Water Resources Data
Michigan
Water Year 1990

U.S. GEOLOGICAL SURVEY WATER-DATA REPORT MI-90-1

Prepared in cooperation with the State of Michigan
and with other agencies

CALENDAR FOR WATER YEAR 1990

1989

OCTOBER

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Water Resources Data Michigan

Water Year 1990

by S.P. Blumer, W.W. Larson, R.J. Minnerick, C.R. Whited, and R.L. LeuVoy

U.S. GEOLOGICAL SURVEY WATER-DATA REPORT MI-90-1
Prepared in cooperation with the State of Michigan
and with other agencies

DEPARTMENT OF THE INTERIOR

MANUEL LUJAN, JR., Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

For information on the water program in Michigan write to
District Chief, Water Resources Division
U.S. Geological Survey
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Lansing, Michigan 48911

1991

PREFACE

This volume of the annual hydrologic data report of Michigan is one of a series of annual reports that document hydrologic data gathered from the U.S. Geological Survey's surface- and ground-water data-collection networks in each state, Puerto Rico, and the Trust Territories. These records of streamflow, ground-water levels, and quality of water provide the hydrologic information needed by state, local, and federal agencies, and the private sector for developing and managing our Nation's land and water resources.

This report is the culmination of a concerted effort by dedicated personnel of the U.S. Geological Survey who collected, compiled, analyzed, verified, and organized the data, and who typed, edited, and assembled the report. In addition to the authors, who had primary responsibility for assuring that the information contained herein is accurate, complete, and adheres to Geological Survey policy and established guidelines, the following individuals contributed significantly to the collection, processing, and tabulation of the data:

S.M. Beall	C.L. Ebsch	D.A. James	R.G. Nettleton
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R.M. Corey	J.C. Failing	J.C. Knudsen	M.F. Soper
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This report was prepared in cooperation with the State of Michigan and with other agencies under the general supervision of T.R. Cummings, District Chief, Michigan, and S.P. Sauer, Regional Hydrologist, Northeastern Region.

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. USGS/WRD/HD-91/249	2.	3. Recipient's Accession No.
4. Title and Subtitle Water Resources Data - Michigan Water Year 1990			5. Report Date March 1991 6.
7. Author(s) S.P. Blumer, W.W. Larson, R.J. Minnerick, C.R. Whited, and R.L. LeuVoy			8. Performing Organization Rept. No. USGS-WDR-MI-90-1
9. Performing Organization Name and Address U.S. Geological Survey, Water Resources Division 6520 Mercantile Way, Suite 5 Lansing, Michigan 48911			10. Project/Task/Work Unit No. 11. Contract(C) or Grant(G) No. (C) (G)
12. Sponsoring Organization Name and Address U.S. Geological Survey, Water Resources Division 6520 Mercantile Way, Suite 5 Lansing, Michigan 48911			13. Type of Report & Period Covered Annual-Oct. 1, 1989 to Sept. 30, 1990 14.

15. Supplementary Notes

Prepared in cooperation with the State of Michigan and with other agencies.

16. Abstract (Limit: 200 words)

Water resources data for the 1990 water year for Michigan consists of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water temperature of ground water. This report contains discharge records for 146 streamflow-gaging stations; stage only records for 1 river-gaging station and 13 lake-gaging stations; stage and contents for 5 lakes and reservoirs; water-quality records for 22 streamflow-gaging stations; water-level records for 51 observation wells; and water-temperature records for 5 observation wells. Also included are 46 crest-stage partial-record stations and 8 low-flow partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program. Miscellaneous data were collected at 63 measuring sites and 22 water-quality sampling sites. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State, local, and Federal agencies in Michigan.

17. Document Analysis a. Descriptors

*Michigan, *Hydrologic data, *Surface water, *Ground water, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Sediments, Water temperatures, Sampling sites, Water levels, Water analyses.

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement:	19. Security Class (This Report)	21. No. of Pages
No restriction on distribution. This report may be purchased from: National Technical Information Service, Springfield, VA 22161	UNCLASSIFIED	292
	20. Security Class (This Page) UNCLASSIFIED	22. Price

(See ANSI-Z39.18)

OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

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GAGING STATIONS, IN DOWNSTREAM ORDER, FOR WHICH RECORDS ARE PUBLISHED

Letters after station name designate type of data: (d) discharge, (c) chemical, (g) gage height, (m) microbiological, (p) pesticide, (r) radio-chemical, (t) water temperature, (s) sediment

GAGING STATIONS, IN DOWNSTREAM ORDER, FOR WHICH RECORDS ARE PUBLISHED--Continued

GAGING STATIONS, IN DOWNSTREAM ORDER, FOR WHICH RECORDS ARE PUBLISHED--Continued

LIST OF COUNTIES FOR WHICH RECORDS OF GROUND-WATER LEVELS ARE PUBLISHED

WATER RESOURCES DATA - MICHIGAN, 1990

INTRODUCTION

The Water Resources Division of the U.S. Geological Survey, in cooperation with State agencies, obtains a large amount of data pertaining to the water resources of Michigan each water year. These data, accumulated during many water years, constitute a valuable data base for developing an improved understanding of the water resources of the State. To make these data readily available to interested parties outside the Geological Survey, the data are published annually in this report series entitled "Water Resources Data - Michigan."

This report includes records on both surface and ground water in the State. Specifically, it contains: (1) Discharge records for 146 streamflow-gaging stations, 46 crest-stage partial-record stations, 8 low-flow partial-record stations, and 63 miscellaneous sites; (2) stage only records for 1 gaging station and 13 lake-gaging stations; (3) stage and content records for 5 lakes and reservoirs; (4) water-quality records for 22 streamflow-gaging stations and 22 miscellaneous sites; (5) water-level records for 51 observation wells; and (6) water-temperature records for 5 observation wells. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State, Local, and Federal agencies in Michigan.

This series of annual reports for Michigan began with the 1961 water year with a report that contained only data relating to the quantities of surface water. For the 1964 water year, a similar report was introduced that contained only data relating to water quality. Beginning with the 1975 water year, the report format was changed to present, in one volume, data on quantities of surface water, quality of surface and ground water, and ground-water levels.

Prior to introduction of this series and for several water years concurrent with it, water-resources data for Michigan were published in U.S. Geological Survey Water-Supply Papers. Data on stream discharge and stage and on lake or reservoir contents and stage, through September 1960, were published annually under the title "Surface-Water Supply of the United States, Part 4." For the 1961 through 1970 water years, the data were published in two 5-year reports. Data on chemical quality, temperature, and suspended sediment for the 1941 through 1970 water years were published annually under the title "Quality of Surface Waters of the United States," and water levels for the 1935 through 1974 water years were published under the title "Ground-Water Levels in the United States." The above mentioned Water-Supply Papers may be consulted in the libraries of the principal cities of the United States and may be purchased from U.S. Geological Survey, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, CO 80225.

Publications similar to this report are published annually by the Geological Survey for all States. These official Survey reports have an identification number consisting of the two-letter State abbreviation, the last two digits of the water year, and the volume number. For example, this volume is identified as "U.S. Geological Survey Water-Data Report MI-90-1." For archiving and general distribution, the reports for 1971-74 water years also are identified as water-data reports. These water-data reports are for sale in paper copy or in microfiche by the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

Additional information, including current prices, for ordering specific reports may be obtained from the District Chief at the address given on the back of the title page or by telephone (517) 377-1608.

COOPERATION

The U.S. Geological Survey and agencies of the State of Michigan have had cooperative agreements for the collection of water-resource records since 1930. Organizations that assisted in collecting the data in this report through cooperative agreement with the Survey are:

Michigan Department of Natural Resources, David F. Hales, Director, through Land and Water Management Division, D.J. Hall, Chief, and Geological Survey Division, R.T. Segall, Chief.

Michigan Department of Transportation, P.M. Nowak, Director.

Assistance with funds or services was given by the U.S. Army Corps of Engineers in collecting records for 9 gaging stations published in this report. Assistance was also furnished by the National Weather Service, National Oceanic Atmospheric Administration, and U.S. Department of Commerce.

The following organizations aided in collecting records:

Macomb County Board of Supervisors; Oakland County Drain Commission; Genesee County Drain Commission; Kalamazoo County; Otsego County; Wayne County; Huron-Clinton Metropolitan Authority; Cities of Ann Arbor, Cadillac, Clare, Coldwater, Flint, Imlay City, Kalamazoo, Lansing, Mason, Norway, Portage, and Ypsilanti; American Aggregate Co.; Consumers Power Co.; Cleveland Cliffs Iron Co.; Mead Corporation; Indiana Michigan Power Co.; Michigan Sugar Co.; Swift-Eckrich, Inc.; Upper Peninsula Power Co.; and Wisconsin-Electric Power Co.

Organizations that supplied data are acknowledged in the station descriptions.

SUMMARY OF HYDROLOGIC CONDITIONS

Surface Water

In the Upper Peninsula, streamflow at Sturgeon River near Sidnaw began the year in the below-normal range. Streamflow remained in the below-normal range through February. In March, streamflow increased to the above-normal range after 8 months (including 3 months in water year (WY) 1989) in the below-normal range. The monthly mean streamflow of 36.8 ft^3/s (cubic feet per second) was the third lowest for December. The monthly mean streamflow of 32.3 ft^3/s was the second lowest for January. Streamflow in April did not follow seasonal patterns and returned to the below-normal range; in fact, the mean discharge of 317 ft^3/s was the third lowest April discharge for the period of record April 1943 to present. Streamflow remained primarily in the normal range for the remainder of the year.

In the Lower Peninsula, streamflow at Muskegon River at Evart and at Red Cedar River at East Lansing was generally in the normal and above-normal range. In April, streamflow at Muskegon River at Evart decreased during a period when streamflow normally increases because of spring runoff. The monthly mean streamflow of 1,462 ft^3/s for April was only 63 percent of the long-term (1951-80) median. Figure 1 shows the monthly and annual mean discharge compared with the median discharge during WY 1951-80 at three index stations.

The highest water levels for 1990 were less than the levels recorded in 1989 for all the Great Lakes adjoining Michigan. The water levels of Lake Superior and Lakes Michigan-Huron were below normal for the entire water year. Levels for Lake St. Clair and Lake Erie were slightly above normal throughout the year. Damage to lake-front property and shoreline because of storms was not serious in WY 1990.

Water Quality

Surface-water-quality data were collected at 18 National Stream Quality Accounting Network stations in WY 1990. Concentrations of dissolved solids and suspended sediments, analyzed from samples collected bimonthly or quarterly at the stations, generally fall within the range of concentrations in all previous samples. Although data are collected on a regular frequency, it is desirable to sample rivers at either high or low stage to determine water-quality characteristics at both extremes. During a period of high flow, runoff from the land is the dominant contributor to a river's discharge and chemical character. During a period of low flow, ground water usually affects a river's water discharge and chemical character. Several low-flow and high-flow samples were collected during the year.

Ground Water

Glacial deposits cover most of the State. The outwash sand and gravel in these deposits form the most productive aquifers in the State. Lacustrine sand also is very productive. Poorly sorted, relatively impermeable mixtures of clay, silt, sand, and gravel, that form some till deposits tend to be poor aquifers; clay deposits generally yield little or no water. In most areas of the State, glacial deposits are less than 200 ft (feet) thick. In some areas in the northern part of the Lower Peninsula, however, the deposits are greater than 800 ft thick. Sandstone, limestone, and dolomite are the principal bedrock aquifers. Where near enough to land surface to be recharged by precipitation, they yield freshwater. Where deeply buried, however, these rocks commonly yield brackish or salty water.

Annual recharge to aquifers in Michigan ranges from 3 to 18 in. (inches) and is derived from precipitation, which averages 31 in. annually.

Water levels were measured at 108 wells in WY 1990. Of these, 51 were selected to comprise a statewide network of observation wells (fig. 9) that is designed to provide statewide areal coverage and to define ground-water conditions in the important aquifers in the State. Water levels in the network of observation wells were within 1 ft of the average for October except for the index well in Chippewa County where the water level was 1.6 ft below average. Water levels generally followed seasonal patterns for the remainder of the year. Water levels in index wells in Chippewa County in the eastern Upper Peninsula, Oakland County in the southeastern Lower Peninsula and to a lesser extent Roscommon County in the north-central Lower Peninsula and Marquette County in the central Upper Peninsula were below the long-term average for the entire year. Water levels in the index wells in Clinton County in the central Lower Peninsula and Calhoun County in the southern Lower Peninsula were above average the entire year. Water levels recorded at the Chippewa County well were extremely low during the year; new monthly minimums were recorded for each month during the period January through May.

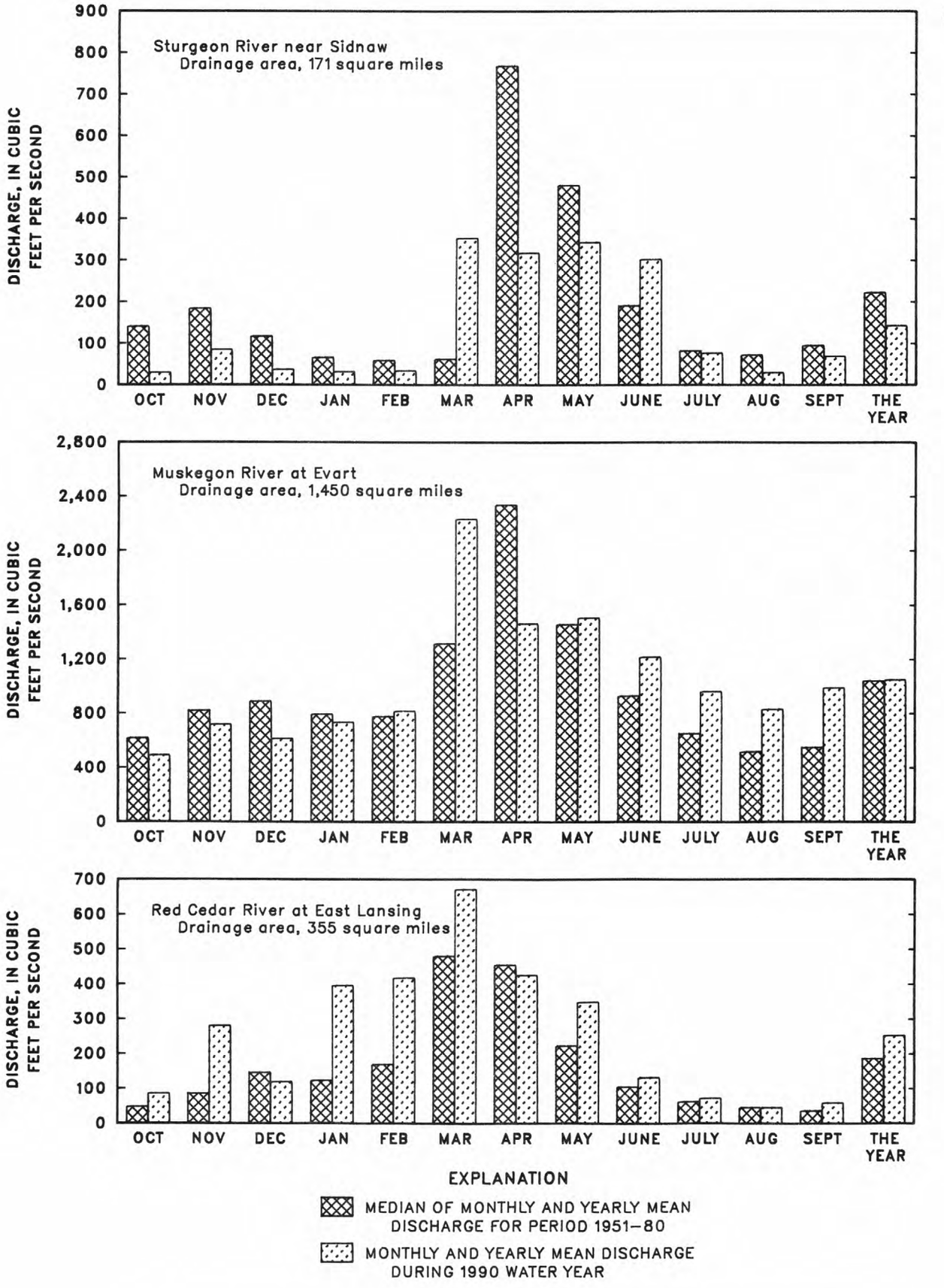

Figure 1.--Discharge during 1990 water year compared with median discharge for period 1951-80 for three representative stations.

The principal aquifers in Michigan are glacial outwash deposits and sandstone, limestone, and dolomite bedrock. The following table lists the aquifers and some of their characteristics.

Aquifer name and description	Well characteristics: Depth (feet) Common range	Depth (feet) May exceed	Yield (gallons/minute) Common range	Yield (gallons/minute) May exceed	Remarks
Glacial aquifers:					
Outwash: Mostly sand and gravel.	25-200	400	1-1,000	2,000	Water generally hard; iron concentrations common; deep wells may produce salty water in places.
Lacustrine sand: Mostly sand, some gravel.	25-100	200	80-500	500	Used for domestic supply in Saginaw Bay and Detroit areas; is salty in places at depth.
Till: Intermixed clay, silt, sand, gravel and boulders; abundant sand and gravel lenses in some areas.	25-200	400	5-200	200	Primary source of domestic supply in western Upper Peninsula.
Bedrock aquifers:					
Saginaw Formation: Sandstone, siltstone, some shale, limestone, and coal.	25-300	500	100-300	1,000	One of Michigan's most important bedrock aquifers; water generally hard; salty in places at depth.
Marshall Formation: Sandstone and siltstone.	25-200	400	100-500	1,500	Another of Michigan's important bedrock aquifers; salty in places and at depth.
Silurian-Devonian rocks: Limestone and dolomite; some shale and sandstone.	25-150	200	10-300	500	Important aquifer in parts of eastern Upper Peninsula; water commonly hard.
Cambrian-Ordovician rocks: Sandstone, limestone, and dolomite.	25-150	200	10-100	500	Important aquifer in eastern Upper Peninsula; water commonly very hard; salty in places and at depth.
Precambrian sandstone: Sandstone interbedded with siltstone.	25-400	500	5-50	100	Important aquifer in western Upper Peninsula; salty in places.

Natural chemical characteristics of ground water in Michigan are determined primarily by the geologic environment through which the water flows. Natural ground water generally is suitable for human consumption and most other uses. Water from glacial deposits, at places, contains elevated concentrations of iron [2.5 to 5.0 mg/L (milligrams per liter)]; water from carbonate rocks is likely to be very hard (400 to 900 mg/L as calcium carbonate); and water from the Saginaw Formation in the Saginaw Bay-Thumb area commonly is highly mineralized (2,000 to 80,000 mg/L of dissolved solids). Throughout the State, salty water underlies and is in contact with freshwater at depths ranging from about 100 ft in the eastern part of the Lower Peninsula to about 900 ft in the northern part. Average dissolved-solids concentration of water from bedrock (535 mg/L) is about twice as great as the average concentration from glacial deposits (241 mg/L) (Cummings, 1980).

REFERENCES CITED

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.

----- 1984, Estimates of dissolved and suspended yield of stream basins in Michigan: U.S. Geological Survey Water-Resources Investigations Report 83-4288, 57 p.

SPECIAL NETWORKS AND PROGRAMS

Hydrologic Bench-Mark Network is a network of 58 sites in small drainage basins around the country whose purpose is to provide consistent data on the hydrology, including water quality, and related factors in representative undeveloped watersheds nationwide, and to provide analyses on a continuing basis to compare and contrast conditions observed in basins more obviously affected by the activities of man.

National Stream Quality Accounting Network (NASQAN) is a nation-wide data-collection network designed by the U.S. Geological Survey to meet many of the information needs of government agencies and other groups involved in natural or regional water-quality planning and management. The 500 or so sites in NASQAN are generally located at the downstream ends of hydrologic accounting units designated by the U.S. Geological Survey Office of Water Data Coordination in consultation with the Water Resources Council. The objectives of NASQAN are (1) to obtain information on the quality and quantity of water moving within and from the United States through a systematic and uniform process of data collection, summarization, analysis, and reporting such that the data may be used for, (2) description of the areal variability of water quality in the Nation's rivers through analysis of data from this and other programs, (3) detection of changes or trends with time in the pattern of occurrence of water-quality characteristics, and (4) providing a nationally consistent data base useful for water quality assessment and hydrologic research.

Radiochemical Program is a network of regularly sampled water-quality stations where samples are collected to be analyzed for radioisotopes. The streams that are sampled represent major drainage basins in the conterminous United States.

EXPLANATION OF THE RECORDS

The surface-water and ground-water records published in this report are for the 1990 water year that began October 1, 1989, and ended September 30, 1990. A calendar of the water year is provided on the inside of the front cover. The records contain streamflow data, stage and content data for lakes and reservoirs, water-quality data for surface water, and ground-water level data. The locations of the stations and wells where the data were collected are shown in figures 4-10. The following sections of the introductory text are presented to provide users with a more detailed explanation of how the hydrologic data published in this report were collected, analyzed, computed, and arranged for presentation.

Station Identification Numbers

Each data station, whether streamsite or well, in this report is assigned a unique identification number. This number is unique in that it applies specifically to a given station and to no other. The number usually is assigned when a station is first established and is retained for that station indefinitely. The systems used by the U.S. Geological Survey to assign identification numbers for surface-water stations and for ground-water well sites differ, but both are based on geographic location. The "downstream order" system is used for all surface-water stations except some lakes and the "latitude-longitude" system is used for wells and lakes.

Downstream Order System

Since October 1, 1950, the order of listing hydrologic-station records in Survey reports is in a downstream direction along the main stream. All stations on a tributary entering upstream from a mainstream station are listed before that station. A station on a tributary that enters between two mainstream stations is listed between them. A similar order is followed in listing stations on first rank, second rank, and other ranks of tributaries. The rank of any tributary with respect to the stream to which it is immediately tributary is indicated by an indention in the "List of Stations" in the front of this report. Each indention represents one rank. This downstream order and system of indention shows which stations are on tributaries between any two stations and the rank of the tributary on which each station is situated.

The station-identification number is assigned according to downstream order. In assigning station numbers, no distinction is made between partial-record stations and other stations; therefore, the station number for a partial-record station indicates downstream-order position in a list made up of both types of stations. Gaps are left in the series of numbers to allow for new stations that may be established; hence, the numbers are not consecutive. The complete eight-digit number for each station, such as 04037500, which appears just to the left of the station name, includes the two-digit Part number "04" plus the six-digit downstream-order number "037500." The Part number designates the major river basin; for example, Part "04" is the St. Lawrence River basin.

Latitude-Longitude System

The identification numbers for wells are assigned according to the grid system of latitude and longitude. The number consists of 15 digits. The first six digits denote the degrees, minutes, and seconds of latitude, the next seven digits denote degrees, minutes, and seconds of longitude, and the last two digits (assigned sequentially) identify the wells or other sites within a 1-second grid. This site-identification number, once assigned, is a pure number and has no locational significance. In the rare instance where the initial determination of latitude and longitude are found to be in error, the station will retain its initial identification number; however, its true latitude and longitude will be listed in the LOCATION paragraph of the station description. (See figure 2.)

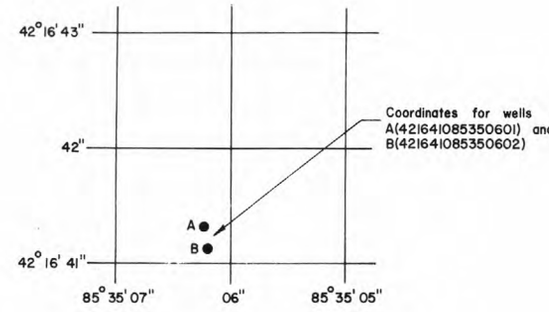

Figure 2. System for numbering wells (latitude and longitude).

Local Well Numbering System

The local well number indicates the location of wells within the rectangular subdivision of land with reference to the Michigan meridian and base line. The first two segments of the well number designate township and range, the third segment of the number designates the section and the letters A through D designate successively smaller subdivisions of the section as shown in figure 3. Thus, a well designated as 32N 6E 16CCCB would be located to the nearest 2.5 acres and would be within the shaded area in section 16. In the event that two or more wells are located in the same 2.5 acre tract, a sequential number designation follows the letter designations--for example, 16CCCB1, 16CCCB2, 16CCCB3, etc.

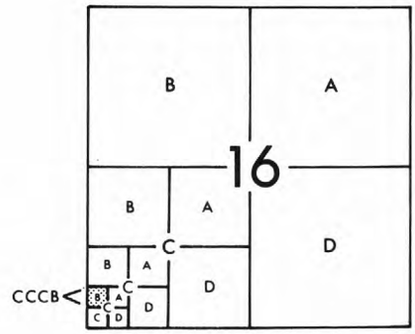

Figure 3. Local well numbering system in Michigan.

Records of Stage and Water Discharge

Records of stage and water discharge may be complete or partial. Complete records of discharge are those obtained using a continuous stage-recording device through which either instantaneous or mean daily discharges may be computed for anytime, or any period of time, during the period of record. Complete records of lake or reservoir content, similarly, are those for which stage or content may be computed or estimated with reasonable accuracy for any time, or period of time. They may be obtained using a continuous stage-recording device, but need not be. Because daily mean discharges and end-of-month contents commonly are published for such stations, they are referred to as "daily stations."

By contrast, partial records are obtained through discrete measurements without using a continuous stage-recording device and pertain only to a few flow characteristics, or perhaps only one. The nature of the partial record is indicated by table titles such as "Crest-stage partial records," or "Low-flow partial records." Records of miscellaneous discharge measurements or of measurements from special studies, such as low-flow seepage studies, may be considered as partial records, but they are presented separately in this report. Location of all complete-record water-discharge stations for which data are given in this report are shown in figures 4 and 5.

Data Collection and Computation

The data obtained at a complete-record gaging station on a stream or canal consist of a continuous record of stage, individual measurements of discharge throughout a range of stages, and notations regarding factors that may affect the relationships between stage and discharge. These data, together with supplemental information, such as weather records, are used to compute daily discharges. The data obtained at a complete-record gaging station on a lake or reservoir consist of a record of stage and of notations regarding factors that may affect the relationship between stage and lake content. These data are used with stage-area and stage-capacity curves or tables to compute water-surface areas and lake storage.

Continuous records of stage are obtained with analog recorders that trace continuous graphs of stage or with digital recorders that punch stage values on paper tapes at selected time intervals. Measurements of discharge are made with current meters using methods adopted by the Geological Survey as a result of experience accumulated since 1880. These methods are described in standard textbooks, in Water-Supply Paper 2175, and in U.S. Geological Survey Techniques of Water-Resources Investigations, Book 3, Chapter A6.

In computing discharge records, results of individual measurements are plotted against the corresponding stages, and stage-discharge relation curves are then constructed. From these curves, rating tables indicating the approximate discharge for any stage within the range of the measurements are prepared. If it is necessary to define extremes of discharge outside the range of the current-meter measurements, the curves are extended using: (1) logarithmic plotting; (2) velocity-area studies; (3) results of indirect measurements of peak discharge, such as slope-area or contracted-opening measurements, and computations of flow over dams or weirs; or (4) step-backwater techniques.

Daily mean discharges are computed by applying the daily mean stages (gage heights) to the stage-discharge curves or tables. If the stage-discharge relation is subject to change because of frequent or continual change in the physical features that form the control, the daily mean discharge is determined by the shifting-control method, in which correction factors based on the individual discharge measurements and notes of the personnel making the measurements are applied to the gage heights before the discharges are determined from the curves or tables. This shifting-control method also is used if the stage-discharge relation is changed temporarily because of aquatic growth or debris on the control. For some stations, formation of ice in the winter may so obscure the stage-discharge relations that daily mean discharges must be estimated from other information such as temperature and precipitation records, notes of observations, and records for other stations in the same or nearby basins for comparable periods.

At some stream-gaging stations, the stage-discharge relation is affected by the backwater from reservoirs, tributary streams, or other sources. This necessitates the use of the slope method in which the slope or fall in a reach of the stream is a factor in computing discharge. The slope or fall is obtained by means of an auxiliary gage set at some distance from the base gage. At some stations the stage-discharge relation is affected by changing stage; at these stations the rate of change in stage is used as a factor in computing discharge.

In computing records of lake or reservoir contents, it is necessary to have available from surveys, curves or tables defining the relationship of stage and content. The application of stage to the stage-content curves or tables gives the contents from which daily, monthly, or yearly changes then are determined. If the stage-content relationship changes because of deposition of sediment in a lake or reservoir, periodic resurveys may be necessary to redefine the relationship. Even when this is done, the contents computed may become increasingly in error as the lapsed time since the last survey increases. Discharges over lake or reservoir spillways are computed from stage-discharge relationships much as other stream discharges are computed.

For some gaging stations, there are periods when no gage-height record is obtained, or the recorded gage height is so faulty that it cannot be used to compute daily discharge or contents. This happens when the recorder stops or for various reasons fails to operate properly. For such periods, the daily discharges are estimated from the recorded range in stage, previous or following record, discharge measurements, weather records, and comparison with other station records from the same or nearby basins. Likewise, daily contents may be estimated from operator's logs, previous or following record, inflow-outflow studies, and other information. Information explaining how estimated daily-discharge values are identified in station records is included in the next two sections, "Data Presentation" (REMARKS paragraph) and "Identifying Estimated Daily Discharge."

Data Presentation

The records published for each gaging station consist of two parts, the manuscript or station description and the data table for the current water year. The manuscript provides, under various headings, descriptive information, such as station location; period of record; average discharge; historical extremes; record accuracy; and other remarks pertinent to station operation and regulation. The following information, as appropriate, is provided with each continuous record of discharge or lake content. Comments to follow clarify information presented under the various headings of the station description.

LOCATION.--Information on locations is obtained from the most accurate maps available. The location of the gage with respect to the cultural and physical features in the vicinity and with respect to the reference place mentioned in the station name is given. River mileages, given for only a few stations, were determined by methods given in "River Mileage Measurement, "Bulletin 14, Revision of October 1968, prepared by the Water Resources Council or were provided by the U.S. Army Corps of Engineers.

DRAINAGE AREA.--Drainage areas are measured using the most accurate maps available. Because the type of maps available varies from one drainage basin to another, the accuracy of drainage areas likewise varies. Drainage areas are updated as better maps become available.

PERIOD OF RECORD.--This indicates the period for which there are published records for the station or for an equivalent station. An equivalent station is one that was in operation at a time that the present station was not, and whose location was such that records from it can reasonably be considered equivalent with records from the present station.

REVISED RECORDS.--Published records, because of new information, occasionally are found to be incorrect, and revisions are printed in later reports. Listed under this heading are all the reports in which revisions have been published for the station and the water years to which the revisions apply. If a revision did not include daily, monthly, or annual figures of discharge, that fact is noted after the year dates as follows: "(M)" means that only the instantaneous maximum discharge was revised; "(m)" that only the instantaneous minimum was revised; and "(P)" that only peak discharges were revised. If the drainage area has been revised, the report in which the most recently revised figure was first published is given.

GAGE.--The type of gage in current use, the datum of the current gage referred to National Geodetic Vertical Datum of 1929 (see glossary), and a condensed history of the types, locations, and datums of previous gages are given under this heading.

REMARKS.--All periods of estimated daily-discharge record will either be identified by date in this paragraph of the station description for water-discharge stations or flagged in the daily-discharge table. (See next section, "Identifying Estimated Daily Discharge.") If a remarks statement is used to identify estimated record, the paragraph will begin with this information presented as the first entry. The paragraph is also used to present information relative to the accuracy of the records, to special methods of computation, to conditions that affect natural flow at the station and, possibly, to other pertinent items. For reservoir stations, information is given on the dam forming the reservoir, the capacity, outlet works and spillway, and purpose and use of the reservoir.

COOPERATION.--Records provided by a cooperating organization or obtained for the Geological Survey by a cooperating organization are identified here.

AVERAGE DISCHARGE.--The discharge value given is the arithmetic mean of the water-year mean discharges. It is computed only for stations having at least 5 water years of complete record, and only water years of complete record are included in the computation. It is not computed for stations where diversions, storage, or other water-use practices cause the value to be meaningless. If water developments significantly altering flow at a station are put into use after the station has been in operation for a period of years, a new average is computed as soon as 5 water years of record have accumulated following the development.

EXTREMES FOR PERIOD OF RECORD.--Extremes may include maximum and minimum stages and maximum and minimum discharges or content. Unless otherwise qualified, the maximum discharge or content is the instantaneous maximum corresponding to the highest stage that occurred. The highest stage may have been obtained from a graphic or digital recorder, a crest-stage gage, or by direct observation of a nonrecording gage. If the maximum stage did not occur on the same day as the maximum discharge or content, it is given separately. Similarly, the minimum is the instantaneous minimum discharge, unless otherwise qualified, and was determined and is reported in the same manner as the maximum.

EXTREMES OUTSIDE PERIOD OF RECORD.--Included here is information concerning major floods or unusually low flows that occurred outside the stated period of record. The information may or may not have been obtained by the U.S. Geological Survey.

EXTREMES FOR CURRENT YEAR.--Extremes given here are similar to those for the period of record, except the peak discharge listing may include secondary peaks. For stations meeting certain criteria, all peak discharges and stages occurring during the water year and greater than a selected base discharge are presented under this heading. The peaks greater than the base discharge, excluding the highest one, are referred to as secondary peaks. Peak discharges are not published for canals, ditches, drains, or streams for which the peaks are subject to substantial control by man. The time of occurrence for peaks is expressed in 24-hour local standard time. For example, 12:30 a.m. is 0030, and 1:30 p.m. is 1330. The minimum for the current water year appears below the table of peak data.

REVISIONS.--If a critical error in published records is discovered, a revision is included in the first report published following discovery of the error.

Although rare, occasionally the records of a discontinued gaging station may need revision. Because, for these stations, there would be no current or, possibly, future station manuscript published to document the revision in a "Revised Records" entry, users of data for these stations who obtained the record from previously published data reports may wish to contact the offices whose addresses are given on the back of the title page of this report to determine if the published records were ever revised after the station was discontinued. Of course, if the data were obtained by computer retrieval, the data would be current and there would be no need to check because any published revision of data is always accompanied by revision of the corresponding data in computer storage.

Manuscript information for lake or reservoir stations differs from that for stream stations in the nature of the "Remarks" and in the inclusion of a skeleton stage-capacity table when daily contents are given.

The daily table for stream-gaging stations gives mean discharge for each day and is followed by monthly and yearly summaries. In the monthly summary below the daily table, the line headed "TOTAL" gives the sum of the daily figures. The line headed "MEAN" gives the average flow in cubic feet per second during the month. The lines headed "MAX" and "MIN" give the maximum and minimum daily discharges, respectively, for the month. Discharge for the month also is usually expressed in cubic feet per second per square mile (line headed "CFSM"), or in inches (line headed "IN."), or in acre-feet (line headed "AC-FT"). Figures for cubic feet per second per square mile and runoff in inches are omitted if there is extensive regulation or diversion or if the drainage area includes large noncontributing areas. In the yearly summary below the monthly summary, the figures shown are the appropriate discharges for the calendar and water years. At some stations monthly and (or) yearly observed discharges are adjusted for reservoir storage or diversion, or diversions or reservoir contents are given. These figures are identified by a symbol and corresponding footnote.

Data collected at partial-record stations follow the information for continuous-record sites. Data for partial-record discharge stations are presented in two tables. The first is a table of annual maximum stage and discharge at crest-stage partial-record stations, and the second is a table of discharge measurements at low-flow partial-record stations. The tables of partial-record stations are followed by a listing of discharge measurements made at sites other than continuous-record or partial-record stations. These measurements are generally made in times of drought or flood to give better areal coverage to those events. Those measurements and others collected for some special reason are called measurements at miscellaneous sites.

Identifying Estimated Daily Discharge

Estimated daily-discharge values published in the water-discharge tables of annual State data reports are identified either by flagging individual daily values with the letter symbol "e" and printing a table footnote, "e Estimated," or by listing the dates of the estimated record in the REMARKS paragraph of the station description.

Accuracy of the Records

The accuracy of streamflow records depends primarily on: (1) The stability of the stage-discharge relation or, if the control is unstable, the frequency of discharge measurements; and (2) the accuracy of measurements of stage, measurements of discharge, and interpretation of records.

The accuracy attributed to the records is indicated under "REMARKS." "Excellent" means that about 95 percent of the daily discharges are within 5 percent of their true values; "good," within 10 percent; and "fair," within 15 percent. Records that do not meet the criteria mentioned are rated "poor." Different accuracies may be attributed to different parts of a given record.

Daily mean discharges in this report are given to the nearest hundredth of a cubic foot per second for values less than 1 ft^3/s; to the nearest tenth between 1.0 and 10 ft^3/s; to whole numbers between 10 and 1,000 ft^3/s; and to 3 significant figures for more than 1,000 ft^3/s. The number of significant figures used is based solely on the magnitude of the discharge value.

Discharge at many stations, as indicated by the monthly mean, may not reflect natural runoff due to the effects of diversion, consumption, regulation by storage, increase or decrease in evaporation due to artificial causes, or to other factors. For such stations, figures of cubic feet per second per square mile and of runoff, in inches, are not published unless satisfactory adjustments can be made for diversions, for changes in contents of reservoirs, or for other changes incident to use and control. Evaporation from a reservoir is not included in the adjustments for changes in reservoir contents, unless it is so stated. Even at those stations where adjustments are made, large errors in computed runoff may occur if adjustments or losses are large in comparison with the observed discharge.

Other Records Available

Information used in the preparation of the records in this publication, such as discharge-measurement notes, gage-height records, temperature measurements, and rating tables are on file in the Michigan District Office. Also, most of the daily mean discharges are in computer-readable form and have been analyzed statistically. Information on the availability of the unpublished information or on the results of statistical analyses of the published records may be obtained from the Michigan District Office.

Records of Surface-Water Quality

Records of surface-water quality ordinarily are obtained at or near stream-gaging stations because interpretation of records of surface-water quality nearly always requires corresponding discharge data. Records of surface-water quality in this report may involve a variety of types of data and measurement frequencies.

Classification of Records

Water-quality data for surface-water sites are grouped into one of three classifications. A continuing-record station is a site where data are collected on a regularly scheduled basis. Frequency may be once or more times daily, weekly, monthly, or quarterly. A partial-record station is a site where limited water-quality data are collected systematically over a period of years. Frequency of sampling is usually less than quarterly. A miscellaneous sampling site is a location other than a continuing or partial-record station where random samples are collected to give better areal coverage to define water-quality conditions in the river basin.

A careful distinction needs to be made between "continuing records" , as used in this report, and "continuous recordings," which refers to a continuous graph or a series of discrete values punched at short intervals on a paper tape. Some records of water quality, such as temperature and specific conductance, may be obtained through continuous recordings; however, because of costs, most data are obtained only monthly or less frequently. Locations of stations for which records on the quality of surface water appear in this report are shown in figures 6 and 7.

Arrangement of Records

Water-quality records collected at a surface-water daily record station are published immediately following that record, regardless of the frequency of sample collection. Station number and name are the same for both records. Where a surface-water daily record station is not available or where the water quality differs significantly from that at the nearby surface-water station, the continuing water-quality record is published with its own station number and name in the regular downstream-order sequence. Water-quality data for miscellaneous sampling sites appear in a separate table following the table of discharge measurements at miscellaneous sites.

On-site Measurements and Sample Collection

In obtaining water-quality data, a major concern needs to be assuring that the data obtained represent the in situ quality of the water. To assure this, certain measurements, such as water temperature, pH, and dissolved oxygen, need to be made on site when the samples are taken. To assure that measurements made in the laboratory also represent the in situ water, carefully prescribed procedures need to be followed in collecting the samples, in treating the samples to prevent changes in quality pending analysis, and in shipping the samples to the laboratory. Procedures for on site measurements and for collecting, treating, and shipping samples are given in publications on "Techniques of Water-Resources Investigations," Book 1, Chap. D2; Book 3, Chap. C2; Book 5, Chap. A1, A3, and A4. All of these references are listed under "PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS" which appears at the end of the introductory text. Also, detailed information on collecting, treating, and shipping samples may be obtained from the Geological Survey Michigan District Office.

One sample can define adequately the water quality at a given time if the mixture of solutes throughout the stream cross section is homogeneous. However, the concentration of solutes at different locations in the cross section may vary widely with different rates of water discharge, depending on the source of material and the turbulence and mixing of the stream. Some streams must be sampled through several vertical sections to obtain a representative sample needed for an accurate mean concentration and for use in calculating load. Many samples obtained for the National Stream Quality Accounting Network (see definitions) are obtained from at least several verticals. Whether samples are obtained from the centroid of flow or from several verticals depends on flow conditions and other factors which must be evaluated by the collector.

Chemical-quality data published in this report are considered to be the most representative values available for the stations listed. The values reported represent water-quality conditions at the time of sampling as much as possible, consistent with available sampling techniques and methods of analysis.

For chemical-quality stations equipped with digital monitors, the records consist of daily maximum, minimum, and mean values for each constituent measured and are based upon hourly punches beginning at 0100 hours and ending at 2400 hours for the day of record. More detailed records (hourly values) may be obtained from the Geological Survey Michigan District Office whose address is given on the back of the title page of this report.

Water Temperature

Water temperatures are measured at all the water-quality stations. In addition, water temperatures are taken at time of discharge measurements for water-discharge stations. Large streams have a small diurnal temperature change; shallow streams may have a daily range of several degrees and may follow closely the changes in air temperature. Some streams may be affected by waste-heat discharges.

At stations where recording instruments are used, either mean temperatures and/or maximum and minimum temperatures for each day are published. Water temperatures measured at the time of water-discharge measurements are on file in the Michigan District Office.

Sediment

Suspended-sediment concentrations are determined from samples collected by using depth-integrating samplers. Samples usually are obtained at several verticals in the cross section.

At some stations, suspended-sediment samples were collected periodically at many verticals in the stream cross section. Although data collected periodically may represent conditions only at the time of observations, such data are useful in establishing seasonal relations between quality and streamflow and in predicting long-term sediment-discharge characteristics of the stream.

Laboratory Measurements

Sediment samples were analyzed in the Geological Survey laboratory in Harrisburg, Pennsylvania. All other samples were analyzed in the Geological Survey laboratories in Arvada, Colorado. Methods used in analyzing sediment samples and computing sediment records are given in TWRI, Book 5, Chap. C1. Methods used by the Geological Survey laboratories are given in TWRI, Book 1, Chap. D2; Book 3, Chap. C2; Book 5, Chap. A1, A3, and A4. In March 1989 the National Water-Quality Laboratory discovered a bias in the turbidimetric method for sulfate analysis, indicating that values below 75 mg/L have a median positive bias of 2 mg/L above the true value for the period between 1982 and 1989. Sulfate values in this report have not been corrected for this bias.

Data Presentation

For continuing-record stations, information pertinent to the history of station operation is provided in descriptive headings preceding the tabular data. These descriptive headings give details regarding location, drainage area, period of record, type of data available, instrumentation, general remarks, cooperation, and extremes for parameters currently measured daily. Tables of chemical, physical, biological, radiochemical data, and so forth, obtained at a frequency less than daily are presented first. Tables of "daily values" of specific conductance and water temperature then follow in sequence.

In the descriptive headings, if the location is identical to that of the discharge gaging station, neither the LOCATION nor the DRAINAGE AREA statements are repeated. The following information, as appropriate, is provided with each continuous-record station. Comments that follow clarify information presented under the various headings of the station description.

LOCATION.--See Data Presentation under "Records of Stage and Water Discharge;" same comments apply.

DRAINAGE AREA.--See Data Presentation under "Records of Stage and Water Discharge;" same comments apply.

PERIOD OF RECORD.--This indicates the periods for which there are published water-quality records for the station. The periods are shown separately for records of parameters measured daily or continuously and those measured less than daily. For those measured daily or continuously, periods of record are given for the parameters individually.

INSTRUMENTATION.--Information is given only if a water-quality monitor or temperature recorder is or was in operation at a station.

REMARKS.--Remarks provide added information pertinent to the collection, analysis, or computation of the records.

COOPERATION.--Records provided by a cooperating organization or obtained for the Geological Survey by a cooperating organization are identified here.

EXTREMES.--Maximums and minimums are given only for parameters measured daily or more frequently. None are given for parameters measured weekly or less frequently, because the true maximums or minimums may not have been sampled. Extremes, when given, are provided for both the period of record and for the current water year.

REVISIONS.--If errors in published water-quality records are discovered after publication, appropriate updates are made to the Water-Quality File in the U.S. Geological Survey's computerized data system, WATSTORE, and subsequently by monthly transfer of update transactions to the U.S. Environmental Protection Agency's STORET system. Because the usual volume of updates makes it impractical to document individual changes in the State data-report series or elsewhere, potential users of U.S. Geological Survey water-quality data are encouraged to obtain all required data from the appropriate computer file to insure the most recent updates.

The surface-water quality records for miscellaneous sampling sites are published in a separate table following the table of discharge measurements at miscellaneous sites. No descriptive statements are given for these records. Each station is published with its own station number and name in the regular downstream-order sequence.

Remark Codes

The following remark codes may appear with the water-quality data in this report:

PRINTED OUTPUT	REMARK
E	Estimated value
>	Actual value is known to be greater than the value shown
<	Actual value is known to be less than the value shown
K	Results based on colony count outside the acceptance range (non-ideal colony count)
L	Biological organism count less than 0.5 percent (organism may be observed) rather than counted
D	Biological organism count equal to or greater than 15 percent (dominant)
&	Biological organism estimated as dominant

Records of Ground-Water Levels

Only water-level data from a national network of observation wells are given in this report. These data are intended to provide a sampling and historical record of water-level changes in the Nation's most important aquifers. Locations of the observation wells in this network in Michigan are shown in figure 9.

Data Collection and Computation

Measurements of water levels are made in many types of wells under varying conditions, but the methods of measurement are standardized to the extent possible. The equipment and measuring techniques used at each observation well ensure that measurements at each well are of consistent accuracy and reliability.

Tables of water-level data are presented by counties arranged in alphabetical order. The prime identification number for a given well is the 15-digit number that appears in the upper left corner of the table. The secondary identification number is the local well number, an alphanumeric number, derived from the township-range location of the well.

Water-level records are obtained from direct measurements with a steel tape or from the graph or punched tape of a water-stage recorder. The water-level measurements in this report are given in feet with reference to land-surface datum (LSD). Land-surface datum is a datum plane that is approximately at land surface at each well. If known, the elevation of the land-surface datum is given in the well description. The height of the measuring point (MP) above or below land-surface datum is given in each well description. Water levels in wells equipped with recording gages are reported for every fifth day and the end of each month (EOM).

Water levels are reported to as many significant figures as can be justified by the local conditions. For example, in a measurement of a depth to water of several hundred feet, the error of determining the absolute value of the total depth to water may be a few tenths of a foot, whereas the error in determining the net change of water level between successive measurements may be only a hundredth or a few hundredths of a foot. For lesser depths to water, the accuracy is greater. Accordingly, most measurements are reported to a hundredth of a foot, but some are given to a tenth of a foot or a larger unit.

Data Presentation

Each well record consists of two parts, the station description and the data table of water levels observed during the water year. The description of the well is presented first through use of descriptive headings preceding the tabular data. The comments to follow clarify information presented under the various headings.

LOCATION.--This paragraph follows the well-identification number and reports the latitude and longitude (given in degrees, minutes, and seconds); the hydrologic-unit number; the distance and direction from a geographic point of reference; and the owner's name.

AQUIFER.--This entry designates by name (if a name exists) and geologic age the aquifer(s) open to the well.

WELL CHARACTERISTICS.--This entry describes the well in terms of depth, diameter, casing depth and/or screened interval, method of construction, use, and additional information such as casing breaks, collapsed screen, and other changes since construction.

INSTRUMENTATION.--This paragraph provides information on both the frequency of measurement and the collection method used, allowing the user to better evaluate the reported water-level extremes by knowing whether they are based on weekly, monthly, or some other frequency of measurement.

DATUM.--This entry describes both the measuring point and the land-surface elevation at the well. The measuring point is described physically (such as top of collar, notch in top of casing, plug in pump base and so on), and in relation to land surface (such as 1.3 ft above land-surface datum). The elevation of the land-surface datum is described in feet above (or below) National Geodetic Vertical Datum of 1929 (NGVD of 1929); it is reported with a precision depending on the method of determination.

REMARKS.--This entry describes factors that may influence the water level in a well or the measurement of the water level. It should identify wells that also are water-quality observation wells, and may be used to acknowledge the assistance of local (non-Survey) observers.

PERIOD OF RECORD.--This entry indicates the period for which there are published records for the well. It reports the month and year of the start of publication of water-level records by the U.S. Geological Survey and the words "to current year" if the records are to be continued into the following year. Periods for which water-level records are available, but are not published by the Geological Survey, may be noted.

EXTREMES FOR PERIOD OF RECORD.--This entry contains the highest and lowest water levels of the period of published record, with respect to land-surface datum, and the dates of their occurrence.

A table of water levels follows the station description for each well. Water levels are reported in feet below land-surface datum and all taped measurements of water level are listed. For wells equipped with recorders, only abbreviated tables are published; generally, only water-level lows are listed for every fifth day and at the end of the month (EOM). The highest and lowest water levels of the water year and their dates of occurrence are shown on a line below the abbreviated table. Because all values are not published for wells with recorders, the extremes may be values that are not listed in the table. Missing records are indicated by dashes in place of the water level.

ACCESS TO WATSTORE DATA

The National WATer Data STOrage and REtrieval System (WATSTORE) was established for handling water data collected through the activities of the U.S. Geological Survey and to provide for more effective and efficient means of releasing the data to the public. The system is operated and maintained on the central computer facilities of the Survey at its National Center in Reston, Virginia.

WATSTORE can provide a variety of useful products ranging from simple data tables to complex statistical analyses. A minimal fee, plus the actual computer cost incurred in producing a desired product, is charged to the requester. Information about the availability of specific types of data, the acquisition of data or products, and user charges can be obtained locally from the Michigan District Office.

General inquiries about WATSTORE may be directed to:

Chief Hydrologist
U.S. Geological Survey
409 National Center
12201 Sunrise Valley Drive
Reston, Virginia 22092

DEFINITION OF TERMS

Terms related to streamflow, water-quality, and other hydrologic data, as used in this report, are defined below. See also table for converting English units to International System (SI) Units on the inside of the back cover.

Acre-foot (AC-FT, acre-ft) is the quantity of water required to cover 1 acre to a depth of 1 foot and is equivalent to 43,560 cubic feet or about 326,000 gallons or 1,233 cubic meters.

Adenosine triphosphate (ATP) is an organic, phosphate-rich, compound important in the transfer of energy in organisms. Its central role in living cells makes it an excellent indicator of the presence of living material in water. A measure of ATP therefore provides a sensitive and rapid estimate of biomass. ATP is reported in micrograms per liter of the original water sample.

Algae are mostly aquatic single-celled, colonial, or multi-celled plants, containing chlorophyll and lacking roots, stems, and leaves.

Algal growth potential (AGP) is the maximum algal dry weight biomass that can be produced in a natural water sample under standardized laboratory conditions. The growth potential is the algal biomass present at stationary phase and is expressed as milligrams dry weight of algae produced per liter of sample.

Aquifer is a geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

Artesian means confined and is used to describe a well in which the water level stands above the top of the aquifer tapped by the well. A flowing artesian well is one in which the water level is above the land surface.

Bacteria are microscopic unicellular organisms, typically spherical, rodlike, or spiral and threadlike in shape, often clumped into colonies. Some bacteria cause disease, while others perform an essential role in nature in the recycling of materials; for example, by decomposing organic matter into a form available for reuse by plants.

Total coliform bacteria are a particular group of bacteria that are used as indicators of possible sewage pollution. They are characterized as aerobic or facultative anaerobic, gram-negative, nonspore-forming, rod-shaped bacteria which ferment lactose with gas formation within 48 hours at 35°C. In the laboratory these bacteria are defined as all the organisms that produce colonies with a golden-green metallic sheen within 24 hours when incubated at 35°C plus or minus 1.0°C on M-Endo medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.

Fecal coliform bacteria are bacteria that are present in the intestine or feces of warm-blooded animals. They are often used as indicators of the sanitary quality of the water. In the laboratory they are defined as all organisms that produce blue colonies within 24 hours when incubated at 44.5°C plus or minus 0.2°C on M-FC medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.

Fecal streptococcal bacteria are bacteria found also in the intestine of warm-blooded animals. Their presence in water is considered to verify fecal pollution. They are characterized as Gram-positive, cocci bacteria which are capable of growth in brain-heart infusion broth. In the laboratory they are defined as all the organisms which produce red or pink colonies within 48 hours at 35°C plus or minus 1.0°C on KF-streptococcus medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample.

Bed material is the sediment mixture of which a streambed, lake, pond, reservoir, or estuary bottom is composed.

Biochemical oxygen demand (BOD) is a measure of the quantity of dissolved oxygen, in milligrams per liter, necessary for the decomposition of organic matter by micro-organisms, such as bacteria.

Biomass is the amount of living matter present at any given time, expressed as the mass per unit area or volume of habitat.

Ash mass is the mass or amount of residue present after the residue from the dry mass determination has been ashed in a muffle furnace at a temperature of 500°C for 1 hour. The ash mass values of zooplankton and phytoplankton are expressed in grams per cubic meter (g/m^3), and periphyton and benthic organisms in grams per square meter (g/m^2).

Dry mass refers to the mass of residue present after drying in an oven at 105°C for zooplankton and periphyton, until the mass remains unchanged. This mass represents the total organic matter, ash and sediment, in the sample. Dry-mass values are expressed in the same units as ash mass.

Organic mass or volatile mass of the living substance is the difference between the dry mass and ash mass and represents the actual mass of the living matter. The organic mass is expressed in the same units as for ash mass and dry mass.

Wet mass is the mass of living matter plus contained water.

Bottom material: See Bed material.

Cells/volume refers to the number of cells of any organism which is counted by using a microscope and grid or counting cell. Many planktonic organisms are multicelled and are counted according to the number of contained cells per sample, usually milliliters (mL) or liters (L).

Chemical oxygen demand (COD) is a measure of the chemically oxidizable material in the water and furnishes an approximation of the amount of organic and reducing material present. The determined value may correlate with natural water color or with carbonaceous organic pollution from sewage or industrial wastes.

Chlorophyll refers to the green pigments of plants. Chlorophyll a and b are the two most common green pigments in plants.

Color unit is produced by one milligram per liter of platinum in the form of the chloroplatinate ion. Color is expressed in units of the platinum-cobalt scale.

Contents is the volume of water in a reservoir or lake. Unless otherwise indicated, volume is computed on the basis of a level pool and does not include bank storage.

Control designates a feature downstream from the gage that determines the stage-discharge relation at the gage. This feature may be a natural constriction of the channel, an artificial structure, or a uniform cross section over a long reach of the channel.

Control structure as used in this report is a structure on a stream or canal that is used to regulate the flow or stage of the stream or to prevent the intrusion of salt water.

Cubic feet per second per square mile (CFSM) is the average number of cubic feet of water flowing per second from each square mile of area drained, assuming that the runoff is distributed uniformly in time and area.

Cubic foot per second (ft^3/s) is the rate of discharge representing a volume of 1 cubic foot passing a given point during 1 second and is equivalent to 7.48 gallons per second or 448.8 gallons per minute or 0.02832 cubic meters per second.

Cubic foot per second-day [$(ft^3/s)/d$] is the volume of water represented by a flow of 1 cubic foot per second for 24 hours. It is equivalent to 86,400 cubic feet, approximately 1.9835 acre-feet, about 646,000 gallons, or 2,445 cubic meters.

Discharge is the volume of water (or more broadly, volume of fluid plus suspended sediment) that passes a given point within a given period of time.

Mean discharge (MEAN) is the arithmetic mean of individual daily mean discharges during a specific period.

Instantaneous discharge is the discharge at a particular instant of time.

Dissolved refers to that material in a representative water sample which passes through a 0.45 um membrane filter. This is a convenient operational definition used by Federal agencies that collect water data. Determinations of "dissolved" constituents are made on subsamples of the filtrate.

Dissolved-solids concentration of water is determined either analytically by the "residue-on-evaporation" method, or mathematically by totaling the concentrations of individual constituents reported in a comprehensive chemical analysis. During the analytical determination of dissolved solids, the bicarbonate (generally a major dissolved component of water) is converted to carbonate. Therefore, in the mathematical calculation of dissolved-solids concentration, the bicarbonate value, in milligrams per liter, is multiplied by 0.492 to reflect the change.

Drainage area of a stream at a specified location is that area, measured in a horizontal plane, enclosed by a topographic divide from which direct surface runoff from precipitation normally drains by gravity into the stream above the specified point. Figures of drainage area given herein include all closed basins, or noncontributing areas, within the area unless otherwise specified.

Drainage basin is a part of the surface of the earth that is occupied by a drainage system, which consists of a surface stream or a body of impounded surface water together with all tributary surface streams and bodies of impounded surface water.

Gage height (G.H.) is the water-surface elevation referred to some arbitrary gage datum. Gage height is often used interchangeably with the more general term "stage," although gage height is more appropriate when used with a reading on a gage.

Gaging station is a particular site on a stream, canal, lake, or reservoir where systematic observations of hydrologic data are obtained.

Hardness of water is a physical-chemical characteristic that is commonly recognized by the increased quantity of soap required to produce lather. It is computed as the sum of equivalents of polyvalent cations and is expressed as the equivalent concentration of calcium carbonate ($CaCO_3$).

Hydrologic Bench-Mark Network is a network of 58 sites in small drainage basins around the country whose purpose is to provide consistent data on the hydrology, including water quality, and related factors in representative undeveloped watersheds nationwide, and to provide analyses on a continuing basis to compare and contrast conditions observed in basins more obviously affected by the activities of man.

Hydrologic unit is a geographic area representing part or all of a surface drainage basin or distinct hydrologic feature as delineated by the Office of Water Data Coordination on the State Hydrologic Unit Maps; each hydrologic unit is identified by an eight-digit number.

Land-surface datum (lsd) is a datum plane that is approximately at land surface at each ground-water observation well.

Measuring point (MP) is an arbitrary permanent reference point from which the distance to the water surface in a well is measured to obtain the water level.

Metamorphic stage refers to the stage of development that an organism exhibits during its transformation from an immature form to an adult form. This developmental process exists for most insects, and the degree of difference from the immature stage to the adult form varies from relatively slight to pronounced, with many intermediates. Examples of metamorphic stages of insects are egg-larva-adult or egg-nymph-adult.

Methylene blue active substances (MBAS) are apparent detergents. The determination depends on the formation of a blue color when methylene blue dye reacts with synthetic anionic detergent compounds.

Micrograms per gram (ug/g) is a unit expressing the concentration of a chemical constituent as the mass (micrograms) of the element per unit mass (gram) of material analyzed.

Micrograms per liter (UG/L, ug/L) is a unit expressing the concentration of chemical constituents in solution as mass (micrograms) of solute per unit volume (liter) of water. One thousand micrograms per liter is equivalent to one milligram per liter.

Milligrams per liter (MG/L, mg/L) is a unit for expressing the concentration of chemical constituents in solution. Milligrams per liter represents the mass of solute per unit volume (liter) of water. Concentration of suspended sediment also is expressed in mg/L and is based on the mass of dry sediment per liter of water-sediment mixture.

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. It was formerly called "Sea Level Datum of 1929" or "mean sea level" in this series of reports. Although the datum was derived from the average sea level over a period of many years at 26 tide stations along the Atlantic, Gulf of Mexico, and Pacific Coasts, it does not necessarily represent local mean sea level at any particular place.

National Stream Quality Accounting Network (NASQAN) is a nationwide data-collection network designed by the U.S. Geological Survey to meet many of the information needs of government agencies and other groups involved in natural or regional water-quality planning and management. The 500 or so sites in NASQAN are generally located at the downstream ends of hydrologic accounting units designated by the U.S. Geological Survey Office of Water Data Coordination in consultation with the Water Resources Council. The objectives of NASQAN are (1) to obtain information on the quality and quantity of water moving within and from the United States through a systematic and uniform process of data collection, summarization, analysis, and reporting such that the data may be used for, (2) description of the areal variability of water quality in the Nation's rivers through analysis of data from this and other programs, (3) detection of changes or trends with time in the pattern of occurrence of water-quality characteristics, and (4) providing a nationally consistent data base useful for water-quality assessment and hydrologic research.

Organism is any living entity.

Organism count/area refers to the number of organisms collected and enumerated in a sample and adjusted to the number per area habitat, usually square meter (m^2), acre, or hectare. Periphyton, benthic organisms, and macrophytes are expressed in these terms.

Organism count/volume refers to the number of organisms collected and enumerated in a sample and adjusted to the number per sample volume, usually milliliter (mL) or liter (L). Numbers of planktonic organisms can be expressed in these terms.

Total organism count is the total number of organisms collected and enumerated in any particular sample.

Parameter Code is a 5-digit number used in the U.S. Geological Survey computerized data system, WATSTORE, to uniquely identify a specific constituent. The codes used in WATSTORE are the same as those used in the U.S. Environmental Protection Agency data system, STORET. The Environmental Protection Agency assigns and approves all requests for new codes.

Partial-record station is a particular site where limited streamflow and/or water-quality data are collected systematically over a period of years for use in hydrologic analyses.

Particle size is the diameter, in millimeters (mm), of a particle determined by either sieve or sedimentation methods. Sedimentation methods (pipet, bottom-withdrawal tube, visual-accumulation tube) determine fall diameter of particles in either distilled water (chemically dispersed) or in native water (the river water at the time and point of sampling).

Particle-size classification used in this report agrees with the recommendation made by the American Geophysical Union Subcommittee on Sediment Terminology. The classification is as follows:

Classification	Size (mm)	Method of analysis
Clay.....	0.00024 - 0.004	Sedimentation
Silt.....	.004 - .062	Sedimentation
Sand.....	.062 - 2.0	Sedimentation or sieve
Gravel.....	2.0 - 64.0	Sieve

The particle-size distributions given in this report are not necessarily representative of all particles in transport in the stream. Most of the organic matter is removed, and the sample is subjected to mechanical and chemical dispersion before analysis in distilled water. Chemical dispersion is not used for native-water analysis.

Percent composition is a unit for expressing the ratio of a particular part of a sample or population to the total sample or population, in terms of types, numbers, mass, or volume.

Periphyton is the assemblage of microorganisms attached to and living upon submerged solid surfaces. While primarily consisting of algae, they also include bacteria, fungi, protozoa, rotifers, and other small organisms.

Pesticides are chemical compounds used to control undesirable organisms. Major categories of pesticides include insecticides, miticides, fungicides, herbicides, and rodenticides.

Picocurie (PC, pCi) is one trillionth (1×10^{-12}) of the amount of radioactivity represented by a curie (Ci). A curie is the amount of radioactivity that yields 3.7×10^{10} radioactive disintegrations per second. A picocurie yields 2.22 dpm (disintegrations per minute).

Plankton is the community of suspended, floating, or weakly swimming organisms that live in the open water of lakes and rivers.

Phytoplankton is the plant part of the plankton. They are usually microscopic and their movement is subject to the water currents. Phytoplankton growth is dependent upon solar radiation and nutrient substances. Because they are able to incorporate as well as release materials to the surrounding water, the phytoplankton have a profound effect upon the quality of the water. They are the primary food producers in the aquatic environment and are commonly known as algae.

Blue-green algae are a group of phytoplankton organisms having a blue pigment, in addition to the green pigment called chlorophyll. Blue-green algae often cause nuisance conditions in water.

Diatoms are the unicellular or colonial algae having a siliceous shell. Their concentrations are expressed as number of cells per milliliter (cells/mL) of sample.

Green algae have chlorophyll pigments similar in color to those of higher green plants. Some forms produce algae mats or floating "moss" in lakes. Their concentrations are expressed as number of cells per milliliter (cells/mL) of sample.

Zooplankton is the animal part of the plankton. Zooplankton are capable of extensive movements within the water column and are often large enough to be seen with the unaided eye. Zooplankton are secondary consumers feeding upon bacteria, phytoplankton, and detritus. Because they are the grazers in the aquatic environment, the zooplankton are a vital part of the aquatic food web. The zooplankton community is dominated by small crustaceans and rotifers.

Polychlorinated biphenyls (PCBs) are industrial chemicals that are mixtures of chlorinated biphenyl compounds having various percentages of chlorine. They are similar in structure to organochlorine insecticides.

Primary productivity is a measure of the rate at which new organic matter is formed and accumulated through photosynthetic and chemosynthetic activity of producer organisms (chiefly, green plants). The rate of primary production is estimated by measuring the amount of oxygen released (oxygen method) or the amount of carbon assimilated (carbon method) by the plants.

Milligrams of carbon per area or volume per unit time [mg C/(m^2.time)] for periphyton and macrophytes and [mg C/(m^3.time)] for phytoplankton are units for expressing primary productivity. They define the amount of carbon dioxide consumed as measured by radioactive carbon (carbon 14). The carbon 14 method is of greater sensitivity than the oxygen light and dark bottle method and is preferred for use in unenriched waters. Unit time may be either the hour or day, depending on the incubation period.

Milligrams of oxygen per area or volume per unit time [$mgO^2/(m^2.time)$] for periphyton and macrophytes and [$mgO^2/(m^3.time)$] for phytoplankton are the units for expressing primary productivity. They define production and respiration rates as estimated from changes in the measured dissolved-oxygen concentration. The oxygen light and dark bottle method is preferred if the rate of primary production is sufficient for accurate measurements to be made within 24 hours. Unit time may be either the hour or day, depending on the incubation period.

Radiochemical program is a network of regularly sampled water-quality stations where samples are collected to be analyzed for radioisotopes. The streams that are sampled represent major drainage basins in the conterminous United States.

Recoverable from bottom material is the amount of a given constituent that is in solution after a representative sample of bottom material has been digested by a method (usually using an acid or mixture of acids) that results in dissolution of readily soluble substances. Complete dissolution of all bottom material is not achieved by the digestion treatment and thus the determination represents less than the total amount (that is, less than 95 percent) of the constituent in the sample. To achieve comparability of analytical data, equivalent digestion procedures would be required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.

Return period is the average time interval between occurrences of a hydrological event of a given or greater magnitude, usually expressed in years. May also be called recurrence interval.

Runoff in inches (IN., in.) shows the depth to which the drainage area would be covered if all the runoff for a given time period were uniformly distributed on it.

Sediment is solid material that originates mostly from disintegrated rocks and is transported by, suspended in, or deposited from water; it includes chemical and biochemical precipitates and decomposed organic material, such as humus. The quantity, characteristics, and cause of the occurrence of sediment in streams are influenced by environmental factors. Some major factors are degree of slope, length of slope, soil characteristics, land usage, and quantity and intensity of precipitation.

Bed load is the sediment that is transported in a stream by rolling, sliding, or skipping along the bed and very close to it. In this report, bed load is considered to consist of particles in transit within 0.25 ft of the streambed.

Bed load discharge (tons per day) is the quantity of bed load measured by dry weight that moves past a section as bed load in a given time.

Suspended sediment is the sediment that at any given time is maintained in suspension by the upward components of turbulent currents or that exists in suspension as a colloid.

Suspended-sediment concentration is the velocity-weighted concentration of suspended sediment in the sampled zone (from the water surface to a point approximately 0.3 ft above the bed) expressed as milligrams of dry sediment per liter of water-sediment mixture (mg/L).

Mean concentration is the time-weighted concentration of suspended sediment passing a stream section during a 24-hour day.

Suspended-sediment discharge (tons/day) is the rate at which dry mass of sediment passes a section of a stream or is the quantity of sediment, as measured by dry mass or volume, that passes a section in a given time. It is calculated in units of tons per day as follows: concentration (mg/L) x discharge (ft^3/s) x 0.0027.

Suspended-sediment load is a general term that refers to material in suspension. It is not synonymous with either discharge or concentration.

Total-sediment discharge (tons/day) is the sum of the suspended-sediment discharge and the bed-load discharge. It is the total quantity of sediment, as measured by dry mass or volume, that passes a section during a given time.

Total-sediment load or total load is a term which refers to the total sediment (bed load plus suspended-sediment load) that is in transport. It is not synonymous with total-sediment discharge.

7-day 10-year low flow (7 Q 10) is the discharge at the 10-year recurrence interval taken from a frequency curve of annual values of the lowest mean discharge for 7 consecutive days (the 7-day low flow).

Sodium-adsorption-ratio (SAR) is the expression of relative activity of sodium ions in exchange reactions within soil and is an index of sodium or alkali hazard to the soil. Waters range in respect to sodium hazard from those which can be used for irrigation on almost all soils to those which are generally unsatisfactory for irrigation.

Solute is any substance that is dissolved in water.

Specific conductance is a measure of the ability of a water to conduct an electrical current. It is expressed in microsiemens per centimeter at 25°C. Specific conductance is related to the type and concentration of ions in solution and can be used for approximating the dissolved-solids content of the water. Commonly, the concentration of dissolved solids (in milligrams per liter) is about 65 percent of the specific conductance (in microsiemens). This relation is not constant from stream to stream, and it may vary in the same source with changes in the composition of the water.

Stage-discharge relation is the relation between gage height (stage) and volume of water, per unit of time, flowing in a channel.

Streamflow is the discharge that occurs in a natural channel. Although the term "discharge" can be applied to the flow of a canal, the word "streamflow" uniquely describes the discharge in a surface stream course. The term "streamflow" is more general than "runoff" as streamflow may be applied to discharge whether or not it is affected by diversion or regulation.

Substrate is the physical surface upon which an organism lives.

Natural substrate refers to any naturally occurring emersed or submersed solid surface, such as a rock or tree, upon which an organism lives.

Artificial substrate is a device which is purposely placed in a stream or lake for colonization of organisms. The artificial substrate simplifies the community structure by standardizing the substrate from which each sample is taken. Examples of artificial substrates are basket samplers (made of wire cages filled with clean streamside rocks) and multiplate samplers (made of hardboard) for benthic organism collection, and plexiglass strips for periphyton collection.

Surface area of a lake is that area outlined on the latest U.S.G.S. topographic map as the boundary of the lake and measured by a planimeter in acres. In localities not covered by topographic maps, the areas are computed from the best maps available at the time planimetered. All areas shown are those for the stage when the planimetered map was made.

Surficial bed material is the part (0.1 to 0.2 ft) of the bed material that is sampled using U.S. Series Bed-Material Samplers.

Suspended (as used in tables of chemical analyses) refers to the amount (concentration) of undissolved material in a water-sediment mixture. It is associated with the material retained on a 0.45-micrometer filter.

Suspended, recoverable is the amount of a given constituent that is in solution after the part of a representative water-suspended sediment sample that is retained on a 0.45 um membrane filter has been digested by a method (usually using a dilute acid solution) that results in dissolution of only readily soluble substances. Complete dissolution of all the particulate matter is not achieved by the digestion treatment and thus the determination represents something less than the "total" amount (that is, less than 95 percent) of the constituent present in the sample. To achieve comparability of analytical data, equivalent digestion procedures are required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.
Determinations of "suspended, recoverable" constituents are made either by analyzing portions of the material collected on the filter or, more commonly, by difference, based on determinations of (1) dissolved and (2) total recoverable concentrations of the constituent.

Suspended, total is the total amount of a given constituent in the part of a representative water-suspended sediment sample that is retained on a 0.45 um membrane filter. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent determined. A knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to determine when the results should be reported as "suspended, total."
Determinations of "suspended, total" constituents are made either by analyzing portions of the material collected on the filter or, more commonly, by difference, based on determinations of (1) dissolved and (2) total concentrations of the constituent.

Taxonomy is the division of biology concerned with the classification and naming of organisms. The classification of organisms is based upon a hierarchial scheme beginning with Kingdom and ending with Species at the base. The higher the classification level, the fewer features the organisms have in common. For example, the taxonomy of a particular mayfly, Hexagenia limbata, is the following:

Kingdom	Animal
Phylum	Arthropoda
Class	Insecta
Order	Ephemeroptera
Family	Ephemeridae
Genus	Hexagenia
Species	Hexagenia limbata

Thermograph is an instrument that continuously records variations of temperature on a chart. The more general term "temperature recorder" is used in the table headings and refers to any instrument that records temperature whether on a chart, a tape, or any other medium.

Time-weighted average is computed by multiplying the number of days in the sampling period by the concentrations of individual constituents for the corresponding period and dividing the sum of the products by the total number of days. A time-weighted average represents the composition of water that would be contained in a vessel or reservoir that had received equal quantities of water from the stream each day for the year.

Tons per acre-foot indicates the dry mass of dissolved solids in 1 acre-foot of water. It is computed by multiplying the concentration of the constituent, in milligrams per liter, by 0.00136.

Tons per day (T/DAY) is the quantity of a substance in solution or suspension that passes a stream section during a 24-hour period.

Total is the total amount of a given constituent in a representative water-suspended sediment sample, regardless of the constituent's physical or chemical form. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent present in both the dissolved and suspended phases of the sample. A knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to judge when the results should be reported as "total." (Note that the word "total" does double duty here, indicating both that the sample consists of a water-suspended sediment mixture and that the analytical method determined all of the constituent in the sample.)

Total discharge is the total quantity of any individual constituent, as measured by dry mass or volume, that passes through a stream cross-section per unit of time. This term needs to be qualified, such as "total sediment discharge," "total chloride discharge," and so on.

Total, recoverable is the amount of a given constituent that is in solution after a representativ water-suspended sediment sample has been digested by a method (usually using a dilute acid solution) that results in dissolution of only readily soluble substances. Complete dissolution of all particulate matter is not achieved by the digestion treatment, and thus the determination represents something less than the "total" amount (that is, less than 95 percent) of the constituent present in the dissolved and suspended phases of the sample. To achieve comparability of analytical data, equivalent digestion procedures are required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results.

Water year in Geological Survey reports dealing with surface-water supply is the 12-month period, October 1 through September 30. The water year is designated by the calendar year in which it ends an which includes 9 of the 12 months. Thus, the year ending September 30, 1990, is called the "1990 wate year."

WDR is used as an abbreviation for "Water-Data Report" in the REVISED RECORDS paragraph to refer to State annual hydrologic-data reports (WRD was used as an abbreviation for "Water-Resources Data" in reports published prior to 1976).

Weighted average is used in this report to indicate discharge-weighted average. It is computed b multiplying the discharge for a sampling period by the concentrations of individual constituents for the corresponding period and dividing the sum of the products by the sum of the discharges. A discharge-weighted average approximates the composition of water that would be found in a reservoir containing all the water passing a given location during the water year after thorough mixing in the reservoir.

WSP is used as an abbreviaton for "Water-Supply Paper" in reference to previously published reports.

PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS

The U.S. Geological Survey publishes a series of manuals describing procedures for planning and conducting specialized work in water-resources investigations. The material is grouped under major subject headings called books and is further divided into sections and chapters. For example, Section A of Book 3 (Applications of Hydraulics) pertains to surface water. The chapter, the unit of publication, is limited to a narrow field of subject matter. This format permits flexibility in revision and publication as the need arises.

The reports listed below are for sale by the U.S. Geological Survey, Books and Open-File Reports Section, Federal Center, Box 25425, Denver, Colorado 80225 (authorized agent of the Superintendent of Documents, Government Printing Office). Prepayment is required. Remittance should be sent by check or money order payable to the U.S. Geological Survey. Prices are not included because they are subject to change. Current prices can be obtained by writing to the above address. When ordering or inquiring about prices for any of these publications, please give the title, book number, chapter number, and "U.S. Geological Survey Techniques of Water-Resources Investigations."

1-D1. *Water temperature--influential factors, field measurement, and data presentation*, by H. H. Stevens, Jr., J. F. Ficke, and G. F. Smoot: USGS--TWRI Book 1, Chapter D1. 1975. 65 pages.

1-D2. *Guidelines for collection and field analysis of ground-water samples for selected unstable constituents*, by W. W. Wood: USGS--TWRI Book 1, Chapter D2. 1976. 24 pages.

2-D1. *Application of surface geophysics to ground-water investigations*, by A. A. R. Zohdy, G. P. Eaton, and D. R. Mabey: USGS--TWRI Book 2, Chapter D1. 1974. 116 pages.

2-D2. *Application of seismic-refraction techniques to hydrologic studies*, by F. P. Haeni: USGS--TWRI Book 2, Chapter D2. 1988. 86 pages.

2-E1. *Application of borehole geophysics to water-resources investigations*, by W. S. Keys and L. M. MacCary: USGS--TWRI Book 2, Chapter E1. 1971. 126 pages.

2-F1. *Application of drilling, coring, and sampling techniques to test holes and wells*, by Eugene Shuter and Warren E. Teasdale: USGS--TWRI Book 2, Chapter F1. 1989. 97 pages.

3-A1. *General field and office procedures for indirect discharge measurements*, by M. A. Benson and Tate Dalrymple: USGS--TWRI Book 3, Chapter A1. 1967. 30 pages.

3-A2. *Measurement of peak discharge by the slope-area method*, by Tate Dalrymple and M. A. Benson: USGS--TWRI Book 3, Chapter A2. 1967. 12 pages.

3-A3. *Measurement of peak discharge at culverts by indirect methods*, by G. L. Bodhaine: USGS--TWRI Book 3, Chapter A3. 1968. 60 pages.

3-A4. *Measurement of peak discharge at width contractions by indirect methods*, by H. F. Matthai: USGS--TWRI Book 3, Chapter A4. 1967. 44 pages.

3-A5. *Measurement of peak discharge at dams by indirect methods*, by Harry Hulsing: USGS--TWRI Book 3, Chapter A5. 1967. 29 pages.

3-A6. *General procedure for gaging streams*, by R. W. Carter and Jacob Davidian: USGS--TWRI Book 3, Chapter A6. 1968. 13 pages.

3-A7. *Stage measurements at gaging stations*, by T. J. Buchanan and W. P. Somers: USGS--TWRI Book 3. Chapter A7. 1968. 28 pages.

3-A8. *Discharge measurements at gaging stations*, by T. J. Buchanan and W. P. Somers: USGS--TWRI Book 3, Chapter A8. 1969. 65 pages.

3-A9. *Measurement of time of travel in streams by dye tracing*, by F. A. Kilpatrick and J. F. Wilson, Jr.: USGS--TWRI Book 3, Chapter A9. 1989. 27 pages.

3-A10. *Discharge ratings at gaging stations*, by E. J. Kennedy: USGS--TWRI Book 3, Chapter A10. 1984. 59 pages.

3-A11. *Measurement of discharge by moving-boat method*, by G. F. Smoot and C. E. Novak: USGS--TWRI Book 3, Chapter A11. 1969. 22 pages.

3-A12. *Fluorometric procedures for dye tracing*, by J. F. Wilson, Jr., E. D. Cobb, and F. A. Kilpatrick: USGS--TWRI Book 3, Chapter A12. 1986. 41 pages.

3-A13. *Computation of continuous records of streamflow*, by E. J. Kennedy: USGS--TWRI Book 3, Chapter A13. 1983. 53 pages.

3-A14. *Use of flumes in measuring discharge*, by F. A. Kilpatrick and V. R. Schneider: USGS--TWRI Book 3, Chapter A14. 1983. 46 pages.

3-A15. *Computation of water-surface profiles in open channels*, by Jacob Davidian: USGS--TWRI Book 3, Chapter A15. 1984. 48 pages.

3-A16. *Measurement of discharge using tracers*, by F. A. Kilpatrick and E. D. Cobb: USGS--TWRI Book 3, Chapter A16. 1985. 52 pages.

3-A17. *Acoustic velocity meter systems*, by Antonius Laenen: USGS--TWRI Book 3, Chapter A17. 1985. 38 pages.

3-A18. *Determination of stream reaeration coefficients by use of tracers*, by F. A. Kilpatrick, R. E. Rathbun, N. Yotsukura, G. W. Parker, and L. L. DeLong: USGS--TWRI Book 3, Chapter A18. 1989. 52 pages.

3-A19. *Levels of streamflow gaging stations*, by E. J. Kennedy: USGS--TWRI Book 3, Chapter A19. 1990. 27 pages.

3-B1. *Aquifer-test design, observation, and data analysis*, by R. W. Stallman: USGS--TWRI Book 3, Chapter B1. 1971. 26 pages.

3-B2. *Introduction to ground-water hydraulics, a programmed text for self-instruction*, by G. D. Bennett: USGS--TWRI Book 3, Chapter B2. 1976. 172 pages.

3-B3. *Type curves for selected problems of flow to wells in confined aquifers*, by J. E. Reed: USGS--TWRI Book 3, Chapter B3. 1980. 106 pages.

3-B4. *Regression modeling of ground-water flow*, by Richard L. Cooley and Richard L. Naff: USGS--TWRI Book 3, Chapter B4. 1990. 232 pages.

3-B5. *Definition of boundary and initial conditions in the analysis of saturated ground-water flow systems--An introduction*, by O. L. Franke, T. E. Reilly, and G. D. Bennett: USGS--TWRI Book 3, Chapter B5. 1987. 15 pages.

3-B6. *The principle of superposition and its application in ground-water hydraulics*, by T. E. Reilly, O. L. Franke, and G. D. Bennett: USGS--TWRI Book 3, Chapter B6. 1987. 28 pages.

3-C1. *Fluvial sediment concepts*, by H. P. Guy: USGS--TWRI Book 3, Chapter C1. 1970. 55 pages.

3-C2. *Field methods for measurement of fluvial sediment*, by H. P. Guy and V. W. Norman: USGS--TWRI Book 3, Chapter C2. 1970. 59 pages.

3-C3. *Computation of fluvial-sediment discharge*, by George Porterfield: USGS--TWRI Book 3, Chapter C3. 1972. 66 pages.

4-A1. *Some statistical tools in hydrology*, by H. C. Riggs: USGS--TWRI Book 4, Chapter A1. 1968. 39 pages.

4-A2. *Frequency curves*, by H. C. Riggs: USGS--TWRI Book 4, Chapter A2. 1968. 15 pages.

4-B1. *Low-flow investigations*, by H. C. Riggs: USGS--TWRI Book 4, Chapter B1. 1972. 18 pages.

4-B2. *Storage analyses for water supply*, by H. C. Riggs and C. H. Hardison: USGS--TWRI Book 4, Chapter B2. 1973. 20 pages.

4-B3. *Regional analyses of streamflow characteristics*, by H. C. Riggs: USGS--TWRI Book 4, Chapter B3. 1973. 15 pages.

4-D1. *Computation of rate and volume of stream depletion by wells*, by C. T. Jenkins: USGS-TWRI Book 4, Chapter D1. 1970. 17 pages.

5-A1. *Methods for determination of inorganic substances in water and fluvial sediments*, by M. J. Fishman and L. C. Friedman: USGS--TWRI Book 5, Chapter A1. 1989. 545 pages.

5-A2. *Determination of minor elements in water by emission spectroscopy*, by P. R. Barnett and E. C. Mallory, Jr.: USGS--TWRI Book 5, Chapter A2. 1971. 31 pages.

5-A3. *Methods for the determination of organic substances in water and fluvial sediments*, edited by R. L. Wershaw, M. J. Fishman, R. R. Grabbe, and L. E. Lowe: USGS--TWRI Book 5, Chapter A3. 1987. 80 pages.

5-A4. *Methods for collection and analysis of aquatic biological and microbiological samples*, by L. J. Britton and P. E. Greeson, editors: USGS--TWRI Book 5, Chapter A4. 1989. 363 pages.

5-A5. *Methods for determination of radioactive substances in water and fluvial sediments*, by L. L. Thatcher, V. J. Janzer, and K. W. Edwards: USGS--TWRI Book 5, Chapter A5. 1977. 95 pages.

5-A6. *Quality assurance practices for the chemical and biological analyses of water and fluvial sediments*, by L. C. Friedman and D. E. Erdmann: USGS--TWRI Book 5, Chapter A6. 1982. 181 pages.

5-C1. *Laboratory theory and methods for sediment analysis*, by H. P. Guy: USGS--TWRI Book 5, Chapter C1. 1969. 58 pages.

6-A1. *A modular three-dimensional finite-difference ground-water flow model*, by M. G. McDonald and A. W. Harbaugh: USGS--TWRI Book 6, Chapter A1. 1988. 586 pages.

7-C1. *Finite difference model for aquifer simulation in two dimensions with results of numerical experiments*, by P. C. Trescott, G. F. Pinder, and S. P. Larson: USGS--TWRI Book 7, Chapter C1. 1976. 116 pages.

7-C2. *Computer model of two-dimensional solute transport and dispersion in ground water*, by L. F. Konikow and J. D. Bredehoeft: USGS--TWRI Book 7, Chapter C2. 1978. 90 pages.

7-C3. *A model for simulation of flow in singular and interconnected channels*, by R. W. Schaffrannek, R. A. Baltzer, and D. E. Goldberg: USGS--TWRI Book 7, Chapter C3. 1981. 110 pages.

8-A1. *Methods of measuring water levels in deep wells*, by M. S. Garber and F. C. Koopman: USGS--TWRI Book 8, Chapter A1. 1968. 23 pages.

8-A2. *Installation and service manual for U.S. Geological Survey manometers*, by J. D. Craig: USGS--TWRI Book 8, Chapter A2. 1983. 57 pages.

8-B2. *Calibration and maintenance of vertical-axis type current meters*, by G. F. Smoot and C. E. Novak: USGS--TWRI Book 8, Chapter B2. 1968. 15 pages.

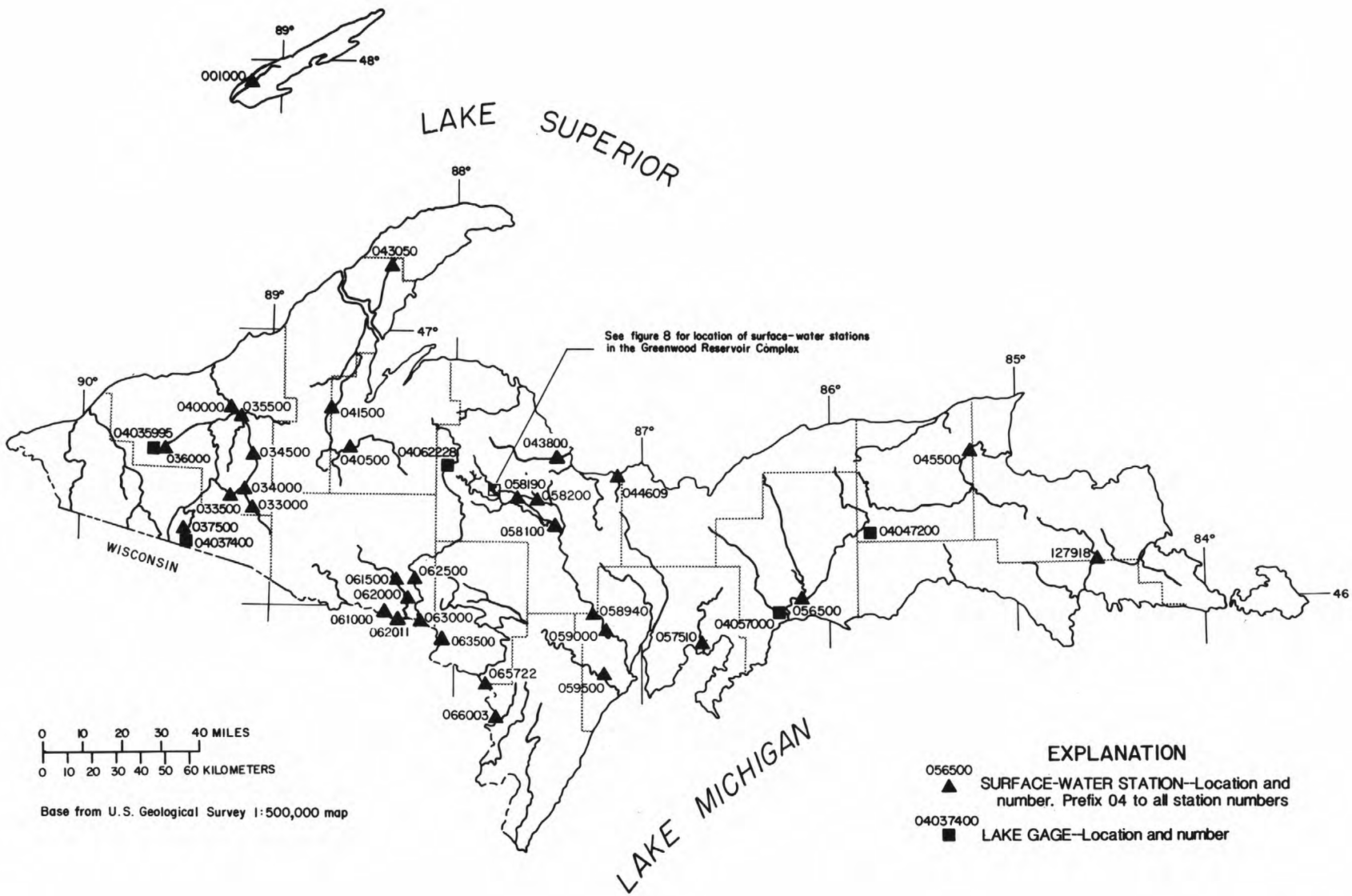

Figure 4.--Identification number and location of active surface-water gaging stations in the Upper Peninsula of Michigan.

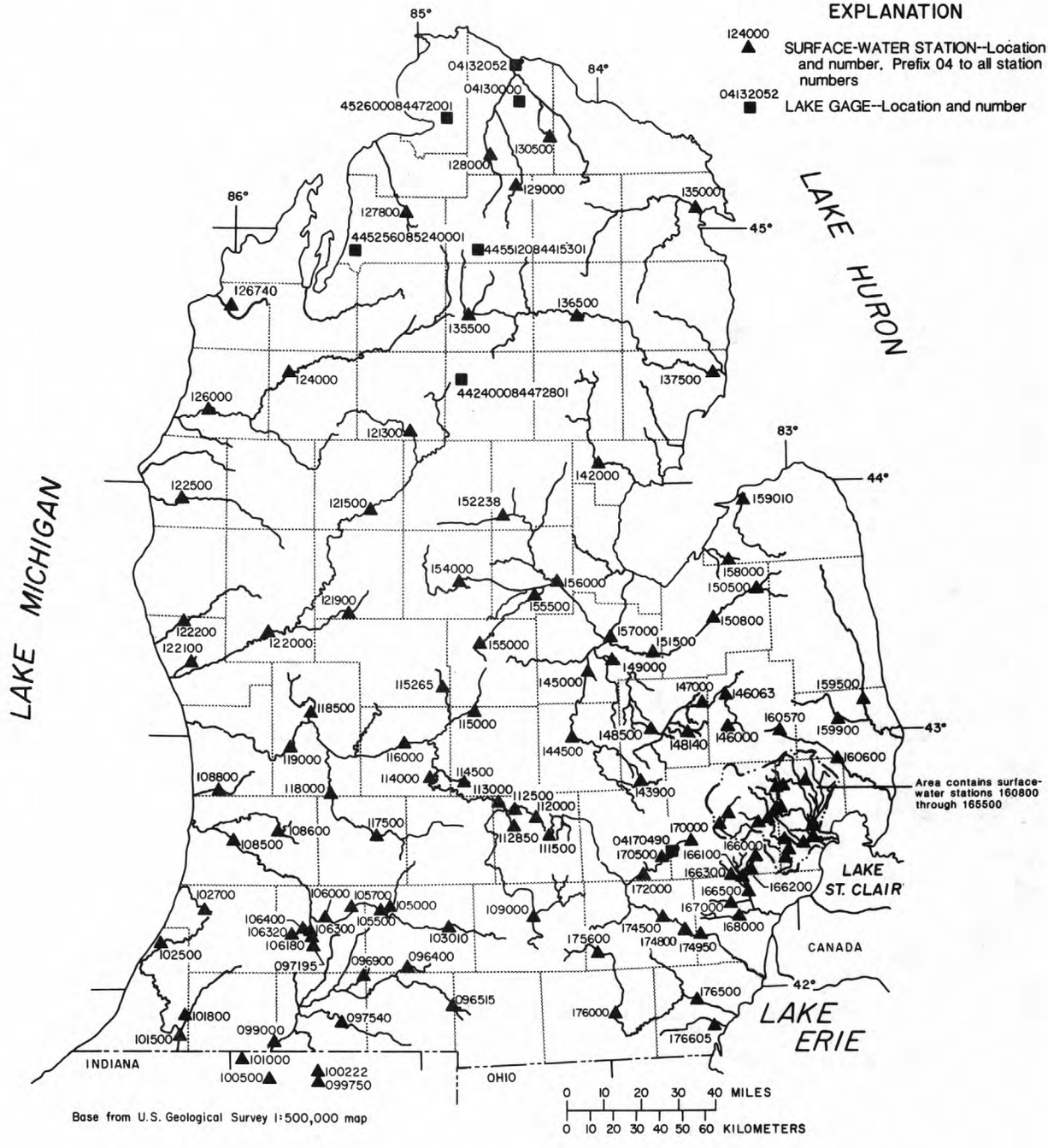

Figure 5.--Identification number and location of active surface-water gaging stations in the Lower Peninsula of Michigan.

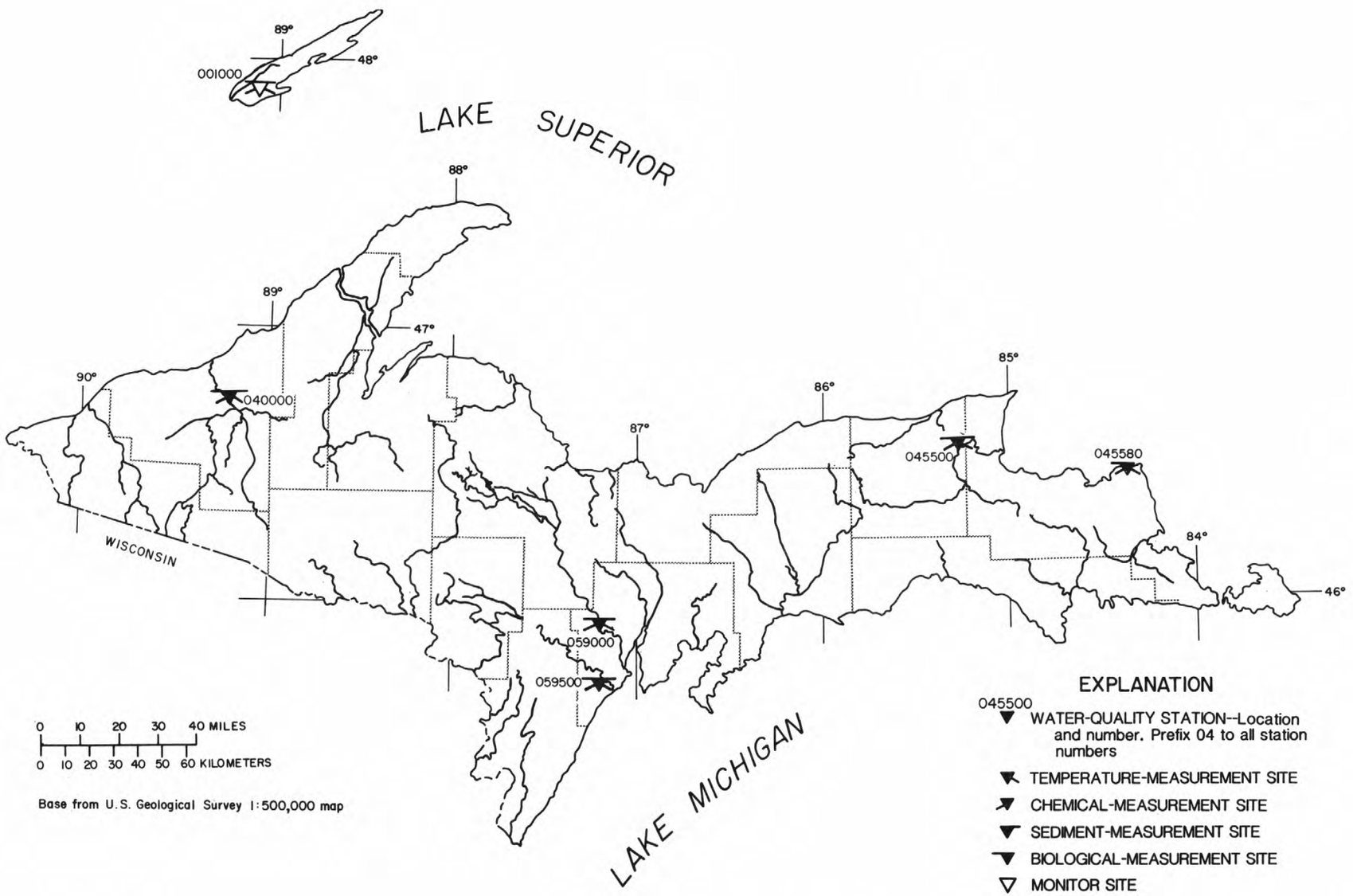

Figure 6.--Identification number and location of active surface-water-quality stations in the Upper Peninsula of Michigan.

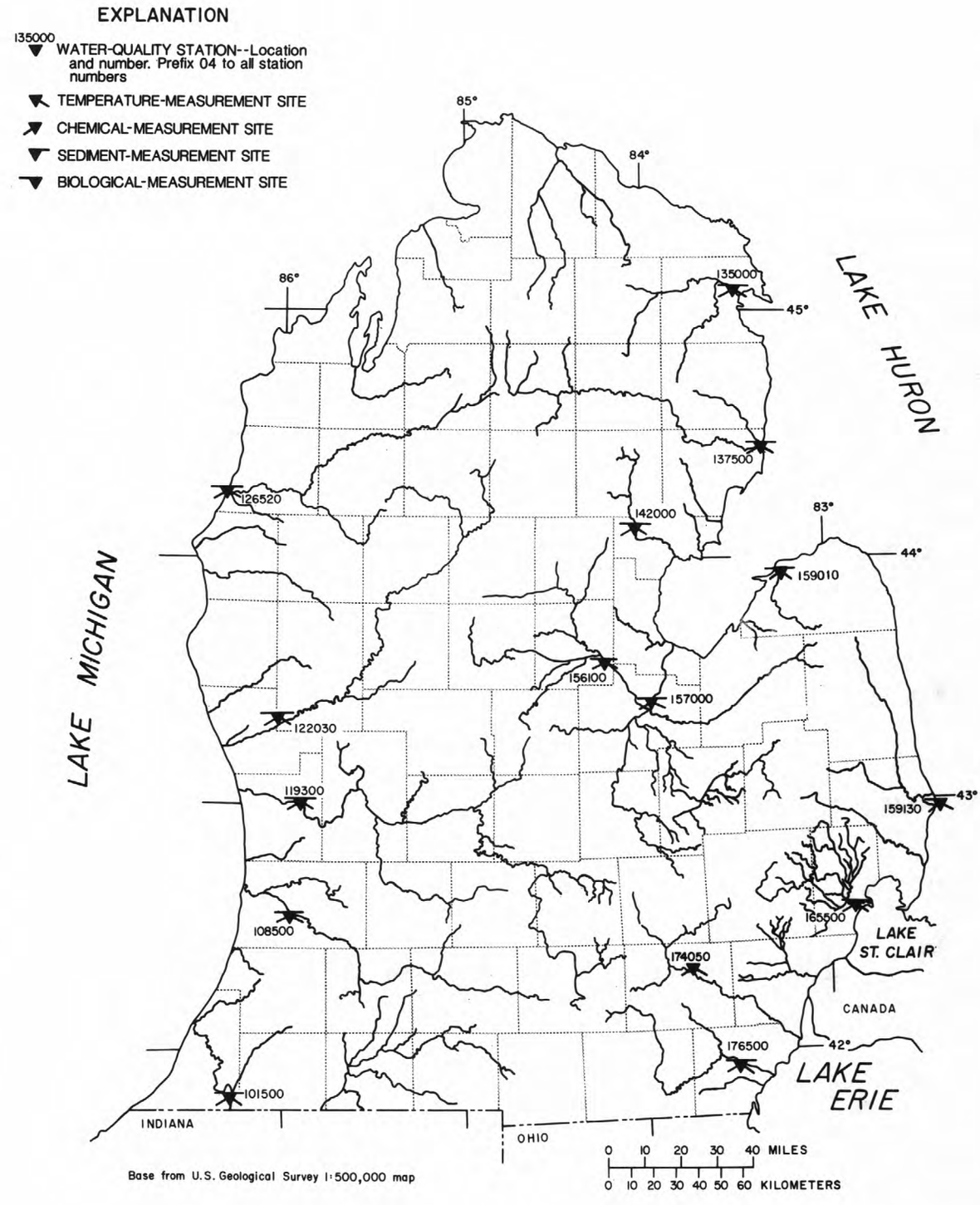

Figure 7.--Identification number and location of active surface-water-quality stations in the Lower Peninsula of Michigan.

STREAMS TRIBUTARY TO LAKE SUPERIOR

04001000 WASHINGTON CREEK AT WINDIGO, MI
(Hydrologic bench-mark station)

LOCATION.--Lat 47°55'23", long 89°08'42", in NW1/4 sec.28, T.64 N., R.38 W., Keweenaw County, Isle Royale National Park, Hydrologic Unit 04020300, on left bank 0.8 mi northeast of Windigo, and 35 mi southwest of Rock Harbor.

DRAINAGE AREA.--13.2 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1964 to current year.

GAGE.--Water-stage recorder and concrete control. Elevation of gage is 605 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 1-7, Dec. 10 to Feb. 7, Feb. 10-19, 21-27, Mar. 12-27, Apr. 5-7, June 15, July 4, July 25 to Aug. 13, and Aug. 28 to Sept. 18. Water-discharge records good except for estimated daily discharges, which are poor.

AVERAGE DISCHARGE.--26 years, 16.7 ft³/s, 17.18 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 480 ft³/s, May 1, 1972, gage height, 6.82 ft, from rating curve extended above 160 ft³/s based on runoff characteristics of nearby stations; maximum gage height, 6.88 ft, Jan. 13, 1975, backwater from ice; minimum daily discharge, 0.44 ft³/s, Aug. 25, 1977; minimum gage height, 2.54 ft, July 28, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 89 ft³/s, Apr. 20, 21, 28, gage height, 4.30 ft, no peak discharge above base discharge of 110 ft³/s; maximum gage height, 4.44 ft, Mar. 16, backwater from ice; minimum discharge, 0.64 ft³/s, Aug. 22, 23, gage height, 2.58 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.4	3.3	1.9	1.6	1.6	1.7	22	38	5.8	20	1.0	.90
2	2.1	3.2	1.9	1.7	1.6	1.7	21	32	6.8	15	1.0	.87
3	2.3	3.1	1.9	1.8	1.6	1.6	20	27	16	12	1.1	.84
4	1.9	3.0	1.8	1.8	1.6	1.6	18	22	14	9.3	1.1	.81
5	2.4	4.8	1.8	1.7	1.6	1.5	18	20	14	7.1	1.1	.80
6	4.3	6.8	1.8	1.7	1.7	1.4	15	18	16	6.0	1.0	.78
7	3.2	6.3	1.7	1.7	1.7	1.4	13	16	13	5.7	.97	.76
8	2.7	7.9	1.7	1.7	1.6	1.4	13	15	12	21	.88	.76
9	2.5	11	1.7	1.7	1.6	1.5	15	15	12	19	.89	.76
10	2.6	9.6	1.7	1.7	1.5	1.5	14	13	10	14	.93	.90
11	2.6	8.5	1.6	1.7	1.5	1.6	13	12	8.5	11	1.0	.95
12	2.5	7.0	1.6	1.7	1.5	1.9	12	11	14	8.3	1.2	1.3
13	2.3	6.4	1.6	1.8	1.5	3.0	14	10	21	6.6	1.3	1.4
14	2.2	6.0	1.6	1.8	1.5	10	21	11	16	5.6	1.0	7.8
15	2.2	5.7	1.6	1.8	1.5	25	27	13	12	5.1	1.0	4.5
16	2.2	4.7	1.6	1.8	1.5	45	29	46	11	5.0	.90	4.0
17	2.1	3.7	1.6	1.7	1.6	35	28	62	10	4.8	.90	3.1
18	2.0	2.8	1.6	1.7	1.6	23	26	47	12	5.1	.86	2.9
19	1.9	2.9	1.6	1.7	1.6	18	40	33	9.7	4.6	.84	3.4
20	1.9	3.3	1.6	1.7	1.6	15	71	25	12	3.9	.77	3.1
21	2.0	2.9	1.6	1.7	1.6	13	79	21	11	3.4	.77	7.4
22	2.0	2.7	1.5	1.7	1.6	12	74	18	9.9	3.0	.75	7.5
23	2.0	2.5	1.5	1.7	1.6	11	73	15	8.7	2.6	.74	6.0
24	1.8	2.3	1.5	1.7	1.6	9.7	65	14	7.4	2.4	.79	5.4
25	1.8	2.4	1.5	1.7	1.6	9.0	66	12	6.5	1.8	1.3	5.0
26	1.8	2.4	1.5	1.7	1.6	8.5	57	11	10	1.7	1.5	4.2
27	1.9	2.2	1.5	1.7	1.6	8.3	49	10	8.7	1.4	1.4	3.6
28	1.9	2.2	1.5	1.7	1.6	8.1	83	8.9	7.4	1.4	1.2	3.1
29	2.3	2.0	1.6	1.7	---	8.1	69	7.8	12	1.5	1.1	3.0
30	3.2	2.0	1.6	1.7	---	9.4	50	7.2	28	1.4	1.0	3.0
31	3.1	---	1.6	1.6	---	13	---	6.5	---	1.1	.95	---
TOTAL	71.1	133.6	50.8	53.1	44.3	302.9	1115	617.4	355.4	210.8	31.24	88.83
MEAN	2.29	4.45	1.64	1.71	1.58	9.77	37.2	19.9	11.8	6.80	1.01	2.96
MAX	4.3	11	1.9	1.8	1.7	45	83	62	28	21	1.5	7.8
MIN	1.4	2.0	1.5	1.6	1.5	1.4	12	6.5	5.8	1.1	.74	.76
CFSM	.17	.34	.12	.13	.12	.74	2.82	1.51	.89	.52	.08	.22
IN.	.20	.38	.14	.15	.12	.85	3.14	1.74	1.00	.59	.09	.25

CAL YR 1989 TOTAL 5096.80 MEAN 14.0 MAX 161 MIN 1.0 CFSM 1.06 IN 14.36
WTR YR 1990 TOTAL 3074.47 MEAN 8.42 MAX 83 MIN .74 CFSM .64 IN 8.66

04001000 WASHINGTON CREEK AT WINDIGO, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1965 to current year.

PERIOD OF DAILY RECORD.--
WATER TEMPERATURE: October 1964 to current year.

INSTRUMENTATION.--Water-temperature recorder since Oct. 20, 1964. Digital recorder set for one-hour-interval punches.

REMARKS.--Quarterly samples were collected at or near gage.

EXTREMES FOR PERIOD OF DAILY RECORD.--
WATER TEMPERATURE (water years 1966-72, 1974-90): Maximum, 24.5°C, July 8, 1987; minimum, 0.0°C on many days during winter.

EXTREMES FOR CURRENT YEAR.--
WATER TEMPERATURE: Maximum, 20.5°C, July 4, Aug. 3; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT										
24...	1100	1.9	180	7.75	2.5	1.3	12.4	92	230	81
FEB										
07...	1315	1.6	178	7.75	0.0	1.5	13.0	91	K2	K3
MAY										
22...	1315	18	73	7.44	10.0	2.0	10.8	97	K16	24
AUG										
08...	1315	0.87	187	7.94	16.0	5.4	8.1	84	K19	82

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
OCT										
24...	71	0	17	6.8	4.5	12	0.2	0.6	99	0
FEB										
07...	80	3	21	6.7	4.4	11	0.2	0.5	94	0
MAY										
22...	38	5	10	3.2	2.0	10	0.1	0.3	41	0
AUG										
08...	98	5	27	7.4	5.3	10	0.2	0.6	113	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT										
24...	81	4.0	5.0	<0.1	14	103	0.14	0.53	<0.01	<0.10
FEB										
07...	77	5.0	4.4	0.1	15	132	0.18	0.57	<0.01	0.18
MAY										
22...	33	4.0	1.3	<0.1	7.2	64	0.09	3.11	<0.01	<0.10
AUG										
08...	92	3.0	7.5	<0.1	14	137	0.19	0.32	<0.01	<0.10

STREAMS TRIBUTARY TO LAKE SUPERIOR

04001000 WASHINGTON CREEK AT WINDIGO, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS TOTAL (MG/L AS P)	PHOSPHORUS DISSOLVED (MG/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT 24...	0.03	0.01	0.30	0.01	<0.01	<0.01	<10	<1	10	<0.5
FEB 07...	0.02	0.03	0.30	0.01	<0.01	<0.01	<10	<1	10	<0.5
MAY 22...	0.03	0.05	0.50	0.01	0.01	<0.01	40	<1	6	<0.5
AUG 08...	0.05	0.03	0.50	0.02	<0.01	<0.01	30	<1	13	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT 24...	<1	2	<3	2	300	<1	<4	16	<0.1	<10
FEB 07...	<1	--	<3	--	440	--	<4	19	<0.1	<10
MAY 22...	<1	<1	<3	2	170	<1	<4	7	<0.1	<10
AUG 08...	<1	<1	<3	2	550	1	<4	62	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	GROSS ALPHA, DISSOLVED (UG/L AS U-NAT)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT)	GROSS BETA, DISSOLVED (PCI/L AS CS-137)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137)
OCT 24...	1	<1	<1.0	45	<6	4	2.1	<0.4	2.1	<0.4
FEB 07...	--	<1	<1.0	46	<6	7	--	--	--	--
MAY 22...	<1	<1	<1.0	21	<6	7	--	--	--	--
AUG 08...	3	<1	<1.0	57	<6	4	--	--	--	--

DATE	GROSS BETA, DISSOLVED (PCI/L AS SR/YT-90)	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/YT-90)	RADIUM 226, DISSOLVED, RADON METHOD (PCI/L)	URANIUM NATURAL DISSOLVED (UG/L AS U)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT 24...	1.7	<0.4	0.13	0.05	2	0.01	67
FEB 07...	--	--	--	--	2	0.01	61
MAY 22...	--	--	--	--	4	0.19	67
AUG 08...	--	--	--	--	10	0.02	87

STREAMS TRIBUTARY TO LAKE SUPERIOR

04001000 WASHINGTON CREEK AT WINDIGO, MI--Continued

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		OCTOBER			NOVEMBER			DECEMBER			JANUARY	
1	13.0	10.5	11.5	2.5	1.5	2.5	.0	.0	.0	.0	.0	.0
2	12.0	8.0	10.0	1.5	.0	.5	.0	.0	.0	.0	.0	.0
3	7.5	5.5	6.5	.5	.0	.0	.5	.0	.0	.0	.0	.0
4	6.5	3.5	5.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
5	6.5	4.5	5.5	1.0	.0	1.0	.0	.0	.0	.0	.0	.0
6	7.0	5.5	6.5	2.0	1.0	1.5	.5	.0	.0	.5	.0	.0
7	6.0	4.0	5.0	3.0	1.5	2.0	.5	.0	.5	.0	.0	.0
8	4.0	2.5	3.5	4.0	2.5	3.0	.5	.0	.0	.0	.0	.0
9	4.0	2.0	3.0	3.5	3.0	3.5	.0	.0	.0	.0	.0	.0
10	5.5	4.0	4.5	3.0	2.0	2.5	.0	.0	.0	.0	.0	.0
11	7.0	4.0	5.5	2.0	.5	1.5	.5	.0	.5	.0	.0	.0
12	7.0	5.0	6.0	1.0	.0	.5	.5	.0	.5	.0	.0	.0
13	6.5	4.0	5.5	1.5	.5	1.0	.0	.0	.0	.5	.0	.0
14	8.0	6.0	6.5	1.5	1.0	1.0	.0	.0	.0	.0	.0	.0
15	7.0	6.0	6.5	1.0	.0	.5	.5	.0	.5	.0	.0	.0
16	6.5	4.5	5.5	.0	.0	.0	.5	.0	.0	.0	.0	.0
17	4.5	3.5	4.0	.5	.0	.0	.5	.0	.0	.0	.0	.0
18	4.0	2.5	3.0	.5	.0	.0	.0	.0	.0	.0	.0	.0
19	2.5	2.0	2.0	.0	.0	.0	.5	.0	.5	.0	.0	.0
20	2.0	2.0	2.0	.0	.0	.0	.5	.5	.5	.0	.0	.0
21	4.0	2.0	3.0	.0	.0	.0	.5	.5	.5	.0	.0	.0
22	3.5	2.0	2.5	.0	.0	.0	.5	.0	.5	.0	.0	.0
23	4.0	2.0	3.0	.0	.0	.0	.5	.0	.0	.0	.0	.0
24	4.5	2.5	3.5	.0	.0	.0	.0	.0	.0	.0	.0	.0
25	6.0	3.5	4.5	.0	.0	.0	.0	.0	.0	.0	.0	.0
26	8.0	5.5	6.5	.0	.0	.0	.5	.5	.5	.0	.0	.0
27	9.0	7.0	8.0	.0	.0	.0	.5	.0	.0	.0	.0	.0
28	8.5	6.0	7.0	.5	.0	.0	.0	.0	.0	.0	.0	.0
29	7.0	5.5	6.0	.5	.0	.0	.5	.0	.0	.0	.0	.0
30	7.0	5.5	6.5	.0	.0	.0	.5	.0	.0	.0	.0	.0
31	5.5	2.5	4.0	---	---	---	.0	.0	.0	.5	.0	.0
MONTH	13.0	2.0	5.0	4.0	.0	.5	.5	.0	.0	.5	.0	.0

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		FEBRUARY			MARCH			APRIL			MAY	
1	.0	.0	.0	.0	.0	.0	.0	.0	.0	7.0	4.5	6.0
2	.5	.0	.0	.0	.0	.0	.0	.0	.0	6.5	4.0	5.0
3	.0	.0	.0	.0	.0	.0	.0	.0	.0	9.0	4.0	6.0
4	.0	.0	.0	.5	.0	.0	.0	.0	.0	9.0	6.0	7.5
5	.0	.0	.0	.5	.0	.0	.0	.0	.0	9.0	5.0	7.0
6	.0	.0	.0	.5	.0	.0	.0	.0	.0	9.0	4.5	6.5
7	.0	.0	.0	.0	.0	.0	.0	.0	.0	8.5	6.0	7.5
8	.0	.0	.0	.0	.0	.0	.0	.0	.0	7.5	6.0	6.5
9	.0	.0	.0	.0	.0	.0	.0	.0	.0	6.0	5.5	6.0
10	.0	.0	.0	.0	.0	.0	.0	.0	.0	6.0	4.0	5.0
11	.5	.0	.0	.0	.0	.0	.0	.0	.0	9.5	3.0	6.0
12	.5	.0	.0	.0	.0	.0	.0	.0	.0	11.5	6.0	8.5
13	.0	.0	.0	.0	.0	.0	.0	.0	.0	11.5	6.0	9.0
14	.5	.0	.5	.0	.0	.0	.5	.0	.0	9.5	8.0	8.5
15	.5	.0	.0	.0	.0	.0	1.0	.0	.0	11.0	7.5	8.5
16	.0	.0	.0	.0	.0	.0	1.0	.0	.0	9.0	7.0	8.0
17	.5	.0	.5	.0	.0	.0	1.5	.0	.0	7.5	6.5	7.0
18	.0	.0	.0	.0	.0	.0	3.5	.0	1.5	11.0	7.0	8.5
19	.0	.0	.0	.0	.0	.0	4.0	1.0	2.0	10.5	8.0	9.0
20	.5	.0	.0	.0	.0	.0	4.0	1.5	2.5	11.0	7.5	9.0
21	.0	.0	.0	.0	.0	.0	4.0	1.5	3.0	11.5	7.0	9.5
22	.0	.0	.0	.0	.0	.0	6.0	3.0	4.5	11.0	9.0	10.0
23	.0	.0	.0	.0	.0	.0	6.5	4.0	5.5	14.0	8.5	11.0
24	.0	.0	.0	.0	.0	.0	9.0	5.5	7.0	14.5	10.0	12.0
25	.5	.0	.0	.0	.0	.0	11.0	8.0	9.5	16.0	10.5	13.0
26	.0	.0	.0	.0	.0	.0	12.5	9.5	11.0	15.5	11.0	13.5
27	.0	.0	.0	.0	.0	.0	11.5	6.5	10.0	16.5	11.0	13.5
28	.0	.0	.0	.0	.0	.0	7.0	5.5	6.0	16.0	11.5	13.5
29	---	---	---	.0	.0	.0	8.0	6.0	6.5	15.0	9.5	12.5
30	---	---	---	.0	.0	.0	9.0	6.5	7.5	14.5	9.0	11.5
31	---	---	---	.0	.0	.0	---	---	---	15.5	9.5	12.5
MONTH	.5	.0	.0	.5	.0	.0	12.5	.0	2.5	16.5	3.0	9.0

STREAMS TRIBUTARY TO LAKE SUPERIOR

04001000 WASHINGTON CREEK AT WINDIGO, MI--Continued

TEMPERATURE, WATER (DEG. C), WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DAY	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN	MAX	MIN	MEAN
		JUNE			JULY			AUGUST			SEPTEMBER	
1	16.5	11.0	13.5	18.0	14.5	16.5	18.0	15.0	16.5	17.5	15.5	16.0
2	18.0	13.5	15.5	18.5	15.0	17.0	18.5	15.5	17.0	17.5	16.0	17.0
3	15.5	10.0	12.5	19.5	17.0	18.0	20.5	18.0	19.0	16.0	14.5	15.5
4	13.0	8.0	10.5	20.5	17.0	18.5	20.0	18.5	19.5	17.5	15.5	16.5
5	11.0	9.0	10.0	18.0	16.5	17.5	19.0	16.5	18.0	17.0	15.0	16.0
6	13.0	10.0	11.0	18.0	14.0	16.0	16.5	14.5	15.5	16.0	15.0	15.5
7	15.0	10.0	12.5	16.5	14.5	15.0	17.0	14.5	15.5	16.0	14.0	15.0
8	14.0	13.0	13.0	17.0	14.0	15.5	18.0	15.5	17.0	14.0	11.5	12.5
9	14.5	11.5	13.0	17.5	14.5	16.0	19.0	17.0	18.0	14.0	12.0	13.0
10	17.5	12.0	14.5	18.0	14.5	16.0	18.5	15.5	17.0	15.0	13.5	14.0
11	17.0	14.0	15.5	17.0	14.0	15.5	15.5	15.0	15.0	14.0	11.5	13.0
12	16.5	15.0	15.5	17.0	13.5	15.5	15.5	13.5	14.5	14.0	13.5	13.5
13	18.0	14.5	16.0	17.0	13.0	15.0	15.5	13.0	14.5	15.0	12.5	13.5
14	18.5	14.5	16.5	17.0	13.5	15.5	17.0	14.5	15.5	14.5	12.5	13.5
15	17.0	14.5	15.5	16.5	14.0	15.5	16.5	14.5	15.5	12.5	11.5	12.0
16	14.5	13.5	14.0	18.5	15.0	16.5	16.5	14.5	15.5	12.0	11.0	11.5
17	14.0	13.0	13.5	17.0	14.5	16.0	17.0	16.0	16.5	11.0	9.0	10.0
18	15.0	12.5	13.5	18.5	14.5	16.5	17.0	15.5	16.5	11.0	9.5	10.0
19	14.5	11.5	13.0	19.0	15.5	17.0	15.5	14.0	15.0	12.0	10.5	11.0
20	14.5	11.5	13.0	18.0	14.5	16.5	15.0	12.5	13.5	11.5	9.5	10.5
21	14.0	12.0	13.0	18.0	14.5	16.0	15.0	12.0	13.5	11.5	10.0	11.0
22	13.5	11.5	12.5	17.5	15.0	16.0	15.0	12.0	13.5	11.0	9.5	10.5
23	16.5	12.5	14.0	18.0	14.0	16.0	16.0	13.5	14.5	9.5	8.0	9.0
24	16.0	11.5	14.0	18.0	14.5	16.5	18.0	15.5	16.5	10.0	9.0	9.5
25	17.5	13.0	15.0	18.5	15.0	17.0	17.5	17.0	17.5	11.5	9.5	10.0
26	18.0	15.0	16.0	19.5	17.5	18.5	17.5	16.0	16.5	11.5	9.5	10.5
27	17.5	14.0	15.5	19.5	18.0	18.5	17.5	15.5	16.5	11.5	9.5	10.5
28	15.5	14.5	15.0	18.5	17.5	18.0	18.0	16.0	17.0	11.0	9.5	10.5
29	15.0	13.5	14.5	20.0	17.5	18.5	17.0	15.0	16.0	10.5	9.5	10.0
30	17.5	14.0	15.5	19.5	17.0	18.0	17.0	15.0	15.5	9.5	9.0	9.5
31	---	---	---	18.0	15.0	16.5	16.0	15.0	15.5	---	---	---
MONTH	18.5	8.0	14.0	20.5	13.0	16.5	20.5	12.0	16.0	17.5	8.0	12.5

04033000 MIDDLE BRANCH ONTONAGON RIVER NEAR PAULDING, MI

LOCATION.--Lat 46°21'25", long 89°04'38", in SE1/4 NE1/4 sec.29, T.46 N., R.38 W., Ontonagon County, Hydrologic Unit 04020102, Ottawa National Forest, on right bank 25 ft downstream from bridge on Forest Service Road 172, 2.4 mi upstream from Bond Falls Reservoir, and 5.7 mi southeast of Paulding.

DRAINAGE AREA.--164 mi².

PERIOD OF RECORD.--June 1942 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,485.66 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Sept. 28, 1942, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 17 to Mar. 18. Records excellent except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--48 years, 172 ft³/s, 14.24 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,050 ft³/s, Apr. 30, 1951, gage height, 10.0 ft, from floodmark; minimum, 27 ft³/s, Nov. 22, 1946, result of freezeup; minimum gage height, 2.96 ft, Nov. 26, 1942, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 480 ft³/s, Mar. 15; maximum gage height, 6.91 ft, Mar. 15, backwater from ice; minimum discharge, 54 ft³/s, Aug. 8, gage height, 3.41 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	73	123	105	92	98	90	155	200	100	97	68	63
2	86	120	100	94	98	94	179	181	98	91	65	61
3	86	114	100	94	97	97	172	163	123	85	63	61
4	82	110	100	94	96	97	169	147	146	83	62	66
5	86	122	100	94	96	92	163	137	132	79	63	71
6	108	151	98	94	95	92	151	129	127	79	62	164
7	102	139	96	94	94	91	146	120	119	74	58	193
8	97	133	94	94	92	90	139	114	112	94	57	155
9	93	138	92	96	92	95	139	113	109	121	62	120
10	93	135	91	97	91	98	150	152	105	104	63	108
11	93	126	90	95	90	100	155	162	98	96	61	100
12	92	115	90	91	90	120	147	189	125	92	63	105
13	86	115	91	90	88	195	141	171	171	76	60	110
14	86	116	92	93	89	315	141	159	158	73	59	124
15	85	119	92	95	90	450	158	169	130	73	75	132
16	86	91	91	95	90	400	161	222	123	74	71	128
17	87	92	90	94	90	310	154	306	154	75	64	116
18	86	94	90	93	90	250	147	285	173	74	71	109
19	86	97	89	91	90	224	146	244	157	74	105	116
20	88	115	88	91	93	219	149	219	144	77	98	114
21	90	115	83	90	97	199	159	186	130	73	82	112
22	88	115	83	90	96	188	155	167	122	68	75	115
23	88	110	84	90	93	163	150	159	120	76	71	117
24	88	110	84	91	91	167	154	149	113	77	68	111
25	86	110	86	92	90	164	158	140	104	76	71	101
26	87	110	91	92	88	150	155	136	110	72	78	95
27	89	110	92	92	89	137	168	131	117	70	82	95
28	90	110	94	95	90	137	212	123	107	72	78	87
29	96	105	94	96	---	133	220	117	104	75	74	80
30	107	105	94	98	---	139	212	110	101	77	71	78
31	117	---	94	99	---	147	---	105	---	74	65	---
TOTAL	2807	3465	2858	2896	2583	5243	4805	5105	3732	2501	2165	3207
MEAN	90.5	116	92.2	93.4	92.3	169	160	165	124	80.7	69.8	107
MAX	117	151	105	99	98	450	220	306	173	121	105	193
MIN	73	91	83	90	88	90	139	105	98	68	57	61
CFSM	.55	.71	.56	.57	.56	1.03	.98	1.01	.76	.49	.43	.65
IN.	.64	.79	.65	.66	.59	1.19	1.09	1.16	.85	.57	.49	.73

CAL YR 1989 TOTAL 51332 MEAN 141 MAX 568 MIN 69 CFSM .86 IN 11.64
WTR YR 1990 TOTAL 41367 MEAN 113 MAX 450 MIN 57 CFSM .69 IN 9.38

STREAMS TRIBUTARY TO LAKE SUPERIOR

04033500 BOND FALLS CANAL NEAR PAULDING, MI

LOCATION.--Lat 46°23'57", long 89°08'47", in SW1/4 NE1/4 sec.11, T.46 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, on left bank 80 ft upstream from intake to pipeline No. 2, 0.8 mi downstream from Bond Falls Reservoir on Middle Branch Ontonagon River, and 1.6 mi east of Paulding.

PERIOD OF RECORD.--July 1942 to current year.

GAGE.--Water-stage recorder and concrete control. Datum of gage is 1,441.59 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1968, nonrecording gage at datum 3.00 ft higher.

REMARKS.--No estimated daily discharges. Records excellent except those below 5.0 ft^3/s, which are poor. Canal diverts water from Bond Falls Reservoir (station 04034000) to South Branch Ontonagon River; water is used for power production at Victoria Dam near Rockland. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--48 years, 141 ft^3/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 368 ft^3/s, May 5, 1960; no flow for several days in 1963-70, 1973-75, 1982, 1987.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	56	54	55	56	55	152	3.1	12	197	210	104	103
2	56	54	55	55	55	150	2.5	39	112	209	163	103
3	55	54	55	56	55	148	1.9	57	101	209	308	103
4	56	54	55	55	55	147	1.9	44	101	208	273	103
5	56	54	55	55	56	145	1.5	43	101	170	136	103
6	56	55	55	55	56	145	2.1	42	102	118	120	104
7	56	55	54	56	56	149	3.5	158	102	107	104	102
8	54	55	55	56	56	148	2.0	311	101	108	82	109
9	54	55	55	55	56	149	2.5	310	102	107	28	117
10	55	55	55	55	55	149	2.6	308	102	107	28	119
11	56	55	55	55	55	148	2.8	183	101	107	58	123
12	56	55	53	55	82	149	3.0	41	25	107	106	69
13	56	56	52	55	128	81	3.2	40	118	107	106	8.4
14	56	55	53	55	152	9.8	3.3	102	12	107	107	8.1
15	56	55	52	55	152	10	3.6	161	11	107	106	7.8
16	55	54	51	55	152	9.4	3.7	106	11	107	107	8.0
17	55	54	52	55	151	9.3	3.1	13	11	107	106	90
18	55	55	50	55	150	9.0	2.6	42	11	106	105	248
19	55	55	49	55	147	9.2	2.9	66	11	106	105	213
20	55	55	48	55	146	9.3	3.4	44	11	106	105	113
21	56	55	52	55	149	9.6	64	100	11	105	105	113
22	56	55	54	55	152	9.3	154	163	11	105	104	112
23	56	55	54	55	150	9.2	179	163	11	105	104	112
24	56	55	55	56	143	9.2	209	163	11	105	105	112
25	56	55	55	55	146	9.4	208	163	121	105	105	112
26	56	55	54	55	150	9.5	208	163	306	105	104	112
27	56	55	54	55	150	11	171	162	275	105	104	112
28	56	55	54	55	150	10	68	162	213	105	103	112
29	56	55	54	55	---	8.4	42	193	211	105	103	111
30	56	55	52	55	---	4.7	27	233	211	104	103	111
31	55	---	54	55	---	4.0	---	244	---	104	103	---
TOTAL	1724	1644	1656	1710	3060	2020.3	1385.2	4031	2824	3773	3500	3073.3
MEAN	55.6	54.8	53.4	55.2	109	65.2	46.2	130	94.1	122	113	102
MAX	56	56	55	56	152	152	209	311	306	210	308	248
MIN	54	54	48	55	55	4.0	1.5	12	11	104	28	7.8

CAL YR 1989 TOTAL 41911.63 MEAN 115 MAX 336 MIN .30
WTR YR 1990 TOTAL 30400.80 MEAN 83.3 MAX 311 MIN 1.5

04034000 BOND FALLS RESERVOIR NEAR PAULDING, MI

LOCATION.--Lat 46°24'29", long 89°07'42", in SW1/4 sec.1, T.46 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, at Bond Falls Dam on Middle Branch Ontonagon River, 2.5 mi east of Paulding.

DRAINAGE AREA.--190 mi².

PERIOD OF RECORD.--June 1942 to current year. Prior to October 1950, monthend contents only published in WSP 1307.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Nonrecording gage read once daily. Datum of gage is 1,335.59 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Reservoir is formed by earthfill and concrete dam with one taintor gate; dam completed in 1937. Capacity of reservoir, 41,300 acre-ft between gage heights of 120 ft (maximum drawdown) and 141 ft (full pond). Dead storage unknown. Water diverted to South Branch Ontonagon River through Bond Falls Canal (station 04033500); water used for power production at Victoria Dam near Rockland.

COOPERATION.--Gage-height record provided by Upper Peninsula Power Co. and converted to acre-feet by U.S. Geological Survey.

EXTREMES FOR PERIOD OF RECORD (SINCE 1947).--Maximum contents observed, 42,980 acre-ft, July 3, 1953, gage height, 141.7 ft, of which 1,680 acre-ft was uncontrolled storage; no usable storage at times; minimum gage height observed, 116.0 ft, Mar. 21, 1970.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 34,070 acre-ft, May 20-23, gage height, 137.9 ft; minimum, 18,740 acre-ft, Sept. 30, gage height, 130.6 ft.

MONTHEND GAGE HEIGHT AND CONTENTS AT 1030, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

Date	Gage height (feet)	Contents (acre-feet)	Change in contents (acre-feet)	Change in contents (equivalent in ft³/s)
Sept. 30	131.4	20,300	--	--
Oct. 31	131.6	20,700	+400	+6.5
Nov. 30	132.6	22,700	+2,000	+33.6
Dec. 31	132.9	23,300	+600	+9.8
CAL YR 1989	--	--	-6,060	-8.4
Jan. 31	133.4	24,300	+1,000	+16.3
Feb. 28	132.0	21,500	-2,800	-50.4
Mar. 31	134.5	26,550	+5,050	+82.1
Apr. 30	137.0	32,000	+5,450	+91.6
May 31	137.2	32,460	+460	+7.5
June 30	136.3	30,460	-2,000	-33.6
July 31	133.8	25,100	-5,360	-87.2
Aug. 31	131.3	20,100	-5,000	-81.3
Sept. 30	130.6	18,740	-1,360	-22.9
WTR YR 1990	--	--	-1,560	-2.2

STREAMS TRIBUTARY TO LAKE SUPERIOR

04034500 MIDDLE BRANCH ONTONAGON RIVER NEAR TROUT CREEK, MI

LOCATION.--Lat 46°28'40", long 89°05'25", in SW1/4 sec.8, T.47 N., R.38 W., Ontonagon County, Hydrologic Unit 04020102, on right bank 0.1 mi upstream from State Highway 28, 3.8 mi west of village of Trout Creek, and 7.5 mi downstream from Bond Falls Reservoir.

DRAINAGE AREA.--203 mi².

PERIOD OF RECORD.--June 1942 to current year.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,132.03 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Nov. 4, 1942, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 8, 12, 13, 15, Dec. 18 to Jan. 1, Feb. 12-15, 18-21, Feb. 25 to Mar. 1, and Mar. 5-7. Records excellent except for estimated daily discharges, which are good. Flow regulated by Bond Falls Reservoir (station 04034000) 7.5 mi upstream. Diversion to South Branch Ontonagon River 8.5 mi upstream by Bond Falls Canal (station 04033500). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--48 years, 64.9 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,750 ft³/s, Nov. 7, 1951, gage height, 5.05 ft; minimum, 14 ft³/s, sometime during period Jan. 23 to Feb. 13, 1947, gage height, 1.14 ft, from recorded range in stage, caused by ice jams upstream from station.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 324 ft³/s, Sept. 17, gage height, 2.75 ft; minimum daily, 39 ft³/s, Feb. 2, 10, 24.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	43	46	45	42	41	40	45	46	44	54	52	53
2	46	46	44	42	39	40	47	45	54	54	52	53
3	43	45	44	42	41	40	45	45	58	54	52	54
4	43	45	45	42	42	40	45	45	56	54	52	53
5	45	48	46	42	43	40	45	45	55	54	52	46
6	45	47	44	42	42	40	44	45	55	54	52	58
7	45	46	44	42	41	40	43	45	54	54	53	47
8	44	47	45	43	42	40	43	45	55	58	53	48
9	45	46	46	42	41	40	45	46	55	54	53	55
10	45	46	45	42	39	41	45	50	54	54	53	56
11	45	45	45	42	40	41	45	50	54	54	53	72
12	44	45	45	40	41	49	44	48	62	54	53	97
13	44	45	45	40	41	51	44	45	59	54	53	109
14	45	45	44	43	41	63	45	46	56	54	56	134
15	44	46	45	42	41	84	47	47	55	54	54	57
16	44	45	44	42	41	71	45	67	57	54	53	61
17	45	44	43	41	41	54	45	58	59	54	53	232
18	45	44	44	41	41	47	45	52	58	54	57	55
19	45	46	44	41	41	45	45	48	57	54	54	98
20	45	46	43	40	41	45	45	46	56	54	53	45
21	45	44	43	42	41	44	45	45	55	54	53	47
22	45	42	43	42	41	44	45	43	55	54	53	47
23	45	41	42	41	41	42	45	43	55	54	53	46
24	44	43	42	41	39	44	45	43	55	54	53	45
25	44	48	43	41	40	42	44	43	54	54	54	45
26	44	46	43	41	40	42	44	43	54	54	54	44
27	44	46	43	41	40	43	47	42	54	54	54	43
28	44	44	42	42	40	41	51	42	54	54	53	43
29	45	44	42	43	---	42	48	42	54	54	53	43
30	45	46	42	41	---	43	46	42	55	53	53	43
31	47	---	42	43	---	43	---	42	---	53	53	---
TOTAL	1382	1357	1357	1291	1142	1421	1357	1434	1658	1676	1649	1929
MEAN	44.6	45.2	43.8	41.6	40.8	45.8	45.2	46.3	55.3	54.1	53.2	64.3
MAX	47	48	46	43	43	84	51	67	62	58	57	232
MIN	43	41	42	40	39	40	43	42	44	53	52	43

CAL YR 1989 TOTAL 19621 MEAN 53.8 MAX 304 MIN 41
WTR YR 1990 TOTAL 17653 MEAN 48.4 MAX 232 MIN 39

04035500 MIDDLE BRANCH ONTONAGON RIVER NEAR ROCKLAND, MI

LOCATION.--Lat 46°41'57", long 89°09'36", in SE1/4 sec.27, T.50 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, on left bank 10 ft upstream from bridge on U.S. Highway 45, 700 ft downstream from East Branch, and 2.8 mi southeast of Rockland.

