

ISWS-75-BUL60(11)

BULLETIN 60-11

STATE OF ILLINOIS

DEPARTMENT OF REGISTRATION AND EDUCATION



*Public Groundwater Supplies  
in Stark County*

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ILLINOIS STATE WATER SURVEY

URBANA

1975

# PUBLIC GROUNDWATER SUPPLIES IN STARK COUNTY

by Dorothy M. Woller and James P. Gibb

## Introduction

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

The definition of public water supply as contained in the Environmental Protection Act of 1970 was used to determine those water systems and wells to be included. Systems and wells described furnish water for drinking or general domestic use in: 1) incorporated municipalities; 2) unincorporated communities where 10 or more separate lots or properties are being served or are intended to be served; 3) state-owned parks and memorials; and 4) state-owned educational, charitable, or penal institutions.

This report includes separate descriptions for groundwater supplies of 4 municipalities in Stark County. These are preceded by brief summaries of the groundwater geology of the county and the development of groundwater sources for municipal use. An explanation of the format used in the descriptions is also given.

**Acknowledgments.** This report was prepared under the general direction of Dr. William C. Ackermann, Chief of the Illinois State Water Survey, and John B. Stall, Head of the Hydrology Section. The work was done under the direct guidance of William H. Walker, Hydrologist. Mrs. J. L. Ivens and Miss Nancy S. Scott edited the manuscript and Mrs. Suzi O'Connor prepared the camera copy. The chemical analyses were made by personnel of the Illinois Environmental Protection Agency under the supervision of John P. Anderson. Thanks are due M. L. Sargent of the Illinois State Geological Survey who prepared the generalized column of rock stratigraphic units and aquifers and, with R. D. Brower, 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.

## Geology

The geology of Stark County is described generally in Illinois State Geological Survey Circular 222, *Groundwater Geology in Western Illinois, North Part* and in Illinois State Water Survey Bulletin 39, *Groundwater in the Peoria Area*. The following brief discussion of geologic conditions in the county is taken largely from these publications. For a more detailed definition of the geology in this portion of the state, the reader is referred to the State Geological Survey which is located on the University of Illinois campus, Urbana.

The glacial drift deposits in Stark County vary in thickness from less than 1 ft in the western portion of the county, where the bedrock is exposed, to more than 200 ft in the southeast corner of the county. Southeast of Wyoming, outwash deposits of sand and gravel occur at the surface. Deeper sand deposits also are found throughout the drift materials in this area but none are considered to provide more than farm or domestic water supplies. Pockets of

sand and gravel occur locally in the Spoon River valley but are not considered sources for large groundwater supplies.

The uppermost bedrock beneath the glacial deposits dips southeasterly at a rate of about 20 ft per mile. The bedrock units considered in this report range in age from Pennsylvanian to Ordovician (see generalized stratigraphic sequence in figure 1).

The uppermost bedrock throughout the county is of Pennsylvanian age and consists mostly of shale, coal, and some thin interbedded layers of sandstone and limestone. These rocks range in thickness from about 450 ft in the northwest to about 150 ft in the southeast corner of the county. The Pennsylvanian rocks are not considered a source for municipal or subdivision water supplies. However, farm and domestic water supplies are obtained locally from sandstone and crinoid limestone units in the upper 200 ft of these rocks.

SYSTEM	SERIES	GROUP OR FORMATION	AQUIFER	LOG	THICKNESS (FT)	GENERALIZED DESCRIPTION	
QUATERNARY	PLEISTOCENE		Sands and Gravels		0-250	Till, gravel, sand, silt, peat, loess	
PENNSYLVANIAN					150-450	Shale, sandstone, clay, limestone, coal	
MISSISSIPPIAN	VALMEYERAN	Keokuk-Burlington			0-215	Limestone, white to brown, very cherty, fossiliferous, dolomitic	
	KINDERHOOKIAN	New Albany			0-135	Shale, green to brown, pyritic, Sporangites, little sandstone and dolomite	
DEVONIAN	UPPER						
	MIDDLE	Cedar Valley-Wapsipinicon			75-100	Limestone and dolomite, silty, cherty, fine gray to buff, part slightly pyritic	
SILURIAN	NIAGARAN	Racine-Marcus	Silurian		200-400	Dolomite, crystalline, vesicular, white to gray, partly cherty	
	ALEXANDRIAN				35-70	Dolomite, dense to vesicular, silty and sandy in lower part	
ORDOVICIAN	CINCINNATIAN	Maquoketa			175-215	Shale, dolomitic, green to gray, some dolomite	
	CHAMPLAINIAN	Galena	Galena-Platteville		190-225	Dolomite and limestone, medium-grained, cherty in lower part	
		Platteville			100-125	Dolomite, fine-grained, cherty	
		Glenwood-St. Peter	Glenwood-St. Peter		90-200	Sandstone, medium-grained, friable, mostly white	
	CANADIAN	Shakopee	Shakopee			145-280	Dolomite, cherty, few sandstone beds
		New Richmond	New Richmond			75-100	Sandstone, some dolomite
		Oneota	Oneota			225 ±	Dolomite, cherty, medium crystalline
Gunter					0-50	Sandstone, dolomitic	

Figure 1. Generalized geological column of rock formations in Stark County  
 (Prepared by M. L. Sargent, Illinois State Geological Survey)

Beneath the Pennsylvanian rocks in the southern three-fourths of the county lie the Mississippian age rocks which consist of shale with thin layers of interbedded sandstone and dolomite, and overlying limestone in the southeast corner of the county. These rocks lie at depths ranging from about 300 ft in the northwest to about 500 ft in the southeast part of the county. They range in thickness from a featheredge along the northern limit to 350 ft in the southeast corner of the county. These rocks generally are not considered a source for water in Stark County.

