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A PROPOSED STREAMFLOW-DATA PROGRAM IN ALASKA

By

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ABSTRACT

The streamflow-data program in Alaska was analyzed to design a better data network. The analysis included (1) definition of the goals of the streamflow-data program, (2) evaluation of the available data to see which goals have already been achieved, and (3) consideration and recommendation of future programs to achieve the goals that have not been met. It was found that few of the goals have been met. Many new gaging stations are proposed to provide data to reach remaining unmet goals. Also, other kinds of data collection are proposed to complement the gaging-station data to attain the goals.

INTRODUCTION

The stream-gaging program of the U.S. Geological Survey in Alaska has evolved through the years as the Federal and State interests in surface-water resources have increased and as funds for stream gaging have become available.

The earliest Alaskan stream gaging was in the early 1900's to determine water supplies for hydraulic placer mining. The stream-gaging records were short, fragmentary, and apparently planned to give site information for particular water-supply needs. About 1910, interest in waterpower and water supply for potential pulp- and paper-industry development in southeastern and south-central Alaska stimulated investigation of water resources. The longest stream-gaging records in Alaska were begun because of this interest. After World War II, population growth around Anchorage, Fairbanks, Juneau, and Ketchikan increased the need to study water resources for potential water supply for domestic, industrial, and hydroelectric-power uses. The Geological Survey established an Alaska District in 1946 and began a Statewide program to collect streamflow information. Most gages were installed on streams having hydroelectric-power potential or on streams near the larger towns.

In 1950, the Geological Survey operated 47 stream-gaging stations in Alaska, 16 of which were in southeast Alaska. All were financed by the Federal government. In 1960, the Geological Survey was operating 72 stream gages, 22 of which were in southeast Alaska. Ten gaging stations were then partially or completely financed by nonfederal agencies. In 1970, the Geological Survey operated 118 stream-gaging stations, 39 of which were in southeast Alaska. Twenty-one of these were partially or completely financed by nonfederal agencies. In addition to these daily-discharge stations, the Alaska District, in cooperation with the Alaska Department of Highways and the U.S. Forest Service, established a network of crest-stage peak-discharge-record stations in 1962. As of 1970, 91 of these crest-stage gages were in operation, 75 of which were financed by the State.

The increasing cost of operation, the restraint on funds and manpower, and the need for a greater variety of hydrologic information, made it imperative that a systematic evaluation of the surface-water program be made so as to determine how to apply the funds and manpower available in order to best serve State and Federal interests. The purpose of this study is to evaluate the streamflow-data program and use this evaluation to design a program that will most efficiently produce the types of information needed.

The concepts and procedures used in this study are presented in detail in the introductory report in this series (Carter and Benson, 1970), and are summarized only briefly in this report. The basic steps are (1) definition of the long-term objectives of the streamflow-data program in quantitative form, (2) examination and analysis of all available data to determine which objectives have already been met, and (3) preparation of a suggested program of data collection and analysis to meet the remaining objectives.

DEFINITIONS

Gaging station: a particular site on a stream where systematic observations of gage height and discharge are obtained.

Discharge: the volumetric flow rate of a stream past a site on the stream. The discharge is given in units of cubic feet per second (cfs).

Drainage basin physical and climatic characteristics used in this report include and are defined as:

Drainage area (A): in square miles.

Main-channel slope (S): in feet per mile.

Stream length (L): in miles

Area of lakes and ponds (S_t): in percent of drainage area.

Mean basin elevation (E): in 1,000 feet above mean sea level.

Forested area (F): in percent of drainage area.

Area of glaciers (Gl): in percent of drainage area.

Mean annual precipitation (P): in inches, from U.S. Weather Bureau publication, "Climate of Alaska."

Precipitation intensity (I): expected in 24 hours each 2 years in inches, from U.S. Weather Bureau Technical Paper 49.

Mean minimum January temperature (t_1): in degrees F, from U.S. Weather Bureau publication, "Climate of Alaska."

Flow characteristics used in this report include and are defined as:

Mean annual flow (Q_a): in cubic feet per second, is the average of the annual flows.

Standard deviation of annual flow (SD_a): in cubic feet per second, is the square root of the sum of the squares of the deviations from the average annual flow divided by the number of annual flows.

Average monthly flow (q_n): in cubic feet per second, is the average flow for each month (q_1 for January, etc.).

Standard deviation of monthly flow (SD_n): in cubic feet per second, is the standard deviation of the average flows for each month.

Peak flow for n-year recurrence interval (Q_n): in cubic feet per second, is the peak flow that would recur, on the average, once in n years.

Minimum 7-day flow for n-year recurrence interval ($M_{7,n}$): in cubic feet per second, is the minimum average flow for 7 consecutive days that would recur, on the average, once in n years.

