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Public Groundwater Supplies
in Pike County

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PUBLIC GROUNDWATER SUPPLIES IN PIKE COUNTY

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Introduction

This publication presents all available information on production wells used for public groundwater supplies in Pike 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 11 municipalities in Pike County. These are preceded by brief summaries of the groundwater geology of the county and the development of groundwater 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 Dr. William C. Ackermann, Chief of the Illinois State Water Survey, and Richard J. Schicht, Head of the Hydrology Section. Mrs. J. Loreena Ivens and Mrs. Patricia A. Motherway edited the manuscript, Mrs. Marilyn J. Innes typed the camera-copy, and John W. Brother, Jr. supervised the preparation of the illustration. The chemical analyses, unless otherwise stated, were made by personnel of the Water Survey Chemistry Section under the supervision of Laurel M. Henley. The analyses made by personnel of the Illinois Environmental Protection Agency were under the supervision of Ira M. Markwood. R. D. Brower and M. L. Sargent, Illinois State Geological Survey, reviewed the geological discussion. Grateful acknowledgment also is given to consulting engineers, well drillers, water superintendents, and municipal officials who have provided valuable information used in this report.

Groundwater Geology

The geology of Pike County is described generally in Illinois State Geological Survey Circular 232, *Groundwater Geology in Western Illinois, South Part*. The following brief discussion of geologic conditions in the county is taken largely from that publication. More detailed definition of the geology in this part of the state can be obtained from the State Geological Survey which is located on the University of Illinois campus, Urbana.

Unconsolidated deposits consisting of glacial drift, wind-blown silt (loess), and alluvium form the present land surface in Pike County and vary greatly in thickness and water-yielding character. Thick, extensive deposits of sand and gravel are present in the bottomlands of the Mississippi and Illinois Rivers where the fill is from 50 to 120 ft thick in partially buried preglacial bedrock valleys. These permeable sand and gravel deposits are suitable for development of

high capacity (200 to 800 gpm) wells for municipal, industrial, and irrigation uses. Sand and gravel deposits also may be associated with tributary stream valleys such as Bay Creek, Hadley Creek, Kiser Creek, and South Fork, McKee Creek.

In the upland areas of the county, the glacial drift deposits are generally less than 50 ft thick and consist principally of tight glacial till. These materials are extensively dissected by tributaries of the Mississippi and Illinois Rivers, and water-bearing sand and gravel deposits are rarely encountered.

Semiconsolidated deposits of gravel, sand, and silt of Cretaceous age are present beneath the drift materials in the north central part of Pike County in the Baylis area. These deposits range in thickness from 0 to 100 ft and may yield small amounts of water to wells.

Beneath the glacial drift and Cretaceous deposits, the

upper bedrock formations consist principally of beds of limestone and shale of widely differing geologic age. Pennsylvanian-age rocks are the uppermost bedrock in the north central part of Pike County in the Fishhook, Baylis, and New Salem area and in a small area southwest of Pittsfield. These rocks range in thickness from a maximum of about 110 ft in the vicinity of Baylis to a featheredge where they have been eroded. These rocks consist principally of shale and are not regarded as water yielding in this area.

The Burlington-Keokuk Limestone (Mississippian age) is the upper bedrock unit beneath most of the upland area of the county and occurs below the Pennsylvanian rocks in the north central area. The Burlington-Keokuk is exposed along the Mississippi and Illinois River valley bluffs and in many of the tributary stream valleys. The Burlington-Keokuk is usually at a depth of about 20 to 70 ft where it is directly beneath the drift and is about 30 to 300 ft deep in the north central area where the Pennsylvanian and Cretaceous rocks are present. It ranges in thickness from 0 to 240 ft. The yield capability of the Burlington-Keokuk Limestone depends on the number, size, and degree of interconnection of water-filled cracks and crevices within the rock that are intersected by the well bore. Quantities of water adequate for domestic and farm use usually can be obtained and, locally, supplies for small communities may be available for development.

The New Albany Shale Group (Mississippian-Devonian age) underlies the Burlington-Keokuk in the upland area of the county and separates it from deeper water-yielding units. The New Albany is exposed along the Mississippi River valley bluff, along the Illinois River bluff south of Valley City, and in many of the tributary stream valleys. It ranges in thickness from 0 to 180 ft. The New Albany is not water yielding.

Devonian, Silurian, and Ordovician age rock units underlie the glacial drift deposits in the Mississippi River bottomland area, the south half of the Illinois River valley bottomland area, and the New Albany Shale Group in the upland area. These units are water yielding but generally contain water too highly mineralized for most uses. The units are not tapped for public water supply in Pike County.

Groundwater Development for Public Use

Groundwater is used as a source for 11 public water supply systems serving Barry, Baylis, Griggsville, Hull, Kinderhook, Milton, Nebo, New Canton, Pearl, Perry, and Pleasant Hill. The locations of these supplies are shown in figure 1.

Unconsolidated sand and gravel deposits are tapped as a source of water for Barry, Griggsville, Hull, Kinderhook, Nebo, New Canton, Perry, and Pleasant Hill. There are presently 20 supply wells finished in sand and gravel at depths

of 38.5 to 84 ft. They are pumped at rates of 50 to 220 gpm depending upon the type of well constructed and the permeability, thickness, and areal extent of the sand and gravel aquifer tapped by each well. Production from these wells in 1977 was estimated to be about 631,000 gpd. Analyses of water samples from these wells indicate that the iron content ranges from 0.0 to 8.4 mg/l and the hardness from 156 to 444 mg/l. Water for Griggsville, Kinderhook, and New Canton is chlorinated and fluoridated. At Hull, Perry, and Pleasant Hill the water is aerated and filtered to remove iron, chlorinated, and fluoridated. At Nebo the water is treated with potassium permanganate, filtered for iron removal, chlorinated, and fluoridated. The water for Barry is treated with potassium permanganate and caustic soda, filtered, zeolite softened, chlorinated, and fluoridated.

The Burlington-Keokuk Limestone is used as a source of water for Baylis, Milton, and Pearl. There are presently six production wells ranging in depth from 56 to 500 ft and one spring open to the Burlington-Keokuk. The wells are pumped at rates of about 15 to 35 gpm and the average spring flow has been estimated at about 50 gpm. Withdrawal from the wells and the spring in 1977 was estimated to be about 73,000 gpd. Analyses of water samples show that the iron content ranges from 0.0 to 5.8 mg/l and the hardness from 20 to 336 mg/l. Water for Pearl is chlorinated and fluoridated. At Milton the water is treated with potassium permanganate and filtered for iron removal, fluoridated, and chlorinated. Water for Baylis is chlorinated and has a natural fluoride concentration that meets state requirements.

Total public water supply pumpage in Pike County for 1977 was about 704,000 gpd. Estimated pumpage from municipal wells tapping sand and gravel was about 90 percent of this total (631,000 gpd) and the remaining 10 percent (73,000 gpd) was from a spring and wells obtaining water from the Burlington-Keokuk Limestone aquifer. The water-bearing sand and gravel deposits associated with the bottomlands of the Mississippi and Illinois Rivers are capable of ultimate yields many times the present withdrawal.

Format

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

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

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 tapped, date drilled, depth, driller, legal location, elevation in feet above mean sea level, log, construction features, yield, pumping equipment, and chemical analyses.*

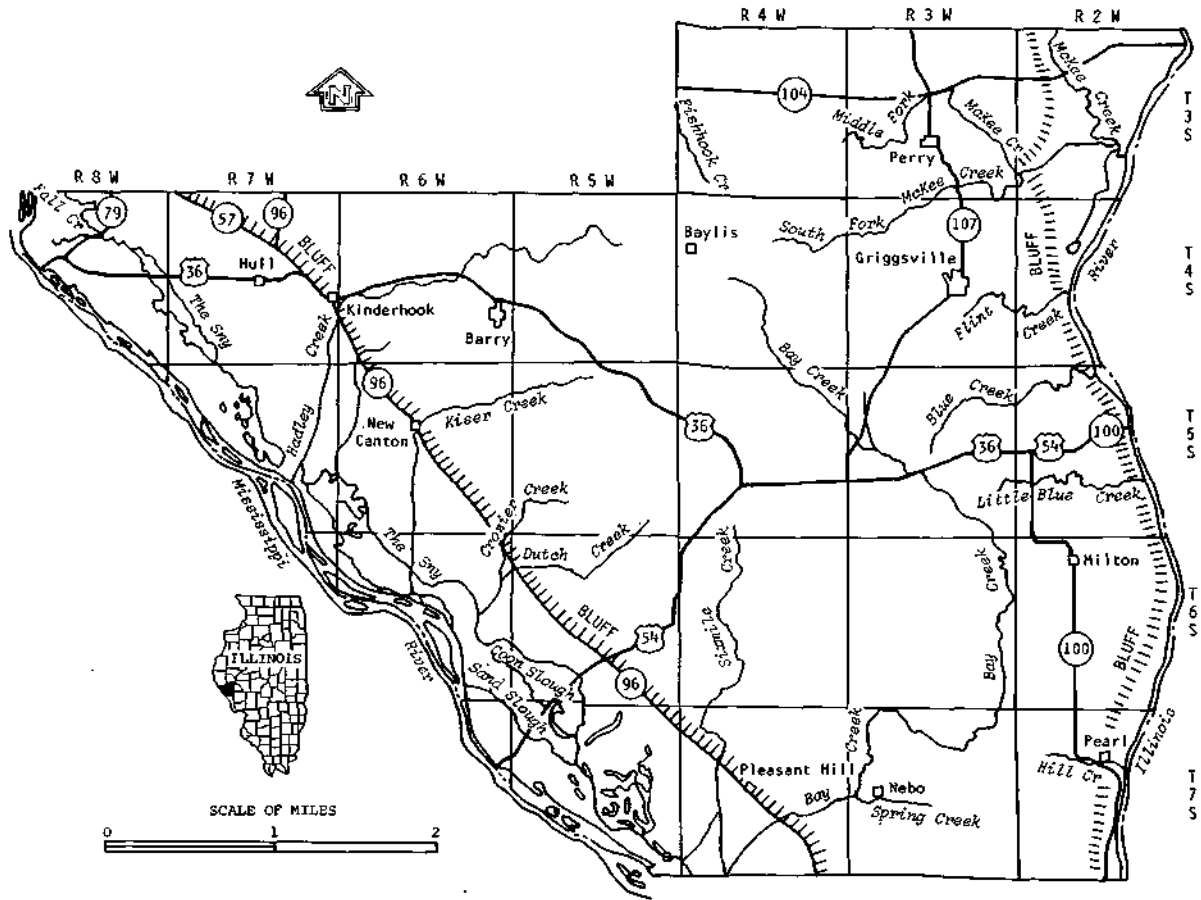


Figure 1. Location of public groundwater supplies in Pike County

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 carbonate rocks which in most of Illinois are dolomitic in composition. When stating the bedrock aquifers tapped by a well, the sample study log provided by the State Geological Survey and the drillers 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 readily determined, only the principal rock type as described by the driller is given (dolomite, sandstone, etc.).

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)
gal.....	gallon(s)
gpd.....	gallons per day
gpm.....	gallons per minute
hp.....	horsepower
hr.....	hour(s)
HTH.....	high test hypochlorite
ID.....	inside diameter
in.....	inch(es)
Lab.....	laboratory
lb.....	pound(s)
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

BARRY

The city of Barry (1444) installed a public water supply in 1880. Two wells (Nos. 1 and 2) are in use. In 1952 there were 500 services, all but 2 or 3 metered; the average and maximum daily pumpages in 1949 were 70,000 and 85,000 gpd, respectively. In 1978 there were 638 services, all metered; the average and maximum daily pumpages in 1977 were 136,740 and 237,600 gpd, respectively. The water is chlorinated, fed potassium permanganate, fed caustic soda, filtered, zeolite softened, postchlorinated, and fluoridated.

