CHAPTER 16—PRESENTATION AND PUBLICATION OF STREAM-GAGING DATA

GENERAL

After the computations of the discharge records for a water year are completed, the records are reviewed by designated engineering personnel and are prepared for publication. The publication process in the U.S.A. usually involves photo-offset printing, and copy must therefore be put in final form for photographing. From the photographic copy, a plate is made for use in the offset printing process.

FORMAT

The published annual report consists of an introductory text, stream-gaging and reservoir station records, tabulations of discharge at partial-record stations and at miscellaneous sites, and an index. The publication format used by the Geological Survey is illustrated in the example pages in figures 284–303 at the end of this chapter. The items that are included in the annual publication are listed in figure 284, which is an example of the table of contents of the report.

In general, most of the figures are self-explanatory, but some require additional explanation. The 9 pages of figure 286 include the 12 items in the table of contents (fig. 284) that start with "Introduction" and end with "Selected references." The 12 items are shown as part of a single figure because they constitute the introductory text that is printed on continuing pages; that is, each item is not started on a fresh page. The map in figure 287 is optional; if the map scale required to show the State or region on a single page is so small that the stations plot in a confusing clutter, the map may be omitted in the annual discharge report. However, any summary reports that cover a period of years of record for the stations should include a map of suitable scale that is folded and placed in a pocket attached to the back cover of the report. The graph in figure 288 is associated with the section titled "Hydrologic Conditions," near the end of the introductory text.

Figures 289–294 show samples of streamflow and reservoir tabulations for the water year that would appear in the main body of the annual report. Figure 289 is a sample page for a routine gaging station. Figure 290 is a sample page for a gaging station whose flow is regulated by a reservoir. Because the flow is controlled, no tabulation is made of supplementary peak discharges (those greater than a given base discharge). In the monthly and annual summaries at the bottom of figure 290, additional figures are given for the mean discharge adjusted for change in reservoir contents. Figure 291 is a sample page

for a reservoir showing daily contents along with a monthly tabulation of change in contents. Daily contents are published only for major reservoirs. More commonly only the month end contents and the monthly change in contents are published, as in figure 292. Where the river basin contains several large reservoirs for which only month end contents and monthly change in contents are to be published, a table, such as that shown in figure 293*A* is published for the entire group. A table of that kind would usually be the last table for the river basin. Figure 293*B* is a continuation sheet for a group of such reservoirs. If all the reservoirs in the basin were relatively small, the data for the group of reservoirs would be abridged to take the form shown in figure 294.

In figure 295, tables *A* and *B* illustrate the way in which the records would be published if the gaging station were originally established a short time before October 1, the starting date of the water year. Table *A* is for a station that was established on Sept. 10. The data for the last 20 days in September would be published with the data for the complete year that followed. The short table shown as Table *A* would precede the daily table for the complete year. Table *B* is for a station that was established on August 1. The short table for August and September would precede the daily table for the complete year. Table *C* in figure 295 is a sample of the daily table for a station on an ephemeral stream that has few days of flow during the water year.

Figure 296 shows a sample "Revisions" paragraph for a gaging station whose past records require extensive revision. The revisions paragraph is always the last paragraph of the station description, as in figure 292. (The symbols used in the revisions paragraph in figure 292 are explained in figure 286*F*.)

If a highly developed river basin has a system of storage and diversion facilities that is too complex to be adequately described in the "Remarks" paragraph of the individual gaging stations, a schematic diagram is provided showing the locations of the reservoirs and canals with respect to the gaging stations. Such a diagram is found in figure 297; the diagram usually precedes the first discharge record for the basin.

Figures 298 and 299 show sample discharge records for partial-record stations. Figure 298 lists low-flow discharge measurements at sites where one or more such measurements are systematically made each year. Figure 299 lists peak discharges for the year, and occasionally one or more smaller peak discharges at sites equipped with a crest-stage gage (see last section in chapter 4). The discharges corresponding to observed peak stages are obtained from a rating table based on indirect determinations of discharge, such as slope-area determinations (chap. 9). Figure 300 shows the results of discharge

measurements made at miscellaneous sites for special studies of various types. Miscellaneous sites are sites other than those where complete records or partial records are obtained each water year.

Figures 301 and 302 show the results of discharge measurements made at miscellaneous sites for two types of studies that are common enough to be identified by a general title. Figure 301 gives the results of a seepage investigation where base flow is measured at intervals in a reach of stream channel; the contribution of intervening tributary flow and the depletion of flow in intervening diversion canals are also measured. The purpose of the study is to investigate water gains and losses resulting from seepage through the streambed and banks. Figure 302 shows the results of low-flow discharge measurements made at miscellaneous sites during a drought period for the purpose of appraising the regional availability of surface flow during periods of critically low runoff.

The last section of the annual discharge report is an alphabetical index; figure 303 is a sample of the first page of such an index. Entries are made in the index for each station or measurement site for which figures of discharge or reservoir storage are given. For each station equipped with a continuous-recording gage, the entry is made under both the stream name and the place name. In addition, entries in the index are made for each section of the introductory text, for each of the terms listed under "Definitions of terms and abbreviations," for each illustration, and for each station plotted on the graph of hydrologic conditions (fig. 288).

In the past, basic groundwater and water-quality data were published under separate covers. At present (1980) the reports incorporate, in a single volume, those data with the surface-water discharge information that was described on the preceding pages. A discussion of ground-water and water-quality data is, however, beyond the scope of this manual.

SELECTED REFERENCE

Hodges, E. B., Ham, C. B., and Anderson, B. A., 1973, Preparation of surface-water data reports: U.S. Geol. Survey Surface-Water Techniques, book 9, chap. 1, 145 p.

CONTENTS

ILLUSTRATIONS

FIGURE 284.—Table of contents for annual published report.

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

FIGURE 285.—List of surface-water stations.

WATER RESOURCES DATA FOR INDIANA. 19XX

PART 1. SURFACE-WATER RECORDS

INTRODUCTION

Surface-water records for the 19XX water year for Indiana, including records of streamflow or reservoir storage at gaging stations, partial-record stations, and miscellaneous sites, are given in this report and their locations shown in figures ___, ___. Records for a few pertinent gaging stations in bordering States also are included. The records were collected and computed by the Water Resources Division of the U.S. Geological Survey under the direction of M. D. Hale, district chief. These data represent that portion of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Indiana.

Through September 30, 1960, the records of discharge and stage of streams and canals and contents and stage of lakes or reservoirs were published in an annual series of U.S. Geological Survey water-supply papers entitled "Surface Water Supply of the United States."

Beginning with the 1961 water year, surface-water records have been released by the Geological Survey in annual reports on a State-boundary basis. Distribution of these reports is limited; they are designed primarily for rapid release of data shortly after the end of the water year to meet local needs. The discharge and reservoir storage records for 1961-65 also will be published in a Geological Survey water-supply paper series entitled "Surface Water Supply of the United States 1961-65."

COOPERATION

The U.S. Geological Survey and organizations of the State of Indiana have had cooperative agreements for the systematic collection of surface-water records since 1930. Organizations that supplied data are acknowledged in station descriptions. Organizations that assisted in collecting data through cooperative agreement with the Survey are:

State Department of Natural Resources, J. E. Mitchell, director, through Bureau of Water and Mineral Resources, W. J. Andrews, deputy director.

State Highway Commission, R. F. Whitehead, chairman, M. L. Hayes, executive director, and F. L. Ashbaucher, chief engineer.

State Board of Health, A. C. Offutt, commissioner, and B. A. Pool, director and chief engineer.

Assistance in the form of funds or services was given by the Corps of Engineers, U.S. Army, in collecting records for 67 gaging stations published in this report.

FIGURE 286A.—Introductory text.

WATER RESOURCES DATA FOR INDIANA, 19XX

The following organizations aided in collecting records:

The city of Indianapolis, through its Board of Public Works and Sanitation and its Flood Control Board; cities of Anderson, Bloomington, Muncie, North Vernon, Richmond, and Jasper; Indianapolis Water Co.; Indianapolis Power and Light Co.; Public Service Co. of Indiana; * * *.

DEFINITION OF TERMS

Definition of terms related to streamflow and other hydrologic data, as used in this report, are defined as follows:

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 325,851 gallons.

Cfs-day 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, 1.9835 acre-feet, or 646,317 gallons, and represents a runoff of 0.0372 inch from 1 square mile.

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.

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 (cfs) 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.

Discharge is the volume of water (or more broadly, total fluids), that passes a given point within a given period of time.

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 noted.

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 gage height or discharge are obtained. When used in connection with a discharge record, the term is applied only to those gaging stations where a continuous record of discharge is obtained.

FIGURE 286*B*.—Introductory text—Continued.

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

Runoff in inches (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.

Stage-discharge relation is the relation between gage height and the amount of water flowing in a channel, expressed as volume per unit of time.

WRD is used as an abbreviation for "Water-Resources Data" in the summary REVISIONS paragraph to refer to previously published State annual basic-data reports.

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

SPECIAL NETWORKS AND PROGRAMS

Hydrologic bench-mark station is one that provides hydrologic data for a basin in which the hydrologic regimen will likely be governed solely by natural conditions. Data collected at a bench-mark station may be used to separate effects of natural from man-made changes in other basins which have been developed and in which the physiography, climate, and geology are similar to those in the undeveloped bench-mark basin.

International Hydrological Decade (IHD) River Stations provide a general index of runoff and materials in the water balance (discharge of water, and dissolved and transported solids) of the world. In the United States, IHD Stations provide indices of runoff and of the general distribution of water in the principal river basins of the conterminous United States and Alaska.

DOWNSTREAM ORDER AND STATION NUMBERS

Records are listed in a downstream direction along the main stream, and stations on tributaries are listed between stations on the main stream in the order in which those tributaries enter the main stream. Stations on tributaries entering above all mainstream stations are listed before the first mainstream station. Stations on tributaries to tributaries are listed in a similar manner. In the list of gaging stations in the front of this report the rank of tributaries is indicated by indention, each indention representing one rank.

As an added means of identification, each gaging station and partial-record station has been assigned a station number. These are in the same downstream order used in this report. In assigning station numbers, no distinction is made between partial-record stations and continuous-record gaging 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 numbers to allow for new stations that may be established; hence the numbers are not consecutive. The complete 8-digit number for each station, such as 03-3355.00, includes the part number "03" and a 6-digit station number. In this report, the nonessential zeros are not shown. For example, the complete number 03-3355.00 would appear as 3-3355, just to the left of the station name. In this report,

FIGURE 286C.—Introductory text—Continued.

the records are listed in downstream order by parts. All records for a drainage basin encompassing more than one State could be arranged in downstream order by assembling pages from the various State reports by station number to include all records in the basin.

EXPLANATION OF SURFACE-WATER DATA

Collection and Computation of Data

The base data collected at gaging stations consists of records of stage and measurements of discharge of streams or canals, and stage, surface area, and contents of lakes or reservoirs. In addition, observations of factors affecting the stage-discharge relation or the stage-capacity relation, weather records, and other information are used to supplement base data in determining the daily flow or volume of water in storage. Records of stage are obtained from a water-stage recorder that gives a continuous graph of the fluctuations (for digital recorders, a tape punched at 15-, 30-, or 60-minute intervals) or from direct readings on a nonrecording gage. Measurements of discharge are made with a current meter, using the general methods adopted by the Geological Survey on the basis of experience in stream gaging since 1888. These methods are described in standard textbooks on the measurement of stream discharge. (See also SELECTED REFERENCES.) Surface areas of lakes or reservoirs are determined from instrument surveys using standard methods. The configuration of the reservoir bottom is determined by sounding at many points.

