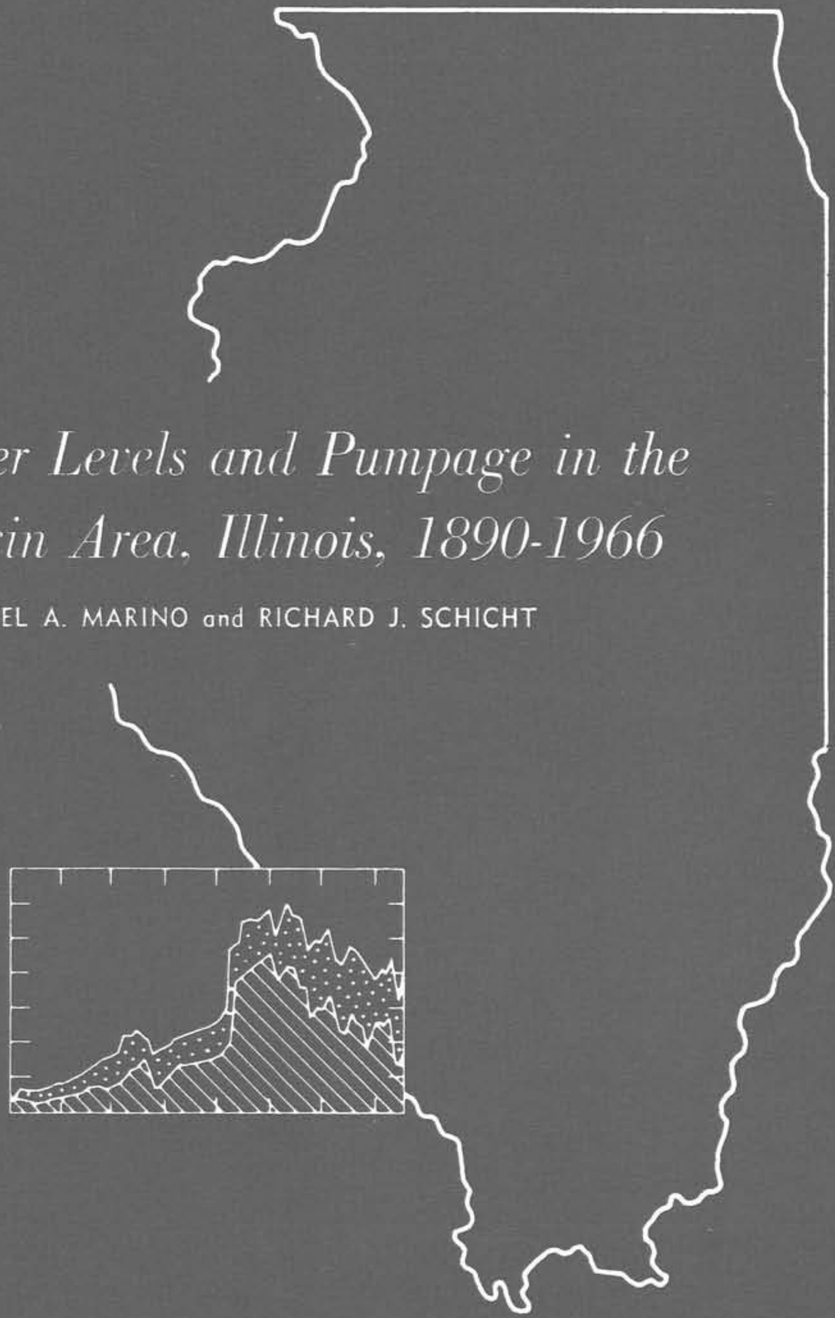
REPORT OF INVESTIGATION 61

STATE OF ILLINOIS

DEPARTMENT OF REGISTRATION AND EDUCATION

Groundwater Levels and Pumpage in the Peoria-Pekin Area, Illinois, 1890-1966

by MIGUEL A. MARINO and RICHARD J. SCHICHT



ILLINOIS STATE WATER SURVEY

URBANA

1969

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Groundwater Levels and Pumpage in the Peoria-Pekin Area, Illinois, 1890-1966

by MIGUEL A. MARINO and RICHARD J. SCHICHT

Title: Groundwater Levels and Pumpage in the Peoria-Pekin Area, Illinois, 1890-1966.

Abstract: Large quantities of groundwater are withdrawn from wells in sand and gravel aquifers along the Illinois River in the Peoria-Pekin area. Pumpage from wells increased from about 1.5 mgd in 1870 to 65 mgd in 1966. The general pattern of flow of water in 1966-1967 was slow movement from all directions towards cones of depression or the Illinois River.

Reference: Marino, Miguel A., and Richard J. Schicht. Groundwater Levels and Pumpage in the Peoria-Pekin Area, Illinois, 1890-1966. Illinois State Water Survey, Urbana, Report of Investigation 61, 1969.

Indexing Terms: groundwater, hydrographs, Illinois, observation wells, pit recharge, potentiometric level, water supply.

STATE OF ILLINOIS
HON. RICHARD B. OGILVIE, Governor

DEPARTMENT OF REGISTRATION AND EDUCATION
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Groundwater Levels and Pumpage in the Peoria-Pekin Area, Illinois, 1890-1966

by Miguel A. Marino and Richard J. Schicht

SUMMARY

Groundwater resources in the Peoria-Pekin area are developed from sand and gravel aquifers. Water-level fluctuations in the aquifers, influenced by large groundwater withdrawals, are currendy monitored in 14 observation wells. Eleven of these wells are equipped with automatic water-level recorders and the three remaining wells are measured manually each month. In addition, water levels are measured periodically by various industries and municipalities in the area. A pumpage inventory has been made annually since 1945.

The Peoria-Pekin area is covered mostly with glacial drift, except in places where bedrock is exposed. In a large part of the area the glacial drift contains a thick deposit of Sankoty sand immediately above bedrock. The Sankoty sand is missing in the immediate vicinity of Peoria and East Peoria where the bedrock is overlain by glacial outwash consisting of stratified sand and gravel deposits. Conditions are favorable for development of large water supplies in the Sankoty sand and glacial outwash.

Estimated pumpage from wells in the Peoria-Pekin area increased from about 1.5 million gallons per day (mgd) in 1870 to 80.6 mgd in 1944. The maximum rate of pumpage increase occurred from 1932 to 1933 when pumpage increased from 39.5 mgd to 60.3 mgd. Since 1944 pumpage has decreased erratically to approximately 65 mgd in 1966. Of the 1966 total pumpage, 59.9 percent was industrial; 39.8 percent was municipal; and 0.3 percent was institutional. Pumpage is concentrated in five major pumping centers: the Central Well Field, Sankoty Well Field, North Well Field, East Peoria, and Pekin South areas.

The general pattern of flow of water in 1966-1967 was slow movement from all directions toward the cones of depression or the Illinois River. Water-level declines, attributed to groundwater withdrawals in the Sankoty, the North, and the Central Well Field areas, have established hydraulic gradients from the Illinois River toward pumping centers.

The average slope of the groundwater surface in areas remote from pumping centers was about 5 feet per mile. Gradients were steeper in the immediate vicinity of pumping centers and exceeded 20 feet per mile within the Sankoty cone of depression. Gradients averaged about 10 and 5 feet per mile in the North and Central Well Field cones of depression, respectively. East of the Illinois River the groundwater surface contours show a steep gradient toward the river. In the immediate proximity of the river the average slope of the groundwater surface is about 30 feet per mile.

INTRODUCTION

The Peoria-Pekin area is in north-central Illinois and includes parts of Peoria, Tazewell, and Woodford Counties. The general Peoria-Pekin area considered in this report extends in a 6 to 12 mile strip on either side of the Illinois River from 6 miles north of Mossville to 5 miles south of Pekin. The area includes the major municipalities of Peoria Heights, Peoria, East Peoria, Bartonville, and Pekin, as shown in figure 1. The area considered covers about 600 square miles and is approximately 30 miles long and 20 miles wide.

According to the latest special census, Peoria is the third largest city in Illinois with a population slightly greater than 130,000. The area is heavily industrialized and is widely recognized as a leading center in the manufacture of earth moving equipment and the distillation of alcoholic beverages. The groundwater resources are important to industries and municipalities in the area and are developed from sand and gravel aquifers. It is estimated that during 1966 an average of about 65 mgd was withdrawn chiefly from industrial and municipal wells.

The State Water Survey maintains an office in Peoria that conducts studies on water quality and related topics. The State Water Survey office also maintains automatic recording gages on 11 observation wells in the area and manually measures water levels in 3 other wells peri-

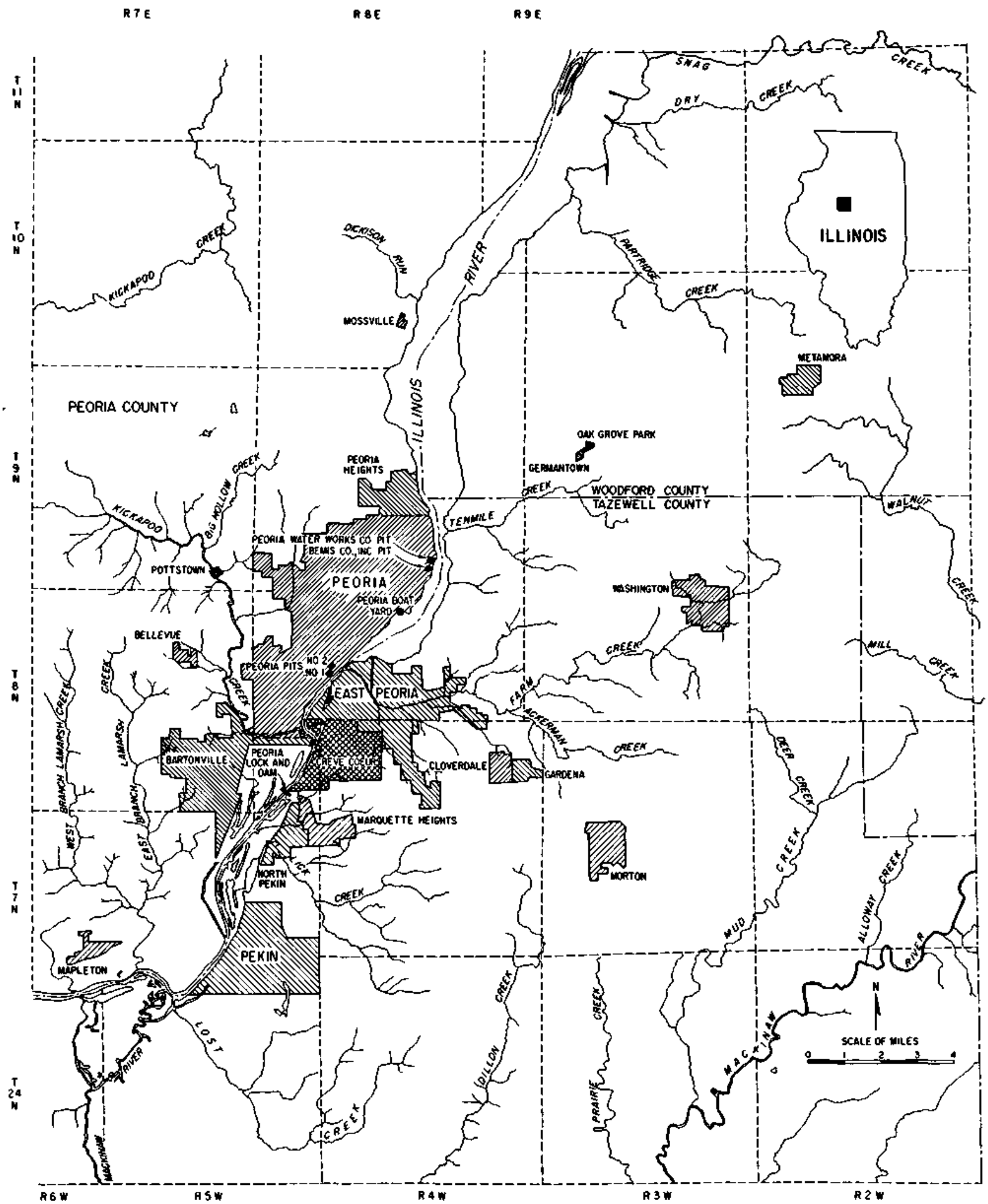

Figure 1. Location of the Peoria-Pekin area

odically. In addition, water levels are measured periodically by various industries and municipalities in the area. A pumpage inventory has been made annually since 1945. From this pumpage data, data in State Water Survey files, earlier pumpage inventories, and data correlating industrial production with groundwater pumpage, a pumpage graph for the period 1840 through 1966 was prepared.

An early report published by the State Water Survey in 1940 (Bulletin 33, *Water Resources in Peoria-Pekin District)* compiled data on 97 water supplies, 73 in Peoria County and 24 in Tazewell County. Detailed information and chemical analyses collected during a well and pumpage inventory in 1933 and 1934 were given for 73 water supplies, 54 in Peoria County and 19 in Tazewell County. By 1940 groundwater levels in the Peoria area were receding at an alarming rate because of increased pumpage.

In 1940 the State Water Survey was requested by local municipal and industrial officials to investigate the groundwater resources of the Peoria region. A report on groundwater conditions in the region (Horberg, Suter, and Larson, 1950) was prepared by the State Water Survey and the State Geological Survey. Water-level data for the period 1933 to 1946 were summarized and groundwater withdrawals during 1945 were discussed. The geology and the chemistry of groundwater in the region were also described in the report. It was estimated that prior to 1946 pumpage had exceeded the practical sustained yield in the Central Well Field area and had approached the practical sustained yield in the Sankoty and North Well Field areas. Remedial measures proposed were: 1) reduction of pumpage and wastage; 2) development of new well fields; 3) substitution of surface water; and 4) replenishment of groundwater. It was concluded that replenishment of groundwater through artificial recharge of surface water by infiltration pits and recharge wells was feasible.

Selection of the method for artificial recharge was governed by the prevailing local conditions. Recharge pits were selected as the method which showed the most promise of recharging at high rates during the periods of low river water temperature (Suter and Harmeson, 1960). Recharge wells were eliminated from consideration because they required high-clarity water for successful operation, whereas it was assumed that pits could operate successfully using river water carrying normal turbidity loads. There are currently three recharge pits in operation in the Peoria area.

This report summarizes data on pumpage and water levels in the Peoria-Pekin area from 1890 through 1966. Information on the geology and hydrology of the area is reviewed briefly as background for interpretation of records. The well-numbering system used in this report is described in the appendix.

Acknowledgments

This report was prepared under the general direction of William C. Ackermann, Chief of the Illinois State Water Survey, and H. F. Smith, Head of the Hydrology Section. R. L. Evans, Head of the Water Quality Section, D. H. Schnepper, Associate Hydrologist, and A. R. Knodel, Associate Hydrologist (deceased) in the Water Quality Section, provided much of the data used in this report. J. W. Brother prepared the illustrations.

Many former and present members of the State Water Survey and State Geological Survey wrote earlier special reports which have been used as reference material, or aided the authors indirectly in preparing this report. Consulting engineers, well drillers, municipal officials, and many industrial firms and other well owners were most cooperative and helpful in making available information on wells.

GEOLOGY AND HYDROLOGY

For a detailed discussion of the geology in the Peoria-Pekin area the reader is referred to Horberg et al. (1950) and Walker et al. (1965). The following section is based largely upon these two reports.

The Peoria-Pekin area is covered mostly with glacial drift except in numerous locations west of Bartonville and south of East Peoria where bedrock is exposed. The drift reaches thicknesses of greater than 500 feet in the ancient Mississippi Valley. The glacial drift is underlain by bedrock formations of Pennsylvanian age which do not constitute an important aquifer because of their low permeability and poor water quality with depth. Large supplies are available from older bedrock formations, but are unsatisfactory because of poor water quality.

In a large part of the area the glacial drift contains a thick deposit of glacial sand (Sankoty sand) averaging 100 feet in thickness immediately above bedrock. The Sankoty sand is missing in the immediate vicinity of Peoria and East Peoria where the bedrock is overlain by glacial outwash consisting of stratified sand and gravel deposits. The sand is also missing on bedrock uplands south of East Peoria and in the western part of the area. Conditions are favorable for development of large water supplies in the Sankoty sand and glacial outwash.

A contour map showing the topography of the bedrock surface is shown in figure 2. Most features of the bedrock topography were delineated, named, and discussed by Horberg et al. (1950). The bedrock surface ranges in elevation from 700 feet above sea level in the northwestern part of the study area to less than 300 feet above sea level along the ancient Mississippi Valley. The outstanding feature of the bedrock surface is the ancient Mississippi Valley which lies in the eastern part of the study area. It has an average width of about 3 miles and is entrenched 300 to 350 feet below adjoining bedrock uplands. An island-like upland in the center of the valley south of Washington rises more than 150 feet above the valley floor.

Other features of the bedrock surface include the Pekin-Sankoty Valley, the Kickapoo Creek Valley, and the present Illinois Valley. The Pekin-Sankoty Valley