Originally, water was obtained from a well completed in 1880 to a depth of 2510 ft by the J. P. Miller Artesian Well Co., Brookfield. This well was abandoned in 1916 and has been sealed. The well was located near the north edge of the city park, approximately 1500 ft S and 2000 ft E of the NW corner of Section 25, T4S, R6W. The land surface elevation at the well is approximately 720 ft.

The well was cased with 7-in. pipe from above the floor of a 12-ft deep pit to a depth of 300 ft. The hole was reported to be 2 in. in diameter at the bottom.

Upon completion, the nonpumping water level was reported to be 135 ft.

A mineral analysis of a sample (Lab. No. 22152) collected July 10, 1911, showed the water to have a hardness of 1017 mg/l, total dissolved minerals of 5021 mg/l, and an iron content of 0.7 mg/l.

SPRING NO. 1 (Watson Spring) was developed for the city in 1916 and use was discontinued in 1957. The spring is located near the pumping station at the foot of a bluff 1 mile west of the city, approximately 600 ft S and 1400 ft E of the NW corner of Section 26, T4S, R6W. On January 5, 1925, water flowed at a rate of 22 gpm.

A mineral analysis of a sample (Lab. No. 114129) collected April 8, 1948, showed the water to have a hardness of 165 mg/l, total dissolved minerals of 192 mg/l, and an iron content of 0.2 mg/l.

SPRING NO. 2 (Hart Spring) was developed for the city in 1953 and use was discontinued in 1957. The spring is located about 1200 ft south-southeast of the pumping station.

A partial analysis of a sample (Lab. No. 103843) collected July 12, 1945, showed the water to have a hardness of 190 mg/l, total dissolved minerals of 240 mg/l, and an iron content of 0.1 mg/l.

OLD WELL NO. 1, finished in sand and gravel, was dug in 1931 to a depth of 19 ft by George Cook, Barry. This well was abandoned in 1954. The well is located near the pumping station, approximately 625 ft S and 1470 ft E of the NW corner of Section 26, T4S, R6W. The land surface elevation at the well is approximately 640 ft.

A 10.5-ft diameter hole was dug to a depth of 19 ft. The upper 5 ft of the well is walled with brick laid in cement

mortar and reduced to 3 ft in diameter at the top. From 5 ft to the bottom of the well, the wall is reported to be concrete.

On April 8, 1948, the nonpumping water level was reported to be 8 ft below land surface. The well was pumped dry after 1.7 hr at 100 gpm. The rate of inflow into the well was about 50 gpm.

A mineral analysis of a sample (Lab. No. 114124) collected April 8, 1948, showed the water to have a hardness of 161 mg/l, total dissolved minerals of 201 mg/l, and an iron content of 0.1 mg/l.

Eight sand point wells were completed in 1934 to depths ranging from 18 to 22 ft. These wells were abandoned about 1948. The wells are located about 200 ft northeast of Spring No. 1, approximately 400 ft S and 1490 ft E of the NW corner of Section 26, T4S, R6W. The wells were installed by jetting 6-in. diameter holes and installing 1.2-in. diameter casings and sand point screens. The annulus between the bore hole and casing-screen assembly is filled with gravel.

A mineral analysis of a sample (Lab. No. 114125) collected from the sand point wells on April 8, 1948, showed the water to have a hardness of 193 mg/l, total dissolved minerals of 256 mg/l, and an iron content of 0.1 mg/l.

OLD WELL NO. 2, consisting of three sand point wells, was completed in April 1948 to depths of 23, 30, and 30 ft, respectively. These wells were abandoned in 1957. The wells are located on the south bank of a creek near the eight sand point wells. The wells were installed by jetting holes and installing 2-in. diameter casings with 2.5-ft lengths (3.5 ft overall lengths) of 2-in. diameter sand point screens at the bottom of each one. The annulus between the bore hole and casing-screen assembly is filled with pea gravel. On April 21, 1948, the nonpumping water level outside the casings was reported to be 3 ft below land surface.

OLD WELL NO. 3, finished in sand and gravel, was completed in May 1951 to a depth of 30 ft by the Calhoun Drilling Co., Batchtown. This well was abandoned in 1957. The well is located about 75 ft southeast of Old Well No. 2 on the east side of the county road and southwest bank of a creek.

The well is cased with 10-in. pipe from 4 ft above land surface to an apparent depth of 25 ft followed by 5 ft of Johnson screen.

In 1954, the yield of this well had declined to 12 gpm.

An emergency well was constructed in March 1953 to a depth of 27 ft by the Calhoun Drilling Co., Batchtown. This well was abandoned in 1954. The well is located north of the creek bed adjacent to a county road about 65 ft east-northeast of Old Well No. 3. The well was cased with 12-in. pipe and equipped with a 2-in. diameter sand point 3 ft long.

Seven test holes were drilled in the spring of 1953 to depths ranging from 33 to 52 ft by C. L. Jennings, New London, Iowa. The holes were located in a tributary of Hadley Creek about 0.5 mile west of the city.

OLD WELL NO. 4, open to the Burlington-Keokuk Limestone, was completed in 1954 to a depth of 325 ft by the J. P. Miller Artesian Well Co., Brookfield. This well was abandoned in 1957. The well is located on the east side of a county road on the north bank of a creek, approximately 400 ft S and 1850 ft E of the NW corner of Section 26, T4S, R6W. The land surface elevation at the well is approximately 600 ft.

A drillers log of Old Well No. 4 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Sand and gravel	31	31
Blue and green shale	70	101
Slate and shale seams	61	162
Limestone	64	226
Shale with limestone streaks	68	294
Slate limestone with shale streaks	31	325

The well is cased with 8-in. ID pipe from about 1.3 ft above the floor of a 4.7-ft deep pit to an unknown depth and 6-in. pipe from about 1.3 ft above the floor of a 4.7-ft deep pit to a depth of 164.7 ft. Below the casing, the hole was finished 8 in. in diameter to the bottom.

A production test was conducted on July 8, 1954, by representatives of the driller and the State Water Survey. After 4.7 hr of pumping at rates ranging from 17.5 to 15.75 gpm, the drawdown was 87.8 ft from a nonpumping water level of 54.0 ft. Thirty-two min after pumping was stopped, the water level had recovered to 57.0 ft.

A partial analysis of a sample (Lab. No. 135259) collected during the initial production test, after pumping for 4 hr at rates of 17.5 to 15.75 gpm, showed the water to have a hardness of 96 mg/l, total dissolved minerals of 1214 mg/l, and an iron content of 0.3 mg/l. Methane gas was reported in a previous sample.

Three test holes were constructed in May 1956 to depths of 64.1, 109.5, and 137 ft, respectively, by the Layne-Western Co., Kirkwood, Mo. The holes were located in Grubb Hollow in the southwest quarter of Section 31, T4S, R6W.

WELL NO. 1 (Grubb Hollow), finished in sand and gravel, was completed in June 1956 to a depth of 72 ft by the Layne-Western Co., Kirkwood, Mo. The well is located about 5 miles west-southwest of Barry and 2 miles south-southeast of Kinderhook on the west side of Route 96, approximately 2500 ft N and 4080 ft W of the SE corner of Section 31, T4S, R6W. The land surface elevation at the well is approximately 500 ft.

A drillers log of Well No. 1 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Top soil	2	2
Brown clay	7	9

<i>Strata (continued)</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Broken rock/sand	3	12
Brown sandy clay, broken rock	5.5	17.5
Gray brown clay	16.5	34
Fine sand, clay balls	7	41
Fine sand	5	46
Medium fine sand	5	51
Fine sand	15	66
Medium fine sand	6	72
Fine sand	35.5	107.5

A 30-in. diameter hole was drilled to a depth of 8.5 ft and finished 26 in. in diameter from 8.5 to 72 ft. The well is cased with 18-in. steel pipe from about 1.5 ft above land surface to a depth of 10 ft and 8-in. steel pipe from 4 ft above land surface to a depth of 57 ft followed by 15 ft of 8-in. No. 5 (0.105 in.) Layne shutter screen. The annulus between the bore hole and the casing-screen assembly is filled with concrete from 0 to 10 ft and with coarse sand and pea gravel from 10 to 72 ft.

A production test using two observation wells was conducted on July 2-3, 1956, by representatives of the driller, the city, the State Water Survey, and Casler and Stapleton, Consulting Engineers. After 21.5 hr of pumping at rates ranging from 201 to 215 gpm, the drawdown was 5.5 ft from a nonpumping water level of 20.0 ft below land surface. Pumping was continued for 2.5 hr at rates of 300 to 303 gpm with a final drawdown of 7.5 ft. Five min after pumping was stopped, the water level had recovered to 21.5 ft.

In March 1970, this well was treated with 1000 gal of acid by the Layne-Western Co., Kirkwood, Mo. The well then reportedly produced 220 gpm with a drawdown of 5.5 ft.

The pumping equipment presently installed is a Layne turbine pump set at 58 ft, rated at 200 gpm at about 403 ft TDH, and powered by a 30-hp 1800 rpm U. S. electric motor.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A19014) of a sample collected March 21, 1977, after pumping for 2 hr at 100 gpm, showed the water to have a hardness of 444 mg/l, total dissolved minerals of 500 mg/l, and an iron content of 0.00 mg/l.

WELL NO. 2 (Grubb Hollow), finished in sand and gravel, was completed in July 1956 to a depth of 69.5 ft by the Layne-Western Co., Kirkwood, Mo. The well is located about 100 ft west of Well No. 1, approximately 2500 ft N and 4180 ft W of the SE corner of Section 31, T4S, R6W. The land surface elevation at the well is approximately 500 ft.

A correlated drillers log of Well No. 2 furnished by the State Geological Survey follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
PLEISTOCENE SERIES		
Red clay	30	30
Blue sandy clay	6	36
Medium sand	8	44

<i>Strata (continued)</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Coarse sand and gravel	17	61
Medium fine sand	11	72
Clay balls	1	73

A 30-in. diameter hole was drilled to a depth of 8.5 ft and finished 26 in. in diameter from 8.5 to 69.5 ft. The well is cased with 18-in. steel pipe from about 1.5 ft above land surface to a depth of 10 ft and 8-in. steel pipe from 6 ft above land surface to a depth of 54.5 ft followed by 15 ft of 8-in. No. 5 (0.105 in.) Layne shutter screen. The annulus between the bore hole and the 18-in. casing is filled with concrete from 0 to 10 ft, and the annulus between the bore hole and casing-screen assembly is filled with pea gravel and coarse sand from 7 to 69.5 ft.

A production test using two observation wells was conducted on July 18-19, 1956, by representatives of the driller, the city, the State Water Survey, and Casler and Stapleton, Consulting Engineers. After 24.1 hr of pumping at rates ranging from 201 to 219 gpm, the drawdown was 4.0 ft from a nonpumping water level of 19.5 ft below land surface.

In 1965, this well was acidized by John Peterson, Barry. The capacity of the well was then rated near its original capacity of 190 gpm.

The pumping equipment presently installed is a 6-in., 13-stage Jacuzzi submersible pump set at 65 ft below the top of the casing, and powered by a 30-hp electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. C008457) is for a water sample from the well collected April 29, 1975, after 3 hr of pumping at 120 gpm.

