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Public Ground-Water Supplies in Greene County

by DOROTHY M. WOLLER, ROBERT D. OLSON, MICHAEL L SARGENT, and ELLIS W. SANDERSON

ILLINOIS STATE WATER SURVEY

CHAMPAIGN

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HON. JAMES R. THOMPSON, Governor

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PUBLIC GROUND-WATER SUPPLIES IN GREENE COUNTY

by Dorothy M. Woller, Robert D. Olson, Michael L. Sargent,[1] and Ellis W. Sanderson

INTRODUCTION

This publication presents all available information on production wells used for public ground-water supplies in Greene County. Bulletin 60, which is divided into separate publications by county, supersedes Bulletin 40 and its Supplements 1 and 2.

This report includes separate descriptions for eight ground-water supplies located in Greene County. Water for three of these supplies is obtained from wells or supplies located in Scott and Macoupin Counties. These are preceded by brief summaries of the ground-water geology and hydrology of the county and the development of ground-water sources for public use. An explanation of the format used in the descriptions is also given.

Acknowledgments. This report was prepared under the general direction of Richard G. Semonin, Chief of the Illinois State Water Survey. John W. Brother, Jr. and Dave Cox prepared the illustrations. The annual pumpage information was provided by James R. Kirk. The chemical analyses, unless otherwise stated, were made by personnel of the Water Survey Analytical Chemistry Laboratory Unit under the supervision of Mark E. Peden. The analyses made by personnel of the Illinois Environmental Protection Agency were under the supervision of Roger Selburg. Ross D. Brower, Associate Geologist, Illinois State Geological Survey, reviewed the geological information in the manuscript. Grateful acknowledgment also is given to consulting engineers, well drillers, water superintendents, and municipal officials who have provided valuable information used in this report.

GROUND-WATER GEOLOGY AND HYDROLOGY

The ground-water geology and hydrology of Greene County are described generally in Illinois State Geological Survey Circular 232, "Groundwater Geology in Western Illinois, South Part." The following brief discussion of geologic and hydrologic conditions in the county is taken largely from this publication. For a more detailed definition of the geology in this part of the state, the reader is referred to the State Geological Survey. More detailed information concerning the ground-water hydrology and water quality may be obtained from the State Water Survey. The Surveys are located on the campus of the University of Illinois at Urbana-Champaign.

Unconsolidated Deposits

Almost all of Greene County lies in the Springfield Plain of the Till Plains Section of the Central Lowland physiographic province. A very small area in the extreme southwest corner of the county lies in the Lincoln Hills Section of the Ozark Plateaus Province, some of which may be unglaciated. The upland area of the county has been completely blanketed by glacial deposits (often referred to as drift), except where local erosion has occurred along the major stream valleys. The county is bordered on the west by the east side of the Illinois River

[1]Illinois State Geological Survey

valley, which ranges from 2 to 4 miles wide and contains thick deposits of alluvium and loess overlying a thick sequence of sand and gravel outwash. The Illinois River valley also is the western boundary of Illinoian drift. The upland area is a till plain with low, broad morainic ridges, crevasse fillings, and kame terraces with intervening small stretches of relatively flat ground moraines and glacial lake beds that are typical of the western Springfield Plain. Well developed but shallow entrenchment characterizes the drainage system, which is in a late youthful stage of dissection from the drift in the uplands.

Unconsolidated materials, mostly drift, alluvium, and loess (Prairie Aquigroup, figure 1), form the present-day land surface in Greene County. The unconsolidated materials vary greatly in thickness and water-yielding character. Thickness ranges from 0 (where bedrock outcrops) to 150 ft. The thickest sections occur in the Illinois River valley and in the Apple Creek and Macoupin Creek bottomlands, which are coincident with partially buried preglacial bedrock valleys (figures 2 and 3). The most favorable prospects for developing ground-water supplies he where unconsolidated deposits are thickest and where glacial meltwater or modern streams have deposited clean sand and gravel.

Extensive deposits of highly permeable sand and gravel are associated with the Illinois River bottomlands. These deposits are suitable for developing large municipal, industrial, and irrigation supplies and offer the greatest potential for ground-water development in Greene County. Their thickness ranges from about 50 ft to as much as 150 ft, and individual wells commonly yield 500 to 1000 gpm. Such deposits supply ground water to the municipal systems at Carrollton, Eldred, and Hillview. The estimated long-term yield is 500 gpm for each of the two supply wells at Carrollton, whereas the wells at Eldred and Hillview have long-term yields of 50 to 100 gpm. Lower long-term yields for the latter two supplies likely are a function of well construction features rather than resource availability.

Sand and gravel deposits favorable for the development of small municipal supplies also may be present in the valleys of Apple Creek and Macoupin Creek. Little information is available on the quantity of water available from these valleys, however, because most areas outside of the public water supply systems remain unexplored. Successful development of a municipal ground-water supply will depend on a thorough exploration program that includes a review of well records, geophysical testing, and test drilling.

Two villages have explored the water supply potential in deposits in the Macoupin Creek bottomlands and have developed water supplies. The village of Kane has developed a supply of 100 gpm from two wells finished in these deposits. The village of Greenfield also finished several supply wells in these deposits. Although each well supplied 10-40 gpm, they have been replaced by an alternate supply because of their inability to provide reliable and adequate quantities of water. As experienced at Greenfield, it is common for sand and gravel aquifers associated with the tributary valleys to be shallow and limited in areal extent. These aquifer characteristics reduce the quantities of water available and signal an acute response to drought conditions.

In upland areas east of the Illinois River valley and outside of the Apple Creek and Macoupin Creek bottomlands, the unconsolidated deposits are less than 50 ft thick and have a very low potential for yielding ground water. Occasionally, though, they contain discontinuous sand and gravel deposits capable of furnishing domestic and farm supplies.

Bedrock

Bedrock units lying directly below unconsolidated deposits in Greene County are assigned to the Upper Bedrock Aquigroup. From the eastern to western boundaries of the county, their geologic ages range from Pennsylvanian to Ordovician (figures 1 and 4). Those bedrock units that become isolated from the bedrock surface by an overlying bedrock confining unit are assigned to either the Mississippi Valley Aquigroup (Mississippian, Devonian, Silurian) or the Midwest Bedrock Aquigroup (Ordovician).

The bedrock surface is formed by units of the Pennsylvanian System in the eastern half of the county. These rocks consist principally of shale and range in thickness from a featheredge at their western extent to more than 200 ft in the northeast corner of the county. They do not appear to offer potential as ground-water sources, except where thin beds of sandstone, fractured shale, or creviced limestone are encountered, usually at depths less than 100 ft. In these cases yields sufficient for small domestic supplies generally can be obtained. No municipal supply in the county utilizes the Pennsylvanian as a source.

