1981

GROUND-WATER DATA FOR MICHIGAN

BY
G.C. HUFFMAN

U.S. GEOLOGICAL SURVEY

Open-File Report 82-754

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

CONVERSION FACTORS

The following factors may be used to convert the inch-pound units published in this report to the International System of Units (SI).

Multiply inch-pound units	By	To obtain SI units
acres (a)	0.4047	hectares (ha)
feet (ft)	.3048	meters (m)
inches (in)	25.4	millimeters (mm)
miles (mi)	1.609	kilometers (km)
million gallons (10^6 gal)	3,785	cubic meters (m^3)
gallons (gal)	3.785	liters (L)
degrees Fahrenheit (°F)	(°F-32)/1.8	degrees Celsius (°C)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

GROUND-WATER DATA FOR MICHIGAN 1981

by G. C. Huffman

U.S. GEOLOGICAL SURVEY

OPEN-FILE REPORT 82-754

Prepared in cooperation with the Michigan

Department of Natural Resources

Lansing, Michigan
1982

UNITED STATES DEPARTMENT OF THE INTERIOR

JAMES G. WATT, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information write to:

Water Resources Division
U.S. Geological Survey
6520 Mercantile Way, Suite 5
Lansing, Michigan 48910

CONTENTS

		Page
Abstract		1
Introduction		1
Purpose		1
Scope		1
Use of data		1
Ground-water records and reports		3
Well-numbering system		9
Ground-water levels		10
Area ground-water data		10
Alpena County		12
Branch County	- city of Coldwater	13
Calhoun County	- city of Battle Creek	14
Clinton County	- city of St. Johns	15
Eaton County	- Delta Township	16
Grand Traverse County		17
Ingham County	- city of Lansing	18
	- city of Mason	19
	- East Lansing-Meridian Water Authority	20
	- Lansing Township	20
	- Michigan State University	21
Kalamazoo County	- city of Kalamazoo	22
	- city of Portage	23
Marquette County	- Iron Range area	24
Oakland County	- Huron-Clinton Metropolitan Authority	25
Oceana County		26
Saginaw County		27
Sanilac County		28
Van Buren County		29
Washtenaw County	- city of Ann Arbor	30
	- city of Ypsilanti	31
	- Ypsilanti Township	32
Tables		33
Selected references		49

FIGURES

Page

1. Map showing distribution of observation wells ---------- 2
2. Map showing areas in the Upper Peninsula where ground-water conditions are described in published reports ------- 4
3. Map showing areas in the Lower Peninsula where ground-water conditions are described in published reports ------- 6
4. Graphs of water levels in selected wells ---------- 11

TABLES

Page

1. Records of Michigan observation wells ---------- 34
2. Reported ground-water pumpage ---------- 39
3. Water-quality data ---------- 45

Altitude. The vertical distance of a point or line above or below the National Geodetic Vertical Datum of 1929. The National Geodetic Vertical Datum of 1929 (NGVD of 1929) is a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "mean sea level." In this report, all altitudes are above NGVD of 1929.

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

GROUND-WATER DATA FOR MICHIGAN

1981

by

G. C. Huffman

ABSTRACT

This report summarizes data on water levels in 124 observation wells and provides information on well locations, depths, altitudes, and aquifers that they tap. Tabulated data include extremes of water levels for 1981 and for the period of record; pumpage of most major ground-water users in the State; and quality data on selected wells. The city of Lansing was the largest reported user of ground-water, pumping 8.6 billion gallons from the Saginaw Formation and glacial deposits.

INTRODUCTION

Purpose

The purpose of this report is to make available the 1981 records of water levels and related data for the principal aquifers of the State. This report is written for municipalities, industries, institutions, consultants, drillers, hydrologists and other people interested in ground-water resources.

Scope

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. Also included are data on municipal water supply. 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 1981 are given in tables 1, 2, and 3. Distribution of observation wells is shown in figure 1.

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 in pumped areas obtained by recorders indicate day-to-day and long-term effects of pumping. This information can be used by municipalities, industries, and institutions to estimate the capacity of aquifers to meet present and future demands for water and whether expansion of present supply systems for ground water is practicable. In an area where

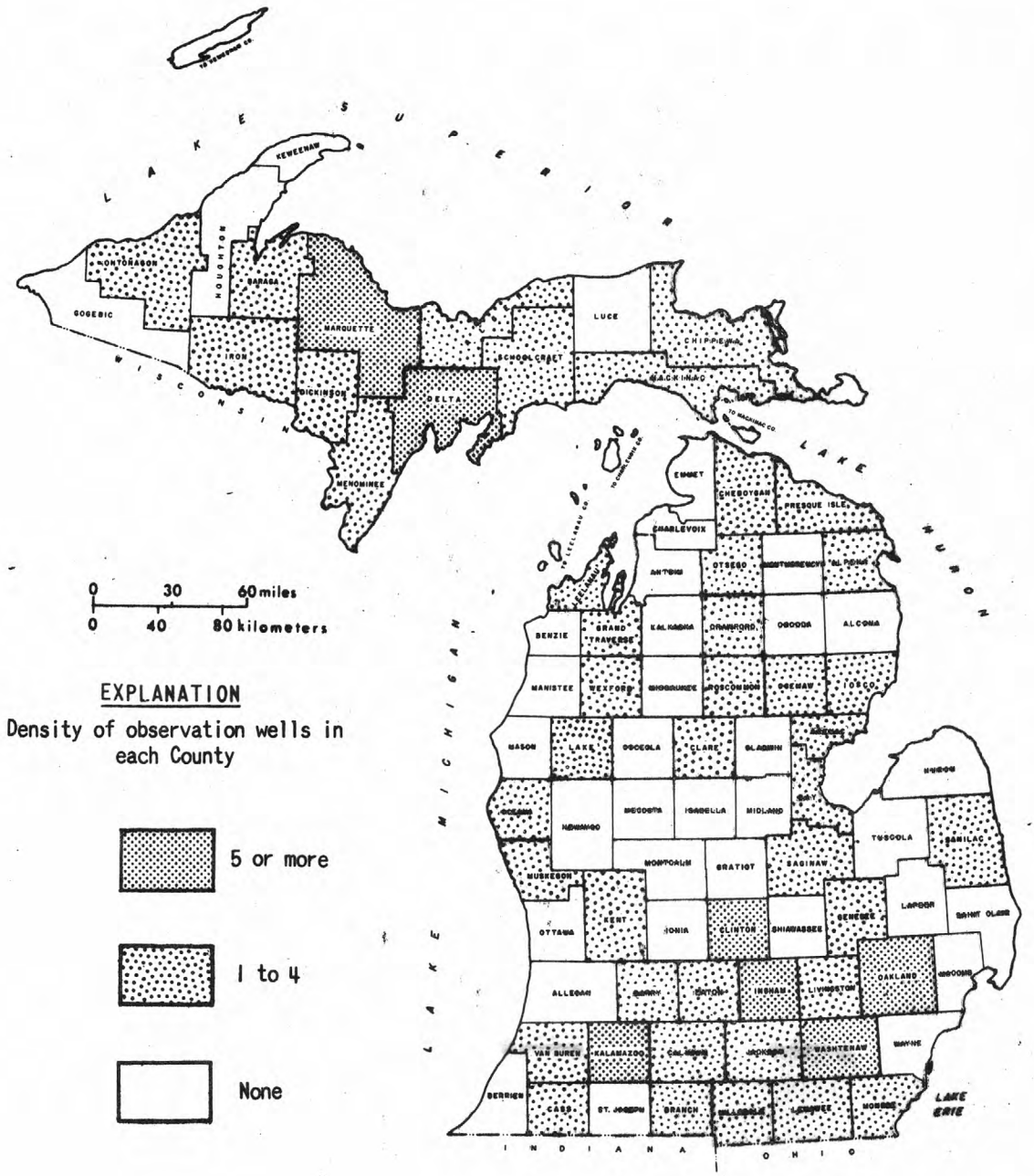


Figure 1.--Distribution of observation wells. Water levels were monitored in 124 observation wells in 1981.

the water level is declining because of pumping, projection of future water levels indicates the depth below which an intake should be installed. Allowing for lower water levels, can extend the life of the installation.

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 48909; or at the U.S. Geological Survey, 6520 Mercantile Way, Suite 5, Lansing, Michigan 48910. Records for the Upper Peninsula 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 2 and 3. In addition, many publications dealing with ground water are listed in the selected references at the end of this report.

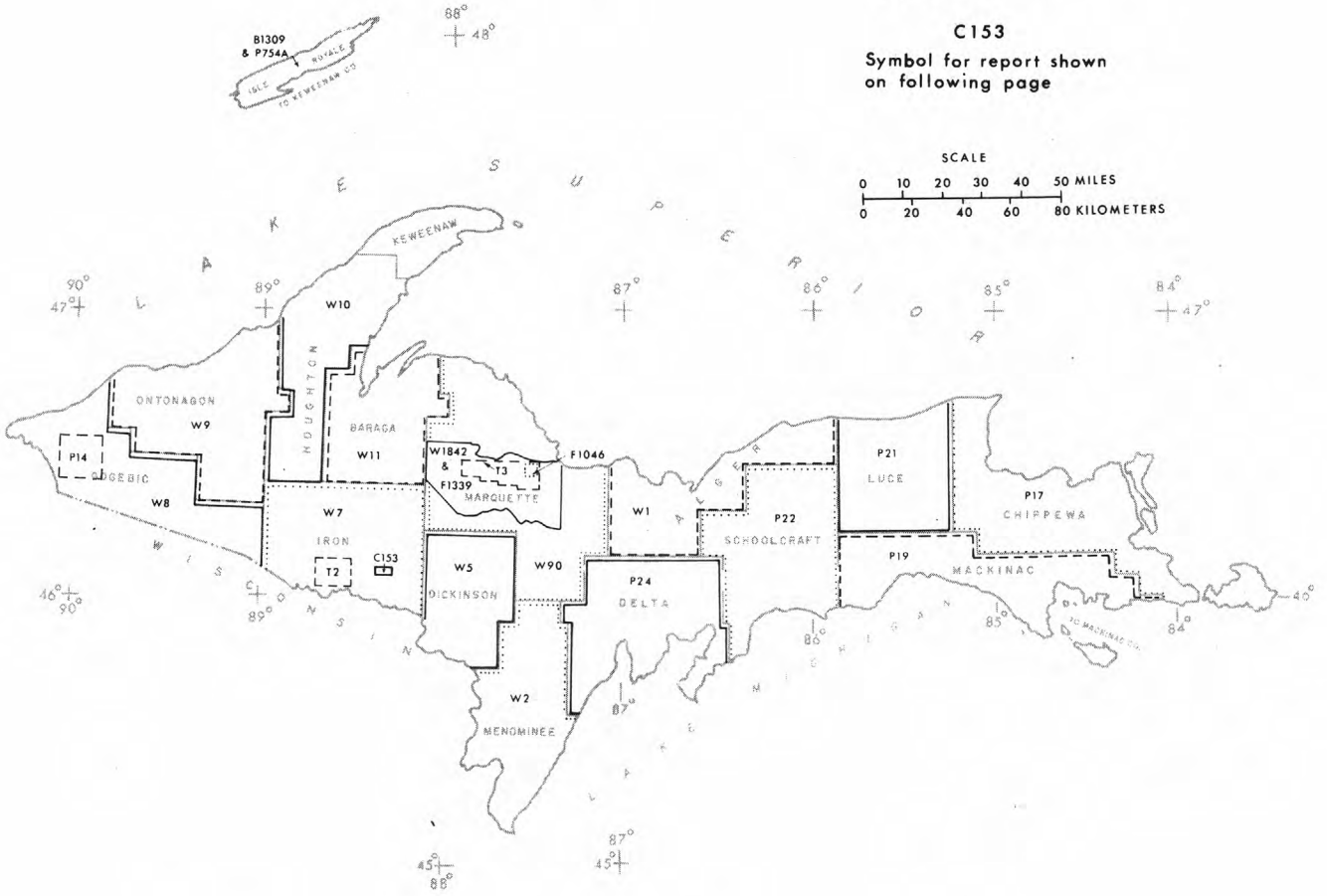


Figure 2.--Areas in the Upper Peninsula where ground-water conditions are described in published reports.

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.

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 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.

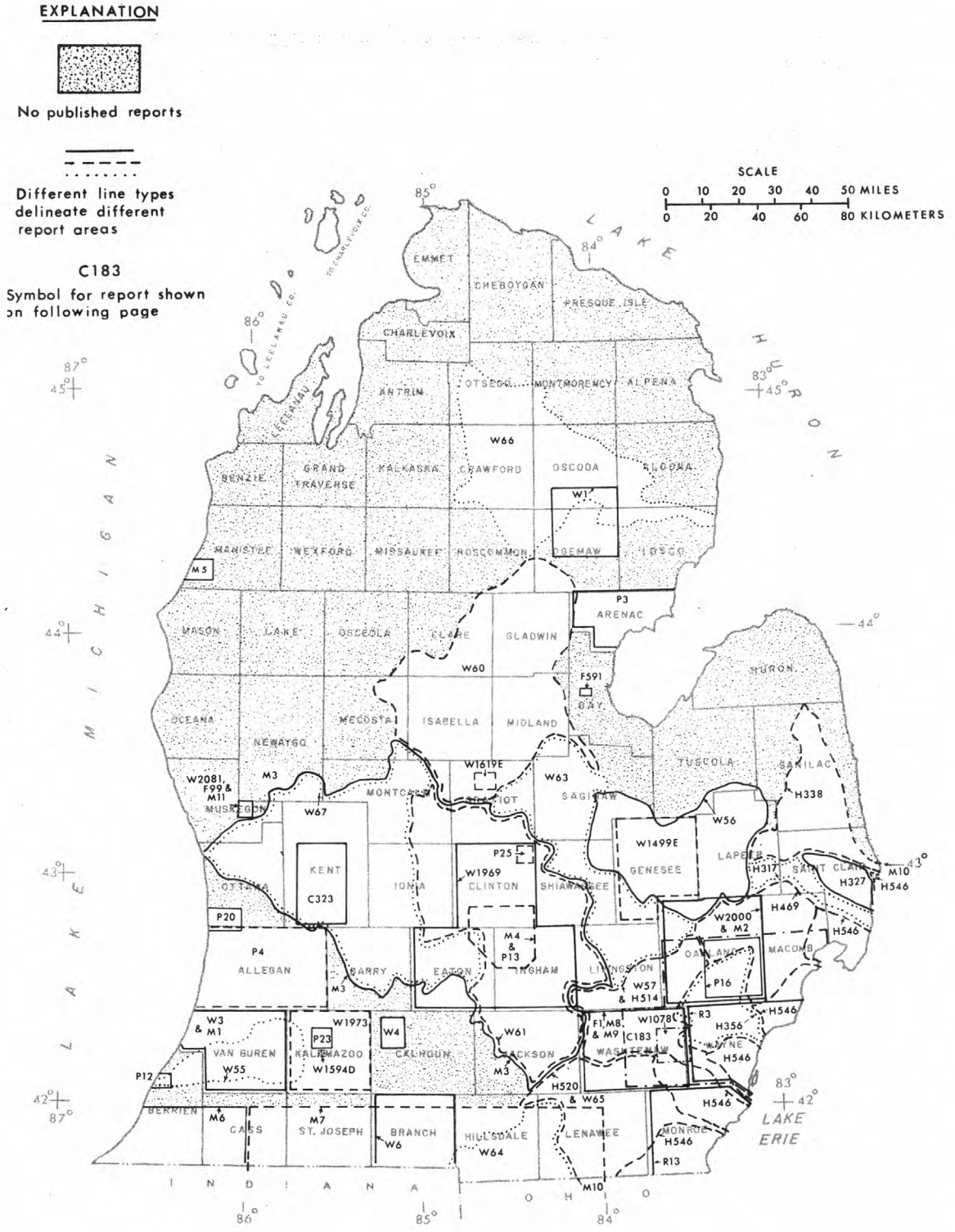


Figure 3.--Areas in the Lower Peninsula where ground-water conditions are described in published reports.

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.

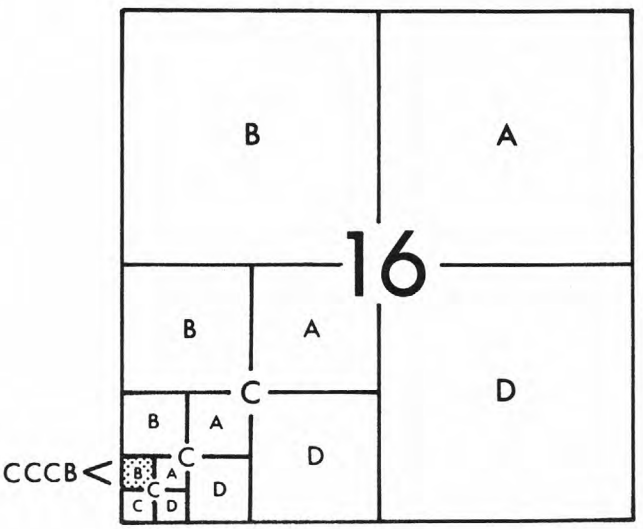
W1973 -- Allen, W. B., Miller, J. B., and Wood, W. W., 1972, Availability of water in Kalamazoo County, Michigan: U.S. Geological Survey Water-Supply Paper 1973.

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.

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, a 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.

GROUND-WATER LEVELS

Water levels, measured in 124 observation wells throughout the State (fig. 1 and table 1) in 1981, generally follow precipitation trends. Above average levels usually occur in areas where precipitation has been above normal; below average levels in areas where precipitation 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. 4) 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, is 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 daily declines in water levels in some wells. Pumping withdrawals can have a major affect on water levels. If withdrawals are greater than recharge declining levels will occur often eliminating precipitation trends. Uniform pumping rates throughout the year, however, may still allow levels to follow precipitation trends.

AREA GROUND-WATER 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. Data on chemical quality of water is based on latest analyses made by the Michigan Department of Health. Where more than one well is involved, a range in quality is generally given. In this report, the unit milligrams per liter (mg/L) can be considered to be numerically equal to parts per million (ppm). Most descriptions are supplemented by illustrations showing water levels.

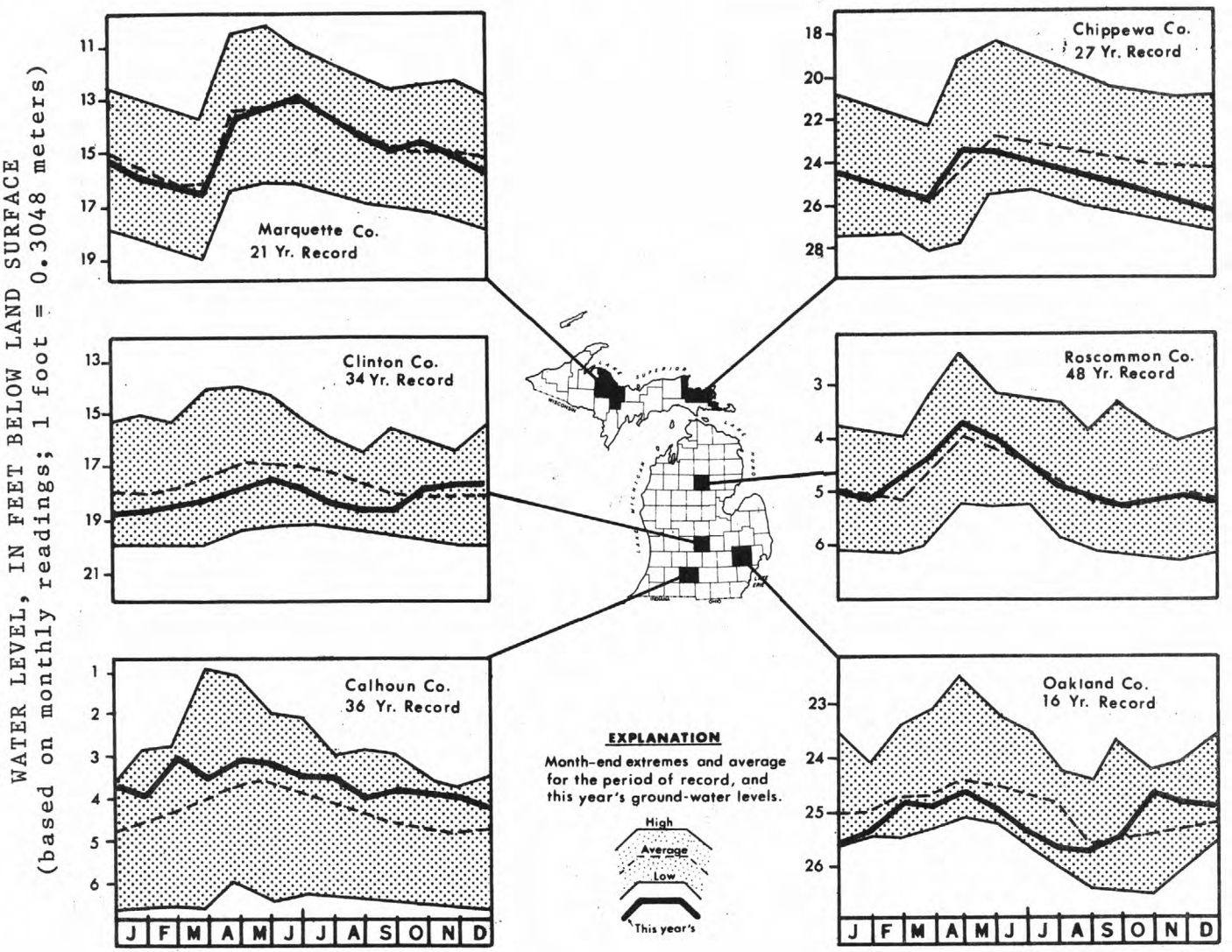
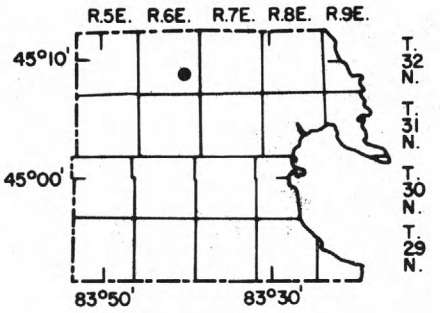
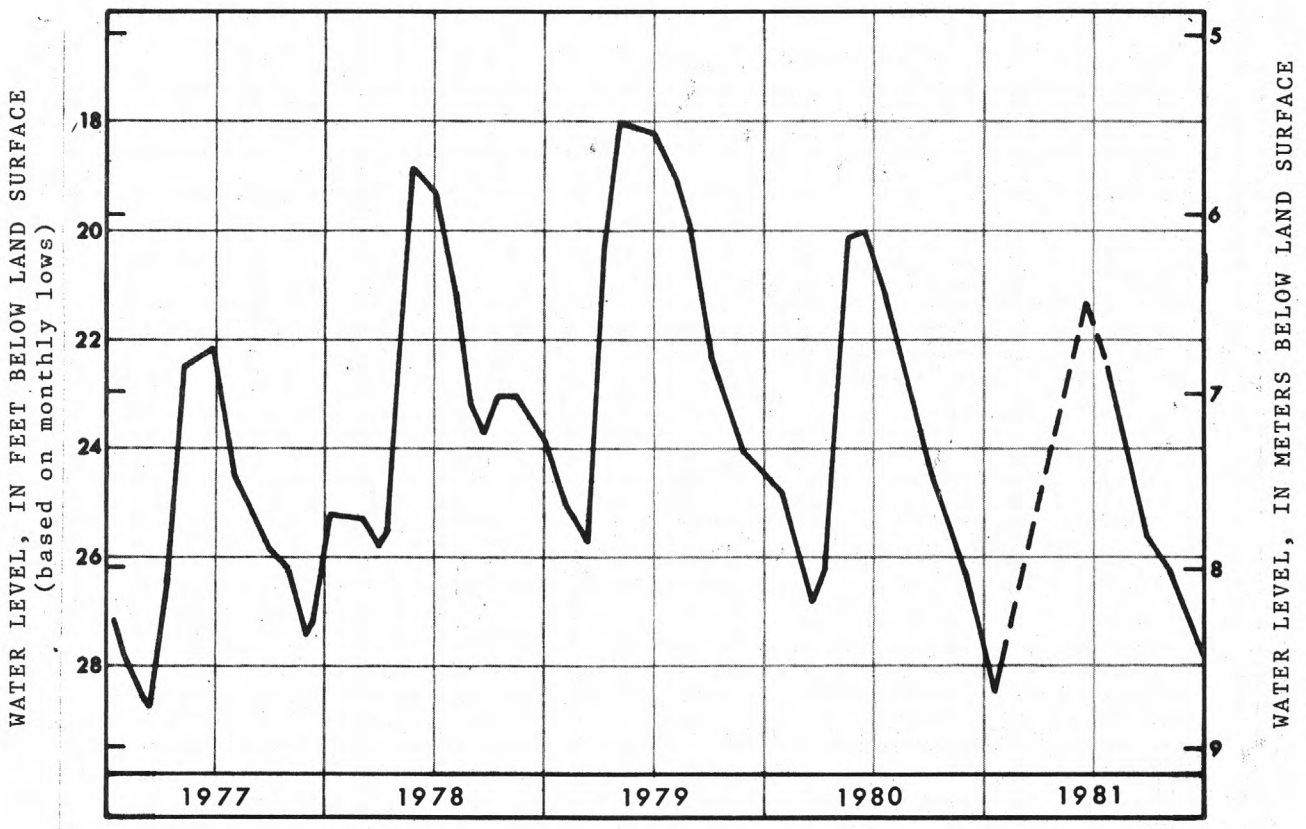


Figure 4.--Water levels in selected wells, 1981.





