GROUND-WATER DATA FOR MICHIGAN 1983

by G. C. Huffman

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ABSTRACT

Water levels, locations, depths, and aquifers tapped are given for 115 observation wells. Tabulated data include extremes of water levels for 1983 and for the period of record, pumpage of most major ground-water users in the State, and quality data on selected wells. The largest reported user of ground-water, the city of Lansing, pumped 8.1 billion gallons from the Saginaw Formation and glacial deposits.

INTRODUCTION

Purpose and Scope

This report makes available, through 1983, the records of water levels and related data for the principal aquifers of the State. It is written for municipalities, industries, institutions, consultants, drillers, hydrologists and other people interested in ground-water resources.

Data on yield of wells, pumpage, quality of water, and trends of ground-water levels for the past 5 years are shown in the text. Many hydrographs are included to illustrate changes in water levels. Records of water levels in observation wells and records of pumpage by most major ground-water users, are given in tables 1 and 2. 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. No water-quality data was obtained during 1983.

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 by municipalities, industries, and institutions 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. 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. Allowing for lower water levels can extend the life of the installation.

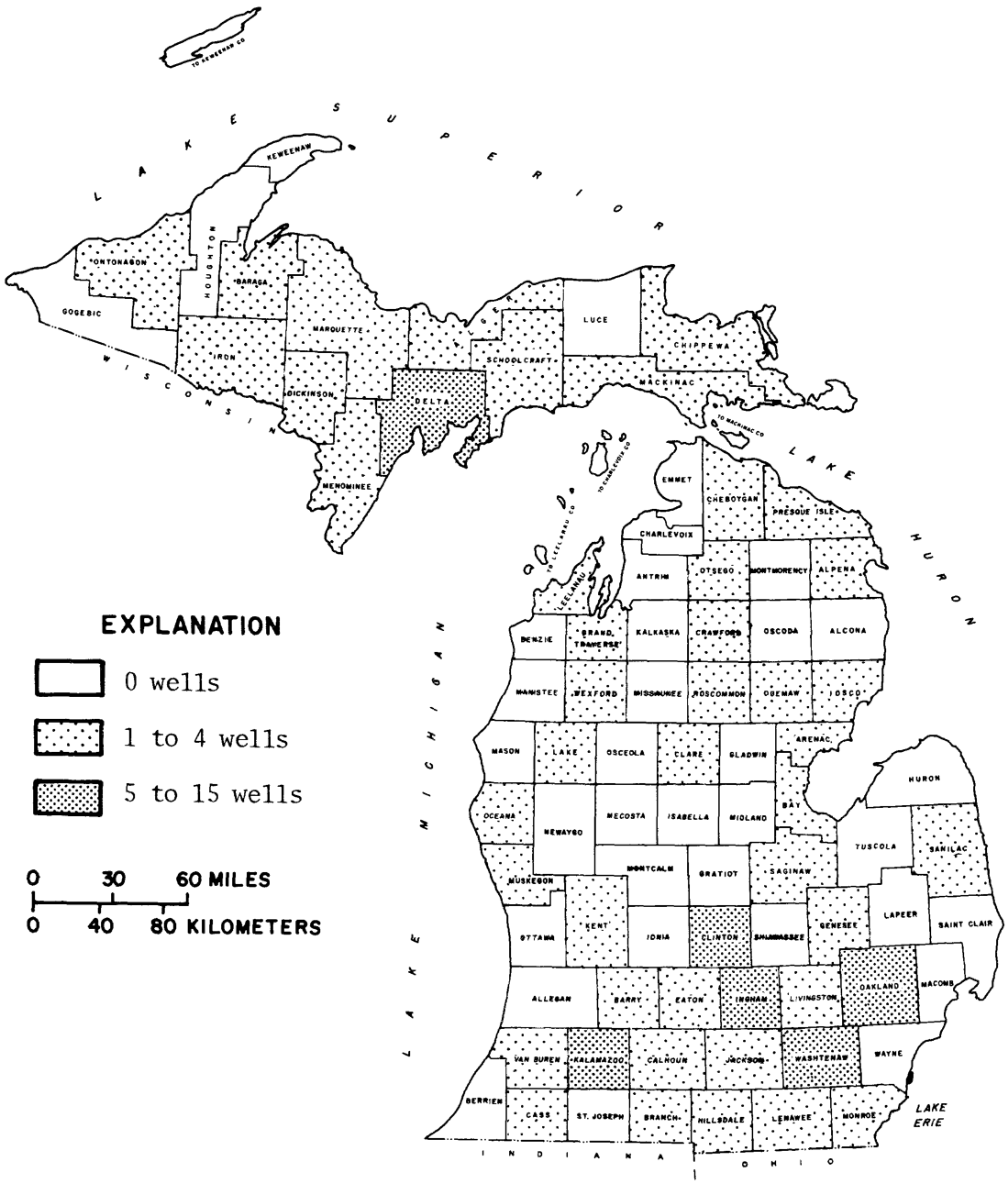


Figure 1.--Distribution of observation wells. Water levels were monitored in 115 wells in 1983.

Normally, the water table fluctuates 2 to 3 feet annually and about 5 feet over a period of years. If an excavation for a basement or septic tank is made when the water table is low, good construction practices would allow for probable higher water levels in the spring. If construction is made after several years of drought, the allowance for rising water levels should be greater. If a site is at all questionable, the depth to the water table can be determined by test borings.

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 48910. Records for the Upper Penninsula are also kept on file in the State and Federal Geological Survey Offices, State Office Building, Escanaba, Michigan 48929.

Records of ground-water levels from 1935 to 1974 are 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.

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.

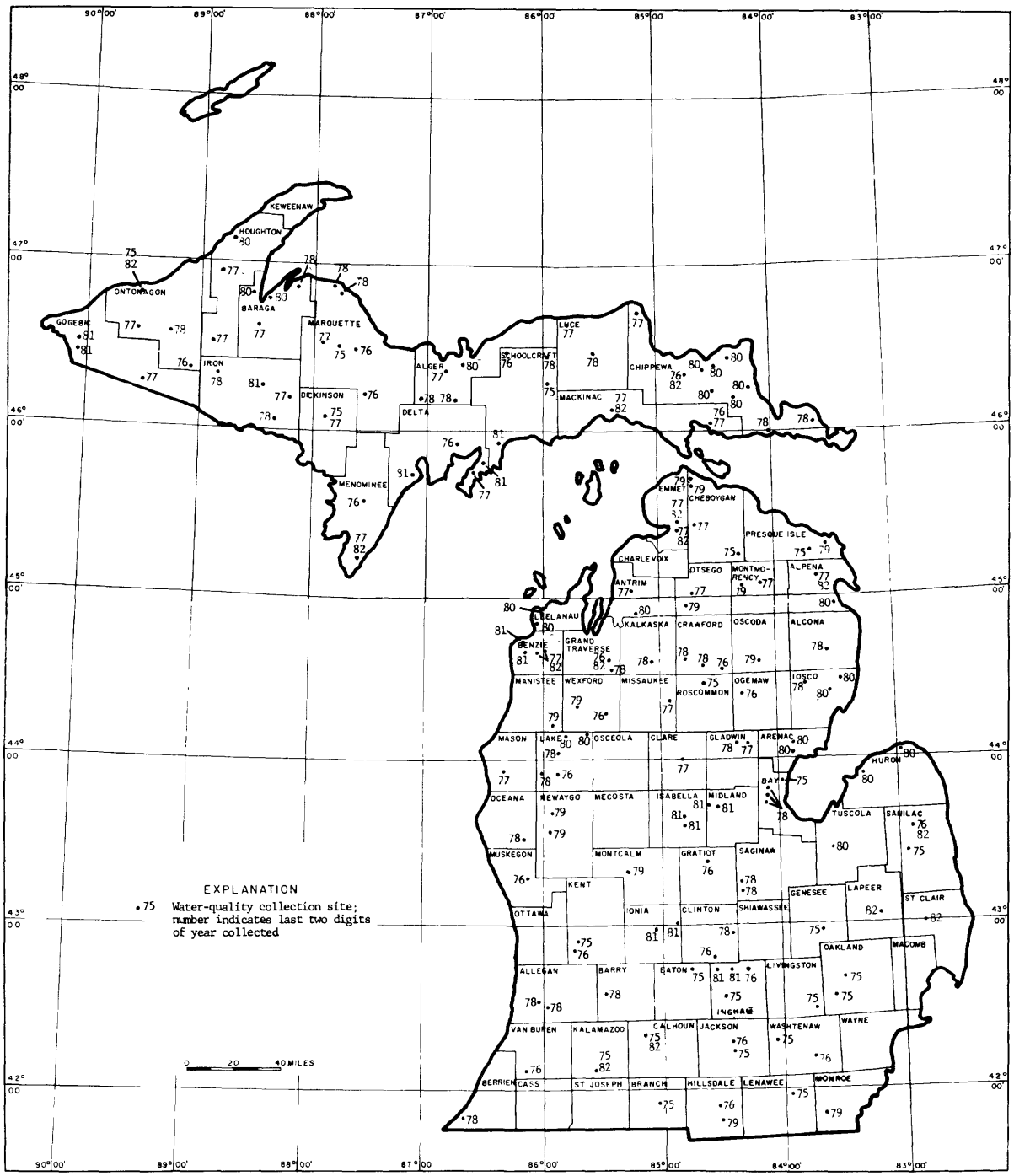
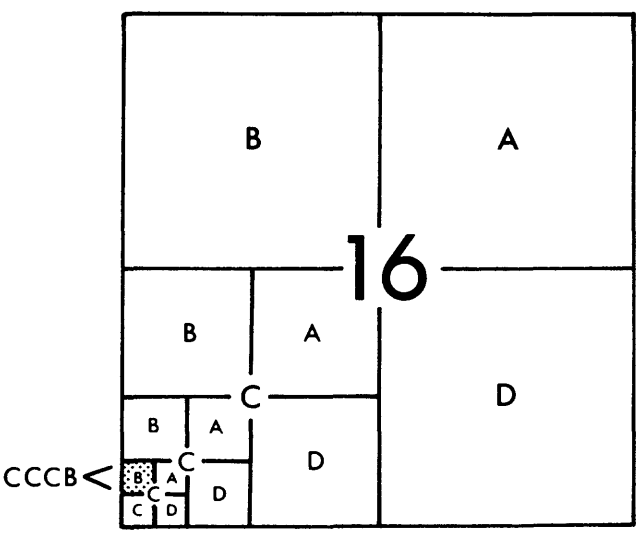


Figure 2.--Water-quality collection sites and year sample collected. (water-quality data are given in the annual ground-water report for year in which sample was collected except that data for the years 1975-76 are in the annual report for 1977. Analyses by U.S. Geological Survey.)

Well-numbering system

The well-numbering system for Michigan indicates the location of wells within the rectangular subdivision of the 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.

Acknowledgements

Acknowledgement 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 accomulation of data presented in this report would have not been possible.

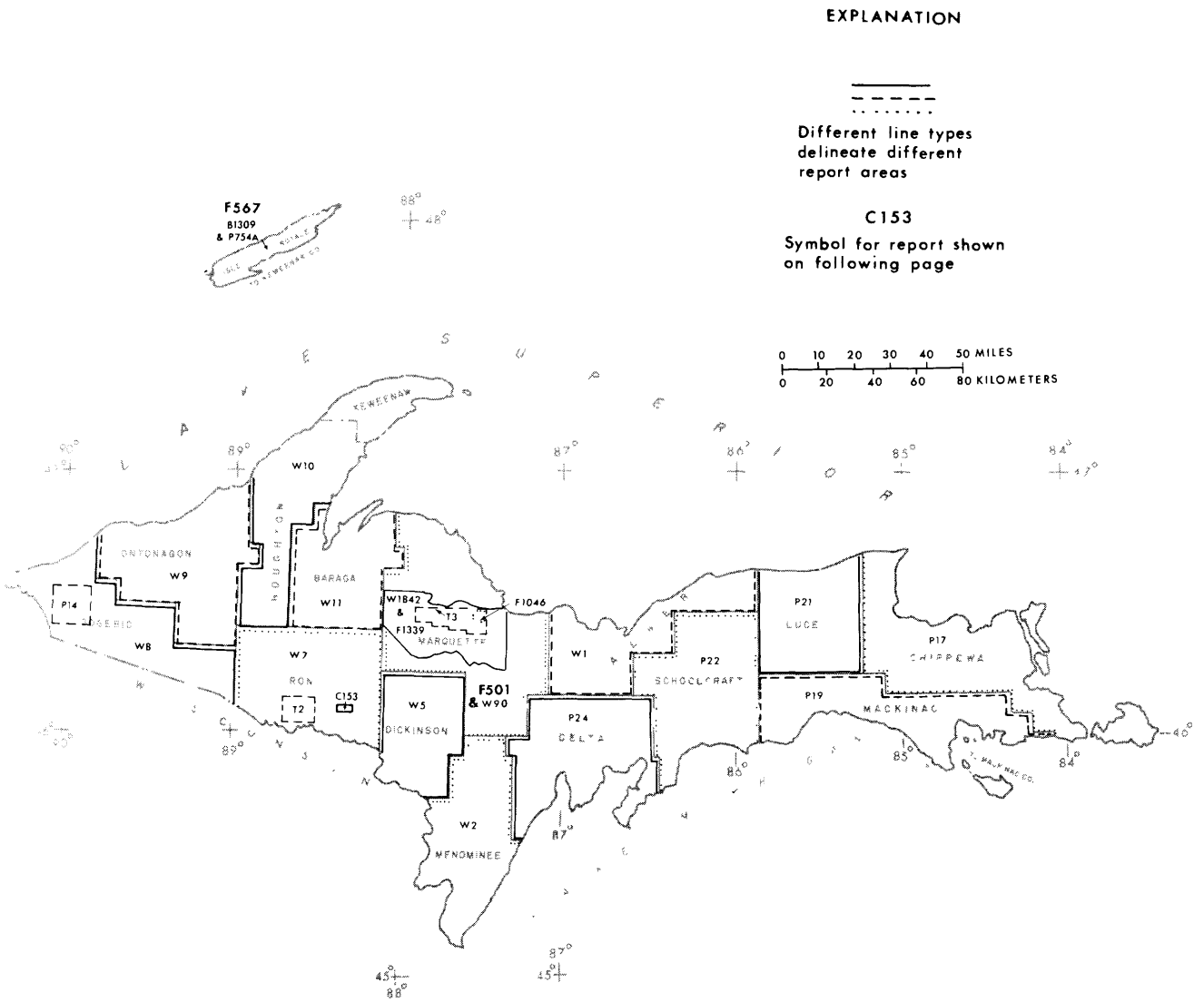


Figure 3.--Areas in the Upper Peninsula where ground-water conditions are described in published reports.

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 Van Alstine, 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 Byerlay, J. R., 1970, Ground water and geology of Keweenaw Peninsula, Michigan: Michigan Geological Survey Water Investigation 10.

W11 -- Doonan, C. J., and Byerlay, 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.