Mississippian-age rocks occur beneath Pennsylvanian units, but they also form the bedrock surface westward from the eroded edge of Pennsylvanian rocks roughly to the base of the bluffs of the Illinois River valley. Mississippian rocks consist of shale, sandstone, and creviced limestones. The rock formations within the Mississippian System regionally dip to the east at about 30 to 40 ft per mile. The upper Mississippian rocks belonging to the Valmeyeran Series range in thickness from a featheredge

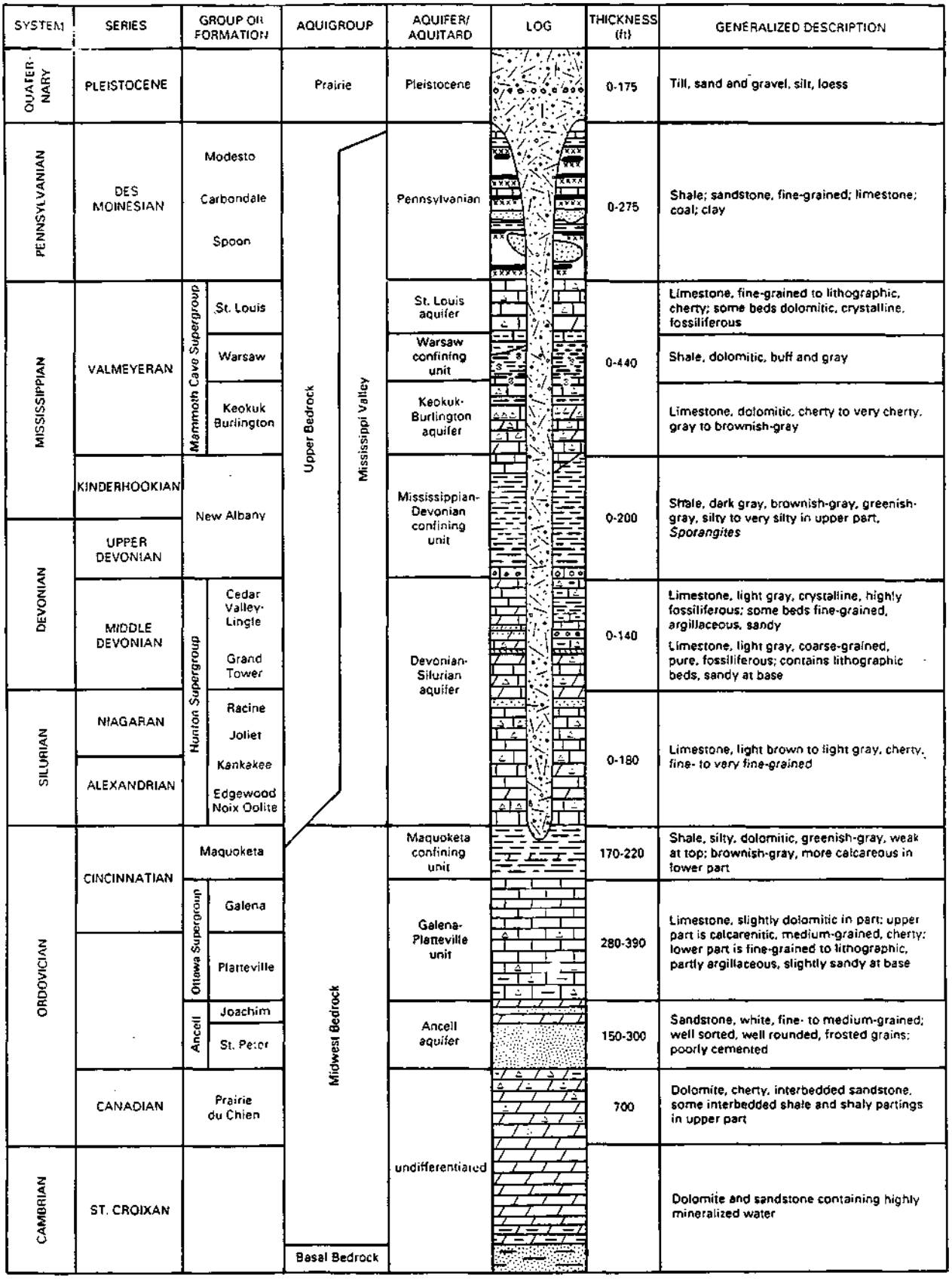

Figure 1. Generalized column of rock stratigraphic units encountered by water-supply wells in Greene County

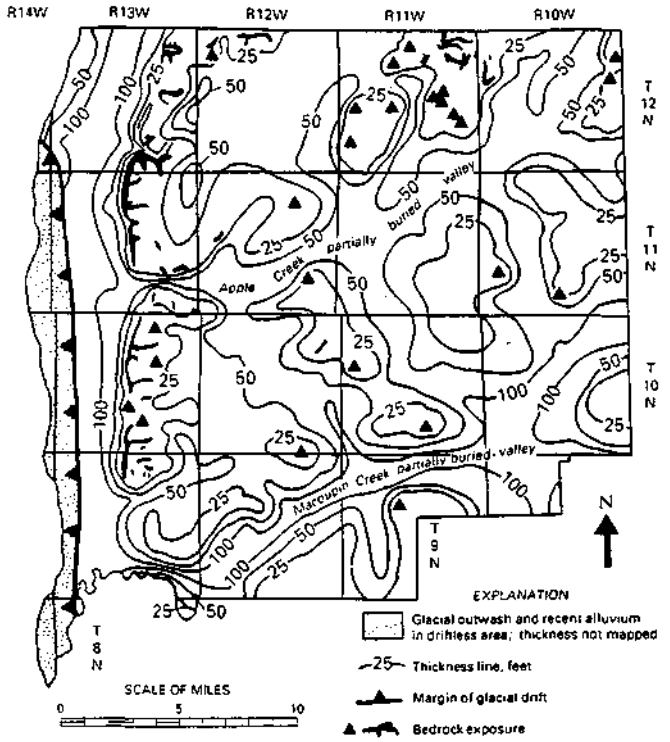

Figure 2. Thickness of glacial drift in Greene County (modified from Piskin and Bergstrom, 1975, ISGS Circular 49D, plate 1)

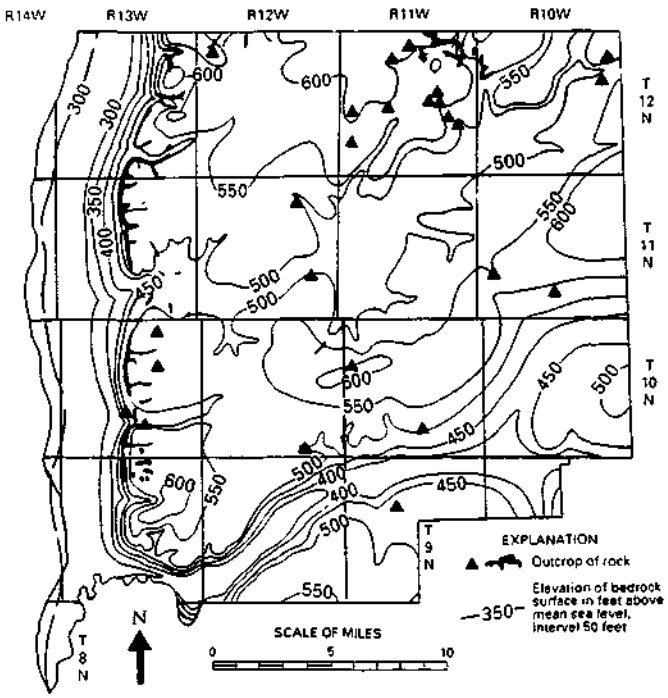

Figure 3. Topography of bedrock surface in Greene County (modified from Horberg, 1950, ISGS Bulletin 73, plate 1)

where they are eroded along the bluffs to as much as 440 ft in the southeast corner of the county.

The Burlington-Keokuk Limestone located within the Valmeyeran Series is the principal aquifer of the Mississippian System. It ranges in thickness from a featheredge along the bluffs to about 200 ft along the east line of the county. The Burlington-Keokuk aquifer is overlain by the Warsaw Shale in the eastern two-thirds of Greene County, except for a small area in the north-central part of the county where it is directly under Pennsylvanian rocks. The Warsaw Shale increases in thickness from a featheredge at its western extent to a maximum of about 80 ft in the east and is not water bearing. The Warsaw Shale and Pennsylvanian rocks confine the Burlington-Keokuk aquifer. Therefore, where the Burlington-Keokuk Limestone is overlain by these rocks, it is assigned to the Mississippi Valley Aquigroup. In the areas of the county where the Burlington-Keokuk Limestone directly underlies unconsolidated deposits, it is assigned to the Upper Bedrock Aquigroup.