WELL NO. 2, LABORATORY NO. C008457

	<i>mg/l</i>	<i>me/l</i>		<i>mg/l</i>	<i>me/l</i>
Iron	Fe	0.9	Silica	SiO ₂	22.0
Manganese	Mn	0.48	Fluoride	F	0.2
Ammonium	NH ₄	0.13	Boron	B	0.1
Sodium	Na	8	Nitrate	NO ₃	5.3
Potassium	K	1.2	Chloride	Cl	12
Calcium	Ca	82	Sulfate	SO ₄	52
Magnesium	Mg	38	Alkalinity(as CaCO ₃)		308
Arsenic	As	0.000	Hardness (as CaCO ₃)		362
Barium	Ba	0.0	Total dissolved minerals		418
Copper	Cu	0.00			
Cadmium	Cd	0.00			
Chromium	Cr	0.00			
Lead	Pb	0.00			
Mercury	Hg	0.0000	pH (as rec'd)		7.8
Nickel	Ni	0.0	Radioactivity		
Selenium	Se	0.00	Alpha	pc/l	2.0
Silver	Ag	0.00	± deviation		1.6
Cyanide	CN	0.00	Beta	pc/l	30.7
Zinc	Zn	0.00	± deviation		13.8

BAYLIS

The village of Baylis (307) installed a public water supply in 1959. Three wells are in use. In 1962 there were 98 services, 11 metered; the average daily pumpage was 9000 gpd. In 1977 there were 123 services, all metered; the average and maximum daily pumpages were only 5000 and 10,000 gpd, respectively, because of water conservation measures. The water is chlorinated.

WELL NO. 1, open to the Burlington-Keokuk Limestone, was completed in February 1957 to a depth of 429 ft by Ray F. Starr, Baylis. The well is located adjacent to the elevated tank in the southeast central part of the village, approximately 460 ft N and 1990 ft E of the SW corner of Section 7, T4S, R4W. The land surface elevation at the well is approximately 870 ft.

A drillers log of Well No. 1 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Clay	12	12
Yellow clay	8	20
Sand	70	90
Sand, brown	12	102
Shale, blue	98	200
Shale, dark	10	210

<i>Strata (continued)</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Lime	2	212
Shale	48	260
Lime	169	429

An 8-in. diameter hole was drilled to a depth of 429 ft. The well is cased with 8-in. steel pipe from 1 ft above the pumphouse floor to a depth of 272 ft.

A production test was conducted on August 20, 1957, by representatives of the driller, the village, the State Water Survey, and Wm. H. Klingner & Associates, Consulting Engineers. After 4.8 hr of pumping at rates ranging from 16.5 to 14.6 gpm, the drawdown was 193 ft from a non-pumping water level of 203 ft below the top of the casing. Pumping was continued for 9 min at a rate of 20 gpm with a drawdown of 208 ft. Thirty-one min after pumping was stopped, the water level had recovered to 296 ft.

The pumping equipment presently installed is a Reda submersible pump set at 413 ft, rated at 36 gpm, and powered by a 7½-hp 3450 rpm Reda electric motor.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. C008334) of a sample collected

April 26, 1975, after pumping for 2 hr at 5 gpm, showed the water to have a hardness of 25 mg/l, total dissolved minerals of 396 mg/l, and an iron content of 0.0 mg/l.

WELL NO. 2, open to the Burlington-Keokuk Limestone, was completed in November 1958 to a depth of 450 ft by Michael M. Callihan, Pittsfield. The well is located about 1000 ft northeast of Well No. 1, approximately 700 ft N and 2440 ft W of the SE corner of Section 7, T4S, R4W. The land surface elevation at the well is 865.3 ft.

A drillers log of Well No. 2 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Clay	70	70
Sand and gravel	33	103
Shale	107	210
Lime	2	212
Shale	41	253
Lime	197	450

A 10-in. diameter hole was drilled to a depth of 103 ft and finished 8 in. in diameter from 103 to 450 ft. The well is cased with 10-in. steel pipe from 2 ft above land surface to a depth of 103 ft and 8-in. steel pipe from 2 ft above land surface to a depth of 263.8 ft.

A production test using one observation well was conducted on December 30, 1958, by representatives of the driller, the village, the State Water Survey, and Wm. H. Klingner & Associates, Consulting Engineers. After 1.4 hr of pumping at rates ranging from 25 to 23 gpm, the drawdown was 106.0 ft from a nonpumping water level of 213.0 ft below land surface. Pumping was continued for 1 hr at rates of 30 to 29 gpm with a drawdown of 147.0 ft. After an additional 28 min of pumping at rates of 45 to 33 gpm, the final drawdown was 218.0 ft. The water level recovered to 227.5 ft after pumping had been stopped for 1.1 hr.

The pumping equipment presently installed is a Reda submersible pump set at 435 ft, rated at 36 gpm, and powered by a 7½-hp Reda electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A19398) is for a water sample from the well collected March 28, 1977, after 24 hr of pumping at 10 gpm. Hydrogen sulfide was apparent when a previous sample was collected.

WELL NO. 2, LABORATORY NO. A19398						
		<i>mg/l</i>	<i>me/l</i>		<i>mg/l</i>	<i>me/l</i>
Iron	Fe	0.00		Silica	SiO ₂	8
Manganese	Mn	0.03		Fluoride	F	1.8 0.10
Ammonium	NH ₄	0.45	0.02	Boron	B	1.2
Sodium	Na	131	5.70	Nitrate	NO ₃	0.0 0.00
Potassium	K	2.4	0.06	Chloride	Cl	53 1.50
Calcium	Ca	4.0	0.20	Sulfate	SO ₄	1 0.02
Magnesium	Mg	3.4	0.28	Alkalinity(as CaCO ₃)	235	4.70
Arsenic	As	0.000				
Barium	Ba	0.0				
Copper	Cu	0.00		Hardness (as CaCO ₃)	24	0.48
Cadmium	Cd	0.00				
Chromium	Cr	0.00				
Lead	Pb	0.02		Total dissolved minerals	360	
Mercury	Hg	0.0000				
Nickel	Ni	0.0				
Selenium	Se	0.00				
Silver	Ag	0.00				
Cyanide	CN	0.01				
Zinc	Zn	0.1		pH (as rec'd)	8.5	

WELL NO. 3, open to the Burlington-Keokuk Limestone, was completed in February 1977 to a depth of 500 ft by the J. B. Bushnell Well Drilling Co., Plymouth. The well is located about 775 ft west of Well No. 1, approximately 560 ft N and 1220 ft E of the SW corner of Section 7, T4S, R4W. The land surface elevation at the well is approximately 860 ft.

The well is cased with 8-in. steel pipe from about 1.5 ft above land surface to an unknown depth.

The pumping equipment presently installed is a Red Jacket submersible pump rated at 36 gpm, and powered by a 3-hp Reda electric motor.

A partial analysis of a sample (Lab. No. 204403) collected February 22, 1977, showed the water to have a hardness of 74 mg/l, total dissolved minerals of 405 mg/l, and an iron content of 1.3 mg/l.

GRIGGSVILLE

The city of Griggsville (1245) installed a public water supply in 1935. Two wells (Nos. 5 and 6) are in use and four wells (Nos. 1-4) are available for emergency use. In 1955 there were 400 services; the average and maximum daily pumpages in 1949 were 45,000 and 60,000 gpd, respectively. In 1977 there were 575 services, all metered; the average and maximum daily pumpages were 150,000 and 200,000 gpd, respectively. The water is chlorinated and fluoridated.

OLD WELL NO. 1, finished in sand and gravel, was completed in March 1935 to a depth of 43 ft by the Thorpe Concrete Well Co., Alton. This well was abandoned in 1964.

The well is located about 3 miles north of the city in the valley of the south fork of McKee Creek, approximately 600 ft N and 300 ft W of the SE corner of Section 34, T3S, R3W. The land surface elevation at the well is approximately 480 ft.

A correlated drillers log of Old Well No. 1 furnished by the State Geological Survey follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
PLEISTOCENE SERIES		
Clay	10	10
Sand and gravel, dirty	20	30
Clay, yellow	4	34

<i>Strata (continued)</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Sand and gravel, dirty	6	40
Hardpan and clay	4	44

A 54-in. diameter hole was drilled to a depth of 43 ft. The well is cased with 26-in. ID by 36-in. OD solid concrete pipe from 9 ft above land surface to a depth of 25 ft. A porous concrete screen of the same size extends from 25 ft to a depth of 43 ft. The annulus between the bore hole and screen is filled with gravel (9 in. in thickness).

A production test was conducted by the State Water Survey on March 11-12, 1935. During the last 5.5 hr of the 24-hr test period, the well reportedly produced at rates of 56 to 58 gpm with a drawdown of 34.5 ft from a nonpumping water level of 1.0 ft below land surface.

On May 12, 1948, the nonpumping water level was reported to be 10 to 12 ft below land surface.

A mineral analysis of a sample (Lab. No. 114728) collected May 12, 1948, showed the water to have a hardness of 361 mg/l, total dissolved minerals of 369 mg/l, and an iron content of 0.0 mg/l.

OLD WELL NO. 2, finished in sand and gravel, was completed in 1935 to a depth of 60 ft by the Thorpe Concrete Well Co., Alton. This well was abandoned about 1957. The well is located about 200 ft north and 250 ft east of Old Well No. 1, approximately 800 ft N and 50 ft W of the SE corner of Section 34, T3S, R3W. The land surface elevation at the well is approximately 472 ft.

The well is cased with 26-in. ID by 36-in. OD solid concrete pipe from 10.5 ft above land surface to a depth of 16 ft. A porous concrete screen of the same size extends from 16 ft to a depth of 60 ft and a concrete plug is placed in the bottom. The annulus between the bore hole and screen is filled with gravel (6.5 in. in thickness).

On May 28, 1957, the nonpumping water level was reported to be 3.91 ft below land surface.

OLD WELL NO. 3, finished in sand and gravel, was completed in May 1935 to a depth of 41.5 ft by the Thorpe Concrete Well Co., Alton. This well was abandoned in 1964. The well is located about 25 ft south and 250 ft east of Old Well No. 1, approximately 575 ft N and 50 ft W of the SE corner of Section 34, T3S, R3W. The land surface elevation at the well is approximately 470 ft.

A drillers log of Old Well No. 3 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
No record	10	10
Sand	16	26
Sandstone	2	28
Mud	6	34
Dirty gravel	7	41

The well is cased with 26-in. ID by 36-in. OD solid concrete pipe to a depth of 13.5 ft. A porous concrete screen of the same size extends from 13.5 ft to a depth of 41.5 ft. The annulus between the bore hole and screen is filled with

gravel (9 in. in thickness).

A production test was conducted on May 10, 1935, by representatives of the State Water Survey and the Caldwell Engineering Co. After 8.5 hr of pumping at rates ranging from 45 to 50 gpm, the drawdown was about 35.0 ft from a nonpumping water level of 1.0 ft below land surface. Pumping was continued for 5 hr at an average rate of 50 gpm with a final drawdown of 26.5 ft.

OLD WELL NO. 4, finished in sand and gravel, was completed about 1956 by the Calhoun Drilling Co., Batchtown. This well was abandoned about 1964. The well is located about 50 ft west of Old Well No. 1, approximately 600 ft N and 350 ft W of the SE corner of Section 34, T3S, R3W. The land surface elevation at the well is approximately 485 ft.

No information is available on the hole and casing-screen assembly.

On May 28, 1957, the nonpumping water level was reported to be 2.96 ft below land surface.

OLD WELL NO. 5, finished in sand and gravel, was completed in 1957 to a depth of 36 ft by the Calhoun Drilling Co., Batchtown. This well was abandoned in 1964. The well is located about 50 ft east of Old Well No. 1, approximately 600 ft N and 250 ft W of the SE corner of Section 34, T3S, R3W. The land surface elevation at the well is approximately 475 ft.

An 8-in. diameter hole was drilled to a depth of 36 ft. The well is cased with 8-in. pipe to a depth of 21 ft followed by 15 ft of 8-in. No. 40 slot Cook screen.

A production test using one observation well was conducted by the State Water Survey on May 28, 1957. After 3.2 hr of pumping at rates ranging from 29 to 31 gpm, the drawdown was 18.0 ft from a nonpumping water level of 3.3 ft below land surface. During this test, Old Well No. 1 was pumped intermittently and Old Well No. 3 was pumping.

A partial analysis of a sample (Lab. No. 143468) collected during the initial production test, after pumping for 3.8 hr at rates of 29 to 31 gpm, showed the water to have a hardness of 384 mg/l, total dissolved minerals of 394 mg/l, and an iron content of 0.7 mg/l.

