

GROUND-WATER DATA FOR MICHIGAN 1985

by G. C. Huffman

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CONTENTS

| | Page |
|---|------|
| Abstract ----- | 1 |
| Introduction ----- | 1 |
| Purpose and scope ----- | 1 |
| Use of data ----- | 1 |
| Ground-water records and reports ----- | 3 |
| Well-numbering system ----- | 5 |
| Acknowledgments ----- | 5 |
| Ground-water levels ----- | 11 |
| Area ground-water data ----- | 13 |
| Alpena County ----- | 14 |
| Branch County - city of Coldwater ----- | 15 |
| Calhoun County - city of Battle Creek ----- | 16 |
| Grand Traverse County ----- | 17 |
| Hillsdale County ----- | 18 |
| Ingham County - city of Lansing ----- | 19 |
| - city of Mason ----- | 20 |
| Kalamazoo County - city of Kalamazoo ----- | 21 |
| Marquette County - Iron Range area ----- | 22 |
| Monroe County ----- | 23 |
| Oakland County ----- | 24 |
| Oceana County ----- | 25 |
| Otsego County ----- | 26 |
| Saginaw County ----- | 27 |
| Sanilac County ----- | 28 |
| Washtenaw County - city of Ann Arbor ----- | 29 |
| - city of Ypsilanti ----- | 30 |
| Tables ----- | 31 |
| Selected references ----- | 42 |

FIGURES

| | Page |
|---|------|
| 1. Map showing distribution of observation wells ----- | 2 |
| 2. Map showing water-quality collection sites and year sample collected -- | 4 |
| 3. Map showing areas in the Upper Peninsula where ground-water conditions are described in published reports ----- | 6 |
| 4. Map showing areas in the Lower Peninsula where ground-water conditions are described in published reports ----- | 8 |
| 5. Graphs of water levels in selected wells ----- | 12 |

TABLES

| | Page |
|--|------|
| 1. Records of Michigan observation wells ----- | 32 |
| 2. Reported ground-water pumpage ----- | 37 |
| 3. Water-quality data ----- | 40 |

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1985

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ABSTRACT

Water levels, locations, depths, and aquifers tapped are given for 113 observation wells. Tabulated data include extremes of water levels for calendar year 1985 and for the period of record, pumpage of most major ground-water users in the State, and water-quality data from selected wells. The largest reported user of ground-water, the city of Lansing, pumped 7.9 billion gallons from the Saginaw Formation and glacial deposits in 1985.

INTRODUCTION

Purpose and Scope

This report makes available, through 1985, the records of water levels and related data for the principal aquifers of Michigan. Data on yield of wells, pumpage, quality of water, and hydrographs of ground-water levels for the past 5 years are shown in the text. Yearly hydrographs are included to illustrate seasonal changes in water levels. Records of water levels in observation wells, records of pumpage by most major ground-water users, and water-quality data from selected wells sampled during 1985 are given in tables 1, 2, and 3. Distribution of observation wells is shown in figure 1. Location of wells sampled for water-quality data and years sampled are shown in figure 2.

Use of Data

The quantity of water available from an aquifer can be determined by analysis of records of water levels and pumpage. Water-level records showing long-term effects of pumping can be used to estimate the capacity of aquifers to meet present and future demands for water and to determine whether expansion of present supply systems for ground water is practicable.

Water levels normally fluctuate annually (fig. 5) and may exhibit long-term trends over a period of years. Should an excavation be made when the levels are low, good construction practices would allow for probable higher levels. When construction is made after several years of drought, the allowance for rising water levels should be greater. Test drilling may be needed at some sites to determine water levels. In an area where the water level is declining because of pumping, projection of future water levels indicates the depth below which well intakes should be installed.

Ground-Water Records and Reports

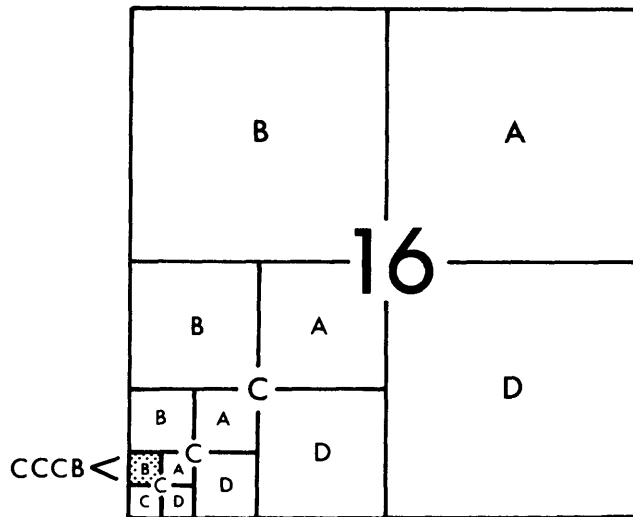
Tabulations of water-level measurements, hydrographs for observation wells, records of chemical quality, water-temperature measurements, well records and logs, aquifer tests, records of pumping for public and industrial supplies, and water-resources reports are on file for public inspection. They may be examined at the Geological Survey Division, Michigan Department of Natural Resources, Mason Building, Lansing, Michigan 48933; or at the U.S. Geological Survey, 6520 Mercantile Way, Suite 5, Lansing, Michigan 48911. Records for the Upper Peninsula are also kept on file in the State and Federal Geological Survey Offices, State Office Building, Escanaba, Michigan 49829.

Ground-water levels from 1935 to 1974 are reported in U.S. Geological Survey Water-Supply Papers (WSP). Records since 1975 are in U.S. Geological Survey Water-Data Reports (WDR). Annual reports, titled "Summary of Ground-Water Conditions in Michigan," were begun in 1956 to supplement the Water-Supply Paper and Water-Data Report series. The title of the report was changed to "Summary of Ground-Water Hydrological Data in Michigan," in 1967 and to "Ground-Water Data for Michigan" in 1973.

Areas covered by reports that describe ground water in Michigan are shown in figures 3 and 4. In addition, many publications dealing with ground water are listed in the selected references at the end of this report.

Well-Numbering System

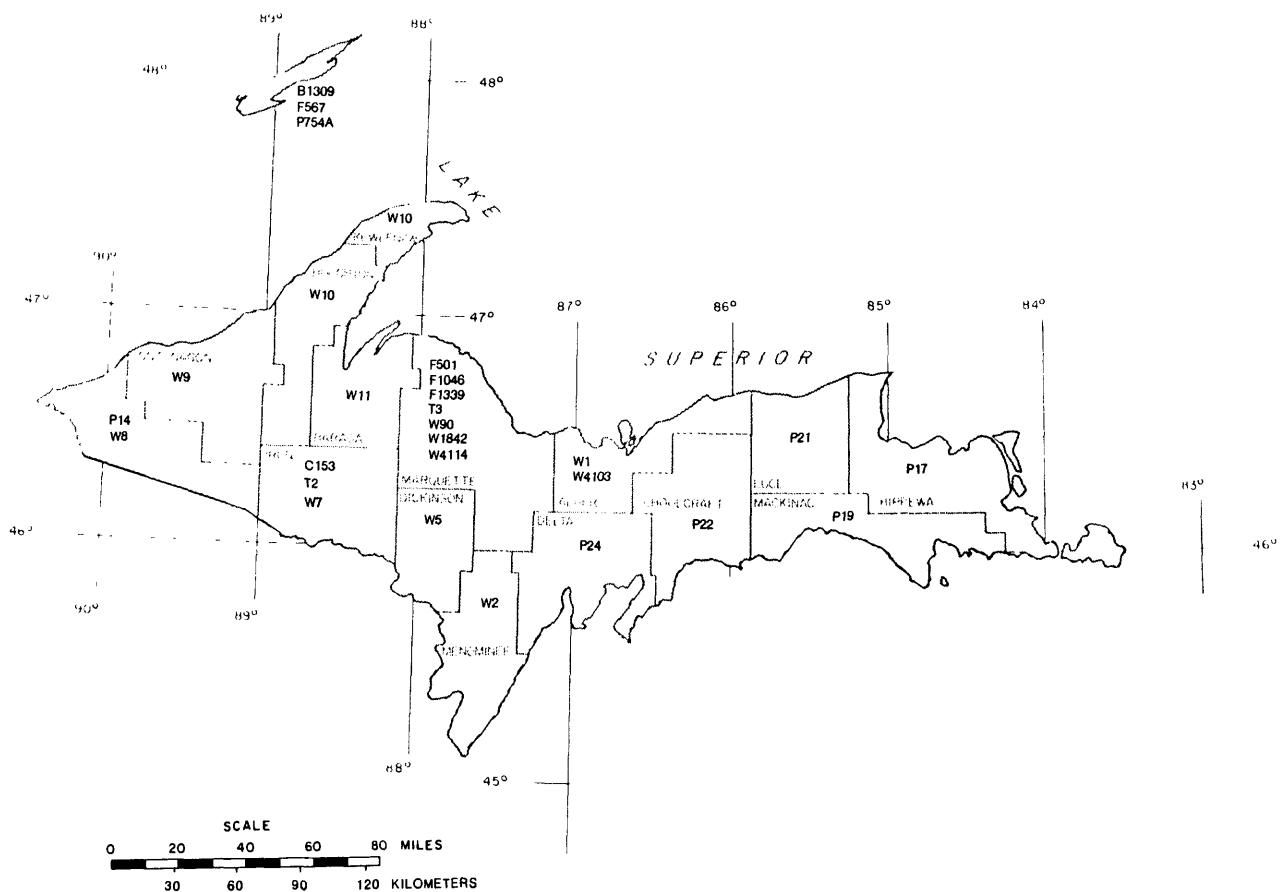
The well-numbering system for Michigan indicates the location of wells within a rectangular subdivision of land with reference to the Michigan meridian and base line. The first two segments of the well number designate township and range, the third segment of the number designates the section, and the letters A through D designate successively smaller subdivisions of the section, as shown below. Thus, a well designated as 32N 6E 16CCCB is located to the nearest 2.5 acres and is within the shaded area in section 16.



For many wells in this report, locations are only given to the nearest 40-acre tract, for example, 16CC. In the event that two or more wells are in the same tract, sequential number designation is added--for example, 16CCCB1, 16CCCB2, etc. The Michigan Geological Survey uses a similar system except that numbers are used instead of letters.

Acknowledgments

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 data presented in this report would not have been possible.



EXPLANATION

C153 Symbol for reports shown on following pages

Figure 3.--Areas in the Upper Peninsula where ground-water conditions are described in published reports.

PUBLISHED REPORTS

Upper Peninsula

- B1309 -- Huber, N. K., 1975, The geologic story of Isle Royale National Park: U.S. Geological Survey Bulletin 1309.
- C153 -- Pettijohn, F. J., 1952, Geology of the northern Crystal Falls area, Iron County, Michigan: U.S. Geological Survey Circular 153.
- F501 -- Doonan, C. J., and VanAlstine, J. L., 1982, Ground water and geology of Marquette County, Michigan: U.S. Geological Survey Open-File Report 82-501.
- F567 -- Grannemann, N. G., and Twenter, F. R., 1982, Ground water for public supply at Windigo, Isle Royale National Park, Michigan: U.S. Geological Survey Open-File Report 82-567.
- F1046 -- Grannemann, N. G., 1978, Water supply potential of the Lake Sally system, Marquette County, Michigan: U.S. Geological Survey Open-File Report 78-1046.
- F1339 -- _____, 1979, Water resources of the Marquette Iron Range area, Marquette County, Michigan: U.S. Geological Survey Open-File Report 79-1339.
- P14 -- Brown, E. A., and Stuart, W. T., 1951, Ground-water resources of the glacial deposits in the Bessemer area, Michigan: Michigan Geological Survey Progress Report 14.
- P17 -- Vanlier, K. E., and Deutsch, Morris, 1958, Reconnaissance of the ground-water resources of Chippewa County, Michigan: Michigan Geological Survey Progress Report 17.
- P19 -- _____, 1958, Reconnaissance of the ground-water resources of Mackinac County, Michigan: Michigan Geological Survey Progress Report 19.
- P21 -- Vanlier, K. E., 1959, Reconnaissance of the ground-water resources of Luce County, Michigan: Michigan Geological Survey Progress Report 21.
- P22 -- Sinclair, W. C., 1959, Reconnaissance of the ground-water resources of Schoolcraft County, Michigan: Michigan Geological Survey Progress Report 22.
- P24 -- _____, 1960, Reconnaissance of the ground-water resources of Delta County, Michigan: Michigan Geological Survey Progress Report 24.
- P754A -- Huber, N. K., 1973, Glacial and postglacial geologic history of Isle Royale National Park, Michigan: U.S. Geological Survey Professional Paper 754-A.
- T2 -- Stuart, W. T., Theis, C. V., and Stanley, G. M., 1948, Ground-water problems in the Iron River district, Michigan: Michigan Geological Survey Technical Report 2.
- T3 -- Stuart, W. T., Brown, E. A., and Rhodehamel, E. C., 1954, Ground-water investigations of the Marquette iron-mining district, Michigan: Michigan Geological Survey Technical Report 3.
- W1 -- Vanlier, K. E., 1963, Reconnaissance of the ground-water resources in Alger County, Michigan: Michigan Geological Survey Water Investigation 1.
- W2 -- _____, 1963, Ground water in Menominee County: Michigan Geological Survey Water Investigation 2.
- W5 -- Hendrickson, G. E., and Doonan, C. J., 1966, Ground-water resources of Dickinson County, Michigan: Michigan Geological Survey Water Investigation 5.
- W7 -- Doonan, C. J., Hendrickson, G. E., 1967, Ground water in Iron County, Michigan: Michigan Geological Survey Water Investigation 7.
- W8 -- _____, 1968, Ground water in Gogebic County, Michigan: Michigan Geological Survey Water Investigation 8.
- W9 -- _____, 1969, Ground water in Ontonagon County, Michigan: Michigan Geological Survey Water Investigation 9.
- W10 -- Doonan, C. J., Hendrickson, G. E., and Byerly, J. R., 1970, Ground water and geology of Keweenaw Peninsula, Michigan: Michigan Geological Survey Water Investigation 10.
- W11 -- Doonan, C. J., and Byerly, J. R., 1973, Ground water and geology of Baraga County, Michigan: Michigan Geological Survey Water Investigation 11.
- W90 -- Twenter, F. R., 1981, Geology and hydrology for environmental planning in Marquette County, Michigan: U.S. Geological Survey Water Resources Investigations, 80-90.
- W1842 -- Wiitala, S. W., Newport, T. G., and Skinner, E. L., 1967, Water Resources of the Marquette Iron Range area, Michigan: U.S. Geological Survey Water-Supply Paper 1842.
- W4103 -- Handy, A. H., and Twenter, F. R., Water Resources of Pictured Rocks National Lakeshore, Michigan, 1985, U.S. Geological Survey Water Resources Investigations Report 85-4103.
- W4114 -- Grannemann, N. G., 1984, Hydrogeology and effects of tailing basins on the hydrology of Sands Plain, Marquette County, Michigan, U.S. Geological Survey Water-Resources Investigations Report 84-4114.

PUBLISHED REPORTS

Lower Peninsula

- C183 -- Wisler, C. O., Stramel, G. J., and Laird, L. B., 1952, Water resources of the Detroit area, Michigan: U.S. Geological Survey Circular 183.
- C323 -- Stramel, G. J., Wisler, C. O., and Laird, L. B., 1954, Water resources of the Grand Rapids area, Michigan: U.S. Geological Survey Circular 323.
- F1 -- Fleck, W. B., 1980, Geology and hydrology for environmental planning in Washtenaw County, Michigan: U.S. Geological Survey Open-File Report unnumbered.
- F99 -- McDonald, M. G., and Fleck, W. B., 1978, Model analysis of the impact on ground-water conditions of the Muskegon County wastewater disposal system, Michigan: U.S. Geological Survey Open-File Report 78-99.
- F511 -- Handy, A. H., 1982, Water quality of coal deposits and abandoned mines, Saginaw County, Michigan: U.S. Geological Survey Open-File Report 82-511.
- F591 -- Stark, J. R., and McDonald, M. G., 1980, Ground water of coal deposits, Bay County, Michigan: U.S. Geological Survey Open-File Report 80-591.
- H317 -- Knutilla, R. L., 1969, Water resources of the Belle River basin, southeastern Michigan: U.S. Geological Survey Hydrological Investigation Atlas HA-317.
- H327 -- _____, 1969, Water resources of the Pine River basin, southeastern Michigan: U.S. Geological Survey Hydrological Investigation Atlas HA-327.
- H338 -- _____, 1970, Water resources of the Black River basin, southeastern Michigan: U.S. Geological Survey Hydrological Investigation Atlas HA-338.
- H356 -- _____, 1971, Water resources of the River Rouge basin, southeastern Michigan: U.S. Geological Survey Hydrological Investigation Atlas HA-356.
- H469 -- Nowlin, J. O., 1973, Water resources of the Clinton River basin, southeastern Michigan: U.S. Geological Survey Hydrological Investigation Atlas HA-469.
- H514 -- Larson, R. W., Allen, W. B., and Hanson, S. D., 1975, Water resources of the Huron River basin, southeastern Michigan: U.S. Geological Survey Hydrological Investigation Atlas HA-514.
- H520 -- Knutilla, R. L., and Allen, W. B., 1975, Water resources of the River Raisin basin, southeastern Michigan: U.S. Geological Survey Hydrological Investigation Atlas HA-520.
- H546 -- Twenter, F. R., Knutilla, R. L., Cummings, T. R., 1975, Water resources of basins for minor streams draining into St. Clair River, Lake St. Clair, Detroit River, and Lake Erie, southeastern Michigan: U.S. Geological Survey Hydrological Investigation Atlas HA-546.
- M1 -- Terwilliger, F. W., 1954, The glacial geology and ground-water resources of Van Buren County, Michigan, pt. 1 of Occasional papers for 1954 on the geology of Michigan: Michigan Geological Survey Publication 48.
- M2 -- Mozola, A. J., 1954, A survey of ground-water resources in Oakland County, Michigan, pt. 2 of Occasional papers for 1954 on the geology of Michigan: Michigan Geological Survey Publication 48.
- M3 -- Vanlier, K. E., 1968, Comprehensive planning study of the Grand River basin, Michigan, Appendix E, Ground-water resources and geology of the Grand River basin, Michigan: U.S. Army Engineers District, Detroit, Michigan.
- M4 -- Vanlier, K. E., and Wheeler, M. L., 1968, Analog simulation of ground-water development of the Saginaw Formation, Lansing metropolitan area, Michigan: Tri-County Planning Commission, Lansing Ground-Water Report.
- M5 -- Childs, K. E., 1970, History of the salt, brine, and paper industries and their probable effect on the ground-water quality in the Manistee Lake area, Michigan: Michigan Department of Natural Resources.
- M6 -- Schneider, A. F., and Keller, S. J., 1970, Indiana Geological Survey regional geological map number 4: Indiana Department of Natural Resources.
- M7 -- Johnson, G. H., and Keller, S. J., 1972, Indiana Geological Survey regional geological map number 8: Indiana Department of Natural Resources.
- M8 -- Twenter, F. R., Knutilla, R. L., and Nowlin, J. O., 1976, Water resources of Washtenaw County, Michigan: Washtenaw County Metropolitan Planning Commission.
- M9 -- Borton, T. E., 1974, Planning perspectives on water resources, Washtenaw County, Michigan: Washtenaw County Metropolitan Planning Commission.
- M10 -- Twenter, F. R., 1975, Ground water and geology -- southeastern Michigan: U.S. Army Corps of Engineers.
- M11 -- Fleck, W. B., and McDonald, M. G., 1978, Three-dimensional finite-difference model of ground-water system underlying the Muskegon County wastewater disposal system, Michigan: U.S. Geological Survey Journal of Research, volume 6, number 3.
- P3 -- Pringle, G. H., 1937, Geology of Arenac County, Michigan: Michigan Geological Survey Progress Report 3.
- P4 -- Riggs, C. H., 1938, Geology of Allegan County, Michigan: Michigan Geological Survey Progress Report 4.
- P12 -- Stuart, W. T., and Stallman, R. W., 1945, Ground-water resources of the Benton Harbor area, Michigan: Michigan Geological Survey Progress Report 12.
- P13 -- Stuart, W. T., 1945, Ground-water resources of the Lansing area, Michigan: Michigan Geological Survey Progress Report 13.
- P16 -- Ferris, J. G., and others, 1954, Ground-water resources of southeastern Oakland County, Michigan: Michigan Geological Survey Progress Report 16.
- P20 -- Deutsch, Morris, Burt, E. M., and Vanlier, K. E., 1958, Summary of ground-water investigations in the Holland area, Michigan: Michigan Geological Survey Progress Report 20.

