COOPERATIVE GROUND-WATER REPORT I
Urbana, Illinois 1959

STATE WATER SURVEY
William C. Ackermann, Chief

STATE GEOLOGICAL SURVEY
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Preliminary Report on GROUND-WATER RESOURCES OF THE CHICAGO REGION, ILLINOIS

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STATE OF ILLINOIS — WILLIAM G. STRATTON, *Governor*

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BOARD OP NATURAL RESOURCES AND CONSERVATION

HON. VERA M. BINKS,

FOREWORD

This report initiates a joint series of publications designed to present results of ground-water resource investigations carried on cooperatively by the State Water Survey and the State Geological Survey. It is

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PRELIMINARY REPORT ON

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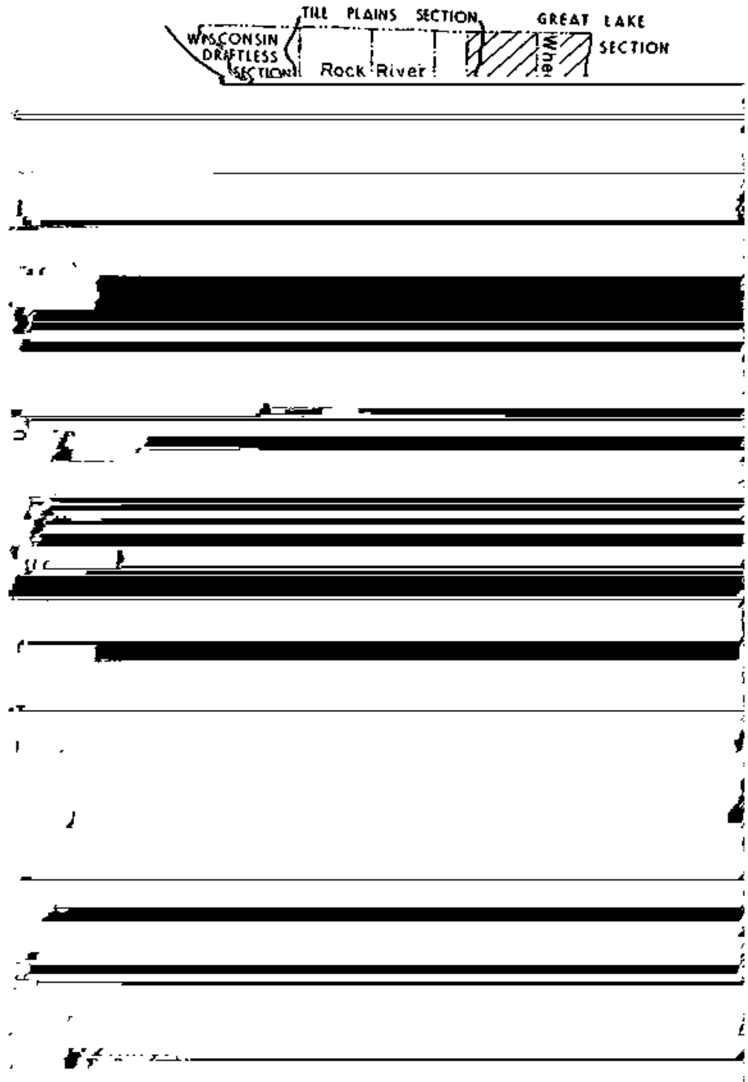
GROVER H.


TILL PLAINS SECTION
GREAT LAKE SECTION
WISCONSIN DRIFTLESS SECTION
Rock River

INTRODUCTION

The Chicago region has been one of the most favorable ground-water areas in Illinois. It is

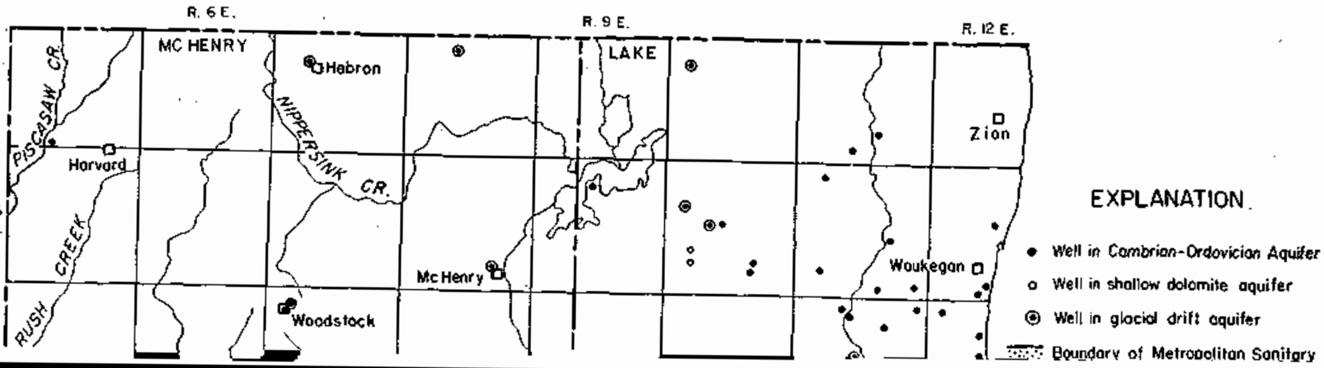

R. 6 E.
R. 9 E.
R. 12 E.
MC HENRY
LAKE
Hebron
PISCASAW CR.
NIPPERSINK CR.
Harvard
Zion
T. 45 N.
RUSH CREEK
McHenry
Woodstock
Waukegan
EXPLANATION
Well in Cambrian-Ordovician Aquifer
Well in shallow dolomite aquifer
Well in glacial drift aquifer
Boundary of Metropolitan Sanitary

TABLE 1. AREA AND POPULATION OF THE CHICAGO REGION BY COUNTY

		1950*		1957†	
County	Area in square miles	Population	Population per square mile	Population	Population per square mile
Cook	954	4,508,792	4,726	5,028,800	5,270
DuPage	331	154,599	467	249,100	750
Part of Grundy	210	11,520	55	16,300	78
Kane	516	150,388	291	179,300	348
Kendall	320	12,115	38	14,200	44
Lake	457	179,097	392	251,300	550
McHenry	611	50,656	83	69,400	113
Part of Will	770	131,097	170	171,400	213
Totals for Region	4,169	5,198,264	1,247	5,979,800	1,432
State of Illinois	55,947	8,712,176	156	9,754,000	174

* U. S. Bureau of the Census.
† Illinois Department of Public Health estimates.

According to the 1954 Census of Manufactures, the eight counties under study had 13,279 manufacturing establishments producing goods valued, after deduction of labor and supply costs, at $7,010,865,000 that year. The state as a whole had 17,628 manufacturing establishments with a net production value of $9,668,752,000. Thus the Chicago region has 75.2 percent of the state's manufacturing establishments and produced 72.5 percent of the value added by manufacturing.

The vast economic importance of the area is a result of many factors (Fryxell, 1927, p. 1-10) : 1) it is near the center of one of the richest agricultural belts in the world; 2) favorable terrain and location have made Chicago a major railway and highway center; 3) the Great Lakes afford a water transportation system that links Chicago with the other great ports of the world; 4) the Chicago Drainage Canal and the Calumet-Sag Channel connect Chicago with the Illinois and Mississippi River systems; 5) adequate resources and moderate climate are favorable for supporting a large population.

All cities that border Lake Michigan in the Chicago region, except Lake Bluff, Zion, and Winthrop Harbor, obtain water supplies from the lake. The City of Chicago, which serves about 60 municipalities and pumps more than a billion gallons a day from the lake, is the largest user of water.

Some 110 municipalities not served by water from Lake Michigan obtain supplies from wells. Suburban and rural water supplies beyond the municipal distribution system are obtained from ground water. Many industries, including a large number of plants within the area served by Lake Michigan water, have private wells and use ground water for processing and cooling. Some industrial water is obtained from surface sources other than Lake Michigan.

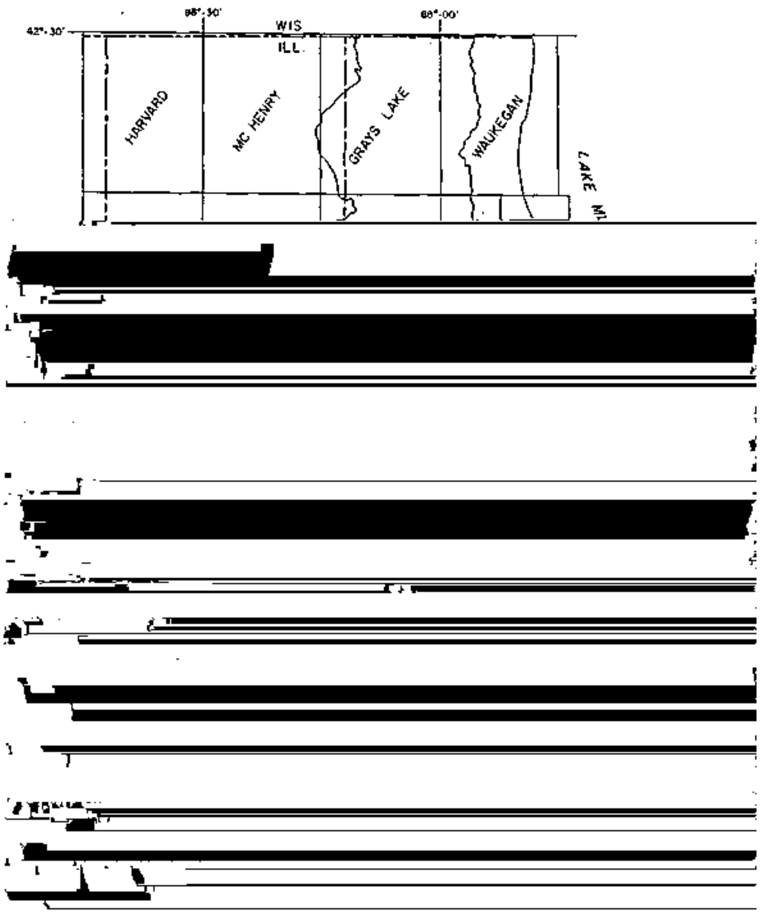


Fig. 3. Quadrangle topographic maps of the Chicago region.

Fig. 2. Chicago region with location of selected wells. Shown are most wells in Cambrian-Ordovician Aquifer for which

5 Tw0.213 Tc(havTc(n) Tj2.468 Tw-883 Tc(ra) Tj.213 Tc(havTc(n) Tj7.040 509.040 Tm0 Tw-0.042 TT7 Michigan) Tj0 Tc,4 Tw0.o0 Tc0 Tc(.n2p13o5) Tj0 T93.360 78

GEOGRAPHY

TOPOGRAPHY

The Chicago region lies near the center of the physiographic Central Lowland Province, a glaciated

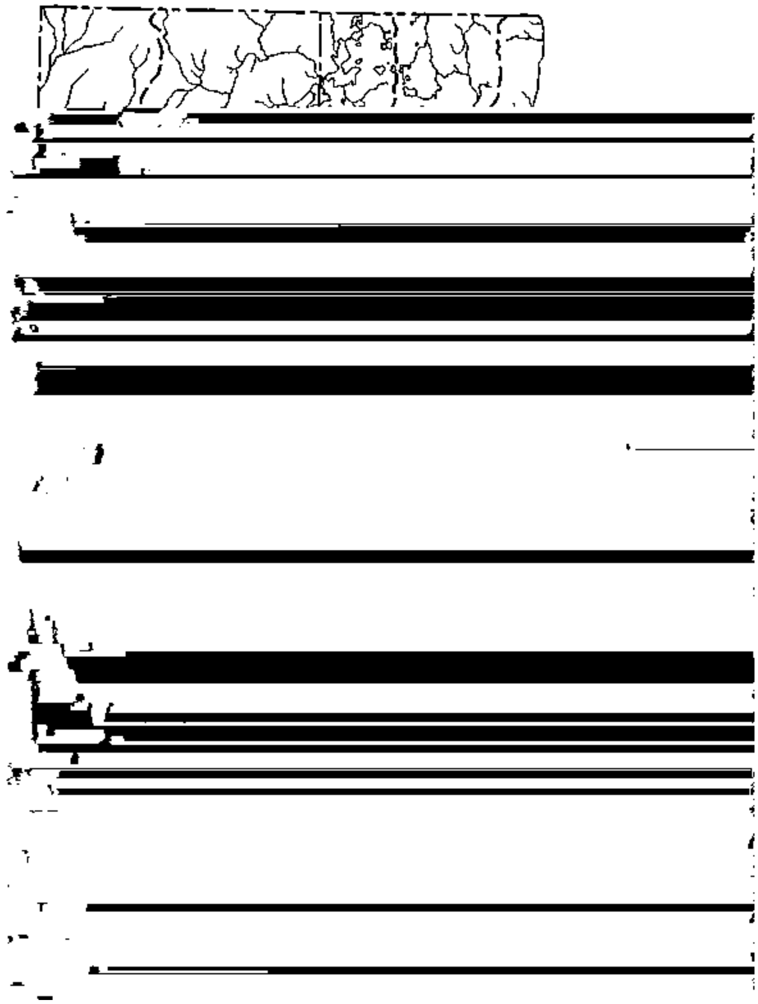


TABLE 2. HIGHEST AND LOWEST MONTHLY PRECIPITATION DURING 1938-1957

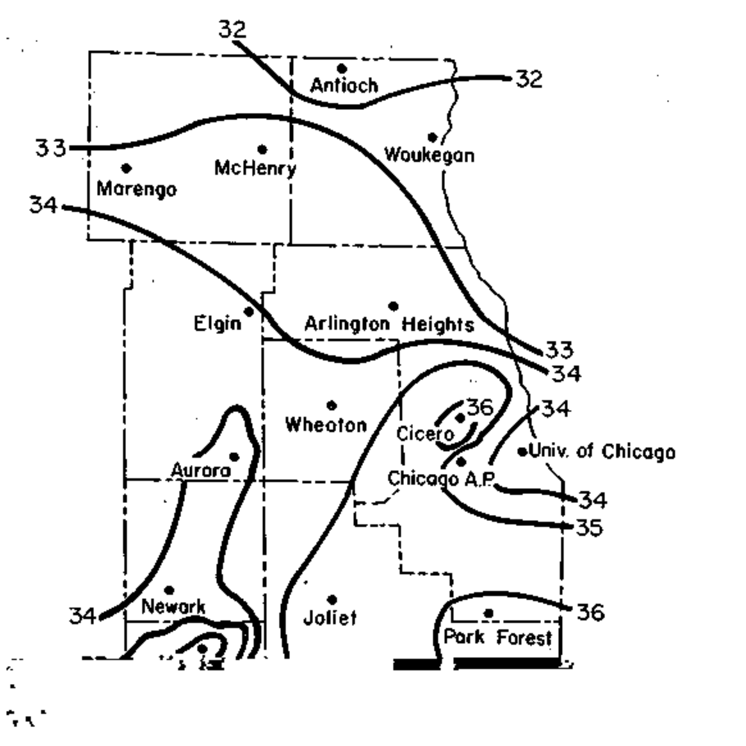
Months	Highest			Lowest		
	Precipitation	Station	Year	Precipitation	Station	Year
January	5.38	Park Forest	1949	0.11	Antioch	1956
February	4.84	Park Forest	1950	0.10	Antioch	1947
March	7.23	Wheaton	1948	0.33	Newark	1956
April	9.72	Channahon Island	1950	0.49	McHenry	1942
May	9.18	Peotone	1943	0.49	Arlington Heights	1950
June	10.65	Wheaton	1939	0.70	Chicago University	1956
July	10.73	Peotone	1957	0.02	Morris	1940
August	9.65	Waukegan	1945	0.46	Newark	1953
September	10.62	Waukegan	1945	0.15	McHenry	1940
October	14.86	Aurora	1954	T	Waukegan	1952
November	5.57	Aurora	1942	0.34	Aurora	1949
December	7.11	Joliet	1949	T	Wheaton	1943

CLIMATE

Precipitation, evaporation, and temperature are the most commonly measured climatic factors that are directly related to the availability, storage, movement, and withdrawal of ground water. Precipitation adds water to the land and evaporation takes it away. Temperature influences evaporation and infiltration and also affects the rate and distribution of ground-water withdrawal.

The climate of the Chicago region is classified as continental with warm summers and cold winters. Precipitation, evaporation, and temperature vary with the latitude. Aside from local influences, such as Lake Michigan and the large urban area of Chicago, the average annual precipitation for the period 1938-1957 ranged from about 32 inches in the north to about 36 inches in the southeast (fig. 7) and the average annual temperature ranged from about 48° F. to 51° P. (fig. 8).