Wells finished in the Burlington-Keokuk Limestone will produce yields depending on the number, size, and degree of interconnection of water-filled cracks and crevices within the rock that are intersected by the well bore. Water from this unit generally decreases both in quantity and quality as depth increases and as the limestone is buried by overlying bedrock units (Mississippi Valley Aquigroup). Quantities of water adequate for domestic and farm use generally can be obtained in Greene County from the Burlington-Keokuk Limestone aquifer when it lies at depths less than 400 ft. In a number of areas, particularly where the limestone directly underlies unconsolidated deposits (Upper Bedrock Aquigroup), the density of fractures and crevices probably is adequate to support well yields of 25 to 50 gpm or more. For example, Carrollton has reportedly obtained several hundred thousand gpd since 1900 from springs that issue from fissures in this limestone along a small tributary of Apple Creek. Roodhouse obtained water from similar springs a short distance to the north in Scott County before drilling two wells 150 ft deep into the Burlington-Keokuk Limestone. These wells normally are pumped at rates of 450 to 600 gpm, but rates decline to about 200 gpm during periods of drought.

Shales from the New Albany Group underlie the Burlington-Keokuk Limestone and form a confining unit

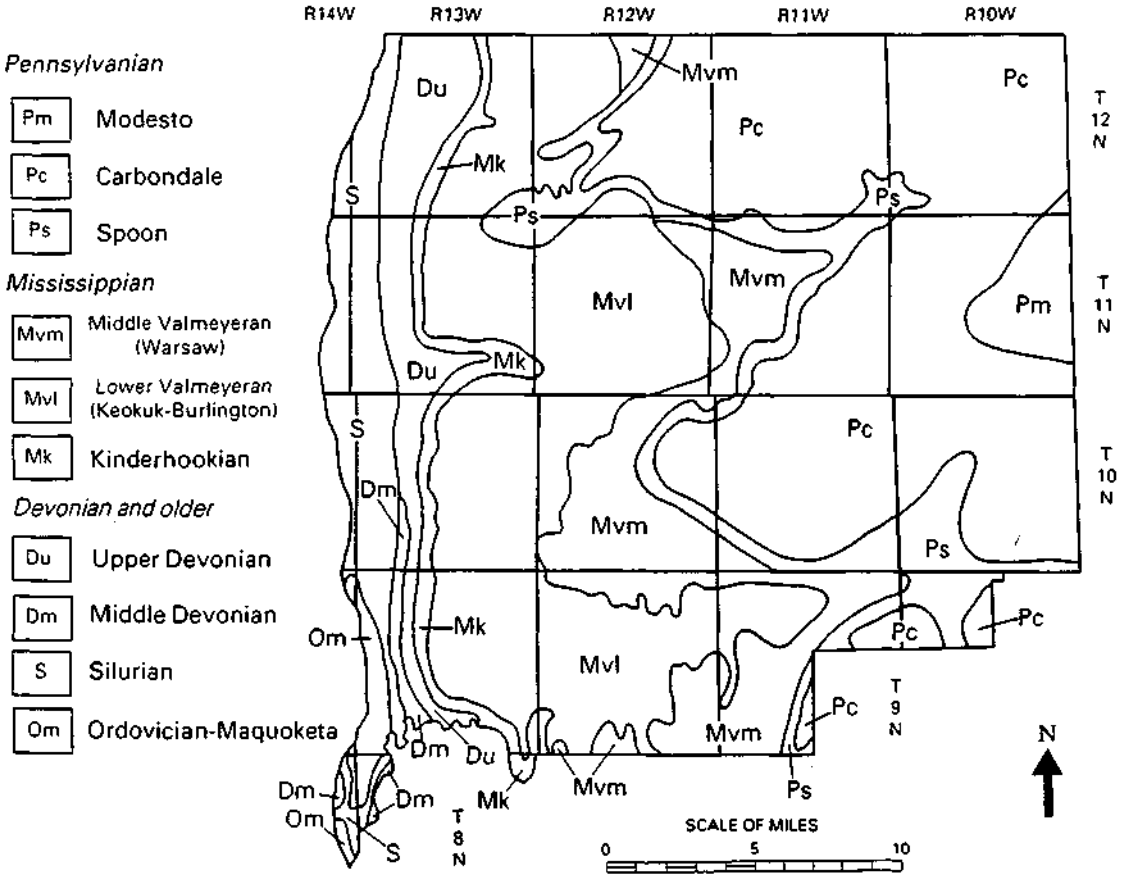

Figure 4. Geologic map of bedrock surface in Greene County (modified from Willman et al., 1967, Geologic Map of Illinois)

for the deeper Devonian and Silurian carbonates. These shales, which have been eroded west of the bluffs along the Illinois River valley, range in thickness from a feather edge along this erosional limit to 200 ft in eastern Greene County.

Limestone and dolomite of Devonian and Silurian age and Ordovician shale (Maquoketa) occur below the New Albany shales, or they underlie unconsolidated materials in the Illinois River bottomlands along the west edge of the county. At more than 200 ft thick, the limestone and dolomite may have potential for development where they directly underlie the unconsolidated deposits (Upper Bedrock Aquigroup); but in the rest of the county the water is too highly mineralized for most uses. Deeper, water-bearing Ordovician-age rock units, such as the St. Peter Sandstone, contain poor-quality water. This was the case when the city of Carrollton obtained water from a well that reportedly penetrated the St. Peter Sandstone; it was abandoned in 1900.

Summary

Ground-water availability in Greene County is extremely variable. The greatest potential for development occurs in thick sand and gravel aquifers associated with the Illinois River bottomlands. Small municipal supplies may also be located through record review, geophysical exploration, and test drilling in unconsolidated deposits in the Apple Creek and Macoupin Creek bottomlands.

East of the Illinois River valley the Burlington-Keokuk Limestone offers potential for the development of small- to moderate-sized ground-water supplies. The shallow Devonian-Silurian limestone and dolomite along the western edge of the county are a potential source of small to moderate amounts of ground water, but they remain unexplored. Deeper horizons, including the St. Peter Sandstone, contain poor-quality water unsuitable for most uses.

GROUND-WATER DEVELOPMENT FOR PUBLIC USE

Ground water is used as a source for eight public water supplies serving Carrollton, Eldred, Hillview, Kane, Mt. Gilead Shelter Care Home, Patterson, Rockbridge, and Roodhouse. Rockbridge and Roodhouse are located in this county, but they receive their water from Macoupin and Scott Counties. Therefore, these two supplies are not included in the following discussion of pumpages and water quality for Greene County. The locations of these supplies are shown in figure 5.

Sand and gravel deposits above bedrock in the unconsolidated materials of the Prairie Aquigroup are tapped at Carrollton, Eldred, Hillview, and Kane as a source of all or a portion of their water supply. Presently, seven production wells, ranging in depth from 52 to 90 ft, tap the sand and gravel deposits. Their reported pumping rates range from 50 to 500 gpm depending primarily upon the type of well and the permeability, thickness, and areal extent of the sand and gravel unit tapped by each well. Production from these wells for 1988 was estimated to be 194,000 gpd. Analyses of water samples show that the iron content ranges from 0.0 to 3.09 mg/L, and the hardness ranges from 181 to 509 mg/L. Water from Carrollton, Eldred, Hillview, and Kane is chlorinated and fluoridated. Water from the wells at Carrollton is lime softened; the water from Hillview is fed potassium permanganate and filtered; and the water from Kane is aerated and filtered.

Seventeen springs discharging from the Upper Bedrock Aquigroup (Burlington-Keokuk Limestone) are tapped at Carrollton. One well at the Mt. Gilead Shelter Care Home is completed in the Upper Bedrock Aquigroup (Burlington-Keokuk Limestone). The well is 205 ft deep and is reportedly pumped at about 8 gpm. Estimated production from the springs and well was 214,900 gpd in 1988. Analyses of water samples from the springs indicate that the iron content ranges from 0.0 to 0.2 mg/L, and the hardness ranges from 282 to 348 mg/L. No analysis is available from the well supply. The water for the Mt. Gilead Shelter Care Home is chlorinated.