PUBLISHED REPORTS--Continued

Lower Peninsula

- P23 -- Deutsch, Morris, Vanlier, K. E., and Giroux, P. R., 1960, Ground-water hydrology and glacial geology of the Kalamazoo area, Michigan: Michigan Geological Survey Progress Report 23.
- P25 -- Vanlier, K. E., 1962, Summary of ground-water investigations in the Elsie area, Michigan: Michigan Geological Survey Progress Report 25.
- R3 -- Mozola, A. J., 1969, Geology for land and ground-water development in Wayne County, Michigan: Michigan Geological Survey Report Investigation 3.
- R13 -- _____, 1970, Geology for environmental planning in Monroe County, Michigan: Michigan Geological Survey Report Investigation 13.
- W1 -- Knutilla, R. L., Twenter, F. R., and Larson, R. W., 1971, Upper Rifle River Basin -- An Evaluation of its Water Resources and Hydrologic Environment: Michigan Geological Survey Water Information Series Report 1.
- W3 -- Giroux, P. R., Hendrickson, G. E., Stoimenoff, L. E., and Whetstone, G. W., 1964, Water resources of Van Buren County, Michigan: Michigan Geological Survey Investigation 3.
- W4 -- Vanlier, K. E., 1966, Ground-water resources of the Battle Creek area, Michigan: Michigan Geological Survey Water Investigation 4.
- W6 -- Giroux, P. R., Stoimenoff, L. E., Nowlin, J. O., and Skinner, E. L., 1966, Water resources of Branch County, Michigan: Michigan Geological Survey Water Investigation 6.
- W55 -- Water resource conditions and uses in the Paw Paw River Basin, 1955, (revised report in 1964): Michigan Water Resources Commission Report.
- W56 -- Water resource conditions and uses in the Flint River Basin, 1956: Michigan Water Resources Commission Report.
- W57 -- Water resource conditions and uses in the Huron River Basin, 1957: Michigan Water Resources Commission Report.
- W60 -- Water resource conditions and uses in the Tittabawassee River Basin, 1960: Michigan Water Resources Commission Report.
- W61 -- Water resource conditions and uses in the Upper Grand River Basin, 1961: Michigan Water Resources Commission Report.
- W63 -- Water resource conditions and uses in the Shiawassee River Basin, 1963: Michigan Water Resources Commission Report.
- W64 -- Water resource conditions and uses in the Maumee River Basin, 1964: Michigan Water Resources Commission Report.
- W65 -- Water resource conditions and uses in the River Raisin Basin, 1965: Michigan Water Resources Commission Report.
- W66 -- Water resource conditions and uses in the Au Sable River Basin, 1966: Michigan Water Resources Commission Report.
- W67 -- Water resource conditions and uses in the Lower Grand River Basin, 1967, (open file): Michigan Water Resources Commission Report.
- W1078 -- McGuinness, C. L., Poindexter, O. F., and Otton, E. G., 1949, Ground-water supplies of the Ypsilanti area, Michigan: U.S. Geological Survey Water-Supply Paper 1078.
- W1499E -- Wiitala, S. W., Vanlier, K. E., and Krieger, R. A., 1963, Water resources of the Flint area, Michigan: U.S. Geological Survey Water-Supply Paper 1499-E.
- W1594D -- Reed, J. E., Deutsch, Morris, and Wiitala, S. W., 1966, Induced recharge of an artesian glacial-drift aquifer at Kalamazoo, Michigan: U.S. Geological Survey Water-Supply paper 1594-D.
- W1619E -- Vanlier, K. E., 1963, Ground-water resources of the Alma area, Michigan: U.S. Geological Survey Water-Supply Paper 1619-E.
- W1969 -- Vanlier, K. E., Wood, W. W., and Brunett, J. O., 1973, Water-supply development and management alternatives for Clinton, Eaton, and Ingham Counties, Michigan: U.S. Geological Survey Water-Supply Paper 1969.
- W1973 -- Allen, W. B., Miller, J. B., and Wood, W. W., 1972, Availability of water in Kalamazoo County, Michigan: U.S. Geological Survey Water-Supply paper 1973.
- W2000 -- Twenter, F. R., and Knutilla, R. L., 1972, Water for a rapidly growing urban community -- Oakland County, Michigan: U.S. Geological Survey Water-Supply paper 2000.
- W2081 -- McDonald, M. G., 1980, Hydraulic characteristics of an underdrained irrigation circle, Muskegon County wastewater disposal system, Michigan: U.S. Geological Survey Water-Supply Paper 2081.
- W4002 -- Stark, J. R., Cummings, T. R., and Twenter, F. R., 1983, Ground-water contamination at Wurtsmith Air Force Base, Michigan: U.S. Geological Survey Water Resources Investigations Report 83-4002.
- W4056 -- Grannemann, N. G., and Twenter, F. R., 1985, Geohydrology and ground-water flow at Verona Well Field, Battle Creek, Michigan: U.S. Geological Survey Water Resources Investigations Report 85-4056.
- W4064 -- Twenter, F. R., Cummings, T. R., and Grannemann, N. G., 1983, Ground-water contamination in East Bay Township, Michigan: U.S. Geological Survey Water-Resources Investigations Report 85-4064.
- W4110 -- Twenter, F. R., and Cummings, T. R., 1985, Quality of ground water in Monitor and Williams Townships, Bay County, Michigan: U.S. Geological Survey Water Resources Investigations Report 85-4110.
- W4112 -- Cummings, T. R., Twenter, F. R., and Holtschlag, D. J., 1984, Hydrology and land use in Van Buren County, Michigan: U.S. Geological Survey Water Resources Investigations Report 84-4112.
- W4253 -- Handy, A. H., and Stark, J. R., 1984, Water resources of Sleeping Bear Dunes National Lakeshore, Michigan: U.S. Geological Survey Water Resources Investigations Report 83-4253.

GROUND-WATER LEVELS

Water levels, measured in 113 observation wells throughout the State (fig. 1 and table 1) in 1985, generally follow precipitation trends. Rising levels usually occur where precipitation has been above normal and declining levels where precipitation has been below normal. Hydrographs (fig. 5) show that water levels are generally highest in spring. At this time, snowmelt and rain normally recharge ground-water reservoirs. However, ice cover or frost in the ground can impede infiltration. Under these conditions, most water from snowmelt flows overland and little recharge occurs. Generally, less recharge occurs during the summer, as most rainfall is evaporated, transpired, or flows overland after intense thunderstorms. In the fall, when evapotranspiration is reduced, heavy rains may cause water levels to rise. Frozen ground impedes infiltration of water during winter.

Although quantity of precipitation is a major factor affecting ground-water levels, many other natural factors, such as soil condition, nature of underlying rock, and slope of the land surface affect the levels. Minor fluctuation in levels are caused by earth tides and variation in barometric pressure. Evapotranspiration causes small daily declines in water levels in some shallow wells. Pumping withdrawals can lower water levels appreciably. If withdrawals are greater than recharge, long-term water-level declines will occur. Uniform pumping rates throughout the year may allow levels to follow precipitation trends.

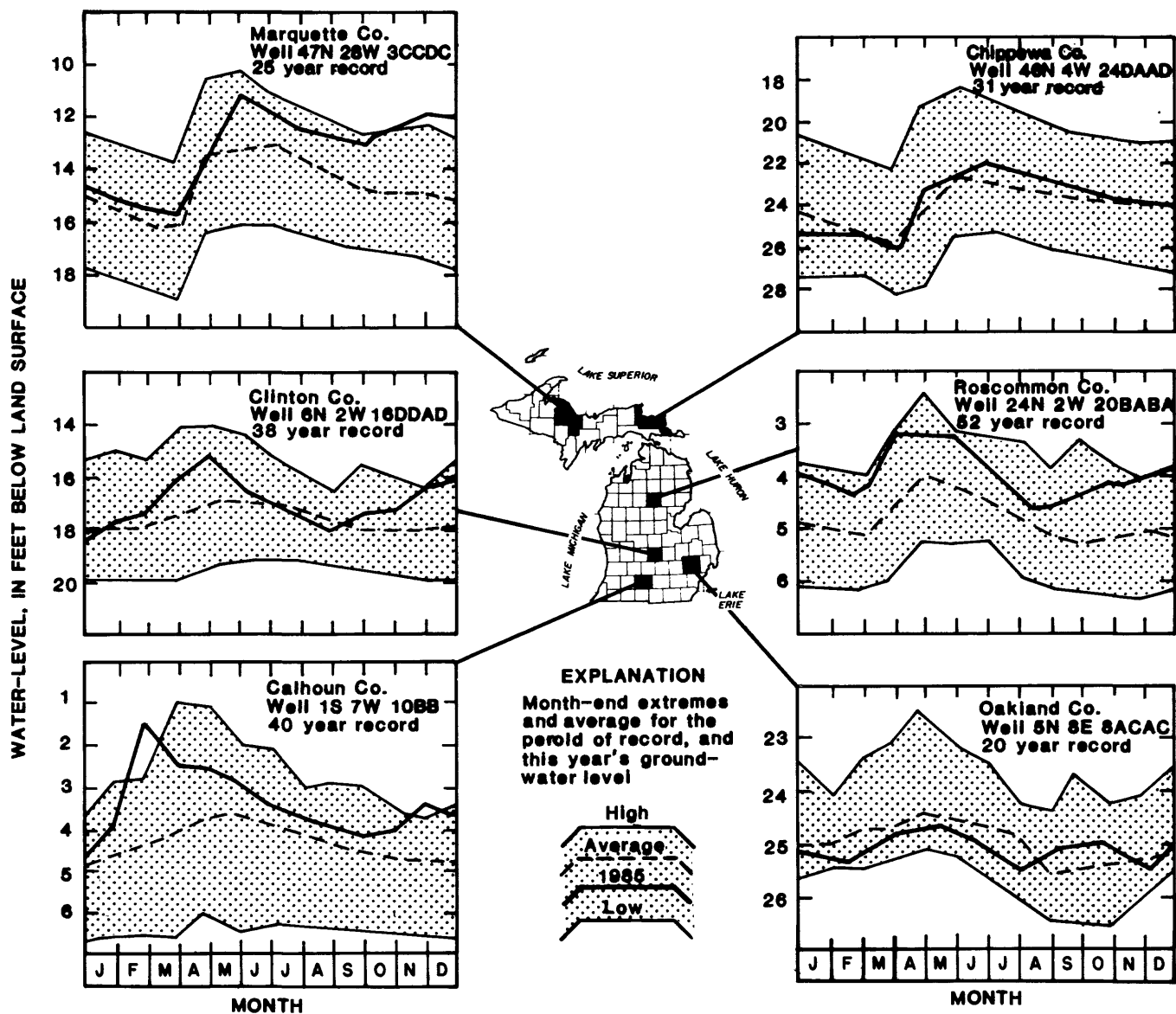
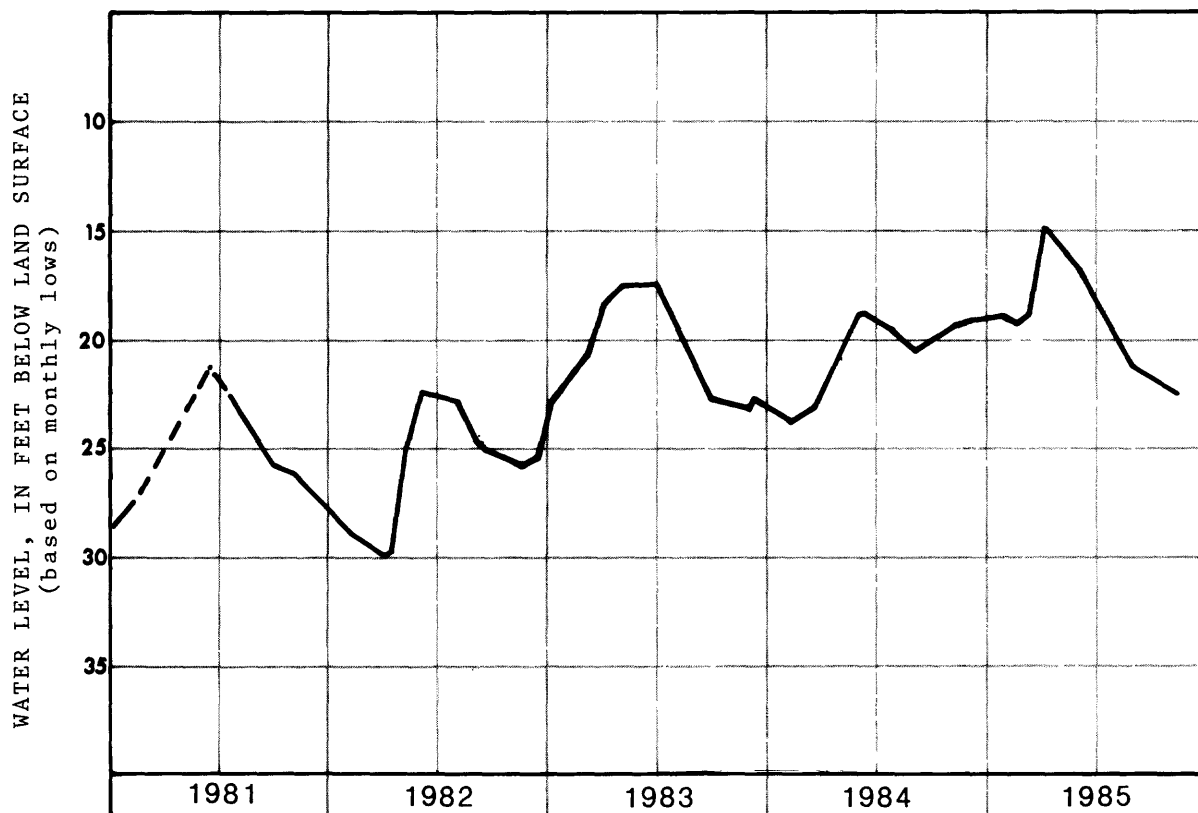
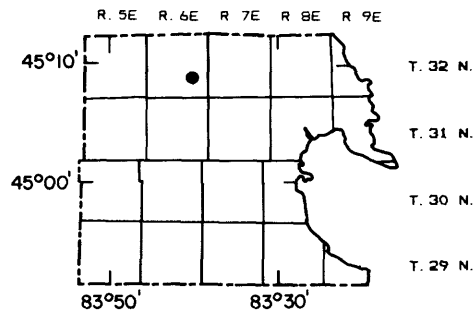


Figure 5.--Water levels in selected wells.

AREA GROUND-WATER DATA

Variation of water levels and descriptions of some ground-water supplies in Michigan follow alphabetically, by county. Yield of wells and pumpage data are given as reported by water departments and consultants.

ALPENA COUNTY



Water levels in well 32N 6E 23DDDA1. Well is 88 feet deep and in sand. Water-quality data in ground-water reports for 1977 and 1982 (Huffman, 1979, 1983).

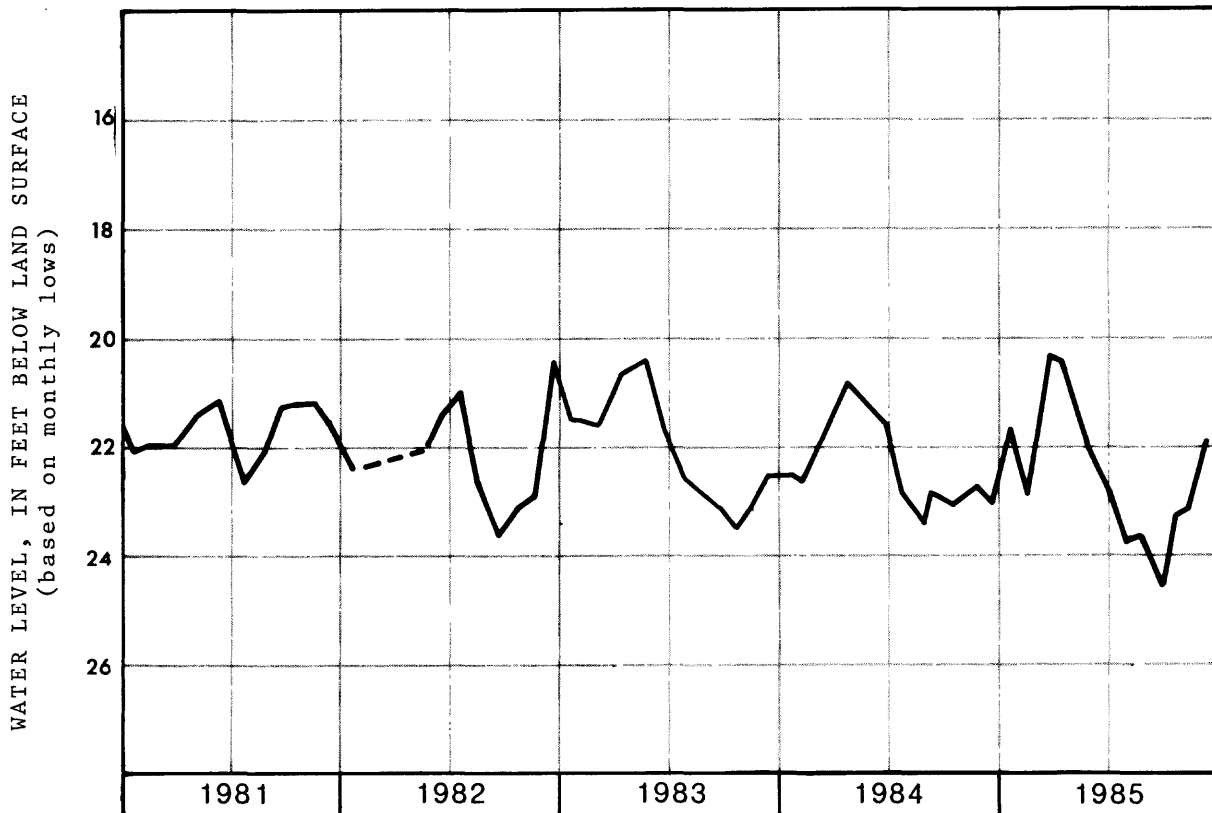
BRANCH COUNTY - CITY OF COLDWATER

SUPPLY AND SOURCE -- 4 wells, 117 to 129 feet deep, tap glacial deposits.

YIELD OF WELLS -- 1,200 to 2,850 gal/min; specific capacity -- 80 to 190 gal/min/ft of drawdown.

PUMPAGE -- Total annual pumpage, in million gallons, for past 5 years.

1985 - 1,168
1984 - 1,115
1983 - 1,308
1982 - 1,123
1981 - 1,122



Water levels in well 6S 6W 22CABA1. Well is 113 feet deep and in glacial deposits.