Precipitation varies through a wide range in intensity, geographic distribution, and frequency of storms. During the period



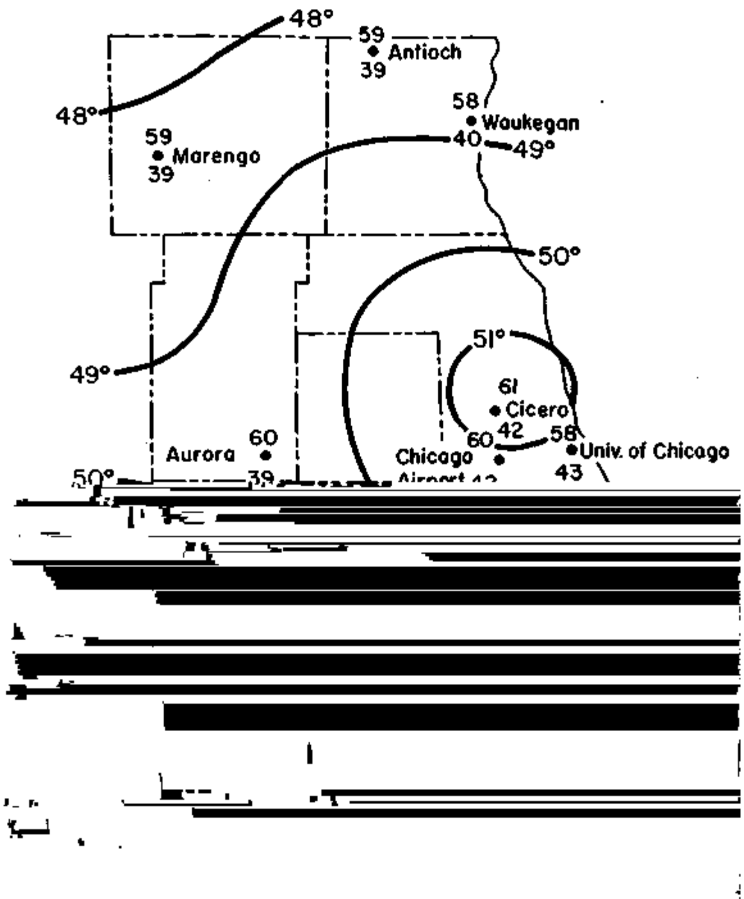
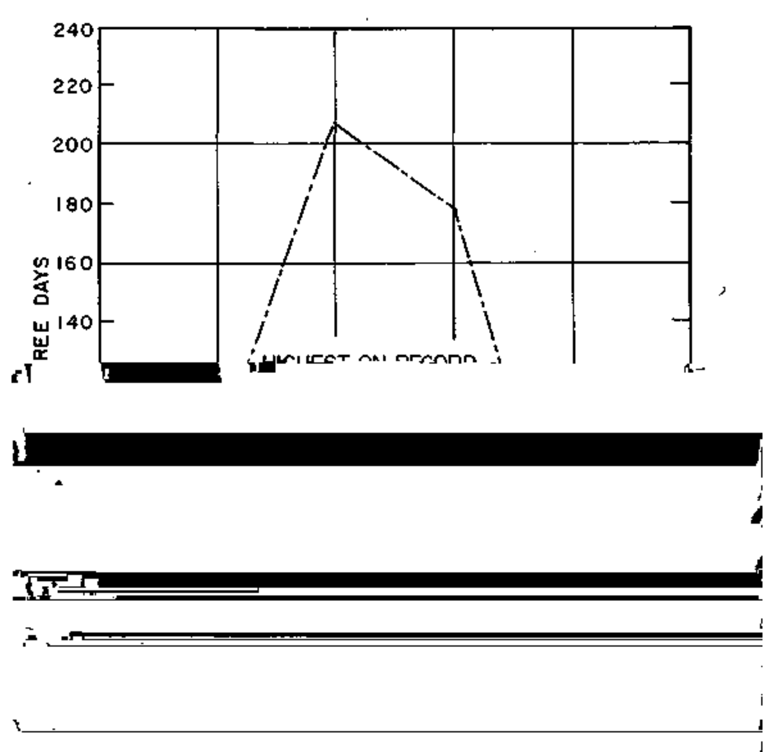


Fig. 8. Mean annual temperature in the Chicago region.

is widely used for air conditioning and other cooling purposes in the Chicago region. To estimate the magnitude of cooling requirements, a classification of cooling degree days is used and computed on a daily basis by subtracting 75 degrees from the mean daily temperature. For the months during which cooling degree days normally occur, the average and extreme values for Chicago are shown in figure 9. On an annual basis, Chicago averages 139 cooling degree days per year. The annual average in the eight county area ranges from 80 in northeastern Lake County to approximately 150 per year in southwestern Grundy County.

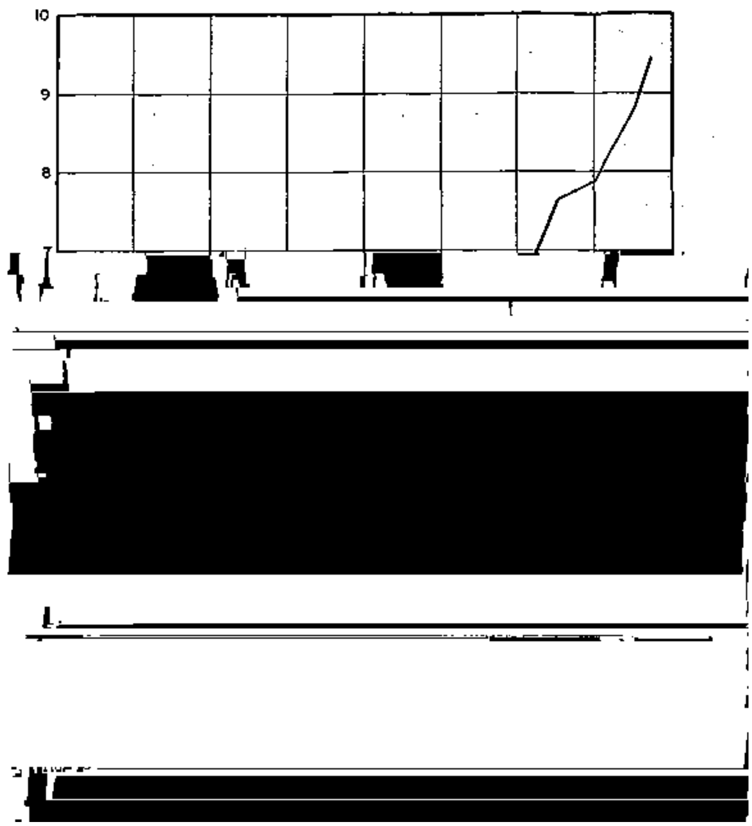
In general, recharge from precipitation to the ground-water reservoir is greatest in the spring, that is, after the ground thaws and before vigorous1

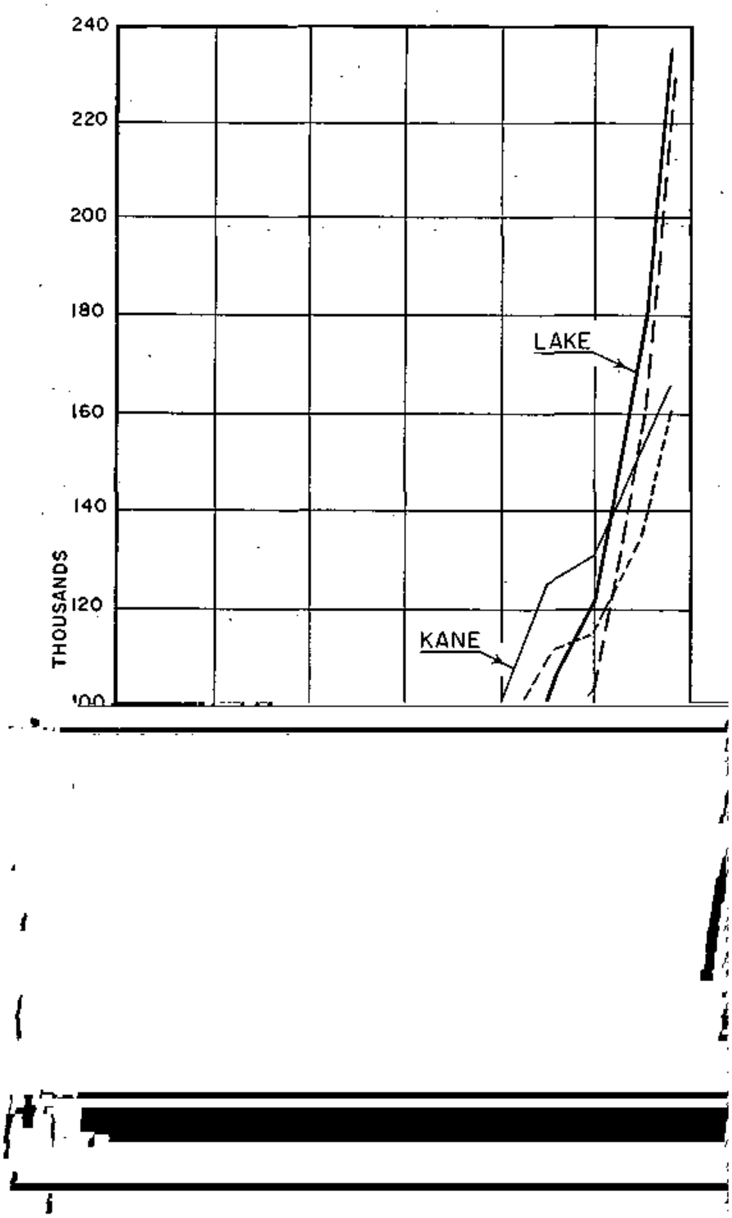


order of. value of output. In addition, Chicago is the focal point for vast rail and truck systems and for petroleum and natural gas pipelines that transport raw materials into the Chicago industrial district and also distribute the products manufactured from these raw materials.

Of the 20 manufacturing groups in the Chicago area classified by the Census of Manufactures for 1954, the iron and steel industry is the largest and is also the largest industrial user of ground water.

Pood processing, including the meat, dairy products, canned and frozen





including water for domestic use, watering stock, and
someN

TABLE 3. WELLS TO PRECAMBRIAN ROCKS NEAR THE CHICAGO REGION

		Top of Precambrian			
Name of well	Sec.-T.-R., county	Depth	Sea level elevation	Thickness penetrated	Type of rock
1. Ivan A. Seele	24-44N-2E	2656	−1786	44	Red granite
2. Northern Ill. Oil and Gas Co.*	28-43N-3E Boone	2925	−2105	73	Gray granite
3. Paul Schulte Wyman No. 1*	35-41N-5E DeKalb	3845	−2935	639	Red granite
4. Vickery No. 1 Mathesius	32-35N-1E LaSalle	3532	−2854	24	Granite

GEOLOGY

Unconsolidated deposits of glacial and Recent age, which overlie the layered bedrock in most of the region (figs. 5-6, in pocket) range from a foot or less to more than 400 feet thick (fig. .12). They are mainly of Wisconsin age, the last major episode of glaciation in the Midwest, as shown in the classification of Pleistocene deposits. Illinoian and possibly older glacial deposits are preserved beneath the Wisconsin drift at some places.

CLASSIFICATION OF PLEISTOCENE DEPOSITS

- Recent stage
- Wisconsin (glacial) stage
  - Mankato substage
  - Cary
  - Tazewell
  - Towan
  - Farmndale
- Sangamon (interglaeial)
- Illinoian (glacial)
- Yarmouth (interglacial)
- Kansan (glacial)
- Aftonian (interglaeial)
- Nebraskan (glacial)

The glacial deposits rest on an eroded bedrock surface of considerable relief

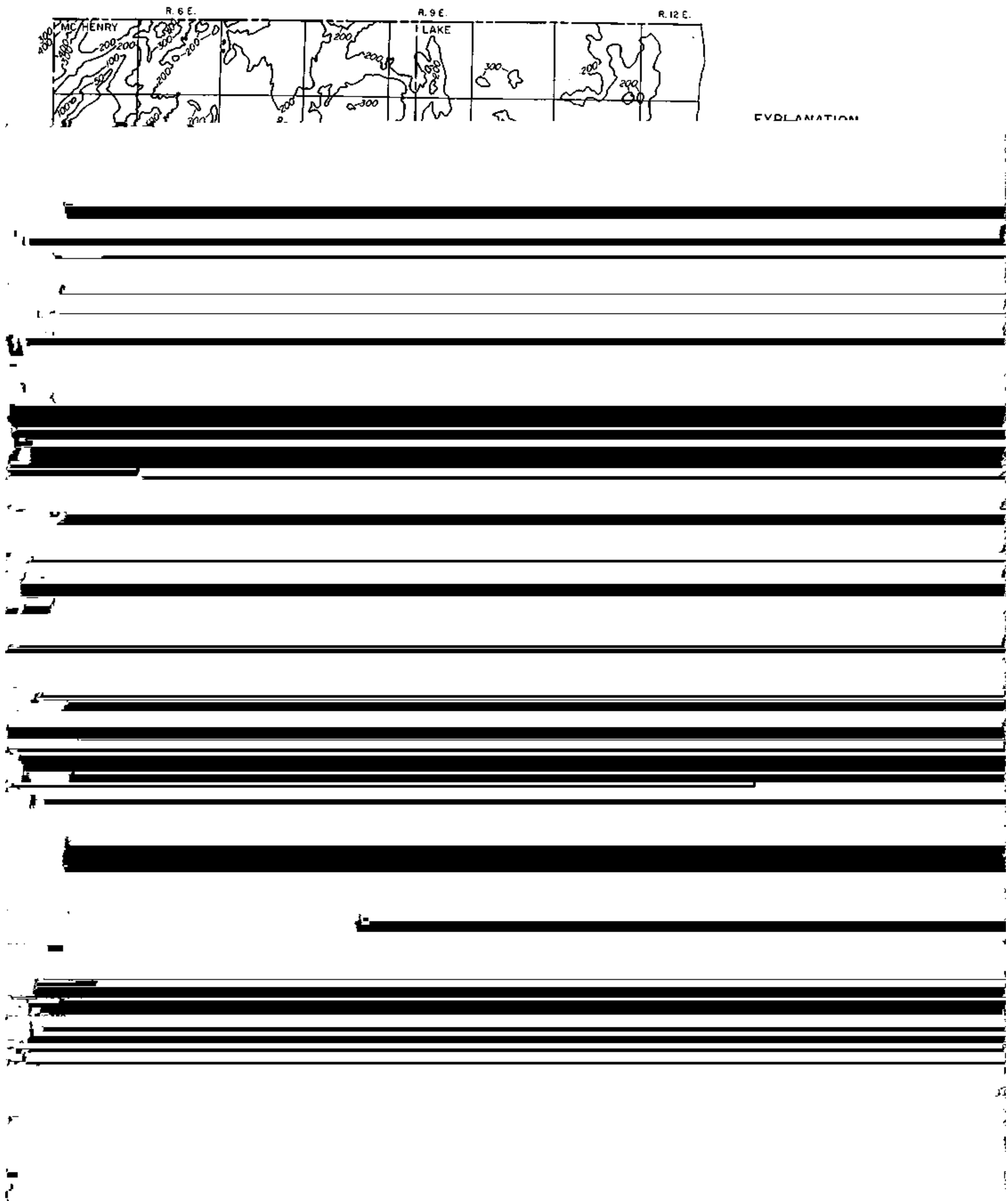
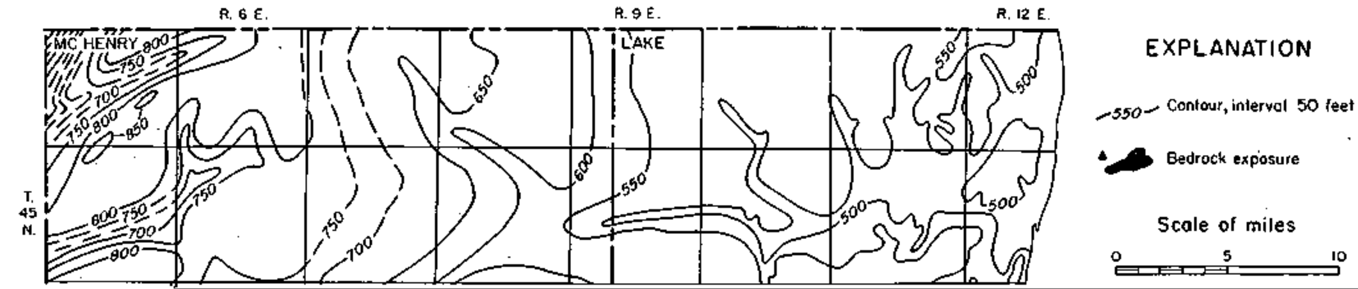


Fig. 12. Thickness of the unconsolidated deposits overlying the bedrock in the Chicago region.

CAMBRIAN


R. 6 E.
R. 9 E.
R. 12 E.
MC HENRY
LAKE
T. 45 N.
EXPLANATION
550 Contour, interval 50 feet
Bedrock exposure
Scale of miles
0 5 10

easily). Throughout the Franconia Formation are large amounts of coarse glauconite that commonly give a greenish tint to the sandstones and shales.

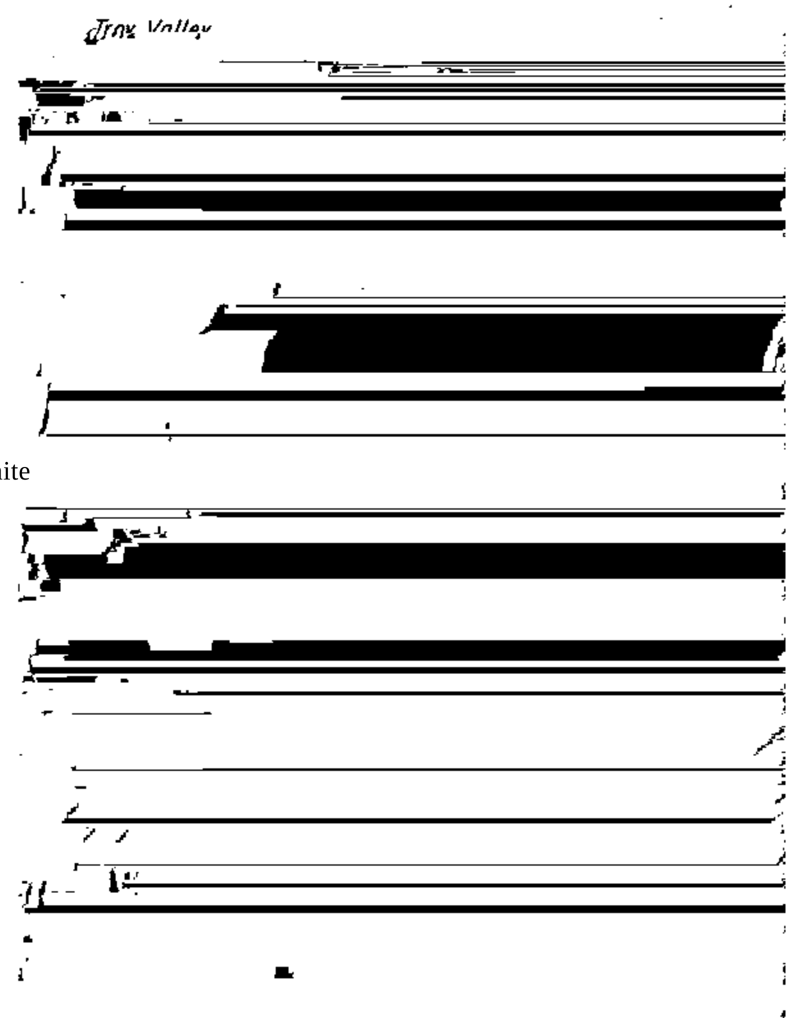
The Franconia Formation underlies the entire region but is known only from wells. It is approximately 100 feet thick and dips from northwest to southeast, as do the underlying formations.

The Trempealeau Dolomite is the uppermost formation of Cambrian age. It grades upward from the underlying Franconia Formation and is commonly slightly sandy and glauconitie at the base. The Trempealeau is buff to gray, very finely crystalline, dense dolomite with minor amounts of geodic quartz and is slightly sandy at the top.

The unconformity that separates the Cambrian and Ordovician rocks occurs at the top of the Trempealeau, causing variation in its thickness. In the northern half of the region the Trempealeau is overlain by the Glenwood-St. Peter Sandstone. The Trempealeau Dolomite has an average thickness of 150 to 200 feet in the region of this report.