The total pumpage for public water supplies in Greene County in 1988 averaged about 408,900 gpd. Of this total, approximately 47 percent (194,000 gpd) was from wells finished in the sand and gravel aquifers of the Prairie Aquigroup, and 53 percent (214,900 gpd) was from wells and springs finished in the Upper Bedrock Aquigroup (Burlington-Keokuk Limestone).

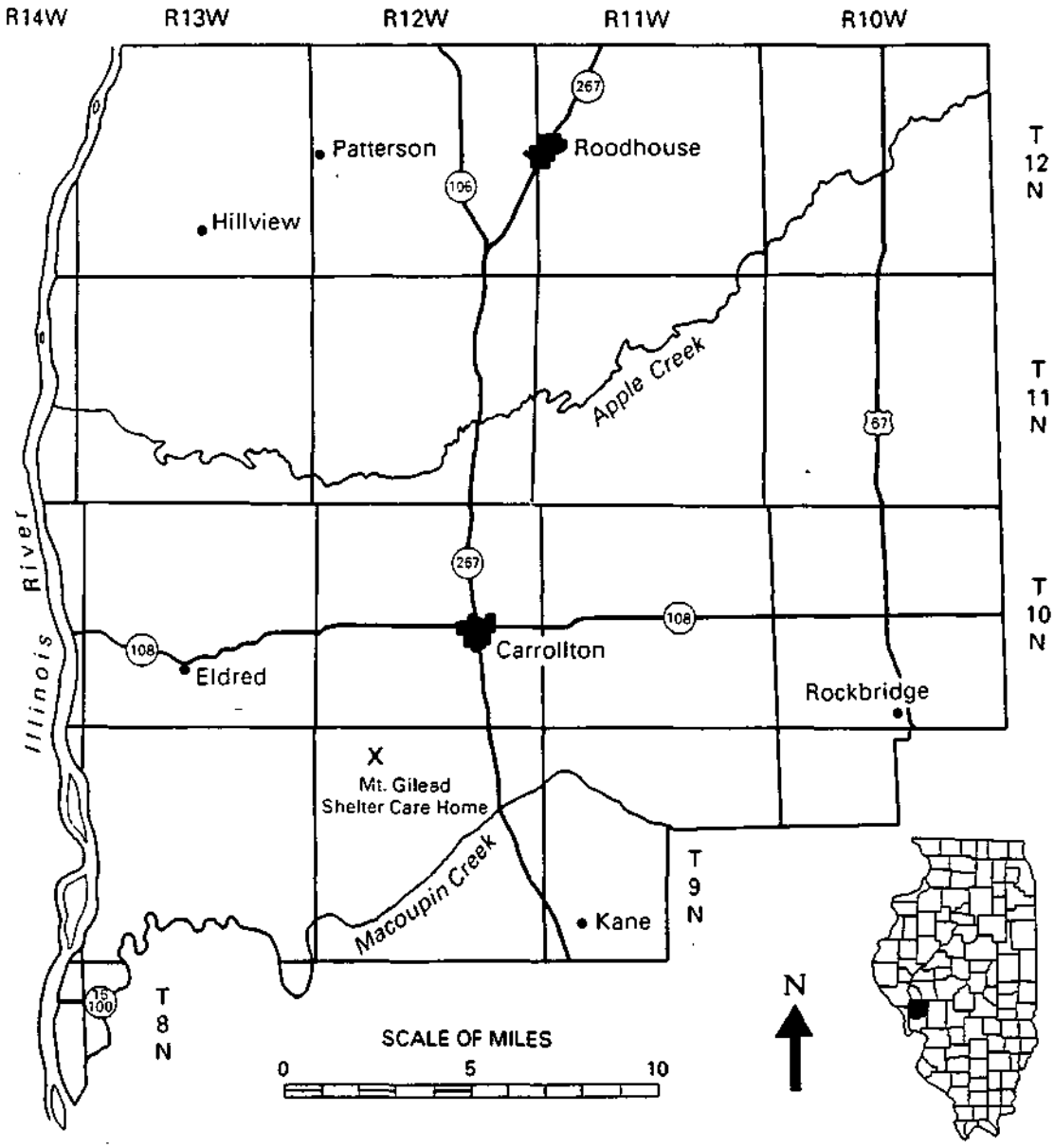

Figure 5. Locations of public ground-water supplies in Greene County

FORMAT

In this publication the descriptions of public groundwater supplies are presented in alphabetical order by place name.

At the beginning of each description the U.S. Census of population for 1980 is given for incorporated places. For unincorporated places, population is estimated by the number of services or residential units and an assumed number of 3.5 persons per service.

The earliest and latest reported values for the number of services and the quantity of water distributed at each supply are given where available.

Individual production wells for each supply are described in the order of their construction. The description for each well includes the *aquifer tapped, date drilled, depth, driller, legal location, elevation in feet above mean sea level, log, construction features, yield, pumping equipment, and chemical analyses.*

When available, drillers logs are used as reported. Commonly used drillers terms such as clay, silt, or pebbly clay generally are synonymous with the glacial tills tabulated by the State Geological Survey. When the bedrock aquifers tapped by a well are described, the drillers log and casing record are used to determine the hydrostratigraphic units open to the well.

The screen sizes given in this publication are for continuous slot-type screens unless stated otherwise. Slot sizes given indicate the width of the slot openings in thousandths of an inch. For example, a 20-slot screen has slot openings 0.020 in. wide, and a 100-slot screen has slots 0.100 in. wide. Approximate equivalent slot openings for other types of screens are given in parentheses after the screen description.

Abbreviations Used

ft.	foot(feet)
gpd	gallons per day
gpm	gallons per minute
hp	horsepower
hr	hour(s)
in.	inch(es)
Lab	laboratory
me/L	milliequivalents per liter
mg/L	milligrams per liter
min	minute(s)
No.(s)	number(s)
pc/L	picocuries per liter
R	range
rpm	revolutions per minute
T	township
TDH	total dynamic head

CARROLLTON

The city of Carrollton (2816) installed a public water supply in 1890. A spring supply and two wells (Nos. 1 and 2) are in use. In 1955 there were 750 services, all metered; the estimated average and maximum pumpages in 1949 were 150,000 and 200,000 gpd, respectively. In 1988 there were 1125 services, all metered; the average pumpage was 323,300 gpd. The water is chlorinated and fluoridated; in addition, the water from the wells is lime softened.

Initially, a well finished in St. Peter Sandstone was completed near the center of the city in May 1890 to a depth of 1330 ft by the Gray Well Co., Chicago. This well was abandoned about 1900 because the water was highly mineralized. An 8-in. diameter hole was drilled to a depth of 150 ft and finished 6 in. in diameter from 150 to 1330 ft. Upon completion, the nonpumping water level was reported to be 50 ft below land surface.

SEVENTEEN SPRINGS, discharging from the Upper Bedrock Aquigroup (Burlington-Keokuk Limestone), were developed in August 1900. The springs are located about 3.5 miles northwest of the city in the floodplain of Coates Creek, approximately 1200 ft S and 10 ft E of the NW corner of Section 8, T10N, R12W. The land surface elevation at the springs is approximately 480 ft.

The following mineral analysis (Lab. No. 212350) is for a water sample from the spring supply collected October 22, 1979.

