

# WATER RESOURCES DATA FOR ALASKA, 2001

## EXPLANATION OF THE RECORDS

The surface-water and ground-water records published in this report are for the 2001 water year that began October 1, 2000, and ended September 30, 2001. 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 and ground water, and ground-water-level data. The locations of the stations and wells where the data were collected are shown in figures 1, 2 and 3. 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 stream site, lake, reservoir, spring, 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 regular surface-water stations and the "latitude-longitude" system is used for wells, lakes, reservoirs, springs, and for surface-water stations where only miscellaneous measurements and/or water-quality samples are collected.

### Downstream Order System

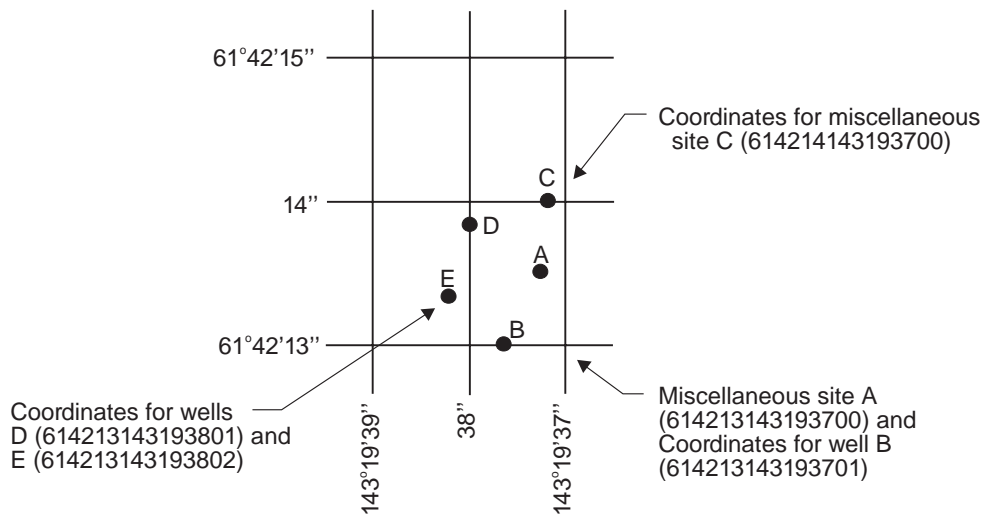
Since October 1, 1950, the order of listing hydrologic-station records in USGS reports is in a downstream direction along the main stream. All stations on a tributary entering upstream from a mainstream station are listed before that station. A station on a tributary that enters between two mainstream 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 indentation in the "List of Stations" in the front of this report. Each indentation represents one rank. This downstream order and system of indentation show which stations are on tributaries between any two stations and the rank of the tributary on which each station is situated. Stations located on islands in Alaska are in downstream order starting at the most westerly point on the island and moving around the island in a counter-clockwise direction (stations on Kodiak Island start at the most northerly point).

The station-identification number is assigned according to downstream order. In assigning station numbers, no distinction is made between regular stations and partial-record stations; therefore, the station number for a partial-record station indicates downstream-order position in a list made up of both types of stations. Water-quality stations located at or near regular stations or partial-record stations have the same number as the regular or partial-record station. 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 15303600, which appears just to the left of the station name, includes the two-digit Part number "15" plus the six-digit downstream order number "303600." The Part number designates the State of Alaska. Occasionally, the downstream order number consists of eight digits.

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## Latitude-Longitude System

The identification numbers for miscellaneous surface-water sites, wells, springs, lakes, and reservoirs 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 and also stored in the computerized data base files. See the accompanying diagram.