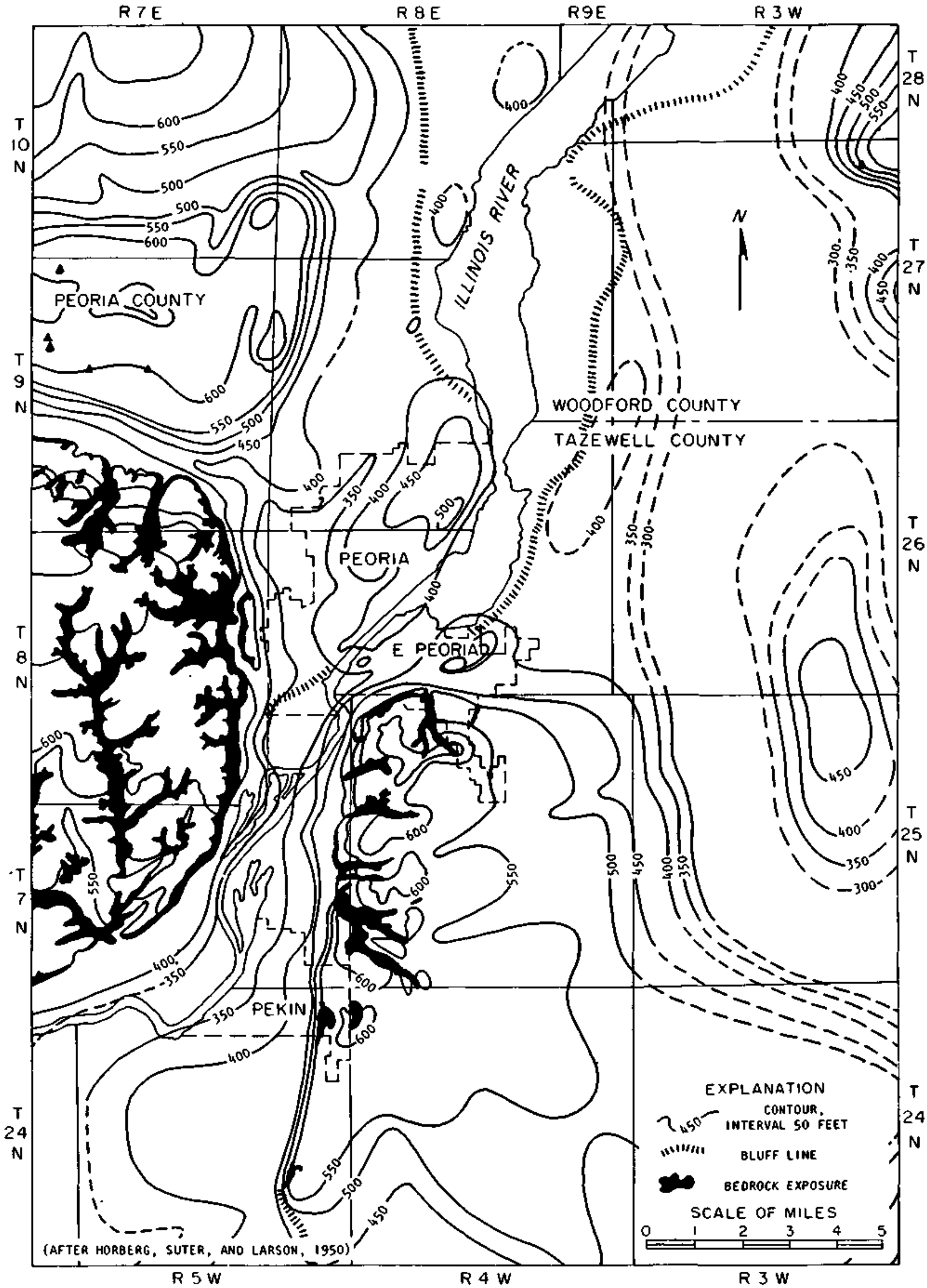

Figure 2. Bedrock topography in the Peoria-Pekin area

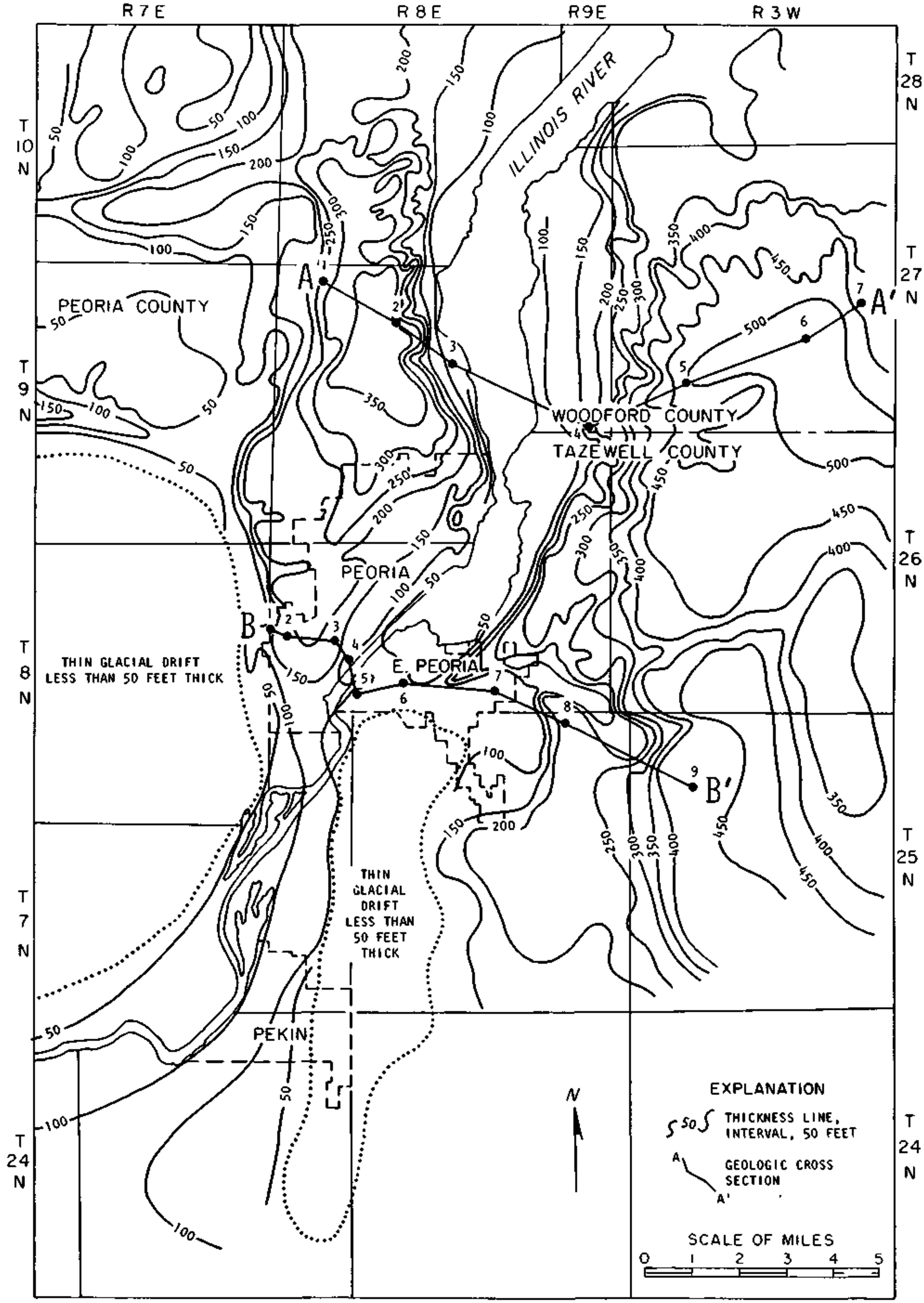

Figure 3. Thickness of the deposits above bedrock and locations of geologic cross sections

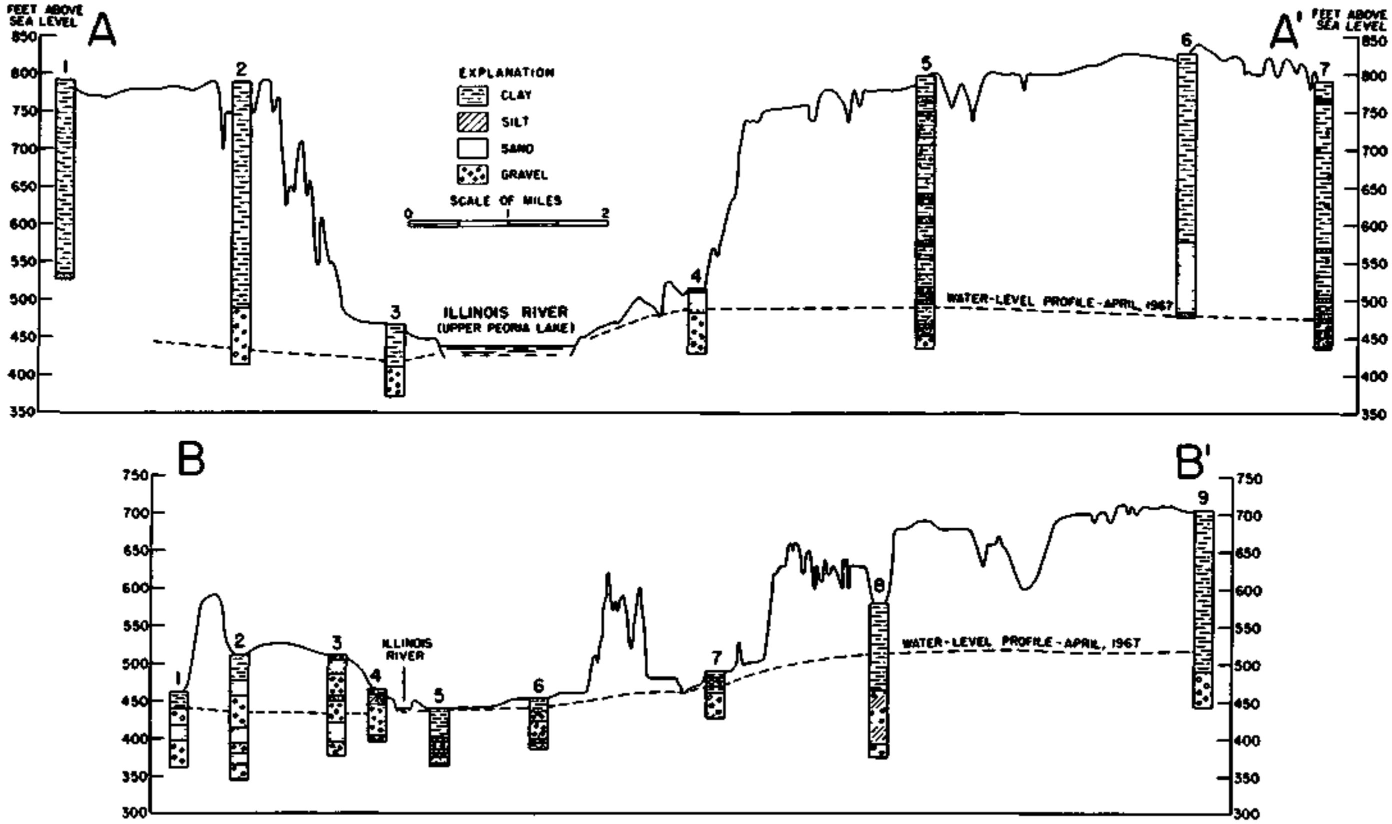

Figure 4. Geologic cross sections and water-level profiles

is about 2 to 3 miles wide. It leaves the ancient Mississippi Valley above Peoria and extends southward joining the present Illinois Valley just south of Peoria. The Kickapoo Creek Valley, which coincides with the west branch and lower course of the present stream, enters the Pekin-Sankoty Valley northwest of Peoria. Another bedrock valley about 5 miles to the north of the Kickapoo Creek Valley enters the Pekin-Sankoty Valley. The present Illinois Valley forms a narrow trench between Peoria and East Peoria then widens to the north and merges with the ancient Mississippi Valley south of Chillicothe. Bedrock uplands dominate the topography in an area west of Peoria and Pekin, and are also present in a narrow strip extending southward from East Peoria.

The thickness of the unconsolidated deposits is shown in figure 3, which also shows the locations of cross sections (figure 4) illustrating in general the nature of the unconsolidated deposits above bedrock. Horberg et al. (1950) subdivided the area according to groundwater availability (figure 5).

As shown in figure 5, a large part of the area is underlain by the Sankoty sand which rests on bedrock and underlies thick glacial drift in the eastern part of the study area and along a strip north of Peoria. Also underlain by Sankoty sand are surficial sand and gravel deposits along the Illinois River. According to Horberg et al. (1950) the thickness of the Sankoty sand varies greatly. Along the Illinois River Valley its thickness varies from about 50 to 150 feet, and beneath the uplands it may reach a depth of almost 300 feet, although the average thickness would be closer to 100 feet. Groundwater conditions in areas underlain by the Sankoty sand are favorable.

Surficial (outwash) deposits overlying bedrock are present along a short reach of the Illinois River in the vicinity of Peoria and East Peoria, and are overlain by thin deposits of recent alluvium. Surficial deposits underlain by Sankoty sand extend from east of Peoria to the Pekin area. These deposits are composed mainly of sand, silt, and gravel. Silt and clay may locally overlie sand and gravel. Small to large supplies of groundwater are obtainable from these deposits.

Thick deposits of glacial drift overlying bedrock occur in an area averaging about 3 miles wide extending southward from East Peoria (see figure 5). These deposits are also present in the northwestern and northeastern corners of the study area. Glacial drift is composed dominantly of unstratified bouldery clays, called glacial till, but include stratified outwash deposits of sand, silt, and gravel. Groundwater conditions in thick glacial drift areas are variable.

As shown in figure 5, thin deposits of glacial drift cover the bedrock in an area extending westward of Bartonville and in an area westward of T9N, R8E. Thin deposits of glacial drift also occur in a tongue-shaped area, about 11 miles long and 2 miles wide, south of East Peoria. Groundwater conditions in these areas are unfavorable.

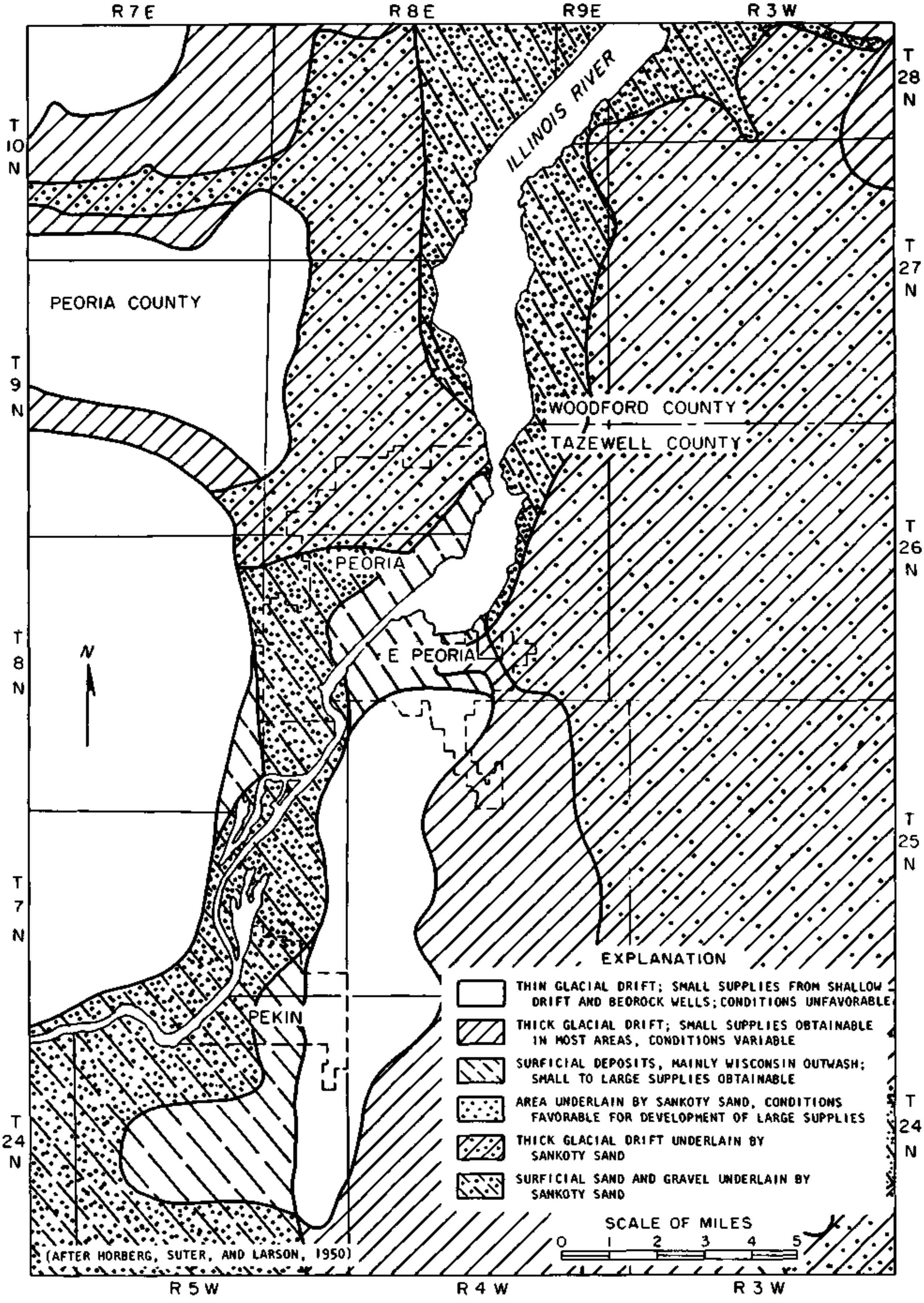

Figure 5. Groundwater conditions in the Peoria-Pekin area

The first significant withdrawal of groundwater in the Peoria-Pekin area started shortly after the Civil War. Groundwater was primarily used by the brewing and distilling industries until the city of Pekin initiated a groundwater supply in 1886. The brewing and distilling industries were located in the vicinity of the Central Well Field area (figure 6) in Peoria. In 1892 a privately owned enterprise under the name of the Peoria Water Works Company began providing groundwater to the city of Peoria from a large dug well located in the North Well Field area (figure 6). During the 1890s groundwater pumpage for industrial use other than brewing and distilling began to increase.

In the Peoria-Pekin area estimated pumpage from wells increased from about 1.5 mgd in 1870 to 80.6 mgd in 1944 as shown in figures 7 and 8. The maximum rate of pumpage increase was from 1932 to 1933 when pumpage increased from 39.5 mgd to 60.3 mgd. Prior to 1932 pumpage had increased at a rate of about 0.5 mgd per year. The rate of pumpage increase from 1934 to 1944 was about 2 mgd per year. Pumpage declined at an average rate of 1.3 mgd per year from 1944 to 1960.

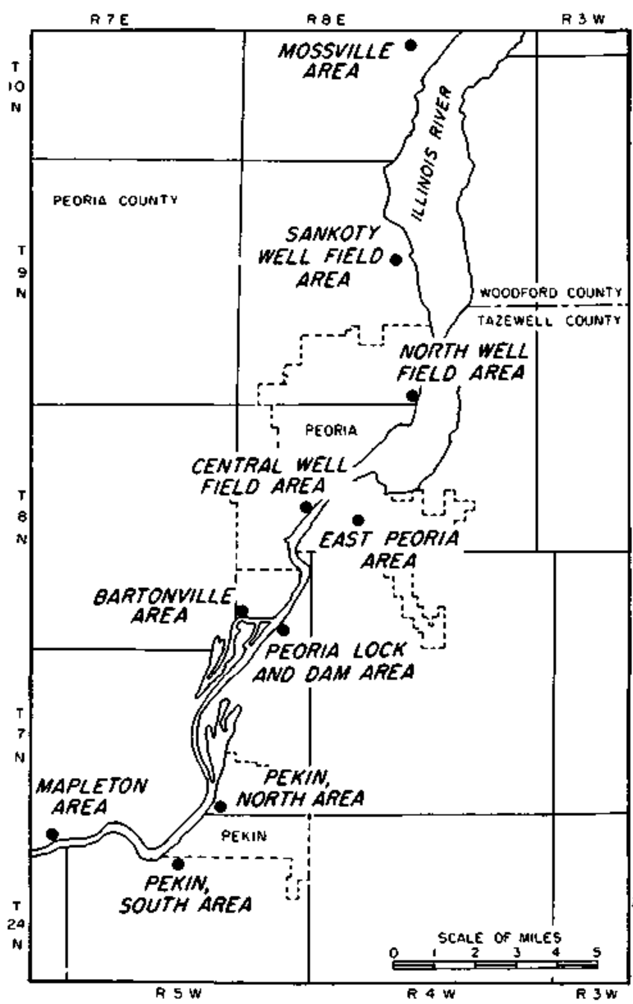

Figure 6. Location of major pumping centers

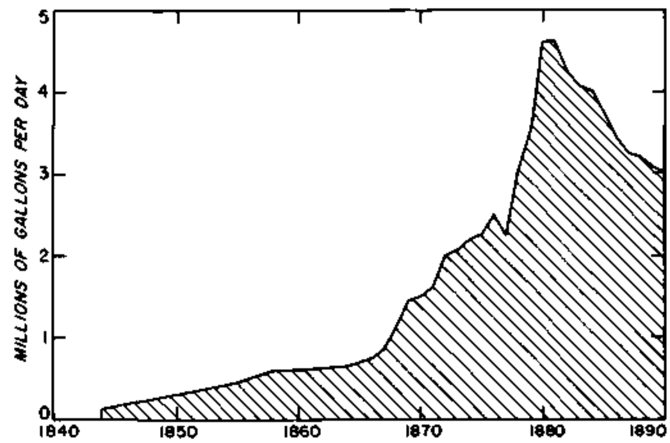

Figure 7. Estimated pumpage, 1844-1890, in the Peoria-Pekin area

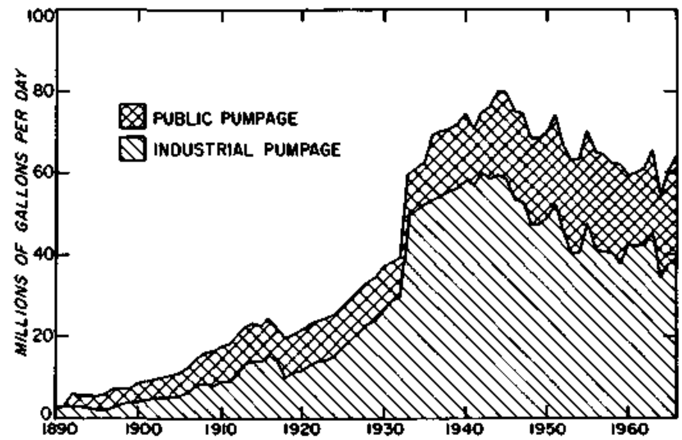

Figure 8. Estimated pumpage, subdivided by use, in the Peoria-Pekin area

Pumpage decreased to about 54.7 mgd in 1964 and then steadily increased to about 64.3 mgd in 1966.

Pumpage use data are classified in this report according to two main categories, *public,* including municipal and institutional, and *industrial.* Pumpage use in various domestic, rural, or irrigation categories was not involved in the study area. Most water-supply systems furnish water for several types of uses. For example, a public supply commonly includes water used for drinking and other domestic uses, manufacturing processes, and lawn sprinkling. Industrial supplies may also be used in part for drinking and other domestic uses. No attempt has been made to determine the final use of water within the public category; for example, any water pumped by a municipality is called a public supply, regardless of the use of the water.

During 1966 public pumpage was about 25.8 mgd or 40.1 percent of the total groundwater withdrawn while industrial pumpage was 38.5 mgd or 59.9 percent of the total pumpage.