Ordovician Rocks

Rocks of Ordovician age in northeastern Illinois are divided in this report into the following geohydrologic units, in ascending order: 1) Prairie du Chien Series, 2) Glenwood-St. Peter Sandstone, 3) Galena-Platteville Dolomite, and 4) Maquoketa Formation Tj3.39r-StDolomite



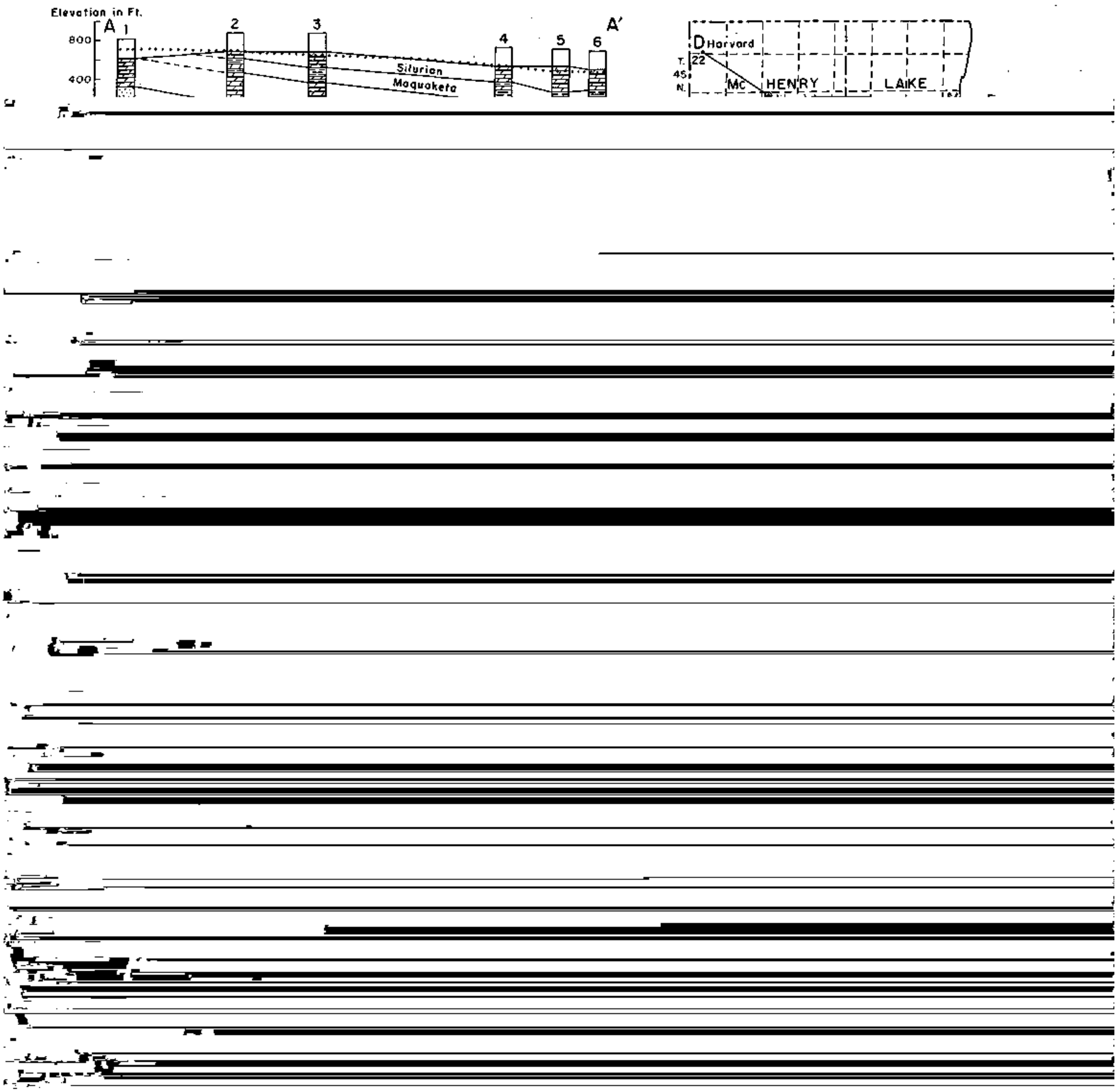


Fig. 15. Cross sections of the structure and stratigraphy of the bedrock and piezometric profiles of the Cambrian-Ordovician Aquifer in the Chicago region.

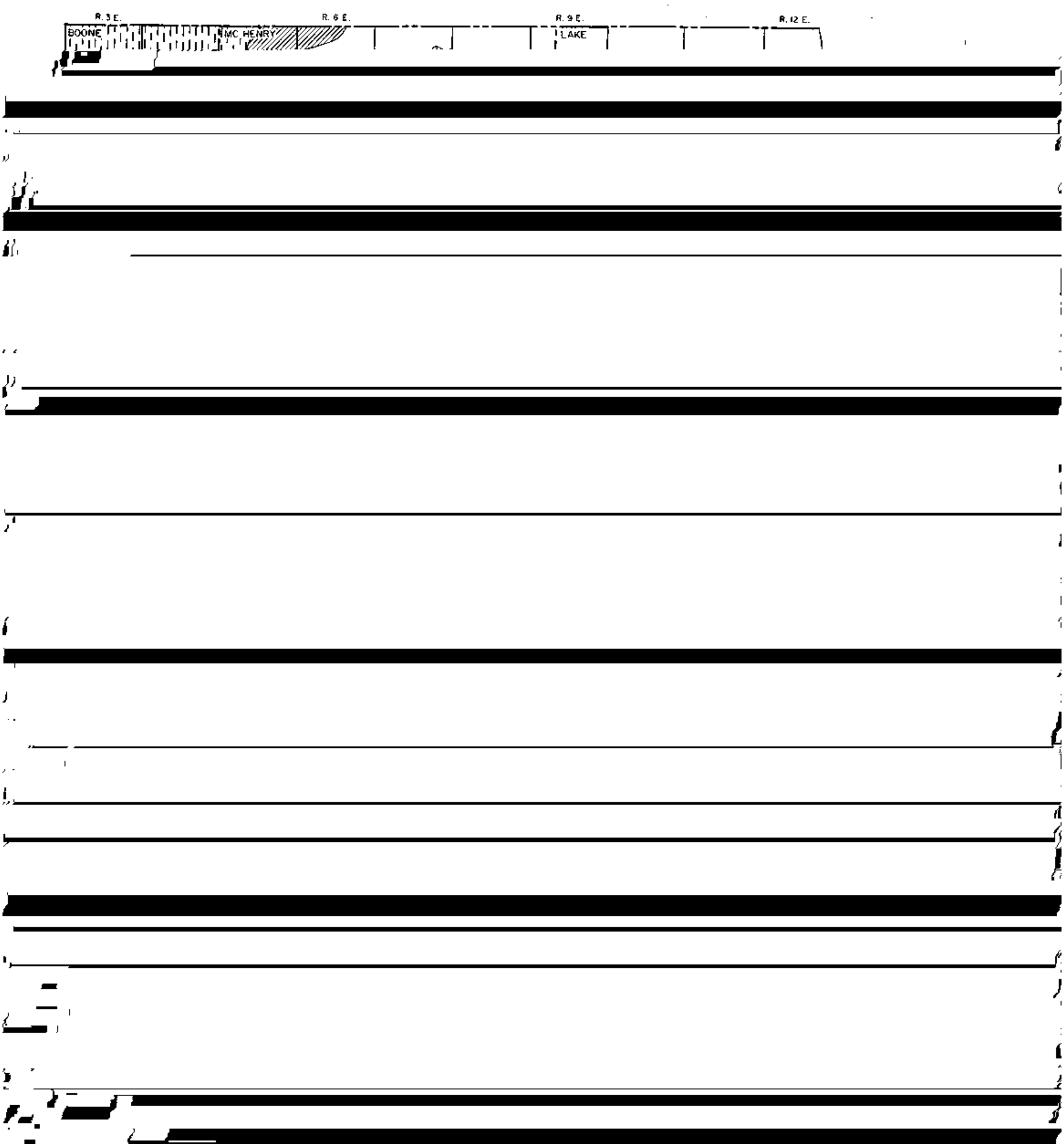


Fig. 16. Areal geology of the bedrock surface and major structures in the Chicago region.

SYSTEM	SERIES	GROUP OR FORMATION	HYDROLOGIC UNITS	LOG	THICKNESS (FT.)	DESCRIPTION
[illegible]	Pleisto-		Glacial			Unconsolidated glacial deposits - pebbly

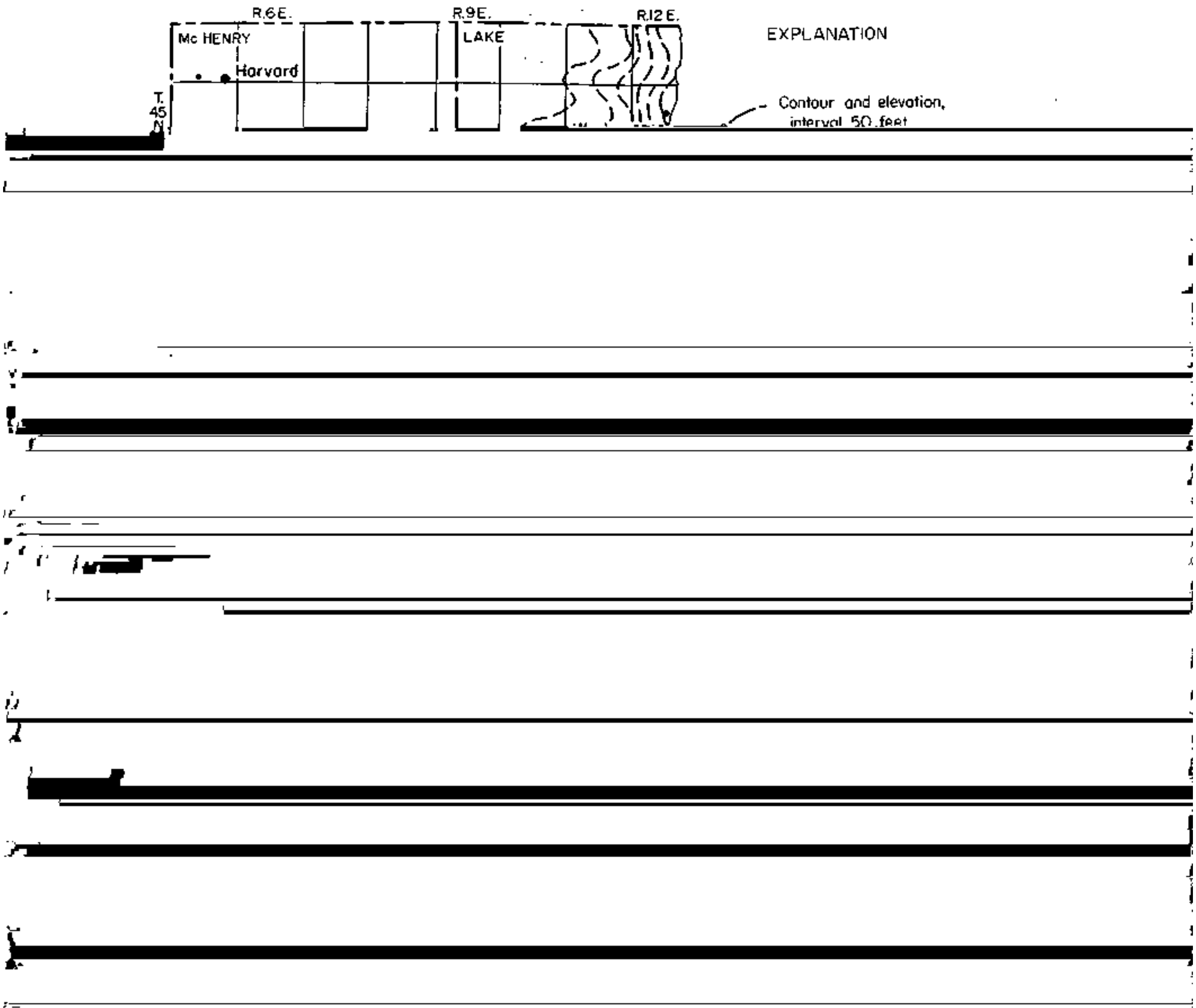
Fig. 17. Stratigraphy and water-yielding properties of the

DRILLING AND CASING CONDITIONS	WATER-YIELDING PROPERTIES	CHEMICAL QUALITY OF WATER	WATER TEMPERATURE °F
Boulders, heaving sand locally; [illegible]	Sand and gravel, permeable. [illegible]		46° min.

rocks and character of the ground water in the Chicago region.

SYSTEM	THIS REPORT	FOLEY, WALTON, & DRESCHER (1953)	WILLMAN & PAYNE (1942)	THWAITES (1927)	FISHER (1925)	ANDERSON (1919)

Fig. 18. Stratigraphic nomenclature used in this and previous reports relating to the Chicago region.


R.6E.
R.9E.
R.12E.
Mc HENRY
LAKE
Harvard
T. 45 N.
EXPLANATION
Contour and elevation, interval 50 feet

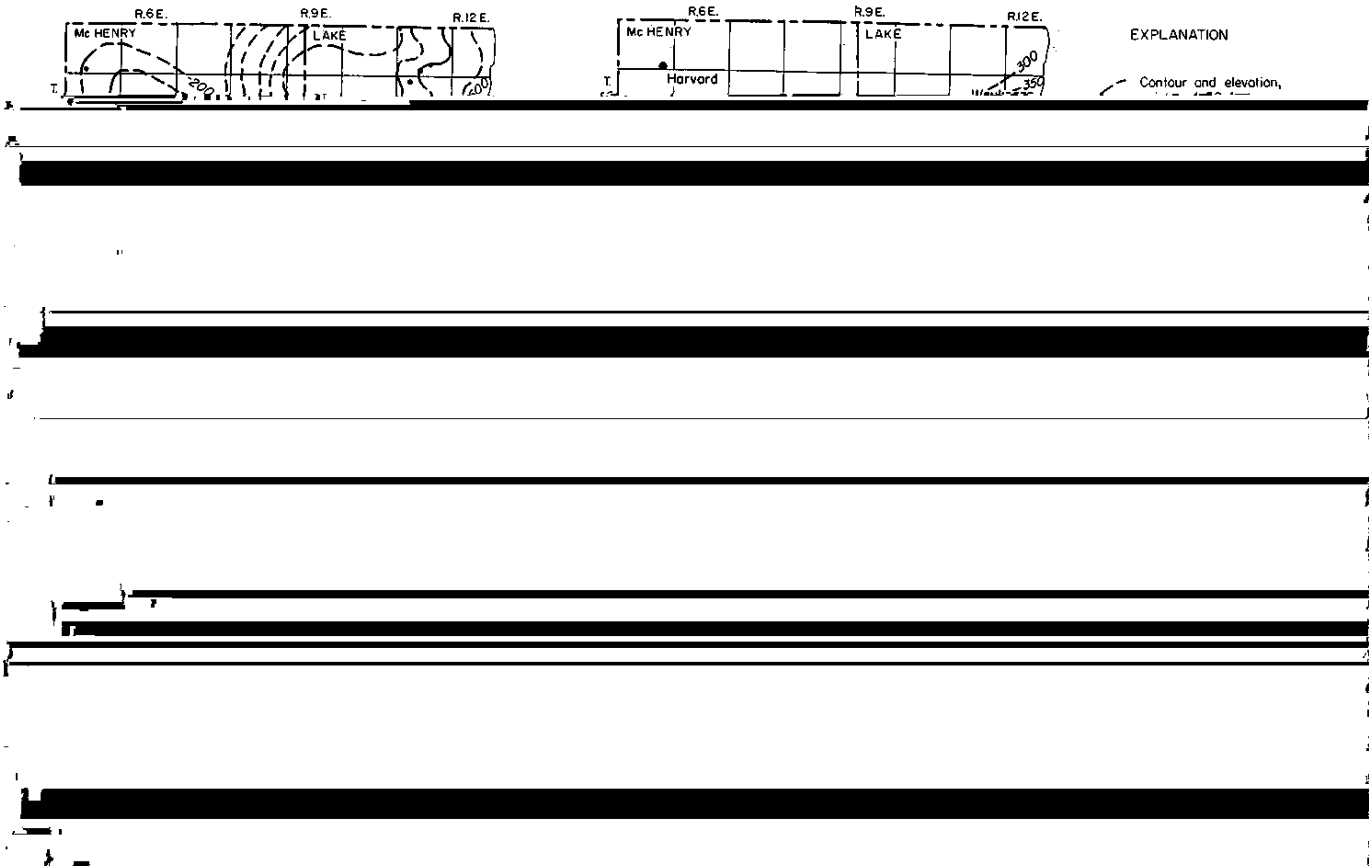


Fig. 20. Elevation of the top (A) and thickness of the upper and middle units (B) of the Eau Claire Formation.

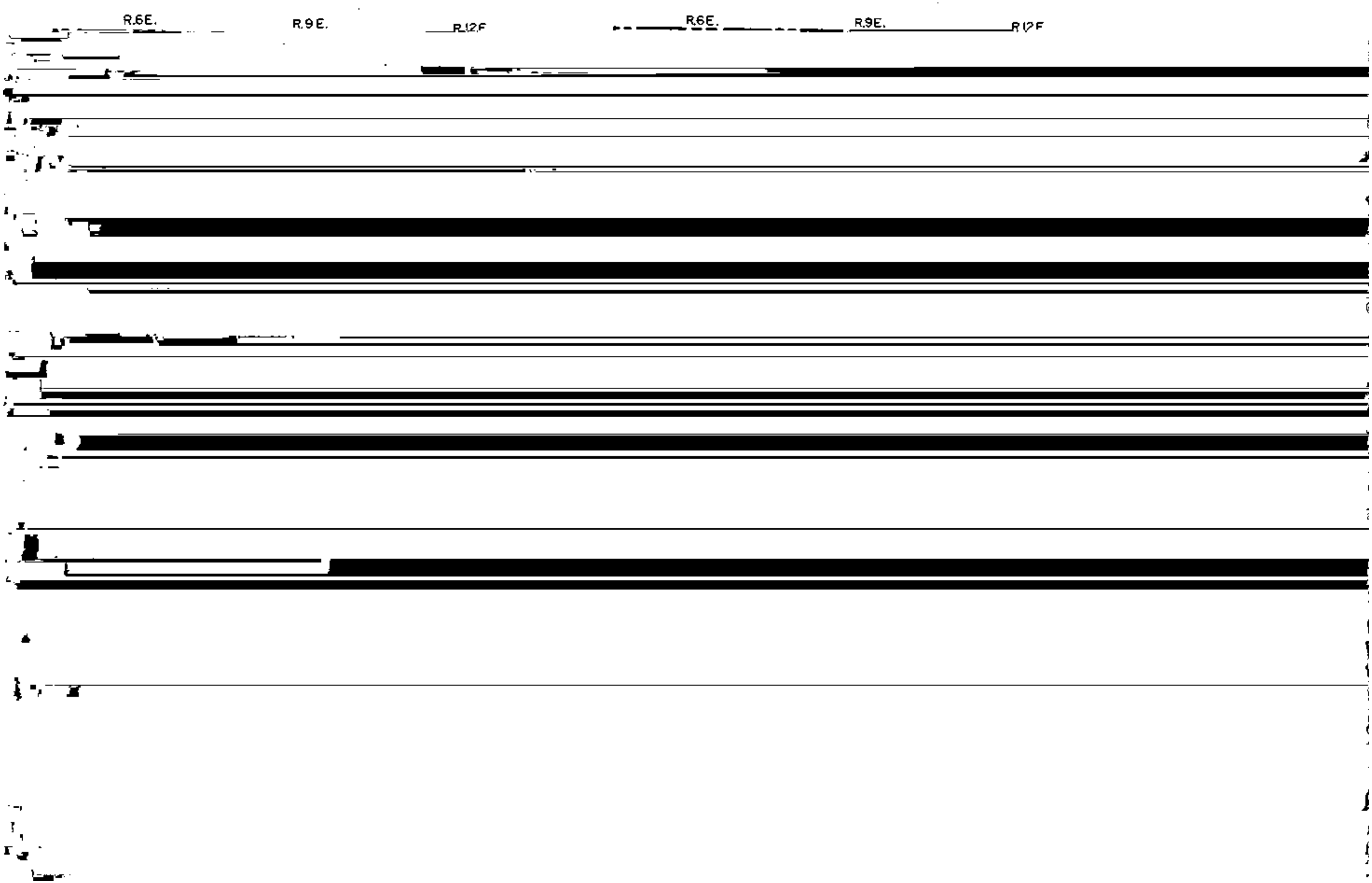


Fig. 21. Elevation of the top (A) and thickness (B) of the Ironton-Galesville Sandstone.