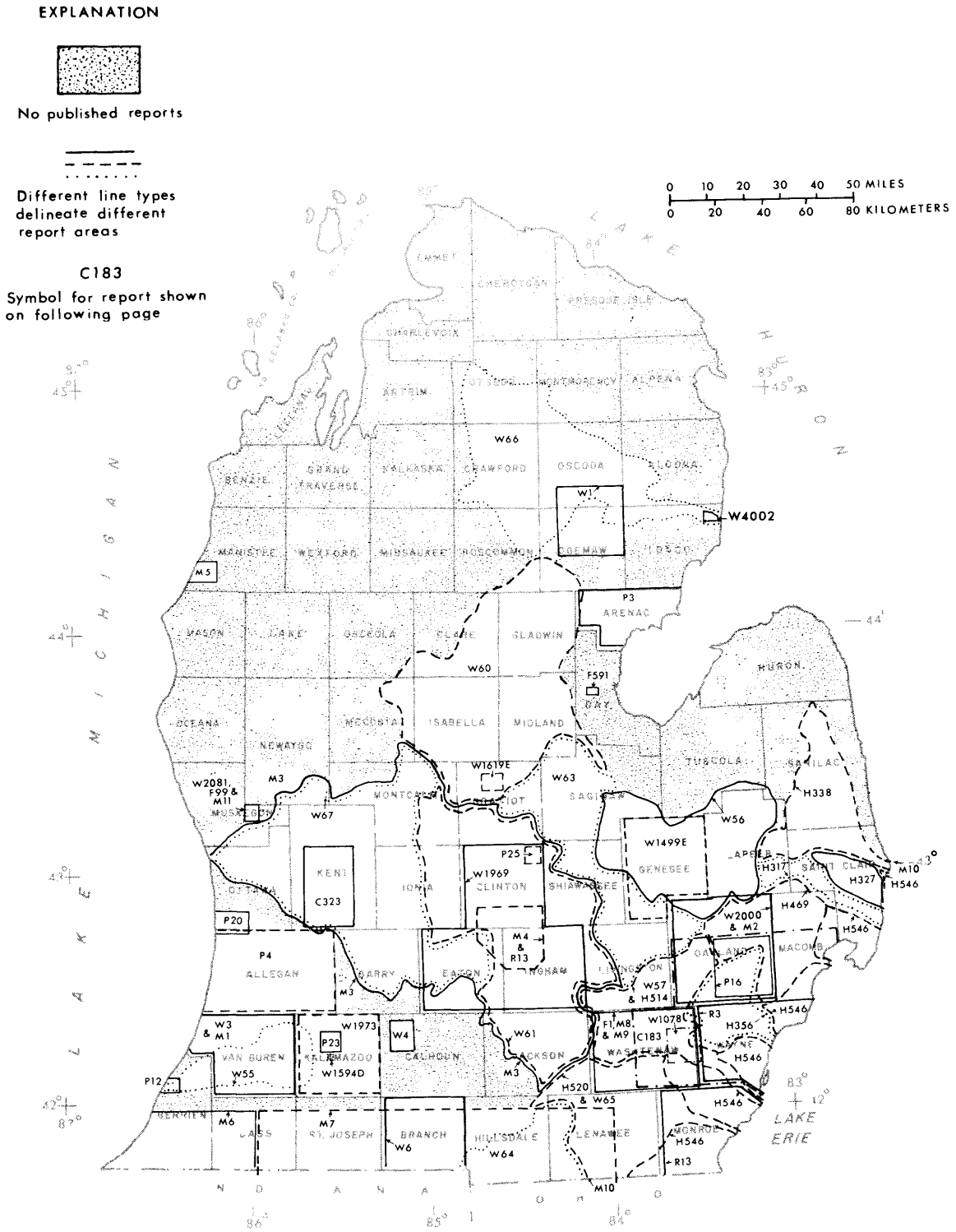


Figure 4.--Areas in the Lower Peninsula where ground-water conditions are described in published reports.

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., 1974, 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.

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.

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 Water 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 Otten, 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 Investigation Report 83-4002.

GROUND-WATER LEVELS

Water levels, measured in 115 observation wells throughout the State (fig. 1 and table 1) in 1983, generally follow precipitation trends. Above-average levels usually occur in areas where precipitation has been above normal and below-average levels in areas where precipitatin has been below normal. 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.

Hydrographs of water levels in wells (fig. 5) show that levels are highest in the spring. At this time, snowmelt and rain normally result in large additions to ground-water reservoirs. However, ice cover or frost in the ground can impede infiltration. Under these conditions, most water from snowmelt and precipitation runs off rapidly, and little goes to recharge the ground-water reservoirs. Recharge is small during the growing season, as most rainfall is evaporated, transpired by vegetation, or runs off overland after heavy showers. In the fall, evapotranspiration is reduced by cold weather. At this time, heavy rains may cause water levels to rise. Frozen ground impedes infiltration of water during winter.

In addition to changes in water levels from precipitation, temporary changes in levels may be caused by earth tides and variation in barometric pressure. Evapotranspiration causes small dialy declines in water levels in some wells. Pumping withdrawals can have a major effect on water levels. If withdrawals are greater than recharge, declining levels will occur. Uniform pumping rates throughout the year may allow levels to follow precipitation trends.

GROUND-WATER-USE DATA

Descriptions of some Michigan ground-water supplies follow alphabetically, by counties. Yield of wells and pumpage data are given as reported by water departments and consultants. Illustrations show water-level trends.

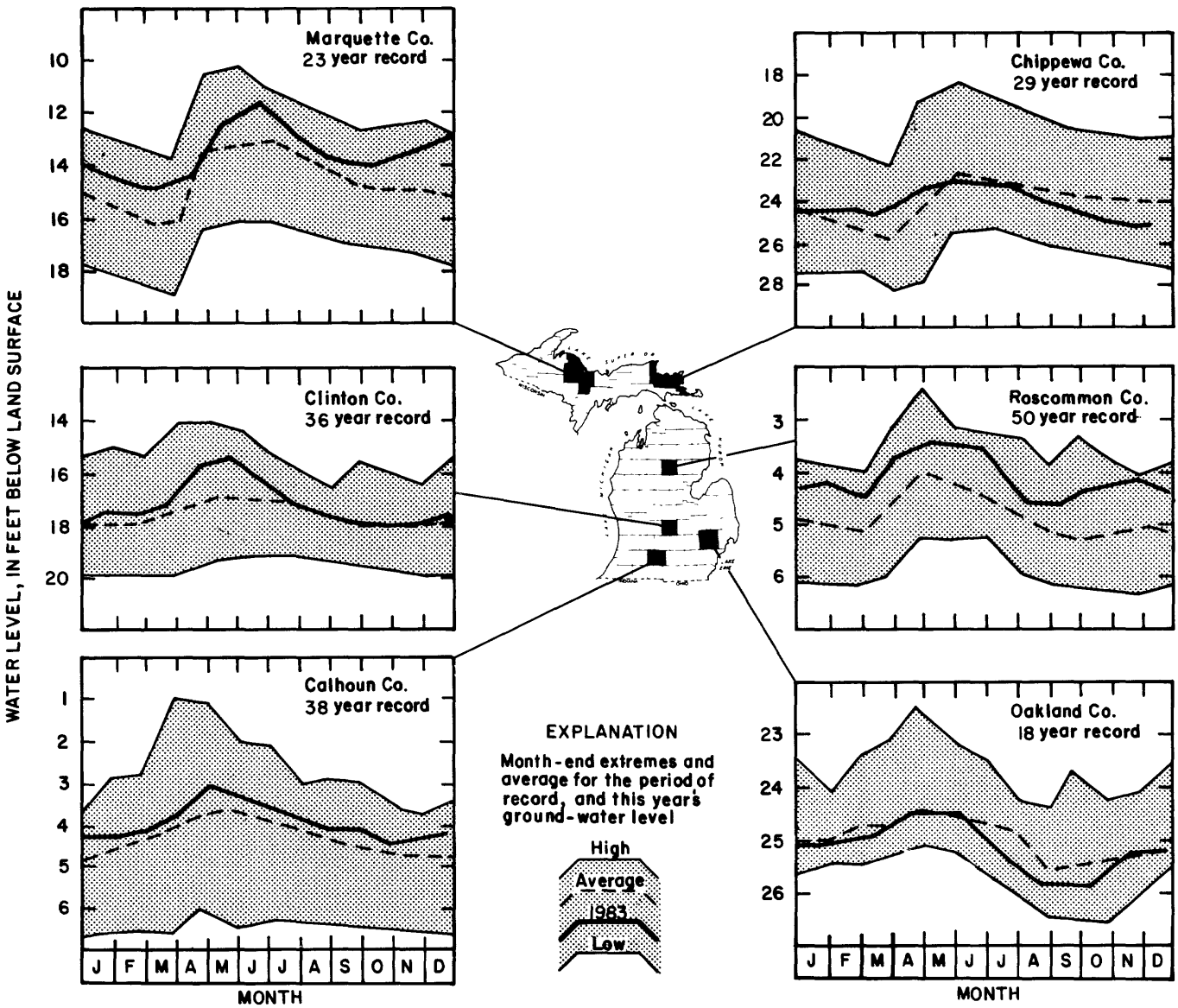
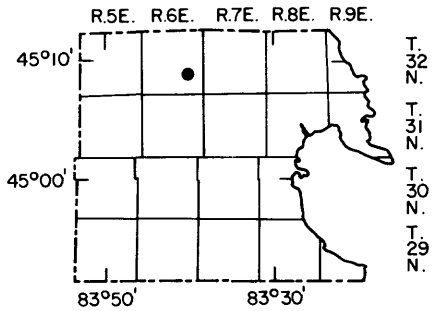
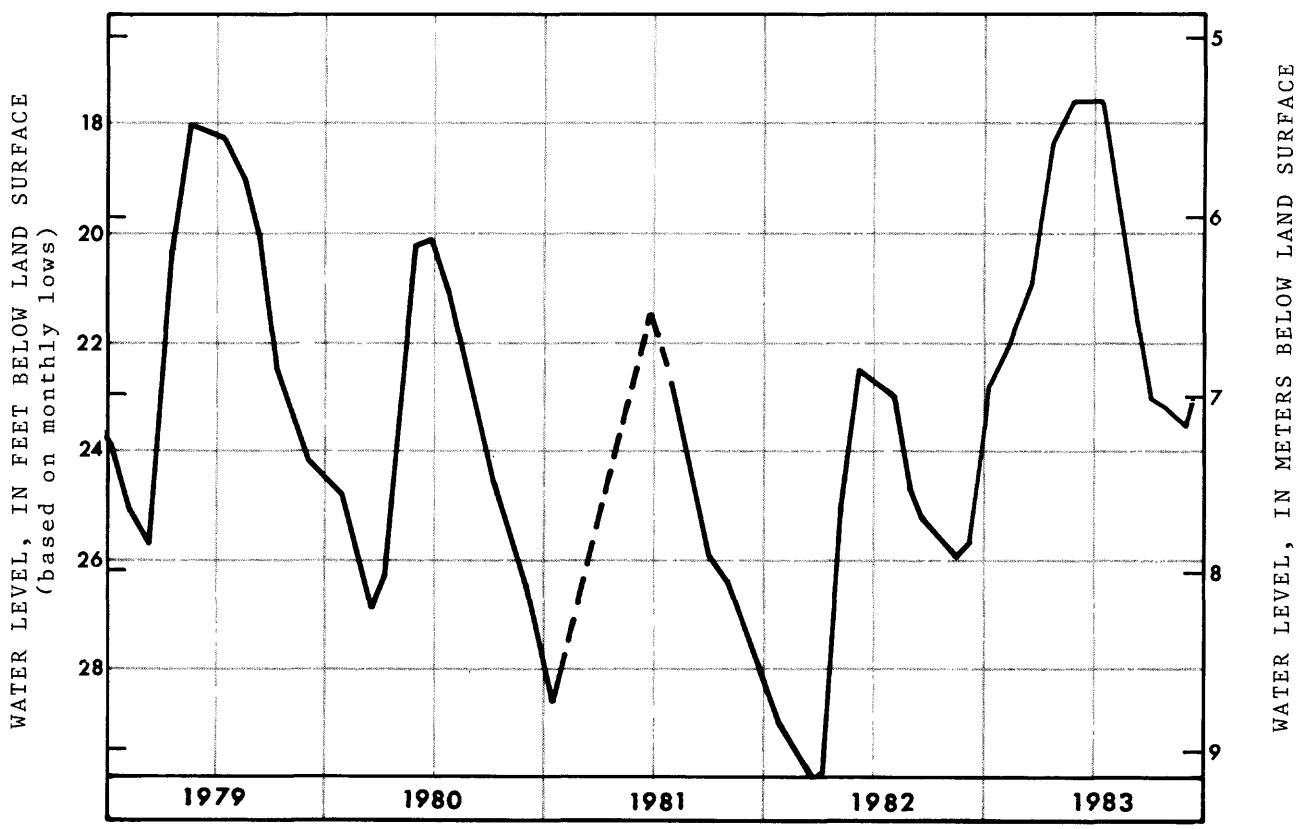


Figure 5.--Water levels in selected wells.





Geological Survey well 32N 6E 23DDDA1 is 88 feet deep and in sand. Water-quality data in ground-water report for 1977 (Huffman, 1979).

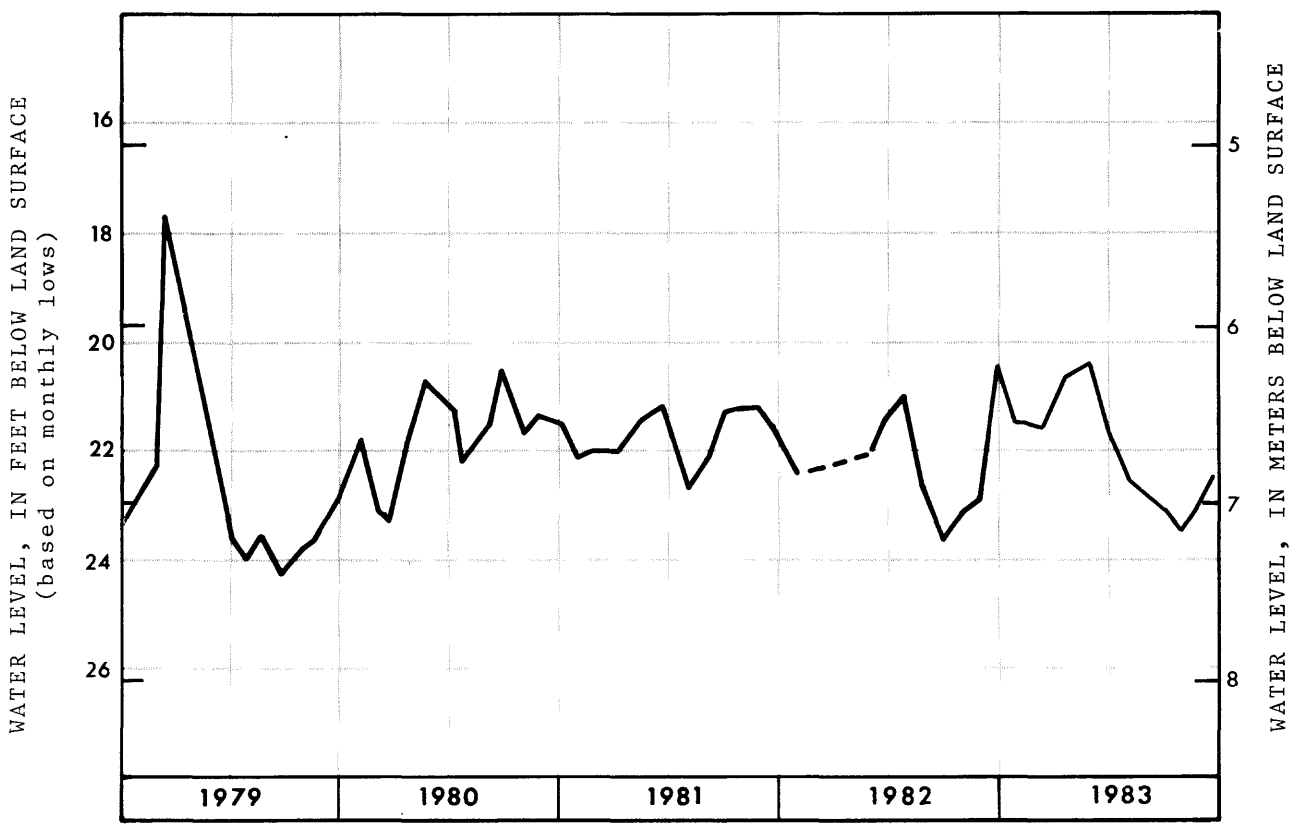
BRANCH COUNTY - CITY OF COLDWATER

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.