For a stream-gaging station rating tables giving the discharge for any stage are prepared from stage-discharge relation curves defined by discharge measurements. If extensions to the rating curves are necessary to define the extremes of discharge, they are made on the basis of indirect measurements of peak discharge (such as slope-area or contracted-opening measurements, computation of flow over dams or weirs), velocity-area studies, and logarithmic plotting. The application of the daily mean gage heights to the rating table gives the daily mean discharge, from which the monthly and the yearly mean discharge.are computed. 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 individual discharge measurements and notes by engineers and observers are used in applying the gage heights to the rating tables. If the stage-discharge relation for a station is temporarily changed by the presence of aquatic growth or debris on the control, the daily mean discharge is computed by what is basically the shifting-control method.

At some stream-gaging stations the stage-discharge relation is affected by 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 determining discharge. Information required for determining 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 determining discharge.

At some stream-gaging stations the stage-discharge relation is affected by ice in the winter, and it becomes impossible to compute the discharge in the usual manner. Discharge for periods of ice effect is computed on the basis of the gage-height record and

FIGURE 286*D*.—Introductory text—Continued.

WATER RESOURCES DATA FOR INDIANA, 19XX

occasional winter discharge measurements, consideration being given to the available information on temperature and precipitation, notes by gage observers and hydrologists, and comparable records of discharge for other stations in the same or nearby basins.

For a lake or reservoir station, capacity tables giving the contents for any stage are prepared from stage-area relation curves defined by surveys. Discharge over spillways is computed from a stage-discharge relation curve defined by discharge measurements. The application of the stage to the capacity table gives the contents, from which the daily, monthly, or yearly change in contents is computed.

If the stage-capacity curve is subject to changes because of deposition of sediment in the reservoir, periodic resurveys of the reservoir are necessary to define new stage-capacity curves. During the period between reservoir surveys the computed contents may be increasingly in error due to the gradual accumulation of sediment.

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 otherwise fails to operate properly, intakes are plugged, the float is frozen in the well, or for various other reasons. For such periods the daily discharges are estimated on the basis of recorded range in stage, adjoining good record, discharge measurements, weather records, and comparison with other station records from the same or nearby basins. Likewise daily contents may be estimated on the basis of operator's log, adjoining good record, inflow-outflow studies, and other information.

The data in this report generally comprise a description of the station and tabulations of basic data. For gaging stations on streams or canals a table showing the daily discharge and monthly and yearly discharge is given. For gaging stations on lakes and reservoirs a monthly summary table of stage and contents or a table showing the daily contents is given. Tables of daily mean gage heights are included for some streamflow stations and for some reservoir stations. Records are published for the water year, which begins on October 1 and ends on September 30. A calendar for the 19XX water year is shown on the reverse side of the front cover to facilitate finding the day of the week for any date.

The description of the gaging station gives the location, drainage area, period of record, type and history of gages, average discharge, extremes of discharge or contents, and general remarks. The location of the gaging station and the drainage area are obtained from the most accurate maps available. River mileage, given under "LOCATION" for some stations, is that determined and used by the Corps of Engineers or other agencies. Periods for which there are published records for the present station or for stations generally equivalent to the present one are given under "PERIOD OF RECORD." The type of gage currently in use, the datum of the present gage above mean sea level, and a condensed history of the types, locations, and datums of previous gages used during the period of record are given under "GAGE." In references to datum of gage, the phrase "mean sea level" denotes "Sea Level Datum of 1929" as used by the Topographic Division of the Geological Survey, unless otherwise qualified. The average discharge for the number of years indicated is given under "AVERAGE DISCHARGE"; it is not given for stations having fewer than 5 complete years of record or for stations where changes in water development during the period of record cause the figure to have little significance. In addition, the median of yearly mean discharges is given for stream-gaging stations having 10 or more complete years of record if the median differs from the average by more than 10 percent. The maximum discharge (or contents) and the maximum gage height, the minimum discharge if there is little or no regulation (or the minimum contents), and the

FIGURE 286*E*.—Introductory text—Continued.

WATER RESOURCES DATA FOR INDIANA, 19XX

minimum gage height if it is significant are given under "EXTREMES." The minimum daily discharge is given if there is extensive regulation (also the minimum discharge and gage height if they are abnormally low). In the first paragraph headed "Current year:" the data given are for the complete current water year unless otherwise specified. In the second paragraph under "EXTREMES" headed "Period of record:" the data given are for the period of record given in the PERIOD OF RECORD paragraph. Reliable information concerning major floods that occurred outside the period of record is given in the third or last paragraph under "EXTREMES." Unless otherwise qualified, the maximum discharge (or contents) corresponds to the crest stage obtained by use of a water-stage recorder (graphic or digital), a crest-stage gage, or a nonrecording gage read at the time of the crest. If the maximum gage height did not occur at the same time as the maximum discharge or contents, it is given separately. Information pertaining to the accuracy of the discharge records, to conditions that affect the natural flow at the gaging station, and availability of Water Quality records, is given under "REMARKS"; for reservoir stations information on the dam forming the reservoir, the capacity, outlet works and spillway, and purpose and use of the reservoir, is also given under "REMARKS."

Previously published records of some stations have been found to be in error on the basis of data or information later obtained. Revisions of such records are usually published along with the current records in one of the annual or compilation reports. In order to make it easier to find such revised records, a paragraph headed "REVISIONS (WATER YEARS)" has been added to the description of all stations for which revised records have been published. Listed therein are all the reports in which revisions have been published, each followed by the water years for which figures are revised in that report. In listing the water years only one number is given; for instance, 1933 stands for the water year October 1, 1932, to September 30, 1933. If no daily, monthly, or annual figures of discharge were revised, that fact is brought out by notations 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 revised figure was first published is given. It should be noted that for all stations for which cubic feet per second per square mile and runoff in inches are published, a revision of the drainage area necessitates corresponding revision of all figures based on the drainage area. Revised figures of cubic feet per second per square mile and runoff in inches resulting from a revision of the drainage area only are usually not published in the annual series of reports.

Skeleton rating tables are published for stream-gaging stations where they serve a useful purpose and the dates of applicability can be easily identified.

Skeleton capacity tables are published for all reservoirs for which records of contents are published on a daily basis.

The daily tables for stream-gaging stations give the discharge corresponding to the daily mean gage height unless there are large or rapid changes in the discharge during a day. For days having large or rapid changes, discharge for the day is computed by averaging the mean discharge for several parts of a day. For digital recorders, the daily mean discharge is always the average of the discharges at each punched reading. For stations equipped with nonrecording gages, the daily discharge corresponds to once-daily readings of the gage or to the mean of twice-daily readings; but for periods of rapidly changing stage the discharge is determined from a gage-height graph based on gage readings.

FIGURE 286*F*.—Introductory text—Continued.

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The daily tables for reservoir stations give the contents corresponding to the water-surface elevation at a given time, usually at 2400 each day. For some reservoirs the elevation at a given time is given in the daily table.

The monthly summary is given below the daily table. For stream-gaging stations the line headed "TOTAL" gives the sum of the daily figures; it is the total cubic feet per second per day for the month. 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 may be 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 of cubic feet per second per square mile and runoff in inches are omitted if there is extensive regulation or diversion, if the drainage area includes large noncontributing areas, or if the average rainfall on the drainage basin is usually less than 20 inches.

For reservoir stations the monthly summary gives the elevation (or gage height) at the end of the month and the change in contents during the month. If elevation or gage height is given in the daily table, the monthly summary gives the contents at the end of the month, rather than the elevation or gage height. For some reservoirs a tabulation of monthly evaporation from the water surface also is included.

In the yearly summary below the monthly summary, the figures of maximum are the maximum daily discharges for the calendar and water years; likewise, the minimums in this summary are the minimum daily discharges.

For reservoir stations the yearly summary gives the change in contents for the calendar year and for the water year. For some reservoirs the yearly evaporation also is included.

Peak discharges and their times of occurrence and corresponding gage heights for many stations are listed below the yearly summary. All independent peaks above the selected base are given. The base discharge, which is given in parentheses, is selected so that an average of about three peaks a year can be presented. Peak discharges are not published for any canals, ditches, drains, or for any stream for which the peaks are subject to substantial control by man. Time of day is expressed in 24-hour local standard time; for example, 12:30 a. m. is 0030 and 1:30 p. m. is 1330.

In a general footnote, introduced by the word "NOTE" certain periods are indicated for which the discharge is computed or estimated by special methods because of no gage-height record, backwater from various sources, or other unusual conditions. Periods of no gage-height record are indicated if the period is continuous for a month or more or includes the maximum discharge for the year. Periods of backwater from an unusual source, of indefinite stage-discharge relation, or of any other unusual condition at the gage are indicated only if they are a month or more in length and the accuracy of the records is affected. Days on which the stage-discharge relation is affected by ice are not indicated. The methods used in computing discharge for various unusual conditions have been explained in preceding paragraphs. Footnotes to reservoir tables may be used to explain the use of new capacity tables or for other special conditions.

FIGURE 286*G*.—Introductory text—Continued.

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Accuracy of Data

The accuracy of discharge data 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 observations of stage, measurements of discharge, and interpretation of records.

The station description under "REMARKS" states the degree of accuracy of the records. "Excellent" means that about 95 percent of the daily discharges is within 5 percent; "good" within 10 percent; and "fair" within 15 percent. "Poor" means that daily discharges have less than "fair" accuracy.

Figures of daily mean discharge in this report are shown to the nearest hundredth of a cubic foot per second for discharges of less than 1 cfs; to tenths between 1.0 and 10 cfs; to whole numbers between 10 and 1,000 cfs; and to 3 significant figures above 1,000 cfs. The number of significant figures used is based solely on the magnitude of the figure. The same rounding rules apply to discharge figures listed for partial-record stations and miscellaneous sites.

Discharge at many stations, as indicated by the monthly mean, may not reflect natural runoff due to the effects of diversion, consumptive use, regulation, evaporation, or other factors. For such stations, discharge in cubic feet per second per square mile and runoff in inches are not published unless satisfactory adjustments can be made for such effects. 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 unadjusted losses (consumptive use, evaporation, seepage, etc.) are large in comparison with the observed discharge.

Publications

Each volume of the 1960 series of U.S. Geological Survey water-supply papers entitled "Surface Water Supply of the United States" contains a listing of the numbers of all water-supply papers in which records of surface-water data were published for the area covered by the individual volumes. Each volume also contains a list of water-supply papers that give detailed information on major floods for the area. A new series of water-supply papers containing surface-water records for the 5-year period October 1, 1960, to September 30, 1965, also will include lists of annual and special reports published as water-supply papers.