High flow volume ($V_{m,n}$): in cubic feet per second, is the highest average flow for m consecutive days that would recur, on the average, once in n years.

Downstream order: gaging stations are listed in the same downstream order used in the water-supply papers. Records are listed in a downstream direction along the main stem with all stations on a tributary entering above a main-stem station listed before that station. If a tributary enters between two main-stem stations, it is listed between them. A similar order is followed listing stations on first rank, second rank, and other ranks of tributaries.

Each complete record station and peak record station has been assigned a station number. Numbers increase in the downstream direction. Numbers are not consecutive so that intervening numbers may be assigned to new stations as they are established.

The general arrangement within Alaska is as follows:

Mainland streams between the Alaska-British Columbia border and longitude 141° W.

Island streams east of longitude 141° W. Listing is south to north and counter-clockwise around each island starting at the western-most point.

Streams tributary to the Pacific Ocean between longitude 141°W and the western tip of the Alaska Peninsula.

The Aleutian Islands.

Streams tributary to the Bering Sea and the Arctic Ocean ending at the Alaska-Yukon border.

The maps and tables in this report are keyed to the provisional map of the subregional breakdown of the State by the Water Resources Council.

Regulated stream: a stream in which the flow is artificially manipulated.

CONCEPTS AND PROCEDURES USED IN THIS STUDY

The principal concept of this study is that streamflow information may be needed at any point on any stream in Alaska, and that the program must be designed to accommodate this need. This information can be provided by a combination of data collection and hydrologic studies that generalize the data obtained at gaging sites. Available statistical techniques now enhance this procedure.

Another important concept is that the goals of the program, including accuracy goals, should be specifically identified. Identification of the goals permits evaluation of existing data to determine which goals have been accomplished and how the program should be modified to accomplish the remaining goals.

The procedures used in this study are those that have been adopted for standard use throughout the U.S. Geological Survey and are presented with reference to the general framework shown in table 1. Streamflow data are classified into four types:

1. Data serving current purposes of water management.
2. Data required for the planning and design of water projects.
3. Long-term streamflow data to define time trends.
4. Environmental data.

For the second type of data, streams are classified as natural or regulated and each of these classifications is further subdivided into principal or minor with the separation of the two occurring at a drainage area of 1,000 square miles. The need for each type of data and the methods of obtaining the data are described in the following sections.

Data for Current Use

Current information on streamflow is needed at many sites for day-by-day decisions on water management, for forecasting of flood hazards and of available supplies, or for the surveillance needed to meet legal requirements. Sites at which the needed data are collected are termed "current-purpose" streamflow stations.

Table 1. —*Framework for design of data collection program*

Type of data	Current use	Planning and Design				Long-term trends	Stream environment
		Natural Flow		Regulated Flow			
		Minor streams	Principal streams	Minor streams	Principal streams		
Goals	To provide current data on streamflow needed for day-by-day decisions on water management as required.	To provide information on statistical characteristics of flow at any site on any stream to the specified accuracy.				To provide a long-term data base of homogeneous records on natural-flow streams.	To describe the hydrologic environment of stream channels and drainage basins.
Drainage area limits	Full range	Less than 1000 sq mi.	Greater than 1000 sq mi.	Less than 1000 sq mi.	Greater than 1000 sq mi.	Full range	Full range
Accuracy goal	As required	Equivalent to 10 years of record.	Equivalent to 25 years of record.	Equivalent to 10 years of record.	Equivalent to 25 years of record.	Highest obtainable	As required
Approach	Operate gaging stations as required to provide specific information needed.	Relate flow characteristics to drainage basin characteristics using data for gaged basins.	Operate gaging stations to obtain 25 years of record (or the equivalent by correlation) at a network of points on principal streams; interpolate between points.	Develop generalized relations that account for the effect of storage, diversion or regulation on natural flow characteristics.	Utilize analytical model of stream system with observed data as input to compute homogeneous records for both natural flow conditions and present conditions of development.	Operate a number of carefully selected gaging stations indefinitely.	Observe and publish information on stream environment.
Evaluate available data	Identify stations where data is used currently and code the specific use of data.	Develop relationship for each flow characteristic and compare standard error with accuracy goal. Evaluate sample.	Lay out network of points on principal streams and compare data available at these points with goal.	Appraise type of regulation, data available, and areas where relationships are needed.	Identify stream systems that should be studied using model approach and determine data requirements.	Select two stations in each WRC subregion to operate indefinitely for this purpose.	Evaluate information available in relation to goals.
Design future program		Identify goals that have not been attained. Consider alternate means of attaining goals. Identify elements of future program.					