1983 - 1,308
1982 - 1,123
1981 - 1,122
1980 - 1,169
1979 - 1,209



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

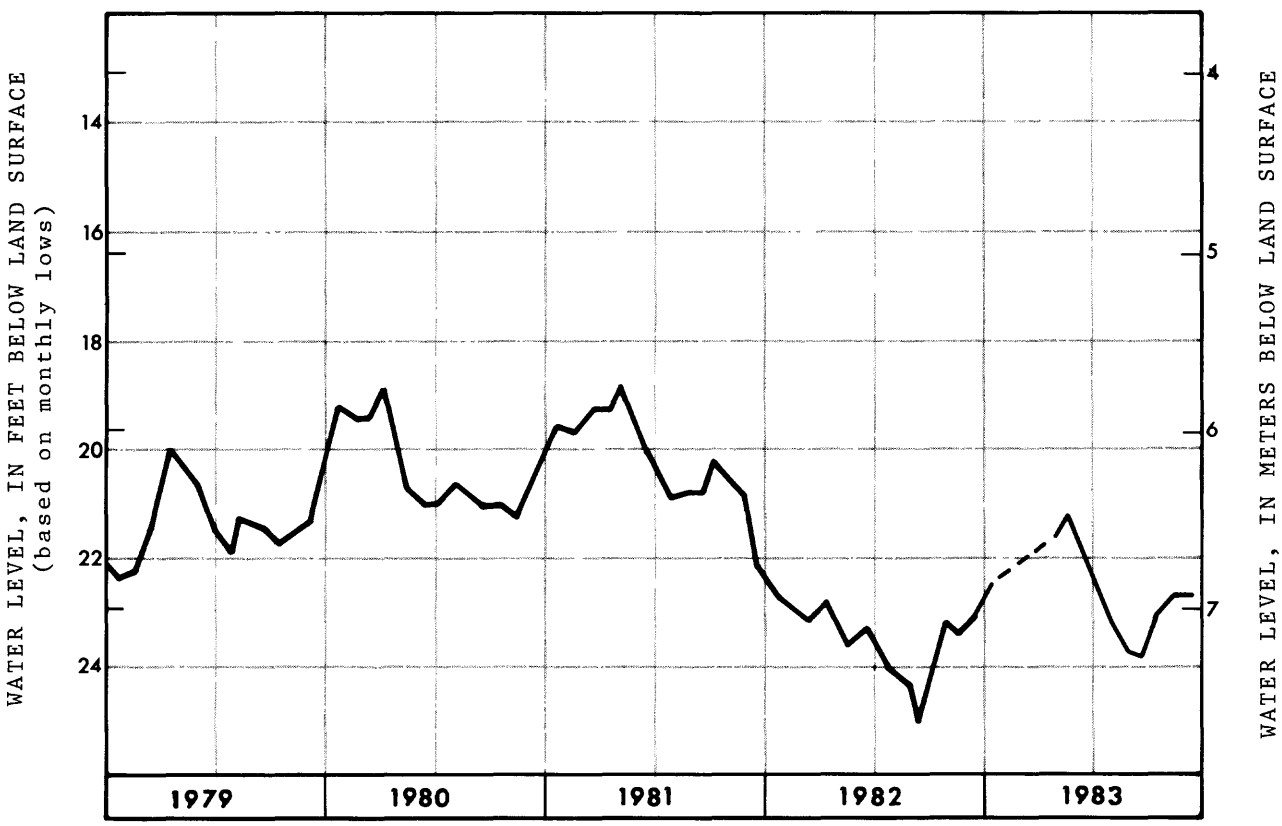
CALHOUN COUNTY - CITY OF BATTLE CREEK

SUPPLY AND SOURCE -- 29 wells, 110 to 152 feet deep, tap sandstones of Marshall Formation. All are located at the Verona Field.

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.

1983 - 3,495
1982 - 3,590
1981 - 2,742
1980 - 2,836
1979 - 2,875



Water levels in well 1S 7W 32BDCC1 at Battle Creek. Well is 95 feet deep and in Marshall Formation.

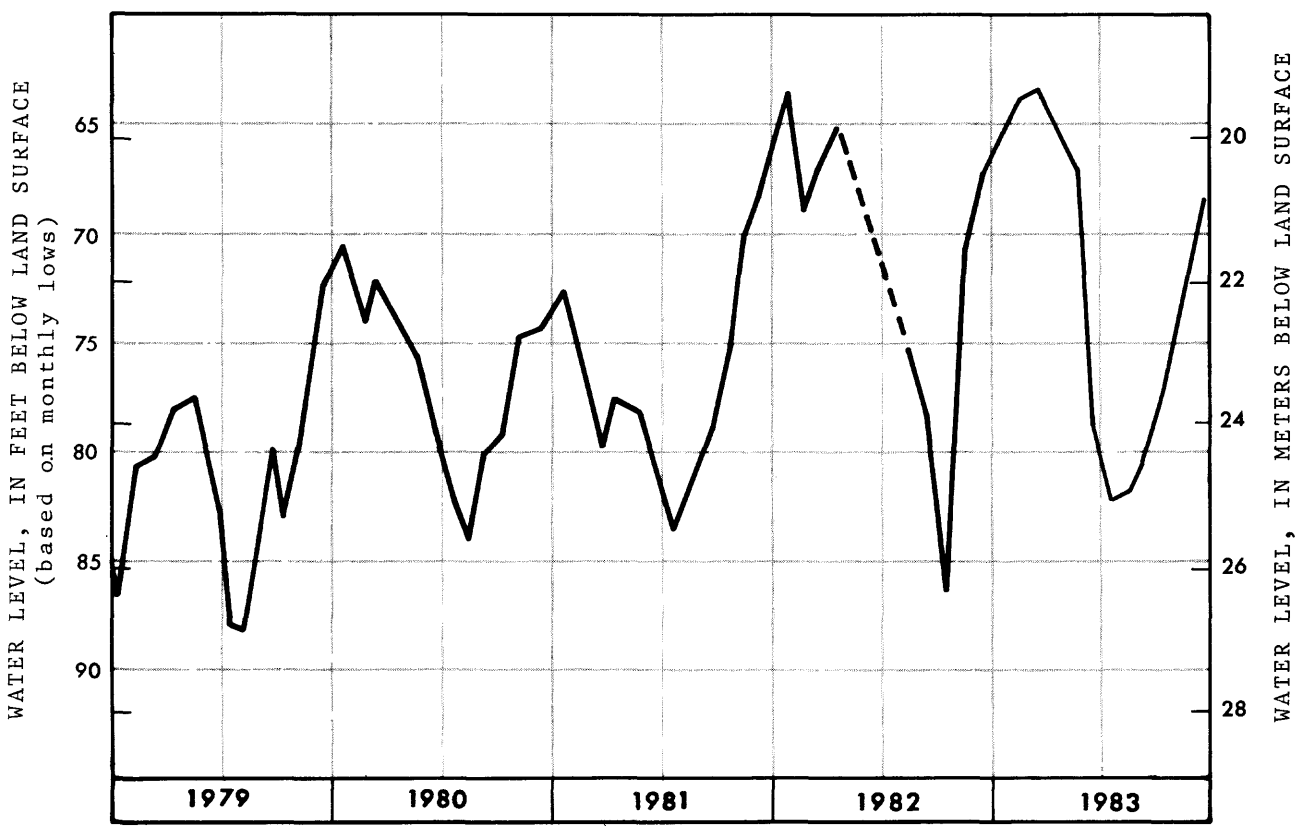
CLINTON COUNTY - CITY OF ST. JOHNS

SUPPLY AND SOURCE -- 7 wells, 420 to 525 feet deep, tap sandstones of Saginaw Formation.

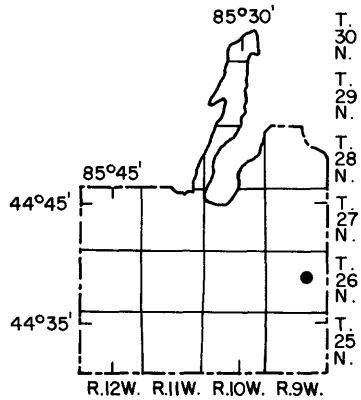
YIELD OF WELLS -- 250 to 500 gal/min; specific capacity -- 3 to 12 gal/min/ft of drawdown.

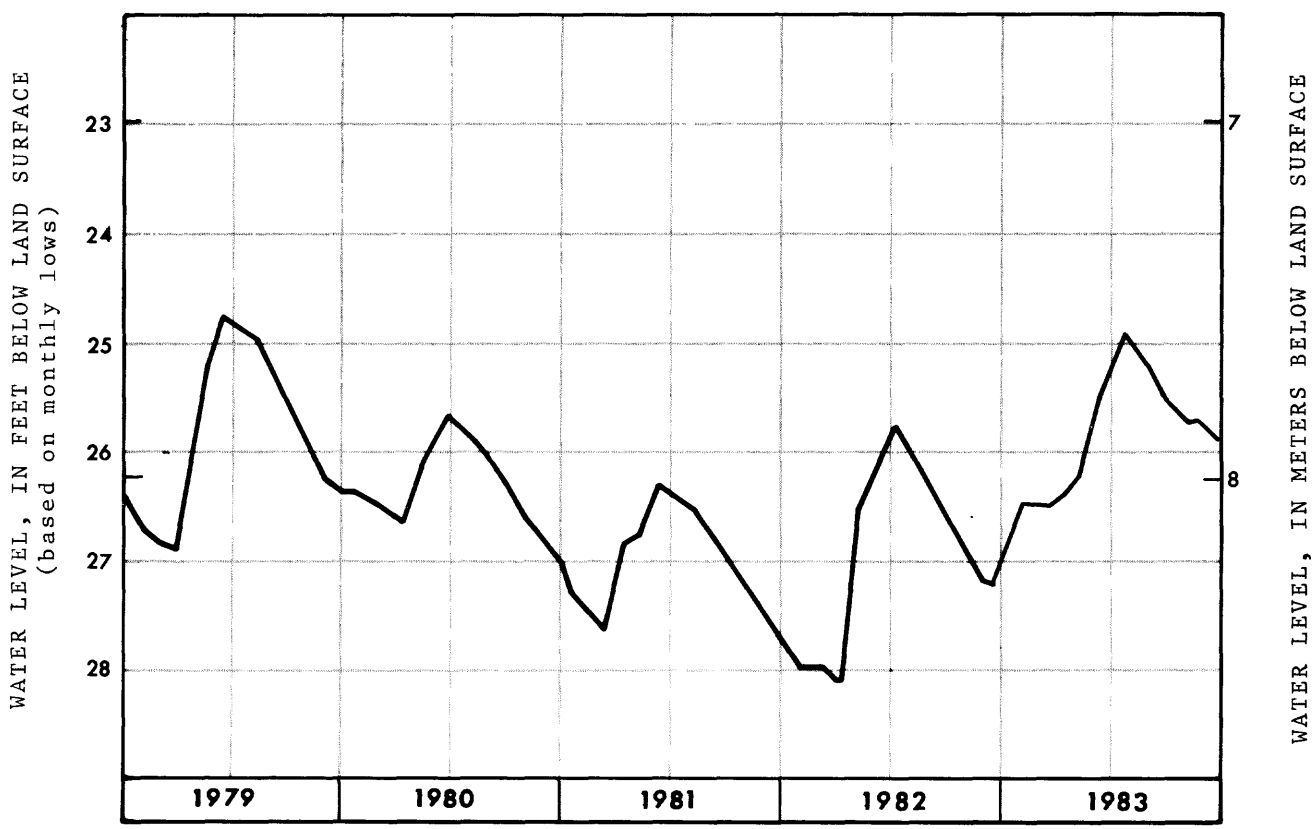
PUMPAGE -- Total annual pumpage, in million gallons, for past 5 years.

1983 - 412
1982 - 414
1981 - 425
1980 - 423
1979 - 511

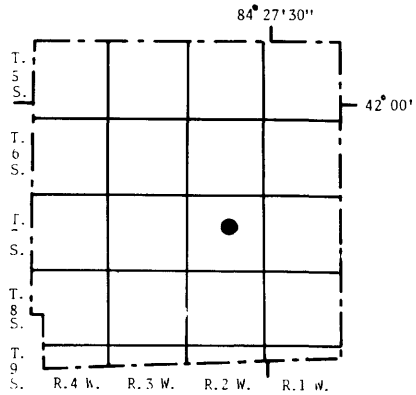


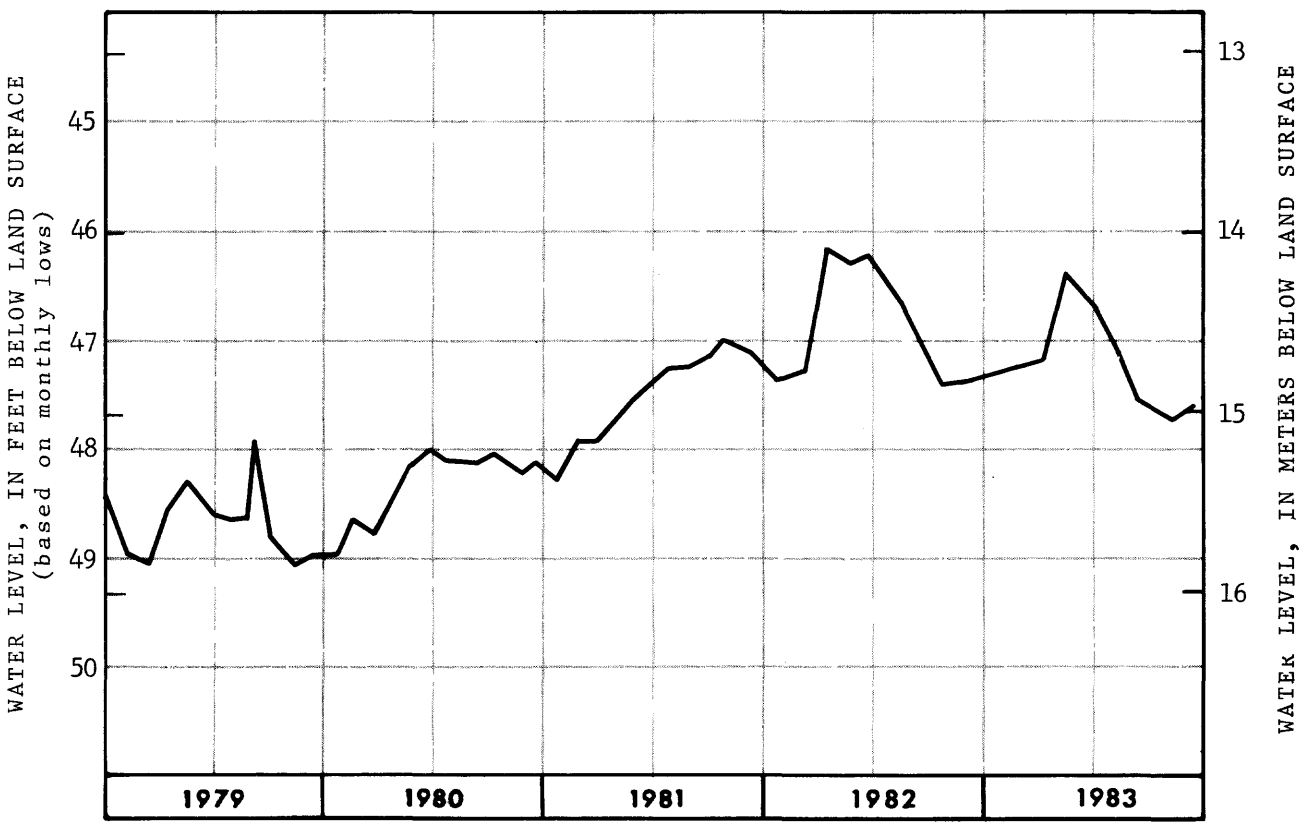
Water levels in well 7N 2W 9BB at St. Johns. Well is 535 feet deep and in Saginaw Formation.





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





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

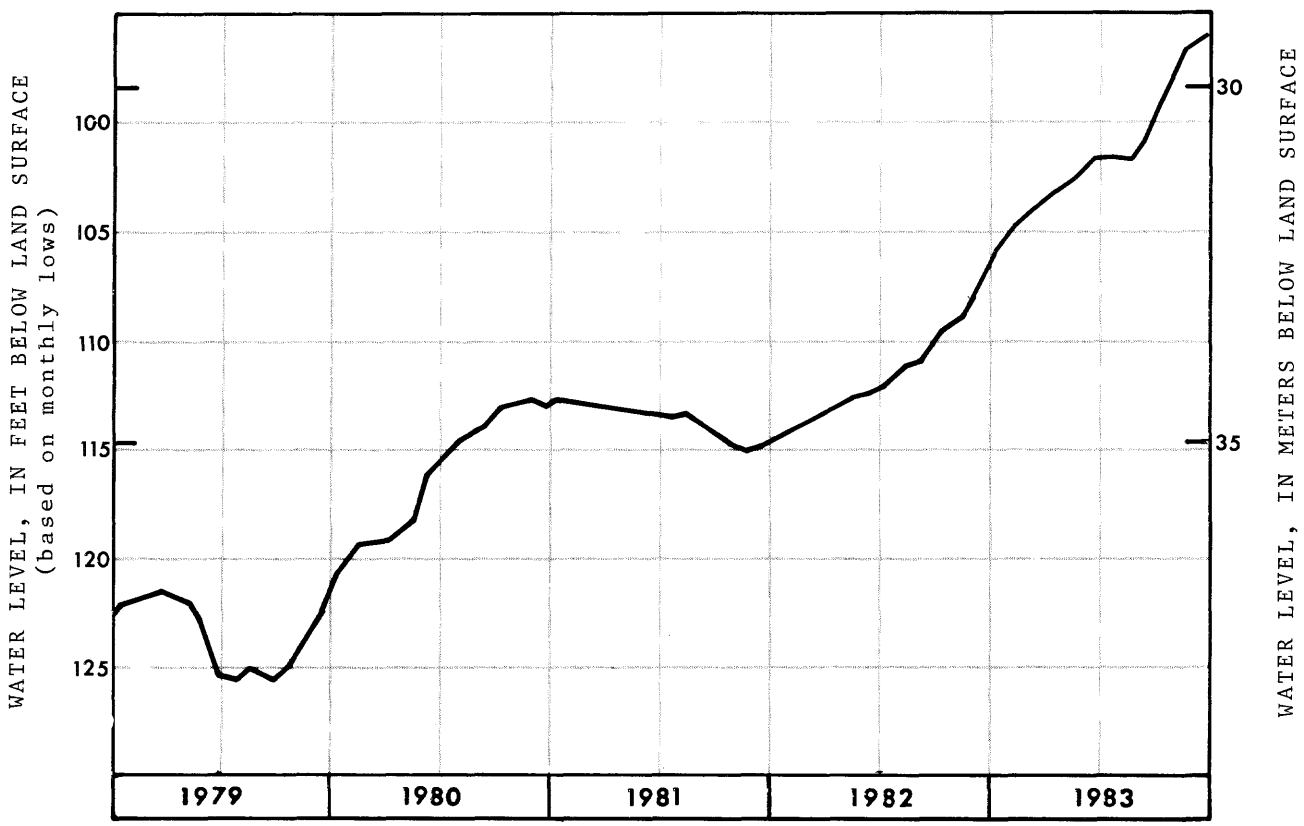
INGHAM COUNTY - CITY OF LANSING

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.