Records through September 1950 for the area covered by this report have been compiled and published in Water-Supply Papers 1305(3A), 1307(4), and 1308(5); records for October 1950 to September 1960 have been compiled and published in Water-Supply Papers 1725(3A), 1727(4), and 1728(5). These reports contain summaries of monthly and annual discharge and monthend storage for all previously published records, as well as some records not contained in the annual series of water-supply papers. All records were reexamined and revised where warranted. Estimates of discharge were made to fill short gaps whenever practical. The yearly summary table for each gaging station lists the numbers of the water-supply papers in which daily records were published for that station.

Special reports on major floods or droughts or of other hydrologic studies for the area have been issued in publications other than water-supply papers. Information relative to these reports may be obtained from the district office.

FIGURE 286*H*.—Introductory text—Continued.

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Other Data Available

Data collected at partial-record stations and at miscellaneous sites are given in three tables at the end of the surface-water records in this report. The first is a table of discharge measurements at low-flow partial-record stations, the second is a table of annual maximum stage and discharge at crest-stage stations, and the third is a table of discharge measurements at miscellaneous sites.

More detailed information than that published for most of the gaging stations, such as discharge measurements, gage-height records, and rating tables, is on file in the district office. Many gaging-station records in (State) through (1966) have been analyzed to give several statistical summaries: (1) the number of days in each year that the daily discharge was between selected limits (duration tables); (2) the lowest mean discharge for selected numbers of consecutive days in each year; and (3) the highest mean discharge for selected numbers of consecutive days in each year.

At or near some gaging stations, water-quality records also are collected. Data are obtained on the chemical quality of the stream water, on water temperature, on suspended-sediment concentration, and on the particle-size distribution of suspended sediment and bed material. These data are given in Part 2 of this report. Under the "REMARKS" paragraph of the gaging-station description, reference is made to water-quality records collected on a regular basis.

HYDROLOGIC CONDITIONS

Precipitation was scattered throughout the year by area and time. Heavy rains the first half of December caused minor flooding in the Wabash and Maumee River basins. Lack of late summer showers left the central and southern parts 3 to 9 inches below average rainfall.

Deficient streamflow in October was relieved in the south by mid-November and in the north by the end of the month. Excessive to near excessive streamflow existed in the first part of December with near record streamflow in the upper Wabash River and Maumee River basins. Near normal streamflow existed from January to May with generally bankfull stages in March and May. Deficient * * *. *(to be completed)*

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FIGURE 286 *I*.—Introductory text—Continued.

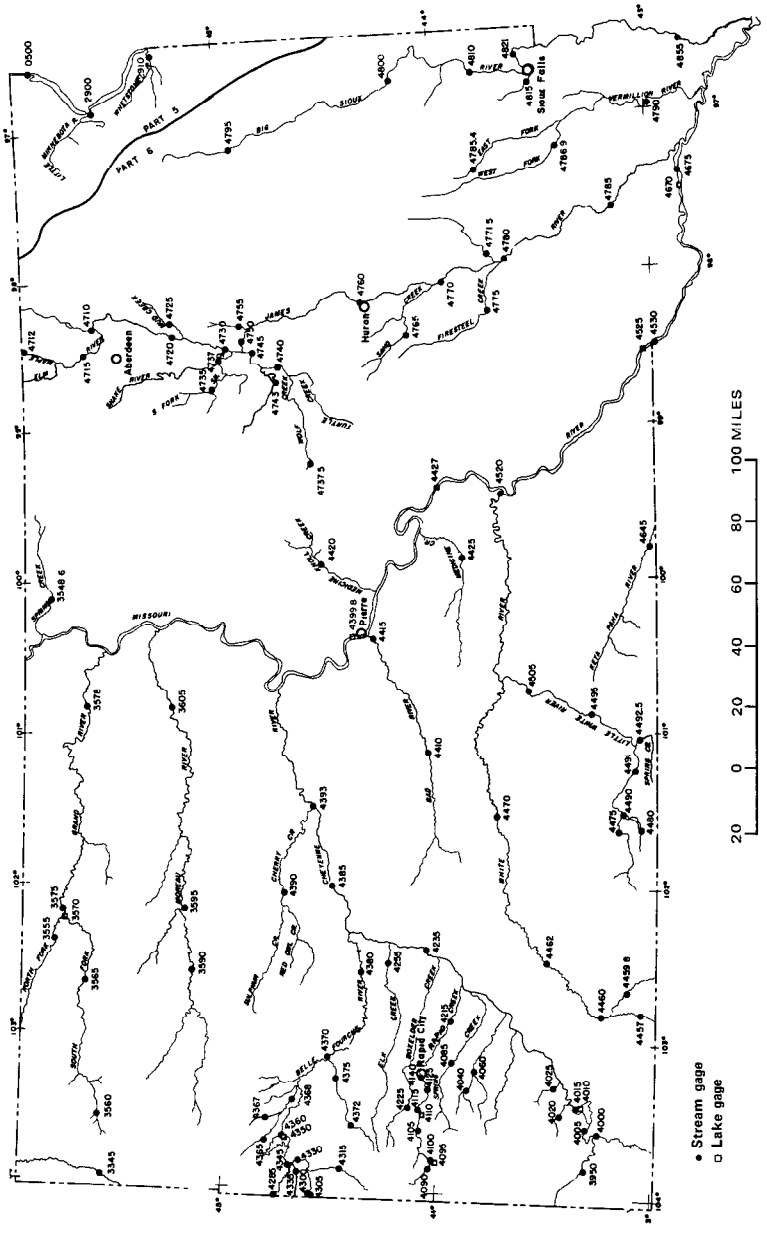

FIGURE 287.—Map of gaging-station locations.

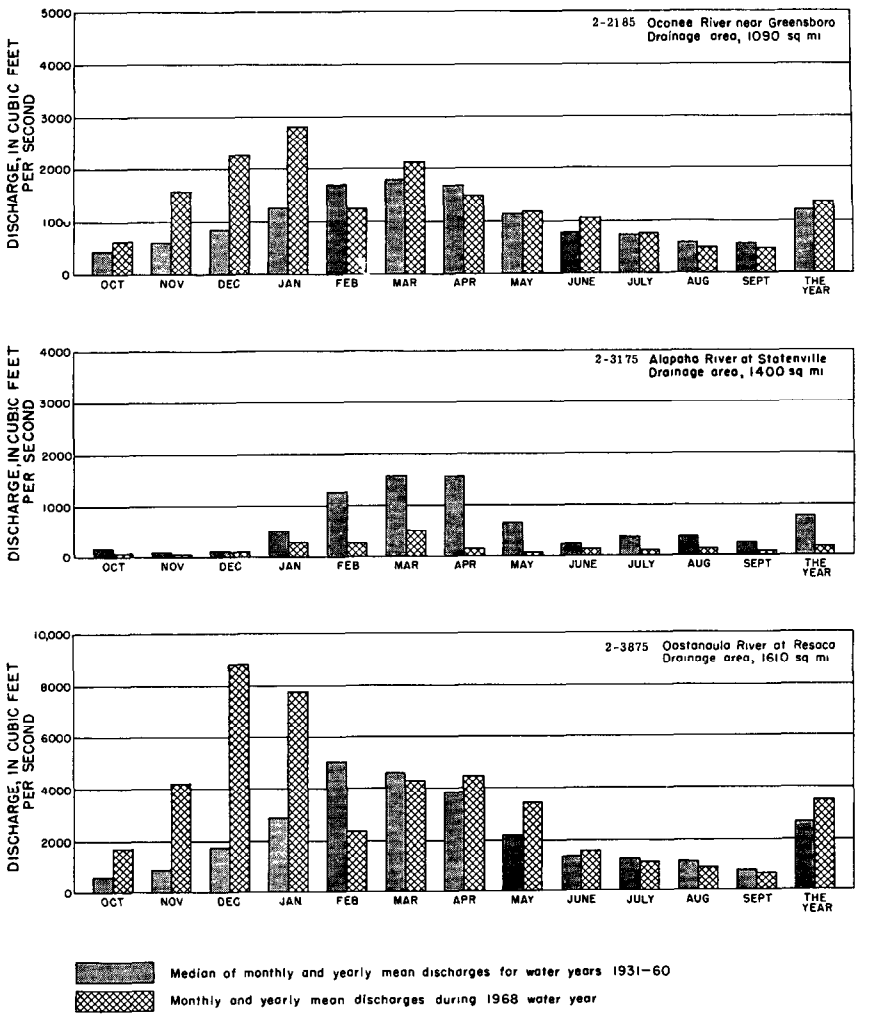

FIGURE 288.—Bar graph of hydrologic conditions.

SKUNK RIVER BASIN

5-4710. South Skunk River below Squaw Creek, near Ames, Iowa

LOCATION.--Lat 42°00'31", long 93°35'38", in NE¼NW¼ sec.13, T.83 N., R.24 W., Story County, on right bank 15 ft downstream from county highway bridge, 0.2 mile downstream from Squaw Creek, 0.3 mile upstream from bridge on U.S. Highway 30, 2 miles southeast of Ames, and at mile 222.6.

DRAINAGE AREA.--556 sq mi.

PERIOD OF RECORD.--October 1952 to current year. Prior to October 1966, published as Skunk River below Squaw Creek, near Ames.

GAGE.--Water-stage recorder and concrete control. Datum of gage is 867.10 ft above mean sea level.

AVERAGE DISCHARGE.--16 years, 226 cfs (5.52 inches per year, 163,600 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 7,310 cfs June 25 (gage height, 12.07 ft); no flow for many days.
Period of record: Maximum discharge, 9,260 cfs Mar. 30, 1960 (gage height, 13.20 ft); no flow for many days during 1953-57, 1964-65, 1967-68.
Flood of May 19, 1944, reached a stage of 13 ft, from floodmarks (discharge, 10,000 cfs).

