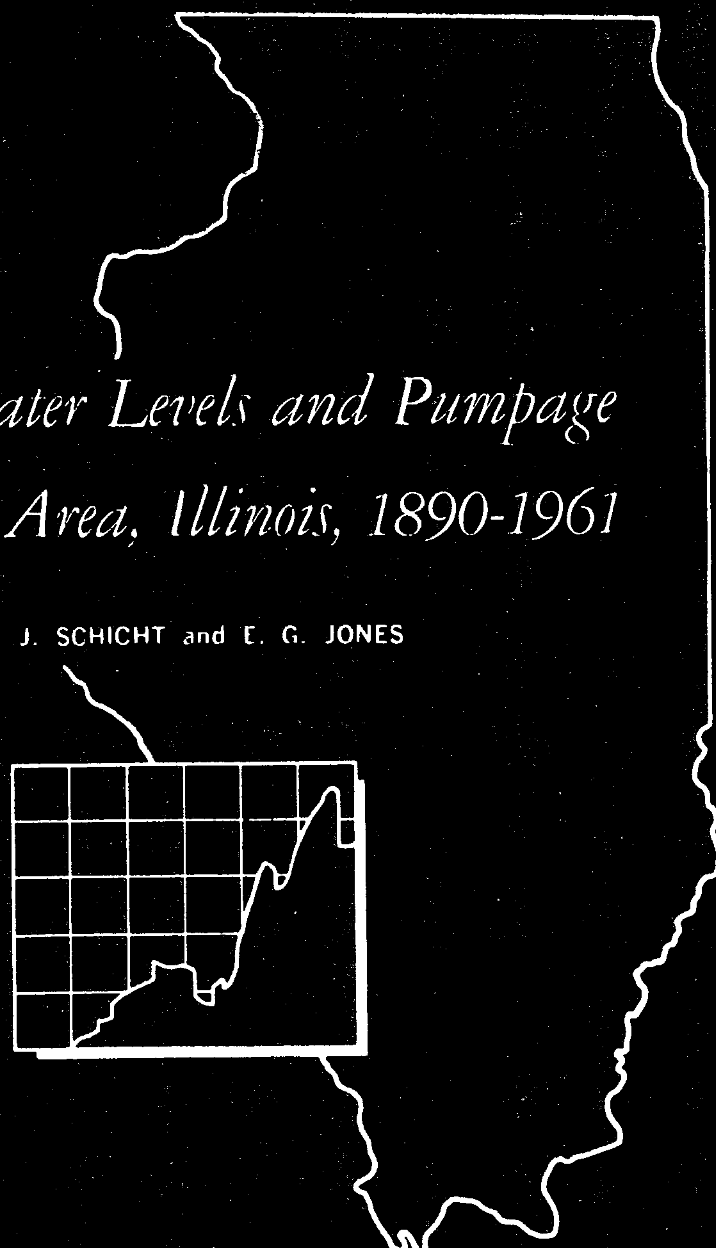
... INVESTIGATION 44

... ILLINOIS

DEPARTMENT OF REGISTRATION AND EDUCATION



Ground-Water Levels and Pumpage in East St. Louis Area, Illinois, 1890-1961

by R. J. SCHICHT and E. G. JONES

ILLINOIS STATE WATER SURVEY

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STATE OF ILLINOIS
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CONTENTS

ILLUSTRATIONS

Figure		Page

Ground-Water Levels and Pumpage

in East St. Louis Area, Illinois, 1890-1961

by R. J. Schicht and E. G. Jones

SUMMARY

Large quantities of ground water are withdrawn from sand and gravel wells in the East St. Louis area along the valley lowlands of the Mississippi River in southwestern Illinois. The unconsolidated valley fill aquifer has an average thickness of 120 feet and is underlain by relatively impermeable Mississippian and Pennsylvanian rocks.

Pumpage from wells increased from 2.1 million gallons per day (mgd) in 1900 to 111.0 mgd in 1956 and was 93.0 mgd in 1960. Of the 1960 total pumpage, 89.8 per cent was industrial, 7.3 per cent was public water supply, 2.6 per cent was domestic, and 0.3 per cent was irrigation. Pumpage is concentrated in five major pumping centers: the Alton, Wood River, Granite City, National City, and Monsanto areas.

As the result of heavy pumping, water levels declined about 50 feet in the Monsanto area, 40 feet in the Wood River area, 20 feet in the Alton area, 15 feet in the National City area, and 10 feet in the Granite City area from 1900 to 1961. From 1957 to 1961 water levels in the Granite City area recovered about 50 feet where pumpage decreased from 31.6 to 8.0 mgd.

Pumping of wells and draining of lowlands have considerably reduced ground-water discharge to the Mississippi River, but have not reversed at all places the natural slope of the water table toward that stream. In the vicinity of some pumping centers, the water table has been lowered below the river and other streams, and induced infiltration of surface water is occurring.

INTRODUCTION

The East St. Louis area, known locally as the "American Bottom," is in southwestern Illinois and includes portions of Madison, St. Clair, and Monroe Counties. It encompasses the major cities of East St. Louis, Granite City, and Wood River, and extends along the valley lowlands of the Mississippi River from the city of Alton south to the village of Dupo, as shown in figure 1. The area covers about 175 square miles and is approximately 30 miles long and 11 miles wide at the widest point. It is one of the most heavily populated and industrialized areas in Illinois. The ground-water resources of a sand and gravel aquifer underlying the area have been extensively developed. It is estimated that during 1960 an average of 93 mgd was withdrawn chiefly from industrial and municipal wells.

The State Water Survey maintains recording gages on 7 observation wells in the area and manually measures water levels in 32 other wells once a month. In addition, water levels are measured periodically by various industries and municipalities. During part of 1960 and most of 1961 the State Water Survey collected data on water levels in 225 wells within areas of influence of pumping and remote from pumping centers. Water levels in 225 wells and the stages of streams were measured during the weeks of June 5 through June 9 and November 27 through December 1, 1961. With these data, maps were prepared to show the piezometric surface and the change in water levels. A pumpage inventory was made during 1961 and records were collected from 82 industries, 7 municipalities, and 30 irrigation well owners. From this pumpage data and other pertinent data in the State Water Survey files, a pumpage graph for the period 1890 through 1960 was prepared.

The State Water Survey accelerated its program of ground-water investigation in the East St. Louis area in 1941 after alarming water-level recessions were observed by local industries especially at Granite City. Water-level data for the period 1941 through 1951 were summarized and the ground-water withdrawals during 1951 were discussed by Bruin and Smith (1953). Ground-water geology of the East St. Louis area has been described by the State Geological Survey (Bergstrom and Walker, 1956).

This report summarizes trends in water levels and pumpage for the period 1890 through 1960. Many of the findings of the two earlier reports are presented to serve as a background for interpretation of the records.

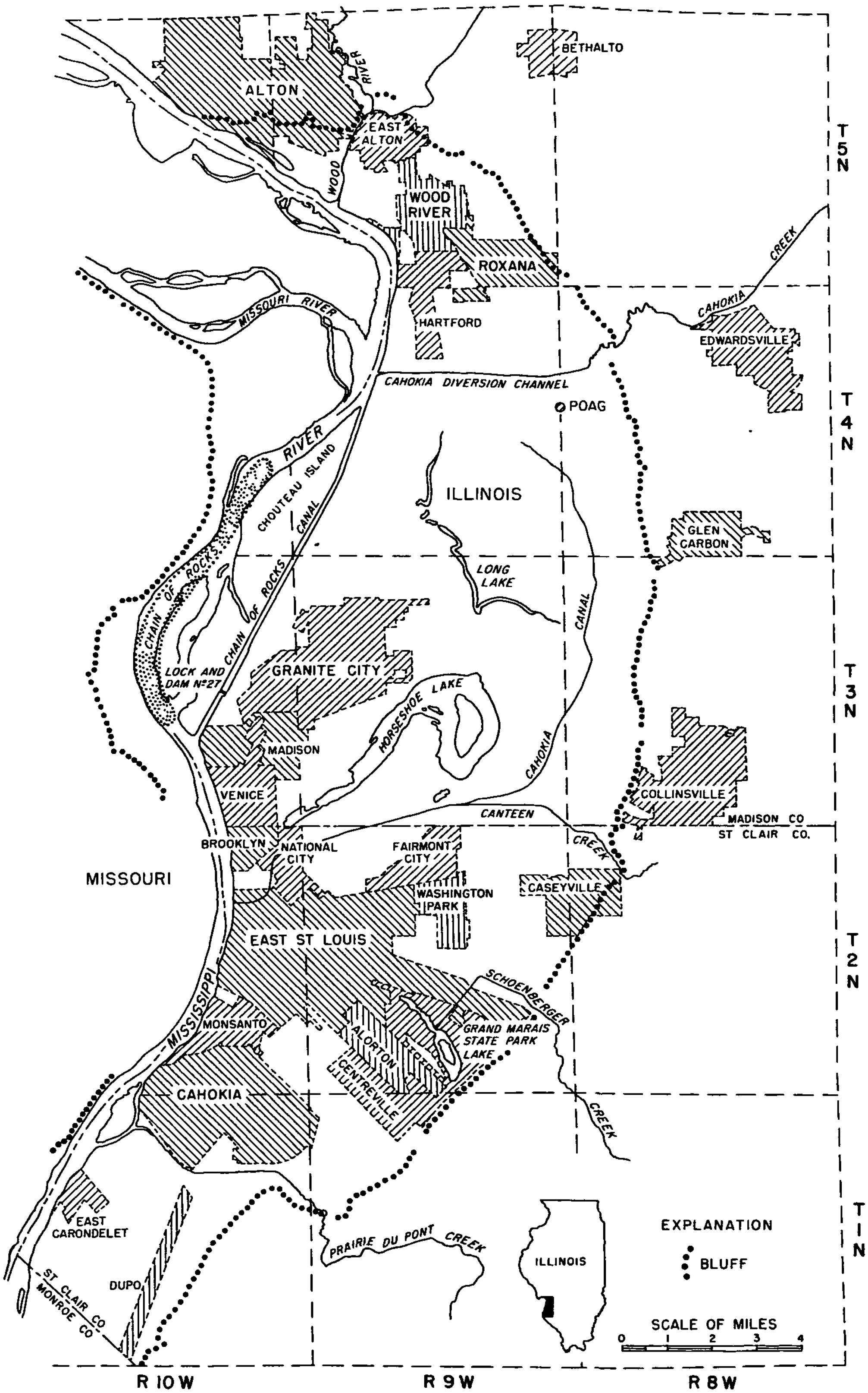


Figure 1. Location of the East St. Louis area

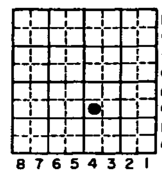
Acknowledgments

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 Engineering Section. William C. Walton, head of ground-water research in the Engineering Section, reviewed and criticized the material and assisted with the final manuscript. 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.

Well-Numbering System

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 one-eighth-mile squares; each one-eighth-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 one-eighth-mile squares; an odd-size section contains more or fewer rows. Rows are numbered from east to west and lettered from south to north as shown in the diagram:



St. Clair County
T2N, R10W
Section 23

The number of the well shown is: STC 2N10W-23.4c. 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. The abbreviations for counties discussed in this report are: Madison, MAD; Monroe, MON; St. Clair, STC.

There are parts of the East St. Louis area where section lines have not been surveyed. For convenience in locating observation wells, normal section lines were assumed to exist in areas not surveyed.

GEOLOGY AND HYDROLOGY OF AQUIFER

Large supplies of ground water chiefly for industrial development are withdrawn from permeable sand and gravel in unconsolidated valley fill in the East St. Louis area. According to Bergstrom and Walker (1956), the valley fill is composed of recent alluvium and glacial valley-train material and is underlain by Mississippian and Pennsylvanian rocks consisting of limestone and dolomite with subordinate amounts of sandstone and shale. The valley fill has an average thickness of 120 feet and ranges in thickness from a feathers edge, near the bluff boundaries of the area and along the reach of the Mississippi River known as the "Chain of Rocks," to more than 170 feet near the city of Wood River. The thickness of the valley fill is generally greatest and exceeds 120 feet in places near the center of a buried bedrock valley that bisects the area as shown in figure 2.

Recent alluvium comprises the major portion of the valley fill in most of the area (Bergstrom and Walker, 1956). The alluvium is composed of fine-grained materials with a low permeability; the grain size increases from the surface down. Recent alluvium rests on older deposits including in many places valley-train materials. The valley-train materials are predominately medium-to-coarse sand and gravel which increase in grain size with depth. The coarsest deposits most favorable for development are commonly encountered near bedrock and often average 30 to 40 feet thick. Logs of wells in cross section A-A[1] in figure 3 show that the valley fill grades with depth from clay to silt to sand and gravel interbedded with layers of silt and clay.

The valley fill is immediately underlain by bedrock formations of Mississippian age in the western part of the area and of Pennsylvanian age in the eastern part. Because of the low permeability of the bedrock formations and poor water quality with depth, the rocks do not constitute an important aquifer in the area.

Ground water in the valley fill occurs under leaky artesian and water-table conditions. Leaky artesian conditions exist at places where fine-grained alluvium, which impedes or retards the vertical movement of water, overlies valley-train deposits and water in the valley-train deposits is under artesian pressure. Under leaky artesian conditions, water levels in wells rise above the top of the valley-train deposits to stages within the alluvium. Water-table conditions prevail at many places where alluvium is missing and the upper surface of the zone of saturation is in valley-train deposits, and at places within deep cones of depression, created by heavy pumping, where water levels in wells rise to stages within the valley-train deposits and water is unconfined. Because water occurs most commonly under leaky artesian conditions in the East St. Louis area, the surface to which water rises, as defined by water levels in wells, is hereafter called the piezometric surface.

Recharge within the area is from precipitation, induced infiltration of surface water from the Mississippi River and small streams traversing the area, and subsurface flow from the bluffs bordering the area. A fraction of the annual precipitation seeps downward through surface materials and into the valley-train deposits. Recharge by induced infiltration occurs at places where heavy pumping from wells has lowered the piezometric surface below stream level.

