities are staged where future demands increase significantly over initial requirements.

23. Non-metropolitan treatment plants are generally staged in 3 or 4 steps. An initial 1975 construction or expansion is sized to supply 1984 needs. Expansions and new plant construction in 1985 coincide with implementation of rural water districts and are designed to meet 1995 demands. Additional expansions in 1995 and 2007 are based upon 2007 and 2020 loads respectively. Treatment plants serving only rural areas and small communities often have no expansions since demand increase from 1985 to 2020 is minor or nonexistent.

24. All facilities, treatment, storage, pumping, and pipelines are staged in the metropolitan area. Treatment, storage, and pumping facilities are expanded at from 5 to 15 year intervals depending upon demand growth in the area of service. Pipelines are extended into areas of new growth and phased in built-up areas using 1995 and 2020 population boundaries of the various growth concepts and using staging outlines of the MUD and Council Bluffs Master Plans as guidelines.

25. Per capita costs due to system expansion generated for the economic analysis are assigned to 1985 and 2007 as midpoints of the 1975 to 1995, and 1995 to 2020 design periods.

RURAL WATER DISTRICTS

26. Rural water district system design is conservative since service of entire rural population and livestock in current (1973) populations is assumed. In actuality, all rural residences will probably not be served and, while the number of livestock is expected to increase, existing private wells or impoundments will continue to supply significant quantities of water for livestock. Industrial development outside of the rural communities is not considered in system design.

SECTION E

FORMULATING THE PLANS

FORMULATING THE PLANS

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SECTION E

FORMULATING THE PLANS

Planning Considerations

ALTERNATIVE RESOURCES

1. Figure E-1 shows the better sources of water in the study area. Supplies of major importance are the Missouri River surface and ground waters and the Platte River ground waters. Other sources of importance are the ground waters of the Elkhorn, Boyer, and Nishnabotna Rivers. Low yield ground water supplies are also found throughout most of the counties.

MISSOURI RIVER RESOURCES

2. Either Missouri River surface or ground waters could easily supply all the water needs for the study area for the foreseeable future. The current flow of the Missouri past Omaha averages more than 16 billion gallons per day. The surface water is moderately hard and is turbid, but otherwise meets United States Public Health Service (USPHS) criteria. Treatment is provided to remove sediment color, bacteria, and hardness. It costs about $70 per million

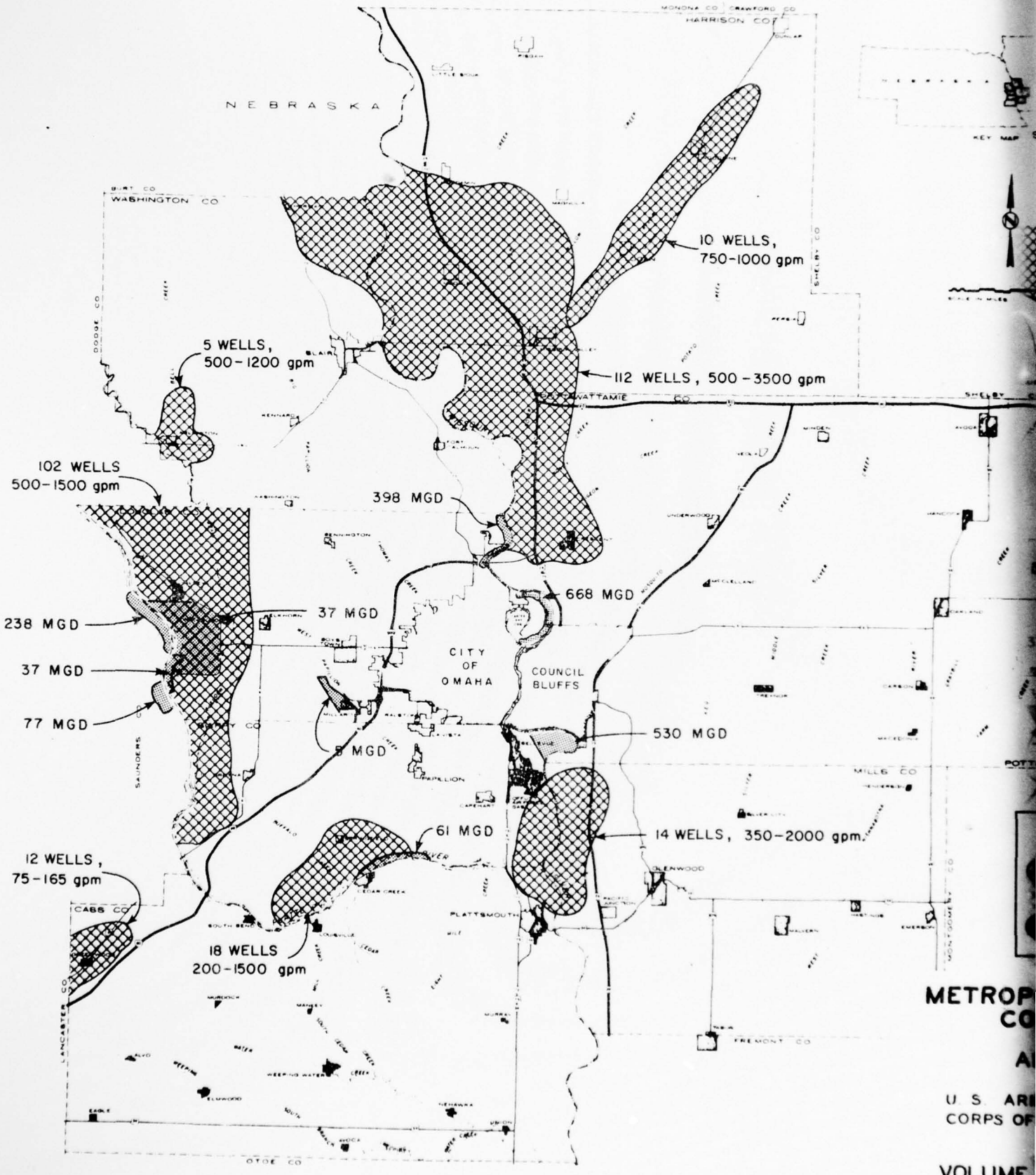
gallons to treat Missouri River surface water to the high quality presently supplied to Omaha and Council Bluffs residents.

3. Abundant supplies of water exist under the Missouri River flood plain. In Douglas County alone, the Missouri River ground waters could supply over a billion gallons per day. This water is higher in hardness, iron, and manganese than Missouri River surface water but it is much lower in sediment. Currently, it would cost about $7 more per million gallons to treat Missouri River ground water rather than surface waters, but future Environmental Protection Agency regulations on the discharge of water treatment plant sludge may make the costs of treating surface and ground water equal. Factors other than economics, such as pollution of the river, will dictate whether additional supplies should be developed from surface or ground water resources.

PLATTE RIVER RESOURCES

4. The Platte River is a relatively high-quality ground water resource for future water supply development. Omaha and Lincoln currently have major well fields along the Platte. Several other communities also use this resource. Treatment to meet USPHS recommended criteria costs about $9 per million gallons less than Missouri River surface waters.

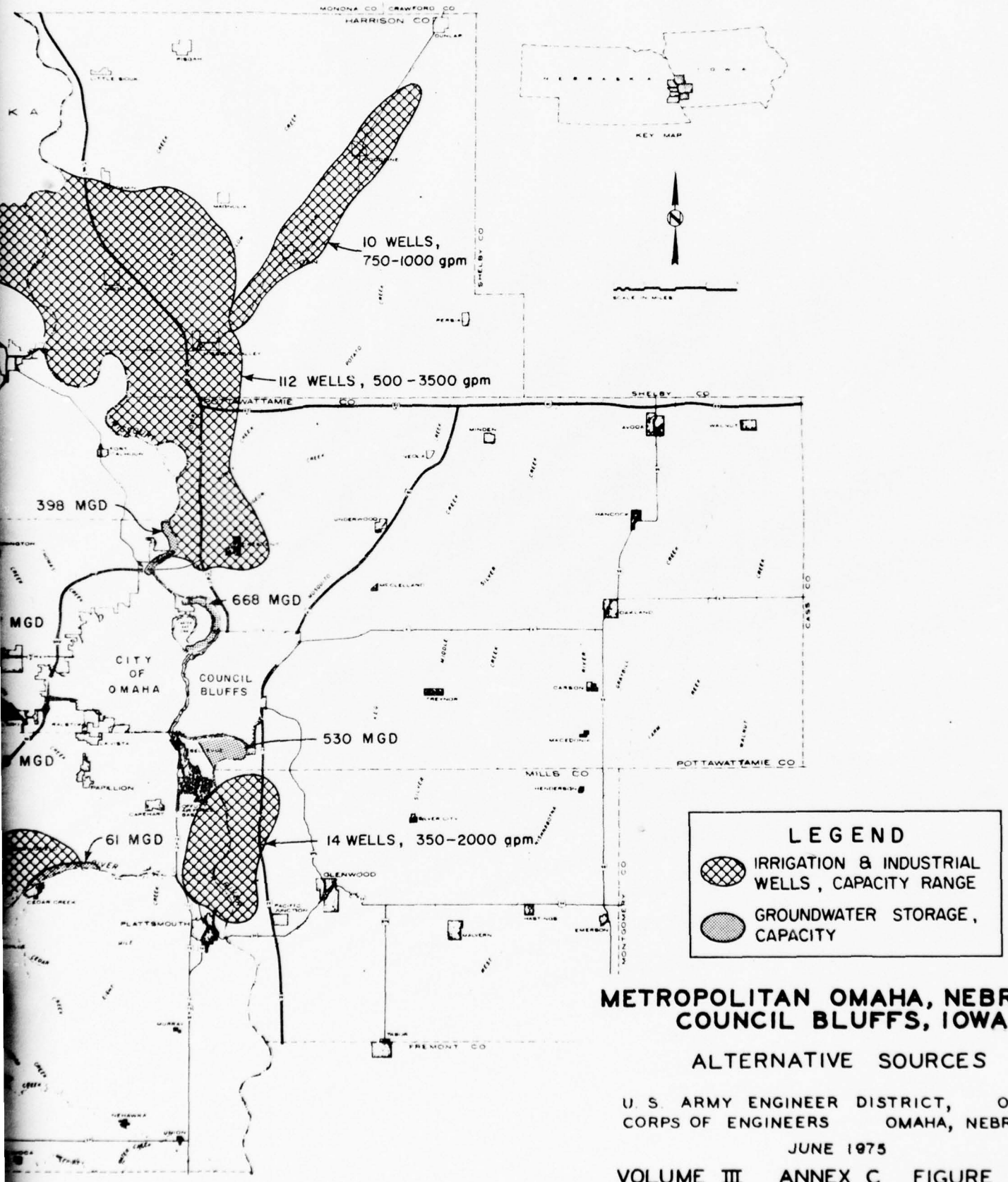
5. Although the quality of the Platte River ground water is good, questions have been raised regarding quantity. Ground waters of the Platte River require recharge from surface flows. Previous studies have indicated that the Metropolitan Utilities District's current Platte well-field requires continual surface recharge to produce its projected capacity of 80 mgd. Lincoln's well field could produce 130 mgd (year 2000 demand) for 19 days without surface recharge before production would be seriously reduced. A



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METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA

ALTERNATIVE SOURCES

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

JUNE 1975

VOLUME III ANNEX C FIGURE E-1

large ground water area near Valley, Nebraska has been estimated to be able to produce 135 mgd for 61 days without recharge. Under maximum irrigation, the Platte River could run dry for three consecutive months in extremely dry years by 2020.

OTHER RESOURCES

6. Areas isolated from the above supply sources must rely largely on ground water supplies. Most of the ground water is moderately hard to extremely hard and contains large amounts of iron, manganese, and dissolved solids. An indication of the ground-water quality can be determined by reviewing the raw water supplies of rural communities as discussed in the Supporting Technical Reports Appendix. State Agency records indicate that within the study area, the raw ground water sources for 44 communities have high iron or manganese, 26 have high total dissolved solids, 4 have high sulfates, 3 have high flourides, and 1 is high in nitrates. In most cases, treatment can provide a good quality water to users.

7. In comparison to Missouri River surface waters, ground waters in the Iowa portion of the study area are two to three times higher in hardness and several times higher in iron and manganese content. The ground waters are also generally higher in total solids. Ground waters in Nebraska are of much better quality than those of Iowa but are generally higher in iron, manganese, and hardness than Missouri River water. A few communities in both Nebraska and Iowa have been able to locate extremely good quality water.

8. It is difficult to find adequate quantities of water in the rural areas as evidenced by existing wells of generally low capacity. Test wells would have to be drilled prior to any significant well-field development.

WASTEWATER RECYCLE

9. The recycling of sewage treatment plant effluents was investigated as an alternative water supply source. The quality of the effluent would range from secondary treatment (Level 1) to zero pollutant discharge (Level 3). These levels are described in the Wastewater Management Plan Formulation Annex. The abundance of fresh water in the study region has previously precluded serious consideration of wastewater recycle.

10. Recycling of highly treated sewage treatment plant effluents for some uses, such as for cooling water, toilet flushing, and lawn watering, but not for drinking purposes may be both feasible and desirable. The Environmental Protection Agency has issued a policy statement that at the present time there should be no direct reuse of advanced wastewater treatment effluents for domestic purposes. Perfection of virus detection techniques and reliability of advanced treatment processes will be required prior to wastewater reuse for domestic consumption.

11. Studies performed in other parts of the country and public contacts in the Omaha-Council Bluffs area indicate some acceptance of wastewater recycle for non-potable water use. Residential applications would require a dual water system as discussed later in this section. Acceptance of wastewater recycle for cropland irrigation appears to be the rule, rather than the exception, in the study area. The Wastewater Management Plan Formulation Annex describes the plans for wastewater recycle irrigation.

12. The majority of "wet" industries in the study area use water for cooling, boiler feed, or food processing. Cooling operations

use large volumes of water directly from the Missouri River. Boilers need small volumes of extremely high quality water. Food processes need potable-quality water. None of the above would have promising applications of recycled wastewater.

STORM RUNOFF

13. The use of storm runoff as a source of water supply was investigated. The Wastewater Management Studies identified that capturing and treating the one-year storm would be sufficient to protect stream water quality. Treatment would consist of screening, settling, and chlorination with subsequent release to the receiving stream. Although the quality would be suitable for some supply uses, sufficient quantity would not be available particularly during maximum water use periods (dry weather) to significantly affect overall water use and system design.

14. Flood control dams, such as those in the Papio Flood Control Project, offer storm runoff use possibilities. The proposed dams are to be constructed only for flood control, recreation, and water quality. Water supply storage would have to be added to the project purpose in order for the dams to be used for water supply. The water in the reservoirs could be of lower quality than that of available ground waters.

POWER PLANT HEATED DISCHARGE

15. There are two basic considerations for using cooling-water discharge in lieu of traditional water supply sources: First, if the heat energy itself can be put to beneficial uses; and second, if subsequent use of the water can serve to dissipate the heat and thus prevent possible thermal pollution of the receiving waters.

16. Several possible uses for this source of water were investigated. On a system-wide basis, power plant cooling water could, after proper treatment, be introduced into the existing municipal distribution system. Modifications to the distribution system would be required due to the higher water temperature. Recycle to the Florence Water Treatment Plant was suggested for intake heating in the winter to reduce icing problems.

17. Several special-purpose uses were also suggested. Growth rates and yields for certain crops can be increased through elevated soil temperatures. Irrigation with heated water could also provide longer growing seasons and protection against early killing frosts. Increased water temperature can increase the rate of growth and ultimate size of certain fish and crustaceans. Another use would be for wastewater treatment plants, where the higher temperatures could increase reaction rates and decrease overall treatment costs. Finally, the heated water could be used in heating pipelines. All of the above are possible uses of the heated water from power plants, but it is important to remember that over 1000 mgd of the water is available for use, and that, most likely, thermal pollution of the river would continue since not all of the water could be used.

FLOW REDUCTION

18. Although projected consumptive water usage in the seven-county study area does not critically approach available supplies, serious consideration of water conservation is not precluded. Reduced water use would result in conservation of energy, chemicals, and equipment required to treat and deliver usable water. Reduction in costs and extent of sewerage and sewage treatment are side benefits of water conservation.

19. Water use reduction alternatives considered and resultant impacts are summarized in table E-1. Nonstructural concepts include public education for voluntary use reduction, incentives to attract low water-quantity demanding industries, legislative actions, and pricing policies. Structural alternatives involve physical devices such as water-saving and water-eliminating toilets, water-saving washing appliances and shower heads, dual water systems, and residential recycle.

20. Of the alternatives considered, water-conserving fixtures, public education, individual metering of all users, and use of pricing policies are the most promising.

21. If per person water use can at least be held to 1973 levels, water use will be 50 million gallons per day less in 2020 than the per person use increase projected in the Metropolitan Utilities District Master Plan. This effect is illustrated in figure E-2. Public education would be the only conservation alternative to cause this reduction.

DUAL WATER SYSTEMS

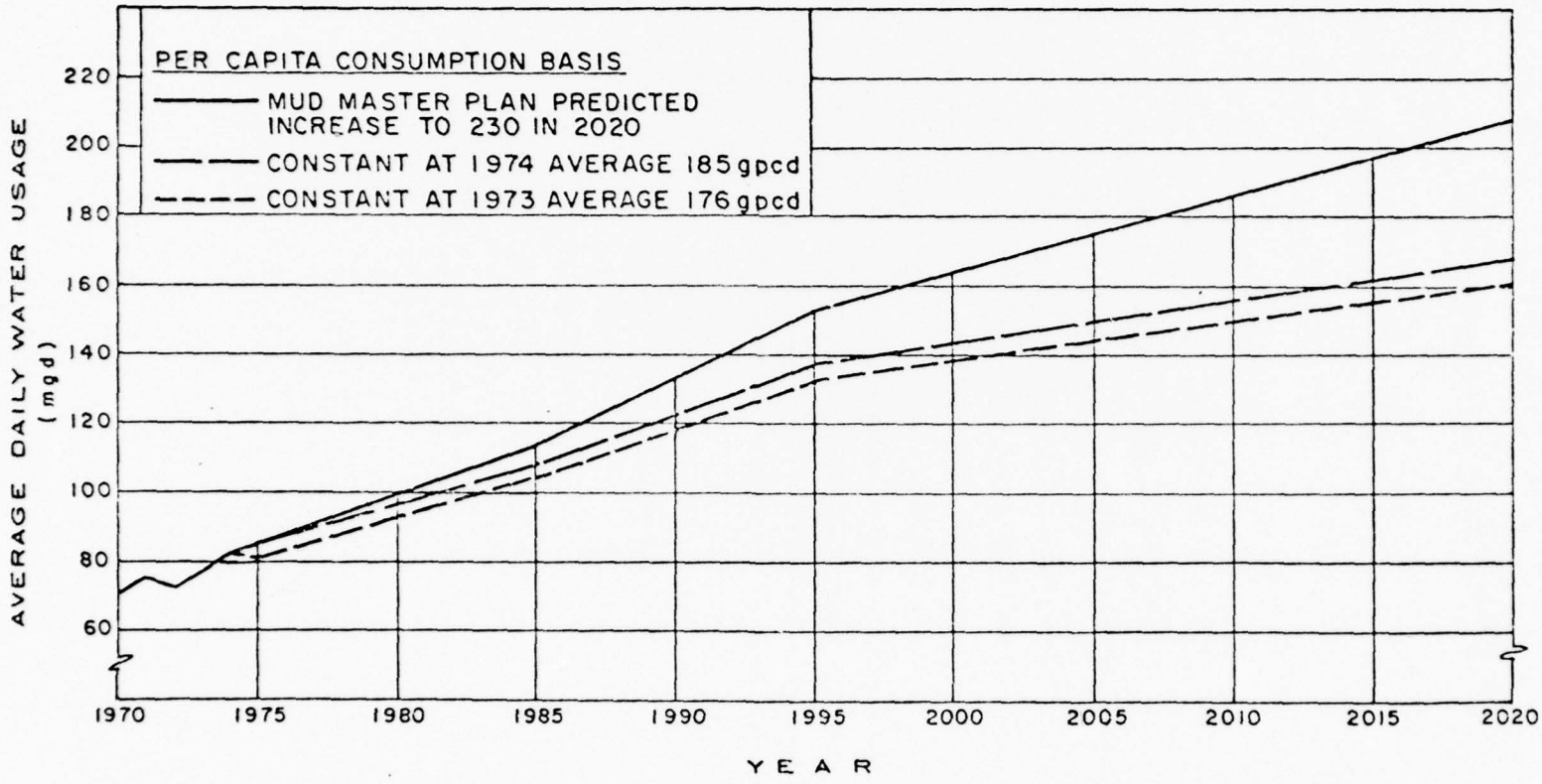
22. The basic purpose of a dual water system is the separation of water into two distribution channels, one directed to uses requiring potable water, the other to uses not requiring potable water. It has been estimated, that as little as 10 percent of the water used in a metropolitan area requires purification for drinking-water quality. Use of a nonpotable water supply was considered for toilet flushing, lawn and garden irrigation, street flushing, fire protection, and industrial cooling operations. Water Supply Plan IV

Table E-1
SUMMARY OF WATER
USE REDUCTION CONCEPTS

WATER USE REDUCTION CONCEPTS				% REDUCTION PER APPLICABLE RESIDENTIAL CUSTOMER (DWELLING UNIT)			1995 TOTAL POTABLE SUPPLY REDUCTION		ALTERNATIVE SUPPLY CONCEPTS			SCOPE OF APPLICABILITY		TECHNOLOGY REQUIRED			INVESTMENT TO IMPLEMENT		PUBLIC ACCEPTABILITY
				POTABLE WATER SUPPLY REQUIREMENTS	TOTAL WATER SUPPLY REQUIREMENTS	SEWAGE FLOWS	PERCENT	ACTUAL (AVERAGE ANNUAL MGD)	NON-POTABLE SUPPLIES: WELLS, SURFACE WATER, STORM WATER, ETC.	REUSE SUPPLY: WASTEWATER SYSTEM-WIDE	REUSE: WASTEWATER, INTERNAL SYSTEM	TOTAL POPULATION	NEW GROWTH AND LAND DEVELOPMENT	EXISTING	DEVELOPING	NEW	PUBLIC	PRIVATE	
				%	%	%	%	MGD											
	NON - STRUCTURAL	1	VOLUNTARY ACTION; WATER CONSERVATION ATTITUDES	NA	NA	NA	NA	NA	NA	NA	NA	X		X			MINOR		GOOD
		2	LEGAL ACTIONS	NA	NA	NA	NA	NA	NA	NA	NA	X		X			MINOR		FAIR
		3	INDUSTRIAL DEVELOPMENT PROMOTION	NA	NA	NA	7%	12MGD	NA	NA	NA		X	X			MINOR		GOOD
		4	PRICING POLICIES (50% PRICE INCREASE)	17%	17%	5%	11%	20MGD	NA	NA	NA	X		X			MINOR		FAIR
		5	METERING OF INDIVIDUAL APARTMENT UNITS AND MOBILE HOMES	25%	25%	25%	3%	5MGD	NA	NA	NA	X		X			MODERATE		GOOD
	STRUCTURAL	6	WATER CONSERVING FIXTURES AND APPLIANCES	6 TO 31%	6 TO 31%	7 TO 39%	.8 TO 4.0%	UP TO 7 MGD	NA	NA	NA	X		X	X			MODERATE	FAIR-GOOD
		7	WATER ELIMINATING TOILETS	32%	32%	40%	5.1%	9 MGD	NA	NA	NA	X			X	X		MODERATE	POOR-FAIR
		8	SYSTEM PRESSURE REDUCTION						NA	NA	NA	X		X			MODERATE		FAIR-GOOD
		9	LEAKAGE AND LOSS CONTROL						NA	NA	NA	X		X			MODERATE		GOOD
		10	DUAL SUPPLY & DISTRIBUTION, SYSTEM WIDE	49%	0 TO 49%	0	15%	26MGD	YES	YES	NO		X	X	X		MAJOR		POOR-GOOD
		11	UNITIZED RESIDENTIAL RECYCLING (ASSUME UP TO 50% NEW HOUSING)	15 TO 66%	0 TO 66%	0 TO 60%	UP TO 6%	UP TO 10MGD	YES	NO	YES		X		X	X		MAJOR	POOR-FAIR

Figure E-2

METROPOLITAN OMAHA WATER USAGE



discusses the use and economics ofdual water systems for new urban growth areas.

REGIONALIZATION

23. Economics of scale, source quality and availability, and service to rural users leads to serious consideration of water supply regionalization. Existing water supply reports for the rural counties have proposed subdividing the counties into several rural water districts. A few rural water districts are in the planning or implementation stage. Communities near MUD service boundaries have found it more cost-effective to connect to the regional system rather than continue their own water supply operations.

24. The Regional Water Supply Study considered three levels of regionalization: (1) several rural water supply areas in each county according to existing plans; (2) one plant centralization for each county; and (3) six treatment plants for the entire seven counties. These plans are discussed in the following paragraphs.