DRAINAGE AREA.--671 mi².

PERIOD OF RECORD.--July 1942 to current year.

GAGE.--Water-stage recorder and crest-stage gage. Datum of gage is 661.1 ft above National Geodetic Vertical Datum of 1929. Prior to Apr. 1, 1959, nonrecording gage at site 400 ft upstream at same datum. Apr. 1, 1959, to Oct. 21, 1968, nonrecording gage at present site and datum.

REMARKS.--Estimated daily discharges: Nov. 17 to Mar. 13 and Mar. 15-26. Records good except for estimated daily discharges, which are fair. Regulation by Bond Falls Reservoir (station 04034000) 30.0 mi upstream. Diversion to South Branch Ontonagon River by Bond Falls Canal (station 04033500) 31.0 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--48 years, 524 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 27,000 ft³/s, Aug. 22, 1942, gage height, 21.2 ft, from floodmarks, from rating curve extended above 7,500 ft³/s, on basis of slope-area measurement of peak flow; minimum observed, 142 ft³/s, Dec. 3, 1963, discharge measurement; minimum daily, 145 ft³/s, Dec. 3, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 9,590 ft³/s, Mar. 15, gage height, 12.29 ft; minimum, 167 ft³/s, Aug. 9, 13-15, gage height, 3.35 ft; minimum daily, 167 ft³/s, Aug. 14.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	195	264	230	240	220	200	1070	396	197	202	175	171
2	211	263	225	245	220	205	1110	328	201	197	173	170
3	230	251	220	245	220	205	670	293	264	198	172	169
4	215	241	220	247	220	205	674	270	490	196	171	175
5	210	256	220	250	220	200	646	253	400	189	170	174
6	221	294	220	250	225	200	470	238	334	185	169	204
7	226	293	215	250	230	200	400	232	296	245	170	256
8	224	274	210	250	230	200	393	222	272	374	169	234
9	218	271	210	250	230	200	417	219	372	320	169	212
10	216	267	210	255	230	205	425	259	328	250	169	204
11	216	257	205	250	225	210	501	339	280	213	169	195
12	214	247	200	240	220	260	439	453	2930	197	169	208
13	211	243	195	235	220	1000	395	433	3590	192	169	224
14	213	236	200	230	220	3530	440	357	1060	187	167	289
15	211	240	200	230	220	6500	627	387	509	183	173	265
16	209	237	200	225	220	7000	541	1450	358	185	178	232
17	210	230	200	222	215	3680	444	1500	524	187	176	304
18	209	235	195	225	210	2130	389	1060	1130	186	179	236
19	209	245	190	230	210	1260	401	702	714	184	207	217
20	210	250	190	230	210	735	420	482	448	190	225	252
21	214	250	190	230	215	585	406	380	395	187	199	218
22	214	250	190	230	215	410	379	326	356	187	185	227
23	216	250	190	230	210	725	365	298	304	203	177	245
24	216	245	195	230	205	610	380	277	272	197	176	230
25	216	240	195	225	200	470	410	257	249	184	179	212
26	217	240	200	225	200	460	364	242	237	180	181	200
27	216	240	220	230	200	330	390	231	227	180	183	192
28	212	235	230	235	200	355	1150	221	218	179	182	186
29	220	235	240	240	---	331	734	212	213	177	177	179
30	233	230	240	235	---	470	502	207	209	178	175	177
31	246	---	240	230	---	821	---	202	---	178	172	---
TOTAL	6698	7509	6485	7339	6060	33892	15952	12726	17377	6290	5505	6457
MEAN	216	250	209	237	216	1093	532	411	579	203	178	215
MAX	246	294	240	255	230	7000	1150	1500	3590	374	225	304
MIN	195	230	190	222	200	200	364	202	197	177	167	169

CAL YR 1989 TOTAL 152688 MEAN 418 MAX 4330 MIN 190
WTR YR 1990 TOTAL 132290 MEAN 362 MAX 7000 MIN 167

STREAMS TRIBUTARY TO LAKE SUPERIOR

04035995 LAKE GOGEBIC NEAR BERGLAND, MI

LOCATION.--Lat 46°35'19", long 89°32'52", in SW1/4 NW1/4 sec.3, T.48 N., R.42 W., Ontonagon County, Hydrologic Unit 04020102, at upstream side of dam on lake outlet, 1.0 mi southeast of Bergland, and 4.3 mi east of Merriweather.

DRAINAGE AREA.--162 mi².

PERIOD OF RECORD.--July 1958 to September 1959 (no winter record), February 1969 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,292.70 ft above National Geodetic Vertical Datum of 1929. July 1958 to September 1959, nonrecording gage at mouth of Merriweather Creek at different datum. February 1969 to September 1988, at datum 1.00 ft higher.

REMARKS.--Lake Gogebic is used as a storage reservoir (capacity 35,200 acre-ft) by Upper Peninsula Power Company for power production at Victoria Dam near Rockland. Lake level is controlled at the outlet by a concrete dam with removable flash boards. Major inlets to Lake Gogebic are Slate River, Trout Brook, and Merriweather Creek. Streamflow records are currently collected at the outlet, West Branch Ontonagon River (station 04036000). Surface area of lake is 14,780 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily gage height, 4.30 ft, present datum, Apr. 22, 1971; minimum daily, 0.68 ft, present datum, Apr. 5, 6, 1970.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 3.71 ft, June 12, result of wind action; minimum, 1.08 ft, Mar. 10, 11.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.54	2.44	2.65	2.63	1.92	1.31	2.04	3.05	3.31	2.98	---	2.57
2	2.50	2.47	2.66	2.61	1.89	1.28	2.09	3.04	3.29	3.00	---	2.52
3	2.47	2.48	2.67	2.58	1.88	1.25	2.12	3.04	3.28	3.04	---	2.53
4	2.46	2.47	2.67	2.58	1.86	1.23	2.15	3.06	3.28	3.00	---	2.51
5	2.48	2.49	2.67	2.55	1.84	1.22	2.16	3.07	3.30	2.94	---	2.51
6	2.47	2.53	2.68	2.53	1.82	1.19	2.17	3.12	3.27	2.93	---	2.73
7	2.43	2.52	2.69	2.50	1.77	1.17	2.17	3.10	3.23	2.95	2.69	2.71
8	2.42	2.55	2.69	2.48	1.73	1.16	2.17	3.12	3.23	2.95	2.69	2.71
9	2.44	2.56	2.69	2.45	1.70	1.15	2.18	3.10	3.21	2.95	2.68	2.68
10	2.43	2.56	2.70	2.42	1.67	1.14	2.20	3.06	3.18	2.91	2.65	2.67
11	2.46	2.57	2.70	2.43	1.63	1.13	2.22	3.17	3.20	2.89	2.64	2.69
12	2.48	2.53	2.70	2.42	1.60	1.17	2.22	3.17	3.28	2.86	2.62	2.67
13	2.41	2.51	2.70	2.38	1.58	1.19	2.22	3.19	3.40	2.87	2.64	2.68
14	2.41	2.50	2.71	2.35	1.56	1.25	2.22	3.21	3.37	2.86	2.65	2.65
15	2.40	2.51	2.72	2.32	1.54	1.43	2.24	3.22	3.32	2.87	2.62	2.64
16	2.36	2.51	2.72	2.29	1.55	1.61	2.26	3.36	3.31	2.87	2.64	2.62
17	2.38	2.58	2.73	2.26	1.56	1.74	2.27	3.49	3.35	2.89	2.64	2.63
18	2.38	2.59	2.73	2.24	1.53	1.82	2.28	3.48	3.35	2.86	2.58	2.66
19	2.37	2.61	2.73	2.21	1.51	1.86	2.28	3.43	3.33	2.84	2.60	2.67
20	2.37	2.50	2.73	2.17	1.48	1.89	2.27	3.42	3.32	2.84	2.59	2.67
21	2.36	2.58	2.75	2.17	1.46	1.92	2.28	3.46	3.28	2.82	2.59	2.70
22	2.39	2.60	2.74	2.15	1.41	1.95	2.30	3.46	3.18	2.81	2.57	2.68
23	2.38	2.63	2.74	2.13	1.39	1.96	2.33	3.45	3.10	2.83	2.58	2.66
24	2.39	2.63	2.72	2.14	1.38	1.97	2.37	3.44	3.09	2.82	2.57	2.71
25	2.41	2.63	2.70	2.10	1.38	1.97	2.44	3.42	3.05	2.83	2.58	2.67
26	2.42	2.62	2.70	2.07	1.36	1.94	2.47	3.41	3.00	2.82	2.60	2.66
27	2.45	2.62	2.68	2.06	1.34	1.93	2.51	3.41	2.97	2.82	2.59	2.64
28	2.40	2.64	2.67	2.03	1.32	1.95	2.77	3.37	2.99	2.81	2.60	2.64
29	2.44	2.65	2.66	2.01	---	1.97	2.87	3.35	2.96	2.80	2.58	2.66
30	2.40	2.66	2.65	1.97	---	1.99	3.00	3.34	2.98	2.77	2.60	2.67
31	2.42	---	2.64	1.93	---	2.01	---	3.33	---	2.79	2.60	---
MEAN	2.42	2.56	2.70	2.30	1.60	1.57	2.31	3.27	3.21	2.88	---	2.65
MAX	2.54	2.66	2.75	2.63	1.92	2.01	3.00	3.49	3.40	3.04	---	2.73
MIN	2.36	2.44	2.64	1.93	1.32	1.13	2.04	3.04	2.96	2.77	---	2.51

STREAMS TRIBUTARY TO LAKE SUPERIOR

04036000 WEST BRANCH ONTONAGON RIVER NEAR BERGLAND, MI

LOCATION.--Lat 46°35'15", long 89°32'30", in SW1/4 NE1/4 sec.3, T.48 N., R.42 W., Ontonagon County, Hydrologic Unit 04020102, on right bank 0.4 mi downstream from dam at outlet of Lake Gogebic, and 1.5 mi east of Bergland.

DRAINAGE AREA.--162 mi².

PERIOD OF RECORD.--July 1942 to current year.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,290.81 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 5, 1942, nonrecording gage 0.4 mi upstream at different datum.

REMARKS.--Estimated daily discharges: Dec. 12, 13, 19-23, 29, 30, Feb. 14, 15, 17, 20, 25, 28, and Mar. 5, 6. Records good except those below 5.0 ft³/s, which are poor. Flow regulated by Lake Gogebic (station 04035995). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--48 years, 172 ft³/s, 14.42 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,400 ft³/s, Apr. 26, 1960, gage height, 5.98 ft; minimum daily, 0.38 ft³/s, Nov. 16, 17, 1989.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 487 ft³/s, June 26, gage height, 3.77 ft; minimum daily, 0.38 ft³/s, Nov. 16, 17.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.95	.46	73	155	222	164	231	5.7	148	18	1.8	.57
2	1.3	.45	60	155	211	159	269	4.8	144	18	1.7	.57
3	1.2	.45	55	149	205	152	282	3.8	137	17	1.6	.56
4	.95	.45	54	183	198	150	291	3.6	137	15	1.7	.56
5	.99	.45	54	248	195	147	296	4.2	142	15	1.7	.57
6	1.0	.45	54	242	180	142	298	5.3	140	13	1.5	.80
7	.87	.45	55	232	231	140	292	5.5	133	13	4.9	.62
8	.72	.45	55	222	263	138	277	4.8	135	13	32	.56
9	.83	.45	55	210	254	139	262	3.9	133	12	2.3	.56
10	.88	.45	55	200	248	135	232	3.5	128	12	1.7	.58
11	.87	.45	56	207	241	134	236	3.8	131	12	1.7	.57
12	.70	.40	56	222	234	142	237	4.0	148	7.7	1.5	34
13	.62	.40	56	264	228	145	236	4.0	184	6.2	1.4	1.5
14	.53	.40	57	255	214	157	238	4.5	326	4.0	1.5	1.2
15	.47	.39	58	241	207	182	241	5.0	297	3.2	1.5	.98
16	.45	.38	58	229	207	225	198	11	295	3.3	1.4	.92
17	.45	.38	58	223	209	252	176	181	320	3.1	1.3	.77
18	.45	.39	58	222	205	269	180	426	310	3.0	1.2	57
19	.45	.40	58	220	199	280	179	397	303	2.8	.92	3.2
20	.45	.42	59	203	196	289	176	282	306	2.4	.85	1.3
21	.45	.42	62	199	191	295	178	175	289	2.4	.84	.87
22	.45	.42	62	192	182	304	174	175	357	2.5	.83	.76
23	.45	.42	61	181	177	303	85	174	406	2.5	.86	.68
24	.45	.42	135	207	174	308	18	174	390	2.5	.86	.61
25	.45	.44	177	232	174	309	8.6	171	368	2.6	.84	.59
26	.45	1.2	172	225	173	299	6.7	169	360	2.7	.83	.58
27	.45	1.3	165	224	169	229	6.2	166	278	2.7	.81	.59
28	.45	1.3	165	260	163	137	9.5	158	112	2.5	.76	.59
29	.46	23	165	217	---	137	6.6	152	55	2.4	.70	.59
30	.47	73	162	242	---	155	6.5	151	20	2.1	.65	.59
31	.47	---	157	236	---	195	---	150	---	1.9	.60	---
TOTAL	20.13	110.44	2627	6697	5750	6212	5326.1	3178.4	6632	220.5	72.75	113.84
MEAN	.65	3.68	84.7	216	205	200	178	103	221	7.11	2.35	3.79
MAX	1.3	73	177	264	263	309	298	426	406	18	32	57
MIN	.45	.38	54	149	163	134	6.2	3.5	20	1.9	.60	.56

CAL YR 1989 TOTAL 48769.18 MEAN 134 MAX 652 MIN .38 CFSM .83 IN 11.20
WTR YR 1990 TOTAL 36960.16 MEAN 101 MAX 426 MIN .38 CFSM .62 IN 8.49

STREAMS TRIBUTARY TO LAKE SUPERIOR

04037400 CISCO LAKE NEAR WATERSMEET, MI

LOCATION.--Lat 46°15'10", long 89°27'07", in NE1/4 sec.32, T.45 N., R.41 W., Gogebic County, Hydrologic Unit 04020102, on right bank at outlet, 100 ft upstream from dam, 13 mi west of Watersmeet. Prior to Oct. 23, 1989, at site 90 ft downstream.

DRAINAGE AREA.--50.6 mi².

PERIOD OF RECORD.--July 1942 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,679.53 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Oct. 28, 1969, nonrecording gage at same site and datum.

REMARKS.--Cisco Lake (capacity 15,600 acre-ft) is the downstream lake in a chain of lakes used as storage reservoirs by Upper Peninsula Power Company for power production at Victoria Dam near Rockland. Lake level is controlled at the outlet by a concrete dam of two bays with removable flash boards. The major inlet to Cisco Lake is the combined outlet from Lindsley Lake and Thousand Island Lake. Streamflow records are currently collected at the outlet, Cisco Branch Ontonagon River (station 04037500). The lake level is maintained at an elevation of about 1,683.5 ft, above NGVD, during winter months and 1,684.0 ft, above NGVD, during summer months. Surface area of lake is 506 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 4.69 ft, July 19, 1942; minimum, 1.72 ft, Mar. 20-22, 1948.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 4.19 ft, June 12; minimum, 3.43 ft, Mar. 25-28.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.90	3.87	3.52	3.59	3.57	3.56	3.48	3.64	3.94	4.02	3.98	4.00
2	3.85	3.86	3.52	3.58	3.57	3.56	3.50	3.66	3.97	4.03	3.98	4.00
3	3.85	3.86	3.52	3.56	3.58	3.56	3.52	3.67	3.97	4.05	3.97	4.03
4	3.86	3.85	3.52	3.53	3.58	3.57	3.53	3.67	3.99	4.00	3.94	4.00
5	3.90	3.85	3.50	3.51	3.57	3.57	3.54	3.66	4.03	3.99	3.92	4.00
6	3.91	3.83	3.48	3.50	3.54	3.57	3.56	3.67	4.01	3.99	3.91	4.13
7	3.92	3.83	3.46	3.48	3.52	3.57	3.56	3.67	4.02	4.02	3.91	4.11
8	3.93	3.81	3.47	3.47	3.50	3.57	3.57	3.67	4.03	4.05	3.91	4.07
9	3.95	3.75	3.48	3.46	3.50	3.58	3.57	3.69	4.02	4.07	3.91	4.02
10	3.96	3.71	3.49	3.45	3.48	3.58	3.55	3.70	4.02	4.06	3.91	3.98
11	3.99	3.66	3.50	3.46	3.46	3.60	3.55	3.75	4.04	4.05	3.91	3.97
12	3.97	3.65	3.51	3.48	3.45	3.63	3.54	3.76	4.09	4.02	3.91	3.95
13	3.98	3.61	3.52	3.49	3.45	3.62	3.52	3.77	4.10	4.00	3.91	3.95
14	3.98	3.59	3.54	3.49	3.45	3.60	3.50	3.80	4.04	4.00	3.91	3.97
15	3.97	3.60	3.56	3.49	3.45	3.65	3.50	3.84	4.00	4.01	3.91	3.98
16	3.95	3.57	3.57	3.49	3.49	3.66	3.51	3.92	3.99	4.01	3.92	3.98
17	3.95	3.60	3.57	3.49	3.52	3.65	3.50	3.96	3.98	4.04	3.92	3.98
18	3.94	3.59	3.58	3.49	3.53	3.63	3.49	3.96	3.94	4.01	3.95	3.98
19	3.93	3.58	3.59	3.50	3.53	3.61	3.48	4.01	3.97	4.02	4.00	3.97
20	3.91	3.56	3.59	3.49	3.54	3.58	3.46	4.00	3.97	4.02	3.99	3.97
21	3.90	3.56	3.59	3.50	3.53	3.55	3.47	3.99	3.96	4.01	3.99	3.97
22	3.91	3.55	3.58	3.51	3.52	3.52	3.48	4.00	3.97	4.01	3.99	3.94
23	3.92	3.55	3.58	3.51	3.53	3.51	3.51	4.00	3.95	4.01	4.00	3.93
24	3.92	3.54	3.58	3.54	3.54	3.49	3.53	4.01	3.97	4.01	3.99	3.94
25	3.92	3.53	3.58	3.54	3.55	3.45	3.55	4.01	3.98	4.01	4.01	3.92
26	3.92	3.52	3.60	3.56	3.56	3.44	3.57	3.98	4.01	4.01	4.04	3.93
27	3.91	3.53	3.60	3.57	3.56	3.43	3.59	3.98	4.03	4.01	4.06	3.93
28	3.87	3.54	3.60	3.58	3.56	3.44	3.67	3.97	4.04	4.00	4.04	3.92
29	3.89	3.54	3.61	3.58	---	3.45	3.66	3.95	4.01	3.99	4.04	3.92
30	3.86	3.52	3.60	3.57	---	3.47	3.65	3.95	4.01	3.98	4.05	3.92
31	3.86	---	3.60	3.57	---	3.48	---	3.94	---	3.98	4.05	---
MEAN	3.92	3.65	3.55	3.52	3.52	3.55	3.54	3.85	4.00	4.02	3.97	3.98
MAX	3.99	3.87	3.61	3.59	3.58	3.66	3.67	4.01	4.10	4.07	4.06	4.13
MIN	3.85	3.52	3.46	3.45	3.45	3.43	3.46	3.64	3.94	3.98	3.91	3.92

CAL YR 1989 MEAN 3.74 MAX 4.08 MIN 3.40
WTR YR 1990 MEAN 3.76 MAX 4.13 MIN 3.43

04037500 CISCO BRANCH ONTONAGON RIVER AT CISCO LAKE OUTLET, MI

LOCATION.--Lat 46°15'12", long 89°27'05", in NE1/4 sec.32, T.45 N., R.41 W., Gogebic County, Hydrologic Unit 04020102, on left bank 80 ft downstream from Cisco Lake Dam, 2.5 mi upstream from Langford Creek, 5.0 mi upstream from U.S. Highway 2, and 13 mi west of Watersmeet.

DRAINAGE AREA.--50.7 mi².

PERIOD OF RECORD.--October 1944 to current year.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,672.69 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1968, nonrecording gage at same site and at datum 4.00 ft higher.

REMARKS.--No estimated daily discharges. Records good except those below 3.0 ft³/s, which are poor. Flow regulated by Cisco Lake (station 04037400). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--46 years, 46.4 ft³/s, 12.43 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 288 ft³/s, May 1-4, 1951, gage height, 6.10 ft, present datum; minimum daily, 0.08 ft³/s, July 21, Aug. 2, 3, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 183 ft³/s, June 13, gage height, 5.60 ft; minimum daily, 0.25 ft³/s, Apr. 25, 26, May 2, 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.34	64	40	47	26	20	17	.27	13	.64	.53	3.5
2	.33	63	40	46	26	19	17	.25	1.1	.73	.68	3.3
3	.34	63	40	56	27	19	18	.25	.93	.62	.55	3.3
4	.35	63	40	65	27	19	18	.26	.92	.39	.51	3.1
5	.34	62	39	64	45	19	19	.28	1.3	.37	.55	3.0
6	.34	61	31	63	64	19	19	.32	.87	.37	.53	70
7	.34	82	23	61	63	19	19	.29	1.1	.38	.52	109
8	.34	107	13	50	62	19	19	.29	1.2	4.1	.46	102
9	.35	101	6.5	38	61	20	42	.32	8.5	9.9	.39	98
10	.34	98	6.8	37	60	20	74	.36	25	11	.39	97
11	.52	92	7.0	38	58	20	72	.36	26	10	.40	79
12	.34	92	7.3	32	38	58	67	.32	70	16	11	65
13	.34	90	7.7	23	18	98	59	.33	142	22	9.0	51
14	.36	64	8.5	23	9.7	115	43	.31	134	8.8	.55	36
15	.37	45	8.9	23	2.9	58	33	.29	116	.55	.40	37
16	15	44	9.2	23	2.9	57	33	.63	113	.40	.37	37
17	27	45	9.2	23	2.7	99	48	.34	107	.59	.34	37
18	26	45	9.5	23	2.6	108	53	.30	59	.46	.37	37
19	26	45	9.8	23	12	107	49	12	24	.50	.37	36
20	24	43	18	23	19	103	35	26	20	.55	.37	44
21	24	43	27	23	19	93	15	26	16	.65	.37	38
22	25	43	27	23	19	85	1.9	26	9.7	.70	.37	37
23	24	43	27	24	19	78	.38	26	3.6	.65	.34	36
24	24	42	27	25	19	86	.29	26	3.4	.70	.35	19
25	48	41	28	25	19	80	.25	26	2.8	.61	.36	5.4
26	68	41	29	26	20	58	.25	25	1.5	.43	.43	5.4
27	68	41	29	26	19	30	.28	25	1.2	.44	5.2	5.1
28	65	41	29	27	19	17	.30	24	1.1	.40	10	5.0
29	66	41	38	27	---	17	.26	23	.73	.40	9.6	5.0
30	64	41	47	26	---	17	.27	23	.63	.40	8.1	4.9
31	64	---	47	26	---	17	---	22	---	.40	5.4	---
TOTAL	663.34	1786	729.4	1059	779.8	1594	773.18	315.77	905.58	94.13	68.80	1112.0
MEAN	21.4	59.5	23.5	34.2	27.9	51.4	25.8	10.2	30.2	3.04	2.22	37.1
MAX	68	107	47	65	64	115	74	26	142	22	11	109
MIN	.33	41	6.5	23	2.6	17	.25	.25	.63	.37	.34	3.0

CAL YR 1989 TOTAL 11153.59 MEAN 30.6 MAX 138 MIN .21 CFSM .60 IN 8.18
WTR YR 1990 TOTAL 9881.00 MEAN 27.1 MAX 142 MIN .25 CFSM .54 IN 7.25

STREAMS TRIBUTARY TO LAKE SUPERIOR

04040000 ONTONAGON RIVER NEAR ROCKLAND, MI
(National stream quality accounting network station)

LOCATION.--Lat 46°43'15", long 89°12'25", in NE1/4 sec.20, T.50 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, on left bank 150 ft downstream from bridge on Victoria Road, 1.8 mi southwest of Rockland, and 2.4 mi downstream from confluence of Middle and West Branches.

DRAINAGE AREA.--1,340 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--June 1942 to current year.

REVISED RECORDS.--WSP 1387: 1943, 1946-47. WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 638.72 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 23, 1943, nonrecording gage and Nov. 23, 1943, to Oct. 17, 1967, water-stage recorder at site 50 ft upstream at same datum.

REMARKS.--Estimated daily discharges: Nov. 26 to Mar. 14. Water-discharge records good except for estimated daily discharges, which are fair. Flow regulated by Victoria powerplant on West Branch 5 mi upstream; Bond Falls Reservoir (station 04034000) 34 mi upstream; Lake Gogebic (station 04035995) and Cisco Lake (station 04037400), in headwaters.

AVERAGE DISCHARGE.--48 years, 1,405 ft³/s, 14.24 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 42,000 ft³/s, Aug. 22, 1942, gage height, 28.6 ft, from floodmark, from rating curve extended above 14,000 ft³/s on basis of slope-area measurement of peak flow; minimum daily, 192 ft³/s, July 28, 29, 1963.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 9,000 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 14	1400	ice jam	*18.99	Mar. 15	2300	*16,800	16.46

Minimum daily discharge, 253 ft³/s, Aug. 12.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	302	532	430	610	610	770	2700	1270	816	566	331	331
2	369	536	510	620	600	770	3370	924	743	563	354	319
3	389	514	460	630	610	660	2200	832	889	504	330	311
4	322	507	420	650	630	770	2000	683	1050	458	469	395
5	438	679	480	690	640	820	1990	653	927	541	513	338
6	330	477	530	750	550	780	1590	560	907	530	426	366
7	389	649	470	800	600	700	1400	520	844	520	390	544
8	347	566	440	700	670	730	1370	559	710	659	310	555
9	379	607	460	720	710	740	1370	749	879	637	374	508
10	376	631	460	720	740	700	1290	856	819	513	280	536
11	338	606	470	750	720	810	1380	855	664	422	275	535
12	314	547	500	690	710	900	1380	1180	3760	457	253	555
13	291	546	410	640	720	2000	1360	942	6860	367	307	571
14	386	544	440	740	740	5800	1410	795	3640	390	403	584
15	400	540	390	700	740	11000	1800	881	2260	409	282	502
16	391	570	420	730	730	14100	1730	2390	1460	397	388	467
17	349	376	440	780	720	9120	1430	3760	1460	404	320	509
18	360	336	450	700	720	5670	1080	3160	2440	378	393	449
19	316	401	450	640	710	3140	1070	2520	2340	383	492	568
20	303	623	430	670	700	2340	1150	1680	1640	402	435	765
21	434	519	400	620	690	2210	1270	1140	1370	322	416	491
22	308	487	350	600	740	2430	1100	1080	1130	407	371	588
23	381	350	440	600	710	2160	1150	1020	1100	382	343	573
24	448	373	390	630	690	1630	1080	985	1060	406	317	533
25	410	423	470	610	630	1570	987	932	921	370	353	532
26	325	480	520	630	630	1520	980	807	917	360	374	479
27	391	460	570	650	660	1450	1040	845	981	377	366	452
28	381	470	580	660	730	1290	2960	741	998	347	344	425
29	434	410	590	660	---	761	2400	772	685	383	321	404
30	551	440	590	660	---	1220	1810	690	644	389	379	378
31	548	---	600	650	---	2060	---	818	---	374	300	---
TOTAL	11700	15199	14560	20900	19050	80621	47847	35599	44914	13617	11209	14563
MEAN	377	507	470	674	680	2601	1595	1148	1497	439	362	485
MAX	551	679	600	800	740	14100	3370	3760	6860	659	513	765
MIN	291	336	350	600	550	660	980	520	644	322	253	311

CAL YR 1989 TOTAL 396542 MEAN 1086 MAX 8590 MIN 239 CFSM .81 IN 11.01
WTR YR 1990 TOTAL 329779 MEAN 904 MAX 14100 MIN 253 CFSM .68 IN 9.16

04040000 ONTONAGON RIVER NEAR ROCKLAND, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1972 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: October 1974 to September 1981.
WATER TEMPERATURE: October 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Oct. 15, 1975 to Sept. 30, 1977.

REMARKS.--Quarterly samples were collected at or near Victoria Road bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975-80): Maximum recorded (more than 20 percent missing record), 192 microsiemens, Mar. 26, 1977, May 28, 1978; minimum recorded, 45 microsiemens, Dec. 2, 1975.
WATER TEMPERATURE (water years 1975-77, 1979-80): Maximum, 28.0°C, July 19, 1977; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT										
05...	1300	957	153	8.13	11.0	4.9	10.0	94	K9	K11
JAN										
17...	1450	802	135	7.78	0.0	8.5	12.8	90	K8	K10
APR										
18...	1500	1310	98	7.30	5.5	32	12.4	100	<3	K5
JUL										
25...	1300	654	162	8.25	21.0	8.3	8.6	99	K10	K7

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
OCT										
05...	80	5	22	6.1	2.7	7	0.1	1.1	92	0
JAN										
17...	63	9	17	5.0	2.6	8	0.1	1.0	66	0
APR										
18...	42	3	11	3.4	2.1	10	0.1	0.8	47	0
JUL										
25...	80	0	22	6.0	2.8	7	0.1	1.0	100	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT										
05...	75	4.0	1.9	0.1	9.8	108	0.15	279	<0.01	<0.10
JAN										
17...	54	5.0	2.7	0.1	8.1	87	0.12	188	--	0.11
APR										
18...	38	6.0	2.0	<0.1	7.4	63	0.09	223	<0.01	<0.10
JUL										
25...	82	--	2.8	<0.1	8.2	100	--	--	<0.01	<0.10

STREAMS TRIBUTARY TO LAKE SUPERIOR

04040000 ONTONAGON RIVER NEAR ROCKLAND, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS TOTAL (MG/L AS P)	PHOSPHORUS DISSOLVED (MG/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT 05...	0.02	0.02	0.40	0.03	<0.01	<0.01	<10	<1	31	<0.5
JAN 17...	0.04	0.04	0.30	0.03	<0.01	<0.01	20	<1	28	<0.5
APR 18...	0.01	0.03	0.60	0.04	0.02	<0.01	160	<1	21	<0.5
JUL 25...	<0.01	0.02	0.30	0.02	<0.01	<0.01	10	1	31	0.6

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT 05...	<1	<1	<3	3	62	<1	<4	44	<0.1	<10
JAN 17...	<1	<1	<3	--	92	--	<4	8	<0.1	<10
APR 18...	<1	<1	<3	3	170	<1	<4	15	<0.1	<10
JUL 25...	<1	<1	<3	2	54	<1	5	6	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT 05...	1	<1	<1.0	50	<6	10	15	39	88
JAN 17...	--	<1	<1.0	42	<6	7	--	--	--
APR 18...	1	<1	<1.0	33	<6	3	37	131	94
JUL 25...	2	<1	<1.0	50	<6	4	13	23	95

04040500 STURGEON RIVER NEAR SIDNAW, MI

LOCATION.--Lat 46°35'03", long 88°34'33", in NE1/4 SE1/4 sec.5, T.48 N., R.34 W., Baraga County, Hydrologic Unit 04020104, on right bank 30 ft downstream from highway bridge, 3.0 mi downstream from Rock River, 3.5 mi northwest of Covington, 6.5 mi upstream from Perch River, 8.5 mi northeast of Sidnaw, and at mile 71.

DRAINAGE AREA.--171 mi².

PERIOD OF RECORD.--October 1912 to September 1915, April 1943 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1507: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,214.40 ft above National Geodetic Vertical Datum of 1929. October 1912 to September 1915, nonrecording gage at site 200 ft upstream at different datum. Apr. 2, 1943 to Oct. 1, 1946, nonrecording gage at present site and datum.

REMARKS.--Estimated daily discharges: Nov. 17-19 and Nov. 23 to Mar. 14. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--50 years, 214 ft³/s, 16.99 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,630 ft³/s, Apr. 24, 1960, gage height, 11.63 ft; minimum, 2.7 ft³/s, Sept. 13, 1976; minimum gage height, 2.97 ft, July 29, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,430 ft³/s, Mar. 16, gage height, 7.51 ft; minimum, 10 ft³/s, Oct. 1, gage height, 3.14 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	11	64	53	33	36	32	315	340	95	81	44	24
2	11	69	52	33	35	32	383	271	87	72	41	23
3	13	62	48	33	35	32	356	228	144	64	37	24
4	14	57	45	32	35	32	372	198	337	57	33	25
5	16	74	42	32	35	31	339	173	306	49	30	27
6	24	140	41	31	34	31	275	155	260	45	27	36
7	31	146	41	31	34	31	260	137	210	56	22	40
8	33	135	40	31	34	31	255	123	179	179	22	42
9	31	130	40	30	34	32	244	113	385	234	22	41
10	29	125	40	30	33	34	238	155	380	192	18	40
11	27	118	39	31	33	39	251	229	319	141	17	37
12	26	103	38	32	33	68	231	504	484	106	17	35
13	24	93	38	33	33	225	216	656	630	84	16	35
14	23	87	37	34	32	500	220	571	566	70	15	47
15	23	87	37	34	32	974	291	570	425	61	14	60
16	22	73	37	33	32	1400	330	675	335	56	15	73
17	22	72	36	32	32	1280	318	805	488	52	13	70
18	21	73	35	31	32	984	289	775	497	49	15	59
19	22	78	34	31	32	746	275	717	482	51	20	65
20	23	91	32	31	32	626	290	604	421	63	35	75
21	30	84	32	31	33	561	325	481	367	59	54	80
22	41	82	32	31	35	527	347	385	312	55	63	95
23	46	76	31	31	35	425	365	319	279	93	45	180
24	47	72	30	32	35	388	383	274	243	85	37	212
25	48	67	29	32	34	361	365	242	204	67	34	172
26	45	62	29	32	33	303	332	211	172	54	34	130
27	43	60	30	33	33	258	305	184	144	47	38	104
28	42	59	30	34	33	239	434	158	122	42	42	86
29	41	56	31	35	---	217	475	138	105	41	39	74
30	42	54	31	36	---	231	427	121	94	46	34	67
31	48	---	32	36	---	267	---	107	---	48	29	---
TOTAL	919	2549	1142	1001	939	10937	9506	10619	9072	2399	922	2078
MEAN	29.6	85.0	36.8	32.3	33.5	353	317	343	302	77.4	29.7	69.3
MAX	48	146	53	36	36	1400	475	805	630	234	63	212
MIN	11	54	29	30	32	31	216	107	87	41	13	23
CFSM	.17	.50	.22	.19	.20	2.06	1.85	2.01	1.77	.45	.17	.41
IN.	.20	.55	.25	.22	.20	2.38	2.07	2.31	1.97	.52	.20	.45

CAL YR 1989 TOTAL 60131.4 MEAN 165 MAX 1510 MIN 9.4 CFSM .97 IN 13.08
WTR YR 1990 TOTAL 52083.0 MEAN 143 MAX 1400 MIN 11 CFSM .84 IN 11.33

04041500 STURGEON RIVER NEAR ALSTON, MI

LOCATION.--Lat 46°43'35", long 88°39'43", in SE1/4 sec.15, T.50 N., R.35 W., Baraga County, Hydrologic Unit 04020104, on right bank in powerhouse of Upper Peninsula Power Co. at Prickett Dam, 4.0 mi upstream from Clear Creek, 5.0 mi southeast of Alston, and at mile 45.

DRAINAGE AREA.--346 mi².

PERIOD OF RECORD.--February 1932 to June 1941, October 1942 to current year. Monthly discharge only for some periods, published in WSP 1307.

GAGE.--Water-stage recorder. Datum of gage is 710.3 ft mean tide at New York City datum (levels by U.S. Army Corps of Engineers). Prior to Jan. 5, 1948, nonrecording gage, and Jan. 5, 1948 to Sept. 30, 1963, water-stage recorder at same site at datum 40.00 ft lower.

REMARKS.--Estimated daily discharges: May 17-19. Records good. Flow regulated by powerplant at station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--56 years (water years 1933-40, 1943-90), 419 ft³/s, 16.45 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,360 ft³/s, Apr. 24, 1960, gage height, 13.09 ft, present datum; minimum daily, about 1 ft³/s, Aug. 14-19, 1960, caused by draining of pond for dam repair.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,290 ft³/s, Mar. 16, gage height, 7.19 ft; minimum daily, 14 ft³/s, Oct. 7.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	16	71	76	61	180	119	506	589	264	171	124	147
2	207	220	145	53	75	208	653	595	289	186	124	133
3	104	181	157	257	173	69	650	597	292	169	125	124
4	56	200	225	139	166	78	647	592	278	140	125	111
5	182	322	269	119	124	302	649	556	299	135	126	94
6	290	87	77	242	130	41	432	345	276	137	126	94
7	14	404	296	15	156	136	477	228	313	142	126	94
8	47	242	62	220	170	255	465	321	288	154	125	141
9	216	258	144	141	203	278	443	282	294	228	126	127
10	196	221	144	148	92	171	444	271	717	357	113	95
11	42	373	190	147	98	345	452	298	744	477	127	110
12	183	173	196	124	148	504	360	271	638	401	124	129
13	15	202	114	67	135	640	317	761	1100	241	112	129
14	28	276	136	144	214	710	316	1450	1100	165	109	145
15	193	170	199	100	52	1380	576	759	866	165	109	168
16	254	203	139	204	146	2260	629	929	451	179	112	168
17	132	160	125	183	79	2110	649	1500	254	189	109	167
18	131	191	162	141	147	1730	533	1300	1340	189	109	168
19	82	186	218	201	236	1040	323	1450	902	101	109	167
20	18	197	205	132	178	638	351	1010	558	236	108	166
21	221	292	126	124	120	640	645	702	695	189	107	167
22	43	184	94	179	90	721	571	619	592	187	107	201
23	83	178	83	131	237	760	518	701	529	177	107	190
24	149	158	124	183	128	652	380	564	495	173	107	194
25	170	139	125	94	116	652	401	292	392	190	107	186
26	29	145	222	132	186	647	498	268	274	196	119	279
27	268	221	173	242	132	648	508	262	295	192	120	267
28	71	282	154	114	167	404	565	297	293	187	139	189
29	122	175	89	184	---	368	595	273	248	155	187	199
30	285	242	136	126	---	303	595	298	171	112	174	226
31	237	---	231	130	---	570	---	299	---	124	163	---
TOTAL	4084	6353	4836	4477	4078	19379	15148	18679	15247	6044	3805	4775
MEAN	132	212	156	144	146	625	505	603	508	195	123	159
MAX	290	404	296	257	237	2260	653	1500	1340	477	187	279
MIN	14	71	62	15	52	41	316	228	171	101	107	94
CFSM	.38	.61	.45	.42	.42	1.81	1.46	1.74	1.47	.56	.36	.46
IN.	.44	.68	.52	.48	.44	2.08	1.63	2.01	1.64	.65	.41	.51

CAL YR 1989 TOTAL 126532 MEAN 347 MAX 2650 MIN 14 CFSM 1.00 IN 13.60
WTR YR 1990 TOTAL 106905 MEAN 293 MAX 2260 MIN 14 CFSM .85 IN 11.49

STREAMS TRIBUTARY TO LAKE SUPERIOR

04043050 TRAP ROCK RIVER NEAR LAKE LINDEN, MI

LOCATION.--Lat 47°13'43", long 88°23'07", in SE1/4 SE1/4 sec.20, T.56 N., R.32 W., Houghton County, Hydrologic Unit 04020103, on right bank 20 ft upstream from bridge on county highway, 2.0 mi northeast of Lake Linden, and 3.0 mi upstream from mouth.

DRAINAGE AREA.--28.0 mi².

PERIOD OF RECORD.--October 1966 to current year.

GAGE.--Water-stage recorder. Datum of gage is 621.7 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 20 to Jan. 3, Jan. 25, 26, Mar. 2-6, and July 15, 16, 18-26. Records excellent except for estimated daily discharges, which are good. Small diversions for sprinkler irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--24 years, 46.2 ft³/s, 22.41 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,590 ft³/s, May 10, 1979, gage height, 10.72 ft; minimum, 1.7 ft³/s, Jan. 18, 1990, gage height, 3.52 ft, caused by ice jam upstream from station.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 380 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 16	0200	*619	*7.93	No other peak greater than base discharge.			

Minimum discharge, 1.7 ft³/s, Jan. 18, gage height, 3.52 ft, caused by ice jam upstream from station.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	13	26	15	15	14	14	159	59	18	21	12	8.7
2	14	21	15	15	14	15	145	50	18	19	12	8.7
3	16	19	15	15	14	14	103	46	25	18	12	8.8
4	14	18	16	15	14	14	83	41	40	17	12	8.7
5	14	23	16	15	14	14	82	35	29	16	12	8.9
6	20	35	16	15	14	14	66	32	34	15	12	9.1
7	17	28	15	15	14	14	52	30	27	16	11	9.5
8	16	26	15	15	14	14	50	28	24	67	11	8.6
9	14	27	15	15	14	14	61	27	26	60	11	8.3
10	15	28	15	15	13	15	54	28	23	33	11	8.9
11	15	25	15	15	13	17	55	41	20	24	10	8.8
12	14	22	15	15	13	25	47	94	57	20	10	12
13	13	20	16	16	13	51	49	64	64	17	10	14
14	13	19	16	17	13	123	74	47	39	16	9.8	26
15	13	19	16	17	13	336	108	44	28	16	9.7	24
16	13	18	16	16	13	487	98	159	25	17	9.5	26
17	13	17	16	16	14	268	77	193	46	16	9.4	19
18	13	17	16	14	14	143	65	127	92	20	9.4	17
19	14	17	16	17	14	99	86	82	68	20	9.4	15
20	14	19	15	16	14	87	103	63	54	17	9.3	14
21	14	21	14	15	14	71	120	49	81	16	9.2	15
22	14	19	14	15	14	71	103	40	55	15	9.0	18
23	14	18	14	14	14	64	94	37	40	15	8.9	20
24	14	17	14	15	14	54	81	33	31	15	9.1	17
25	13	17	14	14	14	46	71	30	25	15	9.4	16
26	14	17	15	14	14	41	61	27	24	15	9.6	15
27	14	16	15	14	15	46	105	26	22	14	9.3	14
28	14	16	15	15	14	37	180	23	20	14	9.1	13
29	14	16	15	15	---	42	104	21	22	14	8.9	12
30	16	16	15	15	---	69	74	20	22	14	8.6	12
31	20	---	15	14	---	119	---	19	---	13	8.6	---
TOTAL	449	617	470	469	386	2438	2610	1615	1099	625	312.2	416.0
MEAN	14.5	20.6	15.2	15.1	13.8	78.6	87.0	52.1	36.6	20.2	10.1	13.9
MAX	20	35	16	17	15	487	180	193	92	67	12	26
MIN	13	16	14	14	13	14	47	19	18	13	8.6	8.3
CFSM	.52	.74	.54	.54	.49	2.81	3.11	1.86	1.31	.72	.36	.50
IN.	.60	.82	.62	.62	.51	3.24	3.47	2.15	1.46	.83	.41	.55

CAL YR 1989 TOTAL 16591.0 MEAN 45.5 MAX 742 MIN 12 CFSM 1.63 IN 22.04
WTR YR 1990 TOTAL 11506.2 MEAN 31.5 MAX 487 MIN 8.3 CFSM 1.13 IN 15.29

STREAMS TRIBUTARY TO LAKE SUPERIOR

04043800 McCLURE STORAGE BASIN RELEASE NEAR MARQUETTE, MI

LOCATION.--Lat 46°34'19", long 87°28'35", in SW1/4 NE1/4 sec.7, T.48 N., R.25 W., Marquette County, Hydrologic Unit 04020105, on left bank in power house of Upper Peninsula Power Co., 600 ft upstream from Reany Creek, 2.5 mi downstream from McClure Dam, and 4.3 mi northwest of Marquette.

PERIOD OF RECORD.--April to September 1990.

GAGE.--Water-stage recorder. Elevation of gage is 785 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--No estimated daily discharges. Records excellent. Flow completely regulated by powerplant at station. Several measurements of water temperature were made during the year.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge during period April to September, 354 ft^3/s, Apr. 1; minimum daily, 0.02 ft^3/s, Aug. 16, 24.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1							354	234	229	180	71	.09
2							351	234	165	230	77	.12
3							343	231	169	223	67	.17
4							341	230	199	174	.31	82
5							343	169	202	231	.38	55
6							345	170	199	231	81	11
7							343	229	202	181	81	.45
8							341	228	205	176	80	.47
9							343	232	169	225	80	.20
10							346	209	169	228	81	.19
11							348	221	282	211	.57	63
12							346	172	338	212	.56	82
13							348	173	332	187	6.4	82
14							347	234	338	1.1	.05	84
15							350	233	349	1.0	.03	1.0
16							293	236	292	83	.02	1.1
17							237	235	291	86	.17	85
18							233	227	346	87	.47	84
19							227	228	350	89	.09	84
20							232	227	344	89	.07	155
21							172	226	330	.67	.06	163
22							168	226	315	.78	.04	1.1
23							228	227	345	89	.03	2.2
24							227	227	345	88	.02	170
25							225	227	279	85	1.0	143
26							225	171	224	84	.13	117
27							229	171	222	84	.13	171
28							167	170	220	.12	56	201
29							170	229	224	.31	161	.41
30							231	226	180	87	160	.50
31							---	230	---	87	108	---
TOTAL							8453	6682	7854	3730.98	1113.53	1840.00
MEAN							282	216	262	120	35.9	61.3
MAX							354	236	350	231	161	201
MIN							167	169	165	.12	.02	.09

STREAMS TRIBUTARY TO LAKE SUPERIOR

04044609 SAND RIVER WILDLIFE FLOODING AT SAND RIVER, MI

LOCATION.--Lat 46°29'14", long 87°07'30", in SW1/4 NE1/4 sec.12, T.47 N., R.23 W., Marquette County, Hydrologic Unit 04020201, on right bank at dam at Sand River, 1.2 mi upstream from mouth.

DRAINAGE AREA.--28.6 mi². Area of Sand River Wildlife Flooding is 0.6 mi².

PERIOD OF RECORD.--October 1983 to current year (gage heights only).

GAGE.--Water-stage recorder. Datum of gage is 600.0 ft above National Geodetic Vertical Datum of 1929 (Michigan Department of Natural Resources bench mark).

REMARKS.--Pond level regulated by concrete dam with two 20-foot stop-log bays and a 20-foot radial gate. Gage-height telemeter at station.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 11.84 ft, Nov. 6, 1988; minimum, 5.06 ft, July 13-16, 1989.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 9.36 ft, Mar. 16; minimum, 5.13 ft, Sept. 2, 3.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5.24	6.71	6.19	6.04	6.08	5.96	6.16	5.56	5.44	5.33	5.30	5.16
2	5.24	6.97	6.18	6.04	6.08	6.02	6.31	5.52	5.43	5.31	5.43	5.13
3	5.23	7.07	6.15	6.04	6.07	6.06	6.52	5.50	5.46	5.28	5.56	5.15
4	5.20	7.08	6.15	6.05	6.07	6.07	6.17	5.48	5.58	5.27	5.47	5.27
5	5.21	7.14	6.15	6.05	6.06	6.07	6.04	5.45	5.58	5.26	5.63	5.37
6	5.32	7.45	6.15	6.05	6.06	6.04	5.91	5.42	5.57	5.26	5.57	5.49
7	5.41	7.77	6.14	6.05	6.06	6.02	5.88	5.41	5.53	5.26	5.50	5.58
8	5.51	7.94	6.12	6.05	6.06	6.01	5.84	5.40	5.49	5.38	5.42	5.66
9	5.53	8.05	6.11	6.06	6.07	6.01	5.84	5.48	5.59	5.45	5.37	5.70
10	5.53	8.14	6.12	6.07	6.07	6.07	5.87	6.06	5.59	5.38	5.38	5.78
11	5.58	8.21	6.13	6.06	6.07	6.15	5.91	6.36	5.53	5.35	5.35	5.85
12	5.58	8.19	6.12	6.05	6.06	6.41	5.86	6.79	5.50	5.33	5.35	5.88
13	5.57	8.14	6.11	6.05	6.07	6.74	5.83	6.90	5.55	5.30	5.38	5.96
14	5.58	8.06	6.10	6.05	6.04	7.10	5.86	6.64	5.51	5.28	5.36	6.09
15	5.60	7.97	6.10	6.06	6.02	8.09	6.01	6.60	5.46	5.32	5.38	6.26
16	5.62	7.89	6.09	6.06	6.02	9.22	6.06	6.55	5.47	5.56	5.33	6.40
17	5.64	7.84	6.09	6.06	6.02	8.43	6.01	6.75	5.65	5.91	5.28	6.47
18	5.65	7.72	6.08	6.06	6.01	7.51	5.93	6.53	5.71	5.94	5.34	6.52
19	5.66	7.59	6.07	6.06	6.01	6.88	5.88	6.26	5.71	5.87	5.42	6.62
20	5.73	7.51	6.06	6.07	6.00	6.66	5.86	6.07	5.65	5.76	5.43	6.70
21	6.00	7.39	6.05	6.07	5.99	6.59	5.87	5.94	5.63	5.64	5.39	6.80
22	6.14	7.27	6.05	6.07	5.99	6.49	5.86	5.85	5.60	5.56	5.35	6.88
23	6.20	7.14	6.04	6.07	5.98	6.33	5.84	5.83	5.63	5.54	5.31	6.99
24	6.25	7.01	6.04	6.09	5.99	6.19	5.79	5.78	5.66	5.50	5.29	7.10
25	6.26	6.91	6.04	6.09	5.98	6.14	5.76	5.72	5.57	5.46	5.28	7.17
26	6.25	6.80	6.03	6.09	5.97	6.05	5.71	5.67	5.50	5.42	5.27	7.21
27	6.22	6.70	6.03	6.09	5.98	5.96	5.69	5.63	5.45	5.39	5.27	7.25
28	6.17	6.59	6.03	6.09	5.96	5.93	5.65	5.58	5.41	5.37	5.26	7.27
29	6.15	6.27	6.03	6.08	---	5.93	5.61	5.55	5.38	5.36	5.24	7.29
30	6.13	6.20	6.03	6.08	---	6.01	5.59	5.51	5.36	5.36	5.21	7.31
31	6.38	---	6.03	6.09	---	6.09	---	5.48	---	5.34	5.19	---
MEAN	5.73	7.39	6.09	6.06	6.03	6.49	5.90	5.91	5.54	5.44	5.36	6.28
MAX	6.38	8.21	6.19	6.09	6.08	9.22	6.52	6.90	5.71	5.94	5.63	7.31
MIN	5.20	6.20	6.03	6.04	5.96	5.93	5.59	5.40	5.36	5.26	5.19	5.13

CAL YR 1989 MEAN 6.40 MAX 9.05 MIN 5.06
WTR YR 1990 MEAN 6.02 MAX 9.22 MIN 5.13

STREAMS TRIBUTARY TO LAKE SUPERIOR

04045500 TAHQUAMENON RIVER NEAR PARADISE, MI
(National stream quality accounting network station)

LOCATION.--Lat 46°34'30", long 85°16'10", in NE1/4 sec.11, T.48 N., R.8 W., Luce County, Hydrologic Unit 04020202, on left bank 0.7 mi upstream from Tahquamenon (Big) Falls, 11.5 mi west of Paradise, and 19 mi northeast of Newberry.

DRAINAGE AREA.--790 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--August 1953 to current year. Prior to October 1989, published as "near Tahquamenon Paradise".

GAGE.--Water-stage recorder. Datum of gage is 698.03 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Mar. 18, 19, 27, 28. Water-discharge records good.

AVERAGE DISCHARGE.--37 years, 927 ft³/s, 15.93 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,990 ft³/s, May 10, 1960, gage height, 10.26 ft; minimum, 157 ft³/s, July 26, 1955, July 8, 1988; minimum gage height, 2.75 ft, July 8, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,060 ft³/s, Mar. 25, gage height, 7.51 ft; minimum, 205 ft³/s, Sept. 1; minimum gage height, 3.11 ft, July 28, 29.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	271	644	563	365	479	455	2380	2100	646	798	433	218
2	262	711	559	359	482	450	2340	1950	543	740	394	215
3	266	747	556	360	490	451	2340	1780	479	658	348	220
4	270	752	547	362	486	454	2330	1610	454	555	311	352
5	277	779	535	369	481	455	2280	1430	455	492	285	791
6	293	850	531	376	475	453	2210	1280	440	442	274	920
7	317	915	531	379	475	449	2090	1130	443	405	268	964
8	336	957	524	383	473	442	1980	985	426	371	264	981
9	348	973	507	381	484	437	1890	844	408	348	260	948
10	341	973	500	384	493	435	1830	916	404	334	269	887
11	349	976	490	390	499	455	1800	1240	404	323	285	823
12	340	969	490	386	506	526	1810	1470	391	305	297	807
13	327	952	490	387	508	628	1800	1600	415	294	300	895
14	333	928	470	387	510	797	1800	1680	439	284	305	1130
15	328	891	459	389	510	1100	1880	1690	446	274	287	1360
16	318	834	448	393	513	1600	1960	1750	432	277	292	1470
17	322	760	432	404	513	2140	1980	2070	438	286	281	1530
18	326	736	423	420	508	2550	2010	2260	448	284	267	1530
19	324	736	414	435	500	2700	2050	2420	486	292	283	1500
20	332	729	408	444	495	2910	2080	2460	498	288	292	1450
21	352	706	404	455	490	2920	2220	2430	511	288	283	1400
22	405	688	394	462	479	3000	2390	2340	556	287	271	1350
23	433	671	385	463	476	2890	2550	2200	671	283	259	1320
24	447	646	377	463	475	2850	2640	2010	868	281	250	1320
25	451	622	373	463	476	2910	2700	1820	955	274	243	1250
26	448	607	370	465	475	2760	2690	1620	975	268	235	1190
27	445	596	371	453	467	2650	2630	1430	981	257	231	1120
28	437	592	369	455	458	2600	2520	1250	967	245	230	1030
29	451	594	368	460	---	2570	2400	1080	912	261	230	949
30	460	574	370	464	---	2520	2240	923	857	354	232	863
31	545	---	370	473	---	2440	---	776	---	434	229	---
TOTAL	11154	23108	14028	12829	13676	49997	65820	50544	17348	11282	8688	30783
MEAN	360	770	453	414	488	1613	2194	1630	578	364	280	1026
MAX	545	976	563	473	513	3000	2700	2460	981	798	433	1530
MIN	262	574	368	359	458	435	1800	776	391	245	229	215
CFSM	.46	.98	.57	.52	.62	2.04	2.78	2.06	.73	.46	.35	1.30
IN.	.53	1.09	.66	.60	.64	2.35	3.10	2.38	.82	.53	.41	1.45

CAL YR 1989 TOTAL 269939 MEAN 740 MAX 3230 MIN 184 CFSM .94 IN 12.71
WTR YR 1990 TOTAL 309257 MEAN 847 MAX 3000 MIN 215 CFSM 1.07 IN 14.56

04045500 TAHQUAMENON RIVER NEAR PARADISE, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1972 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: October 1974 to September 1981.
WATER TEMPERATURE: October 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Oct. 1, 1975 to Sept. 30, 1981.

REMARKS.--Quarterly cross-sectional samples were collected at cableway 40 ft downstream from gage or at wading section 600 ft downstream from gage.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1976-77, 1979-81): Maximum recorded (more than 20 percent missing record), 238 microsiemens, Jan. 24, 1977; minimum, 34 microsiemens, Apr. 17, 18, 1976.
WATER TEMPERATURE (water years 1976-77, 1979-81): Maximum, 26.5°C, May 21, 1977; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT										
11...	1445	372	177	8.03	7.5	1.8	10.2	89	<5	<5
JAN										
09...	1445	366	177	7.63	0.0	2.5	6.7	48	K42	K37
APR										
23...	1630	2600	61	7.15	7.0	2.1	9.7	82	K8	K10
JUL										
17...	1500	279	170	7.83	20.5	3.2	6.6	76	K9	K9

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
OCT										
11...	94	17	26	7.0	2.2	5	0.1	0.7	94	0
JAN										
09...	81	13	22	6.3	2.3	6	0.1	0.7	83	0
APR										
23...	30	13	8.4	2.2	1.0	7	0.1	0.6	21	0
JUL										
17...	89	8	25	6.5	2.1	5	0.1	0.6	99	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT										
11...	77	13	2.1	0.2	6.8	102	0.14	102	<0.01	0.28
JAN										
09...	68	13	1.9	<0.1	10	118	0.16	117	<0.01	0.15
APR										
23...	17	6.9	1.2	<0.1	3.7	64	0.09	449	<0.01	<0.10
JUL										
17...	81	8.9	2.2	<0.1	5.0	119	0.16	89.6	<0.01	<0.10

STREAMS TRIBUTARY TO LAKE SUPERIOR

04045500 TAHQUAMENON RIVER NEAR PARADISE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS TOTAL (MG/L AS P)	PHOSPHORUS DISSOLVED (MG/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT 11...	0.01	0.01	0.2	<0.01	<0.01	<0.01	20	<1	24	<0.5
JAN 09...	0.07	0.08	0.3	0.05	0.02	0.01	40	<1	22	<0.5
APR 23...	0.04	0.04	0.5	0.02	<0.01	<0.01	140	<1	12	<0.5
JUL 17...	0.04	0.05	0.6	0.02	<0.01	<0.01	30	<1	27	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT 11...	<1	<1	<3	2	250	<1	<4	8	<0.1	10
JAN 09...	<1	<1	<3	<1	340	<1	5	55	<0.1	10
APR 23...	<1	1	<3	3	210	1	<4	11	<0.1	<10
JUL 17...	1	<1	<3	2	790	1	<4	9	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT 11...	1	<1	<1.0	58	<6	6	5	5.0	80
JAN 09...	1	<1	<1.0	53	<6	6	3	3.0	60
APR 23...	1	<1	<1.0	20	<6	8	4	28	100
JUL 17...	1	<1	<1.0	59	<6	12	5	3.8	82

04045580 ST. MARYS RIVER ABOVE SAULT STE. MARIE, MI
(National stream quality accounting network and radiochemical station)

LOCATION.--Lat 46°29'29", long 84°25'17", in NW1/4 sec.10, T.47 N., R.1 W., Chippewa County, Hydrologic Unit 04020300, at Sault Ste. Marie municipal raw-water intake at Big Point, 2.6 mi west of the International Bridge, at Sault Ste. Marie.

DRAINAGE AREA.--80,900 mi², approximately.

PERIOD OF RECORD.--Water years 1970 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: March 1974 to September 1981.
WATER TEMPERATURE: March 1974 to September 1981.

REMARKS.--Quarterly samples were collected at the raw-water tap in Sault Ste. Marie municipal water plant at Big Point. Intake is 1,500 ft from water plant at a depth of 30 ft, 10 ft above bottom of channel. Prior to the 1983 water year, water temperatures were measured at the raw-water tap. Since 1983, water temperatures have been measured in the stream near the water plant, and therefore, are not comparable with those in "EXTREMES FOR PERIOD OF DAILY RECORD."

COOPERATION.--Discharges are monthly means provided by U.S. Army Corps of Engineers, Sault Ste. Marie.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975-81): Maximum daily, 113 microsiemens, Oct. 26, 1980; minimum daily, 76 microsiemens, Apr. 24, 1975.
WATER TEMPERATURE (water years 1975-81): Maximum daily, 24.0°C, July 25, 1979; minimum daily, 0.0°C, Mar. 14, 15, 1974, Feb. 1, 1979.

EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A water temperature of 27.0°C was measured July 12, 1988.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DISCHARGE, IN CUBIC FEET PER SECOND	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	TEMPERATURE WATER (DEG C)	TURBIDITY (NTU)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	COLIFORM, FECAL, 0.7 UM-MF (COLS./100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT										
12...	1345	71800	96	7.78	12.5	0.3	10.9	105	K1	<1
JAN										
10...	1400	67100	97	7.71	0.0	0.2	14.2	100	K3	<2
APR										
25...	0745	66700	87	7.71	1.0	1.6	13.2	95	K2	K2
JUL										
18...	1400	65800	97	7.92	25.0	1.0	8.6	107	40	39

DATE	HARDNESS TOTAL (MG/L AS CACO3)	HARDNESS NONCARB DISSOLV FLD. AS CACO3 (MG/L)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE WATER DIS IT FIELD MG/L AS HCO3	CARBONATE WATER DIS IT FIELD MG/L AS CO3
OCT										
12...	44	2	13	2.8	1.5	7	0.1	0.5	51	0
JAN										
10...	44	0	13	2.8	1.5	7	0.1	0.5	57	0
APR										
25...	41	1	12	2.6	1.3	6	0.1	0.5	49	0
JUL										
18...	44	4	13	2.8	1.4	6	0.1	0.5	49	0

DATE	ALKALINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	SOLIDS, DISSOLVED (TONS PER DAY)	NITROGEN, NITRITE DISSOLVED (MG/L AS N)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)
OCT										
12...	42	4.0	1.1	0.1	2.2	48	0.06	9310	<0.01	<0.10
JAN										
10...	46	4.0	1.3	<0.1	2.4	59	0.08	10700	<0.01	0.32
APR										
25...	40	2.8	--	<0.1	2.5	50	--	--	<0.01	0.30
JUL										
18...	40	2.8	2.1	<0.1	2.2	63	0.09	11200	<0.01	0.30

STREAMS TRIBUTARY TO ST. MARYS RIVER

04045580 ST. MARYS RIVER ABOVE SAULT STE. MARIE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS TOTAL (MG/L AS P)	PHOSPHORUS DISSOLVED (MG/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT 12...	0.02	0.02	0.5	<0.01	<0.01	<0.01	<10	<1	12	<0.5
JAN 10...	0.01	0.02	<0.2	0.03	<0.01	<0.01	10	<1	12	<0.5
APR 25...	<0.01	<0.01	0.3	0.01	<0.01	<0.01	20	<1	11	<0.5
JUL 18...	0.02	0.01	0.3	<0.01	<0.01	<0.01	<10	<1	14	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT 12...	<1	<1	<3	3	7	<1	<4	1	<0.1	<10
JAN 10...	<1	<1	<3	2	4	<1	<4	<1	<0.1	<10
APR 25...	<1	<1	<3	3	27	<1	<4	3	<0.1	<10
JUL 18...	<1	<1	<3	4	6	<1	<4	2	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	GROSS ALPHA, SUSP. TOTAL (UG/L AS U-NAT)	GROSS BETA, DISSOLVED (PCI/L AS CS-137)	GROSS BETA, SUSP. TOTAL (PCI/L AS CS-137)	GROSS BETA, DISSOLVED (PCI/L AS SR/YT-90)
OCT 12...	<1	<1	<1.0	24	<6	74	<0.4	2.0	<0.4	1.6
JAN 10...	1	<1	<1.0	23	<6	76	--	--	--	--
APR 25...	1	<1	<1.0	21	<6	79	--	--	--	--
JUL 18...	1	<1	<1.0	22	<6	64	--	--	--	--

DATE	GROSS BETA, SUSP. TOTAL (PCI/L AS SR/YT-90)	RADIUM 226, DISSOLVED, RADON METHOD (PCI/L)	URANIUM NATURAL DISSOLVED (UG/L AS U)
OCT 12...	<0.4	0.14	0.07
JAN 10...	--	--	--
APR 25...	--	--	--
JUL 18...	--	--	--

STREAMS TRIBUTARY TO LAKE MICHIGAN

04047200 MANISTIQUE LAKE NEAR CURTIS, MI

LOCATION.--Lat 46°14'47", long 85°51'06", in SW1/4 SE1/4 sec.31, T.45 N., R.12 W., Luce County, Hydrologic Unit 04060106, at lake outlet, 5.8 mi northwest of Curtis.

DRAINAGE AREA.--118 mi², approximately.

PERIOD OF RECORD.--April 1942 to current year.

GAGE.--Water-stage recorder. Datum of gage is 683.08 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Apr. 15, 1943 and Oct. 1, 1968, to Oct. 4, 1976, nonrecording gage at same datum.

REMARKS.--Lake level controlled by concrete dam with removable flash boards constructed in 1978 on the outlet, and by a dam on Portage Creek, one of the inlets. From 1948 to 1978 lake level controlled by timber dam with removable flash boards on outlet. Occasionally during periods of high flow, backwater from Fox River raises the lake level. Major inlets to Manistique Lake are Helmer Creek from North Manistique Lake, Portage Creek from South Manistique Lake, and Fork Lake Outlet. The outlet is Manistique River. Streamflow records were collected for South Manistique Lake Outlet (station 04046500) from May 1942 to September 1944, for North Manistique Lake Outlet (station 04047000) from August 1942 to September 1944, and for Manistique River (station 04047500) from April 1942 to June 1950. Established legal level; 686.00 ft above NGVD, established by Circuit Court, January 1948. Surface area of lake is 10,100 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 6.28 ft, May 14, 15, or 16, 1960, from floodmark; minimum, 1.33 ft, Aug. 10, 1948, result of dam construction.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 3.90 ft, May 20; minimum, 2.48 ft, Mar. 9, 10, 11.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.86	3.05	2.94	2.78	2.68	2.56	3.08	3.19	3.73	---	3.20	3.01
2	2.79	3.08	2.94	2.77	2.68	2.54	3.11	3.19	3.71	---	3.19	3.00
3	2.80	3.10	2.95	2.76	2.68	2.53	3.12	3.20	3.72	---	3.18	3.01
4	2.84	3.13	2.95	2.75	2.67	2.53	3.13	3.22	3.72	---	3.17	3.00
5	2.86	3.14	2.93	2.74	2.67	2.52	3.13	3.19	3.73	---	3.14	3.01
6	2.82	3.13	2.92	2.74	2.66	2.51	3.13	3.20	---	---	3.13	3.02
7	2.85	3.17	2.92	2.73	2.65	2.50	3.13	3.22	---	---	3.12	3.02
8	2.87	3.19	2.91	2.72	2.64	2.49	3.13	3.21	---	---	3.11	3.01
9	2.89	3.16	2.91	2.71	2.64	2.49	3.14	3.20	---	---	3.10	3.00
10	2.90	3.10	2.91	2.70	2.64	2.49	3.18	3.25	---	---	3.13	2.99
11	2.90	3.04	2.90	2.71	2.63	2.49	3.18	3.34	---	---	3.13	2.99
12	2.87	3.08	2.89	2.71	2.63	2.54	3.18	3.38	---	---	3.12	2.97
13	2.89	3.11	2.88	2.70	2.61	2.56	3.19	3.40	---	---	3.11	3.14
14	2.90	3.07	2.87	2.70	2.61	2.60	3.19	3.43	---	---	3.09	3.16
15	2.90	3.05	2.86	2.69	2.60	2.65	3.20	3.46	---	---	3.10	3.21
16	2.88	2.97	2.85	2.67	2.61	2.73	3.22	3.62	---	---	3.09	3.23
17	2.89	3.06	2.84	2.68	2.61	2.80	3.24	3.69	---	3.27	3.09	3.24
18	2.87	3.07	2.83	2.67	2.61	2.87	3.25	3.66	---	3.25	3.12	3.24
19	2.88	3.06	2.82	2.66	2.60	2.92	3.25	3.81	---	3.26	3.15	3.23
20	2.89	3.03	2.81	2.65	2.59	2.96	3.25	3.87	---	3.26	3.11	3.25
21	2.89	3.03	2.81	2.65	2.58	2.99	3.26	3.85	---	3.25	3.08	3.26
22	2.91	3.01	2.82	2.65	2.57	3.01	3.27	3.86	---	3.24	3.08	3.21
23	2.92	2.99	2.81	2.65	2.56	3.04	3.28	3.87	---	3.22	3.08	3.19
24	2.93	2.97	2.80	2.68	2.56	3.06	3.29	3.88	---	3.22	3.07	3.22
25	2.94	2.95	2.79	2.69	2.56	3.06	3.31	3.88	---	3.21	3.07	3.23
26	2.94	2.94	2.79	2.72	2.56	3.07	3.31	3.87	---	3.20	3.07	3.23
27	2.94	2.94	2.79	2.72	2.57	3.07	3.30	3.86	---	3.20	3.07	3.22
28	2.96	2.95	2.78	2.71	2.56	3.07	3.31	3.84	---	3.18	3.04	3.21
29	2.98	2.94	2.78	2.71	---	3.07	3.29	3.82	---	3.20	3.05	3.21
30	2.98	2.94	2.78	2.70	---	3.07	3.26	3.78	---	3.22	3.04	3.19
31	3.01	---	2.78	2.69	---	3.08	---	3.76	---	3.21	3.04	---
MEAN	2.90	3.05	2.86	2.70	2.62	2.77	3.21	3.55	---	---	3.11	3.13
MAX	3.01	3.19	2.95	2.78	2.68	3.08	3.31	3.88	---	---	3.20	3.26
MIN	2.79	2.94	2.78	2.65	2.56	2.49	3.08	3.19	---	---	3.04	2.97

CAL YR 1989 MEAN 3.25 MAX 3.83 MIN 2.78

STREAMS TRIBUTARY TO LAKE MICHIGAN

04056500 MANISTIQUE RIVER NEAR MANISTIQUE, MI

LOCATION.--Lat 46°01'50", long 86°09'40", in SE1/4 sec.15, T.42 N., R.15 W., Schoolcraft County, Hydrologic Unit 04060106, on left bank 1.0 mi downstream from West Branch, 6.0 mi northeast of Manistique, and at mile 19.5.

DRAINAGE AREA.--1,100 mi², approximately.

PERIOD OF RECORD.--March 1938 to current year.

REVISED RECORDS.--WSP 1387: 1940-42(M), 1943, 1945. WSP 1627, 1727: 1938, 1939.

GAGE.--Water-stage recorder. Elevation of gage is 608 ft, from river-profile map. Prior to July 15, 1939, non-recording gage at site 1,600 ft upstream at different datum.

REMARKS.--Estimated daily discharges: Nov. 19 to Mar. 28. Records good except for estimated daily discharges, which are fair. Since July 1948, slight regulation by dam on outlet of Manistique Lake (station 04047200). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--52 years, 1,435 ft³/s, 17.72 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 16,900 ft³/s, May 11, 1960, gage height, 12.85 ft; minimum, 288 ft³/s, Oct. 4, 1948; minimum gage height, 1.01 ft, Aug. 23, 1941.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,290 ft³/s, Mar. 20; maximum gage height, 11.17 ft, Mar. 19, 20, backwater from ice; minimum discharge, 478 ft³/s, Oct. 4, 5; minimum gage height, 2.66 ft, Sept. 4, 5.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	543	823	800	740	800	770	2910	2150	1440	1040	700	536
2	540	959	790	740	800	770	2970	2000	1350	987	676	517
3	497	1040	790	740	800	760	3090	1860	1420	944	639	499
4	479	1070	790	740	800	760	3170	1690	1570	906	610	491
5	485	1100	790	740	810	740	3150	1490	1620	871	609	489
6	511	1180	790	750	820	730	3060	1370	1620	841	610	549
7	545	1270	790	760	820	720	2910	1280	1570	818	601	627
8	582	1310	800	770	820	710	2750	1210	1470	803	588	632
9	584	1310	800	770	820	720	2630	1170	1370	805	575	606
10	573	1300	800	770	810	730	2620	1360	1290	795	574	572
11	556	1320	810	780	810	760	2660	1890	1260	785	584	553
12	532	1320	810	780	810	810	2660	2300	1240	759	619	578
13	521	1300	800	780	820	1010	2600	2550	1250	729	627	584
14	513	1290	790	780	820	1300	2530	2710	1290	704	615	677
15	508	1270	790	790	820	1800	2500	2770	1290	691	616	844
16	506	1240	780	800	810	2400	2510	2800	1220	683	597	940
17	499	1160	780	810	810	3200	2580	3050	1160	716	601	966
18	498	975	770	820	800	4100	2610	3530	1200	768	629	965
19	497	1000	770	820	800	5000	2600	3960	1220	762	689	993
20	504	990	770	820	800	5200	2530	4290	1210	753	662	1040
21	526	950	770	810	800	5200	2420	4340	1190	754	625	1030
22	552	930	760	810	800	5100	2360	4110	1170	736	594	1030
23	602	910	760	810	800	4800	2370	3750	1280	685	567	1030
24	647	890	760	810	800	4600	2420	3370	1380	661	548	1030
25	655	870	760	810	770	4300	2490	3020	1380	650	539	1050
26	646	850	750	810	750	4000	2560	2690	1310	643	536	1030
27	634	830	740	800	730	3700	2590	2400	1230	625	540	984
28	631	810	740	800	740	3500	2560	2150	1160	610	591	928
29	631	810	740	800	---	3370	2460	1930	1130	611	594	876
30	644	800	740	800	---	3130	2310	1730	1090	631	573	847
31	702	---	740	800	---	2980	---	1550	---	672	557	---
TOTAL	17343	31877	24070	24360	22390	77670	79580	76470	39380	23438	18685	23493
MEAN	559	1063	776	786	800	2505	2653	2467	1313	756	603	783
MAX	702	1320	810	820	820	5200	3170	4340	1620	1040	700	1050
MIN	479	800	740	740	730	710	2310	1170	1090	610	536	489
CFSM	.51	.97	.71	.72	.73	2.28	2.41	2.24	1.19	.69	.55	.71
IN.	.59	1.08	.81	.82	.76	2.63	2.69	2.59	1.33	.79	.63	.79

CAL YR 1989 TOTAL 482893 MEAN 1323 MAX 5550 MIN 479 CFSM 1.20 IN 16.33
WTR YR 1990 TOTAL 458756 MEAN 1257 MAX 5200 MIN 479 CFSM 1.14 IN 15.51

STREAMS TRIBUTARY TO LAKE MICHIGAN

04057000 INDIAN LAKE NEAR MANISTIQUE, MI

LOCATION.--Lat 45°59'30", long 86°17'15", in SW1/4 NE1/4 sec.34, T.42 N., R.16 W., Schoolcraft County, Hydrologic Unit 04060106, on east shore, just upstream from highway bridge over outlet of Indian Lake, 2.0 mi northwest of Manistique.

DRAINAGE AREA.--302 mi².

PERIOD OF RECORD.--March 1938 to current year.

GAGE.--Water-stage recorder. Datum of gage is 608.66 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to July 9, 1942, nonrecording gage at site 0.5 mi northwest at same datum.

REMARKS.--Indian lake is regulated by two vertical lift gates in concrete and earth-fill dam 1.5 mi downstream from lake on outlet. Major inlets to Indian Lake are Silver Creek, Dufour Creek, Indian River, Dead Creek, Smith Creek and Big Spring. Streamflow records for Indian River (station 04057000), at lake outlet, were collected from March 1938 to September 1971; annual peak discharge 1972-82. Established legal level; 613.27 ft, above NGVD. Surface area of lake is 8,660 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily gage height, 7.79 ft, June 24, 1943; minimum daily, 3.01 ft, Feb. 20, 1948.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 5.23 ft, May 18; minimum, 3.11 ft, Mar. 7, 8, 9, 10.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.25	4.82	3.81	3.34	3.28	3.14	4.14	4.43	4.46	4.61	4.64	4.52
2	4.30	4.73	3.80	3.32	3.27	3.14	4.19	4.46	4.50	4.59	4.62	4.53
3	4.32	4.66	3.78	3.31	3.26	3.14	4.20	4.48	4.61	4.57	4.58	4.53
4	4.31	4.61	3.75	3.30	3.24	3.14	4.20	4.52	4.60	4.54	4.58	4.56
5	4.31	4.59	3.71	3.30	3.24	3.13	4.20	4.57	4.61	4.51	4.61	4.57
6	4.40	4.59	3.70	3.29	3.24	3.12	4.19	4.58	4.63	4.50	4.58	4.62
7	4.42	4.60	3.68	3.28	3.23	3.12	4.17	4.59	4.63	4.51	4.59	4.63
8	4.41	4.51	3.64	3.27	3.24	3.11	4.15	4.64	4.63	4.55	4.60	4.64
9	4.41	4.49	3.61	3.27	3.24	3.12	4.15	4.69	4.67	4.59	4.62	4.66
10	4.43	4.44	3.60	3.26	3.25	3.12	4.16	4.88	4.66	4.60	4.62	4.67
11	4.47	4.43	3.57	3.28	3.23	3.14	4.15	4.95	4.64	4.61	4.62	4.66
12	4.51	4.33	3.56	3.28	3.22	3.25	4.15	4.98	4.65	4.61	4.63	4.69
13	4.51	4.27	3.58	3.27	3.22	3.29	4.13	5.03	4.70	4.61	4.64	4.69
14	4.51	4.23	3.57	3.25	3.21	3.40	4.12	5.08	4.71	4.62	4.67	4.77
15	4.52	4.18	3.55	3.25	3.20	3.44	4.13	5.08	4.71	4.64	4.71	4.76
16	4.56	4.19	3.53	3.25	3.21	3.52	4.13	5.03	4.70	4.68	4.68	4.73
17	4.55	3.43	3.51	3.26	3.22	3.65	4.14	5.13	4.72	4.68	4.67	4.70
18	4.56	3.95	3.50	3.27	3.21	3.78	4.13	5.18	4.75	4.66	4.68	4.67
19	4.57	4.06	3.48	3.26	3.20	3.87	4.13	5.15	4.66	4.64	4.71	4.71
20	4.61	4.11	3.46	3.25	3.19	3.96	4.11	5.14	4.61	4.63	4.70	4.69
21	4.66	4.11	3.44	3.25	3.17	4.03	4.10	5.13	4.59	4.62	4.69	4.70
22	4.68	4.09	3.43	3.26	3.17	4.10	4.09	5.08	4.58	4.61	4.68	4.71
23	4.70	4.06	3.42	3.26	3.17	4.16	4.07	5.06	4.66	4.59	4.66	4.67
24	4.72	4.01	3.39	3.26	3.18	4.16	4.06	5.01	4.65	4.58	4.65	4.65
25	4.74	3.97	3.39	3.26	3.18	4.18	4.05	4.95	4.63	4.57	4.63	4.62
26	4.76	3.94	3.38	3.26	3.15	4.20	4.10	4.89	4.64	4.60	4.63	4.60
27	4.79	3.92	3.37	3.25	3.16	4.19	4.19	4.82	4.63	4.61	4.62	4.58
28	4.82	3.92	3.36	3.28	3.15	4.15	4.25	4.75	4.60	4.63	4.61	4.56
29	4.86	3.88	3.36	3.28	---	4.15	4.31	4.66	4.64	4.69	4.58	4.53
30	4.89	3.85	3.34	3.28	---	4.15	4.37	4.58	4.63	4.71	4.57	4.52
31	4.92	---	3.35	3.28	---	4.14	---	4.51	---	4.67	4.53	---
MEAN	4.56	4.23	3.54	3.27	3.21	3.62	4.16	4.84	4.64	4.61	4.63	4.64
MAX	4.92	4.82	3.81	3.34	3.28	4.20	4.37	5.18	4.75	4.71	4.71	4.77
MIN	4.25	3.43	3.34	3.25	3.15	3.11	4.05	4.43	4.46	4.50	4.53	4.52

CAL YR 1989 MEAN 4.16 MAX 4.95 MIN 3.34
WTR YR 1990 MEAN 4.17 MAX 5.18 MIN 3.11

04057510 STURGEON RIVER NEAR NAHMA JUNCTION, MI

LOCATION.--Lat 45°56'35", long 86°42'20", in SW1/4 SE1/4 sec.17, T.41 N., R.19 W., Delta County, Hydrologic Unit 04030112, Hiawatha National Forest, on left bank 30 ft upstream from bridge on Forest Service Road 2231, 500 ft downstream from Mormon Creek, 0.1 mi east of Federal Forest Highway 13, and 3.2 mi north of Nahma Junction.

DRAINAGE AREA.--183 mi².

PERIOD OF RECORD.--October 1966 to current year.

GAGE.--Water-stage recorder. Datum of gage is 610.99 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Nov. 18 to Mar. 28. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--24 years, 201 ft³/s, 14.92 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,120 ft³/s, Apr. 21, 1985, gage height, 11.50 ft; minimum, 32 ft³/s, July 8, 1988, gage height, 3.55 ft.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 1,140 ft³/s, Mar. 17; maximum gage height, 9.21 ft, Mar. 17, backwater from ice; minimum discharge, 47 ft³/s, Oct. 1, 2, 3, 4, 5, gage height, 3.70 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	47	176	100	73	74	71	350	166	167	99	67	76
2	48	174	95	74	74	72	398	154	159	94	60	72
3	48	164	90	74	74	72	395	144	207	89	56	69
4	47	156	84	74	74	72	391	135	224	85	67	69
5	48	181	79	74	74	72	361	128	206	80	159	70
6	55	231	75	74	74	70	310	121	225	76	127	80
7	56	224	74	74	74	68	288	114	205	73	99	87
8	56	208	73	74	74	68	267	109	179	80	82	80
9	57	205	71	74	74	68	270	114	169	87	72	78
10	60	200	70	74	73	70	299	378	160	78	69	78
11	63	188	70	73	73	80	306	604	147	72	69	71
12	60	180	69	72	72	120	285	594	142	68	68	68
13	59	171	68	71	72	187	266	522	187	64	70	68
14	58	163	66	70	72	300	263	452	200	61	69	79
15	57	157	65	74	72	450	280	578	169	63	96	91
16	57	153	64	74	72	750	289	674	150	72	143	92
17	56	148	63	75	72	1140	305	946	175	86	127	87
18	55	150	61	75	72	1000	282	928	188	90	121	82
19	54	152	59	75	72	900	268	847	181	81	195	98
20	57	150	58	75	72	820	264	718	161	80	180	105
21	68	140	57	75	72	720	265	597	145	77	149	101
22	77	135	56	75	72	640	261	487	135	72	129	110
23	78	130	56	75	72	580	257	434	159	71	116	113
24	76	125	56	75	72	520	250	412	170	85	106	116
25	75	120	56	75	71	470	247	361	148	77	101	111
26	73	120	56	75	68	410	235	316	133	69	99	103
27	71	120	57	75	69	370	222	279	125	65	98	97
28	71	115	60	75	70	320	207	246	116	62	94	92
29	75	110	63	75	---	292	190	219	110	65	90	89
30	81	105	66	74	---	297	176	197	106	82	84	87
31	143	---	70	74	---	322	---	181	---	78	79	---
TOTAL	1986	4751	2107	2296	2026	11391	8447	12155	4948	2381	3141	2619
MEAN	64.1	158	68.0	74.1	72.4	367	282	392	165	76.8	101	87.3
MAX	143	231	100	75	74	1140	398	946	225	99	195	116
MIN	47	105	56	70	68	68	176	109	106	61	56	68
CFSM	.35	.86	.37	.41	.40	2.01	1.54	2.14	.90	.42	.55	.48
IN.	.40	.97	.43	.47	.41	2.32	1.72	2.47	1.01	.48	.64	.53

CAL YR 1989 TOTAL 57661 MEAN 158 MAX 663 MIN 47 CFSM .86 IN 11.72
WTR YR 1990 TOTAL 58248 MEAN 160 MAX 1140 MIN 47 CFSM .87 IN 11.84

04057800 MIDDLE BRANCH ESCANABA RIVER AT HUMBOLDT, MI

LOCATION.--Lat 46°29'57", long 87°53'11", in SW1/4 sec.1, T.47 N., R.29 W., Marquette County, Hydrologic Unit 04030110, on left bank 15 ft upstream from county highway, 1.5 mi downstream from Halfway Creek, and 0.3 mi north of Humboldt.

DRAINAGE AREA.--46.0 mi².

PERIOD OF RECORD.--June 1959 to current year.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. V-notch sharp-crested weir since Oct. 3, 1960. Datum of gage is 1,521.20 ft above National Geodetic Vertical Datum of 1929 (Cleveland-Cliffs Iron Co. bench mark). Prior to Sept. 1, 1960, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 15-18, Nov. 20 to Jan. 22, Feb. 18-22, Feb. 25 to Mar. 2, and Mar. 12-15. Records good except for estimated daily discharges, which are fair. From July 1960 to June 1972, some diversion 100 ft upstream by industry for iron ore processing; figures of runoff adjusted. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--31 years, 61.4 ft³/s, 18.13 in/yr, adjusted for diversion 1960 to 1972.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,930 ft³/s, Apr. 20, 1985, gage height, 9.21 ft; minimum, 4.0 ft³/s, Sept. 12, 1976; minimum gage height, 1.07 ft, Aug. 24, 1960.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 485 ft³/s, Mar. 17, gage height, 5.39 ft; minimum, 7.8 ft³/s, Oct. 1, 2, gage height, 1.68 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	8.1	62	22	18	17	14	107	56	34	30	16	14
2	10	51	22	18	16	15	122	50	33	27	15	13
3	11	40	20	18	16	15	114	45	49	25	14	12
4	11	36	19	18	16	15	109	41	75	23	14	32
5	13	54	18	18	16	15	95	39	64	21	21	36
6	20	86	18	18	16	15	85	36	60	20	41	40
7	16	74	17	18	16	14	77	35	51	22	25	35
8	14	70	17	18	15	13	72	33	45	52	17	25
9	12	67	17	18	15	14	73	34	53	74	13	20
10	13	59	17	18	15	14	71	48	57	52	13	19
11	12	51	16	17	15	15	70	70	45	40	12	16
12	12	45	16	17	15	20	64	124	61	32	13	15
13	12	41	16	17	15	40	62	153	94	27	12	16
14	11	40	16	18	14	75	66	166	82	24	12	28
15	11	40	15	18	14	150	88	187	69	29	11	45
16	12	40	15	18	14	339	93	202	68	27	11	41
17	13	40	15	17	15	470	84	315	119	23	11	33
18	13	40	14	16	15	362	76	293	123	20	22	27
19	14	40	14	16	15	287	78	219	110	19	25	37
20	15	39	13	16	15	241	89	159	86	19	17	38
21	26	37	13	16	15	194	103	120	71	18	14	36
22	33	34	13	16	15	161	108	96	61	16	12	40
23	35	32	13	16	15	137	110	85	69	18	11	65
24	42	30	13	17	15	138	104	77	68	20	11	68
25	51	28	13	18	14	121	110	68	55	18	50	51
26	60	27	13	17	13	93	99	61	47	21	83	40
27	52	26	14	17	13	90	95	55	44	19	45	33
28	44	25	15	17	13	74	85	49	40	18	31	28
29	41	24	16	18	---	71	72	45	37	19	23	25
30	39	23	16	17	---	79	65	41	34	25	18	27
31	50	---	17	17	---	89	---	37	---	20	15	---
TOTAL	726.1	1301	493	536	418	3390	2646	3039	1904	818	648	955
MEAN	23.4	43.4	15.9	17.3	14.9	109	88.2	98.0	63.5	26.4	20.9	31.8
MAX	60	86	22	18	17	470	122	315	123	74	83	68
MIN	8.1	23	13	16	13	13	62	33	33	16	11	12
CFSM	.51	.94	.35	.38	.32	2.37	1.92	2.13	1.38	.57	.45	.69
IN.	.59	1.05	.40	.43	.34	2.74	2.14	2.46	1.54	.66	.52	.77

CAL YR 1989 TOTAL 19014.5 MEAN 52.1 MAX 556 MIN 8.0 CFSM 1.13 IN 15.38
WTR YR 1990 TOTAL 16874.1 MEAN 46.2 MAX 470 MIN 8.1 CFSM 1.00 IN 13.65

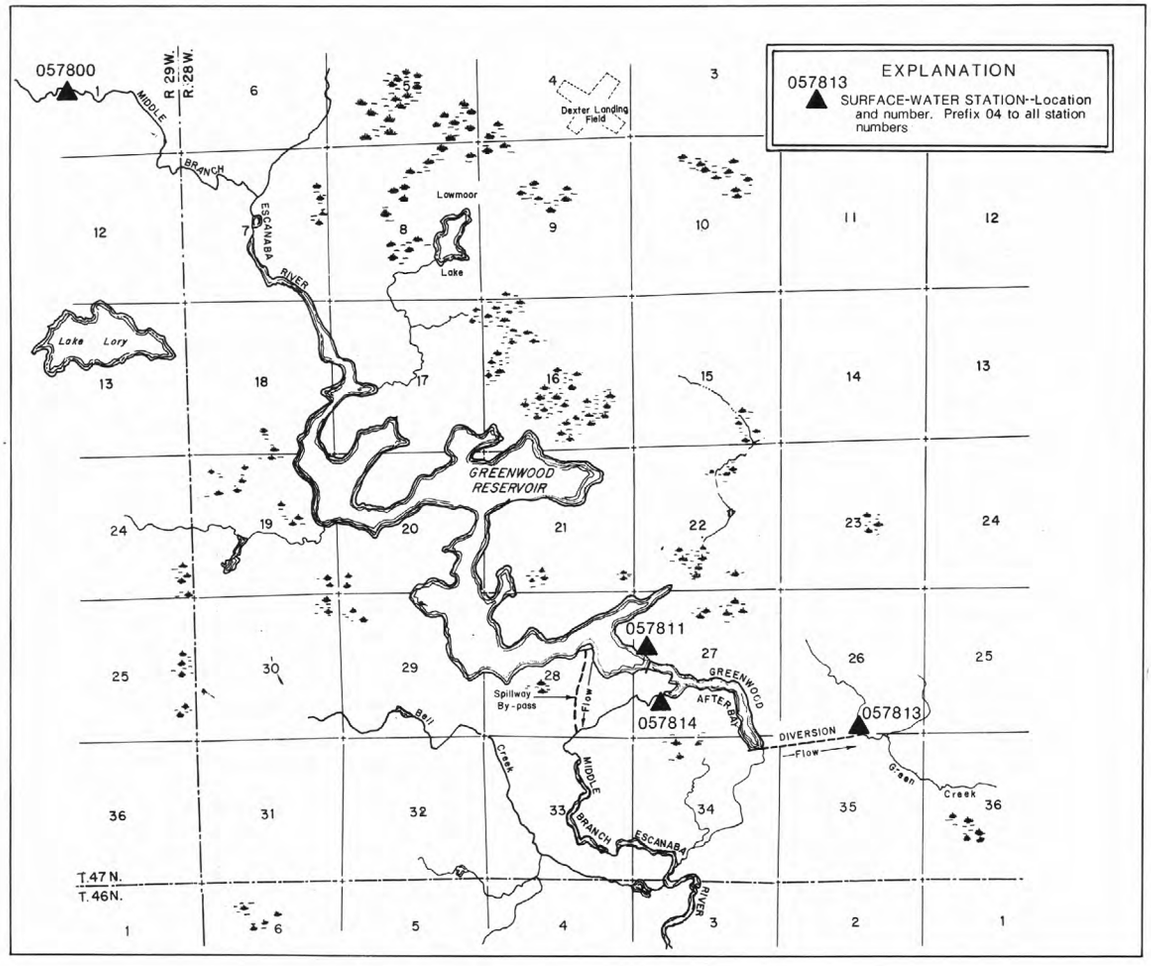

Figure 8.--Identification number and location of active surface-water gaging stations in and around the Greenwood Reservoir Complex.

STREAMS TRIBUTARY TO LAKE MICHIGAN

04057811 GREENWOOD RESERVOIR NEAR GREENWOOD, MI

LOCATION.--Lat 46°26'32", long 87°48'02", in NW1/4 SW1/4 sec.27, T.47 N., R.28 W., Marquette County, Hydrologic Unit 04030110, at downstream side of dam on Middle Branch Escanaba River, 3.7 mi southwest of Greenwood.

DRAINAGE AREA.--67.4 mi².

PERIOD OF RECORD.--December 1972 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,400.00 ft above National Geodetic Vertical Datum of 1929 (levels by Cleveland-Cliffs Iron Co.); gage readings have been converted to elevations NGVD. Prior to Feb. 20, 1973, nonrecording gage at same site and datum.

REMARKS.--The reservoir is formed by an earth/rockfill main dam and several earthfill dikes surrounding the storage area. Storage began Dec. 22, 1972. The fixed-crest concrete spillway was completed in September 1973. Capacity of reservoir, 23,300 acre-ft at spillway elevation 1,515 ft. Above elevation 1,515 ft, water flows over concrete spillway into Middle Branch Escanaba River about 2,000 ft downstream from Greenwood Release (station 04057814). The main dam is equipped with an outlet structure with 4 valves to control flow to afterbay (conservation pool) which has a capacity of 420 acre-ft at elevation 1,480 ft. Two outlet systems from the afterbay provide for diversion and release flow. Diverted flow to Green Creek gaged at Greenwood Diversion (station 04057813); released flow to Middle Branch Escanaba River gaged at Greenwood Release (station 04057814). Reservoir impounds water for diversion to Schweitzer Reservoir (station 04058190), for use in iron ore processing.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 26,520 acre-ft, Apr. 21, 22, 23, 1985, elevation, 1,517.3 ft; minimum since first filling, 3,240 acre-ft, Mar. 12, 1977, elevation, 1,491.1 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 24,140 acre-ft, May 17-19, elevation, 1,515.6 ft; minimum, 12,190 acre-ft, Mar. 11, elevation, 1,505.1 ft.

MONTHEND ELEVATION, IN FEET NGVD, AND CONTENTS AT 2400, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)	Change in contents (equivalent in ft³/s)
Sept. 30	1,511.1	18,420	--	--
Oct. 31	1,510.3	17,460	-960	-15.6
Nov. 30	1,511.2	18,540	+1,080	+18.1
Dec. 31	1,509.7	16,770	-1,770	-28.8
CAL YR 1989	--	--	-6,670	-9.2
Jan. 31	1,508.0	15,000	-1,770	-28.8
Feb. 28	1,506.0	13,000	-2,000	-36.0
Mar. 31	1,511.3	18,660	+5,660	+92.0
Apr. 30	1,514.6	22,780	+4,120	+69.2
May 31	1,515.1	23,440	+660	+10.7
June 30	1,515.0	23,300	-140	-2.4
July 31	1,514.0	22,000	-1,300	-21.1
Aug. 31	1,513.0	20,700	-1,300	-21.1
Sept. 30	1,513.1	20,830	+130	+2.2
WTR YR 1990	--	--	+2,410	+3.3

STREAMS TRIBUTARY TO LAKE MICHIGAN

04057813 GREENWOOD DIVERSION NEAR GREENWOOD, MI

LOCATION.--Lat 46°26'04", long 87°46'10", in NW1/4 NE1/4 sec.35, T.47 N., R.28 W., Marquette County, Hydrologic Unit 04030110, on left bank at downstream end of pipeline, 200 ft upstream from Green Creek, 0.7 mi downstream from Greenwood Afterbay, and 3.6 mi south of Greenwood.

PERIOD OF RECORD.--December 1972 to current year.

GAGE.--Water-stage recorder and concrete flume. Datum of gage is 1,454.57 ft above National Geodetic Vertical Datum of 1929 (Cleveland-Cliffs Iron Co. bench mark). Prior to Aug. 22, 1973, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records excellent. Flow completely regulated. A pipeline, 0.7 mi long, diverts water from Greenwood Reservoir (station 04057811) into Green Creek, tributary to Schweitzer Reservoir (station 04058190). Water is used for iron ore processing; some returned to Middle Branch Escanaba River 27 mi downstream via another Green Creek; some returned 31 mi downstream via Goose Lake Outlet and East Branch Escanaba River. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 30 ft^3/s, June 25-28, 1977, Nov. 9, 1979; no flow, Dec. 27, 1972 to Jan. 6, 1973; minimum daily discharge since diversion began Jan. 7, 1973, 0.01 ft^3/s, Apr. 16, 17, 1987.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	26	4.6	26	26	25	25	8.8	14	12	19	26	4.5
2	26	4.5	26	26	25	25	8.8	14	12	18	26	4.5
3	26	4.5	26	26	25	25	8.8	14	13	18	26	4.4
4	26	4.5	26	26	25	25	8.8	14	13	18	26	4.4
5	26	4.5	25	26	25	25	8.8	14	14	17	26	4.3
6	26	4.5	22	26	25	25	8.8	14	15	17	26	4.3
7	26	4.4	21	26	25	25	8.8	14	15	17	26	4.2
8	26	4.4	19	26	25	25	8.8	15	15	17	26	4.2
9	26	4.4	19	26	25	25	8.8	19	15	18	26	4.2
10	26	4.4	19	26	25	25	8.8	21	15	23	26	4.2
11	26	4.4	19	26	25	25	8.8	21	15	26	26	4.2
12	26	4.3	19	26	25	25	8.8	21	15	26	26	4.2
13	26	4.3	19	26	25	26	8.8	21	15	26	26	4.3
14	26	4.3	19	26	25	26	8.8	21	14	26	26	4.3
15	26	4.3	19	26	25	26	8.8	15	14	26	26	4.4
16	26	4.3	19	26	25	22	9.5	8.7	14	27	26	4.4
17	26	4.3	19	26	25	19	11	9.0	14	27	26	4.5
18	26	4.3	19	26	25	19	11	9.3	14	27	26	4.5
19	26	4.3	19	26	25	11	11	9.4	14	27	26	4.6
20	24	11	19	26	25	1.1	11	9.4	14	26	26	4.6
21	23	23	19	26	25	1.1	11	9.4	14	26	24	4.6
22	23	25	19	26	25	1.0	11	9.4	14	27	18	4.6
23	19	25	19	26	25	1.1	11	9.4	14	27	16	4.6
24	9.6	25	19	25	25	.99	12	9.3	14	27	14	4.6
25	4.5	25	19	25	25	.93	14	9.1	14	26	10	4.6
26	4.6	25	19	25	25	.93	14	8.6	14	26	10	4.6
27	4.6	25	19	25	25	5.3	14	8.2	14	26	5.0	4.6
28	4.6	25	20	25	25	8.8	14	7.8	16	26	.09	4.5
29	4.6	25	26	25	---	8.7	14	8.8	19	26	.13	4.5
30	4.6	26	26	25	---	8.8	14	11	19	26	.20	4.5
31	4.6	---	26	25	---	8.7	---	12	---	26	2.5	---
TOTAL	624.7	343.5	650	798	700	496.45	314.5	400.8	434	735	619.92	132.9
MEAN	20.2	11.5	21.0	25.7	25.0	16.0	10.5	12.9	14.5	23.7	20.0	4.43
MAX	26	26	26	26	25	26	14	21	19	27	26	4.6
MIN	4.5	4.3	19	25	25	.93	8.8	7.8	12	17	.09	4.2

CAL YR 1989 TOTAL 5266.18 MEAN 14.4 MAX 26 MIN .03
WTR YR 1990 TOTAL 6249.77 MEAN 17.1 MAX 27 MIN .09

04057814 GREENWOOD RELEASE NEAR GREENWOOD, MI

LOCATION.--Lat 46°26'22", long 87°47'52", in NW1/4 SW1/4 sec.27, T.47 N., R.28 W., Marquette County, Hydrologic Unit 04030110, on left bank at outlet of Greenwood Afterbay releasing to Middle Branch Escanaba River, 2.6 mi upstream from Bell Creek and 3.8 mi southwest of Greenwood.

DRAINAGE AREA.--67.4 mi².

PERIOD OF RECORD.--October 1972 to current year.

GAGE.--Water-stage recorder and concrete flume. Datum of gage is 1,473.77 ft above National Geodetic Vertical Datum of 1929 (Cleveland-Cliffs Iron Co. bench mark). Prior to Nov. 7, 1973, nonrecording gage at same site and different datum.

REMARKS.--No estimated daily discharges. Records excellent. Since December 1972, flow from Greenwood Reservoir (station 04057811) below spillway elevation 1,515 ft is completely regulated by the afterbay release structure into the Middle Branch Escanaba River. Since January 1973, water diverted immediately upstream from station via Greenwood Diversion (station 04057813) to Green Creek for iron ore processing and some returned to Middle Branch Escanaba River 27 mi downstream via another Green Creek. Since October 1979, some of the diversion returned 31 mi downstream via Goose Lake Outlet and East Branch Escanaba River. Overflow from reservoir spillway bypasses and returns to the Middle Branch Escanaba River 0.5 mi downstream from station. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge (prior to regulation), 290 ft³/s, Oct. 1, 1972; (since regulation began), 63 ft³/s, July 10, 11, 1974; minimum daily, 6.4 ft³/s, Nov. 10, 1987, release structure closed for trash rack cleaning and flume inspection.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	25	26	26	26	23	25	26	24	24	25	25	25
2	25	26	27	26	23	25	26	24	25	25	25	25
3	25	26	27	25	23	25	26	24	25	25	25	25
4	25	25	27	25	23	25	26	25	25	25	25	24
5	25	25	27	25	23	26	26	26	25	24	25	24
6	25	25	26	25	23	26	26	26	25	23	25	25
7	25	25	26	25	24	26	26	26	25	23	25	25
8	25	25	26	25	25	26	26	26	25	23	25	24
9	25	25	26	25	25	26	26	25	25	23	25	23
10	25	24	26	25	25	26	26	25	25	25	25	23
11	25	24	25	25	25	26	26	25	25	25	25	24
12	25	24	25	24	25	26	26	25	25	26	25	25
13	25	24	25	24	25	25	26	25	25	27	25	25
14	25	24	25	23	25	25	26	25	25	27	25	26
15	25	24	25	23	25	25	26	25	24	27	25	27
16	25	24	25	23	25	26	26	26	24	27	25	27
17	25	24	25	23	25	26	26	28	24	27	25	27
18	24	24	25	23	25	27	26	29	25	27	25	28
19	24	24	25	23	25	27	25	29	25	26	25	27
20	24	24	25	23	25	27	25	29	24	26	25	25
21	25	25	25	23	25	27	25	29	24	26	25	25
22	25	25	24	24	25	27	25	29	24	26	25	25
23	25	25	25	25	25	27	25	29	24	26	26	25
24	25	24	25	24	25	27	25	29	24	26	26	25
25	26	24	25	24	25	27	25	28	24	26	26	25
26	27	24	26	23	25	27	25	26	24	26	26	25
27	27	24	26	23	25	26	25	24	23	26	26	25
28	26	25	26	23	25	26	25	23	23	26	26	25
29	26	25	26	23	---	26	24	22	27	26	26	25
30	26	26	26	23	---	26	24	23	26	26	26	25
31	26	---	26	23	---	26	---	25	---	26	26	---
TOTAL	781	739	794	744	687	808	766	804	738	792	784	754
MEAN	25.2	24.6	25.6	24.0	24.5	26.1	25.5	25.9	24.6	25.5	25.3	25.1
MAX	27	26	27	26	25	27	26	29	27	27	26	28
MIN	24	24	24	23	23	25	24	22	23	23	25	23

CAL YR 1989 TOTAL 11076 MEAN 30.3 MAX 59 MIN 21
WTR YR 1990 TOTAL 9191 MEAN 25.2 MAX 29 MIN 22

STREAMS TRIBUTARY TO LAKE MICHIGAN

04058100 MIDDLE BRANCH ESCANABA RIVER NEAR PRINCETON, MI

LOCATION.--Lat 46°19'02", long 87°30'07", in NW1/4 sec.12, T.45 N., R.26 W., Marquette County, Hydrologic Unit 04030110, on right bank 400 ft downstream from powerplant, 0.3 mi upstream from Green Creek, and 2.2 mi northwest of Princeton.

DRAINAGE AREA.--210 mi^2.

PERIOD OF RECORD.--July 1961 to September 1982, October 1989 to September 1990.

GAGE.--Water-stage recorder. Datum of gage is 1,102.68 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Oct. 1-27. Records good except for estimated daily discharges, Oct. 16-27, which are poor. Flow regulated by powerplant upstream from station. Since December 1972, additional regulation 27 mi upstream by Greenwood Release (station 04057814). Since January 1973, some flow diverted to Green Creek via Greenwood Diversion 27 mi upstream (station 04057813) by industry for iron ore processing and some returned 0.3 mi downstream via another Green Creek. Since October 1979, some of the diversion returned 5.0 mi downstream via Goose Lake Outlet and East Branch Escanaba River. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--22 years, 221 ft^3/s, 14.29 in/yr, adjusted for storage and diversion since December 1972.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,580 ft^3/s, May 6, 1972, gage height, 7.85 ft; maximum gage height, 8.37 ft, Apr. 27, 1979; minimum discharge recorded, 2.2 ft^3/s, Oct. 5, 1964; minimum daily, 4.1 ft^3/s, Feb. 4, 1967.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Apr. 22, 1985, reached a stage of 11.84 ft, from floodmark, discharge, 4,200 ft^3/s, from rating curve extended above 2,400 ft^3/s.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 748 ft^3/s, May 18, 19, gage height, 4.09 ft; minimum, 3.3 ft^3/s, Feb. 7, gage height, 0.77 ft; minimum daily, 6.1 ft^3/s, July 5.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	78	186	104	99	87	93	191	192	143	103	86	114
2	76	198	105	91	87	92	205	168	139	246	80	102
3	68	198	106	86	87	93	205	124	123	241	80	94
4	76	160	106	86	87	92	205	104	131	11	80	90
5	76	160	106	86	87	92	205	109	243	6.1	79	91
6	76	160	106	86	86	93	190	115	197	123	80	112
7	76	178	106	86	76	94	173	117	161	179	80	115
8	76	200	106	86	112	92	169	117	198	126	78	108
9	78	202	106	94	96	92	164	117	210	102	78	101
10	78	193	106	98	92	91	161	171	186	148	78	101
11	78	186	106	98	93	91	162	177	164	166	78	100
12	78	176	100	99	92	97	162	203	182	130	78	96
13	78	153	97	98	92	169	162	300	193	111	78	95
14	79	141	91	94	92	211	162	341	208	111	78	109
15	80	141	90	90	91	305	162	331	273	111	78	123
16	40	144	90	90	91	430	162	406	257	98	78	127
17	50	151	90	90	90	542	175	631	233	90	78	122
18	70	151	90	90	90	548	196	728	302	90	78	113
19	80	142	90	91	90	448	193	733	362	90	80	120
20	80	134	90	92	90	414	170	646	174	90	116	133
21	90	129	90	90	92	410	160	539	235	90	151	137
22	100	123	91	88	92	361	160	450	230	90	181	134
23	100	123	91	97	93	310	160	385	210	90	175	132
24	100	123	86	102	93	215	160	282	195	91	74	128
25	100	123	82	91	93	175	160	274	179	90	49	122
26	225	123	84	84	94	288	164	306	165	87	86	114
27	203	111	86	84	93	212	192	252	155	89	228	104
28	104	105	86	86	93	157	212	210	129	97	250	74
29	96	105	86	86	---	171	217	207	118	94	179	75
30	100	104	93	86	---	171	211	195	109	93	160	89
31	274	---	100	87	---	172	---	162	---	94	132	---
TOTAL	2963	4523	2966	2811	2551	6821	5370	9092	5804	3377.1	3284	3275
MEAN	95.6	151	95.7	90.7	91.1	220	179	293	193	109	106	109
MAX	274	202	106	102	112	548	217	733	362	246	250	137
MIN	40	104	82	84	76	91	160	104	109	6.1	49	74

WTR YR 1990 TOTAL 52837.1 MEAN 145 MAX 733 MIN 6.1 MEAN+ 165 CFSM+ .79 IN+ 10.68

\+ Adjusted for diversion and change in contents in Greenwood Reservoir.

04058190 SCHWEITZER RESERVOIR NEAR PALMER, MI

LOCATION.--Lat 46°25'00", long 87°38'48", in SE1/4 NW1/4 sec.2, T.46 N., R.27 W., Marquette County, Hydrologic Unit 04030110, on left bank 120 ft upstream from dam on Schweitzer Creek, 3.0 mi southwest of Palmer.

DRAINAGE AREA.--23.1 mi².

PERIOD OF RECORD.--January 1963 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,300.00 ft above National Geodetic Vertical Datum of 1929 (Cleveland-Cliffs Iron Co. reference mark); gage readings have been converted to elevations NGVD. Prior to Oct. 25, 1967, nonrecording gage at same site and datum.

REMARKS.--Reservoir is formed by an earthfill dam with fixed crest concrete spillway completed in 1963. Capacity of reservoir, 5,300 acre-ft at spillway elevation, 1,338.00 ft. The dam includes a discharge pipe equipped with valve to control release flow to Schweitzer Creek (station 04058200). An average of 1.8 ft³/s was diverted from the headwaters of basin by the City of Ishpeming for municipal supply and the effluent discharged to the Carp River basin. An average of 27 ft³/s was diverted from reservoir for iron ore processing, some returned to Middle Branch Escanaba River basin via Green Creek and some returned to the East Branch Escanaba River basin via Goose Lake Outlet. Since January 1973, controlled diversion from Greenwood Reservoir (station 04057811) via Greenwood Diversion (station 04057813) into Schweitzer Reservoir. Controlled inflow averaged 17.1 ft³/s for the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents recorded, 5,900 acre-ft, May 31, 1970, Apr. 20, 1985, elevation, 1,339.5 ft; minimum recorded since first filling, 2,920 acre-ft, Apr. 10, 1974, elevation, 1,329.7 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 5,500 acre-ft, May 17, elevation, 1,338.5 ft; minimum, 4,260 acre-ft, Mar. 11, elevation, 1,334.7 ft.

MONTHEND ELEVATION, IN FEET NGVD, AND CONTENTS AT 2400, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)	Change in contents (equivalent in ft³/s)
Sept. 30	1,337.2	5,020	--	--
Oct. 31	1,337.6	5,160	+140	+2.3
Nov. 30	1,336.9	4,920	-240	-4.0
Dec. 31	1,337.2	5,020	+100	+1.6
CAL YR 1989	--	--	-400	-0.6
Jan. 31	1,336.6	4,830	-190	-3.1
Feb. 28	1,335.2	4,410	-420	-7.6
Mar. 31	1,337.4	5,070	+680	+11.1
Apr. 30	1,336.9	4,920	-170	-2.9
May 31	1,337.6	5,160	+240	+3.9
June 30	1,336.8	4,890	-270	-4.5
July 31	1,334.9	4,320	-570	-9.3
Aug. 31	1,337.1	4,990	+660	+10.8
Sept. 30	1,337.6	5,160	+180	+3.0
WTR YR 1990	--	--	+140	+0.2

STREAMS TRIBUTARY TO LAKE MICHIGAN

04058200 SCHWEITZER CREEK NEAR PALMER, MI

LOCATION.--Lat 46°24'40", long 87°37'27", in SW1/4 sec.1, T.46 N., R.27 W., Marquette County, Hydrologic Unit 04030110, on right bank 10 ft upstream from highway bridge, 2.5 mi southwest of Palmer.

DRAINAGE AREA.--23.6 mi².

PERIOD OF RECORD.--October 1960 to current year.

GAGE.--Water-stage recorder. Concrete control since Oct. 1, 1963. Datum of gage is 1,268.28 ft above National Geodetic Vertical Datum of 1929 (Cleveland-Cliffs Iron Co. bench mark). Prior to Aug 21, 1961, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Oct. 1 to Nov. 16, Dec. 7-10, 12, 13, Jan. 13, Feb. 14-16, 19, 20, 24-27, and Mar. 6, 7. Records good except for estimated daily discharges, which are fair. Since August 1962, flow completely regulated by Schweitzer Reservoir (station 04058190) 1.0 mi upstream. An average of 1.8 ft³/s was diverted from headwaters of basin by the City of Ishpeming for municipal supply (furnished by City of Ishpeming) and the effluent discharged to the Carp River basin. An average of 27 ft³/s was diverted from Schweitzer Reservoir by industry for iron ore processing (furnished by Cleveland Cliffs Iron Co.), some returned to the Middle Branch Escanaba River via Green Creek and some returned via Goose Lake Outlet and East Branch Escanaba River. Diversion into Schweitzer Reservoir from Greenwood Reservoir (station 04057811) via Greenwood Diversion (station 04057813). Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 860 ft³/s, May 31, 1970, gage height, 6.50 ft; minimum, 0.4 ft³/s, Sept. 6, 1962, gage height, 1.22 ft; minimum daily, 1.0 ft³/s, Apr. 9-18, May 5, 6, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 135 ft³/s, May 17, gage height, 4.13 ft; minimum daily, 3.5 ft³/s, Nov. 17-21, 26, Dec. 4, 6, 16, 22, 23, Mar. 8, but may have been less during periods of estimated daily discharges.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.8	4.0	3.6	3.6	3.6	3.7	4.3	4.0	4.2	4.0	3.7	3.7
2	3.7	3.9	3.7	3.7	3.6	3.6	4.4	4.0	4.3	4.0	3.7	3.7
3	3.7	3.7	3.6	3.9	3.6	3.6	4.3	4.0	4.5	4.0	3.8	3.7
4	3.7	3.7	3.5	3.8	3.7	3.6	4.2	4.0	4.4	3.8	3.9	4.0
5	4.1	4.1	3.6	3.8	3.7	3.7	4.2	4.0	4.4	3.9	3.8	3.7
6	3.7	3.8	3.5	3.8	3.6	3.6	4.2	4.0	4.3	3.9	3.8	4.2
7	3.7	3.7	3.6	3.8	3.6	3.6	4.2	4.0	4.2	4.4	3.7	3.8
8	3.7	3.7	3.6	3.8	3.7	3.5	4.4	3.9	4.3	4.9	3.7	4.0
9	3.7	3.7	3.6	3.8	3.7	3.7	4.3	4.2	4.4	4.1	3.7	4.1
10	3.7	3.7	3.6	3.8	3.6	3.8	4.3	4.8	4.2	3.9	3.8	4.2
11	3.7	3.7	3.6	3.8	3.6	3.9	4.2	5.3	4.1	3.8	3.8	4.5
12	3.7	3.6	3.6	3.8	3.6	4.7	4.2	5.4	4.5	3.9	4.0	5.5
13	3.7	3.6	3.6	3.8	3.6	4.6	4.2	4.9	4.4	3.9	3.8	5.7
14	3.7	3.6	3.6	3.8	3.6	6.7	4.2	5.1	4.2	3.9	3.9	6.1
15	3.6	3.6	3.6	3.8	3.6	8.4	4.6	25	4.1	4.0	3.8	5.9
16	3.6	3.6	3.5	3.8	3.7	6.7	4.2	67	4.7	4.1	3.8	5.8
17	3.6	3.5	3.6	3.8	3.6	11	4.2	123	4.6	4.1	3.9	5.6
18	3.6	3.5	3.6	3.8	3.6	46	4.2	71	4.3	4.0	4.0	5.8
19	3.6	3.5	3.6	3.8	3.6	43	4.1	41	4.2	3.9	3.9	6.2
20	3.8	3.5	3.6	3.7	3.6	23	4.2	27	4.2	3.9	3.8	5.7
21	3.7	3.5	3.6	3.8	3.6	14	4.2	18	4.1	3.8	3.8	5.8
22	3.6	3.6	3.5	3.8	3.6	10	4.0	12	4.2	3.8	3.7	5.8
23	3.6	3.6	3.5	3.8	3.6	6.9	4.0	8.6	4.3	4.0	3.7	5.9
24	3.6	3.7	3.6	3.8	3.6	4.7	4.0	6.4	4.1	3.8	3.7	5.7
25	3.6	3.6	3.6	3.8	3.6	4.3	4.0	4.9	4.0	3.7	4.1	5.7
26	3.8	3.5	3.6	3.8	3.6	4.2	4.1	4.5	4.0	3.6	3.9	5.7
27	3.7	3.6	3.6	3.7	3.6	4.2	4.2	4.4	4.0	3.7	3.7	5.6
28	3.7	3.6	3.6	3.8	3.6	4.2	4.0	4.3	4.0	3.7	3.8	5.6
29	3.7	3.7	3.6	3.7	---	4.3	4.0	4.3	4.0	4.7	3.7	5.7
30	3.7	3.6	3.6	3.7	---	4.3	4.0	4.2	4.0	3.8	3.7	5.9
31	3.8	---	3.6	3.6	---	4.2	---	4.2	---	3.8	3.7	---
TOTAL	114.6	109.7	111.2	117.0	101.3	259.7	125.6	491.4	127.2	122.8	117.8	153.3
MEAN	3.70	3.66	3.59	3.77	3.62	8.38	4.19	15.9	4.24	3.96	3.80	5.11
MAX	4.1	4.1	3.7	3.9	3.7	46	4.6	123	4.7	4.9	4.1	6.2
MIN	3.6	3.5	3.5	3.6	3.6	3.5	4.0	3.9	4.0	3.6	3.7	3.7

CAL YR 1989 TOTAL 3005.8 MEAN 8.24 MAX 194 MIN 3.5
WTR YR 1990 TOTAL 1951.6 MEAN 5.35 MAX 123 MIN 3.5

04058940 ESCANABA RIVER NEAR ST. NICHOLAS, MI

LOCATION.--Lat 45°58'45", long 87°16'13", in SW1/4 NE1/4 sec.2, T.41 N., R.24 W., Delta County, Hydrologic Unit 04030110, on right bank 600 ft downstream from Boney Falls Dam, 2.1 mi west of St. Nicholas, and 23.1 mi upstream from mouth.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--December 1987 to current year (gage heights only).

GAGE.--Water-stage recorder. Datum of gage is 854.03 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Diurnal fluctuation caused by hydroelectric plant 600 ft upstream. Some regulation by Schweitzer Reservoir (station 04058190) about 40 mi upstream and Greenwood Reservoir (station 04057811) about 50 mi upstream. Gage-height telemeter at station.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height recorded, 5.11 ft, Apr. 7, 1988, but may have been higher during period of no gage-height record, Apr. 8-14, 1988; minimum daily, 1.97 ft, Oct. 18, 1990.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 4.54 ft, May 17, 18; minimum daily, 1.97 ft, Oct. 18.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.11	2.95	2.23	2.12	2.10	2.11	2.69	2.80	2.42	2.22	2.13	2.07
2	2.08	2.73	2.19	2.13	2.10	2.12	2.80	2.70	2.41	2.19	2.09	2.03
3	2.04	2.75	2.09	2.13	2.10	2.13	2.76	2.60	2.36	2.47	2.08	2.02
4	2.04	2.60	2.13	2.13	2.11	2.13	2.76	2.48	2.43	2.21	2.11	2.02
5	2.05	2.64	2.18	2.15	2.11	2.12	2.74	2.46	2.49	2.01	2.13	2.02
6	2.07	2.83	2.20	2.12	2.11	2.12	2.68	2.42	2.68	2.01	2.17	2.10
7	2.13	2.79	2.10	2.12	2.12	2.11	2.65	2.39	2.49	2.23	2.04	2.15
8	2.11	2.73	2.08	2.12	2.09	2.13	2.62	2.36	2.47	2.29	2.07	2.14
9	2.10	2.66	2.10	2.12	2.16	2.18	2.62	2.42	2.54	2.40	2.05	2.11
10	2.09	2.58	2.15	2.12	2.14	2.15	2.59	2.81	2.54	2.34	2.05	2.08
11	2.10	2.43	2.15	2.14	2.14	2.14	2.64	3.07	2.44	2.33	2.05	2.07
12	2.09	2.27	2.12	2.13	2.12	2.21	2.62	3.38	2.47	2.28	2.05	2.09
13	2.08	2.53	2.10	2.13	2.13	2.33	2.60	3.63	2.76	2.19	2.07	2.06
14	2.07	2.48	2.10	2.13	2.12	2.73	2.60	3.66	2.83	2.18	2.08	2.11
15	2.07	2.47	2.09	2.12	2.11	3.18	2.67	3.74	2.73	2.18	2.07	2.16
16	2.07	2.45	2.09	2.13	2.10	3.84	2.76	4.02	2.69	2.19	2.08	2.24
17	2.01	2.30	2.10	2.12	2.10	4.10	2.74	4.35	2.79	2.17	2.05	2.19
18	1.97	2.30	2.11	2.12	2.10	4.09	2.70	4.46	2.95	2.19	2.07	2.16
19	2.07	2.33	2.10	2.12	2.11	3.80	2.71	4.26	3.05	2.17	2.15	2.14
20	2.14	2.46	2.09	2.11	2.10	3.67	2.65	3.99	2.90	2.15	2.16	2.20
21	2.23	2.23	2.08	2.12	2.10	3.69	2.68	3.70	2.46	2.15	2.19	2.26
22	2.40	2.23	2.08	2.11	2.10	3.49	2.71	3.48	2.64	2.13	2.19	2.26
23	2.42	2.17	2.08	2.12	2.12	3.11	2.73	3.27	2.58	2.12	2.21	2.23
24	2.40	2.14	2.08	2.14	2.11	2.93	2.76	3.14	2.57	2.15	2.21	2.23
25	2.38	2.27	2.08	2.13	2.10	2.90	2.82	2.89	2.51	2.13	2.01	2.19
26	2.36	2.22	2.07	2.12	2.11	2.85	2.84	2.91	2.44	2.12	2.01	2.16
27	2.58	2.25	2.08	2.12	2.12	2.82	2.91	2.83	2.40	2.09	2.08	2.12
28	2.30	2.16	2.09	2.11	2.11	2.69	3.00	2.69	2.31	2.10	2.33	2.09
29	2.28	2.05	2.09	2.11	---	2.71	2.97	2.63	2.29	2.12	2.26	2.04
30	2.32	2.17	2.13	2.11	---	2.69	2.88	2.58	2.26	2.15	2.16	2.05
31	2.58	---	2.13	2.11	---	2.64	---	2.51	---	2.17	2.12	---
MEAN	2.19	2.44	2.11	2.12	2.11	2.77	2.73	3.12	2.56	2.19	2.11	2.13
MAX	2.58	2.95	2.23	2.15	2.16	4.10	3.00	4.46	3.05	2.47	2.33	2.26
MIN	1.97	2.05	2.07	2.11	2.09	2.11	2.59	2.36	2.26	2.01	2.01	2.02

WTR YR 1990 MEAN 2.38 MAX 4.46 MIN 1.97

STREAMS TRIBUTARY TO LAKE MICHIGAN

04059000 ESCANABA RIVER AT CORNELL, MI
(National stream quality accounting network station)

LOCATION.--Lat 45°54'31", long 87°12'49", in NW1/4 sec.32, T.41 N., R.23 W., Delta County, Hydrologic Unit 04030110, on right bank 50 ft downstream from bridge on County Road 519, 0.4 mi downstream from Bobs Creek, 0.7 mi northeast of Cornell, and 16 mi upstream from mouth.

DRAINAGE AREA.--870 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--August 1903 to December 1912, January 1913 to November 1915 (gage heights only), October 1950 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as "near Escanaba" 1903-15.

REVISED RECORDS.--WSP 1387: 1904. WDR MI-85: 1970 (M).

GAGE.--Water-stage recorder. Datum of gage is 749.26 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). August 1903 to November 1915, nonrecording gage at site 10 mi downstream at different datum.

REMARKS.--Estimated daily discharges: Nov. 17 to Apr. 19. Water-discharge records good except for estimated daily discharges, which are fair. Since 1950, diurnal fluctuation and occasional slight regulation by Boney Falls powerplant 7 mi upstream. Since August 1962, some regulation by Schweitzer Reservoir (station 04058190) about 50 mi upstream. Since December 1972, some regulation by Greenwood Reservoir (station 04057811) about 60 mi upstream. Gage-height telemeter at station.

AVERAGE DISCHARGE.--49 years (water years 1904-12, 1951-90), 879 ft³/s, 13.72 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 10,700 ft³/s, Apr. 26, 1979, gage height, 5.00 ft; maximum gage height, 6.40 ft, Apr. 9, 1971, backwater from ice; minimum discharge observed, 90 ft³/s, July 5, 1910, gage height, 1.5 ft, site and datum then in use, but may have been less during extended periods of no gage-height record during winter periods of 1903-12, or periods of ice effect in 1959.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,510 ft³/s, May 18, gage height, 3.58 ft; maximum gage height, 4.35 ft, Mar. 16, backwater from ice; minimum daily discharge, 199 ft³/s, Oct. 18.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	249	1230	370	300	280	290	770	925	559	378	302	271
2	250	894	350	300	280	295	880	816	535	353	271	247
3	241	831	280	300	280	300	860	727	544	544	268	233
4	238	820	300	300	290	300	850	625	561	392	296	236
5	244	934	330	310	290	295	830	586	604	238	299	223
6	257	1090	350	300	290	295	780	541	785	231	313	297
7	283	996	280	300	300	290	730	517	629	345	266	304
8	284	889	270	300	280	300	700	493	602	412	272	313
9	269	805	280	300	320	335	700	593	643	488	255	291
10	270	705	310	300	310	310	680	1250	645	442	252	271
11	272	621	310	310	310	310	710	1600	571	433	250	264
12	276	468	300	300	300	350	700	1970	584	389	260	282
13	270	627	280	300	300	440	680	2150	923	343	262	259
14	265	593	280	300	300	810	680	2140	1000	318	272	303
15	263	589	280	300	290	1390	740	2330	857	327	274	317
16	263	590	280	300	280	2570	840	3050	835	335	269	374
17	239	520	280	300	280	3160	820	4150	943	327	258	338
18	199	450	290	300	280	3130	780	4230	1160	327	255	317
19	251	500	280	300	290	2490	800	3510	1190	315	333	313
20	325	540	280	290	280	2230	770	2800	1050	306	343	325
21	443	390	270	300	280	2270	785	2190	623	301	346	380
22	506	380	270	290	280	1900	819	1840	746	286	340	371
23	520	330	270	300	290	1300	845	1570	702	306	351	362
24	479	340	270	310	290	1050	883	1400	682	297	358	352
25	462	400	270	300	280	1010	948	1110	611	293	258	335
26	447	370	270	300	290	950	983	1080	558	288	237	309
27	588	390	270	300	295	915	1060	997	511	277	265	288
28	431	320	280	290	290	800	1160	834	454	273	420	270
29	398	270	280	290	---	790	1110	772	425	297	382	239
30	653	340	300	290	---	770	1010	701	410	305	325	247
31	1120	---	300	290	---	740	---	635	---	326	292	---
TOTAL	11255	18222	9030	9270	8125	32385	24903	48132	20942	10492	9144	8931
MEAN	363	607	291	299	290	1045	830	1553	698	338	295	298
MAX	1120	1230	370	310	320	3160	1160	4230	1190	544	420	380
MIN	199	270	270	290	280	290	680	493	410	231	237	223
CFSM	.42	.70	.33	.34	.33	1.20	.95	1.79	.80	.39	.34	.34
IN.	.48	.78	.39	.40	.35	1.38	1.06	2.06	.90	.45	.39	.38

CAL YR 1989 TOTAL 275832 MEAN 756 MAX 3760 MIN 199 CFSM .87 IN 11.79
WTR YR 1990 TOTAL 210831 MEAN 578 MAX 4230 MIN 199 CFSM .66 IN 9.01

04059000 ESCANABA RIVER AT CORNELL, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1969-73, 1975 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: February 1975 to September 1981.
WATER TEMPERATURE: February 1975 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Oct. 15, 1975 to Sept. 30, 1981.

REMARKS.--Bimonthly cross-sectional samples were collected at or near bridge. From October 1975 to September 1981, instrument-recorded specific conductance below 200 microsiemens does not represent the conductance of the cross section. Results of a study of conductance in the cross section are available in the District files.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975, 1978-81): Maximum daily recorded (more than 20 percent missing record), 360 microsiemens, Sept. 10, 1975; minimum measured, 114 microsiemens, Apr. 15, 1981.
WATER TEMPERATURE (water years 1975, 1977-81): Maximum daily recorded (more than 20 percent missing record), 35.0°C, July 31, 1975; minimum, 0.0°C on many days during winter.

EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A specific conductance of 72 microsiemens was measured Apr. 24, 1985.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV										
09...	1530	712	183	8.22	4.0	1.3	12.9	104	K30	K89
JAN										
03...	1430	E300	304	8.11	0.0	1.2	11.6	83	K5	K5
MAR										
07...	1315	287	268	8.15	0.0	1.6	13.6	94	K20	K3
MAY										
02...	1200	839	160	8.28	10.0	2.1	11.4	103	K13	<7
JUN										
28...	1240	506	220	8.49	18.5	2.0	9.9	109	K6	300
SEP										
11...	1330	281	206	8.59	22.0	1.8	10.1	118	<5	K9

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
NOV										
09...	82	15	19	8.3	7.7	17	0.4	1.1	81	0
JAN										
03...	110	0	25	11	22	30	0.9	2.0	149	0
MAR										
07...	110	0	24	11	16	24	0.7	2.1	143	0
MAY										
02...	69	0	15	7.7	3.8	11	0.2	0.8	87	0
JUN										
28...	78	0	16	9.1	14	28	0.7	1.3	104	2
SEP										
11...	99	0	24	9.6	6.0	11	0.3	1.1	120	1

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
NOV										
09...	66	15	5.5	0.1	7.7	134	0.18	258	<0.01	0.22
JAN										
03...	122	16	8.6	0.1	11	177	0.24	--	<0.01	0.28
MAR										
07...	117	15	8.8	<0.1	10	155	0.21	120	0.02	0.40
MAY										
02...	71	9.6	2.6	0.1	4.5	101	0.14	229	<0.01	<0.10
JUN										
28...	89	14	7.1	0.2	6.7	151	0.21	206	<0.01	0.10
SEP										
11...	100	6.4	5.0	<0.1	8.2	122	0.17	92.6	<0.01	<0.10

04059000 ESCANABA RIVER AT CORNELL, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS TOTAL (MG/L AS P)	PHOSPHORUS DISSOLVED (MG/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
NOV 09...	0.04	0.02	0.6	0.02	<0.01	0.01	40	<1	9	<0.5
JAN 03...	0.07	0.09	0.4	<0.01	<0.01	<0.01	20	<1	12	<0.5
MAR 07...	0.03	0.04	0.3	0.02	0.01	<0.01	--	--	--	--
MAY 02...	0.01	<0.01	0.5	0.02	0.02	<0.01	20	<1	9	<0.5
JUN 28...	0.02	0.02	0.3	<0.01	<0.01	<0.01	40	<1	12	<0.5
SEP 11...	<0.01	<0.01	0.5	0.01	<0.01	<0.01	--	--	--	--

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
NOV 09...	<1	<1	<3	1	340	<1	<4	10	<0.1	<10
JAN 03...	<1	<1	<3	<1	340	<1	<4	5	<0.1	<10
MAR 07...	--	--	--	--	--	--	--	--	--	--
MAY 02...	<1	<1	<3	4	330	8	<4	15	<0.1	<10
JUN 28...	<1	<1	<3	3	360	1	4	26	<0.1	<10
SEP 11...	--	--	--	--	--	--	--	--	--	--

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV 09...	1	<1	<1.0	30	<6	<3	11	21	58
JAN 03...	1	<1	<1.0	47	<6	6	2	--	55
MAR 07...	--	--	--	--	--	--	1	0.77	65
MAY 02...	<1	<1	<1.0	35	<6	11	3	6.8	100
JUN 28...	1	<1	<1.0	47	<6	<3	5	6.8	71
SEP 11...	--	--	--	--	--	--	3	2.3	75

STREAMS TRIBUTARY TO LAKE MICHIGAN

04059500 FORD RIVER NEAR HYDE, MI
(National stream quality accounting network station)

LOCATION.--Lat 45°45'20", long 87°12'05", in SW1/4 sec.19, T.39 N., R.23 W., Delta County, Hydrologic Unit 04030109, on right bank 40 ft downstream from bridge on County Road 533, 1.4 mi downstream from Tenmile Creek, and 1.5 mi north of Hyde.

DRAINAGE AREA.--450 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1954 to current year.

GAGE.--Water-stage recorder. Datum of gage is 681.77 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Nov. 20 to Mar. 21. Water-discharge records good except for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--36 years, 380 ft³/s, 11.47 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,590 ft³/s, May 7, 1960, gage height, 8.27 ft; minimum, 18 ft³/s, Aug. 30, 1976, July 7, 8, 1988; minimum gage height, 1.30 ft, July 7, 8, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,990 ft³/s, May 17, gage height, 5.69 ft; minimum daily, 35 ft³/s, Dec. 27.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	39	311	98	46	52	50	280	587	277	150	61	49
2	41	386	94	48	52	50	320	520	253	134	66	44
3	39	392	88	49	52	52	321	460	258	121	62	41
4	38	365	81	50	52	52	328	407	262	110	60	40
5	40	356	74	50	52	53	320	359	272	97	68	39
6	44	405	67	50	52	52	283	321	330	87	73	59
7	44	447	64	51	52	50	258	292	345	82	71	71
8	49	462	60	52	52	47	240	270	329	90	69	86
9	55	452	56	52	52	52	236	290	323	97	65	116
10	61	424	54	54	51	60	249	912	306	104	60	116
11	60	397	52	54	51	80	248	1190	278	122	56	100
12	59	360	50	54	51	120	240	1370	294	111	52	92
13	60	324	48	54	51	195	236	1370	545	93	51	88
14	61	300	46	54	51	600	235	1290	683	82	52	115
15	58	281	45	54	51	1300	244	1360	622	79	60	125
16	59	271	43	54	50	1400	263	1980	552	79	56	138
17	59	181	41	54	50	1350	292	2860	589	83	55	147
18	53	151	37	54	49	1300	292	2470	635	81	76	144
19	53	155	36	54	49	1300	284	2120	628	78	77	144
20	60	160	36	54	49	1300	285	1910	591	76	70	135
21	70	155	36	54	49	1200	298	1660	515	72	80	132
22	77	140	36	54	49	1000	320	1360	441	71	81	142
23	94	130	36	54	50	806	350	1120	419	72	75	152
24	109	130	36	54	50	586	393	929	362	70	75	154
25	117	125	36	54	50	506	464	732	311	67	73	147
26	113	130	36	53	49	391	519	588	273	64	69	136
27	107	130	35	53	48	350	558	520	238	61	65	120
28	102	120	36	52	49	338	657	464	202	59	62	106
29	101	110	38	52	---	306	677	407	184	63	60	96
30	114	100	43	52	---	306	653	350	168	63	57	88
31	193	---	45	52	---	286	---	311	---	59	52	---
TOTAL	2229	7850	1583	1626	1415	15538	10343	30779	11485	2677	2009	3162
MEAN	71.9	262	51.1	52.5	50.5	501	345	993	383	86.4	64.8	105
MAX	193	462	98	54	52	1400	677	2860	683	150	81	154
MIN	38	100	35	46	48	47	235	270	168	59	51	39
CFSM	.16	.58	.11	.12	.11	1.11	.77	2.21	.85	.19	.14	.23
IN.	.18	.65	.13	.13	.12	1.28	.86	2.54	.95	.22	.17	.26

CAL YR 1989 TOTAL 117193 MEAN 321 MAX 1920 MIN 35 CFSM .71 IN 9.69
WTR YR 1990 TOTAL 90696 MEAN 248 MAX 2860 MIN 35 CFSM .55 IN 7.50

STREAMS TRIBUTARY TO LAKE MICHIGAN

04059500 FORD RIVER NEAR HYDE, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1956 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: December 1974 to September 1981.
WATER TEMPERATURE: July 1956 to September 1981.

INSTRUMENTATION.--Water-temperature recorder from July 20, 1956 to Sept. 30, 1975. Water-quality monitor from Oct. 1, 1975 to Sept. 30, 1981.