REMARKS.--Records good except those for winter periods and period of no gage-height record, which are poor.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	16	17	2.3	0	10	0	52	68	48	847	64	13
2	17	12	2.5	0	8.6	0	52	62	40	592	56	11
3	19	9.8	2.7	0	7.4	0	35	58	35	449	50	18
4	18	7.2	2.9	0	6.2	0	29	52	26	352	50	118
5	17	6.2	3.1	0	6.2	0	17	48	22	284	52	83
6	15	5.2	3.2	0	7.2	0	12	44	19	252	48	58
7	24	36	6.2	0	39	0	11	48	17	271	44	56
8	5.4	3.6	57	0	6.2	7.8	9.2	48	16	216	95	40
9	5.2	3.2	6.7	0	2.2	76	7.8	44	26	182	103	28
10	4.8	3.6	78	0	2.0	62	78	40	94	135	92	23
11	4.3	39	7.2	0	18	52	6.7	38	493	114	70	19
12	4.0	3.6	7.8	0	16	52	5.7	36	129	101	60	16
13	4.6	3.6	4.3	0	.58	38	6.7	38	52	98	54	14
14	4.0	3.2	3.6	0	.22	26	23	48	519	90	46	11
15	3.4	3.2	3.2	0	0	19	11	44	272	79	42	9.2
16	28	2.8	2.8	0	0	18	9.2	46	111	75	38	8.5
17	2.4	2.8	3.6	0	0	19	11	46	60	77	33	17
18	2.1	2.6	3.2	0	0	17	26	42	48	353	40	14
19	1.8	2.8	2.8	0	0	18	30	44	42	424	35	14
20	1.6	2.8	3.6	0	0	15	70	42	36	241	28	12
21	2.2	2.8	2.0	0	0	13	62	38	31	173	24	10
22	2.2	2.6	1.0	0	0	9.2	60	36	26	128	19	9.2
23	2.2	2.0	.54	0	0	6.2	233	36	52	181	17	8.5
24	5.7	2.6	.28	0	0	6.2	480	33	735	158	14	7.8
25	6.7	2.8	.15	0	0	5.7	324	36	5,910	107	15	6.2
26	6.7	2.6	0	0	0	5.2	216	52	3,600	90	21	5.7
27	6.2	2.5	0	0	0	6.2	153	52	2,000	157	16	4.7
28	5.7	2.4	0	2.0	0	57	107	65	1,330	161	13	4.7
29	10	2.3	0	18	0	5.7	85	92	1,980	103	12	47
30	12	2.2	0	7.2	------	57	75	54	1,440	83	15	38
31	15	------	0	6.7	------	14	------	54	------	72	15	------
TOTAL	133.6	127.5	89.17	33.9	64.10	502.6	2,123.5	1,484	19,209	6,645	1,281	724.5
MEAN	4.31	4.25	2.88	1.09	2.21	16.2	70.8	47.9	640	214	41.3	24.2
MAX	13	17	7.8	18	10	76	480	92	5,910	847	103	118
MIN	1.5	2.0	0	0	0	0	5.2	33	16	72	12	4.7
CFSM	.008	.008	.005	.002	.004	.03	.13	.09	1.15	.38	.07	.04
IN.	.009	.009	.006	.002	.004	.03	.14	.10	1.28	.44	.09	.05
AC-FT	265	253	177	67	127	997	4,210	2,940	38,100	13,180	2,540	1,440

CAL YR 1967: TOTAL 47,968.01 MEAN 131 MAX 4,070 MIN 0 CFSM .24 IN. 3.21 AC-FT 95,140
WTR YR 1968: TOTAL 32,417.87 MEAN 88.6 MAX 5,910 MIN 0 CFSM .16 IN. 2.17 AC-FT 64,300

PEAK DISCHARGE (BASE, 2,500 CFS)

DATE	TIME	G.H.	DISCHARGE	DATE	TIME	G.H.	DISCHARGE
6-25	1700	12.07	7,310	6-29	1500	6.71	2,550

NOTE.--No gage-height record Oct. 6 to Nov. 20.

FIGURE 289.—Daily discharge record.

MOBILE RIVER BASIN

2-3940. Etowah River at Allatoona Dam, above Cartersville, Ga.

LOCATION.--Lat 34°09'48", long 84°44'30", Bartow County, on right bank 0.8 mile downstream from Allatoona Dam, 2.0 miles upstream from Nashville, Chattahooga and St. Louis Railway bridge, and 3.0 miles east of Cartersville.

DRAINAGE AREA.--1,110 sq mi, approximately.

PERIOD OF RECORD.--September 1938 to current year. Prior to October 1949, published as Etowah River above Cartersville.

GAGE.--Water-stage recorder. Datum of gage is 686.92 ft above sea level (levels by Corps of Engineers). Prior to Dec. 19, 1938, nonrecording gage at same site and datum.

AVERAGE DISCHARGE.--30 years, 1,800 cfs (22.02 inches per year), adjusted for storage since 1950.

EXTREMES.--Current year: Maximum discharge, 9,340 cfs Jan. 18 (gage height, 7.65 ft); minimum daily, 213 cfs Jan. 27, 28, Feb. 3, 4. Period of record: Maximum discharge, 40,400 cfs Jan. 8, 1946 (gage height, 20.8 ft), from rating curve extended above 26,000 cfs; minimum daily, 152 cfs Oct. 15, 1966.

REMARKS.--Flow regulated by Allatoona Reservoir since December 1949 (See sta 2-3935.)

COOPERATION.--Gage-height record, 19 discharge measurements, and computations of daily discharge furnished by Corps of Engineers; records reviewed by Geological Survey.

DISCHARGE, IN CFS, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	220	3,630	5,430	5,200	5,190	855	1,510	3,820	227	2,130	992	289
2	2,650	3,580	280	5,240	5,230	227	1,160	3,820	227	2,140	939	289
3	2,650	3,570	220	5,250	213	234	1,500	3,820	2,540	2,140	256	950
4	2,650	264	5,300	5,250	213	1,480	1,500	272	2,540	234	248	950
5	2,650	264	5,490	5,240	1,860	1,470	1,500	272	2,560	2,140	1,600	950
6	2,650	5,330	5,540	220	1,840	1,480	3,810	2,440	2,550	234	1,600	950
7	234	3,020	5,570	220	1,840	1,480	272	2,440	2,550	227	1,630	280
8	234	2,850	5,570	4,980	1,840	1,480	5,120	2,440	234	1,220	1,630	289
9	1,390	2,860	234	4,980	1,840	234	5,180	2,440	234	1,220	1,630	1,680
10	1,390	2,910	227	2,590	220	234	5,180	2,440	1,780	1,220	272	1,660
11	1,390	2,590	5,180	1,340	220	1,270	5,230	256	2,910	1,220	280	1,660
12	1,390	1,120	5,540	1,340	2,430	1,270	5,230	264	2,910	1,220	1,470	1,660
13	1,390	3,280	5,580	1,510	2,430	2,710	272	1,480	2,910	234	1,480	1,660
14	248	5,310	5,600	1,500	2,490	2,710	272	1,490	2,910	234	1,480	289
15	248	5,330	5,580	5,600	2,460	2,710	4,040	1,490	241	1,510	1,480	289
16	1,780	5,380	220	5,940	2,460	5,170	4,040	5,460	234	1,510	1,480	1,680
17	1,780	5,400	220	7,140	220	1,860	4,040	5,460	1,710	1,510	280	1,700
18	1,780	241	5,020	7,370	220	5,820	4,040	248	1,700	1,510	280	1,660
19	1,820	234	5,050	7,530	1,290	5,530	4,040	241	1,700	1,510	1,470	1,660
20	1,860	4,580	5,050	5,390	1,290	5,530	280	3,890	1,710	241	1,480	1,660
21	256	4,620	5,560	1,890	1,290	5,530	280	3,890	1,700	241	1,470	289
22	256	4,640	1,500	5,730	1,290	5,590	1,030	3,910	227	1,640	1,780	289
23	2,190	241	794	5,750	1,290	256	1,030	3,890	227	1,640	1,470	1,780
24	2,190	4,620	1,690	5,780	227	248	1,030	3,890	1,030	1,640	280	1,810
25	2,210	241	2,380	5,780	220	4,900	1,030	241	1,030	1,640	280	1,810
26	2,210	234	4,970	5,780	842	4,930	1,030	248	1,030	1,640	879	1,810
27	2,190	5,280	5,610	213	842	4,930	280	929	1,030	248	867	1,810
28	256	5,340	5,610	213	849	4,930	280	2,710	1,030	248	574	272
29	248	5,360	5,610	5,100	855	5,010	1,680	2,730	227	992	867	272
30	3,580	5,400	4,880	5,120	------	256	2,820	2,730	227	932	886	1,610
31	3,600	------	1,750	5,140	------	256	------	2,730	------	932	289	------
TOTAL	49,590	99,719	117,255	130,326	43,501	80,590	68,706	72,381	42,135	35,397	31,619	33,957
MEAN	1,600	3,324	3,782	4,204	1,500	2,600	2,290	2,335	1,405	1,142	1,020	1,132
MAX	3,600	5,400	5,610	7,530	5,230	5,820	5,230	5,460	2,910	2,140	1,780	1,810
MIN	220	234	220	213	213	227	272	241	227	227	248	272
MEAN†	1,197	2,524	3,327	4,362	2,169	3,317	3,198	2,366	1,415	1,079	680	840
CFSM†	1.08	2.27	3.00	3.93	1.95	2.99	2.88	2.13	1.27	.97	.61	.76
IN.†	1.24	2.53	3.46	4.53	2.10	3.45	3.21	2.46	1.42	1.12	.70	.85

CAL YR 1967: TOTAL 799,710 MAX 7,930 MIN 192 MEAN 2,191 MEAN† 2,230 CFSM† 2.01 IN.† 27.28
WTR YR 1968: TOTAL 805,176 MAX 7,530 MIN 213 MEAN 2,200 MEAN† 2,209 CFSM† 1.99 IN.† 27.09

† Adjusted for change in contents in Allatoona Reservoir.

FIGURE 290.—Daily discharge record (adjusted).

ARKANSAS RIVER BASIN

7-2590. Blue Mountain Reservoir near Waveland, Ark.

LOCATION.--Lat 35°06'06", long 93°39'02", in NE¼ sec.15, T 5 N., R 25 W., Yell County, at control tower for outlet works of dam on Petit Jean Creek, 1.3 miles southwest of Waveland

DRAINAGE AREA.--488 sq mi.

PERIOD OF RECORD.--March 1947 to current year.

GAGE --Water-stage recorder Datum of gage is at mean sea level (levels by Corps of Engineers)

EXTREMES --Current year. Maximum contents, 130,940 acre-ft May 23 (elevation, 405 37 ft); minimum, 2,150 acre-ft Oct 2, 3 (elevation, 370.68 ft).
Period of record: Maximum contents, 298,560 acre-ft May 26, 19XX (elevation, 422.54 ft), including 40,560 acre-ft of uncontrolled storage above spillway crest; minimum since initial filling to conservation pool level, 2,150 acre-ft Oct. 2, 3, 19XX (elevation, 370.68 ft).

REMARKS.--Reservoir is formed by earthfill dam, storage began Mar 13, 1947. Total capacity, 258,000 acre-ft at elevation 419.0 ft (crest of uncontrolled spillway), including 25,000 acre-ft at elevation 384.0 ft (conservation pool level), and 1,940 acre-ft of dead storage at elevation 370.00 ft (invert of gate sills of outlet tunnel). Under normal operating conditions reservoir water surface will be maintained at approximately conservation pool level for purposes of conservation and recreation, storage above this level is used for flood control. Figures given herein represent total contents.

COOPERATION.--Records furnished by Corps of Engineers.