1983 - 8,105
1982 - 8,182
1981 - 8,607
1980 - 8,592
1979 - 9,574



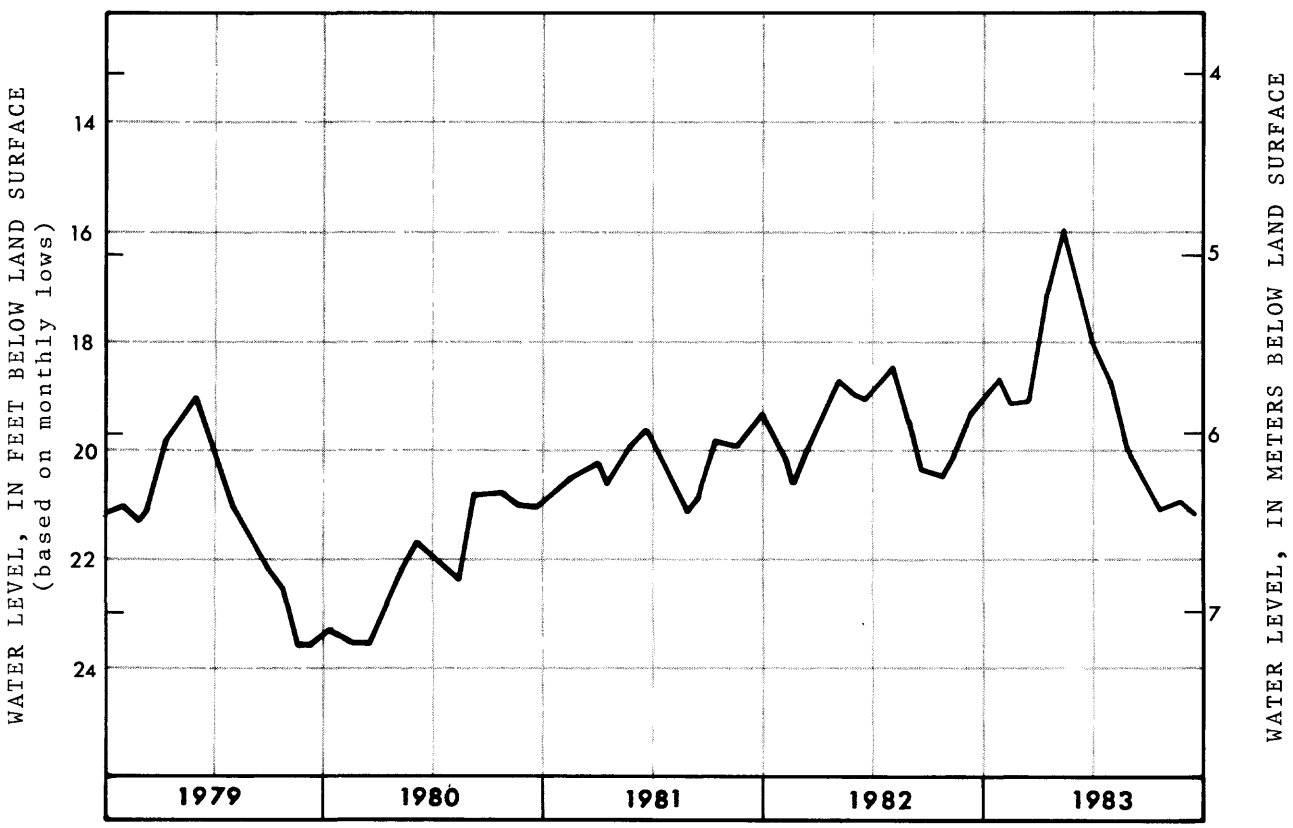
Water levels in well 4N 2W 17AB at Lansing. Well is 424 feet deep and in Saginaw Formation.

SUPPLY AND SOURCE -- 1 well, about 50 feet deep, taps glacial deposits; 1 well, 223 feet deep, taps 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.

1983 - 232
1982 - 228
1981 - 233
1980 - 217
1979 - 230



Water levels in well 2N 1W 5BCAB1 at Mason. Well is 210 feet deep and in Saginaw Formation.

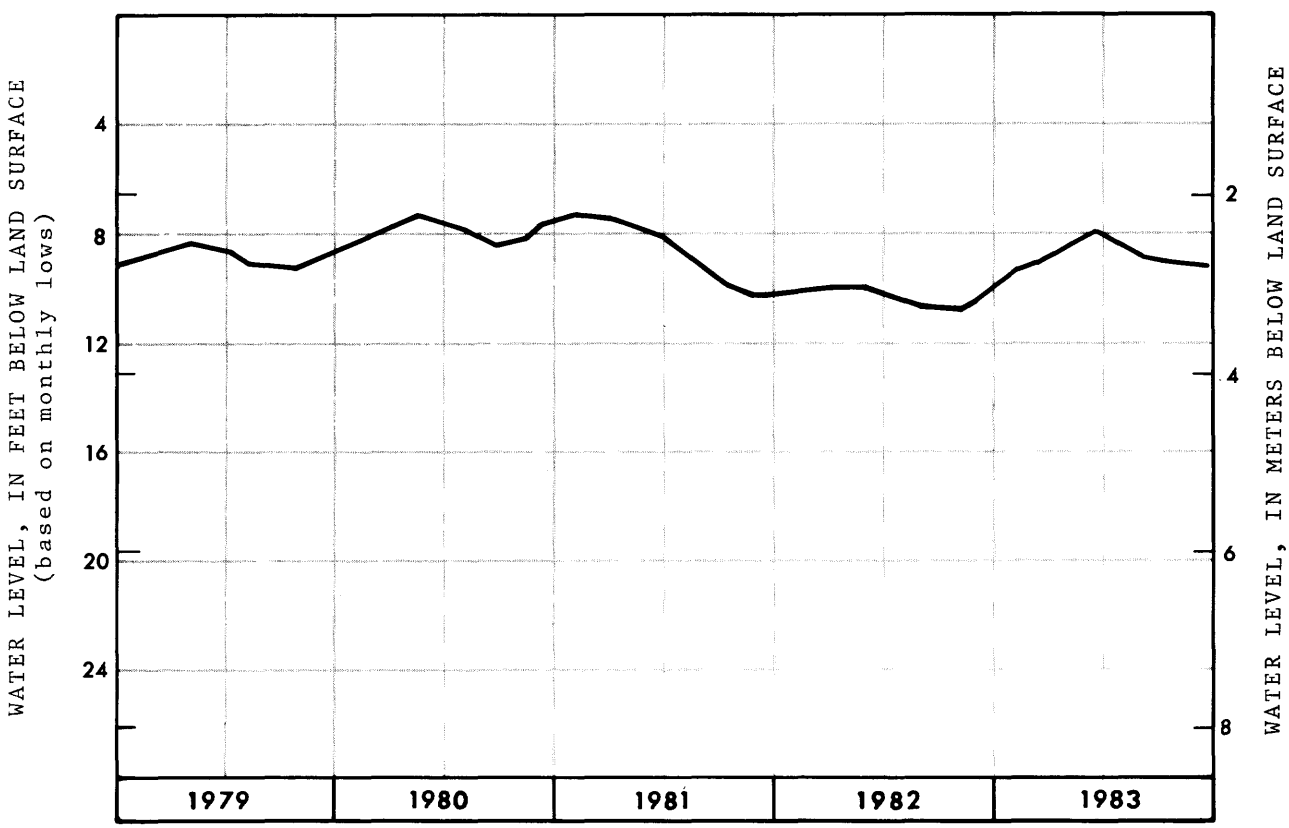
KALAMAZOO COUNTY - CITY OF KALAMAZOO

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

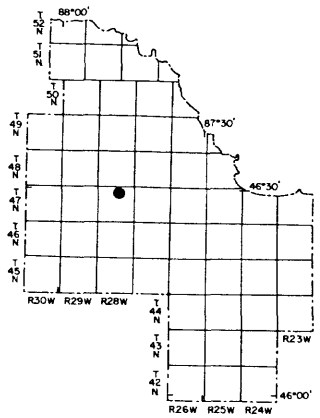
YIELD OF WELLS -- 200 to 2,000 gal/min; specific capacity -- 7 to 100 gal/min/ft of drawdown.

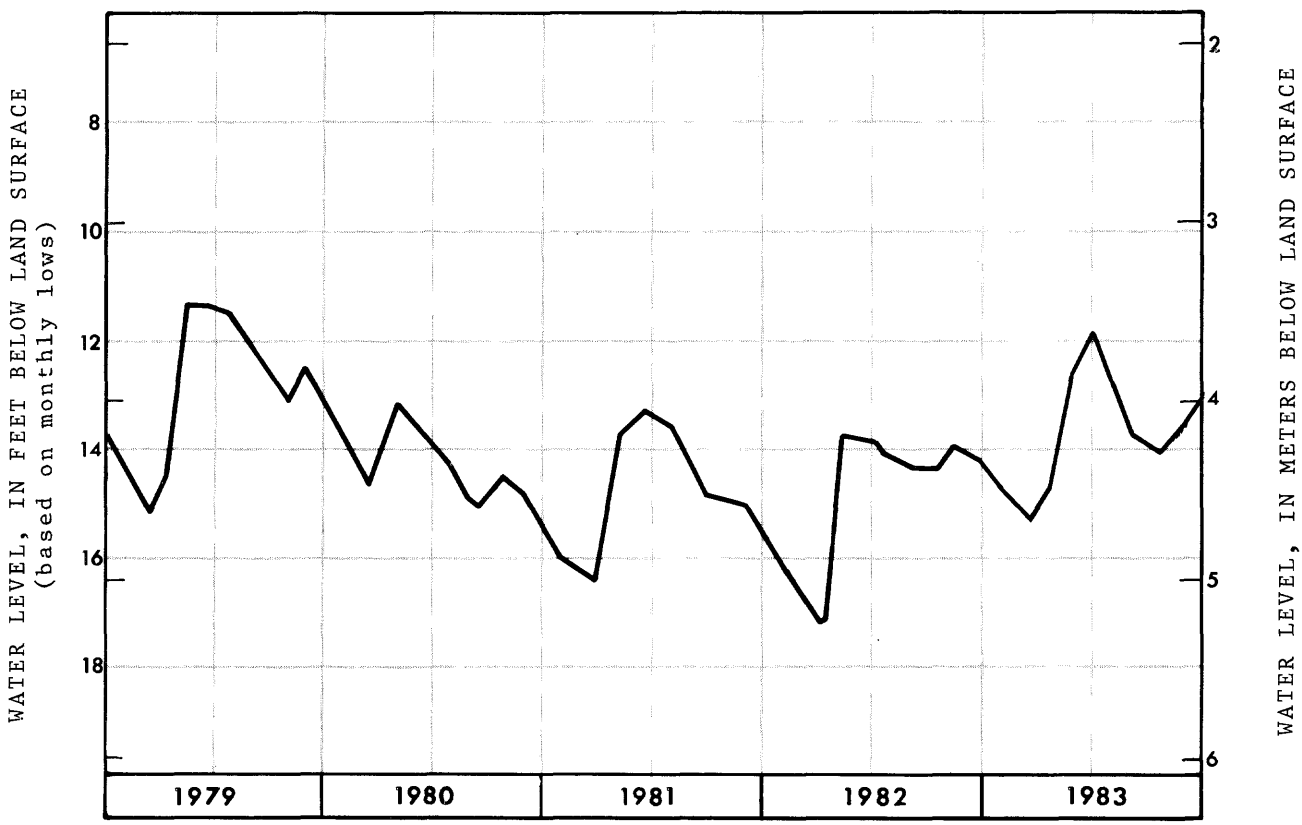
PUMPAGE -- Total annual pumpage, in million gallons, for past 5 years.

1983 - 7,204
1982 - 5,772
1981 - 6,393
1980 - 5,774
1979 - 6,520

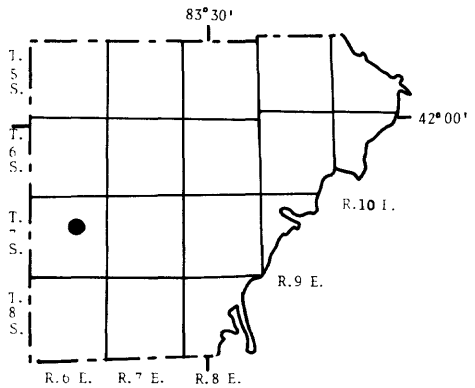


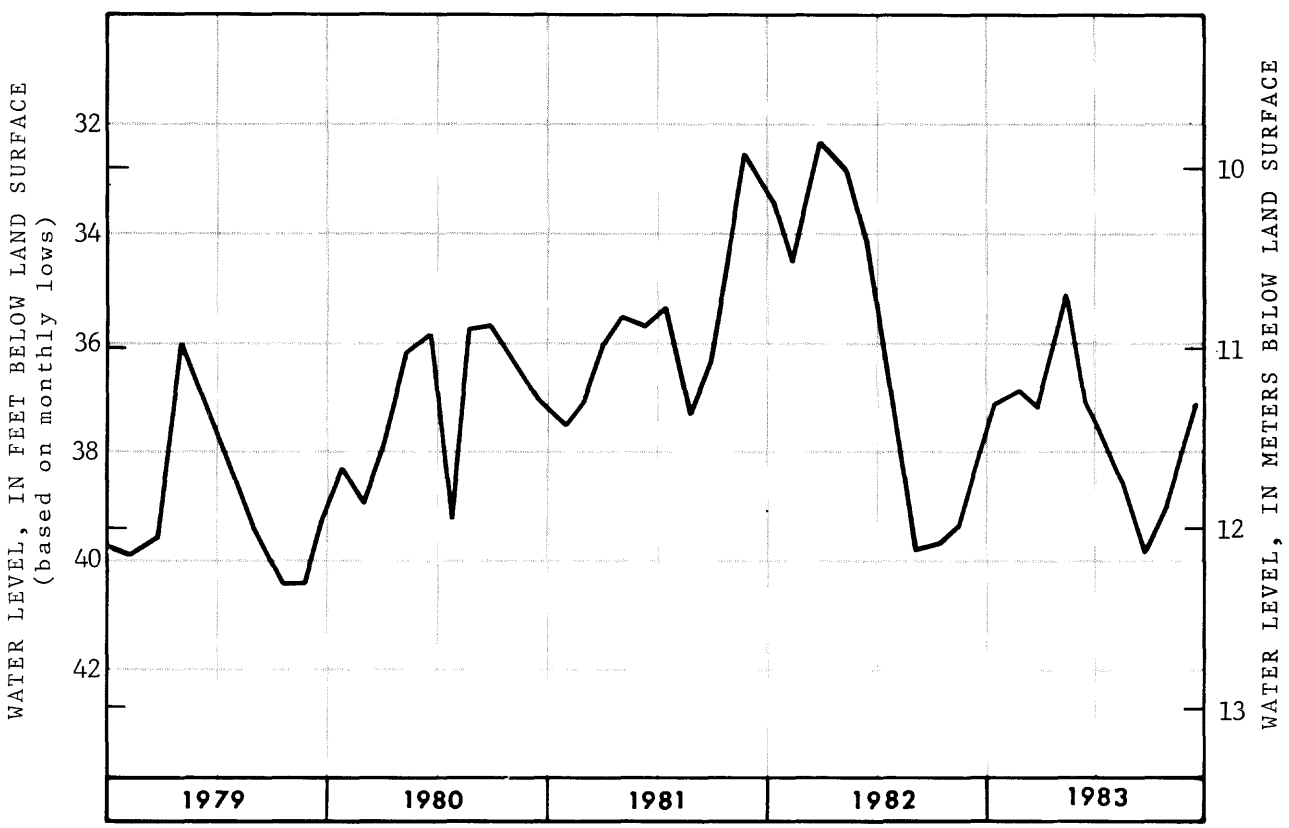
Water levels in well 2S 11W 22CD at Kalamazoo. Well is 137 feet deep and in outwash.