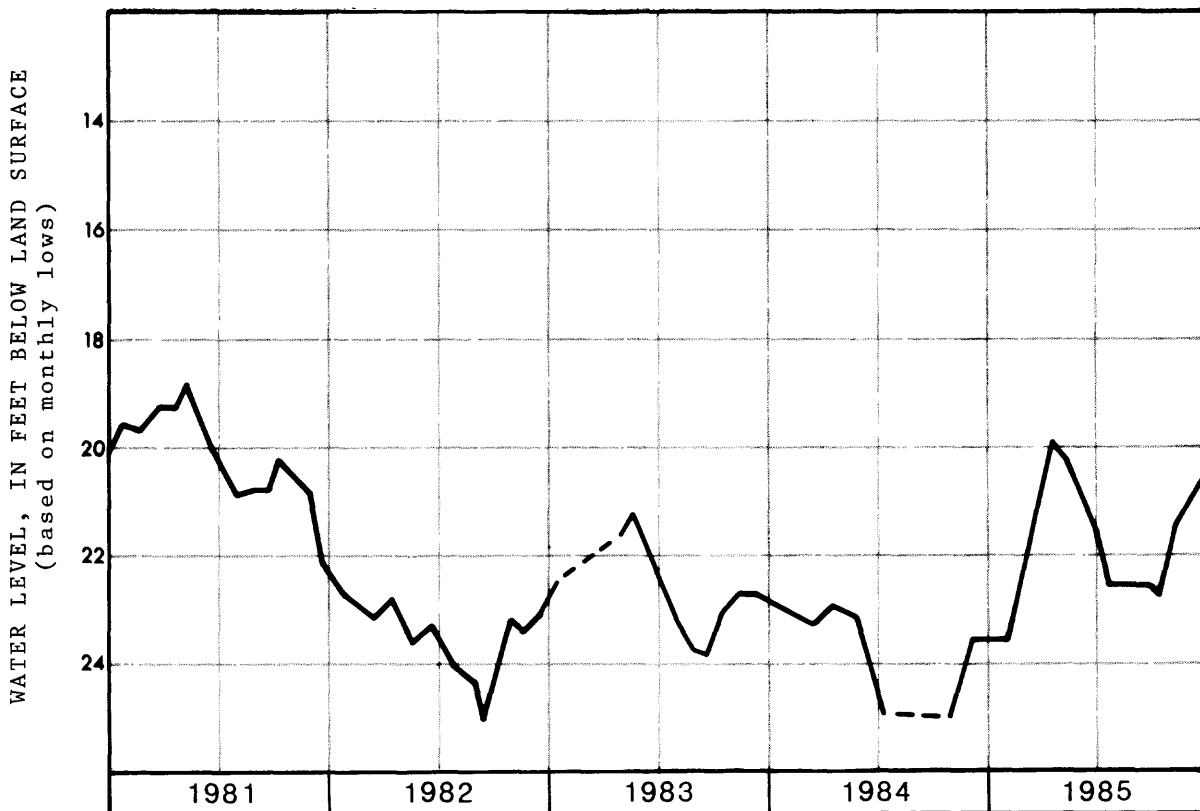
CALHOUN COUNTY - CITY OF BATTLE CREEK

SUPPLY AND SOURCE -- 38 wells, 110 to 180 feet deep, tap sandstones of Marshall Formation.

YIELD OF WELLS -- 300 to 1,000 gal/min; specific capacity -- 50 to 650 gal/min/ft of drawdown.

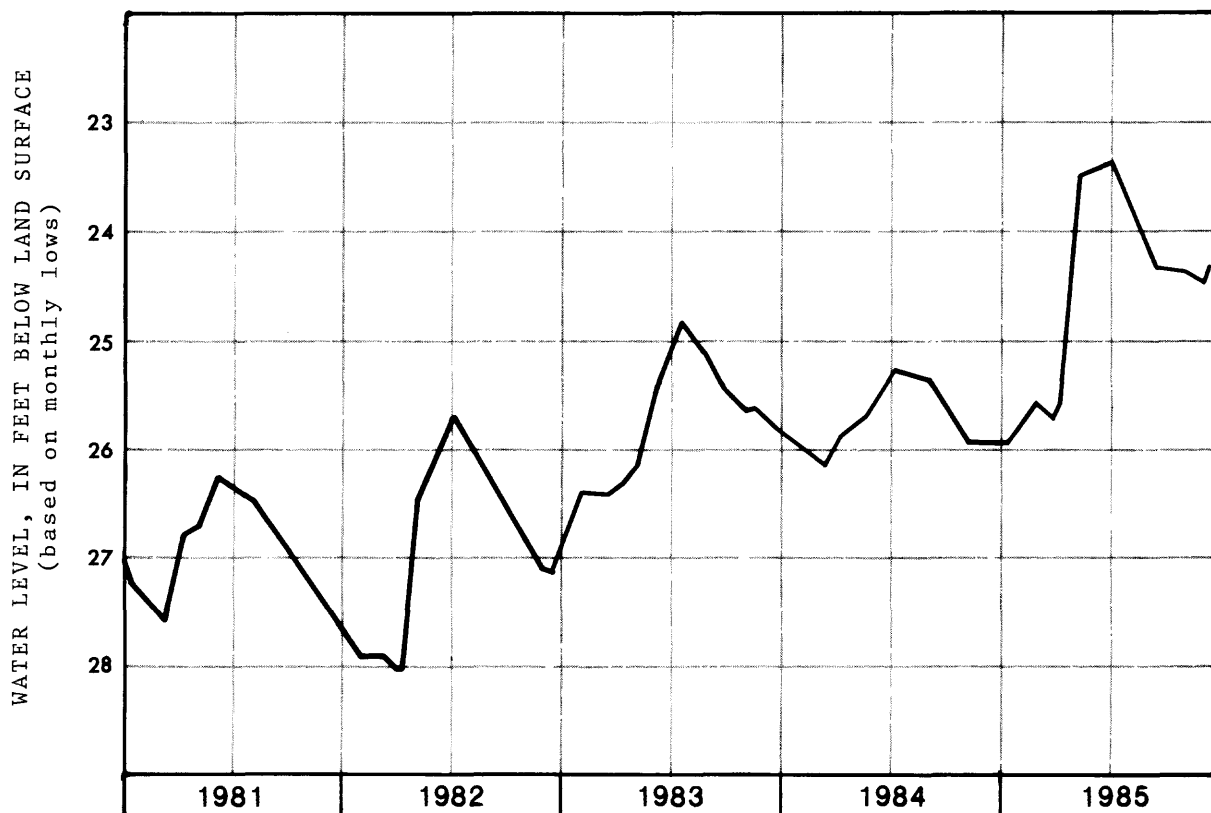
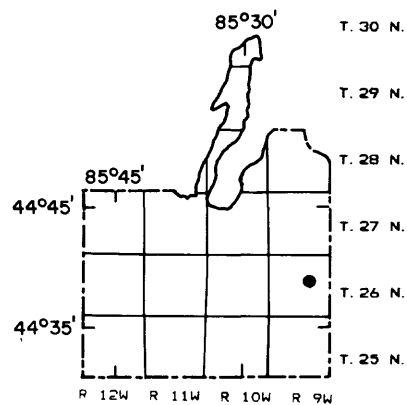
PUMPAGE -- Total annual pumpage, in million gallons, for past 5 years.

1985 - 2,950
1984 - 3,083
1983 - 3,495
1982 - 3,590
1981 - 2,742



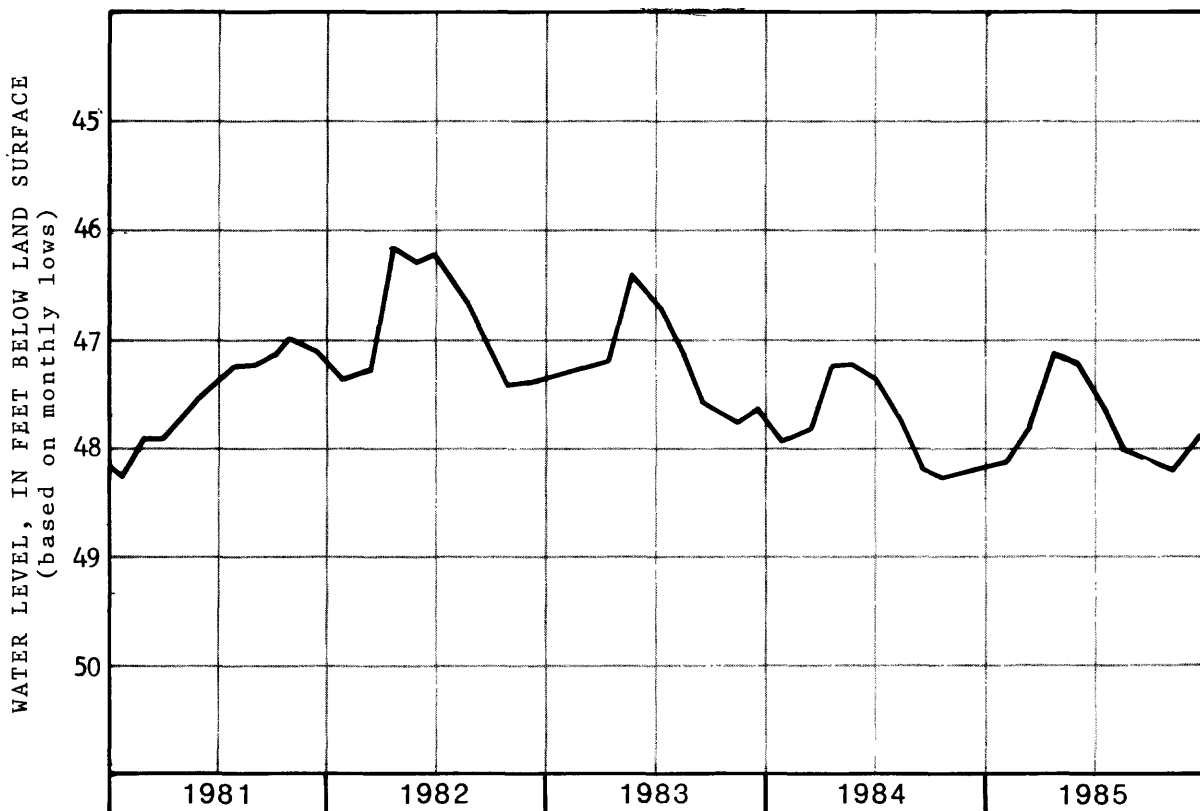
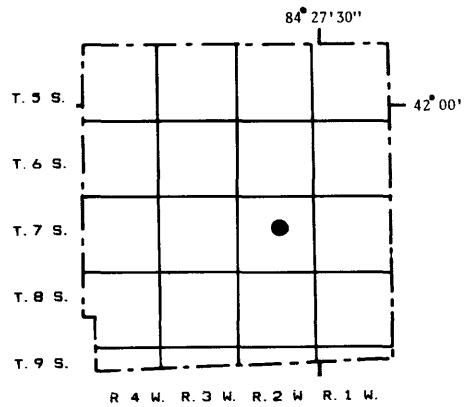
Water levels in well 1S 7W 32BDCC1. Well is 95 feet deep and in Marshall Formation. Water-quality data in ground-water reports for 1977 and 1982 (Huffman, 1979, 1983).

GRAND TRAVERSE COUNTY



Water levels in well 26N 9W 14ABAA1. Well is 80 feet deep and in sand. Water-quality data in ground-water reports for 1977 and 1982 (Huffman 1979, 1983).

HILLSDALE COUNTY



Water levels in well 7S 2W 15BCBA1. Well is 150 feet deep and in glacial outwash. Water-quality data in ground-water reports for 1979 and 1984 (Huffman, 1980, 1985).

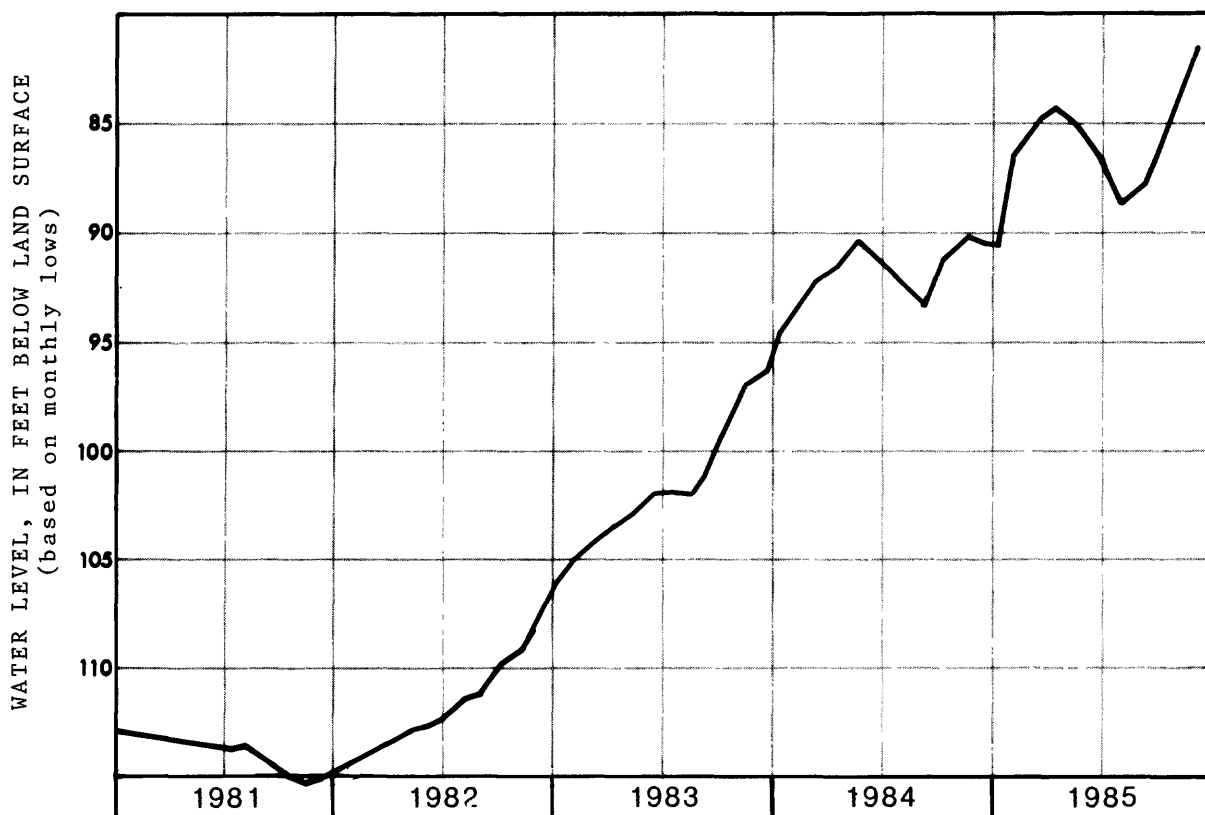
INGHAM COUNTY - CITY OF LANSING

SUPPLY AND SOURCE -- 125 wells, 400 to 425 feet deep, tap sandstones of Saginaw Formation; 3 wells, 85 to 105 feet deep, tap sand beds in glacial deposits.

YIELD OF WELLS -- Sandstone - 100 to 700 gal/min; specific capacity -- 3 to 10 gal/min/ft of drawdown.
-- Glacial deposits - 790 to 1,200 gal/min, specific capacity -- 12 to 80 gal/min/ft of drawdown.

PUMPAGE -- Total annual pumpage, in million gallons, for past 5 years.

1985 - 7,945
1984 - 8,249
1983 - 8,105
1982 - 8,182
1981 - 8,607



Water levels in well 4N 2W 17AB. Well is 424 feet deep and in Saginaw Formation.

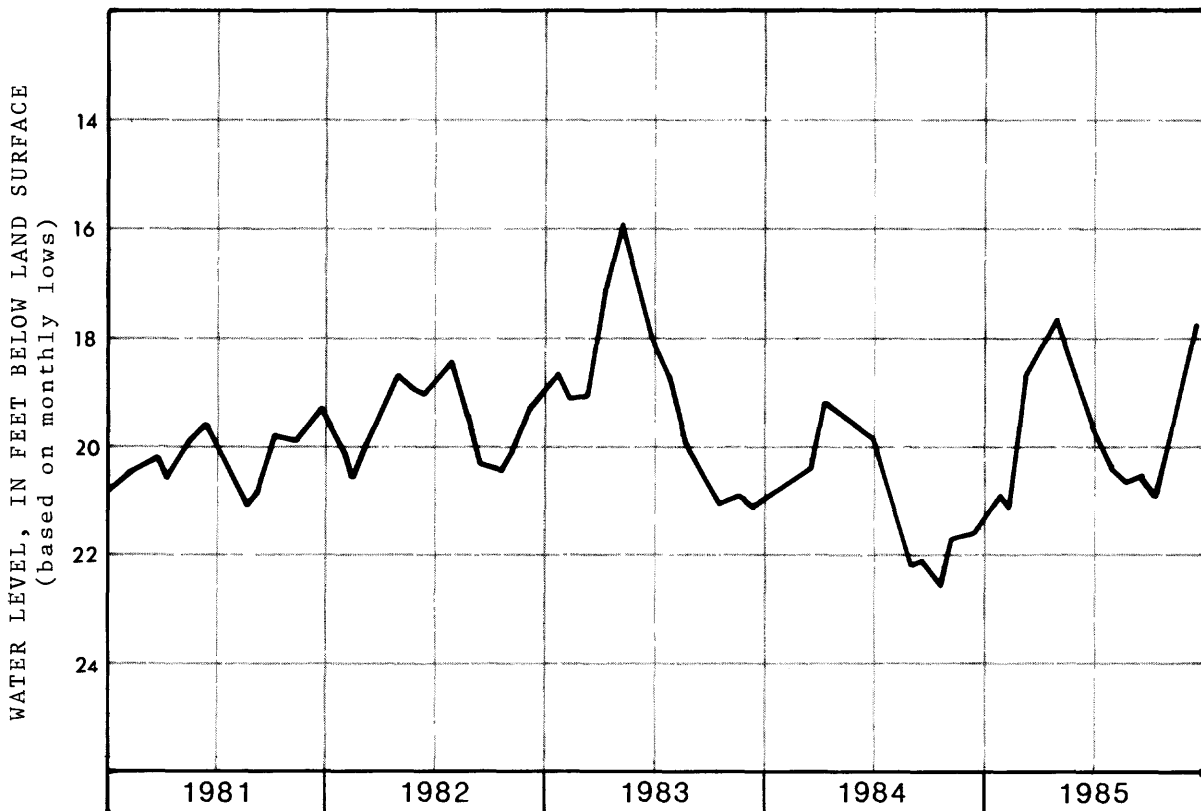
INGHAM COUNTY - CITY OF MASON

SUPPLY AND SOURCE -- 1 well, about 50 feet deep, taps glacial deposits;
2 wells, 218, 223 feet deep, tap sandstones of Saginaw Formation.

YIELD OF WELLS -- 675 to 700 gal/min; specific capacity -- No. 3 yields
30 gal/min/ft of drawdown from the glacial drift.

PUMPAGE -- Total annual pumpage, in million gallons, for past 5 years.

1985 - 240
1984 - 240
1983 - 232
1982 - 228
1981 - 233



Water levels in well 2N 1W 5BCAB1. Well is 210 feet deep and in Saginaw Formation. Water-quality data in ground-water reports for 1977 and 1984 (Huffman, 1979, 1985).

KALAMAZOO COUNTY - CITY OF KALAMAZOO

SUPPLY AND SOURCE -- 84 wells, 130 to 254 feet deep, tap glacial deposits.

YIELD OF WELLS -- 200 to 2,000 gal/min; specific capacity -- 7 to 100 gal/min/ft of drawdown.

PUMPAGE -- Total annual pumpage, in million gallons, for past 5 years.