Pumpage is concentrated in 10 pumping centers (figure 6). Three pumping centers, the Pekin South area, the Pekin North area, and the Mapleton area, are lo-

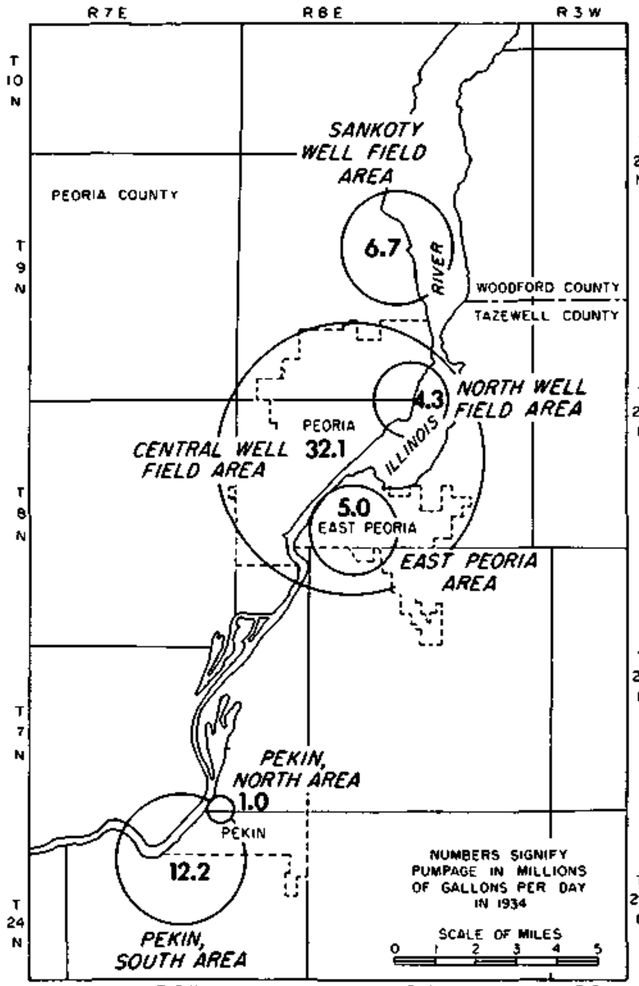

Figure 9. Distribution of estimated pumpage during 1934

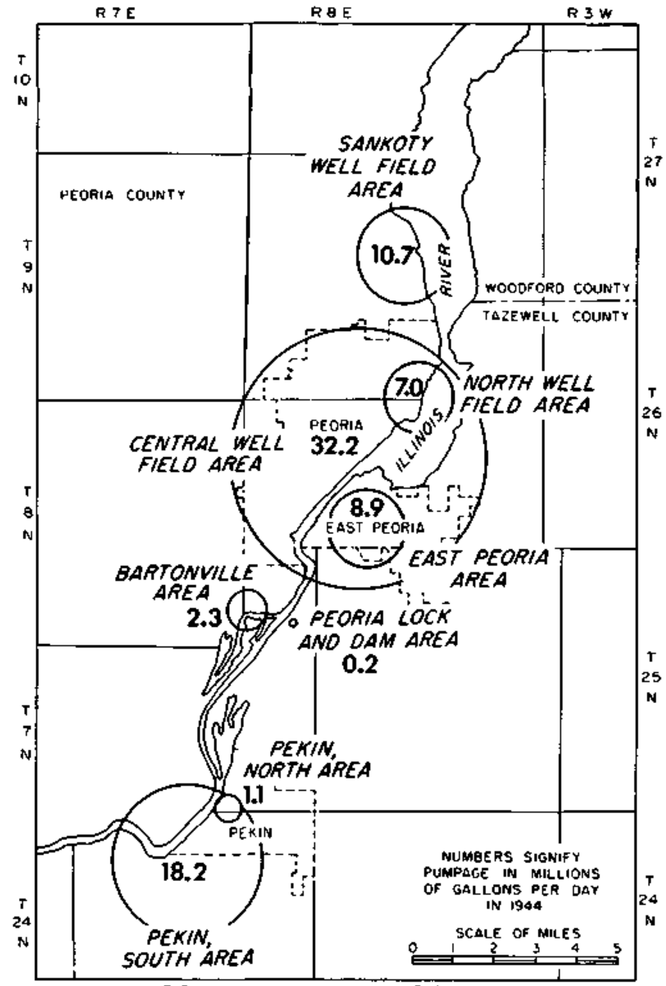

Figure 10. Distribution of estimated pumpage during 1944

cated in the vicinity of Pekin and constitute the Pekin area. Seven pumping centers, the Mossville, Sankoty Well Field, North Well Field, Central Well Field, East Peoria, Bartonville, and Peoria Lock and Dam areas, constitute the Peoria area. The distributions of pumpage in 1934, 1944, and 1966 are shown in figures 9, 10, and 11, respectively. Estimated pumpages from the Peoria and Pekin areas are shown in figures 12 and 13.

Of the 1966 total pumpage 59.6 percent or 38.3 mgd was concentrated in the Central Well Field area and in an industrial center about 1.5 miles southwest of Pekin (Pekin South area). The remainder of the 1966 total pumpage was rather evenly distributed among six of the remaining eight pumping centers: the Sankoty Well Field, North Well Field, East Peoria, Bartonville, Mapleton, and Pekin North areas. Two minor pumping centers are located in the Peoria Lock and Dam and Mossville areas.

Records of pumpage are excellent for the period 1945-1966. Estimates of pumpage were made in the Peoria-Pekin area during 1933, 1934, and 1940. A few records are available for the intervening years. Municipal pumpage for the city of Peoria is well documented in reports by the National Board of Fire Underwriters. The graphs in figures 14 through 20 were completed by piecing together fragments of information on pumpage found in published reports, in the files of the State Water Survey, and in the files of industries; by making evaluations based on the number of wells, their reported yields, time of construction, and the number of hours in production per day; by taking into consideration population growth and per capita consumption; and by correlating production data with water use.

Industrial Supplies

Peoria Area. Appreciable quantities of groundwater were first used by the early brewing and distilling industries. The first brewery was established about 1837 and the first distillery was established about 1844. The first distillery processed about 200 bushels of corn per day. Records on file at the Peoria Board of Trade show that 1,097,317 bushels of corn were processed in 1869 by 10 distilleries. By 1881, 5,004,973 bushels of corn were processed by 9 distilleries. It was estimated by present day distillers in the Peoria area that between 200 and 400 gallons of water at a temperature of 60 F

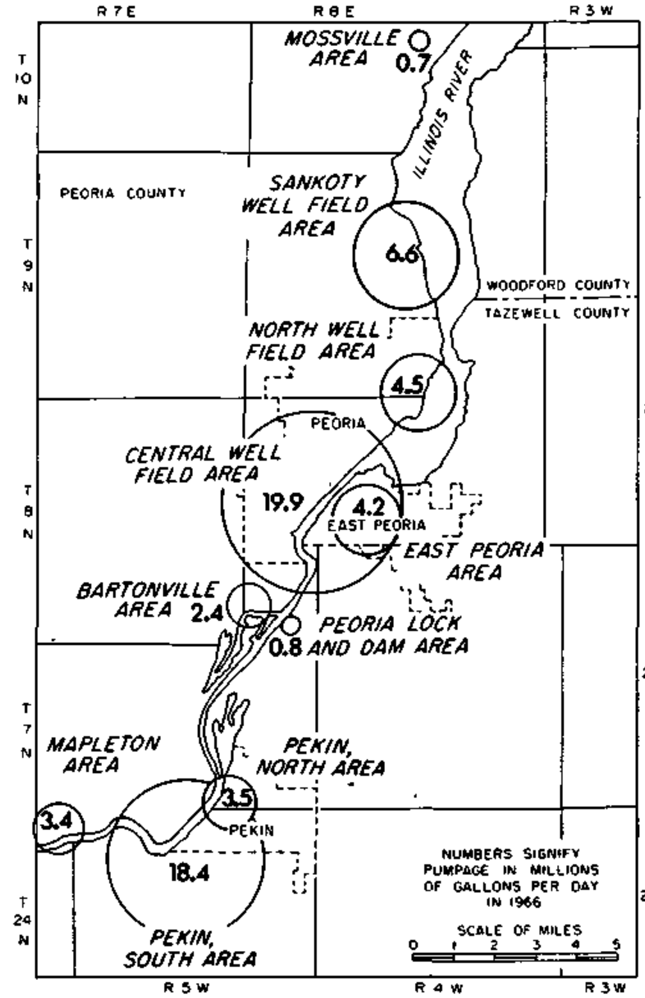

Figure 11. Distribution of estimated pumpage during 1966

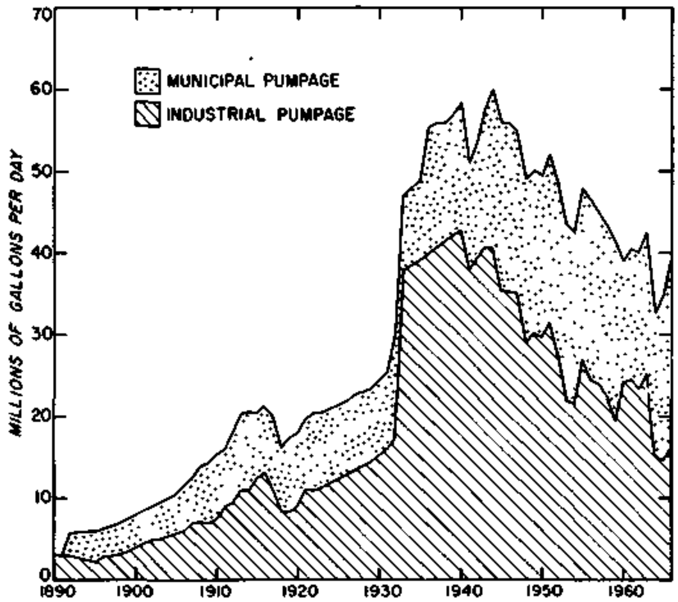

Figure 12. Estimated pumpage, subdivided by use, in the Peoria area

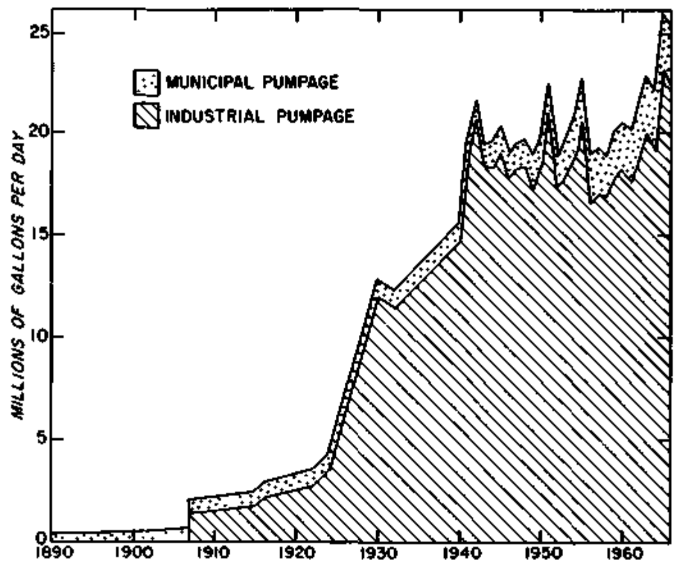

Figure 13. Estimated pumpage, subdivided by use, in the Pekin area

was needed to process 1 bushel of corn which produced about 4 gallons of spirits. According to early newspaper articles, the distilling industry was attracted to Peoria for several reasons including the "plentiful supply of cold water provided from wells sunk to depths of 30 to 35 feet."

Industrial pumpage during the 19th century was estimated from Peoria Board of Trade data on bushels of corn processed for the production of high wines and spirits. Industrial pumpage reached a peak in 1881 when an estimated 4.7 mgd was withdrawn. Industrial pumpage declined to about 2.0 mgd in 1895 and then increased gradually to 13.0 mgd in 1916 because of increased industrial activity. Because distillation of whiskey was drastically reduced during World War I, industrial use decreased from 13.0 mgd in 1916 to 8.4 mgd in 1918 and 1919. During prohibition, 1919 to 1933, a few distilleries continued to operate producing industrial alcohol.

Industrial pumpage increased from 8.4 mgd in 1919 to 17.5 mgd in 1932. Industrial use increased sharply to about 37 mgd in 1934 after the end of prohibition. Industrial pumpage reached its peak in 1940 when 43 mgd was withdrawn. Industrial use of groundwater declined to about 19.5 mgd in 1959 as industries began conserving water and using surface water from the Illinois River. Pumpage increased from 19.5 mgd in 1959 to about 25.3 mgd in 1963, but decreased to 16.2 mgd in 1966.

The major industries in the Peoria area using groundwater are distilleries; breweries; meat packing plants; and manufacturers of earth moving equipment, steel products, and chemicals. Data on industrial pumpage were obtained from 48 plants. The majority of the industrial plants do not meter their pumpage; thus, in many cases, pumpage estimates were based on the number of hours the pump operated and the pump capacity, and in some cases, on production data. Industrial pumpage generally is more uniform throughout the year than public pumpage, unless air-conditioning installations are used, the industry is seasonal, or a change in operation occurs as a result of strikes or vacation shutdowns.

Pekin Area. Industrial pumpage in the Pekin area is concentrated in an industrial complex about 1.5 miles southwest of Pekin and more recently across the river near Mapleton (see figure 6). According to Walker et al. (1965) industrial use of groundwater increased from about 1.4 mgd in 1907 to about 20.6 mgd in 1942 (see figure 20). From 1942 to 1966 average annual pumpage has fluctuated from 21.1 mgd in 1951 to 20.0 mgd in 1963 to 22.3 in 1966 (see figure 13). The greatest increase in pumpage was between 1940 and 1942 when pumpage increased from 14.8 mgd to 20.6 mgd.

Data on industrial pumpage were obtained from 10 industries. The major industries in the Pekin area using groundwater are distilleries, power companies, and food processing companies.

Public Supplies

Public supplies include both municipal and institutional uses. Pekin, East Peoria, Marquette Heights, Peoria Heights, Creve Coeur, and North Pekin are dependent upon groundwater as a source of supply. The Peoria Water Works Company provides water service for Peoria, Bartonville, Bellevue, and some unincorporated areas in adjacent townships. Part of the water provided by the Peoria Water Works Company is surface water from the Illinois River, but prior to 1960 the source was entirely groundwater. The Peoria Water Works Company has wells in three pumping centers: the Sankoty, the North, and the Central Well Fields.

Public pumpage increased at a fairly uniform rate until 1959, then decreased from 24.3 mgd in 1959 to 17.0 mgd in 1960 largely as a result of the Peoria Water Works Company obtaining surface water from the Illinois River. Public pumpage was 25.8 mgd in 1966, and municipal pumpage was estimated to be 25.6 mgd.

Water pumped by hotels, hospitals, theaters, motels, and restaurants is classified as institutional pumpage. The water withdrawn from institutional wells is used primarily for air conditioning. Institutional pumpage averaged 0.2 mgd in 1966.

Distribution of Pumpage

Central Well Field Area. As shown in figures 7 and 14, pumpage in the Central Well Field area increased considerably from less than 100,000 gallons per day (gpd) in the late 1840s to 19.9 mgd in 1966. In 1966, 9.6 mgd was public pumpage and 10.3 mgd was industrial pumpage.

Pumpage increased gradually from less than 100,000 gpd in the late 1840s to 4.7 mgd in 1881 and then declined to 2.4 mgd in 1895. After 1895 pumpage increased gradually to 9.8 mgd in 1916. Pumpage declined to 5.8 mgd in 1919 due largely to the effects of prohibition on the distilling industry. Because of an increased industrial activity, pumpage increased to about 10.1 mgd in 1930. During 1933 and 1934 pumpage was about 32 mgd as a result of the ending of prohibition which provided a great stimulus to the distilling industry.

In 1933 about 0.9 mgd of the total pumpage was for institutional use. This increased to about 4.0 mgd by 1944. In 1944 the Peoria Water Works Company drilled a well in the Central Field and by the next year was pumping 2.3 mgd. Public pumpage increased gradually from 0.9 mgd in 1933 to 10.0 mgd in 1956. It decreased to 5.9 mgd by 1962 and increased to 9.8 mgd by 1966. Municipal pumpage does not show a normal growth in the Central Well Field area because the Peoria Water Works Company has wells in three areas and frequently shifts pumpage from one area to another.

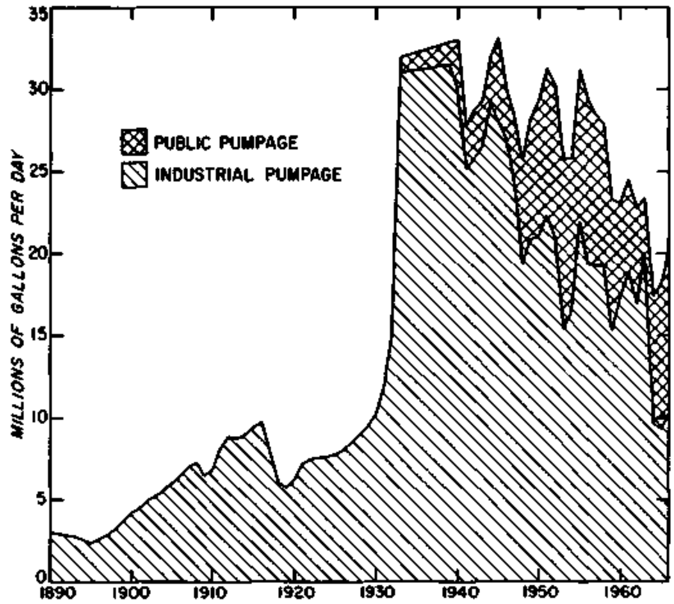

Figure 14. Estimated pumpage, subdivided by use, in the Central Well Field area

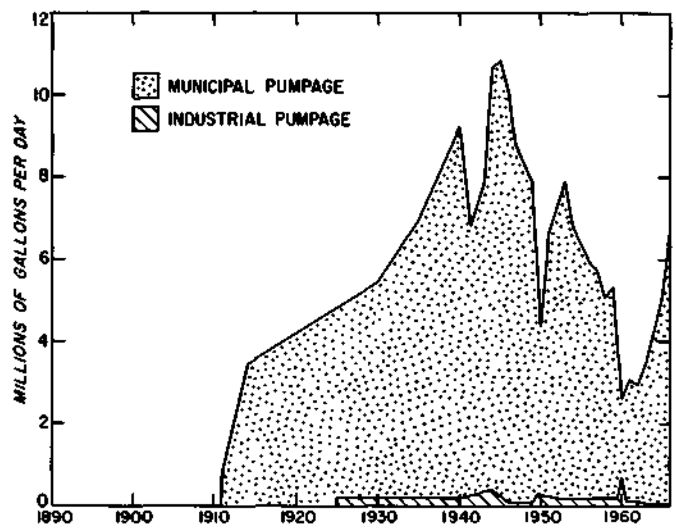

Figure 15. Estimated pumpage, subdivided by use, in the Sankoty Well Field area

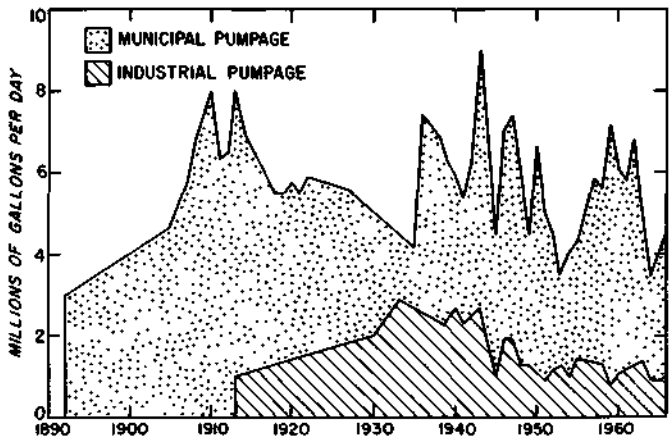

Figure 16. Estimated pumpage, subdivided by use, in the North Well Field area

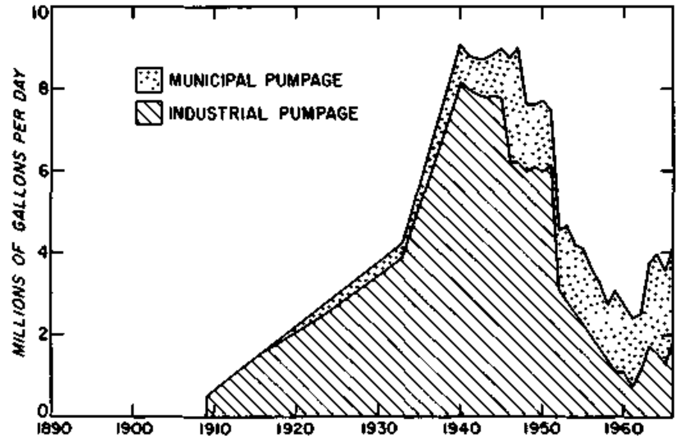

Figure 17. Estimated pumpage, subdivided by use, in the East Peoria Well Field area

Pumpage declined from a peak of about 33.2 mgd in 1945 to 19.9 mgd in 1966 as the result of the conservation of water by industries, the use of larger amounts of surface water, and the closing of a few distilleries. During the period 1945 to 1966, pumpage was the smallest in 1964,17.4 mgd.