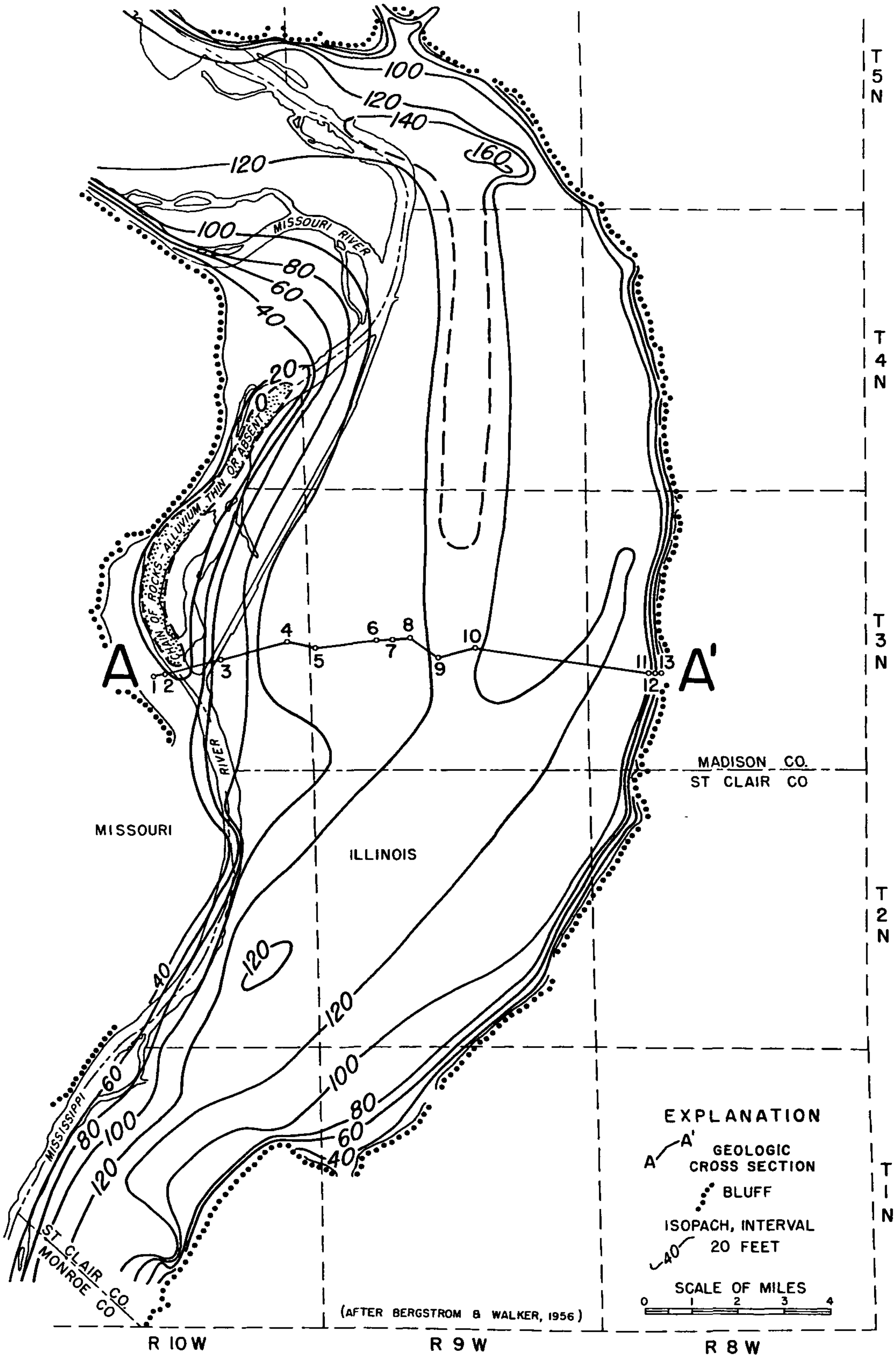


Figure 2. Thickness of the valley fill

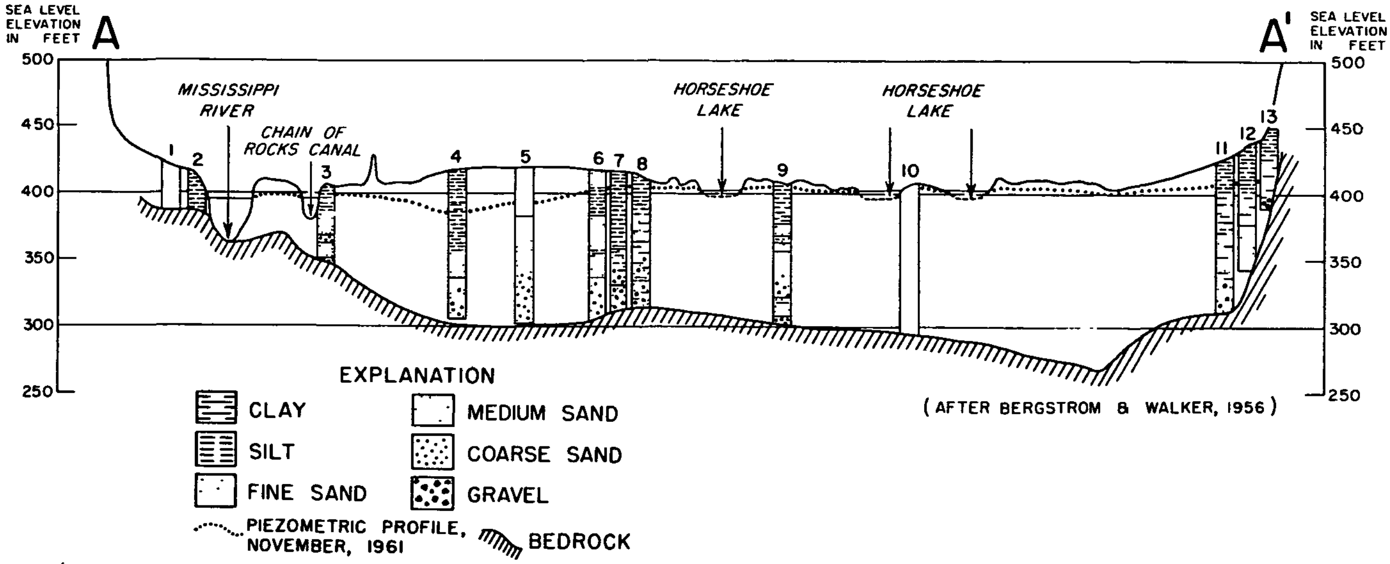


Figure 3. Geologic cross section and piezometric profile of the valley fill

PUMPAGE FROM WELLS

The first significant withdrawal of ground water in the East St. Louis area started in the late 1890's. Prior to 1900 ground water was primarily used for domestic and farm supplies; since 1900 pumpage has been mostly for industrial use. Estimated pumpage from wells increased from 2.1 mgd in 1900 to 111.0 mgd in 1956 as shown in figure 4. Maximum rates of pumpage increase were 5.3 mgd per year for the period 1937 to 1944 and 4.7 mgd per year for the period 1949 to 1956. Pumpage declined sharply from 111,0 mgd in 1956 to92.0 mgd in 1958 and then gradually increased to 93.0 mgd in 1960. Withdrawal of ground water also declined during the years of the depression of the 1930's and after World War II. The average rate of pumpage increase for the period 1890 through 1960 was about 1.5 mgd per year.

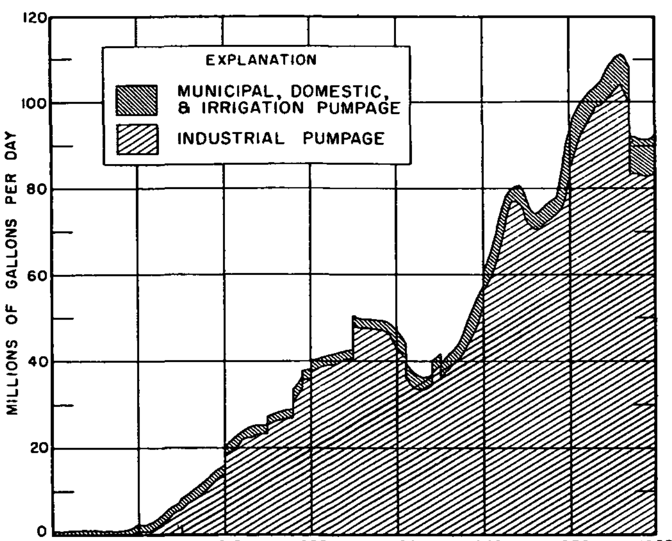


Figure 4. Estimated pumpage, 1890 through 1960, subdivided by use

Pumpage use data are classified in this report according to four main categories: 1) public, including municipal and institutional; 2) industrial; 3) domestic, including rural farm non-irrigation, and rural non-farm; and 4) irrigation, including farm, and golf courses and cemeteries. Mostwater-supply systems furnish water for several types of use. 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 and domestic categories; for example, any water pumped by a municipality is called a public supply, regardless of the use of the water. However, the final use of water within the industrial category has been determined in part, and any water pumped by an industry and furnished to a municipality is included in the public use category.

Of the 1960 total pumpage, withdrawals for public water-supply systems amounted to about 7.3 per cent, or 6.8 mgd; industrial pumpage was about 89.8 per cent, or 83.5 mgd; domestic pumpage was 2.6 per cent, or 2.4 mgd; and irrigation pumpage was 0.3 per cent, or 0.3 mgd.

Pumpage is concentrated in five major pumping centers: the Alton, Wood River, Granite City, National City, and Monsanto areas. Also, there are five minor pumping centers: the Fairmont City, Caseyville, Poag, Troy, and Glen Carbon areas. Tho location of the pumping centers and the distribution of pumpage in 1960 are shown in figure 5.

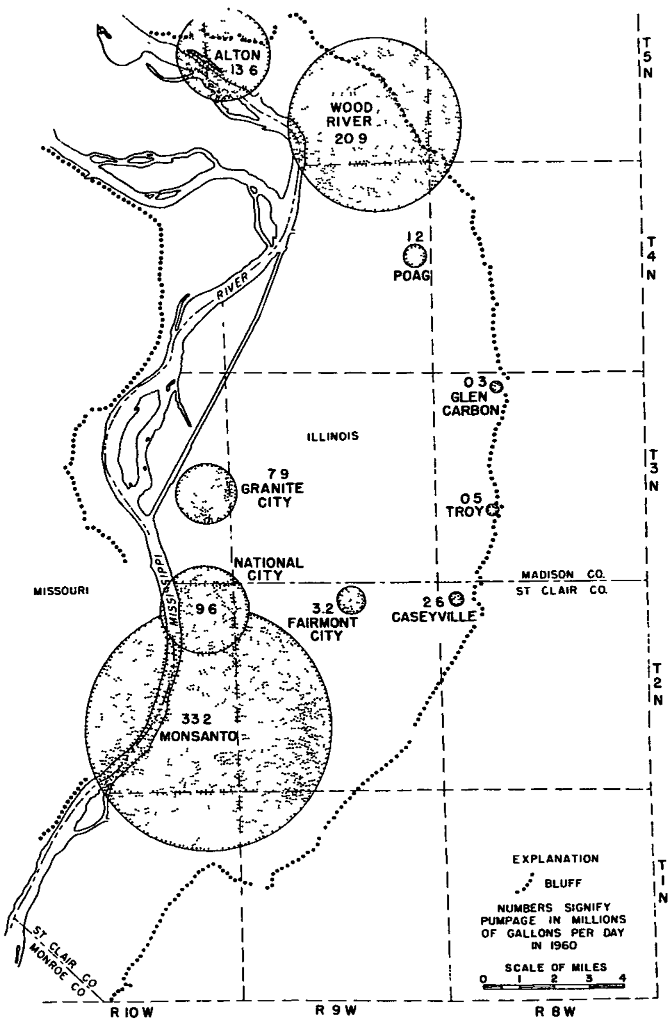


Figure 5. Distribution of estimated pumpage in 1960

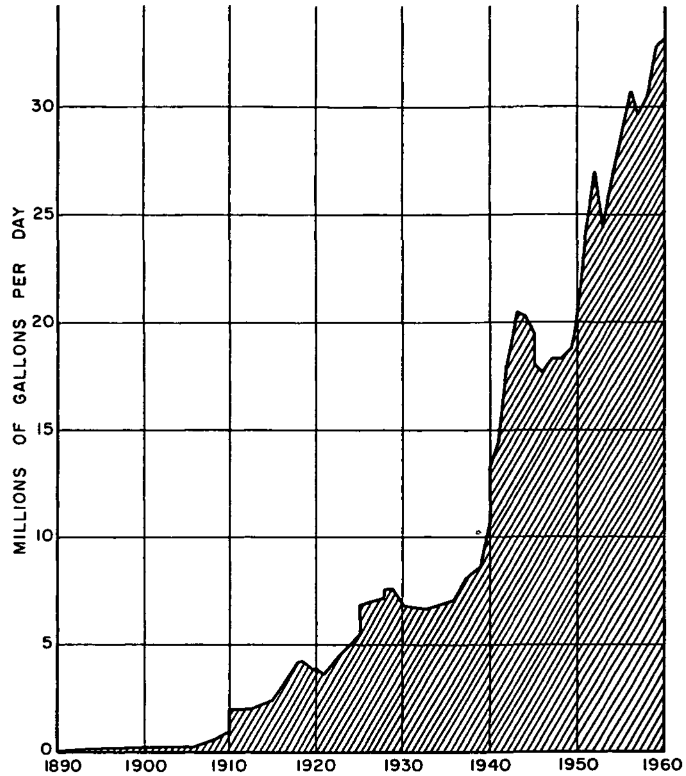


Figure 6. Estimated pumpage, Monsanto area

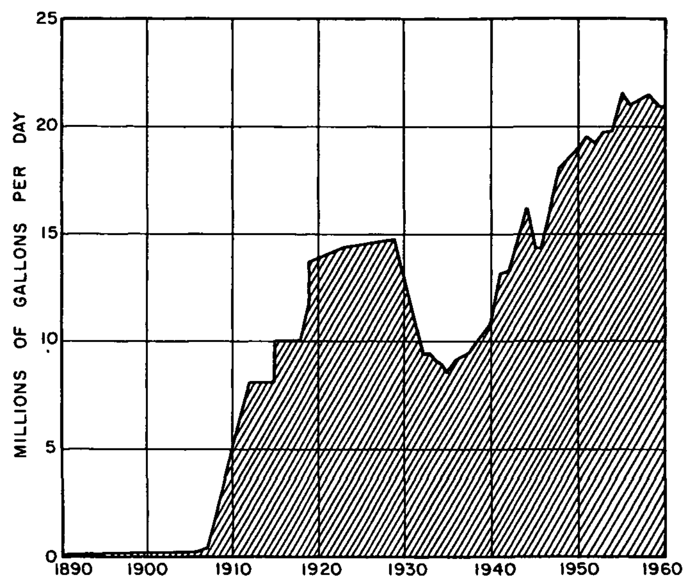


Figure 7. Estimated pumpage, Wood River area

As shown in figures 6-10, changes in pumpage for the period of record are similar in all major pumping centers. Poor economic conditions are reflected in the decreased pumpage during the years of the late 1920's and early 1930's. The effects of increased production during World War II and the post war reduction in production are evident. There has been a general and gradual increase in pumpage from the five minor pumping centers throughout the period of record, as shown in figure 11.

Records of pumpage are fairly complete for the period 1941 to 1960; very few records are available for years prior to 1941. Some of the larger industries have fairly complete records of pumpage for the period 1930 to 1960. The graphs in figures 6-11 were constructed 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

The first record of an industrial well in the East St. Louis area is for a well drilled in 1894 by the Big Four Railroad in East Alton (Bowman and Reeds, 1907). The well was 54 feet deep and 8 inches in diameter and was pumped at an average rate of 75,000 gallons per day (gpd). The water was used primarily in locomotive boilers. The meat packing industry in National City started to pump large quantities of ground water in 1900. Estimated pumpage from wells in National City increased from 400,000 gpd in 1900 to 5.3 mgd in 1910.

Industrial pumpage has increased very rapidly in comparison with public pumpage, as shown in figure 4, and in 1960 was 83.5 mgd. Estimated industrial pumpage increased from 480,000 gpd in 1900 to 47 mgd in 1928, which was a fairly uniform

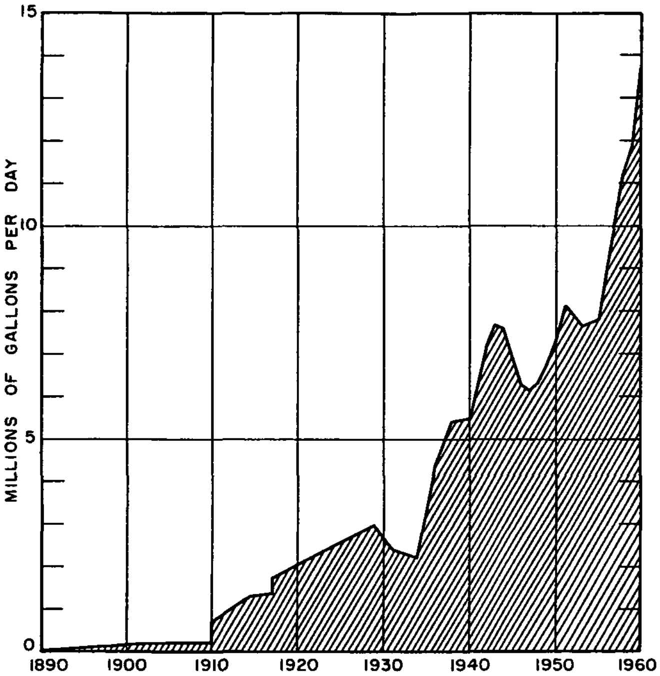


Figure 8. Estimated pumpage, Alton area

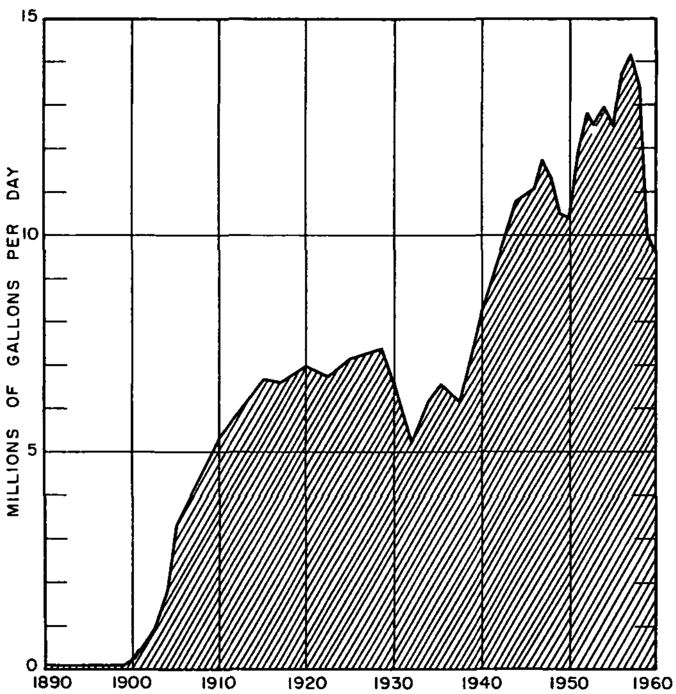


Figure 9. Estimated pumpage, National City area

rate of about 1.6 mgd per year. As a result of the depression, industrial pumpage declined from 47 mgd in 1928 to 34 mgd in 1933. After 1933, industrial pumpage increased at an average rate of 4.0 mgd per year, from 34 mgd in 1933 to 77 mgd in 1944. There was a slight reduction again during 1944-46; but, during the next 10 years, industrial pumpage increased at an average rate of 3.3 mgd per year, from 71 mgd in 1946 to 104 mgd in 1956. Then, primarily because a large industry in Granite City abandoned its wells and started to use river water, industrial pumpage declined sharply to 83 mgd in 1958.

The major industries in the East St. Louis area using ground water are oil refineries, chemical plants, ore refining plants, meat packing plants, and steel plants. Data on industrial pumpage were obtained from 82 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 large air-conditioning installations are used, the industry is seasonal, or a change in operation occurs as a result of strikes or vacation shut-downs.

Public Supplies

Public supplies include both municipal and institutional uses. The first municipal well was drilled in 1899 by the city of Edwardsville at a site near Poag and was pumped at an average rate of 300,000 gpd. The second municipal well was drilled in 1901 by the city of Collinsville at a site about one mile north of Caseyville and was pumped at an average rate of 100,000 gpd. In 1960 there were 10 public water supplies in the East St. Louis area having an estimated total pumpage of 6.8 mgd. Public pumpage has increased at a fairly uniform rate throughout the period of record. Municipal pumpage shows a gradual change with seasons; the average winter use is about three-fourths of the average summer use.

Water pumped by hotels, hospitals, theaters, motels, and restaurants is classified as institutional pumpage. The water withdrawn from institutional wells is primarily used for air conditioning. In 1960 institutional pumpage averaged about 400,000 gpd.

Domestic Supplies

Domestic pumpage, including rural farm non-irrigation and rural non-farm use, was estimated by considering rural population as reported by the U. S. Bureau of the Census and per capita use. A per capita use of 50 gpd was used in computations of pumpage during recent years. Most domestic pumpage is from small diameter (1-1/4- and 2-inch) driven wells. Domestic pumpage increased uniformly from about 1 mgd in 1900 to 2.4 mgd in 1960.

Irrigation Supplies

Development of ground water for irrigation on a significant scale started in 1954 during a severe drouth extending from 1952 through 1956 (Hudson and Roberts, 1955). Pumpage for irrigation is seasonal and varies considerably from year to year, depending on climatic conditions. In 1960 there were 30 irrigation wells in the East St. Louis area. Estimated irrigation pumpage ranged from 540,000 gpd in 1959 to 300,000 gpd in 1960 and averaged about 400,000 gpd for the period 1954 to 1960. Water withdrawn from wells is used primarily to irrigate horse-radish and truck crops. Irrigation pumpage estimates were based on the number of wells, their reported yields, and total hours of operation.

