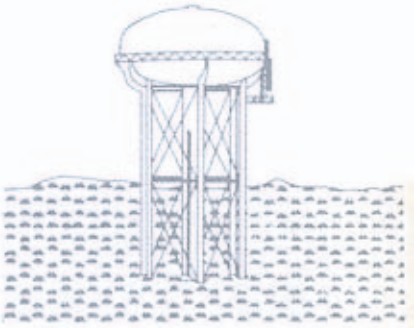
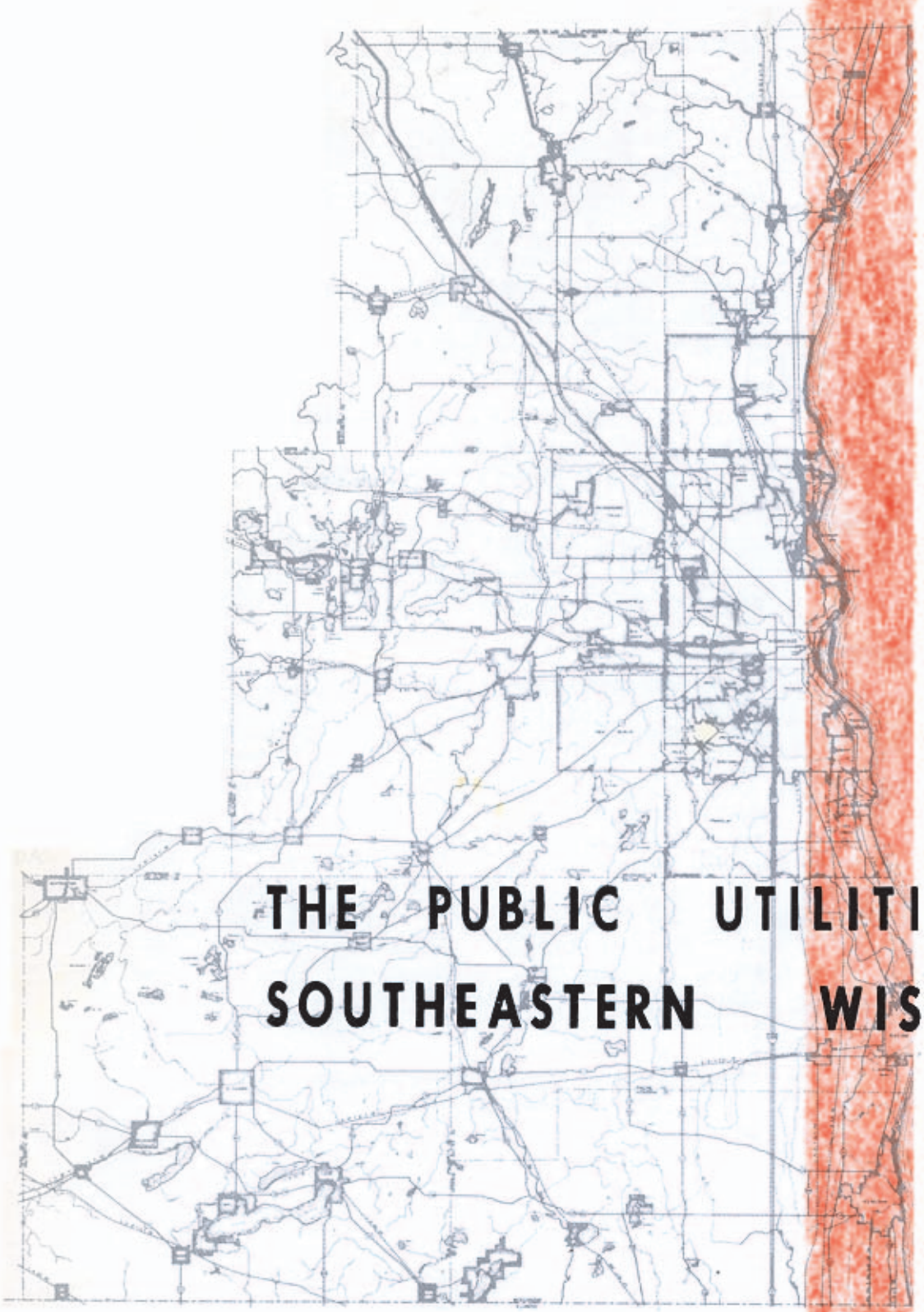
PLANNING REPORT NO. 6





THE PUBLIC UTILITIES OF SOUTHEASTERN WISCONSIN

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

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J.C. ZIMMERMAN ENGINEERING COMPANY

CONSULTING ENGINEERS

WEST ALLIS, WISCONSIN

FOR THE

SOUTHEASTERN WISCONSIN REGIONAL

PLANNING COMMISSION

OLD COURTHOUSE

WAUKESHA, WISCONSIN

The preparation of this report was financed in part through an urban planning grant from the Housing and Home Finance Agency, under the provisions of Section 701 of the Housing Act of 1954, as amended.

July, 1963

Price: $2.50

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SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

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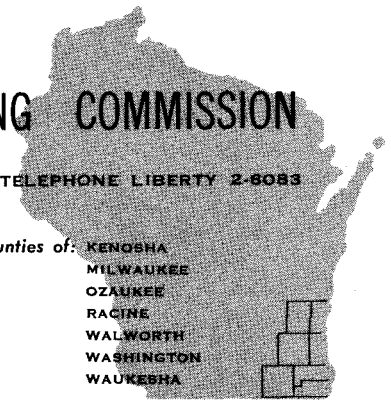

STATEMENT OF THE EXECUTIVE DIRECTOR

This report presents the results of a Regional public utilities study conducted under contract by the J. C. Zimmerman Engineering Company for the Southeastern Wisconsin Regional Planning Commission. This study was one of a series performed under Urban Planning Grant No. Wis. P-6(G) from the Housing and Home Finance Agency. The study began in October of 1962 and was completed in July of 1963.

Urban development today is highly dependent upon the utility facilities which serve the individual land uses with power, light, heat, water and sewerage. Moreover, certain of these utility facilities are closely linked to the surface and ground water resources of the Region and, therefore, may affect greatly the overall quality of the Regional environment. A clear picture of public utility systems serving the Region is, therefore, essential to any sound Regional planning effort. This report and the inventories and analyses upon which this report is based attempt to present such a picture.

This study includes a physical inventory of the various utility systems serving the Region and provides data on their existing service areas, and on their basic capacity to absorb new urban growth and development. A great deal of data concerning the public utility systems of the Region was collected, mapped and tabulated as a part of this study. The majority of this data is not amenable to publication but is available in the Commission's files for use by state, county and local planners, economic development groups and individuals concerned with development.

Kurt W. Bauer

K. W. Bauer
Executive Director

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Civil - Sanitary - Municipal

Consulting Engineers

J. C. ZIMMERMAN ENGINEERING CO.

11121 W. Oklahoma Avenue

WEST ALLIS, WISCONSIN

LINCOLN 5-5840

July 24, 1963

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION:

In September of 1962 the Commission engaged the services of our firm to prepare a public utilities survey and analysis of the Region. The public utilities to be studied included those which furnish electric power, gas and water service and which collect and dispose of sanitary sewage and storm water runoff. This survey involved an extensive program of research of records of the various utility agencies, together with interviews held with their officers, technical staff members, and operating personnel. The survey further included the mapping of the components of these utility systems, the compiling of a physical inventory of these components, and the analysis of relevant capacity to determine the ability of these systems to sustain further urbanization within the Region.

This survey would have been impossible without the cooperation of many individual utility agencies, officials of state regulatory bodies, and local consulting engineering firms. We wish particularly to acknowledge the assistance given by representatives of the Wisconsin State Board of Health, the Sewerage Commission of the City of Milwaukee, the Wisconsin Electric Power Company, Waukesha County Park and Planning Commission, and the City Engineers of the Cities of Milwaukee, Racine, Kenosha, West Allis, Waukesha, and Burlington. Extensive use was made of the excellent records of the Public Service Commission of the State of Wisconsin.

It is with great pleasure that we transmit to you this report, "The Public Utilities of Southeastern Wisconsin," together with the supplementary maps and tabular data referred to above.

Very truly yours,

J. C. ZIMMERMAN ENGINEERING CO.

Jeremy C. Zimmerman

Jeremy C. Zimmerman

JCZ:KR

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Chapter I
INTRODUCTION

The Region studied in this report is comprised of the seven southeasterly counties of the State of Wisconsin. This area includes the Counties of Kenosha, Milwaukee, Ozaukee, Racine, Walworth, Washington and Waukesha. The Region is located in a prime position with regard to future development: it is bounded on the east by Lake Michigan, which provides an ample quantity of fresh water for both domestic and industrial use, as well as being a portion of a major international transportation network; on the south, it is bounded by the rapidly expanding northeastern Illinois metropolitan area; and on the west and north, the area is bounded by the fertile agricultural lands and desirable recreational areas of the State of Wisconsin.

Development today is highly dependent upon the utility facilities which serve the individual land uses with power, light, heat, water and sewerage. How well the Region and its principal parts can sustain development will depend to a considerable extent upon the location and capacities of these utility facilities. Moreover, certain of these utility facilities are closely linked to the surface and ground water resources of the Region and, therefore, may affect greatly the overall quality of the Regional environment.

ROLE OF TOPOGRAPHIC FEATURES

Of great importance to any consideration of water related public utility systems within the Region is the fact that a subcontinental divide traverses the Region in a north-south direction. This divide separates the Region into two major drainage areas, an easterly portion (Milwaukee and Ozaukee Counties and the easterly portions of Washington, Waukesha, Racine and Kenosha Counties), which drains to the Atlantic Ocean via the St. Lawrence River, and a westerly portion which drains to the Gulf of Mexico via the Mississippi River. Shaped by this major geographic feature, numerous small streams and rivers traverse the Region. All, however, have relatively limited upstream drainage areas and relatively low flows during dry weather. As a result, pollution loads transmitted to these rivers must be carefully adjusted to their dry weather waste assimilation capacities if serious environmental problems are to be avoided and multiple uses of the streams permitted. The problem of waste disposal is further aggravated by soil conditions within the Region, for the Region has a relatively high percentage of its area covered by soils unsuited to urban development utilizing on-site sewage disposal systems.

A BASIC PROBLEM

This report presents the results of a physical inventory of the various utility systems serving the Region. Analyses of the information collected shows that, while existing electric, gas, and water utilities are in excellent condition to support further development within the Region, sanitary sewerage facilities, with a few notable exceptions, are generally operating very nearly at or beyond their original design capacities. Well-developed storm water drainage systems are lacking in the majority of communities within the Region, the exceptions being the older, larger, and more densely populated communities.

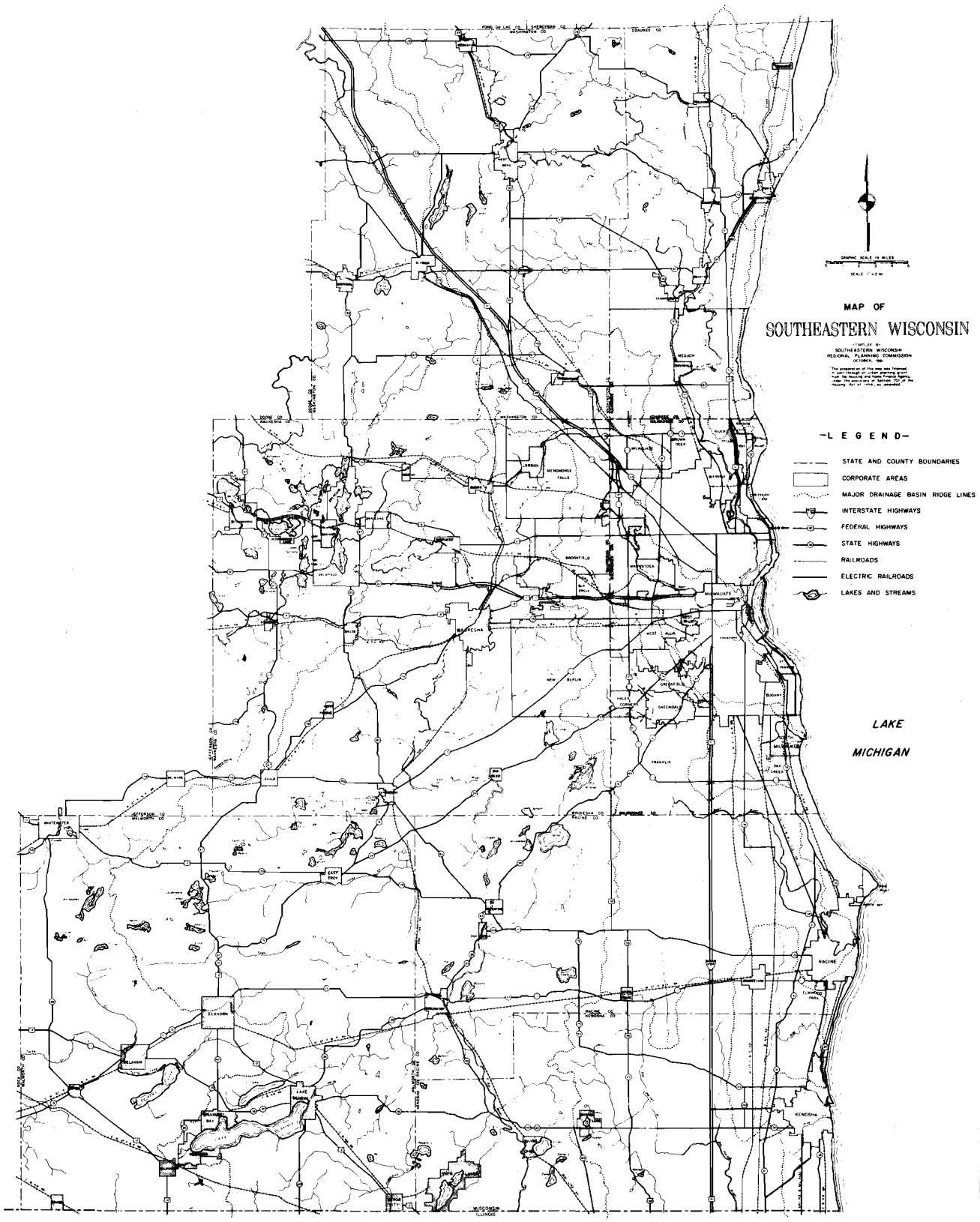
Table 1 presents a summary of data relating to population and utility service in the Region. It should be noted that a very substantial percentage of the population of the Region is served by four basic public utilities. Examination of Tables 2 through 4 covering customer service (included in later sections of this report) demonstrate, however, that the substantial majority of the population so served dwells in the three major metropolitan areas adjacent to Lake Michigan. These are the metropolitan areas of Milwaukee, Racine and Kenosha.

An examination of the maps in the appendix to this report will indicate that the major metropolitan areas -- particularly Milwaukee -- presently served with sewer, water, and gas are already heavily urbanized and that any substantial future growth must take place beyond these areas and their well-developed utility systems.

To permit this growth to occur in an orderly manner and not adversely affect the cost or service standards of the utility facilities ser-

vicing the present residents of the Region, it will be necessary to co-ordinate the long-range planning efforts of all the various individual utility groups involved.

This Regional Utilities Inventory is one of the first steps toward such a program of co-ordination.



SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

SOUTHEASTERN WISCONSIN REGION

DRAWN: R. S. Humphrey DATE: 30 Oct 61
CHECKED:
SCALE:
REVISED: 15 Feb 62 Dol R Behnke

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MAP I

Table 1

PUBLIC UTILITY CUSTOMER SERVICE IN SOUTHEASTERN WISCONSIN REGION

						ELECTRIC		GAS		WATER		SANITARY SEWER	
COUNTY	TOWNS	CITIES	VILL.	1960 POPULATION	% OF REGIONAL TOTAL	NO. OF CUST.	% OF REGIONAL TOTAL	NO. OF CUST.	% OF REGIONAL TOTAL	POPULATION SERVED	% OF REGIONAL TOTAL	POPULATION SERVED	% OF REGIONAL TOTAL
KENOSHA	8	1	3(1)	100,615	6.4	36,705	6.8	26,402	6.9	75,000	5.8	78,500	5.8
MILWAUKEE	0	10	9	1,036,047	65.8	337,042	63.0	281,121	73.7	984,800	75.8	1,028,970	75.8
OZAUKEE	6	3	5	38,441	2.5	12,343	2.3	4,969	1.3	17,310	1.3	20,580	1.5
RACINE	9	2	7(2)	141,781	9.0	48,713	9.1	31,716	8.3	113,590	8.8	109,900	8.1
WALWORTH	16	4	7	52,368	3.3	28,673	5.4	11,611	3.0	28,770	2.2	27,980	2.0
WASHINGTON	13	2	4(3)	46,119	2.9	16,703	3.0	4,851	1.3	20,650	1.6	22,060	1.6
WAUKESHA	14	5	18	158,249	10.1	55,581	10.4	20,812	5.5	58,990	4.5	70,600	5.2
REGIONAL TOTALS	66	27	53	1,573,620	100.0	535,760	100.0	381,482	100.0	1,299,110	100.0	1,358,590	100.0

1. Village of Paddock Lake incorporated in June 1960.

2. Village of Elmwood Park Incorporated in June 1960.

3. Village of Barton Consolidated with the City of West Bend, November 1961.

Table 2

ELECTRIC AND GAS UTILITIES

CUSTOMER SERVICE IN THE SOUTHEASTERN WISCONSIN REGION

CUSTOMERS SERVED

	ELECTRIC UTILITIES			GAS UTILITIES		
County	Wisconsin Electric Power Co.	Wisconsin Power and Light Co.	Municipal	Milwaukee Gas Light Company	Wisconsin Natural Gas Company	Wisconsin Southern Gas Co.
KENOSHA	34,172	2,533	0	0	22,544	3,858
MILWAUKEE	337,042	0	0	264,947	16,174	0
OZAUKEE	10,924	0	1,419	4,969	0	0
RACINE	48,713	0	0	0	29,340	2,376
WALWORTH	8,141	18,955	1,577	0	1,424	10,187
WASHINGTON	14,140	0	2,563	4,851	0	0
WAUKESHA	52,156	0	3,425	9,083	11,729	0
TOTALS	505,288	21,488	8,984	283,850	81,211	16,421

Total Electric Customers in the Region 535,760

Total Gas Customers in the Region 381,482

Table 3

WATER UTILITIES - AREA AND POPULATION SERVED BY SOURCE OF SUPPLY - 1962 SOURCE OF SUPPLY

County	Area Served S.Q.M.	Lake Michigan Water M.G.D.	Well Water M.G.D.	Total M.G.D.	Lake Michigan Water M.G.D.	Well Water M.G.D.	Total M.G.D.
KENOSHA	11.50	12.27	0	12.27	75,000	0	75,000
MILWAUKEE	127.40	175.74	1.84	177.41	966,600	18,200	984,800
OZAUKEE	5.30	0.82	1.79	2.61	6,700	10,610	17,310
RACINE	17.09	14.58	1.38	15.96	100,000	13,590	113,590
WALWORTH	10.59	0	3.21	3.21	0	28,770	28,770
WASHINGTON	5.63	0	3.05	3.05	0	20,650	20,650
WAUKESHA	14.77	0	6.91	6.91	0	58,990	58,990
REGIONAL TOTALS	175.19	203.41	18.18	221.42	1,148,300	150,810	1,299,110

Table 4

SANITARY SEWERAGE UTILITIES

AREA AND POPULATION SERVED -- BY WATERSHEDS

County	LAKE MICHIGAN														MISSISSIPPI RIVER					
	Lake Michigan		Misc. (Lake Michigan)		Menomonee River		Milwaukee River		Oak Creek		Pike River		Root River		Des Plaines River		Fox River		Rock River	
	Population	Area Sq. Mi.	Population	Area Sq. Mi.	Population	Area Sq. Mi.	Population	Area Sq. Mi.	Population	Area Sq. Mi.	Population	Area Sq. Mi.	Population	Area Sq. Mi.	Population	Area Sq. Mi.	Population	Area Sq. Mi.	Population	Area Sq. Mi.
Kenosha	75,000	11.36	450	0.12	--	--	--	--	--	--	--	--	--	--	50	0.21	3,000	0.90	--	--
Milwaukee	1,013,350	134.22	720	0.20	--	--	--	--	200	0.40	--	--	14,700	4.90	--	--	--	--	--	--
Ozaukee	6,700	1.84	650	0.20	--	--	13,230	4.74	--	--	--	--	--	--	--	--	--	--	--	--
Racine	93,000	15.20	4,600	1.64	--	--	--	--	--	--	1,500	0.70	3,200	0.75	--	--	7,600	2.14	--	--
Walworth	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	9,900	3.33	18,080	6.14
Washington	--	--	--	--	850	0.23	14,070	3.79	--	--	--	--	--	--	--	--	--	--	7,140	1.79
Waukesha	8,600	5.98	--	--	12,100	3.45	--	--	--	--	--	--	--	--	--	--	39,500	10.92	10,400	3.33
Regional Totals	1,196,650	168.60	6,620	2.16	12,950	3.68	27,300	8.53	200	0.40	1,500	0.70	17,900	5.65	50	0.21	60,000	17.29	35,620	11.26

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Chapter II
GENERAL DESCRIPTION OF STUDY

The study reported on herein included the collection of data and the compiling of a physical inventory of public utility facilities in southeastern Wisconsin. These inventory operations included the preparation of maps indicating the geographic location of these facilities together with sizes, grades, and elevations of trunk lines, and the delineation of existing and proposed service areas. In addition, relevant capacity and cost data were compiled and tabulated. The systems analysed included sanitary sewerage, storm water drainage, water, gas, and electric systems.

In general, the data tabulated included data furnished by technical or operating personnel of the various utility systems supplemented by data made available from the files of state or local regulatory bodies. It was found that the format and degree of detail of such data varied widely, not only between communities, but also between the systems analysed. In particular, it was noted that while all communities maintained detailed and up-to-date data on water systems in compliance with Public Service Commission requirements, few maintained as detailed records on sanitary sewerage or storm water drainage systems.

MAPPING

Mapping operations included the collection or preparation of sanitary sewerage system plans for each city, village or sanitary district showing the geographic location of all existing trunk sewers, sewage pumping stations, sewage treatment plants, and emergency overflows or bypasses. Trunk sewer sizes, invert grades and elevations were shown, and combined sewerage areas identified. Facilities under construction or programmed for construction were shown as existing facilities.

Storm water drainage systems were mapped showing geographic location of trunk sewers, storm water pumping stations, and improved water courses and drainage channels. Sizes, invert grades and elevations together with tributary drainage areas were shown.

Water supply systems were mapped including geographic location of water transmission mains, water pumping stations, water treatment plants, reservoirs, elevated storage tanks and standpipes, wells, and intakes. Sizes of water transmission mains were indicated, and water service areas defined.

The supply system data were then transferred to utility overlays to the regional base maps prepared by the Southeastern Wisconsin Regional Planning Commission (SEWRPC). These overlays consist of plastic sheet tracings at the same scale as the base maps (1" = 2,000'). Sanitary sewerage, water supply, and storm water drainage facilities are each drawn on a separate sheet. Gas and electric systems are drawn on the same sheet. Ten base maps, each with four utility overlays, are available. Kenosha, Milwaukee, Ozaukee, and Racine Counties are available as single sheets, while Walworth, Washington, and Waukesha Counties require two sheets. In this form, prints may be made of the regional base maps together with whichever utility overlay is desired.

The gas and electric overlay tracings show the location of high pressure gas transmission mains, gas plant facilities, and electric transmission lines of 26,400 volts and over. Gas utility service and franchise areas are shown together with electric franchise areas. It is considered that the entire Region is serviced with electricity in that virtually every dwelling has electric service.

Prints of any of the above described utilities superimposed upon the appropriate regional base map may be secured from SEWRPC for the cost of reproduction and handling.

The maps included in the appendix to this report were prepared from these overlay maps. These maps indicate utility service areas together with major features of the various utility systems. For more detailed information and correlation of plant location with the data presented in the tables included in the appendix, it will be necessary to examine copies of the base maps together with the desired utility

overlay or the original systems inventory maps on file with SEWRPC.

Further inventory operations included the tabulation of capacity and operating data for sanitary sewerage and water supply systems. This data is presented in the Tables 5 through 11B included in the appendix. Tables 5 through 11 summarize the number of customers or population served by electric, gas, water and sanitary sewerage utilities.

Tables 5A through 11A summarize capacity data for public water utilities. This data includes: location, name of operating agency, area served in square miles, date of original construction, per cent metered, effective storage, active sources of supply, treatment provided, estimated normal capacity of supply, present average consumption, present average industrial consumption, required supply capacity, estimated per capita consumption both total and excluding industrial use, and excess capacity of supply expressed both in million gallons per day and population.

Tables 5B through 11B summarize capacity data for sanitary sewerage utilities. This data includes: location, name of agency, area served in square miles, treatment provided, disposal of effluent or overflow, date of original construction, present average flows, estimated population served, estimated total equivalent population served, and excess capacities of plants in million gallons per day and population. Few plants were found that recorded, or could estimate accurately, what proportion of total flows was contributed by industries or by ground water infiltration. Therefore, such comparisons were not made.

In addition to the above operations, a memorandum was prepared summarizing the physical properties of these sanitary sewerage and water utilities. Tabulations included in this memorandum included: miles of pipe by sizes, services, meters, treatment plants, pumping stations, wells, reservoirs, and appurtenances. From this tabulation an estimate of total capital investment in pipe and plants at replacement cost was made. Such estimates were based upon estimated average present-day unit costs for similar work assuming raw land conditions. Three copies of this memorandum are on file with SEWRPC.

In later sections of this report, potential problems within the Region relating to ground and surface water uses and disposal are discussed. Chapter IV summarizes these problems and recommends various planning programs which should be initiated to minimize the severity of these problems.

Chapter III
GENERAL DESCRIPTION OF UTILITY FACILITIES

ELECTRIC UTILITIES

Two major privately-owned electric utilities are authorized within the Region which, together with five small municipal utilities, provide service to the entire Region.

The Wisconsin Electric Power Company is authorized to operate in the major portion of the Region and serves an area of 2,386 square miles, or 88.5 per cent of the total area of the Region;[1] and 505,288 customers, or 94.3 per cent of the total number of electric customers within the Region. The Wisconsin Light and Power Company is authorized to operate in parts of Kenosha and Walworth Counties; and it services an area of 274 square miles, or 10.2 per cent of the total area of the Region; and 21,488 customers, or 4.0 per cent of the total number of electric customers within the Region. Municipal utilities are operated by the Cities of Cedarburg, Elkhorn, Hartford and Oconomowoc, and the Village of Slinger. Together, these municipal utilities serve an area of 35 square miles, or 1.3 per cent of the total area of the Region; and 8,984 customers, or 1.7 per cent of the total number of electric customers within the Region.

Generally, a plentiful supply of electric power is available in any area of the Region. Residential service is available anywhere within the Region, and low voltage lines are in place on virtually every rural highway.

Discussions with representatives of the utility companies revealed that electric power adequate to meet any commercial or industrial need could and would, as a matter of policy, be extended to any customer requesting electric service anywhere within the authorized service area; with the sole limitation being that the anticipated earnings from a particular customer must, over a four-year period, be equal to or greater than the cost of extending such service. Should the anticipated revenues be of a lesser amount, the utility may require that the excess cost of such service extension be borne by the potential customer. Such capital recovery may be charged to the customer at a rate equal to one-forty-eighth (1/48) of the capital investment as a minimum monthly charge. After four years the minimum bill then reverts to the rates applicable to the type of service received. The primary purpose of this requirement is to avoid placing the excessive costs of service extensions upon existing customers of the utility.

Further discussions disclosed that problems in this respect are only encountered with customers who have a high demand rate, yet use little power continuously. Generally, a power demand of less than 300 kilowatts can be supplied at local distribution level voltages of 3.8 and 8.3 kilovolts, while power demands in excess of 300 kilowatts may under certain conditions require higher voltage service lines, i.e., 13.2 kilovolts (supplied only in downtown Milwaukee) or 26.4 kilovolts. All lines of 26.4 kilovolt line voltage or over have, therefore, been mapped on the overlays to the regional base maps; and these overlays can, therefore, be used to assist in industrial site location with respect to power service.

GAS UTILITIES

Three gas utilities are authorized to operate within the Region and provide all public gas service therein.

The Milwaukee Gas Light Company is authorized in parts of Milwaukee, Ozaukee, Waukesha and Washington Counties. It serves an area of 664 square miles, or 24.7 per cent of the total area of the Region; and 283,850 customers, or 74.4 per cent of the total number of gas customers within the Region.

The Wisconsin Natural Gas Company is authorized in parts of Kenosha, Milwaukee, Racine, Walworth and Waukesha Counties. It serves an area of 925 square miles, or 34.3 per cent of the total area of the Region; and 81,211 customers, or 21.3 per cent of the total number of gas customers within the Region.

[1] Total area of the Region is 2,695 square miles, including 67 square miles of inland water area.

The Wisconsin Southern Gas Company is authorized in parts of Kenosha, Racine and Walworth Counties. It serves an area of 634 square miles, or 23.5 per cent of the total area of the Region; and 16,421 customers, or 4.3 per cent of the total number of gas customers within the Region.

In parts of Ozaukee, Racine, Walworth, Washington and Waukesha Counties, no gas utility is authorized to operate. These areas total 472 square miles, or 17.5 per cent of the total area of the Region.

Almost all of the gas sold within the Region is natural gas, supplied by the Michigan-Wisconsin Pipe Line Company.

Dual pipe lines enter the Region from the south at a point approximately six miles west of the Village of Genoa City in Walworth County and continue northeasterly, passing southeast of the City of Burlington in Racine County and then extending northerly into Waukesha County at a point approximately seven miles east of the Village of Mukwonago and continuing northerly through Waukesha County and entering Washington County at a point approximately one mile west of the Village of Germantown. The pipe lines continue north through Washington County and leave the Region at a point approximately four miles east of the Village of Kewaskum. This pipe line consists of dual 24-inch and 22-inch lines at the south limits of the Region and dual 20-inch and 14-inch lines at the north limits of the Region. Natural gas may be supplied to the Region via this pipe line from either of two major gas fields from the south or one major gas field from the north.

