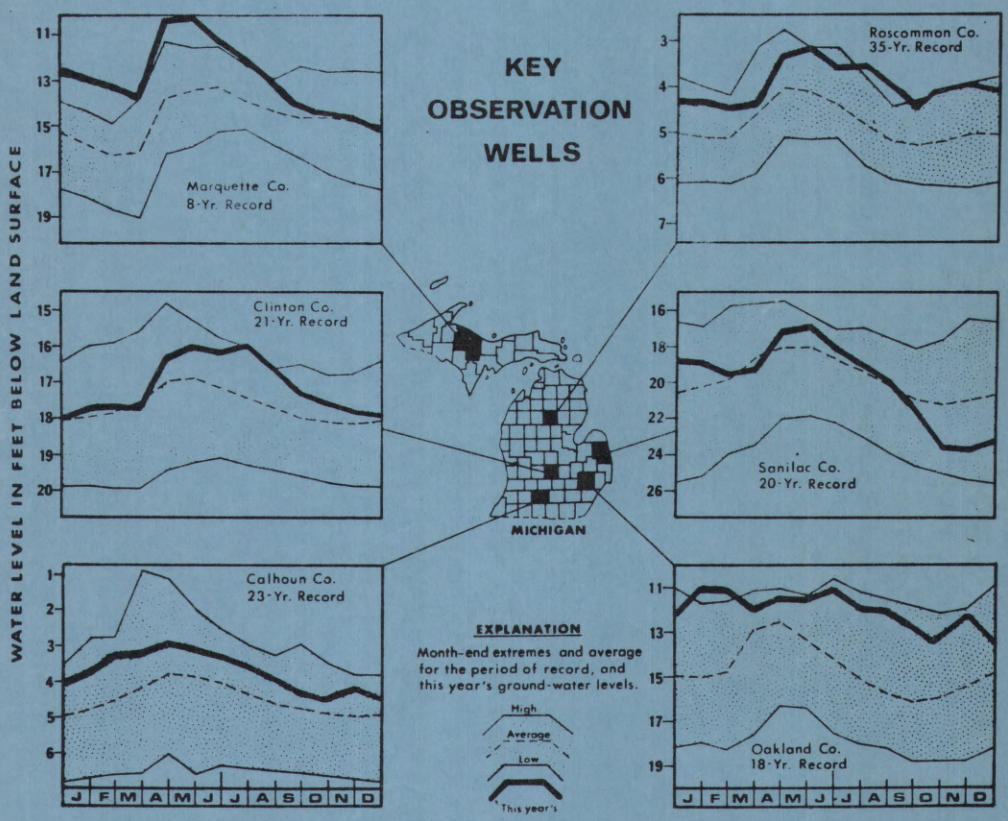
# SUMMARY
# OF
# GROUND-WATER HYDROLOGICAL DATA
# IN
# MICHIGAN
# IN
# 1969

BY

P. R. GIROUX AND G. C. HUFFMAN
U. S. GEOLOGICAL SURVEY




PREPARED IN COOPERATION WITH THE
MICHIGAN DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY DIVISION

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P. R. GIROUX AND G. C. HUFFMAN
U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

Prepared by the U. S. Geological Survey
in cooperation with
State of Michigan
Department of Natural Resources
R. A. MacMullan, Director
Geological Survey Division
G. E. Eddy, State Geologist

Copies of this report may be obtained from
District Chief, Water Resources Division
U. S. Geological Survey
700 Capitol Savings and Loan Building
Lansing, Michigan 48933

1970

## PREFACE

The program of ground-water investigations in Michigan is conducted in cooperation with the Michigan Department of Natural Resources, R. A. MacMullan, Director, through the Geological Survey Division, G. E. Eddy, State Geologist, and under an overall agreement for water-resources investigations in Michigan with the State Bureau of Water Management, R. W. Purdy, Executive Secretary.

The collection of ground-water level records and other related data is also aided by the following municipalities, institutions, and private organizations:

Cities or villages of Alma, Ann Arbor, Battle Creek, Coldwater, Dowagiac, Grand Ledge, Hillsdale, Holland, Ironwood, Jackson, Kalamazoo, Lansing, Marshall, Mason, Plymouth, Portage, St. Johsn. St. Louis, Wyoming, and Ypsilanti; the townships of Battle Creek, Pinconning, Waterford and Ypsilanti; Cranbrook School; Kent Metropolitan Airport; Michigan Technological University, Oakland University; State institutions at Howell, Ionia, and Ypsilanti; the Huron-Clinton Metropolitan Authority; the Fisher Body Division of General Motors Corporation, the Jervis Corporation, Brown Company, Wisconsin-Michigan Power Company, the Cleveland-Cliffs Iron Company, the UpJohn Company, and American Aggregates Corporation; Counties of Branch, Van Buren, Kalamazoo, and Oakland; Tri-County Planning Commission, and the U. S. Army Engineers.

Acknowledgment is made to personnel of Federal and State agencies, county and township governments, industrial concerns, well drillers, consultants, municipalities and public utilities without whose cooperation the accumulation of the basic data presented in this report would have not been possible.

## Previous Investigations

In addition to this series of water-level reports, records and interpretations of water levels in Michigan have been published annually in U. S. Geological Survey Water-Supply Papers entitled "Water Levels and Artesian Pressures in the United States." The following tabulation lists the numbers of Water-Supply Papers containing water-level data for Michigan:

| Year | No. | Year | No. | Year | No. |
|---|---|---|---|---|---|
| 1935 | 777 | 1943 | 986 | 1951 | 1191 |
| 1936 | 817 | 1944 | 1016 | 1952 | 1221 |
| 1937 | 840 | 1945 | 1023 | 1953 | 1265 |
| 1938 | 845 | 1946 | 1071 | 1954 | 1321 |
| 1939 | 886 | 1947 | 1096 | 1955 | 1404 |
| 1940 | 906 | 1948 | 1126 | 1956-57 | 1537 |
| 1941 | 936 | 1949 | 1156 | 1958-62 | 1782 |
| 1942 | 944 | 1950 | 1165 | 1963-67 | 1977 |

Beginning in 1956, annual publication of Water-Supply Papers was discontinued. The series was changed to include a reduced amount of water-level records, and the interpretative text was eliminated. Subsequent reports were published for the year 1956-57 and 1958-62 and are to be published every 5 years thereafter.

To supplement the abbreviated water-level reports, publication of annual reports was begun for Michigan in 1956 and entitled "Summary of Ground-Water Conditions in Michigan." The first seven of these reports, for the years 1956-62, were published by the Michigan Department of Natural Resources. Subsequent reports are open-file publications. Beginning with the 1967 report, the title was changed to "Summary of Ground-Water Hydrological Data in Michigan".

Many of the publications dealing with ground-water conditions in Michigan are listed under SELECTED REFERENCES at the end of this report.

## How open-file data and published records can be obtained

Complete tabulations of water-level measurements and hydrographs for individula observation wells, records of chemical quality of ground-water, water-temperature measurements, well records including logs, aquifer tests, records of pumping for public supply and industrial use, and published and unpublished water-resource reports are on file for public inspection. They may be examined at the office of the Geological Survey Division, Michigan Department of Natural Resources, Mason Building, Lansing, 48926; or at the Michigan District office of the U. S. Geological Survey, 700 Capitol Savings and Loan Building, Lansing 48933. Records for the Northern Peninsula are also kept on file in the State and Federal Geological Survey offices, State Office Building, Escanaba, Michigan 49829.

U. S. Geological Survey Water-Supply Papers are for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20242, or can be consulted at the offices listed above and in most major university and municipal libraries.

The U. S. Geological Survey issues a monthly publication entitled "Water Resources Review" which briefly summarizes ground-water levels and streamflow throughout the United States. The monthly issues can be obtained free of charge by application to the Director, U. S. Geological Survey, Washington, D. C. 20242.

The Lansing office of the U. S. Geological Survey also issues monthly a single-page graphical presentation of current ground-water and streamflow conditions in selected Michigan wells and streams. Figure 5 of this report illustrates the ground-water part of this monthly summary. This issue is free upon request.

Copies of annual "Summaries of Ground-Water Conditions in Michigan" and "Summaries of Ground-Water Hydrological Data in Michigan" are free on application. Publications of the Michigan Geological Survey can be purchased from the Michigan Department of Natural Resources, Publications Room, Mason Building, Lansing, Michigan 48926.

Reports of cooperative ground-water investigations covering specific areas of the State are also published by the Michigan Geological Survey or the U. S. Geological Survey. These reports are also available for inspection and sale at the offices listed above.

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# SUMMARY OF GROUND-WATER HYDROLOGICAL DATA, IN MICHIGAN, IN 1969

By P. R. Giroux and G. C. Huffman

## INTRODUCTION

### Purpose of this report

The purpose of this report is to make available the records of ground-water levels in the principal aquifers of the State through 1969 and to compile other related data, such as records of ground-water pumpage, data on municipal, public and industrial water-supply facilities, and the effects of precipitation on ground-water levels. Records of water levels in areas of heavy pumpage, and in areas where changes are principally from natural influences, are illustrated or tabulated to allow comparison between these types of water-level fluctuations. The water levels and related data provide a day-to-day record for the evaluation of available ground-water supplies. The long-term records serve as a framework to which short-term records may be related.

This report is written for those persons, municipalities, industries, institutions, consultants, drillers, and hydrologists interested in the ground-water resources of the State.

### What this report contains

Table 1 contains records of measurements of ground-water levels in observation wells, well locations, depths, elevations, aquifers which they tap, and the extremes of water level for the past record and in 1969. Table 2 contains records of ground-water pumpage in 1969 of most major ground-water users in the State.

Numerous hydrographs are included in the report to illustrate changes of water level. Most of these illustrations also show the effects on water levels of ground-water pumpage and variations in precipitation.

Shown in summary form in the text, are supplementary data on the yield of wells, pumpage, storage facilities, treatment, quality of water, per capita use and trends of ground-water levels for 1969 and for part of the previous record.

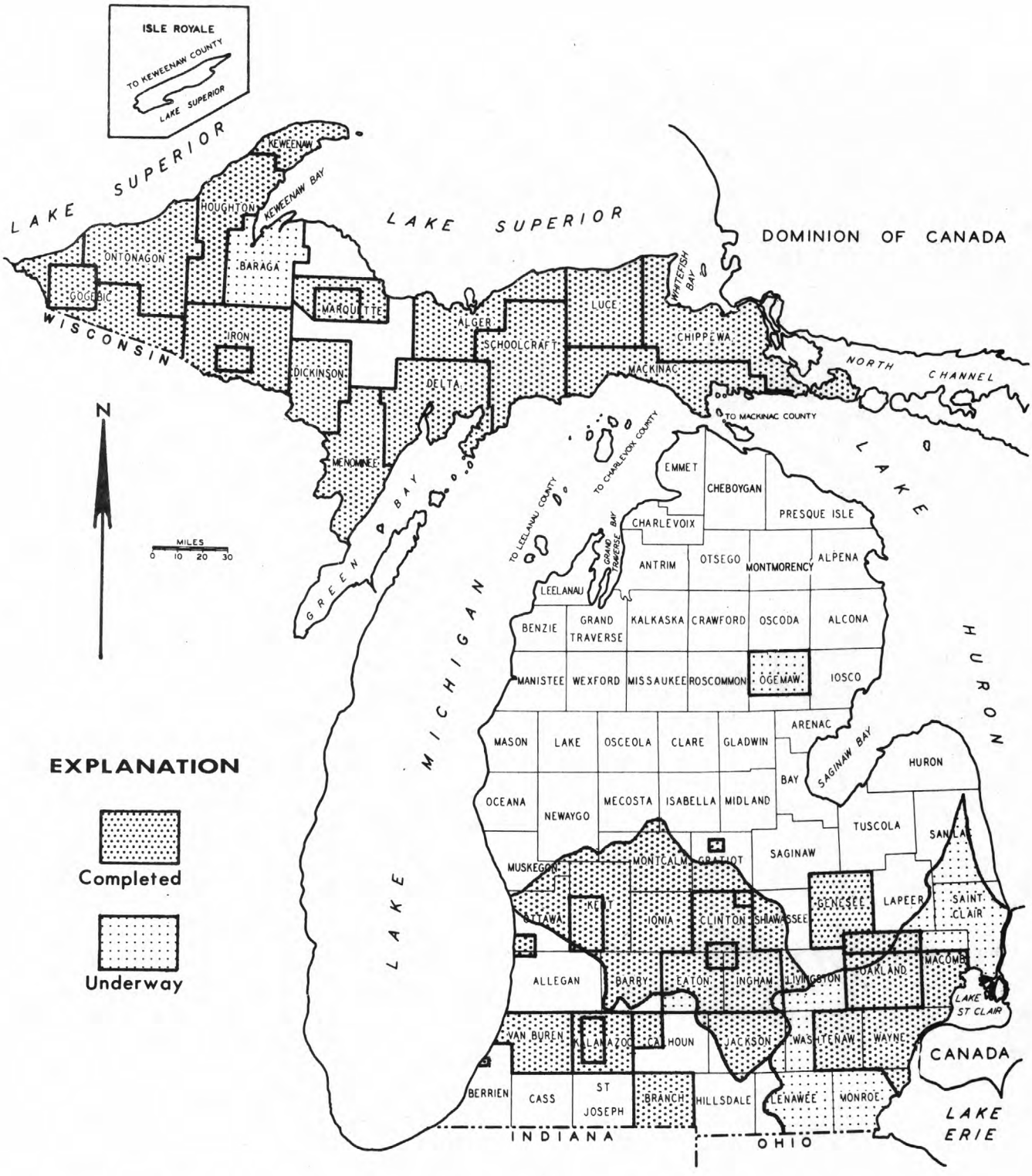



Figure 1.--Areas where water-resources investigations containing some ground-water data are completed or underway.

**Completed reports or those in press are listed under REFERENCES.**

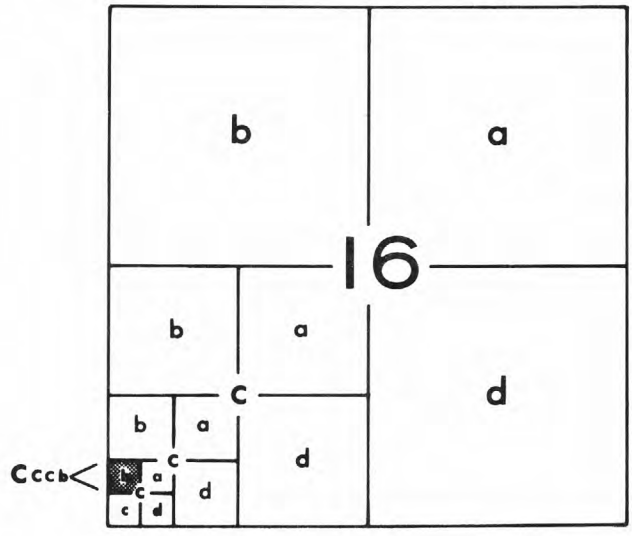
The yield of wells is shown specifically or as a range of production in gallons per minute (gpm). The specific capacity (gallons per minute per foot of drawdown) is also given as a range, or specifically for each well. Yield and specific capacity data are as reported by water departments and consultants.

Progress of areal water-resources investigations containing ground-water data for Michigan as of the end of 1969 are shown in figure 1. Reports for areas completed are listed in references at the end of this report. Some of the investigations encompass areas previously studied or more intensively investigated.

As shown in figure 2, more than half of the counties in Michigan have observation wells.

## Well numbering system

The well-numbering system for Michigan was changed in 1966 to facilitate coding. The new system still indicates the location of wells within the rectangular subdivision of the land with reference to the Michigan meridian and base line in that the first two segments of the well number designate township and range. However, the third segment instead of giving the section number and well number within the section--now gives the section number and an a, b, c, d, breakdown of the section as illustrated below. Thus, where a well was formerly designated as number 32N 6E 16-1 it can now be broken down in the section as 32N 6E 16-cccb. This would pinpoint the location to the nearest 2.5-acre part of section 16 (see cut).



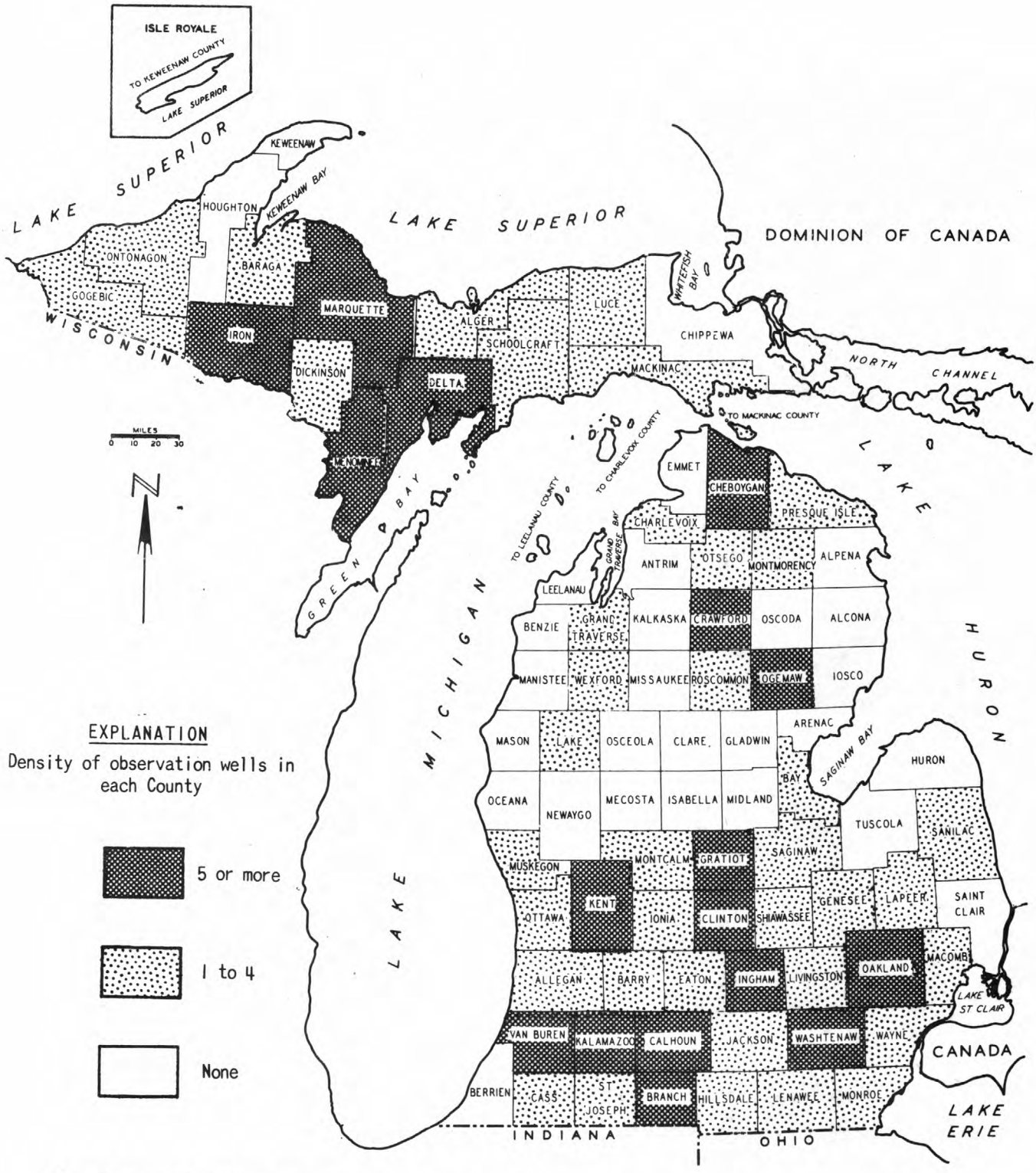



Figure 2.--In 1969, measurements of water levels were made in 252 observation wells, of which 84 were continuous recording stations.

For the purpose of this report well locations in sections are only broken down in 1/4 1/4 -- i.e. 16-cc. In the event that two or more wells are located in the same 40-acre tract, a number designation can follow the letter designations--i.e. 16-cc-1, 2, 3, 4, etc. The Michigan Geological Survey uses a similar system except that numbers are used in lieu of letters.

## Availability of water in the glacial drift

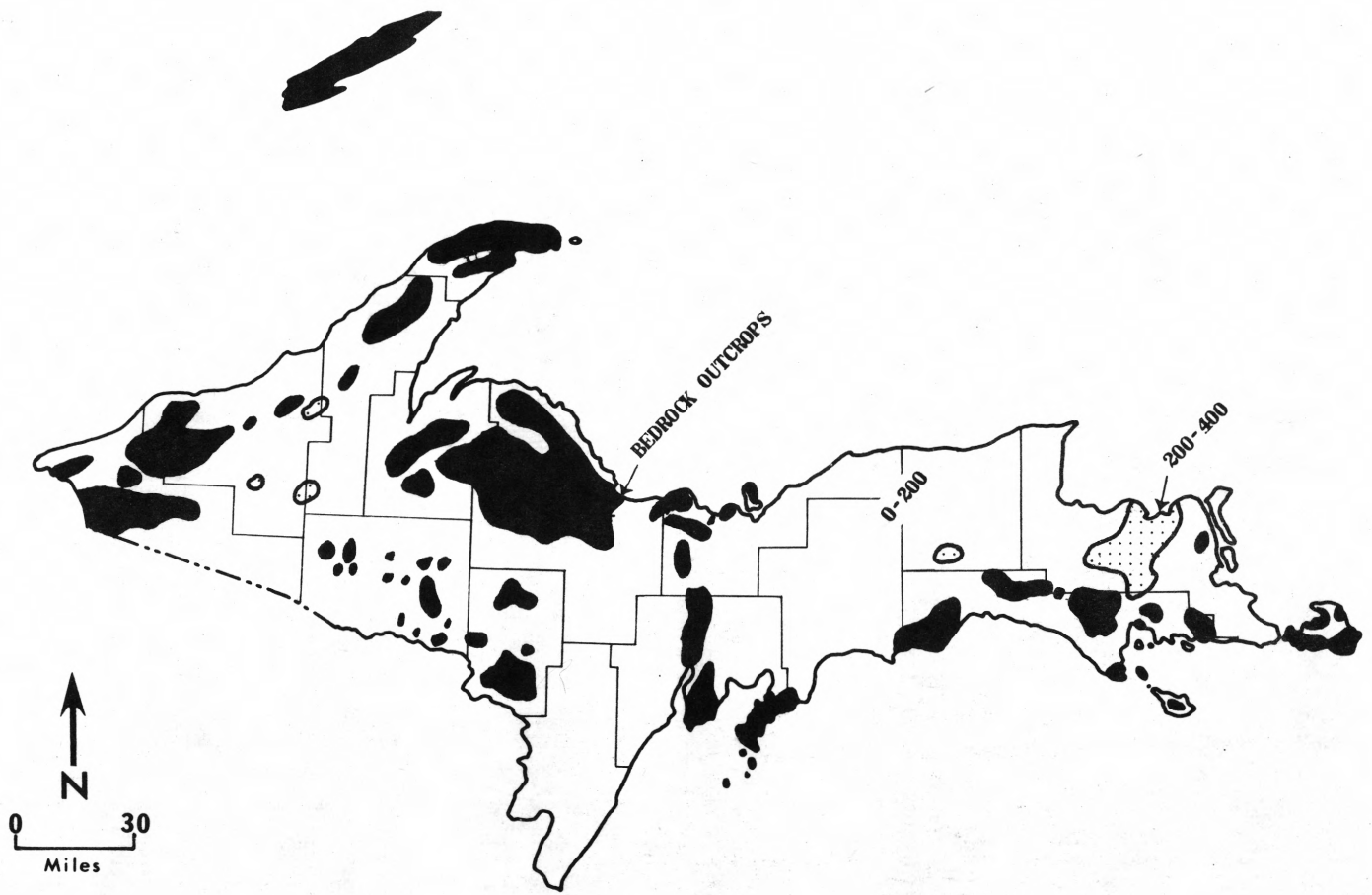
The most productive aquifers in Michigan are glacial drift aquifers in areas where they are of sufficient thickness and contain sand and gravel materials. The thickness of the glacial materials in Michigan ranges from zero in the bedrock outcrop areas, to as much as 800 feet in the northwest part of the lower peninsula (fig. 3). In some areas of the southern peninsula the bedrock underlying the drift consists either of unproductive shales or of bedrock containing saline water. In these areas the glacial drift may be the only source of fresh ground water (Twenter, 1966).

## Uses of data in this report

In areas where ground water is used for municipal or industrial supplies, hydrographs of water levels show the effects of discharge from wells, and natural, induced, and artificial recharge to aquifers. Declines, except those caused by precipitation deficiencies and evapotranspiration, generally indicate depletion of storage in the aquifers caused by pumping. An effective method of determining the amount of water available from an aquifer is the analysis of long-term records of water levels and pumpage.

Many of the water-level records in pumped areas are obtained by means of continuous recorders. These recording stations provide the continuous collection of basic water-level data which serve to indicate both the day-to-day and the long-term effects of pumping. This information can be used by municipalities, industries, institutions or their consultants to estimate the capacity of aquifers to meet present and future demands for water, to determine the desirable separation between wells, and whether expansion of present ground-water supply systems is practicable.

When a well is installed in an area of steadily falling water levels caused by heavy municipal or industrial pumping, a projection of future water levels should be made for a reasonable number of years. The well should then be drilled deep enough to take advantage of the full thickness of the aquifer and the suction pipe installed far enough below the water level in the well to provide for the probable lowering of water levels and thereby extend the life of the installation. Much future expense can thus be eliminated.


BEDROCK OUTCROPS
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200-400
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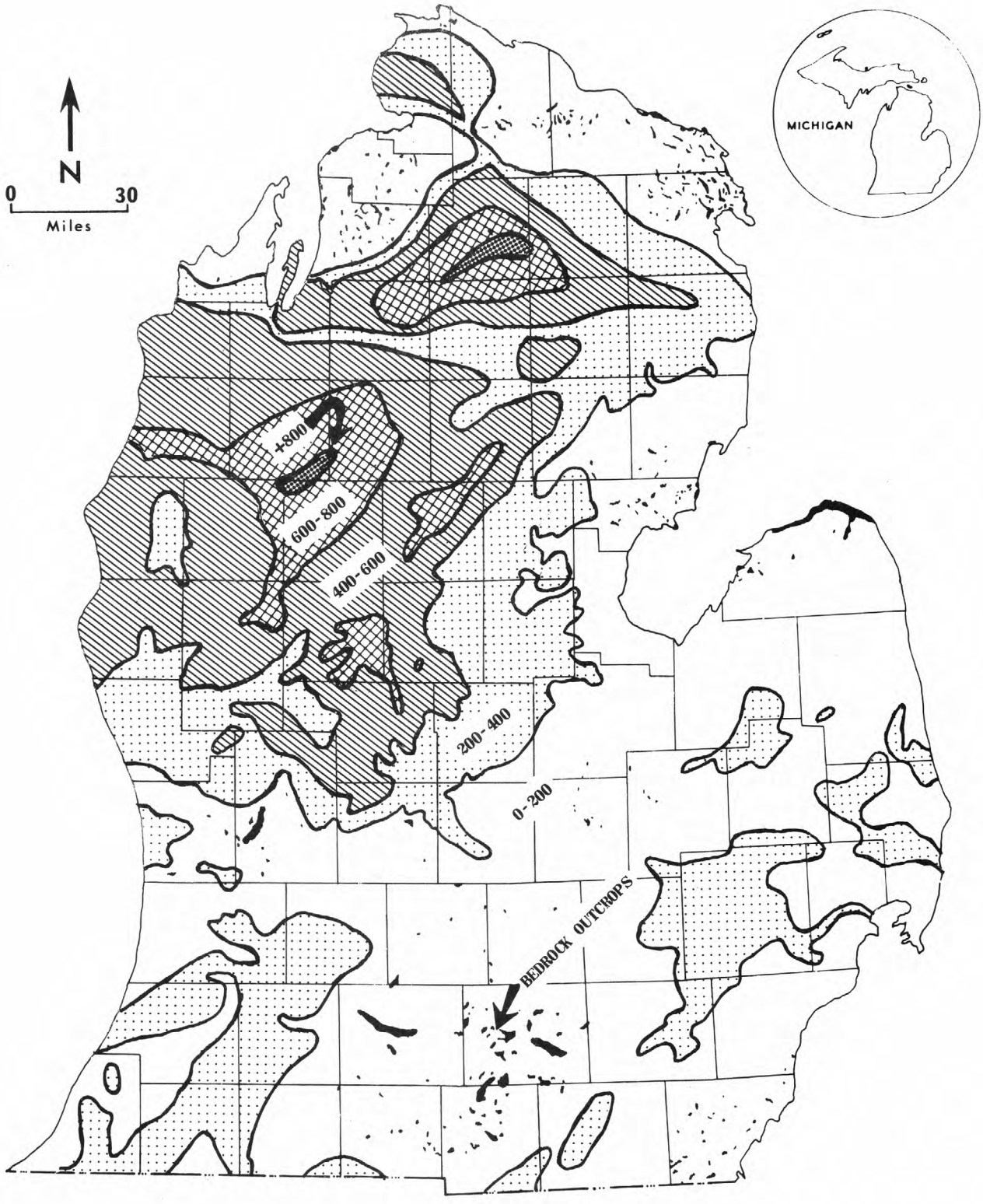


Figure 3.--Generalized drift thickness in feet, and areas where bedrock is at or near the surface.

Southern Peninsula generalized from drift thickness map, scale 1/500,000, compiled by James Akers, Sept., 1938, Mich. Dept. of Natural Resources.

A factor generally overlooked is the water problem often encountered after a basement or septic tank is constructed for a building or home. The water table fluctuates an average of from 2 to 3 feet annually and about 5 feet over a period of years (figs. 5, 6). Thus, if an excavation is made in the fall when the water table is low, allowances should be made for the probable higher water levels in the spring. If construction is made after several years of drought conditions, a larger allowance should be made for the subsequent rise in water levels. If a site is at all questionable borings should be made to determine the depth to the water table and allowances for the probable rise in water levels made.

Builders of farm ponds and artificial lakes should also take into account the fluctuations of the water table where these bodies of water depend on the height of the water table for their levels.

## Automatic data processing

In 1966, a program of automatic data processing (ADP) of ground-water records was begun by the U. S. Geological Survey. The well records used in the study of Oakland County's water resources, recently completed, were coded, punched, and assembled for computerized analysis. Most of the basic records in the Tri-County investigation were also processed by computer.

Records of chemical analyses of ground-water as well as data from a selected number of observation wells, are being automated on a nationwide basis.

The ADP program affords a modern way of updating and retrieval of records.

## GROUND-WATER LEVELS IN 1969

Water levels in most wells continued, during the first half of 1969, the rising trend of the past several years. However, stages fell during the latter part of the year and were lower than at the end of 1968. During 1969, record-high levels were observed in 90 wells and record lows in 28 (table 1). Most of the record lows occurred in heavily pumped areas, or at stations having only 2 to 3 years of record.

Water levels in general paralleled precipitation trends which were generally rising during the first half of 1969 and falling during the latter part of the year.

Precipitation in 1969 was deficient in the southeastern part of the lower peninsula and in the western part of the upper peninsula (fig. 4). The total precipitation for the 1965-69 period has been well above average. As a result, water levels, in areas affected principally by natural influences, have in general been rising (figs. 5, 6).

In 1969, record and near-record lows of water levels were recorded in some of the heavily-pumped areas of the State (table 1). Increasing population, industrial growth, and modern water uses create large additional demands for water. These demands result in increased pumping and lower water levels, and often indicate a need for expansion of water-supply facilities.

Although precipitation is the major climatic factor affecting ground-water levels, the annual total rainfall may not always bear a direct relationship to the amount of recharge received by an aquifer. Many factors affect this relationship, such as time of year, duration, intensity, and the form of precipitation.

Hydrographs of natural fluctuations of water levels in wells (figs. 5, 6, 8, 33, 37, 38), show that spring is the season when water levels are highest and when most ground-water recharge occurs. In the spring snowmelt and rain normally result in large additions to the ground-water reservoirs. However, ice cover or frost in the ground can impede infiltration. Under these conditions, most water from snowmelt and precipitation may be lost to ground-water reservoirs by quick surface runoff. During the growing season there is very little recharge as most rainfall is evaporated, is transpired by vegetation, or runs off overland when precipitation occurs as heavy showers. In the fall evapotranspiration (return of water to the atmosphere as a vapor from water surfaces, from soil, and from living plants) is reduced by cold weather. Thus, substantial rises in water levels usually follow fall rains. During the winter, frozen ground impedes the infiltration of water.

In addition to changes in water levels from precipitation, such phenomena as earth tide, barometric pressure variations, and earthquakes also cause temporary changes in levels. Also, effects of evapotranspiration show small daily declines in water levels in wells.

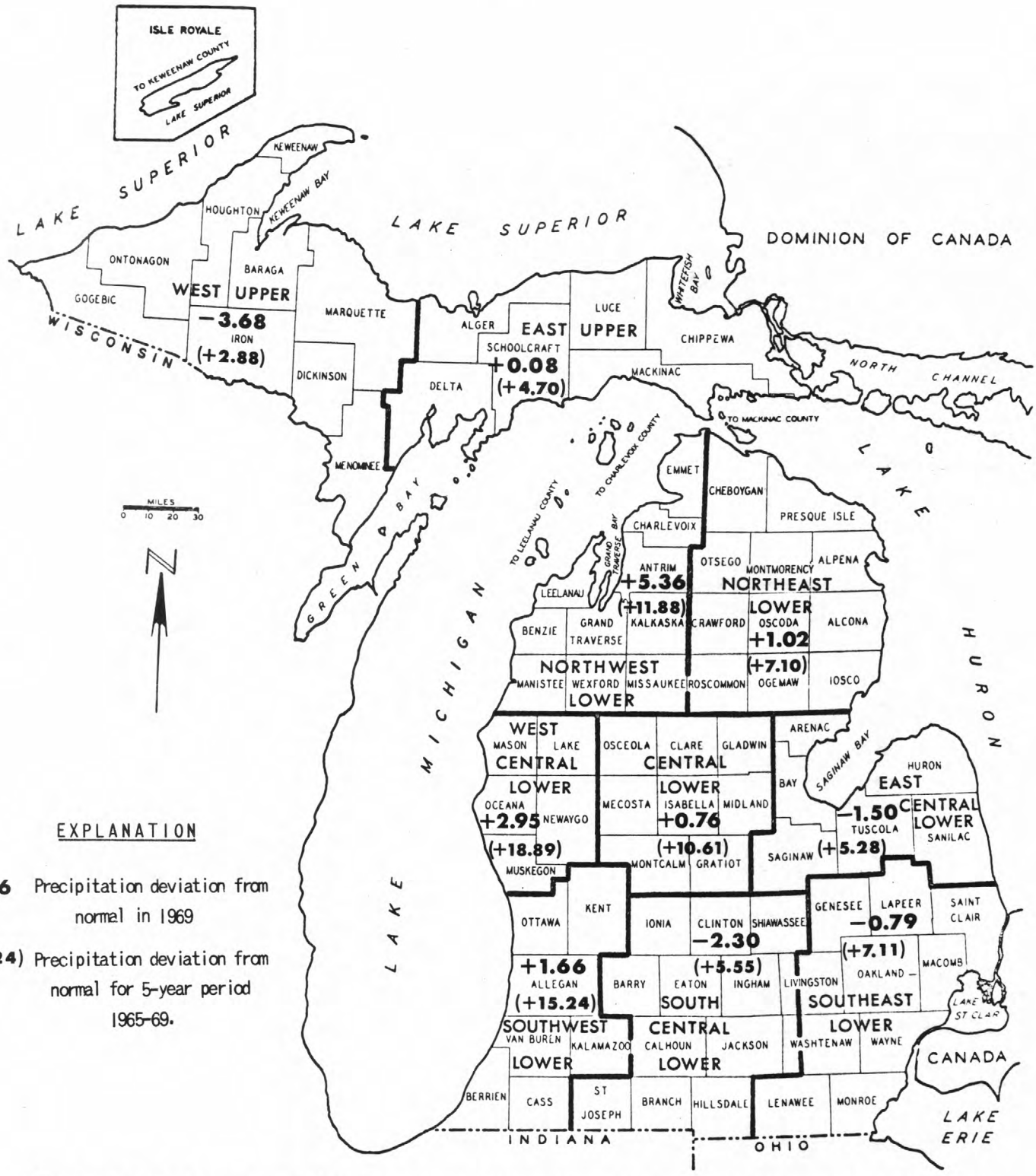


Figure 4.--In 1969, precipitation varied from 3.68 inches below normal in the western part of the upper peninsula, to 5.36 inches above normal in the northwest part of the lower peninsula.

**Precipitation for the 5-year period 1965-69, however, was above normal for all climatological divisions, ranging from excesses of 2.88 to 18.89 inches above normal.**

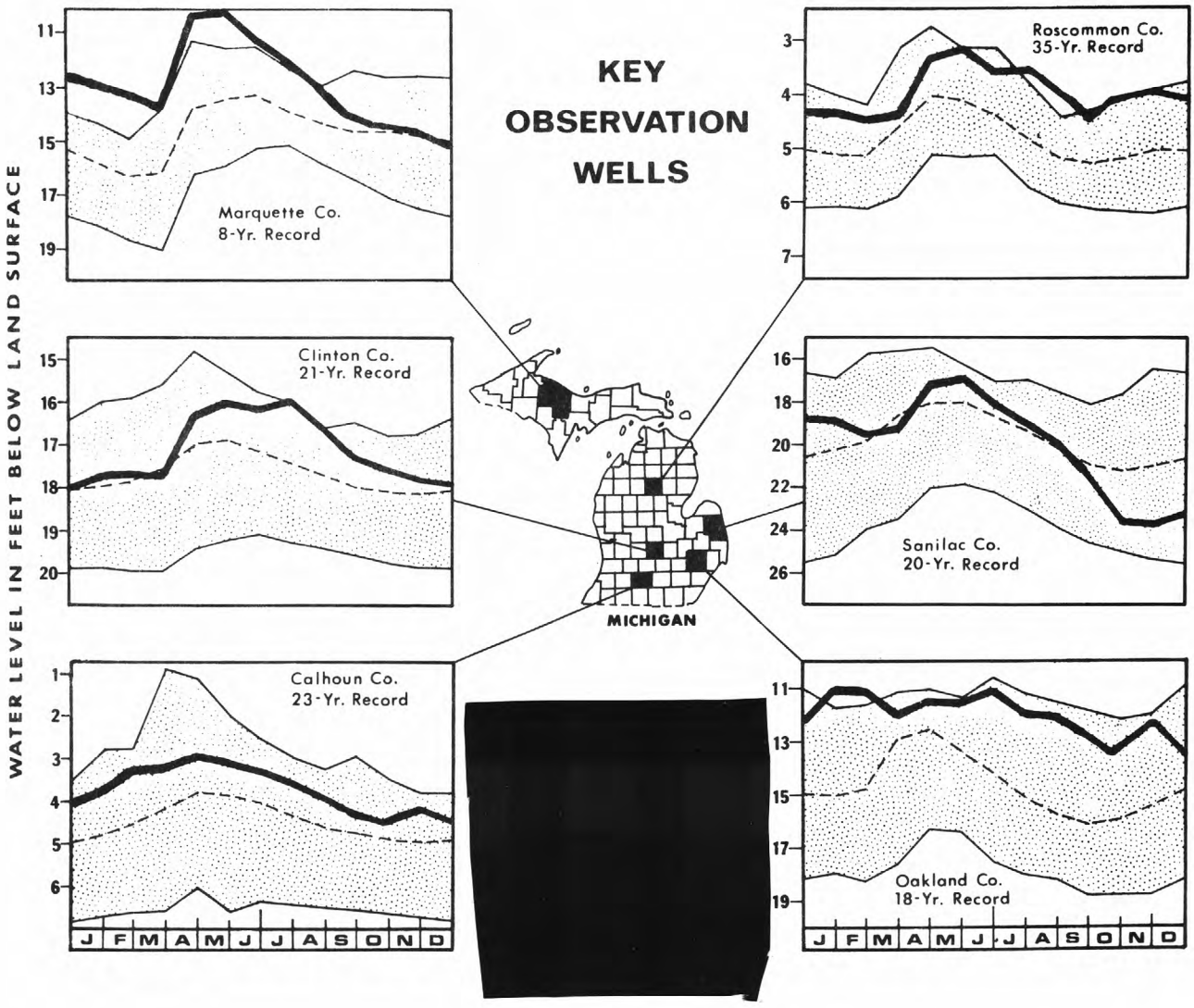


Figure 5.--In 1969, water levels in these observation wells were at record high in some wells. However, year-end levels were generally lower than at the beginning of the year.

Water levels in these wells are representative of conditions of aquifers in the areas where the wells are located.