## Local Number

The local number, which is assigned to well and spring sites, is derived in part from the rectangular subdivision of public lands and is used in Alaska as the site name. The first two letters indicate the principal meridian and the quadrant formed by the intersection of the base line and the principal meridian. The first three digits indicate the township in which the well or spring is located, the next three digits the range, and the last two digits the section. The letters following the section number indicate the quarter section, the quarter-quarter section, and so forth to the fourth order subdivision. Each of these subdivisions is lettered counter-clockwise, from the northeast corner. Each site within the smallest order of subdivision is then given a sequential number. Finally, each well within a section is assigned a sequential map number indicated by the last three digits. Thus, SB00601115BCAD1 001 denotes the Seward meridian (S), the northwest quadrant (B), township 6 north, range 11 west, section 15; and the site is in the SE<sup>1</sup>/<sub>4</sub> of NE<sup>1</sup>/<sub>4</sub> of the SW<sup>1</sup>/<sub>4</sub> of the NW<sup>1</sup>/<sub>4</sub> (BCAD) of the section. It was the first site in the 2.5 acre "D" subdivision assigned a sequential number (1). The next space is left blank. The next three digits, 001, indicate the sequence in which a site was located on a map. Thus, 001 indicates the first site plotted in the one-square-mile section. The next space is left blank. The last five digits, such as 00114, are the Alaska (AK) register number. Therefore, the local number is SB00601115BCAD1 001 00114. The local number for springs

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is the same, except for the last three digits and the Alaska (AK) register number, as indicated by the following example: SB00601115BCAD1S 4065S. Note: Public-land surveys have not been completed for a large portion of Alaska, therefore, some "local numbers" reflect this in an abbreviated form, e.g., SB00601115.

### Records of Stage and Water Discharge

Records of stage and water discharge may be complete or partial. Complete records of discharge are those at which daily mean discharges can be computed or estimated with reasonable accuracy from the supporting data and information. Because the daily mean discharges commonly are published, the stations are referred to as "daily stations."

By contrast, partial records are obtained through discrete measurements 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 from special studies, such as low-flow seepage studies, may be considered as partial records, but they are presented separately in this report. Periodic lake-level measurements are also presented separately. Locations of all complete-record and crest-stage partial record stations for which data are given in this report are shown in figures 2 and 3, respectively.

### Data Collection and Computation

#### Methodology

The base data collected at gaging stations consist of stage records and discharge measurements of streams, and stage of lakes. In addition, observations of factors affecting the stage-discharge relation, weather records, and other information are used to supplement base data in determining the daily flow. Records of stage are obtained from direct readings on a nonrecording gage or from a water-stage recorder that gives either a continuous graph of the fluctuations, a tape punched at selected time intervals, or an electronic data logger. Measurements of discharge are made with a current meter, using the general methods adopted by the U.S. Geological Survey. These methods are described in standard textbooks, in U.S. Geological Survey Water-Supply Paper 2175, and in U.S. Geological Survey Techniques of Water Resources Investigations, Book 3, Chapter A6.

#### Computation

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) results of indirect measurements of peak discharge, such as slope-area or flow-through-culvert measurements and computations of flow-over-dams or weirs; (3) step-backwater techniques; or (4) velocity-area studies.

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

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or continual change in the physical features that form the control, the daily mean discharge is determined by shifting control method, in which correction factors based on the individual discharge measurements and notes of the person who made the measurement are added (or subtracted) 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 debris or aquatic growth on the control.

In computing records of reservoir contents, it is necessary to have curves or tables defining the relation of stage and contents (from prior survey and computations). The application of stage to stage-content curves or tables gives the contents from which daily, monthly, or yearly changes can be determined. Discharges over lake or reservoir spillways are computed from stage-discharge relations much as other stream discharges are computed. Discharge through hydro-power plants can be calculated indirectly by using the theoretical relation of flow-rates with the amount of power being generated by each turbine, the reservoir level, and the estimated efficiency of each turbine. It is necessary to have tables, curves, or formulas relating the above variables (usually supplied by the manufacturer of the turbine). It is also necessary to have records of reservoir elevation, either from periodic observations or continuous records, and power-generation records (usually furnished by the operators of the power plant).