Initial Plans

DESCRIPTION

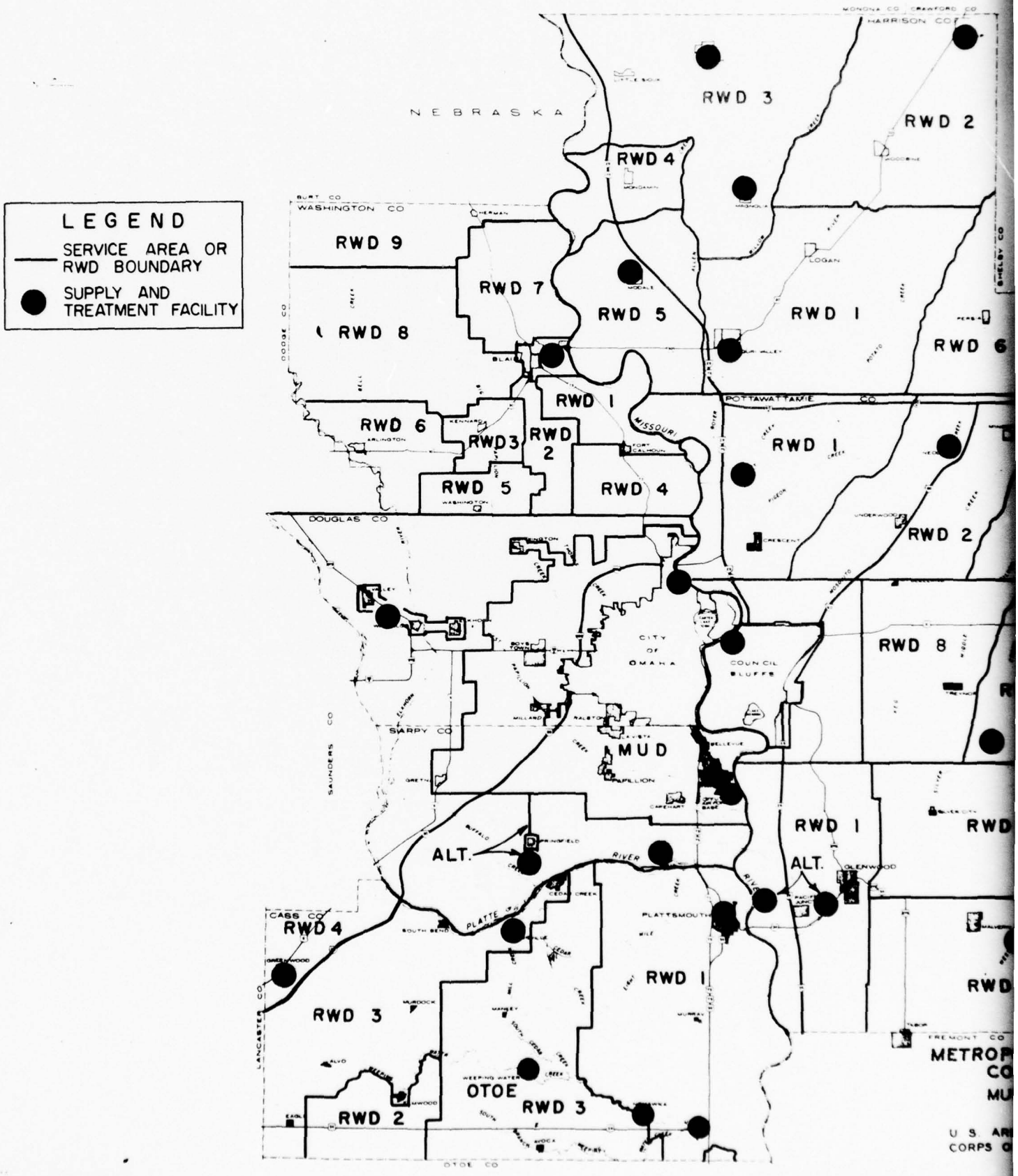
25. Four initial water supply plans were developed for the study area. Figures E-3 through E-5 depict service areas for Supply Plans I, II, and III. Areas of substantial new growth in all of the alternative growth concepts are considered for dual water systems and are presented as Plan IV, which is shown in figure E-6.

26. A basic assumption of all supply plans is that, eventually, essentially all area residents will be served by a rural or urban water system and that treatment of all water sources is desirable and beneficial. The support for centralization and upgrading of water supplies are indications of area resident concern over future water quality and availability. Current changes and planning in the study area which are indicative of this concern are:

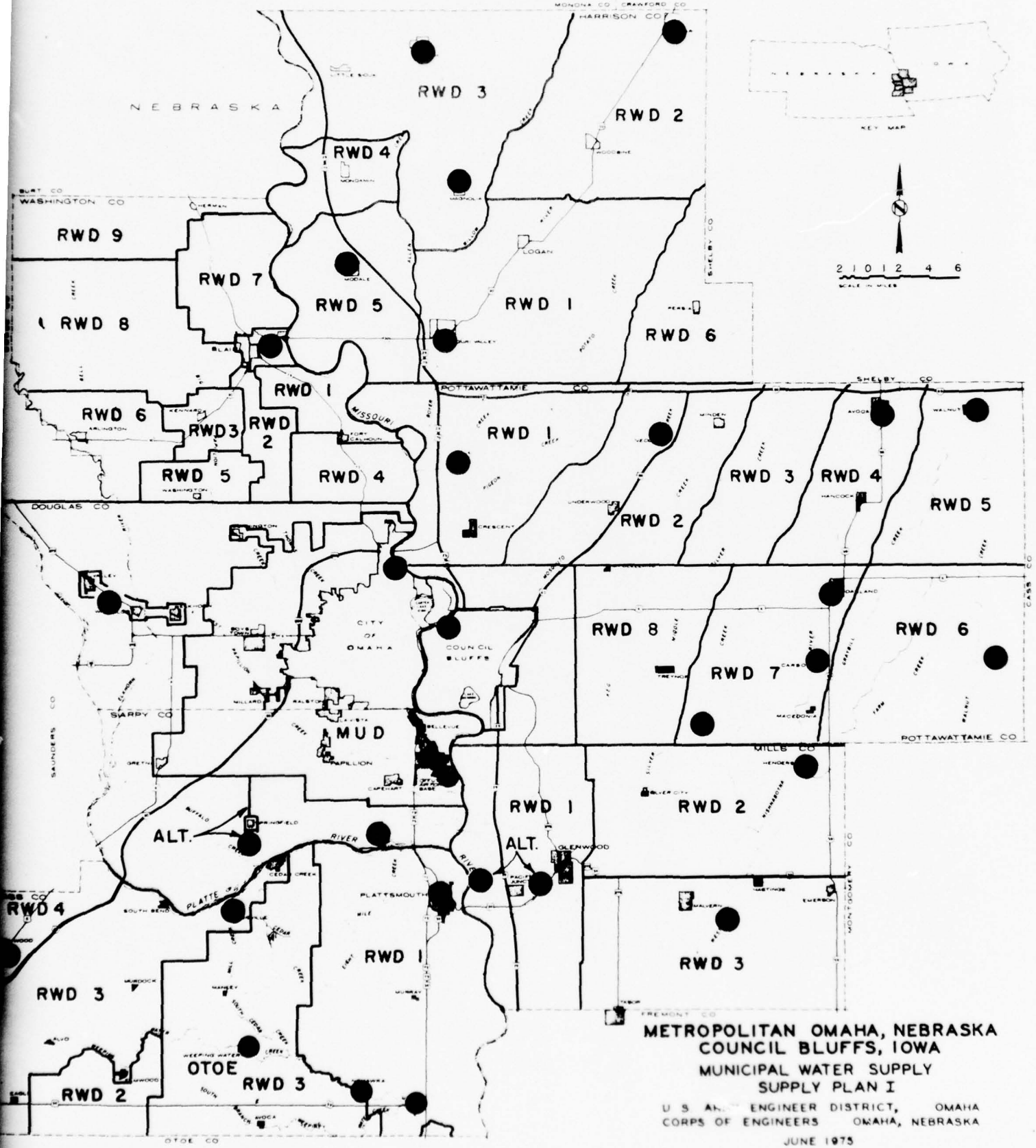
- The existence of county-wide reports in four study-area counties;

- Rural water district implementation in a fifth; and

- Eventual service to nearly all residents of Douglas and Sarpy counties as envisioned in MUD's Long Range Comprehensive Water System Master Plan.


LEGEND
SERVICE AREA OR RWD BOUNDARY
SUPPLY AND TREATMENT FACILITY
NEBRASKA
RWD 3
RWD 2
RWD 4
RWD 9
RWD 7
RWD 5
RWD 1
RWD 8
RWD 6
RWD 1
RWD 6
RWD 3
RWD 2
RWD 5
RWD 4
RWD 1
RWD 2
RWD 8
MUD
ALT.
ALT.
RWD 1
RWD 4
RWD 3
RWD 1
RWD 3
RWD 2
OTOE
WASHINGTON CO
DOUGLAS CO
SARPY CO
CASS CO
OTOE CO
DODGE CO
SAUNDERS CO
LANCASTER CO
POTTAWATTAMIE CO
HARRISON CO
SHELBY CO
CITY OF OMAHA
COUNCIL BLUFFS
PLATTSMOUTH
MISSOURI
PLATTE
METROP
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VOLUME III



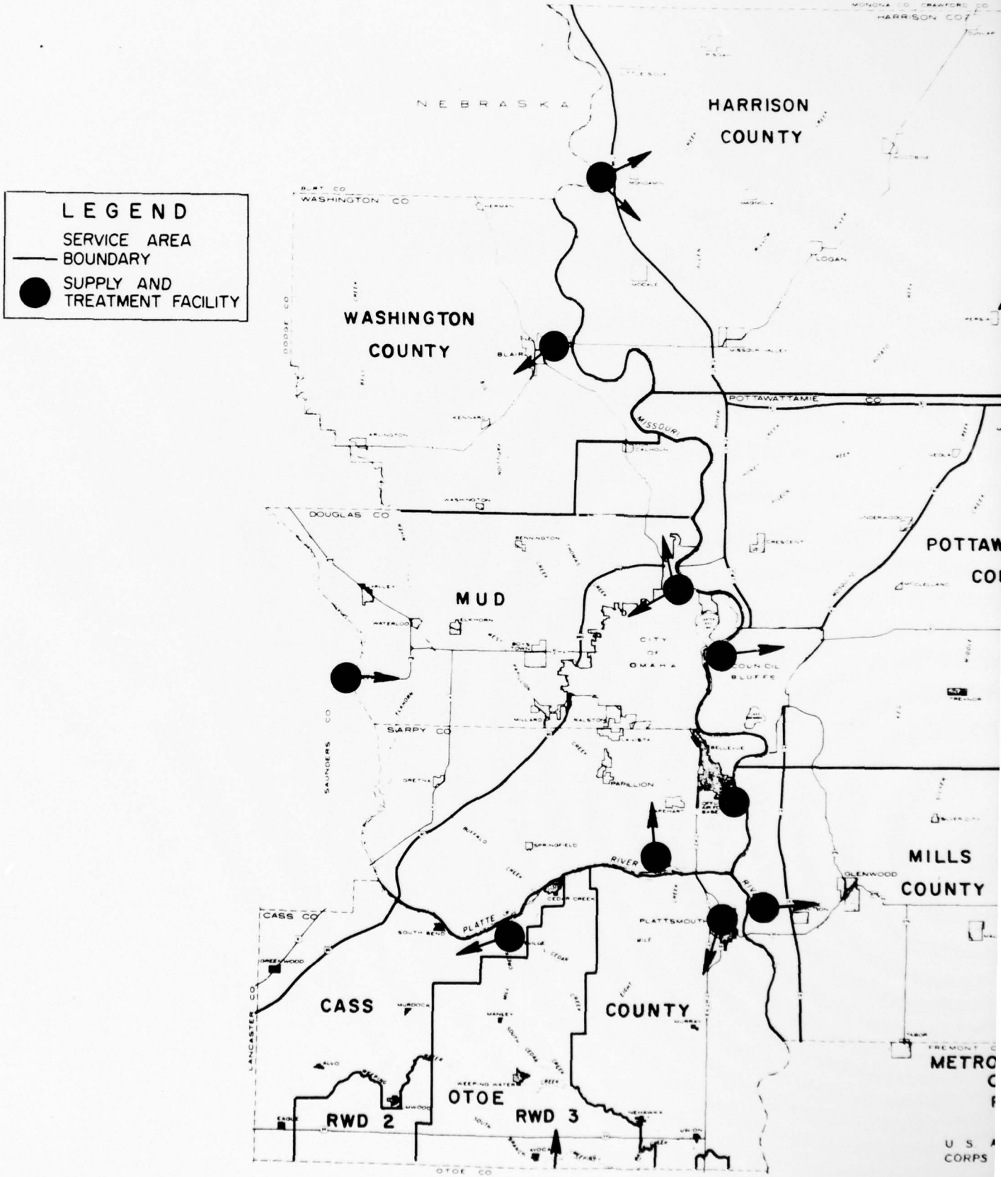
METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA

MUNICIPAL WATER SUPPLY
SUPPLY PLAN I

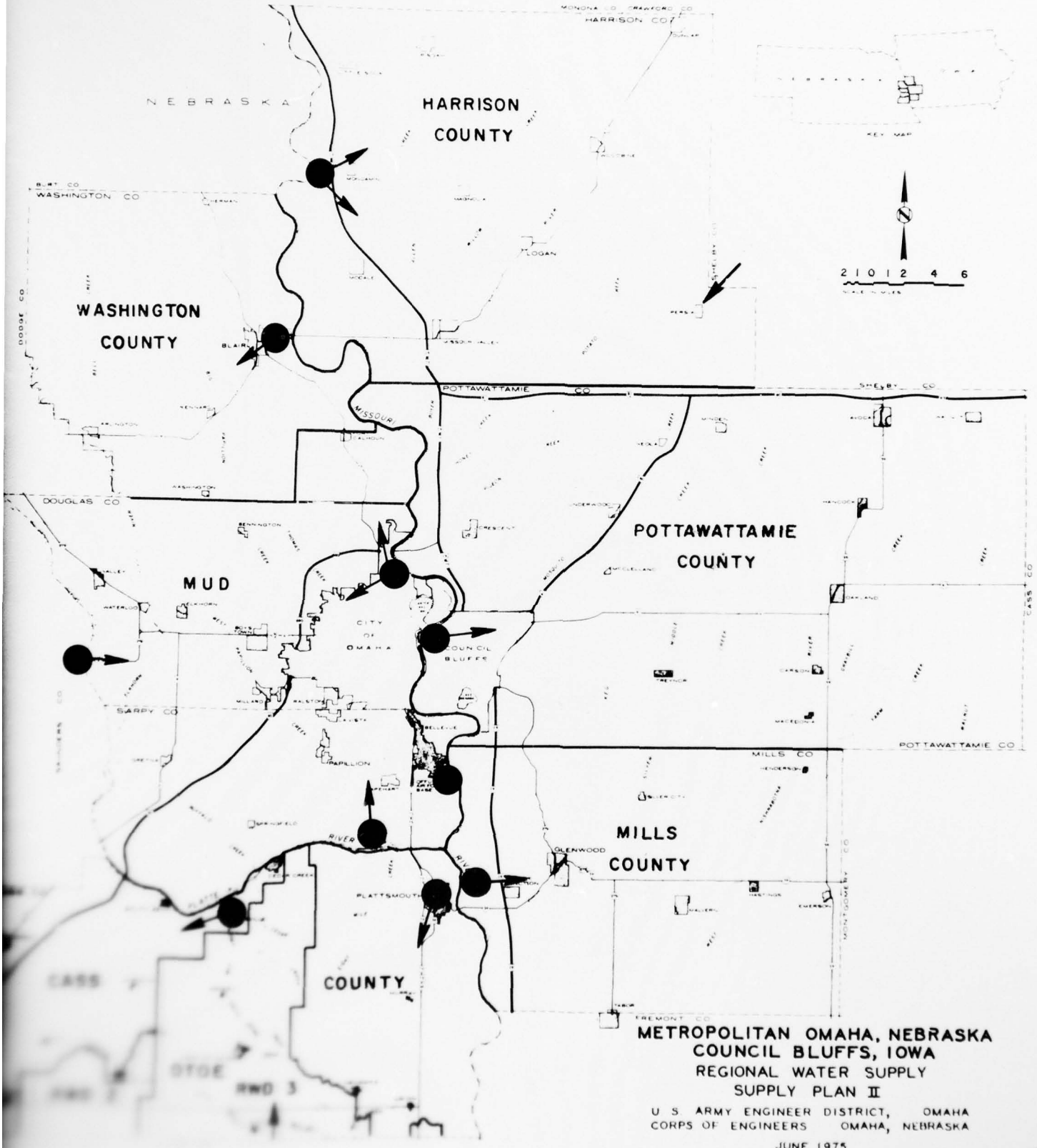
U S ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

JUNE 1975

VOLUME III ANNEX C FIGURE E-3


LEGEND
SERVICE AREA BOUNDARY
SUPPLY AND TREATMENT FACILITY
NEBRASKA
HARRISON COUNTY
WASHINGTON CO
WASHINGTON COUNTY
BLAIR
POTTAWATTAMIE CO
MISSOURI
DOUGLAS CO
MUD
CITY OF OMAHA
COUNCIL BLUFFS
SARPY CO
SAUNDERS CO
PAPILLION
RIVER
MILLS COUNTY
GLENWOOD
CASS CO
PLATTE
PLATTSMOUTH
CASS
COUNTY
OTOE
RWD 2
RWD 3
LANCASTER CO
OTOE CO
METRO
U S
CORPS

VOLUME III

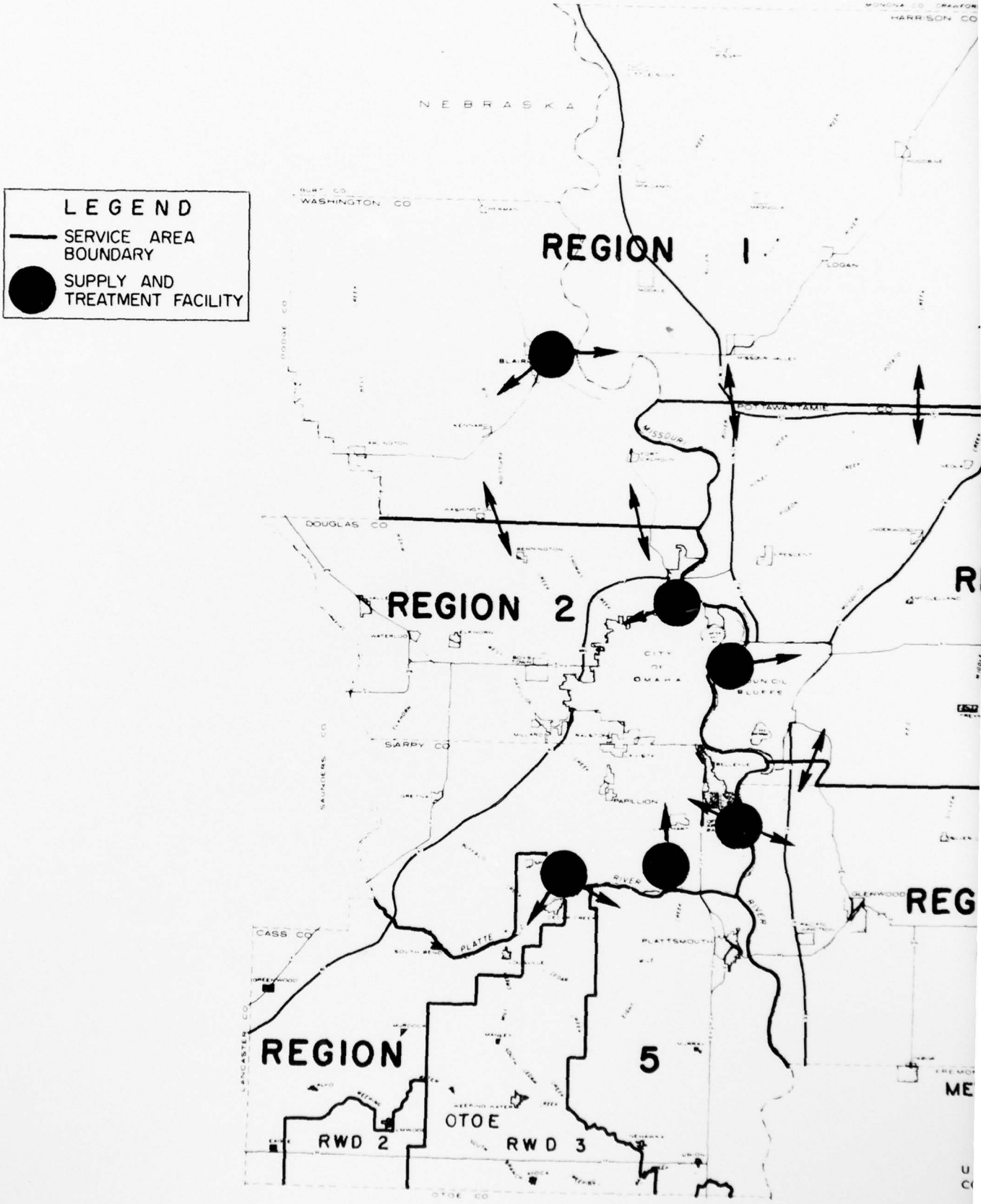


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COUNCIL BLUFFS, IOWA
REGIONAL WATER SUPPLY
SUPPLY PLAN II

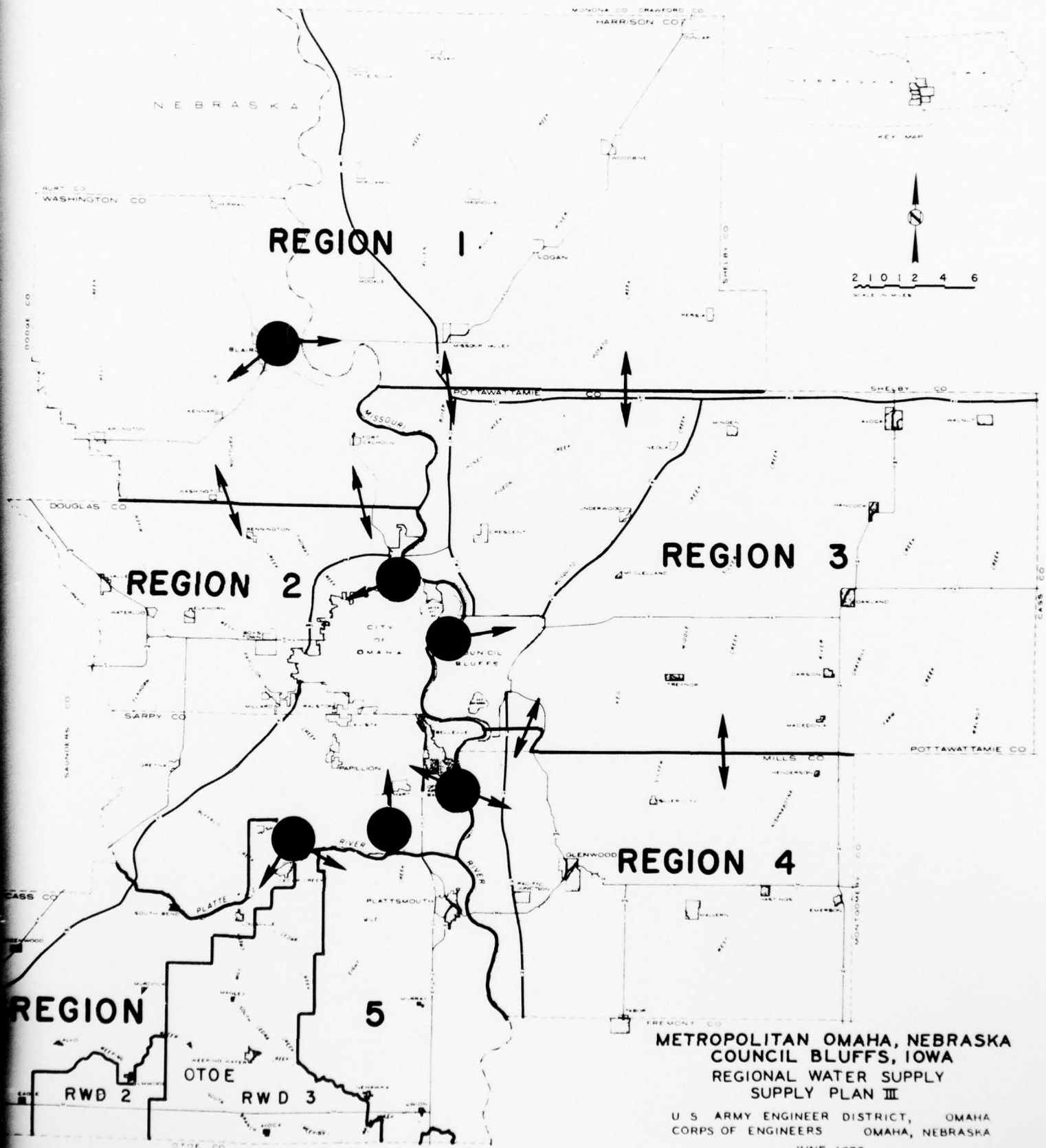
U S ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