In addition to the Michigan-Wisconsin Pipe Line Company supply described above, the Natural Gas Pipe Line Company of America supplies natural gas to the Wisconsin Southern Gas Company system through a connection at the Village of Genoa City in Walworth County.

Both the Wisconsin Southern Gas Company and the Wisconsin Natural Gas Company maintain gas producing facilities on standby and for "peak shaving."

As will be noted on the maps included in the appendix to this report, gas mains are not readily available in many of the more sparsely developed areas of the Region.

Discussions with gas company representatives indicated that, as with the electric utilities, the extension of new transmission and distribution facilities must be economically justifiable and that the burden of financing such extensions cannot be placed upon existing customers of the utility.

Any major customer can obtain natural gas service anywhere within the authorized portion of the Region; but extensions to serve small potential customers in areas remote from existing mains must, as a matter of general policy, be deferred until the number of such consumers economically justifies the extension. An individual analysis must be made of each such proposed installation which will compare probable construction costs, and thus needed annual return, with estimates of probable annual revenues from potential customers within the area to be served by the proposed extensions.

WATER UTILITIES

The majority of public water service within the Region is provided by publicly owned water utilities. Forty-five municipalities operate their own utilities, as do six sanitary districts. Six municipalities are served by the water utility of another municipality or sanitary district. Together these 51 publicly owned water utilities serve an area of 192 square miles, or 7.1 per cent of the total area of the Region; and 1,300,000 persons, or 78.3 per cent of the total estimated 1962 population of the Region.[2]

In addition to these publicly owned water utilities, 54 private or cooperatively owned water systems serve a population of about 12,000 persons, or 0.7 per cent of the total estimated 1962 population of the Region. Many of these small water systems serve summer residents only and suspend operations during cold weather. Very few have standby supply or storage facilities, and the great majority do not keep detailed records or file annual reports to state or local regulatory bodies. It is anticipated that many of these systems, particularly in Milwaukee County and the eastern portions of Waukesha County, will eventually be absorbed into municipal water utilities.

All water supplied by the publicly owned water utilities is drawn either from Lake Michigan or from wells.

[2] 1,660,000 persons. Estimate by SEWRPC.

Filtered Lake Michigan water in an amount averaging 203.41 M.G.D.[3] was supplied to an aggregate area of 147 square miles, or 5.5 per cent of the total area of the Region; and a population of about 1,149,000 persons, or 69.2 per cent of the total estimated 1962 population of the Region, by all systems utilizing this source of supply.

Well water in an amount averaging 18.18 M.G.D. was supplied to an aggregate of 45 square miles, or 1.6 per cent of the total area of the Region; and a population of about 151,000 persons, or 9.1 per cent of the total estimated 1962 population of the Region, by all publicly owned systems utilizing this source of supply.

In general, water service from a municipal utility is, as a matter of local policy, furnished only to property within the corporate limits of that municipality. Only the Cities of Milwaukee and Racine provide water service beyond their corporate limits in any substantial amount.

The tabulations included in the following chapters of this report indicate that the majority of municipalities have a plentiful supply of water with respect to present day domestic and industrial demands. It should be noted, however, that the tabulations shown do not include any provisions for fire fighting and further assume that all facilities are maintained in such a condition that they may operate at their original installed capacity. The capacities shown thus represent the basic capacity "available" to present facilities and may be substantially greater than the actual capacity of operable equipment at any particular given time.

Generally, Lake Michigan offers an unusually excellent supply of water to those areas within economic reach and lying east of the subcontinental divide.

Examination of existing well locations and yields indicates that substantial quantities of well water have been found in many portions of the Region. In comparison with many other regions of the Midwest in which water supply has long been a critical problem requiring costly solutions, the Region is presently in a highly favorable position with regard to the development of additional supply capacity for any potential major user.

However, in the more densely populated portions of the Region using ground water extensively, declining water tables have already produced problems, particularly for users with older wells drilled to shallow depths at a time when ground water levels were substantially higher. Studies at Greendale in Milwaukee County have indicated that pumping levels in the municipal wells have declined an average of about ten feet per year in recent years, necessitating periodic lowering of pump settings and/or the addition of new pump bowls and larger motors to produce the same quantities of water.

While plentiful supplies of ground water are presently available in most areas of the Region, problems involving allocation of use will probably become more frequent in the more heavily urbanized localities in future years.

Lake Michigan Supplies

The largest Lake Michigan supply within the Region is operated by the City of Milwaukee Water Department. This utility serves not only the residents of the City of Milwaukee, but also provides retail service to customers in the Cities of Greenfield and St. Francis, the Village of West Milwaukee and scattered residential, commercial and industrial customers along common borderlines in several adjacent communities. In addition, Milwaukee serves the institutions and parks of Milwaukee County, as well as two large industrial complexes located in the Cities of Cudahy and Glendale. Milwaukee further sold water in 1962 to five municipal utilities on a wholesale basis, these utilities reselling water to their own customers and providing such storage or re-pumping facilities as they required. In 1962 these communities included the Cities of Wauwatosa and West Allis, together with the Villages of Fox Point, Shorewood and Whitefish Bay. Service to Fox Point and Whitefish Bay was discontinued in the spring of 1963 upon the completion of the North Shore Water Utility.

Extensive studies have been made by the Milwaukee Water Department to evaluate the feasibility of providing water service to other Milwaukee County communities, as well as to areas in the eastern portion of Waukesha County. Such service may materialize in the near future.

Two City of Milwaukee water filtration plants presently have a rated capacity of 300 M.G.D.; however, provisions were made in the design of the recently completed Howard Avenue filtration plant and Texas Avenue intake lines to

[3] Million gallons per day.

permit the ready construction of 200 M.G.D. additional plant capacity as the need arises.

In addition to the City of Milwaukee and its customers, five other Milwaukee County communities are served from a Lake Michigan supply. Three of the communities Fox Point, Glendale and Whitefish Bay, have jointly formed the North Shore Water Utility which commenced operation in early 1963. Their new filtration plant located in the City of Glendale provides a rated capacity of 12.0 M.G.D. It is estimated that this plant will be adequate to serve a total population of 46,000 persons in the three communities. It is further estimated that about 36,000 persons will be served by this system in 1963. This includes approximately 10,000 persons in the City of Glendale who up to now have been served by either community or individual wells.

The Cities of Cudahy and South Milwaukee each have their own filtration plants for processing Lake Michigan water, with present rated capacities of 3.0 and 4.5 M.G.D. respectively. South Milwaukee is presently constructing a 3.5 M.G.D. addition to its filtration plant.

The remaining Lake Michigan frontage of Milwaukee County lies within the City of Oak Creek. While Oak Creek is presently served entirely by a well supply, studies currently underway indicate that it will be economically feasible to construct and operate a Lake Michigan supply at such time as the present utility is expanded to serve a connected population of about 15,000 persons. In view of Oak Creek's strategic location with respect to industrial plant sites and the availability of sanitary sewerage facilities, it is possible that this requirement may be met within a reasonably short period of time.

The City of Racine operates the second largest Lake Michigan water utility within the Region, pumping an average of 14.57 M.G.D. in 1962.

In addition to customers within the city, the Racine Water Department also provides the Villages of Elmwood Park and North Bay with retail water service and furnishes water on a wholesale basis to the North Park and South Lawn sanitary districts. It is anticipated that wholesale water service to the Village of Sturtevant will commence in the summer of 1963. The Racine filtration plant provides a nominal rated capacity of 40.0 M.G.D.

The third largest Lake Michigan utility is operated by the City of Kenosha. Kenosha presently provides water to sanitary district No. 1 of the Town of Somers and to one subdivision in the Town of Pleasant Prairie. In 1962 average daily pumpage of the Kenosha water works was 12.27 M.G.D., and maximum daily pumpage was 22.76 M.G.D. Rated capacity of the Kenosha Water Department is 20.0 M.G.D., and expansion of plant capacity to meet peak demand rates is planned for the near future.

The remaining Lake Michigan supply within the Region is operated by the City of Port Washington. Its filtration plant provides a rated capacity of 1.5 M.G.D., and service is provided only to the City of Port Washington. Average daily pumpage in 1962 was 0.87 M.G.D.

In summary, these eight Lake Michigan water filtration plants produced water in an amount averaging 203.41 M.G.D. in 1962. Total filtration plant capacity is rated at 381.00 M.G.D.

Well Supplies

A total of 33 incorporated municipalities, together with five sanitary districts, operate water utilities which draw their basic supply from wells.

The largest community presently served with well water is the City of Waukesha. The Waukesha Water Utility draws its water from six sandstone wells varying in depth from 1,785 feet to 2,120 feet. Waukesha's latest well was placed in service in the spring of 1963. Together these six wells have an estimated normal capacity of 8.6 M.G.D., and in 1962 produced water at an average rate of 4.56 M.G.D. In 1962 Waukesha served an estimated population of about 32,000 persons and a small military installation outside the city limits.

Of the remaining 32 municipalities served with well water, only the City of West Bend and the Village of Menomonee Falls served 1962 populations in excess of 10,000 persons, while an additional nine communities served 1962 populations in excess of 5,000 persons.

In addition to these publicly owned utilities and the 54 privately or co-operatively owned subdivision supplies tabulated, a substantial number of private wells supply water to their residential, commercial, industrial and institutional owners. While the present study does not attempt to catalog such users, it is reasonable to assume that the balance of the residents of the Region,

or about 360,000 persons, draw their water from privately owned wells. Assuming that per capita usage by these residents is approximately equal to that of water utility customers, total residential use from private wells might be estimated at about 250 per cent of that consumed by residential customers of publicly owned water utilities supplied by wells. No realistic estimate can be made at this time of water usage by the commercial, industrial and institutional private well owners.

Generally, the capacity data pertaining to publicly owned well supplies tabulated in later sections of this report represent rated capacities, assuming that wells and well pumping equipment are maintained at their original installed capacity.

A detailed investigation of a particular community at a particular date would doubtless indicate an actual capacity somewhat lower than that shown in these tabulations. For example, the 1962 annual report of the Waukesha Water Utility indicated that actual well production capability varied from 7.9 M.G.D. to 9.3 M.G.D. during the year.

In any well system variations in capacity of wells may be affected by such factors as decline of pumping levels, clogging of screens or the complete removal of a well from service during a period of well rehabilitation. The capacities, therefore, should be considered as potential capacities rather than actual capacities, as no account can be taken in a report such as this of actual maintenance practices in the individual community.

SANITARY SEWERAGE UTILITIES

Virtually all sanitary sewerage service within the Region is provided by publicly owned agencies. These agencies generally take the form of a commission or department in the case of an incorporated municipality or a town sanitary district in unincorporated areas.

Two privately owned sewerage utilities operate within the Region and serve a total of about 130 customers.

At present 53 sewage treatment works are in operation within the Region and together serve a combined area of about 219 square miles, or 8.2 per cent of the total area of the Region; and about 1,359,000 persons, or 81.9 per cent of the total estimated 1962 population of the Region.

The majority of these existing treatment works are presently operating near or at design capacity, and with the exception of the Sewerage Commission of the City of Milwaukee's Puetz Road plant, now under construction, there are no major plant expansions presently underway within the Region.

In recent years officials of state and local bodies regulating sewage works within the Region have expressed concern over the ability of local streams having low dry weather flows to handle increased sewage loads. Professional opinions currently expressed vary as to whether the lesser danger will be to discharge increased loads to streams which, though not utilized for public water supply within the Region, nevertheless have certain recreational values, or to Lake Michigan which while having a greater capacity for waste assimilation, is a major source of public water supply. In any event the problem of finding a source of adequate assimilation for such wastes will eventually become critical.

The ultimate solution to this problem will have effects far beyond that of waste disposal alone, inasmuch as it also must be related to problems involving water supply. Court decisions involving the supply of Lake Michigan water to Illinois communities beyond the sub-continental divide indicate that diversion of additional quantities of water in excess of present quotas will not be permitted unless waste waters are returned to their original watershed. Such decisions would seem to imply that should long-range plans for the Region include plans to supply Lake Michigan water to areas west of the sub-continental divide, it will also be necessary to plan to return waste waters from the same area to the Lake Michigan watershed.

Sewerage Utilities in the Great Lakes Drainage Basin

Sewage wastes originating within the Region and presently discharged to Lake Michigan include those discharged directly into the Lake or to small streams immediately tributary thereto and, in addition, those discharged into the headwaters of the Milwaukee, Menomonee, Root, Kinnickinnic and Pike Rivers, and Oak and Sauk Creeks.

Sanitary sewerage utilities within this watershed serve a total of 190 square miles, or 7.1 per

cent of the total area of the Region; and 1,263,000 persons, or 76.1 per cent of the total population of the Region.

The largest sewerage utility operating within the Lake Michigan watershed is the Sewerage Commission of the City of Milwaukee. The commission presently operates the Jones Island plant which serves an estimated population of 991,000 persons, as well as four small plants --two in the City of Oak Creek and one each in the Villages of Greendale and Hales Corners which together serve an estimated population of 16,250 persons. Two other small treatment works within the metropolitan district are locally operated and serve about 720 persons. Milwaukee is presently constructing a second sewage treatment plant at Puetz Road and Lake Michigan in the City of Oak Creek and also a network of intercepting sewers connecting to this plant and designed to serve the balance of the unserved areas of Milwaukee County together with certain eastern portions of Waukesha County whose drainage naturally flows eastward into Milwaukee County. Intercepting sewers entering the Puetz Road plant site will have a design capacity of 320 M.G.D. The treatment plant now under construction will provide primary treatment with chlorination and will have a nominal design capacity of 60 M.G.D. Basic site facilities now under construction will permit ready expansion to a capacity of 120 M.G.D. and accommodate secondary treatment facilities. It is anticipated that, upon completion of this plant and intercepting sewer system, the six small treatment works in Milwaukee County described previously will be abandoned. In addition, studies are now underway locally to evaluate the feasibility of abandoning local treatment works in the Villages of Butler and Menomonee Falls and the Indianwood plant in the City of Brookfield (all three facilities in the eastern portion of Waukesha County).

Upon implementation of this program the entire County of Milwaukee excepting the City of South Milwaukee would be served by either the Puetz Road or Jones Island plants of the Sewerage Commission of the City of Milwaukee. The South Milwaukee plant presently serves a population of about 22,000 persons.

Other communities which discharge treated sewage directly to Lake Michigan include the Cities of Kenosha, Port Washington and Racine.

The Kenosha plant serves a population of about 75,000 persons, including a portion of the Town of Pleasant Prairie. The Port Washington plant serves a population of about 6,700 persons, all of whom reside within the City. The Racine plant serves a population of about 93,000 persons, including in addition to the City of Racine, the Village of North Bay and portions of the Town of Mt. Pleasant.

In addition to the above described facilities, 19 other treatment works discharge into watersheds which ultimately drain into Lake Michigan.

These include the Pleasant Homes subdivision plant in Kenosha County and the North Park sanitary district plant in Racine. County which serve a combined total of about 5,050 persons and which discharge into small streams immediately adjacent to Lake Michigan.

Treated sewage from eight communities in Ozaukee and Washington Counties is discharged into the Milwaukee River basin. These include the Cities of Cedarburg and West Bend, and the Villages of Fredonia, Grafton, Saukville, Thiensville, Jackson and Kewaskum. Two small plants are proposed for 1963 construction in the City of Mequon which will discharge to the Milwaukee River. Together the treatment works of these communities serve a population of about 27,300 persons.

Treated sewage from four communities in Milwaukee and Racine Counties is discharged into the Root River basin. These include the Villages of Greendale and Hales Corners in Milwaukee County (discussed previously) and the Village of Union Grove and the Caddy Vista sanitary district in Racine County. Together the treatment works of these communities serve a population of about 17,900 persons.

Treated sewage from four communities in Washington and Waukesha Counties is discharged into the Menomonee River basin. These include the Village of Germantown in Washington County, and the Villages of Butler and Menomonee Falls and the Indianwood subdivision of the City of Brookfield in Waukesha County. Together the treatment works of these communities serve a population of about 12,950 persons.

Treated sewage from about 1,500 persons in the Village of Sturtevant in Racine County is discharged to the Pike River basin and from about 200 persons in the City of Oak Creek is discharged into Oak Creek basin.

Sewerage Utilities in the Mississippi

River Drainage Basin

Sewage wastes originating within the Region and presently discharged to the Gulf of Mexico via the Mississippi River include those discharged to the watersheds of the Des Plaines, Fox and Rock Rivers.

Treated sewage from thirteen communities in Kenosha, Racine, Walworth and Waukesha Counties is discharged into the Fox River basin. These include the Cities of Burlington, Lake Geneva, Brookfield and Waukesha, and the Villages of Twin Lakes, Waterford, East Troy, Fontana, Genoa City, Williams Bay, Mukwonago, Pewaukee and Sussex. Together the treatment works of these communities serve a population of about 60,000 persons.

Treated sewage from ten communities in Walworth, Washington and Waukesha Counties is discharged into the Rock River basin. These include the Cities of Delavan, Elkhorn, Whitewater, Hartford and Oconomowoc, and the Villages of Sharon, Walworth, Slinger, Dousman and Hartland. Together the treatment works at these communities serve a population of about 35,620 persons.

Treated sewage from about 50 persons in Paddock Lake Dells subdivision is discharged to the Des Plaines River basin. In total, sewerage systems within the Region ultimately discharging to the Gulf of Mexico via the Mississippi River now serve an area of about 29 square miles, or 1.1 per cent of the total area of the Region; and a population of about 95,670 persons, or 5.8 per cent of the total estimated 1962 population of the Region.

STORM WATER DRAINAGE SYSTEMS

The majority of complete storm water drainage systems occur in the older and more densely populated cities of the Region. In these cities, storm drainage systems are planned, designed, and constructed in a manner similar to sanitary sewerage and water utility facilities; and detailed records are maintained. In the majority of other smaller communities, where urban development tends to be less dense, the tendency is to utilize open surface channels to as great a degree as possible. In such communities sub-surface conduits are generally installed as appurtenances to street construction or maintenance programs rather than as separate utility systems.

The more extensive storm sewerage systems occur in the older and larger communities such as in the Milwaukee metropolitan area, and in the Cities of Racine, Kenosha and Waukesha. In many of these communities the basic storm water drainage system was originally constructed in the form of combined storm and sanitary sewers. In more recent years additions to these systems were made on a separate basis, and programs of separating the existing combined systems were instituted.

These programs of separating combined systems into separate storm and sanitary sewer systems generally require the installation of a new parallel sewer, adjacent to the existing one. In addition, the reconnection of either sanitary lateral sewers or catch basin connections to the new sewer, depending on which function the new sewer is designed to serve, is necessary. As combined sewers are usually found in the older, heavily built-up areas of the city, where permanent pavements must be removed and replaced and many utility crossings made, costs of such work are extremely high. Further difficulties must be anticipated in the separation of wastes in the internal plumbing systems of many of the older buildings. Where such separation is being carried out today, it is generally in conjunction with street repaving programs in order to minimize pavement replacement costs and disturbance to local traffic. It is doubtful whether complete separation of sewers will be completed in major urban areas within the foreseeable future, unless funds are budgeted for such work at a substantially increased rate.

Storm water drainage system designs, in distinction from other utility installations (i.e., electric, gas, water, and sanitary sewerage), are not subject to the review of any existing state regulatory body. Thus design standards for such facilities vary substantially--not only from community to community, but within the community--because the designer has wide latitude in making basic assumptions concerning the degree of ultimate land development or the degree of protection required. Storm water conduits and open channel improvements within the Region currently may be installed by state, county and town highway departments, farm or local drainage districts, private owners and federal agencies, as well as by municipal bodies.

As urbanization continues within the Region, and as boundaries of presently isolated communities approach one another within each watershed, the now individual drainage systems will need to form a single unified system. Such unification with an ability to carry probable future runoff loadings is highly unlikely under present design and construction practices.

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Chapter IV
SUMMARY AND CONCLUSIONS

Utility facilities within the Region are generally functioning at an adequate level and are capable of supporting short term urban growth at present rates. There is, however, an apparent need to undertake long-range planning with respect to certain key problems affecting water supply, sanitary sewerage and storm water drainage services within the Region if further aggravation of problems which have recently become evident within the Region and which are similar to those being experienced by other urbanizing regions of the country is to be avoided. There is further evidence of a need for an increased degree of co-ordination between the utility agencies presently operating within the Region. These utility agencies are extremely diverse in organizational form and objectives. While some of the many service areas of the utility agencies adjoin or overlap, others are as yet isolated. As urban development continues within the Region, however, the utility services will become increasingly interrelated. A center of co-ordination for utility planning and development will become essential for areawide co-ordination of efforts. Substantial savings will be possible through such a co-ordinating through the avoidance of duplication of study efforts and capital investments in plant facilities designed to perform overlapping functions. True co-ordination can only be achieved within the framework of long-range, areawide land use and utility planning.

Basic utilities studied under this report included those furnishing electric power, gas and water, and those collecting and treating sanitary sewage and disposing of surface storm water runoff.

Electric power and gas are distributed primarily by privately owned, publicly regulated utility companies. The Region lies entirely within the authorized service areas of two large privately owned utilities and five relatively small municipally owned utilities. Eighty-two per cent of the area of the Region lies within the authorized service areas of three privately owned gas utilities; the remaining 18 per cent, now mainly undeveloped, will probably be added to the authorized service area of one or more of these companies ultimately. Seven per cent of the area of the Region is presently served by public water supplies provided by 51 publicly owned water utilities, primarily municipally controlled. Eight per cent of the area of the Region is presently served by sanitary sewerage systems operated by 53 sewerage utilities, also primarily municipally controlled. Storm water drainage service is provided to some degree by virtually every level of government and by agencies ranging from the State Highway Commission of Wisconsin to town road maintenance organizations, and from the Metropolitan Sewerage Commission of the County of Milwaukee to farm drainage districts.

When it is realized that these water related utility services must ultimately form integrated, areawide systems and must be properly related to each other and to the resource base, the problem of co-ordination and the need for long range planning of utility systems on a regional basis becomes apparent.

ELECTRIC AND GAS UTILITIES

Electric utilities within the Region primarily generate their own power, utilizing coal obtained from national markets. Their distribution networks, of predominantly overhead wire, distribute this power to all classes of customers within the Region. Gas utilities within the Region primarily distribute natural gas obtained from two interstate pipe line companies. In both instances natural resources within the Region have little effect on the quantity or quality of service available, since the basic materials required are delivered to the Region in response to local demands translated into economic terms.

The problem of ensuring a continued adequate supply of electric power and natural gas for increased demands anticipated within the Region is primarily one of assisting these utilities in forecasting potential development within the Region so that expansion of production and distribution facilities may be accomplished on a sound financial basis.

WATER AND SANITARY SEWERAGE UTILITIES

As stated previously, 51 publicly owned water utilities and 53 publicly owned sanitary sewerage utilities presently operate within the Region. The majority of these utilities are organized as water and sewer departments of an incorporated municipality and serve only those areas within the political boundaries of that municipality. Where sanitary districts or metropolitan sewerage districts are organized, sewer and water service area limits may not coincide although they often tend to approximate one another. Therefore, a general pattern of water and sewer service areas following political boundary lines rather than natural topographic boundaries such as watersheds exists. This problem is compounded by the fact that the governing bodies of these utilities are primarily concerned with the problems within their own political subdivision rather than problems affecting the area as a whole and themselves only in part. Due to the limits thus placed on long-ranged planning, benefits available through the lower unit costs and increased operating efficiency of larger utilities are often lost.

Other more serious problems may arise due to this lack of inter-community co-ordination in utility planning operations. Of prime concern is the problem of ground water depletion in heavily urbanized areas. Rapidly lowering water tables have seriously affected the water supply of communities and individual private citizens in the Milwaukee metropolitan area, and a comparison with longstanding similar difficulties in the Chicago metropolitan area to the south indicates the problem will become increasingly severe and more costly to deal with as increased withdrawals from these aquifers occur. Barring the discovery of a means of artificially replenishing these aquifers, it would appear that such areas of high water use must ultimately turn to a surface source of water supply. While in that portion of the Region lying east of the sub-continental divide, the extension of Lake Michigan supplies to depleted areas should provide a satisfactory solution; existing legal constraints appear to bar that source to areas lying west of the divide. Should depletion occur in those areas, a surface supply could only be secured by impoundment of local rivers or streams. The ability of these streams to assimilate increasing pollution loads and yet serve as a satisfactory source of water supply will require extensive study. Again looking beyond the Region, it is found that the Chicago metropolitan area draws the greater part of its public water supply from Lake Michigan while discharging the greater part of its waste water to the Mississippi River basin, thus minimizing pollution of its basic source of supply.

It would, therefore, appear that at least two basic studies are needed to provide data for a satisfactory analysis of the long-range water supply and waste water disposal problems in the Region. These would include:

1. A comprehensive analysis of the potential of ground water supplies within the Region, particularly evaluating what effect the discontinuance of ground water use in the eastern portion of the Region might have upon the supply available from aquifers in the western portion of the Region and the ability of these aquifers to sustain continued urban development.

2. A comprehensive analysis of the ability of Lake Michigan and the Fox River to assimilate increasing waste loadings and still serve multipurpose uses.

Should ground water studies indicate an inability of the ground water supply to sustain further urbanization, additional studies will be required. It is suggested that these include an evaluation of the technical and legal factors involved and comparative economic analysis of long-range programs which would consider the following:

1. The supply of Lake Michigan water to the entire Region and the return of all waste waters to their original sources.

2. The supply of Lake Michigan water to the entire Region and the diversion of a portion of waste waters to the Mississippi River basin possibly via the Fox River.

3. The complete and continued separation of the eastern and western portions of the Region for purposes of water supply and waste water disposal.

STORM WATER DRAINAGE FACILITIES

Storm water drainage problems within the Region, including those of a purely local nature, follow a rather consistent pattern:

1. Urbanization was commenced in the lower portions of the drainage basin.

2. Channel improvements were constructed

based on designs which assumed that upstream areas of the drainage basin would remain rural in nature and that future peak flows would be no greater than those previously experienced.

3. High value improvements were constructed immediately adjacent to the improved channel.

4. Subsequent upstream urbanization materially increased peak storm water runoff rates.

It should be anticipated that these present problems will continue to increase in severity as further urbanization occurs. In particular, the following areas should be carefully analysed:

1. Root River in Racine County. Aggravated by rapid urbanization in upstream portions of Milwaukee County and by similar development in eastern Waukesha County.

2. Menomonee and Milwaukee Rivers in Milwaukee County, including branches such as Honey and Underwood Creeks. Aggravated by rapid urbanization in eastern Waukesha County and southern Ozaukee and Washington Counties.

3. Fox River throughout Waukesha, Racine and Kenosha Counties.

Local storm water drainage improvements generally follow a similar pattern, usually resulting from the enclosure of minor local streams with conduits of limited capacity. In these instances, however, the entire drainage area often lies within one incorporated municipality; and a greater public sentiment to accept responsibility and construct relief facilities is found.

Within Milwaukee County the Metropolitan Sewerage Commission presently exercises intercommunity control, not only of sanitary sewerage facilities, but in more recent years storm water drainage facilities as well.

To ensure future cooperation among the many independent agencies constructing and maintaining storm water drainage facilities, it is essential that one centralized co-ordinating agency be established with authority to review designs and construction plans for storm water drainage facilities. A program of long-range storm water drainage facility planning, coupled with co-ordinating review of construction plans, will serve to ultimately provide fully integrated systems as presently isolated communities grow into close proximity with one another.

It should be anticipated that areawide drainage planning may, in addition, effect some solutions to existing problems, possibly through recommendations leading to construction of combined flood water retention and recreational use basins on major streams where current problems exist.

Areawide planning should, in addition, tend to encourage use of common technical standards among the individual agencies. In particular, the use of a common survey datum plane[4] by all utility organizations will make possible areawide analyses of water related facilities, facilitate the exchange of useful design data between communities and minimize needless error.

[4] An analysis of the system plans for communities having sanitary sewerage systems indicates that many datum planes are in use throughout the Region. It was ascertained that eight communities utilize the United States Coast and Geodetic Survey datum for their plans. In Milwaukee and eastern Waukesha Counties, twenty-two communities use City of Milwaukee Datum, for which a definite conversion factor to U. S. G. S. Datum is known. Ten other communities utilize a local datum for which a definite conversion factor was given. An additional twenty-eight communities used local datum planes for which a definite conversion factor is unknown or used more than one datum plane for various parts of their systems.

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APPENDIX A — DETAILED TABULATION OF COUNTY, TOWN, AND MUNICIPAL UTILITY SERVICE

The following tabulations indicate the number of customers (meters) served by the various electric, gas and water utilities throughout the Region; the population served by water and sewerage utilities; and estimates on the remaining excess capacities of the utility plants.

Tables 5, 6, 7, 8, 9, 10 and 11 indicate by county, town and municipality the recorded 1960 populations, the number of electric, gas and water utility customers, and the estimated population served by sanitary sewerage utilities.

Tables 5A, 6A, 7A, 8A, 9A, 10A and 11A summarize data relating to municipal water utilities. This includes name of agency, area served, per cent metered, effective storage,[5] source of supply, treatment provided, estimated normal capacity of supply,[6] present average consumption,[7] present maximum day demand,[8] present average industrial use, estimated population served, average per capita usage (both total and excluding industrial use) and computed excess capacity of supply. In computing the excess capacity of supply in persons, a per capita demand of two times the per capita use, excluding industrial use, was used in most instances. No attempt was made in these computations to include an allowance of water for fire fighting purposes, or to evaluate the ability of storage or booster pumping facilities to meet peak demands. The computations rather present an attempt to evaluate the ability of the basic supply facilities to support population growth.

Tables 5B, 6B, 7B, 8B, 9B, 10B and 11B summarize data relating to municipal sewerage utilities. This includes name of agency, area served, treatment provided, disposal of effluent,[9] plant capacity in M.G.D. and population, present average flow, estimated population presently served, average per capita flow, total equivalent population served and excess capacity of plant in M.G.D. and population. Inasmuch as many of the smaller plants have no metering equipment or laboratories, average flows and equivalent populations served are based in many instances upon estimates by operating personnel or upon the latest available test data.

[5] Not including volumn of mains, treatment units, etc.

[6] Capacity of basic productive units, i.e., wells, filtration plants, assuming units maintained at installed capacities.

[7] Water pumped to distribution system.