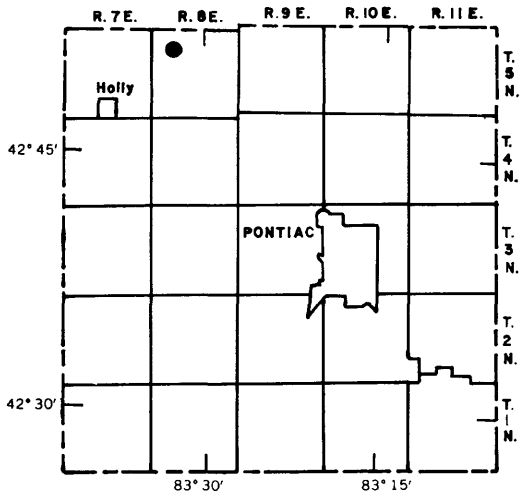


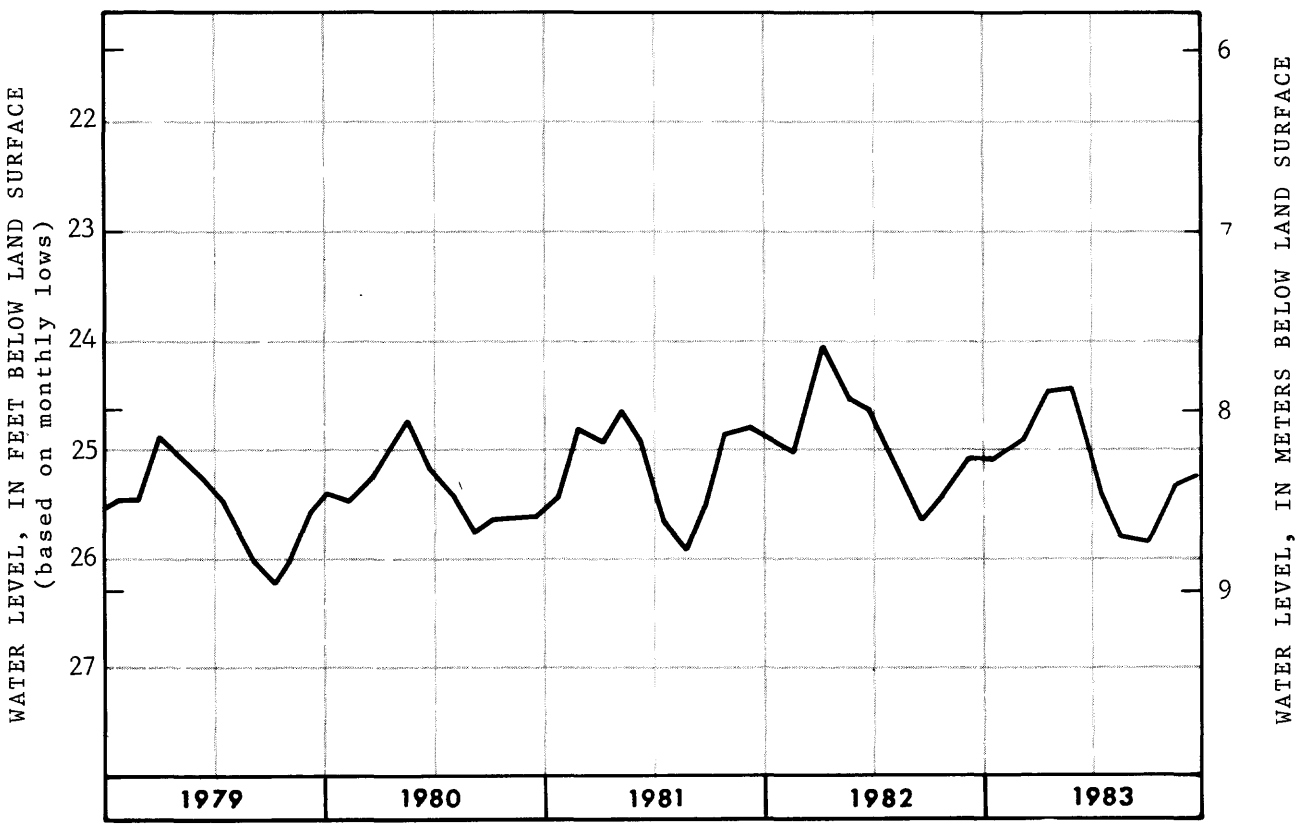
Water levels in well 47N 28W 3CCDC1. Well is 75 feet deep and in outwash. Levels are typical of observation wells in Marquette Iron Range.



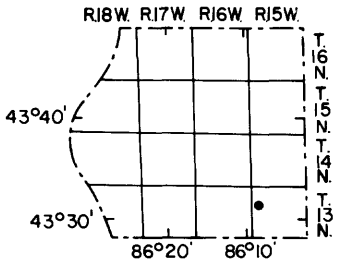


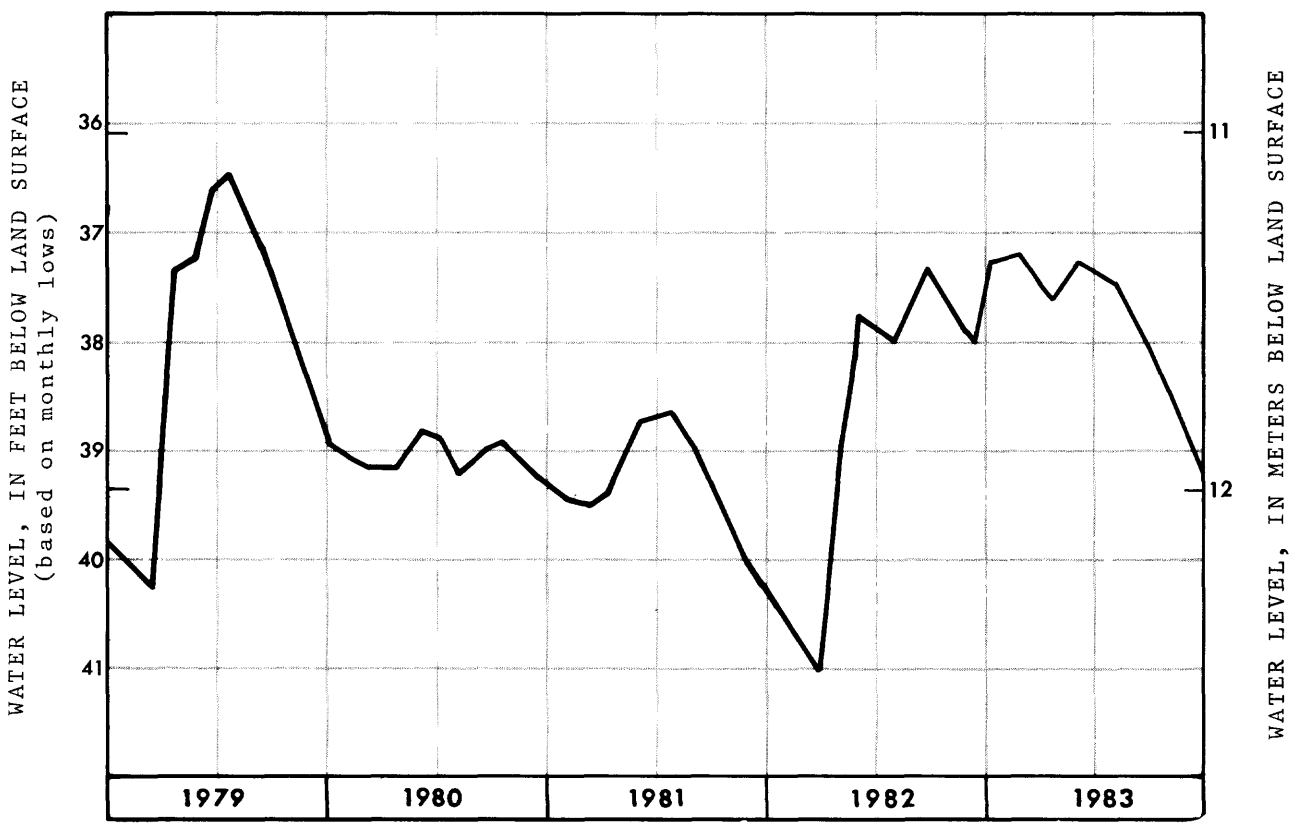
Water levels in well 7S 6E 15ACAA1. Well is 73 feet deep and in the Detroit River Group. Water-quality data in ground-water report for 1979 (Huffman, 1980).



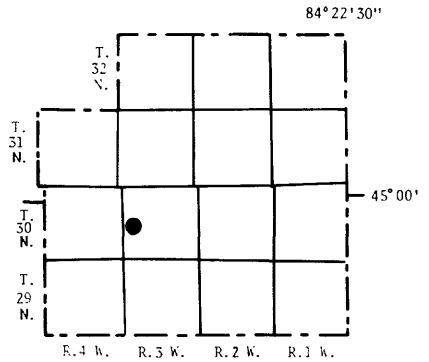


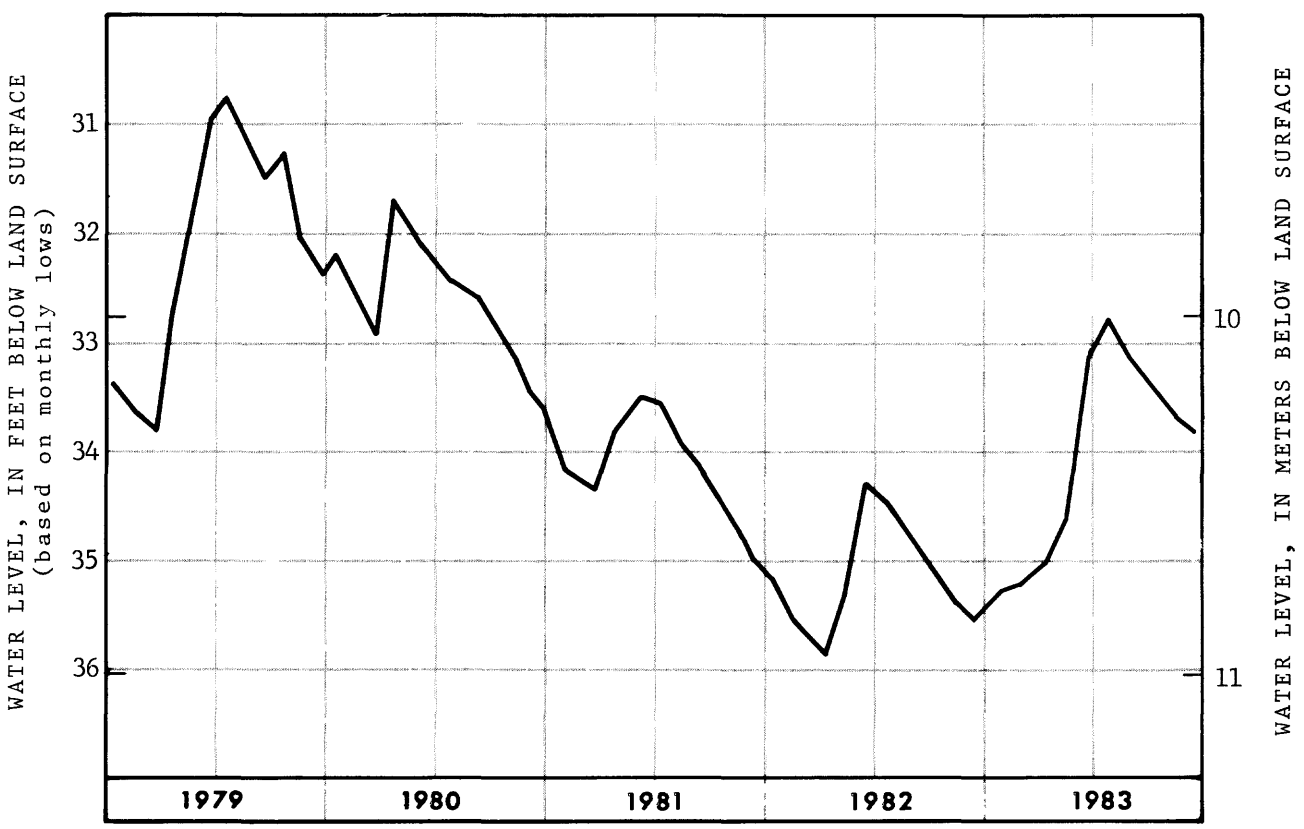
Water levels in well 5N 8E 8ACAC1. Well is 42 feet deep and in glacial deposits.



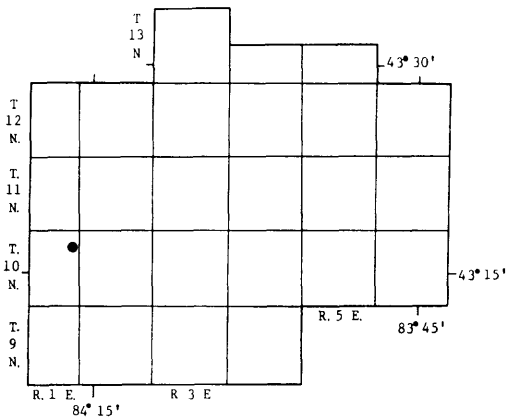


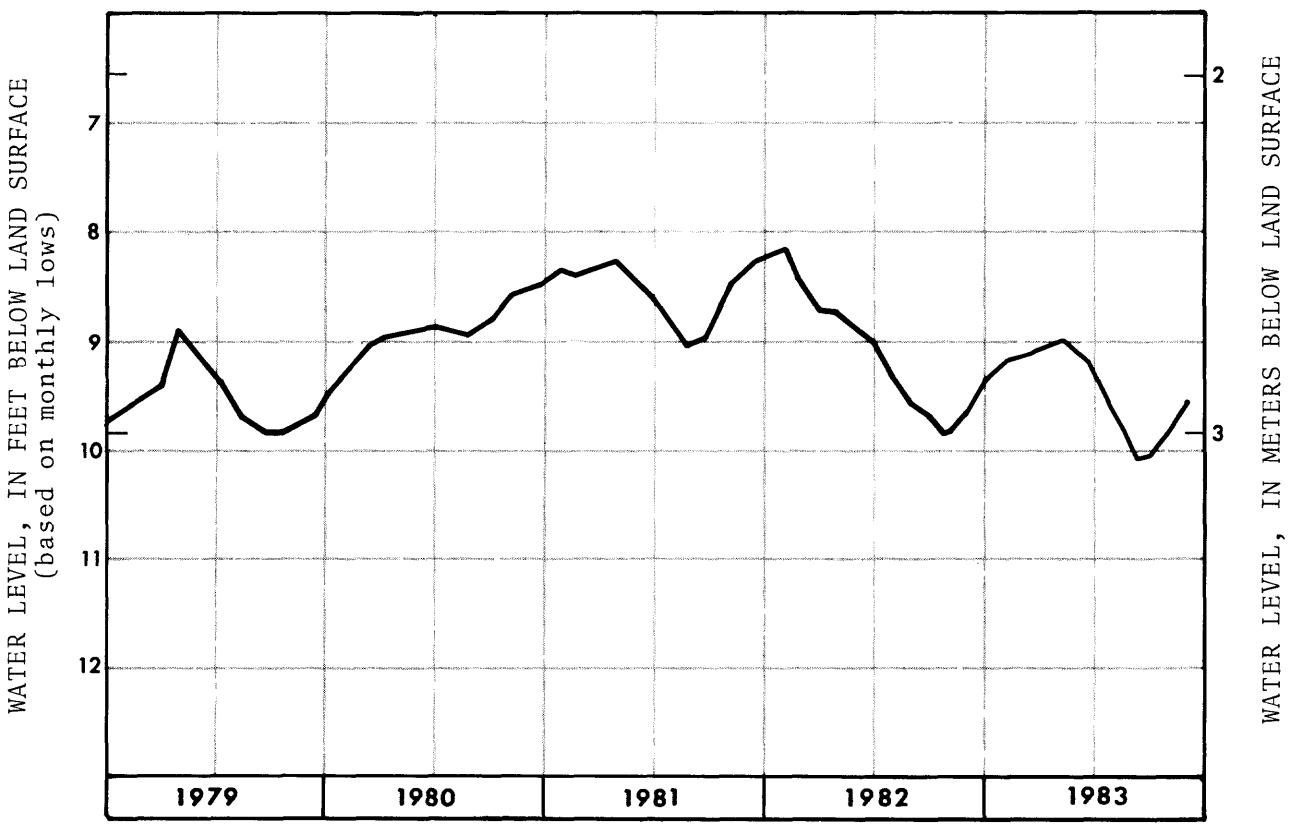
Geological Survey well 13N 15W 18AAAA1. Well is 79 feet deep and in outwash. Water-quality data in ground-water report for 1977 (Huffman, 1979).