Beneath the Pennsylvanian rocks in the northern one-fourth of the county, and beneath the Mississippian rocks in the southern three-fourths of the county, lie limestones and dolomites of Devonian age. These rocks lie at depths from about 350 ft in the northwest to about 700 ft in the southeast. They are relatively uniform in thickness (75 to 100 ft). The yield capability of the Devonian rocks is generally small and depends primarily upon the number, size, and degree of interconnection of water-filled cracks and crevices penetrated by a well bore.

The Silurian Dolomite lies below the Devonian rocks. This dolomite is encountered at depths from about 450 ft in the northwest to 800 ft in the southeast. It ranges in thickness from about 200 ft in the northwest to about 400 ft in the southeast. Water from the Silurian rocks is also obtained from the cracks and crevices of these rocks.

The Maquoketa Group of Ordovician age is composed primarily of nonwater-bearing shales that separate the Silurian rocks from deeper water-bearing units. These shales lie at depths from about 750 ft in the northwest to about 1050 ft in the southeast part of the county. They range in thickness from about 175 to 215 ft.

Below the Maquoketa Group occurs a thick sequence of hydrologically connected aquifers of Ordovician age. They consist in downward order of the Galena-Platteville Dolomite Groups, Glenwood-St. Peter Sandstone, Shakopee Dolomite, New Richmond Sandstone, and Oneota Dolomite.

### **Groundwater Development for Municipal Use**

The unconsolidated sand and gravel deposits generally do not provide adequate water for municipal use and have not been tapped by any municipalities in Stark County.

The underlying bedrock units are tapped for water supplies at Bradford, located in the northeastern part of the county, LaFayette, located on the western edge of the county, and Toulon and Wyoming, located in the central part of the county. In these wells various combinations of water-yielding units in the shallow and deeper lying Ordovician rocks may be open to the hole with each contributing a portion of the water withdrawn.

Water obtained from the bedrock units in Stark County is normally highly mineralized with one or more mineral

The Galena-Platteville lies at depths from about 950 ft in the northwest to about 1250 ft in the southeast part of the county. It ranges in thickness from 290 to 350 ft. Water from this dolomite is also obtained from cracks and crevices intersected by a well bore. Even though moderate quantities of water (50 to 100 gpm) may be available from this rock unit, no municipal wells tap only this unit. Instead, wells are usually open to the overlying Devonian and Silurian rocks or to the deeper aquifers of Ordovician age.

The Glenwood-St. Peter Sandstone lies below the Galena-Platteville at depths from about 1250 ft in the northwest to about 1600 ft in the southeast part of the county. It ranges in thickness from about 90 to 200 ft. The Glenwood-St. Peter is one of the more reliable water-yielding units of the Ordovician sequence.

Below the Glenwood-St. Peter lies the Shakopee Dolomite which consists of dolomite interbedded with a few sandstone layers. This unit lies at depths of about 1450 ft in the northwest to about 1800 ft in the southeast corner of the county. It ranges in thickness from about 145 to 280 ft. Water from the Shakopee is obtained from cracks and crevices intersected by a well bore.

The New Richmond Sandstone lies below the Shakopee at depths from about 1650 ft in the northwest to about 2000 ft in the southeast part of the county. It is relatively thin (75 to 100 ft) and yields only a small portion of the total water-yielding capability of the Ordovician aquifers.

Below the New Richmond lies the Oneota Dolomite, the deepest known fresh water-bearing unit in the county. It lies at depths from about 1750 ft in the northwest to about 2100 ft in the southeast. This dolomite is about 225 ft thick throughout the county and yields water from cracks and crevices intersected by a well bore.

The Gunter Sandstone lies below the Oneota and is the basal unit of the Ordovician age rocks. It is relatively thin (0 to 50 ft) and is not considered a source for large quantities of water. Units below the Gunter generally contain water that is too highly mineralized for most uses.

constituent exceeding the recommended limits established in the U. S. Public Health Service Drinking Water Standards. Sulfate and chloride contents greater than the recommended 250 mg/l are common and may cause the water to be unpalatable to persons not accustomed to it. Hydrogen sulfide gas is also commonly found in the water from wells open to the Silurian and Galena-Platteville Dolomites. Sufficient data are not available to determine the sources for chlorides, sulfates, and high total mineral contents. In some parts of the county the Pennsylvanian rocks are known to contain highly mineralized water, and in other areas the deeper Ordovician age aquifers are suspected to contain such water. To insure that water of the best possible mineral quality is obtained, care-

ful sampling of water from each aquifer unit penetrated is suggested so that the more highly mineralized units can be effectively sealed from the well.