Distribution of Pumpage

Monsanto Area

As shown in figure 6, pumpage in the Monsanto area increased considerably from less than 100,000 in 1903 to 33.2 mgd in 1960. Pumpage growth was fairly uniform from 1903 to 1939, accelerated sharply during World War II, and continued to climb with only minor interruptions after World War II. The average rate of pumpage increase, 1939 to 1960, was about 1.2 mgd per year. Ground-water withdrawals are largely from wells owned by 17 industries; the greatest use of water is by chemical plants.

Wood River Area

Estimated pumpage in the Wood River area increased from less than 100,000 gpd in 1900 to 20.9 mgd in 1960, or at an average rate of about 350,000 gpd per year as shown in figure 7. Pumpage reached a peak of 14.8 mgd in 1929 and then declined sharply to a low of 8.8mgd in 1935 as a result of the depression. Pumpage increased rather uniformly from 1935 to 1955 at an average rate of 640,000 gpd per year and reached another peak of 21.6 mgd in 1955. Ground-water withdrawals are largely from wells owned by 13 industries; the greatest use of water is by oil refineries.

Alton Area

Pumpage in the Alton area increased from about 0.2 mgd in 1900 to 13.6 mgd in 1960 as shown in figure 8. Growth of pumpage was gradual with minor declines during the periods 1929 to 1934, 1944 to 1947, and 1951 to 1955. Pumpage increased sharply from 7.8 mgd in 1955 to 13.7 mgd in 1960, at an average rate of about 1.2 mgd per year. Ground-water withdrawals are largely from wells owned by 4 industries; the greatest use of water is for box-board manufacturing.

National City Area

Pumpage increased in the National City area from 0.3 rngd in 1900 to 9.6 mgd in 1960 as shown in figure 9. The greatest withdrawal of ground water occurred in 1957 when an average of 14.2 mgd was pumped. Pumpage decreased rapidly during the next three years to 9.6 mgd in 1960 as the demand for water by meat packing companies diminished. Ground-water withdrawals are largely from wells owned by 15 industries; the greatest use of water is by meat packing plants.

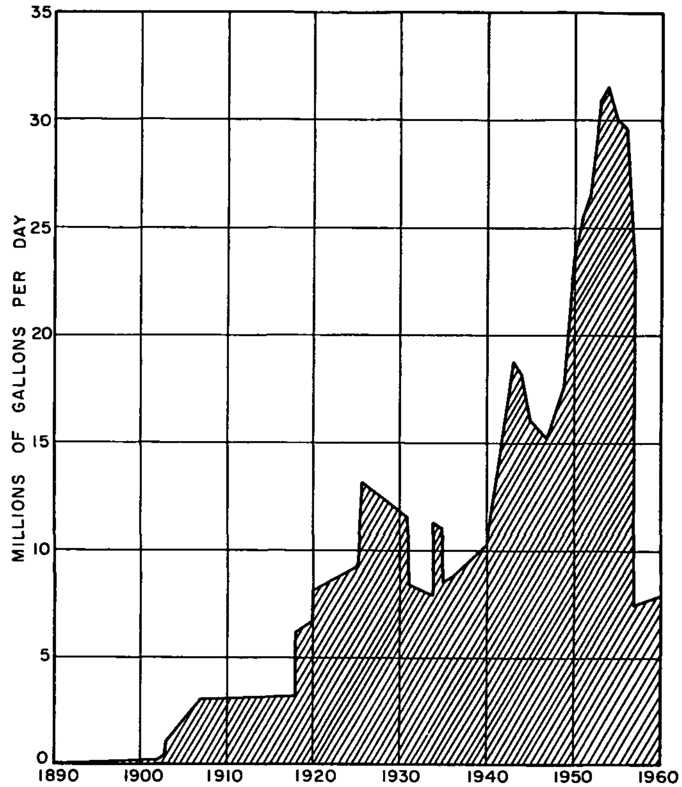


Figure 10. Estimated pumpage, Granite City area

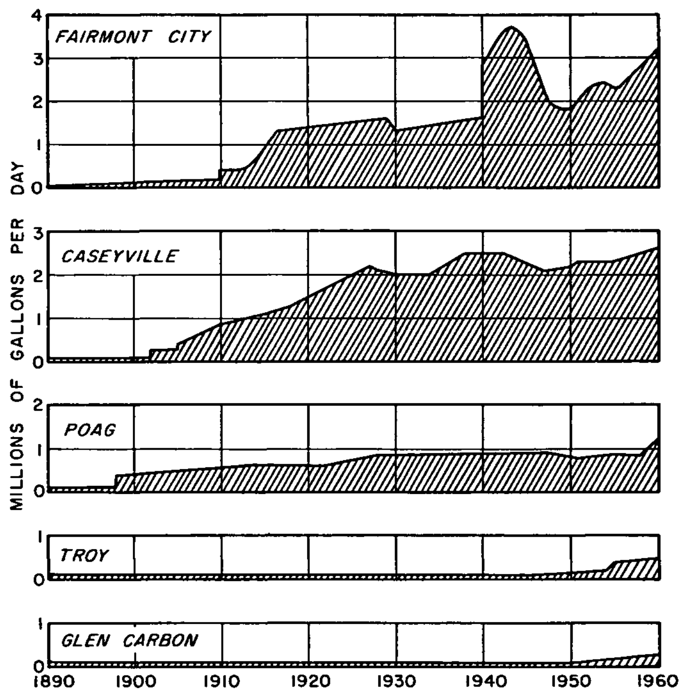


Figure 11. Estimated pumpage, Fairmont City, Caseyville, Poag, Tray, and Glen Carbon areas

Granite City Area

Pumpage in the Granite City area increased at an erratic rate from less than 100,000 gpd in 1900 to 31.6 mgd in 1954 as shown in figure 10. Because of a severe decline in water levels caused by heavy pumpage concentrated in a relatively small area and the severe drouth of 1952-1956, the Granite City Steel Company abandoned its wells in 1957 and began obtaining water supplies from the Mississippi River. As a result, withdrawal of ground water dropped sharply from the peak of 31.6 mgd in 1954 to 7.6 mgd in 1958 and was 7.9 mgd in 1960. Additional significant peaks of pumpage of 13.3 and 18.9 mgd were reached in 1925 and 1943, respectively. Pumpage declined from these peaks to 8.0 mgd in 1933 and to 15.3 mgd in 1947. At present ground-water withdrawals are largely from wells owned by 7 industries. The greatest use of water prior to 1957 was by steel plants.

Minor Pumping Areas

Pumpage in the Fairmont City area is industrial; pumpage from the Caseyville, Poag, Troy, and Glen Carbon areas is mostly for municipal supplies. As shown in figure 11, pumpage in the Fairmont City area increased from 400,000 gpd in 1910 to 3.7 mgd in 1944 and was 3.2 mgd in 1960. Pumpage in the Caseyville area was 2.6 mgd in 1960, of which 1.6 mgd was withdrawn from wells owned by the city of Collinsville. Pumpage in the Poag, Troy, and Glen Carbon areas increased gradually during the period of record to 1.2, 0.5, and 0.3 mgd in 1960, respectively. The rate of pumpage increase accelerated slightly during the 1950's largely because of increases in withdrawals for irrigation.

WATER LEVELS IN WELLS

Water levels in wells have been measured periodically for more than 20 years by the State Water Survey and by industries and municipalities in the area. Data for several wells with 20 or more years of record are shown in figures 12-14. The locations of the wells are given in figure 15 and descriptive records of the wells appear in table 1 in the appendix.

As illustrated by the hydrograph for well STC 2N9W-26.8f in figure 16, water levels in the East St. Louis area generally recede in the late spring, summer, and early fall when discharge from the ground-water reservoir by evapotranspiration, by ground-water runoff into streams, and by pumping from wells is greater than recharge from precipitation and induced infiltration of surface water from the Mississippi River and other streams. Water levels generally begin to recover in the early winter when conditions are favorable for the infiltration of rainfall to the water table. The recovery of water levels is especially pronounced during the spring months when the ground-water reservoir receives most of its annual recharge. Maximum and minimum annual water levels are recorded at different times of the year. Water levels are frequently highest in May and lowest in December, depending primarily upon climatic conditions, pumping, and the stage of the Mississippi River.

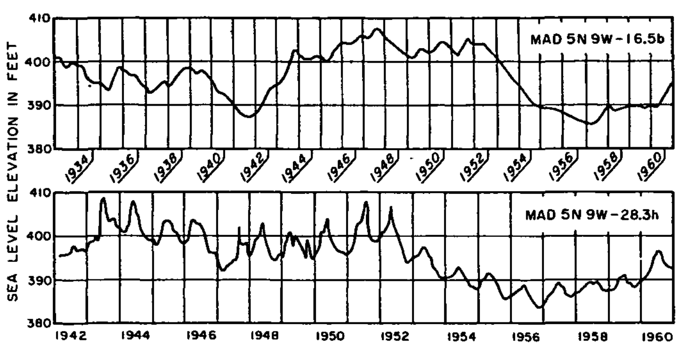


Figure 12. Water levels in wells MAD 5N9W-16.5b, 1933-1960, and MAD 5N9W-28.3h, 1942-1960

Most summer and early fall rains have little or no effect on water levels because evapotranspiration and soil-moisture requirements have first priority on rainfall and are often in excess of precipitation. Water levels do rise during some summer months,

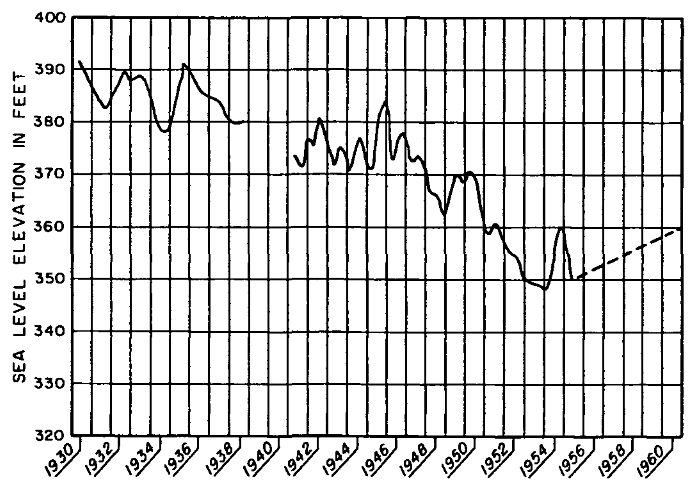


Figure 13. Water levels in wells, Monsanto pumping center, 1930-1960

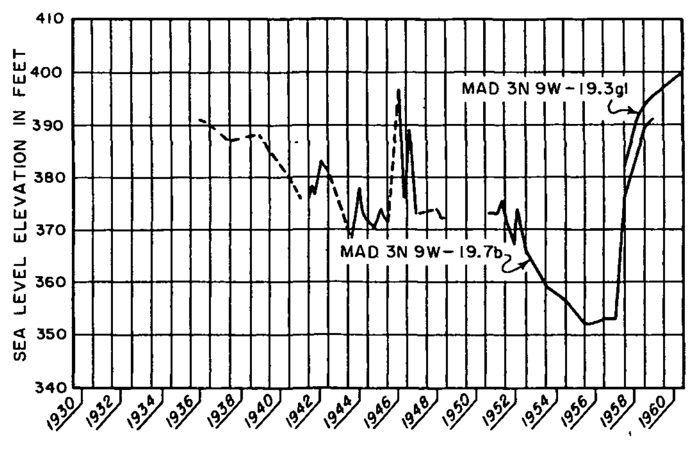


Figure 14. Water levels in wells, Granite City pumping center, 1936-1960

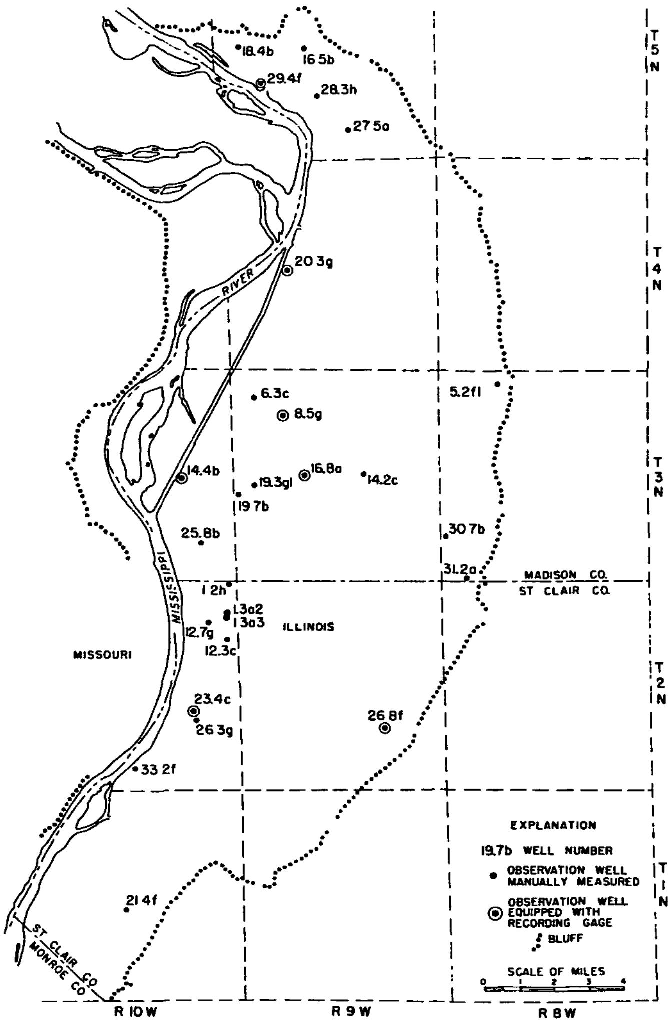


Figure 15. Location of key observation wells

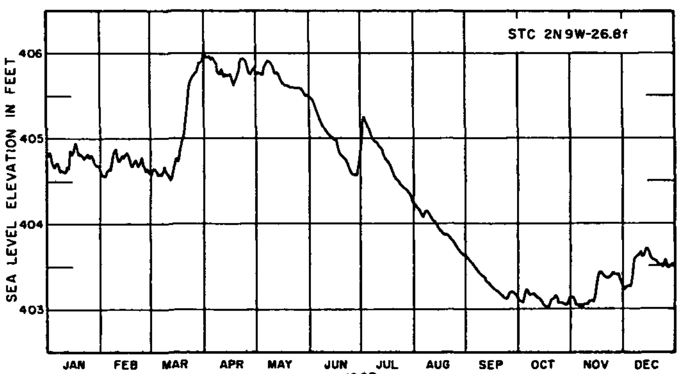


Figure 16. Water levels in well STC 2N9W-26.8f, 1960

however, when precipitation is excessive. As illustrated by figure 17, water levels rose conspicuously June 17, July 18, and August 12, 1958, indicating appreciable ground-water recharge on those dates. However, water levels in the well (figure 16) declined appreciably during the period July 3 to September 13, 1960, indicating little or no ground-water recharge. According to the hydrographs in figure 18, water levels in wells remote from major pumping centers have a seasonal fluctuation ranging from 1 to 13 feet and averaging about 4 feet.

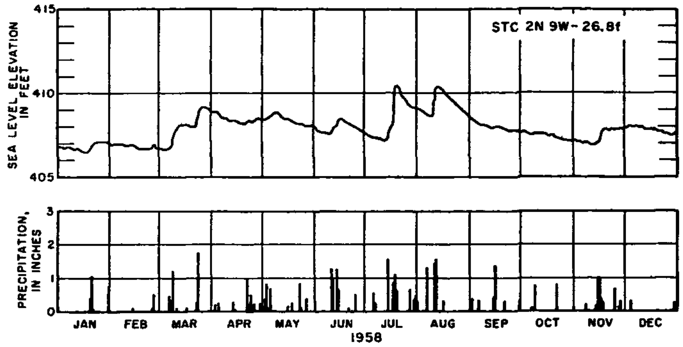


Figure 17. Water levels in well STC 2N9W-26.8f and daily precipitation at Edwardsville, 1958

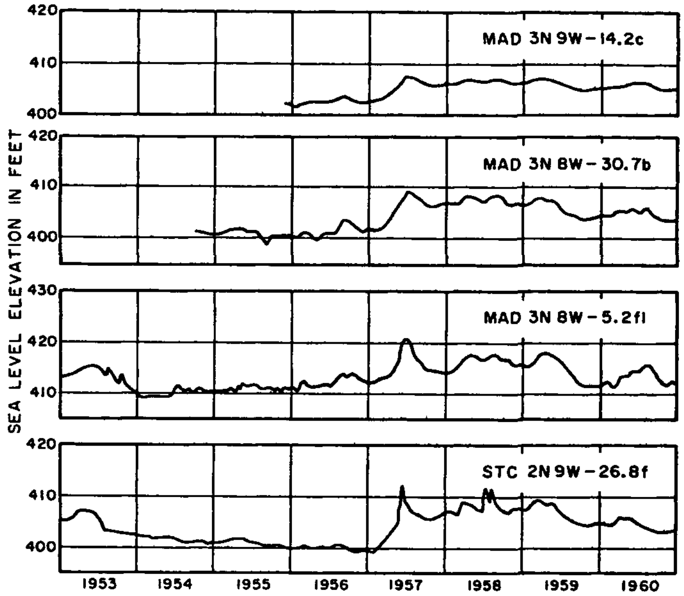


Figure 18. Water levels in wells remote from major pumping centers, 1953-1960

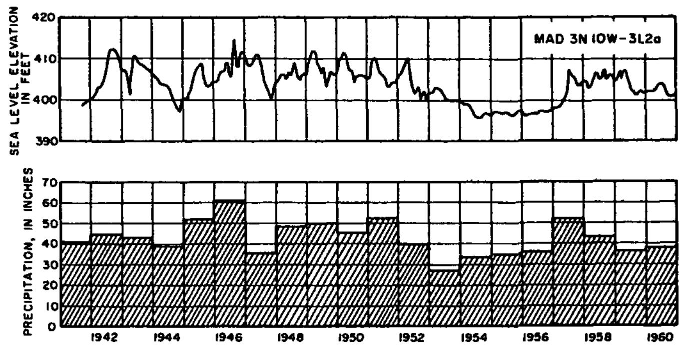


Figure 19. Water levels in well MAD 3N10W-31.2a and annual precipitation at Edwardsville, 1941—1960

Water levels in the East St. Louis area declined appreciably during the drouth, 1952-1956. The records of the U. S. Weather Bureau at Edwardsville indicate that rainfall averaged about 34.3 inches per year from 1952 through 1956, or about 6.5 inches per year below normal. The hydrograph of water levels in well MAD 3N10W-31.2a and the graph of annual precipitation at Edwardsville for 1941 to 1960 in figure 19 illustrate the pronounced effect of the prolonged drouth on water levels. Water levels were highest in 1946 when the average elevation of water levels was 408 feet and rainfall recorded at Edwardsville was 60.33 inches. Water levels were lowest during 1955 and 1956 near the end of the drouth when the average elevation was 397 feet. Water levels averaged about 405 feet in elevation during 1942 through 1951, but declined to an average elevation of 398 feet from 1953 through 1956. Water levels recovered in 1957, and then gradually declined during the latter part of 1959 and 1960.