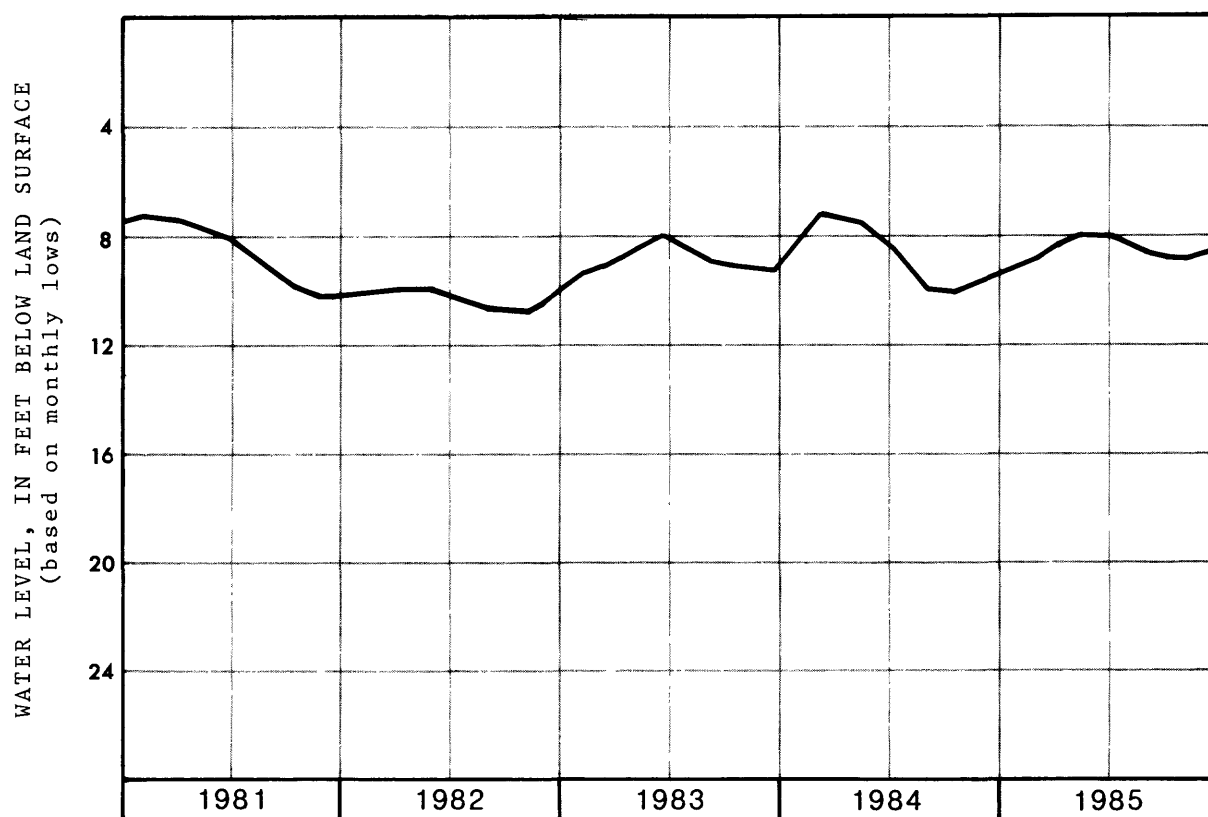
1985 - 6,736

1984 - 7,275

1983 - 7,204

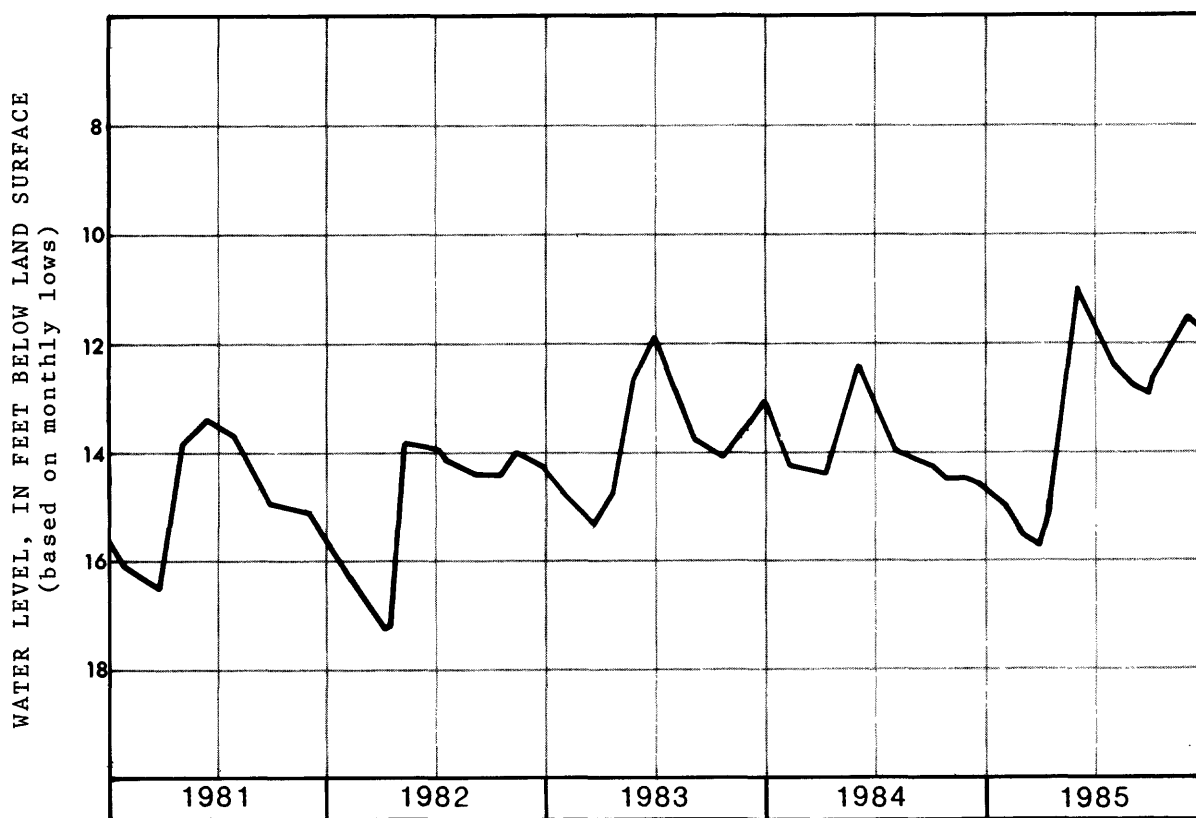
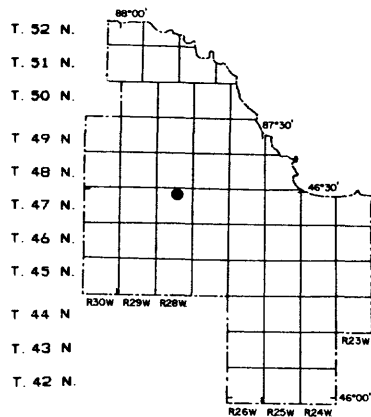
1982 - 5,772

1981 - 6,393



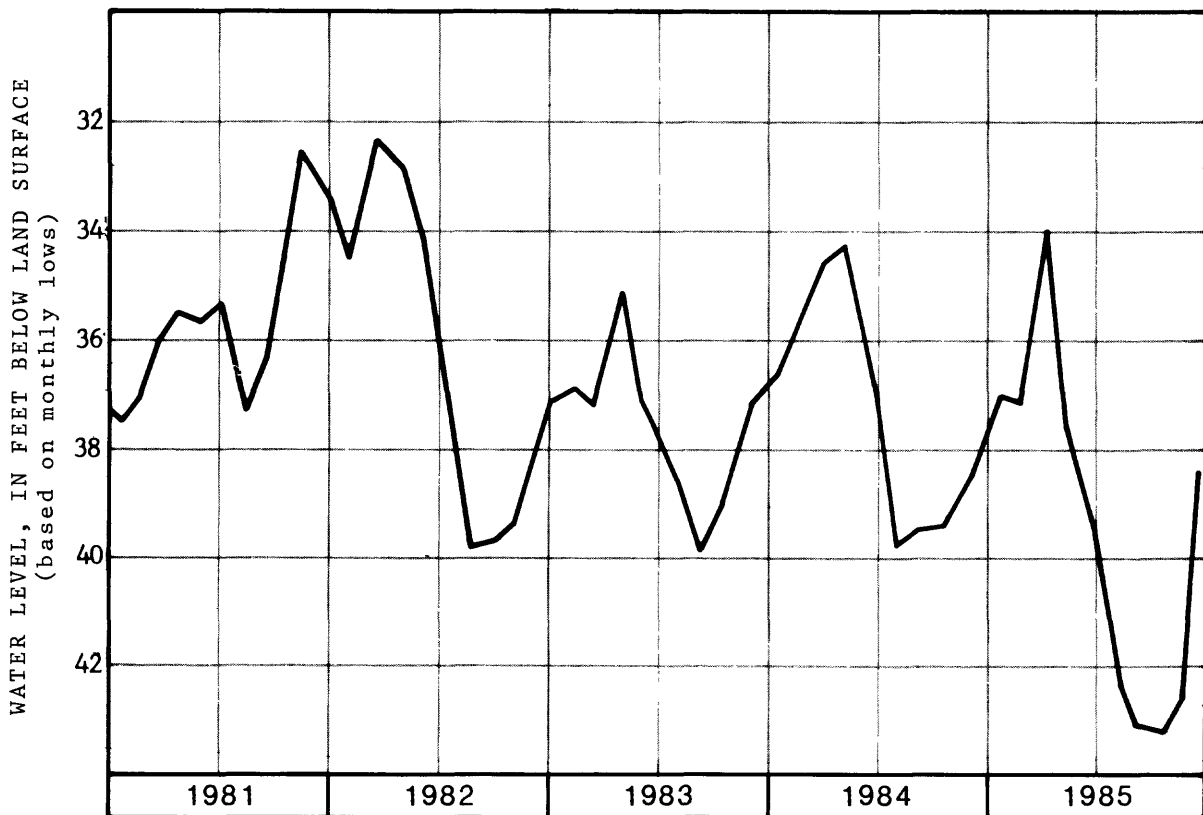
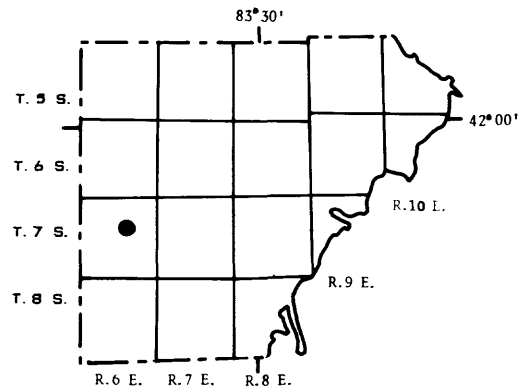
Water levels in well 2S 11W 22CD. Well is 137 feet deep and in outwash.

MARQUETTE COUNTY - IRON RANGE AREA



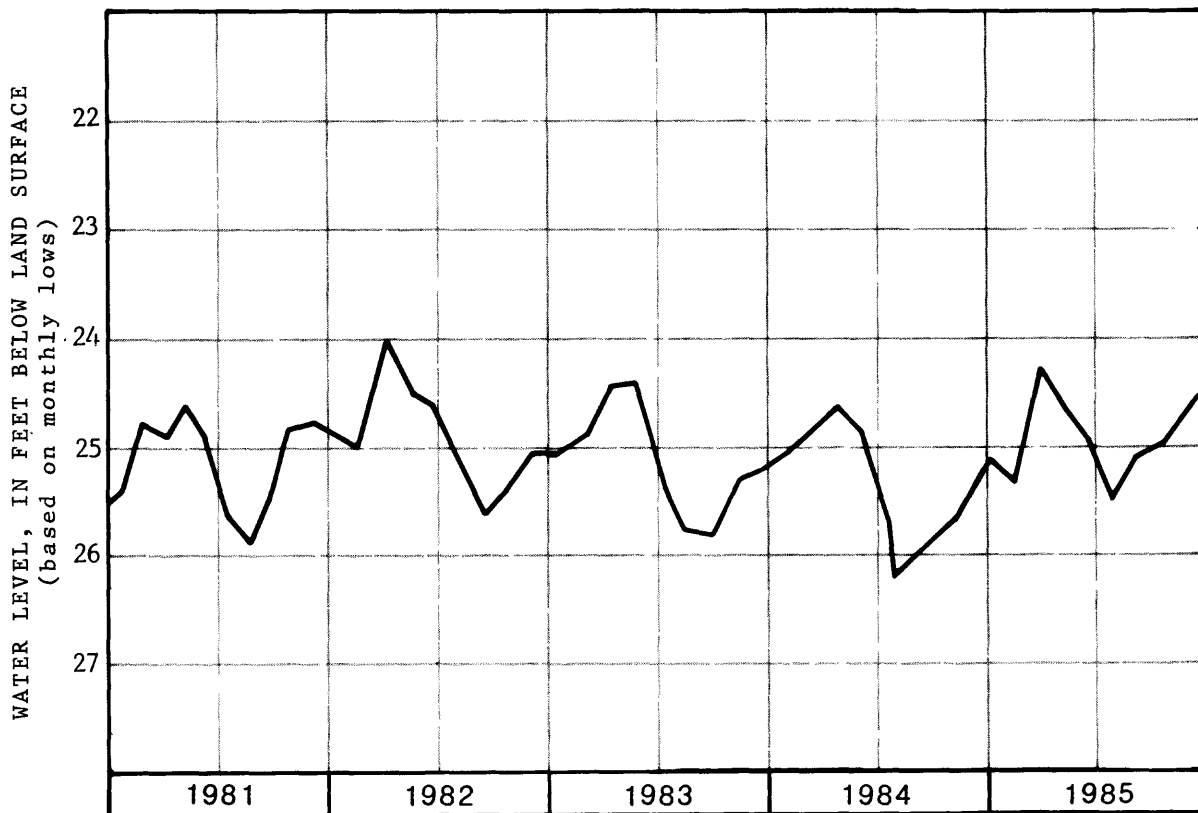
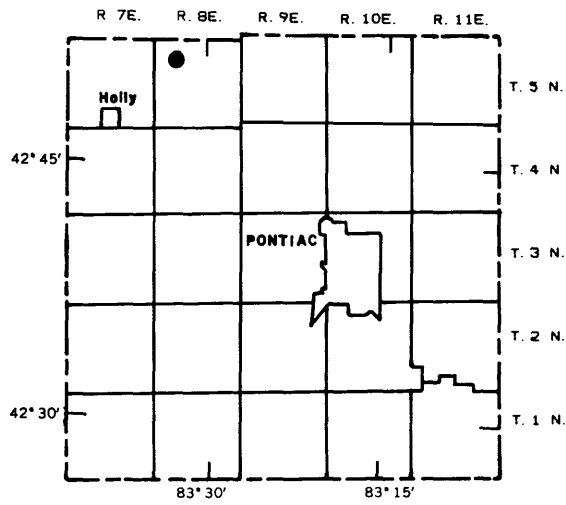
Water levels in well 47N 28W 3CCDC1. Well is 75 feet deep and in outwash. Levels are typical of observation wells in Marquette Iron Range. Water-quality data in ground-water report for 1977 (Huffman, 1979).

MONROE COUNTY



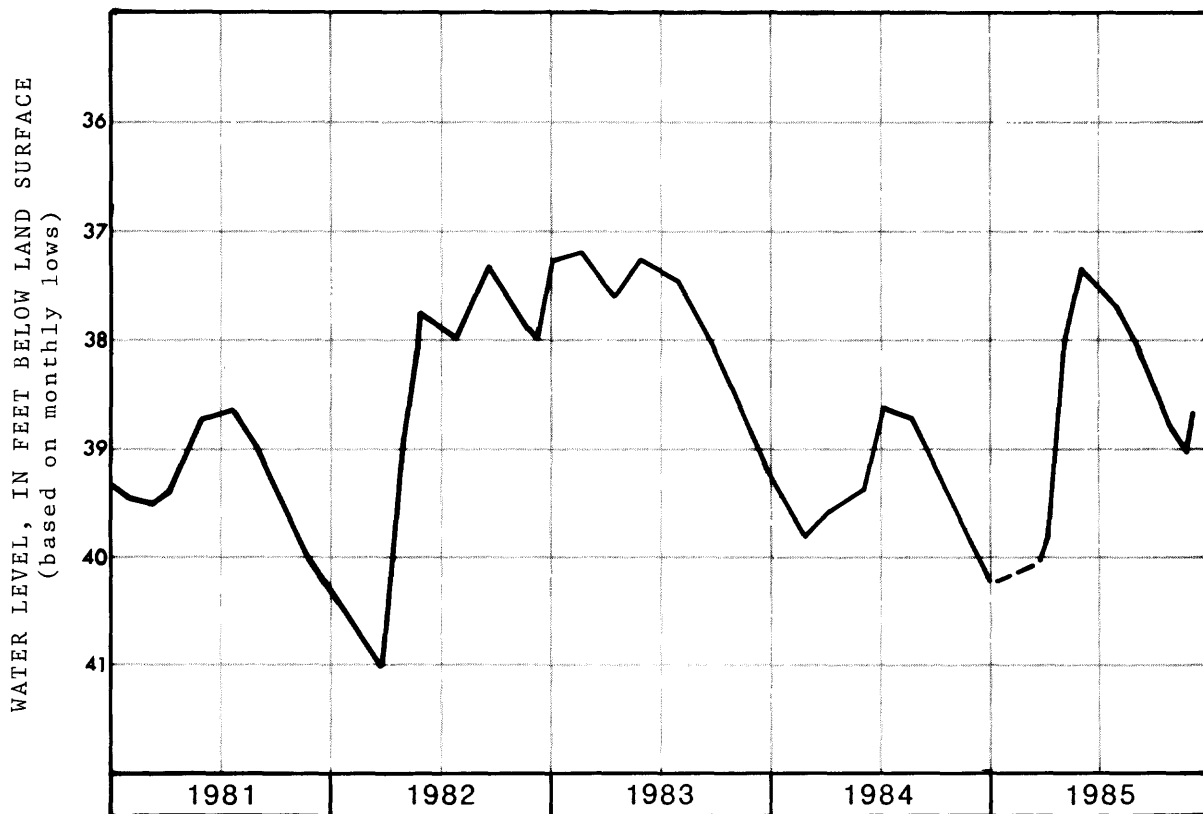
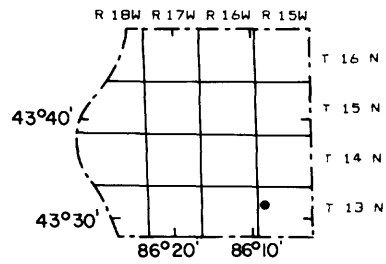
Water levels in well 7S 6E 15ACAA1. Well is 73 feet deep and in the Detroit River Group. Water-quality data in ground-water reports for 1979 and 1984 (Huffman, 1980, 1985).

OAKLAND COUNTY



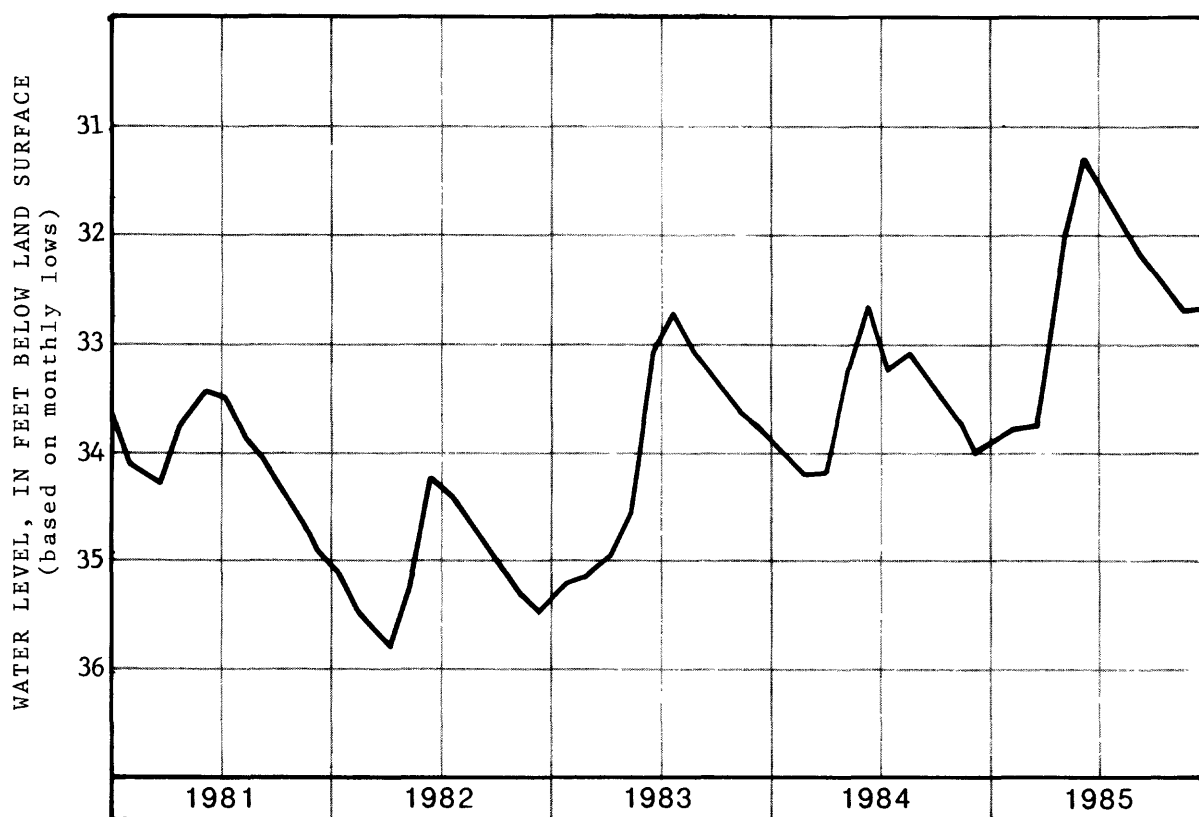
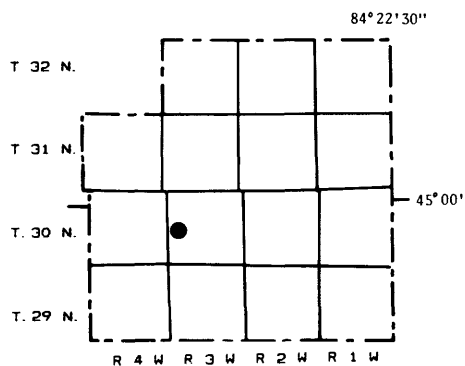
Water levels in well 5N 8E 8ACAC1. Well is 42 feet deep and in glacial deposits.