JUNE 1975

VOLUME III ANNEX C FIGURE E-4


LEGEND
SERVICE AREA BOUNDARY
SUPPLY AND TREATMENT FACILITY
NEBRASKA
WASHINGTON CO
HARRISON CO
REGION 1
DOUGLAS CO
REGION 2
SARPY CO
CASS CO
PLATTE
REGION 5
OTOE
RWD 2
RWD 3
OTOE CO

VOLUME

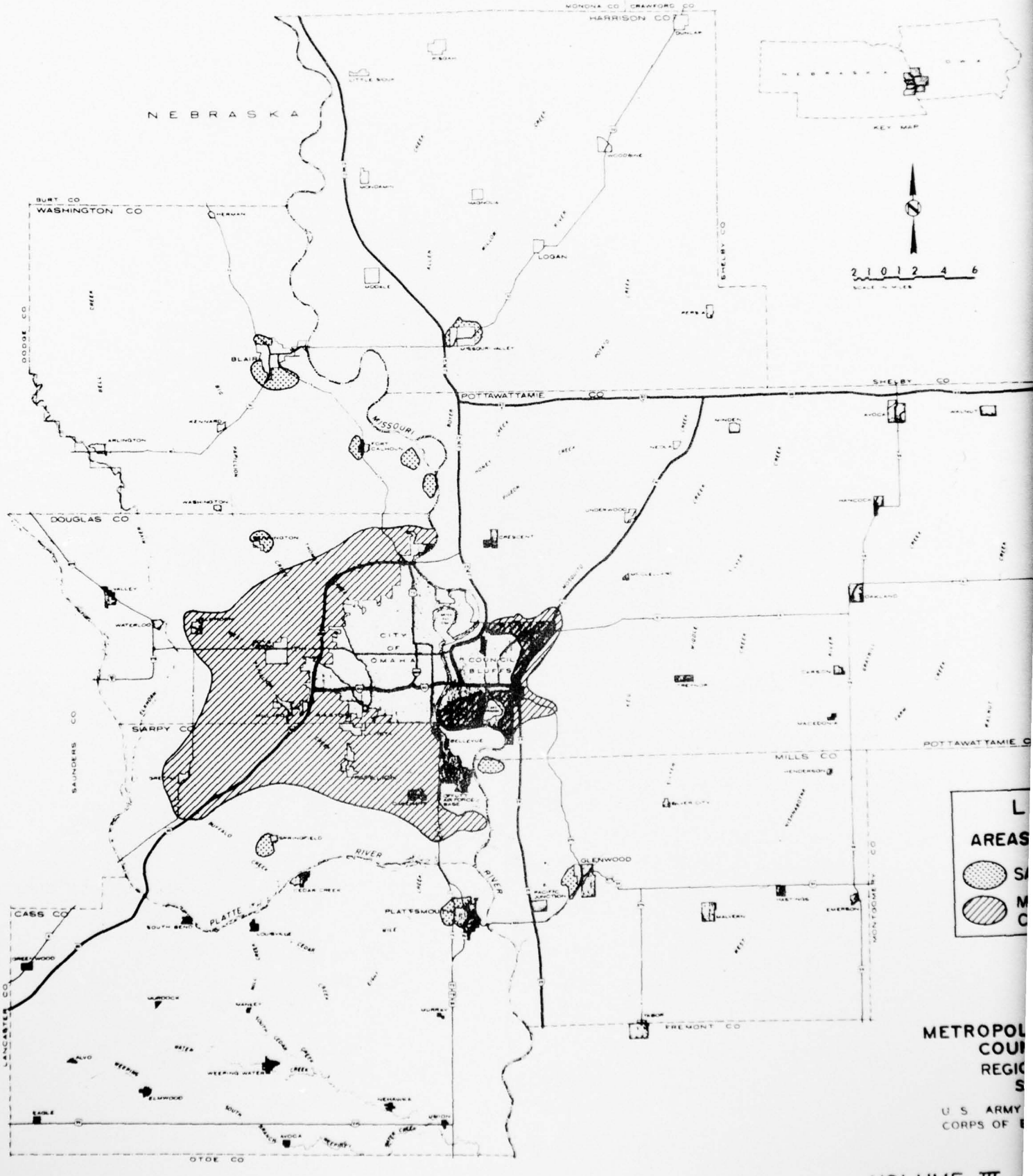


METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
REGIONAL WATER SUPPLY
SUPPLY PLAN III

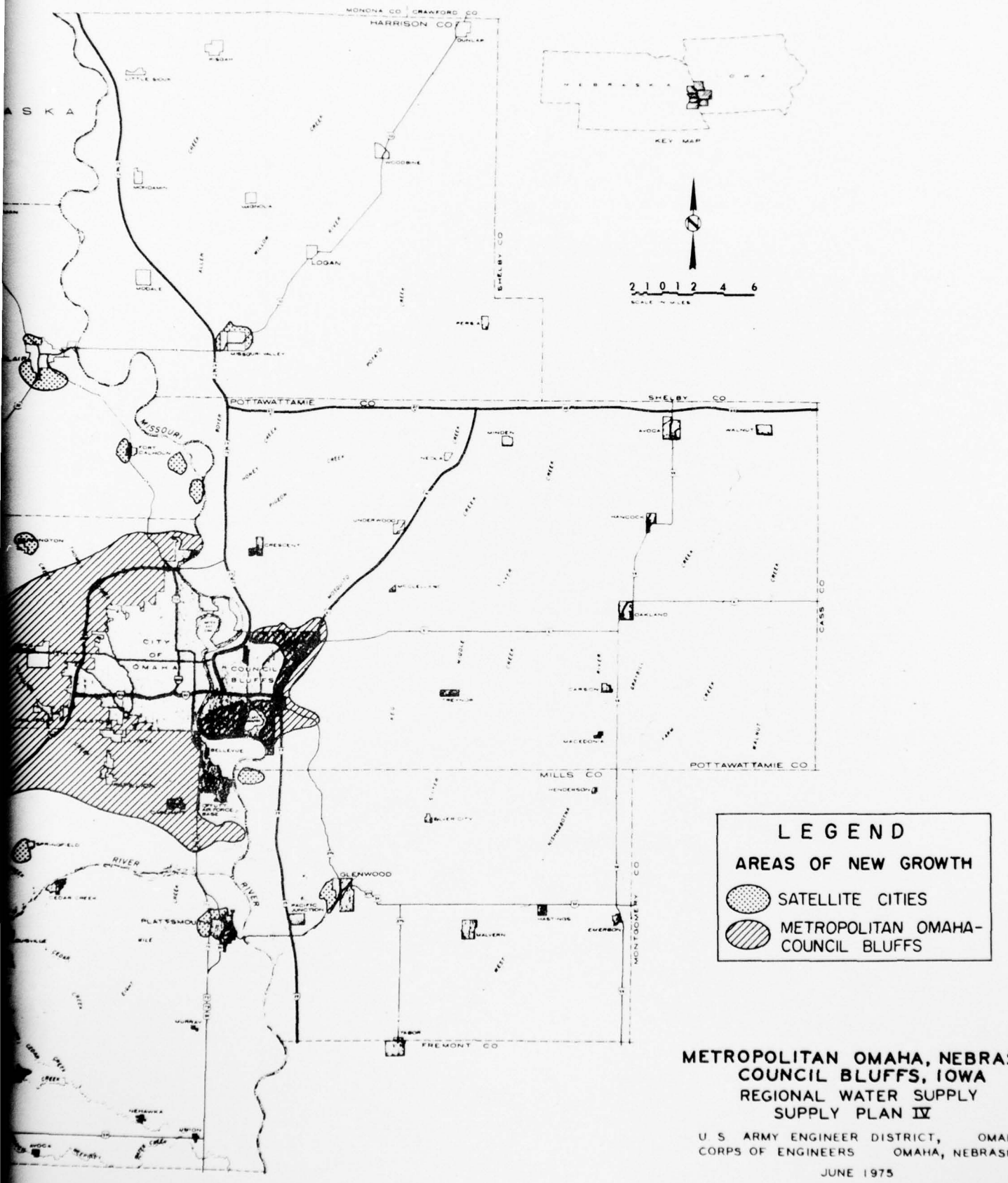
U S ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

JUNE 1975

VOLUME III ANNEX C FIGURE E-5


NEBRASKA
HARRISON CO
WASHINGTON CO
BURT CO
DODGE CO
SHELBY CO
LOGAN
BLAIR
POTTAWATTAMIE CO
MISSOURI
DOUGLAS CO
CITY OF OMAHA
COUNCIL BLUFFS
SARPY CO
SAUNDERS CO
MILLS CO
GLENWOOD
RIVER
PLATTE
PLATTSMOUTH
CASS CO
LANCASTER CO
FREMONT CO
OTOE CO
KEY MAP
2 1 0 1 2 4 6
AREAS
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VOLUME III



METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
REGIONAL WATER SUPPLY
SUPPLY PLAN IV

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

JUNE 1975

VOLUME III ANNEX C FIGURE E-6

Raw water sources high in hardness or with other constituents in excess of recommended limits, and provisions of the 1974 Safe Drinking Water Act make treatment of all potable waters desirable if not a necessity.

27. Existing systems, and system and supply development as recommended in engineering and planning reports, form the basis for Supply Plan I. The counties of Washington, Harrison, Pottawattamie, and Mills each have a report proposing rural water districts with boundaries and supply sources as shown in figure E-3. RWD 1 in Cass County is in operation, Otoe RWD 3 and RWD 2 are in the planning and engineering phase.

28. In the metropolitan area, Plan I proposes expansion of the existing Council Bluffs, Florence, and Platte South treatment plants and the development of new sources at a Missouri South site near Waterloo and possibly at Springfield.

29. Supply Plan II features increased centralization of supply. The economy and increased reliability and flexibility of larger treatment plants leads to the evaluation of essentially one treatment facility per county in the non-metropolitan counties. The metropolitan area is served by Council Bluffs, Florence, Platte South, and a new Platte West supply and treatment facility.

30. Complete regionalization with six treatment plants supplying an interlocked distribution grid is featured in Plan III. This plan envisions Missouri River crossings at Blair and a Missouri South Plant to serve Harrison and Mills counties in Iowa. Water from the same treatment plant will serve both States.

31. Nonpotable water supply sources discussed earlier in this section are evaluated for use in a dual potable-nonpotable system in Plan IV. It was initially determined that either of two levels of nonpotable service, out-of-house only or out-of-house plus toilet flushing, in areas of substantial new development might prove feasible.

32. To test the applicability of a dual system in the study area, water requirements and costs are computed for use of a nonpotable supply and distribution system for residential out-of-house and in-house toilet flushing uses in developing areas of Omaha in Growth Concepts A and C. Fire-flow requirements will also be provided by the nonpotable system.

33. Water use reduction concepts were not considered an integral part of the initial plans but were considered as special considerations that could be applied to all plans.

EVALUATION

34. Criteria used for initial evaluations were primarily economical and technical feasibility. Initial cost data for Supply Plans I, II, and III appeared to be equivalent enough not to cause rejection of any of the three. All three plans are technically feasible. Supply Plan IV was excluded at this point for the reasons discussed below.

35. The increased distribution costs were compared to decreased water treatment capital and operation and maintenance costs for a dual water system using raw surface or ground water supplies, stormwater treated to two treatment levels, and wastewater treated to

three treatment levels, including the "zero pollutant discharge" level. Details concerning this evaluation can be found in the Supporting Technical Reports Appendix. The results of the evaluations are shown in table E-2.

36. In addition to costs, public acceptability, waste treatment process reliability, and the relative abundance of fresh water supplies would tend to disfavor Plan IV. Further refinement and expansion of Plan IV was not warranted.

37. Table E-1 summarizes the effects of implementing various water use reduction concepts. Combining all of the reduction concepts could appreciably affect future water demands; however, some of the concepts should receive less emphasis due to several factors as discussed below.

38. Industrial Development Promotion - Providing preference to low water-using industries could reduce 1995 water demands by about 7 percent. Agribusiness is the number one industry in Nebraska and Iowa creating a demand for food and agriculture product industries which are characteristically high water-users. The major water supplier in the study area, MUD, has voiced strong support for supplying water to the agribusiness industry.

39. Pricing Policies - Twenty-five percent price increases by Council Bluffs in 1968 and by the Omaha Metropolitan Utilities District in 1969 have not produced any change in water usage. A 50 percent increase aimed solely at reducing consumption would probably be publicly unacceptable.

Table E-2
Annual Cost Comparison-Dual Vs. Conventional System
($1,000/yr)

Concept	Nonpotable Supply Source	Amortized Capital Cost Increase (1)	Distribution System O&M Cost Increase (2)	Treatment O&M Cost Decrease (3)	Net Annual Cost Increase (1+2-3)
IA	Surface	7,978	1,417	755	8,640
	Ground	7,175	1,417	431	8,551
	Stormwater				
	Level 1	9,841	1,417	670	10,588
	Level 2	7,053	1,417	847	7,623
	Wastewater				
	Level 1	7,839	1,417	-154	9,410
	Level 2	7,408	1,417	370	8,455
	Level 3	7,053	1,417	847	7,623
IC	Surface	6,189	1,003	371	6,821
	Ground	5,836	1,003	212	6,627
	Stormwater				
	Level 1	7,159	1,003	329	7,833
	Level 2	5,783	1,003	416	6,370
	Wastewater				
	Level 1	6,173	1,003	- 77	7,253
	Level 2	5,956	1,003	182	6,777
	Level 3	5,783	1,003	416	6,370

40. Metering - The only opportunity to reduce water usage by individual metering appears to be for apartments and mobile homes which total 59,000 units in the study area. Costs for installing individual meters would exceed short-term savings. Plumbing repairs are more apt to be made if the management is responsible for the water bills than if tenants pay the bills.

SECTION F

PLANS SELECTED FOR FURTHER CONSIDERATION

PLANS SELECTED FOR FURTHER CONSIDERATION

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SECTION F

PLANS SELECTED FOR FURTHER CONSIDERATION

1. Three regional supply plans for the non-metropolitan area, four plans matching Growth Concepts A, B, C, and D for the metro area, and alternative supply sources for these plans are described below.

Alternative Regional Plans

SUPPLY PLAN I

2. Plan I takes into consideration the existing long-range plans of MUD and Council Bluffs and essentially follows water supply and distribution plans for the remainder of the study area. Supply and distribution systems are generally by county except for the MUD and Council Bluffs systems.

NON-METROPOLITAN AREA

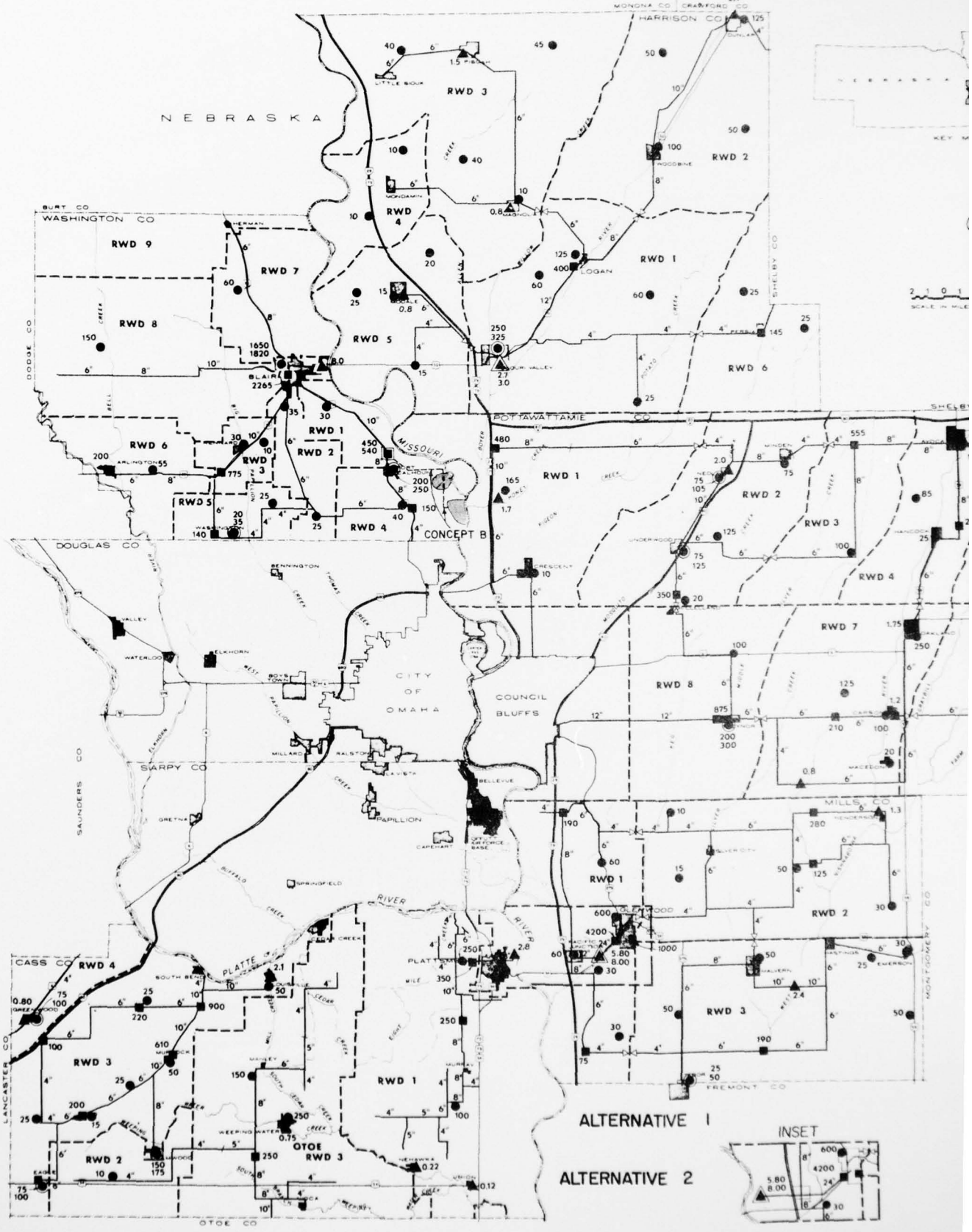
3. A detailed layout of Plan I for the non-metropolitan areas is shown in figure F-1.

4. Washington County. Washington County is divided into nine rural water districts. Eight of the districts, including all rural communities, are interconnected and served from a single facility at Blair which provides treated Missouri River water. An area of northern Washington County, designated RWD IX, would not be served by the system developed in the county study apparently due to a high capital cost per connection.

5. The treatment plant at Blair is considered as a new facility with initial construction in 1975 based upon recommendations of a report on water supply and treatment for the city of Blair. Treated Missouri River surface water is preferred over ground water because of its better quality.

6. Harrison County. Harrison County is divided into six rural water districts. Five of the districts are interconnected with treated well-field supplies located in four of the districts. Treatment plant locations would be at Pisgah, Modale, Magnolia, Dunlap, and Missouri Valley. Harrison County RWD 6, serving the southeastern part of the county including the town of Persia, is to be supplied by a rural water district in Shelby County. All communities in the county are to be included in the rural districts. Well fields of the capacities required at the locations indicated in the county report will probably require numerous low-yield wells with questionable reliability under extended maximum production conditions. Investigation of well-field sites and capacities would be required prior to implementation of this supply concept.

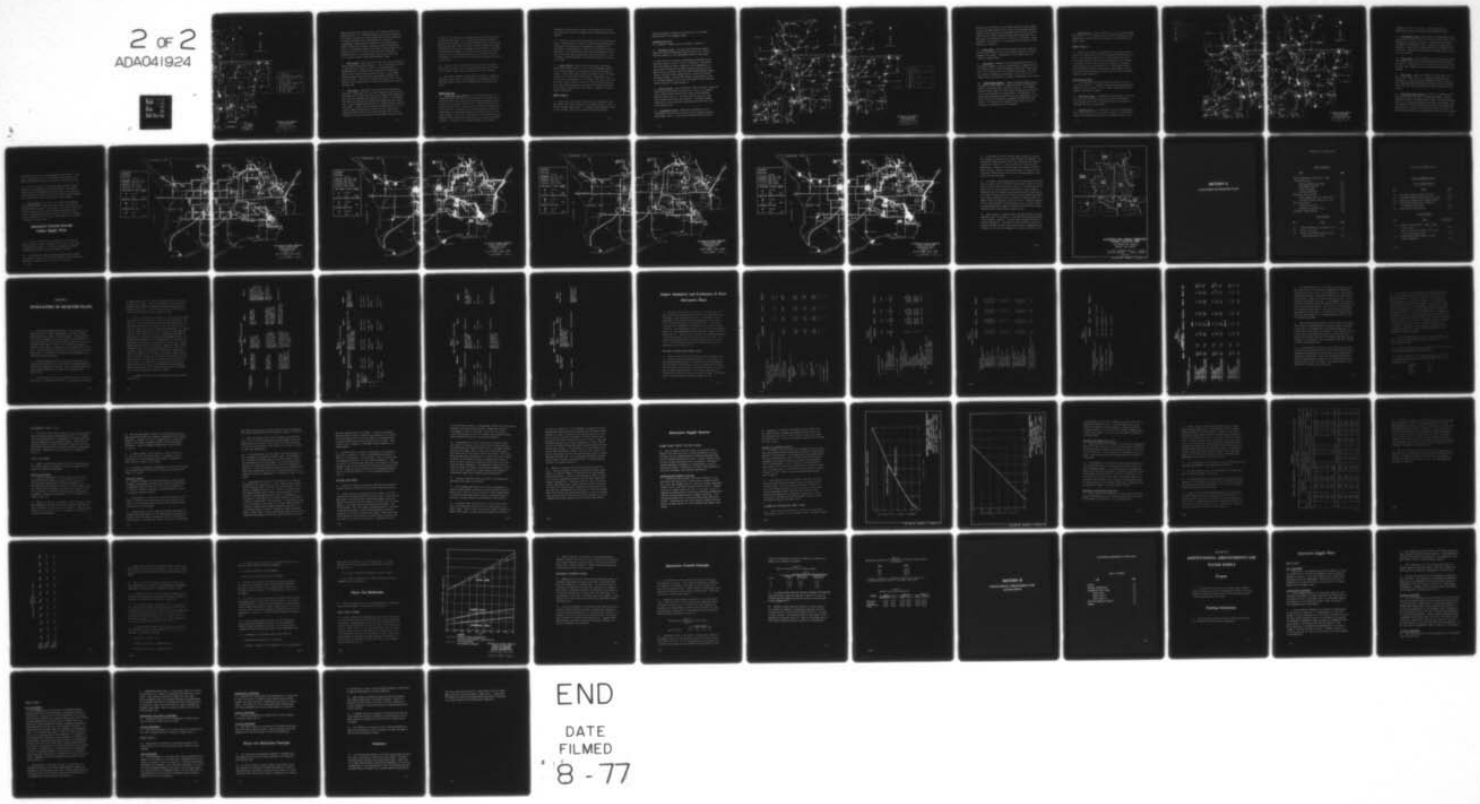
7. Pottawattamie County. Rural Pottawattamie County is divided into eight rural water districts. One of the rural water districts and the town of Crescent are to be served from the Council Bluffs


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MONONA CO
CRAWFORD CO
WASHINGTON CO
BURT CO
DODGE CO
SHELBY CO
POTTAWATTAMIE CO
DOUGLAS CO
SARPY CO
SAUNDERS CO
CASS CO
LANCASTER CO
OTOE CO
MILLS CO
FREMONT CO
MONTGOMERY CO
RWD 1
RWD 2
RWD 3
RWD 4
RWD 5
RWD 6
RWD 7
RWD 8
RWD 9
LOGAN
BLAIR
ARLINGTON
CONCEPT B
CITY OF OMAHA
COUNCIL BLUFFS
BELLEVUE
PAPILLION
SPRINGFIELD
MISSOURI RIVER
PLATTE RIVER
ALTERNATIVE 1
ALTERNATIVE 2
INSET