The Silurian Dolomite has been tapped as the primary source of supply at LaFayette and by one well at Toulon (Well No. 2). These wells are 758 and 780 ft deep and reportedly yield 52 to 55 gpm and 205 to 320 gpm, respectively. The estimated production from the LaFayette well was 14,000 gpd in 1972. Past and recent analyses of water from both wells indicate that the iron content ranges from 0.1 to 1.4 mg/l, hardness from 55 to 156 mg/l, sulfates from 60 to 265 mg/l, chlorides from 200 to 600 mg/l, and total dissolved minerals from 900 to 1900 mg/l. At LaFayette the water is chlorinated and treated with polyphosphate to keep iron in solution. At Toulon the water is aerated to remove hydrogen sulfide and is chlorinated. The natural fluoride content from both wells is adequate to meet present standards.

Wyoming Well No. 2 penetrates the Galena-Platteville Dolomite and is also open to the overlying Pennsylvanian, Mississippian, Devonian, and Silurian units. This well is 1400 ft deep and reportedly yields from 150 to 380 gpm. Past and recent analyses of water from this well indicate that the iron content ranges from a trace to 0.2 mg/l, hardness from 79 to 180 mg/l, sulfates from 300 to 305 mg/l, chlorides from 265 to 280 mg/l, and total dissolved minerals from 1140 to 1250 mg/l. The water at Wyoming is chlorinated and then aerated to remove hydrogen sulfide. The natural fluoride content is adequate to meet present standards.

Wyoming Well No. 1 penetrates the Glenwood-St. Peter Sandstone and is also open to the overlying Galena-Platteville Dolomite. This well is 1557 ft deep and reportedly yields from 200 to 300 gpm. Past and recent analyses of water from this well indicate that the iron content ranges

from a trace to 0.7 mg/l, hardness from 182 to 187 mg/l, sulfates from 240 to 305 mg/l, chlorides from 230 to 290 mg/l, and total dissolved minerals from 1040 to 1195 mg/l. The natural fluoride content of water from this well meets present standards.

Toulon Well No. 1 also penetrates the Glenwood-St. Peter Sandstone and is open to the overlying Devonian, Silurian, and Galena-Platteville units. This well is 1452 ft deep and reportedly yields from 150 to 200 gpm. Past and recent analyses of water from this well indicate that the iron content ranges from a trace to 1.2 mg/l, hardness from 104 to 198 mg/l, sulfates from 240 to 350 mg/l, chlorides from 465 to 570 mg/l, and total dissolved minerals from 1130 to 1875 mg/l. The natural fluoride content of water from this well satisfies present standards.

All the units of the Ordovician System are tapped by Bradford Well No. 2. Bradford Well No. 1 also taps all the Ordovician units except for the Galena-Platteville Dolomite. These wells are 2052 and 2082 ft deep respectively and reportedly yield from 85 to 180 gpm. Estimated production from these wells in 1973 was about 120,000 gpd. Past and recent analyses of water from these wells indicate that the iron content ranges from 0.0 to 2.4 mg/l, hardness from 224 to 324 mg/l, sulfates from 230 to 325 mg/l, chlorides from 405 to 580 mg/l, and total dissolved minerals from 1290 to 1515 mg/l. The water contains hydrogen sulfide. The natural fluoride content of water from these wells is adequate to satisfy the present standards.

Total municipal pumpage in Stark County for 1973 was about 380,500 gpd. Estimated pumpage from municipal wells tapping only the Silurian aquifer was about 16 percent of this total (60,500 gpd), wells tapping the Silurian and one or more Ordovician units was about 33 percent (125,000 gpd), and the remaining 51 percent (195,000 gpd) was pumped from various combinations of units in the Ordovician rocks.

## Format

In this publication the descriptions of public groundwater supplies are presented in alphabetical order by place name as follows: Bradford, LaFayette, Toulon, and Wyoming.

At the beginning of each description the U. S. Census of population for 1970 is given for incorporated places.

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

Individual production wells for each supply are described in the order of their construction. The description for each well includes the *aquifer or aquifers 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, sample study logs prepared by the Illinois State Geological Survey are presented. When these are not 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. Similarly, limestones or dolomites reported by drillers usually are calciferous rocks which in most of Illinois are dolomitic in composition. When stating the bed-rock aquifers tapped by a well, the sample study log by the Geological Survey and the casing record are used to determine the geohydrologic units open to the hole. If only a drillers log is available and the geohydrologic units cannot be determined readily, then the principal rock type usually is given (i.e., dolomite).

## 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)
OD.....	outside diameter
pc/l.....	picocuries per liter
R.....	range
rpm.....	revolutions per minute
T.....	township
TDH.....	total dynamic head

## BRADFORD

The village of Bradford (885) installed a public water supply in 1903. Two wells are in use. In 1950 there were 275 services; the average and maximum daily pumpages were 45,000 and 55,000 gpd, respectively. In 1973 there were 350 services, 2 percent metered; the average and maximum daily pumpages were 120,000 and 180,000 gpd, respectively. The water is pumped to a ground storage reservoir equipped with splash plates to facilitate hydrogen sulfide removal and then repumped to the distribution system. The natural fluoride concentration in the water is adequate to satisfy state requirements.