SPRING SUPPLY, LABORATORY NO. 212350

		mg/L	*me/L*			*mg/L*	*me/L*
Iron(total)	**Fe**	**0.2**		**Silica**	**SiO_2**	**17.4**	
Manganese	**Mn**	**0.00**		**Fluoride**	**F**	**0.2**	
Ammonium	**NH_4**	**0.0**	**0.00**	**Boron**	**B**	**0.1**	
Sodium	**Na**	**9.2**	**0.40**	**Nitrate**	**NO_3**	**21.8**	**0.35**
Potassium	**K**	**1.5**	**0.04**	**Chloride**	**C1**	**13**	**0.37**
Calcium	**Ca**	**88.0**	**4.39**	**Sulfate**	**SO_4**	**34.1**	**0.71**
Magnesium	**Mg**	**28.8**	**2.37**	**Alkalinity (as**	**$CaCO_3$)**	**290**	**5.80**
Strontium	**Sr**	**0.13**	**0.00**				
				Hardness (as	**$CaCO_3$)**	**338**	**6.76**
Barium	**Ba**	**<0.1**					
Cadmium	**Cd**	**0.00**		**Total dissolved**			
Chromium	**Cr**	**0.00**		**minerals**		**400**	
Copper	**Cu**	**0.01**					
Lead	**Pb**	**<0.05**					
Lithium	**Li**	**0.00**					
Nickel	**Ni**	**0.00**		**Turbidity**	**7**		
Silver	**Ag**	**0.00**		**Color**	**0**		
Zinc	**Zn**	**0.02**		**Odor**	**0**		

The springs are within an area of about 20 by 40 ft with concrete walls, 15 ft high, erected to enclose the springs.

In 1917 the total yield of the springs was reported to be about 600,000 gpd. In 1934 it was reported that the springs produced about 375,000 gpd.

As part of a ground-water exploration program the city constructed eight test holes in 1941 and seven more in 1954. Seven of these holes ranged in depth from 53 to 56 ft. The holes were located in the SW quarter of Section 6, the SE quarter of Section 7, and the NE quarter of Section 8, T10N, R12W.

Four test holes were constructed in 1956 by the Orient Drilling Co., Jerseyville, to depths ranging from 50 to 69 ft. The holes were located in the NE quarter of the NE quarter of the NE quarter of Section 7, T10N, R12W. The fourth test hole was drilled to a depth of 63 ft and cased with 61 ft of 6-in. pipe with the bottom 31 ft slotted with 1/4- by 3/8-in. slots (backfilled to 55 ft). A production test using three observation wells was conducted on October 11-12, 1956, by representatives of the city, the State Water Survey, and Casler & Stapleton, Consulting Engineers. After 24 hr of pumping at rates ranging from 100 to 75 gpm, the final drawdown was 28.5 ft from a nonpumping water level of 8.0 ft below land surface.

Test Hole No. 1 was constructed in October 1981 to a depth of 90 ft by the Layne-Western Co., St. Louis, Missouri. It was located approximately 75 ft N and 739 ft E of the SW corner of Section 8, T10N, R13W. Upon completion, the nonpumping water level was reported to be 9.25 ft below land surface.

Test Hole No. 2 was constructed in October 1981 to a depth of 91 ft by the Layne-Western Co., St. Louis, Missouri. It was located approximately 800 ft N and 550 ft E of the SW corner of Section 8, T10N, R13W. Upon completion, the nonpumping water level was reported to be 9 ft below land surface.

WELL NO. 1, finished in sand and gravel of the Prairie Aquigroup, was completed in September 1982 to a depth of 87 ft by Albrecht Well Drilling, Inc., Ohio, Illinois. The well is located in the Illinois River valley, approximately 45 ft N and 1345 ft E of the SW corner of Section 8, T10N, R13W. The land surface elevation at the well is 427.4 ft.

A 30-in. diameter hole was drilled to a depth of 87 ft. The well is cased with 12-in. pipe from about 1 ft above land surface to a depth of 69 ft followed by 18 ft of 12-in. No. 80 slot Johnson screen. The annulus between the borehole and casing-screen assembly is filled with cement from 0 to 17 ft and with No. 3 Muscatine gravel from 17 to 87 ft.

WELL NO. 1, DRILLERS LOG

Strata	*Thickness (ft)*	*Depth (ft)*
Brown silty clay	6	6
Fine to medium sand	14	20
Medium to coarse sand	35	55
Medium sand and boulders around 65 ft	13	68
Boulders and medium and fine sand	12	80
Medium to coarse sand with boulders	7	87
Bedrock		

A production test using three observation wells was conducted on September 22-23, 1982, by representatives of the driller, the State Water Survey, and Casler, Houser & Hutchison, Consulting Engineers. After 20 hr of pumping at rates ranging from 500 to 510 gpm, the final drawdown was 6.40 ft from a nonpumping water level of 8.29 ft below land surface. One hr after pumping was stopped, the water level had recovered to 8.67 ft.

The pumping equipment presently installed is an 11-stage Peabody Floway vertical turbine pump set at 70 ft, rated at 500 gpm at about 370 ft TDH, and powered by a 75-hp, 1770 rpm electric motor.

A partial analysis of a sample (Lab. No. 217773) collected during the initial production test, showed the water to have a hardness of 343 mg/L, total dissolved minerals of 370 mg/L, and an iron content of 1.9 mg/L.

WELL NO. 2, finished in sand and gravel of the Prairie Aquigroup, was completed in September 1982 to a depth of 80 ft by Albrecht Well Drilling, Inc., Ohio, Illinois. The well is located about 250 ft northeast of Well No. 1, approximately 260 ft N and 1375 ft E of the SW corner of Section 8, T10N, R13W. The land surface elevation at the well is approximately 428 ft.

A 30-in. diameter hole was drilled to a depth of 80 ft. The well is cased with 12-in. pipe from land surface to a depth of 62 ft followed by 18 ft of 12-in. No. 80 slot Johnson stainless steel screen. The annulus between the borehole and casing-screen assembly is filled with cement from 0 to 10 ft and with No. 3 Muscatine gravel from 10 to 80 ft.

WELL NO. 2, DRILLERS LOG

Strata	*Thickness (ft)*	*Depth (ft)*
Brown silty clay	6	6
Fine to medium sand	12	18
Medium to coarse sand and gravel	34	52
Medium sand and gravel	13	65
Boulders with medium sand and gravel	15	80
Clay		

A production test using two observation wells was conducted on September 23, 1982, by representatives of the driller, the State Water Survey, and Casler, Houser & Hutchison, Consulting Engineers. After 2 hr of pumping at rates ranging from 535 to 485 gpm, the final drawdown was 7.98 ft from a nonpumping water level of 9.78 ft below land surface. Twenty-five min after pumping was stopped, the water level had recovered to 9.90 ft.

The pumping equipment presently installed is an 11-stage Peabody Floway vertical turbine pump set at 60 ft, rated at 500 gpm at about 370 ft TDH, and powered by a 75-hp electric motor.

A partial analysis of a sample (Lab. No. 217774) collected September 24, 1982, showed the water to have a hardness of 361 mg/L, total dissolved minerals of 390 mg/L, and an iron content of 1.9 mg/L.

On the basis of the production tests conducted on Well Nos. 1 and 2 in September 1982, the long-term yield for each of these two wells was estimated to be 500 gpm (720,000 gpd).

ELDRED

The village of Eldred (286) installed a public water supply in 1959. One well (No. 1) is in use and another well (No. 2) is available for emergency use. In 1962 there were 100 services, 5 metered; the average pumpage was 16,000 gpd. In 1988 there were 131 services; the average pumpage was 27,960 gpd. The water is chlorinated and fluoridated.

WELL NO. 1, finished in sand and gravel of the Prairie Aquigroup, was completed in June 1959 to a depth of 52 ft by the Calhoun Drilling Co., Batchtown. The well is located near the intersection of Locust and Maple Sts., approximately 2000 ft S and 950 ft E of the NW corner of Section 28, T10N, R13W. The land surface elevation at the well is approximately 445 ft.

WELL NO. 1, DRILLERS LOG

Strata	*Thickness (ft)*	*Depth (ft)*
Black soil	5	5
Yellow clay, hard	8	13
Yellow clay, soft caved	5	18
Sandy yellow clay	12	30
Fine dirty sand	3	33
Clean sand, coarse	19	52

An 8-in. diameter hole was drilled to a depth of 52 ft. The well is cased with 8-in. steel pipe from about 2 ft above land surface to a depth of 42 ft followed by 10 ft of 8-in. No. 20 slot Cook silicon bronze wire-wound screen.