REMARKS.--Quarterly cross-sectional samples were collected at or near bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975-77, 1979-81): Maximum, 482 microsiemens, Dec. 2, 1976; minimum recorded, 131 microsiemens, May 22, 1976, but may have been lower during instrument malfunction May 18-21, 1976.
WATER TEMPERATURE (water years 1956-81): Maximum, 31.0°C, July 31, 1975; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV										
06...	1430	389	266	8.20	3.5	1.1	12.8	100	K60	310
FEB										
01...	1330	52	394	8.00	0.0	1.0	8.4	59	K2	K8
MAY										
01...	1130	599	245	8.29	10.0	1.0	11.0	100	K24	K10
JUL										
16...	1245	79	318	8.48	19.5	0.5	10.0	112	K30	K17

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
NOV										
06...	150	30	35	15	1.6	2	0.1	0.9	145	0
FEB										
01...	220	23	49	23	1.9	2	0.1	0.9	237	0
MAY										
01...	140	29	33	14	1.3	2	0.0	0.6	135	0
JUL										
16...	180	13	42	19	1.7	2	0.0	0.7	203	2

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
NOV										
06...	119	15	3.8	<0.1	8.2	196	0.27	206	<0.01	0.18
FEB										
01...	194	13	2.5	0.1	11	230	0.31	32.3	0.02	0.20
MAY										
01...	111	26	1.2	<0.1	3.1	162	0.22	262	<0.01	<0.10
JUL										
16...	170	8.7	3.6	<0.1	5.8	210	0.29	44.8	<0.01	<0.10

STREAMS TRIBUTARY TO LAKE MICHIGAN

04059500 FORD RIVER NEAR HYDE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS TOTAL (MG/L AS P)	PHOSPHORUS DISSOLVED (MG/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
NOV										
06...	0.02	0.01	0.7	0.01	<0.01	<0.01	10	<1	11	<0.5
FEB										
01...	0.05	0.05	0.4	0.01	<0.01	<0.01	<10	<1	14	<0.5
MAY										
01...	0.01	0.01	0.7	0.02	<0.01	<0.01	<10	<1	11	<0.5
JUL										
16...	0.02	0.01	0.5	<0.01	0.01	<0.01	<10	<1	13	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
NOV										
06...	<1	<1	<3	1	110	<1	<4	5	<0.1	<10
FEB										
01...	<1	<1	<3	3	64	1	<4	8	<0.1	<10
MAY										
01...	<1	<1	<3	3	82	1	<4	12	<0.1	<10
JUL										
16...	<1	<1	<3	1	36	<1	<4	14	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV									
06...	1	<1	<1.0	40	<6	12	6	6.3	67
FEB									
01...	1	<1	1.0	68	<6	10	3	0.42	38
MAY									
01...	<1	<1	<1.0	39	<6	<3	4	6.5	75
JUL									
16...	<1	<1	<1.0	62	<6	<3	3	0.64	58

STREAMS TRIBUTARY TO LAKE MICHIGAN

04061000 BRULE RIVER NEAR FLORENCE, WI

LOCATION.--Lat 45°57'31", long 88°15'57", in SE1/4 SE1/4 sec.11, T.41 N., R.32 W., Michigan Meridian, Iron County, Hydrologic Unit 04030106, on left bank 40 ft upstream from highway bridge, 1.0 mi upstream from Paint River, 2.5 mi north of Florence, WI, and 5.0 mi upstream from confluence with Michigamme River.

DRAINAGE AREA.--389 mi².

PERIOD OF RECORD.--January 1914 to February 1916, June 1944 to current year.

REVISED RECORDS.--WSP 1387: 1914-16. WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,200.55 ft above National Geodetic Vertical Datum of 1929 (levels by Owen Ayres Associates). Prior to Aug. 29, 1944, nonrecording gage at bridge 40 ft downstream at same datum.

REMARKS.--Estimated daily discharges: Nov. 17 to Mar. 31. Records excellent except for estimated daily discharges, which are fair. Discharge includes some mine pumpage prior to August 1977. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--47 years (water years 1915, 1945-90), 356 ft³/s, 12.43 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,700 ft³/s, July 2, 1953, gage height, 6.57 ft; maximum gage height, 8.60 ft, Dec. 20, 1983, backwater from ice; minimum discharge, 118 ft³/s, Dec. 2, 1963 (discharge measurement); minimum gage height, 1.76 ft, July 29, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 700 ft³/s, Mar. 16; maximum gage height, 5.76 ft, Nov. 19, backwater from ice; minimum discharge, 156 ft³/s, Aug. 9, 10, 11, but may have been less during period of ice effect Nov. 17 to Dec. 24; minimum gage height, 1.77 ft, Aug. 9, 10, 11.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	169	248	180	198	192	185	227	279	199	185	197	177
2	169	231	190	198	185	188	247	254	204	180	187	175
3	170	221	195	198	182	188	246	232	268	178	239	171
4	169	215	190	195	180	185	239	217	281	178	200	175
5	176	229	190	187	180	180	230	206	258	171	182	186
6	199	279	180	180	185	180	220	216	276	167	173	283
7	193	267	170	180	185	178	217	217	269	170	165	361
8	186	261	160	185	190	177	215	205	249	227	162	309
9	182	251	158	185	190	177	214	225	240	293	161	275
10	184	239	158	190	188	180	225	359	231	243	161	240
11	183	230	160	190	185	190	223	361	219	222	174	213
12	180	215	170	190	185	240	216	363	244	198	185	222
13	178	212	175	190	180	370	210	333	316	180	183	239
14	175	209	174	190	175	570	213	311	300	170	175	305
15	177	218	173	190	178	690	223	382	259	169	209	369
16	181	209	173	192	180	700	223	504	252	177	189	305
17	181	175	170	192	180	600	217	648	327	182	180	266
18	179	157	167	192	180	450	210	533	318	175	201	236
19	180	160	160	191	180	360	210	452	286	171	314	240
20	188	163	160	190	182	310	217	416	255	186	334	239
21	209	168	157	190	184	280	226	371	231	179	274	251
22	205	167	157	190	184	260	221	328	222	172	231	255
23	198	165	157	190	184	240	222	315	232	174	203	245
24	194	162	157	190	184	230	233	302	219	182	188	230
25	187	162	170	190	184	225	243	285	203	173	195	216
26	187	165	190	190	184	222	256	272	209	168	236	203
27	187	170	195	190	184	220	262	258	209	164	240	193
28	187	175	198	190	184	220	298	250	198	167	219	185
29	195	170	198	195	---	220	329	233	195	217	200	182
30	211	167	198	200	---	220	306	219	191	299	187	199
31	247	---	198	200	---	220	---	208	---	230	180	---
TOTAL	5806	6060	5428	5918	5134	8855	7038	9754	7360	5947	6324	7145
MEAN	187	202	175	191	183	286	235	315	245	192	204	238
MAX	247	279	198	200	192	700	329	648	327	299	334	369
MIN	169	157	157	180	175	177	210	205	191	164	161	171
CFSM	.48	.52	.45	.49	.47	.74	.60	.81	.63	.49	.52	.61
IN.	.56	.58	.52	.57	.49	.85	.67	.93	.70	.57	.60	.68

CAL YR 1989 TOTAL 88955 MEAN 244 MAX 661 MIN 157 CFSM .63 IN 8.51
WTR YR 1990 TOTAL 80769 MEAN 221 MAX 700 MIN 157 CFSM .57 IN 7.72

04061500 PAINT RIVER AT CRYSTAL FALLS, MI

LOCATION.--Lat 46°06'21", long 88°20'05", in SE1/4 sec.20, T.43 N., R.32 W., Iron County, Hydrologic Unit 04030106, on right bank 150 ft downstream from municipal powerplant at Crystal Falls, 14.5 mi upstream from mouth.

DRAINAGE AREA.--597 mi^2.

PERIOD OF RECORD.--August 1944 to current year.

REVISED RECORDS.--WSP 1174: 1947-48(m). WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 1,306.1 ft above National Geodetic Vertical Datum of 1929 (Wisconsin Electric Power Co. bench mark).

REMARKS.--Estimated daily discharges: Dec. 7 to Jan. 30. Records good. Diurnal fluctuation caused by powerplant immediately upstream; since storage capacity is small, daily flows are not affected appreciably. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--46 years, 593 ft^3/s, 13.49 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 10,900 ft^3/s, Apr. 25, 1960, gage height, 9.82 ft; minimum, 7.7 ft^3/s, Sept. 17, 1950, gage height, 0.89 ft; minimum daily, 81 ft^3/s, Nov. 1, 1947.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,760 ft^3/s, Mar. 14, gage height, 4.11 ft; minimum, 100 ft^3/s, Aug. 9, 10, 11, gage height, 1.61 ft; minimum daily, 119 ft^3/s, Aug. 12.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	153	341	287	210	238	231	481	654	325	202	249	139
2	241	351	286	228	252	254	530	591	274	308	223	137
3	197	354	254	221	242	245	607	527	283	273	272	133
4	193	310	271	244	245	239	595	461	443	194	130	225
5	236	328	274	233	239	230	579	430	404	297	143	196
6	232	387	277	214	251	228	560	341	392	220	248	372
7	221	420	259	239	244	222	507	423	403	186	185	601
8	247	412	233	252	242	219	483	330	391	220	162	469
9	254	404	239	236	254	234	464	341	375	392	150	307
10	238	391	253	254	261	254	470	478	360	325	149	352
11	215	387	247	248	222	267	476	549	375	282	130	295
12	235	352	234	245	265	302	472	565	437	310	119	288
13	274	348	226	228	244	529	455	572	647	263	205	261
14	195	330	228	247	247	818	442	573	807	181	189	360
15	185	340	227	248	226	897	454	640	714	173	167	387
16	264	301	223	250	244	1410	501	849	668	283	207	339
17	222	214	239	238	233	1560	506	1350	651	213	215	353
18	222	270	244	244	233	1350	509	1350	655	216	142	328
19	215	307	242	254	247	1080	494	1200	737	188	218	322
20	249	360	249	227	242	976	495	1040	695	222	268	339
21	204	315	240	229	235	916	500	885	655	147	257	346
22	220	302	220	244	237	851	504	770	531	140	199	327
23	260	267	227	249	248	750	507	696	484	206	193	307
24	257	267	224	253	240	699	512	621	405	188	200	317
25	251	279	224	252	240	658	527	534	396	196	130	300
26	278	293	222	256	238	599	503	475	351	199	189	278
27	303	289	218	233	232	524	558	444	319	195	281	287
28	212	278	213	241	232	524	563	390	312	153	233	268
29	243	260	210	241	---	493	677	401	307	165	222	238
30	318	273	205	244	---	472	688	347	275	329	207	216
31	328	---	221	257	---	467	---	310	---	306	213	---
TOTAL	7362	9730	7416	7459	6773	18498	15619	19137	14071	7172	6095	9087
MEAN	237	324	239	241	242	597	521	617	469	231	197	303
MAX	328	420	287	257	265	1560	688	1350	807	392	281	601
MIN	153	214	205	210	222	219	442	310	274	140	119	133
CFSM	.40	.54	.40	.40	.41	1.00	.87	1.03	.79	.39	.33	.51
IN.	.46	.61	.46	.46	.42	1.15	.97	1.19	.88	.45	.38	.57

CAL YR 1989 TOTAL 170395 MEAN 467 MAX 3030 MIN 138 CFSM .78 IN 10.62
WTR YR 1990 TOTAL 128419 MEAN 352 MAX 1560 MIN 119 CFSM .59 IN 8.00

STREAMS TRIBUTARY TO LAKE MICHIGAN

04062000 PAINT RIVER NEAR ALPHA, MI

LOCATION.--Lat 46°00'40", long 88°15'30", in NW1/4 NW1/4 sec.25, T.42 N., R.32 W., Iron County, Hydrologic Unit 04030106, on right bank 0.6 mi downstream from Lower Paint Dam, 5.5 mi upstream from Brule River, and 6.0 mi southeast of Alpha.

DRAINAGE AREA.--631 mi².

PERIOD OF RECORD.--June 1952 to current year. Monthly discharge only for period October 1953 to September 1960, published in WSP 1727.

REVISED RECORDS.--WSP 1727: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 1,260 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Oct. 9 to Nov. 2, Nov. 17, 20, 21, 23, 28-30, Dec. 3 to Mar. 16, Mar. 18-20, 23-27, and Sept. 18-30. Records good. Flow completely regulated by power plant and Lower Paint Dam, 0.6 mi upstream. Records not adjusted for diversion to Michigamme River by Paint River Diversion Canal. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--38 years, 170 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 8,050 ft³/s, July 2, 1953, gage height, 10.50 ft; minimum daily, 62 ft³/s, Mar. 22, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 920 ft³/s, June 14, gage height, 4.65 ft; minimum daily, 75 ft³/s, Apr. 28.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	89	90	90	85	85	89	84	78	78	90	98	95
2	89	90	90	85	85	89	83	77	77	90	98	95
3	88	90	90	85	85	89	84	76	79	92	99	96
4	88	89	90	85	85	89	83	82	78	93	99	97
5	88	88	90	85	85	89	78	86	87	93	98	98
6	88	88	88	85	85	89	83	86	87	93	98	96
7	88	88	88	85	85	89	77	86	83	94	98	95
8	90	88	88	85	85	89	78	86	82	97	99	94
9	90	88	88	85	85	89	78	87	85	93	98	93
10	90	88	87	85	85	89	83	88	93	101	105	92
11	90	90	86	85	85	89	82	87	86	99	98	90
12	90	88	86	85	85	89	82	88	91	95	98	91
13	90	88	86	85	85	89	84	86	88	95	98	92
14	90	88	86	85	85	89	84	87	533	95	98	93
15	90	86	85	85	85	89	82	109	601	95	98	91
16	90	86	85	85	85	89	83	158	89	96	98	90
17	90	90	85	85	87	92	82	89	90	96	99	90
18	90	90	85	85	87	92	82	88	88	96	99	91
19	90	87	85	85	87	92	83	87	88	98	98	91
20	90	87	85	85	87	90	85	86	88	98	98	91
21	90	87	85	85	87	88	84	86	88	97	98	91
22	90	87	85	85	87	89	83	85	88	95	98	91
23	90	88	85	85	87	88	82	82	88	95	98	92
24	90	88	85	85	87	88	83	82	88	95	98	92
25	90	88	85	85	87	88	82	81	88	96	98	92
26	90	87	85	85	87	86	82	82	88	97	98	92
27	90	87	85	85	89	86	79	82	88	97	97	92
28	90	87	85	85	89	84	75	81	94	96	94	93
29	90	88	85	85	---	84	76	85	88	96	93	93
30	90	90	85	85	---	84	77	80	90	95	94	93
31	90	---	85	85	---	84	---	80	---	97	94	---
TOTAL	2778	2644	2678	2635	2408	2739	2443	2703	3559	2955	3032	2782
MEAN	89.6	88.1	86.4	85.0	86.0	88.4	81.4	87.2	119	95.3	97.8	92.7
MAX	90	90	90	85	89	92	85	158	601	101	105	98
MIN	88	86	85	85	85	84	75	76	77	90	93	90

CAL YR 1989 TOTAL 45761 MEAN 125 MAX 1400 MIN 78
WTR YR 1990 TOTAL 33356 MEAN 91.4 MAX 601 MIN 75

STREAMS TRIBUTARY TO LAKE MICHIGAN

04062011 BRULE RIVER NEAR COMMONWEALTH, WI

LOCATION.--Lat 45°56'51", long 88°12'55", in NW1/4 sec. 14, T.40 N., R.18 E., Wisconsin Meridian, Florence County, Hydrologic Unit 04030106, on right bank 900 ft downstream from Brule Island Dam, 1.5 mi upstream from confluence with Michigamme River, and 2.8 mi north of Commonwealth, WI.

DRAINAGE AREA.--1,020 mi².

PERIOD OF RECORD.--October 1989 to September 1990.

GAGE.--Water-stage recorder. Elevation of gage is 1,130 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Oct. 1-19. Records excellent except for estimated daily discharges, which are good. Flow regulated by powerplant 900 ft upstream and by Lower Paint Dam 8.2 mi upstream. Records not adjusted for diversion to Michigamme River by Paint River Diversion Canal. Several measurements of water temperature were made during the year.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,310 ft³/s, Feb. 23, gage height, 8.51 ft; minimum daily, 190 ft³/s, Oct. 9.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	270	394	274	287	275	247	202	389	298	232	320	241
2	230	416	305	287	260	241	244	302	382	254	255	278
3	235	320	287	287	249	273	305	290	339	295	299	278
4	235	353	412	287	248	294	333	321	340	307	346	282
5	235	351	217	284	281	298	341	298	459	260	262	264
6	300	299	261	232	278	302	233	331	436	203	251	354
7	310	439	273	279	328	298	246	257	260	198	270	495
8	280	401	275	282	317	263	313	301	319	257	258	446
9	190	404	208	277	313	221	357	382	370	384	273	396
10	250	350	208	277	280	236	298	468	338	328	223	373
11	300	328	330	277	264	309	294	610	333	314	236	300
12	320	241	257	328	291	355	329	513	428	312	264	304
13	240	292	263	280	269	496	283	421	407	228	322	378
14	230	347	226	267	325	785	309	410	832	263	239	333
15	260	392	266	264	499	802	316	548	1100	219	298	552
16	260	306	256	335	532	1010	350	911	351	267	268	387
17	260	272	272	309	521	1020	293	727	533	370	280	351
18	290	228	359	286	457	675	469	679	311	226	342	315
19	360	226	243	283	418	501	353	498	368	222	340	347
20	223	242	251	285	409	378	326	654	407	236	474	352
21	290	249	225	249	391	319	281	415	231	278	417	394
22	287	250	225	298	336	274	295	489	216	260	332	343
23	301	244	225	298	409	235	338	437	406	252	278	314
24	285	241	225	321	364	213	320	411	284	310	293	348
25	301	239	263	253	348	212	318	434	284	263	228	339
26	344	241	310	338	375	206	366	365	349	248	326	278
27	265	326	266	283	331	205	398	310	230	274	348	308
28	311	351	318	285	274	201	336	325	323	216	363	280
29	261	235	296	311	---	200	393	306	249	238	299	264
30	268	224	293	309	---	200	413	324	314	395	253	301
31	364	---	292	323	---	201	---	219	---	333	227	---
TOTAL	8555	9201	8381	8961	9642	11470	9652	13345	11497	8442	9184	10195
MEAN	276	307	270	289	344	370	322	430	383	272	296	340
MAX	364	439	412	338	532	1020	469	911	1100	395	474	552
MIN	190	224	208	232	248	200	202	219	216	198	223	241

WTR YR 1990 TOTAL 118525 MEAN 325 MAX 1100 MIN 190

04062228 LAKE MICHIGAMME NEAR CHAMPION, MI

LOCATION.--Lat 46°31'39", long 88°00'15", in NE1/4 SW1/4 sec.25, T.48 N., R.30 W., Marquette County, Hydrologic Unit 04030107, on left bank 60 ft downstream from railroad bridge, at mouth of Peshekee River, 2.1 mi northwest of Champion.

DRAINAGE AREA.--193 mi².

PERIOD OF RECORD.--July 1942 to current year.

GAGE.--Water-stage recorder. Datum of gage is 1,548.83 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Aug. 8, 1962, nonrecording gage at same site and datum.

REMARKS.--Major inlets to Lake Michigamme are Peshekee River and Spurr River. The outlet is Michigamme River. Streamflow records were collected for Michigamme River (station 04062230) from October 1968 to September 1982 and for Peshekee River (station 04062200) from July 1961 to September 1978. It has been determined that the gage records river stage rather than lake stage when the lake stage falls below a gage height of about 0.10 ft. This last occurred during the 1976 and 1977 water years. Lake stage for this period was determined on the basis of stage-discharge relation at the lake outlet using discharge figures from station 04062230. Surface area of lake is 4,260 acres.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 8.49 ft, Apr. 21, 22 or 23, 1985, from floodmark; minimum, -0.50 ft, Sept. 30, Oct. 1, 1976.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 3.72 ft, Mar. 23; minimum, 0.77 ft, Oct. 16, 17.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.88	1.45	1.87	1.71	1.59	1.53	2.92	3.36	2.49	2.38	1.75	1.25
2	.88	1.49	1.86	1.71	1.58	1.52	2.97	3.25	2.42	2.30	1.75	1.20
3	.86	1.52	1.86	1.70	1.57	1.51	2.99	3.14	2.42	2.23	1.72	1.18
4	.84	1.55	1.84	1.69	1.57	1.50	3.01	3.04	2.43	2.17	1.69	1.23
5	.84	1.61	1.83	1.67	1.56	1.49	3.02	2.94	2.45	2.07	1.65	1.23
6	.87	1.72	1.83	1.66	1.55	1.48	2.99	2.85	2.48	2.00	1.62	1.27
7	.85	1.79	1.82	1.66	1.54	1.48	2.94	2.75	2.45	1.96	1.58	1.26
8	.85	1.88	1.81	1.64	1.53	1.48	2.89	2.68	2.43	2.05	1.56	1.25
9	.85	1.96	1.81	1.62	1.53	1.48	2.86	2.60	2.45	2.07	1.53	1.24
10	.84	2.01	1.80	1.60	1.53	1.48	2.83	2.61	2.45	2.05	1.49	1.22
11	.86	2.07	1.79	1.64	1.53	1.50	2.79	2.61	2.46	2.02	1.45	1.21
12	.86	2.04	1.78	1.66	1.52	1.64	2.75	2.62	2.53	1.96	1.43	1.21
13	.82	2.03	1.77	1.65	1.52	1.87	2.70	2.73	2.64	1.92	1.41	1.22
14	.81	2.03	1.76	1.65	1.50	2.06	2.66	2.89	2.71	1.87	1.39	1.27
15	.81	2.03	1.75	1.64	1.49	2.21	2.68	3.10	2.73	1.83	1.35	1.32
16	.79	2.05	1.74	1.62	1.53	2.72	2.71	3.31	2.74	1.81	1.33	1.37
17	.78	2.03	1.73	1.60	1.54	3.11	2.74	3.53	2.81	1.78	1.31	1.39
18	.80	2.02	1.72	1.60	1.54	3.35	2.75	3.68	2.88	1.75	1.34	1.40
19	.79	2.00	1.70	1.58	1.55	3.53	2.77	3.69	2.90	1.71	1.34	1.44
20	.81	2.00	1.69	1.57	1.55	3.62	2.80	3.68	2.93	1.69	1.32	1.45
21	.92	1.99	1.69	1.56	1.55	3.67	2.89	3.61	2.94	1.68	1.30	1.50
22	.96	1.99	1.68	1.56	1.54	3.67	3.03	3.51	2.89	1.66	1.28	1.54
23	.99	1.96	1.67	1.56	1.53	3.66	3.19	3.39	2.87	1.66	1.27	1.63
24	1.05	1.95	1.66	1.57	1.53	3.55	3.32	3.28	2.84	1.66	1.24	1.74
25	1.14	1.94	1.66	1.57	1.52	3.44	3.41	3.16	2.81	1.65	1.31	1.78
26	1.23	1.92	1.67	1.57	1.53	3.33	3.45	3.05	2.77	1.64	1.34	1.81
27	1.27	1.92	1.68	1.58	1.54	3.22	3.42	2.95	2.69	1.61	1.33	1.83
28	1.27	1.92	1.69	1.60	1.53	3.13	3.41	2.85	2.62	1.59	1.33	1.83
29	1.32	1.90	1.71	1.60	---	3.04	3.42	2.75	2.55	1.62	1.29	1.81
30	1.34	1.88	1.71	1.60	---	2.97	3.42	2.66	2.47	1.71	1.28	1.79
31	1.40	---	1.71	1.59	---	2.93	---	2.57	---	1.74	1.27	---
MEAN	.95	1.89	1.75	1.62	1.54	2.49	2.99	3.06	2.64	1.87	1.43	1.43
MAX	1.40	2.07	1.87	1.71	1.59	3.67	3.45	3.69	2.94	2.38	1.75	1.83
MIN	.78	1.45	1.66	1.56	1.49	1.48	2.66	2.57	2.42	1.59	1.24	1.18

CAL YR 1989 MEAN 2.01 MAX 4.92 MIN .78
WTR YR 1990 MEAN 1.97 MAX 3.69 MIN .78

04062500 MICHIGAMME RIVER NEAR CRYSTAL FALLS, MI

LOCATION.--Lat 46°06'50", long 88°12'57", in NW1/4 sec.20, T.43 N., R.31 W., Iron County, Hydrologic Unit 04030107, on right bank 400 ft upstream from highway bridge, 5.0 mi downstream from Michigamme Reservoir, 6.0 mi east of Crystal Falls, and 15 mi upstream from confluence with Brule River.

DRAINAGE AREA.--656 mi².

PERIOD OF RECORD.--August 1944 to current year.

REVISED RECORDS.--WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 1,300 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Nov. 23, 24, 29, and Dec. 8, 9. Records excellent. Flow regulated by powerplant and by Michigamme Reservoir, capacity, 119,950 acre-ft, 5 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--46 years, 708 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,260 ft³/s, Apr. 28, 1960, gage height, 10.73 ft; minimum daily, 71 ft³/s, Nov. 26, 1950.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,340 ft³/s, June 20, gage height, 5.12 ft; minimum daily, 153 ft³/s, Nov. 12.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	497	202	207	879	881	790	195	196	231	802	749	207
2	497	200	210	878	877	653	198	194	235	802	745	206
3	495	198	208	876	875	393	196	194	711	800	450	205
4	494	199	209	874	871	391	199	194	914	797	218	552
5	499	206	209	872	912	398	199	198	911	796	216	715
6	497	208	209	870	919	392	198	199	911	517	384	545
7	495	207	209	867	939	296	198	201	907	223	242	467
8	495	208	209	866	936	304	199	202	901	234	363	231
9	388	207	209	865	930	306	203	211	898	228	744	227
10	188	206	211	862	924	307	204	217	894	225	741	585
11	189	193	304	863	920	310	205	505	894	222	630	746
12	189	153	502	857	916	317	204	916	876	224	546	748
13	189	163	579	857	908	404	203	616	837	228	593	746
14	190	177	666	855	903	301	203	233	829	227	739	503
15	190	181	849	852	899	215	207	244	820	228	729	227
16	190	177	846	851	896	207	207	284	833	229	737	213
17	189	196	845	849	887	196	204	846	850	555	600	566
18	188	210	878	847	882	185	204	1280	742	763	221	773
19	188	209	905	845	874	182	204	1250	356	761	216	847
20	189	211	902	843	868	183	205	1240	1090	382	213	835
21	193	208	902	841	862	185	201	1220	1030	220	212	519
22	192	208	899	879	855	186	190	1210	824	220	351	227
23	192	208	898	910	848	183	193	1200	1050	576	260	223
24	192	208	896	907	839	184	196	1200	1160	732	457	602
25	194	208	894	903	831	186	194	1200	1030	784	219	774
26	195	208	890	899	822	186	197	1050	813	782	218	634
27	193	209	889	898	812	187	203	901	809	426	294	288
28	195	208	888	894	801	188	211	899	808	219	439	234
29	198	208	885	891	---	189	206	897	806	243	734	234
30	201	208	882	888	---	190	199	490	805	509	732	233
31	206	---	882	885	---	190	---	232	---	755	477	---
TOTAL	8587	5992	19171	27023	24687	8784	6025	19919	24775	14709	14469	14112
MEAN	277	200	618	872	882	283	201	643	826	474	467	470
MAX	499	211	905	910	939	790	211	1280	1160	802	749	847
MIN	188	153	207	841	801	182	190	194	231	219	212	205

CAL YR 1989 TOTAL 219120 MEAN 600 MAX 3820 MIN 146
WTR YR 1990 TOTAL 188253 MEAN 516 MAX 1280 MIN 153

04063000 MENOMINEE RIVER NEAR FLORENCE, WI

LOCATION.--Lat 45°57'04", long 88°11'13", in NE1/4 sec.16, T.41 N., R.31 W., Michigan Meridian, Iron County, Hydrologic Unit 04030108, on left bank 0.5 mi downstream from confluence of Brule and Michigamme Rivers, 3.5 mi northeast of Florence, WI, and at mile 117.

DRAINAGE AREA.--1,780 mi².

PERIOD OF RECORD.--July 1950 to current year. Published as "at Twin Falls near Iron Mountain, MI" January 1914 to June 1950. Records published for both sites July 1950 to September 1957.

REVISED RECORDS.--WSP 1707: 1953(M). WSP 1911: Drainage area of former site.

GAGE.--Water-stage recorder. Datum of gage is 1,119.23 ft above National Geodetic Vertical Datum of 1929 (levels by Owen Ayres Associates). Prior to July 1950, headwater and tailwater gages and generation data entered hourly in daily log sheets by company employees at the Twin Falls Powerplant of Wisconsin Electric Power Co., 10.4 mi downstream.

REMARKS.--No estimated daily discharges. Records excellent. Prior to July 1950, discharge determined from powerplant records computed on basis of load-discharge rating of hydroelectric units and rating for tailwater gage during periods of spill. Rating developed by U.S. Geological Survey. Flow regulated by powerplants, by Michigamme Reservoir, capacity, 119,950 acre-ft, by Peavy Pond, capacity, 33,860 acre-ft, on Michigamme River, and by many smaller reservoirs upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--40 years, 1,838 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 19,500 ft³/s, Apr. 26, 1960, gage height, 14.15 ft; minimum, 38 ft³/s, Aug. 21, 1962, Sept. 26, 1975; minimum gage height, 1.18 ft, Aug. 21, 1962, Nov. 4, 1965; minimum daily discharge, 57 ft³/s, Sept. 26, 1975.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,200 ft³/s, June 14, gage height, 6.38 ft; minimum, 203 ft³/s, Dec. 8, gage height, 1.87 ft; minimum daily, 527 ft³/s, Apr. 22.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	728	828	887	1250	1470	1290	692	1110	1180	978	1100	697
2	668	797	733	1210	1510	1290	710	1300	1020	873	1050	582
3	721	856	742	1390	1470	1350	876	1310	940	942	1100	823
4	701	769	841	1330	1470	1370	854	1390	1400	1060	807	1020
5	604	804	703	1480	1500	1370	981	1210	1450	1070	626	1020
6	769	855	547	1340	1470	1380	889	718	1760	801	947	1060
7	767	1040	835	1460	1560	1380	627	672	1750	896	948	1170
8	757	1060	760	1420	1540	1340	702	797	1830	628	1020	1420
9	862	868	763	1370	1540	1290	716	1130	1830	898	1120	1450
10	900	964	614	1370	1530	1300	684	1500	1760	923	968	1220
11	978	828	945	1390	1510	1370	953	1940	1690	924	1230	1300
12	737	794	847	1370	1530	1580	706	2210	1720	985	961	1290
13	925	709	837	1430	1500	1940	790	1830	1300	1020	1040	1440
14	852	868	1020	1420	1560	2550	653	1060	2160	1040	874	1400
15	800	935	1400	1390	1690	3380	559	1540	2460	699	988	1580
16	778	898	1390	1400	1730	3350	808	2330	2070	969	1090	1410
17	766	894	1430	1480	1540	3190	683	2870	2230	1030	1130	1420
18	797	727	1480	1410	1490	2570	760	2930	2090	1030	814	1330
19	677	769	1340	1370	1560	2030	875	2630	2230	1100	588	1300
20	761	746	1380	1410	1540	1770	757	2770	1880	1060	974	1340
21	803	731	1420	1370	1410	1530	553	2570	1990	725	807	1440
22	716	781	1470	1360	1370	1350	527	2650	1240	728	809	1340
23	771	767	1470	1560	1500	1100	860	2560	2120	965	1010	1310
24	728	703	1370	1560	1490	1280	558	2630	2430	1050	895	1330
25	669	687	1330	1500	1380	976	744	2580	1750	1070	653	1190
26	654	797	1480	1480	1480	980	704	2140	1530	1180	578	1000
27	746	863	1440	1320	1330	1000	581	1230	1620	958	927	776
28	671	837	1520	1400	1110	992	702	834	1700	679	933	888
29	789	790	1450	1460	---	993	605	991	1470	716	1090	694
30	685	864	1390	1420	---	974	953	1360	1110	947	980	659
31	772	---	1330	1490	---	640	---	1240	---	841	1010	---
TOTAL	23552	24829	35164	43610	41780	48905	22062	54032	51710	28785	29067	34899
MEAN	760	828	1134	1407	1492	1578	735	1743	1724	929	938	1163
MAX	978	1060	1520	1560	1730	3380	981	2930	2460	1180	1230	1580
MIN	604	687	547	1210	1110	640	527	672	940	628	578	582

CAL YR 1989 TOTAL 514686 MEAN 1410 MAX 7100 MIN 535
WTR YR 1990 TOTAL 438395 MEAN 1201 MAX 3380 MIN 527

04063500 MENOMINEE RIVER AT TWIN FALLS NEAR IRON MOUNTAIN, MI

LOCATION.--Lat 46°52'17", long 88°04'12", in NE1/4 SE1/4 sec. 12, T.40 N., R.31 W., Michigan Meridian, Dickinson County, Hydrologic Unit 04030108, on left bank in powerhouse of Wisconsin Electric Power Co. at Twin Falls Dam, 3.6 mi north of Iron Mountain, and at mile 106.6.

DRAINAGE AREA.--1,800 mi².

PERIOD OF RECORD.--January 1914 to September 1957, October 1989 to September 1990. Published as "near Florence, WI" October 1957 to September 1989. Records published for both sites July 1950 to September 1957.

GAGE.--Water-stage recorder. Datum of gage is 1,062 ft above National Geodetic Vertical Datum of 1929 (levels by Wisconsin Electric Power Co.). Prior to September 1957, headwater and tailwater gages and generation data entered hourly in daily log sheets by company employees.

REMARKS.--Estimated daily discharges: Oct. 1 to Nov. 8. Records good. Prior to September 1957, discharge determined from powerplant records computed on basis of load-discharge rating of hydroelectric units and rating for tailwater gage during periods of spill. Rating developed by U.S. Geological Survey. Flow regulated by powerplants, by Michigamme Reservoir, capacity, 119,950 acre ft, by Peavy Pond, capacity, 33,860 acre-ft, on Michigamme River, and by many smaller reservoirs upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--44 years, 1,796 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 16,700 ft³/s, Apr. 23, 24, 1916; minimum daily, 154 ft³/s, Aug. 9, 1925.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,220 ft³/s, Mar. 15, gage height, 8.55 ft; minimum, 399 ft³/s, Aug. 30, gage height, 6.07 ft; minimum daily, 532 ft³/s, Aug. 26.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	830	800	865	1130	1390	1300	614	1020	1080	855	982	625
2	960	730	872	1100	1500	1140	656	1200	936	880	1040	652
3	870	750	808	1190	1380	1170	821	1240	881	959	1030	673
4	890	700	825	1230	1450	1210	831	1270	1310	966	740	979
5	860	780	771	1230	1360	1330	842	1120	1420	1010	635	971
6	840	870	703	1400	1470	1330	892	687	1520	769	941	1030
7	920	1010	832	1270	1430	1330	714	724	1630	791	945	1080
8	990	1080	881	1300	1460	1340	657	749	1670	750	1000	1500
9	820	753	719	1240	1490	1250	693	946	1680	930	1040	1350
10	960	914	702	1310	1460	1140	729	1790	1690	838	907	1200
11	780	763	927	1210	1400	1240	786	1870	1580	906	1110	1220
12	920	736	913	1220	1460	1500	816	2230	1600	969	1040	1220
13	830	701	853	1250	1580	1910	762	1750	1170	1030	1060	1350
14	820	825	1120	1300	1440	2710	611	1170	2070	916	902	1370
15	840	807	1600	1390	1640	4080	584	1430	2810	666	985	1550
16	870	975	1400	1290	1720	3910	739	2280	1920	990	1110	1380
17	800	881	1460	1300	1600	3410	816	3250	2310	1060	1090	1390
18	750	790	1440	1320	1360	2590	750	3350	2020	1040	888	1220
19	610	694	1490	1270	1520	1880	793	2830	2180	1030	687	1340
20	690	791	1350	1320	1440	1630	680	2970	1740	942	873	1260
21	740	717	1340	1280	1320	1460	576	2700	1670	701	824	1410
22	750	838	1340	1230	1250	1260	576	2740	1350	677	841	1320
23	600	824	1310	1470	1430	1100	700	2830	2150	1030	903	1340
24	680	719	1250	1460	1420	1090	633	2740	2350	976	851	1200
25	670	706	1290	1400	1350	957	595	2650	1940	1030	681	1170
26	640	828	1460	1390	1410	964	636	2260	1320	1080	532	1100
27	700	843	1440	1220	1400	968	598	1180	1500	975	950	900
28	660	911	1420	1300	1020	967	621	754	1590	666	908	819
29	710	892	1370	1380	---	953	599	1030	1480	684	936	590
30	740	864	1250	1400	---	906	893	1320	1050	866	990	589
31	850	---	1250	1400	---	623	---	1110	---	895	994	---
TOTAL	24590	24492	35251	40200	40150	48648	21213	55190	49617	27877	28415	33798
MEAN	793	816	1137	1297	1434	1569	707	1780	1654	899	917	1127
MAX	990	1080	1600	1470	1720	4080	893	3350	2810	1080	1110	1550
MIN	600	694	702	1100	1020	623	576	687	881	666	532	589

WTR YR 1990 TOTAL 429441 MEAN 1177 MAX 4080 MIN 532

STREAMS TRIBUTARY TO LAKE MICHIGAN

04065722 MENOMINEE RIVER NEAR VULCAN, MI

LOCATION.--Lat 45°44'12", long 87°51'48", sec.34, T.39 N., R.29 W., Michigan Meridian, Dickinson County, Hydrologic Unit 04030108, on left bank 0.35 mi downstream from Sturgeon Falls Dam, 3.0 mi south of Vulcan, and at mile 78.7.

DRAINAGE AREA.--2,900 mi².

PERIOD OF RECORD.--December 1987 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 820 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--No estimated daily discharges. Records excellent. Flow regulated by powerplants, by Michigamme Reservoir, capacity, 119,950 acre-ft, by Peavy Pond, capacity, 33,860 acre-ft, on Michigamme River, and by smaller reservoirs upstream from station. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 8,760 ft³/s, June 10, 1989, gage height, 11.63 ft; minimum, 815 ft³/s, Aug. 3, 4, 1988, gage height, 4.67 ft; minimum daily, 846 ft³/s, Aug. 3, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 7,230 ft³/s, Mar. 16, gage height, 10.45 ft; minimum, 912 ft³/s, Oct. 2-4, gage height, 4.75 ft; minimum daily, 912 ft³/s, Oct. 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	957	1660	1200	1800	1810	1720	1220	1990	1890	1550	1290	1320
2	924	1560	1140	1650	1780	1560	1360	2150	1630	1350	1510	1010
3	912	1510	1120	1720	1730	1370	1460	2170	1560	1540	1470	1060
4	927	1520	1130	1670	1740	1500	1530	2160	2360	1550	1190	1370
5	935	1310	1080	1750	1710	1750	1310	2060	2470	1520	1080	1370
6	927	1640	1050	1760	1750	1730	1500	1300	2670	1420	1310	1410
7	943	1730	1070	1730	1880	1620	1320	1330	2680	1070	1430	1570
8	967	1960	1080	1790	1790	1670	1260	1280	2920	1130	1250	2010
9	989	1720	1070	1750	1790	1790	1290	1650	2860	1500	1300	2390
10	1310	1560	1060	1700	1860	1540	1330	2710	2640	1620	1300	2040
11	1110	1560	1070	1720	1840	1630	1320	3390	2640	1480	1170	2010
12	1180	1310	1080	1840	1870	2060	1340	4270	2750	1500	1320	2040
13	1120	1520	1100	1780	1770	2320	1330	4160	3070	1510	1390	2110
14	1150	1430	1090	1730	1850	3580	1110	2950	3560	1520	1300	2270
15	1110	1460	1650	1690	1800	6180	1090	3640	4850	1150	1480	2630
16	1090	1460	1760	1770	1990	6370	1270	4430	3560	1430	1290	2610
17	1070	1490	1730	1750	1980	5890	1280	6510	4160	1650	1480	2410
18	1090	1130	1660	1730	1900	5060	1300	6540	3700	1360	2100	2290
19	1030	1090	1810	1740	1660	4050	1350	5890	3920	1460	1630	2320
20	996	1240	2210	1680	1750	3640	1340	5280	3510	1570	1640	2180
21	1000	1180	2050	1810	1740	2880	1120	5030	3010	1200	1750	2140
22	1240	1180	2120	1650	1720	2860	1130	4990	2600	1110	1680	2420
23	1250	1150	2210	1720	1750	2230	1340	4570	2830	1290	1600	2270
24	1050	1170	1860	1850	1620	2100	1330	4360	3640	1260	1400	2170
25	1010	1070	1850	1800	1670	1590	1590	4140	3410	1450	1160	2060
26	1010	1030	2090	1870	1710	1830	1320	3810	2370	1440	1090	1950
27	1010	1120	2150	1900	1630	1770	1530	2700	2240	1450	1490	1790
28	1020	1330	2030	1610	1560	1850	1380	2030	2400	1090	1560	1520
29	1120	1190	2040	1810	---	1600	1700	2120	2290	1090	1550	1220
30	1220	1170	1920	1690	---	1570	1920	2340	1870	1220	1430	1100
31	1840	---	1740	1820	---	1210	---	2120	---	1510	1350	---
TOTAL	33507	41450	48220	54280	49650	78520	40670	104070	86060	42990	43990	57060
MEAN	1081	1382	1555	1751	1773	2533	1356	3357	2869	1387	1419	1902
MAX	1840	1960	2210	1900	1990	6370	1920	6540	4850	1650	2100	2630
MIN	912	1030	1050	1610	1560	1210	1090	1280	1560	1070	1080	1010

CAL YR 1989 TOTAL 753983 MEAN 2066 MAX 8460 MIN 912
WTR YR 1990 TOTAL 680467 MEAN 1864 MAX 6540 MIN 912

04066003 MENOMINEE RIVER BELOW PEMENE CREEK NEAR PEMBINE, WI

LOCATION.--Lat 45°34'46", long 87°47'13", in NE1/4 sec.29, T.37 N., R.28 W., Michigan Meridian, Menominee County, Hydrologic Unit 04030108, on left bank 40 ft downstream from County Trunk Z bridge, 0.9 mi downstream from Pemene Creek, 3.9 mi west of Nathan, 10.6 mi southeast of Pembine, WI, and at mile 64.3.

DRAINAGE AREA.--3,140 mi².

PERIOD OF RECORD.--October 1949 to current year. Published as "near Pembine, WI" prior to August 1982. Monthly discharge only for some periods, published in WSP 1307.

GAGE.--Water-stage recorder. Elevation of gage is 740 ft above National Geodetic Vertical Datum of 1929, from topographic map. October 1949 to Oct. 27, 1972, water-stage recorder at site 1.0 mi upstream at different datum, and Oct. 28, 1972, to August 1982, water-stage recorder at site 1.5 mi upstream at different datum.

REMARKS.--Estimated daily discharges: Nov. 22 to Mar. 16. Records good except for estimated daily discharges, which are fair. Flow regulated by powerplants, by Michigamme Reservoir, capacity, 119,950 acre-ft, by Peavy Pond, capacity, 33,860 acre-ft, on Michigamme River, and by many smaller reservoirs upstream from station.

AVERAGE DISCHARGE.--41 years, 2,945 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 26,900 ft³/s, May 8, 1960, gage height, 13.90 ft, site and datum then in use; minimum, 694 ft³/s, Sept. 3, 1969, gage height, 1.66 ft, site and datum then in use.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 7,880 ft³/s, May 18, gage height, 11.06 ft; maximum gage height, 14.67 ft, Mar. 15, backwater from ice; minimum daily discharge, 989 ft³/s, Oct. 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1030	1990	1200	1300	1700	1400	1250	2120	2110	1770	1480	1500
2	1010	1680	1100	1300	1500	1400	1370	2240	1850	1510	1480	1110
3	989	1570	1200	1300	1500	1200	1470	2220	1710	1540	1590	1100
4	996	1560	1200	1200	1500	1200	1580	2300	2280	1580	1390	1270
5	1020	1510	1100	1200	1500	1400	1450	2230	2640	1610	1190	1410
6	1020	1590	1100	1500	1500	1400	1470	1460	2860	1510	1270	1490
7	1030	1830	1000	1300	1600	1500	1420	1420	2850	1280	1430	1600
8	1050	2010	1000	1400	1600	1400	1350	1350	3010	1140	1400	2010
9	1040	1880	1100	1500	1600	1400	1280	1450	3110	1360	1340	2480
10	1230	1620	1100	1400	1600	1500	1360	2870	2730	1670	1370	2090
11	1210	1670	1100	1400	1400	1400	1380	3880	2630	1440	1370	2010
12	1210	1440	1000	1400	1500	2000	1310	4680	2980	1520	1280	2070
13	1170	1550	1000	1300	1500	3000	1410	4740	3490	1470	1400	2140
14	1150	1520	1000	1400	1400	4500	1270	3680	3920	1460	1370	2320
15	1160	1460	1200	1400	1500	6200	1160	4170	5370	1310	1430	2740
16	1130	1440	1500	1400	1600	7000	1290	4840	3980	1260	1380	2910
17	1110	1590	1500	1500	1700	6740	1340	7420	4290	1620	1390	2370
18	1110	1260	1300	1500	1500	5560	1360	7700	4020	1490	1780	2330
19	1090	1540	1500	1500	1500	4300	1410	6850	4010	1400	2240	2320
20	1060	1220	1400	1400	1400	3930	1420	6040	3860	1570	1750	2230
21	1080	1260	1300	1500	1500	3100	1300	5610	3260	1460	1960	2100
22	1210	1100	1300	1400	1500	3120	1260	5480	2740	1180	1810	2380
23	1340	1100	1200	1400	1400	2300	1360	5010	2860	1230	1670	2210
24	1170	1200	1200	1400	1400	2140	1520	4690	3830	1350	1530	2090
25	1080	1200	1200	1600	1300	1950	1630	4640	3550	1430	1380	2030
26	1080	1200	1300	1600	1400	1770	1620	4260	2690	1550	1190	1970
27	1090	1200	1400	1400	1500	1820	1490	3070	2310	1530	1400	1440
28	1090	1100	1500	1200	1300	1870	1690	2310	2490	1370	1580	1470
29	1150	1100	1500	1400	---	1680	1770	2130	2540	1200	1600	1370
30	1240	1100	1300	1500	---	1660	1970	2480	2090	1200	1510	1150
31	1700	---	1300	1600	---	1340	---	2320	---	1490	1400	---
TOTAL	35045	43490	38100	43600	41900	81180	42960	115660	92060	44500	46360	57710
MEAN	1130	1450	1229	1406	1496	2619	1432	3731	3069	1435	1495	1924
MAX	1700	2010	1500	1600	1700	7000	1970	7700	5370	1770	2240	2910
MIN	989	1100	1000	1200	1300	1200	1160	1350	1710	1140	1190	1100

CAL YR 1989 TOTAL 775725 MEAN 2125 MAX 9280 MIN 989
WTR YR 1990 TOTAL 682565 MEAN 1870 MAX 7700 MIN 989

04067500 MENOMINEE RIVER NEAR McALLISTER, WI

LOCATION.--Lat 45°19'33", long 87°39'48", in SW1/4 SE1/4 sec.17, T.33 N., R.23 E., Marinette County, WI, Hydrologic Unit 04030108, on right bank 85 ft downstream from bridge on County Highway JJ, 2.9 mi downstream from Grand Rapids Dam, 2.6 mi east of McAllister, WI, 1.9 mi downstream from Little Cedar River, and at mile 22.6.

DRAINAGE AREA.--3,930 mi².

PERIOD OF RECORD.--March 1945 to September 1961, October 1961 to September 1979 (miscellaneous measurements and annual maximums only), October 1979 to September 1986, October 1986 to March 1987 (crest-stage partial-record station), April 1988 to September 1990 (discontinued).

REVISED RECORDS.--WDR WI-80-1: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 622.20 ft above National Geodetic Vertical Datum of 1929 (Michigan Department of Transportation reference mark). Prior to May 15, 1945, nonrecording gage 1,400 ft downstream at same datum; May 16, 1945, to September 1961, water-stage recorder 1,000 ft downstream at same datum; October 1961 to September 1979, crest-stage gage 1,100 ft downstream at same datum. October 1979 to September 1986, water-stage recorder at same site and datum; October 1986 to March 1987, crest-stage gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 28-30, Dec. 7 to Mar. 18, and May 7 to July 12. Records good except for estimated daily discharges, which are fair. Flow regulated by powerplants, by Michigamme Reservoir, capacity, 119,950 acre-ft, by Peavy Pond, capacity, 33,860 acre-ft, on the Michigamme River, and by many smaller reservoirs upstream from station. Gage-height telemeter at station.

AVERAGE DISCHARGE.--25 years (water years 1946-61, 1980-86, 1989-90), 3,503 ft³/s.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 32,500 ft³/s, May 9, 1960, gage height, 20.0 ft, from graph based on gage readings; minimum observed, 538 ft³/s, Oct. 6, 1946, gage height, 7.29 ft.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 10,000 ft³/s, May 18; maximum gage height recorded, 15.04 ft, Mar. 17, backwater from ice, but may have been higher during period of no gage-height record, May 7 to July 12; minimum daily discharge, 1,050 ft³/s, Oct. 6.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1250	2120	1560	1800	1900	1900	1870	2360	2600	2200	1900	1680
2	1060	2400	1510	1700	2000	1900	1820	2360	2500	2000	2000	1590
3	1220	2210	1280	1700	1900	1800	2020	2580	2200	1800	1750	1490
4	1060	1850	1430	1700	1800	1700	2040	2660	2300	1700	1900	1340
5	1060	2070	1330	1700	1900	1600	2120	2420	2500	1800	1770	1450
6	1050	1950	1370	1800	1900	1900	2120	2210	3100	1700	1490	1800
7	1060	2010	1300	1900	1900	1900	1870	1600	3200	1600	1580	2040
8	1120	2350	1200	1800	2000	1900	1710	1700	3200	1600	1680	2210
9	1210	2380	1200	1800	2100	1900	1770	1800	3300	1800	1680	2560
10	1300	2230	1300	2000	2000	1800	1890	2700	3600	1800	1460	2940
11	1280	2030	1300	1800	2000	2000	1910	4100	3100	1900	1500	2480
12	1240	1950	1200	1800	2000	1900	1870	5800	3000	1800	1620	2480
13	1480	1690	1100	1900	2000	2500	1780	6200	5200	1710	1470	2590
14	1290	1700	1200	1800	2000	4000	1680	5800	6400	1660	1810	3060
15	1340	1960	1200	1900	1900	5200	1800	5400	6200	1670	1580	3210
16	1310	1770	1300	2000	2000	6400	1520	6000	7000	1750	1590	3420
17	1250	1750	1900	1900	2100	8600	1660	7400	5600	1890	1690	3710
18	1420	1680	1900	2000	2300	9000	1770	10000	5600	1990	1660	3360
19	1230	1420	1800	2000	2100	8370	1780	9000	5200	1880	2400	3580
20	1280	1580	2000	1900	1900	6570	1750	8000	5000	1470	2630	3320
21	1090	1510	1400	1800	1800	5760	1820	7600	4900	1660	2020	3140
22	1330	1340	1700	2000	2000	4250	1580	6200	3900	1670	2330	2900
23	1270	1230	1700	2000	1900	3830	1660	6400	3400	1520	2110	3090
24	1630	1360	1800	1900	1900	3170	1740	6000	4300	1520	2140	2840
25	1490	1430	1700	2000	1900	2540	1920	5800	5200	1590	2050	2820
26	1140	1420	1600	2000	1700	2610	2160	5800	3500	1630	1630	2540
27	1220	1390	1700	1900	1900	2640	2100	5400	2900	1650	1630	2370
28	1310	1300	1800	1900	1900	2770	2040	4000	2500	1750	1960	1860
29	1210	1200	2000	1800	---	2610	2050	2500	2800	1790	1910	1790
30	1400	1300	2000	1800	---	2000	2240	2600	2600	1860	1960	1720
31	1900	---	1700	1900	---	2070	---	2700	---	1840	1770	---
TOTAL	39500	52580	47480	57900	54700	107090	56060	145090	116800	54200	56670	75380
MEAN	1274	1753	1532	1868	1954	3455	1869	4680	3893	1748	1828	2513
MAX	1900	2400	2000	2000	2300	9000	2240	10000	7000	2200	2630	3710
MIN	1050	1200	1100	1700	1700	1600	1520	1600	2200	1470	1460	1340

CAL YR 1989 TOTAL 908000 MEAN 2488 MAX 9490 MIN 1050
WTR YR 1990 TOTAL 863450 MEAN 2366 MAX 10000 MIN 1050

04096400 ST. JOSEPH RIVER NEAR BURLINGTON, MI

LOCATION.--Lat 42°06'10", long 85°02'25", in SW1/4 SW1/4 sec.20, T.4 S., R.6 W., Calhoun County, Hydrologic Unit 04050001, on right bank 10 ft upstream from bridge on 13 Mile Road, 2.0 mi east of Burlington, 4.0 mi downstream from Tekonsha Creek, and at mile 164.

DRAINAGE AREA.--201 mi².

PERIOD OF RECORD.--October 1962 to current year.

GAGE.--Water-stage recorder. Datum of gage is 916.21 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 7 to Jan. 6, Jan. 13, 14, Feb. 17-20, Feb. 26 to Mar. 7, and Apr. 4 to Sept. 30. Records fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--28 years, 177 ft³/s, 11.96 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,390 ft³/s, June 5, 1989, gage height, 5.82 ft; minimum, 8.0 ft³/s, Aug. 9, 10, 11, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 903 ft³/s, Mar. 13; minimum daily, 69 ft³/s, Sept. 5.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	95	112	174	110	200	470	344	240	270	240	90	90
2	97	111	168	120	226	450	362	220	260	230	89	83
3	94	109	162	135	233	425	364	220	250	220	90	77
4	90	107	154	150	232	400	355	230	240	205	90	73
5	88	106	158	180	231	380	345	250	230	190	91	69
6	89	110	157	230	232	360	335	260	220	175	92	70
7	88	121	145	240	230	350	325	255	215	160	95	73
8	88	145	140	237	226	356	320	245	210	145	93	77
9	97	153	135	255	230	388	315	230	200	130	86	83
10	105	152	130	288	231	557	320	235	190	120	82	90
11	106	146	130	279	226	775	330	245	185	120	85	86
12	105	140	125	260	221	879	345	255	180	120	90	84
13	109	135	120	240	219	903	360	270	170	120	110	84
14	106	136	120	220	215	896	360	285	165	120	130	85
15	100	179	115	204	206	886	355	300	160	120	140	87
16	98	277	115	202	182	878	350	340	155	120	150	89
17	99	286	110	234	185	851	345	400	150	120	145	90
18	99	271	110	300	185	803	340	450	145	125	135	94
19	104	254	105	290	180	749	340	500	140	125	130	95
20	118	257	105	275	175	684	340	510	130	125	125	94
21	134	258	100	271	172	612	345	500	120	130	130	94
22	142	235	97	263	233	563	350	470	120	150	135	110
23	140	219	94	247	515	549	345	440	125	180	140	120
24	137	202	92	234	564	503	340	410	125	160	140	130
25	133	188	90	247	536	462	330	385	120	155	135	125
26	128	186	87	270	580	428	320	360	120	145	130	115
27	124	183	84	245	530	396	305	350	130	135	120	110
28	119	193	85	237	500	370	290	330	150	125	115	110
29	117	192	86	230	---	349	270	310	190	115	110	105
30	114	183	90	219	---	356	250	280	250	105	105	100
31	114	---	100	207	---	343	---	270	---	100	98	---
TOTAL	3377	5346	3683	7119	7895	17371	9995	10045	5315	4530	3496	2792
MEAN	109	178	119	230	282	560	333	324	177	146	113	93.1
MAX	142	286	174	300	580	903	364	510	270	240	150	130
MIN	88	106	84	110	172	343	250	220	120	100	82	69
CFSM	.54	.89	.59	1.14	1.40	2.79	1.66	1.61	.88	.73	.56	.46
IN.	.62	.99	.68	1.32	1.46	3.21	1.85	1.86	.98	.84	.65	.52

CAL YR 1989 TOTAL 80782 MEAN 221 MAX 1330 MIN 84 CFSM 1.10 IN 14.95
WTR YR 1990 TOTAL 80964 MEAN 222 MAX 903 MIN 69 CFSM 1.10 IN 14.98

04096515 SOUTH BRANCH HOG CREEK NEAR ALLEN, MI

LOCATION.--Lat 41°56'55", long 84°49'40", in NE1/4 SE1/4 sec.13, T.6 S., R.5 W., Branch County, Hydrologic Unit 04050001, on left bank 12 ft downstream from bridge on U.S. Highway 12, 1.0 mi downstream from Little Hog Creek, and 3.1 mi west of Allen.

DRAINAGE AREA.--48.7 mi².

PERIOD OF RECORD.--October 1969 to current year. Prior to October 1987, published as Hog Creek near Allen.

GAGE.--Water-stage recorder. Elevation of gage is 1,010 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to May 23, 1970, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 23, 24, 30, Dec. 3-5, Dec. 8 to Jan. 3, Jan. 10-15, Feb. 15-21, Feb. 25 to Mar. 2, and Mar. 6, 7. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--21 years, 43.1 ft³/s, 12.02 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 664 ft³/s, Feb. 25, 1985, gage height, 6.0 ft, from floodmark; maximum gage height, 6.20 ft, June 1, 1989; minimum discharge, 0.48 ft³/s, Aug. 5, 1988; minimum gage height, 1.20 ft, July 16, Aug. 5, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 369 ft³/s, Feb. 24, gage height, 4.95 ft; maximum gage height, 4.97 ft, Feb. 25, backwater from ice; minimum discharge, 7.2 ft/s, Sept. 6, gage height, 1.50 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	10	15	30	32	42	150	82	45	39	93	12	11
2	10	14	28	40	58	125	87	41	38	81	11	9.9
3	10	13	26	50	74	114	91	38	52	64	9.9	9.0
4	9.6	12	25	74	77	107	89	43	61	50	10	8.3
5	9.2	12	24	97	72	97	85	65	56	40	13	7.9
6	9.2	14	24	123	68	90	80	65	51	33	13	7.5
7	9.2	21	23	135	64	83	74	56	46	27	12	9.1
8	8.9	31	23	124	62	77	68	48	47	24	11	10
9	8.7	30	22	110	67	90	64	42	52	21	10	9.2
10	9.9	29	21	100	72	144	74	43	48	19	9.2	8.8
11	12	28	20	98	70	255	98	43	42	20	8.6	8.4
12	11	25	20	90	65	305	110	42	37	24	11	8.0
13	11	23	19	80	60	293	105	68	33	20	48	7.9
14	10	23	18	70	57	252	100	92	31	20	53	13
15	10	34	18	60	54	212	98	97	29	20	36	27
16	10	49	17	52	52	193	93	103	26	18	27	20
17	10	56	16	60	50	176	87	127	24	26	23	17
18	11	56	16	81	47	157	81	153	22	24	21	14
19	13	53	15	90	44	140	74	147	19	19	21	16
20	18	54	15	87	42	127	71	127	18	18	21	16
21	21	57	14	77	39	116	83	109	19	20	23	17
22	23	54	14	70	76	109	90	96	19	23	27	39
23	20	46	13	63	212	111	88	84	24	33	27	35
24	18	41	13	60	353	109	83	75	23	28	24	26
25	17	38	12	62	330	102	77	68	20	23	21	22
26	17	37	12	67	265	95	71	69	17	20	18	19
27	16	35	12	66	220	88	66	67	17	17	17	17
28	15	39	12	63	180	82	61	61	36	16	15	16
29	15	37	15	57	---	77	56	54	83	15	14	17
30	15	33	20	51	---	79	50	48	100	14	13	17
31	15	---	25	45	---	79	---	44	---	13	12	---
TOTAL	402.7	1009	582	2334	2872	4234	2436	2260	1129	883	591.7	463.0
MEAN	13.0	33.6	18.8	75.3	103	137	81.2	72.9	37.6	28.5	19.1	15.4
MAX	23	57	30	135	353	305	110	153	100	93	53	39
MIN	8.7	12	12	32	39	77	50	38	17	13	8.6	7.5
CFSM	.27	.69	.39	1.55	2.12	2.81	1.67	1.50	.77	.59	.39	.32
IN.	.31	.77	.44	1.78	2.19	3.23	1.86	1.73	.86	.67	.45	.35

CAL YR 1989 TOTAL 17478.7 MEAN 47.9 MAX 599 MIN 8.7 CFSM .98 IN 13.35
WTR YR 1990 TOTAL 19196.4 MEAN 52.6 MAX 353 MIN 7.5 CFSM 1.08 IN 14.66

04096900 NOTTAWA CREEK NEAR ATHENS, MI

LOCATION.--Lat 42°03'20", long 85°18'30", in NW1/4 sec.12, T.5 S., R.9 W., St. Joseph County, Hydrologic Unit 04050001, on right bank at downstream side of bridge on Shorts Road, 4.2 mi southwest of Athens, and 5.0 mi downstream from Pine Creek.

DRAINAGE AREA.--162 mi².

PERIOD OF RECORD.--October 1966 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 9, Dec. 13 to Jan. 5, Jan. 13, Feb. 15, 19-21, 24-26, Mar. 6, 7, and Aug. 7-28. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--24 years, 151 ft³/s, 12.66 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,190 ft³/s, June 2, 1989, gage height, 7.85 ft; minimum, 21 ft³/s, July 28, 29, 30, Aug. 4, 6, 1977, Aug. 4, 1988; minimum gage height, 0.37 ft, Oct. 16, 18, 20, 21, Nov. 8, 1971.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 743 ft³/s, Mar. 13, gage height, 4.36 ft; minimum daily, 54 ft³/s, Sept. 13.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	80	91	145	95	149	237	234	147	143	318	81	68
2	80	91	142	100	169	224	252	140	137	278	77	65
3	80	92	133	110	192	219	260	136	136	231	74	62
4	79	91	126	130	189	209	255	141	130	190	78	59
5	79	92	124	185	178	193	241	162	124	156	81	57
6	81	95	121	184	173	170	221	175	124	133	81	56
7	79	105	114	169	170	165	205	172	122	118	80	62
8	78	118	113	159	170	165	192	162	124	110	74	64
9	78	125	110	155	178	202	184	149	126	101	71	63
10	79	125	105	164	186	325	205	148	123	91	66	61
11	80	125	101	168	183	510	265	155	119	90	65	58
12	80	122	99	163	172	670	301	155	117	87	70	57
13	79	117	98	150	164	737	292	175	115	83	72	54
14	78	118	96	137	158	714	284	200	115	84	72	63
15	78	144	94	129	157	643	283	205	113	92	74	69
16	78	206	93	131	156	557	274	242	110	93	77	70
17	79	252	92	170	151	481	251	358	108	106	80	70
18	79	266	91	236	145	420	226	445	108	111	75	68
19	82	251	90	248	140	369	207	455	106	108	80	71
20	90	240	89	227	130	325	201	411	104	116	100	69
21	100	229	88	208	125	290	259	359	102	119	130	71
22	107	213	87	190	167	273	307	303	103	131	150	81
23	111	189	86	171	276	276	300	256	115	144	145	82
24	111	171	84	165	340	280	272	220	116	145	135	80
25	110	163	82	178	350	267	247	198	111	138	120	77
26	107	158	79	213	360	250	223	196	106	129	110	70
27	103	153	75	212	332	229	200	196	104	119	96	64
28	99	156	76	206	270	212	180	186	121	109	85	60
29	95	159	80	191	---	202	165	174	206	101	80	57
30	93	151	85	170	---	208	155	162	311	94	75	56
31	91	---	90	157	---	222	---	152	---	86	71	---
TOTAL	2723	4608	3088	5271	5530	10244	7141	6735	3799	4011	2725	1964
MEAN	87.8	154	99.6	170	198	330	238	217	127	129	87.9	65.5
MAX	111	266	145	248	360	737	307	455	311	318	150	82
MIN	78	91	75	95	125	165	155	136	102	83	65	54
CFSM	.54	.95	.62	1.05	1.22	2.04	1.47	1.34	.78	.80	.54	.40
IN.	.63	1.06	.71	1.21	1.27	2.35	1.64	1.55	.87	.92	.63	.45

CAL YR 1989 TOTAL 68344 MEAN 187 MAX 2170 MIN 75 CFSM 1.15 IN 15.69
WTR YR 1990 TOTAL 57839 MEAN 158 MAX 737 MIN 54 CFSM .98 IN 13.28

STREAMS TRIBUTARY TO LAKE MICHIGAN

04097195 GOURDNECK CANAL NEAR SCHOOLCRAFT, MI

LOCATION.--Lat 42°09'54", long 85°36'17", in NW1/4 sec.33, T.3 S., R.11 W., Kalamazoo County, Hydrologic Unit 04050001, on right bank at downstream end of culvert on Osterhout Avenue, 3.8 mi northeast of Schoolcraft.

DRAINAGE AREA.--Indeterminate.

PERIOD OF RECORD.--October 1965 to December 1972, October 1982 to current year.

GAGE.--Water-stage recorder. Metal V-notch weir Aug. 4, 1969, to Dec. 31, 1972. Datum of gage is 854.98 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources).

REMARKS.--Estimated daily discharges: Oct. 1-19, Dec. 8 to Jan. 3, and June 18 to July 3. Records poor. Canal diverts water from Gourdneck Creek to West Lake to sustain lake levels. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 16 ft^3/s, Dec. 10-12, 1966, Apr. 22-24, 1967; no flow on many days during November, December, 1970, January, February, 1971.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.7	1.3	.82	.68	.88	2.1	4.4	3.9	3.3	1.0	.89	.84
2	1.7	1.2	.79	.70	.92	2.0	4.4	3.8	2.3	.98	.89	.84
3	1.6	1.2	.83	.75	.93	2.0	4.4	3.7	2.2	.95	.87	.86
4	1.6	1.2	.86	.85	.93	2.0	4.4	3.8	2.0	.97	.91	.84
5	1.6	1.1	.85	.95	.93	1.9	4.3	4.0	2.0	.99	.88	.86
6	1.6	1.1	.80	.95	.93	1.9	4.3	4.1	2.0	1.0	1.1	.86
7	1.6	1.1	.78	.91	.93	1.8	4.2	4.1	1.9	1.0	1.1	.91
8	1.6	1.2	.78	.88	.93	1.8	4.2	4.0	1.9	1.1	1.1	.90
9	1.5	1.2	.78	.87	.93	2.1	4.2	3.9	1.9	1.1	1.2	.90
10	1.5	1.1	.77	.89	.90	2.4	4.3	3.9	1.8	1.1	1.1	.90
11	1.5	1.1	.77	.89	.89	3.7	4.4	4.0	1.8	1.1	1.1	.93
12	1.5	1.1	.76	.90	.87	4.8	4.4	4.0	1.7	1.1	1.2	.99
13	1.4	1.0	.75	.95	.86	4.9	4.3	4.1	1.7	1.2	1.2	1.0
14	1.4	.99	.74	.96	.83	4.9	4.4	4.2	1.7	1.2	1.2	1.0
15	1.4	1.2	.74	.90	.85	4.8	4.4	4.2	1.6	1.2	1.2	.98
16	1.4	1.2	.73	.83	.89	4.8	4.3	4.3	1.5	1.2	1.2	.99
17	1.4	1.0	.72	.86	.86	4.7	4.3	4.5	1.5	1.3	1.2	.96
18	1.4	.98	.71	.91	.86	4.6	4.2	4.7	1.4	1.3	1.2	.96
19	1.5	.94	.70	.89	.86	4.6	4.1	4.6	1.3	1.4	1.2	1.0
20	1.6	.99	.70	.89	.83	4.6	4.1	4.6	1.3	1.4	1.2	1.0
21	1.6	.93	.69	.89	.83	4.5	4.3	4.5	1.2	1.4	1.3	1.1
22	1.6	.87	.68	.89	1.2	4.5	4.3	4.5	1.2	1.5	1.2	1.2
23	1.6	.79	.67	.89	2.3	4.5	4.3	4.4	1.2	1.3	1.2	1.2
24	1.5	.75	.67	.88	2.3	4.4	4.2	4.2	1.1	1.3	1.3	1.2
25	1.5	.73	.66	.92	2.3	4.3	4.1	4.2	1.1	1.1	1.2	1.2
26	1.5	.70	.65	.84	2.2	4.3	4.1	4.2	1.1	1.1	1.3	1.2
27	1.4	.71	.64	.89	2.1	4.2	4.0	4.2	1.1	.99	1.2	1.2
28	1.4	.79	.64	.89	2.1	4.2	4.0	4.1	1.3	1.0	1.2	1.2
29	1.3	.81	.64	.89	---	4.2	3.9	4.0	1.2	.99	1.1	1.2
30	1.3	.83	.64	.89	---	4.3	3.9	3.9	1.1	.95	.95	1.3
31	1.3	---	.66	.87	---	4.3	---	3.8	---	.90	.86	---
TOTAL	46.5	30.11	22.62	27.15	33.14	114.1	127.1	128.4	48.4	35.12	34.75	30.52
MEAN	1.50	1.00	.73	.88	1.18	3.68	4.24	4.14	1.61	1.13	1.12	1.02
MAX	1.7	1.3	.86	.96	2.3	4.9	4.4	4.7	3.3	1.5	1.3	1.3
MIN	1.3	.70	.64	.68	.83	1.8	3.9	3.7	1.1	.90	.86	.84

CAL YR 1989 TOTAL 782.73 MEAN 2.14 MAX 3.9 MIN .64
WTR YR 1990 TOTAL 677.91 MEAN 1.86 MAX 4.9 MIN .64

STREAMS TRIBUTARY TO LAKE MICHIGAN

04097540 PRAIRIE RIVER NEAR NOTTAWA, MI

LOCATION.--Lat 41°53'18", long 85°24'34", in NW1/4 SW1/4 sec.6, T.7 S., R.9 W., St. Joseph County, Hydrologic Unit 04050001, on left bank 10 ft upstream from bridge on State Highway 66, 3.0 mi upstream from unnamed tributary, and 3.0 mi southeast of Nottawa.

DRAINAGE AREA.--106 mi².

PERIOD OF RECORD.--October 1962 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 13 to Jan. 4, Feb. 15, and Feb. 26 to Mar. 1. Records good except for estimated daily discharges, which are fair. Since 1987, some diversion by pumping for sprinkler irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--28 years, 94.9 ft³/s, 12.16 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 797 ft³/s, Feb. 26, 1985, gage height, 6.30 ft; minimum, 5.4 ft³/s, Aug. 4, 5, 1988, gage height, 1.57 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 385 ft³/s, Feb. 25, gage height, 5.17 ft; maximum gage height, 5.36 ft, Feb. 26, backwater from ice; minimum discharge, 37 ft³/s, Aug. 11, gage height, 2.33 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	43	58	79	75	134	240	164	116	123	123	54	54
2	43	57	78	80	140	218	169	112	119	113	50	52
3	42	56	76	86	142	207	170	110	123	103	47	49
4	41	56	75	110	144	201	166	114	120	93	47	47
5	40	56	73	125	142	196	161	128	119	86	48	47
6	41	56	72	131	139	187	154	129	116	82	51	48
7	41	61	70	131	134	176	146	126	113	78	51	52
8	41	65	68	126	130	170	141	119	112	72	49	53
9	41	68	66	123	128	184	139	113	113	66	45	52
10	43	69	64	123	127	222	147	119	112	63	40	51
11	45	68	64	122	127	282	160	120	111	66	41	50
12	46	67	63	120	126	332	170	121	107	67	50	49
13	46	65	62	116	124	347	176	144	102	67	62	48
14	45	66	60	112	121	327	178	164	98	69	69	50
15	46	75	59	109	120	296	174	176	95	68	76	53
16	47	91	58	108	123	270	170	192	91	66	76	58
17	50	102	57	112	124	249	164	236	89	73	72	58
18	51	104	56	122	121	230	156	265	86	71	69	56
19	54	101	56	128	117	218	147	278	81	68	66	57
20	60	99	55	129	114	204	144	268	82	70	66	56
21	65	96	55	128	111	193	153	242	84	72	71	58
22	68	92	55	125	132	186	155	213	84	84	74	67
23	69	87	55	121	202	185	157	191	88	94	76	72
24	68	84	54	119	311	182	154	174	88	95	76	72
25	67	81	54	123	371	178	147	164	88	90	74	69
26	65	79	54	129	345	171	141	164	85	82	71	66
27	63	79	54	130	315	164	134	157	84	76	67	62
28	62	84	56	129	275	157	129	150	92	71	64	59
29	61	84	60	125	---	154	124	143	109	67	62	58
30	60	82	64	124	---	159	121	137	125	63	59	59
31	59	---	68	132	---	159	---	130	---	60	56	---
TOTAL	1613	2288	1940	3673	4639	6644	4611	5015	3039	2418	1879	1682
MEAN	52.0	76.3	62.6	118	166	214	154	162	101	78.0	60.6	56.1
MAX	69	104	79	132	371	347	178	278	125	123	76	72
MIN	40	56	54	75	111	154	121	110	81	60	40	47
CFSM	.49	.72	.59	1.11	1.57	2.02	1.45	1.53	.95	.74	.57	.53
IN.	.57	.80	.68	1.29	1.63	2.33	1.62	1.76	1.07	.85	.66	.59

CAL YR 1989 TOTAL 34294 MEAN 94.0 MAX 563 MIN 40 CFSM .89 IN 12.04
WTR YR 1990 TOTAL 39441 MEAN 108 MAX 371 MIN 40 CFSM 1.02 IN 13.84

04099000 ST. JOSEPH RIVER AT MOTTVILLE, MI

LOCATION.--Lat 41°48'03", long 85°45'22", in SW1/4 sec.6, T.8 S., R.12 W., St. Joseph County, Hydrologic Unit 04050001, on right bank 500 ft upstream from bridge on U.S. Highway 12 in Mottville, 0.4 mi downstream from Indiana Michigan Power Co. hydroelectric plant, 4 mi upstream from Pigeon River, and at mile 96.

DRAINAGE AREA.--1,866 mi².

PERIOD OF RECORD.--October 1923 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1387: 1930, 1932, 1938, 1940-42, 1945. WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 755.3 ft, Indiana Michigan Power Co. datum. Prior to Oct. 1, 1951, at site 0.4 mi upstream at datum 4.2 ft higher.

REMARKS.--Estimated daily discharges: Dec. 15-18, 21-26. Records good except for estimated daily discharges, which are fair. Flow regulated by powerplants upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--67 years, 1,613 ft³/s, 11.74 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 11,400 ft³/s, June 4, 1989, gage height, 10.41 ft; maximum gage height, 10.76 ft, Apr. 27, 1950, present datum; minimum daily discharge, 39 ft³/s, Oct. 19, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,900 ft³/s, Mar. 14, gage height, 7.35 ft; minimum daily, 552 ft³/s, Aug. 2.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	813	1540	1710	1440	1990	4040	2930	2290	2430	1780	1070	1050
2	1100	1180	1670	1400	2170	3980	3120	2120	2380	2100	552	1050
3	1160	946	1670	1280	2130	3800	2930	2010	2180	2070	667	986
4	1000	1170	1660	1390	2160	3440	2950	2020	2020	1990	1110	834
5	1010	905	1620	1540	2220	3580	3020	2040	1970	1620	1020	981
6	1010	1090	1580	1800	2260	3480	3040	2050	2000	1550	793	943
7	1220	1280	1560	1820	2200	3100	2970	2100	1990	1460	992	863
8	757	1300	1360	1820	2100	3150	2710	2010	1910	1310	738	843
9	799	1290	1270	1960	2170	3260	2660	1990	1870	974	946	681
10	1020	1320	1260	1830	2190	3290	2790	2110	1870	1080	702	868
11	941	1330	1270	2030	2120	4030	2870	2120	1870	1120	663	985
12	939	1300	1560	1960	2090	4650	3010	2180	1840	1070	838	722
13	987	1290	1080	1940	2060	5490	3220	2540	1760	1090	1260	770
14	946	1310	1180	1950	2090	5770	3420	2560	1700	1020	1330	877
15	753	1600	1050	1890	2160	5730	3180	2690	1660	808	980	979
16	757	1760	930	1820	2000	5570	3280	2690	1660	809	934	959
17	1200	1810	980	1810	2030	5330	3240	3520	1530	1520	994	1330
18	1010	1890	1000	2130	2070	4930	3140	4060	1390	1340	1010	1190
19	923	2310	1140	2170	1930	4740	3130	4310	1330	1210	898	836
20	957	1890	1240	2190	1870	4330	2880	4690	1170	1600	1270	1040
21	1040	2200	1350	2390	1860	4220	3070	4380	1340	1550	1310	1070
22	1510	2090	1300	2250	2160	3810	3230	4310	1360	1260	1310	1090
23	1050	2050	1400	2260	2560	3900	3220	3890	1460	1790	1460	1100
24	1210	1880	1350	2100	2860	3850	3170	3660	1430	1760	1480	1570
25	1270	1890	1300	2120	3420	3610	3180	3440	1090	1650	1360	1240
26	1390	1880	1550	2180	3580	3510	2840	3370	1140	1500	1510	1130
27	1300	1860	1220	2380	3870	3280	2680	3190	1310	1370	1360	1340
28	1300	1800	1230	2420	4350	3260	2720	3000	1320	1240	970	1190
29	1190	1690	1480	2330	---	2940	2580	2750	1420	1210	1010	1030
30	1150	1730	1580	2190	---	3130	2330	2460	1600	1140	1060	870
31	1330	---	1110	2120	---	3140	---	2440	---	1410	1060	---
TOTAL	33042	47581	41660	60910	66670	124340	89510	88990	50000	43401	32657	30417
MEAN	1066	1586	1344	1965	2381	4011	2984	2871	1667	1400	1053	1014
MAX	1510	2310	1710	2420	4350	5770	3420	4690	2430	2100	1510	1570
MIN	753	905	930	1280	1860	2940	2330	1990	1090	808	552	681
CFSM	.57	.85	.72	1.05	1.28	2.15	1.60	1.54	.89	.75	.56	.54
IN.	.66	.95	.83	1.21	1.33	2.48	1.78	1.77	1.00	.87	.65	.61

CAL YR 1989 TOTAL 724821 MEAN 1986 MAX 10700 MIN 753 CFSM 1.06 IN 14.45
WTR YR 1990 TOTAL 709178 MEAN 1943 MAX 5770 MIN 552 CFSM 1.04 IN 14.14

STREAMS TRIBUTARY TO LAKE MICHIGAN

04099750 PIGEON RIVER NEAR SCOTT, IN

LOCATION.--Lat 41°44'56", long 85°34'35", in SE1/4 NW1/4 sec.14, T.38 N., R.8 E., Lagrange County, Hydrologic Unit 04050001, on right bank 20 ft downstream from bridge on County Road 750 North, 1,200 ft downstream from Page Ditch, 0.7 mi south of Indiana-Michigan State line, and 1.2 mi northwest of Scott, IN.

DRAINAGE AREA.--361 mi², of which 53.9 mi² does not contribute directly to surface runoff.

PERIOD OF RECORD.--June 1968 to current year.

REVISED RECORDS.--WSP 2111: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 815.00 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 9, Dec. 12 to Jan. 8, and Feb. 25-28. Records good except for estimated daily discharges, which are fair.

AVERAGE DISCHARGE.--22 years, 367 ft³/s, 13.81 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,370 ft³/s, Mar. 21, 1982, gage height, 7.85 ft; minimum daily, 42 ft³/s, Oct. 21, 1971.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,360 ft³/s, Feb. 26, gage height, 6.21 ft; minimum daily, 145 ft³/s, Dec. 27.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	192	199	250	170	426	1210	531	378	524	333	189	201
2	190	196	273	185	480	1160	539	351	548	317	182	198
3	187	194	266	200	529	1110	530	348	570	302	176	196
4	181	191	240	250	513	1050	514	373	575	289	185	194
5	177	188	236	350	510	953	476	439	541	281	207	191
6	177	193	240	420	515	884	483	408	522	269	205	194
7	175	200	236	430	520	812	469	379	519	259	199	204
8	172	235	229	420	515	754	454	362	540	249	189	193
9	170	230	220	412	527	794	442	342	575	235	180	188
10	175	219	219	452	539	893	488	354	548	223	170	190
11	175	212	218	443	511	1050	566	358	521	233	167	187
12	170	205	210	418	483	1050	572	361	508	252	175	183
13	152	201	205	401	462	994	540	490	493	238	269	180
14	149	205	202	384	445	949	565	598	471	236	272	189
15	156	253	198	369	453	913	585	564	449	240	255	215
16	164	327	190	350	451	886	574	673	395	233	255	210
17	173	382	182	388	430	861	557	940	388	232	263	202
18	175	365	176	447	409	817	546	1180	373	221	271	193
19	180	357	172	458	379	752	518	1230	351	213	287	196
20	219	377	168	461	372	714	507	1190	342	247	291	199
21	263	402	166	508	361	679	538	1170	324	258	320	216
22	244	388	160	511	497	653	527	1120	319	295	307	272
23	223	363	156	505	963	651	504	1060	342	311	296	246
24	216	343	153	495	1280	613	491	982	337	280	293	230
25	163	330	150	515	1150	556	478	897	314	264	291	219
26	179	313	147	537	1200	545	464	876	302	253	284	210
27	212	307	145	521	1220	524	447	855	307	242	274	204
28	179	311	146	499	1230	502	429	761	324	233	271	199
29	188	297	147	482	---	496	412	707	342	224	259	200
30	210	282	150	462	---	533	395	655	343	215	245	199
31	209	---	160	440	---	526	---	603	---	201	221	---
TOTAL	5795	8265	6010	12883	17370	24884	15141	21004	13007	7878	7448	6098
MEAN	187	275	194	416	620	803	505	678	434	254	240	203
MAX	263	402	273	537	1280	1210	585	1230	575	333	320	272
MIN	149	188	145	170	361	496	395	342	302	201	167	180
CFSM	.61	.90	.63	1.35	2.02	2.61	1.64	2.21	1.41	.83	.78	.66
IN.	.70	1.00	.73	1.56	2.10	3.02	1.83	2.55	1.58	.95	.90	.74

CAL YR 1989 TOTAL 118457 MEAN 325 MAX 983 MIN 145 CFSM 1.06 IN 14.35
WTR YR 1990 TOTAL 145783 MEAN 399 MAX 1280 MIN 145 CFSM 1.30 IN 17.66

04100222 NORTH BRANCH ELKHART RIVER AT COSPERVILLE, IN

LOCATION.--Lat 41°28'54", long 85°28'32", in NE1/4 NW1/4 sec.22, T.35 N., R.9 E., Noble County, Hydrologic Unit 04050001, on right bank at downstream side of bridge on County Road 900 North at Cosperville, IN, 1,300 ft downstream from Boyd Ditch, 1.7 mi upstream from Hustin Ditch, and 3.1 mi downstream from Waldron Lake.

DRAINAGE AREA.--142 mi².

PERIOD OF RECORD.--October 1971 to current year.

GAGE.--Water-stage recorder. Datum of gage is 880.12 ft above National Geodetic Vertical Datum of 1929 (levels by Indiana Department of Natural Resources).

REMARKS.--Estimated daily discharges: Dec. 9, Dec. 12 to Jan. 4, and Jan. 25. Records good except for period Dec. 12 to Jan. 4, which are fair. Flow regulated at times by dam at Waldron Lake.

AVERAGE DISCHARGE.--19 years, 140 ft³/s, 13.39 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 919 ft³/s, Mar. 23, 1982, gage height, 8.12 ft; minimum daily, 2.2 ft³/s, July 7, 1988, caused by regulation.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 545 ft³/s, Feb. 26, gage height, 6.38 ft; minimum daily, 37 ft³/s, Oct. 14.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	60	49	87	59	193	526	212	158	262	111	96	137
2	58	48	84	62	216	514	212	148	247	110	91	131
3	55	49	82	67	230	500	212	140	248	108	86	125
4	51	49	81	82	235	480	208	139	241	104	87	118
5	49	48	79	124	231	459	203	141	231	99	88	112
6	47	48	77	135	229	436	196	139	220	94	86	106
7	44	52	75	138	225	410	188	134	209	89	84	108
8	42	56	73	138	220	389	181	128	298	84	81	106
9	40	55	71	140	218	388	174	122	344	79	78	105
10	41	56	69	143	213	398	184	117	358	75	74	102
11	41	55	68	147	208	421	206	115	355	82	71	100
12	39	54	65	144	200	420	215	116	343	85	78	96
13	39	53	65	143	192	414	216	153	324	86	109	93
14	37	55	64	140	189	404	222	178	306	86	123	96
15	39	73	62	138	192	391	227	190	283	84	128	100
16	38	95	61	155	187	382	227	250	258	83	129	104
17	40	105	60	192	185	367	223	340	233	82	127	103
18	41	107	59	216	183	353	218	382	207	79	127	101
19	43	107	57	222	179	340	211	403	184	77	124	102
20	49	105	56	227	175	325	210	405	166	78	128	100
21	55	105	55	228	171	311	230	403	149	81	129	101
22	58	104	54	228	278	297	232	393	137	97	128	103
23	60	102	53	223	426	285	229	378	125	112	127	104
24	60	99	51	230	498	273	222	361	114	120	126	103
25	59	97	50	240	526	258	214	349	107	123	123	101
26	58	96	49	232	542	246	206	360	101	123	119	98
27	55	96	48	229	542	232	198	353	96	120	115	94
28	52	93	48	224	537	220	190	339	95	115	123	92
29	50	92	49	217	---	213	180	322	103	112	147	89
30	49	89	50	208	---	212	169	302	109	107	146	85
31	48	---	54	199	---	210	---	281	---	101	143	---
TOTAL	1497	2292	1956	5270	7620	11074	6215	7739	6453	2986	3421	3115
MEAN	48.3	76.4	63.1	170	272	357	207	250	215	96.3	110	104
MAX	60	107	87	240	542	526	232	405	358	123	147	137
MIN	37	48	48	59	171	210	169	115	95	75	71	85
CFSM	.34	.54	.44	1.20	1.92	2.52	1.46	1.76	1.51	.68	.78	.73
IN.	.39	.60	.51	1.38	2.00	2.90	1.63	2.03	1.69	.78	.90	.82

CAL YR 1989 TOTAL 42854 MEAN 117 MAX 362 MIN 24 CFSM .83 IN 11.23
WTR YR 1990 TOTAL 59638 MEAN 163 MAX 542 MIN 37 CFSM 1.15 IN 15.62

STREAMS TRIBUTARY TO LAKE MICHIGAN

04100500 ELKHART RIVER AT GOSHEN, IN

LOCATION.--Lat 41°35'36", long 85°50'55", in NE1/4 NE1/4 sec.8, T.36 N., R.6 E., Elkhart County, Hydrologic Unit 04050001, on right bank 20 ft downstream from River Avenue bridge at Goshen, IN, 0.4 mi upstream from Rock Run, and at mile 16.1.

DRAINAGE AREA.--594 mi².

PERIOD OF RECORD.--April 1931 to current year.

REVISED RECORDS.--WSP 1337: 1939(M). WSP 1557: 1954. WSP 2111: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 769.43 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 20, 1931, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 14 to Jan. 3, Feb. 24 to Mar. 1, and Mar. 3, 4. Records good except for estimated daily discharges, which are fair. Occasional low-flow regulation at Goshen Dam, 3.4 mi upstream.

AVERAGE DISCHARGE.--59 years, 527 ft³/s, 12.05 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,360 ft³/s, Feb. 24, 1985; maximum gage height, 11.94 ft, Mar. 14, 1982; minimum daily discharge, 7.0 ft³/s, Aug. 11, 1964, result of extreme regulation.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,800 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Feb. 23	1600	*3,900	*8.66	May 18	0600	2,810	7.01
Mar. 11	2200	1,950	5.61				

Minimum daily discharge, 157 ft³/s, Oct. 16.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	221	200	306	255	726	1900	811	707	956	517	485	878
2	218	197	308	260	793	1810	837	670	912	490	430	842
3	214	199	304	270	1030	1770	835	638	962	479	392	824
4	211	200	286	384	953	1670	813	671	954	471	406	806
5	208	200	294	746	853	1540	788	725	860	462	442	786
6	204	211	295	673	806	1430	768	668	814	442	398	754
7	198	234	286	554	792	1320	751	628	775	419	370	772
8	198	256	274	522	781	1270	734	603	954	400	350	772
9	193	251	252	526	797	1490	722	577	1570	382	330	708
10	186	247	251	572	826	1720	793	602	1390	367	313	661
11	179	241	281	588	776	1880	1030	571	1160	465	298	619
12	173	237	252	572	746	1830	1010	574	1060	629	308	592
13	174	235	203	537	717	1570	906	950	990	530	566	564
14	170	245	220	520	693	1400	938	1410	945	485	592	596
15	162	297	210	528	709	1310	1030	1130	910	472	483	758
16	157	510	200	536	690	1260	982	1290	860	457	443	749
17	163	574	190	713	662	1210	944	2400	806	445	424	710
18	163	482	190	980	641	1160	908	2630	757	424	512	628
19	173	431	190	1040	643	1110	873	1960	703	404	607	626
20	196	429	190	888	630	1060	868	1630	671	446	682	630
21	227	427	175	846	622	1020	977	1470	651	511	783	628
22	240	402	167	858	1160	998	1060	1390	629	818	799	700
23	245	386	165	834	3430	975	971	1350	645	1330	746	676
24	237	369	165	816	3100	928	911	1290	598	1250	688	648
25	230	356	175	840	2400	891	871	1250	549	942	646	585
26	225	350	190	947	2530	860	841	1400	537	788	620	544
27	221	346	195	929	2330	827	811	1490	544	743	600	505
28	212	338	200	844	2090	799	784	1320	535	719	630	481
29	207	327	205	804	---	792	763	1190	540	679	1120	466
30	205	317	210	780	---	811	738	1100	542	622	1270	458
31	204	---	220	748	---	800	---	1020	---	545	998	---
TOTAL	6214	9494	7049	20910	32926	39411	26068	35304	24779	18133	17731	19966
MEAN	200	316	227	675	1176	1271	869	1139	826	585	572	666
MAX	245	574	308	1040	3430	1900	1060	2630	1570	1330	1270	878
MIN	157	197	165	255	622	792	722	571	535	367	298	458
CFSM	.34	.53	.38	1.14	1.98	2.14	1.46	1.92	1.39	.98	.96	1.12
IN.	.39	.59	.44	1.31	2.06	2.47	1.63	2.21	1.55	1.14	1.11	1.25

CAL YR 1989 TOTAL 178390 MEAN 489 MAX 3530 MIN 157 CFSM .82 IN 11.17
WTR YR 1990 TOTAL 257985 MEAN 707 MAX 3430 MIN 157 CFSM 1.19 IN 16.16

04101000 ST. JOSEPH RIVER AT ELKHART, IN

LOCATION.--Lat 41°41'30", long 85°58'30", in SW1/4 NE1/4 sec.5, T.37 N., R.5 E., Elkhart County, Hydrologic Unit 04050001, on left bank 200 ft downstream from Elkhart River, 200 ft upstream from Main Street bridge in Elkhart, IN, 2,000 ft downstream from Christiana Creek, 0.5 mi downstream from Elkhart Hydroelectric Plant, and at mile 76.5.

DRAINAGE AREA.--3,370 mi².

PERIOD OF RECORD.--August 1947 to current year. Gage heights at site 0.8 mi downstream at different datum from September 1924 to March 1926 are available in the Indiana District Office.

REVISED RECORDS.--WSP 2111: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 700.00 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by Elkhart Hydroelectric Plant.

AVERAGE DISCHARGE.--43 years, 3,230 ft³/s, 13.02 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 18,800 ft³/s, Feb. 27, 1985; maximum gage height, 27.91 ft, Mar. 21, 1982; minimum daily discharge, 336 ft³/s, Aug. 5, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 9,620 ft³/s, May 18, gage height, 23.28 ft; minimum daily, 1,420 ft³/s, Oct. 16.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1650	2280	2880	2230	3750	7960	5120	4020	4730	3360	2530	2670
2	1820	2220	2660	2610	3990	7760	5280	3940	4660	3370	1710	2580
3	1980	1750	2880	2350	4350	7780	5240	3620	4470	3380	1740	2540
4	1860	1850	2750	2730	4600	7160	4990	3730	4310	3310	2210	2310
5	1770	1810	2720	3350	4180	6780	5200	3840	4090	2960	2420	2410
6	1780	1780	2650	3430	4090	6830	5030	3820	4050	2860	1800	2360
7	1900	2160	2620	3420	4320	6050	5050	3780	3990	2670	2340	2400
8	1670	2210	2530	3340	3870	6190	4680	3670	4130	2560	1700	2310
9	1460	2260	2190	3420	3980	6720	4510	3500	4690	2210	2080	2150
10	1800	2260	2270	3570	4080	7170	4910	3730	4600	1940	1710	2050
11	1750	2260	2860	3530	4090	8210	5310	3700	4310	2540	1630	2460
12	1720	2210	2390	3680	4030	8310	5470	3720	4110	2460	1810	1990
13	1750	2190	2220	3410	3890	8960	5640	4950	3900	2410	2460	1970
14	1720	2250	1920	3480	3770	9210	5840	5550	3820	2310	2890	2210
15	1590	2550	1850	3320	3790	9000	5640	5370	3620	2130	2440	2470
16	1420	3210	1620	3330	3910	8880	5660	5550	3600	1970	2140	2540
17	1870	3260	1790	3510	3550	8460	5730	7410	3430	2530	2230	2640
18	1820	3250	1950	4050	3680	8130	5350	8900	3180	2740	2340	2820
19	1750	3590	2090	4390	3680	7690	5380	8460	3030	2370	2370	2240
20	1820	3370	2270	4180	3450	7060	5110	8470	2800	2760	2910	2380
21	1980	3430	2370	4200	3410	6890	5560	8070	2960	3120	3690	2570
22	2350	3470	2270	4280	4410	6500	5510	7650	2940	3280	3150	2780
23	2230	3310	2540	4250	7420	6340	5540	7260	3110	4180	3330	2770
24	2100	3210	2390	4010	8550	6340	5520	6900	3120	4200	3120	3020
25	2220	3120	2240	4160	7570	6040	5100	6590	2660	3660	3020	2970
26	2240	3070	2700	4330	7750	5780	5170	6740	2540	3320	3000	2480
27	2170	3080	2210	4290	7910	5290	4530	6430	2820	3100	2940	2680
28	2170	3100	2090	4340	7970	5520	4760	6050	2830	2840	2590	2610
29	2120	2950	2300	4410	---	5030	4360	5900	2880	2800	2700	2350
30	1930	2830	2600	4030	---	5260	4180	4890	2990	2530	3160	2180
31	2180	---	2320	3850	---	5340	---	5010	---	2760	2850	---
TOTAL	58590	80290	73140	113480	134040	218640	155370	171220	108370	88630	77010	73910
MEAN	1890	2676	2359	3661	4787	7053	5179	5523	3612	2859	2484	2464
MAX	2350	3590	2880	4410	8550	9210	5840	8900	4730	4200	3690	3020
MIN	1420	1750	1620	2230	3410	5030	4180	3500	2540	1940	1630	1970
CFSM	.56	.79	.70	1.09	1.42	2.09	1.54	1.64	1.07	.85	.74	.73
IN.	.65	.89	.81	1.25	1.48	2.41	1.72	1.89	1.20	.98	.85	.82

CAL YR 1989 TOTAL 1242290 MEAN 3404 MAX 15000 MIN 1420 CFSM 1.01 IN 13.71
WTR YR 1990 TOTAL 1352690 MEAN 3706 MAX 9210 MIN 1420 CFSM 1.10 IN 14.93

STREAMS TRIBUTARY TO LAKE MICHIGAN

04101500 ST. JOSEPH RIVER AT NILES, MI
(National stream quality accounting network station)

LOCATION.--Lat 41°49'45", long 86°15'35", in SW1/4 sec.26, T.7 S., R.17 W., Berrien County, Hydrologic Unit 04050001, on right bank 100 ft upstream from Main Street Bridge in Niles, 0.6 mi downstream from dam at French Paper Co., 1.3 mi upstream from Dowagiac River, and at mile 44.

DRAINAGE AREA.--3,666 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1930 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1387: 1931, 1933-36, 1940-43, 1945-46(M). WSP 1911: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 633.02 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1968, at datum 2.00 ft higher. Oct. 1, 1930, to Feb. 11, 1931, nonrecording gage on Main Street Bridge, and Feb. 12 to June 30, 1931, nonrecording gage 50 ft upstream from present site (gage heights referred to NGVD). Oct. 1, 1943, to Apr. 12, 1970, auxiliary gage was headwater gage at hydroelectric plant at Buchanan Dam, 8 mi downstream from base gage at different datum. Since Apr. 13, 1970, auxiliary water-stage recorder at sewage-treatment plant, 1.1 mi downstream from base gage at same datum.

REMARKS.--Estimated daily discharges: Dec. 22-28. Water-discharge records good except for estimated daily discharges, which are fair. Flow regulated by powerplants upstream from station.

AVERAGE DISCHARGE.--60 years, 3,333 ft³/s, 12.35 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 20,200 ft³/s, Apr. 5, 1950, gage height, 15.10 ft, present datum; minimum daily, 420 ft³/s, Aug. 30, 1931.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 11,100 ft³/s, Feb. 24, gage height, 10.57 ft; minimum daily, 1,790 ft³/s, Nov. 7.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2190	2540	3280	2350	4300	8950	5830	4510	5580	3730	3160	3160
2	2000	3080	3010	2560	4420	8360	5650	4400	5030	3640	2470	2990
3	2290	2970	3310	2670	4820	8650	5990	4180	5110	3880	1830	2900
4	2330	2270	3030	2870	4900	8530	5560	4360	4800	3720	2610	2750
5	2150	2210	3030	3770	5020	7440	5710	4370	4770	3560	2760	2680
6	2150	2030	2990	3830	4490	7560	5490	4320	4540	3250	2650	2810
7	2090	1790	2980	3640	4530	6840	5510	4260	4470	3160	2370	3000
8	2260	2540	2910	3760	4520	6600	5440	4250	4810	2890	2330	2770
9	1810	2540	2740	3720	4240	7830	4890	4040	5090	2870	2220	2630
10	1940	2650	2520	3940	4380	8410	5360	4410	5420	2240	2400	2200
11	2160	2630	2750	3800	4400	9640	6020	4370	4830	2840	1930	2790
12	2020	2630	3050	4000	4410	10000	6090	4370	4780	2940	2190	2510
13	2040	2510	2650	3910	4330	9490	6060	5530	4420	2890	2690	2260
14	2070	2660	2230	3730	4210	10100	6280	6990	4380	2800	3200	2580
15	2020	3130	2000	3720	4230	10100	6760	6600	4250	2520	3180	2840
16	1890	3610	2030	3710	4220	9670	6070	6270	3920	2310	2550	3080
17	1900	3900	1900	3940	4170	9460	6230	8820	4070	2760	2550	2910
18	2330	3750	2150	4670	3850	8900	6150	10000	3650	3080	2790	3190
19	2100	3790	2190	4990	4030	8400	5760	10100	3510	2970	2790	2900
20	2230	4060	2400	4980	3900	8070	6000	9140	3400	3320	3390	2550
21	2500	3810	2460	4480	3800	7470	5820	9320	3320	3680	4800	2940
22	2390	3950	2600	4700	4690	7430	6100	8480	3490	3950	4030	3330
23	2900	3750	2800	4610	9250	6940	6340	8330	3540	4890	3710	3350
24	2260	3530	2700	4550	10800	6830	5860	7680	3710	5140	3870	3280
25	2600	3520	2500	4720	9000	6730	5950	7410	3340	4440	3470	3550
26	2570	3500	3000	5020	8360	6420	5610	7630	2950	4020	3310	3000
27	2570	3400	2600	4830	8860	6050	5350	7520	2990	3500	3590	2950
28	2510	3600	2400	4680	8670	5730	5070	6850	3390	3380	3150	3090
29	2520	3350	2390	4820	---	6010	5110	6470	3540	3180	2950	2860
30	2330	3160	2400	4650	---	5450	4720	6080	3330	2980	3530	2640
31	2370	---	2730	4190	---	5850	---	5240	---	2990	3390	---
TOTAL	69490	92860	81730	125810	150800	243910	172780	196300	124430	103520	91860	86490
MEAN	2242	3095	2636	4058	5386	7868	5759	6332	4148	3339	2963	2883
MAX	2900	4060	3310	5020	10800	10100	6760	10100	5580	5140	4800	3550
MIN	1810	1790	1900	2350	3800	5450	4720	4040	2950	2240	1830	2200
CFSM	.61	.84	.72	1.11	1.47	2.15	1.57	1.73	1.13	.91	.81	.79
IN.	.71	.94	.83	1.28	1.53	2.48	1.75	1.99	1.26	1.05	.93	.88

CAL YR 1989 TOTAL 1392770 MEAN 3816 MAX 16000 MIN 1700 CFSM 1.04 IN 14.13
WTR YR 1990 TOTAL 1539980 MEAN 4219 MAX 10800 MIN 1790 CFSM 1.15 IN 15.63

04101500 ST. JOSEPH RIVER AT NILES, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1972-75, 1979 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: February 1979 to September 1984.
WATER TEMPERATURE: February 1979 to September 1984.

INSTRUMENTATION.--Water-quality monitor from Oct. 9, 1980 to Sept. 30, 1984.

REMARKS.--Bimonthly cross-sectional samples were collected at Grant Street bridge 0.2 mi upstream from gage.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1982, 1984): Maximum, 678 microsiemens, Feb. 16, 1982; minimum, 278 microsiemens, Mar. 19, 1982.
WATER TEMPERATURE (water years 1980, 1982-84): Maximum daily recorded (more than 20 percent missing record), 29.0°C, July 20, 21, 1980; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV										
07...	1430	1800	592	8.3	9.0	1.4	8.6	77	K9600	1200
JAN										
24...	1430	4700	576	8.3	3.0	1.8	13.2	101	K7000	920
MAR										
27...	1400	6280	527	8.3	7.0	2.0	12.7	105	K430	K160
MAY										
22...	1400	8310	515	8.3	15.5	6.5	10.0	102	2000	600
JUL										
10...	1400	1870	576	8.6	25.0	4.1	7.8	97	K67	K120
SEP										
05...	1800	2720	560	8.4	25.0	4.5	8.8	109	--	--

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
NOV										
07...	300	70	79	24	18	12	0.5	2.5	276	0
JAN										
24...	270	65	75	20	10	9	0.3	2.6	249	0
MAR										
27...	260	63	74	19	10	8	0.3	2.1	244	0
MAY										
22...	260	67	74	19	9.6	7	0.3	2.0	239	0
JUL										
10...	270	53	73	22	15	11	0.4	2.0	254	7
SEP										
05...	270	60	70	22	14	10	0.4	2.4	237	7

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)
NOV									
07...	226	52	30	0.1	7.9	346	0.47	1680	0.08
JAN									
24...	204	54	26	0.1	7.8	345	0.47	4380	0.03
MAR									
27...	200	49	23	<0.1	5.4	340	0.46	5770	0.03
MAY									
22...	196	43	18	0.2	6.2	311	0.42	6980	0.03
JUL									
10...	220	44	26	<0.1	6.2	377	0.51	1900	0.01
SEP									
05...	206	48	27	0.2	6.2	320	0.44	2350	0.02

STREAMS TRIBUTARY TO LAKE MICHIGAN

04101500 ST. JOSEPH RIVER AT NILES, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS TOTAL (MG/L AS P)	PHOSPHORUS DISSOLVED (MG/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)
NOV 07...	1.2	0.28	0.26	0.80	0.05	0.02	0.02	<10	<1	61
JAN 24...	2.7	0.20	0.21	0.80	0.05	0.03	0.02	--	--	--
MAR 27...	1.8	0.09	0.08	0.70	0.03	<0.01	<0.01	10	1	--
MAY 22...	1.8	0.04	0.04	1.2	0.04	0.03	0.01	10	1	53
JUL 10...	1.1	0.03	0.04	0.80	0.06	<0.01	<0.01	--	--	--
SEP 05...	1.0	0.12	0.08	0.80	0.06	0.03	0.02	20	2	77

DATE	BERYLLIUM, DISSOLVED (UG/L AS BE)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)
NOV 07...	<0.5	<1	<1	<3	1	10	<1	5	19	<0.1
JAN 24...	--	--	--	--	--	--	--	--	--	--
MAR 27...	0.7	<1	--	<3	--	14	--	5	12	<0.1
MAY 22...	<0.5	<1	<1	<3	1	21	1	5	6	<0.1
JUL 10...	--	--	--	--	--	--	--	--	--	--
SEP 05...	<0.5	<1	<1	<3	1	4	<1	7	1	<0.1

DATE	MOLYBDENUM, DISSOLVED (UG/L AS MO)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV 07...	<10	1	<1	<1.0	140	<6	6	9	44	92
JAN 24...	--	--	--	--	--	--	--	12	152	72
MAR 27...	<10	--	--	<1.0	130	<6	<3	5	85	100
MAY 22...	<10	1	<1	<1.0	130	<6	<3	26	583	93
JUL 10...	--	--	--	--	--	--	--	19	96	84
SEP 05...	<10	1	<1	<1.0	150	<6	4	13	95	98

04101800 DOWAGIAC RIVER AT SUMNERVILLE, MI

LOCATION.--Lat 41°54'48", long 86°12'47", in SE1/4 sec.30, T.6 S., R.16 W., Cass County, Hydrologic Unit 04050001, on right bank 30 ft upstream from bridge on Indian Lake Road, 0.3 mi west of Sumnerville.

DRAINAGE AREA.--255 mi².

PERIOD OF RECORD.--October 1960 to current year.

GAGE.--Water-stage recorder. Datum of gage is 692.62 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by millpond and lake-level control dam upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--30 years, 290 ft³/s, 15.44 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,590 ft³/s, Feb. 24, 1985, gage height, 9.26 ft; minimum, 86 ft³/s, Sept. 10, 1964; minimum gage height, 2.57 ft, Aug. 8, 9, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,030 ft³/s, Mar. 11, gage height, 7.29 ft; minimum, 146 ft³/s, Aug. 11, gage height, 3.18 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	154	199	268	233	323	366	437	307	276	256	183	189
2	154	197	264	228	414	361	479	294	271	241	174	181
3	155	202	266	230	410	368	473	288	268	228	163	175
4	152	206	267	320	375	341	427	368	257	213	179	173
5	155	203	266	418	348	333	402	469	251	204	198	169
6	158	203	265	365	341	326	381	395	253	195	181	171
7	157	226	263	324	331	311	361	356	246	186	171	200
8	156	244	251	303	322	318	347	328	256	181	164	198
9	155	231	239	314	317	505	342	305	264	174	158	188
10	157	231	237	394	305	740	451	393	245	169	151	184
11	160	227	236	370	294	995	495	446	237	178	159	181
12	158	220	232	341	287	946	451	404	228	184	205	182
13	158	216	220	312	287	744	409	522	221	175	301	180
14	158	218	225	295	281	616	447	511	218	178	250	245
15	156	318	206	286	279	546	447	457	216	182	232	420
16	159	476	220	307	316	500	410	555	205	182	219	388
17	165	442	212	465	304	459	411	666	201	195	208	347
18	170	389	210	521	298	428	382	640	200	186	221	295
19	170	359	212	418	297	420	362	518	193	183	219	276
20	194	403	214	364	282	402	370	484	204	282	332	268
21	273	429	194	347	277	393	523	449	213	293	380	303
22	282	375	202	327	385	424	484	407	212	282	367	414
23	254	333	206	313	635	529	423	377	289	296	315	419
24	239	307	211	309	587	461	391	358	286	262	285	435
25	232	294	213	458	466	419	370	350	252	241	266	356
26	223	287	214	629	445	396	352	388	239	229	247	313
27	215	284	215	501	418	374	335	365	236	218	236	286
28	208	298	217	420	392	361	324	338	232	206	226	267
29	203	285	218	375	---	368	337	319	280	198	219	257
30	201	275	219	346	---	461	321	302	281	197	204	250
31	201	---	230	327	---	435	---	287	---	191	195	---
TOTAL	5732	8577	7112	11160	10016	14646	12144	12646	7230	6585	7008	7910
MEAN	185	286	229	360	358	472	405	408	241	212	226	264
MAX	282	476	268	629	635	995	523	666	289	296	380	435
MIN	152	197	194	228	277	311	321	287	193	169	151	169
CFSM	.73	1.12	.90	1.41	1.40	1.85	1.59	1.60	.95	.83	.89	1.04
IN.	.84	1.25	1.04	1.63	1.46	2.14	1.77	1.84	1.05	.96	1.02	1.15

CAL YR 1989 TOTAL 99687 MEAN 273 MAX 713 MIN 147 CFSM 1.07 IN 14.54
WTR YR 1990 TOTAL 110766 MEAN 303 MAX 995 MIN 151 CFSM 1.19 IN 16.16

04102500 PAW PAW RIVER AT RIVERSIDE, MI

LOCATION.--Lat 42°11'10", long 86°22'06", in SW1/4 SE1/4 sec.23, T.3 S., R.18 W., Berrien County, Hydrologic Unit 04050001, on left bank 40 ft upstream from bridge on Coloma Road, 0.8 mi east of Riverside.

DRAINAGE AREA.--390 mi².

PERIOD OF RECORD.--October 1951 to current year.

REVISED RECORDS.--WSP 1337: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 588.80 ft above National Geodetic Vertical Datum of 1929. May 10, 1966, to July 11, 1967, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 15 to Jan. 3. Records good except for estimated daily discharges, which are fair. Diurnal fluctuation, principally during low flow, caused by paper mill upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--39 years, 453 ft³/s, 15.77 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,580 ft³/s, Oct. 4, 1986, gage height, 10.90 ft; minimum, 99 ft³/s, July 5, 1964, gage height, 2.66 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,590 ft³/s, Mar. 14, gage height, 9.02 ft; minimum, 241 ft³/s, Oct. 5; minimum gage height, 4.15 ft, Sept. 6.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	260	312	457	385	668	779	578	466	416	444	301	308
2	257	304	451	390	613	752	590	442	403	452	290	295
3	255	311	446	385	589	692	621	425	394	451	271	286
4	250	315	439	463	572	633	640	443	379	399	285	280
5	246	316	432	550	555	588	632	533	365	349	298	269
6	268	329	432	660	546	552	624	637	358	324	302	249
7	266	342	432	664	542	523	612	639	355	307	307	271
8	267	364	425	620	526	499	583	639	352	295	295	300
9	273	377	409	614	498	532	544	651	353	282	278	301
10	265	389	398	647	483	757	537	693	349	279	273	300
11	263	391	392	689	478	1080	564	698	347	267	261	288
12	266	388	392	657	468	1190	593	696	334	265	263	280
13	267	385	384	624	456	1200	594	664	322	267	283	281
14	270	379	381	595	443	1490	614	715	309	273	294	307
15	272	422	380	570	436	1510	675	736	312	277	302	398
16	272	520	370	545	438	1300	693	719	312	279	306	429
17	278	637	360	569	434	1100	667	793	298	279	291	453
18	277	640	355	675	436	938	657	859	290	277	289	443
19	280	607	350	746	443	821	645	836	285	272	307	425
20	299	615	350	712	443	725	628	830	290	320	339	404
21	330	656	345	707	431	658	663	842	319	386	401	400
22	364	664	345	722	444	629	753	837	346	418	470	431
23	377	634	350	707	548	645	719	784	391	450	484	453
24	376	601	350	651	707	688	685	705	425	462	476	502
25	373	580	355	623	749	661	676	633	425	452	498	508
26	369	563	355	675	645	640	662	583	419	433	532	478
27	359	538	355	738	669	634	622	554	401	392	516	441
28	332	508	360	718	737	618	564	525	360	340	435	396
29	324	485	360	728	---	594	516	497	380	321	379	361
30	332	468	370	748	---	582	492	475	422	314	353	352
31	329	---	380	732	---	580	---	449	---	307	331	---
TOTAL	9216	14040	11960	19509	14997	24590	18643	19998	10711	10633	10710	10889
MEAN	297	468	386	629	536	793	621	645	357	343	345	363
MAX	377	664	457	748	749	1510	753	859	425	462	532	508
MIN	246	304	345	385	431	499	492	425	285	265	261	249
CFSM	.76	1.20	.99	1.61	1.37	2.03	1.59	1.65	.92	.88	.89	.93
IN.	.88	1.34	1.14	1.86	1.43	2.35	1.78	1.91	1.02	1.01	1.02	1.04

CAL YR 1989 TOTAL 156905 MEAN 430 MAX 1330 MIN 246 CFSM 1.10 IN 14.97
WTR YR 1990 TOTAL 175896 MEAN 482 MAX 1510 MIN 246 CFSM 1.24 IN 16.78

04102700 SOUTH BRANCH BLACK RIVER NEAR BANGOR, MI

LOCATION.--Lat 42°21'15", long 86°11'15", in NW1/4 sec.28, T.1 S., R.16 W., Van Buren County, Hydrologic Unit 04050002, on left bank 50 ft upstream from bridge on 66th Street, 4.9 mi northwest of Bangor.

DRAINAGE AREA.--83.6 mi².

PERIOD OF RECORD.--June 1966 to current year. Prior to October 1981, published as Black River near Bangor.

REVISED RECORDS.--WDR MI-81: 1973-75(M), 1979(M).

GAGE.--Water-stage recorder. Elevation of gage is 610 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 9, 10, Dec. 13 to Jan. 4, Feb. 16-20, 25-27, and Mar. 2-5. Records good except for estimated daily discharges, which are fair. Occasional regulation caused by mills upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--24 years, 106 ft³/s, 17.22 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,860 ft³/s, Sept. 30, 1986, gage height, 13.63 ft; minimum, 20 ft³/s, Sept. 28, 1966, Aug. 18, 19, 1984; minimum gage height, 1.79 ft, Aug. 18, 19, 1984.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 400 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 11	1300	*814	*10.35	No other peak greater than base discharge.			

Minimum discharge, 29 ft³/s, Oct. 5, 9; minimum gage height, 2.23 ft, July 18, Aug. 12.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	36	36	91	60	106	131	132	78	69	57	41	43
2	36	35	85	70	115	120	159	71	67	50	39	40
3	33	36	82	85	123	120	181	66	64	45	36	38
4	30	37	79	100	113	115	154	103	59	42	38	37
5	30	38	77	189	102	105	130	288	57	39	43	35
6	33	45	77	189	103	100	115	273	56	37	40	35
7	32	49	76	149	105	94	105	183	53	35	37	40
8	31	54	71	126	101	93	97	132	54	35	36	39
9	30	51	68	120	98	193	94	105	54	33	35	38
10	31	50	65	165	96	423	119	140	51	33	33	35
11	32	49	61	172	93	761	166	188	49	35	32	34
12	32	49	59	151	90	727	155	161	47	35	33	33
13	31	47	58	124	89	578	129	167	46	33	42	32
14	31	47	57	108	87	427	148	204	43	33	41	39
15	31	94	55	99	83	321	193	163	44	33	37	62
16	30	185	54	101	84	252	162	194	42	34	35	67
17	31	192	52	216	85	190	152	301	41	34	34	63
18	32	157	51	345	84	150	143	340	39	32	36	54
19	32	128	50	284	83	131	120	251	37	32	44	51
20	36	130	49	197	82	117	114	226	38	102	49	50
21	46	162	48	159	81	109	214	236	41	139	77	52
22	49	146	48	147	100	116	220	181	41	106	107	74
23	45	116	47	134	235	206	162	139	48	121	94	85
24	42	98	47	131	283	192	131	116	50	102	79	106
25	40	87	47	173	200	152	113	103	45	81	67	89
26	39	81	47	293	180	129	100	106	41	66	59	72
27	38	80	47	275	160	113	94	103	39	57	61	61
28	37	107	48	208	146	102	90	94	40	51	82	55
29	38	114	49	162	---	98	93	89	64	47	66	51
30	37	101	50	132	---	131	85	82	68	46	54	50
31	36	---	51	115	---	140	---	74	---	44	47	---
TOTAL	1087	2601	1846	4979	3307	6636	4070	4957	1487	1669	1554	1560
MEAN	35.1	86.7	59.5	161	118	214	136	160	49.6	53.8	50.1	52.0
MAX	49	192	91	345	283	761	220	340	69	139	107	106
MIN	30	35	47	60	81	93	85	66	37	32	32	32
CFSM	.42	1.04	.71	1.93	1.41	2.56	1.63	1.91	.59	.64	.60	.62
IN.	.48	1.16	.82	2.22	1.47	2.95	1.81	2.21	.66	.74	.69	.69

CAL YR 1989 TOTAL 29765 MEAN 81.5 MAX 554 MIN 30 CFSM .98 IN 13.24
WTR YR 1990 TOTAL 35753 MEAN 98.0 MAX 761 MIN 30 CFSM 1.17 IN 15.91

STREAMS TRIBUTARY TO LAKE MICHIGAN

04103010 KALAMAZOO RIVER NEAR MARENGO, MI

LOCATION.--Lat 42°15'42", long 84°51'21", in SW1/4 SE1/4 sec.26, T.2 S., R.5 W., Calhoun County, Hydrologic Unit 04050003, on right bank at upstream side of bridge on B Drive North, 0.8 mi south of Marengo, and 5.0 mi west of Albion.

DRAINAGE AREA.--267 mi².

PERIOD OF RECORD.--October 1986 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 910 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 9 to Jan. 4, Feb. 25-27, and Sept. 10-30. Records good except for estimated daily discharges, which are fair. Some diversion by pumping for irrigation. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,160 ft³/s, June 3, 1989, gage height, 10.18 ft; minimum, 88 ft³/s, Aug. 19, 1987, gage height, 5.90 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 805 ft³/s, Mar. 12, gage height, 9.01 ft; minimum daily, 150 ft³/s, Dec. 25-27; minimum gage height, 6.39 ft, Dec. 15, result of freezeup.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	191	214	250	180	238	354	382	281	286	349	197	183
2	194	213	243	190	284	334	414	273	279	329	192	177
3	194	210	233	200	303	331	414	268	298	294	187	175
4	193	206	228	260	293	324	405	286	297	265	190	174
5	193	205	223	404	276	309	384	330	301	243	195	171
6	197	212	219	389	265	294	365	342	293	229	195	173
7	191	238	215	337	266	280	347	336	282	222	202	219
8	190	258	207	291	269	275	335	315	286	216	200	212
9	191	264	200	276	293	328	329	293	292	208	195	208
10	203	259	195	293	304	473	378	298	282	204	189	200
11	204	253	190	297	288	649	454	284	276	212	186	190
12	204	244	185	282	268	774	469	282	266	211	193	185
13	203	241	180	260	259	791	446	315	257	209	208	185
14	201	252	180	245	260	748	437	343	263	245	217	190
15	197	336	175	237	246	675	415	386	266	257	218	200
16	197	418	175	242	273	623	395	540	258	258	215	220
17	199	418	170	299	261	573	374	616	252	304	211	230
18	199	395	170	381	250	520	356	691	251	261	206	235
19	211	359	165	376	242	481	339	668	236	245	222	240
20	234	346	165	334	234	443	349	610	232	250	234	240
21	252	337	160	303	227	415	452	508	230	253	274	240
22	259	323	160	279	299	411	452	441	238	255	281	250
23	261	294	155	267	516	428	425	392	255	263	269	245
24	254	270	155	266	580	422	388	393	259	259	257	240
25	246	256	150	297	520	404	357	378	254	248	241	225
26	235	253	150	314	470	378	335	390	244	234	227	215
27	227	256	150	306	440	362	319	380	234	224	219	205
28	221	272	155	286	402	345	307	360	276	216	211	200
29	216	277	160	269	---	338	296	338	330	210	202	190
30	214	263	170	256	---	363	286	317	357	207	193	185
31	217	---	175	242	---	363	---	298	---	202	190	---
TOTAL	6588	8342	5708	8858	8826	13808	11404	11952	8130	7582	6616	6202
MEAN	213	278	184	286	315	445	380	386	271	245	213	207
MAX	261	418	250	404	580	791	469	691	357	349	281	250
MIN	190	205	150	180	227	275	286	268	230	202	186	171
CFSM	.80	1.04	.69	1.07	1.18	1.67	1.42	1.45	1.02	.92	.80	.78
IN.	.92	1.16	.80	1.23	1.23	1.92	1.59	1.67	1.13	1.06	.92	.86

CAL YR 1989 TOTAL 102750 MEAN 282 MAX 1140 MIN 150 CFSM 1.06 IN 14.32
WTR YR 1990 TOTAL 104016 MEAN 285 MAX 791 MIN 150 CFSM 1.07 IN 14.49

STREAMS TRIBUTARY TO LAKE MICHIGAN

04105000 BATTLE CREEK AT BATTLE CREEK, MI

LOCATION.--Lat 42°19'55", long 85°09'15", in NW1/4 sec.5, T.2 S., R.7 W., Calhoun County, Hydrologic Unit 04050003, on right bank 350 ft upstream from Emmett Street Bridge in Battle Creek, 3.0 mi upstream from mouth.

DRAINAGE AREA.--241 mi².

PERIOD OF RECORD.--October 1930 to September 1931, October 1932 to July 1933, January 1934 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1387: 1931, 1944. WSP 1507: 1956.

GAGE.--Water-stage recorder. Datum of gage is 823.24 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to May 14, 1951, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 20 to Jan. 2. Records good except for estimated daily discharges, which are fair. Occasional slight regulation prior to November 1943. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--57 years (water years 1931, 1935-90), 204 ft³/s, 11.50 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,640 ft³/s, Apr. 7, 1947, gage height, 4.48 ft, from floodmark; minimum, 22 ft³/s, Aug. 14, 1934; minimum gage height, about -0.5 ft in July 1936 and on Aug. 31, 1939, due to opening of gates at dam forming control.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,710 ft³/s, Mar. 13, gage height, 2.84 ft; minimum, 63 ft³/s, Aug. 10, 11, gage height, 0.63 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	88	105	208	105	312	485	286	231	220	160	93	79
2	85	115	206	110	285	461	308	214	196	135	78	69
3	84	113	195	112	262	411	331	199	181	117	74	67
4	85	109	173	137	249	349	359	201	176	104	76	67
5	85	107	174	175	241	357	383	234	170	94	84	69
6	87	108	153	199	239	291	377	270	163	89	91	69
7	89	112	131	228	239	266	351	286	158	85	87	96
8	91	115	130	282	244	293	320	276	156	77	79	110
9	87	135	140	347	270	289	294	251	146	77	81	118
10	91	143	131	346	301	341	293	228	137	82	70	113
11	93	142	121	314	323	562	296	211	132	80	69	102
12	96	141	119	284	330	1290	309	204	124	84	74	91
13	94	144	114	269	314	1670	343	216	117	90	81	80
14	95	145	119	253	289	1620	379	234	112	97	77	88
15	89	187	109	229	203	1380	377	254	110	107	78	114
16	79	254	109	220	226	1130	359	317	109	109	80	132
17	83	303	106	250	239	938	350	396	99	110	90	130
18	88	386	108	316	221	778	340	538	81	102	78	123
19	92	449	107	336	252	644	323	714	94	110	88	126
20	100	442	100	481	218	542	319	766	101	155	109	120
21	121	405	98	549	218	458	343	676	104	185	153	114
22	135	371	96	466	269	412	369	574	105	208	171	119
23	140	339	94	373	298	395	448	491	115	219	167	124
24	142	305	91	349	314	377	515	429	124	206	152	119
25	137	296	89	317	284	361	464	390	120	182	134	110
26	134	262	87	324	431	349	400	368	113	147	119	103
27	128	236	85	355	576	327	350	347	112	124	107	99
28	120	221	84	419	552	299	310	326	125	112	97	93
29	116	210	92	437	---	280	278	302	151	104	90	85
30	114	208	98	387	---	279	251	274	165	94	84	82
31	112	---	100	361	---	279	---	247	---	87	77	---
TOTAL	3180	6608	3767	9330	8199	17913	10425	10664	4016	3732	2988	3011
MEAN	103	220	122	301	293	578	348	344	134	120	96.4	100
MAX	142	449	208	549	576	1670	515	766	220	219	171	132
MIN	79	105	84	105	203	266	251	199	81	77	69	67
CFSM	.43	.91	.51	1.25	1.22	2.40	1.44	1.43	.56	.50	.40	.42
IN.	.49	1.02	.58	1.44	1.27	2.76	1.61	1.65	.62	.58	.46	.46

CAL YR 1989 TOTAL 82719 MEAN 227 MAX 1600 MIN 71 CFSM .94 IN 12.77
WTR YR 1990 TOTAL 83833 MEAN 230 MAX 1670 MIN 67 CFSM .95 IN 12.94

04105500 KALAMAZOO RIVER NEAR BATTLE CREEK, MI

LOCATION.--Lat 42°19'26", long 85°11'51", in SW1/4 sec.1, T.2 S., R.8 W., Calhoun County, Hydrologic Unit 04050003, on left bank 20 ft upstream from bridge on Kendall Street in Battle Creek.

DRAINAGE AREA.--824 mi².

PERIOD OF RECORD.--July 1937 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 924: 1938-39. WSP 1387: 1938, 1945-46, 1948.

GAGE.--Water-stage recorder. Elevation of gage is 815 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to Oct. 1, 1957, water-stage recorder at site 4.7 mi downstream at different datum. Oct. 1, 1957, to June 15, 1959, nonrecording gage at bridge 1,800 ft upstream at different datum. June 16, 1959, to Oct. 13, 1960, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records good. Diurnal fluctuation below 1,500 ft³/s caused by powerplants upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--53 years, 674 ft³/s, 11.11 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,290 ft³/s, Apr. 7, 1947, gage height, 9.13 ft, site and datum then in use; minimum, 50 ft³/s, Sept. 22, 1939, site then in use; minimum daily, 86 ft³/s, Aug. 5, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,590 ft³/s, Mar. 13, gage height, 6.32 ft; minimum, 283 ft³/s, Sept. 5, gage height, 3.05 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	450	550	711	527	855	1380	1040	808	822	876	475	474
2	455	543	687	554	935	1290	1150	768	795	779	458	459
3	432	541	689	557	907	1180	1200	741	791	754	447	416
4	460	518	654	751	879	1110	1220	831	791	663	455	394
5	447	511	649	889	848	1070	1220	912	767	599	457	374
6	444	508	595	954	818	944	1190	952	751	572	460	410
7	448	606	591	930	806	872	1100	949	735	545	468	552
8	436	727	535	895	807	924	982	917	712	525	457	508
9	414	655	518	971	864	995	985	855	682	500	440	499
10	474	652	579	969	952	1280	1040	832	668	538	438	510
11	475	646	548	926	965	1860	1190	846	660	508	398	481
12	467	631	516	881	911	2820	1250	809	638	547	489	453
13	490	610	451	833	877	3500	1270	915	586	503	506	447
14	463	645	471	780	869	3460	1300	972	587	579	514	463
15	464	928	416	749	702	3100	1280	1040	615	626	493	484
16	466	1150	418	742	821	2660	1230	1420	563	648	468	554
17	467	1230	467	893	805	2280	1180	1800	568	720	509	585
18	473	1250	488	1150	766	2020	1130	2030	526	679	481	581
19	476	1270	493	1200	767	1810	1040	2180	545	678	551	602
20	551	1220	483	1270	814	1580	1100	2160	561	822	617	594
21	575	1170	443	1280	622	1390	1330	1970	546	841	759	581
22	597	1050	445	1150	941	1300	1420	1700	587	839	811	609
23	606	951	446	984	1250	1300	1460	1490	618	813	783	631
24	616	848	500	949	1440	1260	1510	1340	624	751	729	618
25	624	830	457	1010	1310	1190	1400	1300	620	699	657	582
26	614	774	453	1070	1460	1140	1240	1280	599	647	614	550
27	589	765	445	1060	1650	1050	1130	1200	621	603	582	521
28	571	747	442	1100	1540	1000	1030	1130	828	535	547	508
29	538	751	459	1080	---	939	943	1040	934	504	524	491
30	509	742	490	995	---	1010	869	937	936	492	504	483
31	588	---	503	946	---	1000	---	891	---	471	488	---
TOTAL	15679	24019	16042	29045	27181	48714	35429	37015	20276	19856	16579	15414
MEAN	506	801	517	937	971	1571	1181	1194	676	641	535	514
MAX	624	1270	711	1280	1650	3500	1510	2180	936	876	811	631
MIN	414	508	416	527	622	872	869	741	526	471	398	374
CFSM	.61	.97	.63	1.14	1.18	1.91	1.43	1.45	.82	.78	.65	.62
IN.	.71	1.08	.72	1.31	1.23	2.20	1.60	1.67	.92	.90	.75	.70

CAL YR 1989 TOTAL 297632 MEAN 815 MAX 4130 MIN 414 CFSM .99 IN 13.44
WTR YR 1990 TOTAL 305249 MEAN 836 MAX 3500 MIN 374 CFSM 1.02 IN 13.78

04105700 AUGUSTA CREEK NEAR AUGUSTA, MI

LOCATION.--Lat 42°21'12", long 85°21'14", in SW1/4 sec.27, T.1 S., R.9 W., Kalamazoo County, Hydrologic Unit 04050003, on left bank 15 ft downstream from bridge on EF Road, 1.3 mi north of Augusta.

DRAINAGE AREA.--38.9 mi².

PERIOD OF RECORD.--October 1964 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 815 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to June 15, 1965, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 8-17, Dec. 22 to Jan. 2, Aug. 26, and Sept. 1, 4, 12. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--26 years, 44.3 ft³/s, 15.47 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 560 ft³/s, June 27, 1978, gage height, 3.41 ft; minimum, 8.9 ft³/s, Jan. 26, 1978, result of freezeup; minimum gage height, 0.65 ft, Jan. 19, 1970.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 118 ft³/s, Mar. 11, gage height, 2.18 ft; minimum, 17 ft³/s, Dec. 13, 14; minimum gage height, 0.74 ft, Dec. 14, result of freezeup.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	32	36	44	35	47	49	60	39	39	62	28	28
2	32	37	43	37	54	50	67	38	39	52	27	27
3	32	41	42	38	49	51	68	38	38	44	27	27
4	31	41	41	55	46	48	64	51	37	39	31	27
5	32	39	41	62	45	47	59	65	36	36	38	26
6	35	39	41	52	46	44	55	58	36	34	35	27
7	34	40	39	46	46	43	52	52	35	32	33	52
8	34	48	36	44	48	45	50	47	36	30	30	44
9	33	45	36	44	56	61	49	41	37	29	29	40
10	35	44	38	46	55	83	60	46	35	29	28	37
11	35	44	37	44	50	110	65	48	34	31	27	34
12	34	43	35	42	47	117	61	47	34	31	29	31
13	34	42	33	41	46	113	57	57	33	29	34	28
14	33	41	34	40	47	105	60	55	34	31	31	32
15	33	56	35	39	41	94	60	62	31	32	33	45
16	34	89	38	42	53	85	57	87	27	31	33	46
17	35	85	35	64	49	76	59	91	26	31	31	42
18	35	77	35	73	45	69	55	85	28	31	31	47
19	36	69	35	64	48	63	52	73	32	32	40	47
20	43	67	35	54	42	59	55	70	33	44	47	43
21	46	66	35	49	44	56	68	65	35	47	65	43
22	45	60	35	46	59	60	63	58	36	49	65	47
23	43	54	34	44	74	66	58	53	47	49	56	45
24	41	50	34	47	70	62	54	54	48	43	50	42
25	39	48	34	62	59	58	50	57	45	38	45	40
26	38	49	34	72	58	55	47	56	40	35	40	38
27	37	49	34	62	56	52	45	52	39	33	35	36
28	36	58	33	56	51	50	43	48	59	31	33	35
29	36	56	34	61	---	51	41	45	72	29	31	35
30	35	52	34	57	---	61	40	43	70	30	30	35
31	36	---	35	50	---	60	---	41	---	30	29	---
TOTAL	1114	1565	1129	1568	1431	2043	1674	1722	1171	1124	1121	1126
MEAN	35.9	52.2	36.4	50.6	51.1	65.9	55.8	55.5	39.0	36.3	36.2	37.5
MAX	46	89	44	73	74	117	68	91	72	62	65	52
MIN	31	36	33	35	41	43	40	38	26	29	27	26
CFSM	.92	1.34	.94	1.30	1.31	1.69	1.43	1.43	1.00	.93	.93	.96
IN.	1.07	1.50	1.08	1.50	1.37	1.95	1.60	1.65	1.12	1.07	1.07	1.08

CAL YR 1989 TOTAL 17118 MEAN 46.9 MAX 201 MIN 28 CFSM 1.21 IN 16.37
WTR YR 1990 TOTAL 16788 MEAN 46.0 MAX 117 MIN 26 CFSM 1.18 IN 16.05

04106000 KALAMAZOO RIVER AT COMSTOCK, MI

LOCATION.--Lat 42°17'08", long 85°30'50", in NE1/4 sec.19, T.2 S., R.10 W., Kalamazoo County, Hydrologic Unit 04050003, on left bank at downstream side of bridge on River Street in Comstock, 0.2 mi downstream from Comstock Creek.

DRAINAGE AREA.--1,010 mi², approximately.

PERIOD OF RECORD.--April to August 1931, October 1932 to December 1979, October 1984 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 824: 1933-36. WSP 1387: 1933, 1934(M), 1935, 1936(M), 1938(M), 1940(M), 1941.