Data for current use are obtained by operating gaging stations to obtain the data specifically required for water-management systems. Current-purpose data stations are identified separately in this study because (1) justification can be related to specific needs; (2) the data may have little or no transfer value in a hydrologic sense; and (3) the locations of the stations, the accuracy requirements, and the period of operation are specified by the user of the data, who usually provides the financing.

This part of the program is not subject to design, but changes in response to the needs for data in water management.

Data for Planning and Design

Streamflow records form the principal basis for the planning and design of water-related facilities. Past hydrologic experience, however, is never precisely duplicated in the future; the exact sequence of wet and dry years probably will not recur. For this reason, designers and planners commonly utilize statistical characteristics of streamflow rather than the records of flow at specific times. Thus, the probability of occurrence of a flow of a given magnitude or other statistical parameter in the future can be approximated from the frequency of such occurrence in the past. Typical statistical characteristics are the mean flow, the flood of 50-year recurrence interval, and the standard deviation of annual mean flows.

A long record of streamflow at the specific site is the best basis for defining statistical characteristics of streamflow at that site. However, it is not feasible to collect a long, continuous streamflow record at every site where it may be needed. An alternative is to use a network of gaging stations to provide information that can be transferred to ungaged sites or to sites at which only limited streamflow data are available. The transfer of streamflow information on natural streams is done by relating flow characteristics to basin characteristics such as drainage area, topography, and climate; by relating a short record to a longer one; or by interpolating between gaged points on a stream channel. Thus, a data program designed to provide flow characteristics at any site in a region consists of operation of a representative network of gaging stations, collection of selected flow data at many other sites, and definition of the physical characteristics of basins above the gaging-station sites.

Accuracy Goals

In using past hydrologic experience to appraise the probability of future occurrences, some error must be tolerated. Natural streamflow is not truly random but, because of the great variation in time and space, such an assumption is reasonable. Therefore, many characteristics of natural streamflow can be interpreted in terms of statistical distributions. Estimates of the magnitude and frequency of occurrence of events of interest to the planner can then be studied, and the probable accuracy of the estimates can be appraised.

The principal measure of the accuracy with which a particular streamflow characteristic can be estimated is the "standard error of estimate," expressed in this report as "standard error"; a percentage of the average value of the characteristic. The standard error is the estimated limit, above and below the average, within which about 67 percent (that is, two in three) of future values of the characteristic are expected to fall, if all assumptions as to normality and randomness are sound. Conversely, one chance in three exists that any given future value of a characteristic will differ from the estimated value by more than one standard error.

In general, the longer the record, the more reliable are the estimates of probable future occurrences. However, even with a long record, say 50-100 years or more, it is not possible to determine with great precision the probability of certain flow characteristics; for example, floods of a given magnitude. The standard error of various streamflow parameters decreases with the years of available record, but at a decreasing rate; typical examples are shown in figure 1.

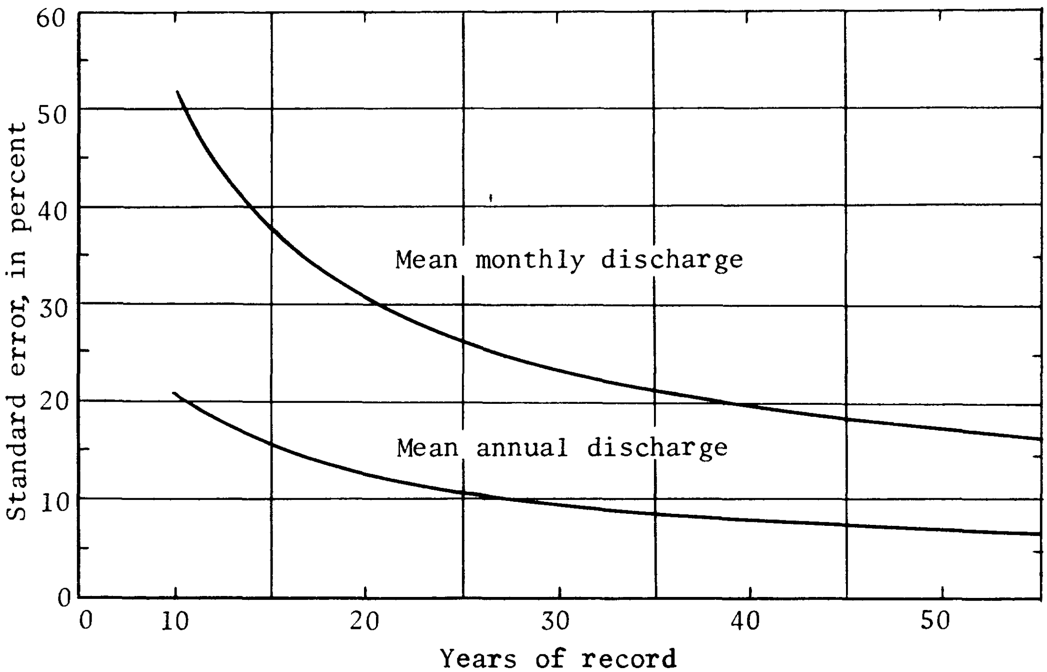

Figure 1.--Curve showing relation of standard error to length of record.