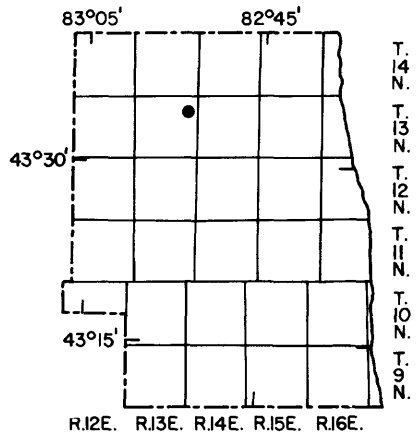


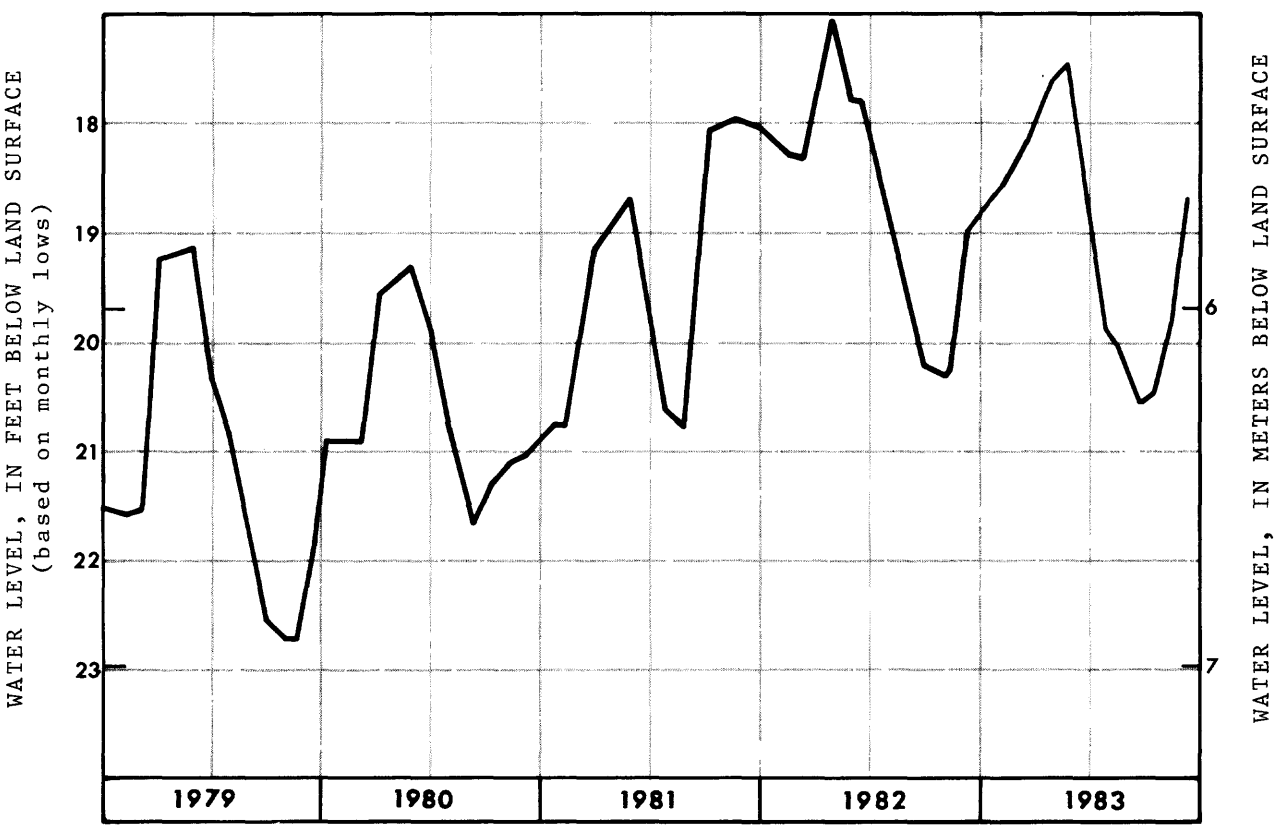
Water levels in well 30N 3W 19ABBB1. Well is 90 feet deep and in glacial outwash. Water-quality data in ground-water report for 1979 (Huffman, 1980).





Water levels in well 10N 1E 12ADAA1. Well is 210 feet deep and in Saginaw Formation. Water-quality data in ground-water report for 1977 (Huffman, 1979).





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

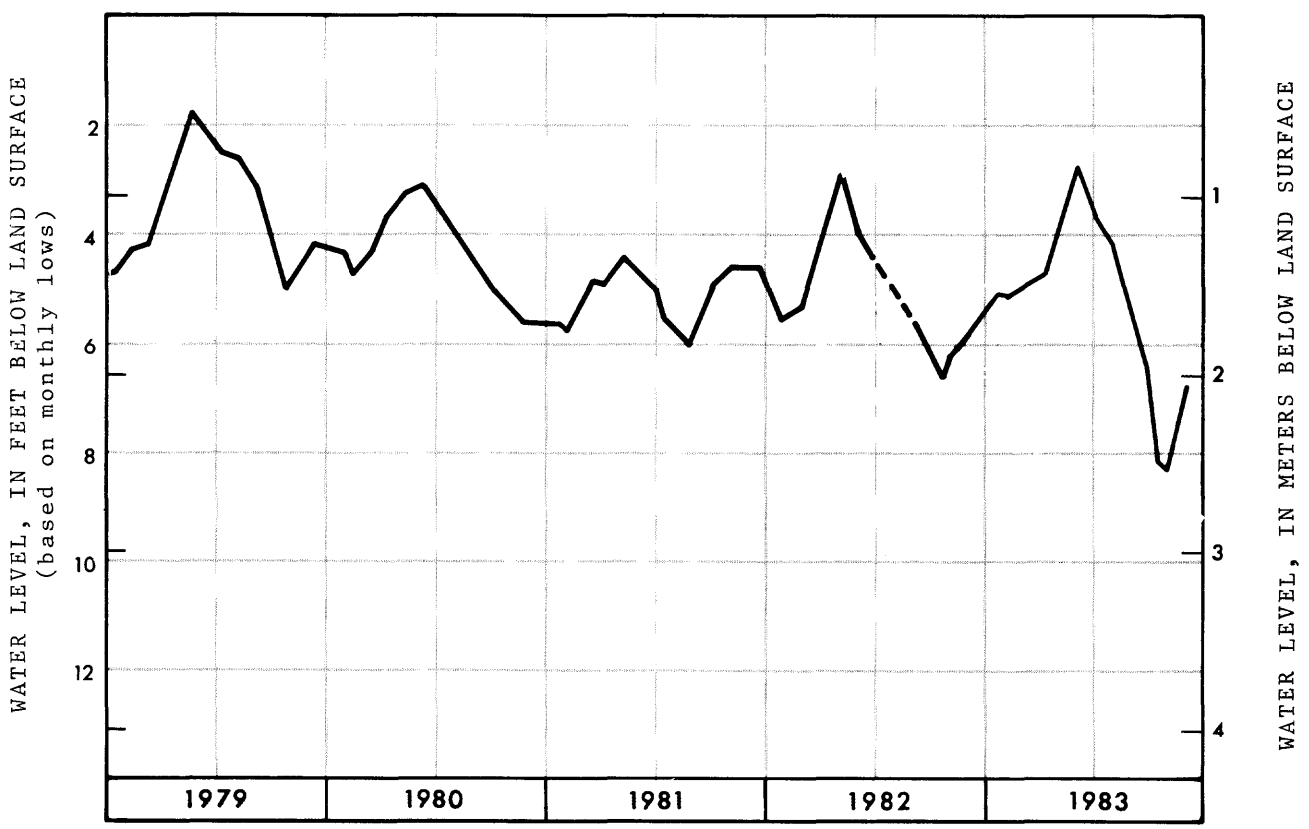
WASHTENAW COUNTY - CITY OF ANN ARBOR

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).

1983 - 810
1982 - 720
1981 - 787
1980 - 742
1979 - 372



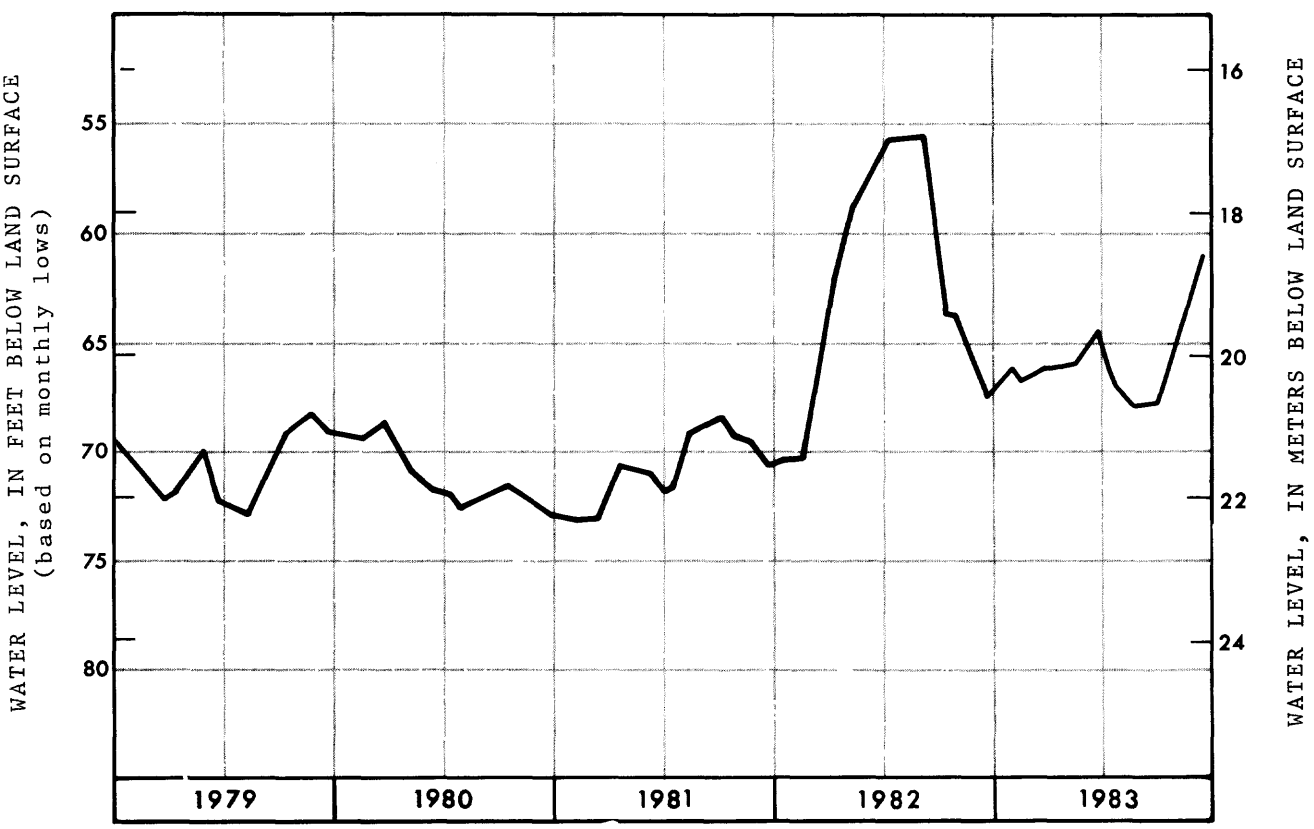
Water levels in well 3S 6E 16BCCD1 at Ann Arbor. Well is 55 feet deep and in glacial deposits.

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.

1983 - 1,112
1982 - 1,196
1981 - 1,385
1980 - 1,288
1979 - 1,140



Water levels in well 3S 7E 9AD at Ypsilanti. 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; WMP - Wisconsin-Michigan Power Company; MSHD - Michigan State Highway Department; USFS - U.S. Forest Service.

AQUIFER:	112GLCL	Glacial deposits	337MRSL	Marshall Formation	
	112GRVL	Gravel	341TRVR	Traverse Group	361OCVCU Ordovician, Upper
	112OTSH	Outwash	344DUND	Dundee Formation	365TBRV Trenton-Black River Group
	112SAND	Sand	348DRRV	Detroit River Group	368PRDC Prairie du Chien Group
	112SDGV	Sand and Gravel	355SLINH	Salina Formation	372MNSG Munising Sandstone
	324SGNW	Saginaw Formation	355MNSQ	Manistique Dolomite	420FRED Freda Sandstone

ALTITUDE: Land-surface datum in feet, National Geodetic Vertical Datum of 1929.
MEASUREMENTS, 1983 (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. 1983 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. 1983	OBSERVED WATER-LEVEL EXTREMES				REMARKS
								THROUGH 1982		IN 1983		
TWP, RANGE, SECT.								MAXIMUM	MINIMUM	MAXIMUM	MINIMUM	
ALGER												
45N 19W 25BDCD1	CCC	66	6	112GLCL	850	25	Q	6.4 Jun 1960	14.2 Apr 1964	9.9 May	10.9 Sep	
ALPENA												
32N 6E 23DDDA1	Alpena State Forest	88	6	112SAND	713	7	R	15.8 May 1979	30.0 Mar 1982	13.6 May	23.3 Nov	
ARENAC												
19N 5E 7DABA1	Omer, D	185	6	324SGNW	667	4	M	8.3 Jul 1980	10.1 Aug 1980	9.0 May	10.9 Jan	
7DABA2	Omer, S	21	6	112GLCL	667	4	M	2.9 Jun 1982	6.9 Aug 1980	2.3 May	4.9 Nov	
BARAGA												
48N 32W 12DD	WMP 14	10	1	112GLCL	1,630	36	M	3.3 Apr 1965	8.1 Sep 1969	4.9 May	6.4 Feb	Meas. by WMP
BARRY												
4N 9W 5DA	Solomon Road	131	2	112GLCL	860	20	Q	111.5 Mar 1978	122.0 Mar 1965	116.0 Jul	116.7 May	
BAY												
17N 4E 22DCAA1	Pinconning Twsp.	110	6	324SGNW	620	22	M	0.0 Mar 1976	10.5 Aug 1963	1.3 Feb	4.7 Aug	
BRANCH												
6S 6W 18CCCD1	Coldwater Twsp.	56	6	112OTSH	950	20	M	18.3 Mar 1976	28.3 Jul 1964	21.7 May	24.0 Nov	
22CA	Coldwater Test 4	113	6	112GLCL	970	20	R	9.0 May 1975	25.9 May 1977	10.0 Mar	23.5 Oct	P
CALHOUN												
1S 7W 10BB	Sabin	12	15	112GLCL	908	38	W	0.9 Mar 1950	7.2 Dec 1964	2.9 May	4.4 Oct	Meas. by owner
32BDCC1	Penfield Twsp.	95	6	337MRSL	845	20	R	15.6 Apr 1974	27.0 Aug 1964	19.2 May	23.9 Sep	P
32DABD	Battle Creek	127	8	337MRSL	830.8	45	D	0.7 Apr 1950	16.8 Jul 1959	6.1 Apr	12.1 Jul	P, Meas. by owner
2S 6W 25AA	Marshall	59	6	337MRSL	904.8	34	M	5.5 May 1950	9.7 Aug 1964	6.9 Jun	8.1 Jul	P, Meas. by owner
CASS												
8S 14W 17BA	Little	55	28	112GLCL	840	39	M	46.2 Jul 1950	55.0 Mar 1957	48.2 Jul	49.1 Feb	
CHEBOYGAN												
33N 1W 26DABB1	Pigeon River CCC	164	6	112SAND	933	18	R	56.1 Jun 1979	60.2 Jul 1982	56.4 Jun	59.2 Jan	
39N 3W 29CBCB1	Mackinaw, D	125	6	344DUND	705	5	M	5.2 May 1979	11.7 Feb 1981	5.5 May	10.8 Oct	
29CBCB2	Mackinaw, S	55	6	112SDGV	705	5	M	2.1 May 1979	6.5 Feb 1981	2.1 Apr	5.6 Aug	
CHIPPEWA												
46N 4W 24DAAD1	Raco	54	6	112OTSH	850	31	R	18.4 Jun 1971	28.4 Apr 1964	22.7 Jun	25.1 Nov	
CLARE												
17N 4W 34DCAD	Clare	91	4	112GLCL	850	9	R	7.9 Mar 1976	24.9 May 1977	9.8 May	21.6 Aug	