### Winter discharge measurements

At most stream-gaging stations in Alaska, 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 or estimated on the basis of the available gage-height record and occasional winter discharge measurements. Consideration is given to the available information on temperature and precipitation, notes by gage observers and hydrographers, and comparable records of discharge for other stations in the same or nearby basins. Determinations of 0.0 or no flow may indicate a lack of distinguishable velocity, but do not necessarily describe a dewatered channel.

### Estimates for periods of no data

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. This happens when the recorder is stopped for the winter 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, prior and subsequent records, discharge measurements, weather records, and comparison with records for other stations in the same or nearby basins. 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

Streamflow data in this report are presented in a format that is considerably different from the format in data reports prior to the 1991 water year. The major changes are that statistical characteristics of discharge now appear in tabular summaries following the water-year data table and less information is provided in the text or station manuscript above the table. These changes represent

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the results of a pilot program to reformat the annual water-data report to meet current user needs and data presentation.

The records published for each continuous-record surface-water discharge station (gaging station) now consist of four parts: the manuscript or station description; the data table of daily mean values of discharge for the current water year with summary data; a tabular statistical summary of monthly mean flow data for a designated period, by water year; and a summary statistics table that includes statistical data of annual, daily, and instantaneous flows as well as data pertaining to annual runoff, 7-day low-flow minimum, and flow duration. Occasionally, data for other than the current year are published, usually to present unpublished data.

### Station manuscript

The manuscript provides, under various headings, descriptive information, such as location of station; drainage area; period of record; record accuracy; and other remarks pertinent to station operation and regulation. For some stations, historical extremes outside the period of record and peak discharges greater than base discharge for the station are given. The following information, as appropriate, is provided with each continuous record of discharge, stage, or reservoir contents. Comments to clarify information presented under the various headings of the station description follow:

**LOCATION.**--Information on locations is obtained from the most accurate maps available. The USGS topographic map showing the location of the station is included in parentheses for many sites, e.g. (Livengood E-1). The location of the gage with respect to the cultural and physical features nearby and to the reference place mentioned in the station name is given.

**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 or because of difficulties in determining drainage boundaries, the accuracy of drainage-area determinations likewise varies. As appropriate, some drainage-area figures are qualified by "approximately." Drainage areas are updated as better maps become available.

**PERIOD OF RECORD.**--This indicates the period for which published records are available for the station or for an equivalent station. An equivalent station is one that was in operation at a time the present station was not, and whose location was such that records from it can be considered reasonably equivalent with records from the current station. Some daily stations were previously operated as partial-record stations or had only monthly discharge records published. These periods are included in the paragraph.

**REVISED RECORDS.**--Published records occasionally are found to be incorrect, usually because of new information, 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 discharge figures, 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.

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**GAGE.**--The type of gage in current use, the datum of the current gage referred to sea level (see "Definition of Terms"), and a condensed history of the types, locations, and datums of previous gages are given under this heading.

**REMARKS.**--Periods of estimated daily discharge will be identified by date in this paragraph for selected stations. For all stations, estimated daily discharge will be flagged in the daily discharge table. (See next section "Identifying Estimated Daily Discharge.") If a REMARKS paragraph is used to identify estimated record, this information would be the first entry. This paragraph is also used to present information relative to the accuracy of the records, to the special methods of computation, to conditions that affect natural flow at the station, and to other pertinent items. For reservoir stations, information is given on the dam forming the reservoir, the capacity, outlet works and spillway, and purpose (use) of the reservoir.

**COOPERATION.**--Records provided by a cooperating organization or obtained for the U.S. Geological Survey by a cooperating organization are identified here. Also, if data or information are supplied which aid in the computation of the record, the agency providing the information is named.

**EXTREMES FOR PERIOD OF RECORD.**--This paragraph is included in the station manuscript for stations for which tabular summary statistics are not appropriate because they have short records, seasonal records, or regulated flow.