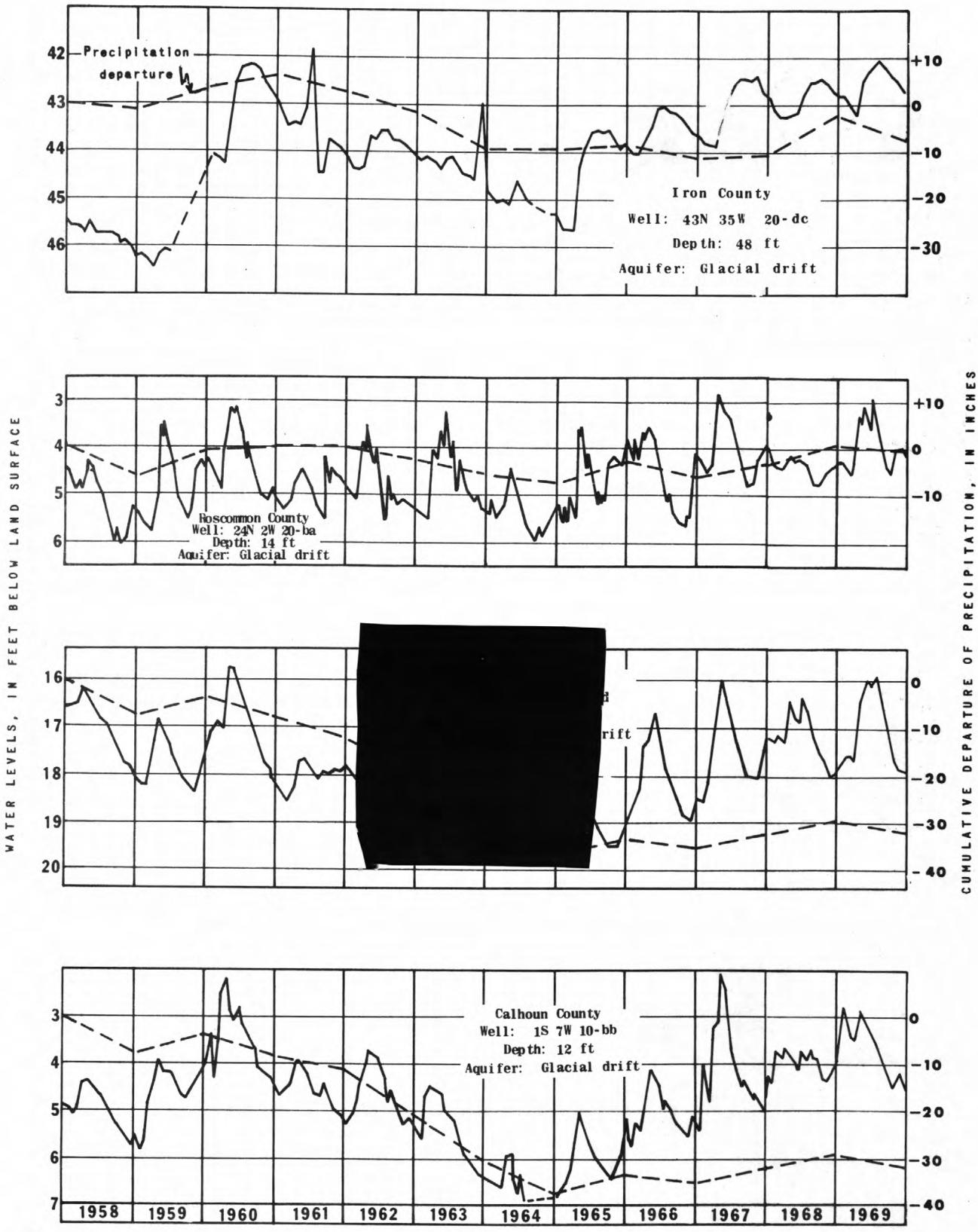


Figure 6.--Long-term records of water levels in four wells, whose levels respond principally to natural climatic conditions.

Precipitation departures (dash lines) illustrate the similarity in water-level trends and the precipitation variations.

## AREA GROUND-WATER LEVELS

Descriptions of some of Michigan's municipal, institutional, industrial, and areal ground-water supplies follow alphabetically by counties. Most descriptions are supplemented by illustrations.

The descriptions include data on the chemical quality of water for a few of the major constituents analyzed. Where more than one well is involved a range in quality is generally given. The data is the latest available information based mostly on analyses made by the Michigan Department of Health. The unit, milligrams per liter (mg/l), used in this report can be considered numerically equal to parts per million (ppm) because of the dilute nature of the waters reported.

Where "population served" figures are given the data is based on the 1960 census unless a later estimate is shown.

Per capita use of water varies greatly because of industrial use in some localities. The per capita use in the following summaries varies from about 80 to 300 gallons per day.

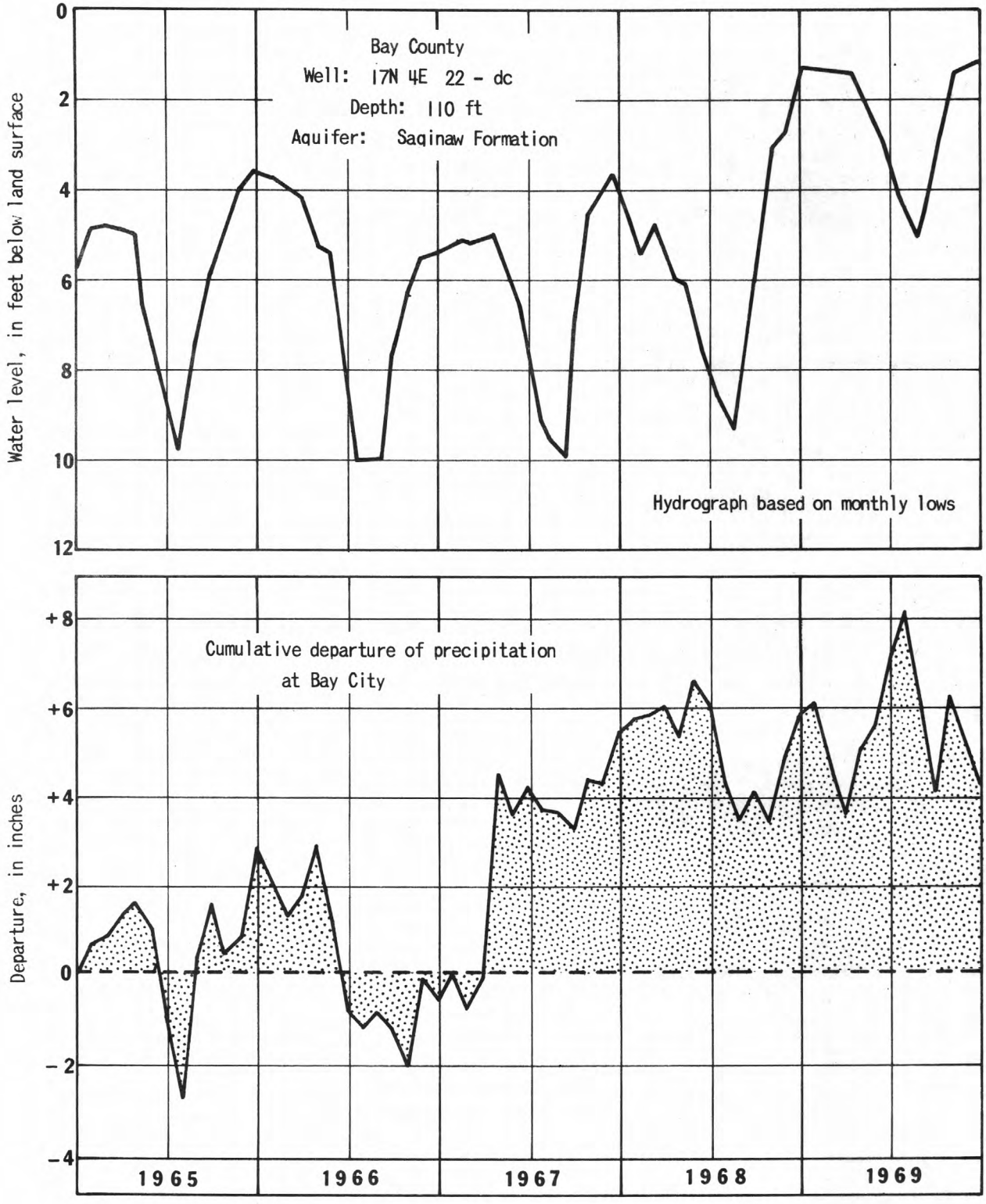


Figure 7.--At Pinconning Township, water levels in the observation well respond principally to variations in precipitation and as a result have been higher during the 1968-69 period.

BAY COUNTY - PINCONNING TOWNSHIP

WATER SUPPLY AND SOURCE -- The only public supply in the Township is at the City of Pinconning. Water is obtained from Saginaw Bay, supplemented by a well, 110 feet deep, tapping sandstones of the Saginaw Formation.

YIELD OF WELLS (in gallons per minute) -- 70.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) -- 1.1.

PUMPAGE IN 1969 -- None from city well. 78.1 million gallons from Saginaw Bay.
MAXIMUM DAY -- 341 thousand gallons.

STORAGE FACILITIES -- 75,000 gallons elevated.

QUALITY OF WATER -- Saginaw Bay:

| | |
|---|---|
| Hardness | 125 mg/1 |
| Iron | 0 mg/1 |
| Chloride | 25 mg/1 |

Well water:

| | |
|---|---|
| Hardness | 650 mg/1 |
| Chloride | 60-106 mg/1 |

TREATMENT -- Standard filtration.

POPULATION SERVED -- 1,329.

PER CAPITA USE -- 161 gallons per day.

REMARKS -- Ground-water levels in the observation well were the highest since record started in 1962 (fig. 7). Record-high levels also occurred in the Sterling Tube observation well about one-third of a mile away from the Pinconning well (table 1, Bay Co.). The high stages were principally the result of above normal precipitation. There has been no municipal pumping from wells by the City of Pinconning since 1965.

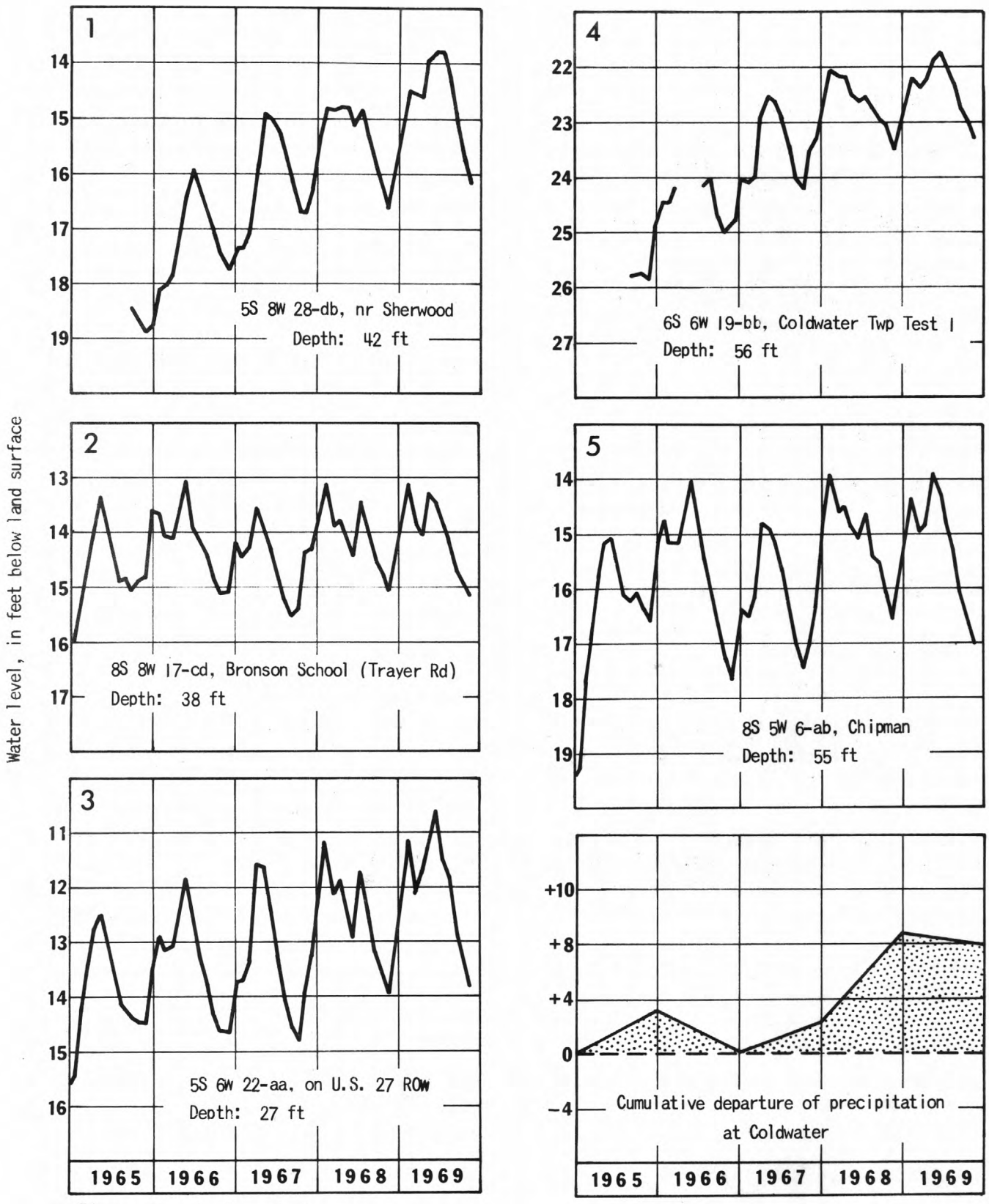


Figure 8.--In Branch County, water levels were at or near record-high stages during the spring of 1969. However, year-end levels were lower than at the end of the previous year as the result of deficient precipitation.

## BRANCH COUNTY

By mid-1969, water levels in observation wells were at or near record high stages (fig. 8). However, deficient precipitation in the latter part of 1969, resulted in a net loss in ground water storage for the year. The number of wells measured in the County (fig. 9) was reduced in 1969 to allow for the collection of other water resources data as part of a continuing program carried on in the county. Data on the chemical and physical quality of water from lakes and ground-water sources has consequently been obtained.

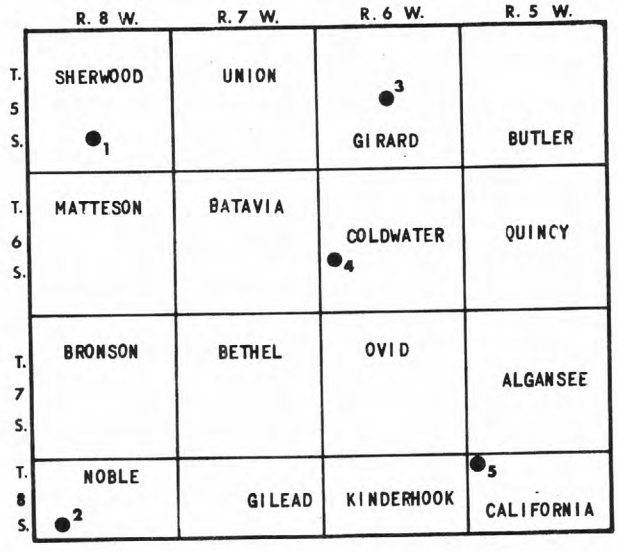


Figure 9.--Location of observation wells in Branch County.

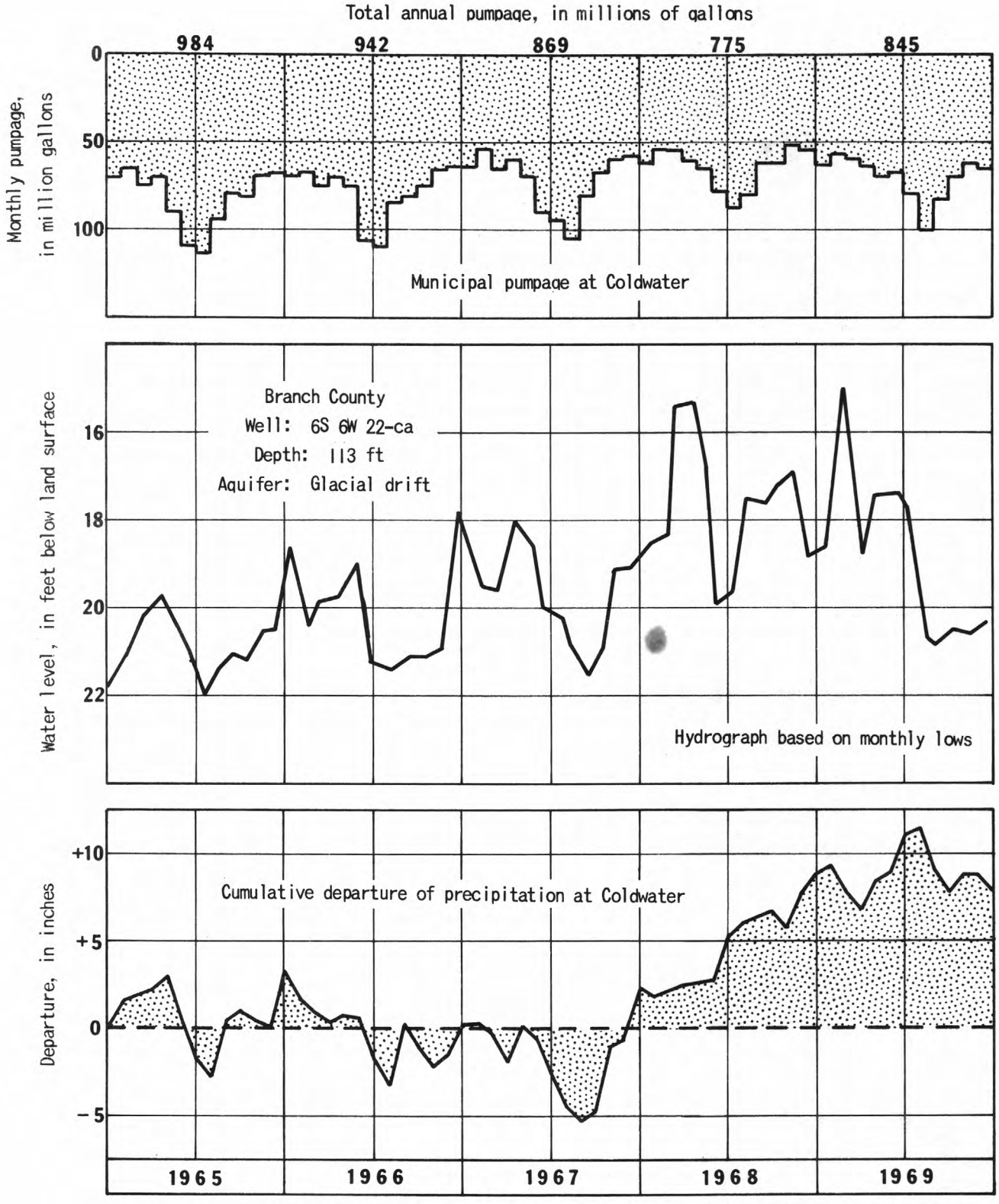


Figure 10.--At Coldwater, water levels in the observation well were high during the spring of 1969, but fell sharply in late summer as the result of heavy pumpage and deficient precipitation.

BRANCH COUNTY - CITY OF COLDWATER

WATER SUPPLY AND SOURCE -- Four wells, 121 to 132 feet deep, finished in glacial drift.

YIELD OF WELLS (in gallons per minute) -- No. 3 - 1,200; no. 4 - 1,400; no. 5 - 2,250; no. 6 - 2,850.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) -- No. 3 - 80; no. 4 - 160; no. 5 - 150; no. 6 - 190.

PUMPAGE IN 1969 -- 845 million gallons.

MAXIMUM DAY -- 5.14 million gallons.

STORAGE FACILITIES -- 1,500,000 gallons elevated.

QUALITY OF WATER -- Hardness 175-310 mg/l
Iron 0.3-1.5 mg/l

TREATMENT -- None.

POPULATION SERVED -- 9,000 estimated.

PER CAPITA USE -- 257 gallons per day.

REMARKS -- At Coldwater, water levels in the observation well in 1969 were near the highest stages of record (fig. 10). However, deficient precipitation in the latter part of the year resulted in an annual net loss of about one foot. Although there is heavy pumpage at the City's field, it would appear that variations in precipitation have more effect on year to year change in water level than pumpage at the present rate. Ground-water storage has not greatly changed over the years except as resulted from deficiencies in precipitation.

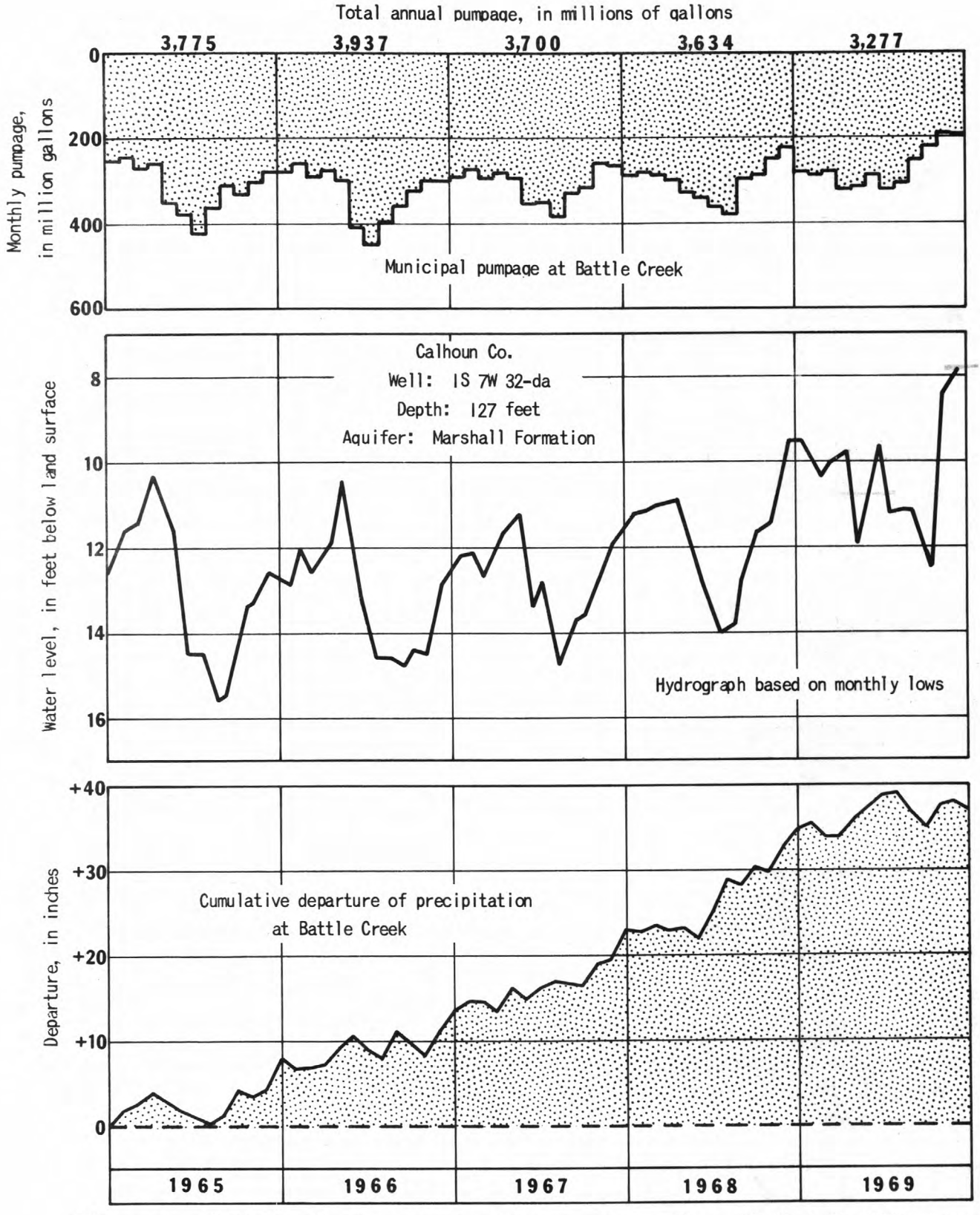


Figure 11.--At Battle Creek, water levels in an observation well that is influenced by municipal pumpage has shown a rising trend since 1966 from the effects of above average precipitation and decreased pumpage.

CALHOUN COUNTY - CITY OF BATTLE CREEK

WATER SUPPLY AND SOURCE -- About 29 wells, 120 to 160 feet deep. All are located at the Verona Field and tap sandstones of the Marshall Formation.

YIELD OF WELLS (in gallons per minute) -- 300 to 1,000.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) -- 50 to 650.

PUMPAGE IN 1969 -- 3,277 million gallons.
MAXIMUM DAY -- 15.18 million gallons.

STORAGE FACILITIES -- 2,000,000 gallons at plant; and 4,000,000 gallons elevated.

QUALITY OF WATER -- Composites of Verona wells -- Hardness 240-285 mg/l
Iron 0.05-5.0 mg/l

TREATMENT -- Chlorination, fluoridation, hexamethaphosphate.

POPULATION SERVED -- 44,169.

PER CAPITA USE -- 203 gallons per day.

REMARKS -- At Battle Creek, water levels in the observation well at the City's Verona well field, reached a stage of 6.1 feet below land surface, the highest since 1957. The high levels were the result of above average precipitation and decreased pumpage during the period 1965-69 (fig. 11). Although large amounts of water have been pumped from wells at the Verona field over the years, water levels have remained high. The extremes of record of 0.7 foot below land surface in 1950 and the low of 16.8 feet below land surface in July 1959 (table 1, Calhoun Co.) attest to the productivity of this Marshall sandstone aquifer.

Water levels in the Hopkins St. well, about a half mile northwest of the Verona observation well, were the highest of record--records dating back to 1964 (table 1, Calhoun Co.).

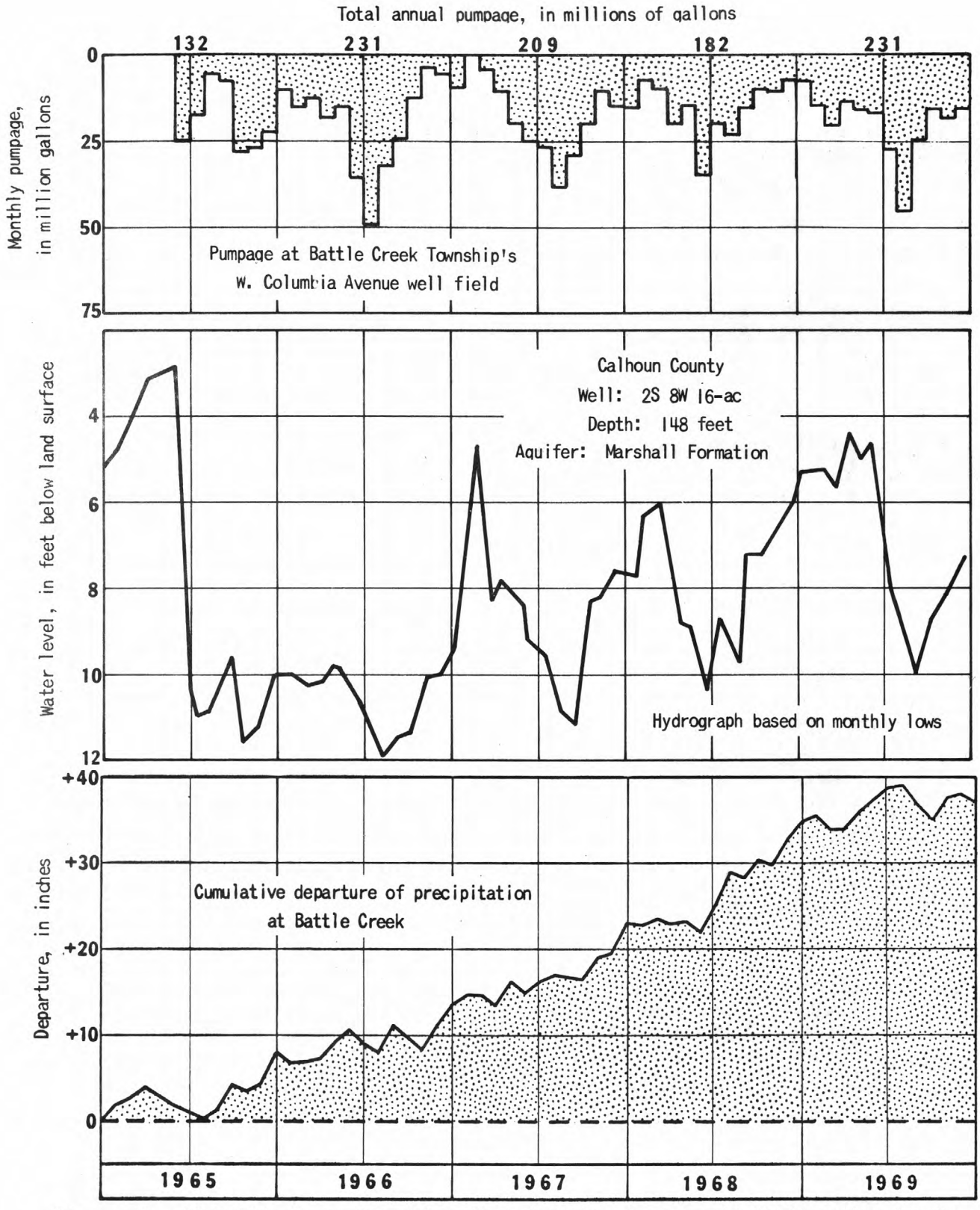


Figure 12.--At Battle Creek Township's West Columbia Avenue well field, water levels in the observation well continued to rise until the spring of 1969, the result of above average precipitation. Increased pumpage and deficient precipitation during the balance of the year resulted in lower levels at the end of the year.

CALHOUN COUNTY - BATTLE CREEK TOWNSHIP

WATER SUPPLY AND SOURCE -- Six wells 143 to 165 feet deep, tap sandstones of the Marshall Formation. Two of the wells are located at the West Columbia Avenue well field.

YIELD OF WELLS (in gallons per minute) -- 950 to 1,200.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) -- 10 to 20.

PUMPAGE IN 1969 -- 509 million gallons (231 at the West Columbia Avenue well field).

MAXIMUM DAY -- 3.94 million gallons.

STORAGE FACILITIES -- 400,000 gallons elevated.

QUALITY OF WATER -- Hardness 270-350 mg/l
Iron 0.5-1.2 mg/l

TREATMENT -- Chlorination.

POPULATION SERVED -- 13,500 estimated.

PER CAPITA USE -- 103 gallons per day.

REMARKS -- At Battle Creek Township's West Columbia Avenue well field two municipal wells pump a moderate amount of water. Water levels in the observation well fluctuate in response to the pumpage, but remain at fairly high levels (fig. 12). Above normal precipitation since pumpage at the well field began has maintained the high water levels.

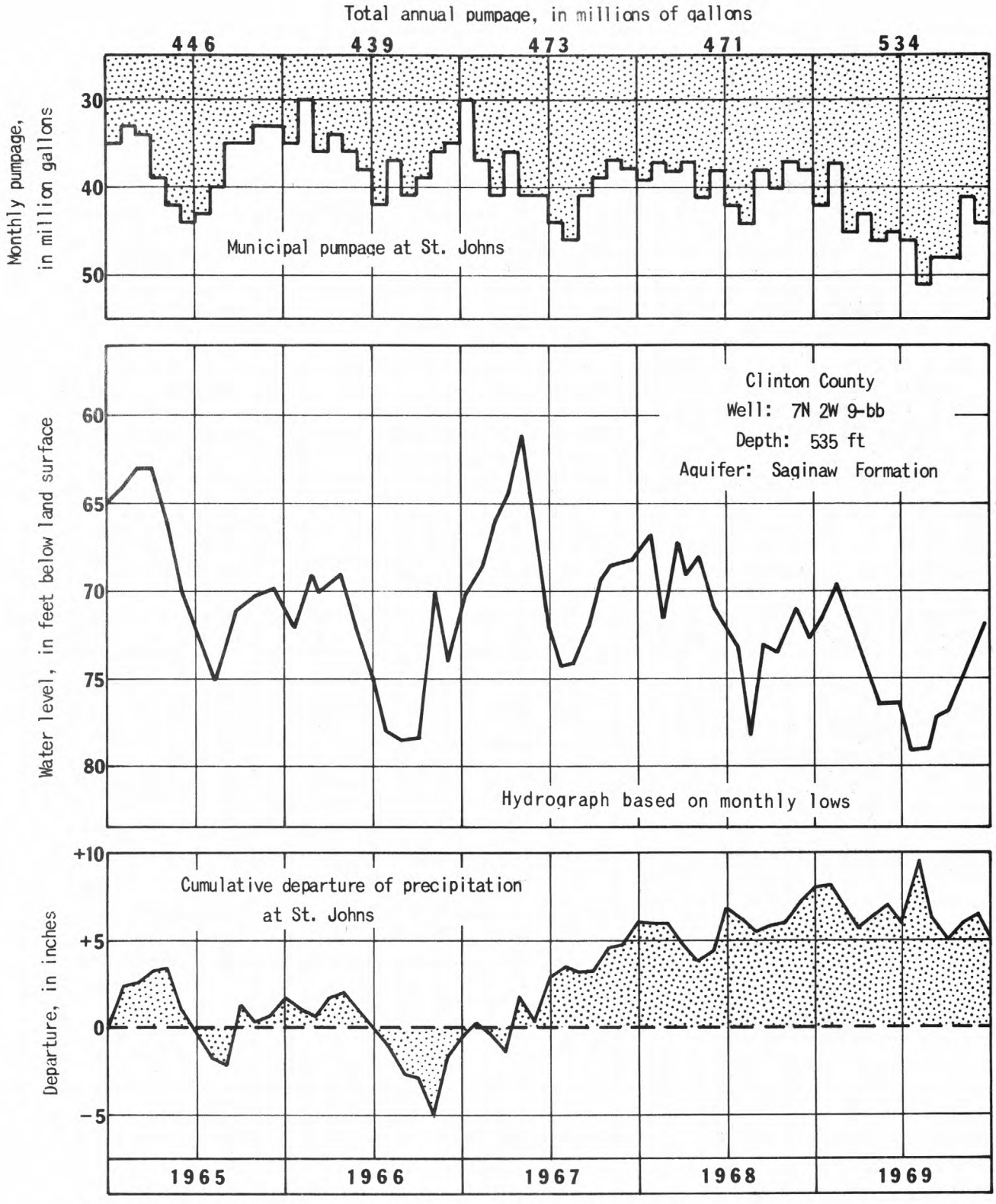


Figure 13.--At St. Johns, the water level fell to a new low for the period of record, in July -- the result of increased pumpage and deficient precipitation.

CLINTON COUNTY - CITY OF ST. JOHNS

WATER SUPPLY AND SOURCE -- Seven wells, about 500 feet deep, tapping sandstones of the Saginaw Formation.

YIELD OF WELLS (in gallons per minute) -- Reportedly average 600 to 900.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) -- 3 to 5.

PUMPAGE IN 1969 -- 534 million gallons.
MAXIMUM DAY -- 1.83 million gallons.

STORAGE FACILITIES -- 600,000 gallons elevated and 400,000 gallons ground storage.

QUALITY OF WATER --

| | |
|---|---|
| Hardness | 340-359 mg/l |
| Iron | 0.2-1.8 mg/l |
| Chlorides | 10-80 mg/l |

TREATMENT -- None.

POPULATION SERVED -- 6,000 estimated.

PER CAPITA USE -- 244 gallons per day.

REMARKS -- At St. Johns, water levels in the observation well have trended downwards since 1967, although precipitation has been above average (fig. 13). The decline in levels is attributed to municipal pumpage about a half a mile from the observation well.

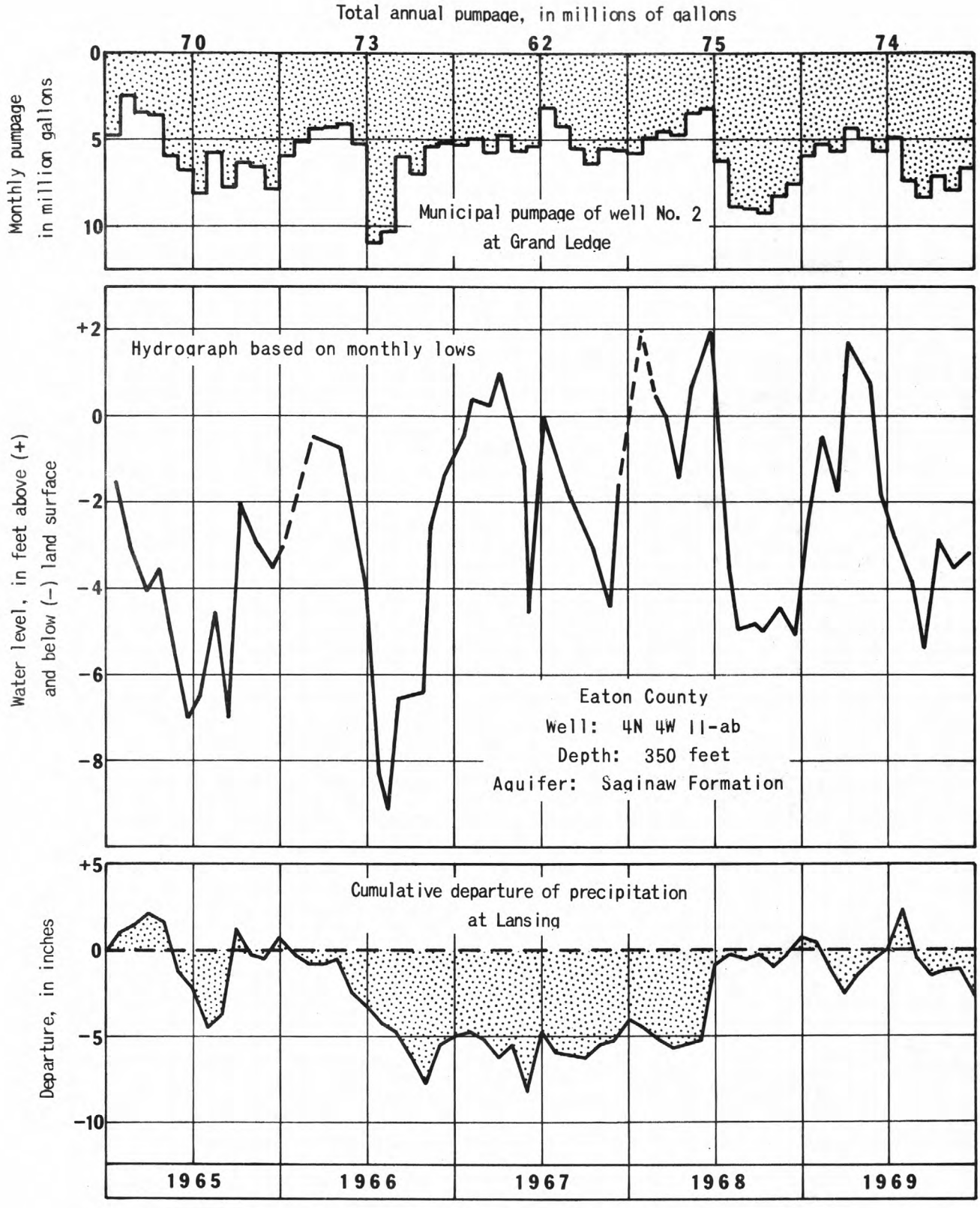


Figure 14.--At Grand Ledge, water levels in this observation well in 1969 showed little change from the previous year's record. Pumpage remained about the same and precipitation was only slightly deficient.

EATON COUNTY - CITY OF GRAND LEDGE

WATER SUPPLY AND SOURCE -- Three wells, nos. 2, 3, and 4, ranging from 241-400 feet in depth, in sandstones of the Saginaw Formation.

YIELD OF WELLS (in gallons per minute) -- 300-525.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) -- 3.5 - 10.

PUMPAGE IN 1969 -- 190 million gallons.

MAXIMUM DAY --

STORAGE FACILITIES -- 100,000 gallons elevated.

QUALITY OF WATER --

| | | |
|---|---|---|
| Hardness | 364-405 | mg/l |
| Iron | 0.5-2.0 | mg/l |
| Fluoride | 0.2-0.3 | mg/l |

TREATMENT -- Chlorination, phosphate.

POPULATION SERVED -- 5,165.

PER CAPITA USE -- Per capita use -- 101 gallons per day.

REMARKS -- Water levels in the observation well at Grand Ledge (fig. 14) respond to changes in artesian pressures caused principally by pumping from municipal well no. 2, about 1,800 feet away. In April, 1969, water levels overflowed the top of the casing of the observation well, which is 4.6 feet above land surface (table 1, Eaton Co.). Water levels at the "Chair Factory" observation well (about a mile from No. 2 well) also were high. Levels here rose to within a tenth of a foot of the high for the 22-year record (table 1).

EATON COUNTY

DELTA CHARTER TOWNSHIP WATER SYSTEM (not illustrated)

WATER SUPPLY AND SOURCE -- Four wells, 370 to 450 feet deep tapping the Saginaw Formation.

YIELD OF WELLS (in gallons per minute) -- 300-360.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) --

PUMPAGE IN 1969 -- 260 million gallons.

MAXIMUM DAY --

STORAGE FACILITIES -- 500,000 gallons elevated.