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WATER AND RELATED LAND RESOURCES MANAGEMENT STUDY. VOLUME III. --ETC(U)
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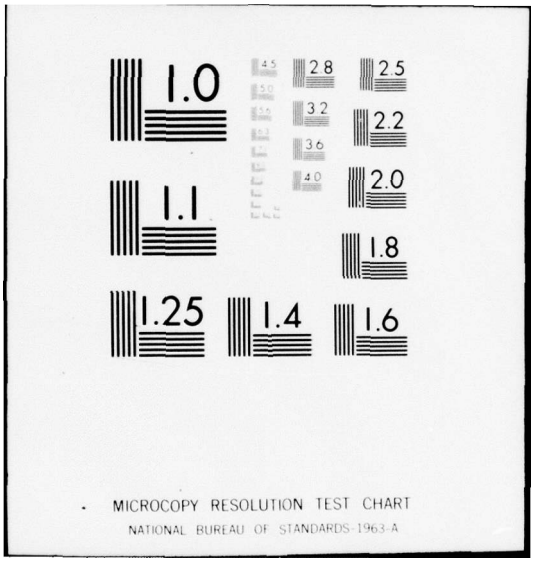
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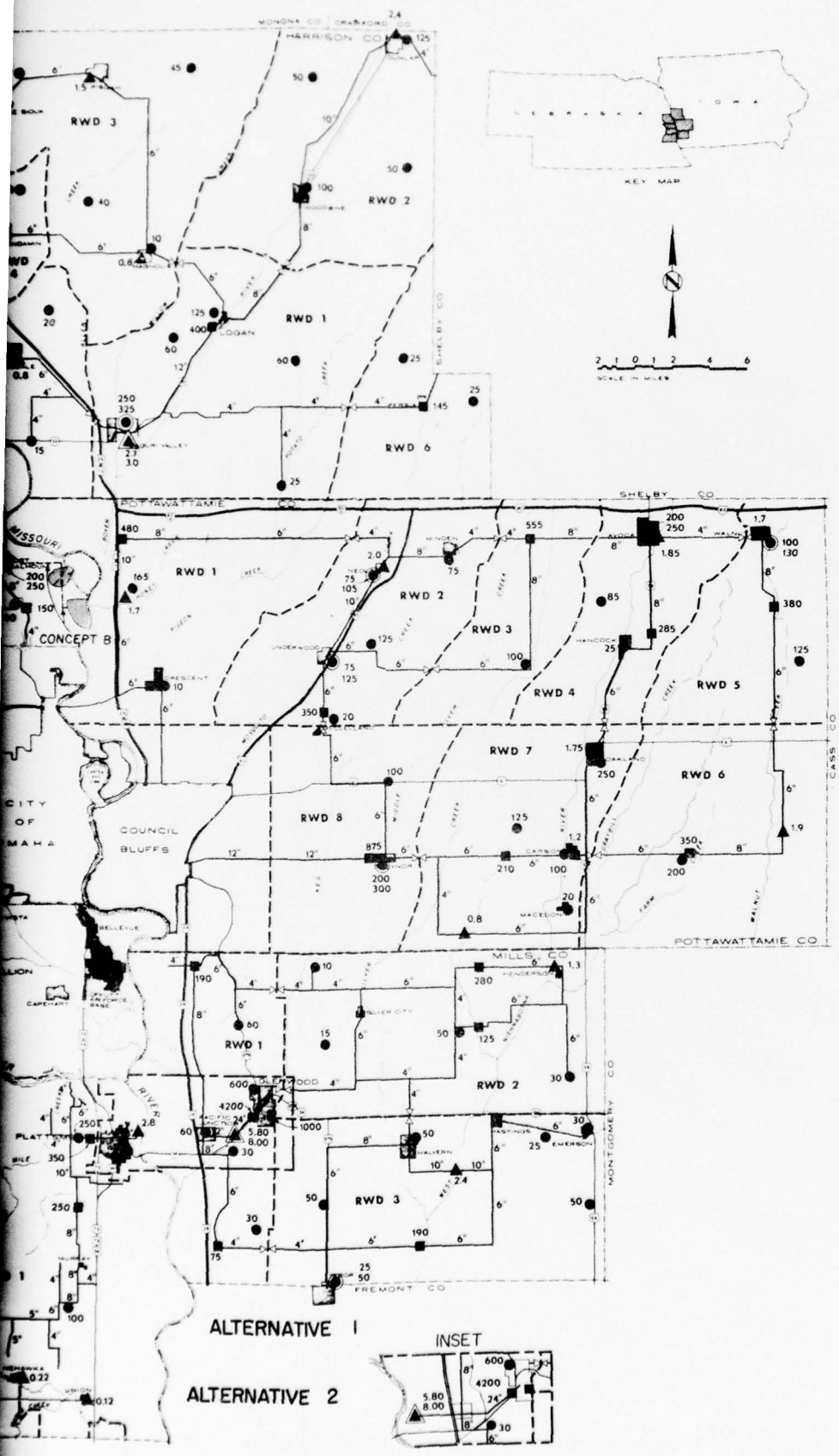
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LEGEND

- WATER MAIN
- RURAL WATER DISTRICT BOUNDARY

WATER TREATMENT PLANT, CAPACITY – YEAR

- ▲ MGD – 1995 & 2020
- △ MGD – 1995
- △ MGD – 2020

STORAGE REQUIREMENTS, CAPACITY – YEAR

- ● GALLONS X 1000 – 1995 & 2020
- ◉ GALLONS X 1000 – 1995
- ◉ GALLONS X 1000 – 2020

BOOSTER STATION, CAPACITY – YEAR

- ■ GPM – 1995 & 2020
- ■ GPM – 1995
- ■ GPM – 2020

ALTERNATIVE 1

ALTERNATIVE 2

INSET

METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
REGIONAL WATER SUPPLY
PLAN I NON-METROPOLITAN

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

JUNE 1975

VOLUME III ANNEX C FIGURE F-1

2

system with eight well fields in six of the districts serving the remaining areas. As in Harrison County, ability of the proposed well fields to supply the county's rural water district needs must be carefully explored before implementation of this plan. Pottawattamie County treatment plants would be located near the towns of Neola, Avoca, Walnut, Oakland, and Carson; along Walnut Creek in the southeast corner of the county, on Honey Creek in the northwest corner of the county, and on a branch of the West Nishnabotna River in the south-central part of the county; and at the existing Council Bluffs water treatment plant.

8. Mills County. Mills County is divided into three self-supplied, interconnected rural water districts. A well field would be located in each district to serve the district. Aquifers along the Nishnabotna River in eastern Mills county should be adequate to supply needs of the two eastern water districts. Mills County treatment plants would be located near Henderson, Malvern, and Pacific Junction. The Pacific Junction water source could be the Missouri River, alternate one or a well field near Pacific Junction, alternate two.

9. Cass County. Cass County is divided into five rural water districts. Cass County RWD 1 is under construction and will serve approximately the eastern one-third of the county with Plattsmouth's well field and treatment plant supplying the water. A preliminary RWD design envisions serving central Cass County from Otoe County RWD 3, which is supplied from wells in the Nemaha Valley in southern Otoe County. A small district designated Cass County RWD is in the planning stage and would buy its water from Otoe County RWD 3. These rural water districts will remain the same for all supply concepts, since they will probably be operational within the next

few years. The remainder of the county has been divided along I-80 to form two districts - RWD 3 supplied from Louisville and RWD 4 supplied from Greenwood. It is quite possible that the RWD 4 areas may be served from a district outside the service area, but a small self-supplied district will be assumed for this concept. The towns of Weeping Water, Nehawka, and Union, which are within the boundaries of the two RWD's already developed but not served by them, are assumed to be self-served by new supply and treatment facilities in this plan.

10. Continued use of Plattsmouth's existing plant for treating ground water, alternate one, versus construction of a new facility with a Missouri River intake, alternate two, is also compared.

11. Cass County treatment plants would be located at Louisville, Greenwood, Weeping Water, Union, Nehawka, and Plattsmouth with an additional source located in the Nemaha Valley in southern Otoe County.

METROPOLITAN AREA

12. Douglas and Sarpy Counties. The principal water utility in Douglas and Sarpy Counties, MUD, has developed a Long Range Comprehensive Water System Master Plan which envisions serving a major portion of the two-county area by 2020. A major supply source to be developed under this plan is a well field along the Platte River south of Valley. As pointed out in the MUD report and as further substantiated by preliminary results of the Platte River Level "B" Study, capacity of this source is limited by the diminished recharge available from a Platte River flow depleted by increasing upstream irrigation. Therefore, the alternative Missouri River source

proposed in the MUD report is used in this concept with a Platte River Valley site used as a common source for Valley, Waterloo, and Elkhorn.

13. "Plan C" of the MUD report is developed to serve metropolitan Omaha. The MUD system is extended to serve Gretna and Bennington, alternate one, or self-service, alternate two, evaluated for Springfield. Rural areas are not served by a rural water district since most of the comparatively small rural population has a large quantity of good quality ground water readily available, or could be served by minor extensions of the MUD system prior to full service by MUD.

14. Council Bluffs. Council Bluffs has a Water Distribution System Master Plan, prepared in 1972, which recommends expansion of the existing plant to treat Missouri River water as needs increase. Distribution system expansion outlined to meet 1995 needs, as projected in the Council Bluffs report, is adequate to serve Growth Concept populations to 2020 because of the lower growth rate and lesser sprawl presently predicted. Major new feeder mains of the Council Bluffs system are approximately the same as presented in the Council Bluffs report, with changes in staging to meet the reduced growth rate.

SUPPLY PLAN II

15. Water supply and treatment facilities are centralized along the Missouri and Platte Rivers where an adequate supply of water is assured in Water Supply Plan II. Treatment plants decrease in number and increase in size while booster pumping stations and

pipelines generally increase in size because of the enlarged service areas of the treatment plants.

NON-METROPOLITAN AREA

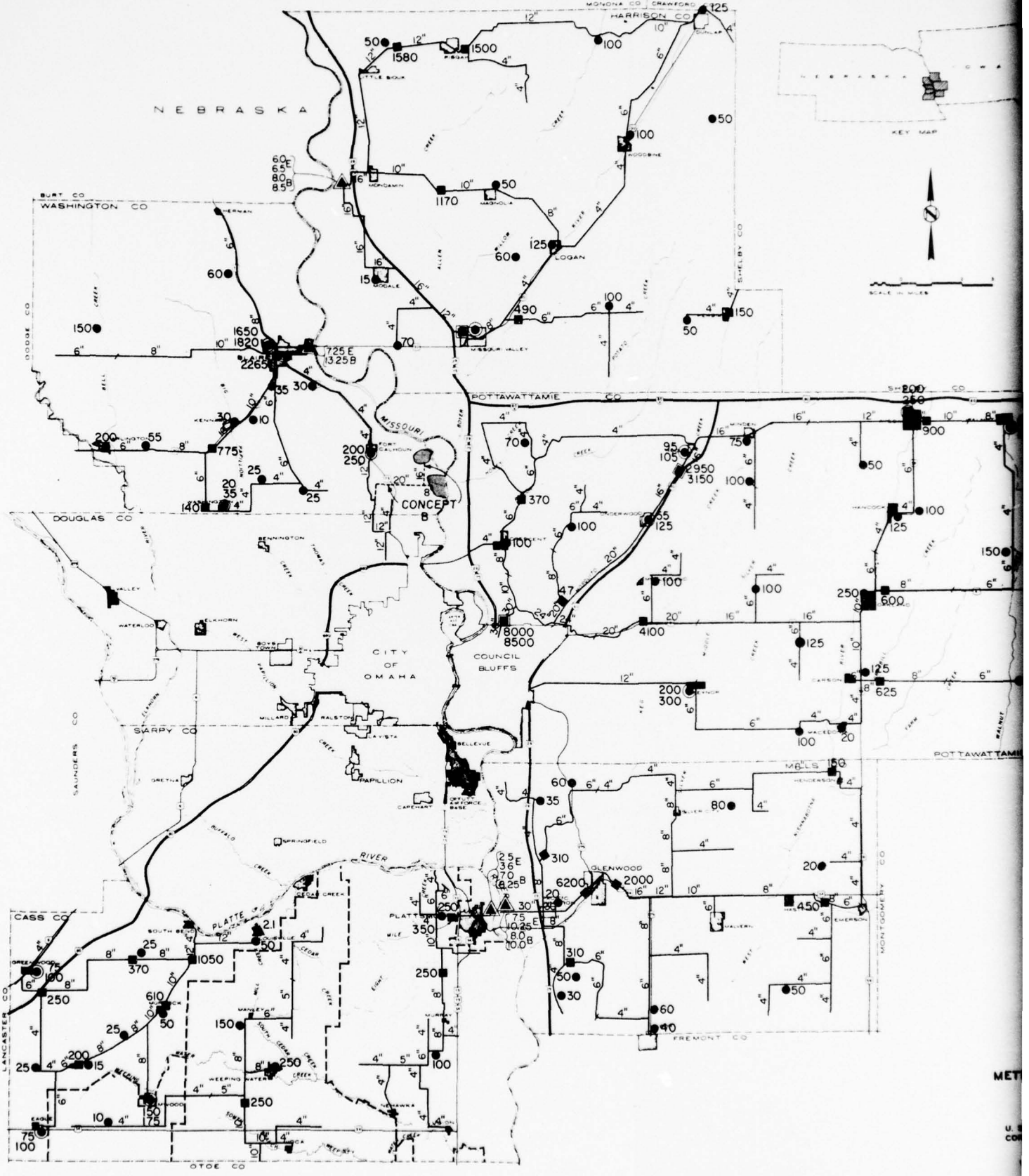
16. Features of Supply Plan II are shown in figure F-2.

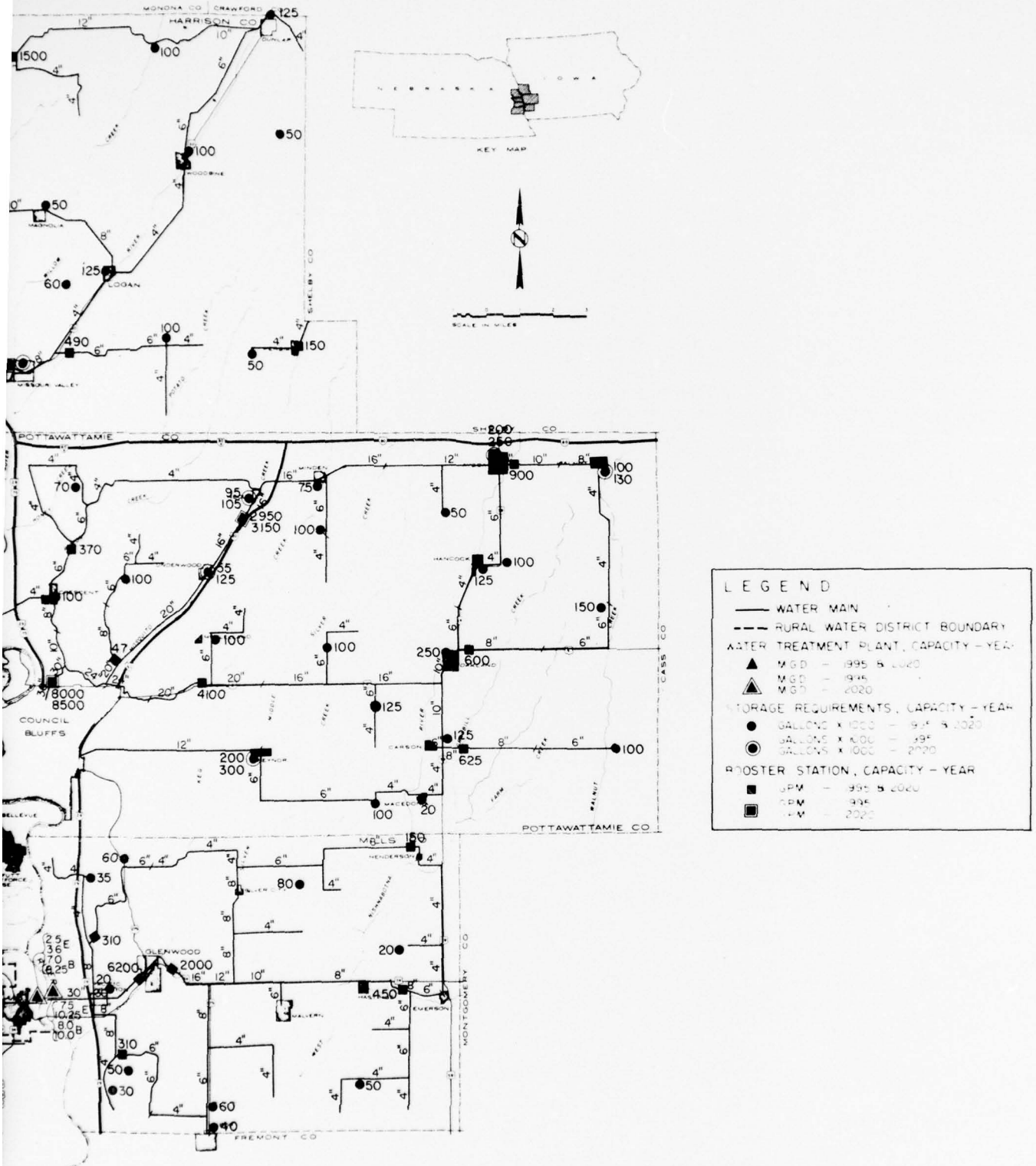
17. Washington County. The supply and distribution network remains the same for Washington County in Plan II as in Plan I, with the exception of the southeastern portion of the county.

18. MUD service of a portion of southeastern Washington County, conforming roughly to RWD 4 of Plan I including Ft. Calhoun and the unincorporated village of Nashville, was recommended in a recent study performed for the Papio Natural Resources District. Water would be purchased from MUD with MUD's Rainwood Road pumping station providing booster pumping and Ft. Calhoun's facilities providing storage. The Papio NRD system is incorporated in Plan II including expansion to serve the "new towns" of Deer Creek and Florence Precinct in Growth Concept B.

19. Harrison County. The five Harrison County rural water districts, served from sources within the districts in Plan 1, are combined into a single district served from a single source along the Missouri River in Plan II. The sixth district would be served from a Shelby County rural water district. Alternative supply sources are a river intake with treatment plant and a well field with treatment plant.

20. Pottawattamie County. Water will be supplied to all of Pottawattamie County from the Council Bluffs' treatment plant in Water Supply Plan II. A new booster pumping station located in


NEBRASKA
MONONA CO
CRAWFORD
HARRISON CO
WASHINGTON CO
BURT CO
DODGE CO
SHELBY CO
POTTAWATTAMIE CO
DOUGLAS CO
SARPY CO
SAUNDERS CO
CASS CO
LANCASTER CO
OTOE CO
MILLS
MONTGOMERY CO
FREMONT CO
CONCEPT B
CITY OF OMAHA
COUNCIL BLUFFS
MISSOURI RIVER
PLATTE RIVER
KEY MAP
SCALE IN MILES



METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
REGIONAL WATER SUPPLY
PLAN II NON-METROPOLITAN

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

JUNE 1975

VOLUME III ANNEX C FIGURE F-2

northern Council Bluffs will pump a major portion of rural demands with the remainder pumped by other Council Bluffs pumping stations. Capacity of the Council Bluffs treatment plant will vary with each Growth Concept, however non-metropolitan water needs supplied by the Council Bluffs plant will be 6.50 mgd in all Concepts. Council Bluffs will also supply the 1.50 mgd needs of the "new town", East Bellevue, in Concept B.

21. Mills County. The three Mills County rural water districts in Plan I are combined into a single district served by a single Missouri River source. Alternatives for the supply source are surface or ground waters.

22. Cass County. Extension of rural water district service to the towns of Nehawka, Union, and Weeping Water is assumed in Plan II for Cass County. Supply and pumping facilities for Cass County RWD 1 and Otoe County RWD 3 are enlarged accordingly. The treatment plant at Greenwood is eliminated in Plan II in favor of a larger facility at Louisville to supply the remainder of the county.

23. Douglas-Sarpy Counties. "Plan B" from MUD's master plan is the basis for development of a system supplying all metropolitan areas of Douglas and Sarpy Counties in Plan II. It is assumed that the "Platte West" site near Valley, Nebraska can be developed to the extent planned by the Master Plan. As indicated in the section on supply sources, some form of flow stabilization in the Platte River will be required to guarantee reliability of this source. All communities and adjacent rural users in the two counties will be served by the MUD system.

24. Council Bluffs. The only change in the Council Bluffs system from Plan I to II is increased supply to rural Pottawattamie County. Treatment and pumping capacity is expanded to meet demands of the entire county.

SUPPLY PLAN III

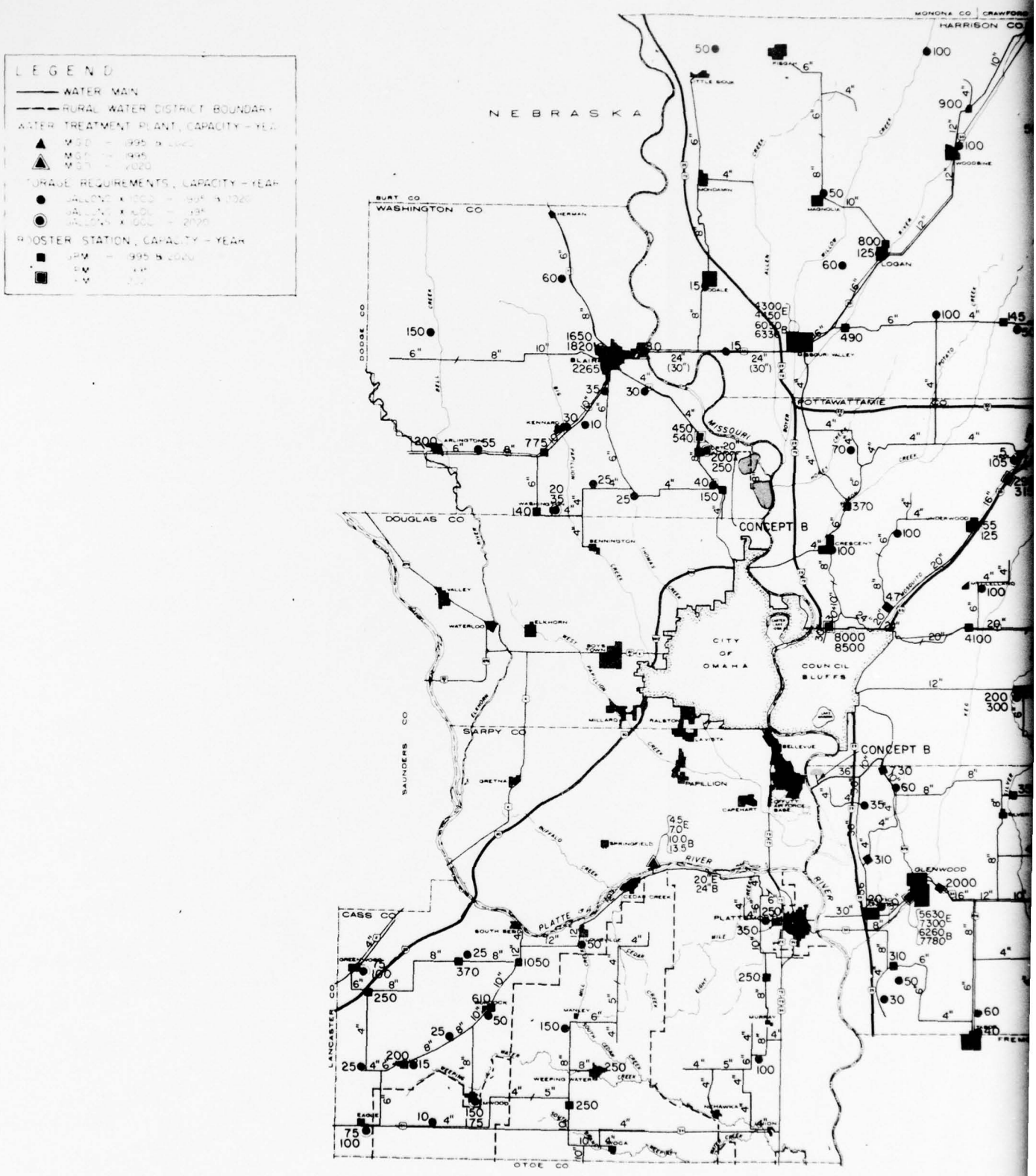
25. Water Supply Plan III is characterized by maximum centralization and regionalization of water supply and distribution facilities. Six treatment plants serve the entire seven-county area. It is envisioned that State and utility autonomy will be retained by wholesale of water from the entity controlling the treatment plant operation to the nontreating user. While system capacity and configuration are still largely on a county basis, interconnection of pipeline networks at county lines will provide maximum reliability and flexibility.