GAGE.--Water-stage recorder. Datum of gage is 756.12 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1987, at datum 3.00 ft higher. Prior to November 1945, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by powerplant 1.2 mi upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--53 years (water years 1933-79, 1985-90), 872 ft³/s, 11.72 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,910 ft³/s, Apr. 8, 1947, gage height, 7.94 ft, datum then in use; minimum, 119 ft³/s, May 29, 1958; minimum gage height, 0.09 ft, May 29, 1958, May 23, 1987, datum then in use; minimum daily discharge, 185 ft³/s, Aug. 7, 1934.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,390 ft³/s, Mar. 15, gage height, 8.79 ft; minimum daily, 359 ft³/s, Sept. 4.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	633	737	1050	723	1200	1800	1370	1110	1100	1230	579	595
2	658	715	1030	800	1100	1630	1410	1040	1040	1120	642	637
3	648	737	1020	818	1270	1510	1530	1000	1010	1020	666	660
4	643	737	995	887	1260	1440	1520	1030	1000	992	626	359
5	642	664	883	999	1160	1360	1530	1150	989	889	605	549
6	658	655	988	1090	1140	1350	1490	1280	987	790	644	712
7	647	823	906	1320	1100	1210	1430	1240	979	716	670	801
8	659	829	806	1190	1110	1130	1400	1200	889	597	598	853
9	647	906	723	1160	1120	1250	1280	1230	877	750	634	588
10	667	907	807	1200	1190	1480	1280	1180	962	598	595	711
11	647	892	801	1290	1270	1830	1400	1140	814	731	580	716
12	735	822	809	1200	1280	2270	1520	1140	740	641	607	634
13	625	811	592	1130	1180	2770	1550	1150	874	668	640	636
14	650	898	640	1070	1150	3690	1550	1200	808	651	799	593
15	662	1040	610	1040	1160	3970	1580	1310	716	730	591	661
16	649	1430	506	1010	1100	3500	1540	1670	798	641	643	727
17	730	1520	511	1080	1080	2910	1500	1910	710	718	654	866
18	659	1540	811	1360	1120	2570	1460	2090	710	822	631	804
19	648	1540	746	1450	1080	2290	1370	2260	659	836	724	779
20	737	1520	645	1500	1030	1980	1320	2260	715	1030	866	779
21	809	1550	661	1510	1070	1870	1470	2290	772	1190	986	787
22	792	1460	572	1500	1090	1760	1690	2210	715	1080	983	793
23	838	1320	610	1370	1450	1650	1660	1950	845	1030	982	830
24	914	1260	683	1270	1640	1600	1660	1700	814	960	981	809
25	874	1150	686	1280	1600	1530	1690	1540	818	1090	968	723
26	769	1100	690	1410	1540	1490	1580	1480	806	1020	899	783
27	732	1080	614	1360	1740	1450	1410	1530	798	963	794	669
28	757	1040	585	1410	1850	1390	1290	1470	873	794	695	640
29	751	1050	643	1370	---	1310	1220	1330	1020	723	656	667
30	735	1050	639	1360	---	1300	1160	1240	1160	723	666	597
31	737	---	723	1280	---	1380	---	1150	---	591	638	---
TOTAL	21952	31783	22985	37437	35080	58670	43860	45480	25998	26334	22242	20958
MEAN	708	1059	741	1208	1253	1893	1462	1467	867	849	717	699
MAX	914	1550	1050	1510	1850	3970	1690	2290	1160	1230	986	866
MIN	625	655	506	723	1030	1130	1160	1000	659	591	579	359
CFSM	.70	1.05	.73	1.20	1.24	1.87	1.45	1.45	.86	.84	.71	.69
IN.	.81	1.17	.85	1.38	1.29	2.16	1.62	1.68	.96	.97	.82	.77

CAL YR 1989 TOTAL 393687 MEAN 1079 MAX 4720 MIN 506 CFSM 1.07 IN 14.50
WTR YR 1990 TOTAL 392779 MEAN 1076 MAX 3970 MIN 359 CFSM 1.07 IN 14.47

STREAMS TRIBUTARY TO LAKE MICHIGAN

04106180 PORTAGE CREEK AT PORTAGE, MI

LOCATION.--Lat 42°12'21", long 85°35'23", in SE1/4 sec.16, T.3 S., R.11 W., Kalamazoo County, Hydrologic Unit 04050003, on right bank 750 ft upstream from bridge on Westnedge Avenue in Portage.

DRAINAGE AREA.--16.5 mi².

PERIOD OF RECORD.--October 1982 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 22-24. Records fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--8 years, 18.7 ft³/s, 15.39 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 118 ft³/s, May 31, 1989, gage height, 3.87 ft; minimum daily, 10 ft³/s, Sept. 15, 1988; minimum gage height, 1.79 ft, June 8, 9, 10, 16, 17, 18, 19, 1987.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 49 ft³/s, July 19, gage height, 3.05 ft, from graph based on gage readings; minimum daily, 14 ft³/s, on many days during the year.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	15	16	16	15	16	16	20	17	17	17	15	16
2	15	16	17	14	20	16	21	17	17	16	15	15
3	14	16	17	15	18	16	20	17	17	15	14	15
4	14	16	17	21	17	16	18	24	17	15	16	15
5	14	16	16	20	16	15	18	24	17	15	16	14
6	15	16	16	18	16	15	17	21	17	14	15	15
7	14	19	16	17	16	15	17	20	17	15	15	17
8	14	18	16	16	16	16	16	18	17	14	15	16
9	14	17	15	16	17	20	16	18	17	14	14	15
10	15	17	16	18	16	26	21	21	16	14	14	15
11	15	17	15	17	15	32	21	21	16	15	14	15
12	15	17	15	16	15	30	19	20	16	15	16	15
13	15	16	15	16	15	24	18	24	16	14	16	15
14	14	18	15	15	15	21	20	22	16	15	15	18
15	14	25	16	15	17	20	19	24	16	15	15	19
16	15	26	16	16	16	20	18	33	15	15	14	19
17	15	22	16	23	15	19	18	30	15	16	14	17
18	15	20	16	23	15	18	17	24	16	15	16	17
19	17	19	16	20	15	18	17	21	16	18	21	18
20	19	21	16	18	14	18	19	22	16	25	22	17
21	21	21	16	17	14	17	23	21	17	20	27	19
22	19	19	16	16	22	19	20	20	17	22	24	20
23	18	18	15	16	25	21	18	19	18	19	20	19
24	17	18	15	16	21	19	17	19	17	17	19	18
25	17	18	15	21	19	18	17	19	16	16	18	17
26	17	18	15	21	17	17	16	20	16	16	18	16
27	16	18	15	19	17	16	15	19	16	15	17	16
28	16	18	14	18	16	16	16	18	18	15	17	16
29	16	17	15	17	---	17	17	18	20	16	17	16
30	16	17	15	16	---	20	17	17	18	16	16	16
31	16	---	15	15	---	19	---	17	---	15	16	---
TOTAL	487	550	484	541	471	590	546	645	500	499	521	496
MEAN	15.7	18.3	15.6	17.5	16.8	19.0	18.2	20.8	16.7	16.1	16.8	16.5
MAX	21	26	17	23	25	32	23	33	20	25	27	20
MIN	14	16	14	14	14	15	15	17	15	14	14	14
CFSM	.95	1.11	.95	1.06	1.02	1.15	1.10	1.26	1.01	.98	1.02	1.00
IN.	1.10	1.24	1.09	1.22	1.06	1.33	1.23	1.45	1.13	1.12	1.17	1.12

CAL YR 1989 TOTAL 7055 MEAN 19.3 MAX 83 MIN 14 CFSM 1.17 IN 15.90
WTR YR 1990 TOTAL 6330 MEAN 17.3 MAX 33 MIN 14 CFSM 1.05 IN 14.27

STREAMS TRIBUTARY TO LAKE MICHIGAN

04106300 PORTAGE CREEK NEAR KALAMAZOO, MI

LOCATION.--Lat 42°14'46", long 85°34'33", in SE1/4 sec.34, T.2 S., R.11 W., Kalamazoo County, Hydrologic Unit 04050003, on left bank 5 ft upstream from bridge on Lovers Lane, 3.0 mi south of Kalamazoo.

DRAINAGE AREA.--22.4 mi^2.

PERIOD OF RECORD.--October 1964 to current year.

GAGE.--Water-stage recorder. Datum of gage is 814.88 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 22 and Aug. 19 to Sept. 4. Records good except for estimated daily discharges, which are poor. Flow includes water which is pumped from ground-water sources by industry and discharged into stream 2.0 mi upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--26 years, 40.6 ft^3/s, 24.61 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 407 ft^3/s, May 30, 1989, gage height, 3.09 ft; maximum gage height, 4.49 ft, June 26, 1978; minimum discharge, 8.0 ft^3/s, Jan. 19, 1965, gage height, 0.88 ft, result of bridge construction upstream.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 137 ft^3/s, May 15, gage height, 1.89 ft; maximum gage height, 1.92 ft, July 20; minimum daily discharge, 23 ft^3/s, Dec. 17.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	28	33	31	24	43	31	52	45	41	42	43	33
2	27	34	33	27	52	29	57	46	42	43	47	32
3	28	33	31	29	45	27	49	44	38	43	47	30
4	28	31	33	56	41	25	46	74	41	41	51	35
5	29	30	32	37	43	26	45	55	42	44	48	36
6	29	32	32	32	44	24	45	44	42	45	46	37
7	25	41	30	29	43	24	45	45	41	42	44	46
8	24	33	29	29	43	29	46	44	42	44	45	35
9	24	31	29	33	43	41	51	43	42	48	43	34
10	27	32	27	32	41	58	71	62	38	51	43	35
11	27	35	29	31	40	66	57	51	40	50	42	36
12	31	31	28	30	39	62	52	49	40	48	47	34
13	27	31	29	29	39	48	52	60	44	49	50	34
14	28	37	30	28	39	43	58	50	48	49	43	48
15	24	64	30	29	40	40	50	72	44	49	43	40
16	27	54	25	31	40	38	51	90	40	52	46	44
17	31	40	23	46	37	35	55	79	39	66	46	37
18	32	36	24	39	38	34	51	59	43	47	41	34
19	35	33	25	33	39	37	50	53	39	59	40	40
20	39	38	27	30	37	43	62	56	44	86	45	35
21	41	35	24	30	38	44	65	50	44	52	50	49
22	34	31	29	28	76	57	52	47	51	60	42	41
23	31	29	29	28	65	52	52	48	45	51	41	38
24	29	32	28	28	53	46	52	47	38	47	41	36
25	30	32	29	47	45	43	54	49	41	49	38	35
26	31	33	29	36	44	46	52	50	43	48	37	33
27	33	34	26	33	37	45	50	43	44	49	37	31
28	32	32	26	28	28	46	49	42	53	42	39	32
29	29	30	27	28	---	49	45	42	63	44	41	29
30	31	32	25	26	---	57	46	41	44	47	37	28
31	32	---	26	31	---	48	---	42	---	45	34	---
TOTAL	923	1049	875	997	1212	1293	1562	1622	1296	1532	1337	1087
MEAN	29.8	35.0	28.2	32.2	43.3	41.7	52.1	52.3	43.2	49.4	43.1	36.2
MAX	41	64	33	56	76	66	71	90	63	86	51	49
MIN	24	29	23	24	28	24	45	41	38	41	34	28

CAL YR 1989 TOTAL 15997 MEAN 43.8 MAX 257 MIN 23
WTR YR 1990 TOTAL 14785 MEAN 40.5 MAX 90 MIN 23

04106320 WEST FORK PORTAGE CREEK NEAR OSHTEMO, MI

LOCATION.--Lat 42°14'07", long 85°38'54", in SE1/4 sec.1, T.3 S., R.12 W., Kalamazoo County, Hydrologic Unit 04050003, on right bank at upstream side of culvert on 12th Street, 2.1 mi southeast of Oshtemo.

DRAINAGE AREA.--13.0 mi².

PERIOD OF RECORD.--May 1972 to current year.

GAGE.--Water-stage recorder. Datum of gage is 868.86 ft, Kalamazoo County Road Commission datum.

REMARKS.--Estimated daily discharges: Dec. 14-29 and Jan. 1-3. Records good except for estimated daily discharges, which are fair. At times, flow is affected by ground-water withdrawals. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--18 years, 6.46 ft³/s, 6.75 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 26 ft³/s, Aug. 31, 1975, gage height, 2.15 ft; minimum, 0.38 ft³/s, July 14, 15, 1988, gage height, 0.89 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 12 ft³/s, Nov. 16, 17, gage height, 1.58 ft; minimum, 2.2 ft³/s, June 19, 20, gage height, 1.02 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.5	5.0	6.7	5.3	5.8	6.1	7.0	3.2	2.9	3.7	3.0	5.0
2	4.6	5.0	6.7	5.6	6.5	6.0	7.7	3.1	2.9	3.5	2.8	5.1
3	4.5	5.1	6.6	6.0	6.6	5.9	7.5	3.1	2.9	3.3	2.8	5.1
4	4.2	5.0	6.4	6.5	6.4	5.7	6.9	4.0	2.7	3.2	3.0	5.0
5	4.2	5.1	6.4	7.1	6.2	5.5	6.6	5.3	2.7	3.0	3.0	4.8
6	4.3	5.3	6.4	6.8	6.0	5.3	6.1	5.3	2.7	2.9	2.9	4.9
7	4.3	5.9	6.3	6.5	5.9	5.1	5.8	4.9	2.7	2.8	2.8	5.3
8	4.3	6.1	6.2	6.1	5.9	5.3	5.4	4.4	2.8	2.7	2.8	5.4
9	4.3	6.1	6.0	5.9	6.0	5.9	5.3	4.0	2.8	2.6	2.8	5.7
10	4.6	6.1	5.9	6.0	5.9	6.8	5.9	4.6	2.8	2.7	2.8	5.5
11	4.6	6.1	5.9	5.9	5.7	8.0	6.6	4.7	2.8	2.6	2.8	5.3
12	4.7	6.0	5.9	5.5	5.7	9.0	6.6	4.5	2.8	2.6	2.9	5.2
13	4.5	5.9	5.7	5.4	5.7	8.8	6.4	5.1	2.8	2.5	3.0	5.2
14	4.5	6.1	5.6	5.4	5.5	8.2	6.7	5.0	2.7	2.6	2.9	5.9
15	4.5	8.7	5.5	5.2	5.9	7.4	6.7	5.2	2.6	2.7	2.8	6.4
16	4.5	12	5.4	5.3	6.1	6.8	6.0	6.1	2.6	2.6	2.8	7.3
17	4.5	12	5.4	6.4	6.0	6.2	5.9	6.6	2.5	2.8	2.8	7.1
18	4.5	11	5.3	7.0	5.9	5.7	5.6	6.0	2.5	2.8	2.8	6.8
19	4.7	10	5.3	6.6	5.9	5.4	5.3	5.4	2.3	3.4	3.6	6.8
20	5.4	10	5.3	6.3	5.7	5.4	5.2	5.1	2.4	5.2	4.3	6.5
21	5.9	9.5	5.2	6.2	5.5	5.4	6.0	4.6	2.5	6.4	5.8	6.6
22	5.7	8.9	5.2	5.9	6.5	5.7	5.8	4.2	2.6	7.1	6.4	6.8
23	5.7	8.4	5.2	5.6	8.1	6.0	5.4	3.8	2.9	6.9	6.4	6.6
24	5.6	8.0	5.2	5.7	8.1	5.9	5.0	3.6	2.9	6.2	6.0	6.3
25	5.4	7.8	5.2	6.6	7.5	7.7	4.8	3.5	2.8	5.5	5.6	5.9
26	5.2	7.6	5.1	6.9	6.9	8.3	4.4	3.6	2.8	5.0	5.3	5.6
27	5.1	7.5	5.1	6.6	6.5	7.6	4.0	3.5	2.8	4.5	5.3	5.1
28	5.1	7.5	5.1	6.2	6.2	6.7	3.7	3.3	3.0	4.2	5.2	4.9
29	5.1	7.2	5.1	6.0	---	6.2	3.5	3.2	3.5	3.9	5.1	4.7
30	5.1	6.8	5.2	5.9	---	6.8	3.3	3.1	3.7	3.6	5.0	4.7
31	5.1	---	5.2	5.9	---	6.8	---	3.0	---	3.3	5.0	---
TOTAL	149.2	221.7	175.7	188.3	174.6	201.6	171.1	135.0	83.4	116.8	120.5	171.5
MEAN	4.81	7.39	5.67	6.07	6.24	6.50	5.70	4.35	2.78	3.77	3.89	5.72
MAX	5.9	12	6.7	7.1	8.1	9.0	7.7	6.6	3.7	7.1	6.4	7.3
MIN	4.2	5.0	5.1	5.2	5.5	5.1	3.3	3.0	2.3	2.5	2.8	4.7
CFSM	.37	.57	.44	.47	.48	.50	.44	.34	.21	.29	.30	.44
IN.	.43	.63	.50	.54	.50	.58	.49	.39	.24	.33	.34	.49

CAL YR 1989 TOTAL 2061.6 MEAN 5.65 MAX 17 MIN 3.1 CFSM .44 IN 5.90
WTR YR 1990 TOTAL 1909.4 MEAN 5.23 MAX 12 MIN 2.3 CFSM .40 IN 5.46

STREAMS TRIBUTARY TO LAKE MICHIGAN

04106400 WEST FORK PORTAGE CREEK AT KALAMAZOO, MI

LOCATION.--Lat 42°14'40", long 85°36'50", in NE1/4 sec.5, T.3 S., R.11 W., Kalamazoo County, Hydrologic Unit 04050003, on right bank 30 ft upstream from culvert on Oakland Drive, 2.5 mi upstream from mouth, and 3.7 mi southwest of main business district of Kalamazoo.

DRAINAGE AREA.--18.7 mi².

PERIOD OF RECORD.--September 1959 to current year.

GAGE.--Water-stage recorder and V-notch sharp-crested weir. Datum of gage is 858.09 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources).

REMARKS.--Estimated daily discharges: Dec. 12 to Jan. 15, Jan. 21, and Feb. 15 to Mar. 7. Records good except for estimated daily discharges, which are fair. At times, flow is affected by ground-water withdrawals. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--31 years, 9.67 ft³/s, 7.02 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 41 ft³/s, Apr. 19, 1975, gage height, 3.32 ft; minimum, 0.91 ft³/s, June 19, 20, 1988; minimum gage height, 0.88 ft, July 30, 1963, caused by construction.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 18 ft³/s, Nov. 15, 16, gage height, 2.76 ft; minimum, 3.9 ft³/s, June 19, 20, July 13, gage height, 2.29 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	7.3	8.4	9.0	7.7	8.8	9.2	11	7.4	5.7	6.5	5.4	6.4
2	7.4	8.2	9.4	8.0	11	9.1	14	7.0	5.6	6.1	5.0	6.3
3	7.7	8.1	9.4	9.0	10	9.0	12	6.6	5.6	5.7	4.8	6.4
4	7.5	8.1	9.2	9.9	9.9	8.9	11	9.1	5.2	5.3	5.2	6.5
5	7.5	8.0	9.0	11	9.5	8.7	10	11	4.8	5.1	5.6	6.4
6	7.8	7.8	8.9	10	9.3	8.5	9.6	9.8	4.6	4.9	5.5	6.3
7	7.6	8.9	8.7	9.7	9.1	8.4	9.0	9.1	4.5	4.6	5.2	7.5
8	7.3	9.3	8.4	9.3	9.1	8.5	8.5	8.4	4.6	4.4	5.0	7.1
9	7.1	9.2	8.3	9.2	9.7	10	8.3	7.8	4.9	4.3	4.8	6.8
10	7.3	9.1	8.4	10	9.4	13	10	9.8	4.8	4.3	4.8	6.6
11	7.3	9.0	8.2	9.5	9.0	16	11	10	4.7	4.3	4.7	6.4
12	7.3	9.0	8.0	9.2	8.7	16	9.8	9.1	4.9	4.3	5.0	6.3
13	7.3	8.7	7.7	9.0	8.6	15	9.4	11	4.8	4.1	5.8	6.1
14	7.2	9.1	7.4	8.7	7.9	14	11	10	4.7	4.1	5.5	7.0
15	6.8	15	7.3	8.4	9.0	13	11	10	4.7	4.3	5.3	8.3
16	7.2	18	7.2	9.3	9.5	12	9.8	13	4.5	4.3	5.0	9.1
17	7.4	16	7.2	13	9.3	11	10	14	4.4	4.3	4.8	8.6
18	7.5	15	7.1	13	9.2	10	8.8	13	4.2	4.3	4.9	8.1
19	7.9	14	7.1	12	9.0	9.3	8.3	11	4.0	5.6	6.5	8.2
20	9.3	14	7.1	11	8.8	8.9	9.1	11	4.2	11	8.1	7.7
21	10	13	7.0	10	8.6	8.6	12	9.6	4.8	11	11	7.9
22	9.8	12	7.0	9.7	10	9.8	11	8.7	4.8	11	12	8.7
23	9.4	11	7.0	9.2	14	11	11	8.0	5.5	11	11	8.0
24	9.2	11	7.0	9.2	12	9.8	12	7.5	5.5	9.5	9.5	7.4
25	9.0	10	6.9	12	11	9.5	11	7.4	5.2	8.4	8.7	6.9
26	8.7	10	6.9	12	10	10	11	8.0	4.9	7.5	8.1	6.6
27	8.4	10	6.8	11	9.6	11	10	7.6	4.8	6.9	7.6	6.5
28	8.4	10	6.8	10	9.3	10	9.6	7.0	5.3	6.6	7.5	6.4
29	8.4	9.8	6.9	9.4	---	10	8.7	6.6	7.0	6.4	7.2	6.3
30	8.2	9.5	7.1	9.0	---	12	7.9	6.2	7.0	6.2	6.9	6.2
31	8.2	---	7.4	8.8	---	11	---	5.9	---	5.9	6.7	---
TOTAL	247.4	319.2	239.8	307.2	269.3	331.2	305.8	280.6	150.2	192.2	203.1	213.0
MEAN	7.98	10.6	7.74	9.91	9.62	10.7	10.2	9.05	5.01	6.20	6.55	7.10
MAX	10	18	9.4	13	14	16	14	14	7.0	11	12	9.1
MIN	6.8	7.8	6.8	7.7	7.9	8.4	7.9	5.9	4.0	4.1	4.7	6.1
CFSM	.43	.57	.41	.53	.51	.57	.55	.48	.27	.33	.35	.38
IN.	.49	.63	.48	.61	.54	.66	.61	.56	.30	.38	.40	.42

CAL YR 1989 TOTAL 3258.9 MEAN 8.93 MAX 37 MIN 5.4 CFSM .48 IN 6.48
WTR YR 1990 TOTAL 3059.0 MEAN 8.38 MAX 18 MIN 4.0 CFSM .45 IN 6.08

STREAMS TRIBUTARY TO LAKE MICHIGAN

04108500 KALAMAZOO RIVER NEAR FENNVILLE, MI
(National stream quality accounting network station)

LOCATION.--Lat 42°35'36", long 85°59'03", in NE1/4 sec.5, T.2 N., R.14 W., Allegan County, Hydrologic Unit 04050003, on left bank 40 ft upstream from bridge on State Highway 89, 2.1 mi downstream from Swan Creek, 4.0 mi downstream from Calkins Dam, and 6.1 mi east of Fennville.

DRAINAGE AREA.--1,600 mi², approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April 1929 to September 1936, October 1937 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as "near Allegan" April 1929 to September 1932; as "at Calkins Bridge, near Allegan" October 1932 to September 1936, and October 1937 to September 1938; as "at Calkins Dam, near Allegan" October 1938 to September 1950.

REVISED RECORDS.--WSP 1387: 1929(M), 1930, 1933, 1934-36(M), 1938(M), 1939-40, 1942.

GAGE.--Water-stage recorder. Datum of gage is 586.51 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). April 1929 to September 1936 at bridge and October 1937 to September 1950 in powerplant, 4.0 mi upstream at NGVD (levels by City of Allegan).

REMARKS.--Estimated daily discharges: Dec. 22-29. Water-discharge records good except for estimated daily discharges, which are fair. Flow regulated at low and medium stages by powerplants upstream from station and since June 1936 by Calkins Dam and powerplant, 4.0 mi upstream from station.

AVERAGE DISCHARGE.--60 years, 1,455 ft³/s, 12.35 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 17,500 ft³/s, Apr. 11, 1947, gage height, 606.76 ft, site and datum then in use; minimum daily, 50 ft³/s, Aug. 19, 1976, caused by shutting off flow at Calkins Dam.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,960 ft³/s, Mar. 16, gage height, 12.09 ft; minimum daily, 714 ft³/s, Sept. 6.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1130	1250	1850	1350	2020	2640	2140	1770	1740	1870	1260	1040
2	1030	872	1560	1350	2030	2520	2300	1720	1650	1670	1020	1010
3	969	1100	1640	1490	1850	2390	2540	1670	1600	1670	895	1000
4	972	1120	1920	1670	1840	2490	2250	1710	1570	1410	1150	950
5	896	1100	1770	1630	2000	2120	2340	2050	1370	1470	1180	910
6	901	1410	1570	2160	2100	2090	2320	2280	1360	1450	1160	714
7	963	1370	1460	1770	1660	1940	2210	2090	1530	1160	1150	1220
8	999	1030	1760	1720	1980	1890	2200	1850	1600	1150	728	1290
9	1010	1080	1460	2000	1990	2070	2080	1970	1660	1110	964	1200
10	1020	1530	1190	2000	1670	2370	2040	2040	1370	1040	929	1160
11	1010	1440	1350	1820	1500	3540	2290	2150	1190	1050	922	829
12	1150	1380	1570	2000	1940	3970	2200	1990	1440	1100	1030	949
13	1100	1200	1250	1990	1990	4130	2330	1900	1390	1100	1250	1110
14	1050	1380	1380	1810	1920	3770	2320	2150	1120	1050	1020	1130
15	949	1480	1060	1570	1830	4040	2510	2000	1230	1050	996	1320
16	812	2100	1000	1650	1920	4670	2480	2170	1350	1070	1240	1110
17	1090	2440	1080	1990	1830	4670	2390	2880	1040	1310	1000	1270
18	942	2660	1030	2090	1790	4180	2360	3410	1110	1030	943	1090
19	981	2370	1110	2330	1670	3630	2290	2930	1170	1030	1010	1370
20	1340	2290	1340	2340	1830	3140	2210	3040	1160	1530	1190	1170
21	1070	2310	1550	2340	1670	3090	2260	3240	1170	1900	1660	1370
22	1350	2380	1050	2340	1670	2640	2350	3040	1270	1690	1770	1310
23	1160	2320	900	2260	2170	2920	2400	3060	1620	1800	1740	1360
24	1220	1990	1000	2190	2520	2610	2450	2870	1420	1730	1280	1300
25	1560	1820	1150	2230	2460	2600	2340	2660	1180	1310	1650	1190
26	1360	1990	1200	2550	2660	2220	2340	2390	1200	1440	1270	1250
27	978	1960	1250	2820	2330	2230	2330	2360	1180	1580	1460	1170
28	1100	2070	1200	2410	2460	2270	2250	2280	1190	1430	1390	1100
29	1120	2220	1300	2100	---	2040	2000	2030	1450	1110	940	1070
30	1050	1860	1400	2320	---	2120	1810	1910	2160	1270	1000	980
31	1230	---	1170	2130	---	2300	---	2060	---	1070	1250	---
TOTAL	33512	51522	41520	62420	55300	89300	68330	71670	41490	41650	36447	33942
MEAN	1081	1717	1339	2014	1975	2881	2278	2312	1383	1344	1176	1131
MAX	1560	2660	1920	2820	2660	4670	2540	3410	2160	1900	1770	1370
MIN	812	872	900	1350	1500	1890	1810	1670	1040	1030	728	714
CFSM	.68	1.07	.84	1.26	1.23	1.80	1.42	1.45	.86	.84	.74	.71
IN.	.78	1.20	.97	1.45	1.29	2.08	1.59	1.67	.96	.97	.85	.79

CAL YR 1989 TOTAL 623002 MEAN 1707 MAX 7300 MIN 812 CFSM 1.07 IN 14.48
WTR YR 1990 TOTAL 627103 MEAN 1718 MAX 4670 MIN 714 CFSM 1.07 IN 14.58

04108500 KALAMAZOO RIVER NEAR FENNVILLE, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1972-75, 1987 to current year.

REMARKS.--Bimonthly cross-sectional samples were collected at bridge.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV										
08...	1200	1030	637	8.6	8.0	3.2	10.8	95	K21	K7
JAN										
25...	1200	2280	557	8.4	2.0	3.4	12.8	98	K48	130
MAR										
28...	1115	2280	536	8.4	6.5	5.8	11.9	98	21	K3
MAY										
23...	1130	3260	495	8.4	15.5	5.7	9.4	96	K40	22
JUL										
11...	1130	1030	584	8.5	24.0	4.4	8.3	101	K12	K1200
SEP										
06...	1230	653	566	8.5	25.0	3.0	11.6	145	21	K68

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
NOV										
08...	290	51	78	24	27	17	0.7	2.7	276	10
JAN										
25...	250	54	69	20	20	14	0.5	2.4	234	5
MAR										
28...	260	65	72	20	16	12	0.4	2.4	237	2
MAY										
23...	240	45	68	18	14	11	0.4	1.8	239	2
JUL										
11...	260	38	67	22	22	16	0.6	1.9	254	7
SEP										
06...	250	51	61	23	27	19	0.7	2.2	225	7

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)
NOV									
08...	242	58	40	0.2	7.8	375	0.51	1040	0.01
JAN									
25...	200	45	32	0.2	9.1	343	0.47	2110	0.02
MAR									
28...	198	44	30	0.2	7.7	342	0.47	2110	0.02
MAY									
23...	200	30	21	0.2	7.8	323	0.44	2840	0.03
JUL									
11...	220	44	37	0.1	6.7	353	0.48	982	0.03
SEP									
06...	196	48	39	<0.1	3.2	323	0.44	569	0.02

STREAMS TRIBUTARY TO LAKE MICHIGAN

04108500 KALAMAZOO RIVER NEAR FENNVILLE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N)	NITRO-GEN,AM-MONIA + ORGANIC TOTAL (MG/L AS N)	PHOS-PHORUS TOTAL (MG/L AS P)	PHOS-PHORUS DIS-SOLVED (MG/L AS P)	PHOS-PHORUS ORTHO, DIS-SOLVED (MG/L AS P)	ALUM-INUM, DIS-SOLVED (UG/L AS AL)	ARSENIC DIS-SOLVED (UG/L AS AS)	BARIUM, DIS-SOLVED (UG/L AS BA)
NOV 08...	1.0	0.07	0.06	0.60	0.05	<0.01	0.02	<10	1	64
JAN 25...	1.5	0.14	0.13	0.80	0.03	<0.01	<0.01	--	--	--
MAR 28...	1.3	0.05	0.05	0.90	0.05	<0.01	0.02	<10	1	53
MAY 23...	1.0	0.04	0.04	0.70	0.04	0.02	0.02	10	1	55
JUL 11...	0.80	0.12	0.11	1.0	0.08	<0.01	<0.01	--	--	--
SEP 06...	0.40	0.08	0.04	0.70	0.05	0.01	<0.01	10	1	72

DATE	BERYL-LIUM, DIS-SOLVED (UG/L AS BE)	CADMIUM DIS-SOLVED (UG/L AS CD)	CHRO-MIUM, DIS-SOLVED (UG/L AS CR)	COBALT, DIS-SOLVED (UG/L AS CO)	COPPER, DIS-SOLVED (UG/L AS CU)	IRON, DIS-SOLVED (UG/L AS FE)	LEAD, DIS-SOLVED (UG/L AS PB)	LITHIUM DIS-SOLVED (UG/L AS LI)	MANGA-NESE, DIS-SOLVED (UG/L AS MN)	MERCURY DIS-SOLVED (UG/L AS HG)
NOV 08...	<0.5	<1	<1	<3	2	21	<1	10	11	<0.1
JAN 25...	--	--	--	--	--	--	--	--	--	--
MAR 28...	0.7	<1	--	<3	--	28	--	6	36	<0.1
MAY 23...	<0.5	<1	<1	<3	2	37	<1	5	12	<0.1
JUL 11...	--	--	--	--	--	--	--	--	--	--
SEP 06...	<0.5	<1	<1	<3	2	6	<1	6	3	<0.1

DATE	MOLYB-DENUM, DIS-SOLVED (UG/L AS MO)	NICKEL, DIS-SOLVED (UG/L AS NI)	SELE-NIUM, DIS-SOLVED (UG/L AS SE)	SILVER, DIS-SOLVED (UG/L AS AG)	STRON-TIUM, DIS-SOLVED (UG/L AS SR)	VANA-DIUM, DIS-SOLVED (UG/L AS V)	ZINC, DIS-SOLVED (UG/L AS ZN)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV 08...	<10	2	<1	<1.0	140	<6	10	10	28	86
JAN 25...	--	--	--	--	--	--	--	11	68	92
MAR 28...	<10	--	--	<1.0	120	<6	<3	12	74	100
MAY 23...	<10	1	<1	<1.0	120	<6	3	17	150	89
JUL 11...	--	--	--	--	--	--	--	20	56	79
SEP 06...	<10	2	<1	<1.0	130	<6	8	16	28	96

STREAMS TRIBUTARY TO LAKE MICHIGAN

04108600 RABBIT RIVER NEAR HOPKINS, MI

LOCATION.--Lat 42°38'32", long 85°43'19", in SE1/4 sec.16, T.3 N., R.12 W., Allegan County, Hydrologic Unit 04050003, on left bank at downstream side of bridge on 18th Street, 2.5 mi northeast of Hopkins.

DRAINAGE AREA.--71.4 mi².

PERIOD OF RECORD.--October 1965 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 700 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 8 to Jan. 8, Jan. 12, 13, Feb. 16-19, and Feb. 25 to Mar. 8. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--25 years, 58.0 ft³/s, 11.03 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,860 ft³/s, May 31, 1989, gage height, 9.57 ft, from floodmark; minimum not determined; minimum daily, 9.2 ft³/s, Aug. 27, 28, 1970, Sept. 18, 1971, Aug. 7, 1987; minimum gage height, 1.68 ft, Aug. 8, 1987.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 300 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 10	2400	*372	*7.33	No other peak greater than base discharge.			

Minimum daily discharge, 19 ft³/s, Oct. 1, 3-5; minimum gage height, 2.08 ft, Sept. 13, 14.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	19	23	85	37	62	65	77	45	43	50	27	24
2	20	22	75	43	65	66	116	43	42	41	25	23
3	19	22	67	50	60	70	111	42	40	36	24	23
4	19	22	63	70	58	60	89	63	39	33	26	22
5	19	22	58	110	55	55	78	122	39	30	32	22
6	22	29	56	95	63	50	71	91	38	29	28	22
7	22	33	50	85	70	48	65	69	37	28	26	31
8	21	38	48	76	67	50	61	60	45	27	25	28
9	20	34	46	69	71	143	59	54	47	26	24	24
10	22	35	44	86	67	268	77	87	42	25	23	23
11	24	36	42	77	58	342	96	101	38	25	22	22
12	22	42	40	65	53	300	82	75	37	25	24	22
13	22	37	39	60	54	241	72	78	35	24	30	22
14	21	35	38	56	55	212	87	69	34	24	27	36
15	21	89	37	52	45	169	95	63	33	26	25	61
16	21	165	36	61	55	128	78	144	31	27	24	58
17	21	148	35	184	52	107	77	204	30	25	23	42
18	22	103	34	254	50	94	69	188	29	23	23	33
19	22	82	33	166	48	90	63	121	27	23	39	33
20	27	105	32	102	46	82	67	113	27	28	40	33
21	33	119	32	80	48	79	135	104	29	30	50	37
22	33	82	32	71	72	95	99	83	30	43	62	56
23	30	61	32	65	145	147	78	72	39	48	46	45
24	29	50	31	100	122	106	69	69	38	35	38	38
25	27	47	31	175	100	87	64	73	32	30	34	33
26	26	47	31	245	90	79	59	71	30	27	31	31
27	25	58	32	165	80	71	55	62	34	26	29	28
28	25	209	32	111	72	67	52	55	64	25	28	27
29	24	169	33	86	---	64	48	50	107	25	26	27
30	23	107	34	73	---	75	46	47	76	40	25	26
31	23	---	35	64	---	74	---	45	---	32	24	---
TOTAL	724	2071	1313	3033	1883	3584	2295	2563	1212	936	930	952
MEAN	23.4	69.0	42.4	97.8	67.3	116	76.5	82.7	40.4	30.2	30.0	31.7
MAX	33	209	85	254	145	342	135	204	107	50	62	61
MIN	19	22	31	37	45	48	46	42	27	23	22	22
CFSM	.33	.97	.59	1.37	.94	1.63	1.07	1.16	.57	.42	.42	.44
IN.	.38	1.08	.68	1.58	.98	1.87	1.20	1.34	.63	.49	.48	.50

CAL YR 1989 TOTAL 22390 MEAN 61.3 MAX 1530 MIN 19 CFSM .86 IN 11.67
WTR YR 1990 TOTAL 21496 MEAN 58.9 MAX 342 MIN 19 CFSM .83 IN 11.20

04108800 MACATAWA RIVER NEAR ZEELAND, MI

LOCATION.--Lat 42°46'40", long 86°01'06", in NW1/4 sec.31, T.5 N., R.14 W., Ottawa County, Hydrologic Unit 04050002, on left bank 20 ft upstream from bridge on State Road, 0.2 mi downstream from South Branch, and 2.5 mi south of Zeeland.

DRAINAGE AREA.--65.8 mi².

PERIOD OF RECORD.--October 1960 to current year. Prior to October 1978, published as Black River near Zeeland.

GAGE.--Water-stage recorder. Datum of gage is 585.7 ft above National Geodetic Vertical Datum of 1929 (levels by Gove Associates, Inc.).

REMARKS.--Estimated daily discharges: Dec. 8 to Jan. 8, Jan. 13, 14, Feb. 15-21, and Feb. 25 to Mar. 8. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--30 years, 68.4 ft³/s, 14.12 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,220 ft³/s, May 11, 1981, gage height, 15.81 ft; minimum, 0.83 ft³/s, Aug. 3, 1988; minimum gage height, 1.61 ft, Sept. 3, 1983.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 900 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 15	2300	986	10.10	Jan. 25	2400	1,110	10.43
Jan. 17	2300	*1,220	*10.70	May 16	2000	1,130	10.47

Minimum discharge, 3.3 ft³/s, Sept. 4, 5, 12, gage height, 1.83 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.4	7.2	34	22	43	65	47	20	19	17	7.3	4.2
2	5.3	6.9	34	27	47	70	242	18	18	13	5.5	4.0
3	5.2	7.4	31	35	39	145	133	17	17	10	5.0	3.8
4	5.1	7.7	30	140	37	80	57	61	16	7.3	8.2	3.7
5	5.7	8.7	29	460	37	48	45	151	14	6.8	15	3.7
6	7.2	21	30	450	76	43	40	52	15	5.8	7.1	4.0
7	6.4	19	29	250	67	38	35	34	14	5.4	6.0	9.6
8	5.3	18	26	165	51	37	31	27	35	5.1	5.1	5.3
9	5.6	13	24	243	46	505	30	24	29	4.9	4.6	4.1
10	5.9	46	22	389	37	735	148	402	19	4.6	4.1	3.9
11	5.7	51	20	220	32	780	139	313	16	4.7	4.0	3.8
12	5.3	67	19	129	30	734	60	95	14	4.8	6.2	3.7
13	5.2	24	18	80	32	497	42	116	13	4.3	6.2	3.7
14	5.3	17	17	59	30	323	187	58	12	4.6	4.5	21
15	5.8	583	17	56	28	116	135	45	12	4.9	4.1	37
16	6.2	785	16	119	27	71	56	632	10	4.6	4.0	14
17	7.0	399	16	728	26	53	50	788	9.9	4.3	4.0	9.1
18	7.2	211	15	864	25	44	39	390	9.0	4.5	4.1	6.3
19	6.8	130	14	328	25	41	33	138	7.8	4.4	21	8.3
20	8.7	470	14	126	25	38	90	315	9.2	20	11	7.2
21	11	250	14	71	27	37	351	141	9.6	7.2	31	14
22	9.0	83	13	59	117	120	95	64	9.6	11	33	35
23	8.1	51	13	53	347	199	52	47	13	10	14	18
24	7.9	41	13	374	218	58	41	73	12	6.2	9.8	12
25	7.5	38	13	579	110	43	35	65	9.5	4.9	7.6	9.0
26	7.2	38	13	749	95	38	31	50	8.1	4.3	6.2	7.7
27	6.8	43	13	283	83	33	26	39	7.7	3.9	9.8	6.4
28	6.6	117	14	141	74	32	24	31	11	3.8	9.5	5.7
29	7.1	45	14	67	---	31	23	26	39	4.6	6.3	5.4
30	7.6	36	15	50	---	36	21	23	37	48	5.2	5.3
31	7.1	---	17	42	---	35	---	20	---	13	4.6	---
TOTAL	205.2	3633.9	607	7358	1831	5125	2338	4275	465.4	257.9	274.0	278.9
MEAN	6.62	121	19.6	237	65.4	165	77.9	138	15.5	8.32	8.84	9.30
MAX	11	785	34	864	347	780	351	788	39	48	33	37
MIN	4.4	6.9	13	22	25	31	21	17	7.7	3.8	4.0	3.7
CFSM	.10	1.84	.30	3.60	.99	2.51	1.18	2.10	.24	.13	.13	.14
IN.	.12	2.05	.34	4.16	1.04	2.90	1.32	2.42	.26	.15	.15	.16

CAL YR 1989 TOTAL 23476.3 MEAN 64.3 MAX 3140 MIN 3.9 CFSM .98 IN 13.27
WTR YR 1990 TOTAL 26649.3 MEAN 73.0 MAX 864 MIN 3.7 CFSM 1.11 IN 15.07

STREAMS TRIBUTARY TO LAKE MICHIGAN

04109000 GRAND RIVER AT JACKSON, MI

LOCATION.--Lat 42°17'05", long 84°24'30", in sec.22, T.2 S., R.1 W., Jackson County, Hydrologic Unit 04050004, on left bank on grounds of sewage-treatment plant, 1 mi north of Jackson, 2.2 mi upstream from Portage River, and at mile 216.

DRAINAGE AREA.--174 mi².

PERIOD OF RECORD.--April 1935 to current year.

REVISED RECORDS.--WSP 974: 1937(M). WSP 1387: 1936. WSP 1727: 1950(M).

GAGE.--Water-stage recorder. Datum of gage is 900.00 ft, Fargo Engineering Co. datum. Prior to Sept. 24, 1935, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records good. Slight regulation by mills upstream from station. Flow includes about 20 ft³/s as sewage effluent, which originates from ground-water sources, from the City of Jackson. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--55 years, 124 ft³/s, 9.68 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,070 ft³/s, June 25, 1937, gage height, 13.50 ft; maximum gage height, 15.44 ft, June 25, 1968; minimum discharge, 9.2 ft³/s, Aug. 22, 1936.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 566 ft³/s, Mar. 16, gage height, 12.18 ft; minimum daily, 54 ft³/s, Oct. 8, 9.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	63	103	110	96	129	420	279	201	174	125	69	69
2	65	79	108	98	155	403	279	172	175	119	66	63
3	64	72	104	108	141	353	248	158	185	94	64	61
4	63	69	101	174	139	312	236	182	166	88	66	64
5	59	67	109	175	150	297	233	185	157	88	64	64
6	58	75	102	209	195	313	230	173	152	89	63	66
7	55	98	94	217	200	305	226	171	146	85	64	151
8	54	100	98	219	199	296	221	173	170	81	63	88
9	54	103	90	227	212	298	219	174	147	82	62	77
10	82	105	94	229	214	342	256	201	137	80	61	80
11	88	102	92	217	212	400	240	193	136	81	61	82
12	88	99	86	210	211	438	231	157	116	77	73	82
13	77	101	87	160	213	470	230	180	108	74	96	80
14	74	123	91	162	212	494	237	172	130	86	75	111
15	70	198	82	160	182	518	230	214	113	76	72	90
16	74	189	86	157	211	551	232	225	105	77	72	96
17	81	175	82	130	214	550	261	335	100	87	70	87
18	77	174	83	138	194	532	273	309	103	83	71	85
19	88	173	82	136	197	516	268	311	98	82	138	108
20	91	179	83	137	187	488	324	312	97	87	100	100
21	105	196	81	137	186	483	340	316	95	82	122	112
22	105	201	79	146	305	437	317	309	107	94	102	109
23	106	193	75	191	358	397	299	304	108	87	99	103
24	86	188	75	199	370	367	291	303	93	84	97	102
25	83	185	75	211	345	344	285	291	90	82	93	103
26	107	182	74	207	372	326	270	284	91	80	89	127
27	109	181	75	199	413	309	258	257	90	78	89	129
28	107	137	77	194	421	294	249	242	102	74	92	124
29	102	120	79	191	---	281	236	231	103	72	87	118
30	104	115	77	179	---	281	224	212	129	74	82	115
31	107	---	108	136	---	269	---	188	---	73	75	---
TOTAL	2546	4082	2739	5349	6537	12084	7722	7135	3723	2621	2497	2846
MEAN	82.1	136	88.4	173	233	390	257	230	124	84.5	80.5	94.9
MAX	109	201	110	229	421	551	340	335	185	125	138	151
MIN	54	67	74	96	129	269	219	157	90	72	61	61
CFSM	.47	.78	.51	.99	1.34	2.24	1.48	1.32	.71	.49	.46	.55
IN.	.54	.87	.59	1.14	1.40	2.58	1.65	1.53	.80	.56	.53	.61

CAL YR 1989 TOTAL 53508 MEAN 147 MAX 569 MIN 54 CFSM .85 IN 11.44
WTR YR 1990 TOTAL 59881 MEAN 164 MAX 551 MIN 54 CFSM .94 IN 12.80

STREAMS TRIBUTARY TO LAKE MICHIGAN

04111500 DEER CREEK NEAR DANSVILLE, MI

LOCATION.--Lat 42°36'30", long 84°19'15", in E1/2 sec.33, T.3 N., R.1 E., Ingham County, Hydrologic Unit 04050004, on right bank 15 ft upstream from bridge on Clark Road, 3.5 mi north of Dansville, and 7.2 mi upstream from mouth.

DRAINAGE AREA.--16.3 mi².

PERIOD OF RECORD.--May 1954 to current year.

REVISED RECORDS.--WSP 1727: 1954(M).

GAGE.--Water-stage recorder and concrete control. Datum of gage is 889.08 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources).

REMARKS.--Estimated daily discharges: Dec. 12-16, 19-23, Dec. 27 to Jan. 10, Feb. 2-4, 16-20, and Feb. 24 to Mar. 7. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--36 years, 11.0 ft³/s, 9.16 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 962 ft³/s, Apr. 19, 1975, gage height, 12.18 ft, from floodmark, from rating curve extended above 610 ft³/s; minimum, 0.04 ft³/s, Sept. 8, 9, 12, 1978, gage height, 2.58 ft.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 100 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Feb. 22	2400	144	5.28	Mar. 10	2300	*193	*6.08

Minimum daily discharge, 0.45 ft³/s, Sept. 1, 2, 5; minimum gage height, 2.63 ft, Dec. 23, 24, result of freezeup.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.0	3.1	8.8	3.0	12	18	19	7.7	5.5	4.9	1.1	.45
2	2.0	3.1	8.6	3.5	12	18	26	7.1	5.2	4.0	.98	.45
3	2.0	2.9	7.6	4.5	11	17	26	6.8	6.4	3.3	.90	.50
4	1.9	2.9	7.4	50	11	15	22	8.4	5.3	2.7	.97	.48
5	1.9	2.9	7.0	60	11	13	19	12	4.7	2.3	1.1	.45
6	2.1	3.1	6.8	45	13	12	18	9.6	4.4	2.1	1.0	.58
7	2.0	3.6	5.7	35	17	11	16	8.4	4.0	1.9	1.0	3.0
8	2.0	4.7	4.9	23	32	15	14	7.3	4.5	1.8	.87	1.6
9	1.8	4.6	4.6	18	42	51	13	6.3	4.4	1.7	.79	1.1
10	2.6	4.5	4.6	17	29	134	27	6.3	3.7	1.6	.74	.96
11	3.2	4.7	4.1	15	20	168	48	5.6	3.6	1.5	.73	.85
12	2.8	4.4	3.8	11	16	132	31	5.4	3.3	1.6	.97	.79
13	2.5	4.2	3.5	9.5	16	85	24	9.2	3.0	1.3	1.4	.72
14	2.4	4.8	3.2	8.6	17	60	25	8.7	5.1	1.6	1.1	1.1
15	2.3	38	3.1	8.4	13	43	24	8.0	4.9	1.7	.93	1.9
16	2.2	71	2.8	15	14	40	20	32	3.9	1.5	.85	2.3
17	2.2	45	2.5	63	12	33	20	62	3.5	1.3	.77	2.1
18	2.4	29	2.5	58	11	25	17	49	3.2	1.3	.74	1.5
19	2.7	22	2.7	29	10	21	15	28	2.9	3.0	1.3	1.6
20	3.8	43	2.6	21	10	19	16	24	2.8	3.4	1.3	1.6
21	4.4	35	2.5	17	9.5	17	50	20	3.0	3.1	1.3	1.5
22	4.4	22	2.4	14	54	18	32	17	2.8	2.6	1.2	1.7
23	4.0	16	2.3	12	124	21	24	14	3.7	3.1	1.2	1.7
24	3.7	13	.70	19	70	18	20	13	3.6	2.3	1.1	1.5
25	3.5	12	3.4	41	55	15	16	13	2.8	1.8	.95	1.4
26	3.5	12	2.2	44	30	14	14	13	2.5	1.6	.82	1.6
27	3.3	12	2.2	26	24	12	12	10	5.0	1.4	.69	1.5
28	3.1	14	2.2	22	21	12	11	8.7	11	1.3	.67	1.5
29	3.1	12	2.3	18	---	11	9.2	7.4	7.4	1.2	.61	1.3
30	3.1	9.9	2.5	14	---	15	8.3	6.7	6.1	1.3	.51	1.3
31	3.0	---	2.7	12	---	15	---	6.2	---	1.2	.49	---
TOTAL	85.9	459.4	122.20	736.5	716.5	1098	636.5	440.8	132.2	65.4	29.08	39.03
MEAN	2.77	15.3	3.94	23.8	25.6	35.4	21.2	14.2	4.41	2.11	.94	1.30
MAX	4.4	71	8.8	63	124	168	50	62	11	4.9	1.4	3.0
MIN	1.8	2.9	.70	3.0	9.5	11	8.3	5.4	2.5	1.2	.49	.45
CFSM	.17	.94	.24	1.46	1.57	2.17	1.30	.87	.27	.13	.06	.08
IN.	.20	1.05	.28	1.68	1.64	2.51	1.45	1.01	.30	.15	.07	.09

CAL YR 1989 TOTAL 4130.80 MEAN 11.3 MAX 188 MIN .70 CFSM .69 IN 9.43
WTR YR 1990 TOTAL 4561.51 MEAN 12.5 MAX 168 MIN .45 CFSM .77 IN 10.41

04112000 SLOAN CREEK NEAR WILLIAMSTON, MI

LOCATION.--Lat 42°40'33", long 84°21'50", in SE1/4 NE1/4 sec.1, T.3 N., R.1 W., Ingham County, Hydrologic Unit 04050004, on left bank 30 ft downstream from culvert on Meridian Road, 2.1 mi upstream from mouth, and 4.2 mi west of Williamston.

DRAINAGE AREA.--9.34 mi².

PERIOD OF RECORD.--June 1954 to current year.

GAGE.--Water-stage recorder and concrete control with V-notch sharp-crested weir. Datum of gage is 862.12 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources).

REMARKS.--Estimated daily discharges: Oct. 1-4, 6-15, Dec. 10, 14, 18, 21-23, 25, 31, Jan. 1, Feb. 2-4, Mar. 2-4, June 12-18, Aug. 17-26, Aug. 30 to Sept. 18, and Sept. 27-30. Records good except for estimated daily discharges, which are poor. At times, low flow is affected by pumpage for irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--36 years, 5.70 ft³/s, 8.29 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,290 ft³/s, Apr. 18, 1975, gage height, 9.99 ft, from rating curve extended above 660 ft³/s on basis of computation of peak flow through culvert and over road embankment; minimum, 0.01 ft³/s, Sept. 11, 1954, Jan. 18, 1957, Aug. 3, 1988; minimum gage height, 1.10 ft, Sept. 11, 1954, Jan. 18, 1957.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 120 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 10	1800	*121	*3.96	No other peak greater than base discharge.			

Minimum daily discharge, 0.10 ft³/s, Sept. 2-5; minimum gage height, 1.32 ft, Aug. 28, 29.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.46	.62	4.7	.94	4.1	7.4	6.7	3.3	1.5	1.7	.23	.11
2	.48	.57	4.4	.96	4.0	7.3	15	2.7	1.5	1.2	.20	.10
3	.45	.55	3.7	1.0	3.9	7.0	15	2.5	1.9	.95	.18	.10
4	.41	.56	3.4	35	3.8	6.2	12	3.0	1.4	.71	.22	.10
5	.39	.60	3.2	26	3.7	5.7	8.6	3.5	1.3	.56	.24	.10
6	.50	.65	3.0	14	4.2	4.7	7.8	3.0	1.2	.48	.23	.20
7	.47	.68	2.5	7.3	6.3	4.4	6.7	2.7	1.1	.43	.23	.66
8	.44	.73	2.2	6.0	22	4.4	5.8	2.4	1.5	.38	.19	.35
9	.40	.75	2.1	6.7	27	32	5.3	2.2	1.4	.36	.16	.25
10	.47	.80	2.0	8.2	16	79	19	2.3	1.2	.32	.15	.22
11	.60	.80	1.9	6.7	9.5	81	29	2.0	1.0	.35	.14	.19
12	.52	.81	1.7	4.7	6.9	62	16	1.9	1.0	.34	.38	.18
13	.50	.78	1.5	3.6	6.6	50	11	2.3	.95	.27	.39	.17
14	.45	1.1	1.4	3.1	7.2	37	9.7	2.2	1.4	.36	.29	.30
15	.41	18	1.4	3.4	5.9	27	9.2	2.2	1.5	.39	.21	.45
16	.35	33	1.3	6.9	5.8	24	7.7	4.2	1.2	.33	.18	.55
17	.37	21	1.2	34	4.6	18	7.3	15	1.0	.29	.17	.50
18	.39	14	1.1	27	4.7	12	6.2	13	.95	.25	.16	.43
19	.47	9.1	1.1	13	4.4	9.3	5.5	7.8	.77	.30	.25	.42
20	.70	23	1.1	7.9	3.9	7.5	6.1	6.8	.76	1.7	.29	.41
21	.73	16	1.0	6.2	3.7	6.9	26	6.1	.76	1.5	.30	.36
22	.69	8.8	.85	5.2	27	7.1	16	5.0	.82	1.0	.30	.50
23	.64	6.3	.75	4.5	56	8.6	11	4.1	1.1	.99	.28	.39
24	.62	4.9	.73	8.7	33	7.3	7.7	3.6	1.0	.70	.24	.33
25	.60	4.3	.80	23	22	6.2	6.4	3.3	.82	.52	.20	.28
26	.58	4.0	.82	24	16	5.4	5.4	3.1	.61	.41	.17	.26
27	.56	5.0	.86	12	12	4.7	4.6	2.6	.77	.35	.14	.26
28	.57	19	.85	9.1	8.5	4.4	4.1	2.3	2.4	.31	.13	.26
29	.56	8.6	.89	6.8	---	4.1	3.7	2.1	1.8	.27	.12	.25
30	.56	6.0	.90	5.4	---	5.0	3.6	1.8	1.9	.26	.13	.25
31	.60	---	.92	4.3	---	5.2	---	1.6	---	.25	.12	---
TOTAL	15.94	211.00	54.27	325.60	332.7	550.8	298.1	120.6	36.51	18.23	6.62	8.93
MEAN	.51	7.03	1.75	10.5	11.9	17.8	9.94	3.89	1.22	.59	.21	.30
MAX	.73	33	4.7	35	56	81	29	15	2.4	1.7	.39	.66
MIN	.35	.55	.73	.94	3.7	4.1	3.6	1.6	.61	.25	.12	.10
CFSM	.06	.75	.19	1.12	1.27	1.91	1.06	.42	.13	.06	.02	.03
IN.	.06	.84	.22	1.30	1.32	2.19	1.19	.48	.15	.07	.03	.04

CAL YR 1989 TOTAL 1738.93 MEAN 4.76 MAX 172 MIN .16 CFSM .51 IN 6.93
WTR YR 1990 TOTAL 1979.30 MEAN 5.42 MAX 81 MIN .10 CFSM .58 IN 7.88

STREAMS TRIBUTARY TO LAKE MICHIGAN

04112500 RED CEDAR RIVER AT EAST LANSING, MI

LOCATION.--Lat 42°43'40", long 84°28'40", in SW1/4 sec.18, T.4 N., R.1 W., Ingham County, Hydrologic Unit 04050004, in left downstream bridge abutment of Farm Lane Bridge on Michigan State University Campus in East Lansing, 4.0 mi upstream from Sycamore Creek, and 5.6 mi upstream from mouth.

DRAINAGE AREA.--355 mi².

PERIOD OF RECORD.--August 1902 to December 1903, March 1931 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as Red Cedar River at Agricultural College, August 1902 to December 1903 and as Cedar River at East Lansing, March 1931 to September 1965. Gage-height records collected in this vicinity 1911-19, and 1920-28 (flood seasons only), are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 1307: 1936(M).

GAGE.--Water-stage recorder and concrete control. Datum of gage is 824.39 ft above National Geodetic Vertical Datum of 1929. August 1902 to December 1903 nonrecording gage at site 0.8 mi downstream at different datum. March 1931 to November 1940 water-stage recorder at site 250 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Dec. 23-29. Records good. Prior to April 1975, occasional regulation at low flow by mill at Williamston, 16 mi upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--60 years, 209 ft³/s, 7.99 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,940 ft³/s, Apr. 20, 1975, gage height, 11.95 ft; minimum, 3 ft³/s, July 31, 1931.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Mar. 24, 1904, reached a stage of 13.4 ft, discharge, 8,000 ft³/s.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,700 ft³/s, Mar. 13, gage height, 6.63 ft; minimum, 26 ft³/s, Sept. 2, 3, 4, 5, gage height, 3.14 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	75	90	259	89	252	557	341	217	181	125	45	29
2	73	88	231	93	245	494	408	203	170	112	43	26
3	69	87	218	96	238	453	471	191	171	97	40	28
4	67	85	188	201	229	416	475	208	176	84	44	28
5	66	89	196	440	225	369	457	230	173	73	45	28
6	67	102	182	520	222	301	435	237	162	65	51	32
7	67	109	156	528	234	266	406	233	149	61	50	88
8	67	113	107	462	310	277	371	217	178	58	44	90
9	67	126	142	405	504	396	338	201	175	58	41	89
10	75	134	154	406	562	839	345	197	156	54	38	71
11	78	130	135	403	509	1320	495	188	136	54	35	56
12	90	128	115	363	427	1610	585	182	122	54	69	47
13	91	118	106	276	378	1690	566	191	112	53	64	44
14	84	124	110	245	360	1610	535	206	150	66	54	62
15	75	239	101	240	306	1410	521	215	158	67	49	62
16	68	485	97	236	294	1200	495	276	140	62	45	96
17	69	596	93	415	297	1020	467	458	118	65	41	86
18	75	607	89	715	260	869	430	613	107	53	38	78
19	90	563	84	706	282	729	386	682	90	56	54	78
20	106	551	82	602	227	615	354	729	81	107	50	69
21	119	591	82	500	215	527	399	746	80	117	52	70
22	120	553	80	429	327	484	498	721	95	104	53	70
23	118	459	79	369	732	479	533	650	105	94	51	66
24	111	372	78	350	957	451	491	565	110	85	48	63
25	104	310	77	424	886	415	444	487	101	75	45	58
26	101	268	76	602	810	388	394	421	89	64	42	55
27	99	267	75	589	745	365	343	362	100	57	39	53
28	98	372	74	492	657	335	295	305	104	53	37	51
29	96	370	74	419	---	296	259	256	131	50	34	51
30	92	307	75	357	---	300	232	218	134	47	32	50
31	91	---	85	294	---	313	---	195	---	46	30	---
TOTAL	2668	8433	3700	12266	11690	20794	12769	10800	3954	2216	1403	1774
MEAN	86.1	281	119	396	418	671	426	348	132	71.5	45.3	59.1
MAX	120	607	259	715	957	1690	585	746	181	125	69	96
MIN	66	85	74	89	215	266	232	182	80	46	30	26
CFSM	.24	.79	.34	1.12	1.18	1.89	1.20	.98	.37	.20	.13	.17
IN.	.28	.88	.39	1.29	1.22	2.18	1.34	1.13	.41	.23	.15	.19

CAL YR 1989 TOTAL 83408 MEAN 229 MAX 1670 MIN 45 CFSM .65 IN 8.74
WTR YR 1990 TOTAL 92467 MEAN 253 MAX 1690 MIN 26 CFSM .71 IN 9.69

04112850 SYCAMORE CREEK NEAR HOLT, MI

LOCATION.--Lat 42°38'25", long 84°28'58", in SW1/4 SW1/4 sec.18, T.3 N., R.1 W., Ingham County, Hydrologic Unit 04050004, on left bank 15 ft downstream from bridge on Holt Road, 1.5 mi east of Holt.

DRAINAGE AREA.--80.6 mi².

PERIOD OF RECORD.--April 1975 to September 1980, May 1989 to September 1990 (discontinued).

GAGE.--Water-stage recorder. Elevation of gage is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges. Dec. 4 to Jan. 2, Jan. 13, 14, Feb. 2-4, 16-19, 25, 26, and Mar. 2-8. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--6 years (water years 1976-80, 1990), 51.0 ft³/s, 8.59 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,110 ft³/s, Apr. 19, 1975, gage height, 10.00 ft; minimum, 3.8 ft³/s, Sept. 29, Oct. 1, 1979.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 674 ft³/s, Mar. 11, gage height, 7.37 ft; minimum daily, 12 ft³/s, Sept. 2-5.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	21	26	59	21	54	99	97	46	33	21	14	13
2	20	24	55	24	51	90	129	42	31	19	14	12
3	20	23	50	29	50	85	152	41	40	18	14	12
4	22	22	45	137	49	75	134	47	35	17	14	12
5	21	21	42	399	50	70	114	68	32	16	15	12
6	21	22	39	295	56	66	106	55	31	16	15	13
7	24	26	36	171	67	62	93	47	30	16	17	49
8	23	33	34	105	110	60	84	42	34	15	15	26
9	21	33	32	89	171	152	77	39	32	15	14	20
10	21	33	31	88	149	428	105	41	28	15	14	18
11	29	32	29	81	100	649	215	40	27	15	13	17
12	31	31	27	65	76	622	178	37	27	15	16	17
13	27	28	25	55	70	483	134	50	25	14	20	16
14	25	31	23	49	78	353	121	51	35	16	17	19
15	23	117	22	46	55	266	125	45	36	16	15	30
16	24	320	21	67	65	227	109	93	28	15	14	29
17	24	298	21	179	58	197	104	173	25	15	14	24
18	26	209	21	290	54	162	95	234	24	15	14	20
19	26	140	20	190	53	134	85	157	23	32	24	21
20	33	158	19	112	53	113	83	113	22	38	19	21
21	39	207	19	85	51	103	188	99	22	31	18	19
22	39	144	19	71	98	102	188	81	22	27	17	22
23	36	96	19	63	454	124	135	68	27	29	17	19
24	34	74	18	84	375	108	110	61	26	24	16	17
25	32	66	18	117	299	96	95	60	23	21	16	17
26	31	65	18	195	228	88	82	58	21	19	15	16
27	29	65	18	127	158	81	71	50	21	17	14	16
28	27	105	17	97	119	76	62	43	22	17	14	14
29	26	83	17	79	---	72	55	40	22	15	14	14
30	26	67	18	65	---	85	49	37	23	15	13	14
31	24	---	20	58	---	90	---	34	---	15	13	---
TOTAL	825	2599	852	3533	3251	5418	3375	2092	827	589	479	569
MEAN	26.6	86.6	27.5	114	116	175	113	67.5	27.6	19.0	15.5	19.0
MAX	39	320	59	399	454	649	215	234	40	38	24	49
MIN	20	21	17	21	49	60	49	34	21	14	13	12
CFSM	.33	1.07	.34	1.41	1.44	2.17	1.40	.84	.34	.24	.19	.24
IN.	.38	1.20	.39	1.63	1.50	2.50	1.56	.97	.38	.27	.22	.26

WTR YR 1990 TOTAL 24409 MEAN 66.9 MAX 649 MIN 12 CFSM .83 IN 11.27

STREAMS TRIBUTARY TO LAKE MICHIGAN

04113000 GRAND RIVER AT LANSING, MI

LOCATION.--Lat 42°45'02", long 84°33'19", in NW1/4 sec.9, T.4 N., R.2 W., Ingham County, Hydrologic Unit 04050004, on right bank 30 ft upstream from bridge on North Grand River Avenue in Lansing, 2.0 mi downstream from Red Cedar River, and at mile 152.

DRAINAGE AREA.--1,230 mi², approximately.

PERIOD OF RECORD.--March 1901 to September 1906, October 1934 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as "at North Lansing" 1901-6. Gage-height records collected in this vicinity 1907-10 (flood seasons only), 1911-19, 1920-28 (flood seasons only), and since 1931 are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 1174: 1949. WSP 1387: 1901, 1903-4, 1935, 1937, 1942.

GAGE.--Water-stage recorder. Datum of gage is 805.53 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to August 1906, nonrecording gage at same site at different datum. November 1934 to June 1949 water-stage recorder at site 1.8 mi downstream at datum 2.42 ft lower.

REMARKS.--No estimated daily discharges. Records good. Large diurnal fluctuation at low and medium flow caused by powerplants upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--61 years, 846 ft³/s, 9.34 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 24,500 ft³/s, Mar. 26, 1904, gage height, 18.60 ft, datum then in use, from rating curve extended above 15,000 ft³/s; minimum, 2.8 ft³/s, Sept. 9, 1963, gage height, 0.85 ft; minimum daily, 20 ft³/s, Aug. 25, 1941.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum discharge since at least 1901, that of Mar. 26, 1904.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 5,370 ft³/s, Mar. 13, gage height, 10.18 ft; minimum daily, 162 ft³/s, Aug. 2.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	359	400	1030	396	1100	1970	1690	1170	980	514	312	273
2	365	452	953	425	1080	1960	1780	1070	962	478	162	252
3	307	479	921	468	1040	1870	1880	1040	961	483	251	234
4	306	437	707	877	1020	1750	1860	1090	927	431	242	268
5	288	434	806	1230	1060	1620	1810	1150	850	389	252	185
6	341	421	708	1460	993	1430	1740	1090	780	335	253	209
7	301	486	620	1420	1050	1310	1580	1090	796	354	276	701
8	302	475	513	1340	1150	1370	1510	998	966	336	255	660
9	292	524	459	1290	1490	1760	1430	985	756	322	251	509
10	374	606	614	1300	1580	2740	1520	973	702	301	235	442
11	298	559	612	1310	1530	4040	1820	829	706	318	220	318
12	392	582	503	1260	1420	4880	1960	822	649	356	447	337
13	361	541	415	1110	1300	5230	1930	945	637	261	322	274
14	398	634	463	980	1310	4990	1910	931	711	376	370	478
15	330	1010	407	990	1250	4410	1810	941	629	422	331	368
16	337	1710	423	1040	1170	3750	1740	1220	639	427	275	615
17	357	1770	410	1380	1170	3300	1700	1800	542	375	280	433
18	360	1790	403	1990	1080	2980	1580	2230	497	328	264	469
19	428	1710	412	1950	1190	2670	1520	2440	468	429	382	453
20	434	1730	404	1830	1050	2430	1480	2720	467	691	447	410
21	474	1700	401	1610	1010	2240	1740	2480	451	523	501	482
22	472	1680	328	1440	1430	2180	2060	2230	515	566	480	422
23	522	1490	372	1270	2140	2160	2210	2040	467	476	534	510
24	487	1300	341	1260	2680	2110	2120	1850	524	437	515	475
25	473	1200	376	1440	2130	2040	1910	1690	496	433	442	351
26	477	1110	277	1720	2120	1870	1710	1630	466	372	405	312
27	471	1180	367	1750	2440	1770	1550	1500	461	338	363	381
28	457	1340	386	1560	2260	1680	1430	1400	454	319	406	451
29	447	1330	347	1420	---	1540	1330	1280	494	337	245	332
30	469	1110	351	1340	---	1580	1220	1190	588	222	312	461
31	489	---	411	1200	---	1560	---	1110	---	311	260	---
TOTAL	12168	30190	15740	40056	40243	77190	51530	43934	19541	12260	10290	12065
MEAN	393	1006	508	1292	1437	2490	1718	1417	651	395	332	402
MAX	522	1790	1030	1990	2680	5230	2210	2720	980	691	534	701
MIN	288	400	277	396	993	1310	1220	822	451	222	162	185
CFSM	.32	.82	.41	1.05	1.17	2.02	1.40	1.15	.53	.32	.27	.33
IN.	.37	.91	.48	1.21	1.22	2.33	1.56	1.33	.59	.37	.31	.36

CAL YR 1989 TOTAL 340876 MEAN 934 MAX 4540 MIN 258 CFSM .76 IN 10.31
WTR YR 1990 TOTAL 365207 MEAN 1001 MAX 5230 MIN 162 CFSM .81 IN 11.05

STREAMS TRIBUTARY TO LAKE MICHIGAN

04114000 GRAND RIVER AT PORTLAND, MI

LOCATION.--Lat 42°51'23", long 84°54'44", in NW1/4 sec.4, T.5 N., R.5 W., Ionia County, Hydrologic Unit 04050004, on left bank at downstream side of bridge on Kent Street, 1.0 mi south of Portland, 1.9 mi upstream from Looking Glass River, and at mile 115.

DRAINAGE AREA.--1,385 mi².

PERIOD OF RECORD.--August 1952 to March 1982, June 1988 to current year. Gage-height records collected in this vicinity 1907-28 (flood seasons only) are contained in reports of the National Weather Service.

GAGE.--Water-stage recorder. Datum of gage is 705.00 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to July 6, 1953, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 15 to Jan. 8. Records good except for estimated daily discharges, which are fair. Slight diurnal fluctuation caused by powerplants upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--31 years (water years 1953-81, 1989-90), 930 ft³/s, 9.12 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 12,400 ft³/s, Apr. 21, 1975, gage height, 12.98 ft; minimum, 38 ft³/s, Oct. 10, 1963; minimum daily, 58 ft³/s, Oct. 9, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 6,210 ft³/s, Mar. 13, gage height, 10.10 ft; minimum daily, 234 ft³/s, Aug. 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	457	581	1310	500	1340	2370	1880	1400	1220	779	368	325
2	450	508	1200	480	1290	2140	2070	1300	1130	650	406	343
3	454	522	1120	520	1270	2170	2190	1230	1110	581	234	317
4	392	549	1010	700	1230	2090	2190	1240	1040	586	328	308
5	396	520	884	1200	1170	1890	2160	1470	1020	513	365	390
6	387	564	928	1600	1220	1750	2050	1390	1010	462	338	286
7	433	535	842	1700	1230	1530	1960	1300	900	415	339	431
8	390	625	771	1650	1270	1520	1790	1270	1030	407	368	831
9	384	579	682	1500	1630	1830	1690	1170	1120	402	330	739
10	391	625	598	1520	1840	2800	1750	1180	881	391	322	607
11	478	711	709	1510	1840	4820	2020	1130	819	375	306	533
12	381	673	737	1460	1700	5870	2160	981	826	397	304	429
13	475	672	622	1370	1570	6150	2250	1080	751	404	687	391
14	450	643	539	1180	1540	6010	2180	1080	760	408	445	303
15	479	934	520	1120	1520	5380	2150	1120	851	537	462	704
16	411	1630	500	1160	1360	4600	2050	1220	737	584	428	525
17	424	2090	500	1570	1360	3970	1990	1760	726	545	368	753
18	445	2080	490	2150	1360	3510	1880	2440	632	494	353	529
19	452	1990	490	2440	1270	3140	1790	2580	593	435	377	597
20	573	1920	500	2160	1300	2860	1750	2850	561	608	500	570
21	560	2040	490	1930	1180	2590	1980	2950	588	964	559	520
22	582	1960	450	1760	1260	2500	2250	2640	552	686	613	650
23	568	1800	400	1520	2190	2560	2450	2390	678	760	587	519
24	612	1600	450	1610	2810	2400	2450	2160	587	613	635	602
25	583	1410	420	1750	2790	2350	2370	2050	615	554	611	568
26	559	1340	450	2310	2520	2220	2050	1890	596	541	526	444
27	577	1250	350	2190	2510	2050	1920	1750	595	464	491	402
28	557	1820	450	2020	2610	2010	1710	1640	616	441	454	474
29	538	1600	470	1770	---	1820	1600	1530	607	407	487	531
30	529	1470	420	1610	---	1850	1470	1380	672	393	328	414
31	555	---	420	1490	---	1810	---	1310	---	313	389	---
TOTAL	14922	35241	19722	47450	46180	90560	60200	50881	23823	16109	13308	15035
MEAN	481	1175	636	1531	1649	2921	2007	1641	794	520	429	501
MAX	612	2090	1310	2440	2810	6150	2450	2950	1220	964	687	831
MIN	381	508	350	480	1170	1520	1470	981	552	313	234	286
CFSM	.35	.85	.46	1.11	1.19	2.11	1.45	1.19	.57	.38	.31	.36
IN.	.40	.95	.53	1.27	1.24	2.43	1.62	1.37	.64	.43	.36	.40

CAL YR 1989 TOTAL 407931 MEAN 1118 MAX 7030 MIN 335 CFSM .81 IN 10.96
WTR YR 1990 TOTAL 433431 MEAN 1187 MAX 6150 MIN 234 CFSM .86 IN 11.64

STREAMS TRIBUTARY TO LAKE MICHIGAN

04114500 LOOKING GLASS RIVER NEAR EAGLE, MI

LOCATION.--Lat 42°49'45", long 84°46'40", in sec.10, T.5 N., R.4 W., Clinton County, Hydrologic Unit 04050004, on right bank at upstream side of former bridge site on Hinman Road, 1.5 mi northeast of Eagle, and 10 mi upstream from mouth.

DRAINAGE AREA.--281 mi^2.

PERIOD OF RECORD.--August 1944 to current year.

REVISED RECORDS.--WSP 1387: 1946-47.

GAGE.--Water-stage recorder. Datum of gage is 747.09 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to June 2, 1962, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 23-25, Dec. 3 to Jan. 17, Jan. 30, 31, Feb. 3-5, 16-21, and Feb. 26 to Mar. 8. Records good except for estimated daily discharges, which are poor. Small intermittent diversion at times into Lake Geneva when discharge is above 50 ft^3/s. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--46 years, 178 ft^3/s, 8.60 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,860 ft^3/s, Apr. 5, 1947, gage height, 7.70 ft, from graph based on gage readings, from rating curve extended above 1,900 ft^3/s; maximum gage height, 9.9 ft, Mar. 7, 1956, from floodmark, backwater from ice; minimum discharge, 10 ft^3/s, July 28, 1965, gage height, 1.01 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 998 ft^3/s, Mar. 11, gage height, 4.76 ft; minimum, 34 ft^3/s, Sept. 3, 4, 5, 6; minimum gage height, 1.38 ft, Sept. 5.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	151	115	365	88	387	335	333	285	185	102	47	40
2	138	111	360	96	368	335	363	264	169	96	45	38
3	125	109	345	105	350	335	358	246	155	89	44	36
4	114	107	340	190	325	335	341	242	138	87	48	35
5	108	108	335	380	300	335	334	260	126	83	56	35
6	104	123	320	350	274	320	339	230	118	74	54	36
7	101	127	280	300	273	290	341	212	112	67	54	56
8	97	135	250	310	286	310	339	202	128	63	55	72
9	94	132	220	340	340	371	336	199	131	61	54	62
10	97	135	190	370	328	641	354	209	117	56	49	62
11	98	141	170	410	307	880	378	195	113	57	46	61
12	95	148	140	370	311	903	355	182	111	56	49	53
13	93	152	130	360	328	770	335	182	108	54	60	49
14	92	151	115	380	339	732	339	176	103	65	62	55
15	90	206	100	410	321	748	347	169	112	72	51	67
16	89	294	95	440	300	792	346	208	101	68	48	88
17	91	275	88	500	290	845	346	288	95	71	47	85
18	87	255	84	450	285	873	339	285	91	67	46	74
19	89	257	82	366	280	879	329	252	87	63	62	76
20	106	312	80	343	280	864	333	268	83	70	60	75
21	114	361	78	351	280	823	412	288	86	93	58	71
22	113	365	76	362	293	782	375	295	83	84	65	71
23	117	360	75	366	364	739	347	304	91	82	64	69
24	120	360	74	431	365	655	335	312	95	79	60	65
25	122	365	74	563	331	580	341	316	89	74	56	60
26	126	368	74	580	330	518	342	315	87	68	53	62
27	125	374	74	473	330	467	339	297	89	64	51	56
28	121	461	74	420	330	425	329	274	101	59	47	49
29	118	443	74	416	---	390	318	250	98	55	45	49
30	119	390	75	410	---	370	305	225	99	54	43	47
31	119	---	80	400	---	343	---	206	---	51	43	---
TOTAL	3373	7240	4917	11330	8895	17985	10328	7636	3301	2184	1622	1754
MEAN	109	241	159	365	318	580	344	246	110	70.5	52.3	58.5
MAX	151	461	365	580	387	903	412	316	185	102	65	88
MIN	87	107	74	88	273	290	305	169	83	51	43	35
CFSM	.39	.86	.57	1.30	1.13	2.06	1.22	.88	.39	.25	.19	.21
IN.	.45	.96	.65	1.50	1.18	2.38	1.37	1.01	.44	.29	.21	.23

CAL YR 1989 TOTAL 77281 MEAN 212 MAX 1120 MIN 52 CFSM .75 IN 10.23
WTR YR 1990 TOTAL 80565 MEAN 221 MAX 903 MIN 35 CFSM .79 IN 10.67

STREAMS TRIBUTARY TO LAKE MICHIGAN

04115000 MAPLE RIVER AT MAPLE RAPIDS, MI

LOCATION.--Lat 43°06'35", long 84°41'35", in sec.5, T.8 N., R.3 W., Clinton County, Hydrologic Unit 04050005, on right bank at downstream side of bridge on Maple Road in Maple Rapids, 50 ft upstream from Pine Creek, and 0.8 mi upstream from Hayworth Creek. Records include flow of Pine Creek.

DRAINAGE AREA.--434 mi².

PERIOD OF RECORD.--August 1944 to current year.

REVISED RECORDS.--WSP 1707: 1956.

GAGE.--Water-stage recorder. Datum of gage is 642.58 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Oct. 4, 1968, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Jan. 29 to Feb. 4 and Mar. 11-13. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--46 years, 268 ft³/s, 8.39 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 8,770 ft³/s, Sept. 12, 1986, gage height, 12.33 ft, from floodmark, caused by dam failure on Rainbow Lake (Pine Creek); minimum, 4.4 ft³/s, Aug. 13, 1965, gage height, 1.62 ft.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood in March 1904 reached a stage of 13.8 ft, from information by local resident.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,370 ft³/s, Mar. 14, gage height, 9.53 ft; minimum, 22 ft³/s, Sept. 4, 14; minimum gage height, 1.81 ft, Sept. 14.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	74	80	698	87	680	438	397	306	175	73	105	30
2	69	83	643	88	610	413	433	284	149	64	71	30
3	65	81	586	89	550	406	517	263	121	58	55	28
4	60	78	530	118	490	398	581	249	115	51	57	24
5	59	76	477	233	433	382	615	244	95	48	70	25
6	57	81	434	259	394	365	617	243	85	43	68	28
7	56	93	387	284	377	340	598	237	81	37	63	49
8	55	110	343	310	373	308	570	230	94	33	58	46
9	53	122	299	318	406	320	535	218	129	34	53	55
10	54	131	263	329	464	522	517	205	130	32	47	53
11	57	129	236	334	504	850	511	204	113	31	43	42
12	58	125	210	342	504	1400	516	202	94	35	40	31
13	68	115	193	344	485	2450	518	201	85	30	40	27
14	75	111	161	315	461	3340	516	194	79	31	38	29
15	79	166	153	281	406	2950	512	189	75	33	37	42
16	79	286	131	256	384	2410	507	180	66	41	36	52
17	83	371	115	324	372	1910	498	232	60	40	34	56
18	85	447	106	456	360	1530	478	289	55	44	33	55
19	86	483	96	549	336	1270	455	323	53	78	67	53
20	97	488	91	602	316	1070	434	361	49	82	92	50
21	121	509	87	592	289	932	441	396	44	83	94	48
22	140	523	83	557	286	832	454	405	49	83	83	57
23	141	512	79	510	336	768	476	400	58	77	69	63
24	123	484	76	481	418	721	480	386	62	71	61	57
25	114	448	76	566	448	664	466	365	59	66	54	51
26	108	409	76	900	458	619	442	343	57	58	51	48
27	101	387	76	1020	458	566	418	315	60	50	47	45
28	93	522	78	1040	457	521	396	286	59	45	44	46
29	91	643	79	980	---	482	375	258	59	42	41	48
30	87	704	82	880	---	445	346	228	65	92	36	50
31	79	---	86	775	---	415	---	201	---	142	32	---
TOTAL	2567	8797	7030	14219	12055	30037	14619	8437	2475	1727	1719	1318
MEAN	82.8	293	227	459	431	969	487	272	82.5	55.7	55.5	43.9
MAX	141	704	698	1040	680	3340	617	405	175	142	105	63
MIN	53	76	76	87	286	308	346	180	44	30	32	24
CFSM	.19	.68	.52	1.06	.99	2.23	1.12	.63	.19	.13	.13	.10
IN.	.22	.75	.60	1.22	1.03	2.57	1.25	.72	.21	.15	.15	.11

CAL YR 1989 TOTAL 110408 MEAN 302 MAX 1830 MIN 39 CFSM .70 IN 9.46
WTR YR 1990 TOTAL 105000 MEAN 288 MAX 3340 MIN 24 CFSM .66 IN 9.00

STREAMS TRIBUTARY TO LAKE MICHIGAN

04115265 FISH CREEK NEAR CRYSTAL, MI

LOCATION.--Lat 43°14'59", long 84°58'52", in NW1/4 NE1/4 sec.23, T.10 N., R.6 W., Montcalm County, Hydrologic Unit 04050005, on left bank 10 ft downstream from bridge on Sidney Road, 3.5 mi southwest of Crystal.

DRAINAGE AREA.--50.5 mi².

PERIOD OF RECORD.--October 1987 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 795 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Oct. 1 and Dec. 16 to Jan. 2. Records good. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 204 ft³/s, Mar. 15, 1989, gage height, 5.42 ft; maximum gage height, 5.53 ft, Mar. 12, 1990; minimum discharge, 7.0 ft³/s, July 10, 14, 1988, gage height, 2.27 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 196 ft³/s, Mar. 12, gage height, 5.53 ft; minimum, 10 ft³/s, July 13, gage height, 2.29 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	17	21	27	19	28	26	48	26	25	24	19	15
2	17	25	27	19	30	26	55	24	23	21	17	13
3	17	25	25	20	27	27	48	24	25	18	16	14
4	17	23	24	25	27	25	40	28	23	17	20	15
5	17	24	24	27	26	24	37	45	22	16	28	14
6	20	33	25	24	26	23	37	34	22	14	25	14
7	18	30	22	23	28	23	34	28	21	13	23	29
8	18	29	21	22	29	22	32	26	35	13	19	21
9	18	27	21	22	46	49	31	34	31	13	17	18
10	22	27	21	23	37	115	36	45	31	12	14	17
11	22	26	21	23	30	134	40	43	24	13	14	16
12	20	25	19	22	28	181	34	34	22	14	15	15
13	19	24	19	22	27	164	33	39	22	12	17	15
14	19	24	20	21	27	129	48	37	21	18	14	18
15	19	54	18	21	24	94	48	30	20	25	13	28
16	19	84	17	21	29	76	37	51	19	23	13	35
17	20	54	17	48	25	61	35	62	18	18	14	24
18	20	41	17	52	26	51	32	48	18	17	14	19
19	20	37	17	33	25	45	33	44	17	29	44	21
20	27	38	17	28	24	41	42	70	17	29	29	21
21	26	42	17	27	24	40	47	52	18	25	25	21
22	24	33	17	26	30	42	37	39	21	22	23	29
23	22	29	17	24	40	51	32	34	33	20	21	22
24	22	27	17	27	33	40	30	32	26	22	21	25
25	21	28	17	43	32	37	29	31	21	18	19	20
26	21	30	18	80	29	36	28	33	20	17	19	17
27	21	31	18	46	28	33	27	33	22	16	20	16
28	20	41	18	55	27	33	26	27	27	14	19	15
29	20	33	18	38	---	33	26	25	23	15	17	15
30	20	29	18	31	---	39	31	24	28	38	16	15
31	21	---	19	29	---	40	---	23	---	25	14	---
TOTAL	624	994	613	941	812	1760	1093	1125	695	591	599	577
MEAN	20.1	33.1	19.8	30.4	29.0	56.8	36.4	36.3	23.2	19.1	19.3	19.2
MAX	27	84	27	80	46	181	55	70	35	38	44	35
MIN	17	21	17	19	24	22	26	23	17	12	13	13
CFSM	.40	.66	.39	.60	.57	1.13	.72	.72	.46	.38	.38	.38
IN.	.46	.73	.45	.69	.60	1.30	.81	.83	.51	.44	.44	.43

CAL YR 1989 TOTAL 10686 MEAN 29.3 MAX 182 MIN 11 CFSM .58 IN 7.87
WTR YR 1990 TOTAL 10424 MEAN 28.6 MAX 181 MIN 12 CFSM .57 IN 7.68

STREAMS TRIBUTARY TO LAKE MICHIGAN

04116000 GRAND RIVER AT IONIA, MI

LOCATION.--Lat 42°58'20", long 85°04'13", in NW1/4 sec.30, T.7 N., R.6 W., Ionia County, Hydrologic Unit 04050006, on left bank 15 ft downstream from bridge on State Highway 66 in Ionia, 2.7 mi downstream from Prairie Creek, and at mile 87.

DRAINAGE AREA.--2,840 mi², approximately.

PERIOD OF RECORD.--March to June 1931, July and September 1931 (fragmentary), July 1951 to current year. Gage-height records collected in this vicinity 1907-28 (flood seasons only) are contained in reports of the National Weather Service.

GAGE.--Water-stage recorder. Datum of gage is 615.38 ft above National Geodetic Vertical Datum of 1929. Mar. 19 to Sept. 24, 1931, nonrecording gage at site 1.5 mi upstream at different datum.

REMARKS.--Estimated daily discharges: Dec. 13 to Jan. 4. Records good except for estimated daily discharges, which are fair. Diurnal fluctuation below about 5,000 ft³/s caused by powerplants upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--39 years (water years 1952-90), 1,971 ft³/s, 9.42 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 21,500 ft³/s, Apr. 1, 1960, gage height, 23.43 ft; minimum, 40 ft³/s, May 13, 1968, gage height, 5.61 ft; minimum daily, 109 ft³/s, July 16, 1977.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 13,600 ft³/s, Mar. 14, gage height, 20.79 ft; minimum, 380 ft³/s, Sept. 6, gage height, 7.22 ft; minimum daily, 485 ft³/s, Sept. 14.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	731	931	3330	890	3490	3880	3310	2580	2030	1090	1300	547
2	771	992	2940	950	3110	3620	3740	2360	1900	1110	1020	492
3	849	919	2650	1100	2960	3490	4120	2190	1800	1020	960	489
4	836	980	2550	1600	2710	3460	4100	2190	1720	911	703	554
5	833	887	2490	2850	2600	3310	4030	2560	1550	836	882	559
6	724	992	2290	3520	2550	3020	3900	2560	1550	809	877	542
7	709	1140	2110	3340	2520	2820	3750	2180	1490	763	838	531
8	705	1120	2040	3320	2610	2660	3550	2160	1360	658	681	961
9	700	1080	1630	3240	2940	3160	3380	2040	1750	652	763	1110
10	722	1160	1870	3370	3500	4480	3370	2130	1610	672	737	968
11	733	1230	1560	3310	3380	6770	3480	2040	1340	648	571	815
12	787	1190	1510	3330	3200	9570	3750	2020	1320	626	577	793
13	815	1240	1400	3050	3040	12500	3790	1780	1300	616	644	743
14	724	1190	1300	2860	2970	13500	3820	1950	1170	710	913	485
15	788	1820	1200	2630	2680	13100	3810	1900	1300	875	771	788
16	771	2980	1100	2510	2730	11700	3720	2300	1200	1000	662	1110
17	879	3490	1050	2960	2660	10200	3560	2470	1090	875	684	1010
18	874	3550	1000	4250	2490	8840	3420	3470	1070	836	653	930
19	802	3440	950	4190	2450	7770	3250	3720	977	943	668	890
20	866	3410	900	3940	2400	6840	3170	3920	900	1110	797	967
21	1030	3710	870	3620	2340	6160	3640	4150	843	1310	824	916
22	1070	3610	840	3310	2340	5500	3960	3990	945	1550	943	966
23	978	3410	820	3060	3090	5320	3950	3790	1010	1140	936	968
24	1160	3150	810	3100	3940	5040	3970	3570	968	1170	930	914
25	991	2910	800	4150	4030	4660	3870	3400	972	1030	1020	888
26	1080	2790	800	5900	3960	4430	3680	3150	970	896	882	865
27	1080	2580	800	5910	3730	4040	3320	2980	969	860	850	844
28	994	3620	800	5470	4110	3780	3120	2700	1040	798	792	736
29	927	4120	800	4800	---	3590	2820	2640	1110	701	731	744
30	911	3570	810	4140	---	3500	2840	2430	1140	1130	655	847
31	988	---	830	3710	---	3390	---	2130	---	1370	678	---
TOTAL	26828	67211	44850	104380	84530	184100	108190	83450	38394	28715	24942	23972
MEAN	865	2240	1447	3367	3019	5939	3606	2692	1280	926	805	799
MAX	1160	4120	3330	5910	4110	13500	4120	4150	2030	1550	1300	1110
MIN	700	887	800	890	2340	2660	2820	1780	843	616	571	485
CFSM	.31	.79	.51	1.19	1.06	2.09	1.27	.95	.45	.33	.28	.28
IN.	.35	.88	.59	1.37	1.11	2.41	1.42	1.09	.50	.38	.33	.31

CAL YR 1989 TOTAL 791123 MEAN 2167 MAX 10700 MIN 700 CFSM .76 IN 10.36
WTR YR 1990 TOTAL 819562 MEAN 2245 MAX 13500 MIN 485 CFSM .79 IN 10.74

STREAMS TRIBUTARY TO LAKE MICHIGAN

04117500 THORNAPPLE RIVER NEAR HASTINGS, MI

LOCATION.--Lat 42°36'57", long 85°14'11", in SE1/4 sec.27, T.3 N., R.8 W., Barry County, Hydrologic Unit 04050007, on right bank at downstream side of bridge on McKeown Road, 0.6 mi downstream from Cedar Creek, 2.0 mi downstream from Thornapple Lake, and 3.2 mi southeast of Hastings.

DRAINAGE AREA.--385 mi².

PERIOD OF RECORD.--October 1944 to current year.

GAGE.--Water-stage recorder. Datum of gage is 786.71 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Oct. 1, 1965, nonrecording gage at same site and datum.

REMARKS.--No estimated daily discharges. Records good. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--46 years, 323 ft³/s, 11.39 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,810 ft³/s, Apr. 7, 1947, gage height, 10.20 ft, from graph based on gage readings; minimum, 33 ft³/s, Aug. 10, 1964; minimum gage height, 2.71 ft, Aug. 10, 1964, July 14, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,580 ft³/s, Mar. 14, gage height, 7.32 ft; minimum, 106 ft³/s, Sept. 6, gage height, 3.05 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	141	161	505	166	486	555	406	280	241	257	137	127
2	138	159	449	170	442	513	458	265	227	233	127	125
3	139	159	395	171	406	486	539	252	212	198	121	120
4	136	158	349	194	378	464	586	273	210	172	128	114
5	135	159	314	288	351	434	579	392	199	155	154	111
6	142	174	292	386	340	388	541	480	190	140	158	109
7	144	196	272	439	352	351	492	471	183	128	153	144
8	142	220	230	477	391	337	447	410	194	119	144	175
9	138	228	203	478	472	363	409	353	212	118	134	180
10	138	228	220	458	559	573	411	319	210	114	125	167
11	141	225	224	451	598	1150	454	317	193	115	118	154
12	141	227	205	428	575	1860	504	306	177	118	123	141
13	143	221	170	372	511	2410	527	312	167	115	155	130
14	141	218	170	325	463	2550	529	325	161	120	182	143
15	139	275	169	300	403	2330	521	324	158	145	181	208
16	137	426	169	290	368	1950	506	378	153	168	165	258
17	137	556	174	386	374	1560	488	502	146	169	147	267
18	139	626	171	636	352	1260	461	632	139	163	134	250
19	144	635	166	812	347	1040	429	703	134	155	178	232
20	162	618	164	857	319	862	406	720	129	181	279	216
21	189	608	160	791	305	714	449	698	134	228	343	207
22	211	586	152	669	321	617	515	630	142	285	360	222
23	213	533	147	544	420	599	550	552	173	320	334	227
24	205	465	143	463	532	591	533	485	205	314	288	217
25	195	401	140	498	529	558	484	446	201	278	244	198
26	186	361	144	724	583	519	437	426	179	234	214	182
27	179	343	143	923	622	471	395	407	166	201	189	167
28	172	383	146	954	616	430	358	370	186	179	171	156
29	168	456	151	884	---	401	328	328	239	164	159	147
30	163	514	153	741	---	389	302	288	263	157	144	138
31	160	---	160	590	---	394	---	260	---	148	135	---
TOTAL	4858	10519	6650	15865	12415	27119	14044	12904	5523	5591	5624	5232
MEAN	157	351	215	512	443	875	468	416	184	180	181	174
MAX	213	635	505	954	622	2550	586	720	263	320	360	267
MIN	135	158	140	166	305	337	302	252	129	114	118	109
CFSM	.41	.91	.56	1.33	1.15	2.27	1.22	1.08	.48	.47	.47	.45
IN.	.47	1.02	.64	1.53	1.20	2.62	1.36	1.25	.53	.54	.54	.51

CAL YR 1989 TOTAL 130202 MEAN 357 MAX 3540 MIN 126 CFSM .93 IN 12.58
WTR YR 1990 TOTAL 126344 MEAN 346 MAX 2550 MIN 109 CFSM .90 IN 12.21

STREAMS TRIBUTARY TO LAKE MICHIGAN

04118000 THORNAPPLE RIVER NEAR CALEDONIA, MI

LOCATION.--Lat 42°48'40", long 85°29'00", in NW1/4 sec.22, T.5 N., R.10 W., Kent County, Hydrologic Unit 04050007, on right bank 200 ft downstream from LaBarge powerplant, 200 ft upstream from 84th Street, 2.3 mi northeast of Caledonia, and 3.3 mi downstream from Coldwater River.

DRAINAGE AREA.--773 mi².

PERIOD OF RECORD.--October 1930 to September 1938, October 1951 to March 1982, October 1983 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 824: 1931-36. WSP 1307: 1931-37.

GAGE.--Water-stage recorder. Datum of gage is 676.31 ft, Consumers Power Co. datum. Oct. 1, 1930, to Sept. 30, 1938, nonrecording gage at same site and at National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Feb. 5 to Mar. 15. Records good except for estimated daily discharges, which are fair. Prior to Dec. 1, 1958, and since Oct. 1, 1983, large diurnal fluctuation at low and medium flow, and occasional regulation during high flow, caused by powerplant upstream from station; occasional fluctuation during the interim period. Several measurements of water temperature were made during the year. Gage-height telemeter at station.

AVERAGE DISCHARGE.--45 years (water years 1931-38, 1952-81, 1984-90), 601 ft³/s, 10.56 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,700 ft³/s, Feb. 27, 1985, gage height, 11.43 ft; minimum, 1.0 ft³/s, May 28, 1968, gage height, 1.40 ft, result of regulation during bridge construction.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Apr. 7, 1947, reached a stage of 14.4 ft, from information by powerplant operator.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 3,800 ft³/s, Mar. 14, 15; minimum discharge, 41 ft³/s, June 5, gage height, 2.05 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	302	331	983	405	1010	1150	793	582	514	578	335	291
2	342	341	882	427	907	1050	915	499	470	521	303	308
3	282	405	814	387	814	980	1080	517	451	431	315	277
4	311	342	733	471	773	940	1090	581	462	384	315	281
5	305	344	675	613	720	900	1080	738	378	407	354	280
6	314	412	633	661	700	800	1050	930	487	374	331	277
7	339	423	591	695	720	720	953	903	396	329	379	357
8	304	507	523	727	780	700	870	807	439	313	324	352
9	299	438	467	768	960	750	799	716	470	296	323	396
10	358	475	450	821	1100	1450	814	685	468	304	304	347
11	315	443	508	788	1200	2250	926	690	422	290	236	339
12	349	523	462	747	1150	3000	920	654	407	306	336	315
13	314	436	398	703	1000	3400	919	637	407	302	391	313
14	224	435	452	653	900	3800	981	635	384	283	308	392
15	305	650	381	612	800	3800	1030	618	371	398	362	398
16	347	1060	331	518	770	3470	940	810	345	332	356	454
17	391	1170	401	849	740	3150	923	1140	358	360	363	483
18	294	1200	401	1410	720	2520	848	1250	331	357	279	522
19	313	1120	405	1420	700	2050	812	1290	319	278	491	422
20	406	1120	397	1430	650	1710	797	1300	321	490	532	468
21	371	1290	383	1340	640	1440	977	1310	320	342	575	446
22	413	1170	323	1260	660	1270	1010	1210	348	564	632	402
23	424	1000	370	1030	850	1330	992	1030	376	528	626	513
24	395	860	365	963	1000	1250	972	908	372	564	601	459
25	401	789	381	1310	1100	1180	911	886	415	495	471	414
26	463	734	371	1780	1200	944	822	841	400	490	451	406
27	367	710	364	1790	1250	935	754	777	363	426	450	359
28	385	1210	397	1750	1250	857	702	732	456	384	342	381
29	357	1180	374	1590	---	802	660	658	548	378	356	307
30	356	1100	379	1470	---	795	616	602	529	390	359	385
31	394	---	390	1230	---	779	---	569	---	373	317	---
TOTAL	10740	22218	14984	30618	25064	50172	26956	25505	12327	12267	12117	11344
MEAN	346	741	483	988	895	1618	899	823	411	396	391	378
MAX	463	1290	983	1790	1250	3800	1090	1310	548	578	632	522
MIN	224	331	323	387	640	700	616	499	319	278	236	277
CFSM	.45	.96	.63	1.28	1.16	2.09	1.16	1.07	.53	.51	.51	.49
IN.	.52	1.07	.72	1.47	1.21	2.41	1.30	1.23	.59	.59	.58	.55

CAL YR 1989 TOTAL 249108 MEAN 682 MAX 4730 MIN 224 CFSM .88 IN 11.99
WTR YR 1990 TOTAL 254312 MEAN 697 MAX 3800 MIN 224 CFSM .90 IN 12.24

STREAMS TRIBUTARY TO LAKE MICHIGAN

04118500 ROGUE RIVER NEAR ROCKFORD, MI

LOCATION.--Lat 43°04'56", long 85°35'27", in NE1/4 sec.15, T.8 N., R.11 W., Kent County, Hydrologic Unit 04050006, on left bank at downstream side of bridge on Packer Drive, 2.2 mi upstream from mouth, and 3.0 mi southwest of Rockford.

DRAINAGE AREA.--234 mi².

PERIOD OF RECORD.--February 1952 to September 1982, October 1987 to current year.

GAGE.--Water-stage recorder. Datum of gage is 624.80 ft above National Geodetic Vertical Datum of 1929 (levels by Johnson and Anderson, Inc.). Prior to Aug. 30, 1952, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 8 to Jan. 3, Feb. 26 to Mar. 8, Mar. 11, 13, and July 27 to Aug. 28. Records good except for estimated daily discharges, which are poor. Some diurnal fluctuation caused by mills upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--33 years, 234 ft³/s, 13.58 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,540 ft³/s, Mar. 6, 1976, gage height, 9.29 ft; minimum, 28 ft³/s, Jan. 22, 1967, gage height, 3.41 ft; minimum daily, 49 ft³/s, Aug. 27, 1955.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Sept. 12, 1986, reached a stage of 11.35 ft, from floodmark, and discharge of about 6,000 ft³/s.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,480 ft³/s, Mar. 13, gage height, 7.76 ft; maximum gage height, 7.82 ft, Mar. 13, backwater from ice; minimum daily discharge, 127 ft³/s, Sept. 5.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	137	164	234	160	321	235	303	200	236	325	240	132
2	137	179	222	180	278	235	351	190	231	324	200	130
3	135	179	212	200	255	235	359	183	224	312	170	131
4	131	180	195	268	235	225	349	223	214	267	210	129
5	136	184	187	217	236	210	338	292	207	215	270	127
6	146	222	202	212	243	205	325	304	207	185	240	131
7	149	219	190	223	238	200	305	319	206	176	225	166
8	150	214	170	233	246	210	291	302	234	164	210	174
9	144	206	165	219	270	348	277	413	227	159	190	164
10	152	213	160	215	270	517	296	738	219	156	175	145
11	151	209	155	218	264	750	295	891	210	151	165	141
12	154	203	155	214	253	1150	291	871	203	145	155	138
13	150	197	155	209	245	1450	282	746	189	136	145	135
14	149	190	155	180	236	1270	324	588	189	138	140	227
15	145	277	155	189	212	910	337	473	186	150	135	252
16	143	293	155	195	217	696	343	584	185	154	135	284
17	145	299	155	295	215	561	333	707	178	147	135	264
18	147	300	150	373	209	473	308	711	167	186	135	244
19	150	289	150	369	227	403	286	652	161	406	150	235
20	163	295	150	402	209	371	309	653	159	394	180	208
21	171	287	150	376	229	340	332	666	159	389	170	217
22	172	277	150	335	249	351	337	636	181	306	165	233
23	171	257	150	274	283	373	326	567	221	250	160	221
24	166	243	150	285	289	371	304	474	231	222	155	207
25	162	233	150	413	244	352	282	440	219	198	155	194
26	162	217	150	476	250	331	262	394	195	177	155	177
27	161	226	150	584	245	305	247	370	176	160	155	165
28	160	251	150	491	240	286	235	339	188	150	150	159
29	158	241	155	445	---	276	225	312	219	160	148	154
30	157	242	155	390	---	291	214	278	340	250	140	154
31	160	---	155	337	---	285	---	259	---	300	137	---
TOTAL	4714	6986	5137	9177	6908	14215	9066	14775	6161	6852	5295	5438
MEAN	152	233	166	296	247	459	302	477	205	221	171	181
MAX	172	300	234	584	321	1450	359	891	340	406	270	284
MIN	131	164	150	160	209	200	214	183	159	136	135	127
CFSM	.65	1.00	.71	1.27	1.06	1.96	1.29	2.04	.88	.94	.73	.77
IN.	.75	1.11	.82	1.46	1.10	2.26	1.44	2.35	.98	1.09	.84	.86

CAL YR 1989 TOTAL 97751 MEAN 268 MAX 1800 MIN 110 CFSM 1.15 IN 15.54
WTR YR 1990 TOTAL 94724 MEAN 260 MAX 1450 MIN 127 CFSM 1.11 IN 15.06

04119000 GRAND RIVER AT GRAND RAPIDS, MI

LOCATION.--Lat 42°57'52", long 85°40'35", in NE1/4 sec.25, T.7 N., R.12 W., Kent County, Hydrologic Unit 04050006, on right bank 500 ft upstream from bridge on Fulton Street, 1.7 mi upstream from Plaster Creek, and at mile 41.

DRAINAGE AREA.--4,900 mi², approximately.

PERIOD OF RECORD.--March 1901 to December 1905, January 1906 to August 1918 (gage heights only), October 1930 to current year. Monthly discharge only for some periods, published in WSP 1307. Gage-height records collected in this vicinity since 1907 are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 924: 1938(M). WSP 1387: 1901-5, 1940.

GAGE.--Water-stage recorder. Datum of gage is 585.70 ft above National Geodetic Vertical Datum of 1929 (levels by City of Grand Rapids). March 1901 to August 1918, nonrecording gage at Fulton Street Bridge and Oct. 1, 1930, to Oct. 26, 1953, water-stage recorder at sewage pumping station 1 mi downstream at datum 2.99 ft higher.

REMARKS.--Estimated daily discharges: Dec. 11 to Jan. 4. Records good except for estimated daily discharges, which are fair. Moderate diurnal fluctuation at low and medium flow caused by powerplants upstream from station. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--64 years, 3,655 ft³/s, 10.13 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 54,000 ft³/s, Mar. 28, 1904, gage height, 19.5 ft, from graph based on gage readings, site then in use; maximum gage height, 19.64 ft, Mar. 1, 1985; minimum daily discharge, 381 ft³/s, Aug. 9, 17, 1936.

EXTREMES OUTSIDE PERIOD OF RECORD.--Maximum discharge since at least 1901, that of Mar. 28, 1904.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 20,800 ft³/s, Mar. 16, gage height, 16.49 ft; minimum, 1,250 ft³/s, Sept. 4, gage height, 3.05 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1900	2410	5970	1900	6570	6320	5830	4610	4110	3260	3010	1640
2	1810	2400	5630	2100	6130	6160	5980	4340	3830	3200	2790	1480
3	1780	2460	5210	2400	5600	6010	6440	4410	3710	3010	2510	1460
4	1890	2500	4840	2750	5270	5800	6710	4450	3400	2970	2540	1330
5	1860	2560	4600	3250	4950	5630	6710	4650	3440	2800	2360	1360
6	1950	2660	4570	4070	4920	5330	6670	4870	3100	2610	2450	1400
7	1820	2850	4270	4720	4790	5030	6400	4490	3190	2420	2410	1620
8	1870	2950	3600	4650	4780	4840	6150	4280	3300	2320	2280	1770
9	1830	2940	3030	4660	5000	5330	5890	4610	3270	2300	2130	1900
10	1940	2900	3240	4700	5390	6630	5870	5470	3410	2220	2010	2080
11	1950	2990	2900	4780	5760	8840	5950	5530	3270	2210	2080	1890
12	1970	3090	2700	4670	5660	11400	6010	5240	3080	2170	1840	1820
13	2030	2900	2500	4720	5520	13600	6100	5190	3120	2120	1940	1750
14	2040	2970	2400	4510	5320	16400	6400	4810	3110	2120	1950	2070
15	1860	4210	2200	4240	5110	19200	6520	4750	2940	2330	2080	2150
16	1940	5730	2050	4100	4830	20600	6420	5320	3000	2630	2030	2140
17	2010	6260	2000	4610	4780	19900	6220	6460	2910	2600	1840	2460
18	2170	6350	1950	6660	4650	17800	6000	6710	2710	2560	1860	2320
19	2260	6250	1900	7320	4600	15600	5770	7080	2650	2910	2430	2420
20	2390	6210	1850	7120	4520	13600	5700	7390	2600	3370	2280	2260
21	2510	6350	1800	6820	4430	11900	5990	7460	2570	3420	2470	2350
22	2400	6450	1750	6350	4580	10400	6350	7440	2560	3420	2560	2450
23	2200	6110	1750	5890	5140	9520	6480	7190	2830	3480	2570	2440
24	2080	5760	1700	5750	5860	8780	6390	6830	2810	3140	2460	2270
25	2390	5360	1700	6570	6300	8150	6290	6540	2750	2980	2350	2260
26	2440	5090	1700	8540	6160	7530	6330	6210	2760	2750	2230	2120
27	2450	4970	1700	9290	6080	7040	5840	5730	2780	2590	2160	2040
28	2440	5340	1700	9400	6190	6530	5430	5440	2840	2400	1980	1990
29	2370	6340	1750	9050	---	6170	4990	5040	3100	2400	1820	1940
30	2420	6410	1750	8220	---	6000	4470	4800	3320	2730	1760	1790
31	2350	---	1800	7270	---	5870	---	4470	---	3130	1680	---
TOTAL	65320	131770	86510	171080	148890	301910	182300	171810	92470	84570	68860	58970
MEAN	2107	4392	2791	5519	5318	9739	6077	5542	3082	2728	2221	1966
MAX	2510	6450	5970	9400	6570	20600	6710	7460	4110	3480	3010	2460
MIN	1780	2400	1700	1900	4430	4840	4470	4280	2560	2120	1680	1330
CFSM	.43	.90	.57	1.13	1.09	1.99	1.24	1.13	.63	.56	.45	.40
IN.	.50	1.00	.66	1.30	1.13	2.29	1.38	1.30	.70	.64	.52	.45

CAL YR 1989 TOTAL 1535760 MEAN 4208 MAX 17000 MIN 1700 CFSM .86 IN 11.66
WTR YR 1990 TOTAL 1564460 MEAN 4286 MAX 20600 MIN 1330 CFSM .88 IN 11.88

04119300 GRAND RIVER AT EASTMANVILLE, MI
(National stream quality accounting network station)

LOCATION.--Lat 43°00'53", long 85°57'21", in NE1/4 NW1/4 sec.10, T.7 N., R.14 W., Ottawa County, Hydrologic Unit 04050006, at bridge on 68th Avenue in Eastmanville, 1.1 mi downstream from Deer Creek, and at mile 19.3.

DRAINAGE AREA.--5,230 mi², approximately.

PERIOD OF RECORD.--Water years 1979 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: February 1979 to September 1983.
WATER TEMPERATURE: February 1979 to September 1983.

INSTRUMENTATION.--Water-quality monitor from Oct. 7, 1980 to Sept. 30, 1983.

REMARKS.--Bimonthly cross-sectional samples were collected at bridge. A water-discharge measurement was made at time of sampling.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1979-82): Maximum daily recorded (more than 20 percent missing record), 1,100 microsiemens, Mar. 2, 1979; minimum measured, 324 microsiemens, Mar. 24, 1982.
WATER TEMPERATURE (water years 1980-81, 1983): Maximum, 28.5°C, July 21, 1983; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV										
09...	1430	3030	659	8.5	7.5	2.5	8.2	71	K570	660
JAN										
26...	1300	9400	526	8.3	0.5	30	12.9	92	1400	>2000
MAR										
29...	1320	6930	567	8.4	6.0	4.8	12.1	98	960	370
MAY										
24...	1200	7840	580	8.3	14.5	8.5	9.3	93	K38	K40
JUL										
12...	1230	1900	642	8.7	23.0	17	11.7	139	K67	K65
SEP										
07...	1300	2300	666	8.4	25.0	15	7.1	88	1100	520

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
NOV										
09...	310	74	83	25	26	15	0.6	3.2	268	10
JAN										
26...	220	48	60	17	17	14	0.5	3.8	210	0
MAR										
29...	270	71	75	20	16	11	0.4	3.0	239	2
MAY										
24...	280	62	77	21	17	12	0.4	2.7	264	0
JUL										
12...	260	67	63	24	33	22	0.9	2.6	217	7
SEP										
07...	270	67	69	24	35	22	0.9	3.2	229	10

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)
NOV									
09...	236	56	39	0.2	6.2	380	0.52	3110	0.05
JAN									
26...	172	42	34	0.1	7.1	311	0.42	7890	0.02
MAR									
29...	200	49	34	0.2	5.4	355	0.48	6640	0.02
MAY									
24...	216	39	30	0.2	7.0	351	0.48	7430	0.03
JUL									
12...	190	61	59	0.1	1.1	381	0.52	1950	0.02
SEP									
07...	204	60	58	0.3	7.4	380	0.52	2360	0.06

04119300 GRAND RIVER AT EASTMANVILLE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS TOTAL (MG/L AS P)	PHOSPHORUS DISSOLVED (MG/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)
NOV 09...	0.96	0.33	0.31	0.90	0.05	0.01	0.03	<10	<1	51
JAN 26...	2.0	0.31	0.31	1.4	0.11	0.04	0.05	--	--	--
MAR 29...	1.6	0.19	0.19	1.1	0.03	0.01	<0.01	<10	1	41
MAY 24...	1.7	0.17	0.17	1.3	0.08	0.04	0.03	<10	1	46
JUL 12...	0.60	0.02	0.03	1.3	0.10	<0.01	<0.01	--	--	--
SEP 07...	0.70	0.34	0.29	1.0	0.06	0.01	<0.01	10	1	52

DATE	BERYLLIUM, DISSOLVED (UG/L AS BE)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)
NOV 09...	<0.5	<1	2	<3	2	14	<1	7	10	<0.1
JAN 26...	--	--	--	--	--	--	--	--	--	--
MAR 29...	0.7	<1	--	<3	--	28	--	5	13	<0.1
MAY 24...	<0.5	<1	<1	<3	2	32	<1	5	8	<0.1
JUL 12...	--	--	--	--	--	--	--	--	--	--
SEP 07...	<0.5	<1	1	<3	1	5	<1	8	4	<0.1

DATE	MOLYBDENUM, DISSOLVED (UG/L AS MO)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV 09...	<10	3	<1	<1.0	300	<6	8	14	115	86
JAN 26...	--	--	--	--	--	--	--	75	1900	89
MAR 29...	<10	--	--	<1.0	190	<6	<3	15	281	90
MAY 24...	<10	7	<1	<1.0	200	<6	13	30	635	93
JUL 12...	--	--	--	--	--	--	--	36	185	80
SEP 07...	<10	4	<1	<1.0	360	<6	4	36	224	99

STREAMS TRIBUTARY TO LAKE MICHIGAN

442400084472801 HOUGHTON LAKE NEAR HOUGHTON LAKE HEIGHTS, MI

LOCATION.--Lat 44°24'16", long 84°47'28", in NW1/4 NW1/4 sec.10, T.23 N., R.4 W., Roscommon County, Hydrologic Unit 04060102, on right bank of Muskegon River at upstream side of bridge on Old U.S. Highway 27, 0.4 mi downstream from Houghton Lake, and 5.2 mi north of Houghton Lake Heights.

DRAINAGE AREA.--222 mi².

PERIOD OF RECORD.--June 1942 to current year, except winter period of 1942-43.

GAGE.--Water-stage recorder. Datum of gage is 1,130.00 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Sept. 28, 1960, nonrecording gage at datum 6.21 ft higher.

REMARKS.--Backus Creek and "The Cut" from Higgins Lake, join about 1 mi upstream from Houghton Lake and become the major inlet. There are also many small tributaries which feed the lake. The outlet is Muskegon River. Houghton Lake is the largest inland lake in Michigan. Established legal level; summer, 1,138.1 ft, minimum winter, 1,137.6 ft, above NGVD.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 10.18 ft, Apr. 23, 1985; minimum observed, 6.95 ft, Sept. 3, 5, Nov. 8, 1958.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 9.11 ft, June 2; minimum, 7.46 ft, Nov. 16.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	8.24	7.90	7.82	7.63	7.72	7.68	8.47	8.68	8.97	8.67	8.47	8.77
2	8.15	7.91	7.81	7.64	7.71	7.67	8.46	8.70	9.00	8.68	8.66	8.73
3	8.09	7.94	7.80	7.63	7.71	7.66	8.45	8.73	8.94	8.66	8.68	8.75
4	8.11	8.05	7.80	7.64	7.71	7.66	8.48	8.75	8.84	8.62	8.65	8.70
5	8.18	7.97	7.79	7.65	7.71	7.66	8.47	8.66	8.93	8.64	8.60	8.61
6	8.09	7.85	7.77	7.65	7.70	7.65	8.57	8.65	8.87	8.64	8.65	8.66
7	8.10	7.91	7.76	7.65	7.69	7.64	8.56	8.68	8.87	8.66	8.65	8.67
8	8.12	7.92	7.76	7.64	7.69	7.64	8.60	8.70	8.90	8.70	8.66	8.69
9	8.16	7.87	7.75	7.64	7.69	7.66	8.61	8.68	8.81	8.66	8.66	8.65
10	8.18	7.83	7.74	7.64	7.69	7.66	8.52	8.72	8.76	8.65	8.65	8.60
11	8.23	7.77	7.72	7.64	7.68	7.68	8.52	8.68	8.81	8.65	8.66	8.60
12	8.15	7.82	7.72	7.64	7.68	7.75	8.56	8.81	8.91	8.61	8.73	8.59
13	8.17	7.88	7.70	7.65	7.67	7.80	8.64	8.79	8.85	8.60	8.72	8.58
14	8.17	7.81	7.69	7.65	7.66	7.84	8.66	8.83	8.82	8.59	8.75	8.55
15	8.17	7.78	7.69	7.64	7.66	7.91	8.49	8.84	8.81	8.58	8.73	8.56
16	8.13	7.67	7.69	7.64	7.68	8.01	8.63	8.90	8.82	8.58	8.73	8.56
17	8.14	7.88	7.69	7.65	7.68	8.09	8.55	8.84	8.82	8.58	8.72	8.54
18	8.04	7.88	7.68	7.66	7.68	8.14	8.59	8.75	8.67	8.65	8.71	8.56
19	7.96	7.90	7.67	7.65	7.67	8.17	8.63	8.89	8.70	8.72	8.79	8.55
20	8.05	7.76	7.67	7.65	7.67	8.20	8.65	8.98	8.73	8.68	8.77	8.53
21	7.99	7.84	7.66	7.64	7.67	8.22	8.71	9.00	8.66	8.71	8.68	8.58
22	8.04	7.86	7.65	7.65	7.66	8.25	8.71	9.02	8.71	8.71	8.75	8.46
23	8.04	7.85	7.65	7.66	7.68	8.25	8.59	9.03	8.67	8.68	8.74	8.36
24	8.03	7.84	7.65	7.68	7.68	8.30	8.73	9.06	8.67	8.70	8.75	8.46
25	8.02	7.83	7.64	7.70	7.70	8.34	8.76	9.08	8.73	8.70	8.76	8.47
26	8.01	7.82	7.63	7.75	7.70	8.30	8.78	9.06	8.73	8.71	8.75	8.43
27	8.01	7.83	7.63	7.75	7.68	8.36	8.81	9.06	8.71	8.71	8.76	8.44
28	8.00	7.83	7.62	7.75	7.68	8.36	8.84	9.05	8.76	8.70	8.77	8.43
29	8.00	7.84	7.63	7.73	---	8.44	8.80	9.03	8.62	8.69	8.78	8.42
30	8.00	7.82	7.64	7.73	---	8.43	8.80	9.01	8.67	8.64	8.78	8.40
31	7.96	---	7.64	7.72	---	8.45	---	9.00	---	8.63	8.79	---
MEAN	8.09	7.86	7.70	7.67	7.69	8.00	8.62	8.86	8.79	8.66	8.71	8.56
MAX	8.24	8.05	7.82	7.75	7.72	8.45	8.84	9.08	9.00	8.72	8.79	8.77
MIN	7.96	7.67	7.62	7.63	7.66	7.64	8.45	8.65	8.62	8.58	8.47	8.36

CAL YR 1989 MEAN 8.48 MAX 9.18 MIN 7.62
WTR YR 1990 MEAN 8.27 MAX 9.08 MIN 7.62

STREAMS TRIBUTARY TO LAKE MICHIGAN

04121300 CLAM RIVER AT VOGEL CENTER, MI

LOCATION.--Lat 44°12'02", long 85°03'10", in SW1/4 NW1/4 sec.21, T.21 N., R.6 W., Missaukee County, Hydrologic Unit 04060102, on left bank 10 ft downstream from bridge on 8 Mile Road, 0.5 mi north of Vogel Center, and 3.5 mi southeast of Falmouth.

DRAINAGE AREA.--243 mi².

PERIOD OF RECORD.--June 1966 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 1,130 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 16-31. Records good except for estimated daily discharges, which are poor. Some regulation at low flow by dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--24 years, 130 ft³/s, 7.26 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,710 ft³/s, Mar. 29, 1989, gage height, 7.31 ft; minimum, 29 ft³/s, Nov. 3, 1969, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 350 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 15	0400	*934	*5.84	June 24	2400	388	4.25
May 21	2200	380	4.19	July 20	1500	419	4.40

Minimum discharge, 52 ft³/s, Feb. 25, gage height, 2.37 ft, result of freezeup.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	83	78	105	86	108	101	177	140	161	215	153	114
2	78	79	100	89	108	107	206	135	162	200	127	114
3	72	79	83	91	96	110	273	123	165	187	107	102
4	72	80	98	94	100	93	287	111	141	174	112	94
5	73	80	99	94	111	101	244	115	126	158	137	88
6	74	87	101	94	107	96	210	112	115	154	146	96
7	73	88	84	96	104	93	192	106	107	153	133	113
8	74	86	86	95	108	102	186	102	104	156	116	122
9	74	84	89	97	123	107	183	105	102	166	105	116
10	79	81	93	99	129	115	192	180	99	164	111	108
11	85	80	90	98	122	166	208	245	98	159	135	101
12	84	77	88	90	125	321	204	224	108	153	151	92
13	79	76	87	80	120	476	187	168	148	140	160	86
14	77	74	86	94	112	814	185	139	142	113	152	104
15	83	79	87	100	97	910	199	142	123	100	147	167
16	94	103	86	95	103	808	206	157	110	95	138	199
17	95	93	86	104	108	601	199	193	102	90	122	187
18	89	98	86	130	120	399	190	223	102	150	109	161
19	83	99	85	130	114	280	182	215	98	287	108	147
20	83	106	84	118	100	228	180	276	95	402	111	144
21	86	110	83	115	106	211	183	354	92	348	113	142
22	87	106	82	110	115	208	184	355	102	228	110	138
23	84	95	82	103	109	232	178	271	225	163	106	138
24	81	96	83	105	107	228	172	213	346	150	101	140
25	80	99	84	97	78	207	169	192	374	146	97	133
26	78	98	84	83	109	194	168	197	292	142	100	125
27	77	99	85	102	105	182	163	193	233	137	118	121
28	77	116	85	125	103	175	158	183	207	132	116	118
29	75	111	85	113	---	173	155	175	196	135	109	119
30	73	109	86	110	---	176	151	169	210	148	113	123
31	75	---	86	113	---	177	---	163	---	154	117	---
TOTAL	2477	2746	2728	3150	3047	8191	5771	5676	4685	5299	3780	3752
MEAN	79.9	91.5	88.0	102	109	264	192	183	156	171	122	125
MAX	95	116	105	130	129	910	287	355	374	402	160	199
MIN	72	74	82	80	78	93	151	102	92	90	97	86
CFSM	.33	.38	.36	.42	.45	1.09	.79	.75	.64	.70	.50	.51
IN.	.38	.42	.42	.48	.47	1.25	.88	.87	.72	.81	.58	.57

CAL YR 1989 TOTAL 49676 MEAN 136 MAX 1680 MIN 68 CFSM .56 IN 7.60
WTR YR 1990 TOTAL 51302 MEAN 141 MAX 910 MIN 72 CFSM .58 IN 7.85

04121500 MUSKEGON RIVER AT EVART, MI

LOCATION.--Lat 43°53'57", long 85°15'19", in NW1/4 NE1/4 sec.3, T.17 N., R.8 W., Osceola County, Hydrologic Unit 04060102, on right bank 500 ft downstream from bridge on U.S. Highway 10 in Evart, 0.4 mi upstream from Twin Creek, and at mile 123.9.

DRAINAGE AREA.--1,450 mi², approximately.

PERIOD OF RECORD.--October 1930 to September 1931, October 1933 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1437: 1934, 1947(M).

GAGE.--Water-stage recorder. Datum of gage is 977.72 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 7, 1956, nonrecording gages at sites 400 ft and 500 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Dec. 15 to Jan. 9, Jan. 14, 19, 23, 28-30, Feb. 2, 3, 5, 10-14, 17, 20, 25, Feb. 28 to Mar. 4, and Mar. 6-8, 14-16. Records good except for estimated daily discharges, which are poor. Some regulation at low flow by dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--58 years, 1,017 ft³/s, 9.52 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 9,040 ft³/s, Mar. 31, 1989, gage height, 14.99 ft; minimum observed, 164 ft³/s, Dec. 20, 1947, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,710 ft³/s, Mar. 18, gage height, 11.63 ft; minimum, 397 ft³/s, Oct. 4, gage height, 6.67 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	413	621	820	600	792	720	1590	963	1140	1460	1010	715
2	416	625	801	600	790	740	1620	911	1080	1430	896	693
3	412	621	738	610	750	750	1770	858	1170	1310	801	672
4	403	629	657	610	721	720	1810	840	1120	1200	788	648
5	408	641	681	620	720	711	1780	920	1030	1110	936	627
6	413	666	716	620	732	690	1710	917	987	1040	967	660
7	415	671	636	620	745	660	1620	859	953	953	931	912
8	412	669	583	630	774	680	1540	811	932	921	847	954
9	413	674	484	630	1100	744	1480	827	910	914	767	932
10	431	671	549	640	1180	915	1490	1490	873	869	720	912
11	452	672	634	650	1050	1290	1540	1860	839	834	695	872
12	463	665	646	653	980	2300	1500	1860	851	793	769	836
13	462	652	614	640	1020	3540	1440	1760	1000	745	884	795
14	460	647	621	640	960	4100	1470	1590	1140	711	957	884
15	454	678	600	640	778	4300	1570	1530	1180	679	919	1360
16	460	762	590	627	717	4400	1580	1660	1060	642	864	1480
17	483	809	580	805	720	4490	1540	1740	972	611	850	1450
18	500	751	580	1210	730	4590	1490	1710	908	638	802	1350
19	500	715	570	1050	740	4040	1440	1640	869	857	960	1280
20	506	798	560	1020	760	3470	1430	1960	820	1070	919	1230
21	510	805	560	923	808	3090	1470	2180	782	1210	873	1180
22	528	794	560	870	831	2900	1430	2240	821	1250	849	1180
23	554	733	560	800	792	2820	1380	2190	1930	1130	801	1150
24	574	711	570	767	822	2630	1320	2030	2160	1000	760	1110
25	582	728	570	799	750	2430	1280	1900	2170	918	726	1060
26	587	769	580	724	684	2250	1220	1800	2180	838	714	1020
27	594	811	580	725	704	2090	1170	1740	1930	765	716	958
28	598	901	580	740	710	1940	1110	1660	1640	721	756	917
29	598	870	590	760	---	1820	1050	1550	1510	723	757	903
30	603	813	590	780	---	1740	1010	1410	1490	1240	746	890
31	616	---	600	781	---	1660	---	1260	---	1200	734	---
TOTAL	15220	21572	19000	22784	22860	69220	43850	46666	36447	29782	25714	29630
MEAN	491	719	613	735	816	2233	1462	1505	1215	961	829	988
MAX	616	901	820	1210	1180	4590	1810	2240	2180	1460	1010	1480
MIN	403	621	484	600	684	660	1010	811	782	611	695	627
CFSM	.34	.50	.42	.51	.56	1.54	1.01	1.04	.84	.66	.57	.68
IN.	.39	.55	.49	.58	.59	1.78	1.12	1.20	.94	.76	.66	.76

CAL YR 1989 TOTAL 367973 MEAN 1008 MAX 8770 MIN 403 CFSM .70 IN 9.44
WTR YR 1990 TOTAL 382745 MEAN 1049 MAX 4590 MIN 403 CFSM .72 IN 9.82

STREAMS TRIBUTARY TO LAKE MICHIGAN

04121900 LITTLE MUSKEGON RIVER NEAR MORLEY, MI

LOCATION.--Lat 43°30'09", long 85°20'33", in SW1/4 SW1/4 sec.24, T.13 N., R.9 W., Mecosta County, Hydrologic Unit 04060102, on right bank at upstream side of highway bridge on 130th Avenue, 0.5 mi downstream from Rustford Dam, and 5.2 mi east of Morley.

DRAINAGE AREA.--138 mi².

PERIOD OF RECORD.--October 1966 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 920 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Nov. 24, Dec. 4, 7-9, Dec. 12 to Jan. 5, Jan. 13, Feb. 16, 21, Feb. 25 to Mar. 1, and Mar. 12, 13. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--24 years, 130 ft³/s, 12.79 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,300 ft³/s, Sept. 12, 1986, gage height, 8.57 ft; minimum, 22 ft³/s, July 21, 1979; minimum gage height, 1.51 ft, July 28, 1987.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 400 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 12	unknown	*763	*5.02	May 10	1500	402	3.54

Minimum discharge, 57 ft³/s, July 13, gage height, 1.73 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	64	98	113	86	109	103	146	78	108	138	112	71
2	66	96	109	88	118	102	166	75	106	115	96	70
3	66	92	104	90	105	105	175	74	127	99	86	67
4	64	90	100	91	103	100	159	106	126	93	102	65
5	66	90	97	92	98	98	148	178	111	88	142	65
6	73	116	97	93	99	96	144	153	106	84	126	67
7	70	106	96	89	101	95	137	135	99	81	113	98
8	69	97	94	89	111	93	132	122	125	79	102	97
9	68	93	92	90	167	145	129	173	130	72	93	84
10	74	91	90	93	153	254	145	350	112	65	87	78
11	76	88	88	92	128	402	156	375	104	63	84	74
12	73	86	86	91	115	655	142	319	100	62	70	72
13	72	84	85	89	111	679	130	249	111	59	76	70
14	72	85	85	86	108	619	145	200	112	62	73	82
15	71	128	85	85	109	476	162	181	112	76	67	116
16	71	168	85	86	110	366	145	214	101	72	67	150
17	72	139	84	169	110	292	135	255	95	66	66	129
18	72	122	84	234	115	242	125	229	96	70	67	101
19	71	112	83	151	101	205	115	187	87	113	88	101
20	87	120	82	128	103	181	125	283	85	93	93	123
21	90	130	81	115	105	172	151	322	84	86	89	119
22	89	113	81	110	108	181	141	284	80	83	85	131
23	86	104	81	105	124	198	127	217	125	80	81	127
24	84	100	81	113	118	176	110	188	122	78	79	112
25	84	98	82	135	115	159	105	209	99	73	77	101
26	83	101	82	158	110	152	103	230	93	70	79	93
27	83	110	83	144	108	142	99	181	116	68	83	72
28	100	186	84	154	105	135	95	154	111	67	78	69
29	97	154	84	139	---	133	91	142	110	73	75	70
30	94	125	84	120	---	142	82	123	120	156	72	71
31	96	---	85	110	---	143	---	114	---	150	71	---
TOTAL	2403	3322	2747	3515	3167	7041	3965	6100	3213	2634	2679	2745
MEAN	77.5	111	88.6	113	113	227	132	197	107	85.0	86.4	91.5
MAX	100	186	113	234	167	679	175	375	130	156	142	150
MIN	64	84	81	85	98	93	82	74	80	59	66	65
CFSM	.56	.80	.64	.82	.82	1.65	.96	1.43	.78	.62	.63	.66
IN.	.65	.90	.74	.95	.85	1.90	1.07	1.64	.87	.71	.72	.74

CAL YR 1989 TOTAL 44997 MEAN 123 MAX 674 MIN 64 CFSM .89 IN 12.13
WTR YR 1990 TOTAL 43531 MEAN 119 MAX 679 MIN 59 CFSM .86 IN 11.73

STREAMS TRIBUTARY TO LAKE MICHIGAN

04122000 MUSKEGON RIVER AT NEWAYGO, MI

LOCATION.--Lat 43°25'20", long 85°48'04", in NE1/4 NE1/4 sec.24, T.12 N., R.13 W., Newaygo County, Hydrologic Unit 04060102, on left bank near nonoperative powerplant in Newaygo, 600 ft downstream from Penoyer Creek, and at mile 39.1.

DRAINAGE AREA.--2,350 mi², approximately.

PERIOD OF RECORD.--July to December 1908, July 1909 to July 1915, January 1916 to December 1919, October 1930 to current year. Monthly discharge only for some periods, published in WSP 1307. Records for June 1901 to December 1906, published in WSP 129, 170, and 206, are unreliable and should not be used.

REVISED RECORDS.--WSP 974: 1933, 1935, 1937-38. WSP 1307: 1940(M). See also PERIOD OF RECORD.

GAGE.--Water-stage recorder. Datum of gage is 625.83 ft above National Geodetic Vertical Datum of 1929. October 1930 to January 1939, nonrecording gage, and Jan. 31, 1939 to Sept. 30, 1963, water-stage recorder at present site at datum 40.0 ft lower.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by powerplants upstream from station, the largest of which are Croton Dam, Hardy Dam (since 1931), and Rogers Dam. Since Dec. 27, 1965, powerplant at Newaygo nonoperative, and in January 1969, dam at Newaygo was removed. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--68 years (water years 1910-14, 1917-19, 1931-90), 2,011 ft³/s, 11.62 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 23,200 ft³/s, Sept. 12, 1986, gage height, 19.54 ft, from floodmark; minimum, 52 ft³/s, Oct. 2, 1965, gage height, 5.31 ft, result of regulation during pipeline repair; minimum daily, 330 ft³/s, Feb. 15, 1914.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 6,170 ft³/s, Mar. 14, gage height, 10.50 ft; minimum, 972 ft³/s, Oct. 27, 28; minimum gage height, 6.74 ft, July 29, Aug. 30, 31; minimum daily discharge, 1,020 ft, Aug. 30, 31.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1050	1670	2030	1570	2380	2110	2750	1680	2140	2650	2170	1030
2	1050	1490	2030	1810	2360	2360	2630	1440	1890	2710	2050	1060
3	1040	1280	2030	1810	2360	2440	2440	1180	1930	2510	1700	1090
4	1040	1300	2030	1820	2350	2400	2510	1340	2090	2380	1990	1150
5	1050	1310	1370	1810	2350	2180	2510	1760	2200	2160	2260	1160
6	1090	1530	1360	1810	2330	2180	2510	1800	2090	1860	1980	1400
7	1140	1810	1570	1870	2290	2380	2530	1830	1910	1770	1720	1770
8	1090	1780	1500	1940	2260	2390	2550	1860	1930	1710	1720	1850
9	1070	1740	1170	1940	2270	2480	2450	2000	2030	1780	1650	1870
10	1060	1540	1160	1940	2420	2770	2330	2990	1830	1670	1580	1890
11	1040	1270	1160	1940	2590	3030	2290	4310	1760	1610	1360	1920
12	1040	1240	1310	1920	2590	3920	2280	4490	1740	1570	1170	1840
13	1060	1210	1260	1910	2550	5590	2270	4440	1760	1410	1170	1740
14	1120	1500	1250	1910	2520	5890	2350	3840	2060	1190	1430	1820
15	1130	1910	1230	1900	2530	6090	2390	3070	2240	1190	1810	1840
16	1150	1880	1220	1910	2480	5670	2390	3030	2220	1190	1840	2520
17	1250	1870	1230	1990	2360	5150	2390	3090	2200	1180	1570	3410
18	1240	1870	1230	2290	2290	5040	2380	3200	2050	1230	1380	2350
19	1250	1860	1230	2860	2290	5110	2360	3370	1780	2280	1750	2350
20	1250	1860	1280	2910	2240	5140	2340	3640	1510	2370	1840	2200
21	1260	1850	1370	2770	2210	4670	2300	3870	1210	2340	1860	1940
22	1250	1870	1420	2770	2120	4200	2280	4040	1520	2670	1850	1760
23	1250	1890	1420	2670	2050	3990	2260	3890	2040	1790	1820	1800
24	1240	1580	1420	2200	2070	3990	2260	3720	2940	1260	1750	1830
25	1250	1220	1420	2240	1980	3830	2200	3700	3730	1440	1710	1880
26	1240	1550	1410	2550	1720	3610	1990	3680	3660	1510	1720	1890
27	1220	1960	1410	2590	1850	3550	1830	3360	3600	2170	2120	1850
28	1260	1990	1370	2580	1980	3400	1800	2760	3390	1770	2310	1720
29	1280	2010	1340	2490	---	3080	1760	2500	2740	1240	1570	1630
30	1270	2050	1340	2410	---	2910	1740	2430	2520	1400	1020	1630
31	1450	---	1350	2410	---	2820	---	2350	---	2060	1020	---
TOTAL	36180	49890	43920	67540	63790	114370	69070	90660	66710	56070	52890	54190
MEAN	1167	1663	1417	2179	2278	3689	2302	2925	2224	1809	1706	1806
MAX	1450	2050	2030	2910	2590	6090	2750	4490	3730	2710	2310	3410
MIN	1040	1210	1160	1570	1720	2110	1740	1180	1210	1180	1020	1030
CFSM	.50	.71	.60	.93	.97	1.57	.98	1.25	.95	.77	.73	.77
IN.	.57	.79	.70	1.07	1.01	1.81	1.09	1.44	1.06	.89	.84	.86

CAL YR 1989 TOTAL 781430 MEAN 2141 MAX 8240 MIN 1030 CFSM .91 IN 12.37
WTR YR 1990 TOTAL 765280 MEAN 2097 MAX 6090 MIN 1020 CFSM .89 IN 12.11

STREAMS TRIBUTARY TO LAKE MICHIGAN

04122030 MUSKEGON RIVER NEAR BRIDGETON, MI
(National stream quality accounting network station)

LOCATION.--Lat 43°19'05", long 86°02'11", in SW1/4 NW1/4 sec.30, T.11 N., R.14 W., Newaygo County, Hydrologic Unit 04060102, at bridge on Maple Island Road, 5 mi southwest of Bridgeton, 13 mi upstream from Muskegon Lake, and 20 mi downstream from gaging station at Newaygo.