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

**EXTREMES FOR CURRENT YEAR or EXTREMES FOR CURRENT PERIOD.**--This paragraph is included in the station manuscript for selected sites where peaks above base discharge are published and for stations for which tabular summary statistics are not appropriate because they have short records, seasonal records, or regulated flow. For records that meet certain criteria, all peak discharges and stages greater than a selected base discharge during the water year are given. The peaks greater than the base discharge, excluding the highest one, are called secondary peaks. The time that the peak occurred is expressed in 24-hour local standard time; for example, 12:30 a.m. is 0030 and 1:30 p.m. is 1330. Except for stations for which tabular summary statistics are not appropriate, the maximum and minimum for the current water year appears below the daily values table in the tabular summaries.

**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. For these stations, there may 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 for previously published data reports may wish to contact the District Office (address 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. If the data for a discontinued station were obtained by computer

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retrieval, the data would be current because any previously published data are automatically 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.

Headings that appeared in reports before water year 1991 for AVERAGE DISCHARGE, EXTREMES FOR PERIOD OF RECORD, and EXTREMES FOR CURRENT YEAR have been deleted and the information contained in these paragraphs, except for the listing of secondary instantaneous peak discharges in the EXTREMES FOR CURRENT YEAR paragraph, is now presented in the tabular summaries following the discharge table or in the REMARKS paragraph, as appropriate, except for stations for which tabular summary statistics are not appropriate. No changes have been made to the data presentation of lake contents.

### Data table of daily mean values

The daily table of discharge records for stream-gaging stations gives the mean discharge for each day of the water year. In the monthly summary for the daily table, the line headed "TOTAL" gives the sum of the daily figures for each month; the line headed "MEAN" gives the average flow in cubic feet per second for the month; and the lines headed "MAX" and "MIN" give the maximum and minimum daily mean discharges, respectively, for each month. Discharge for the month also may be expressed in acre-feet (line headed "AC-FT"), in cubic feet per second per square mile (line headed "CFSM"), or in inches (line headed "IN"). Figures for cubic feet per second per square mile and runoff in inches are omitted if there is extensive regulation or diversion, if the contributing drainage area or boundaries are unknown, or if the flow is mostly from a spring. At some stations, monthly and (or) yearly discharges are adjusted for diversions or changes in reservoir contents.

### Statistics of monthly mean data

A tabular summary of the mean (line headed "MEAN"), maximum (line headed "MAX"), and minimum (line headed "MIN") of monthly mean flows for each month for a designated period is provided below the mean values table. The water years of the first occurrence of the maximum and minimum monthly flows are provided immediately below those figures. The designated period will be expressed as "FOR WATER YEARS \_\_\_\_ - \_\_\_\_, BY WATER YEAR (WY)," and will list the first and last water years of the range of years selected from the PERIOD OF RECORD paragraph in the station manuscript. It will consist of all the station records within the specified water years, inclusive, including complete months of record for partial water years, if any, and may coincide with the period of record for the station. The water years for which the statistics are computed will be consecutive, unless a break in the station record is indicated in the manuscript.

### Summary statistics

A table titled "SUMMARY STATISTICS" follows the statistics of monthly mean data tabulation. This table consists of four columns, with the first column containing the line headings of the statistics being reported. The table provides a statistical summary of yearly, daily, and instantaneous flows, not only for the current water year but also for the previous calendar year and for a desig-

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nated period, as appropriate. The designated period selected, "WATER YEARS \_\_\_\_ - \_\_\_\_" will consist of all of the station records within the specific water years, inclusive, including complete months of record for partial water years, if any, and may coincide with the period of record for the station. The water years for which the statistics are computed will be consecutive, unless a break in the station record is indicated in the manuscript. All of the calculations for the statistical characteristics designated ANNUAL (see line headings below), except for the "ANNUAL 7-DAY MINIMUM" statistic, are calculated for the designated period using complete water years. The other statistical characteristics may be calculated using partial water years.