WELL NO. 1, open to the St. Peter, Shakopee, New Richmond, and Oneota units of Ordovician age, was completed in 1898 to a depth of 2082 ft. The well is located in the main pumping station, approximately 400 ft N and 530 ft W of the SE corner of Section 23, T14N, R7E. The land surface elevation at the well is approximately 800 ft.

A drillers log of Well No. 1 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Top soil	3	3
Clay	137	140
Soapstone	40	180
Coal shale	75	255
Shale	235	490
Limestone	40	530
Shale	320	850
Limestone	145	995
Shale	65	1060
Limestone	270	1330
Shale	60	1390
Limestone	238	1628
St. Peter sandstone	88	1716
Limestone	266	1982
Potsdam sandstone	100	2082

A 10-in. diameter hole was drilled to a depth of 121 ft, reduced to 8 in. between 121 and 509 ft, reduced to 6 in. between 509 and 709 ft, and finished 5 in. in diameter from 709 to 2082 ft. The well is cased with 10-in. pipe from land surface to a depth of 121 ft, 8-in. pipe to 509 ft, 6-in. pipe from 509 to 709 ft, and 5-in. pipe from 709 ft to 1612 ft.

Nonpumping water levels were reported as follows: 150 ft below land surface in 1898, 160 ft in 1917, and 247 ft in 1926.

The pumping equipment presently installed is a Red Jack-et submersible pump (Model No. 9M6BK2C, Serial No. P566) rated at 85 gpm, and powered by a 15-hp electric motor.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. 01625) of a sample collected September 21, 1971, after pumping for 1 hr at 180 gpm, showed the water to have a hardness of 320 mg/l, total dissolved minerals of 1510 mg/l, and an iron content of

0.0 mg/l. The iron content has been greater on previous analyses.

WELL NO. 2, open to all the formations of the Ordovician System, was constructed in July 1936 to a depth of 1681 ft and was reportedly deepened in October 1936 to a depth of 2052 ft by the Sewell Well Co., St. Louis, Mo. The well is located 70 ft W of Well No. 1 and approximately 400 ft N and 600 ft W of the SE corner of Section 23, T14N, R7E. The land surface elevation at the well is approximately 800 ft.

A sample study log of Well No. 2 furnished by the State Geological Survey follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
PLEISTOCENE SYSTEM		
Soil and till	70	70
PENNSYLVANIAN SYSTEM		
Shale, thin beds of sandstone, limestone, and coal	435	505
MISSISSIPPIAN-DEVONIAN SYSTEM		
New Albany Group, shale	10	515
DEVONIAN SYSTEM		
Cedar Valley Limestone (shale is probably cave)	35	550
Wapsipinicon Limestone	65	615
SILURIAN SYSTEM		
Niagaran-Alexandrian Series		
Dolomite, thin shale bed at base	30	645
Dolomite	370	1015
ORDOVICIAN SYSTEM		
Maquoketa Group, shale, dolomite, and limestone	215	1230
Galena-Platteville Groups, limestone, and dolomite	340	1570
Glenwood Sandstone, incoherent	35	1605
St. Peter Sandstone, incoherent	55	1660
Shakopee Dolomite, thin shale and sandstone beds	280	1940
New Richmond Sandstone		
Sandstone, dolomitic and dolomite	40	1980
Sandstone, incoherent	20	2000
Sandstone, dolomitic	15	2015
Oneota Dolomite, thin sandstone beds	37	2052

A 12-in. diameter hole was drilled to a depth of 146.6 ft, reduced to 10 in. between 146.6 and 525.9 ft, and finished 8 in. in diameter from 525.9 to 2052 ft. The well is cased with 12-in. pipe from land surface to a depth of 146.6 ft, 10-in. pipe from 131 ft to 525.9 ft, and 8-in. pipe from 507.9 ft to 1439.4 ft.

Before deepening, a production test was conducted by the State Water Survey on July 28, 1936. After 1 hr of pumping at a rate of 51 gpm, the drawdown was 85 ft from a non-pumping water level of 236 ft below the pump base. An increase to 54 gpm caused the pump to break suction after 33 min with a drawdown of 91.5 ft.

After deepening, a production test was conducted by the State Water Survey on October 7-8, 1936. After 24 hr of pumping at rates of 113 to 64 gpm, the final drawdown was 50.8 ft from a nonpumping water level of 234.3 ft below the top of the casing.

In 1952 the well reportedly produced 180 gpm with a drawdown of 56 ft from a nonpumping water level of 268 ft.

The pumping equipment presently installed is a Sumo submersible turbine pump (Model No. 9C9T250B) rated at 100 gpm at about 522 ft TDH, and powered by a 25-hp electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. 01626) is for a water sample from the well collected on September 21, 1971, after 1 hr of pumping at 290 gpm. The iron content on a previous analysis was as high as 0.9 mg/l.