Groundwater withdrawals are largely from wells owned by 10 industries and the Peoria Water Works Company; the greatest withdrawals are by the distilling industries and the Peoria Water Works Company.

Sankoty Well Field Area. Pumpage in the Sankoty Well Field area increased from about 0.7 mgd in 1911 to 10.8 mgd in 1945 as shown in figure 15. After 1945 pumpage declined to about 2.6 mgd in 1960 and then increased to 3.6 mgd in 1963 and 6.6 mgd in 1966.

Groundwater withdrawals in the Sankoty Well Field area are largely from wells owned by the Peoria Water Works Company and the village of Peoria Heights. Industrial pumpage has averaged only about 200,000 gpd since 1925. In 1966 industrial pumpage was negligible.

The Peoria Water Works Company and Peoria Heights began withdrawing water from the area in 1911 and 1934, respectively. The decline in pumpage since 1945 is due largely to the shift of pumpage by the Peoria Water Works Company to the Central Well Field.

North Well Field Area. Pumpage in the North Well Field area is largely by the Peoria Water Works Company and the Bemis Company, Inc. Groundwater withdrawals by the Peoria Water Works Company were initiated in 1892. Industrial use of groundwater was started about 1913. Pumpage in the North Well Field area was about 4.5 mgd in 1966. During 1966 withdrawals for municipal and industrial supplies amounted to 3.5 and 1.0 mgd, respectively.

As shown in figure 16, pumpage increased from 3.0 mgd in 1892 to 8.0 mgd in 1910. To supplement the municipal supply the Peoria Water Works Company placed wells in service in the Sankoty Well Field area in 1911. As pumpage from the Sankoty increased, less dependence was placed upon the North Well Field, and municipal pumpage from the field decreased to about 1.5 mgd in 1935. Total pumpage in the North Well Field was 4.2 mgd in 1935 as industrial pumpage increased from 1.0 mgd in 1913 to 2.7 mgd in 1935. After 1935 pumpage fluctuated between a high of 9.0 mgd in 1943 to a low of 3.5 mgd in 1953.

East Peoria Area. As shown in figure 17, pumpage in the East Peoria area increased from about 0.5 mgd in 1909 to 4.2 mgd in 1933. After 1933 pumpage increased sharply to about 9.1 mgd in 1940. Pumpage remained relatively stable until 1947 and then declined to 2.4 mgd in 1961. The decline in pumpage from 1947 to 1961 was largely due to the conservation of water and the use of surface water from the Illinois River by industries. Pumpage increased to 4.2 mgd in 1966. During 1966 withdrawals for public and industrial supplies amounted to 2.3 and 1.9 mgd, respectively. The largest users of groundwater in the area are the city of East Peoria and the Caterpillar Tractor Company.

Mossville Area. As shown in figure 18, groundwater in the Mossville area averaged about 150,000 gpd from 1958 to 1962. In 1963, pumpage increased to about 1.0 mgd as new industrial plants in the area began full operation. Pumpage decreased to about 0.7 mgd during 1966. Pumpage in the Mossville area is predominantly industrial.

Bartonville Area. Pumpage in the Bartonville area is for industrial use as shown in figure 18. Groundwater withdrawals began in 1940 when approximately 1.2 mgd was withdrawn. Pumpage steadily increased to 2.9 mgd in 1943 and gradually decreased to 1.1 mgd in 1946. Pumpage remained uniform at 1.1 mgd from 1946 to 1959 and reached its highest peak in 1963, about 4.2 mgd. Pumpage in 1966 was about 2.4 mgd.

Peoria Lock and Dam Area. Pumpage in the vicinity of the Peoria Lock and Dam is shown in figure 18. Withdrawals of groundwater is chiefly from wells owned by Marquette Heights, Creve Coeur, and North Pekin. Groundwater withdrawals from dewatering during construction of the Peoria Lock and Dam is shown in fig-

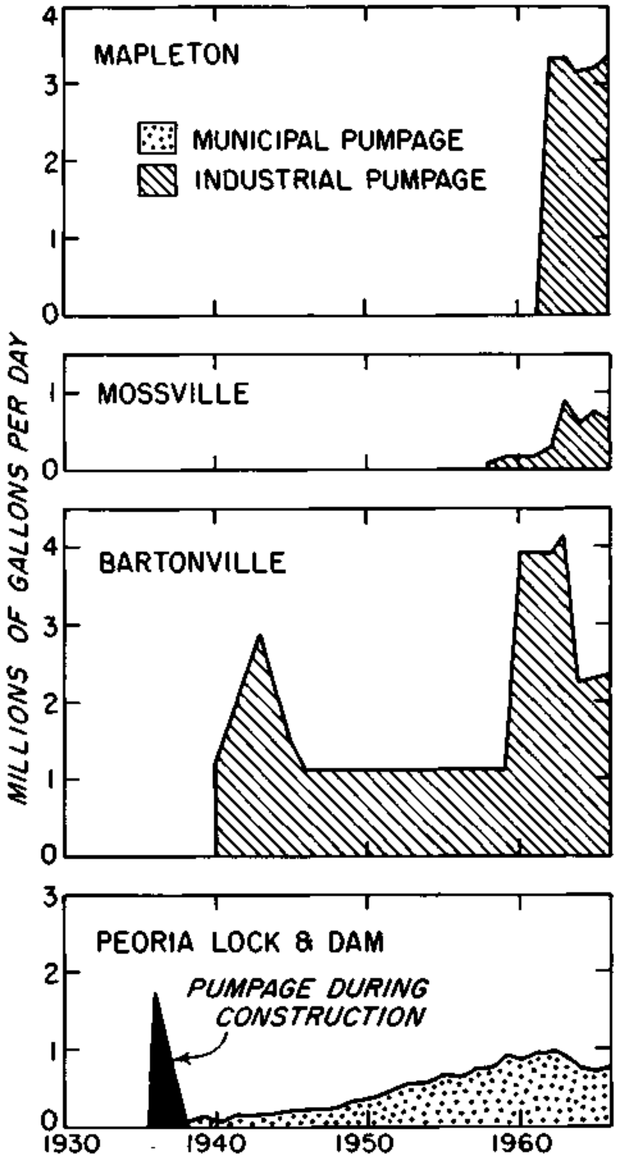

Figure 18. Estimated pumpage in the Ma pie ton, Mossrille, Bartonville, and Peoria Lock and Dam areas

ure 18 for the years 1936, 1937, and 1938. Pumpage for dewatering was greatest in 1936, about 1.8 mgd. Municipal pumpage increased gradually from 60,000 gpd in 1938 to about 0.9 mgd in 1963. Pumpage in 1966 was 0.8 mgd.

Mapleton Area. Pumpage in the Mapleton area is for industrial use as shown in figure 18. Pumpage in 1966 was 3.4 mgd.

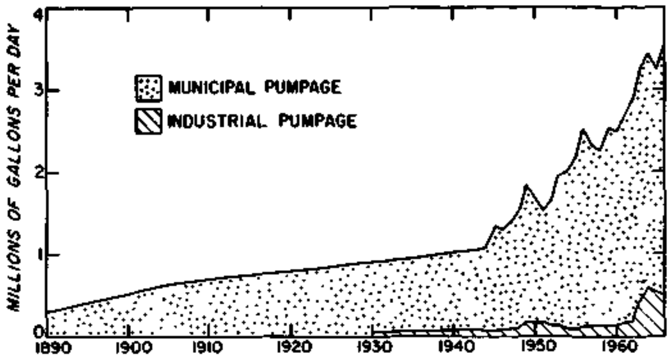

Figure 19. Estimated pumpage, subdivided by use, in the Pekin North area

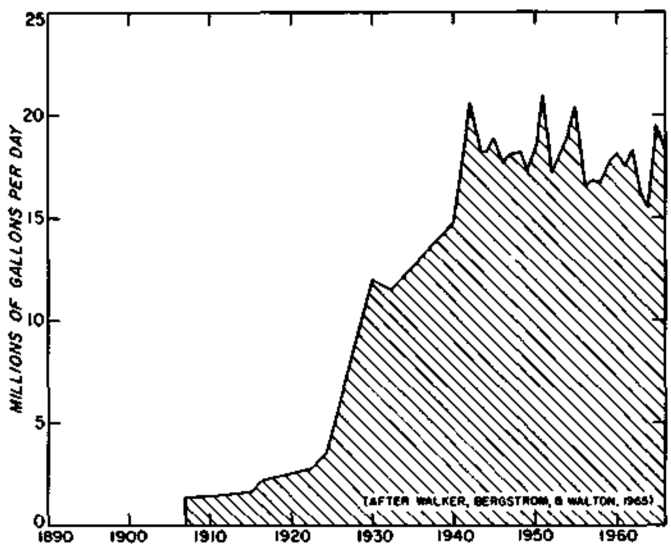

Figure 20. Estimated industrial pumpage in the Pekin South area

Pekin North Area. As shown in figure 19 pumpage in the Pekin North area increased gradually from about 0.2 mgd in 1890 to 1.1 mgd in 1943. Pumpage after 1943 exhibited a greater rate of increase climbing to about 3.5 mgd in 1966. Pumpage in the area is predominantly municipal (Pekin Water Works). Industrial pumpage was less than 200,000 gpd until 1963 when it was about 400,000 gpd. Industrial pumpage in 1966 was about 500,000 gpd.

Pekin South Area. Pumpage in the Pekin South area is for industrial use (figure 20). According to Walker et al. (1965), pumpage in the area increased from about 1.4 mgd in 1907 to 13.8 mgd in 194a. Pumpage in the area after 1940 was greatest in 1951, 20.9 mgd, and least, 15.5 mgd, in 1964. Pumpage in 1966 was 18.4 mgd.

ARTIFICIAL RECHARGE

Artificial groundwater recharge with surface water from the Illlinois River by infiltration pits was introduced in the Peoria area in 1951. A preliminary test using a gravel pit as an infiltration pit was conducted in 1941 (Horberg, Suter, and Larson, 1950; Suter and Harmeson, 1960). Comparison of methods of artificial recharge (see Suter and Harmeson, 1960) and favorable results obtained from the preliminary test led to the selection of infiltration pits as the method of artificial recharge.

Three infiltration pits are currently in operation in the Peoria area. Two of these pits were built by the State Water Survey and are now operated by the city of Peoria engineering department under the direction of the Water Resources and Flood Control Committee of the Peoria Association of Commerce, in consultation with the Water Survey. Artificial recharge was started in Pit 1 on October 4, 1951, and in Pit 2 on September 29, 1956; both are in the Central Well Field area. The other pit, owned by the Peoria Water Works Company, is in the North Well Field area. A fourth pit was operated by the Bemis Company, Inc., also in the North Well Field area. These pits were placed in operation on February 29, 1956, and December 30, 1955, respectively.

Average annual recharge in million gallons per day is given in table 1 for the Central and North Well Field area pits. As shown in table 1, artificial recharge was greatest in the Peoria area during 1961, 6.90 mgd, and least during the initial year of operation (1951), 0.34 mgd. Maximum average recharge was recorded at the Peoria Water Works Company pit, 4.00 mgd, during 1962.

Table 1. Artificial Groundwater Recharge in the Peoria Area, 1951-1966

(Average annual recharge in million gallons per day)

Year	Central Well Field area (State Water Survey Pitsl and 2)	North Well Field area (Peoria Water Works)	North Well Field area (Bemis Company)	Total
1951	0.34			0.34
1952	0.68			0.68
1953	0.48			0.48
1954	0.64			0.64
1955	1.11			1.11
1956	2.09	1.52	1.96	5.57
1957	2.91	1.53	0.53	4.97
1958	2 61	2.06	1.12	5.79
1959	2 33	2.24	1.01	5.58
1960	2.52	3.03	0.30	5.85
1961	2.78	3.88	0.24	6.90
1962	1.38	4.00		5.38
1963	1.10	2.75	0.26	3.85
1964	1.98	2.68	0.16	4.82
1965	1.35	1.01		2.36
1966	0.99	1.64		2.63

The description and operation of the pits and the suitability of surface water from the Illinois River as a source for artificial recharge are discussed in detail by Suter and Harmeson (1960). Subsequent developments in operation of the pits are reported by Thomas (1968).

Some groundwater pumped by industries in the Pekin South area is returned to the aquifer by a gravel pit located in the immediate vicinity of the well field. From 1958 through 1966 an average of 2.1 mgd was returned.

WATER LEVELS IN WELLS

Water levels in wells in the Peoria-Pekin area have been measured periodically for more than 20 years by the State Water Survey and by industries and municipalities. Most of the wells are located within and near pumping centers. The locations of key observation wells are shown in figure 21. Descriptive records of the wells presently being measured appear in appendix table A.

Water levels in wells PEO 8N8E-20.7f in the Central Well Field area and TAZ 24N5W-3.3h in the Pekin North area have been measured since 1933. Water levels in well PEO 8N8E-19.2e in the Central area were measured from 1936 through 1946, after which the well was replaced as an observation well by PEO 8N8E-19.2f. Data for the above wells are shown in figures 22 and 23.

Water levels in the Peoria-Pekin area generally recede in the late spring, summer, and fall when evapotranspiration losses and discharge from the groundwater reservoir by pumping from wells are greater than recharge from precipitation and induced infiltration of surface water from the Illinois River. Discharge by groundwater runoff during the above period also occurs in places remote from pumping centers where groundwater levels are above stages in the river and above stages in tributary streams and creeks. Water levels generally begin to recover in early winter months when conditions are favorable for the infiltration of rainfall. The recovery of water levels is most pronounced during the spring months. Maximum and minimum annual water levels are recorded at different times from year to year. Water levels are frequently highest in May and lowest in December, depending primarily upon climatic conditions, pumping, and the stage of the Illinois River.

During the summer and early fall most rains have slight or no effect on water levels because evapotranspiration and soil moisture demands must be met and are often greater than precipitation. Water levels are affected, however, when precipitation is greater than evapotranspiration and soil moisture requirements. As

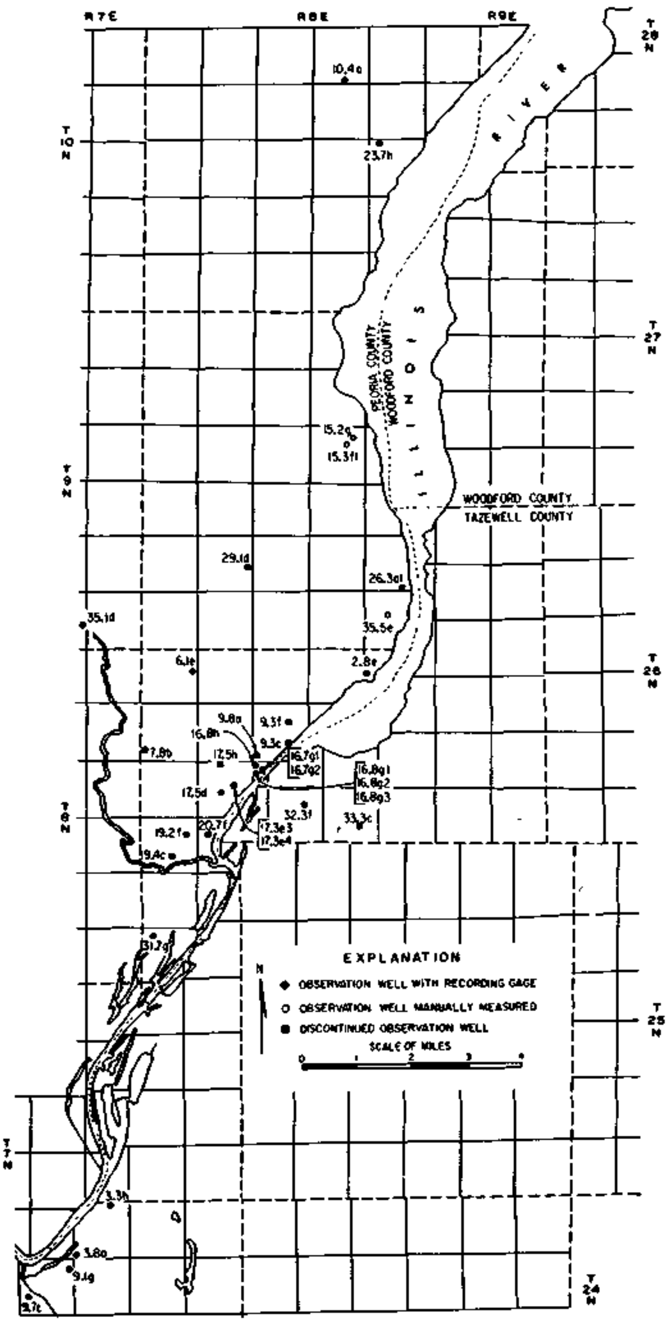

Figure 21. Location of key observation wells

illustrated by the hydrograph for well LIV 27N3E-30.1a (figure 24) located near El Paso (Livingston County) about 35 miles east of Peoria, water levels were affected considerably after heavy rains during the middle of July, early September, and late October. Precipitation during the latter part of July and during August had little noticeable effect on water levels.

Water levels in well PEO 9N7E-35.1d furnish a good index of the trend of the water table in the Peoria area from 1942 to 1964. The well is in an area remote from pumping centers and the effects of the Illinois River. The hydrograph of water levels in the well and the graph of annual precipitation at Peoria for 1942 through 1964 in figure 25 illustrate the effects of below normal precipitation on water levels. Water levels were lowest during 1956 when the average groundwater elevation was about 460.5 feet. Rainfall averaged about 27.8 inches per year during 1955 and 1956 or about 6.9 inches below normal.

Water levels in the shallow deposits along the Illinois River are affected by the stage of the Illinois River. Prior to groundwater development in the area, water levels in the deposits along the river were at most places at a higher elevation than the surface elevation of the Illinois River during low river stages. Water levels in well CSS 18N12W-15.4g, located only a few hundred feet from the Illinois River, in Reardstown (Cass County) about 75 miles southwest of Peoria, and corresponding Illinois River stages at Reardstown are shown in figure 26. During periods when the stage of the Illinois River was low, water levels in the well were from less than a foot to 1 foot higher than the river. During periods when the stage of the river rose above the water level in the well, water levels in the well rose correspondingly, reaching a peak a few days after the peak river stage. As the stage of the river declined, water levels in the well also declined but at a lesser rate. The surface elevation of the river was higher than water levels in the well during most of the year.