DRAINAGE AREA.--2,420 mi², approximately.

PERIOD OF RECORD.--Water years 1974 to August 1990 (discontinued).

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: November 1974 to September 1981.
WATER TEMPERATURE: November 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Nov. 12, 1975 to Sept. 24, 1981.

REMARKS.--Quarterly cross-sectional samples were collected at or near bridge. Water-discharge measurements were made at time of sampling. Some regulation by upstream dams.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975, 1978-81): Maximum, 1,550 microsiemens, Sept. 24, 1979; minimum, 69 microsiemens, May 3, 1979.
WATER TEMPERATURE (water years 1975, 1977-81): Maximum, 33.0°C, July 19, 1977; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV										
08...	1130	1800	404	8.17	9.0	1.5	10.4	93	K13	K19
MAR										
29...	1000	3490	303	7.97	4.0	1.0	12.1	93	K4	K6
JUN										
27...	1030	3810	313	8.08	18.5	3.8	8.0	87	K36	76
AUG										
01...	1015	2550	340	8.28	20.5	4.0	7.9	89	--	K54

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
NOV										
08...	200	33	52	16	11	11	0.3	1.1	199	0
MAR										
29...	140	26	39	11	8.2	11	0.3	1.9	143	0
JUN										
27...	150	17	42	12	7.9	10	0.3	1.2	167	0
AUG										
01...	160	13	44	13	8.7	10	0.3	1.1	183	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
NOV										
08...	163	22	19	0.1	5.1	239	0.33	1160	<0.01	0.29
MAR										
29...	117	16	15	<0.1	6.6	170	0.23	1600	<0.01	0.40
JUN										
27...	137	10	15	<0.1	5.6	172	0.23	1770	<0.01	0.20
AUG										
01...	150	16	15	0.1	5.3	198	0.27	1360	<0.01	0.20

04122030 MUSKEGON RIVER NEAR BRIDGETON, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS TOTAL (MG/L AS P)	PHOSPHORUS DISSOLVED (MG/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
NOV 08...	0.02	0.02	0.5	0.02	<0.01	<0.01	<10	<1	22	<0.5
MAR 29...	0.12	0.11	0.6	0.03	0.01	<0.01	<10	<1	19	<0.5
JUN 27...	0.02	0.01	<0.2	0.03	0.02	<0.01	<10	1	21	<0.5
AUG 01...	0.02	0.02	0.9	0.03	0.02	<0.01	<10	1	20	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
NOV 08...	<1	<1	<3	2	7	1	5	4	0.1	<10
MAR 29...	<1	<5	<3	<10	51	<10	<4	10	<0.1	<10
JUN 27...	<1	<1	<3	3	20	1	5	3	<0.1	<10
AUG 01...	<1	<1	<3	6	10	<1	4	2	0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV 08...	2	<1	<1.0	170	<6	<3	11	53	41
MAR 29...	<10	<1	2.0	110	<6	30	24	226	26
JUN 27...	1	<1	<1.0	120	<6	5	27	278	48
AUG 01...	1	<1	<1.0	140	<6	5	27	186	54

04122100 BEAR CREEK NEAR MUSKEGON, MI

LOCATION.--Lat 43°17'19", long 86°13'22", in SW1/4 NW1/4 sec.4, T.10 N., R.16 W., Muskegon County, Hydrologic Unit 04060102, on left bank at upstream side of bridge on North Getty Street, 1.5 mi upstream from Little Bear Creek, and 3.9 mi northeast of Muskegon.

DRAINAGE AREA.--14.8 mi².

PERIOD OF RECORD.--October 1965 to current year.

REVISED RECORDS.--WDR MI-80-1: 1976(M), 1978(M), 1979(P).

GAGE.--Water-stage recorder. Datum of gage is 590.00 ft above National Geodetic Vertical Datum of 1929 (Michigan Department of Natural Resources bench mark). Prior to Mar. 17, 1978, at different datum.

REMARKS.--Estimated daily discharges: Dec. 7-10, Dec. 12 to Jan. 7, and Feb. 20, 25-27. Records good except for estimated daily discharges, which are poor. Some regulation during low flow by dams and irrigation upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--25 years, 17.2 ft³/s, 15.78 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 930 ft³/s, Mar. 5, 1976, gage height, 11.00 ft, datum then in use; minimum, 1.0 ft³/s, Aug. 5, 17, 22, 1971.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 100 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
May 10	1300	*190	*14.58	No other peak greater than base discharge.			

Minimum discharge, 3.6 ft³/s, Sept. 6, gage height, 10.38 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.3	5.5	9.9	7.8	21	15	18	13	16	13	5.6	4.3
2	4.1	5.5	10	7.9	23	16	25	12	16	12	5.2	4.5
3	4.5	5.6	9.5	8.0	19	20	23	12	17	11	5.2	4.5
4	4.3	5.9	9.2	8.1	17	17	20	25	15	9.9	6.5	4.3
5	6.0	6.6	9.0	8.1	17	14	19	32	14	9.3	6.9	4.0
6	6.9	7.6	9.1	8.2	19	14	19	24	14	8.4	6.3	4.4
7	5.4	6.7	8.7	10	19	15	18	20	13	8.2	5.6	9.5
8	5.1	6.3	8.5	13	20	14	17	18	20	8.4	5.5	5.9
9	4.9	6.1	8.2	15	22	37	16	29	18	7.6	5.0	5.3
10	6.1	6.8	8.0	17	19	43	19	128	15	7.4	5.0	5.0
11	5.6	6.9	7.8	16	16	49	18	94	13	7.1	4.8	5.0
12	5.3	6.7	7.8	15	15	73	17	50	13	6.9	4.8	4.6
13	5.2	6.3	7.7	14	17	51	16	46	12	6.6	4.7	4.8
14	5.1	6.3	7.6	13	16	43	23	36	16	6.8	4.5	11
15	5.2	11	7.6	12	19	35	23	32	16	7.4	4.7	10
16	5.4	13	7.6	12	18	29	20	42	13	7.0	4.5	11
17	5.5	11	7.5	37	14	26	20	43	12	6.4	4.7	7.9
18	5.2	10	7.5	48	15	24	18	34	11	6.2	5.0	6.9
19	5.4	10	7.5	27	14	22	16	31	10	6.7	9.3	7.5
20	6.5	17	7.4	22	14	21	23	76	11	7.3	6.4	7.2
21	7.2	15	7.4	20	14	20	28	58	11	6.8	6.1	11
22	6.1	12	7.4	19	18	24	22	38	14	6.7	5.7	11
23	5.8	10	7.4	18	25	27	19	30	34	6.6	5.4	8.7
24	5.7	9.8	7.4	28	24	22	18	30	25	6.2	5.5	7.7
25	5.5	10	7.4	33	21	20	17	28	19	5.6	5.2	7.0
26	5.1	9.6	7.5	33	18	19	16	25	17	5.4	5.6	6.6
27	5.3	10	7.5	29	16	18	15	23	16	5.2	5.4	6.1
28	5.5	13	7.5	37	15	17	14	21	16	5.1	5.0	6.1
29	5.5	11	7.6	26	---	17	13	19	17	7.1	4.9	5.9
30	5.3	11	7.6	22	---	21	13	18	15	7.4	4.6	6.1
31	5.6	---	7.7	20	---	19	---	16	---	6.3	4.5	---
TOTAL	168.6	272.2	248.5	604.1	505	802	563	1103	469	232.0	168.1	203.8
MEAN	5.44	9.07	8.02	19.5	18.0	25.9	18.8	35.6	15.6	7.48	5.42	6.79
MAX	7.2	17	10	48	25	73	28	128	34	13	9.3	11
MIN	4.1	5.5	7.4	7.8	14	14	13	12	10	5.1	4.5	4.0
CFSM	.37	.61	.54	1.32	1.22	1.75	1.27	2.41	1.05	.51	.37	.46
IN.	.42	.68	.62	1.52	1.27	2.02	1.42	2.77	1.18	.58	.42	.51

CAL YR 1989 TOTAL 4886.2 MEAN 13.4 MAX 75 MIN 3.3 CFSM .91 IN 12.28
WTR YR 1990 TOTAL 5339.3 MEAN 14.6 MAX 128 MIN 4.0 CFSM .99 IN 13.42

STREAMS TRIBUTARY TO LAKE MICHIGAN

04122200 WHITE RIVER NEAR WHITEHALL, MI

LOCATION.--Lat 43°27'51", long 86°13'57", in SE1/4 NW1/4 sec.4, T.12 N., R.16 W., Muskegon County, Hydrologic Unit 04060101, on right bank 30 ft downstream from bridge on Fruitvale Road, 6.3 mi downstream from North Branch, and 6.9 mi northeast of Whitehall.

DRAINAGE AREA.--406 mi².

PERIOD OF RECORD.--August 1957 to current year.

REVISED RECORDS.--WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 594.1 ft above National Geodetic Vertical Datum of 1929. Nov. 18, 1957, to Oct. 22, 1958, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 10-12, Dec. 15 to Jan. 9, and Feb. 27, 28. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--33 years, 447 ft³/s, 14.95 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,400 ft³/s, Sept. 1, 1975, gage height, 7.46 ft; minimum, 163 ft³/s, Aug. 18, 19, 1958.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,450 ft³/s, Mar. 13, 14, gage height, 5.25 ft; minimum, 225 ft³/s, Oct. 1, 2, gage height, 1.61 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	228	279	415	370	427	421	512	383	406	547	371	277
2	227	279	394	375	440	421	522	375	397	672	330	272
3	232	281	382	380	441	418	563	360	419	617	308	266
4	233	292	375	380	415	408	573	392	484	476	340	263
5	241	319	363	380	402	394	546	479	495	424	394	260
6	262	335	363	385	399	376	515	552	473	384	419	265
7	264	337	353	390	403	365	500	532	428	362	408	316
8	256	328	317	390	420	370	485	476	433	357	358	297
9	253	315	329	390	505	441	468	476	499	355	328	265
10	272	310	360	393	612	575	472	616	543	349	310	288
11	282	309	365	391	599	688	492	1050	527	333	285	303
12	275	304	365	379	531	836	495	1210	461	319	272	285
13	264	301	322	377	491	1290	479	1040	424	309	306	278
14	261	304	366	354	491	1370	483	954	494	303	311	329
15	259	334	360	355	478	1200	532	846	629	313	306	447
16	263	395	360	350	454	1100	573	742	724	323	302	518
17	271	437	360	424	452	979	569	681	590	317	294	514
18	268	437	355	621	431	867	534	675	476	315	288	462
19	266	411	355	752	428	771	491	651	427	376	352	425
20	276	419	355	681	407	679	478	666	405	464	379	391
21	303	444	355	573	392	611	524	790	394	488	350	371
22	315	443	350	496	427	588	553	872	400	446	333	412
23	304	411	350	456	465	606	528	777	531	403	322	429
24	294	379	350	474	483	636	502	697	653	375	305	415
25	286	365	350	542	457	613	472	595	643	348	304	387
26	279	369	350	553	409	567	443	564	520	323	298	360
27	278	377	350	530	410	526	422	549	463	317	332	339
28	275	422	355	531	415	501	400	518	452	306	342	326
29	273	472	360	517	---	488	384	472	447	312	318	320
30	271	454	365	485	---	495	375	442	426	345	299	311
31	273	---	370	449	---	510	---	423	---	377	286	---
TOTAL	8304	10862	11119	14123	12684	20110	14885	19855	14663	11955	10150	10391
MEAN	268	362	359	456	453	649	496	640	489	386	327	346
MAX	315	472	415	752	612	1370	573	1210	724	672	419	518
MIN	227	279	317	350	392	365	375	360	394	303	272	260
CFSM	.66	.89	.88	1.12	1.12	1.60	1.22	1.58	1.20	.95	.81	.85
IN.	.76	1.00	1.02	1.29	1.16	1.84	1.36	1.82	1.34	1.10	.93	.95

CAL YR 1989 TOTAL 162121 MEAN 444 MAX 2160 MIN 227 CFSM 1.09 IN 14.85
WTR YR 1990 TOTAL 159101 MEAN 436 MAX 1370 MIN 227 CFSM 1.07 IN 14.58

STREAMS TRIBUTARY TO LAKE MICHIGAN

04122500 PERE MARQUETTE RIVER AT SCOTTVILLE, MI

LOCATION.--Lat 43°56'42", long 86°16'43", in NW1/4 NW1/4 sec.19, T.18 N., R.16 W., Mason County, Hydrologic Unit 04060101, on right bank 20 ft upstream from highway bridge at south edge of Scottville, 1.4 mi upstream from India Creek, and 5.6 mi downstream from Big South Branch.

DRAINAGE AREA.--681 mi².

PERIOD OF RECORD.--August 1939 to current year. Prior to October 1942, published as "at Custer".

REVISED RECORDS.--WSP 1437: 1941(M), 1943(M), 1949(M), 1950. WDR MI-81: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 597.66 ft above National Geodetic Vertical Datum of 1929. Prior to June 12, 1943, nonrecording gage at bridge 4.5 mi upstream at different datum.

REMARKS.--Estimated daily discharges: Dec. 10-12, Dec. 14 to Jan. 9, Jan. 29, and Feb. 27, 28. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--51 years, 694 ft³/s, 13.84 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,440 ft³/s, Sept. 13, 1986, gage height, 8.07 ft; minimum, 209 ft³/s, Dec. 11, 1962, discharge measurement; minimum daily, 310 ft³/s, Aug. 9, 10, 1941.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,220 ft³/s, Mar. 15, gage height, 5.23 ft; minimum, 437 ft³/s, Oct. 1, 2, 3, 4, 5, gage height, 1.71 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	439	508	663	620	761	668	895	686	740	1060	686	594
2	437	514	642	630	732	690	943	675	729	1220	638	578
3	439	511	627	630	717	663	1000	660	753	1290	618	560
4	438	513	598	640	677	651	1050	663	812	1220	1020	544
5	443	522	589	640	682	629	1050	708	853	1040	1060	538
6	461	527	589	640	686	623	995	783	823	898	980	602
7	465	529	587	650	673	602	936	822	766	814	883	751
8	466	533	526	650	685	600	892	769	731	761	766	831
9	467	528	518	650	830	675	856	742	716	729	692	849
10	488	522	610	659	938	786	854	964	720	707	646	809
11	493	526	620	637	998	986	858	1190	701	679	618	701
12	503	521	625	626	966	1280	878	1460	808	650	658	635
13	490	527	626	596	920	1590	864	1660	921	627	741	596
14	478	525	625	579	894	1890	853	1600	908	611	699	663
15	474	531	620	576	863	2190	869	1410	1020	616	653	785
16	488	566	620	586	813	2110	920	1280	1200	653	627	845
17	495	623	610	693	758	1880	945	1230	1540	645	611	907
18	495	646	600	860	724	1660	921	1210	1590	636	599	925
19	494	615	600	987	720	1490	891	1180	1260	723	659	876
20	503	616	590	1040	680	1360	861	1220	1030	839	717	791
21	521	637	590	972	649	1260	849	1270	917	925	747	757
22	537	649	590	911	690	1190	871	1340	873	969	711	750
23	542	636	590	871	715	1170	899	1380	1140	905	668	793
24	530	604	590	827	726	1180	864	1280	1190	831	641	807
25	518	583	590	837	715	1180	816	1140	1270	794	626	777
26	510	586	590	926	668	1120	786	1050	1360	719	670	730
27	508	604	600	796	668	1040	763	988	1260	669	778	682
28	504	645	600	768	668	982	737	926	1040	642	775	647
29	497	688	610	760	---	935	712	860	938	642	768	638
30	494	716	610	756	---	906	696	808	927	690	688	633
31	502	---	620	769	---	892	---	768	---	694	631	---
TOTAL	15119	17251	18665	22782	21216	34878	26324	32722	29536	24898	22274	21594
MEAN	488	575	602	735	758	1125	877	1056	985	803	719	720
MAX	542	716	663	1040	998	2190	1050	1660	1590	1290	1060	925
MIN	437	508	518	576	649	600	696	660	701	611	599	538
CFSM	.72	.84	.88	1.08	1.11	1.65	1.29	1.55	1.45	1.18	1.06	1.06
IN.	.83	.94	1.02	1.24	1.16	1.91	1.44	1.79	1.61	1.36	1.22	1.18

CAL YR 1989 TOTAL 269848 MEAN 739 MAX 3000 MIN 437 CFSM 1.09 IN 14.74
WTR YR 1990 TOTAL 287259 MEAN 787 MAX 2190 MIN 437 CFSM 1.16 IN 15.69

STREAMS TRIBUTARY TO LAKE MICHIGAN

04124000 MANISTEE RIVER NEAR SHERMAN, MI

LOCATION.--Lat 44°26'11", long 85°41'55", in NE1/4 NE1/4 sec.36, T.24 N., R.12 W., Wexford County, Hydrologic Unit 04060103, on downstream side of bridge near right pier on State Highway 37, 250 ft upstream from Wheeler Creek, 0.9 mi north of Sherman, and at mile 60.8.

DRAINAGE AREA.--857 mi².

PERIOD OF RECORD.--July 1903 to May 1916, October 1930 to September 1931, October 1933 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1004: 1936(M). WSP 1307: 1911, 1913-14(M), 1934(M), 1936(M), 1937, 1939-40(M). WSP 1437: 1911, 1913(M), 1937. WDR MI-88: Drainage area.

GAGE.--Nonrecording gage and since May 1988 crest-stage gage at downstream side of bridge. Elevation of gage is 804 ft, from river profile map. Prior to Apr. 13, 1934, at various datums.

REMARKS.--Estimated daily discharges: Nov. 23, 27-30, Dec. 9 to Jan. 2, Jan. 27, 28, 30, Feb. 1, 3, Feb. 27 to Mar. 1, Apr. 15, June 2-5, 7, 9-27, June 29 to Aug. 1, Aug. 3-16, Aug. 18 to Sept. 4, and Sept. 6-19, 21. Records poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--70 years (water years 1904-15, 1931, 1934-90), 1,061 ft³/s, 16.81 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,570 ft³/s, Mar. 25, 1913, gage height, 7.1 ft, from graph based on gage readings, datum then in use; minimum daily, 540 ft³/s, Feb. 21-23, 1936.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,100 ft³/s, Mar. 18, gage height, 15.99 ft; minimum daily, 794 ft³/s, Oct. 4, 5, gage height, 10.97 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	800	854	966	950	1000	940	1320	1030	974	1500	1050	840
2	803	866	954	960	1000	962	1480	998	1000	1550	1040	820
3	798	866	946	1010	970	934	1740	986	1050	1500	1050	810
4	794	869	950	966	946	910	1570	974	1070	1400	1100	810
5	794	869	938	1060	950	878	1490	974	1030	1300	1150	809
6	806	887	922	1020	974	836	1390	974	986	1150	1100	950
7	809	898	914	986	970	878	1310	966	980	1050	1050	1080
8	818	906	806	982	966	898	1270	958	958	1000	1000	1120
9	815	910	860	986	1070	914	1250	954	950	950	980	1080
10	827	906	920	990	1130	962	1270	1290	940	920	930	1000
11	857	898	940	978	1090	1070	1310	1720	1000	900	920	950
12	848	890	950	978	1010	1670	1280	1640	1130	860	980	880
13	839	881	960	954	1010	2220	1250	1580	1200	840	1020	860
14	830	875	960	930	1030	2560	1240	1430	1300	830	980	980
15	833	894	950	926	990	2760	1270	1350	1500	850	950	1020
16	851	946	940	934	966	2840	1300	1320	1600	880	900	1030
17	869	962	930	1110	958	3020	1320	1310	1700	880	848	1020
18	906	962	930	1240	926	3080	1300	1290	1620	920	900	1000
19	890	970	920	1210	938	2860	1260	1250	1500	1000	960	960
20	884	978	920	1160	918	2520	1250	1540	1400	1100	1000	942
21	934	982	920	1120	930	2100	1260	1620	1230	1250	990	920
22	926	986	920	1070	954	1900	1270	1580	1330	1300	980	910
23	906	960	920	1070	958	1850	1240	1390	1500	1150	950	938
24	902	906	920	1070	966	1720	1210	1300	1600	1100	920	942
25	884	910	920	1070	902	1600	1200	1210	1700	1050	910	930
26	872	950	920	1070	894	1480	1180	1170	1650	990	970	922
27	863	980	920	1060	920	1430	1160	1130	1530	980	1050	902
28	857	1000	930	1040	930	1370	1120	1090	1360	980	1020	884
29	851	1000	930	1010	---	1350	1080	1050	1300	1050	980	902
30	845	980	930	1000	---	1330	1050	1020	1300	1100	940	926
31	845	---	940	986	---	1330	---	990	---	1050	890	---
TOTAL	26356	27741	28746	31896	27266	51172	38640	38084	38388	33380	30508	28137
MEAN	850	925	927	1029	974	1651	1288	1229	1280	1077	984	938
MAX	934	1000	966	1240	1130	3080	1740	1720	1700	1550	1150	1120
MIN	794	854	806	926	894	836	1050	954	940	830	848	809
CFSM	.99	1.08	1.08	1.20	1.14	1.93	1.50	1.43	1.49	1.26	1.15	1.10
IN.	1.14	1.20	1.25	1.38	1.18	2.22	1.68	1.65	1.67	1.45	1.32	1.22

CAL YR 1989 TOTAL 379542 MEAN 1040 MAX 2800 MIN 794 CFSM 1.21 IN 16.47
WTR YR 1990 TOTAL 400314 MEAN 1097 MAX 3080 MIN 794 CFSM 1.28 IN 17.38

STREAMS TRIBUTARY TO LAKE MICHIGAN

04126000 MANISTEE RIVER NEAR MANISTEE, MI

LOCATION.--Lat 44°16'14", long 86°11'56", in NW1/4 NW1/4 sec.36, T.22 N., R.16 W., Manistee County, Hydrologic Unit 04060103, on right bank 6.4 mi northeast of Manistee, 7.8 mi upstream from Manistee Lake, and at mile 10.8.

DRAINAGE AREA.--1,677 mi².

PERIOD OF RECORD.--October 1951 to current year. Monthly discharge only for October, November, 1951, published in WSP 1727.

REVISED RECORDS.--WDR MI-88: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 585 ft, from river-profile map.

REMARKS.--Estimated daily discharges: Dec. 19 to Jan. 7. Records good except for estimated daily discharges, which are fair. Flow regulated at all stages by Tippy Hydroelectric Powerplant 21 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--39 years, 2,049 ft³/s, 16.59 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,280 ft³/s, Oct. 5, 1986, gage height, 8.44 ft; maximum gage height, 9.25 ft, Dec. 28, 1985, backwater from ice; minimum daily discharge, 570 ft³/s, June 18, 1980.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 6,890 ft³/s, June 26, gage height, 8.56 ft; maximum gage height, 8.62 ft, Dec. 26, backwater from ice; minimum discharge, 976 ft³/s, Nov. 13, gage height, 4.19 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1600	1650	2100	1850	2000	1970	2480	2020	2200	3740	2160	1820
2	1560	1670	1750	1850	2010	1980	2610	2290	1920	4170	2090	1750
3	1550	1650	1830	1950	1970	2140	2840	2190	2010	3930	2110	1680
4	1530	1650	1700	1950	1990	1920	2960	1970	2340	3670	2230	1620
5	1550	1690	1840	1900	2020	1780	3260	1940	2520	2320	1950	1710
6	1570	1620	1850	2090	1980	1770	2940	1800	2340	2260	1830	2130
7	1600	1730	1830	2090	1950	1760	2890	1720	2070	2150	2460	2310
8	1600	1780	1710	2090	1750	1790	2770	1890	1990	2140	2260	2200
9	1620	1760	1690	1960	2110	1840	2650	1950	1900	2160	1550	2130
10	1920	1360	1700	2030	2200	2190	2660	2440	1970	2290	1700	2190
11	2430	1440	1360	2070	2180	2230	2550	3170	1950	2280	1940	2060
12	1290	1270	1490	2060	2230	2750	2140	3710	2060	2230	1740	1770
13	1260	1080	2090	1970	2250	4010	2360	3830	2620	1830	1750	1510
14	1760	1170	1590	1910	2140	4850	2490	3430	2970	1800	1900	1880
15	1640	1230	1660	1910	1990	5780	2610	2940	3210	1910	1920	2850
16	1710	1750	1730	1890	2040	6320	2650	2930	2850	1920	1760	3060
17	1720	1960	1710	2120	2080	5380	2790	3030	2810	2220	1810	2280
18	1810	1640	1620	2600	2090	5140	2810	2810	2870	1950	1850	2260
19	1810	1720	1700	2600	1900	4960	2700	2520	2730	2150	1840	2140
20	1550	1810	1700	2940	1850	4810	2620	2830	2530	2420	2260	2070
21	1910	2030	1500	2480	1860	4430	2380	3580	2340	2340	2050	1880
22	1960	1800	1450	2280	1890	4150	2440	3910	2310	1910	1970	2020
23	1690	1790	1580	2250	1890	3890	2530	3980	2630	2110	1770	2050
24	1770	1840	1500	1990	1950	3570	2520	3440	3660	2100	2060	2040
25	1790	1850	1850	2220	1870	3240	2460	2860	5030	2030	1790	2020
26	1870	1810	1760	2670	1810	2950	2140	2760	6660	1900	2150	2300
27	1590	1870	1680	2110	1800	2880	2260	2440	5630	1850	2150	1840
28	1770	1920	1700	2180	1650	3120	2270	2190	3980	1970	1530	1760
29	1550	1920	1800	2130	---	2850	2220	1980	2850	1780	1780	1810
30	1630	1910	1950	2030	---	2760	1990	2280	2840	1940	1840	2170
31	1900	---	1850	2020	---	2500	---	2120	---	2290	1810	---
TOTAL	52510	50370	53270	66190	55450	101710	76990	82950	85790	71760	60010	61310
MEAN	1694	1679	1718	2135	1980	3281	2566	2676	2860	2315	1936	2044
MAX	2430	2030	2100	2940	2250	6320	3260	3980	6660	4170	2460	3060
MIN	1260	1080	1360	1850	1650	1760	1990	1720	1900	1780	1530	1510
CFSM	1.01	1.00	1.02	1.27	1.18	1.96	1.53	1.60	1.71	1.38	1.15	1.22
IN.	1.16	1.12	1.18	1.47	1.23	2.26	1.71	1.84	1.90	1.59	1.33	1.36

CAL YR 1989 TOTAL 768800 MEAN 2106 MAX 6800 MIN 1080 CFSM 1.26 IN 17.05
WTR YR 1990 TOTAL 818310 MEAN 2242 MAX 6660 MIN 1080 CFSM 1.34 IN 18.15

04126520 MANISTEE RIVER AT MANISTEE, MI
(National stream quality accounting network station)

LOCATION.--Lat 44°15'02", long 86°19'09", in SW1/4 SW1/4 sec.1, T.21 N., R.17 W., Manistee County, Hydrologic Unit 04060103, at upstream side of bridge on U.S. Highway 31 in Manistee, and 1.3 mi upstream from mouth.

DRAINAGE AREA.--1,928 mi², revised.

PERIOD OF RECORD.--Water years 1974 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: November 1974 to September 1981.
WATER TEMPERATURE: November 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Mar. 18, 1977 to Sept. 30, 1981.

REMARKS.--Bimonthly cross-sectional samples were collected at Washington Street bridge. Water-discharge measurements were made at time of sampling.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975-81): Maximum daily, 1,680 microsiemens, Nov. 18, 1974; minimum, 226 microsiemens, Apr. 22, 1980.
WATER TEMPERATURE (water years 1975-81): Maximum, 26.5°C, July 8, 1981, minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV										
07...	1330	2360	400	8.19	8.0	2.4	10.6	92	48	K17
JAN										
09...	1315	2280	522	7.96	1.0	4.3	11.9	87	K55	K23
MAR										
30...	0915	3110	276	8.02	5.0	7.8	11.5	92	K7	K7
MAY										
23...	1030	4610	404	7.90	14.0	0.8	8.6	85	63	58
JUN										
28...	0900	4400	309	7.93	18.5	4.8	6.5	71	--	--
AUG										
02...	0915	2200	348	8.25	21.0	3.4	8.1	92	54	K28

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
NOV										
07...	190	41	55	13	9.9	10	0.3	1.1	183	0
JAN										
09...	220	67	67	13	12	10	0.4	1.6	188	0
MAR										
30...	130	27	38	9.3	6.7	10	0.3	1.0	130	0
MAY										
23...	180	50	55	11	9.3	10	0.3	1.3	162	0
JUN										
28...	160	6	44	11	6.0	8	0.2	0.8	182	0
AUG										
02...	170	16	47	12	8.8	10	0.3	0.8	184	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
NOV										
07...	150	14	28	0.1	8.3	227	0.31	1450	<0.01	0.30
JAN										
09...	154	14	58	0.1	8.9	293	0.40	1800	0.01	0.32
MAR										
30...	107	12	16	<0.1	6.9	180	0.24	1510	<0.01	0.20
MAY										
23...	133	12	45	<0.1	7.0	246	0.33	3060	<0.01	0.20
JUN										
28...	149	8.4	11	<0.1	8.2	182	0.25	2160	<0.01	<0.10
AUG										
02...	151	12	17	0.2	7.4	203	0.28	1210	<0.01	<0.10

STREAMS TRIBUTARY TO LAKE MICHIGAN

04126520 MANISTEE RIVER AT MANISTEE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS TOTAL (MG/L AS P)	PHOSPHORUS DISSOLVED (MG/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
NOV 07...	0.05	0.05	0.6	0.02	<0.01	<0.01	<10	<1	18	<0.5
JAN 09...	0.08	0.08	0.4	0.02	<0.01	<0.01	--	--	--	--
MAR 30...	0.04	0.04	0.4	0.02	<0.01	<0.01	20	<1	16	<0.5
MAY 23...	0.04	0.03	0.5	0.02	<0.01	<0.01	--	--	--	--
JUN 28...	0.03	0.02	0.4	0.05	0.03	<0.01	10	1	20	<0.5
AUG 02...	0.02	0.02	1.2	0.02	0.01	<0.01	<10	<1	19	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
NOV 07...	<1	<1	<3	1	19	<1	11	6	<0.1	<10
JAN 09...	--	--	--	--	--	--	--	--	--	--
MAR 30...	2	<5	<3	<10	62	<10	5	8	<0.1	<10
MAY 23...	--	--	--	--	--	--	--	--	--	--
JUN 28...	<1	<1	<3	2	76	1	6	10	<0.1	<10
AUG 02...	<1	<1	<3	2	16	<1	6	3	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV 07...	<1	<1	<1.0	250	<6	<3	9	57	78
JAN 09...	--	--	--	--	--	--	9	55	100
MAR 30...	<10	<1	1.0	120	<6	7	10	84	95
MAY 23...	--	--	--	--	--	--	8	100	76
JUN 28...	1	<1	<1.0	110	<6	7	10	119	76
AUG 02...	1	<1	<1.0	150	<6	6	9	53	96

STREAMS TRIBUTARY TO LAKE MICHIGAN

04126740 PLATTE RIVER AT HONOR, MI

LOCATION.--Lat 44°40'05", long 86°02'05", in SW1/4 NW1/4 sec.8, T.26 N., R.14 W., Benzie County, Hydrologic Unit 04060104, on right bank 20 ft downstream from bridge on U.S. Highway 31, 1.0 mi west of Honor.

DRAINAGE AREA.--118 mi².

PERIOD OF RECORD.--April to September 1990.

GAGE.--Water-stage recorder. Elevation of gage is 590 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--No estimated daily discharges. Records good. Some diversion for fish hatchery 6 mi upstream from station. Several measurements of water temperature were made during the year.

EXTREMES FOR CURRENT YEAR.--Maximum discharge during period April to September, 447 ft³/s, June 17, gage height, 3.11 ft; minimum, 103 ft³/s, Aug. 16, gage height, 120 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1							145	134	134	168	120	117
2							171	133	134	157	119	115
3							156	132	148	152	122	115
4							149	132	150	147	129	115
5							148	133	140	143	126	114
6							147	132	139	141	123	144
7							145	131	136	138	122	142
8							143	130	135	148	120	128
9							142	134	135	143	118	124
10							147	213	133	138	126	123
11							142	172	131	134	123	120
12							139	154	165	132	121	121
13							137	148	168	130	119	120
14							143	150	150	129	117	220
15							143	157	143	137	119	149
16							145	156	139	137	117	138
17							149	153	259	133	116	130
18							141	148	171	131	121	127
19							139	149	156	131	129	139
20							143	178	150	130	122	130
21							142	155	146	127	121	127
22							139	148	167	141	120	128
23							138	147	285	140	119	136
24							137	145	185	129	119	127
25							136	144	166	126	118	123
26							135	144	162	125	127	122
27							135	142	157	124	125	119
28							135	140	154	124	122	120
29							134	138	154	127	119	118
30							135	136	256	127	118	125
31							---	134	---	122	117	---
TOTAL							4280	4542	4848	4211	3754	3876
MEAN							143	147	162	136	121	129
MAX							171	213	285	168	129	220
MIN							134	130	131	122	116	114
CFSM							1.21	1.25	1.37	1.15	1.03	1.09
IN.							1.35	1.43	1.53	1.33	1.18	1.22

STREAMS TRIBUTARY TO LAKE MICHIGAN

445256085240001 ELK LAKE NEAR ELK RAPIDS, MI

LOCATION.--Lat 44°50'43", long 85°23'33", in SW1/4 SW1/4 sec.3, T.28 N., R.9 W., Grand Traverse County, Hydrologic Unit 04060105, at Gay Road, 3.5 mi south of Elk Rapids.

DRAINAGE AREA.--410 mi², approximately.

PERIOD OF RECORD.--October 1951 to current year.

GAGE.--Water-stage recorder. Datum of gage is 586.25 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to June 20, 1952, nonrecording gage at same datum.

REMARKS.--Elk Lake is at the end of a long chain of interconnected lakes and is contiguous with Lake Skegemog. The major inlet to these lakes is Torch River. Smaller inlets include Williamsburg, Battle, Barker, and Desmond Creeks. The outlet of Elk Lake is Elk River. Lake elevation controlled by dam at Elk Rapids. Established legal level; summer, 589.50 ft, winter, 588.90 ft, above NGVD.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 3.88 ft, Oct. 6, 1986; minimum, 2.08 ft, Dec. 30, 31, 1981.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 3.60 ft, June 30; minimum, 2.50 ft, Nov. 6, 7.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.17	2.69	2.62	2.59	2.62	2.54	3.15	3.13	3.19	3.56	3.14	3.13
2	3.17	2.66	2.59	2.58	2.62	2.55	3.21	3.12	3.21	3.54	3.11	3.12
3	3.16	2.63	2.63	2.58	2.61	2.56	3.23	3.11	3.26	3.51	3.09	3.10
4	3.16	2.58	2.61	2.60	2.62	2.58	3.23	3.09	3.27	3.48	3.12	3.08
5	3.17	2.54	2.60	2.60	2.63	2.59	3.21	3.09	3.26	3.44	3.10	3.07
6	3.17	2.52	2.59	2.60	2.63	2.59	3.19	3.09	3.24	3.39	3.07	3.15
7	3.16	2.51	2.59	2.60	2.63	2.59	3.18	3.08	3.23	3.34	3.04	3.20
8	3.17	2.52	2.60	2.59	2.63	2.60	3.16	3.07	3.23	3.33	3.02	3.18
9	3.17	2.55	2.59	2.60	2.64	2.62	3.16	3.11	3.21	3.33	3.03	3.16
10	3.19	2.58	2.57	2.62	2.64	2.62	3.18	3.18	3.20	3.29	3.11	3.16
11	3.20	2.63	2.57	2.61	2.64	2.64	3.18	3.19	3.19	3.25	3.14	3.14
12	3.18	2.69	2.56	2.61	2.63	2.71	3.17	3.18	3.22	3.23	3.14	3.14
13	3.19	2.73	2.56	2.60	2.62	2.73	3.16	3.18	3.30	3.21	3.13	3.14
14	3.20	2.74	2.55	2.60	2.62	2.79	3.17	3.18	3.31	3.21	3.10	3.17
15	3.24	2.73	2.56	2.59	2.62	2.81	3.17	3.19	3.31	3.21	3.14	3.21
16	3.27	2.74	2.56	2.59	2.63	2.80	3.17	3.20	3.30	3.21	3.14	3.19
17	3.24	2.75	2.55	2.65	2.62	2.79	3.18	3.19	3.36	3.20	3.14	3.17
18	3.19	2.70	2.55	2.67	2.61	2.77	3.19	3.17	3.39	3.20	3.16	3.15
19	3.13	2.66	2.54	2.65	2.59	2.76	3.17	3.17	3.39	3.20	3.21	3.16
20	3.10	2.62	2.53	2.63	2.59	2.75	3.17	3.20	3.39	3.21	3.20	3.15
21	3.11	2.68	2.53	2.64	2.59	2.77	3.19	3.20	3.37	3.20	3.19	3.14
22	3.09	2.69	2.55	2.63	2.58	2.82	3.18	3.20	3.39	3.19	3.18	3.12
23	3.06	2.65	2.55	2.62	2.58	2.86	3.18	3.22	3.49	3.20	3.17	3.14
24	3.01	2.63	2.55	2.63	2.58	2.90	3.17	3.24	3.52	3.19	3.16	3.15
25	2.96	2.61	2.55	2.66	2.58	2.93	3.16	3.25	3.52	3.17	3.15	3.15
26	2.92	2.60	2.58	2.70	2.57	2.97	3.17	3.24	3.52	3.15	3.17	3.17
27	2.87	2.62	2.57	2.67	2.56	3.00	3.16	3.24	3.52	3.13	3.19	3.19
28	2.83	2.65	2.55	2.64	2.55	3.03	3.16	3.23	3.51	3.11	3.19	3.20
29	2.81	2.65	2.57	2.62	---	3.06	3.15	3.22	3.55	3.11	3.18	3.20
30	2.77	2.62	2.57	2.60	---	3.09	3.15	3.21	3.57	3.19	3.16	3.22
31	2.74	---	2.58	2.60	---	3.12	---	3.20	---	3.17	3.15	---
MEAN	3.09	2.64	2.57	2.62	2.61	2.77	3.18	3.17	3.35	3.26	3.14	3.16
MAX	3.27	2.75	2.63	2.70	2.64	3.12	3.23	3.25	3.57	3.56	3.21	3.22
MIN	2.74	2.51	2.53	2.58	2.55	2.54	3.15	3.07	3.19	3.11	3.02	3.07

CAL YR 1989 MEAN 2.93 MAX 3.33 MIN 2.47
WTR YR 1990 MEAN 2.96 MAX 3.57 MIN 2.51

STREAMS TRIBUTARY TO LAKE MICHIGAN

04127800 JORDAN RIVER NEAR EAST JORDAN, MI

LOCATION.--Lat 45°06'09", long 85°05'53", in NW1/4 NW1/4 sec.7, T.31 N., R.6 W., Antrim County, Hydrologic Unit 04060105, on right bank 300 ft downstream from Webster Bridge, 4.2 mi south of East Jordan, and 4.5 mi upstream from mouth.

DRAINAGE AREA.--67.9 mi².

PERIOD OF RECORD.--Occasional low-flow measurements, water years 1960-65. October 1966 to current year.

REVISED RECORDS.--WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 596.43 ft above National Geodetic Vertical Datum of 1929 (Antrim County Road Commission bench mark). Nov. 19, 1959 to Sept. 30, 1966, nonrecording gage at present site and at site 600 ft upstream at same datum.

REMARKS.--Estimated daily discharges: Dec. 9, 12-18, 20-29, Feb. 3, 18, 26, 27, and Mar. 5. Records good except for estimated daily discharges, which are fair. Some regulation at low flow by fish hatchery upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--24 years, 188 ft³/s, 37.60 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,360 ft³/s, July 19, 1975, gage height, 6.51 ft; minimum, 91 ft³/s, Mar. 8, 1982, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 400 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Jan. 17	2000	531	5.02	June 23	1700	599	5.21
Mar. 12	2200	*747	*5.58				

Minimum discharge, 137 ft³/s, Feb. 25, gage height, 2.91 ft, result of freezeup.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	161	178	178	177	212	174	201	180	173	185	168	162
2	161	174	179	176	208	177	235	177	175	178	165	161
3	162	173	180	177	195	176	213	176	219	174	174	159
4	163	173	176	186	187	171	198	178	207	172	225	160
5	165	180	176	180	183	170	196	178	181	171	192	160
6	177	204	178	178	182	169	192	176	180	170	175	213
7	169	183	176	177	181	169	191	176	173	167	169	183
8	169	174	174	177	185	170	191	175	173	192	166	167
9	168	190	174	185	202	186	193	200	180	242	164	163
10	178	194	175	198	196	199	203	341	174	180	171	163
11	172	188	176	188	184	226	194	292	170	171	171	160
12	168	178	174	185	182	496	188	226	233	167	166	164
13	164	174	174	181	184	512	188	196	249	166	166	161
14	165	173	174	180	180	632	196	189	194	168	163	226
15	179	179	174	179	177	539	205	212	178	171	179	200
16	214	195	174	178	180	390	198	210	175	174	169	177
17	182	187	174	382	180	278	216	215	265	167	166	164
18	170	183	174	345	178	243	197	218	209	171	172	162
19	169	181	174	232	177	222	194	201	186	169	231	179
20	191	199	174	206	178	211	200	236	181	170	182	169
21	205	195	174	197	177	211	207	204	187	165	170	166
22	180	182	174	191	178	219	192	190	203	167	167	179
23	174	178	174	185	177	221	186	188	509	181	166	235
24	170	178	174	192	177	199	185	196	294	168	166	182
25	169	178	175	194	172	197	183	187	202	164	165	168
26	168	182	175	194	172	200	180	183	191	163	194	163
27	168	185	175	189	173	194	179	179	185	163	184	161
28	167	215	176	192	173	194	177	180	179	164	169	160
29	168	185	176	185	---	196	177	175	258	170	167	166
30	168	181	177	184	---	201	179	173	201	269	164	174
31	180	---	178	182	---	203	---	173	---	179	162	---
TOTAL	5364	5519	5436	6152	5130	7745	5834	6180	6284	5478	5408	5207
MEAN	173	184	175	198	183	250	194	199	209	177	174	174
MAX	214	215	180	382	212	632	235	341	509	269	231	235
MIN	161	173	174	176	172	169	177	173	170	163	162	159
CFSM	2.55	2.71	2.58	2.92	2.70	3.68	2.86	2.93	3.08	2.61	2.56	2.56
IN.	2.94	3.02	2.98	3.37	2.81	4.24	3.20	3.39	3.44	3.00	2.96	2.85

CAL YR 1989 TOTAL 67051 MEAN 184 MAX 613 MIN 157 CFSM 2.71 IN 36.73
WTR YR 1990 TOTAL 69737 MEAN 191 MAX 632 MIN 159 CFSM 2.81 IN 38.21

STREAMS TRIBUTARY TO LAKE HURON

04127918 PINE RIVER NEAR RUDYARD, MI

LOCATION.--Lat 46°11'09", long 84°35'52", in NW1/4 NE1/4 sec.30, T.44 N., R.2 W., Chippewa County, Hydrologic Unit 04070002, on right bank 15 ft upstream from bridge on Mackinac Trail, 3.2 mi south of Rudyard.

DRAINAGE AREA.--184 mi².

PERIOD OF RECORD.--April 1972 to current year.

GAGE.--Water-stage recorder. Datum of gage is 601.50 ft above National Geodetic Vertical Datum of 1929. Prior to Aug. 4, 1972, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 17 to Apr. 1. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--18 years, 235 ft³/s, 17.34 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,500 ft³/s, Mar. 30, 1986, gage height, 18.44 ft; minimum, 33 ft³/s, Nov. 16, 1989, result of freezeup; minimum gage height, 1.83 ft, July 29, 30, 1982.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,200 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 16	1700	ice jam	*7.75	May 17	2200	*1,490	7.58

Minimum discharge, 33 ft³/s, Nov. 16, gage height, 1.85 ft, result of freezeup.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	63	103	81	78	95	99	800	225	99	159	75	62
2	61	101	81	80	95	100	1120	202	96	131	67	61
3	60	99	78	82	96	100	799	182	97	115	62	58
4	63	91	76	83	96	100	556	166	101	107	61	392
5	62	99	79	83	96	100	482	156	99	104	61	677
6	79	166	75	83	96	100	352	146	100	98	60	421
7	86	181	72	83	96	99	304	136	102	92	57	270
8	82	163	71	83	96	100	355	130	96	93	72	192
9	79	152	72	82	96	105	507	127	94	116	113	157
10	75	146	72	80	96	110	676	367	95	107	109	143
11	74	137	70	80	96	125	721	482	90	93	110	122
12	71	142	69	80	96	170	502	360	85	86	92	148
13	70	133	67	80	96	250	422	267	97	79	89	258
14	69	127	66	80	96	600	567	220	112	74	83	488
15	69	121	66	81	96	830	783	219	100	75	81	507
16	73	95	64	83	96	900	647	525	91	78	79	372
17	76	94	62	85	96	760	514	1270	97	87	71	262
18	74	95	62	86	96	660	532	1160	130	94	70	205
19	72	100	61	87	96	570	668	708	135	83	70	191
20	74	99	61	88	96	630	708	449	118	79	68	197
21	82	97	62	88	96	710	777	326	112	75	63	184
22	94	95	62	88	96	760	786	259	158	75	60	227
23	91	93	62	88	96	600	775	220	401	74	58	298
24	85	91	63	89	96	520	726	194	479	70	58	336
25	81	88	64	91	97	620	717	175	292	69	60	249
26	81	84	65	92	98	560	603	160	214	65	65	204
27	80	82	67	92	99	450	485	146	197	63	67	176
28	77	82	69	93	99	430	379	134	166	61	83	156
29	78	83	71	94	---	380	299	121	171	62	86	145
30	82	81	74	94	---	540	244	114	185	87	75	137
31	90	---	76	95	---	640	---	105	---	91	65	---
TOTAL	2353	3320	2140	2651	2695	12718	17806	9451	4409	2742	2290	7295
MEAN	75.9	111	69.0	85.5	96.3	410	594	305	147	88.5	73.9	243
MAX	94	181	81	95	99	900	1120	1270	479	159	113	677
MIN	60	81	61	78	95	99	244	105	85	61	57	58
CFSM	.41	.60	.38	.47	.52	2.23	3.23	1.66	.80	.48	.40	1.32
IN.	.48	.67	.43	.54	.54	2.57	3.60	1.91	.89	.55	.46	1.47

CAL YR 1989 TOTAL 72314 MEAN 198 MAX 2500 MIN 53 CFSM 1.08 IN 14.62
WTR YR 1990 TOTAL 69870 MEAN 191 MAX 1270 MIN 57 CFSM 1.04 IN 14.13

STREAMS TRIBUTARY TO LAKE HURON

452600084472001 CROOKED LAKE NEAR CONWAY, MI

LOCATION.--Lat 45°23'52", long 84°49'22", in NE1/4 SW1/4 sec.29, T.35 N., R.4 W., Emmet County, Hydrologic Unit 04070004, at Minnehaha Creek Inlet on Channel Road, 2.5 mi southeast of Conway.

DRAINAGE AREA.--101 mi².

PERIOD OF RECORD.--June 1942 to July 1945 (summer months only), August 1945 to current year.

GAGE.--Water-stage recorder. Datum of gage is 593.38 ft above National Geodetic Vertical Datum of 1929. Prior to June 13, 1960, nonrecording gage at datum 1.00 ft higher. June 13, 1960 to June 29, 1964, nonrecording gage at same datum.

REMARKS.--Crooked Lake is the upstream end of the navigable inland water route. Major inlets are Minnehaha Creek, Round Lake Outlet, and Pickerel Lake Outlet. The outlet is Crooked River. Lake elevation controlled by dam and boat lock at Alanson.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 3.60 ft, Apr. 12, 1948 (present datum); minimum, 0.54 ft, Mar. 30, 1982.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 2.90 ft, June 24; minimum, 1.02 ft, Mar. 8, 9, 10.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.22	2.32	1.44	1.24	1.45	1.15	1.93	2.09	2.35	2.76	2.38	2.29
2	2.23	2.22	1.44	1.21	1.48	1.10	1.98	2.11	2.34	2.71	2.36	2.28
3	2.23	2.11	1.46	1.19	1.48	1.09	2.03	2.13	2.36	2.66	2.35	2.27
4	2.21	2.02	1.43	1.18	1.48	1.13	2.02	2.15	2.37	2.62	2.36	2.26
5	2.22	1.94	1.42	1.18	1.45	1.08	2.00	2.17	2.36	2.59	2.37	2.26
6	2.25	1.89	1.41	1.16	1.43	1.06	1.97	2.17	2.34	2.55	2.35	2.28
7	2.25	1.83	1.46	1.15	1.41	1.05	1.94	2.19	2.34	2.51	2.33	2.29
8	2.25	1.77	1.38	1.13	1.39	1.03	1.90	2.20	2.34	2.51	2.32	2.27
9	2.24	1.73	1.37	1.13	1.39	1.03	1.89	2.24	2.34	2.53	2.30	2.26
10	2.27	1.71	1.35	1.16	1.38	1.03	1.90	2.41	---	2.51	2.29	2.27
11	2.27	1.66	1.33	1.19	1.36	1.06	1.88	2.50	---	2.48	2.29	2.26
12	2.27	1.63	1.32	1.24	1.35	1.25	1.84	2.52	---	2.46	2.27	2.25
13	2.27	1.59	1.31	1.33	1.33	1.43	1.83	2.52	2.34	2.43	2.26	2.25
14	2.28	1.56	1.32	1.17	1.32	1.68	1.81	2.50	2.34	2.41	2.24	2.31
15	2.29	1.54	1.33	1.16	1.33	1.95	1.80	2.51	2.33	2.38	2.26	2.36
16	2.39	1.60	1.31	1.14	1.35	2.16	1.80	2.54	2.33	2.37	2.26	2.35
17	2.39	1.56	1.32	1.33	1.38	2.25	1.81	2.57	2.42	2.35	2.26	2.32
18	2.38	1.57	1.32	1.45	1.31	2.27	1.78	2.56	2.51	2.33	2.28	2.31
19	2.38	1.53	1.32	1.46	1.29	2.24	1.75	2.57	2.51	2.34	2.34	2.33
20	2.40	1.58	1.32	1.46	1.27	2.20	1.73	2.60	2.50	2.34	2.32	2.33
21	2.41	1.53	1.34	1.47	1.24	2.16	1.73	2.59	2.49	2.32	2.31	2.31
22	2.40	1.50	1.34	1.46	1.20	2.14	1.77	2.56	2.50	2.31	2.30	2.35
23	2.40	1.48	1.35	1.44	1.19	2.14	1.82	2.54	2.74	2.30	2.30	2.38
24	2.39	1.47	1.35	1.45	1.22	2.10	1.87	2.54	2.88	2.29	2.29	2.33
25	2.38	1.44	1.35	1.48	1.23	2.06	1.92	2.52	2.86	2.28	2.29	2.33
26	2.37	1.43	1.34	1.55	1.20	2.03	1.97	2.50	2.85	2.27	2.28	2.33
27	2.37	1.42	1.34	1.52	1.19	2.00	2.01	2.46	2.83	2.27	2.29	2.32
28	2.36	1.48	1.35	1.50	1.18	1.97	2.04	2.43	2.79	2.27	2.33	2.32
29	2.35	1.47	1.36	1.47	---	1.96	2.06	2.42	2.82	2.28	2.33	2.31
30	2.36	1.45	1.35	1.45	---	1.95	2.09	2.38	2.80	2.41	2.28	2.32
31	2.35	---	1.31	1.44	---	1.93	---	2.36	---	2.40	2.31	---
MEAN	2.32	1.67	1.36	1.32	1.33	1.67	1.90	2.40	---	2.43	2.31	2.30
MAX	2.41	2.32	1.46	1.55	1.48	2.27	2.09	2.60	---	2.76	2.38	2.38
MIN	2.21	1.42	1.31	1.13	1.18	1.03	1.73	2.09	---	2.27	2.24	2.25

CAL YR 1989 MEAN 1.91 MAX 2.69 MIN 1.00

04128000 STURGEON RIVER NEAR WOLVERINE, MI

LOCATION.--Lat 45°17'56", long 84°36'40", in SE1/4 NE1/4 sec.36, T.34 N., R.3 W., Cheboygan County, Hydrologic Unit 04070004, on left bank 1.8 mi north of Wolverine, 2.8 mi downstream from West Branch, and 9 mi upstream from mouth.

DRAINAGE AREA.--198 mi².

PERIOD OF RECORD.--April 1942 to current year.

REVISED RECORDS.--WSP 1307: 1944(M), 1948(M). WSP 1727: 1951(M). WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 740 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to June 15, 1942, nonrecording gage at site 1.0 mi upstream, and June 16, 1942, to Sept. 30, 1958, at site 0.7 mi upstream at different datums.

REMARKS.--Estimated daily discharges: Nov. 24, Dec. 4, 5, 7, 8, 10, 11, Dec. 14 to Jan. 2, Jan. 13, 15, 27-29, Feb. 4-6, 12, 13, 15, 18-22, Feb. 26 to Mar. 1, and Mar. 3, 5, 7, 8. Records good except for estimated daily discharges, which are poor. Prior to July 1975, intermittent regulation at low flows from ponds 2.4 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--48 years, 221 ft³/s, 15.16 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,290 ft³/s, Sept. 29, 1972, gage height, 3.72 ft; maximum gage height, 4.48 ft, Sept. 14, 1961; minimum discharge, 94 ft³/s, Jan. 19, 1971, result of freezeup; minimum daily, 113 ft³/s, Aug. 6, 1958.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 936 ft³/s, Mar. 16, gage height, 3.23 ft; minimum, 104 ft³/s, Feb. 25, gage height, 1.31 ft, result of freezeup.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	163	221	222	202	235	199	297	213	193	243	203	189
2	166	210	213	202	250	199	359	211	194	222	190	182
3	173	210	206	201	220	185	364	209	205	209	187	183
4	180	205	208	209	215	176	314	208	212	201	221	183
5	176	217	210	208	215	190	297	213	202	198	225	184
6	188	264	213	203	215	196	271	212	197	198	206	203
7	185	245	205	200	214	198	260	209	193	188	193	211
8	181	219	200	201	216	200	257	206	187	229	190	196
9	178	224	194	203	229	205	267	233	193	353	183	187
10	188	245	195	222	230	207	299	488	197	250	182	181
11	196	237	195	218	215	240	299	489	188	212	189	182
12	188	224	144	214	210	442	265	349	194	197	186	177
13	182	214	182	210	205	569	255	289	233	193	192	176
14	183	208	195	206	205	713	271	269	223	188	183	234
15	198	209	200	206	204	799	295	271	201	192	185	292
16	272	244	200	206	203	859	289	300	205	193	183	230
17	250	244	200	384	177	715	306	328	244	197	175	199
18	207	230	200	450	200	490	281	316	269	219	203	193
19	195	226	200	316	200	384	292	309	230	206	270	203
20	218	254	200	272	200	346	298	325	216	200	219	206
21	263	265	201	252	200	330	295	313	231	189	199	198
22	237	231	202	243	200	337	283	262	224	182	191	205
23	216	215	202	230	198	353	272	247	594	200	184	231
24	210	215	202	231	195	311	263	265	633	204	183	215
25	208	214	202	231	166	298	263	251	355	186	179	200
26	204	216	202	230	195	290	251	234	280	176	181	204
27	203	214	203	225	198	274	247	225	260	175	190	193
28	199	250	203	220	198	272	230	220	239	176	254	187
29	197	230	203	215	---	272	229	210	355	178	219	188
30	193	225	202	215	---	282	224	205	299	321	201	209
31	205	---	202	212	---	284	---	197	---	263	186	---
TOTAL	6202	6825	6206	7237	5808	10815	8393	8276	7646	6538	6132	6021
MEAN	200	228	200	233	207	349	280	267	255	211	198	201
MAX	272	265	222	450	250	859	364	489	633	353	270	292
MIN	163	205	144	200	166	176	224	197	187	175	175	176
CFSM	1.01	1.15	1.01	1.18	1.05	1.76	1.41	1.35	1.29	1.07	1.00	1.02
IN.	1.17	1.28	1.17	1.36	1.09	2.03	1.58	1.55	1.44	1.23	1.15	1.13

CAL YR 1989 TOTAL 80940 MEAN 222 MAX 742 MIN 144 CFSM 1.12 IN 15.21
WTR YR 1990 TOTAL 86099 MEAN 236 MAX 859 MIN 144 CFSM 1.19 IN 16.18

STREAMS TRIBUTARY TO LAKE HURON

04129000 PIGEON RIVER NEAR VANDERBILT, MI

LOCATION.--Lat 45°10'15", long 84°26'18", in SE1/4 SW1/4 sec.9, T.32 N., R.1 W., Otsego County, Hydrologic Unit 04070004, on right bank at Pigeon River Country State Forest Headquarters, 11.1 mi east of Vanderbilt, and 26 mi upstream from Mullett Lake.

DRAINAGE AREA.--62.6 mi².

PERIOD OF RECORD.--September 1950 to current year (discontinued).

REVISED RECORDS.--WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 886.24 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 9 to Jan. 5, Jan. 14, 15, 27, 28, 30, 31, Feb. 3-6, 12-22, and Feb. 24 to Mar. 8. Records good except for estimated daily discharges, which are poor. Prior to May 16, 1957, and since Apr. 22, 1958, occasional regulation by Lansing Club Dam 3.5 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--40 years, 78.6 ft³/s, 17.05 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,500 ft³/s, May 15, 1957, gage height, 6.80 ft, from floodmark, from rating curve extended above 500 ft³/s, result of failure of Lansing Club Dam; minimum discharge, 12 ft³/s, Mar. 22, 1989; minimum gage height, 1.23 ft, Jan. 8, 1957; minimum daily discharge, 24 ft³/s, Jan. 8, 1957.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 479 ft³/s, Mar. 17, gage height, 5.27 ft; minimum, 13 ft³/s, Nov. 18, gage height, 1.54 ft, result of regulation; minimum daily, 51 ft³/s, July 14, Sept. 13.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	57	72	77	66	76	64	96	76	64	81	65	56
2	55	67	75	67	76	64	137	66	64	66	63	55
3	57	70	74	67	73	64	132	73	72	61	53	53
4	58	64	73	67	70	63	129	69	87	62	69	53
5	59	74	68	67	70	63	102	67	76	60	80	54
6	60	104	68	67	70	63	96	70	68	60	59	58
7	69	86	87	68	69	64	83	63	60	60	60	69
8	61	80	63	69	76	65	83	74	59	81	60	53
9	59	76	63	65	75	69	89	75	66	155	55	59
10	62	84	63	69	80	75	119	194	66	92	55	54
11	70	78	63	78	66	84	107	158	58	79	57	54
12	60	80	62	74	66	197	95	133	66	72	57	53
13	57	73	63	71	66	267	87	98	82	65	61	51
14	61	73	64	69	66	278	96	81	62	51	56	75
15	64	70	65	68	66	371	106	96	70	55	54	107
16	80	89	65	66	65	416	98	95	60	70	63	69
17	84	85	65	111	64	266	116	121	78	55	55	56
18	74	113	65	153	64	153	110	112	94	60	56	66
19	67	55	65	105	64	127	86	110	73	60	92	69
20	76	80	65	88	65	112	108	123	60	59	68	72
21	97	99	65	83	65	103	113	120	71	59	64	74
22	87	72	66	81	65	111	103	94	72	57	63	59
23	72	92	66	70	65	126	92	102	231	60	56	77
24	72	68	66	77	64	118	102	86	247	59	55	73
25	69	73	66	83	64	87	89	87	110	58	55	63
26	68	75	66	78	64	97	89	73	90	55	54	72
27	63	76	66	76	64	70	82	74	76	55	55	59
28	67	86	66	75	64	88	75	72	74	54	118	56
29	61	94	66	74	---	109	63	69	103	53	65	58
30	65	68	66	72	---	74	72	69	88	98	57	58
31	63	---	66	74	---	106	---	69	---	83	61	---
TOTAL	2074	2376	2078	2398	1902	4014	2955	2869	2547	2095	1941	1885
MEAN	66.9	79.2	67.0	77.4	67.9	129	98.5	92.5	84.9	67.6	62.6	62.8
MAX	97	113	87	153	80	416	137	194	247	155	118	107
MIN	55	55	62	65	64	63	63	63	58	51	53	51
CFSM	1.07	1.27	1.07	1.24	1.09	2.06	1.57	1.48	1.36	1.08	1.00	1.00
IN.	1.23	1.41	1.23	1.42	1.13	2.39	1.76	1.70	1.51	1.24	1.15	1.12

CAL YR 1989 TOTAL 26919 MEAN 73.8 MAX 337 MIN 44 CFSM 1.18 IN 16.00
WTR YR 1990 TOTAL 29134 MEAN 79.8 MAX 416 MIN 51 CFSM 1.28 IN 17.31

STREAMS TRIBUTARY TO LAKE HURON

04130000 MULLETT LAKE NEAR CHEBOYGAN, MI

LOCATION.--Lat 45°34'38", long 84°29'15", in SW1/4 SW1/4 sec.19, T.37 N., R.1 W., Cheboygan County, Hydrologic Unit 04070004, on right bank of Cheboygan River, 300 ft downstream from Mullett Lake, 2.4 mi upstream from Black River, and 4.8 mi south of Cheboygan.

DRAINAGE AREA.--889 mi².

PERIOD OF RECORD.--November 1942 to current year.

GAGE.--Water-stage recorder. Datum of gage is 591.21 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Mullett Lake is part of the navigable inland water route. The major inlet is Indian River. Other inlets are Pigeon, Little Pigeon, and Little Sturgeon Rivers and Negro and Scott Creeks. The outlet is Cheboygan River. Streamflow records were collected for Cheboygan River (station 04130000) from October 1942 to September 1982 and for Indian River (station 04128500) from April 1942 to September 1982. Lake level regulated by hydroelectric dam and spillway in Cheboygan.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily gage height, 3.27 ft, May 13, 14, 1960; minimum daily, 0.88 ft, Mar. 19, 1984.

EXTREMES FOR CURRENT YEAR.--Maximum daily gage height, 2.92 ft, June 26; minimum daily, 1.51 ft, Mar. 10.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.28	2.21	2.09	1.74	2.01	1.64	2.14	2.11	2.43	2.84	2.79	2.46
2	2.28	2.19	2.11	1.73	2.00	1.61	2.16	2.12	2.42	2.83	2.70	2.40
3	2.27	2.19	2.11	1.73	1.99	1.60	2.16	2.11	2.46	2.77	2.69	2.41
4	2.28	2.19	2.10	1.75	1.98	1.58	2.17	2.13	2.41	2.69	2.66	2.47
5	2.29	2.15	2.06	1.76	1.97	1.57	2.15	2.18	2.42	2.59	2.63	2.50
6	2.26	2.15	2.01	1.77	1.95	1.56	2.14	2.20	2.42	2.54	2.60	2.54
7	2.24	2.15	1.99	1.78	1.93	1.54	2.12	2.23	2.40	2.47	2.60	2.52
8	2.21	2.15	1.96	1.78	1.92	1.52	2.09	2.23	2.40	2.47	2.59	2.56
9	2.25	2.17	1.94	1.79	1.91	1.52	2.06	2.27	2.40	2.48	2.50	2.60
10	2.24	2.17	1.92	1.81	1.89	1.51	2.07	2.43	2.39	2.49	2.43	2.60
11	2.28	2.17	1.90	1.83	1.88	1.52	2.06	2.53	2.42	2.40	2.39	2.61
12	2.28	2.14	1.88	1.84	1.87	1.61	2.04	2.57	2.44	2.34	2.41	2.64
13	2.25	2.13	1.86	1.83	1.85	1.66	2.03	2.58	2.44	2.33	2.48	2.60
14	2.25	2.12	1.84	1.83	1.83	1.83	2.01	2.58	2.44	2.30	2.58	2.59
15	2.29	2.11	1.83	1.83	1.81	2.03	2.01	2.60	2.44	2.26	2.54	2.58
16	2.32	2.13	1.82	1.82	1.82	2.21	2.01	2.65	2.41	2.29	2.59	2.61
17	2.32	2.20	1.81	1.91	1.82	2.36	2.02	2.73	2.50	2.29	2.61	2.65
18	2.31	2.18	1.80	1.94	1.80	2.45	2.02	2.74	2.52	2.31	2.58	2.67
19	2.28	2.23	1.79	1.95	1.78	2.49	2.00	2.72	2.51	2.32	2.62	2.60
20	2.31	2.14	1.79	1.96	1.76	2.47	1.97	2.71	2.50	2.34	2.64	2.55
21	2.31	2.11	1.78	1.98	1.75	2.45	1.94	2.73	2.52	2.35	2.60	2.51
22	2.29	2.11	1.77	1.99	1.73	2.42	1.92	2.71	2.48	2.35	2.56	2.44
23	2.29	2.11	1.77	1.99	1.72	2.40	1.90	2.68	2.62	2.37	2.53	2.40
24	2.28	2.08	1.76	2.01	1.72	2.38	1.88	2.66	2.80	2.40	2.51	2.49
25	2.28	2.05	1.75	2.04	1.70	2.35	1.88	2.63	2.84	2.44	2.49	2.46
26	2.27	2.10	1.74	2.08	1.69	2.31	1.88	2.59	2.92	2.43	2.48	2.44
27	2.27	2.19	1.74	2.06	1.67	2.28	1.93	2.57	2.87	2.46	2.47	2.46
28	2.24	2.16	1.73	2.05	1.65	2.25	1.99	2.54	2.78	2.51	2.56	2.47
29	2.22	2.19	1.74	2.03	---	2.22	2.03	2.49	2.79	2.58	2.54	2.51
30	2.21	2.11	1.73	2.02	---	2.19	2.07	2.49	2.86	2.67	2.53	2.56
31	2.24	---	1.74	2.01	---	2.16	---	2.48	---	2.75	2.50	---
MEAN	2.27	2.15	1.87	1.89	1.84	1.99	2.03	2.48	2.54	2.47	2.56	2.53
MAX	2.32	2.23	2.11	2.08	2.01	2.49	2.17	2.74	2.92	2.84	2.79	2.67
MIN	2.21	2.05	1.73	1.73	1.65	1.51	1.88	2.11	2.39	2.26	2.39	2.40

CAL YR 1989 MEAN 2.14 MAX 2.73 MIN 1.47
WTR YR 1990 MEAN 2.22 MAX 2.92 MIN 1.51

STREAMS TRIBUTARY TO LAKE HURON

04130500 BLACK RIVER NEAR TOWER, MI

LOCATION.--Lat 45°23'33", long 84°20'00", in SE1/4 NE1/4 sec.29, T.35 N., R.1 E., Cheboygan County, Hydrologic Unit 04070005, on right bank 400 ft downstream from Kleber Dam, 1,000 ft upstream from Milligan Creek, 3.0 mi northwest of Tower, and 10.8 mi upstream from Black Lake.

DRAINAGE AREA.--311 mi^2.

PERIOD OF RECORD.--October 1942 to current year. Monthly discharge only for October 1942, published in WSP 1307.

REVISED RECORDS.--WSP 1307: 1942. WDR MI-83: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 658.00 ft, above National Geodetic Vertical Datum of 1929 (Stanley Engineering Co. benchmark). Prior to Aug. 1, 1949, at site 1 mi upstream at different datum.

REMARKS.--No estimated daily discharges. Records good. Flow completely regulated by Kleber Dam 400 ft upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--48 years, 272 ft^3/s, 11.88 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,340 ft^3/s, Apr. 17, 1960, gage height, 7.13 ft; minimum, 0.60 ft^3/s, Mar. 11, 1950; minimum daily, 4.0 ft^3/s, Nov. 27, 1949.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,950 ft^3/s, Mar. 15, gage height, 6.56 ft; minimum, 7.7 ft^3/s, Feb. 7, gage height, 1.14 ft; minimum daily, 119 ft^3/s, Oct. 5.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	128	166	216	150	271	212	359	239	193	569	300	185
2	126	166	241	154	247	202	396	240	184	446	324	180
3	129	158	226	161	249	228	461	219	178	343	233	154
4	127	169	146	177	251	220	480	200	244	232	187	188
5	119	167	141	183	217	190	481	200	243	223	238	187
6	127	171	157	174	200	173	465	201	243	189	220	180
7	127	192	191	171	224	183	407	199	221	192	212	186
8	143	210	200	173	252	189	345	189	186	210	198	192
9	152	193	162	185	251	189	302	194	185	323	179	187
10	137	210	159	197	251	224	326	375	170	383	169	170
11	140	212	161	196	254	246	345	441	172	312	169	174
12	145	191	164	196	253	287	358	497	180	338	169	164
13	176	176	159	185	252	619	371	484	167	198	165	156
14	162	173	141	183	201	1050	303	341	186	188	180	174
15	139	188	138	175	246	1500	320	325	172	210	189	214
16	161	216	163	169	223	1760	329	263	158	243	162	274
17	183	196	159	218	183	1760	365	369	189	188	148	239
18	219	151	153	245	160	1420	370	407	204	219	157	208
19	229	171	159	311	198	1190	332	381	223	205	190	193
20	186	215	162	345	251	877	332	351	194	183	211	190
21	182	238	169	338	249	665	343	308	193	190	290	187
22	196	205	164	313	245	624	298	398	179	191	238	219
23	201	189	153	327	254	584	367	335	381	184	195	233
24	221	190	137	240	254	456	322	283	662	205	165	180
25	192	181	136	315	254	489	300	294	643	235	169	176
26	153	206	146	246	217	488	316	266	628	200	168	185
27	188	238	155	246	189	444	310	266	612	160	190	187
28	190	237	157	231	221	369	325	232	462	186	250	155
29	170	182	152	209	---	351	258	199	481	154	252	156
30	167	178	142	241	---	358	213	200	628	205	253	192
31	166	---	140	243	---	303	---	195	---	187	246	---
TOTAL	5081	5735	5049	6897	6517	17850	10499	9091	8761	7491	6416	5665
MEAN	164	191	163	222	233	576	350	293	292	242	207	189
MAX	229	238	241	345	271	1760	481	497	662	569	324	274
MIN	119	151	136	150	160	173	213	189	158	154	148	154
CFSM	.53	.61	.52	.71	.75	1.85	1.13	.94	.94	.78	.67	.61
IN.	.61	.69	.60	.82	.78	2.14	1.26	1.09	1.05	.90	.77	.68

CAL YR 1989 TOTAL 82460 MEAN 226 MAX 1200 MIN 110 CFSM .73 IN 9.86
WTR YR 1990 TOTAL 95052 MEAN 260 MAX 1760 MIN 119 CFSM .84 IN 11.37

STREAMS TRIBUTARY TO LAKE HURON

04132052 CHEBOYGAN POND AT CHEBOYGAN, MI

LOCATION.--Lat 45°38'09", long 84°28'50", in SW1/4 SE1/4 sec.31, T.38 N., R.1 W., Cheboygan County, Hydrologic Unit 04070004, on right bank 660 ft downstream from Lincoln Avenue in Cheboygan, 1.8 mi upstream from mouth of Cheboygan River.

DRAINAGE AREA.--1,500 mi², approximately.

PERIOD OF RECORD.--November 1942 to current year.

GAGE.--Water-stage recorder. Datum of gage is 590.00 ft above National Geodetic Vertical Datum of 1929. Prior to Aug. 30, 1967, nonrecording gage at same datum.

REMARKS.--Cheboygan Pond is formed by an earthfill dam, hydro-electric dam, boat lock and concrete spillway which contains 6 vertical lift gates. Cheboygan Pond is part of the navigable inland water route. The inlet and outlet of Cheboygan Pond is the Cheboygan River. Other inlets are Black River and Tannery Gulley. Water quality records were collected from October 1974 to September 1986. Streamflow records for Cheboygan River (station 04130000) were collected from October 1942 to September 1982. Pond elevation regulated by hydroelectric dam and spillway.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 3.93 ft, Nov. 9, 1988; minimum, -0.27 ft, Mar. 11, 12, 1984.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 3.82 ft, Aug. 1; minimum, 1.57 ft, July 8.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.22	2.83	2.44	2.22	2.35	1.97	1.62	2.79	2.87	2.72	3.43	2.87
2	3.16	2.81	2.65	2.22	2.30	1.96	1.62	2.80	2.88	2.69	3.13	2.86
3	3.16	2.80	2.40	2.25	2.28	1.97	1.70	2.80	2.92	2.39	3.19	3.11
4	3.10	2.74	2.42	2.35	2.27	1.96	1.78	2.87	2.95	2.15	3.17	3.37
5	3.05	2.72	2.34	2.36	2.26	1.93	1.77	2.98	2.98	1.98	3.17	3.38
6	3.04	2.74	2.26	2.37	2.24	1.92	1.78	2.98	2.99	2.15	3.20	3.34
7	2.94	2.73	2.25	2.37	2.22	1.90	1.78	3.02	3.01	1.80	3.21	3.26
8	2.91	2.73	2.24	2.37	2.22	1.89	1.77	2.99	3.01	1.75	3.06	3.45
9	3.10	2.72	2.24	2.37	2.21	1.89	1.73	3.01	3.02	2.14	2.62	3.54
10	3.06	2.71	2.24	2.37	2.21	1.87	1.78	3.05	3.10	2.54	2.62	3.39
11	3.07	2.69	2.23	2.38	2.18	1.86	1.81	3.12	3.17	2.11	2.76	3.47
12	3.06	2.67	2.23	2.37	2.16	1.91	1.82	3.11	3.07	2.22	3.12	3.42
13	3.03	2.67	2.21	2.37	2.13	1.93	1.84	3.09	3.08	2.34	3.43	3.30
14	3.13	2.64	2.21	2.37	2.11	2.03	1.82	3.10	3.09	2.34	3.47	3.17
15	3.22	2.63	2.22	2.37	2.10	2.11	1.81	3.12	3.08	2.28	3.34	3.27
16	3.12	2.62	2.23	2.37	2.10	2.19	1.81	3.17	3.05	2.50	3.48	3.52
17	3.04	2.66	2.23	2.39	2.10	2.28	1.82	3.30	3.14	2.57	3.40	3.61
18	3.03	2.65	2.22	2.41	2.11	2.35	1.85	3.26	3.10	2.70	3.36	3.34
19	3.01	2.66	2.22	2.41	2.10	2.27	1.82	3.13	3.12	2.89	3.53	2.90
20	3.00	2.59	2.22	2.41	2.10	2.12	1.77	3.11	3.09	2.95	3.40	2.85
21	2.97	2.45	2.22	2.41	2.12	1.95	1.70	3.15	3.10	2.99	3.18	2.80
22	2.93	2.45	2.22	2.42	2.10	1.82	1.69	3.02	3.03	2.99	3.06	2.63
23	2.95	2.46	2.22	2.42	2.07	1.80	1.68	2.92	3.14	3.08	3.02	2.90
24	2.95	2.43	2.23	2.43	2.04	1.81	1.68	2.87	3.29	3.11	3.08	3.28
25	2.93	2.43	2.22	2.45	2.03	1.80	1.72	2.90	3.17	3.19	3.06	3.16
26	2.92	2.83	2.21	2.41	2.03	1.73	1.95	2.86	3.15	3.11	3.05	3.14
27	2.91	2.87	2.22	2.36	2.02	1.73	2.22	2.87	2.80	3.22	3.06	3.23
28	2.84	2.44	2.20	2.36	1.98	1.71	2.62	2.87	2.20	3.44	3.10	3.38
29	2.84	2.46	2.21	2.35	---	1.71	2.70	2.86	2.33	3.53	3.03	3.43
30	2.85	2.44	2.22	2.35	---	1.67	2.75	2.90	2.77	3.52	3.05	3.48
31	2.86	---	2.22	2.35	---	1.65	---	2.90	---	3.72	2.98	---
MEAN	3.01	2.64	2.26	2.37	2.15	1.93	1.87	3.00	2.99	2.68	3.15	3.23
MAX	3.22	2.87	2.65	2.45	2.35	2.35	2.75	3.30	3.29	3.72	3.53	3.61
MIN	2.84	2.43	2.20	2.22	1.98	1.65	1.62	2.79	2.20	1.75	2.62	2.63

CAL YR 1989 MEAN 2.66 MAX 3.54 MIN 1.95
WTR YR 1990 MEAN 2.61 MAX 3.72 MIN 1.62

04135000 THUNDER BAY RIVER NEAR ALPENA, MI
(National stream quality accounting network station)

LOCATION.--Lat 45°05'39", long 83°29'59", in SW1/4 SE1/4 sec.7, T.31 N., R.8 E., Alpena County, Hydrologic Unit 04070006, on left bank 1,000 ft downstream from Alpena Power Company Fourmile Dam, 2.5 mi upstream from Bagley Street in Alpena, and 6.0 mi upstream from mouth.

DRAINAGE AREA.--1,238 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--April 1901 to December 1908, October 1979 to current year. Occasional discharge measurements, water years 1945-50.

REVISED RECORDS.--WSP 1307: 1901-09. WDR MI-80: Drainage area.

GAGE.--Two water-stage recorders. Elevation of gage on main (north) channel and secondary gage on spill (south) channel is 615 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 1 to Mar. 18. Water-discharge records good except for estimated daily discharges, which are poor. Flow regulated at all stages by hydroelectric plant 1,000 ft upstream.

AVERAGE DISCHARGE.--18 years (water years 1902-08, 1980-90), 901 ft³/s, 9.88 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 12,100 ft³/s, Mar. 28, 1986; minimum daily, 30 ft³/s, June 5, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 9,680 ft³/s, Mar. 17; minimum daily, 148 ft³/s, July 7.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	262	326	658	538	855	736	870	844	819	1050	802	646
2	339	369	650	548	920	789	1010	712	542	1050	773	493
3	303	384	461	530	791	555	1040	687	526	1060	625	511
4	265	328	455	534	795	628	1270	657	609	937	481	843
5	275	434	472	500	868	665	1530	541	478	868	479	1010
6	299	457	616	524	950	611	1660	498	470	611	737	958
7	258	461	597	500	966	543	1660	592	590	148	523	666
8	255	493	548	560	912	614	1440	561	597	303	490	495
9	382	513	431	529	967	705	1410	580	449	1200	554	514
10	305	563	553	532	930	673	1400	588	503	1170	613	519
11	297	565	596	528	924	930	1410	660	642	678	504	516
12	363	552	492	576	978	1120	1400	550	461	976	474	513
13	323	596	507	451	957	1360	1320	838	455	813	583	513
14	328	493	398	550	947	2680	1270	812	489	530	575	509
15	382	560	484	566	944	5180	1250	742	642	472	498	507
16	345	619	408	528	952	9180	1190	778	508	624	500	509
17	388	529	548	562	759	9680	1220	1010	405	710	600	512
18	420	496	569	427	681	8180	1230	1260	486	759	464	538
19	455	489	530	433	867	6310	1240	1200	434	742	484	532
20	705	812	612	646	776	3620	1120	1210	453	678	634	536
21	384	590	594	771	910	2530	1110	1200	449	472	698	518
22	399	604	494	754	545	2080	1050	1130	436	470	792	516
23	653	532	462	791	761	1760	1100	1240	359	605	743	526
24	538	609	606	653	659	1620	1110	1260	666	534	781	520
25	490	525	450	808	600	1460	1150	1250	718	546	494	522
26	414	758	636	751	801	1380	1120	1150	919	557	593	522
27	413	665	550	724	675	1250	1040	795	779	657	716	515
28	296	590	496	773	708	1100	963	762	723	427	924	513
29	370	619	544	854	---	1120	599	779	817	334	934	513
30	489	626	408	882	---	1080	788	694	970	476	1020	512
31	392	---	538	839	---	933	---	720	---	698	1150	---
TOTAL	11787	16157	16363	19162	23398	71072	35970	26300	17394	21155	20238	17017
MEAN	380	539	528	618	836	2293	1199	848	580	682	653	567
MAX	705	812	658	882	978	9680	1660	1260	970	1200	1150	1010
MIN	255	326	398	427	545	543	599	498	359	148	464	493
CFSM	.31	.44	.43	.50	.68	1.85	.97	.69	.47	.55	.53	.46
IN.	.35	.49	.49	.58	.70	2.14	1.08	.79	.52	.64	.61	.51

CAL YR 1989 TOTAL 258736 MEAN 709 MAX 9630 MIN 199 CFSM .57 IN 7.77
WTR YR 1990 TOTAL 296013 MEAN 811 MAX 9680 MIN 148 CFSM .66 IN 8.89

04135000 THUNDER BAY RIVER NEAR ALPENA, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1980 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: October 1979 to September 1985.
WATER TEMPERATURE: October 1979 to September 1985.

INSTRUMENTATION.--Water-quality monitor from Oct. 9, 1980 to Sept. 30, 1985.

REMARKS.--Bimonthly cross-sectional samples were collected near the gage. From February 1979 to September 1979, samples were collected 6.9 mi downstream from gage (station 04135020).

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1980-83): Maximum, 511 microsiemens, Jan. 2, 1982; minimum measured, 120 microsiemens, Dec. 19, 1981.
WATER TEMPERATURE (water years 1980-83): Maximum, 31.0°C, July 11, 12, 1981; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV										
02...	0930	393	371	8.26	9.5	4.0	10.8	97	K6	K6
DEC										
22...	1130	222	400	7.89	0.0	1.6	--	--	K8	30
MAR										
07...	1430	981	435	7.94	1.0	1.8	13.6	96	K1	K10
APR										
18...	0945	1260	334	8.13	3.5	1.0	--	--	K2	K7
JUL										
12...	0930	1230	355	8.28	21.0	2.5	7.8	89	60	K26
AUG										
23...	0945	1000	345	8.25	20.0	3.4	8.7	97	K19	K7

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
NOV										
02...	200	11	54	16	6.2	6	0.2	0.8	232	0
DEC										
22...	210	0	57	16	6.3	6	0.2	1.0	255	0
MAR										
07...	230	25	62	17	6.6	6	0.2	0.9	244	0
APR										
18...	180	29	52	12	4.4	5	0.1	1.0	183	0
JUL										
12...	200	16	55	14	4.6	5	0.1	1.0	218	0
AUG										
23...	190	8	52	15	5.5	6	0.2	0.6	224	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
NOV										
02...	190	14	5.6	0.1	8.9	213	0.29	226	<0.01	<0.10
DEC										
22...	209	13	5.6	0.2	11	240	0.33	144	<0.01	0.14
MAR										
07...	200	20	8.8	0.4	12	252	0.34	667	<0.01	0.10
APR										
18...	150	22	8.2	0.3	4.3	209	0.28	711	<0.01	<0.10
JUL										
12...	179	12	8.1	<0.1	8.4	224	0.30	744	<0.01	0.10
AUG										
23...	184	9.0	5.1	0.4	10	214	0.29	578	<0.01	<0.10

STREAMS TRIBUTARY TO LAKE HURON

04135000 THUNDER BAY RIVER NEAR ALPENA, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS TOTAL (MG/L AS P)	PHOSPHORUS DISSOLVED (MG/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
NOV										
02...	0.03	0.02	0.5	0.02	<0.01	<0.01	<10	<1	20	<0.5
DEC										
22...	0.06	0.07	0.5	<0.01	0.01	<0.01	--	--	--	--
MAR										
07...	0.03	0.02	0.4	<0.01	<0.01	<0.01	<10	<1	23	<0.5
APR										
18...	0.03	<0.01	0.8	<0.01	<0.01	<0.01	10	<1	16	<0.5
JUL										
12...	0.04	0.02	0.9	0.02	0.01	<0.01	--	--	--	--
AUG										
23...	0.02	0.01	0.6	0.02	<0.01	<0.01	20	<1	22	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
NOV										
02...	<1	<1	<3	<1	12	<1	4	5	<0.1	<10
DEC										
22...	--	--	--	--	--	--	--	--	--	--
MAR										
07...	<1	<5	<3	<10	24	<10	<4	12	<0.1	<10
APR										
18...	<1	<1	<3	1	37	<1	<4	6	<0.1	10
JUL										
12...	--	--	--	--	--	--	--	--	--	--
AUG										
23...	1.0	<1	<3	5	24	4	<4	3	0.2	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV									
02...	<1	<1	<1.0	100	<6	4	8	8.5	90
DEC									
22...	--	--	--	--	--	--	5	3.0	70
MAR									
07...	<10	<1	<1.0	120	<6	7	1	2.6	60
APR									
18...	<1	<1	<1.0	100	<6	<3	4	14	64
JUL									
12...	--	--	--	--	--	--	7	23	88
AUG									
23...	2	<1	<1.0	110	<6	8	3	8.1	75

STREAMS TRIBUTARY TO LAKE HURON

04135500 AU SABLE RIVER AT GRAYLING, MI

LOCATION.--Lat 44°39'35", long 84°42'45", in SE1/4 SE1/4 sec. 7, T.26 N., R.3 W., Crawford County, Hydrologic Unit 04070007, on right bank 65 ft upstream from bridge on Interstate Highway 75 (Business Loop) in Grayling, 0.7 mi upstream from East Branch, and 114 mi upstream from mouth.

DRAINAGE AREA.--110 mi².

PERIOD OF RECORD.--October 1942 to current year. Monthly discharge only for some periods, published in WSP 1307. Prior to October 1954, published as Middle Branch Au Sable River at Grayling.

GAGE.--Water-stage recorder and steel-crested dam. Datum of gage is 1,123.49 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Oct. 25-27. Records good except for estimated daily discharges, which are poor. Prior to Dec. 31, 1952, diurnal fluctuation caused by powerplant 2.5 mi upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--48 years, 76.1 ft³/s, 9.39 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 274 ft³/s, June 2, 1943, gage height, 3.00 ft; minimum, 28 ft³/s, Apr. 21, 1946, gage height, 0.80 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 237 ft³/s, Mar. 16, gage height, 2.66 ft; minimum, 45 ft³/s, Oct. 2, 3, gage height, 1.09 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	46	65	74	62	70	65	109	78	74	83	81	57
2	47	68	71	63	66	68	118	76	72	75	71	57
3	46	68	64	63	59	67	124	75	76	70	66	55
4	51	67	63	65	65	61	119	74	77	65	66	55
5	53	67	68	65	70	63	111	73	76	62	69	55
6	54	71	68	66	70	62	103	73	74	61	69	66
7	56	73	64	67	68	62	98	72	71	60	67	75
8	56	72	59	66	69	64	95	70	69	69	65	73
9	56	72	62	66	72	69	95	70	67	91	62	67
10	56	70	66	71	74	72	98	96	66	119	61	71
11	57	71	66	75	68	78	101	119	68	100	60	70
12	60	71	60	69	70	111	98	115	72	80	62	64
13	60	71	57	63	80	151	93	101	87	72	62	63
14	55	70	62	66	74	187	93	93	99	68	60	70
15	54	74	63	69	67	220	97	91	91	68	61	87
16	65	81	61	68	70	235	99	94	81	66	65	91
17	86	74	61	76	68	227	98	98	78	64	66	79
18	84	76	61	88	72	200	97	97	82	65	68	70
19	76	77	60	90	74	166	95	92	84	74	90	68
20	76	79	58	82	64	145	95	101	79	85	105	68
21	78	80	58	86	69	132	98	109	78	89	94	70
22	78	78	57	84	73	127	98	103	81	76	79	69
23	75	68	57	78	73	129	94	92	103	68	71	72
24	72	66	58	79	71	125	93	87	119	65	67	77
25	72	71	60	75	55	118	91	84	109	63	64	74
26	71	70	58	60	65	113	88	83	95	61	63	69
27	69	70	60	73	69	107	85	82	89	59	63	66
28	65	74	60	84	65	103	81	82	84	59	62	65
29	64	73	60	72	---	101	79	81	81	59	64	64
30	62	75	59	68	---	101	79	79	85	72	60	63
31	63	---	62	72	---	104	---	76	---	85	58	---
TOTAL	1963	2162	1917	2231	1930	3633	2922	2716	2467	2253	2121	2050
MEAN	63.3	72.1	61.8	72.0	68.9	117	97.4	87.6	82.2	72.7	68.4	68.3
MAX	86	81	74	90	80	235	124	119	119	119	105	91
MIN	46	65	57	60	55	61	79	70	66	59	58	55
CFSM	.58	.66	.56	.66	.63	1.06	.89	.80	.75	.66	.62	.62
IN.	.66	.73	.65	.75	.65	1.23	.99	.92	.83	.76	.72	.69

CAL YR 1989 TOTAL 28287 MEAN 77.5 MAX 202 MIN 46 CFSM .71 IN 9.57
WTR YR 1990 TOTAL 28365 MEAN 77.7 MAX 235 MIN 46 CFSM .71 IN 9.59

STREAMS TRIBUTARY TO LAKE HURON

445512084415301 OTSEGO LAKE NEAR GAYLORD, MI

LOCATION.--Lat 44°55'52", long 84°41'33", in SW1/4 SE1/4 sec.5, T.29 N., R.3 W., Otsego County, Hydrologic Unit 04070007, at Otsego Lake State Park, 200 ft northwest of boat ramp, 6.7 mi south of Gaylord.

DRAINAGE AREA.--Not determined.

PERIOD OF RECORD.--August 1942 to current year, except for winter months 1942-43, 1943-44, 1977-78.

GAGE.--Water-stage recorder. Datum of gage is 1,270.03 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Aug. 18, 1958, nonrecording gage at datum 2.0 ft higher.

REMARKS.--Otsego Lake has no natural inlets or outlets. In December 1972 an outlet tube and pump system was installed connecting the lake with the North Branch Au Sable River to lower lake levels. Established legal level; maximum, 1,273.5 ft, minimum, 1,272.0 ft, above NGVD.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 5.10 ft, May 6, 7, 1972; minimum, 0.96 ft, Aug. 14, 1959.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 3.65 ft, Mar. 14, 15; minimum, 2.29 ft, Oct. 14, 15.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.38	2.90	2.72	2.81	3.09	3.04	3.38	3.30	3.29	3.31	3.26	3.04
2	2.38	2.78	2.73	2.81	3.09	3.04	3.38	3.29	3.28	3.30	3.24	3.03
3	2.37	2.72	2.74	2.82	3.10	3.04	3.37	3.28	3.27	3.29	3.22	3.01
4	2.36	2.68	2.74	2.83	3.10	3.03	3.37	3.28	3.26	3.29	3.22	2.99
5	2.35	2.64	2.74	2.79	3.10	3.03	3.36	3.28	3.26	3.29	3.23	2.98
6	2.32	2.63	2.74	2.80	3.10	3.02	3.36	3.27	3.25	3.28	3.23	2.98
7	2.31	2.61	2.74	2.79	3.10	3.01	3.36	3.26	3.24	3.27	3.21	3.00
8	2.31	2.60	2.74	2.85	3.10	3.01	3.35	3.25	3.23	3.27	3.19	2.99
9	2.30	2.58	2.73	2.81	3.11	3.01	3.34	3.25	3.21	3.33	3.18	2.98
10	2.31	2.57	2.74	2.81	3.12	3.01	3.34	3.30	3.21	3.32	3.16	2.97
11	2.30	2.56	2.74	2.86	3.11	3.01	3.33	3.36	3.20	3.31	3.17	2.96
12	2.30	2.57	2.74	2.87	3.11	3.17	3.33	3.36	3.19	3.31	3.17	2.94
13	2.30	2.56	2.75	2.84	3.11	3.50	3.33	3.34	3.18	3.31	3.17	2.94
14	2.29	2.57	2.74	2.81	3.11	3.62	3.33	3.34	3.18	3.30	3.15	2.94
15	2.31	2.57	2.74	2.88	3.11	3.64	3.31	3.33	3.18	3.29	3.13	2.97
16	2.41	2.59	2.75	2.88	3.10	3.61	3.31	3.33	3.17	3.28	3.12	2.98
17	2.44	2.62	2.75	2.90	3.09	3.58	3.31	3.33	3.17	3.27	3.11	2.97
18	2.43	2.64	2.75	3.04	3.09	3.55	3.31	3.32	3.18	3.26	3.11	2.95
19	2.43	2.65	2.76	3.07	3.08	3.53	3.31	3.32	3.18	3.25	3.13	2.94
20	2.42	2.65	2.76	3.06	3.08	3.51	3.30	3.32	3.17	3.23	3.16	2.94
21	2.42	2.67	2.76	3.05	3.08	3.49	3.30	3.32	3.17	3.23	3.16	2.92
22	2.42	2.67	2.77	3.05	3.08	3.48	3.31	3.32	3.17	3.22	3.15	2.92
23	2.41	2.67	2.77	3.05	3.07	3.46	3.31	3.32	3.25	3.22	3.14	2.94
24	2.41	2.68	2.77	3.05	3.06	3.45	3.31	3.31	3.33	3.22	3.13	2.95
25	2.41	2.68	2.77	3.04	3.06	3.44	3.31	3.31	3.32	3.21	3.12	2.93
26	2.40	2.68	2.78	3.05	3.06	3.43	3.30	3.31	3.32	3.21	3.11	2.93
27	2.41	2.69	2.78	3.06	3.06	3.42	3.30	3.31	3.32	3.20	3.11	2.93
28	2.41	2.70	2.78	3.07	3.04	3.41	3.30	3.31	3.31	3.19	3.10	2.92
29	2.40	2.70	2.79	3.08	---	3.40	3.30	3.30	3.30	3.16	3.09	2.92
30	---	2.71	2.79	3.09	---	3.39	3.30	3.30	3.30	3.25	3.07	2.92
31	---	---	2.80	3.08	---	3.39	---	3.29	---	3.28	3.06	---
MEAN	---	2.65	2.75	2.94	3.09	3.31	3.33	3.31	3.24	3.26	3.15	2.96
MAX	---	2.90	2.80	3.09	3.12	3.64	3.38	3.36	3.33	3.33	3.26	3.04
MIN	---	2.56	2.72	2.79	3.04	3.01	3.30	3.25	3.17	3.16	3.06	2.92

STREAMS TRIBUTARY TO LAKE HURON

04136500 AU SABLE RIVER AT MIO, MI

LOCATION.--Lat 44°39'36", long 84°07'52", in SE1/4 NE1/4 sec.12, T.26 N., R.2 E., Oscoda County, Hydrologic Unit 04070007, on right bank 150 ft upstream from bridge on State Highway 33 in Mio, 500 ft downstream from Mio hydroelectric plant, 9.5 mi downstream from Big Creek, and 73.0 mi upstream from mouth.

DRAINAGE AREA.--1,100 mi², approximately.

PERIOD OF RECORD.--July 1952 to current year.

GAGE.--Water-stage recorder. Datum of gage is 929.60 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Records good. Flow regulated by Mio Dam 500 ft upstream. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--38 years, 994 ft³/s, 12.27 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,380 ft³/s, Sept. 30, 1986, gage height, 6.16 ft; minimum, 7.0 ft³/s, Aug. 4, 1977, gage height, -0.09 ft; minimum daily, 21 ft³/s, Aug. 9, 1977.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,160 ft³/s, Mar. 16, gage height, 5.40 ft; minimum, 186 ft³/s, Oct. 3, gage height, 1.26 ft; minimum daily, 582 ft³/s, Dec. 13.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	710	755	833	782	836	753	1140	958	851	847	865	754
2	711	766	823	782	819	820	1210	918	861	827	793	739
3	699	763	794	775	679	817	1380	900	913	826	785	726
4	711	756	684	798	723	696	1340	899	947	822	748	732
5	690	784	739	792	828	706	1210	899	932	767	855	732
6	707	810	812	789	845	726	1170	899	907	706	849	749
7	733	822	792	793	793	727	1210	848	885	721	761	783
8	729	825	709	803	764	812	1120	888	896	839	761	829
9	741	821	617	796	797	855	1070	817	897	996	758	839
10	753	800	757	787	815	813	1070	922	855	1030	747	836
11	753	814	833	748	780	834	1090	1400	808	961	842	806
12	779	821	691	756	767	1290	1170	1180	817	819	934	778
13	792	811	582	755	833	2040	1140	1100	909	761	889	735
14	750	810	703	734	822	1980	1090	1060	1010	776	795	800
15	760	796	764	762	785	2570	1210	1020	918	797	828	990
16	930	889	674	771	771	2900	1180	1070	844	793	813	933
17	974	925	639	780	747	2800	1110	1200	858	777	799	842
18	898	847	712	888	720	2350	1100	1150	864	801	801	845
19	844	797	726	903	769	2100	1090	1120	832	823	1380	813
20	889	810	714	866	784	1720	1090	1190	826	869	1160	803
21	863	839	660	855	784	1490	1140	1450	862	876	965	822
22	843	818	620	834	818	1370	1160	1290	868	850	857	749
23	860	738	666	828	794	1390	1130	1140	996	816	868	736
24	860	761	739	821	788	1470	1080	1140	1150	792	839	816
25	838	835	767	862	622	1360	1110	1110	1120	788	793	839
26	822	842	728	841	607	1270	1090	1050	1040	762	789	839
27	835	814	710	787	828	1200	1020	993	960	732	789	836
28	813	836	727	787	798	1160	979	939	906	770	943	830
29	776	863	745	791	---	1130	980	915	898	748	878	812
30	770	843	749	771	---	1120	980	916	889	802	791	795
31	759	---	767	817	---	1150	---	878	---	952	767	---
TOTAL	24592	24411	22476	24854	21716	42419	33859	32259	27319	25446	26442	24138
MEAN	793	814	725	802	776	1368	1129	1041	911	821	853	805
MAX	974	925	833	903	845	2900	1380	1450	1150	1030	1380	990
MIN	690	738	582	734	607	696	979	817	808	706	747	726
CFSM	.72	.74	.66	.73	.71	1.24	1.03	.95	.83	.75	.78	.73
IN.	.83	.83	.76	.84	.73	1.43	1.15	1.09	.92	.86	.89	.82

CAL YR 1989 TOTAL 335740 MEAN 920 MAX 3240 MIN 582 CFSM .84 IN 11.35
WTR YR 1990 TOTAL 329931 MEAN 904 MAX 2900 MIN 582 CFSM .82 IN 11.16

STREAMS TRIBUTARY TO LAKE HURON

04137500 AU SABLE RIVER NEAR AU SABLE, MI
(National stream quality accounting network station)

LOCATION.--Lat 44°26'09", long 83°26'28", in NE1/4 NW1/4 sec.35, T.24 N., R.8 E., Iosco County, Hydrologic Unit 04070007, at bridge on Rea Road, 5.5 mi northwest of Au Sable, and 10.4 mi upstream from mouth.

DRAINAGE AREA.--1,540 mi², approximately.

WATER DISCHARGE RECORDS

PERIOD OF RECORD.--August 1987 to current year. Records for July 1939 to September 1940, published in WSP 874, 894, and 1307, have been found to be unreliable and should not be used.

GAGE.--Water-stage recorder. Datum of gage is 583.93 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Water-discharge records good. Flow regulated by Foote Dam 0.6 mi upstream.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,660 ft³/s, Mar. 29, 1989, gage height, 16.02 ft; minimum, 337 ft³/s, Sept. 14, 1990, gage height, 7.24 ft; minimum daily, 460 ft³/s, Aug. 13, 1987.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,710 ft³/s, Mar. 14; maximum gage height, 13.22 ft, Aug. 20; minimum 337 ft³/s, Sept. 14, gage height, 7.24 ft; minimum daily, 587 ft³/s, July 28.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1140	847	1170	1320	1650	1330	1580	1400	1410	1670	1310	996
2	1200	839	1190	1320	1360	1360	1740	1270	1220	1260	1040	1020
3	1260	915	1110	1310	1140	1360	2150	1500	1210	1100	1040	966
4	1240	1100	892	1340	1150	1140	2430	1300	1300	1250	783	1030
5	1090	1750	991	1290	1350	1170	2050	1310	1320	1360	1250	1170
6	929	1270	1270	1170	1380	1250	1550	1320	1340	1390	1200	1180
7	943	631	1270	1270	1670	1160	1600	1320	1370	1190	999	1220
8	1050	675	1280	1360	1330	1260	1750	1320	1580	1070	1010	1250
9	1250	685	945	1350	1210	1930	1750	1560	1470	1600	1100	1260
10	1120	688	825	1330	1240	2090	1620	1700	1440	1490	1050	1220
11	763	722	1020	1530	1350	1460	1590	1740	1400	1450	1150	1260
12	604	911	1210	1400	1370	2200	1640	1820	1080	1310	1850	1210
13	600	1950	1300	1210	1490	2810	1530	1590	1470	1170	1740	1190
14	601	1500	1290	1240	1250	3250	1650	1530	1790	1170	1150	1520
15	942	855	1190	1480	1220	3700	1850	1690	1620	1310	1150	1560
16	1230	1100	971	1380	1290	3690	1800	1830	1140	1300	1620	1740
17	1280	1280	908	1380	1270	3690	1750	1960	1090	1260	1410	1310
18	1300	1660	917	1490	1300	3680	1670	1730	1270	1340	1100	1250
19	1290	1680	941	1450	1290	3480	1670	1730	1270	1370	2430	1010
20	1820	1180	993	1330	1320	2440	1620	1940	1250	1360	2280	994
21	2020	1190	1190	1470	1320	2010	1680	2180	1350	1860	1300	1260
22	1720	1170	1260	1800	1300	1840	1650	2110	1260	2140	1790	1150
23	1370	979	1150	1730	1330	2110	1630	1960	1370	1680	1310	1070
24	1190	833	915	1300	1360	2220	1690	1900	1700	1270	1250	1170
25	1160	876	816	1380	1320	2210	1650	1610	1960	1270	1220	1280
26	1050	1030	1070	1800	1110	1810	1640	1710	1930	1140	1260	1060
27	1050	1160	1650	1630	940	1430	1580	1460	1860	763	1280	1640
28	1140	1170	1510	1280	1120	1710	1550	1350	1520	587	1780	933
29	1420	1190	1240	1280	---	1890	1100	1390	1330	952	1450	864
30	1100	1170	1290	1190	---	1660	1360	1560	1640	859	1160	1120
31	842	---	1310	1280	---	1670	---	1560	---	1380	1090	---
TOTAL	35714	33006	35084	43090	36430	65010	50520	50350	42960	40321	41552	35903
MEAN	1152	1100	1132	1390	1301	2097	1684	1624	1432	1301	1340	1197
MAX	2020	1950	1650	1800	1670	3700	2430	2180	1960	2140	2430	1740
MIN	600	631	816	1170	940	1140	1100	1270	1080	587	783	864
CFSM	.75	.71	.74	.90	.85	1.36	1.09	1.06	.93	.85	.87	.78
IN.	.86	.80	.85	1.04	.88	1.57	1.22	1.22	1.04	.97	1.00	.87

CAL YR 1989 TOTAL 492126 MEAN 1348 MAX 5430 MIN 600 CFSM .88 IN 11.89
WTR YR 1990 TOTAL 509940 MEAN 1397 MAX 3700 MIN 587 CFSM .91 IN 12.32

STREAMS TRIBUTARY TO LAKE HURON

04137500 AU SABLE RIVER NEAR AU SABLE, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1978 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: April 1978 to September 1981.
WATER TEMPERATURE: April 1978 to September 1981.

REMARKS.--Bimonthly cross-sectional samples were collected at bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1978-79): Maximum daily, 346 microsiemens, Nov. 21, 1978; minimum daily, 229 microsiemens, Apr. 19, 21, 1979.
WATER TEMPERATURE (water years 1979-80): Maximum measured, 28.0°C, Aug. 8, 1979; minimum daily, 0.0°C on many days during winter.
EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--Specific conductance of 354 microsiemens was measured Feb. 3, 1988.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV										
01...	1330	839	--	8.25	9.5	0.6	10.4	--	K1	K2
DEC										
21...	1130	1260	313	8.17	1.0	0.6	12.8	91	<1	K2
MAR										
08...	1145	1350	309	8.18	1.0	0.5	13.6	96	<1	<1
APR										
17...	1330	1720	230	8.04	4.5	0.3	--	--	<1	K1
JUL										
10...	1330	1460	291	8.34	23.0	1.5	8.1	96	K13	K13
AUG										
13...	1400	1300	294	8.44	22.0	0.7	8.0	93	K6	K20

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
NOV										
01...	160	--	46	12	5.0	6	0.2	0.6	--	--
DEC										
21...	160	7	47	11	4.9	6	0.2	0.7	190	0
MAR										
08...	170	7	48	11	4.8	6	0.2	0.6	193	0
APR										
17...	120	11	35	7.7	3.4	6	0.1	0.7	132	0
JUL										
10...	150	0	42	11	4.5	6	0.2	0.5	172	6
AUG										
13...	160	2	44	11	4.7	6	0.2	0.5	177	5

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
NOV										
01...	--	10	5.8	0.1	8.7	177	0.24	401	<0.01	<0.10
DEC										
21...	156	12	5.2	0.1	8.5	183	0.25	623	<0.01	<0.10
MAR										
08...	158	10	6.9	0.2	9.4	181	0.25	660	<0.01	0.20
APR										
17...	108	11	7.7	0.1	6.3	137	0.19	636	<0.01	0.10
JUL										
10...	151	8.7	6.7	0.1	7.7	165	0.22	650	<0.01	<0.10
AUG										
13...	153	11	8.2	0.1	9.3	173	0.24	607	<0.01	<0.10

STREAMS TRIBUTARY TO LAKE HURON

04137500 AU SABLE RIVER NEAR AU SABLE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS TOTAL (MG/L AS P)	PHOSPHORUS DISSOLVED (MG/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
NOV										
01...	0.02	<0.01	0.2	0.01	<0.01	<0.01	<10	1	22	<0.5
DEC										
21...	0.03	0.03	<0.2	<0.01	<0.01	<0.01	--	--	--	--
MAR										
08...	0.02	0.01	<0.2	<0.01	<0.01	<0.01	<10	1	20	<0.5
APR										
17...	0.02	<0.01	0.7	0.01	<0.01	<0.01	<10	<1	14	<0.5
JUL										
10...	0.03	<0.01	<0.2	0.01	0.01	<0.01	--	--	--	--
AUG										
13...	<0.01	<0.01	0.4	0.01	<0.01	<0.01	<10	2	20	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
NOV										
01...	<1	<1	<3	1	4	<1	<4	2	<0.1	<10
DEC										
21...	--	--	--	--	--	--	--	--	--	--
MAR										
08...	<1	<5	<3	<10	5	<10	<4	5	<0.1	<10
APR										
17...	2	<1	<3	3	35	2	<4	3	<0.1	10
JUL										
10...	--	--	--	--	--	--	--	--	--	--
AUG										
13...	<1	<1	<3	3	3	<1	5	<1	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
NOV									
01...	<1	<1	<1.0	77	<6	<3	2	4.5	46
DEC									
21...	--	--	--	--	--	--	5	17	100
MAR									
08...	<10	<1	<1.0	75	<6	5	3	11	16
APR									
17...	1	<1	<1.0	50	<6	4	3	14	58
JUL									
10...	--	--	--	--	--	--	6	24	78
AUG									
13...	1	<1	<1.0	67	<6	7	3	11	83

04142000 RIFLE RIVER NEAR STERLING, MI
(National stream quality accounting network station)

LOCATION.--Lat 44°04'21", long 84°01'12", in NE1/4 SW1/4 sec.5, T.19 N., R.4 E., Arenac County, Hydrologic Unit 04080101, on left bank 30 ft downstream from bridge on Melita Road, 2.8 mi north of Sterling, and 20 mi upstream from mouth.

DRAINAGE AREA.--320 mi², approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--November 1905 to December 1908 (gage heights and discharge measurements only), October 1936 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as Rifle River at Michigan Highway 70 near Sterling 1936-61.

REVISED RECORDS.--WSP 1437: 1937(M), 1939-40(M).

GAGE.--Water-stage recorder. Datum of gage is 649.48 ft above National Geodetic Vertical Datum of 1929. November 1905 to December 1908, nonrecording gage at site 400 ft downstream at different datum. Jan. 13, 1937, to Jan. 10, 1939, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 17 to Mar. 13. Water-discharge records good except for estimated daily discharges, which are poor. Occasional regulation by dams upstream from station.

AVERAGE DISCHARGE.--54 years, 312 ft³/s, 13.24 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,340 ft³/s, Mar. 28, 1950, gage height, 13.74 ft, from rating curve extended above 3,800 ft³/s; minimum, 75 ft³/s, Nov. 22, 1964, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,600 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 13	0600	ice jam	*13.24	Mar. 14	0200	*3,030	9.49

Minimum discharge, 94 ft³/s, Nov. 23, gage height, 1.05 ft, result of freeze up.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	130	169	200	150	200	180	337	241	216	195	170	195
2	133	186	195	150	185	180	458	225	214	181	159	187
3	134	209	190	150	180	175	709	221	244	173	156	178
4	134	196	185	155	175	170	570	228	258	172	172	173
5	136	194	180	155	170	165	473	255	224	165	237	170
6	142	203	175	160	170	160	401	250	213	162	213	216
7	152	190	170	160	180	160	360	233	207	157	182	321
8	145	175	165	160	190	165	326	223	197	172	171	255
9	142	175	160	160	250	170	304	249	199	204	161	217
10	149	173	155	160	220	180	350	291	191	184	162	201
11	161	170	150	160	210	250	418	308	187	166	174	191
12	153	174	150	155	200	500	351	268	191	159	176	184
13	145	171	150	155	195	1300	312	249	216	154	431	182
14	159	166	150	150	195	2860	352	244	224	154	330	218
15	174	199	150	150	190	2310	481	254	224	163	235	339
16	166	291	145	160	190	1850	428	310	197	164	216	287
17	176	200	145	250	185	1410	381	468	188	156	195	245
18	169	190	145	450	185	1020	344	524	182	174	193	215
19	163	185	145	300	180	721	309	401	176	237	285	211
20	207	180	145	250	180	569	305	645	171	197	303	215
21	234	175	145	210	180	513	343	838	171	177	243	209
22	202	170	145	190	190	496	334	596	178	166	217	217
23	178	140	145	190	200	553	310	442	252	169	202	213
24	169	170	145	210	200	472	307	378	282	225	194	206
25	201	170	145	230	195	418	292	315	224	190	188	197
26	230	175	145	260	190	399	281	281	199	168	183	193
27	200	180	145	240	185	364	267	271	213	159	212	188
28	183	200	150	320	180	342	257	253	205	157	319	190
29	171	210	150	270	---	331	257	240	201	158	296	198
30	170	205	150	240	---	332	246	226	209	200	228	205
31	167	---	150	220	---	341	---	222	---	201	206	---
TOTAL	5175	5591	4865	6320	5350	19056	10863	10149	6253	5459	6809	6416
MEAN	167	186	157	204	191	615	362	327	208	176	220	214
MAX	234	291	200	450	250	2860	709	838	282	237	431	339
MIN	130	140	145	150	170	160	246	221	171	154	156	170
CFSM	.52	.58	.49	.64	.60	1.92	1.13	1.02	.65	.55	.69	.67
IN.	.60	.65	.57	.73	.62	2.22	1.26	1.18	.73	.63	.79	.75

CAL YR 1989 TOTAL 101213 MEAN 277 MAX 3710 MIN 130 CFSM .87 IN 11.77
WTR YR 1990 TOTAL 92306 MEAN 253 MAX 2860 MIN 130 CFSM .79 IN 10.73

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1966-72, 1974 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: November 1974 to September 1981.
WATER TEMPERATURE: November 1974 to September 1981.
SUSPENDED-SEDIMENT DISCHARGE: April to September 1966, October 1969 to September 1970, April to September 1972.

INSTRUMENTATION.--Water-quality monitor from Aug. 28, 1975 to Sept. 30, 1981.

REMARKS.--Quarterly cross-sectional samples were collected at or near bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975-77, 1979-80): Maximum recorded (more than 20 percent missing record), 567 microsiemens, Sept. 6, 1979; minimum, 157 microsiemens, Aug. 31, 1975, but may have been lower during instrument malfunction Sept. 1-10, 1975.
WATER TEMPERATURE (water years 1976-77, 1980): Maximum, 30.5°C, July 20, 1977; minimum, 0.0°C on many days during winter.
SEDIMENT CONCENTRATION (water years 1970, 1972): Maximum daily mean, 304 mg/L, Apr. 13, 1972; minimum daily, 0 mg/L on several days in water year 1972.
SEDIMENT LOAD (water years 1970, 1972): Maximum daily, 1,760 tons, Apr. 13, 1972; minimum daily, 0 ton on several days during 1972.
EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A suspended-sediment concentration of 647 mg/L was measured Mar. 27, 1967, and a sediment load of 3,270 tons was calculated Mar. 27, 1967.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT										
18...	1100	192	432	8.28	5.5	1.1	11.8	95	57	K31
JAN										
18...	1130	450	367	8.06	0.0	23	--	--	--	E14000
APR										
24...	1130	309	423	7.84	13.5	1.4	6.5	64	K29	K59
AUG										
07...	1200	186	422	8.45	23.5	4.4	8.7	104	98	79

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
OCT										
18...	210	32	60	15	9.5	9	0.3	1.2	219	0
JAN										
18...	170	27	47	12	9.4	11	0.3	3.2	171	0
APR										
24...	200	33	57	14	8.6	8	0.3	1.6	204	0
AUG										
07...	220	26	62	16	9.7	9	0.3	1.1	223	7

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
OCT										
18...	180	26	12	0.1	9.2	253	0.34	131	<0.01	0.12
JAN										
18...	140	29	15	0.1	7.7	230	0.31	279	0.01	0.51
APR										
24...	167	32	16	0.2	4.4	245	0.33	204	0.03	0.20
AUG										
07...	195	21	13	<0.1	9.0	254	0.35	128	0.13	--

STREAMS TRIBUTARY TO LAKE HURON

04142000 RIFLE RIVER NEAR STERLING, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS TOTAL (MG/L AS P)	PHOSPHORUS DISSOLVED (MG/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT 18...	0.03	0.02	0.5	0.02	<0.01	0.02	<10	1	51	<0.5
JAN 18...	0.25	0.26	1.2	0.15	0.07	0.08	20	<1	45	<0.5
APR 24...	0.64	0.62	1.7	0.11	0.08	0.05	20	2	48	<0.5
AUG 07...	0.05	0.07	1.2	0.12	0.09	0.08	<10	3	56	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT 18...	<1	<1	<3	1	22	<1	5	8	<0.1	<10
JAN 18...	<1	<1	<3	<10	69	<10	<4	30	<0.1	<10
APR 24...	<1	<1	<3	2	20	<1	4	22	<0.1	<10
AUG 07...	1	<1	<3	1	14	<1	8	6	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT 18...	<1	<1	<1.0	220	<6	13	12	6.2	71
JAN 18...	<10	<1	<1.0	190	<6	<3	101	123	86
APR 24...	1	<1	<1.0	220	<6	4	19	16	77
AUG 07...	1	<1	<1.0	230	<6	6	12	6.0	86

STREAMS TRIBUTARY TO LAKE HURON

04143900 SHIAWASSEE RIVER AT LINDEN, MI

LOCATION.--Lat 42°48'56", long 83°48'08", in SW1/4 sec.19, T.5 N., R.6 E., Genesee County, Hydrologic Unit 04080203, on right bank at upstream side of bridge on Hogan Road, 1.0 mi west of Linden.

DRAINAGE AREA.--83.7 mi².

PERIOD OF RECORD.--October 1967 to current year.

REVISED RECORDS.--WDR MI-87: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 844.96 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 7 to Jan. 5 and Feb. 25. Records good except for estimated daily discharges, which are fair. Flow regulated by dam at Linden since 1967. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--23 years, 61.1 ft³/s, 9.91 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 476 ft³/s, Apr. 22, 1975, gage height, 7.43 ft; minimum, 0.74 ft³/s, May 22, 23, 1971; minimum gage height, 2.82 ft, Aug. 2, 1971.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 184 ft³/s, Mar. 18, gage height, 5.80 ft; minimum, 7.0 ft³/s, July 29, Aug. 1, gage height, 3.45 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	42	39	105	46	90	121	112	84	73	60	11	29
2	40	36	102	45	87	122	111	74	54	59	18	29
3	34	33	92	44	81	117	110	67	61	58	18	28
4	23	27	84	55	79	111	111	64	66	57	18	26
5	17	22	78	65	79	106	110	62	69	56	19	15
6	17	23	74	76	78	104	112	62	63	56	19	15
7	17	33	69	77	69	92	111	62	56	56	19	19
8	16	42	66	78	68	89	109	61	50	53	19	18
9	17	43	62	86	71	94	107	61	69	13	18	28
10	24	44	58	94	74	103	110	62	65	8.2	12	38
11	24	44	55	87	78	114	118	62	64	8.2	11	47
12	24	44	52	86	86	123	117	63	60	13	12	45
13	25	45	49	87	91	135	118	64	58	19	12	42
14	27	50	46	87	93	146	122	62	57	20	12	44
15	40	68	45	87	91	160	123	63	27	20	11	48
16	49	86	44	83	91	174	124	70	24	20	12	47
17	51	93	43	86	88	180	124	86	25	21	12	45
18	42	102	42	86	88	182	121	103	26	31	12	44
19	34	112	42	87	88	178	121	135	27	42	18	45
20	37	119	41	91	85	175	117	168	30	45	20	44
21	37	125	40	98	82	167	121	173	32	44	23	45
22	39	132	40	106	83	158	123	174	34	39	23	45
23	46	135	39	108	96	154	118	172	38	34	26	45
24	51	126	39	109	103	145	116	169	39	28	31	43
25	55	117	38	110	105	141	117	166	41	24	31	38
26	56	110	38	109	106	137	109	153	49	29	31	40
27	53	104	37	107	106	133	105	139	60	21	31	39
28	50	110	37	106	113	131	101	125	62	14	30	37
29	46	111	37	105	---	123	93	113	61	12	29	38
30	45	107	37	100	---	120	88	103	62	19	29	33
31	42	---	48	98	---	114	---	92	---	19	29	---
TOTAL	1120	2282	1679	2689	2449	4149	3399	3114	1502	998.4	616	1099
MEAN	36.1	76.1	54.2	86.7	87.5	134	113	100	50.1	32.2	19.9	36.6
MAX	56	135	105	110	113	182	124	174	73	60	31	48
MIN	16	22	37	44	68	89	88	61	24	8.2	11	15
CFSM	.43	.91	.65	1.04	1.05	1.60	1.35	1.20	.60	.39	.24	.44
IN.	.50	1.01	.75	1.20	1.09	1.84	1.51	1.38	.67	.44	.27	.49

CAL YR 1989 TOTAL 23016.0 MEAN 63.1 MAX 173 MIN 16 CFSM .75 IN 10.23
WTR YR 1990 TOTAL 25096.4 MEAN 68.8 MAX 182 MIN 8.2 CFSM .82 IN 11.15

STREAMS TRIBUTARY TO LAKE HURON

04144500 SHIAWASSEE RIVER AT OWOSSO, MI

LOCATION.--Lat 43°00'54", long 84°10'52", in SW1/4 sec.12, T.7 N., R.2 E., Shiawassee County, Hydrologic Unit 04080203, on right bank on grounds of sewage-treatment plant, 1.5 mi north of Owosso.

DRAINAGE AREA.--538 mi².

PERIOD OF RECORD.--March 1931 to current year. Monthly discharge only for some periods, published in WSP 1307. Gage-height records for flood seasons collected in this vicinity 1904, 1910-30 are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 1307: 1949(M). WSP 1337: 1932, 1934, 1936-38, 1944.

GAGE.--Water-stage recorder. Datum of gage is 707.25 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 15, 1933, at site 1.5 mi upstream at datum 5.46 ft higher.

REMARKS.--Estimated daily discharges: Dec. 10 to Jan. 20, Feb. 4, 5, 16-22, and Feb. 25 to Mar. 7. Records good except for estimated daily discharges, which are poor. Flow regulated below about 800 ft³/s by powerplant at Shiawasseetown prior to February 1953; occasional regulation at low stages since. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--59 years, 341 ft³/s, 8.61 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,240 ft³/s, Apr. 6, 1947, gage height, 10.35 ft; minimum, 0.2 ft³/s, July 27, 1934, gage height, 1.12 ft; minimum daily, 2.0 ft³/s, July 28, 1934.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,500 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 12	0600	*2,380	*6.67	May 21	2100	1,700	5.97

Minimum daily discharge, 59 ft³/s, Aug. 18.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	147	228	612	240	494	930	648	369	366	258	102	103
2	142	225	566	230	473	860	708	410	324	256	93	98
3	135	225	507	225	454	800	716	361	311	243	88	90
4	133	222	416	360	430	730	679	348	303	204	95	77
5	137	218	434	600	410	670	657	342	264	179	91	70
6	138	228	459	700	390	610	656	345	282	178	102	73
7	129	204	374	650	405	560	633	348	270	169	89	148
8	123	197	335	670	510	524	606	310	267	166	79	156
9	120	222	315	690	760	679	575	325	294	164	84	183
10	127	242	300	720	751	1460	618	308	305	156	83	193
11	123	249	280	690	694	2110	796	288	286	157	72	178
12	134	248	260	600	653	2330	855	280	266	142	71	189
13	147	237	250	520	594	2090	848	275	251	122	68	176
14	147	223	240	480	568	1920	958	264	231	115	65	197
15	141	276	235	470	505	1890	966	255	276	130	65	197
16	137	525	230	460	480	1810	879	309	296	123	76	231
17	137	638	225	600	470	1690	738	465	300	107	64	229
18	140	671	220	900	460	1500	674	828	257	93	59	225
19	157	718	220	860	455	1310	628	1100	193	127	125	224
20	191	787	215	800	450	1080	609	1410	191	154	173	210
21	215	830	215	768	470	873	755	1640	201	156	196	214
22	225	723	210	659	500	826	779	1640	211	165	184	209
23	234	653	205	555	893	822	731	1390	270	173	172	203
24	240	613	205	616	1140	781	706	1030	290	169	167	203
25	235	562	200	866	950	752	674	833	266	164	143	181
26	225	520	200	1120	1000	721	696	695	234	156	134	167
27	221	513	195	906	1100	688	660	624	221	149	129	155
28	232	648	195	860	1000	654	626	579	209	133	121	149
29	248	708	190	783	---	629	553	512	208	122	121	143
30	241	655	210	633	---	623	484	429	232	115	123	139
31	239	---	250	554	---	614	---	394	---	107	109	---
TOTAL	5340	13208	8968	19785	17459	33536	21111	18706	7875	4852	3343	5010
MEAN	172	440	289	638	624	1082	704	603	263	157	108	167
MAX	248	830	612	1120	1140	2330	966	1640	366	258	196	231
MIN	120	197	190	225	390	524	484	255	191	93	59	70
CFSM	.32	.82	.54	1.19	1.16	2.01	1.31	1.12	.49	.29	.20	.31
IN.	.37	.91	.62	1.37	1.21	2.32	1.46	1.29	.54	.34	.23	.35

CAL YR 1989 TOTAL 149339 MEAN 409 MAX 2090 MIN 111 CFSM .76 IN 10.33
WTR YR 1990 TOTAL 159193 MEAN 436 MAX 2330 MIN 59 CFSM .81 IN 11.01

STREAMS TRIBUTARY TO LAKE HURON

04145000 SHIAWASSEE RIVER NEAR FERGUS, MI

LOCATION.--Lat 43°15'17", long 84°06'20", in sec.22, T.10 N., R.3 E., Saginaw County, Hydrologic Unit 04080203, on right bank at downstream side of bridge on Fergus Road, 1.2 mi east of Fergus, 1.8 mi upstream from Bear Creek, and 14 mi upstream from mouth.

DRAINAGE AREA.--637 mi².

PERIOD OF RECORD.--October 1939 to September 1984, October 1988 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1337: 1940(M), 1941-42, 1943(M), 1944, 1945(M), 1946, 1947(M), 1948, 1950. WSP 1627: 1952, 1954(M), 1957.

GAGE.--Water-stage recorder. Datum of gage is 585.80 ft above National Geodetic Vertical Datum of 1929. Prior to Aug. 22, 1968, nonrecording gage at same site and datum. Prior to Oct. 1, 1970, at datum 2.00 ft higher.

REMARKS.--Estimated daily discharges: Nov. 24, 25, Dec. 4 to Mar. 9, Aug. 3, 4, 8-18, and Sept. 4-6. Records good except for estimated daily discharges, which are fair. Some regulation at low stages by powerplant at Shiawasseetown prior to February 1953; occasional regulation at low stages since. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--47 years, 425 ft³/s, 9.06 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 7,500 ft³/s, Apr. 6, 1947, including overflow by-passing gage; maximum gage height, 15.44 ft, present datum, Mar. 29, 1960; minimum discharge, 27 ft³/s, Aug. 8, 1966.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,700 ft³/s, Mar. 12, gage height, 9.95 ft; minimum daily, 65 ft³/s, Aug. 18.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	165	246	728	280	570	1000	787	517	460	276	109	103
2	159	238	668	270	550	950	898	450	420	280	103	98
3	155	237	601	260	520	900	1020	483	376	267	100	92
4	144	235	500	400	500	850	953	437	382	251	105	85
5	146	232	510	700	460	750	882	459	363	203	113	78
6	155	255	520	820	480	700	868	431	313	187	100	88
7	147	242	450	760	550	640	843	436	361	181	142	142
8	136	221	390	780	760	660	795	418	342	172	95	179
9	131	229	360	820	850	690	753	382	340	172	90	182
10	140	256	340	840	880	1950	761	396	379	167	85	214
11	142	268	320	780	780	3160	1020	374	360	158	80	216
12	136	273	290	680	700	3640	1110	358	331	161	80	204
13	156	271	280	610	660	3040	1090	365	310	144	75	217
14	165	260	275	560	630	2480	1130	345	300	126	72	225
15	159	311	270	540	590	2230	1230	338	282	129	72	282
16	154	579	265	540	560	2100	1140	355	343	168	85	291
17	155	801	260	700	550	1930	1010	484	347	131	75	287
18	154	769	255	1050	540	1720	874	866	332	118	65	268
19	160	837	250	1000	530	1480	805	1160	259	117	141	260
20	204	944	245	920	530	1280	768	1520	199	176	189	242
21	224	1120	245	820	550	1050	924	1810	225	180	208	222
22	247	932	240	700	600	966	1060	1920	224	171	207	238
23	251	797	235	660	1100	1050	947	1710	279	184	179	215
24	260	730	235	850	1300	976	904	1330	333	190	173	209
25	258	670	230	1100	1100	918	861	1040	313	181	169	200
26	243	616	225	1300	1200	891	838	898	289	172	146	181
27	234	587	225	1050	1300	839	826	783	252	165	138	168
28	235	806	220	950	1100	802	766	720	235	156	133	162
29	261	908	220	850	---	768	705	661	241	137	122	164
30	253	804	250	700	---	764	606	567	228	140	120	160
31	253	---	290	620	---	761	---	494	---	128	120	---
TOTAL	5782	15674	10392	22910	20440	41935	27174	22507	9418	5388	3691	5672
MEAN	187	522	335	739	730	1353	906	726	314	174	119	189
MAX	261	1120	728	1300	1300	3640	1230	1920	460	280	208	291
MIN	131	221	220	260	460	640	606	338	199	117	65	78
CFSM	.29	.82	.53	1.16	1.15	2.12	1.42	1.14	.49	.27	.19	.30
IN.	.34	.92	.61	1.34	1.19	2.45	1.59	1.31	.55	.31	.22	.33

CAL YR 1989 TOTAL 173488 MEAN 475 MAX 2060 MIN 106 CFSM .75 IN 10.13
WTR YR 1990 TOTAL 190983 MEAN 523 MAX 3640 MIN 65 CFSM .82 IN 11.15

04146000 FARMERS CREEK NEAR LAPEER, MI

LOCATION.--Lat 43°02'41", long 83°20'14", in sec.6, T.7 N., R.10 E., Lapeer County, Hydrologic Unit 04080204, on left bank on grounds of sewage-treatment plant at Michigan Home and Training School, 2.0 mi west of Lapeer.

DRAINAGE AREA.--55.3 mi².

PERIOD OF RECORD.--October 1932 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 924: 1940. WSP 1084: 1942(M), 1943. WSP 1337: 1934-38, 1940(M), 1944(M), 1945, 1946(M), 1948-51(M). WSP 1727: 1952 (M). WDR MI-78: Drainage area.

GAGE.--Water-stage recorder. Concrete control since Oct. 12, 1938. Datum of gage is 805.79 ft above National Geodetic Vertical Datum of 1929. Prior to May 25, 1954, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Nov. 23, 24, Dec. 3-14, Dec. 17 to Jan. 23, Jan. 27, 30, Feb. 16 to Mar. 1, Mar. 7, June 19 to July 10, and July 12-16, 25, 26. Records good except for estimated daily discharges, which are poor. Prior to 1941, occasional regulation caused by dam upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--58 years, 31.5 ft³/s, 7.74 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,380 ft³/s, Sept. 9, 1985, gage height, 20.95 ft, from floodmark; minimum, 0.14 ft³/s, Sept. 16, 18, 1970; minimum gage height, 14.18 ft, Jan. 1, 1937.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 160 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 14	1300	*177	*17.00	No other peak greater than base discharge.			

Minimum daily discharge, 1.6 ft³/s, Aug. 11, 12, 14.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	11	28	40	13	49	80	52	32	17	6.5	2.6	4.7
2	9.6	24	38	14	48	65	54	29	15	5.7	2.5	4.2
3	7.8	20	33	15	45	59	59	22	15	5.2	2.4	3.5
4	7.9	18	30	16	42	55	61	13	13	4.8	2.3	3.2
5	7.5	16	28	25	41	53	63	14	12	4.5	2.4	3.1
6	6.6	19	26	40	40	52	66	11	11	4.1	2.0	3.7
7	6.0	20	24	50	40	49	65	9.5	11	3.8	1.9	7.5
8	6.0	22	23	60	44	45	64	8.1	11	3.5	1.9	12
9	5.5	23	22	56	52	57	61	5.9	12	3.8	1.8	16
10	5.5	25	21	53	58	72	64	5.4	13	3.2	1.7	15
11	5.3	25	20	50	66	105	68	5.8	12	2.8	1.6	13
12	6.1	22	19	47	65	141	74	4.6	11	2.7	1.6	11
13	6.6	22	18	43	62	166	82	4.9	10	2.6	1.7	9.5
14	6.9	22	17	40	59	175	84	4.6	15	2.5	1.6	9.4
15	6.2	34	17	36	55	166	79	4.4	17	2.6	1.7	11
16	6.2	50	17	34	52	151	74	4.9	19	2.7	1.9	15
17	9.5	59	16	40	50	128	73	16	21	2.8	1.7	18
18	14	70	15	60	47	109	69	24	19	3.9	1.8	17
19	18	71	15	85	45	94	65	52	15	4.9	4.7	16
20	32	69	14	110	42	82	63	102	12	4.6	12	15
21	48	61	14	100	40	72	63	103	10	4.9	17	27
22	43	55	13	90	45	69	60	81	9.0	5.9	17	43
23	52	50	12	85	55	68	60	60	11	5.8	16	28
24	60	43	12	74	65	66	60	53	9.5	6.5	14	19
25	47	40	12	69	75	66	58	49	8.5	5.8	11	16
26	36	37	11	67	90	64	55	44	8.0	4.5	8.4	16
27	29	34	11	66	83	60	50	36	7.5	4.1	6.6	15
28	35	38	11	66	86	56	46	29	8.0	4.0	8.8	12
29	48	39	11	61	---	52	41	26	8.5	3.6	7.7	9.9
30	42	41	11	57	---	51	36	23	7.5	3.5	7.0	10
31	34	---	12	52	---	48	---	19	---	2.9	6.2	---
TOTAL	658.2	1097	583	1674	1541	2576	1869	896.1	368.5	128.7	171.5	403.7
MEAN	21.2	36.6	18.8	54.0	55.0	83.1	62.3	28.9	12.3	4.15	5.53	13.5
MAX	60	71	40	110	90	175	84	103	21	6.5	17	43
MIN	5.3	16	11	13	40	45	36	4.4	7.5	2.5	1.6	3.1
CFSM	.38	.66	.34	.98	1.00	1.50	1.13	.52	.22	.08	.10	.24
IN.	.44	.74	.39	1.13	1.04	1.73	1.26	.60	.25	.09	.12	.27

CAL YR 1989 TOTAL 9034.0 MEAN 24.8 MAX 83 MIN 2.6 CFSM .45 IN 6.08
WTR YR 1990 TOTAL 11966.7 MEAN 32.8 MAX 175 MIN 1.6 CFSM .59 IN 8.05

STREAMS TRIBUTARY TO LAKE HURON

04146063 SOUTH BRANCH FLINT RIVER NEAR COLUMBIAVILLE, MI

LOCATION.--Lat 43°09'34", long 83°21'03", in NE1/4 NE1/4 sec.36, T.9 N., R.9 E., Lapeer County, Hydrologic Unit 04080204, on right bank at upstream side of bridge on Columbiaville Road, 3.0 mi east of Columbiaville, and 3.2 mi upstream from confluence of North and South Branches.

DRAINAGE AREA.--221 mi^2.

PERIOD OF RECORD.--March 1980 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 765 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 4 to Jan. 24, Feb. 3-5, 16-21, Feb. 26 to Mar. 7, and May 19 to June 7. Records fair. Several measurements of water temperature were made during the year. Gage-height telemeter at station.