WELL NO. 2, LABORATORY NO. 01626

		mg/l	me/l			mg/l	me/l
Iron	Fe	0.0	0.0	Silica	SiO <sub>2</sub>	11	
Manganese	Mn	0.0	0.0	Fluoride	F	1.15	0.06
Ammonium	NH <sub>4</sub>	2.2	0.12	Nitrate	NO <sub>3</sub>	0	0.0
Sodium	Na	446	19.40	Chloride	Cl	508	14.33
Potassium	K	14.0	0.36	Sulfate	SO <sub>4</sub>	325	6.76
Calcium	Ca	78.4	3.91	Alkalinity (as CaCO <sub>3</sub> )		253	5.06
Magnesium	Mg	29.5	2.42				
				Hardness (as CaCO <sub>3</sub> )		324	
Barium	Ba	0.0		Total dissolved minerals		1512	
Copper	Cu	0.0					
Cadmium	Cd	0.00					
Chromium	Cr	0.0		pH(as rec'd)		7.6	
Lead	Pb	0.00		Radioactivity			
Mercury	Hg	< 0.0005		Alpha pc/l		25	
Nickel	Ni	0.1		±deviation		9	
Silver	Ag	0.0		Beta pc/l		36	
Zinc	Zn	0.0		±deviation		9	

## LA FAYETTE

The village of LaFayette (268) installed a public water supply in 1960. One well is in use. In 1960 there were 40 services. In 1973 there were 96 services, all metered; the average and maximum daily pumpages were 10,500 and 15,000 gpd, respectively. The water is chlorinated and treated with polyphosphate to keep iron in solution. The natural fluoride concentration in the water is adequate to satisfy state requirements.

WELL NO. 1, open to the Silurian, was completed in September 1959 to a depth of 758 ft by the Winslow Well Drilling Co., Walcott, Iowa. The well is located in the public park near the center of the village, approximately 1450 ft N and 2600 ft W of the SE corner of Section 18, T13N, R4E. The land surface elevation at the well is approximately 785 ft.

A drillers log of Well No. 1 follows:

Strata	Thickness (ft)	Depth (ft)
Yellow clay	5	5
Gray mud and sand	35	40
Yellow mud and gravel	65	105
Gray mud and sand	57	162
Coal	3	165
Gray and black shale	325	490
Hard brown rock	10	500
Hard gray rock	40	540
Hard yellow and white rock	15	555
Hard gray and yellow rock	45	600
Hard white rock	158	758

An 8-in. diameter hole was drilled to a depth of 490 ft and finished 7.9 in. in diameter from 490 to 758 ft. The well is cased with 8-in. pipe from 2 ft above land surface to

a depth of 490 ft. The top of the well casing is equipped with a pitless adapter.

A production test was conducted on September 8, 1959, by representatives of the State Water Survey and Baxter & Woodman, Consulting Engineers. After 6 hr of pumping at rates of 52 to 55 gpm, the drawdown was 29.0 ft from a non-pumping water level of 289.6 ft. One hr after pumping was stopped, the water level had recovered to 291.3 ft.

The pumping equipment presently installed is a 6-in., 12-stage Red Jacket submersible turbine pump set at 420 ft, rated at 85 gpm, and powered by a 15-hp General Electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B111279) is for a water sample from the well collected on June 6, 1973, after 8.5 min of pumping at 85 gpm. Hydrogen sulfide was apparent on a previous analysis.

WELL NO. 1, LABORATORY NO. B111279

		mg/l	me/l			mg/l	me/l
Iron	Fe	0.12	0.00	Silica	SiO <sub>2</sub>	10	
Manganese	Mn	0.01	0.00	Fluoride	F	2	0.10
Ammonium	NH <sub>4</sub>	0.60	0.03	Boron	B	1.4	
Sodium	Na	396	17.23	Nitrate	NO <sub>3</sub>	0.00	0.00
Potassium	K	7	0.18	Chloride	Cl	220	6.20
Calcium	Ca	12	0.60	Sulfate	SO <sub>4</sub>	62	1.29
Magnesium	Mg	6	0.49	Alkalinity (as CaCO <sub>3</sub> )		528	10.56
Arsenic	As	0.00					
Copper	Cu	0.10		Hardness (as CaCO <sub>3</sub> )		55	1.09
Cadmium	Cd	0.00					
Chromium	Cr	0.00		Total dissolved minerals		1105	
Lead	Pb	0.00					
Mercury	Hg	0.0000					
Nickel	Ni	0.00					
Selenium	Se	0.00					
Silver	Ag	0.00					
Zinc	Zn	0.04		pH (as rec'd)		8.1	



## TOULON

The city of Toulon (1207) installed a public water supply in 1908. Two wells are in use. In 1950 there were 417 services, all metered; the average and maximum daily pumpages were 90,000 and 100,000 gpd, respectively. In 1973 there were 555 services, all metered; the average and maximum daily pumpages were 100,000 and 150,000 gpd, respectively. The water is discharged through aerators to a collecting reservoir to remove hydrogen sulfide, chlorinated, and repumped to the distribution system. The natural fluoride concentration in the water is adequate to satisfy state requirements.