[8] For year 1962.

[9] Stream to which effluent is discharged.

Table 5

KENOSHA COUNTY - UTILITY CUSTOMER SERVICE

Location	1960 Population	Number of Utility Customers			Sanitary Sewerage Est. Population Served
		Electric	Gas	Public Water	
Kenosha County	100,615	36,705	26,402	18,812	78,500
Cities					
Kenosha	67,899	22,895	20,639	18,430	75,000
Villages					
Silver Lake	1,077	495	301	None	None
Paddock Lake	(c)	721	321	15	50(a)
Twin Lakes	1,497	1,612	1,047	None	3,000
Towns					
Brighton	1,081	266	3	None	None
Bristol	2,155	829	212	None	None
Paris	1,423	416	7	None	None
Pleasant Prairie	10,287	3,088	1,276	None	450(b)
Randall	1,013	809	453	None	None
Salem	5,541	2,633	1,243	None	None
Somers	7,139	2,081	628	367	None
Wheatland	1,503	860	272	None	None

(a) Paddock Lake Sanitary District.

(b) Pleasant Homes Subdivision (2 town systems included in Kenosha total).

(c) Incorporated in 1960.

Table 5A

KENOSHA COUNTY - WATER UTILITIES

Location	Name of Agency	Communities Served	Area Served Sq. Mi.	Public Private	Date of Original Construc.	Per Cent Metered	Effective Storage	Source of Supply	Treatment Provided	Estimated Normal Capacity of Supply M. G. D.	Present Average Consump. M. G. D.	Present Maximum Day Demand M. G. D.	Present Ind'l. Average Use M. G. D.	Present Ave. Con. Excluding Ind'l. M. G. D.	Est. Pop. Pres. Served	Average Per Capita Use Total G. P. D.	Average Per Capita Use Exclud. Ind'l. Use G. P. D.	Computed Excess Capacity of Supply Based on Present Use M. G. D.	Computed Excess Capacity of Supply Based on Present Use Persons
Kenosha	Kenosha Water Department	City of Kenosha, Part of Town of Somers	11.51	Public	1880	100%	5.40	Lake Michigan	Filtration Chlorine	20.0	12.27	22.76	4.62	7.65	75,000	164	102	0	0

Table 5B

KENOSHA COUNTY - SANITARY SEWERAGE UTILITIES

Location	Name of Agency	Communities Served	Area Served Sq. Mi.	Treatment Provided	Disposal of Effluent	Date of Original Construction	Capacity of Plant M. G. D.	Capacity of Plant Population	Present Ave. Flow--M. G. D.	Est. Pop. Presently Served	Ave. Per Cap. Flow G. P. D.	Total Equiv. Pop. Pres. Served	Excess Capacity of Plant M. G. D.	Excess Capacity of Plant Population
Kenosha	City of Kenosha	City of Kenosha and Part of Town of Pleasant Prairie	11.36	Primary and Chlorination	Lake Michigan	1941	10.00	60,000	14.46	75,000	193	75,500	0	0
Paddock Lake	Paddock Lake Dells S. D.	Part of Paddock Lake	0.21	Activated Sludge	Brighton Creek	1958	0.16	1,600	--	50	50	50	0.30	1,550
Twin Lakes	Village of Twin Lakes	Village of Twin Lakes	0.90	Trickling Filter	Bassett Creek	1957	0.32	3,200	--	3,000	--	3,000	--	200
Pleasant Prairie	Town of Pleas. Prairie San. Dist. #1	Pleasant Homes Subdivision	0.12	Activated Sludge and Sand Filters and Lagoon	Creek to Lake Michigan	1960	0.06	600	--	450	--	450	--	150
TOTALS	--	--	12.59	--	--	--	10.54	65,400	14.46	78,500	--	79,000	0.30	1,900

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Table 6

MILWAUKEE COUNTY - UTILITY CUSTOMER SERVICE

Location	1960 Population	Number of Utility Customers			Sanitary Sewerage
		Electric	Gas	Public Water	Est. Population Served
Milwaukee County	1,036,047	337,042	281,121	200,376	1,028,970
Cities					
Cudahy	17,975	5,963	4,229	3,854	(c)
Franklin	10,006	2,620	398	None	400(d)
Glendale	9,537	3,766	2,811	None	(c)
Greenfield	17,636	5,090	2,609	(a)	(c)
Milwaukee	741,324	242,733	212,925	151,857(a)	991,000(c)
Oak Creek	9,372	2,563	626	51	1,870(e)
St. Francis	10,065	2,730	2,067	(a)	(c)
South Milwaukee	20,307	6,348	3,628	4,858	21,000(f)
Wauwatosa	56,923	17,914	14,377	10,607	(c)
West Allis	68,157	22,696	18,522	15,485	(c)
Villages					
Bayside	3,078	1,051	725	None	(c)
Brown Deer	11,280	2,537	2,035	2,100	(c)
Fox Point	7,315	2,229	1,767	2,157	(c)
Greendale	6,843	2,689	1,861	1,071	9,700(e)
Hales Corners	5,549	1,817	668	None	5,000(e)
River Hills	1,257	383	199	None	(c)
Shorewood	15,990	6,230	5,323	3,579	(c)
West Milwaukee	5,043	2,117	1,754	(a)	(c)
Whitefish Bay	18,390	5,566	4,597	4,757	(c)
Towns					
None					
Other					
North Shore Water Utility		--	--	None(b)	

(a) Greenfield, St. Francis and West Milwaukee have Milwaukee retail service and are included in Milwaukee total.

(b) North Shore Water Utility commenced operating in 1963, and it will serve all customers shown for the Villages of Fox Point and Whitefish Bay and an estimated 2,500+ customers in the City of Glendale.

(c) Included in Milwaukee total.

(d) Operated by Franklin SD #1; area served is within Metropolitan District.

(e) Operated by Milwaukee Sewerage Commission.

(f) Not part of Metropolitan District.

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Table 6A

MILWAUKEE COUNTY - WATER UTILITIES

Location	Name of Agency	Communities Served	Area Served Sq. Mi.	Public Private	Date of Original Construc.	Per Cent Metered	Effective Storage	Source of Supply	Treatment Provided	Estimated Normal Capacity of Supply M. G. D.	Present Average Consump. M. G. D.	Present Maximum Day Demand M. G. D.	Present Ind'l. Average Use M. G. D.	Present Ave. Con. Excluding Ind'l. M. G. D.	Est. Pop. Pres. Served	Average Per Capita Use Total G. P. D.	Average Per Capita Use Exclud. Ind'l. Use G. P. D.	Computed Excess Capacity of Supply Based on Present Use M. G. D.	Computed Excess Capacity of Supply Based on Present Use Persons
Cudahy	Cudahy Water Department	City of Cudahy	3.79	Public	1890	100%	2.50	Lake Michigan	Filtration Chlorine	3.00	3.00	3.56	1.40	1.60	18,000	167	89	0	0
Glendale	Glendale Water Utility	City of Glendale	--	Public	1963	100%	1.00	North Shore Water Util.	--	--	-	--	--	--	--	--	--	--	--
Milwaukee	Milwaukee Water Works	(a)	103.32	Public		100%	106.27	Lake Michigan	Filtration Chlorine Fluoride	300.00	151.83	271.90	68.27	83.56	775,000	196	108	28.10	131,000
Oak Creek	Oak Creek Sewer & Water Utility	Part of City of Oak Creek	0.47	Public	1958	100%	1.00	2 Wells	Chlorine	2.00	0.47	0.80	0.41	0.06	200	Not Applicable		1.20	6,000
South Milwaukee	South Milwaukee Water Department	City of South Milwaukee	4.33	Public	1893	100%	3.20	Lake Michigan	Filtration Chlorine	4.50(c)	3.80	5.51	2.50	1.30	21,600	176	60	0	0
Wauwatosa	Wauwatosa Water Department	City of Wauwatosa	--	Public		100%	5.50	City of Milwaukee	Chlorine	--	4.00	9.33	0.18	3.82	42,000	96	91	--	--
West Allis	West Allis Water Department	City of West Allis	--	Public		100%	5.00	City of Milwaukee	Chlorine	--	8.47	8.62	3.24	5.23	68,000	125	77	--	--
Brown Deer	Brown Deer Public Utility	Village of Brown Deer	2.82	Public	1957	100%	0.14	15 Wells	None	4.30	0.68	1.86	0.01	0.67	8,000	85	84	2.44	14,500
Fox Point	Water Utility of Vill. of Fox Point	Village of Fox Point	--	Public		100%	1.50	City of Milwaukee	None	--	1.02	3.00	0	1.02	7,500	136	136	--	--
Greendale	Greendale Mun. Utility	Village of Greendale	2.07	Public	1936	100%	0.50	2 Wells	Softening Chlorine	1.90	0.69	1.67	0	0.69	10,000	69	69	0.23	1,600
Shorewood	Shorewood Mun. Water Department	Village of Shorewood	--	Public		100%	0	City of Milwaukee	None	--	1.70	--	0	1.70	16,000	106	106	--	--
Whitefish Bay	Whitefish Bay Water Utility	Village of Whitefish Bay	--	Public		100%	1.00	City of Milwaukee	None	--	2.08	--	0	2.08	18,500	113	113	--	--
Glendale	North Shore Water Utility	(b)	10.60	Public	1963	100%	4.50	Lake Michigan	Filtration Chlorine Fluoride	12.00	No 1962 Consump.	--	--	--	--	--	--	12.00	46,000
Totals	--	--	127.40	--	--	--	132.11	--	--	327.70	177.74	--	76.01	101.73	984,800	--	--	43.97	199,100

(a) Retail service to Milwaukee, Greenfield, St. Francis and West Milwaukee. Wholesale service to Shorewood, Wauwatosa and West Allis. Probable wholesale service to Greendale in 1964. Served Fox Point and Whitefish Bay in 1962, service discontinued in 1963.

(b) Service to City of Glendale, Villages of Fox Point and Whitefish Bay commenced in 1963. Present Glendale population of 10,400 will be added to those shown in table for Fox Point and Whitefish Bay.

(c) Presently constructing 3.5 M. G. D. addition.

Table 6B

MILWAUKEE COUNTY - SANITARY SEWERAGE UTILITIES

Location	Name of Agency	Communities Served	Area Served Sq. Mi.	Treatment Provided	Disposal of Effluent	Date of Original Construction	Capacity of Plant M. G. D.	Capacity of Plant Population	Present Ave. Flow--M. G. D.	Est. Pop. Presently Served	Ave. Per Cap. Flow G. P. D.	Total Equiv. Pop. Pres. Served	Excess Capacity of Plant M. G. D.	Excess Capacity of Plant Population
Jones Island Milwaukee	Sew. Com. of City of Milwaukee	17(a)	130.00	Activated Sludge	Lake Michigan	1925	200.00	2,446,000	172.32	991,000	173.9	2,460,000	27.68	0
Puetz Road Oak Creek	Sew. Com. of City of Milwaukee			Primary and Chlorination (Under Con.)	Lake Michigan	1962--1964	60.00	300,000	0	0	--	--	60.00	300,000
South Milwaukee	City of S. Milwaukee	South Milwaukee	3.80	Primary and Chlorination	Lake Michigan	1937	3.00	22,000	3.00	21,000	143.0	42,000	0	0
Greendale	Sew. Com. of City of Milwaukee	Greendale	1.90	Activated Sludge	Root River	1936	0.40	4,000	0.63	9,700	65.0	9,700	0	0
Hales Corners	Sew. Com. of City of Milwaukee	Hales Corners	3.00	Trickling Filter	Root River	1941	0.90	8,000	0.55	5,000	110.0	5,000	0.35	3,000
(Drexel) Oak Creek	Sew. Com. of City of Milwaukee	Part of Oak Creek	0.40	Stabilization Pond	Oak Creek	1957	0.30	3,000	0.24	200	Not Applicable	2,260	0.06	740
(Oakview) Oak Creek	City of Oak Creek	Part of Oak Creek	0.10	Stabilization Pond	Ditch	1955	0.03	350	No Meter	320	--	320	--	30
(New Deal) Oak Creek	Sew. Com. of City of Milwaukee	Part of Oak Creek	0.42	Primary and Chlorination	Lake Michigan	1939	0.20	1,500	0.11	1,350	82.0	1,350	0.09	150
Franklin	City of Franklin S. D. #1	Part of Franklin	0.10	Trickling Filter	Ditch	1954	0.04	400	No Meter	400	--	400	0	0
TOTALS	--	--	139.72	--	--	--	264.87	2,785,250	176.85	1,028,970	--	2,521,030	88.18	303,920

(a) In Milwaukee County--Cities of Cudahy, Glendale, Greenfield, Milwaukee, St. Francis, Wauwatosa and West Allis, and the Villages of Bayside, Brown Deer, Fox Point, River Hills, Shorewood, West Milwaukee and Whitefish Bay. In Waukesha County--Part of Cities of Brookfield and New Berlin, and the Village of Elm Grove.

Table 7

OZAUKEE COUNTY - UTILITY CUSTOMER SERVICE

Location	1960 Population	Number of Utility Customers			Sanitary Sewerage
		Electric	Gas	Public Water	Est. Population Served
Ozaukee County	38,441	12,343	4,969	4,786	20,580
Cities					
Cedarburg	5,191	1,426	923	1,419	5,100
Mequon	8,543	2,776	994	None	None
Port Washington	5,984	2,265	1,286	1,930	6,700
Villages					
Bayside	103	(a)	(a)	(a)	(a)
Belgium	643	229	None	None	650
Fredonia	710	252	None	223	720
Grafton	3,748	1,123	726	974	3,860
Saukville	1,038	349	186	240	800
Thiensville	2,507	901	549	None	2,750
Towns					
Belgium	1,646	544	None	None	None
Cedarburg	2,248	527	98	None	None
Fredonia	1,475	436	None	None	None
Grafton	1,996	677	147	None	None
Port Washington	1,303	399	51	None	None
Saukville	1,306	439	9	None	None

(a) Included under Bayside, Milwaukee County.

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Table 7A

OZAUKEE COUNTY - WATER UTILITIES

Location	Name of Agency	Communities Served	Area Served Sq. Mi.	Public or Private	Date of Original Construc.	Per Cent Metered	Effective Storage	Source of Supply	Treatment Provided	Estimated Normal Capacity of Supply M. G. D.	Present Average Consump. M. G. D.	Present Maximum Day Demand M. G. D.	Present Ind'l. Average Use M. G. D.	Present Ave. Con. Excluding Ind'l. M. G. D.	Est. Pop. Pres. Served	Average Per Capita Use Total G. P. D.	Average Per Capita Use Exclud. Ind'l. Use G. P. D.	Computed Excess Capacity of Supply Based on Present Use M. G. D.	Computed Excess Capacity of Supply Based on Present Use Persons
Cedarburg	Cedarburg Light and Water Commission	City of Cedarburg	1.84	Public	1914	100%	0.42	3 Wells	Chlorine Fluoride	2.50	0.92	1.58	0.36	0.56	5,200	177	108	0.92	4,200
Port Washington	Pt. Washington Municipal Water Utility	City of Pt. Washington	1.91	Public	1906	100%	0.40	Lake Michigan	Filtration Chlorination	1.50	0.82	1.57	0.08	0.74	6,700	122	110	0	0
Fredonia	Fredonia Mun. Water & Sewer Utility	Village of Fredonia	0.34	Public	1938	100%	0.12	1 Well	None	0.29	0.06	0.16	0.01	0.05	750	80	67	0.13	900
Grafton	Grafton Sewer & Water Department	Village of Grafton	1.00	Public	1928	100%	0.20	3 Wells	None	1.87	0.63	1.07	0.20	0.43	3,860	163	111	0.80	3,600
Saukville	Saukville Mun. Water & Sewer Utility	Village of Saukville	0.21	Public	1942	100%	0.06	2 Wells	None	0.64	0.18	0.36	0.05	0.13	800	225	162	0.28	800
Totals	--	--	5.30	--	--	--	1.20	--	--	6.80	2.61	--	0.70	1.91	17,310	--	--	2.13	9,500

Table 7B

OZAUKEE COUNTY - SANITARY SEWERAGE UTILITIES

Location	Name of Agency	Communities Served	Area Served Sq. Mi.	Treatment Provided	Disposal of Effluent	Date of Original Construction	Capacity of Plant M. G. D.	Capacity of Plant Population	Present Ave. Flow--M. G. D.	Est. Pop. Presently Served	Ave. Per Cap. Flow G. P. D.	Total Equiv. Pop. Pres. Served	Excess Capacity of Plant M. G. D.	Excess Capacity of Plant Population
Cedarburg	City of Cedarburg	City of Cedarburg	1.84	Activated Sludge	Cedar Creek	1927	1.00	10,000	0.60	5,100	117	5,100	0.40	4,900
Mequon	City of Mequon	Part of Mequon	0.10	Activated Sludge	Milwaukee River	Proposed for 1963 Construction	0.04	375	None	None	None	None	0.04	375
Mequon	City of Mequon	Part of Mequon	0.30	Activated Sludge	Milwaukee River	Proposed for 1963 Construction	0.04	375	None	None	None	None	0.04	375
Port Washington	City of Pt. Washington	City of Pt. Washington	1.84	Primary and Chlorination	Lake Michigan	1955	1.00	10,000	0.78	6,700	116	6,700	0.22	3,300
Belgium	Village of Belgium	Village of Belgium	0.20	Activated Sludge	Sheboygan River	1956	0.10	1,200	0.04	650	62	1,000	0.06	200
Fredonia	Fredonia Mun. Sewer & Water Utility	Village of Fredonia	0.40	Activated Sludge	Milwaukee River	1940	0.08	3,000	0.06	720	83	800	0.02	2,200
Grafton	Grafton Sew. & Water Dept.	Village of Grafton	1.00	Activated Sludge	Milwaukee River	1930	1.00	10,000	0.24	3,860	66	3,860	0.76	6,140
Saukville	Saukville Mun. Sewer & Water Utility	Village of Saukville	0.23	High Rate Filter	Milwaukee River	1942	0.32	1,600	0.18	800	220	1,200	0.14	400
Thiensville	Village of Thiensville	Village of Thiensville	0.87	Activated Sludge	Milwaukee River	1951	0.24	3,000	0.22	2,750	80	2,750	0.02	250
TOTALS	--	--	6.78	--	--	--	3.82	39,550	2.12	20,580	--	21,410	1.70	18,140

Table 8

RACINE COUNTY - UTILITY CUSTOMER SERVICE

Location	1960 Population	Number of Utility Customers: Electric	Gas	Public Water	Sanitary Sewerage Est. Population Served
Racine County	141,781	48,713	31,716	29,373	109,900
Cities					
Burlington	5,856	2,283	1,537	1,848	6,100
Racine	89,144	30,190	25,675	24,751	93,000
Villages					
Elmwood Park	(e)	130	73	(a)	None
North Bay	264	111	58	(a)	(a)
Rochester	413	152	60	None	None
Sturtevant	1,488	526	328	402	1,500
Union Grove	1,970	664	413	626	2,100
Waterford	1,500	590	201	462	1,500
Wind Point	463	221	56	None	None
Towns					
Burlington	3,765	1,814	839	None	None
Caledonia	9,696	3,109	805	844(b)	5,700
Dover	3,503	784	157	None	None
Mt. Pleasant	12,358	3,528	1,001	400(c)	(a)
Norway	3,341	1,380	382	40(d)	None
Raymond	2,344	769	None		None
Rochester	919	367	14	None	None
Waterford	2,681	1,409	32	None	None
Yorkville	2,076	686	85	None	None

(a) Included in City of Racine customers.

(b) North Park Sanitary District; Crestview Sanitary District; Caddy Vista Sanitary District.

(c) South Lawn Sanitary District.

(d) North Cape Sanitary District.

(e) Incorporated in 1960.

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Table 8A

RACINE COUNTY - WATER UTILITIES

Location	Name of Agency	Communities Served	Area Served Sq. Mi.	Public or Private	Date of Original Construc.	Per Cent Metered	Effective Storage	Source of Supply	Treatment Provided	Estimated Normal Capacity of Supply M. G. D.	Present Average Consump. M. G. D.	Present Maximum Day Demand M. G. D.	Present Ind'l. Average Use M. G. D.	Present Ave. Con. Excluding Ind'l. M. G. D.	Est. Pop. Pres. Served	Average Per Capita Use Total G. P. D.	Average Per Capita Use Exclud. Ind'l. Use G. P. D.	Computed Excess Capacity of Supply Based on Present Use M. G. D.	Computed Excess Capacity of Supply Based on Present Use Persons
Burlington	Burlington Mun. Water Works	City of Burlington	1.67	Public	1889	100%	0.46	3 Wells	None	4.21	0.75	1.57	0.17	0.58	6,100	123	95	2.64	13,900
Racine	Racine (a) Water Department	5(b)	13.50	Public	1886	100%	11.00	Lake Michigan	Filtration Chlorine	40.00	14.58	25.63	5.98	8.60	100,000	146	86	13.00	86,000
Sturtevant (a)	Sturtevant Water & Sewer Ut. Comm.	Village of Sturtevant	0.40	Public	1926	100%	0.13	1 Well	Softening	0.60	0.12	0.19	0	0.12	1,500	82	82	0.41	2,500
Union Grove	Union Grove Water Department	Village of Union Grove	0.40	Public	1928	100%	0.12	3 Wells	Chlorine	1.14	0.25	0.46	0.08	0.17	2,100	119	83	0.68	4,100
Waterford	Waterford Mun. Water Utility	Village of Waterford	0.50	Public	1932	100%	0.03	2 Wells	None	0.60	0.13	0.27	0	0.13	1,520	87	87	0.33	1,900
Town of Caledonia	Caddy Vista Sanitary District	Part of Town of Caledonia	0.20	Public	1955	0	0	1 Well	None	0.78	0.07	0.55	0	0.07	1,070	67	67	0.23	1,700
Town of Caledonia	Crestview Sanitary District	Part of Town of Caledonia	0.33	Public	1957	0	0	1 Well	None	0.65	0.06	0.23	0	0.06	1,170	48	48	0.42	4,300
Towns of Norway & Raymond	North Cape Sanitary District	Part of Towns of Norway and Raymond	0.09	Public	1955	0	0	1 Well	None	0.07	--	--	--	--	130	--	--	--	--
Totals	--	--	17.09	--	--	--	11.74	--	--	8.05	15.96	--	6.23	9.78	113,590	--	--	17.71	114,400

(a) Villages of North Bay and Elmwood Park plus Colonial Heights Subdivision are served retail. North Park Sanitary District and South Lawn Sanitary District are served wholesale. Sturtevant will be added wholesale in 1963.

(b) City of Racine, Village of Elmwood Park, Village of North Bay, part of Town of Caledonia, and part of Town of Mt. Pleasant.

Table 8B

RACINE COUNTY - SANITARY SEWERAGE UTILITIES

Location	Name of Agency	Communities Served	Area Served Sq. Mi.	Treatment Provided	Disposal of Effluent	Date of Original Construction	Capacity of Plant M. G. D.	Capacity of Plant Population	Present Ave. Flow--M. G. D.	Est. Pop. Presently Served	Ave. Per Cap. Flow G. P. D.	Total Equiv. Pop. Pres. Served	Excess Capacity of Plant M. G. D.	Excess Capacity of Plant Population
Burlington	City of Burlington	City of Burlington	1.68	Trickling Filter	Fox River	1935	1.00	6,000	1.10	6,100	180	6,100	0	0
Racine	City of Racine	3(a)	15.20	Primary and Chlorination	Lake Michigan	1939	17.60	85,000	17.29	93,000	186	174,900	0.31	0
Sturtevant	Sturtevant Water and Sewer Utility Commission	Village of Sturtevant	0.70	Trickling Filter	Pike River	1959	0.30	3,000	0.10	1,500	67	1,500	0.20	1,500
Union Grove	Village of Union Grove	Village of Union Grove	0.55	Activated Sludge	Root River	1937	0.30	3,000	0.25	2,100	119	2,100	0.05	900
Waterford	Village of Waterford	Village of Waterford	0.46	Primary	Fox River	1932	0.06	1,000	--	1,500	--	1,500	--	0
Caledonia	Caddy Vista Sanitary Dist.	Caddy Vista Subdivision	0.20	Trickling Filter	Root River	1956	0.20	2,000	0.07	1,100	64	1,100	0.13	900
Caledonia	North Park Sanitary Dist.	3(b)	1.64	Trickling Filter	Creek to Lake Michigan	1953	0.41	4,000	--	4,600	--	4,600	--	0
TOTALS	--	--	20.43	--	--	--	19.87	104,000	18.81	109,900	--	191,800	0.69	3,300

(a) City of Racine, Village of North Bay, Town of Mt. Pleasant.

(b) North Park Sanitary District, Crestview Sanitary District, Village of Wind Point.

Table 9

WALWORTH COUNTY - UTILITY CUSTOMER SERVICE

Location	1960 Population	Number of Utility Customers			Sanitary Sewerage Est. Population Served
		Electric	Gas	Public Water	
Walworth County	52,368	28,673	11,611	9,447	27,980
Cities					
Delavan	4,846	2,167	1,301	1,446	5,000
Elkhorn	3,586	1,577	759	1,246	4,000
Lake Geneva	4,929	2,564	1,507	1,728	4,350
Whitewater	6,380	2,016	1,134	1,664	6,500
Villages					
Darien	805	394	178	None	None
East Troy	1,455	579	209	491	1,500
Fontana	1,326	1,137	776	639	1,500
Genoa City	1,005	532	233	297	1,050
Sharon	1,167	564	173	373	1,180
Walworth	1,494	787	358	567	1,400
Williams Bay	1,347	1,235	851	971	1,500
Towns					
Bloomfield	2,154	1,946	815	None	None
Darien	1,119	449	21	None	None
Delavan	3,138	2,637	1,656	None	None
East Troy	2,247	1,180	74	None	None
Geneva	2,253	1,629	574	None	None
Lafayette	899	296	1	None	None
La Grange	1,087	862	None	None	None
Linn	1,620	1,927	735	None	None
Lyons	1,878	706	192	None	None
Richmond	935	527	None	None	None
Sharon	1,030	387	8	None	None
Spring Prairie	1,164	411	None	None	None
Sugar Creek	1,532	702	4	None	None
Troy	1,060	490	None	25(a)	None
Walworth	1,064	527	45	None	None
Whitewater	848	445	7	None	None

(a) Sanitary District No. 1 — Town of Troy

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Table 9A

WALWORTH COUNTY - WATER UTILITIES

Location	Name of Agency	Communities Served	Area Served Sq. Mi.	Public or Private	Date of Original Construc.	Per Cent Metered	Effective Storage	Source of Supply	Treatment Provided	Estimated Normal Capacity of Supply M. G. D.	Present Average Consump. M. G. D.	Present Maximum Day Demand M. G. D.	Present Ind'l. Average Use M. G. D.	Present Ave. Con. Excluding Ind'l. M. G. D.	Est. Pop. Pres. Served	Average Per Capita Use Total G. P. D.	Average Per Capita Use Exclud. Ind'l. Use G. P. D.	Computed Excess Capacity of Supply Based on Present Use M. G. D.	Computed Excess Capacity of Supply Based on Present Use Persons
Delavan	Delavan Water & Sewage Comm.	City of Delavan	2.24	Public	1893	100%	0.15	3 Wells	Chlorine	1.78	0.59	1.10	0.04	0.55	5,070	116	108	0.60	2,800
Elkhorn	Elkhorn Light & Water Comm.	City of Elkhorn	1.50	Public	1898	100%	0.46	3 Wells	Lime Softening Chlorine	2.28	0.38	0.69	0.08	0.30	4,000	95	75	1.52	10,000
Lake Geneva	Lake Geneva Water Department	City of Lake Geneva	1.87	Public	1890	100%	0.32	3 Wells	None	3.29	0.59	1.25	0	0.59	5,100	116	116	2.04	8,800
Whitewater	Whitewater Mun. Water Department	City of Whitewater	1.71	Public	1912	100%	1.04	3 Wells	Softening Chlorine	2.93	0.67	1.02	0.07	0.60	6,400	105	94	1.59	8,500
East Troy	East Troy Mun. Water Utility	Village of East Troy	0.52	Public	1908	100%	0.07	3 Wells	None	0.88	0.23	0.50	0.06	0.17	1,500	153	113	0.38	1,700
Fontana	Fontana Water Utility	Village of Fontana on Geneva Lake	0.50	Public	1949	100%	0.10	2 Wells	None	1.21	0.10	0.30	0	0.10	1,400	72	72	0.91	6,300
Genoa City	Genoa City Mun. Water & Sewer Utility	Village of Genoa City	0.25	Public	1922	100%	0.12	1 Well	None	0.50	0.06	0.11	0.01	0.05	1,020	55	49	0.39	3,900
Sharon	Sharon Water Works & Sewer System	Village of Sharon	0.49	Public	1886	100%	0.08	2 Wells	Chlorine	1.03	0.08	0.20	0.02	0.06	1,200	67	55	0.83	7,500
Walworth	Walworth Water & Sewer Dept.	Village of Walworth	0.52	Public	1911	100%	0.05	2 Wells	None	0.81	0.20	0.34	0.06	0.14	1,500	133	93	0.47	2,500
Williams Bay	Williams Bay Water Department	Village of Williams Bay	0.95	Public	1931	100%	0.30	2 Wells	Softening Chlorine	2.16	0.31	0.77	0	0.31	1,500	206	206	1.39	3,400
Town of Troy	San. Dist. #1 Town of Troy	Part of Town of Troy	0.04	Public	1957	100%	0	1 Well	None	0.14	0.00	--	0	0.00	80	290	290	0.13	120
Totals	--	--	10.59	--	--	--	2.69	--	--	17.01	3.21	--	0.34	2.87	28,770	--	--	10.25	55,520

Table 9B

WALWORTH COUNTY - SANITARY SEWERAGE UTILITIES

Location	Name of Agency	Communities Served	Area Served Sq. Mi.	Treatment Provided	Disposal of Effluent	Date of Original Construction	Capacity of Plant M. G. D.	Capacity of Plant Population	Present Ave. Flow--M. G. D.	Est. Pop. Presently Served	Ave. Per Cap. Flow G. P. D.	Total Equiv. Pop. Pres. Served	Excess Capacity of Plant M. G. D.	Excess Capacity of Plant Population
Delavan	Delavan Water & Sew. Comm.	City of Delavan	2.24	High Rate Filter	Turtle Creek	1930	1.00	10,000	0.80	5,000	160	5,000	0.20	5,000
Elkhorn	City of Elkhorn	City of Elkhorn	1.56	High Rate Filter	Jackson Creek	1927	0.49	9,000	0.38	4,000	95	4,000	0.11	5,000
Lake Geneva*	City of Lake Geneva	City of Lake Geneva	1.30	Trickling Filter	White River	1930	0.48	3,840	0.59	4,350	135	6,528	0	0
Whitewater	City of Whitewater	City of Whitewater	1.47	High Rate Filter	Rock River	1930	0.60	20,300	1.05	6,500	162	42,300	0	0
East Troy	Village of East Troy	Village of East Troy	0.45	Trickling Filter	Honey Creek	1959	0.32	2,500	0.15	1,500	100	1,500	0.17	1,000
Fontana*	Village of Fontana	Village of Fontana	0.50	High Rate Filter	To Lagoons No Outlet	1957	0.40	4,000	0.15	1,500	102	3,000	0.25	1,000
Genoa City	Village of Genoa City	Village of Genoa City	0.18	Trickling Filter	Nippersink Creek	1922	0.12	1,200	0.10	1,050	95	1,050	0.02	150
Sharon	Village of Sharon	Village of Sharon	0.47	Trickling Filter	Turtle Creek	1959	0.16	1,560	0.10	1,180	85	1,180	0.05	380
Walworth	Walworth Water & Sew. Department	Village of Walworth	0.40	Trickling Filter	Piskesol Creek	1953	0.15	1,480	0.10	1,400	72	1,400	0.05	80
Williams Bay	Village of Williams Bay	Village of Williams Bay	0.90	Activated Sludge	To Lagoons No Outlet	1931	0.49	4,900	0.42	1,500	280	4,800	0.07	0
TOTALS	--	--	9.47	--	--	--	4.21	58,780	3.84	27,980	--	70,758	0.92	12,610

*Indicates plants with wide variation in residential population during the year.