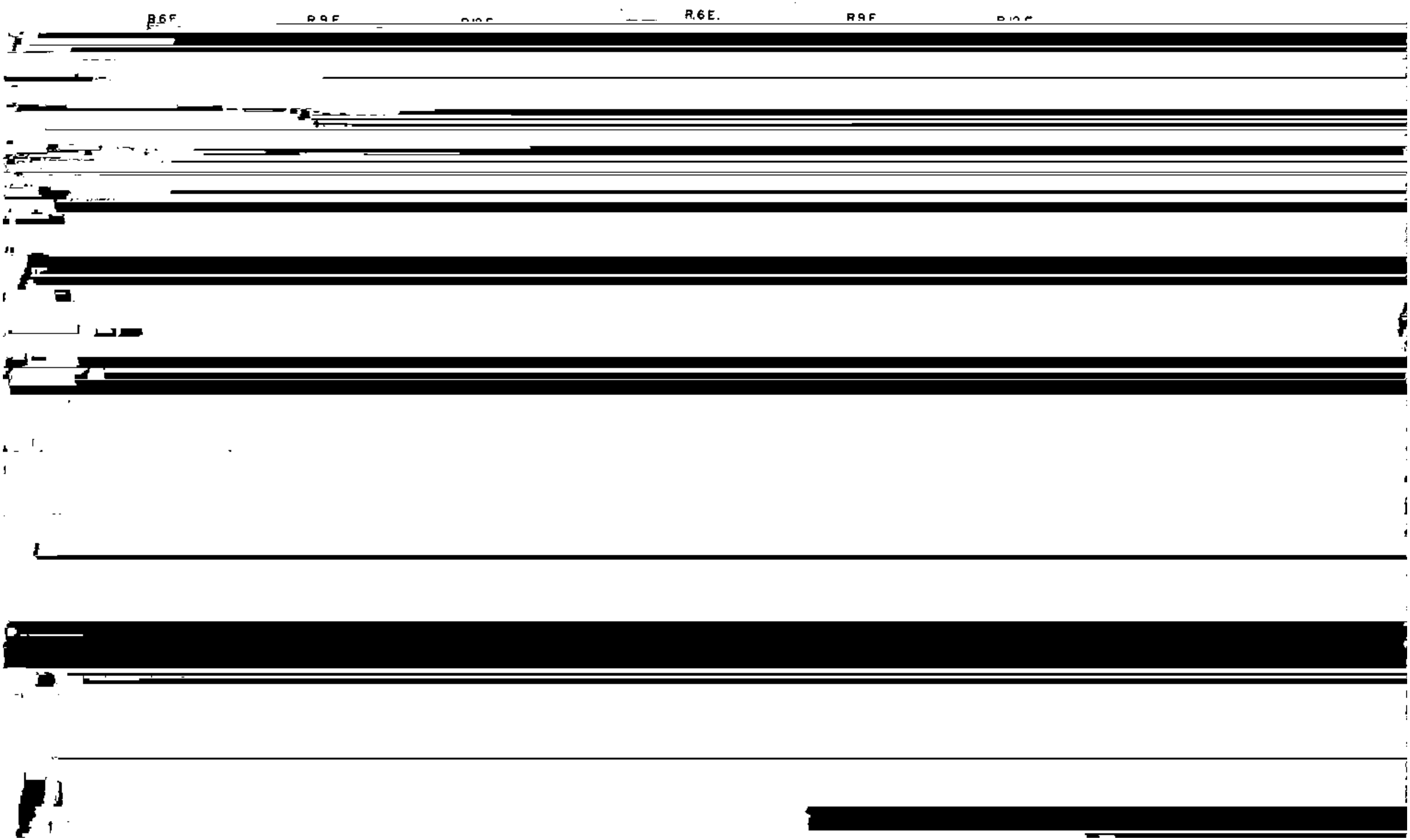
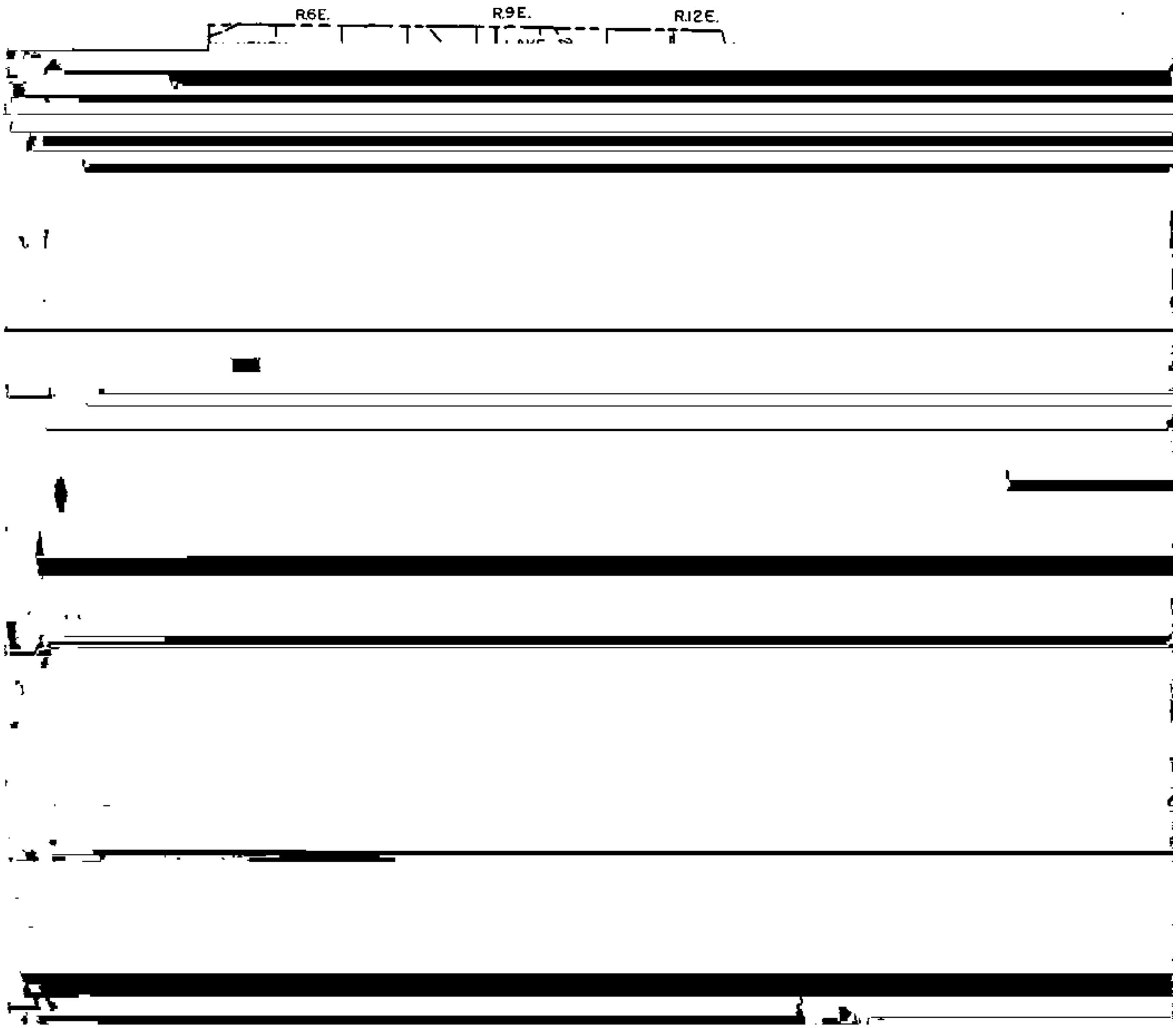


Fig. 22. Elevation of the top (A) and thickness (B) of the Glenwood-St. Peter Sandstone.


R.6E.
R.9E.
R.12E.

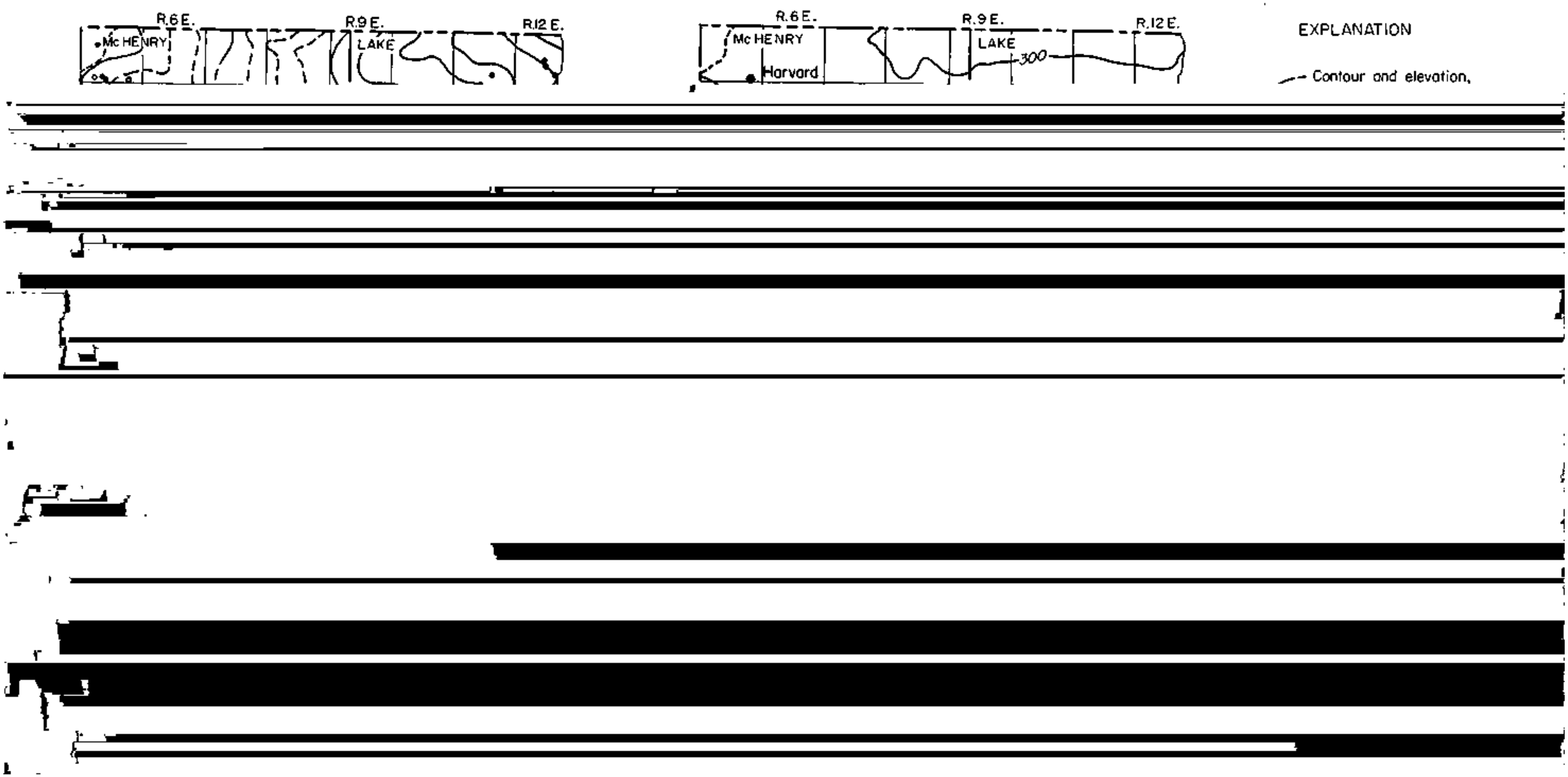


Fig. 24. Elevation of the top (A) and thickness (B) of the Galena-Platteville Dolomite.

The Maquoketa Formation can be divided into three units (fig. 25) : 1) lower shale, 2) middle dolomite and/or limestone and shale, and 3) upper dolomitic shale. There is commonly difficulty in separating the middle and upper units that may grade into each other.

The lower unit is normally a brittle, dark brown, occasionally gray or grayish brown, dolomitic shale grading' locally to dark brown, argillaceous dolomite. This

Fig. 25. Lithologic character and thickness of the upper (A), middle (B), and lower (C) units of the Maquoketa Formation.

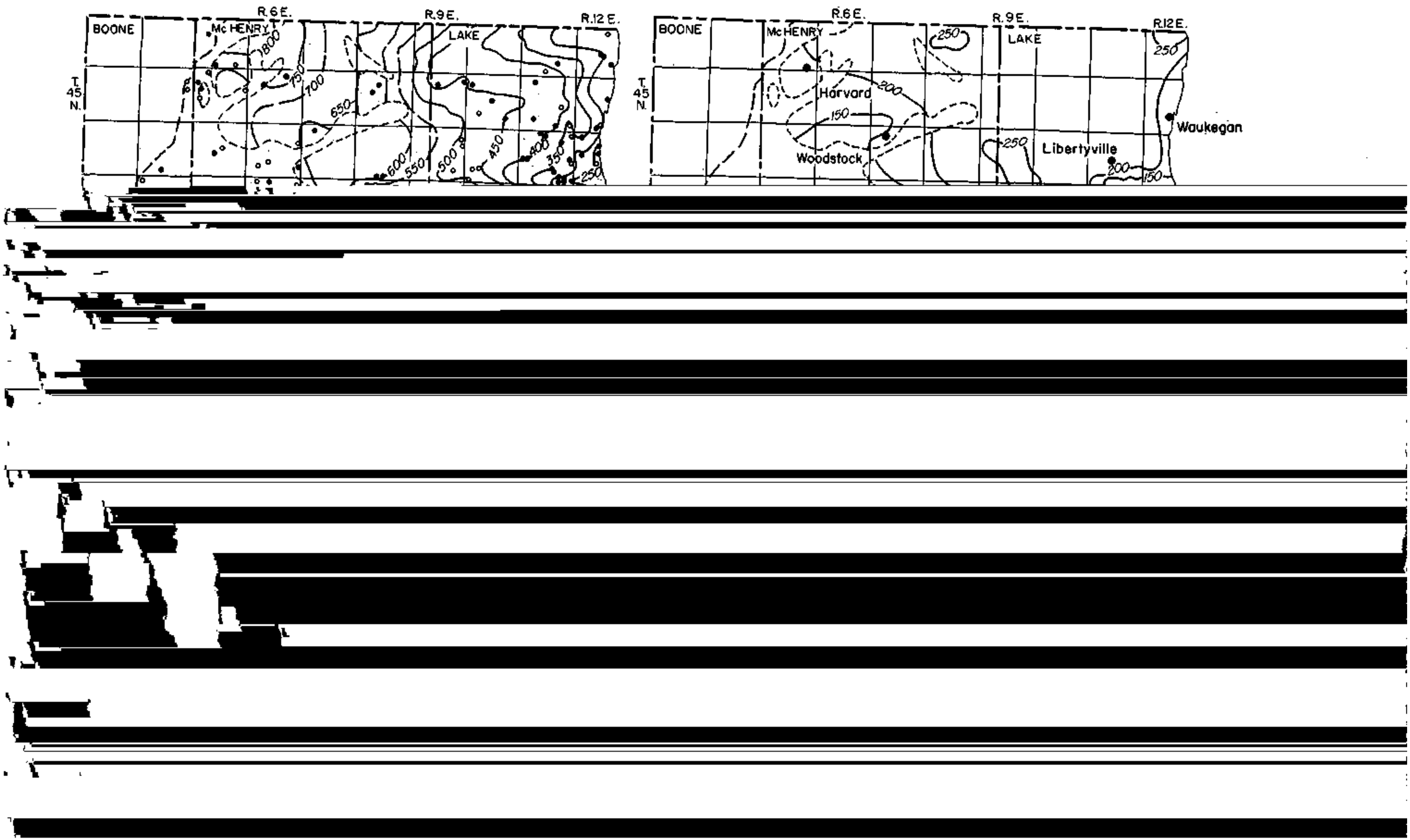
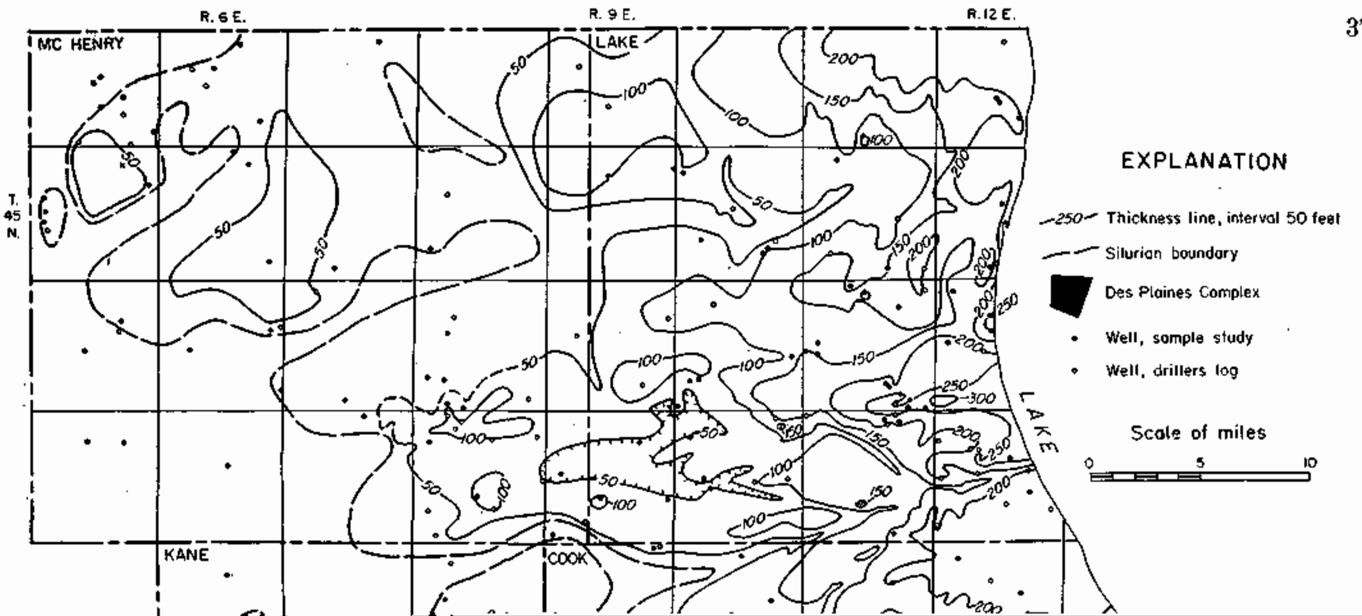


Fig. 26. Elevation of the top (A) and thickness (B) of the Maquoketa Formation.
Thickness is not shown where the Maquoketa crops out or directly underlies the glacial drift.