QUALITY OF WATER --

| | | |
|---|---|---|
| Hardness | 260-365 | mg/l |
| Iron | 0.4-0.6 | mg/l |
| Chlorides | 0.5 | mg/l |
| Fluorides | 0.2-0.3 | mg/l |

TREATMENT -- Chlorination and phosphate.

POPULATION SERVED -- 8,000 estimated.

PER CAPITA USE -- 89 gallons per day.

REMARKS -- Increased population and commercial development in Delta Township has resulted in an increase in water use and a lowering of the water levels in the Saginaw Formation in this area. For example, water levels in the Robins Road observation well have fallen 36 feet since the beginning of measurement in 1953 (table 1, Eaton Co.) or about 2 feet per year. Pumpage in the Township in 1969 constituted a 60 percent increase over 1967's pumpage of 165 million gallons. Two new wells are planned for 1970.

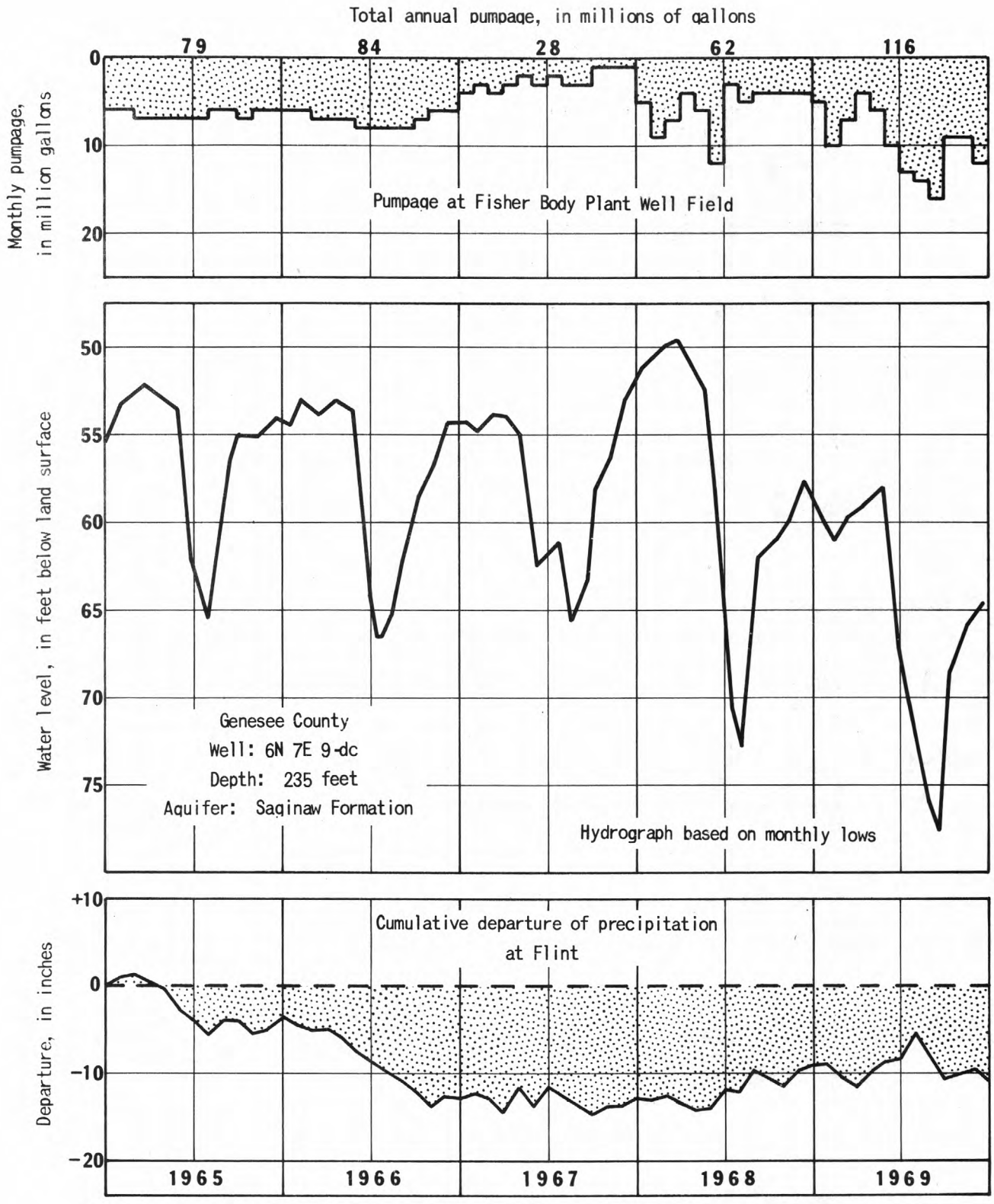


Figure 15.--At Fisher Body's well field near Grand Blanc, water levels in the observation well were the lowest of the record as the result of increased pumpage.

Use of Fisher Body wells by the City of Grand Blanc was the reason for the increased pumpage.

GENESEE COUNTY
FISHER BODY, GMC, AT GRAND BLANC

WATER SUPPLY AND SOURCE -- Four wells, 200-275 feet deep, tap sandstones of the Saginaw Formation.

YIELD OF WELLS (in gallons per minute) -- 250-300.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) -- 3 1/2 to 6 2/3.

PUMPAGE IN 1969 -- 116 million gallons.

MAXIMUM DAY --

STORAGE FACILITIES -- Ground and elevated: 100,000 plant
650,000 fire protection

QUALITY OF WATER --

| | |
|---|---|
| Hardness | 255-344 mg/1 |
| Iron | 0.4-1.0 mg/1 |
| Chloride | 72-120 mg/1 |

TREATMENT -- Phosphate and chlorination.

POPULATION SERVED --

PER CAPITA USE --

REMARKS -- At Fisher Body's well field, water levels in the observation well (fig. 15) declined sharply during the 1968-69 period, when the City of Grand Blanc began using all but one of the Plant's wells to augment other sources of water for its municipal supply. The heavier pumping resulted in new lows for the 18-year record. A further draft on the aquifer is due to the pumping by new subdivisions in the area.

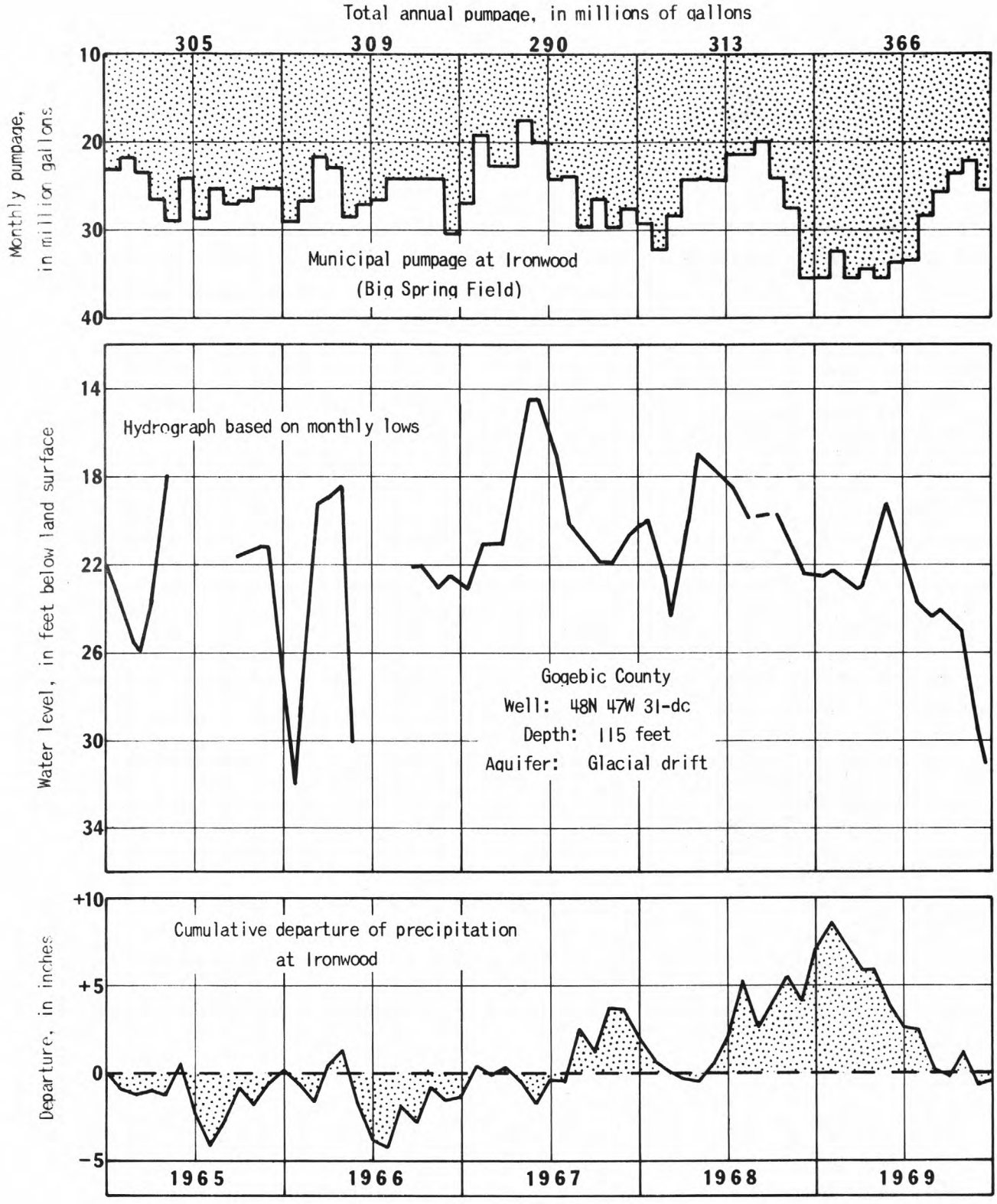


Figure 16.--At Ironwood's Big Spring Field, water levels in the observation well were the lowest observed for the past several years -- a result of increased pumpage and deficient precipitation.

GOGEBIC COUNTY - CITY OF IRONWOOD

WATER SUPPLY AND SOURCE -- Five wells, 41 to 118 feet deep, finished in glacial drift at Spring Creek and Big Springs field near Ironwood. No. 1 - 41 feet deep; Nos. 2 and 3 - 118 feet deep; No. 4 - 69 feet deep; and No. 5 - 47 feet deep. Nos. 1, 3, and 4 are 26 inches in diameter and nos. 2 and 5 are 12 inches.

YIELD OF WELLS (in gallons per minute) -- No. 1 - 380; no. 2 - 135; no. 3 - 360; no. 4 - 200; no. 5 - 240.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) -- No. 1 - 47; no. 3 - 21; no. 4 - 6; no. 5 - 27.

PUMPAGE IN 1969 -- 445 million gallons.

MAXIMUM DAY -- 1.54 million gallons.

STORAGE FACILITIES -- 1,000,000 gallons ground level, and 2,500,000 gallons elevated.

QUALITY OF WATER --

| | |
|---|---|
| Hardness | 63-186 mg/l |
| Iron | 0.0-0.1 mg/l |
| Chloride | 4-63 mg/l |

TREATMENT -- Chlorination.

POPULATION SERVED -- 11,500 estimated.

PER CAPITA USE -- 106 gallons per day.

REMARKS -- Water levels in the two observation wells at Ironwood, reflect withdrawals of ground water at the two municipal well fields. Stages in the observation well at the Big Spring field were sharply lower in 1969, as a result of increased pumpage (fig. 16).

At the Spring Creek field water levels in the observation well (fig. 17) remained high as pumpage decreased in 1969. The proximity of Spring Creek at the field, results in recharge to the aquifer when wells are pumped. The water level of 0.7 feet above land surface in April, 1969, was the highest of the 9-year record (table 1, Gogebic Co.).

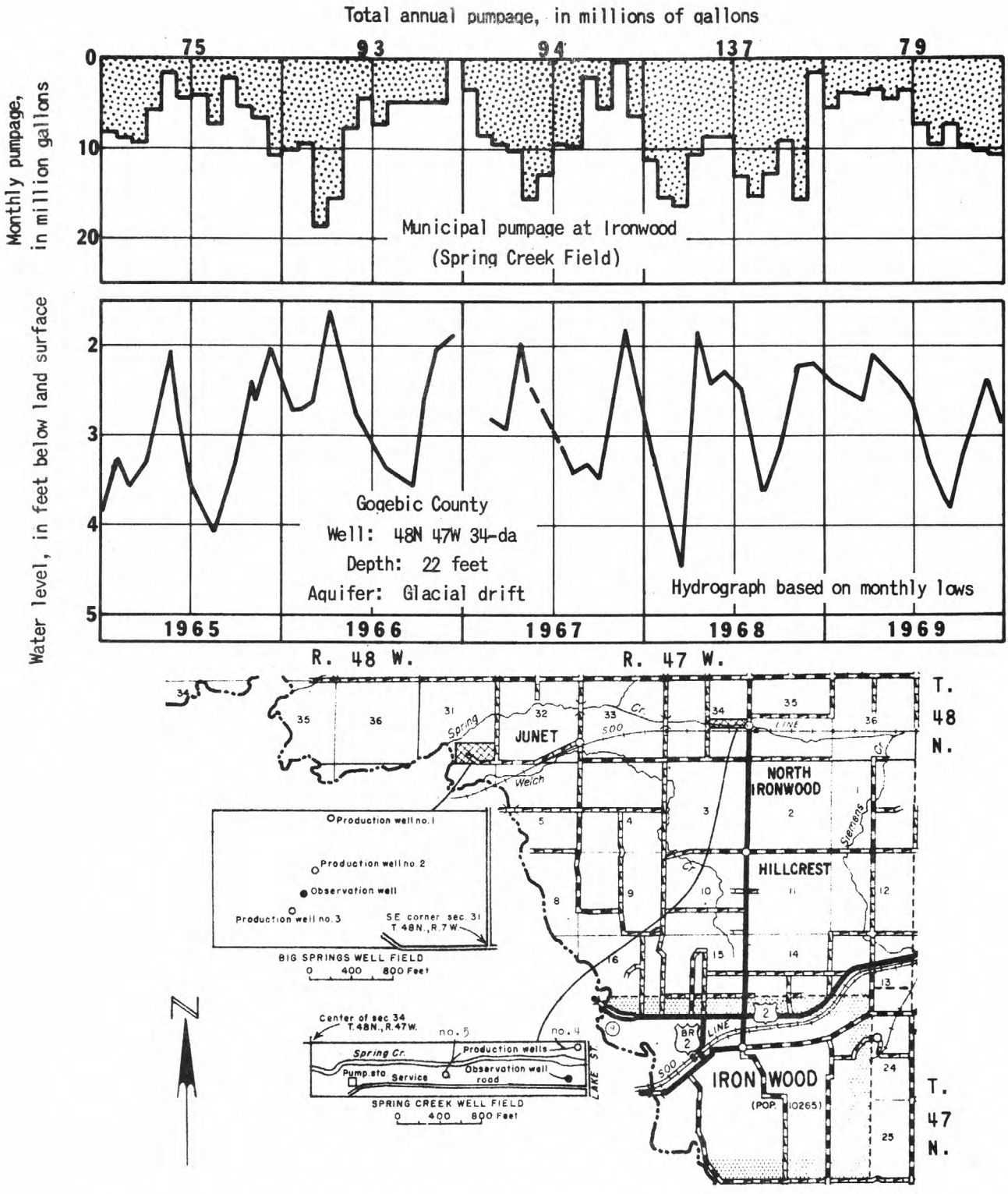


Figure 17.--At Ironwood's Spring Creek Field, water levels in the observation well were higher overall than in 1968 reflecting decreased pumping at this field.

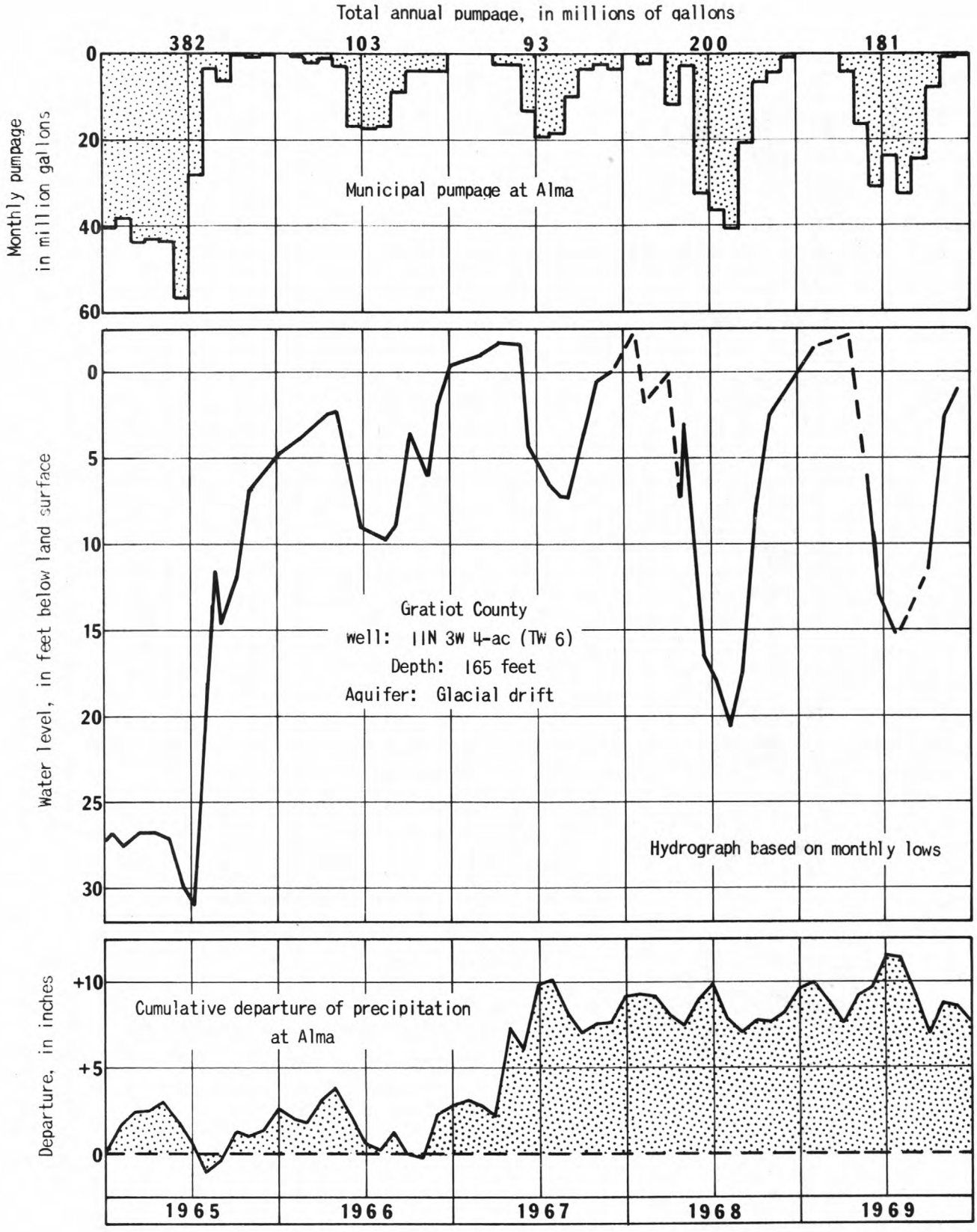


Figure 18.--At Alma, water levels in the observation well drop sharply during the warmer months when ground water is added to water pumped from the Pine River, the City's main source of water.

GRATIOT COUNTY - CITY OF ALMA

WATER SUPPLY AND SOURCE --Five wells, 82 to 155 feet deep, tapping buried outwash deposits of glacial drift. Standby well, 550 feet deep, tapping sandstone of the Saginaw Formation. Since 1965, most water for municipal use has been obtained from the Pine River.

YIELD OF WELLS (in gallons per minute) -- 175 - 875.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) -- Glacial drift 12-25; Saginaw Formation - 2 1/2.

PUMPAGE IN 1969 -- 181 million gallons, also 619 mg of river.water. Total 800 mg.

MAXIMUM DAY -- 3.08 million gallons.

STORAGE FACILITIES -- 1,000,000 gallons ground level for treated water, 500,000 gallons elevated for treated water; 200,000 gallons on industrial water.

QUALITY OF WATER --

| Drift: | | | Saginaw: | |
|---|---|---|---|---|
| Hardness | 350-451 | mg/l | Hardness | 250 mg/l |
| Iron | 1.4-1.7 | mg/l | Iron | 1.1 mg/l |
| Fluoride | 0.1-0.2 | mg/l | Fluoride | 0.1 mg/l |

TREATMENT --None for ground water.

POPULATION SERVED --8,978.

PER CAPITA USE -- 244 gallons per day (includes surface water).

REMARKS -- Water levels in the observation well at Alma have remained high since mid-1965 when the City began using water from the Pine River for its main supply (fig. 18). Above average precipitation since 1965 coupled with the decrease in pumping has caused ground-water levels to frequently rise above land surface.

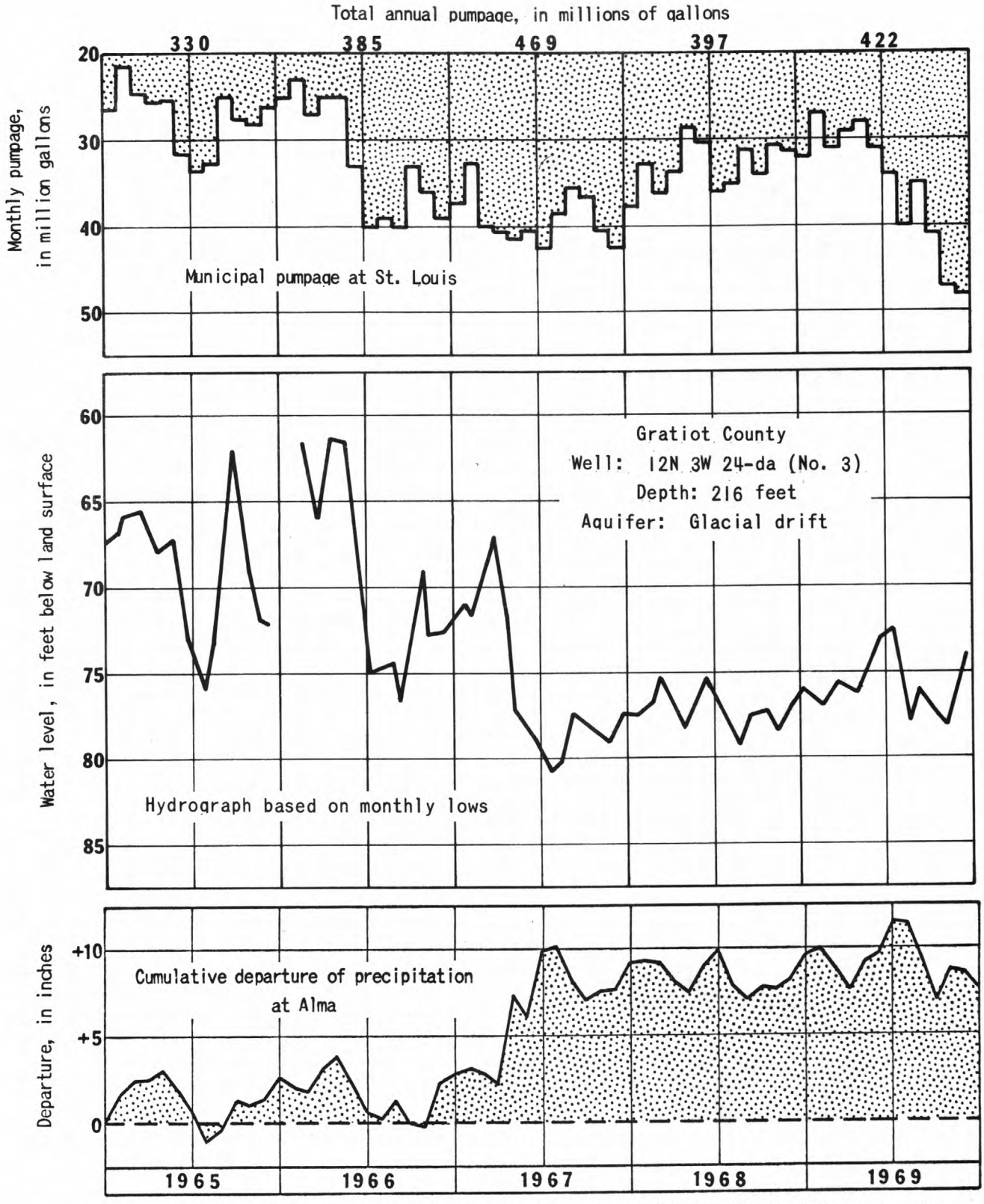


Figure 19.--At St. Louis, water levels in the observation well in 1967, were the lowest of the ten-year record. Since 1967, increased precipitation and somewhat less pumpage has precluded any further decline.

GRATIOT COUNTY - CITY OF ST. LOUIS

WATER SUPPLY AND SOURCE -- Six wells, 136 to 223 feet deep, tapping buried outwash deposits of the glacial drift.

YIELD OF WELLS (in gallons per minute) -- No. 1 - 400; no. 2 - 550; no. 4 - 400; no. 5 - 360; no. 6 - 350; no. 7 - 400.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) -- No. 1 - 11; no. 2 - 15; no. 4 - 10; no. 5 - 13; no. 6 - 8.

PUMPAGE IN 1969 -- 422 million gallons.
MAXIMUM DAY -- 1.86 million gallons.

STORAGE FACILITIES -- Hydropneumatic storage of 9,800 gallons; 500,000 gallons elevated.

QUALITY OF WATER --

| | |
|---|---|
| Hardness | 260-325 mg/l |
| Iron | 0.5-1.0 mg/l |
| Fluoride | 0.1-0.4 mg/l |

TREATMENT -- None.

POPULATION SERVED -- 4,500 estimated.

PER CAPITA USE -- 257 gallons per day.

REMARKS -- Increased municipal pumpage at St. Louis has resulted in generally lower water levels during the last three years (fig. 19). For example, the 1969 pumpage was about 25 percent more than in 1965.

INGHAM COUNTY
CITY OF EAST LANSING (not illustrated)

WATER SUPPLY AND SOURCE -- Ten wells, 385 to 400 feet deep, tapping sandstones of the Saginaw Formation.

YIELD OF WELLS (in gallons per minute) -- 275 to 825.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) --3 to 11.

PUMPAGE IN 1969 -- 1,250 million gallons.
MAXIMUM DAY -- 5.20 million gallons.

STORAGE FACILITIES -- 525,000 gallons elevated, 1,000,000 ground storage.

QUALITY OF WATER --

| | | |
|---|---|---|
| Hardness | 325-565 | mg/1 |
| Iron | 0.8-3.0 | mg/1 |
| Chloride | 3-34 | mg/1 |

TREATMENT -- Chlorination, softening and iron removal, fluoride, phosphate.

POPULATION SERVED -- 34,000 estimated.

PER CAPITA USE -- 101 gallons per day.

REMARKS --Water levels in the "Marble School" observation well (table 1, Ingham Co.) have been declining since the start of record in 1953. The new low of record, about 61 feet below land surface or 40 feet below levels recorded in 1953, was established in 1969.

INGHAM COUNTY
LANSING TOWNSHIP (not illustrated)

WATER SUPPLY AND SOURCE -- Seven wells, 399 to 417 feet deep, tapping sandstones of the Saginaw Formation.

YIELD OF WELLS (in gallons per minute) -- 260 to 500.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) -- 2.6 to 8.

PUMPAGE IN 1969 -- 749 million gallons.
MAXIMUM DAY -- 21.14.

STORAGE FACILITIES -- 200,000 gallons elevated, and 2,000,000 underground storage tank.

QUALITY OF WATER --

| | | |
|---|---|---|
| Hardness | 290-350 | mg/l |
| Iron | 0.4-1.0 | mg/l |
| Fluoride | 0.4 | mg/l |

TREATMENT -- Chlorination, and phosphate for iron control.

POPULATION SERVED -- 6,100 estimated.

PER CAPITA USE -- 336 gallons per day.

REMARKS -- Pumpage by Lansing Township has nearly doubled since 1960. About two-thirds of the water is furnished to industry.

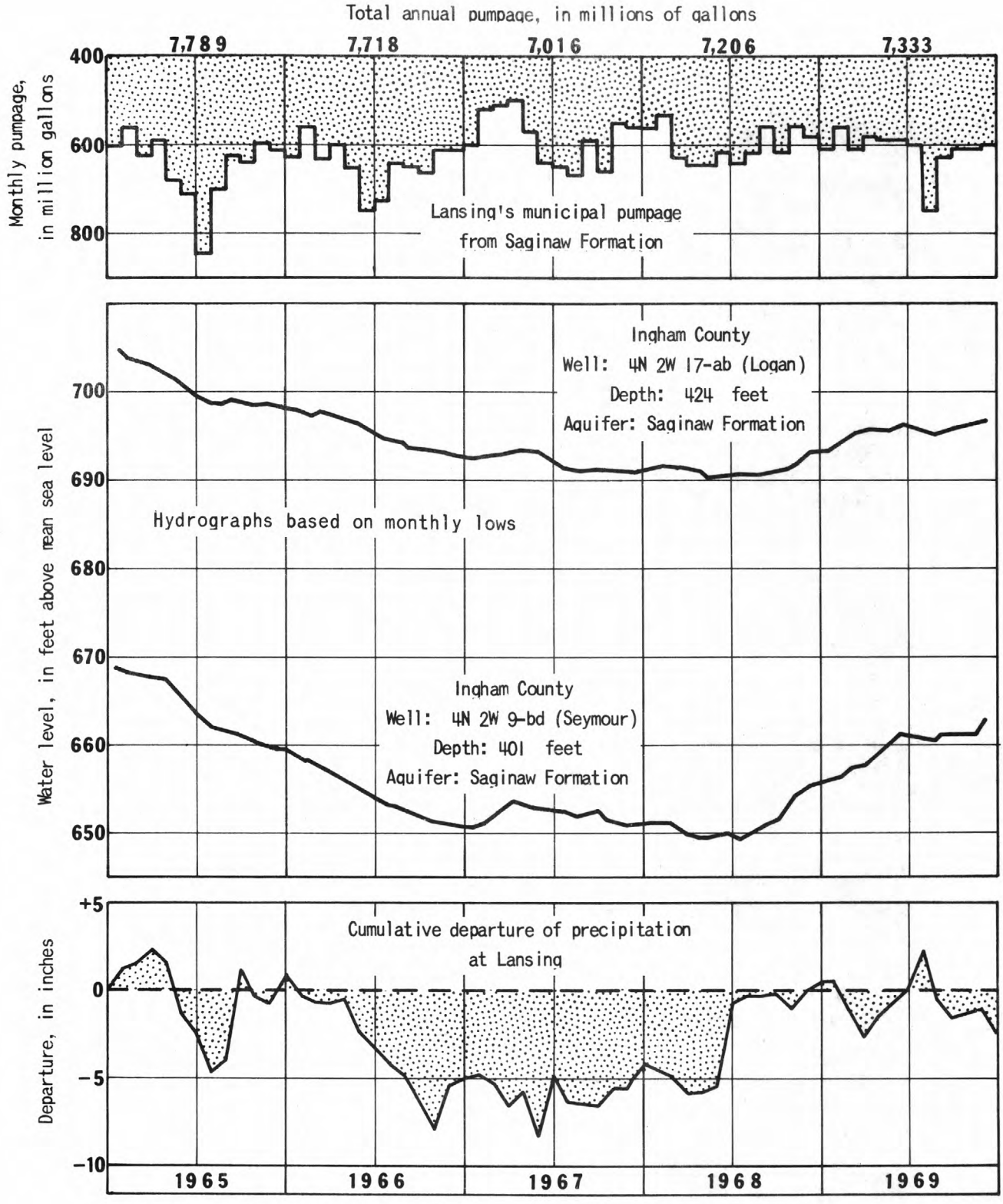


Figure 20.--At Lansing, water levels in these two observation wells continued a a rising trend in 1969. The rise is the result of decreased pumping from the Saginaw Formation by the City and above average precipitation.

INGHAM COUNTY - CITY OF LANSING

WATER SUPPLY AND SOURCE -- 115 wells, 400-425 feet deep, tapping sandstones of the Saginaw Formation. Two wells, 50 to 60 feet deep are finished in glacial drift, but are seldom used. Three wells, 85 to 105 feet deep, finished in glacial drift are located at Stiefel Field.

YIELD OF WELLS (in gallons per minute) -- 100 to 700 (sandstone).
790 to 1,200 (glacial drift).

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) — 3 to 10 reported for rock wells, 12 to 80 for glacial drift wells.

PUMPAGE IN 1969 -- 8,365 million gallons.

MAXIMUM DAY -- 37.69 million gallons.

STORAGE FACILITIES -- Ground storage of 22,000,000 gallons.

| QUALITY OF WATER -- | | Saginaw sandstone | Glacial drift |
|---|---|---|---|
| Treated: | Hardness | 85 mg/l | 85 mg/l |
| Raw: | Hardness | 200-600 mg/l | 348 mg/l |
| | Iron | 0.03-4.0 mg/l | 0.0 mg/l |

TREATMENT -- Fluoridation, chlorination, lime-soda ash softening, iron removal, polyphosphate, sedimentation, coagulation, filtration, and taste and odor control.

POPULATION SERVED -- 131,000 estimated.

PER CAPITA USE -- 175 gallons per day.

REMARKS -- In the heavily pumped Lansing area water levels in some observation wells recovered in 1968-69 from the low levels of previous years. The recoveries were partially the result of decreased pumping in recent years from the Saginaw Formation (fig. 20). The decreased pumping was made possible by the use of a new well field (Stiefel) in Eaton County where the City obtains water from the glacial drift (fig. 21). The Stiefel field obtains recharge from the Grand River.

Some new lows were recorded in the area in 1969, (table 1, Ingham and Eaton Counties) as the result of increased pumping by some of the surrounding Townships and by Michigan State University. About 13 billion gallons of ground water was pumped in 1969 by municipal, institutional, and industrial wells in the Lansing area, an increase of about 300 million gallons over 1968. The distribution of observation wells in the Tri-County area is shown by Figure 22.

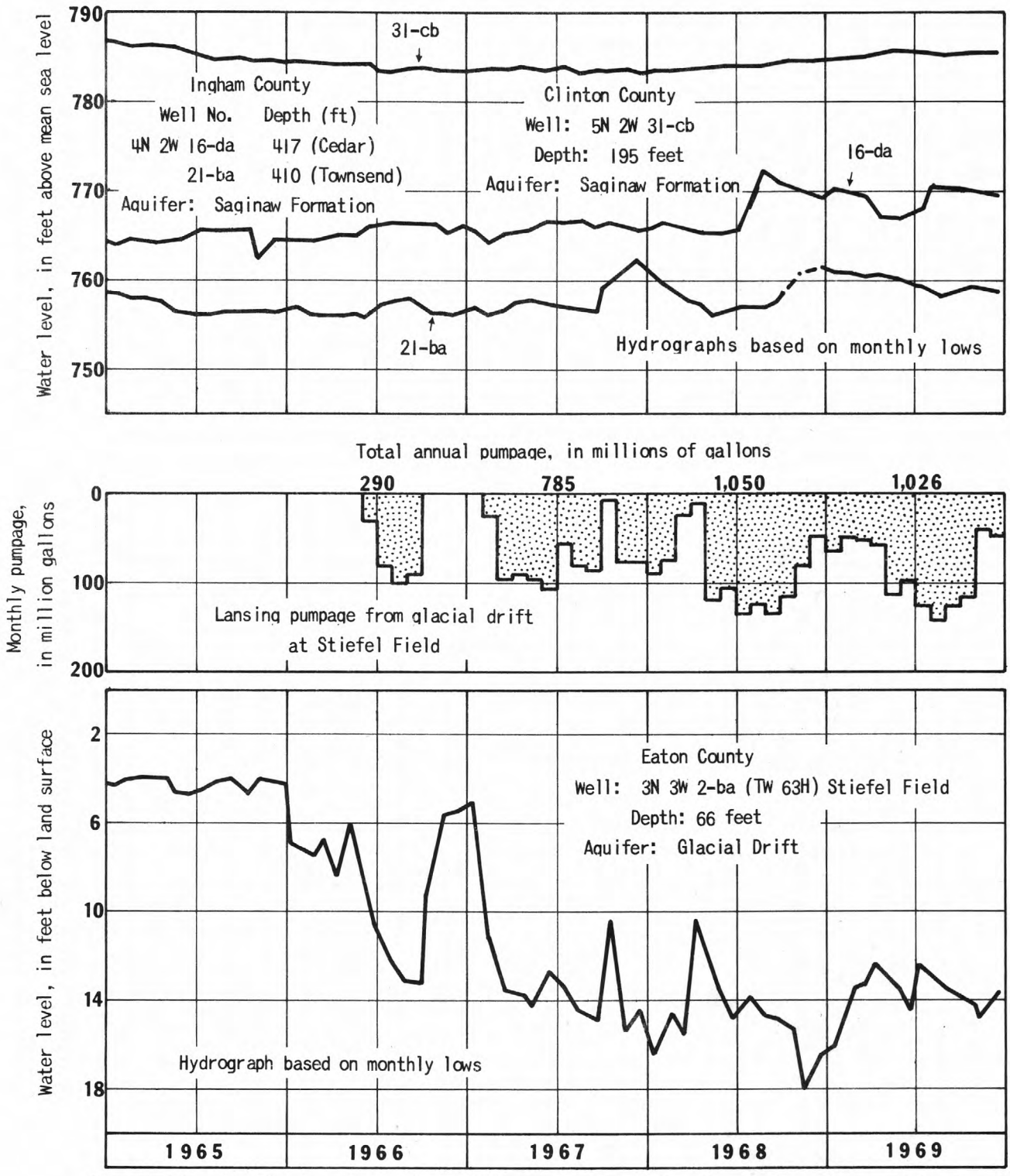


Figure 21.--In the Lansing metropolitan area water levels in the three wells in the Saginaw Formation showed little change in 1969. At the Stiefel Field, water levels in the observation well have apparently stabilized at the present rate of pumping.

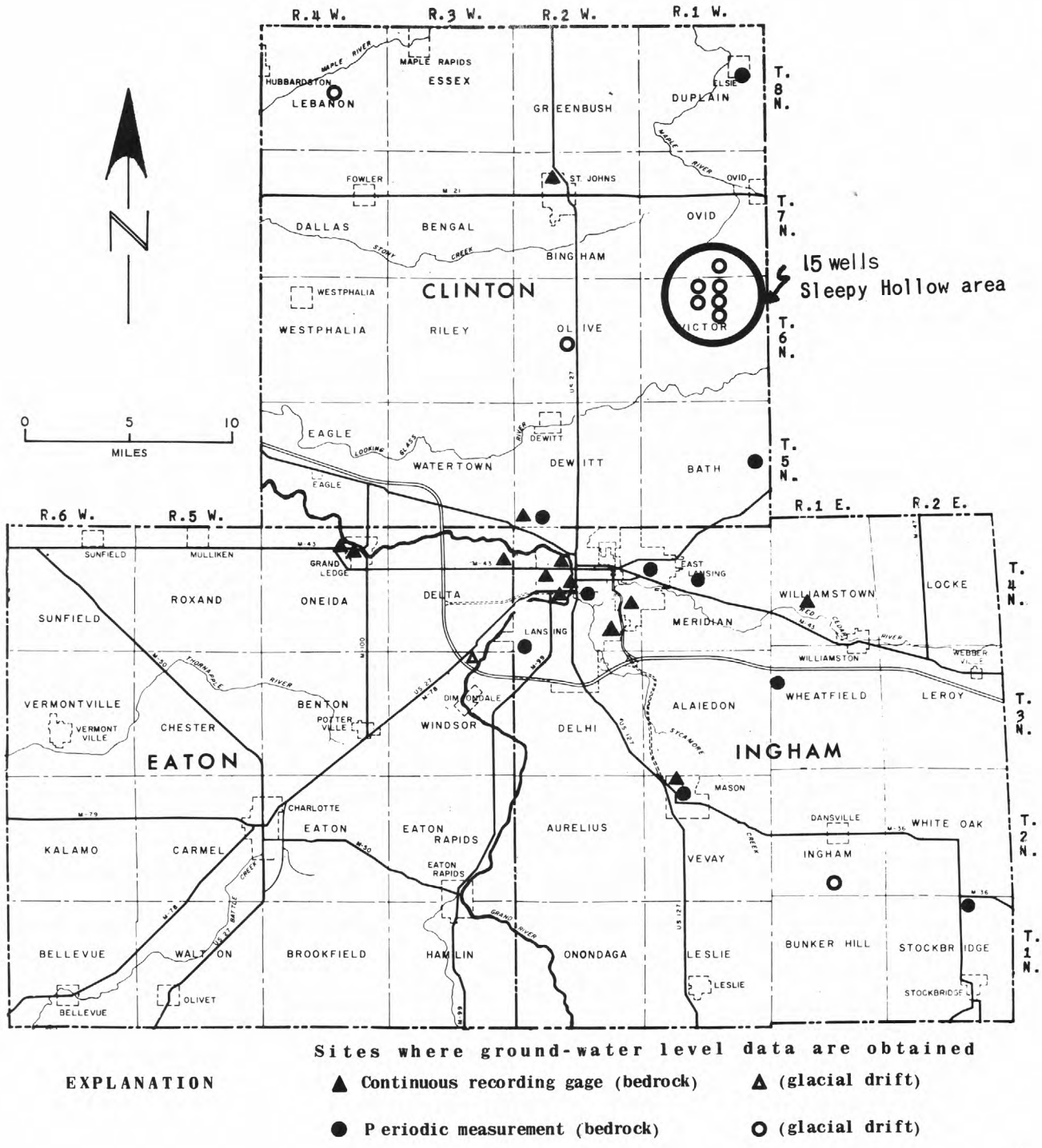


Figure 22.--Location of observation wells in the Tri-County area. The wells in the Sleepy Hollow area are being monitored to ascertain ground-water conditions in the glacial drift prior to development of an impoundment to create an artificial lake.