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

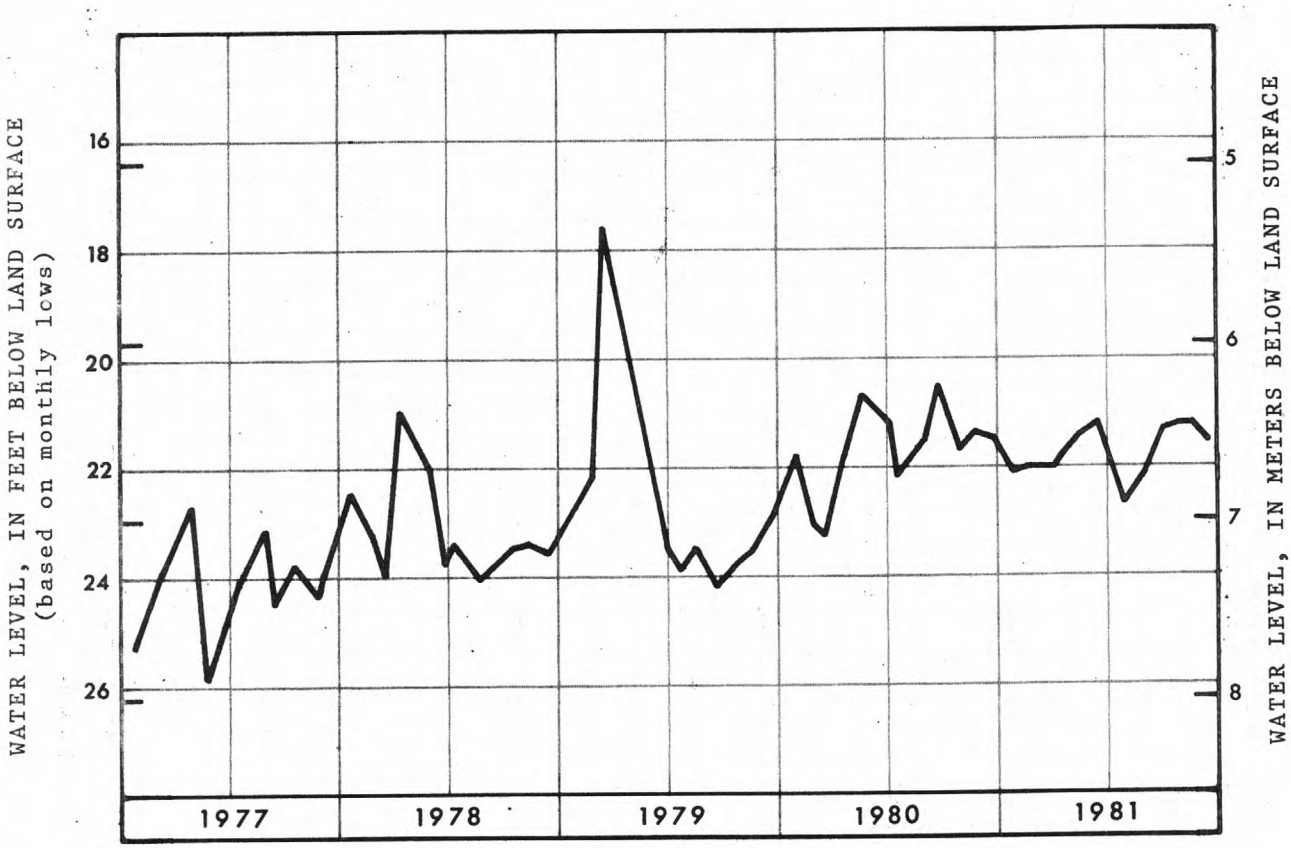
SUPPLY AND SOURCE -- 4 wells, 117 to 129 feet deep, tap glacial deposits.

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.

1981 - 1,122
1980 - 1,169
1979 - 1,209
1978 - 1,223
1977 - 1,154

QUALITY OF WATER -- Hardness 305-320 mg/L
Iron 1.9-2.3 mg/L
Diss. Solids 364-386 mg/L



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

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

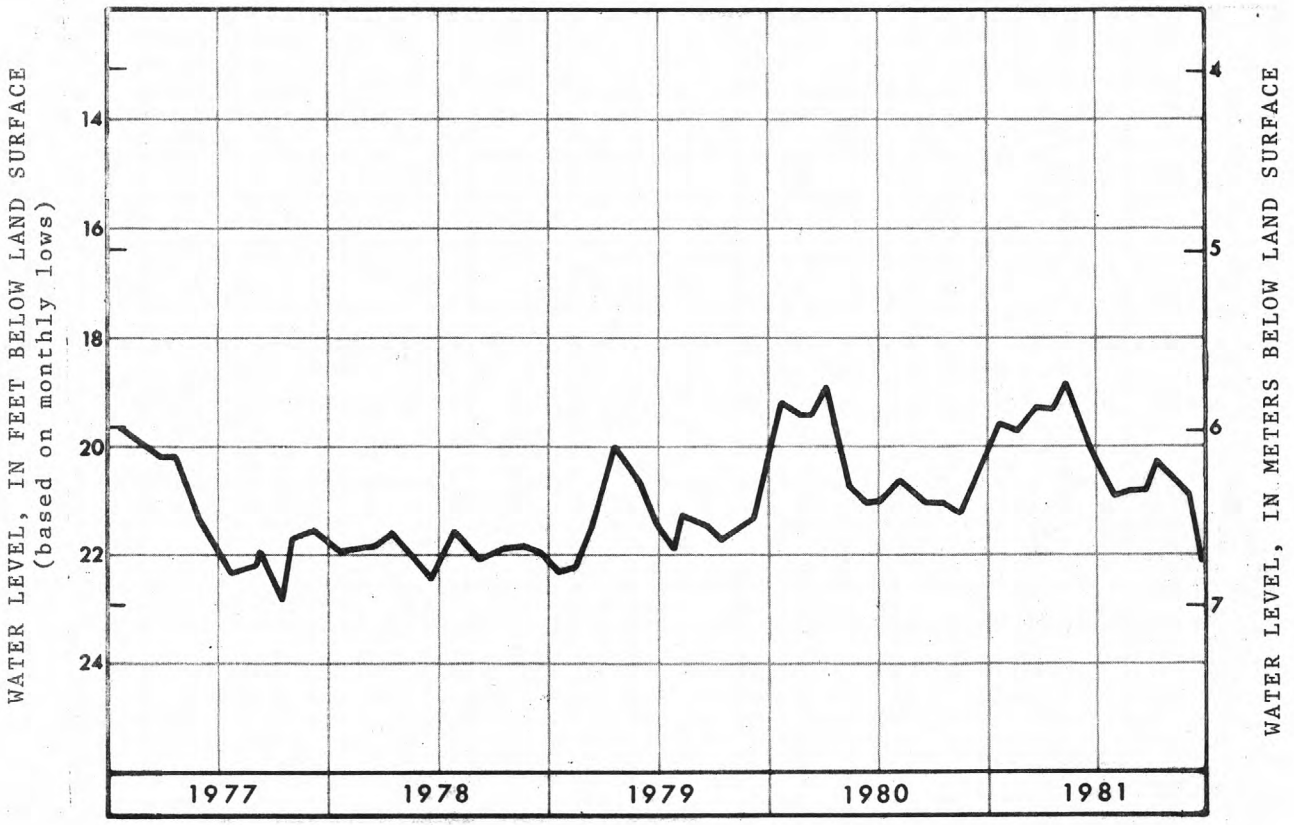
YIELD OF WELLS -- 300 to 1,000 gal/min; specific capacity -- 50 to 650 gal/min/ft of drawdown.

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

1981	2,742
1980	2,836
1979	2,875
1978	2,659
1977	2,443

QUALITY OF WATER --

Hardness	295-345 mg/L
Iron	0.05-1.3 mg/L
Diss. Solids	333-413 mg/L



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

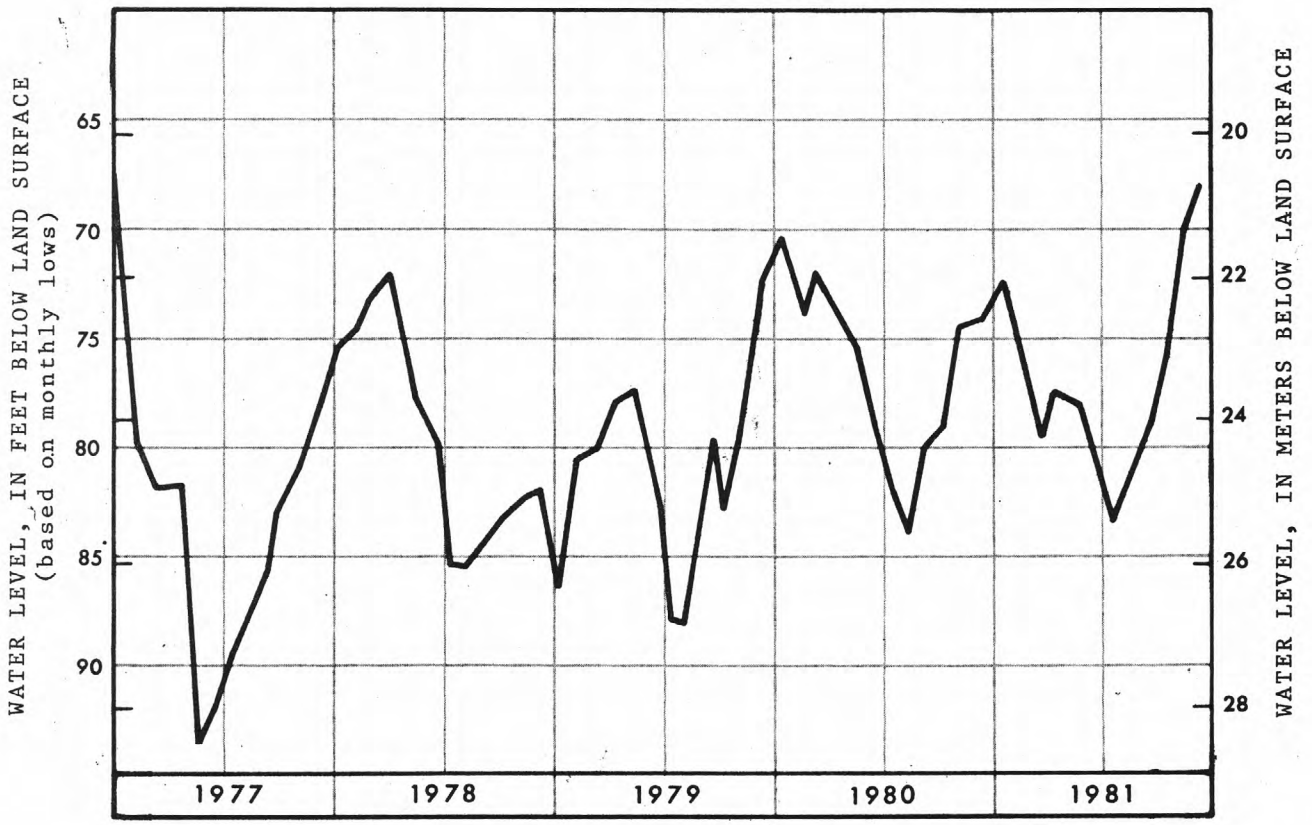
SUPPLY AND SOURCE -- 7 wells, 420 to 525 feet deep, tap sandstones of Saginaw Formation.

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.

1981 - 425
1980 - 423
1979 - 511
1978 - 529
1977 - 607

QUALITY OF WATER -- Hardness 260-310 mg/L
Iron 0.15-1.0 mg/L
Diss. Solids 360-390 mg/L



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

SUPPLY AND SOURCE -- 8 wells, 268 to 423 feet deep, tap Saginaw Formation.

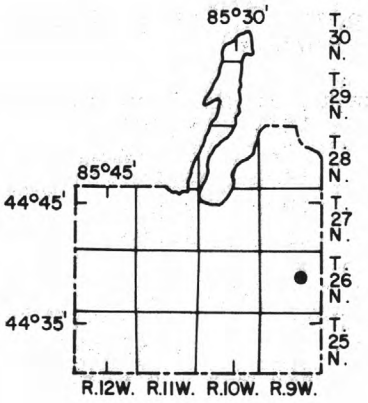
YIELD OF WELLS -- 160 to 700 gal/min.

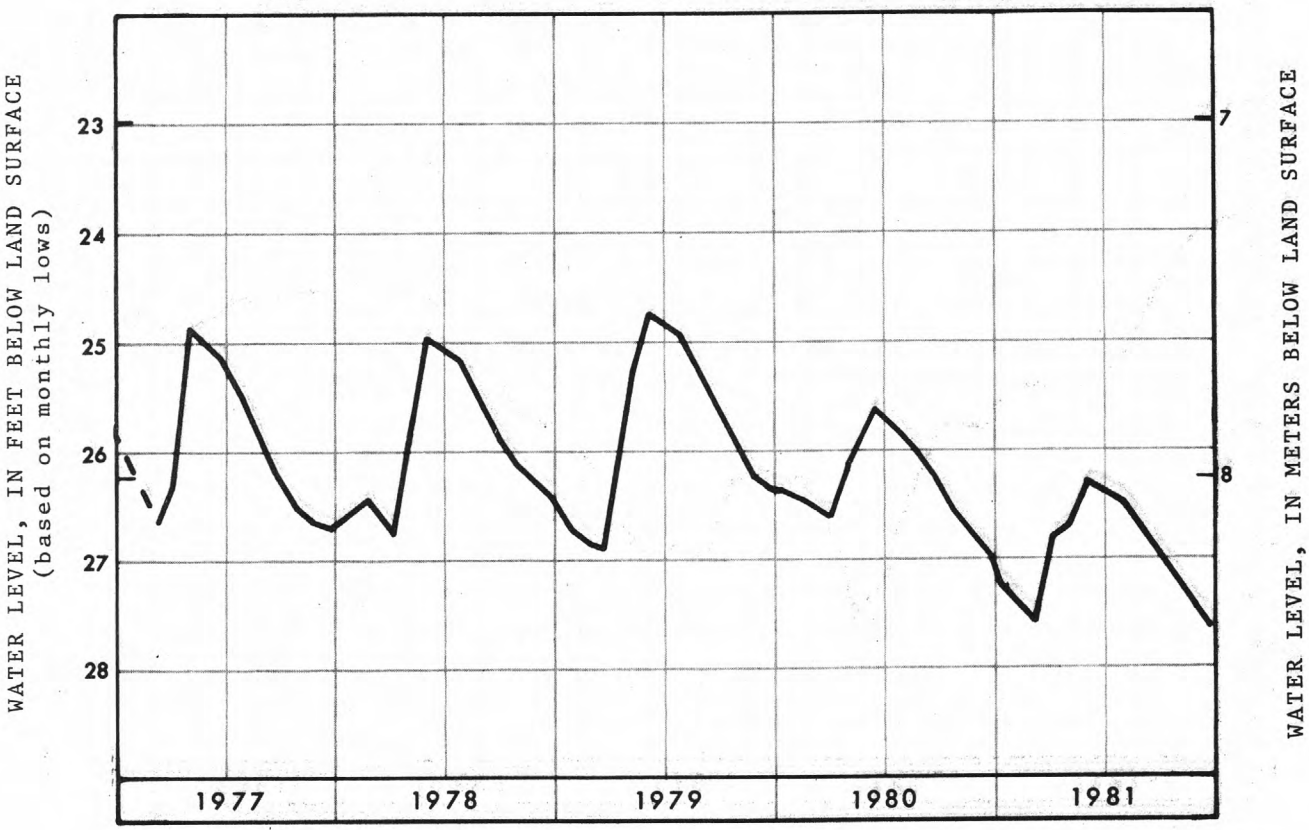
PUMPAGE -- Total annual pumpage, in million gallons, for past 5 years.

1981	844
1980	753
1979	800
1978	771
1977	645

QUALITY OF WATER --

Hardness	275-429 mg/L
Iron	0.4-3.1 mg/L
Diss. Solids	364-539 mg/L





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).

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.

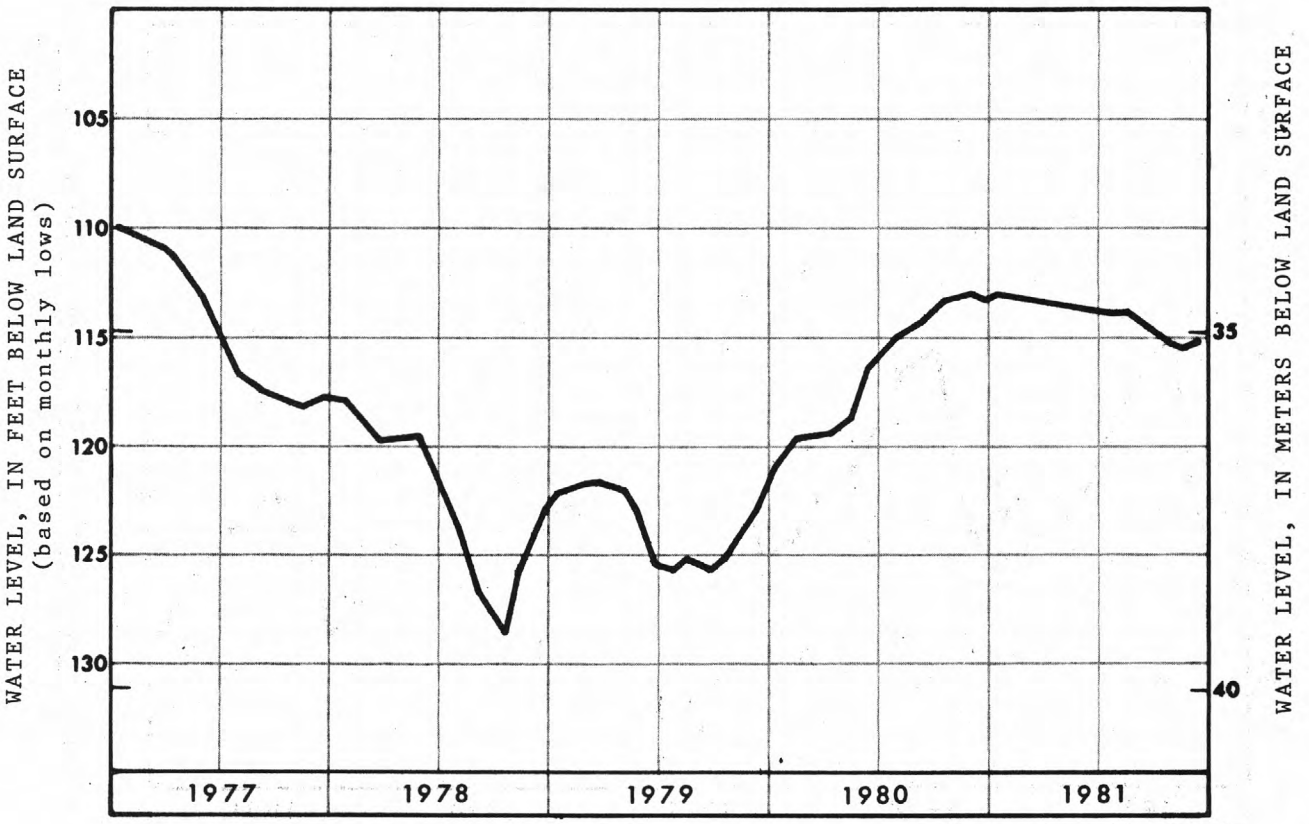
YIELD OF WELLS -- Sandstone - 100 to 700 gal/min; specific capacity --3 to 10 gal/min/ft of drawdown.
-- Glacial deposits - 790 to 1,200 gal/min, specific capacity -- 12 to 80 gal/min/ft of drawdown.

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

1981	8,607
1980	8,592
1979	9,574
1978	9,308
1977	9,203

QUALITY OF WATER -- Composite at Plant

Hardness	385 mg/L
Iron	0.88 mg/L
Diss. Solids	456 mg/L



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

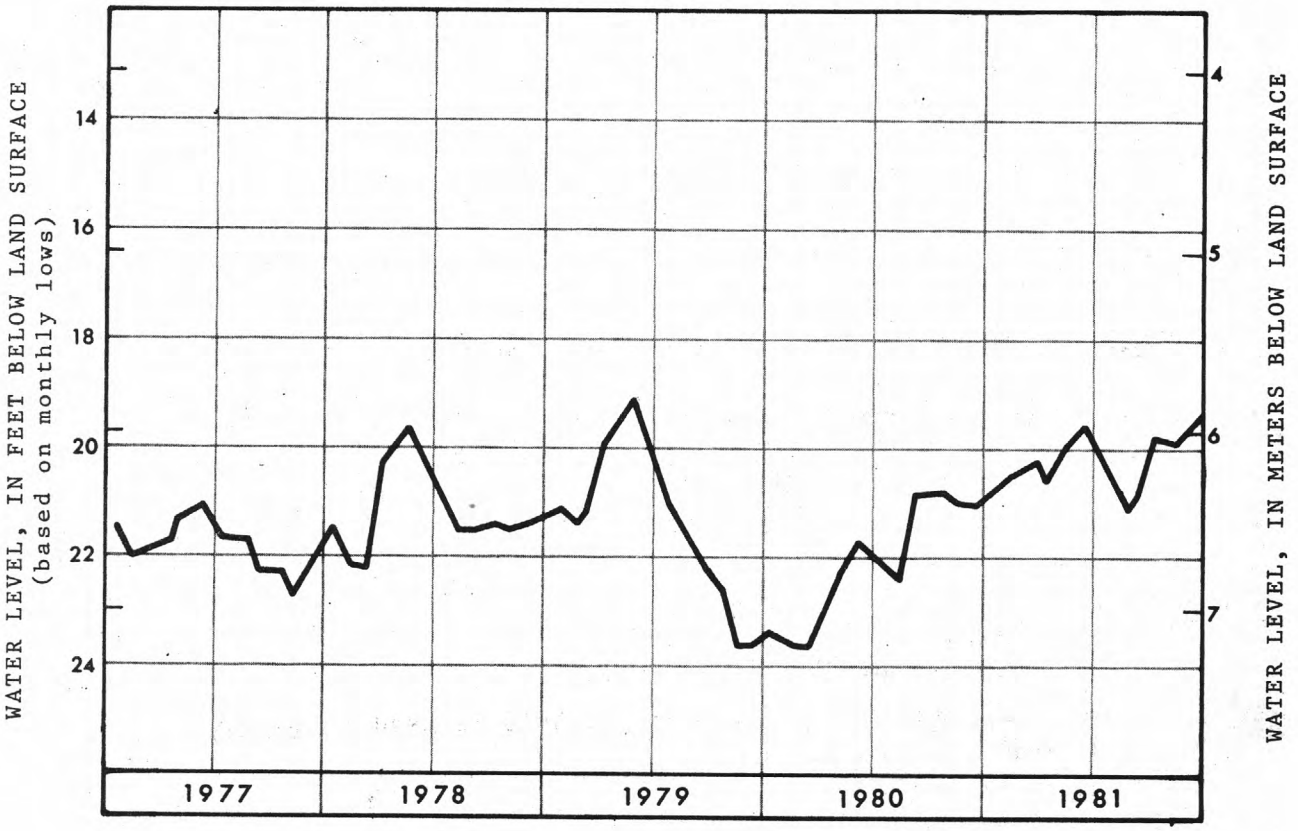
SUPPLY AND SOURCE -- 1 well, about 50 feet deep, taps glacial deposits; 1 well, 223 feet deep, taps sandstones of Saginaw Formation.

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.

1981 - 233
1980 - 217
1979 - 230
1978 - 191
1977 - 206

QUALITY OF WATER -- Hardness 335-464 mg/L
Iron 0.0-0.40 mg/L
Diss. Solids 353-497 mg/L



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

INGHAM COUNTY
EAST LANSING-MERIDIAN WATER AUTHORITY

SUPPLY AND SOURCE -- 24 wells, 295 to 422 feet deep, tap Saginaw Formation; 1 well taps glacial deposits.

YIELD OF WELLS -- 280 to 1,000 gal/min; specific capacity -- 2 to 12 gal/min/ft of drawdown.