Table 10

WASHINGTON COUNTY - UTILITY CUSTOMER SERVICE

Location	1960 Population	Number of Utility Customers			Sanitary Sewerage
		Electric	Gas	Public Water	Est. Population Served
Washington County	46,119	16,703	4,851	5,628	22,060
Cities					
Hartford	5,627	2,164	1,042	1,626	6,000
West Bend	11,538	4,186	2,401	3,269	12,000
Villages					
Germantown	622	233	167	None	850
Jackson	458	182	133	None	500
Kewaskum	1,572	555	144	463	1,570
Slinger	1,141	385	224	270	1,140
Towns					
Addison	2,072	599	None	--	--
Barton	1,204	394	12	--	--
Erin	1,133	416	None	--	--
Farmington	1,433	506	None	--	--
Germantown	3,984	1,211	281	--	--
Hartford	1,870	715	83	--	--
Jackson	1,576	508	74	--	--
Kewaskum	897	271	11	--	--
Polk	2,090	748	149	--	--
Richfield	3,172	1,224	--	--	--
Trenton	2,657	846	24	--	--
Wayne	1,081	297	--	--	--
West Bend	1,992	1,263	106	--	--

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Table 10A

WASHINGTON COUNTY - WATER UTILITIES

Location	Name of Agency	Communities Served	Area Served Sq. Mi.	Public or Private	Date of Original Construc.	Per Cent Metered	Effective Storage	Source of Supply	Treatment Provided	Estimated Normal Capacity of Supply M. G. D.	Present Average Consump. M. G. D.	Present Maximum Day Demand M. G. D.	Present Ind'l. Average Use M. G. D.	Present Ave. Con. Excluding Ind'l. M. G. D.	Est. Pop. Pres. Served	Average Per Capita Use Total G. P. D.	Average Per Capita Use Exclud. Ind'l. Use G. P. D.	Computed Excess Capacity of Supply Based on Present Use M. G. D.	Computed Excess Capacity of Supply Based on Present Use Persons
Hartford	Hartford Utilities Department	City of Hartford	1.46	Public	1907	100%	0.50	5 Wells	Fluoride Chlorine	2.27	0.86	1.70	0.41	0.45	5,900	146	76	0.57	3,700
West Bend	West Bend Water Department	City of West Bend	3.34	Public	1908	100%	0.66	5 Wells	Fluoride Chlorine	5.57	1.50	3.05	0.50	1.00	12,000	125	83	2.52	15,000
Kewaskum	Kewaskum Mun. Water Department	Village of Kewaskum	0.50	Public	1928	100%	0.23	2 Wells	Fluoride	1.38	0.53	1.08	0.36	0.17	1,600	331	106	0.30	1,400
Slinger	Village/Slinger Utilities	Village of Slinger	0.33	Public	1911	100%	0.06	4 Wells	None	1.34	0.16	0.36	0.11	0.05	1,150	137	41	0.98	9,800
Totals	--	--	5.63	--	--	--	1.45	--	--	10.56	3.05	--	1.38	1.67	20,650	--	--	4.37	15,900

Table 10B

WASHINGTON COUNTY - SANITARY SEWERAGE UTILITIES

Location	Name of Agency	Communities Served	Area Served Sq. Mi.	Treatment Provided	Disposal of Effluent	Date of Original Construction	Capacity of Plant M. G. D.	Capacity of Plant Population	Present Ave. Flow--M. G. D.	Est. Pop. Presently Served	Ave. Per Cap. Flow G. P. D.	Total Equiv. Pop. Pres. Served	Excess Capacity of Plant M. G. D.	Excess Capacity of Plant Population
Hartford	City of Hartford	Hartford	1.47	High Rate Filter	Rubicon River	1924	0.75	42,600	0.67	6,000	111	15,000	0.08	0
West Bend	City of West Bend	West Bend	3.20	Trickling Filter	Milwaukee River	1936	0.72	7,200	1.20	12,000	100	16,350	0	0
Germantown	Village of Germantown	Germantown	0.23	Trickling Filter	Menomonee River	1956	0.20	2,000	0.19	850	223	4,170	0.01	0
Jackson	Village of Jackson	Jackson	0.20	Trickling Filter	Cedar Creek		0.03	250	0.05	500	108	500	0	0
Kewaskum	Village of Kewaskum	Kewaskum	0.39	Activated Sludge	Milwaukee River		0.30	5,570	0.25	1,570	160	5,000	0.05	570
Slinger	Village of Slinger	Slinger	0.32	High Rate Filter	Rubicon River	1947	0.15	10,500	0.26	1,140	228	1,500	0	9,000
TOTALS	--	--	5.81	--	--	--	2.15	68,120	2.62	22,060	--	46,520	0.14	9,570

Table 11

WAUKESHA COUNTY - UTILITY CUSTOMER SERVICE

Location	1960 Population	Number of Utility Customers: Electric	Gas	Public Water	Sanitary Sewerage Est. Population Served
Waukesha County	158,249	55,581	20,812	15,322	70,600
Cities					
Brookfield	19,812	6,716	3,232	228	5,300
Delafield	2,334	861	170	None	None
New Berlin	15,788	4,998	755	None	0
Oconomowoc	6,682	2,685	1,188	2,104	7,500
Waukesha	30,004	9,814	6,621	7,841	32,150
Villages					
Big Bend	797	296	None	None	None
Butler	2,274	746	577	None	2,500
Chenequa	445	249	None	None	None
Dousman	410	151	None	None	700
Eagle	620	233	111	188	None
Elm Grove	4,994	1,549	914	None	5,100
Hartland	2,088	698	261	564	2,200
Lac La Belle	276	80	None	None	None
Lannon	1,084	280	65	None	None
Menomonee Falls	18,276	6,809	4,677	3,082	9,300
Merton	407	141	21	None	None
Mukwonago	1,877	713	284	604	1,950
Nashotah	321	300	29	None	None
North Prairie	489	191	None	None	None
Oconomowoc Lake	414	199	47	None	None
Pewaukee	2,484	823	335	711	2,800
Sussex	1,087	419	129	None	1,100
Wales	356	136	None	None	None
Towns					
Brookfield	1,990	609	305	--	--
Delafield	2,822	1,014	None	--	--
Eagle	1,103	502	6	--	--
Genesee	2,183	685	None	--	--
Lisbon	2,885	898	27	--	--
Merton	3,077	1,467	29	--	--
Mukwonago	1,579	627	61	--	--
Muskego	8,888	2,930	98	--	--
Oconomowoc	4,465	2,121	641	--	--
Ottawa	1,092	531	None	--	--
Pewaukee	5,797	1,901	79	--	--
Summit	3,472	1,436	28	--	--
Vernon	2,037	633	None	--	--
Waukesha	3,540	1,140	122	--	--

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Table 11A

WAUKESHA COUNTY - WATER UTILITIES

Location	Name of Agency	Communities Served	Area Served Sq. Mi.	Public or Private	Date of Original Construc.	Per Cent Metered	Effective Storage	Source of Supply	Treatment Provided	Estimated Normal Capacity of Supply M. G. D.	Present Average Consump. M. G. D.	Present Maximum Day Demand M. G. D.	Present Ind'l. Average Use M. G. D.	Present Ave. Con. Excluding Ind'l. M. G. D.	Est. Pop. Pres. Served	Average Per Capita Use		Computed Excess Capacity of Supply Based on Present Use	
																Total G. P. D.	Exclud. Ind'l. Use G. P. D.	M. G. D.	Persons
Brookfield	City/Brookfield Water Utility	City of Brookfield	0.30	Public	1947	100%	0.15	3 Wells	None	1.15	0.02	0.17	0	0.02	900	256	256	0.98	3,200
Oconomowoc	Oconomowoc Utilities	City of Oconomowoc	2.00	Public	1900	100%	0.55	3 Wells	Fluoride Chlorine	4.86	0.79	1.64	0.12	0.67	6,800	116	99	3.22	16,000
Waukesha	Waukesha Water Utility	City of Waukesha	6.70	Public	1887	100%	1.03	6 Wells	Chlorine	8.61	4.56	7.71	2.24	2.32	32,100	142	72	0.90	6,200
Eagle	Village/Eagle Utility	Village of Eagle	0.25	Public	1953	0	0.10	1 Well	None	0.17	0.03	0.12	0	0.03	650	46	46	0.05	500
Hartland	Hartland Mun. Water Department	Village of Hartland	0.75	Public	1933	100%	0.13	2 Wells	None	1.43	0.14	0.18	0	0.14	2,200	64	64	1.25	9,800
Menomonee Falls	Village/Men. Falls Water Utility	Village of Menomonee Falls	2.90	Public	1925	100%	1.41	4 Wells	Fluoride	4.38	0.94	1.68	0.14	0.80	11,200	84	72	2.70	18,800
Mukwonago	Mukwonago Water Utility	Village of Mukwonago	0.72	Public	1913	100%	0.21	2 Wells	Fluoride	0.76	0.15	0.30	0	0.15	2,000	75	75	0.46	3,100
Pewaukee	Pewaukee Mun. Water & Sewerage Utility	Village of Pewaukee	0.80	Public	1930	100%	0.22	2 Wells	Fluoride Chlorine	1.15	0.25	0.43	0.06	0.19	2,800	91	68	0.72	5,300
Town of Brookfield	Westbrooke San. Dist. #1	Part of Town of Brookfield	0.35	Public	1960	100%	0	2 Wells	None	0.60	0.03	--	0	0.03	340	88	88	0.54	3,000
Totals	--	--	14.77	--	--	--	3.80	--	--	23.11	6.91	--	2.56	4.35	58,990	--	--	10.82	65,900

Table 11B

WAUKESHA COUNTY - SANITARY SEWERAGE UTILITIES

Location	Name of Agency	Communities Served	Area Served Sq. Mi.	Treatment Provided	Disposal of Effluent	Date of Original Construction	Capacity of Plant M.G.D.	Capacity of Plant Population	Present Ave. Flow--M.G.D.	Est. Pop. Presently Served	Ave. Per Cap. Flow G.P.D.	Total Equiv. Pop. Pres. Served	Excess Capacity of Plant M.G.D.	Excess Capacity of Plant Population
Brookfield	City of Brookfield	Part of Brookfield	2.52	To Milwaukee	To Milwaukee	--	--	--	0.37	3,500	106	--	--	--
Brookfield	City of Brookfield	Part of Brookfield	2.94	Activated Sludge	Fox River	1961	1.00	10,000	0.20	1,500	133	1,500	0.80	8,500
Brookfield	City of Brookfield	Indianwood Subdivision	0.14	Activated Sludge	Dousman Ditch	1958	0.02	316	--	300	--	300	--	16
New Berlin	City of New Berlin	Part of New Berlin	0.86	To Milwaukee	To Milwaukee	1962	--	--	--	--	--	--	--	--
Oconomowoc	City of Oconomowoc	Oconomowoc	2.19	Trickling Filter	Oconomowoc River	1936	1.30	15,200	1.19	7,500	158	15,000	0.11	200
Waukesha	City of Waukesha	Waukesha	6.00	High Rate Filter	Fox River	1890	4.00	46,000	4.68	32,150	146	44,500	0	1,500
Butler	Village of Butler	Butler	0.47	Sep. Tank & Sand Filter	Menomonee River		0.05	800	--	2,500	--	--	--	0
Dousman	Village of Dousman	Dousman	0.36	Activated Sludge	Bark River	1960	0.12	1,200	0.04	700	57	700	0.08	500
Elm Grove	San. Dist. #1 and #2	Elm Grove	2.60	To Milwaukee	To Milwaukee	--	--	--	0.61	5,100	119	--	--	--
Hartland	Village of Hartland	Hartland	0.78	Activated Sludge	Bark River	1933	0.35	3,500	0.14	2,200	64	2,200	0.21	1,300
Menomonee Falls	Village of Menomonee Falls	Menomonee Falls	2.84	Tr. Filter & Contact Aeration	Menomonee River	1927	1.90	19,000	1.05	9,300	113	9,300	0.85	9,700
Mukwonago	Village of Mukwonago	Mukwonago	0.52	High Rate Filter	Mukwonago River		0.23	3,500	0.15	1,950	74	1,950	0.08	1,550
Pewaukee	Village of Pewaukee	Pewaukee	0.75	Trickling Filter	Pewaukee River	1930	0.30	3,000	0.23	2,800	80	2,800	0.07	200
Sussex	Village of Sussex	Sussex	0.71	Trickling Filter	Sussex Creek	1959	0.30	3,000	0.08	1,100	72	1,100	0.09	1,900
TOTALS	--	--	23.68	--	--	--	9.57	105,516	8.74	70,600	--	79,350	2.39	25,366

APPENDIX B

MAPS

The following maps present a graphic summary of utility data collected during the course of these inventory operations.

Each county is presented as follows:

The county base map shows corporate limits, major highways and major natural drainage courses and watershed boundaries.

Overlay maps with the suffix "A" indicate present electric authorized service areas together with gas service and authorized service areas.

Overlay maps with the suffix "B" indicate present public water service areas together with utility facilities, including wells and filtration plants.

Overlay maps with the suffix "C" indicate present sanitary sewerage service areas together with sewage treatment plant locations.

For more detailed information on these utility facilities, the large scale regional base map overlays or inventory systems maps should be consulted. Samples of these base map overlays are included herein as described above. Full sized reproductions of these maps at the scale of 1" = 2,000' can be obtained from SEWRPC for the cost of printing and handling.

For still more detailed information on these utility facilities, the large scale system plans collected for each city, village or sanitary district should be consulted. A sample (suffix "D") of a portion of such a system plan showing sanitary sewage facilities is included in this appendix.

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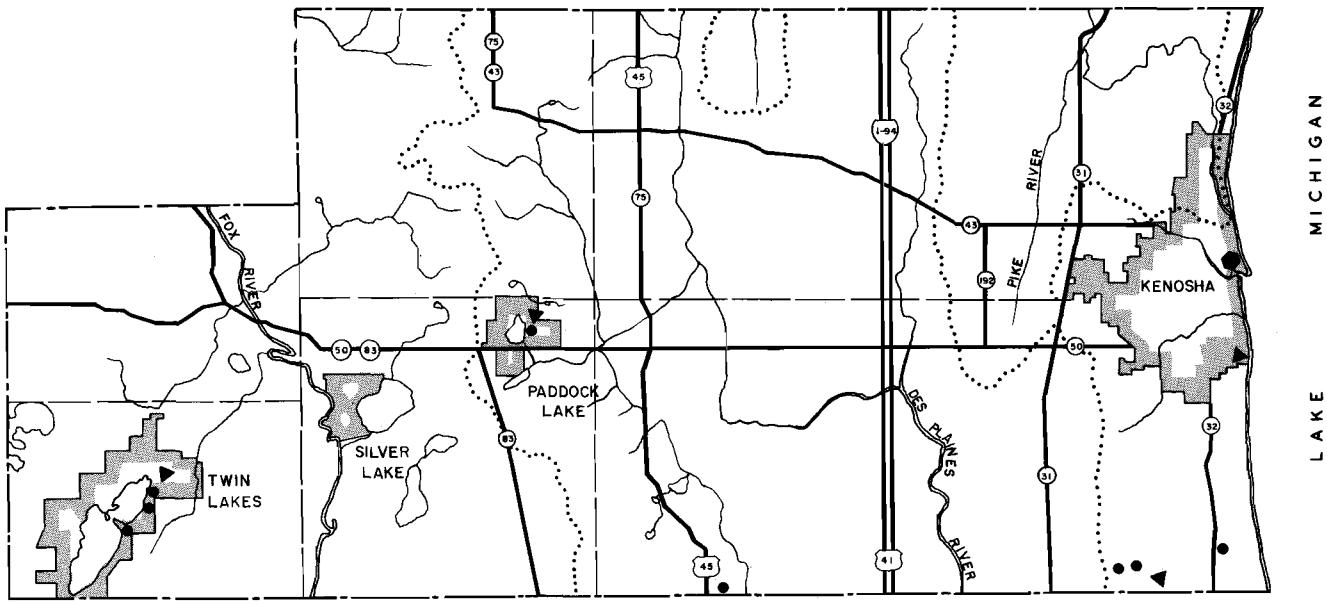
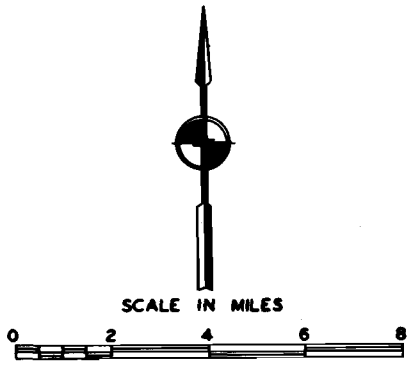
KENOSHA COUNTY





LEGEND

MAJOR WATERSHED BOUNDARY LINES

CORPORATE AREAS

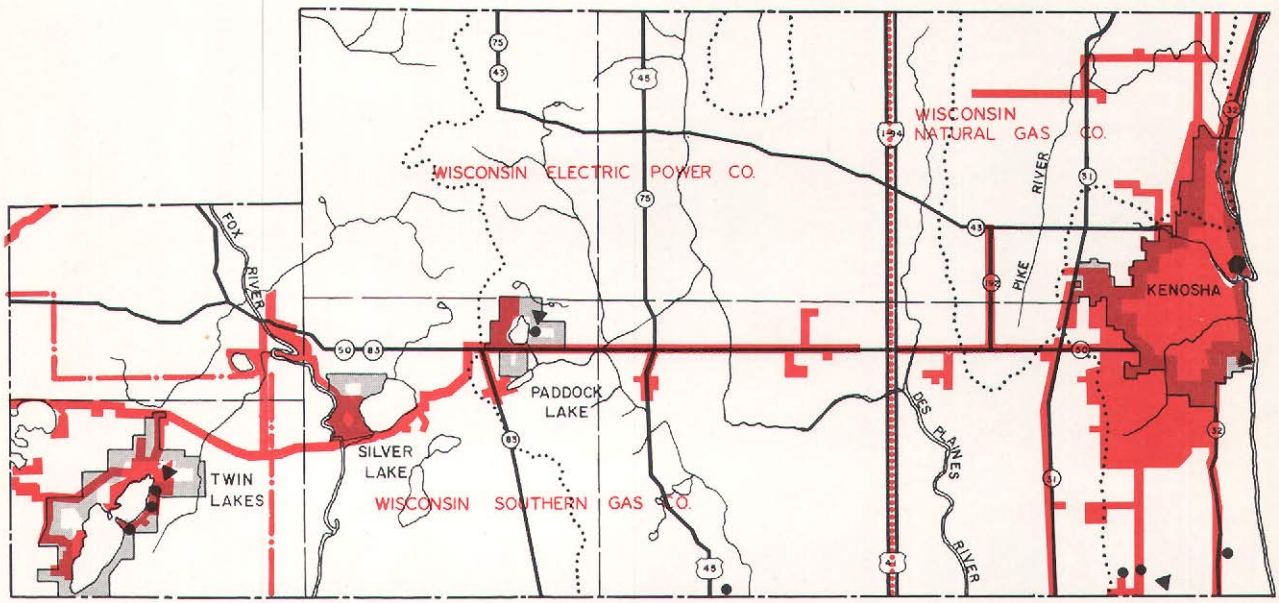
REGIONAL PUBLIC UTILITIES SURVEY

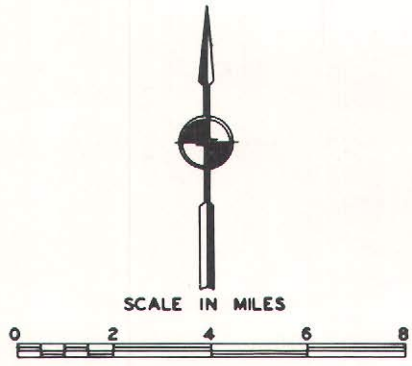
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 2

KENOSHA COUNTY





LEGEND

- MAJOR WATERSHED BOUNDARY LINES
- CORPORATE AREAS
- GAS SERVICE AREAS
- GAS FRANCHISE AREA LIMITS
- POWER FRANCHISE AREA LIMITS

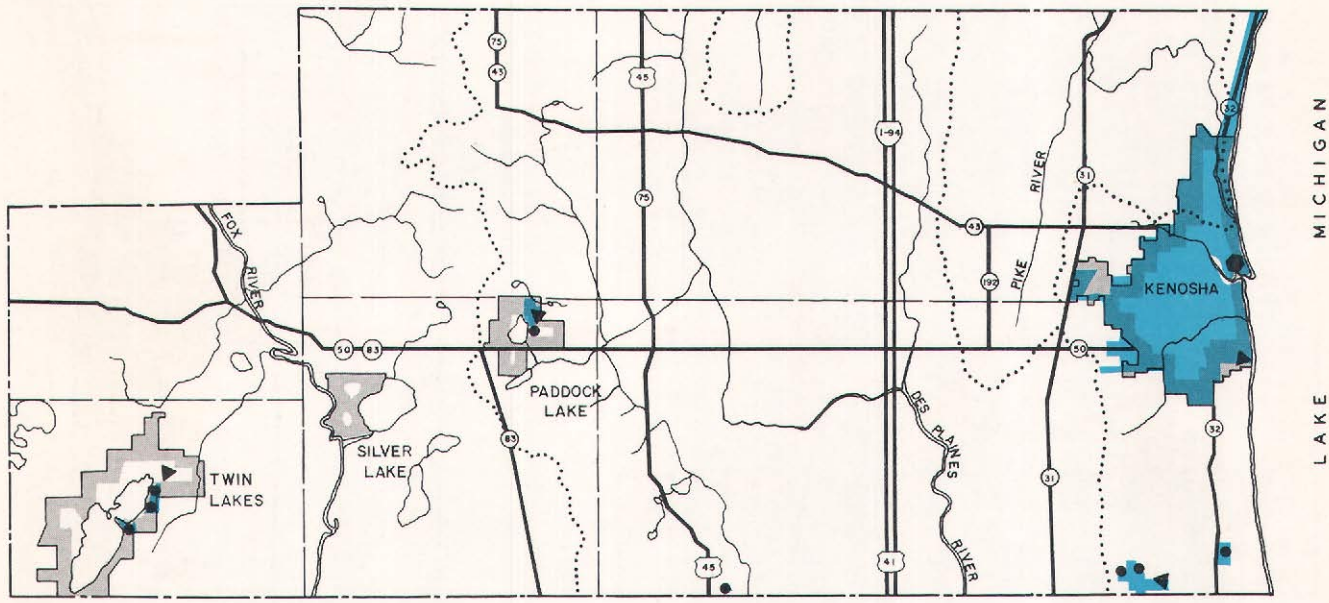
REGIONAL PUBLIC UTILITIES SURVEY

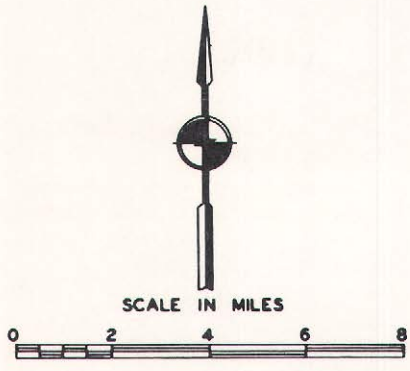
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE : JULY , 1963
MAP 2 A

KENOSHA COUNTY





LEGEND

MAJOR WATERSHED BOUNDARY LINES
CORPORATE AREAS

WATER SYSTEM SERVICE AREAS
WATER FILTRATION PLANT
WATER SYSTEM WELLS

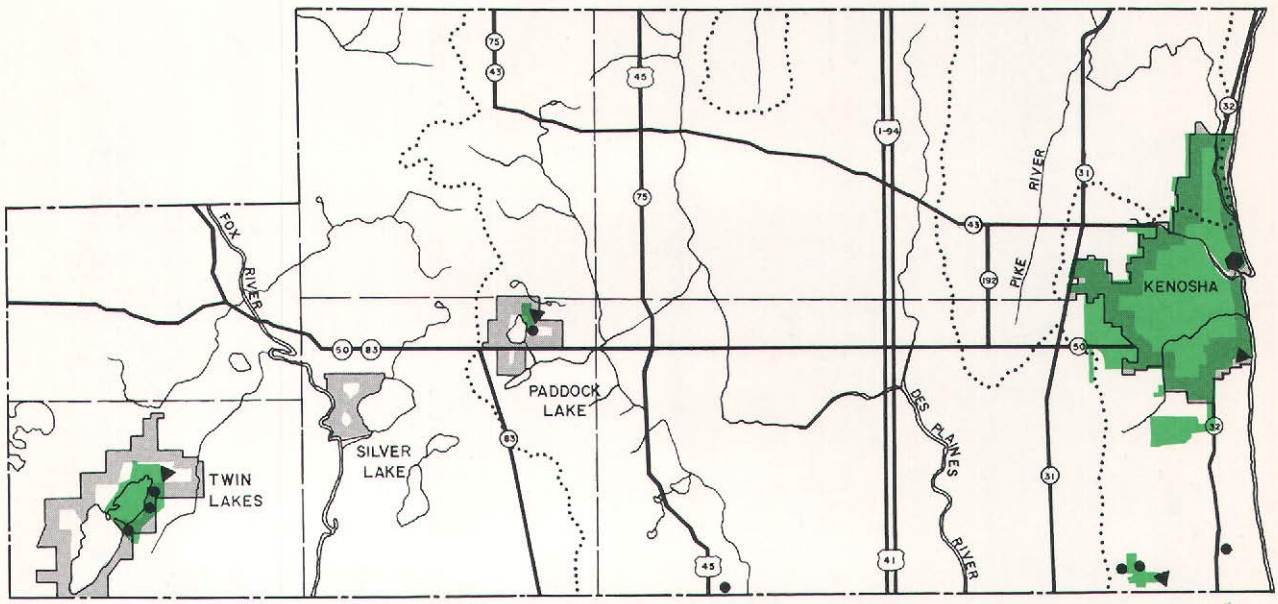
REGIONAL PUBLIC UTILITIES SURVEY

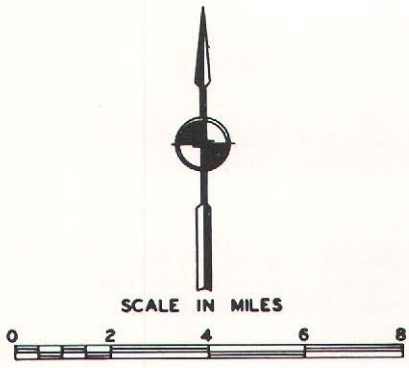
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 2 B