A production test was conducted on June 16, 1959, by representatives of the driller, the village, the State Water Survey, and Wm. H. Klingner & Associates, Engineers. After 6 hr of pumping at rates ranging from 106 to 110 gpm, the final drawdown was 5.35 ft from a nonpumping water level of 25.53 ft below the top of the casing. One hr after pumping was stopped, the water level had recovered to 25.67 ft. On the basis of the production test data, it was estimated that this well should yield 100 gpm (144,000 gpd) on a long-term basis.

The pumping equipment presently installed is a Jacuzzi vertical turbine pump set at 39 ft, rated at 100 gpm at about 256 ft TDH, and powered by a 10-hp, 1800 rpm U. S. electric motor.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B105209) of a sample collected November 14, 1973, after pumping for 1 hr at 88 gpm, showed the water to have a hardness of 485 mg/L, total dissolved minerals of 597 mg/L, and an iron content of 0.00 mg/L.

WELL NO. 2, finished in sand and gravel of the Prairie Aquigroup, was completed in May 1971 to a depth of 56 ft by the Calhoun Drilling Co., Batchtown. This well is available for emergency use. The well is located about 85 ft north of Well No. 1, approximately 1915 ft S and 950 ft E of the NW corner of Section 28, T10N, R13W. The land surface elevation at the well is approximately 445 ft.

A 6-in. diameter hole was drilled to a depth of 56 ft. The well is cased with 6-in. steel pipe from about 1 ft above land surface to a depth of 50 ft followed by 6 ft of 6-in. screen.

The pumping equipment presently installed is a Reda pump set at 45 ft, rated at about 53 gpm, and powered by a 5-hp Reda electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B09573) is for a water sample from the well collected August 21, 1978, after 1.8 hr of pumping at 50 gpm.

WELL NO. 2, LABORATORY NO. B09S73

		mg/L	*me/L*			*mg/L*	*me/L*
Iron	Fe	0.1		Silica	SiO_2	28	
Manganese	Mn	0.01		Fluoride	F	0.2	0.01
Ammonium	NH_4	0.0	0.00	Boron	B	0.1	
Sodium	Na	16	0.70	Cyanide	CN	0.00	
Potassium	K	1.3	0.03	Nitrate	NO_3	26	0.42
Calcium	Ca	102	5.09	Chloride	C1	23	0.65
Magnesium	Mg	44	3.62	Sulfate	SO_4	101	2.10
				Alkalinity (as	$CaCO_3$)	305	6.10
Arsenic	As	0.00					
Barium	Ba	0.1		Hardness (as	$CaCO_3$)	434	8.68
Cadmium	Cd	0.00					
Chromium	Cr	0.00		Total dissolved			
Copper	Cu	0.00		minerals		538	
Lead	Pb	0.00					
Mercury	Hg	<0.00002					
Nickel	Ni	0.0					
Selenium	Se	0.00					
Silver	Ag	0.00					
Zinc	Zn	0.0		pH (as rec'd)		7.6	

HILLVIEW

The village of Hillview (328) installed a public water supply in 1969. One well (No. 2) is in use. In 1970 there were 75 services, all metered; the average pumpage was 15,000 gpd. In 1988 there were 102 services, all metered; the estimated average pumpage was 16,400 gpd. The water is fed potassium permanganate, filtered to remove iron, chlorinated, and fluoridated.

WELL NO. 1, finished in sand and gravel of the Prairie Aquigroup, was completed in July 1968 to a depth of 69.5

ft by the Layne-Western Co., St. Louis, Missouri. This well is not in use. The well is located inside the water treatment plant at the west edge of the village, approximately 1300 ft N and 85 ft W of the SE corner of Section 28, T12N, R13W. The land surface elevation at the well is approximately 440 ft.

WELL NO. 1, DRILLERS LOG

Strata	*Thickness (ft)*	*Depth (ft)*
Brown clay	**15**	**15**
Brown clay with sand	**7**	**22**
Fine sand, gray and brown	**27**	**49**
Gray clay and gravel	**10**	**59**
Sand, gravel and boulders	**13**	**72**
Rock	**at**	**72**

A 13-in. diameter hole was drilled to a depth of 69.5 ft. The well is cased with 8-in. steel pipe from about 2 ft above land surface to a depth of 59.5 ft followed by 10 ft of 6-in. No. 6 (0.080 in.) Layne shutter screen. The annulus between the borehole and casing-screen assembly is filled with cement from 0 to 10 ft, with puddled clay from 10 to 22 ft, and with gravel from 22 to 69.5 ft.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B9334) is for a water sample from the well collected August 21, 1972, after 45 min of pumping at 50 gpm.

WELL NO. 1, LABORATORY NO. B9334

		mg/L	*me/L*			*mg/L*	*me/L*
Iron	**Fe**	**1.1**	**0.04**	**Silica**	**SiO_2**	**19**	
Manganese	**Mn**	**0.3**	**0.01**	**Fluoride**	**F**	**0.2**	**0.01**
Ammonium	**NH_4**	**0.0**		**Boron**	**B**	**0.65**	
Sodium	**Na**	**28.5**	**1.24**	**Nitrate**	**NO_3**	**0.0**	
Potassium	**K**	**1.77**	**0.05**	**Chloride**	**C1**	**23**	**0.65**
Calcium	**Ca**	**100**	**4.99**	**Sulfate**	**SO_4**	**71**	**1.48**
Magnesium	**Mg**	**44.3**	**3.64**	**Alkalinity (as**	**$CaCO_3$)**	**384**	**7.68**
Arsenic	**As**	**0.00**		**Hardness (as**	**$CaCO_3$)**	**432**	
Barium	**Ba**	**0.1**					
Cadmium	**Cd**	**0.00**		**Total dissolved**			
Chromium	**Cr**	**0.00**		**minerals**		**561**	
Copper	**Cu**	**0.00**					
Lead	**Pb**	**0.00**		**pH (as rec'd)**	**7.9**		
Mercury	**Hg**	**0.0000**		**Radioactivity**			
Nickel	**Ni**	**0.0**		**Alpha *pc/L***	**0.9**		
Selenium	**Se**	**0.00**		**± deviation**	**1.7**		
Silver	**Ag**	**0.00**		**Beta *pc/L***	**4.8**		
Zinc	**Zn**	**0.0**		**± deviation**	**2.8**		

A production test was conducted on July 10, 1968, by representatives of the driller, the village, the State Water Survey, and Caldwell-Rhoads Co., Consulting Engineers. After 5 hr of pumping at rates of 50 to 60 gpm, the final drawdown was 39.18 ft from a nonpumping water level of 8.66 ft below land surface. One hr after pumping was stopped, the water level had recovered to 11.50 ft. On the basis of the production test data, it was estimated that this well should yield 50 gpm (72,000 gpd) on a long-term basis.

The pumping equipment presently installed is a submersible pump set at 56 ft below the top of the casing, rated at 60 gpm, and powered by a 3-hp electric motor.

Test Hole No. 1-85 was constructed in June 1985 to a depth of 80 ft by E. C. Baker & Sons, Inc., Sigel. It was located approximately 50 ft S and 1270 ft E of the NW corner of Section 28, T12N, R13W. The test hole was 6 in. in diameter and cased with 2.5-in. black steel pipe from about 3.2 ft above land surface to a depth of 79 ft (bottom 6 ft slotted). Upon completion, the nonpumping water level was reported to be 4 ft below land surface.

Test Hole No. 2-85 was constructed in 1985 to a depth of 91.9 ft by E. C. Baker & Sons, Inc., Sigel. It was located approximately 40 ft S and 660 ft W of the NE corner of Section 29, T12N, R13W. The test hole was cased with 2.5-in. steel pipe from about 1.3 ft above land surface to a depth of 91.9 ft (slotted from 81.9 to 90.9 ft). Upon completion, the nonpumping water level was reported to be 8.4 ft below land surface.