In areas remote from pumping centers, water levels are at most places at a higher elevation than the surface elevation of the Mississippi River. During periods of high river stages, ground-water levels near the river are noticeably affected. Water levels in well MAD 5N9W-24.4f, whichis only a few hundred feet from the river, and corresponding Mississippi River stages at Hartford, Illinois, are shown in figure 20. During January and most of February when the stage of the Mississippi River was low, water levels in the well were 1 to 3 feet higher than the river. During the latter part of February the stage of the Mississippi River rose above the water level in the well and, correspondingly, water levels in the well rose reaching a peak a few days after the peak river stage. As the stage of the Mississippi River declined, water levels in the well also declined but at a lesser rate than the decline of the river stage. During the first week in April, water levels were above river stages. During the latter part of 1956 when ground-water levels and Mississippi River stages were low, as shown in figure 21, water levels in well MAD 5N9W-29.4f were mostly at elevations slightly higher, about 1 foot, than the surface elevation of the Mississippi River.

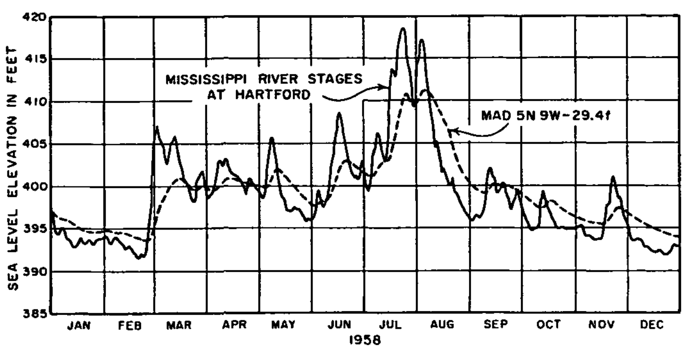


Figure 20. Water levels in well MAD 5N9W-29.4f and Mississippi River stages at Hartford, 1958

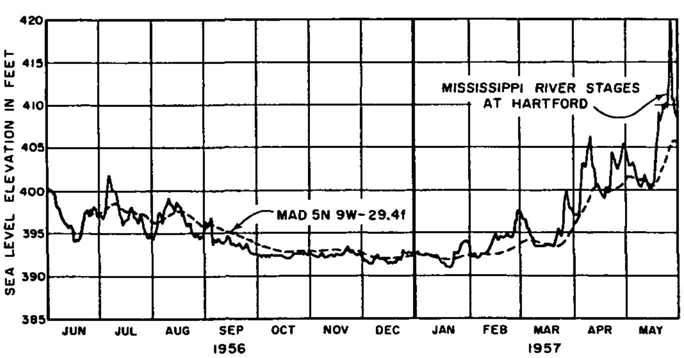


Figure 21. Water levels in well MAD 5N9W-29.4f and Mississippi River stages at Hartford, June 1956-May 1957

Large withdrawals from the ground-water reservoir have lowered water levels considerably at many places particularly in the Monsanto, National City, Wood River, and Alton areas. As a result of the lowering of water levels in the pumping centers and the close proximity of some pumping centers to the Mississippi River, ground-water levels in many parts of the cones of depression are lower than the surface of the Mississippi River. Water levels in well STC 2N10W-23.4c, located in the Monsanto cone about 0.75 mile from the river, and the Mississippi River stages at the St. Louis gage for 1956 and 1958 are shown in figures 22 and 23. During 1958, the average surface elevation of the Mississippi River was 386 feet, and the average elevation of water levels in well STC 2N10W-23.4c was 374 feet. Thus, ground-water levels were on the average about 12 feet lower than the surface of the river. During 1956, the average surface elevation of the Mississippi River was 381 feet, and the average elevation of water levels in the well was 396 feet. The effects of changes in the stage of the Mississippi River on water levels in the well are more evident during 1958 than during 1956 because changes in river stage were greater and more abrupt. In 1958, significant changes in water levels and corresponding river stages occurred in March, May, June, July, August, September, and November. In 1956 large changes occurred only in April, May, July, and August. However, even large changes in the stage of the Mississippi River result in comparatively

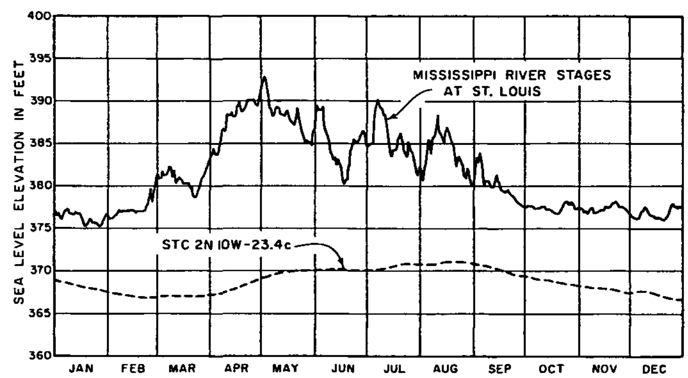


Figure 22. Water levels in well STC 2N10W-23.4c and Mississippi River stages at St. Louis, 1956

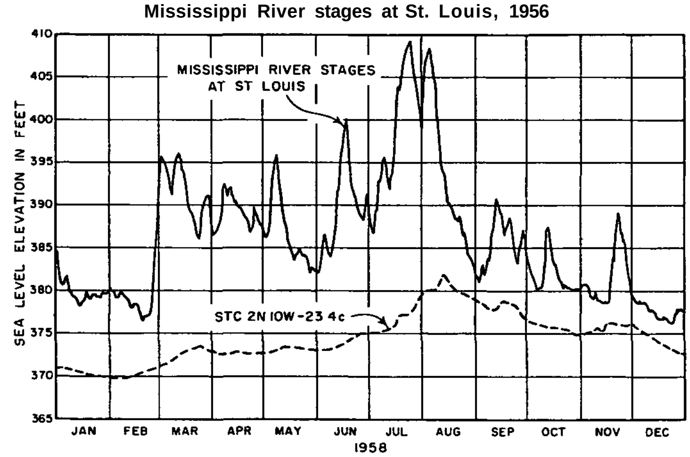


Figure 23. Water levels in well STC 2N10W-23.4c and Mississippi River stages at St. Louis, 1958

small changes in water levels in the well; a rise of 20 feet in river stage results in a rise of only a few feet in water levels in the well.

Ground-water levels fluctuate in response to pumpage changes in addition to recharge from precipitation and induced infiltration. In well MAD 3N10W-31.2a (figure 19) water levels rose 5 feet during the late winter and early spring months of 1952 chiefly as the result of recharge from precipitation. The well is remote from major pumping centers. In contrast, water levels during the same period in well MAD 3N9W-19.7b (figure 24) near a

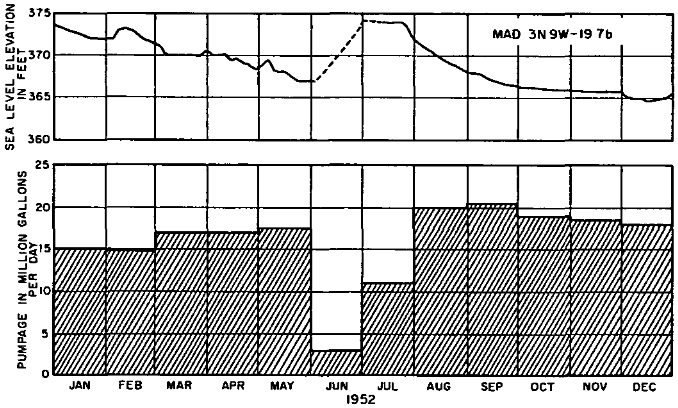


Figure 24. Water levels in well MAD 3N9W-19.7b and pumpage in Granite City pumping center, 1952

center of heavy pumping at Granite City declined about 7 feet as pumping in the vicinity of the well averaged about 16 mgd. During June, pumpage decreased greatly to an average rate of 3 mgd and as a result water levels rose from an elevation of 367 feet to 374 feet, or about 7 feet. From August through December, pumpage increased and averaged about 19 mgd; water levels declined in response to the pumpage increase to an elevation of about 365 feet, or about 9 feet.

East Alton and Alton Areas

Water levels in well MAD 5N9W-16.5b in figure 12 are affected in part by pumpage in the East Alton area, which has been fairly constant averaging about 1.3 mgd since 1932. The well is located about 3 miles northwest of the center of the Wood River pumping center and about 2 miles east of the center of the Alton pumping center. Water levels declined about 6 feet between December 1932 and December

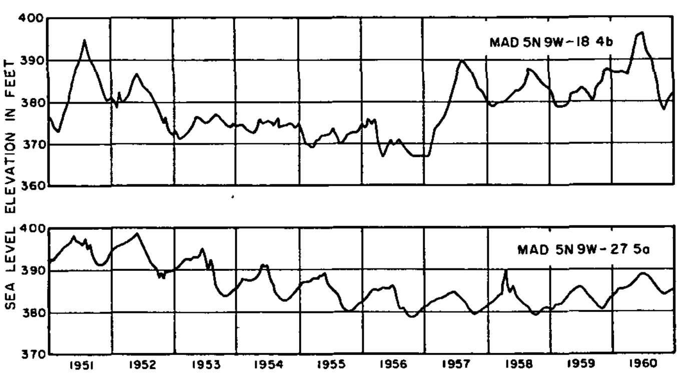


Figure 25. Water levels in wells MAD 5N9W-18.4b and MAD 5N9W-27.5a, 1951-1960

1960, from an elevation of 401 feet to 395 feet. During the severe drouth from 1952 through 1956, water levels declined 18 feet or at an average rate of 3.0 feet per year. Water levels recovered during 1957 when above normal rainfall was recorded at Edwardsville. Water levels averaged about 390 feet in elevation during 1958 and 1959 when precipitation was near normal and below normal, respectively, and rose during 1960 as the result of a decrease in pumpage and favorable recharge conditions.

Water levels in well MAD 5N9W-18.4b (in figure 25) are indicative of conditions in the Alton area. Water levels declined during 1952 to 1956 largely because of an inorease in pumpage from 7.8 mgd in 1952 to 9.0 mgd in 1956 and a decrease in recharge during the drouth period. The average rate of decline from 1952 to 1956 was 3 feet per year. Water levels recovered from 1957 to 1960 at a rate of 4 feet per year partly because of a shift in pumpage to wells along the Mississippi River.

Wood River Area

Water levels in the Wood River area have declined from an estimated elevation of about 420 feet in 1900 to an elevation of 380 feet in 1960, or at an average rate of 0.67 foot per year. During the same period, pumpage in the Wood River area increased from about 100,000 gpd to 20.9 mgd. Water levels in well MAD 5N9W-28.3h from 1942 to 1960 and in well MAD 5N9W-27.5a from 1951 to 1960 are shown in figures 12 and 25, respectively. The highest water-level elevation in well MAD 5N9W-28.3h occurred in 1943 and was 409 feet; the lowest water-level elevation occurred in 1956 and was 384 feet. Water levels in the well were at an average elevation of 400 feet during the period 1942 to 1952 and declined from 1952 to 1956 at an average rate of 3.0 feet per year. Water levels recovered at an average rate of 2.3 feet per year from 1957 through 1960. The average annual fluctuation of water levels in the Wood River area is 7 feet and ranges in magnitude from 3 to 13 feet. The large range in fluctuation is due partly to erratic industrial pumping schedules. Large quantities of ground water are often withdrawn during the summer and pumpage is reduced during the fall, winter, and spring months when Mississippi River water is used. An estimated 20 mgd is pumped during many summer months. Water-level trends in well MAD 5N9W-27.5a likewise reflect changes in the annual pumpage cycle and are similar to those in well MAD 5N9W-28.3h.

Granite City Area

Water levels in the Granite City area are shown in figures 14 and 26. From 1936 through 1951 water levels declined at an average rate of 1 foot per year; the rate of water-level decline increased to 4 feet per year during the period 1952 through June 1957 as recharge from precipitation decreased and pumpage increased. After June 1957 the Granite Gity Steel Company began using the Mississippi River as

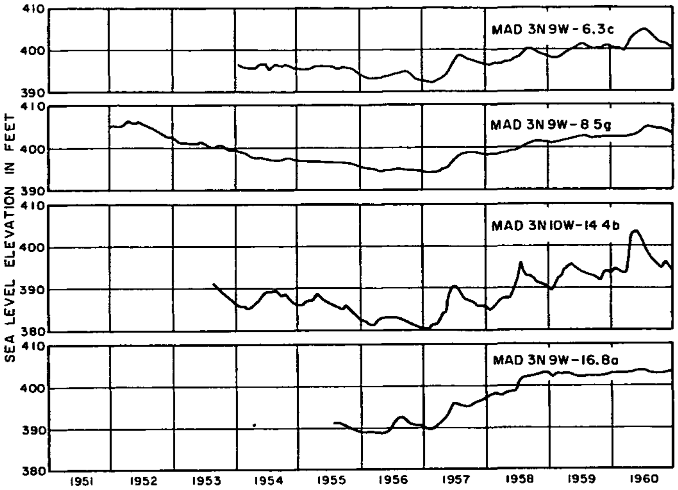


Figure 26. Water levels in wells in Granite City area, 1952-1960

a source of water supply and water levels in wells recovered at a fast rate, averaging 12 feet per year from June 1957 through 1961. Water levels in wells MAD 3N9W-8.5g and MAD 3N10W-14.4b, several miles from the pumping center, declined at an average rate of about 2 feet per year from 1953 to 1956, and recovered at an average rate of 3 feet per year after 1957. Annual fluctuations of water levels are greatest in well MAD 3N10W-14.4b, a relief well along the Chain of Rocks Canal, and average about 7 feet per year. Annual changes of water levels in wells MAD 3N9W-6.3c, MAD 3N9W-8.5g, and MAD 3N9W-l6.8a are less than in well MAD 3N10W-14.4b, and average only a few feet per year.

National City Area

Hydrographs of wells in the National City area are shown in figures 27 and 28. Water levels in well STC 2N10W-1.3a2 declined at an average rate of 1.0

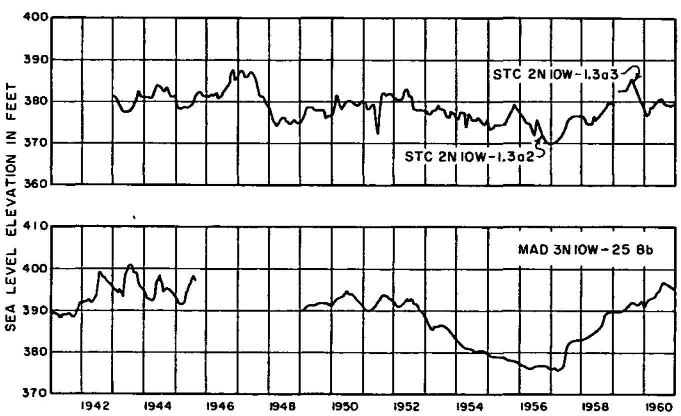


Figure 27. Water levels in wells in National City area, 1941-1960

foot per year as pumpage increased from 10.1 mgd in 1943 to 13.7 mgd in 1956. Water levels in the well recovered at a rate of 2.5 feet per year from 1957 to 1960 as pumpage in the area decreased. Water levels in well MAD 3NlQW-25.8b declined during the drouth period from an elevation of 393 feet in January 1952 to an elevation of 376 feet in December 1956, nr at anaverage rate of about 3.5 feet per year.

Water levels in 1956 in the well were under the influence of pumping in both the National City and Granite City pumping centers. During 1960, water levels in the well were influenced chiefly by pumping in the National City area because pumpage in the Granite City area was small. Water levels recovered from an elevation of 376 feet in December 1956 to an elevation of 395 feet in December 1960, or at an average rate of about 5 feet per year because of the pumpage decrease in the Granite City pumping center. Water levels in wells STC 2N10W-12.3c, STC

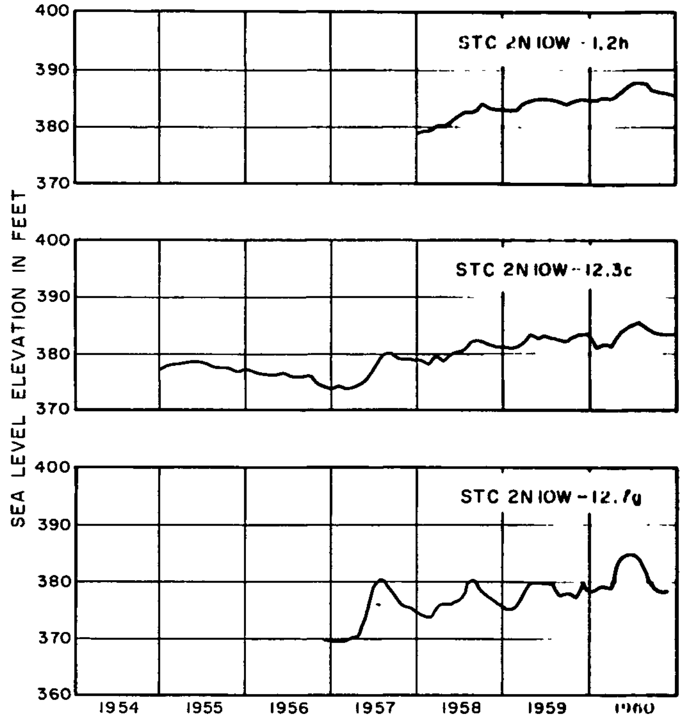


Figure 28. Water levels in wells in National City area, 1955-1960

2N10W-12.7g.and STC 2N10W-1.2h in figure 28 show a rise of about 8 feet from 1956 to 1960, which is an average rate of about 2 feet per year. Pumpage in the National City area decreased during that period about 4.1 mgd.