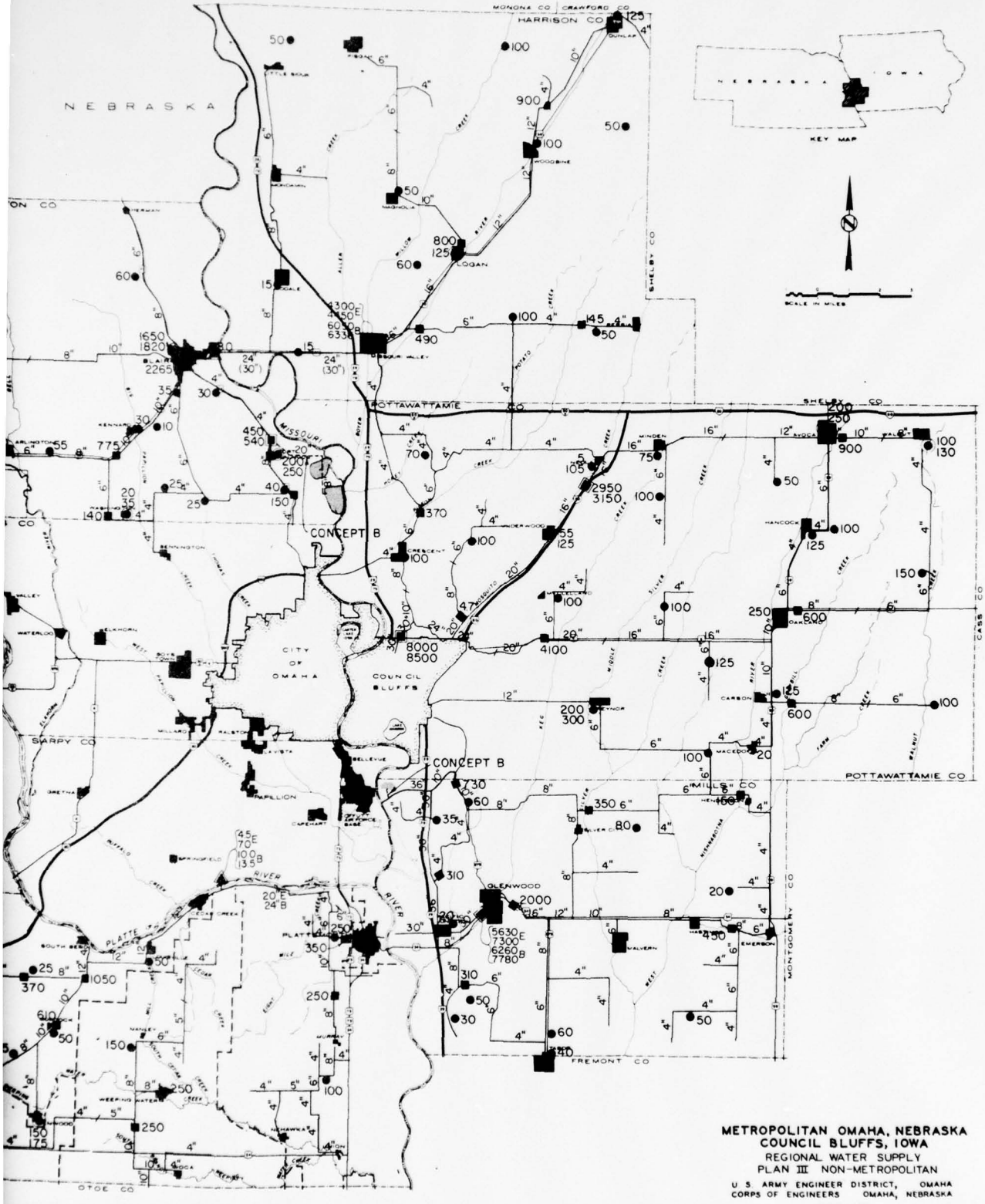
NON-METROPOLITAN AREA

26. The non-metropolitan area distribution system for Plan III is shown in figure F-3. Treatment plants serving non-metropolitan areas are located at Blair, Council Bluffs, Springfield, and the Missouri River south of Omaha.

27. Washington County. The Washington County system is identical to Plan I except treatment facilities at Blair are expanded to serve Harrison County and the southern portion of the system is interconnected with the MUD network.

28. Harrison County. All of Harrison County's requirements are met by the treatment facility at Blair in Plan III. Major distribution piping networks run generally northeastward from a river


LEGEND
WATER MAIN
RURAL WATER DISTRICT BOUNDARY
WATER TREATMENT PLANT, CAPACITY - YEAR
BOOSTER STATION, CAPACITY - YEAR
NEBRASKA
HARRISON CO
WASHINGTON CO
DOUGLAS CO
SARPY CO
CASS CO
OTOE CO
SAUNDERS CO
DODGE CO
BURT CO
POTTAWATTAMIE CO
CONCEPT B
CITY OF OMAHA
COUNCIL BLUFFS
BLAIR
ARLINGTON
KENNARD
BENNINGTON
VALLEY
WATERLOO
ELKHORN
MILLARD
RALSTON
LA VISTA
PAPILLION
GRETNA
BELLEVUE
OFFUTT AIR FORCE BASE
SPRINGFIELD
GREENWOOD
SOUTH BEND
MURDOCK
MANLEY
WEEPING WATER
ELMWOOD
EAGLE
AVOCA
MISSOURI RIVER
PLATTE RIVER
LOGAN
MAGNOLIA
WOODBINE
CRESCENT
MODALE
PISGAH
LITTLE SIOUX
MONONA CO
CRAWFORD



METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
REGIONAL WATER SUPPLY
PLAN III NON-METROPOLITAN

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

JUNE 1975

VOLUME III ANNEX C FIGURE F-3

crossing at the Blair Toll Bridge. Pipelines cross into Pottawattamie County at Harrison County's southern border.

29. Pottawattamie County. Water supply to Pottawattamie County is basically the same in Plan III as in Plan II with Council Bluffs supplying the bulk of water needs. A small portion of extreme southwestern Pottawattamie County, including the Growth Concept B "new town" of East Bellevue, is served by the MUD Missouri River South Plant. Pipeline connections also interconnect with Harrison and Mills Counties.

30. Mills County. A river crossing at the Bellevue Bridge from MUD's Missouri River South Plant supplies water to Mills County in Plan III. Nearly seven miles of 36-inch pipeline to the principal water user (Glenwood) make the economics of this system questionable.

31. Cass County. Distribution systems for Cass County are the same in Plan II and Plan III. A single treatment plant near Springfield in Sarpy County and transmission lines to Louisville and Plattsmouth replace treatment facilities in these two towns. Otoe County RWD 3 and Cass County RWD 2 remain supplied from Otoe County.

32. Douglas and Sarpy Counties. In Plan III, Douglas and Sarpy Counties are served from three treatment facilities: Florence, Platte River South, and Missouri River South. This plan evaluates service to all urban and adjacent rural areas of the county, with the Missouri River South site developed for the third major treatment facility in place of the Platte River West site of Plan II. Again, water availability considerations dictate use of the Missouri

River source in place of the more desirable Platte source. Location of the Missouri River site also facilitates service of an entire non-metropolitan county (Mills) from a major urban plant.

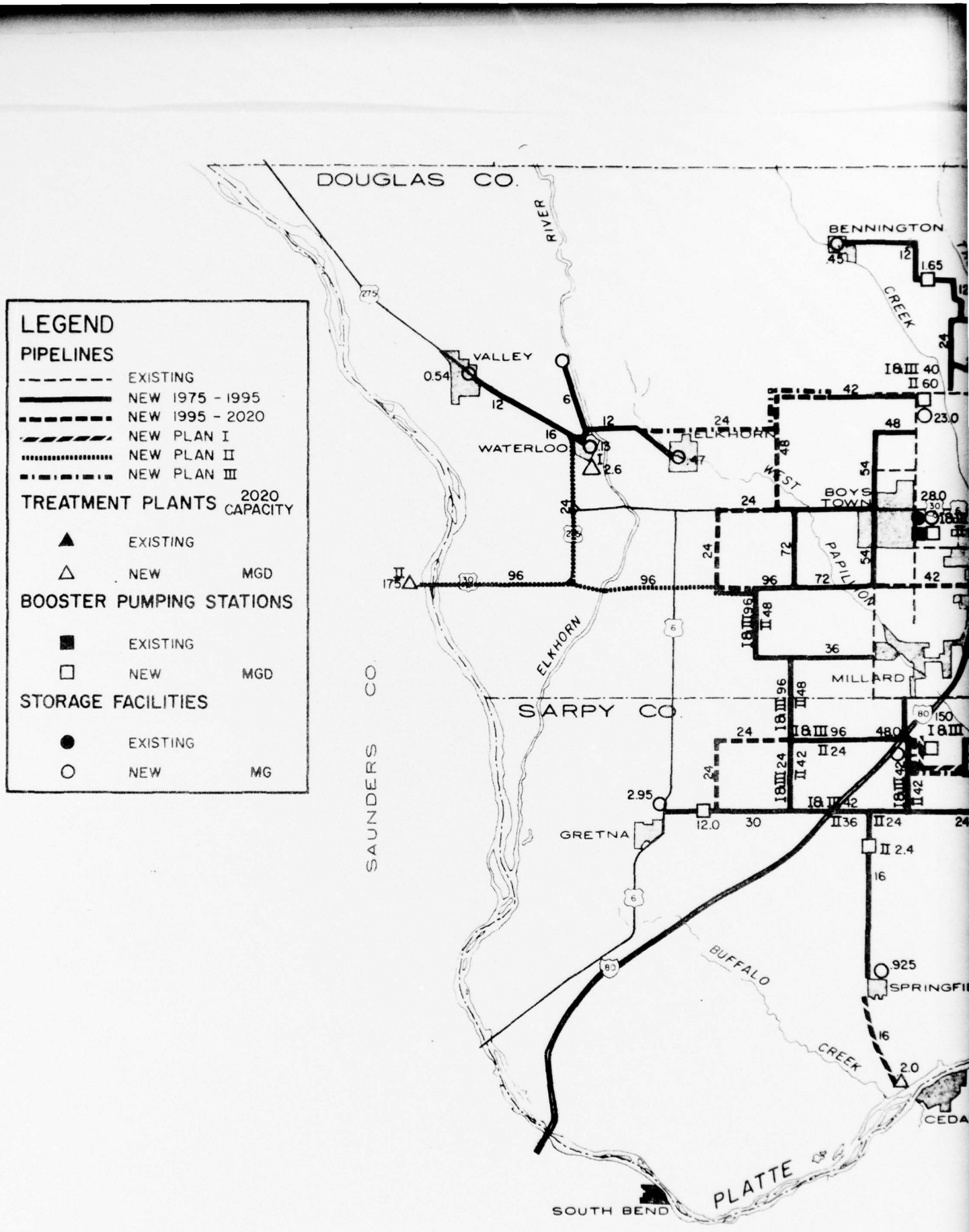
33. Service reliability of non-metropolitan systems is greatly enhanced by interconnection with the MUD system. Connections occur along the Douglas-Washington County line, at the non-metropolitan Springfield treatment plant, and between the Pottawattamie County network and the MUD supplied Mills County system.

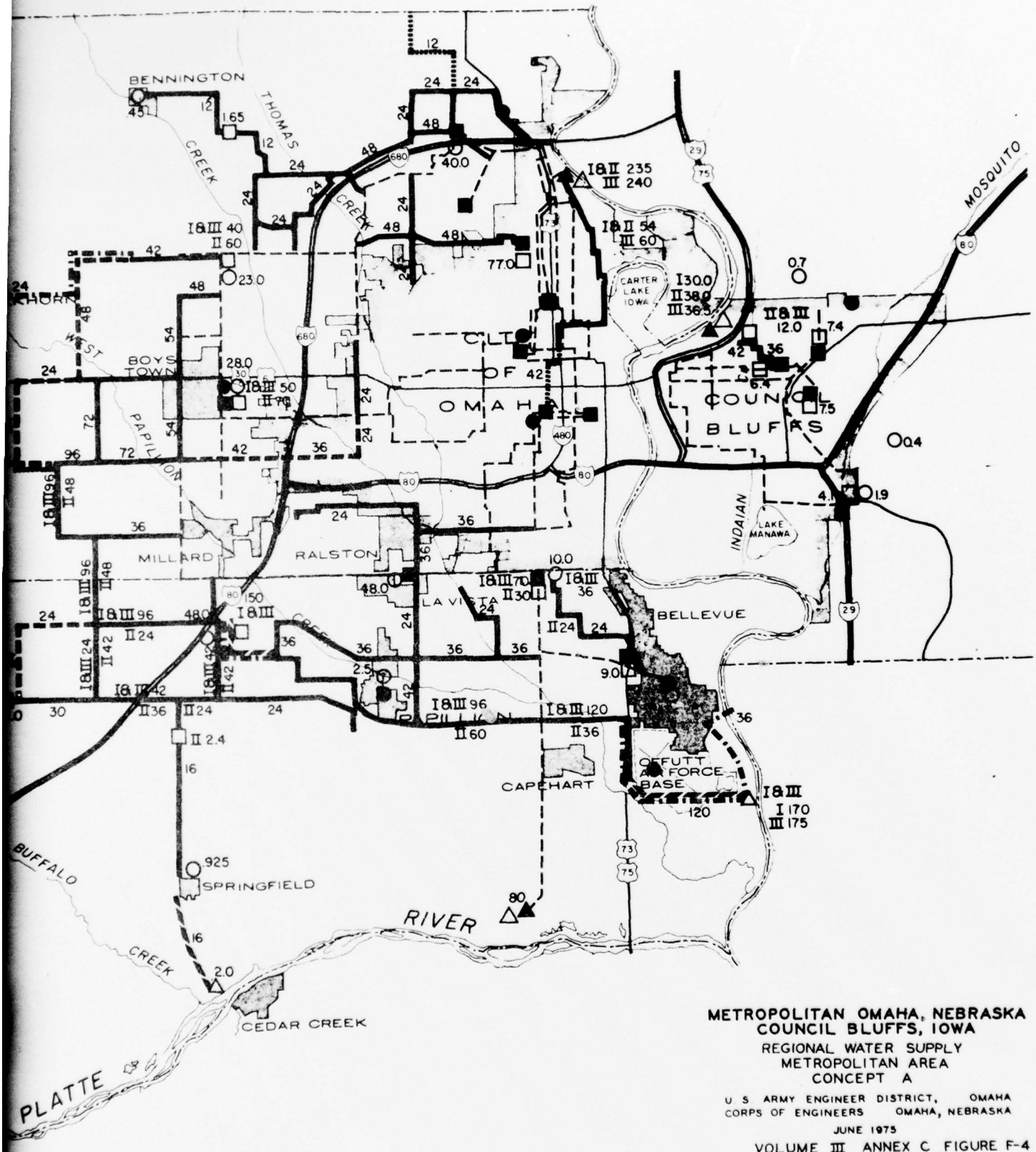
34. Council Bluffs. As in Plan II the Council Bluffs system supplies Pottawattamie County, with the exception of a small extreme southwestern portion of the county. The Concept B "new town" of East Bellevue in Mills County is also not served by Council Bluffs. Non-metropolitan reliability and flexibility is improved via interconnection with the Council Bluffs system and by meshing of networks at county lines.

Alternative Growth Concept Urban Supply Plans

35. In non-metropolitan areas, the satellite cities and new towns of Concept B impose increased, or new, loads on the supply and distribution system. The effect is evaluated in terms of increased facility size and new or enlarged pipelines.

36. In metropolitan areas, both demand magnitude and location are affected. Supply and distribution systems for each Supply Plan are shown by Growth Concept in figures F-4 through F-7.


LEGEND
PIPELINES
EXISTING
NEW 1975 - 1995
NEW 1995 - 2020
NEW PLAN I
NEW PLAN II
NEW PLAN III
TREATMENT PLANTS 2020 CAPACITY
EXISTING
NEW MGD
BOOSTER PUMPING STATIONS
EXISTING
NEW MGD
STORAGE FACILITIES
EXISTING
NEW MG
DOUGLAS CO.
SARPY CO.
SAUNDERS CO.
ELKHORN RIVER
BENNINGTON
VALLEY
WATERLOO
ELKHORN
WEST
BOYS TOWN
PAPILLION
MILLARD
GRETNA
SOUTH BEND
PLATTE
BUFFALO CREEK
CREEK
SPRINGFI
CEDA

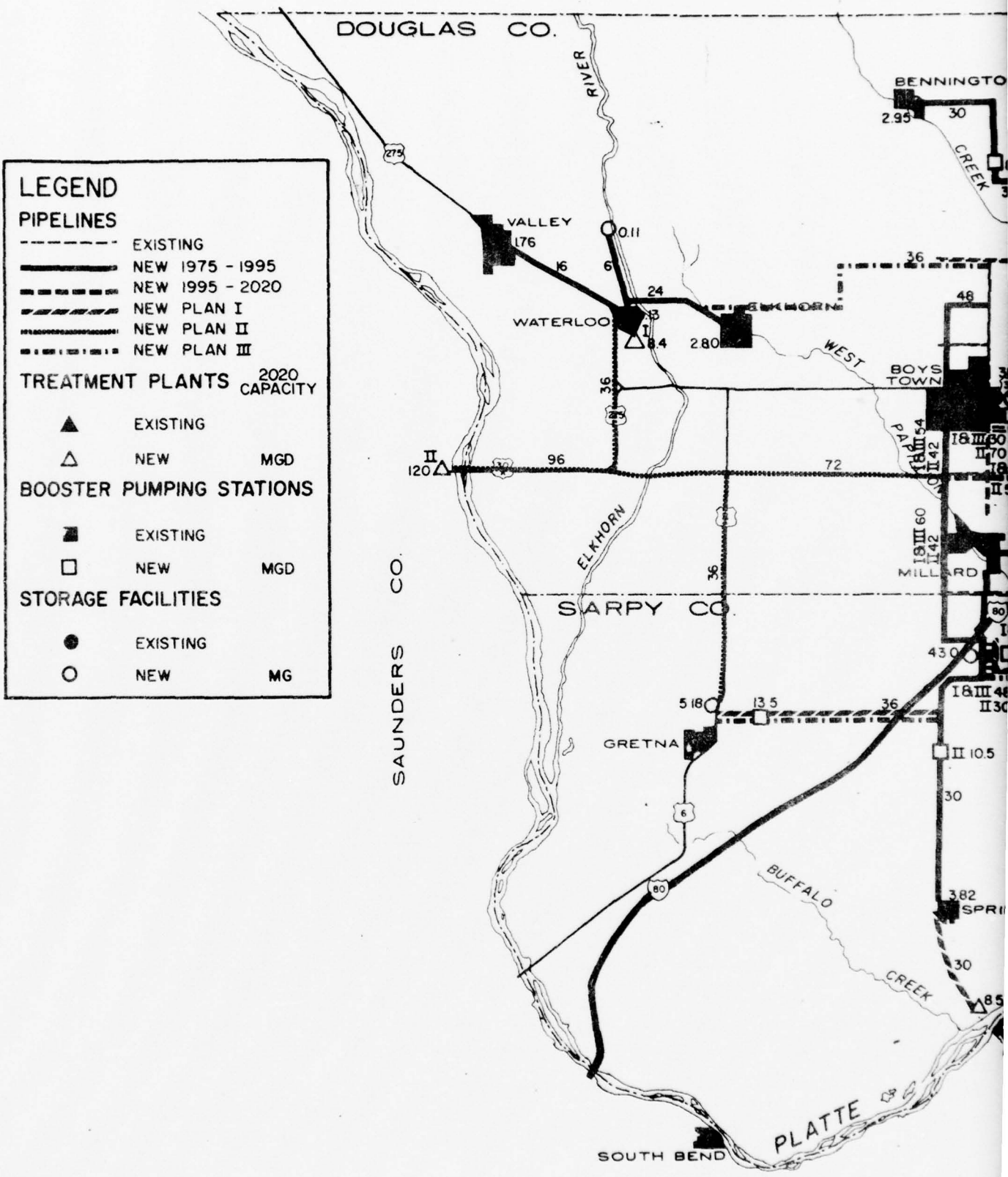


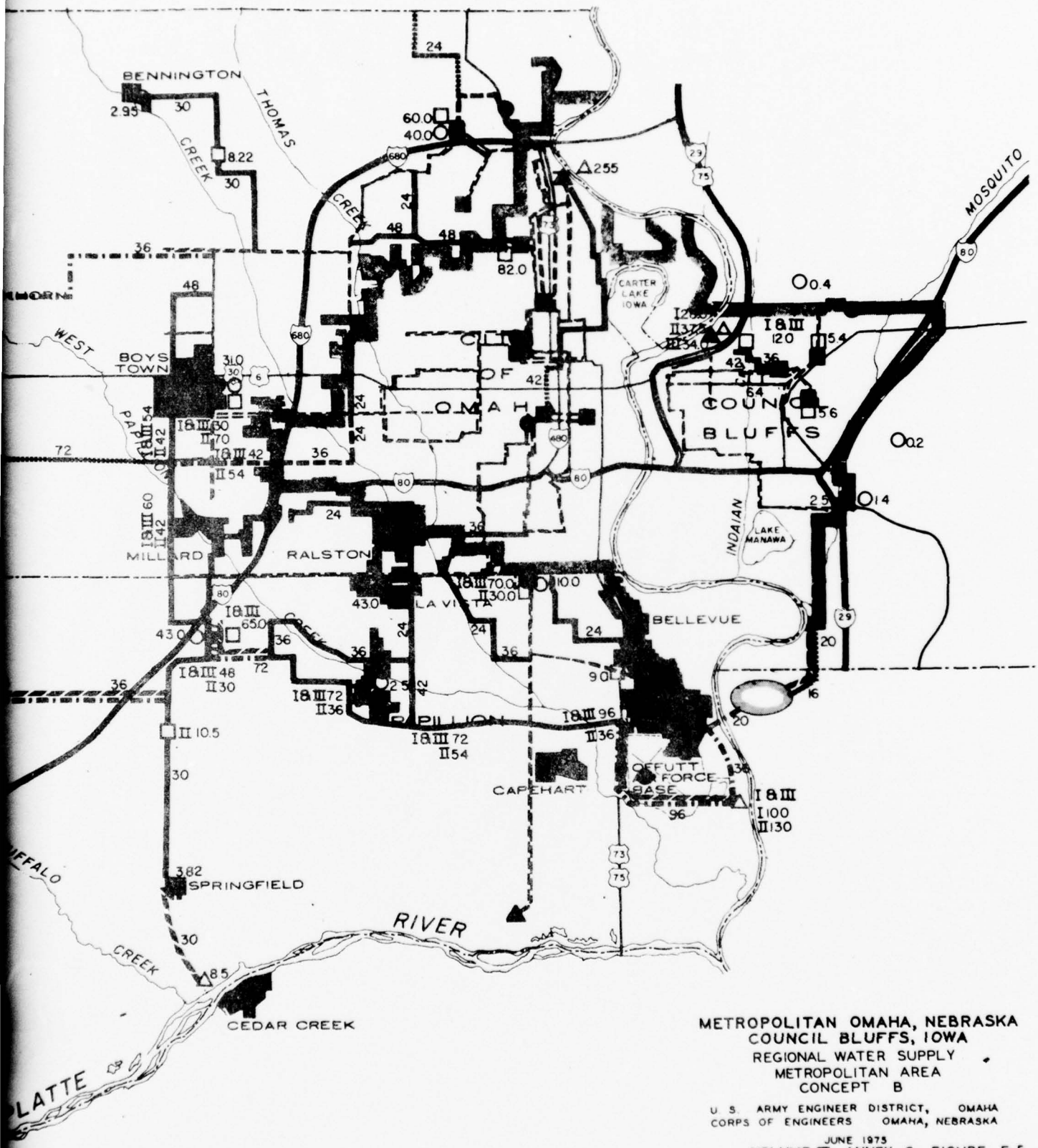
METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
REGIONAL WATER SUPPLY
METROPOLITAN AREA
CONCEPT A

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

JUNE 1975

VOLUME III ANNEX C FIGURE F-4

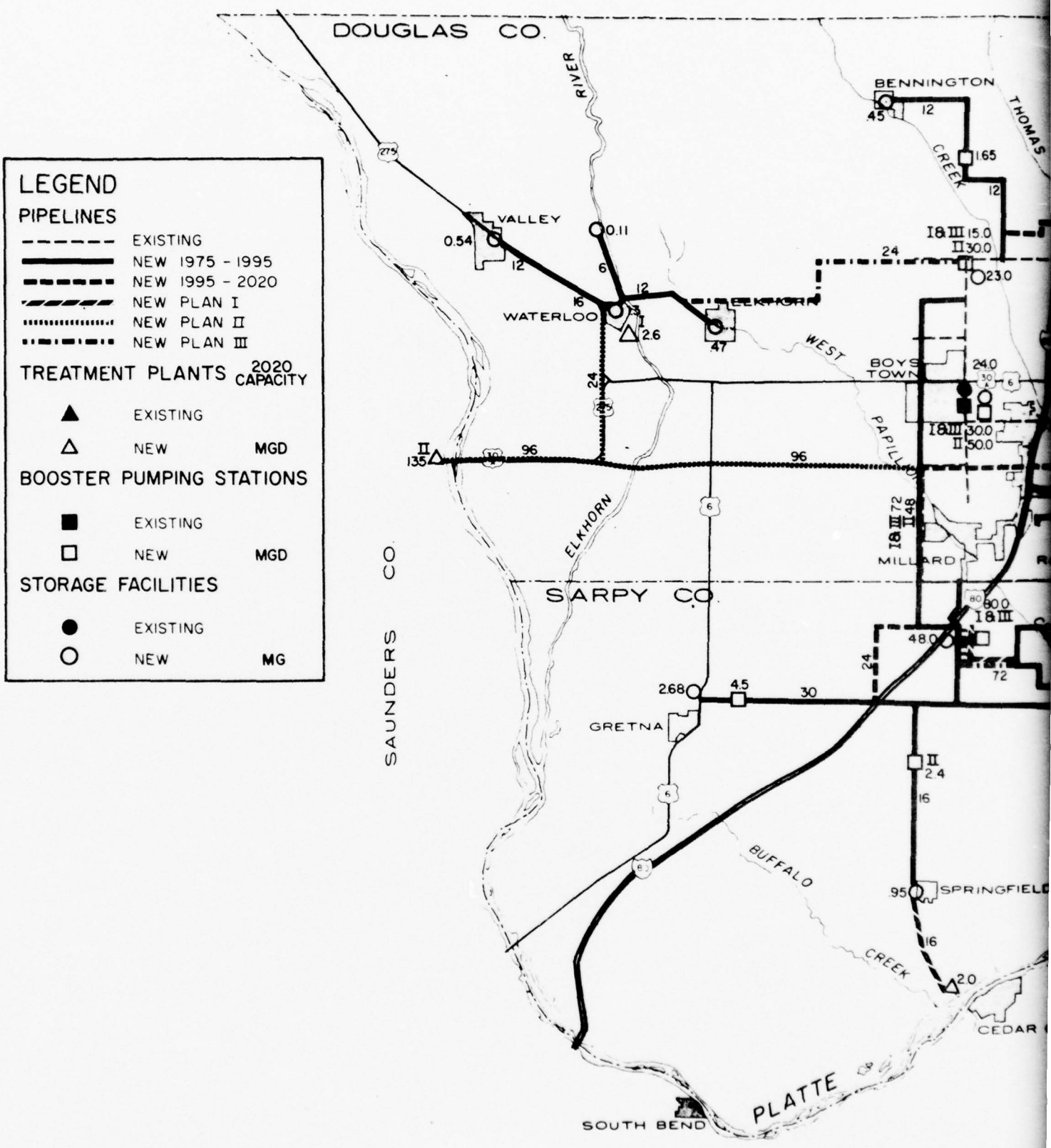

LEGEND
PIPELINES
EXISTING
NEW 1975 - 1995
NEW 1995 - 2020
NEW PLAN I
NEW PLAN II
NEW PLAN III
TREATMENT PLANTS 2020 CAPACITY
EXISTING
NEW MGD
BOOSTER PUMPING STATIONS
EXISTING
NEW MGD
STORAGE FACILITIES
EXISTING
NEW MG
DOUGLAS CO.
SARPY CO.
SAUNDERS CO.
RIVER
VALLEY
WATERLOO
ELKHORN
WEST
BOYS TOWN
MILLARD
GRETNA
SOUTH BEND
PLATTE
BUFFALO
CREEK
BENNINGTO
275
80
6