Capacity table (elevation, in feet, and contents, in acre-feet)

370	1,940	390	44,810
371	2,250	395	66,370
372	2,920	400	93,620
375	5,680	405	128,140
380	14,400	406	135,700
385	27,700		

CONTENTS, IN ACRE-FEET, AT 2400, WATER YEAR OCTOBER 19XX TO SEPTEMBER 19XX

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	2,160	2,380	2,460	15,000	3,250	26,810	29,480	29,940	104,570	28,620	26,230	23,220
2	2,150	2,380	2,450	12,440	3,250	26,810	29,320	29,910	101,410	28,470	25,930	23,110
3	2,920	2,450	2,430	10,020	3,310	26,750	29,200	29,850	97,420	28,250	25,650	23,050
4	5,580	13,190	2,420	7,340	5,050	26,660	29,320	29,970	92,740	28,560	25,560	23,020
5	6,400	15,780	2,420	5,950	8,780	26,320	29,510	33,560	88,610	28,680	25,440	22,970
6	5,750	14,140	2,420	5,120	11,620	25,860	29,720	51,800	84,600	28,430	25,280	22,890
7	4,580	11,340	2,420	4,680	13,300	25,310	29,910	57,390	80,830	28,130	25,220	22,830
8	3,450	8,740	2,440	4,740	14,730	25,310	30,030	57,780	77,100	27,910	25,160	22,750
9	3,080	6,400	2,450	5,160	16,140	26,110	29,910	56,340	72,680	27,790	25,100	22,800
10	2,850	4,940	2,580	5,420	17,020	26,600	29,850	53,850	68,350	27,610	25,040	22,720
11	2,580	3,680	5,310	5,420	17,680	26,690	29,850	51,040	64,010	27,490	24,950	22,670
12	2,420	3,050	8,290	5,310	18,230	26,320	29,750	47,680	59,750	27,360	24,790	22,480
13	2,850	2,750	9,290	5,450	18,710	26,050	29,720	44,190	55,940	27,700	24,730	22,370
14	2,990	2,580	8,430	9,620	19,090	28,190	29,720	40,860	51,840	27,790	24,590	22,200
15	2,880	2,620	6,760	21,070	19,760	34,630	29,720	37,420	48,000	27,580	24,500	22,170
16	2,650	2,750	8,170	11,670	20,310	37,090	29,820	34,060	44,550	27,330	24,450	22,060
17	2,480	2,780	16,280	18,230	21,900	36,920	29,910	31,680	41,550	27,090	24,340	22,010
18	2,400	2,780	26,690	21,160	23,960	36,110	29,750	32,920	38,660	27,090	24,370	21,950
19	2,340	2,780	30,490	20,640	25,250	34,940	29,540	56,470	35,810	26,940	24,310	21,870
20	2,360	2,740	29,750	18,660	25,890	33,460	29,690	100,700	33,390	26,840	24,310	21,870
21	2,380	2,670	27,700	16,140	26,480	31,810	29,380	127,160	31,850	27,030	24,340	22,310
22	2,380	2,550	25,130	13,450	26,780	30,490	29,290	130,180	30,800	27,090	24,260	22,280
23	2,360	2,480	22,450	11,330	27,120	29,880	29,320	130,410	30,000	28,560	24,090	22,170
24	2,340	2,410	19,210	9,420	27,000	29,450	29,410	128,520	29,600	32,350	23,980	22,230
25	2,320	2,340	16,210	7,770	26,540	30,120	29,410	126,260	29,230	33,120	23,820	22,370
26	2,320	2,320	12,990	5,900	25,890	30,940	29,480	124,520	29,690	32,750	23,740	22,170
27	2,320	2,330	19,210	4,840	25,310	31,240	29,480	121,350	29,850	31,440	23,630	21,950
28	2,320	2,440	23,270	3,900	25,930	31,110	29,510	118,060	29,540	30,000	23,540	21,680
29	2,320	2,480	22,830	3,410	26,900	31,170	29,820	114,810	29,200	28,560	23,460	21,430
30	2,320	2,480	20,800	3,280	------	30,280	29,850	111,360	29,170	27,640	23,380	21,240
31	2,370	------	17,950	3,250	------	29,820	------	107,630	------	26,940	23,300	------
(†)	371.18	371.35	381.49	372.50	384.74	385 69	385.70	402.16	385.48	384.75	383.51	382.76
(#)	+210	+110	+15,470	-14,700	+23,650	+2,920	+30	+77,780	-78,460	-2,230	-3,640	-2,060
MAX	6,400	15,780	30,490	21,160	27,120	37,090	30,030	130,410	104,570	33,120	26,230	23,220
MIN	2,150	2,320	2,420	3,250	3,250	25,310	29,200	29,850	29,170	26,840	23,300	21,240

CAL YR 19XX..... . . .. # -7,240
WTR YR 19XX. . . .. # +19,080

† Elevation, in feet, at end of month.
# Change in contents, in acre-feet.

FIGURE 291.—Daily reservoir record.

MISSISSIPPI RIVER MAIN STEM

5-2010. Winnibigoshish Lake near Deer River, Minn.

LOCATION.--Lat 47°25'42", long 94°03'00", in XX¼ sec.25, T 146 N., R.27 W., Itasca County, at dam on Mississippi River, 1 mile northwest of Little Winnibigoshish Lake and 14 miles northwest of town of Deer River.

DRAINAGE AREA --1,442 sq mi

PERIOD OF RECORD.--April 1884 to current year (monthend contents only). Prior to October 1941 monthend contents published in WSP 1308. Published as Winnibigoshish Reservoir near Deer River October 1941 to September 1956.

GAGE --Water-stage recorder. Datum of gage is 1,289.47 ft above mean sea level. Prior to July 8, 1949, nonrecording gage at same site and datum

EXTREMES.--Current year: Maximum contents, 561,880 acre-ft July 29 (gage height, 9.95 ft); minimum, 466,570 acre-ft Apr. 1 (gage height, 8.50 ft).
Period of record: Maximum contents observed, 996,500 acre-ft July 30, 1905 (gage height, 14.45 ft), minimum observed, 33,680 acre-ft below zero of capacity table Oct. 20, 1931 (gage height, -0.69 ft).

REMARKS --Reservoir is formed by concrete and timber dam controlling Winnibigoshish Lake and several other natural lakes; dam completed and storage began in 1884. Capacity, 967,930 acre-ft between gage height 0.00 and 14.2 ft (maximum operating level), of which 653,580 acre-ft is usable storage above 6.00 ft (minimum allowable level). Figures given herein represent contents above gage height 0.00 ft. Water is used to benefit navigation on Mississippi River below Minneapolis.

COOPERATION.--Records furnished by Corps of Engineers in cfs-days and converted to acre-feet by Geological Survey.

REVISIONS (WATER YEARS).--WSP 1308: 1905(M).

MONTHEND GAGE HEIGHT AND CONTENTS AT 2400, WATER YEAR OCTOBER 19XX TO SEPTEMBER 19XX

Date	Gage height (feet)	Contents (acre-feet)	Change in contents (acre-feet)
Sept.30	9.63	540,740	-
Oct. 31	9.51	532,880	-7,860
Nov. 30	9 31	519,750	-13,130
Dec. 31	9.28	517,780	-1,970
CAL YR 19XX	-	-	+106,510
Jan. 31	9.22	513,840	-3,940
Feb. 29	8.94	495,460	-18,380
Mar. 31	8.51	467,230	-28,230
Apr. 30	9 05	502.680	+35,450
May 31	9.37	523,690	+21,010
June 30	9.63	540,740	+17,050
July 31	9.80	551,900	+11,160
Aug. 31	9.21	513,190	-38,710
Sept 30	8.82	487,580	-25,610
WTR YR 19XX	-	-	-53,160

FIGURE 292.—Monthly reservoir record.

YAKIMA RIVER BASIN

Reservoirs in Yakima River basin

12-4740. KEECHELUS LAKE.--Lat 47°19'XX", long 121°20'XX", Kittitas County, at dam on Yakima River at outlet of Keechelus Lake, 3.X miles northwest of Martin and 10 miles northwest of Easton. Drainage area, 55.8 sq mi. Period of record, January 1906 to current year. Nonrecording gage read twice daily. Datum of gage is at mean sea level (Bureau of Reclamation bench mark). Extremes for current year: Maximum contents observed, 159,930 acre-ft June 17 (elevation, 2,517.84 ft); minimum observed, 33,560 acre-ft Sept. 30 (elevation, 2,450.97 ft). Extremes for period of record: Maximum contents observed, 160,570 acre-ft May 16, 1925 (elevation, 2,518.09 ft); minimum observed, 448 acre-ft Sept. 6, 12, 13, 1906 (original crib dam); minimum elevation observed, 2,428.30 ft Sept. 20, 1926.

Reservoir is formed on natural lake by earth- and gravel-fill dam completed in 1917; storage above crib dam began Jan. 12, 1906; above present dam Aug. 19, 1914. Initial filling of present reservoir June 15, 1920. Usable capacity, 157,800 acre-ft between elevation 2,425 00 (invert of gate sill) and 2,517.00 ft (spillway crest). Dead storage below elevation 2,425.00 ft, XXX acre-ft. Spillway raised 2 ft Sept. 12, 1952. Figures given herein represent usable contents. Water is used for irrigation.

12-4755. KACHESS LAKE.-- * * *. (Format similar to the above)

12-4785. CLE ELUM LAKE.-- * * *. (Format similar to the above)

12-4875. BUMPING LAKE.--Lat 46°52'XX", long 121°18'XX", in SW¼ sec.23, T.16 N., R.12 E. (unsurveyed), Yakima County, at dam on Bumping River at outlet of Bumping Lake, 12 miles upstream from American River and 19 miles west of Nile. Drainage area, 68.6 sq mi. Period of record, June to July 1906, April 1909 to current year. Nonrecording gage read twice daily. Datum of gage is at mean sea level (Bureau of Reclamation bench mark). Extremes for current year: Maximum contents observed, 36,160 acre-ft June 16 (elevation, 3,427.85 ft); minimum observed, 4,980 acre-ft Sept. 30 (elevation, 3,396.67 ft). Extremes for period of record: Maximum contents observed, 39,840 acre-ft June 21, 22, 1925 (elevation, 3,430.55 ft); minimum observed, 1,130 acre-ft Feb. 5-9, 1949 (elevation, 3,390.80 ft).

Reservoir is formed on natural lake by earthfill dam completed in 1910; storage began Nov 3, 1910. Usable capacity, 33,700 acre-ft between elevation 3,389.00 (invert of gate sill) and 3,426.00 ft (spillway crest). No dead storage Figures given herein represent usable contents Water is used for irrigation.

MONTHEND ELEVATION AND CONTENTS AT 2400, WATER YEAR OCTOBER 19XX TO SEPTEMBER 19XX

Date	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)	Elevation (feet)	Contents (acre-feet)	Change in contents (acre-feet)
	12-4740. Keechelus Lake			12-4755. Kachess Lake		
Sept.30	2,486.95	90,120	-	2,246.60	172,150	-
Oct. 31	2,493.45	103,090	+12,970	2,252 57	197,330	+25,180
Nov. 30	2,505.50	129,580	+26,490	2,259.10	225,930	+28,600
Dec 31	2,495.52	107,420	-22,160	2,252.02	194,970	-30,960
CAL YR 19XX	-	-	-15,540	-	-	+5,890
Jan. 31	2,482.77	82,300	-25,120	2,248.11	178,420	-16,550
Feb. 29	2,488.84	93,800	+11,500	2,250.63	189,030	+10,610
Mar. 31	2,496 23	108,920	+15,120	2,254.11	203,980	+14,950
Apr. 30	2,509.21	138,380	+29,460	2,260.20	230,860	+26,880
May 31	2,514.95	152,560	+14,180	2,260.39	231,710	+850
June 30	2,517.38	158,750	+6,190	2,261.88	238,440	+6,730
July 31	2,502.09	121,750	-37,000	2,250.93	190,310	-48,130
Aug. 31	2,473.38	66,130	-55,620	2,242 39	155,110	-35,200
Sept.30	2,450 79	33,320	-32,810	2,237.37	135,660	-19,450
WTR YR 19XX	-	-	-56,800	-	-	-36,490
	12-4785. Cle Elum Lake			12-4875. Bumping Lake		
Sept.30	2,181.55	192,540	-	3,404.42	10,700	-
Oct. 31	2,199.96	262,020	+69,480	3,400.70	7,820	-2,880
Nov. 30	2,226.81	375,470	+113,450	3,412.50	18,060	+10,240
Dec. 31	2,217 13	332,920	-42,550	3,403.55	10,000	-8,060
CAL YR 19XX	-	-	+102,930	-	-	-4,110
Jan. 31	2,202.74	273,140	-59,780	3,397.77	5,730	-4,270
Feb. 29	2,207.24	291,440	+18,300	3,400.18	7,440	+1,710
Mar. 31	2,215.62	326,460	+35,020	3,408.68	14,370	+6,930
Apr. 30	2,229.42	387,310	+60,850	3,413.32	18,900	+4,530
May 31	2,233.11	404,330	+17,020	3,421.87	30,980	+12,080
June 30	2,237.95	427,130	+22,800	3,427.31	35,430	+4,450
July 31	2,216.17	328,800	-98,330	3,410.90	16,470	-18,960
Aug. 31	2,187.53	214,330	-114,470	3,403.30	9,810	-6,660
Sept.30	2,158.33	115,360	-98,970	3,396.60	4,930	-4,880
WTR YR 19XX	-	-	-77,180	-	-	-5,770

FIGURE 293A.—Group reservoir records (large reservoirs).