Monsanto Area

Well STC 2N10W-33.2f is located on the fringe of the Monsanto cone of depression, and the effects of pumping in the Monsanto area do not appear to have affected water levels in the well to any great extent during the period 1951 through 1960. Water levels in this well (figure 29), which is 0.25 mile from the Mississippi River, are greatly affected by changes in river stage. The average annual water-level fluctuation in the well is about 15 feet, and during the drouth water levels declined at an average rate of 4 feet per year.

Water levels in well STC 2N10W-23.4c change in response to changes in pumping in the Monsanto pumping center, recharge from precipitation, and induced infiltration from the Mississippi River. Water levels in the well declined at an average rate of about 1.3 feet per year as pumpage increased from 18 mgd in 1942 to 30.7 mgd in 1956. The aver-

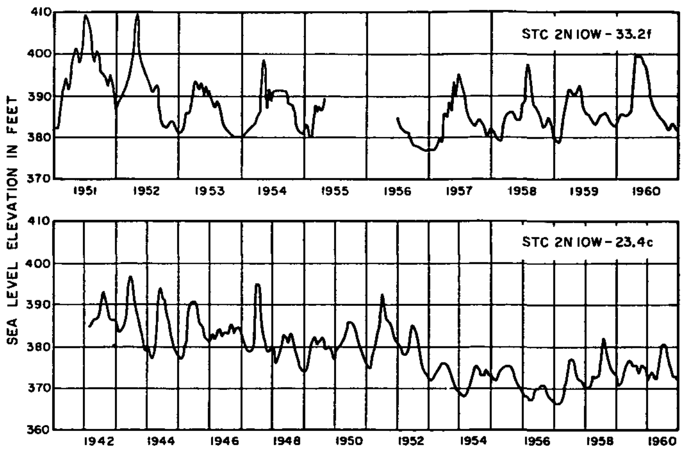


Figure 29. Water levels in wells STC 2N10W-23.4c, 1942-1960, and STC 2N10W.33.2f, 1951-1960

age rate of decline was about 3 feet per year during the drouth period, 1952-1956. Water-level elevations from 1953 to 1956 have averaged about 372 feet. A composite hydrograph for wells near the center of the Monsanto cone of depression is shown in figure 13. Water levels declined at an average rate of 2 feet per year as pumpage increased from 7 mgd in 1930 to 20.5 mgd in 1950. Water levels recovered from an elevation of about 348 feet in 1953 to about 360 feet in 1960 as part of the withdrawals were shifted to a new well field near the Mississippi River.

Piezometric Surfaces

Prior to the settlement of the East St. Louis area, the water table was very near the surface and shallow lakes, ponds, swamps, and poorly drained areas were widespread. Flood waters from the Mississippi River, Wood River, Cahokia Creek, Canteen Creek, Schoenberger Creek, and Prairie Du Pont Creek frequently inundated large sections of the lowlands. The general direction of movement of ground-water was west and south toward the Mississippi River and other streams and lakes.

Figure 30 depicts the surface drainage system in 1900 and the estimated piezometric surface prior to heavy industrial development. The piezometric surface sloped from an estimated elevation of about 420 feet near the bluffs to about 400 feet near the Mississippi River. The average slope of the piezometric surface was about 3 feet per mile; however, the slope ranged from 6 feet per mile in the Alton area to 1 foot per mile in the Dupo area. The slope of the piezometric surface was greatest near the bluffs.

Development of the East St. Louis area led to the construction of levees and drainage ditches and subsequent change in ground-water levels. Bruin and Smith (1953) estimated that the natural lake area had been reduced by more than 40 per cent between 1907 and 1950 and that probably 40 miles of improved drainage ditches had been constructed during the same period. They further estimated that these developments caused lowering of ground-water levels by 2 to 12 feet. In addition, the establishment of industrial centers and the subsequent use of large quantities of ground water by industries and municipalities has lowered water levels appreciably in the Alton, Wood River, Granite City, National City, East St. Louis, and Monsanto areas. Lowering of water levels caused by withdrawals of ground water has also been experienced in the Poag, Caseyville, Glen Carbon, Troy, and Fairmont City areas.

From 1952 to 1956 water levels declined appreciably in the East St. Louis area as the result of drouth conditions, low Mississippi River stages, and record high ground-water withdrawals. Figure 31 shows the piezometric surface in December 1956, when water levels were at recordlow stages at many places. Data on nonpumping water levels in table 2 (in appendix) were used to prepare the map.

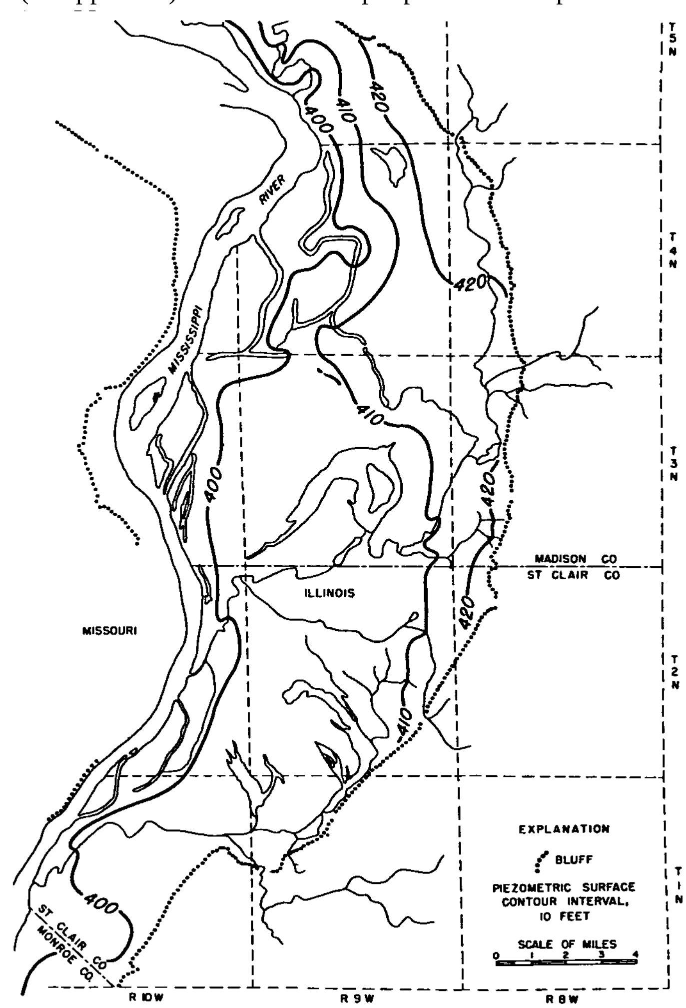


Figure 30. Drainage system and estimated elevation of piezometric surface about 1900

The illustration shows clearly the cones of depression in the piezometric surface which have developed as the result of heavy pumping. It will be noted that a considerable lowering has taken place in the piezometric surface since 1900. In 1956 the deepest cone of depression was in the Granite City area. Other pronounced cones are centered in major pumping centers.

During 1961, two mass measurements of ground-water levels were made; one in June when water levels were near maximum stages and one in No-

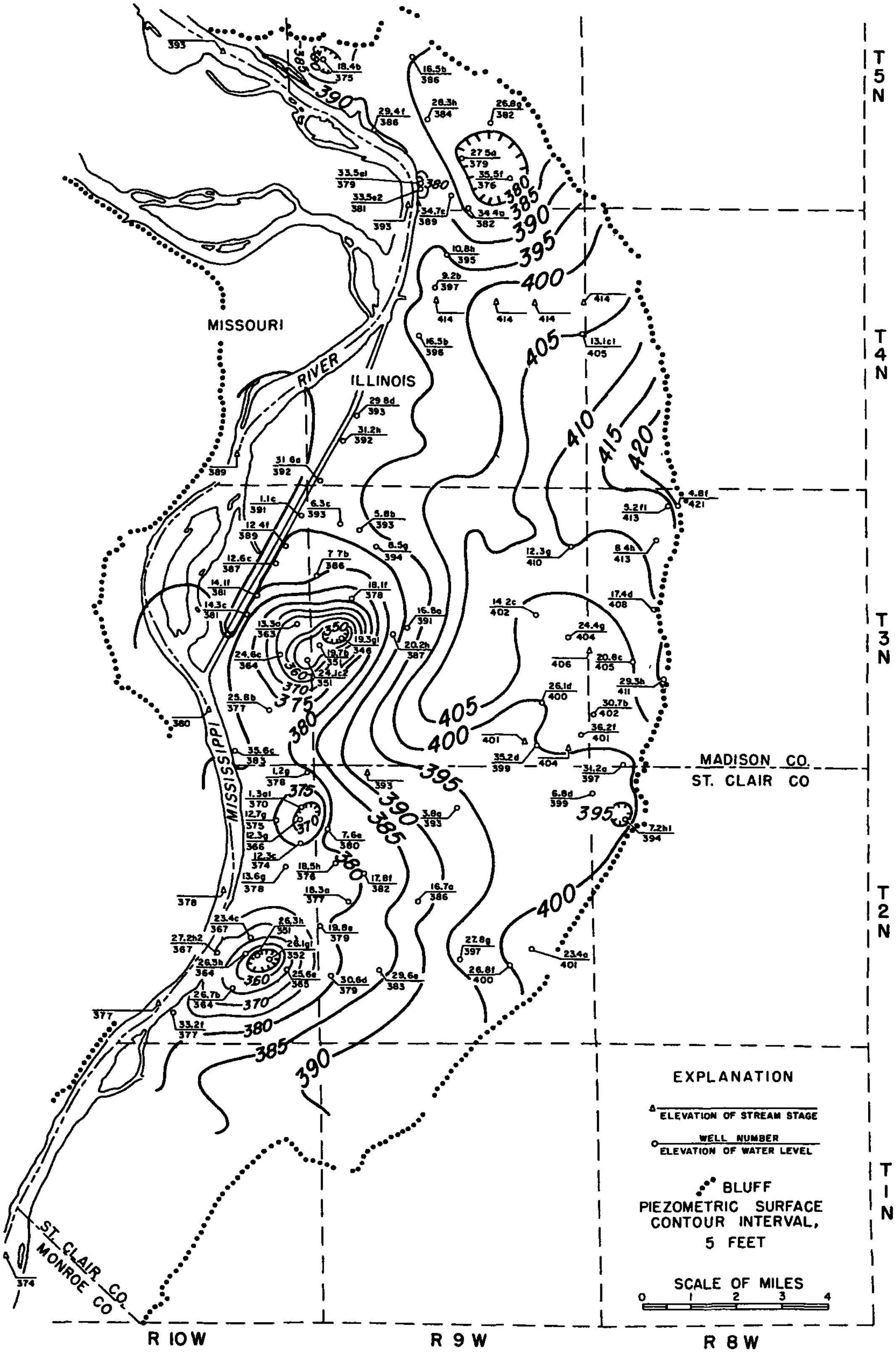


Figure 31. Approximate elevation of piezometric surface, December 1956

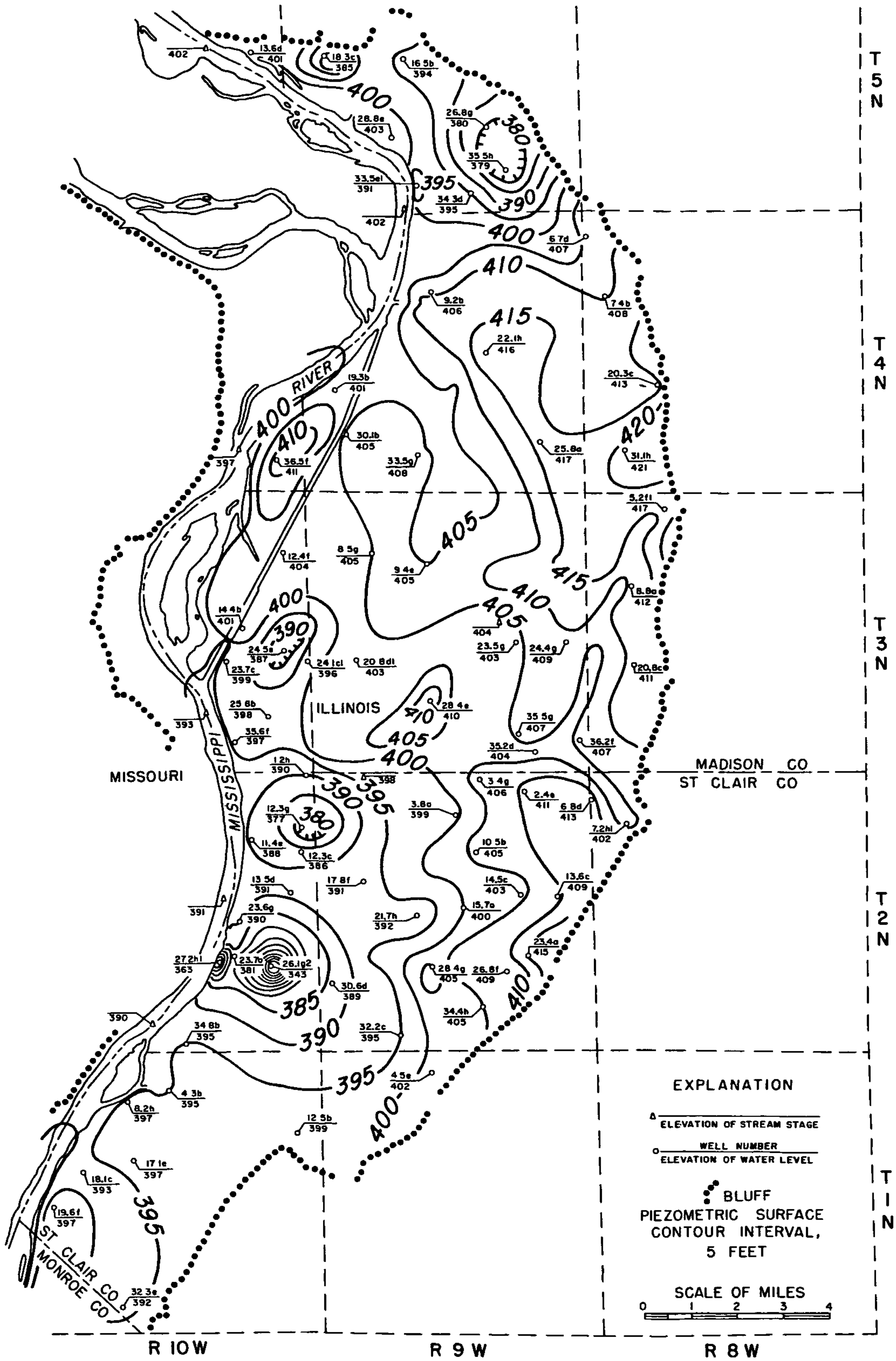


Figure 32. Approximate elevation of piezometric surface, June 1961

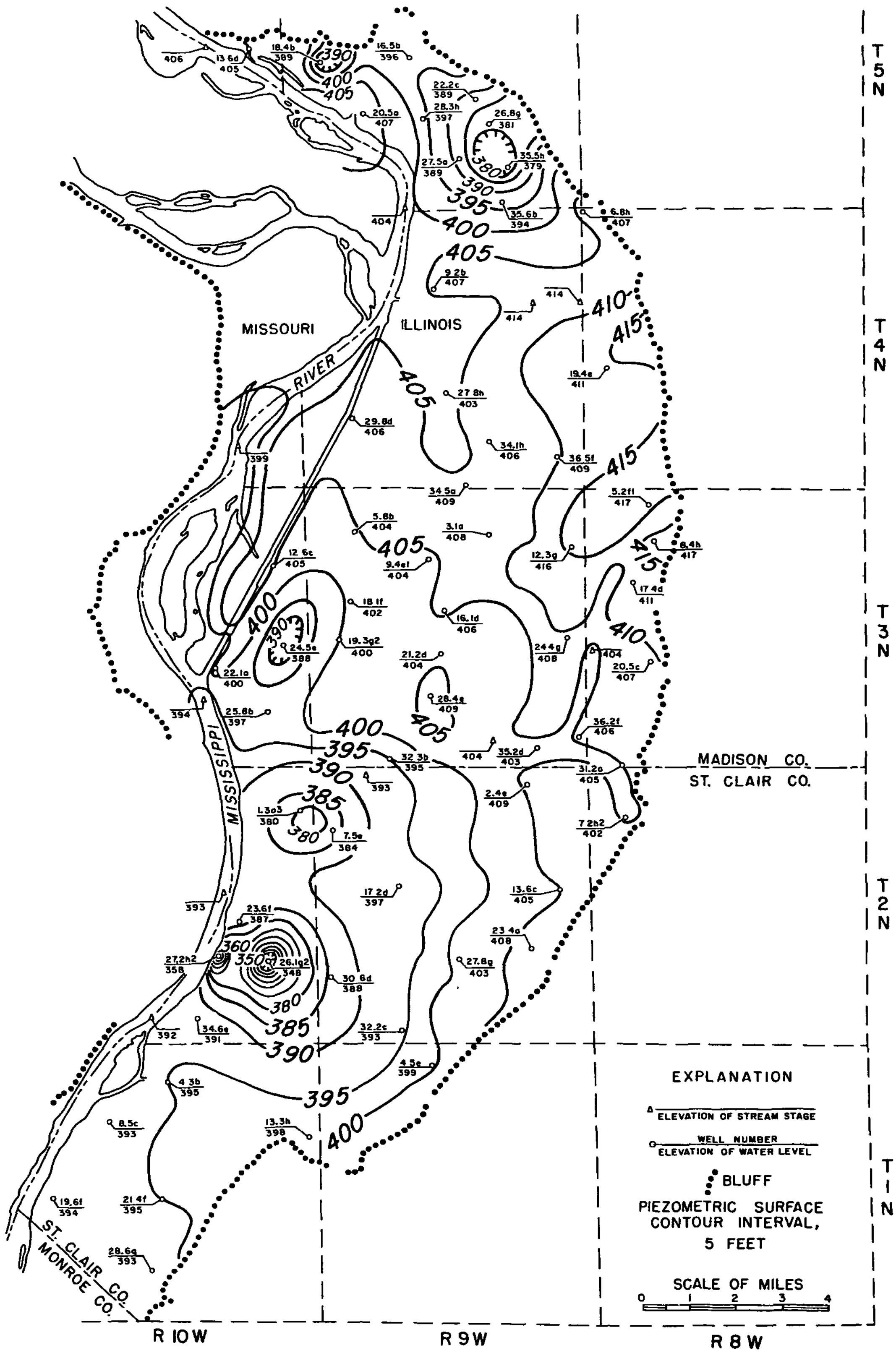


Figure 33. Approximate elevation of piezometric surface, November 1961

vember when water levels were near minimum stages. Ground-water and surface-water level data collected during the mass measurements are given in tables 2, 3, and 4 in the appendix. The piezometric surface maps for June and November are shown in figures 32 and 33, respectively. Features of the two piezometric surface maps are generally the same. The deepest cone of depression in November 1961 was centered in the Monsanto area where the lowest water levels were at an average elevation of about 350 feet. A smaller cone of depression occurred near the Mississippi River about 1.5 miles west of the large Monsanto cone of depression in the vicinity of a small pumping center. The water levels in the center of this cone of depression were at an elevation of about 360 feet. The elevations of the lowest water levels in other important cones of depression were: 380 feet in the Wood River area, 390 feet in the Alton area, 390 feet in the Granite City area, and 380 feet in the National City area. .