Large withdrawals from the groundwater reservoir have lowered water levels considerably along the reach of the Illinois River from the Sankoty Well Field area to Pekin. As a result of lowering water levels and the close proximity of areas of withdrawal to the river,

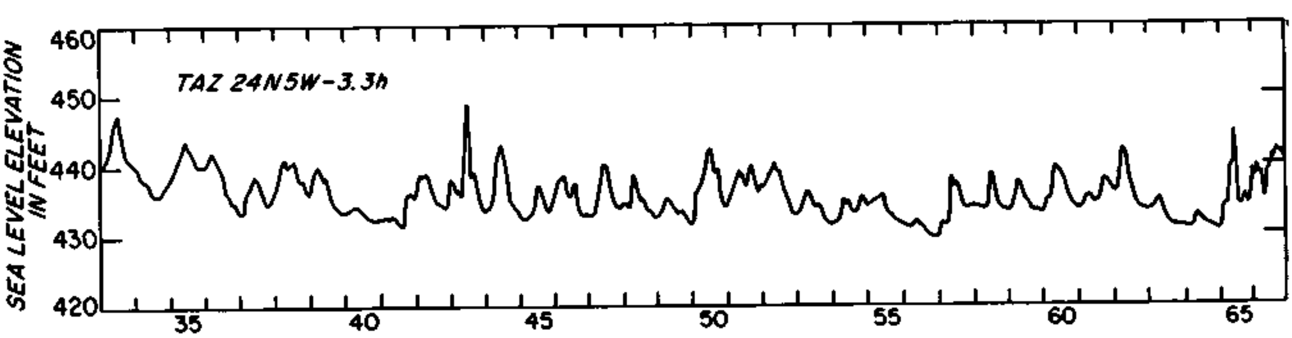

Figure 22. Water levels in well in the Pekin North area

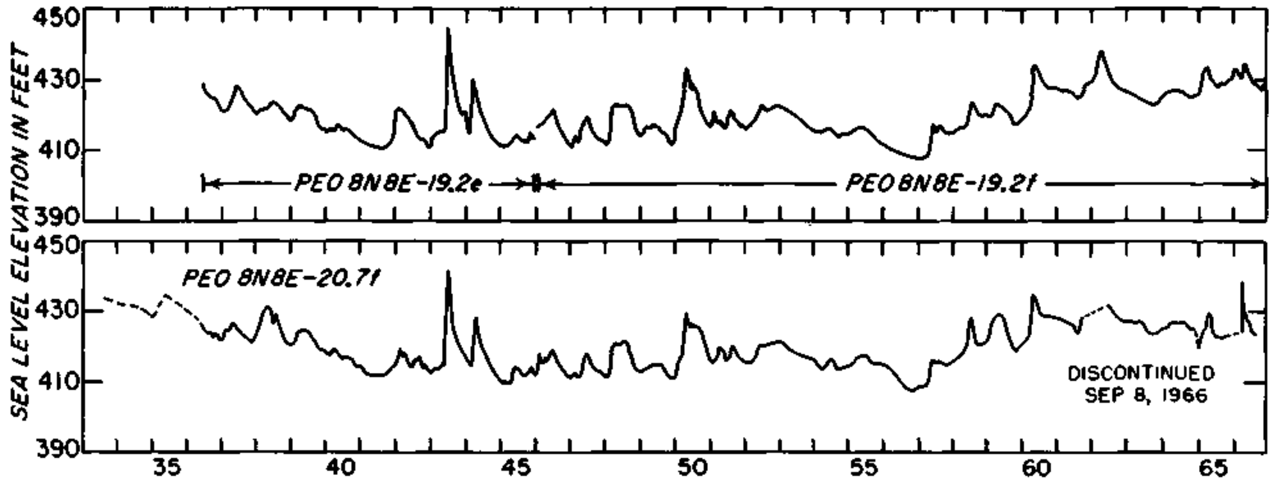

Figure 23. Water levels in wells in the Central Well Field area

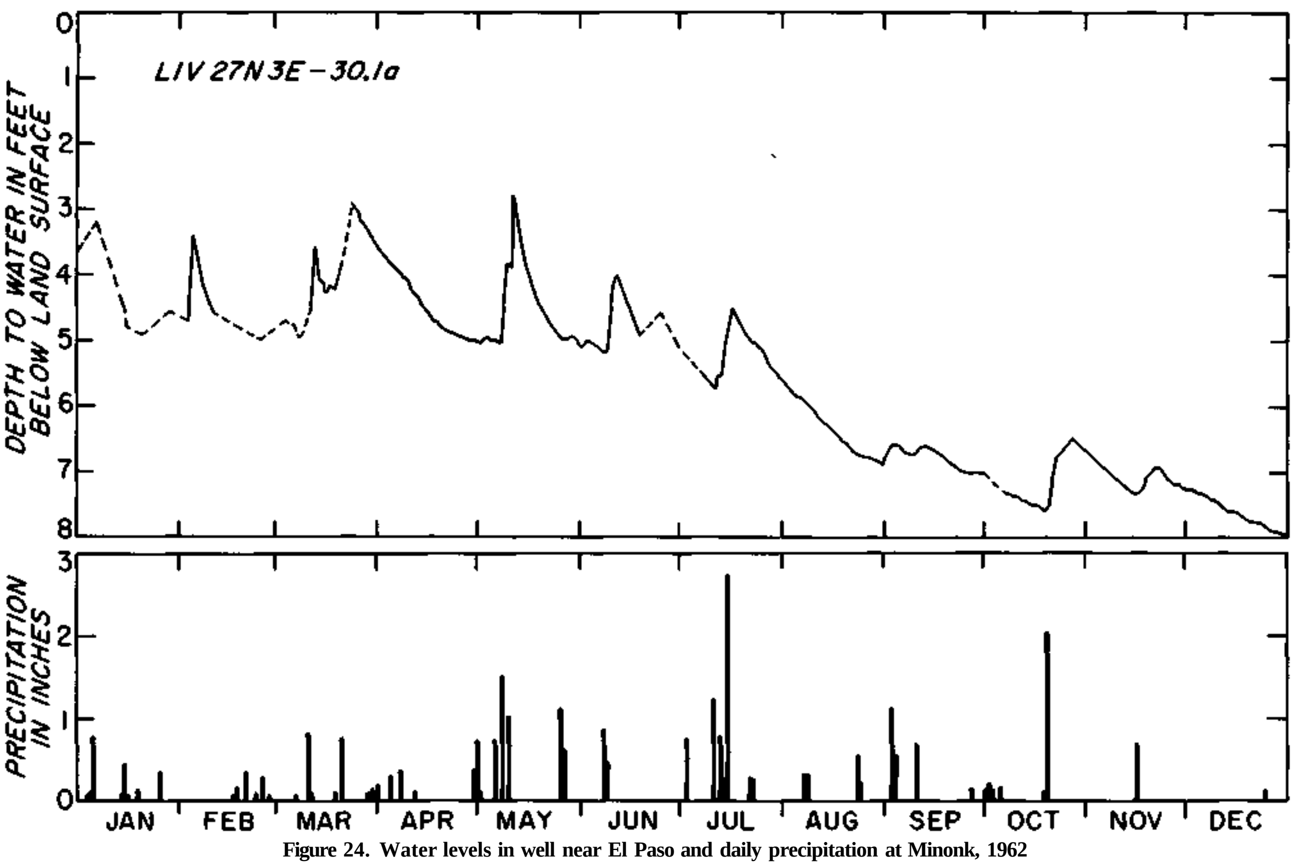

Figure 24. Water levels in well near El Paso and daily precipitation at Minonk, 1962

groundwater levels along much of the reach are lower than the surface of the Illinois River. Water levels in wells in the Sankoty, North, Central, East Peoria, and Pekin South Well Field areas and corresponding Illinois River stages are shown in figures 27 through 29.

Water levels in well PEO 9N8E-15.2g in the Sankoty Well Field area and Illinois River stages at the Peoria Boatyard are shown in figure 27. The well is located about 1900 feet from the Illinois River. The effects of changes in the stage of the Illinois River on water levels in the well are evident during each of the years shown. Water-level fluctuations caused by nearby pumpage are superimposed on the annual water-level cycle.

Water levels in well PEO 9N8E-35.5e and Illinois River stages at the Peoria Boatyard are shown in figure 28. The well is located in the North Well Field area about 600 feet from the Illinois River. The effects of river stage changes on water levels in the well are similar to those shown on figure 27. As shown in figures 27 and 28, during periods of low river stage the aver-

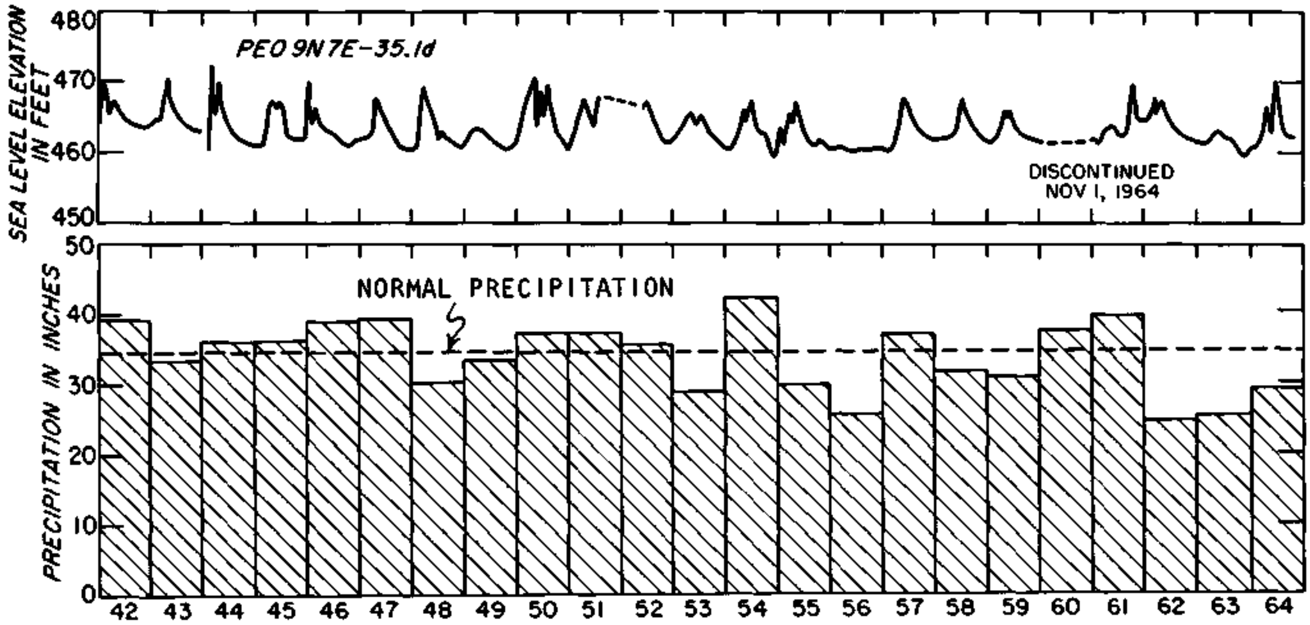

Figure 25. Water levels in well and annual precipitation at Peoria, 1942-1964

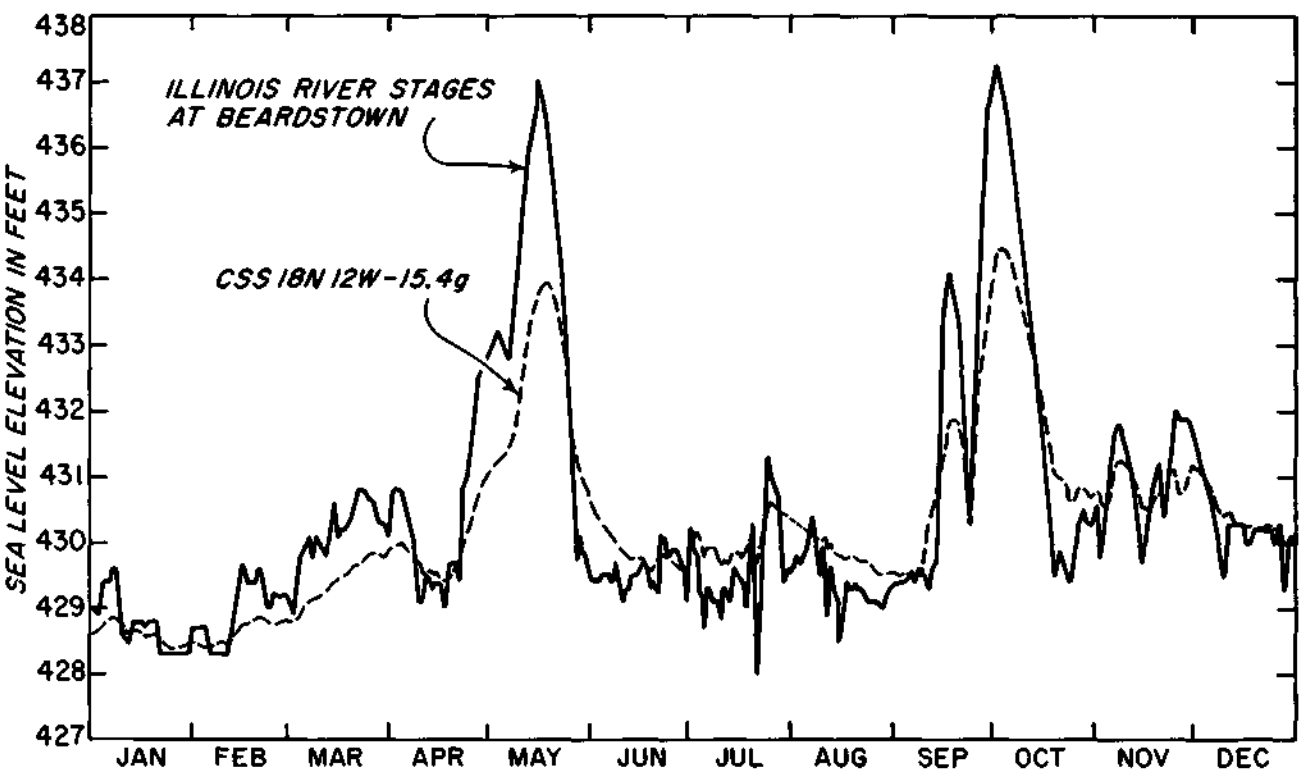

Figure 26. Water levels in well and Illinois River stages at Beardstown, 1961

age surface elevation of the river is 20 to 25 feet higher than corresponding water levels in the wells. Differences in elevation during high river stages are much less.

The relation between water levels in well PEO 8N8E-2.8e and Illinois River stages is shown in figure 29. The well is located about the same distance from the Illinois River as well PEO 9N8E-15.2g and is in the same well field but a greater distance from the center of pumpage. From 1941 to early in 1944 water levels in the well averaged less than 5 feet below the surface elevation of the river. After 1944 water levels in the well recovered to stages above the surface elevation of the river as pumpage in the immediate vicinity of the well decreased sharply.

Water levels in wells TAZ 26N4W-33.3c, in the East Peoria Well Field area, and PEO 8N8E-9.3c and PEO 8N8E-20.7f, in the Central Well Field area, and the Illinois River stages at the Peoria Boatyard are shown dur-

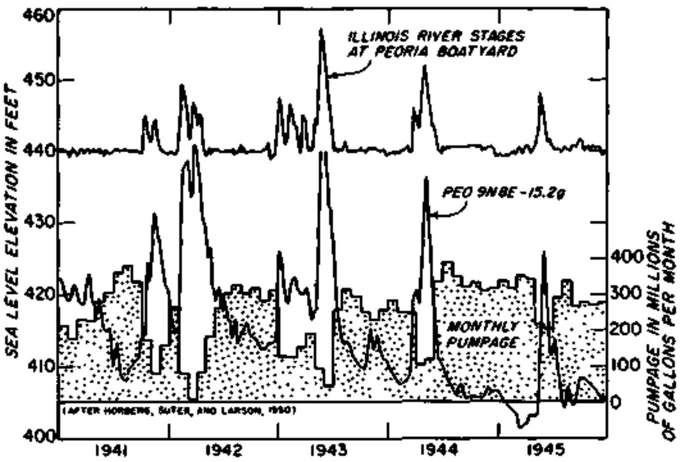

Figure 27. Water levels in well, pumpage by Peoria Water Works Company in Sankoty Well Field, and Illinois River stages

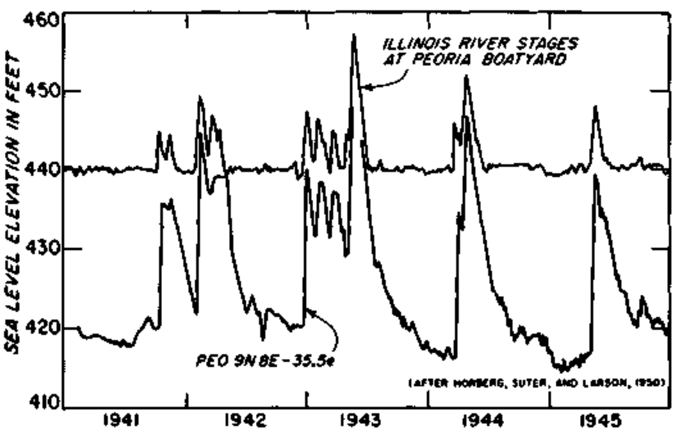

Figure 28. Water levels in well PEO 9N8E-35.5e and Illinois River stages

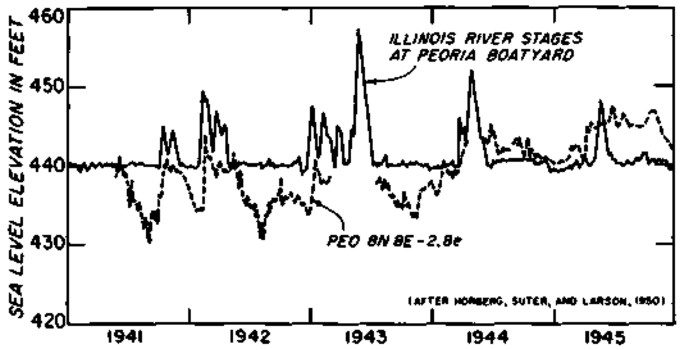

Figure 29. Water levels in well PEO 8N8E-2.8e and Illinois River stages

ing 1956 and 1960 in figures 30 and 31, respectively. During 1956 the average surface elevation of the river was about 440 feet and only minor changes in stage occurred. The effect of river stage change on water levels in wells was not noticeable. Water levels in the above wells average 10 to 30 feet below the surface elevation of the river depending upon the distance of the wells from the river and the location of wells in relation to areas of heavy pumpage. In 1960, as shown in figure 31, the stage of the Illinois River rose appreciably and, correspondingly, water levels rose in the wells, reaching a peak after the peak river stage. Lesser changes in river stage occurred during January, February, May, and June, and had little noticeable effect on the water levels in the wells.

Water levels in wells TAZ 24N5W-9.7c and TAZ 24N5W-3.8a, in the Pekin South Well Field area, and Illinois River stages at the Pekin Highway Bridge during 1956 are shown in figure 32. Water levels in well TAZ 24N5W-3.8a, located near the center of pumpage, average about 8 feet lower than the surface elevation of the river. Water levels in well TAZ 24N5W-9.7c, located on the southern edge of the pumping center, were below the surface elevation of the river, except for brief periods during low river stages in the summer.

Water levels in the vicinity of infiltration pits are affected during periods when the pits are in operation. The effects of artificial recharge on water levels in wells immediately adjacent to the pits are especially pronounced as shown in figure 33. Water levels in well PEO 8N8E-16.7g2 receded sharply after the operation of the pits ceased on April 14, and continued to recede until operation of the pits resumed in September.