Long-Term Streamflow Data

Characteristics of streamflow defined from gaging-station records are used to estimate future-flow characteristics, on the assumption that the observed record is a representative sample of the long-term flows of the streams. To confirm this assumption, or to better define the ways in which the characteristics of flows change with time, selected gaging stations on natural streams should be operated indefinitely. No specific accuracy goal is assigned.

For these purposes, the stations should be placed on streams draining basins that have undergone no significant manmade changes and that are expected to remain so in the future. The stations should be well distributed areally and should be placed in basins having different physical characteristics.

Environmental Data

Environmental data describe the physical environment in which the water exists, especially those features related to recreation, waste disposal, conjunctive surface-water-ground-water supply, and preservation of the esthetic qualities of the water. The types of data required for this purpose are suggested by the following:

1. Geologic and hydraulic properties of the stream-aquifer systems.
2. Time of travel of solutes in stream channels.
3. Definition of flood profiles along stream channels.
4. Identification of flood plains of streams for floods of various frequencies.
5. Definition of stream and stream-channel properties, such as velocities, depths, bank vegetation, bed material, water temperature, water quality, and accessibility.
6. Effects of manmade changes in the environment on the quantity and quality of streamflow.
7. Character of the drainage basin, including area, vegetal cover, and land and channel slopes.
8. Climatic factors influencing the water supply.

GOALS OF ALASKA'S STREAMFLOW PROGRAM

The objective of the Alaska streamflow-data program is to provide information on flow at any point on any stream. Within this general objective, specific goals are set for each of the four types of data that represent the particular information that is needed. Acceptable accuracy levels are also specified because accuracy levels not only govern cost and techniques used in providing information, but also provide a measure of specific goals. The uses of streamflow information in planning, design, and operation of water-related facilities and activities are illustrated in table 2.

Data for Current Use

The program goal for this type of data is to provide the particular information needed at specific sites for current use. This part of the program is not subject to design in advance because demands change frequently in response to changing conditions. Accuracy goals at a given site depend on the requirements of a particular management system, and can be met by intensive observations or by more sophisticated instrumentation as needed.

Data for Planning and Design

The goal for this type of data is to define, using an appropriate accuracy, the statistical flow characteristics for all streams in Alaska. This includes not only all natural streams but also the few regulated streams.

Accuracy goals in this report are defined in terms of accuracy of statistical characteristics of streamflow, rather than accuracy of basic data such as individual discharge measurements or daily flows. Except for a few stations having unusual problems, accuracy of the basic data is adequate for use in determining statistical characteristics; accuracy of statistical characteristics is limited almost exclusively by the length of streamflow record.

Table 2.--Examples of surface-water information used in planning, design, and operation of water-related facilities and activities.

Problem	Subproblem	Surface-water information needed
Irrigation	Reservoir design, traditional method	Twenty or more years of monthly flows; monthly evaporation; peak-flow frequency.
	Reservoir design, simulation method	Mean and standard deviation of flows for each month, serial correlation of monthly flows, and a stochastic model; monthly evaporation; peak-flow frequency.
	Operation	Current records of inflow and outflow; reservoir contents.
Flood forecasting		Current records of streamflow and stage; stage-discharge relation; flood-routing coefficients; precipitation; deterministic model.
Flood control	Levees	Flood-peak-frequency curve; channel cross sections and profiles.
	Reservoir design	Flood-volume-frequency relation (storage required-frequency relation); flood-routing coefficients.
	Reservoir operation	Same as flood forecasting, plus peak-flow frequency for downstream uncontrolled areas; time of travel of flood wave (or routing coefficients).
	Zoning and insurance	Flood profiles; peak-stage frequency curves; velocity of overbank flow.
Highways	Bridge design	Peak-flow frequency; channel cross sections and profiles; stage-discharge relation.
	Grade design	Stage frequency and duration.
Municipal and industrial	Water supply	Low-flow frequency; storage requirements, peak-flow frequency; time of travel; synthetic streamflow records.
Recreation	Streams	Low-flow frequency; velocity; depth.
	Lakes	Peak-flow frequency; seepage; low-flow frequency.
Farm water supply	Design	Peak-flow frequency; low-flow frequency; storage requirements, seepage.

The principal measure of the accuracy with which a particular streamflow characteristic can be determined is the standard error, expressed in this report as a percentage of the estimated value of the characteristic. For flow characteristics (except standard deviations of annual and monthly flows) calculated from streamflow records at a particular site, the standard error can be calculated from a theoretical relation of standard error to variability index (standard deviation of the logarithms of the data) and number of years of record. For standard deviations of annual and monthly flows, the standard errors, in percent, can be calculated from the number of years of record.