KENOSHA COUNTY





LEGEND

MAJOR WATERSHED BOUNDARY LINES
CORPORATE AREAS

SANITARY SEWER SERVICE AREAS
SEWAGE TREATMENT PLANT

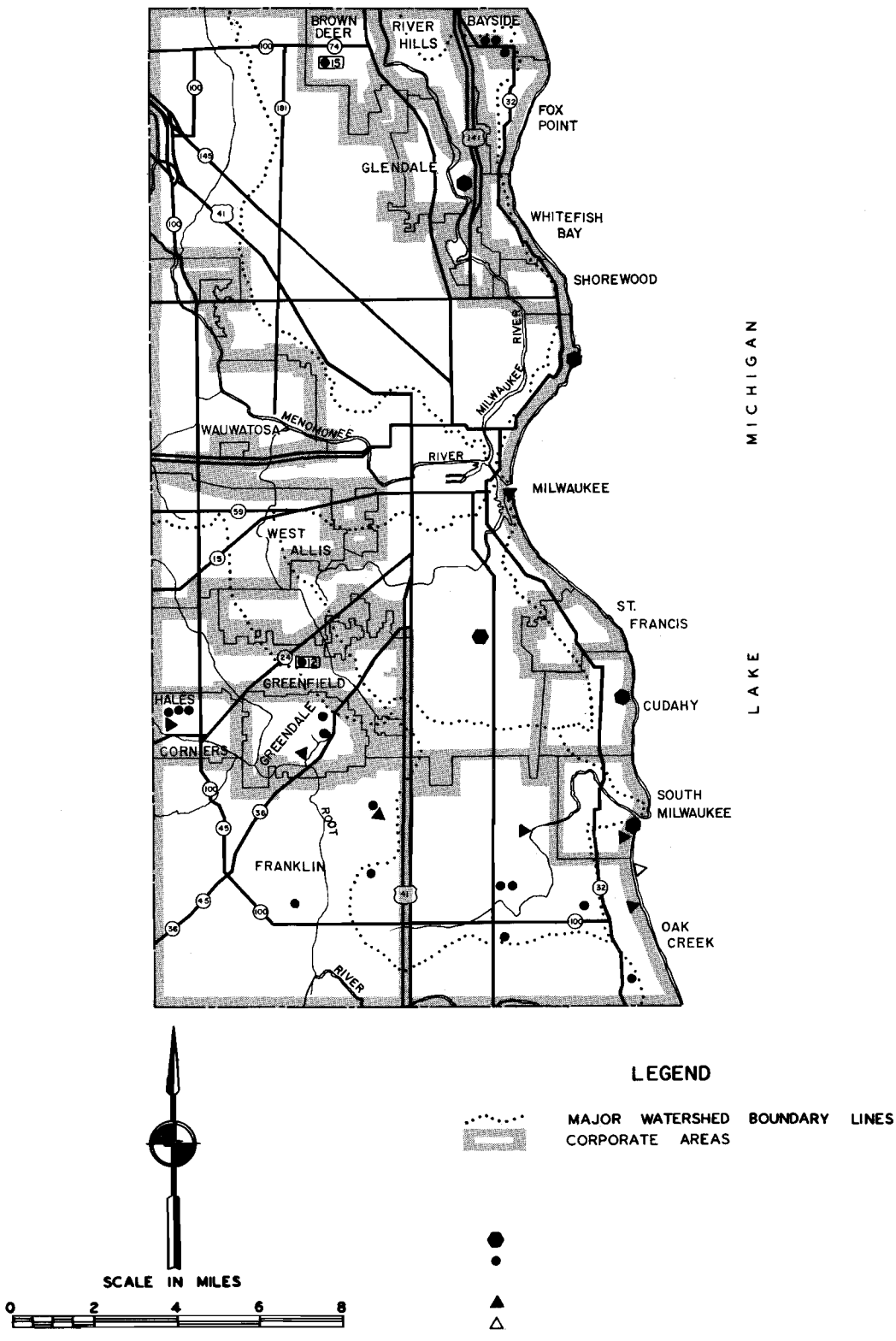
REGIONAL PUBLIC UTILITIES SURVEY

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 2C

MILWAUKEE COUNTY



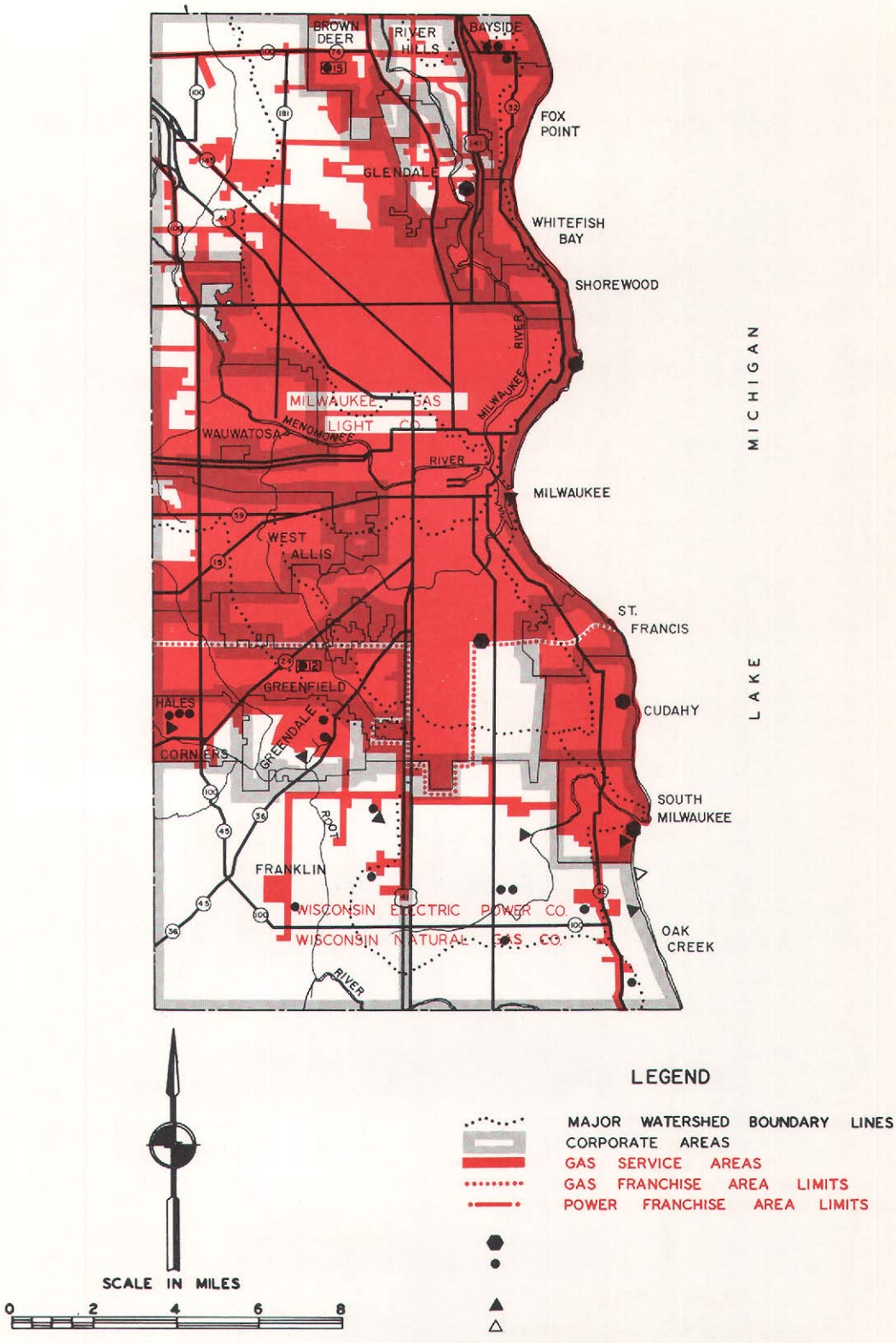
REGIONAL PUBLIC UTILITIES SURVEY

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 3

MILWAUKEE COUNTY



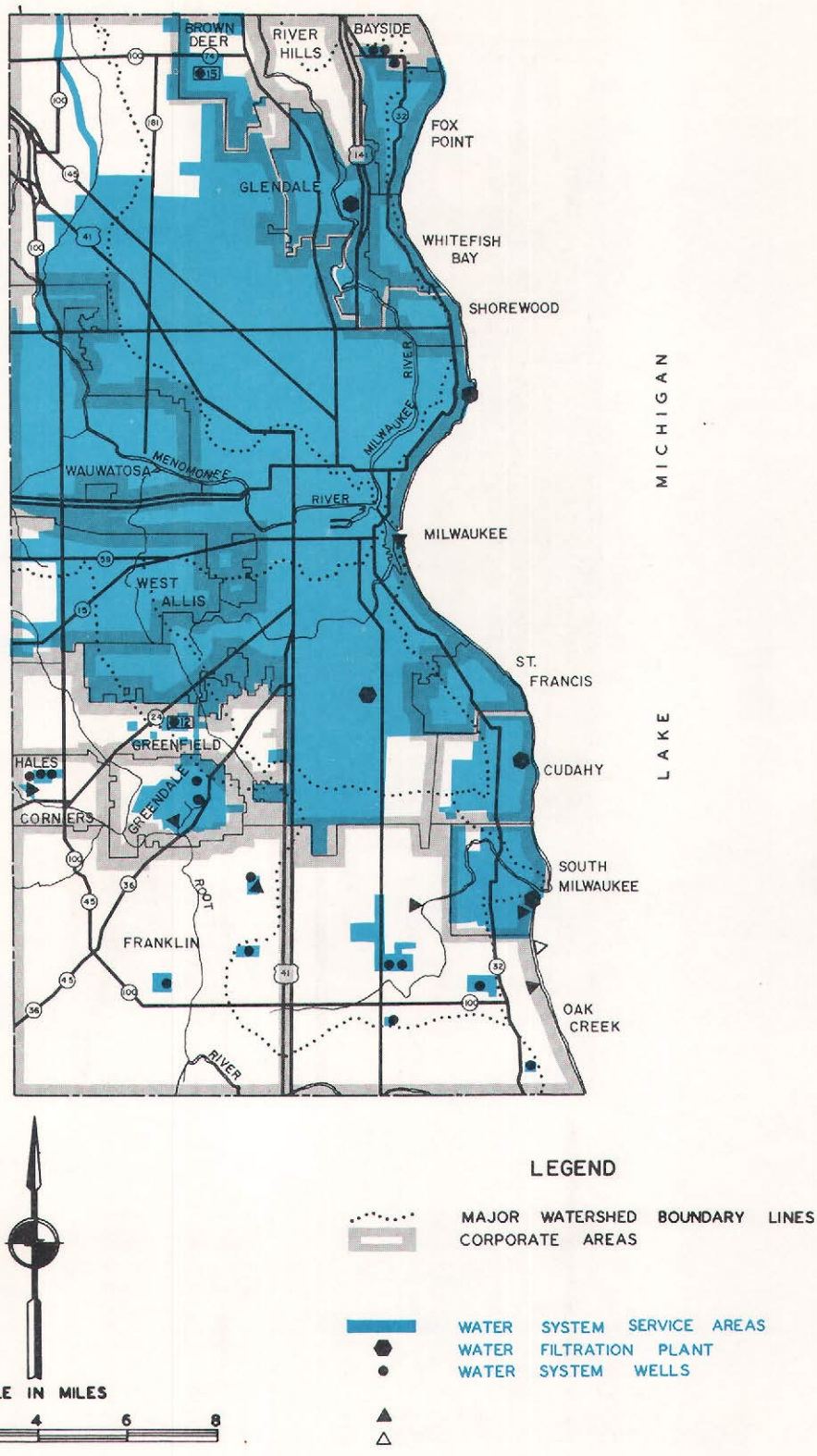
REGIONAL PUBLIC UTILITIES SURVEY

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 3 A

MILWAUKEE COUNTY



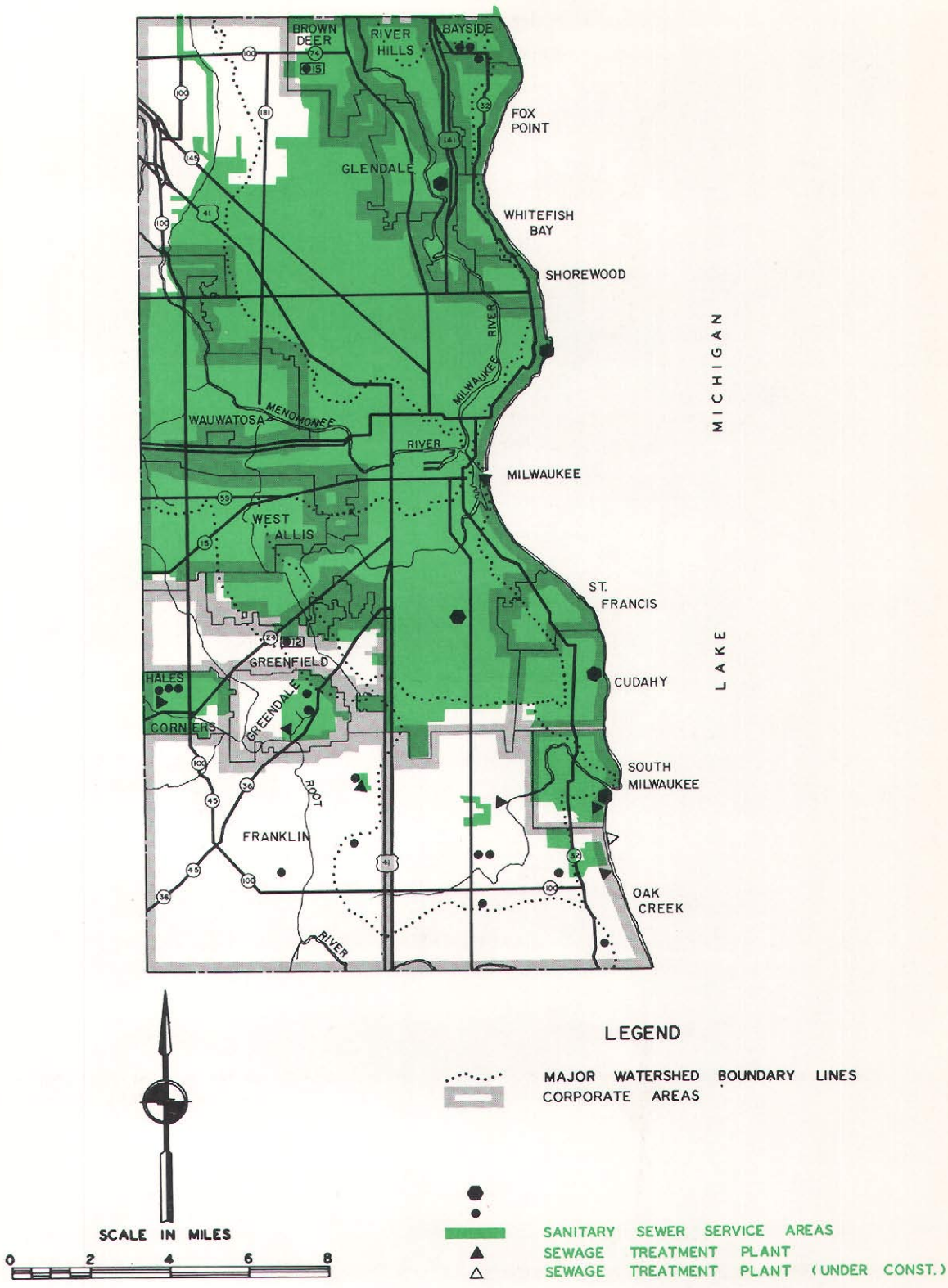
REGIONAL PUBLIC UTILITIES SURVEY

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 3B

MILWAUKEE COUNTY



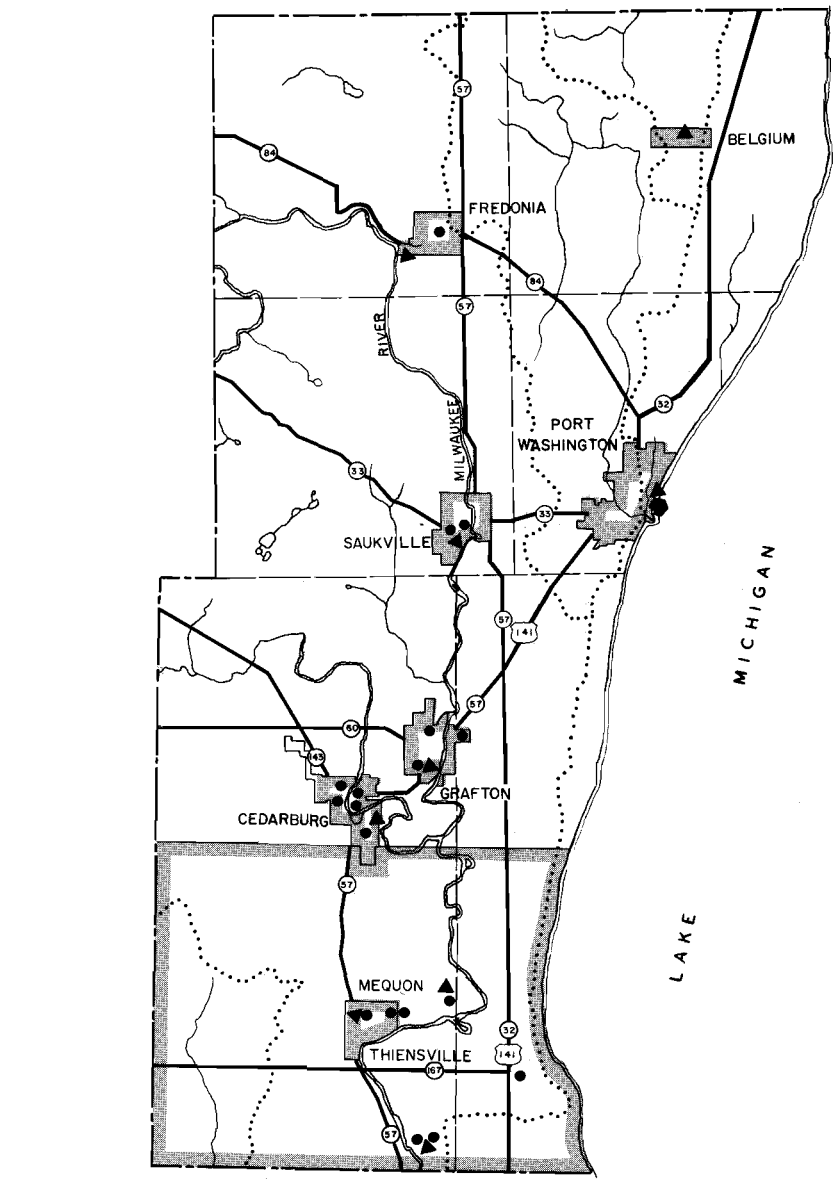
REGIONAL PUBLIC UTILITIES SURVEY

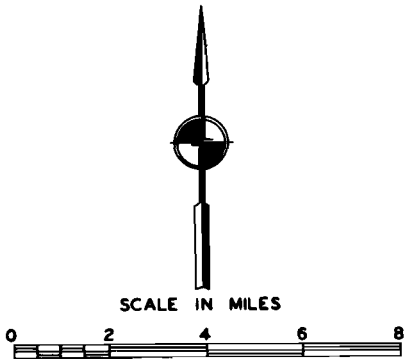
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 3 C

OZAUKEE COUNTY





LEGEND

MAJOR WATERSHED BOUNDARY LINES
CORPORATE AREAS

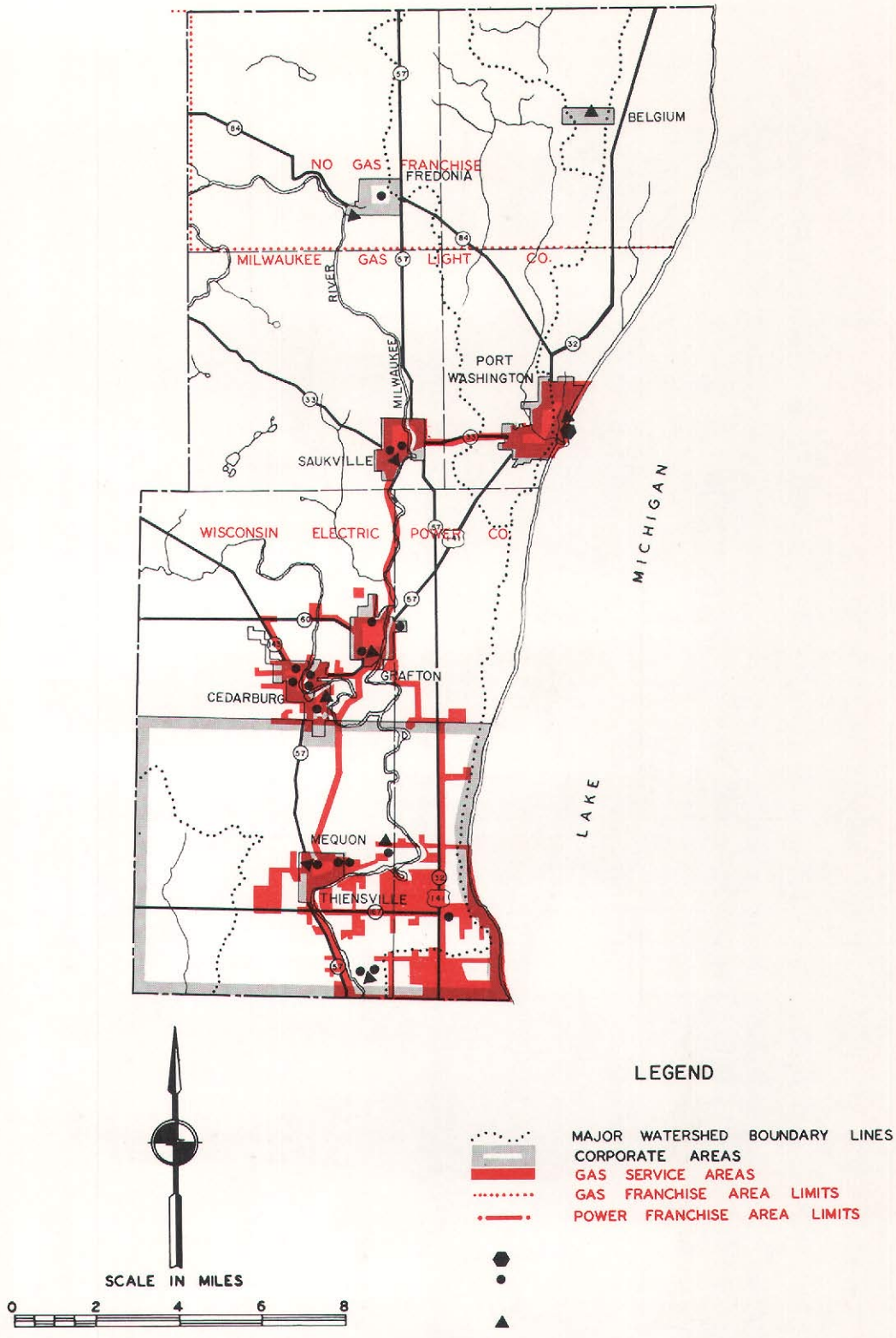
REGIONAL PUBLIC UTILITIES SURVEY

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 4

OZAUKEE COUNTY



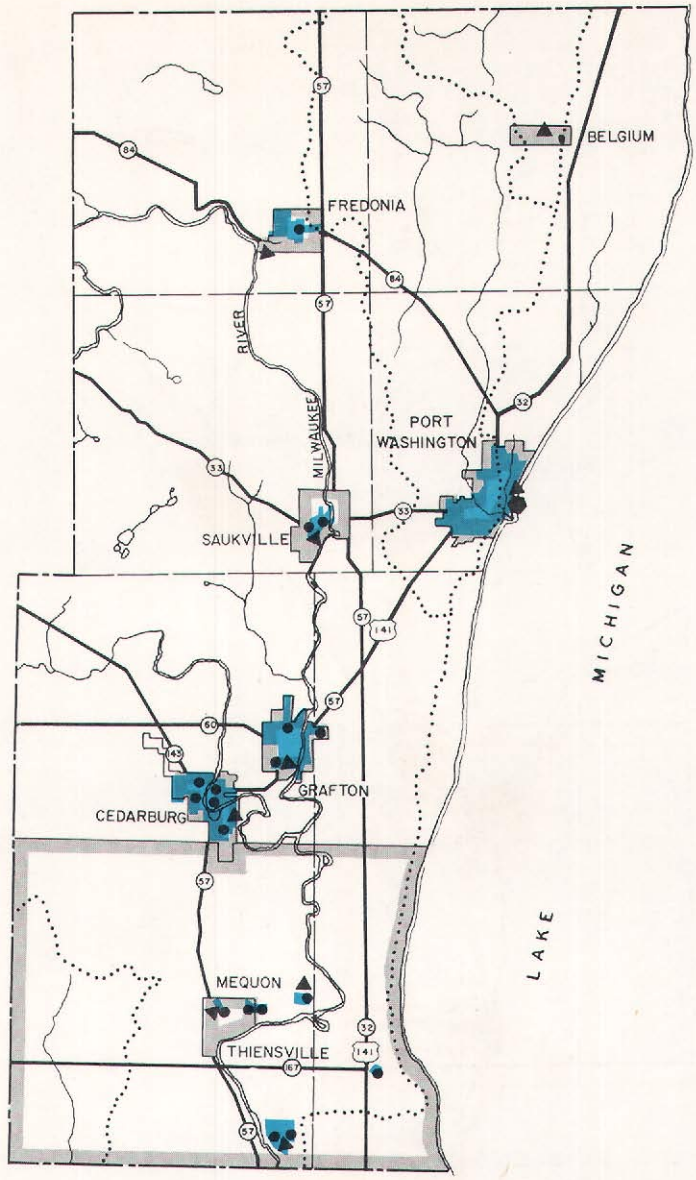
REGIONAL PUBLIC UTILITIES SURVEY

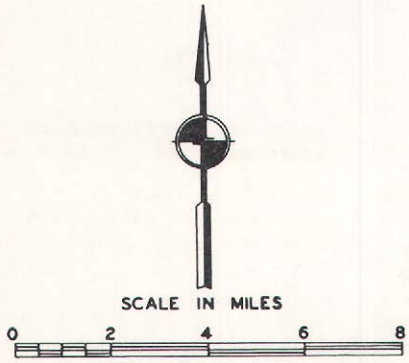
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 4 A

OZAUKEE COUNTY





LEGEND

MAJOR WATERSHED BOUNDARY LINES
CORPORATE AREAS

WATER SYSTEM SERVICE AREAS
WATER FILTRATION PLANT
WATER SYSTEM WELLS

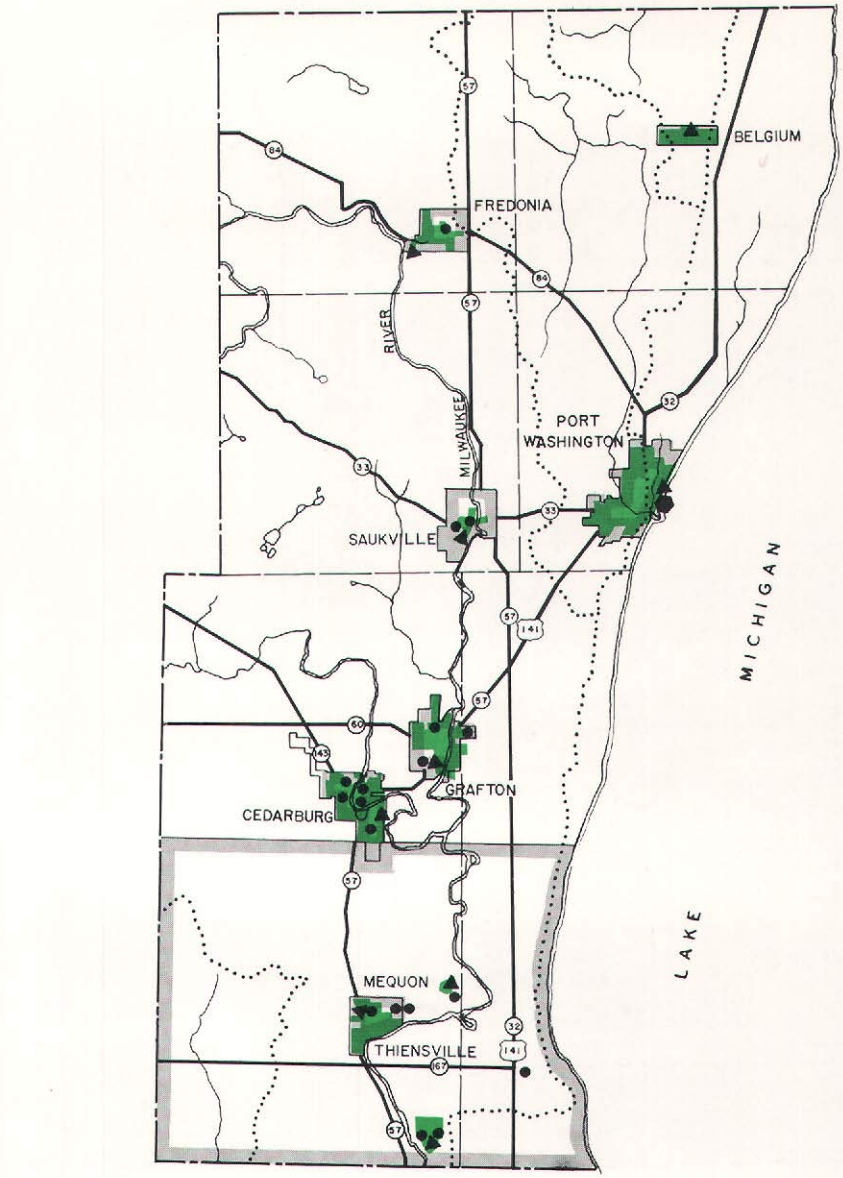
REGIONAL PUBLIC UTILITIES SURVEY

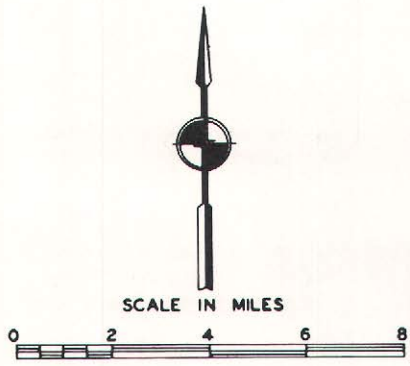
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 4 B