AVERAGE DISCHARGE.--10 years, 184 ft^3/s, 11.31 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,090 ft^3/s, Sept. 9, 1985, gage height, 9.60 ft; maximum gage height, 9.61 ft, Feb. 26, 1985, backwater from ice; minimum discharge, 12 ft^3/s, July 11, 1988, gage height, 1.22 ft.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 858 ft^3/s, Mar. 13, gage height, 4.74 ft; maximum gage height, 5.69 ft, Jan. 19, backwater from ice; minimum daily discharge, 31 ft^3/s, Sept. 4, 5.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	69	90	160	70	179	250	212	118	100	84	59	42
2	62	82	150	65	175	225	248	106	95	79	56	37
3	59	75	142	72	165	215	288	98	130	73	53	33
4	48	72	135	110	160	200	309	90	105	66	51	31
5	51	68	130	160	150	190	296	105	90	60	46	31
6	51	70	125	250	159	175	286	111	85	54	47	35
7	48	70	115	220	160	170	271	104	81	51	48	82
8	47	82	105	200	184	174	254	99	93	48	52	97
9	57	90	95	210	276	204	238	92	102	63	62	89
10	59	83	91	230	309	414	239	81	101	58	56	82
11	77	83	90	220	261	537	331	76	100	48	45	83
12	79	76	87	200	234	713	344	73	97	51	46	64
13	76	70	82	180	224	846	325	77	91	50	48	57
14	70	67	79	160	229	823	317	82	116	50	44	54
15	63	109	76	150	181	740	317	80	165	52	38	68
16	60	252	73	150	180	652	297	89	116	53	40	69
17	66	282	70	220	170	612	296	162	106	53	38	77
18	75	270	67	300	165	520	284	396	105	50	34	73
19	68	266	65	450	160	433	250	380	95	69	47	70
20	93	267	63	410	155	365	242	400	85	65	63	72
21	139	268	60	380	150	313	249	400	82	73	76	70
22	134	221	57	340	175	285	253	375	78	74	77	84
23	124	191	55	280	367	313	243	310	99	59	75	92
24	130	179	53	255	392	314	217	270	110	66	66	81
25	130	159	52	273	323	281	224	240	107	63	58	71
26	129	150	51	300	320	261	211	215	102	61	50	60
27	102	144	51	263	320	238	181	190	90	60	45	57
28	97	169	50	264	290	215	178	170	85	64	58	54
29	103	186	50	237	---	200	151	150	91	59	58	51
30	104	159	52	211	---	197	138	130	92	45	50	58
31	97	---	75	195	---	205	---	115	---	47	46	---
TOTAL	2567	4350	2606	7025	6213	11280	7689	5384	2994	1848	1632	1924
MEAN	82.8	145	84.1	227	222	364	256	174	99.8	59.6	52.6	64.1
MAX	139	282	160	450	392	846	344	400	165	84	77	97
MIN	47	67	50	65	150	170	138	73	78	45	34	31
CFSM	.38	.66	.38	1.03	1.01	1.65	1.16	.79	.45	.27	.24	.29
IN.	.43	.73	.44	1.18	1.05	1.90	1.29	.91	.50	.31	.27	.32

CAL YR 1989 TOTAL 44229 MEAN 121 MAX 450 MIN 39 CFSM .55 IN 7.44
WTR YR 1990 TOTAL 55512 MEAN 152 MAX 846 MIN 31 CFSM .69 IN 9.34

STREAMS TRIBUTARY TO LAKE HURON

04147000 HOLLOWAY RESERVOIR NEAR OTISVILLE, MI

LOCATION.--Lat 43°07'15", long 83°29'45", in NW1/4 sec.11, T.8 N., R.8 E., Genesee County, Hydrologic Unit 04080204, in gatehouse on right side of Holloway Dam on Flint River, 3.5 mi southeast of Otisville.

DRAINAGE AREA.--526 mi².

PERIOD OF RECORD.--March 1954 to current year.

REVISED RECORDS.--WSP 2111: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is National Geodetic Vertical Datum of 1929 (levels by City of Flint).

REMARKS.--Reservoir is formed by an earth-fill dam with concrete spillway completed in 1953. Capacity of reservoir, 1,256,000,000 ft³ at elevation 760.00 ft. The spillway section includes two 90-foot drum gates with minimum crest elevation of 751 ft, maximum at 755 ft, three 20-foot radial gates with sill elevation of 745 ft, and 2 sluices (each 4 by 6 ft), one on each side with valve controls. Entrance elevation of sluiceways is 724 ft. Reservoir is used to regulate flow for sewage dilution for City of Flint.

COOPERATION.--Reservoir elevations furnished by City of Flint.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 996,000,000 ft³, Mar. 8, 1956, elevation, 757.4 ft; minimum, reservoir empty at times during October, November, 1954, January, February, 1955, October, 1971.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 819,500,000 ft³, May 22, elevation, 755.55 ft; minimum, 480,200,000 ft³, Dec. 26, elevation, 751.12 ft.

MONTHEND ELEVATION, IN FEET NGVD, AND CONTENTS, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

Date	Elevation (feet)	Contents (millions of cubic feet)	Change in contents (millions of cubic feet)	Change in contents (equivalent in ft³/s)
Sept. 30	754.90	761	--	--
Oct. 31	755.07	776	+15	+5.6
Nov. 30	751.53	505	-271	-105
Dec. 31	751.12	480	-25	-9.3
CAL YR 1989	--	--	-13	-0.4
Jan. 31	751.72	517	+37	+13.8
Feb. 28	751.81	524	+7	+2.9
Mar. 31	751.59	508	-16	-6.0
Apr. 30	754.86	757	+249	+96.1
May 31	755.14	783	+26	+9.7
June 30	755.04	774	-9	-3.5
July 31	754.80	752	-22	-8.2
Aug. 31	752.24	554	-198	-73.9
Sept. 30	754.45	723	+169	+65.2
WTR YR 1990	--	--	-38	-1.2

STREAMS TRIBUTARY TO LAKE HURON

04148140 KEARSLEY CREEK NEAR DAVISON, MI

LOCATION.--Lat 43°02'01", long 83°34'53", in NE1/4 sec.12, T.7 N., R.7 E., Genesee County, Hydrologic Unit 04080204, on right bank 10 ft upstream from bridge on Davison Road, 1.4 mi downstream from Black Creek, and 3.3 mi west of Davison.

DRAINAGE AREA.--99.4 mi².

PERIOD OF RECORD.--October 1965 to current year.

REVISED RECORDS.--WDR MI-78: Drainage area. WDR MI-85: 1968(M), 1973(M), 1975, 1982(P).

GAGE.--Water-stage recorder. Datum of gage is 747.39 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 4 to Jan. 23, Jan. 29 to Feb. 6, Feb. 13-22, Feb. 26 to Mar. 8, and Aug. 7-24. Records good except for estimated daily discharges, which are fair. Some diurnal fluctuation caused by small dams, and occasional diversion for sprinkler irrigation upstream from station. Several measurements of water temperature were made during the year. Gage-height telemeter at station.

AVERAGE DISCHARGE.--25 years, 72.3 ft³/s, 9.88 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,500 ft³/s, Sept. 9, 1985, gage height, 11.85 ft, from floodmark; minimum, 1.6 ft³/s, July 9, 1988, gage height, 2.62 ft.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 350 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 12	0300	*496	*8.51	June 14	1700	357	7.35

Minimum daily discharge, 4.2 ft³/s, Sept. 5.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	14	25	82	27	75	135	112	53	28	18	7.4	6.2
2	13	24	73	29	70	120	131	44	32	15	6.7	5.9
3	13	24	65	40	68	115	146	43	45	18	6.2	5.3
4	13	23	61	80	66	105	146	45	34	18	6.6	4.8
5	13	24	57	140	65	97	147	63	29	16	7.0	4.2
6	14	27	53	160	64	90	148	70	29	15	6.8	14
7	13	28	49	150	74	86	137	69	33	13	6.3	43
8	14	29	45	135	113	82	127	46	40	12	6.1	20
9	13	33	41	120	167	187	115	28	37	13	5.9	22
10	23	37	38	120	158	337	134	29	39	13	5.7	20
11	19	37	35	115	144	455	190	34	35	14	5.5	18
12	24	36	33	100	126	475	169	37	30	14	5.3	16
13	26	33	31	80	110	407	166	44	27	10	9.2	16
14	24	36	29	72	100	364	169	39	197	11	9.8	23
15	21	86	28	70	87	312	160	43	168	12	7.2	23
16	20	175	27	90	86	290	142	60	80	14	6.0	28
17	21	172	26	140	85	246	137	148	54	16	5.3	25
18	20	171	25	210	80	207	114	180	43	30	10	24
19	25	170	25	190	75	182	118	172	33	20	70	25
20	35	189	24	170	70	160	115	230	28	18	25	22
21	38	175	24	140	65	139	127	239	29	11	23	22
22	41	151	23	120	110	131	118	187	32	8.0	21	23
23	41	126	23	110	271	145	118	156	44	9.1	19	20
24	39	96	23	147	243	133	117	129	43	10	17	19
25	35	75	22	168	210	133	108	96	41	11	15	17
26	32	70	22	186	180	128	97	87	36	11	13	16
27	30	68	22	152	165	113	90	82	38	9.1	12	14
28	27	121	22	140	150	101	82	71	47	7.5	12	13
29	25	116	22	110	---	96	75	56	54	6.7	9.1	12
30	25	113	23	100	---	104	66	39	27	9.7	7.6	12
31	26	---	25	85	---	101	---	25	---	11	6.9	---
TOTAL	737	2490	1098	3696	3277	5776	3821	2644	1432	414.1	373.6	533.4
MEAN	23.8	83.0	35.4	119	117	186	127	85.3	47.7	13.4	12.1	17.8
MAX	41	189	82	210	271	475	190	239	197	30	70	43
MIN	13	23	22	27	64	82	66	25	27	6.7	5.3	4.2
CFSM	.24	.84	.36	1.20	1.18	1.87	1.28	.86	.48	.14	.12	.18
IN.	.28	.93	.41	1.38	1.23	2.16	1.43	.99	.54	.15	.14	.20

CAL YR 1989 TOTAL 22127.0 MEAN 60.6 MAX 273 MIN 13 CFSM .61 IN 8.28
WTR YR 1990 TOTAL 26292.1 MEAN 72.0 MAX 475 MIN 4.2 CFSM .72 IN 9.84

04148500 FLINT RIVER NEAR FLINT, MI

LOCATION.--Lat 43°02'20", long 83°46'18", in SW1/4 sec.4, T.7 N., R.6 E., Genesee County, Hydrologic Unit 04080204, on left bank on grounds of sewage-treatment plant, 1.2 mi upstream from Pirnie Creek, and 5.0 mi downstream from Swartz Creek.

DRAINAGE AREA.--956 mi².

PERIOD OF RECORD.--September 1903 to March 1904 (gage heights only), August 1932 to current year. Gage-height records for flood seasons collected in this vicinity 1911-32, are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 954: 1941. WSP 1337: 1933-34(M), 1935-37. WDR MI-78: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 678.80 ft above National Geodetic Vertical Datum of 1929 (levels by the National Weather Service and City of Flint).

REMARKS.--No estimated daily discharges. Records good. Some regulation by reservoirs upstream from station (station 04147000). Occasional diversion for industrial use. Since Dec. 17, 1967, flow contains up to 50 ft³/s as sewage effluent which originates outside the basin. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--58 years, 615 ft³/s, 8.74 in/yr, adjusted for storage since 1954.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 14,900 ft³/s, Apr. 6, 1947, gage height, 16.35 ft; maximum gage height, 16.95 ft, Sept. 6, 1985; minimum discharge, 9.0 ft³/s, Aug. 7, 1934.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,540 ft³/s, Mar. 12, gage height, 9.15 ft; minimum, 63 ft³/s, Aug. 8, gage height, 2.74 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	159	273	736	264	872	1170	876	519	402	328	144	144
2	168	484	705	257	843	1130	987	480	366	276	149	157
3	164	564	630	279	722	1130	1020	442	547	252	142	147
4	154	878	519	1020	698	1020	1110	454	409	219	165	148
5	152	896	482	1110	667	950	1170	488	354	225	170	155
6	157	992	487	868	694	857	1220	424	322	213	156	381
7	149	974	433	870	688	776	1110	426	312	185	157	690
8	139	836	395	874	762	737	1120	406	450	173	132	281
9	151	537	365	916	1080	1220	1010	459	368	207	146	192
10	322	357	354	1030	1220	2130	1050	385	331	186	149	185
11	212	365	349	993	1180	3180	1370	377	311	175	139	197
12	190	356	335	912	1110	3460	1230	366	295	184	159	173
13	193	433	308	791	1010	3460	1190	447	277	168	207	175
14	195	269	301	708	1080	3310	1280	370	1080	167	162	319
15	191	750	297	661	974	3010	1250	376	1030	160	151	269
16	204	1010	278	657	862	2760	1120	687	678	187	153	337
17	252	994	268	1460	850	2590	931	1430	388	169	150	217
18	210	969	266	1930	725	2170	750	1500	416	253	209	198
19	307	942	263	1730	729	1960	666	1330	379	297	906	254
20	342	1140	248	1750	685	1670	852	1530	350	353	306	213
21	283	1090	226	1750	641	1380	1030	1550	338	227	211	237
22	295	947	223	1620	1080	1250	925	1500	399	199	191	232
23	325	834	211	1420	1830	1360	903	1300	478	212	181	186
24	341	716	206	1450	1790	1140	859	1050	394	201	175	150
25	341	638	200	1540	1510	1120	689	990	341	170	165	181
26	330	591	199	1690	1310	1120	722	862	346	171	159	187
27	312	624	204	1370	1300	1070	812	760	354	177	166	174
28	286	967	199	1240	1260	991	707	669	335	156	175	179
29	271	811	189	1160	---	932	574	592	416	149	174	170
30	283	750	198	1060	---	909	539	505	389	149	158	178
31	288	---	289	971	---	736	---	444	---	153	153	---
TOTAL	7366	21987	10363	34351	28172	50698	29072	23118	12855	6341	5960	6706
MEAN	238	733	334	1108	1006	1635	969	746	429	205	192	224
MAX	342	1140	736	1930	1830	3460	1370	1550	1080	353	906	690
MIN	139	269	189	257	641	736	539	366	277	149	132	144
MEAN+	243	628	325	1122	1009	1629	1065	755	425	196	118	289
CFSM+	.25	.66	.34	1.17	1.06	1.70	1.11	.79	.44	.21	.12	.30
IN.+	.29	.73	.39	1.35	1.10	1.96	1.24	.91	.50	.24	.14	.34

CAL YR 1989 TOTAL 208974 MEAN 573 MAX 2880 MIN 139 MEAN+ 572 CFSM+ .60 IN+ 8.12
WTR YR 1990 TOTAL 236989 MEAN 649 MAX 3460 MIN 132 MEAN+ 648 CFSM+ .68 IN+ 9.20

\+ Adjusted for change in contents in Holloway Reservoir.

STREAMS TRIBUTARY TO LAKE HURON

04149000 FLINT RIVER NEAR FOSTERS, MI

LOCATION.--Lat 43°18'30", long 83°57'13", in SE1/4 SE1/4 sec.35, T.11 N., R.4 E., Saginaw County, Hydrologic Unit 04080204, on left bank 20 ft downstream from bridge on State Highway 13, 2 mi west of Fosters, and 6.5 mi downstream from Silver Creek. Records include flow of Birch Run.

DRAINAGE AREA.--1,188 mi², includes that of Birch Run upstream from State Highway 13.

PERIOD OF RECORD.--October 1939 to September 1984, October 1987 to current year. Monthly discharge only for some periods, published in WSP 1307. Gage-height records for flood seasons collected in this vicinity 1910-20, 1922-27 are contained in reports of the National Weather Service.

REVISED RECORDS.--WSP 954: 1941. WSP 1337: 1940, 1942, 1943-44(M), 1945, 1946-47(M), 1948-50. WDR MI-78: Drainage area.

GAGE.--Water-stage recorder and crest-stage gage. Elevation of gage is 600 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to Oct. 1, 1969, nonrecording gage at site 2.2 mi upstream at datum 582.22 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 8 to Jan. 11, Jan. 27 to Apr. 18, May 8-11, and Sept. 7, 8, 15, 26, 27. Records fair. Some regulation by reservoirs upstream from the city of Flint. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--48 years, 745 ft³/s, 8.52 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 19,000 ft³/s, Apr. 7, 1947, including flow by-passing gage; maximum gage height, 18.6 ft, Feb. 2, 1968, site and datum then in use; minimum discharge observed, 27 ft³/s, Aug. 6, 1941.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of March 1904 reached a stage of 18.4 ft, from National Weather Service data, site and datum then in use.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,890 ft³/s, Mar. 13, gage height, 13.95 ft; minimum daily, 164 ft³/s, Aug. 10.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	209	337	851	320	1200	1500	900	670	544	510	185	203
2	207	336	806	300	1100	1450	1100	634	502	418	170	192
3	204	555	777	290	1000	1400	1200	591	566	361	172	196
4	204	672	741	320	900	1400	1300	557	584	331	181	191
5	202	898	748	1200	860	1300	1400	653	501	293	214	191
6	198	975	586	1250	830	1050	1450	599	449	290	216	214
7	198	993	549	1000	860	1000	1500	559	416	278	196	570
8	198	1020	500	1000	870	950	1400	530	409	250	191	650
9	187	801	450	1000	1000	1000	1350	600	562	241	171	355
10	193	561	430	1100	1400	1400	1300	510	453	266	164	261
11	383	451	410	1200	1500	2500	1400	500	415	237	176	245
12	279	434	400	1130	1450	3800	1700	475	391	229	167	251
13	242	427	380	1010	1400	4500	1500	495	382	226	198	229
14	234	493	360	987	1250	4500	1550	535	459	212	240	235
15	239	446	350	794	1350	4100	1600	474	1440	217	194	400
16	237	1100	330	748	1200	3700	1450	525	1020	220	178	363
17	249	1150	320	1260	1050	3500	1300	1000	689	233	176	409
18	297	1090	310	2330	1000	3100	1100	1900	488	216	174	287
19	282	1010	300	2030	950	2700	936	1510	499	369	658	264
20	408	1080	290	1820	900	2400	902	1560	458	379	800	318
21	433	1290	280	1830	850	2000	1220	1730	451	436	386	278
22	358	1120	260	1730	800	1700	1280	1660	419	289	288	314
23	358	988	250	1600	1500	1500	1140	1560	576	255	261	303
24	379	866	240	1490	2300	1600	1110	1270	610	279	247	252
25	394	758	230	1670	2200	1400	998	1140	482	263	237	219
26	396	707	225	2150	1900	1300	882	1060	433	221	221	250
27	386	662	225	2000	1700	1000	922	932	441	213	215	255
28	378	946	225	1700	1600	1250	956	833	437	219	256	227
29	361	1120	220	1500	---	1200	803	762	557	194	247	235
30	353	874	220	1400	---	1150	718	679	580	184	230	227
31	351	---	250	1300	---	1050	---	598	---	181	213	---
TOTAL	8997	24160	12513	39459	34920	62400	36367	27101	16213	8510	7622	8584
MEAN	290	805	404	1273	1247	2013	1212	874	540	275	246	286
MAX	433	1290	851	2330	2300	4500	1700	1900	1440	510	800	650
MIN	187	336	220	290	800	950	718	474	382	181	164	191

CAL YR 1989 TOTAL 263818 MEAN 723 MAX 3000 MIN 187
WTR YR 1990 TOTAL 286846 MEAN 786 MAX 4500 MIN 164

04150500 CASS RIVER AT CASS CITY, MI

LOCATION.--Lat 43°35'03", long 83°10'34", in NE1/4 NE1/4 sec.4, T.13 N., R.11 E., Tuscola County, Hydrologic Unit 04080205, on left bank 600 ft downstream from bridge on Cemetery Road, 0.3 mi downstream from confluence of North and South Branches, and 1.1 mi south of Cass City.

DRAINAGE AREA.--359 mi².

PERIOD OF RECORD.--October 1947 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1337: 1949-50. WSP 1727: 1948(M), 1950. WDR MI-78: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 697.92 ft above National Geodetic Vertical Datum of 1929. Prior to Nov. 14, 1952, nonrecording gage at site 600 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Nov. 18-24, Nov. 30 to Jan. 18, Jan. 22 to Feb. 7, Feb. 10-21, and Feb. 26 to Mar. 8. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--43 years, 217 ft³/s, 8.21 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 12,500 ft³/s, Sept. 12, 1986, gage height, 19.82 ft, from floodmark; minimum, 0.50 ft³/s, Sept. 26, 1948.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,400 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Jan. 18	1500	2,670	10.25	Mar. 13	0600	*4,010	*11.82

Minimum discharge, 5.8 ft³/s, Aug. 14; minimum gage height, 4.58 ft, Oct. 5.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	11	26	90	30	200	170	234	103	73	35	7.4	60
2	10	26	70	30	160	150	333	92	68	35	8.7	37
3	9.3	26	55	30	140	140	605	86	74	36	7.0	24
4	8.6	26	50	50	130	135	666	78	72	39	9.2	20
5	8.4	26	46	80	125	130	592	96	67	37	11	16
6	8.7	30	43	110	125	130	486	106	63	36	14	35
7	8.7	35	41	130	130	130	401	105	58	33	17	273
8	10	40	41	120	142	135	327	95	51	35	13	271
9	11	42	43	115	534	155	277	91	49	38	10	215
10	14	50	44	110	500	1270	267	85	44	39	8.1	154
11	16	46	42	105	350	2510	301	80	41	40	7.1	100
12	19	43	40	105	260	3440	318	80	37	35	6.5	65
13	20	39	36	100	200	3700	282	75	38	31	7.3	49
14	18	38	33	90	180	2680	266	73	35	28	6.6	41
15	16	61	32	82	140	1840	318	71	37	28	6.7	53
16	14	166	31	80	130	1550	324	77	69	26	8.4	62
17	11	235	30	300	125	1560	305	139	50	23	8.6	56
18	12	220	30	1500	120	971	294	428	35	21	8.0	44
19	17	200	30	1860	120	652	254	382	28	29	14	42
20	33	170	30	1350	125	481	229	313	24	33	28	41
21	43	150	30	766	130	391	277	372	23	32	30	41
22	48	130	30	350	134	356	292	359	23	29	26	44
23	47	115	30	250	356	463	271	277	32	22	22	43
24	42	100	30	220	690	495	237	217	41	18	19	38
25	39	94	30	270	389	385	207	204	46	15	15	36
26	35	90	30	500	330	319	182	195	44	12	13	31
27	32	95	30	600	250	272	161	159	45	9.6	12	29
28	29	296	30	520	200	240	143	129	37	8.6	127	26
29	29	411	30	450	---	217	125	107	35	8.2	223	23
30	31	200	30	395	---	212	115	92	35	7.6	166	21
31	27	---	30	270	---	220	---	82	---	6.8	109	---
TOTAL	677.7	3226	1187	10968	6415	25499	9089	4848	1374	825.8	968.6	1990
MEAN	21.9	108	38.3	354	229	823	303	156	45.8	26.6	31.2	66.3
MAX	48	411	90	1860	690	3700	666	428	74	40	223	273
MIN	8.4	26	30	30	120	130	115	71	23	6.8	6.5	16
CFSM	.06	.30	.11	.99	.64	2.29	.84	.44	.13	.07	.09	.19
IN.	.07	.33	.12	1.14	.66	2.64	.94	.50	.14	.09	.10	.21

CAL YR 1989 TOTAL 51238.9 MEAN 140 MAX 1570 MIN 8.4 CFSM .39 IN 5.31
WTR YR 1990 TOTAL 67068.1 MEAN 184 MAX 3700 MIN 6.5 CFSM .51 IN 6.95

STREAMS TRIBUTARY TO LAKE HURON

04150800 CASS RIVER AT WAHJAMEGA, MI

LOCATION.--Lat 43°27'02", long 83°26'29", in NW1/4 NW1/4 sec.20, T.12 N., R.9 E., Tuscola County, Hydrologic Unit 04080205, on right bank 90 ft upstream from bridge on Chambers Road, on grounds of Caro Regional Center at Wahjamega, 1.9 mi downstream from Michigan Sugar Co. dam, and 40 mi upstream from mouth.

DRAINAGE AREA.--645 mi².

PERIOD OF RECORD.--October 1968 to current year.

REVISED RECORDS.--WDR MI-78: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 632.60 ft above National Geodetic Vertical Datum of 1929 (levels by Edmonds Engineering, Inc.). Prior to June 19, 1969, nonrecording gage at bridge 90 ft downstream at present datum.

REMARKS.--Estimated daily discharges: Nov. 20-25, Nov. 30 to Dec. 10, Dec. 13 to Jan. 4, Jan. 12-14, Feb. 3-7, 16-20, Feb. 27 to Mar. 9, and May 5-29. Records good except for estimated daily discharges, which are poor. Some regulation by dam at Michigan Sugar Co., 1.9 mi upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--22 years, 444 ft³/s, 9.35 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 20,000 ft³/s, Sept. 12, 1986, gage height, 26.66 ft, from floodmark; minimum, 16 ft³/s, July 14, 15, 16, 1988, gage height, 2.80 ft.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 2,400 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Jan. 19	0100	3,750	11.74	Mar. 13	1200	*6,270	*15.43

Minimum discharge, 31 ft³/s, Aug. 2-4, gage height, 2.90.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	40	74	310	96	446	410	454	226	156	71	32	124
2	40	68	220	96	411	360	566	201	139	63	31	88
3	39	67	180	96	340	330	941	183	158	56	31	65
4	38	66	160	130	310	310	1030	179	153	51	34	52
5	38	69	140	192	290	300	957	217	140	49	36	47
6	38	83	135	232	285	290	820	240	130	44	40	59
7	38	89	130	322	300	290	710	250	124	41	42	180
8	38	102	130	322	337	300	609	230	112	39	45	380
9	39	104	135	283	641	320	530	210	102	40	45	327
10	46	104	140	272	1080	1110	511	200	94	39	42	246
11	54	106	134	270	779	3440	574	190	83	37	39	175
12	56	104	128	270	595	5330	581	180	78	35	37	126
13	56	101	110	265	519	6190	532	175	78	34	39	96
14	56	97	105	235	446	4820	498	170	79	34	38	90
15	53	152	100	207	355	3120	552	170	77	34	37	103
16	53	334	98	195	330	2100	576	180	71	35	36	110
17	55	416	96	554	300	2230	557	270	93	35	36	107
18	49	409	96	2520	280	1530	540	450	81	49	35	95
19	50	344	96	3040	270	1030	487	620	66	80	37	89
20	78	310	96	1710	280	786	455	600	56	63	40	85
21	101	260	96	1180	294	664	517	760	53	56	50	82
22	112	240	96	786	346	610	567	600	56	52	60	86
23	109	220	96	632	593	689	528	500	76	53	57	83
24	101	205	96	560	971	783	480	450	100	49	52	78
25	94	200	96	618	863	668	430	400	99	44	47	74
26	90	191	96	1070	690	577	392	360	96	40	44	70
27	81	196	96	1060	580	500	355	330	93	37	42	64
28	77	536	96	932	480	450	326	290	84	36	82	63
29	72	724	96	815	---	417	288	250	78	34	233	60
30	68	500	96	649	---	411	254	210	74	34	241	57
31	73	---	96	526	---	430	---	182	---	33	175	---
TOTAL	1932	6471	3795	20135	13411	40795	16617	9473	2879	1397	1835	3361
MEAN	62.3	216	122	650	479	1316	554	306	96.0	45.1	59.2	112
MAX	112	724	310	3040	1080	6190	1030	760	158	80	241	380
MIN	38	66	96	96	270	290	254	170	53	33	31	47
CFSM	.10	.34	.19	1.01	.74	2.04	.86	.47	.15	.07	.09	.17
IN.	.11	.37	.22	1.16	.77	2.35	.96	.55	.17	.08	.11	.19

CAL YR 1989 TOTAL 103115 MEAN 283 MAX 2530 MIN 38 CFSM .44 IN 5.95
WTR YR 1990 TOTAL 122101 MEAN 335 MAX 6190 MIN 31 CFSM .52 IN 7.04

04151500 CASS RIVER AT FRANKENMUTH, MI

LOCATION.--Lat 43°19'40", long 83°44'53", in NW1/4 SE1/4 sec.27, T.11 N., R.6 E., Saginaw County, Hydrologic Unit 04080205, on right bank 2,000 ft downstream from dam in Frankenmuth, 3,600 ft upstream from highway bridge on Dehmel Road, 3.4 mi upstream from Dead Creek, and 17 mi upstream from mouth.

DRAINAGE AREA.--841 mi².

PERIOD OF RECORD.--February 1908 to March 1909, July 1935 to September 1936, June 1939 to current year.

REVISED RECORDS.--WSP 1307: 1936(M), 1940(M). WSP 1727: 1952. WSP 1911: 1952. WDR MI-78: Drainage area.

GAGE--Water-stage recorder. Datum of gage is 583.96 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). February 1908 to March 1909, nonrecording gage at site 2,000 ft upstream at datum 1.81 ft lower. July 18 to September 11, 1935, nonrecording gage; Sept. 12, 1935, to Sept. 30, 1936, and June 20, 1939, to Sept. 30, 1949, water-stage recorder, at site 3,600 ft downstream at datum 0.04 ft higher.

REMARKS.--Estimated daily discharges: Nov. 20-26, Nov. 30 to Dec. 23, Dec. 27 to Jan. 6, Jan. 8-16, Feb. 4-7, 17-20, and Feb. 27 to Mar. 8. Records good except for estimated daily discharges, which are poor. Occasional regulation by dams upstream from station. Prior to 1950, regulation at low and medium flows by mill upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--52 years, 512 ft³/s, 8.27 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 22,200 ft³/s, Sept. 12, 1986, gage height, 27.52 ft; minimum daily, about 1.5 ft³/s, Aug. 6, 1944.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,500 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Jan. 19	1100	4,140	14.56	Mar. 13	1400	*7,710	*18.33

Minimum discharge, 44 ft³/s, Aug. 2, gage height, 3.28 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	59	104	400	120	570	520	611	353	224	116	48	177
2	59	104	300	120	523	470	719	325	198	105	46	139
3	61	98	250	120	429	430	1080	294	203	96	49	107
4	56	94	200	170	380	410	1400	282	219	86	58	86
5	53	94	180	230	360	390	1360	323	204	78	69	76
6	54	109	170	300	360	380	1210	359	186	71	69	72
7	53	124	165	388	370	370	1040	357	174	66	67	104
8	52	132	165	410	412	380	879	332	173	64	67	252
9	54	140	170	380	562	496	757	301	161	72	67	360
10	88	143	175	350	1150	1210	727	279	146	68	67	305
11	93	139	170	350	1050	3710	834	270	133	63	63	245
12	86	137	160	350	771	6200	854	255	126	59	64	186
13	85	134	140	330	652	7590	788	260	119	54	73	148
14	83	135	130	310	577	6980	729	252	119	54	63	128
15	80	177	125	280	483	4620	780	243	120	56	65	136
16	78	321	125	260	448	2900	821	248	111	58	59	146
17	77	443	120	678	380	2590	806	356	106	51	56	143
18	80	457	120	2070	360	2200	773	653	123	63	70	139
19	78	407	120	3850	350	1520	709	884	112	96	86	128
20	88	370	120	2740	350	1130	655	846	98	118	73	122
21	116	330	120	1850	370	919	733	915	89	101	69	116
22	136	300	120	1280	430	826	807	871	92	91	84	117
23	142	270	120	890	702	923	762	732	125	85	87	118
24	142	250	119	768	1080	1020	690	609	144	84	83	111
25	135	250	118	800	1190	949	620	557	148	81	76	108
26	129	240	122	1200	985	801	559	513	143	71	68	101
27	124	240	120	1410	740	690	504	470	138	64	77	93
28	113	391	120	1260	620	617	457	403	130	59	121	88
29	107	791	120	1090	---	563	420	338	123	54	147	88
30	101	600	120	895	---	556	383	291	126	53	258	104
31	99	---	120	710	---	571	---	255	---	55	221	---
TOTAL	2761	7524	4824	25959	16654	52931	23467	13426	4313	2292	2570	4243
MEAN	89.1	251	156	837	595	1707	782	433	144	73.9	82.9	141
MAX	142	791	400	3850	1190	7590	1400	915	224	118	258	360
MIN	52	94	118	120	350	370	383	243	89	51	46	72
CFSM	.11	.30	.19	1.00	.71	2.03	.93	.52	.17	.09	.10	.17
IN.	.12	.33	.21	1.15	.74	2.34	1.04	.59	.19	.10	.11	.19

CAL YR 1989 TOTAL 141691 MEAN 388 MAX 3300 MIN 52 CFSM .46 IN 6.27
WTR YR 1990 TOTAL 160964 MEAN 441 MAX 7590 MIN 46 CFSM .52 IN 7.12

04152238 SOUTH BRANCH TOBACCO RIVER NEAR BEAVERTON, MI

LOCATION.--Lat 43°52'01", long 84°32'43", in SE1/4 NE1/4 sec.16, T.17 N., R.2 W., Gladwin County, Hydrologic Unit 04080201, on left bank 40 ft upstream from bridge on Grout Road, 3.0 mi upstream from Ross Lake, and 3.2 mi southwest of Beaverton.

DRAINAGE AREA.--160 mi².

PERIOD OF RECORD.--January 1987 to current year.

GAGE.--Water stage recorder. Datum of gage is 709.92 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Nov. 19 to Mar. 12. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,350 ft³/s, Mar. 13, 1990, gage height, 10.50 ft; maximum gage height, 11.06 ft, Mar. 12, 1990, backwater from ice; minimum discharge, 39 ft³/s, July 6, Sept. 9, 1988; minimum gage height, 3.26 ft, July 6, 1988.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,350 ft³/s, Mar. 13, gage height, 10.50 ft; maximum gage height, 11.06 ft, Mar. 12, backwater from ice; minimum discharge, 51 ft³/s, Oct. 1, gage height, 3.65 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	52	73	80	58	80	71	143	93	85	95	97	59
2	54	71	78	60	74	70	202	88	81	84	76	59
3	55	70	76	60	70	69	321	87	96	77	67	58
4	55	70	74	60	67	68	250	91	104	72	67	57
5	58	72	72	62	66	66	201	155	93	68	106	57
6	63	81	70	62	68	65	172	154	86	66	102	63
7	65	87	68	62	72	64	156	123	82	63	96	106
8	62	82	66	62	120	64	146	106	79	59	86	129
9	63	80	64	62	300	80	137	102	81	69	76	85
10	67	77	62	62	150	200	149	180	78	73	70	75
11	79	75	60	62	100	400	188	307	74	65	67	69
12	77	74	59	62	90	980	165	221	74	59	68	64
13	72	71	58	60	80	1290	142	159	101	58	81	61
14	68	74	58	60	75	1070	155	147	103	57	72	69
15	70	88	57	60	72	747	226	132	95	62	67	156
16	71	152	56	70	71	478	195	142	85	61	65	145
17	72	140	56	100	70	349	168	216	78	57	63	124
18	72	109	56	250	70	273	151	218	74	58	62	101
19	70	90	56	150	70	209	136	175	70	119	71	88
20	74	84	56	100	70	178	131	317	67	113	137	85
21	82	78	56	86	72	164	147	390	67	93	116	79
22	81	74	56	76	74	177	149	261	70	82	93	91
23	77	72	56	76	78	234	135	193	226	73	73	101
24	77	70	56	84	80	209	127	161	404	70	74	92
25	74	69	56	90	78	172	122	144	230	65	70	84
26	74	68	56	100	76	155	116	130	139	61	66	77
27	71	72	56	90	74	143	109	117	117	56	66	74
28	71	82	56	120	72	142	103	108	101	54	70	77
29	70	82	56	95	---	137	99	103	101	56	69	84
30	69	82	56	90	---	136	95	98	99	123	64	83
31	70	---	56	85	---	145	---	92	---	145	60	---
TOTAL	2135	2469	1898	2576	2439	8605	4736	5010	3240	2313	2417	2552
MEAN	68.9	82.3	61.2	83.1	87.1	278	158	162	108	74.6	78.0	85.1
MAX	82	152	80	250	300	1290	321	390	404	145	137	156
MIN	52	68	56	58	66	64	95	87	67	54	60	57
CFSM	.43	.51	.38	.52	.54	1.74	.99	1.01	.68	.47	.49	.53
IN.	.50	.57	.44	.60	.57	2.00	1.10	1.16	.75	.54	.56	.59

CAL YR 1989 TOTAL 43531 MEAN 119 MAX 1050 MIN 52 CFSM .74 IN 10.12
WTR YR 1990 TOTAL 40390 MEAN 111 MAX 1290 MIN 52 CFSM .69 IN 9.39

04154000 CHIPPEWA RIVER NEAR MOUNT PLEASANT, MI

LOCATION.--Lat 43°37'32", long 84°42'28", in NW1/4 NW1/4 sec.8, T.14 N., R.3 W., Isabella County, Hydrologic Unit 04080202, on right bank 12 ft downstream from bridge on South Leaton Road, 3.8 mi northeast of Mount Pleasant, and 36 mi upstream from mouth.

DRAINAGE AREA.--416 mi².

PERIOD OF RECORD.--October 1930 to September 1931, October 1932 to current year. Monthly discharge only for some periods, published in WSP 1307. Gage-height records for flood seasons collected in this vicinity 1910-27, are contained in reports of National Weather Service.

REVISED RECORDS.--WSP 744: Drainage area. WSP 1337: 1931, 1933-40, 1945, 1948-49.

GAGE.--Water-stage recorder. Datum of gage is 710.38 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Oct. 21, 1938, nonrecording gage at site 30 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Nov. 24, Dec. 3-5, Dec. 7 to Jan. 23, Jan. 29, 30, Feb. 3, 4, 16, 18-21, Feb. 26 to Mar. 1, and Mar. 5, 7-9. Records good except for estimated daily discharges, which are poor. Diurnal fluctuation below 750 ft³/s caused by powerplant at Mount Pleasant prior to 1962, occasional regulation at low flow since. Since July 30, 1968, occasional regulation by control structures on lake outlets. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--59 years, 318 ft³/s, 10.38 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,660 ft³/s, Sept. 12, 1986, gage height, 15.58 ft, from floodmark; minimum, 12 ft³/s, Aug. 18, 1945; minimum gage height, 2.70 ft, Oct. 8, 1966; minimum daily discharge, 19 ft³/s, Aug. 16, 1936.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,000 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 12	2100	*1,580	*7.67	No other peak greater than base discharge			

Minimum discharge, 146 ft³/s, Oct. 1, 4, 5, gage height, 2.98 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	147	265	284	210	270	250	424	273	318	288	279	195
2	150	267	274	210	307	248	472	257	304	272	251	187
3	153	257	265	210	275	265	542	237	310	256	225	180
4	149	252	260	215	265	255	519	274	314	237	219	177
5	151	247	255	220	258	250	488	415	317	225	240	174
6	158	259	247	220	265	248	458	426	314	214	254	191
7	162	250	240	220	270	245	428	396	302	196	260	271
8	161	247	230	220	268	240	407	356	308	193	238	287
9	163	243	225	220	355	300	384	415	305	193	220	276
10	171	238	220	220	327	765	393	512	283	197	206	256
11	177	233	215	220	295	848	413	653	264	199	201	233
12	175	232	210	220	290	1340	408	680	271	190	205	216
13	174	229	205	215	283	1420	388	691	289	177	212	205
14	170	225	205	210	275	1220	401	626	294	176	207	241
15	171	271	205	210	274	1380	457	552	298	182	194	293
16	196	298	200	210	270	1430	452	548	279	184	187	345
17	229	290	200	450	274	1240	436	626	261	177	181	359
18	245	281	200	600	260	1040	410	612	247	190	182	324
19	289	273	200	400	250	875	387	550	227	224	357	317
20	324	279	200	300	250	738	375	680	213	240	377	311
21	315	283	200	280	255	634	396	798	209	241	398	293
22	309	272	200	260	267	601	397	716	243	234	372	299
23	307	260	200	260	289	558	391	658	418	223	335	301
24	304	255	200	294	284	556	373	590	488	214	304	282
25	299	249	200	328	283	555	362	534	479	199	276	267
26	294	245	200	369	270	521	347	487	438	186	257	252
27	290	250	200	327	260	484	330	451	405	178	243	241
28	285	293	205	446	255	458	314	421	348	172	237	232
29	278	297	205	330	---	432	302	392	316	169	225	224
30	275	286	205	290	---	427	284	361	301	209	216	223
31	271	---	205	277	---	423	---	337	---	280	206	---
TOTAL	6942	7826	6760	8661	7744	20246	12138	15524	9363	6515	7764	7652
MEAN	224	261	218	279	277	653	405	501	312	210	250	255
MAX	324	298	284	600	355	1430	542	798	488	288	398	359
MIN	147	225	200	210	250	240	284	237	209	169	181	174
CFSM	.54	.63	.52	.67	.67	1.57	.97	1.20	.75	.51	.60	.61
IN.	.62	.70	.60	.77	.69	1.81	1.09	1.39	.84	.58	.69	.68

CAL YR 1989 TOTAL 125968 MEAN 345 MAX 1900 MIN 145 CFSM .83 IN 11.26
WTR YR 1990 TOTAL 117135 MEAN 321 MAX 1430 MIN 147 CFSM .77 IN 10.47

STREAMS TRIBUTARY TO LAKE HURON

04155000 PINE RIVER AT ALMA, MI

LOCATION.--Lat 43°22'46", long 84°39'20", in SW1/4 SE1/4 sec.34, T.12 N., R.3 W., Gratiot County, Hydrologic Unit 04080202, on right bank 270 ft downstream from Superior Street Bridge in Alma, 0.6 mi downstream from municipal reservoir, and 38 mi upstream from mouth.

DRAINAGE AREA.--288 mi².

PERIOD OF RECORD.--October 1930 to current year. Gage-height records for flood seasons collected in this vicinity 1910-28 are contained in reports of National Weather Service.

REVISED RECORDS.--WSP 744: Drainage area. WSP 1307: 1945(M). WSP 1337: 1931, 1932-34(M), 1936, 1939, 1945, 1949.

GAGE.--Water-stage recorder. Datum of gage is 718.37 ft above National Geodetic Vertical Datum of 1929. Prior to Dec. 10, 1930, nonrecording gage at Superior Street Bridge at different datum. Dec. 10, 1930, to June 15, 1938, nonrecording gage at site 70 ft downstream from bridge, and June 16 to Oct. 25, 1938, nonrecording gage at bridge at present datum.

REMARKS.--Estimated daily discharges: Dec. 6, 7, Dec. 10 to Jan. 18, Feb. 1-8, and Feb. 17 to Mar. 10. Records good above 350 ft³/s and fair below, except for estimated daily discharges, which are poor. Flow regulated by dam 0.6 mi upstream from station, and by variable backwater from powerplant at St. Louis, 5.2 mi downstream. About 3.9 ft³/s diverted upstream from station for municipal and industrial use; sewage effluent is returned downstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--60 years, 222 ft³/s, 10.47 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 5,160 ft³/s, Sept. 12, 1986, gage height, 12.82 ft, from floodmark; minimum daily, 0.40 ft³/s, Sept. 6, 1964, caused by closing dam during construction of waterworks.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,380 ft³/s, Mar. 13, gage height, 8.63 ft; minimum, 48 ft³/s, July 28; minimum gage height, 1.07 ft, Dec. 16, July 13, 14.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	100	135	228	110	220	145	296	196	201	136	108	94
2	97	145	213	110	180	145	361	184	211	136	108	100
3	90	154	191	110	160	140	421	178	193	129	98	103
4	86	166	139	110	150	140	416	192	169	113	98	107
5	92	169	133	115	150	135	410	237	173	95	96	111
6	106	170	125	115	160	135	386	272	167	78	109	136
7	117	169	120	115	170	135	351	314	157	77	131	150
8	130	178	113	115	250	140	333	318	227	79	117	132
9	128	179	113	115	325	250	305	274	207	77	111	157
10	135	173	110	115	325	450	294	274	203	75	106	163
11	137	174	110	115	311	1070	303	305	239	73	96	144
12	141	147	105	115	275	1950	309	364	201	68	90	143
13	145	146	105	115	241	2210	304	426	148	63	87	151
14	139	155	105	115	247	2330	322	432	150	65	93	159
15	125	258	105	120	221	2000	313	385	185	79	97	150
16	112	350	105	130	171	1480	353	379	184	99	96	209
17	107	356	105	200	155	1120	351	410	152	112	93	226
18	115	339	105	250	150	906	331	428	122	105	95	224
19	129	336	105	292	145	758	292	471	107	108	142	218
20	156	294	105	329	145	643	282	567	119	139	150	188
21	165	275	105	373	150	547	306	543	133	152	158	191
22	145	257	105	346	160	490	324	502	154	92	160	194
23	148	239	105	263	170	455	331	515	164	88	138	175
24	148	201	105	221	165	398	314	477	158	101	148	186
25	139	206	105	540	160	410	283	381	172	109	142	179
26	101	204	105	701	155	383	257	302	164	107	133	162
27	99	205	105	517	150	336	243	277	145	79	142	152
28	122	266	105	601	150	299	229	258	131	52	143	167
29	155	266	105	483	---	282	215	232	139	68	109	172
30	152	271	105	368	---	281	207	206	138	125	83	129
31	145	---	110	304	---	282	---	193	---	128	86	---
TOTAL	3906	6583	3700	7628	5411	20445	9442	10492	5013	3007	3563	4772
MEAN	126	219	119	246	193	660	315	338	167	97.0	115	159
MAX	165	356	228	701	325	2330	421	567	239	152	160	226
MIN	86	135	105	110	145	135	207	178	107	52	83	94
CFSM	.44	.76	.41	.85	.67	2.29	1.09	1.17	.58	.34	.40	.55
IN.	.50	.85	.48	.99	.70	2.64	1.22	1.36	.65	.39	.46	.62

CAL YR 1989 TOTAL 86354 MEAN 237 MAX 1270 MIN 61 CFSM .82 IN 11.15
WTR YR 1990 TOTAL 83962 MEAN 230 MAX 2330 MIN 52 CFSM .80 IN 10.85

04155500 PINE RIVER NEAR MIDLAND, MI

LOCATION.--Lat 43°33'52", long 84°22'09", in SW1/4 NW1/4 sec.4, T.13 N., R.1 E., Midland County, Hydrologic Unit 04080202, on left bank at downstream side of bridge on Meridian Road, 7.2 mi southwest of Midland, and 7.8 mi upstream from Chippewa River.

DRAINAGE AREA.--390 mi², approximately.

PERIOD OF RECORD.--May 1934 to September 1938, February 1948 to current year.

REVISED RECORDS.--WSP 1207: Drainage area. WSP 1307: 1935(M). WSP 1337: 1936-38, 1948-49.

GAGE.--Water-stage recorder. Datum of gage is 623.94 ft above National Geodetic Vertical Datum of 1929. Prior to Sept. 30, 1938, nonrecording gage at same site at datum 5.55 ft lower. Feb. 3, 1948, to Dec. 13, 1951, nonrecording gage at present site and datum.

REMARKS.--Estimated daily discharges: Nov. 18-25, 29-30, and Dec. 2 to Mar. 12. Records good except for estimated daily discharges, which are poor. Regulation at low and medium flows by hydroelectric powerplant at St. Louis. Some diversion upstream from station for irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--46 years, 308 ft³/s, 10.72 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 9,360 ft³/s, Sept. 12, 1986, gage height, 11.74 ft; maximum gage height, 12.08 ft, Feb. 2, 1968, backwater from ice; minimum discharge since 1953, 7.6 ft³/s, July 1, 2, 1988; minimum daily, 7.8 ft³/s, July 2, 1988.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,200 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 12	0700	ice jam	*11.73	Mar. 12	2400	*3,530	7.37

Minimum discharge, 11 ft³/s, Oct. 28, 29, gage height, 2.10 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	90	119	293	115	300	200	368	227	148	151	213	50
2	104	115	210	115	250	195	463	222	156	147	95	53
3	99	103	200	115	220	190	640	215	222	142	104	53
4	95	111	160	115	210	185	676	164	204	139	113	56
5	80	121	140	120	200	180	600	197	164	125	133	57
6	74	157	130	120	220	180	541	268	161	119	121	67
7	73	158	125	120	230	185	435	289	160	84	110	160
8	76	160	120	120	350	190	415	337	137	71	154	249
9	95	159	115	120	450	350	408	452	354	77	141	143
10	109	172	115	120	450	450	425	370	308	68	99	123
11	104	115	115	120	430	1450	432	339	135	67	103	153
12	104	185	110	120	380	2900	416	364	235	69	103	141
13	105	144	110	120	330	3320	426	445	317	66	103	69
14	114	104	110	120	340	2940	332	489	175	67	90	104
15	122	147	110	130	300	2780	578	474	102	66	78	193
16	121	454	110	160	230	2150	350	460	117	52	89	134
17	120	439	110	270	210	1600	526	554	205	53	76	274
18	96	390	110	350	200	1200	393	643	194	91	76	285
19	95	320	105	400	190	959	425	539	146	109	119	257
20	103	300	105	450	190	812	352	679	91	107	175	258
21	87	280	105	500	200	694	384	789	79	122	197	211
22	196	260	110	450	220	624	448	675	89	300	189	231
23	129	250	110	350	230	644	427	543	371	132	220	316
24	131	230	110	300	225	581	409	548	334	111	94	182
25	129	220	110	700	220	493	387	544	234	121	127	183
26	321	213	110	950	215	478	345	462	213	114	136	197
27	110	217	115	750	210	465	295	332	224	128	94	189
28	16	214	115	850	205	439	283	301	207	168	101	106
29	14	240	115	640	---	365	275	293	170	62	148	85
30	92	270	115	500	---	361	235	280	160	39	171	213
31	125	---	115	400	---	361	---	213	---	105	77	---
TOTAL	3329	6367	3933	9810	7405	27921	12689	12707	5812	3272	3849	4792
MEAN	107	212	127	316	264	901	423	410	194	106	124	160
MAX	321	454	293	950	450	3320	676	789	371	300	220	316
MIN	14	103	105	115	190	180	235	164	79	39	76	50
CFSM	.27	.54	.33	.81	.68	2.31	1.09	1.05	.50	.27	.32	.41
IN.	.32	.61	.38	.94	.71	2.66	1.21	1.21	.55	.31	.37	.46

CAL YR 1989 TOTAL 117421 MEAN 322 MAX 2280 MIN 14 CFSM .83 IN 11.20
WTR YR 1990 TOTAL 101886 MEAN 279 MAX 3320 MIN 14 CFSM .72 IN 9.72

04156000 TITTABAWASSEE RIVER AT MIDLAND, MI

LOCATION.--Lat 43°35'43", long 84°14'08", in NW1/4 NE1/4 sec.28, T.14 N., R.2 E., Midland County, Hydrologic Unit 04080201, on right bank 2,000 ft downstream from dam at Dow Chemical Co. in Midland, 0.7 mi upstream from Bullock Creek, 1.4 mi downstream from Chippewa River, and 23 mi upstream from mouth.

DRAINAGE AREA.--2,400 mi², approximately.

PERIOD OF RECORD.--March 1936 to current year. Gage-height records for flood seasons collected in this vicinity 1910-26, 1928, and since 1946 are contained in reports of National Weather Service.

REVISED RECORDS.--WSP 1045: 1945. WSP 1144: 1948.

GAGE.--Water-stage recorder. Datum of gage is 580.28 ft above National Geodetic Vertical Datum of 1929. Prior to Sept. 30, 1955, at datum 10.00 ft higher.

REMARKS.--Estimated daily discharges: Nov. 23-27 and Dec. 2 to Mar. 2. Records fair except for estimated daily discharges, which are poor. Water is diverted from river a short distance upstream from station for industrial use. Small part returned to river 0.25 mi downstream from station, remainder returned 1 mi downstream. Extremes and daily discharges not adjusted for diversion. Prior to May 20, 1970, discharge below 4,000 ft³/s regulated by dam 2,000 ft upstream from station; fixed crest dam since. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--54 years, 1,729 ft³/s, 9.78 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 38,700 ft³/s, Sept. 13, 1986, gage height, 33.89 ft, from floodmark; minimum, 39 ft³/s, Oct. 1, 1942; minimum gage height, 8.78 ft, July 2, 3, 1988; minimum daily discharge, 111 ft³/s, Aug. 21, 1949.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 7,000 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 13	1600	*18,300	*25.43	No other peak greater than base discharge.			

Minimum discharge, 259 ft³/s, Oct. 1, gage height, 9.09 ft; minimum daily, 274 ft³/s, Oct. 1.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	274	979	1360	420	900	1100	1700	1520	1110	616	891	751
2	446	1020	750	800	800	1000	2400	1770	761	1000	958	370
3	605	867	500	1100	700	879	4180	1690	732	898	785	354
4	638	564	600	1200	600	867	4450	1240	988	560	519	748
5	506	514	680	1300	700	1290	3870	1470	943	753	453	671
6	596	951	620	800	730	1250	3470	1640	839	909	904	974
7	355	924	560	450	760	1210	1870	1880	954	496	965	1800
8	301	905	600	800	770	1190	2030	2150	1100	388	822	1120
9	519	892	500	840	1200	1600	2040	2390	825	655	809	796
10	549	1030	410	700	2000	3950	1990	2950	810	705	612	896
11	531	590	560	760	1400	6720	2470	3390	920	573	442	953
12	662	529	620	600	1000	12400	2500	3050	919	545	444	957
13	679	958	500	450	800	17800	2370	2240	1290	540	680	756
14	417	835	540	420	740	16900	3080	2460	1080	384	752	851
15	369	965	800	700	700	14700	2170	2580	1130	348	642	1780
16	641	1420	400	660	800	11800	2190	2620	635	484	1540	793
17	724	1770	400	1200	540	7820	2410	3370	647	518	715	1070
18	878	1380	700	2000	520	5850	2400	4540	1030	580	481	1570
19	803	843	900	2300	500	4760	2310	3510	995	755	450	1350
20	1010	1310	910	800	700	4080	2230	3570	807	788	878	1020
21	760	1290	920	560	900	3690	1710	6080	887	655	1150	1300
22	758	1200	920	640	1200	3650	1480	5260	919	720	1350	975
23	849	540	420	800	1250	3950	1650	3920	921	826	1530	663
24	867	1000	400	1000	1100	3730	1480	3590	1490	766	881	1030
25	743	750	420	1300	1050	2750	1410	3290	1780	766	534	917
26	795	540	700	2100	1200	2590	1400	2080	1350	751	500	1040
27	773	900	800	1700	1300	2210	1380	1500	1550	626	741	1190
28	478	1190	760	1400	1250	2000	1430	1130	1420	469	1170	1050
29	421	1500	560	1700	---	2020	1330	1660	1200	394	1600	528
30	710	1780	450	1500	---	2220	1300	1670	719	621	1070	464
31	847	---	420	1200	---	2260	---	1460	---	696	886	---
TOTAL	19504	29936	19680	32200	26110	148236	66700	81670	30751	19785	26154	28737
MEAN	629	998	635	1039	933	4782	2223	2635	1025	638	844	958
MAX	1010	1780	1360	2300	2000	17800	4450	6080	1780	1000	1600	1800
MIN	274	514	400	420	500	867	1300	1130	635	348	442	354
MEAN+	638	1009	642	1045	938	4790	2231	2643	1029	644	848	965
CFSM+	.27	.42	.27	.44	.39	2.00	.93	1.10	.43	.27	.35	.40
IN.+	.31	.47	.31	.50	.41	2.30	1.04	1.27	.48	.31	.41	.45

CAL YR 1989 TOTAL 580393 MEAN 1590 MAX 14800 MIN 274 MEAN+ 1599 CFSM+ .67 IN+ 9.04
WTR YR 1990 TOTAL 529463 MEAN 1451 MAX 17800 MIN 274 MEAN+ 1458 CFSM+ .61 IN+ 8.25

+ Adjusted for diversion; records furnished by Dow Chemical Co.

04156100 TITTABAWASSEE RIVER NEAR MIDLAND, MI
(National stream quality accounting network station)

LOCATION.--Lat 43°34'07", long 84°11'37", in SW1/4 SE1/4 sec.35, T.14 N., R.2 E., Midland County, Hydrologic Unit 04080201; at bridge on Gordonville Road, 3.0 mi downstream from gaging station 04156000, and 20 mi upstream from mouth.

DRAINAGE AREA.--2,450 mi².

PERIOD OF RECORD.--Water years 1987 to current year.

REMARKS.--Bimonthly cross-sectional samples were collected at or near bridge. Water-discharge measurements were made at time of sampling. All flow except for high-water is regulated by powerplant at Sanford.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DISCHARGE, INST. CUBIC FEET PER SECOND	SPECIFIC CONDUCTANCE (US/CM)	PH (STANDARD UNITS)	TEMPERATURE WATER (DEG C)	TURBIDITY (NTU)	OXYGEN, DISSOLVED (MG/L)	OXYGEN, DISSOLVED (PERCENT SATURATION)	COLIFORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREPTOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
OCT 17...	1130	470	944	8.23	10.0	1.2	9.2	83	K120	K33
JAN 17...	1200	1600	872	7.96	1.5	20	--	--	1400	K5400
MAR 06...	1330	1510	918	8.12	1.0	3.0	14.2	100	K56	140
APR 27...	1200	1290	714	8.25	20.5	2.9	8.5	97	K1100	220
JUN 05...	1130	802	588	8.45	18.5	4.6	9.7	106	130	K36
AUG 10...	1000	484	1140	8.56	23.0	2.5	10.4	124	K53	K33

DATE	HARDNESS TOTAL (MG/L AS CACO3)	HARDNESS NONCARB DISSOLV FLD. AS CACO3 (MG/L)	CALCIUM DISSOLVED (MG/L AS CA)	MAGNESIUM, DISSOLVED (MG/L AS MG)	SODIUM, DISSOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM ADSORPTION RATIO	POTASSIUM, DISSOLVED (MG/L AS K)	BICARBONATE WATER DIS IT FIELD MG/L AS HCO3	CARBONATE WATER DIS IT FIELD MG/L AS CO3
OCT 17...	250	80	70	19	86	42	2	3.1	212	0
JAN 17...	240	69	69	17	77	40	2	4.2	211	0
MAR 06...	290	96	83	20	72	35	2	3.4	237	0
APR 27...	250	75	70	18	46	28	1	2.7	213	0
JUN 05...	220	52	62	17	33	24	1	2.1	209	1
AUG 10...	250	79	72	17	130	53	4	2.8	188	10

DATE	ALKALINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DISSOLVED (MG/L AS SO4)	CHLORIDE, DISSOLVED (MG/L AS CL)	FLUORIDE, DISSOLVED (MG/L AS F)	SILICA, DISSOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DISSOLVED (MG/L)	SOLIDS, DISSOLVED (TONS PER AC-FT)	SOLIDS, DISSOLVED (TONS PER DAY)	NITROGEN, NITRITE DISSOLVED (MG/L AS N)	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)
OCT 17...	174	39	160	0.2	4.3	521	0.71	661	0.04	0.14
JAN 17...	173	36	130	0.2	8.2	491	0.67	2120	0.02	0.79
MAR 06...	194	46	140	0.2	7.9	549	0.75	2240	0.02	1.4
APR 27...	175	37	97	0.1	1.7	430	0.58	1500	0.04	0.80
JUN 05...	173	34	67	0.1	2.7	356	0.48	771	0.02	0.40
AUG 10...	170	42	230	<0.1	5.6	620	0.84	810	0.05	0.20

STREAMS TRIBUTARY TO LAKE HURON

04156100 TITTABAWASSEE RIVER NEAR MIDLAND, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS TOTAL (MG/L AS P)	PHOSPHORUS DISSOLVED (MG/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
OCT 17...	0.39	0.39	0.8	0.05	0.02	0.02	10	<1	35	<0.5
JAN 17...	0.38	0.40	1.1	0.15	0.06	0.08	--	--	--	--
MAR 06...	0.21	0.19	0.8	0.04	0.02	0.01	<10	1	42	<0.5
APR 27...	0.09	0.08	1.0	0.03	<0.01	<0.01	40	<1	38	<0.5
JUN 05...	0.17	0.17	1.1	0.04	<0.01	<0.01	--	--	--	--
AUG 10...	0.22	0.24	1.1	0.06	<0.01	<0.01	<10	1	34	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
OCT 17...	<1	<1	<3	2	23	<1	8	17	<0.1	<10
JAN 17...	--	--	--	--	--	--	--	--	--	--
MAR 06...	<1	<5	<3	<10	34	<10	10	24	<0.1	<10
APR 27...	<1	<1	<3	5	19	2	7	10	<0.1	<10
JUN 05...	--	--	--	--	--	--	--	--	--	--
AUG 10...	1	1	<3	4	5	<1	11	3	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
OCT 17...	1	<1	<1.0	360	<6	9	8	10	100
JAN 17...	--	--	--	--	--	--	58	251	97
MAR 06...	<10	<1	<1.0	450	<6	9	9	37	100
APR 27...	1	<1	<1.0	320	<6	<3	6	21	78
JUN 05...	--	--	--	--	--	--	22	48	68
AUG 10...	2	<1	<1.0	420	<6	4	14	18	90

04157000 SAGINAW RIVER AT SAGINAW, MI

LOCATION.--Lat 43°24'46", long 83°57'47", in NW1/4 SE1/4 sec.26, T.12 N., R.4 E., Saginaw County, Hydrologic Unit 04080206, on right bank 1,000 ft downstream from bridge on Rust Avenue in Saginaw, 1.9 mi downstream from Tittabawassee River, and 20.3 mi upstream from mouth.

DRAINAGE AREA.--6,060 mi², approximately.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--1904, 1908-9, 1912-13, 1916, 1918-19, 1929-30, and 1942 (flood discharge for certain periods only) in WSP 1084; December 1942 to current year (high-water periods only); no high water 1944, 1949, 1953, 1955, 1958, 1961, 1963, 1964, 1966. Gage-height records for flood seasons collected in this vicinity 1910-20, and for entire years since 1921 are contained in reports of National Weather Service.

GAGE.--Water-stage recorder. Datum of gage is 565.11 ft, International Great Lakes datum. Prior to Oct. 1, 1972, nonrecording gage at site 1.9 mi downstream at same datum. Auxiliary water-stage recorder on right bank at Essexville.

REMARKS.--No estimated daily discharges. Water-discharge records good. Only daily discharges greater than 10,000 ft³/s are published. Considerable diversion through metropolitan area of Saginaw. National Weather Service gage-height telemeter at station.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 68,000 ft³/s, Mar. 30, 1904, gage height, 24.9 ft, site then in use.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 33,900 ft³/s, Mar. 15; maximum daily gage height, 18.93 ft, Mar. 15.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1						---	---	---				
2						---	---	---				
3						---	10800	---				
4						---	11300	---				
5						---	10900	---				
6						---	10100	---				
7						---	---	---				
8						---	---	---				
9						---	---	---				
10						---	---	---				
11						13300	---	---				
12						19500	---	---				
13						28300	---	---				
14						33300	---	---				
15						33900	---	---				
16						32400	---	---				
17						27700	---	---				
18						22200	---	---				
19						17900	---	---				
20						13600	---	---				
21						11100	---	11800				
22						---	---	11900				
23						10600	---	10100				
24						10400	---	---				
25						---	---	---				
26						---	---	---				
27						---	---	---				
28						---	---	---				
29						---	---	---				
30						---	---	---				
31						---	---	---				

STREAMS TRIBUTARY TO LAKE HURON

04157000 SAGINAW RIVER AT SAGINAW, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1975-86, 1989 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: November 1974 to September 1981.
WATER TEMPERATURE: November 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Nov. 6, 1976 to Sept. 30, 1981.

REMARKS.--Cross-sectional samples were collected at Rust Ave. bridge. Water-discharge meausrements were made at time of sampling.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975, 1977, 1979): Maximum recorded (more than 20 percent missing record), 1,230 microsiemens, Jan. 5, 1977; minimum recorded (more than 20 percent missing record), 224 microsiemens, Mar. 13, 1977.
WATER TEMPERATURES (water years 1975-77, 1979): Maximum, 30.0°C, July 10, 14, 20, 1977; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
DEC										
13...	0930	E2600	--	8.24	0.0	4.3	13.6	--	540	320
MAR										
01...	0900	E5800	899	--	0.5	6.8	--	--	K80	K75
APR										
26...	0945	5310	712	8.20	19.5	18	8.4	94	K31	K7
AUG										
09...	1200	2490	698	8.58	22.5	24	9.5	111	K54	K17

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER WH IT FIELD MG/L AS HCO3	CAR-BONATE WATER WH IT FIELD MG/L AS CO3	ALKA-LINITY WAT WH TOT IT FIELD MG/L AS CACO3
DEC										
13...	310	83	24	47	25	1	3.1	295	0	242
MAR										
01...	280	79	21	68	34	2	3.4	--	--	--
APR										
26...	280	75	22	34	21	0.9	3.1	251	0	206
AUG										
09...	230	62	18	54	34	2	2.6	222	1	181

DATE	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
DEC									
13...	58	88	0.1	6.7	474	0.64	--	0.03	2.0
MAR									
01...	46	140	0.2	7.3	546	0.74	--	0.02	2.0
APR									
26...	47	68	0.2	1.3	447	0.61	6410	0.04	1.4
AUG									
09...	42	92	0.3	4.5	410	0.56	2760	0.02	0.40

04157000 SAGINAW RIVER AT SAGINAW, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS TOTAL (MG/L AS P)	PHOSPHORUS DISSOLVED (MG/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
DEC 13...	0.17	0.15	0.6	0.05	0.03	0.02	<10	<1	44	<0.5
MAR 01...	0.26	0.20	1.5	0.05	0.01	0.01	<10	<1	40	<0.5
APR 26...	0.04	0.03	1.2	0.04	0.01	<0.01	20	1	46	<0.5
AUG 09...	0.03	0.03	1.1	0.10	<0.01	<0.01	<10	2	39	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
DEC 13...	<1	<1	<3	2	17	<1	11	20	<0.1	<10
MAR 01...	<1	<5	<3	<10	31	10	9	19	<0.1	<10
APR 26...	<1	<1	<3	5	12	<1	6	9	<0.1	<10
AUG 09...	<1	1	<3	4	7	<1	9	1	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
DEC 13...	1	<1	<1.0	350	<6	6	55	--	81
MAR 01...	<10	<1	<1.0	410	<6	8	14	--	96
APR 26...	3	<3	<1.0	260	<6	<3	48	688	99
AUG 09...	<1	<1	<1.0	310	<6	6	49	329	97

STREAMS TRIBUTARY TO LAKE HURON

04158000 COLUMBIA DRAIN NEAR SEBEWAING, MI

LOCATION.--Lat 43°43'38", long 83°23'46", in SE1/4 SE1/4 sec.10, T.15 N., R.9 E., Huron County, Hydrologic Unit 04080103, on right bank 10 ft downstream from bridge on Gettel Road, 2.4 mi upstream from mouth, and 2.5 mi southeast of Sebewaing.

DRAINAGE AREA.--33.9 mi².

PERIOD OF RECORD.--January 1940 to September 1954, January 1988 to September 1990 (discontinued). Monthly discharge only for October to December 1939, published in WSP 1307. Published as East Fork Sebewaing River (Columbia Drain) near Sebewaing 1940-54.

REVISED RECORDS.--WSP 1307: 1943, 1947-1948, 1950. WSP 1727: 1952 (M). WDR MI-88: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 602.00 ft (revised from WDR MI-89-1) above National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to Apr. 1, 1941, nonrecording gage at same site. Prior to Jan. 1, 1988, at datum 5.0 ft higher.

REMARKS.--Estimated daily discharges: Nov. 18-24, Dec. 2-8, Dec. 14 to Jan. 17, Jan. 31, Feb. 2-7, 12-20, and Feb. 25 to Mar. 10. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--17 years (water years 1940-54, 1989-90), 17.4 ft³/s, 6.97 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,720 ft³/s, Mar. 11, 1952, gage height, 11.12 ft; maximum gage height, 14.70 ft, present datum, Mar. 15, 1943, backwater from ice; no flow at times most years.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of September 1986 exceeded a stage of 18.0 ft, present datum, discharge not determined. Information supplied by local resident.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 200 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage Height (ft)	Date	Time	Discharge (ft³/s)	Gage Height (ft)
Jan. 17	--	*638	*a10.21	Aug. 28	0700	*638	9.72
Jan. 25	2200	375	8.36	Sept. 6	2200	630	9.69
Mar. 12	0700	625	9.67				

a Ice jam.

Minimum discharge, 0.03 ft³/s, Aug. 3, 4, gage height, 4.13 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.37	2.2	21	1.0	10	11	14	4.7	3.7	1.5	.10	25
2	.39	2.2	14	1.6	7.0	10	27	4.0	3.3	1.2	.08	18
3	.39	2.1	11	3.0	5.8	9.5	52	3.8	4.7	.87	.04	13
4	.36	4.0	9.0	5.0	5.0	9.0	48	4.0	4.7	.65	21	11
5	.35	3.4	7.0	9.0	4.6	8.5	37	8.9	3.5	.47	33	9.5
6	.42	2.6	5.6	15	4.7	8.4	27	10	2.9	.34	34	204
7	.45	7.0	4.5	30	5.2	8.3	21	8.2	2.5	.22	44	343
8	.53	7.5	4.0	12	10	8.2	17	6.8	2.0	.21	18	145
9	.52	7.4	3.5	5.0	47	25	14	6.8	1.8	.27	9.4	77
10	.87	6.8	3.8	11	33	100	16	7.7	1.7	.18	6.0	45
11	1.3	5.0	3.8	25	18	277	22	6.8	1.3	.17	4.3	27
12	2.1	3.8	3.5	8.0	12	534	18	5.6	1.3	.24	3.4	17
13	1.5	2.8	3.2	3.7	9.0	270	14	5.8	1.4	.23	2.9	13
14	1.1	2.9	2.8	3.2	6.0	174	15	5.3	1.4	.23	2.7	15
15	1.1	8.1	2.5	3.1	5.2	113	21	4.8	1.1	.54	2.5	40
16	1.0	46	2.1	3.0	4.8	84	18	5.7	.97	2.1	2.1	36
17	1.2	29	1.8	365	4.6	61	16	18	.75	.72	1.7	25
18	1.2	20	1.6	173	4.5	41	12	35	.63	4.3	1.6	17
19	1.5	15	1.4	75	4.4	29	10	19	.60	6.6	4.9	15
20	2.4	11	1.2	68	4.3	23	11	36	.53	3.5	32	16
21	5.3	9.5	1.0	31	7.9	21	17	49	.45	2.1	23	16
22	5.0	8.5	.90	18	27	27	18	31	.51	1.4	13	17
23	3.8	8.0	.85	18	107	43	16	22	1.1	1.1	9.9	18
24	3.2	7.4	.76	34	70	30	13	18	2.3	.78	7.8	13
25	2.9	7.1	.70	90	40	23	11	14	2.2	.62	6.6	10
26	2.7	7.8	.66	97	25	17	9.0	12	1.7	.48	5.8	8.7
27	2.5	9.1	.64	43	15	15	7.8	9.8	1.3	.35	8.1	6.5
28	2.3	123	.66	39	13	14	7.1	7.9	1.2	.25	399	6.0
29	2.3	64	.70	29	---	13	6.2	6.4	2.0	.20	151	5.3
30	2.1	41	.76	17	---	14	5.4	5.0	1.9	.18	70	5.0
31	2.2	---	.84	13	---	14	---	4.3	---	.15	39	---
TOTAL	53.35	474.2	115.77	1248.6	510.0	2034.9	540.5	386.3	55.44	32.15	956.92	1217.0
MEAN	1.72	15.8	3.73	40.3	18.2	65.6	18.0	12.5	1.85	1.04	30.9	40.6
MAX	5.3	123	21	365	107	534	52	49	4.7	6.6	399	343
MIN	.35	2.1	.64	1.0	4.3	8.2	5.4	3.8	.45	.15	.04	5.0
CFSM	.05	.47	.11	1.19	.54	1.94	.53	.37	.06	.03	.91	1.20
IN.	.06	.52	.13	1.37	.56	2.23	.59	.42	.06	.04	1.05	1.34

CAL YR 1989 TOTAL 4472.89 MEAN 12.3 MAX 558 MIN .00 CFSM .36 IN 4.91
WTR YR 1990 TOTAL 7625.13 MEAN 20.9 MAX 534 MIN .04 CFSM .62 IN 8.37

04159010 PIGEON RIVER NEAR CASEVILLE, MI
(National stream quality accounting network station)

LOCATION.--Lat 43°56'22", long 83°14'30", in SW1/4 NW1/4 sec.31, T.18 N., R.11 E., Huron County, Hydrologic Unit 04080103, on left bank at upstream side of bridge on Kinde Road, 1.5 mi east of Caseville, and 3.1 mi upstream from mouth.

DRAINAGE AREA.--125 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1986 to current year.

GAGE.--Water-stage recorder. Datum of gage 578.43 ft above National Geodetic Vertical Datum of 1929. Prior to June 10, 1987, nonrecording gage at same datum.

REMARKS.--Estimated daily discharges: Nov. 16 to Mar. 13 and Aug. 8-17. Water discharge records fair except for estimated daily discharges, which are poor. Some diversions at low flows for agricultural irrigation.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,200 ft³/s, Mar. 13, 1990, gage height, 14.75 ft, from graph based on gage readings; no flow at times most years.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood in September 1986 reached a stage of 18.2 ft, from floodmark, and discharge of 2,900 ft³/s, from indirect computation of discharge.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,200 ft³/s, Mar. 13, gage height, 14.75 ft, from graph based on gage readings; minimum daily, 0.20 ft³/s, Aug. 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.6	5.1	130	13	60	54	62	29	34	54	.68	178
2	1.5	5.4	80	14	45	45	82	25	29	31	.29	106
3	1.3	5.5	60	16	35	40	174	21	32	20	.20	63
4	1.2	5.0	45	20	25	37	258	19	33	15	.69	42
5	1.3	4.9	35	25	20	35	261	30	34	12	56	32
6	1.3	5.7	27	35	18	33	216	44	28	8.3	123	38
7	1.2	6.3	23	60	17	31	166	45	25	5.8	162	152
8	1.2	5.6	21	110	18	31	134	41	22	5.6	75	347
9	1.4	7.5	19	45	20	35	106	39	20	5.4	40	348
10	1.8	8.9	17	18	50	45	96	40	15	4.2	25	208
11	2.7	10	16	16	250	150	109	40	12	3.4	17	134
12	2.6	9.8	15	14	150	1000	133	32	12	4.6	14	84
13	1.9	9.7	14	13	100	2040	113	30	15	2.7	12	58
14	2.9	8.9	13	12	60	1260	95	27	15	2.8	10	57
15	3.2	14	12	11	30	720	107	25	16	3.3	9.0	88
16	2.9	50	11	11	23	466	138	25	12	5.7	8.0	126
17	2.7	180	11	40	20	349	136	58	8.1	5.4	7.0	124
18	2.6	110	10	150	18	281	106	179	6.8	4.7	5.7	91
19	2.6	70	10	500	17	210	85	193	8.0	5.7	90	68
20	4.2	60	10	250	16	161	75	285	7.2	8.0	214	57
21	9.3	40	10	100	16	135	74	335	4.8	9.6	137	54
22	6.4	35	10	80	16	123	105	284	7.5	8.0	74	54
23	12	31	10	70	40	137	114	206	12	6.1	52	55
24	15	29	10	66	100	165	97	156	37	4.5	44	57
25	13	27	10	150	250	147	77	136	99	3.8	34	49
26	14	26	10	400	200	117	64	118	72	3.1	25	40
27	13	30	10	300	130	91	56	93	48	2.5	30	35
28	9.9	33	10	210	90	73	47	72	36	1.3	538	31
29	8.3	500	11	150	---	64	42	57	33	.74	796	28
30	7.0	200	11	110	---	60	35	48	49	1.1	638	25
31	5.8	---	12	80	---	59	---	38	---	.89	323	---
TOTAL	155.8	1533.3	693	3089	1834	8194	3363	2770	782.4	249.23	3560.56	2829
MEAN	5.03	51.1	22.4	99.6	65.5	264	112	89.4	26.1	8.04	115	94.3
MAX	15	500	130	500	250	2040	261	335	99	54	796	348
MIN	1.2	4.9	10	11	16	31	35	19	4.8	.74	.20	25
CFSM	.04	.41	.18	.80	.52	2.11	.90	.72	.21	.06	.92	.75
IN.	.05	.46	.21	.92	.55	2.44	1.00	.82	.23	.07	1.06	.84

CAL YR 1989 TOTAL 18559.40 MEAN 50.8 MAX 900 MIN .00 CFSM .41 IN 5.52
WTR YR 1990 TOTAL 29053.29 MEAN 79.6 MAX 2040 MIN .20 CFSM .64 IN 8.65

STREAMS TRIBUTARY TO LAKE HURON

04159010 PIGEON RIVER NEAR CASEVILLE, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1978 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: April 1978 to September 1981.
WATER TEMPERATURE: April 1978 to September 1981.

REMARKS.--Quarterly cross-sectional samples were collected at or near bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water year 1980): Maximum daily recorded (more than 20 percent missing record), 2,000 microsiemens, Oct. 20, 1979; minimum daily recorded (more than 20 percent missing record), 175 microsiemens, Mar. 6, 1979.
WATER TEMPERATURE (water year 1978): Maximum daily recorded (more than 20 percent missing record), 27.5°C, July 7, 1978; minimun daily recorded (more than 20 percent missing record), 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
DEC										
12...	1330	14	997	8.03	0.0	37	11.9	83	120	670
FEB										
28...	1330	88	783	--	0.0	4.0	10.2	71	K91	320
APR										
25...	1330	76	814	8.27	19.0	2.0	11.0	122	180	K13
AUG										
08...	1345	72	869	8.20	18.5	4.5	8.5	92	K980	260

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
DEC										
12...	490	170	140	35	17	7	0.3	3.5	395	0
FEB										
28...	380	--	110	26	11	6	0.2	3.7	--	--
APR										
25...	400	160	110	30	14	7	0.3	3.8	287	0
AUG										
08...	430	180	120	31	14	7	0.3	5.1	306	0

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
DEC										
12...	324	130	55	0.2	8.1	632	0.86	23.9	0.03	3.4
FEB										
28...	--	88	45	0.2	5.9	528	0.72	125	0.05	6.9
APR										
25...	235	74	53	0.1	0.4	549	0.75	113	0.06	7.9
AUG										
08...	251	89	56	0.3	9.7	584	0.79	114	<0.01	<0.10

04159010 PIGEON RIVER NEAR CASEVILLE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS TOTAL (MG/L AS P)	PHOSPHORUS DISSOLVED (MG/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)
DEC 12...	0.07	0.04	0.3	0.02	<0.01	<0.01	<10	<1	60	<0.5
FEB 28...	0.07	0.07	0.7	0.05	0.04	0.04	10	<1	44	<0.5
APR 25...	0.06	0.06	1.3	0.04	0.02	0.01	20	1	43	<0.5
AUG 08...	0.01	<0.01	0.3	<0.01	<0.01	<0.01	<10	1	50	<0.5

DATE	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)
DEC 12...	<1	<1	<3	2	10	<1	9	16	<0.1	<10
FEB 28...	<1	<5	<3	<10	15	<10	6	9	<0.1	<10
APR 25...	<1	<1	<3	4	7	1	8	9	<0.1	<10
AUG 08...	<1	1	<3	2	10	<1	12	9	<0.1	<10

DATE	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
DEC 12...	1	1	<1.0	330	<6	10	4	0.15	70
FEB 28...	20	1	<1.0	230	<6	7	21	5.0	77
APR 25...	1	<1	<1.0	260	<6	14	5	1.0	85
AUG 08...	<1	1	<1.0	290	<6	5	15	2.9	87

STREAMS TRIBUTARY TO ST. CLAIR RIVER

04159130 ST. CLAIR RIVER AT PORT HURON, MI
(National stream quality accounting network station)

LOCATION.--Lat 42°59'19", long 82°25'29", in SE1/4 sec.3, T.6 N., R.17 E., St. Clair County, Hydrologic Unit 04090001, at Port Huron municipal water-treatment plant in Port Huron.

DRAINAGE AREA.--222,400 mi², approximately.

PERIOD OF RECORD.--Water years 1970-73, 1978 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: April 1978 to September 1981.
WATER TEMPERATURE: April 1978 to September 1981.

REMARKS.--Bimonthly samples were collected near the Port Huron municipal water-treatment plant. Daily-mean water discharge is reported at sample time.

COOPERATION.--Water discharges were provided by the National Oceanic and Atmospheric Administration.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1979-81): Maximum daiy, 260 microsiemens, Dec. 18, 1980; minimum daily, 194 microsiemens, Jan. 27, 28, 1980.
WATER TEMPERATURE (water years 1979-81): Maximum daily, 24.0°C, Aug. 14-16, 1980; minimum daily, 0.0°C on many days during winter.

EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A specific conductance of 164 microsiemens was measured July 3, 1972.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DIS-CHARGE, IN CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
NOV										
03...	1230	193000	214	8.3	10.0	1.6	9.2	83	K11	K10
DEC										
12...	1215	184000	220	8.2	0.5	1.0	14.1	100	<1	<1
APR										
02...	1200	181000	209	8.2	2.5	0.5	13.5	102	<1	<1
MAY										
16...	1200	176000	215	8.2	7.0	0.2	12.4	106	<1	K2
JUN										
13...	1330	183000	221	8.4	13.0	0.4	10.9	106	--	<1
SEP										
10...	1315	188000	217	8.5	21.0	1.0	9.2	105	K1	K1

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
NOV										
03...	100	19	29	7.6	3.7	7	0.2	0.9	103	0
DEC										
12...	97	20	27	7.3	3.8	8	0.2	0.9	95	0
APR										
02...	100	22	29	7.7	3.6	7	0.2	0.9	100	0
MAY										
16...	100	21	29	7.3	3.7	7	0.2	0.8	100	0
JUN										
13...	100	19	28	7.4	3.9	8	0.2	0.9	97	1
SEP										
10...	100	18	28	7.2	3.6	7	0.2	0.9	98	1

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)
NOV									
03...	84	16	6.1	0.1	1.2	117	0.16	61000	<0.01
DEC									
12...	78	16	5.8	0.1	1.1	115	0.16	57100	<0.01
APR									
02...	82	16	7.0	<0.1	1.4	123	0.17	60100	0.02
MAY									
16...	82	16	7.2	0.2	1.5	112	0.15	53200	<0.01
JUN									
13...	81	16	7.9	<0.1	1.0	117	0.16	57800	<0.01
SEP									
10...	82	17	7.7	0.1	0.83	114	0.16	57900	<0.01

04159130 ST. CLAIR RIVER AT PORT HURON, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS TOTAL (MG/L AS P)	PHOSPHORUS DISSOLVED (MG/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)
NOV									
03...	0.28	<0.01	0.01	0.30	0.03	0.01	0.01	<10	<1
DEC									
12...	0.30	<0.01	0.01	0.30	<0.01	<0.01	<0.01	--	--
APR									
02...	0.40	<0.01	<0.01	1.4	<0.01	<0.01	<0.01	<10	1
MAY									
16...	0.30	<0.01	<0.01	0.30	0.01	<0.01	<0.01	<10	<1
JUN									
13...	0.30	<0.01	<0.01	0.70	<0.01	0.02	<0.01	--	--
SEP									
10...	0.30	<0.01	<0.01	0.50	<0.01	<0.01	0.01	<10	<1

DATE	BARIUM, DISSOLVED (UG/L AS BA)	BERYLLIUM, DISSOLVED (UG/L AS BE)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)
NOV									
03...	21	<0.5	<1	<1	<3	1	<3	<1	<4
DEC									
12...	--	--	--	--	--	--	--	--	--
APR									
02...	16	<0.5	<1	--	<3	--	6	--	<4
MAY									
16...	14	<0.5	<1	<1	<3	1	<3	<1	<4
JUN									
13...	--	--	--	--	--	--	--	--	--
SEP									
10...	19	<0.5	<1	<1	<3	1	4	<1	5

DATE	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)	MOLYBDENUM, DISSOLVED (UG/L AS MO)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)
NOV									
03...	<1	<0.1	<10	1	<1	<1.0	100	<6	<3
DEC									
12...	--	--	--	--	--	--	--	--	--
APR									
02...	2	<0.1	<10	--	<1	2.0	97	<6	4
MAY									
16...	<1	<0.1	<10	1	<1	<1.0	97	<6	4
JUN									
13...	--	--	--	--	--	--	--	--	--
SEP									
10...	<1	<0.1	<10	1	<1	<1.0	100	<6	11

STREAMS TRIBUTARY TO ST. CLAIR RIVER

04159500 BLACK RIVER NEAR FARGO, MI

LOCATION.--Lat 43°05'32", long 82°37'05", in NW1/4 sec.32, T.8 N., R.16 E., St. Clair County, Hydrologic Unit 04090001, on left bank 20 ft downstream from bridge on Norman Road, 2.1 mi east of Fargo, 5.3 mi upstream from Mill Creek, and 12 mi northwest of Port Huron.

DRAINAGE AREA.--480 mi².

PERIOD OF RECORD.--February 1944 to current year.

REVISED RECORDS.--WSP 1307: 1950(M). WSP 1627: 1956-58. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 613.75 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to July 9, 1954, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Oct. 14 to Nov. 1, Nov. 23 to Jan. 25, Jan. 28 to Feb. 7, Feb. 16-22, and Feb. 26 to Mar. 9. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--46 years, 294 ft³/s, 8.32 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 14,400 ft³/s, Apr. 5, 1947, gage height, 16.06 ft, from floodmark, from rating curve extended above 9,500 ft³/s; maximum gage height observed, 18.05 ft, Feb. 20, 1951, backwater from ice; minimum discharge observed, 1.8 ft³/s, Sept. 18, 19, 1946.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,500 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 13	0400	*4,400	*10.78	No other peak greater than base discharge.			

Minimum discharge, 8.6 ft³/s, Oct. 4, 5, gage height, 1.74 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	19	20	80	35	150	290	288	110	88	55	25	41
2	18	19	70	36	130	240	403	100	80	53	27	32
3	13	18	62	40	140	270	713	89	77	59	23	27
4	12	19	56	150	130	320	890	86	75	51	23	23
5	11	19	64	350	120	220	754	88	75	44	25	20
6	14	20	50	900	110	180	550	116	71	38	25	20
7	13	21	44	700	110	160	421	128	66	34	24	26
8	14	24	43	350	190	150	339	109	60	32	24	61
9	14	26	39	270	939	300	276	92	64	33	21	76
10	16	27	34	260	1140	2410	260	88	60	32	21	61
11	18	29	30	250	599	3260	557	82	54	33	19	51
12	19	29	39	210	377	3660	522	79	51	30	22	38
13	21	29	37	170	277	4240	375	77	47	28	24	33
14	21	31	36	120	214	2880	330	75	64	31	22	31
15	19	73	34	100	157	1790	503	71	1130	33	22	33
16	17	189	33	92	120	1400	491	71	570	31	26	39
17	15	153	33	450	115	1860	370	409	236	29	26	43
18	15	133	32	850	110	1050	335	1370	141	28	24	52
19	17	99	31	650	105	638	277	752	99	36	29	52
20	19	79	30	480	100	448	237	511	82	114	37	42
21	27	86	29	320	98	353	259	656	71	89	37	35
22	46	59	28	290	150	328	305	555	64	67	37	34
23	43	54	27	240	646	780	275	368	67	50	33	30
24	38	50	26	220	1110	777	239	293	70	43	29	29
25	34	47	26	300	735	463	208	279	71	37	26	26
26	30	45	26	920	480	342	188	253	74	31	24	24
27	27	44	26	850	400	276	165	204	70	29	22	23
28	26	46	28	450	340	232	151	167	61	26	29	22
29	24	55	29	350	---	206	135	136	55	25	44	21
30	22	85	31	250	---	216	119	114	51	24	73	24
31	21	---	32	200	---	256	---	97	---	23	57	---
TOTAL	663	1628	1185	10853	9292	29995	10935	7625	3844	1268	900	1069
MEAN	21.4	54.3	38.2	350	332	968	365	246	128	40.9	29.0	35.6
MAX	46	189	80	920	1140	4240	890	1370	1130	114	73	76
MIN	11	18	26	35	98	150	119	71	47	23	19	20
CFSM	.05	.11	.08	.73	.69	2.02	.76	.51	.27	.09	.06	.07
IN.	.05	.13	.09	.84	.72	2.32	.85	.59	.30	.10	.07	.08

CAL YR 1989 TOTAL 45693 MEAN 125 MAX 1400 MIN 11 CFSM .26 IN 3.54
WTR YR 1990 TOTAL 79257 MEAN 217 MAX 4240 MIN 11 CFSM .45 IN 6.14

04159900 MILL CREEK NEAR AVOCA, MI

LOCATION.--Lat 43°03'16", long 82°44'05", in NW1/4 sec.8, T.7 N., R.15 E., St. Clair County, Hydrologic Unit 04090001, on left bank at downstream side of bridge on Bricker Road, 0.2 mi upstream from Gleason Drain, and 2.3 mi west of Avoca.

DRAINAGE AREA.--169 mi².

PERIOD OF RECORD.--April 1963 to September 1975, October 1975 to September 1979 (operated as a crest-stage partial-record station), October 1987 to current year. Also operated as a low-flow partial-record station in water year 1979.

GAGE.--Water-stage recorder. Datum of gage is 711.31 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Oct. 28 to Nov. 1, Nov. 3 to Feb. 21, and Feb. 25 to Mar. 9. Records good except for estimated daily discharges, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--15 years (water years 1964-75, 1988-90), 91.4 ft³/s, 7.34 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,570 ft³/s, Apr. 19, 1975, gage height, 8.87 ft; minimum, 0.8 ft³/s, Aug. 9, 10, 11, 1964; minimum gage height, 0.56 ft, July 28, 1965.

EXTREMES FOR CURRENT YEAR.-- Peak discharges greater than base discharge of 900 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 12	2200	*986	*6.04	No other peak greater than base discharge.			

Minimum daily discharge, 3.6 ft³/s, Aug. 7, 12.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	9.3	15	40	22	80	120	140	47	35	17	7.7	10
2	9.3	16	37	24	70	110	182	44	30	17	7.9	10
3	7.8	16	34	27	75	140	232	41	29	17	6.2	10
4	12	15	33	60	72	130	230	40	26	15	5.5	10
5	14	14	31	170	60	90	212	44	24	14	4.6	9.6
6	14	14	28	270	62	66	185	58	22	12	3.8	9.9
7	13	14	26	240	62	62	161	59	21	12	3.6	15
8	13	16	24	190	70	60	138	59	21	12	5.1	11
9	13	19	25	150	350	180	117	54	20	13	5.2	13
10	13	21	24	140	300	599	134	48	21	11	4.4	15
11	13	19	23	120	200	760	284	44	20	11	4.3	14
12	13	17	23	100	150	909	303	41	19	9.6	3.6	11
13	17	16	22	85	110	962	228	42	17	8.7	4.2	10
14	14	18	22	70	90	844	214	40	21	8.8	3.8	10
15	14	100	21	55	75	664	276	39	22	9.8	4.4	11
16	11	350	21	52	65	585	247	38	28	11	5.0	11
17	14	250	20	70	62	641	193	169	22	11	4.6	11
18	18	150	20	280	60	479	168	425	18	12	4.2	11
19	22	98	19	260	59	346	137	355	19	17	5.3	11
20	27	78	18	230	56	255	118	280	19	18	5.4	11
21	26	90	18	170	60	200	129	289	18	13	6.5	11
22	32	66	17	120	129	180	129	245	16	13	7.5	12
23	27	60	17	130	411	297	116	181	18	13	7.0	10
24	22	54	16	110	539	301	107	144	18	14	7.5	11
25	19	48	16	200	270	214	93	127	19	14	8.0	10
26	15	44	16	300	220	169	82	122	18	14	8.3	9.6
27	15	41	16	250	180	137	74	86	16	14	8.5	9.4
28	14	46	17	200	140	115	66	66	15	14	13	9.3
29	13	50	18	160	---	99	61	53	15	12	10	8.8
30	13	45	19	120	---	106	54	46	16	10	10	8.8
31	14	---	21	95	---	122	---	40	---	8.1	9.8	---
TOTAL	491.4	1800	702	4470	4077	9942	4810	3366	623	396.0	194.9	324.4
MEAN	15.9	60.0	22.6	144	146	321	160	109	20.8	12.8	6.29	10.8
MAX	32	350	40	300	539	962	303	425	35	18	13	15
MIN	7.8	14	16	22	56	60	54	38	15	8.1	3.6	8.8
CFSM	.09	.36	.13	.85	.86	1.90	.95	.65	.12	.08	.04	.06
IN.	.11	.40	.15	.98	.90	2.19	1.06	.74	.14	.09	.04	.07

CAL YR 1989 TOTAL 20219.9 MEAN 55.4 MAX 586 MIN 7.8 CFSM .33 IN 4.45
WTR YR 1990 TOTAL 31196.7 MEAN 85.5 MAX 962 MIN 3.6 CFSM .51 IN 6.87

STREAMS TRIBUTARY TO ST. CLAIR RIVER

04160570 NORTH BRANCH BELLE RIVER AT IMLAY CITY, MI

LOCATION.--Lat 43°01'49", long 83°04'02", in SW1/4 NW1/4 sec.16, T.7 N., R.12 E., Lapeer County, Hydrologic Unit 04090001, on left bank 12 ft upstream from bridge on State Highway 21, 0.6 mi northeast of Imlay City.

DRAINAGE AREA.--18.0 mi².

PERIOD OF RECORD.--August 1965 to current year.

GAGE.--Water-stage recorder. Concrete control Aug. 20, 1965, to Nov. 2, 1981. Datum of gage is 789.69 ft above National Geodetic Vertical Datum of 1929 (levels by Boldt, McLeod, and Johnson, Inc.). Prior to Feb. 24, 1985, at datum 2.00 ft higher.

REMARKS.--Estimated daily discharges: Nov. 22-26, Dec. 2 to Jan. 25, Feb. 12-22, Feb. 25 to Mar. 8, May 17-30, and Sept. 2-4. Records fair except for estimated daily discharge, which are poor. Some diversion by pumping for sprinkler irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--25 years, 12.0 ft³/s, 9.05 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 354 ft³/s, June 12, 1986, gage height, 6.66 ft, from rating curve extended above 100 ft³/s; maximum gage height, 9.33 ft, Apr. 19, 1975, datum then in use; no flow part of each day June 27, 28, 1977, June 26-28, 1979, June 30, 1988, caused by irrigation pumpage.

EXTREMES FOR CURRENT YEAR.--Maximum daily discharge, 97 ft³/s, Mar. 12; minimum daily, 0.68 ft³/s, Aug. 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.3	4.9	7.9	3.8	14	20	26	4.1	4.8	2.4	.85	2.3
2	3.1	4.9	7.0	4.0	12	24	30	3.8	5.1	2.2	.72	2.1
3	3.1	4.5	6.5	4.1	13	27	33	3.4	7.4	5.9	.68	1.8
4	3.0	4.0	7.0	4.5	13	24	31	3.5	8.4	5.4	.86	2.0
5	3.1	4.0	5.7	25	13	17	25	5.8	9.7	3.6	1.1	2.2
6	3.4	4.1	5.2	75	12	12	24	4.7	8.4	2.5	.96	4.0
7	3.1	5.5	5.0	65	14	9.9	19	4.0	9.0	2.1	1.1	13
8	2.8	7.6	4.8	40	42	7.5	15	3.5	21	1.7	.98	6.8
9	2.9	6.2	4.7	25	63	53	13	3.2	21	2.2	.88	4.6
10	8.0	5.8	4.5	23	44	83	32	3.1	14	1.8	.78	3.5
11	8.5	5.3	4.1	25	29	91	65	2.6	11	1.9	.81	2.9
12	5.4	4.8	4.2	21	20	97	30	2.4	11	2.1	.73	2.4
13	4.7	4.3	4.3	18	17	89	20	3.4	9.8	1.3	1.4	1.8
14	4.1	10	4.2	13	16	74	29	3.2	17	1.4	1.5	2.4
15	3.6	51	4.0	11	14	53	30	2.9	19	1.6	2.4	3.4
16	3.5	80	3.9	8.6	13	82	23	5.7	10	1.4	2.5	4.4
17	3.4	50	3.8	35	12	62	23	78	12	1.4	1.7	3.5
18	3.7	26	3.7	70	11	40	17	58	10	1.5	1.7	2.4
19	4.7	17	3.6	66	11	33	14	35	6.8	2.1	4.4	2.2
20	12	24	3.5	40	10	29	14	31	4.7	2.6	4.4	1.9
21	9.9	19	3.4	24	9.5	26	17	27	3.7	2.9	3.5	1.8
22	7.5	12	3.3	15	25	33	13	21	3.6	2.4	3.0	2.8
23	6.3	9.6	3.2	16	88	52	11	16	4.6	2.7	2.8	2.1
24	5.4	7.8	3.1	13	66	29	9.3	12	4.8	4.5	2.6	1.7
25	4.9	7.2	3.0	17	50	20	8.4	10	4.3	4.9	2.3	1.5
26	4.5	6.8	3.0	27	35	19	7.3	9.3	3.3	3.5	1.9	1.3
27	4.1	7.9	3.0	21	27	18	6.6	8.2	3.2	2.9	1.9	1.4
28	3.9	16	3.0	22	23	17	5.7	7.5	3.0	2.4	5.4	2.1
29	4.1	12	3.1	20	---	16	4.9	6.6	3.6	1.9	4.5	2.7
30	4.0	9.5	3.2	19	---	24	4.5	6.4	3.0	1.2	3.1	2.2
31	4.0	---	3.4	15	---	19	---	6.1	---	1.0	2.6	---
TOTAL	148.0	431.7	132.3	786.0	716.5	1200.4	600.7	391.4	257.2	77.4	64.05	89.2
MEAN	4.77	14.4	4.27	25.4	25.6	38.7	20.0	12.6	8.57	2.50	2.07	2.97
MAX	12	80	7.9	75	88	97	65	78	21	5.9	5.4	13
MIN	2.8	4.0	3.0	3.8	9.5	7.5	4.5	2.4	3.0	1.0	.68	1.3
CFSM	.27	.80	.24	1.41	1.42	2.15	1.11	.70	.48	.14	.12	.17
IN.	.31	.89	.27	1.62	1.48	2.48	1.24	.81	.53	.16	.13	.18

CAL YR 1989 TOTAL 3236.70 MEAN 8.87 MAX 108 MIN 1.4 CFSM .49 IN 6.69
WTR YR 1990 TOTAL 4894.85 MEAN 13.4 MAX 97 MIN .68 CFSM .74 IN 10.12

STREAMS TRIBUTARY TO ST. CLAIR RIVER

04160600 BELLE RIVER AT MEMPHIS, MI

LOCATION.--Lat 42°54'03", long 82°46'09", in NW1/4 SE1/4 sec.35, T.6 N., R.14 E., St. Clair County, Hydrologic Unit 04090001, on right downstream side of bridge on State Highway 19 at Memphis.

DRAINAGE AREA.--151 mi².

PERIOD OF RECORD.--October 1962 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 705.41 ft above National Geodetic Vertical Datum of 1929 (Michigan Department of Transportation bench mark).

REMARKS.--Estimated daily discharges: Dec. 3 to Jan. 5, Jan. 10-17, 22-24, Feb. 15-21, and Feb. 26 to Mar. 9. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--28 years, 90.8 ft³/s, 8.17 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,520 ft³/s, Apr. 19, 1975, gage height, 8.96 ft; minimum, 2.3 ft³/s, Sept. 6, 10, 1978; minimum gage height, 1.17 ft, Sept. 6, 1978.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of April 1947 reached a stage of about 9 ft, from information by local residents.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 600 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 16	2100	680	4.98	Feb. 23	2000	635	4.83
Jan. 6	0900	713	5.09	Mar. 11	2000	*1,090	*6.22
Jan. 18	1800	689	5.01	May 18	1200	800	5.38

Minimum discharge, 7.4 ft³/s, Aug. 1, 3, 4, gage height, 1.43 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	18	24	58	28	68	130	185	49	34	23	8.2	13
2	17	25	50	28	64	150	258	48	31	18	8.2	12
3	18	24	47	29	73	190	251	46	31	16	8.2	12
4	17	23	45	100	66	160	250	47	30	16	8.4	11
5	17	24	50	300	64	125	218	54	29	18	9.3	12
6	17	23	40	657	60	98	187	60	28	17	10	14
7	17	25	35	497	60	86	154	57	28	15	11	20
8	17	28	34	292	211	100	120	52	26	14	11	34
9	16	36	35	192	529	260	104	49	32	14	10	27
10	18	37	32	170	457	705	135	48	35	14	9.8	18
11	22	35	30	140	267	953	385	46	34	12	9.2	15
12	30	31	29	120	160	978	334	42	27	12	9.9	13
13	28	29	28	100	119	928	215	46	27	12	11	12
14	26	32	27	85	125	672	206	50	27	14	11	12
15	21	228	27	75	87	448	286	48	30	14	11	14
16	21	591	26	65	82	390	217	50	33	15	11	18
17	18	577	26	260	80	482	164	191	28	14	12	18
18	20	322	25	593	77	327	142	684	26	12	12	18
19	23	192	24	567	75	233	110	456	24	11	12	17
20	27	137	24	327	72	181	95	279	21	15	13	16
21	48	163	23	177	75	148	114	267	22	20	16	16
22	51	127	22	120	199	178	127	208	23	19	15	16
23	44	105	21	100	512	354	103	136	25	17	14	17
24	38	85	21	95	585	291	87	99	28	15	14	16
25	34	64	20	188	313	184	78	81	29	15	13	14
26	31	57	20	291	240	138	71	70	25	15	12	13
27	28	52	21	249	180	115	65	60	28	14	11	12
28	27	60	21	194	140	100	60	53	23	12	14	11
29	25	76	22	135	---	91	55	48	19	11	16	11
30	24	61	23	128	---	97	53	43	23	9.9	18	12
31	25	---	25	115	---	135	---	38	---	8.9	16	---
TOTAL	783	3293	931	6417	5040	9427	4829	3505	826	452.8	365.2	464
MEAN	25.3	110	30.0	207	180	304	161	113	27.5	14.6	11.8	15.5
MAX	51	591	58	657	585	978	385	684	35	23	18	34
MIN	16	23	20	28	60	86	53	38	19	8.9	8.2	11
CFSM	.17	.73	.20	1.37	1.19	2.01	1.07	.75	.18	.10	.08	.10
IN.	.19	.81	.23	1.58	1.24	2.32	1.19	.86	.20	.11	.09	.11

CAL YR 1989 TOTAL 22563.0 MEAN 61.8 MAX 682 MIN 13 CFSM .41 IN 5.56
WTR YR 1990 TOTAL 36333.0 MEAN 99.5 MAX 978 MIN 8.2 CFSM .66 IN 8.95

STREAMS TRIBUTARY TO LAKE ST. CLAIR

04160800 SASHABAW CREEK NEAR DRAYTON PLAINS, MI

LOCATION.--Lat 42°43'12", long 83°21'13", in SE1/4 sec.26, T.4 N., R.9 E., Oakland County, Hydrologic Unit 04090003, on right bank at upstream side of culverts on Maybee Road, 1.1 mi upstream from mouth, and 2.5 mi northeast of Drayton Plains.

DRAINAGE AREA.--20.9 mi².

PERIOD OF RECORD.--October 1959 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Metal V-notch weir Aug. 30, 1961, to Mar. 6, 1968. Elevation of gage is 970 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 3 to Jan. 5, Jan. 13, 14, Feb. 16-20, Feb. 25 to Mar. 7, and Sept. 17-19. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--31 years, 12.9 ft³/s, 8.38 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 181 ft³/s, Oct. 1, 1981, gage height, 4.53 ft; minimum, 0.03 ft³/s, July 9, 16, 1988; minimum gage height, 1.59 ft, Aug. 1, 2, 1960.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 55 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 16	0300	62	3.39	Mar. 13	0100	75	3.61
Jan. 18	0300	60	3.36	Mar. 23	0600	62	3.39
Feb. 23	0200	74	3.60	May 17	1800	*76	3.62
Feb. 25	1400	ice jam	*3.64				

Minimum discharge, 0.80 ft³/s, Sept. 5, 6, gage height, 1.89 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	9.7	6.4	16	7.6	18	30	38	18	14	8.7	2.4	1.4
2	9.3	6.1	16	8.5	20	29	39	16	13	7.9	2.3	1.2
3	8.6	6.5	16	9.0	18	29	39	14	15	6.9	2.2	1.0
4	7.7	5.6	13	18	18	28	36	16	14	6.2	2.1	.93
5	6.9	5.4	11	30	17	27	34	28	12	5.6	2.6	.83
6	7.1	6.1	11	26	17	24	34	24	11	5.1	2.7	.85
7	6.4	8.2	10	21	19	22	32	21	9.5	4.3	2.5	10
8	6.1	11	9.0	17	27	24	29	19	21	4.0	2.3	11
9	5.4	9.8	8.5	16	39	33	26	17	22	4.0	2.0	5.6
10	8.4	9.1	8.0	18	34	52	36	15	16	4.4	1.8	4.3
11	9.3	8.4	7.5	18	29	60	49	13	14	4.4	1.6	4.0
12	7.7	8.0	7.0	18	24	66	40	12	12	4.7	1.5	3.4
13	6.8	7.3	6.6	17	23	71	36	20	11	4.4	2.3	2.9
14	6.0	9.3	6.4	15	25	67	37	20	15	3.9	3.0	2.8
15	5.3	42	6.3	13	25	61	37	19	13	4.9	2.5	6.5
16	4.9	60	6.2	13	23	67	33	28	9.6	4.8	2.3	6.7
17	5.0	53	6.2	35	21	65	34	57	9.0	4.0	2.1	8.6
18	5.0	44	6.1	52	19	59	31	57	8.8	3.5	1.8	8.0
19	6.5	36	6.1	40	18	54	29	45	8.1	3.3	4.7	7.5
20	13	35	6.0	28	17	51	30	44	8.9	4.1	7.7	6.9
21	12	32	6.0	24	18	47	44	42	13	6.3	5.3	6.4
22	10	26	5.9	23	37	47	37	35	12	4.8	4.5	8.0
23	8.9	24	5.9	24	65	59	33	32	18	5.2	3.9	6.6
24	7.8	20	5.9	26	54	51	31	30	17	4.7	3.6	5.5
25	7.2	19	5.9	30	48	46	29	28	14	3.9	3.1	4.8
26	6.6	19	5.8	31	40	41	28	26	12	3.1	2.8	4.4
27	6.2	18	5.8	27	33	37	25	24	11	2.6	2.4	4.1
28	5.9	22	5.8	26	31	34	23	22	9.7	2.4	2.1	3.8
29	5.9	19	6.0	23	---	32	22	20	9.8	2.2	2.1	3.7
30	5.7	17	6.4	22	---	39	20	18	9.2	2.3	1.8	4.0
31	6.1	---	7.0	18	---	38	---	16	---	2.5	1.6	---
TOTAL	227.4	593.2	249.3	694.1	777	1390	991	796	382.6	139.1	85.6	145.71
MEAN	7.34	19.8	8.04	22.4	27.8	44.8	33.0	25.7	12.8	4.49	2.76	4.86
MAX	13	60	16	52	65	71	49	57	22	8.7	7.7	11
MIN	4.9	5.4	5.8	7.6	17	22	20	12	8.1	2.2	1.5	.83
CFSM	.35	.95	.39	1.07	1.33	2.14	1.58	1.23	.61	.22	.13	.23
IN.	.40	1.06	.44	1.24	1.38	2.47	1.76	1.42	.68	.25	.15	.26

CAL YR 1989 TOTAL 5284.80 MEAN 14.5 MAX 65 MIN 3.2 CFSM .69 IN 9.41
WTR YR 1990 TOTAL 6471.01 MEAN 17.7 MAX 71 MIN .83 CFSM .85 IN 11.52

04160900 CLINTON RIVER NEAR DRAYTON PLAINS, MI

LOCATION.--Lat 42°39'37", long 83°23'25", in NE1/4 sec.21, T.3 N., R.9 E., Oakland County, Hydrologic Unit 04090003, on left bank at downstream side of bridge on State Highway 59, 1.0 mi downstream from State fish hatchery, and 2.0 mi south of Drayton Plains.

DRAINAGE AREA.--79.2 mi².

PERIOD OF RECORD.--October 1959 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Elevation of gage is 940 ft above National Geodetic Vertical Datum of 1929, from topographic map. Jan. 29 to July 9, 1964, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 11 to Jan. 2. Records good except for estimated daily discharges, which are fair. Some regulation and occasional diversion for lake-level control at many lakes upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--31 years, 51.3 ft³/s, 8.80 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 276 ft³/s, Mar. 12, 1974, gage height, 4.95 ft; minimum, 2.4 ft³/s, May 31, 1961; minimum gage height, 1.23 ft, Jan. 4, 1961.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 148 ft³/s, May 23, gage height, 3.90 ft; minimum, 10 ft³/s, Sept. 8, gage height, 2.15 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	16	42	94	47	80	110	128	62	76	48	15	12
2	21	42	92	46	84	109	127	54	63	46	12	12
3	25	42	90	46	82	107	126	52	59	38	12	12
4	25	41	89	58	80	106	122	57	48	30	13	11
5	25	40	87	60	78	105	114	65	46	32	13	11
6	21	40	85	59	76	103	113	62	45	31	13	12
7	15	42	84	61	75	101	111	62	40	28	15	13
8	15	42	81	63	75	99	111	65	60	22	15	11
9	15	42	81	64	76	105	108	71	83	22	15	32
10	16	44	79	67	76	106	115	68	85	20	14	80
11	14	44	76	67	77	111	117	64	80	19	11	80
12	14	44	72	68	78	116	116	55	72	18	11	76
13	18	59	68	69	78	122	115	53	64	14	13	72
14	28	73	66	69	80	127	117	51	61	13	14	74
15	28	87	63	69	86	132	115	57	60	13	15	69
16	28	94	61	67	88	143	114	78	59	13	15	66
17	27	94	60	75	88	142	112	107	57	13	15	57
18	28	95	58	77	88	142	110	114	56	17	17	36
19	44	96	54	80	86	142	107	126	50	23	52	12
20	55	96	53	83	85	140	103	135	36	24	67	11
21	53	94	52	85	83	137	90	140	28	24	82	12
22	51	93	51	87	99	138	80	146	38	21	77	24
23	50	90	51	86	109	139	73	147	64	23	70	68
24	50	87	51	86	110	137	75	146	65	23	58	44
25	50	89	51	88	113	134	87	138	67	28	40	11
26	51	91	50	87	114	133	81	130	67	27	32	16
27	51	92	50	87	113	130	79	126	65	24	32	27
28	50	92	49	86	112	128	79	123	52	16	32	27
29	48	91	47	85	---	126	77	119	39	15	26	27
30	47	92	47	83	---	130	72	112	44	17	13	26
31	45	---	48	81	---	127	---	95	---	17	12	---
TOTAL	1024	2110	2040	2236	2469	3827	3094	2880	1729	719	841	1041
MEAN	33.0	70.3	65.8	72.1	88.2	123	103	92.9	57.6	23.2	27.1	34.7
MAX	55	96	94	88	114	143	128	147	85	48	82	80
MIN	14	40	47	46	75	99	72	51	28	13	11	11
CFSM	.42	.89	.83	.91	1.11	1.55	1.30	1.17	.73	.29	.34	.44
IN.	.48	.99	.96	1.05	1.16	1.80	1.45	1.35	.81	.34	.40	.49

CAL YR 1989 TOTAL 20227.2 MEAN 55.4 MAX 142 MIN 8.4 CFSM .70 IN 9.50
WTR YR 1990 TOTAL 24010.0 MEAN 65.8 MAX 147 MIN 11 CFSM .83 IN 11.28

STREAMS TRIBUTARY TO LAKE ST. CLAIR

04161100 GALLOWAY CREEK NEAR AUBURN HEIGHTS, MI

LOCATION.--Lat 42°40'02", long 83°12'02", in SE1/4 sec.18, T.3 N., R.11 E., Oakland County, Hydrologic Unit 04090003, on right bank 12 ft downstream from wooden bridge on Oakland University property, 2.7 mi northeast of Auburn Heights.

DRAINAGE AREA.--17.9 mi².

PERIOD OF RECORD.--October 1959 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder and concrete control since Aug. 20, 1960. Datum of gage is 820.78 ft above National Geodetic Vertical Datum of 1929 (levels by Johnson and Anderson, Inc.).

REMARKS.--Estimated daily discharges: Dec. 11-21, Dec 27 to Jan. 12, Feb. 3, 4, 16, 17, 19, Feb. 25 to Mar. 1, and Sept. 18-30. Records good except for estimated daily discharge, which are poor. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--31 years, 11.0 ft³/s, 8.35 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 536 ft³/s, Aug. 24, 1985, gage height, 5.62 ft; maximum gage height, 6.27 ft, June 25, 1968; minimum discharge, 0.01 ft³/s, on many days during July and August, 1964; minimum gage height, 0.82 ft, Aug. 1, 1960.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 120 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 15	2130	157	a4.60	May 17	1030	134	a4.45
Feb. 22	1800	*192	*a4.75	Aug. 19	0500	121	4.31

a From graph based on gage readings.

Minimum discharge, 1.4 ft³/s, Aug. 2, 3; minimum gage height, 1.45 ft, Dec. 23, Aug. 2, 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.9	7.0	11	4.5	10	13	35	9.7	5.1	4.4	1.7	2.3
2	4.3	6.3	10	6.0	13	25	32	8.6	4.9	3.3	1.6	2.0
3	3.9	5.5	8.8	35	10	28	27	8.2	9.0	2.7	1.5	1.8
4	3.4	4.9	7.9	80	9.2	19	22	17	6.9	2.4	6.0	1.8
5	3.7	4.8	7.6	60	9.9	16	23	33	5.3	2.3	7.8	1.8
6	5.1	5.8	7.8	25	12	13	24	20	4.7	2.0	3.8	8.4
7	3.9	20	6.8	15	21	11	22	15	4.3	1.9	2.9	58
8	3.5	19	6.2	16	37	11	18	12	27	1.9	2.3	19
9	3.3	13	5.9	18	41	46	16	10	16	2.1	2.0	8.9
10	16	11	5.4	37	32	67	48	9.7	9.2	1.9	1.8	19
11	11	9.1	5.0	23	22	68	58	8.9	6.5	2.5	1.8	16
12	7.1	8.0	4.8	18	17	66	35	8.2	5.3	2.2	7.5	8.2
13	5.5	6.9	4.6	13	17	59	27	23	4.8	1.9	28	5.7
14	4.8	20	4.3	11	19	48	36	17	21	5.0	10	21
15	4.4	92	4.1	12	15	38	31	15	17	3.9	4.8	24
16	4.2	115	3.9	15	14	54	23	39	9.4	2.9	3.5	29
17	4.9	64	3.6	61	13	42	24	88	6.2	2.3	2.7	14
18	4.4	42	3.4	68	12	30	19	70	4.8	2.0	2.5	11
19	14	33	3.1	37	11	24	16	40	3.8	2.3	64	16
20	30	31	2.9	28	10	21	20	37	4.2	8.8	23	13
21	19	23	2.7	21	9.9	19	45	34	7.0	4.5	13	18
22	12	18	2.2	17	84	34	28	24	11	4.8	8.2	28
23	9.0	14	1.7	14	116	57	21	19	18	3.9	6.1	17
24	7.8	12	1.7	23	58	31	19	16	12	3.0	5.0	11
25	7.0	11	1.7	31	27	24	30	13	7.2	2.5	4.4	8.0
26	6.3	12	2.4	30	22	20	19	11	5.2	2.5	3.8	5.6
27	5.9	11	2.7	20	19	17	16	9.7	4.9	2.0	3.7	6.0
28	5.4	20	2.8	18	15	15	14	8.4	4.4	1.8	7.3	6.4
29	5.2	15	3.0	15	---	14	12	7.2	4.6	1.7	4.0	5.5
30	5.0	12	3.2	12	---	34	11	6.1	4.8	2.0	3.0	4.7
31	7.2	---	3.5	10	---	26	---	5.4	---	1.8	2.6	---
TOTAL	231.1	666.3	144.7	793.5	696.0	990	771	643.1	254.5	89.2	240.3	391.1
MEAN	7.45	22.2	4.67	25.6	24.9	31.9	25.7	20.7	8.48	2.88	7.75	13.0
MAX	30	115	11	80	116	68	58	88	27	8.8	64	58
MIN	3.3	4.8	1.7	4.5	9.2	11	11	5.4	3.8	1.7	1.5	1.8
CFSM	.42	1.24	.26	1.43	1.39	1.78	1.44	1.16	.47	.16	.43	.73
IN.	.48	1.38	.30	1.65	1.45	2.06	1.60	1.34	.53	.19	.50	.81

CAL YR 1989 TOTAL 5487.1 MEAN 15.0 MAX 154 MIN 1.7 CFSM .84 IN 11.40
WTR YR 1990 TOTAL 5910.8 MEAN 16.2 MAX 116 MIN 1.5 CFSM .91 IN 12.28

STREAMS TRIBUTARY TO LAKE ST. CLAIR

04161500 PAINT CREEK NEAR LAKE ORION, MI

LOCATION.--Lat 42°46'03", long 83°13'12", in NE1/4 sec.13, T.4 N., R.10 E., Oakland County, Hydrologic Unit 04090003, on left bank 100 ft upstream from railroad bridge, 1.6 mi southeast of Lake Orion, and 2.8 mi upstream from Trout Creek.

DRAINAGE AREA.--38.5 mi².

PERIOD OF RECORD.--September 1955 to September 1975, October 1975 to September 1988 (operated as a crest-stage partial-record station), October 1988 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 929.80 ft above National Geodetic Vertical Datum of 1929 (levels by Giffels and Webster Engineering, Inc.).

REMARKS.--Estimated daily discharges: Dec. 4 to Jan. 4 and Feb. 24-26. Records good except for estimated daily discharges, which are fair. Occasional regulation by Lake Orion. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--22 years (water years 1956-75, 1989-90), 25.4 ft³/s, 8.96 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 428 ft³/s, Apr. 19, 1975, gage height, 4.26 ft, from floodmark; maximum gage height, 4.43 ft, Sept. 22, 1971, result of construction downstream; minimum discharge, 1.2 ft³/s, June 28, July 13, 14, 15, 1959.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 90 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 15	0100	*123	*3.06	May 20	1400	116	3.01
May 17	0830	104	a2.91				

a From graph based on gage readings.

Minimum discharge, 4.1 ft³/s, Aug. 3, 4, 10, 11, 12, gage height, 1.57 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	12	13	30	13	35	47	22	23	17	16	4.8	6.6
2	12	13	29	14	37	48	25	20	16	15	4.6	6.1
3	12	13	28	15	36	48	26	18	19	13	4.4	5.3
4	11	12	25	25	34	44	33	20	17	11	4.9	4.8
5	14	12	21	23	33	48	39	28	16	8.9	5.8	4.8
6	17	13	19	22	32	48	42	27	15	8.0	5.5	8.3
7	15	14	17	22	31	45	43	27	14	7.1	5.0	19
8	15	14	15	23	31	48	44	26	22	7.0	4.7	14
9	14	14	14	24	31	56	45	24	24	7.5	4.8	14
10	17	14	13	26	32	53	57	23	22	6.8	4.4	14
11	15	14	13	26	33	56	58	19	20	6.5	4.3	13
12	14	13	13	26	34	43	57	18	18	6.4	4.2	12
13	14	13	13	26	35	61	56	26	19	5.5	6.9	11
14	13	21	12	26	36	109	59	26	26	6.5	6.0	13
15	13	44	12	25	40	112	58	27	28	7.2	5.7	13
16	13	54	12	26	40	112	56	34	27	7.5	6.2	13
17	13	57	12	34	37	106	57	60	26	7.4	5.8	11
18	12	55	12	32	35	94	53	73	19	7.2	6.4	10
19	14	51	12	34	34	87	47	98	15	9.1	14	12
20	15	48	12	38	32	79	49	111	15	12	12	11
21	15	44	12	43	31	70	55	100	18	11	11	12
22	14	41	12	44	44	73	54	88	19	10	11	13
23	14	39	12	41	47	70	53	79	21	10	11	12
24	14	37	12	42	49	59	51	71	20	11	10	11
25	14	34	12	41	53	56	47	64	19	9.3	9.8	10
26	14	32	12	40	50	65	42	56	18	8.0	9.1	9.9
27	14	31	12	40	51	70	32	44	18	7.3	8.5	9.7
28	13	32	12	39	48	74	28	35	17	6.9	10	9.2
29	13	34	12	38	---	47	26	28	17	6.4	8.9	9.0
30	13	34	13	37	---	19	24	23	17	6.3	8.0	11
31	13	---	13	36	---	18	---	20	---	5.5	7.2	---
TOTAL	426	860	468	941	1061	1965	1338	1336	579	267.3	224.9	322.7
MEAN	13.7	28.7	15.1	30.4	37.9	63.4	44.6	43.1	19.3	8.62	7.25	10.8
MAX	17	57	30	44	53	112	59	111	28	16	14	19
MIN	11	12	12	13	31	18	22	18	14	5.5	4.2	4.8
CFSM	.36	.75	.39	.79	.98	1.65	1.16	1.12	.50	.22	.19	.28
IN.	.41	.83	.45	.91	1.03	1.90	1.29	1.29	.56	.26	.22	.31

CAL YR 1989 TOTAL 7912.7 MEAN 21.7 MAX 81 MIN 4.6 CFSM .56 IN 7.65
WTR YR 1990 TOTAL 9788.9 MEAN 26.8 MAX 112 MIN 4.2 CFSM .70 IN 9.46

STREAMS TRIBUTARY TO LAKE ST. CLAIR

04161540 PAINT CREEK AT ROCHESTER, MI

LOCATION.--Lat 42°41'18", long 83°08'35", in NW1/4 SE1/4 sec.10, T.3 N., R.11 E., Oakland County, Hydrologic Unit 04090003, on right bank at upstream side of bridge on Ludlow Street in Rochester, and 1.5 mi upstream from mouth.

DRAINAGE AREA.--70.9 mi².

PERIOD OF RECORD.--October 1959 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 755.11 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 4 to Jan. 4, Feb. 16-21, 25, 26, and Mar. 2-9. Records good except for estimated daily discharges, which are fair. Occasional regulation by Lake Orion. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--31 years, 52.4 ft³/s, 10.04 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 918 ft³/s, Feb. 1, 1968; maximum gage height, 5.95 ft, Feb. 10, 1965, backwater from ice; minimum discharge, 1.2 ft³/s, Aug. 19, 1974, caused by regulation due to bridge construction; minimum gage height, 1.26 ft, Sept. 16, 1960.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 300 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Feb. 22	2000	*352	*3.47	May 17	1700	312	3.34

Minimum discharge, 13 ft³/s, Aug. 3, 4, gage height, 1.53 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	33	39	62	44	61	84	88	53	38	32	15	19
2	36	38	60	52	65	82	86	49	36	28	14	18
3	34	37	58	70	62	81	77	47	45	25	13	16
4	33	35	55	115	60	80	78	58	43	23	17	15
5	34	35	52	99	58	80	83	94	38	22	21	15
6	42	38	50	60	59	79	89	73	35	21	17	22
7	37	54	48	49	68	76	84	65	31	19	16	104
8	37	55	46	47	96	76	82	59	67	19	16	37
9	35	45	44	51	113	115	80	55	56	19	15	31
10	52	42	41	64	87	166	134	53	45	19	14	31
11	43	39	39	59	71	180	153	50	39	20	14	32
12	37	38	38	54	68	197	121	47	36	20	16	27
13	36	37	37	51	71	179	109	76	36	18	37	25
14	34	59	36	49	76	190	122	68	73	22	21	43
15	33	199	35	47	71	189	118	69	62	22	17	45
16	33	216	35	50	70	196	105	103	49	20	17	43
17	33	133	34	137	67	178	108	233	44	18	16	34
18	33	105	33	143	64	150	97	183	40	17	20	27
19	47	92	33	80	60	132	89	157	33	19	72	35
20	76	93	33	72	57	122	93	179	32	30	35	33
21	58	83	33	72	56	112	137	173	42	26	30	33
22	48	74	32	72	192	132	110	137	45	23	27	39
23	43	70	32	69	228	163	101	119	63	24	26	32
24	43	65	32	80	130	120	95	106	52	22	26	29
25	43	64	32	96	120	102	89	96	40	21	24	27
26	43	63	32	93	105	103	83	88	35	18	23	26
27	42	62	32	77	97	102	73	76	34	17	23	25
28	38	74	32	77	88	104	61	65	33	16	27	24
29	37	67	32	69	---	99	57	57	34	16	23	23
30	35	66	33	64	---	85	55	47	34	16	21	24
31	38	---	38	61	---	70	---	42	---	16	19	---
TOTAL	1246	2117	1229	2223	2420	3824	2857	2777	1290	648	692	934
MEAN	40.2	70.6	39.6	71.7	86.4	123	95.2	89.6	43.0	20.9	22.3	31.1
MAX	76	216	62	143	228	197	153	233	73	32	72	104
MIN	33	35	32	44	56	70	55	42	31	16	13	15
CFSM	.57	1.00	.56	1.01	1.22	1.74	1.34	1.26	.61	.30	.32	.44
IN.	.65	1.11	.64	1.17	1.27	2.01	1.50	1.46	.68	.34	.36	.49

CAL YR 1989 TOTAL 18991 MEAN 52.0 MAX 297 MIN 15 CFSM .73 IN 9.96
WTR YR 1990 TOTAL 22257 MEAN 61.0 MAX 233 MIN 13 CFSM .86 IN 11.68

STREAMS TRIBUTARY TO LAKE ST. CLAIR

04161580 STONY CREEK NEAR ROMEO, MI

LOCATION.--Lat 42°48'03", long 83°05'25", in SW1/4 sec.31, T.5 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on right bank at upstream side of culvert on Romeo Road, and 4.0 mi west of Romeo.

DRAINAGE AREA.--25.6 mi².

PERIOD OF RECORD.--October 1964 to current year.

GAGE.--Water-stage recorder. Datum of gage is 861.64 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 3 to Jan. 3, Jan. 13-19, Feb. 16-22, 25, 26, Mar. 3-8, and July 25 to Aug. 9. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--26 years, 17.4 ft³/s, 9.23 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 290 ft³/s, Apr. 19, 1975, gage height, 5.19 ft; minimum, 0.92 ft³/s, Oct. 5, 9, 1967; minimum gage height, 1.28 ft, July 27, 28, 1965.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 100 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Mar. 13	0500	*105	*3.34	No other peak greater than base discharge.			

Minimum daily discharge, 2.9 ft³/s, Aug. 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	6.4	13	25	9.6	20	33	41	17	7.1	5.9	3.3	3.9
2	8.0	8.9	24	9.8	21	31	42	15	6.4	5.0	3.1	4.4
3	7.2	7.0	22	9.8	21	29	40	14	7.6	5.1	2.9	5.1
4	6.4	7.4	20	26	20	26	37	16	7.0	4.5	3.6	4.8
5	6.2	8.5	18	25	19	25	35	31	6.0	4.1	4.5	6.7
6	6.7	7.4	16	18	19	23	36	22	5.5	4.0	4.7	8.8
7	6.3	10	15	16	21	22	33	19	5.1	4.7	3.9	21
8	5.7	14	14	16	30	20	30	12	8.8	5.3	3.7	15
9	5.7	10	13	19	43	33	27	9.2	12	5.1	3.5	16
10	10	16	12	21	39	56	38	8.2	11	4.9	3.2	15
11	11	18	11	19	30	73	49	7.7	7.2	4.3	3.1	17
12	7.7	13	11	18	26	89	44	7.1	6.1	4.2	3.1	15
13	7.5	9.7	10	17	27	103	39	19	6.5	3.8	4.2	13
14	8.8	15	10	16	28	93	42	16	11	4.2	4.4	13
15	5.8	53	9.8	15	23	78	42	12	11	4.7	3.7	16
16	6.0	68	9.6	15	21	75	37	16	6.2	4.2	3.4	14
17	6.0	48	9.4	21	20	69	38	51	5.3	4.1	3.4	11
18	7.4	46	9.2	43	19	58	34	59	6.5	4.4	3.4	7.5
19	12	43	9.0	40	18	50	31	43	7.0	4.8	8.0	9.3
20	28	43	8.6	37	17	41	31	38	7.0	6.7	5.6	9.0
21	24	33	8.0	34	17	36	39	38	8.5	6.5	9.4	15
22	18	20	7.8	30	25	40	34	31	8.3	5.3	12	19
23	15	17	7.4	26	64	59	30	37	12	5.0	11	17
24	16	13	7.2	27	62	52	29	41	11	4.6	9.7	15
25	15	12	7.0	32	56	45	27	38	8.0	4.5	7.3	12
26	12	13	7.0	33	47	41	25	35	6.0	4.1	6.0	7.1
27	11	13	7.2	29	43	36	23	26	5.6	3.8	5.4	6.0
28	11	30	7.4	30	39	32	21	16	5.3	3.6	5.9	5.5
29	16	29	8.0	25	---	31	20	12	6.5	3.5	5.2	5.5
30	16	27	8.8	22	---	38	18	19	6.9	3.5	4.3	5.7
31	12	---	9.4	21	---	37	---	11	---	3.5	4.0	---
TOTAL	334.8	665.9	361.8	720.2	835	1474	1012	736.2	228.4	141.9	158.9	333.3
MEAN	10.8	22.2	11.7	23.2	29.8	47.5	33.7	23.7	7.61	4.58	5.13	11.1
MAX	28	68	25	43	64	103	49	59	12	6.7	12	21
MIN	5.7	7.0	7.0	9.6	17	20	18	7.1	5.1	3.5	2.9	3.9
CFSM	.42	.87	.46	.91	1.16	1.86	1.32	.93	.30	.18	.20	.43
IN.	.49	.97	.53	1.05	1.21	2.14	1.47	1.07	.33	.21	.23	.48

CAL YR 1989 TOTAL 5668.4 MEAN 15.5 MAX 96 MIN 3.0 CFSM .61 IN 8.24
WTR YR 1990 TOTAL 7002.4 MEAN 19.2 MAX 103 MIN 2.9 CFSM .75 IN 10.17

04161790 STONY LAKE NEAR WASHINGTON, MI

LOCATION.--Lat 42°42'58", long 83°05'58", in SE1/4 sec.31, T.4 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on left bank 1,000 ft east of bridge over dam on Stony Creek, 2.7 mi west of Washington.

DRAINAGE AREA.--68.0 mi².

PERIOD OF RECORD.--February 1963 to current year.

REVISED RECORDS.--WDR MI-77-1: 1976.

GAGE.--Water-stage recorder. Datum of gage is 790.00 ft above National Geodetic Vertical Datum of 1929 (levels by Huron-Clinton Metropolitan Authority); gage readings have been converted to elevations NGVD.

REMARKS.--Reservoir is formed by an earthfill dam with concrete spillway completed in 1962. The spillway section includes a drum gate with minimum crest elevation of 796 ft, maximum of 802 ft; and 2 sluices, one on each side, with valve controls capable of draining lake. Total capacity (new capacity table put into use Oct. 1, 1973), 4,649 acre-ft at elevation of 802 ft. The reservoir began filling February 1963. Lake is used for recreational purposes.

EXTREMES FOR PERIOD OF RECORD.--Maximum contents, 5,495 acre-ft, May 17, 18, 1974, Apr. 20, 1975, elevation, 803.6 ft; minimum recorded, 1,758 acre-ft, Nov. 21, 1967, elevation, 794.7 ft.

EXTREMES FOR CURRENT YEAR.--Maximum contents, 5,018 acre-ft, May 20, elevation, 802.71 ft; minimum, 3,426 acre-ft, Dec. 24-29, elevation, 799.42 ft.

MONTHEND ELEVATION, IN FEET NGVD, AND CONTENTS AT 2400, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)	Change in contents (equivalent in ft³/s)
Sept. 30	802.17	4,737	--	--
Oct. 31	802.24	4,774	+37	+0.6
Nov. 30	802.02	4,659	-115	-1.9
Dec. 31	799.49	3,457	-1,202	-19.5
CAL YR 1989	--	--	-696	-1.0
Jan. 31	799.66	3,531	+74	+1.2
Feb. 28	799.85	3,615	+84	+1.5
Mar. 31	802.46	4,888	+1,273	+20.7
Apr. 30	802.22	4,763	-125	-2.1
May 31	802.27	4,789	+26	+0.4
June 30	802.19	4,748	-41	-0.7
July 31	802.06	4,680	-68	-1.1
Aug. 31	802.09	4,696	+16	+0.3
Sept. 30	802.14	4,722	+26	+0.4
WTR YR 1990	--	--	-15	0

04161800 STONY CREEK NEAR WASHINGTON, MI

LOCATION.--Lat 42°42'55", long 83°05'31", in SW1/4 sec.31, T.4 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on left bank at downstream side of bridge on Mt. Vernon Road, 500 ft downstream from Stony Lake Dam, and 2.9 mi west of Washington.

DRAINAGE AREA.--68.2 mi².

PERIOD OF RECORD.--July 1958 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 772.59 ft above National Geodetic Vertical Datum of 1929 (levels by Huron-Clinton Metropolitan Authority).

REMARKS.--No estimated daily discharges. Records good. Occasional diurnal fluctuation caused by mills upstream from station prior to February 1963; occasional regulation by Stony Lake since (see preceding page). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--32 years, 42.9 ft³/s, 8.54 in/yr, adjusted for storage since 1963.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 552 ft³/s, June 10, 1988, gage height, 6.44 ft, from rating curve extended above 380 ft³/s, caused by momentary release of water from Stony Lake; maximum gage height, 6.71 ft, Mar. 6, 1959, backwater from ice; minimum discharge, 0.9 ft³/s, July 10, 1963; minimum gage height, 1.79 ft, Apr. 6, 1979; minimum daily discharge, 1.3 ft³/s, July 31, Aug. 1, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 212 ft³/s, Dec. 9, gage height, 4.40 ft; minimum, 4.8 ft³/s, July 8, gage height, 2.03 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	23	34	93	29	51	80	89	45	36	22	6.8	12
2	24	33	99	29	56	75	97	41	33	18	6.9	12
3	22	30	74	28	50	75	103	38	33	15	6.7	10
4	18	27	93	41	51	71	91	44	32	13	8.2	7.2
5	16	25	103	59	48	69	88	62	29	13	13	7.9
6	19	26	97	60	47	62	87	62	26	11	11	10
7	18	32	118	56	47	55	84	60	26	5.8	8.9	30
8	18	38	77	51	56	53	77	53	36	5.4	8.6	30
9	17	38	122	49	75	62	70	47	40	9.0	8.3	31
10	24	37	80	54	88	87	87	40	38	9.4	8.0	30
11	27	35	50	56	85	124	101	35	34	10	7.8	28
12	27	36	40	55	76	160	106	34	31	15	7.4	25
13	26	34	33	49	68	121	103	46	28	10	15	25
14	25	39	30	45	67	59	104	48	47	7.9	13	29
15	24	71	29	45	72	84	103	52	55	10	12	34
16	25	123	27	45	65	93	98	55	45	10	12	36
17	28	136	25	58	62	120	94	81	35	10	11	31
18	24	122	24	93	54	131	84	116	28	10	11	26
19	27	102	24	101	53	92	79	128	22	12	21	27
20	36	95	23	101	49	67	76	130	21	19	22	26
21	44	87	22	91	46	56	92	127	25	23	22	25
22	44	78	21	78	73	71	88	108	27	23	23	29
23	43	62	20	67	137	85	85	93	34	22	24	28
24	40	53	18	65	147	92	78	85	35	21	25	27
25	39	47	18	69	127	98	73	82	33	18	24	26
26	37	44	19	76	109	95	67	78	29	16	23	27
27	35	42	19	74	102	84	62	70	26	14	21	24
28	33	74	19	71	90	78	57	61	24	12	22	22
29	31	90	21	65	---	73	52	53	22	11	20	20
30	30	71	23	58	---	82	49	43	22	13	16	16
31	33	---	29	53	---	84	---	39	---	9.8	14	---
TOTAL	877	1761	1490	1871	2051	2638	2524	2056	952	418.3	452.6	711.1
MEAN	28.3	58.7	48.1	60.4	73.3	85.1	84.1	66.3	31.7	13.5	14.6	23.7
MAX	44	136	122	101	147	160	106	130	55	23	25	36
MIN	16	25	18	28	46	53	49	34	21	5.4	6.7	7.2
MEAN+	28.9	56.8	28.6	61.6	74.8	106	82.0	66.7	31.0	12.4	14.9	24.1
CFSM+	.42	.83	.42	.90	1.10	1.55	1.20	.98	.45	.18	.22	.35
IN.+	.49	.93	.48	1.04	1.14	1.79	1.34	1.13	.51	.21	.25	.39

CAL YR 1989 TOTAL 16298.8 MEAN 44.7 MAX 203 MIN 9.3 MEAN+ 43.7 CFSM+ .64 IN+ 8.70
WTR YR 1990 TOTAL 17802.0 MEAN 48.8 MAX 160 MIN 5.4 MEAN+ 48.8 CFSM+ .72 IN+ 9.70

+ Adjusted for change in contents in Stony Lake.