PUMPAGE -- Total annual pumpage, in million gallons.

1981	1,916
1980	1,741
1979	1,775
1978	1,702
1977	1,654

QUALITY OF WATER --

Hardness	360-505 mg/L
Iron	0.5-3.8 mg/L
Diss. Solids	386-662 mg/L

INGHAM COUNTY - LANSING TOWNSHIP

SUPPLY AND SOURCE -- 7 wells, 399 to 440 feet deep, tap sandstones of Saginaw Formation.

YIELD OF WELLS -- 260 to 500 gal/min; specific capacity -- 3 to 8 gal/min/ft of drawdown.

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

1981	516
1980	513
1979	532
1978	538
1977	508

QUALITY OF WATER --

Hardness	274-435 mg/L
Iron	0.35-13.0 mg/L
Diss. Solids	320-528 mg/L

REMARKS -- Most ground water pumped by the township is used to supply industrial plants in the area.

INGHAM COUNTY
MICHIGAN STATE UNIVERSITY

SUPPLY AND SOURCE -- 19 wells, 347 to 435 feet deep, tap sandstones of Saginaw Formation; 2 wells are on a standby basis only.

YIELD OF WELLS -- 147 to 654 gal/min; specific capacity -- 1 to 11 gal/min/ft of drawdown.

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

1981	1,643
1980	1,627
1979	1,679
1978	1,698
1977	1,675

QUALITY OF WATER --

Hardness	315-350 mg/L
Iron	0.15-1.20 mg/L
Diss. Solids	361-405 mg/L

KALAMAZOO COUNTY - CITY OF KALAMAZOO

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

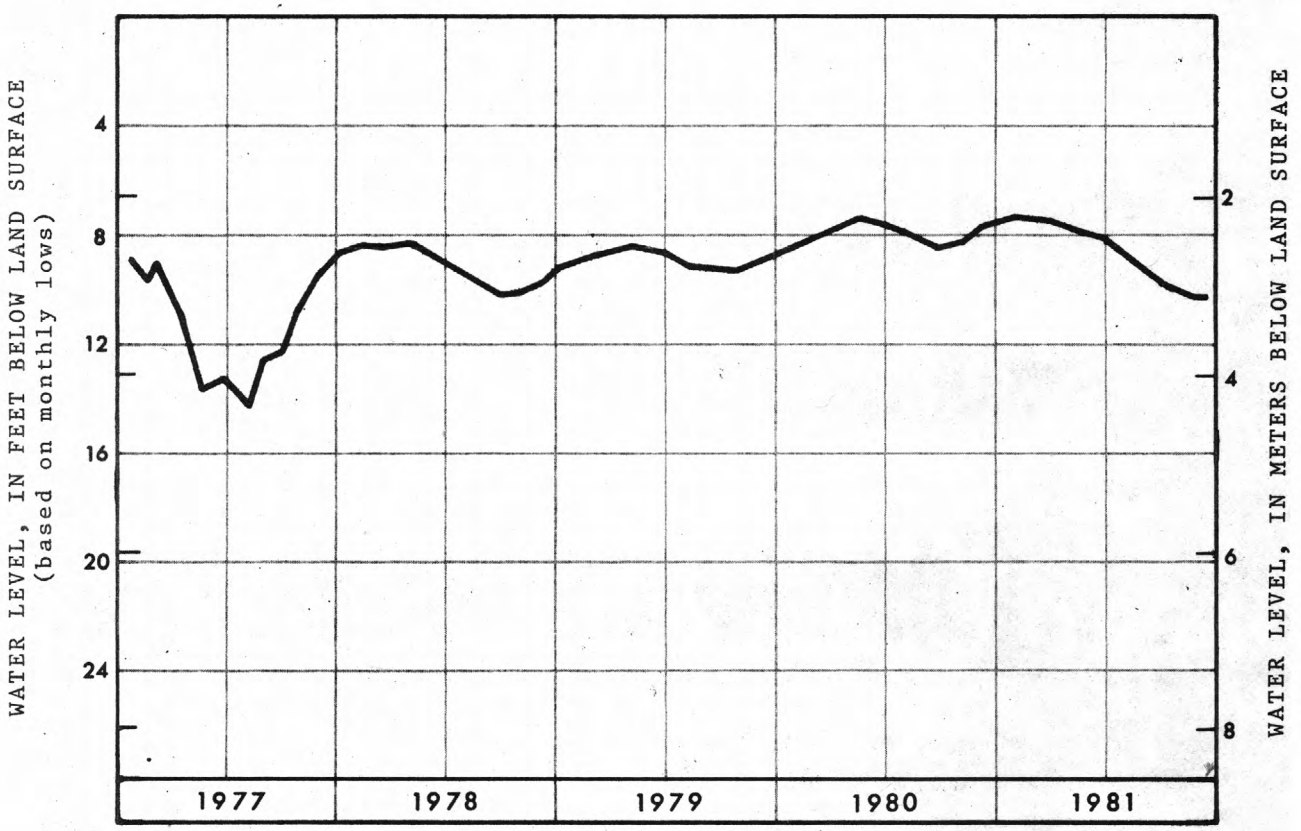
YIELD OF WELLS -- 200 to 2,000 gal/min; specific capacity -- 7 to 100 gal/min/ft of drawdown.

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

1981	6,393
1980	5,774
1979	6,520
1978	6,551
1977	6,476

QUALITY OF WATER -- Composite of 2 pumping stations:

Hardness	385-420	mg/L
Iron	0.49-3.10	mg/L
Diss. Solids	499-530	mg/L



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

KALAMAZOO COUNTY - CITY OF PORTAGE

SUPPLY AND SOURCE -- 15 wells, 92 to 184 feet deep, tap glacial deposits.

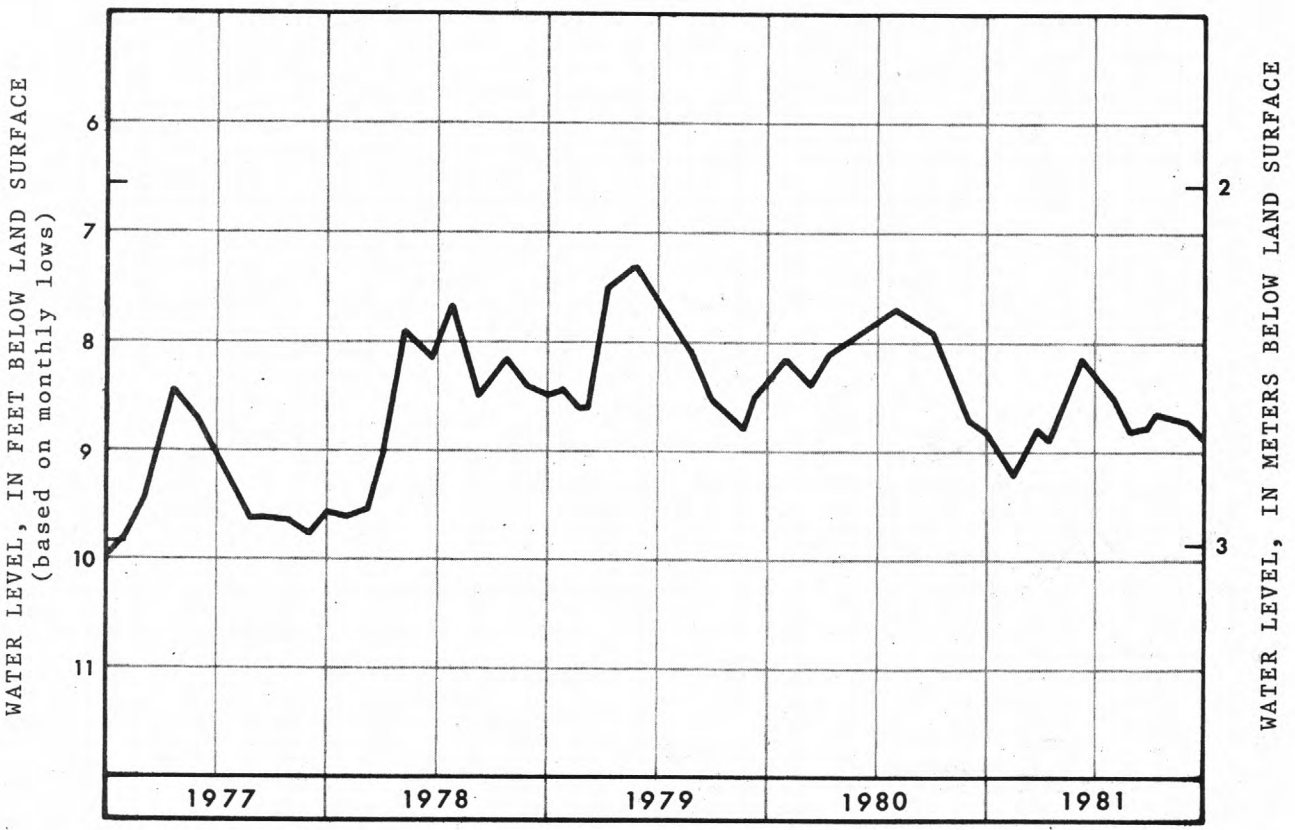
YIELD OF WELLS -- 300 to 1,000 gal/min; specific capacity -- 25 gal/min/ft of drawdown.

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

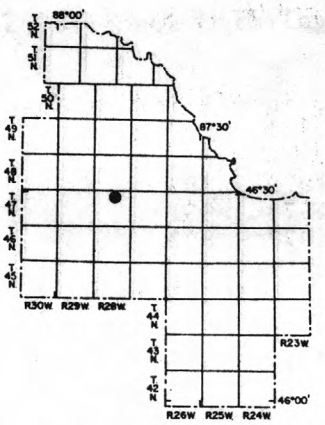
1981	909
1980	811
1979	893
1978	851
1977	802

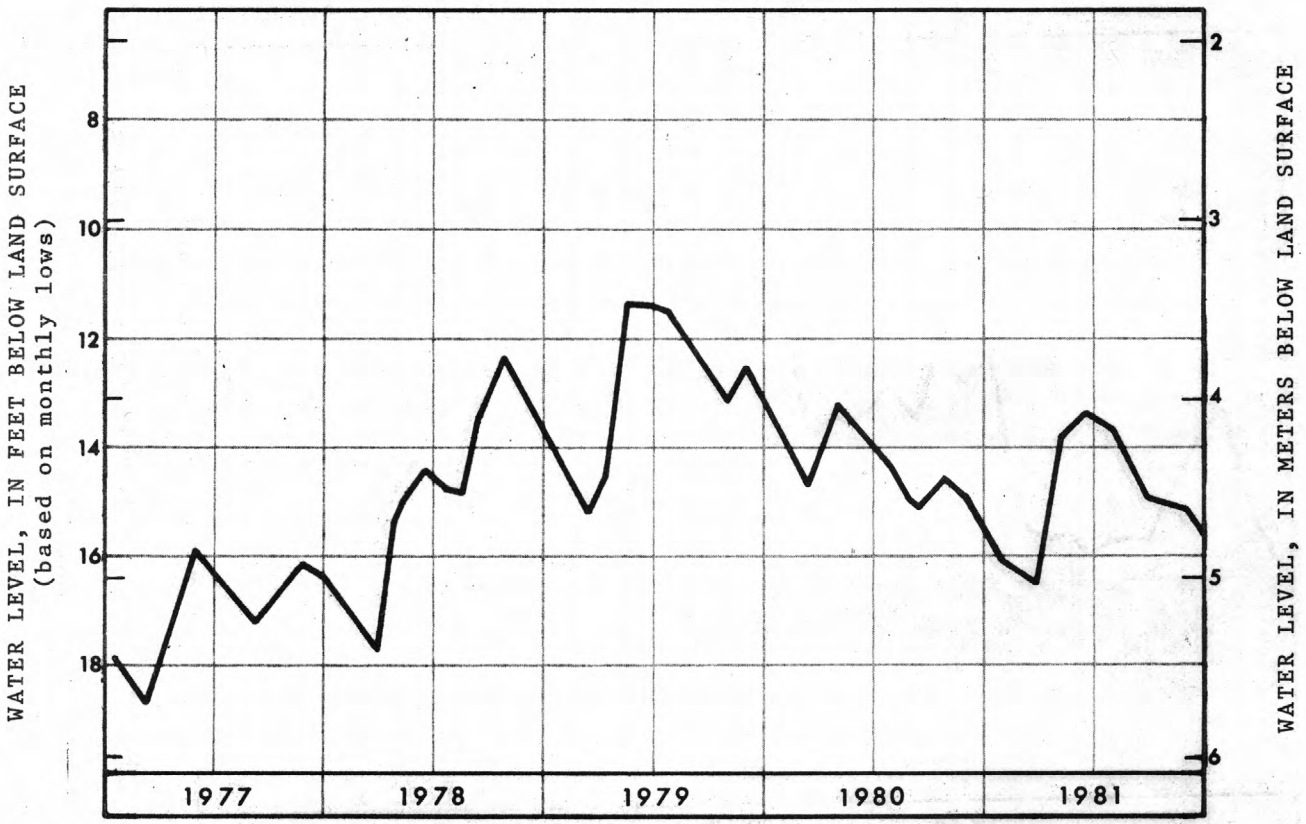
QUALITY OF WATER --

Hardness	185-345 mg/L
Iron	.08-1.2 mg/L
Diss. Solids	206-469 mg/L

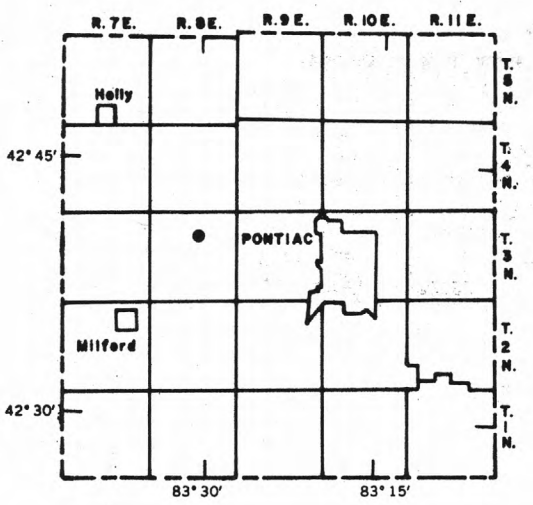


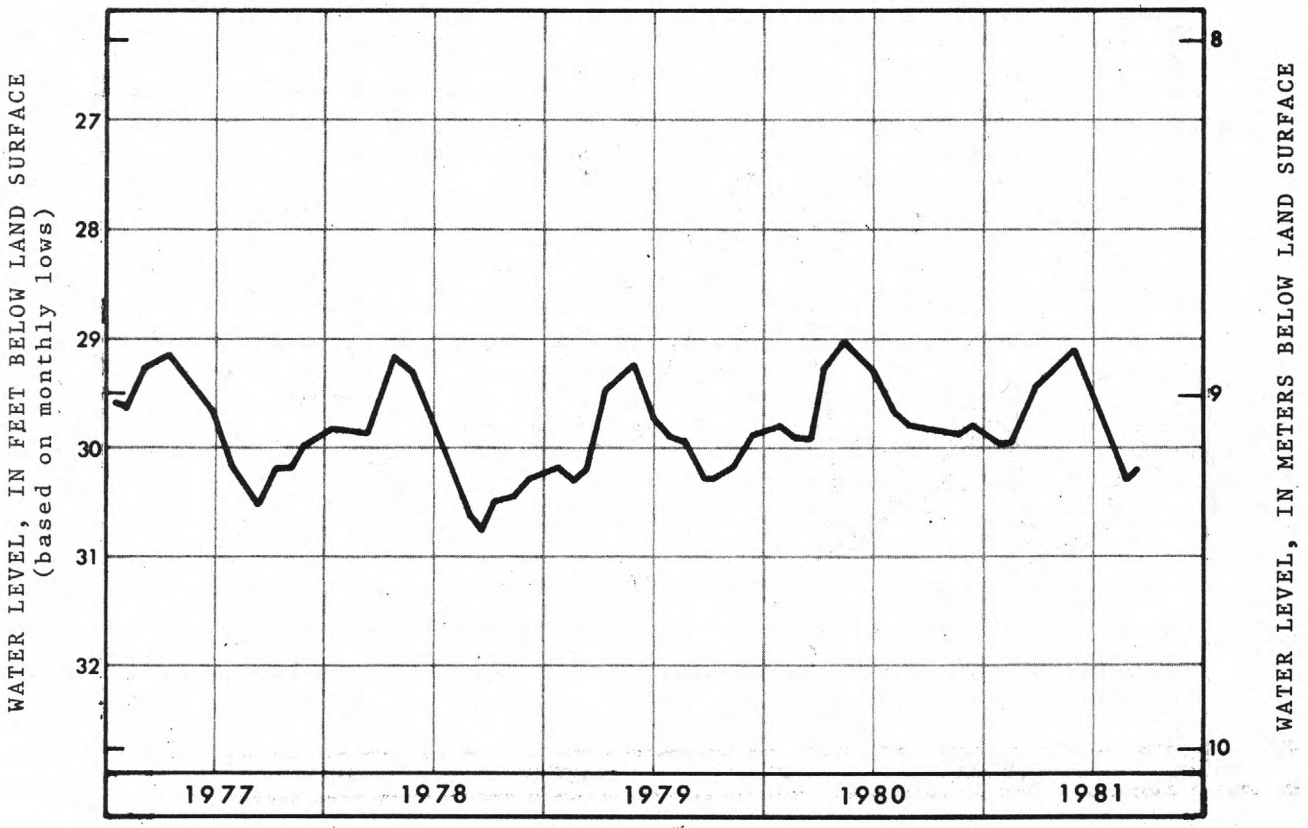
Water levels in well 3S 11W 22BD at Portage. Well is 120 feet deep and in outwash.



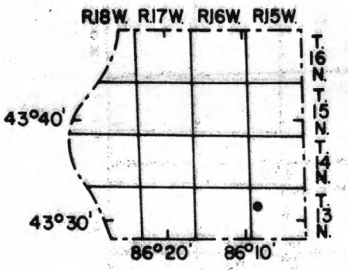


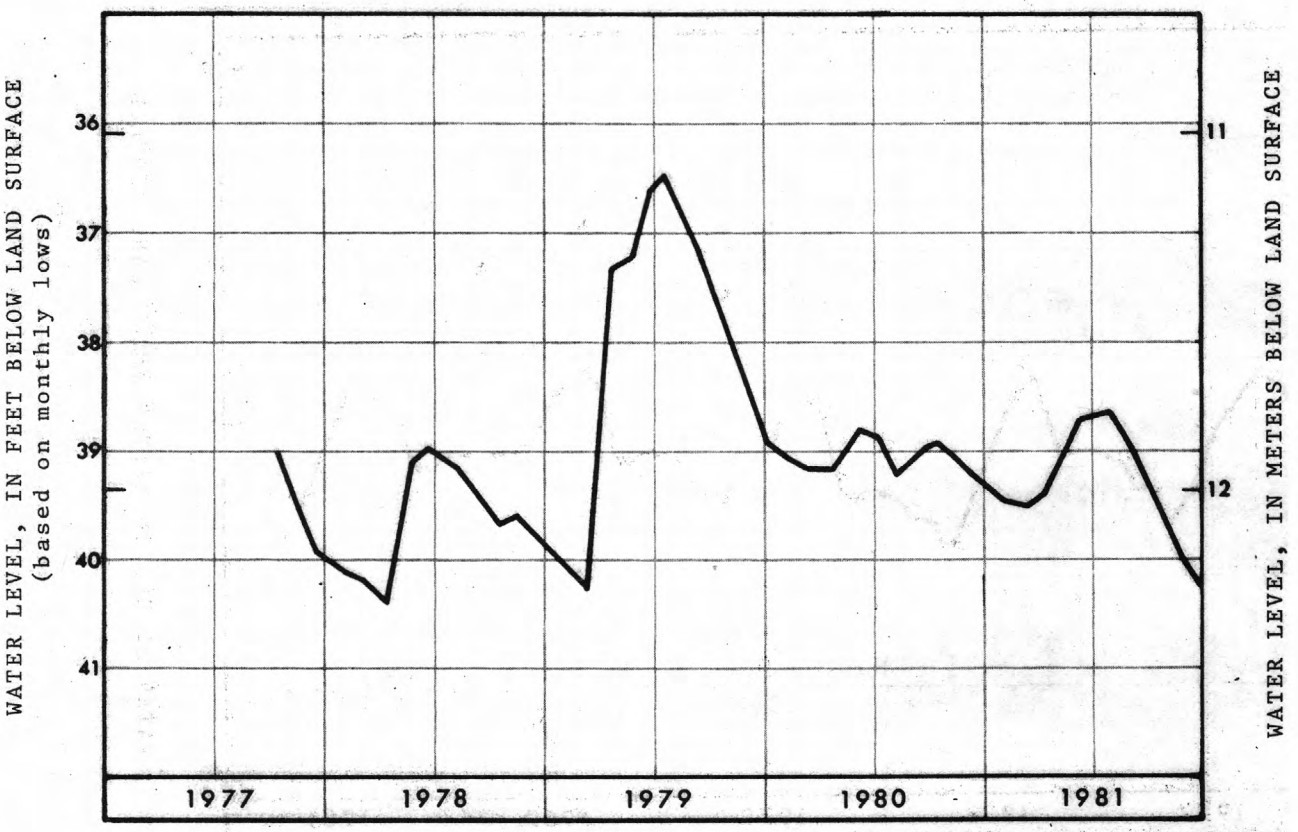
Water levels in well 47N 28W 3CCDC1. Well is 75 feet deep and in outwash. Levels are typical of observation wells in Marquette Iron Range.



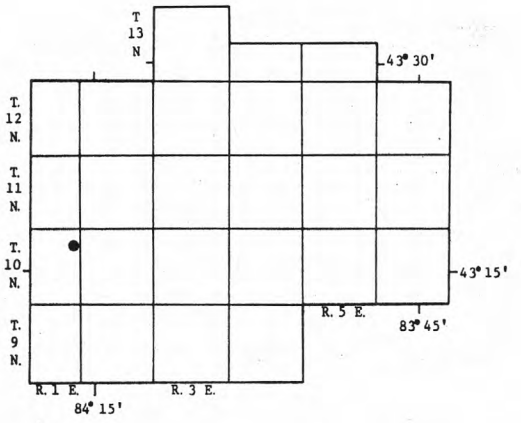


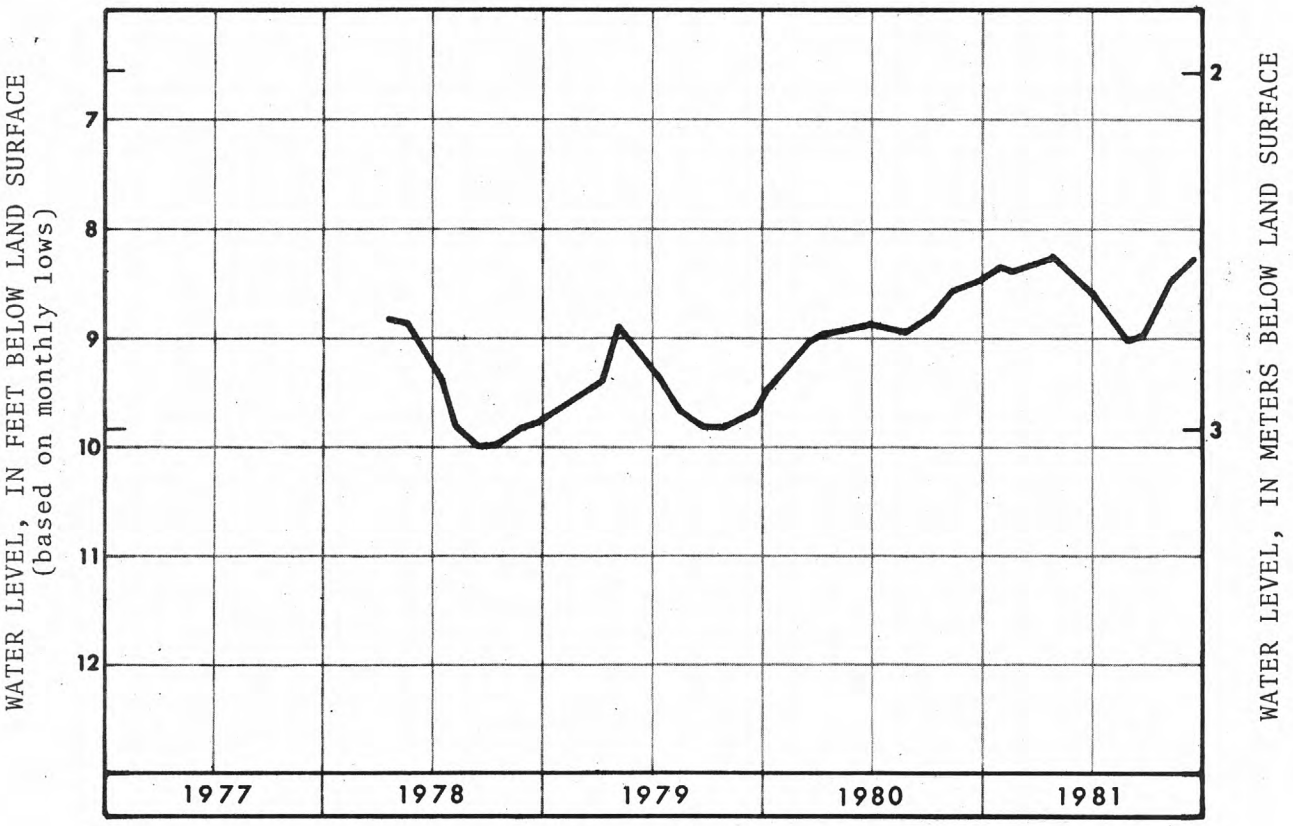
Water levels in well 3N 8E 10AB. Well is 163 feet deep and in glacial deposits.