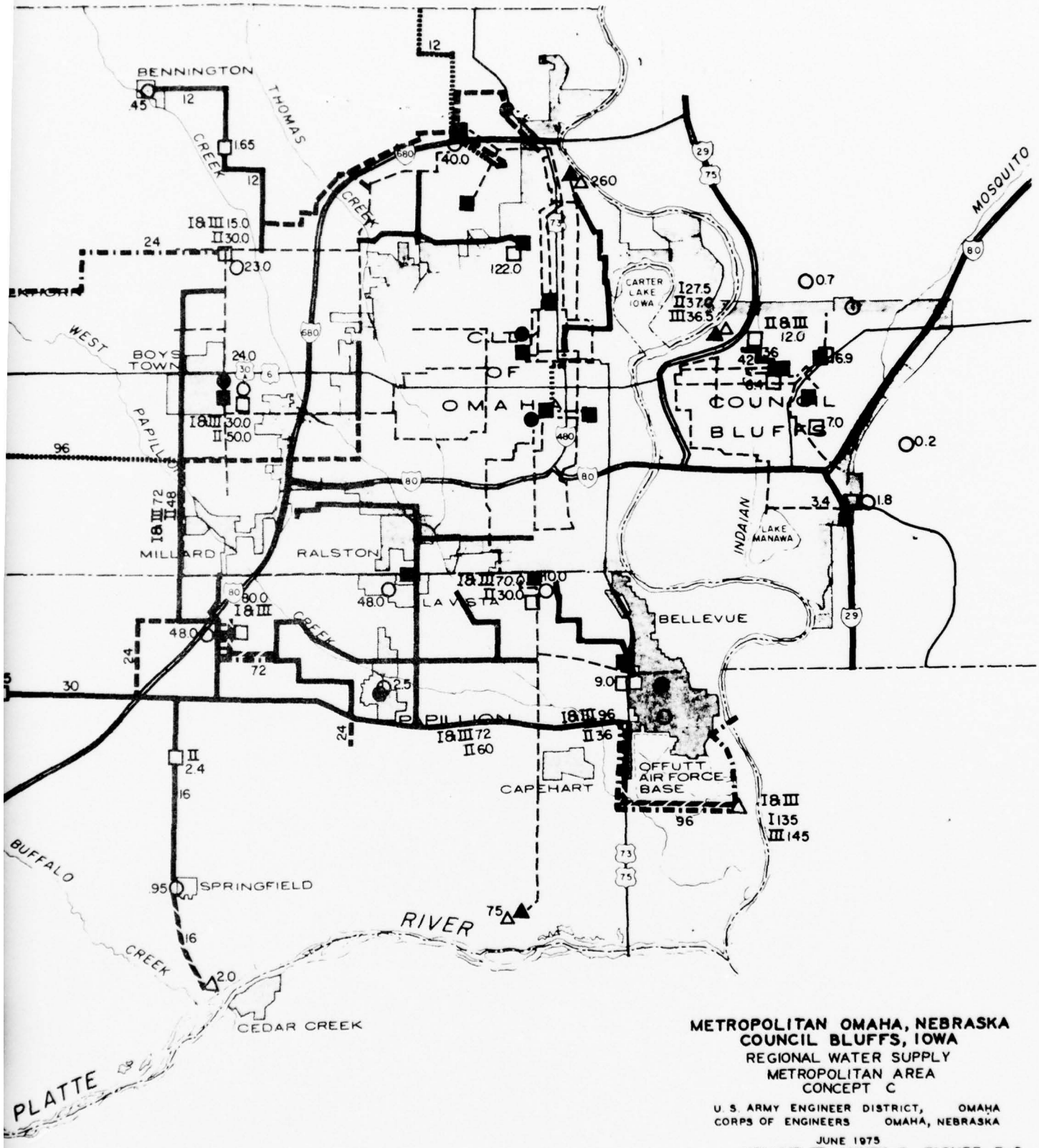


METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
REGIONAL WATER SUPPLY
METROPOLITAN AREA
CONCEPT B

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

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VOLUME III ANNEX C FIGURE F-5

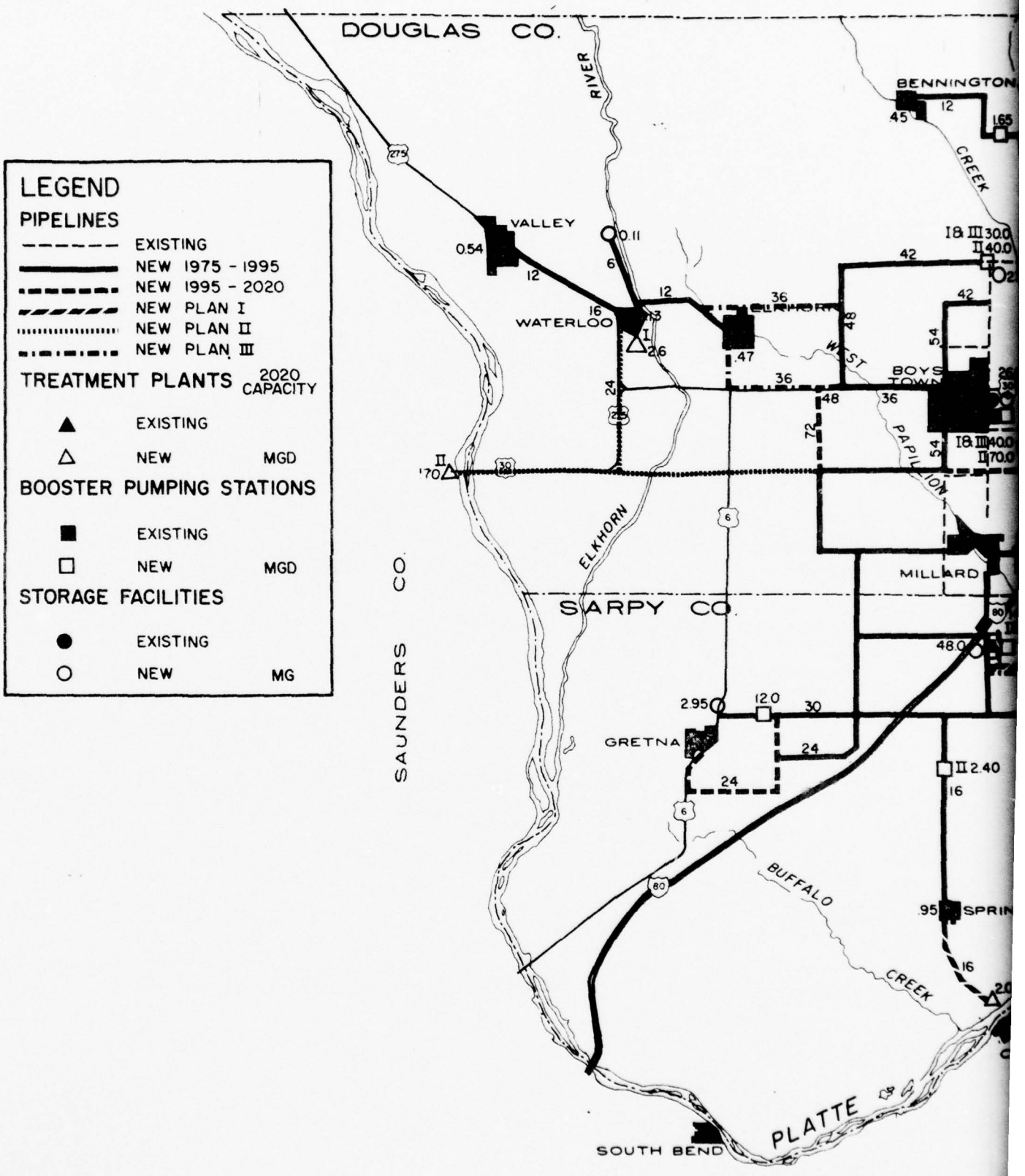

LEGEND
PIPELINES
EXISTING
NEW 1975 - 1995
NEW 1995 - 2020
NEW PLAN I
NEW PLAN II
NEW PLAN III
TREATMENT PLANTS 2020 CAPACITY
EXISTING
NEW MGD
BOOSTER PUMPING STATIONS
EXISTING
NEW MGD
STORAGE FACILITIES
EXISTING
NEW MG
DOUGLAS CO.
SARPY CO.
SAUNDERS CO.
RIVER
ELKHORN
WEST
PAPILLION
CREEK
BUFFALO
PLATTE
VALLEY
WATERLOO
ELKHORN
BENNINGTON
THOMAS
BOYS TOWN
MILLARD
GRETNA
SPRINGFIELD
SOUTH BEND
CEDAR

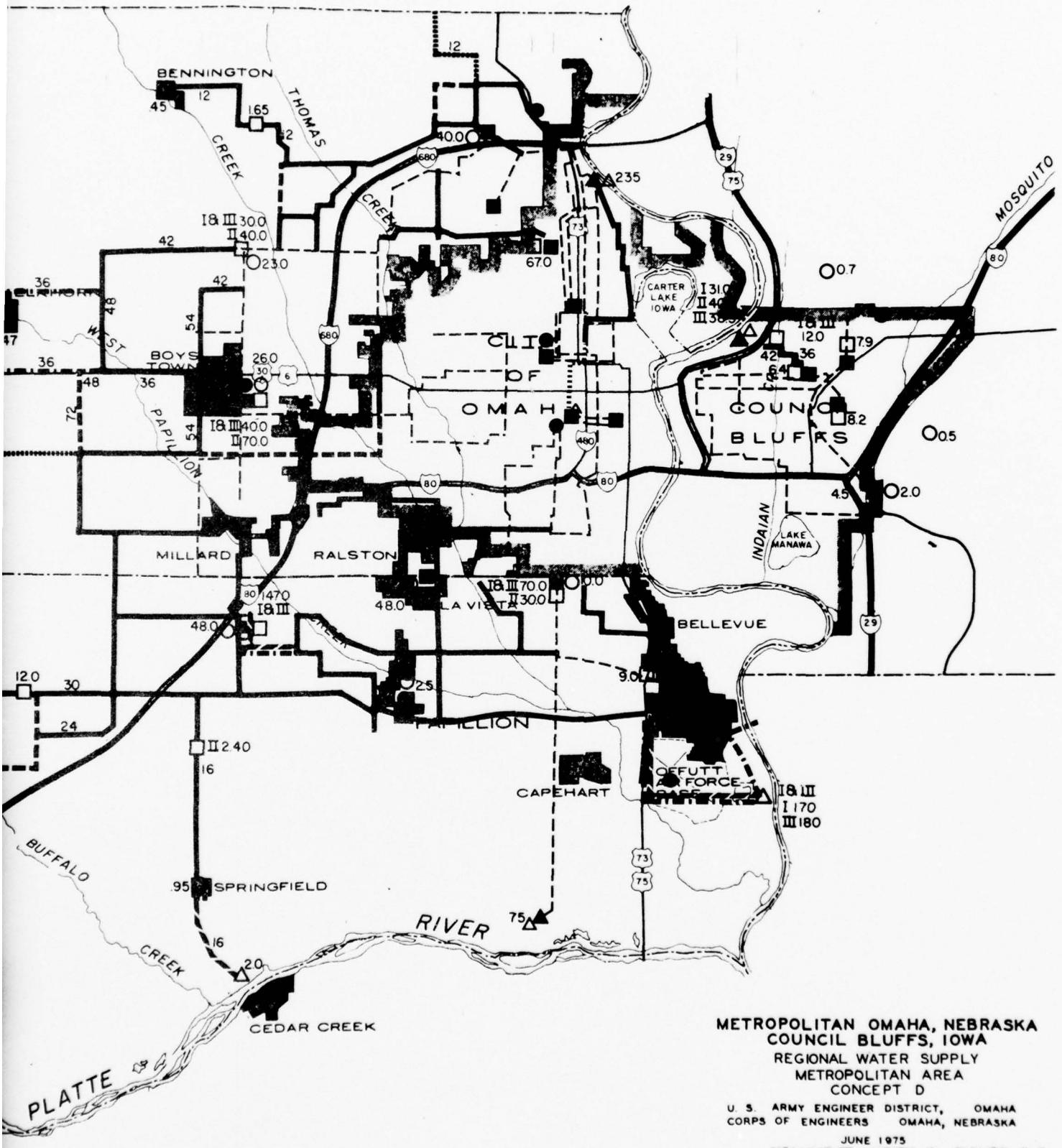


METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
REGIONAL WATER SUPPLY
METROPOLITAN AREA
CONCEPT C

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

JUNE 1975
VOLUME III ANNEX C FIGURE F-6


LEGEND
PIPELINES
EXISTING
NEW 1975 - 1995
NEW 1995 - 2020
NEW PLAN I
NEW PLAN II
NEW PLAN III
TREATMENT PLANTS 2020 CAPACITY
EXISTING
NEW MGD
BOOSTER PUMPING STATIONS
EXISTING
NEW MGD
STORAGE FACILITIES
EXISTING
NEW MG
DOUGLAS CO.
SARPY CO.
SAUNDERS CO.
VALLEY
WATERLOO
ELKHORN
RIVER
BENNINGTON
CREEK
BOYS TOWN
WEST
PAPILLION
MILLARD
GRETNA
BUFFALO
CREEK
SOUTH BEND
PLATTE



METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
REGIONAL WATER SUPPLY
METROPOLITAN AREA
CONCEPT D

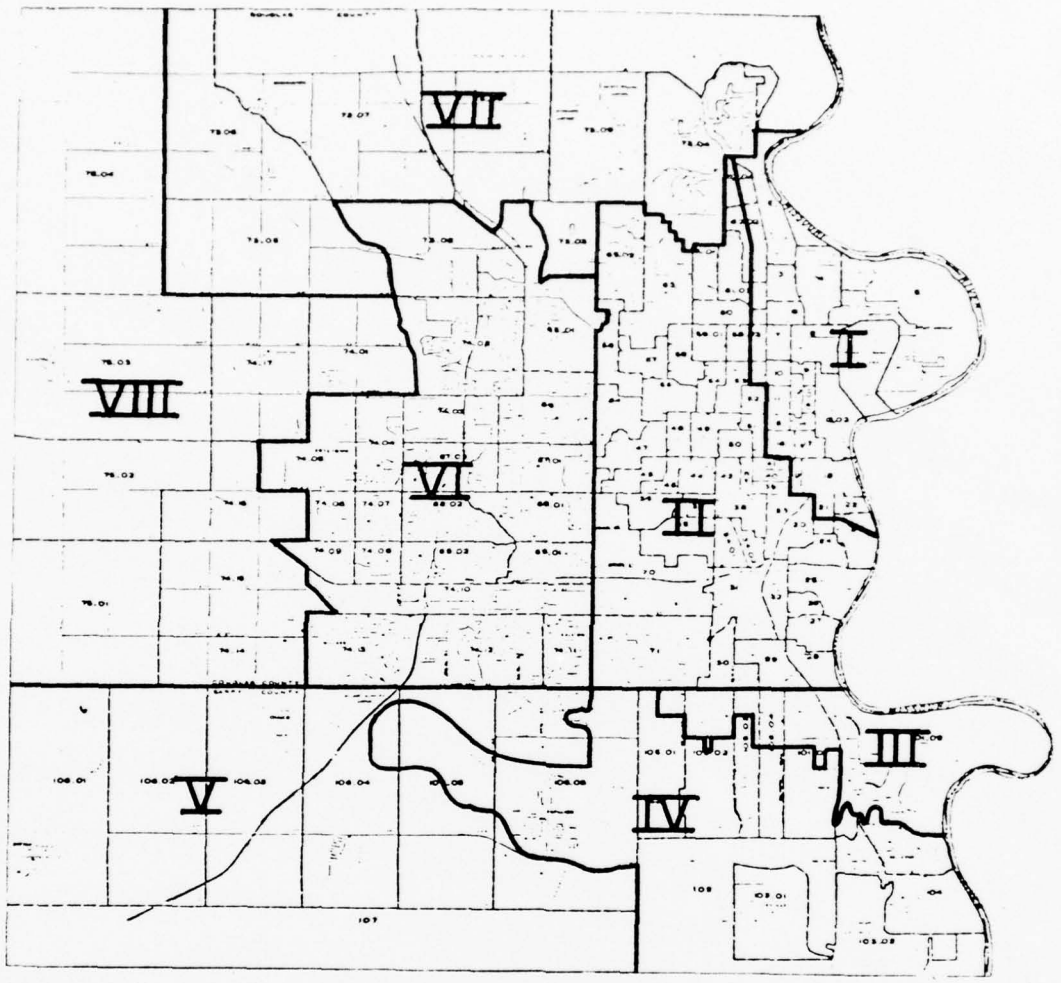
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

JUNE 1975
VOLUME III ANNEX C FIGURE F-7

37. To determine the effect of each Growth Concept on facility size, usage, and ultimate cost, areas of demand were assigned. The metropolitan Omaha area was divided into eight water-use areas as indicated in figure F-8. Council Bluffs was divided into four demand zones. Demands within these areas were computed for each Growth Concept. Areas, or portions of areas, to be supplied by a particular treatment facility and booster pumping station in each Supply Plan were allocated.

38. For example, areas assumed served by the Platte West treatment plant in Plan II and by the Missouri South plant in Plan III include Area V, Area VIII and two-thirds of Area VI. All water supplied to Areas V and VIII by the Missouri South plant in Plan III must be repumped by the I-80 booster pumping station, while a large portion of the area can be served direct from the Plan II Platte West Plant. Thus, pumping costs are higher for service to western portions of Omaha in Plan III (and Plan I) than in Plan II. Less water consumption in outlying areas in Growth Concepts B and C, due to reduced or constrained growth, lessen the pumping cost differential between plans and reduce piping network extent and size.

39. Lesser sprawl in Concepts B and C generally lowers all system component costs. For instance, the MUD Fort Street pumping station is not needed in Concept B. One cost which increases is service to outlying communities. Pipelines built specifically to these communities increase in length as the urban fringe is constrained, and increase in size where the community is a Concept B satellite city.



METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA

METROPOLITAN OMAHA
WATER USE AREAS

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

JUNE 1975

VOLUME III ANNEX C FIGURE F-8

SECTION G

EVALUATION OF SELECTED PLANS

EVALUATION OF SELECTED PLANS

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SECTION G

EVALUATION OF SELECTED PLANS

1. This section presents the results of the evaluation of the plans selected for further consideration. The three regional supply plans are a mixture of many components. In Supply Plan II, the economic advantage of the Platte well field near Valley is large enough that it may bias an equivalent evaluation of all three regional supply plans. Therefore, for evaluation purposes, all regional supply plans were assumed to use the Missouri River South site. The Platte West site could also be used with any of the three supply plans. An evaluation of Platte West versus Missouri South sites was conducted separately.

2. Separate evaluations were also conducted for the water use reduction alternatives and for the distribution systems associated with the four urban growth patterns. Water use reduction and alternative growth patterns are applicable to all regional water supply plans.

3. The final three plans were evaluated along with a fourth alternative plan, a do-nothing alternative. This alternative represents

the water system that will result in the study area in the absence of water supply plans. Under this alternative, the metropolitan supplies would continue to expand, rural municipalities would upgrade and expand their own facilities, and rural areas would continue to supply themselves on an individual basis.

4. Since no cost data were available, the costs for the do-nothing alternative were computed based on the following assumptions. The costs for the municipal water supplies were based on selected price data assuming that water is presently priced at the level to recover all costs, capital, and operation and maintenance. The average cost of a rural domestic well is $2,500, based on an estimate provided by a local well-drilling firm. This estimate was based on the costs of a 180-foot well in eastern Pottawattamie County. The average cost of operating a well was estimated at $50 per year, an approximation of the cost of electricity to run the well. It was assumed that each existing well must be replaced one and one-half times before 2020, which is roughly equivalent to a useful life of 30 years. Actually, a domestic well would have a longer useful life-in the range of 40 to 50 years. The shorter useful life was used to calculate depreciation to make some allowance for the cost of major repairs. These costs were distributed evenly over the next 45 years. The costs used in the metropolitan area are the same as those used in Plan I of the alternative plans, assuming that the Metropolitan Utilities District and Council Bluffs implement their existing master distribution plans.

5. The summary comparison of the alternative plans is presented in Table G-1.

Table G-1
Summary Comparison of Alternative Plans

	Do-Nothing	Plan I	Plan II	Plan III
A. Plan Description				
1. Non-metro area	Fifty-three municipal systems; 13,188 individual well supplies.	Thirty-one rural water systems covering entire non-metro area; twenty-two treatment plants.	One treatment plant per county; distribution system county wide.	One plant serves Washington and Harrison Counties; Pottawattamie County served by Council Bluffs; Mills County served by MUD; two supply sources for Cass County.
2. Metro area	Implementation of Council Bluffs' and MUD's master plans.	Implementation of Council Bluffs' and MUD's master plans; 3 Missouri River plants and one Platte River plant serve metro-area.	Same as Plan I except MUD service extended to all of Douglas and Sarpy Counties; Council Bluffs extended to all of Pottawattamie County.	Same as Plan II except MUD service extended to Mills County.
B. Significant Impacts	Forty-Two communities with aesthetic water quality; four with health problems; water shortage possibly in twenty-six communities; rural population decline.	All residents receive reliable supply meeting USPHS standards; fire protection enhanced; rural population and economic activity stabilized or increased.	Same as Plan I with increased supply reliability and lower management costs.	Same as Plan II.

Table G-1
(Cont'd)
Summary Comparison of Alternative Plans

	Do-Nothing	Plan I	Plan II	Plan III
C. Plan Evaluation				
1. Contribution to planning objectives	Planning objectives met for metro area residents only.	Meets all water supply planning objectives except for reduced water use; for non-metro areas use will probably increase.	Same as Plan I but at less economic cost.	Same as Plan I at less economic costs than than Plan I; more than Plan II.
2. Relationship to four national accounts				
a. NED beneficial impacts	$427.2 million	$462.2 million	$465.1 million	$465.6 million
NED adverse impacts	$400.4 million	$462.3 million	$441.3 million	$448.2 million
b. EQ	No major effect	No major effect	No major effect	No major effect
c. SWB	No change	Improved	Improved	Improved
d. RD				
(1) Net income	None	-$80.1 million	$23.8 million	$17.4 million
(2) Economic stability	Decrease	Improved	Improved	Improved

Table G-1
(Cont'd)
Summary Comparison of Alternative Plans

	Do-Nothing	Plan I	Plan II	Plan III
3. Plan response to associated evaluation criteria				
a. Acceptability	Currently acceptable	Good: per-user costs equivalent to costs incurred in other areas for similar services.	Same as Plan I	Fair: higher costs than Plans I and II; institutional obstacles
b. Efficiency	Fair	Fair	Good	Fair
c. Geographic scope	Partial	Entire area	Entire area	Entire area
d. NED benefit/cost ratio	1.07	1.00	1.05	1.04
D. Implementation Responsibility				
1. Organizations	Municipalities, MUD	Nebr: MUD, municipalities, and Natural Resource Districts. Iowa: municipalities and benefitted water districts.	Same as Plan I	New organization required across State lines

Table G-1
(Cont'd)
Summary Comparison of Alternative Plans

	Do-Nothing	Plan I	Plan II	Plan III
2. Financing	User charges and revenue bonds	Grants and/or loans from Farmers Home Administration user charges; all organizations listed above can issue revenue bonds.	Same as Plan I	Same as Plan I
3. Political & legal	No changes	Existing laws permit.	Existing laws permit.	Nebraska laws permit agreements required with Iowa County Boards of Supervisors.