BEDROCK STRUCTUR


R. 6 E.
R. 9 E.
R. 12 E.
MC HENRY
LAKE
KANE
COOK
T. 45 N.
EXPLANATION
Thickness line, interval 50 feet
Silurian boundary
Des Plaines Complex
Well, sample study
Well, drillers log
Scale of miles
0
5
10

The bedrock surface is scored by a number of stream valleys and their tributaries whose bottom slopes are either directed eastward toward present Lake Michigan, southwestward toward the Illinois-Mississippi drainage system, or southward toward the Mahomet-Mississippi drainage system. Figure 14 shows the axes of the main valleys and the major drainage divide prior to glaciation of the region. The divide, passing from southeastern Will County to northwestern McHenry County, is well west of the present divide developed on the glaciated surface (fig. 4).

Most of the bedrock valleys

TABLE 4. CHARACTERISTICS OF GLACIOFLUVIAL DEPOSITS

Name	Form	Composition and structure
Esker	Winding ridge	Sand and gravel, poorly sorted; irregular, arcuate bedding
Kame	Hill or knoll	Coarse sand and gravel, poorly sorted; irregular bedding
Kame terrace	Knolly ridges or [illegible]	Sand and gravel, poorly [illegible]

Glaciolacustrine deposits consist of well sorted sand and gravel accumulated along beaches by wave action, inclined sand and gravel beds laid down in deltas, and fine sediment that settled in quiet waters off shore. They are characteristically found on the Chicago lake plain, though not restricted to it in the area of the report. The most extensive and conspicuous deposits of the lake plain are the beach ridges and spits (fig. 5). The prominence of some of the beach ridges was increased during glacial times by the deposition of wind-blown sand in the form of dunes.

Recent Deposits

Much of the deposition of sediments taking place today in the region involves the reworking or redistribution of glacial deposits. Silts, paraiso glaciation. The meltwater came from glacial lobes in northeastern Illinois, south-central Michigan, and northern Indiana. Outwash was deposited along the Fox River Valley. In the Kankakee Valley the water constituted a flood with currents that transported large slabs of limestone and built bars of rubble. The volume of water was so great that it could not all escape down the Illinois Valley and therefore rose to form a series of lakes between the younger Tazewell moraines (figs. 5 and 6B-B). In the lakes, channels were eroded and gravels were deposited by strong currents, silt and

The occurrence of unusual thicknesses of Glenwood-St. Peter in channel areas (fig. 22B) may result in greater yields where the sand is clean. Often, however, the thickening in the channel areas is a result of thickening of the lower shale or rubble zone, which does not readily yield water. Water in the lower part of the Glenwood-St. Peter in the channel areas may be slightly more highly mineralized because it circulates poorly in the less permeable part of the sandstone.

The Glenwood-St. Peter presents some difficulties in drilling and well construction because the friable sands tend to slough off and the lower shale and rubble zone tends to cave. It is common practice to set a liner through the lower part of the formation.

Prairie du Chien Series

The Shakopee and Oneota Dolomites are not well creviced and yield little ground water. The New Richmond Sandstone no doubt furnishes some ground water in deep rock wells, but its variation in dolomite content and thickness makes it unpredictable as a ground-water source.

Trempealeau Dolomite

The presence of water-yielding crevices in the upper part of the Trempealeau Dolomite in some wells is reported by drilling contractors and is indicated in a few caliper logs of deep wells. Crevicing may be related' to the unconformity between the Trempealeau and Prairie du Chien Series or, in the northern half of the region, between the Trempealeau and Glenwood-St. Peter Sandstone. Filling of the fissure systems has occurred locally. Where unusually high specific capacities of deep rock wells are obtained it is likely that cavities in the Trempealeau provide substantial quantities of water.

Franconia Formation

Althj6.351

openings has been controlled by fracture and bedding planes near the surface and by regional dips.

About 75 percent of the dolomite wells in a selected 17-township area in southern Cook and Will Counties are completed within the upper 75 feet of the rock (fig. 41).

Because the openings occur mainly in the upper part of the rock it is likely that there is good connection with the overlying glacial drift.

In the circulation of ground water in other limestone terrains, concentration of flow and greater velocities near the points of discharge along drainage lines result in the enlargement of channels. If in the northeast region of Illinois the bedrock valleys were lines of discharge during the development of solution openings, they should be bordered by areas of high permeability and consequently high productivity. Available production figures are inadequate to test this hypothesis.

There is, however, an additional reason why higher yields may be anticipated in the areas underlying and adjoining bedrock valleys. As openings in the dolomite are connected with porous zones in the drift, it follows that where

Glacial fill in buried bedrock valleys (figs. 6 and 17)

1. Troy Valley.
2. Newark Valley.
3. Hadley Valley.

Buried sand and gravel deposits of various origins (figs. 2, 5, and 6)

1. Lemont drift of Joliet, Orland Park, Downers Grove, and Worth area.
2. Marseilles sand

PUBLIC SUPPLIES

Municipal

The data on municipal pumpage from 1938 to 1955 inclusive (table 5) have been taken as published periodically by the Illinois Department of Public Health. The data for 1957 (table 5) were collected by the State Water Survey.

In general table 5 shows a steady increase in municipal pumpage. The reductions shown for the 1938-1944 period are attributed to extension of Lake Michigan supplies to communities in Cook and Lake Counties that formerly were supplied by well water. In McHenry County the apparent decline is nop

County	Glacial drift aquifers	Shallow dolomite aquifers	Deep aquifers
Cook	(0)*	11,955(15)*	10,615(10)*
DuPage	(0)	10.759(15)	4.809 (4)
[illegible]			

	Glacial drift	Shallow dolomite	Deep
[illegible]			

County	Year 1938	1944	1948	1955	1957
Cook	11,456	10,280	12,659	17,166	22,570
DuPage	4,385	6,726	7,045	9,764	15,568
Grundy	400	422	889	1,065	1,313
Kane	7,263	9,833	10,546	12,727	14,357
Kendall	110	265	265	578	596
Lake	1,080	990	1,653	1,980	2,904
[illegible]					

TABLE 8. ESTIMATED INDUSTRIAL PUMPAGE BY APPARENT SOURCE. 1957

In 1,000 gallons per day

County	Glacial drift aquifers	Shallow dolomite aquifers	Deep aquifers	Total
Cook	negligible	482	21,035	21,517
DuPage	neg.	784	673	1,457
Grundy	neg.	neg.	neg.	neg.
Kane	72	569	1,950	2,591
Kendall	neg.	neg.	neg.	neg.
Lake	neg.	neg.	269	269
McHenry	neg.	neg.	456	456
Will	neg.	258	8,684	8,942
Total	72	2,093	33,067	35,232

RURAL NON-IRRIGATION SUPPLIES

Pumpage for farms and individual residences is rarely measured. The data summarized in table 9 are estimates obtained by considering the rural population of each county as given in the 1950 report of the U.S. Bureau of the Census, the population increase for 1956 as shown by the Illinois Department of Public Health, and the probable percentage of the population which depends on individual water supplies. Based on a survey of selected rural areas within the Chicago region, it was determined that the per capita use averages 50 gallons per day. This figure, as determined by the sampling, should not be confused with higher use per capita figures commonly cited which include municipal, industrial, and commercial uses. Rural non-irrigation, in this report, refers to domestic and livestock uses.

None of this pumpage is from the deeper sandstones. Much of the pumpage from the glacial drift is from dug wells. Currently, many wells in the shallow aquifers are equipped with electric pumps. Although these installations are still in the minority, their pumpage is greater because they are more convenient than manually operated pumps.

The total rural non-irrigation pumpage amounts to 13,160,000 gpd which is about one fourth of the total pumpage from the shallow aquifers. The water comes from small, wells of low capacity that are distributed generally throughout the region. Being widely distributed, these wells make an efficient use of ground water, without the problems of interference and drawdown inherent in the industrial and municipal pumpage.

TABLE 9. ESTIMATED RURAL NON-IRRIGATION PUMPAGE BY APPARENT SOURCE, 1957

In 1,000 gallons per day

IRRIGATION SUPPLIES

Farm

There are 45 known irrigation systems in the eight counties, but only 12 of these, as summarized in table 10, use ground water. Pumpage for irrigation is irregular in that it is highly seasonal and also varies greatly from year to year. The momentary use may be high but of short duration. The total pumpage is calculated on an annual basis. Ground-water pumpage for irrigation is from the glacial drift and shallow dolomite aquifers.

Golf Courses and Cemeteries

The pumpage shown in table 11 is used primarily for irrigating grass and perennial plants in golf courses and cemeteries throughout the growing season. Wells in glacial drift aquifers were not considered in this table and are 5745622 Tw0.41 315.600 526.800 Tm0 Tw0.377m00 526.800

County	No. of systems	Glacial drift aquifers	Shallow dolomite aquifers	Total pumpage
Cook	3	0	9.0	9.0
DuPage	1	3.5	0	3.5
Lake	1	3.0	0	3.0
McHenry	1	4.0	0	4.0
Will	6	0	12.5	12.5
Total	12	10.5	21.5	32.0

County	Shallow aquifers	Deep aquifers	Total
Cook	188	196	384
DuPage	116	negligible	116
Kane	25	neg.	25
Lake	20	neg.	20
McHenry	8	neg.	8
Will	10	neg.	10
Total	367	196	563

TABLE 12. SUMMARY OF ESTIMATED TOTAL PUMPAGE BY USE, 1957

In 1,000 gallons per day

County	Public	Industrial	Non-Irrig.	Irrig.	Total
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 13. SUMMARY OF ESTIMATED TOTAL PUMPAGE BY APPARENT SOURCE, 1957

In 1,000 gallons per day

County	Glacial drift aquifers	Shallow dolomite aquifers	Deep aquifers	Total
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Fig. 28. Pumpage per square mile from shallow aquifers.

Fig. 29. Pumpage per square mile from deep aquifers.

DISTRIBUTION AND DENSITY OF PUMPAGE

Pumpage from the shallow aquifers and the deep aquifers was grouped into districts consisting of one or more townships, and the average pumpage per square mile (density of pumpage) for each district was computed. The areal extent, pumpage, and density of pumpage for each district are given in table 14. The density of pumpage for the shallow aquifers and the deep aquifers in the various districts is shown graphically in figures 28 and 29.

Township	Range	Shallow	Deep	Shallow	Deep
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

HYDROLOGY OF AQUIFERS

CAMBRIAN-ORDOVICIAN AND MT. SIMON AQUIFERS

The Cambrian-Ordovieian Aquifer consists in downward order of the Galena-Platteville Dolomite, Glenwood-St. Peter Sandstone, Prairie du Chien Series, Trempealeau Dolomite, Franconia Formation, and Ironton-Galesville Sandstone. It is considered in most detail in this report.

The Ironton-Galesville Sandstone is the most productive formation of the group. The Galena-Platteville Dolomite and Prairie du Chien Series generally are not well creviced and are not major contributors. The Trempealeau Dolomite is locally well creviced and is partly responsible for exceptionally high yields of several deep wells in the Chicago-Joliet-Fox Valley area. The Mt. Simon Aquifer, consisting of the sandstone of the Mt. Simon and lower Eau Claire Formations (fig. 19), yields moderate supplies in the western part of the area where the water is of acceptable quality.

The Maquoketa Formation above the Galena-Platteville Dolomite acts as a barrier between the shallow dolomite and deeper aquifers and confines the water in the deeper aquifers under artesian pressure. Any original differences in artesian pressure among the units of the Cambrian-Ordovician Aquifer have been largely equalized by the great number of wells open in all units. Available data indicate that on a regional basis, the entire sequence of strata, from the top of the Galena-Platteville to the top of the shale beds of the Eau Claire Formation, essentially behave hydraulically as one aquifer. Some differences in pressure in the various strata probably still exist in places where the permeability of intervening beds is low and there are not enough wells to have permitted equalization. However, the entire sequence of strata is treated as one aquifer in this report.

The Mt. Simon Aquifer beneath the Eau Claire Formation is fairly permeable and yields moderate amounts of water to wells. The Cambrian-Ordovician Aquifer is effectively separated from the Mt. Simon Aquifer by impermeable beds of the Eau Claire Formation. The artesian pressure in the Mt. Simon Aquifer is greater than that in the Cambrian-Ordovieian Aquifer.

In wells open to the Cambrian-Ordovieian Aquifer, Silurian age dolomite, and Mt. Simon Aquifer, ground water moves downward from the dolomite and upward from the Mt. Simon into the Cambrian-Ordovieian Aquifer.

HYDRAULIC PROPERTIES

The significant hydraulic properties of aquifers are expressed mathematically by the coefficients of transmissibility, T, and storage, S. The capacity of a formation to transmit ground water is expressed by the *coefficient of transmissibility,j04 Tc expr6ee Gauife0 Tc(dl) Tj3.r75 Tw0.317 Tc45.920 Tm0 Tw0.359 6(Simo) Tj0 Tc(Tc(s) 3 T*

$$T = \frac{527.7\ Q \log_{10} \frac{r_2}{r_1}}{s_1 - s_2} \qquad (1)$$

$$s = \frac{114.6\ Q}{T} \int_u^\infty \frac{e^{-u}}{u}\, du \qquad (2)$$

$$s = \frac{114.6\ Q}{T} \left(-0.5772 - \log_e u + u - \frac{u^2}{2.2!} + \frac{u^3}{3.3!} - \frac{u^4}{4.4!} \ldots \text{etc.}\right)$$

TABLE 15. REPRESENTATIVE COEFFICIENTS OF TRANSMISSIBILITY OF THE CAMBRIAN-ORDOVICIAN AQUIFER

County	Well owner	Depth of well (feet)	Date of test	Pumping rate (gpm)	Coefficient of transmissibility (gpd/ft)
Boone	City of Belvidere	1861	1951	615	17,500
[redacted]					
Boone	City of Belvidere	1800	1943	852	22,500
Boone (Belvidere)	Keene Canning		1942	392	19,900
Cook	Corn Products Refining Co.	1543	1942	510	15,600
Cook	Corn Products Refining Co.	1525	1944	765	17,200
Cook	Corn Products Refining Co.	1481	1945	1020	17,200
Cook	Village of Arlington Heights	1525	1946	870	16,800
[redacted]					
Cook	Red River Refinery	1625	1946	320	17,000
Cook	Mars Inc.	1978	1942	839	16,000
Cook	City of Chicago Heights	1794	1942	650	11,600
Cook	Village of Glenview	1251	1916	146	17,200
Cook	Baxter Lab.	1500	1946	239	15,300
Cook	Village of Mt. Prospect	1370	1951	715	18,100
Cook	Village of Riverside	2047	1944	876	17,100
Cook	Village of South Chicago Heights	2756	1941	420	10,800
Cook	Village of Willow Springs	1542	1952	1100	20,600
DeKalb	City of DeKalb	1331	1947	1000	23,200
DeKalb	City of DeKalb	1325	1930	180	18,200
DeKalb	City of DeKalb	1291	1952	1130	24,100
DeKalb	Village of Hinckley	708	1947	200	17,100
DeKalb (DeKalb)	C. M. St. P. & P. R. R.	737	1934	200	23,100
DeKalb	Village of Malta	853	1942	100	12,400
DeKalb	City of Sandwich	600	1949	730	26,900
DuPage	Village of Bensenville	1445	1954	230	17,800
DuPage	City of Elmhurst	1480	1944	625	18,000
DuPage	City of Elmhurst	1480	1944	920	14,700
[redacted]					

lowered in

$$t = \frac{R^2S}{112T_e \log_{10}\left(\frac{2R}{r}\right)^2}$$

boundaries. A recharge boundary exists about 47 miles west of Chicago (see subsequent section on recharge). Geologic and hydrologic data collected in northern Illinois indicate that permeabilities in the Cambrian-Ordovician Aquife

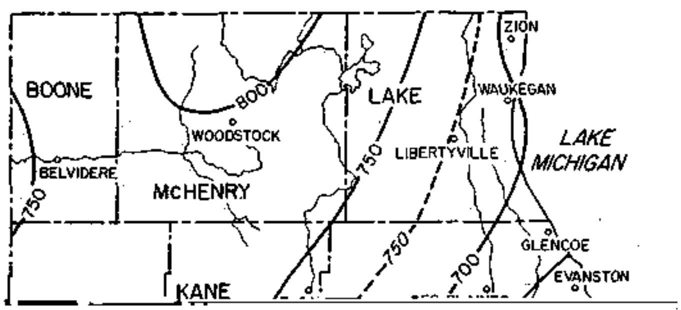


TABLE 18. WATER LEVELS IN DEEP WELLS ABOUT 1915
Elevations in Feet Above Mean Sea Level

Location	Owner	Depth of well (feet)	Surface elevation	Depth to water (ft.) above surface (+)	Date	Water-level elevation
Boone County						
Belvidere	City of Belvidere	1950	755	8	1909	747
[redacted]						
Summit	Corn Products Refining Co.	1638	592	187	1915	405
Bellwood	Village of Bellwood	1538	635	75	1913	560
Berwyn	City of Berwyn	1650	605	166	1914	439
Blue Island	City of Blue Island	1649	641	231	1914	410
Chicago Stock Yards	Chicago Stock Yards Companies	1600	592	239	1915	353
Chicago, Pitney Ct., & Archer Ave.	Light & Coke Co.	1800	588	213	1914	375
Chicago, 26th St. & Blue Island Ave.	McCormick Reaper Co.	1744	590	219	1914	371
[redacted]						

Location	Owner	Depth [illegible] well (feet)	[illegible] elevation	Depth [illegible] water (feet)	Date	Water-[illegible] elevation
Boone County						
Belvidere	City of Belvidere	1800	778	40	1957	738
Cook County						
Chicago	American Can Co.	1806	630	492	10/57	138
[redacted]						
Arlington Heights	City of Arlington Heights	1525	686	380	5/58	306
Arlington Heights	Arlington Park Jockey Club	1825	730	373	2/58	357
North Lake	Automatic Electric Co.	1900	655	441	5/57	214
Morton Grove	Avon Products Inc.	1525	644	335	3/58	309
Morton Grove	Baxter Lab. Inc.	1700	627	348	7/58	279
[redacted]						
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[redacted]						

TABLE 19. (Continued)

Location	Owner	Depth of well (feet)	Surface elevation	Depth to water (feet)	Date	Water-level elevation
DuPage County						
Bensenville	Village of Bensenville	1442	676	448	5/58	228
Bensenville	Village of Bensenville	1445	670	431	5/58	239
Bensenville	C. M. & St. P. & P. R.R.	1461	671	443	5/58	228
Elmhurst	City of Elmhurst	2194	680	385	3/58	295
Elmhurst	City of Elmhurst	1502	690	558	4/58	132
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 19. (Continued)

		Depth of well	Surface eleva-	Depth to water		Water-level eleva-
Livingston County						
Cardiff	Cardiff	1785	638	121	10/58	517
Odell	Village of Odell	1941	720	129	10/56	591
McHenry County						
Crystal Lake	City of Crystal Lake	1218	917	293	3/57	624
Crystal Lake	City of Crystal Lake	1555	930	295	3/57	635
Huntley	Dean Milk Co.	1610	890	159	7/58	731
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

in the piezometric surface occur in the vicinity of Elmhurst and at Des Plaines. A significant feature shown in figure 34 is the bending of isopiestic lines around pumpage centers in the Elgin and Aurora areas along the Fox Valley in Kane County.