WELL NO. 1, open to the Silurian, Galena-Platteville, and Glenwood-St. Peter, was constructed in November 1911 to a depth of 1445 ft by W. H. Gray & Bros., Chicago, and rehabilitated in April 1943 to a depth of 1452 ft by the Varner Well Drilling Co., Dubuque, Iowa. The well is located on North Franklin St., approximately 1225 ft N and 1225 ft E of the SW corner of Section 19, T13N, R6E. The land surface elevation at the well is approximately 725 ft.

A summary of a radioactivity log of Well No. 1 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
PLEISTOCENE SYSTEM	148	148
PENNSYLVANIAN SYSTEM	92	240
MISSISSIPPIAN-DEVONIAN SYSTEM		
New Albany Group, shale	137	377
DEVONIAN SYSTEM		
Limestone and dolomite	91	468
SILURIAN SYSTEM		
Dolomite	294	762
ORDOVICIAN SYSTEM		
Maquoketa Shale Group	190	952
Galena Group, limestone and dolomite	257	1209
Platteville Group, dolomite	167	1376
Glenwood and St. Peter Sandstones		
Sandstone	68	1444
Shale or/shaly sandstone	3	1447

Originally, a 10-in. diameter hole was drilled to a depth of 201 ft, reduced to 8 in. between 201 and 385 ft, and finished 6 in. in diameter from 385 to 1445 ft; the upper 100 ft was cased. In 1943 the Varner Well Drilling Co. removed the old casing and reamed the hole to 12 in. in diameter from land surface to a depth of 400 ft, reduced it to 10 in. between 400 and 985 ft, and finished it at 8 in. in diameter from 985 to 1452 ft. A 10-in. casing was installed from land surface to a depth of 400 ft (cemented in) and an 8-in. liner from 755 ft to a depth of 985 ft.

In 1913 the well reportedly produced 150 gpm for 24 hr with no noticeable drawdown from a nonpumping water level of 90 ft below the top of the well.

Nonpumping water levels were reported to be 180 ft in 1920 and 190 ft below land surface in 1941.

After rehabilitation, a production test was conducted by the State Water Survey on December 7, 1943. After 7.3 hr of pumping at rates of 174 to 160 gpm, the drawdown was

51.0 ft from a nonpumping water level of 192.0 ft below the top of the casing.

On March 9, 1954, the nonpumping water level was reported to be 225 ft.

A production test using one observation well was conducted by the State Water Survey on June 10, 1957. After 6.3 hr of pumping at varying rates of 206 to 155 gpm, the drawdown was 73.3 ft from a nonpumping water level of 237.2 ft below the pump base.

The pumping equipment presently installed is a Crane Deming turbine pump set at 384 ft, rated at 300 gpm, and powered by a 30-hp 1800 rpm U. S. electric motor (Model No. CFU, Serial No. 2569130).

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. 04284) is for a water sample from the well collected on February 28, 1972, after 1.2 hr of pumping at 275 gpm.

WELL NO. 1, LABORATORY NO. 04284

	<i>mg/l</i>	<i>me/l</i>	<i>mg/l</i>	<i>me/l</i>
Iron	Fe 0.1	0.00	Silica	SiO <sub>2</sub> 9.5
Manganese	Mn 0.0		Fluoride	F 2.5 0.13
Ammonium	NH <sub>4</sub> 1.8	0.01	Boron	B 1.7
Sodium	Na 636	27.67	Nitrate	NO <sub>3</sub> 0.0 0.00
Potassium	K 11.0	0.28	Chloride	Cl 540 15.23
Calcium	Ca 23	1.15	Sulfate	SO <sub>4</sub> 238 4.95
Magnesium	Mg 12.5	1.03	Alkalinity (as Ca CO <sub>3</sub> )	448 9.28
Barium	Ba 0.0		Hardness (as CaCO <sub>3</sub> )	104
Copper	Cu 0.0		Total dissolved minerals	1875
Cadmium	Cd 0.00			
Chromium	Cr 0.0		Radioactivity	
Lead	Pb 0.00		Mercury	Hg <0.0005
Mercury	Hg <0.0005		Nickel	Ni 0.0 ± deviation 7
Nickel	Ni 0.0	±	Silver	Ag 0.0
Silver	Ag 0.0		Zinc	Zn 0.0 ± deviation 7
Zinc	Zn 0.0	±		

WELL NO. 2, open to the Silurian, was completed in August 1942 to a depth of 780 ft by the Varner Well Drilling Co., Dubuque, Iowa. The well is located 75 ft E of Well No. 1, southeast of the intersection of Vine and Franklin Sts., approximately 1230 ft N and 1300 ft E of the SW corner of Section 19, T13N, R6E. The land surface elevation at the well is approximately 723 ft.