Seven test holes and one test well were drilled in the valley of the south fork of McKee Creek in July 1962 by the Layne-Western Co., Kirkwood, Mo. to depths ranging from 28 to 50 ft. Five of the holes were located in the SE quarter of Section 34 and the other 2 holes were in the SW quarter of Section 35, T3S, R3W. The test well, 36 ft deep, was located approximately 2580 ft N and 2440 ft W of the SE corner of Section 34, T3S, R3W. An 18-in. diameter hole was drilled to a depth of 36 ft. The test well was cased with 8-in. pipe from land surface to a depth of 26 ft followed by 10 ft of 8-in. No. 6 (0.080 in.) Layne shutter screen. The annulus between the bore hole and the casing-screen assembly was filled with Meramec gravel. A production test using two observation wells was conducted on July 18, 1962, by representatives of the driller, the city, the State Water Survey, and

Wm. H. Klingner & Associates, Consulting Engineers. After 4.1 hr of pumping at a rate of 80 gpm, the drawdown was 5.85 ft from a nonpumping water level of 9.22 ft below land surface. One hr after pumping was stopped, the water level had recovered to 9.77 ft. Analysis of this production test data and the available geologic data indicated that the practical sustained yield of 2 production wells spaced 250 ft apart would be in the order of 144,000 gpd.

Eight test holes were drilled in September 1963 by the Layne-Western Co., Kirkwood, Mo. to depths ranging from 25.5 to 36.3 ft.

WELL NO. 1 (West Well), finished in sand and gravel, was completed in September 1963 to a depth of 33 ft by the Layne-Western Co., Kirkwood, Mo. This well is available for emergency use. The well is located about 3.5 miles north of the city on the west side of Route 107 at the site of Test Hole No. 8-63, approximately 2540 ft N and 2540 ft W of the SE corner of Section 34, T3S, R3W. The land surface elevation at the well is 481.7 ft.

A drillers log of Well No. 1 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Brown silty clay	6	6
Dirty fine brown sand with gray clay	9	15
Loose medium to coarse sand and gravel with clay layer at 23 ft	9	24
Coarse sand and gravel - loose	3	27
Loose coarse sand and gravel and boulders	6.5	33.5

A 24-in. diameter hole was drilled to a depth of 33 ft. The well is cased with 10-in. steel pipe from about 1 ft above the pumphouse floor to a depth of 23 ft below original land surface followed by 10 ft of 10-in. No. 6 (0.080 in.) Layne stainless steel shutter screen. The annulus between the bore hole and the casing-screen assembly is filled with bentonite and clay to a depth of 10 ft and with Meramec gravel from 10 to 33 ft. The pumphouse rests on a 6-ft high earth berm that is 30 ft in diameter.

A production test was conducted by Wm. H. Klingner & Associates, Consulting Engineers, on October 5, 1963. After pumping the well for 4 successive periods of 15 min each at rates of 63, 76, 90, and 100 gpm, the final drawdown was 6.31 ft from a nonpumping water level of 11.73 ft below land surface. Fifteen min after pumping was stopped, the water level had recovered to 12.27 ft.

In 1967, this well was acidized.

The pumping equipment presently installed is a Fairbanks-Morse Pomona turbine pump rated at 100 gpm, and powered by a 7½-hp 1760 rpm electric motor.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A19278) of a sample collected March 23, 1977, after pumping for 4 hr at 80 gpm, showed the water to have a hardness of 316 mg/l, total dissolved minerals of 360 mg/l, and an iron content of 0.00 mg/l.

WELL NO. 2 (Middle Well), finished in sand and gravel, was completed in September 1963 to a depth of 33 ft by the

Layne-Western Co., Kirkwood, Mo. This well is available for emergency use. The well is located about 300 ft east of Well No. 1 at the site of Test Hole No. 7-63, approximately 2540 ft N and 2240 ft W of the SE corner of Section 34, T3S, R3W. The land surface elevation at the well is approximately 488 ft.

A drillers log of Well No. 2 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Brown sandy silty clay	12	12
Clean fine to medium gray sand	2	14
Medium to coarse loose gray sand	5	19
Medium to coarse sand and gravel	5	24
Loose coarse sand and gravel	3	27
Loose coarse sand and gravel with thin clay layer at 31 ft	7.5	34.5

A 24-in. diameter hole was drilled to a depth of 33 ft. The well is cased with 10-in. pipe to a depth of 23 ft below original land surface followed by 10 ft of 10-in. No. 6 (0.080 in.) Layne stainless steel shutter screen. The annulus between the bore hole and the casing-screen assembly is filled with bentonite and clay to a depth of 10 ft and with Meramec gravel from 10 to 33 ft. The pumphouse rests on a 6-ft high earth berm that is 30 ft in diameter.

A production test was conducted by the State Water Survey on October 1, 1963. After pumping the well for 4 successive periods of 15 min each at rates of 52, 69, 80, and 100 gpm, the final drawdown was 6.74 ft from a nonpumping water level of 11.24 ft below land surface. Five min after pumping was stopped, the water level had recovered to 11.89 ft.

In 1968, this well was acidized.

In March 1973, the screen in this well was cleaned for a period of three days with 100 lb of Weltone, and the well was chlorinated.

The pumping equipment presently installed is a Red Jacket submersible pump set at about 38 ft below the pump base, rated at 60 gpm, and powered by an electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A19251) is for a water sample from the well collected March 23, 1977, after 4 hr of pumping at 60 gpm.

WELL NO. 2, LABORATORY NO. A19251						
		<i>mg/l</i>	<i>me/l</i>		<i>mg/l</i>	<i>me/l</i>
Iron	Fe	1.15		Silica	SiO ₂	14
Manganese	Mn	0.09		Fluoride	F	0.2
Ammonium	NH ₄	0.06	0.00	Boron	B	0.1
Sodium	Na	7.8	0.34	Nitrate	NO ₃	2.6
Potassium	K	0.8	0.02	Chloride	Cl	7
Calcium	Ca	82	4.09	Sulfate	SO ₄	30
Magnesium	Mg	28	2.30	Alkalinity(as CaCO ₃)		285
Arsenic	As	0.000				
Barium	Ba	0.0				
Copper	Cu	0.00		Hardness (as CaCO ₃)		323
Cadmium	Cd	0.00				
Chromium	Cr	0.00		Total dissolved minerals		340
Lead	Pb	0.01				
Mercury	Hg	0.0000				
Nickel	Ni	0.0				
Selenium	Se	0.00				
Silver	Ag	0.00				
Cyanide	CN	0.01				
Zinc	Zn	0.0		pH (as rec'd)		7.2

WELL NO. 3 (East Well), finished in sand and gravel, was completed in September 1963 to a depth of 34 ft by the Layne-Western Co., Kirkwood, Mo. This well is available for emergency use. The well is located about 300 ft east of Well No. 2 at the site of Test Hole No. 6-63, approximately 2540 ft N and 1940 ft W of the SE corner of Section 34, T3S, R3W. The land surface elevation at the well is 481.0 ft.

A drillers log of Well No. 3 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Brown silty clay	8	8
Fine brown sandy clay	3	11
Soft gray clay	3.5	14.5
Loose fine to medium gray sand - little clay	5.5	20
Medium to coarse sand - some gravel	8	28
Medium to coarse sand and gravel with brown clay mixed in	6.7	34.7
Limestone		

A 24-in. diameter hole was drilled to a depth of 34 ft. The well is cased with 10-in. steel pipe from about 1 ft above the pumphouse floor to a depth of 24 ft below original land surface followed by 10 ft of 10-in. No. 6 (0.080 in.) Layne stainless steel shutter screen. The annulus between the bore hole and the casing-screen assembly is filled with bentonite and clay to a depth of 10 ft and with Meramec gravel from 10 to 34 ft. The pumphouse rests on a 6-ft high earth berm that is 30 ft in diameter.

A production test using two observation wells was conducted on October 1, 1963, by representatives of the State Water Survey and Wm. H. Klingner & Associates, Consulting Engineers. After 15 min of pumping at a rate of 52 gpm, the drawdown was 11.14 ft from a nonpumping water level of 12.46 ft below land surface.

A production test was conducted on October 7, 1963, by representatives of the State Water Survey and Wm. H. Klingner & Associates. After pumping the well for 3 successive periods of 15, 15, and 10 min at rates of 52, 56, and 60 gpm, the drawdown was 16.61 ft from a nonpumping water level of 11.93 ft below land surface. Fifty-three min after pumping was stopped, the water level had recovered to 12.38 ft. After a 43-min idle period, pumping was continued for 2 hr at a rate of 52 gpm with a drawdown of 11.79 ft from a nonpumping water level of 12.17 ft below land surface.

In 1968, this well was acidized.

The pumping equipment presently installed is a Fairbanks-Morse Pomona turbine pump set at 36 ft below the pump base, rated at 100 gpm, and powered by a 3-hp electric motor.

A partial analysis of a sample (Lab. No. 161359) collected during the initial production test, after pumping for 15 min at 52 gpm, showed the water to have a hardness of 168 mg/l, total dissolved minerals of 256 mg/l, and an iron content of 8.2 mg/l.

WELL NO. 4, finished in sand and gravel, was completed in August 1965 to a depth of 34 ft by the Layne-Western Co.,

Kirkwood, Mo. This well is used primarily during periods of high water demand. The well is located about 300 ft west and 100 ft south of Well No. 1, approximately 2440 ft N and 2440 ft E of the SW corner of Section 34, T3S, R3W. The land surface elevation at the well is approximately 488 ft.

A drillers log of Well No. 4 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Sandy, brown, clay	12	12
Gray clay	4	16
Medium gray clay	3	19
Coarse sand and gravel	15.5	34.5
Rock		

A 36-in. diameter hole was drilled to a depth of 14 ft and finished 24 in. in diameter from 14 to 34 ft. The well is equipped with a 10-in. diameter pitless adapter from 7.5 ft above land surface to a depth of 4 ft and cased with 8-in. steel pipe from 4 ft to a depth of 24 ft followed by 10 ft of 8-in. No. 5 (0.105 in.) Layne stainless steel shutter screen. A 24-in. diameter corrugated metal pipe extends from 9 ft above land surface to a depth of 2 ft and is filled with concrete from 7.5 ft above land surface to a depth of 2 ft. The annulus between the bore hole and the metal pipe and between the bore hole and casing-screen assembly is filled with concrete to a depth of 10 ft, with sand and gravel backfill from 10 to 20 ft, and with torpedo size Meramec gravel from 20 to 34 ft.

A production test was conducted on August 10, 1965, by representatives of the driller, the city, the State Water Survey, and Wm. H. Klingner & Associates, Consulting Engineers. After 6.1 hr of pumping at rates ranging from 75 to 78 gpm, the final drawdown was 7.15 ft from a nonpumping water level of 12.98 ft below land surface. One hr after pumping was stopped, the water level had recovered to 13.92 ft. On the basis of the production test data, it was estimated that this well should yield about 80 gpm (115,200 gpd) on a long-term basis. It was further estimated that the practical sustained yield of a 3-well system (Nos. 1, 2, and 4) should be in the magnitude of 110 gpm (158,400 gpd).

The pumping equipment presently installed is a Valley submersible pump set at 30 ft, rated at 79 gpm, and powered by a 7½-hp Franklin electric motor.

A partial analysis of a sample (Lab. No. 166943) collected during the initial production test, after pumping for 5.5 hr at rates of 75 to 78 gpm, showed the water to have a hardness of 280 mg/l, total dissolved minerals of 335 mg/l, and an iron content of 6.4 mg/l.