OZAUKEE COUNTY





LEGEND

MAJOR WATERSHED BOUNDARY LINES
CORPORATE AREAS

SANITARY SEWER SERVICE AREAS
SEWAGE TREATMENT PLANT

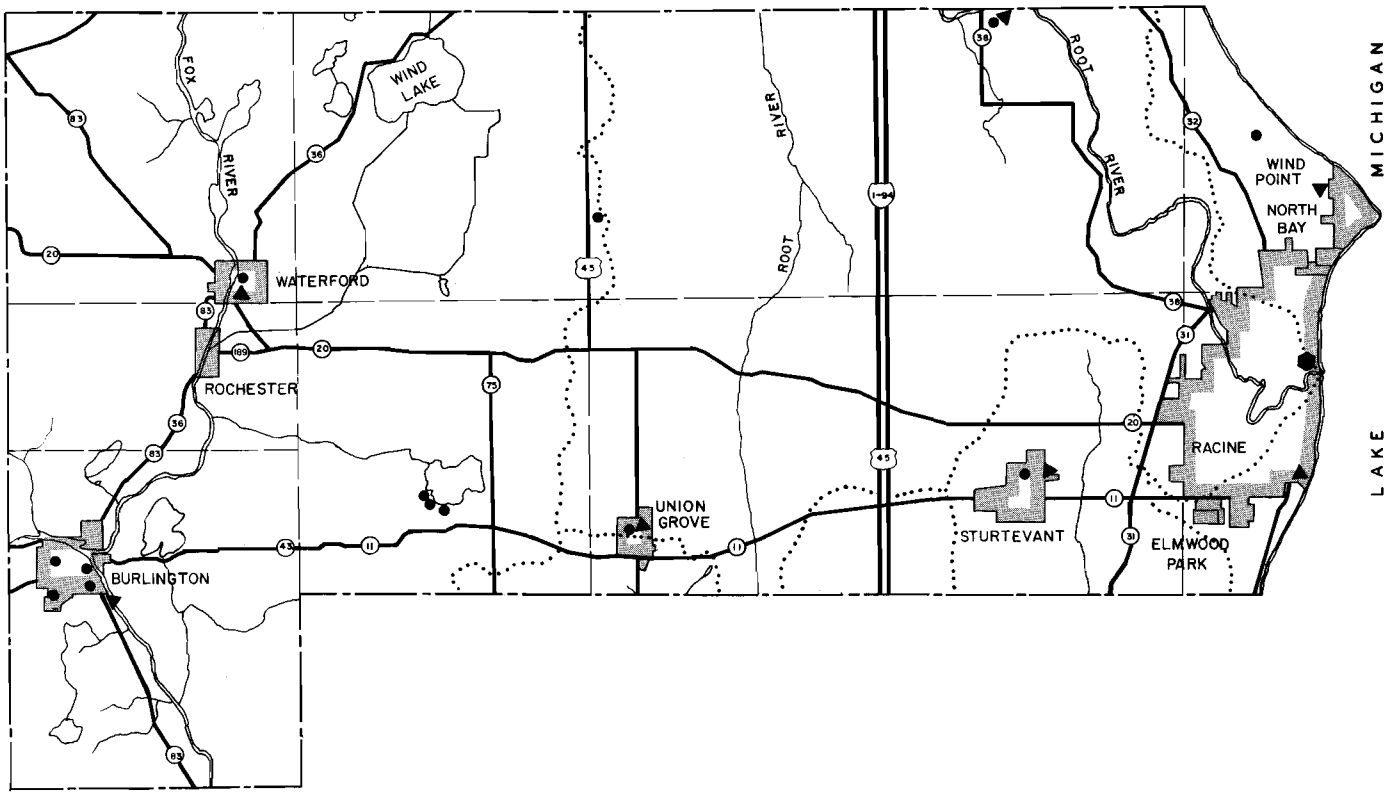
REGIONAL PUBLIC UTILITIES SURVEY

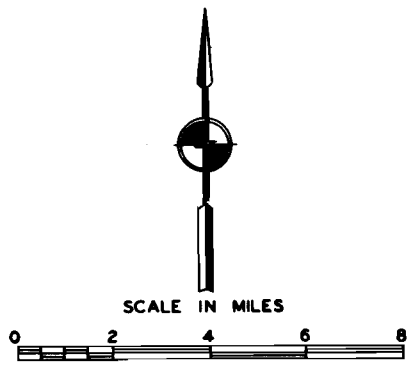
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 4C

RACINE COUNTY





LEGEND

MAJOR WATERSHED BOUNDARY LINES
CORPORATE AREAS

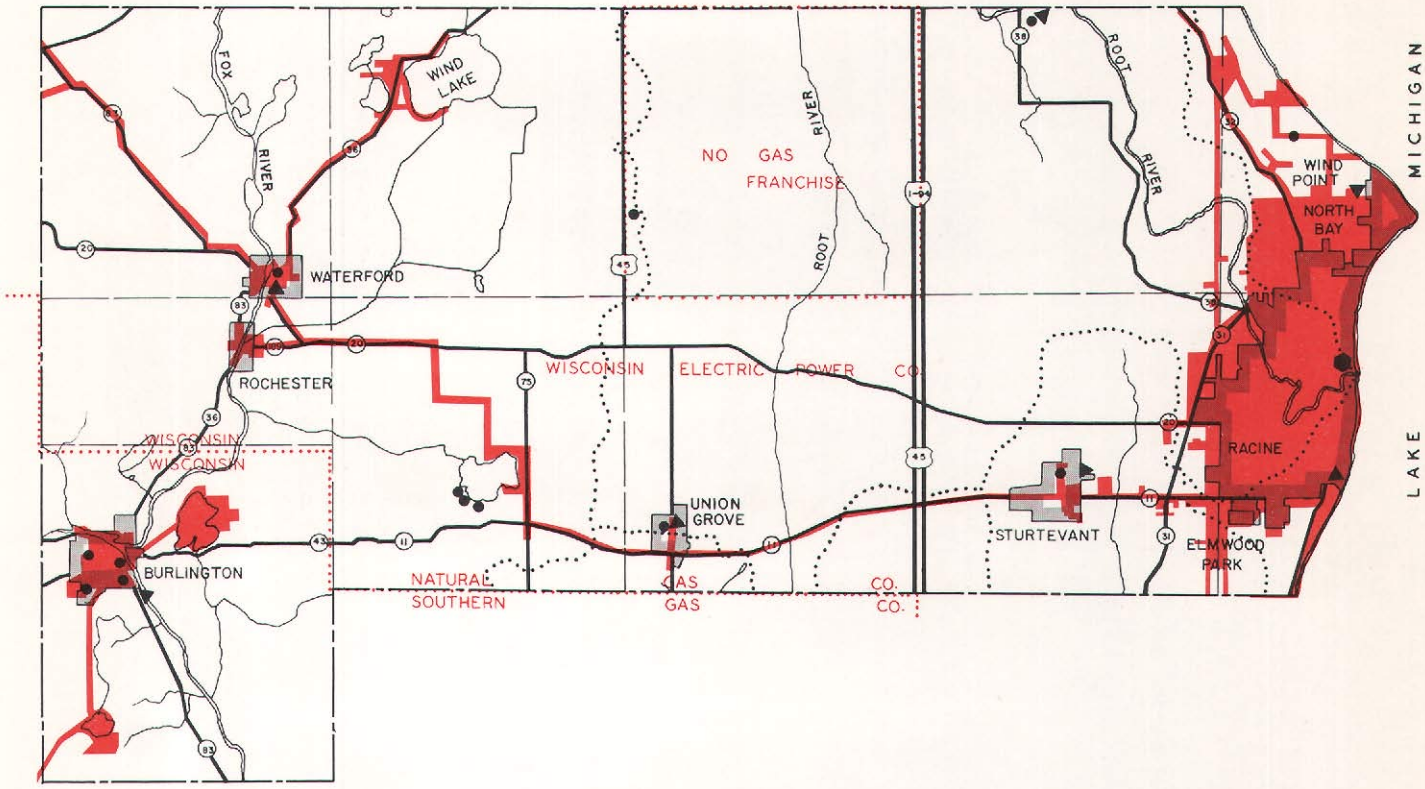
REGIONAL PUBLIC UTILITIES SURVEY

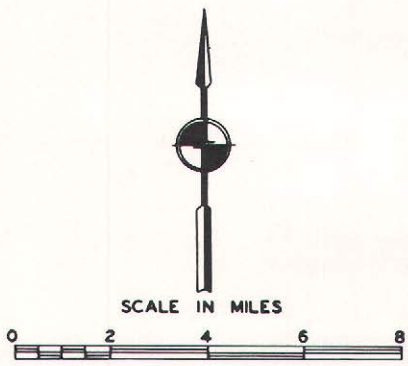
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 5

RACINE COUNTY





LEGEND

- MAJOR WATERSHED BOUNDARY LINES
- CORPORATE AREAS
- GAS SERVICE AREAS
- GAS FRANCHISE AREA LIMITS
- POWER FRANCHISE LIMITS

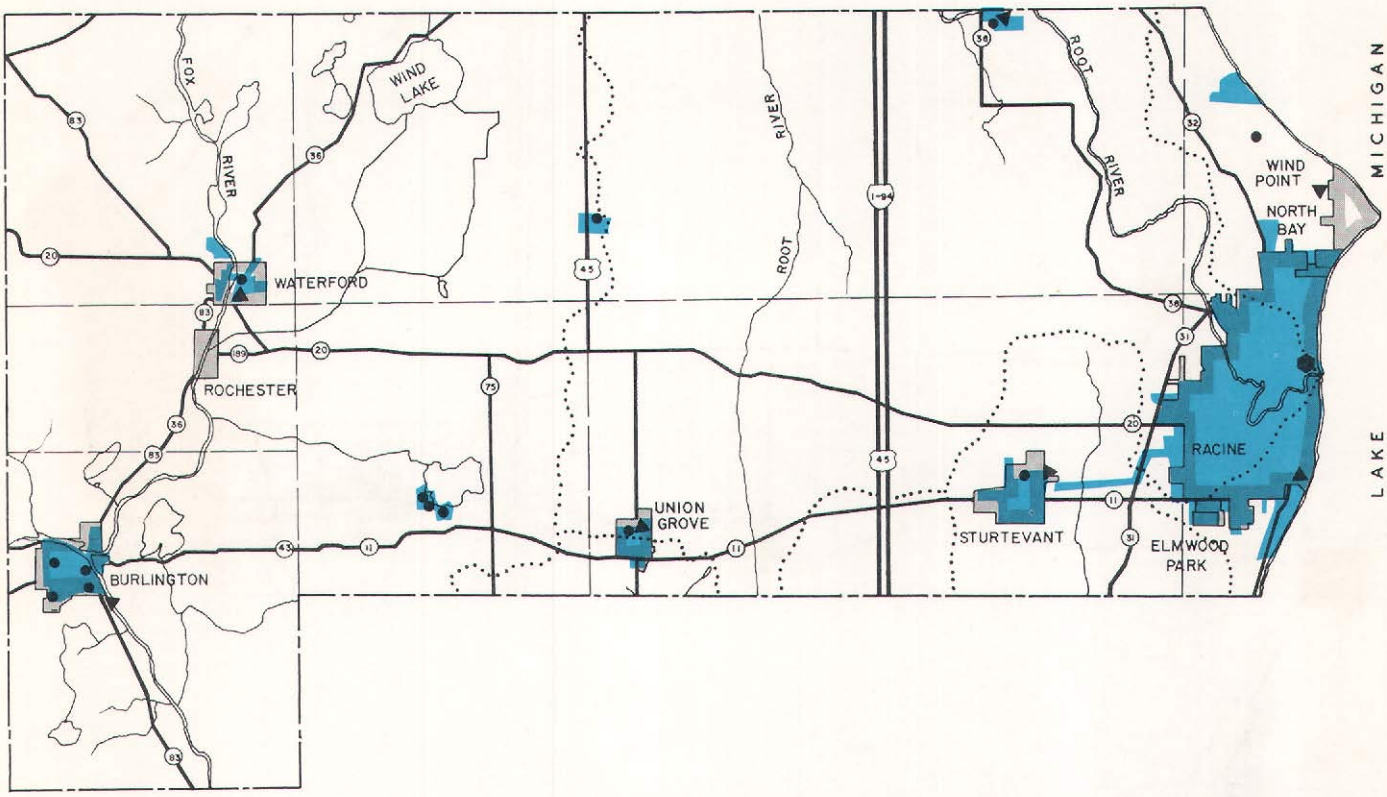
REGIONAL PUBLIC UTILITIES SURVEY

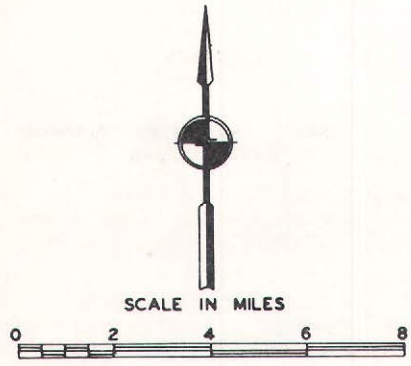
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 5 A

RACINE COUNTY





LEGEND

MAJOR WATERSHED BOUNDARY LINES
CORPORATE AREAS

WATER SYSTEM SERVICE AREAS
WATER FILTRATION PLANT
WATER SYSTEM WELLS

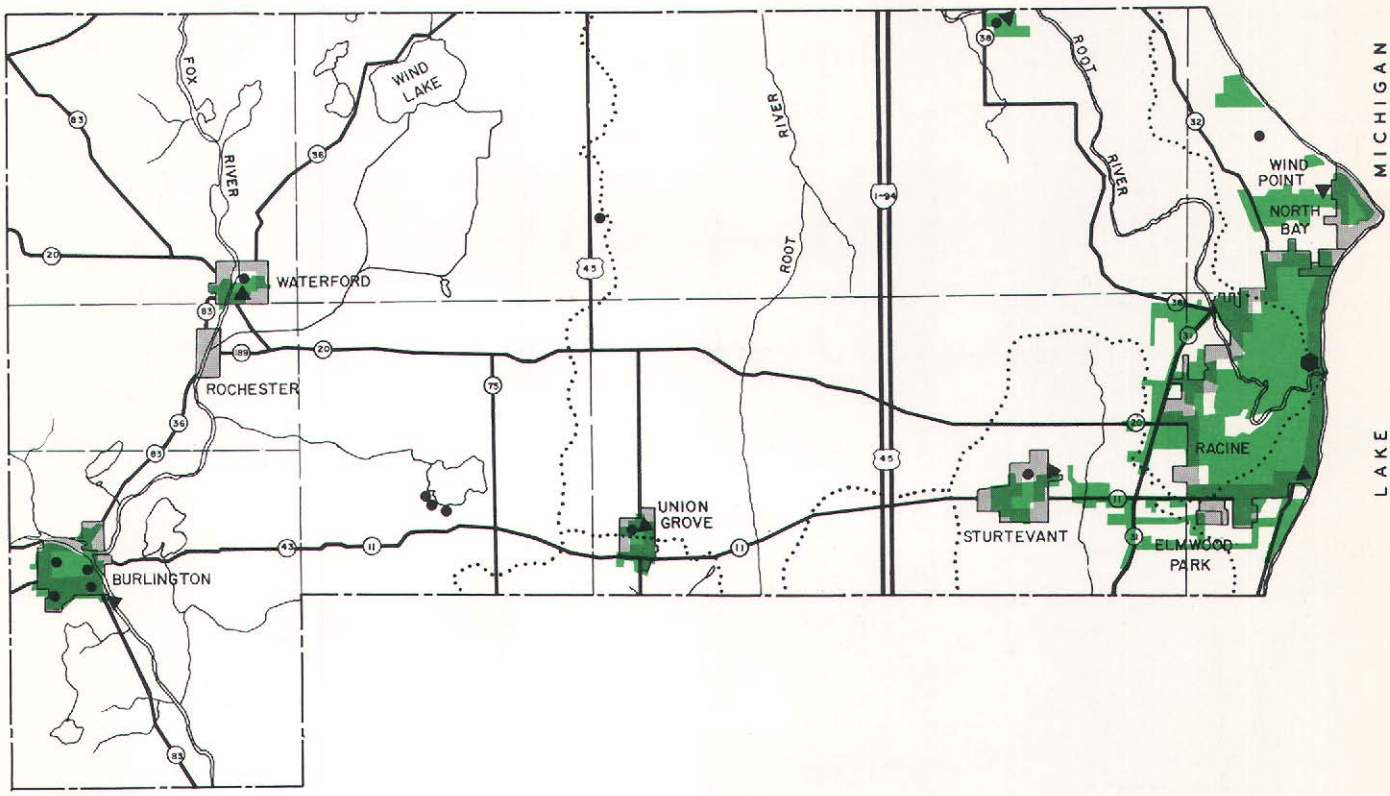
REGIONAL PUBLIC UTILITIES SURVEY

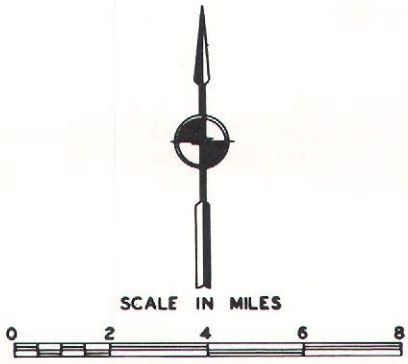
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE : JULY , 1963
MAP 5 B

RACINE COUNTY





LEGEND

MAJOR WATERSHED BOUNDARY LINES
CORPORATE AREAS

SANITARY SEWER SERVICE AREAS
SEWAGE TREATMENT PLANT

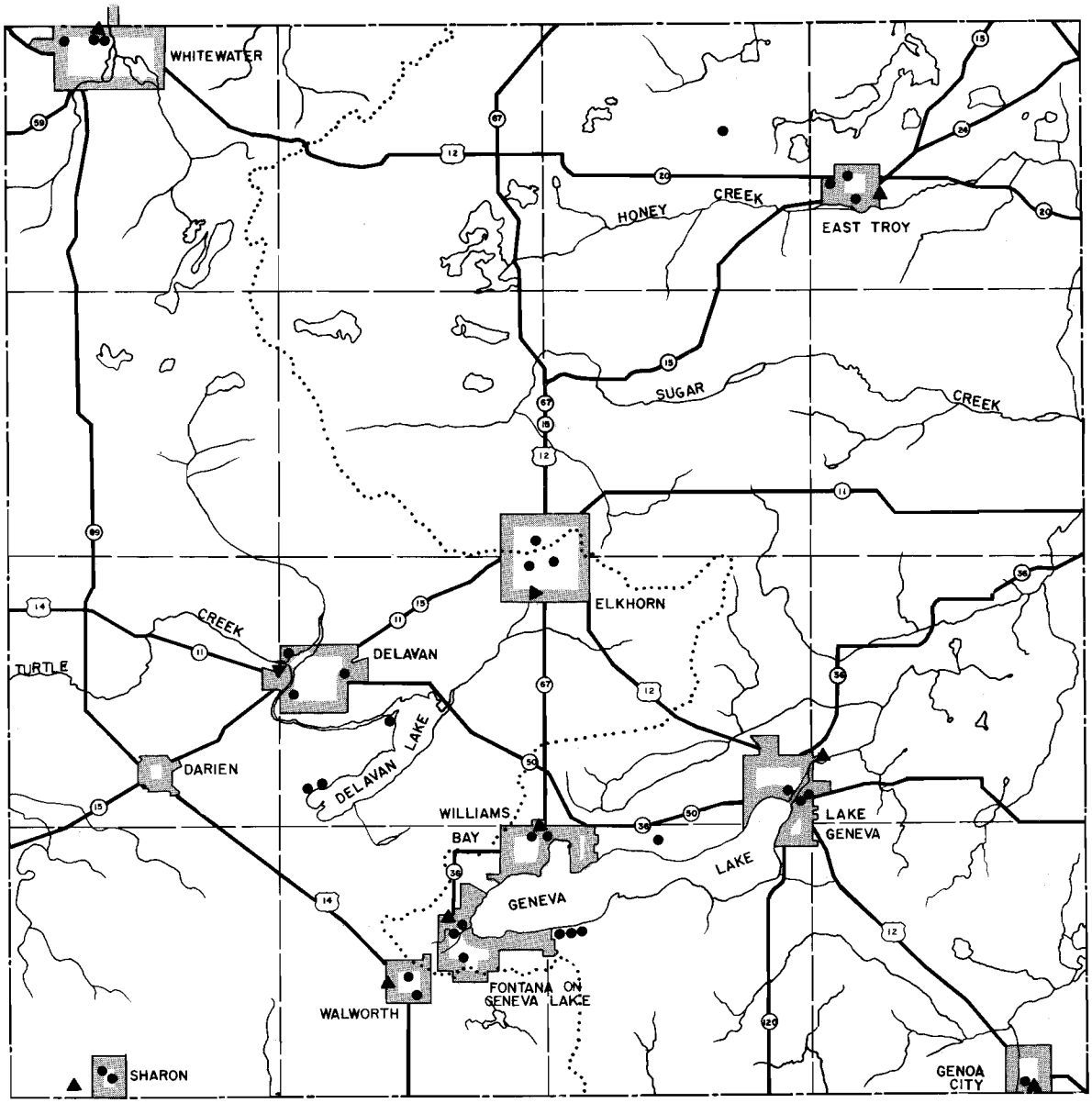
REGIONAL PUBLIC UTILITIES SURVEY

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 5 C

WALWORTH COUNTY



LEGEND

MAJOR WATERSHED BOUNDARY LINES
CORPORATE AREAS

SCALE IN MILES

0 2 4 6 8

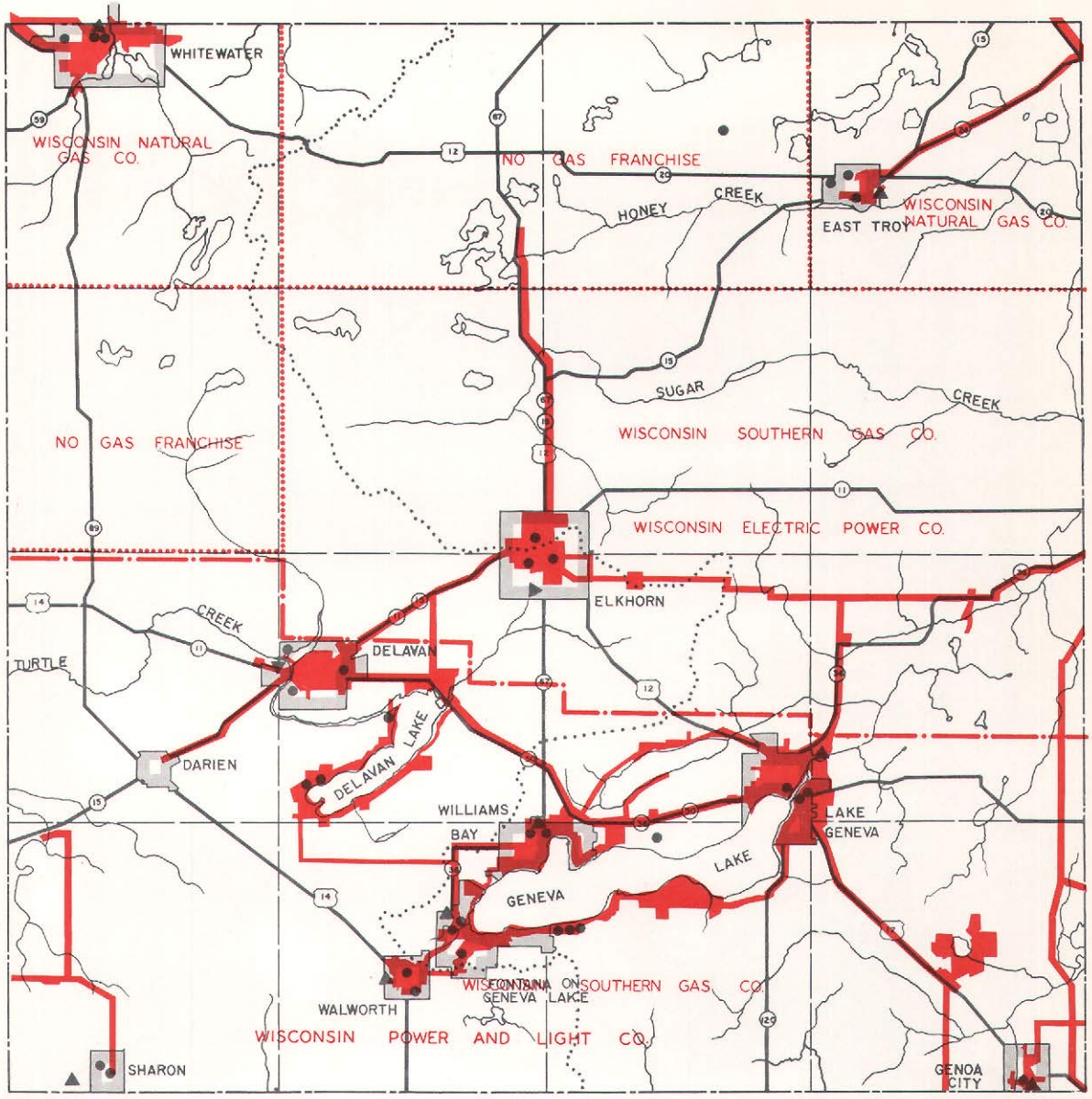
REGIONAL PUBLIC UTILITIES SURVEY

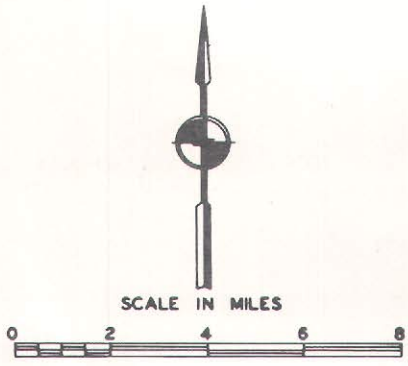
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE : JULY , 1963
MAP 6

WALWORTH COUNTY





LEGEND

- MAJOR WATERSHED BOUNDARY LINES
- CORPORATE AREAS
- GAS SERVICE AREAS
- GAS FRANCHISE AREA LIMITS
- POWER FRANCHISE AREA LIMITS

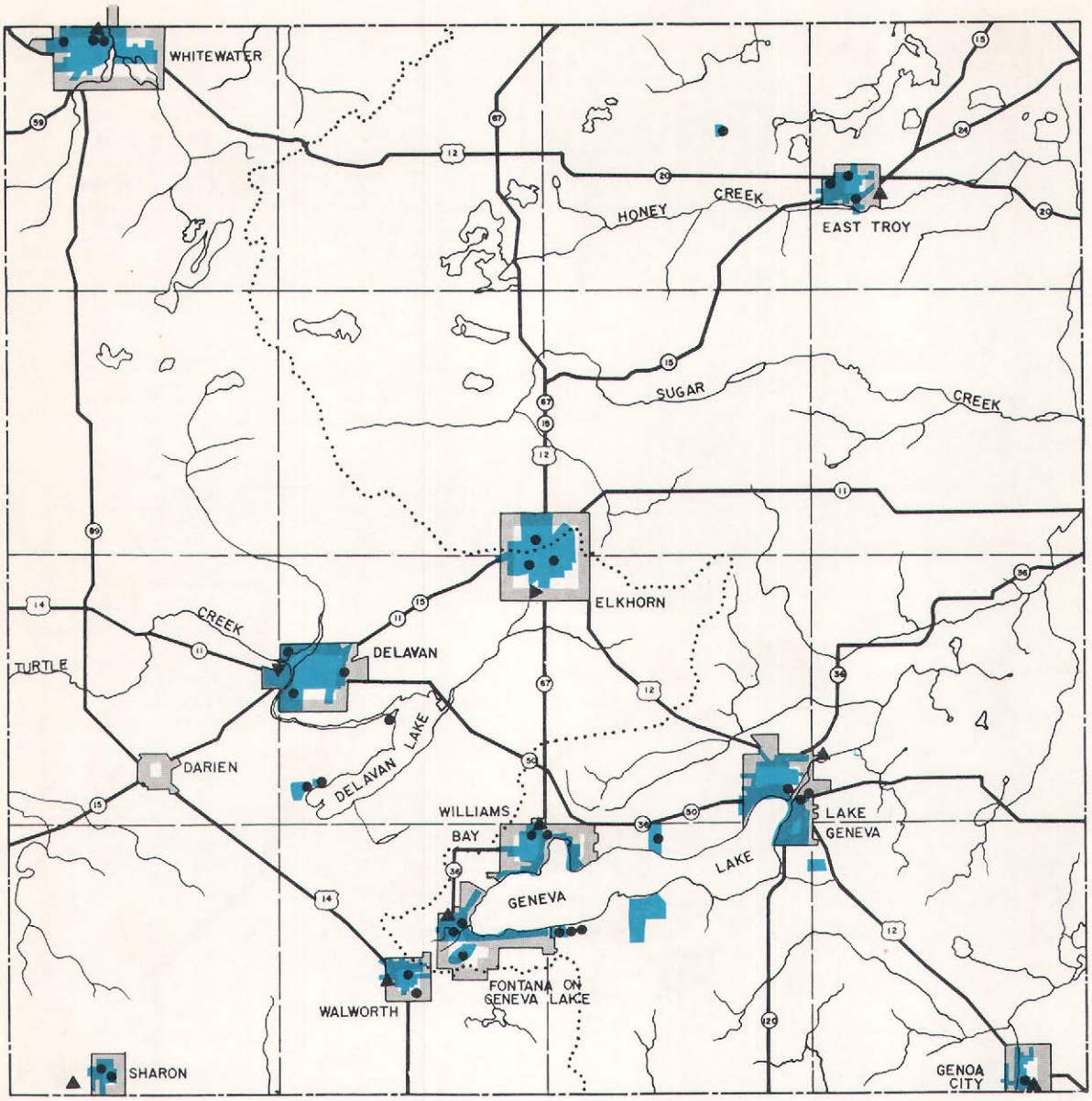
REGIONAL PUBLIC UTILITIES SURVEY

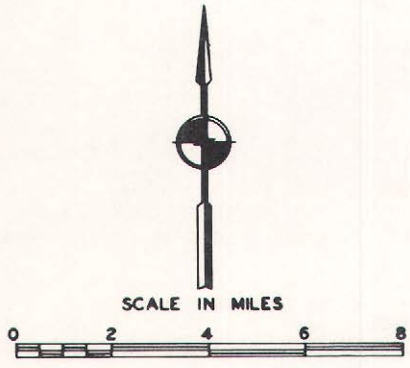
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 6A