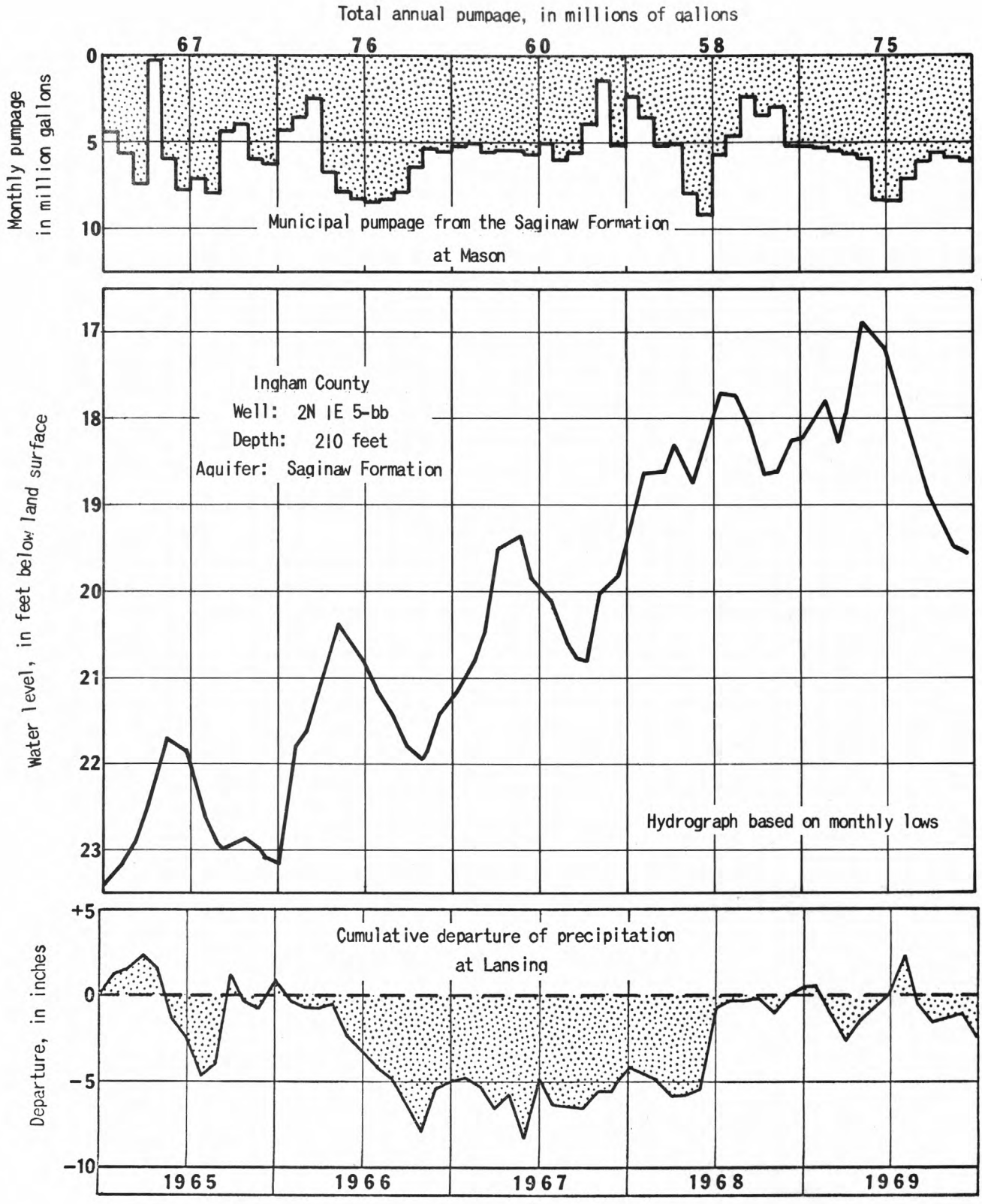


Figure 23.--At Mason, a rising trend in water levels in the observation well was reversed in the Spring of 1969, as the result of increased municipal and industrial pumpage from the Saginaw Formation and deficient precipitation.

INGHAM COUNTY - CITY OF MASON

WATER SUPPLY AND SOURCE -- One well, about 50 feet deep, finished in glacial drift and one well, 223 feet deep, tapping sandstones of the Saginaw Formation.

YIELD OF WELLS (in gallons per minute) -- 675-700.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) — No. 3 yields 30 gpm from the glacial drift.

PUMPAGE IN 1969 -- 202 million gallons.

MAXIMUM DAY --

STORAGE FACILITIES -- 360,000 elevated.

QUALITY OF WATER --

| | | |
|---|---|---|
| Hardness | 310-400 | mg/l |
| Iron | 0.3 | mg/l |
| Fluoride | 0-0.2 | mg/l |
| Chloride | 8-44 | mg/l |

TREATMENT -- Chlorination and fluoride.

POPULATION SERVED -- 5,900 estimated.

PER CAPITA USE -- 94 gallons per day.

REMARKS -- In May, 1969, water levels in the observation well at Mason rose to a new high for the 6-year record (fig. 23). Although water levels declined in the latter part of 1969 due to increased municipal and industrial pumping, end-of-the year stages were higher than those for most previous years of record. The City is reportedly planning to develop a well field at the site of the observation well.

INGHAM COUNTY
MERIDIAN TOWNSHIP (not illustrated)

WATER SUPPLY AND SOURCE -- Sixteen wells finished in the Saginaw Formation supply water to the township. Wells range in depth from 295 feet to 422 feet. About 100 million gallons of water is purchased from the neighboring city of East Lansing to supply the Township's Water District No. 1.

YIELD OF WELLS (in gallons per minute) -- About 200 to 500.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) -- 5 to 25.

PUMPAGE IN 1969 -- 190 million gallons.
MAXIMUM DAY --

STORAGE FACILITIES -- 580,000 gallons.

QUALITY OF WATER --

| | | |
|---|---|---|
| Hardness | 235-395 | mg/l |
| Iron | 0.9-4.5 | mg/l |
| Fluoride | 0.15-0.5 | mg/l |

TREATMENT -- None.

POPULATION SERVED -- 3,050 estimated.

PER CAPITA USE -- 171 gallons per day.

REMARKS -- Use of water has quadrupled since 1964 in this part of the Lansing metropolitan area as population and commercial enterprise have increased.

INGHAM COUNTY
MICHIGAN STATE UNIVERSITY (not illustrated)

WATER SUPPLY AND SOURCE - Seventeen wells, 353-435 feet deep, tapping sandstones of the Saginaw Formation. Two of these wells are on a standby basis only.

YIELD OF WELLS (in gallons per minute) -- 147-654.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) — 1.5 to 11.2.

PUMPAGE IN 1969 -- 1,970 million gallons.
MAXIMUM DAY -- 7.24 million gallons.

STORAGE FACILITIES -- 1,050,000 gallons below-ground storage.

QUALITY OF WATER -- Composite: Average, raw water

| | |
|---|---|
| Hardness | 324 mg/l |
| Iron | 0.3 mg/l |
| Fluoride | 0.4 mg/l |

TREATMENT -- Chlorination, caustic soda to reduce $CO_2$; fluoride, polyphosphate.

POPULATION SERVED -- 40,000 estimated.

PER CAPITA USE -- 135 gallons per day.

REMARKS -- Although pumpage by the University was 50 million gallons less than in 1968, the 1969 pumpage was the second highest of record. Water levels in the "Spartan Village" observation well near the University fell to a new low for the eighth consecutive year. In 24 years the water levels have fallen about 75 feet. Pumpage at the University has doubled since 1960.

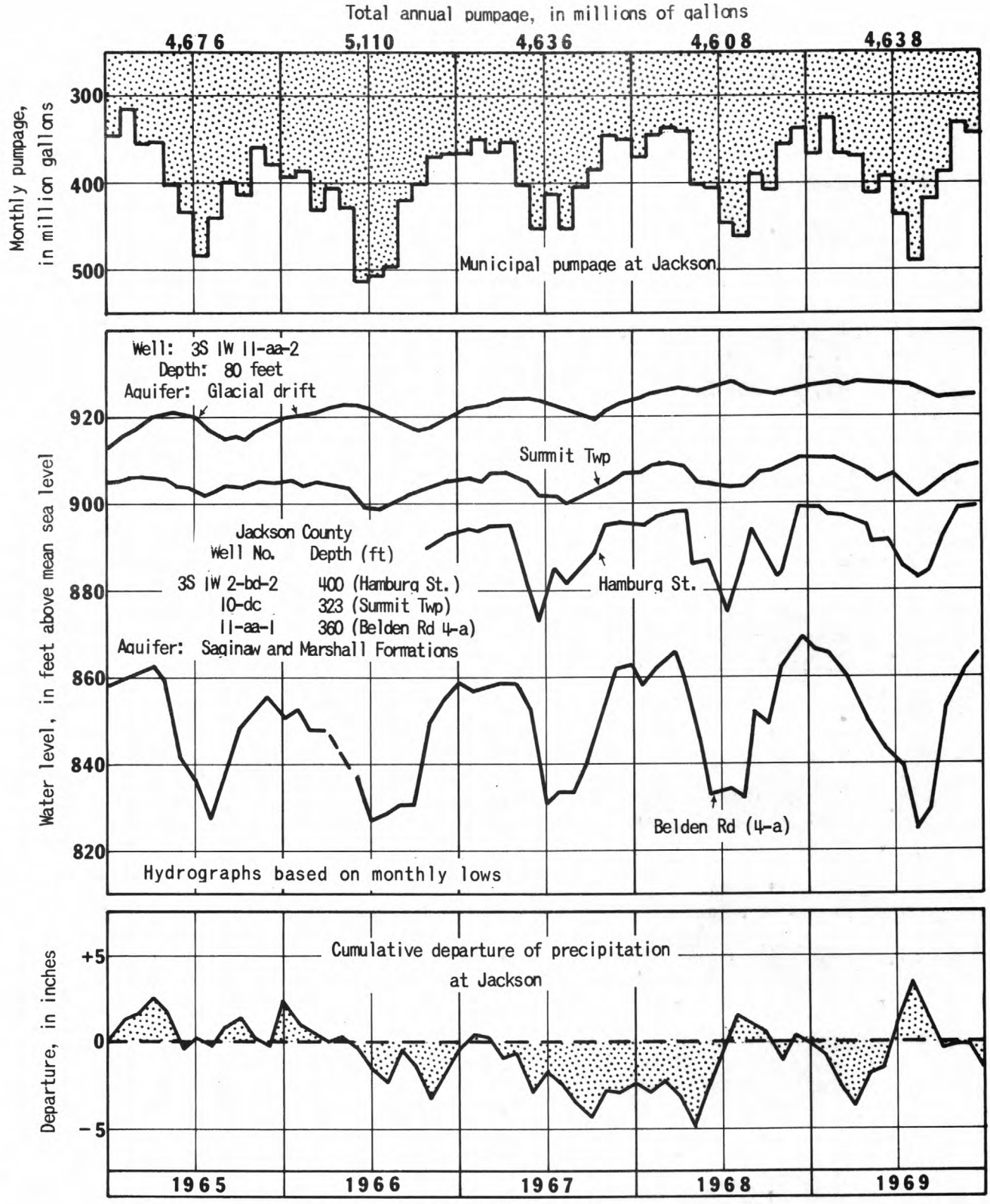


Figure 24.--In 1969, water levels in observation well 4-a at Belden Road Station, Jackson, fell to a new low for the 13-year record; little change occurred in the other observation wells.

JACKSON COUNTY - CITY OF JACKSON

WATER SUPPLY AND SOURCE -- 14 wells, 380 to 400 feet deep, tapping sandstones of the Saginaw, Parma and Marshall Formations.

YIELD OF WELLS (in gallons per minute) -- Range from 1,000 to 2,800.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) — Reported average, 100; specifically, No. 12 well - 56.

PUMPAGE IN 1969 -- 4,638 million gallons.
MAXIMUM DAY -- 19.83 million gallons.

STORAGE FACILITIES -- 3,000,000 gallons elevated, plus 3,000,000 gallons ground.

QUALITY OF WATER --

| | |
|---|---|
| Hardness | 340-390 mg/1 |
| Iron | 0.3-1.0 mg/1 |
| Chloride | 13-88 mg/1 |

TREATMENT -- Chlorination and fluoridation.

POPULATION SERVED -- 52,220 estimated.
PER CAPITA USE -- 243 gallons per day.

REMARKS -- At Jackson, water levels in the observation wells generally remained higher than in recent years. However, heavy pumping in August of 1969, resulted in a new low for the 13-year record (fig. 24). Total precipitation for the 5-year period illustrated has been about average and water levels have not changed significantly at the present rate of pumping.

Wells 11-aa-1 and 11-aa-2 are located at the Belden Road well field whereas 2-bd-2 and 10-dc are located several miles from the main well field (fig. 25).

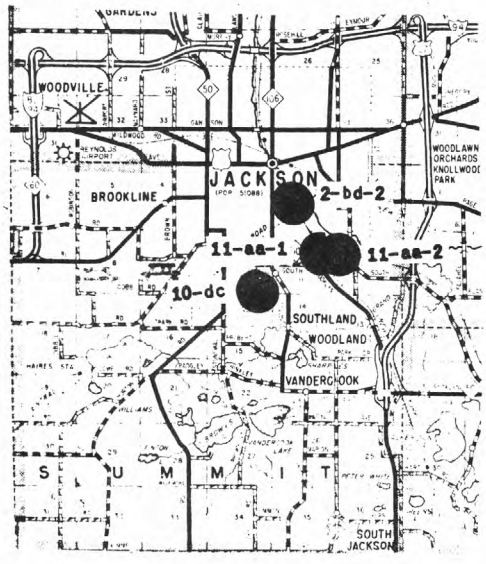


Figure 25.--Location of observation wells.

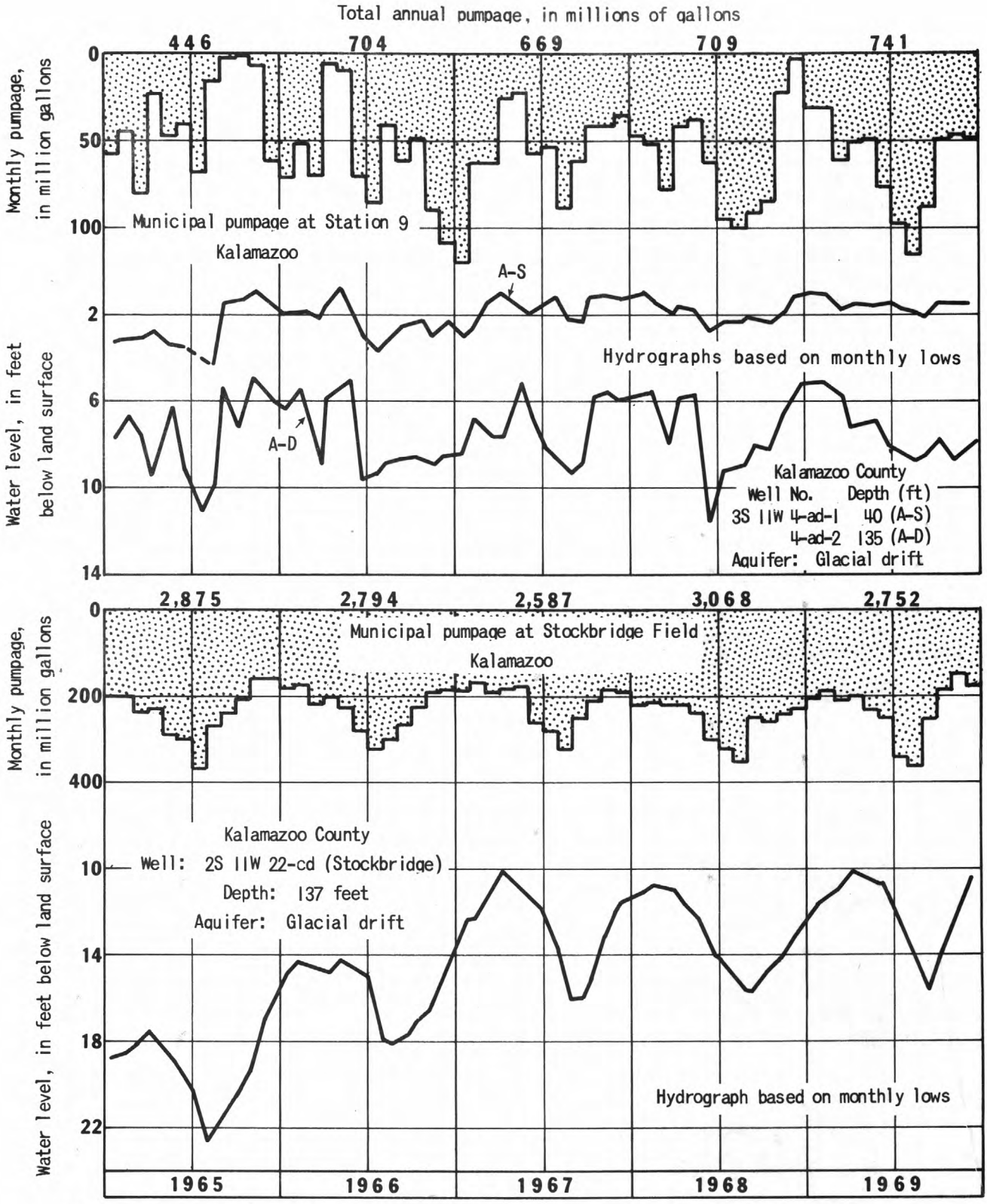


Figure 26.--In 1969, water levels in observation wells at Station 9, declined as the the result of increased pumpage; whereas higher year-end levels were observed at the Stockbridge well as the result of decreased pumpage.

KALAMAZOO COUNTY - CITY OF KALAMAZOO

WATER SUPPLY AND SOURCE -- About 84 wells, 130 to 254 feet deep, finished in glacial drift.

YIELD OF WELLS (in gallons per minute) -- 200 - 2,000.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) — 7 - 100.

PUMPAGE IN 1969 -- 6,058 million gallons.
MAXIMUM DAY -- 36.06 million gallons.

STORAGE FACILITIES -- 15,150,000 gallons elevated.

QUALITY OF WATER --

| | | |
|---|---|---|
| Hardness | 312-350 | mg/l |
| Chloride | 2-18 | mg/l |
| Iron | 0.25-0.75 | mg/l |

TREATMENT -- Chlorination, fluoridation, hexametaphosphate.

POPULATION SERVED -- 115,000 estimated.
PER CAPITA USE -- 144 gallons per day.

REMARKS -- Variations in pumping patterns and about average precipitation resulted in only small net changes in ground-water levels in the observation wells in the City of Kalamazoo area (figs. 26-28) during 1969. However, record high-water levels were observed at the Stockbridge, Kendall, and Atwater wells and record lows at Brown Co. and Allied Paper wells.

In 1969, 6 new wells were installed in the County for observation purposes. The shallow Campbell Lake and Schoonover Lake wells (table 1) serve to indicate natural conditions prior to possible development of the City of Kalamazoo area well fields. The deep Colony, Emerald, and Maple field observation wells (table 1) were drilled to monitor changes in water levels as the result of pumping at each field. The deep Prairie View Park well (table 1) was installed to reflect natural water-level conditions south of the City.

Pumpage by the City of Kalamazoo was about 300 million gallons less than the record high in 1968, but was still the second largest pumpage of record.

Recharge from surface ponds and streams maintain high ground-water levels in the aquifers despite continually increasing pumpage.

The location of observation wells in Kalamazoo County is shown on figure 29.

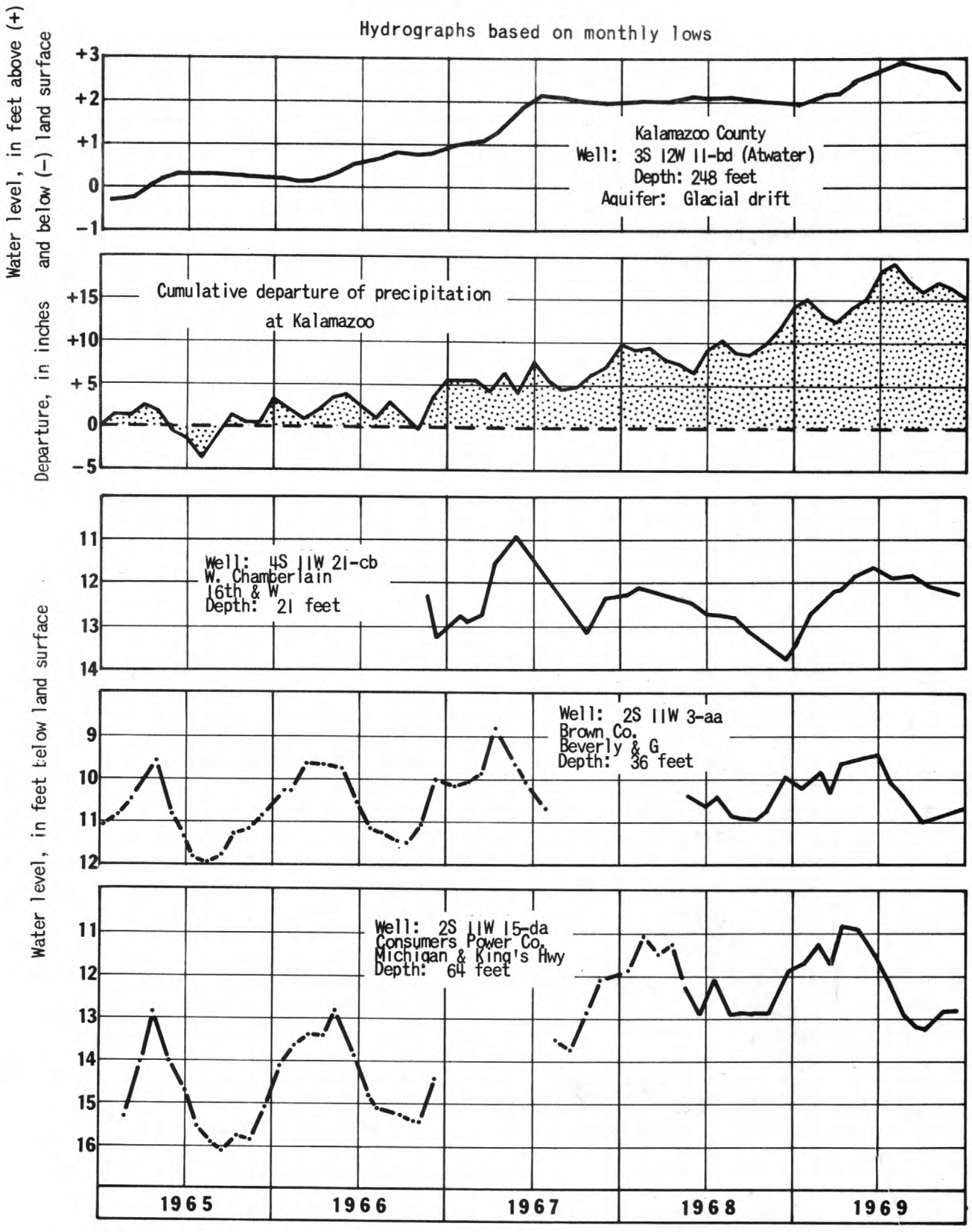


Figure 27.--In Kalamazoo County, water levels in these observation wells rose as the the result of atove average precipitation since 1965. The Atwater and Chamberlain wells are located in areas remote from pumping influences, whereas the Brown and Consumers wells are in areas of heavy ground-water withdrawals.

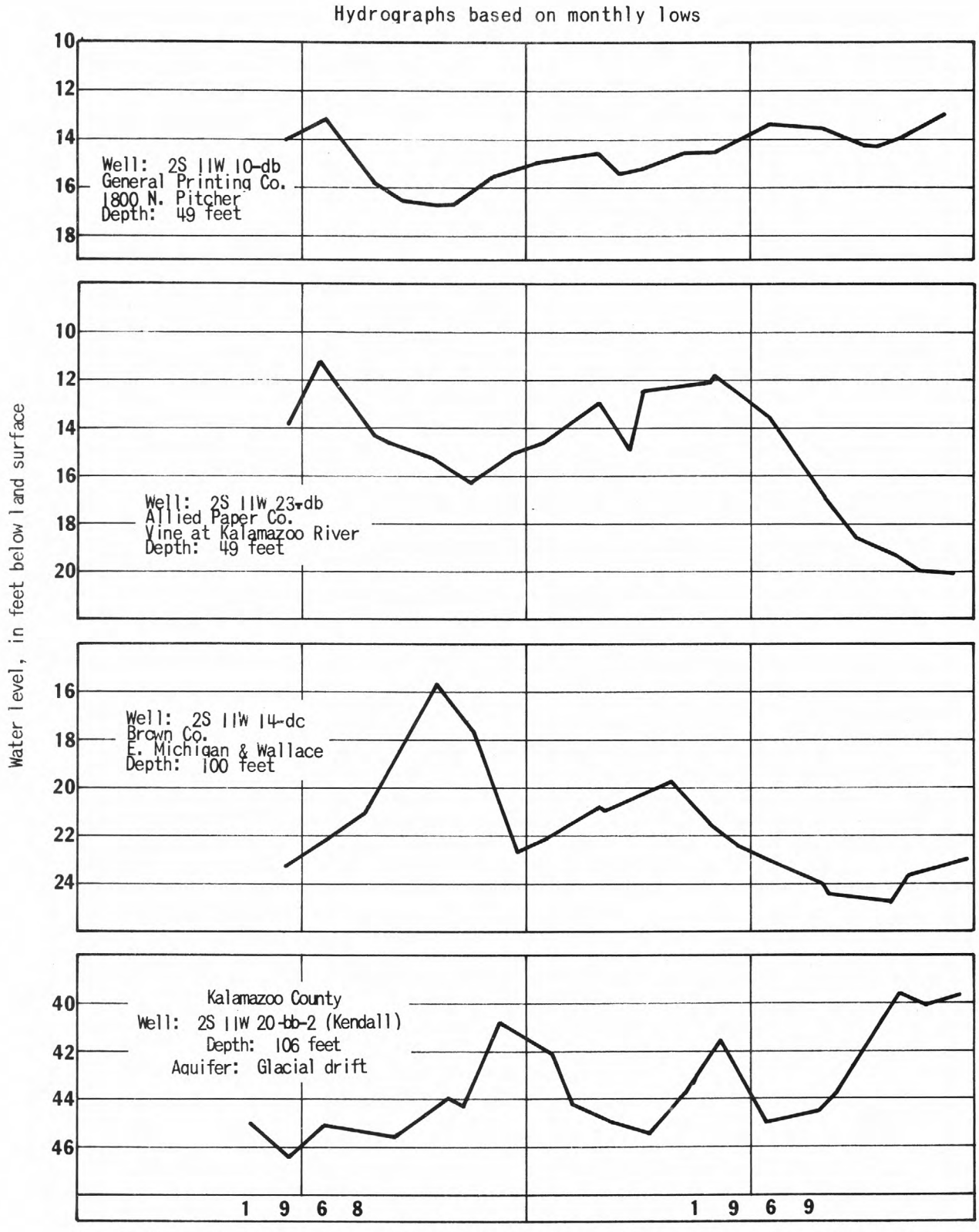


Figure 28.--At Kalamazoo, water levels in these observation wells reflect area pumpage and precipitation. Pumpage greater than the available recharge produced locally lower levels in the Allied and Brown wells.

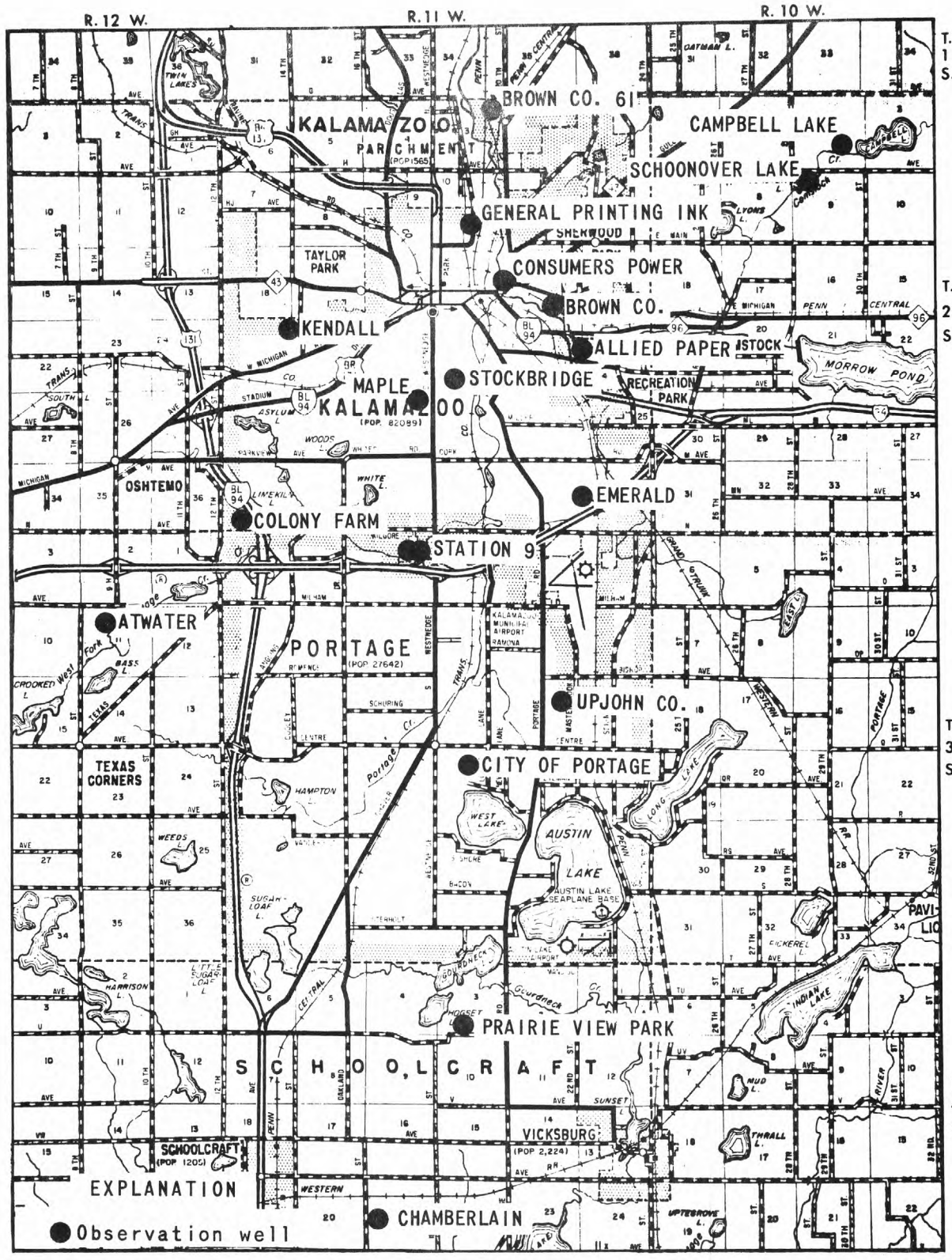


Figure 29.--Location of observation wells in Kalamazoo County.

The Atwater, Chamberlain, and Prairie View Park wells are in areas where their water levels are affected principally by natural influences. The remainder of the wells are in areas of heavy ground-water withdrawals.

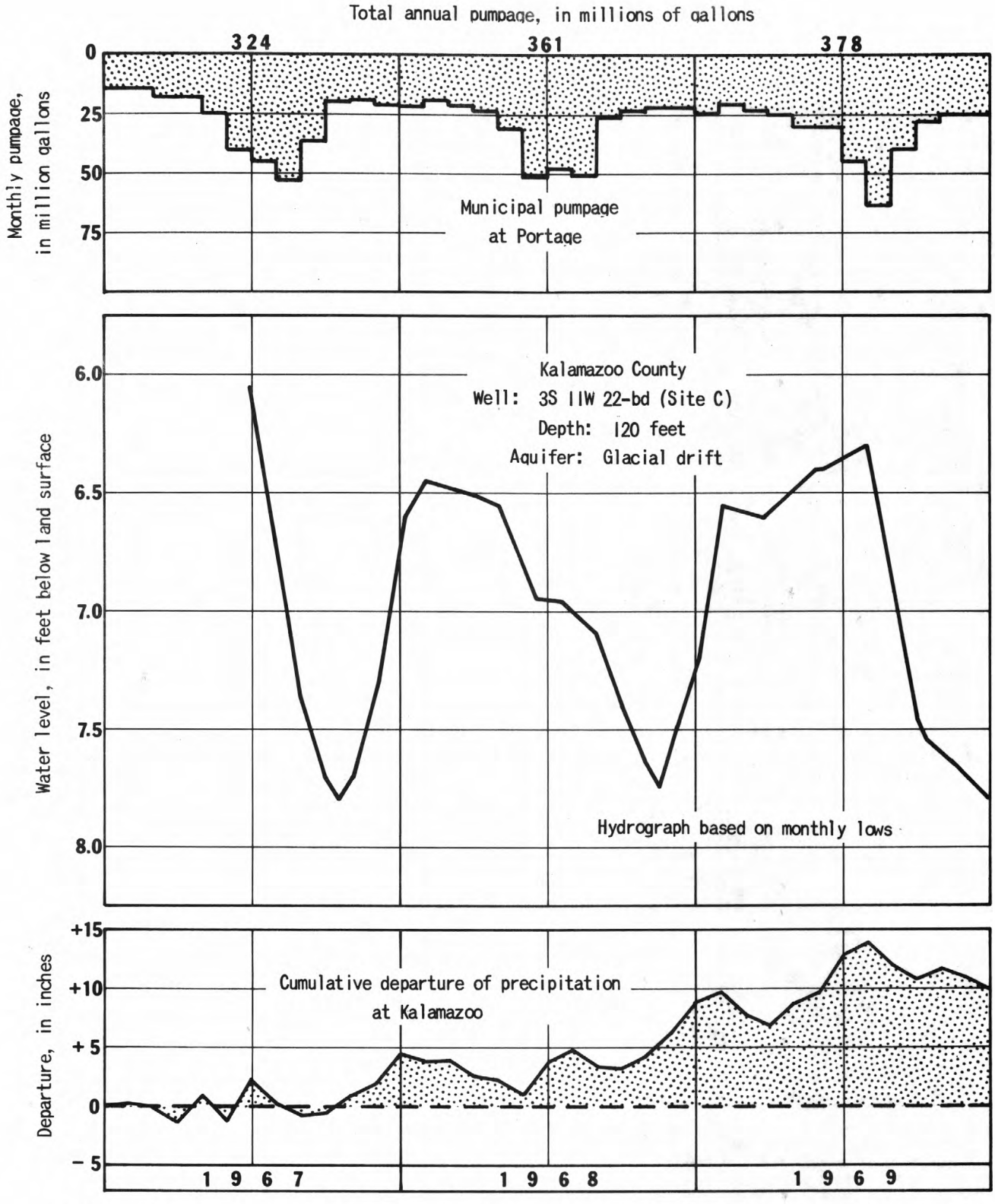


Figure 30.--At Portage, water levels in the observation well showed little year to year change despite increased municipal pumpage.

KALAMAZOO COUNTY - CITY OF PORTAGE

WATER SUPPLY AND SOURCE -- 15 wells ranging from 95 to 185 feet in depth finished in glacial drift.

YIELD OF WELLS (in gallons per minute) -- 300 to 1,000.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) — 25.

PUMPAGE IN 1969 -- 378 million gallons.
MAXIMUM DAY -- 3.48 million gallons.

STORAGE FACILITIES -- 150,000 gallons elevated.

QUALITY OF WATER -- Iron 0.03 to 0.3 mg/l
Hardness 181 mg/l

TREATMENT -- Chlorination and phosphate.

POPULATION SERVED -- 12,000 estimated.

PER CAPITA USE -- 86 gallons per day.

REMARKS -- At the Portage observation well, year-end water levels have indicated a decline of about one-foot per year on the basis of the 3-year record (fig. 30). As precipitation has shown a gain of about 10 inches for the period, the decline reflects heavier area pumping.

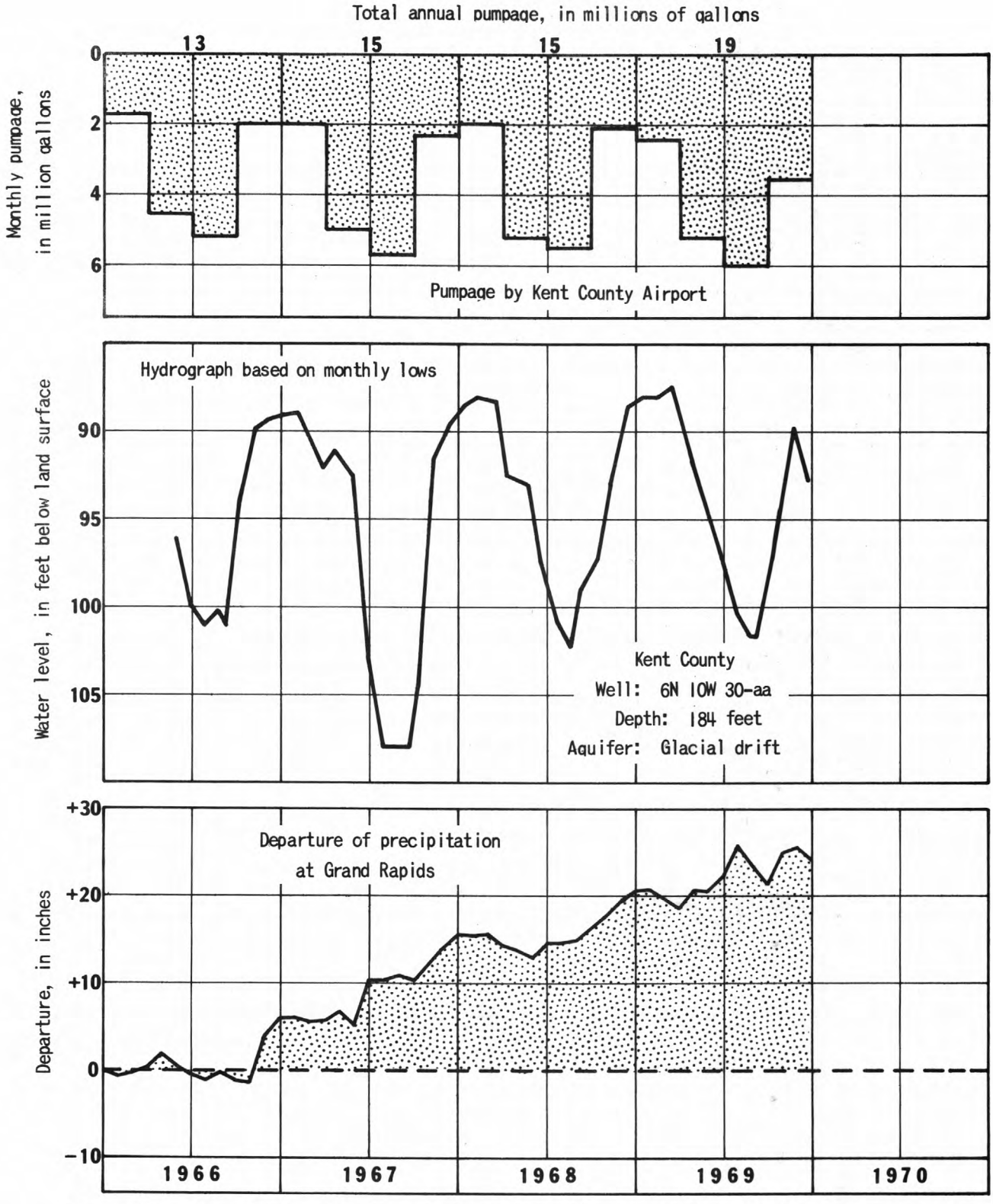


Figure 31.--At Kent County Airport, near Grand Rapids, water levels in the observation well show a slightly rising trend as the result of above average precipitation since 1966.

KENT COUNTY - KENT COUNTY AIRPORT

WATER SUPPLY AND SOURCE -- Three wells, 180 to 203 feet deep, finished in glacial drift.

YIELD OF WELLS (in gallons per minute) -- 100 to 360.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) -- 2.3.

PUMPAGE IN 1969 -- 19.2 million gallons.

MAXIMUM DAY --

STORAGE FACILITIES --100,000 gallons ground storage tank.

QUALITY OF WATER -- Hardness 435-460 mg/l
3-4 mg/l

TREATMENT -- Iron removal, phosphates, and chlorination.