One test well and two test holes were drilled in 1974 by John Shoemaker, Griggsville, to depths of 77, 60, and 62 ft, respectively. The test well was located approximately 1000 ft S and 1500 ft E of the NW corner of Section 4, T4S, R3W. An 8-in. diameter hole was drilled to a depth of 77 ft. The test well was cased with 6-in. pipe from 1.5 ft above land surface to a depth of 70 ft followed by 7 ft of 6-in. No. 25 slot

Johnson stainless steel screen. A production test was conducted on July 8, 1974, by representatives of the driller, the city, the State Water Survey, and Wm. H. Klingner & Associates, Consulting Engineers. After 2 hr of pumping at rates of 100 to 99 gpm, the final drawdown was 7.53 ft from a nonpumping water level of 23.27 ft below land surface. Thirty min after pumping was stopped, the water level had recovered to 26.75 ft. On the basis of the production test data, it was estimated that this test well would not yield more than 50 gpm (72,000 gpd) on a long-term basis. One test hole was located approximately 600 ft S and 1900 ft E of the NW corner of Section 4, T4S, R3W. Upon completion, the nonpumping water level was reported to be less than 8 ft. The second test hole was located approximately 900 ft S and 2500 ft E of the NW corner of Section 4, T4S, R3W. Upon completion, the nonpumping water level was reported to be 3 ft below land surface.

Two test holes were drilled in April 1976 by the Layne-Western Co., Kirkwood, Mo., to depths of 79 and 81.5 ft. The holes were located in the Illinois River bottomlands in the NW quarter of Section 33, and the NE quarter of Section 32, T3S, R2W.

WELL NO. 5, finished in sand and gravel, was completed in December 1977 to a depth of 84 ft by the J. P. Miller Artesian Well Co., Brookfield. The well is located about 6 miles northeast of the city, approximately 394 ft S and 101 ft E of the NW corner of Section 33, T3S, R2W. The land surface elevation at the well is approximately 430 ft.

A drillers log of Well No. 5 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Top soil and clay	13	13
Clay	7	20
Sand	4	24
Sandy clay	10	34
Sand and gravel	15	49
Fine to medium gravel	35	84

A 24-in. diameter hole was drilled to a depth of 84 ft. The well is cased with 8-in. pipe from 5 ft above land surface to a depth of 69 ft followed by 15 ft of 8-in. No. 40 slot Johnson stainless steel screen. The annulus between the bore hole and the casing-screen assembly is filled with cement from 0 to 15 ft, with impervious fill from 15 to 54 ft, and with No. 1 Northern gravel from 54 to 84 ft.

A production test using one observation well was conducted on January 3, 1978, by representatives of the driller, the State Water Survey, and Wm. H. Klingner & Associates, Consulting Engineers. After 3 hr of pumping at a rate of 220 gpm, the drawdown was 16.31 ft from a nonpumping water level of 5.61 ft below land surface. Thirty min after pump-

ing was stopped, the water level had recovered to 6.18 ft. On the basis of the production test data, it was estimated that this well should yield 200 gpm (288,000 gpd) on a long-term basis.

The pumping equipment recently installed is a Red Jacket submersible pump rated at 215 gpm, and powered by a 20-hp electric motor.

A partial analysis of a sample (Lab. No. 207243) collected during the initial production test, after pumping for 3 hr at 220 gpm, showed the water to have a hardness of 262 mg/l, total dissolved minerals of 316 mg/l, and an iron content of 4.2 mg/l.

WELL NO. 6, finished in sand and gravel, was completed in December 1977 to a depth of 70.9 ft by the J. P. Miller Artesian Well Co., Brookfield. The well is located about 295 ft northeast of Well No. 5, approximately 249 ft S and 352 ft E of the NW corner of Section 33, T3S, R2W. The land surface elevation at the well is approximately 430 ft.

A drillers log of Well No. 6 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Black top soil	2	2
Blue clay	32	34
Coarse sand (water bearing)	44	78

A 24-in. diameter hole was drilled to a depth of 70.9 ft. The well is cased with 8-in. pipe from land surface to a depth of 55.9 ft followed by 15 ft of 8-in. No. 40 slot Johnson stainless steel screen. The annulus between the bore hole and the casing-screen assembly is filled with cement from 0 to 15 ft, with impervious fill from 15 to 44.9 ft, and with No. 1 Northern gravel from 44.9 to 70.9 ft.

A production test using one observation well was conducted on December 21, 1977, by representatives of the driller, the city, the State Water Survey, and Wm. H. Klingner & Associates, Consulting Engineers. After 3 hr of pumping at rates ranging from 148 to 135 gpm, the drawdown was 19.24 ft from a nonpumping water level of 6.98 ft below land surface. Thirty min after pumping was stopped, the water level had recovered to 7.08 ft. On the basis of the production test data, it was estimated that this well should yield 200 gpm (288,000 gpd) on a long-term basis.

The pumping equipment presently installed is a Red Jacket submersible pump rated at 215 gpm, and powered by a 20-hp electric motor.

A partial analysis of a sample (Lab. No. 207072) collected during the initial production test, after pumping for 2.5 hr at rates of 148 to 135 gpm, showed the water to have a hardness of 262 mg/l, total dissolved minerals of 295 mg/l, and an iron content of 2.1 mg/l.

HULL

The village of Hull (585) installed a public water supply in 1936. Two wells are in use. In 1950 there were 160 services; the average and maximum daily pumpages were 25,000 and 30,000 gpd, respectively. In 1977 there were about 235 services, none metered; the average and maximum daily pumpages in 1976 were 70,000 and 120,000 gpd, respectively. The water is aerated, chlorinated, fluoridated, and filtered.

WELL NO. 1, finished in sand and gravel, was completed in 1936 to a depth of 51.2 ft by E. W. Franke, Batchtown. This well is alternated monthly with Well No. 2. The well is located inside the treatment plant near the southwest corner of Walnut and Railroad Sts., approximately 2300 ft N and 1450 ft W of the SE corner of Section 21, T4S, R7W. The land surface elevation at the well is approximately 465 ft.

A correlated drillers log of Well No. 1 furnished by the State Geological Survey follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
PLEISTOCENE SERIES		
Gumbo and clay	20	20
Sand	30	50

An 8-in. diameter hole was drilled to a depth of 51.2 ft. The well is cased with 8-in. pipe from 3 ft above land surface to a depth of 41 ft and equipped with 10 ft of 8-in. No. 20 slot Cook Everdur screen.

A production test was conducted by the State Water Survey on March 24, 1936. After 8 hr of pumping at rates of 146 to 150 gpm, the drawdown was 5.9 ft from a non-pumping water level of 9.9 ft below land surface.

A second production test was conducted by the State Water Survey on June 17-18, 1936. After 24 hr of pumping at a rate of 142 gpm, the drawdown was 5.9 ft from a non-pumping water level of 12.9 ft below land surface.

In 1963, this well was cleaned by Rowland & Sons, Rushville, with Weltone followed by HTH, and then allowed to stand in the well for 24 hr.

In 1966, this well was cleaned with Weltone by Rowland & Sons, Rushville.

The pumping equipment presently installed is a Red Jacket submersible pump set at 38 ft, rated at 130 gpm at about 80 ft TDH, and powered by a 7-hp 3450 rpm Franklin electric motor.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A19578) of a sample collected March 30, 1977, after pumping for 30 min at 118 gpm,

showed the water to have a hardness of 259 mg/l, total dissolved minerals of 355 mg/l, and an iron content of 2.0 mg/l.

WELL NO. 2, finished in sand and gravel, was completed in May 1963 to a depth of 45 ft by Herb Schultz, Hull. This well is alternated monthly with Well No. 1. The well is located about 7 ft south of Well No. 1 outside of the treatment plant, approximately 2293 ft N and 1450 ft W of the SE corner of Section 21, T4S, R7W. The land surface elevation at the well is approximately 465 ft.

A drillers log of Well No. 2 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Black soil	6	6
Drift	9	15
Water sand	30	45

An 8-in. diameter hole was drilled to a depth of 45 ft. The well is cased with 8-in. pipe from 2 ft above land surface to a depth of 35 ft followed by 10 ft of 8-in. No. 18 slot Cook screen.

In 1967, this well was cleaned with Weltone by Rowland & Sons, Rushville.

The pumping equipment presently installed consists of a 5-hp 3450 rpm electric motor, a 3-stage Red Jacket submersible pump set at 30 ft, rated at 130 gpm at about 80 ft TDH, and has 30 ft of column pipe.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A19579) is for a water sample from the well collected March 30, 1977, after 30 min of pumping at 118 gpm.

WELL NO. 2, LABORATORY NO. A19579							
		<i>mg/l</i>	<i>me/l</i>			<i>mg/l</i>	<i>me/l</i>
Iron	Fe	2.3		Silica	SiO ₂	28	
Manganese	Mn	1.90		Fluoride	F	0.1	0.00
Ammonium	NH ₄	0.13	0.01	Boron	B	0.1	
Sodium	Na	18	0.78	Nitrate	NO ₃	0.00	0.00
Potassium	K	2.5	0.06	Chloride	Cl	22	0.62
Calcium	Ca	79	3.94	Sulfate	SO ₄	52	1.08
Magnesium	Mg	16	1.32	Alkalinity(as CaCO ₃)		215	4.30
Arsenic	As	0.001					
Barium	Ba	0.2		Hardness (as CaCO ₃)		269	5.38
Copper	Cu	0.00					
Cadmium	Cd	0.00					
Chromium	Cr	0.02		Total dissolved			
Lead	Pb	0.00		minerals		385	
Mercury	Hg	0.0000					
Nickel	Ni	0.0					
Selenium	Se	0.00					
Silver	Ag	0.00					
Zinc	Zn	0.0		pH (as rec'd)		7.4	

KINDERHOOK

The village of Kinderhook (281) installed a public water supply in 1941. Two wells are in use. In 1950 there were 90 services, 25 metered; the average and maximum daily pumpages were 20,000 and 25,000 gpd, respectively. In 1978 there were 112 services, all metered; the average and maximum daily pumpages were 25,000 and 45,000 gpd, respectively. The water is fluoridated and chlorinated.

Prior to the installation of a public water supply, a test well was constructed in 1939 to a depth of 30 ft. The test well was located in the southern part of the village, approximately 500 ft N and 1400 ft W of the SE corner of Section 24, T4S, R7W. The test well was equipped with a 3-ft length of 2-in. diameter well point. Upon completion, the nonpumping water level was reported to be 25 ft below land surface.

WELL NO. 1, finished in sand and gravel, was completed in 1940 to a depth of 40 ft by E. W. Franke, Batchtown. This well is alternated monthly with Well No. 2. The well is located about 0.2 mile south of Route 36 on the west side of Route 96, approximately 450 ft N and 1400 ft W of the SE corner of Section 24, T4S, R7W. The land surface elevation at the well is approximately 475 ft.

A correlated drillers log of Well No. 1 furnished by the State Geological Survey follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
PLEISTOCENE SERIES		
No record	30	30
Sand	10	40

A 6-in. diameter hole was drilled to a depth of 40 ft. The well is cased with 6-in. pipe from 6 ft above land surface to a depth of 30 ft followed by 10 ft of 6-in. No. 34 slot Johnson Everdur screen.

A production test was conducted by the driller on March 22, 1940. After 12 hr of pumping at rates ranging from 106 to 135 gpm, the drawdown was 5.2 ft from a non-pumping water level of 21.0 ft below land surface.

Nonpumping water levels were reported to be 25 ft below the top of the casing in July 1953, and 23 ft in September 1955.

The pumping equipment presently installed is a turbine pump rated at about 75 gpm, and powered by a 7½-hp 3600 rpm U. S. electric motor (No. 179564).

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A111340) of a sample collected January 2, 1975, after pumping for 30 min at 75 gpm, showed the water to have a hardness of 290 mg/l, total dissolved minerals of 370 mg/l, and an iron content of 0.0 mg/l.

WELL NO. 2, finished in sand and gravel, was completed in April 1958 to a depth of 38.5 ft by E. W. Franke, Batchtown. This well is alternated monthly with Well No. 1. The well is located about 12 ft north of Well No. 1, approximately 462 ft N and 1400 ft W of the SE corner of Section 24, T4S, R7W. The land surface elevation at the well is approximately 475 ft.