RIO GRANDE BASIN

Reservoirs in Rio Grande basin--Continued

MONTHEND ELEVATION OR GAGE HEIGHT AND CONTENTS, WATER YEAR OCTOBER 19XX TO SEPTEMBER 19XX

Date	Gage height (feet)	Contents (acre-feet)	Change in contents (acre-feet)	Elevation or gage height (feet)	Contents (acre-feet)	Change in contents (acre-feet)	Elevation or gage height (feet)	Contents (acre-feet)	Change in contents (acre-feet)
	8-3165. Nichols Reservoir†			8-3285. Jemez Canyon Reservoir†			8-3414. Bluewater Lake‡		
Sept.30	142.3	168	-	0	0	-	7,371.2	5,510	-
Oct. 31	139.0	129	-39	5,143.2	753	+753	7,370.4	5,170	-340
Nov. 30	143.1	178	+49	0	0	-753	7,370.0	5,000	-170
Dec. 31	143.8	187	+9	0	0	0	7,369.7	4,880	-120
CAL YR 19XX	-	-	-349	-	-	0	-	-	-2,500
Jan 31	-	a228	+41	0	0	0	7,369.5	4,800	-80
Feb. 29	150.0	279	+51	0	0	0	7,369.4	4,760	-40
Mar. 31	157.7	438	+159	5,146.40	1,090	+1,090	7,381.4	12,020	+7,260
Apr. 30	167.5	701	+263	5,142.70	480	-610	7,381.0	11,700	-320
May 31	167.5	701	0	5,128.80	0	-480	7,380.4	11,240	-460
June 30	165 1	628	-73	0	0	0	7,379.5	10,560	-680
July 31	159.4	477	-151	0	0	0	7,378.5	9,820	-740
Aug. 31	154.2	360	-117	0	0	0	7,377.5	9,120	-700
Sept.30	139.0	129	-231	0	0	0	7,376.7	8,580	-540
WTR YR 19XX	-	-	-39	-	-	0	-	-	+3,070
	8-3605. Elephant Butte Res.††			8-3620. Caballo Reservoir‡			8-3840. Alamogordo Reservoir‡		
Sept.30	4,334.46	532,800	-	4,140.42	41,690	-	4,269.90	100,600	-
Oct. 31	4,333.30	517,500	-15,300	4,144.95	58,170	+16,480	4,269.80	100,200	-400
Nov. 30	4,335.70	549,300	+31,800	4,145.20	59,200	+1,030	4,270.40	102,600	+2,400
Dec. 31	4,338.40	586,400	+37,100	4,145.55	60,640	+1,440	4,271.90	108,600	+6,000
CAL YR 19XX	-	-	-402,400	-	-	-85,360	-	-	-15,100
Jan 31	4,338.50	587,800	+1,400	4,152.53	92,290	+31,650	4,273 20	114,100	+5,500
Feb. 29	4,338 50	587,800	0	4,157 71	125,850	+33,560	4,274.15	118,200	+4,100
Mar. 31	4,336.07	554,300	-33,500	4,152.24	92,340	-33,510	4,269.15	97,710	-20,490
Apr. 30	4,338 98	594,500	+40,200	4,156.60	118,400	+26,060	4,271.10	105,400	+7,690
May 31	4,336.90	565,700	-28,800	4,159.16	135,700	+17,300	4,264.10	79,540	-25,860
June 30	4,335.53	547,100	-18,600	4,157.89	124,300	-11,400	4,267.70	92,270	+12,730
July 31	4,330.10	476,400	-70,700	4,152.30	92,670	-31,630	4,274.90	121,600	+29,330
Aug. 31	4,324.61	410,100	-66,300	4,136.24	29,260	-63,410	4,274.65	120,500	-1,100
Sept.30	4,322.42	385,100	-25,000	4,123 48	4,900	-24,360	4,273.95	117,400	-3,100
WTR YR 19XX	-	-	-147,700	-	-	-36,790	-	-	+16,800
	8-4005. Lake McMillan‡			8-4038. Lake Avalon‡			8-4100. Red Bluff Reservoir††		
Sept.30	19 10	9,620	-	15.70	1,560	-	2,807.9	63,150	-
Oct. 31	18.30	7,330	-2,290	16.30	1,920	+360	-	a65,100	+1,950
Nov. 30	18.75	8,580	+1,250	17.40	2,620	+700	-	a69,100	+4,000
Dec 31	19.50	10,850	+2,270	18.20	3,200	+580	2,809.7	70,300	+1,200
CAL YR 19XX	-	-	-26,890	-	-	-2,060	-	-	-35,900
Jan 31	19 75	11,650	+800	15.75	1,590	-1,610	2,810.6	73,900	+3,600
Feb. 29	19.65	11,330	-320	16.10	1,800	+210	2,810.8	74,700	+800
Mar. 31	22.30	20,940	+9,610	14.75	1,070	-730	2,811.0	75,500	+800
Apr. 30	17.60	5,510	-15,430	15.40	1,400	+330	2,807.4	61,400	-14,100
May 31	19.75	11,650	+6,140	15.55	1,480	+80	2,805.5	54,750	-6,650
June 30	21.05	16,150	+4,500	14.75	1,070	-410	2,804.3	50,900	-3,850
July 31	25.95	38,580	+22,430	19.15	3,960	+2,890	2,815.4	96,000	+45,100
Aug. 31	24.15	29,140	-9,440	16.00	1,740	-2,220	-	a93,000	-3,000
Sept.30	21.15	16,520	-12,620	15.70	1,560	-180	-	a85,400	-7,600
WTR YR 19XX	-	-	+6,900	-	-	0	-	-	+22,250

† Elevation or gage height at 2400.
‡ Elevation or gage height at 0800.
†† Daily mean gage height.
a Interpolated.

FIGURE 293 *B*. Group reservoir records (large reservoirs)—Continued.

ANDROSCOGGIN RIVER BASIN

Reservoirs in Androscoggin River basin

1-0505. RANGELEY LAKE on Rangeley Stream, at Oquossoc, Maine, used for power and log driving, has usable capacity of 1,339,200,000 cu ft in top 4 ft of lake (top of flashboards). Gage-height record furnished by Union Water Power Co.

1-0510. MOOSELOOKMEGUNTIC LAKE at Upper Dam, in Richardson Township, Maine, used for power and log driving, has usable capacity of 8,370,000,000 cu ft between gage heights 8.3 and 20.5 ft. Gage-height record furnished by Union Water Power Co.

1-0515. UPPER AND LOWER RICHARDSON LAKES on Rapid River, at Middle Dam, Maine, used for power and log driving, has usable capacity of 5,691,500,000 cu ft between gage heights 3.0 and 20.5 ft. Gage-height record furnished by Union Water Power Co.

1-0520. AZISCOHOS LAKE on Magalloway River, in Lincoln Township, 3 miles east of village of Wilsons Mills, Maine, completed in 1911 for power, has usable capacity of 9,593,000,000 cu ft between elevations 1,490.0 and 1,535.0 ft. Elevation record furnished by Union Water Power Co.

1-0530. UMBAGOG LAKE on Androscoggin River, at Errol Dam, 0.8 mile northeast of Errol, N.H., used for power and log driving, has usable capacity of 3,080,160,000 cu ft between gage heights 5.5 and 15.0 ft. Gage-height record furnished by Union Water Power C

1-0560. GULF ISLAND POND on Androscoggin River, 3 miles upstream from Lewiston, Maine, completed in 1928 for power, has capacity of 1,100,000,000 cu ft in top 10 ft of pond below elevation 262 ft. Elevation record furnished by Central Maine Power Co.

1-0565. LAKE AUBURN on outlet stream to Androscoggin River, at East Auburn, Maine, used for storing water supply of Auburn and Lewiston, has usable capacity of 580,000,000 cu ft between elevations 254.7 and 260.7 ft. .Elevation record furnished by Auburn Water District.

1-0575. PENNESSEEWASSEE LAKE on short outlet stream to Little Androscoggin River, at Norway, Maine, used for recreation, has usable capacity of 192,000,000 cu ft between gage heights 95.0 and 100.0 ft. Gage-height record furnished by Town of Norway.

1-0580. THOMPSON LAKE on short outlet stream to Little Androscoggin River, at Oxford, Maine, used for power and process water, has usable capacity of 950,000,000 cu ft between gage heights 95.0 and 100.0 ft. Gage-height record furnished by Robinson Manufacturing Co.

MONTHEND CONTENTS, IN MILLIONS OF CUBIC FEET, WATER YEAR OCTOBER 1967 TO SEPTEMBER 1968

Date	Rangeley Lake†	Mooselookmeguntic Lake†	Upper and Lower Richardson Lakes†	Aziscohos Lake†	Umbagog Lake†
Sept. 30, 1967	754	4,470	4,047	6,492	1,434
Oct. 31	837	3,076	3,862	6,926	1,668
Nov. 30	194	1,266	4,084	6,576	1,848
Dec. 31	84	534	4,047	6,688	1,920
Jan. 31, 1968	0	124	3,233	5,098	1,506
Feb. 29	0	0	2,540	3,938	850
Mar. 31	265	1,033	2,339	4,410	1,794
Apr. 30	1,366	6,474	4,918	8,830	3,138
May 31	1,366	8,154	5,691	9,702	2,300
June 30	1,366	8,370	5,691	9,872	3,119
July 31	1,185	7,724	5,350	9,253	1,958
Aug. 31	920	5,799	4,269	7,587	1,884
Sept. 30	656	4,368	3,270	6,394	1,578

Date	Gulf Island Pond‡	Lake Auburn†	Pennesseewassee Lake††	Thompson Lake‡‡
Sept. 30, 1967	2,316	386	98	1,913
Oct. 31	2,416	408	107	1,799
Nov. 30	2,195	386	111	1,742
Dec. 31	2,296	408	116	1,780
Jan. 31, 1968	2,199	430	111	1,723
Feb. 29	2,080	430	111	1,685
Mar. 31	2,500	604	111	1,970
Apr. 30	2,495	664	116	2,065
May 31	2,487	640	98	2,046
June 30	2,497	640	78	2,046
July 31	2,199	556	59	1,932
Aug. 31	2,211	474	66	1,818
Sept. 30	2,370	419	74	1,742

† Contents at 0700 on first day of following month.
‡ Contents at 2400.
†† Contents as of last day of month, by interpolation.
‡‡ Contents at 0800.