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

COUNTY AND WELL NUMBER TWP, RANGE, SECT.	NAME	DEPTH (FT)	DIAMETER (IN)	AQUIFER	ALTITUDE	YRS. RECORD	MEAS. 1983	OBSERVED WATER-LEVEL EXTREMES				REMARKS
								THROUGH 1982		IN 1983		
								MAXIMUM	MINIMUM	MAXIMUM	MINIMUM	
CLINTON												
5N 2W 31CBBA1	Capital City Airport	195	6	324SGNW	850	26	R	45.0 Mar 1949	66.4 Jan 1967	54.2 May	56.9 Sep	P
" 32DC	Quarantine Farm	135	4	324SGNW	849.2	40	M	42.0 Sep 1944	99.2 May 1966	74.5 Mar	85.5 Aug	P
6N 1W 3BB2	Sleepy Hollow 5	62	1	112GLCL	814.0	14	I	38.2 Sep 1975	43.5 Nov 1966	37.6 Apr		
6N 2W 16DDAD1	MSHD, U.S. 27	23	14	112GLCL	803.3	36	M	13.8 Apr 1974	19.9 Feb 1964	15.4 May	18.0 Sep	Federal key well
7N 1W 34CC	Sleepy Hollow 7	32	1	112OTSH	785.3	17	A	17.1 Mar 1973	20.3 Oct 1973	16.5 Apr		
2W 9BBCD	St. Johns	535	6	324SGNW	743.4	20	R	52.2 May 1967	93.7 May 1977	54.3 Apr	82.1 Jul	P
CRAWFORD												
25N 1W 15DDCD1	Eldorado	56	6	112GLCL	1,190	36	R	25.7 May 1976	36.0 Apr 1951	28.5 Jul	30.9 Jan	
DELTA												
39N 23W 28AC	Schemmel	530	5	372MNSG	680	26	R	1.3 May 1960	8.6 Feb 1977	4.3 Apr	6.8 Sep	
41N 18W 31CD	Isabella	250	5	361ODVCU	615	26	M	3.3 Sep 1979	6.4 Feb 1977	4.1 Mar	6.0 Aug	
42N 18W 17ABBD	Cooks CCC	60	6	112GLCL	760	22	Q	21.2 May 1960	28.4 Mar 1966	23.0 May	24.4 Oct	
42N 19W 20AA	Pollack CCC	134	6	112GLCL	740	26	Q	23.4 Jul 1982	28.1 Feb 1977	24.5 Jun	25.0 Jan	
43N 19W 24BB	Clarage	405	4	365TBRV	860	26	Q	77.0 Jul 1960	88.8 Oct 1966	78.3 Jun	79.0 Jan	
DICKINSON												
43N 28W 32ADAB1	Felch	31	1	112SAND	1,160	18	M	13.1 May 1972	16.8 May 1968	13.5 Jun	14.9 Mar	
EATON												
3N 3W 2BA	Lansing, Stiefel	66	1	112GLCL	839	20	R	3.1 Mar 1965	18.0 Nov 1968	4.8 Jan	12.0 Nov	P
4N 3W 12CD	Robins Road	381	6	324SGNW	861.9	31	R	67.5 Nov 1953	103.6 Aug 1969	75.3 Dec	96.7 Jun	P
GENESEE												
6N 7E 9DCCC1	Fisher Body No. 2	385	10	324SGNW	837.0	11	R	52.3 Dec 1975	87.0 Jun 1977	54.2 May	76.6 Jun	P
GRAND TRAVERSE												
26N 9W 14ABAA1	Fife Lake State Forest	80	6	112SAND	960	7	R	24.3 Sep 1976	28.0 Mar 1982	24.7 Jul	26.7 Jan	
HILLSDALE												
7S 2W 10BDDD1	Pittsford Game Area	20	1	112SAND	1,070	18	M	5.8 Apr 1982	11.1 Sep 1967	6.6 May	8.6 Sep	
2W 15BCBA1	Osseo	150	6	112OTSH	1,095	5	M	46.1 Apr 1982	49.0 Dec 1979	46.4 May	47.8 Nov	
INGHAM												
2N 1E 34DB	Dansville Game Area	87	2	112GLCL	930	20	Q	22.4 Apr 1974	29.3 Oct 1964	23.1 Jun	25.3 Sep	
2N 1W 5BCAB1	Mason	210	8	324SGNW	890	20	R	14.7 Mar 1973	23.8 Nov 1964	15.0 May	21.1 Dec	P
3N 1E 7DDCA1	Lotte	184	3	324SGNW	900	20	M	+2.4 Apr 1974	7.0 Nov 1964	+2.2 Apr	2.4 Oct	
2W 23BCBD	Holt	188	8	324SGNW	895	2	R	18.5 Apr 1982	22.5 Oct 1982	18.3 May	23.6 Oct	
4N 1W 16DA	Meridian Twsp.	398	4	342SGNW	841.2	16	M	6.3 Mar 1976	17.3 Aug 1981	11.8 May	17.4 Jul	P
28BCAD1	Okemos	125	4	324SGNW	865	8	R	18.1 May 1976	24.2 Sep 1978	18.7 May	21.5 Sep	
4N 2W 16DA	Lansing, Cedar	417	12	324SGNW	829.1	39	R	42.0 Mar 1946	67.0 Aug 1949	41.0 Dec	47.0 Apr	P
17AB	Lansing, Logan	424	20	324SGNW	858.7	53	R	34.3 Dec 1929	168.3 May 1968	94.2 Dec	106.2 Jan	P
21BA3	Lansing, Scott Park	400	4	324SGNW	835	5	R	45.6 Dec 1982	58.8 Jun 1979	38.6 Dec	47.8 Jan	P
22BC	Lansing, P-5	338	12	324SGNW	823.6	54	M	7.1 Jul 1932	80.5 Feb 1970	40.9 Dec	56.6 Feb	P
24CA	Spartan Village	453	10	324SGNW	853.4	39	R	25.5 Mar 1946	105.5 May 1972	73.0 Mar	87.9 Jul	P
27BB	Fenner Arboretum	215	6	324SGNW	835	16	R	52.0 Jul 1968	89.5 Oct 1972	47.8 Jun	62.7 Jul	P
31CC	Maybell Street	204	3	324SGNW	880.2	40	M	18.9 Apr 1952	45.9 Jul 1980	40.0 Jul	44.6 Nov	P

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

COUNTY AND WELL NUMBER TWP, RANGE, SECT.	NAME	DEPTH (FT)	DIAMETER(IN)	AQUIFER	ALTITUDE	YRS. RECORD	MEAS. 1983	OBSERVED WATER-LEVEL EXTREMES				REMARKS
								THROUGH 1982		IN 1983		
								MAXIMUM	MINIMUM	MAXIMUM	MINIMUM	
IOSCO												
24N 7E 13ADAD1	Oscoda	69	6	112SAND	760	4	M	30.2 Jul 1980	32.7 Mar 1982	29.9 Jul	32.7 Feb	
IRON												
43N 35W 11AD	WMP 23	47	36	112GLCL	1,565	39	M	35.5 Jul 1973	47.1 Aug 1949	35.3 Aug	38.7 Jun	Meas. by WMP
20DC	WMP 25	48	1	112GLCL	1,560	39	M	40.7 Jun 1973	48.3 Aug 1949	41.2 Jun	42.7 Feb	Do.
44N 37W 14BB	CCC Camp	102	6	112GLCL	1,730	25	Q	91.8 Oct 1973	97.1 Aug 1982	91.4 Nov	96.1 Mar	
JACKSON												
3S 1W 11AA1	Jackson, 4a Belden	360	6	324SQNW, 337MRSL	935	26	D	18.6 Jan 1961	119.1 Jun 1971	46.7 Dec	89.0 Jun	P, Meas. by owner
KALAMAZOO												
2S 10W 4D	Kalamazoo, Campbell	13	4	112OTSH	836.5	15	R	1.9 Apr 1974	7.7 Oct 1982	5.0 Apr	7.1 Sep	P
9B	Kalamazoo, Schoonover	21	6	112OTSH	828	15	R	+1.0 Apr 1975	4.0 Sep 1981	0.8 May	3.0 Oct	P
11W 20BB2	Kalamazoo, Kendall	106	4	112OTSH	880	16	R	12.5 Feb 1976	48.4 Jun 1971	17.0 Apr	45.6 Jul	P
22CD	Kalamazoo, Stockbridge	137	4	112OTSH	764.7	24	R	4.8 Feb 1975	31.1 Aug 1961	7.9 Jun	10.5 Jan	P
28AA	Kalamazoo, Maple	245	4	112OTSH	820	15	R	32.9 Jan 1979	61.6 Jun 1973	34.0 Apr	51.2 Sep	P
31CD	Kalamazoo, Colony	226	4	112OTSH	910	15	R	41.4 Sep 1982	71.8 May 1978	51.2 Jan	65.3 Jun	P
36CB	Kalamazoo, Emerald	226	4	112OTSH	860	15	R	25.7 May 1976	50.4 Jun 1971	26.1 May	45.1 Jul	P
3S 11W 4AD1	Kalamazoo, A-D	135	3	112OTSH	854.0	25	R	0.5 May 1967	12.9 Jul 1964	3.1 May	11.7 Sep	P
4AD2	Kalamazoo, A-S	40	3	112OTSH	854.0	25	R	+0.2 Sep 1975	9.1 Nov 1959	0.9 May	2.4 Mar	P
14AA	Upjohn 28	233	16	112OTSH	870	17	R	23.5 Aug 1982	45.2 Jul 1977	24.3 Jan	40.7 Aug	P
22BBCD	Portage	102	12	112GLCL	877	2	R	25.5 Jun 1982	27.3 Oct 1982	25.5 May	27.9 Nov	P
12W 11BD	Kalamazoo, Atwater	248	3	112OTSH	880	23	R	+3.0 Sep 1969	1.0 Aug 1977	+1.2 May	0.2 Jul	P
11AD1	Kalamazoo, Sabo-D	300	4	112OTSH	877	11	R	4.5 Jul 1973	16.4 Jul 1977	5.8 May	15.2 Aug	P
11AD2	Kalamazoo, Sabo-S	38	6	112OTSH	877	11	R	9.1 Aug 1975	12.7 Aug 1977	10.0 May	12.0 Jul	P
4S 11W 3CDDA1	Prairie View Park	190	4	112OTSH	870	15	R	18.1 Apr 1982	20.6 Dec 1977	18.5 May	19.9 Nov	
KENT												
5N 12W 4DCCD1	Wyoming, Wobma	86	6	112GRVL	868.0	22	M	7.8 Oct 1978	12.9 Aug 1964	9.4 May	11.0 Sep	
10N 12W 13DD	Rogue River Game Area	30	1	112GLCL	785	18	Q	0.8 Jan 1975	9.2 Oct 1969	4.1 Jan	8.1 Oct	
LAKE												
20N 13W 13ACAC1	Irons	57	6	112OTSH	945	4	M	14.7 Jul 1980	18.0 Mar 1982	15.0 Jun	16.4 Dec	
LEELANAU												
28N 14W 8DDCA1	Sleeping Bear, D	138	6	112SAND	750	4	M	113.1 Mar 1980	114.2 May 1982	114.0 Nov	114.5 Jun	
28N 14W 18BABB1	Sleeping Bear, S	60	6	112SAND	625	4	R	22.9 Apr 1982	24.9 Nov 1982	23.3 Jun	24.3 Feb	
LENAWEE												
5S 1E 12DDBD1	Onsted Game Area	39	1	112GLCL	1,000	18	M	15.9 Mar 1982	19.3 Sep 1971	16.1 May	17.6 Sep	
6S 4E 8DDBA1	Fisher Body	81	8	112OTSH	800	19	R	9.9 Apr 1982	18.4 Feb 1965	10.6 May	12.6 Feb	

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

COUNTY AND WELL NUMBER TWP, RANGE, SECT.	NAME	DEPTH (FT)	DIAMETER (IN)	AQUIFER	ALTITUDE	YRS. RECORD	MEAS. 1983	OBSERVED WATER-LEVEL EXTREMES				REMARKS
								THROUGH 1982		IN 1983		
								MAXIMUM	MINIMUM	MAXIMUM	MINIMUM	
LIVINGSTON												
1N 6E 13DBAB1	American Aggregate	29	2	112OTSH	930	14	R	12.1 Apr 1974	21.6 Oct 1979	13.7 Jun	16.2 Dec	
2N 6E 31BA2	Brighton	83	10	112GLCL	935	10	R	27.2 Sep 1975	58.6 Jul 1978	27.8 May	52.2 Jun	P
MACKINAC												
41N 5W 23BC	Round Lake CCC	47	6	355SLINH	610	28	Q	4.3 May 1959	17.8 Feb 1981	9.2 Apr	14.3 Oct	
42N 2W 7AABB1	Pontchartrain CCC	102	6	355MNSQ	680	28	R	13.1 May 1960	32.3 Feb 1977	17.4 Mar	29.7 Sep	
MARQUETTE												
47N 28W 3CCDC1	Ely Twsp.	75	8	112OTSH	1,572.0	23	R	9.7 May 1973	19.3 Apr 1964	10.9 Jun	15.2 Mar	Federal key well
48N 29W 30CC	Van Riper Park	78	6	112GLCL	1,560	15	M	9.6 May 1973	15.7 Feb 1977	10.6 Jun	12.8 Feb	
49N 30W 22AC	WMP 13	17	1	112GLCL	1,680	36	M	0.6 May 1951	13.3 Sep 1948	2.9 May	10.5 Aug	Meas. by WMP
MENOMINEE												
37N 26W 19DADA1	Carney	17	4	365TBRV	800	25	Q	3.5 Apr 1979	8.6 Jan 1977	3.5 Mar	5.6 Sep	
MONROE												
7S 6E 15ACAA1	Petersburg, rock	73	6	348DRRV	860	5	M	32.3 Mar 1982	40.2 Nov 1979	35.1 May	39.8 Sep	
15ADBB1	Petersburg Game Area	17	1	112GLCL	675	18	M	3.0 Feb 1966	6.8 Nov 1978	4.5 May	6.1 Oct	
MUSKEGON												
11N 15W 34ADDD1	Muskegon Game Area	31	1	112SAND	595	18	Q	+0.2 Apr 1978	4.7 Sep 1972	0.3 Mar	2.9 Jul	
OAKLAND												
2N 7E 5BA	Honeywell Lake Road	44	2	112GLCL	1,020	16	R	23.9 Apr 1976	28.9 Dec 1971	26.0 Mar	27.3 Oct	
8E 18DBAD1	Proud Lake Park	45	6	112OTSH	910	15	R	2.8 May 1974	6.4 Sep 1971	3.9 May	5.7 Sep	P
3N 7E 5DA	Fish Lake Road	49	2	112GLCL	1,055	15	R	29.5 Jun 1976	38.7 Dec 1972	33.2 Jul	34.6 Mar	
10E 13AC	Oakland University	183	6	112GLCL	940	3	R	56.6 Dec 1982	93.5 Jul 1963	56.3 May	58.2 Apr	
5N 8E 8ACAC1	Holly Recreation Area	42	1	112GLCL	930	18	M	22.3 Apr 1974	26.5 Sep 1966	24.4 Apr	25.8 Aug	
OCEANA												
13N 15W 18AAAA1	Hesperia	79	6	112OTSH	703	6	R	36.6 Jun 1979	41.0 Mar 1982	36.9 Feb	39.1 Dec	
OGEMAW												
23N 1E 2BAAA1	Rose City Road, D	105	1	112GLCL	1,265	16	Q	73.6 Oct 1976	78.2 Apr 1969	76.4 Jul	76.7 Apr	
2BAAA2	Rose City Road, S	20	1	112SAND	1,265	16	Q	7.6 Apr 1976	13.6 Dec 1972	9.9 Jul	12.1 Jan	
ONTONAGON												
46N 38W 30ADDD1	USFS	65	1	112SDGV	1,530	17	M	16.0 Jun 1973	19.7 Mar 1978	16.4 Jun	17.4 Feb	Disc., 6-83
51N 41W 8BDBC1	Silver City	100	6	420FRED	620	26	Q	8.2 Apr 1959	21.8 Dec 1976	8.3 Apr	14.3 Sep	
OTSEGO												
30N 3W 19ABBB1	Gaylord	90	6	112OTSH	1,308	5	M	30.7 Jul 1979	35.8 Apr 1982	33.1 Jun	35.2 Jan	