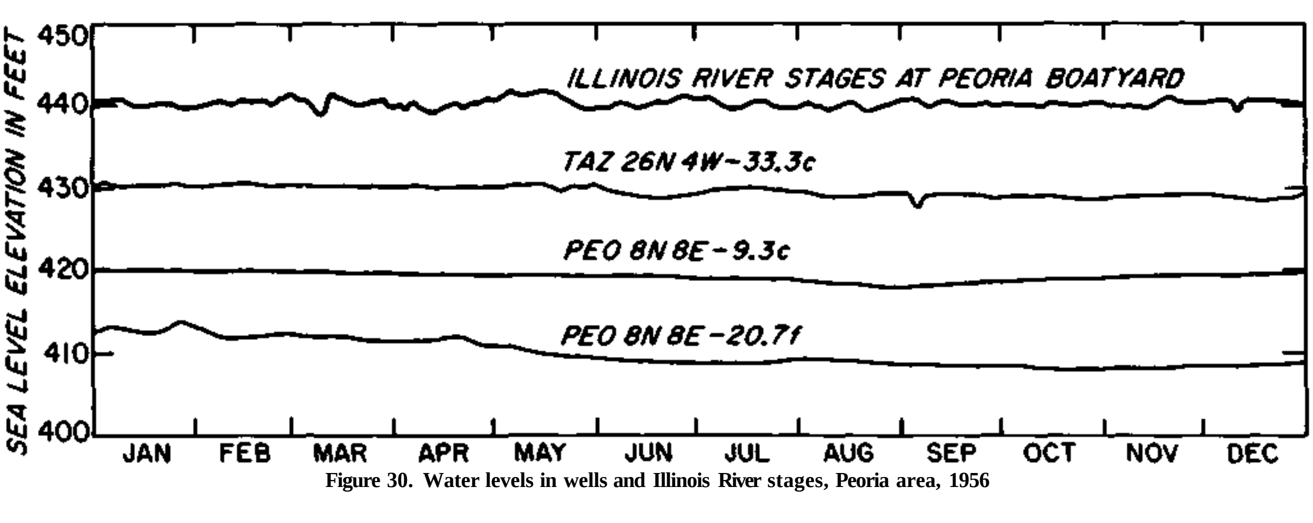

Figure 30. Water levels in wells and Illinois River stages, Peoria area, 1956

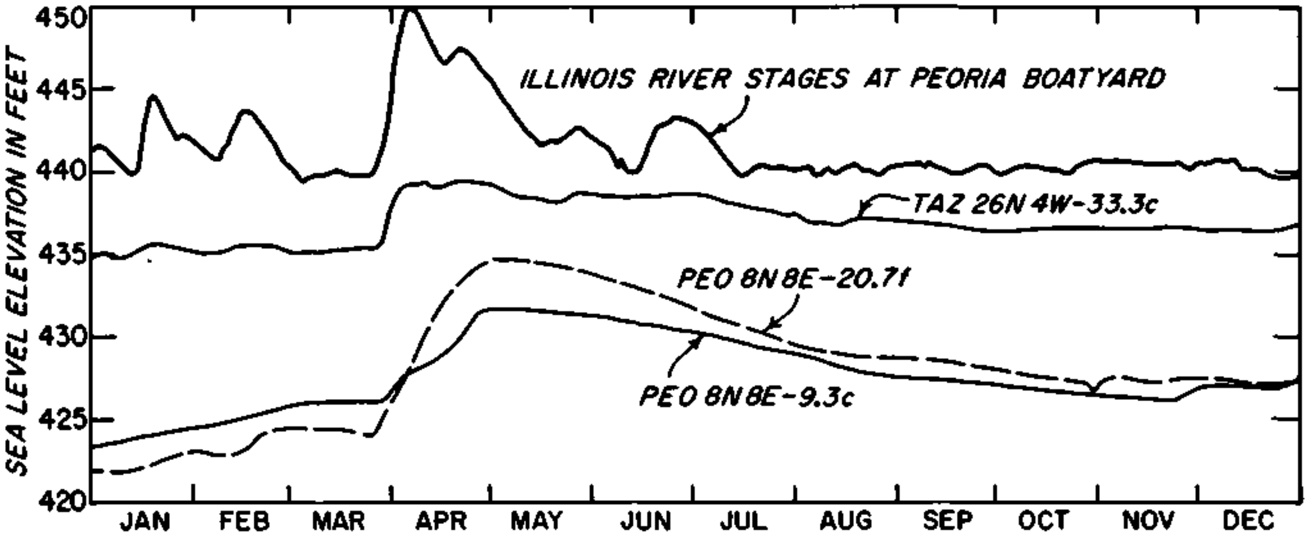

Figure 31. Water levels in wells and Illinois River stages, Peoria area, 1960

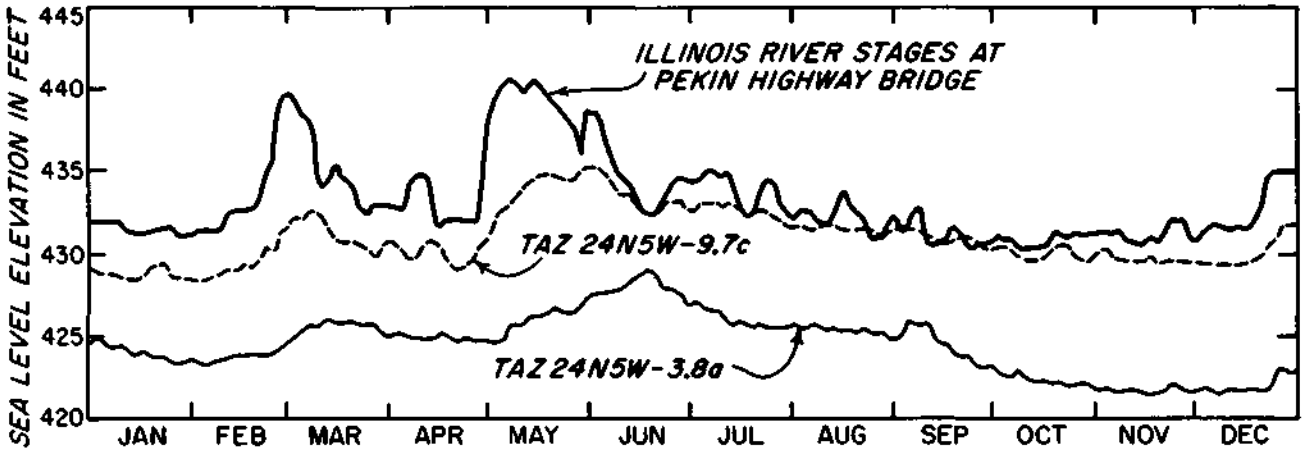

Figure 32. Water levels in wells and Illinois River stages, Pekin area, 1956

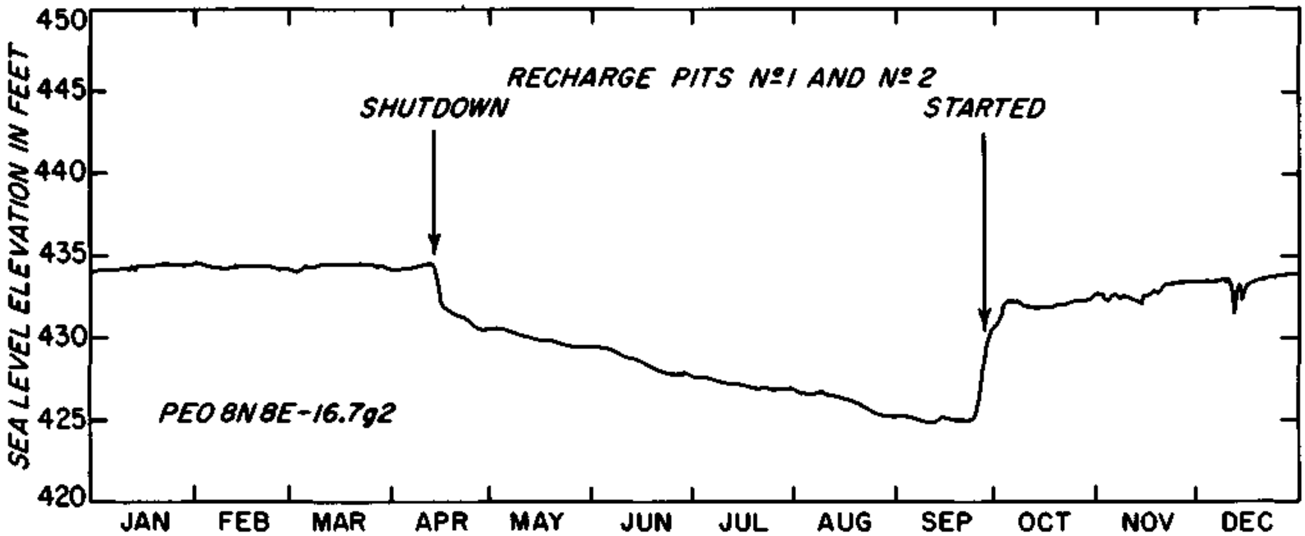

Figure 33. Water levels in well adjacent to recharge pits, 1961

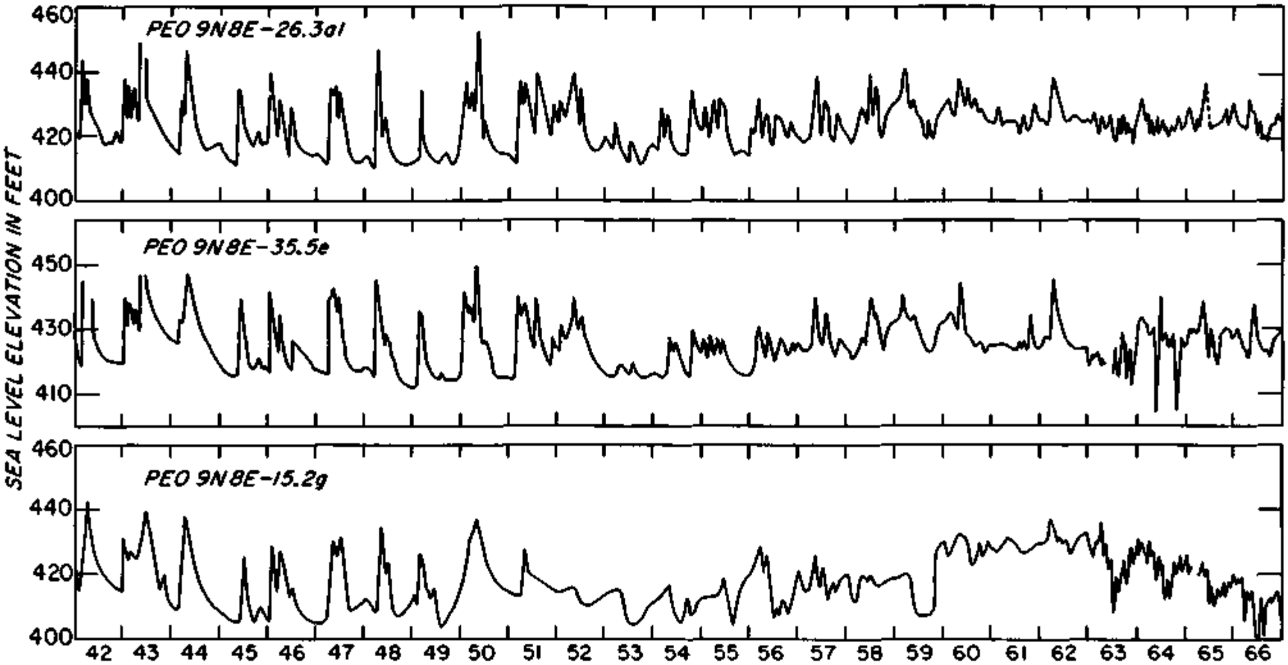

Figure 34. Water levels in wells in the North and Sankoty Well Field areas

Sankoty Well Field Area

A hydrograph of water levels in well PEO 9N8E-15.2g, located near the center of the Sankoty Well Field area cone of depression, from 1942-1966 is shown in figure 34. Water levels in the well respond to changes in pumping, recharge from precipitation, and induced infiltration from the Illinois River.

Water levels declined about 2.5 feet per year as pumpage in the area increased from 6.8 mgd in 1942 to 10.8 mgd in 1945. Water levels recovered gradually from an elevation of 405 feet at the end of 1945 to an elevation of 415 feet by the end of 1950 as pumpage declined sharply to 4.4 mgd by 1950. From 1950 to the end of 1953 water levels declined about 1 foot per year as pumpage increased to 7.9 mgd. Although pumpage declined again after 1953, water levels remained low because of unfavorable conditions for recharge. From 1960 to 1962 pumpage was low, about 3 mgd per year, and water levels rose from an average elevation of 415 feet to an average elevation of 430 feet. Water levels declined from an average elevation of 420 feet in 1963 to an average elevation of 410 feet in 1966 as pumpage in the area increased from 3.6 mgd to 6.6 mgd, respectively.

North Well Field Area

Water levels in wells PEO 9N8E-26.3al and PEO 9N8E-35.5e have been measured since 1942 (see figure 34). The wells are located near the Illinois River and within the North Well Field area cone of depression. Water levels in the area are affected by changes in pumping, recharge from precipitation, induced infiltration from the Illinois River, and since 1956, artificial recharge with surface water.

Pumping changes from 1942 to 1953 were erratic, and water levels in wells PEO 9N8E-26.3al and PEO 9N8E-35.5e did not reflect appreciable water level trends. After 1953 water levels in these wells rose an average of 1 foot per year although pumpage increased from 3.5 mgd in 1953 to 6.8 mgd in 1962. The rise in water levels was partly due to artificial recharge with surface water which averaged 3.3 mgd during the period 1956 to 1963. From 1964 to 1966 water levels remained at an average elevation of 425 feet although pumpage increased from 3.5 mgd to 4.5 mgd, respectively, and artificial recharge with surface water averaged 1.8 mgd.

Central Well Field Area

As was shown in figure 14, pumpage in the Central Well Field area increased from about 14 mgd at the end of 1932 to 33 mgd by 1940. Pumpage increased less abruptly after 1934 when pumpage was 31.8 mgd. During this period recharge from precipitation and induced infiltration of surface water from the Illinois River did not balance discharge, and water levels in wells did not stabilize but receded at an alarming rate.

As shown by the hydrograph of water levels in well PEO 8N8E-20.7f (see figure 23), water levels declined at an average rate of 2.5 feet per year from the end of 1933 to the summer of 1941. Water levels recovered markedly during 1942, 1943, and 1944 as pumpage decreased to 29 mgd by 1944 and high river stages made conditions more favorable for recharge by induced infiltration. Water levels were low in 1945, averaging

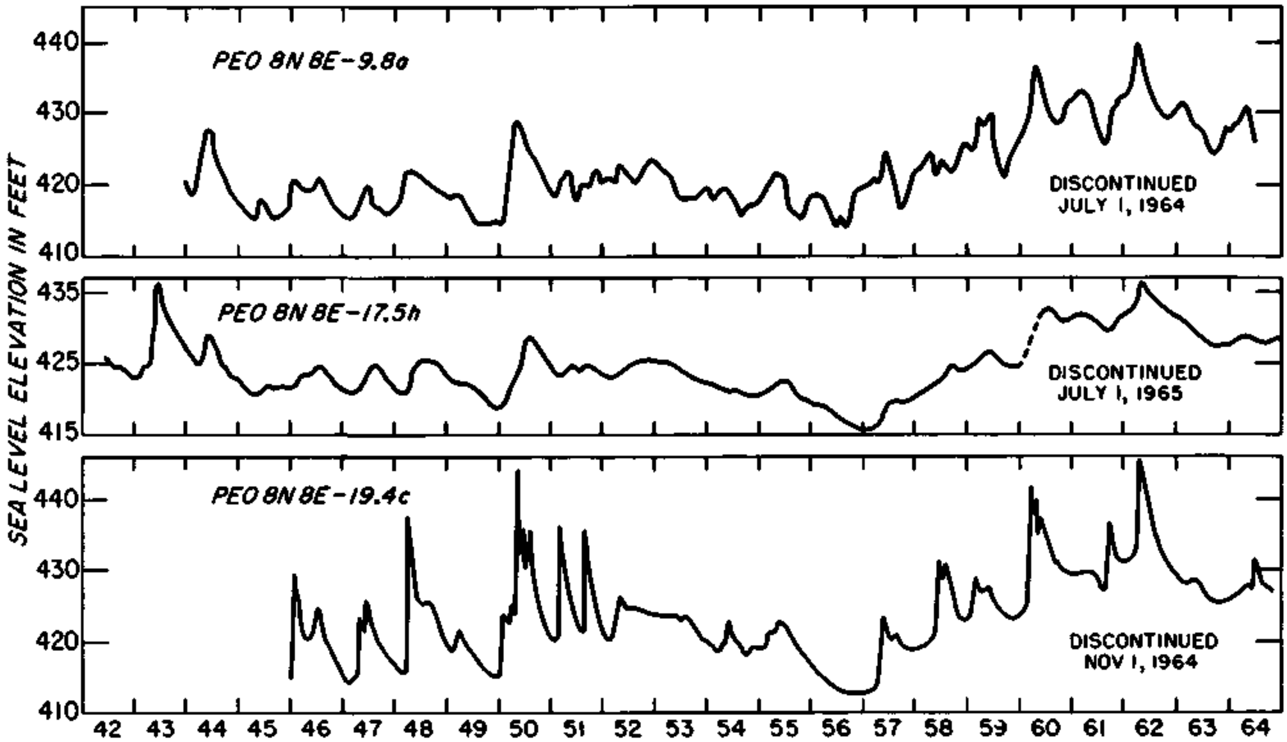

Figure 35. Water levels in wells in Central Well Field area

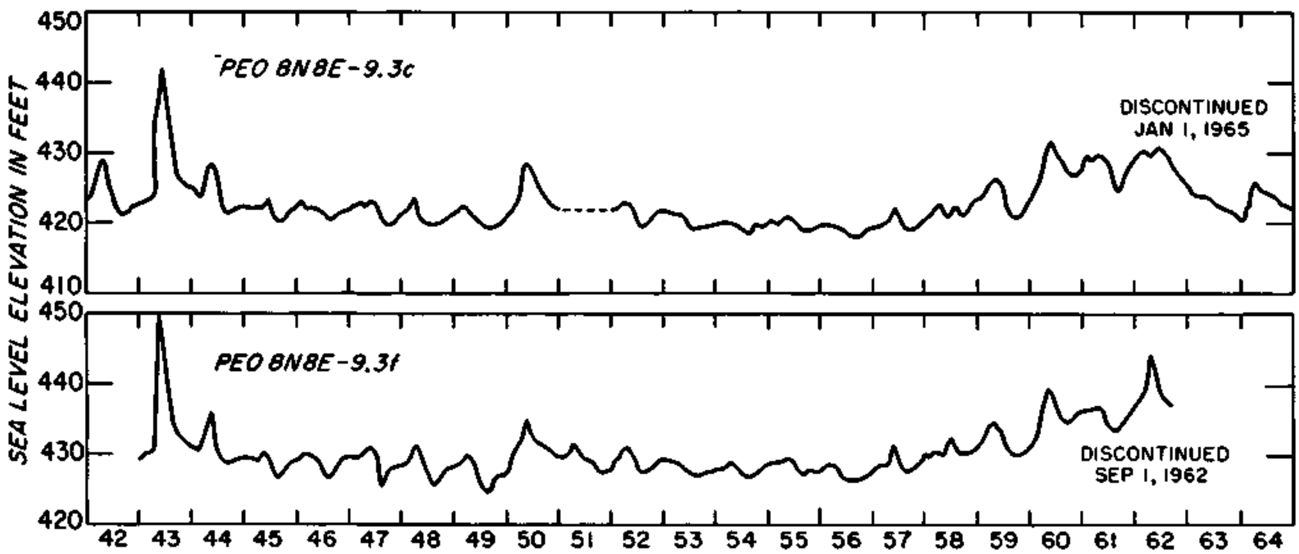

Figure 36. Water levels in wells in Central Well Field area

about 412 feet in elevation as pumpage increased to a record high of 33.2 mgd. From 1945 to the end of 1952 water levels recovered at a rate of about 1.5 feet per year as pumpage declined to 25.8 mgd by 1953. Water levels declined to a record low of 408 feet in elevation during 1956 because of unfavorable recharge conditions, much below normal precipitation, and low river stages. Water levels recovered at a rate of 3.3 feet per year after 1956 as conditions for recharge were more favorable, pumpage declined, and the use of surface water from the Illinois River for artificial recharge was accelerated.

As shown in figures 23 and 35, water level changes in wells PEO 8N8E-19.2f, PEO 8N8E-9.8a, PEO 8N8E-19.4c, and PEO 8N8E-17.5h parallel water level changes in well PEO 8N8E-20.7f.

Water levels in wells PEO 8N8E-9.3c and PEO 8N8E-9.3f, located on the northern fringe of the Central Well Field area, are shown in figure 36. The water level changes are similar to those shown in figures 23 and 35.