The general pattern of flow of water in 1961 was slow movement from all directions toward the cones of depression or the Mississippi River and other streams. The lowering of water levels in the Alton, Wood River, National City, and Monsanto areas that has accompanied withdrawals of ground water in these areas has established hydraulic gradients from the Mississippi River towards pumping centers. Ground-water levels were below the surface of the river at places and appreciable quantities of water were diverted from the river into the aquifer by the process of induced infiltration. However, the piezometric surface was above the river at other places. For example, southwest of the Granite City cone of depression, water levels adjacent to the river were higher than the normal river stage and there was discharge of ground water into the river.

The average slope of the piezometric surface in areas remote from pumping centers was 5 feet per mile.. Gradients were steeper in the immediate vicinity of pumping centers and exceeded 30 feet per mile within the Monsanto cone of depression. Gradients averaged about 10 feet per mile within the Alton, Granite City, National City, and Wood River cones of depression.

Along Canteen Creek and Cahokia Canal east of Horseshoe Lake, and around Horseshoe Lake, Long Lake, and Grand Marais State Park Lake, the piezometric surface was higher than the water surface and ground-water was discharged into these streams and lakes. Below the confluence of Canteen Creek and Cahokia Canal south of Horseshoe Lake, the piezometric surface was lower than the water surface of Cahokia Canal at places where ground-water levels have declined as the result of heavy pumping. Surface of the water in the Cahokia Diversion Channel south of Wood River is kept above the piezometric surface at an elevation of 413 feet by a low water dam near the outlet of the channel. Water surface levels are also controlled in the Chain of Rocks Canal by lock No. 27 near Granite City and were higher than the piezometric surface adjacent to the canal. The piezometric surface in the vicinity of Wood River near Alton and Prairie Du Pont Creek south of Monsanto was slightly higher than the surface of the streams. At the lower end of Horseshoe Lake north of National City, ground-water levels were lower than the lake level.

South of Prairie Du Pont Creek, ground water normally flows toward the Mississippi River. Ground water flows from the vicinity of Long Lake northwest towards the Mississippi River between the northern end of Chain of Rocks Canal and the outlet of the Cahokia Diversion Channel. Ground water flows toward the Mississippi River along the western half of Chouteau Island.

The piezometric surface map for December 1956 is similar in many respects to the piezometric surface maps for June and November 1961. Significant differences are that the cone of depression in the Granite City area was much deeper in 1956 than in 1961 and ground-water levels were lower in the vicinity of streams and lakes in 1956 than they were in 1961.

Changes in Water Levels

The piezometric surface map for 1900 was compared with the piezometric surface map for November 1961, and water-level changes were computed. Figure 34 shows the change in water levels in the

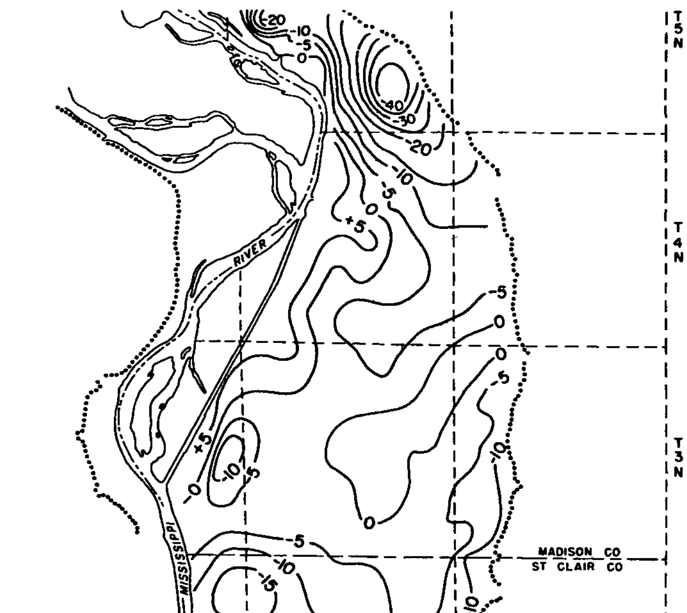


Figure 34. Estimated change in water levels, 1900-November 1961

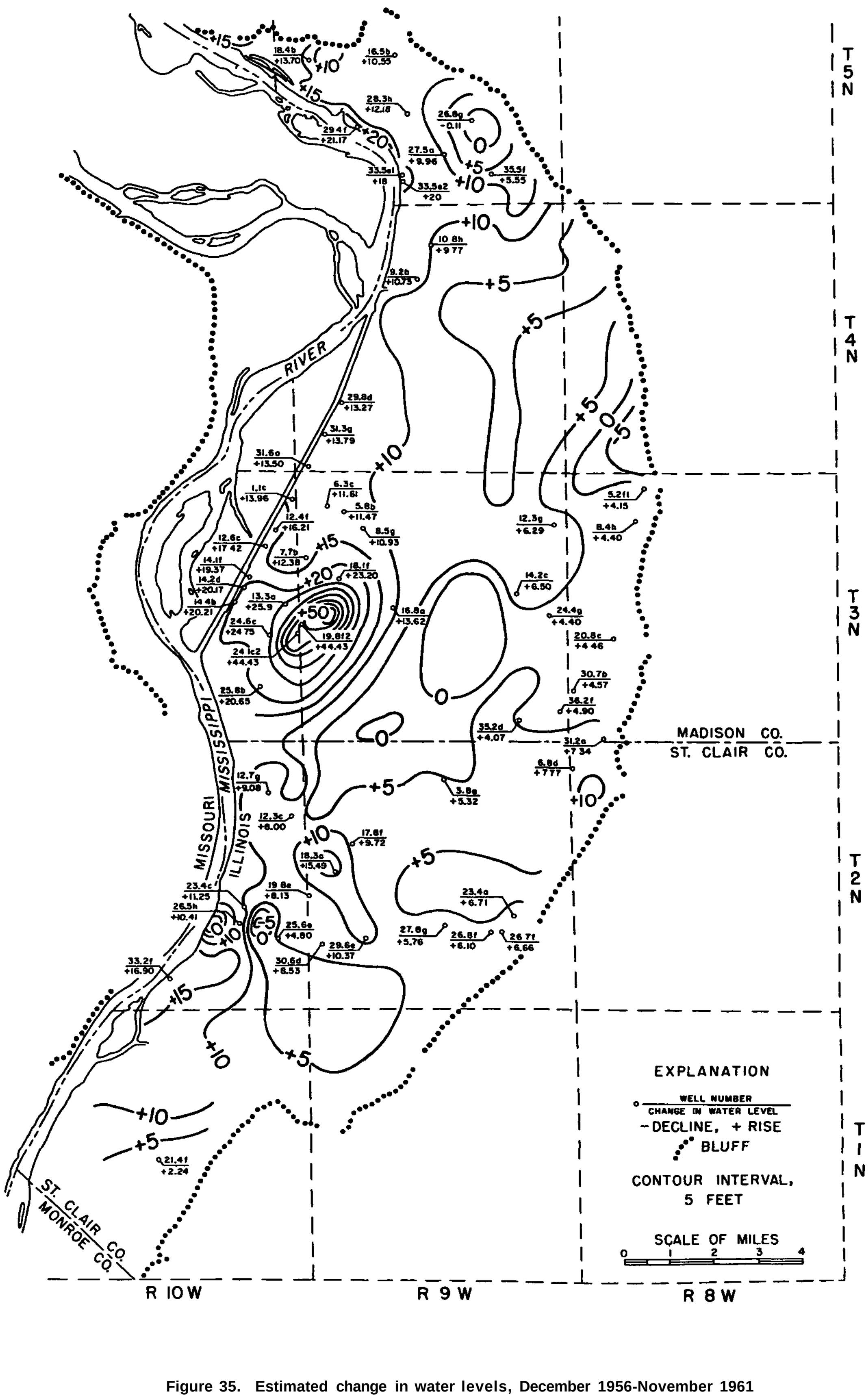


Figure 35. Estimated change in water levels, December 1956-November 1961

East St. Louis area during the 61-year period. The greatest declines occurred in the major pumping centers (figure 5) and were as follow: 50 feet in the Monsanto area, 40 feet in the Wood River area, 20 feet in the Alton area, 15 feet in the National City-

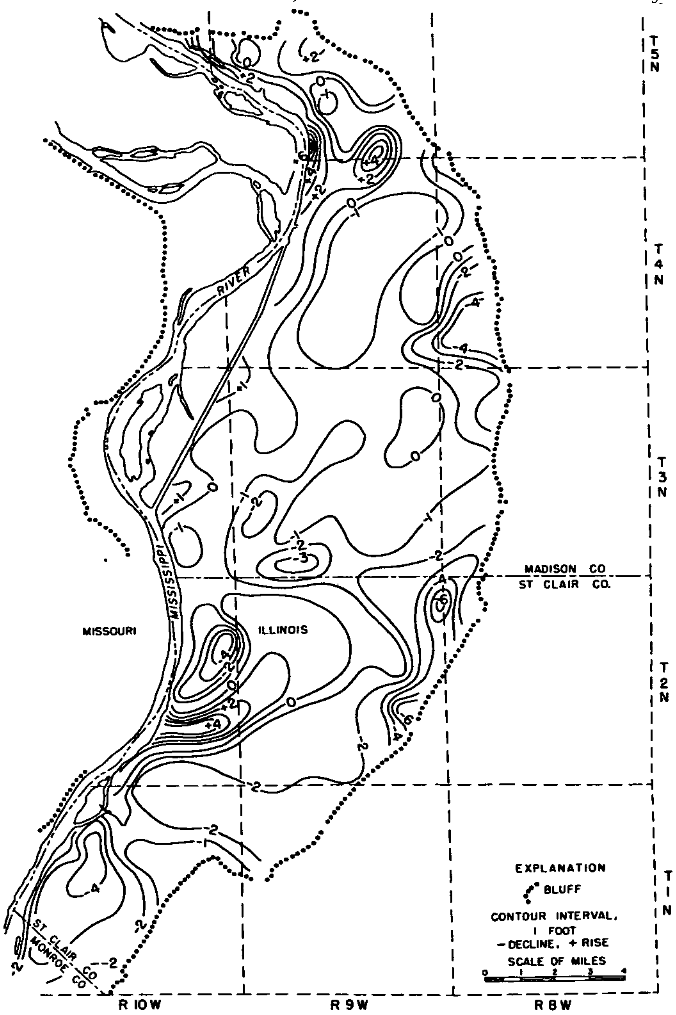


Figure 36. Estimated change in water levels, June 1961-November 1961

area, and 10 feet in the Granite City area. Water levels rose more than 5 feet along the Chain of Rocks Canal behind the locks of the Canal where the stage of surface water in 1961 was above the estimated piezometric surface in 1900. In areas remote from major pumping centers and the Mississippi River, water levels declined an average of about 5 feet. Water levels have not changed appreciably in the area around Horseshoe Lake.

The piezometric surface map for December 1956 was compared with the piezometric surface map for November 1961. Figure 35 shows the change in water levels in the East St. Louis area from December 1956 to November 1961. The greatest rises in water levels exceeding 50 feet were recorded in the Granite City area and are due largely to a reduction in pumpage in the area from 31.6 mgd in 1956 to about 8.0 mgd in 1961. Water levels declined slightly in the center of the Monsanto cone of depression because of anincrease in pumpage of about 3 mgd from 1956 to 1961. Water levels rose more than 5 feet in other places in the Monsanto area and more than 10 feet in the Alton area. Water levels in the Wood River area declined less than 1 foot near the center of pumping and rose more than 10 feet in other places. Along the Mississippi River west of Wood River water levels rose more than 20 feet; along the Mississippi River west of Monsanto water levels declined slightly in an area affected by an increase in pumpage from wells near the river. In areas remote from major pumping centers and the Mississippi River, water levels rose on the average about 5 feet.

Changes in water levels from June to November 1961 were computed and were used to prepare figure 36. The stage of the Mississippi River was higher during November than in June and as a result groundwater levels rose appreciably along the river especially in areas where induced infiltration occurs. Water levels declined more than a foot at many places in the Granite City and National City areas and along the bluffs north of Prairie Du Pont Creek. Water-level declines averaged about 3 feet south of Prairie Du Pont Creek. Water-level rises exceeded 5 feet in the Alton area and exceeded 7 feet along the Mississippi River west of Wood River. Water levels rose in excess of 4 feet in the Monsanto area. A tongue of water-level rise extended eastward through Monsanto and to a point about 5 miles northeastward of Monsanto.

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APPENDIX

Table 1. Observation Well Records

Well Number	Owner	Use*	Depth of well (feet)	Diameter of well (inches)	Screen Length (feet)	Screen Diameter (inches)	Type of well**	Remarks
MAD 5N10W-								
13.2a	Wood River Drainage & Levee District (upper)	R	74.8	8	42.8	8	D	No. 41X
13.5c	do.	R	74.5	8	46.8	8	D	No. 20
13.6d	do.	R	78.8	8	54.8	8	D	No. 16
13.7e	do.	R	58.3	8	19.1	8	D	No. 8
14.1e	do.	R	55.0	8	23.4	8	D	No. 1
24.1h	do.	R	70.7	8	39.1	8	D	No. 51
MAD 5N9W-								
16.5b	Olin Mathieson, Incorporated	N	85.1	17	24	17	D	Broadway Well
18.4b	Alton Box Board Company	N	89	4	4	4	D	Diesel House Well
18.3c	LaClede Steel Company	A					D	
19.3c	Wood River Drainage & Levee District (upper)	R	86.3	8	39.1	8	D	No. 100
19.4h	American Smelting and Refining Company	I	92	8			D	No. 1
19.6e	Wood River Drainage & Levee District (upper)	R	86.0	8	58.5	8	D	No. 87XX
19.7f	do.	R	78.3	8	46.8	8	D	No. 80X
19.8g	do.	R	70.3	8	34.8	8	D	No. 68X
20.5a	Wood River Drainage & Levee District (lower)	R	77.9	8	58.5	8	D	No. 105
22.2c	Village of Bethalto	P	95	30x40	48	30x40	D	No. 3, Porous Concrete Screen
26.8g	City of Wood River	P	116	12	40	12	D	No. 10
27.1b	Village of Roxana	P	122	30x40		30x40	D	No. 1, Porous Concrete Screen
27.5a	Ohio Oil Company	I						South Well
28.2d	American Oil Company	N					D	Test Well
28.3h	Kienstra Brothers	I	90	10			D	

* R Relief Well
I Industrial Supply
P Public Supply
A Abandoned
IR Irrigation Supply
D Domestic Supply
N Not Used

** D Drilled Well
d Driven Well
du Dug Well
C Collector Well

Table 1 (Continued)

Well Number	Owner	Use	Depth of well (feet)	Diameter of well (inches)	Screen Length (feet)	Screen Diameter (inches)	Type of well	Remarks
MAD 5N9W-								
28.4c	Wood River Drainage & Levee District (lower)	R	97.6	8	62.5	8	D	No. 146
28.8e	do.	R	81.0	8	47.1	8	D	No. 138
29.1e	do.	R	85.5	8	42.8	8	D	No. 135
29.4f	Olin Mathieson, Incorporated	N					D	No. AN-1, Test Well
29.4g	Wood River Drainage & Levee District (lower)	R	89.2	8	50.5	8	D	No. 121
29.5g	do.	R	81.2	8	58.5	8	D	No. 114
33.5e1	Shell Oil Refinery	N	107	6			D	North Test Well
33.5e2	do.	N	107	*b*			D	South Test Well
34.3d	Anlin Company	I	114.4				D	No. 1
34.4a	Sinclair Oil Refinery	I	110	16			D	No. 1
34.7c	International Shoe Company	I	110	8			D	
35.5f	Shell Oil Refinery	I	130	30x40	52	30x40	D	No. 52, Porous Concrete Screen
35.5h	do.	I	130.5	30x40	68	30x40	D	No. 41, Porous Concrete Screen
35.6b	do.	I	118	30x40	40	30x40	D	No. 60, Porous Concrete Screen
MAD 4N8W-								
6.7d	Erwin Finke	A	40	6			D	
6.8h	Duo Craft Manufacturing Company	A						
7.4b	E. N. West	A	30	1 1/4			d	
18.2e	N. Pintar	A	30	1 1/4			d	
19.4e	I. J. Hittner	A	40	1 1/4			d	
20.3c	St. Pauls United Church of Christ	N	44	36			du	
20.4g	Herbert Klingeman	D	29	36			du	
30.1f	Chas. Riggins	A	30	36			du	
31.1h	E. Lewis	A	30	1 1/4			d	
MAD 4N9W-								
1.7h	R. Roseberry	A		6			D	
9.2b	Louis Hoehn	A	40	36			du	
10.8h	Ashland Oil Company	I	112	8	20	8	D	
12.4h	C. Louch	A	40	1 1/4			d	
13.1c1	City of Edwardsville	P	113.6	16	42	16	D	No. 3
13.1c2	do.	P	116.5	16	40	16	D	No. 4
14.8h	East St. Louis Drainage & Levee District	R	74.00	8	47.1	8	D	No. 3
16.5b	G. Hackethal	A						
19.3b	H. Hantleman	A	30	36			du	
20.3g	East St. Louis Drain- ' age 8c Levee District (Chain of Rocks Canal)	R	69.5	8	50.0	8	D	No. 196