OCEANA COUNTY



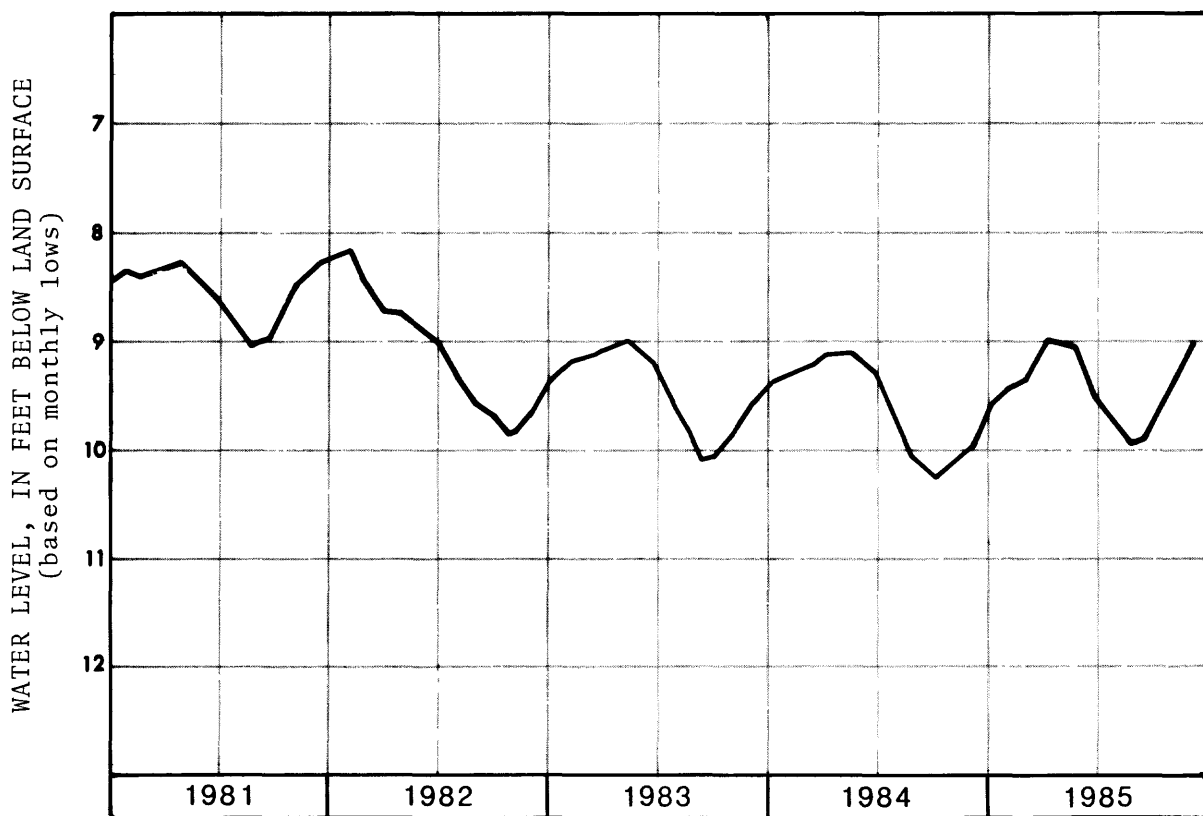
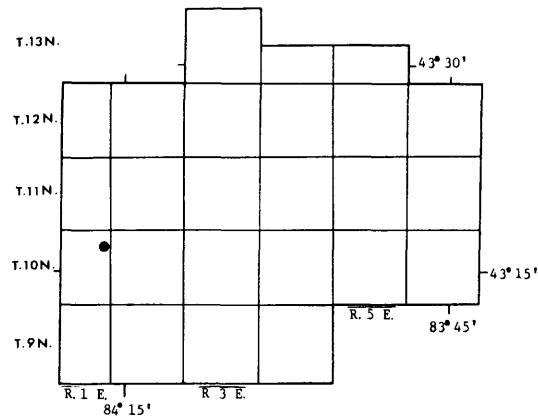
Water levels in well 13N 15W 18AAAA1. Well is 79 feet deep and in outwash. Water-quality data in ground-water reports for 1978 and 1984 (Huffman, 1979, 1985).

OTSEGO COUNTY



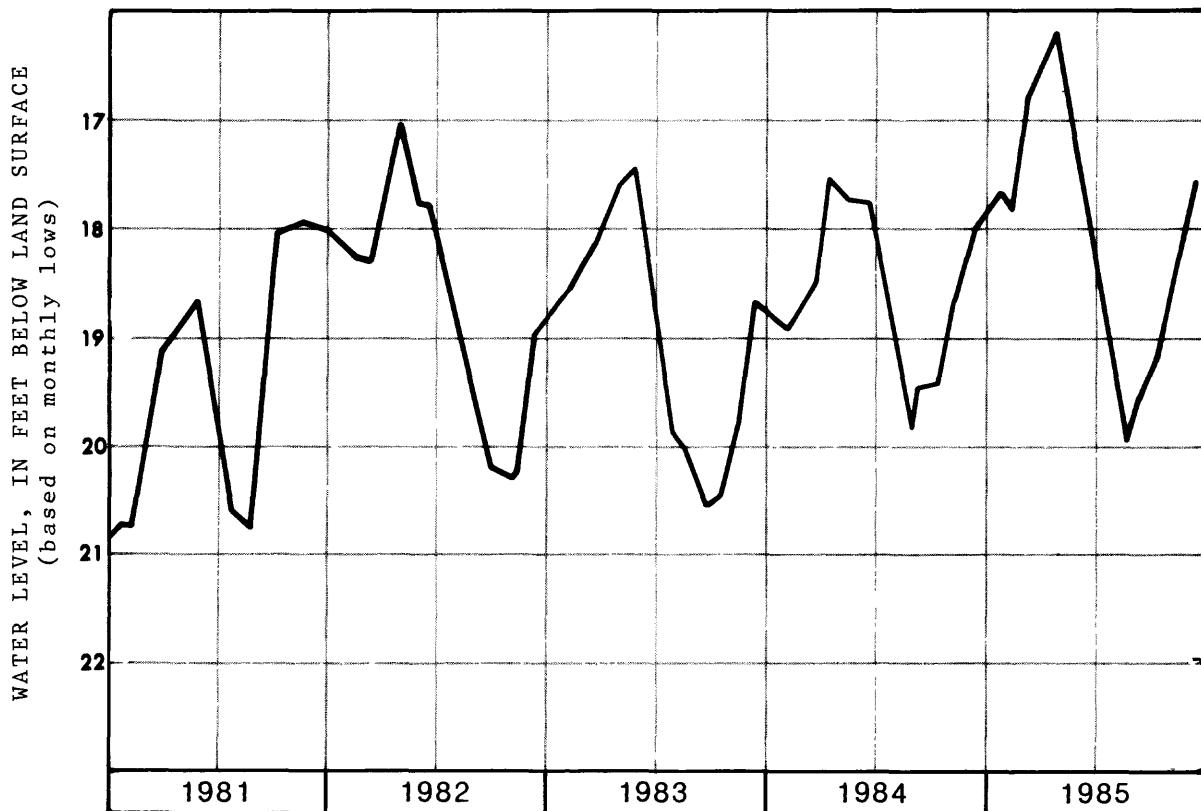
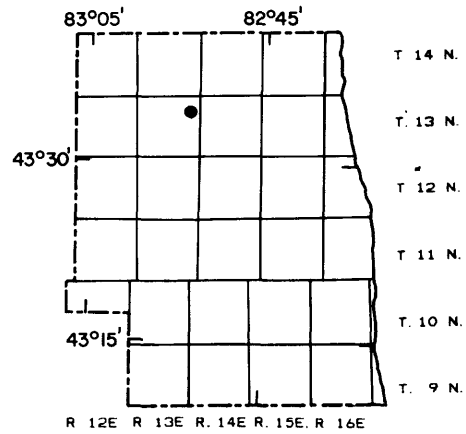
Water levels in well 30N 3W 19ABBB1. Well is 90 feet deep and in glacial outwash. Water-quality data in ground-water reports for 1979 and 1984 (Huffman, 1980, 1985).

SAGINAW COUNTY



Water levels in well 10N 1E 22DADA1. Well is 210 feet deep and in Saginaw Formation. Water-quality data in ground-water reports for 1977 and 1984 (Huffman, 1979, 1985).

SANILAC COUNTY



Water levels in well 13N 13E 12ADAA1. Well is 130 feet deep and in the Marshall Formation. Water-quality data in ground-water reports for 1977 and 1982 (Huffman, 1979, 1983).

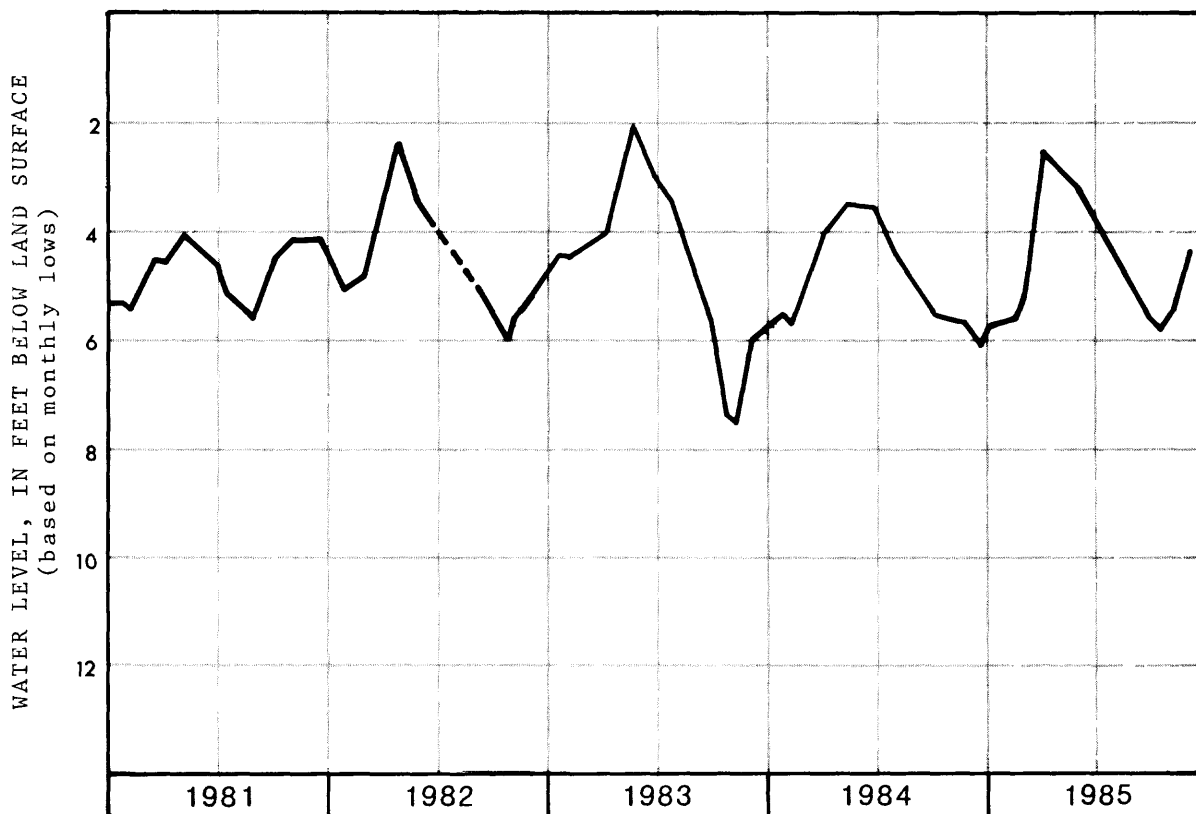
WASHTENAW COUNTY - CITY OF ANN ARBOR

SUPPLY AND SOURCE -- 3 wells, 91 to 196 feet deep, tap glacial deposits; most water is pumped from the Huron River.

YIELD OF WELLS -- 1,050 to 4,860 gal/min; specific capacity -- 20 to 600 gal/min/ft of drawdown.

PUMPAGE -- Total annual ground-water pumpage, in million gallons, for past 5 years (ground water is used to augment supply from Huron River).

| | | |
|------|---|-------|
| 1985 | - | 1,177 |
| 1984 | - | 1,192 |
| 1983 | - | 810 |
| 1982 | - | 720 |
| 1981 | - | 787 |



Water levels in well 3S 6E 16BCCD1. Well is 55 feet deep and in glacial deposits. Water-quality data in ground-water reports 1977 and 1984 (Huffman, 1979, 1985).

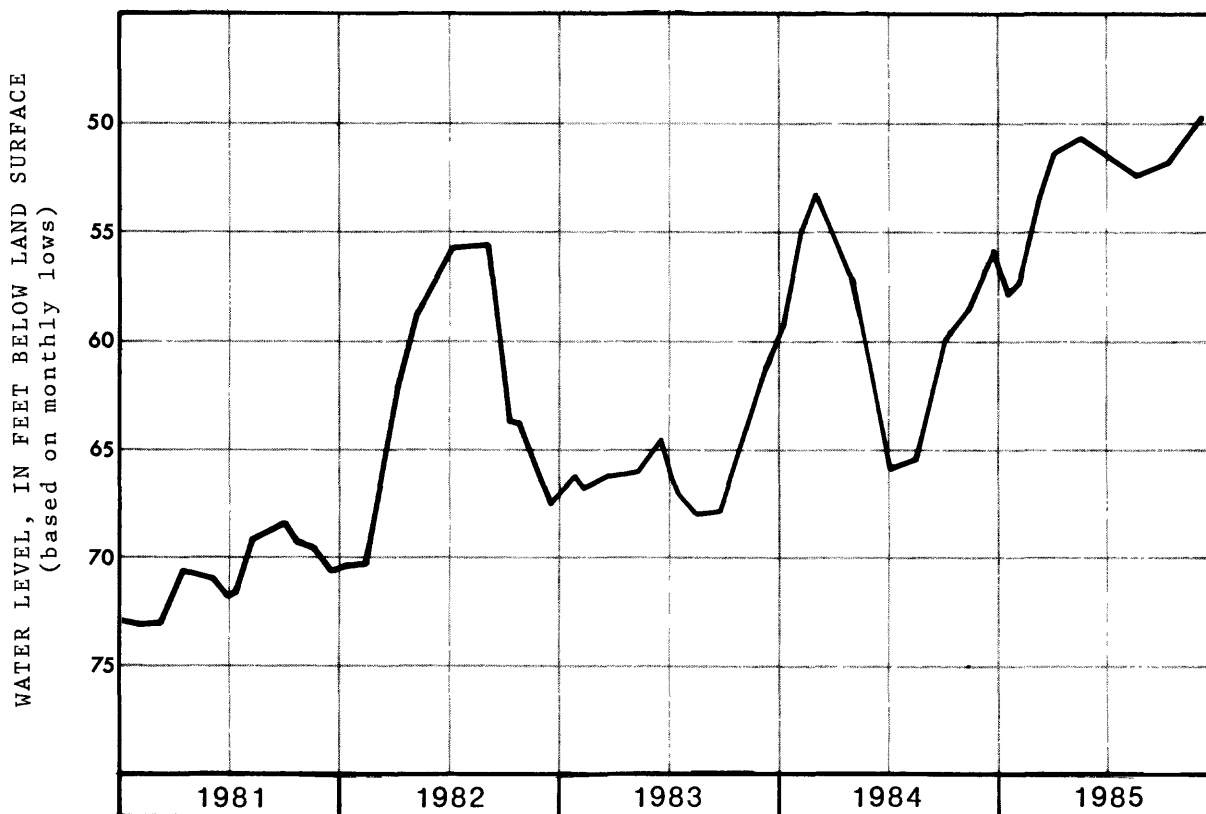
WASHTENAW COUNTY - CITY OF YPSILANTI

SUPPLY AND SOURCE -- 6 wells, 87 to 102 feet deep, tap glacial deposits.

YIELD OF WELLS -- Average 450 gal/min; specific capacity -- 25 to 180 gal/min/ft of drawdown.

PUMPAGE -- Total annual pumpage, in million gallons, for past 5 years.

1985 - 906
1984 - 1,155
1983 - 1,112
1982 - 1,196
1981 - 1,385



Water levels in well 3S 7E 9ADB1. Well is 94 feet deep and in glacial deposits.

TABLES

Table 1.--Records of Michigan observation wells

COUNTY AND WELL NUMBER: See section in text entitled "Well-numbering system".

NAME: MDNR - Michigan Department of Natural Resources; WEP - Wisconsin Electric Power Company; MSHD - Michigan State Highway

Department; USFS - U.S. Forest Service.

AQUIFER: 112GLCL Glacial deposits 337MRSI Marshall Formation 3610DVCU Ordovician, Upper
 112GRVL Gravel 341TRVR Traverse Group 365TBRV Trenton-Black River Group
 112OTSH Outwash 344DUND Dundee Formation 368PRDC Prairie du Chien Group
 112SAND Sand 348DRRV Detroit River Group 372MNSG Munising Sandstone
 112SDGV Sand and Gravel 355SLINH Salina Formation 420FRED Freda Sandstone
 324SGNW Saginaw Formation 355MNSQ Manistique Dolomite

ALTITUDE: Land-surface datum in feet above sea level.

MEASUREMENTS, 1985 (frequency); R - Continuous recorder; D - Daily; W - Weekly; M - Monthly; Q - Quarterly; S - Semiannually;

A - Annually; I - Intermittent.

OBSERVED WATER-LEVEL EXTREMES: In feet below or above (+) land surface. 1985 measurements underscored are extremes for entire record.