WELL NO. 2, finished in sand and gravel of the Prairie Aquigroup, was completed in April 1987 to a depth of 90 ft by E. C. Baker & Sons, Inc., Sigel. The well is located approximately 40 ft S and 800 ft W of the NE corner of Section 29, T12N, R13W. The land surface elevation at the well is approximately 430 ft.

WELL NO. 2, DRILLERS LOG

Strata	*Thickness (ft)*	*Depth (ft)*
Soil	**5**	**5**
Fine yellow sand	**33**	**38**
Sand with some gravel	**52**	**90**

An 18-in. diameter hole was drilled to a depth of 90 ft. The well is cased with 8-in. pipe from about 2 ft above land surface to a depth of about 70 ft followed by 20 ft of 6-in. No. 55 slot Cook stainless steel screen. The annulus between the borehole and casing-screen assembly is filled with No. 1 Northern gravel from 20 to 90 ft.

A production test was conducted on April 30, 1987, by representatives of the driller, the village, the State Water Survey, and Casler, Houser, & Hutchinson, Consulting Engineers. After 2 hr of pumping at rates of 96 to 99 gpm, the final drawdown was 1.90 ft from a nonpumping water level of 10.82 ft below land surface. Seventeen min after pumping was stopped, full recovery was reported. On the basis of the production test data, it was estimated that this well should yield 100 gpm (144,000 gpd) on a long-term basis.

The pumping equipment presently installed is a submersible pump set at about 60 ft below the top of the casing, rated at 120 gpm, and powered by a 10-hp electric motor.

A partial analysis of a sample (Lab. No. 222085) collected during the initial production test, after pumping for 1.9 hr at 96 to 99 gpm, showed the water to have a hardness of 181 mg/L, total dissolved minerals of 233 mg/L, and an iron content of <0.09 mg/L.

KANE

The village of Kane (445) installed a public water supply in 1965. Two wells are in use. In 1965 there were 105 services, all metered; the average and maximum pumpages were 20,000 and 40,000 gpd, respectively. In 1987 there were 250 services, all metered; the estimated average and maximum pumpages were 40,000 and 50,000 gpd, respectively. The water is aerated, chlorinated, fluoridated, and filtered.

Prior to construction of a public water supply, two test wells were constructed in November 1963 to depths of 55.2 and 59 ft by the Layne-Western Co., St. Louis, Missouri. The first test well was located approximately 314 ft S and 35 ft E of the NW corner of the NE quarter of Section 17, T9N, R11W. A 10-in. diameter hole was drilled to a depth of 55.2 ft and cased with 2-in. pipe from about 1.8 ft above land surface to a depth of 48.2 ft followed by 7 ft of 2-in. slotted pipe. The second test well was located approximately 364 ft S and 1285 ft W of the NE corner of Section 17, T9N, R11W. A 16-in. diameter hole was drilled to a depth of 59 ft and cased with 8-in. pipe from about 2 ft above land surface to a depth of 39 ft followed by 20 ft of 8-in. slotted pipe. A production test was conducted on November 27, 1963, by representatives of the driller, the State Water Survey, and Wm. H. Klingner & Associates, Engineers. After 4 hr of pumping at a rate of 100 gpm, the final drawdown was 5.50 ft from a nonpumping water level of 16.06 ft below land surface. One hr after pumping was stopped, the water level had recovered to 16.26 ft.

WELL NO. 1, finished in sand and gravel of the Prairie Aquigroup, was completed in August 1964 to a depth of 57 ft by the Layne-Western Co., St. Louis, Missouri. The well is located about 3 miles northeast of the village and about 0.5 mile north of the treatment plant, approximately 364 ft S and 1160 ft W of the NE corner of Section 17, T9N, R11W. The land surface elevation at the well is approximately 450 ft.

WELL NO.1, DRILLERS LOG

Strata	*Thickness (ft)*	*Depth (ft)*
Top soil	3	3
Brown clay	15	18
Fine brown sand	12	30
Coarse sand and gravel	27	57
Hard gray clay	7	64

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B042221) is for a water sample from the well collected March 3, 1981, after 8 hr of pumping at 75 gpm.

WELL NO. 1, LABORATORY NO. B042221

		mg/L	*me/L*			*mg/L*	*me/L*
Iron	Fe	0.44		Silica	SiO_2	21	
Manganese	Mn	0362		Fluoride	F	0.14	0.01
Ammonium	NH_4	< 0.1		Boron	B	0.02	
Sodium	Na	14	0.61	Cyanide	CN	<0.005	
Potassium	K	1.1	0.03	Nitrate	NO_3	113	0.18
Calcium	Ca	56	2.79	Chloride	C1	7	0.20
Magnesium	Mg	17.0	1.40	Sulfate	SO_4	56	1.16
Strontium	Sr	0.117		Alkalinity (as	$CaCO_3$)	157	3.14
Arsenic	As	<0.001		Hardness (as	$CaCO_3$)	205	4.10
Barium	Ba	0.051					
Beryllium	Be	<0.0005		Total dissolved			
Cadmium	Cd	<0.003		minerals		290	
Chromium	Cr	<0.007					
Cobalt	Co	<0.005					
Copper	Cu	0.015					
Lead	Pb	<0.005					
Mercury	Hg	<0.00005					
Nickel	Ni	0.009					
Selenium	Se	0.002					
Silver	Ag	<0.005					
Vanadium	V	<0.004					
Zinc	Zn	0.014		pH (as rec'd)		7.0	

A 12-in. diameter hole was drilled to a depth of 57 ft. The well is cased with 8-in. steel pipe from about 12 ft above original land surface to a depth of 42 ft followed by 15 ft of 8-in. No. 40 slot Cook screen. A 21-in. corrugated metal pipe extends from 12 ft above original land surface to a depth of 2.5 ft to provide flood protection. The annulus between the 21-in. corrugated pipe and the 8-in. casing and between the borehole and 8-in. casing is filled with concrete from 10 ft above original land surface to a depth of 12 ft, and the annulus between the borehole and casing-screen assembly is filled with Merramec gravel from 12 to 57 ft. An earth berm, 8 ft in diameter and 5 ft high, surrounds the well. The top of the casing is equipped with a pitless adapter.

A production test was conducted on August 17, 1964, by representatives of the driller, the State Water Survey, and Wm. H. Klingner & Associates, Engineers. After 4 hr of pumping at rates ranging from 205 to 222 gpm, the final drawdown was 13.3 ft from a nonpumping water level of 14.5 ft below original land surface. One hr after pumping was stopped, the water level had recovered to 14.9 ft. On the basis of the production test data, it was estimated that this well should yield 100 gpm (144,000 gpd) on a long-term basis.

A production test was conducted by the State Water Survey on July 16, 1973. After 2 hr of pumping at a rate of 55 gpm, the drawdown was 4.0 ft from a nonpumping water level of 7.0 ft below original land surface. Four min after pumping was stopped, full recovery was reported.

In June 1984, this well was acidized. The production capacity was reportedly increased from 30 to about 80 gpm.

The pumping equipment presently installed is a Red Jacket submersible pump rated at 100 gpm, and powered by a 5-hp electric motor.

WELL NO. 2, finished in sand and gravel of the Prairie Aquigroup, was completed in October 1985 to a depth of 57 ft by the Layne-Western Co., St. Louis, Missouri. The well is located northeast of Well No. 1, approximately 350 ft S and 1150 ft W of the NE corner of Section 17, T9N, R11W. The land surface elevation at the well is approximately 453 ft.

WELL NO. 2, DRILLERS LOG

Strata	***Thickness*** *(ft)*	***Depth*** *(ft)*
Soil	**2**	**2**
Clay	**16**	**18**
Fine brown sand	**12**	**30**
Coarse sand and gravel	**20**	**SO**
Medium gray sand	**7**	**57**
Hard clay	**7**	**64**

A 20-in. diameter hole was drilled to a depth of 57 ft. The well is cased with 8-in. black steel pipe from about 10 ft above original land surface to a depth of 42 ft followed by 15 ft of 8-in. No. 40 slot Cook screen. The annulus between the borehole and casing-screen assembly is filled with concrete from about 10 ft above original land surface to a depth of 20 ft and with gravel from 20 to 57 ft. The top of the casing is equipped with a pitless adapter.