Impact Assessment and Evaluation of Final Alternative Plans

6. The beneficial and adverse impacts of the three final alternative plans, and the do-nothing alternative were evaluated and are displayed in four accounts in Table G-2. The national economic development (NED) account includes a measurement of the change in output of goods and services on a national basis. This account concludes with a computation of net NED benefits and a NED benefit/cost ratio. The environmental quality (EQ) account includes measurements of the plan characteristics that may cause a change in environmental quality. The social well-being account includes measurements of the plan characteristics that may affect people directly. The regional development account includes a measurement of the distribution of beneficial and adverse effects among various geographic subdivisions of the study region.

NATIONAL ECONOMIC DEVELOPMENT (NED)

7. Beneficial NED impacts include the value of increased output of goods and services-including water supply, fire insurance, and water softening-and the value of output from the use of unemployed labor resources in construction. Since the market value of municipal water supply does not reflect the user's valuation, the economic value of water must be imputed. In this study, the cost of the do-nothing alternative approximates the value of water. The present value of the do-nothing alternative is $396.4 million .

Table G-2
System of Accounts

Accounts	Do-Nothing	Plan I	Plan II	Plan III
1. National Economic Development (Present value in million $)				
A. Beneficial Impacts				
(1) Value of increased output of goods and services				
Water supply	396.4	396.4	396.4	396.4
Fire Insurance		4.4	5.2	5.2
Water softening		19.8	24.0	24.0
(2) Value of output from use of unemployed labor resources				
Construction labor	27.3	30.2	29.6	29.6
(3) Total NED benefits	423.7	450.8	455.2	455.2
B. Adverse Impacts				
(1) Value of resources required				
Metropolitan				
Capital	225.2	220.2	218.9	218.9
O&M	123.0	119.9	119.3	119.3
Total	348.2	340.1	338.2	338.2
Non-Metropolitan				
Capital	36.2	82.0	76.9	76.6
O&M	12.0	24.8	24.0	22.2
Total	48.2	106.8	100.9	98.8
Total Study Area				
Capital	261.4	302.2	295.8	295.5
O&M	135.0	144.7	143.3	141.5
Total	396.4	446.9	439.1	437.0
(2) Total NED costs	396.4	446.9	439.1	437.0
C. Net NED Benefits	27.3	3.9	16.1	18.2
D. Net NED Benefits/Costs	1.07	1.01	1.04	1.04

Table G-2
(Cont'd)
System of Accounts

	Do-Nothing	Plan I	Plan II	Plan III
2. Environmental Quality				
A. Enhancement	none	none	none	none
B. Degraded				
(1) Treatment plants	32	29	9	6
(2) Pumping stations	12	50	51	53
(3) New pipelines	0 miles	790 miles	812 miles	840 miles
(4) New storage facilities	0	136	137	136
3. Social Well-Being				
A. Beneficial Impacts				
(1) Enhancement of health, safety and community well-being.				
Meets standards	No	Yes	Yes	Yes
Taste	--	Improved	Improved	Improved
Appearance	--	Improved	Improved	Improved
Staining	--	Reduced	Reduced	Reduced
(2) Real income				
Soap costs	--	Reduced	Reduced	Reduced
Corrosiveness	--	Reduced	Reduced	Reduced
Staining	--	Reduced	Reduced	Reduced
(3) Emergency preparedness				
Fire protection	--	Improved	Improved	Improved
B. Adverse Impacts				
(1) Deterioration of quality of life, health and safety. Number of targets required to disable the region's water supply.	32	29	9	6

Table G-2
(Cont'd)
System of Accounts

	Do-Nothing	Plan I	Plan II	Plan III
(2) Real income				
Average monthly cost per family in dollars.				
Urban area	5.30	5.49	5.27	5.47
Washington County	6.70	22.95	20.00	21.00
Cass County	7.28	22.30	22.30	22.30
Harrison County	10.30	22.85	24.75	24.75
Pottawattamie County	10.90	26.60	25.25	25.25
Mills County	9.37	28.55	26.10	27.30
Percent of family income				
Urban area	0.5	0.6	0.5	0.6
Washington County	0.9	3.0	2.6	2.7
Cass County	1.0	3.1	3.1	3.1
Harrison County	1.4	3.2	3.4	3.4
Pottawattamie County	1.3	3.1	3.0	3.0
Mills County	1.0	3.1	2.9	3.0
Percent of family income (poverty families)				
Urban area	3.3	3.4	3.3	3.3
Washington County	4.7	15.9	13.9	14.6
Cass County	4.4	13.5	13.5	13.5
Harrison County	6.0	13.3	14.4	14.4
Pottawattamie County	6.5	15.7	14.9	14.9
Mills County	6.4	19.6	17.9	18.7
(3) Emergency preparedness				
Chemical requirements ($1,000/year)	1,937	2,057	1,899	1,963
Annual energy requirements (1,000 megawatts)	164	166	171	166

Table G-2
(Cont'd)
System of Accounts

	Do-Nothing	Plan I	Plan II	Plan III
B. Population Distribution				
(1) Effect on alternative growth patterns	(See text - paragraphs 32 through 34)			
C. Economic Base and Stability				
(1) Crop acreage	(See text - paragraphs 33 and 34)			
(2) Livestock production	(See text - paragraph 35)			
(3) Agribusiness as proportion of total industry	(See text - paragraph 35)			

Table G-2
(Cont'd)
System of Accounts

	SMSA-NE	Pottawattamie Co., Council Bluffs	Pottawattamie Co., Remainder	Washington Co.	Harrison Co.	Mills Co.	Cass Co.	Total
4. Regional Development								
A. Income (million $, present value)								
Plan I								
(1) Beneficial impacts -								
Water supply	322.6	25.6	16.7	5.8	9.9	7.3	8.5	396.4
Unemployment	25.1	5.1						30.2
Fire insurance	0.5		1.4	0.5	0.8	0.6	0.6	4.4
Water softening	2.9		5.4	1.7	4.2	3.3	2.3	19.8
(2) Adverse Impacts -								
Value of resources required	314.5	25.6	28.5	17.7	18.7	25.8	16.1	446.9
(3) Net regional income effects	36.6	5.1	-5.0	-9.7	-3.8	-14.6	-4.7	3.9
Plan II								
(1) Beneficial impacts -								
Water supply	322.6	25.6	16.7	5.8	9.9	7.3	8.5	396.4
Unemployment	24.6	5.0						29.6
Fire insurance	1.3		1.4	0.5	0.8	0.6	0.6	5.2
Water softening	7.1		5.4	1.7	4.2	3.3	2.3	24.0
(2) Adverse impacts -								
Value of resources required	312.6	25.6	23.3	16.8	19.0	23.1	18.7	439.1
(3) Net regional income effects	43.0	5.0	0.2	-8.8	-4.1	-11.9	-7.3	16.1
Plan III								
(1) Beneficial impacts -								
Water supply	322.6	25.6	16.7	5.8	9.9	7.3	8.5	396.4
Unemployment	24.6	5.0						29.6
Fire insurance	1.3		1.4	0.5	0.8	0.6	0.6	5.2
Water softening	7.1		5.4	1.7	4.2	3.3	2.3	24.0
(2) Adverse impacts -								
Value of resources required	312.6	25.6	22.7	15.9	18.3	21.9	20.0	437.0
(3) Net regional income impacts	43.0	5.0	0.8	-7.9	-3.4	-10.7	-8.6	18.2

8. The value displayed for fire insurance is based on the concept that persons living outside the Omaha-Council Bluffs metropolitan area will pay less for fire insurance if a regional water supply plan providing a pressurized water source at each residence is implemented. Data was collected concerning the cost of fire insurance in different localities. It was assumed that one-half of the rate differential between the Omaha-Council Bluffs metropolitan area and the outlying areas was due to a lack of a readily available pressurized water supply. The rate differential (adjusted) was multiplied by the number of residences in the outlying areas. The result was considered the estimated annual benefit for lower fire insurance premiums.

9. Water softening benefits were included because of the significant lowering of hardness that will result in most of the study area outside of the Omaha-Council Bluffs metropolitan area if a regional water supply plan is implemented. Using the HDR report as a data source, an inventory was taken of all towns that used a source with hard water and that did not soften this water through treatment to an acceptable level of hardness. Water that exceeded 180 mg/l was considered hard.

10. It was estimated that there is a $4.47 per month per family difference between softening the very hard water in the rural and non-metropolitan areas and softening water in the Omaha-Council Bluffs metropolitan area. Total water softening benefits were derived by multiplying the number of rural families served by a regional system by $4.47 per month. The present values of these benefits are included in the NED account.

11. Use of unemployed labor resources is considered as an addition to the benefits resulting from a plan. Only direct labor during construction is included. One-half of the construction cost was assumed to be direct labor costs. A certain portion of this direct labor was assumed to consist of employees that would otherwise be unemployed. Local construction firms indicated that up to 70 percent of the work force on such jobs would come from the unemployed sector. Since the sporadic nature of construction employment is likely to cause this percentage to be inflated, and because the national unemployment rate in the construction industry is approximately 13.7 percent, the estimated portion of construction workers that otherwise would be unemployed was reduced to 20 percent. The value of output from use of unemployed labor resources was calculated by multiplying the construction cost by one-half and then by 20 percent.

12. Total NED benefits shown in table G-2 are the sums of the cost of the do-nothing alternative and 10 percent (1/2 x 20%) of the construction cost.

13. Adverse NED impacts include the present values of the capital, operation, maintenance, and replacement costs.

14. Net NED benefits are the difference between the total NED benefits and total NED costs. Benefit-cost ratios for the four alternatives are:

Do-Nothing	1.07
Plan I	1.01
Plan II	1.04
Plan III	1.04

ENVIRONMENTAL QUALITY (EQ)

15. There are no known characteristics of any of the alternatives that are likely to enhance environmental quality. It is assumed that each alternative would be implemented in a manner that would minimize degradation of environmental quality. Potential plan features that tend to degrade environmental quality include treatment plants, pumping stations, pipeline construction, and storage facilities. Measurements of these features are displayed on table G-2.

SOCIAL WELL-BEING

16. Impacts on social well-being (SWB) include those associated with health, safety, and community well-being, changes in real income, and emergency preparedness.

BENEFICIAL SWB IMPACTS

17. Beneficial SWB impacts include a measure of each plan's health enhancement potential, such as the ability to meet the Interim Primary Drinking Water Standards promulgated by the Environmental Protection Agency; adequacy of supply, taste, appearance, and staining; increase in real income as a result of reduction in soap use, and reduced corrosiveness and staining; and improvement of emergency preparedness for fire protection as displayed in table G-2.

18. Plans I, II, and III are designed to meet the Interim Primary Water Standards. The Omaha and Council Bluffs water systems also meet the standards in the do-nothing alternative. These standards, however, are not met by 42 of the 53 communities in the area with the do-nothing alternative.

19. The available supply of water for the study period for both Omaha and Council Bluffs water systems is adequate in the do-nothing alternative. However, 15 of the 53 communities in the area were judged to have current inadequate supplies with the do-nothing alternative. Supply is adequate through year 2020 with Plans I, II, and III.

20. A slight increase in real income will result from Plans I, II, and III in the rural areas because of a decrease in use of soap, reduction in corrosiveness, and reduction in staining of water fixtures, utensils, and clothing.

21. An increase in emergency preparedness will occur with increased water storage capacities resulting in improved fire protection in Plans I, II, and III.

ADVERSE SWB IMPACTS

22. Adverse SWB impacts include deterioration of safety against sabotage by centralization of facilities, reduction in real income of individuals caused by the cost of the plan, and reduction of the ability to respond to emergency situations because of the use of energy and chemical resources.

23. Although table G-2 indicates a significant difference in the number of treatment plants associated with each concept, over 85 percent of the population would be served by the four major metropolitan plants in all concepts.

24. Average monthly cost per family was obtained by dividing the estimated amortized capital cost and operation and maintenance cost for year 2020 by the number of families projected for year 1995 in Growth Concept A. The amortized capital costs used in this analysis

were reduced from the total capital costs by a figure representing the $1,000 hookup fees for the rural areas in Plans I, II, and III.

25. While the average monthly cost per family only varies from $5.30 to $5.49 for the alternatives, costs per family in the non-SMSA counties of the region vary from $6.70 to $10.90 per month for the do-nothing alternative and from $20.00 to $28.55 per month for the other alternatives.

26. The average monthly cost per family is also shown table G-2 as a percentage of the mean 1970 family income. Approximately 0.5 to 0.6 percent of the mean family income is required to finance all alternatives for the urban areas. In the non-urban counties, this value is higher and varies from 0.9 percent for Washington County to 1.4 percent for Harrison County for the do-nothing alternative and is much higher in the rural counties, varying from 2.6 percent for Plan II in Washington to 3.1 percent for Plan I in Mills County.

27. Approximately 6.8 percent of the families in the SMSA had incomes below the poverty level in 1970. Families with incomes below the poverty level in the rest of the region varied from 8.4 percent in Washington County to 11.7 percent in Harrison County. The average monthly cost per family is shown in table G-2 as a percent of the mean family poverty income. Approximately 3.3 to 3.4 percent of the mean income of poverty families is required to finance all alternatives in the urban area. In the non-urban area, 4.7 to 6.0 percent of the income of the poverty families would be required to finance the do-nothing alternative and from 13.3 to 19.6 percent would be required to finance the other alternative plans. Actual costs to poverty families are likely to be less than this since water-supply billings are generally based on use, and

water use varies directly with income. It should be emphasized that the discussion above is based on an estimated cost per family, not on an average monthly billing per family. An average monthly billing per family would depend on water pricing policies. Such a policy could be designed to alleviate economic hardship on low income groups.

28. Adverse effects on emergency preparedness include chemicals and energy requirements. Chemical requirements are displayed in table G-2 in increments of $1,000 per year. Plan II is least chemical-consumptive and Plan I is most chemical-consumptive. There is, however, not a significant difference in the amount of chemicals consumed in any of the alternatives, including the do-nothing alternative. Energy requirements vary from 164,000 megawatts annually for the do-nothing alternative to 171,000 megawatts annually for Plan II.

REGIONAL DEVELOPMENT

29. Impacts on regional development are associated with regional income, population distribution, and economic base and stability.

30. Income impacts are represented by the incidence of the NED benefits and costs among entities within the region. Total benefits and costs for each alternative were allocated among entities by adding the separable costs and a share of the joint costs for shared systems. Joint costs include both capital and O&M costs. Each entity's share of the joint capital cost was allocated on the basis of maximum daily demand. Operation and maintenance costs were allocated on the basis of average daily demand. Water supply beneficial impacts for each alternative concept shown in table G-2 are the costs of the do-nothing alternative. Unemployment benefits

are the difference between the unemployment benefits for the do-nothing alternative and each alternative plan. Unemployment benefits were assumed to accrue to the SMSA. Therefore, net regional income effects shown on table G-2 represent the difference between each alternative plan and the do-nothing alternative.

31. Implementation of any one of the three alternative plans would result in positive income effects for the urban portions of the study region and negative income effects in the small communities and rural areas. Thus the cost of the alternative plans bear heavily on the lower-income areas of the region. This represents an undesirable redistribution of income which could be offset by basing the allocation procedure on something other than use which, in effect, would be a subsidy from the urban to the rural areas and small communities. The undesirable redistribution of income could also be offset by direct Federal assistance in developing the rural regional water system possible under grants or low-interest loans from the Farmers Home Administration.

32. Population distribution may be affected by implementation of particular water supply alternatives.

33. The do-nothing alternative would limit the quantity and quality of water supplies outside the existing metropolitan water service area. This, in turn, would tend to promote redevelopment of older areas and higher-density growth on the urban fringes. This type of growth characterizes Alternative Growth Concept C.

34. Alternative Water Supply Plans I, II, and III all, more or less, provide adequate quantities of high quality water to the entire region. This, in turn, would tend to promote continued low density urban sprawl, continued decay and expansion of the urban

core, and the possibility of the development of satellite cities. These growth characteristics are consistent with Alternative Growth Concepts A, B, and D, depending on the controls exerted on growth. Lack of control on growth would result in Growth Concepts A and D while controlled growth could lead to Growth Concept B. Water use (primarily residential) will also be sensitive to growth concept, due to the different residential densities associated with the different growth concepts. Concepts A and D will have similar residential water use figures. However, Concept C will result in 6.6 percent less average day water use than Concept A, and 14.0 percent less peak hour water use. The corresponding figures for the difference between Concept A and Concept B are 4.9 percent (average day) and 10.9 percent (peak hour).

35. Impacts on regional economic base and stability would be minor. Slight decreases in cropland may result from Water Supply Plans I, II, and III because of influences on the land-consuming growth alternatives. Livestock production may increase if Plans I, II, or III are implemented because of improved water quality and quantity dependability. Livestock production could be curtailed, however, with these plans if small livestock profits continue and the costs of the regional water supplies are allocated in accordance with use. Agribusiness, as a proportion of the total economic base of the region, may increase with Plans I, II, and III because these regional supply concepts would promote business in the rural communities and these communities tend to attract agribusiness.

Alternative Supply Sources

GROUND VERSUS SURFACE RAW WATER SOURCE

36. Water treatment facilities located in the plain of the Missouri River have the option of using the Missouri River as a raw water source or tapping generally abundant ground-water supplies in aquifers underlying the valley. Several factors, including cost, dictate which source is to be developed. Proximity of upstream wastewater discharges is a consideration in use of a surface water supply. Availability and cost of land required for well-field development also warrants consideration.

NON-METROPOLITAN TREATMENT FACILITIES

37. Non-metropolitan treatment facilities considered by this study which have the option of either ground or surface sources are located near Mondamin (Plan II), Blair (all Plans), Plattsmouth (Plans I and II), and Pacific Junction (Plans I and II). Maximum capacities of these plants range from 3.6 to 28 mgd. Figure G-1 compares the present worth of capital and operation and maintenance costs for ground and surface water treatment facilities. Cost differences between use of ground and surface water sources are minimal. Considerations other than treatment economies therefore dictate raw water sources for the non-metropolitan Missouri River plants.

38. Discharges of industrial and domestic wastes, particularly from combined sewers in Omaha, unless abated, would dictate that the Plattsmouth and Pacific Junction facilities use ground rather than surface waters. The Blair and Mondamin plants could efficiently use either source.

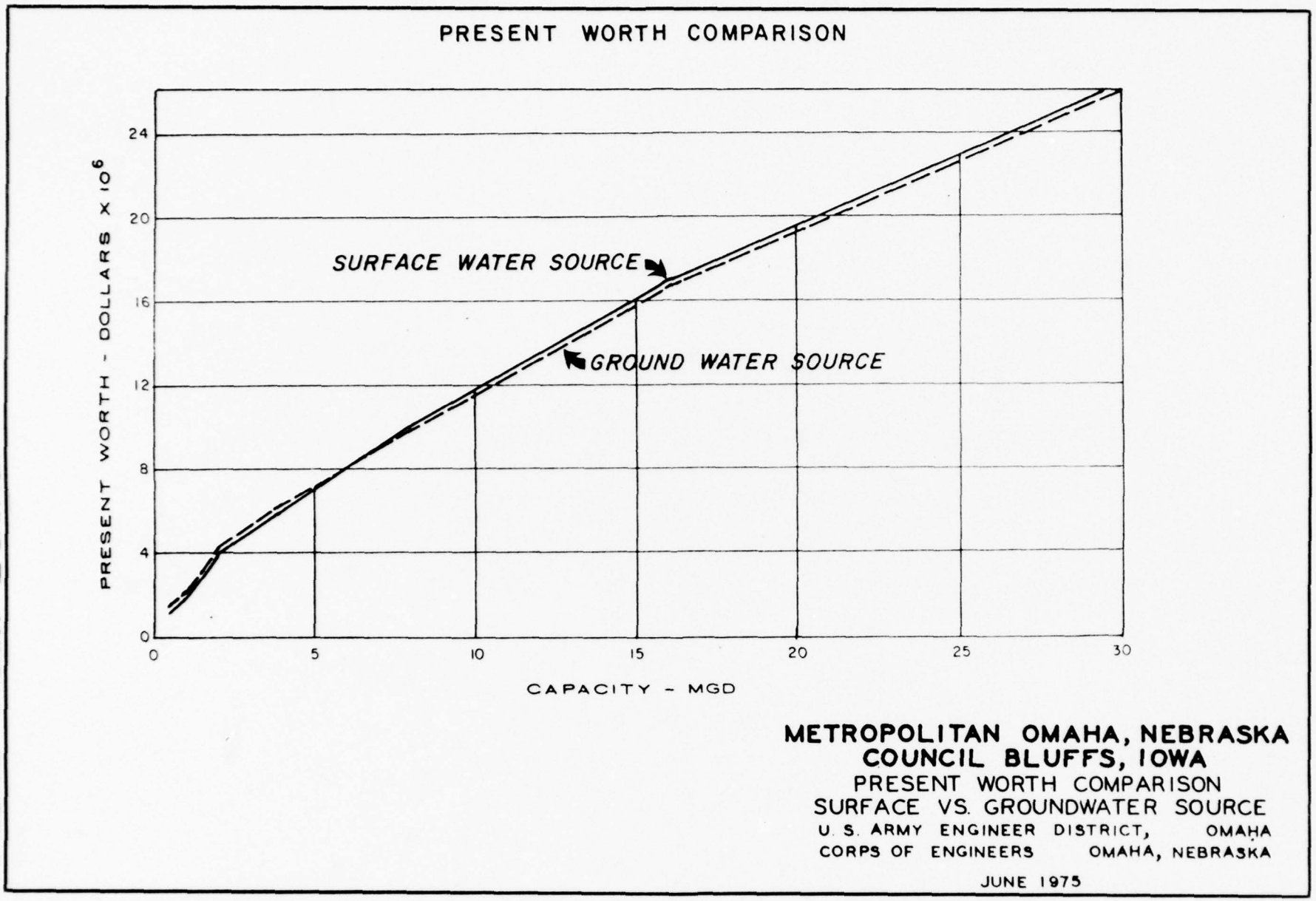
METROPOLITAN TREATMENT FACILITIES

39. The Missouri River South Plant and expansions of the Florence and Council Bluffs treatment plants have the option of using either surface or ground sources. Cost trade-offs for these larger facilities are increased chemical cost for ground water sources versus increased sludge handling capital and operation and maintenance cost for surface water. Figure G-2 shows the annual savings of using surface water rather than ground water as a raw water source. From a break-even point of 10 mgd average daily treatment, savings increase at a rate of $960 per year per additional mgd average daily treatment.

40. Dollar savings of using the Missouri River as a raw water source are significant on an annual basis, especially at higher treatment rates. The $57,500 annual savings at 70 mgd is $2.25 per million gallons treated, less than 3 percent of total operation and maintenance expense and less than 1 percent of the operation and maintenance plus amortized capital total. Other non-economic considerations somewhat dependent on site location may therefore determine raw water source.

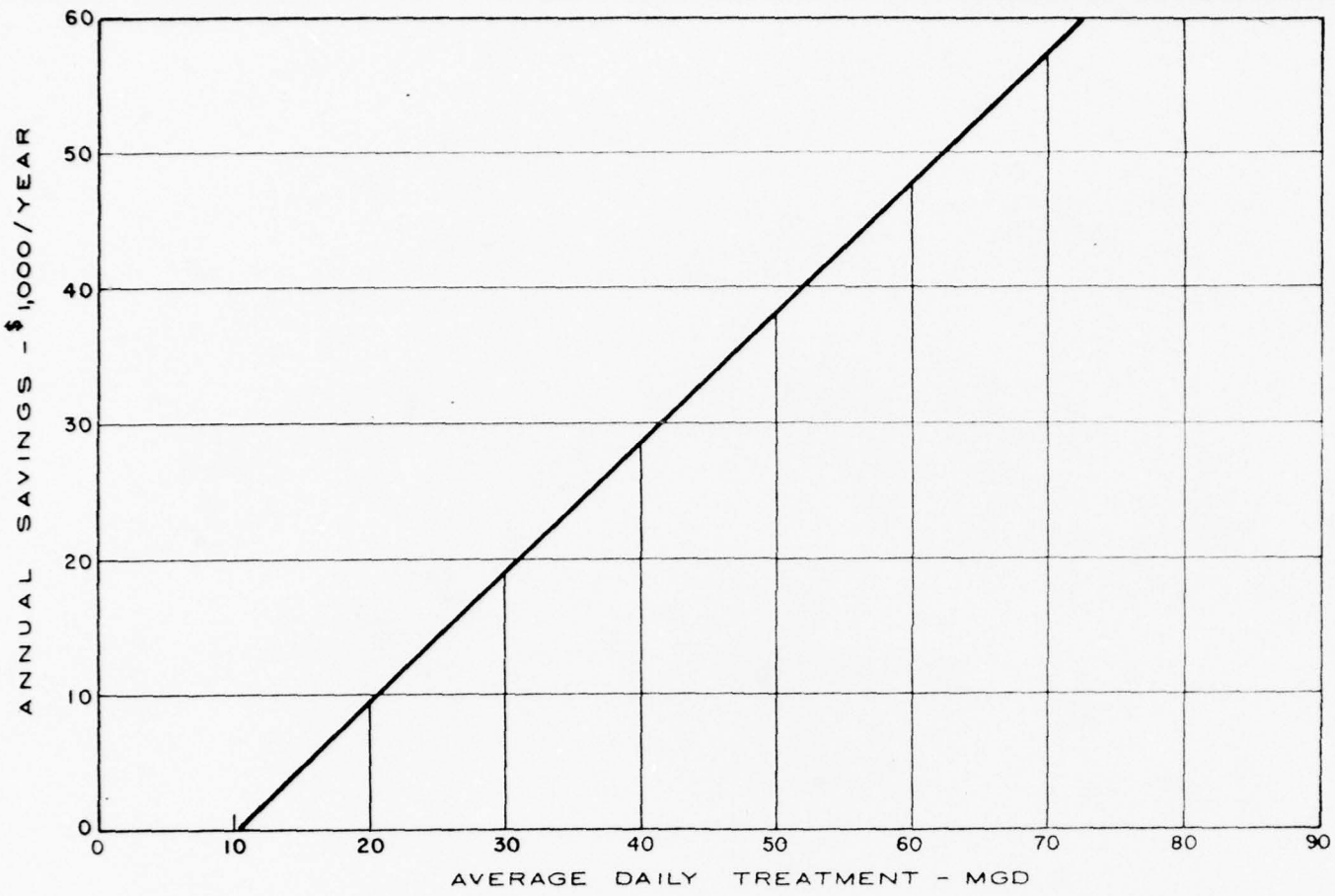
ALTERNATIVE METROPOLITAN SUPPLY SITES

41. A major economic consideration in metropolitan Omaha water supply plans is location of a third major source. Alternative sites



METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
PRESENT WORTH COMPARISON
SURFACE VS. GROUNDWATER SOURCE
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA
JUNE 1975

VOLUME III ANNEX C FIGURE G-1



METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
ANNUAL SAVINGS
SURFACE VS. GROUNDWATER SOURCE
METROPOLITAN AREA

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

JUNE 1975

VOLUME III ANNEX C FIGURE G-2

on the Missouri River south of Omaha and the Platte River west of Omaha were evaluated in detail in the MUD Master Plan and the Platte River West site was recommended. Increased supply and treatment capacity in the area of MUD's Florence treatment plant to meet water needs to 2020 was a third alternative evaluated in the Master Plan.