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 | NAME | DEPTH (FT) | DIAMETER (IN) | AQUIFER | ALTITUDE | YRS. RECORD | MEAS. 1985 | OBSERVED WATER-LEVEL EXTREMES | | | | REMARKS |
|------------------------------|---------------------|------------|---------------|---------|----------|-------------|------------|-------------------------------|----------------|-----------|-----------|-------------------|
| | | | | | | | | THROUGH 1984 | | IN 1985 | | |
| | | | | | | | | MAXIMUM | MINIMUM | MAXIMUM | MINIMUM | |
| TWP, RANGE, SECT | | | | | | | | | | | | |
| ALGER | | | | | | | | | | | | |
| 45N 19W 25HXD1 | CCC | 66 | 6 | 112GLCL | 850 | 27 | Q | 6.4 Jun 1960 | 14.2 Apr 1964 | 9.9 May | 11.3 Jan | |
| ALPENA | | | | | | | | | | | | |
| 32N 6E 23DDWA1 | Alpena State Forest | 88 | 6 | 112SAND | 713 | 9 | R | 13.6 May 1983 | 30.0 Mar 1982 | 14.4 Apr | 22.5 Nov | |
| ARENA | | | | | | | | | | | | |
| 19N 5E 7DABA1 | Omer, D | 185 | 6 | 324SGNW | 667 | 6 | M | 8.3 Jul 1980 | 10.9 Oct 1984 | 9.9 Apr | 10.7 Oct | |
| 7DABA2 | Omer, S | 21 | 6 | 112GLCL | 667 | 6 | M | 2.3 May 1983 | 6.9 Aug 1980 | 2.4 Apr | 5.2 Aug | |
| BARAGA | | | | | | | | | | | | |
| 48N 32W 12DD | WEP 14 | 10 | 1 | 112GLCL | 1,630 | 38 | M | 3.3 Apr 1965 | 8.1 Sep 1969 | 5.7 Apr | 7.2 Feb | Meas. by WEP |
| BARRY | | | | | | | | | | | | |
| 4N 9W 5DA | Solomon Road | 131 | 2 | 112GLCL | 860 | 22 | Q | 111.5 Mar 1978 | 122.0 Mar 1965 | 115.7 Aug | 117.4 Jan | |
| BAY | | | | | | | | | | | | |
| 17N 4E 22ICAA1 | Pinconning Twsp. | 110 | 6 | 324SGNW | 620 | 24 | M | 0.0 Mar 1976 | 10.5 Aug 1963 | 1.4 Apr | 3.1 Oct | |
| BRANCH | | | | | | | | | | | | |
| 6S 6W 18CCCD1 | Coldwater Twsp. | 56 | 6 | 112OTSH | 950 | 22 | M | 18.3 Mar 1976 | 28.3 Jul 1964 | 20.3 May | 24.5 Nov | |
| 22CABA1 | Coldwater Test 4 | 113 | 6 | 112GLCL | 970 | 22 | R | 9.0 May 1975 | 25.9 May 1977 | 9.6 Apr | 24.5 Sep | P |
| CALHOUN | | | | | | | | | | | | |
| 1S 7W 10BB | Sabin | 12 | 15 | 112GLCL | 908 | 40 | W | 0.9 Mar 1950 | 7.2 Dec 1964 | 1.4 Feb | 4.4 Jan | Meas. by owner |
| 32BXCI | Penfield Twsp. | 95 | 6 | 337MRSI | 845 | 22 | R | 15.6 Apr 1974 | 27.0 Aug 1964 | 18.3 Apr | 23.6 Jan | P |
| 32DABD | Battle Creek | 127 | 8 | 337MRSI | 830.8 | 47 | D | 0.7 Apr 1950 | 16.8 Jul 1959 | 5.4 Apr | 9.1 Jan | P, Meas. by owner |
| 2S 6W 25AA | Marshall | 59 | 6 | 337MRSI | 904.8 | 36 | M | 5.5 May 1950 | 9.7 Aug 1964 | 6.6 May | 8.0 Feb | P, Meas. by owner |
| CASS | | | | | | | | | | | | |
| 8S 14W 17BA | Little | 55 | 28 | 112GLCL | 840 | 41 | M | 46.2 Jul 1950 | 55.0 Mar 1957 | 47.2 Jun | 49.4 Jan | |
| CHEBOYGAN | | | | | | | | | | | | |
| 33N 1W 26DABA1 | Pigeon River CCC | 164 | 6 | 112SAND | 933 | 20 | R | 56.1 Jun 1979 | 60.2 Jul 1982 | 55.2 May | 57.8 Jan | |
| 39N 3W 29CBCB1 | Mackinaw, D | 125 | 6 | 344DUND | 705 | 7 | M | 5.2 May 1979 | 11.7 Feb 1981 | 5.3 May | 8.5 Sep | |
| 29CBCB2 | Mackinaw, S | 55 | 6 | 112SDGV | 705 | 7 | M | 2.0 Apr 1984 | 6.5 Feb 1981 | 2.0 Nov | 4.0 Jul | |

Table 1.--Records of Michigan observation wells--Continued

| COUNTY AND WELL NUMBER | NAME | DEPTH (FT) | DIAMETER (IN) | AQUIFER | ALTITUDE | YRS. RECORD | MEAS. 1985 | OBSERVED WATER-LEVEL EXTREMES | | | | REMARKS |
|------------------------------|------------------------|------------|---------------|----------|----------|-------------|------------|-------------------------------|----------------|----------|----------|------------------|
| | | | | | | | | THROUGH 1984 | | IN 1985 | | |
| | | | | | | | | MAXIMUM | MINIMUM | MAXIMUM | MINIMUM | |
| TWP, RANGE, SECT | | | | | | | | | | | | |
| CHIPPewa | | | | | | | | | | | | |
| 46N 4W 24WAD1 | Raco | 54 | 6 | 112OTSH | 850 | 33 | R | 18.4 Jun 1971 | 28.4 Apr 1964 | 21.3 May | 25.9 Apr | |
| CLARE | | | | | | | | | | | | |
| 17N 4W 34WCA1 | Clare | 91 | 4 | 112GLCL | 850 | 11 | R | 7.9 Mar 1976 | 24.9 May 1977 | 9.1 Apr | 18.3 Jul | |
| CLINTON | | | | | | | | | | | | |
| 5N 2W 31CBRA1 | Capital City Airport | 195 | 6 | 324SGNW | 850 | 28 | R | 45.0 Mar 1949 | 66.4 Jan 1967 | 52.7 Mar | 55.8 Jul | P |
| 32DC | Quarantine Farm | 135 | 4 | 324SGNW | 849.2 | 42 | M | 42.0 Sep 1944 | 99.2 May 1966 | 74.1 Jan | 83.2 Jul | P |
| 6N 1W 3BR2 | Sleepy Hollow 5 | 62 | 1 | 112GLCL | 814.0 | 16 | I | 37.6 Apr 1983 | 43.5 Nov 1966 | | 37.8 Mar | |
| 6N 2W 16WAD1 | MSW, U.S. 27 | 23 | 14 | 112GLCL | 803.3 | 38 | M | 13.8 Apr 1974 | 19.9 Feb 1964 | 15.2 Apr | 18.0 Aug | Federal key well |
| 7N 1W 34CC | Sleepy Hollow 7 | 32 | 1 | 112OTSH | 785.3 | 19 | A | 16.5 Apr 1983 | 20.3 Oct 1973 | | 16.9 Mar | |
| CRAWFORD | | | | | | | | | | | | |
| 25N 1W 15WCD1 | Eldorado | 56 | 6 | 112GLCL | 1,190 | 38 | R | 25.7 May 1976 | 36.0 Apr 1951 | 26.8 May | 29.5 Jan | |
| DELTA | | | | | | | | | | | | |
| 39N 2W 28AC | Schemmel | 530 | 5 | 372MNSG | 680 | 28 | R | 1.3 May 1960 | 8.6 Feb 1977 | 5.0 Apr | 7.2 Aug | |
| 41N 18W 31CD | Isabella | 250 | 5 | 361ODVCU | 615 | 28 | M | 3.3 Sep 1979 | 6.4 Feb 1977 | 4.2 Apr | 5.8 Jul | |
| 42N 18W 17ABRD | Cooks CCC | 60 | 6 | 112GLCL | 760 | 24 | Q | 21.2 May 1960 | 28.4 Mar 1966 | 22.9 May | 24.0 Sep | |
| 42N 19W 20AA | Pollack CCC | 134 | 6 | 112GLCL | 740 | 28 | Q | 23.4 Jul 1982 | 28.1 Feb 1977 | 25.0 May | 25.4 Jan | |
| 43N 19W 24BB | Clarage | 405 | 4 | 365TBRV | 860 | 28 | Q | 77.0 Jul 1960 | 88.8 Oct 1966 | 78.9 Sep | 79.7 Jan | |
| DICKINSON | | | | | | | | | | | | |
| 43N 28W 32ADAB1 | Felch | 31 | 1 | 112SAND | 1,160 | 20 | M | 13.1 May 1972 | 16.8 May 1968 | 13.5 Apr | 15.2 Feb | |
| LATON | | | | | | | | | | | | |
| 3N 3W 2BA | Lansing, Stiefel | 66 | 1 | 112GLCL | 839 | 22 | R | 3.1 Mar 1965 | 18.0 Nov 1968 | 3.4 Feb | 8.8 Dec | P |
| 4N 3W 12CD | Robins Road | 381 | 6 | 324SGNW | 861.9 | 33 | R | 67.5 Nov 1953 | 103.6 Aug 1969 | 71.2 Mar | 93.8 Jul | P |
| GENESEE | | | | | | | | | | | | |
| 6N 7E 9WCC1 | Fisher Body No. 2 | 385 | 10 | 324SGNW | 387.0 | 13 | R | 52.3 Dec 1975 | 87.0 Jun 1977 | 56.7 Nov | 74.7 Aug | P |
| GRAND TRAVERSE | | | | | | | | | | | | |
| 26N 9W 14ABAA1 | Pike Lake State Forest | 80 | 6 | 112SAND | 960 | 9 | R | 24.3 Sep 1976 | 28.0 Mar 1982 | 23.0 May | 26.0 Jan | |
| HILLSDALE | | | | | | | | | | | | |
| 7S 2W 10BDDD1 | Pittsford Game Area | 20 | 1 | 112SAND | 1,070 | 20 | M | 5.8 Apr 1982 | 11.1 Sep 1967 | 6.6 Apr | 8.6 Sep | |
| 2W 15BCRA1 | Osseo | 150 | 6 | 112OTSH | 1,095 | 7 | M | 46.1 Apr 1982 | 49.0 Dec 1979 | 47.1 Apr | 48.2 Jan | |
| INCLAM | | | | | | | | | | | | |
| 2N 1E 24DB | Dansville Game Area | 87 | 2 | 112GLCL | 930 | 22 | Q | 22.4 Apr 1974 | 29.3 Oct 1964 | 22.8 Mar | 24.7 Sep | |
| 2N 1W 5WCA1 | Mason | 210 | 8 | 324SGNW | 890 | 22 | R | 14.7 Mar 1973 | 23.8 Nov 1964 | 16.0 Apr | 21.2 Feb | P |
| 3N 1E 7WCA1 | Lotte | 184 | 3 | 324SGNW | 900 | 22 | M | +2.4 Apr 1974 | 7.0 Nov 1964 | +2.0 Apr | 3.7 Sep | |
| 2W 23BCBD | Holt | 188 | 8 | 324SGNW | 895 | 4 | R | 18.3 May 1983 | 24.2 Oct 1984 | 18.9 Apr | 25.5 Oct | P |
| 4N 1W 16DA | Meridian Dwp. | 398 | 4 | 342SGNW | 841.2 | 18 | M | 6.3 Mar 1976 | 18.6 Jul 1984 | 12.7 Apr | 18.6 Jul | P |

Table 1.--Records of Michigan observation wells--Continued

| COUNTY AND WELL NUMBER | NAME | DEPTH (FT) | DIAMETER (IN) | AQUIFER | ALTITUDE | YRS. RECORD | MEAS. 1985 | OBSERVED WATER-LEVEL EXTREMES | | | | REMARKS |
|------------------------------|------------------------|------------|---------------|---------------------|----------|-------------|------------|-------------------------------|----------------|-----------------|-----------------|------------------------|
| | | | | | | | | THROUGH 1984 | | IN 1985 | | |
| | | | | | | | | MAXIMUM | MINIMUM | MAXIMUM | MINIMUM | |
| TWP, RANGE, SECT | | | | | | | | | | | | |
| INGHAM--Continued | | | | | | | | | | | | |
| 4N 1W 28BCAD1 | Okemos | 125 | 4 | 324SGNW | 865 | 10 | R | 18.1 May 1976 | 24.2 Sep 1978 | <u>17.6 Apr</u> | 21.7 Jul | P |
| 2W 9RD | Lansing, Seymour | 401 | 14 | 324SGNW | 828.8 | 52 | R | 15.6 Mar 1931 | 179.4 Apr 1968 | 47.1 Dec | 50.0 Dec | P,Record resumed 12-85 |
| 16DA | Lansing, Cedar | 417 | 12 | 324SGNW | 829.1 | 41 | R | 38.8 Jun 1984 | 67.0 Aug 1949 | <u>34.5 Dec</u> | 42.0 Jul | P |
| 17AB | Lansing, Logan | 424 | 20 | 324SGNW | 858.7 | 55 | R | 34.3 Dec 1929 | 168.3 May 1968 | 78.4 Dec | 90.7 Jan | P |
| 21RA3 | Lansing, Scott Park | 400 | 4 | 324SGNW | 835 | 7 | R | 33.6 Sep 1984 | 58.8 Jun 1979 | <u>32.0 Jan</u> | 42.0 Jul | P |
| 22BC | Lansing, P-5 | 338 | 12 | 324SGNW | 823.6 | 56 | M | 7.1 Jul 1932 | 80.5 Feb 1979 | 28.9 May | 34.4 Mar | P |
| 24CA | Spartan Village | 453 | 10 | 324SGNW | 853.4 | 41 | R | 25.5 Mar 1946 | 105.5 May 1972 | 61.5 Dec | 79.9 Jan | P |
| 27BB | Fenner Arboretum | 215 | 6 | 324SGNW | 835 | 18 | R | 47.8 Jun 1983 | 89.5 Oct 1972 | <u>45.1 Oct</u> | 56.4 Feb | P |
| 31CC | Maybel Street | 204 | 3 | 324SGNW | 880.2 | 42 | M | 18.9 Apr 1952 | 45.9 Jul 1980 | 39.4 Apr | 45.3 Mar | P |
| IOSCO | | | | | | | | | | | | |
| 24N 7E 13AWD1 | Oscoda | 69 | 6 | 112SAND | 760 | 6 | M | 28.9 Jul 1984 | 32.7 Mar 1982 | <u>28.3 Jun</u> | 31.0 Jan | |
| IRON | | | | | | | | | | | | |
| 43N 35W 11AD | WEP 23 | 47 | 36 | 112GLCL | 1,565 | 41 | M | 35.3 Aug 1983 | 47.1 Aug 1949 | 37.2 Dec | 39.2 Mar | Meas. by WEP |
| 20XC | WEP 25 | 48 | 1 | 112GLCL | 1,560 | 41 | M | 40.7 Jun 1973 | 48.3 Aug 1949 | 42.4 Nov | 43.3 Feb | Do. |
| 44N 37W 14BB | CCC Camp | 102 | 6 | 112GLCL | 1,730 | 27 | Q | 91.3 Jun 1984 | 97.1 Aug 1982 | <u>90.9 Nov</u> | 91.6 Jun | |
| JACKSON | | | | | | | | | | | | |
| 3S 1W 11AA1 | Jackson, 4a Belden | 360 | 6 | 324SGNW, 337MRSI | 935 | 28 | D | 18.6 Jan 1961 | 119.1 Jun 1971 | 58.0 Jan | 83.2 May | P, Meas. by owner |
| KALAMAZOO | | | | | | | | | | | | |
| 2S 10W 4D | Kalamazoo, Campbell | 13 | 4 | 1120TSH | 836.5 | 17 | R | 1.9 Apr 1974 | 8.4 Sep 1984 | 5.0 May | 7.5 Jan | P |
| 9B | Kalamazoo, Schoonover | 21 | 6 | 1120TSH | 828 | 17 | R | +1.0 Apr 1975 | 4.3 Oct 1984 | 0.8 Apr | 3.5 Jul | P |
| 11W 20RB2 | Kalamazoo, Kendall | 106 | 4 | 1120TSH | 880 | 18 | R | 12.5 Feb 1976 | 48.4 Jun 1971 | 17.1 Apr | 40.1 Feb | P |
| 22CD | Kalamazoo, Stockbridge | 137 | 4 | 1120TSH | 764.7 | 26 | R | 4.8 Feb 1975 | 31.1 Aug 1961 | 7.8 May | 9.3 Jan | P |
| 28AA | Kalamazoo, Maple | 245 | 4 | 1120TSH | 820 | 17 | R | 32.9 Jan 1979 | 61.6 Jun 1973 | 38.0 Apr | <u>73.1 Jul</u> | P |
| 31CD | Kalamazoo, Colony | 226 | 4 | 1120TSH | 910 | 17 | R | 41.4 Sep 1982 | 71.8 May 1978 | 50.8 Aug | 63.8 Apr | P |
| 36CB | Kalamazoo, Emerald | 226 | 4 | 1120TSH | 860 | 17 | R | 25.7 May 1976 | 50.4 Jun 1971 | <u>25.4 Apr</u> | 42.2 Jul | P |
| 3S 11W 4AD1 | Kalamazoo, A-D | 135 | 3 | 1120TSH | 854.0 | 27 | R | 0.5 May 1967 | 12.9 Jul 1964 | 2.1 Nov | 10.0 Jul | P |
| 4AD2 | Kalamazoo, A-S | 40 | 3 | 1120TSH | 854.0 | 27 | R | +0.2 Sep 1975 | 9.1 Nov 1959 | 0.1 Nov | 1.6 Jul | P |
| 14AA | Upjohn 28 | 233 | 16 | 1120TSH | 870 | 19 | R | 23.5 Aug 1982 | 45.2 Jul 1977 | 33.1 Jul | 41.2 Sep | P |
| 22BRCB | Portage | 102 | 12 | 112GLCL | 877 | 4 | R | 25.5 Jun 1982 | 27.9 Nov 1984 | <u>24.8 Apr</u> | 27.8 Nov | P |
| 12W 11BD | Kalamazoo, Atwater | 248 | 3 | 1120TSH | 880 | 25 | R | +3.0 Sep 1969 | 1.0 Aug 1977 | +1.4 Nov | 0.3 Jan | P |
| 11AD1 | Kalamazoo, Sabo-D | 300 | 4 | 1120TSH | 877 | 13 | R | 4.5 Jul 1973 | 16.6 Jul 1984 | 5.4 Nov | 16.3 Aug | P |
| 11AD2 | Kalamazoo, Sabo-S | 38 | 6 | 1120TSH | 877 | 13 | R | 9.1 Aug 1975 | 12.8 Aug 1984 | 9.7 Nov | 12.0 Aug | P |
| 4S 11W 3CDMA1 | Prairie View Park | 190 | 4 | 1120TSH | 870 | 17 | R | 18.1 Apr 1982 | 20.6 Dec 1977 | <u>18.0 Apr</u> | 20.1 Oct | |
| KENT | | | | | | | | | | | | |
| 5N 12W 4DCCD1 | Wyoming, Wohna | 86 | 6 | 112GRVL | 868.0 | 24 | M | 7.8 Oct 1978 | 12.9 Aug 1964 | 9.1 Mar | 11.4 Aug | |
| 10N 12W 13DD | Rouge River Game Area | 30 | 1 | 112GLCL | 785 | 20 | Q | 0.8 Jan 1975 | 9.2 Oct 1969 | 4.6 Apr | 8.2 Oct | |