The date or water year, as appropriate, of the first occurrence of each statistic reporting extreme values of discharge is provided adjacent to the statistic. Repeated occurrences may be noted in the REMARKS paragraph of the manuscript or in footnotes. Because the designated period may not be the same as the station period of record published in the manuscript, occasionally the dates of occurrence listed for the daily and instantaneous extremes in the designated-period column may not be within the selected water years listed in the heading. When this occurs, it will be noted in the REMARKS paragraph or in footnotes. Selected streamflow duration curve statistics and runoff data are also given. Runoff data may be omitted if there is extensive regulation or diversion of flow in the drainage basin.

The following summary statistics data, as appropriate, are provided with each continuous record of discharge. The comments clarify information presented under the various line headings of the summary statistics table.

**ANNUAL TOTAL.**--The sum of the daily mean values of discharge for the year. At some stations, the annual total discharge is adjusted for reservoir storage or diversion. The adjusted figures are identified by a symbol and corresponding footnotes.

**ANNUAL MEAN.**--The arithmetic mean of the individual daily mean discharges for the year noted or for the designated period. At some stations, the annual mean discharge is adjusted for reservoir storage or diversion. The adjusted figures are identified by a symbol and corresponding footnotes.

**HIGHEST ANNUAL MEAN.**--The maximum annual mean discharge occurring for the designated period.

**LOWEST ANNUAL MEAN.**--The minimum annual mean discharge occurring for the designated period.

**HIGHEST DAILY MEAN.**--The maximum daily mean discharge for the year or for the designated period.

**LOWEST DAILY MEAN.**--The minimum daily mean discharge for the year or for the designated period.

**ANNUAL 7-DAY MINIMUM.**--The lowest mean discharge for consecutive days for a calendar year or a water year. Note that most low-flow frequency analyses of annual 7-day minimum flows use a climatic year (April 1 - March 31). The date shown in the summary statistics table is the initial



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date of the 7-day period. (This value should not be confused with the 7-day 10-year low-flow statistic.)

**MAXIMUM PEAK FLOW.**--The maximum instantaneous discharge occurring for the water year or for the designated period. Note that secondary instantaneous peak discharges above a selected base discharge are stored in District computer files for stations meeting certain criteria. Those discharge values may be obtained by contacting the District Office. (See address on the back of the title page.)

**MAXIMUM PEAK STAGE.**--The maximum instantaneous stage occurring for the water year or for the designated period. If the dates of occurrence for the instantaneous peak flow and instantaneous peak stage differ, footnotes may be used to provide further information. (For Alaska, a second line heading, **INSTANTANEOUS PEAK STAGE**, is used for stations where the peak stage was from a backwater condition and had a different date from the peak discharge.)

**INSTANTANEOUS LOW FLOW.**--The minimum instantaneous discharge occurring for the water year or for the designated period.

**ANNUAL RUNOFF.**--Indicates the total quantity of water in runoff for a drainage area for the year. Data reports may use any of the following units of measurement in presenting annual runoff data:

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

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

Inches (INCHES) indicates the depth to which the drainage area would be covered if all of the runoff for a given time period were uniformly distributed on it.

**10 PERCENT EXCEEDS.**--The discharge that has been exceeded 10 percent of the time for the designated period.

**50 PERCENT EXCEEDS.**--The discharge that has been exceeded 50 percent of the time for the designated period.

**90 PERCENT EXCEEDS.**--The discharge that has been exceeded 90 percent of the time for the designated period.

Data collected at partial-record stations follow the information for continuous-record sites. In prior years, data for low-flow partial-record stations have been published, but no stations were in operation in the current water year. Data are presented in two tables. The first is a table of annual maximum stage and discharge at crest-stage partial-record stations. The second is a table of discharge measurements made at crest-stage partial-record stations and miscellaneous sites. Occasionally, a series of discharge measurements are made within a short time period to investigate the seepage

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gains or losses along a reach of a stream or to determine the low-flow characteristics of an area. Such measurements are given in special tables following the listing of miscellaneous measurements. Lake-level data collected at miscellaneous selected lakes are included. The data are being collected at these selected lakes to define lake-level changes in response to seasonal variations, the effects of man, droughts, and changes in the ground-water system. The lake-level data follow the water-quality data tables for miscellaneous sites.