FIGURE 294.—Group reservoir records (small reservoirs).

"A"

DISCHARGE, IN CUBIC FEET PER SECOND, 19XX

Sept 10	4.6	Sept.21	5.3
11	4.4	22	6.5
12	4.6	23	6.7
13	4.7	24	6.7
14	4.9	25	6.8
15	4.7	26	7.1
16	4.4	27	10
17	4.4	28	11
18	4.4	29	11
19	4.4	30	11
20	4.7		

[Daily table for complete year follows.]

"B"

DISCHARGE, IN CUBIC FEET PER SECOND, 19XX

DAY	AUG	SEP	DAY	AUG	SEP	DAY	AUG	SEP	DAY	AUG	SEP	DAY	AUG	SEP
1	6.9	5.4	7	9.3	5.4	13	6.9	4.1	19	6.4	3.1	25	4.9	3.4
2	6.4	4.9	8	12	5.4	14	6.4	3.8	20	5.9	3.8	26	4.1	3.8
3	6.4	4.9	9	12	6.4	15	8.6	3.4	21	5.9	3.4	27	4.5	3.8
4	6.4	4.9	10	10	4.5	16	11	2.8	22	6.4	3.4	28	4.5	3.8
5	7.4	4.9	11	17	4.1	17	6.9	2.3	23	6.4	3.1	29	4.5	3.8
6	9.3	4.9	12	8.0	4.1	18	6.9	2.8	24	5.4	3.4	30	4.5	3.4
												31	5.4	
Total													226.6	121.2
Max													17	6.4
Min													4 1	2.3
Mean													7.31	4.04
Runoff in acre-feet													449	240

PEAK DISCHARGE (BASE, 50 CFS).--No peak above base.

[Daily table for complete year follows.]

"C"

DISCHARGE, IN CUBIC FEET PER SECOND, FEBRUARY 1961 TO SEPTEMBER 1965

July 3, 1961	1.9	Nov. 7, 1963	0
July 30, 1961	1.5	Nov. 21, 1963	2
Aug. 18, 1961	3.4	Aug. 12, 1964	
Nov. 21, 1961	6	Sept.14, 1964	1
Aug. 17, 1963	8	Aug. 17, 1965	
Oct. 19, 1963	.3		

Month	Cfs-days	Maximum	Minimum	Mean	Runoff acre-fe
July 1961	3.4	1.9	0	0.11	6.7
August	3.4	3.4	0	.11	6.7
November	.6	.6	0	.02	1.2
WTR YR 1962	.6	.6	0	.002	1.2
CAL YR 1962	0	0	0	0	0
August 1963	.8	.8	0	.03	1.6
WTR YR 1963	.8	.8	0	.002	1.6
October 1963	.3	.3	0	.01	.6
November	2.9	2.6	0	.10	5.8
CAL YR 1963	4.0	2.6	0	.01	8 0
August 1964	.5	.5	0	.02	1 0
September	1.0	1.0	0	.03	2.0
WTR YR 1964	4.7	2.6	0	.01	9.4
CAL YR 1964	1.5	1.0	0	.004	3.0
August 1965	.1	.1	0	.003	.2
WTR YR 1965	.1	.1	0	.0003	.2

PEAK DISCHARGE (BASE, 20 CFS).--July 3, 1961 (2130) 113 cfs (3.36 ft); July 30, 1961 (1500) 90 cfs (3.02 ft); Aug. 18, 1961 (2000) 179 cfs (4.28 ft); Nov. 21, 1961 (1030) 39 cfs (2.16 ft); Aug. 17, 1963 (1030) 46 cfs (2.28 ft); Oct. 19, 1963 (0700) 25 cfs (1.93 ft); Nov. 7, 1963 (1430) 24 cfs (1.91 ft); Nov. 21, 1963 (1300) 61 cfs (2.53 ft); Sept. 14, 1964 (about 2000) 74 cfs (2.75 ft).

NOTE.--Flow occurred only on days listed above.

FIGURE 295.—Discharge tables for short periods.

REVISIONS (WATER YEARS) --WSP 1277: 1939-42. Revised figures of discharge, in cubic feet per second, for the water years 1963-65, superseding those published in WRD XXXX, 1963-65, are given herewith

Date	Discharge	Date	Discharge	Date	Discharge
1962		1963-Con.		1965	
Dec. 28	137	July 22	157	Feb. 15	164
29	137	29	505	16	239
30	267			22	464
31	122	1964		26	228
1963		Mar. 6	276	Mar. 3	408
Mar. 11	137	7	258	6	227
*	*	23	184	20	552
20	323	* *	*	*	*
		Apr. 12	206	June 18	676

Month	Cfs-days	Maximum	Minimum	Mean	Per square mile	Runoff in inches
December 1962.....	1,676	267	13	54.1	1.45	1.67
CAL YR 1962.....	X,XXX.X	XXX	X.X	XX.X	.XX	XX.XX
March 1963.....	3,137	891	16	101	2 71	3.12
* *	*	* *	*	*	*	*
CAL YR 1965.... ..	14,970 6	1,150	5 9	41 0	1.10	14.95

FIGURE 296.—Revisions of published records.

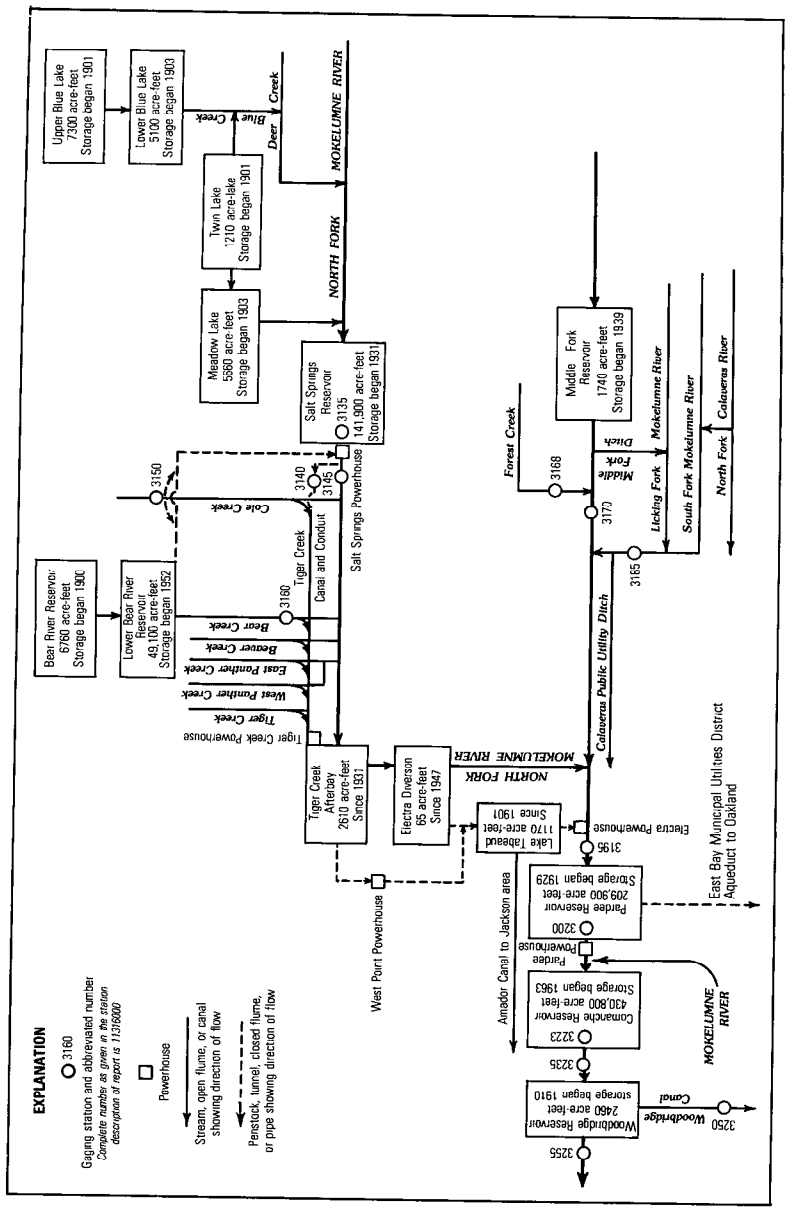

FIGURE 297.—Schematic diagram showing reservoirs, canals, and gaging stations.

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 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.

Records collected at partial-record stations are presented in two tables. The first is a table of discharge measurements at low-flow partial-record stations, and the second is a table of annual maximum stage and discharge at crest-stage stations. Discharge measurements made at miscellaneous sites for both low flow and high flow are given in a third table.

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. *Most of 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 1968

Station No.	*Station name*	*Location*	Drainage *area* (sq mi)	Period *of* record	Measurements	
					Date	Discharg (cfs)
		Savannah River basin				
2-1804	Tiger Creek at Lakemont, Ga.	Lat 34°47'03", long 83°24'58", Rabun County, at county highway bridge, at Lakemont.	a26	1951, 1959-60, 1962-68	7- 2-68 8-28-68	34 17
*2-1913	Broad River above Carlton, Ga.	Lat 34°04'37", long 83°00'22", Madison County, at State Highway 72, 2.8 miles northeast of Carlton.	760	1897-1913‡, 1943, 1953-54, 1959, 1962-68	7-22-68 9-13-68	532 396
* 2-1975.3	* Sweetwater Creek near Bonesville, Ga.	* Lat 33°26'16", long 82°27'00", McDuffie County, at State Highway 10, 0.8 mile northwest of Bonesville.	* 7.46	* 1953, 1955, 1959-61, 1963, 1965-68	* 8-30-68	* .30

* Also a crest-stage partial-record station.
‡ Operated as a continuous-record gaging station.
a Approximately.

FIGURE 298.—Low-flow partial records.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

The following table contains annual maximum discharge for crest-stage stations. A crest-stage 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, and discharge measurements may have been made for purposes of establishing the stage-discharge relation, but these are 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 1968

Station No.	Station name	Location	Drainage area (sq mi)	Period of record	Annual maximum		
					Date	Gage height (feet)	Discharge (cfs)
Virgin River basin							
9-4151	Pulsipher Wash near Mesquite, Nev.	Lat 36°48'04", long 114°06'35", in NW¼SW¼ sec.18, T.13 S., R.71 E., Clark County, at culvert on U.S. Highway 91, 2.4 miles west of Mesquite.	4.58	1963-68	11-21-67	a5.85	b150
Walker Lake basin							
10-2952	West Walker River at Leavitt Meadows, near Coleville, Calif.	Lat 38°19'XX", long 119°33'XX", in NW¼NW¼ sec.34, T.6 N., R.22 E., Mono County, at Leavitt Meadows Lodge, 16 miles south of Coleville.	73.0	1946-64, 1967-68	7- -67 6- -68	5.95 4.71	c1,600 940
Owyhee River basin							
13-1759	Reed Creek near Owyhee, Nev.	Lat 41°53'46", long 116°03'39", in SW¼SE¼ sec.7, T.46 N., R.53 E., Elko County, at culvert on State Highway 11-A, 3.X miles southeast of Owyhee.	6.51	1962-68	2-20-68	2.58	d5
13-1766	Taylor Canyon tributary near Tuscarora, Nev.	Lat 41°14'XX", long 116°02'XX", in S½ sec.29, T.39 N., R.53 E., Elko County, at culvert on State Highway 11, 11 miles southeast of Tuscarora.	e1.2	1967-68	1967 2-20-68	(f) 2.99	d7 (f)

See footnotes at end of table, p._____.