The pumping equipment presently installed is a 4-in. Layne & Bowler submersible turbine pump rated at 75 gpm at about 106 ft TDH, and powered by a 5-hp electric motor.

MT. GILEAD SHELTER CARE HOME

Mt. Gilead Shelter Care Home (est. 25), located about 3.5 miles southwest of Carrollton, installed a public water supply in 1985. The water system is owned and operated by Mrs. Alfreda Steinacher. In 1981 there were 2 services (including Shelter Care Home and adjacent church), none metered. In 1988 there was 1 service, not metered; the estimated average pumpage was 1200 gpd. The water is chlorinated.

WELL NO. 1, open to the Upper Bedrock Aquigroup (Burlington-Keokuk Limestone), was completed to a depth of 205 ft. The well is located in the SE quarter of the SE quarter of the NE quarter of Section 7, T9N, R12W. The land surface elevation at the well is approximately 620 ft.

The well is cased with 8-in. pipe from above the floor of a 3.5-ft deep pit to an unknown depth.

The pumping equipment presently installed is a Myers submersible pump rated at 8 gpm, and powered by a 1/2-hp, 3450 rpm electric motor.

PATTERSON

The village of Patterson (185), also known as Wilmington, installed a public water supply in 1975. Finished water for this supply is obtained from the city of Roodhouse. In 1976 there were 64 services; the average consumption in 1977 was 8060 gpd. In 1988 there were 64 services; the average consumption was 14,950 gpd.

ROCKBRIDGE

The village of Rockbridge (258) installed a public water supply in 1966. Finished water for this supply is obtained from the village of Medora. In 1980 there were 86 services, all metered; the average consumption was 10,000 gpd. In 1988 there were 92 services, all metered; the average consumption was 14,400 gpd.

ROODHOUSE

The city of Roodhouse (2364) installed a public water supply in 1906. Water for Roodhouse is obtained from wells located in Scott County. Two wells are in use. This supply also furnishes water to Patterson (Greene County), Manchester (Scott County), and the Alsey-Glasgow Water Commission (Scott County). In 1950 the average and maximum pumpages were 180,000 and 200,000 gpd, respectively. In 1988 there were 1317 services, all metered; the average pumpage was 388,750 gpd (including Patterson, Manchester, and Alsey-Glasgow Water Commission). The water is chlorinated and fluoridated.

Initially, water was secured from an impounding reservoir formed by building a dam on a small drainage area near the city.

From 1920 to 1928, water was obtained from springs located about 6 miles northwest of the city, approximately 1600 ft S and 2400 ft W of the NE corner of Section 32, T13N, R12W, Scott County.

WELL NO. 1 (North Well), open to the Upper Bedrock Aquigroup (Burlington-Keokuk Limestone), was completed in 1928 to a depth of 170 ft by the Layne-North Central Co., Chicago. The well is located about 6 miles northwest of the city near the springs, approximately 1590 ft S and 2400 ft W of the NE corner of Section 32, T13N, R12W, Scott County. The land surface elevation at the well is approximately 510 ft.

WELL NO. 1, DRILLERS LOG

Strata	*Thickness (ft)*	*Depth (ft)*
Top soil and clay	7	7
Limestone	163	170

The well is cased with 24-in. steel pipe. The top of the casing is in a pit below the pumphouse and extends from 3 ft below the pumphouse floor to a depth of 7 ft.

On March 15, 1934, the nonpumping water level was reported to be 6 ft.

A production test using one observation well was conducted by the State Water Survey on June 20, 1972. After 1 hr of pumping at a rate of 510 gpm, the drawdown was 0.37 ft from a nonpumping water level of 6.15 ft below land surface.

On August 18, 1976, the nonpumping water level was reported to be 14 ft.

The pumping equipment presently installed is a 12-in., 16-stage Layne turbine pump (No. 4605A) set at 120 ft, rated at 600 gpm, and powered by a 120-hp Fairbanks Morse vertical diesel engine (No. 918164).

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B11309) of a sample collected September 14, 1976, showed the water to have a

hardness of 340 mg/L, total dissolved minerals of 399 mg/L, and an iron content of 0.1 mg/L.

WELL NO. 2 (South Well), open to the Upper Bedrock Aquigroup (Burlington-Keokuk Limestone), was completed in January 1928 to a depth of 125 ft by the Layne-North Central Co., Chicago. The well is located 10 ft south of Well No. 1, approximately 1600 ft S and 2400 ft W of the NE corner of Section 32, T13N, R12W, Scott County. The land surface elevation at the well is approximately 510 ft.

WELL NO. 2, DRILLERS LOG

Strata	*Thickness (ft)*	*Depth (ft)*
Top soil and clay	**7**	**7**
Limestone	**118**	**125**

A 24-in. diameter hole was drilled to a depth of 7 ft and finished 20 in. in diameter from 7 to 125 ft. The well is cased with 24-in. steel pipe. The top of the casing is in a pit below the pumphouse and extends from 3 ft below the pumphouse floor to a depth of 7 ft.

On March 15, 1934, the nonpumping water level was reported to be 6 ft.

A production test using one observation well was conducted by the State Water Survey on June 20, 1972. After 2 hr of pumping at a rate of 500 gpm, the drawdown was 0.32 ft from a nonpumping water level of 6.62 ft below land surface. Eight min after pumping was stopped, the water level had recovered to 6.60 ft.

From January 27, 1977, through February 9, 1977, nonpumping water levels were reported to range from about 49.5 to 58.8 ft.

The pumping equipment presently installed is a 15-in., 12-stage Layne turbine pump (No. 4607) set at 120 ft, rated at 450 gpm, and powered by a 100-hp, 1200 rpm U. S. electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B11308) is for a water sample from the well collected September 14, 1976.

WELL NO. 2, LABORATORY NO. B11308

		mg/L	*me/L*			*mg/L*	*me/L*
Iron	**Fe**	**0.1**		**Silica**	**SiO_2**	**13**	
Manganese	**Mn**	**0.03**		**Fluoride**	**F**	**0.3**	**0.02**
Ammonium	**NH_4**	**0.0**	**0.00**	**Boron**	**B**	**0.1**	
Sodium	**Na**	**16**	**0.70**	**Cyanide**	**CN**	**chlorine present**	
Potassium	**K**	**1.6**	**0.04**	**Nitrate**	**NO_3**	**5.3**	**0.08**
Calcium	**Ca**	**86**	**4.29**	**Chloride**	**C1**	**14**	**0.40**
Magnesium	**Mg**	**31**	**2.55**	**Sulfate**	**SO_4**	**28**	**0.58**
				Alkalinity (as	**$CaCO_3$)**	**326**	**6.52**
Arsenic	**As**	**0.00**					
Barium	**Ba**	**0.1**		**Hardness (as**	**$CaCO_3$)**	**342**	**6.84**
Cadmium	**Cd**	**0.00**					
Chromium	***Ct***	**0.00**		**Total dissolved**			
Copper	**Cu**	**0.00**		**minerals**		**408**	
Lead	**Pb**	**0.00**					
Nickel	**Ni**	**0.0**					
Selenium	**Se**	**0.00**					
Silver	**Ag**	**0.00**					
Zinc	**Zn**	**0.0**		**pH (as rec'd)**	**7.1**		

In the late months of 1976, water levels in the production wells declined and in January 1977 the well pumps would break suction if operated at usual rates. The available information indicates that the dry weather in 1976 and the severe winter of 1976-1977 resulted in below normal ground-water recharge causing the water-level decline. The pumpage and water-level data collected during this period suggest that the combined yield of the two wells is about 300,000 gpd during a prolonged drought.