### Identifying Estimated Daily Discharge

Estimated daily-discharge values in the current annual data report are identified by the "e" notation next to each mean daily discharge in the daily values tables. Prior to the report for the 1985 water year, estimated daily-discharge values were not specifically identified.

### Accuracy of the Records

The accuracy of streamflow 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 interpretations 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 are within 5 percent of the true value; "good" within 10 percent; and "fair" within 15 percent. Records are rated as "poor" when they do not meet the criteria above. Different accuracies may be attributed to different parts of a given record.

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 ft<sup>3</sup>/s; to the nearest tenth between 1.0 and 10 ft<sup>3</sup>/s; to whole numbers between 10 and 1,000 ft<sup>3</sup>/s; and to 3 significant figures above 1,000 ft<sup>3</sup>/s. The number of significant figures used is based solely on the magnitude of the discharge value. The same rounding rules apply to discharges listed for partial-record stations and miscellaneous measurement sites.

Discharge at many stations, as indicated by the monthly mean, may not reflect natural runoff due to the effects of diversion, flow from springs, 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 or for other factors that might affect the flows. At those stations where adjustments are made, large errors in computed runoff may occur if adjustments are large in comparison to observed discharge. Evaporation from a reservoir is not included in the adjustments for changes in reservoir contents.

### Other Data Available

Information of a more detailed nature than that published for most of the gaging stations such as observations of water temperatures, discharge measurements, gage-height records, and rating tables, is filed in the field offices at Anchorage, Fairbanks, and Juneau for their areas of responsibility. Also, most of the daily mean discharges are in computer files and can be retrieved for statistical analyses. Information on the availability of unpublished data or statistical analyses may be obtained from the District Office in Anchorage.

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## 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 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 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 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 recorded at short intervals. Some records of water quality, such as temperature and specific conductance, may be obtained by continuous recordings; however, because of costs, most data are obtained only monthly or less frequently.

### 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 partial-record stations and for miscellaneous sampling sites appear in separate tables following the table of discharge measurements at miscellaneous sites.

### On-Site Measurements and Sample Collection

To assure the data obtained represent the *in situ* quality of the water, certain measurements, such as water temperature, pH, alkalinity, and dissolved oxygen, are made onsite when the samples are collected. To assure that measurements made in the laboratory also represent the *in situ* water, prescribed procedures are followed in collecting, treating, and shipping the samples to prevent changes in quality pending analysis in the laboratory. These procedures are given in U.S. Geological Survey Techniques of Water-Resources Investigations, Book 1, Chapter D2; Book 3, Chapter C2; Book 5, Chapters A1, A3, and A4.

One sample can adequately define 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, de-

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pending 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. For the tables of surface-water quality that are published in this report, parameter code 82398 (SAMPLING METHOD, CODES) lists a numeric value which corresponds to the following explanation:

- 10 - Equal width increment (EWI)
- 20 - Equal discharge increment (EDI)
- 25 - Timed sampling interval
- 30 - Single vertical
- 40 - Multiple verticals
- 50 - Point sample
- 60 - Weighted bottle
- 70 - Grab sample (dip)
- 80 - Discharge integrated, equal transit rate (ETR)
- 90 - Discharge integrated, centroid
- 100 - Van Dorn sampler
- 110 - Sewage sampler
- 120 - Velocity integrated
- 8010 - Other