POPULATION SERVED --

PER CAPITA USE --

REMARKS -- At Kent County Airport, water levels in the observation well indicate that no serious decline is occurring at the present rate of ground-water withdrawal (fig. 31). Pumpage is heavier during the warmer months due to the use of water for air conditioning of the airport buildings.

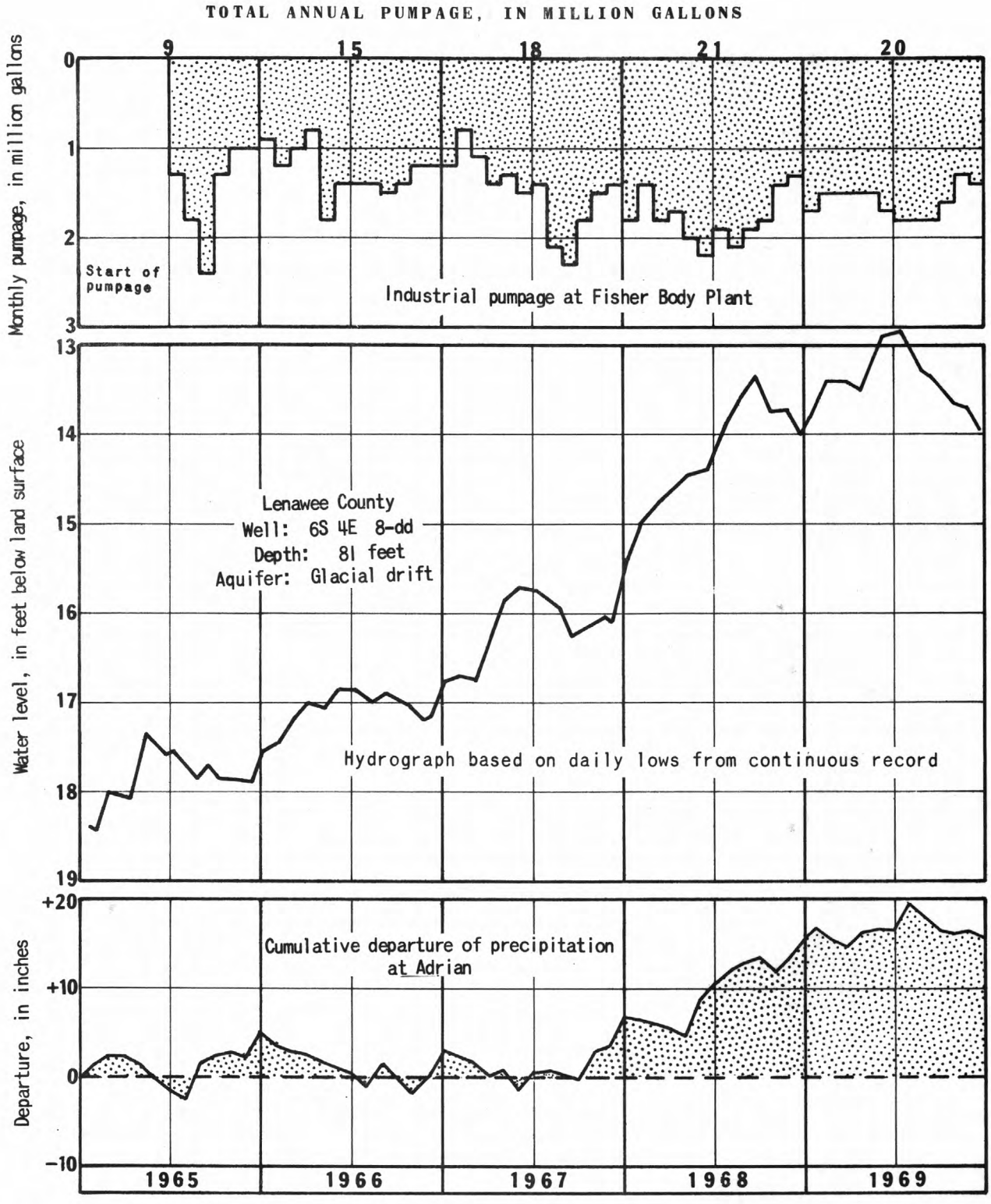


Figure 32.--At Fisher Body's well field near Tecumseh, water levels in the observation well have risen about four feet since early 1965, principally as the result of recharge from above average precipitation.

LENAWEE COUNTY
FISHER BODY, GMC, NEAR TECUMSEH

WATER SUPPLY AND SOURCE -- Three 12-inch wells, no. 2 (89 feet deep), no. 3 (85 feet deep), and no. 4 (76 feet deep). Wells have 20 feet of 0.025-inch slot screens.

YIELD OF WELLS (in gallons per minute) -- About 500.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) — No. 2 and 3 - 25; no. 4 - 30.

PUMPAGE IN 1969 -- 19.7 million gallons.
MAXIMUM DAY -- 0.11 million gallons.

STORAGE FACILITIES --

QUALITY OF WATER --

| | | |
|---|---|---|
| Hardness | 415-525 | mg/1 |
| Iron | 2.2-4.2 | mg/1 |
| Fluoride | 0.2 | mg/1 |

TREATMENT --

POPULATION SERVED --

PER CAPITA USE --

REMARKS -- At the Fisher Body well field in Lenawee County, water levels in the observation well respond principally to variations in precipitation as pumpage withdrawals from the field have been light. Some increase in pumping occurs during the summer months when water is used for irrigation.

Water levels in the observation well in 1969 rose to a new high of record as the result of increased precipitation (fig. 32).

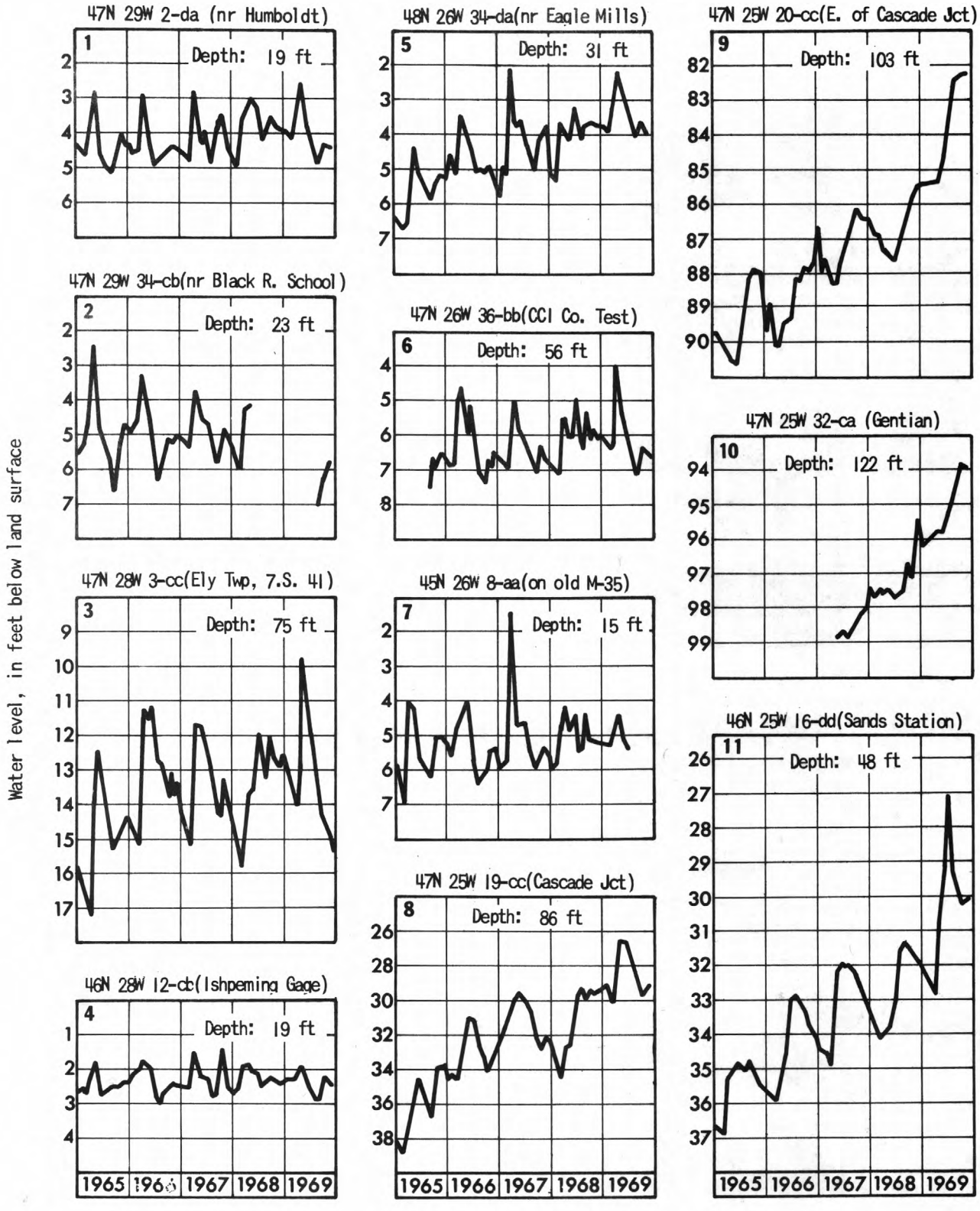


Figure 33.--In the Marquette County Iron Range area (see map, fig. 35), water levels in observation wells finished in glacial drift are being monitored as a basis for evaluating possible effects from future industrial development.

REMARKS -- Measurement of ground-water levels in the Marquette Iron Range was continued in 1969. However, the number of observation wells measured was reduced from 12 to 11.

The observation wells are all finished in glacial drift (fig. 33) and the water levels fluctuate in response to natural climatic conditions. Deficient precipitation in 1969 (fig. 34) resulted in lower stages in the shallower wells. However, in the deeper wells, 1969 levels were generally the highest of the record probably the result of above average precipitation in the two previous years.

The observation wells are located throughout the area (fig. 35) to obtain a general view of ground-water level conditions.

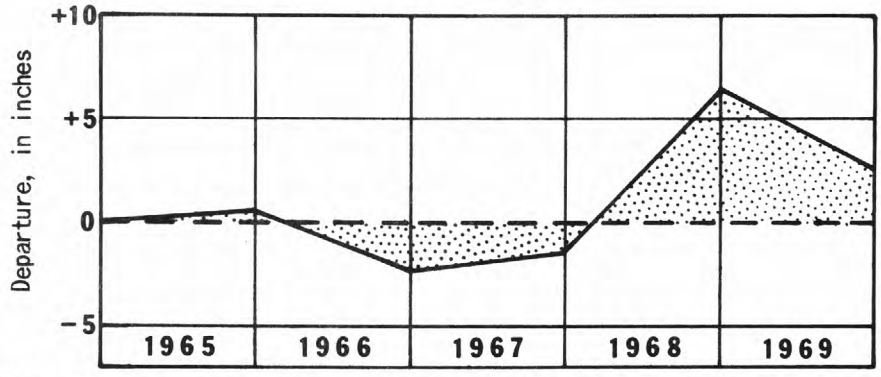


Figure 34.--Cumulative departure of precipitation from normal in West Upper Climatological Division of Michigan.

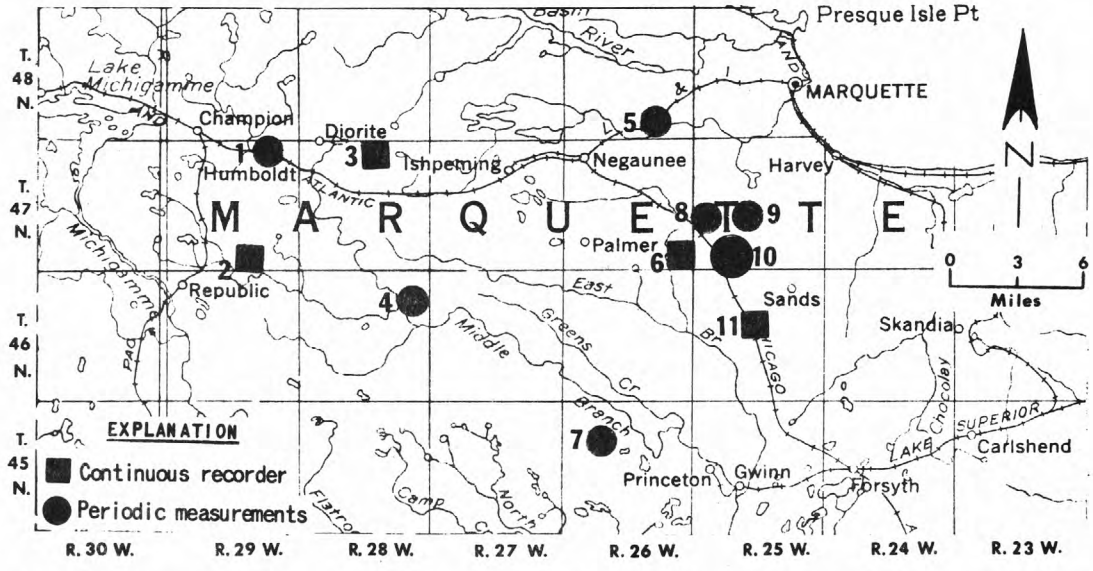


Figure 35.--Location of observation wells in the Marquette Iron Range area.

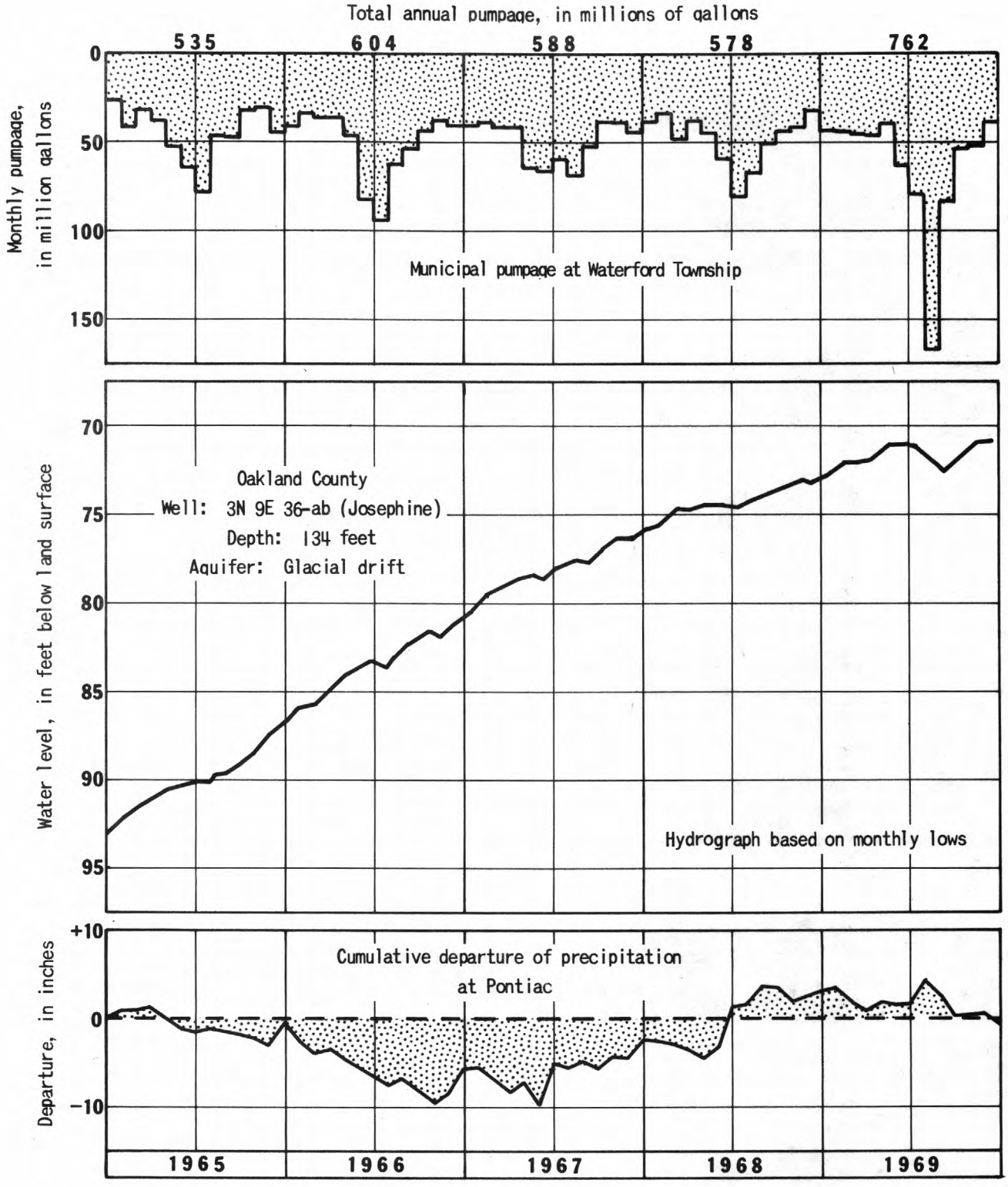


Figure 36.--At Waterford Township, water levels in the observation well continued to rise as a result of the discontinuance of pumping of ground water in 1963 by the neighboring City of Pontiac.

OAKLAND COUNTY - WATERFORD TOWNSHIP

WATER SUPPLY AND SOURCE -- 13 wells, 85 to 327 feet deep, tapping the glacial drift.

YIELD OF WELLS (in gallons per minute) -- 300 to 1,750.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) -- 26 to 88.

PUMPAGE IN 1969 -- 762 million gallons.

MAXIMUM DAY --

STORAGE FACILITIES -- 8,250,000 gallons elevated.

QUALITY OF WATER -- Hardness 283-300 mg/l
Iron 1.4-2.3 mg/l

TREATMENT -- Phosphate and chlorination.

POPULATION SERVED -- 18,000 estimated.

PER CAPITA USE -- 116 gallons per day.

REMARKS -- At Waterford Township, water levels continued to rise in the observation well during 1969. The rise in 1969, occurred despite increased township pumping and a decrease in precipitation (fig. 36). Water levels have been recovering in this area since 1963 when the City of Pontiac discontinued the use of wells and began using water from the Detroit system. Water levels have risen about 62 feet since pumpage was discontinued.

Pumpage in Waterford Township in August of 1969 was the largest of any month since the beginning of the water-supply system.

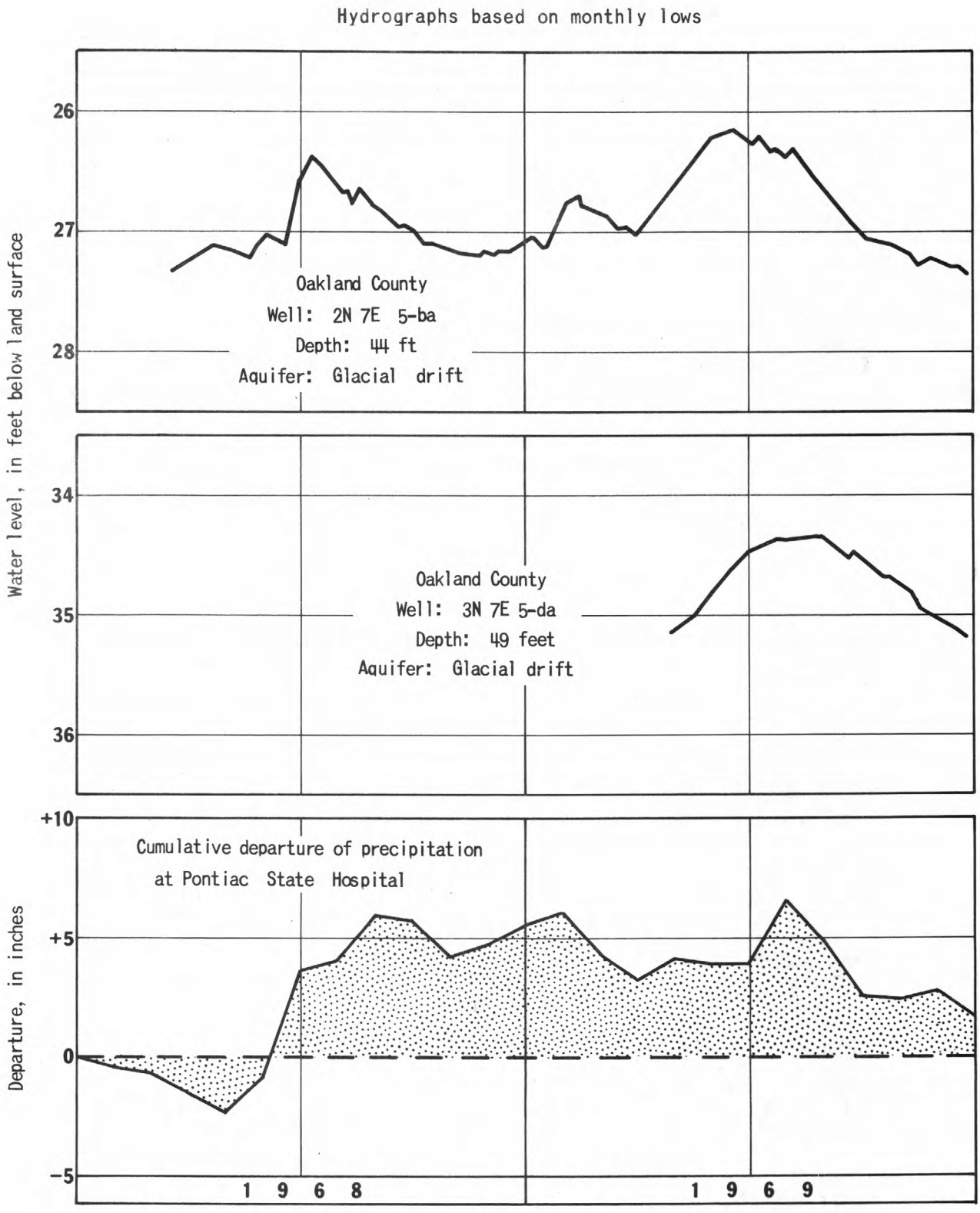


Figure 37.-- In Oakland County, water levels in two wells on American Aggregates Corporation property closely follow trends of precipitation.

REMARKS -- In Oakland County, water levels in two observation wells on American Aggregates Corporation property respond to natural climatic conditions. For example, water levels in well 5-ba (top hydrograph, fig. 37) show a small net loss for the year 1969, in response to below average precipitation during the year.

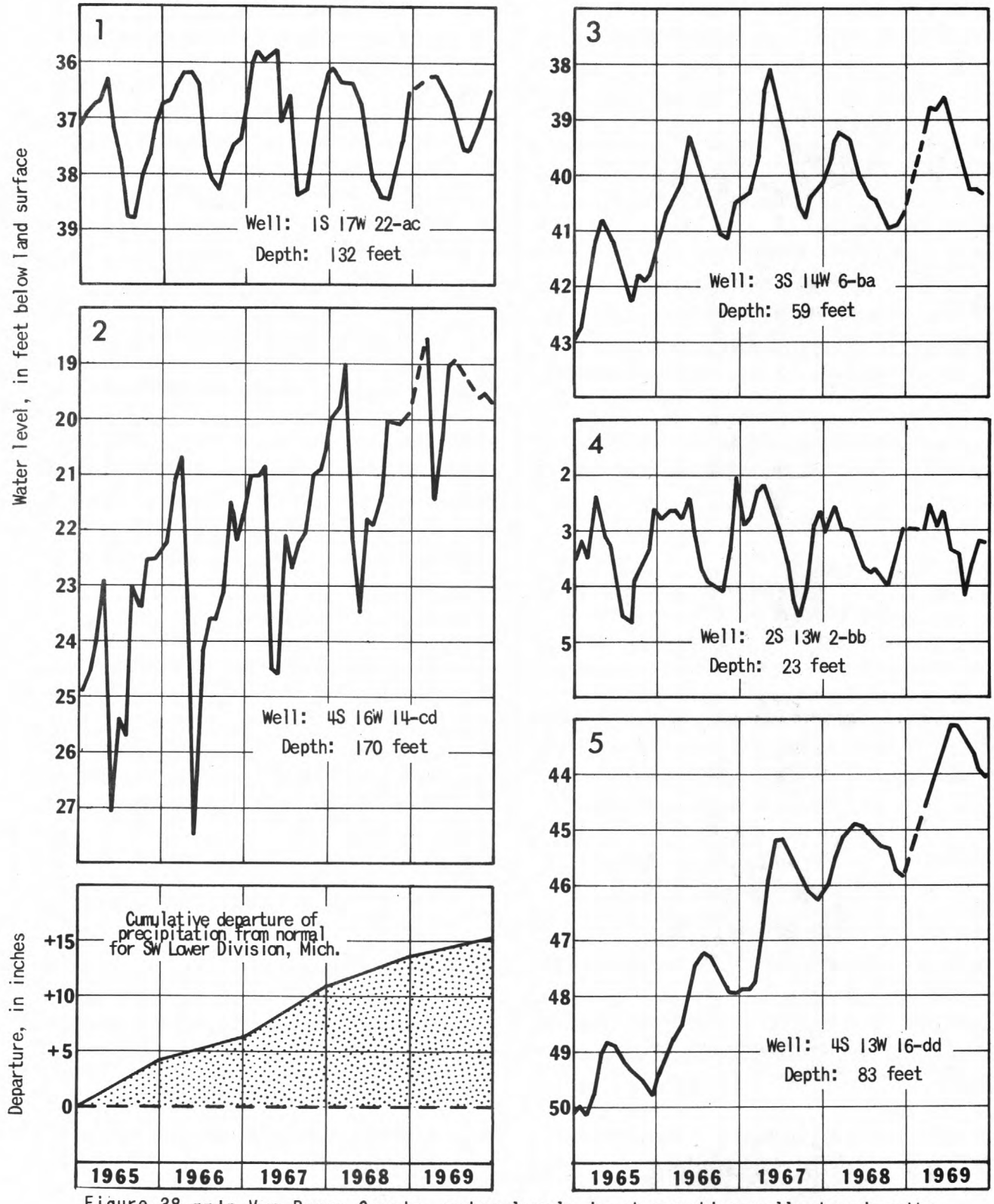


Figure 38.--In Van Buren County, water levels in observation wells tapping the glacial drift, rose to new highs in the 1967-69 period as a result of above-normal precipitation.

## VAN BUREN COUNTY

REMARKS -- In Van Buren County, water levels in observation wells (fig. 38) rose as a result of above average precipitation over the past five years. Water levels in two of the wells rose to record high stages in 1969 (table 1, Branch Co.). In 4 of the 5 wells, 1969 year-end levels were higher than at the end of 1968.

Water levels in well "2" are affected by irrigation and industrial pumpage, but the general trend is similar to trends of water levels in other wells in the County.

The distribution of observation wells in the County is shown in figure 39.

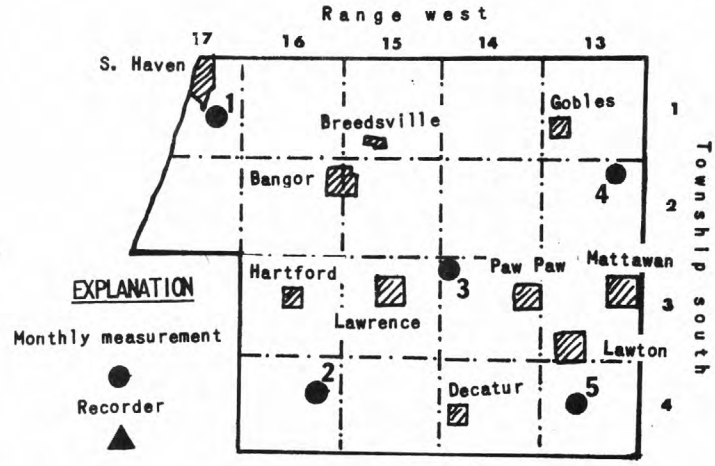


Figure 39.--Location of observation wells in Van Buren County.

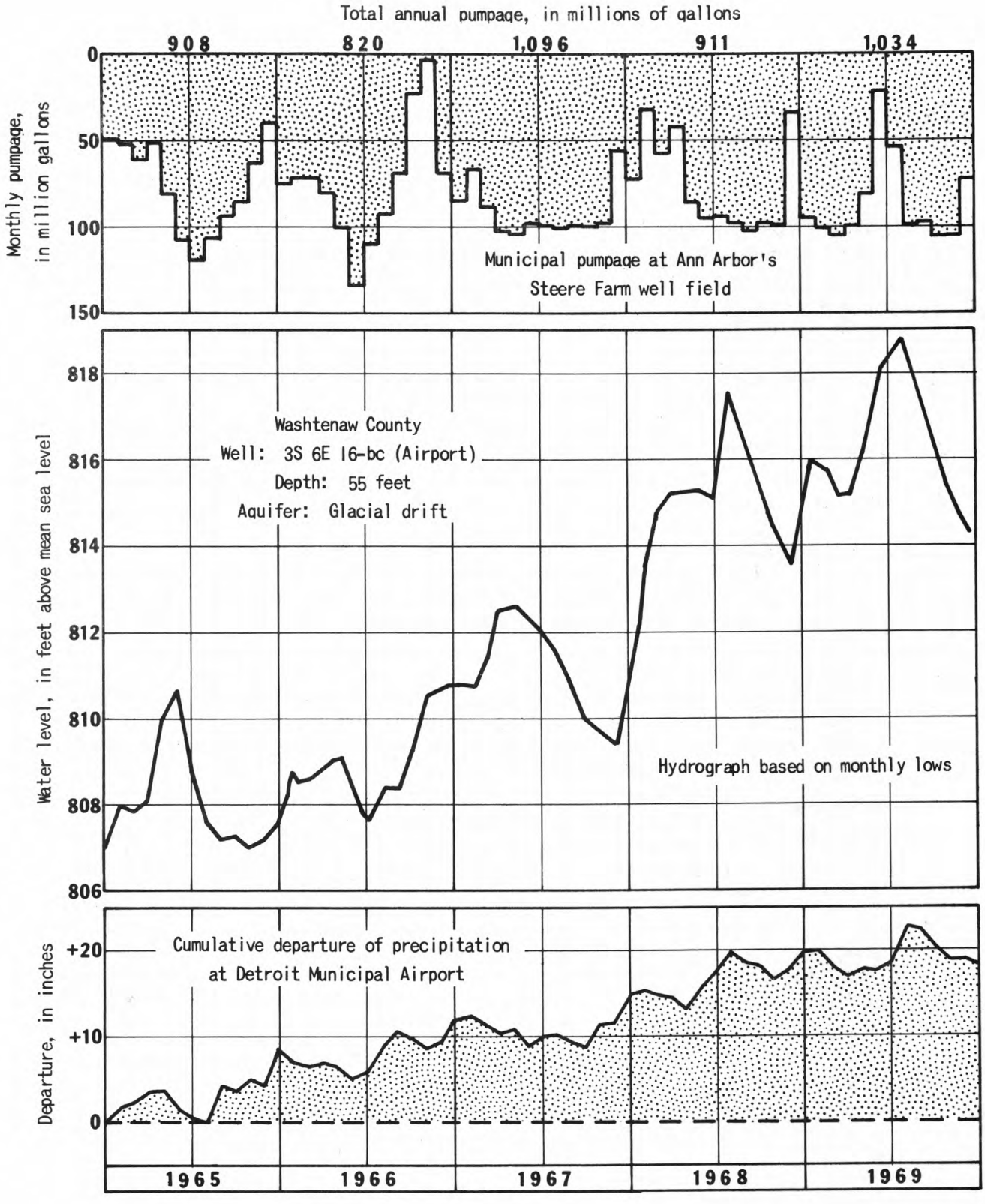


Figure 40.--At Ann Arbor's municipal well field, south of the City, water levels in the observation well continued to rise and were at record high stages in 1969, principally the result of above average precipitation during the 1965-69 period.

WASHTENAW COUNTY - CITY OF ANN ARBOR

WATER SUPPLY AND SOURCE --Three wells, 91 to 196 feet deep, finished in glacial drift; and water from the Huron River.

YIELD OF WELLS (in gallons per minute) -- 1,050 to 4,860.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) — About 20 to 600.

PUMPAGE IN 1969 -- Total 5,290 million gallons - surface water and ground water. (1,251 million gallons ground water).

MAXIMUM DAY -- 25.22 million gallons. 4,039

STORAGE FACILITIES -- Treatment plant: 6,057,000 gallons
Ground level on system: 6,200,000 gallons.
Elevated storage: 1,000,000 gallons.

QUALITY OF WATER -- Treated water: Hardness 95 mg/l Iron 0.0.
Ground water: Hardness 355-585; Iron 0.25 - 2.4.

TREATMENT -- Lime and soda ash softening, fluoridation, chlorination and filtration.

POPULATION SERVED -- 98,000 estimated.

PER CAPITA USE -- 148 gallons per day total surface and ground water.

REMARKS -- At Ann Arbor, water levels in the observation well rose to the highest of record for the second consecutive year (fig. 40). Most ground-water pumping by the City occurs at the Airport, south of the City, where the observation well is located.

Despite the high stages in July, water levels at the end of 1969, were slightly below the levels at the end of 1968, the result of increased pumping and below average precipitation.

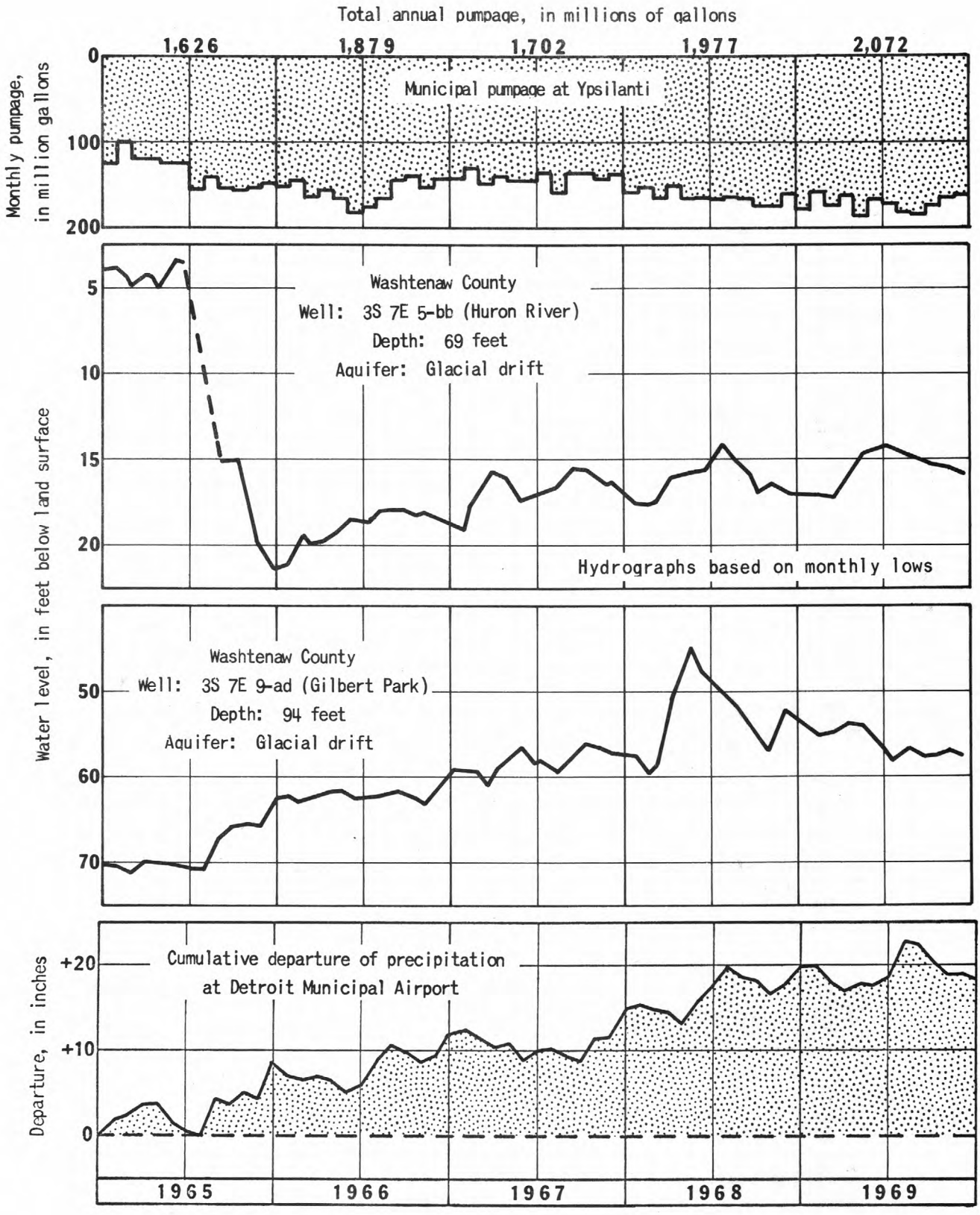


Figure 41.--As the result of above average precipitation, water levels in the observation wells at Ypsilanti showed a general rising trend, despite increased municipal pumpage.

WASHTENAW COUNTY - CITY OF YPSILANTI

WATER SUPPLY AND SOURCE -- Obtained from seven wells, 87 to 102 feet deep, finished in glacial drift.

YIELD OF WELLS (in gallons per minute) -- 450 average for 5 of the wells--wells are not metered individually.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) -- 25 to 180, estimated.

PUMPAGE IN 1969 -- 2,072 million gallons.

MAXIMUM DAY -- 7.23 million gallons.

STORAGE FACILITIES -- Treated water at plant 2,000,000 gallons. Elevated storage 1,250,000.

QUALITY OF WATER --

| | | | |
|---|---|---|---|
| Treated water: | Hardness | 86 mg/1 | Iron 0.0 mg/1 |
| Raw water: | Hardness | 305-320 mg/1 | |
| | Iron | 1.2-1.6 mg/1 | |
| | Fluoride | 0.3 mg/1 | |

TREATMENT -- Lime softening, and iron removal.

POPULATION SERVED -- 28,000 estimated.

PER CAPITA USE -- 203 gallons per day.

REMARKS -- Water levels in both observation wells at Ypsilanti (fig. 41), are primarily influenced by municipal ground-water withdrawals. The long-term trends, however, correlate with trends of precipitation. Notice that after the initial decline in water levels caused by the start of pumping from nearby wells, water levels in the Huron River observation well closely correspond to the graph of precipitation.

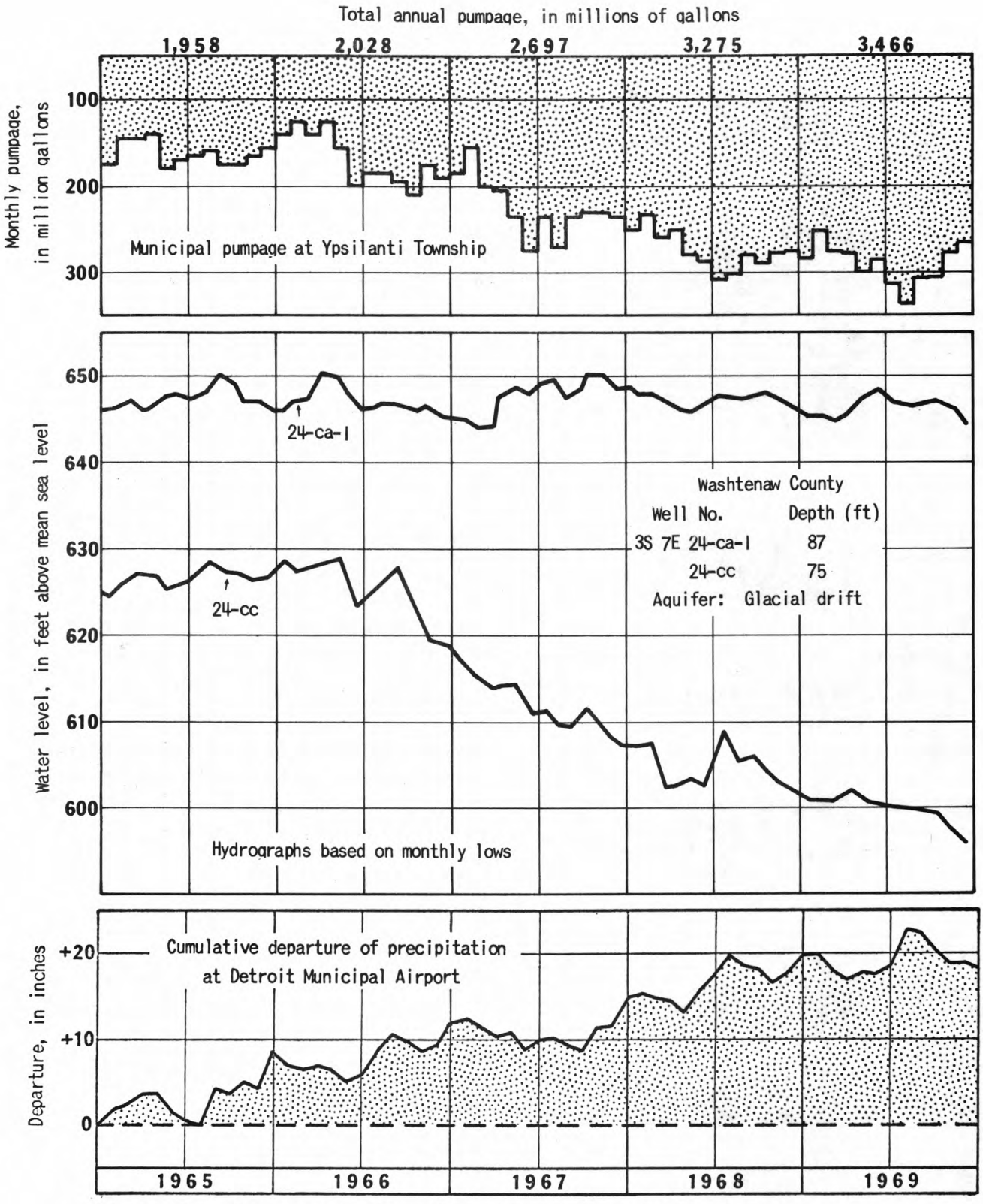


Figure 42.--At Ypsilanti Township's well field, water levels in the observation wells are affected by pumpage from the well field. Levels in well 24-cc fell to new lows of record as pumpage continued to increase.