MISSOURI SOUTH VERSUS FLORENCE SITE

42. Based upon cost curves generated for this report, transmission mains would cost $13,660,000 more for the site north of Omaha than for the site south of Omaha in Growth Concept A and $8,750,000 more in Growth Concept C. Other costs would be comparable for the two sites. A major new booster pumping station would be required in either case.

43. The advantage of initial pumping from a higher elevation at the Florence site would be offset by additional head loss in the longer transmission main. The indicated savings in transmission main capital cost make development of a Missouri South supply source and treatment plant economically preferable to expansion in the vicinity of the Florence Plant. Being downstream of Omaha's combined sewer and treatment plant discharge, a ground supply would be more attractive for the Missouri South plant. Additional costs of treating groundwater versus surface are $776,000.

PLATTE WEST VERSUS MISSOURI SOUTH SITE

44. Source reliability problems at the Platte River site warrant detailed consideration of the economic benefits accrued by metropolitan Omaha in development of the Platte West site.

45. Of major economic concern are increased chemical, primary pumping, and secondary pumping costs associated with the Missouri South site versus the Platte West site. Chemical costs reflect the generally more desirable quality of Platte Valley ground water versus either Missouri River water or Missouri River Valley ground water. A higher treatment plant ground elevation and more direct route to developing usage centers decrease the primary and secondary pumping requirements. Power and fuel costs for pumping are reduced and less booster station capacity is required. An additional economic consideration when evaluating Missouri River water as a source is the reduced sludge handling capital and operation and maintenance cost of using a ground water source.

46. Cost differentials between Missouri South and Platte West source locations are summarized on an annual basis in table G-3.

47. The present value of water supply savings if the Platte West site is developed amounts to $4,600,000.

48. Four additional factors are important in evaluating the Platte West site. These are source availability and reliability, highest and best use of the water, the impacts of the well field on surface flows, and urban growth implications.

49. Surface flows recharge ground waters along the Platte River. The Platte West well field would tap an aquifer estimated to be able to produce 135 mgd for 61 days at zero flow conditions in the Platte River. Current plans call for a 50 mgd Platte West facility by 1993 with a 50 mgd increase by 2004. Average daily treatment by 2020 is projected at 74 mgd under Growth Concept A.

Table G-3

ANNUAL COST COMPARISON - MISSOURI SOUTH VS. PLATTE WEST SOURCE

($1,000/YEAR)

Concept	YEAR	AVERAGE TREATMENT (mgd)	ANNUAL OPERATION AND MAINTENANCE TREATMENT AND PUMPING				AMORTIZED CAPITAL		TOTAL ANNUAL SAVINGS	SAVINGS (¢/1000 gal)
			CHEMICAL	POWER & FUEL	SLUDGE HANDLING	OTHER	SLUDGE HANDLING	PUMPING		
Missouri River Valley Ground Water										
A	1995	41.35	173.3	168.4		10.1		271.4	623.2	4.1
	2020	73.73	308.9	326.4		20.7		271.4	927.4	3.4
B	1995	37.42	156.8	124.9		6.4		61.7	349.8	2.6
	2020	55.74	232.1	144.4		5.4		61.7	443.6	2.2
C	1995	35.61	149.2	107.5		5.0		111.0	372.7	2.9
	2020	60.17	252.1	174.8		7.7		111.0	545.6	2.5
D	1995	43.17	180.9	170.9		10.1		264.0	625.9	4.0
	2020	72.64	304.4	322.3		20.4		264.0	911.1	3.4
Missouri River Water										
A	1995	41.35	80.4	168.4	50.9	10.1	168.9	271.4	750.1	5.0
	2020	73.73	143.4	326.4	84.0	20.7	168.9	271.4	1014.8	3.8
B	1995	37.42	72.8	124.9	47.0	6.4	115.8	61.7	428.6	3.1
	2020	55.74	108.4	144.4	65.5	5.4	115.8	61.7	501.2	2.5
C	1995	35.61	69.3	107.5	45.1	5.0	130.3	111.0	468.2	3.6
	2020	60.17	117.1	174.8	70.1	7.7	130.3	111.0	611.0	2.8
D	1995	43.17	84.0	170.9	52.8	10.1	154.5	264.0	736.3	4.7
	2020	72.64	141.3	322.3	82.7	20.4	154.5	264.0	985.2	3.7

50. The Platte River Basin Level "B" Study has projected low flows and two alternative levels of irrigation development. The Beta Plan represents a maximum irrigation development while the Alpha Plan represents a minimum irrigation development. Under the Beta Plan, there is a high probability that extremely low flows (less than 100 c.f.s.) would occur near the Platte West well field in 18 months out of 18 years. There will also be a high probability of three consecutive zero-flow months. The situation is not as critical under the Alpha Plan; however, there is still a high probability that two consecutive months of zero flows will occur.

51. Both the Fish and Wildlife Task Force for the Platte Level "B" study and the U. S. Fish and Wildlife Service have recommended maintenance of at least the average monthly flow that is exceeded 60 percent of the time over a period of years. The flows established are listed in table G-4.

Table G-4
Recommended Minimum Platte River Flows
(c.f.s.)

Stream Station	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
Lower Platte- N. Bend	2,560	3,250	2,690	2,680	3,920	5,150	4,180	3,960	3,680	1,860	1,330	1,670
Lower Platte- Ashland	2,710	3,520	3,200	2,670	4,920	7,120	5,390	6,390	6,490	4,060	2,020	2,220

52. When flows are higher than the minimum flows listed above, water could be extracted from the Platte. If the flows are naturally less than the above amounts, then the natural flow is recommended.

53. Based on the above discussion, controls on Platte River water development are necessary to prevent adverse environmental conditions. Priorities on use of Platte water must be set.

54. To determine the value of Platte water for municipal and industrial use versus agricultural use, an economic analysis was performed to determine the present worth of each use.

55. The 1975 present value of savings to MUD, if they develop the Platte West site rather than the Missouri River South Site (ground water), is $4.6 million. After making certain assumptions, it was estimated that the present value of profits foregone by irrigators if they are denied the use of irrigation water from Platte River sources is $0.4 million. The following assumptions were made in arriving at the figure of $0.4 million:

A 70-day irrigation season. With the Platte West average daily treatment of 50 mgd, this results in 3,500 mg of water not available for irrigation purposes.

- Corn was the irrigated crop.
- Dryland corn yields 64.5 bushels per acre.
- Irrigated corn yields 125 bushels per acre.

- The cost per acre for center pivot irrigation would be $71.46 (made up of both fixed and variable components).

- A 12-inch application rate was assumed.

- The price of corn would be $1.64 per bushel.

56. In order for the value of the lost irrigation opportunity to equal the cost savings to MUD in developing the Platte West site rather than the Missouri South (ground) site, the value of corn must be $4.84 per bushel. The present value of corn is $2.75 per bushel.

57. The effect of well field pumping on the Platte River flow was investigated as part of the Platte Level "B" Study. In the case of a Platte West site, 98 percent of the withdrawal will come directly from the Platte River after an initial pumping period of 1.69 years. For each 100 mgd of well field capacity developed at this site, an additional 63 c.f.s. will be removed from the Platte River surface flow.

58. There is concern among the public that the Platte West supply source and transmission main would be an inducement to further westward urban sprawl of Omaha. This problem could be remedied by restriction and connections to the transmission line.

59. In summary, the Platte-West supply source would be:

- Economically advantageous to development.

- Reliable if surface flows recommended by the Fish and Wildlife

Task Force for the Platte Level "B" Study and the U. S. Fish and Wildlife Service are maintained; questionable reliability if they are not.

- Not a cause of adverse environmental problem by itself.

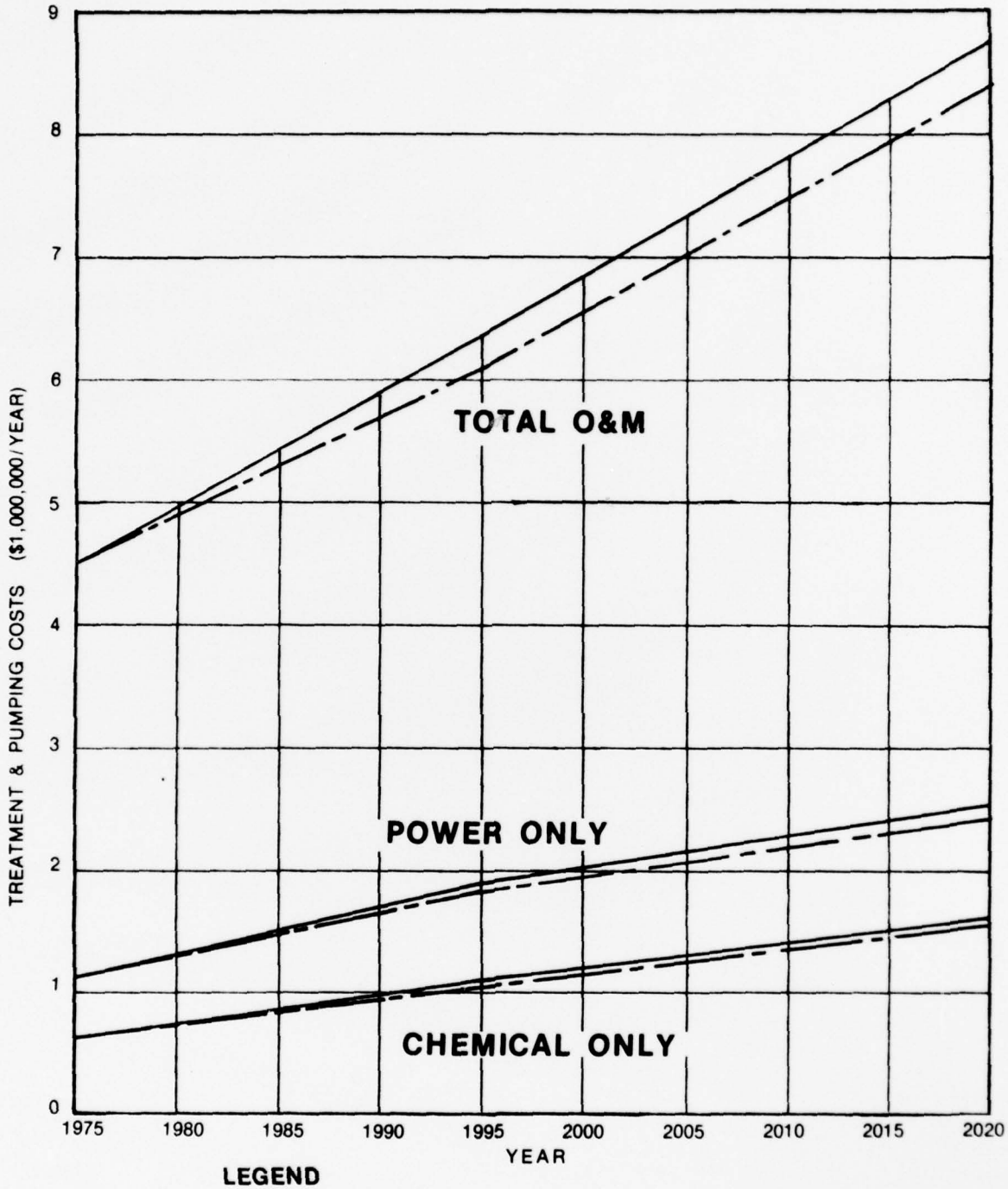
- Not a cause of urban sprawl if restrictions are provided in transmission line connections.

Water Use Reduction

60. Water use reduction is not a final alternative for evaluation, but the cost savings for this concept are significant.

WATER SUPPLY SAVINGS

61. Annual operation and maintenance savings for water supply due to water use reduction are proportional to the reduction in average daily usage. Annual savings in total O&M, power, and chemicals for Omaha and Council Bluffs are depicted in figure G-3 for Water Supply Plan II - Growth Concept A. The use of three major water conserving fixtures results in a 31 percent reduction of in-house flow. The three water-saving fixtures are water-saving toilets, flow-reduction shower heads, and water-saving washing machines. This reduction in flow results in a 4-percent savings in O&M costs or approximately $300,000 per year by 2020.



LEGEND

PRESENT TREND CONSUMPTION

REDUCED CONSUMPTION LEVELS DUE TO FLOW REDUCTION APPLIANCES & DEVICES

METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA

EFFECT OF REDUCED WATER CONSUMPTION

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

VOLUME III ANNEX C FIGURE G-3

62. Capital costs are proportional to peak-day and peak-hour demands. Present worth capital savings, resulting from 100-percent use of water-conserving fixtures, would be $2.9 million for Water Supply Plan I - Growth Concept A. Similar percent reductions are realized with the other growth concepts.

WASTEWATER TREATMENT SAVINGS

63. Assuming an 80 percent residential in-house water usage, the 31-percent water supply decrease would become a 39-percent wastewater flow reduction for in-house usage. The effects of this reduction are an estimated 16-percent flow decrease at the Missouri River Plant, a 19-percent decrease at the Mosquito Creek Plant, and a 36-percent decrease in flow at the Papillion Creek Plant. The net decrease at each plant is dependent upon the percentage of residential flow to that plant, and the Papillion Creek Plant is mainly residential flow.

64. If all the residents of the Papillion Creek service area were to use the water-conserving fixtures, a capital cost reduction of 9 percent and an O&M reduction of 13 percent would be realized. An analysis of the minor urban areas indicated savings of 13 percent and 14 percent for capital and O&M respectively. Treatment plant components that are sized on organic loadings are affected very little by wastewater flow reduction.

Alternative Growth Concepts

65. The alternative growth concepts affect future water supply requirements in two ways. First, areas of residential, industrial, and commercial development differ among the four concepts, thus altering water demand centers. Second, density of development varies changing the quantity of water required by water users. These lead to differing costs for water supply.

66. Constrained growth futures can result in lower water supply costs. Lesser sprawl in Growth Concepts B and C generally lowers all system component costs. If Platte River water availability dictates that a second Missouri River source is required, the constrained growth concepts will be less affected than would westward sprawl concepts as indicated in table G-5.

Table G-5
Platte West vs. Missouri River South (1995)
($1,000)

	Growth Concept			
	A	B	C	D
Annual Savings	750	400	420	675

67. Constrained growth is also found to reduce water consumption and enhance costs. The use reduction results principally from reduced lawn irrigation. Table G-6 summarizes housing density effect on average day consumption, and maximum-day and maximum-hour load

factors for residential and general commercial new growth only, based on 1995 population estimates.

Table G-6
Change In MUD Factors Due to Housing Density

Growth	Factor (Percent change from MUD Projections) Average Day Usage	Maximum Day Load Factor	Maximum Hour Load Factor
A	+ 0.7	+ 3.2	+ 3.6
B	- 3.2	- 6.1	- 7.3
C	- 4.8	- 8.9	-10.4
D	+ 0.7	- 1.2	+ 1.6

68. The present worth costs for the four alternative metropolitan area distribution plans are presented in table G-7 in order to indicate the water supply savings which could be realized under Growth Concepts B or C.

69. Savings to rural users are realized in Growth Concept B. The increase in population in Washington, Harrison, and Mills Counties results in lower average monthly billings to the users in those counties. The average monthly billings, based on 1995 population projections, table G-8. Table G-8 indicates that for water supply purposes population dispersion is cost-effective.

Table G-7
Metropolitan Present Worth Comparison of Alternative Supply Plans *
($1,000,000)

Plan	Cost
I-A	340.09
I-B	309.51
I-C	303.02
I-D	335.64

* Concept B includes the differential present worth costs due to increased population growth for the minor urban areas.

Table G-8
Average Monthly Water Billing ($)

County	Plan I		Plan II		Plan III	
	Concept ACD	B	ACD	B	ACD	B
Washington	22.95	13.95	20.00	10.90	21.00	13.00
Harrison	22.85	18.50	24.75	19.75	24.75	19.85
Pottawattamie	22.60	26.60	25.25	25.25	25.25	25.25
Mills	28.55	19.05	26.10	19.00	27.30	20.40

SECTION H

INSTITUTIONAL ARRANGEMENTS FOR WATER SUPPLY

INSTITUTIONAL ARRANGEMENTS FOR WATER SUPPLY

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SECTION H

INSTITUTIONAL ARRANGEMENTS FOR WATER SUPPLY

Purpose

1. The purpose of this section is to define legal, organizational, financial, and political arrangements required to implement alternative water supply plans and water use reduction concepts in the metropolitan and rural areas.

Existing Institutions

2. The description and capabilities of existing institutions are in Volume VIII, Institutional Arrangements.

Alternative Supply Plans

SUPPLY PLAN I

LECAL ARRANGEMENTS

3. Supply Plan I is implementable within the framework of existing institutions in both Iowa and Nebraska; no major legislative changes are required. State water permits will be required where new supply sources are established. Permits from the Corps of Engineers will be required where new inlet works are to be established along the Missouri River.

ORGANIZATIONAL ARRANGEMENTS

4. In the Nebraska portion of the study area, nearly all rural residents obtain water for domestic uses from individual wells. In the eastern portion of Cass County there is a rural water district which serves rural and residential areas. Water is provided by the Plattsmouth water supply system.

5. A recent change in Nebraska law eliminated the establishment of new rural water districts. The establishment of rural water systems is now the responsibility of the natural resources districts. The Papio Natural Resources District is developing a rural system for southeastern Washington County for which the contemplated water supply agency is the Metropolitan Utilities District. Papio NRD is applying to the Farmers Home Administration for a grant to construct the water distribution lines. Successful completion of the project may set the pattern for other rural water supply systems in the study area.

6. The expansion of MUD facilities to serve rural Douglas and Sarpy Counties is organizationally feasible. The MUD master plan includes provisions for this expansion. The proposed new treatment plant at Valley is organizationally feasible.

7. Rural residents in the Iowa counties obtain water for domestic uses from individual wells. There are no known rural water districts in Harrison, Pottawattamie, or Mills County.

8. The Iowa Code authorizes the establishment of benefitted water districts. The procedures for obtaining State permits for water and for the formation of these districts are outlined in paragraphs 325 and 368, Section B, Volume VIII, (Institutional Arrangements). Benefitted water districts provide the organizational mechanism to implement Supply Plan I.

FINANCIAL ARRANGEMENTS

9. The cost of constructing water treatment facilities and water distribution systems presents the major problem for the residents of this study area. Federal grants or loans, administered by the Farmers Home Administration, may be available for a portion of the capital improvements for rural systems; however, revenues from service charges must cover the cost of operation and maintenance of new and existing systems. Natural resources districts and MUD in Nebraska and benefitted water districts in Iowa have the legal authority to issue revenue bonds for construction of facilities. All municipalities in the study area also have this authority. The per user costs are displayed in table 2, Section G of this annex.

POLITICAL ARRANGEMENTS

10. This study has found no political obstacles to the implementation of Supply Plan I.

SUPPLY PLAN II

LEGAL ARRANGEMENTS

11. The implementation of Supply Plan II in Nebraska presents possible political and legal obstacles for the Metropolitan Utilities District. This plan calls for the construction of a new well field and water treatment plant along the Platte River west of Omaha. The legal obstacles for MUD result from low surface flow in the Platte River during extended dry periods, increasing irrigation demands upstream from the well site, and transbasin diversion. The legal questions surrounding these three issues are not completely clear. It is probable that removal of water from the aquifers near the river will decrease surface flow downstream. It is possible that unconstrained withdrawal of water upstream for irrigation will reduce surface flow and available ground water at the proposed MUD site and render this water supply source unusable during extended dry periods. The proposed site diverts ground water from the Platte River basin to the MUD system. Although there is no present prohibition on transbasin diversion of ground water, it is probable that ground water controls will be adopted by the State in the near future. Resolution of these problems may require action by the State Legislature.

12. Implementation of the other portions of Supply Plan II in Nebraska pertaining to rural water systems does not present any significant legal problems at this time. Pending ground water controls may require State permits to construct or extend water supply systems that rely upon ground water sources.

13. Implementing Supply Plan II in Iowa would require the counties to establish one or a system of benefitted water districts for each county. There would be one source of supply for each county. Since the Missouri River is a navigable waterway, the establishment of the Missouri River source in Harrison and Mills Counties requires the counties to apply for a permit from the Corps of Engineers to construct inlet works. This is required by Section 10 of the 1899 River and Harbor Act.

ORGANIZATIONAL AND FINANCIAL ARRANGEMENTS

14. Organizational and financial arrangements for Supply Plan II would be similar to those for Supply Plan I.

POLITICAL ARRANGEMENTS

15. Other than the opposition to the MUD plant on the Platte River, there are no apparent political obstacles to Supply Plan II.

SUPPLY PLAN III

16. Supply Plan III proposes five water-supply regions and six supply sources, two of which would supply water across the State boundary.

LEGAL ARRANGEMENTS

17. The establishment of interstate water supply agreements does not appear to be an obstacle in the study area. Agreements of this type between the States, or any of the agencies or political subdivisions, are authorized by Nebraska in the Interlocal Cooperation Act (Article 22, Revised Nebraska Statutes, 1943) and in the Iowa Code, Chapter 28E, Joint Exercise of Governmental Powers. As with Supply Plan II, the construction of inlet works on the Missouri River requires a permit from the Corps of Engineers.

ORGANIZATIONAL ARRANGEMENTS

18. Concurrent with establishing legal agreements for the suppliers at Blair and Bellevue to engage in water supply across the State boundary, the water suppliers' organizations would have to be established. Both suppliers could be established under Nebraska laws and obtain agreements with the Iowa County Boards of Supervisors.

FINANCIAL ARRANGEMENTS

19. Financial arrangements for Supply Plan III would be similar to those for Plans I and II.

POLITICAL ARRANGEMENTS

20. There may be some public opposition to interstate water supply agencies unless an adequate number of public meetings are held and assurances of equitable charges for service are established.

Water Use Reduction Concepts

21. The institutional arrangements necessary to implement water use reduction take the form of State statutes, local ordinances, and building codes.

22. In order to curtail the use of water, other than by voluntary practices, the States could pass laws limiting the hours of lawn sprinkling, car washing, and other exterior uses. The probability that such laws would be enacted is considered to be slight.

It is difficult to obtain clear and equitable wording in these types of laws and enforcement is even more difficult.

23. Legal action to authorize pricing policies which penalize high quantity users may be politically unpopular. There is a precedence for such action in the city of Lincoln, Nebraska, so it may be possible to institute some type of conservation-oriented pricing policies.

24. It appears that local ordinances or building codes requiring water conserving fixtures are feasible, provided that the cost of these fixtures is competitive with the price of fixtures now on the market.

25. The possibility of requiring a dual, potable-nonpotable system is institutionally unlikely because of the high cost associated with dual distribution systems.

Summary

26. The institutional analysis of the three supply plans indicates that Plan I requires the least institutional change to implement and incorporates existing county water supply plans. Supply Plan II is least complex from an organizational standpoint, but the legal problems make it less feasible from a total institutional analysis. The main problem in Supply Plan II centers around the proposed MUD

well field along the Platte River. Supply Plan II could be implemented using MUD sources discussed in Supply Plan I. Supply Plan III requires the most institutional modification and is considered to be least feasible from an institutional standpoint.