Table 1.--Records of Michigan observation wells--Continued

| COUNTY AND WELL NUMBER | NAME | DEPTH (FT) | DIAMETER (IN) | AQUIFER | ALTITUDE | YRS. RECORD | MEAS. 1985 | OBSERVED WATER-LEVEL EXTREMES | | | | REMARKS |
|------------------------------|-----------------------|------------|---------------|----------|----------|-------------|------------|-------------------------------|----------------|------------------|-----------------|------------------|
| | | | | | | | | THROUGH 1984 | | IN 1985 | | |
| | | | | | | | | MAXIMUM | MINIMUM | MAXIMUM | MINIMUM | |
| TWP, RANGE, SECT | | | | | | | | | | | | |
| LAKE | | | | | | | | | | | | |
| 20N 13W 13ACAC1 | Irons | 57 | 6 | 1120TSH | 945 | 6 | M | 14.7 Jul 1980 | 18.0 Mar 1982 | <u>11.1 Dec</u> | 15.5 Mar | |
| LEELANAU | | | | | | | | | | | | |
| 28N 14W 8DDCA1 | Sleeping Bear, D | 138 | 6 | 112SAND | 750 | 6 | M | 113.1 Mar 1980 | 114.5 Jun 1984 | <u>112.2 Aug</u> | 114.2 Jan | |
| 28N 14W 18RABR1 | Sleeping Bear, S | 60 | 6 | 112SAND | 625 | 6 | R | 22.9 Apr 1982 | 24.9 Nov 1982 | <u>21.8 Apr</u> | 23.6 Feb | |
| LENAWEE | | | | | | | | | | | | |
| 5S 1E 12DDBD1 | Onsted Game Area | 39 | 1 | 112GLCL | 1,000 | 20 | M | 15.9 Mar 1982 | 19.3 Sep 1971 | 16.1 Apr | 17.3 Aug | |
| 6S 4E 8DDWA1 | Fisher Body | 81 | 8 | 1120TSH | 800 | 21 | R | 9.9 Apr 1982 | 18.4 Feb 1965 | 11.5 May | 13.5 Feb | |
| LIVINGSTON | | | | | | | | | | | | |
| 1N 6E 13DRAB1 | American Aggregate | 29 | 2 | 1120TSH | 930 | 16 | R | 12.1 Apr 1974 | 21.6 Oct 1979 | 13.9 Apr | 17.0 Jan | |
| 2N 6E 31BA2 | Brighton | 83 | 10 | 112GLCL | 935 | 12 | R | 27.2 Sep 1975 | 58.6 Jul 1978 | 27.9 Apr | 54.8 Sep | P, Disc. 10-85 |
| MACKINAC | | | | | | | | | | | | |
| 41N 5W 23BC | Round Lake CCC | 47 | 6 | 355SLINH | 610 | 30 | Q | 4.3 May 1959 | 17.8 Feb 1981 | <u>2.9 Apr</u> | 12.3 Aug | |
| 42N 2W 7AABR1 | Pontchartrain CCC | 102 | 6 | 355MNSQ | 680 | 30 | R | 13.1 May 1960 | 32.3 Feb 1977 | <u>12.5 Apr</u> | 27.2 Sep | |
| MARQUETTE | | | | | | | | | | | | |
| 47N 28W 3CCJCL | Ely Twsp. | 75 | 8 | 1120TSH | 1,572.0 | 25 | R | 9.7 May 1973 | 19.3 Apr 1964 | <u>9.4 Apr</u> | 15.8 Mar | Federal key well |
| 49N 30W 22AC | WEP 13 | 17 | 1 | 112GLCL | 1,680 | 38 | M | 0.6 May 1951 | 13.3 Sep 1948 | 5.5 Apr | 10.5 Aug | Meas. by WEP |
| MEQUIGNEE | | | | | | | | | | | | |
| 37N 26W 19DADA1 | Carney | 17 | 4 | 365TBRV | 800 | 27 | Q | 3.5 Apr 1979 | 8.6 Jan 1977 | 4.6 Sep | 15.2 Jun | |
| MONROE | | | | | | | | | | | | |
| 7S 6E 15ACAA1 | Petersburg, rock | 73 | 6 | 348DRRV | 860 | 7 | M | 32.3 Mar 1982 | 40.2 Nov 1979 | 34.0 Apr | <u>43.2 Oct</u> | |
| 15ADBB1 | Petersburg Game Area | 17 | 1 | 112GLCL | 675 | 20 | M | 3.0 Feb 1966 | 6.8 Nov 1978 | 4.7 Apr | <u>7.4 Oct</u> | |
| MUSKEGON | | | | | | | | | | | | |
| 11N 15W 34ADND1 | Muskegon Game Area | 31 | 1 | 112SAND | 595 | 20 | Q | +0.2 Apr 1978 | 4.7 Sep 1972 | 0.2 Apr | 3.4 Jul | |
| OAKLAND | | | | | | | | | | | | |
| 2N 7E 5BA | Honeywell Lake Road | 44 | 2 | 112GLCL | 1,020 | 18 | R | 23.9 Apr 1976 | 28.9 Dec 1971 | 25.7 Apr | 27.4 Jan | |
| 8E 18DBAD1 | Proud Lake Park | 45 | 6 | 1120TSH | 910 | 17 | R | 2.8 May 1974 | 6.4 Sep 1971 | 3.6 Apr | 5.3 Feb | P |
| 3N 7E 5DA | Fish Lake Road | 49 | 2 | 112GLCL | 1,055 | 17 | R | 29.5 Jun 1976 | 38.7 Dec 1972 | 33.2 Jun | 35.7 Jan | |
| 10E 13AC | Oakland University | 183 | 6 | 112GLCL | 940 | 5 | R | 56.2 Apr 1984 | 93.5 Jul 1963 | 56.8 Dec | 59.3 Mar | |
| 5N 8E 8ACAC1 | Holly Recreation Area | 42 | 1 | 112GLCL | 930 | 20 | M | 22.3 Apr 1974 | 26.5 Sep 1966 | 24.3 Apr | 25.5 Jul | |
| OCEANA | | | | | | | | | | | | |
| 13N 15W 18AAAA1 | Hesperia | 79 | 6 | 1120TSH | 703 | 8 | R | 36.6 Jun 1979 | 41.0 Mar 1982 | 37.2 Jun | 40.2 Jan | |
| OSHTAW | | | | | | | | | | | | |
| 23N 1E 2BAAA1 | Rose City Road, D | 105 | 1 | 112GLCL | 1,265 | 18 | Q | 73.6 Oct 1976 | 78.2 Apr 1969 | 74.9 Jul | 75.5 Oct | |
| 2BAAA2 | Rose City Road, S | 20 | 1 | 112SAND | 1,265 | 18 | Q | 7.6 Apr 1976 | 13.6 Dec 1972 | 9.4 Jul | 10.6 Jan | |

Table 1.--Records of Michigan observation wells--Continued

| COUNTY AND WELL NUMBER | NAME | DEPTH (FT) | DIAMETER (IN) | AQUIFER | ALTITUDE | YRS. RECORD | MEAS. 1985 | OBSERVED WATER-LEVEL EXTREMES | | | | REMARKS |
|------------------------------|-------------------------|------------|---------------|----------|----------|-------------|------------------|-------------------------------|-----------------|----------|------------------|---------|
| | | | | | | | | THROUGH 1984 | | IN 1985 | | |
| TWP, RANGE, SECT | | | | | | | | MAXIMUM | MINIMUM | MAXIMUM | MINIMUM | |
| <u>ONTONAGON</u> | | | | | | | | | | | | |
| 51N 41W 8R0BC1 | Silver City | 100 | 6 | 420FRED | 620 | 28 | Q 8.2 Apr 1959 | 21.8 Dec 1976 | 9.6 Mar | 12.5 Sep | | |
| <u>OTSEGO</u> | | | | | | | | | | | | |
| 30N 3W 19ABBB1 | Gaylord | 90 | 6 | 1120TSH | 1,308 | 7 | M 30.7 Jul 1979 | 35.8 Apr 1982 | 31.3 Jun | 33.8 Feb | | |
| <u>PRUSQUE ISLE</u> | | | | | | | | | | | | |
| 33N 6E 8RBBB1 | Styma | 61 | 6 | 341TRVR | 800 | 27 | Q 4.8 Mar 1984 | 18.8 Mar 1963 | 5.2 Apr | 12.1 Jul | | |
| <u>ROSCOMMON</u> | | | | | | | | | | | | |
| 24N 2W 20RABA1 | Exp. Station | 14 | 8 | 1120TSH | 1,145.3 | 52 | R 2.1 Apr 1976 | 6.2 Dec 1949 | 2.3 Apr | 4.7 Aug | Federal key well | |
| <u>SAGINAW</u> | | | | | | | | | | | | |
| 10N 1E 22DADA1 | Marion Springs, D | 210 | 6 | 324SGNW | 657 | 8 | R 7.9 Feb 1981 | 10.3 Oct 1984 | 8.5 Apr | 9.9 Aug | | |
| <u>SANILAC</u> | | | | | | | | | | | | |
| 13N 13E 12ADA1 | Minden Game Area | 130 | 6 | 337MRSL | 805 | 9 | R 16.4 Apr 1982 | 22.7 Oct 1979 | <u>15.5 Apr</u> | 20.0 Aug | | |
| <u>SCHOOLCRAFT</u> | | | | | | | | | | | | |
| 45N 13W 16CCCB1 | Seney | 154 | 4 | 3610DVCU | 710 | 34 | R 4.6 Apr 1971 | 6.5 Oct 1963 | 5.0 Apr | 5.9 Aug | | |
| 47N 16W 30RBBB1 | Cusino CCC | 57 | 6 | 368PRDC | 900 | 29 | R 5.7 May 1960 | 16.4 Feb 1977 | <u>5.6 Apr</u> | 14.7 Sep | | |
| <u>VAN BUREN</u> | | | | | | | | | | | | |
| 2S 13W 2RBCD1 | Almena, D | 108 | 4 | 112GLCL | 737 | 5 | M 7.4 Apr 1984 | 10.7 Aug 1981 | <u>5.8 Mar</u> | 9.0 Dec | | |
| 2RBCD2 | Almena, S | 44 | 4 | 112GLCL | 737 | 5 | M 9.0 Oct 1982 | 12.6 Sep 1984 | 9.2 Mar | 12.4 Aug | | |
| <u>WASHTENAW</u> | | | | | | | | | | | | |
| 2S 3E 9DABR2 | Waterloo Park | 48 | 6 | 112SDGV | 970 | 17 | R 4.1 May 1974 | 7.0 Aug 1971 | 4.5 Apr | 6.5 Sep | P | |
| 3S 6E 16RCCD1 | Ann Arbor | 55 | 10 | 112GLCL | 821.5 | 23 | R 0.7 Mar 1974 | 15.9 Oct 1964 | 1.9 Apr | 5.8 Oct | P | |
| 7E 5BB | Ypsilanti, Superior | 69 | 8 | 112GLCL | 720 | 24 | R 1.8 Feb 1965 | 21.4 Dec 1965 | 5.8 Aug | 11.6 Feb | P | |
| 9ADBCL | Ypsilanti, Gilbert | 94 | 6 | 112GLCL | 710 | 35 | R 29.1 Nov 1945 | 78.8 Oct 1974 | 47.4 Dec | 57.7 Jan | P | |
| 24CA1 | Ypsilanti Twsp. 104 | 87 | 4 | 112GLCL | 665.6 | 40 | R 5.8 Jan 1950 | 22.7 Feb 1971 | 13.4 Jul | 16.2 Feb | P | |
| 24CD | Ypsilanti Twsp. 117 | 75 | 6 | 112GLCL | 657.8 | 39 | R 4.7 Oct 1981 | 63.2 Feb 1970 | 7.5 Apr | 22.5 Aug | P | |
| <u>WEXFORD</u> | | | | | | | | | | | | |
| 22N 12W 13BA | Harrietta Fish Hatchery | 141 | 4 | 112GLCL | 1,060 | 25 | R +13.8 Mar 1970 | 1.6 Jan 1981 | +8.4 Jun | +4.8 Feb | P | |

12

Table 2.--Reported ground-water pumpage
(in millions of gallons)

| COUNTY AND WATER USER | 1985 TOTAL | MAX DAY | MIN DAY | COUNTY AND WATER USER | 1985 TOTAL | MAX DAY | MIN DAY |
|-----------------------------|---------------|------------|------------|---|---------------|------------|------------|
| ALCONA Harrisville | 20.4 | 0.137 | 0.040 | CLINTON Maple Rapids | 28.1 | -- | -- |
| ALGER Burt Twp. | 48.5 | .225 | .080 | Ovid | 70.4 | 0.291 | 0.091 |
| Chatham | 10.8 | .133 | .012 | St. Johns | 422.3 | 2.318 | .677 |
| ALLIGAN Douglas | 86.4 | -- | -- | Westphalia | 19.2 | .195 | .048 |
| Fennville | 245.3 | -- | -- | CRAWFORD Grayling | 238.2 | 1.095 | .480 |
| Otsego | 372.0 | 1.539 | .732 | DICKINSON Breitung Twp. | 41.6 | -- | -- |
| Plainwell | 198.6 | 1.030 | .298 | EATON Bellevue | 46.0 | .270 | .020 |
| Saugatuck | 115.2 | -- | -- | Charlotte | 399.1 | 2.128 | .705 |
| ANTRIM Bellaire | 59.4 | .369 | .103 | Delta Twp. | 943.0 | -- | -- |
| Central Lake | 54.7 | .293 | -- | Eaton Rapids | 276.9 | 1.235 | .552 |
| Mancelona | 184.8 | 1.188 | .151 | Sunfield | 27.1 | -- | -- |
| BARRY Middleville | 116.2 | -- | -- | EMMET Harbor Springs | 164.2 | 1.413 | .270 |
| Nashville | 43.6 | .271 | .066 | Petosky | 547.5 | 2.474 | 1.251 |
| BENZIE Beulah | 17.1 | .108 | .022 | GENESEE Beecher Metro. Dist. | 482.4 | 1.982 | .929 |
| Frankfort | 89.5 | .442 | .176 | Burton | 276.9 | 1.681 | .388 |
| BERRIEN Berrien Springs | 161.1 | .958 | .278 | Davison | 228.8 | 1.499 | .209 |
| Buchanan | 314.8 | 1.786 | .276 | Fenton | 283.2 | 1.379 | .550 |
| Coloma | 103.0 | .638 | .180 | Grand Blanc | 418.2 | 2.875 | .762 |
| Niles | 978.5 | 4.140 | 1.230 | Grand Blanc Twp. | 173.2 | -- | -- |
| Niles Twp. | 105.0 | 1.536 | .003 | Linden | 66.2 | .395 | .049 |
| Watervliet | 80.5 | .695 | .000 | Otisville | 20.9 | -- | -- |
| BRANCH Bronson | 210.9 | 1.323 | .280 | GLAUBIN Beaverton | 47.7 | -- | -- |
| Coldwater | 1,168.1 | 5.230 | 1.850 | COCEBIC Marenisco Twp. | 45.1 | .210 | .092 |
| Quincy | 90.9 | -- | -- | Wakefield | 147.6 | .639 | .314 |
| Reg. Center Dev. Disab. | 50.8 | .290 | .053 | GRAND TRAVERSE Kingsley | 26.7 | -- | -- |
| CALHOUN Albion | 964.0 | 3.662 | 1.580 | GRATIOT Alma | 0.2 | -- | -- |
| Athens | 42.4 | -- | -- | Breckenridge | 45.8 | .249 | .062 |
| Battle Creek | 2,949.8 | 12.690 | 4.050 | Ithaca | 122.3 | -- | -- |
| Battle Creek Twp. | 677.3 | 4.490 | 1.180 | St. Louis | 268.5 | 1.823 | .325 |
| Homer | 68.8 | .344 | .102 | HILLSDALE Hillsdale | 409.4 | 1.718 | .567 |
| Marshall | 515.1 | 2.354 | .821 | Jonesville | 174.0 | 1.000 | .236 |
| CASS Cassopolis | 86.8 | .458 | .106 | Litchfield | 48.7 | .324 | .082 |
| CHARLEVOIX Boyer City | 265.7 | 1.909 | .410 | Waldron | 27.3 | .155 | .013 |
| East Jordan | 217.9 | 1.020 | .330 | HOUGHTON a) Adams Twp. - S. Range Water Auth. | 306.9 | -- | -- |
| CHIPPWA Kinross Twp. | 115.4 | .581 | .133 | b) Adams Twp. - S. Range Water Auth. | 92.6 | -- | -- |
| CLARE Clare | 233.7 | 1.370 | .327 | Chassell Twp. | 40.8 | .180 | .094 |
| Larwell | 47.3 | .670 | .040 | Houghton | 186.7 | 1.727 | .115 |
| Harrison | 74.9 | .377 | .153 | c) N. Michigan Water Co. | 349.9 | 1.621 | .706 |
| | | | | IRON Pigeon | 43.9 | -- | -- |

Table 2.--Reported ground-water pumpage--Continued
(in millions of gallons)

| COUNTY AND WATER USER | 1985 TOTAL | MAX DAY | MIN DAY | COUNTY AND WATER USER | 1985 TOTAL | MAX DAY | MIN DAY |
|-----------------------------|---------------|------------|------------|-----------------------------|---------------|------------|------------|
| INGHAM | | | | LAPEER | | | |
| E. Lansing-Meridian Twp. | 2,106.6 | 10.480 | 4.160 | Columbiaville | 31.0 | 0.177 | 0.031 |
| Lansing | 7,944.8 | 33.520 | 16.762 | Dryden | 14.8 | .093 | .009 |
| Lansing Twp. | 410.9 | -- | -- | | | | |
| Leslie | 96.3 | -- | -- | LEELANAU | | | |
| Mason | 240.1 | -- | -- | Northport | 29.0 | .222 | .012 |
| Michigan State Univ. | 1,632.1 | -- | -- | | | | |
| Stockbridge | 52.7 | -- | .073 | LENAWEE | | | |
| Webberville | 54.8 | -- | -- | Clinton | 96.1 | -- | -- |
| Williamston | 91.0 | .558 | .156 | Hudson | 130.7 | .566 | .232 |
| | | | | Morenci | 89.8 | .458 | .131 |
| IONIA | | | | Onsted | 31.1 | .182 | .059 |
| Belding | 651.4 | -- | -- | Tecumseh | 351.3 | 1.585 | .283 |
| Riverside Facility, Ionia | 41.0 | .258 | .046 | Inland Div., Tecumseh | 10.4 | .079 | -- |
| Mich. Reformatory, Ionia | 77.4 | -- | -- | | | | |
| Mich. Training Unit, Ionia | 41.7 | .300 | .072 | LIVINGSTON | | | |
| d)Muir | 49.7 | .318 | .071 | Brighton | 273.5 | 1.400 | .450 |
| Pewamo | 20.1 | -- | -- | Fowlerville | 122.8 | .476 | .218 |
| Portland | 165.5 | -- | -- | Howell | 462.8 | 1.907 | .792 |
| Saranac | 104.6 | .590 | .080 | Maxey Boys School | 48.1 | .723 | .055 |
| | | | | | | | |
| IOSCO | | | | LUCE | | | |
| Oscoda Twp. | 275.2 | -- | -- | Newberry | 79.7 | .406 | .106 |
| | | | | Newberry Health Center | 18.3 | -- | -- |
| IRON | | | | | | | |
| Alpha | e)11.7 | -- | -- | MACOMB | | | |
| Caspian | 113.2 | .562 | .217 | Armada | 37.3 | .187 | .066 |
| Crystal Falls | 156.5 | .938 | .252 | Romeo | 243.1 | .838 | .410 |
| Iron River | 133.3 | .600 | .103 | | | | |
| Stambaugh | 77.9 | .429 | .000 | MANISTEE | | | |
| Stambaugh Twp. | 43.7 | -- | -- | Filer Twp. | 53.5 | .511 | .000 |
| | | | | | | | |
| ISABELLA | | | | MARQUETTE | | | |
| f)Mt. Pleasant | 858.0 | 3.997 | 1.335 | Ishpeming Twp. | 136.3 | .851 | .293 |
| | | | | K. I. Sawyer AFB | 420.7 | 2.240 | .737 |
| JACKSON | | | | Powell Twp. | 17.5 | .148 | .015 |
| Concord | 74.7 | 1.054 | .006 | | | | |
| Grass Lake | 24.8 | .162 | .030 | MEMORINEE | | | |
| Jackson | 3,061.9 | 11.420 | 4.600 | Stephenson | 40.2 | .242 | .081 |
| Springport | 37.3 | -- | -- | | | | |
| State Prison, Jackson | 574.4 | -- | -- | MIDLAND | | | |
| | | | | Coleman | 58.6 | .380 | .097 |
| KALAMAZOO | | | | | | | |
| Augusta | 34.2 | .865 | .057 | MISSAUKIE | | | |
| Galesburg | 68.4 | .543 | .113 | Lake City | 58.5 | .802 | .051 |
| Kalamazoo | 6,735.7 | 36.575 | 12.830 | | | | |
| Parchment | 108.9 | .931 | .111 | MONROE | | | |
| Portage | 1,279.2 | 10.798 | 1.612 | Petersburg | 48.2 | .204 | .031 |
| Upjohn Co. | 6,991.3 | 25.025 | 6.242 | | | | |
| Simpson Paper Co. | 194.3 | 1.411 | .069 | MONTCALM | | | |
| Vicksburg | 123.6 | .847 | .114 | Carson City | 61.8 | .290 | .130 |
| | | | | Edmore | 61.8 | .595 | .061 |
| KALKASKA | | | | Greenville | 949.0 | 4.447 | 1.142 |
| Kalkaska | 169.5 | 1.234 | .206 | Howard City | 36.5 | -- | -- |
| | | | | Sheridan | 34.3 | -- | -- |
| KINZ | | | | | | | |
| Alloytek, Inc. | 93.0 | -- | -- | MUSKIEGON | | | |
| Cedar Springs | 147.3 | -- | -- | Montague | 87.1 | .718 | .071 |
| Kent County Airport | e)12.0 | -- | -- | | | | |
| Lowell | 259.2 | 1.633 | .353 | NEWAYGO | | | |
| Plainfield Twp. | 787.9 | 6.770 | 1.120 | Freemont | 382.5 | 3.122 | .159 |
| Sparta | 187.9 | .837 | .309 | Hesperia | 23.0 | -- | -- |
| | | | | Newaygo | 60.0 | -- | -- |
| LAKE | | | | White Cloud | 84.6 | .400 | .106 |
| Baldwin | 72.0 | .515 | -- | | | | |