Changes in artesian pressure produced by pumping since the days of early settlement have been pronounced and widespread. The artesian pressure in the vicinity of Chicago has declined on the average about 600 feet. In 1864 the 700-foot isopiestic line passed through Chicago. By 1958 the 700-foot isopiestic line had migrated northwestward about 52 miles to a position in western McHenry County and eastern DeKalb County. A ground-water divide exists in eastern Boone County and in northeastern DeKalb County.

The general pattern of flow of water in the Cambrian-Ordovician Aquifer in 1958 is slow movement from all directions toward the deep cones of depression centered at Chicago and at Joliet. Some of the water flowing toward Chicago and Joliet is intercepted by cones of depression developed locally within the large cones in the Aurora, Elgin, Des Plaines, and Elmhurst areas. The lowering of head that has accompanied the withdrawals of ground water has established steep hydraulic gradients west and north of Chicago, and large quantities of water are at present beingydrauli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recharge may be derived in the future from the Lake Michigan basin. The present study indicates no significant amount of recharge from Lake Michigan at this time.

MOVEMENT OF WATER IN CAMBRIAN-ORDOVICIAN AQUIFER

The quantity of water percolating through a given cross section of an aquifer is proportional to the hydraulic gradient (slope of the piezometric surface) and the coefficient of transmissibility, and it can be computed by using the following modified form of the Darcy equation (see Ferris, 1951, p. 226):

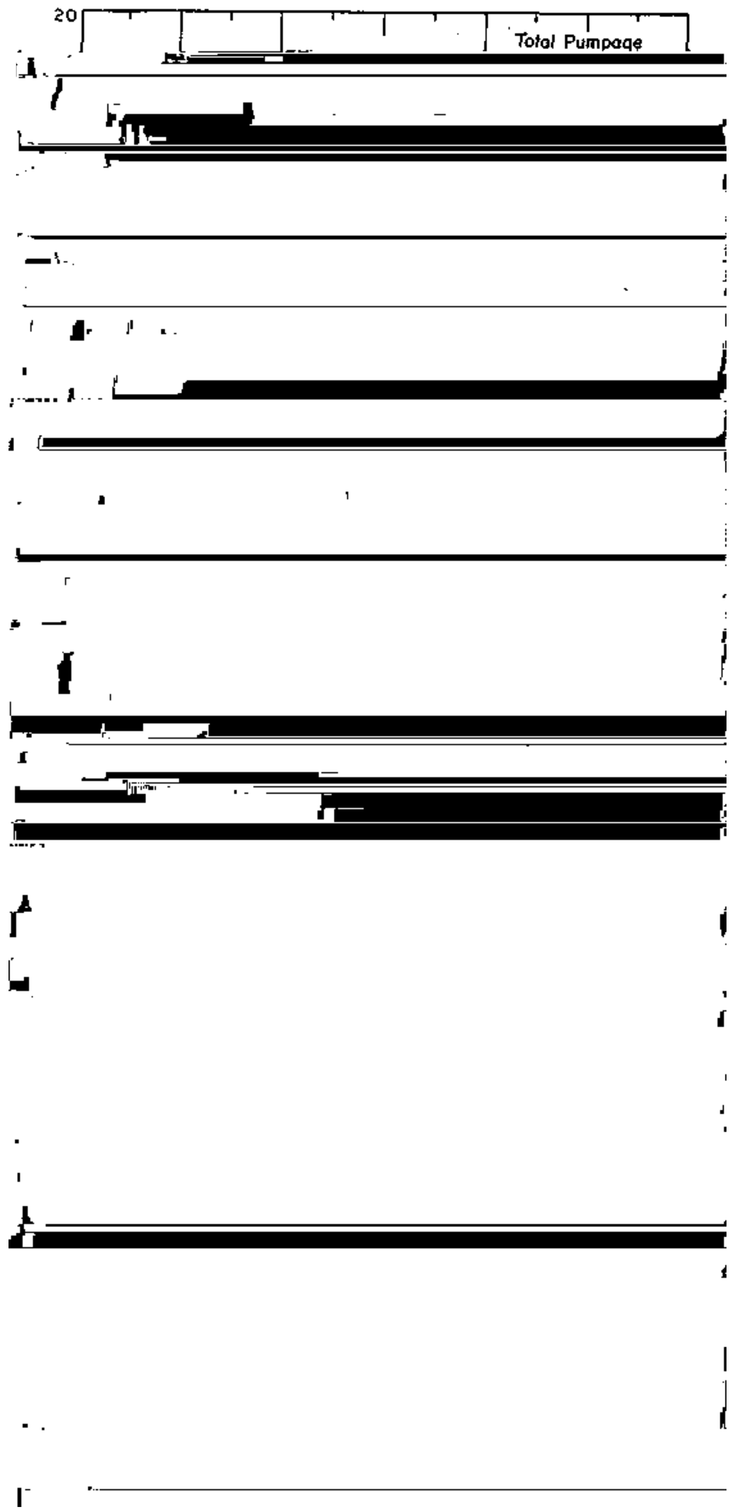
$$Q = TIL \qquad (3)$$

in which Q is the discharge in gallons per day; T is the coefficient of transmissibility in gallons per day per foot; I is the hydraulic gradient in feet per mile; and L is the width of the cross section through which discharge occurs in miles.

A study was made of the movement of ground water towards Chicago in response to the natural hydraulic gradient of the piezometric surface. Flow lines were drawn from McHenry and Kane Counties toward the northern and southern boundaries of Cook County at right angles to the estimated piezometric surface contours for 1864 given in figure 32. These two flow lines delimit the section of the Cambrian-Ordovician Aquifer through which water was

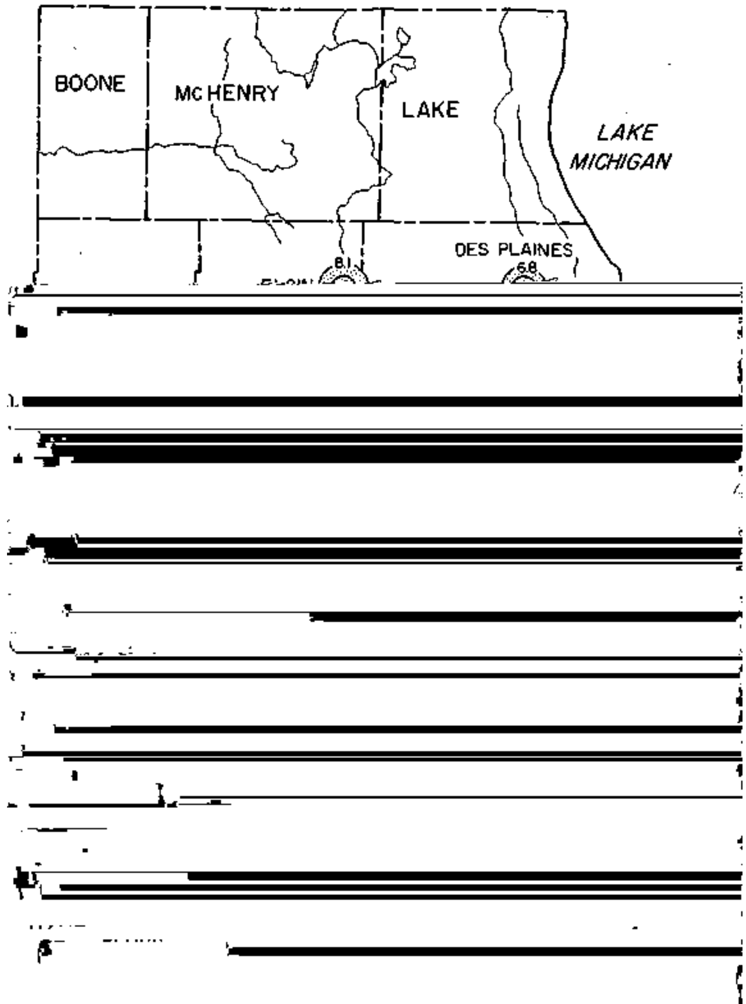
TABLE 20. AMOUNT OF WATER MOVING INTO THE CONES OF DEPRESSION OF PUMP009c(i3E) Tj

Pumping center	Water (*mgd*)
Chicago area	11.0
Joliet area	11.6
Elmhurst area	5.3
Des Plaines area	3.5
Elgin area	4.1
Aurora area	7.3
Total	42.8



Pumping center	1908 Total pumpage (*mgd*)	1958 Total pumpage (*mgd*)
Chicago area	21.3	23.4
Joliet area	1.8	14.0
Elmhurst area	0.4	9.8
Des Plaines area	0.4	6.8
Elgin area	[illegible]	[illegible]

In 1908, 50 years ago, there was very little pumpage outside Chicago except at Aurora and Elgin (table 21). Since that time the net increase in pumpage at Chicago has been only about 10 percent although in the 1920's and 1940's much higher pumping rates were obtained. Pumpage in areas near Chicago (Elmhurst and Des Plaines) has increased to 15 times that recorded in 1908. During the past 50 years, pumpage at Joliet has increased from 1.8 to 14.0 mgd and pumpage along the Fox Valley in the Aurora and Elgin areas has more than

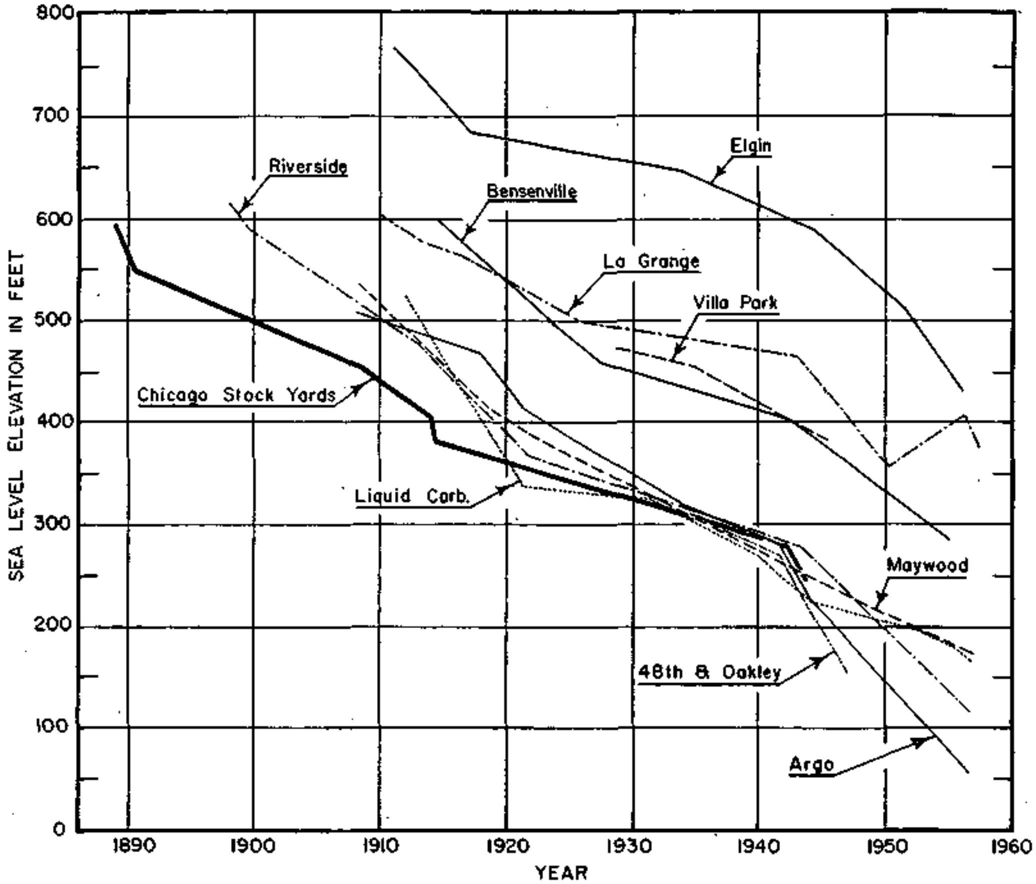


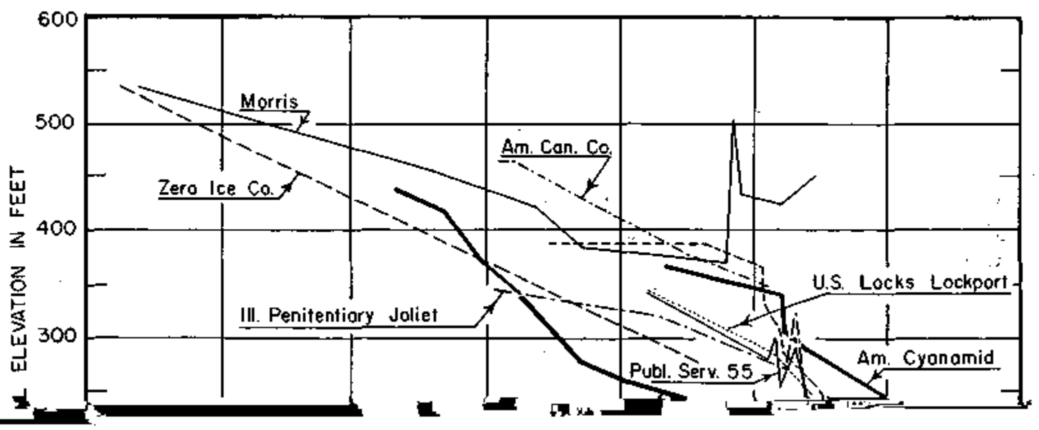
DECLINE OF ARTESIAN PRESSURE IN CAMBRIAN-ORDOVICIAN AQUIFER

In 1864 the artesian pressure in the Cambrian-Ordovician Aquifer was sufficient to cause wells to flow in many parts of the Chicago-Joliet-Fox Valley area. The estimated isopiestic lines in figure 32 indicate that in 1864 the average elevation of the piezometric surface at Chicago and Joliet was about 700 feet. By 1895 the pressure had dropped in response to withdrawals of water to elevations of about 550 feet at Chicago and 600 feet at Joliet. In a period of 31 years, water levels at Chicago had declined about 150 feet or at a rate of about five feet per year because large amounts of water were being taken from storage within the aquifer. As pumping continued, the nonpumping water levels continued to decline, and by 1915 were 400 feet above sea level at Chicago and Joliet. The average rate of decline and total decline in artesian pressure at Chicago, 1895-1915, were about 7.5 feet per year and 150 feet respectively.

As a result of continued heavy pumping, the nonpumping water levels in deep wells declined from an elevation of 400 feet in 1915 to about 50 feet at Chicago and about 25 feet at Joliet in 1958 (fig. 34). The average rate of decline at Chicago in the 43-year period, 1915-1958, was eight feet per year. In many areas the average rate of decline has increased during recent years to more than 10 feet per year in response to progressive increases in pumpage.

Since 1864 the artesian pressure at Chicago has declined about 660 feet. The average rate of decline, 1864-1958, was 7.1 feet per year. Figures 38 and 39 show the rates of decline of artesian pressure at Chicago and at


SEA LEVEL ELEVATION IN FEET
YEAR
Elgin
Riverside
Bensenville
La Grange
Villa Park
Chicago Stock Yards
Liquid Carb.
Maywood
48th & Oakley
Argo
800
700
600
500
400
300
200
100
0
1890
1900
1910
1920
1930
1940
1950
1960


ELEVATION IN FEET
Morris
Am. Can. Co.
Zero Ice Co.
U.S. Locks Lockport
Ill. Penitentiary Joliet
Am. Cyanamid
Publ. Serv. 55
600
500
400
300

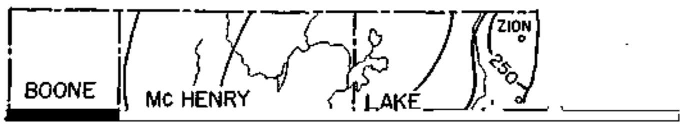


Fig. 40.

Predicted ele-

Pumping center	Fractional decline in feet
Chicago area	215.5
Joliet area	80.4
Elmhurst area	55.0
Des Plaines area	16.8
Elgin area	27.2
Aurora area	55.1
Total	450.0

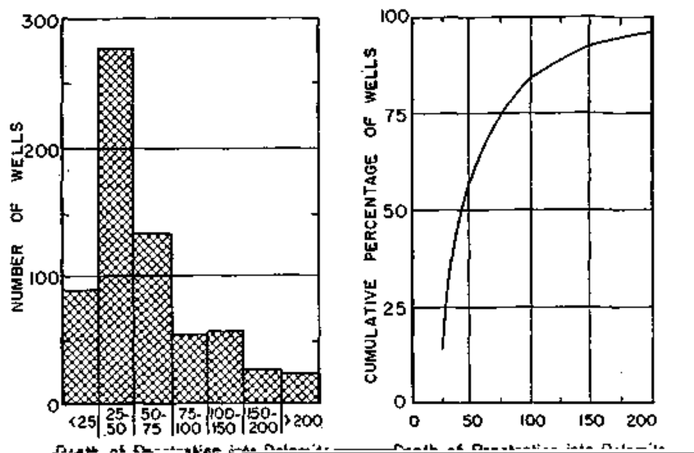
and dolomites of the Maquoketa and Galena-Platteville Formations in the western part of the region.