Table 1 (Continued)

Well Number	Owner	Use	Depth of well (feet)	Diameter of well (inches)	Screen Length (feet)	Screen Diameter (inches)	Type of well	Remarks
MAD 4N9W-								
21.5h	B. Olbert	A	106	1 1/4			d	
22.1h	Great Lakes Carbon	A	25	1 1/4			d	
25.2d	W. H. Young	A	45	6			D	
25.8a	Unknown	A	32	1 1/4			d	
27.8h	J. Franko	A	45	1 1/4			d	
29.7b	Thomason	IR	106	30x40	60	30x40	D	Porous Concrete Screen
29.8d	East St. Louis Drainage & Levee District (Chain of Rocks Canal)	R	64.6	8	50	8	D	No. 161
30.1b	do.	R	68.8	8	50	8	D	No. 155
31.2h	do.	R	68.8	8	50	8	D	No. 150
31.3g	do.	R	67.8	8	50	8	D	No. 145
31.6a	do.	R	65.8	8	50	8	D	No. 126
33.5g	Tri-City Speedway	P	85	12	15	12	D	
34.1h	M. Theis	D	30	36			du	
34.5a	Magnolia Oil Company	A	26	4			D	
MAD 4N10W-								
36.5f	A. Reckert	D	20	1 1/4			d	
MAD 3N8W-								
4.8f	G. Sepmeyer		30	8			D	Filled May 1957
5.2f1	Village of Glen Carbon	P	66	12	21.7	12	D	No. 2
5.2f2	do.	P	63	30x40	48	30x40	D	No. 3
6.1e	L. Grass	A	15	1 1/4			d	
8.4h	F. Sampson	IR	100	14	32	14	D	
8.8a	J. Keller	A	22	1 1/4			d	
17.4d	Formerly Sugar Loaf Coal Company	IR	60					
20.5c	T. Kosten	IR	100	12	30	12	D	
20.8c	L. J. Fournie	IR	100	3			d	
29.3h	City of Troy	P	115	10	20	10	D	
30.7b	V. W. Eckmann	IR	104	30x40	80	30x40	D	
31.2a	City of Collinsville	P	102	24	30	24	D	Highway Well
MAD 3N9W-								
3.1a	E. Cummins	A	17.5	36			du	
5.8b	H. Bischoff	IR	110	30x40	60	30x40	D	East Well
6.3c	do.	IR	110	30x40	60	30x40	D	West Well
7.7b	A. O. Smith Corporation	I	105	12	20	.12	D	South Well
8.5g	State Water Survey	N	80	8			D	No. 3
9.4e	M. J. Hill	A	25	36			du	
10.4b	W. Engelke	IR	104	12			D	
11.6g	Breune Estate	A	15	36			du	Filled Aug. 1961
12.3g	R. Coleman	A	20	36			du	
14.2c	W. Hanfelder	IR	102	12	32.2	12	D	
16.1d	T. Marz	A	27	1 1/4			d	
16.8a	Granite City Steel Company	N						E-2
18.1f	A. Stoever		45	1 1/4			d	

Table 1 (Continued)

Well Number	Owner	Use	Depth of well (feet)	Diameter of well (inches)	Screen Length (feet)	Screen Diameter (inches)	Type of well	Remarks
MAD 3N9W-								
19.3g1	Granite City Steel Company	N					C	
19.3g2	do.	N						R-1. Test Well
19.7b	do.	N						No. 11
19.8fl	do.						C	
19.8f2	do.	N						R-3, Test Well E-1
20.2h	do.	N						
20.7e	do.	N					C	
20.8dl	do.	N					D	No. 6
20.8d2	do.	N					D	No. 12
20.8el	do.	N					D	No. 4
20.8e2	do.	N					D	No. 13
21.2d	V. Clayton	A	24	1 1/4				
23.5g	R. Becker	A	23	1 1/4				
24.4g	Richard Rees	IR	104	30x40	56	30x40	D	
24.8e	F. Gillham	IR	24	2			d	
26.1d	Niehaus		18	36			du	Filled Sept. 1960
28.4e	J. Buehrer	A	106	2			d	
32.3b	H. Mueller	A	23	1 1/4			d	
32.6g	H. Aufderheid	N	26	36			du	
35.2d	G. Powell Jr.	IR	100	12	33	12	D	
35.5g	H. Kosten	IR	32	2			d	
36.2f	V. L. Eckmann	IR	59	2			d	
MAD 3N10W-								
1.1c	East St. Louis Drainage & Levee District (Chain of Rocks)	R	52.8	8	40	8	D	No. 98
12.4f	do.	R	56.3	8	43.5	8	D	No. 69
12.6c	do.	R	55.3	8	42.5	8	D	No. 56
13.3a	Union Starch & Refining Company	A	115				D	No. 13
13.8g	East St. Louis Drainage & Levee District (Chain of Rocks)	R	64.8	8	50	8	D	No. 38
14.1f	do.	R	62.8	8	50	8	D	No. 33
14.2d	do.	R	67.7	8	50	8	D	No. 26
14.3c	do.	R	68.8	8	50	8	D	No. 24
14.4b	do.	R	67.6	8	50	8	D	No. 18
22.1a	East St. Louis Drainage & Levee District	R	58.8	8	19.1	8	D	No. 43
22.1c	do.	R	58.9	8	35.1	8	D	No. 33
23.6c	do.	R	58.9	8	34.8	8	D	No. 7
23.7c	do.	R	59.2	8	42.8	8	D	No. 20
24.1c1	Granite City Steel Company	N					C	
24.1c2	do.	N						No. R-2, Test Well
24.3h	Dressel Young Dairy	I	110	8	20	8	D	
24.5e	General Steel Casting Company	I	114	30			D	No. 13

Table 1 (Continued)

Well Number	Owner	Use	Depth of well (feet)	Diameter of well (inches)	Screen Length (feet)	Screen Diameter (inches)	Type of well	Remarks
MAD 3N10W-								
24.6c	General Steel Casting Company	I					D	No. 11
25.8b	Celotex Company	I	110	16			D	
26.6b	East St. Louis Drainage & Levee District	R	59.7	8	42.8	8	D	No. 78
26.7d	do.	R	55.2	8	39.1	8	D	No. 70
26.8e	do.	R	69.9	8	46.5	8	D	No. 64
26.8h	do.	R	55.0	8	35.1	8	D	No. 53
35.6c	Union Electric Company							
35.6f	East St. Louis Drainage & Levee District	R	62.6	8	39.1	8	D	No. 96
35.6h	do.	R	58.6	8	39.1	8	D	No. 87
36.5h	LaClede Steel Company	I	100	30x40	68	30x40	D	North Well
STC 2N8W-								
6.1d	Keller Brothers	IR	108	16			D	
6.8d	E. A. Weissert	IR	105	12	20	12	D	
7.2h1	Western Fibre Company	I		14			D	No. 2
7.2h2	do.	I	128	8			D	No. 3
STC 2N9W-								
2.4e	State of Illinois	A	34	2			d	
3.4g	Merrill Estates	A	48	2			d	
3.8a	General Chemical Company	A	124	30x40	12	30x40	D	No. 9
7.5e	Circle Packing Company	I	111	12	20	12	D	No. 2
7.6e	Hunter Packing Company	I	106	16	40	16	D	No. 6
10.5b	J. E. Jouglard	D	30	1 1/4			d	
11.7h	F. Hylta	IR	40	2			d	
12.5d	V. Stafford	N	48	1 1/4			d	
13.6c	C. Weissert	IR	100	12			D	
13.7f	J. Courtney	IR	47	2			d	
14.5c	C. Weissert	IR	99	12			D	
15.3b	J. Beever	A	32	1 1/4			d	
15.7a	J. Scranz	IR	98	12	40	12	D	
16.7a	East St. Louis Castings Company	I					D	No. 6
17.2d	City of East St. Louis	P	108	12			D	Jones Park
17.8f	Illinois Power Company	A	113	12			D	
18.3a	Gateway Paint Company	N	115	12			D	
18.5h	City Ice and Fuel Company	I	116	12			D	
19.8e	Central Brewery	A	80				D	
21.7h	Locke Stove Company	I					D	
23.4a	V. Moser	A	42	36			du	
24.6e	O. H. Smith	A	42	2			d	

Table 1 (Continued)

Well Number	Owner	Use	Depth of well (feet)	Diameter of well (inches)	Screen Length (feet)	Screen Diameter (inches)	Type of well	Remarks
STC 2N9W-								
26.7f	State Water Survey	N	81	8			D	No. 2
26.8f	do.	N	81	8			D	No. 1
27.8g	State of Illinois	IR	44	16			D	
28.4g	do.	A	44	12			D	
29.6e	Aluminum Company of America	I	115	16	20	16	D	
30.6d	Alton and Southern Railroad	I	110	12			D	Davis Yards
32.2c	L. Ridgway	A	24	1 1/4			d	
33.1f	V. DeMange	D	43	1 1/4			d	
33.2d	Cahokia Downs Race Track	P						
34.4h	H. W. Thomas	A	30	1 1/4			d	
STC 2N10W								
1.2g	Kasco Dog Food Company	I					D	
1.2h	Armour Fertilizer Company	I	110	10	20	10	D	
1.3a1	National Stockyards	I	110				D	No. 1
1.3a2	do.	I					D	No. 3
1.3a3	do.	I	108				D	No. 4
11.3d	East St. Louis Drainage & Levee District		90	10			D	North Side Pumping Station
11.4e	do.	R	85.8	8	62.8	8	D	No. 105
12.3c	Chicago Curled Hair Company	I	106	12	21	12	D	
12.3g	Swift and Company	I	104	4 4			D	No. 13
12.7g	Terminal Ice Company	I					D	No. 2
13.5d	St. Mary's Hospital	P	75	4	25	4	D	
13.6g	S. S. Kresge Company	P	110	10			D	
23.4c	Mississippi Avenue Warehouse (G. J. Nooney & Company)	I	115	8			D	
23.6f	East St. Louis Drainage & Levee District	R	98	8	50.8	8	D	No. 118
23.6g	do.	R	85.7	8	61.9	8	D	No. 111
23.7a	do.	R	90.6	8	50.8	8	D	No. 136
23.7b	do.	R	93.8	8	70.5	8	D	No. 126
25.5d	Socony Mobil Oil Company	I	108	24	35	24	D	
25.6e	Socony Vacuum Company	I	115	16	30	16	D	
26.1gl	Monsanto Chemical Company	N	105	6			D	No. 13A
26.1g2	do.	N	111	4			D	No. 8A
26.2e	do.	N	111	4			D	No. SR-2, Test Well
26.3g	do.	N						No. 14
26.3h	American Zinc Company	I	105	16			D	No. 2
26.5h	Monsanto Chemical Company	N					D	No. R-2, Test Well

Table 1 (Continued)

Well Number	Owner	Use	Depth of well (feet)	Diameter of well (inches)	Screen Length (feet)	Screen Diameter (inches)	Type of well	Remarks
STC 2N10W-								
26.7b	Midwest Rubber Company	I					D	No. 3
STC 2N10W-								
27.2g	Monsanto Chemical Company	N	100	7			D	No. S-2, Test Well
27.2hl	do.	N	90	7			D	No. XS-1,Test Well
27.2h2	do.	N	100	7			D	No. S-1, Test Well
33.2f	Alton and Southern Railroad	N	100	8			D	Fox Terminal
34.5h	East St. Louis Drainage & Levee District	R	74.8	8	39.1	8	D	No. 137
34.6e	do.	R	90.3	8	54.8	8	D	No. 159
34.7c	do.	R	78.7	8	54.8	8	D	No. 169
34.8b	do.	R	82.3	8	58.5	8	D	No. 180
STC 1N9W-								
4.5e	E. Westerheide	A	17	1 1/4			d	
6.2a	S. Shield	A	30	1 1/4			d	
STC 1N10W-								
4.1g	East St. Louis Drainage & Levee District	R	82.7	8	35.1	8	D	No. 196
4.2e	do.	R	74.5	8	50.8	8	D	No. 207
4.3b	do.	R	70.5	8	50.8	8	D	No. 237
4.3c	do.	R	74.5	8	35.1	8	D	No. 223
4.7b	Prairie Du Pont Drainage 8c Levee District	R	74.6	8	42.8	8	D	No. 23
8.2h	do.	R	85.8	8	47.1	8	D	No. 28
8.5c	do.	R	98.1	8	31.4	8	D	No. 34
8.7a	do.	R	94.5	8	31.4	8	D	No. 45
9.1f	East St. Louis Drainage & Levee District	R	66.3	8	47.1	8	D	No. 262
9.2h	do.	R	81.5	8	54.8	8	D	No. 251
9.4h	Prairie Du Pont Drainage & Levee District	R	94.2	8	39.1	8	D	No. 15
10.1c	East St. Louis Drainage & Levee District	R	85.3	8	56.2	8	D	No. 273
10.4c	do.	R	66.3	8	47.1	8	D	No. 263
12.5b	do.	R	97.2	8	58.5	8	D	No. 278
13.3h	do.	R	77.3	8	27.1	8	D	No. 286
15.1d	Charles Dixon	A	23	1 1/4			d	
16.2g	W. Descher	D	24	36			du	
17.1e	O. Kelling	A	21	1 1/4			d	
18.1c	W. Reeg	A	37	1 1/4			d	
19.6f	Prairie Du Pont Drainage & Levee District	R	66.9	8	39.4	8	D	No. 46

Table 1 (Continued)

Well Number	Owner	Use	Depth of well (feet)	Diameter of well (inches)	Screen Length (feet)	Screen Diameter (inches)	Type of well	Remarks
STC 1N10W-								
21.1a	L. Lindeman	A	62	1 1/4			D	
21.4f	Missouri Pacific Railroad	N	102	26			D	South Well
28.6a	Vegefat Incorporated	I	40	12			D	
30.6h	Prairie Du Pont Drainage & Levee District	R	82.5	8	54.8	8	D	No. 55
32.3e	L. W. Bieller	A	37	1 1/4			d	
MON 1N10W-								
30.8b	Prairie Du Pont Drainage & Levee District	R	86.7	8	54.8	8	D	No. 69
31.4d	L. Pulcher	A	20	36			du	

Table 2. Water-Level Data for Wells

Hell Number	Elevation of measuring point (feet)	Water levels (feet): December 1956, Depth to water	December 1956, Mean sea level elevation	June 1961, Depth to water	June 1961, Mean sea level elevation	November 1961, Depth to water	November 1961, Mean sea level elevation	Water level changes (feet): From December 1956 to November 1961	From June 1961 to November 1961
MAD 5H10W-									
13.2a	413.4			12.80	400.6	10.63	402.77		2.17
13.5c	412.8			12.32	400.48	8.00	404.80		4.32
13.6d	416.1			14.82	401.28	10.67	405.43		4.15
13.7e	415.2			11.92	403.28	6.46	408.74		5.46
14.1e	411.9			7.92	403.98	2.09	409.81		5.83
24.1h	414.7			14.50	400.20	12.27	402.43		2.23
MAD 5N9W-									
16.5b	443.03	57,.13	385.9	48.67	394.36	46.58	396.45	10.55	2.09
18.3c	436.7			52.02	384.68	52.30	384.4		-0.28
18.4b	438.1	62.80	375.3	50.10	388	49.10	389	13.70	1.00
19.3c	415.7			12.76	402.94	10.10	405.60		2.66
19.4h	430			37.45	392.55	37.54	392.46		-0.09
19.6e	415.8			13.76	402.04	10.64	405.16		3.12
19.7f	413.3			12.21	401.09	9.47	403.83		2.74
19.8g	414.7			13.90	400.80	11.22	403.48		2.68
20.5a	413.4			8.86	404.54	6.73	406.67		2.13
22.2c	440.71			53.10	387.61	51.56	389.15		1.54
26.8g	441.72	60,.22	381.50	62.00	379.72	60.33	381.39	-0..11	1.67
27.1b	446.02			67.45	378.57				
27.5a	428.52	49..82	378.7	39.21	389.31	39.86	388.66	9..96	-0.65
28.2d					396.24		394.57		-1.67
28.3h	432.60	48..20	384.4	35.45	397.15	36.02	396.58	12..18	-0.57
28.4c	413.3			14.07	399.23	12.31	400.99		1.76
28.8e	418.2			15.04	403.16	11.58	406.62		3.46
29.1e	413.4			15.55	397.85	12.22	401.18		3.33
29.4f	416.07	30..17	385.9	11.35	404.72	9.00	407.07	21..17	2.35
29.4g	414.4			10.41	403.49	8.13	406.27		2.78
29.5g	415.4			11.67	403.73	8.80	406.60		2.87
33.5e1	418.44	39	379.44	27	391.44	21	397.44	18.00	6.00
33.5e2	417.89	37	380.89	24	393.89	17	400.89	20.00	7.00
34.3d	429			33.88	395.12				
34.4a			381.92						
34.7c			388.69			40.20			
35.5f	445.55	69.55	376.0	66.35	379.20	64.00	381.55	5.55	2.35
35.5h	446.53			68.03	378.50	68.00	378.53		0.03
35.6b	445.69			55.50	390.19	51.21	394.48		4.29
MAD 4N8W-									
6.7d	432			24.87	407.13				
6.8h	441.18			34.84	406.34	33.70	407.48		1.14
7.4b	428			20.09	407.91	21.08	406.92		-0.99
16.2e	430			17.39	412.61	17.01	412.99		0.38
19.4e	429			16.44	412.56	17.77	411.23		-1.33
20.3c	452.5			39.44	413.06	41.80	410.70		-2.36
20.4g	469			16.80	452.20	19.59	449.41		-2.79
30.1f	425			10.45	414.55	14.95	410.05		-4.50
31.1h	426			5.17	420.83				
MAD 4N9W-									
1.7h	441			44.37	396.63	44.48	396.52		-0.11
9.2b	434.61	38.11	396.5	28.18	406.43	27.38	407.23	10.73	0.80
10.8h	432.57	37.57	395.0	28.80	403.77	27.80	404.77	9.77	1.00
12.411	427			22.54	404.46				
13.1c1	439.15	34.65	404.5	28.0	411.15				
13.1c2	440.10					28.34	411.76		
14.8h	422.89					19.84	403.05		
19.3b	422			20.79	401.21	18.95	403.05		1.34
20.3g	414.39			10.58	403.81	6.65	407.74		3.93