STREAMS TRIBUTARY TO LAKE ST. CLAIR

04163400 PLUM BROOK AT UTICA, MI

LOCATION.--Lat 42°36'05", long 83°04'27", in SE1/4 NE1/4 sec.7, T.2 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on left bank at upstream side of bridge on Ryan Road, 1.0 mi southwest of Utica.

DRAINAGE AREA.--16.5 mi².

PERIOD OF RECORD.--July 1965 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 619.79 ft above National Geodetic Vertical Datum of 1929 (levels by Johnson and Anderson, Inc.).

REMARKS.--Estimated daily discharges: Dec. 6, 7, Dec. 15 to Jan. 9, Jan. 12, 13, Feb. 1-5, 16-20, and Feb. 24 to Apr. 5. Records good except for estimated daily discharges, which are poor. Occasional diversion for sprinkler irrigation. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--25 years, 13.4 ft³/s, 11.03 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,160 ft³/s, June 26, 1968, gage height, 10.36 ft; no flow part of each day July 19, 28, 1966, Aug. 22-28, Sept. 3, 11, 1969.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 200 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 15	1800	278	7.19	Feb. 22	1900	*434	*8.27

Minimum discharge, 0.60 ft³/s, July 28, Aug. 9, 10, gage height, 1.70 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2.8	6.7	5.9	4.0	8.8	32	37	7.5	4.5	4.1	1.2	2.4
2	5.3	4.3	5.6	5.0	9.4	34	32	6.9	4.1	3.5	.97	1.9
3	5.0	3.4	5.7	20	8.5	21	27	5.9	13	3.6	.95	1.6
4	3.7	2.8	4.0	80	8.2	17	23	12	7.1	2.6	3.0	3.4
5	2.7	3.0	4.7	40	9.0	15	19	50	5.5	1.8	12	2.2
6	3.3	7.5	5.4	22	12	13	24	19	4.1	1.4	4.0	5.0
7	3.1	24	4.1	13	26	22	17	15	3.4	1.3	2.4	109
8	2.4	23	3.7	15	41	55	15	12	24	1.4	2.5	22
9	2.4	15	3.3	16	35	130	16	9.0	13	3.0	1.4	11
10	11	11	3.4	34	22	150	61	7.7	6.5	1.9	.80	9.1
11	10	7.8	3.5	21	16	140	71	7.3	6.4	3.4	.90	16
12	4.5	6.1	3.4	13	17	100	29	6.1	7.0	2.4	3.7	8.6
13	2.9	5.2	3.1	10	16	60	20	28	5.2	1.5	25	5.6
14	2.6	17	3.0	9.0	16	50	34	19	10	4.3	8.7	13
15	2.5	149	2.9	12	11	45	28	12	12	6.7	4.6	24
16	2.9	128	2.8	12	10	37	21	59	5.4	2.8	2.6	20
17	3.2	39	2.8	51	9.0	28	23	79	3.6	1.8	2.4	15
18	4.3	21	2.7	44	8.5	20	17	35	3.2	1.7	2.2	9.2
19	7.2	16	2.6	20	8.0	16	13	18	2.5	3.5	105	13
20	41	20	2.5	15	8.5	22	14	20	3.3	5.5	27	11
21	15	17	2.4	14	10	38	43	21	4.3	4.7	19	12
22	8.6	11	2.4	13	187	50	20	16	5.3	5.0	11	29
23	8.1	8.2	2.3	15	197	32	18	11	16	8.5	8.2	11
24	7.3	7.0	2.3	20	90	22	15	9.9	9.4	4.1	6.4	9.8
25	5.0	7.0	2.3	28	55	16	21	9.9	5.9	2.3	4.9	8.7
26	4.2	7.3	2.4	26	25	13	14	8.2	4.2	2.1	3.9	5.1
27	3.6	8.4	2.5	16	22	12	11	7.1	6.2	1.4	3.2	5.2
28	3.2	10	2.7	14	20	17	10	6.0	15	1.1	9.2	5.8
29	3.1	7.7	3.0	11	---	24	8.8	5.4	7.8	1.3	6.7	4.9
30	2.9	6.7	3.2	11	---	29	8.6	5.3	5.2	1.4	2.9	4.2
31	4.8	---	3.5	8.7	---	35	---	5.4	---	2.9	3.5	---
TOTAL	188.6	600.1	104.1	632.7	905.9	1295	710.4	533.6	223.1	93.0	290.22	398.7
MEAN	6.08	20.0	3.36	20.4	32.4	41.8	23.7	17.2	7.44	3.00	9.36	13.3
MAX	41	149	5.9	80	197	150	71	79	24	8.5	105	109
MIN	2.4	2.8	2.3	4.0	8.0	12	8.6	5.3	2.5	1.1	.80	1.6
CFSM	.37	1.21	.20	1.24	1.96	2.53	1.44	1.04	.45	.18	.57	.81
IN.	.43	1.35	.23	1.43	2.04	2.92	1.60	1.20	.50	.21	.65	.90

CAL YR 1989 TOTAL 4719.30 MEAN 12.9 MAX 193 MIN 1.8 CFSM .78 IN 10.64
WTR YR 1990 TOTAL 5975.42 MEAN 16.4 MAX 197 MIN .80 CFSM .99 IN 13.47

STREAMS TRIBUTARY TO LAKE ST. CLAIR

04164000 CLINTON RIVER NEAR FRASER, MI

LOCATION.--Lat 42°34'38", long 82°57'05", in SE1/4 NE1/4 sec.19, T.2 N., R.13 E., Macomb County, Hydrologic Unit 04090003, on right bank 50 ft downstream from bridge on Garfield Road, 2.8 mi north of Fraser, and 4.0 mi upstream from North Branch.

DRAINAGE AREA.--444 mi².

PERIOD OF RECORD.--May 1947 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 577.71 ft above National Geodetic Vertical Datum of 1929 (Macomb County bench mark). Prior to Nov. 17, 1949, and from May 29 to July 31, 1990, nonrecording gage at same site and datum. Nov. 17, 1949 to Apr. 5, 1990, water-stage recorder at site 800 ft downstream at same datum.

REMARKS.--Estimated daily discharges: Feb. 27 to May 28, May 31, June 1, 3, 5-8, 12-15, 21, 22, 26-30, and July 2, 5, 14-18, 20-23. Records good except those for the period Feb. 27 to Aug. 1, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--43 years, 383 ft³/s, 11.71 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 8,840 ft³/s, Oct. 1, 1981, gage height, 19.56 ft; minimum, 47 ft³/s, Sept. 6, 1955; minimum gage height, 4.29 ft, Sept. 7, 1954.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Apr. 5 or 6, 1947, reached a stage of 20 ft, from floodmark, and discharge of about 9,000 ft³/s.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 2,000 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 15	2000	4,020	15.77	Aug. 19	0600	3,980	15.73
Feb. 22	2200	*5,880	*17.48	Sept. 7	0700	4,300	16.05
Apr. 11	--	unknown	unknown				

Minimum discharge, 95 ft³/s, Aug. 2, gage height, 4.89 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	217	302	407	424	382	580	700	370	290	243	110	137
2	219	257	431	291	473	700	760	360	262	220	103	121
3	227	250	423	306	406	800	710	340	700	216	106	115
4	216	252	363	1150	384	620	650	400	321	181	148	116
5	214	247	429	1130	381	560	610	940	260	170	298	121
6	225	402	436	677	451	500	720	700	250	152	146	234
7	207	635	416	457	545	480	640	500	240	125	128	2950
8	182	626	402	414	669	470	550	490	740	116	117	821
9	169	519	347	428	706	900	450	460	545	146	109	433
10	384	553	408	592	608	1400	800	410	419	137	105	342
11	339	317	335	478	510	1350	1550	350	329	142	115	500
12	224	295	305	426	462	1250	1250	320	270	142	165	302
13	214	360	265	375	454	1150	1000	500	250	133	674	272
14	207	572	275	354	531	1050	900	640	540	200	287	411
15	225	1750	255	339	456	920	920	500	600	220	186	672
16	247	2460	238	347	500	1000	840	950	395	170	170	634
17	302	1300	237	827	538	1000	720	1400	329	200	141	423
18	283	768	231	968	465	850	640	1200	307	180	123	323
19	381	617	236	645	478	750	580	1000	260	213	2810	439
20	884	571	237	514	435	670	550	940	196	400	987	287
21	485	541	225	497	414	600	920	920	240	230	572	294
22	376	516	233	484	2640	700	800	700	250	250	406	609
23	330	503	215	474	3820	1050	720	680	568	260	307	337
24	321	450	218	508	1910	900	600	630	377	189	272	313
25	313	420	217	561	956	750	650	550	299	171	250	250
26	302	412	221	655	731	640	600	580	250	150	209	212
27	296	401	212	517	650	590	500	520	250	140	194	177
28	290	525	208	469	610	560	420	480	360	121	313	158
29	280	443	221	437	---	550	400	446	230	115	208	158
30	280	429	229	415	---	720	390	379	220	118	158	153
31	334	---	428	392	---	680	---	310	---	128	144	---
TOTAL	9173	17693	9303	16551	21565	24740	21540	18965	10547	5578	10061	12314
MEAN	296	590	300	534	770	798	718	612	352	180	325	410
MAX	884	2460	436	1150	3820	1400	1550	1400	740	400	2810	2950
MIN	169	247	208	291	381	470	390	310	196	115	103	115
CFSM	.67	1.33	.68	1.20	1.73	1.80	1.62	1.38	.79	.41	.73	.92
IN.	.77	1.48	.78	1.39	1.81	2.07	1.80	1.59	.88	.47	.84	1.03

CAL YR 1989 TOTAL 151031 MEAN 414 MAX 2500 MIN 132 CFSM .93 IN 12.65
WTR YR 1990 TOTAL 178030 MEAN 488 MAX 3820 MIN 103 CFSM 1.10 IN 14.92

STREAMS TRIBUTARY TO LAKE ST. CLAIR

04164100 EAST POND CREEK AT ROMEO, MI

LOCATION.--Lat 42°49'21", long 83°01'13", in NE1/4 SE1/4 sec.27, T.5 N., R.12 E., Macomb County, Hydrologic Unit 04090003, on right bank at upstream side of bridge on State Highway 53, 1.4 mi north of Romeo.

DRAINAGE AREA.--21.8 mi².

PERIOD OF RECORD.--September 1958 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 780 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 4 to Jan. 8, Jan. 13, 14, Feb. 25 to Mar. 1, and Sept. 27-30. Records good except for estimated daily discharges, which are fair. Occasional regulation by lakes upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--32 years, 16.2 ft³/s, 10.09 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 358 ft³/s, Feb. 10, 1965, gage height, 4.48 ft; maximum gage height, 4.56 ft, Mar. 12, 1962, backwater from ice; minimum discharge, 0.8 ft³/s, July 30, 31, 1964, Aug. 6, 7, 1965; minimum gage height, 0.71 ft, July 21, 1959.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 80 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Jan. 5	0900	ice jam	*2.92	May 17	1400	*80	2.38

Minimum daily discharge, 3.7 ft³/s, July 29.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	6.2	11	17	12	21	28	38	18	19	9.0	4.1	6.1
2	6.6	11	17	15	21	26	35	15	18	8.2	4.0	5.6
3	6.3	11	16	20	20	26	34	15	19	5.5	3.8	5.5
4	6.1	10	15	25	20	25	32	17	19	5.3	3.8	5.0
5	5.8	9.4	14	35	19	23	31	26	18	5.8	4.4	4.7
6	6.2	11	13	26	19	22	31	23	18	5.6	4.9	6.0
7	5.8	13	13	20	20	22	29	23	16	5.3	5.7	20
8	5.8	15	12	18	26	22	27	21	21	5.1	4.9	13
9	5.7	13	12	20	29	28	26	19	21	5.2	4.4	11
10	8.6	12	11	23	27	42	32	18	18	5.0	4.0	9.5
11	9.4	11	10	22	25	56	39	17	16	5.4	3.8	8.8
12	8.3	11	10	21	24	65	36	17	15	5.9	3.8	8.2
13	7.6	11	9.8	20	24	70	33	31	14	5.8	6.3	7.7
14	6.8	15	9.6	19	25	66	37	30	16	6.5	5.8	9.7
15	6.6	41	9.5	18	24	61	37	27	15	7.3	5.2	12
16	4.9	53	9.4	19	24	64	36	32	10	8.1	5.3	13
17	6.3	44	9.2	36	23	57	39	61	10	8.7	4.9	12
18	7.0	37	9.0	41	22	50	21	58	11	6.7	4.8	11
19	9.6	33	8.8	34	21	44	27	48	10	6.5	9.6	12
20	19	31	8.6	30	20	39	28	51	9.8	6.6	9.3	11
21	17	28	8.6	29	19	36	33	50	11	6.4	8.6	10
22	14	24	8.6	28	37	38	30	46	11	7.4	7.8	11
23	15	21	8.5	26	58	50	26	42	13	7.2	7.3	11
24	13	19	8.4	27	47	40	25	39	13	6.6	6.3	10
25	12	18	8.3	30	44	34	24	36	11	6.0	6.2	9.8
26	11	17	8.2	30	38	32	23	35	10	5.3	5.9	9.4
27	11	19	8.2	27	33	29	22	32	9.9	4.8	5.7	9.3
28	11	20	8.3	26	31	27	21	30	9.4	4.0	8.9	8.6
29	10	17	8.4	24	---	26	20	28	9.4	3.7	8.7	8.2
30	8.4	16	8.5	22	---	31	19	25	9.2	3.9	7.9	8.4
31	9.9	---	9.8	21	---	29	---	22	---	4.3	7.0	---
TOTAL	280.9	602.4	327.7	764	761	1208	891	952	420.7	187.1	183.1	287.5
MEAN	9.06	20.1	10.6	24.6	27.2	39.0	29.7	30.7	14.0	6.04	5.91	9.58
MAX	19	53	17	41	58	70	39	61	21	9.0	9.6	20
MIN	4.9	9.4	8.2	12	19	22	19	15	9.2	3.7	3.8	4.7
CFSM	.42	.92	.49	1.13	1.25	1.79	1.36	1.41	.64	.28	.27	.44
IN.	.48	1.03	.56	1.30	1.30	2.06	1.52	1.62	.72	.32	.31	.49

CAL YR 1989 TOTAL 6139.6 MEAN 16.8 MAX 146 MIN 4.6 CFSM .77 IN 10.48
WTR YR 1990 TOTAL 6865.4 MEAN 18.8 MAX 70 MIN 3.7 CFSM .86 IN 11.71

04164300 EAST BRANCH COON CREEK AT ARMADA, MI

LOCATION.--Lat 42°50'45", long 82°53'06", in NE1/4 sec.23, T.5 N., R.13 E., Macomb County, Hydrologic Unit 04090003, on right bank at downstream side of bridge on Prospect Street in Armada.

DRAINAGE AREA.--13.0 mi².

PERIOD OF RECORD.--October 1958 to current year.

REVISED RECORDS.--WDR MI-83: 1982.

GAGE.--Water-stage recorder and concrete control. Elevation of gage is 735 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 11-23, Feb. 16, 17, 19, and Feb. 25 to Mar. 1. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--32 years, 7.17 ft³/s, 7.49 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 910 ft³/s, Apr. 19, 1975, gage height, 6.69 ft; no flow Jan. 25 to Feb. 9, 1961, result of freezeup.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 100 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Feb. 8	2400	148	3.27	Mar. 11	2400	*163	*3.38
Feb. 23	0100	150	3.28	May 17	2100	124	3.08

Minimum daily discharge, 0.02 ft³/s, Dec. 30.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.55	.09	2.8	.07	4.1	4.2	20	2.0	1.1	.17	.09	.14
2	.51	.10	2.5	.07	3.4	9.3	26	1.7	1.1	.17	.07	.20
3	.55	.11	2.2	.05	3.4	20	21	1.5	1.3	.16	.07	.33
4	.48	.11	1.8	.08	3.4	14	21	2.1	1.5	.14	.11	.31
5	.44	.09	1.6	.85	3.1	7.8	14	4.6	1.2	.19	.11	.35
6	.54	.05	1.7	7.5	3.4	5.2	12	2.7	.90	.16	.12	.77
7	.54	.16	1.6	10	4.9	3.8	8.4	2.3	.76	.15	.12	.90
8	.56	.15	1.4	6.6	44	3.4	5.9	1.8	.89	.14	.11	.99
9	.49	.16	1.3	8.9	81	55	4.5	1.5	.84	.25	.12	.68
10	.69	.13	1.2	21	38	120	21	1.4	.75	.27	.12	.70
11	.57	.11	1.1	15	16	124	56	1.2	.62	.30	.14	.45
12	.54	.10	1.1	8.3	8.2	134	25	1.1	.47	.27	.35	.28
13	.50	.08	1.0	5.4	8.8	106	13	2.4	.43	.18	.57	.29
14	.47	.19	1.0	3.7	11	55	31	2.1	.97	.24	.16	.83
15	.10	17	.95	3.2	4.9	31	31	1.6	.56	.13	.21	.45
16	.08	73	.90	4.4	4.6	43	14	7.0	.39	.11	.26	1.1
17	.17	36	.85	49	4.3	35	10	52	.28	.11	.17	.75
18	.16	16	.80	61	4.1	15	7.4	57	.21	.13	.20	.56
19	.25	8.3	.75	19	3.5	8.7	5.2	23	.17	.22	.50	.85
20	.40	7.2	.70	11	3.1	6.5	4.8	17	.25	.32	.22	.51
21	.27	7.2	.65	7.2	2.8	5.6	8.5	19	.24	.13	.17	.51
22	.23	5.8	.60	6.2	23	19	6.6	9.9	.34	.14	.17	.55
23	.16	4.1	.55	4.9	97	59	5.1	5.6	.42	.15	.17	.46
24	.14	3.4	.45	9.4	57	18	4.0	3.9	.46	.15	.21	.38
25	.12	3.1	.30	18	8.2	9.0	3.3	3.2	.36	.14	.21	.31
26	.10	3.0	.19	26	7.2	6.4	2.8	2.7	.27	.14	.17	.33
27	.09	2.9	.13	13	6.2	4.7	2.6	2.4	.23	.14	.23	.23
28	.07	4.8	.10	8.8	5.3	4.0	2.7	2.0	.21	.13	.51	.29
29	.04	4.2	.04	6.7	---	3.5	2.5	1.7	.19	.12	.19	.47
30	.05	3.1	.02	5.7	---	6.7	2.4	1.5	.19	.09	.18	.61
31	.07	---	.04	4.9	---	7.1	---	1.2	---	.09	.20	---
TOTAL	9.93	200.73	30.32	345.92	463.9	943.9	391.7	239.1	17.60	5.23	6.23	15.58
MEAN	.32	6.69	.98	11.2	16.6	30.4	13.1	7.71	.59	.17	.20	.52
MAX	.69	73	2.8	61	97	134	56	57	1.5	.32	.57	1.1
MIN	.04	.05	.02	.05	2.8	3.4	2.4	1.1	.17	.09	.07	.14
CFSM	.03	.52	.08	.86	1.28	2.34	1.01	.59	.05	.01	.02	.04
IN.	.03	.57	.09	.99	1.33	2.70	1.12	.68	.05	.01	.02	.04

CAL YR 1989 TOTAL 1718.18 MEAN 4.71 MAX 169 MIN .02 CFSM .36 IN 4.92
WTR YR 1990 TOTAL 2670.14 MEAN 7.32 MAX 134 MIN .02 CFSM .56 IN 7.64

STREAMS TRIBUTARY TO LAKE ST. CLAIR

04164500 NORTH BRANCH CLINTON RIVER NEAR MOUNT CLEMENS, MI

LOCATION.--Lat 42°37'45", long 82°53'25", in SW1/4 sec.35, T.3 N., R.13 E., Macomb County, Hydrologic Unit 04090003, on left bank 30 ft upstream from bridge on State Highway 59, 2 mi north of Mount Clemens, and 3.6 mi upstream from mouth.

DRAINAGE AREA.--199 mi².

PERIOD OF RECORD.--May 1947 to current year.

REVISED RECORDS.--WSP 1437: 1948. WSP 1557: Drainage area.

GAGE.--Water-stage recorder. Concrete control since September 1961. Datum of gage is 576.38 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Nov. 15, 1949, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 4 to Jan. 5, Jan. 12-14, 19, 20, Feb. 17-20, Feb. 25 to Mar. 8, and Apr. 8 to May 17. Records good expect for estimated daily discharge, which are fair. Some regulation at times by mill upstream from station. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--43 years, 127 ft³/s, 8.67 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,700 ft³/s, Feb. 2, 1968, gage height, 18.62 ft; minimum, 0.08 ft³/s, part of each day July 4-10, 14, 15, 1988; minimum gage height, 3.12 ft, Sept. 13, 14, 1954.

EXTREMES OUTSIDE PERIOD OF RECORD.--Flood of Apr. 5 or 6, 1947, reached a stage of 20.0 ft, from floodmark.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,200 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 16	2200	1,730	12.83	Mar. 12	0600	1,390	12.16
Feb. 23	2100	*2,040	*13.38				

Minimum discharge, 1.4 ft³/s, Aug. 4, gage height, 3.90 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	24	42	97	34	112	240	296	70	45	20	4.8	12
2	22	47	87	39	104	235	434	68	40	18	3.5	9.9
3	21	46	79	45	104	350	449	68	44	15	2.6	8.3
4	21	44	75	70	113	375	389	80	44	12	2.2	7.4
5	20	42	70	350	100	250	338	200	40	9.6	4.1	7.0
6	20	43	63	555	98	200	326	150	37	8.1	9.5	7.5
7	20	52	56	531	109	170	321	110	34	6.8	9.8	37
8	21	121	51	380	275	155	310	90	36	6.7	9.8	42
9	20	147	46	273	531	236	300	84	46	7.8	12	36
10	21	121	45	318	797	679	350	75	45	5.7	8.1	25
11	27	88	41	382	568	1280	500	66	37	5.6	5.5	20
12	36	71	39	290	278	1370	350	64	31	8.0	6.0	17
13	35	61	36	200	189	1370	270	130	28	8.8	10	15
14	29	60	35	150	199	1190	340	120	31	12	14	15
15	25	289	34	138	213	741	380	100	54	14	14	17
16	23	1250	32	130	177	530	280	122	43	16	12	29
17	22	1440	31	236	165	518	210	373	32	15	12	31
18	21	742	29	557	150	509	180	566	25	13	12	28
19	25	395	28	650	140	341	140	727	22	13	14	26
20	57	236	27	450	130	241	130	473	20	15	21	26
21	132	209	26	325	121	202	250	331	19	20	25	28
22	121	178	25	210	288	191	230	322	23	19	22	30
23	84	128	23	166	1630	418	190	218	28	18	19	29
24	66	113	23	179	1710	626	140	155	36	16	17	27
25	62	99	22	253	700	418	120	121	34	15	16	23
26	57	90	22	332	470	248	100	102	28	12	14	20
27	52	89	23	345	350	196	95	90	24	9.8	13	18
28	48	103	24	247	270	162	86	79	21	7.5	14	17
29	45	190	26	190	---	143	82	68	20	5.9	17	16
30	43	131	26	149	---	174	75	59	20	5.7	19	15
31	41	---	30	144	---	279	---	52	---	5.2	14	---
TOTAL	1261	6667	1271	8318	10091	14037	7661	5333	987	364.2	376.9	639.1
MEAN	40.7	222	41.0	268	360	453	255	172	32.9	11.7	12.2	21.3
MAX	132	1440	97	650	1710	1370	500	727	54	20	25	42
MIN	20	42	22	34	98	143	75	52	19	5.2	2.2	7.0
CFSM	.21	1.12	.21	1.35	1.81	2.28	1.28	.86	.17	.06	.06	.11
IN.	.24	1.25	.24	1.55	1.89	2.62	1.43	1.00	.18	.07	.07	.12

CAL YR 1989 TOTAL 42876.0 MEAN 117 MAX 1490 MIN 11 CFSM .59 IN 8.01
WTR YR 1990 TOTAL 57006.2 MEAN 156 MAX 1710 MIN 2.2 CFSM .78 IN 10.66

04165500 CLINTON RIVER AT MOUNT CLEMENS, MI
(National stream quality accounting network station)

LOCATION.--Lat 42°35'45", long 82°54'35", Macomb County, Hydrologic Unit 04090003, on left bank at downstream side of bridge on Moravian Drive, 0.2 mi downstream from North Branch, and 0.5 mi west of Mount Clemens.

DRAINAGE AREA.--734 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--May 1934 to current year.

REVISED RECORDS.--WSP 1084: 1943, 1945-46. WSP 1937: 1935, 1936(M), 1937-39, 1949(M), 1950. WSP 1557: Drainage area. WSP 1727: 1952(M), 1954(M).

GAGE.--Water-stage recorder. Datum of gage is 570.43 ft above National Geodetic Vertical Datum of 1929. May 10, 1934 to Jan. 11, 1939, nonrecording gage at same site and datum. Auxiliary gage is a water-stage recorder on right bank 2.0 mi downstream from base gage at same datum. Mar. 15, 1938 to Jan. 3, 1952, auxiliary nonrecording gage 1.6 mi downstream from base gage at same datum.

REMARKS.--Estimated daily discharges: Oct. 1-9, Dec. 14 to Jan. 3, July 6-13, July 25 to Aug. 4, Aug. 7-11, 16-18, and Sept. 1-5. Water-discharge records fair. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--56 years, 547 ft³/s, 10.12 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 21,200 ft³/s, Apr. 6, 1947, gage height, 23.55 ft, from floodmark; minimum not determined; minimum gage height, 2.72 ft, Nov. 29, 1963.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,000 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 16	0400	5,000	11.50	Aug. 19	1300	3,300	9.60
Feb. 23	0400	*7,800	*14.50	Sept. 7	1200	3,920	10.32
Mar. 12	0100	3,040	9.27				

Minimum daily discharge, 120 ft³/s, Aug. 1, 2.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	280	366	565	450	566	935	1100	495	389	282	120	170
2	270	320	574	370	647	1000	1350	487	341	256	120	150
3	270	312	528	400	582	1360	1280	451	794	240	140	140
4	260	334	467	1520	583	1150	1120	577	416	228	150	140
5	255	325	542	1980	559	961	1060	1450	328	210	345	150
6	265	439	555	1300	631	805	1180	871	313	170	194	241
7	245	702	511	969	771	745	1050	673	294	140	160	2970
8	220	849	496	803	1190	723	931	656	844	170	145	1180
9	210	682	449	732	1560	1440	824	612	742	160	130	544
10	422	655	491	1040	1650	2450	1370	519	493	165	130	399
11	454	447	422	931	1280	2970	2620	455	389	165	155	581
12	308	365	393	812	889	2980	1910	426	327	170	195	356
13	291	424	358	645	745	2880	1360	883	295	150	751	313
14	264	605	330	557	845	2480	1350	808	612	226	362	419
15	274	1960	310	511	741	1820	1440	653	725	253	231	887
16	274	4640	300	517	777	1700	1220	1630	459	190	200	789
17	329	3270	290	1260	818	1690	1020	2220	378	227	170	571
18	316	1830	290	1880	701	1460	908	2100	341	185	150	389
19	391	1200	285	1520	711	1210	809	1790	293	282	2410	551
20	1110	941	285	1250	620	996	761	1490	244	462	1290	378
21	665	855	280	938	598	889	1490	1360	285	266	693	286
22	527	783	280	784	2660	916	1230	1120	294	283	474	839
23	458	712	275	730	7030	1820	1040	979	648	307	350	493
24	424	632	270	774	4380	1630	846	881	493	219	302	381
25	402	595	265	941	2090	1240	886	745	352	200	286	359
26	382	567	265	1170	1450	965	788	772	299	180	245	281
27	370	568	260	986	1210	873	628	685	302	160	228	240
28	360	708	255	824	1050	810	568	614	446	140	394	224
29	349	680	270	709	---	781	529	566	272	140	260	228
30	343	620	290	632	---	1040	519	472	257	150	208	187
31	379	---	520	591	---	1070	---	415	---	130	193	---
TOTAL	11367	27386	11671	28526	37334	43789	33187	27855	12665	6506	11181	14836
MEAN	367	913	376	920	1333	1413	1106	899	422	210	361	495
MAX	1110	4640	574	1980	7030	2980	2620	2220	844	462	2410	2970
MIN	210	312	255	370	559	723	519	415	244	130	120	140
CFSM	.50	1.24	.51	1.25	1.82	1.93	1.51	1.23	.58	.29	.49	.67
IN.	.58	1.39	.59	1.45	1.89	2.22	1.68	1.41	.64	.33	.57	.75

CAL YR 1989 TOTAL 225311 MEAN 617 MAX 4640 MIN 170 CFSM .84 IN 11.42
WTR YR 1990 TOTAL 266303 MEAN 730 MAX 7030 MIN 120 CFSM 1.00 IN 13.50

STREAMS TRIBUTARY TO LAKE ST. CLAIR

04165500 CLINTON RIVER AT MOUNT CLEMENS, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1967, 1969, 1973 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: October 1974 to September 1981.
WATER TEMPERATURE: October 1974 to September 1981.

INSTRUMENTATION.--Water-quality monitor from Aug. 13, 1975 to Sept. 6, 1981.

REMARKS.--Quarterly cross-sectional samples were collected at bridge.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1975-76, 1978-81): Maximum, 3,580 microsiemens, Jan. 26, 1978; minimum, 126 microsiemens, July 29, 1976.
WATER TEMPERATURE (water years 1975-81): Maximum, 29.5°C, Sept. 20, 1978; minimum, 0.0°C on many days during winter.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
DEC										
13...	1330	338	947	8.2	0.5	3.1	13.5	96	4000	830
APR										
03...	1100	1350	772	8.4	5.5	7.2	11.2	91	K900	760
JUN										
14...	1130	391	845	8.2	20.5	17	6.0	68	>600	>2000
SEP										
11...	1200	654	596	8.2	21.0	34	6.2	71	K6800	K2600

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
DEC										
13...	310	84	83	25	70	33	2	4.5	276	0
APR										
03...	280	81	77	21	49	27	1	4.1	227	7
JUN										
14...	270	62	72	22	63	33	2	4.7	254	0
SEP										
11...	190	--	52	15	44	33	1	3.6	--	--

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)
DEC									
13...	226	58	120	0.3	6.1	548	0.75	500	0.02
APR									
03...	198	46	87	<0.1	4.7	467	0.64	1700	0.02
JUN									
14...	208	54	120	0.5	5.2	499	0.68	527	0.07
SEP									
11...	--	35	77	0.3	4.8	350	0.48	618	0.02

04165500 CLINTON RIVER AT MOUNT CLEMENS, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN,AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS TOTAL (MG/L AS P)	PHOSPHORUS DISSOLVED (MG/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)
DEC 13...	2.4	0.28	0.28	0.70	0.15	0.10	0.10	<10	<1	51
APR 03...	1.6	0.09	0.09	0.70	0.09	0.03	0.02	<10	1	44
JUN 14...	2.5	0.15	0.14	1.5	0.12	0.12	0.12	20	2	55
SEP 11...	1.3	0.06	0.04	0.70	0.11	0.04	0.05	20	1	45

DATE	BERYLLIUM, DISSOLVED (UG/L AS BE)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)
DEC 13...	<0.5	<1	1	<3	1	14	<1	9	50	<0.1
APR 03...	<0.5	<1	--	<3	--	22	--	6	28	<0.1
JUN 14...	<0.5	<1	<1	<3	13	9	<1	11	35	<0.1
SEP 11...	<0.5	<1	6	<3	2	12	1	8	8	<0.1

DATE	MOLYBDENUM, DISSOLVED (UG/L AS MO)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
DEC 13...	<10	5	<1	<1.0	220	<6	14	12	11	100
APR 03...	<10	--	<1	2.0	210	<6	14	29	106	95
JUN 14...	10	5	<1	<1.0	220	<6	9	57	60	100
SEP 11...	<10	3	<1	<1.0	170	<6	7	142	251	99

STREAMS TRIBUTARY TO DETROIT RIVER

04166000 RIVER ROUGE AT BIRMINGHAM, MI

LOCATION.--Lat 42°32'45", long 83°13'25", in NW1/4 sec.36, T.2 N., R.10 E., Oakland County, Hydrologic Unit 04090004, on left bank 25 ft downstream from mouth of Quarton Lake outlet, and 100 ft upstream from bridge on Maple Road at Birmingham.

DRAINAGE AREA.--33.3 mi². Prior to water year 1971, drainage area was 36.9 mi². An area of 3.6 mi² noncontributing since then.

PERIOD OF RECORD.--June 1950 to current year.

REVISED RECORDS.--WSP 1387: 1951-52(M). WSP 1557: Drainage area.

GAGE.--Water-stage recorder. Concrete control since July 27, 1962. Datum of gage is 715.94 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--No estimated daily discharges. Records good. Occasional regulation by Quarton Lake upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--20 years (water years 1951-70), 15.3 ft³/s, 5.63 in/yr; 20 years (water years 1971-90), 23.4 ft³/s, 9.54 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,390 ft³/s, June 26, 1968, gage height, 8.70 ft; minimum, 0.10 ft³/s, Aug. 8, 9, 1963; minimum gage height, 1.02 ft, Oct. 12, 1961.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 180 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 15	2100	294	3.88	Apr. 10	2000	184	3.24
Jan. 4	1900	222	3.47	Aug. 18	2400	353	a4.20
Feb. 22	2000	*457	*4.70	Sept. 7	0300	326	4.06

a From graph based on gage readings.

Minimum discharge, 4.9 ft³/s, Aug. 3, 4, gage height, 1.62 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	9.2	13	18	22	19	38	56	20	13	14	5.4	8.4
2	9.8	11	18	15	25	44	51	20	14	11	5.5	8.1
3	9.7	11	17	16	19	49	41	19	29	9.7	5.4	7.6
4	9.2	10	14	118	17	39	35	40	17	9.0	10	7.5
5	9.5	9.9	14	71	16	34	37	70	13	8.1	19	7.5
6	10	11	14	34	18	32	39	34	13	7.3	10	29
7	9.2	34	13	27	29	30	34	26	12	7.2	8.1	220
8	8.7	32	12	25	44	31	31	22	55	7.4	7.1	47
9	8.1	19	11	32	46	87	28	19	29	8.6	7.1	22
10	24	21	12	49	32	113	104	19	17	7.8	6.4	28
11	18	20	13	33	23	112	96	20	14	8.3	6.2	37
12	12	18	13	27	20	97	51	20	13	8.2	14	20
13	9.2	17	12	22	21	87	42	55	13	7.4	54	15
14	8.6	38	12	21	26	68	58	35	33	12	19	33
15	8.1	177	12	21	25	52	50	28	22	13	12	52
16	7.7	164	12	23	24	73	41	88	14	9.1	9.0	44
17	8.1	69	12	79	22	58	40	111	12	7.8	8.0	28
18	9.7	43	11	68	20	44	34	64	12	7.2	15	18
19	18	33	11	38	19	41	31	40	11	7.8	209	28
20	47	33	11	31	18	39	40	44	12	8.2	56	21
21	24	27	11	29	17	37	75	40	16	8.6	32	35
22	17	24	9.9	27	211	68	44	31	22	12	23	56
23	14	23	9.9	26	244	93	36	28	47	12	20	25
24	14	22	9.4	33	97	54	32	28	26	9.2	18	19
25	12	21	9.7	39	57	43	34	26	17	7.9	15	17
26	11	21	10	38	46	38	30	24	15	7.2	13	16
27	10	21	10	29	43	33	27	20	17	6.2	12	15
28	10	24	10	27	40	30	24	18	13	5.6	13	14
29	9.6	20	11	24	---	30	22	16	12	5.6	12	13
30	9.1	19	12	23	---	57	21	15	15	5.6	10	13
31	12	---	21	21	---	45	---	14	---	5.6	9.6	---
TOTAL	396.5	1005.9	385.9	1088	1238	1696	1284	1054	568	264.6	663.8	904.1
MEAN	12.8	33.5	12.4	35.1	44.2	54.7	42.8	34.0	18.9	8.54	21.4	30.1
MAX	47	177	21	118	244	113	104	111	55	14	209	220
MIN	7.7	9.9	9.4	15	16	30	21	14	11	5.6	5.4	7.5
CFSM	.38	1.01	.37	1.05	1.33	1.64	1.29	1.02	.57	.26	.64	.90
IN.	.44	1.12	.43	1.22	1.38	1.89	1.43	1.18	.63	.30	.74	1.01

CAL YR 1989 TOTAL 9668.1 MEAN 26.5 MAX 500 MIN 7.0 CFSM .80 IN 10.80
WTR YR 1990 TOTAL 10548.8 MEAN 28.9 MAX 244 MIN 5.4 CFSM .87 IN 11.78

04166100 RIVER ROUGE AT SOUTHFIELD, MI

LOCATION.--Lat 42°26'52", long 83°17'52", in SW1/4 sec.32, T.1 N., R.10 E., Oakland County, Hydrologic Unit 04090004, on right bank at downstream side of bridge on Beech Road at Southfield, and 4.2 mi east of Farmington.

DRAINAGE AREA.--87.9 mi².

PERIOD OF RECORD.--April 1958 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 609.62 ft, City of Southfield datum. Prior to Sept. 30, 1958, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 18 to Jan. 3 and Feb. 25-28. Records good. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--32 years, 64.4 ft³/s, 9.95 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,900 ft³/s, June 26, 1968, gage height, 19.04 ft; minimum, 0.1 ft³/s, Aug. 2, 1964, gage height, 1.15 ft.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 700 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 15	2200	1,200	11.31	May 17	1400	714	9.46
Jan. 4	2100	749	9.60	Aug. 19	1400	740	9.53
Feb. 22	2400	*1,800	*12.91	Sept. 7	0800	1,350	11.66
Apr. 10	2300	735	9.50				

Minimum discharge, 14 ft³/s, Aug. 2, 3, 4, gage height, 2.89 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	25	41	46	62	55	111	152	51	31	70	15	20
2	30	31	45	43	90	134	146	49	32	47	14	19
3	32	28	43	47	66	161	112	47	116	37	14	18
4	31	26	45	393	60	114	94	119	48	31	34	18
5	30	26	43	473	57	96	96	263	36	28	72	17
6	36	51	39	158	69	90	103	96	34	24	27	44
7	32	134	42	107	101	86	91	69	31	22	22	984
8	30	107	35	94	145	81	82	60	161	22	18	172
9	31	56	33	100	152	368	74	53	91	24	17	70
10	87	60	36	202	106	465	350	49	47	22	16	52
11	56	50	35	117	76	507	411	50	37	24	15	68
12	31	41	33	86	64	381	157	48	32	24	26	47
13	24	37	28	66	64	278	117	187	31	21	156	37
14	22	68	35	62	90	206	185	99	129	37	57	82
15	21	571	31	57	117	155	148	70	69	36	30	150
16	22	900	36	65	130	277	113	351	39	26	23	139
17	29	228	33	379	96	186	111	521	31	39	20	82
18	32	126	31	244	82	131	91	206	28	20	19	50
19	69	95	30	119	71	115	83	106	25	59	563	110
20	148	90	29	90	64	120	111	113	25	37	181	62
21	71	76	28	84	68	111	265	102	62	33	90	76
22	46	66	28	79	730	211	134	75	78	51	61	182
23	36	61	28	75	1280	354	102	65	157	43	48	69
24	34	56	27	104	452	159	88	61	80	26	42	49
25	34	54	27	124	180	124	82	58	46	22	37	42
26	33	54	27	122	140	104	76	55	37	19	32	37
27	28	52	28	81	120	85	70	50	88	17	30	33
28	27	71	29	75	115	78	64	43	99	16	29	31
29	27	53	31	67	---	76	58	39	47	15	28	30
30	25	47	38	62	---	153	55	35	153	16	24	30
31	40	---	58	57	---	115	---	34	---	16	22	---
TOTAL	1219	3356	1077	3894	4840	5632	3821	3224	1920	924	1782	2820
MEAN	39.3	112	34.7	126	173	182	127	104	64.0	29.8	57.5	94.0
MAX	148	900	58	473	1280	507	411	521	161	70	563	984
MIN	21	26	27	43	55	76	55	34	25	15	14	17
CFSM	.45	1.27	.40	1.43	1.97	2.07	1.45	1.18	.73	.34	.65	1.07
IN.	.52	1.42	.46	1.65	2.05	2.38	1.62	1.36	.81	.39	.75	1.19

CAL YR 1989 TOTAL 28779 MEAN 78.8 MAX 1610 MIN 19 CFSM .90 IN 12.18
WTR YR 1990 TOTAL 34509 MEAN 94.5 MAX 1280 MIN 14 CFSM 1.08 IN 14.60

STREAMS TRIBUTARY TO DETROIT RIVER

04166200 EVANS DITCH AT SOUTHFIELD, MI

LOCATION.--Lat 42°27'28", long 83°16'03", in SE1/4 sec.28, T.1 N., R.10 E., Oakland County, Hydrologic Unit 04090004, on right bank 70 ft upstream from bridge on Nine Mile Road at Southfield, 1.6 mi upstream from mouth, and 5.5 mi east of Farmington.

DRAINAGE AREA.--9.49 mi².

PERIOD OF RECORD.--September 1958 to current year.

GAGE.--Water-stage recorder. Datum of gage is 615.07 ft, City of Southfield datum.

REMARKS.--Estimated daily discharges: Dec. 15-31 and Feb. 22, 24, 25. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--32 years, 8.57 ft³/s, 12.26 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,200 ft³/s, Oct. 1, 1981, gage height, 15.03 ft, from floodmark, from rating curve extended above 410 ft³/s; no flow June 13-15, 1986, caused by regulation of unknown source.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 330 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 15	1945	449	9.90	Aug. 19	0330	511	10.27
Feb. 22	--	531	*a10.58	Sept. 7	0515	*555	10.55
July 19	2000	394	9.49				

a Ice jam.

Minimum daily discharge, 1.2 ft³/s, Oct. 13, Aug. 11.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	1.8	1.9	2.5	5.7	4.3	9.0	17	3.3	2.3	3.0	1.6	1.9
2	2.4	1.8	2.6	3.7	13	17	13	3.0	3.6	2.2	1.6	1.9
3	2.1	1.5	2.3	9.3	5.3	13	7.6	2.9	39	2.1	1.6	1.7
4	2.0	1.5	2.3	88	5.0	8.5	6.5	32	4.6	1.9	20	1.9
5	2.3	2.5	2.3	11	6.3	7.2	11	48	3.4	1.8	4.5	1.9
6	2.7	12	2.2	5.6	11	6.7	6.5	8.0	3.0	1.7	3.1	53
7	1.9	44	2.0	4.8	14	5.9	5.8	5.2	2.6	1.6	2.7	185
8	1.9	5.5	1.8	4.6	12	7.3	4.9	4.4	57	1.6	1.5	5.8
9	1.9	3.8	1.9	12	14	74	4.8	3.9	4.4	1.8	1.4	3.8
10	23	8.2	1.9	13	6.9	46	75	3.9	3.3	1.7	1.4	3.7
11	1.7	3.1	1.9	6.2	5.3	42	20	3.3	2.8	3.2	1.2	3.2
12	1.3	2.5	1.8	5.1	4.6	28	10	3.9	2.6	2.0	16	2.8
13	1.2	2.3	1.8	3.8	5.9	17	7.9	37	2.6	1.6	48	2.8
14	1.3	8.5	1.7	3.4	9.0	12	26	5.5	42	10	2.5	32
15	2.0	134	1.6	3.7	5.5	9.3	11	7.6	3.6	2.6	1.9	5.5
16	2.5	40	1.5	5.4	9.3	28	7.8	79	2.5	2.0	1.8	34
17	6.2	8.0	1.5	66	8.0	11	7.8	46	2.5	19	1.7	4.4
18	1.9	5.4	1.5	16	6.9	8.0	5.6	10	2.5	2.3	2.2	3.2
19	23	4.4	1.5	6.9	7.2	8.5	5.1	6.6	2.1	68	123	24
20	15	4.6	1.4	5.8	5.5	8.1	22	12	4.2	11	5.5	4.3
21	4.9	4.1	1.4	6.3	5.9	6.8	29	5.6	5.1	7.5	7.4	30
22	2.4	4.0	1.4	6.5	260	37	8.6	4.4	29	22	3.4	11
23	2.0	3.6	1.3	5.9	106	17	6.6	4.1	11	4.0	2.8	4.2
24	2.0	3.3	1.3	10	17	8.5	5.7	3.7	3.3	2.8	2.5	3.2
25	2.0	3.4	1.3	15	12	7.1	5.1	3.5	2.3	2.3	2.3	2.8
26	1.9	3.4	1.3	7.3	9.9	6.1	4.6	3.2	2.1	2.2	2.2	2.6
27	1.9	4.4	1.3	5.4	9.9	5.6	4.1	3.0	25	2.0	2.1	2.4
28	1.9	8.6	1.4	5.0	8.4	5.3	3.9	2.7	4.3	1.9	2.3	2.3
29	1.9	2.6	1.6	4.5	---	6.5	3.6	2.5	3.1	1.7	2.3	2.2
30	1.9	2.6	2.5	4.1	---	20	3.4	2.6	33	1.7	2.2	2.9
31	6.7	---	20	3.7	---	7.3	---	2.4	---	1.7	1.9	---
TOTAL	127.6	335.5	72.8	353.7	588.1	493.7	349.9	363.2	308.8	190.9	274.6	440.4
MEAN	4.12	11.2	2.35	11.4	21.0	15.9	11.7	11.7	10.3	6.16	8.86	14.7
MAX	23	134	20	88	260	74	75	79	57	68	123	185
MIN	1.2	1.5	1.3	3.4	4.3	5.3	3.4	2.4	2.1	1.6	1.2	1.7
CFSM	.43	1.18	.25	1.20	2.21	1.68	1.23	1.23	1.09	.65	.93	1.55
IN.	.50	1.31	.29	1.39	2.31	1.94	1.37	1.42	1.21	.75	1.08	1.73

CAL YR 1989 TOTAL 2885.2 MEAN 7.90 MAX 150 MIN 1.2 CFSM .83 IN 11.31
WTR YR 1990 TOTAL 3899.2 MEAN 10.7 MAX 260 MIN 1.2 CFSM 1.13 IN 15.28

STREAMS TRIBUTARY TO DETROIT RIVER

04166300 UPPER RIVER ROUGE AT FARMINGTON, MI

LOCATION.--Lat 42°27'52", long 83°22'11", in NW1/4 sec.27, T.1 N., R.9 E., Oakland County, Hydrologic Unit 04090004, on left bank 800 ft downstream from bridge on Shiawassee Road at Farmington.

DRAINAGE AREA.--17.5 mi².

PERIOD OF RECORD.--March 1958 to current year.

REVISED RECORDS.--WSP 1912: 1959(M), 1960(M).

GAGE.--Water-stage recorder and concrete control. Datum of gage is 690.4 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 8 to Jan. 9, Feb. 24-28, and Mar. 6. Records good except for estimated daily discharges, which are fair. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--32 years, 12.6 ft³/s, 9.78 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,500 ft³/s, June 25, 1968, gage height, 8.70 ft; minimum, 0.07 ft³/s, Aug. 30, 1966, result of regulation; minimum daily, 0.32 ft³/s, Aug. 10, 1964, Aug. 29, 1966.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 120 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 15	2100	192	4.46	Aug. 19	0500	147	4.20
Feb. 22	2000	*412	*5.53	Sept. 7	0400	400	5.48
Apr. 10	1900	132	4.12				

Minimum discharge, 2.1 ft³/s, Aug. 2, gage height, 2.82 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	5.5	7.2	8.6	17	11	22	34	10	6.9	32	3.9	4.0
2	5.7	6.7	8.6	12	18	26	34	9.8	7.5	14	3.4	3.8
3	5.3	6.3	6.8	12	14	30	26	9.8	14	9.7	3.4	3.7
4	4.9	6.1	8.1	64	12	21	21	24	9.0	7.8	8.1	3.6
5	4.9	6.0	7.4	70	12	17	20	46	7.8	6.8	11	3.6
6	5.2	8.0	7.6	25	14	16	20	20	7.5	6.0	7.5	21
7	4.9	26	6.6	20	24	15	19	14	6.8	5.4	5.8	215
8	5.0	22	6.0	19	34	15	17	12	30	5.3	4.6	47
9	5.2	13	5.6	23	38	79	15	11	19	5.0	4.4	19
10	13	14	6.0	39	27	97	74	11	10	4.8	3.8	12
11	10	11	6.4	23	19	106	71	9.6	8.6	5.7	3.7	9.4
12	7.6	9.5	6.6	17	15	92	36	9.2	7.4	6.2	5.1	7.9
13	6.5	8.3	6.4	15	15	68	26	32	7.1	5.3	24	7.0
14	5.9	22	6.2	12	20	46	36	19	31	7.4	12	16
15	5.4	122	6.1	11	18	36	29	14	21	7.2	7.1	22
16	5.2	133	6.0	16	22	72	22	46	10	6.6	5.7	26
17	5.9	55	5.8	71	20	47	22	80	8.1	6.2	5.0	16
18	6.0	32	5.7	59	19	32	18	40	7.0	5.5	6.0	9.7
19	13	22	5.6	29	16	26	15	22	6.3	6.5	85	21
20	26	22	5.5	21	13	23	24	25	6.3	5.6	29	13
21	15	17	5.3	17	13	21	49	22	7.4	5.5	16	22
22	10	14	5.1	15	181	47	28	15	12	7.8	10	39
23	8.3	12	5.0	13	216	64	21	13	25	7.6	8.5	15
24	7.4	11	4.9	22	70	33	19	11	17	6.1	7.3	10
25	6.9	10	4.9	31	40	25	17	11	9.8	4.9	6.5	8.4
26	7.2	11	5.0	29	28	22	15	10	7.6	4.3	5.9	7.4
27	6.6	10	5.0	18	25	18	14	9.6	16	4.0	5.4	6.7
28	6.3	12	5.2	16	23	17	13	8.8	22	3.9	5.4	6.3
29	5.2	10	6.0	13	---	16	12	8.1	13	3.6	5.1	6.0
30	4.8	8.8	9.0	11	---	32	11	7.7	50	3.9	4.5	6.0
31	7.4	---	16	10	---	23	---	7.2	---	4.0	4.0	---
TOTAL	236.2	667.9	203.0	770	977	1204	778	587.8	411.1	214.6	317.1	607.5
MEAN	7.62	22.3	6.55	24.8	34.9	38.8	25.9	19.0	13.7	6.92	10.2	20.3
MAX	26	133	16	71	216	106	74	80	50	32	85	215
MIN	4.8	6.0	4.9	10	11	15	11	7.2	6.3	3.6	3.4	3.6
CFSM	.44	1.27	.37	1.42	1.99	2.22	1.48	1.09	.78	.40	.58	1.16
IN.	.50	1.42	.43	1.64	2.08	2.56	1.65	1.25	.87	.46	.67	1.29

CAL YR 1989 TOTAL 6496.8 MEAN 17.8 MAX 450 MIN 4.4 CFSM 1.02 IN 13.81
WTR YR 1990 TOTAL 6974.2 MEAN 19.1 MAX 216 MIN 3.4 CFSM 1.09 IN 14.82

STREAMS TRIBUTARY TO DETROIT RIVER

04166500 RIVER ROUGE AT DETROIT, MI

LOCATION.--Lat 42°22'20", long 83°15'20", in SW1/4 sec.27, T.1 S., R.10 E., Wayne County, Hydrologic Unit 04090004, on right bank 500 ft upstream from bridge on Plymouth Road at Detroit, and 4 mi upstream from Middle River Rouge.

DRAINAGE AREA.--187 mi².

PERIOD OF RECORD.--October 1930 to current year. Monthly discharge only for some periods, published in WSP 1307.

REVISED RECORDS.--WSP 1034: 1933(M). WSP 1054: 1939, 1943, 1945(M). WSP 1437: 1931-32, 1934, 1936(M), 1937-38, 1944(M), 1945. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 584.00 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 16, 1948, nonrecording gage at site 1 mi downstream at datum 4.6 ft lower.

REMARKS.--Estimated daily discharges: Oct. 4-11 and Dec. 20 to Jan. 3. Records good. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--60 years, 119 ft³/s, 8.64 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 13,000 ft³/s, Apr. 5, 1947; maximum gage height, 23.0 ft, Apr. 6, 1947, from floodmark, site and datum then in use; minimum discharge, 1.8 ft³/s, Aug. 1, 2, 1964, gage height, 3.00 ft.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,200 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Nov. 16	1200	1,920	13.80	Sept. 7	1400	3,360	16.57
Feb. 23	0800	*3,810	*17.19				

Minimum discharge, 23 ft³/s, Aug. 3, gage height, 4.15 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	41	90	73	150	94	201	255	91	61	196	32	33
2	42	60	72	105	213	228	285	85	59	84	29	31
3	44	53	74	95	136	311	214	83	417	65	27	28
4	44	49	56	598	113	221	172	238	122	56	57	29
5	45	51	70	875	106	175	163	582	78	50	169	28
6	46	122	65	267	131	150	188	199	66	44	57	127
7	45	238	58	166	192	144	155	129	62	40	45	2750
8	45	323	58	146	266	145	143	107	333	39	35	1130
9	50	124	53	139	289	621	130	96	218	40	31	169
10	145	118	55	310	226	928	516	92	93	40	30	106
11	100	110	57	206	151	929	887	90	70	42	34	99
12	65	83	55	150	121	764	316	84	61	45	95	88
13	51	72	54	118	113	555	216	377	59	37	370	68
14	45	72	51	110	186	360	311	236	241	70	122	131
15	42	645	51	98	132	275	293	159	193	76	58	296
16	40	1790	49	107	166	505	202	611	79	50	44	268
17	47	761	49	578	189	376	188	890	61	87	37	170
18	65	245	49	530	141	242	160	546	57	43	35	93
19	98	170	46	239	159	205	140	209	50	76	832	216
20	317	151	45	164	118	206	164	171	48	137	444	143
21	153	140	44	148	111	187	579	192	90	72	147	144
22	94	111	43	136	1150	243	271	135	103	97	98	394
23	73	102	42	135	3290	670	187	114	279	116	73	143
24	62	91	42	174	1530	294	157	103	168	56	63	90
25	59	88	42	218	429	216	141	98	85	44	57	75
26	59	86	42	257	288	183	133	95	64	37	49	69
27	55	90	44	152	267	155	121	91	91	32	47	61
28	52	152	46	134	232	138	111	78	253	31	43	57
29	51	92	50	117	---	133	102	73	91	29	44	54
30	49	80	60	106	---	262	97	67	189	47	38	54
31	60	---	140	100	---	211	---	63	---	35	35	---
TOTAL	2184	6359	1735	6828	10539	10233	6997	6184	3841	1913	3277	7144
MEAN	70.5	212	56.0	220	376	330	233	199	128	61.7	106	238
MAX	317	1790	140	875	3290	929	887	890	417	196	832	2750
MIN	40	49	42	95	94	133	97	63	48	29	27	28
CFSM	.38	1.13	.30	1.18	2.01	1.77	1.25	1.06	.68	.33	.57	1.27
IN.	.43	1.26	.35	1.36	2.10	2.04	1.39	1.23	.76	.38	.65	1.42

CAL YR 1989 TOTAL 52819 MEAN 145 MAX 3220 MIN 38 CFSM .78 IN 10.51
WTR YR 1990 TOTAL 67234 MEAN 184 MAX 3290 MIN 27 CFSM .98 IN 13.37

04167000 MIDDLE RIVER ROUGE NEAR GARDEN CITY, MI

LOCATION.--Lat 42°20'55", long 83°18'45", in SW1/4 NW1/4 sec.6, T.2 S., R.10 E., Wayne County, Hydrologic Unit 04090004, on right bank 200 ft downstream from bridge on Inkster Road, 1.8 mi northeast of Garden City, and 6.0 mi upstream from mouth.

DRAINAGE AREA.--99.9 mi².

PERIOD OF RECORD.--October 1930 to September 1933 (published as "at Detroit"), June 1947 to September 1977, October 1977 to September 1983 (operated as a crest-stage partial-record station only), October 1983 to current year. Monthly discharge only for October, November, 1930, published in WSP 1307.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 600.95 ft above National Geodetic Vertical Datum of 1929. Nov. 21, 1930 to Sept. 30, 1933, nonrecording gage at site 4.8 mi downstream at datum 17.48 ft lower. June 6, 1947 to Oct. 18, 1948, nonrecording gage at site 200 ft upstream at present datum.

REMARKS.--Estimated daily discharges: Dec. 16-31. Records good. Occasional regulation by reservoirs upstream from station since 1956. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--40 years (water years 1931-33, 1948-77, 1984-90), 73.0 ft³/s, 9.92 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 2,330 ft³/s, June 26, 1968; maximum gage height, 10.50 ft, May 10, 1948; minimum discharge, 0.9 ft³/s, Aug. 16, 1956.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 700 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Feb. 23	0700	*1,670	9.61	Sept. 7	1300	1,150	*10.05

Minimum daily discharge, 23 ft³/s, Sept. 3-5.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	36	49	58	89	70	148	159	71	46	101	26	25
2	38	41	57	55	173	163	187	67	52	57	25	24
3	38	38	57	61	108	197	159	64	291	47	25	23
4	36	35	52	289	90	166	133	180	105	42	63	23
5	36	36	50	322	86	134	122	219	63	40	96	23
6	42	82	50	167	97	119	115	139	54	37	44	61
7	36	171	48	107	120	107	103	97	50	34	32	923
8	33	143	45	94	150	110	96	81	187	33	29	415
9	32	84	42	95	205	326	92	72	95	35	26	113
10	87	78	41	162	180	459	303	71	66	34	25	72
11	63	64	41	133	132	526	368	67	53	38	31	64
12	47	53	41	100	101	508	264	63	48	35	124	55
13	39	48	39	77	93	434	177	236	46	33	252	47
14	35	48	38	67	128	321	202	142	223	60	79	85
15	33	256	37	62	110	236	182	130	86	45	45	88
16	33	551	34	70	120	335	146	336	59	38	35	171
17	39	324	34	209	124	301	127	312	46	35	30	86
18	43	175	33	350	108	211	110	254	42	36	28	66
19	81	117	32	230	107	173	98	165	37	40	154	116
20	116	98	31	136	92	144	136	122	37	48	78	75
21	77	91	30	114	86	127	304	103	46	47	75	115
22	57	81	30	101	753	162	208	89	72	86	51	164
23	46	71	29	95	1460	251	149	78	100	59	45	82
24	42	62	28	109	789	203	119	73	77	58	39	69
25	39	57	28	148	379	152	105	69	55	36	35	62
26	37	57	28	175	237	128	96	73	43	31	32	56
27	37	71	28	130	201	115	88	63	109	28	30	50
28	36	110	30	101	170	107	83	54	175	27	30	45
29	35	71	32	89	---	104	77	51	67	26	53	42
30	36	64	37	80	---	154	73	48	133	50	33	43
31	48	---	110	70	---	133	---	47	---	40	27	---
TOTAL	1433	3226	1270	4087	6469	6754	4581	3636	2563	1356	1697	3283
MEAN	46.2	108	41.0	132	231	218	153	117	85.4	43.7	54.7	109
MAX	116	551	110	350	1460	526	368	336	291	101	252	923
MIN	32	35	28	55	70	104	73	47	37	26	25	23
CFSM	.46	1.08	.41	1.32	2.31	2.18	1.53	1.17	.86	.44	.55	1.09
IN.	.53	1.20	.47	1.52	2.41	2.51	1.71	1.35	.95	.50	.63	1.22

CAL YR 1989 TOTAL 31324 MEAN 85.8 MAX 1050 MIN 26 CFSM .86 IN 11.66
WTR YR 1990 TOTAL 40355 MEAN 111 MAX 1460 MIN 23 CFSM 1.11 IN 15.03

STREAMS TRIBUTARY TO DETROIT RIVER

04168000 LOWER RIVER ROUGE AT INKSTER, MI

LOCATION.--Lat 42°18'00", long 83°18'00", in SW1/4 SE1/4 sec.19, T.2 S., R.10 E., Wayne County, Hydrologic Unit 04090004, on right bank 10 ft downstream from bridge on John Daly Road, 0.6 mi northeast of Inkster, and 4.8 mi upstream from mouth.

DRAINAGE AREA.--83.2 mi².

PERIOD OF RECORD.--June 1947 to current year.

REVISED RECORDS.--WSP 1174: 1948(M). WSP 1437: 1949. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 593.14 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 20, 1948, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 4, 8, 9, 14-31, and Jan. 3, 4, 13, 14. Records good. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--43 years, 53.4 ft³/s, 8.72 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,600 ft³/s, June 26, 1968, gage height, 13.62 ft; minimum, 0.2 ft³/s, Sept. 13, 1955, Jan. 23, 1961.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 900 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Feb. 23	1600	*2,230	*12.01	Sept. 7	0700	922	9.19

Minimum discharge, 0.82 ft³/s, Aug. 12, gage height, 2.57 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	3.8	12	22	30	40	86	72	25	13	21	3.5	2.6
2	4.3	8.2	19	17	133	114	104	21	17	11	3.0	2.3
3	4.1	7.4	17	25	98	181	98	20	194	7.9	19	1.8
4	3.8	6.5	16	180	73	133	74	94	70	6.5	18	1.4
5	4.0	7.3	15	242	61	87	62	107	30	4.8	29	1.9
6	5.1	26	14	74	67	68	54	59	23	4.2	8.1	43
7	5.9	77	13	46	111	59	47	40	18	3.5	3.7	795
8	3.5	68	12	38	188	61	40	31	92	3.3	3.5	151
9	2.6	32	11	50	158	333	36	25	46	6.4	2.1	47
10	29	37	10	129	138	678	207	26	26	4.7	1.4	30
11	13	22	11	97	80	618	412	34	18	5.5	1.5	24
12	7.1	16	12	50	59	469	164	19	13	4.1	65	16
13	5.2	13	11	38	52	312	97	123	12	3.6	160	14
14	4.4	13	10	33	71	186	121	90	125	16	30	58
15	3.9	147	9.5	28	46	135	124	83	61	8.5	12	49
16	5.1	356	9.0	35	76	271	83	354	25	5.0	9.1	79
17	11	147	8.5	114	87	199	65	424	17	4.5	6.5	55
18	11	65	8.0	276	74	114	50	214	12	4.3	5.4	26
19	28	44	7.6	118	71	92	43	102	9.5	4.8	102	104
20	40	39	7.3	74	55	74	73	76	8.9	31	54	87
21	24	37	7.2	61	52	63	419	58	18	36	42	91
22	15	29	7.0	54	628	72	182	44	25	37	29	206
23	11	21	7.0	49	1720	124	101	34	31	23	15	75
24	9.5	21	7.0	86	1050	82	70	30	23	28	12	41
25	9.9	18	7.0	139	239	62	55	27	14	8.5	8.3	30
26	9.0	18	7.3	178	155	51	45	32	9.3	6.0	6.7	23
27	7.5	25	7.7	80	120	44	38	27	50	4.4	5.4	18
28	7.1	66	8.3	73	96	40	34	21	32	3.4	4.6	16
29	6.5	35	9.0	53	---	38	31	18	14	2.9	7.6	14
30	6.5	23	13	42	---	63	29	16	42	23	2.7	14
31	12	---	65	38	---	56	---	14	---	13	2.3	---
TOTAL	312.8	1436.4	388.4	2547	5798	4965	3030	2288	1088.7	345.8	672.4	2116.0
MEAN	10.1	47.9	12.5	82.2	207	160	101	73.8	36.3	11.2	21.7	70.5
MAX	40	356	65	276	1720	678	419	424	194	37	160	795
MIN	2.6	6.5	7.0	17	40	38	29	14	8.9	2.9	1.4	1.4
CFSM	.12	.58	.15	.99	2.49	1.92	1.21	.89	.44	.14	.26	.85
IN.	.14	.64	.17	1.14	2.59	2.22	1.35	1.02	.49	.15	.30	.95

CAL YR 1989 TOTAL 14293.4 MEAN 39.2 MAX 586 MIN 1.1 CFSM .47 IN 6.39
WTR YR 1990 TOTAL 24988.5 MEAN 68.5 MAX 1720 MIN 1.4 CFSM .82 IN 11.17

04170000 HURON RIVER AT MILFORD, MI

LOCATION.--Lat 42°34'44", long 83°37'36", in NE1/4 sec.16, T.2 N., R.7 E., Oakland County, Hydrologic Unit 04090005, on left bank 40 ft downstream from bridge on General Motors Road, 0.5 mi downstream from Sherwood Creek, and 0.5 mi west of Milford.

DRAINAGE AREA.--132 mi².

PERIOD OF RECORD.--September 1948 to current year.

REVISED RECORDS.--WSP 1337: 1952(m). WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 880.00 ft above National Geodetic Vertical Datum of 1929. Prior to Apr. 1, 1970, at site 240 ft upstream at same datum.

REMARKS.--No estimated daily discharges. Records good. Flow below about 300 ft³/s regulated by powerplant 1.5 mi upstream from station prior to May 20, 1957; occasional regulation for lake level control since. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--42 years, 97.9 ft³/s, 10.07 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 648 ft³/s, Oct. 3, 1981, gage height, 7.87 ft; maximum gage height, 8.26 ft, June 28, 1968; minimum daily discharge, 5.2 ft³/s, Oct. 21, 1971.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 272 ft³/s, Mar. 13, gage height, 6.52 ft; minimum daily, 28 ft³/s, Aug. 11, 12.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	57	67	127	85	105	159	199	152	115	86	38	42
2	60	61	125	84	116	155	203	146	104	79	35	43
3	61	55	124	84	115	157	201	138	103	71	35	39
4	51	51	124	114	111	151	195	134	99	65	34	35
5	43	47	123	132	109	147	191	150	97	58	44	34
6	45	52	125	121	107	139	188	145	92	55	39	46
7	46	63	124	112	110	134	184	134	89	50	38	137
8	46	77	125	106	120	130	184	126	96	44	41	142
9	43	73	124	105	137	154	181	121	103	42	39	133
10	59	68	121	113	137	189	198	115	109	39	35	116
11	64	67	120	111	129	218	226	113	106	41	28	101
12	57	64	117	107	124	239	231	109	101	46	28	93
13	53	61	115	103	125	264	219	113	96	41	54	88
14	53	71	114	99	138	269	211	114	103	42	55	90
15	53	116	111	95	143	258	206	109	108	44	48	100
16	54	163	109	96	143	256	200	115	100	41	44	109
17	61	184	107	119	140	252	192	152	89	38	42	104
18	61	172	101	144	135	241	191	180	81	33	36	100
19	72	155	97	134	130	230	187	189	78	33	64	103
20	88	143	92	126	125	219	186	197	75	39	78	106
21	89	144	84	120	119	210	207	193	76	38	78	106
22	86	138	80	115	151	211	210	179	75	39	76	116
23	83	127	74	110	212	229	194	171	83	41	72	114
24	78	125	69	110	230	232	181	157	88	41	68	109
25	72	123	66	115	210	219	177	147	82	38	63	104
26	69	124	66	117	198	200	175	144	73	33	57	99
27	68	127	66	112	177	189	173	143	70	30	53	97
28	68	134	66	109	167	182	168	138	79	29	49	95
29	65	134	68	109	---	179	160	132	79	32	46	94
30	71	128	72	106	---	189	158	130	86	36	44	94
31	69	---	83	106	---	194	---	125	---	38	44	---
TOTAL	1945	3114	3119	3419	3963	6195	5776	4411	2735	1382	1505	2789
MEAN	62.7	104	101	110	142	200	193	142	91.2	44.6	48.5	93.0
MAX	89	184	127	144	230	269	231	197	115	86	78	142
MIN	43	47	66	84	105	130	158	109	70	29	28	34
CFSM	.48	.79	.77	.83	1.08	1.52	1.46	1.08	.69	.34	.37	.71
IN.	.55	.88	.88	.96	1.12	1.75	1.63	1.24	.77	.39	.42	.79

CAL YR 1989 TOTAL 31019 MEAN 85.0 MAX 252 MIN 35 CFSM .64 IN 8.74
WTR YR 1990 TOTAL 40353 MEAN 111 MAX 269 MIN 28 CFSM .84 IN 11.37

STREAMS TRIBUTARY TO LAKE ERIE

04170490 KENT LAKE NEAR NEW HUDSON, MI

LOCATION.--Lat 42°30'45", long 83°40'34", in sec.1, T.1 N., R.6 E., Livingston County, Hydrologic Unit 04090005, at Kent Lake Dam, 2 mi upstream from Woodruff Creek, and 3 mi west of New Hudson.

DRAINAGE AREA.--148 mi².

PERIOD OF RECORD.--April 1949 to current year.

GAGE.--Water-stage recorder. Datum of gage is 868.00 ft above National Geodetic Vertical Datum of 1929 (Huron-Clinton Metropolitan Authority bench mark).

REMARKS.--The inlet and outlet is the Huron River which enters the northeast end of the lake and leaves the southwest end of the lake. Streamflow records are currently collected on the Huron River at sites about 1 mi upstream (04170000) and 150 ft downstream (04170500) from Kent Lake. Maximum depth 38 ft, surface area 1,200 acres. A concrete dam with steel drum spillway is used to control the lake level.

EXTREMES FOR PERIOD OF RECORD.--Maximum gage height, 16.68 ft, Apr. 6, 1950; minimum, 11.60 ft, Mar. 7, 8, 1968.

EXTREMES FOR CURRENT YEAR.--Maximum gage height, 15.95 ft, Sept. 7; minimum, 12.54 ft, Jan. 1-4.

GAGE HEIGHT (FEET ABOVE DATUM), WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	15.58	---	12.70	12.55	12.62	12.84	13.47	15.42	15.34	15.30	15.60	15.68
2	15.58	---	12.68	12.54	12.66	12.82	13.59	15.41	15.31	15.27	15.60	15.68
3	15.57	---	12.68	12.54	12.65	12.81	13.85	15.40	15.30	15.27	15.59	15.67
4	15.55	---	12.67	12.60	12.64	12.80	13.97	15.42	15.31	15.37	15.60	15.65
5	15.54	---	12.67	12.68	12.62	12.79	14.03	15.42	15.28	15.48	15.63	15.65
6	15.54	---	12.67	12.69	12.62	12.77	14.09	15.41	15.27	15.55	15.62	15.67
7	15.53	---	12.66	12.68	12.62	12.74	14.24	15.38	15.26	15.59	15.61	15.93
8	15.53	---	12.67	12.66	12.63	12.73	14.33	15.36	15.28	15.61	15.61	15.93
9	15.52	---	12.67	12.65	12.67	12.77	14.39	15.35	15.28	15.64	15.61	15.93
10	15.55	---	12.66	12.66	12.69	12.83	14.68	15.31	15.29	15.64	15.61	15.92
11	15.57	---	12.66	12.66	12.70	12.91	14.84	15.32	15.29	15.65	15.60	15.89
12	15.57	---	12.65	12.65	12.68	12.98	14.92	15.32	15.28	15.66	15.60	15.85
13	15.57	---	12.65	12.63	12.68	13.06	14.95	15.34	15.28	15.64	15.67	15.83
14	15.56	---	12.65	12.61	12.71	13.10	14.96	15.32	15.33	15.64	15.68	15.84
15	15.56	---	12.64	12.60	12.76	13.10	14.95	15.32	15.34	15.65	15.68	15.86
16	15.57	---	12.63	12.60	12.75	13.10	15.00	15.33	15.32	15.65	15.67	15.89
17	15.58	---	12.62	12.63	12.74	13.07	15.25	15.40	15.29	15.64	15.67	15.88
18	15.57	---	12.61	12.69	12.72	13.06	15.37	15.46	15.27	15.64	15.67	15.86
19	15.60	---	12.61	12.72	12.71	13.04	15.43	15.50	15.25	15.65	15.72	15.87
20	15.60	---	12.59	12.72	12.69	13.00	15.48	15.53	15.24	15.66	15.74	15.87
21	15.62	12.79	12.60	12.70	12.67	12.97	15.54	15.54	15.24	15.66	15.76	15.88
22	15.63	12.76	12.63	12.68	12.76	12.96	15.55	15.52	15.25	15.67	15.77	15.91
23	15.63	12.73	12.66	12.67	12.89	12.98	15.54	15.50	15.28	15.66	15.77	15.90
24	15.63	12.71	12.69	12.65	12.96	12.98	15.51	15.49	15.29	15.66	15.77	15.88
25	15.63	12.70	12.70	12.65	12.97	12.97	15.49	15.46	15.28	15.65	15.75	15.87
26	15.63	12.69	12.71	12.67	12.95	13.02	15.48	15.44	15.27	15.64	15.74	15.87
27	---	12.69	12.72	12.65	12.92	13.22	15.47	15.42	15.26	15.62	15.74	15.85
28	---	12.71	12.72	12.65	12.87	13.33	15.46	15.41	15.26	15.62	15.73	15.84
29	---	12.70	12.72	12.64	---	13.38	15.45	15.39	15.27	15.61	15.73	15.84
30	---	12.70	12.71	12.63	---	13.42	15.43	15.37	15.29	15.62	15.71	15.83
31	---	---	12.61	12.62	---	13.44	---	15.35	---	15.61	15.69	---
MEAN	---	---	12.66	12.64	12.73	13.00	14.89	15.41	15.28	15.59	15.68	15.83
MAX	---	---	12.72	12.72	12.97	13.44	15.55	15.54	15.34	15.67	15.77	15.93
MIN	---	---	12.59	12.54	12.62	12.73	13.47	15.31	15.24	15.27	15.59	15.65

04170500 HURON RIVER NEAR NEW HUDSON, MI

LOCATION.--Lat 42°30'45", long 83°40'35", in NE1/4 sec.1, T.1 N., R.6 E., Livingston County, Hydrologic Unit 04090005, on right bank 150 ft downstream from Kent Lake Dam, 2 mi upstream from Woodruff Creek, and 3 mi west of New Hudson.

DRAINAGE AREA.--148 mi².

PERIOD OF RECORD.--August 1948 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 868.00 ft above National Geodetic Vertical Datum of 1929 (Huron-Clinton Metropolitan Authority bench mark).

REMARKS.--Estimated daily discharges: Oct. 1-4, Jan. 13, 14, June 26 to July 2, July 9 to Sept. 6, and Sept. 17-30. Records poor. Occasional regulation by Kent Lake (see preceding page). Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--42 years, 112 ft³/s, 10.28 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,080 ft³/s, Dec. 29, 1950, gage height, 5.05 ft, from rating curve extended above 600 ft³/s; minimum, 2.6 ft³/s, May 27, 1963, gage height, 0.53 ft; minimum daily, 6.4 ft³/s, May 7, 1963.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 360 ft³/s, Nov. 15, gage height, 3.15 ft; minimum daily, 11 ft³/s, July 4.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	66	125	159	109	128	206	207	160	135	110	40	49
2	70	105	156	108	142	199	110	158	126	105	39	48
3	68	91	156	108	141	196	124	154	123	52	38	45
4	66	79	152	123	138	191	162	162	126	11	41	42
5	64	72	152	144	132	189	182	167	116	15	48	40
6	64	206	152	149	132	182	140	161	110	26	45	50
7	61	252	149	146	131	174	129	153	110	36	44	151
8	59	244	149	140	134	170	158	147	118	42	43	157
9	58	244	148	137	146	181	112	144	120	48	42	154
10	69	187	149	140	154	201	120	132	123	49	40	146
11	74	154	148	140	154	226	173	137	123	51	33	132
12	74	142	146	138	150	251	200	134	118	53	35	111
13	71	211	142	133	149	278	211	138	114	50	60	95
14	69	221	143	128	157	295	217	131	124	50	60	90
15	66	274	141	124	173	295	213	133	131	52	55	102
16	67	305	139	123	172	298	116	135	124	51	50	114
17	73	251	136	134	167	286	99	157	112	50	45	106
18	70	228	133	151	161	279	142	175	101	49	42	105
19	85	207	130	158	157	272	162	189	94	48	75	110
20	91	194	125	158	151	256	180	197	90	50	86	120
21	97	186	118	154	147	243	203	203	90	51	88	125
22	98	177	110	148	167	239	204	195	92	51	90	130
23	97	169	105	143	209	247	202	188	103	50	84	125
24	95	162	99	139	232	246	193	182	109	49	78	120
25	89	158	95	141	240	239	188	173	106	47	72	115
26	85	157	92	145	243	177	186	169	98	44	64	110
27	83	157	92	140	231	130	181	162	96	41	60	108
28	82	162	90	137	217	161	174	159	98	38	57	107
29	81	160	90	135	---	178	170	153	100	36	53	106
30	137	159	93	131	---	192	167	143	105	40	50	105
31	160	---	107	128	---	198	---	137	---	41	49	---
TOTAL	2489	5439	3996	4232	4655	6875	5025	4928	3335	1486	1706	3118
MEAN	80.3	181	129	137	166	222	168	159	111	47.9	55.0	104
MAX	160	305	159	158	243	298	217	203	135	110	90	157
MIN	58	72	90	108	128	130	99	131	90	11	33	40
CFSM	.54	1.22	.87	.93	1.12	1.50	1.14	1.07	.75	.32	.37	.70
IN.	.63	1.37	1.00	1.06	1.17	1.73	1.26	1.24	.84	.37	.43	.78

CAL YR 1989 TOTAL 36427 MEAN 99.8 MAX 305 MIN 12 CFSM .67 IN 9.16
WTR YR 1990 TOTAL 47284 MEAN 130 MAX 305 MIN 11 CFSM .88 IN 11.88

STREAMS TRIBUTARY TO LAKE ERIE

04172000 HURON RIVER NEAR HAMBURG, MI

LOCATION.--Lat 42°27'55", long 83°48'00", in sec.24, T.1 N., R.5 E., Livingston County, Hydrologic Unit 04090005, on right bank at downstream side of bridge on Hamburg Road, 1.1 mi north of Hamburg, and 3 mi upstream from Strawberry Lake.

DRAINAGE AREA.--308 mi².

PERIOD OF RECORD.--October 1951 to current year.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 850.00 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). Prior to Aug. 12, 1953, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 8 to Jan. 3, and Jan. 25 to Feb. 12. Records good except for estimated daily discharges, which are fair. Occasional regulation by Kent Lake (station 04170490), 11 mi upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--39 years, 214 ft³/s, 9.44 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 1,560 ft³/s, May 15, 1956, gage height, 8.35 ft; maximum gage height, 8.46 ft, June 30, 1968; minimum discharge, 26 ft³/s, July 15, 16, 1988; minimum gage height, 3.16 ft, Aug. 1-3, 1964.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 792 ft³/s, Mar. 15, gage height, 6.49 ft; minimum daily, 75 ft³/s, Aug. 3, 4.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	126	198	243	175	265	530	400	312	241	190	78	112
2	124	190	240	180	290	488	416	294	233	190	76	105
3	120	168	237	190	285	457	390	283	231	182	75	101
4	116	149	237	215	275	432	354	284	230	142	75	96
5	112	136	228	246	270	408	357	308	226	110	79	91
6	112	131	223	271	270	378	370	317	217	95	82	92
7	110	177	209	276	280	355	358	310	209	90	83	177
8	107	256	205	258	300	340	330	295	215	91	83	258
9	106	282	205	243	340	347	328	281	227	93	82	300
10	112	300	205	239	340	376	326	269	227	97	80	307
11	122	284	205	238	320	440	337	254	222	99	78	291
12	128	238	200	239	318	536	367	243	218	100	78	262
13	127	199	200	234	314	653	404	247	213	97	92	235
14	126	221	200	224	319	740	434	251	215	94	103	215
15	122	296	200	215	335	782	449	248	230	97	108	211
16	120	364	195	209	339	786	447	258	234	100	109	216
17	120	429	190	226	335	760	409	291	231	100	108	216
18	121	446	190	265	323	722	344	330	221	99	112	207
19	123	422	185	290	314	682	332	362	203	103	122	202
20	139	391	180	307	302	642	341	394	189	103	133	201
21	155	356	170	313	290	596	374	417	182	105	144	200
22	163	328	160	306	310	561	396	422	180	107	152	214
23	165	305	150	289	385	548	412	412	192	110	153	217
24	163	285	140	277	463	535	417	391	203	108	155	210
25	160	270	135	285	568	526	410	368	199	104	151	200
26	152	258	135	290	692	512	393	346	193	99	149	194
27	144	249	135	280	647	472	377	324	188	96	144	188
28	138	252	140	275	586	398	362	304	184	91	135	175
29	133	250	145	270	---	368	346	286	182	86	133	165
30	129	248	150	265	---	377	329	268	184	83	130	159
31	158	---	170	265	---	386	---	253	---	81	121	---
TOTAL	4053	8078	5807	7855	10075	16133	11309	9622	6319	3342	3403	5817
MEAN	131	269	187	253	360	520	377	310	211	108	110	194
MAX	165	446	243	313	692	786	449	422	241	190	155	307
MIN	106	131	135	175	265	340	326	243	180	81	75	91
CFSM	.43	.87	.61	.82	1.17	1.69	1.22	1.01	.69	.35	.36	.63
IN.	.49	.98	.70	.95	1.22	1.95	1.37	1.16	.76	.40	.41	.70

CAL YR 1989 TOTAL 77321 MEAN 212 MAX 725 MIN 100 CFSM .69 IN 9.34
WTR YR 1990 TOTAL 91813 MEAN 252 MAX 786 MIN 75 CFSM .82 IN 11.09

04174050 HURON RIVER AT DELHI MILLS, MI

LOCATION.--Lat 42°20'01", long 83°48'34", in SE1/4 sec.2, T.2 S., R.5 E., Washtenaw County, Hydrologic Unit 04090005, at bridge on East Delhi Road, 5.0 mi northwest of Ann Arbor, 5.2 mi downstream from Mill Creek, 5.1 mi upstream from Barton Dam, and 60.0 mi upstream from mouth.

DRAINAGE AREA.--699 mi².

PERIOD OF RECORD.--Water years 1971-81, 1983 to current year.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	SPECIFIC CONDUCTANCE LAB (US/CM)	TEMPERATURE WATER (DEG C)	CARBON, ORGANIC TOTAL (MG/L AS C)	ALDRIN, TOTAL (UG/L)	CHLORDANE, TOTAL (UG/L)	CHLORDYRIFOS TOTAL RECOVER (UG/L)	DEF TOTAL (UG/L)	DDD, TOTAL (UG/L)	DDE, TOTAL (UG/L)
NOV 01...	1345	668	9.5	7.8	<0.01	<0.1	--	<0.01	<0.01	<0.01
DEC 14...	1850	661	0.0	6.9	<0.01	<0.1	--	<0.01	<0.01	<0.01
APR 04...	1700	571	7.0	7.9	<0.01	<0.1	--	<0.01	<0.01	<0.01
JUN 15...	1800	604	23.5	13	<0.01	<0.1	--	<0.01	<0.01	<0.01
AUG 09...	1445	625	23.5	6.7	<0.01	<0.1	<0.01	<0.01	<0.01	<0.01
SEP 12...	1215	627	22.0	8.9	<0.01	<0.1	<0.01	<0.01	<0.01	<0.01

DATE	DDT, TOTAL (UG/L)	DIAZINON, TOTAL (UG/L)	DIELDRIN TOTAL (UG/L)	DISYSTON TOTAL (UG/L)	ENDOSULFAN, TOTAL (UG/L)	ENDRIN, TOTAL (UG/L)	ETHION, TOTAL (UG/L)	FONOFOS (DYFONATE) WATER WHOLE TOT.REC (UG/L	HEPTACHLOR, TOTAL (UG/L)
NOV 01...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	<0.01
DEC 14...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	<0.01
APR 04...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	<0.01
JUN 15...	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	<0.01
AUG 09...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
SEP 12...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

DATE	HEPTACHLOR EPOXIDE TOTAL (UG/L)	LINDANE TOTAL (UG/L)	MALATHION, TOTAL (UG/L)	METHOXYCHLOR, TOTAL (UG/L)	METHYL PARATHION, TOTAL (UG/L)	METHYL TRITHION, TOTAL (UG/L)	MIREX, TOTAL (UG/L)	NAPHTHALENES, POLYCHLOR. TOTAL (UG/L)	PARATHION, TOTAL (UG/L)
NOV 01...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.01
DEC 14...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.01
APR 04...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.01
JUN 15...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.01
AUG 09...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.01
SEP 12...	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.1	<0.01

STREAMS TRIBUTARY TO LAKE ERIE

04174050 HURON RIVER AT DELHI MILLS, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	PCB, TOTAL (UG/L)	PER-THANE TOTAL (UG/L)	TOX-APHENE, TOTAL (UG/L)	PHORATE OTAL (UG/L)	TOTAL TRI-THION (UG/L)	2,4-D, TOTAL (UG/L)	2, 4-DP TOTAL (UG/L)	2,4,5-T TOTAL (UG/L)	SILVEX, TOTAL (UG/L)
NOV									
01...	<0.1	<0.1	<1	<0.01	<0.01	0.07	<0.01	<0.01	<0.01
DEC									
14...	<0.1	<0.1	<1	<0.01	<0.01	0.03	<0.01	<0.01	<0.01
APR									
04...	<0.1	<0.1	<1	<0.01	<0.01	0.02	<0.01	<0.01	<0.01
JUN									
15...	<0.1	<0.1	<1	<0.01	<0.01	0.15	<0.01	<0.01	<0.01
AUG									
09...	<0.1	<0.1	<1	<0.01	<0.01	0.13	<0.01	<0.01	<0.01
SEP									
12...	<0.1	<0.1	<1	<0.01	<0.01	0.10	<0.01	<0.01	<0.01

STREAMS TRIBUTARY TO LAKE ERIE

04174500 HURON RIVER AT ANN ARBOR, MI

LOCATION.--Lat 42°17'10", long 83°44'00", in NW1/4 sec.28, T.2 S., R.6 E., Washtenaw County, Hydrologic Unit 04090005, on left bank 100 ft upstream from bridge on Wall Street in Ann Arbor, 0.7 mi downstream from Argo Dam, and 4.2 mi upstream from Geddes Dam.

DRAINAGE AREA.--729 mi².

PERIOD OF RECORD.--February 1904 to current year. Monthly discharge only for some periods, published in WSP 1307. Published as "at Geddes" February 1904 to December 1914 and as "at Barton" January 1914 to September 1940.

REVISED RECORDS.--WSP 874: 1938. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 744.81 ft above National Geodetic Vertical Datum of 1929 (levels by Michigan Department of Natural Resources). February 1904 to December 1914 at Geddes Dam, 4.2 mi downstream, and January 1914 to September 1947 at Barton Dam, 2.6 mi upstream, flow computed from records of operation of powerplants and records of depth of flow over dam and/or flow through undersluices.

REMARKS.--Estimated daily discharges: Dec. 21-26. Records good. Diversion upstream from station for Ann Arbor municipal supply had negligible effect on natural flow prior to 1955, figures of runoff adjusted since. Flow regulated by powerplants prior to May 1962. From June 1962 to 1975 occasional regulation for lake level control operations upstream from station. Since 1975 extensive regulation of flow exists due to automation of gates at dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--86 years, 461 ft³/s, 8.59 in/yr, adjusted for diversion since 1955.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge, 5,840 ft³/s, Mar. 14, 1918; minimum daily, 4 ft³/s, Aug. 2, Sept. 11, 1931, plant leakage, but may be doubtful due to change in leakage.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,220 ft³/s, Feb. 23, gage height, 15.56 ft; minimum daily, 96 ft³/s, Aug. 2.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	238	273	495	345	601	1340	1040	700	525	351	128	142
2	235	284	501	335	700	1230	1090	673	586	332	96	137
3	217	290	486	335	684	1190	1090	521	633	295	98	171
4	205	290	464	532	648	1090	1030	615	543	233	151	164
5	204	294	456	749	605	975	935	896	440	230	143	149
6	198	294	450	654	593	923	746	769	408	221	138	202
7	174	363	435	597	620	866	741	706	434	249	124	603
8	223	398	417	574	686	848	807	653	502	191	117	595
9	120	548	399	608	782	1030	825	567	557	203	110	447
10	213	617	393	686	827	1590	942	606	514	189	102	406
11	209	683	392	675	738	1940	1070	637	462	152	106	433
12	246	643	385	611	712	2150	1070	393	321	173	185	417
13	223	565	358	561	733	2220	1050	576	375	173	212	346
14	193	411	366	538	790	2180	1080	699	422	178	164	406
15	195	515	325	518	778	2370	1160	653	460	184	140	450
16	192	785	329	527	791	2310	1100	829	409	177	164	460
17	206	821	316	691	762	2140	1000	1200	329	146	153	432
18	219	814	300	869	752	1830	993	1280	331	150	117	398
19	292	765	300	806	707	1720	855	1110	360	228	467	449
20	282	846	302	753	699	1450	887	1050	270	293	385	423
21	290	882	300	717	659	1280	1320	1060	274	206	294	483
22	287	792	300	719	1230	1410	1440	995	340	221	306	510
23	283	698	300	685	2010	1460	1310	970	411	228	269	511
24	263	649	300	714	2010	1370	1150	953	388	241	250	443
25	302	582	300	779	1600	1300	1050	836	305	195	290	409
26	280	552	300	884	1390	1130	946	915	268	160	161	329
27	273	559	299	782	1360	966	730	849	324	161	199	367
28	310	549	297	745	1400	837	808	718	394	156	278	358
29	299	541	296	681	---	866	822	694	375	151	134	342
30	286	513	299	655	---	1030	804	663	370	148	169	339
31	286	---	345	610	---	1080	---	530	---	140	135	---
TOTAL	7443	16816	11205	19935	25867	44121	29891	24316	12330	6355	5785	11321
MEAN	240	561	361	643	924	1423	996	784	411	205	187	377
MAX	310	882	501	884	2010	2370	1440	1280	633	351	467	603
MIN	120	273	296	335	593	837	730	393	268	140	96	137
MEAN+	260	578	377	659	940	1439	1014	806	433	232	211	401
CFSM+	.36	.79	.52	.90	1.29	1.97	1.39	1.11	.59	.32	.29	.55
IN+	.41	.89	.60	1.04	1.34	2.28	1.55	1.27	.66	.37	.33	.61

CAL YR 1989 TOTAL 168741 MEAN 462 MAX 1890 MIN 120 MEAN+ 481 CFSM+ .66 IN+ 8.96
WTR YR 1990 TOTAL 215385 MEAN 590 MAX 2370 MIN 96 MEAN+ 610 CFSM+ .84 IN+ 11.36

\+ Adjusted for diversion for municipal supply; record furnished by City of Ann Arbor.

04174800 HURON RIVER AT YPSILANTI, MI

LOCATION.--Lat 42°14'57", long 83°36'45", in SW1/4 sec.4, T.3 S., R.7 E., Washtenaw County, Hydrologic Unit 04090005, on left bank 30 ft downstream from bridge on Forest Avenue in Ypsilanti, 4.9 mi downstream from Geddes Dam, 5.6 mi upstream from Ford Dam, and at mile 42.8.

DRAINAGE AREA.--807 mi².

PERIOD OF RECORD.--June 1974 to September 1984, October 1989 to September 1990.

GAGE.--Water-stage recorder. Elevation of gage is 700 ft above National Goedetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Oct. 1 to Nov. 24, Nov. 30 to Jan. 15, Feb. 25-27, Mar. 13 to Apr. 9, and Apr. 28 to May 15. Records fair. Considerable regulation caused by many dams upstream from station; storage capacity is small.

AVERAGE DISCHARGE.--11 years, 595 ft³/s, 10.01 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 4,500 ft³/s, May 2, 1983, gage height, 12.64 ft; minimum daily, 62 ft³/s, June 28, 1984.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 4,220 ft³/s, Feb. 23, gage height, 12.44 ft; minimum daily, 144 ft³/s, Aug. 3.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	320	370	650	440	732	1630	1300	900	598	423	201	205
2	310	380	650	440	972	1570	1350	800	702	420	159	195
3	300	385	630	450	870	1510	1350	680	900	369	144	228
4	285	390	620	850	809	1400	1300	750	691	315	270	237
5	280	390	600	1000	763	1240	1150	1100	499	292	240	221
6	270	410	580	860	742	1150	980	950	487	290	212	218
7	250	480	560	750	821	1070	980	860	511	316	235	1380
8	300	580	540	720	897	1040	1000	800	631	246	167	814
9	180	700	520	800	1080	1480	1200	700	668	314	177	586
10	290	830	510	880	1090	2190	1350	750	601	254	161	529
11	290	900	510	840	969	2570	1480	780	548	228	197	540
12	330	800	500	750	904	2670	1380	520	406	228	312	527
13	300	700	480	700	903	2700	1300	700	434	256	433	450
14	270	540	470	680	1060	2650	1360	850	562	251	269	556
15	270	700	440	670	949	2900	1400	800	559	263	211	585
16	275	1000	430	664	1030	2800	1390	1180	515	258	220	627
17	285	1050	420	954	941	2600	1260	1550	397	210	229	545
18	320	1000	400	1240	911	2300	1190	1580	398	225	182	501
19	380	980	400	1060	893	2100	1060	1390	439	288	1020	665
20	370	1100	400	944	846	1800	1170	1260	353	388	550	562
21	380	1150	400	928	802	1600	1980	1270	344	292	502	666
22	375	1000	400	897	2080	1700	1790	1190	418	307	400	718
23	370	860	400	835	3360	1800	1640	1140	543	303	369	660
24	360	800	395	898	2580	1700	1440	1130	489	326	337	571
25	400	764	395	1050	2000	1600	1320	987	381	270	323	516
26	380	717	395	1170	1700	1400	1220	1090	351	240	262	423
27	370	730	395	1020	1700	1200	903	993	390	220	297	459
28	410	732	390	906	1710	1100	980	823	484	220	322	445
29	390	688	390	870	---	1100	1000	789	493	208	241	425
30	385	660	400	805	---	1250	980	762	480	204	245	407
31	380	---	450	754	---	1300	---	620	---	200	193	---
TOTAL	10075	21786	14720	25825	34114	55120	38203	29694	15272	8624	9080	15461
MEAN	325	726	475	833	1218	1778	1273	958	509	278	293	515
MAX	410	1150	650	1240	3360	2900	1980	1580	900	423	1020	1380
MIN	180	370	390	440	732	1040	903	520	344	200	144	195

WTR YR 1990 TOTAL 277974 MEAN 762 MAX 3360 MIN 144

04174950 WILLOW RUN NEAR RAWSONVILLE, MI

LOCATION.--Lat 42°13'09", long 83°32'13", in SW1/4 sec.18, T.3 S., R.8 E., Wayne County, Hydrologic Unit 04090005, on right bank 30 ft upstream from culverts on North I-94 Service Road, 0.7 mi upstream from mouth, and 0.8 mi northeast of Rawsonville.

DRAINAGE AREA.--Indeterminate.

PERIOD OF RECORD.--April 1986 to current year (seasonal records only, April to September).

GAGE.--Water-stage recorder. Elevation of gage is 670 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Sept. 26-30. Actual surface drainage area is 6.28 mi². Flow contains effluent from sewage-treatment plant about 1 mi upstream from station. Some of this flow originates from ground-water sources and other sources outside the basin.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily discharge during period April to September, 142 ft³/s, Aug. 19, 1990; minimum daily, 21 ft³/s, Aug. 31, Sept. 1, 18, 1986, July 5, 1987, July 5, 1989.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1							45	37	37	32	28	30
2							45	38	48	30	28	28
3							46	36	53	29	28	27
4							48	56	37	30	38	28
5							45	46	37	30	32	32
6							42	37	35	30	27	43
7							42	34	34	28	33	139
8							40	39	58	27	30	51
9							41	36	37	30	28	43
10							72	35	32	30	29	42
11							60	33	34	29	38	38
12							55	33	34	28	49	41
13							48	52	35	27	67	34
14							51	39	55	30	38	46
15							44	49	35	26	32	33
16							41	66	34	25	32	43
17							45	58	33	31	32	40
18							44	47	31	30	28	38
19							42	42	38	29	142	62
20							67	39	37	30	56	44
21							79	38	35	30	55	56
22							56	39	37	35	43	49
23							45	35	45	29	39	38
24							45	36	32	30	38	37
25							45	38	29	31	35	40
26							42	34	37	31	31	40
27							43	31	33	29	31	39
28							41	30	36	29	34	38
29							39	34	34	26	31	37
30							36	34	35	28	31	36
31							---	34	---	31	27	---
TOTAL							1434	1235	1127	910	1210	1292
MEAN							47.8	39.8	37.6	29.4	39.0	43.1
MAX							79	66	58	35	142	139
MIN							36	30	29	25	27	27

04175600 RIVER RAISIN NEAR MANCHESTER, MI

LOCATION.--Lat 42°10'05", long 84°04'34", in NE1/4 SE1/4 sec.33, T.3 S., R.3 E., Washtenaw County, Hydrologic Unit 04100002, on left bank at downstream side of bridge on Sharon Valley Road, 2.5 mi northwest of Manchester.

DRAINAGE AREA.--132 mi².

PERIOD OF RECORD.--January 1970 to September 1981, January 1985 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 900 ft above National Geodetic Vertical Datum of 1929, from topographic map. Prior to July 30, 1970, nonrecording gage at same site and datum.

REMARKS.--Estimated daily discharges: Dec. 12 to Jan. 8, Jan. 13, 14, 19, Feb. 15, Feb. 25 to Mar. 1, and Mar. 8. Records good except for estimated daily discharges, which are poor. Occasional regulation caused by many dams upstream from station. Several measurements of water temperature were made during the year.

AVERAGE DISCHARGE.--16 years (water years 1971-81, 1986-90), 104 ft³/s, 10.70 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 869 ft³/s, Feb. 24, 1985, gage height, 7.21 ft; minimum, 4.5 ft³/s, Nov. 29, 1971; minimum gage height, 1.16 ft, Oct. 12, Nov. 4, 1978.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 280 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Feb. 23	1000	476	5.71	Apr. 21	1700	282	4.68
Feb. 25	--	ice jam	*5.98	May 18	0400	285	4.70
Mar. 13	0900	*480	5.73				

Minimum discharge, 10 ft³/s, Oct. 9, gage height, 1.50 ft; minimum daily, 27 ft³/s, Oct. 9.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	42	56	80	100	120	300	230	118	109	85	34	59
2	43	51	79	90	158	287	250	110	104	78	28	56
3	44	51	79	85	171	285	247	104	120	75	31	47
4	42	48	74	110	162	269	231	112	121	72	28	45
5	38	48	74	180	151	248	211	154	115	68	39	43
6	39	56	72	150	146	239	193	161	111	63	38	41
7	41	70	70	125	146	218	180	142	105	59	37	72
8	36	103	71	115	156	230	170	126	108	54	34	85
9	27	103	67	110	179	249	161	116	116	51	32	79
10	39	100	62	133	190	354	193	111	110	47	30	74
11	54	93	60	136	172	418	265	108	105	47	29	68
12	51	84	60	127	154	454	259	97	100	47	30	61
13	47	75	60	120	148	475	233	118	94	43	60	56
14	42	79	60	115	149	449	222	150	101	45	85	58
15	42	111	60	107	158	426	222	151	115	46	91	74
16	41	164	60	109	166	426	212	182	108	46	89	75
17	45	183	60	136	179	414	199	241	99	48	83	73
18	48	160	60	186	178	388	181	271	90	46	76	60
19	47	136	60	160	168	360	170	231	83	45	94	73
20	70	138	60	145	141	334	174	199	77	47	117	91
21	86	135	59	135	130	316	259	178	68	51	130	87
22	82	119	58	131	200	305	262	162	66	53	137	116
23	72	108	58	131	459	329	228	150	80	57	126	110
24	65	95	57	141	458	309	197	142	80	56	118	100
25	62	91	57	168	400	284	180	142	73	52	110	89
26	60	93	56	195	380	256	166	154	67	49	104	79
27	57	91	56	172	350	233	153	158	63	47	95	71
28	56	98	56	162	330	215	142	149	64	43	88	66
29	54	95	57	145	---	201	134	136	73	41	79	64
30	53	89	60	132	---	212	124	124	79	39	72	65
31	55	---	70	124	---	217	---	116	---	37	65	---
TOTAL	1580	2923	1972	4175	5899	9700	6048	4613	2804	1637	2209	2137
MEAN	51.0	97.4	63.6	135	211	313	202	149	93.5	52.8	71.3	71.2
MAX	86	183	80	195	459	475	265	271	121	85	137	116
MIN	27	48	56	85	120	201	124	97	63	37	28	41
CFSM	.39	.74	.48	1.02	1.60	2.37	1.53	1.13	.71	.40	.54	.54
IN.	.45	.82	.56	1.18	1.66	2.73	1.70	1.30	.79	.46	.62	.60

CAL YR 1989 TOTAL 41153 MEAN 113 MAX 612 MIN 27 CFSM .86 IN 11.60
WTR YR 1990 TOTAL 45697 MEAN 125 MAX 475 MIN 27 CFSM .95 IN 12.88

STREAMS TRIBUTARY TO LAKE ERIE

04176000 RIVER RAISIN NEAR ADRIAN, MI

LOCATION.--Lat 41°54'15", long 83°58'50", in NW1/4 sec.5, T.7 S., R.4 E., Lenawee County, Hydrologic Unit 04100002, on right bank at downstream side of bridge on Academy Road, 1.7 mi east of Adrian, and 2.6 mi downstream from South Branch.

DRAINAGE AREA.--463 mi².

PERIOD OF RECORD.--October 1953 to September 1978, October 1978 to September 1984 (operated as a crest-stage partial-record station only), October 1984 to current year. Records for October 1930 to August 1931 and October 1932 to April 1938, published as "Raisin River" in WSP 714, 744, 759, 784, 804, 824, and 854, have been found to be unreliable and should not be used.

REVISED RECORDS.--WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 693.2 ft above National Geodetic Vertical Datum of 1929.

REMARKS.--Estimated daily discharges: Dec. 5 to Jan. 8, Jan. 12-14, Feb. 22-27, and Mar. 1-8. Records good except for estimated daily discharges, which are poor. Diurnal fluctuation caused by powerplant at Tecumseh, 11 mi upstream from station, prior to June 27, 1968. Several measurements of water temperature were made during the year. National Weather Service gage-height telemeter at station.

AVERAGE DISCHARGE.--31 years (water years 1954-78, 1985-90), 329 ft³/s, 9.65 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 6,660 ft³/s, Mar. 15, 1982, gage height, 15.77 ft; minimum, 18 ft³/s, Aug. 10, 1964, gage height, 1.33 ft; minimum daily, 25 ft³/s, Oct. 26, 1965.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 1,400 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Feb. 24	--	*3,650	unknown	May 18	0400	1,400	10.57
Mar. 12	0200	2,090	11.77				

Minimum discharge, 89 ft³/s, Aug. 4, gage height, 2.79 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	144	191	285	220	389	1050	591	382	341	302	104	182
2	166	189	269	250	571	920	619	360	306	260	99	169
3	206	187	253	280	813	850	647	338	802	232	95	156
4	142	184	236	430	813	800	636	347	1030	210	95	146
5	138	183	230	550	611	750	603	462	814	198	123	137
6	135	188	225	850	533	680	566	506	511	183	124	134
7	131	205	220	650	554	660	537	470	455	171	120	183
8	128	250	215	560	609	630	510	434	453	162	112	183
9	128	286	210	493	642	786	486	397	462	152	104	197
10	148	290	205	570	723	1390	570	371	429	145	97	186
11	144	277	200	651	684	1990	916	352	387	150	93	185
12	143	262	195	470	570	2040	1140	346	345	158	140	170
13	174	247	190	420	503	1800	974	528	319	155	416	161
14	143	238	185	380	478	1540	781	780	299	157	338	167
15	145	286	180	360	477	1340	741	859	307	155	270	197
16	148	546	180	350	479	1230	696	904	305	147	234	207
17	157	770	175	407	487	1180	637	1250	288	151	206	207
18	187	736	175	682	474	1090	582	1340	269	125	197	196
19	176	564	170	831	469	976	554	1060	244	111	318	202
20	210	476	170	663	457	871	463	823	228	126	376	208
21	221	448	165	520	424	805	534	667	231	130	446	230
22	235	432	165	458	1300	755	657	564	227	149	606	368
23	243	382	165	425	3000	744	663	522	251	166	518	395
24	236	336	165	415	3500	757	616	458	242	156	387	341
25	250	309	165	495	3200	729	558	450	235	148	345	247
26	217	291	165	695	2100	673	510	484	218	138	303	256
27	228	282	170	713	1450	633	463	479	205	129	262	241
28	201	297	175	564	1240	585	446	460	274	121	237	205
29	195	329	180	498	---	564	420	434	368	118	277	212
30	191	309	190	450	---	563	399	403	374	112	218	204
31	191	---	200	410	---	566	---	372	---	111	191	---
TOTAL	5501	9970	6073	15710	27550	29947	18515	17602	11219	4928	7451	6272
MEAN	177	332	196	507	984	966	617	568	374	159	240	209
MAX	250	770	285	850	3500	2040	1140	1340	1030	302	606	395
MIN	128	183	165	220	389	563	399	338	205	111	93	134
CFSM	.38	.72	.42	1.10	2.13	2.09	1.33	1.23	.81	.34	.52	.45
IN.	.44	.80	.49	1.26	2.21	2.41	1.49	1.41	.90	.40	.60	.50

CAL YR 1989 TOTAL 142621 MEAN 391 MAX 2860 MIN 121 CFSM .84 IN 11.46
WTR YR 1990 TOTAL 160738 MEAN 440 MAX 3500 MIN 93 CFSM .95 IN 12.91

04176500 RIVER RAISIN NEAR MONROE, MI
(National stream quality accounting network station)

LOCATION.--Lat 41°57'38", long 83°31'52", Monroe County, Hydrologic Unit 04100002, on left bank 0.8 mi downstream from bridge on Ida Maybee Road, 5.0 mi downstream from Saline River, and 7.5 mi west of Monroe.

DRAINAGE AREA.--1,042 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--September 1937 to current year. Published as "Raisin River at Monroe" 1937-52 and as "River Raisin at Monroe" 1952-53.

REVISED RECORDS.--WSP 954: 1938-40(M), 1941. WSP 1437: 1939, 1948. WSP 2112: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 616.26 ft above National Geodetic Vertical Datum of 1929. Prior to Oct. 1, 1953, at site 9 mi downstream at datum 46.26 ft lower.

REMARKS.--Estimated daily discharges: Dec. 4 to Jan. 10, Jan. 12-14, and Feb. 25-27. Water-discharge records good except for estimated daily discharges, which are fair. Diurnal fluctuation caused by powerplants upstream from station prior to June 27, 1968. At times, flow is affected by irrigation pumpage.

AVERAGE DISCHARGE.--53 years, 733 ft³/s, 9.55 in/yr.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 15,300 ft³/s, Mar. 16, 1982, gage height, 10.4 ft; maximum gage height, 11.16 ft, Mar. 15, 1982, backwater from ice; minimum discharge, about 2 ft³/s, Sept. 4, 1938, Sept. 19, 20, 1941, site then in use.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 3,500 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Feb. 24	2100	*8,280	*8.98	May 16	2400	3,950	6.54
Mar. 14	0400	4,530	6.93				

Minimum discharge, 112 ft³/s, Aug. 4, gage height, 2.11 ft.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	193	242	474	300	734	3730	888	629	552	499	137	259
2	195	235	456	350	1160	2780	1010	585	516	465	127	229
3	185	235	412	400	1800	2600	1130	554	1200	382	118	210
4	185	226	350	500	1830	2230	1140	571	1380	326	116	198
5	224	222	330	1300	1860	1980	1080	845	1390	286	119	192
6	203	225	310	2100	1670	1750	993	1070	1340	256	126	185
7	177	237	300	1900	1550	1510	909	1090	1080	238	142	198
8	171	253	290	1100	1580	1280	832	947	881	224	151	281
9	164	301	280	900	1580	1550	781	786	921	214	143	301
10	170	319	275	1000	1550	3070	909	688	850	204	131	264
11	165	340	270	1090	1380	3980	2020	600	833	196	123	247
12	168	332	265	900	1240	4270	2000	547	700	188	121	242
13	178	324	260	800	1100	4430	2090	908	589	184	171	232
14	181	318	255	720	952	4410	1980	1590	516	193	265	228
15	179	349	250	654	883	3830	1750	1710	539	198	424	224
16	183	995	245	610	911	3330	1460	2930	527	193	374	253
17	183	1290	240	717	993	2920	1270	3550	455	194	305	269
18	182	1290	235	1740	1040	2390	1120	3100	420	189	262	278
19	201	1230	230	1900	1070	2030	991	2970	382	189	261	295
20	228	1060	225	2030	1010	1780	911	2770	357	178	314	286
21	263	871	220	1800	926	1550	1100	2260	344	160	468	350
22	272	744	220	1360	2270	1370	1220	1600	324	160	651	368
23	288	668	220	1080	6970	1260	1350	1160	328	174	724	493
24	298	612	220	1010	7780	1210	1250	964	335	185	727	537
25	299	549	225	1140	7700	1140	1100	847	342	195	607	484
26	289	495	225	1410	6700	1090	982	810	327	187	459	414
27	281	469	225	1340	5700	1010	881	796	314	178	393	331
28	268	466	230	1330	4250	936	798	771	308	163	350	300
29	258	485	240	1190	---	877	735	727	348	153	325	279
30	250	470	250	981	---	851	685	668	417	150	296	247
31	247	---	270	835	---	858	---	608	---	146	306	---
TOTAL	6728	15852	8497	34487	68189	68002	35365	39651	18815	6847	9236	8674
MEAN	217	528	274	1112	2435	2194	1179	1279	627	221	298	289
MAX	299	1290	474	2100	7780	4430	2090	3550	1390	499	727	537
MIN	164	222	220	300	734	851	685	547	308	146	116	185
CFSM	.21	.51	.26	1.07	2.34	2.11	1.13	1.23	.60	.21	.29	.28
IN.	.24	.57	.30	1.23	2.43	2.43	1.26	1.42	.67	.24	.33	.31

CAL YR 1989 TOTAL 282578 MEAN 774 MAX 8010 MIN 164 CFSM .74 IN 10.09
WTR YR 1990 TOTAL 320343 MEAN 878 MAX 7780 MIN 116 CFSM .84 IN 11.44

04176500 RIVER RAISIN NEAR MONROE, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1966-75, 1978 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: April 1978 to July 1981.
WATER TEMPERATURE: March 1966 to September 1972, April 1978 to July 1981.
SUSPENDED-SEDIMENT DISCHARGE: March 1966 to September 1972.

INSTRUMENTATION.--Water-quality monitor from Mar. 23 to July 13, 1981.

REMARKS.--Cross-sectional samples were collected at gaging station, or 0.8 mi upstream at bridge on Ida Maybee Road.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE (water years 1979-81): Maximum daily, 1,020 microsiemens, Feb. 16, 1979; minimum daily recorded (more than 20 percent missing record), 263 microsiemens, Jan. 25, 1981.
WATER TEMPERATURE (water years 1967, 1970-72, 1979-80): Maximum daiy recorded (more than 20 percent missing record), 32.0°C, July 18, 1972; minimum daily, 0.0°C on many days during winter.
SEDIMENT CONCENTRATION (water years 1967-72): Maximum daily mean, 1,430 mg/L, Dec. 22, 1967; minimum daily mean, 1 mg/L on several days in 1970.
SEDIMENT LOAD: Maximum daily, 28,000 tons, Dec. 22, 1967; minimum daily, 0.29 ton, Aug. 31, 1971.

EXTREMES OUTSIDE PERIOD OF DAILY RECORD.--A specific conductance of 200 microsiemens was measured Feb. 25, 1985.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 UM-MF (COLS./ 100 ML)	STREP-TOCOCCI FECAL, KF AGAR (COLS. PER 100 ML)
DEC										
14...	1130	363	913	8.5	0.0	1.4	16.8	118	K38	K12
APR										
04...	1130	1140	664	8.5	5.5	78	12.2	100	K72	K120
JUN										
15...	1230	548	685	8.4	22.5	34	8.9	105	K1000	280
27...	1130	308	738	8.5	21.0	--	10.1	116	--	--
AUG										
08...	1500	153	708	8.6	25.0	15	10.7	132	--	--
SEP										
12...	1200	241	618	8.5	23.0	24	9.8	117	K96	780

DATE	HARD-NESS TOTAL (MG/L AS CACO3)	HARD-NESS NONCARB DISSOLV FLD. AS CACO3 (MG/L)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	BICAR-BONATE WATER DIS IT FIELD MG/L AS HCO3	CAR-BONATE WATER DIS IT FIELD MG/L AS CO3
DEC										
14...	410	140	120	27	22	10	0.5	12	305	10
APR										
04...	320	100	92	21	14	9	0.3	4.9	244	7
JUN										
15...	340	100	99	22	15	9	0.4	6.8	283	2
27...	--	--	--	--	--	--	--	--	--	--
AUG										
08...	310	--	85	24	28	16	0.7	8.6	--	--
SEP										
12...	280	53	77	20	21	14	0.6	4.4	251	10

DATE	ALKA-LINITY WAT DIS TOT IT FIELD MG/L AS CACO3	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	SOLIDS, DIS-SOLVED (TONS PER AC-FT)	SOLIDS, DIS-SOLVED (TONS PER DAY)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)
DEC									
14...	266	130	45	0.3	7.0	551	0.75	540	0.03
APR									
04...	212	65	33	<0.1	4.6	425	0.58	1310	0.02
JUN									
15...	236	92	37	0.4	7.6	470	0.64	695	0.03
27...	--	99	39	--	--	--	--	--	0.02
AUG									
08...	--	100	52	0.2	5.3	442	0.60	183	<0.01
SEP									
12...	222	56	40	0.2	9.4	372	0.51	242	<0.01

STREAMS TRIBUTARY TO LAKE ERIE

04176500 RIVER RAISIN NEAR MONROE, MI--Continued

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	NITROGEN, NO2+NO3 DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA TOTAL (MG/L AS N)	NITROGEN, AMMONIA DISSOLVED (MG/L AS N)	NITROGEN, AMMONIA + ORGANIC TOTAL (MG/L AS N)	PHOSPHORUS TOTAL (MG/L AS P)	PHOSPHORUS DISSOLVED (MG/L AS P)	PHOSPHORUS ORTHO, DISSOLVED (MG/L AS P)	ALUMINUM, DISSOLVED (UG/L AS AL)	ARSENIC DISSOLVED (UG/L AS AS)	BARIUM, DISSOLVED (UG/L AS BA)
DEC										
14...	2.4	0.14	0.14	0.70	0.03	0.03	0.01	<10	<1	67
APR										
04...	3.9	0.04	0.03	0.80	0.05	0.02	0.01	<10	1	48
JUN										
15...	4.2	0.03	0.01	0.90	0.04	0.05	0.04	14	1	68
27...	1.7	--	--	--	--	--	--	--	--	--
AUG										
08...	0.40	--	--	--	--	--	--	--	--	--
SEP										
12...	1.0	0.02	<0.01	0.50	0.08	0.03	0.04	10	1	65

DATE	BERYLLIUM, DISSOLVED (UG/L AS BE)	CADMIUM DISSOLVED (UG/L AS CD)	CHROMIUM, DISSOLVED (UG/L AS CR)	COBALT, DISSOLVED (UG/L AS CO)	COPPER, DISSOLVED (UG/L AS CU)	IRON, DISSOLVED (UG/L AS FE)	LEAD, DISSOLVED (UG/L AS PB)	LITHIUM DISSOLVED (UG/L AS LI)	MANGANESE, DISSOLVED (UG/L AS MN)	MERCURY DISSOLVED (UG/L AS HG)
DEC										
14...	<0.5	<1	1	<3	2	4	<1	14	33	<0.1
APR										
04...	<0.5	<1	--	<3	--	16	--	9	18	<0.1
JUN										
15...	<0.5	<1	<1	<3	3	5	<1	14	13	<0.1
27...	--	--	--	--	--	--	--	--	--	--
AUG										
08...	--	--	--	--	--	--	--	--	--	--
SEP										
12...	<0.5	<1	1	<3	6	7	1	10	9	<0.1

DATE	MOLYBDENUM, DISSOLVED (UG/L AS MO)	NICKEL, DISSOLVED (UG/L AS NI)	SELENIUM, DISSOLVED (UG/L AS SE)	SILVER, DISSOLVED (UG/L AS AG)	STRONTIUM, DISSOLVED (UG/L AS SR)	VANADIUM, DISSOLVED (UG/L AS V)	ZINC, DISSOLVED (UG/L AS ZN)	SEDIMENT, SUSPENDED (MG/L)	SEDIMENT, DISCHARGE, SUSPENDED (T/DAY)	SED. SUSP. SIEVE DIAM. % FINER THAN .062 MM
DEC										
14...	<10	2	<1	<1.0	770	<6	5	58	57	48
APR										
04...	<10	--	<1	2.0	400	<6	6	12	37	100
JUN										
15...	<10	2	<1	<1.0	530	<6	3	49	73	99
27...	--	--	--	--	--	--	--	--	--	--
AUG										
08...	--	--	--	--	--	--	--	--	--	--
SEP										
12...	<10	2	<1	<1.0	410	<6	3	44	29	100

STREAMS TRIBUTARY TO LAKE ERIE

04176605 OTTER CREEK AT LA SALLE, MI

LOCATION.--Lat 41°52'01", long 83°27'13", in NW1/4 NW1/4 sec.23 (private claim 47), T.7 S., R.8 E., Monroe County, Hydrologic Unit 04100001, on right bank 150 ft upstream from bridge on State Highway 125 in La Salle, 2.3 mi downstream from South Branch, and 4.6 mi southwest of Monroe.

DRAINAGE AREA.--51.0 mi².

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1987 to current year.

GAGE.--Water-stage recorder. Elevation of gage is 580 ft above National Geodetic Vertical Datum of 1929, from topographic map.

REMARKS.--Estimated daily discharges: Dec. 4 to Jan. 14, Feb. 25, 26, and Mar. 5-8. Water-discharge records fair except for estimated daily discharges and discharges below 1.0 ft³/s, which are poor.

EXTREMES FOR PERIOD OF RECORD--Maximum discharge, 2,050 ft³/s, Feb. 23, 1990, gage height, 10.73 ft, from rating curve extended above 700 ft³/s; no flow June 21 to July 16, 1988.

EXTREMES FOR CURRENT YEAR.--Peak discharges greater than base discharge of 400 ft³/s and maximum (*):

Date	Time	Discharge (ft³/s)	Gage height (ft)	Date	Time	Discharge (ft³/s)	Gage height (ft)
Feb. 23	0100	*a2,050	*10.73	May 16	1900	623	8.52

a From rating curve extended above 700 ft³/s.

Minimum daily discharge, 0.01 ft³/s, Aug. 11.

DISCHARGE, IN CUBIC FEET PER SECOND, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	4.8	6.5	18	3.5	30	128	99	26	18	9.0	.39	1.6
2	4.7	6.2	18	8.0	208	132	109	23	17	5.7	.26	1.3
3	4.5	5.7	15	19	191	141	93	21	30	4.1	.15	1.0
4	3.9	5.1	12	100	115	112	74	47	36	3.1	.11	.89
5	3.5	4.8	10	150	84	70	57	154	28	2.4	.30	.79
6	3.4	4.8	9.0	70	98	60	44	102	23	2.0	.40	.74
7	3.1	5.1	8.0	45	105	55	40	64	19	1.7	.34	5.5
8	2.9	6.6	7.5	30	86	50	38	44	20	1.6	.20	6.8
9	2.8	7.7	6.6	22	72	206	35	35	26	1.4	.10	4.4
10	3.1	7.2	6.0	70	59	306	125	31	20	1.3	.05	2.8
11	3.8	6.3	5.5	55	47	285	293	26	15	2.0	.01	1.8
12	3.8	5.7	5.0	45	39	208	159	23	13	2.4	.80	1.5
13	3.1	5.1	4.7	37	37	157	110	203	12	1.9	24	1.5
14	2.9	5.3	4.3	32	37	128	101	204	11	2.2	14	1.8
15	2.8	11	4.0	30	41	106	97	122	9.4	2.3	5.9	3.9
16	2.7	106	3.6	30	68	139	75	405	7.7	1.9	3.3	5.5
17	3.4	89	3.4	84	99	147	60	424	6.8	1.5	2.2	6.5
18	6.4	53	3.2	224	77	102	44	247	5.8	1.1	1.6	4.9
19	7.9	37	3.1	129	88	81	39	136	4.8	.86	6.4	6.5
20	17	35	2.9	79	77	72	41	101	4.9	.81	9.3	11
21	24	32	2.8	71	63	64	141	72	5.3	.86	13	9.5
22	23	27	2.7	68	769	57	120	52	5.2	1.4	13	19
23	17	23	2.6	67	1440	59	88	42	7.5	2.4	9.6	17
24	13	23	2.5	69	578	47	69	37	7.7	1.9	7.2	11
25	11	18	2.4	70	250	43	57	35	6.6	1.2	5.3	8.1
26	9.8	18	2.3	73	180	39	50	52	4.9	.87	4.0	6.3
27	8.5	18	2.2	52	143	34	46	45	4.3	.63	3.1	5.1
28	7.7	23	2.2	44	141	33	45	35	5.1	.48	2.5	4.3
29	6.9	23	2.2	41	---	31	38	29	8.6	.34	3.2	4.0
30	6.6	23	2.3	37	---	43	30	24	11	.31	2.6	3.8
31	6.5	---	2.5	31	---	80	---	21	---	.63	2.1	---
TOTAL	224.5	641.1	176.5	1885.5	5222	3215	2417	2882	393.6	60.29	135.41	158.82
MEAN	7.24	21.4	5.69	60.8	187	104	80.6	93.0	13.1	1.94	4.37	5.29
MAX	24	106	18	224	1440	306	293	424	36	9.0	24	19
MIN	2.7	4.8	2.2	3.5	30	31	30	21	4.3	.31	.01	.74
CFSM	.14	.42	.11	1.19	3.67	2.04	1.58	1.82	.26	.04	.09	.10
IN.	.16	.47	.13	1.38	3.81	2.35	1.76	2.10	.29	.04	.10	.12

CAL YR 1989 TOTAL 13222.10 MEAN 36.2 MAX 579 MIN 1.8 CFSM .71 IN 9.64
WTR YR 1990 TOTAL 17411.72 MEAN 47.7 MAX 1440 MIN .01 CFSM .94 IN 12.70

STREAMS TRIBUTARY TO LAKE ERIE

04176605 OTTER CREEK AT LA SALLE, MI--Continued

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1972-73, 1990.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	HARD-NESS TOTAL (MG/L AS CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)
JUN										
27...	1455	4.30	560	8.8	25.0	--	10.6	131	--	--
AUG										
07...	1430	0.34	651	8.2	22.5	3.5	10.0	--	270	71
SEP										
11...	1120	1.80	751	8.3	21.5	7.9	9.9	114	290	82

DATE	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)	SODIUM, DIS-SOLVED (MG/L AS NA)	SODIUM PERCENT	SODIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY LAB (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)
JUN									
27...	--	--	--	--	--	--	65	45	--
AUG									
07...	22	25	17	0.7	3.8	123	130	59	0.2
SEP									
11...	20	34	20	0.9	6.2	164	93	84	0.2

DATE	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
JUN				
27...	--	--	0.02	1.6
AUG				
07...	2.8	424	<0.01	<0.1
SEP				
11...	4.6	447	<0.01	0.4

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

As the number of streams on which streamflow information is likely to be desired far exceeds the number of stream-gaging stations feasible to operate at one time, the Geological Survey collects limited streamflow data at sites other than stream-gaging stations. When limited streamflow data are collected on a systematic basis over a period of years for use in hydrologic analyses, the site at which the data are collected is called a partial-record station. Data collected at these partial-record stations are usable in low-flow or floodflow analyses, depending on the type of data collected. In addition, discharge measurements are made at other sites not included in the partial-record program. These measurements are generally made in time of drought or flood to give better areal coverage to those events. Those measurements and others collected for some special reason are called measurements at miscellaneous sites.

Records collected at partial-record stations are presented in two tables. The first is a table of annual maximum stage and discharge at crest-stage partial-record stations and the second is a table of discharge measurements at low-flow partial-record stations. Discharge measurements at miscellaneous sites are given in a third table.

Crest-stage partial-record stations

The following table contains annual maximum discharge for crest-stage stations. A crest-stage gage is a device which will register the peak stage occurring between inspections of the gage. A stage-discharge relation for each gage is developed from discharge measurements made by indirect measurements of peak flow or by current meter. The date of the maximum discharge is not always certain but is usually determined by comparison with nearby continuous-record stations, weather records, or local inquiry. Only the maximum discharge for each water year is given. Information on some lower floods may have been obtained but is not published herein. The years given in the period of record represent water years for which the annual maximum has been determined.

Annual maximum discharge at crest-stage partial-record stations during water year 1990

Station No.	Station Name	Location	Drainage area (mi^2)	Period of record	Annual Maximum		
					Date	Gage height (ft)	Discharge (ft^3/s)
		STREAMS TRIBUTARY TO LAKE SUPERIOR					
04041000	Perch River near Sidnaw, MI	Lat 46°31'06", long 88°39'48", in NE1/4 sec.34, T.48 N., R.35 W., Baraga County, Hydrologic Unit 04020104, at State Highway 28, 2.5 mi east of Sidnaw.	63.1	1913-15‡, 1957-90	03-16-90	8.60	198
04044200	Carp Creek at Ishpeming, MI	Lat 46°29'11", long 87°41'21", in NW1/4 sec.9, T.47 N., R.27 W., Marquette County, Hydrologic Unit 04020105, at Highway 41A in Ishpeming.	16.5	1970-90	03-17-90	<5.90	<109
04044813	Two Hearted River near Paradise, MI	Lat 46°41'15", long 85°26'26", in SE1/4 NW1/4 sec.33, T.50 N., R.9 W., Luce County, Hydrologic Unit 04020201, on right bank, 300 ft downstream from end of Trail Road, 3.2 mi upstream from mouth, and 20 mi northwest of Paradise.	200	1973-90	04-25-90	9.65	987
04045538	West Branch Waiska River near Brimley, MI	Lat 46°21'18", long 84°35'35", in SW1/4 NW1/4 sec.29, T.46 N., R.2 W., Chippewa County, Hydrologic Unit 04020203, at county road, 3.2 mi upstream from mouth, and 3.5 mi south of Brimley.	40.7	1973-90	09-04-90	6.16	274
04045559	East Branch Waiska River near Brimley, MI	Lat 46°25'07", long 84°28'24", in NW1/4 NE1/4 sec.6, T.46 N., R.1 W., Chippewa County, Hydrologic Unit 04020203, at county road, 4.0 mi upstream from mouth, and 4.7 mi east of Brimley.	30.1	1973-90	05-17-90	9.02	335
		STREAMS TRIBUTARY TO LAKE MICHIGAN					
04046000	Black River near Garnet, MI	Lat 46°07'05", long 85°21'55", in SE1/4 sec.13, T.43 N., R.9 W., Mackinac County, Hydrologic Unit 04060107, on right bank 10 ft upstream from footbridge, 15 ft downstream from Peters Creek, 3.5 mi upstream from mouth, and 4 mi southwest of Garnet.	a28	1951-78‡, 1979-90	05-16-90	b4.66	168
04057900	Black River near Republic, MI	Lat 42°25'08", long 87°53'21", in NE1/4 sec.2, T.46 N., R.29 W., Marquette County, Hydrologic Unit 04030110, at county road, 4.4 mi east of Republic.	34.4	1961-68‡, 1970-90	05-17-90	c3.04	183
04059400	Tenmile Creek at Perronville, MI	Lat 45°48'38", long 87°22'00", in NW1/4 NW1/4 sec.2, T.39 N., R.25 W., Menominee County, Hydrologic Unit 04030109, at county road, 1 mi northwest of Perronville, and 11.5 mi upstream from Ford River.	38.4	1971-77‡, 1978-90	05-17-90	4.53	351

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Annual maximum discharge at crest-stage partial-record stations during water year 1990--Continued

Station No.	Station Name	Location	Drainage area (mi²)	Period of record	Annual Maximum		
					Date	Gage height (ft)	Discharge (ft³/s)
		STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued					
04062300	Michigamme River at Republic, MI	Lat 46°23'03", long 87°58'48", in SE1/4 sec.18, T.46 N., R.29 W., Marquette County, Hydrologic Unit 04030107, on left bank 400 ft upstream from county highway, 0.3 mi upstream from Trout Falls Creek, and 0.6 mi south of Republic.	240	1961-75‡, 1976-90	05-18-90	3.85	1,040
04096272	Beebe Creek near Hillsdale, MI	Lat 41°57'15", long 84°38'20", in NE1/4 NE1/4 sec.15, T.6 S., R.3 W., Hillsdale County, Hydrologic Unit 04050001, at Moore Road, 1.2 mi northwest of Hillsdale.	42.4	1974-78‡, 1979-90	02-24-90	6.27	334
04096340	St. Joseph River at Clarendon, MI	Lat 42°07'51", long 84°51'56", in SW1/4 SW1/4 sec.11, T.4 S., R.5 W., Calhoun County, Hydrologic Unit 04050001, at 22 Mile Road in Clarendon.	144	1974-77‡, 1978-90	03-12-90	7.13	592
04097170	Portage River near Vicksburg, MI	Lat 42°06'53", long 85°29'08", in SW1/4 sec.16, T.4 S., R.10 W., Kalamazoo County, Hydrologic Unit 04050001, at W Avenue, 2.4 mi east of Vicksburg.	68.2	1946-51‡, 1965-80‡, 1980-90	03-12-90	4.97	183
04108645	Rabbit River at Hamilton, MI	Lat 42°40'31", long 86°00'13", in NE1/4 sec.6, T.3 N., R.14 W., Allegan County, Hydrologic Unit 04050003, at State Highway 40 in Hamilton.	274	1979-90	03-12-90	14.30	1,520
04112700	Sycamore Creek near Mason, MI	Lat 42°36'38", long 84°27'58", in NE1/4 NE1/4 sec.31, T.3 N., R.1 W., Ingham County, Hydrologic Unit 04050004, at Harper Road, 0.7 mi downstream from Aurelius and Vevay Drain, and 2.6 mi northwest of Mason.	39.5	1975-90	03-11-90	9.64	252
04113090	Carrier Creek near Grand Ledge, MI	Lat 42°43'36", long 84°39'16", in SE1/4 SW1/4 sec.15, T.4 N., R.3 W., Eaton County, Hydrologic Unit 04050004, at St. Joe Highway, 3.7 mi upstream from mouth, and 4.0 mi southeast of Grand Ledge.	7.18	1975-90	03-11-90	5.92	109
04117000	Quaker Brook near Nashville, MI	Lat 42°33'57", long 85°05'37", in NW1/4 sec. 13, T.2 N., R.7 W., Barry County, Hydrologic Unit 04050007, on left bank 150 ft upstream from culvert on county road, 500 ft upstream from small tributary, and 2.5 mi south of Nashville.	7.60	1954-75‡, 1976-90	03-10-90	4.07	121
04119055	Plaster Creek at Grand Rapids, MI	Lat 42°54'46", long 85°39'02", in SE1/4 sec.7, T.6 N., R.11 W., Kent County, Hydrologic Unit 04050006, at 28th Street in Grand Rapids.	46.6	1974-90	01-17-90	7.66	583
04119160	Buck Creek at Grandville, MI	Lat 42°54'09", long 85°45'46", in SE1/4 sec.18, T.6 N., R.12 W., Kent county, Hydrologic Unit 04050006, at Wilson Avenue in Grandville.	50.5	1974-90	01-17-90	7.94	599
*04120295	Black Creek near Muskegon, MI	Lat 43°12'14", long 86°09'52", in NE1/4 NW1/4 sec.1, T.9 N., R.16 W., Muskegon County, Hydrologic Unit 04060101, at Mill Iron Road, 4.8 mi east of Muskegon, and 4.9 mi upstream from mouth.	a39	1975, 1977, 1979-90	03-13-90	3.18	205
04122230	North Branch Pentwater River near Pentwater, MI	Lat 43°47'42", long 86°21'30", in NE1/4 SE1/4 sec.8, T.16 N., R.17 W., Oceana County, Hydrologic Unit 04060101, at Oceana Drive, 3.5 mi northeast of Pentwater.	42.3	1975-90	03-13-90	3.27	257
04124500	East Branch Pine River near Tustin, MI	Lat 44°06'09", long 85°31'02", in NE1/4 NW1/4 sec.28, T.20 N., R.10 W., Osceola County, Hydrologic Unit 04060103, at Marion Road, 3.0 mi west of Tustin.	60.0	1952-63‡, 1964-90	03-13-90	5.15	442

See footnotes at end of table.