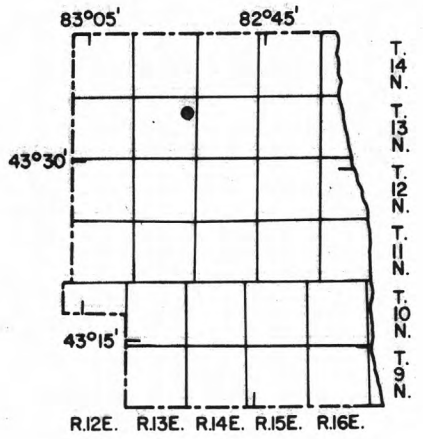


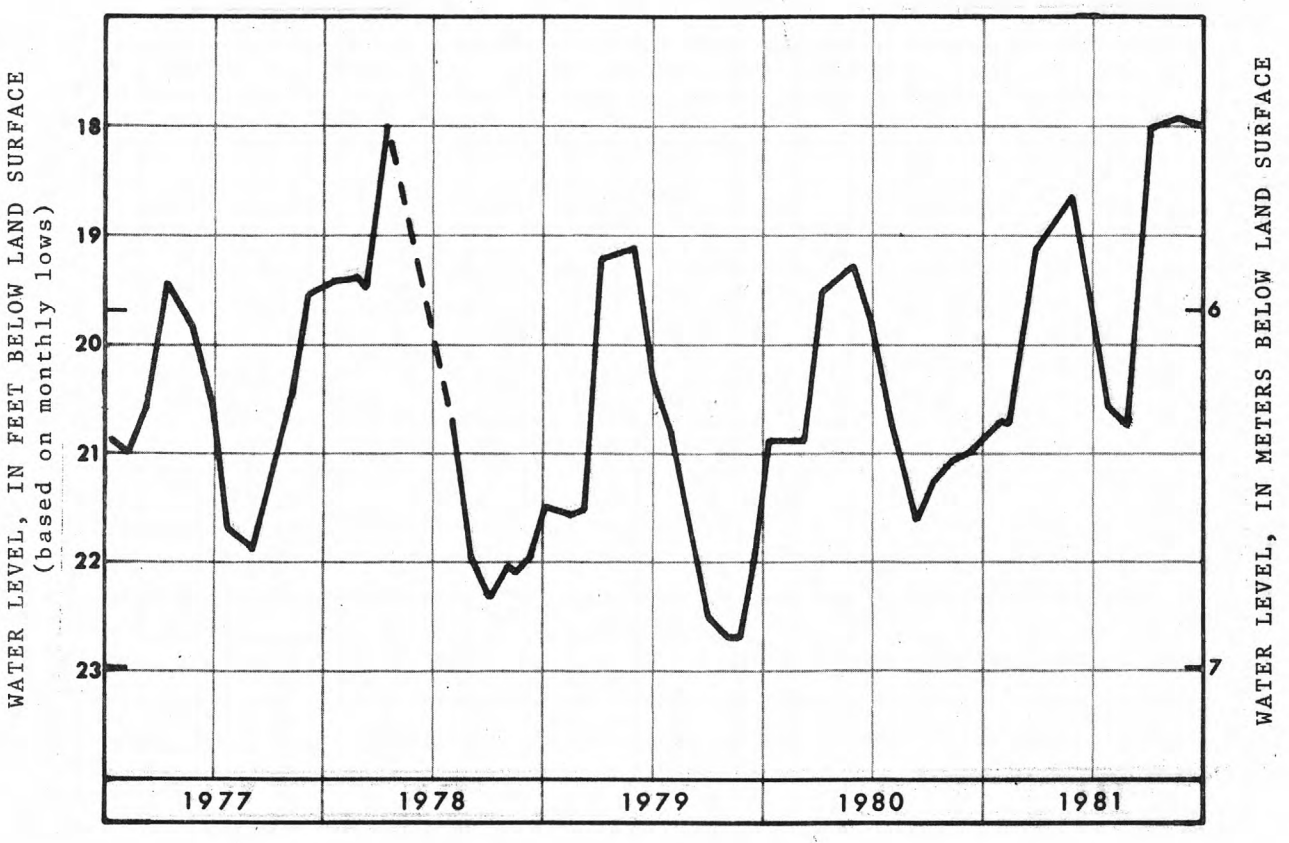
Geological Survey well 13N 15W 18AAAA1. Well is 79 feet deep and in outwash. Water-quality data in ground-water report for 1977 (Huffman, 1979).



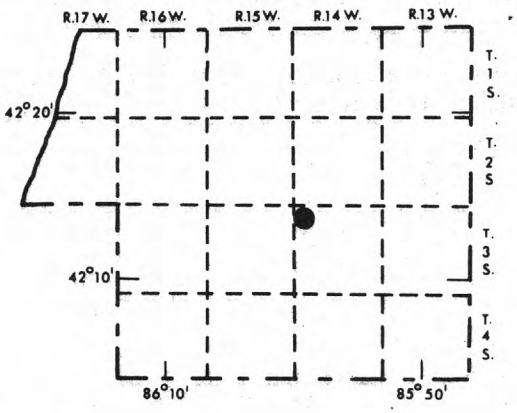


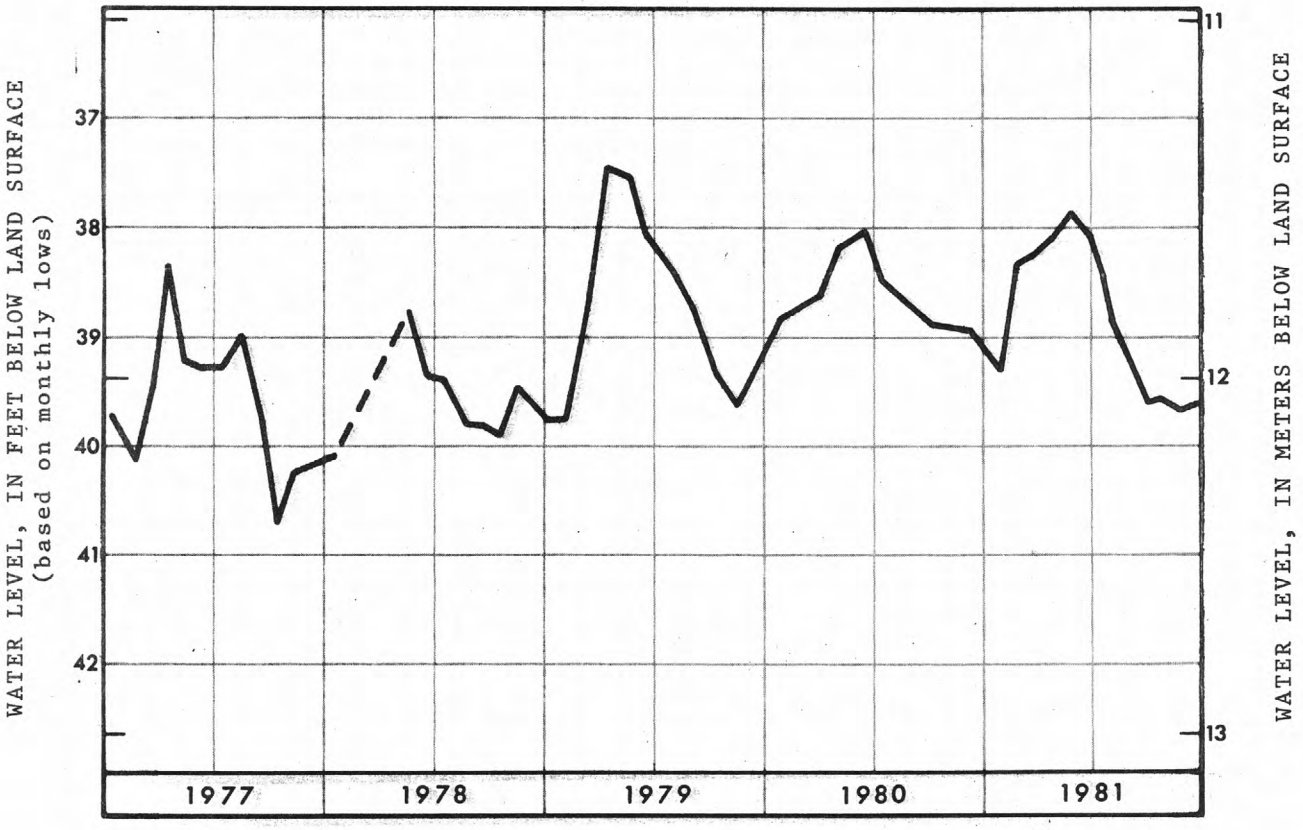
Water levels in well 10N 1E 12ADAA1. Well is 210 feet deep and in Saginaw Formation. Water-quality data in ground-water report for 1977 (Huffman, 1979).





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).





Water levels in well 3S 14W 6BA. Well is 59 feet deep and in glacial deposits.

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

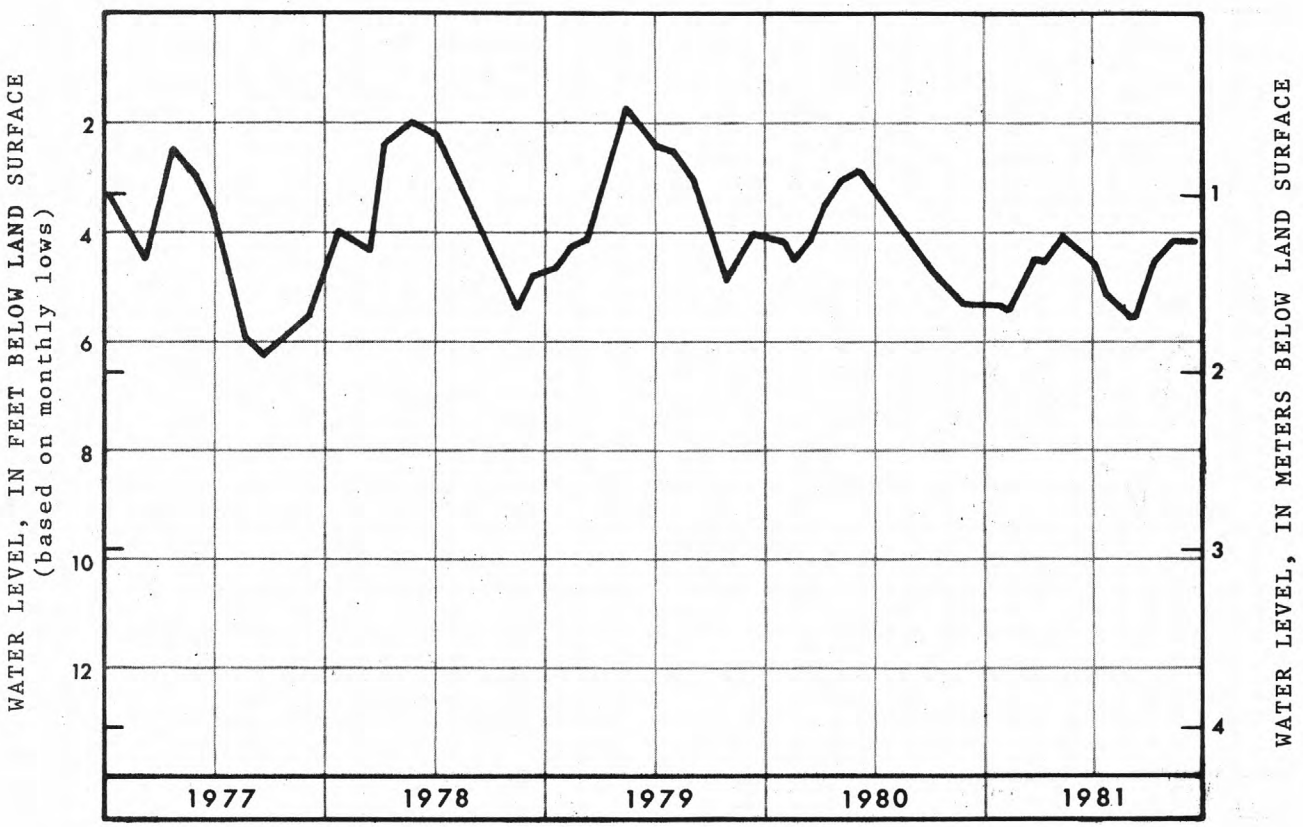
YIELD OF WELLS -- 1,050 to 4,860 gal/min; specific capacity -- 20 to 600 gal/min/ft of drawdown.

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

1981 - 787
1980 - 742
1979 - 372
1978 - 705
1977 - 674

QUALITY OF WATER -- Ground water:

Hardness	355-585 mg/L
Iron	0.25-2.4 mg/L



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.

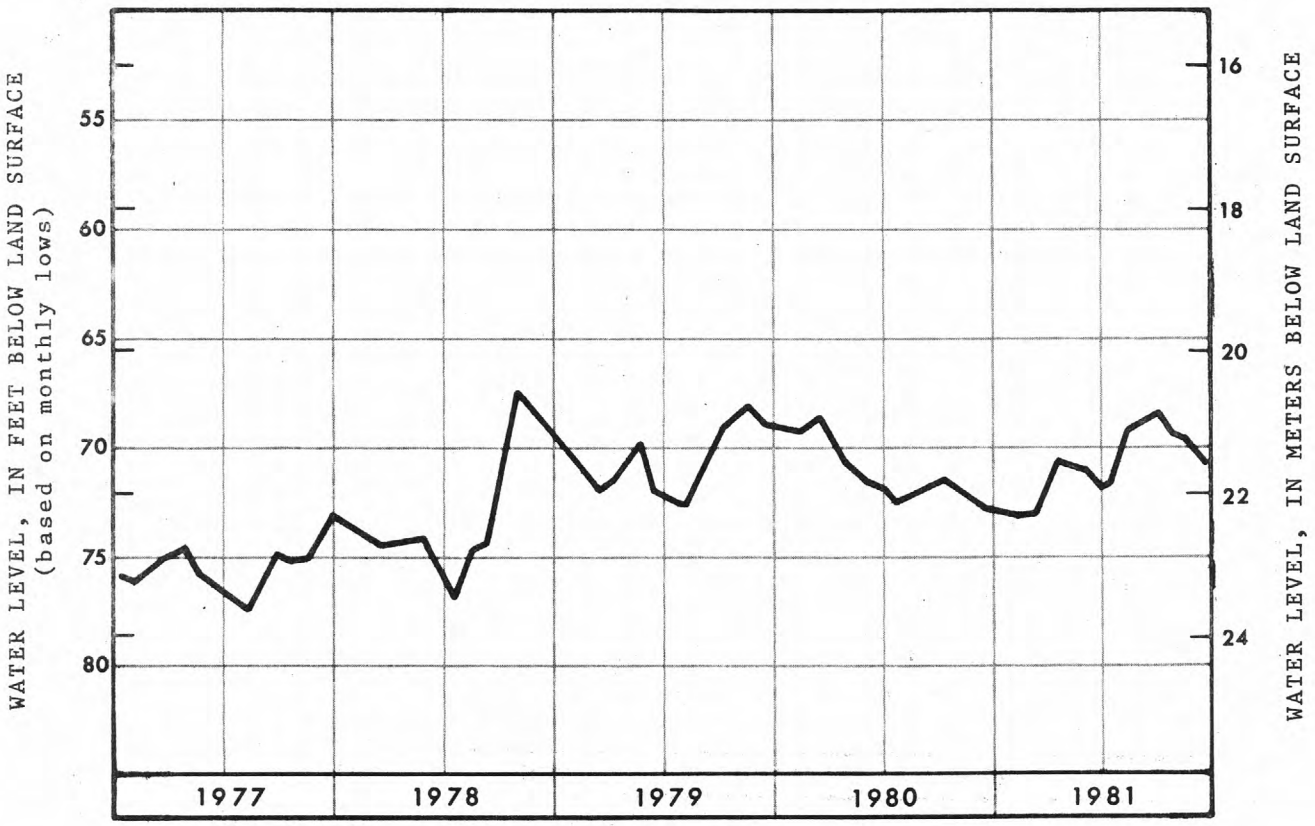
YIELD OF WELLS -- Average 450 gal/min; specific capacity -- 25 to 180 gal/min/ft of drawdown.

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

1981	1,385
1980	1,288
1979	1,140
1978	1,296
1977	1,440

QUALITY OF WATER -- Composite

Hardness	355 mg/L
Iron	0.2 mg/L
Diss. Solids	475 mg/L



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

SUPPLY AND SOURCE -- 9 wells, 50 to 95 feet deep, tap glacial deposits.

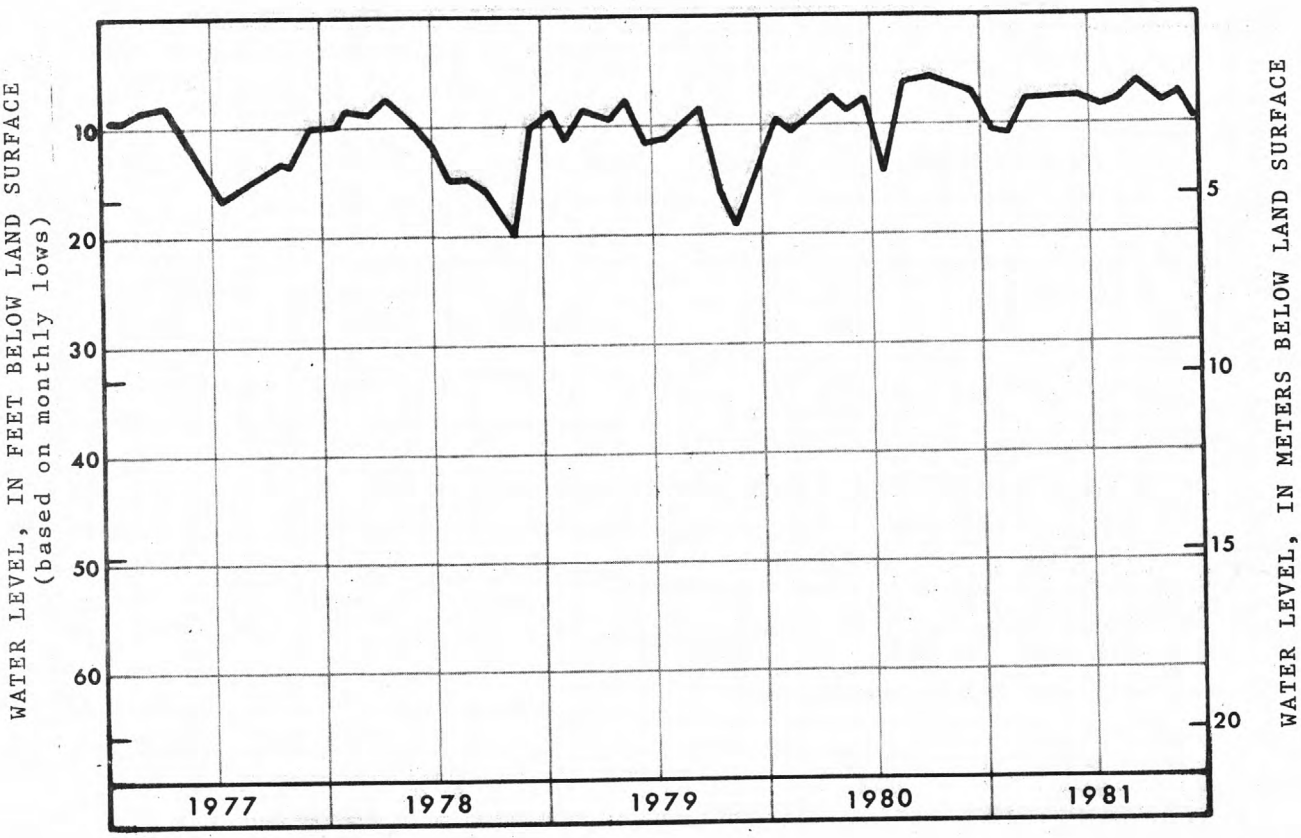
YIELD OF WELLS -- 700 to 3,500 gal/min.

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

1981 -	26
1980 -	32
1979 -	431
1978 -	986
1977 -	792

QUALITY OF WATER -- Composite

Hardness	370 mg/L
Iron	0.5 mg/L
Diss. Solids	496 mg/L



Water levels in well 3S 7E 24CD at Ypsilanti Township. Well is 75 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; HCMA - Huron-Clinton Metropolitan Authority; BCRC - Branch County Road Commission.