Table 2 (Continued)

Well Number	Elevation of measuring point (feet)	Water levels (feet) December 1956 Depth to water	December 1956 Mean sea level elevation	June 1961 Depth to water	June 1961 Mean sea level elevation	November 1961 Depth to water	November 1961 Mean sea level elevation	Water level changes (feet) From December 1956 to November 1961	From June 1961 to November 1961
HAD 4N9W- (cont.)									
21.5h	419.14			6.47	412.67				
22.1h	.430			13.71	416.29				
25.2d	421			9.33	411.67	9.05	411.95		0.28
25.8a	428.5			11.81	416.69				
27.8h	409.0			4.66	404.34	6.46	402.54		-1.80
29.7b	421.06	27.46	393.60			15.00	406.06	12.46	
29.8d	413.42	20.90	392.52	7.85	405.57	7.63	405.79	13.27	0.22
30.1b	416.70	24.31	392.39	11.41	405.29	10.78	405.92	13.53	0.63
31.2h	416.95	24.69	392.26	12.00	404.95	11.14	405.81	13.55	0.86
31.3g	415.57	23.46	392.11	10.75	404.82	9.67	405.90	13.79	1.08
31.6a	408.02	16.20	391.82	3.85	404.17	2.70	405.32	13.50	1.15
33.5g	420			11.82	408.18				
34.1h	423			15.54	407.46	16.71	406.29		-1.17
34.5a	421					12.23	408.77		
MAD 4N10W- 36.5f	415			3.59	411.41	6.25	408.75		-2.65
MAD 3N8W- 4.8f			420.5						
5.2f1	439.65	27.15	412.5	22	417.65	23.0	416.65	4.15	-1.00
5.2f2	438.75			21	417.75	23.0	415.75		-2.00
6.1e	425			7.18	417.82	8.76	416.24		-1.58
8.4h	430	17.00	413	10.54	419.46	12.60	417.40	4.40	-2.06
8.8a	422			10.03	411.97	11.32	410.68		-1.29
17.4d	416.06	8.06	408.0	4.00	412.06	4.78	411.28	3.28	-0.78
20.5c	430					22.56	407.44		
20.8c	422	17.20	404.8	11.15	410.85	12.74	409.26	4.46	-1.59
29.3h			411.47						
30.7b	421.28	19.28	402.0	13.07	408.21	14.71	406.57	4.57	-1.64
31.2a	428.22	30.82	397.4	20.15	408.07	23.48	404.74	7.34	-3.33
MAD 3N9W- 3.1a	415			6.63	408.37	6.86	408.14		-0.23
5.8b	424.45	31.45	393.0	20.69	403.76	19.98	404.47	11.47	0.71
6.3c	426.66	33.96	392.7	22.93	403.73	22.35	404.31	11.61	0.58
7.7b	425.08	39.48	385.6	22.72	402.36	27.10	397.98	12.38	-4.38
8.5g	420.84	26.24	394.6	15.67	405.17	15.31	405.53	10.93	0.36
9.4e	421			16.47	404.53	17.14	403.86		-0.67
10.4b	415			5.61	409.39	6.66	408.34		-1.05
11.6g	418			11.28	406.72				
12.3g	420.5	10.50	410.0	4.58	415.92	4.21	416.29	6.29	0.37
14.2c	425.50	23.50	402.0	17.27	408.23	17.00	408.50	6.50	0.27
16.1d	422			14.19	407.81	16.05	405.95		-1.86
16.8a	414.67	24.17	390.5	9.55	405.12	10.55	404.12	13.62	-1.00
18.1f	412.90	34.50	378.4	11.30	401.60	11.30	401.60	23.20	0.00
19.3gl			345.5						
19.3g2	417.74			17.12	400.62	18.17	399.57		-1.05
19.7b			351.0						
19.8fl	422.14					28.92	395.22		
19.8f2	418.59	67.59	351.0			23.16	395.43	44.43	
20.2h	415.88			10.93	404.95	11.57	404.31		-0.64
20.7e	418.73			14.77	403.96	16.44	402.29		-1.67
20.8dl	416.68			13.44	403.24	15.67	401.01		-2.23
20.8d2	414.71			11.73	402.98	13.75	400.96		-2.02
20.8el	416.33			12.91	403.42	14.85	401.48		-1.94
20.8e2	416.26			12.97	403.29	15.57	400.69		-2.60
21.2d	408			3.94	404.06	4.16	403.84		-0.22

Table 2 (Continued)

Well Number	Elevation of measuring point (feet)	Water levels (feet): December 1956, Depth to water	December 1956, Mean sea level elevation	June 1961, Depth to water	June 1961, Mean sea level elevation	November 1961, Depth to water	November 1961, Mean sea level elevation	Water level changes (feet): From December 1956 to November 1961	From June 1961 to November 1961
MAD 3N9W- (cont.)									
23.5g	419			16.20	402.80	16.70	402.30		-0.50
24.4g	425.90	22.10	403.80	16.93	408.97	17.70	408.20	4.40	-0.77
24.4e	420			10.62	409.38				
26.1d			400.0						
28.4e	417.5			7.08	410.42	8.15	409.35		-1.07
32.3b	410			11.94	398.06	15.36	394.64		-3.42
32.6g	418			11.89	406.11				
35.2d	411.21	12.00	399.21	6.75	404.46	7.93	403.28	4.07	-1.18
35.5g	415.5			8.98	406.52	9.60	405.90		-0.62
36.2f	421.12	20.12	401.00	13.66	407.46	15.22	405.90	4.90	-1.56
MAD 3N10W- 1.1c	407.11	16.01	391.10	,3.22	403.89	2.05	405.06	13.96	1.17
12.4f	406.98	18.19	388.79	2.59	404.39	1.98	405.00	16.21	0.61
12.6c	407.51	20.10	387.41	3.14	404.37	2.68	404.83	17.42	0.46
13.3a	425	67.00	363.00	35.94	389.06	36.10	388.90	25.90	-0.16
13.8g	409.43			8.22	401.21	8.30	401.13		-0.08
14.1f	406.78	25.32	381.46	6.10	400.68	5.95	400.83	19.37	0.15
14.2d	411.36	30.36	381.00	10.68	400.68	10.19	401.17	20.17	0.49
14.3c	413.53	32.78	380.75	12.85	400.68	12.36	401.17	20.42	0.49
14.4b	413.69	32.89	380.80	12.99	400.70	12.68	401.01	20.21	0.31
22.1a	412.2			12.95	399.25	11.76	400.44		1.19
22.1c	412.9			14.54	398.36	13.84	399.06		0.70
23.6c	413.5			15.15	398.35	14.08	399.42		1.07
23.7c	412.4			13.37	399.03	13.70	398.70		-0.33
24.1c1	422.34			26.10	396.24	26.70	395.64		-0.60
24.1c2	418.59	67.59	351.00	22.55	396.04	23.16	395.43	44.43	-0.61
24.3h	421								
24.5e	420			32.52	387.48	32.39	387.61		0.13
24.6c	420	56.00	364.00	31.15	388.85	31.25	388.75	24.75	-0.10
25.8b	414.96	38.16	376.80	16.78	398.18	17.51	397.45	20.65	-0.73
26.6b	411.3			11.18	400.12	12.53	398.77		-1.35
26.7d	411.2			11.46	399.74	11.82	399.38		-0.36
26.8e	411.1			11.69	399.41	11.97	399.13		-0.28
26.8h	411.8			12.37	399.43	12.56	399.24		-0.19
35.6c			383.3						
35.6f	401.8			5.21	396.59	6.22	395.58		-1.01
35.6h	404.6			5.62	398.98				
36.5h	414.25			16.45	397.80	17.10	397.15		-0.65
STC 2N8W- 6.1d	425			19.22	405.78	21.48	403.52		-2.26
6.8d	429.27	29.77	399.5	16.00	413.27	22.0	407.27	7.77	-6.00
7.2h1	427	33.26	393.74	24.70	402.30				
7.2h2	430					28.35	401.65		
STC 2N9W- 2.4e	418.5			7.80	410.70	9.90	408.60		-2.10
3.4g	422			16.00	406	18.69	403.31		-2.69
3.8a	424	31.00	393	24.99	399.01	25.68	398.32	5.32	-0.69
7.5e	420			36.58	383.42	36.16	383.84		0.42
7.6e	420	40.00	380	39.40	380.60				
10.5b	417			11.56	405.44				
11.7h	419			13.12	405.88	15.38	403.62		-2.26
12.5d	420			8.64	411.36	12.54	407.46		-3.90
13.6c	421.70			13.0	408.70	16.33	405.37		-3.33
13.7f	419.5			9.34	410.16	12.32	407.18		-2.98
14.5c	425			21.55	403.45	21.77	403.23		-0.22
15.3b	413			11.37	401.63	12.90	400.10		-1.53

Table 2 (Continued)

Hell Number	Elevation of meas-uring point (feet)	Water levels (feet): December 1956, Depth to water	December 1956, Mean sea level elevation	June 1961, Depth to water	June 1961, Mean eea level elevation	November 1961, Depth to water	November 1961, Mean sea level elevation	Water level changes (feet): From December 1956 to Novem-ber 1961	From June 1961 to November 1961
STC 2N9W-	(cont.)								
15.7a	420			20.45	399.55	21.29	398.71		-0.84
16.7a			386						
17.2d	415			19.36	395.64	18.48	396.52		0.88
17.8f	417.21	35.21	382.0	26.55	390.66	25.49	391.72	9.72	1.06
18.3a	416.5	39.50	377	25.49	391.01	24.01	392.49	15.49	1.48
18.5h			376						
19.8e	418.78	40.18	378.6			32.05	386.73	8.13	
21.7h	410			17.56	392.44	17.32	392.68		0.24
23.4a	423.86	22.56	401.3	9.00	414.86	15.85	408.01	6.71	-6.85
24.6e	428			15.53	412.47	20.56	407.44		-5.03
26.7f	424.18	24.76	399.42	15.17	409.01	18.10	406.08	6.66	-2.98
26.8f	421.39	21.72	399.67	12.77	408.62	15.62	405.77	6.10	-2.85
27.8g	415	17.56	397.44			11.80	403.20	5.76	
28.4g	409			3.70	405.30				
29.6e	419.26	36.40	382.86	25.46	393.80	26.63	392.63	9.77	-1.17
30.6d	415	36.00	379.0	26.41	388.59	27.47	387.53	8.53	-1.06
32.2c	408			13.01	394.99	14.86	393.14		-1.85
33.1f	415			12.67	402.33				
33.2d	415			12.67	402.33				
34.4h	417			12.04	404.96	14.24	402.76		-2.20
STC 2N10W- 1.2g			378.0						
1.2h	412			22.57	389.43	23.53	388.47		-0.96
1.3al	418.4	48.40	370.0						
1.3a3	418.48			38.70	379.78	38.42	380.06		0.28
11.3d	422.5			35	387.5				
11.4e	411.3			23.61	387.69				
12.3c	418.54	44.54	374.0	32.15	386.39	36.54	382.00	8.00	-4.39
12.3g	419	52.90	366.1	42	377.0				
12.7g	410	35.40	374.60	24.97	385.03	26.32	383.68	9.08	-1.35
13.5d	418			27.02	390.98				
13.6g			378.0						
23.4c	399.72	32.62	367.1	21.19	378.53	21.37	378.35	11.25	-0.18
23.6f	415.7			26.79	388.91	28.86	386.84		-2.07
23.6g	397.5			7.67	389.83	5.41	392.09		2.26
23.7a	406.5			25.48	381.02	25.31	381.19		0.17
23.7b	408.2			21.47	386.73	22.60	385.60		-1.13
25.5d	412			33.88	378.12				
25.6e	411	46.40	364.6	45.50	365.50	41.60	369.40	4.80	3.90
26.1gl	411.37		351.89						
26.1g2	411.24			68.00	343.24	63.60	347.64		4.40
26.2a	413.70					62.50	351.20		
26.3b	421.52	70.27	351.25	54.32	367.20				
26.5h	408.76	44.86	363.9	35.52	373.24	34.45	374.31	10.41	1.07
26.7b			364.0						
27.2g			366.49						
STC 2N10W- 27.2h1	415.65			52.40	363.25				
27.2h2			367.00				357.75	-9.25	
33.2f	409.35	32.35	377.00	16.05	393.30	15.45	393.90	16.90	0.60
34.5h	407.8			18.25	389.55	18.12	389.68		0.13
34.6e	405.7			13.53	392.17	15.09	390.61		-1.56
34.7c	399.1			5.39	393.71	7.77	391.33		-2.38
34.8b	398.0			3.50	394.50	6.18	391.82		-2.68
STC 1N9W- 4.5a	411			9.33	401.67	11.91	399.09		-2.58
6.2a	416			18.04	397.96	20.63	395.37		-2.59

Table 2 (Continued)

Well Dumber	Elevation of measuring point (feet)	Water levels (feet): December 1956 Depth to water	December 1956 Mean sea level elevation	June 1961 Depth to water	June 1961 Mean sea level elevation	Hovember 1961 Depth to water	Hovember 1961 Mean sea level elevation	Water level changes (feet): From December 1956 to Hovember 1961	From June 1961 to Hovember 1961
STC 1N10V-									
4.1g	399.0			3.50	395.50	6.14	392.86		-2.64
4.2e	396.4			0.70	395.70	2.80	393.60		-2.10
4.3b	398.6			3.12	395.48	4.03	394.57		-0.91
4.3c	397.7			2.77	394.93	3.37	394.33		-0.60
4.7b	409.4			13.80	395.60	15.32	394.08		-1.52
8.2h	407.8			10.39	397.41	13.87	393.93		-3.48
8.5e	405.1			8.00	397.10	11.91	393.19		-3.91
8.7a	406.3			9.66	396.64	11.89	394.41		-2.23
9.1f	403.63			6.49	397.14	7.62	396.01		-1.13
9.2h	404.55			7.46	397.09	8.62	395.93		-1.16
9.4h	409.9			14.71	395.19	15.76	394.14		-1.05
10.1c	403.29			6.08	397.21	7.08	396.21		-1.00
10.4c	402.24			5.05	397.19	6.12	396.12		-1.07
12.5b	401.74			2.86	398.88	4.04	397.70		-1.18
13.3h	402.25			3.11	399.14	4.11	398.14		-1.00
15.1d	414			17.12	396.88				
16.2g	411.5			13.62	397.88	14.22	397.28		-0.60
17.1e	400			3.04	396.96	7.42	392.58		-4.38
18.1c	403			9.79	393.21				
19.6f	406.4			9.18	397.22	12.73	393.67		-3.55
21.1a	410			14.31	395.69	17.01	392.99		-2.70
21.4f	412.01	19.01	393.00			16.77	395.24	2. 24	-0.79
28.6a	405			9.92	395.08	12.47	392.53		-2.55
30.6h	405.3			8.31	396.99	11.84	393.46		-3.53
32.3e	414			22.28	391.72	23.19	390.81		-0.91
MON 1N10W-									
30.8b	408.1			11.24	396.86	14.43	393.67		-3.19
31.4d	407.00			11.69	395.31	13.85	393.15		-2.16

Table 3. Lake and Stream Elevations

Gage number	Description	Elevation of measuring point (feet)	Water surface elevation (feet) 12/31/56	6/8/61	11/30/61
1	Highway Bridge No. 1	440.23	413.78	Elevation of measuring point changed	
2	Highway Bridge No. 2	440.42	413.82	413.95	414.05
3	Highway Bridge No. 3	441.38	413.88	413.99	414.11
4	Highway Bridge No. 4	442.95	413.90	414.07	414.14
1	State Route No. 3, Bridge	409.80	392.90	397.51	393.04
2	Sand Prairie Road Bridge, Canteen Creek	418.04	400.52	401.39	400.39
3	Sand Prairie Road Bridge	418.55	400.13	401.18	399.79
4	Hadley Bridge	416.40	405.50	404.30	404.30
5	Black Lane Bridge, Canteen Creek	420.80	404.35	401.50	401.87
1	Mollenbrock Bridge, Horseshoe Lake		Dry	404.38	404.30
	Horseshoe Lake Control Works	403.71		403.89	403.89
	Chain of Rocks Canal (upper)	(Surface water elevations reported)	391.35	401.15	
	Chain of Rocks Canal (lower)		380.05	392.10	

Table 4. Mississippi River Stages

Gage description	Mississippi River mile number	Water surface elevation (feet) 12/31/56	6/9/61	11/30/61
Lock and Dam No. 26 Alton, Illinois (lower)	202.7	393.27	403.05	405.52
Hartford, Illinois	196.8	392.74	402.17	404.26
Chain of Rocks, Mo.	190.4	389.21	396.9	399.00
Bissell Point, Mo.	183.3	380.05	391.6	394.20
St. Louis, Mo.	179.6	377.74	390.5	393.00
Engineer Depot, Mo.	176.8	376.98	389.5	392.40