The standard error of a streamflow characteristic decreases with years of available record, but at a decreasing rate as shown in table 3. For both natural and regulated principal streams, the importance and multiple uses of data justify a higher accuracy so the proposed goal is an accuracy equivalent to that obtained from 25 years of record. For the remaining streams, accuracy equivalent to that obtained from 10 years of record is proposed as the goal. The goals apply to both natural and regulated streams.

Long-Term Streamflow Data

The goal for this type of data is to operate indefinitely a small network of stations for streams that are expected to remain relatively free from manmade changes. One or two stations should be located in each major drainage area in the State, and the stations should gage streams having differing physical characteristics.

Environmental Data

Environmental data describe the flow and the stream channel in terms that will be valuable in planning the use of the stream for any purpose such as recreation, waste disposal, conjunctive surface-water-ground-water supply, and in guarding against water hazards. The long-range goals for this type of data in Alaska include those suggested on page 13.

Table 3.--Variability and accuracy of statistical characteristics of streamflow in Alaska.

Streamflow characteristic	Alaska average variability index	Standard error, in percent, for indicated length of record years				
		5	10	25	50	100
Mean annual flow	0.161	7	5	3	2.2	1.5
Standard deviation of annual flow	--	32	22	14	10	7
Mean monthly flow (average)	0.369	16	12	6	5	3.5
Standard deviation of monthly flow	--	32	22	14	10	7
50-year peak flow	0.165	30	22	14	10	7
50-year 7-day high flow	0.106	19	13	8	6	4
2-year 7-day low flow	0.171	17	12	8	5	4
20-year 7-day low flow	0.171	25	18	12	8	6

EVALUATION OF EXISTING DATA

In this evaluation, all available data are considered and analyzed in relation to program objectives. A separate evaluation is made for each of the four types of data.

Data for Current Use

The principal current uses of data are summarized in the following table for the 47 current-purpose gaging stations operated by the U.S. Geological Survey in Alaska.

Use of data	Number of stations
1. Assessment	12
2. Operation	15
3. Forecasting	10
4. Water-quality assessment	2
5. Research or special study	8

Many stations provide data for more than one current use and also provide data for planning and design. Gaging stations that are operated to satisfy the need for current-purpose data are listed and coded according to the specific use of data in table 4. If more than one use is made of the data, the first indicated is the principal one. The brackets around "C" and "H" in this table indicate that the station is no longer needed for this purpose.

The U.S. Weather Bureau also operates a hydrometric network of 19 flood-stage gages for flood forecasting in Alaska.

Table 4.--Gaging stations in operation and proposed for the network.

Column 1: B, benchmark or long-term-trend station.

Column 2: C, current-purpose station; (), station is no longer needed for the purpose indicated.

Columns 3-5: Purposes for which current-purpose station is operated; 1, assessment; 2, operation; 3, forecasting; 4, disposal; 5, water quality; 6, compact or legal; 7, research or special study.

Column 6: P, principal-stream station; H, hydrologic station except when classified as P; R, regulated stream; (), station is no longer needed for the purpose indicated.

Column 7: Effect of regulation on low and monthly flow for stations shown as C or R in column 2 or 6, respectively; 0, no appreciable effect; 1, no appreciable effect on daily flow (diurnal fluctuation only); 2, no appreciable effect on weekly flows; 3, monthly flow not affected by more than 10 percent of natural conditions; 4, low and monthly flow affected by undetermined amount.

Column 8: Effect of regulation on peak flow for stations shown as C or R in columns 2 or 6, respectively; 0, no appreciable effect; 1, annual peak flow affected by less than 10 percent; 2, annual peak flow affected by more than 10 percent; 3, annual peak flow affected by undetermined amount.

Column 9: Financing of stations; 1, federal, 2, cooperative program; 3, other federal agency; 4, federal and cooperative program; 5, federal and other federal agency; 6, cooperative program and other federal agency; 7, federal, cooperative program and other federal agency; 8, Federal Power Commission licensees.

Table 4.--Gaging stations in operation and proposed for the network.