Table 2.--Reported ground-water pumpage--Continued
(in millions of gallons)

| COUNTY AND WATER USER | 1985 TOTAL | MAX DAY | MIN DAY | COUNTY AND WATER USER | 1985 TOTAL | MAX DAY | MIN DAY |
|-----------------------------|---------------|------------|------------|-----------------------------|---------------|------------|------------|
| OAKLAND | | | | ST. JOSEPH | | | |
| Holly | 167.3 | 0.750 | 0.350 | Constantine | 107.4 | 0.738 | 0.108 |
| Independence Twp. | 144.7 | -- | -- | Sturgis | 841.6 | 4.519 | 1.337 |
| Milford | 240.2 | 1.156 | .357 | | | | |
| Orion Twp. | 222.4 | 1.601 | .398 | SAGINAW | | | |
| Oxford | 159.1 | .939 | .135 | Chesaning | 114.1 | .566 | .182 |
| Rochester | 640.8 | 3.098 | 1.034 | | | | |
| Southfield | 4.8 | -- | -- | SANILAC | | | |
| Sylvan Lake | 69.6 | -- | -- | Croswell | 192.9 | .914 | .215 |
| Walled Lake | 319.5 | -- | -- | Deckerville | 49.5 | .237 | .026 |
| Waterford Twp. | 2,055.9 | -- | -- | Marlette | 100.0 | -- | -- |
| Wolverine Lake | 68.6 | -- | -- | Peck | 28.0 | .141 | .039 |
| | | | | Port Sanilac | 35.6 | -- | -- |
| OCEANA | | | | Sandusky | 163.9 | .853 | .195 |
| Shelby | 135.6 | -- | -- | | | | |
| | | | | SHITAWASSEE | | | |
| OCEMAW | | | | Bancroft | 20.4 | -- | -- |
| West Branch | 105.0 | .589 | .000 | Byron | 22.1 | -- | -- |
| | | | | Durand | 125.3 | .521 | .207 |
| ONTONAGON | | | | Owosso | e) 794.5 | 3.240 | 1.480 |
| Bergland Twp. | c) 10.4 | -- | -- | Perry | 61.1 | .336 | .110 |
| | | | | | | | |
| OSCEOLA | | | | TUSCOLOA | | | |
| Evart | 743.0 | 3.687 | .319 | Caro | 189.6 | .945 | .253 |
| Reed City | 121.5 | -- | -- | Cass City | 110.6 | .541 | .131 |
| | | | | Mayville | 32.7 | -- | -- |
| OTSERO | | | | State Hosp., Caro | 52.5 | .420 | .090 |
| Gaylord | 211.3 | -- | -- | Vassar | 204.7 | 1.122 | .368 |
| | | | | | | | |
| OTTAWA | | | | VAN BUREN | | | |
| Spring Lake | 183.0 | -- | -- | Bangor | 65.6 | .423 | .082 |
| | | | | Decatur | 90.2 | -- | -- |
| PRESQUE ISLE | | | | Hartford | 109.4 | .707 | .125 |
| Onaway | 73.4 | .268 | -- | Lawrence | 35.6 | -- | -- |
| Rogers City | 152.6 | 1.392 | .222 | Lawton | 302.0 | 1.984 | -- |
| | | | | Paw Paw | 196.3 | 1.296 | .250 |
| | | | | | | | |
| ROSCOMMON | | | | WASHTENAW | | | |
| Roscommon | 74.2 | -- | -- | Ann Arbor | g) 1,176.6 | 4.474 | -- |
| | | | | Dexter | 77.9 | -- | -- |
| ST. CLAIR | | | | Saline | 522.7 | 2.203 | .751 |
| Capac | 38.4 | .401 | .045 | Webster Twp. | 42.2 | .486 | .017 |
| Yale | 85.9 | -- | -- | Ypsilanti | 906.5 | 4.406 | .492 |
| | | | | Ypsilanti Twp. | 1,640.3 | 10.933 | .000 |
| | | | | | | | |
| | | | | WEXFORD | | | |
| | | | | Cadillac | 770.4 | 3.390 | 1.206 |
| | | | | Minton | 52.2 | .278 | .059 |

NOTES

- Amount pumped to supply Houghton, Hancock, Portage Township, Copper Range Company, and Atlantic Mine.
- Amount pumped to supply Painesdale, Trimountain, Baltic, and South Range.
- Amount pumped to supply Calumet, Calumet Township, Copper City, Lake Linden, Laurin, Osceola Township, Torch Lake Township, Ahmeek, and Allicouez Township.
- Supplies water to Lyons.
- Wholly or partly estimated.
- Use Ranney Collector system at Chippewa River site.
- Also pumped 4,700 million gallons from Huron River.

Table 3.--Water-quality data

LOCAL IDENTIFIER: See section in text entitled "Well-numbering system"; also includes abbreviated spelling of county name.
 GEOLOGIC UNIT: 112LKBD Lakebeds 112SAND Sand 324SGNW Saginaw Formation 1120TSH Outwash
 UNITS: Units are reported in NTU = Nephelometric Turbidity Units, MG/L = Milligrams per liter; UG/L = Micrograms per liter;
 PCI/L = Picocuries per liter.

| LOCAL IDENTIFIER | DATE OF SAMPLE | GEOLOGIC UNIT | DEPTH OF WELL, TOTAL (FEET) | SPECIFIC CONDUCTANCE (US/CM) | PH (STANDARD UNITS) | TEMPERATURE (DEG C) | COLOR (PLATINUM-COBALT UNITS) | TURBIDITY (NTU) | HARDNESS (MG/L AS CaCO3) | HARDNESS NONCARBONATE (MG/L AS CaCO3) |
|-------------------------|----------------|---------------|-----------------------------|------------------------------|---------------------|---------------------|-------------------------------|-----------------|--------------------------|---------------------------------------|
| 19N 05E 07DABA01 ARENAC | 08-06-85 | 324SGNW | 190 | 1310 | 7.5 | 10.0 | 5 | 4.5 | 240 | 25 |
| 19N 05E 07DABA02 ARENAC | 08-06-85 | 112LKBD | 21 | 240 | 8.0 | 8.5 | 15 | 5.5 | 120 | 10 |
| 24N 07E 13ADAA01 IOSCO | 09-19-85 | 112SAND | 69 | 258 | 8.0 | 9.5 | 5 | .20 | 130 | 11 |
| 20N 13W 13ACAC01 LAKE | 08-01-85 | 112DTSH | 58 | 134 | 8.7 | 9.0 | 10 | .50 | 62 | 8 |
| | 10-22-85 | | | 129 | 8.7 | 9.5 | -- | -- | -- | -- |
| 28N 14W 08DDCA01 LELANU | 08-29-85 | 112SAND | 138 | 302 | -- | 9.0 | 5 | .20 | 130 | 9 |
| 28N 14W 18BABB01 LELANU | 08-29-85 | 112SAND | 60 | 331 | -- | 9.0 | 5 | .80 | 170 | 11 |

| LOCAL IDENTIFIER | CALCIUM DIS-SOLVED (MG/L AS Ca) | MAGNESIUM DIS-SOLVED (MG/L AS Mg) | SODIUM DIS-SOLVED (MG/L AS Na) | POTASSIUM DIS-SOLVED (MG/L AS K) | ALKALINITY LAB (MG/L AS CaCO3) | SULFATE DIS-SOLVED (MG/L AS SO4) | CHLORIDE DIS-SOLVED (MG/L AS Cl) | FLUORIDE DIS-SOLVED (MG/L AS F) | SILICA DIS-SOLVED (MG/L AS SiO2) | SOLIDS, RESIDUE AT 180 DEG C DIS-SOLVED (MG/L) |
|-------------------------|---------------------------------|-----------------------------------|--------------------------------|----------------------------------|--------------------------------|----------------------------------|----------------------------------|---------------------------------|----------------------------------|--|
| 19N 05E 07DABA01 ARENAC | 72 | 15 | 190 | 6.6 | 217 | 300 | 87 | .80 | 6.2 | 842 |
| 19N 05E 07DABA02 ARENAC | 36 | 7.2 | 2.5 | .50 | 110 | 12 | 1.6 | < .10 | 7.4 | 138 |
| 24N 07E 13ADAA01 IOSCO | 40 | 8.0 | 1.3 | .30 | 122 | 13 | .80 | < .10 | 6.1 | 144 |
| 20N 13W 13ACAC01 LAKE | 17 | 4.7 | .70 | .30 | 54 | 9.4 | 1.0 | < .10 | 4.7 | 76 |
| | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 28N 14W 08DDCA01 LELANU | 36 | 10 | 2.7 | 2.5 | 122 | 9.6 | 7.7 | .10 | 5.7 | 154 |
| 28N 14W 18BABB01 LELANU | 43 | 14 | .80 | .50 | 154 | 9.6 | .90 | < .10 | 7.1 | 173 |

| LOCAL IDENTIFIER | SOLIDS, SUM OF CONSTITUENTS, DIS-SOLVED (MG/L) | NITROGEN, NITRITE TOTAL (MG/L AS N) | NITROGEN, AMMONIA TOTAL (MG/L AS N) | NITROGEN, ORGANIC TOTAL (MG/L AS N) | NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N) | NITROGEN, NO2+NO3 TOTAL (MG/L AS N) | NITROGEN, TOTAL (MG/L AS N) | PHOSPHORUS, TOTAL (MG/L AS P) | PHOSPHORUS, ORTHO, TOTAL (MG/L AS P) | ALUMINUM, TOTAL RECOVERABLE (MG/L AS AL) |
|-------------------------|--|-------------------------------------|-------------------------------------|-------------------------------------|---|-------------------------------------|-----------------------------|-------------------------------|--------------------------------------|--|
| 19N 05E 07DABA01 ARENAC | 810 | .010 | .650 | .05 | .60 | < .10 | -- | < .010 | < .010 | 1000 |
| 19N 05E 07DABA02 ARENAC | 130 | .030 | .030 | .17 | .20 | .10 | .30 | .050 | .050 | 10 |
| 24N 07E 13ADAA01 IOSCO | 140 | < .010 | .100 | -- | < .10 | .10 | -- | .030 | .050 | 240 |
| 20N 13W 13ACAC01 LAKE | 70 | < .010 | .010 | .19 | .20 | .10 | .30 | .030 | .030 | < 10 |
| | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 28N 14W 08DDCA01 LELANU | 150 | < .010 | .010 | .19 | .20 | 1.3 | 1.5 | .060 | .030 | 30 |
| 28N 14W 18BABB01 LELANU | 170 | < .010 | < .010 | -- | .10 | .60 | .70 | .020 | < .010 | 40 |

| LOCAL IDENTIFIER | ARSENIC TOTAL (UG/L AS AS) | BARIUM, TOTAL RECOVERABLE (UG/L AS Ba) | BERYLLIUM, TOTAL RECOVERABLE (UG/L AS Be) | BORON, TOTAL RECOVERABLE (UG/L AS B) | CADMIUM, TOTAL RECOVERABLE (UG/L AS Cd) | CHROMIUM, TOTAL RECOVERABLE (UG/L AS Cr) | COBALT, TOTAL RECOVERABLE (UG/L AS Co) | COPPER, TOTAL RECOVERABLE (UG/L AS Cu) | IRON, TOTAL RECOVERABLE (UG/L AS Fe) | IRON, DIS-SOLVED (UG/L AS Fe) |
|-------------------------|----------------------------|--|---|--------------------------------------|---|--|--|--|--------------------------------------|-------------------------------|
| 19N 05E 07DABA01 ARENAC | 3 | < 100 | < 10 | 1600 | < 1 | 10 | 3 | 30 | 8500 | 570 |
| 19N 05E 07DABA02 ARENAC | 1 | < 100 | < 10 | < 20 | < 1 | 10 | < 1 | 4 | 380 | 10 |
| 24N 07E 13ADAA01 IOSCO | 1 | -- | -- | < 20 | -- | -- | -- | -- | -- | 8 |
| 20N 13W 13ACAC01 LAKE | < 1 | < 100 | < 10 | < 20 | < 1 | < 10 | < 1 | 13 | 80 | < 3 |
| | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 28N 14W 08DDCA01 LELANU | < 1 | < 100 | < 10 | < 20 | < 1 | 10 | 1 | 4 | 360 | 12 |
| 28N 14W 18BABB01 LELANU | < 1 | < 100 | < 10 | < 20 | < 1 | 10 | < 1 | 4 | 200 | 9 |

Table 3.--Water-quality data--Continued

| LOCAL IDENTIFIER | | | | LEAD, TOTAL RECOV- ERABLE (UG/L AS PB) | LITHIUM TOTAL RECOV- ERABLE (UG/L AS LI) | MANGA- NESE, TOTAL RECOV- ERABLE (UG/L AS MN) | MANGA- NESE, DIS- SOLVED (UG/L AS MN) | MERCURY TOTAL RECOV- ERABLE (UG/L AS HG) | MOLYB- DENUM, TOTAL RECOV- ERABLE (UG/L AS MD) | NICKEL, TOTAL RECOV- ERABLE (UG/L AS NI) | SELE- NIUM, TOTAL RECOV- ERABLE (UG/L AS SE) | SILVER, TOTAL RECOV- ERABLE (UG/L AS AG) | STRON- TIUM, TOTAL RECOV- ERABLE (UG/L AS SR) |
|------------------|--------|--|--|---|---|---|--|---|--|---|--|---|---|
| 19N 05E 07DABA01 | ARENAC | | | 23 | 20 | 300 | 21 | .1 | 5 | 15 | <1 | <1 | 2100 |
| 19N 05E 07DABA02 | ARENAC | | | <1 | <10 | 40 | 13 | <1 | <1 | 3 | <1 | <1 | 60 |
| 24N 07E 13ADAA01 | IOSCO | | | -- | -- | -- | 5 | <1 | -- | -- | <1 | -- | -- |
| 20N 13W 13ACAC01 | LAKE | | | <1 | <10 | <10 | <1 | <1 | <1 | 8 | <1 | <1 | 60 |
| | | | | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 28N 14W 08DDCA01 | LELANU | | | 3 | <10 | <10 | 2 | <1 | <1 | 4 | <1 | <1 | 60 |
| 28N 14W 18BABB01 | LELANU | | | 1 | <10 | 40 | 2 | <1 | <1 | 4 | <1 | <1 | 70 |

| LOCAL IDENTIFIER | | | | VANA- DIUM, DIS- SOLVED (UG/L AS V) | ZINC, TOTAL RECOV- ERABLE (UG/L AS ZN) | TRITIUM TOTAL (PCI/L) | CARBON, ORGANIC DIS- SOLVED (MG/L AS C) | CARBON, ORGANIC SUS- PENDED TOTAL (MG/L AS C) | CYANIDE TOTAL (MG/L AS CN) | PHENOLS TOTAL (UG/L) | 2,4-D, TOTAL (UG/L) | 2, 4-DP TOTAL (UG/L) |
|------------------|--------|--|--|--|---|-----------------------------|--|---|-------------------------------------|----------------------------|---------------------------|----------------------------|
| 19N 05E 07DABA01 | ARENAC | | | <1 | 50 | <240 | 6.4 | .10 | <.01 | 3 | <.01 | <.01 |
| 19N 05E 07DABA02 | ARENAC | | | 2 | 20 | <200 | 3.6 | .10 | <.01 | 4 | <.01 | <.01 |
| 24N 07E 13ADAA01 | IOSCO | | | <1 | -- | -- | 2.6 | .10 | <.01 | 6 | <.01 | <.01 |
| 20N 13W 13ACAC01 | LAKE | | | -- | 70 | <200 | -- | -- | <.01 | 4 | -- | -- |
| | | | | -- | -- | -- | -- | -- | -- | -- | <.01 | <.01 |
| 28N 14W 08DDCA01 | LELANU | | | <1 | 150 | -- | 2.7 | .10 | <.01 | 17 | <.01 | <.01 |
| 28N 14W 18BABB01 | LELANU | | | <1 | 60 | -- | 2.2 | <.10 | <.01 | 6 | .10 | <.01 |

| LOCAL IDENTIFIER | | | | 2, 4, 5-T TOTAL (UG/L) | SILVEX, TOTAL (UG/L) | URANIUM DIS- SOLVED, EXTRAC- TION (UG/L) |
|------------------|--------|--|--|------------------------------|----------------------------|---|
| 19N 05E 07DABA01 | ARENAC | | | <.01 | <.01 | .43 |
| 19N 05E 07DABA02 | ARENAC | | | <.01 | <.01 | .57 |
| 24N 07E 13ADAA01 | IOSCO | | | <.01 | <.01 | -- |
| 20N 13W 13ACAC01 | LAKE | | | -- | -- | .45 |
| | | | | <.01 | <.01 | -- |
| 28N 14W 08DDCA01 | LELANU | | | <.01 | <.01 | -- |
| 28N 14W 18BABB01 | LELANU | | | <.01 | <.01 | -- |

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U.S. Geological Survey Water-Supply Papers (contain ground-water data for Michigan)

| <u>Year</u> | <u>WSP Number</u> | <u>Year</u> | <u>WSP Number</u> | <u>Year</u> | <u>WSP Number</u> |
|-------------|-----------------------|-------------|-----------------------|-------------|-----------------------|
| 1935 | 777 | 1944 | 1016 | 1953 | 1265 |
| 1936 | 817 | 1945 | 1023 | 1954 | 1321 |
| 1937 | 840 | 1946 | 1071 | 1955 | 1404 |
| 1938 | 845 | 1947 | 1096 | 1956-57 | 1537 |
| 1939 | 886 | 1948 | 1126 | 1958-62 | 1782 |
| 1940 | 906 | 1949 | 1156 | 1963-67 | 1977 |
| 1941 | 936 | 1950 | 1165 | 1968-72 | 2140 |
| 1942 | 944 | 1951 | 1191 | | |
| 1943 | 986 | 1952 | 1221 | | |

U.S. Geological Survey Water-Data Reports:

| <u>Year</u> | <u>WDR Number</u> |
|-------------|-------------------|
| 1975 | MI-75-1 |
| 1976 | MI-76-1 |
| 1977 | MI-77-1 |
| 1978 | MI-78-1 |
| 1979 | MI-79-1 |
| 1980 | MI-80-1 |
| 1981 | MI-81-1 |
| 1982 | MI-82-1 |
| 1983 | MI-83-1 |
| 1984 | MI-84-1 |
| 1985 | MI-85-1 |