To better define the sample, parameter code 84164 (SAMPLER TYPE) lists a numeric value which corresponds to the following explanation:

- |                           |  |
|---------------------------|--|
| 100 - Van Dorn sampler    | 3045 - US DH -81 with Teflon cap and nozzle    |
| 110 - Sewage sampler      | 3050 - Collapsible Teflon Bag in Frame Sampler |
| 3001 - Sampler, US DH-48  | 3053 - US D-95 Teflon bottle                   |
| 3002 - Sampler, US DH-59  | 3054 - US D-95 Teflon bottle                   |
| 3003 - Sampler, US DH-75P | 3055 - US D-96 Teflon bag                      |
| 3004 - Sampler, US DH-75Q | 3060 - Weighted Bottle Sampler                 |
| 3007 - Sampler, US D-49   | 3070 - Grab Sampler                            |
| 3009 - Sampler, US D-74   | 4020 - Open top bailer                         |
| 3011 - Sampler, US D-77   | 4025 - Double valve bailer                     |
| 3015 - Sampler, US P-63   | 4041 - Submersible Helical Rotor Pump          |
| 3016 - Sampler, US P-72   | 4080 - Peristaltic pump                        |
| 3042 - Sampler, US P-61   | 4100 - Flowing Well                            |
| 3044 - US DH-81           | 8010 - Other                                   |

For further explanation on sampling methods, see Techniques of Water-Resources Investigations, Book 3, Chapter C2, "Field Methods for Measurement of Fluvial Sediment."

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. In the rare case where an apparent inconsistency exists between a reported pH value and the relative abundance of carbon dioxide species (carbonate and bicarbonate), the inconsistency is

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the result of a slight uptake of carbon dioxide from the air by the sample between measurement of pH in the field and determination of carbonate and bicarbonate in the laboratory.

### Water Temperature

Water temperatures are measured at most of the water-quality stations. In addition, water temperatures are sometimes taken at the time of discharge measurements at water-discharge stations. Large streams have a small daily 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 temperature recording instruments are used, maximum and minimum temperatures for each day are published. Mean temperatures are published when diurnal variations are greater than 2.0 °C more than 5 percent of the water year. Water temperatures measured at the time of water-discharge measurements are on file in the District field offices.

### 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, or a single sample may be obtained at a fixed point and a coefficient applied to determine the mean concentration in the cross sections.

During periods of rapidly changing flow or rapidly changing concentration, samples may have been collected more frequently (twice daily or, in some instances, hourly). The published sediment discharges for days of rapidly changing flow or concentration were computed by the subdivided day method (time-discharge weighted average). Therefore, for those days when the published sediment discharge value differs from the value computed as the product of discharge times mean concentration times 0.0027, the reader can assume that the sediment discharge for that day was computed by the subdivided day method. For periods when no samples were collected, daily loads of suspended sediment were estimated on the basis of water discharge, sediment concentrations observed immediately before and after the periods, and suspended-sediment loads for other periods of similar discharge.

At other 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 in predicting long-term sediment-discharge characteristics of the stream.

In addition to the records of quantities of suspended sediment, records of periodic measurements of the particle-size distribution of the suspended sediment and bed material are included.

### Laboratory Measurements

Sediment samples are analyzed in the U.S. Geological Survey laboratory in Vancouver, Washington. Methods used in analyzing sediment samples and computing sediment records are given in *Techniques of Water-Resources Investigations*, Book 5, Chapter C1. Methods used by the Geolog-

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ical Survey laboratory are given in TWRI, Book 1, Chapter D2; Book 3, Chapter C2; Book 5, Chapters A1, A3, and A4.

### Records of Ground-Water Levels

Ground-water level data from a statewide network of observation wells are published in this report. This network consists of observation wells (figure 3) located either in important aquifers or in areas of significant water use.

### Data Collection and Computation

Water-level measurements are made in many types of wells, under varying conditions of access and weather conditions. However, the equipment and measuring techniques used at each observation well assure that the measurements are of consistent accuracy and reliability.