Ground water occurs in joints, fissures, and solution channels that range in size from hairline cracks to caverns. The locations of these openings cannot be predicted from the surface. Locally such openings may be partly filled with silt and clay which may be troublesome in development of wells. However, the upper part of the dolomite is usually the most productive. The thickness of the Silurian rocks ranges from a feather edge in the western part of the area to more than 450 feet in the southeast (fig. 27). Silurian rocks are the primary source of water for most household and farm wells and for many municipal and industrial wells. Many of the wells penetrate only the upper part of the dolomite, as shown in figure 41. Usually only the municipal and industrial wells penetrate the entire thickness of the aquifer.

The daily pumpage during 1957 from wells penetrating the shallow dolomite aquifers is given in table 13. The greater part of this pumpage occurs in Cook and DuPage Counties. Many high capacity wells have been constructed in parts of these counties where many crevices have been encountered.

A study was made of the specific capacities of municipal and industrial supply wells in the shallow dolomite in Cook, DuPage, Kane, Lake, McHenry, and Will Counties. Specific-capacity data obtained from the files of the State Water Survey, for 154 wells, are given in table 24. The data for the counties are summarized in table 25.

Specific capacities listed in the tables range from 0.1 to 550 gpm per foot. Wells(pe) Tj0 Tc(r) z nhav th1



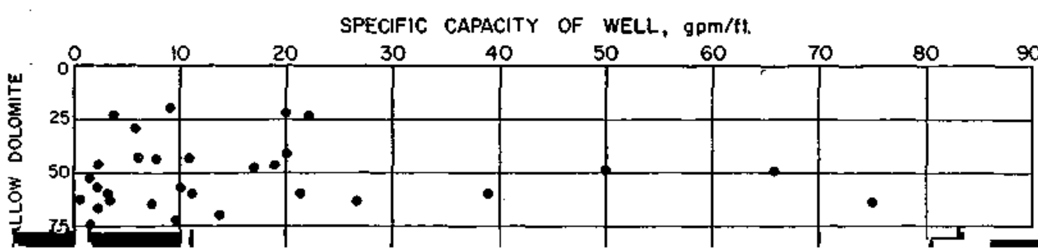


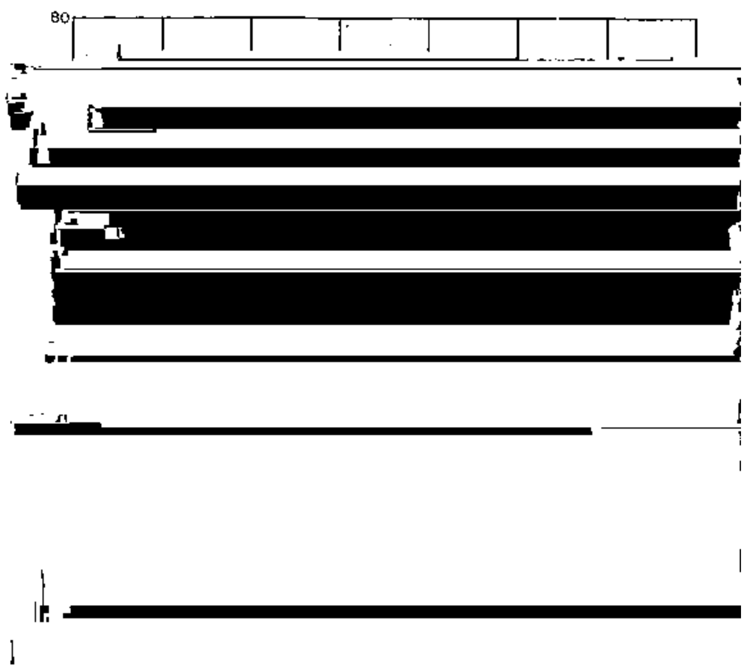
TABLE 24. SPECIFIC-CAPACITY DATA FOR WELLS IN SHALLOW DOLOMITE

Location and owner of well	Well No.	Depth of well (feet)	Diameter of casing (inches)	Penetration of well below top of aquifer (feet)	Date of test	Nonpumping level (feet)	Pumping rate (gpm)	Draw-down (feet)	Specific capacity (gpm/ft)
Cook County									
Arlington Heights									
Village	1	140	10	23	1946	25	240	61.5	3.9
State Highway Garage	1	172			1951	25	37	16	2.3
Jockey Club	3	761			1946	37	86	150	0.6
National Mortgage Co.	1	201			1949	33	120	117	1.0
Barrington									
Village	1	305	12–10	60	1943	66.1	200	9.3	21.5
Village	2	210	16	60	1946	53	400		
Barrington Woods		250			1953	44	22.3	161.5	0.13
Village	1	305	12–10	60	1933	60.8	350	3.7	96
Village	2	210	16	60	1929	53.5	540	13.8	39
Bartlett									
Village	1	200	8	49	1923	33	265	4	66
Village	1	200	8	49	1946	37	200	4	50
Berkeley									
Village	2	151	10	47	1930	44	150	8	19
Village	2	151	10	47	1944	60	200	12	17
Chicago									
[illegible]									
Chicago Heights									
City	15	193	24	158	1946	88	1000	27	37
City	18	251	26	209	1941	Flowing	1650	39	42
City	19	330		288	1946	20	400	17	24
City	21	203	30–24	161	1945	22	870	24	36
City	21	203	30–24	161	1945	22	1670	45.5	37
City	22	270	33–22	200	1946	26	960	21	46
City	23	260	30–24	202	1946	33.5	1800	55	33
City	23	260	30–24	202	1956	33.5	1270	28	45
American Locomotive Co.	3	222			1942	56	1150	2.1	550
Flintkote Co.	3	300			1946	106	310	107	2.9
Penn Salt Co.	1	215	16–266		1954	7	108		
Victor Chemical	3	433			1947	37	118	215	0.5
Victor Chemical	4	250			1947	56	347	111	3.1
Flossmoor									
Village	1	275	10	210	1945	90	300	20+	
Village	2	351	12–10	286	1945	40	425	20	21
Village	3	467	16–14–12	402	1941	64.5	395	89.5	4.4
Village	1	275	10	210	1940	47	300	38	8
Glencoe									
H. Levy	1	206			1937	72	27	13	2.1
Hillside									
Village	2	180	8–6	158	1937	35	40	25	1.6
Hinsdale									
Suburban Sanatorium	1	357			1952	39	322	112	2.9
Homewood									
Village	1	252	12–10	182	1923	29	170	22	7.7
Village	Tw 1-46	460	6	351	1945	29	210	59	3.5
Village	1	252	12–10	182	1945	34	245	133	1.8
Village	3	436	22	364	1945	35	250	242	1.0
Dixmoor	4	226	10	162	1946	17	240	73	3.3
Oaklawn Cemetery	2	302			1946	42	175	16	11
Ravisloe CC	3	420			1953	41	530	38	14
La Grange									
[illegible]									

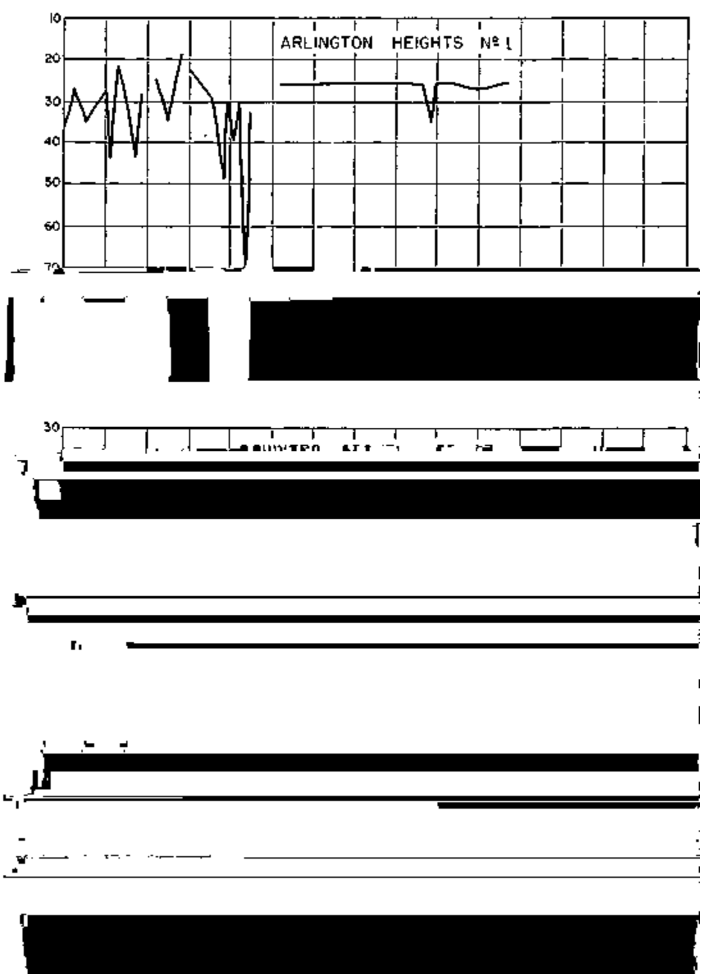
TABLE 24. (Continued)

Location and owner of well	Well No.	Depth of well *(feet)*	Diameter of casing *(inches)*	Penetration of well below top of aquifer *(feet)*	Date of test	Nonpumping level *(feet)*	Pumping rate *(gpm)*	Draw-down *(feet)*	Specific capacity *(gpm/ft)*
Wheaton									
[redacted]									
McHenry County									
Cary									
Village		300	10	146	1947	30	113	70	1.6
Crystal Lake									
City		280	10	20	1947	107	415	46	9.0
Nat. Grain Yeast		319			1940	106	140	63	2.2
Pure Oil Co.		423			1948	74	75	85	0.9
Fox River Grove		145	13	43	1947	9	250	23	10.9
Kane County									
Aurora									
Hanson Greenhouse	1	103	8	85	1937	7	25	21	1.2
Marviray Manor	1	300		85	1946	27	50	5	10.0
Batavia									
Campana	1	281	10	60	1945	37	280	90	3.1
Geneva									
Burgess Norton No. 2	2	220		74	1950	50	200	120	1.7
Montgomery									
Village	1	175	10–8	23	1947	54	100	5	20.0
North Aurora									
Village	West Well	190		57	1953		20	2	10.0
Lake County									
Fox Lake									
Chain O'Lakes St. Pk.	1	270			1940	54.5	40	97	0.4
Half-Day									
E. Ryerson, Jr.	1	200			1940	6	25	119	0.2
Lake Zurich									
Village	3	443	6	65	1949	135.5	209	29	7.2
Mt. St. Joseph	1	400			1949	106	121	74	1.6
Libertyville									
Village	5	251	24–16	64	1935		442	129	3.4
Village	7	287	12	114	1947	15	495	82	6.0
Village	5th Ave	250		95	1950	7	96	161	0.6
Village	TW	215		58	1950	33	210	19	11
Village		227		70	1951	39	590	43	13.7
Mundelein									
Village	2	285	12	46	1930	64	125	57	2.2
Village	3	213	10	57	1947	90	125	60	2.1
Round Lake									
Village	1	350	6	120	1945	40	175	10	17.5
Village	2	359	10	89	1945	51	288	107	2.7
Beach	1	342		117	1948	41	100	158	0.6
Park	1	279	6	29	1939	46	150	26	5.8
Park	3	313	10	53	1944	46	100	74	1.4
Wauconda									
[redacted]									

No. of wells for which	Average depth	Average dia	Average	Average pumping	Average specific	Range of specific	Average specific capacity per foot



36 screened wells was 25.5 feet. The data in table 26



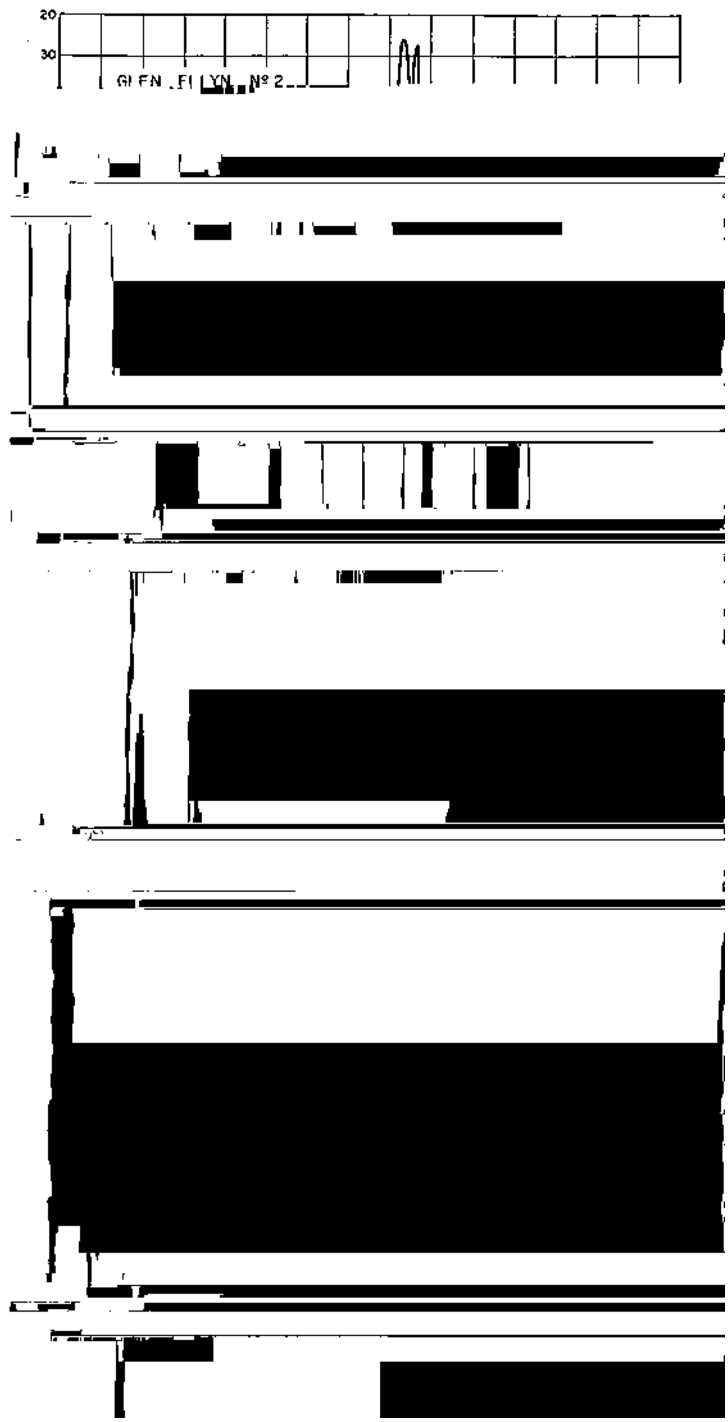


TABLE 26. SPECIFIC-CAPACITY DATA FOR WELLS IN GLACIAL DRIFT

Location and owner of well	Well No.	Depth of well *(feet)*	Diameter of casing *(inches)*	Screen length-dia. *(ft. - in.)*		Thickness of aquifer *(feet)*	Date of Test	Non-pumping level *(feet)*	Pumping rate *(gpm)*	Drawdown *(feet)*	Specific capacity *(gpm/ft)*
Lake County											
Antioch											
Village	2	226	10	20		70	1946	39	200	22	9.1
[redacted]											
Gurnee											
Hoag Farm	1	145	12	25		110	1949	31.5	289	77	3.8
Island Lake											
Village	19–u	116	10	24	10	150	1940	29	503	11	46.0
Village	K–9	87	8	10	7	150	1943	9	280	16	17.5
Lake Villa											
Village	1	167	12–10	26	10	233	1938	55	154	4.5	34.2
Libertyville											
Village	6	83	8	30	8	167	1943	28	380	14	27
Fould's Milling	2	202	8	14	8	190	1945	7	275	84.5	3.3
Milburn											
Traer Well		190	12	17		90	1948	42	127	13	9.8
Mundelein											
[redacted]											
Round Lake											
Village	2	225	10	None		56	1945	51	290	107	2.7
McHenry County											
Crystal Lake											
[redacted]											

Therefore, the present withdrawal of 75 mgd is within the potential yield of the shallow aquifers. The fact that there has been no decline even in the area of heaviest pumpage indicates that the potential yield of the shallow aquifers probably is considerably larger than the present withdrawal.

The pumpage per square mile of 68,400 gpd in DuPage County is equivalent to a yearly infiltration from precipitation of 1.43 inches or about 4 percent of the average annual total. Actual infiltration of precipitation must be greater than 1.43 inches since water levels have not declined and ground water is discharged as base flow of streams in the area. It has been estimated for the state as a whole that about 10 to 12 percent of the annual precipitation reaches the ground-water reservoir, and it is reasonable to believe that recharge in the Chicago region is within this order of magnitude.

The shallow aquifers are the most likely sources to investigate for additional ground-water supplies. These aquifers are more readily recharged than the deep aquifers and locally have coefficients of transmissibility considerably higher than the Cambrian-Ordovician Aquifer. The present yield of the shallow aquifers is well within their potential yield, whereas, withdrawal of water from the deep aquifers has already approached the calculated sustained yield.

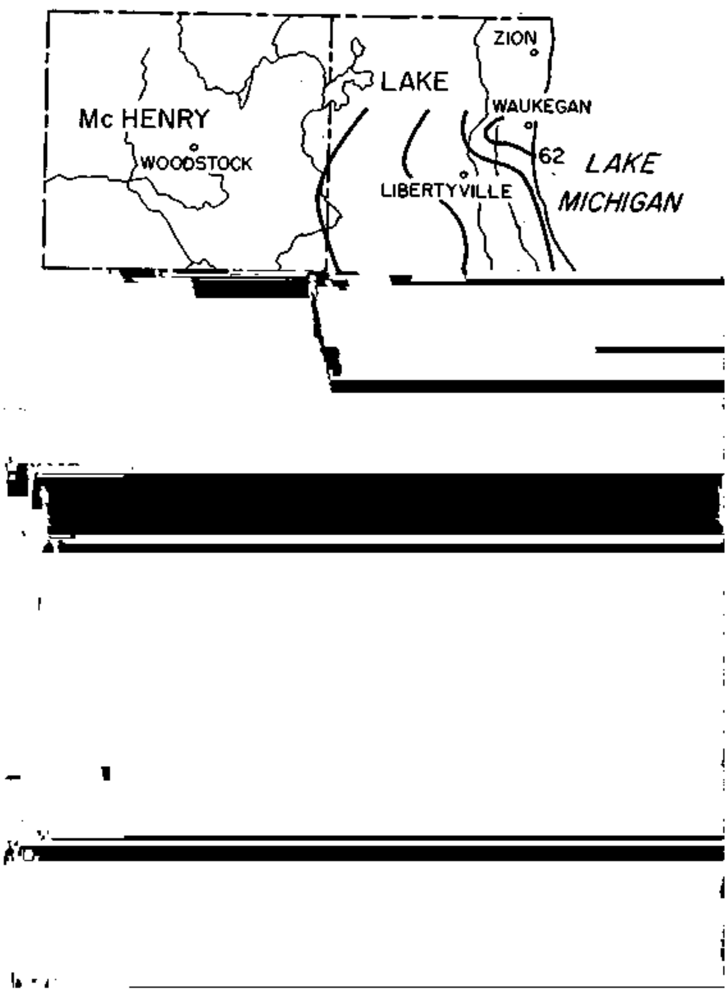


Fig. 45. Temperature of water from Ironton-Galesvllle Sandstone.