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

COUNTY AND WELL NUMBER TWP, RANGE, SECT.	NAME	DEPTH (FT)	DIAMETER(IN)	AQUIFER	ALTITUDE	YRS. RECORD	MEAS. 1983	OBSERVED WATER-LEVEL EXTREMES				REMARKS
								THROUGH 1982		IN 1983		
								MAXIMUM	MINIMUM	MAXIMUM	MINIMUM	
PRESQUE ISLE												
33N 6E 8BBBB1	Styma	61	6	341TRVR	800	25	Q	5.1 Mar 1979	18.8 Mar 1963	6.4 Apr	12.2 Oct	
ROSCOMMON												
24N 2W 20BABA1	Exp. Station	14	8	112OTSH	1,145.3	50	R	2.1 Apr 1976	6.2 Dec 1949	2.7 Jun	4.5 Sep	Federal key well
SAGINAW												
10N 1E 22DADA1	Marion Springs, D	210	6	324SGNW	657	6	R	7.9 Feb 1981	10.0 Sep 1978	8.6 May	10.1 Sep	
SANILAC												
13N 13E 12ADAA1	Minden Game Area	130	6	337MRSL	805	7	R	16.4 Apr 1982	22.7 Oct 1979	17.0 May	20.5 Sep	
SCHOOLCRAFT												
45N 13W 16CCCB1	Seney	154	4	361ODVCU	710	32	R	4.6 Apr 1971	6.5 Oct 1963	5.0 Mar	6.3 Sep	
47N 16W 30BBBB1	Cusino CCC	57	6	368PRDC	900	27	R	5.7 May 1960	16.4 Feb 1977	9.4 May	14.9 Sep	
VAN BUREN												
2S 13W 2BBCD1	Almena, D	108	4	112GLCL	737	3	M	8.3 Feb 1981	10.7 Aug 1981	8.7 Apr	10.4 Jul	
2BBCD2	Almena, S	44	4	112GLCL	737	3	M	9.0 Oct 1982	12.0 Sep 1981	9.7 Apr	11.8 Aug	
WASHTENAW												
2S 3E 9DAAB2	Waterloo Park	48	6	112SDGV	970	15	R	4.1 May 1974	7.0 Aug 1971	4.4 May	6.8 Sep	P
3S 6E 16BCCD1	Ann Arbor	55	10	112GLCL	821.5	21	R	0.7 Mar 1974	15.9 Oct 1964	1.6 May	7.5 Nov	P
7E 5BB	Ypsilanti, Superior	69	8	112GLCL	720	22	R	1.8 Feb 1965	21.4 Dec 1965	2.5 Jun	11.5 Sep	P
9AD	Ypsilanti, Gilbert	94	6	112GLCL	710	33	R	29.1 Nov 1945	78.8 Oct 1974	57.3 Dec	68.0 Oct	P
24CA1	Ypsilanti Twsp. 104	87	4	112GLCL	665.6	38	R	5.8 Jan 1950	22.7 Feb 1971	12.8 May	15.8 Nov	P
24CD	Ypsilanti Twsp. 117	75	6	112GLCL	657.8	37	R	4.7 Oct 1981	63.2 Feb 1970	5.8 May	13.7 Dec	P
WEXFORD												
22N 12W 13BA	Harrietta Fish Hatchery	141	4	112GLCL	1,060	23	R	+13.8 Mar 1970	1.6 Jan 1981	+8.8 Jul	+3.4 Dec	P

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

COUNTY AND WATER USER	1983 TOTAL	MAX DAY	MIN DAY
ALCONA			
Harrisville	20.8	.113	.036
ALGER			
Burt Twp.	54.1	--	--
Chatham	9.3	.054	.013
ALLEGAN			
Douglas	83.9	--	--
Otsego	378.9	1.576	.774
Plainwell	202.3	1.078	.344
Saugatuck	92.6	--	--
ANTRIM			
Bellaire	61.9	.360	.073
Central Lake	56.7	.292	.108
Mancelona	152.4	1.399	.147
BARRY			
Hastings	304.5	1.590	.539
Middleville	110.1	--	--
Nashville	37.6	.172	.040
BENZIE			
Beulah	18.3	.134	.028
Frankfort	93.8	--	--
BERRIEN			
Berrien Springs	162.1	1.032	.260
Buchanan	e)304.1	1.515	.240
Coloma	163.5	.853	.201
Niles	938.0	4.550	1.440
Niles Twp.	61.8	.720	.003
Watervliet	75.7	.460	.000
BRANCH			
Bronson	358.6	--	--
Coldwater	1,037.5	5.694	1.675
Quincy	81.9	--	--
Reg. Center Dev. Disab.	53.6	.397	.064
Union City	55.2	--	--
CALHOUN			
Albion	981.0	4.278	1.621
Athens	36.2	--	--
Battle Creek	3,495.1	16.450	4.320
Battle Creek Twp.	685.6	4.240	1.220
Homer	60.2	.291	.087
Marshall	355.9	1.953	.529
CASS			
Cassopolis	79.7	.471	.119
Dowagiac	323.5	1.974	.329
CHARLEVOIX			
Boyne City	164.8	.564	.247
Boyne Falls	145.3	--	--
East Jordan	211.0	1.100	.330
CHEBOYGAN			
Mackinaw City	84.9	.681	.090
CHIPPEWA			
Kinross Twp.	168.6	1.366	.225
CLARE			
Clare	206..	2.257	.363
Farwell	44.1	.380	.030
Harrison	71.1	.318	.143

COUNTY AND WATER USER	1983 TOTAL	MAX DAY	MIN DAY
CLINTON			
Fowler	25.8	.255	.032
Maple Rapids	23.2	.091	.049
Ovid	61.1	.301	.061
St. Johns	412.4	1.882	.609
Westphalia	19.3	.167	.024
CRAWFORD			
Grayling	207.0	.962	.313
DICKINSON			
Breitung Twp.	51.6	--	--
EATON			
Bellevue	48.5	.260	.065
Charlotte	398.1	1.912	.666
Delta Twp.	891.4	-	
Eaton Rapids	283.9	1.478	.348
Grand Ledge	222.2	1.135	.259
Sunfield	31.3	--	--
EMMET			
Harbor Springs	180.0	1.720	.260
Petoskey	529.2	--	--
GENESEE			
Beecher Metro. Dist.	464.6	1.962	.920
Burton	279.7	1.685	.395
Davison	211.4	1.893	.000
Grand Blanc	398.3	2.369	.624
Linden	61.7	.300	.100
Otisville	18.5	--	--
GLADWIN			
Beaverton	55.5	--	--
GOGEBIC			
Ironwood	480.2	--	-
Marenisco Twp.	61.5	.252	.112
Wakefield	112.1	.807	.216
GRAND TRAVERSE			
Kingsley	27.1	--	-
GRATIOT			
Alma	9.1	--	--
Breckenridge	40.8	.329	.030
Ithaca	132.7	--	--
St. Louis	163.1	.963	.303
HILLSDALE			
Hillsdale	453.1	2.165	.729
Jonesville	136.9	.999	.202
Litchfield	51.3	1.008	.089
HOUGHTON			
a)Adams Twp. - S. Range Water Auth.	337.3	1.320	--
b)Adams Twp. - S. Range Water Auth.	80.6	.300	.210
Chassel Twp.	13.7	.213	.070
Houghton	415.1	1.623	.709
c)N. Michigan Water Co.	330.8	1.297	.515
HURON			
Ubly	26.2	-	--
Pigeon	59.1	.190	.130
Sebewaing	115.1		-

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

COUNTY AND WATER USER	1983 TOTAL	MAX DAY	MIN DAY
INGHAM			
E. Lansing-Meridian Twp.	1,986.9	10.317	3.794
Lansing	8,105.4	34.860	15.500
Lansing Twp.	430.7	--	--
Leslie	92.9	--	--
Mason	231.7	--	.001
Michigan State Univ.	1,623.0	5.472	1.940
Stockbridge	40.4	--	--
Webberville	60.2	.354	.120
Williamston	96.4	1.371	.162
IONIA			
Belding	494.4	--	--
Ionia	332.6	2.010	.498
Ionia State Hosp.	45.3	.206	.084
Mich. Reformatory, Ionia	198.0	--	--
Mich. Training Unit, Ionia	61.4	.330	.120
d)Muir	48.8	.919	.102
Pewamo	19.4	--	--
Saranac	186.0	1.080	.010
IOSCO			
Oscoda Twp.	266.2	--	--
Wurtsmith AFB	244.9	1.342	.413
IRON			
Alpha	e)10.4	--	--
Caspian	99.2	.497	.186
Crystal Falls	145.7	.806	.312
Crystal Falls Twp.	88.8	.340	.189
Iron River	139.7	.776	.221
Iron River Twp.	142.4	.714	.033
Stambaugh	81.4	.373	.103
Stambaugh Twp.	40.1	--	--
ISABELLA			
f)Mt. Pleasant	880.5	4.047	1.273
JACKSON			
Concord	49.7	.301	.006
Grass Lake	232.1	1.667	.321
Jackson	3,087.3	12.720	4.600
Springport	37.7	--	--
State Prison, Jackson	561.0	--	--
KALAMAZOO			
Galesburg	90.7	1.104	.145
James River Corp.	669.8	3.581	.823
Kalamazoo	7,204.2	41.883	12.671
Parchment	104.0	1.117	.061
Portage	1,140.4	10.108	1.236
Upjohn Co.	6,056.2	22.753	8.950
Vicksburg	122.4	.925	.145
KALKASKA			
Kalkaska	143.5	.940	.189
KENT			
Alloytek, Inc.	44.8	--	--
Cedar Springs	133.2	.786	.114
Kent County Airport	e)12.0	--	--
Lowell	245.4	1.626	.312
Plainfield Twp.	690.7	7.200	.878
Sparta	155.1	.772	.283
LAKE			
Baldwin	66.5	.450	.035
LAPEER			
Columbiaville	38.4	.234	.053
Dryden	14.3	--	--
North Branch	32.7	.170	.072
LEELANAU			
Northport	26.9	.279	.014
LENAWEE			
Adisson	26.3	--	--
Britton	21.3	.078	.045
Clinton	90.9	--	--
Hudson	108.7	.661	.165
Morenci	94.7	.482	.111
Onsted	39.6	.239	.074
Tecumseh	366.3	2.252	.334
Fisher Body, Tecumseh	8.3	.076	--
LIVINGSTON			
Brighton	270.7	--	--
Fowlerville	113.8	.636	.183
Green Oak Twp.	36.3	.340	.033
Howell	409.6	1.878	.774
Maxey Boys School	39.2	.253	.043
LUCE			
Newberry	100.3	.492	.128
Newberry Health Center	24.5	--	--
MACOMB			
Armada	35.3	.225	.032
Richmond	130.5	--	--
Romeo	205.3	--	--
MANISTEE			
Filer Twp.	58.2	.647	.000
Manistee	403.4	--	--
MARQUETTE			
Ishpeming Twp.	135.9	.823	.233
K.I. Sawyer AFB	480.0	2.391	.893
Powell Twp.	e)11.3	--	.018
Richmond Twp.	e)41.0	--	--
MENOMINEE			
Stephenson	38.4	.242	.062
MIDLAND			
Coleman	51.9	.353	.094
MISSAUKEE			
Lake City	49.9	--	--
MONROE			
Milan	314.6	--	--
Petersburg	32.4	.140	.068
MONTCALM			
Carson City	57.3	.310	.090
Edmore	68.0	.777	.060
Greenville	837.6	4.488	1.032
Howard City	26.4	--	--
Sheridan	32.3	--	--
Stanton	96.5	--	--
MUSKEGON			
Montague	91.7	.767	.031
Whitehall	510.7	2.547	.674
NEWAYGO			
Freemont	413.7	3.306	.282
Hesperia	20.3	--	--
Newaygo	77.2	.735	.032
White Cloud	81.6	.579	.050

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

COUNTY AND WATER USER	1983 TOTAL	MAX DAY	MIN DAY
OAKLAND			
Holly	154.4	.767	.283
Independence Twp.	142.0	--	--
Milford	226.9	1.419	.387
Orion Twp.	255.6	1.671	.414
Oxford	146.0	.798	.129
Rochester	620.9	3.264	1.030
Southfield	e)4.1	--	--
Sylvan Lake	67.6	--	--
Walled Lake	270.3	--	--
Waterford Twp.	2,010.1	--	--
Wolverine Lake	e)52.8	--	--
South Lyon	632.6	2.228	--
OCEANA			
Hart	217.0	--	--
Pentwater	61.9	--	--
Shelby	14.4	--	--
OGEMAW			
West Branch	105.1	.787	.000
ONTONAGON			
Bergland Twp.	4.7	--	--
OSCEOLA			
Evart	778.8	3.630	.520
Reed City	141.9	--	--
OTSEGO			
Gaylord	206.9	--	--
PRESQUE ISLE			
Onaway	62.1	.308	.120
Rogers City	167.0	1.752	.285
ROSCOMMON			
Roscommon	73.3	--	--
SAGINAW			
Chesaning	103.2	.494	.168
Tittabawassee Twp.	86.0	.313	.201
ST. CLAIR			
Capac	42.3	.387	.036
Yale	72.2	--	--
ST. JOSEPH			
Constantine	115.4	.686	.119
Sturgis	e)833.1	3.868	1.202
SANILAC			
Croswell	208.4	1.062	.150
Deckerville	47.6	.216	.025
Marlette	92.7	.457	.115
Peck	22.4	.139	.041
Port Sanilac	41.5	.437	.059
Sandusky	231.0	1.138	.285
SHIAWASSEE			
Bancroft	18.0	--	--
Byron	22.3	--	--
Durand	141.3	.624	.266
Owosso	e)777.7	3.064	1.356
Perry	60.0	--	--
TUSCOLA			
Akron	1.8	--	--
Caro	214.8	--	--
Cass City	100.2	.840	.135
Kingston	14.8	--	--
Mayville	39.3	--	--
State Hosp., Caro	36.1	.190	.050
Vassar	194.2	1.370	.487
VAN BUREN			
Bangor	61.8	.338	.080
Decatur	107.0	--	--
Gobles	20.4	.169	.029
Hartford	114.3	.683	.109
Lawrence	41.3	--	--
Lawton	325.1	1.746	.336
Paw Paw	186.3	1.042	--
WASHTENAW			
Ann Arbor	g)810.1	4.500	.890
Chelsea	199.3	.851	.220
Dexter	75.6	--	--
Saline	493.0	2.453	.629
Webster Twp.	44.8	.381	.027
Ypsilanti	1,112.0	5.522	1.096
Ypsilanti Twp.	1,157.6	9.589	.000
WEXFORD			
Cadillac	675.9	3.542	1.103
Manton	51.7	.278	.048

NOTES

a) Amount pumped to supply Houghton, Hancock, Portage Township, Copper Range Company, and Atlantic Mine.
b) Amount pumped to supply Painesdale, Trimountain, Baltic, and South Range.
c) Amount pumped to supply Calumet, Calumet Township, Copper City, Lake Linden, Laurin, Osceola Township, Torch Lake Township, Ahmeek, and Allouez Township.
d) Supplies water to Lyons.
e) Wholly or partly estimated.
f) Use Ranney collector system at Chippewa River site.
g) Also pumped 4,806 million gallons from Huron River.

SELECTED REFERENCES

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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:

Year	WDR Number
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