WASHTENAW COUNTY - YPSILANTI TOWNSHIP

WATER SUPPLY AND SOURCE -- Eight wells, 50 to 95 feet deep, finished in glacial drift.

YIELD OF WELLS (in gallons per minute) -- 700 to 3,500.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) --

PUMPAGE IN 1969 -- 3,466 million gallons.
MAXIMUM DAY -- 14.36 million gallons.

STORAGE FACILITIES -- 2,000,000 gallons ground storage.

QUALITY OF WATER --

| Treated: | | Raw: | |
|---|---|---|---|
| Hardness | 88 mg/1 | Hardness | 280-355 mg/1 |
| Iron | 0 mg/1 | Iron | 0.3-1.8 mg/1 |
| Fluoride | 0.1 mg/1 | Fluoride | 0.1-0.6 mg/1 |

TREATMENT -- Lime softening, chlorination.

POPULATION SERVED -- 30,000 estimated.

PER CAPITA USE -- 316 gallons per day.

REMARKS -- At Ypsilanti Township's well field, water levels have declined despite above average precipitation since 1965 (fig. 42).

During the period illustrated, pumpage has increased from 1,958 to 3,466 million gallons and is the cause of the decline in water levels. Changes in water level in observation well 24-ca-1 (fig. 40) is small for the period shown, as this well is further from the pumping wells. However, since 1950 water levels in this well have fallen over 10 feet (table 1, Washtenaw Co.).

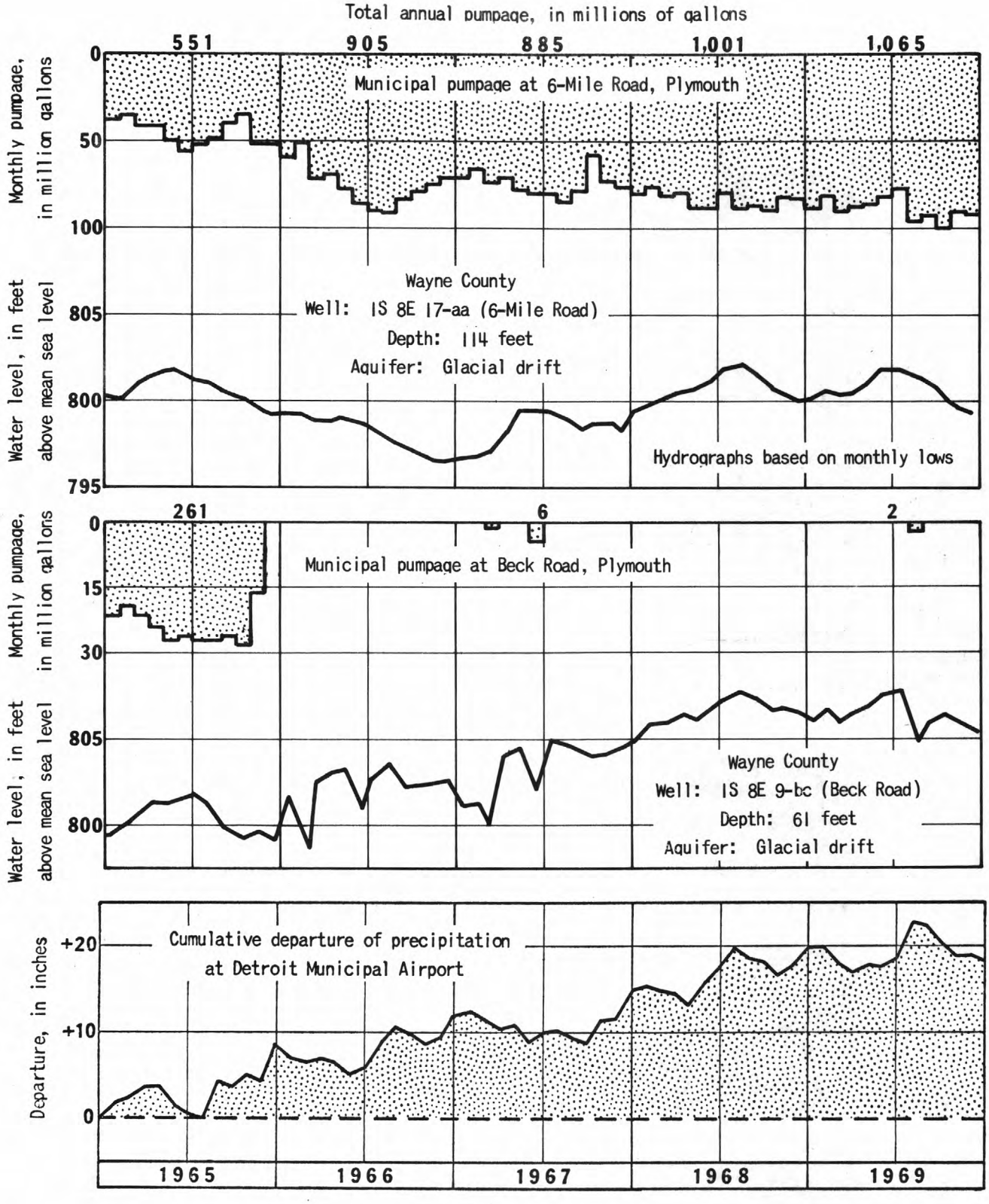


Figure 43.--At Plymouth's 6-Mile and Beck Road well fields, water levels in the observation wells fell slightly in 1969. Precipitation appears to have more effect on water levels than does pumpage.

WAYNE COUNTY - CITY OF PLYMOUTH

WATER SUPPLY AND SOURCE -- Six wells, 20 to 110 feet deep, finished in glacial drift and located at three well fields.

YIELD OF WELLS (in gallons per minute) -- 500 to 2,400.

SPECIFIC CAPACITY OF WELLS (in gallons per minute per ft of drawdown) — 84 to 700.

PUMPAGE IN 1969 -- 1,145 million gallons.
MAXIMUM DAY -- 3.65 million gallons.

STORAGE FACILITIES -- 2,000,000 gallons storage reservoir.

QUALITY OF WATER --

| | |
|---|---|
| Hardness | 325-395 mg/l |
| Iron | 0.1-1.1 mg/l |
| Fluoride | 0.2-0.4 mg/l |
| Chloride | 31-59 mg/l |

TREATMENT -- Chlorination, fluoridation, phosphate.

POPULATION SERVED -- 11,000 estimated.
PER CAPITA USE -- 285 gallons per day.

REMARKS -- At Plymouth, water levels in the observation well at the Beck Road field have closely followed trends in precipitation since the discontinuance of pumping at this field (fig. 43).

Water levels in the observation well at 6-Mile Road field are heavily influenced by pumping on a day to day basis, but long-term trends also follow precipitation trends. Despite the increased pumpage at 6-Mile, water levels in the observation well were about the same at the end of 1969 as they were at the beginning of 1965. Some decline in water levels would probably have occurred if above average precipitation for the 5-year period had not occurred.

# TABLE 1. RECORDS OF MICHIGAN OBSERVATION WELLS.

COUNTY AND WELL NUMBER: For explanation of well numbers see text under - Introduction "Well numbering system".
OWNER: MDNR - Mich. Dept. of Natural Resources; WMP - Wisconsin-Michigan Power Co.; MSHD - Mich. State Highway Dept.; USFS - U. S. Forest Service; HCMA - Huron-Clinton Metropolitan Authority; BCRC - Branch County Road Commission; LCRC - Luce County Road Commission.
AQUIFER:

Qgd - Glacial drift deposits of Pleistocene (Quaternary) age
IPs - Saginaw Formation of Pennsylvanian age
Mb - Bayport Limestone of Mississippian age
Mm - Marshall Formation of Mississippian age
Dt - Traverse Group of Middle and Late Devonian age
Ss - Salina Formation of Late Silurian age
Sm - Manistique Dolomite of Middle Silurian age
Or - Limestones of Richmond age (Late Ordovician)
Otb - Black River and Trenton Limestones of Middle Ordovician age
Op - Prairie du Chien Group of Early Ordovician age (previously designated as Au Train Formation)
€m - Munising Sandstone of Cambrian age
p€f - Freda Sandstone of Keweenawan age (Precambrian)
Pgr - Grand River Group of Pennsylvanian age

ALTITUDE: Land-surface datum in feet above mean sea level.
OBSERVED WATER-LEVEL EXTREMES: In feet below or above (+) land surface. 1969 measurements underscored are extremes for entire record.
FREQUENCY OF MEASUREMENT: R - Continuous recorder; D - Daily; W - Weekly; M - Monthly; Q - Quawterly; S - Semiannually; A - Annually; I - Intermittent.
REMARKS: P - Water levels affected by pumping. Water-level measurements are made by the U. S. Geological Survey unless otherwise noted.

| COUNTY AND WELL NUMBER (TWP. RANGE. SECTION) | OWNER OR OTHER DESIGNATION | DEPTH (ft) | DIAMETER (in) | AQUIFER | ALTITUDE | YEARS OF RECORD | FREQUENCY OF MEAS., 1969 | OBSERVED WATER-LEVEL EXTREMES | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | THROUGH 1968 | | IN 1969 | | |
| | | | | | | | | HIGH DATE | LOW DATE | HIGH DATE | LOW DATE | |
| ALGER COUNTY | | | | | | | | | | | | |
| 45N 19W 25-bd | USFS (former CCC camp) | 66 | 6 | Qgd | 850 | 11 | Q | 6.4 June 1960 | 14.2 Apr. 1964 | 10.1 July | 11.2 Jan | |
| ALLEGAN COUNTY | | | | | | | | | | | | |
| 3N 14 W 23-dd | Allegan State Game Area | 41 | 1 | Qgd | 700 | 4 | M | 9.5 Dec 1965 | 13.3 Nov 1967 | 11.2 May | 13.3 Nov | |
| BARAGA COUNTY | | | | | | | | | | | | |
| 49N 33W 18-ca | Mich. Tech. Univ. | 12 | 16 | Qgd | 1,320 | 9 | R | 4.9 Apr 1960 | 9.4 Feb 1959 | 5.8 Apr | 9.3 Jan | |
| 48N 32W 12-dd | MSHD (WMP 14) | 10 | 1 | Qgd | 1,630 | 22 | M | 3.3 Apr 1965 | 7.6 Oct 1967 | 6.2 Apr | 8.1 Sept | |
| BARRY COUNTY | | | | | | | | | | | | |
| 3N 10W 3-da | MDNR (Shaw L. Rd) | 53 | 2 | Qgd | 760 | 6 | Q | 35.1 Aug 1967 | 36.4 Jan 1965 | 35.3 Apr | 36.6 Jan | |
| 4N 9W 5-da | MDNR (Solomon Rd) | 131 | 2 | Qgd | 860 | 6 | Q | 119.3 Jan 1964 | 122.0 Mar 1965 | 120.0 July | 120.4 Apr | |
| BAY COUNTY | | | | | | | | | | | | |
| 17N 4E 15-dc | Pinconning Twp. (Twp. Hall) | 61 | 2 | Ps | 610 | 8 | Q | +1.1 Apr 1967 | 5.0 Aug 1962 | +0.4 Apr | 0.1 Oct | |
| 22-ad | Sterling Tube Co. (Horn Rd) | 170 | 6 | Ps | 620 | 8 | M | 5.7 Dec 1968 | 13.0 Sept 1962 | 5.4 Jan | 7.3 Sept | |
| 22-dc | Pinconning Twp (2nd St) | 110 | 6 | Ps | 620 | 8 | R | 0.9 Dec 1968 | 10.5 Aug 1963 | 0.7 Dec | 5.0 Aug | |
| BRANCH COUNTY | | | | | | | | | | | | |
| 5S 6W 22-aa | MSHD (U. S. 27) | 27 | 1 | Qgd | 950 | 6 | M | 11.2 Feb 1968 | 16.3 Nov 1964 | 10.6 June | 13.8 Nov | |
| 8W 28-db | BCRC (Sherwood) | 42 | 1 | Qgd | 880 | 5 | M | 14.8 Feb 1968 | 18.9 Nov 1965 | 13.8 June | 16.2 Nov | |
| 6S 6W 19-bb | Coldwater Twp. (Test 1) | 56 | 6 | Qgd | 950 | 6 | M | 22.1 Feb 1968 | 28.3 July 1964 | 21.0 July | 23.3 Nov | |
| 22-ca | City of Coldwater (test for No. 4) | 113 | 6 | Qgd | 970 | 6 | R | 10.0 May 1967 | 24.1 Aug 1964 | 10.2 Feb | 20.8 Sept | P |
| 8S 5W 6-ab | Chipman (Calif. No. 2 School) | 55 | 4 | Qgd | 1,032 | 6 | M | 13.9 Feb 1968 | 19.4 Dec 1964 | 13.9 May | 17.0 Nov | |
| 8W 17-cd | Bronson School (Trayer Rd) | 38 | 1 | Qgd | 917 | 6 | M | 13.1 May 1966 | 16.3 Nov 1964 | 13.3 May | 16.2 Nov | |
| CALHOUN COUNTY | | | | | | | | | | | | |
| 1S 7W 10-bb | K Sabin (M 78) | 12 | 15 | Qgd | 907.99 | 24 | W | 0.9 Mar 1950 | 7.2 Dec 1964 | 2.8 Feb | 4.4 Dec | Meas. by owner |
| 2S-bd | Penfield Twp (Hopkins St) | 95 | 6 | Mm | 845 | 6 | R | 21.2 Apr 1968 | 27.0 Aug 1964 | 19.6 Dec | 22.4 Sept | P |
| 2S-da | City of Battle Creek (Verona 22) | 127 | 8 | Mm | 830.79 | 31 | D | 0.7 Apr 1950 | 16.8 July 1959 | 6.1 Dec | 12.4 Oct | P, Meas. by owner |
| 2S 6W 25-aa | City of Marshall (Ferguson) | 59 | 6 | Mm | 904.85 | 20 | M | 5.5 May 1950 | 9.7 Aug 1964 | 7.0 June | 7.9 Sept | P, Meas. by owner |
| 2S 2-db | Oliver Elec. Mfg. Co. (Angell St) | 92 | 10 | Mm | 819.99 | 24 | Q | 4.8 Apr 1947 | 15.6 Mar 1964 | 14.0 Apr | 15.1 Oct | P |
| 1S-ac | Battle Creek Twp. (Territorial Rd) | 148 | 8 | Mm | 917 | 6 | R | 0.3 May 1967 | 12.0 Aug 1966 | +0.7 May | 10.0 Sept | P |

## TABLE 1. RECORDS OF MICHIGAN OBSERVATION WELLS. (CONTINUED)

| COUNTY AND WELL NUMBER TWP., RANGE, SECTION | OWNER OR OTHER DESIGNATION | DEPTH (ft) | DIAMETER (in) | AQUIFER | ALTITUDE | YEARS OF RECORD | FREQUENCY OF MEAS., 1969 | OBSERVED WATER-LEVEL EXTREMES | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | THROUGH 1968 | | IN 1969 | | |
| | | | | | | | | HIGH DATE | LOW DATE | HIGH DATE | LOW DATE | |
| CASS COUNTY | | | | | | | | | | | | |
| 8S 14W 17-ba | T. Little (Starbrick Rd) | 55 | 28 | Qgd | 840 | 25 | W | 46.2 July 1950 | 55.0 Mar 1957 | 47.7 July | 50.1 Mar | |
| CHARLEVOIX COUNTY | | | | | | | | | | | | |
| 32N 4W 10-da | MDNR(33) (Thumb Lake) | 17 | 2 | Qgd | 1,060 | 30 | M | 1.2 Mar 1958 | 7.4 Feb 1959 | 1.5 May | 3.7 Mar | |
| 33N 4W 2-ac | MDNR(Wolverine CCC) | 94 | 6 | Qgd | 970 | 22 | Q | 69.5 July 1960 | 75.8 Apr 1956 | 70.1 Oct | 73.8 Apr | |
| CHEBOYGAN COUNTY | | | | | | | | | | | | |
| 33N 1W 22-cd | MDNR(Cornwall Lake impoundment) No. 4 | 15 | 1 | Qgd | 863 | 4 | M | 1.5 Apr 1967 | 6.2 Oct 1966 | 1.8 May | 3.8 Aug | |
| 22-dc | Do. No. 5 | 19 | 1 | Qgd | 866 | 4 | M | 2.5 Apr 1967 | 8.3 Oct 1966 | 2.9 Apr | 5.6 Oct | |
| 26-bb | Do. No. 1-B | 42 | 1 | Qgd | 915 | 4 | M | 31.0 Aug 1967 | 34.8 Mar 1967 | 31.1 July | 33.6 Mar | |
| 26-da | Do. Pigeon R. CCC | 164 | 6 | Qgd | 933 | 4 | R | 57.1 May 1968 | 61.8 Nov 1966 | 57.1 June | 58.6 Jan | |
| 27-ab | Do. No. 6 | 20 | 1 | Qgd | 862.22 | 4 | M | 8.2 June 1968 | 18.1 Nov 1966 | 4.0 Apr | 5.0 Jan | |
| 27-ba | Do. No. 11 | 82 | 1 | Qgd | 863.8 | 4 | M | 9.3 Jan 1966 | 13.3 Dec 1967 | 9.8 Aug | 11.4 Jan | |
| 27-cb | Do. No. 7 | 32 | 1 | Qgd | 853.5 | 4 | M | 18.6 Apr 1967 | 21.0 Nov 1966 | 18.9 May | 20.3 Mar | |
| 27-cc | Do. No. 8 | 37 | 1 | Qgd | 886 | 4 | M | 24.0 Aug 1967 | 27.4 Mar 1966 | 24.2 Sept | 26.0 Mar | |
| 27-db | Do. No. 9 | 32 | 1 | Qgd | 881.5 | 4 | M | 18.5 July 1967 | 23.0 Jan 1967 | 18.7 June | 20.6 Mar | |
| 27-dc | Do. No. 10 | 32 | 1 | Qgd | 879.5 | 4 | M | 16.0 Aug 1967 | 19.4 Feb 1966 | 16.1 Aug | 17.9 Mar | |
| 34-aa | Do. No. 12 | 22 | 1 | Qgd | 850 | 4 | M | 7.6 Dec 1967 | 9.9 Oct 1966 | 8.2 May | 9.4 Oct | |
| 34N 1W 1-cb | MDNR (7) (M-68) | 11 | 2 | Qgd | 780 | 24 | Q | 2.8 Mar 1938 | 5.6 Oct 1955 | 3.6 July | 4.3 Oct | |
| CLINTON COUNTY | | | | | | | | | | | | |
| 5N 1W 24-bd | MDNR (Rose Lake) | 40 | 2 | Qgd | 870 | 6 | Q | 29.6 Apr 1968 | 32.2 Sept 1964 | 29.3 July | 30.3 Oct | |
| 2W 31-cb | Mich. Dept. of Aeronautics (Airport) | 195 | 6 | Pms | 850 | 12 | R | 45.0 Mar 1949 | 66.4 Jan 1967 | 63.2 Dec | 65.1 Jan | P |
| 32-dc | Mich. Health Dept. (Quarantine Farm) | 135 | 4 | Pms | 849.21 | 26 | M | 42.0 Sept 1944 | 99.2 May 1966 | 96.4 Jan | 98.9 Oct | P |
| 6N 1W 3-bb-1 | MDNR(Sleepy Hollow impoundment) No. 6 | 42 | 1 | Qgd | 784.77 | 4 | I | 8.6 May 1967 | 12.8 Nov 1966 | 7.7 May | 10.5 Sept | |
| 3-bb-2 | Do. No 5 | 62 | 1 | Qgd | 814.05 | 4 | I | 41.4 Apr 1968 | 43.3 Nov 1966 | 40.8 May | 41.7 Oct | |
| 4-da | Do. No. 4 | 57 | 1 | Qgd | 817.74 | 4 | I | 39.4 Apr 1968 | 41.7 Jan 1966 | 38.7 Sept | 39.6 Mar | |
| 9-dc | Do. No. 14 | 32 | 1 | Qgd | 797 | 4 | I | 1.6 Apr 1967 | 6.5 Sept 1967 | 0.7 Apr | 5.8 Sept | |
| 9-dd | Do. No. 1 | 22 | 1 | Qgd | 789.15 | 4 | I | 3.5 Apr 1967 | 5.2 Sept 1966 | 3.0 Apr | 4.6 Oct | |
| 10-ad | Do. No. 12 | 37 | 1 | Qgd | 802.98 | 4 | I | 5.0 Apr 1968 | 11.8 Nov 1966 | 4.8 Apr | 9.2 Oct | |
| 10-ba | Do. No. 3 | 42 | 1 | Qgd | 792.48 | 4 | I | 6.0 Mar 1966 | 11.6 Nov 1966 | 4.3 Apr | 10.7 Oct | |
| 10-bc | Do. No. 2 | 32 | 1 | Qgd | 801.38 | 4 | I | 17.3 May 1967 | 19.8 Nov 1966 | 16.4 May | 18.1 Oct | |
| 10-dd | Do. No. 13 | 32 | 1 | Qgd | 815 | 4 | I | 12.7 May 1967 | 18.4 Aug 1966 | 12.3 May | 15.5 Oct | |
| 15-cc | Do. No. 15 | 17 | 1 | Qgd | 805 | 4 | I | 2.9 May 1967 | 5.4 Aug 1966 | 1.8 May | 3.4 Mar | |
| 6N 2W 16-dd | MSHD (U.S. 27) | 23 | 14 | Qgd | 803.32 | 22 | M | 14.6 Apr 1952 | 19.9 Feb 1964 | 16.0 May | 17.9 Nov | Fed Key well |
| 7N 1W 34-ca | MDNR(Sleepy Hollow impoundment) No. 9 | 39 | 1 | Qgd | 793.84 | 4 | I | 16.4 June 1968 | 21.7 Dec 1966 | 14.9 May | 18.2 Oct | |
| 34-cb | Do. No. 10 | 62 | 1 | Qgd | 787.22 | 4 | I | 21.0 May 1967 | 23.2 Nov 1966 | 20.6 May | 22.2 Oct | |
| 34-cc | Do. No. 7 | 32 | 1 | Qgd | 785.34 | 4 | I | 17.9 Apr 1968 | 20.0 Nov 1966 | 17.7 May | 19.2 Oct | |
| 34-cd | Do. No. 8 | 28 | 1 | Qgd | 783.39 | 4 | I | 15.8 Apr 1968 | 18.9 July 1967 | 15.4 May | 17.2 Oct | |

## TABLE 1. RECORDS OF MICHIGAN OBSERVATION WELLS. (CONTINUED)

| COUNTY AND WELL NUMBER TWP., RANGE, SECTION | OWNER OR OTHER DESIGNATION | DEPTH (ft) | DIAMETER (in) | AQUIFER | ALTITUDE | YEARS OF RECORD | FREQUENCY OF MEAS., 1969 | OBSERVED WATER-LEVEL EXTREMES | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | THROUGH 1968 | | IN 1969 | | |
| | | | | | | | | HIGH DATE | LOW DATE | HIGH DATE | LOW DATE | |
| CLINTON COUNTY (Continued) | | | | | | | | | | | | |
| 2W 9-bb | City of St. Johns (6" test) | 535 | 6 | Ps | 743.36 | 6 | R | 52.2 May 1967 | 78.3 Aug 1968 | 57.6 Jan | 79.1 July | P |
| 8N 1W 13-bc | Village of Elsie (12" test) | 298 | 12 | Ps | 699.68 | 23 | Q | +4.2* May 1965 | 37.6 Oct 1957 | 3.6 Apr | 11.2 Oct | P, *well flowing |
| 4W 22-bd | MDNR(Maple R. Game Area) | 90 | 2 | Qgd | 680 | 6 | Q | 65.2 Aug 1967 | 70.8 Jan 1965 | 65.4 Jan | 67.8 Apr | |
| CRAWFORD COUNTY | | | | | | | | | | | | |
| 25N 1W 15-dd | USFS (Eldorado) | 56 | 6 | Qgd | 1,190 | 22 | R | 29.4 July 1960 | 36.0 Apr 1951 | 28.9 Aug | 31.5 Mar | |
| 3W 28-cc | MDNR (8) (M-76) | 13 | 1 | Qgd | 1,175.14 | 35 | Q | 8.6 July 1960 | 11.3 Oct 1958 | 10.0 Apr | 10.4 Dec | |
| 26N 4W 11-cb | MDNR(Game Refuge) | 12 | 15 | Qgd | 1,147.59 | 28 | R | 4.0 June 1943 | 9.8 Sept 1958 | 5.6 May | 9.0 Oct | |
| 27N 1W 20-cc | MDNR (22) (N. Down River Rd) | 15 | 2 | Qgd | 1,140 | 34 | Q | 1.6 July 1943 | 5.9 Oct. 1955 | 3.2 July | 4.0 Dec | |
| 4W 23-aa | MDNR (51 (U.S. 27) | 17 | 2 | Qgd | 1,180 | 30 | Q | 10.9 July 1943 | 15.6 Dec 1964 | 12.4 July | 12.9 Oct | |
| DELTA COUNTY | | | | | | | | | | | | |
| 38N 22W 24-db | USFS (3) (Peninsula Point) | 36 | 6 | Or | 585 | 12 | Q | 0.3 May 1964 | 5.5 Oct 1958 | 1.6 May | 4.5 Oct | |
| 39N 23W 28-ab | M & S. Blake (Schemmel) | 530 | 5 | Om | 680 | 12 | R | 1.3 May 1960 | 5.1 Dec 1966 | 2.6 June | 4.7 Sept | |
| 41N 18W 31-cd | C. Thompson (Isabella) | 250 | 4 | Or | 615 | 12 | Q | 3.6 June 1968 | 6.3 Feb 1961 | 3.9 May | 4.7 July | |
| 19W 17-ca | USFS (Morman Cr. CCC camp) | 58 | 6 | Or | 635 | 12 | Q | 0.0 May 1967 | 4.5 Nov 1963 | 1.0 May | 4.0 Oct | |
| 42N 18W 17-ac | USFS (Cooks CCC camp) | 60 | 6 | Qgd | 770 | 12 | Q | 21.2 May 1960 | 28.4 Mar 1966 | 22.4 May | 24.2 Jan | |
| 19W 20-aa | USFS (Pollack CCC camp) | 134 | 6 | Or | 730 | 12 | Q | 23.8 Mar 1960 | 28.0 Mar 1966 | 24.4 July | 25.4 Jan | |
| 43N 19W 24-bb | H. Clarage (FFHwy-13) | 405 | 4 | Otb | 860 | 12 | Q | 77.0 July 1960 | 88.8 Oct 1966 | 77.7 July | 79.1 Jan | |
| DICKINSON COUNTY | | | | | | | | | | | | |
| 42N 27W 33-ba | E. LaFreniere (WMP 10) | 12 | 36 | Qgd | 1,060 | 16 | M | 2.7 May 1960 | 10.8 Oct 1955 | 4.0 Apr | 10.2 Oct | Meas by WMF |
| 43N 28W 32-ad | MDNR(Felch) | 1 | 29 | Qgd | 1,160 | 4 | Q | 13.6 May 1967 | 16.8 May 1968 | 14.0 May | 15.8 Dec | |
| EATON COUNTY | | | | | | | | | | | | |
| 3N 3W 2-ba | City of Lansing (TW 63H) (Stiefel Farm) | 66 | 1 | Qgd | 839 | 6 | R | 3.1 Mar 1965 | 18.0 Nov 1968 | e4.6 Apr | 16.1 Jan | P |
| 4N 3W 12-cd | F. Wheeler (Robins Rd) | 381 | 6 | Ps | 861.91 | 17 | R | 67.5 Nov 1953 | 101.7 July 1968 | 91.1 July | 103.6 Aug | P |
| 4W 2-cc | City of Grand Ledge (Chair Co.) | 376 | 12 | Ps | 846.59 | 22 | R | 19.7 July 1968 | 30.1 Aug 1964 | 19.8 July | 23.9 Dec | P |
| 11-ab | City of Grand Ledge (Park) | 350 | 8 | Ps | 788.9 | 10 | R | +4.6 Mar 1967 | 9.1 Aug 1966 | *+4.6 July | 5.4 Sept | P *well flowing |
| GENESEE COUNTY | | | | | | | | | | | | |
| 6N 7E 9-dc | Fisher Body Div., GMC (Grand Blanc) | 235 | 6 | Ps | 841.71 | 18 | R | 37.8 Nov 1952 | 72.8 Aug 1968 | 51.4 May | 77.5 Sept | P |
| 7N 7E 32-cc | A. Arndt (Maple Rd) | 140 | 2 | Qgd | 792.27 | 24 | Q | 18.5 June 1947 | 44.4 Oct 1967 | 42.6 Apr | 48.0 Oct | P |
| GOGEBIC COUNTY | | | | | | | | | | | | |
| 48N 47W 31-dc | City of Ironwood (Big Springs) | 115 | 1 | Qgd | 1,170 | 7 | R | 12.6 June 1966 | 33.0 Jan 1966 | 17.3 Apr | 31.0 Dec | P |
| 34-da | City of Ironwood (Spring Creek Gp 3) | 22 | 6 | Qgd | 1,190 | 9 | R | +0.1 May 1962 | 4.5 Mar 1968 | +0.7 Apr | 3.8 Sept | P |
| GRAND TRAVERSE COUNTY | | | | | | | | | | | | |
| 26N 9W 13-cc | MDNR(2) (6 roads) | 13 | 2 | Qgd | 961.78 | 30 | M | 4.4 Apr 1967 | 7.9 Oct 1949 | 4.6 Apr | 6.8 Feb | |
| 11W 27-cb | MDNR(2) (Mill Rd) | 14 | 2 | Qgd | 914.25 | 29 | Q | 1.1 Apr 1962 | 4.0 Aug 1936 | 1.4 July | 2.2 Oct | |
| 27N 9W 4-ab | MDNR(18 (Williamsburg) | 15 | 2 | Qgd | 687.01 | 28 | M | 0.2 Feb 1966 | 2.5 July 1935 | 0.9 Oct | 1.4 Jan | |

# TABLE 1. RECORDS OF MICHIGAN OBSERVATION WELLS. (CONTINUED)

| COUNTY AND WELL NUMBER<br>TWP., RANGE, SECTION | OWNER<br>OR OTHER DESIGNATION | DEPTH (ft) | DIAMETER (in) | AQUIFER | ALTITUDE | YEARS OF RECORD | FREQUENCY OF MEAS., 1969 | OBSERVED WATER-LEVEL EXTREMES | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | THROUGH 1968 | | IN 1969 | | |
| | | | | | | | | HIGH DATE | LOW DATE | HIGH DATE | LOW DATE | |
| GRATIOT COUNTY | | | | | | | | | | | | |
| 9N 3W 33-ad | MDNR(Maple Rd) | 55 | 3 | Qgd | 658 | 6 | Q | 11.1 Mar 1965 | 16.6 July 1965 | 12.4 Apr | 15.5 Oct | |
| 11N 3W 3-bb | E. Waber (Prospect St.) | 49 | 2 | Qgd | 733.20 | 24 | M | 4.1 May 1968 | 36.3 Oct. 1964 | +0.9 July | 16.6 Sept | P |
| 4-ac | City of Alma (TW 6) (Pine River) | 165 | 8 | Qgd | 733.31 | 14 | R | +2.4 Jan 1968 | 31.0 July 1965 | *+2.5 Mar | 15.1 July | P *well flowing |
| 12N 2W 18-ba | Mich. Chemical Co. (Riverside Dr.) | 1,216 | 5 | Mm | 720 | 13 | M | 124.5 Dec 1968 | 267.7 Aug 1957 | 117.6 Dec | 123.7 Jan | |
| 3W 24-da | City of St. Louis (3) | 261 | 16 | Qgd | 730 | 10 | R | 37.9 Jan 1964 | 80.7 July 1967 | 68.0 May | 78.2 Nov | P |
| 35-bc | Reed Excavating Co. (Bridge St) | 20 | 36 | Qgd | 738.78 | 20 | M | 12.7 Apr 1967 | 17.9 Feb 1963 | 14.8 May | 17.2 Sept | |
| HILLSDALE COUNTY | | | | | | | | | | | | |
| 6S 3W 23-bb | City of Hillsdale TW 6 | 26 | 6 | Qgd | 1,070 | 12 | W | 1.3 Jan 1968 | 13.0 Sept 1957 | 1.0 May | 7.9 Dec | P, Meas by owner |
| 7S 2W 10-ca | Pittsford State Game Area | 20 | 1 | Qgd | 1,070 | 4 | M | 8.2 Apr 1967 | 11.1 Sept 1967 | 7.7 May | 10.0 Nov | |
| HOUGHTON CO. | | | | | | | | | | | | |
| 54N 33W 32-ca | Jerome Soumis (Chassell) | 228 | 4 | ? | 650 | 1 | I | | | 20.3 Apr | 21.8 Sept | Record started 4-69 |
| INGHAM COUNTY | | | | | | | | | | | | |
| 1N 2E 3-ab | MSHD (M-36 & M-52) | 320 | 5 | Ps | 960 | 2 | M | 27.2 Dec 1968 | 27.8 Aug 1968 | 26.2 June | 28.5 Sept | |
| 2N 1E 34-db | MDNR(Williamston Rd) | 87 | 2 | Qgd | 980 | 6 | Q | 23.5 Aug 1968 | 29.3 Oct 1964 | 22.9 Apr | 24.7 Oct | |
| 3N 1E 7-cd | M. Lotte (windmill) | 184 | 3 | Ps | 900 | 6 | M | +0.3 July 1968 | 7.0 Nov 1964 | +0.7 Apr | 3.6 Dec | |
| 4N 1E 21-cd | Duncan Lumber Co. (Sherwood) | 265 | 8 | Ps | 890 | 7 | R | 20.1 May 1967 | 23.2 Aug 1965 | 20.5 May | 22.7 Sept | |
| 2N 1W 5-bb | City of Mason (Gravel Pit) | 210 | 8 | Ps | 890 | 6 | R | 16.8 July 1968 | 23.8 Nov 1964 | 16.4 May | 19.6 Dec | P |
| 5-dd | do. (old No. 2) | 150 | 6 | Ps | 890 | 22 | W | 0.1 June 1949 | 10.7 Aug 1964 | 4.2 Jan | 8.9 Aug | P, Meas by owner |
| 4N 1W 16-da | Meridian Twp (4" test) | 398 | 4 | Ps | 841.16 | 2 | M | 6.7 Dec 1968 | 8.7 Oct. 1968 | 6.9 July | 11.3 Aug | |
| 18-ad | Marble School (Hagadorn Rd) | 175 | 3 | Ps | 847.85 | 18 | M | 20.1 Apr 1953 | 57.7 Oct 1968 | 50.6 Mar | 61.4 Nov | P |
| 4N 2W 9-bd | City of Lansing (Seymour 1) | 401 | 14 | Ps | 828.81 | 41 | R | 15.6 Mar 1931 | 179.4 Apr 1968 | 162.5 Dec | 172.8 Jan | P |
| 16-da | City of Lansing (Cedar) | 417 | 12 | Ps | 829.11 | 25 | R | 42.0 Mar 1946 | 67.0 Aug 1949 | 56.6 Aug | 62.0 Apr | P |
| 17-ab | City of Lansing (Logan) | 424 | 20 | Ps | 858.72 | 39 | R | 34.3 Dec 1929 | 168.3 May 1968 | 159.6 July | 164.3 Jan | P |
| 21-ba | City of Lansing (Townsend) | 410 | 14 | Ps | 834.10 | 43 | R | 2.0 May 1906 | 78.2 June 1966 | 68.0 Mar | 76.0 Aug | P |
| 22-bc | City of Lansing (P-5) | 338 | 12 | Ps | 823.64 | 40 | M | 7.1 July 1932 | 69.4 Dec 1966 | 64.7 June | 76.8 Dec | P |
| 24-ca | Michigan State Univ. (Spartan Village) | 453 | 10 | Ps | 853.45 | 25 | R | 25.5 Mar 1946 | 96.1 Apr 1968 | 85.0 Dec | 100.2 Aug | P |
| 27-bb | Fenner Arboretum Park | 215 | 6 | Ps | 835 | 2 | R | 52.0 July 1968 | 58.9 Dec 1968 | 57.6 July | 61.8 Apr | |
| 31-cc | C. Weber (Maybel St.) | 204 | 3 | Ps | 880.15 | 26 | M | 18.9 Apr 1952 | 34.3 Sept 1968 | 28.9 Jan | 37.4 Nov | P |
| IONIA COUNTY | | | | | | | | | | | | |
| 5N 5W 17-cd | MDNR(Morris Rd) | 98 | 2 | Qgd | 830 | 6 | Q | 85.3 July 1968 | 88.9 Nov 1964 | 84.4 July | 85.6 Jan | well destroyed 12-69 |
| 6N 5W 33-aa | Barley-Erhart Co. | 15 | 180 | Qgd | 715 | 13 | Q | 4.6 Apr 1960 | 10.7 Aug 1965 | 7.2 Jan | 10.2 Oct | |
| 7N 7W 23-bb | Mich. Tng. Unit at Ionia | 127 | 6 | Qgd | 741.65 | 10 | R | 28.0 Feb 1968 | 34.1 Oct 1961 | 29.4 Apr | 32.3 Sep | P |
| 25-ac | Ionia State Hospital | 23 | 6 | Qgd | 635.76 | 10 | R | 1.2 Mar 1962 | 15.3 Oct 1963 | 2.5 Feb | 14.6 Sept | P |
| IRON COUNTY | | | | | | | | | | | | |
| 42N 31W 33-db | Iron Co. (WMP 7) | 11 | 1 | Qgd | 1,275 | 22 | M | +0.2 May 1960 | 6.3 Oct 1948 | 0.4 Apr | 4.8 Oct | Meas. by WMP |

Bob Ives

Sanilac
St. Clair
Lapeer
Macomb
Oakland
Livingston
Wash tenaw
Wayne
Monroe
Lenawee