WALWORTH COUNTY





LEGEND

MAJOR WATERSHED BOUNDARY LINES
CORPORATE AREAS

WATER SYSTEM SERVICE AREAS
WATER SYSTEM WELLS

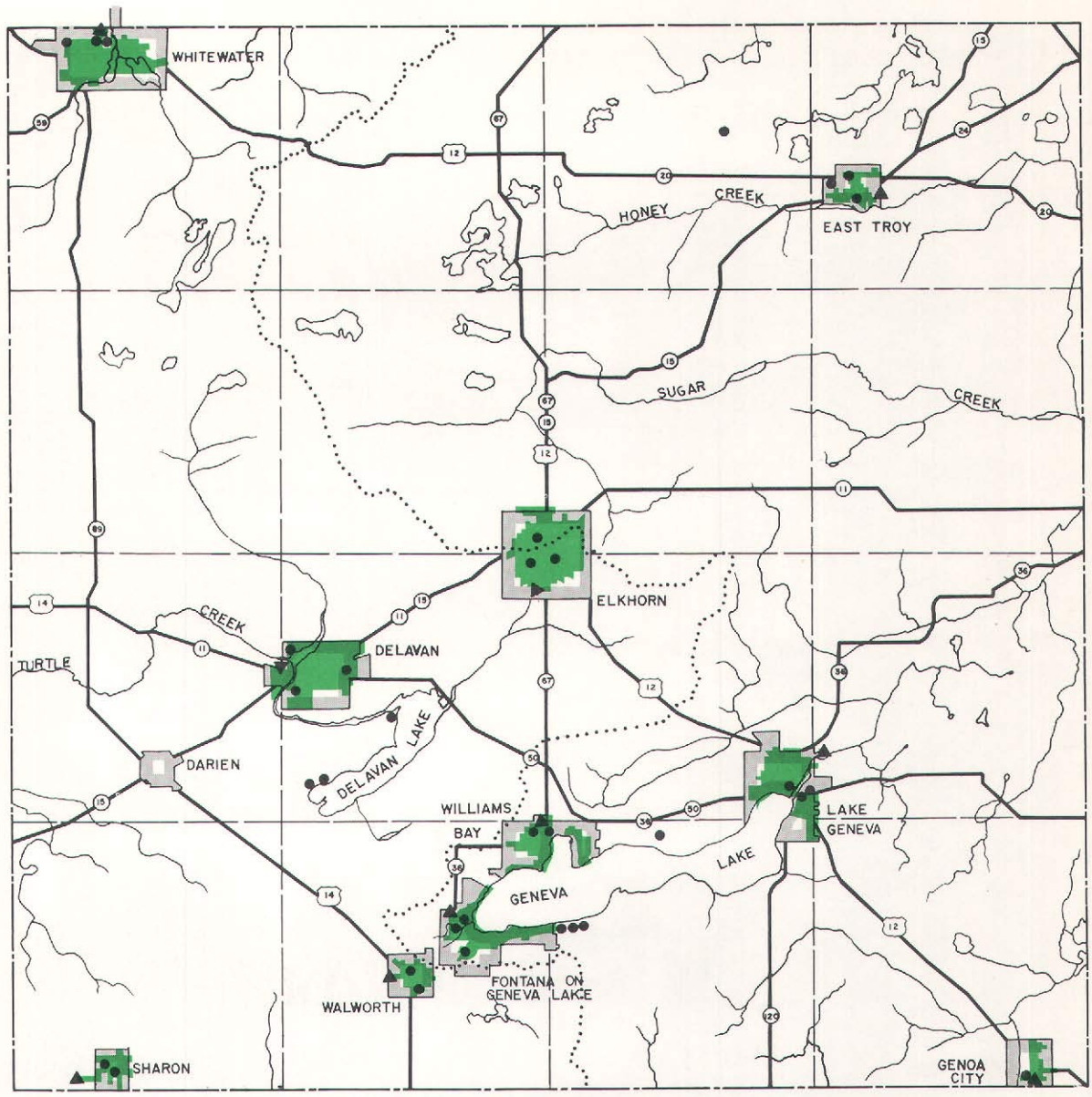
REGIONAL PUBLIC UTILITIES SURVEY

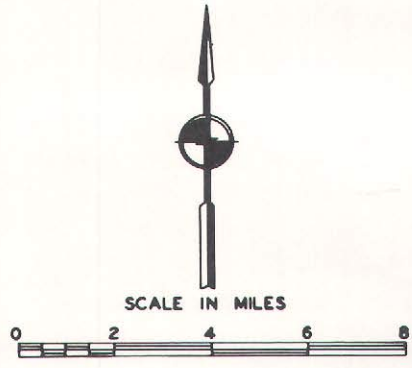
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 6 B

WALWORTH COUNTY





LEGEND

MAJOR WATERSHED BOUNDARY LINES
CORPORATE AREAS

SANITARY SEWER SERVICE AREAS
SEWAGE TREATMENT PLANTS

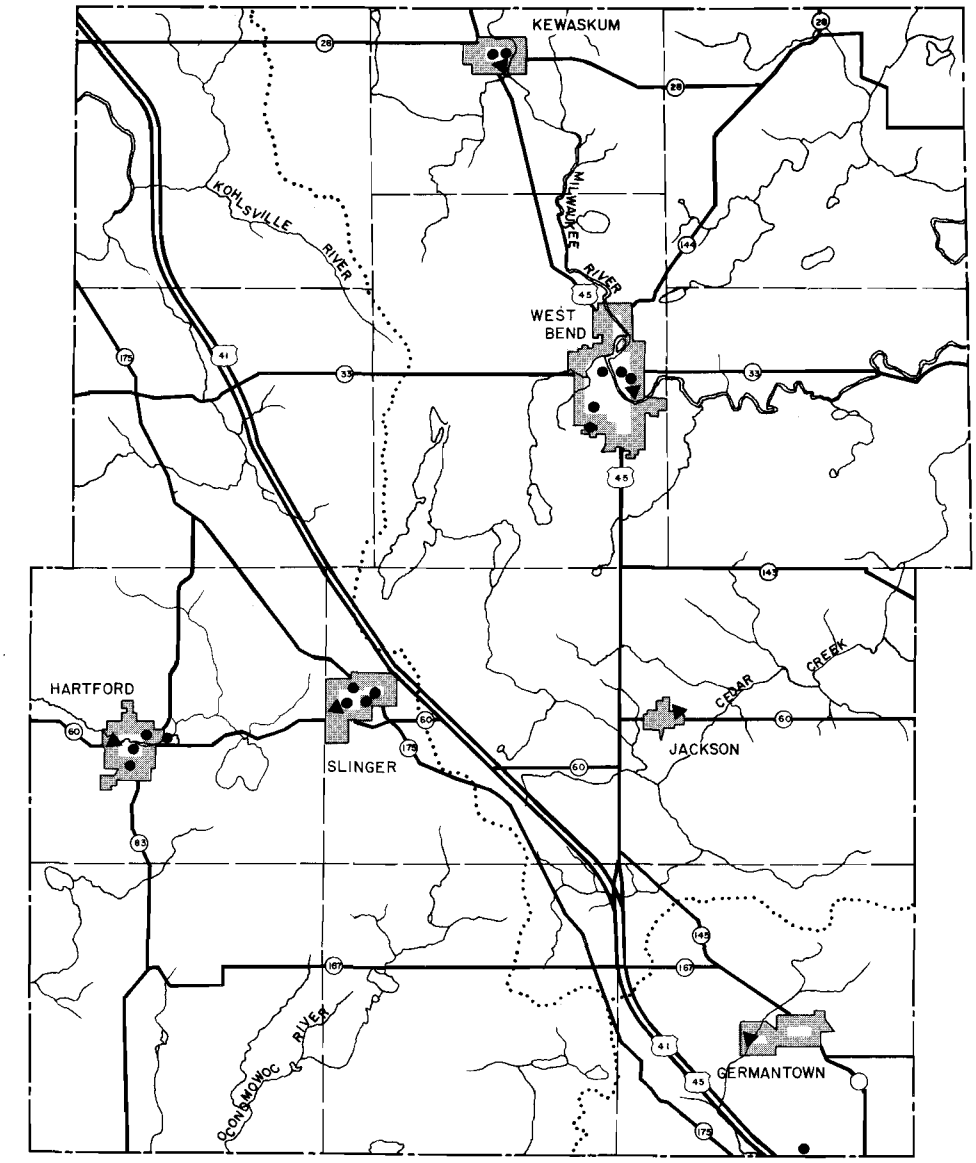
REGIONAL PUBLIC UTILITIES SURVEY

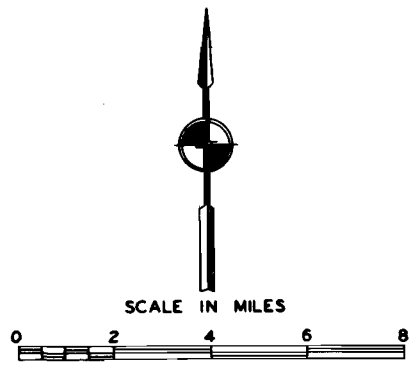
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 6 C

WASHINGTON COUNTY





LEGEND

MAJOR WATERSHED BOUNDARY LINES

CORPORATE AREAS

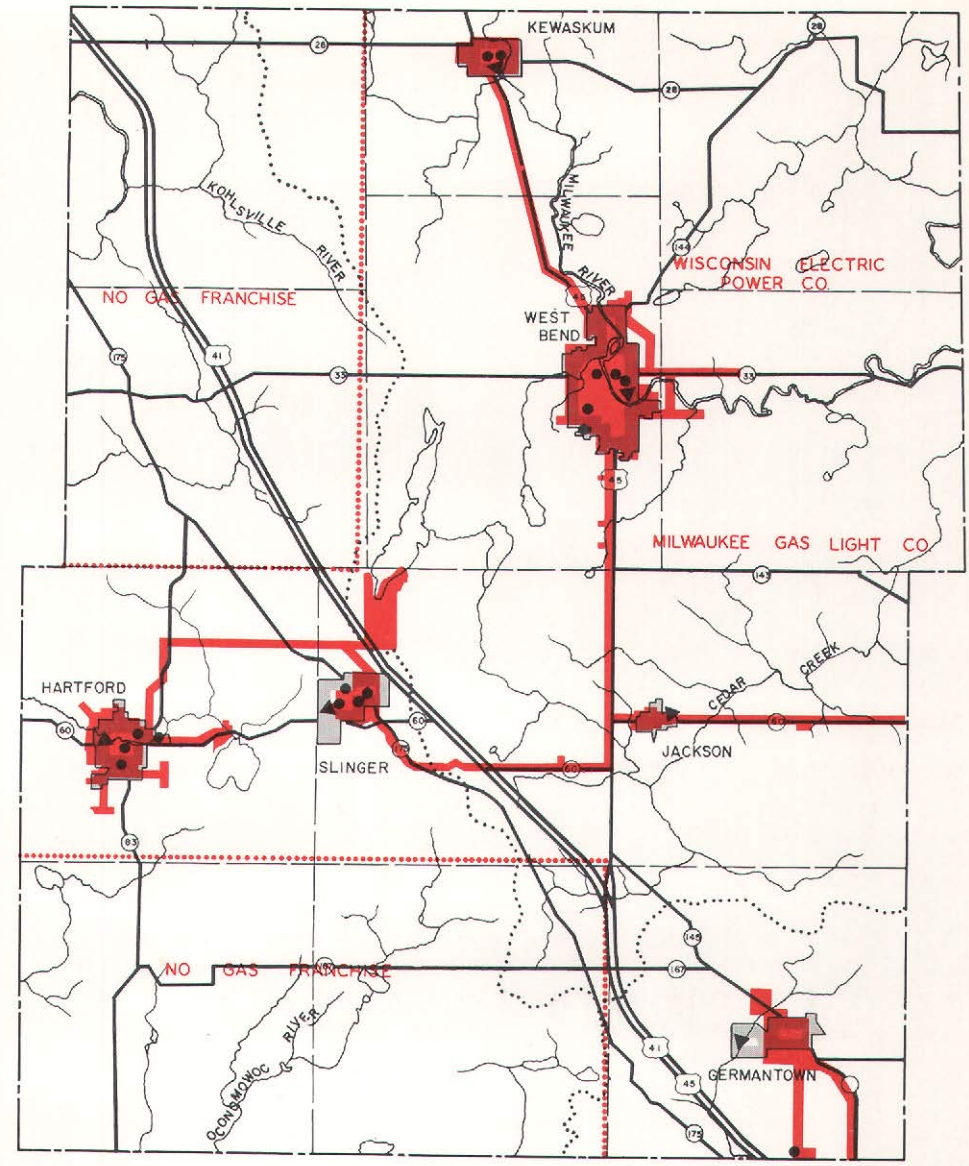
REGIONAL PUBLIC UTILITIES SURVEY

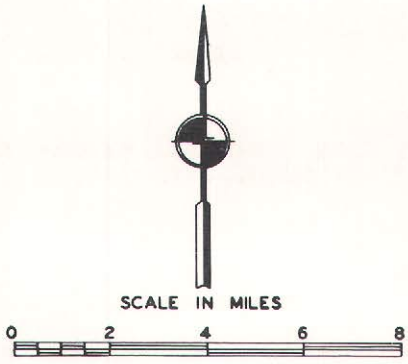
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 7

WASHINGTON COUNTY





LEGEND

- MAJOR WATERSHED BOUNDARY LINES
- CORPORATE AREAS
- GAS SERVICE AREAS
- GAS FRANCHISE AREA LIMITS
- POWER FRANCHISE AREA LIMITS

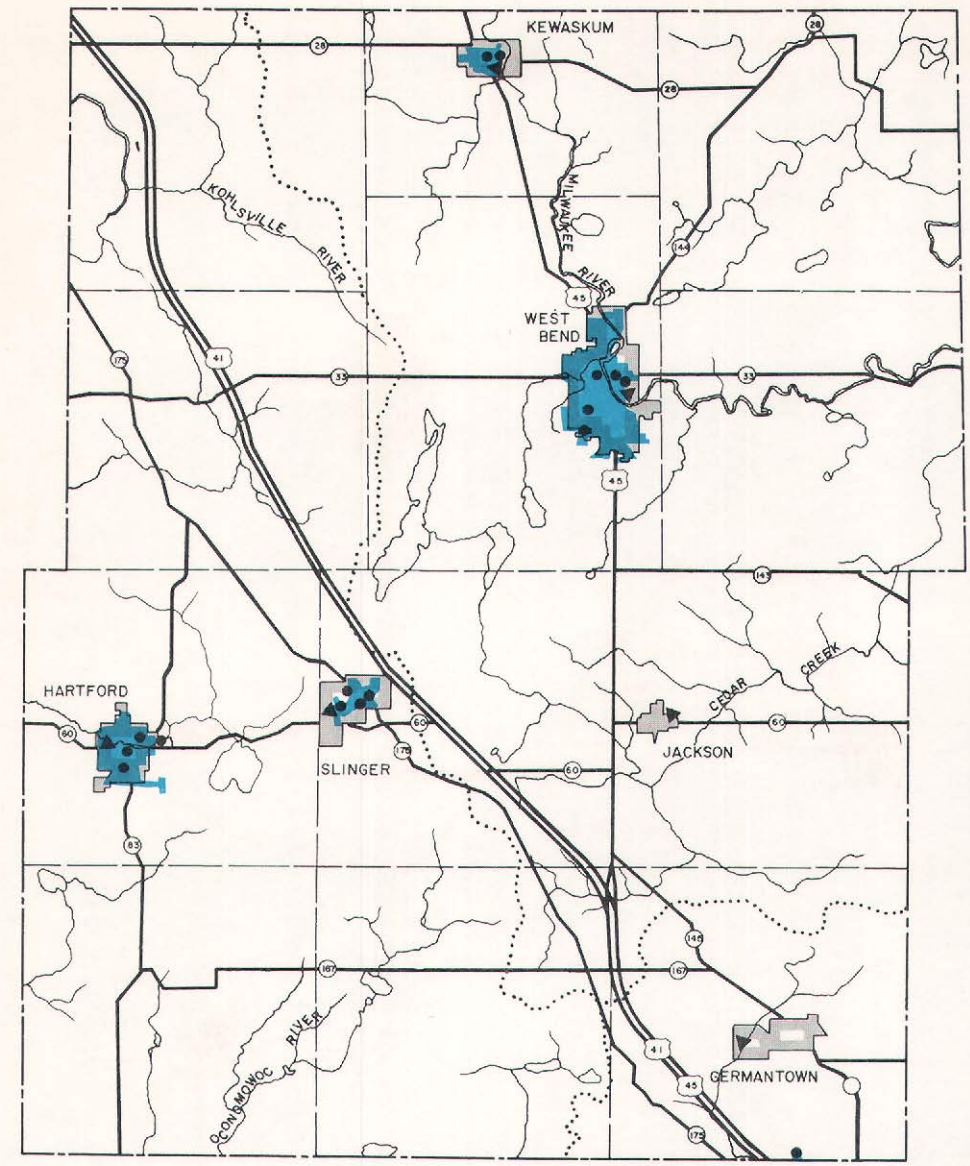
REGIONAL PUBLIC UTILITIES SURVEY

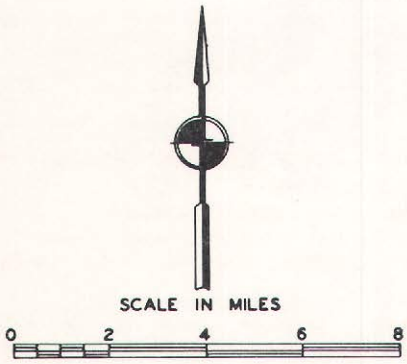
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 7 A

WASHINGTON COUNTY





LEGEND

MAJOR WATERSHED BOUNDARY LINES
CORPORATE AREAS

WATER SYSTEM SERVICE AREAS
WATER SYSTEM WELLS

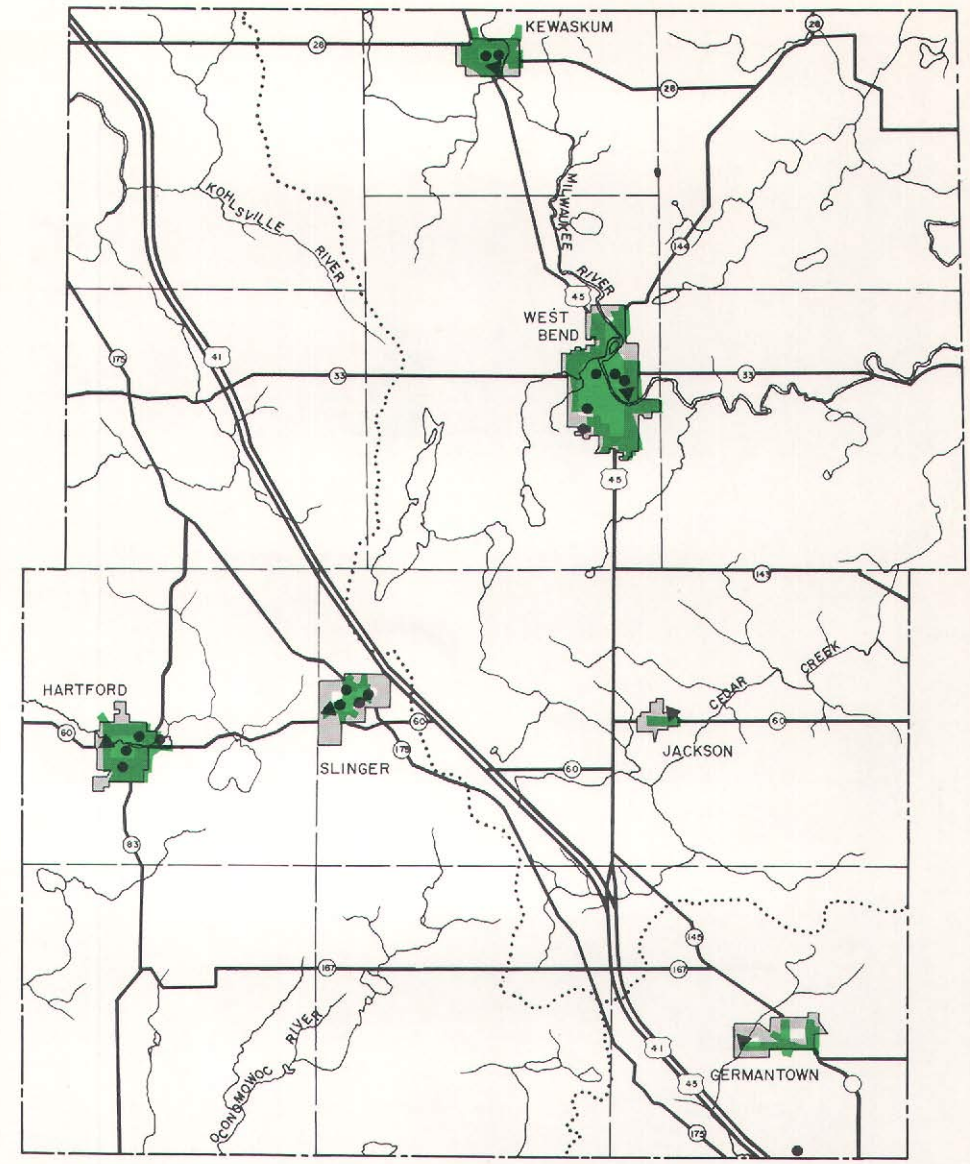
REGIONAL PUBLIC UTILITIES SURVEY

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE : JULY , 1963
MAP 7 B

WASHINGTON COUNTY



SCALE IN MILES

0 2 4 6 8

LEGEND

MAJOR WATERSHED BOUNDARY LINES

CORPORATE AREAS

SANITARY SEWER SERVICE AREAS

SEWAGE TREATMENT PLANTS

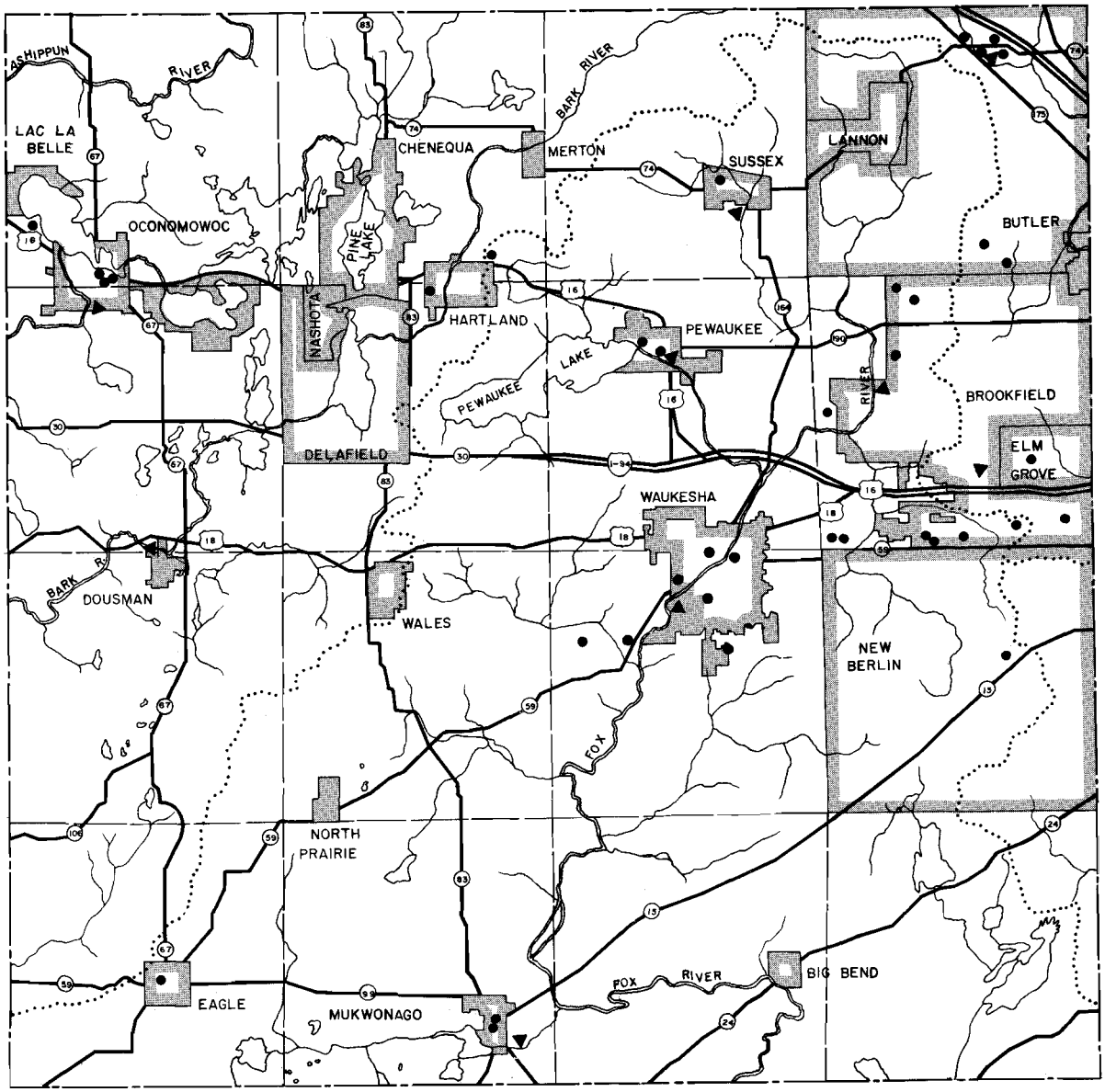
REGIONAL PUBLIC UTILITIES SURVEY

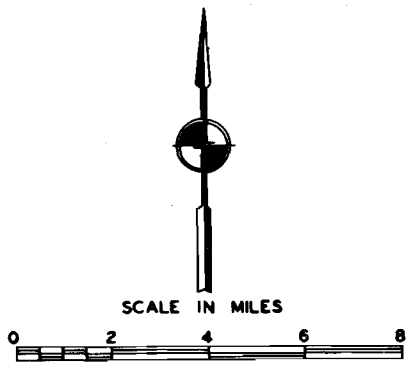
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 7 C

WAUKESHA COUNTY





LEGEND

MAJOR WATERSHED BOUNDARY LIMITS

CORPORATE AREAS

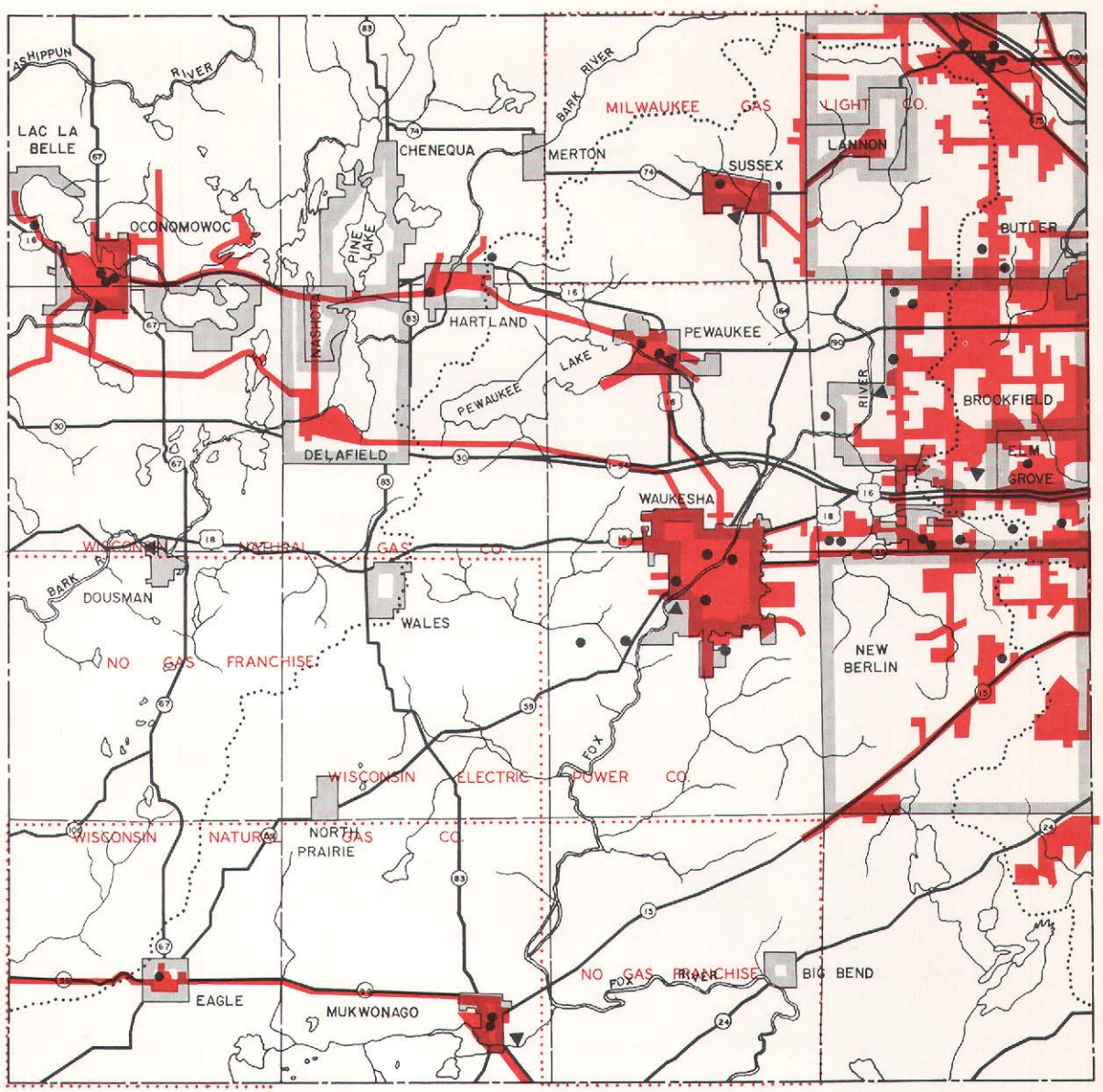
REGIONAL PUBLIC UTILITIES SURVEY

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 8

WAUKESHA COUNTY



LEGEND

- MAJOR WATERSHED BOUNDARY LIMITS
- CORPORATE AREAS
- GAS SERVICE AREAS
- GAS FRANCHISE AREA LIMITS
- POWER FRANCHISE AREA LIMITS