An 18-in. diameter hole was drilled to a depth of 400 ft, reduced to 14 in. between 400 and 422 ft, and finished 12.8 in. in diameter from 422 to 780 ft. The well is cased with 18-in. OD steel drive pipe from land surface to a depth of 59 ft, 16-in. OD steel pipe from land surface to a depth of 382 ft, and a 10-in. pipe from 0.2 ft above land surface to a depth of 445 ft (cemented in).

A production test, before the 10-in. casing was installed, was conducted by the State Water Survey on August 19-20, 1942. After 3.6 hr of pumping at varying rates of 205 to 210 gpm, the drawdown was 17.8 ft from a nonpumping water level of 203.2 ft below the top of the casing.

After the 10-in. casing was installed, another production test was conducted by the State Water Survey on September 10, 1942. After 2.5 hr of pumping at varying rates of 242 to 233 gpm, the drawdown was 38.7 ft from a non-pumping water level of 204.0 ft below the pump foundation.

A driller's and sample study log of Well No. 2 furnished by the State Geological Survey follows:

Strata	Thickness (ft)	Depth (ft)
<b>PLEISTOCENE SYSTEM</b>		
"Clay"	25	25
"Sand and gravel"	10	35
"Shale and gravel"	20	55
<b>PENNSYLVANIAN SYSTEM</b>		
"Shale, some limestone, thin sandstone bed at base"	250	305
<b>MISSISSIPPIAN-DEVONIAN SYSTEM</b>		
New Albany Group		
"Shale"	70	375
<b>DEVONIAN SYSTEM</b>		
Cedar Valley Limestone	55	430
Wapsipinicon Limestone, thin dolomite and sandstone at base	42	472
<b>SILURIAN SYSTEM</b>		
Niagaran-Alexandrian Series		
Dolomite	28	500
"Limestone"	265	765
<b>ORDOVICIAN SYSTEM</b>		
Maquoketa Group		
"Shale and limestone"	15	780

On December 10, 1943, the production rate was checked by the State Water Survey and was found to be 225 gpm with a drawdown of 19.5 ft.

The pumping equipment presently installed is a Fairbanks-Morse Pomona turbine pump set at 334 ft, rated at 300 gpm, and powered by a 30-hp 1765 rpm U. S. electric motor (Model No. RU, Serial No. R2014529).

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. 04285) is for a water sample from the well collected on February 28, 1972, after 1.2 hr of pumping at 265 gpm.

WELL NO. 2, LABORATORY NO. 04285									
		mg/l		me/l		mg/l		me/l	
Iron	Fe	0.1	0.00	Silica	SiO <sub>2</sub>	9.0			
Manganese	Mn	0.0	0.0	Fluoride	F	2.5	0.13		
Ammonium	NH <sub>4</sub>	1.7	0.09	Boron	B	1.8			
Sodium	Na	680	29.58	Nitrate	NO <sub>3</sub>	0.0	0.00		
Potassium	K	10.0	0.26	Chloride	Cl	600	16.92		
Calcium	Ca	21	1.05	Sulfate	SO <sub>4</sub>	225	4.68		
Magnesium	Mg	8.5	0.70	Alkalinity (as CaCO <sub>3</sub> )		476	9.52		
				Hardness (as CaCO <sub>3</sub> )		88			
Barium	Ba	0.0		Total dissolved minerals		1934			
Copper	Cu	0.0		pH (as rec'd)		7.8			
Cadmium	Cd	0.00		Radioactivity					
Chromium	Cr	0.0		Alpha	pc/l	4			
Lead	Pb	0.00		± deviation		5			
Mercury	Hg	<0.0005		Beta	pc/l	0			
Nickel	Ni	0.0		± deviation		5			
Silver	Ag	0.0							
Zinc	Zn	0.0							

## WYOMING

The city of Wyoming (1563) installed a public water supply in 1902. Two wells are in use. In 1950 there were 500 services, 90 percent metered; the estimated average and maximum daily pumpages were 70,000 and 80,000 gpd, respectively. In 1973 there were 640 services, 40 percent metered; the average and maximum daily pumpages were 150,000 and 200,000 gpd, respectively. The water is chlorinated, discharged through an aerator to a collecting reservoir to remove hydrogen sulfide, and then repumped to the distribution system. The natural fluoride concentration in the water is adequate to satisfy state requirements.

WELL NO. 1, open to the Galena-Platteville and Glenwood-St. Peter, was completed in 1902 to a depth of 1557 ft by Mr. Dean, Galva. The well is located on city-owned property just east of the business district, approximately 50 ft S and 900 ft E of the NW corner of Section 1, T12N, R6E. The land surface elevation at the well is approximately 705 ft.

A 12-in. diameter hole was drilled to a depth of 242 ft, reduced to 9 in. between 242 and 765 ft, and finished 8 in. in diameter from 765 to 1557 ft. The well is cased with 10-in. pipe from land surface to a depth of 242 ft, 8-in. pipe from 242 ft to 765 ft, and 6-in. pipe from 765 ft to 1197 ft.

Upon completion, the well reportedly produced 200 gpm for 10 hr with no noticeable drawdown from a nonpumping water level of 85 ft below land surface.

Nonpumping water levels below land surface were reported as follows: 85 ft in 1915, 117 ft in 1919, 130 ft in 1938, 153 ft in 1940, and 156 ft in 1942.