Station no.	Station name	1	2	3	4	5	6	7	8	9
15-										
0080.00	Salmon R nr Hyder		C	7			H			3
0115.00	Red R nr Metlakatla						H			1
0120.00	Winstanley C nr Ketchikan						(H)			1
0156.00	Klahini R nr Bell Island		C	1			H			3
0220.00	Harding R nr Wrangell	B					H			1
0248.00	STIKINE R NR WRANGELL						P			1
0260.00	Cascade C nr Petersburg						(H)			1
0310.00	Long R ab Long Lake nr Juneau		C	5	7		H			3
0340.00	Long R nr Juneau		C	7			R	4	4	1
0360.00	Speel R nr Juneau						H			1
0412.00	TAKU R NR JUNEAU						P			1
0480.00	Sheep C nr Juneau		C	1			(H)			1
0500.00	Gold C at Juneau						(H)			1
0520.00	Lemon C nr Juneau		(C)	7			H			1
0525.00	Mendenhall R nr Auke Bay		C	7			H			2
0528.00	Montana C nr Auke Bay		C	7			H			2
0538.00	Lake C at Auke Bay		C	7			H			3
0540.00	Auke C at Auke Bay		C	7			H			3
0542.00	Herbert R nr Auke Bay						H			2
0546.00	BRIDGET COVE TRIB NR AUKE BAY						H			3
0549.00	Davies C nr Auke Bay						H			2
0561.00	Skagway R at Skagway						H			3
0562.00	West C nr Skagway						H			1
0562.10	Taiya R nr Skagway						H			3
0565.00	CHILKAT R NR KLUKWAN						P			1
0595.00	Whipple C nr Ward Cove		C	1			H			3
0720.00	Fish C nr Ketchikan	<u>B</u>					(H)			1
0815.00	Staney C nr Craig						H			1
0818.00	North Branch Trocadero C nr Hydaburg		C	1			H			3
0851.00	Old Tom C nr Kasaan						(H)			1
0866.00	Big Creek nr Point Baker						H			3
0934.00	Sashin C nr Big Port Walter		C	2						3
0936.00	E B Lovers Cove nr Big Port Walter		C	2	7					3
0980.00	Baranof R at Baranof						(H)			1
1069.20	Kadashan R ab Hook C nr Tenakee		C	2	7		H			3
1069.40	Hook C ab trib nr Tenakee		C	2	7		H			3
1069.60	Hook C ab Kadashan R nr Tenakee		C	2	7		H			3
1069.80	Tonalite C nr Tenakee		C	2	7		H			3
1070.00	Kadashan R nr Tenakee						H			1
1080.00	Pavlof R nr Tenakee						H			1

NOTE: Stations in all capital letters are new proposed stations. Underline of code letter indicates proposed new purpose of existing station.

Table 4.--Gaging stations in operation and proposed for the network--continued.

Station no.	Station name	1	2	3	4	5	6	7	8	9
15-										
1086.00	Hilda C nr Douglas						H			2
1088.00	Lawson C at Douglas		C	2	7		H			2
1090.00	Fish C nr Auke Bay						H			1
1210.00	ALSEK R NR YAKUTAT						P			1
1950.00	Dick C nr Cordova						H			3
2000.00	GAKONA R AT GAKONA		C	1						1
2002.00	GULKANA R NR PAXSON		C	1			H			1
2003.00	SOURDOUGH C AT SOURDOUGH		C	1			H			1
2004.00	GULKANA R NR GULKANA		C	1			P			1
2010.00	DRY C NR GLENNALLEN						H			1
2020.00	Tazlina R nr Glennallen						P			1
2060.00	KLUTINA R AT COPPER CENTER		C	1						1
2080.00	Tonsina R at Tonsina						(H)			1
2081.00	Squirrel C at Tonsina	B̲					H			2
2082.00	ROCK C NR TONSINA						H			1
2119.00	CHITINA R NR CHITINA						P			1
2120.00	Copper R nr Chitina						P			1
2160.00	Power C nr Cordova	B̲					(H)			1
2190.00	W F Olsen Bay C nr Cordova		(C)	7			H			3
2260.00	SOLOMON GULCH NR VALDEZ						H			1
2369.00	Wolverine C nr Lawing		C	1	7		H			1
2370.00	NELLIE JUAN R NR HUNTER						H			1
2386.00	Spruce C nr Seward						H			3
2387.00	NUKA R NR HOMER						H			3
2390.00	Bradley R nr Homer		C	1			(H)			3
2395.00	Fritz C nr Homer						H			1
2399.00	Anchor R nr Anchor Point						H			2
2416.00	Ninilchik R at Ninilchik		C	5	7		H			3
2420.00	Kasilof R nr Kasilof						(H)			1
2480.00	Trail R nr Lawing	B̲					(H)			1
2580.00	Kenai R at Cooper Landing		C	1			P			1
2663.00	Kenai R at Soldotna						P			3
2665.00	Beaver C at Kenai						H			2
2679.00	Resurrection C nr Hope						H			3
2725.30	CALIFORNIA C AT GIRDWOOD						H			1
2725.50	Glacier C nr Girdwood						H			3
2739.00	S F Campbell C at Canyon Mouth nr Anchorage		C	1	7		H			2
2740.00	S F Campbell C nr Anchorage		C	1	7		(H)			2
2746.00	Campbell C nr Spenard						H			3
2750.00	Chester C at Anchorage						H			2

NOTE: Stations in all capital letters are new proposed stations. Underline of code letter indicates proposed new purpose of existing station.