AQUIFER:

112GLCL	Glacial deposits	337MRSL	Marshall Formation	361OCVCU	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	355GLINH	Salina Formation	420FRED	Freda Sandstone
324SGNW	Saginaw Formation	355MNSQ	Manistique Dolomite		

ALTITUDE: Land-surface datum in feet above mean sea level.
MEASUREMENTS, 1981 (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. 1981 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 TWP, RANGE, SECT	NAME	DEPTH (FT)	DIAMETER(IN)	AQUIFER	ALTITUDE	YRS. RECORD	MEAS. 1981	OBSERVED WATER-LEVEL EXTREMES				REMARKS
								THROUGH 1980		IN 1981		
								MAXIMUM	MINIMUM	MAXIMUM	MINIMUM	
ALGER												
45N 19W 25BD	CCC	66	6	112GLCL	850	23	Q	6.4 Jun 1960	14.2 Apr 1964	10.8 Jul	11.6 Jan	
ALPENA												
32N 6E 23DDDA1	Alpena State Forest	88	6	112SAND	713	5	R	15.8 May 1979	28.7 Mar 1977	22.0 Jul	28.5 Jan	
ARENAC												
19N 5E 7DABA1	Omer - Deep	185	6	324SGNW	667	2	M	8.3 Jul 1980	10.1 Aug 1980	9.3 Mar	9.8 Sep	
7DABA2	Omer - Shallow	21	6	112GLCL	667	2	M	5.8 Jul 1980	6.9 Aug 1980	4.6 May	6.9 Feb	
BARAGA												
48N 32W 12DD	WMP 14	10	1	112GLCL	1,630	34	M	3.3 Apr 1965	8.1 Sep 1969	6.3 Apr	7.4 Jul	Meas. by WMP
BARRY												
4N 9W 5DA	Solomon Road	131	2	112GLCL	860	18	Q	111.5 Mar 1978	122.0 Mar 1965	116.1 Aug	117.2 Jan	
BAY												
17N 4E 22DCAA1	Pinconning Township	110	6	324SGNW	620	20	M	0.0 Mar 1976	10.5 Aug 1963	1.6 Dec	3.5 Aug	
BRANCH												
6S 6W 18CCCD1	Coldwater Township	56	6	112OTSH	950	18	M	18.3 Mar 1976	28.3 Jul 1964	21.6 Sep	22.7 Jan	
22CA	Coldwater Test 4	113	6	112GLCL	970	18	R	9.0 May 1975	25.9 May 1977	10.4 Aug	22.7 Jul	P
CALHOUN												
1S 7W 10BB	Sabin	12	15	112GLCL	908.0	36	W	0.9 Mar 1950	7.2 Dec 1964	3.1 Mar	4.3 Dec	Meas. by owner
32BDCC1	Penfield Township	95	6	337MRSL	845	18	R	15.6 Apr 1974	27.0 Aug 1964	18.1 May	22.2 Dec	P
32DABD	Battle Creek	127	8	337MRSL	830.8	43	D	0.7 Apr 1950	16.8 Jul 1959	5.2 Apr	10.6 Dec	P, Meas. by owner
2S 6W 25AA	Marshall	59	6	337MRSL	904.8	32	M	5.5 May 1950	9.7 Aug 1964	7.4 May	8.2 Feb	P, Meas. by owner
CASS												
8S 14W 17BA	Little	55	28	112GLCL	840	37	M	46.2 Jul 1950	55.0 Mar 1957	49.1 Oct	51.8 Feb	
CHEBOYGAN												
33N 1W 26FABB1	Pigeon River CCC	164	6	112SAND	933	16	R	56.1 Jun 1979	59.9 Dec 1965	58.8 Jan	59.7 Dec	
39N 3W 29CBCB1	Mackinaw 1	125	6	344DUND	705	3	M	5.2 May 1979	11.3 Dec 1980	6.8 Apr	11.7 Feb	
29CBCB2	Mackinaw 2	55	6	112SDGV	705	3	M	2.1 May 1979	6.1 Dec 1980	3.3 Apr	6.5 Feb	
CHIPPEWA												
46N 4W 24DADA1	Raco	54	6	112OTSH	850	29	R	18.4 Jun 1971	28.4 Apr 1964	23.3 May	26.2 Dec	
CLARE												
17N 4W 34DCAD	Clare	91	4	112GLCL	850	7	R	7.9 Mar 1976	24.9 May 1977	11.3 May	20.3 Jul	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. 1981	OBSERVED WATER-LEVEL EXTREMES THROUGH 1980 MAXIMUM	THROUGH 1980 MINIMUM	IN 1981 MAXIMUM	IN 1981 MINIMUM	REMARKS
CLINTON												
5N 2W 31CBBA1	Capital City Airport	195	6	324SGNW	850	24	R	45.0 Mar 1949	66.4 Jan 1967	56.9 Dec	60.1 Feb	P
32DC	Quarantine Farm	135	4	324SGNW	849.2	38	M	42.0 Sep 1944	99.2 May 1966	84.1 May	84.1 Jan	P
6N 2W 16DD	MSHD, U.S. 27	23	14	112GLCL	803.3	34	M	13.8 Apr 1974	19.9 Feb 1964	17.6 May	18.8 Jan	Federal key well
7N 1W 34CC	Sleepy Hollow 7	32	1	112OTSH	785.3	15	A	17.1 Mar 1973	20.3 Oct 1973	17.3 Apr		
2W 9BBCD	St. Johns	535	6	324SGNW	743.4	18	R	52.2 May 1967	93.7 May 1977	59.0 Jan	83.7 Jul	P
CRAWFORD												
25N 1W 15DDCD1	Eldorado	56	6	112GLCL	1.190	34	R	25.7 May 1976	36.0 Apr 1951	29.6 Sep	31.6 Mar	
DELTA												
39N 23W 28AC	Schemmel	530	5	372MNSG	680	24	R	1.3 May 1960	8.9 Feb 1977	5.1 Apr	6.6 Aug	
41N 18W 31CD	Isabella	250	5	3610DVCU	615	24	M	3.3 Sep 1979	6.4 Feb 1977	4.1 Apr	5.3 Jan	
42N 18W 17ABBD	Cooks CCC	60	6	112GLCL	760	20	Q	21.2 May 1960	28.4 Mar 1966	24.0 Jul	24.8 Jan	
42N 19W 20AA	Pollack CCC	134	6	112GLCL	740	24	Q	23.8 Mar 1960	28.1 Feb 1971	25.4 Jul	25.7 Jan	
43N 19W 24BB	Clarage	405	4	365TBRV	860	24	Q	77.0 Jul 1960	88.8 Oct 1966	79.9 Jul	80.3 Apr	
DICKINSON												
43N 28W 32ADAB1	Felch	31	1	112SAND	1,160	16	M	13.1 May 1972	16.8 May 1968	13.8 Jul	15.4 Jan	
EATON												
3N 3W 2BA	Lansing - Stiefel	66	1	112GLCL	839	18	R	3.1 Mar 1965	18.0 Nov 1968	4.3 Nov	11.1 Jan	P
4N 3W 12CD	Robins Road	381	6	324SGNW	861.9	29	R	67.5 Nov 1953	103.6 Aug 1969	80.6 Nov	100.3 Aug	P
GENESEE												
6N 7E 9DCCC1	Fisher Body No. 2	385	10	324SGNW	837.0	9	R	52.3 Dec 1975	87.0 Jun 1977	56.1 Dec	74.4 Jul	P
GRAND TRAVERSE												
26N 9W 14ABAA1	Fife Lake State Forest	80	6	112SAND	960	5	R	24.3 Sep 1976	26.7 Dec 1977	26.2 Jun	27.6 Dec	
HILLSDALE												
7S 2W 10BDDD1	Pittsford Game Area	20	1	112SAND	1.070	16	M	7.0 May 1978	11.1 Sep 1967	7.2 Sep	8.5 Jan	
7S 2W 15BCBA1	Osseo	150	6	112OTSH	1,095	3	M	47.9 Jun 1979	49.0 Dec 1979	47.0 Oct	48.3 Jan	
INGHAM												
2N 1E 34DB	Dansville Game Area	87	2	112GLCL	930	18	Q	22.4 Apr 1974	29.3 Oct 1964	23.5 Mar	24.2 Oct	
3N 1E 7DD	Lotte	184	3	324SGNW	900	18	M	+2.4 Apr 1974	7.0 Nov 1964	+0.5 Apr	2.4 Aug	
2N 1W 5BCAB1	Mason	210	8	324SGNW	890	18	R	14.7 Mar 1973	23.8 Nov 1964	18.0 Dec	21.1 Aug	P
4N 1W 16DA	Meridian Township	398	4	324SGNW	841.2	14	M	6.3 Mar 1976	15.5 Jun 1979	11.7 Mar	17.3 Aug	P
28BCAD1	Okemos	125	4	324SGNW	865	6	R	18.1 May 1976	24.2 Sep 1978	20.0 May	23.1 Aug	
4N 2W 16DA	Lansing - Cedar	417	12	324SGNW	829.1	37	R	42.0 Mar 1946	67.0 Aug 1949	45.6 Mar	51.2 Dec	P
17AB	Lansing - Logan	424	20	324SGNW	858.7	51	R	34.3 Dec 1929	168.3 May 1968	110.8 Jan	115.4 Nov	P
21BA3	Lansing - Scott Park	400	4	324SGNW	835	3	R	47.6 Nov 1980	58.8 Jun 1979	47.8 Jan	54.0 Aug	P
22BC	Lansing - P-5	338	12	324SGNW	823.6	52	M	7.1 Jul 1932	80.5 Feb 1970	65.5 Jan	78.6 Dec	P
24CA	Spartan Village	453	10	324SGNW	853.4	37	R	25.5 Mar 1946	105.5 May 1972	81.3 Jan	93.6 Oct	P
27BB	Fenner Arboretum	215	6	324SGNW	835	14	R	52.0 Jul 1968	89.5 Oct 1972	66.8 Aug	75.8 Dec	P
31CC	Maybel Street	204	3	324SGNW	880.2	38	M	18.9 Apr 1952	45.9 Jul 1980	40.5 Mar	45.7 Jun	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. 1981	OBSERVED WATER-LEVEL EXTREMES				REMARKS
								THROUGH 1980		IN 1981		
								MAXIMUM	MINIMUM	MAXIMUM	MINIMUM	
IOSCO												
24N 7E 13ADAD1	Oscoda	69	6	112SAND	760	2	M	30.2 Jul 1980	31.3 Dec 1980	31.0 Jul	32.1 Apr	
IRON												
43N 35W 11AD	WMP 23	47	36	112GLCL	1,565	37	M	35.5 Jul 1973	47.1 Aug 1949	36.3 Jul	38.9 Mar	Meas. by WMP
20DC	WMP 25	48	1	112GLCL	1,560	37	M	40.7 Jun 1973	48.3 Aug 1949	42.0 Jul	43.4 Feb	Do.
44N 37W 14BB	CCC Camp	102	6	112GLCL	1,730	23	Q	91.8 Oct 1973	96.7 Oct 1977*	93.0 Jul	95.2 Oct	*Revised 1981
JACKSON												
3S 1W 2BDBA1	Jackson - Hamburg	400	12	324SGNW, 337MRSL	935	16	R	16.3 Jan 1971	68.8 Jun 1971	18.0 Jan	41.5 Aug	P, Disc. 9-81
10DC	Summit Township	323	12	324SGNW, 337MRSL	935	22	R	14.3 Jan 1961	36.5 Jun 1971	15.6 Jan	27.0 Aug	P, Do.
11AA1	Jackson - 4a Belden	360	6	324SGNW, 337MRSL	935	24	D	18.6 Jan 1961	119.1 Jun 1971	42.9 Jan	96.1 Aug	P, Meas. by owner
11AADD2	Jackson - Belden	36	3	112OTSH	928.8	20	R	+1.9 Apr 1977	18.2 Nov 1964	+1.1 Apr	1.8 Jan	Disc. 9-81
KALAMAZOO												
2S 10W 4D	Kalamazoo - Campbell	13	4	112OTSH	836.5	13	M	1.9 Apr 1974	4.2 Nov 1980	3.6 May	6.8 Oct	P
9B	Kalamazoo - Schopnover	21	6	112OTSH	828	13	R	+1.0 Apr 1975	2.5 Nov 1980	1.5 May	4.0 Sep	P
11W 20BB2	Kalamazoo - Kendall	106	4	112OTSH	880	14	R	12.5 Feb 1976	48.4 Jun 1971	17.8 Sep	41.9 Jul	P
22CD	Kalamazoo - Stockbridge	137	4	112OTSH	764.7	22	R	4.8 Feb 1975	31.1 Aug 1961	7.3 Jan	10.2 Dec	P
28AA	Kalamazoo - Maple	245	4	112OTSH	820	13	R	32.9 Jan 1979	61.6 Jun 1973	34.1 Jan	39.3 Jul	P
31CD	Kalamazoo - Colony	226	4	112OTSH	910	13	R	51.1 Jun 1974	71.8 May 1978	52.0 May	52.6 Jul	P
36CB	Kalamazoo - Emerald	226	4	112OTSH	860	13	R	25.7 May 1976	50.4 Jun 1971	27.3 June	41.7 Jul	P
3S11W 4AD1	Kalamazoo - A-D	135	3	112OTSH	854.0	23	R	0.5 May 1967	12.9 Jul 1964	1.5 Mar	10.8 Jul	P
4AD2	Kalamazoo - A-S	40	3	112OTSH	854.0	23	R	+0.2 Sep 1975	9.1 Nov 1959	0.6 Feb	3.6 Aug	P
14AA	Upjohn 28	233	16	112OTSH	870	15	R	25.2 Feb 1976	45.2 Jul 1977	26.8 Dec	42.1 Jun	P
22BD	Portage - Site C	120	8	112OTSH	865	15	R	5.9 Jun 1967	10.2 Nov 1976	8.0 Jun	9.2 Feb	P
12W 11BD	Kalamazoo - Atwater	248	3	112OTSH	880	21	R	+3.0 Sep 1969	1.0 Aug 1977	+0.7 Mar	0.6 Aug	P
11AD1	Kalamazoo - Sabo-D	300	4	112OTSH	877	9	R	4.5 Jul 1973	16.4 Jul 1977	6.0 Feb	17.1 Jul	P
11AD2	Kalamazoo - Sabo-S	38	6	112OTSH	877	9	R	9.1 Aug 1975	12.7 Aug 1977	10.1 Feb	12.6 Jul	P
4S 11W 3CDDA1	Prairie View Park	190	4	112OTSH	870	13	R	18.2 Apr 1979	20.6 Dec 1977	18.8 May	19.7 Feb	
KENT												
5N 12W 4DCCD1	Wyoming - Wolma	86	6	112GRVL	868.0	20	M	7.8 Oct 1978	12.9 Aug 1964	8.6 May	11.0 Aug	
6N 10W 30AA	Kent County Airport	184	10	112GLCL	800	16	R	83.1 Apr 1977	109.7 Jul 1980	83.2 Mar	100.0 Aug	P, Disc. 11-81
12W 17AD1	Alloytek	30	12	112GLCL	606	32	M	6.8 Apr 1965	16.4 Feb 1954	9.6 May	11.8 Nov	P, Meas. by owner
10N 12W 13DD	Rogue River Game Area	30	1	112GLCL	785	16	Q	0.8 Jan 1975	9.2 Oct 1969	0.9 Oct	5.9 Aug	
LAKE												
20N 13W 13ACAC1	Irons	57	6	112OTSH	945	2	M	14.7 Jul 1980	15.8 Dec 1980	15.4 May	17.4 Dec	
LEELANAU												
28N 14W 8DDCA1	Sleeping Bear - D	138	6	112SAND	750	2	M	113.1 Mar 1980	113.5 Jul 1980	113.4 Apr	113.7 Aug	
28N 14W 18BABB1	Sleeping Bear - S	60	6	112SAND	625	2	R	23.2 May 1980	24.0 Sep 1980	23.1 Apr	24.5 Oct	
LENAWEE												
5S 1E 12DD	Onsted Game Area	39	1	112GLCL	1,000	16	M	16.1 May 1975	19.3 Sep 1971	16.6 Jun	17.1 Jan	
6S 4E 8DDBA1	Fisher Body	81	8	112OTSH	800	17	R	11.2 May 1976	18.4 Feb 1965	11.0 Nov	14.2 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. 1981	OBSERVED WATER-LEVEL EXTREMES THROUGH 1980 MAXIMUM	THROUGH 1980 MINIMUM	IN 1981 MAXIMUM	IN 1981 MINIMUM	REMARKS
LIVINGSTON												
1N 6E 13DBAB1	American Aggregate	29	2	112OTSH	930	12	R	12.1 Apr 1974	21.6 Oct 1979	14.2 Nov	16.6 Jan	
2N 6E 31BA2	Brighton	83	10	112GLCL	935	8	R	27.2 Sep 1975	58.6 Jul 1978	28.5 Nov	52.6 May	P
MACKINAC												
41N 5W 23BC	Round Lake CCC	47	6	355SLINH	610	26	Q	4.3 May 1959	17.5 Mar 1959	7.4 Apr	17.8 Feb	
42N 2W 7AABB1	Pontchartrain CCC	102	6	355MNSQ	680	26	R	13.1 May 1960	32.3 Feb 1977	17.9 Apr	30.3 Oct	
MARQUETTE												
46N 25W 16DD	Sands Station	48	1	112GLCL	1,198.4	19	M	27.1 Jul 1969	37.7 May 1964	31.5 Jul	32.8 Apr	Disc. 11-81
47N 25W 20CC	East Cascade Junction	103	1	112GLCL	1,229.8	19	M	78.5 Oct 1973	90.6 Jun 1965	80.7 Jan	82.9 Dec	
32CA	Gentain	122	1	112GLCL	1,239.2	17	M	83.6 Apr 1976	100.0 Oct 1964	91.1 Jan	92.5 Nov	Disc. 11-81
26W 27BC	Laitala	31	1	112GLCL	1,290	14	M	+3.4 Apr 1979	10.1 Oct 1969	1.0 Apr	5.8 Nov	Do.
36BBDB1	C.C. - Goose Lake	56	8	112OTSH	1,210	17	R	3.6 Apr 1969	8.8 Mar 1977	4.8 May	6.7 Feb	Disc. 11-81
28W 3CCDC1	Ely Township	75	8	112OTSH	1,572.0	21	R	9.7 May 1973	19.3 Apr 1964	12.7 Jun	16.5 Mar	Federal key well
48N 29W 30CC	Van Riper Park	78	6	112GLCL	1,560	13	M	9.6 May 1973	15.7 Feb 1977	11.3 May	13.7 Mar	
49N 30W 22AC	WMP 13	17	1	112GLCL	1,680	34	M	0.6 May 1951	13.3 Sep 1948	8.2 Apr	10.3 Aug	Meas. by WMP
MENOMINEE												
37N 26W 19DADA1	Carney	17	4	365TBRV	800	23	Q	3.5 Apr 1979	8.6 Jan 1977	4.8 Jun	5.7 Feb	
MONROE												
7S 6E 15ADEB1	Petersburg Game Area	17	1	112GLCL	675	16	M	3.0 Feb 1966	6.8 Nov 1978	4.2 Nov	5.6 Feb	
7S 6E 15ACAA1	Petersburg - Rock	73	6	348DRRV	680	3	M	35.7 Sep 1980	40.2 Nov 1979	32.6 Nov	37.5 Jan	
MUSKEGON												
11N 15W 34ADDD1	Muskegon Game Area	31	1	112SAND	595	16	Q	+0.2 Apr 1978	4.7 Sep 1972	0.4 Mar	3.7 Aug	
OAKLAND												
2N 7E 5BA	Honeywell Lake Road	44	2	112GLCL	1,020	14	R	23.9 Apr 1976	28.9 Dec 1971	26.5 May	28.0 Jan	
8E 18DBAD1	Proud Lake Park	45	6	112OTSH	910	13	R	2.8 May 1974	6.4 Sep 1971	4.4 Nov	5.6 Aug	P
3N 7E 5DA	Fish Lake Road	49	2	112GLCL	1.055	13	R	29.5 Jun 1976	38.7 Dec 1972	35.4 Nov	36.7 Feb	
8E 3DBAB1	White Lake Road	163	6	112OTSH	1,000	10	R	7.2 May 1976	11.2 Sep 1978	9.0 May	10.7 Aug	Disc. 9-81
10AB	Teggerdine Road	163	6	112GLCL	1,000	10	R	27.8 Mar 1976	30.8 Sep 1978	28.9 Apr	30.3 Aug	Do.
10E 13AC	Oakland University	183	6	112GLCL	940	1	R	56.9 Feb 1978	93.5 Jul 1963	56.9 Apr	58.8 Jul	
5N 8E 8AC	Holly Recreation Area	42	1	112GLCL	930	16	M	22.3 Apr 1974	26.5 Sep 1966	24.6 May	25.9 Aug	
OCEANA												
13N 15W 18AAAA1	Hesperia	79	6	112OTSH	703	4	R	36.6 Jun 1979	40.4 Apr 1978	38.5 Jun	40.3 Dec	
OGEMAW												
23N 1E 2BAAA1	Rose City Road-D	105	1	112GLCL	1,265	14	Q	73.6 Oct 1976	78.2 Apr 1969	75.8 Jan	76.2 Apr	
2BAAA2	Rose City Road-S	20	1	112SAND	1,265	14	Q	7.6 Apr 1976	13.6 Dec 1972	10.0 Jul	12.8 Jan	
ONTONAGON												
46N 38W 30ADDD1	USFS	65	1	112SDGV	1,530	15	M	16.0 Jun 1973	19.7 Mar 1978	16.5 Jun	18.0 Apr	
51N 41W 8BDBC1	Silver City	100	6	420FRED	620	24	Q	8.2 Apr 1959	21.8 Dec 1976	9.7 Jun	11.9 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. 1981	OBSERVED WATER-LEVEL EXTREMES				REMARKS
								THROUGH 1980		IN 1981		
								MAXIMUM	MINIMUM	MAXIMUM	MINIMUM	
OTSEGO												
30N 3W 19ABBB1	Gaylord	90	6	112OTSH	1,308	3	M	30.7 Jul 1979	33.9 Jun 1979	33.4 Jun	34.9 Dec	
PRESQUE ISLE												
33N 6E 8BBBB1	Styma	61	6	341TRVR	800	23	Q	5.1 Mar 1979	18.8 Mar 1963	8.4 Apr	15.5 Feb	
ROSCOMMON												
24N 2W 20BABA1	Exp. Station	14	8	112OTSH	1,145.3	48	R	2.1 Apr 1976	6.2 Dec 1949	3.6 May	5.3 Nov	Federal key well
SAGINAW												
10N 1E 22DADA1	Marion Springs	210	6	324SGNW	657	4	R	8.0 Dec 1980	10.0 Sep 1978	7.9 Feb	9.0 Aug	
SANILAC												
13N 13E 12ADAA1	Minden Game Area	130	6	337MRSL	805	5	R	17.7 Apr 1978	22.7 Oct 1979	17.4 Dec	20.8 Aug	
SCHOOLCRAFT												
45N 13W 16CCCB1	Seney	154	4	361ODVCU	710	30	R	4.6 Apr 1971	6.5 Oct 1963	5.0 Apr	6.0 Sep	
47N 16W 30BBBB1	Cusino CCC	57	6	368PRDC	900	25	R	5.7 May 1960	16.4 Feb 1977	7.6 Apr	15.3 Oct	
VAN BUREN												
3S 14W 6BA	Martin	59	1	112GLCL	740	19	M	37.2 May 1974	43.3 Nov 1964	37.9 May	39.7 May	
WASHTENAW												
2S 3E 9DAAB2	Waterloo Park	48	6	112SDGV	970	13	R	4.1 May 1974	7.0 Aug 1971	4.5 Feb	6.0 Jul	P
3S 6E 16BCCD1	Ann Arbor	55	10	112GLCL	821.5	19	R	0.7 Mar 1974	15.9 Oct 1964	3.4 Jun	5.5 Aug	P
7E 5BB	Ypsilanti - Superior	69	8	112GLCL	720	20	R	1.8 Feb 1965	21.4 Dec 1965	2.1 Feb	14.3 Aug	P
9AD	Ypsilanti - Gilbert	94	6	112GLCL	710	31	R	29.1 Nov 1945	78.8 Oct 1974	66.7 Aug	73.1 Jan	P
24CA1	Ypsilanti Township 104	87	4	112GLCL	665.6	36	R	5.8 Jan 1950	22.7 Feb 1971	12.2 Oct	15.1 Jan	P
24CD	Ypsilanti Township 117	75	6	112GLCL	657.8	35	R	5.3 May 1978	63.2 Feb 1970	4.7 Oct	10.8 Jan	P
WEXFORD												
22N 12W 13BA	Harrietta Fish Hatchery	141	4	112GLCL	1,060	21	R	+13.8 Mar 1970	1.1 Feb 1980	+3.1 Aug	1.6 Jan	P

TABLE 2. REPORTED GROUND-WATER PUMPAGE, IN 1981 (IN MILLIONS OF GALLONS)

COUNTY AND WATER USER	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	1981 TOTAL	MAX DAY	MIN DAY
ALCONA															
Harrisville	2.1	1.6	1.3	1.2	1.4	1.6	2.6	2.2	2.0	1.6	1.6	1.8	21.0	.104	.019
ALGER															
Burt Twp.	2.2	3.0	3.0	2.6	2.6	2.8	4.1	3.5	2.6	2.4	2.7	3.2	34.7	--	--
Chatham	1.2	1.1	1.2	1.3	1.0	.8	1.3	1.4	.7	.7	.7	.8	12.2	--	--
ALLEGAN															
Allegan	24.8	22.4	24.3	24.7	29.8	32.5	49.1	37.6	36.1	29.1	26.8	23.2	360.4	1.864	.442
Douglas	3.9	4.1	5.0	5.4	7.7	8.3	6.3	5.2	4.6	3.7	3.7	4.0	61.9	--	--
Fennville	16.9	15.3	8.3	5.1	15.6	12.2	24.3	26.6	35.8	27.3	26.8	20.6	234.8	--	--
Otsego	31.2	26.9	29.1	28.9	33.8	35.5	36.7	35.9	31.4	34.3	31.1	33.9	388.7	--	--
Plainwell	14.1	12.9	14.8	14.3	19.1	16.5	22.6	19.5	17.0	16.2	16.0	15.8	198.8	1.120	.341
Saugatuck	7.1	7.2	9.4	9.8	13.3	15.0	11.1	8.6	7.2	5.7	5.1	5.3	104.8	--	--
ANTRIM															
Bellaire	4.0	3.7	4.0	3.8	4.3	5.3	6.6	5.2	4.4	4.4	4.3	--	50.0	.262	.120
Central Lake													50.7	.360	.106
Ellsworth	.3	.9	1.1	1.3	1.4	1.4	2.5	1.6	1.7	.9	1.7	.6	15.4	.401	.010
Mancelona	11.0	11.0	11.1	9.9	6.4	9.8	14.5	11.7	8.5	29.2	11.0	7.9	142.0	--	.125
BARRY															
Hastings	26.9	21.6	23.9	27.6	31.9	30.6	39.4	36.7	27.1	24.1	21.3	24.3	335.4	2.065	.555
Middleville	14.9	14.7	14.7	14.5	13.6	10.0	15.9	13.3	12.5	12.5	10.0	9.9	156.5	--	--
Nashville	3.7	3.0	3.3	3.3	3.6	3.6	3.6	3.6	3.2	3.3	3.1	3.3	40.6	.190	.051
BENZIE															
Beulah	2.0	1.4	1.5	1.5	1.4	1.9	3.0	2.7	1.5	1.3	1.1	1.0	20.3	--	--
Frankfort	6.7	6.2	6.7	6.2	8.0	8.4	13.0	9.8	6.5	5.7	5.2	6.0	88.4	--	--
BERRIEN															
Buchanan	42.3	38.8	42.2	41.7	45.0	45.5	51.4	46.5	41.9	45.9	43.1	41.6	525.9	2.140	1.009
Coloma	13.4	11.0	10.2	7.6	9.1	13.0	15.1	14.1	12.2	17.0	16.3	11.6	150.6	.717	.174
Niles	71.8	64.2	73.1	75.8	75.2	78.8	85.6	86.5	73.9	71.4	67.4	68.0	891.7	4.900	1.210
Niles Twp.	3.8	3.3	3.6	3.6	4.8	5.3	8.2	5.6	3.9	3.4	3.1	3.4	52.0	.481	.011
Watervliet	5.5	4.9	5.6	5.8	6.1	6.5	8.0	7.8	6.2	6.0	6.1	5.8	74.3	.428	.149
BRANCH															
Bronson	25.0	21.7	27.1	29.2	33.6	35.4	30.7	30.8	29.7	31.7	25.7	25.6	346.2	1.631	.492
Coldwater	92.2	81.8	88.6	84.6	94.2	103.2	125.1	111.4	95.9	89.0	80.4	75.4	1,121.8	5.471	1.849
Quincy	7.0	6.7	7.4	8.0	8.1	7.5	8.1	7.4	6.6	5.6	6.0	5.4	83.8	--	--
Reg. Center Dev. Disab.	5.2	4.6	4.5	4.2	4.5	4.4	4.6	4.7	4.4	4.6	4.6	4.8	55.1	--	--
CALHOUN															
Albion	72.3	69.4	73.0	72.3	79.6	86.5	88.6	87.7	90.6	87.1	75.7	70.7	953.5	5.776	1.345
Athens	2.8	2.4	2.3	5.7	2.7	3.2	6.1	5.5	2.7	2.2	2.4	4.0	42.0	.400	.004
Battle Creek	239.2	214.6	239.4	248.8	251.3	244.4	275.3	245.4	202.4	184.3	182.0	214.8	2,741.9	11.750	4.200
Homer	4.7	4.8	5.0	4.6	5.2	4.9	5.2	4.7	4.5	4.2	3.8	3.9	55.5	.243	.082
Marshall	32.9	30.1	33.5	32.9	34.5	37.1	41.9	38.7	36.3	36.4	30.7	32.3	417.3	1.922	.624
CASS															
Cassopolis	4.1	4.3	4.2	4.0	4.7	4.9	5.1	6.4	6.6	6.2	5.9	5.4	61.8	.356	--
Dowagiac	24.8	23.5	24.6	24.0	24.4	26.3	33.9	28.4	24.8	25.7	24.4	23.4	308.2	1.894	.190
CHARLEVOIX															
Boyne City	13.5	13.3	13.5	13.0	13.0	13.7	16.8	15.5	16.0	12.9	12.1	12.8	166.1	.850	.263
East Jordan	15.7	13.3	13.3	13.6	15.9	17.8	22.6	21.1	17.4	15.4	13.6	12.1	191.8	.940	.290
CHEBOYGAN															
Cheboygan	42.0	26.0	1.3	15.0	16.0	10.0	20.0	17.3	17.4	17.0	15.3	16.4	213.7	1.382	--
Mackinaw City	2.6	2.8	3.4	3.3	6.1	7.8	13.5	13.1	7.7	6.1	4.3	3.6	74.3	.528	.061
CHIPPEWA															
Kincheloe AFB	15.1	13.6	15.2	14.3	17.7	14.4	28.0	25.3	20.5	20.3	16.9	19.4	220.7	1.395	.363