SCALE IN MILES

0 2 4 6 8

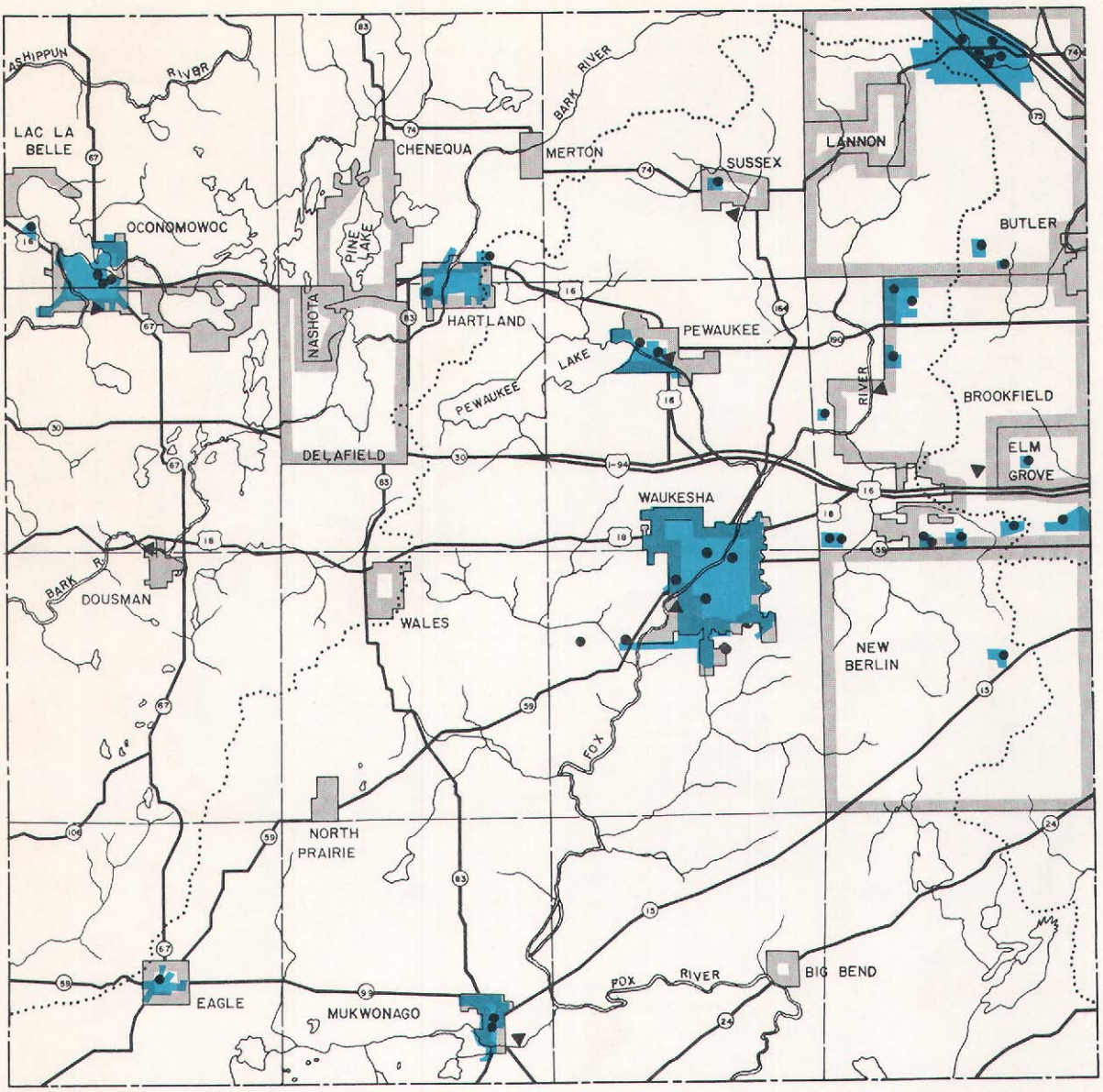
REGIONAL PUBLIC UTILITIES SURVEY

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE : JULY , 1963
MAP 8 A

WAUKESHA COUNTY



SCALE IN MILES

0 2 4 6 8

LEGEND

MAJOR WATERSHED BOUNDARY LIMITS

CORPORATE AREAS

WATER SYSTEM SERVICE AREAS

WATER SYSTEM WELLS

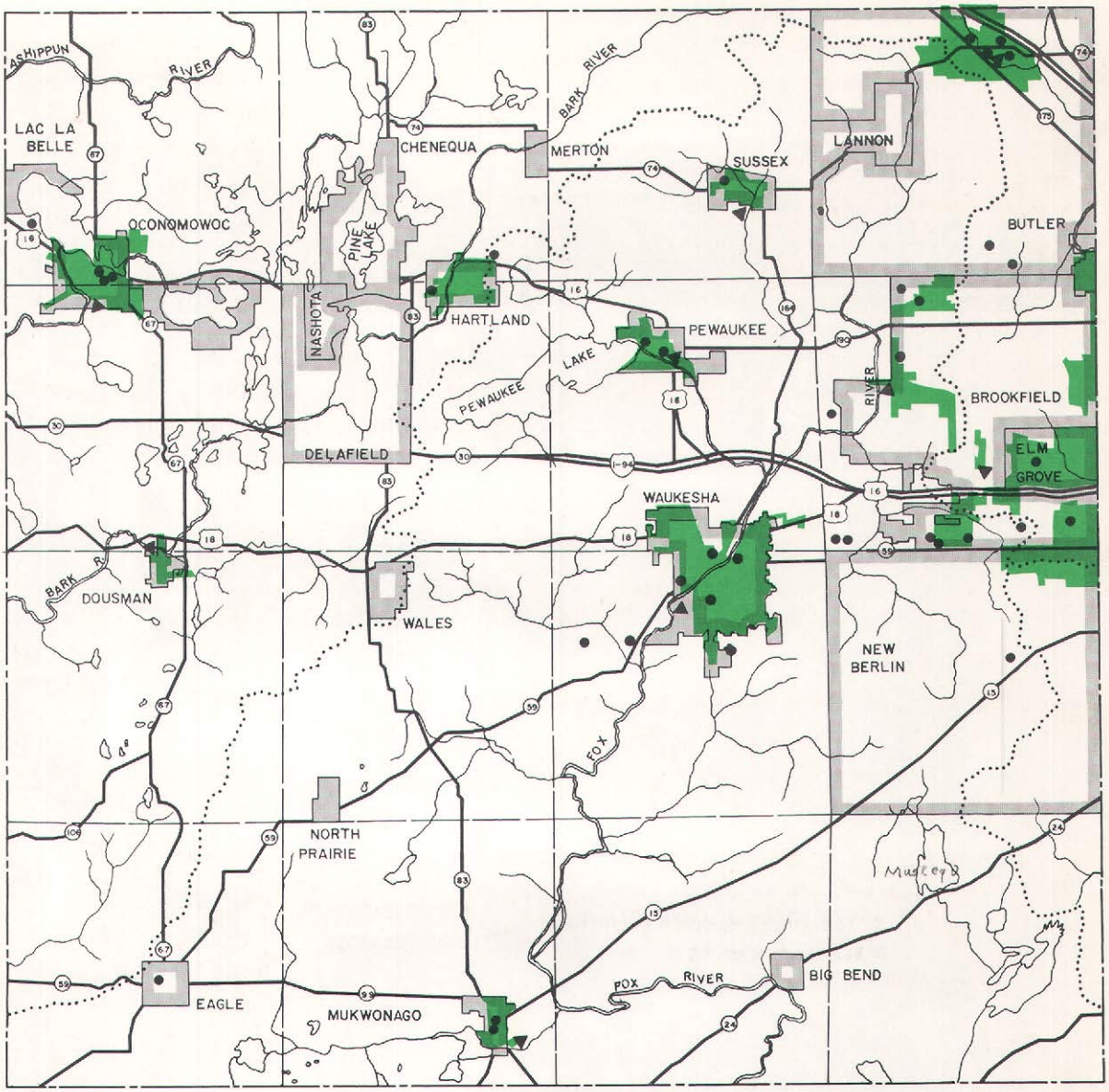
REGIONAL PUBLIC UTILITIES SURVEY

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

DATE: JULY, 1963
MAP 8B

WAUKESHA COUNTY



SCALE IN MILES

0 2 4 6 8

LEGEND

MAJOR WATERSHED BOUNDARY LIMITS
CORPORATE AREAS

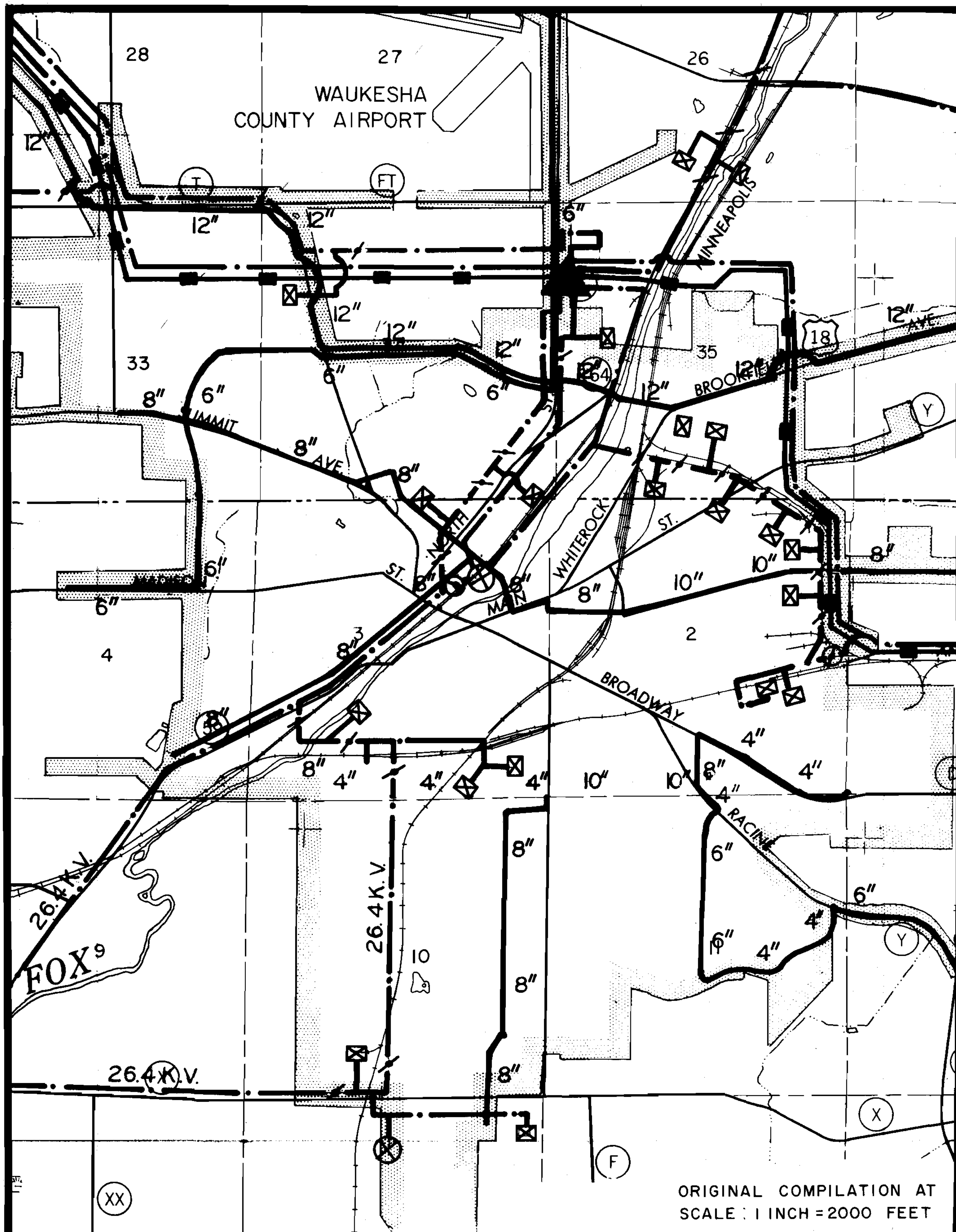
SANITARY SEWER SERVICE AREAS
SEWAGE TREATMENT PLANT

REGIONAL PUBLIC UTILITIES SURVEY

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

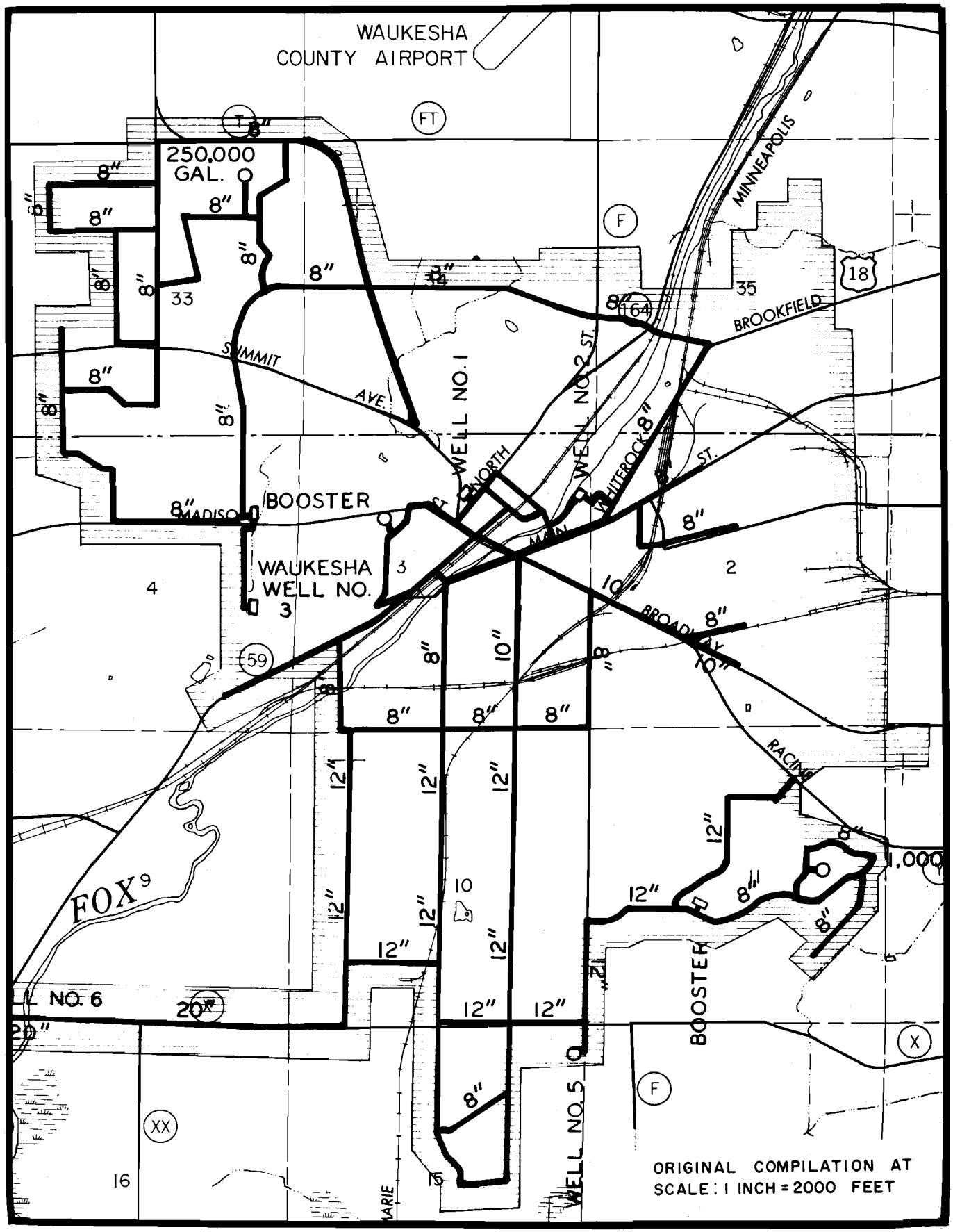
J. C. ZIMMERMAN ENGINEERING CO.
CONSULTING ENGINEERS

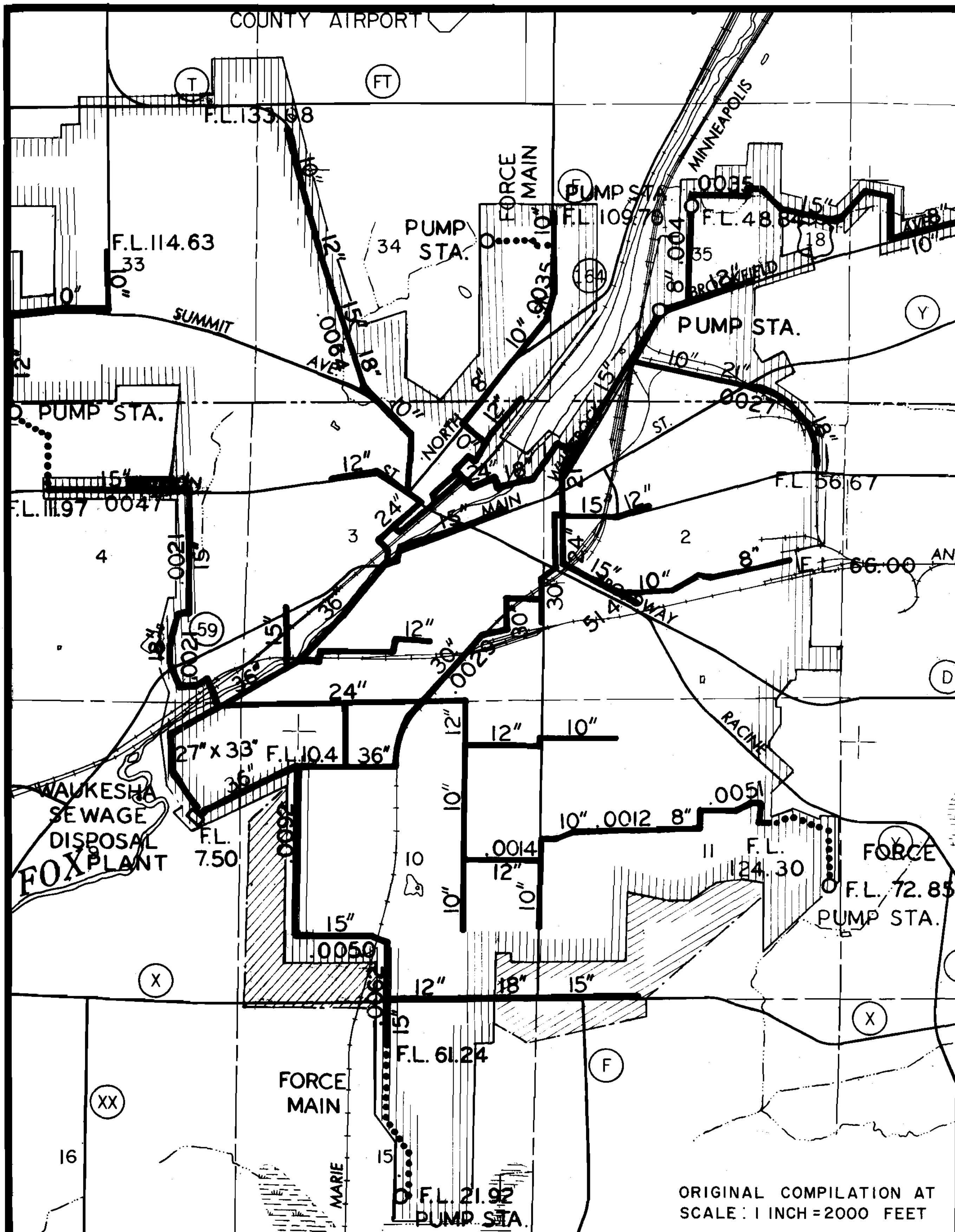
DATE: JULY, 1963
MAP 8C



28
27
26
WAUKESHA
COUNTY AIRPORT
33
35
4
3
2
10
MINNEAPOLIS
SUMMIT AVE
NORTH ST.
MAIN
WHITEROCK
ST.
BROOKFIELD
BROADWAY
RACINE
AVE
18
164
T
FT
Y
X
XX
F
26.4 K.V.
FOX
12″
8″
6″
10″
4″
ORIGINAL COMPILATION AT
SCALE : 1 INCH = 2000 FEET

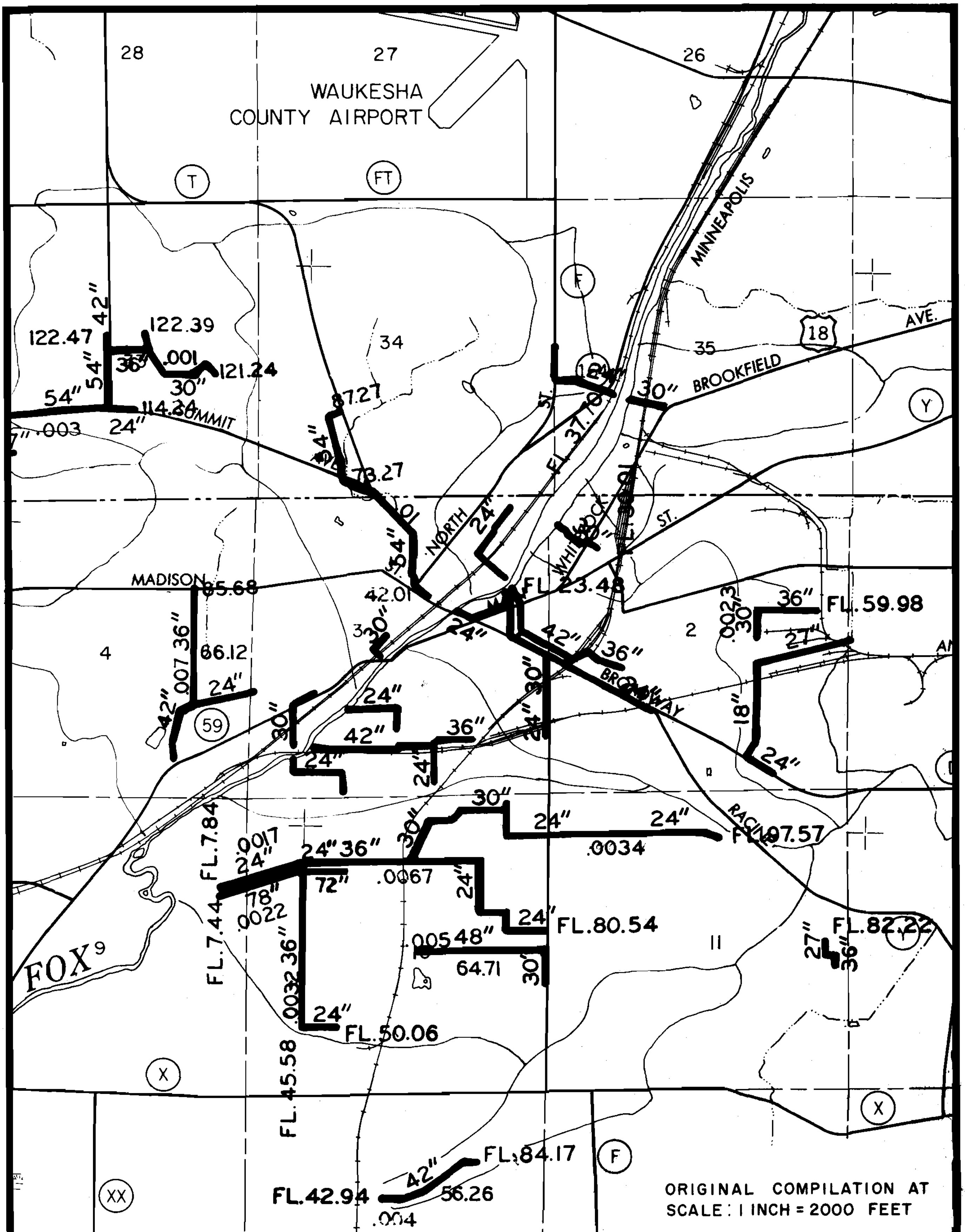
MAP 9


WAUKESHA
COUNTY AIRPORT
250,000
GAL.
MINNEAPOLIS
BROOKFIELD
SUMMIT
AVE.
WELL NO. 1
WELL NO. 2
ST.
NORTH
MAIN
WHITEROCK
BOOSTER
MADISON
WAUKESHA
WELL NO.
3
BROADWAY
RACINE
FOX
WELL NO. 6
BOOSTER
WELL NO. 5
MARIE
ORIGINAL COMPILATION AT
SCALE: 1 INCH = 2000 FEET

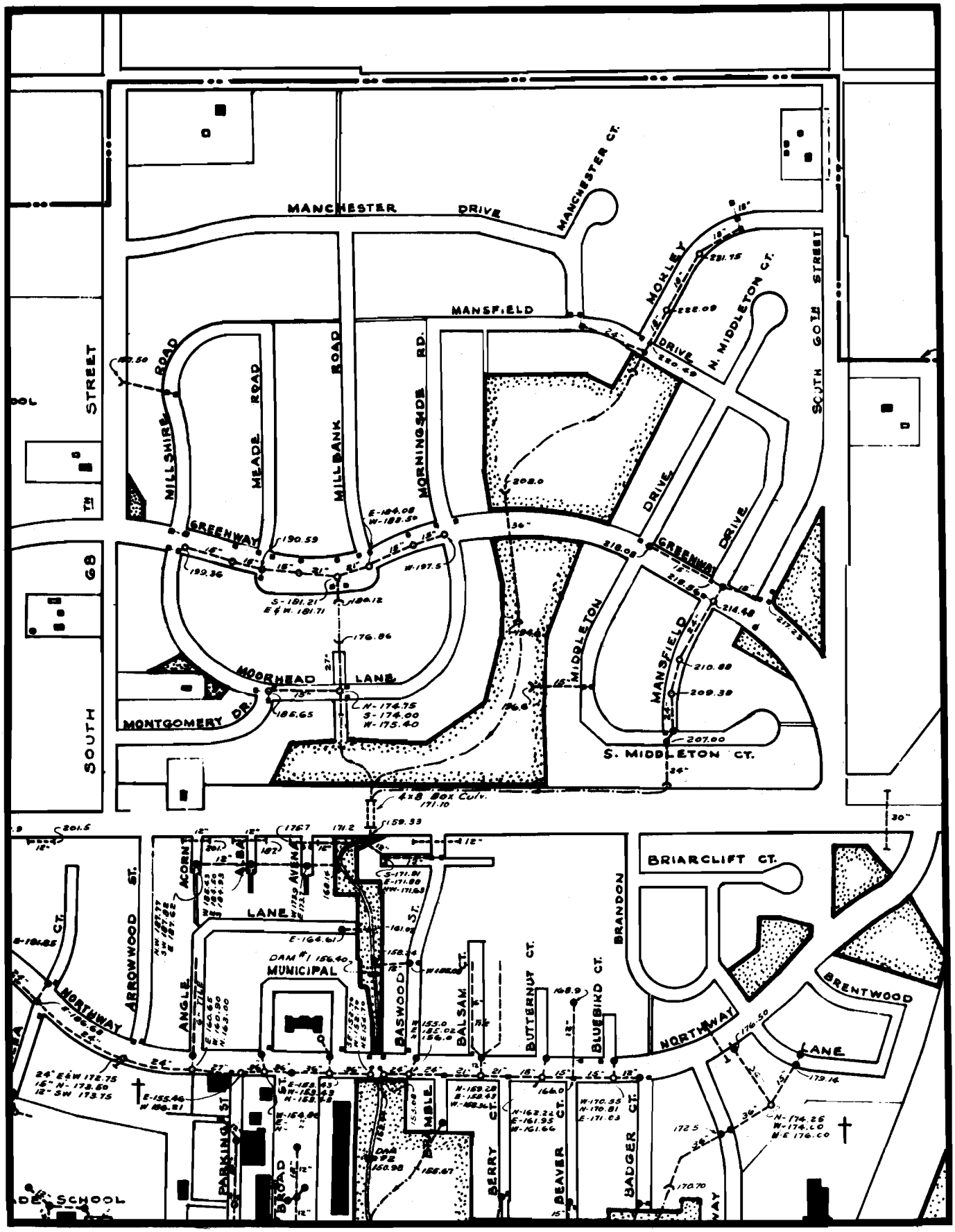


COUNTY AIRPORT
F.L. 133.98
F.L. 114.63
FORCE MAIN
PUMP STA.
PUMP STA.
F.L. 109.76
F.L. 48.84
MINNEAPOLIS
BROOKFIELD
PUMP STA.
SUMMIT AVE.
NORTH ST.
PUMP STA.
F.L. 11.97 .0047
MAIN
F.L. 56.67
F.L. 66.00
WAUKESHA SEWAGE DISPOSAL PLANT
FOX
F.L. 7.50
27" X 33"
F.L. 10.4
.0014
10" .0012 8" .0051
F.L. 124.30
FORCE
F.L. 72.85
PUMP STA.
RACINE
F.L. 61.24
FORCE MAIN
MARIE
F.L. 21.92
PUMP STA.
ORIGINAL COMPILATION AT
SCALE: 1 INCH = 2000 FEET

MAP 11


28
27
26
WAUKESHA
COUNTY AIRPORT
T
FT
F
34
35
MINNEAPOLIS
18
AVE.
BROOKFIELD
Y
122.47
42"
122.39
.001
121.24
54"
36"
30"
54"
114.24
SUMMIT
.003
24"
87.27
73.27
NORTH
24"
FL.37.10
30"
WHITE ROCK
ST.
MADISON
85.68
42.01
FL.23.48
36"
FL.59.98
.0023
30"
2
4
.007 36"
86.12
24"
42"
59
42"
36"
BROADWAY
27"
18"
24"
30"
24"
42"
36"
24"
30"
24"
24"
30"
30"
24"
24"
RACINE
FL.97.57
.0034
FL.7.84
.0017
24"
24" 36"
72"
.0067
78"
.0022
FL.7.44
24"
24"
FL.80.54
FL.82.22
27"
36"
11
.005 48"
64.71
30"
FOX
.0032 36"
24"
FL.50.06
FL.45.58
X
X
F
FL.84.17
42"
XX
FL.42.94
56.26
.004
ORIGINAL COMPILATION AT
SCALE: 1 INCH = 2000 FEET

MAP 12


MANCHESTER DRIVE
MANCHESTER CT.
MANSFIELD
MORLEY
N. MIDDLETON CT.
SOUTH GOTH STREET
MILLSHIRE ROAD
MEADE ROAD
MILLBANK ROAD
MORNINGSIDE RD.
DRIVE
GREENWAY
MOORHEAD LANE
MONTGOMERY DR.
SOUTH
MIDDLETON
MANSFIELD
S. MIDDLETON CT.
4x8 Box Culv.
BRIARCLIFT CT.
BRANDON
BRENTWOOD
LANE
NORTHWAY
ARROWWOOD CT.
ANGLE
ACORN
BASWOOD CT.
BALSAM CT.
BUTTERNUT CT.
BLUEBIRD CT.
DAM #1 156.40
MUNICIPAL
PARKING
BROAD
BERRY CT.
BEAVER CT.
BADGER CT.
SCHOOL

MAP 13

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