East Peoria Well Field Area

Water levels in the East Peoria area are affected by local pumpage, pumpage in the Central Well Field

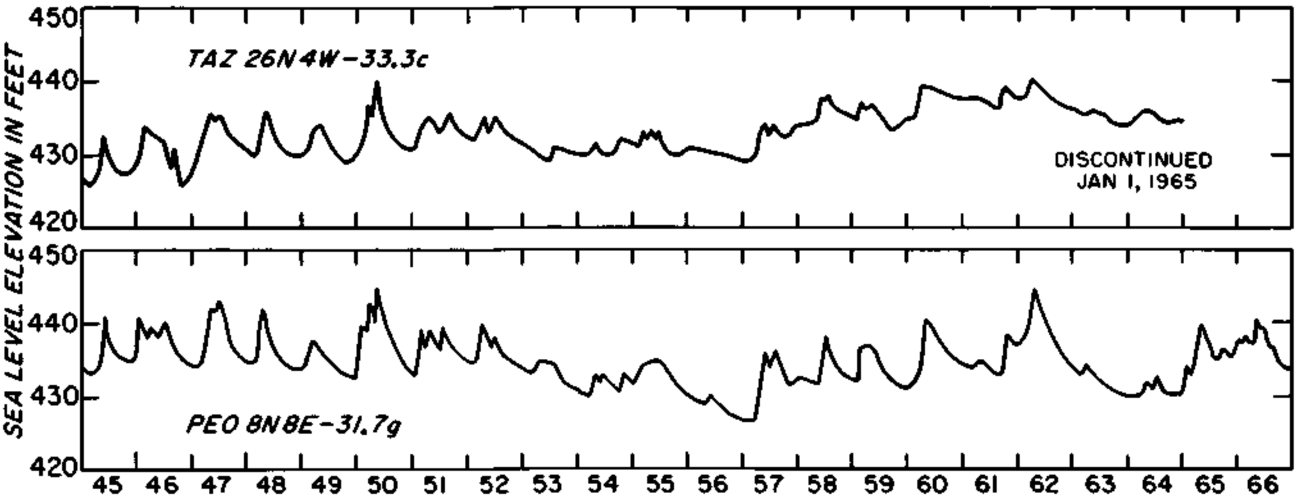

Figure 37. Water levels in wells in the East Peoria Well Field and Bartonville areas

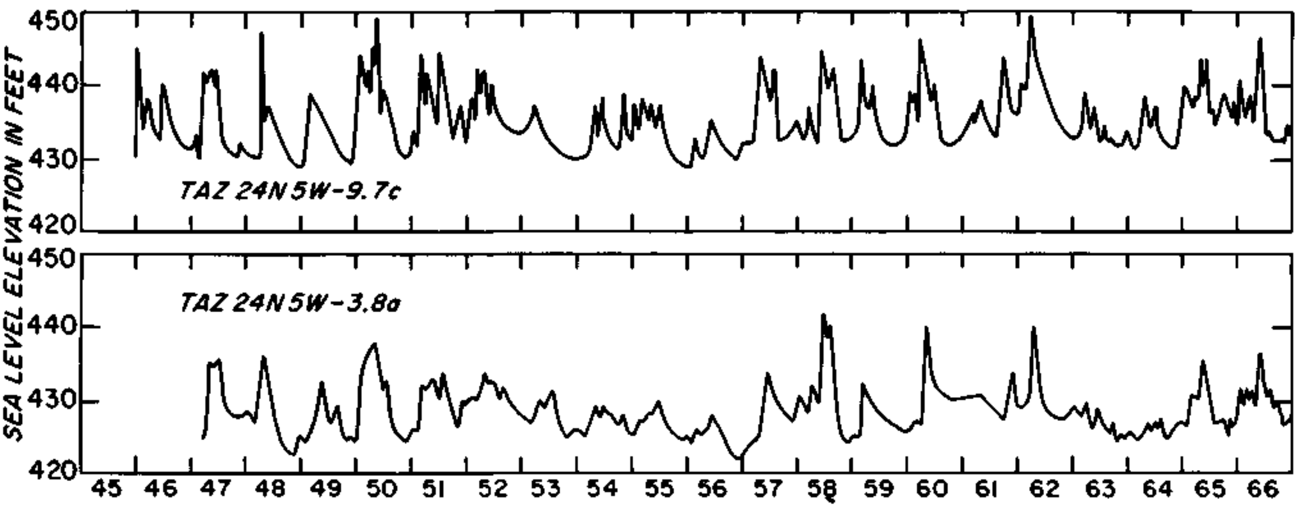

Figure 38. Water levels in wells in the Pekin area

area, recharge from precipitation, and recharge from induced infiltration of surface water from the Illinois River. As shown by the hydrograph of water levels in well TAZ 26N4W-33.3c (figure 37), water levels in the East Peoria area recovered at an average rate of 0.75 foot per year from 1945 to 1952 as pumpage decreased in the area about 4.4 mgd. Although pumpage dropped during the period 1953-1956, water levels receded slighdy because of unfavorable conditions for recharge. Pumpage decline continued until 1962, and as recharge conditions became more favorable water levels rose at an average rate of 1 foot per year from 1957 to 1962. From 1962 to 1963 water levels declined an average of 3 feet as pumpage increased from 2.5 mgd to 3.7 mgd. Water levels remained at an average elevation of 435 feet during 1963 and 1964 although pumpage increased about 0.3 mgd during this period.

Bartonville Area

Water levels in well PEO 8N8E-31.7g located in the Bartonville area are shown in figure 37. Recession of water levels from 1945 to 1951 is not evident as pumpage remained constant during the period (figure 18). Water levels receded during the 1952-1956 drought at an average rate of 2 feet per year. After the drought water levels recovered at an average rate of 0.75 foot per year. From 1963 to 1966 water levels in the well rose about 5 feet while pumpage in the area declined from 4.1 mgd to 2.3 mgd.

Pekin Area

Hydrographs of water levels in the Pekin area are shown in figures 22 and 38. Water levels in well TAZ 24N5W-3.3h (figure 22) declined at an average rate of 1 foot per year as pumpage increased from 12.4 mgd in 1933 to 20.0 mgd in 1941. No great changes in pumpage were recorded after 1941, and water levels reflected changes in quantities of recharge. Water levels in the well declined during the drought period from an elevation of 433 feet in January 1953 to an elevation of 429 feet in December 1956. Water levels recovered 4 feet

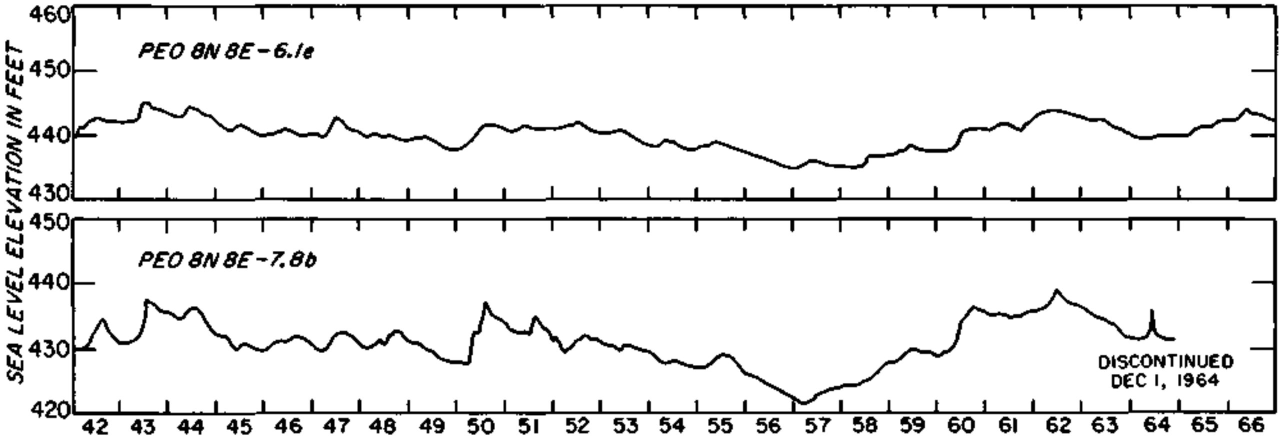

Figure 39. Water levels in wells remote from major pumping centers in the Peoria area

during 1957 as conditions became more favorable for recharge. Similar changes in water levels occurred in wells TAZ 24N5W-9.7c and TAZ 24N5W-3.8a (figure 38).

Areas Remote from Pumping Centers

Hydrographs of water levels in wells PEO 8N8E-6.1e and PEO 8N8E-7.8b are shown in figure 39. Well PEO 8N8E-6.1e is located 2.5 miles from the Central Well Field area and 4 miles from the North Well Field area. Well PEO 8N8E-7.8b is located 2 miles from the Central Well Field area. Water levels during the period 1942 through 1951 reflect variations in amounts and distribution of annual recharge; no water level trends are apparent. During the 1952-1956 drought, water levels receded at average rates of 1.4 feet per year in well PEO 8N8E-6.1e and 2 feet per year in well PEO 8N8E-7.8b. Water levels recovered after the drought at average rates of 1.3 feet per year in well PEO 8N8E-6.1e and 2.5 feet per year in well PEO 8N8E-7.8b.

Water-Level Contour Maps

Prior to the period of large groundwater withdrawals, groundwater levels along the Illinois River were near the river surface elevation. The establishment of industrial centers with the subsequent use of large quantities of groundwater by industries and municipalities has lowered water levels appreciably along the river from Peoria to Pekin. Cones of depression created by pumping were apparent in the Sankoty, the North, the Central, and the Pekin Well Field areas by 1933 (Horberg et al., 1950), about the time the heavy pumping started. Horberg et al. (1950) presented a generalized groundwater contour map for 1933 and groundwater contour maps for several periods from 1941 to 1945.

During 1966-1967 two mass measurements of groundwater levels were made in the Peoria area, one in August 1966 when water levels were near minimum stages and one in April 1967 when water levels were

Table 2. Illinois River Stages

Gage description	Illinois River mile number	Water surface elevations (feet above msl) August 10, 1966	April 19, 1967
Chillicothe	180.3	440.5	445.0
Peoria Boatyard	164.2	440.4	444.6
Peoria Lock and Dam (upper)	157.8	440.1	443.8
Peoria Lock and Dam (lower)	157.6	432.2	443.8
Pekin	152.9	431.8	443.0

near maximum stages. Data on groundwater and surface water levels collected during the mass measurements are given in table 2 and in appendix table B.

The groundwater surface maps for August and April are shown in figures 40 and 41, respectively. Features of the two maps are generally the same. The deepest cone of depression in August 1966 was centered in the Sankoty Well Field area where the lowest water levels were at an average elevation of about 410 feet. A smaller cone of depression occurred in the North Well Field area which is about 2.5 miles south of the large Sankoty cone of depression. The water levels in the center of this cone of depression were at an elevation of about 420 feet. The elevation of the water levels in the center of the Central Well Field area cone of depression was about 430 feet. This cone of depression is about 5.5 miles southwest of the large Sankoty cone of depression. During April 1967 the water levels in the Sankoty, the North, and the Central Well Field areas were at an elevation of about 415 feet, 430 feet, and 430 feet, respectively.

The general pattern of flow of water in 1966-1967 was slow movement from all directions toward the cones of depression or the Illinois River. The lowering of water levels in the Sankoty, the North, and the Central Well Field areas that has accompanied withdrawals of groundwater in these areas has established hydraulic gradients from the Illinois River toward pumping centers. Groundwater levels were below the surface of the river in the vicinity of pumping centers, and appreciable quantities of water were diverted from the river into the aquifer by the process of induced infiltration. However, the

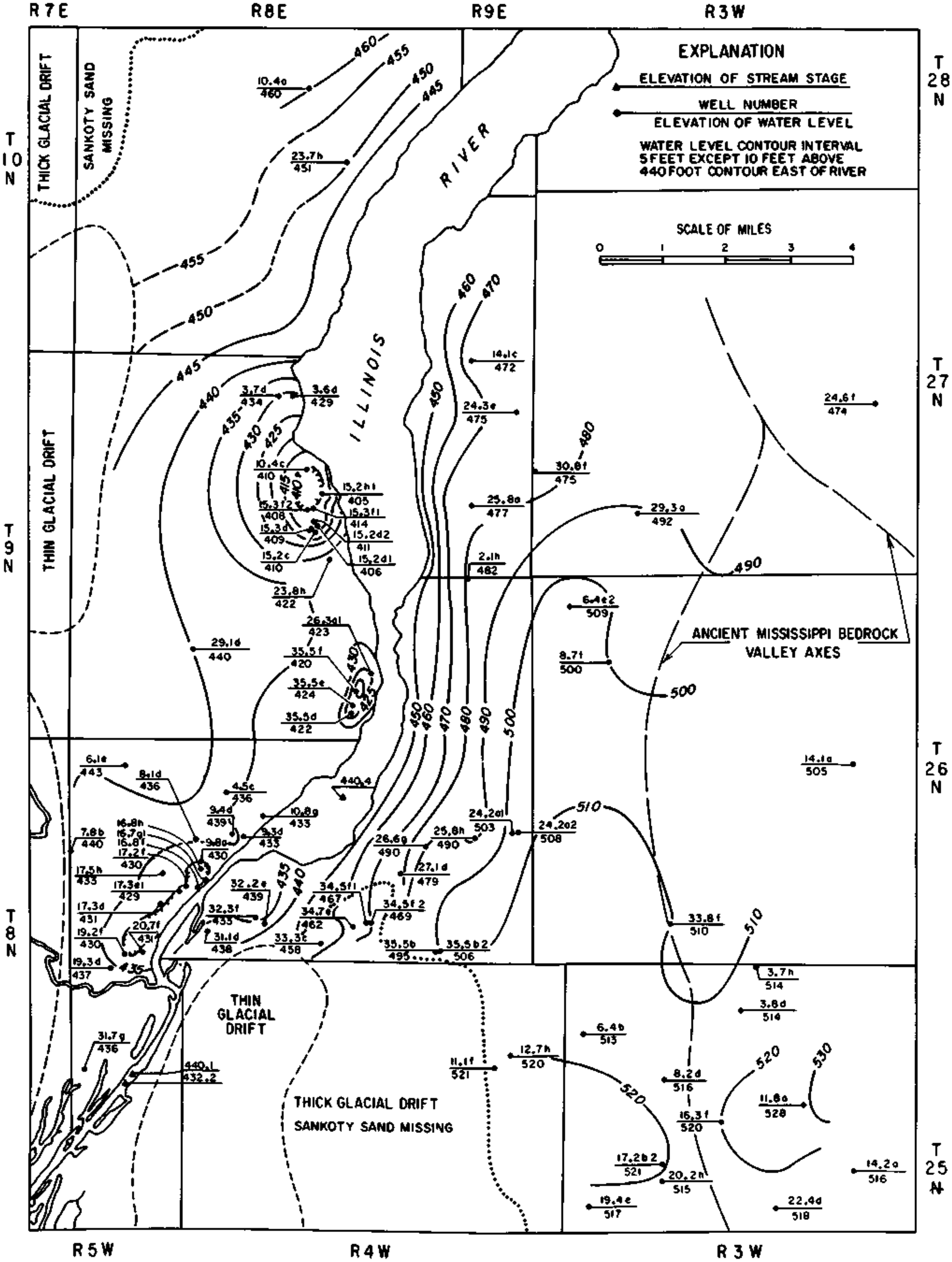

Figure 40. Water-level contour map, August 8-12,1966

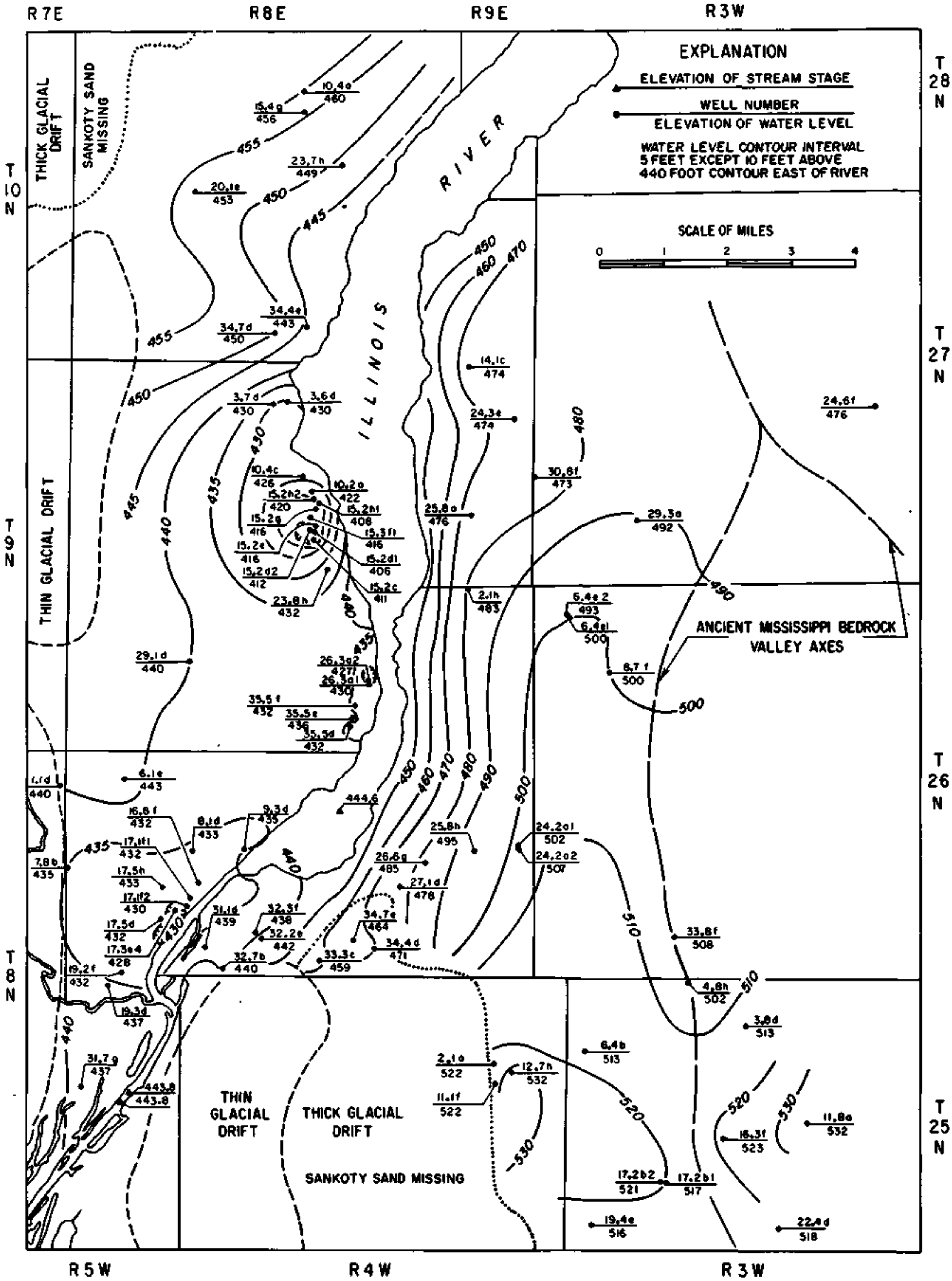

Figure 41. Water-level contour map, April 17-21,1967

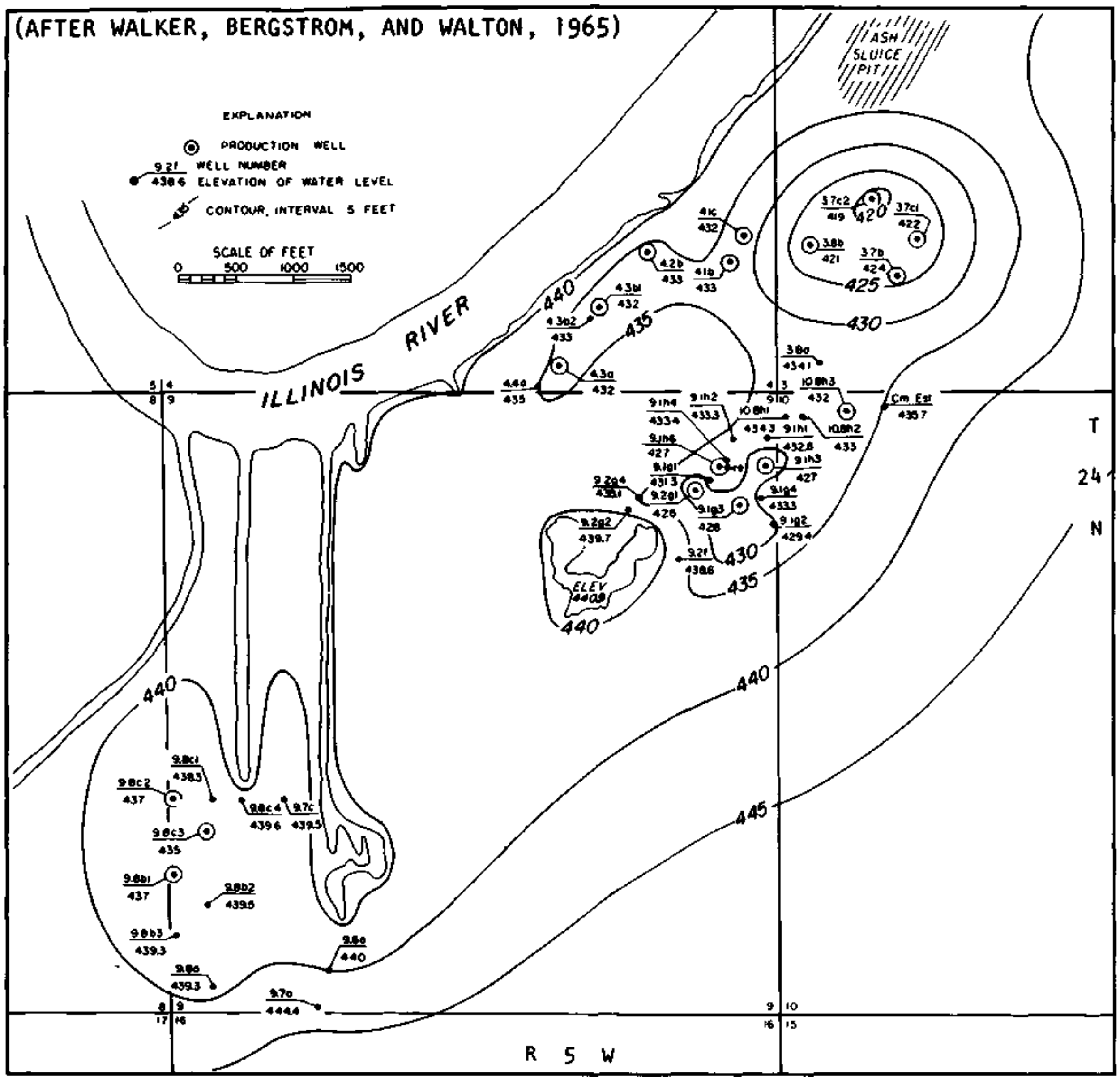

Figure 42. Approximate eleyaHon of the water table in the Pekin area. May 1962

groundwater surface was above the river at other places. For example, north of the Sankoty cone of depression, water levels adjacent to the river were higher than the normal river stage, and there was discharge of groundwater into the river.