TABLE 2. REPORTED GROUND-WATER PUMPAGE, IN 1981 (IN MILLIONS OF GALLONS)-CONTINUED

COUNTY AND WATER USER	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	1981 TOTAL	MAX DAY	MIN DAY
CLARE															
Clare	19.4	17.2	20.0	22.5	21.5	31.1	30.0	24.7	19.4	18.5	17.2	18.5	260.0	1.237	.392
Farwell													55.2	.330	.060
Harrison	4.1	6.3	4.2	6.0	7.2	7.3	9.6	7.9	6.2	5.0	4.7	5.5	74.0	.535	--
CLINTON															
Fowler	2.3	1.8	1.8	2.3	2.0	2.1	2.5	2.0	1.9	2.4	2.4	2.2	25.7	.262	.040
Maple Rapids	1.9	1.8	1.6	1.8	1.9	1.8	2.1	2.7	2.2	1.7	1.6	1.6	22.7	.086	.052
Ovid	4.6	4.2	4.4	4.4	4.7	4.8	5.0	4.7	4.3	4.3	4.4	8.8	58.6	.378	.105
St. Johns	33.1	31.6	35.0	33.4	39.0	39.9	42.0	40.4	36.2	34.1	30.8	29.2	424.7	2.080	.499
Westphalia	1.5	1.4	1.9	1.7	1.9	2.0	1.9	1.8	1.8	1.8	1.5	1.5	20.7	.386	.023
CRAWFORD															
Grayling	15.3	13.6	14.5	14.4	18.5	20.9	26.0	19.2	13.8	14.3	13.0	13.4	196.9	.954	.311
DICKINSON															
Breitung Twp.	4.1	3.7	4.2	4.2	4.7	3.3	3.5	3.2	2.6	3.2	3.3	3.9	43.9	--	--
EATON															
Bellevue	4.3	4.1	5.3	5.9	7.2	5.0	5.2	4.3	3.7	3.6	3.9	4.4	56.9	.365	.075
Charlotte	32.7	32.8	33.0	31.1	34.0	37.2	39.0	38.1	32.7	34.6	31.0	32.2	408.4	2.462	.300
Delta Twp.	53.0	48.6	58.6	56.9	62.9	84.4	105.4	108.4	68.1	64.2	67.7	66.2	844.4	5.230	.702
Eaton Rapids	26.9	27.4	34.4	28.0	30.2	35.3	39.9	44.3	29.0	25.8	23.7	21.7	366.6	1.802	.632
Grand Ledge	19.7	17.5	17.6	16.9	18.5	20.0	24.4	21.6	17.8	17.5	16.4	17.8	225.7	1.322	.187
Olivet	2.4	2.4	2.6	2.4	2.7	3.1	2.6	2.4	2.5	2.0	2.6	2.7	30.4	--	--
Sunfield	2.3	2.3	2.8	2.4	2.1	2.8	3.5	2.9	2.6	2.4	2.3	2.0	30.4	--	--
EMMET															
Harbor Springs	12.7	10.4	11.3	11.3	15.5	18.8	36.2	26.8	14.0	11.4	10.6	11.1	190.1	1.642	.310
Petosky	30.9	25.4	30.2	27.2	33.9	50.1	53.5	59.8	40.1	43.1	38.7	42.5	475.4	2.015	.753
GENESEE															
Beecher Mero. Dist.	38.1	34.8	35.7	36.1	36.8	41.0	42.9	44.3	35.6	37.3	34.2	34.7	451.5	1.992	.882
Burton	24.3	26.2	25.5	24.0	23.5	25.2	25.3	25.5	23.1	24.6	21.3	21.9	290.4	1.527	.443
Fenton	26.5	23.1	25.2	23.8	27.1	29.2	33.2	28.5	24.6	23.8	22.2	26.3	313.5	1.502	.565
Grand Blanc	28.5	24.7	30.1	27.5	37.3	42.6	48.1	46.2	31.5	29.6	34.0	28.9	409.0	2.398	.402
Linden	5.4	4.0	4.6	4.4	5.6	5.9	5.7	7.5	5.2	5.2	4.5	4.6	62.6	.300	.100
Montrose	6.1	5.6	5.9	5.6	5.8	6.1	5.4	5.4	5.3	5.9	5.7	6.4	69.2	.447	.113
Otisville	1.4	1.2	1.3	1.3	1.7	1.8	2.9	1.7	1.6	1.5	1.6	1.5	19.5	.134	.033
GLADWIN															
Beaverton	3.9	4.1	5.0	4.2	3.6	3.3	3.4	3.4	3.8	4.2	4.0	3.9	46.8	--	--
GOGEBIC															
Ironwood	45.6	40.6	40.2	39.6	42.3	39.0	39.9	39.0	34.1	35.7	35.1	37.9	469.0	1.678	.842
Wakefield	8.7	8.0	9.1	7.8	7.5	7.3	9.2	8.2	7.7	7.3	8.9	8.6	98.3	.560	.152
GRAND TRAVERSE															
Kingsley	1.9	1.6	1.6	1.5	2.8	3.0	5.0	2.1	1.6	1.9	1.5	1.6	26.1	--	--
GRATIOT															
Alma		3.1	6.3		4.6			6.4					20.4	--	--
Breckenridge	3.2	3.1	2.9	2.9	3.2	3.2	3.5	3.0	2.9	3.0	2.8	2.9	36.6	.183	.040
Ithaca	10.0	7.7	7.1	9.3	8.2	10.3	9.4	11.1	8.3	9.9	7.5	6.5	105.3	--	--
St. Louis	9.4	9.0	10.9	12.1	10.7	12.5	12.7	11.6	9.4	11.6	12.9	10.2	133.0	.752	.217
HILLSDALE															
Camden	.9	1.0	.9	.8	.8	.9	1.1	1.0	1.1	.8	.9	.8	11.0	.050	.011
Hillsdale	45.0	40.7	48.9	47.8	49.1	46.4	52.0	43.3	39.1	32.8	26.6	28.0	499.7	2.075	.560
Jonesville	12.4	13.0	13.7	13.7	13.4	13.3	15.4	10.4	12.3	12.3	12.6	13.7	156.2	.782	.221
Litchfield	3.1	3.8	3.9	3.9	4.0	5.4	5.7	5.1	4.8	4.4	4.4	4.1	52.6	.261	.091
Waldron	2.6	2.5	2.7	2.6	2.7	2.2	2.8	2.6	2.6	2.7	2.4	3.0	31.4	.137	.036
HOUGHTON															
a)Adams Twp. - S. Range Water Auth.	25.6	25.2	26.5	26.6	24.8	22.5	26.0	24.7	24.4	25.7	24.0	26.4	302.4	1.030	.660
b)Adams Twp. - S. Range Water Auth.	9.8	9.5	10.5	10.5	10.9	10.3	10.8	10.4	9.5	9.9	11.1	9.7	122.9	.780	.280
Chassel Twp.	3.4	3.2	3.2	3.1	3.5	3.0			3.3	3.8	4.0	3.7	34.2	.164	.083
Houghton	41.7	38.9	40.7	40.8	39.6	33.0	36.2	35.6	36.4	36.6	32.2	31.5	443.2	--	--
c)N. Michigan Water Co.	35.4	34.0	34.2	30.7	33.6	33.1	36.4	34.4	28.8	26.4	23.6	23.7	374.3	1.326	.456

TABLE 2. REPORTED GROUND-WATER PUMPAGE, IN 1981 (IN MILLIONS OF GALLONS)-CONTINUED

COUNTY AND WATER USER	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	1981 TOTAL	MAX DAY	MIN DAY
HURON															
Elkton	2.0	1.7	1.9	2.2	2.3	2.6	2.8	2.3	2.1	2.2	2.0	2.3	26.4	--	--
Pigeon	4.4	3.4	3.7	3.6	4.1	4.3	5.1	4.8	4.5	4.3	3.4	3.8	49.4	.160	.090
Sebewaing	10.7	11.3	8.5	8.5	7.8	10.1	9.7	8.6	9.4	9.0	9.2	10.2	113.0	--	--
INGHAM															
E. Lansing-Meridian Twp.	153.2	138.6	140.0	139.1	159.4	178.9	220.7	199.0	150.1	157.0	144.5	135.0	1,915.5	8.964	3.371
Lansing	676.1	626.4	693.1	679.7	724.7	788.6	888.8	819.6	713.0	704.0	665.3	628.1	8,607.4	36.270	16.660
Lansing Twp.	33.0	33.5	37.2	53.7	47.0	50.9	52.8	53.7	28.9	46.1	42.3	37.1	516.2	--	--
Leslie	7.0	6.3	6.5	6.5	7.3	8.7	12.4	9.5	6.8	6.7	6.2	6.5	90.4	--	--
Mason	18.2	16.2	18.1	17.4	19.3	21.4	25.2	21.0	20.9	19.4	18.3	17.4	232.8	.608	.001
Michigan State Univ.	139.4	133.3	130.5	150.6	151.1	132.2	150.5	143.6	125.9	147.4	141.2	97.0	1,642.7	5.355	2.226
Stockbridge	3.7	3.2	3.3	4.2	3.5	4.0	4.4	4.1	3.7	3.8	3.1	3.3	44.3	.198	.078
Webberville	3.8	3.2	3.7	3.2	3.6	4.7	7.9	5.4	3.7	3.5	3.4	3.8	49.9	.561	.092
Williamston	8.1	6.9	7.7	8.3	9.9	11.1	13.4	10.3	9.4	10.1	8.9	8.7	112.8	1.156	.139
IONIA															
Belding	46.5	44.3	49.8	49.7	54.4	55.7	58.4	51.2	48.8	48.7	40.1	38.3	585.9	--	--
Ionia	25.2	24.4	23.8	26.5	25.5	27.9	30.0	31.9	27.3	27.3	23.2	24.6	317.6	1.409	.361
Mich. Reformatory, Ionia	14.8	11.1	13.1	14.5	13.2	13.7	17.1	17.1	16.1	16.7	17.1	18.9	183.4	--	--
Mich. Training Unit, Ionia	5.3	4.6	4.8	4.9	5.6	6.3	9.3	6.9	5.1	5.1	4.9	5.0	67.8	.446	.142
d)Muir	3.4	2.9	3.1	3.5	3.3	4.4	7.0	5.8	3.4	3.5	3.2	3.1	46.6	--	--
Pewamo	1.4	1.3	1.7	.9	1.5	1.7	2.2	2.2	1.3	1.3	1.1	1.2	17.8	--	--
Portland	10.8	10.8	11.6	12.4	14.2	15.1	14.9	14.1	13.9	12.9	14.7	12.9	158.3	.650	--
Riverside Center	8.4	8.3	7.8	7.9	7.8	7.8	8.4	8.4	7.5	7.7	7.6	6.3	94.0	.528	.111
Saranac	9.7	10.6	11.9	11.4	12.7	13.0	13.5	11.3	9.1	8.7	8.0	7.4	127.3	.847	.122
IOSCO															
Oscoda Twp.	17.7	15.7	15.4	15.6	23.5	22.5	28.7	22.5	21.9	21.7	14.7	14.5	234.4	--	--
Wurtsmith AFB	29.6	24.5	15.3	23.3	29.6	27.2	30.2	25.9	22.0	20.3	17.0	31.0	295.9	--	--
IRON															
Alpha													e)10.4	--	--
Caspian	9.4	8.7	9.6	8.7	9.0	9.1	8.8	7.7	6.3	6.2	5.5	6.1	95.1	.418	.121
Crystal Falls	13.8	12.8	14.0	13.0	15.8	14.4	20.0	17.0	13.7	13.6	13.4	14.0	175.5	.862	.349
Crystal Falls Twp.	7.0	7.2	7.2	6.7	6.3	6.7	4.3	3.0	3.1	2.7	3.2	3.0	60.4	.276	--
Iron River	10.8	11.5	11.7	8.9	9.5	9.8	11.4	10.0	9.0	8.9	8.2	9.0	118.7	.575	.166
Iron River Twp.	11.3	10.5	11.3	9.5	8.7	10.2	11.1	10.5	9.0	8.6	9.6	10.5	120.8	.224	.022
Stambaugh	6.0	5.6	6.3	6.4	6.6	6.1	7.0	6.6	6.7	6.9	5.7	5.7	75.6	.353	.161
Stambaugh Twp.	4.2	4.6	4.3	4.2	3.7	4.4	4.7	4.5	3.2	3.4	3.4	3.5	48.1	--	--
ISABELLA															
f)Mt. Pleasant	76.2	80.9	83.1	75.8	67.0	66.3	78.5	70.6	76.1	75.7	68.0	78.5	896.7	3.506	1.240
Shepherd	4.2	3.8	4.8	5.0	4.8	5.8	5.7	5.5	5.0	4.2	3.6	3.6	56.0	.355	.057
JACKSON															
Concord	3.0	3.0	3.1	3.4	4.0	4.3	4.4	4.3	3.4	3.6	2.7	2.1	42.3	.276	.068
Grass Lake	1.9	1.8	1.8	1.7	2.1	2.0	2.7	3.1	1.8	1.7	1.6	1.6	23.8	.216	.036
Jackson	273.3	272.4	291.4	296.2	302.2	312.3	312.5	341.5	296.0	290.3	265.8	257.6	3,511.5	13.690	3.670
Springport	3.5	2.5	2.9	3.1	3.3	3.3	2.4	3.3	3.1	3.1	3.3	2.4	36.2	--	--
State Prison, Jackson	44.9	41,8	50.0	50.0	51.2	48.0	51.5	54.2	40.0	49.9	44.0	44.0	569.5	--	--
KALAMAZOO															
Galesburg	6.9	5.7	5.7	6.1	6.2	7.1	10.5	9.4	7.5	6.5	5.9	5.8	83.3	.648	.109
James River Corp.	241.0	224.5	239.3	226.6	251.8	256.4	267.6	240.1	278.6	279.6	269.5	248.2	3,023.2	--	--
Kalamazoo	465.0	427.6	453.9	487.2	540.8	623.2	806.7	680.7	539.9	486.5	450.0	431.2	6,392.7	39.678	10.878
Parchment	5.7	5.1	5.7	5.8	7.3	9.3	14.1	10.0	6.7	6.6	5.7	5.7	87.7	1.066	.058
Portage	61.7	55.4	61.0	60.0	73.6	84.7	150.1	101.8	70.0	65.7	62.2	62.8	909.0	8.361	1.028
Simpson Paper Co.	45.0	42.8	43.1	37.2	28.4	33.8	35.1	23.6	24.7	30.4	21.8	26.0	391.9	3.331	.487
Upjohn Co.	552.5	515.7	570.0	601.7	587.5	632.8	593.8	574.8	516.4	544.5	484.4	450.1	6,624.2	24.946	9.926
Vicksburg	10.4	9.1	9.2	8.7	9.6	11.8	15.7	11.9	9.8	8.8	7.9	8.1	121.0	.743	.040
KALKASKA															
Kalkaska	14.7	13.9	13.2	10.2	13.5	10.0	21.6	14.0	10.5	10.2	8.2	10.5	150.5	.757	.240
KENT															
Cedar Springs	9.0	8.6	9.6	9.7	10.5	10.8	14.7	13.2	9.3	9.4	8.6	8.9	122.3	--	--
Kent Coutny Airport													e)12.0	--	--
Lowell	19.1	19.1	20.5	20.1	22.6	25.9	28.3	28.0	21.2	20.8	18.6	17.6	261.8	1.449	.223
Plainfield Twp.	37.5	33.8	35.3	37.1	55.2	75.5	111.1	83.5	46.9	39.9	37.1	38.7	631.6	5.507	.806
Sparta	11.2	10.0	11.5	11.2	12.9	14.5	18.6	16.3	12.8	13.5	11.7	11.0	155.2	.732	.260

TABLE 2. REPORTED GROUND-WATER PUMPAGE, IN 1981 (IN MILLIONS OF GALLONS)-CONTINUED

COUNTY AND WATER USER	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	1981 TOTAL	MAX DAY	MIN DAY
LAKE															
Baldwin	2.4	4.8	5.2	3.0	4.0	4.7	5.3	6.5	4.1	3.1	3.1	5.0	51.2	--	--
LAPEER															
Columbiaville	2.4	2.2	2.7	2.6	3.0	3.9	5.3	3.4	3.0	2.9	2.8	3.0	37.2	.720	.058
Q) Dryden			3.4			3.3			3.4			3.2	13.3	--	--
North Branch	2.4	2.1	2.5	2.6	2.5	3.0	3.5	2.7	2.6	2.4	2.2	2.4	30.9	.237	.073
LEELANAU															
Northport	2.3	2.3	2.1	2.4	3.5	2.9	2.9	3.2	2.5	1.7	1.2	1.1	29.1	.235	.017
LENAWEE															
Clinton	6.4	7.2	6.3	6.7	6.9	7.8	8.1	8.0	8.6	6.7	6.9	6.7	86.3	--	--
Hudson	7.9	7.4	7.9	7.5	8.2	8.0	8.8	8.7	7.0	7.8	7.1	6.5	92.8	.400	.113
Morenci	7.3	6.7	7.6	7.3	7.2	8.2	8.8	9.1	6.4	7.8	7.3	7.8	91.5	.482	.145
Onsted	3.4	3.1	3.4	3.3	3.7	3.5	4.0	3.9	3.8	3.9	3.7	3.2	42.9	--	--
Tecumseh	36.6	34.7	35.1	27.4	28.9	30.4	34.4	32.2	29.0	29.4	27.6	29.0	374.7	1.962	.071
Fisher Body, Tecumseh	.9	.7	.9	.9	.9	1.0	.8	.9	.9	1.0	.7	.5	10.1	.107	.000
LIVINGSTON															
Brighton	20.6	19.4	21.5	19.6	23.6	27.2	32.9	28.8	23.2	22.9	21.5	21.3	282.5	1.500	.300
Fowlerville	6.9	7.2	8.6	7.5	9.0	10.8	14.8	16.5	14.2	14.0	13.9	13.8	137.2	.949	.176
Green Oak Twp.	2.2	1.9	2.1	2.1	3.1	4.4	3.1	2.5	2.4	2.6	2.4	2.3	31.1	--	--
Hillcrest Center, Howell	1.0	1.8	1.4	2.1	1.9	4.0	2.7	2.1	2.1	2.0	2.0	2.0	25.1	.344	.011
Howell	31.8	27.7	31.8	31.0	36.7	41.0	47.4	40.7	31.6	32.3	30.1	32.2	414.3	1.966	.735
Maxey Boys School	3.5	3.1	3.7	3.8	4.4	4.9	5.1	4.9	4.0	3.8	3.6	3.8	48.6	.332	.075
LUCE															
Newberry	10.1	9.3	10.5	8.6	8.8	9.3	8.7	10.6	9.2	8.5	7.6	11.3	112.5	.464	.271
Newberry Health Center	3.6	3.3	4.3	3.9	3.8	3.0	3.5	3.8	3.3	3.6	3.8	3.5	43.4	--	--
MACOMB															
Armada	1.6	2.1	2.4	2.5	2.6	3.3	3.5	3.5	3.0	3.1	2.8	3.0	33.4	.205	.032
Richmond	10.2	9.3	9.6	9.6	10.9	10.0	11.8	12.2	11.5	11.5	10.5	11.1	128.2	--	--
Romeo	13.6	11.8	13.5	12.1	13.8	13.9	13.8	16.5	11.9	12.5	12.3	12.3	158.0	--	--
MANISTEE															
Filer Twp.	5.0	3.3	1.5	4.2	5.8	7.3	11.2	7.1	4.5	3.6	3.7	3.5	60.7	.644	--
Manistee	46.1	37.1	37.4	38.6	42.9	48.3	61.1	52.0	35.9	29.7	35.0	45.7	509.8	2.519	.966
MARQUETTE															
Ishpeming Twp.	9.6	9.6	10.4	9.5	13.1	10.6	14.0	11.9	10.5	9.9	9.3	8.8	127.2	--	--
K. I. Sawyer AFB	35.7	31.9	34.3	32.4	42.4	36.0	48.8	37.5	31.2	33.4	32.9	34.3	430.8	2.206	.855
Powell Twp.	.5	.4	.6	.6	.9	.6	.8	.7	.5	.5	.5	.5	e)7.1	.042	.012
Richmond Twp.	2.0	2.6	3.7	3.4	3.4	3.4	3.4	4.0	3.1	3.4	3.3	3.8	e)39.5	--	--
MENOMINEE															
Stephenson	2.8	3.5	2.8	2.7	3.4	3.3	3.9	3.1	2.8	2.8	2.8	2.5	36.4	.208	.065
MIDLAND															
Coleman	4.0	4.0	3.5	3.0	3.7	3.9	5.9	3.5	3.3	3.0	2.8	3.2	43.8	.288	.088
MISSAUKEE															
Lake City	4.7	4.7	4.6	3.5	4.3	8.1	10.2	6.6	5.7	2.8	3.4	3.0	61.6	1.257	.006
MONROE															
Petersburg	2.8	2.5	2.4	2.3	3.0	3.3	3.9	3.6	3.4	3.2	2.9	3.6	36.9	--	--
MONTCALM															
Carson City	5.3	5.0	5.1	4.8	4.9	5.1	5.4	5.0	4.7	4.4	4.1	4.2	58.0	.250	.110
Edmore	3.8	3.3	3.6	3.4	5.2	7.3	10.2	6.3	4.3	2.9	3.4	3.4	58.1	.527	--
Greenville	86.8	78.8	87.6	83.8	88.6	86.9	99.5	83.0	73.5	71.5	59.2	55.2	954.4	4.222	1.117
Howard City	4.6	3.4	3.9	3.2	2.2	2.7	2.8	2.5	2.3	2.3	2.0	2.3	34.2	--	--
Sheridan	1.9	1.6	2.1	1.8	2.2	2.5	5.1	2.8	2.1	2.2	1.8	1.9	28.0	--	--
Stanton	5.7	4.2	7.9	7.6	7.6	7.9	9.8	5.4	7.0	7.3	8.9	8.2	87.5	--	--
MUSKEGON															
Montague	5.5	5.2	6.0	6.0	7.8	8.7	15.7	9.9	6.1	5.6	5.3	5.5	87.3	--	--
Ravenna	2.9	4.7	2.9	1.9	2.5	2.8	4.6	3.5	3.1	2.5	1.8	1.8	35.0	.260	.016