Table 4.--Gaging stations in operation and proposed for the network --continued.

Station no.	Station name	1	2	3	4	5	6	7	8	9
15-										
2751.00	Chester C at Arctic Blvd nr Anchorage		C	2	1		H			3
2760.00	Ship C nr Anchorage						(H)			2
2765.00	Ship C at Elmendorf AFB nr Anchorage		C	2	1					2
2766.00	SHIP C AT POST ROAD NR ANCHORAGE		C	2						3
2771.00	Eagle R at Eagle River						H			2
2810.00	Knik R nr Palmer						P			3
2820.00	Caribou C nr Sutton						H			1
2824.00	PURITAN C NR SUTTON						H			1
2840.00	Matanuska R at Palmer						P			1
2860.00	COTTONWOOD C NR WASILLA						H			1
2900.00	L Susitna R nr Palmer		C	1			(H)			1
2910.00	Susitna R nr Denali						P			3
2912.00	Maclaren R nr Paxson						H			1
2915.00	Susitna R nr Cantwell						P			3
2920.00	Susitna R at Gold Creek						P			1
2924.00	Chulitna R nr Talkeetna						P			1
2927.00	Talkeetna R nr Talkeetna	B					P			3
2930.00	CASWELL C NR CASWELL						H			1
2943.30	YENTNA R NR SUSITNA STATION						P			1
2943.50	SUSITNA R AT SUSITNA STATION						P			1
2941.00	KROTO C NR WILLOW						H			1
2943.00	Skwentna R nr Skwentna						P			1
2945.00	Chakachatna R nr Tyonek						P			1
2955.00	L KITOI C NR AFOGNAK						H			1
2956.00	TERROR R NR KODIAK						H			1
2960.00	Uganik R nr Kodiak	B					H			1
2963.00	SPIRADON L O NR LARSEN BAY						H			1
2970.00	DOG SALMON C NR AYAKULIK						H			1
2972.00	Myrtle C nr Kodiak						H			2
2975.10	CHIGNIK R NR CHIGNIK						H			1
2976.40	Limpet C on Amchitka Island		C	2	7		H			3
2976.50	Falls C on Amchitka Island		C	2	7		H			3
2976.55	Clevenger C on Amchitka Island		C	2	7		H			3
2976.60	Constantine Spring on Amchitka Island		C	2	7					3
2976.80	Bridge C on Amchitka Island		C	2	7		H			3
2976.90	White Alice C on Amchitka Island		C	2	7		H			3
2977.00	ESKIMO C AT KING SALMON						H			1
2977.10	LAKE C ON SHEMYA ISLAND						H			3
2977.13	SAND C ON SHEMYA ISLAND						H			3
2977.16	GALLERY C ON SHEMYA ISLAND						H			3

NOTE:. Stations in all capital letters are new proposed stations. Underline of code letter indicates proposed new purpose of existing station.

Table 4.--Gaging stations in operation and proposed for the network--continued.

Station no.	Station name	1	2	3	4	5	6	7	8	9
15-										
2978.20	UGASHIK R NR UGASHIK						P			1
2980.00	TANALIAN R NR PORT ALSWORTH						H			1
3000.00	NEWHALEN R NR ILIAMNA						P			1
3005.00	Kvichak R at Igiugig						P			1
3020.00	Nuyakuk R nr Dillingham						P			1
3021.20	NUSHAGAK R AT NEW KOLIGANEK		C	3			P			1
3028.00	GRANT L O NR ALEKNAGIK						H			1
3029.00	MOODY C AT ALEKNAGIK						H			1
3030.00	Wood R at Aleknagik						P			1
3030.10	SILVER SALMON C NR ALEKNAGIK						H			1
3036.00	Kuskokwim R at McGrath		C	3			P			3
3038.00	HOLITNA R. NR SLEETMUTE						P			1
3040.00	Kuskokwim R at Crooked Creek		C	3			P			1
3059.00	DENNISON FORK NR TETLIN JUNCTION						H			1
3059.20	W F TRIB NR TETLIN JUNCTION						H			1
3059.50	TAYLOR C NR CHICKEN						H			1
3060.00	DENNISON FORK NR CHICKEN						P			1
3480.00	FORTYMILE R AT STEEL CREEK						P			1
3500.00	STEEL C AT STEEL CREEK						H			1
3560.00	Yukon R at Eagle						P			3
3890.00	Porcupine R nr Fort Yukon						P			3
3892.00	BLACK R AT CHALKYITSIK						P			1
3893.50	EAST FORK CHANDALAR R NR VENETIE						P			1
3895.00	Chandalar R nr Venetie						P			3
4385.00	BEDROCK C NR MILLER HOUSE						H			1
4398.00	Boulder C nr Central						H			2
4530.00	YUKON R NR STEVENS VILLAGE						P			1
4578.00	Hess C nr Stevens Village		C	1			H			1
4699.00	SILVER C NR NORTHWAY JUNCTION						H			1
4700.00	Chisana R at Northway Junction						P			1
4715.00	TANANA R TRIB NR TETLIN JUNCTION						H			1
4760.00	Tanana R nr Tanacross						P			1
4763.00	Berry C nr Dot Lake						H			2
4780.40	Phelan C nr Paxson		C	1	7		H			1
4810.00	Tanana R nr Harding Lake		C	3						3
4840.00	Salcha R nr Salchaket		C	3			P			3
4860.00	MOOSE C AT EIELSON AFB NR FAIRBANKS						H			1
4870.00	W F CHENA R NR CHENA HOT SPRINGS		C	2			H			3
4923.00	N F CHENA R NR CHENA HOT SPRINGS		C	2			H			3
4927.00	E F CHENA R NR CHENA HOT SPRINGS		C	2			H			3