FIGURE 299.—Crest-stage partial records.

DISCHARGE AT PARTIAL-RECORD STATIONS AND MISCELLANEOUS SITES

Discharge measurements at miscellaneous sites

Measurements of streamflow at points other than gaging stations are given in the following table. Those that are measurements base flow are designated by an asterisk (*), measurements of peak flow by a dagger (†)

Discharge measurements made at miscellaneous sites during water year 19XX

Stream	Tributary to	Location	Drainage area (sq mi)	Measured previously (water years)	Measurements	
					Date	Discharge (cfs)
Part 6A		Yellowstone River basin				
Little Wind River a/	Wind River	Lat 42°57'37", long 108°29'54", in NE¼SE¼ sec 22, T 1 S , R 3 E , Fremont County, at bridge on county road, 1.2 miles upstream from Popo Agie River, 0.5 mile west of Arapahoe, Wyo	b650	1966-67	10-26-XX 2- 1-XX 3-30-XX 6-23-XX 8- 1-XX	137 91 53 †3,760 *7 8
Bighorn River	Yellowstone River	Lat 44°12'XX", long 107°55'XX", in sec.28, T 49 N , R 92 W , Big Horn County, at bridge on county road, 0 2 mile west of Fairden, 1.2 miles downstream from Fivemile Creek, 5.8 miles southeast of Manderson, Wyo.	11,020	1949-55‡, 1955-56‡	10- 3-XX 2-11-XX 5-17-XX	*437 *c980 7,430
Do	.. do	Lat * * *.	-	-	6- 7-XX	†d17,300
Part 9		Green River basin				
Bitter Creek	Green River	Lat 41°31'25", long 109°25'41", in NE¼SE¼ sec.24, T.18 N , R 107 W , Sweetwater County, 1.7 miles east of town of Green River, Wyo., and 1.9 miles upstream from mouth.	-	1958, 1966-67	10- 6-XX 3-19-XX 7-13-XX	*5.6 15 * 91
Part 10		Bear River basin				
Bear River	Great Salt Lake	Lat 41°19'XX", long 111°01'XX", in NE¼ sec.1, T 15 N , R.121 W , Uinta County, at bridge on county road, 3.5 miles northwest of Evanston, Wyo.	715	1913-56‡	9-12-XX	*8 3
Part 13		Salt River basin				
Stump Creek	Salt River	Lat 42°47'00", long 111°03'10", in NE¼SW¼ sec 27, T.7 S., R 46 E , Lincoln County, at bridge on county road, 1.2 miles upstream from Wyoming-Idaho State line, 3.3 miles west of Auburn, Wyo.	102	1946-49‡, 1962-65	11- 3-XX 1-16-XX 5-21-XX 8-28-XX	*24 *11 †375 *26

‡ Operated as a continuous-record gaging station
a Formerly published as Popo Agie River.
b Approximately.
c Not previously published.
d Revised

FIGURE 300.—Discharge measurements at miscellaneous sites.

RIO GRANDE BASIN

Pecos River seepage investigations—Acme to Artesia, N Mex.

Two series of discharge measurements were made during the 19XX water year, on Jan. 20 and Mar. 31, on the Pecos River and tributaries and diversions in New Mexico, to study channel gains and losses. The reach is 81 6 miles in length and extends from the gaging station Pecos River near Acme (8-3860) to the gaging station Pecos River near Artesia (8-3965). The measurements were made during periods of constant base flow of the streams, for 10 days before the investigations no measurable precipitation had fallen Tributary flow was considered a contribution and not a gain; diversion was considered a deduction and not a loss Indicated gains or losses may be substantially in error as affected by small inaccuracies in open-channel measurements Records of chemical analyses and water temperatures obtained at the time of this investigation are published in Part 2 of this report. Previous seepage investigations of this reach were made at least once each water year 1953-60, 1962-66

Pecos River mile	Stream	Location	Discharge, in cubic feet per second			
			Meas. disch.	Gain or loss	Meas disch.	Gain or loss
			Jan 20, 19XX		Mar. 31, 19XX	
94 0	Pecos River	Gaging station near Acme (8-3860).	4.83	-	40 9	-
89 1	.. do ..	SE¼SW¼NE¼ sec.27, T.9 S , R 25 E., above Bitter Lakes.	2 33	-2 50	28 3	-12 6
78 4	. do. .	NE¼NE¼NE¼ sec.33, T 10 S , R 25 E , at mouth of Bitter Creek..	4.25	+1 92	33 8	+5.5
78 4	Bitter Creek	NE¼NE¼NE¼ sec 33, T 10 S , R 25 E , at mouth....	2 96	-	5 76	-
74.7	Pecos River	SE¼SE¼NE¼ sec.9, T.11 S., R.25 E., above Rio Hondo..	8.79	+1 58	43 8	+4.2
74 6	Rio Hondo	NE¼NE¼SE¼ sec 9, T.11 S., R 25 E., at mouth	7 14	-	7.23	-
74 5	Pecos River	SE¼NE¼SE¼ sec 9, T.11 S , R 25 E., below Rio Hondo.	15.8 *	-.13 *	49.4 *	-1.6
46 7	Pecos River	SE¼NE¼NE¼ sec 12, T.14 S., R 26 E., at Hagerman bridge.	31 8	+9 7	70 9	+15.4
46 5	Diversion	* * *	9 42	-	15.7	-
44 2	Pecos River	SW¼SW¼SE¼ sec 13, T.14 S , R 26 E.... .... * * *	22 5 *	+ 1 *	58 6 *	+3 4
30 6	Pecos River	Gaging station near Lake Arthur (8-3955) .... * * * * *	25.7 *	+3 05 *	54.5 *	-2.9
12 4	Pecos River	Gaging station near Artesia (8-3965).	34.0	+2 78	54.1	-4.2
		Overall net gain or loss		+14.8		+1.4

[NOTE.--In the above example many lines have been omitted as indicated by asterisks, but the figures of "gain or loss" are based on complete data.]

FIGURE 301.—Seepage investigation.

STREAMS TRIBUTARY TO LAKE ST. CLAIR

North Branch Clinton River basin low-flow investigations

Two series of base-flow discharge measurements were made in the North Branch Clinton River basin as part of a comprehensive program now being carried on in cooperation with the Macomb County Board of Supervisors and the Macomb County Road Commission to investigate the surface water resources of the county The first series was made on June 9, as soon as conditions were suitable for high base flow The second series was made on Aug. 18, under conditions of low base flow. The data collected in these series of measurements, along with that already collected and to be collected in the future, will provide the basis for determining the base-flow yields of various parts of the basin.

Weather records at Mount Clemens near the southern part of the area and at Romeo near the west-central part show that no precipitation occurred for five days prior to June 9 and four days prior to Aug. 18. Therefore, the measurements are considered to represent base flow

The measurements on each stream are listed in order proceeding downstream, and each tributary is inserted in the order in which it enters the main stream. Drainage areas shown were determined from recent U.S Geological Survey topographic maps of a scale of 1:24,000 and contour interval of 5 to 10 ft Previous series of measurements were made in water years 1959-64

Discharge measurements of North Branch Clinton River and tributaries near Mount Clemens, Mich

Stream	Location	Drainage area (sq mi)	Discharge, in cubic feet per second			
			Measured discharge	Cfs per square mile	Measured discharge	Cfs per square mile
			June 9, 19XX		Aug. 18, 19XX	
North Branch Clinton River.	NW¼ sec 27, T 6 N , R 12 E , at State Highway 53, in Almont	9 56	2.42	0 253	1.19	0.124
Do	NW¼ sec.1, T 5 N , R.12 E., at Macomb-Lapeer County line, 2.8 miles southeast of Almont	17.1	3 34	195	1 26	.074
Apel drain	NW¼ sec.13, T 5 N , R.12 E , at McKay Rd., 0 5 mile above mouth and 3 8 miles north of Romeo	4 04	93	.230	.48	.119
Newland drain	SW¼ sec 19, T 5 N , R 13 E , at mouth, 2.8 miles northeast of Romeo.	9 39	2.11	.225	60	.064
Mahaffy drain	NW¼ sec.25, T 5 N , R 12 E , at Mack Rd. (34-Mile), 0.6 mile above mouth and 2 1 miles northeast of Romeo	2.64	.52	197	05	019
North Branch Clinton River	SW¼ sec.30, T 5 N , R 13 E , at 33-Mile Rd , 2 2 miles northeast of Romeo	49 7	11.0	.221	4 00	.080
East Pond Creek	SW¼ sec 7, T.5 N., R 12 E., at Dewey Rd (36-Mile), 3.8 miles northeast of Lakeville.	9.49	1.87	197	.06	.006
Do	SW¼ sec.29, T 5 N , R 12 E , at Schooley Rd. (33-Mile), 3.1 miles northwest of Romeo.	14 2	4 24	.299	1.47	.104
Do	Gaging station near Romeo (4-1641).	21.8	8.13	373	3.10	142
Do	NW¼ sec.6, T 4 N , R.13 E , at Powell Rd , 0.5 mile above mouth and 1.6 miles east of Romeo	24.5	8.52	348	3.43	.140
North Branch Clinton River	NW¼ sec 16, T 4 N , R 13 E , at 30-Mile Rd , 2 0 miles northwest of Ray Center.	80 5	18 2	.226	5 77	.072
Coon Creek	NE¼ sec.21, T 5 N., R 13 E , at Armada Center Rd., 2 1 miles west of Armada	3.98	75	188	33	083
Do	SW¼ sec.1, T 4 N , R 13 E , at North Rd , 3.4 miles south of Armada.	10 0	1.35	135	.34	.034
Do	SW¼ sec 25, T 4 N , R 13 E , at North Rd , 1.4 miles north of Meade.	15.2	1 26	083	05	003
Tupper Brook	NW¼ sec 11, T.4 N , R 13 E , at 31-Mile Rd., 3.7 miles south of Armada	4.21	0	0	0	0
Do	NW¼ sec.23, T 4 N., R.13 E , at 29-Mile Rd , at Ray Center.	8 62	0	0	0	0
East Branch Coon Creek	SE¼ sec 2, T 5 N , R.13 E , at Pratt Rd , 3 0 miles north of Armada.	8.34	50	.060	.04	005
Do	Gaging station at Armada (4-1643)	13.0	.71	.055	06	005
Middle Branch Clinton River.	Private Claim 546, T 2 N., R.13 E., at Heydereich Rd., near mouth, just above Miller drain, 1 0 mile west of Mount Clemens	74 7	8.88	119	2 71	.036

FIGURE 302.—Low-flow investigation.

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FIGURE 303.–Index for annual published report (only first page).