A drillers log of Well No. 2 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Drift	25	25
Fine yellow sand	1	26
Fine gravel and coarse sand	12.5	38.5

An 8-in. diameter hole was drilled to a depth of 38.5 ft. The well is cased with 8-in. pipe to a depth of 28.5 ft followed by 10 ft of 8-in. No. 40 slot Cook Everdur metal screen.

A production test was conducted on April 16, 1958, by representatives of the driller, the village, the State Water Survey, and Wm. H. Klingner & Associates, Consulting Engineers. After 4.8 hr of intermittent pumping at rates ranging from 88 to 152 gpm, the drawdown was 4.3 ft from a nonpumping water level of 19.7 ft below land surface. Forty-four min after pumping was stopped, the water level had recovered to 19.8 ft. During this test, Well No. 1 was pumping intermittently.

The pumping equipment presently installed is a Fairbanks-Morse Pomona turbine pump (Serial No. A2A815) rated at 75 gpm, and powered by a 7½-hp Fairbanks-Morse electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A111341) is for a water sample from the well collected January 2, 1975, after 30 min of pumping at 75 gpm.

WELL NO. 2, LABORATORY NO. A111341					
		<i>mg/l</i>		<i>me/l</i>	
Iron	Fe	0.0	Silica	SiO ₂	18
Manganese	Mn	0.00	Fluoride	F	0.1
Ammonium	NH ₄	0.0	Boron	B	0.2
Sodium	Na	15	Nitrate	NO ₃	19
Potassium	K	3.0	Chloride	Cl	20
Calcium	Ca	80	Sulfate	SO ₄	55
Magnesium	Mg	28	Alkalinity(as CaCO ₃)		255
Arsenic	As	0.00	Hardness (as CaCO ₃)		315
Barium	Ba	0.0	Total dissolved		
Copper	Cu	0.04	minerals		425
Cadmium	Cd	0.00			
Chromium	Cr	0.00			
Lead	Pb	0.00			
Mercury	Hg	0.0000	pH (as rec'd)		7.1
Nickel	Ni	0.0	Radioactivity		
Selenium	Se	0.00	Alpha	<i>pc/l</i>	3.2
Silver	Ag	0.00	± deviation		2.2
Cyanide	CN	0.000	Beta	<i>pc/l</i>	4.8
Zinc	Zn	0.0	± deviation		1.9

MILTON

The village of Milton (337) installed a public water supply in 1955. One well (No. 4) is in use and two wells (Nos. 1 and 2) are available for emergency use. In 1961 there were 130 services, 15 metered; the average daily pumpage was 8000 to 9000 gpd. In 1977 there were 150 services, all metered; the estimated average and maximum daily pumpages were 18,000 and 30,000 gpd, respectively. The water from Well No. 4 is fluoridated, treated with potassium permanganate, filtered, and chlorinated.

WELL NO. 1, open to the Burlington-Keokuk Limestone, was constructed in September 1955 to a depth of 115 ft and deepened in October 1962 to a reported depth of 220 ft by the Calhoun Drilling Co., Batchtown. This well is available for emergency use. The well is located at the south end of Davis St., approximately 750 ft N and 750 ft W of the SE corner of Section 5, T6S, R2W. The land surface elevation at the well is approximately 645 ft.

Originally, a 10-in. diameter hole was drilled to a depth of 50 ft and finished 8 in. in diameter from 50 to 115 ft. The diameter of the hole from 115 to 220 ft is unknown. The well is cased with 10-in. standard steel pipe from land surface to a depth of 39 ft and 8-in. standard steel pipe from land surface to a depth of 50 ft (perforated from 40 to 50 ft).

A production test was conducted during drilling at a depth of 78 ft by the driller on September 2, 1955. After 3.1 hr of pumping at a rate of 25 gpm, the drawdown was 51.3 ft from a nonpumping water level of 13.7 ft. Pumping was continued for 5.9 hr at rates ranging from 20 to 15 gpm with a final drawdown of 48.5 ft. Fifty-five min after pumping was stopped, the water level had recovered to 47.3 ft.

A production test was conducted at a depth of 115 ft by the driller on September 9, 1955. After 8.8 hr of pumping at rates ranging from 20 to 35 gpm, the drawdown was 63.2 ft from a nonpumping water level of 13.7 ft. The pump then broke suction. Ten min after pumping was stopped, the water level had recovered to 73.8 ft.

The pumping equipment presently installed is a submersible pump set at 200 ft, rated at 25 gpm, and powered by a 2-hp electric motor.

WELL NO. 2, open to the Burlington-Keokuk Limestone, was completed in 1956 to a depth of 118 ft by the Calhoun Drilling Co., Batchtown. This well is available for emergency use. The well is located about 52 ft north of Mill St. in Cherry Alley between West and Davis Sts., approximately 1165 ft N and 1390 ft W of the SE corner of Section 5, T6S, R2W. The land surface elevation at the well is approximately 650 ft.

The well is cased with 10-in. standard steel pipe to a depth of 68.6 ft and 8-in. standard steel pipe from 2 ft above land surface to a depth of 103 ft. Below the casing, the hole is 8 in. in diameter to the bottom.

A production test using one observation well (No. 1) was conducted on June 5, 1956, by representatives of the driller and Wm. H. Klingner & Associates, Consulting Engineers. After 1.6 hr of pumping at a rate of 20 gpm, the drawdown was 78.2 ft from a nonpumping water level of 16.8 ft. The pump then broke suction. Pumping was continued for 6.2 hr at a rate of 15 gpm with a final drawdown of 55.4 ft. The water level recovered to 30.2 ft after pumping had been stopped for 1.2 hr.

The pumping equipment presently installed is a Fairbanks-Morse Pomona vertical turbine pump rated at 15 gpm, and powered by a 5-hp electric motor.

A mineral analysis of a sample (Lab. No. 152614) collected June 29, 1960, showed the water to have a hardness of 291 mg/l, total dissolved minerals of 375 mg/l, and an iron content of 0.2 mg/l.

WELL NO. 3, open to the Burlington-Keokuk Limestone, was completed in February 1966 to a depth of 63 ft by the Calhoun Drilling Co., Batchtown. This well is presently in use only as an observation well. The well is located about 0.5 mile southeast of the village, approximately 40 ft S and 2250 ft E of the NW corner of Section 9, T6S, R2W. The land surface elevation at the well is approximately 630 ft.

A drillers log of Well No. 3 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Black soil	10	10
Grayish muck	10	20
Grayish muck, soft and caving	10	30
Broken rock	14	44
Softer material, quit making water	1	45
Green shale and broken rock	11	56
Hard rock	7	63

An 8-in. diameter hole was drilled to a depth of 63 ft. The well is cased with 8-in. steel pipe from about 1.7 ft above land surface to a depth of 56 ft.

A production test was conducted on March 1-2, 1966, by representatives of the driller, the State Water Survey, and Wm. H. Klingner & Associates, Consulting Engineers. After 23.9 hr of pumping at a rate of 75 gpm, the final drawdown was 25.16 ft from a nonpumping water level of 0.50 ft below land surface. One hr after pumping was stopped, the water level had recovered to 8.35 ft.

A production test using one observation well was conducted on June 5-7, 1969, by representatives of the village, the State Water Survey, and Wm. H. Klingner & Associates. After 50.2 hr of pumping at rates ranging from 105 to 91 gpm, the final drawdown was 46.67 ft from a nonpumping water level of 0.99 ft below the top of the casing. The water level recovered to 12.64 ft after pumping had been stopped for 2.5 hr. On the basis of the production test data, it was estimated that this well should yield 30 gpm (43,200 gpd) on a long-term basis.

A partial analysis of a sample (Lab. No. 178370) collected

June 7, 1969, after pumping for 49.7 hr at 91 gpm, showed the water to have a hardness of 328 mg/l, total dissolved minerals of 391 mg/l, and an iron content of 5.3 mg/l. Hydrogen sulfide was also apparent when this sample was collected.

WELL NO. 4, open to the Burlington-Keokuk Limestone, was completed in November 1969 to a depth of 56 ft by the Calhoun Drilling Co., Batchtown. The well is located about 10 ft north of Well No. 3, approximately 30 ft S and 2250 ft E of the NW corner of Section 9, T6S, R2W. The land surface elevation at the well is approximately 630 ft.

A drillers log of Well No. 4 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Black soil and gray muck	21	21
Gray shale	11	32
Broken rock	7	39
Coarse rock with some shale	7	46
Soft lime, more broken	7	53
Shaley lime, more broken	3	56
Hard rock		

A 12-in. diameter hole was drilled to a depth of 56 ft. The well is cased with 8-in. steel pipe to a depth of 48 ft followed by 8 ft of 8-in. No. 160 slot Johnson stainless steel screen. The annulus between the bore hole and casing-screen assembly is filled with cement from 0 to 35 ft and with gravel from 35 to 56 ft.

A production test using one observation well was conducted on November 24, 1969, by representatives of the driller, the village, the State Water Survey, and Wm. H. Klingner & Associates, Consulting Engineers. After 2.5 hr

of pumping at rates ranging from 30 to 33 gpm, the final drawdown was 7.35 ft from a nonpumping water level of 0.19 ft below land surface. Thirty min after pumping was stopped, the water level had recovered to 1.10 ft. On the basis of the production test data, it was estimated that this well should yield 45 gpm (64,800 gpd) on a long-term basis.

The pumping equipment presently installed is a Red Jacket submersible pump rated at 60 gpm at about 165 ft TDH, and powered by a 5-hp electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A19395) is for a water sample from the well collected March 28, 1977, after 30 min of pumping at 30 gpm.

WELL NO. 4, LABORATORY NO. A19395

	<i>mg/l</i>	<i>me/l</i>	<i>mg/l</i>	<i>me/l</i>	
Iron	Fe	5.0	Silica	SiCO ₂	11
Manganese	Mn	0.07	Fluoride	F	0.25
Ammonium	NH ₄	5.14	Boron	B	0.2
Sodium	Na	25	Nitrate	NO ₃	0.0
Potassium	K	1.0	Chloride	Cl	4
Calcium	Ca	68	Sulfate	SO ₄	1
Magnesium	Mg	33	Alkalinity(as CaCO ₃)		375
Arsenic	As	0.010			
Copper	Cu	0.00	Hardness (as CaCO ₃)		314
Cadmium	Cd	0.00			
Chromium	Cr	0.00	Total dissolved		
Lead	Pb	0.00	minerals		395
Mercury	Hg	0.0000			
Nickel	Ni	0.0			
Selenium	Se	0.00			
Silver	Ag	0.00			
Zinc	Zn	0.0	pH (as rec'd)		7.3

NEBO

The village of Nebo (454) installed a public water supply in 1953. Two wells are in use. In 1954 there were 156 services, 6 metered; the average daily pumpage was 15,000 gpd. In 1977 there were 220 services, none metered; the average and maximum daily pumpages were 75,000 and 110,000 gpd, respectively. The water is fluoridated, treated with potassium permanganate, filtered, and chlorinated.

WELL NO. 1, finished in sand and gravel, was completed in January 1953 to a depth of 43 ft by the Calhoun Drilling Co., Batchtown. The well is located in the northwest corner of the water plant in the southwest part of the village, approximately 800 ft S and 2393 ft E of the NW corner of Section 19, T7S, R3W. The land surface elevation at the well is 479.5 ft.