## TABLE 1. RECORDS OF MICHIGAN OBSERVATION WELLS. (CONTINUED)

| COUNTY AND WELL NUMBER (TWP., RANGE, SECTION) | OWNER, OR OTHER DESIGNATION | DEPTH (ft) | DIAMETER (in) | AQUIFER | ALTITUDE | YEARS OF RECORD | FREQUENCY OF MEAS., 1969 | OBSERVED WATER-LEVEL EXTREMES THROUGH 1968 HIGH | THROUGH 1968 HIGH DATE | THROUGH 1968 LOW | THROUGH 1968 LOW DATE | IN 1969 HIGH | IN 1969 HIGH DATE | IN 1969 LOW | IN 1969 LOW DATE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IRON COUNTY (Continued) | | | | | | | | | | | | | | | | |
| 43N 32W 26-ac | Cayia Mine (shaft) | 200+ | 4 | | 1,420 | 11 | Q | 29.8 | May 1960 | 39.7 | Jan 1964 | 30.2 | Apr | 36.2 | Dec | Mine drainage study |
| 35W 11-ad | J. Javoroski (WMP 23) | 47 | 36 | Qgd | 1,565 | 25 | M | 38.2 | Oct 1968 | 47.1 | Aug 1949 | 37.8 | July | 39.2 | Apr | Meas. by WMP |
| 20-dc | B. Henriksen (WMP 25) | 48 | 1 | Qgd | 1,560 | 25 | M | 41.7 | June 1953 | 48.3 | Aug 1949 | 42.1 | July | 43.2 | Apr | Do. |
| 33-bd | MSHD (WMP 34) | 12 | 1 | Qgd | 1,520 | 22 | M | 1.9 | July 1953 | 8.4 | Mar 1949 | 2.6 | June | 4.8 | Dec | Do. |
| 44N 33W 10-cc | Iron County (WMP 21) | 8 | 1 | Qgd | 1,540 | 22 | M | 2.0 | Apr 1954 | 8.0 | Feb 1964 | 2.6 | Apr | 6.8 | Oct | Do. |
| 37W 14-bb | USFS (Former CCC camp) | 102 | 6 | Qgd | 1,720 | 11 | Q | 93.8 | Nov 1960 | 96.2 | Sept 1964 | 93.4 | Dec | 94.1 | May | |
| 45N 37W 23-ac | USFS (WMP 28) | 8 | 1 | Qgd | 1,610 | 22 | M | 0.7 | Apr 1965 | 4.7 | Sept 1948 | 1.2 | May | 4.0 | Sep | Meas. by WMP |
| 46N 33W 18-bc | MSHD (WMP 17) | 12 | 1 | Qgd | 1,560 | 22 | M | 2.8 | Apr 1949 | dry | Feb 1956 | 4.0 | Apr | 7.7 | Oct | Do. |
| JACKSON COUNTY | | | | | | | | | | | | | | | | |
| 3S 1W 2-bd | City of Jackson (Hamburg St) | 400 | 12 | Ps,Mm | 935 | 4 | R | 21.0 | Dec 1968 | 62.3 | June 1967 | 21.0 | Jan | 52.1 | Aug | P |
| 10-dc | Summit Twp. (Francis St.) | 323 | 12 | Ps,Mm | 935 | 10 | R | 14.3 | Jan 1961 | 36.2 | July 1965 | 16.9 | Jan | 33.5 | Aug | P |
| 11-aa-1 | City of Jackson (4a) (Belden Rd) | 360 | 6 | Ps,Mm | 935 | 13 | D | 18.6 | Jan 1961 | 108.0 | June 1966 | 40.7 | Dec | 110.0 | Aug | P, Meas. by owner |
| 11-aa-2 | City of Jackson (Belden Rd) | 36 | 3 | Qgd | 928.82 | 8 | R | +1.5 | July 1968 | 18.2 | Nov 1964 | 0.0 | June | 4.7 | Oct | |
| KALAMAZOO CO. | | | | | | | | | | | | | | | | |
| 2S 10W 4-d | City of Kalamazoo (Campbell Lake) | 13 | 4 | Qgd | 836.5 | 1 | R | | | | | 2.4 | June | 3.0 | Mar | Record started 3-69 |
| 9-b | City of Kalamazoo (Schoonover Lake) | 21 | 6 | Qgd | 828 | 1 | R | | | | | +0.5 | June | 0.0 | Sept | Do. |
| 2S 11W 3-aa | Brown Co. (61) | 36 | 6 | Qgd | 763.18 | 14 | R | 8.3 | May 1967 | 14.0 | Aug 1967 | 8.4 | June | 11.0 | Oct | P |
| 2S 11W 10-db | General Printing | 49 | 10 | Qgd | 761 | 2 | R | 12.4 | July 1968 | 16.8 | Oct 1968 | 12.7 | July | 15.4 | Mar | |
| 14-dc | Brown Co. | 100 | 12 | Qgd | 780 | 2 | R | 10.4 | Dec 1968 | 23.3 | June 1968 | 11.8 | Apr | 24.7 | Oct | |
| 15-da | Consumers Power Co. (steam plant) | 64 | 12 | Qgd | 766.17 | 24 | R | 9.2 | Mar 1950 | 19.4 | Sept 1964 | 9.2 | Feb | 13.2 | Sept | P |
| 20-bb-2 | City of Kalamazoo Kendall (Deep) | 106 | 4 | Qgd | 880 | 2 | R | 22.4 | Dec 1968 | 47.1 | July 1968 | 19.6 | Aug | 45.4 | | P |
| 22-cd | City of Kalamazoo (Stockbridge) | 137 | 4 | Qgd | 764.7 | 10 | R | 6.7 | May 1967 | 31.1 | Aug 1961 | 6.0 | Apr | 15.5 | Sept | P |
| 23-ad | Allied Paper Co. | 43 | 12 | Qgd | 760 | 2 | R | 3.8 | July 1968 | 16.4 | Nov 1968 | 4.4 | Feb | 20.2 | Dec | P |
| 28-aa | City of Kalamazoo (Maple Station) | 245 | 4 | Qgd | 820 | 1 | R | | | | | 36.5 | Dec | 53.1 | Aug | P Record started 8-69 |
| 31-cd | City of Kalamazoo (Colony Farm Station) | 226 | 4 | Qgd | 910 | 1 | R | | | | | 54.9 | Dec | 66.1 | Aug | P Do. |
| 36-cb | City of Kalamazoo (Emerald Station) | 226 | 4 | Qgd | 860 | 1 | R | | | | | 30.0 | Dec | 47.0 | Aug | P Do. |
| 3S 11W 4-ad-1 | City of Kalamazoo (A-D) | 135 | 3 | Qgd | 854.03 | 11 | R | 0.5 | May 1967 | 12.9 | July 1964 | 0.8 | June | 8.8 | Aug | P |
| 4-ad-2 | City of Kalamazoo (A-S) | 40 | 3 | Qgd | 854.01 | 11 | R | 0.0 | Oct 1961 | 9.1 | Nov 1959 | 0.0 | June | 2.2 | Sept | P |
| 14-aa | UpJohn Co. (28) | 233 | 16 | Qgd | 870 | 3 | R | 27.5 | Feb 1968 | 45.0 | May 1967 | 28.3 | Feb | 43.4 | May | P |
| 22-bd | City of Portage (site C) | 120 | 8 | Qgd | 865 | 3 | R | 5.9 | June 1967 | 7.8 | Nov 1967 | 5.9 | June | 7.8 | Dec | P |
| 12W 11-bd | City of Kalamazoo (Atwater) | 248 | 3 | Qgd | 880 | 9 | R | +2.3 | July 1967 | 0.3 | Jan 1965 | +3.0 | Aug | +2.0 | Jan | |
| 4S 11W 3-cd | Prarie View Co. Park | 190 | 4 | Qgd | 870 | 1 | R | | | | | 19.2 | Aug | 20.0 | Dec | Record started 8-69 |
| 21-cb | W. Chamberlain (16th St) | 21 | 1 | Qgd | 863 | 4 | W | 10.6 | May 1967 | 13.8 | Dec 1968 | 10.5 | Oct | 13.4 | Jan | |
| KENT COUNTY | | | | | | | | | | | | | | | | |
| 5N 12W 4-dc | City of Wyoming (Wobma) | 86 | 6 | Qgd | 685.97 | 8 | R | 9.7 | Apr 1967 | 12.9 | Aug 1964 | 9.8 | Feb | 11.3 | Oct | |
| 6N 10W 30-aa | Kent Co. Airport | 184 | 10 | Qgd | 800 | 4 | R | 86.4 | Mar 1968 | 108.0 | Sept 1967 | 85.7 | Mar | 101.7 | Aug | P |
| 12W 17-ad-1 | Jervis Corp. (30th St.) | 30 | 12 | Qgd | 606 | 20 | M | 6.8 | Apr 1965 | 16.4 | Feb 1954 | 9.8 | Apr | 11.6 | Oct | P, Meas. by owner |

## TABLE 1. RECORDS OF MICHIGAN OBSERVATION WELLS. (CONTINUED)

| COUNTY AND WELL NUMBER TWP., RANGE, SECTION | OWNER OR OTHER DESIGNATION | DEPTH (ft) | DIAMETER (in) | AQUIFER | ALTITUDE | FREQUENCY OF MEAS., 1969 | YEARS OF RECORD | OBSERVED WATER-LEVEL EXTREMES THROUGH 1968 HIGH DATE | THROUGH 1968 LOW DATE | IN 1969 HIGH DATE | IN 1969 LOW DATE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KENT COUNTY (Continued) | | | | | | | | | | | | |
| 6N 12W 17-ad-2 | Jervis Corp. (30th St.) | 26 | 6 | Qgd | 606.05 | 20 | M | 6.8 Apr 1965 | 16.3 Feb 1954 | 9.8 Apr | 11.5 Oct | P, Meas, by owner |
| 27-bb | City of Wyoming (44th St.) | 265 | 14 | Mm | 707.24 | 8 | R | 48.8 Feb 1968 | 56.0 Aug 1964 | 48.4 May | 50.0 Oct | P |
| 10N 12W 13-dd | Rogue R. State Game Area | 30 | 1 | Qgd | 785 | 4 | M | 4.6 May 1967 | 9.1 Nov 1966 | 6.6 June | 9.2 Oct | |
| LAKE COUNTY | | | | | | | | | | | | |
| 17N 13W 4-ad | C & O R.R. (West Well) | 83 | 8 | Qgd | 840 | 13 | Q | 16.2 July 1967 | 20.4 May 1958 | 15.2 July | 17.7 Apr | |
| LAPEER COUNTY | | | | | | | | | | | | |
| 8N 10E 24-bc | Lapeer State Game Area | 24 | 1 | Qgd | 845 | 4 | M | 4.4 Apr 1968 | 10.3 Nov 1966 | 6.7 June | 9.3 Nov | |
| LENAWEE COUNTY | | | | | | | | | | | | |
| 5S 1E 12-dd | Onsted State Game Area | 39 | 1 | Qgd | 1,000 | 4 | M | 16.7 Apr 1967 | 18.8 Sept 1967 | 16.6 May | 18.0 Sept | |
| 6S 4E 8-dd | Fisher Body Div. (GMC) (Tecumseh Plant) | 81 | 8 | Qgd | 800 | 5 | R | 13.2 Aug 1968 | 18.4 Feb 1965 | 12.6 June | 14.0 Dec | P |
| LIVINGSTON COUNTY | | | | | | | | | | | | |
| 1N 3E 11-ad | MDNR (Roche Rd) | 78 | 2 | Qgd | 980 | 6 | Q | 51.6 Oct 1968 | 55.3 Jan 1965 | 50.5 July | 51.6 Jan | |
| 2N 4E 3-cb | Howell State Hospital (Deer Lake) | 375 | 8 | Pm,Mm Mb | 916.13 | 12 | R | 10.0 May 1964 | 27.8 Dec 1958 | 12.8 July | 19.6 Sept | P |
| LUCE COUNTY | | | | | | | | | | | | |
| 47N 10W 7-aa | LCRC (CR 407) | 14 | 2 | Qgd | 900 | 3 | Q | 2.5 Jan 1967 | 4.9 Oct 1967 | 1.6 Apr | 4.4 Sept | |
| 49N 11W 2-ab | State (5) (Muskallunge L.) | 7 | 1 | Qgd | 630 | 11 | Q | +0.4 May 1960 | 6.6 Dec 1963 | +0.4 Apr | 4.5 Sept | Lake Hydr. Study |
| MACKINAC COUNTY | | | | | | | | | | | | |
| 41N 5W 23-bc | MDNR (Round L. CCC camp) | 47 | 6 | Ss | 610 | 14 | Q | 4.3 May 1959 | 17.5 Mar 1959 | 6.6 Apr | 12.9 Sept | |
| 42N 2W 7-aa | USFS (Pontchartrain CCC) | 102 | 6 | Sm | 650 | 14 | R | 13.1 May 1960 | 32.2 Nov 1963 | 15.8 Apr | 27.1 Oct | |
| 9-ba | K. Kerr (Nuns Creek School) | 84 | 2 | Sm | 650 | 12 | Q | +3.3 Mar 1966 | 6.1 Oct 1966 | +3.5 Apr* | 3.9 Oct | *well flowing |
| MACOMB COUNTY | | | | | | | | | | | | |
| 4N 12E 31-bd-5 | HCMA (Auger Hole) | 72 | 2 | Qgd | 814.53 | 3 | R | 11.5 June 1968 | 16.5 Oct 1967 | 11.4 May | 14.1 Jan | Meas. disc 7-69 |
| MARQUETTE COUNTY | | | | | | | | | | | | |
| 44N 26W 28-da | MDNR (Escanaba River CCC) | 31 | 6 | Qgd | 1,120 | 16 | S | 1.9 May 1960 | 2.8 Aug 1957 | 2.5 Mar | 2.8 Aug | |
| 45N 26W 8-aa | Marquette Co. Rd Comm. (Old M-35) | 15 | 1 | Qgd | 1,220 | 7 | M | 1.4 Apr 1967 | 7.0 Mar 1965 | 4.4 May | 5.4 July | Meas. disc 7-69 |
| 46N 25W 16-dd | G. Johnson (Sands sta.) | 48 | 1 | Qgd | 1,198.43 | 7 | M | 31.4 Sep 1968 | 37.7 May 1964 | 27.1 July | 32.9 Apr | |
| 28W 12-cb | Mrs S. Hill (Ishpeming gage) | 19 | 1 | Qgd | 1,410 | 8 | M | 1.4 Oct 1967 | 3.0 Aug 1963 | 1.9 May | 2.9 Aug | |
| 47N 25W 19-cc | MDNR (Cascade Jct.) | 86 | 1 | Qgd | 1,223.11 | 7 | M | 29.2 Aug 1968 | 39.0 Feb 1965 | 26.4 May | 30.1 Mar | |
| 20-cc | MDNR (E. of Cascade Jct.) | 103 | 1 | Qgd | 1,229.78 | 7 | M | 85.4 Dec 1968 | 90.6 June 1965 | 82.2 Dec | 85.4 Feb | |
| 27-bc | A. E. Laitala | 31 | 1 | Qgd | | 1 | | | | 2.4 Aug | 10.1 Oct | |
| 32-ca | MDNR (Gentian) | 122 | 1 | Qgd | 1,239.17 | 5 | M | 95.4 Dec 1968 | 100.0 Oct 1964 | 93.8 Oct | 96.2 Feb | |
| 26W 36-bb | Cleveland Cliffs Iron Co. (test) | 56 | 8 | Qgd | 1,210 | 5 | R | 4.6 Apr 1966 | 7.5 Sept 1965 | 3.6 Apr | 7.2 Sept | |
| 27W 8-ba | Cleveland Cliffs Iron Co. (near Rock Lake) | 37 | 1 | Qgd | 1,430 | 2 | M | 4.6 Dec 1968 | 5.3 Aug 1968 | 3.6 May | 4.9 Oct | |
| 28W 3-cc | Ely Twp (U.S. 41) | 75 | 8 | Qgd | 1,571.99 | 9 | R | 11.2 Apr 1966 | 19.3 Apr 1964 | 9.9 May | 15.5 Dec | Fed. key well |

## TABLE 1. RECORDS OF MICHIGAN OBSERVATION WELLS. (CONTINUED)

| COUNTY AND WELL NUMBER<br>TWP., RANGE, SECTION | OWNER<br>OR OTHER DESIGNATION | DEPTH (ft) | DIAMETER (in) | AQUIFER | ALTITUDE | YEARS OF RECORD | FREQUENCY OF MEAS., 1969 | OBSERVED WATER-LEVEL EXTREMES | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | THROUGH 1968 | | IN 1969 | | |
| | | | | | | | | HIGH DATE | LOW DATE | HIGH DATE | LOW DATE | |
| MARQUETTE COUNTY (Continued) | | | | | | | | | | | | |
| 47N 29W 2-da | Marquette Co. Rd. Comm. (near Humboldt) | 19 | 1 | Qgd | 1,527.32 | 7 | M | 2.8 May 1965 | 5.5 Aug 1963 | 3.8 June | 4.9 Sept | |
| 34-cb | Do. (near Black River School) | | | | | | | | | | | |
| 48N 26W 34-da | Do. (near Eagle Mills) | 31 | 1 | Qgd | 1,282.99 | 7 | M | 2.0 Apr 1967 | 7.0 Apr 1964 | 2.2 May | 4.1 Sept | |
| 29W 30-cc | Van Riper State Park | 78 | 6 | Qgd | 1,560 | 1 | M | | | 11.0 June | 13.9 Nov | |
| 49N 30W 22-ac | Marquette Co. Rd. Comm (WMP 13) | 17 | 1 | Qgd | 1,680 | 22 | M | 0.6 May 1951 | 13.3 Sept 1948 | 6.6 Apr | 10.7 Sept | Meas. by WMP |
| MENOMINEE COUNTY | | | | | | | | | | | | |
| 37N 26W 19-da | MSHD (Carney) | 16 | 4 | Otb | 800 | 11 | M | 3.7 May 1960 | 7.7 July 1967 | 3.9 Mar | 7.1 Sept | |
| 41N 25W 34-ad-1 | Hanna Mining Company (LB 69-7 Lower) | | | | | 1 | M | | | +10.5 May | +6.9 Oct | Record started 3-69 |
| 34 ad-2 | Do. (LB 69-7 Upper) | | | | | 1 | M | | | +1.5 May | +0.3 Oct | Do. |
| 34-ad-3 | Do. (LB 68-1) | | | | | 2 | M | | | +7.1 May | +4.3 Oct | |
| 34 ad-1 | Do. (LB 67-1) | | | | | 2 | R | | | +10.2 May | +5.7 Sept | Record started 7-68 |
| 34 da-2 | Do. (Auger 68-2) | | 1 | Qgd | 920 | 1 | M | | | 4.3 July | 7.4 Sept | Record started 1-69 |
| 34 da-3 | Do. (Auger 68-1) | | 1 | Qgd | 920 | 1 | R | | | 2.3 Apr | 8.0 Sept | Record started 12-68 |
| 34-da-4 | Do. (LB 68-4) | | | | | 1 | M | | | 1.5 May | 2.4 Aug | Record started 5-69 |
| 35-ba | Do. (LB 69-4) | | | | | 1 | M | | | +0.9 July | 0.6 Aug | Record started 7-69 |
| 35-bb | Do. (LB 69-5) | | | | | 1 | M | | | 3.3 May | 4.7 Aug | Record started 3-69 |
| 35-bc | Do. (LB 69-1) | | | | | 1 | M | | | 0.4 May | 2.0 Aug | Do. |
| MONROE COUNTY | | | | | | | | | | | | |
| 7S 6E 15-ad | Petersburg State Game Area | 17 | 1 | Qgd | 675 | 4 | M | 3.0 Feb 1966 | 6.4 Sept 1967 | 4.1 May | 5.4 Nov | |
| MONTCALM COUNTY | | | | | | | | | | | | |
| 10N 8W 17-bb | L. Packard (Colby Rd) | 28 | 2 | Qgd | 865 | 6 | Q | 19.2 Aug 1967 | 23.5 Mar 1964 | 20.7 July | 21.9 Jan | |
| MONTMORENCY COUNTY | | | | | | | | | | | | |
| 29N 3E 21-ab | MDNR(32) (Co. Rd 612) | 14 | 2 | Qgd | 900 | 25 | Q | 2.5 July 1960 | 5.9 Jan 1956 | 3.0 July | 4.1 Apr | |
| MUSKEGON COUNTY | | | | | | | | | | | | |
| 11N 15W 34-da | Muskegon State Game Area | 31 | 1 | Qgd | 595 | 4 | M | 0.4 Feb 1966 | 4.0 Oct 1966 | 0.7 Feb | 3.6 Sept | |
| OAKLAND COUNTY | | | | | | | | | | | | |
| 2N 7E 5-ba | American Aggregates (Honeywell Lake Rd) | 44 | 2 | Qgd | 1,020 | 2 | R | 26.4 July 1968 | 27.3 Mar 1968 | 26.1 June | 27.4 Dec | |
| 3E 18-da | Proud Lake State Park | 45 | 6 | Qgd | 910 | 1 | R | | | 3.7 July | 5.3 Dec | Record started 7-69 |
| 10E 22-ba | Cranbrook School (3) | 65 | 6 | Qgd | 788 | 20 | R | 10.4 May 1963 | 18.9 Dec 1964 | 11.6 Apr | 13.8 Nov | |
| 3N 7E 1-cd | USGS Test W1 | 42 | 1 | Qgd | 1,050 | 4 | M | 20.8 Dec 1968 | 25.1 Dec 1966 | 19.9 May | 20.7 Jan | Meas. disc. 5-69 |
| 2-cd | Do. D5 | 27 | 1 | Qgd | 1,033 | 4 | M | 17.2 July 1968 | 22.2 Dec 1966 | 17.3 May | 18.0 Mar | do |

## TABLE 1. RECORDS OF MICHIGAN OBSERVATION WELLS. (CONTINUED)

| COUNTY AND WELL NUMBER TWP., RANGE, SECTION | OWNER OR OTHER DESIGNATION | DEPTH (ft) | DIAMETER (in) | AQUIFER | ALTITUDE | YEARS OF RECORD | FREQUENCY OF MEAS., 1969 | OBSERVED WATER-LEVEL EXTREMES | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | THROUGH 1968 | | IN 1969 | | |
| | | | | | | | | HIGH DATE | LOW DATE | HIGH DATE | LOW DATE | |
| OAKLAND COUNTY (Continued) | | | | | | | | | | | | |
| 3N 7E 5-da | American Aggregates (Fish Lake Rd) | 49 | 2 | Qgd | 1,055 | 1 | R | - | | 34.3 Aug | 35.2 Apr | Record started 4-69 |
| 10-aa | USGS Test D4 | 37 | 1 | Qgd | 1,035 | 3 | M | 24.0 Aug 1968 | 28.5 Mar 1967 | 24.0 May | 24.7 Jan | Meas disc. 5-69 |
| 11-ca | Do. D1 | 22 | 1 | Qgd | 1,020 | 4 | M | 9.2 Aug 1968 | 14.0 Dec 1966 | 9.1 May | 10.1 Mar | Do. |
| 11-cc | Do. D2 | 27 | 1 | Qgd | 1,025 | 3 | R | 12.7 July 1968 | 18.5 Feb 1967 | 12.9 May | 13.9 Jan | Do. |
| 12-db | Do. W2 | 32 | 1 | Qgd | 1,025 | 4 | M | 10.4 Dec 1968 | 14.5 Nov 1966 | 9.7 May | 10.5 Mar | Do. |
| 13-bd | Do. W3 | 42 | 1 | Qgd | 1,045 | 4 | M | 26.0 June 1968 | 30.1 Dec 1966 | 25.0 May | 26.2 Jan | Do. |
| 14-da | Do. D6 | 42 | 1 | Qgd | 1,037 | 4 | M | 25.0 July 1968 | 28.8 Dec 1966 | 24.7 May | 25.6 Jan | Do. |
| 15-aa | Do. D3 | 42 | 1 | Qgd | 1,043 | 3 | M | 28.4 Aug 1968 | 33.4 Mar 1967 | 28.4 May | 29.2 Jan | Do. |
| 8E 6-cd | Do. W4 | 42 | 1 | Qgd | 1,045 | 3 | M | 9.6 July 1968 | 16.4 Feb 1967 | 8.5 May | 11.9 Jan | Do. |
| 7-ac | Do. W5 | 47 | 1 | Qgd | 1,035 | 3 | R | 23.0 July 1968 | 30.1 Sept 1968 | 22.2 May | 24.4 Jan | Do. |
| 18-bc | Do. W8 | 52 | 1 | Qgd | 1,050 | 3 | M | 33.5 July 1968 | 36.9 Feb 1967 | 32.6 May | 33.8 Jan | Do. |
| 36-ab | Waterford Twp. (Josephine Street) | 134 | 12 | Qgd | 976.70 | 10 | R | 71.2 Dec 1968 | 100.5 Aug 1963 | 69.7 Dec | 72.7 Jan | P |
| 3N 10E 13-ac | Oakland Univ | 183 | 6 | Qgd | 940 | 9 | R | 65.3 Dec 1968 | 93.5 July 1963 | 63.9 Dec | 67.4 May | |
| 32-ab | City of Pontiac (LS 6) (Hayes-Jones Rec. Ctr.) | 184 | 12 | Qgd | 923.13 | 7 | R | 39.6 Dec 1968 | 99.4 Oct 1963 | 36.4 Dec | 42.2 Aug | |
| 5N 8E 8-ac | Holly State Recreation Area | 42 | 1 | Qgd | 930 | 4 | M | 23.9 Feb 1967 | 26.5 Sept 1966 | 23.6 June | 25.7 Nov | |
| OGEMAW COUNTY | | | | | | | | | | | | |
| 23N 1E 2-ba-1 | Ogemaw Co. Rd. Comm. (Rose City Rd.) | 105 | 1 | Qgd | 1,265 | 2 | Q | 77.2 Oct 1968 | 77.9 Oct 1968 | 77.4 Sept | 78.2 Apr | Record started 10-68 |
| 2-ba-2 | Do. (Rose City Rd.) | 20 | 1 | Qgd | 1,265 | 2 | Q | 11.5 Dec 1968 | 11.6 Oct 1968 | 8.7 July | 11.4 Jan | Do. |
| 4-ad | MDNR (Fire suppression well #15) | 21 | 4 | Qgd | 1,230 | 16 | Q | 1.1 Apr 1960 | 4.4 Oct 1964 | 1.3 Apr | 1.9 Dec | |
| 2E 2-ba | Charles Hudson | 7 | 36 | Qgd | 1,230 | 19 | R | 0.4 May 1952 | 4.3 Mar 1959 | 2.9 Jan | 5.6 Sept | Meas. disc. 9-69 |
| 6-aa | Ogemaw Co. Rd. Comm. (Fairview Rd.) | 133 | 1 | Qgd | 1,270 | 2 | Q | 103.1 Oct 1968 | 103.3 Nov 1968 | 102.8 Oct | 103.6 Apr | Record started 10-68 |
| 24N 2E 35-cd | Jim Kelley | 70 | 1 | Qgd | 1,130 | 2 | Q | 9.7 Nov 1968 | 11.9 Dec 1968 | 10.4 Sept | 12.7 Feb | Do. |
| 3E 8-bb | Ogemaw Co. Rd. Comm (Beechwood Rd) | 89 | 1 | Qgd | 1,215 | 2 | Q | 87.3 Nov 1968 | 87.4 Nov 1968 | 86.8 Oct | 87.8 Apr | Record started 11-68 |
| ONTONAGON COUNTY | | | | | | | | | | | | |
| 46N 38W 30-ad | USFS | 65 | 1 | Qgd | 1,530 | 3 | M | 17.0 July 1968 | 18.2 Mar 1968 | 16.6 May | 18.4 Dec | |
| 51N 41W 8-bd | Mich. Corrections Dept. (Silver City) | 100 | 6 | p€f | 620 | 12 | Q | 8.2 Apr 1959 | 18.9 Oct 1963 | 9.0 May | 13.6 Aug | |
| OTSEGO COUNTY | | | | | | | | | | | | |
| 29N 3W 29-dc | MDC (106) (Waters) | 15 | 2 | Qgd | 1,260 | 37 | Q | 5.1 Apr 1967 | 9.7 Oct 1958 | 6.7 Apr | 8.0 Oct | |
| OTTAWA COUNTY | | | | | | | | | | | | |
| 5N 15W 27-cc | City of Holland (Waverly Rd) | 102 | 1 | Qgd | 640 | 23 | M | 42.2 Dec 1968 | dry July 1953 | 40.8 June | 42.4 Jan | Meas. by owner |
| PRESQUE ISLE CO. | | | | | | | | | | | | |
| 33N 2E 30-da | MDC (19) (Truck trail) | 14 | 2 | Qgd | 800 | 33 | Q | 0.6 July 1960 | 5.7 Jan 1956 | 2.6 July | 3.6 Apr | |
| 6E 8-bb | A. Styma (Farm) | 61 | 6 | Dt | 800 | 11 | Q | 5.4 Apr 1967 | 18.8 Mar 1963 | 6.1 Apr | 12.2 Oct | |
| 21-aa | M. Ardycan (M-65) | 43 | 5 | Dt | 790 | 11 | Q | 1.1 Apr 1963 | 7.6 Oct 1966 | 2.5 Apr | 6.0 Oct | |

## TABLE 1. RECORDS OF MICHIGAN OBSERVATION WELLS. (CONTINUED)

| COUNTY AND WELL NUMBER TWP., RANGE, SECTION | OWNER OR OTHER DESIGNATION | DEPTH (ft) | DIAMETER (in) | AQUIFER | ALTITUDE | YEARS OF RECORD | FREQUENCY OF MEAS., 1969 | OBSERVED WATER-LEVEL EXTREMES | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | THROUGH 1968 | | IN 1969 | | |
| | | | | | | | | HIGH DATE | LOW DATE | HIGH DATE | LOW DATE | |
| ROSCOMMON COUNTY | | | | | | | | | | | | |
| 22N 3W 22-ad | MDNR(7) (Fox Farm) | 14 | 2 | Qgd | 1,170.58 | 36 | Q | 2.6 Apr 1960 | 7.5 Oct 1964 | 2.3 July | 4.0 Dec | |
| 23N 1W 3-dd | MDNR(50) (M-76) | 12 | 2 | Qgd | 1,188.95 | 31 | Q | 1.6 June 1943 | 7.3 Dec 1949 | 3.2 Apr | 4.1 Oct | |
| 24N 2W 20-ba | MDNR(1) (Exp. Sta.) | 14 | 8 | Qgd | 1,145.30 | 36 | R | 2.7 May 1967 | 6.2 Dec 1949 | 2.8 June | 4.6 Mar | Fed. key well |
| SAGINAW COUNTY | | | | | | | | | | | | |
| 9N 3E 16-bd | R. Ellis (Liberty St.) | 129 | 3 | Ps | 643 | 12 | W | 26.7 Dec 1966 | 53.8 Sept 1959 | 25.8 Nov | 40.2 Feb | P, Meas. by owner |
| SANILAC COUNTY | | | | | | | | | | | | |
| 12N 13E 33-dd | MSHD (at Elmer) | 150 | 3 | Mm | 800 | 22 | W | 15.4 Apr 1951 | 25.6 Jan 1965 | 16.8 May | 23.8 Nov | |
| SCHOOLCRAFT COUNTY | | | | | | | | | | | | |
| 45N 13W 16-cc | U.S. Fish & Wildlife (Seney) | 154 | 4 | Or | 710 | 18 | R | 4.8 May 1960 | 6.5 Oct 1963 | 4.9 Jan | 5.8 Sept | |
| 47N 16W 30-bb | MDNR(Cusino CCC) | 57 | 6 | Op | 900 | 13 | R | 5.7 May 1960 | 16.3 Oct 1963 | 6.9 Apr | 15.3 Dec | |
| SHIAWASSEE COUNTY | | | | | | | | | | | | |
| 5N 2E 16-da | A. Cobb (at Perry) | 26 | 1 | Qgd | 896.00 | 22 | Q | 17.3 May 1950 | 23.2* Jan 1964 | 18.9 July | 20.6 Oct | *W/L below obstruction in pipe |
| VAN BUREN COUNTY | | | | | | | | | | | | |
| 1S 17W 22-ad | Stevie Bros. (M-140) | 132 | 4 | Qgd | 640 | 7 | M | 35.6 May 1967 | e39.15 Aug 1964 | 36.2 Mar | 37.6 Aug | |
| 2S 13W 2-bb | Co. Road Commission (8) (24th St.) | 23 | 1 | Qgd | 740 | 7 | M | 2.0 Dec 1966 | 5.1 Sept 1964 | 2.5 Apr | 4.2 Sept | |
| 3S 14W 6-ba | R. Martin (3) 48th St. | 59 | 1 | Qgd | 740 | 7 | M | 38.1 May 1967 | 43.3 Nov 1964 | 38.6 June | 40.3 Dec | |
| 4S 16W 14-cd | O. Klett (Keeler) | 170 | 14 | Qgd | 800 | 7 | R | 18.6 Apr 1968 | 27.6 Aug 1964 | 17.9 June | 21.4 Apr | P |
| 13W 16-dd | Porter Twp. (1) (Twp. Hall) | 83 | 1 | Qgd | 930 | 7 | M | 44.9 May 1968 | 50.4 Oct 1964 | 43.1 July | 44.6 Mar | |
| WASHTENAW COUNTY | | | | | | | | | | | | |
| 2S 3E 9-da | Waterloo State Park | 48 | 6 | Qgd | 970 | 1 | R | | | 4.4 July | 6.1 Nov | Record started 7-69 |
| 3S 6E 16-bc | City of Ann Arbor (Airport) | 55 | 10 | Qgd | 821.50 | 7 | R | 3.0 July 1968 | 15.9 Oct 1964 | 2.3 July | 8.3 Dec | P |
| 7E 5-bb | City of Ypsilanti (Huron River) | 69 | 8 | Qgd | 720 | 8 | R | 1.8 Feb 1965 | 21.4 Dec 1965 | 9.4 July | 17.3 Mar | P |
| 9-ac | City of Ypsilanti (NR) (River St) | 50 | 6 | Qgd | 710 | 19 | M | 27.6 July 1968 | 51.6 Nov 1964 | 31.2 May | 37.5 Nov | P |
| 9-ad | City of Ypsilanti (GP) (Gilbert Park) | 94 | 6 | Qgd | 710 | 19 | R | 29.1 Nov 1945 | 70.4 Oct 1964 | 50.1 Jan | 58.0 July | P |
| 24-ca-1 | Ypsilanti Twp. (104) (Water Works) | 87 | 4 | Qgd | 665.56 | 24 | R | 5.8 Jan 1950 | 21.4 Feb 1967 | 16.5 June | 21.3 Dec | P |
| 24-cb | Do. (109) | 77 | 4 | Qgd | 665.56 | 24 | M | 15.2 June 1945 | 53.6 Apr 1968 | 54.9 Jan | 57.2 Dec | P |
| 24-cc | Do. (117) | 75 | 6 | Qgd | 657.83 | 23 | R | 5.7 Feb 1950 | 56.1 Dec 1968 | 42.7 May | 62.0 Dec | P |
| 4S 6E 9-bb | Ypsi. State Hosp. (TW 20) (Moon Rd) | 184 | 6 | Qgd | 800 | 24 | W | 51.2 May 1948 | 88.1 June 1949 | 63.4 May | 81.9 Oct | P, Meas by owner |
| 10-bc | Ypsi. State Hosp. (TW 22) (Warner Rd) | 173 | 6 | Qgd | 794 | 24 | W | 56.6 Oct 1962 | 88.3 July 1955 | 67.2 Mar | 74.2 Dec | P, Do. |
| WAYNE COUNTY | | | | | | | | | | | | |
| 1S 8E 9-bc | City of Plymouth (Beck Rd) | 61 | 6 | Qgd | 820 | 9 | R | 9.3 Aug 1968 | 21.3 Feb 1966 | 9.6 July | 15.2 Aug | P |
| 17-aa | Do. (6-Mile Rd) | 114 | 6 | Qgd | 856 | 8 | R | 50.4 Apr 1963 | 59.6 Dec 1966 | 52.7 July | 56.6 Dec | P |

## TABLE 1. RECORDS OF MICHIGAN OBSERVATION WELLS. (CONTINUED)

| COUNTY AND WELL NUMBER (TWP., RANGE, SECTION) | OWNER OR OTHER DESIGNATION | DEPTH (ft) | DIAMETER (in) | AQUIFER | ALTITUDE | YEARS OF RECORD | FREQUENCY OF MEAS., 1969 | OBSERVED WATER-LEVEL EXTREMES | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | THROUGH 1968 | | IN 1969 | | |
| | | | | | | | | HIGH DATE | LOW DATE | HIGH DATE | LOW DATE | |
| WEXFORD COUNTY | | | | | | | | | | | | |
| 21N 9W 4-ab | City of Cadillac (Lakeside) | 277 | 6 | Qgd | 1,291.10 | 21 | Q | 20.0 July 1953 | 27.6 June 1964 | 21.7 Jan | 23.4 Apr | P |
| 22N 12W 13-ba | Harrietta State Fish Hatchery | 141 | 4 | Qgd | 1,060 | 9 | R | +13.6 Feb 1961 | +1.5 Jan 1966 | +10.8 Oct | +5.8 Mar | P |
| 24N 9W 19-bc | MDNR(38) (No. 37 Rd) | 11 | 2 | Qgd | 994.16 | 28 | Q | 0.5 Apr 1959 | 3.7 Aug 1936 | 1.2 Apr | 2.6 Oct | |