TABLE 2. REPORTED GROUND-WATER PUMPAGE, IN 1981 (IN MILLIONS OF GALLONS)-CONTINUED

COUNTY AND WATER USER	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	1981 TOTAL	MAX DAY	MIN DAY
NEWAYGO															
Fremont	28.4	29.2	28.6	21.3	19.2	33.4	43.6	34.2	23.3	21.9	23.5	23.5	330.1	3.730	.212
Hesperia													19.3	--	--
Newaygo	5.7	4.3	4.4	4.3	4.4	4.5	5.6	5.1	4.1	4.4	3.5	3.7	54.0	.837	.040
White Cloud	12.5	9.6	10.7	11.4	12.8	13.7	16.3	13.9	10.8	11.3	10.8	11.9	145.7	.803	.287
OAKLAND															
Holly	13.1	11.5	12.9	12.2	13.4	14.9	17.1	13.6	12.4	12.0	11.4	11.6	156.1	.787	.265
Independence Twp.	5.0	7.4	6.8	7.6	12.0	21.1	10.9	12.3	7.2	9.9	7.8	8.7	116.7	--	--
Milford	19.0	17.9	19.0	19.0	20.2	25.1	27.4	22.4	17.1	16.4	15.5	16.7	235.7	1.435	.398
Orion Twp.	14.7	12.9	14.9	13.5	17.4	32.0	35.6	30.9	17.7	16.0	11.7	16.1	233.4	1.625	.433
Oxford	11.2	10.2	11.2	10.8	12.3	14.9	15.6	16.0	12.0	10.6	9.6	8.4	142.8	.883	.095
Rochester	60.3	61.3	68.9	64.9	69.1	78.1	88.1	79.2	66.3	63.6	56.9	55.4	812.0	3.709	1.286
Southfield													e)5.1	--	--
Sylvan Lake	4.7	4.8	4.5	5.3	5.2	5.9	8.5	6.3	5.7	4.6	5.2	4.9	65.6	--	--
Walled Lake			43.3			48.1			53.9			38.3	183.6	--	--
Waterford Twp.	125.8	116.3	128.4	123.7	122.4	205.4	233.5	190.4	134.1	117.3	108.8	117.6	1,723.7	15.696	--
Wolverine Lake			7.0			11.0			14.5			9.3	e)41.8	--	--
OCEANA															
Hart	10.9	10.1	19.0	10.7	6.7	23.2	9.8	18.1	12.7	12.3	12.0	15.0	160.5	--	--
Pentwater	4.2	3.2	3.6	3.4	4.8	5.9	9.3	8.3	3.9	3.3	3.7	3.6	57.2	.370	.097
Shelby	1.3	1.4	1.7	1.7	1.6	1.7	2.8	1.8	1.2	1.1	1.3	1.3	18.9	--	--
OGEMAW															
West Branch	9.2	8.2	9.1	8.6	9.9	11.5	11.7	10.3	9.4	9.3	8.8	9.1	115.1	1.200	.185
ONTONAGON															
Bergland Twp.	.9	.8	.8	.8	.9	.9	1.0	1.0	.9	.8	.8	.8	10.4	--	--
OSCEOLA															
Evart	56.0	50.0	55.0	55.0	58.0	61.0	62.0	45.0	53.0	53.0	40.0	37.5	625.5	2.800	.350
Marion	6.3	6.1	6.3	5.2	4.6	4.7	5.9	5.8	4.0	4.3	4.0	3.8	61.0	.249	.094
Reed City	13.4	10.9	10.7	10.1	11.1	12.0	15.1	11.7	9.9	9.7	8.9	9.6	133.1	--	--
OTSEGO															
Gaylord	16.3	14.7	14.9	16.2	21.7	21.2	30.2	21.5	17.7	18.4	14.0	16.8	223.6	--	--
Alpine Center, Gaylord	.9	.8	.9	.9	.9	.8	.8	.7	.7	.7	.6	.4	9.1	.038	.004
OTTAWA															
Spring Lake	8.9	8.0	9.0	9.3	12.6	16.8	20.0	18.8	11.4	10.6	8.4	7.5	141.3	1.989	.075
PRESQUE ISLE															
Onaway	4.4	4.5	5.3	3.5	4.9	4.8	5.9	4.4	3.4	3.2	3.0	3.4	50.7	--	--
Rogers City	12.6	11.3	11.4	12.0	14.3	15.5	29.0	19.6	12.4	12.3	10.1	11.4	171.9	1.365	.265
SAGINAW															
Chesaning	8.7	7.0	7.1	7.8	8.1	10.6	10.3	8.9	8.2	9.0	8.9	11.8	106.4	.505	.148
Tittabawassee Twp.	5.8	5.6	6.3	5.7	5.5	7.8	7.3	7.3	6.6	6.4	6.1	6.9	77.3	.355	.180
ST. CLAIR															
Capac	3.9	3.5	3.6	3.5	3.9	3.9	4.8	4.5	3.8	3.7	3.4	3.7	46.2	.211	.083
Yale	4.9	5.4	9.6	4.5	9.1	14.0	14.8	6.1	5.2	12.3	4.5	4.3	94.7	--	--
ST. JOSEPH															
Constantine	9.0	8.6	9.1	7.4	9.0	10.7	10.3	9.1	9.1	8.6	7.6	9.1	107.6	.709	.097
Mendon	14.3	12.8	15.7	13.7	15.2	15.0	15.8	13.9	12.8	13.2	9.2	9.6	161.2	.884	.076
Sturgis	105.1	79.5	78.2	75.1	80.8	78.5	96.8	87.9	76.6	73.0	66.9	63.4	e)961.8	5.014	1.435

TABLE 2. REPORTED GROUND-WATER PUMPAGE, IN 1981 (IN MILLIONS OF GALLONS)-CONTINUED

COUNTY AND WATER USER	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	1981 TOTAL	MAX DAY	MIN DAY
SANILAC															
Croswell	13.7	10.1	9.6	11.7	15.8	18.8	21.2	21.2	14.3	14.0	12.6	8.6	171.6	.906	.147
Deckerville	3.7	3.4	4.0	3.9	4.7	5.0	4.8	4.6	4.7	4.5	3.8	3.8	50.9	.307	.036
Marlette	9.2	8.4	8.7	8.7	9.9	9.6	10.0	9.4	8.3	7.0	6.5	6.1	101.8	.445	.118
Peck	1.3	2.6	2.4	2.2	2.9	2.9	2.5	2.1	2.1	2.4	1.9	1.6	26.9	.150	.043
Port Sanilac	2.8	3.1	3.0	3.4	3.4	5.4	7.6	5.8	4.3	3.6	3.3	3.0	48.7	.370	.091
SHIAWASSEE															
Bancroft	1.4	1.1	1.0	1.6	1.2	1.9	2.0	1.7	1.4	1.5	.7	1.0	16.5	--	--
Byron	2.3	2.0	1.8	1.6	1.9	1.9	2.6	2.2	1.8	1.6	1.5	1.5	22.7	--	--
Corunna	7.3	7.1	7.7	7.0	8.1	6.0	7.3	5.0	6.4	6.9	6.0	6.8	81.6	.513	.139
Durand	10.8	9.3	10.8	10.8	11.3	12.3	14.0	13.4	11.2	11.3	10.2	10.7	136.1	.625	.207
Owosso	71.8	60.3	63.7	62.2	69.0	75.2	78.6	74.8	64.2	61.3	59.4	60.5	e)801.0	3.288	1.445
Perry	4.2	4.0	4.5	4.3	4.8	5.7	7.1	9.1	4.9	4.7	4.2	4.1	61.6	.419	.061
TUSCOLA															
Akron	1.1	.8	1.0	3.2	1.7	1.9	1.8	1.1	1.0	1.0	.9	.9	16.4	--	--
Caro	21.6	17.0	14.9	14.7	16.1	18.4	20.2	16.7	15.3	20.2	21.0	19.9	216.0	--	--
Cass City	8.0	7.7	8.3	8.4	8.2	9.9	10.2	9.2	7.6	8.1	6.8	7.1	99.5	.470	.137
Kingston	1.1	.9	1.0	1.0	1.0	.9	1.1	1.1	1.0	1.1	1.0	1.1	12.3	.060	.029
Mayville	3.9	4.0	3.8	3.9	4.1	4.2	4.2	4.2	4.0	4.0	3.8	3.9	48.0	--	--
State Hosp., Caro	3.5	3.4	3.4	3.4	3.7	3.0	3.2	2.7	3.0	2.6	2.8	3.0	37.7	.340	.030
Vassar	18.6	18.0	20.1	19.5	20.3	24.9	24.6	20.3	17.3	20.1	17.2	16.2	237.1	2.155	.212
VAN BUREN															
Bangor	4.6	4.1	4.6	4.6	4.9	5.1	6.2	6.2	4.8	13.8	4.2	4.7	67.8	.639	.024
Decatur	7.5	7.1	8.5	8.1	9.7	9.6	13.2	11.3	8.4	8.3	7.6	8.1	107.4	--	--
Gobles	1.5	1.5	1.8	1.6	1.8	1.8	2.4	1.8	1.6	1.6	1.4	1.5	20.3	.127	.043
Hartford	8.7	7.5	7.5	7.6	8.7	7.9	9.0	9.3	9.1	7.6	7.1	7.3	97.3	.431	.109
Lawrence	3.4	3.1	3.5	3.4	3.6	3.2	3.7	4.0	3.2	1.7	1.5	2.2	36.5	--	--
Lawton	26.4	16.1	25.0	16.6	18.4	18.1	16.3	23.4	21.7	46.8	14.5	20.4	263.7	1.962	.287
Paw Paw	18.4	16.9	17.9	14.2	17.2	19.8	20.1	12.3	17.0	20.4	13.4	13.3	200.9	1.308	.043
WASHTENAW															
Ann Arbor	71.4	43.3	61.1	78.8	66.1	68.4	72.5	72.0	52.0	70.8	69.8	60.6	g)786.8	5.274	.044
Chelsea	16.2	14.7	16.4	15.2	16.3	15.8	18.9	16.6	15.2	17.5	15.6	14.2	192.6	1.115	.323
Dexter	5.8	5.2	5.2	5.1	6.2	5.8	6.5	6.2	6.1	6.2	5.8	5.3	69.4	.322	.130
Manchester	8.2	7.5	8.9	8.5	9.2	10.0	11.6	12.8	13.0	13.1	11.9	6.1	120.8	.725	.112
Saline	37.2	32.6	35.3	38.1	41.6	43.2	40.0	48.8	42.1	40.4	37.8	34.0	471.1	2.087	.639
Webster Twp.	2.4	1.8	2.2	2.1	3.1	3.2	7.4	5.5	2.4	2.2	2.0	2.1	36.4	.428	.014
Ypsilanti	110.7	88.2	93.5	95.4	147.3	126.9	106.5	111.0	121.5	128.4	134.1	121.9	1,385.4	6.759	2.080
Ypsilanti Twp.						7.0	3.8	2.8	1.6	4.0		6.3	25.5	--	.000
WEXFORD															
Caddillac	59.8	53.4	60.7	53.3	67.6	70.2	83.8	72.3	44.1	46.3	39.2	43.0	693.7	3.379	1.062
Manton	5.1	4.0	4.5	3.6	5.4	4.5	6.6	4.4	3.7	3.8	3.7	3.4	52.7	.298	.097

NOTES

a) Amount pumped to supply Houghton, Hancock, Portage Township, Cooper Range Campany, 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, Laurim, Osceola Township, Torch Lake Township, Ahmeek, and Alleouez Township.
d) Supplies water to Lyons.
e) Wholly or partly estimated.
f) Use Ranney collecter system at Chippewa River site.
g) Also pumped 4,342 million gallons from Huron River.
Q) Quarterly figures.

TABLE 3. WATER-QUALITY DATA

LOCAL IDENTIFIER: See section in text entitled "Well-numbering system"; also includes abbreviated spelling of county name.
GEOLOGIC UNIT: 112GLCL Glacial deposits; 112SAND Sand; 355BBLF Burnt Bluff Formation; 112GRVL Gravel; 324SGNW Saginaw Formation; 372MNSG Munising Sandstone
UNITS: Units are reported in NTU = Nephelometric Turbidity Units, MG/L = Milligrams per liter; UG/L = Micrograms per Liter.

LOCAL IDENTIFIER		DATE OF SAMPLE	GEOLOGIC UNIT	DEPTH OF WELL, TOTAL (FEET)	TEMPERATURE (DEG C)	TURBIDITY (NTU)	COLOR (PLATINUM-COBALT UNITS)	SPECIFIC CONDUCTANCE (UMHOS)	PH (UNITS)	NITROGEN, TOTAL (MG/L AS N)	NITROGEN, ORGANIC TOTAL (MG/L AS N)
27N 15W 27BCCB01	BENZIE	81-09-01	112SAND	87	9.0	1.4	1	540	8.1	.31	.22
		81-11-13		87	--	--	--	--	--	--	--
27N 15W 27BCDC01	BENZIE	81-08-31	112SAND	85	8.5	1.1	<1	520	8.5	.30	.17
		81-11-12		85	--	--	--	--	--	--	--
39N 18W 17ACCB01	DELTA	81-12-07	355BBLF	247	8.5	3.5	3	894	7.5	<.10	.11
39N 22W 30BCCD01	DELTA	81-12-18	372MNSG	844	12.0	.60	<1	415	8.0	.02	.04
47N 46W 04DBAA01	GOGEBC	81-12-09	112SAND	18	7.0	.10	5	191	7.5	.77	.04
47N 46W 20ABDC01	GOGEBC	81-12-09	112GLCL	69	7.0	.50	25	200	7.4	.42	.06
04N 01W 16DADD01	INGHAM	81-08-27	324SGNW	398	10.0	2.1	<1	560	7.5	.43	.07
04N 02W 09ACBD01	INGHAM	81-09-02	324SGNW	443	13.0	7.7	1	1300	6.9	.69	.40
		81-11-24		443	--	--	--	--	--	--	--
07N 05W 12CDCC01	IONIA	81-11-18	324SGNW	485	12.0	8.4	2	603	6.9	.18	.00
07N 06W 18DCAB01	IONIA	81-11-18	112GLCL	110	10.0	3.4	2	661	6.9	.58	<.10
44N 33W 08AAAA01	IRON	81-12-10	112GRVL	30	8.0	.50	4	945	7.9	7.1	.06
14N 04W 27BBDB01	ISBELA	81-08-28	112GLCL	190	10.0	22	<1	820	7.4	.83	.23
14N 04W 27BBDB02	ISBELA	81-08-28	324SGNW	545	12.0	9.2	<1	890	7.4	.35	.08
16N 02W 29ABBD01	MIDLND	81-08-31	112GLCL	100	8.5	.10	2	600	7.4	1.2	.22
16N 02W 30AACB01	MIDLND	81-08-31	324SGNW	555	10.0	3.2	<1	490	7.6	.18	.12
41N 16W 29BCBC01	SCHCFT	81-12-07	372MNSG	2030	15.5	3.7	2	1790	7.4	<.10	.07

LOCAL IDENTIFIER		NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, NITRITE TOTAL (MG/L AS N)	NITROGEN, NITRATE TOTAL (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N)	PHOSPHORUS, TOTAL (MG/L AS P)	CARBON, ORGANIC DISSOLVED (MG/L AS C)	CARBON, ORGANIC SUSPENDED TOTAL (MG/L AS C)	CYANIDE TOTAL (MG/L AS CN)	HARDNESS (MG/L AS CACO3)
27N 15W 27BCCB01	BENZIE	<.010	<.010	.09	.22	.09	<.010	--	.2	<.01	220
		--	--	--	--	--	--	--	--	--	--
27N 15W 27BCDC01	BENZIE	<.010	<.010	.13	.17	.13	.010	1.3	--	<.01	200
		--	--	--	--	--	--	--	--	--	--
39N 18W 17ACCB01	DELTA	.110	<.010	<.01	<.10	<.01	<.010	.9	.1	<.01	400
39N 22W 30BCCD01	DELTA	.040	<.010	.02	<.10	.02	.260	.3	<.1	<.01	170
47N 46W 04DBAA01	GOGEBC	.040	<.010	.77	<.10	.77	.020	2.9	<.1	<.01	88
47N 46W 20ABDC01	GOGEBC	.060	<.010	.42	<.10	.42	.020	8.2	<.1	<.01	93
04N 01W 16DADD01	INGHAM	.330	<.010	.03	.40	.03	.020	1.3	.3	<.01	230
04N 02W 09ACBD01	INGHAM	.290	<.010	<.01	.69	<.01	.010	2.9	.3	<.01	690
07N 05W 12CDCC01	IONIA	.230	<.010	.01	.17	.01	.020	1.0	--	.00	300
07N 06W 18DCAB01	IONIA	<.010	<.010	.58	<.10	.58	.020	2.2	.3	<.01	320
44N 33W 08AAAA01	IRON	.060	.060	7.0	<.10	7.1	.020	3.7	<.1	<.01	270
14N 04W 27BBDB01	ISBELA	.560	.030	.01	.79	.04	.050	2.9	.2	<.01	460
14N 04W 27BBDB02	ISBELA	.270	<.010	<.01	.35	<.01	<.010	1.0	.3	<.01	440
16N 02W 29ABBD01	MIDLND	.030	.020	.91	.25	.93	<.010	1.7	--	<.01	300
16N 02W 30AACB01	MIDLND	.060	<.010	<.01	.18	<.01	.050	1.7	--	<.01	280
41N 16W 29BCBC01	SCHCFT	.070	<.010	<.01	<.10	<.01	<.010	<.3	.1	<.01	480

LOCAL IDENTIFIER		CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM ADSORPTION RATIO	PERCENT SODIUM	POTASSIUM, DISSOLVED (MG/L AS K)	CHLORIDE, DISSOLVED (MG/L AS CL)	SULFATE DISSOLVED (MG/L AS SO4)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)
27N 15W 27BCCB01	BENZIE	68	11	13	.4	12	1.4	93	3.7	<.1	8.6
		--	--	--	--	--	--	--	--	--	--
27N 15W 27BCDC01	BENZIE	69	7.8	15	.5	14	1.8	110	11	<.1	7.0
		--	--	--	--	--	--	--	--	--	--
39N 18W 17ACCB01	DELTA	109	30	3.6	.1	2	2.3	6.7	330	1.5	6.5
39N 22W 30BCCD01	DELTA	39	18	20	.7	20	3.2	14	37	.3	7.9
47N 46W 04DBAA01	GOGEBC	25	6.3	5.2	.3	11	.7	4.0	7.4	<.1	14
47N 46W 20ABDC01	GOGEBC	27	6.3	2.5	.1	5	.8	1.2	9.7	<.1	15
04N 01W 16DADD01	INGHAM	59	19	28	.8	21	2.5	3.8	31	.4	10
04N 02W 09ACBD01	INGHAM	190	53	40	.7	11	4.4	79	270	.2	13
07N 05W 12CDCC01	IONIA	73	28	20	.5	13	1.7	18	6.3	.6	17
07N 06W 18DCAB01	IONIA	85	26	12	.3	8	1.6	34	51	.1	11
44N 33W 08AAAA01	IRON	69	23	63	1.8	33	10	140	34	<.1	10
14N 04W 27BBDB01	ISBELA	110	45	23	.5	10	1.5	9.4	140	.4	15
14N 04W 27BBDB02	ISBELA	120	33	40	.8	17	2.0	26	200	<.1	11
16N 02W 29ABBD01	MIDLND	83	23	11	.3	7	1.6	44	30	.1	14
16N 02W 30AACB01	MIDLND	74	22	5.2	.1	4	1.7	1.4	3.1	.2	16
41N 16W 29BCBC01	SCHCFT	117	46	140	3.0	38	8.8	470	47	.4	6.4

TABLE 3. WATER-QUALITY DATA (CONTINUED)

LOCAL IDENTIFIER		ARSENIC TOTAL (UG/L AS AS)	BARIUM, TOTAL RECOVERABLE (UG/L AS BA)	BERYLLIUM, TOTAL RECOVERABLE (UG/L AS BE)	BISMUTH DISSOLVED (UG/L AS BI)	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)
27N 15W 27BCCB01	BENZIE	2	<50	<10	<1000	20	1	70	7	5	870
		--	--	--	--	--	--	10	--	--	--
27N 15W 27BCDC01	BENZIE	5	100	<10	<1000	<10	1	60	1	3	1100
		--	--	--	--	--	--	10	--	--	--
39N 18W 17ACCB01	DELTA	1	<100	<10	<1000	160	<1	<0	2	5	710
39N 22W 30BCCD01	DELTA	1	100	<10	<1000	290	<1	20	4	10	60
47N 46W 04DBAA01	GOGEBC	1	<100	<10	<1000	50	<1	20	<1	7	80
47N 46W 20ABDC01	GOGEBC	1	<100	<10	<1000	40	<1	20	<1	20	160
04N 01W 16DADD01	INGHAM	3	100	<10	<100	720	3	20	1	8	340
04N 02W 09ACBD01	INGHAM	6	100	<10	<1000	510	3	<10	6	4	5200
		--	--	--	--	--	--	--	--	--	--
07N 05W 12CDCC01	IONIA	3	100	<10	<1000	20	<1	20	<1	4	880
07N 06W 18DCAB01	IONIA	2	100	<10	<1000	<10	<1	20	<1	9	470
44N 33W 08AAAA01	IRON	1	<100	<10	<1000	120	<1	20	<1	11	180
14N 04W 27BBDB01	ISBELA	4	100	<10	<1000	80	2	10	2	2	1500
14N 04W 27BBDB02	ISBELA	2	100	<10	<1000	120	2	10	2	3	1000
16N 02W 29ABBD01	MIDLND	10	100	<10	<1000	<10	1	<10	2	9	80
16N 02W 30AACB01	MIDLND	6	100	<10	<1000	<10	1	<10	2	5	1400
41N 16W 29BCBC01	SCHCFT	1	100	<10	<1000	170	<1	<0	16	8	150000

LOCAL IDENTIFIER		IRON, DISSOLVED (UG/L AS FE)	LEAD, TOTAL RECOVERABLE (UG/L AS PB)	MANGANESE, SUSPENDED RECOV. (UG/L AS MN)	MANGANESE, TOTAL RECOVERABLE (UG/L AS MN)	MANGANESE, DISSOLVED (UG/L AS MN)	MOLYBDENUM, TOTAL RECOVERABLE (UG/L AS MO)	NICKEL, TOTAL RECOVERABLE (UG/L AS NI)	SILVER, TOTAL RECOVERABLE (UG/L AS AG)	STRONTIUM, TOTAL RECOVERABLE (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)
27N 15W 27BCCB01	BENZIE	<10	11	10	20	10	1	20	<1	80	<10
		--	8	--	--	--	--	--	--	--	--
27N 15W 27BCDC01	BENZIE	10	8	--	30	<10	5	6	<1	80	30
		--	8	--	--	--	--	--	--	--	--
39N 18W 17ACCB01	DELTA	430	1	2	10	8	<1	2	<1	980	<10
39N 22W 30BCCD01	DELTA	9	<1	0	10	13	1	1	<1	670	<10
47N 46W 04DBAA01	GOGEBC	11	1	--	<10	<1	2	1	<1	50	10
47N 46W 20ABDC01	GOGEBC	32	1	0	190	190	2	3	<1	50	10
04N 01W 16DADD01	INGHAM	250	14	0	130	140	9	1	<1	720	10
04N 02W 09ACBD01	INGHAM	2000	33	0	230	230	6	6	<1	310	30
		--	--	--	--	--	--	--	--	--	--
07N 05W 12CDCC01	IONIA	700	2	10	40	30	1	<1	<1	570	<10
07N 06W 18DCAB01	IONIA	320	2	20	60	44	1	<1	<1	110	<10
44N 33W 08AAAA01	IRON	57	2	10	120	110	1	3	<1	350	10
14N 04W 27BBDB01	ISBELA	1600	8	0	40	60	7	3	5	1400	30
14N 04W 27BBDB02	ISBELA	890	8	10	30	20	6	21	2	1500	10
16N 02W 29ABBD01	MIDLND	20	10	0	70	70	4	9	<1	130	30
16N 02W 30AACB01	MIDLND	1200	15	0	50	50	4	3	<1	170	10
41N 16W 29BCBC01	SCHCFT	470	3	60	220	160	<1	3	<1	3100	10