A sample study summary log of Well No. 1 furnished by the State Geological Survey follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
PLEISTOCENE SERIES		
Sample missing	10	10
Till, grayish brown, silty, gravelly, calcareous	8	18
Gravel, mainly chert, brown, angular, fine to medium, clean noncalcareous	1	19
Sand, brown, coarse to very coarse, clean, noncalcareous; gravel, mainly chert, fine	2	21
Silt, dark gray, gravelly, calcareous	8	29
Gravel, white to brown, mostly chert, fine to medium; some sand fine	5	34
Sand, white to brown, mostly chert, medium to coarse, angular, noncalcareous	4	38
Gravel, white to brown, fine to medium; sand fine to coarse, well rounded to angular, noncalcareous	5	43

An 8-in. diameter hole was drilled to a depth of 43 ft. The well is cased with 8-in. standard steel pipe from 4 ft above land surface to a depth of 33 ft and equipped with 10.3 ft of 8-in. No. 60 slot Cook Everdur screen.

A production test was conducted on February 9, 1953, by representatives of the driller, the village, the State Water Survey, and Wm. H. Klingner & Associates, Consulting Engineers. After 5 hr of pumping at rates ranging from 102 to 95 gpm, the drawdown was 11.05 ft from a nonpumping water level of 9.85 ft below land surface. Thirty min after pumping was stopped, the water level had recovered to 13.75 ft.

On June 1, 1957, the well reportedly produced 45 gpm for 8 hr with a drawdown of 2.31 ft from a nonpumping water level of 11.44 ft below the pump base.

In 1970, this well was treated with Calgon by Rowland & Sons, Rushville.

The pumping equipment presently installed is a Red Jacket submersible pump (Model No. 200K1) set at 33 ft, rated at 50 gpm at about 165 ft TDH, and powered by a 3-hp electric motor.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A12920) of a sample collected January 28, 1975, after pumping for 30 min at 50 gpm, showed the water to have a hardness of 255 mg/l, total dissolved minerals of 335 mg/l, and an iron content of 3.9 mg/l.

WELL NO. 2, finished in sand and gravel, was completed in September 1973 to a depth of 52 ft by the Calhoun Drilling Co., Batchtown. The well is located on the west side of the village adjacent to the fire station, approximately 500 ft S and 2420 ft E of the NW corner of Section 19, T7S, R3W. The land surface elevation at the well is approximately 480 ft.

A drillers log of Well No. 2 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Yellow clay	18	18
Blue muck and gravel	2	20
Blue muck	20	40
Clean gravel and sand	2	42
Sand and gravel	10	52

A 16-in. diameter hole was drilled to a depth of 16 ft and finished 8 in. in diameter from 16 to 52 ft. The well is

equipped with a 10-in. diameter pitless adapter from 1.5 ft above land surface to a depth of 4 ft and cased with 8-in. steel pipe from 4 ft to a depth of 42 ft followed by 10 ft of 8-in. Johnson stainless screen. The screened section consists of 5 ft of No. 30 slot followed by 5 ft of No. 20 slot.

A production test was conducted on September 12, 1973, by representatives of the driller, the village, the State Water Survey, and Wm. H. Klingner & Associates, Consulting Engineers. After 2 hr of pumping at a rate of 50 gpm, the drawdown was 14.19 ft from a nonpumping water level of 15.94 ft below land surface. One hr after pumping was stopped, the water level had recovered to 17.56 ft.

The pumping equipment presently installed is a Red Jacket submersible pump set at 42 ft, rated at 50 gpm at about 165 ft TDH, and powered by a 3-hp electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B50210) is for a water sample from the well collected May 31, 1978, after 1 hr of pumping at 50 gpm.

WELL NO. 2, LABORATORY NO. B50210						
		<i>mg/l</i>	<i>me/l</i>		<i>mg/l</i>	<i>me/l</i>
Iron	Fe	2.8		Silica	SiO ₂	21
Manganese	Mn	0.43		Fluoride	F	0.2 0.01
Ammonium	NH ₄	0.1	0.01	Boron	B	0.1
Sodium	Na	26	1.13	Nitrate	NO ₃	3.5 0.06
Potassium	K	3.0	0.08	Chloride	Cl	25 0.70
Calcium	Ca	59	2.94	Sulfate	SO ₄	69 1.44
Magnesium	Mg	18	1.48	Alkalinity(as CaCO ₃)		182 3.64
Arsenic	As	0.01				
Barium	Ba	0.0		Hardness (as CaCO ₃)		234 4.68
Copper	Cu	0.01				
Cadmium	Cd	0.00				
Chromium	Cr	0.00		Total dissolved		
				minerals		339
Lead	Pb	0.00				
Mercury	Hg	0.0005				
Nickel	Ni	0.0				
Selenium	Se	0.00				
Silver	Ag	0.00				
Cyanide	CN	0.00				
Zinc	Zn	0.0		pH (as rec'd)		7.3

NEW CANTON

The town of New Canton (486) installed a public water supply in 1952. One well (No. 1) is in use and another well (No. 3) is available for emergency use. In 1955 there were 145 services, all metered; the average and maximum daily pumpages were 14,000 and 40,000 gpd, respectively. In 1978 there were 190 services, all metered; the average and maximum daily pumpages were 25,000 and 50,000 gpd, respectively. The water is chlorinated and fluoridated.

WELL NO. 1, finished in sand and gravel, was completed in May 1952 to a depth of 54 ft by the Calhoun Drilling Co.,

Batchtown. The well is located at the north edge of town about 125 ft east of Route 96, approximately 140 ft S and 1725 ft E of the NW corner of Section 16, T5S, R6W. The land surface elevation at the well is approximately 470 ft.

A sample study summary log of Well No. 1 furnished by the State Geological Survey follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
PLEISTOCENE SERIES		
No samples	7	7
Sand and gravel, mostly chert, angular, silty, sandy, yellow brown, noncalcareous	13	20

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Silt, mottled yellow brown to gray, few angular chert fragments, noncalcareous	5	25
Sand, brown, fine to medium, very silty, noncalcareous	10	35
Sand, brown, fine to medium, very silty, micaceous, noncalcareous	8	43
Sand, brown, fine to medium, little gravel, slightly silty, mostly rounded, poorly sorted, noncalcareous	5	48
Sand, medium to coarse and gravel, brown, rounded, very slightly silty, fairly well sorted, noncalcareous	2	50
Sand, medium to coarse, little gravel, mostly rounded, clean, noncalcareous	4	54

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A20447) is for a water sample from the well collected April 13, 1977, after 2 hr of pumping at 100 gpm.

WELL NO. 1, LABORATORY NO. A20447

	<i>mg/l</i>	<i>me/l</i>		<i>mg/l</i>	<i>me/l</i>
Iron	Fe	0.00	Silica	SiO ₂	15
Manganese	Mn	0.00	Fluoride	F	0.2 0.01
Ammonium	NH ₄	0.06 0.00	Boron	B	0.3
Sodium	Na	8.0 0.35	Nitrate	NO ₃	10.12 0.16
Potassium	K	2.0 0.05	Chloride	Cl	7 0.20
Calcium	Ca	46.0 2.30	Sulfate	SO ₄	25 0.52
Magnesium	Mg	15.0 1.23	Alkalinity(as CaCO ₃)		170 3.40
Arsenic	As	0.000			
Barium	Ba	0.0			
Copper	Cu	0.00	Hardness (as CaCO ₃)		176 3.52
Cadmium	Cd	0.00			
Chromium	Cr	0.00			
			Total dissolved		
Lead	Pb	0.00	minerals		260
Mercury	Hg	0.0000			
Nickel	Ni	0.0			
Selenium	Se	0.00			
Silver	Ag	0.00			
Zinc	Zn	0.0	pH (as rec'd)		6.8

An 8-in. diameter hole was drilled to a depth of 54 ft. The well is cased with 8-in. steel pipe from 1 ft above the pumphouse floor to a depth of 45 ft followed by 9 ft of 8-in. No. 20 slot Cook Everdur screen.

A production test was conducted on May 27, 1952, by representatives of the driller, the town, the State Water Survey, and Wm. H. Klingner & Associates, Consulting Engineers. After 4.4 hr of pumping at rates ranging from 129 to 138 gpm, the drawdown was 8.29 ft from a nonpumping water level of 8.26 ft below land surface. Seven min after pumping was stopped, full recovery was observed.

PEARL

The village of Pearl (323) installed a public water supply in 1914. The water system was initially owned by Dr. F. M. Thurman, and then owned by W. M. Thurman until the village purchased the system in May 1954. One spring is in use. In 1952 there were 60 services, none metered; the average and maximum daily pumpages were 20,000 and

On December 13, 1956, the nonpumping water level was reported to be 22.2 ft after a 12-hr idle period.

The pumping equipment presently installed consists of a 5-hp 1750 rpm electric motor, a 9-stage Fairbanks-Morse Pomona turbine pump (No. AN4334) rated at 100 gpm at about 130 ft head, and has 35 ft of 4-in. column pipe.

WELL NO. 2, finished in sand and gravel, was completed in 1952 to a depth of 50 ft by the Calhoun Drilling Co., Batchtown. This well was abandoned and plugged in 1977. The well is located about 5 ft west of Well No. 1, approximately 140 ft S and 1720 ft E of the NW corner of Section 16, T5S, R6W. The land surface elevation at the well is approximately 470 ft.

The well is cased with 6-in. outer pipe from 1 ft above the pumphouse floor to a depth of 10 ft and a 3-in. pipe with attached well point screen to a depth of 50 ft.

WELL NO. 3, finished in sand and gravel, was completed in July 1977 to a depth of 53.5 ft by the Calhoun Drilling Co., Batchtown. This well is available for emergency use. The well is located northwest of Well No. 1, approximately 115 ft S and 1690 ft E of the NW corner of Section 16, T5S, R6W. The land surface elevation at the well is approximately 469 ft.

A drillers log of Well No. 3 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Black dirt with some creek gravel	20	20
Dirty gravel	15	35
Silt	7	42
Fine to medium sand	8	50
Medium to coarse sand	3.5	53.5
Shale	6.5	60

A 16-in. diameter hole was drilled to a depth of 20 ft and finished 6 in. in diameter from 20 to 60 ft. The well is equipped with a pitless adapter from about 4.5 ft above land surface to a depth of 5 ft and cased with 6-in. pipe to a depth of 46 ft and equipped with 10 ft (7.5 ft exposed) of 6-in. No. 20 slot Johnson stainless steel screen. The annulus between the bore hole and the 6-in. casing is filled with concrete.

The pumping equipment presently installed is a Red Jacket submersible pump (Model No. HA 110) set at 45 ft, rated at 100 gpm at about 135 ft TDH, and powered by a 5-hp electric motor.

25,000 gpd, respectively. In 1977 there were 145 services, 2 percent metered; the average and maximum daily pumpages were 50,000 and 70,000 gpd, respectively. The water flows into 540-gal and 1350-gal collecting basins, is chlorinated, fluoridated, pumped to a 28,500-gal ground storage reservoir located at the top of the limestone bluff, and then

flows by gravity to the distribution system.

A SPRING SUPPLY from the Burlington-Keokuk Limestone, was developed in 1914 for the village by Dr. F. M. Thurman, Pearl. The spring is located about 0.5 mile south of the village, approximately 1500 ft S and 1200 ft E of the NW corner of Section 15, T7S, R2W. The land surface

elevation at the spring is approximately 470 ft.

In 1914, the spring reportedly flowed at a rate of about 50 gpm.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A12293) is for a water sample from the spring collected January 15, 1975.