Annual maximum discharge at crest-stage partial-record stations during water year 1990--Continued

Station No.	Station Name	Location	Drainage area (mi²)	Period of record	Annual Maximum		
					Date	Gage height (ft)	Discharge (ft³/s)
		STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued					
04126600	Betsie River near Benzonia, MI	Lat 44°36'02", long 86°05'57", in NW1/4 NW1/4 sec.2, T.25 N., R.15 W., Benzie County, Hydrologic Unit 04060104, at U.S. Highway 31, 1.2 mi south of Benzonia.	a170	1975-90	03-27-76	4.97	d914
					03-13-77	4.40	d804
					05-14-78	3.60	d672
					03-31-79	5.11	d942
					04-10-80	4.06	d746
					04-04-81	3.78	d701
					03-15-90	5.26	971
04127850	Boyne River near Boyne City, MI	Lat 45°11'48", long 84°57'26", in NW1/4 SW1/4 sec.5, T.32 N., R.5 W., Charlevoix County, Hydrologic Unit 04060105, at Dam Road, 0.3 mi downstream from Boyne River hydroelectric plant, and 2.8 mi southeast of Boyne City.	64.2	1975-90	03-12-90	4.66	590
		STREAMS TRIBUTARY TO LAKE HURON					
04140200	Klacking Creek near Selkirk, MI	Lat 44°20'05", long 84°08'46", in NE1/4 NE1/4 sec.2, T.22 N., R.2 E., Ogemaw County, Hydrologic Unit 04080101, at Campbell Road, 4.0 mi northwest of Selkirk.	7.51	1953-90	03-13-90	1.84	82
04140500	Rifle River at Selkirk, MI	Lat 44°18'48", long 84°04'10", in SE1/4 NE1/4 sec.9, T.22 N., R.3 E., Ogemaw County, Hydrologic Unit 04080101, at State Road in Selkirk.	117	1950-82‡, 1983-90	03-13-90	4.20	1,480
04146020	South Branch Flint River near Millville, MI	Lat 43°04'44", long 83°18'25", in SE1/4 sec. 29, T.8 N., R.10 E., Lapeer County, Hydrologic Unit 04080204, at Saginaw Road, 1.6 mi north of Lapeer.	160	1974-90	03-13-90	7.62	569
04146450	North Branch Flint River near Columbiaville, MI	Lat 43°11'18", long 83°22'03", in NW1/4 sec. 24, T.9 N., R.9 E., Lapeer County, Hydrologic Unit 04080204, at Barnes Lake Road, 2.9 mi northeast of Columbiaville.	223	1987-90	03-13-90	14.04	860
		STREAMS TRIBUTARY TO ST. CLAIR RIVER					
04160350	Pine River near Rattle Run, MI	Lat 42°52'49", long 82°34'04", in NE1/4 sec.9, T.5 N., R.16 E., St. Clair County, Hydrologic Unit 04090001, at Gratiot Road, 1.9 mi northeast of Rattle Run.	135	1974-90	03-13-90	15.62	1,260
		STREAMS TRIBUTARY TO LAKE ST. CLAIR					
04161000	Clinton River at Auburn Heights, MI	Lat 42°38'00", long 83°13'28", in NW1/4 sec. 36, T.3 N., R.10 E., Oakland County, Hydrologic Unit 04090003, at Auburn Road in Auburn Heights.	123	1935-40‡, 1957-82‡, 1983-90	08-19-90	4.42	1,120
04161760	West Branch Stony Creek near Washington, MI	Lat 42°43'53", long 83°06'02", in SE1/4 sec.25, T.4 N., R.11 E., Oakland County, Hydrologic Unit 04090003, at Huron-Clinton Metropolitan Park Road, 3.4 mi west of Washington.	22.5	1965-90	03-13-90	2.74	61
04164010	North Branch Clinton River at Almont, MI	Lat 42°54'59", long 83°02'42", in NE1/4 sec.28, T.6 N., R.12 E., Lapeer County, Hydrologic Unit 04090003, at State Highway 53 in Almont.	9.56	1959-62, 1963-68‡, 1969-90	--	<3.72	<167
04164050	North Branch Clinton River near Romeo, MI	Lat 42°49'11", long 82°58'35", in NW1/4 sec.31, T.5 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at 33 Mile Road, 2.2 mi northeast of Romeo.	49.7	1959-64, 1965-69‡, 1970-90	03-11-90	e3.40	550

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Annual maximum discharge at crest-stage partial-record stations during water year 1990--Continued

Station No.	Station Name	Location	Drainage area (mi^2)	Period of record	Annual Maximum		
					Date	Gage height (ft)	Discharge (ft^3/s)
		STREAMS TRIBUTARY TO LAKE ST. CLAIR--Continued					
04164150	North Branch Clinton River near Meade, MI	Lat 42°43'50", long 82°54'23", in NE1/4 sec.34, T.4 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at 27 Mile Road, 1.9 mi northwest of Meade.	89.6	1959-67, 1968-72‡, 1973-90	02-23-90	f5.71	590
04164200	Coon Creek near Armada, MI	Lat 42°47'41", long 82°52'58", in SW1/4 sec.1, T.4 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at North Road, 3.4 mi south of Armada.	10.0	1959-65, 1966-70‡, 1971-90	03-11-90	5.15	140
04164350	Highbank Creek near Armada, MI	Lat 42°28'24", long 82°51'08", in NW1/4 sec.6, T.4 N., R.14 E., Macomb County, Hydrologic Unit 04090003, at 32 Mile Road, 3.0 mi southeast of Armada.	14.9	1959-65, 1965-70‡, 1971-90	03-11-90	g<15.20	<616
04164360	East Branch Coon Creek near New Haven, MI	Lat 42°45'46", long 82°50'57", in NW1/4 sec.19, T.4 N., R.14 E., Macomb County, Hydrologic Unit 04090003, at 29 Mile Road, 3.4 mi northwest of New Haven.	36.1	1959-67, 1968-72‡, 1973-90	03-12-90	7.57	568
04164400	Deer Creek near Meade, MI	Lat 42°42'39", long 82°51'32", in NW1/4 sec.6, T.3 N., R.14 E., Macomb County, Hydrologic Unit 04090003, at 25 1/2 Mile Road, 0.9 mi southeast of Meade.	12.7	1959-60, 1960-65‡, 1966-90	02-23-90	7.77	520
04164450	McBride Drain near Macomb, MI	Lat 42°41'14", long 82°55'14", in NE1/4 NE1/4 sec.16, T.3 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at 24 Mile Road, 2.2 mi southeast of Macomb.	5.79	1960-64‡, 1965-90	02-22-90	h7.64	i135
04164600	Middle Branch Clinton River near Macomb, MI	Lat 42°42'03", long 82°59'44", in SE1/4 sec.2, T.3 N., R.12 E., Macomb County, Hydrologic Unit 04090003, at Schoenherr Road, 2.0 mi west of Macomb.	22.2	1959-64, 1965-69‡, 1971-90	02-22-90	10.09	507
04164800	Middle Branch Clinton River at Macomb, MI	Lat 42°42'23", long 82°57'33", in SW1/4 sec.5, T.3 N., R.13 E., Macomb County, Hydrologic Unit 04090003, at Romeo Plank Road, 0.4 mi north of Macomb.	41.0	1959-62, 1963-68‡, 1969, 1970-82‡, 1983-90	02-22-90	j12.52	929
04165200	Gloede Ditch near Waldenburg, MI	Lat 42°37'39", long 82°57'10", in SW1/4 sec. 32, T.3 N., R.13 E., Macomb County, Hydrologic Unit 04090003, 2.2 mi south of Waldenburg.	16.0	1959, 1959-64‡, 1965-90	02-22-90	17.04	363
		STREAMS TRIBUTARY TO DETROIT RIVER					
04168660	Frank and Poet Drain at Trenton, MI	Lat 42°09'19", long 83°12'22", in NW1/4 sec.13, T.4 S., R.10 E., Wayne County, Hydrologic Unit 04090004, at King Road in Trenton.	19.3	1972-90	09-07-90	9.55	655
		STREAMS TRIBUTARY TO LAKE ERIE					
04168800	Huron River near Andersonville, MI	Lat 42°41'35", long 83°29'56", in NW1/4 SE1/4 sec.3, T.3 N., R.8 E., Oakland County, Hydrologic Unit 04090005, at White Lake Road, 2.5 mi south of Andersonville.	14.0	1974-90	05-17-90	2.68	84
04173250	Mill Creek near Lima Center, MI	Lat 42°15'56", long 83°56'45", in NE1/4 sec.34, T.2 S., R.4 E., Washtenaw County, Hydrologic Unit 04090005, at Guenther Road, 2.0 mi upstream from North Fork Mill Creek, and 2.2 mi south of Lima Center.	47.3	1973-90	08-19-90	9.05	426
04175960	South Branch River Raisin near Adrian, MI	Lat 41°55'03", long 84°00'37", in SE1/4 sec.25, T.6 S., R.3 E., Lenawee County, Hydrologic Unit 04100002, at Howell Highway, 2.0 mi northeast of Adrian.	165	1979-90	02-24-90	11.45	2,810

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Annual maximum discharge at crest-stage partial-record stations during water year 1990--Continued

Station No.	Station Name	Location	Drainage area (mi^2)	Period of record	Annual Maximum		
					Date	Gage height (ft)	Discharge (ft^3/s)
		STREAMS TRIBUTARY TO LAKE ERIE--Continued					
04176400	Saline River near Saline, MI	Lat 42°07'50", long 83°46'35", in SW1/4 sec.18, T.4 S., R.6 E., Washtenaw County, Hydrologic Unit 04100002, at Maple Road, 2.8 mi south of Saline.	94.6	1966-77†, 1978-90	02-24-90	12.03	2,000

† Operated as a continuous-record gaging station.
* Also a low-flow partial-record station.
a Approximately.
b Maximum gage height, 5.53 ft, Sept. 14, backwater from beaver dam.
c Maximum gage height, 3.11 ft, Mar. 17, backwater from ice.
d Revised.
e Maximum gage height, 3.41 ft, Jan. 5, backwater from ice.
f Maximum gage height, 5.80 ft, Jan. 5, backwater from ice.
g Maximum gage height, 15.27 ft, Feb. 22, backwater from ice.
h Backwater from ice.
i Estimated.
j Maximum gage height, 13.10 ft, Jan. 5, backwater from ice.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Low-flow partial-record stations

Measurements of streamflow in the area covered by this report made at low-flow partial-record stations are given in the following table. These measurements were made during periods of base flow when streamflow is primarily from ground-water storage. These measurements, when correlated with the simultaneous discharge of a nearby stream where continuous records are available, will give a picture of the low-flow potentiality of a stream. The column headed "Period of record" shows the water years in which measurements were made at the same, or practically the same, site.

Discharge measurements made at low-flow partial-record stations during water year 1990

Station No.	Station Name	Location	Drainage area (mi^2)	Period of record	Measurements	
					Date	Discharge (ft^3/s)
		STREAMS TRIBUTARY TO LAKE SUPERIOR				
04044400	Carp River near Negaunee, MI	Lat 46°31'29", long 87°34'25", in SE1/4 sec.29, T.48 N., R.26 W., Marquette County, Hydrologic Unit 04020105, at U.S. Highway 41, 2.0 mi northeast of Negaunee.	51.4	1961-86‡a, 1987-90a	10-04-89	b48.8
					06-14-90	b81.4
					07-24-90	b17.5
					09-12-90	b10.6
		STREAMS TRIBUTARY TO LAKE MICHIGAN				
04057580	Whitefish River near Rapid River, MI	Lat 45°57'56", long 86°55'15", in SE1/4 NW1/4 sec.10, T.41 N., R.21 W., Delta County, Hydrologic Unit 04030111, about 800 ft downstream from Chippeny Creek, 3.5 mi northeast of Rapid River.	284	1973-90	10-05-89	58.4
					05-07-90	209
					08-01-90	87.7
					09-13-90	86.0
04058120	Green Creek near Palmer, MI	Lat 46°22'22", long 87°36'21", in NW1/4 sec.19, T.46 N., R.26 W., Marquette County, Hydrologic Unit 04030110, at County Highway 565, 4.5 mi south of Palmer.	8.42	1961-65, 1970-90c	10-03-89	b7.77
					06-12-90	b7.04
					07-23-90	b2.12
					09-13-90	b2.12
04059034	Escanaba River near Wells, MI	Lat 45°48'22", long 87°05'51", in SW1/4 NW1/4 sec.1, T.39 N., R.23 W., Delta County, Hydrologic Unit 04030110, 600 ft downstream from Bichler Creek, 2.0 mi northwest of Wells, and 2.5 mi upstream from mouth.	d920	1981-90c	06-28-90	b558
					08-01-90	b326
					08-24-90	b456
					09-10-90	b315
04096517	South Branch Hog Creek Tributary near Allen, MI	Lat 41°57'33", long 84°49'33", in SW1/4 SW1/4 sec.7, T.6 S., R.4 W., Hillsdale County, Hydrologic Unit 04050001, at Squires Road, 0.3 mi upstream from mouth, and 3.0 mi west of Allen.	2.61	1969-90	10-03-89	1.22
					05-01-90	1.42
					06-12-90	1.30
					07-23-90	1.49
04114594	Maple River near St. Johns, MI	Lat 43°02'43", long 84°28'11", in SE1/4 SE1/4 sec.30, T.8 N., R.1 W., Clinton County, Hydrologic Unit 04050005, at Colony Road, 4.5 mi northeast of St. Johns.	--	1981-90	04-24-90	b170
					06-06-90	39.7
					07-11-90	20.7
					08-28-90	20.2
*04120295	Black Creek near Muskegon, MI	Lat 43°12'14", long 86°09'52", in NE1/4 NW1/4 sec.1, T.9 N., R.16 W., Muskegon County, Hydrologic Unit 04060101, at Mill Iron Road, 4.8 mi east of Muskegon, and 4.9 mi upstream from mouth.	d39	1974-90	10-18-89	29.5
					03-13-90	b210
					06-26-90	b43.9
					09-18-90	b32.8
04121239	Clam River at Cadillac, MI	Lat 44°15'49", long 85°24'04", in NE1/4 NE1/4 sec.33, T.22 N., R.9 W., Wexford County, Hydrologic Unit 04060102, at Smith Street in Cadillac.	d48	1983-84, 1986-90	01-02-90	21.5
					03-30-90	b76.5
					05-14-90	2.63
					09-11-90	4.04

‡ Operated as a continuous-record gaging station.
* Also a crest-stage partial-record station.
a Affected by domestic diversion.
b Not base flow.
c Affected by diversion for industrial use.
d Approximately.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Special study and miscellaneous sites

Discharge measurements in the following table were made at special study and miscellaneous sites throughout the State.

Discharge measurements made at special study and miscellaneous sites during water year 1990

Station No.	Stream	Tributary to	Location	Drainage area (mi^2)	Measured previously (water years)	Measurements	
						Date	Discharge (ft^3/s)
			STREAMS TRIBUTARY TO LAKE SUPERIOR				
04034100	Bond Falls Lower By-Pass	Middle Branch Ontonagon River	Lat 46°24'27", long 89°07'44", in SE1/4 SW1/4 sec.1, T.46 N., R.39 W., Ontonagon County, Hydrologic Unit 04020102, at Bond Falls Road, 2.2 mi west of Calderwood.	--	1942,1945, 1963-64, 1967,1969, 1971-72, 1974, 1979-81, 1983-84, 1987-89	08-01-90	a39.8
04044200	Carp Creek	Deer Lake	Lat 46°29'11", long 87°41'21", in NW1/4 sec.9, T.47 N., R.27 W., Marquette County, Hydrologic Unit 04020105, at highway 41A in Ishpeming.	16.5	1961-70b, 1970-89c	10-04-89 02-13-90	*7.61 *9.03
04044201	Rock Lake Outlet	Carp Creek	Lat 46°29'20", long 87°41'35", in NW1/4 NW1/4 sec.9, T.47 N., R.27 W., Marquette County, Hydrologic Unit 04020105, 40 ft downstream from railroad culverts, 400 ft upstream from mouth, in Ishpeming.	--	--	02-13-90	*1.25
04059032	Escanaba River	Lake Michigan	Lat 45°48'50", long 87°06'06", in SE1/4 SE1/4 sec.35, T.40 N., R.23 W., Delta County, Hydrologic Unit 04030110, 800 ft downstream from No. 2 dam, 2.7 mi upstream from mouth, 2.2 mi northwest of Wells.	--	--	11-09-89	a222
040620105	Brule Dam Spillway Channel	Brule River	Lat 45°56'53", long 88°13'00", in NW1/4 SW1/4 sec.17, T.41 N., R.31 W., Michigan Meridian, Iron County, Hydrologic Unit 04030106, 900 ft downstream from Brule Dam spill gates, 2.3 mi northeast of Florence, WI.	--	--	02-23-90	a32.4
			STREAMS TRIBUTARY TO LAKE MICHIGAN				
04104700	Battle Creek	Kalamazoo River	Lat 42°21'51", long 85°07'20", in SE1/4 SE1/4 sec.21, T.1 S., R.7 W., Calhoun County, Hydrologic Unit 04050003, at Nine Mile Road, 4.4 mi northeast of Battle Creek.	--	1989	10-04-89 02-07-90 05-02-90 06-13-90 07-24-90 09-05-90	*61.5 *191 *168 *88.0 *171 *53.0
04104950	Wanadoga Creek	Battle Creek	Lat 42°22'12", long 85°07'44", in NW1/4 SE1/4 sec.21, T.1 S., R.7 W., Calhoun County, Hydrologic Unit 04050003, at Q Drive North, 1.3 mi west of Pennfield.	--	1965, 1983, 1989	10-04-89 02-07-90 05-02-90 06-13-90 07-24-90 09-05-90	*17.0 *44.7 *36.3 *20.1 *40.6 *14.4
04108900	Grand River	Lake Michigan	Lat 42°10'08", long 84°23'02", in SE1/4 NE1/4 sec.35, T.3 S., R.1 W., Jackson County, Hydrologic Unit 04050004, at Draper Road, 2.0 mi south of Vandercook Lake.	41.0	1961, 1963-65, 1974-79, 1987, 1989	04-11-90	d69.2
04110663	Unnamed Tributary	Perry Creek	Lat 42°27'38", long 84°28'57", in SW1/4 NW1/4 sec.19, T.1 N., R.1 W., Ingham County, Hydrologic Unit 04050004, at Ridley Road, 2.0 mi west of Leslie.	--	--	03-09-90 03-09-90 03-10-90 03-11-90 03-30-90 05-17-90 05-17-90 07-10-90	d3.47 d5.28 d8.01 d25.8 *d1.57 d19.6 d13.6 *d0.17
04112670	Willow Creek	Sycamore Creek	Lat 42°32'18", long 84°29'26", in SW1/4 SE1/4 sec.24, T.2 N., R.2 W., Ingham County, Hydrologic Unit 04050004, at Toles Road, 3.7 mi southwest of Mason.	--	--	03-09-90 03-09-90 03-11-90 03-30-90 07-10-90	d4.22 d4.87 d7.75 *d3.51 *d2.17

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at special study and miscellaneous sites during water year 1990--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi^2)	Measured previously (water years)	Measurements	
						Date	Discharge (ft^3/s)
			STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued				
04112673	Unnamed Tributary	Willow Creek	Lat 42°32'33", long 84°27'45", in NW1/4 SW1/4 sec.20, T.2 N., R.1 W., Ingham County, Hydrologic Unit 04050004, at Tuttle Road, 0.2 mi south of Lyon Road, 2.7 mi southwest of Mason.	--	--	03-30-90	*d0.33
						04-11-90	d0.65
						05-16-90	d0.55
						05-17-90	d2.28
						05-17-90	d0.85
						07-10-90	*d0.15
04112676	Unnamed Tributary	Willow Creek	Lat 42°32'45", long 84°27'45", in SE1/4 NE1/4 sec.19, T.2 N., R.1 W., Ingham County, Hydrologic Unit 04050004, at Tuttle Road near intersection with Lyon Road, 2.5 mi southwest of Mason.	--	--	03-09-90	de7.41
						03-09-90	de11.6
						03-10-90	de32.1
						03-12-90	de45.7
04112694	Unnamed Tributary	Sycamore Creek	Lat 42°35'00", long 84°26'30", in NW1/4 SW1/4 sec.4, T.2 N., R.1 W., Ingham County, Hydrologic Unit 04050004, at North Jefferson Avenue, in Mason.	2.60	1971, 1989	09-14-90	d10.4
04124200	Manistee River	Manistee Lake	Lat 44°21'30", long 85°49'15", in SE1/4 NE1/4 sec. 25, T.23 N., R.13 W., Manistee County, Hydrologic Unit 04060103, at Hodenpyl Dam, 3.0 mi east of Marilla.	999	1969-70, 1987	09-24-90	f160
						09-24-90	f434
						09-24-90	f708
						09-24-90	f982
						09-24-90	f3,820
						09-25-90	f1,360
						09-25-90	f1,690
						09-25-90	f1,920
						09-25-90	f2,070
						09-25-90	f2,210
						09-26-90	f1,940
						09-26-90	f2,070
						09-26-90	f2,200
04125550	Manistee River	Manistee Lake	Lat 44°15'34", long 85°56'27", in NW1/4 SW1/4 sec.31, T.22 N., R.13 W., Manistee County, Hydrologic Unit 04060103, at Tippy Dam, 3.0 mi north of Wellston.	--	1987	07-17-90	f1,630
						07-17-90	f1,680
						07-17-90	f1,910
						07-17-90	f3,130
						07-18-90	f1,070
						07-18-90	f1,490
						07-18-90	f4,640
						07-19-90	f822
						07-19-90	f1,040
						07-19-90	f1,240
04126664	Platte River	Lake Michigan	Lat 44°39'56", long 85°55'59", in NE1/4 SW1/4 sec.7, T.26 N., R.13 W., Benzie County, Hydrologic Unit 04060104, 200 ft upstream from Brundage Creek, upstream from State Fish Hatchery, 4.0 mi east of Honor.	--	1975, 1987-88	04-03-90	d83.2
						05-25-90	*d70.6
						08-20-90	d62.4
04126690	Brundage Creek	Platte River	Lat 44°39'48", long 85°55'27", in SW1/4 SE1/4 sec.7, T.26 N., R.13 W., Benzie County, Hydrologic Unit 04060104, at U.S. Highway 31, 700 ft downstream from Stanley Creek, 4.7 mi east of Honor.	12.5	1958, 1966-69, 1980-81	04-02-90	d17.0
						04-03-90	d12.3
						05-25-90	*d14.0
04126695	Brundage Creek	Platte River	Lat 44°39'58", long 85°55'58", in NE1/4 SW1/4 sec.7, T.26 N., R.13 W., Benzie County, Hydrologic Unit 04060104, at County Road 669, 4.0 mi east of Honor.	--	1987	04-02-90	de9.90
						04-03-90	de6.54
						05-25-90	de4.07
04126700	Platte River	Lake Michigan	Lat 44°39'36", long 85°56'36", in SW1/4 SE1/4 sec.12, T.26 N., R.14 W., Benzie County, Hydrologic Unit 04060104, at U.S. Highway 31, 4.0 mi east of Honor.	91.9	1958, 1960-69, 1980-81, 1987-88	04-03-90	d104
						05-24-90	*d91.5
						08-20-90	d80.9
						09-17-90	d87.5
04126751	North Branch Platte River	Platte River	Lat 44°41'01", long 86°03'30", in SE1/4 NE1/4 sec.1, T.26 N., R.15 W., Benzie County, Hydrologic Unit 04060104, at Deadstream Road, 2.5 mi northwest of Honor.	31.1	1958, 1980-81, 1987-88	05-25-90	*d31.0
						09-17-90	d36.1

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at special study and miscellaneous sites during water year 1990--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi^2)	Measured previously (water years)	Measurements	
						Date	Discharge (ft^3/s)
			STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued				
04126755	Platte River	Lake Michigan	Lat 44°42'39", long 86°07'08", in NE1/4 SE1/4 sec.28, T.27 N., R.15 W., Benzie County, Hydrologic Unit 04060104, at State Highway 22, 6.2 mi northwest of Honor.	166	1946-48, 1958, 1979-82, 1987-88	04-03-90 05-24-90 08-20-90 09-17-90	d216 *d189 d140 d168
04126785	Hatlems Creek	Glen Lake	Lat 44°50'44", long 85°57'42", in SW1/4 NE1/4 sec.11, T.28 N., R.14 W., Leelanau County, Hydrologic Unit 04060104, at mouth, 0.8 mi southwest of Burdickville.	--	--	08-21-90	d5.73
04126795	Glen Lake Outlet	Fisher Lake	Lat 44°53'32", long 85°56'46", in SW1/4 NE1/4 sec.25, T.29 N., R.13 W., Leelanau County, Hydrologic Unit 04060104, in narrows midway between Glen and Fisher Lakes, 2.0 mi east of Glen Arbor.	--	--	08-21-90	d26.3
04126800	Crystal River	Lake Michigan	Lat 44°54'00", long 85°57'15", in NW1/4 SW1/4 sec.24, T.29 N., R.14 W., Leelanau County, Hydrologic Unit 04060104, 0.7 mi downstream from Glen Lake, 1.8 mi east of Glen Arbor.	--	1946-51, 1988-89	08-21-90	d27.2
041275532	Dingman River	Sixmile Lake	Lat 45°05'38", long 85°11'37", in SE1/4 SW1/4 sec.8, T.31 N., R.7 W., Antrim County, Hydrologic Unit 04060105, at Dingman School Road, 3.0 mi northwest of Pleasant Valley.	--	--	04-11-90 05-01-90 06-04-90 07-10-90 08-07-90 09-04-90	31.1 *18.2 23.7 24.7 19.8 *13.6
041275534	St. Clair Lake Outlet	Ellsworth Lake	Lat 45°09'57", long 85°14'24", in NW1/4 SW1/4 sec.13, T.32 N., R.8 W., Antrim County, Hydrologic Unit 04060105, at Bridge Street, in Ellsworth.	--	--	04-11-90 05-01-90 06-04-90 07-10-90 08-07-90 09-04-90	75.1 *48.4 53.0 59.5 39.0 *27.9
041275536	Green River	Hanley Lake	Lat 45°05'47", long 85°15'26", in SE1/4 SW1/4 sec.11, T.31 N., R.8 W., Antrim County, Hydrologic Unit 04060105, at Mohrman Bridge Road, 1.8 mi north of Central Lake.	--	--	04-11-90 05-01-90 06-04-90 07-10-90 08-07-90 09-04-90	107 *58.5 83.5 108 57.5 *40.4
041275538	Intermediate River	Lake Bellaire	Lat 44°59'20", long 85°12'27", in NE1/4 NW1/4 sec.19, T.30 N., R.7 W., Antrim County, Hydrologic Unit 04060105, 0.6 mi downstream from Intermediate Lake, 1.0 mi north of Bellaire.	--	--	04-11-90 05-02-90 06-05-90 07-11-90 08-08-90 09-05-90	161 52.9 133 208 102 *89.4
04127565	Intermediate River	Lake Bellaire	Lat 44°58'42", long 85°12'36", in SE1/4 SE1/4 sec. 24, T.30 N., R.8 W., Antrim County, Hydrologic Unit 04060105, at State Highway 88, in Bellaire.	--	1982	04-11-90 05-01-90 06-04-90 07-10-90 08-07-90 09-04-90	253 144 260 277 200 *177
04127568	Clam River	Torch Lake	Lat 44°56'30", long 85°16'55", in SE1/4 NW1/4 sec.4, T.29 N., R.8 W., Antrim County, Hydrologic Unit 04060105, at East Torch Lake Drive, in Clam River.	--	1977	04-12-90 05-01-90 06-04-90 07-10-90 08-07-90 09-05-90	353 251 318 368 232 *255
04127570	Torch River	Lake Skegemog	Lat 44°51'02", long 85°19'39", in NE1/4 SW1/4 sec.6, T.28 N., R.8 W., Antrim County, Hydrologic Unit 04060105, at County Road 593, in Torch River.	--	--	04-12-90 05-02-90 06-05-90 07-11-90 08-08-90 09-05-90	480 468 467 616 359 *324

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at special study and miscellaneous sites during water year 1990--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi^2)	Measured previously (water years)	Measurements	
						Date	Discharge (ft^3/s)
			STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued				
04127590	Rapid River	Torch River	Lat 44°50'16", long 85°16'58", in NW1/4 SE1/4 sec.9, T.28 N., R.8 W., Kalkaska County, Hydrologic Unit 04060105, at Rapid City Road, in Rapid City.	--	--	04-12-90	112
						05-01-90	101
						06-04-90	117
						07-10-90	109
						08-07-90	108
						09-04-90	*96.5
04127695	Elk River	Lake Michigan	Lat 44°53'59", long 85°24'33", in SE1/4 NW1/4 sec.21, T.29 N., R.9 W., Antrim County, Hydrologic Unit 04060105, at U.S. Highway 31, in Elk Rapids.	513	--	04-12-90	710
						05-01-90	733
						06-04-90	691
						07-10-90	1,020
						08-07-90	670
						09-04-90	567
04130480	Black River	Black Lake	Lat 45°21'48", long 84°17'49', in SW1/4 NE1/4 sec.3, T.34 N., R.1 E., Cheboygan County, Hydrologic Unit 04070005, 100 ft downstream from Tower Dam, in Tower.	--	--	10-11-89	f6.61
						10-11-89	f79.1
						10-11-89	f107
						10-11-89	f133
						10-12-89	f165
						10-12-89	f210
			STREAMS TRIBUTARY TO LAKE ERIE				
04172606	Portage Lake Outlet	Huron River	Lat 42°24'55", long 83°54'20", in SE1/4 SE1/4 sec.1, T.1 S., R.4 E., Washtenaw County, Hydrologic Unit 04090005, at McGregor Road near DNR access site, 1.0 mi northeast of Dover.	--	1977-78, 1989	10-24-89	*d51.5
04174705	Fleming Creek	Huron River	Lat 42°16'58", long 83°39'59", in SE1/4, NE1/4 sec.25, T.2 S., R.6 E., Washtenaw County, Hydrologic Unit 04090005 at Radrick Golf Course, 1.0 mi north of Geddes.	30.2	--	07-19-89	*8.43
						09-05-89	7.96
						10-12-89	*8.56
						10-30-89	*9.27
						11-22-89	23.6
						01-05-90	76.7
						02-14-90	43.4
						03-12-90	216
						03-28-90	*32.0
						04-13-90	53.0
						05-09-90	*22.6
						06-21-90	*10.3
						09-19-90	28.5
04175100	Huron River	Lake Erie	Lat 42°05'38", long 83°17'43", in SE1/4 SW1/4 sec.31, T.4 S., R.10 E., Wayne County, Hydrologic Unit 04090005, at Telegraph Road, at Flat Rock.	866	1952, 1961, 1970-71, 1982	07-02-90	*437
						08-08-90	*102
04175177	Swan Creek	Lake Erie	Lat 42°04'27", long 83°24'02", in SE1/4 NE1/4 sec.7, T.5 S., R.9 E., Monroe County, Hydrologic Unit 04100001, at Maxwell Road, 1.0 mi northwest of Carleton.	--	--	07-02-90	*2.10
						08-08-90	*0.14
04175229	Swan Creek	Lake Erie	Lat 42°01'21", long 83°18'09", in NE1/4 NE1/4 sec.36, T.5 S., R.9 E., Monroe County, Hydrologic Unit 04100001, at Labo Road, 1.5 mi north of Newport.	--	--	07-02-90	*3.99
						08-08-90	*0.41
04175340	Stony Creek	Lake Erie	Lat 42°05'05", long 83°34'43", in NE1/4 NE1/4 sec.3, T.5 S., R.7 E., Monroe County, Hydrologic Unit 04100001, at former gaging station, at Tuttle Hill Road, 0.3 mi northeast of Oakville.	68.0	1970-81‡, 1984	07-02-90	*15.8
						08-08-90	*8.05
						09-11-90	22.7
04175407	Stony Creek	Lake Erie	Lat 41°57'12", long 83°19'22", in SE1/4 SE1/4 sec.23, T.6 S., R.9 E., Monroe County, Hydrologic Unit 04100001, at township park off Nadeau Road, 1.0 mi northwest of Woodland Beach.	--	--	06-27-90	25.0
						08-09-90	*7.58
						09-11-90	29.7
04175463	Sandy Creek	Lake Erie	Lat 41°56'28", long 83°21'19", in NW1/4 SW1/4 sec.27, T.6 S., R.9 E., Monroe County, Hydrologic Unit 04100001, at Yax Road, 1.8 mi east of Golfcrest.	--	1973	06-27-90	1.08
						09-11-90	g0.12

See footnotes at end of table.

Discharge measurements made at special study and miscellaneous sites during water year 1990--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi^2)	Measured previously (water years)	Measurements	
						Date	Discharge (ft^3/s)
			STREAMS TRIBUTARY TO LAKE ERIE--Continued				
04176162	River Raisin	Lake Erie	Lat 41°54'08", long 83°43'04", in SW1/4 NE1/4 sec.4, T.7 S., R.6 E., Monroe County, Hydrologic Unit 04100002, at Deerfield Road, at Petersburg.	--	--	07-03-90 08-09-90	*321 *110
04176173	Little River Raisin	River Raisin	Lat 41°56'43", long 83°42'15", in NE1/4 SW1/4 sec.22, T.6 S., R.6 E., Monroe County, Hydrologic Unit 04100002, adjacent to Brewer Road, 2.5 mi southwest of Dundee.	--	--	07-03-90 08-07-90	*9.16 *0.77
04176262	Macon Creek	River Raisin	Lat 41°58'38", long 83°41'16", in NW1/4 SW1/4 sec.1, T.6 S., R.6 E., Monroe County, Hydrologic Unit 04100002, at Ann Arbor Road, 2.0 mi north of Dundee.	--	--	07-02-90 08-07-90	*7.71 *2.64
04176298	North Branch Macon Creek	Macon Creek	Lat 42°05'11", long 83°45'44", in NW1/4 SE1/4 sec.31, T.4 S., R.6 E., Washtenaw County, Hydrologic Unit 04100002, at Ridge Road, 5.6 mi south of Saline.	--	1989	11-01-89 11-17-89	d1.21 d30.6
04176315	North Branch Macon Creek	Macon Creek	Lat 42°00'29", long 83°40'04", in SE1/4 NW1/4 sec.36, T.5 S., R.6 E., Monroe County, Hydrologic Unit 04100002, at Oelke Road, 0.8 mi south of Azalia.	--	--	07-02-90 08-09-90	*2.53 *0.19
04176332	Macon Creek	River Raisin	Lat 41°58'47", long 83°37'33", in NE1/4 NW1/4 sec.8, T.6 S., R.7 E., Monroe County, Hydrologic Unit 04100002, adjacent to Stowell Road, 2.0 mi northeast of Dundee.	--	--	07-02-90 08-09-90	*16.2 *1.64
04176349	Saline-Bridgewater Drain	Saline River	Lat 42°08'18", long 83°52'08", in NW1/4 NW1/4 sec.17, T.4 S., R.5 E., Washtenaw County, Hydrologic Unit 04100002, at Feldcamp Road, 200 ft upstream from mouth, 0.5 mi north of Benton.	--	1981-82, 1989	11-01-89 11-17-89	d1.81 d14.0
04176355	Bauer Drain	Saline River	Lat 42°09'38", long 83°51'01", in SE1/4 NW1/4 sec.4, T.4 S., R.5 E., Washtenaw County, Hydrologic Unit 04100002, at Austin Road, 3.5 mi west of Saline.	7.30	1970-72, 1981-82, 1989	11-01-89 11-17-89	d0.68 d10.3
04176365	Saline River	River Raisin	Lat 42°10'15", long 83°49'32", in SE1/4 SW1/4 sec.34, T.3 S., R.5 E., Washtenaw County, Hydrologic Unit 04100002, at Dell Road, 2.0 mi west of Saline.	44.3	1964, 1980-82, 1988-89	11-01-89 11-17-89	d9.13 d77.2
04176400	Saline River	River Raisin	Lat 42°07'50", long 83°46'35", in NW1/4 SW1/4 sec.18, T.4 S., R.5 E., Washtenaw County, Hydrologic Unit 04100002, at former gaging station, at Maple Road, 2.8 mi south of Saline.	94.6	1966-77†, 1978-89c	11-01-90 06-28-90 07-03-90 08-09-90	d26.3 32.9 *27.8 *20.9
04176422	Saline River	River Raisin	Lat 42°03'46", long 83°39'14", in SW1/4 NW1/4 sec.7, T.5 S., R.7 E., Monroe County, Hydrologic Unit 04100002, at Sherman Road, 2.0 mi southeast of Milan.	--	--	07-02-90 08-08-90	*33.0 *21.9
04176430	Saline River	River Raisin	Lat 41°59'53", long 83°37'28", in NW1/4 NE1/4 sec.5, T.6 S., R.7 E., Monroe County, Hydrologic Unit 04100002, at Day Road, 3.3 mi northeast of Dundee.	127	1963, 1970, 1984	07-03-90 08-09-90	*34.3 *21.6
04176439	Saline River	River Raisin	Lat 41°58'59", long 83°36'59", in NE1/4 NE1/4 sec.8, T.6 S., R.7 E., Monroe County, Hydrologic Unit 04100002, at Bigelow Road, 0.6 mi upstream from mouth, 3.0 mi east of Dundee.	--	1981-82, 1989	11-01-89 11-17-89	d30.1 d274
04176537	River Raisin	Lake Erie	Lat 41°54'58", long 83°23'40" in private claim 230, T.7 S., R.9 E., Monroe County, Hydrologic Unit 04100002, at Macomb Street, in Monroe.	--	--	06-27-90 08-08-90	285 *141

See footnotes at end of table.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements made at special study and miscellaneous sites during water year 1990--Continued

Station No.	Stream	Tributary to	Location	Drainage area (mi^2)	Measured previously (water years)	Measurements	
						Date	Discharge (ft^3/s)
			STREAMS TRIBUTARY TO LAKE ERIE--Continued				
04176555	Plum Creek	Lake Erie	Lat 41°54'55", long 83°28'23" in SW1/4 sec.34, T.6 S., R.8 E., Monroe County, Hydrologic Unit 04100001, at Raisinville Road, 3.0 mi west of Monroe.	--	1971	07-02-90 08-07-90	*1.46 *0.06
04176560	Pitts Creek	Plum Creek	Lat 41°54'39", long 83°28'31", in NE1/4 NE1/4 sec. 3, T.7 S., R.8 E., Monroe County, Hydrologic Unit 04100001, at Raisinville Road, 1.5 mi east of Strasburg.	--	1971-72	07-02-90 08-07-90	*1.86 *0.28
04176565	Plum Creek	Lake Erie	Lat 41°54'13", long 83°23'53", in private claim 499, T.7 S., R.9 E., Monroe County, Hydrologic Unit 04100002, at La Plaisance Road, in Monroe.	--	1976	06-27-90 08-07-90 09-12-90	1.90 *0.82 7.48
04176588	Lockwood Drain	North Branch Otter Creek	Lat 41°52'02", long 83°33'14", in SW1/4 SW1/4 sec.13, T.7 S., R.7 E., Monroe County, Hydrologic Unit 04100001, at Geiger Road, 1.0 mi east of Ida Center.	--	--	07-03-90 08-08-90	*1.29 *0.09
04176638	Little Lake Creek	Lake Erie	Lat 41°46'35", long 83°30'23", in NW1/4 NW1/4 sec.20, T.8 S., R.7 E., Monroe County, Hydrologic Unit 04100001, at State Highway 125, 1.5 mi southwest of Erie.	--	--	07-03-90 08-08-90 09-11-90	0.18 *0.02 *0.02
04176680	Halfway Creek	Lake Erie	Lat 41°44'07", long 83°36'18", in NW1/4 NW1/4 sec.4, T.9 S., R.7 E., Monroe County, Hydrologic Unit 04100001, at Smith Road, 2.3 mi southeast of Lambertville.	34.2	1971-73	07-02-90 08-08-90 09-11-90	*0.68 *1.01 0.84
04176727	North Tenmile Creek	Tenmile Creek	Lat 41°44'47", long 83°41'07", in NW1/4 NW1/4 sec.35, T.8 S., R.6 E., Monroe County, Hydrologic Unit 04100001, at Jeffs Road, 2.0 mi south of Whiteford Center.	--	--	07-02-90 08-08-90 09-11-90	*1.28 0.00 0.00

* Base flow.
† Operated as a continuous-record gaging station.
a Affected by regulation and diversion.
b Operated as a low-flow partial-record station.
c Operated as a crest-stage partial-record station.
d Discharge measurement made by employees of Michigan Department of Natural Resources.
e Affected by diversion.
f Flow regulated by powerplant.
g Estimated.

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Water-quality partial-record stations are particular sites where chemical-quality, biologial and/or sediment data are collected systematiclly over a period of years for use in hydrologic analyses. These data are collected usually less than quarterly. Samples collected at sites other than gaging stations and partial-record stations to give better areal coverage in a river basin are referred to as miscellaneous sites.

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	HARD-NESS TOTAL (MG/L AS CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)
04175100	HURON RIVER AT FLATROCK, MI (LAT 42 05 38N LONG 083 17 43W)										
JUL 1990											
02...	1415	437	690	8.4	25.0	--	8.5	--	--	--	--
AUG											
08...	1300	102	664	8.6	24.0	11	9.2	111	230	61	20
04175177	SWAN CREEK NEAR CARLETON, MI (LAT 42 04 27N LONG 083 24 02W)										
JUL 1990											
02...	1240	2.1	673	8.3	23.5	--	7.2	--	--	--	--
AUG											
08...	1140	0.14	770	8.2	20.5	20	7.0	79	290	88	18
04175229	SWAN CREEK NEAR NEWPORT, MI (LAT 42 01 21N LONG 083 18 09W)										
JUL 1990											
02...	1545	3.99	765	7.8	24.0	--	4.3	--	--	--	--
AUG											
08...	1400	0.41	1,230	7.9	23.5	12	6.8	82	480	130	38
04175340	STONY CREEK AT OAKVILLE, MI (LAT 42 05 05N LONG 083 34 43W)										
JUL 1990											
02...	1030	15.8	828	8.4	18.5	--	7.4	--	--	--	--
AUG											
08...	1000	8.05	720	8.4	16.5	25	9.0	94	290	79	23
04175407	STONY CREEK NEAR WOODLAND BEACH, MI (LAT 41 57 12N LONG 083 19 22W)										
JUN 1990											
27...	1120	25.0	644	8.3	20.0	--	7.0	79	--	--	--
AUG											
09...	0930	7.58	741	8.3	19.0	4.7	7.3	80	330	90	26
04175463	SANDY CREEK NEAR GOLFCREST, MI (LAT 41 56 28N LONG 083 21 19W)										
JUN 1990											
27...	1030	1.08	766	8.2	20.0	--	6.0	68	--	--	--
AUG											
08...	1515	--	1,290	7.9	22.0	3.5	10.2	--	540	150	41
SEP											
11...	1430	E0.12	653	8.1	22.5	2.3	8.4	99	280	79	19
04176162	RIVER RAISIN AT PETERSBURG, MI (LAT 41 54 08N LONG 083 43 04W)										
JUL 1990											
03...	1130	321	614	8.3	22.5	--	7.0	83	--	--	--
AUG											
09...	1030	110	656	8.6	20.5	3.5	9.4	107	310	88	23
04176173	LITTLE RIVER RAISIN NEAR DUNDEE, MI (LAT 41 56 43N LONG 083 42 15W)										
JUL 1990											
03...	1415	9.16	674	8.5	28.0	--	15.6	205	--	--	--
AUG											
07...	1530	0.77	545	8.6	27.0	10	11.0	141	230	54	22
04176262	MACON CREEK NEAR DUNDEE, MI (LAT 41 58 38N LONG 083 41 16W)										
JUL 1990											
02...	1240	7.71	699	8.6	20.0	--	8.4	95	--	--	--
AUG											
07...	1130	2.64	676	8.4	18.0	7.0	9.3	100	310	86	24

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990--Continued

DATE	SODIUM, DIS-SOLVED (MG/L AS NA)	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY LAB (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
04175100	HURON RIVER AT FLATROCK, MI (LAT 42 05 38N LONG 083 17 43W)									
JUL 1990										
02...	--	--	--	46	70	--	--	--	0.03	0.6
AUG										
08...	39	3.6	179	48	79	0.3	6.0	387	0.02	0.4
04175177	SWAN CREEK NEAR CARLETON, MI (LAT 42 04 27N LONG 083 24 02W)									
JUL 1990										
02...	--	--	--	61	60	--	--	--	0.02	1.3
AUG										
08...	35	7.6	192	67	88	<0.1	6.1	479	0.02	0.7
04175229	SWAN CREEK NEAR NEWPORT, MI (LAT 42 01 21N LONG 083 18 09W)									
JUL 1990										
02...	--	--	--	85	75	--	--	--	0.09	2.0
AUG										
08...	61	8.2	183	300	110	0.1	5.2	782	0.20	1.7
04175340	STONY CREEK AT OAKVILLE, MI (LAT 42 05 05N LONG 083 34 43W)									
JUL 1990										
02...	--	--	--	63	60	--	--	--	0.01	0.8
AUG										
08...	25	2.8	214	54	43	0.3	4.5	412	<0.01	0.4
04175407	STONY CREEK NEAR WOODLAND BEACH, MI (LAT 41 57 12N LONG 083 19 22W)									
JUN 1990										
27...	--	--	--	64	47	--	--	--	0.01	1.3
AUG										
09...	24	2.8	208	110	57	0.4	5.7	445	<0.01	0.3
04175463	SANDY CREEK NEAR GOLFCREST, MI (LAT 41 56 28N LONG 083 21 19W)									
JUN 1990										
27...	--	--	--	110	70	--	--	--	0.03	2.5
AUG										
08...	65	4.3	149	380	120	0.4	4.9	906	<0.01	<0.1
SEP										
11...	33	4.5	144	110	59	0.3	4.4	431	<0.01	<0.1
04176162	RIVER RAISIN AT PETERSBURG, MI (LAT 41 54 08N LONG 083 43 04W)									
JUL 1990										
03...	--	--	--	46	30	--	--	--	0.07	5.6
AUG										
09...	25	2.4	233	64	59	0.1	8.8	426	<0.01	0.6
04176173	LITTLE RIVER RAISIN NEAR DUNDEE, MI (LAT 41 56 43N LONG 083 42 15W)									
JUL 1990										
03...	--	--	--	62	43	--	--	--	0.06	7.8
AUG										
07...	20	4.3	135	69	54	0.2	2.0	380	0.01	<0.1
04176262	MACON CREEK NEAR DUNDEE, MI (LAT 41 58 38N LONG 083 41 16W)									
JUL 1990										
02...	--	--	--	72	41	--	--	--	0.01	3.6
AUG										
07...	21	5.1	219	88	44	0.2	3.4	377	0.01	1.0

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990--Continued

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	HARD-NESS TOTAL (MG/L AS CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)
04176315	NORTH BRANCH MACON CREEK NEAR AZALIA, MI (LAT 42 00 29N LONG 083 40 04W)										
JUL 1990											
02...	1000	2.53	735	8.3	18.0	--	8.4	91	--	--	--
AUG											
09...	1115	0.19	592	8.3	18.0	4.4	8.1	--	270	68	24
04176332	MACON CREEK NEAR DUNDEE, MI (LAT 41 58 47N LONG 083 37 33W)										
JUL 1990											
02...	1520	16.2	705	8.4	22.5	--	8.9	105	--	--	--
AUG											
09...	0930	1.64	3,150	7.7	19.5	3.4	6.8	76	1,300	440	37
04176400	SALINE RIVER NEAR SALINE, MI (LAT 42 07 50N LONG 083 46 35W)										
JUL 1990											
03...	1040	27.8	821	8.3	19.5	--	7.6	85	--	--	--
AUG											
09...	1215	20.9	901	8.3	18.5	3.0	8.4	92	370	100	28
04176422	SALINE RIVER NEAR MILAN, MI (LAT 42 03 46N LONG 083 39 14W)										
JUL 1990											
02...	0920	33.0	816	8.4	22.0	--	6.7	79	--	--	--
AUG											
08...	0835	21.9	809	8.2	19.5	43	7.1	79	330	90	26
04176430	SALINE RIVER NEAR DUNDEE, MI (LAT 41 59 53N LONG 083 37 28W)										
JUL 1990											
03...	0850	34.3	796	8.4	21.0	--	7.1	82	--	--	--
AUG											
09...	1045	21.6	840	8.3	19.0	55	7.1	78	330	91	26
04176537	RIVER RAISIN AT MONROE, MI (LAT 41 54 58N LONG 083 23 40W)										
JUN 1990											
27...	1525	285	733	8.6	23.0	--	10.1	121	--	--	--
AUG											
08...	1045	141	657	8.6	23.0	11	11.0	130	280	73	23
04176555	PLUM CREEK NEAR MONROE, MI (LAT 41 54 55N LONG 083 28 23W)										
JUL 1990											
02...	1000	1.46	806	8.1	19.5	--	6.6	73	--	--	--
AUG											
07...	1330	0.06	2,150	7.6	17.0	11	4.0	--	1,400	390	95
04176560	PITTS CREEK NR STRASBURG, MI (LAT 41 54 39N LONG 083 28 31W)										
JUL 1990											
02...	1100	1.86	855	8.0	19.0	--	7.1	78	--	--	--
AUG											
07...	1230	0.28	2,730	7.9	18.5	5.1	5.0	--	1,800	510	120
04176565	PLUM CREEK AT MONROE, MI (LAT 41 54 13N LONG 083 23 53W)										
JUN 1990											
27...	1330	1.90	901	8.8	22.0	--	13.2	154	--	--	--
AUG											
07...	1000	0.82	2,180	8.1	19.0	15	8.7	96	1,400	480	49

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990--Continued

DATE	SODIUM, DIS-SOLVED (MG/L AS NA)	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY LAB (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
04176315	NORTH BRANCH MACON CREEK NEAR AZALIA, MI (LAT 42 00 29N LONG 083 40 04W)									
JUL 1990 02...	--	--	--	61	41	--	--	--	0.03	3.5
AUG 09...	19	7.5	195	69	44	0.4	0.8	355	<0.01	0.3
04176332	MACON CREEK NEAR DUNDEE, MI (LAT 41 58 47N LONG 083 37 33W)									
JUL 1990 02...	--	--	--	68	37	--	--	--	0.03	3.5
AUG 09...	59	5.6	59	--	95	0.5	4.0	2,820	<0.01	0.2
04176400	SALINE RIVER NEAR SALINE, MI (LAT 42 07 50N LONG 083 46 35W)									
JUL 1990 03...	--	--	--	100	60	--	--	--	0.02	1.7
AUG 09...	36	3.5	262	83	69	0.2	11	544	0.01	1.9
04176422	SALINE RIVER NEAR MILAN, MI (LAT 42 03 46N LONG 083 39 14W)									
JUL 1990 02...	--	--	--	94	67	--	--	--	0.02	1.9
AUG 08...	40	3.8	222	85	74	0.2	9.1	495	0.02	1.7
04176430	SALINE RIVER NEAR DUNDEE, MI (LAT 41 59 53N LONG 083 37 28W)									
JUL 1990 03...	--	--	--	95	68	--	--	--	0.01	1.9
AUG 09...	44	4.0	225	86	81	0.3	9.3	515	<0.01	1.8
04176537	RIVER RAISIN AT MONROE, MI (LAT 41 54 58N LONG 083 23 40W)									
JUN 1990 27...	--	--	--	89	38	--	--	--	0.01	1.7
AUG 08...	26	6.4	200	81	46	0.3	4.8	392	<0.01	<0.1
04176555	PLUM CREEK NEAR MONROE, MI (LAT 41 54 55N LONG 083 28 23W)									
JUL 1990 02...	--	--	--	130	59	--	--	--	0.03	4.1
AUG 07...	49	4.5	225	1,000	92	0.7	11	1,920	<0.01	<0.1
04176560	PITTS CREEK NR STRASBURG, MI (LAT 41 54 39N LONG 083 28 31W)									
JUL 1990 02...	--	--	--	98	85	--	--	--	0.07	6.1
AUG 07...	49	5.1	204	1,500	100	0.2	11	2,560	0.03	0.6
04176565	PLUM CREEK AT MONROE, MI (LAT 41 54 13N LONG 083 23 53W)									
JUN 1990 27...	--	--	--	240	72	--	--	--	0.02	1.4
AUG 07...	14	2.7	161	1,100	33	0.8	8.5	2,020	<0.01	<0.10

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990--Continued

DATE	TIME	DIS-CHARGE, INST. CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH (STAND-ARD UNITS)	TEMPER-ATURE WATER (DEG C)	TUR-BID-ITY (NTU)	OXYGEN, DIS-SOLVED (MG/L)	OXYGEN, DIS-SOLVED (PER-CENT SATUR-ATION)	HARD-NESS TOTAL (MG/L AS CACO3)	CALCIUM DIS-SOLVED (MG/L AS CA)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG)
04176588	LOCKWOOD DRAIN NEAR IDA CENTER, MI (LAT 41 52 02N LONG 083 33 14W)										
JUL 1990											
03...	1015	1.29	522	8.1	21.5	--	7.1	82	--	--	--
AUG											
08...	0900	0.09	556	8.2	15.5	2.5	6.2	63	200	54	15
04176638	LITTLE LAKE CREEK NEAR ERIE, MI (LAT 41 46 35N LONG 083 30 23W)										
JUL 1990											
03...	0900	0.18	673	8.0	19.0	--	5.9	65	--	--	--
AUG											
08...	1245	0.02	661	7.9	19.0	10	10.8	--	280	82	19
04176680	HALFWAY CREEK NR LAMBERTVILLE, MI (LAT 41 44 07N LONG 083 36 18W)										
JUL 1990											
02...	1430	0.68	832	8.2	21.5	--	7.0	81	--	--	--
AUG											
08...	1045	1.01	845	8.3	17.0	2.4	8.8	--	400	110	30
SEP											
11...	0900	0.84	899	8.1	19.5	4.5	7.0	77	440	120	35
04176727	NORTH TENMILE CREEK NEAR WHITEFORD CENTER, MI (LAT 41 44 47N LONG 083 41 07W)										
JUL 1990											
02...	1330	1.28	608	8.3	23.0	--	8.0	95	--	--	--

ANALYSES OF SAMPLES COLLECTED AT WATER-QUALITY PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

WATER QUALITY DATA, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990--Continued

DATE	SODIUM, DIS-SOLVED (MG/L AS NA)	POTAS-SIUM, DIS-SOLVED (MG/L AS K)	ALKA-LINITY LAB (MG/L AS CACO3)	SULFATE DIS-SOLVED (MG/L AS SO4)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL)	FLUO-RIDE, DIS-SOLVED (MG/L AS F)	SILICA, DIS-SOLVED (MG/L AS SIO2)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L)	NITRO-GEN, NITRITE DIS-SOLVED (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS-SOLVED (MG/L AS N)
04176588	LOCKWOOD DRAIN NEAR IDA CENTER, MI (LAT 41 52 02N LONG 083 33 14W)									
JUL 1990										
03...	--	--	--	48	48	--	--	--	0.01	1.0
AUG										
08...	32	4.6	151	34	70	0.1	2.6	334	<0.01	<0.1
04176638	LITTLE LAKE CREEK NEAR ERIE, MI (LAT 41 46 35N LONG 083 30 23W)									
JUL 1990										
03...	--	--	--	60	55	--	--	--	0.03	1.1
AUG										
08...	24	5.5	231	39	60	<0.1	7.9	386	0.01	<0.1
04176680	HALFWAY CREEK NR LAMBERTVILLE, MI (LAT 41 44 07N LONG 083 36 18W)									
JUL 1990										
02...	--	--	--	180	47	--	--	--	0.03	0.8
AUG										
08...	14	2.5	226	200	34	0.3	9.3	592	<0.01	0.3
SEP										
11...	16	3.4	230	230	35	0.3	9.2	612	<0.01	0.3
04176727	NORTH TENMILE CREEK NEAR WHITEFORD CENTER, MI (LAT 41 44 47N LONG 083 41 07W)									
JUL 1990										
02...	--	--	--	49	55	--	--	--	0.03	2.6

Figure 9.--Location of observation wells published in this report.

GROUND-WATER LEVELS

ALGER COUNTY

461608086373801. Local number, 45N 19W 25BDCD.
LOCATION.--Lat 46°16'08", long 86°37'38", Hydrologic Unit 04060106, 250 ft northwest of State Highway 44, and 0.2 mi northeast of Kentucky. Owner: U.S. Forest Service.
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 66 ft.
INSTRUMENTATION.--Quarterly measurement.
DATUM.--Elevation of land-surface datum is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 3.6 ft above land-surface datum.
REMARKS.--Water temperature also measured.
PERIOD OF RECORD.--June 1959 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 6.35 ft below land-surface datum, June 29, 1960; lowest measured, 14.19 ft below land-surface datum, Apr. 3, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 27	12.04	MAR 20	12.09	JUN 6	11.15	SEP 20	11.99

ALPENA COUNTY

450850083393401. Local number, 32N 6E 23DDDA.
LOCATION.--Lat 45°08'50", long 83°39'34", Hydrologic Unit 04070006, on Graham Road, 3 mi east and 1.5 mi north of Long Rapids. Owner: U.S. Geological Survey.
AQUIFER.-- Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table observation well, diameter 6 in., depth 88 ft, screened 79 to 88 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 713 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 2.7 ft above land-surface datum.
REMARKS.--Bottom of hole near top of bedrock.
PERIOD OF RECORD.--November 1976 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 13.61 ft below land-surface datum, May 22, 1983; lowest recorded, 30.01 ft below land-surface datum, Mar. 27, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	25.92	26.76	27.46	28.38	28.97	29.53	21.21	20.43	19.93	19.03	19.05	19.29
10	26.19	26.94	27.63	28.53	29.08	29.61	20.96	20.41	20.03	18.71	19.02	19.48
15	26.40	27.05	27.76	28.68	29.16	29.00	20.87	20.56	19.96	18.78	18.95	19.44
20	26.36	27.21	27.91	28.75	29.28	26.90	20.52	20.05	19.93	18.92	19.08	19.68
25	26.53	27.31	28.06	28.81	29.39	24.13	20.41	19.69	19.94	19.09	19.10	19.69
EOM	26.65	27.41	28.23	28.92	29.42	22.35	20.44	19.77	19.43	19.03	19.27	20.01

WTR YR 1990 HIGHEST 18.60 JUL 11 LOWEST 29.63 MAR 11

ARENAC COUNTY

440342083542801. Local number, 19N 5E 7DABA1.
LOCATION.--Lat 44°03'42", long 83°54'28", Hydrologic Unit 04080101, 3 mi northeast of Omer. Owner: U.S. Geological Survey.
AQUIFER.--Saginaw Formation of Pennsylvanian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 185 ft., screened 180 to 185 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 667 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.
PERIOD OF RECORD.--June 1980 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 8.28 ft below land-surface datum, July 15, 1980; lowest measured, 11.85 ft below land-surface datum, Aug. 31, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 4	11.79	DEC 13	11.80	APR 16	11.14	MAY 30	11.15	JUL 23	11.52	AUG 27	11.74
NOV 14	11.60	FEB 1	11.24								

440342083542801. Local number, 19N 5E 7DABA2.
LOCATION.--Lat 44°03'42", long 83°54'28", Hydrologic Unit 04080101, 3 mi northeast of Omer.
Owner: U.S. Geological Survey.
AQUIFER.--Lake bed sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 21 ft, screened 16 to 21 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 667 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.20 ft above land-surface datum.
PERIOD OF RECORD.--June 1980 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 2.35 ft below land-surface datum, Apr. 29, 1985; lowest measured, 7.05 ft below land-surface datum, Oct. 16, 1987.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 4	6.10	DEC 13	5.31	APR 16	3.17	MAY 30	3.36	JUL 23	4.91	AUG 27	5.32
NOV 14	6.20	FEB 1	5.41								

BARAGA COUNTY

463353088144301. Local number, 48N 32W 12DDCC.
LOCATION.--Lat 46°33'53", long 88°14'43", Hydrologic Unit 04030107, 95 ft north of U.S. Highway 41, and 0.5 mi southeast of Nestoria Road. Owner: Michigan Department of Transportation.
AQUIFER.--Sand and gravel of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 1.5 in., depth 10 ft, screened 7 to 10 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 1,630 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 4.78 ft above land-surface datum.
PERIOD OF RECORD.--September 1948 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 3.27 ft below land-surface datum, Apr. 30, 1965; lowest measured, 9.93 ft below land-surface datum, Jan. 30, 1987.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 4	6.32	JAN 16	4.51	APR 20	5.99	JUN 19	5.48	JUL 26	6.37	AUG 22	6.46

BARRY COUNTY

424540085232001. Local number, 4N 9W 5DAAA.
LOCATION.--Lat 42°45'40", long 85°23'20", Hydrologic Unit 04050007, on Soloman Road, 4 mi east and 3.5 mi north of Middleville. Owner: Michigan Department of Natural Resources.
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 2 in., depth 131 ft.
INSTRUMENTATION.--Quarterly measurement.
DATUM.--Elevation of land-surface datum is 860 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.
PERIOD OF RECORD.--December 1964 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 111.51 ft below land-surface datum, Mar. 20, 1978; lowest measured, 122.02 ft below land-surface datum, Mar. 5, 1965.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
JAN 31	116.40	MAR 15	116.35	APR 26	116.35	JUL 12	115.39

GROUND-WATER LEVELS

BAY COUNTY

435128083582401. Local number, 17N 4E 22DCAA.
LOCATION.--Lat 43°51'28", long 83°58'24", Hydrologic Unit 04080102, at end of Second Street in Pinconning. Owner: Pinconning Township.
AQUIFER.--Saginaw Formation of Pennsylvanian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 110 ft, cased to 60 ft, open bottom.
INSTRUMENTATION.--Monthly measurement. Water-level recorder from August 1962 to October 1979.
DATUM.--Elevation of land-surface datum is 620 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood shelter base, 2.00 ft above land-surface datum.
REMARKS.--Water levels affected by regional pumping.
PERIOD OF RECORD.--August 1962 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 0.05 ft below land-surface datum, Mar. 5, 1976; lowest recorded, 10.53 ft below land-surface datum, Aug. 8, 1963.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 4	4.28	DEC 13	3.29	MAR 16	2.48	MAY 30	2.67	JUL 23	4.55	AUG 27	4.66
NOV 14	1.15	FEB 1	2.77	APR 16	2.45						

BRANCH COUNTY

415602084593701. Local number, 6S 6W 22CABA.
LOCATION.--Lat 41°56'02", long 84°59'37", Hydrologic Unit 04050001, at Bennett and Tibbits Streets in Coldwater. Owner: City of Coldwater.
AQUIFER.--Sand and gravel of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 113 ft, screened 108 to 113 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 970 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood shelter base, 2.50 ft above land-surface datum.
REMARKS.--Water levels affected by nearby pumping.
PERIOD OF RECORD.--January 1964 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 8.77 ft below land-surface datum, June 4, 1989; lowest recorded, 25.9 ft below land-surface datum, May 25, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	16.66	21.20	21.47	21.56	21.87	19.25	19.42	11.63	19.18	19.97	13.24	21.21
10	21.73	21.45	21.46	21.23	13.38	11.17	19.49	19.42	11.73	19.81	20.22	13.66
15	16.90	23.11	21.59	18.01	20.67	10.65	15.77	18.93	19.40	12.37	20.26	13.54
20	21.73	15.52	22.06	21.16	20.51	18.68	19.01	12.00	12.83	15.74	20.08	20.82
25	21.66	21.30	21.56	13.40	19.48	11.81	18.74	18.60	19.62	19.80	12.58	15.05
EOM	22.08	21.53	13.65	20.82	19.36	13.07	18.95	18.72	12.06	20.00	20.41	20.21

WTR YR 1990 HIGHEST 10.04 MAR 17, 18 LOWEST 23.30 JAN 18

CALHOUN COUNTY

422422085071501. Local number, 1S 7W 10BBAB.
LOCATION.--Lat 42°24'22", long 85°07'15", Hydrologic Unit 04050003, at State Highways 78 and 66, 5 mi north of Battle Creek. Owner: Rilla Sabin.
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Dug water-table well, diameter 1.25 in., depth 12 ft, screened 9 to 12 feet.
INSTRUMENTATION.--Weekly measurement by observer.
DATUM.--Elevation of land-surface datum is 970.99 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of casing, 1.50 ft above land-surface datum.
PERIOD OF RECORD.--September 1946 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 0.89 ft below land-surface datum, Mar. 28, 1950; lowest, dry, July 29, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 4	4.30	DEC 6	4.62	FEB 7	4.30	APR 4	3.23	JUN 6	3.50	AUG 1	3.91
11	4.18	13	4.65	14	4.32	11	3.21	13	3.64	8	3.88
18	3.90	20	4.67	MAR 7	4.20	18	3.18	20	3.90	15	4.10
25	3.66	27	4.70	14	3.98	25	3.17	27	3.83	22	4.22
NOV 1	3.70	JAN 3	4.60	21	3.64	MAY 2	3.20	JUL 4	3.84	29	4.35
8	3.88	10	4.54	28	3.25	9	3.24	11	3.86	SEP 5	4.50
15	4.10	17	4.36			16	3.32	18	3.90	12	4.53
22	4.41	24	4.25			23	3.40	25	3.93	19	4.54
29	4 62	31	4.25			30	3.46			26	4.57

CALHOUN COUNTY--Continued

422025085084001. Local number, 1S 7W 32DABA.
LOCATION.--Lat 42°20'25", long 85°08'40", Hydrologic Unit 04050003, at Verona well field in Battle Creek. Owner: City of Battle Creek.
AQUIFER.--Marshall Formation of Mississippian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 8 in., depth 127 ft, cased to 103 ft.
INSTRUMENTATION.--Daily measurement by observer.
DATUM.--Elevation of land-surface datum is 830.79 ft above National Geodetic Vertical Datum of 1929. Measuring point: Recorder base, 2.10 ft above land-surface datum.
REMARKS.--Water levels affected by nearby municipal pumping.
PERIOD OF RECORD.--October 1939 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 0.7 ft below land-surface datum, Apr. 26, 27, 1950; lowest measured, 16.75 ft below land-surface datum, July 16, 1959.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	10.00	8.50	8.30	9.50	9.20	8.70	8.10	8.20	9.40	9.50	9.50	9.50
10	8.80	8.20	8.20	9.10	9.40	8.70	7.50	8.10	8.40	10.70	10.55	10.00
15	9.00	8.40	8.40	9.10	9.50	8.40	6.85	8.90	10.00	9.30	9.60	9.65
20	9.60	8.70	8.90	9.30	8.90	--	7.10	8.50	10.50	9.80	9.90	10.20
25	9.20	8.60	8.40	9.60	9.20	7.40	7.70	8.30	9.10	9.60	9.60	9.65
EOM	9.20	8.40	9.40	8.60	9.40	7.80	8.90	9.00	9.05	10.30	9.45	9.00

CASS COUNTY

414651085575601. Local number, 8S 14W 17BAAA.
LOCATION.--Lat 41°46'51", long 85°57'56", Hydrologic Unit 04050001, at U.S. Highway 112, 2 mi east of Adamsville. Owner: Ted Little.
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Dug water-table well, diameter 28 in., depth 55 ft, cribbed with brick to open bottom.
INSTRUMENTATION.--Monthly measurement by observer.
DATUM.--Elevation of land-surface datum is 840 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of wooden platform, 0.80 ft above land-surface datum.
PERIOD OF RECORD.--September 1945 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 46.20 ft below land-surface datum, July 16, 1950; lowest measured, dry, Mar. 10, 1947, Jan. 23, Feb. 24, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 24	52.10	DEC 23	53.20	FEB 23	52.90	APR 24	52.25	JUN 25	51.90	AUG 24	51.50
NOV 24	53.00	JAN 25	52.90	MAR 22	52.40	MAY 25	52.00	JUL 25	51.80	SEP 25	51.30

CHEBOYGAN COUNTY

454427084424001. Local number, 39N 3W 29CBCB1.
LOCATION.--Lat 45°44'27", long 84°42'40", Hydrologic Unit 04070003, at Stimpson Road, 3 mi southeast of Mackinaw City. Owner: U.S. Geological Survey.
AQUIFER.--Dundee Formation of Devonian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 121 ft, cased to 104 ft, open bottom.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 705 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 1.90 ft above land-surface datum.
PERIOD OF RECORD.--January 1979 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 4.71 ft below land-surface datum, Apr. 8, 1986; lowest measured, 11.68 ft below land-surface datum, Feb. 11, 1981.

WATER LEVEL, IN FEET BELOW LAND SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 12	10.38	JAN 4	9.56	MAR 20	4.84	JUN 12	6.41	JUL 24	6.51	AUG 28	7.71
NOV 21	9.92	FEB 6	8.51	MAY 3	6.10						

GROUND-WATER LEVELS

CHEBOYGAN COUNTY--Continued

454427084424002. Local number, 39N 3W 29CBCB2.
LOCATION.-- Lat 45°44'27", long 84°42'40", Hydrologic Unit 04070003, at Stimpson Road, 3 mi southeast of Mackinaw City. Owner: U.S. Geological Survey.
AQUIFER.--Sand and gravel of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 55 ft, screened 40 to 55 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 705 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.5 ft above land-surface datum.
PERIOD OF RECORD.--February 1979 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 1.80 ft below land-surface datum, Apr. 8, 1986; lowest measured, 6.47 ft below land-surface datum, Feb. 11, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 12	6.04	JAN 4	5.72	MAR 20	2.19	JUN 12	3.04	JUL 24	3.22	AUG 28	3.99
NOV 21	5.58	FEB 6	4.98	MAY 30	2.68						

CHIPPEWA COUNTY

462159084442201. Local number, 46N 4W 24DADA.
LOCATION.--Lat 46°21'59", long 84°44'22", Hydrologic Unit 04020203, on trail 0.2 mi south of State Highway 28, 1 mi west of Raco. Owner: U.S. Forest Service.
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 54 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 850 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of shelter base, 3.07 ft above land-surface datum.
PERIOD OF RECORD.--June 1952 to April 1965. November 1969 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 18.40 ft below land-surface datum, June 7, 1971; lowest recorded, 28.43 ft below land-surface datum, Apr. 14, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	25.72	26.27	26.76	27.27	27.78	28.18	28.19	26.93	25.79	25.41	25.63	26.10
10	25.82	26.35	26.85	27.36	27.86	28.25	28.13	26.50	25.52	25.40	25.70	26.12
15	25.90	26.44	26.92	27.45	27.92	28.32	28.09	26.22	25.46	25.39	25.79	26.08
20	25.98	---	27.01	27.53	28.00	28.36	28.04	26.02	25.42	25.42	25.88	26.06
25	26.09	---	27.09	27.62	28.07	28.33	27.95	25.87	25.42	25.48	25.95	25.97
EOM	26.18	26.68	27.19	27.71	28.11	28.25	27.48	25.71	25.41	25.55	26.05	25.94

WTR YR 1990 HIGHEST 25.37 JUL 8 LOWEST 28.36 MAR 19-21

CLINTON COUNTY

425410084323501. Local number, 6N 2W 16DDAD.
LOCATION.--Lat 42°54'10", long 84°32'35", Hydrologic Unit 04050005, at U.S. Highway 27, 6 mi south of St. Johns. Owner: Michigan Department of Transportation.
AQUIFER.--Gravel of Pleistocene age.
WELL CHARACTERISTICS.--Driven water-table well, diameter 2 in., depth 26 ft, screened 23 to 26 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 803.32 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of casing, 0.10 ft below land-surface datum.
REMARKS.--Federal key well. Measuring point changed from 1.30 ft above land-surface datum to 0.10 ft below land-surface datum on Sept. 23, 1980.
PERIOD OF RECORD.--August 1948 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 13.84 ft below land-surface datum, Apr. 30, 1974; lowest measured, 19.93 ft below land-surface datum, Feb. 27, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 27	17.09	DEC 27	16.77	FEB 26	16.33	APR 27	15.20	JUN 28	16.47	AUG 28	17.28
NOV 29	16.73	JAN 29	16.48	MAR 30	15.57	MAY 29	15.65	JUL 27	16.94	SEP 27	17.57

GROUND-WATER LEVELS

CRAWFORD COUNTY

443308084245001. Local number, 25N 1W 15DDCD.
LOCATION.--Lat 44°33'08", long 84°24'50", Hydrologic Unit 04070007, at State Highway 18, 2.6 mi south of Eldorado. Owner: U.S. Forest Service.
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 56 ft, cased.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 1,190 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of shelter base, 2.95 ft above land-surface datum.
PERIOD OF RECORD.--November 1948 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 25.55 ft below land-surface datum, Nov. 10, 1986; lowest recorded, 35.97 ft below land-surface datum Apr. 4-6, 1951.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	28.78	29.18	29.50	29.88	30.27	30.61	30.45	30.25	30.14	29.91	29.86	30.12
10	28.83	29.21	29.58	29.94	30.32	30.69	30.40	30.21	30.12	29.87	29.89	30.15
15	28.88	29.28	29.65	30.01	30.39	30.71	30.35	30.20	30.08	29.84	29.93	30.18
20	28.93	29.32	29.70	30.07	30.46	30.71	30.32	30.19	30.04	29.84	29.99	30.22
25	28.99	29.39	29.75	30.11	30.52	30.69	30.28	30.19	29.98	29.83	30.02	30.25
EOM	29.14	29.45	29.81	30.19	30.56	30.56	30.25	30.18	29.95	29.85	30.07	30.30

WTR YR 1990 HIGHEST 28.74 OCT 1 LOWEST 30.71 MAR 13-22

DELTA COUNTY

454446087090401. Local number, 39N 23W 28ACCC.
LOCATION.--Lat 45°44'46", long 87°09'04", Hydrologic Unit 04030111, 3.5 mi west of Escanaba. Owner: M. Blake.
AQUIFER.--Munising Sandstone of Cambrian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 5 in., depth 530 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 680 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of shelter base, 3.39 ft above land-surface datum.
PERIOD OF RECORD.--July 1968 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 1.5 ft below land-surface datum, May 6, 1960; lowest recorded, 8.9 ft below land-surface datum, Feb. 6, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	7.65	6.82	6.96	7.52	7.36	7.37	6.22	6.29	6.00	6.38	6.81	6.88
10	7.75	6.81	7.08	8.21	7.29	7.34	6.17	5.93	6.08	6.63	7.09	6.78
15	7.65	6.87	7.13	7.32	7.33	6.17	6.31	5.99	5.82	6.50	6.71	6.44
20	7.58	6.96	7.39	7.13	7.44	6.34	6.18	5.96	5.89	6.62	6.56	6.68
25	7.47	6.87	7.41	7.13	7.47	6.28	6.32	6.03	6.15	6.58	6.56	6.56
EOM	7.07	7.02	7.27	7.42	7.49	6.45	6.31	6.48	6.46	6.70	6.73	6.75

WTR YR 1990 HIGHEST 5.41 MAY 17 LOWEST 8.22 AUG 17

DICKINSON COUNTY

460458087493901. Local number, 43N 28W 32ADAB.
LOCATION.--Lat 46°04'58", long 87°49'39", Hydrologic Unit 04030109, 6.25 mi north of Felch. Owner: Michigan Department of Natural Resources.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Augered water-table well, diameter 1.25 in., depth 31 ft, screened 29 to 31 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 1,160 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Hole in top of cap, 4.00 ft above land-surface datum.
REMARKS.--Water temperature also measured.
PERIOD OF RECORD.--October 1966 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 12.95 ft below land-surface datum, Apr. 9, 1986; lowest measured, 16.50 ft below land-surface datum, Mar. 2, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 25	15.56	DEC 7	15.70	FEB 2	16.05	APR 5	15.84	JUN 6	15.09	SEP 6	15.59
NOV 3	15.52	JAN 5	16.00	MAR 2	16.19	MAY 3	15.70	JUL 16	15.42		

GROUND-WATER LEVELS

EATON COUNTY

424435084365001. Local number, 4N 3W 12CDAD.
LOCATION.--Lat 42°44'35", long 84°36'50", Hydrologic Unit 04050004, at Robins Road, in Delta Township, 0.5 mi west of Lansing. Owner: F. Wheeler.
AQUIFER.--Saginaw Formation of Pennsylvanian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 381 ft, cased to 140 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 862.91 ft above National Geodetic Vertical Datum of 1929. Measuring point: Plywood instrument shelf, 1.00 ft above land-surface datum.
REMARKS.--Water levels affected by pumping.
PERIOD OF RECORD.--October 1953 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 64.54 ft below land-surface datum, Oct. 31, 1989; lowest recorded, 103.6 ft below land-surface datum, Aug. 28, 1969.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	68.35	68.25	77.95	74.93	71.46	66.69	66.08	79.17	81.90	86.38	85.19	87.71
10	65.77	68.09	78.53	76.09	69.04	68.16	68.09	79.50	84.41	88.63	84.51	82.63
15	65.42	74.16	78.07	76.09	67.03	66.29	68.14	76.09	85.76	86.48	83.25	82.00
20	65.26	76.76	75.07	75.51	66.49	66.27	68.15	75.86	86.11	85.79	82.50	80.09
25	65.14	77.29	75.13	74.33	66.80	68.55	74.20	77.60	83.48	83.62	83.19	77.83
EOM	64.96	77.75	74.06	72.77	65.87	68.40	78.08	79.03	85.09	84.35	87.40	78.37

WTR YR 1990 HIGHEST 64.54 OCT 31 LOWEST 88.80 JUL 11

GENESEE COUNTY

425552083382801. Local number, 6N 7E 9DCCC.
LOCATION.--Lat 42°55'52", long 83°38'28", Hydrologic Unit 04080204, at Fisher Body Plant in Grand Blanc. Owner: General Motors Corporation.
AQUIFER.--Saginaw Formation of Pennsylvanian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 10 in., depth 385 ft, cased to 150 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 837.0 ft above National Geodetic Vertical Datum of 1929. Measuring point: Instrument shelf, 1.50 ft above land-surface datum.
REMARKS.--Water levels affected by nearby pumping. Measurements made by Plant Water Department.
PERIOD OF RECORD.--January 1974 to September 1990 (discontinued).
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 52.3 ft below land-surface datum, Dec. 29, 1975; lowest recorded, 87.74 ft below land-surface datum, July 9, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	68.69	64.15	66.88	---	63.12	66.15	62.10	65.20	67.52	72.20	74.55	76.20
10	65.74	63.81	---	67.69	63.40	64.10	---	63.75	67.65	69.20	78.02	75.59
15	66.95	64.64	---	68.82	65.00	60.63	---	65.25	66.30	70.98	78.43	71.45
20	65.23	65.11	---	---	67.05	63.91	61.90	65.30	67.00	77.00	76.88	68.75
25	64.04	66.85	---	67.95	64.67	65.75	62.98	63.95	72.10	74.00	76.28	65.90
EOM	64.65	65.59	---	63.96	68.10	---	65.80	67.70	72.10	75.40	77.70	66.45

WTR YR 1990 HIGHEST 60.35 MAR 15 LOWEST 79.52 AUG 7

GRAND TRAVERSE COUNTY

443921085213501. Local number, 26N 9W 14ABAA.
LOCATION.--Lat 44°39'21", long 85°21'35", Hydrologic Unit 04060105, 5.5 mi north of Fife Lake. Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 80 ft, PVC pipe and screen.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 960 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 2.85 ft above land-surface datum.
PERIOD OF RECORD.--June 1976 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 21.32 ft below land-surface datum, Oct. 22, 26, 27, 1986; lowest recorded, 28.05 ft below land-surface datum, Apr. 3, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	24.79	25.18	25.56	25.91	26.22	26.45	24.36	24.33	24.60	24.28	23.86	24.25
10	24.86	25.25	25.62	25.96	26.25	26.48	24.27	24.37	24.64	24.08	23.91	24.32
15	24.92	25.31	25.68	26.02	26.29	26.47	24.23	24.44	24.65	23.93	23.98	24.36
20	24.98	25.38	25.74	26.06	26.34	25.91	24.23	24.50	24.66	23.84	24.06	24.43
25	25.06	25.44	25.79	26.11	26.39	25.10	24.23	24.53	24.68	23.80	24.12	24.48
EOM	25.13	25.50	25.85	26.18	26.41	24.56	24.28	24.57	24.54	23.81	24.19	24.55

WTR YR 1990 HIGHEST 23.78 JUL 29, 30 LOWEST 26.48 MAR 10-14

GROUND-WATER LEVELS

HILLSDALE COUNTY

415154084315401. Local number, 7S 2W 15BCBA1.
LOCATION.--Lat 41°51'54", long 84°31'54", Hydrologic Unit 04100003, on Trail Road, 7 mi southeast of Hillsdale. Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 150 ft, screened 135 to 150 ft.
INSTRUMENTATION.--Water-level recorder. Monthly measurement prior to Sept. 30, 1988.
DATUM.--Elevation of land-surface datum is 1,092 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.50 ft above land-surface datum.
PERIOD OF RECORD.--November 1978 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 46.14 ft below land-surface datum, Apr. 13, 1982; lowest recorded, 49.49 ft below land-surface datum, Oct. 30, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	48.65	48.68	48.60	48.88	48.78	48.42	47.73	47.52	47.53	47.60	47.74	47.91
10	48.62	48.69	48.75	48.80	48.59	48.23	47.80	47.44	47.55	47.67	47.81	47.90
15	48.62	48.66	48.80	48.89	48.69	47.98	47.66	47.62	47.53	47.57	47.76	47.81
20	48.56	48.68	48.86	48.90	48.83	48.14	47.78	47.46	47.51	47.67	47.80	47.94
25	48.80	48.74	48.84	48.72	48.74	48.05	47.62	47.55	47.63	47.75	47.82	47.91
EOM	48.64	48.80	48.76	48.85	48.59	47.80	47.58	47.59	47.52	47.74	47.85	48.02

WTR YR 1990 HIGHEST 47.28 JUN 23 LOWEST 49.03 DEC 22, 23

415236084313701. Local number, 7S 2W 10BDDD.
LOCATION.--Lat 41°52'36", long 84°31'37", Hydrologic Unit 04100003, at State Highway 34, 2.5 mi west of Pittsford. Owner: Michigan Department of Natural Resources.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Augered water-table well, diameter 1.25 in., depth 20 ft, screened 17 to 20 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 1,070 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 4.00 ft above land-surface datum.
PERIOD OF RECORD.--December 1965 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 5.79 ft below land-surface datum, Apr. 13, 1982; lowest measured, 11.1 ft below land-surface datum, Sept. 21, 1967.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 3	8.76	DEC 26	8.79	MAR 20	6.61	JUN 12	7.37	JUL 23	8.12	SEP 4	8.44
NOV 14	8.59	FEB 6	7.76	MAY 1	7.26						

INGHAM COUNTY

424424084340301. Local number, 4N 2W 17ABAA.
LOCATION.--Lat 42°44'24", long 84°34'03", Hydrologic Unit 04050004, at Kirby and Logan Streets in Lansing. Owner: City of Lansing.
AQUIFER.--Saginaw Formation of Pennsylvanian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 20 in., depth 424 ft.
INSTRUMENTATION.--Water-level recorder. Monthly measurement prior to August 1960.
DATUM.--Elevation of land-surface datum is 858.72 ft above National Geodetic Vertical Datum of 1929. Measuring point: Plywood shelter base, 0.5 ft above land-surface datum.
REMARKS.--Water levels affected by regional pumping.
PERIOD OF RECORD.--December 1929 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 34.3 ft below land-surface datum, December 1929; lowest recorded, 168.3 ft below land-surface datum, May 7, 1968.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	62.63	61.55	60.95	61.26	62.15	64.13	65.07	65.69	66.50	67.54	68.40	68.54
10	62.25	61.47	61.23	60.99	62.10	64.08	65.29	65.51	66.81	67.75	68.35	68.62
15	62.06	61.12	61.21	61.29	62.63	64.08	65.48	65.95	66.87	67.83	68.41	68.25
20	61.78	61.12	61.35	61.46	63.33	64.82	65.80	65.99	66.86	67.97	68.49	68.49
25	62.28	61.22	61.12	61.17	63.84	64.96	65.71	66.28	67.33	68.33	68.46	68.01
EOM	61.70	61.55	60.80	61.99	63.84	64.99	65.70	66.54	67.19	68.30	68.45	68.30

WTR YR 1990 HIGHEST 60.35 JAN 11 LOWEST 68.85 SEP 17

GROUND-WATER LEVELS

IOSCO COUNTY

442839083312301. Local number, 24N 7E 13ADAD1.
LOCATION.--Lat 44°28'39", long 83°31'23", Hydrologic Unit 04070007, 10 mi west of Oscoda.
Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 69 ft, screened 54 to 69 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 760 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.
PERIOD OF RECORD.--June 1980 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 25.49 ft below land-surface datum, Sept. 25, 1986; lowest measured, 32.71 ft below land-surface datum, Mar. 23, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 12	31.05	NOV 30	31.43	MAR 8	32.24	MAY 16	31.75	AUG 2	31.30	SEP 17	31.70
NOV 1	31.24	DEC 21	31.61	APR 17	31.75	JUL 10	31.21				

IRON COUNTY

461257088542001. Local number, 44N 37W 14BBCA.
LOCATION.--Lat 46°12'57", long 88°54'20", Hydrologic Unit 04030106, at Federal Forest Highway 16, 0.5 mi south of Elmwood. Owner: Michigan Department of Transportation.
AQUIFER.--Sand and gravel of Pleistocene age.
WELL CHARACTERISTICS.--Driven water-table well, diameter 6 in., depth 102 ft.
INSTRUMENTATION.--Quarterly measurement.
DATUM.--Elevation of land-surface datum is 1,730 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of plywood shelter base, 4.21 ft above land-surface datum.
PERIOD OF RECORD.--October 1959 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 90.57 ft below land-surface datum, Sept. 25, 1986; lowest measured, 97.11 ft below land-surface datum, Aug. 16, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 1	93.06	MAY 15	93.60	AUG 21	93.88

JACKSON COUNTY

421346084230801. Local number, 3S 1W 11AADD1.
LOCATION.--Lat 42°13'46", long 84°23'08", Hydrologic Unit 04050004, at Belden and Mansion Streets in Jackson. Owner: City of Jackson.
AQUIFER.--Saginaw Formation of Pennsylvanian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 16 in., depth 360 ft, open bottom.
INSTRUMENTATION.--Daily measurement by observer; lowest monthly reading shown.
DATUM.--Elevation of land-surface datum is 935 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood recorder shelf, 5.50 ft above land-surface datum.
REMARKS.--Water levels affected by pumping.
PERIOD OF RECORD.--June 1957 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 18.6 ft below land-surface datum, Jan. 2, 1961; lowest measured, 122.0 ft below land-surface datum, July 8, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 6	80.3	DEC 14	72.6	FEB 7	72.7	APR 26	84.5	JUN 15	82.9	AUG 2	85.2
NOV 17	76.7	JAN 9	69.7	MAR 28	69.5	MAY 3	83.3	JUL 12	89.2	SEP 21	86.6

GROUND-WATER LEVELS

KALAMAZOO COUNTY

421325085404801. Local number, 3S 12W 11BDAD.
LOCATION.--Lat 42°13'25", long 85°04'48", Hydrologic Unit 04050003, at Kalamazoo Valley Community College. Owner: City of Kalamazoo.
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 3 in., depth 248 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 880 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of shelter base, 4.00 ft above land-surface datum.
PERIOD OF RECORD.--March 1961 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, +2.98 ft above land-surface datum, Sept. 4, 1969; lowest recorded, 1.10 ft below land-surface datum, July 14, 15, 1988.

WATER LEVEL, IN FEET ABOVE (+) AND BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	+0.34	+0.44	+0.42	+0.38	+0.34	+0.34	+0.33	0.35	0.55	---	0.90	0.08
10	+ .28	+ .40	+ .38	+ .31	+ .29	+ .32	+ .40	.44	.60	---	.95	.00
15	+ .28	+ .47	---	+ .33	+ .30	+ .36	+ .06	.43	.63	---	.92	+ .01
20	+ .35	+ .44	---	+ .38	+ .26	+ .38	.10	.44	.61	---	.90	.19
25	+ .31	+ .46	---	+ .31	+ .38	+ .40	.18	.52	---	0.77	+ .07	.22
EOM	+ .40	+ .42	+ .39	+ .35	+ .34	+ .37	.27	.51	---	.89	+ .30	.30

WTR YR 1990 HIGHEST +0.85 APR 13 LOWEST 0.98 AUG 7

KENT COUNTY

425030085434901. Local number, 5N 12W 4DCCD.
LOCATION.--Lat 42°50'30", long 85°43'49", Hydrologic Unit 04050006, 0.4 mi west of Byron Center Road, 2.1 mi north of Byron Center. Owner: City of Wyoming.
AQUIFER.--Sand and gravel of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 86 ft.
INSTRUMENTATION.--Monthly measurement. Water-level recorder October 1962 to July 1978.
DATUM.--Elevation of land-surface datum is 685.97 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of shelter base, 2.80 ft above land-surface datum.
PERIOD OF RECORD.--October 1962 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 8.28 ft below land-surface datum, Apr. 14, 1974; lowest recorded, 12.91 ft below land-surface datum, Aug. 19, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 7	10.65	JAN 31	9.68	APR 26	9.67	JUN 5	9.83	JUL 12	10.66	AUG 29	10.42
DEC 21	10.26	MAR 15	9.37								

LAKE COUNTY

440737085483701. Local number, 20N 13W 13ACAC1.
LOCATION.--Lat 44°07'37", long 85°48'37", Hydrologic Unit 04060103, 5 mi east of Irons. Owner: U.S. Geological Survey.
AQUIFER.--Outwash deposits of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 57 ft, screened 42 to 57 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 945 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.
PERIOD OF RECORD.--March 1980 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 9.13 ft below land-surface datum, Oct. 8, Nov. 12, 1986; lowest measured, 17.71 ft below land-surface datum, Mar. 14, 1980.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 19	12.57	JAN 10	13.67	MAR 28	12.71	JUN 26	12.32	JUL 31	12.05	SEP 20	12.51
DEC 7	13.35	FEB 23	14.20	MAY 10	12.47						

GROUND-WATER LEVELS

LEELANAU COUNTY

445020086012201. Local number, 28N 14W 8DDCA1.
LOCATION.--Lat 44°50'20", long 86°01'22", Hydrologic Unit 04060104, 2.5 mi northeast of Empire.
Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 138 ft, screened 123 to 138 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 750 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.
PERIOD OF RECORD.--February 1978 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 111.25 ft below land-surface datum, Apr. 7, 1987; lowest measured, 114.49 ft below land-surface datum, June 21, 1983.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 3	112.48	JAN 2	112.52	MAR 22	112.62	JUN 13	112.73	JUL 25	112.70	SEP 6	112.50
NOV 8	112.39	FEB 13	112.63	MAY 7	112.69						

445011086031401. Local number, 28N 14W 18BABB1.
LOCATION.--Lat 44°50'11", long 86°03'14", Hydrologic Unit 04060104, 2 mi north of Empire.
Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 60 ft, screened 45 to 60 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 625 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.00 ft above land-surface datum.
PERIOD OF RECORD.--November 1979 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 20.79 ft below land-surface datum, Oct. 14, 15, 1986; lowest recorded, 24.76 ft below land-surface datum, Sept. 29, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	24.14	24.30	24.31	24.39	24.16	24.08	23.16	23.53	23.70	23.14	23.59	23.95
10	24.17	24.33	24.34	24.43	24.11	24.11	23.26	23.58	23.74	23.15	23.64	---
15	24.20	24.34	24.35	24.47	24.09	23.92	23.32	23.59	23.77	23.21	23.70	---
20	24.22	24.36	24.37	24.43	24.06	23.12	23.39	23.60	23.64	23.31	23.77	---
25	24.25	24.35	24.36	24.34	24.05	22.92	23.44	23.64	23.40	23.42	23.83	---
EOM	24.29	24.35	24.38	24.23	24.05	22.99	23.48	23.67	23.22	23.51	23.89	---

WTR YR 1990 HIGHEST 22.91 MAR 25 LOWEST 24.47 JAN 15-19

LENAWEE COUNTY

420246084150601. Local number, 5S 1E 12DDBD.
LOCATION.--Lat 42°02'46", long 84°15'06", Hydrologic Unit 04100002, in the Onsted State Game Area, 2 mi west of Cambridge Junction. Owner: Michigan Department of Natural Resources.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 1.25 in., depth 39 ft, screened 36 to 39 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 1,000 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 3.50 ft above land-surface datum.
REMARKS.--Water temperature also measured.
PERIOD OF RECORD.--December 1965 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 15.89 ft below land-surface datum, Mar. 26, 1982; lowest measured, 19.33 ft below land-surface datum, Sept. 2, 1971.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 16	17.39	JAN 9	16.95	MAR 30	16.40	JUN 22	16.93	AUG 3	17.29	SEP 21	16.99
NOV 28	17.03	FEB 16	16.69	MAY 11	16.73						

GROUND-WATER LEVELS

LIVINGSTON COUNTY

422853083402801. Local number, 1N 6E 13DBAB.
LOCATION.--Lat 42°28'53", long 83°40'28", Hydrologic Unit 04090005, at Twelve Mile Road, 2 mi northwest of South Lyon. Owner: American Aggregate Corporation.
AQUIFER.--Glacial deposits of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 2 in., depth 29 ft, 1.25 in. diameter screen.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 930 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 2.50 ft above land-surface datum.
PERIOD OF RECORD.--April 1970 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 12.1 ft below land-surface datum, Apr. 22, 1974; lowest recorded, 21.58 ft below land-surface datum, Oct. 30, 31, Nov. 1, 1979.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	15.58	15.57	15.92	16.51	16.22	15.73	14.89	14.72	14.92	15.13	15.52	---
10	15.69	15.57	16.01	16.34	16.19	15.73	14.90	14.76	14.98	15.21	15.56	---
15	15.61	15.71	16.14	16.36	16.16	15.13	14.79	14.85	15.02	15.27	15.58	---
20	15.51	15.71	16.26	16.24	16.13	14.89	14.78	14.77	14.99	15.33	15.68	15.82
25	15.60	15.86	16.32	16.22	15.86	14.79	14.76	14.77	15.03	15.39	15.73	15.82
EOM	15.67	15.84	16.40	16.22	15.79	14.81	14.76	14.86	15.07	15.47	15.78	15.88

WTR YR 1990 HIGHEST 14.71 MAR 29, 30, MAY 10 LOWEST 16.51 JAN 2-5

MACKINAC COUNTY

460321084354801. Local number, 42N 2W 7AABB.
LOCATION.--Lat 46°03'21", long 84°35'48", Hydrologic Unit 04070002, at Pontchartrain and St. Ignace Roads, 2 mi north of Pontchartrain Shores. Owner: U.S. Forest Service.
AQUIFER.--Manistique Dolomite of Silurian age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 102 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 650 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of shelter floor, 2.30 ft above land-surface datum.
PERIOD OF RECORD.--June 1956 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 12.49 ft below land-surface datum, Apr. 21, 1985; lowest recorded, 32.3 ft below land-surface datum, Feb. 7, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	30.04	30.70	28.08	28.88	28.10	28.04	20.30	22.52	22.94	23.79	25.84	26.79
10	30.21	30.07	28.18	28.98	27.81	27.94	20.95	22.85	23.68	22.89	26.04	26.61
15	30.39	29.83	28.22	29.18	27.76	19.00	21.29	22.34	24.11	23.63	26.07	22.97
20	30.48	29.39	28.33	28.19	27.79	17.45	21.07	18.62	24.25	24.35	26.46	24.36
25	30.66	28.81	28.41	28.09	27.95	19.12	21.34	20.52	23.46	24.92	26.78	24.94
EOM	30.68	28.41	28.61	28.26	27.92	20.82	21.93	22.20	23.46	25.40	27.20	25.44

WTR YR 1990 HIGHEST 15.69 MAR 17 LOWEST 30.80 NOV 3

MARQUETTE COUNTY

462938087475901. Local number, 47N 28W 3CCDC.
LOCATION.--Lat 46°29'38", long 87°47'59", Hydrologic Unit 04020105, on U.S Highway 41 and State Highway 28, and 4.8 mi west of Ishpeming. Owner: Ely Township.
AQUIFER.--Sand and gravel of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 8 in., depth 72 ft, screened 68 to 72 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 1,571.99 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of recorder base, 3.00 ft above land-surface datum.
REMARKS.--Federal key well.
PERIOD OF RECORD.--August 1961 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 9.41 ft below land-surface datum, Apr. 21, 1985; lowest recorded, 19.26 ft below land-surface datum, Apr. 10, 11, 1964.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	14.23	14.52	14.73	15.37	15.99	16.50	14.81	14.77	13.87	14.12	14.80	15.35
10	14.34	14.44	14.84	15.49	16.08	16.57	14.85	14.76	13.93	14.15	14.91	15.42
15	14.43	14.44	14.94	15.61	16.17	16.23	14.86	14.59	13.93	14.22	15.03	15.48
20	14.51	14.53	15.04	15.69	16.26	14.80	14.85	13.95	13.82	14.37	15.13	15.54
25	14.57	14.57	15.14	15.78	16.36	14.81	14.77	13.81	13.87	14.52	15.20	15.54
EOM	14.56	14.67	15.25	15.91	16.40	14.84	14.72	13.85	13.99	14.69	15.27	15.61

WTR YR 1990 HIGHEST 13.79 JUN 3 LOWEST 16.58 MAR 11, 12

GROUND-WATER LEVELS

MENOMINEE COUNTY

453504087331301. Local number, 37N 26W 19DADA.
LOCATION.--Lat 45°35'04", long 87°33'13", Hydrologic Unit 04030108, at U.S. Highway 41 at Carney.
Owner: Michigan Department of Transportation.
AQUIFER.--Trenton Limestone and Black River Formation of Middle Ordovician age.
WELL CHARACTERISTICS.--Water-table well, diameter 4 in., depth 17 ft, cased.
INSTRUMENTATION.--Quarterly measurement.
DATUM.--Elevation of land-surface datum is 800 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of 2 in. reducing nipple, 1.26 ft above land-surface datum.
REMARKS.--Water temperature also measured.
PERIOD OF RECORD.--September 1959 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 3.32 ft below land-surface datum, Mar. 31, 1986; lowest measured, 8.62 ft below land-surface datum, Jan. 17, 1977.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 18	6.49	MAR 5	5.77	JUN 19	4.10	SEP 21	4.57

MONROE COUNTY

415206083414401. Local number, 7S 6E 15ACAA.
LOCATION.--Lat 41°52'06", long 83°41'44", Hydrologic Unit 04100002, at Teal Road, 2 mi southeast of Petersburg. Owner: U.S. Geological Survey.
AQUIFER.--Detroit River Group of Devonian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 72 ft, cased to 53 ft, open bottom.
INSTRUMENTATION.--Water-level recorder. Monthly measurement prior to Sept. 30, 1988.
DATUM.--Elevation of land-surface datum is 680 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.50 ft above land-surface datum.
PERIOD OF RECORD.--November 1978 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 32.30 ft below land-surface datum, Mar. 26, 1982; lowest recorded, 46.54 ft below land-surface datum, July 9, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	---	39.81	39.25	---	39.15	37.91	36.84	36.83	37.22	---	42.10	41.90
10	---	39.71	---	39.75	39.02	37.74	36.87	37.17	37.29	---	42.79	41.52
15	39.93	39.77	---	39.50	38.94	37.03	36.85	37.01	37.83	---	42.50	41.26
20	39.84	39.50	---	39.50	38.94	37.03	36.85	37.01	38.17	---	42.10	41.20
25	40.07	39.58	---	39.43	38.14	37.03	36.85	37.09	---	---	41.70	40.95
EOM	39.84	39.49	---	39.14	38.14	37.14	36.83	37.38	---	---	41.54	41.19

WTR YR 1990 HIGHEST 36.83 APR 28 - MAY 10 LOWEST 42.90 AUG 12

415235083414001. Local number, 7S 6E 15ADBB.
LOCATION.--Lat 41°52'35", long 83°41'40", Hydrologic Unit 04100002, at Teal Road, 1.5 mi southeast of Petersburg. Owner: Michigan Department of Natural Resources.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 1.25 in., depth 17 ft, screened 14 to 17 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 675 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 4.00 ft above land-surface datum.
PERIOD OF RECORD.--December 1965 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 3.00 ft below land-surface datum, Feb. 14, 1966; lowest measured, 7.58 ft below land-surface datum, Oct. 6, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 13	6.20	JAN 8	6.65	MAR 29	5.40	JUN 22	5.41	AUG 2	6.34	SEP 20	6.91
NOV 27	6.41	FEB 15	6.39	MAY 10	5.44						

GROUND-WATER LEVELS

OAKLAND COUNTY

425116083321501. Local number, 5N 8E 8ACAC.
LOCATION.--Lat 42°51'16", long 83°32'15", Hydrologic Unit 04080204, at Van Atta Road, 6 mi northeast of Holly. Owner: Michigan Department of Natural Resources.
AQUIFER.--Sand and gravel of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 1.25 in., depth 42 ft, screened 39 to 42 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 930 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 3.00 ft above land-surface datum.
REMARKS.--Water temperature also measured.
PERIOD OF RECORD.--November 1965 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 22.30 ft below land-surface datum, Apr. 24, 1974; lowest measured, 26.48 ft below land-surface datum, Sept. 9, 1966.

WATER LEVEL IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 2	25.92	JAN 24	25.43	APR 6	24.84	MAY 31	24.93	JUL 11	25.76	SEP 20	26.18
DEC 14	25.66	MAR 8	25.16	17	24.69	JUN 29	25.43	AUG 25	26.14		

OCEANA COUNTY

433133086082601. Local number, 13N 15W 18AAAA.
LOCATION.--Lat 43°31'33", long 86°08'26", Hydrologic Unit 04060101, 6 mi southwest of Hesperia. Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 6 in., depth 79 ft, screened 69 to 79 ft.
INSTRUMENTATION.--Water-level recorder. Monthly measurements August 1977 to July 1979.
DATUM.--Elevation of land-surface datum is 703 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.50 ft above land-surface datum.
PERIOD OF RECORD.--August 1977 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 35.76 ft below land-surface datum, Dec. 2, 3, 1986; lowest recorded, 40.99 ft below land-surface datum, Mar. 28, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	38.59	38.97	39.40	39.87	40.31	40.67	40.57	40.52	40.35	39.99	39.95	40.26
10	38.65	39.05	39.49	39.95	40.37	40.72	40.55	40.53	40.27	39.96	39.97	40.31
15	38.70	39.12	39.56	40.02	40.44	40.75	40.52	40.55	40.21	39.94	40.01	40.35
20	38.76	39.20	39.63	40.09	40.51	40.77	40.52	40.53	40.15	39.93	40.08	40.40
25	38.85	39.26	39.70	40.16	40.58	40.71	40.51	40.49	40.09	39.93	40.14	40.44
EOM	38.92	39.34	39.79	40.25	40.61	40.62	40.52	40.42	40.03	39.93	40.21	40.50

WTR YR 1990 HIGHEST 38.53 OCT 1, 2 LOWEST 40.77 MAR 19, 20

OGEMAW COUNTY

442514084164702. Local number, 23N 1E 2BAAA.
LOCATION.--Lat 44°25'14", long 84°16'47", Hydrologic Unit 04070007, at south side of Rose City Road, and 8 mi west of Rose City. Owner: Ogemaw County Road Commission.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 1.25 in., depth 20 ft.
INSTRUMENTATION.--Quarterly measurement.
DATUM.--Elevation of land-surface datum is 1,265 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.30 ft above land-surface datum.
PERIOD OF RECORD.--November 1968 to October 1971, April 1974 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 7.62 ft below land-surface datum, Apr. 13, 1976; lowest measured, 13.6 ft below land-surface datum, December 1972.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
DEC 11	12.92	FEB 27	13.23	SEP 6	12.09

GROUND-WATER LEVELS

ONTONAGON COUNTY

465002089321601. Local number, 51N 41W 8BDBC.
LOCATION.--Lat 46°50'02", long 89°32'16", Hydrologic Unit 04020101, 325 ft south of State Highway 64, 1.5 mi east of Silver City. Owner: Michigan Department of Corrections.
AQUIFER.--Freda Sandstone of Keweenawan age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 100 ft, cased to 32 ft.
INSTRUMENTATION.--Quarterly measurement.
DATUM.--Elevation of land-surface datum is 620 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 3.50 ft above land-surface datum.
PERIOD OF RECORD.--October 1958 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 8.20 ft below land-surface datum, Apr. 15, 1959; lowest measured, 21.82 ft below land-surface datum, Dec. 15, 1976.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 1	17.87	JAN 18	14.19	MAY 9	10.27	AUG 22	14.67

OTSEGO COUNTY

445920084425801. Local number, 30N 3W 19ABBB.
LOCATION.--Lat 44°59'20", long 84°42'58", Hydrologic Unit 04070007, at Old Alba Road, 3 mi southwest of Gaylord. Owner: U.S. Geological Survey.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 87 ft, screened 72 to 87 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 1,307 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 2.50 ft above land-surface datum.
PERIOD OF RECORD.---January 1979 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured 30.56 ft below land-surface datum, Dec. 10, 1986; lowest measured, 35.82 ft below land-surface datum, Apr. 1, 1982.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 10	32.81	JAN 5	33.62	MAR 20	33.87	JUN 12	32.66	JUL 24	32.52	AUG 27	32.66
NOV 22	33.24	FEB 5	33.84	MAY 4	32.86						

PRESQUE ISLE COUNTY

451634083441801. Local number, 33N 6E 8BBBB.
LOCATION.--Lat 45°16'34", long 83°44'18", Hydrologic Unit 04070006, at south side of Grand Lake Highway, 2 mi west and 1 mi north of Posen. Owner: A. Styma.
AQUIFER.--Traverse Group.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 61 ft.
INSTRUMENTATION.--Quarterly measurement.
DATUM.--Elevation of land-surface datum is 815 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 0.50 ft above land-surface datum.
PERIOD OF RECORD.--December 1959 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 5.10 ft below land-surface datum, Mar. 2, 1979; lowest measured, 16.83 ft below land-surface datum, Mar. 5, 1963.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
NOV 2	15.30	MAR 19	5.67	JUL 14	11.59

GROUND-WATER LEVELS

ROSCOMMON COUNTY

442722084350701. Local number, 24N 2W 20BABA.
LOCATION.--Lat 44°27'22", long 84°35'07", Hydrologic Unit 04070007, at State Highway 103, 2 mi south of Roscommon. Owner: Michigan Department of Natural Resources.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Jetted water-table well, diameter 8 in., depth 14 ft, open bottom.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 1,145.30 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of casing, 2.50 ft above land-surface datum.
REMARKS.--Federal key well.
PERIOD OF RECORD.--December 1934 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 2.29 ft below land-surface datum, Apr. 19, 1985; lowest recorded, 6.23 ft below land-surface datum, Dec. 6-11, 1949.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	5.43	5.50	5.57	5.72	5.78	5.84	4.38	4.58	4.23	4.69	5.02	5.31
10	5.43	5.51	5.60	5.73	5.74	5.81	4.40	4.62	4.33	4.77	5.07	5.28
15	5.44	5.53	5.62	5.75	5.78	5.11	4.42	4.55	4.37	4.85	5.10	5.23
20	5.44	5.52	5.65	5.66	5.80	4.38	4.44	4.47	4.46	4.85	5.12	5.24
25	5.46	5.54	5.68	5.73	5.81	4.40	4.46	4.13	4.52	4.92	5.17	5.29
EOM	5.48	5.55	5.71	5.76	5.82	4.42	4.52	4.19	4.59	4.97	5.23	5.32

WTR YR 1990 HIGHEST 4.13 MAY 24-27 LOWEST 5.85 MAR 9

SAGINAW COUNTY

431457084194401. Local number, 10N 1E 22DADA1.
LOCATION.--Lat 43°14'57", long 84°19'44", Hydrologic Unit 04080203, at west side of Merrill Road, 0.35 mi north of Marion Springs. Owner: U.S. Geological Survey.
AQUIFER.--Saginaw Formation of Pennsylvanian age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 6 in., depth 210 ft, cased to 170 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 657 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 2.50 ft above land-surface datum.
PERIOD OF RECORD.--December 1977 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 7.93 ft below land-surface datum, Feb. 10, 1981; lowest recorded, 10.92 ft below land-surface datum, Sept. 1, 1988.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	9.75	9.65	9.37	9.30	9.29	9.18	8.94	8.93	9.12	9.40	9.56	9.65
10	9.69	9.62	9.48	9.21	9.17	9.07	8.99	8.84	9.19	9.50	9.55	9.54
15	9.74	9.59	9.40	9.29	9.25	9.04	8.93	8.99	9.19	9.45	9.60	9.45
20	9.64	9.49	9.41	9.31	9.29	9.19	9.02	8.93	9.22	9.50	9.51	9.49
25	9.80	9.53	9.36	9.20	9.26	9.15	8.97	9.03	9.31	9.56	9.52	9.38
EOM	9.69	9.51	9.26	9.30	9.21	9.02	8.96	9.10	9.25	9.59	9.60	9.48

WTR YR 1990 HIGHEST 8.73 MAY 10 LOWEST 9.85 OCT 18, 19

SANILAC COUNTY

433439082523601. Local number, 13N 13E 12ADAA.
LOCATION.--Lat 43°34'39", long 82°52'36", Hydrologic Unit 04090001, at Wheatland Road, 3 mi east and 0.75 mi north of Argyle. Owner: U.S. Geological Survey.
AQUIFER.--Marshall Formation of Mississippian age.
WELL CHARACTERISTICS.--Drilled artesian observation well, diameter 6 in., depth 130 ft, cased with plastic pipe to 48 ft, open bottom.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 805 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Plywood instrument shelf, 2.50 ft above land-surface datum.
PERIOD OF RECORD.--October 1976 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 15.54 ft below land-surface datum, Apr 6, 1985; lowest recorded, 22.71 ft below land-surface datum, Nov. 20, 1979.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	21.35	21.26	20.23	20.47	19.44	18.96	17.83	18.01	18.45	19.82	20.80	21.09
10	21.39	21.23	20.33	20.36	19.11	18.82	17.88	18.19	18.81	20.01	20.94	20.45
15	21.41	21.18	20.37	20.34	19.18	18.03	17.76	18.32	19.04	20.16	21.06	20.54
20	21.34	20.75	20.44	19.62	19.27	18.07	17.79	17.72	19.25	20.23	21.12	20.58
25	21.30	20.72	20.45	19.65	18.96	17.98	17.77	17.89	19.38	20.37	21.13	20.61
EOM	21.28	20.24	20.52	19.48	18.93	18.01	17.97	18.31	19.53	20.60	20.96	20.73

WTR YR 1990 HIGHEST 17.63 APR 22, MAY 20 LOWEST 21.45 OCT 17

GROUND-WATER LEVELS

SCHOOLCRAFT COUNTY

461720085565201. Local number, 45N 13W 16CCCB.
LOCATION.--Lat 46°17'20", long 85°56'52", Hydrologic Unit 04060106, at headquarters building of Seney Wildlife Refuge. Owner: U.S. Fish and Wildlife Service.
AQUIFER.--Limestones of Upper Ordovician age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 4 in., depth 151 ft, cased to 65 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 710 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 3.60 ft below land-surface datum.
PERIOD OF RECORD.--June 1952 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 4.64 ft below land-surface datum, Apr. 13, 1971; lowest recorded, 6.50 ft below land-surface datum, Oct. 23, 1963.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	5.72	5.45	5.27	5.24	5.16	5.23	5.33	5.42	5.32	5.39	5.55	5.76
10	5.68	5.39	5.31	5.23	5.17	5.19	5.42	5.30	5.35	5.43	5.56	5.74
15	5.71	5.40	5.31	5.22	5.21	5.07	5.41	5.24	5.34	5.44	5.57	5.51
20	5.71	5.36	5.30	5.22	5.21	5.13	5.39	5.17	5.30	5.48	5.63	5.46
25	5.67	5.35	5.25	5.17	5.23	5.26	5.35	5.28	5.28	5.55	5.67	5.41
EOM	5.54	5.34	5.22	5.18	5.20	5.30	5.40	5.36	5.31	5.54	5.73	5.48

WTR YR 1990 HIGHEST 4.90 MAR 17 LOWEST 5.80 SEP 3

VAN BUREN COUNTY

421945085481502. Local number, 2S 13W 2BBCB2.
LOCATION.--Lat 42°19'45", long 85°48'15", Hydrologic Unit 04050001, at Fish Lake Road, 2.5 mi north of State Highway 43, and 16 mi east of Bangor. Owner: Van Buren County Road Commission.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled artesian well, diameter 4 in., depth 40 ft, screened 36 to 40 ft.
INSTRUMENTATION.--Monthly measurement.
DATUM.--Elevation of land-surface datum is 737 ft above National Geodetic Vertical Datum of 1929, from topographic map. Measuring point: Top of casing, 1.00 ft above land-surface datum.
PERIOD OF RECORD.--May 1981 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level measured, 8.38 ft below land-surface datum, Oct. 6, 1986; lowest measured, 12.58 ft below land-surface datum, Sept. 19, 1984.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL	DATE	WATER LEVEL
OCT 5	11.79	DEC 28	11.16	MAR 22	10.10	JUN 14	10.90	JUL 25	11.38	SEP 6	11.82
NOV 16	11.26	FEB 8	10.55	MAY 3	10.54						

WASHTENAW COUNTY

421228083331601. Local number, 3S 7E 24CADB.
LOCATION.--Lat 42°12'28", long 83°33'16", Hydrologic Unit 04090005, at Bridge Street, and at Ypsilanti Township Waterworks. Owner: Ypsilanti Township.
AQUIFER.--Sand of Pleistocene age.
WELL CHARACTERISTICS.--Drilled water-table well, diameter 4 in., depth 80 ft, screened 77 to 80 ft.
INSTRUMENTATION.--Water-level recorder.
DATUM.--Elevation of land-surface datum is 665.65 ft above National Geodetic Vertical Datum of 1929. Measuring point: Top of coupling, 3.00 ft above land-surface datum.
REMARKS.--Water level affected by nearby pumping.
PERIOD OF RECORD.--July 1943 to June 1945, December 1949 to current year.
EXTREMES FOR PERIOD OF RECORD.--Highest water level recorded, 5.79 ft below land-surface datum, Jan. 5, 1950; lowest recorded, 22.66 ft below land-surface datum, Feb. 13, 1971.

WATER LEVEL, IN FEET BELOW LAND-SURFACE DATUM, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
LOWEST VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
5	13.72	13.58	13.63	13.41	13.29	13.42	13.44	13.99	14.14	14.09	14.43	14.44
10	13.46	13.60	13.59	13.53	13.40	13.26	13.43	14.05	14.23	14.17	14.40	14.38
15	13.50	13.46	13.42	13.42	13.59	12.90	13.38	14.15	14.30	14.08	14.31	14.30
20	13.55	13.28	13.36	13.34	13.64	13.08	13.44	14.06	14.31	14.17	14.27	14.34
25	13.62	13.68	13.21	13.19	13.27	13.07	13.45	13.97	14.30	14.21	14.26	14.08
EOM	13.44	13.81	13.10	13.39	13.21	13.33	13.84	14.07	14.17	14.36	14.44	14.18

WTR YR 1990 HIGHEST 12.81 MAR 17 LOWEST 14.48 SEP 3, 4

TEMPERATURE OF GROUND WATER

Temperatures of ground water are measured as part of a state-wide water resource investigation in cooperation with the Michigan Department of Natural Resources. The purpose of these measurements is to determine the natural ground-water temperature of selected points throughout the State. These data can be used to estimate ground-water temperatures in many areas in the State. Measurements of temperature were made by means of "lazy" thermometers (Heath, 1964).

TEMPERATURE (°C) OF GROUND WATER AT INDICATED DEPTH, WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990

DATE	WATER TEMPERATURE (°C)	DATE	WATER TEMPERATURE (°C)	DATE	WATER TEMPERATURE (°C)
ALGER COUNTY, 45N 19W 25BDCD (LAT 46°16'08", LONG 86°37'38") DEPTH 66 FT					
OCT 27	8.0	MAR 20	6.5	JUN 6	6.5
DICKINSON COUNTY, 43N 28W 32ADAB (LAT 46°04'58", LONG 87°49'39") DEPTH 31 FT					
OCT 25	7.5	FEB 2	7.0	MAY 3	5.5
NOV 3	8.0	MAR 2	6.5	JUN 6	6.5
DEC 7	7.5	APR 5	6.0	SEP 6	7.0
JAN 5	7.5				
LENAWEE COUNTY, 5S 1E 12DDBD (LAT 42°02'46", LONG 84°15'06") DEPTH 39 FT					
OCT 16	9.5	FEB 16	10.0	JUN 22	8.5
NOV 28	10.0	MAR 30	9.5	AUG 3	9.0
JAN 9	10.0	MAY 11	9.0	SEP 21	9.5
MENOMINEE COUNTY, 37N 26W 19DADA (LAT 45°35'04", LONG 87°33'13") DEPTH 17 FT					
OCT 18	11.5	JUN 19	7.0	SEP 21	11.0
MAR 5	6.0				
OAKLAND COUNTY, 5N 8E 8ACAC (LAT 42°51'16', LONG 83°32'15") DEPTH 42 FT					
NOV 2	10.0	APR 6	10.5	JUL 11	9.5
DEC 14	10.0	17	10.0	AUG 25	9.5
JAN 24	10.0	MAY 31	9.5	SEP 20	9.5
MAR 8	10.0	JUN 29	9.5		

DISCONTINUED GAGING STATIONS

The following continuous-record streamflow or stage stations in Michigan have been discontinued or converted to partial-record stations. The column headed "Period of record" shows the water years in which daily streamflow or stage records were collected and published.

Station No.	Station Name	Drainage area (mi^2)	Period of record
	STREAMS TRIBUTARY TO LAKE SUPERIOR		
04028000	Montreal River at Ironwood, MI	63.0	1918-22, 1924-26, 1949-54
04030000	Montreal River near Saxon, WI	262	1938-70
04030500	Black River at Ramsay, MI	a82	1924-25
04031000	Black River near Bessemer, MI	200	1955-82
04031500	Presque Isle River at Marenisco, MI	171	1945-82
04032000	Presque Isle River near Tula, MI	261	*1945-73
04032500	Iron River near White Pine, MI	98.1	1952-57
04035000	East Branch Ontonagon River near Mass, MI	272	1942-79
04038000	Cisco Branch Ontonagon River near Watersmeet, MI	62.2	1942-44
04039500	South Branch Ontonagon River at Ewen, MI	348	*1942-71
04041000	Perch River near Sidnaw, MI	63.1	*1913-15
04042000	Sturgeon River near Baraga, MI	379	1927-31, 1943-47
04042500	Otter River near Elo, MI	162	*1942-72
04043000	Sturgeon River near Arnheim, MI	705	1942-74
04043500	Dead River near Negaunee, MI	138	1902-03
04044000	Dead River at Forestville, MI	158	1899-1902
04044400	Carp River near Negaunee, MI	51.4	1961-87
04044500	Carp River near Marquette, MI	a86	1902-04
04044563	Big Creek near Harvey, MI	17.0	1979-81
04044573	Cedar Creek near Harvey, MI	9.04	1979-81
04044583	Cherry Creek near Harvey, MI	4.53	1965-70, 1979-81
04044595	Silver Creek at Harvey, MI	8.58	1979-81
04045000	Tahquamenon River at Newberry, MI	a200	1934-36
	STREAMS TRIBUTARY TO LAKE MICHIGAN		
04046000	Black River near Garnet, MI	a28	*1951-78
04046500	South Manistique Lake Outlet at Curtis, MI	a44	1942-44
04047000	North Manistique Lake Outlet at Helmer, MI	a15	1942-44
04047500	Manistique River near Germfask, MI	a120	1942-50
04048000	Fox River at Seney, MI	107	1942-44
04048500	East Branch Fox River near Germfask, MI	104	1942-44
04049000	Holland Creek near Seney, MI	a13	1938-42
04049500	Manistique River at Germfask, MI	341	*1938-70
04050000	Goose Pen Outlet at Germfask, MI	--	1939-41
04050500	Grays Creek near Germfask, MI	a36	1938-40
04051000	Pine Creek near Germfask, MI	a11	1938-40
04051500	Sand Creek near Germfask, MI	a6	1938-40
04052000	Driggs River near Seney, MI	a70	1938-42
04052500	Walsh Creek near Seney, MI	a12	1938-42
04053000	Driggs River near Germfask, MI	114	1938-41
04053500	Marsh Creek near Shingleton, MI	a20	1938-42
04054000	Marsh Creek near Germfask, MI	--	1938-41
04054500	Duck Creek near Blaney, MI	a92	1938-54
04055000	Manistique River near Blaney, MI	704	*1938-70
04055500	Creighton River near Shingleton, MI	a35	1938-42
04056000	West Branch Manistique River near Manistique, MI	322	1938-56
04057000	Indian River near Manistique, MI	302	*1938-71
04057500	Sturgeon River near St. Jacques, MI	167	1950-52
04057820	Middle Branch Escanaba River near Greenwood, MI	73.3	*1973-82
04057900	Black River near Republic, MI	34.4	*1961-68
04058000	Middle Branch Escanaba River near Ishpeming, MI	128	1954-75
04058100	Middle Branch Escanaba River near Princeton, MI	210	1961-82
04058130	Green Creek near Princeton, MI	13.8	1977-82
04058300	Warner Creek near Palmer, MI	14.2	*1961-68, 1972-78
04058400	Goose Lake Outlet near Sands Station, MI	37.5	*1966-82
04058500	East Branch Escanaba River at Gwinn, MI	124	1955-80
04059400	Tenmile Creek at Perronville, MI	38.4	*1971-77
04060000	Iron River near Iron River, MI	a65	1901-04
04060500	Iron River at Caspian, MI	92.1	1948-80
04062100	Peshekee River near Michigamme, MI	66.5	1961-68

See footnotes at end of table.

DISCONTINUED GAGING STATIONS

Station No.	Station Name	Drainage area (mi^2)	Period of record
	STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued		
04062200	Peshekee River near Champion, MI	133	*1961-78
04062230	Michigamme River near Michigamme, MI	194	1969-82
04062270	Michigamme River near Champion, MI	231	1964-69
04062300	Michigamme River at Republic, MI	240	*1961-75
04062400	Michigamme River near Witch Lake, MI	316	1964-80
04065000	Menominee River near Iron Mountain, MI	a2,420	1898-99, 1903-14
04065300	West Branch Sturgeon River near Randville, MI	56.1	1958-81
04065393	East Branch Sturgeon River below Skunk Creek near Felch, MI	61.8	1974-84
04065397	East Branch Sturgeon River at Hardwood, MI	90.8	1978-83
04065500	Sturgeon River near Foster City, MI	237	1955-80
04065600	Pine Creek near Iron Mountain, MI	16.8	1972-81
04067000	Menominee River below Koss, MI	3,730	1907-09, 1913-81
04095500	Galien River near New Troy, MI	a47	1945-47
04096000	East Branch Galien River near New Troy, MI	19.2	1945-47
04096272	Beebe Creek near Hillsdale, MI	42.4	*1974-78
04096312	Sand Creek at Litchfield, MI	20.6	*1974-77
04096325	Soap Creek near Litchfield, MI	10.9	1975-77
04096340	St. Joseph River at Clarendon, MI	144	*1974-77
04096500	Sauk (East Branch Coldwater) River at Coldwater, MI	--	1938-62
04096600	Coldwater River near Hodunk, MI	293	1963-89
04097000	St. Joseph River at Mendon, MI	918	1903-05
04097060	Little Portage Creek near Fulton, MI	27.0	*1965-67
04097170	Portage River near Vicksburg, MI	68.2	*1946-51, 1965-80
04097200	Gourdneck Creek near Schoolcraft, MI	7.29	1964-73
04097500	St. Joseph River at Three Rivers, MI	1,350	1953-83
04098500	Fawn River near White Pigeon, MI	192	*1903-04, 1958-75
04102000	St. Joseph River at Berrien Springs, MI	4,081	*1901-07, 1909-32, 1951-56
04102320	Paw Paw River near Paw Paw, MI	195	1980-82
04102420	Paw Paw River near Hartford, MI	311	1980-82
04102850	South Branch Kalamazoo River near Albion, MI	146	1972-76
04103000	Reed's Springs near Albion, MI	--	1905-06
04103500	Kalamazoo River at Marshall, MI	449	1949-82
04104000	Battle Creek at Charlotte, MI	a67	1948-54
04104500	Battle Creek at Bellevue, MI	178	1948-53
04105800	Gull Creek near Galesburg, MI	38.1	*1965-73
04106190	Portage Creek near Portage, MI	18.6	1965-67
04106500	Portage Creek at Kalamazoo, MI	46.8	1948-58, 1975-86
04107000	Gun River at dam near Shelbyville, MI	a30	1946-47
04107500	Gun River near Martin, MI	a35	1946-47
04108000	Kalamazoo River near Allegan, MI	a1,470	1903-08
04109500	Portage River below Little Portage Lake near Munith, MI	a55	1944-56
04110000	Orchard Creek at Munith, MI	a49	1944-56
04110500	Portage River near Munith, MI	118	1944-46
04111000	Grand River near Eaton Rapids, MI	661	1951-82
04111379	Red Cedar River near Williamston, MI	163	1975-89
04112904	Mud Lake Drain at Lansing, MI	4.28	1975-76
04113097	Carrier Creek near Lansing, MI	12.1	1975-80
04113500	Sebewa Creek near Sunfield, MI	24.1	1954-56
04115500	Fish Creek near Carson City, MI	145	1936-38
04116500	Flat River at Smyrna, MI	528	1951-86
04117000	Quaker Brook near Nashville, MI	7.60	*1954-75
04119300	Grand River at Eastmanville, MI	a5,230	1976-77
04120000	Crockery Creek at Slocums Grove, MI	--	1903
04120500	Higgins Lake Outlet (head of Muskegon River) near Roscommon, MI	49.2	1942-50
04121000	Muskegon River near Merritt, MI	355	*1947-74
04123000	Big Sable River near Freesoil, MI	115	*1942-74
04123500	Manistee River near Grayling, MI	123	*1943-74
04124500	East Branch Pine River near Tustin, MI	60.0	*1952-63
04125000	Pine River near Le Roy, MI	128	*1952-63
04125500	Pine River near Hoxeyville, MI	251	1952-82

See footnotes at end of table.

DISCONTINUED GAGING STATIONS

Station No.	Station Name	Drainage area (mi^2)	Period of record
	STREAMS TRIBUTARY TO LAKE MICHIGAN--Continued		
04126200	Little Manistee River near Freesoil, MI	178	*1957-75
04126500	Little Manistee River near Stronach, MI	a196	1931
04127000	Boardman River near Mayfield, MI	182	1952-89
04127500	Boardman River at Traverse City, MI	--	1903-04
	STREAMS TRIBUTARY TO LAKE HURON		
04128500	Indian River at Indian River, MI	598	1942-82
04129500	Pigeon River at Afton, MI	139	1942-81
04130000	Cheboygan River near Cheboygan, MI	889	1943-82
04131000	Rainy River near Onaway, MI	75.7	1942-52
04131500	Rainy River near Ocqueoc, MI	87.9	*1953-79
04132000	Black River near Cheboygan, MI	558	*1943-74
04132500	Thunder Bay River near Hillman, MI	232	*1945-73
04133000	Upper South Branch Thunder Bay River near Lachine, MI	171	1945-54
04133500	Thunder Bay River near Bolton, MI	588	1945-80
04134000	North Branch Thunder Bay River near Bolton, MI	184	1945-80
04134500	Lower South Branch Thunder Bay River near Hubbard Lake, MI	146	1945-54
04135600	East Branch Au Sable River at Grayling, MI	76.0	1958-84
04135700	South Branch Au Sable River near Luzerne, MI	401	1967-89
04136000	Au Sable River near Red Oak, MI	a1,000	1909-16, 1931
04137000	Au Sable River at Bamfield, MI	a1,420	1902-14
04138000	East Branch Au Gres River at McIvor, MI	a84	*1951-74
04138500	Au Gres River near National City, MI	154	1951-81
04139000	Houghton Creek near Lupton, MI	29.7	*1950-73
04139500	Rifle River at "The Ranch" near Lupton, MI	56.8	1950-71
04140000	Prior Creek near Selkirk, MI	21.4	*1950-73
04140500	Rifle River at Selkirk, MI	117	*1950-82
04141000	South Branch Shepards Creek near Selkirk, MI	1.15	*1952-78
04141500	West Branch Rifle River near Selkirk, MI	a52	*1952-63
04143000	Rifle River at Omer, MI	364	1902-04
04143500	North Branch Kawkawlin River near Kawkawlin, MI	101	1951-82
04144000	Shiawassee River at Byron, MI	365	1948-83
04145500	Bad River near Brant, MI	a89	*1949-59
04146500	Flint River at Columbiaville, MI	470	1932-33, 1948-52
04147500	Flint River near Otisville, MI	530	1953-89
04147990	Butternut Creek near Genesee, MI	34.7	1970-84
04148000	Flint River at Genesee, MI	a593	1931-52
04148160	Gilkey Creek near Flint, MI	6.43	1970-84
04148200	Swartz Creek near Holly, MI	12.1	*1956-75
04148300	Swartz Creek at Flint, MI	115	1970-84
04148440	Thread Creek near Flint, MI	54.4	1970-84
04148720	Brent Run near Montrose, MI	20.8	1970-84
04149500	Flint River near Alicia, MI	--	‡1949-84
04150000	South Branch Cass River near Cass City, MI	238	1949-80
04151000	Cass River at Vassar, MI	710	*1910-28, 1949-70
04152500	Tobacco River at Beaverton, MI	487	1948-82
04153000	Kinney Creek near Clare, MI	a9	1935-36
04153500	Salt River near North Bradley, MI	138	1934-71
04154500	Chippewa River near Midland, MI	597	*1948-73
04156500	Tittabawassee River at Freeland, MI	a2,530	1903-10, 1912-36
04157500	Sebewaing River (State Drain) near Sebewaing, MI	67.3	1940-54
04158500	Pigeon River near Owendale, MI	53.2	1953-82
04159000	Pigeon River near Pigeon, MI	93.3	1947-52
	STREAMS TRIBUTARY TO ST. CLAIR RIVER		
04159488	Silver Creek near Jeddo, MI	20.6	1978-82
04160000	Mill Creek near Abbottsford, MI	185	*1947-64
04160050	Black River near Port Huron, MI	684	1931, 1933-44
	STREAMS TRIBUTARY TO LAKE ST. CLAIR		
04161000	Clinton River at Auburn Heights, MI	123	*1935-40, 1957-82
04161820	Clinton River at Sterling Heights, MI	309	1979-83
04162000	Red Run near Royal Oak, MI	36.5	b1953-68
04162010	Red Run near Warren, MI	--	1980-88
04162500	Bear Creek at Warren, MI	17.3	1954-57

See footnotes at end of table.

DISCONTINUED GAGING STATIONS

Station No.	Station Name	Drainage area (mi^2)	Period of record
	STREAMS TRIBUTARY TO LAKE ST. CLAIR--Continued		
04162900	Big Beaver Creek near Warren, MI	--	1959-88
04163000	Big Beaver Creek at Warren, MI	25.2	1954-58
04163500	Plum Brook near Utica, MI	22.9	1954-66
04163900	Red Run near Cady, MI	--	ǂ1980-82
04164010	North Branch Clinton River at Almont, MI	9.56	*1963-68
04164050	North Branch Clinton River near Romeo, MI	49.7	*1965-69
04164150	North Branch Clinton River near Meade, MI	89.6	*1968-72
04164200	Coon Creek near Armada, MI	10.0	*1966-70
04164250	Tupper Brook at Ray Center, MI	8.62	*1960-64
04164350	Highbank Creek near Armada, MI	14.9	*1965-70
04164360	East Branch Coon Creek near New Haven, MI	36.1	*1968-72
04164400	Deer Creek near Meade, MI	12.7	*1960-65
04164450	McBride Drain near Macomb, MI	5.79	*1960-64
04164600	Middle Branch Clinton River near Macomb, MI	22.2	*1965-69
04164800	Middle Branch Clinton River at Macomb, MI	41.0	*1963-68, 1970-82
04165000	Middle Branch Clinton River near Mount Clemens, MI	a51	1947-49
04165200	Gloede Ditch near Waldenburg, MI	16.0	*1959-64
04165556	Clinton River By-Pass below weir at Mount Clemens, MI	--	ǂ1980-83
04165557	Clinton River By-Pass at mouth at Mount Clemens, MI	--	ǂ1980-83
	STREAMS TRIBUTARY TO DETROIT RIVER		
04168500	Lower River Rouge at Dearborn, MI	91.9	1931-33
	STREAMS TRIBUTARY TO LAKE ERIE		
04169000	Hayes Creek at Commerce, MI	a8	1946-51
04169500	Huron River at Commerce, MI	57.3	*1946-75
04171000	Davis Creek near Whitmore Lake, MI	65.8	1953-54
04171500	Ore Creek near Brighton, MI	a31	1951-68
04172500	Portage River near Pinckney, MI	79.1	*1945-71
04173000	Huron River near Dexter, MI	522	*1904, 1946-72, 1976-77
04173500	Mill Creek near Dexter, MI	128	1952-83
04174000	Huron River at Dexter, MI	--	ǂ1904-16
04175340	Stony Creek at Oakville, MI	68.0	1970-81
04175500	Huron River at Flat Rock, MI	851	1904-11, ǂ1912-22
04175700	River Raisin near Tecumseh, MI	267	1956-80
04176400	Saline River near Saline, MI	94.6	*1966-77

* Previous or subsequent operation as a crest-stage partial-record station.
ǂ Stage record only.
a Approximately.
b Records available in District Office only.

☆U.S. GOVERNMENT PRINTING OFFICE: 1991-544-340

October 1, 1978

FACTORS FOR CONVERTING INCH-POUND UNITS TO INTERNATIONAL SYSTEM UNITS (SI)

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

Multiply inch-pound units	By	To obtain SI units
	Length	
inches (in)	2.54×10^{1}	millimeters (mm)
	2.54×10^{-2}	meters (m)
feet (ft)	3.048×10^{-1}	meters (m)
miles (mi)	1.609×10^{0}	kilometers (km)
	Area	
acres	4.047×10^{3}	square meters (m^2)
	4.047×10^{-1}	square hectometers (hm^2)
	4.047×10^{-3}	square kilometers (km^2)
square miles (mi^2)	2.590×10^{0}	square kilometers (km^2)
	Volume	
gallons (gal)	3.785×10^{0}	liters (L)
	3.785×10^{0}	cubic decimeters (dm^3)
	3.785×10^{-3}	cubic meters (m^3)
million gallons	3.785×10^{3}	cubic meters (m^3)
	3.785×10^{-3}	cubic hectometers (hm^3)
cubic feet (ft^3)	2.832×10^{1}	cubic decimeters (dm^3)
	2.832×10^{-2}	cubic meters (m^3)
cfs-days	2.447×10^{3}	cubic meters (m^3)
	2.447×10^{-3}	cubic hectometers (hm^3)
acre-feet (acre-ft)	1.233×10^{3}	cubic meters (m^3)
	1.233×10^{-3}	cubic hectometers (hm^3)
	1.233×10^{-6}	cubic kilometers (km^3)
	Flow	
cubic feet per second (ft^3/s)	2.832×10^{1}	liters per second (L/s)
	2.832×10^{1}	cubic decimeters per second (dm^3/s)
	2.832×10^{-2}	cubic meters per second (m^3/s)
gallons per minute (gal/min)	6.309×10^{-2}	liters per second (L/s)
	6.309×10^{-2}	cubic decimeters per second (dm^3/s)
	6.309×10^{-5}	cubic meters per second (m^3/s)
million gallons per day	4.381×10^{1}	cubic decimeters per second (dm^3/s)
	4.381×10^{-2}	cubic meters per second (m^3/s)
	Mass	
tons (short)	9.072×10^{-1}	megagrams (Mg) or metric tons

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