The average slope of the groundwater surface in areas remote from pumping centers was about 5 feet per mile. Gradients were steeper in the immediate vicinity of pumping centers and exceeded 20 feet per mile within the Sankoty cone of depression. Gradients averaged about 10 and 5 feet per mile in the North Well Field and Central Well Field cones of depression, respectively. East of the Illinois River the groundwater surface contours show a steep gradient toward the river. In the immediate proximity of the river the average slope of the groundwater surface is about 30 feet per mile. From data collected prior to 1966 and during mass water-level measurements in 1966 and 1967 it appears that the groundwater in the ancient Mississippi bedrock valley flows north toward the Illinois River from near Morton. The axes of the ancient Mississippi bedrock valley are shown in figures 40 and 41. A groundwater trough, whose flanks are at 520 feet above sea level, is evident near Morton. The west axis of the ancient bedrock valley passes through the trough.

In 1962 mass measurements of groundwater levels were made in the Pekin area (Walker et al., 1950). Pronounced cones of depression that have developed as the result of heavy pumping are centered at the well fields of industries in the area. As shown in figures 42 and 43, a groundwater mound appears in the vicinity of a recharge pit near the center of the area. The 440 and 435 water-table contours bend irregularly around intake and discharge canals and roughly parallel the river's edge.

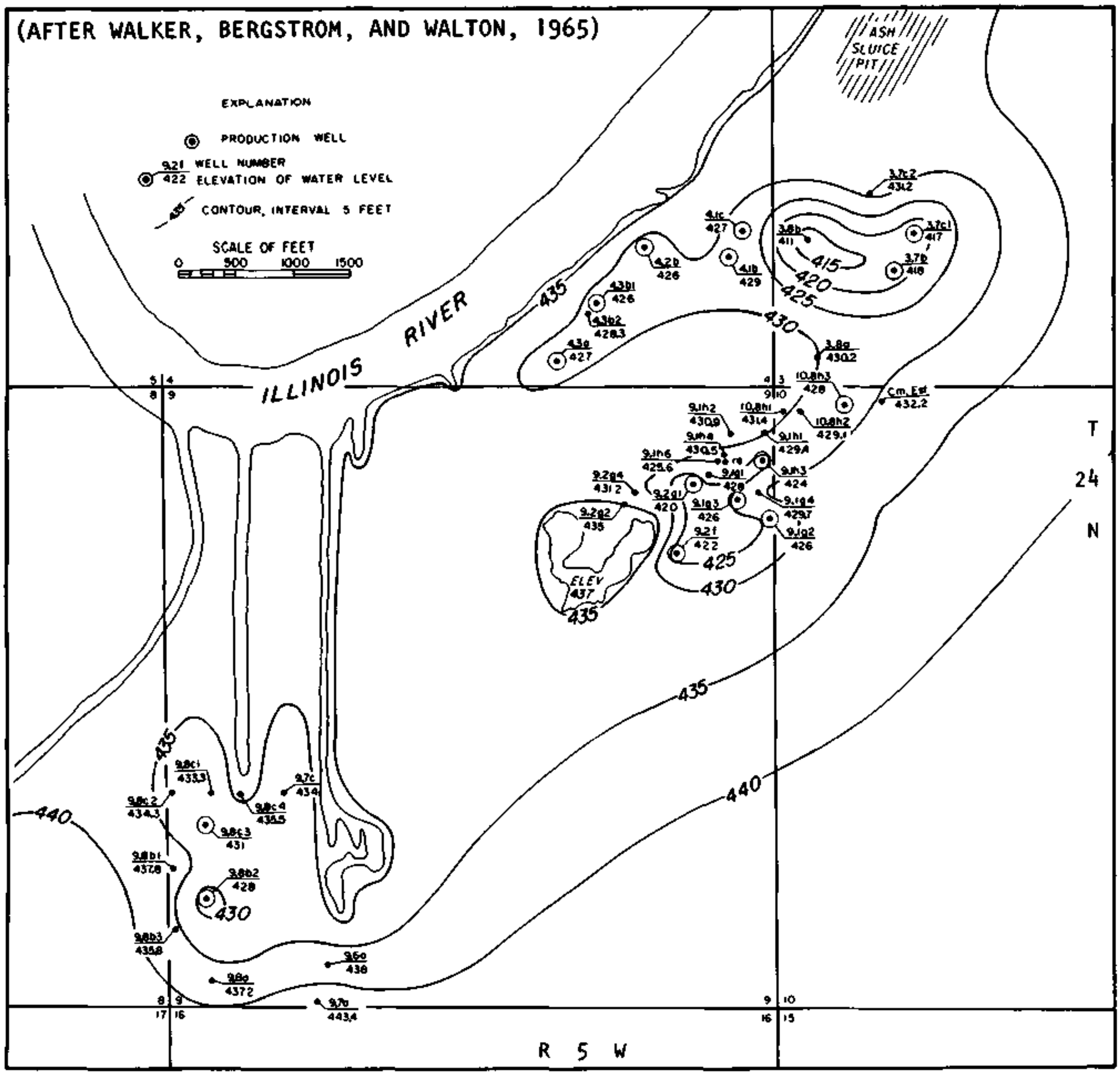

Figure 43. Approximate elevation of the water table in the Pekin area, August 1962

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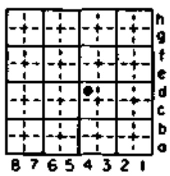
Thomas, Roger L. 1968. Coarse filter media for artificial recharge. Illinois State Water Survey Report of Investigation 60.

Walker, W. H., R. E. Bergstrom, and W. C. Walton. 1965. Preliminary report on groundwater resources of the Havana region in west-central Illinois. Illinois State Water Survey and Illinois State Geological Survey Cooperative Ground-Water Report 3.

The well-numbering system used in this report is based on the location of the well, and uses the township, range, and section for identification. The well number consists of five parts: county abbreviation, township, range, section, and coordinate within the section. Sections are divided into rows of 1/8-mile squares. Each 1/8-mile square contains 10 acres and corresponds to a quarter of a quarter of a quarter section. A normal section of 1 square mile contains 8 rows of 1/8-mile squares; an odd-sized section contains more or fewer rows. Rows are numbered from east to west and lettered from south to north as shown in the diagram.



Peoria County
T8N, R8E
sec. 15

The number of the well shown is PEO 8N8E-15.4A Where there is more than one well in a 10-acre square they are identified by arabic numbers after the lower case letter in the well number. Any number assigned to the well by the owner is shown in parentheses after the location well number. For example the first well listed in table A is owned by Pleasant Valley Public Water District and is known as Well No. 2, which is indicated by (2) in the well number PEO 8N7E-l.ld(2). Directional titles used by the owner are indicated by (E) for East Well and (W) for West Well. Test wells are indicated by (T).

The abbreviations for counties discussed in this report are:

Peoria PEO   Tazewell TAZ   Woodford WDF

Other abbreviations used are:

(C) City owned   CCb. Country Club
(V) Village owned   Sbd. Subdivision

Table A. Observation Well Records

Well number	Owner	Use°	Depth of well (feet)	Diameter of well fin)	Screen Length (feet)	Screen Diameter (in)
PEO-						
8N7E-						
l.ld(2)	Pleasant Valley Public Water District	P	95	10	20	10
1.4e(l)	Pleasant Valley Public Water District	P	72	10	24	10
8N8E-						
4.5c	Planck's Laundry	A		4		
6.1e(8)	State Water Survey	N	162	6	9	6
7.8b(7)	State Water Survey	N	110	6	7	6
8.1d	Peona Apron and Towel Cleaners	I	124	8		
9.3d	Central Ill. Light Co.	N	25	4		
9.4d	E. M. Smith and Co.	A	60	4		
9.8a(l)	Peona Service Co.	A	93	4		2
10.8g	H. S. Beeney	I	125	6	5	6
16.7gl(22)	State Water Survey	N	46	6	5	6
16.7g2(27)	State Water Survey	N	53	12	10	12
16.8f (2)	Hiram Walker & Sons	I	53	26	20	
16.8gl(19)	State Water Survey	N	53	6	7	6
16.8g2 (20)	State Water Survey	N	66	6		
16.8g3(3)	Pabst Brewing Co.	N		6	8	6
16.8h(24)	State Water Survey	N	71	6	5	6
17.1fl(3)	Hiram Walker & Sons	I	55	26	20	26
17.1f2(8)	Hiram Walker & Sons	I	60			
17.2f(5)	Hiram Walker & Sons	I	67			
17.3el(7)	Hiram Walker & Sons	I	69			
17.3e2(9)	Hiram Walker & Sons	I	73			
17.3e3	Hiram Walker & Sons	N		4		
17.3e4	Hiram Walker & Sons	N		4		
	Hiram Walker & Sons	N	85	6	6	6
17.5d(T)	State Water Survey	N	134	4	7	4
17.5h(9)	Commercial Solvents Co.	N	79	26	21	26
19.3d(3) / 19.2f(6)	Barrett Division (Allied Chem. Corp.)	I	105	25	39	25
20.7f	Peoria Sanitary District	P	102	12		
31.7g(W)	Keystone Steel & Wire	N	166	12	18	12
9N8E-	Peoria Park District	P	60	6	4	6
3.6d(2)	Peoria Park District	D	77	4		
3.7d	Peona Water Works Co.	P	93	25	24	25
10.2a(10)	Kammerer Concrete Prod.	I		4		
10.4c	Peoria Heights (V)	P	90	18	20	18
15.2c(4)	Peona Heights (V)	P	125	18	20	18
15.2dl(5)	Peona Heights (V)	P	135	16	20	16
15.2d2(7)	Peona Water Works Co.	P		25	39	25
15.2e(ll)	Peona Water Works Co.	P	127			
15.2g(7) / 15.2hl(8)	Peona Water Works Co.	P	126 / 89			
15.2h2(9)	Peoria Water Works Co.	P	92 / 95	25	26	25
15.3d(6)	Peona Heights (V)	P		16	20	16
15.3fl(13)	Peona Water Works Co.	N	122			
15.3f2(14)	Peona Water Works Co.	P	130	10	30	10
	Peona Heights (V)	P	127	16	25	15
23.8h(l)	Peona Water Works Co.	N	116	6		
26.3al(3)	Peona Water Works Co.					
26.3a2(3)	(Reserve Well)	P	60		22	
29.1d(17)	State Water Survey	N	314	4	3	2
35.5d(T)		N				
	Bemis Co., Inc.	I	62	26	10	26
35.5e(2) / 35.5f(3)	Bemis Co., Inc.	I	63	26	10	26

°D—domestic supply; P—public supply:; I—industrial supply; N-not: used; A—abandoned

Well number	Owner	Use°	Depth of well (feet)	Diameter of well (in)	Screen Length (feet)	Screen Diameter (m)
10N8E-						
10.4a(20)	Caterpillar Tractor Co.	N	99	6	3	6
15.4g(7>	Caterpillar Tractor Co.	I	90	16	20	16
20.1e(T)	Harold A. Jenn	N	300	4		4
23.7h(13)	Caterpillar Tractor Co.	N		6		6
34.4e	Hendryx Lane Sbd.	P	58	6	8	6
34.7d	Brookview Sbd.	P	110	6	10	6
TAZ—						
25N3W-						
3.7h	George W. Hart	D	340	4		
3.8d	H. F. Menold	D	365	4		
4.8h	Duane Schmidt	D	300	6		
6.4b	Hall E. Scott	D	236	4		
8.2d	Jack Krantz	D	300	4		
11.8a	R. S. Blosser	D	300	6		
14.2a	IBC Homes	p				
16.3f	George Ackerman	D	280	6		
17.2bl(E)	Libby, McNeill & Libby	I	260			
17.2b2(W)	Libby, McNeill & Libby	I	260			
19.4e	Allis Chalmers	I	250	4	4	4
20.2h(4)	Morton (C)	P	264	12	25	
22.4d	C. G. Miller	D	240	6		
25N4W-						
2.1a(2)	Clover Avenue Water Corp.	P	230	6		
11 If				4		
12.7h	Pleasant Hill School	D	220	4		
26N3W-						
6.4el,16)	Caterpillar Tractor Co.	I	298	8	21	8
6 4e2(l8)	Caterpillar Tractor Co.	I	296	8	21	8
8.7f	Harvard Hills Sbd.	P	314	4	3	4
14.1a(7)	Washington (C)	P	306	12		
33.8f	Pine Lakes CCb.	P	297	8	35	12
26N4W-						
2.1h(T)	Grandview Trailer Ct.	N	25	2		
24.2al(2)	North Tazewell Public Watcr District	p	284	10	20	8
24.2a2(3)	North Tazewell Public Water District	P	283	10	22	8
25.8h	Valley View Knolls Corp.	P	223	6	10	6
26.6g	East Peona (C)	P	246	6	8	6
27.1d	Arnold Acres	P	198	4		
	State Water Survey	N		4		
31.1d(5)	Caterpillar Tractor Co.	I	60	12	15	12
32.2e(14)	Caterpillar Tractor Co.	N	63	12		
32.3f(4)	Caterpillar Tractor Co.	I	84	12	15	8
	East Peona (C)	N	30	12		
32.7b (17)	East Peona (C)		63	2		
33.3fl(T) / 34.3d	East Peona (C)	P	50	10	20	10
34.5f2 / 34.4d	East Peona (C)	P	46	10	20	10
34.7e	T.P. & W. RR	I				
35.5bl	East Peoria (C)	P	113	12	30	12
35.5b2	East Peona (C)	P	115	12	30	12
WDF-						
27N3W-						
24.6f	Metamora (V)	P	370	12		
29.3a	Caterpillar Trail Water Distnct	P	335	10	20	10
30.8f	Far Hills Estates	P		4		
27N4W-						
14.1c	Riverview School	D		4		
24.3e	M. L. Gorham	D	168	6		
25.8a	Norman Dean	D	77	4		

Table B. Water-Level Data for Wells

Well number	Elevation of measuring point (feet)	Water levels: August 1966 — Depth to water (feet)	Water levels: August 1966 — Elevation (feet above msl)	Water levels: April 1967 — Depth to water (feet)	Water levels: April 1967 — Elevation (feet above msl)	Water-level change (feet)
PEO-						
8N7E-						
1.1d(2)	478			38	440	
1.4e(l)	470	29	441	30	440	-1.00
8N8E-						
4.5c	523	86.67	436.33			
6.1e(8)	509	65.67	443.33	65.70	443.30	-0.03
7.8b(7)	461.4	21.60	439.80	26.37	435.03	-4.77
8.1d	518.88	83.16	435.72	85.43	433.45	—2.27
9.3d	452.31	19.42	432.89	17.75	434.56	1.67
9.4d	480	40.70	439.30			
9.8a(l)	497.55	67.32	430.23			
10.8g	463	30.12	432.88			
16.7gl(22)	453.0	23.19	429.81	20.76	432.24	2.43
16.7g2(27)	459.2	29.36	429.84	26.93	432.27	2.43
16.8f(2)	467.8	3.75	430.30	3.55	432.30	0.20
16.8gl(19)	455.4	26.22	429.18	23.58	431.82	2.64
16.8g2(20)	462	32.48	429.52	30.23	431.77	2.25
16.8g3(3)	459	29.25	429.75	27.25	431.75	2.00
16.8h(24)	469.4	39.47	429.93	37.20	432.20	2.27
17. If 1(3)	470.8	41.10	429.70	39.10	431.70	2.00
17.1f2(8)	469.0	38.80	430.20	36.80	432.20	2.00
17.2f(5)	472.0	42.00	430.00	39.50	432.50	2.50
17.3el(7)	475.0	46.00	429.0			
17.3e2(9)	476.3	46.00	430.3	44.00	432.3	2.00
17.3e3(0)	465			32.33	432.67	
17.3e4	465			36.80	428.20	
17.5d(T)	472	41.45	430.55	39.77	432.23	1.68
17.5h(9)	512	79.08	432.92	79.24	432.76	-0.16
19.2f(6)	453	22.54	430.46	21.10	431.90	1.44
19.3d(3)	439.5	3.5	436.5	3.5	436.5	0.00
20.7f	454.34	23.56	430.78			
31.7g(W)	449	12.80	436.20	11.60	437.40	1.20
9N8E-						
3.6d(2)	470	41	429	40	430	1.00
3.7d	490	56.38	433.62	59.70	430.30	-3.32
10.2a (10)	471.74			50.00	421.74	
10.4c	465	55.02	409.98	39.48	425.52	15.54
15.2c(4)	500	90	410	89	411	1.00
15.2dl(5)	495	89	406	89	406	0.00
15.2d2(7)	495	84	411	83	412	1.00
15.2e(ll)	483.4			67.45	415.95	
15.2g(7)	470			54.43	415.57	
15.2hl(8)	463	58.21	404.79	55.21	407.79	3.00
15.2h2(9)	468			48.18	419.82	
15.3d(6)	500	91	409			
15.3fl(13)	483	68.70	414.30	66.64	416.36	2.06
15.3f2(14)	485	76.54	408.46			
23 8h(l)	537	106	431	105	432	1.00
26.3al(3)	455	32.00	423.00	25.32	429.68	6.68
26.3a2(3)	455			28.05	426.95	
29.1d(17)	665.1	225.16	439.94	225.17	439.93	-0.01
35.5d(T)	480	58.49	421.51	47.72	432.28	10.77
35.5e(2)	461.14	37.00	424.14	25.50	435.64	11.50
35.5f(3)	461	41.17	419.83	29.19	431.81	11.98
10N8E-						
10.4a (20)	511	50.72	460.28	50.72	460.28	0.00
15.4g(7)	510			54.50	455.5	
20.1e(T)	750			296.70	453.30	
23.7h(13)	475	24.20	450.80	26.20	448.80	-2.00
34.4e	473			30	443	
34.7d	510			59.71	450.29	
TAZ-						
25N3W-						
3.7h	780	265.80	514.20			
3.8d	740	226.50	513.50	226.59	513.41	—0.09
4.8h	767			265.30	501.70	
6.4b	700	187.0	513.0	186.52	513.48	0.48
8.2d	705	188.7	516.3			
11.8a	775	247	528	243	532	4.00
14.2a	785	269.10	515.90			
16.3f	716	195.90	520.10	192.92	523.08	2.98
17.2bl(E)	712	200.60	511.40	195.31	516.69	5.29
17.2b2(W)	712	191.20	520.80	190.88	521.12	0.32
19.4e	712	195.10	516.90	196.23	515.77	—1.13
20.2h(4)	710	195.40	514.60	195.04	514.96	—0.38
22.4d	700	182.20	517.80	182.12	517.88	0.08
25N4W-						
2.1a(2)	710			187.7	522.3	
ll.1f	710	189.4	520.6	188.44	521.56	0.96
12.7h	705	184.9	520.1	173.38	531.62	11.52
26N3W-						
6.4el(16)	736			235.93	500.07	
6.4e2(18)	736	227	509	243	493	-16.00
8.7f	766	266	500	266	500	0.00
14.1a(7)	730	225	505			
33.8f	752	242	510	244.5	507.5	-2.50
26N4W-						
2.1h(T)	487	4.80	482.20	3.90	483.10	0.90
24.2al(2)	690	187	503	188	502	-1.00
24.2a2(3)	690	182	508	183	507	-1.00
25.8h	662	171.85	490.15	167.12	494.88	4.73
26.6g	682	191.94	490.06	197.11	484.89	-5.17
27.1d	630	150.64	479.36	151.62	478.38	-0.98
31.1d(5)	441	3.20	437.80	1.88	439.12	1.32
32.2e(14)	452.89	13.59	439.30	11.28	441.61	2.31
32.3f(4)	452.64	19.79	432.85	14.44	438.20	5.35
32.7b(17)	443.38			3.51	439.87	
33.3c(T)	470	11.64	458.36	10.52	459.48	1.12
34.4d	490			19	471	
34.5fl	485	18	467			
34.5f2	480	11	469			
34.7e	480	17.79	462.21	16.21	463.79	1.58
35.5bl	540	45	495			
35.5b2	540	34	506			
WDF-						
27N3W-						
24.6f	790	316	474	314	476	2.00
29.3a	790	298	492	298	492	0.00
30.8f	655	180	475	182	473	-2.00
27N4W-						
14.1c	540	68.34	471.66	66.12	473.88	2.22
24.3e	585	110.35	474.65	111.03	473.97	-0.68
25.8a	530	53.47	476.53	53.81	476.19	-0.34