SPRING, LABORATORY NO. A12293					
		mg/l	me/l		mg/l me/l
Iron	Fe	0.0		Silica	SiO ₂ 20
Manganese	Mn	0.00		Fluoride	F 0.1 0.00
Ammonium	NH ₄	0.0	0.00	Boron	B 0.1
Sodium	Na	8	0.35	Nitrate	NO ₃ 20 0.32
Potassium	K	1.0	0.03	Chloride	Cl 5 0.14
Calcium	Ca	60	2.99	Sulfate	SO ₄ 25 0.52
Magnesium	Mg	14	1.15	Alkalinity(as CaCO ₃)	195 3.90
				Hardness (as CaCO ₃)	205 4.10
Arsenic	As	0.00			
Barium	Ba	0.0		Total dissolved	
Copper	Cu	0.00		minerals	270
Cadmium	Cd	0.00			
Chromium	Cr	0.00		pH (as rec'd)	7.8
Lead	Pb	0.00		Radioactivity	
Mercury	Hg	0.0000		Alpha	pc/l 0.0
Nickel	Ni	0.0		± deviation	0.0
Selenium	Se	0.00		Beta	pc/l 0.8
Silver	Ag	0.00		± deviation	1.2
Cyanide	CN	0.000			
Zinc	Zn	0.0			

PERRY

The village of Perry (451) installed a public water supply in 1956. Two wells are in use. In 1957 there were 173 services, all metered; the average daily pumpage in 1962 was 25,000 gpd. In 1977 there were 240 services, all metered; the average and maximum daily pumpages were 40,000 and 65,000 gpd, respectively. The water is chlorinated, fluoridated, aerated, and filtered.

WELL NO. 1 (North Well), finished in sand and gravel, was completed in February 1956 to a depth of 49 ft by the J. B. Bushnell Well Drilling Co., Plymouth. The well is located about 50 ft from the main treatment building 0.2 mile north of the village, approximately 1791 ft S and 1457 ft W of the NE corner of Section 21, T3S, R3W. The land surface elevation at the well is 548.7 ft.

A correlated drillers log of Well No. 1 furnished by the State Geological Survey follows:

Strata	Thickness (ft)	Depth (ft)
PLEISTOCENE SERIES		
Top soil	5	5
Hardpan	10	15
Gray mud	3	18
Muddy gravel	14	32
Clean gravel	20	52

An 8-in. diameter hole was drilled to a depth of 52 ft. The well is cased with 8-in. standard steel pipe from about 0.5 ft above the wellhouse floor to a depth of 39 ft followed by 10 ft (12 ft overall length) of 8-in. No. 80 slot Johnson Everdur screen.

A production test using one observation well was conducted on April 3, 1956, by representatives of the driller, the village, the State Water Survey, and Wm. H. Klingner & Associates, Consulting Engineers. After 7.3 hr of pumping at a rate of 34 gpm, the drawdown was 7.27 ft from a non-pumping water level of 13.48 ft below land surface. One hr after pumping was stopped, the water level had recovered to 13.92 ft.

The pumping equipment presently installed is a Red Jacket submersible pump set at 44 ft, rated at 70 gpm, and powered by a 5-hp electric motor.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A13303) of a sample collected February 3, 1975, after pumping for 30 min at 65 gpm, showed the water to have a hardness of 310 mg/l, total dissolved minerals of 350 mg/l, and an iron content of 0.4 mg/l.

WELL NO. 2 (South Well), finished in sand and gravel, was

completed in February 1956 to a depth of 72 ft by the J. B. Bushnell Well Drilling Co., Plymouth. The well is located in the southwest corner of the main treatment building about 172 ft south of Well No. 1, approximately 1963 ft S and 1445 ft W of the NE corner of Section 21, T3S, R3W. The land surface elevation at the well is 564.2 ft.

A correlated drillers log of Well No. 2 furnished by the State Geological Survey follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
PLEISTOCENE SERIES		
Top soil	2	2
Yellow clay	28	30
Gray shale (gravel)	12	42
Muddy sand and gravel	14	56
Sand	2	58
Clean sand and gravel	16	74

An 8-in. diameter hole was drilled to a depth of 74 ft. The well is cased with 8-in. standard pipe from 1 ft above the pumphouse floor to a depth of 60 ft followed by 12 ft of 8-in. Johnson Everdur screen. The screen section consists of 4 ft of No. 40 slot followed by 8 ft of No. 80 slot.

A production test using one observation well was conducted on May 24, 1956, by representatives of the driller, the village, the State Water Survey, and Wm. H. Klingner & Associates, Consulting Engineers. After 6.5 hr of pumping at rates ranging from 29.5 to 30.5 gpm, the drawdown was 2.16 ft from a nonpumping water level of 29.72 ft below

land surface. Fifty-five min after pumping was stopped, the water level had recovered to 29.78 ft.

The pumping equipment presently installed is a Red Jacket submersible pump set at 58 ft, rated at 50 gpm, and powered by a 7½-hp 3600 rpm electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. B110485) is for a water sample from the well collected May 15, 1973, after 1 hr of pumping at 50 gpm.

WELL NO. 2, LABORATORY NO. B110485							
		<i>mg/l</i>	<i>me/l</i>			<i>mg/l</i>	<i>me/l</i>
Iron	Fe	3.4	0.12	Silica	SiO ₂	23	
Manganese	Mn	0.05	0.00	Fluoride	F	0.4	0.02
Ammonium	NH ₄	0.40	0.02	Boron	B	0.1	
Sodium	Na	24	1.04	Nitrate	NO ₃	0.0	
Potassium	K	0.85	0.02	Chloride	Cl	54	1.52
Calcium	Ca	110	5.49	Sulfate	SO ₄	82	1.71
Magnesium	Mg	52	4.27	Alkalinity (as CaCO ₃)		368	7.36
				Hardness (as CaCO ₃)		488	9.76
Arsenic	As	0.00		Total dissolved			
Barium	Ba	0.1		minerals			
Copper	Cu	0.06		559			
Cadmium	Cd	0.00		pH (as rec'd)			
Chromium	Cr	0.00		Radioactivity			
Lead	Pb	0.00		Alpha <i>pc/l</i>			
Mercury	Hg	0.0000		± deviation			
Nickel	Ni	0.0		Beta <i>pc/l</i>			
Selenium	Se	0.00		± deviation			
Silver	Ag	0.00		7.4			
Zinc	Zn	0.01		1.2			
				2.2			
				9.6			
				3.8			

PLEASANT HILL

The village of Pleasant Hill (1064) installed a public water supply in 1936. Two wells are in use. In 1951 there were 290 services; the average and maximum daily pumpages in 1949 were 30,000 and 35,000 gpd, respectively. In 1977 there were 550 services, 95 percent metered; the average and maximum daily pumpages were 110,000 and 175,000 gpd, respectively. The water is aerated, chlorinated, fluoridated, and filtered.

WELL NO. 1, finished in sand and gravel, was completed in 1936 to a depth of 57 ft by E. W. Franke, Batchtown. This well is alternated daily with Well No. 2. The well is located in the treatment plant 75 ft west of Main St. about 0.2 mile southwest of the village, approximately 2000 ft N and 500 ft W of the SE corner of Section 20, T7S, R4W. The land surface elevation at the well is approximately 450 ft.

A drillers log of Well No. 1 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Fine sand mixed with small amount of loam	5	5
Fine sand	5	10

<i>Strata (continued)</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Medium sand	10	20
Fine sand	10	30
Fine sand with small percent medium sand	5	35
Medium sand mixed with small gravel	12	47
Fine sand	13	60

An 8-in. diameter hole was drilled to a depth of 57 ft. The well is cased with 8-in. steel pipe from about 1.2 ft above the pump station floor to a depth of 47 ft followed by 10 ft of 8-in. No. 20 slot Cook Everdur screen.

A production test was conducted by the State Water Survey on April 14, 1936. After 6 hr of pumping at rates of 170 to 178 gpm, the drawdown was 5.1 ft from a nonpumping water level of 11.6 ft below land surface.

A second production test was conducted by the State Water Survey on June 16-17, 1936. After 24 hr of pumping at rates ranging from 156 to 178 gpm, the drawdown was 5.2 ft from a nonpumping water level of 13.0 ft below land surface.

In June 1946, the nonpumping water level was reported

to be 15 ft below the pump base.

In June 1954, the well reportedly produced 100 gpm with a drawdown of 8 ft from a nonpumping water level of 17 ft below land surface.

In 1957, this well was acidized by E. W. Franke, and a new pump was installed. The production was then reported to be 178 gpm with a drawdown of 5 ft.

In November 1963, after 5 hr of pumping at a rate of about 180 gpm, the drawdown was 21 ft from a nonpumping water level of 15 ft below land surface.

In 1969, this well was acidized by Rowland & Sons, Rushville, but little improvement was realized.

In September 1974, the well was reported to have decreased in yield because the well screen had plugged with iron. The well was acidized several times, but little or no effect in increasing the well capacity was observed.

In 1975, this well was acidized by the Calhoun Drilling Co., Batchtown. The production was then reported to have improved.

The pumping equipment presently installed is a Deming turbine pump set at 50 ft, rated at 175 gpm at about 60 ft TDH, and powered by a 5-hp U. S. electric motor.

A mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A20011) of a sample collected April 6, 1977, after pumping for 30 min at 100 gpm, showed the water to have a hardness of 305 mg/l, total dissolved minerals of 380 mg/l, and an iron content of 0.80 mg/l.

WELL NO. 2, finished in sand and gravel, was completed in October 1963 to a depth of 60 ft by the Calhoun Drilling Co., Batchtown. This well is alternated daily with Well No. 1. The well is located about 100 ft north of Well No. 1, approximately 2100 ft N and 500 ft W of the SE corner of Section 20, T7S, R4W. The land surface elevation at the well is approximately 450 ft.

A drillers log of Well No. 2 follows:

<i>Strata</i>	<i>Thickness (ft)</i>	<i>Depth (ft)</i>
Top soil	4	4
Various grades of sand	56	60

A 10-in. diameter hole was drilled to a depth of 60 ft. The well is cased with 10-in. steel pipe from about 1.2 ft above the pumphouse floor to a depth of 50 ft followed by 10 ft of 10-in. No. 20 slot Cook Everdur screen.

A production test was conducted on November 4, 1963, by representatives of the driller, the village, the State Water Survey, and Wm. H. Klingner & Associates, Consulting Engineers. After 4.8 hr of pumping at a rate of 125 gpm, the final drawdown was 3.46 ft from a nonpumping water level of 10.72 ft below land surface. Thirty min after pumping was stopped, the water level had recovered to 10.93 ft. During this test, Well No. 1 was operating.

On November 22, 1963, the well reportedly produced 145 gpm with a drawdown of 4.23 ft from a nonpumping water level of 13.33 ft.

In September 1974, the well was reported to have decreased in yield because the well screen had plugged with iron. The well was acidized several times in the last few years resulting only in a temporary increase of the well capacity.

In 1975, this well was acidized by the Calhoun Drilling Co. The production was then reported to have improved.

The pumping equipment presently installed is a Deming vertical turbine pump set at 50 ft, rated at 175 gpm at about 60 ft TDH, and powered by a 5-hp 1700 rpm U. S. electric motor.

The following mineral analysis made by the Illinois Environmental Protection Agency (Lab. No. A20012) is for a water sample from the well collected April 6, 1977, after 30 min of pumping at 100 gpm.

WELL NO. 2, LABORATORY NO. A20012					
		<i>mg/l</i>	<i>me/l</i>	<i>mg/l</i>	<i>me/l</i>
Iron	Fe	1.20		Silica	SiO ₂ 28
Manganese	Mn	1.00		Fluoride	F 0.3 0.02
Ammonium	NH ₄	0.25	0.01	Boron	B 0.2
Sodium	Na	7.2	0.31	Nitrate	NO ₃ 4.40 0.07
Potassium	K	2.0	0.05	Chloride	Cl 8 0.23
Calcium	Ca	80.0	3.99	Sulfate	SO ₄ 27 0.56
Magnesium	Mg	25.1	2.07	Alkalinity(as CaCO ₃)	270 5.40
Arsenic	As	0.002		Hardness (as CaCO ₃)	304 6.08
Barium	Ba	0.1			
Copper	Cu	0.00			
Cadmium	Cd	0.00		Total dissolved	
Chromium	Cr	0.00		minerals	360
Lead	Pb	0.00			
Mercury	Hg	0.0000			
Nickel	Ni	0.0			
Selenium	Se	0.00			
Silver	Ag	0.00			
Cyanide	CN	0.000			
Zinc	Zn	0.0		pH (as rec'd)	7.7