Tables of water-level data are presented by Hydrologic Subregion. The station-identification number for a given well is the 15-digit number that appears in the upper left corner of the station description. The secondary identification number is the local 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, battery-operated electric tape, or from a water-stage recorder that gives a continuous graph of water-level fluctuations, a paper tape punched at selected time intervals, or data stored at selected time intervals on an electronic data logger. The water-level measurements in this report are given in feet with reference to either sea level or land-surface datum. Sea level is the datum plane on which the national network of precise levels is based; land-surface datum is a datum plane that is approximately at land surface at each well. The altitude of the land-surface datum is given in the well description. The height of the measuring point above or below land-surface datum is also given in each well description. Water levels in wells equipped with recording gages are the highest ground-water level recorded in the well on the day indicated.

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 and if an electric water sensor is used, the error in determining the absolute value of the total depth to water may be a few tenths of a foot. However, 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 may be given only to a tenth of a foot.

### Data Presentation

Each well record consists of the station description and the data table of water levels observed during the water year. The description of the well is presented through use of descriptive headings preceding the tabular data. Clarification of each heading is given below.

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**LOCATION.**--This paragraph follows the well-identification number and reports the latitude and longitude (given in degrees, minutes, and seconds); the Hydrologic Unit; 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, 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 sea level; 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 U.S. Geological Survey, may be noted.

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

A table of water levels follows the station description for each well. Water levels are reported in feet above or below land-surface datum. Water levels that are above land-surface datum have negative values. For wells equipped with recorders, water level values listed are the highest recorded in the well on the day indicated. Missing records are indicated by dashes in place of the water level.

Information of a more detailed nature than that published, such as well depths and water levels from other ground-water sites throughout the State, is filed in the Anchorage field office. Much of the data are in computer files and can be retrieved for analysis. Information on the availability of unpublished data may be obtained from the District Office in Anchorage.

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## Records of Ground-Water Quality

Records of ground-water quality in this report differ from other types of records in that for most sampling sites they consist of only one set of measurements for the water year. The quality of ground water ordinarily changes slowly; therefore, for most general purposes one annual sampling, or a few samples taken at infrequent intervals during the year, is sufficient. Frequent measurement of the same constituents is not necessary unless one is concerned with a particular problem, such as monitoring for trends in nitrate concentration. In special cases where the quality of ground water may change more rapidly, more frequent measurements are made to identify the nature of the changes.

## Data Collection and Computation

The records of ground-water quality in this report were obtained mostly as a part of special studies in specific areas. Consequently, a number of chemical analyses are presented for some areas but none for other areas. As a result, the records for this year, by themselves, do not provide a balanced view of ground-water quality statewide. Such a view can be attained only by considering records for this year in context with similar records obtained for these and other areas in earlier years.

## Data Presentation

The records of ground-water quality are published in a section titled QUALITY OF GROUND WATER immediately following the ground-water-level records. Data for quality of ground water are listed by Hydrologic Subregion, and are identified by well number. The station-identification number for wells sampled is the 15-digit number derived from the latitude-longitude locations. No descriptive statements are given for ground-water-quality records; however, the well number, depth of well, date of sampling, and other pertinent data are given in the table containing the chemical analyses of the ground water.

## ACCESS TO USGS WATER DATA

The USGS provides near real-time stage and discharge data for many of the gaging stations equipped with the necessary telemetry and historic daily-mean and peak-flow discharge data for most current or discontinued gaging stations through the Internet. These data may be accessed at:

<http://water.usgs.gov>

Some water-quality and ground-water data also are available through the Internet. In addition, data can be provided in various machine-readable formats on magnetic tape or 3-1/2 inch floppy disk. Information about the availability of specific types of data or products, and user charges, can be obtained locally from each of the Water Resources Division District Offices (see address on the back of the title page).