In 1943 after 8 hr of pumping at an estimated rate of 300 gpm, the drawdown was 2.25 ft from a nonpumping water level of 158.00 ft below land surface.

The pumping equipment presently installed consists of a 30-hp 1770 rpm General Electric motor (Model No. 12F20, Serial No. 5422356), a 7-in., 17-stage Fairbanks-Morse Pomona turbine pump rated at 330 gpm at about 195 ft TDH, and 240 ft of 5-in. column pipe.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B110824) of a sample collected May 23, 1973, after pumping for 1 hr at 500 gpm, showed the water to have a hardness of 187 mg/l, total dissolved minerals of 1193 mg/l, and an iron content of 0.10 mg/l. Hydrogen sulfide was apparent on a previous analysis.

WELL NO. 2, open to the Pennsylvanian, Mississippian, Devonian, Silurian, and Galena-Platteville, was completed in

April 1947 to a depth of 1400 ft by the Varner Well Drilling Co., Dubuque, Iowa. The well is located at the southeast corner of Elm and Williams Sts., approximately 120 ft S and 900 ft E of the NW corner of Section 1, T12N, R6E. The land surface elevation at the well is approximately 705 ft.

A sample study log of Well No. 2 furnished by the State Geological Survey follows:

Strata	Thickness (ft)	Depth (ft)
<b>PLEISTOCENE SYSTEM</b>		
Loess, soils at top and bottom	20	20
Till and clay	155	175
Soil and till	15	190
Sand, with granule gravel at base, clean	10	200
Sand and granule gravel, silty	5	205
Till	5	210
<b>PENNSYLVANIAN SYSTEM</b>		
Shale, thin sandstone bed	145	355
Sandstone, silty, incoherent	25	380
Shale and sandstone	21	401
<b>MISSISSIPPIAN-DEVONIAN SYSTEM</b>		
New Albany Group, shale	134	535
<b>DEVONIAN SYSTEM</b>		
Cedar Valley Limestone	50	585
Wapsipinicon Limestone, dolomite, and thin sandstone bed at base	51	636
<b>SILURIAN SYSTEM</b>		
Niagaran-Alexandrian Series		
Dolomite, little crevice clay	54	690
Dolomite	100	790
Dolomite, little crevice clay	85	875
Dolomite, thin siltstone bed at base	58	933
<b>ORDOVICIAN SYSTEM</b>		
Maquoketa Group, shale and dolomite	191	1124
Galena-Platteville Groups, limestone and dolomite	276	1400

A 24-in. diameter hole was drilled to a depth of 193.7 ft, reduced to 23 in. between 193.7 and 390 ft, reduced to 19 in. between 390 and 941 ft, reduced to 15 in. between 941 and 1045 ft, and finished 12 in. in diameter from 1045 to 1400 ft. The well is cased with 24-in. OD steel drive pipe

from land surface to a depth of 193.7 ft, 20-in. OD steel pipe from land surface to a depth of 390 ft (cemented in), and 12-in. liner pipe from 930 ft to a depth of 1049 ft.

A production test was conducted on April 17, 1947, by representatives of the driller, the city, and the State Water Survey. After 5 hr of pumping at rates of 152 to 380 gpm, the drawdown was 16 ft from a nonpumping water level of 172 ft.

The pumping equipment presently installed is a 10-in., 9-stage Peerless turbine pump (Serial No. 34463) rated at 300 gpm at about 280 ft TDH, and powered by a 30-hp 1800 rpm U. S. electric motor (Model No. CFU, Serial No. 551208).

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B18437) is for a water sample from the well collected on October 16, 1972, after 30 min of pumping at 300 gpm.

WELL NO. 2, LABORATORY NO. B1843 7

	mg/l	me/l	mg/l	me/l
Iron	Fe 0.14	0.01	Silica	SiO <sub>2</sub> 9.0
Manganese	Mn 0.00	0.00	Fluoride	F 1.8 0.10
Ammonium	NH <sub>4</sub> 0.5	0.03	Boron	B 0.20
Sodium	Na 345.0	15.01	Nitrate	NO <sub>3</sub> 4.4 0.07
Potassium	K 14.0	0.36	Chloride	Cl 280.0 7.90
Calcium	Ca 41.0	2.05	Sulfate	SO <sub>4</sub> 300.0 6.24
Magnesium	Mg 18.8	1.54	Alkalinity (as CaCO <sub>3</sub> )	244.0 4.88
Arsenic	As 0.0 0			
Barium	Ba 0.0 0			
Copper	Cu 0.0 0		Hardness (as CaCO <sub>3</sub> )	180
Cadmium	Cd 0.0 0			
Chromium	Cr 0.0 0			
Lead	Pb 0.0 5*			
Mercury	Hg 0.0000		Total dissolved minerals	1188
Nickel	Ni 0.0 0			
Selenium	Se 0.0 0			
Silver	Ag 0.0 0			
Zinc	Zn 0.0 0		pH (as rec'd)	8.4

\*Later samples collected for lead analysis showed 0.00 mg/l