Additional studies of precipitation, infiltration, runoff, aquifer characteristics, and aquifer distribution are needed before the potential yield of the shallow aquifers can be determined quantitatively.

WATER QUALITY

Many of the approximately 1600 mineral analyses which have been made in the Chicago region are given in State Water Survey Bulletins 34, 35, 36, 40 and Supplement 1 to Bulletin 40. Typical analyses are given in Appendix A (Larson, 1957, p. 11-15).

Ground waters in the Chicago region vary in quality between the different producing aquifers and also within individual aquifers at different geographical locations. Below an elevation of 1300 feet below sea level, ground water in the deep aquifers is too highly mineralized for most purposes.

This section discusses temperature and the mineral content of the waters from a) the drift and shallow dolomite aquifers, b) Cambrian-Ordovician Aquifer, and c) the Mt. Simon Aquifer.

The quality of water obtained from any well depends not only on the geological formations penetrated during drilling, but also on the geographical location, the relative productivity of the various formations, the relative artesian head of the various formations, and often on the rate of pumping as well as the idle period and time of pumping prior to collection of the sample. In some areas, open and unplugged wells may permit water from one aquifer to migrate to another aquifer.

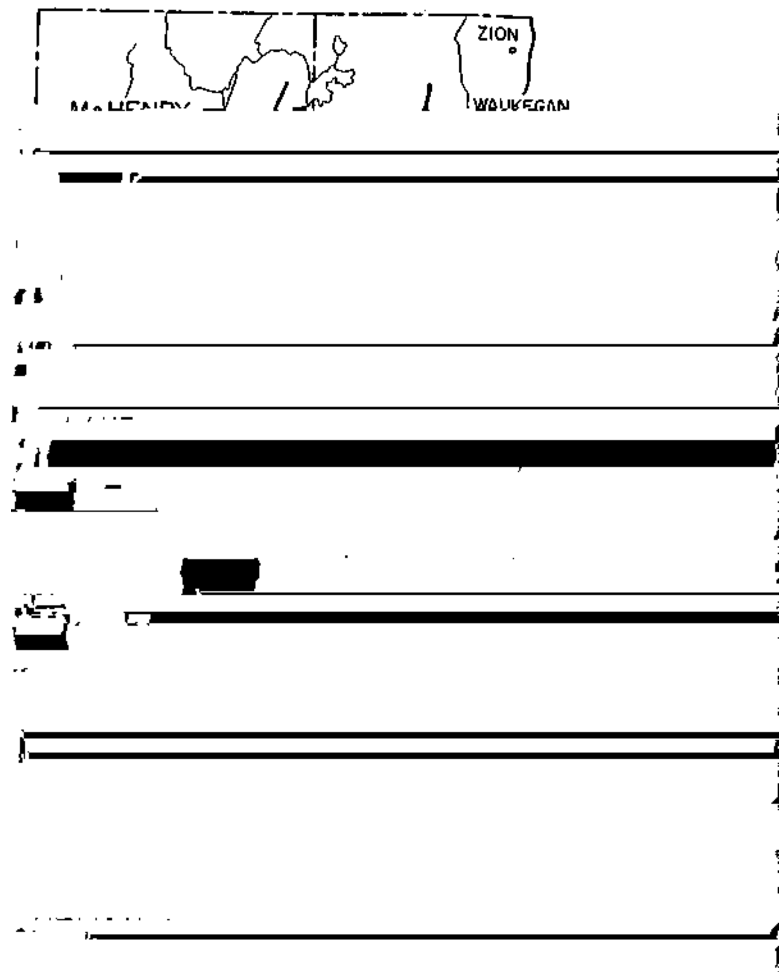
TEMPERATURE

The temperature of water from 213 drift and dolomite wells of 100 to 300 feet depth in the region averaged 51.6° F. with 71 percent of the temperatures ranging from 50.5° F. to 52.5° F. Temperatures above 52.5° F. were noted at 34 wells with a maximum of 54° F., and below 50.5° F. at 27 wells with a minimum of 46° F. It may be assumed that these "abnormal" temperatures were due to the entrance of water from depths less than 100 feet during warm or cold seasons respectively.

The temperatures of water from wells entering the Cambrian-Ordovician. Aquifer are influenced by the proportions of water entering the well from the shallow drift and dolomite aquifers. The following observations have been made on wells which were constructed in such a way as to case out and seal with cement grout all waters from above the base of the Maquoketa Formation. Certain inconsistencies, even at many of these wells, may be due to the presence of water from shallow aquifers or the deeper Mt. Simon Aquifer by entrance to the well through the crevices in the Trempealeau or Galena-Platteville Formations from nearby wells.

is concerned primarily with this part of the Cambrian-Ordovician Aquifer.

The mineral quality of the water from the Ironton-Galesville Sandstone is relatively uniform over an extensive area in the western two thirds of the region and generally exemplified by that at Montgomery near Aurora (Appendix A) (fig. 48). The mineralization increases eastward at an increasingly rapid rate as the formation becomes deeper (fig. 21A). From the eastern



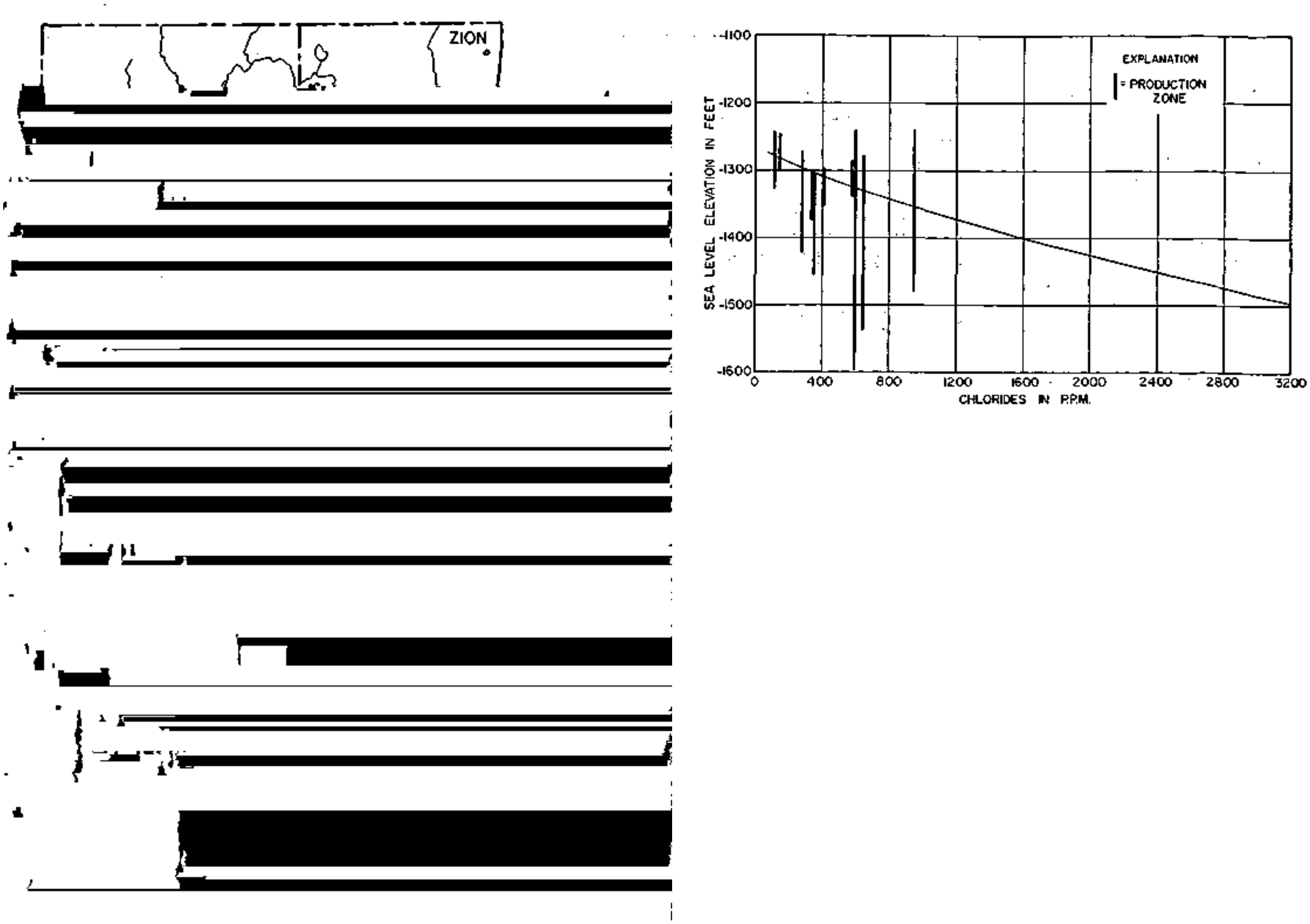


Fig. 49. Chloride content of water from Cambrian-Ordovician Aquifer.

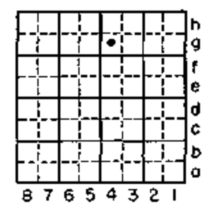
When not blended with waters from

		ppm	epm
Turbidity		14.	
Color		0.	
Odor		0.	
Iron (total)	Fe	2.3	
Manganese	Mn	0.0	
Calcium	Ca	81.	4.05
Magnesium	Mg	47.	3.87
Ammonium	NH_4	0.6	0.03
Sodium	Na	7.	0.31
Silica	SiO_2	22.7	
Fluoride	F	0.2	
Boron	B	Tr.	
Chloride	Cl	8.	.23
Nitrate	NO_3	0.2	Tr.
Sulfate	SO_4	5.3	.11

		ppm	epm
Turbidity		16.	
Color		0.	
Odor		0.	
Iron (total)	Fe	[illegible]	
[redacted]			
Calcium	Ca	283.0	14.15
Magnesium	Mg	201.6	16.58
Ammonium	NH_4	0.7	.04
Sodium	Na	41.	1.78
Silica	SiO_2	25.3	
Fluoride	F	0.2	
Boron	B	0.3	
Chloride	Cl	[illegible]	[illegible]

		ppm	epm
Turbidity		30.	
Color		0.	
Odor		0.	
Iron (total)	Fe	1.4	
Manganese	Mn	0.2	
Calcium	Ca	75.8	3.79
Magnesium	Mg	58.5	4.80
Ammonium	NH_4	Tr.	Tr.
Sodium	Na	62.	3.70
Silica	SiO_2	18.0	
Chloride	Cl	4.	.11
Nitrate	NO_3	4.2	.07
Sulfate	SO_4	422.5	8.79
Alkalinity	(as $CaCO_3$)	116.	2.32
Hardness	(as $CaCO_3$)	430.	8.59
Total Dissolved Minerals		756.	
Temp. (reported)		51° F.	
pH (reported)		7.6	

		ppm	epm
Turbidity		10.	
Color		0.	
Odor (at well)		H_2S	
Iron (total)	Fe	1.2	
Manganese	Mn	0.0	
Calcium	Ca	17.5	.88
Magnesium	Mg	8.4	.69
Ammonium	NH_4	0.7	.04
Sodium	Na	112.	4.87
Silica	SiO_2	12.	
Chloride	Cl	4.	.11
Nitrate	NO_3	[illegible]	[illegible]



Well No.	Owner	Use	Year	Surface elevation above	Depth	Deepest formation	Main	Type of
COOK COUNTY								
COK 35N13E-1.2c	Flossmoor #1	P	1925	675	467	Sil	Sil Dol	SS 6296; DL
COK 35N13E-26.8b	Matteson #2	P	1956	706	305	Sil	Sil Dol	SS 26488; DL
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Well No. (location)	Owner	Use	Year drilled	Surface elevation above sea level	Depth (ft.)	Deepest formation reached	Main aquifer	Type of record
COOK COUNTY—(Continued)								
COK 37N13E-4.5a	Oak Lawn #1	P	1931	611	1946	MS	C-O/MS	DL
COK 37N13E-5.1a	Oak Lawn #2	P	1937	614	1600	EC	C-O	SS 2171; DL
COK 37N13E-19.1b	Jurge Humphries	..	1925	596	1385	Tr	G-SP/Tr	SS 513; DL
COK 37N13E-26.1g	Oak Hill Cemetery #2	I	1958	617	1636	EC	C-O	DL

[illegible]			[illegible]	Surface elevation [illegible]	[illegible]	Deepest [illegible]	[illegible]	[illegible]

[redacted]

[redacted]

[redacted]

[redacted]

COOK COUNTY—(Continued)

COK 39N13E-35.1h	Liquid Carbonic Co.	I	1935	597	1558	EC	C-O	SS 1735; DL
COK 39N14E-4.5e	Oscar Mayer	I	1909	592	1626	I-G	C-O	DL
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[redacted]

[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[redacted]

Well No. *(location)*	Owner	Use	Year drilled	Surface elevation above sea level	Depth *(ft.)*	Deepest formation reached	Main aquifer	Type of record
			COOK COUNTY—(Continued)					
COK 42N11E-33.3c	Mt. Prospect #4	P	1949	689	1375	EC	C-O	SS 19845
COK 42N11E-34.8f	Mt. Prospect # 5	P	1954	676	1820	MS	C-O/MS	SS 25168

[redacted]

COK 42N12E-5.7d	Marshall Salzman	R	1957	687	1404	G-SP	G-SP Ss	SS 28043; DL
COK 42N12E-9.3c	Northbrook City	P	....	646	1345	EC	C-O	SS 49; DL
COK 42N12E-14.7f	St. Mary's #2	P & IR	1931	666	1983	MS	C-O/MS	SS 1118; DL
COK 42N12E-29.1a	Ill. Municipal #4	P	1957	677	1405	I-G	C-O	SS 27885; DL

[redacted]

Well No. *(location)*	Owner	Use	Year drilled	Surface elevation above sea level	Depth *(ft.)*	Deepest formation reached	Main aquifer	Type of record
			KANE COUNTY—(Continued)					
KNE 38N8E-15.3h	Aurora #12A	P	1935	670	2251	MS	C-O/MS	SS 1690; DL
KNE 38N8E-15.5h	Aurora #4	P	1895	635	2445	MS	C-O/MS	DL
KNE 38N8E-21.5g	Aurora #10	P	1924	682	2299	MS	C-O/MS	DL
KNE 38N8E-22.6h	American Well Works	I	....	675	701	G-SP	G-SP Ss	DL
KNE 38N8E-22.7d	Tivoli Theatre	P	1940	652	1410	EC	C-O	SS 5080; DL
KNE 38N8E-22.8d	Walker Laundry	I	1931	650	1438	I-G	C-O	SS 1134; DL
KNE 38N8E-23.1h	Aurora #15	P	1950	694	2150	MS	C-O/MS	SS 20577; DL
KNE 38N8E-28.4e	Aurora #7	P	1914-15	630	2163	MS	C-O/MS	SS; DL
KNE 38N8E-32.2d	C. B. & Q. RR. #2	I	1947	640	740	G-SP	G-SP Ss	SS 17443
KNE 38N8E-32.2e	Lyon Metal	I		635	659	G-SP	G-SP Ss	DL

Well No. *(location)*	Owner	Use	Year drilled	Surface elevation above sea level	Depth *(ft.)*	Deepest formation reached	Main aquifer	Type of record
			KENDALL COUNTY—(Continued)					
KEN 36N6E-16.5e	Milbrook School	P	1940	630	140	G-SP	G-SP Ss	DL
KEN 36N6E-16.8a	Pees Bros.	R	1941	635	145	G-SP	G-SP Ss	DL
KEN 36N6E-17.–	E. A. Pionke #1	R	1953	615	109	G-SP	G-SP Ss	DL
KEN 36N6E-25.8b	C. R. Johnson	R	1946	720	265	G-SP	G-SP Ss	DL
KEN 36N6E-30.6f	G. L. Harris	R	1947	565	67	G-SP	G-SP Ss	SS 17754
KEN 36N6E-32.4e	Nelson #1	R	1954	775	425	G-SP	G-SP Ss	DL
KEN 36N6E-33.8d	Harry Hughes	R	1947	712	201	G-SP	G-SP Ss	SS 17751; DL
KEN 36N8E-29.8d	Christian	R	1924	620	500	G-SP	G-SP Ss	DL
[redacted]								
KEN 36N8E-36.1d	Rose Procter #1	R	1943-44	647	2325	MS	....	SS 10744; DL
KEN 37N6E-4.4d	Chicago YWCA	P	....	695	425	G-SP	G-SP Ss	DL
KEN 37N6E-7.3g	Clarence Smith	R	....	710	302	G-SP	G-SP Ss	DL
[redacted]								
KEN 37N7E-22.8g	T. A. Gantt #1	R	1939	628	575	G-SP	G-SP Ss	DL
KEN37N7E-28.4e	John Demetralis	R	1941	640	620	G-SP	G-SP Ss	SS 7977
KEN 37N7E-32.1e	Yorkville	P	1923	584	590	G-SP	G-SP Ss	DL

Well No.	Owner	Use	Year	Surface elevation above	Depth	Deepest formation	Main	Type of

[redacted]

McHENRY COUNTY

LKE 45N12E-33.2f3	Am. Steel & Wire #3	I	1891	597	2004	MS	C-O/MS	DL
LKE 46N10E-8.7c1	Antioch #1	P	1907	231	780	Dr	S & G	DL

[redacted]

LKE 46N11E-27.2a	Central Fur Farm Coop.	I	1957	673	1230	EC	C-O	SS 29299
LKE 46N11E-33.–	J. R. Simpson, Jr.	R	1932	680	1364	EC	C-O	SS 1265
LKE 46N12E-21.1a	Zion City #3	P	1935	629	995	G-SP	G-SP Ss	SS 1618; DL
LKE 46N12E-21.1b	Zion City #1	P	1925	631	1025	G-SP	G-SP Ss	SS 485; DL
LKE 46N12E-27.–	Beach State Park	P	1947	590	1002	G-SP	G-SP Ss	SS 17181
MCH 43N7E-33.8h	Dean Milk Co.	I	1946	900	62	Dr	S & G	DL
MCH 43N8E-5.4g	Crystal Lake City	P	1930	915	2000	MS	C-O/MS	SS 902

[redacted]

[redacted]

Well No. (location)	Owner	Use	Year drilled	Surface elevation above sea level	Depth (ft.)	Deepest formation reached	Main aquifer	Type of record
WIL 35N10E-16.6a	U. S. Engineer's #1	I	1937	540	855	PdC	G-SP Ss	SS 2155; DL

[redacted]