## TABLE 2. REPORTED GROUND-WATER PUMPAGE, IN 1969. (IN MILLIONS OF GALLONS)

| WATER USER | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | SEPT | OCT | NOV | DEC | 1969 TOTAL | MAX DAY | MIN DAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ALCONA COUNTY | | | | | | | | | | | | | | | |
| City of Harrisville | 1.6 | 1.4 | 1.4 | 1.0 | 1.1 | 1.4 | 2.5 | 2.3 | 1.4 | 1.2 | 1.2 | 1.1 | 17.6 | .120 | .026 |
| ALGER COUNTY | | | | | | | | | | | | | | | |
| Township of Burt | 1.7 | 1.2 | 2.2 | 1.8 | 1.9 | 2.1 | 3.1 | 3.2 | 1.9 | 1.7 | 1.7 | 1.7 | 24.2 | -- | -- |
| ALLEGAN COUNTY | | | | | | | | | | | | | | | |
| City of Allegan | 22.5 | 21.9 | 19.5 | 21.9 | 24.7 | 26.7 | 32.9 | 37.9 | 43.9 | 31.7 | 26.2 | 23.9 | 333.7 | 1.929 | .460 |
| City of Plainwell | 11.9 | 10.4 | 11.6 | 12.9 | 13.5 | 12.2 | 19.9 | 23.5 | 15.2 | 13.0 | 11.6 | 13.7 | 169.4 | 1.160 | .283 |
| City of Otsego | 16.7 | 15.7 | 17.2 | 17.6 | 19.6 | 20.8 | 28.4 | 32.1 | 24.0 | 21.5 | 17.9 | 18.0 | 249.5 | 1.526 | .422 |
| ANTRIM COUNTY | | | | | | | | | | | | | | | |
| Village of Mancelona | 17.9 | 14.4 | 17.4 | 15.3 | 14.3 | 14.8 | 16.4 | 16.2 | 16.8 | 17.5 | 15.4 | 21.2 | 197.6 | -- | -- |
| BARRY COUNTY | | | | | | | | | | | | | | | |
| City of Hastings | 35.6 | 32.7 | 37.4 | 35.3 | 38.2 | 39.8 | 48.3 | 53.6 | 45.0 | 41.1 | 33.7 | 36.8 | 477.5 | 3.574 | .655 |
| Village of Middleville | 13.1 | 11.7 | 13.1 | 12.4 | 13.7 | 13.3 | 16.0 | 15.5 | 18.0 | 15.5 | 11.8 | 14.3 | 168.4 | -- | -- |
| BENZIE COUNTY | | | | | | | | | | | | | | | |
| City of Frankfort | 5.3 | 4.6 | 5.2 | 5.6 | 5.9 | 5.3 | 8.3 | 10.1 | 7.9 | 6.6 | 5.8 | 5.2 | 75.8 | .561 | .129 |
| BERRIEN COUNTY | | | | | | | | | | | | | | | |
| Village of Berrien Springs | 8.3 | 7.3 | 8.5 | 7.9 | 9.4 | 9.1 | 11.3 | 14.6 | 11.4 | 9.1 | 8.6 | 8.7 | 114.2 | .950 | .101 |
| City of Buchanan | 80.6 | 73.0 | 81.5 | 82.3 | 90.9 | 86.4 | 93.4 | 97.2 | 82.9 | 78.3 | 78.6 | 79.6 | 1,004.7 | 3.962 | 1.680 |
| City of Coloma | 7.1 | 6.5 | 6.8 | 7.1 | 7.0 | 7.5 | 8.0 | 10.4 | 8.9 | 7.3 | 4.1 | 8.2 | 88.9 | .881 | .071 |
| City of Niles | 86.6 | 74.6 | 84.6 | 81.4 | 93.6 | 94.6 | 92.7 | [e]121.9 | 107.0 | 93.3 | [e]83.2 | 87.4 | 1,100.9 | 5.230 | 1.580 |
| BRANCH COUNTY | | | | | | | | | | | | | | | |
| City of Bronson | 20.8 | 20.9 | 16.1 | 14.5 | 15.3 | 14.3 | 14.6 | 16.9 | 16.1 | 16.4 | 14.3 | 14.8 | 195.0 | .882 | .083 |
| City of Coldwater | 63.2 | 56.8 | 60.5 | 64.0 | 70.5 | 68.4 | 79.6 | 100.8 | 82.9 | 69.7 | 62.6 | 65.8 | 844.8 | 5.143 | 1.070 |
| State Home and Training School at Coldwater | 14.9 | 14.0 | 14.6 | 14.6 | 15.2 | 15.0 | 16.3 | 16.5 | 15.3 | 15.1 | 14.3 | 15.0 | 180.8 | -- | -- |
| Village of Quincy | | | | | | | | | | | | | | | |
| Village of Union City | --------[e]20.4-------- | | | ---[e]14.3----- | | 7.7 | 7.9 | 8.8 | 7.8 | 8.7 | 6.8 | 7.3 | 89.7 | -- | -- |
| CALHOUN COUNTY | | | | | | | | | | | | | | | |
| City of Albion | 165.7 | 153.3 | 163.3 | 163.2 | 169.0 | 166.8 | 148.3 | 182.2 | 158.9 | 158.3 | 138.5 | 132.9 | 1,900.4 | 7.062 | 2.941 |
| American Legion Hospital at Battle Creek | .7 | .8 | .6 | .8 | .8 | .8 | .8 | 1.0 | .9 | .8 | .8 | .8 | 9.6 | -- | -- |
| Village of Athens | 2.4 | 1.9 | 1.9 | 2.2 | 2.3 | 2.4 | 3.0 | 2.9 | 3.2 | 7.9 | 5.2 | 2.9 | 38.2 | .292 | .057 |
| City of Battle Creek | 280.9 | 288.8 | 278.9 | 320.5 | 314.8 | 291.0 | 322.9 | 312.4 | 253.9 | 222.8 | 194.4 | 196.3 | 3,277.6 | 15.180 | 4.780 |
| Township of Battle Creek | 35.6 | 32.9 | 37.1 | 37.2 | 41.5 | 40.6 | 57.2 | 73.9 | 50.6 | 37.1 | 32.0 | 33.0 | 508.7 | 3.943 | .760 |
| City of Marshall | 49.5 | 44.0 | 46.6 | 41.9 | 37.4 | 37.8 | 44.5 | 51.2 | 43.3 | 40.3 | 36.3 | 36.8 | 509.6 | 2.230 | .936 |
| CASS COUNTY | | | | | | | | | | | | | | | |
| City of Dowagiac | 20.5 | 17.8 | 20.2 | 19.5 | 19.9 | 21.3 | 25.2 | 28.7 | 25.5 | 24.5 | 19.6 | 19.8 | 262.5 | -- | -- |
| Village of Marcellus | 3.0 | 3.0 | 3.5 | 3.6 | 4.4 | 3.8 | 4.7 | 5.6 | 4.4 | 4.1 | 3.2 | 3.5 | 46.8 | -- | -- |
| CHARLEVOIX COUNTY | | | | | | | | | | | | | | | |
| City of East Jordan | 13.6 | 13.7 | 15.4 | 15.7 | 18.1 | 17.2 | 21.3 | 27.5 | 18.5 | 19.5 | 18.4 | 20.2 | 219.1 | 1.460 | .220 |
| CHEBOYGAN COUNTY | | | | | | | | | | | | | | | |
| City of Cheboygan | 20.2 | 20.1 | 24.9 | 25.3 | 22.9 | 25.1 | 26.0 | 26.8 | 25.2 | 24.4 | 22.1 | 26.1 | 289.1 | 2.580 | .446 |
| Village of Mackinac City | 4.3 | 4.6 | 4.5 | 4.7 | 5.4 | 6.8 | 10.4 | 11.9 | 6.4 | 4.9 | 3.8 | 3.4 | 71.1 | .431 | .102 |
| CHIPPEWA COUNTY | | | | | | | | | | | | | | | |
| Kincheloe Air Force Base near Kinross | 30.3 | 27.7 | 35.3 | 38.8 | 42.2 | 38.7 | 50.9 | 53.5 | 39.1 | 30.4 | 27.6 | 29.3 | 443.8 | 2.217 | .758 |
| CLARE COUNTY | | | | | | | | | | | | | | | |
| City of Clare | 20.5 | 17.6 | [e]20.6 | 20.3 | 24.0 | 24.4 | 29.6 | 29.2 | [e]29.8 | 19.6 | 18.6 | 18.8 | 273.0 | 1.290 | .497 |
| City of Harrison | 3.6 | 3.6 | 4.0 | 3.1 | 3.6 | 3.5 | 4.8 | 5.7 | 3.7 | 3.2 | 3.0 | 3.1 | 44.9 | .258 | .070 |
| CLINTON COUNTY | | | | | | | | | | | | | | | |
| Village of Ovid | 2.8 | 2.8 | 3.1 | 3.0 | 3.3 | 3.4 | 3.6 | 4.1 | 3.9 | 4.5 | 4.5 | 5.1 | 44.1 | .201 | .076 |
| City of St. Johns | 41.7 | 37.2 | 45.1 | 43.1 | 46.3 | 44.7 | 45.5 | 50.7 | 48.1 | 47.7 | 40.6 | 43.7 | 534.4 | 1.825 | .670 |
| CRAWFORD COUNTY | | | | | | | | | | | | | | | |
| City of Grayling | 5.2 | 7.4 | 6.1 | 7.9 | 8.1 | 10.7 | 12.4 | 13.3 | 9.1 | 7.3 | 6.3 | 5.0 | 98.8 | .703 | .194 |
| EATON COUNTY | | | | | | | | | | | | | | | |
| Delta Charter Twp. | | | | | | | | | | | | | 260.0 | | |
| City of Charlotte | 53.0 | 42.9 | 46.8 | 48.7 | 50.1 | 50.8 | 49.1 | 57.2 | 53.5 | 54.6 | 48.6 | 55.3 | 610.6 | 3.032 | .929 |
| City of Eaton Rapids | 27.8 | 22.3 | 22.7 | 22.0 | 23.7 | 22.5 | 25.0 | 28.5 | 26.7 | 20.1 | 15.5 | 17.1 | 273.9 | 1.333 | .392 |
| City of Grand Ledge | 14.0 | 13.2 | 14.3 | 14.3 | 15.4 | 15.7 | 19.9 | 19.9 | 17.6 | 15.4 | 14.5 | 15.8 | 190.0 | -- | -- |
| Village of Bellevue | 3.8 | [b]5.1 | [b]5.2 | 3.7 | 4.3 | 4.2 | 4.3 | 4.8 | 4.4 | 4.3 | 4.0 | 3.8 | 51.9 | .270 | .076 |
| City of Olivet | | | | | | | | | | | | | [c]50.0 | | |
| Olds Parts Warehouse near Lansing | 1.4 | 1.5 | 1.0 | 1.1 | 1.7 | 1.8 | 1.6 | 5.2 | 2.8 | 3.1 | 1.9 | 2.0 | 25.1 | | |
| EMMET COUNTY | | | | | | | | | | | | | | | |
| City of Harbor Springs | 9.8 | 12.3 | 10.4 | 11.1 | 13.6 | 17.8 | 22.9 | 32.8 | 23.8 | 12.1 | 11.3 | 8.9 | 186.8 | 1.787 | .317 |
| GENESSEE COUNTY | | | | | | | | | | | | | | | |
| Beecher Metropolitan District | 33.9 | 29.1 | 32.5 | 32.3 | 34.7 | 35.3 | 39.6 | 43.1 | 38.1 | 34.8 | 31.9 | 32.5 | 417.8 | 1.891 | .879 |
| [d]Village of Clio | | | | | | | | | | | | | | | |
| City of Davison | 18.2 | 16.9 | 18.2 | 15.1 | 16.8 | 18.1 | 22.8 | 24.8 | 24.0 | 17.8 | 15.6 | 17.8 | 226.1 | 1.203 | .342 |
| City of Fenton | 21.4 | 20.2 | 22.1 | 21.6 | 23.8 | 23.6 | 24.8 | 30.9 | 27.3 | 23.0 | 22.9 | 22.7 | 284.3 | 1.319 | .485 |
| Fisher Body Div. at Grand Blanc | .5 | .7 | .1 | .3 | .3 | 1.5 | .6 | .8 | .8 | .6 | .6 | .6 | 7.4 | | |
| City of Mt. Morris | 7.2 | 6.6 | 7.4 | 7.3 | 8.0 | 7.6 | 8.1 | 8.7 | 8.1 | 7.7 | 7.2 | 7.4 | 91.3 | .348 | .120 |
| Village of Otisville | 1.2 | 1.0 | 1.2 | 1.1 | 1.2 | 1.2 | 1.4 | 1.5 | 1.3 | 1.1 | 1.1 | 1.1 | 14.4 | .066 | .024 |

## TABLE 2. REPORTED GROUND-WATER PUMPAGE, IN 1969. (IN MILLIONS OF GALLONS)—Continued

| WATER USER | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | SEPT | OCT | NOV | DEC | 1969 TOTAL | MAX DAY | MIN DAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GLADWIN COUNTY | | | | | | | | | | | | | | | |
| City of Beaverton | 3.3 | 3.1 | 3.0 | 3.0 | 2.9 | 2.7 | 3.1 | 2.8 | 2.9 | 2.5 | 2.2 | 2.2 | 33.7 | .145 | .043 |
| GOGEBIC COUNTY | | | | | | | | | | | | | | | |
| City of Bessemer | 12.8 | 12.7 | 12.7 | 13.0 | 11.2 | 12.6 | 12.9 | 12.6 | 10.3 | 9.5 | 9.2 | 8.5 | 138.0 | .390 | .105 |
| City of Ironwood | 41.1 | 36.2 | 39.4 | 37.5 | 39.7 | 37.3 | 40.8 | 38.1 | 33.0 | 33.6 | 32.3 | 36.4 | 445.4 | 1.547 | .697 |
| City of Wakefield | 10.1 | 8.4 | 8.9 | 9.0 | 9.9 | 9.1 | 10.0 | 9.2 | 7.8 | 8.3 | 7.9 | 8.3 | 106.9 | — | — |
| GRATIOT COUNTY | | | | | | | | | | | | | | | |
| [f] City of Alma | 0.0 | 0.0 | 0.0 | 5.6 | 21.2 | 38.2 | 29.3 | 41.5 | 32.3 | 9.6 | 1.5 | 1.4 | 180.6 | 3.081 | — |
| Village of Breckenridge | 2.7 | 2.6 | 2.8 | 2.6 | 3.1 | 3.0 | 3.6 | 3.8 | 3.2 | 2.8 | 2.8 | 2.8 | 35.8 | .169 | .043 |
| City of Ithaca | 7.3 | 5.9 | 5.5 | 5.9 | 6.1 | 6.0 | 6.3 | 6.6 | 6.4 | 6.4 | 5.1 | 6.2 | 73.7 | .407 | .113 |
| City of St. Louis | 32.1 | 27.1 | 30.8 | 28.6 | 28.5 | 31.1 | 34.0 | 39.6 | 34.9 | 40.8 | 46.9 | 47.7 | 422.1 | 1.862 | .694 |
| HILLSDALE COUNTY | | | | | | | | | | | | | | | |
| Village of Jonesville | 13.9 | 13.3 | 10.7 | 15.6 | 15.7 | 16.0 | 15.9 | 16.8 | 16.8 | 15.2 | 13.0 | 14.9 | 177.8 | .875 | .465 |
| [g] City of Hillsdale | 0.0 | 0.0 | 0.0 | 0.0 | 27.6 | 34.3 | 33.9 | 35.0 | 32.2 | 32.1 | 31.3 | 30.7 | 257.1 | 2.560 | 1.089 |
| HOUGHTON COUNTY | | | | | | | | | | | | | | | |
| City of Hancock | 16.2 | 15.0 | 16.0 | 16.0 | 16.7 | 16.2 | 18.4 | 18.3 | 16.6 | 16.8 | 15.6 | 16.0 | 197.8 | .790 | .341 |
| City of Houghton | 32.3 | 32.1 | 32.1 | 32.7 | 29.5 | 23.1 | 22.7 | 24.0 | 25.2 | 30.2 | 28.4 | 24.6 | 336.9 | 1.230 | .529 |
| Township of Chassell | 3.1 | 2.8 | 2.9 | 2.9 | 3.2 | 3.3 | 3.6 | 3.7 | 2.7 | 2.8 | 2.6 | 2.2 | 35.8 | .154 | .051 |
| HURON COUNTY | | | | | | | | | | | | | | | |
| Village of Pigeon | 4.6 | 4.2 | 5.1 | 5.8 | 6.1 | 6.5 | 8.9 | 9.1 | 6.6 | 7.1 | 5.6 | 6.0 | [e] 75.6 | .287 | .157 |
| Village of Sebewaing | 13.4 | 13.9 | 13.4 | 10.5 | 8.4 | 10.6 | 12.0 | 15.2 | 10.8 | 10.8 | 7.3 | 7.0 | 133.3 | — | — |
| INGHAM COUNTY | | | | | | | | | | | | | | | |
| City of East Lansing | 95.6 | 87.8 | 94.7 | 97.8 | 111.2 | 105.1 | 113.1 | 130.1 | 111.2 | 110.1 | 97.8 | 95.1 | 1,249.6 | 5.2 | — |
| City of Lansing (Rockwells) | 605.7 | 557.0 | 612.2 | 577.3 | 587.0 | 594.2 | 603.2 | 745.0 | 632.6 | 610.8 | 611.0 | 597.6 | 7,333.6 | 37.692 | 13.990 |
| City of Lansing Stiefel Field (Eaton Co.) (Gravel) | 61.6 | 48.3 | 50.5 | 57.0 | 112.1 | 97.6 | 126.2 | 141.9 | 127.3 | 116.7 | 39.2 | 47.4 | 1,025.8 | — | — |
| NW Field (Gravel) | -- | — | -- | — | 0.2 | — | 0.8 | 2.1 | 1.5 | 0.7 | — | -- | 5.3 | — | — |
| Township of Lansing | 55.8 | 60.0 | 57.0 | 73.1 | 55.1 | 60.5 | 64.9 | 71.6 | 80.8 | 58.6 | 58.8 | 52.4 | 748.6 | 21.140 | — |
| Village of Leslie | 5.6 | 4.9 | 5.3 | 4.8 | 5.1 | 5.0 | 5.5 | 10.3 | 6.5 | 4.8 | 5.0 | 4.7 | 67.5 | .708 | .091 |
| City of Mason | 15.3 | 14.2 | 16.2 | 15.4 | 16.9 | 16.7 | 18.4 | 24.1 | 19.2 | 16.0 | 14.3 | 15.4 | 202.1 | .857 | .384 |
| Township of Meridian | 10.4 | 12.0 | 13.8 | 13.5 | 15.2 | 15.7 | 16.2 | 25.9 | 17.8 | 16.7 | 16.6 | 16.2 | 190.0 | — | — |
| Michigan State University at East Lansing | 165.3 | 153.1 | 150.2 | 177.2 | 202.2 | 160.1 | 171.1 | 173.4 | 157.0 | 188.4 | 144.9 | 127.2 | 1,970.1 | 7.244 | 3.133 |
| Oldsmobile Forge #2 at Lansing, | 16.4 | 14.2 | 18.8 | 15.0 | 15.9 | 16.5 | 10.8 | 14.3 | 19.8 | 12.9 | 11.5 | 16.5 | 182.6 | — | — |
| Oldsmobile Main Plant #1, at Lansing, | 2.6 | 2.6 | 2.3 | 2.6 | 2.5 | 2.4 | 1.9 | 2.0 | 2.4 | 2.1 | [h] 0 | [h] 0 | 23.4 | — | — |
| IONIA COUNTY | | | | | | | | | | | | | | | |
| City of Ionia | 30.4 | 27.3 | 29.4 | 27.2 | 31.8 | 31.6 | 35.6 | 42.5 | 35.9 | 34.3 | 31.2 | 30.3 | 387.5 | 1.659 | .538 |
| State Hospital at Ionia | 9.3 | 8.1 | 8.8 | 8.3 | 8.8 | 8.5 | 9.1 | 10.6 | 9.9 | 7.6 | 7.3 | 7.2 | 103.5 | .582 | .188 |
| Michigan Reformatory at Ionia | 20.0 | 19.9 | 18.5 | 20.2 | 18.5 | 19.4 | 19.5 | 19.5 | 19.5 | 19.5 | 18.0 | 20.0 | 232.5 | .890 | .480 |
| Michigan Training Unit at Ionia | 2.5 | 2.1 | 2.4 | 1.2 | 2.9 | 3.3 | 5.4 | 10.5 | 6.6 | 3.7 | 2.2 | 2.4 | 45.2 | .425 | .038 |
| City of Portland | 10.1 | 10.3 | 11.7 | 11.4 | 21.3 | 12.8 | 12.1 | 16.9 | 17.3 | 12.5 | 12.5 | 12.8 | 161.7 | — | — |
| Village of Saranac | 11.0 | 8.6 | 10.2 | 10.4 | 9.7 | 8.7 | 10.0 | 10.1 | 9.6 | 10.8 | 8.2 | 8.7 | 116.0 | .536 | .084 |
| IOSCO COUNTY | | | | | | | | | | | | | | | |
| Wurtsmith Air Force Base near Oscoda | 25.0 | 24.4 | 27.1 | 28.1 | 40.1 | 34.3 | 52.1 | 50.0 | 29.5 | 21.6 | 23.1 | 23.8 | 379.1 | 2.922 | .460 |
| IRON COUNTY | | | | | | | | | | | | | | | |
| City of Caspian | 10.8 | 10.9 | 12.6 | 15.6 | 13.4 | 13.0 | 8.9 | 10.8 | 11.5 | 10.5 | 9.5 | 10.2 | 137.7 | .502 | .120 |
| City of Crystal Falls | 15.6 | 12.9 | 14.4 | 13.0 | 13.7 | 13.9 | 16.5 | 22.0 | 17.4 | 15.8 | 14.8 | 14.1 | 184.1 | .839 | .383 |
| City of Iron River | 12.3 | 11.4 | 12.9 | 13.1 | 12.6 | 11.0 | 11.8 | 12.0 | 7.3 | 10.0 | 9.6 | 10.1 | 134.1 | .715 | .238 |
| City of Stambaugh | 5.6 | 4.9 | 5.4 | 5.3 | 5.4 | 5.0 | 5.5 | 5.4 | 4.7 | 4.9 | 4.4 | 4.7 | 61.2 | .275 | .113 |
| Township of Stambaugh | 1.8 | 1.5 | 1.6 | 1.5 | 1.7 | 1.9 | 2.9 | 3.7 | 1.9 | 1.8 | 2.0 | 1.6 | 23.9 | .142 | .084 |
| ISABELLA COUNTY | | | | | | | | | | | | | | | |
| City of Mt. Pleasant | 62.2 | 52.2 | 57.2 | 61.4 | 71.7 | 58.2 | 73.1 | 75.7 | 73.3 | 74.8 | 65.5 | 63.5 | [k] 788.8 | 3.338 | .702 |
| Village of Shepherd | 2.1 | 2.0 | 2.2 | 2.3 | 2.2 | 2.0 | 2.3 | 2.8 | 2.4 | 2.3 | 2.2 | 2.5 | 27.3 | — | — |
| JACKSON COUNTY | | | | | | | | | | | | | | | |
| Village of Concord | 2.2 | 2.1 | 2.4 | 2.3 | 2.6 | 2.3 | 2.7 | 3.0 | 2.9 | 2.6 | 2.3 | 2.9 | 30.3 | .285 | .114 |
| [g] Village of Grass Lake | | | 5.4 | | | 7.7 | | | 7.3 | | | 5.9 | 26.3 | — | — |
| City of Jackson | 365.9 | 325.1 | 366.2 | 369.1 | 411.8 | 391.8 | 437.3 | 490.1 | 418.5 | 389.0 | 331.1 | 342.5 | 4,638.4 | 19.830 | 5.960 |
| State Prison of Southern Michigan at Jackson | 31.4 | 29.1 | 34.8 | 34.4 | 37.6 | 33.0 | 37.4 | 41.5 | 36.4 | 35.9 | 31.7 | 32.2 | 415.4 | 1.816 | .874 |
| KALAMAZOO COUNTY | | | | | | | | | | | | | | | |
| Village of Augusta | 2.1 | 1.8 | 2.2 | 1.4 | 1.9 | 2.0 | 3.5 | 3.8 | 2.8 | 2.5 | 2.1 | 2.2 | 28.3 | .125 | .048 |
| City of Kalamazoo | 425.3 | 393.1 | 426.2 | 456.5 | 505.2 | 520.0 | 689.2 | 770.5 | 604.7 | 449.7 | 397.2 | 412.8 | 6,050.4 | 36.065 | 8.571 |
| State Hospital at Kalamazoo | 19.0 | 21.0 | 17.9 | 14.7 | 16.0 | 13.0 | 11.3 | 11.8 | 12.8 | 14.6 | 14.1 | 17.9 | 184.1 | .795 | .302 |
| State Hospital at Kalamazoo Colony Farm | 1.5 | 1.2 | 1.0 | 1.6 | 1.0 | 1.7 | .9 | Pumping discontinued permanently | | | | | 8.9 | — | — |
| City of Portage | 23.8 | 21.0 | 23.4 | 24.7 | 30.4 | 29.6 | 43.8 | 63.1 | 39.5 | 28.0 | 25.5 | 25.1 | 377.9 | 3.484 | .455 |
| Village of Vicksburg | 10.7 | 10.2 | 10.1 | 9.4 | 6.4 | 9.1 | 9.0 | 19.4 | 8.5 | 8.2 | 6.9 | 8.6 | 116.5 | 1.038 | .168 |
| Upjohn Company near Kalamazoo | 396.5 | 387.7 | 413.5 | 440.6 | 453.3 | 433.2 | 455.5 | 490.6 | 453.0 | 466.0 | 387.8 | 365.9 | 5,143.6 | 18.450 | 8.288 |
| City of Parchment | 6.2 | 5.5 | 6.0 | 6.8 | 7.9 | 8.3 | 13.5 | 15.5 | 13.8 | 8.4 | 7.0 | 7.1 | 106.0 | 1.134 | .157 |
| Brown Company Specialties Paper Division | 59.9 | 70.0 | 71.2 | 58.9 | 62.3 | 71.9 | 63.6 | 71.8 | 83.2 | 66.6 | 68.8 | 65.6 | 813.8 | — | — |
| Converting Board Division | 205.5 | 197.8 | 185.0 | 180.9 | 170.0 | 154.5 | 156.8 | 160.2 | 171.1 | 110.2 | 113.9 | 117.7 | 1,923.6 | — | — |

## TABLE 2. REPORTED GROUND-WATER PUMPAGE, IN 1969. (IN MILLIONS OF GALLONS)—Continued

| WATER USER | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | SEPT | OCT | NOV | DEC | 1969 TOTAL | MAX DAY | MIN DAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| KALAMAZOO COUNTY (Continued) | | | | | | | | | | | | | | | |
| Simpson-Lee Paper Company at Vicksburg | 83.7 | 75.6 | 83.7 | 81.0 | 62.1 | 64.8 | 64.8 | 64.8 | 62.1 | 83.7 | 64.8 | 83.7 | e/874.8 | 2.700 | 1.500 |
| City of Schoolcraft | 5.9 | 7.0 | 6.6 | 6.0 | 5.4 | 6.2 | 7.0 | 6.5 | 6.3 | 6.1 | 6.0 | 5.8 | e/74.8 | -- | -- |
| City of Galesburg | 3.6 | 3.1 | 3.7 | 3.3 | 4.0 | 4.5 | 5.7 | 6.6 | 5.3 | 3.5 | 3.3 | 3.5 | 50.1 | .310 | .061 |
| KALKASKA COUNTY | | | | | | | | | | | | | | | |
| Village of Kalkaska | 4.3 | 3.4 | 5.3 | 4.0 | 6.0 | 7.8 | 11.6 | 14.2 | 8.3 | 4.8 | 4.7 | 5.1 | 79.5 | .574 | .061 |
| KENT COUNTY | | | | | | | | | | | | | | | |
| City of Lowell | 16.1 | 14.9 | 17.1 | 17.1 | 17.4 | 14.7 | 15.1 | 18.0 | 14.0 | 13.5 | 13.9 | 14.2 | 186.0 | .864 | .147 |
| Village of Sparta | 8.4 | 7.6 | 8.2 | 8.1 | 9.7 | 9.2 | 11.8 | 17.2 | 11.3 | 9.6 | 10.8 | 11.9 | 123.8 | .661 | .160 |
| Kent County Airport near Grand Rapids | | | 2.4 | | | 2.6 | | | 3.3 | | | 3.5 | 11.8 | | |
| Kent County Airport near Grand Rapids for Air Conditioning | | | | | | | | | | | | | e/7.5 | -- | -- |
| LAPEER COUNTY | | | | | | | | | | | | | | | |
| Village of Imlay City | 10.0 | 10.0 | 10.9 | 10.8 | 9.1 | 10.7 | 11.9 | 17.2 | 11.2 | 10.9 | 5.0 | 7.6 | 125.3 | .449 | .363 |
| State Home & Training School at Lapeer | 19.7 | 16.3 | 19.1 | 18.8 | 19.1 | 16.4 | 17.4 | 15.7 | 17.6 | 16.7 | 18.7 | 17.5 | 213.0 | -- | -- |
| LENAWEE COUNTY | | | | | | | | | | | | | | | |
| e/Village of Clinton | | | 15.6 | | | 20.7 | | | 21.6 | | | 19.7 | 77.6 | -- | -- |
| City of Hudson | 11.7 | 10.0 | 9.4 | 9.9 | 10.6 | 10.5 | 10.9 | 11.9 | 10.2 | 8.7 | 8.3 | 9.6 | 121.7 | .558 | .183 |
| City of Morenci | 6.0 | 5.8 | 6.4 | 6.3 | 6.5 | 6.6 | 6.9 | 7.7 | 6.3 | 6.0 | 6.6 | 6.9 | 78.0 | .286 | .157 |
| City of Tecumseh | 39.3 | 37.3 | 40.7 | 38.0 | 44.5 | 48.7 | 50.2 | 62.1 | 53.0 | 46.8 | 41.5 | 42.0 | 544.1 | 2.774 | .602 |
| Fisher Body Div. G.M.C. near Tecumseh | 1.7 | 1.5 | 1.5 | 1.5 | 1.6 | 1.8 | 1.9 | 1.9 | 1.9 | 1.7 | 1.3 | 1.4 | e/19.7 | .106 | .028 |
| LIVINGSTON COUNTY | | | | | | | | | | | | | | | |
| City of Brighton | 12.2 | 11.7 | 13.4 | 13.7 | 12.7 | 15.1 | 17.3 | 18.7 | 16.3 | 13.9 | 12.5 | 11.2 | 168.7 | .687 | .267 |
| City of Howell | 28.9 | 26.7 | 28.4 | 28.4 | 29.7 | 29.5 | 30.0 | 33.1 | 36.6 | 39.9 | 26.0 | 27.7 | 364.9 | 1.487 | .633 |
| State Hospital at Howell | 3.6 | 3.1 | 3.5 | 3.6 | 4.0 | 3.9 | 4.7 | 4.7 | 4.5 | 4.1 | 2.0 | 3.2 | 44.9 | .209 | .048 |
| LUCE COUNTY | | | | | | | | | | | | | | | |
| City of Newberry | 10.7 | 11.0 | 10.6 | 12.4 | 11.0 | 13.8 | 19.5 | 14.2 | 21.6 | 9.6 | 9.8 | 12.5 | 156.7 | -- | -- |
| State Hospital at Newberry | 7.0 | 6.5 | 6.2 | 6.2 | 6.7 | 7.3 | 6.8 | 6.5 | 6.9 | 6.2 | 6.3 | 5.8 | 78.4 | -- | -- |
| MACOMB COUNTY | | | | | | | | | | | | | | | |
| Village of Richmond | 10.5 | 8.8 | 11.7 | 8.6 | 9.6 | 12.8 | 10.5 | 13.1 | 9.8 | 9.8 | 10.9 | 8.4 | 124.5 | -- | -- |
| Village of Romeo | | | | | | | | | | | | | | | |
| MANISTEE COUNTY | | | | | | | | | | | | | | | |
| City of Manistee | 37.5 | 42.7 | 36.5 | 36.5 | 46.9 | 39.2 | 47.1 | 65.3 | 44.1 | 41.3 | 36.8 | 38.2 | 512.1 | -- | -- |
| MARQUETTE COUNTY | | | | | | | | | | | | | | | |
| State House of Corr. & Br. Prison at Marquette | 8.0 | 7.1 | 7.4 | 5.6 | 7.0 | 7.4 | 7.6 | 7.6 | 7.5 | 7.8 | 7.1 | 7.4 | 87.5 | .276 | .029 |
| K. I. Sawyer Air Force Base near Gwinn | 29.1 | 25.9 | 29.4 | 32.3 | 43.7 | 33.7 | 49.1 | 61.7 | 32.8 | 30.1 | 29.6 | 29.9 | 427.3 | 2.498 | .624 |
| MONROE COUNTY | | | | | | | | | | | | | | | |
| Village of Carleton | 3.1 | 2.8 | 3.1 | 3.1 | 3.3 | 3.1 | 1.3 | July 14 - Converted to Detroit system | | | | | 19.8 | .158 | .078 |
| MONTCALM COUNTY | | | | | | | | | | | | | | | |
| City of Carson City | 9.1 | 8.4 | 9.0 | 10.0 | 9.2 | 8.7 | 9.4 | 10.3 | 10.5 | 9.1 | 9.7 | 9.4 | 112.8 | .493 | .170 |
| City of Greenville | 47.7 | 40.7 | 43.5 | 43.0 | 47.2 | 47.8 | 59.0 | 70.4 | 69.3 | 63.8 | 44.2 | 50.6 | 627.2 | 3.159 | .518 |
| Village of Sheridan | 1.7 | 1.4 | 1.6 | 1.4 | 1.8 | 1.8 | 3.0 | 3.8 | 2.5 | 1.9 | 1.6 | 1.8 | 24.3 | | |
| City of Stanton | 2.0 | 1.9 | 2.0 | 1.5 | 1.2 | 2.0 | 2.2 | 2.2 | 1.6 | 1.6 | 1.7 | 2.5 | 22.4 | | |
| MUSKEGON COUNTY | | | | | | | | | | | | | | | |
| City of Montague | 7.0 | 4.4 | 6.1 | 6.0 | 7.4 | 6.3 | 10.3 | 15.9 | 12.3 | 6.3 | 4.9 | 5.8 | 92.7 | -- | -- |
| City of Whitehall | 23.2 | 23.6 | 28.1 | 29.5 | 34.3 | 37.9 | 35.6 | 50.7 | 33.2 | 28.9 | 26.6 | 29.2 | 380.8 | 2.229 | .505 |
| NEWAYGO COUNTY | | | | | | | | | | | | | | | |
| City of Fremont | 19.7 | 18.3 | 17.7 | 20.3 | 21.7 | 25.1 | 34.5 | 46.0 | 32.6 | 29.5 | 24.9 | 28.2 | 318.5 | .873 | |
| OAKLAND COUNTY | | | | | | | | | | | | | | | |
| Cranbrook School | 5.0 | 4.7 | 4.2 | 5.0 | 8.1 | 8.4 | 6.2 | 7.7 | 7.7 | 7.8 | 5.7 | 4.9 | 75.4 | | |
| Village of Oxford | | | | | | | | | | | | | m/47.2 | -- | -- |
| Village of Rochester | 48.6 | 48.1 | 49.7 | 48.3 | 54.2 | 56.7 | 62.8 | 72.6 | 58.7 | 52.5 | 51.9 | 50.8 | 654.9 | 2.967 | 1.302 |
| City of South Lyon | 68.4 | 62.9 | 67.1 | 63.7 | 69.6 | 75.3 | 53.1 | 81.3 | 75.8 | 71.2 | 66.2 | 59.1 | 813.7 | 3.192 | .456 |
| City of Sylvan Lake | 5.2 | 5.5 | 5.1 | 6.4 | 4.9 | 7.3 | 7.0 | 7.2 | 6.8 | 6.7 | 6.3 | 5.0 | e/73.4 | -- | -- |
| City of Troy | 2.0 | 2.1 | 3.1 | 3.0 | 3.0 | 3.4 | 5.4 | 5.0 | 3.5 | 2.9 | 2.5 | 2.2 | n/38.1 | -- | -- |
| Township of Waterford | 44.4 | 44.7 | 45.9 | 46.6 | 40.0 | 63.7 | 80.3 | 166.6 | 83.0 | 54.1 | 53.2 | 39.2 | 761.7 | -- | -- |
| OCEANNA COUNTY | | | | | | | | | | | | | | | |
| City of Hart | 13.3 | 11.4 | 12.0 | 9.0 | 11.9 | 17.2 | 31.5 | 24.6 | 20.5 | 24.6 | 18.7 | 14.1 | 208.8 | -- | -- |
| OGEMAW COUNTY | | | | | | | | | | | | | | | |
| City of West Branch | 5.7 | 5.5 | 6.0 | 7.0 | 7.6 | 7.5 | 10.7 | 10.0 | 7.7 | 7.1 | 7.5 | 7.4 | 89.7 | .449 | .144 |
| OSCEOLA COUNTY | | | | | | | | | | | | | | | |
| City of Evart | 45.4 | 44.5 | 46.3 | 45.8 | 48.0 | 44.2 | 51.5 | 56.1 | 54.6 | 56.7 | 44.6 | 52.2 | 589.9 | 2.530 | .124 |

## TABLE 2. REPORTED GROUND-WATER PUMPAGE, IN 1969. (IN MILLIONS OF GALLONS)—Continued

| WATER USER | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | SEPT | OCT | NOV | DEC | 1969 TOTAL | MAX DAY | MIN DAY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OTSEGO COUNTY | | | | | | | | | | | | | | | |
| City of Gaylord | 8.8 | 8.8 | 15.4 | 7.2 | e)15.0 | e)15.0 | 8.4 | 16.4 | 14.7 | 13.3 | 10.4 | 14.0 | 147.4 | -- | -- |
| State Home at Gaylord | .9 | .9 | .9 | .8 | .8 | .9 | .8 | .9 | .8 | .8 | .7 | .6 | 9.8 | .054 | .012 |
| OTTAWA COUNTY | | | | | | | | | | | | | | | |
| Village of Spring Lake | 8.5 | 8.9 | 9.5 | 9.2 | 13.0 | 14.8 | 20.2 | 32.7 | 15.1 | 9.9 | 10.6 | 10.2 | 162.6 | 1.450 | .114 |
| City of Coopersville | 5.0 | 4.4 | 5.0 | 5.4 | 6.0 | 6.1 | 5.2 | 6.3 | 5.2 | 5.5 | 5.0 | 5.0 | e)64.1 | .250 | .064 |
| PRESQUE ISLE COUNTY | | | | | | | | | | | | | | | |
| City of Onaway | | | | | | | | | | | | | | | |
| City of Rogers City | 7.8 | 7.3 | 8.1 | 8.0 | 9.1 | 8.5 | 16.4 | 13.2 | 7.5 | 8.6 | 7.7 | 8.4 | 110.6 | .876 | .073 |
| SANILAC COUNTY | | | | | | | | | | | | | | | |
| City of Croswell | 28.7 | 20.1 | 17.4 | 14.8 | 17.3 | 21.8 | 27.3 | 53.5 | 25.6 | 79.3 | 26.3 | 28.0 | 360.1 | 1.619 | .154 |
| City of Sandusky | 15.9 | 15.0 | 13.7 | 12.7 | 14.2 | 14.6 | 19.8 | 22.8 | 18.5 | 16.2 | 13.8 | 14.1 | 191.3 | 1.015 | .253 |
| SHIAWASSEE COUNTY | | | | | | | | | | | | | | | |
| City of Corunna | 2.6 | 4.7 | 5.4 | 5.5 | 5.5 | 5.2 | NA | 4.7 | 6.1 | 6.5 | 5.5 | 5.1 | NA | -- | -- |
| City of Durand | 12.4 | 11.4 | 12.5 | 10.7 | 12.2 | 11.8 | 13.2 | 15.4 | 14.5 | 14.1 | 13.1 | 15.6 | 156.9 | .673 | .280 |
| City of Owosso | 73.3 | 71.3 | 78.5 | 75.2 | 79.2 | 80.2 | 86.6 | 93.5 | 84.3 | 81.4 | 70.0 | 74.2 | 947.7 | 3.6 | 2.8 |
| City of Perry | 2.2 | 1.0 | 2.9 | 2.0 | 2.6 | 2.4 | 3.0 | 3.4 | 3.0 | 2.5 | 2.4 | 2.3 | 29.7 | -- | -- |
| ST. CLAIR COUNTY | | | | | | | | | | | | | | | |
| Village of Capac | 2.9 | 2.7 | 2.7 | 2.4 | 2.7 | 2.4 | 3.0 | 4.2 | 4.2 | 3.2 | 2.7 | 1.0 | 34.1 | -- | -- |
| City of Yale | 4.9 | 3.8 | 5.3 | 4.9 | 5.5 | 5.0 | 5.4 | 5.1 | 5.1 | 4.2 | 4.0 | 3.8 | 57.0 | -- | -- |
| ST. JOSEPH COUNTY | | | | | | | | | | | | | | | |
| Village of Constantine | | | | | | | | | | | | | | | |
| City of Sturgis | 58.2 | 54.9 | 60.4 | 45.7 | 51.9 | 51.3 | 57.7 | 71.5 | 58.0 | 50.2 | 44.3 | 48.0 | p)652.1 | 3.206 | .960 |
| City of Three Rivers | 29.4 | 26.0 | 27.7 | 28.6 | 33.8 | 31.8 | 37.8 | 45.0 | 37.6 | 30.6 | 27.8 | 21.5 | 377.6 | 1.988 | .605 |
| TUSCOLA COUNTY | | | | | | | | | | | | | | | |
| State Hospital at Caro | 13.2 | 7.8 | 9.3 | 9.1 | 8.7 | 7.4 | 8.2 | 6.9 | 9.1 | 7.8 | 7.1 | 7.1 | 101.7 | .491 | .170 |
| Village of Cass City | 6.6 | 6.4 | 6.8 | 6.8 | 8.2 | 9.0 | 10.6 | 11.8 | 9.1 | 7.9 | 6.3 | 6.4 | 95.9 | .543 | .144 |
| VAN BUREN COUNTY | | | | | | | | | | | | | | | |
| City of Bangor | | | | | | | | | | | | | | | |
| City of Hartford | 4.5 | 7.3 | 8.0 | 9.8 | 9.3 | 8.1 | 11.7 | 3.8 | 7.1 | 3.4 | 6.8 | 9.0 | e)88.8 | .670 | .130 |
| Village of Lawton | 13.2 | 12.8 | 14.9 | 13.2 | 12.8 | 14.9 | 15.4 | 19.1 | 12.5 | 23.7 | 14.9 | 13.6 | 181.0 | 1.344 | .230 |
| Village of Paw Paw | 17.0 | 14.8 | 16.5 | 13.6 | 14.4 | 17.4 | 22.2 | 20.5 | 12.4 | 8.6 | 10.8 | 13.8 | 182.0 | 1.060 | .254 |
| WASHTENAW COUNTY | | | | | | | | | | | | | | | |
| City of Ann Arbor | 105.5 | 101.7 | 106.1 | 101.0 | 88.8 | 49.3 | 83.8 | 125.9 | 144.4 | 134.4 | 114.7 | 95.0 | q)1,250.6 | -- | -- |
| Boy's Training School at Whitmore Lake | 6.7 | 6.0 | 6.3 | 6.4 | 7.1 | 6.5 | 8.2 | 6.9 | 5.8 | 7.2 | 6.3 | 6.4 | 79.8 | .675 | .116 |
| Cassidy Lake Tech. School | 1.2 | 1.0 | 1.2 | 1.2 | 1.8 | 1.6 | 1.8 | 1.4 | 1.2 | 1.1 | 1.0 | 1.1 | 15.6 | -- | -- |
| Village of Dexter | | | | | | | | | | | | | | | |
| City of Saline | 15.5 | 14.1 | 15.6 | 15.3 | 18.0 | 18.5 | 19.5 | 23.6 | 20.8 | 17.5 | 14.9 | 15.7 | 209.0 | 1.073 | .306 |
| City of Ypsilanti | 178.1 | 157.9 | 174.2 | 163.9 | 186.9 | 168.4 | 172.9 | 182.8 | 184.1 | 174.8 | 165.6 | 162.8 | 2,072.4 | 7.232 | 3.680 |
| Township of Ypsilanti | 283.4 | 248.1 | 275.7 | 267.9 | 299.2 | 283.9 | 312.6 | 337.5 | 307.5 | 306.5 | 278.4 | 265.8 | 3,466.5 | 14.365 | 4.764 |
| State Hospital at Ypsilanti | 16.7 | 15.4 | 16.0 | 16.1 | 17.7 | 17.9 | 20.6 | 19.2 | 20.2 | 20.6 | 20.1 | 20.4 | 220.9 | .660 | .281 |
| WAYNE COUNTY | | | | | | | | | | | | | | | |
| State Hospital at Northville | 18.6 | 17.4 | 18.1 | 17.4 | 15.3 | 15.3 | 16.4 | 16.9 | 15.6 | 16.3 | 15.2 | 15.7 | 198.2 | .823 | .296 |
| City of Plymouth | 88.4 | 83.0 | 90.9 | 90.0 | 98.2 | 95.3 | 89.2 | 116.6 | 106.5 | 104.1 | 90.8 | 92.1 | 1,145.1 | 3.620 | 1.990 |
| Plymouth State Home & Training School at Northville | 8.1 | 8.0 | 8.7 | 8.4 | 7.9 | 2.4 | 9.2 | 10.1 | 9.4 | 9.4 | 9.1 | 9.5 | 100.2 | .241 | .046 |
| WEXFORD COUNTY | | | | | | | | | | | | | | | |
| City of Cadillac | 49.1 | 48.5 | 50.4 | 44.2 | 69.4 | 68.4 | 97.1 | 120.2 | 73.2 | 49.5 | 44.7 | 57.1 | 771.8 | -- | -- |

NOTES

NA) Not available.
a) Quarterly figures.
b) Water lost due to broken main.
c) Estimate for year.
d) Well supply abandoned due to gasoline contamination from oil line break -- now obtaining water from Flint and Detroit systems.
e) Wholly or partly estimated.
f) Also pumped 619 million gallons from the Pine River.
g) Also pumped 404 million gallons from Baw Beese Lake.
h) Use of wells discontinued.
k) Use Ranney collector system at Chippewa River site.
m) Annual total based on sales figures.
n) Also used 130 million gallons from Detroit system.
p) A local industry using 17% of municipal supply moved.
q) Also pumped 2,203 million gallons from the Huron River.

# WATER RESOURCES INVESTIGATIONS IN MICHIGAN

## REPORTS OF INVESTIGATIONS

Selected references on water in Michigan are given below. Many of them are available for reference at one of the offices listed in the preface of this report and at the larger public and university libraries. A more complete listing of Geological Survey reports and their availability is given in a pamphlet "Geological and Water-Supply Reports and Maps--Michigan". Price lists of available publications of the Michigan Geological Survey are available from that agency.

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