LOCAL IDENTIFIER		ZINC, TOTAL RECOVERABLE (UG/L AS ZN)	TIN, DISSOLVED (UG/L AS SN) (A.A.S. DIRECT)	ALUMINUM, TOTAL RECOVERABLE (UG/L AS AL)	GALLIUM DISSOLVED (UG/L AS GA)	GERMANIUM, DISSOLVED (UG/L AS GE)	LITHIUM TOTAL RECOVERABLE (UG/L AS LI)	SELENIUM, TOTAL (UG/L AS SE)	TITANIUM, DISSOLVED (UG/L AS TI)	ZIRCONIUM, DISSOLVED (UG/L AS ZR)	TRITIUM TOTAL (PCI/L)
27N 15W 27BCCB01	BENZIE	20	1000	30	30	50	<10	<1	<5	<5	<200
		--	--	--	--	--	--	--	--	--	--
27N 15W 27BCDC01	BENZIE	20	700	10	<30	30	<10	<1	<5	<5	<200
		--	--	--	--	--	--	--	--	--	--
39N 18W 17ACCB01	DELTA	40	<50	50	<30	100	40	<1	<5	<5	<200
39N 22W 30BCCD01	DELTA	60	<50	30	<30	<30	20	<1	<5	<5	<200
47N 46W 04DBAA01	GOGEBC	50	<50	50	30	<30	<10	<1	<5	<5	<200
47N 46W 20ABDC01	GOGEBC	50	<50	50	<30	<30	<10	<1	<5	<5	<200
04N 01W 16DADD01	INGHAM	10	3000	50	30	70	--	<1	<5	<5	<200
04N 02W 09ACBD01	INGHAM	10	5000	<10	<30	100	10	<1	<5	<5	<200
		--	--	--	--	--	--	--	--	--	--
07N 05W 12CDCC01	IONIA	30	<50	<10	<30	70	20	<1	<5	<5	<200
07N 06W 18DCAB01	IONIA	30	<50	80	<30	70	<10	1	<5	<5	<200
44N 33W 08AAAA01	IRON	50	<50	40	<30	<30	<10	<1	<5	<5	<200
14N 04W 27BBDB01	ISBELA	<10	5000	30	<30	100	<10	<1	<5	<5	<200
14N 04W 27BBDB02	ISBELA	20	3000	40	30	100	20	<1	<5	<5	<200
16N 02W 29ABBD01	MIDLND	20	3000	<10	<30	70	<10	<1	<5	<5	<200
16N 02W 30AACB01	MIDLND	20	<50	20	<30	70	10	<1	<5	<5	<200
41N 16W 29BCBC01	SCHCFT	40	<50	<100	<30	100	50	<1	<5	<5	<200

TABLE 3. WATER-QUALITY DATA (CONTINUED)

LOCAL IDENTIFIER		PHENOLS (UG/L)	PERTHANE TOTAL (UG/L)	NAPHTHALENES, POLYCHLOR. TOTAL (UG/L)	ALDRIN, TOTAL (UG/L)	LINDANE TOTAL (UG/L)	CHLORDANE, TOTAL (UG/L)	DDD, TOTAL (UG/L)	DDE, TOTAL (UG/L)	DDT, TOTAL (UG/L)	DIELDRIN TOTAL (UG/L)
27N 15W 27BCCB01	BENZIE	<1	<.01	<.10	<.01	<.01	<.10	<.01	<.01	<.01	<.01
		--	--	--	--	--	--	--	--	--	--
27N 15W 27BCDC01	BENZIE	<1	<.01	<.10	<.01	<.01	<.10	<.01	<.01	<.01	<.01
		--	--	--	--	--	--	--	--	--	--
39N 18W 17ACCB01	DELTA	2	<.01	<.10	<.01	<.01	<.10	<.01	<.01	<.01	<.01
39N 22W 30BCCD01	DELTA	<1	<.01	<.10	<.01	<.01	<.01	<.01	<.01	<.01	<.01
47N 46W 04DBAA01	GOGEBC	<1	<.01	<.10	<.01	<.01	<.10	<.01	<.01	<.01	<.01
47N 46W 20ABDC01	GOGEBC	2	<.01	<.10	<.01	<.01	<.10	<.01	<.01	<.01	<.01
04N 01W 16DADD01	INGHAM	4	<.01	<.10	<.01	<.01	<.10	<.01	<.01	<.01	<.01
04N 02W 09ACBD01	INGHAM	<1	<.01	<.10	<.01	<.01	<.10	<.01	<.01	<.01	<.01
		--	--	--	--	--	--	--	--	--	--
07N 05W 12CDCC01	IONIA	<1	<.01	<.10	<.01	<.01	<.10	<.01	<.01	<.01	<.01
07N 06W 18DCAB01	IONIA	<1	--	--	--	--	--	--	--	--	--
44N 33W 08AAAA01	IRON	<1	--	--	--	--	--	--	--	--	--
14N 04W 27BBDB01	ISBELA	<1	<.01	<.10	<.01	<.01	<.10	<.01	<.01	<.01	<.01
14N 04W 27BBDB02	ISBELA	<1	<.01	<.10	<.01	<.01	<.10	<.01	<.01	<.01	<.01
16N 02W 29ABBD01	MIDLND	<1	<.01	<.10	<.01	<.01	<.10	<.01	<.01	<.01	<.01
16N 02W 30AACB01	MIDLND	<1	<.01	<.10	<.01	<.01	<.10	<.01	<.01	<.01	<.01
41N 16W 29BCBC01	SCHCFT	1	<.01	<.10	<.01	<.01	<.10	<.01	<.01	<.01	<.01

LOCAL IDENTIFIER		ENDOSULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	TOXAPHENE, TOTAL (UG/L)	HEPTACHLOR, TOTAL (UG/L)	HEPTACHLOR EPOXIDE TOTAL (UG/L)	PCB, TOTAL (UG/L)	MALATHION, TOTAL (UG/L)	PARATHION, TOTAL (UG/L)	DIAZINON, TOTAL (UG/L)
27N 15W 27BCCB01	BENZIE	<.01	<.01	<.01	<0	<.01	<.01	<.10	<.01	<.01	<.01
		--	--	--	--	--	--	--	--	--	--
27N 15W 27BCDC01	BENZIE	<.01	<.01	<.01	<0	<.01	<.01	<.10	<.01	<.01	<.01
		--	--	--	--	--	--	--	--	--	--
39N 18W 17ACCB01	DELTA	<.01	<.01	<.01	<0	<.01	<.01	<.10	<.01	<.01	<.01
39N 22W 30BCCD01	DELTA	<.01	<.01	<.01	<0	<.01	<.01	<.10	<.01	<.01	<.01
47N 46W 04DBAA01	GOGEBC	<.01	<.01	<.01	<0	<.01	<.01	<.10	<.01	<.01	<.01
47N 46W 20ABDC01	GOGEBC	<.01	<.01	<.01	<0	<.01	<.01	<.10	<.01	<.01	<.01
04N 01W 16DADD01	INGHAM	<.01	<.01	<.01	<0	<.01	<.01	<.10	<.01	<.01	<.01
04N 02W 09ACBD01	INGHAM	<.01	<.01	<.01	<0	<.01	<.01	<.10	<.01	<.01	.02
		--	--	<.01	--	--	--	--	<.01	<.01	.04
07N 05W 12CDCC01	IONIA	<.01	<.01	<.01	<0	<.01	<.01	<.10	<.01	<.01	<.01
07N 06W 18DCAB01	IONIA	--	--	<.01	--	--	--	--	<.01	<.01	<.01
44N 33W 08AAAA01	IRON	--	--	--	--	--	--	--	--	--	--
14N 04W 27BBDB01	ISBELA	<.01	<.01	<.01	<0	<.01	<.01	<.10	<.01	<.01	<.01
14N 04W 27BBDB02	ISBELA	<.01	<.01	<.01	<0	<.01	<.01	<.10	<.01	<.01	<.01
16N 02W 29ABBD01	MIDLND	<.01	<.01	<.01	<0	<.01	<.01	<.10	<.01	<.01	<.01
16N 02W 30AACB01	MIDLND	<.01	<.01	<.01	<0	<.01	<.01	<.10	<.01	<.01	<.01
41N 16W 29BCBC01	SCHCFT	<.01	<.01	<.01	<0	<.01	<.01	<.10	<.01	<.01	<.01

LOCAL IDENTIFIER		METHYL PARATHION, TOTAL (UG/L)	2,4-D, TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	MIREX, TOTAL (UG/L)	SILVEX, TOTAL (UG/L)	TOTAL TRITHION (UG/L)	METHYL TRITHION, TOTAL (UG/L)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, SUM OF CONSTITUENTS, DISSOLVED (MG/L)	PHOSPHORUS, ORTHO, TOTAL (MG/L AS P)
27N 15W 27BCCB01	BENZIE	<.01	<.01	<.01	<.01	<.01	<.01	<.01	430	271	<.010
		--	--	--	--	--	--	--	--	--	--
27N 15W 27BCDC01	BENZIE	<.01	<.01	<.01	<.01	<.01	<.01	<.01	343	266	.010
		--	--	--	--	--	--	--	--	--	--
39N 18W 17ACCB01	DELTA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	612	569	<.010
39N 22W 30BCCD01	DELTA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	232	242	<.010
47N 46W 04DBAA01	GOGEBC	<.01	<.01	<.01	<.01	<.01	<.01	<.01	125	112	.040
47N 46W 20ABDC01	GOGEBC	<.01	<.01	<.01	<.01	<.01	<.01	<.01	140	117	.060
04N 01W 16DADD01	INGHAM	<.01	<.01	<.01	<.01	<.01	<.01	<.01	322	310	.010
04N 02W 09ACBD01	INGHAM	<.01	<.01	<.01	<.01	<.01	<.01	<.01	1010	874	<.010
		<.01	--	--	--	--	<.01	<.01	--	--	--
07N 05W 12CDCC01	IONIA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	365	364	<.010
07N 06W 18DCAB01	IONIA	<.01	<.01	<.01	--	<.01	<.01	<.01	394	383	.030
44N 33W 08AAAA01	IRON	--	<.01	<.01	--	<.01	--	--	529	462	.070
14N 04W 27BBDB01	ISBELA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	540	532	.030
14N 04W 27BBDB02	ISBELA	<.01	<.01	<.01	<.01	<.01	<.01	<.01	626	577	<.010
16N 02W 29ABBD01	MIDLND	<.01	<.01	<.01	<.01	<.01	<.01	<.01	386	273	<.010
16N 02W 30AACB01	MIDLND	<.01	<.01	<.01	<.01	<.01	<.01	<.01	293	293	.010
41N 16W 29BCBC01	SCHCFT	<.01	<.01	<.01	<.01	<.01	<.01	<.01	1110	920	<.010

TABLE 3. WATER-QUALITY DATA (CONTINUED)

LOCAL IDENTIFIER		PHOSPHORUS TOTAL (MG/L AS PO4)	NITROGEN, TOTAL (MG/L AS NO3)	MERCURY TOTAL RECOVERABLE (UG/L AS HG)	URANIUM DISSOLVED, EXTRACTION (UG/L)	2, 4-DP TOTAL (UG/L)	ALKALINITY LAB (MG/L AS CACO3)	HARDNESS NONCARBONATE (MG/L AS CACO3)
27N 15W 27BCCB01	BENZIE	--	1.4	.2	.16	<.01	120	95
		--	--	<.1	--	--	--	--
27N 15W 27BCDC01	BENZIE	.03	1.3	.2	.08	<.01	73	130
		--	--	<.1	--	--	--	--
39N 18W 17ACCB01	DELTA	--	<.10	<.1	.20	<.01	60	340
39N 22W 30BCCD01	DELTA	.80	.09	<.1	.09	<.01	170	2.0
47N 46W 04DBAA01	GOGEBC	.06	3.4	<.1	.09	<.01	84	4.0
47N 46W 20ABDC01	GOGEBC	.06	1.9	<.1	11	<.01	88	5.0
04N 01W 16DADD01	INGHAM	.06	1.9	<.1	.04	<.01	260	.00
04N 02W 09ACBD01	INGHAM	.03	3.0	<.1	1	<.01	370	320
		--	--	--	--	--	--	--
07N 05W 12CDCC01	IONIA	.06	.80	<.1	--	<.01	330	.00
07N 06W 18DCAB01	IONIA	.06	2.6	<.1	.47	<.01	270	49
44N 33W 08AAAA01	IRON	.06	31	<.1	1.5	<.01	190	77
14N 04W 27BBDB01	ISBELA	.15	3.7	<.1	.06	<.01	310	150
14N 04W 27BBDB02	ISBELA	--	1.5	<.1	.16	<.01	240	200
16N 02W 29ABBD01	MIDLND	--	5.2	.2	.14	<.01	110	190
16N 02W 30AACB01	MIDLND	.15	.80	<.1	.02	<.01	280	.00
41N 16W 29BCBC01	SCHCFT	--	<.10	.1	.14	<.01	130	350

SELECTED REFERENCES

Allen, W. B., 1977, Flowing wells in Michigan, 1974: Michigan Geological Survey Water Information Series Report 2, 27 p., 5 figs., 2 pls., 16 refs.

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, 129 p., 36 figs., 9 pls.

Bedell, D. J., and Van Til, R. L., 1979, Irrigation in Michigan, 1977: Michigan Department of Natural Resources, Water Management Division, 44 p., 10 figs., 5 tables, 13 refs.

Borton, T. E., 1974, Planning perspectives on water resources, Washtenaw County, Michigan: Washtenaw County Metropolitan Planning Commission, 69 p.

Brown, E. A., and Stuart, W. T., 1951, Ground-water resources of the glacial deposits in the Bessemer area, Michigan, 1950: Michigan Geological Survey Progress Report 14, 68 p., 27 figs.

Cummings, T. R., 1980, Chemical and physical characteristics of natural ground waters in Michigan--a preliminary report: U.S. Geological Survey Open-File Report 80-953, 34 p., 12 figs., 5 tables, 13 refs.

Deutsch, Morris, 1956, Effects of dissemination of radioactive materials on water resources conservation--with special references to Michigan: Michigan State University Agricultural Experiment Station Water Bulletin 2.

----- 1961a, Hydrogeologic aspects of ground-water pollution: Water Well Journal, v. 15, no. 9.

----- 1961b, Incidents of chromium contamination of ground-water in Michigan: U.S. Public Health Service Technical Report W61-5, p. 98-104.

----- 1962a, Controlled induced-recharge tests at Kalamazoo, Michigan: Journal of American Water Works Association, v. 54, no. 2, p. 181-196.

----- 1962b, Phenol contamination of an artesian aquifer at Alma, Michigan: Proceedings of the Society for Water Treatment and Examination, v. 11, p. 94-100, 2 figs.

----- 1963, Ground-water contamination and legal controls in Michigan: U.S. Geological Survey Water-Supply Paper 1691, 79 p., 23 figs.

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, 87 p., 16 figs.

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, 122 p., 21 figs.

Deutsch, Morris, and Vanlier, K. E., 1961, Ground water for Michigan's future: U.S. Geological Survey Open-File Report, unnumbered.

Doonan, C. J., and Byerlay, J. R., 1973, Ground water and geology of Baraga County, Michigan: Michigan Geological Survey Water Investigation 11, 26 p., 2 figs., 2 pls.

Doonan, C. J., and Hendrickson, G. E., 1967, Ground water in Iron County, Michigan: Michigan Geological Survey Water Investigation 7, 61 p., 3 figs., 2 pls.

----- 1968a, Ground water in Gogebic County, Michigan: Michigan Geological Survey Water Investigation 8, 22 p., 5 figs., 2 pls.

----- 1969, Ground water in Ontonagon County, Michigan: Michigan Geological Survey Water Investigation 9, 29 p., 5 figs., 1 pl.

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, 41 p., 1 fig., 2 pls.

Ferris, J. G., and others, 1954, Ground-water resources of the southeastern Oakland County, Michigan: Michigan Geological Survey Progress Report 16, 158 p., 44 figs., 6 pls.

Fleck, W. B., 1980, Geology and hydrology for environmental planning in Washtenaw County, Michigan: U.S. Geological Survey Open-File Report, unnumbered, 23 p., 21 figs., 14 refs.

Fleck, W. B., and McDonald, M. G., 1978, Three dimensional finite-difference model of ground-water systems underlying the Muskegon County wastewater disposal system, Michigan: U.S. Geological Survey Journal of Research, v. 6, no. 3, p. 307-318, 16 figs., 14 refs.

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, 144 p., 45 figs.

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, 158 p., 34 figs., 2 pls.

Grannemann, N. G., 1978, Water Supply Potential of the Lake Sally System, Marquette County, Michigan: U.S. Geological Survey Open-File Report 78-1046, 14 p., 6 figs., 1 table, 12 refs.

----- 1979, Water Resources of the Marquette Iron Range area, Marquette County, Michigan: U.S. Geological Survey Open-File Report 79-1339, 77 p., 34 figs., 20 tables, 23 refs.

Great Lakes Basin Commission, 1975, Appendix 3, Geology and ground water: Great Lakes Basin Framework Study, 152 p., 15 tables, 60 figs.

Hendrickson, G. E., 1966, Michigan's Au Sable River--Today and tomorrow: Michigan Geological Survey Bulletin 3, 80 p., 29 figs., 11 photos.

Hendrickson, G. E., and Doonan, C. J., 1966, Ground-water resources of Dickinson County, Michigan: Michigan Geological Survey Water Investigation 5, 49 p., 5 figs., 3 pls.

Huber, N. K., 1973, Glacial and post glacial geological history of Isle Royale National Park, Michigan: U.S. Geological Survey Professional Paper 754-A, 15 p., 19 figs., 1 plate, 26 refs.

----- 1973, Geologic map of Isle Royale National Park, Keweenaw County, Michigan: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-796, 1 sheet (scale 1:62,500), 11 refs.

----- 1975, The geological story of Isle Royale National Park, Keweenaw County, Michigan: U.S. Geological Survey Bulletin 1309, 66 p., 76 figs., 22 refs.

Huffman, G. C., 1979, Ground-water data for Michigan, 1977, U.S. Geological Survey Open-File Report 79-332, 75 p., 5 figs.

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, 66 p., 64 figs.

McDonald, M. G., 1981, Hydraulic characteristics of an underdrained irrigation circle, Muskegon County wastewater disposal system, Michigan: U.S. Geological Survey Water-Supply Paper 2081, 14 p., 9 figs., 9 refs.

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, 63 p., 17 figs., 14 refs.

McGuinness, C. L., Poindexter, O. P., and Otten, E. G., 1949, Ground-water supplies of the Ypsilanti area, Michigan: U.S. Geological Survey Water-Supply Paper 1078, 105 p., 7 figs., 5 pls.

Michigan Department of Health, 1961, Data on public water supplies in Michigan: Michigan Department Health Engineering Bulletin 4, 57 p.

Michigan Water Resources Commission, 1953, Water resources of the Clinton River Basin, 55 p., 9 figs.

Michigan Water Resources Commission, 1956, Water resources conditions and uses in the Flint River Basin, 75 p., 14 figs.

Michigan Water Resources Commission, 1957, Water resources conditions and uses in the Huron River Basin, 149 p., 27 figs., 2 pls.

----- 1960, Water resources conditions and uses in the Tittabawassee River Basin, 117 p., 19 figs.

----- 1961, Water resources conditions and uses in the Upper Grand River Basin, 137 p., 19 figs.

----- 1963, Water resources conditions and uses in the Shiawassee River Basin, 113 p., 32 figs., 1 pl.

----- 1964, Water resources conditions and uses in the Paw Paw River Basin, (revised from 1955 edition), 56 p., 6 figs.

----- 1964, Water resources conditions and uses in the Michigan portion of the Maumee River Basin, 67 p., 18 figs.

----- 1965, Water resources conditions and uses in the River Raisin Basin, 105 p., 38 figs.

----- 1966, Water resources conditions and uses in the Au Sable River Basin, 116 p., 30 figs.

----- 1968, Water resources conditions and uses in the Lower Grand River Basin, 133 p., 38 figs.

----- 1968, Water resources of southeastern Michigan, 162 p., 61 figs.

----- 1968, Water resources of the lower Lake Huron Drainage Basin, 189 p., 64 figs.

----- 1968, Water resources of the lower Lake Michigan Drainage Basin, 172 p., 54 figs.

----- 1968, Water quality standards for Michigan intrastate waters.

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, p. 96-348, 31 figs.

----- 1969, Geology for land and ground-water development in Wayne County, Michigan: Michigan Geological Survey Report Investigation 3, 25 p., 9 figs., 4 pls.

----- 1970, Geology for environmental planning in Monroe County, Michigan: Michigan Geological Survey Report Investigation 13, 34 p., 18 figs., 6 pls.

Murray, C. R., and Reeves, E. B., 1977, Estimated use of water in the United States, 1975: U.S. Geological Survey Circular 765, 39 p., 12 figs.

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, 62 p., 36 figs., 2 pls.

Sinclair, W. C., 1959, Reconnaissance of the ground-water resources of Schoolcraft County, Michigan: Michigan Geological Survey Progress Report 22, 84 p., 14 figs.

----- 1960, Reconnaissance of the ground-water resources of Delta County, Michigan: Michigan Geological Survey Progress Report 24, 93 p., 13 figs.

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, 36 p., 22 figs., 1 table, 13 refs.

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, 40 p., 29 figs., 3 pls.

Stuart, W. T., 1945, Ground-water resources of the Lansing area, Michigan: Michigan Geological Survey Progress Report 13, 35 p., 11 figs.

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, 92 p., 8 figs.

Stuart, W. T., and Stallman, R. W., 1945, Ground-water resources of the Benton Harbor area, Michigan: Michigan Geological Survey Progress Report 12, 15 p., 4 figs.

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, 59 p., 16 figs.

Terwilliger, F. W., 1954, The glacial geology and ground-water resources of Van Buren County, Michigan, pt. 1 of Occasional papers of 1954 on the geology of Michigan: Michigan Geological Survey Publication 48, p. 1-95, 24 figs., 1 pl.

Twenter, F. R., 1966a, General availability and quality of ground water in the bedrock deposits in Michigan: State Resources Planning Division, Michigan Department of Commerce and Michigan Water Resources Commission, map (color).

----- 1966b, General availability of ground water in the glacial deposits in Michigan: State Resources Planning Division, Michigan Department of Commerce and Michigan Water Resources Commission, map (color).

----- 1975, Ground water and geology--Southeastern Michigan: U.S. Army Corps of Engineers, Detroit, Michigan, 143 p., 31 figs., 36 tables, 46 refs.

Twenter, F. R., 1981, Geology and hydrology for environmental planning in Marquette County, Michigan: U.S. Geological Survey Water Resources Investigations 80-90, 44 p., 16 figs., 21 refs.

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, 150 p., 90 figs.

Twenter, F. R., Knutilla, R. L., and Nowlin, J. O., 1976, Water resources of Washtenaw County, Michigan: Washtenaw County Planning Commission, 143 p., 43 figs., 18 tables, 25 refs.

Use designation areas for Michigan's intrastate water quality standards, March 1969.

Vanlier, K. E., 1959, Reconnaissance of the ground-water resources of Luce County, Michigan: Michigan Geological Survey Progress Report 21, 76 p., 11 figs., 3 pls.

----- 1962, Summary of ground-water investigations in the Elsie area, Michigan: Michigan Geological Survey Progress Report 25, 35 p., 7 figs.

----- 1963, Ground-water resources of the Alma area, Michigan: U.S. Geological Survey Water-Supply Paper 1619-E, 66 p., 20 figs., 2 pls.

----- 1963a, Ground water in Alger County, Michigan: Michigan Geological Survey Water Investigation 1, 55 p., 13 figs.

----- 1963b, Ground water in Menominee County, Michigan: Michigan Geological Survey Water Investigation 2, 42 p., 11 figs.

----- 1966, Ground water resources of the Battle Creek area, Michigan: Michigan Geological Survey Water Investigation 4, 52 p., 19 figs.

----- 1968, Appendix E of the report on the Grand River Comprehensive Basin Study: U.S. Army Engineers District, Detroit, Michigan, 82 p., 2 figs.

Vanlier, K. E., and Deutsch, Morris, 1958a, Reconnaissance of the ground-water resources of Chippewa County, Michigan: Michigan Geological Survey Progress Report 17, 56 p., 7 figs., 7 pls.

----- 1958b, Reconnaissance of the ground-water resources of Mackinac County, Michigan: Michigan Geological Survey Progress Report 19, 82 p., 8 figs., 6 pls.

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, 40 p., 23 figs.

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, 111 p., 35 figs., 3 pls.

Weist, W. G., 1978, Summary appraisals of the nations ground-water resources--Great Lakes Region: U.S. Geological Survey Professional Paper 813-J, 30 p., 14 figs., 5 tables, 35 refs.

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, 142 p., 40 figs., 4 pls.

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, 86 p., 32 figs., 6 pls.

Wisler, C. O., Stramel, G. J., and Laird, L. B., 1952, Water resources of the Detroit area, Michigan: U.S. Geological Survey Circular 183, 36 p., 30 figs., 4 pls.

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

Year	WSP Number	Year	WSP Number	Year	WSP Number
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