NOTE: Stations in all capital letters are new proposed stations. Underline of code letter indicates proposed new purpose of existing station.

Table 4.--Gaging stations in operation and proposed for the network--concluded.

Station no.	Station name	1	2	3	4	5	6	7	8	9
15-										
4930.00	Chena R nr Two Rivers		C	3			P			3
4933.00	S F CHENA R NR TWO RIVERS		C	2			H			3
5110.00	L Chena R nr Fairbanks		C	3			H			3
5140.00	Chena R at Fairbanks		C	3			P			3
5145.00	Wood R nr Fairbanks						H			3
5155.00	Tanana R at Nenana		C	3			P			3
5158.00	Seattle C nr Cantwell						H			2
5160.00	Nenana R nr Windy						P			3
5180.00	Nenana R nr Healy						P			1
5183.50	Teklanika R nr Lignite						H			1
5350.00	Caribou C nr Chatanika	B					H			1
5470.00	KANTISHNA R NR TOKLAT						P			1
5644.00	NOWITNA R NR RUBY						P			1
5646.00	Melozitna R nr Ruby						P			3
5648.00	Yukon R at Ruby						P			3
5648.70	DIETRICH R NR BETTLES		C	1			H			1
5648.75	M F KOYUKUK R NR WISEMAN		C	1			H			1
5648.85	JIM R NR BETTLES		C	1			H			1
5649.00	Koyukuk R nr Hughes		C	3			P			3
5656.30	INNOKO R AT SHAGELUK						P			1
6140.00	NOME R NR NOME						H			1
6210.00	Snake R nr Nome	B					H			3
6682.00	CRATER C NR NOME						H			1
7120.00	Kuzitrin R nr Nome						P			3
7440.00	Kobuk R at Ambler		C	3			P			3
7460.00	Noatak R at Noatak						P			3
8750.00	COLVILLE R AT UMIAT						P			3
8960.00	Kuparuk R nr Deadhorse						H			1
8967.00	Putuligayuk R nr Deadhorse						H			1
9100.00	SAGAVANIRKTOK R NR GALBRAITH LAKE		C	1			P			1
9150.00	ATIGUN R NR GALBRAITH LAKE		C	1			H			1
9200.00	SAGAVANIRKTOK R NR SAGWON						P			1

NOTE: Stations in all capital letters are new proposed stations. Underline of code letter indicates proposed new purpose of existing station.

Data for Planning and Design

The statistical characteristics of streamflow can be defined by sample gaging, analytical methods of generalization, systems approach, or by any combination of the three. To determine how well the goals for this type of data can be met using existing information, all available data were considered and analyzed. The following discussion conforms to the framework shown in figure 1.

Minor Streams having Natural Flow

Because of the large number of minor streams, some method of regionalization of available data must be used to define the flow characteristics of ungaged streams. The most effective means of regionalization presently known, and the one that should lead most rapidly to the general definition of streamflow characteristics, is the multiple-regression method. It defines streamflow in terms of the environment; that is, in terms of the basin characteristics and climatic characteristics that cause variation of streamflow from one place to another (Benson, 1962; Benson, 1964). The regresssion equation used has the form

$$Y = a \cdot A^{b} \cdot S^{c} \cdot P^{d}$$

where Y is a streamflow characteristic and A, S, P... are basin or climatic characteristics. The constants a, b, c... are determined by a standard statistical procedure, using data from stations at which the streamflow characteristics are well defined.

Once the equation and its constants are defined, streamflow characteristics for a specific site in a given basin can be approximated by substituting the appropriate values of the hydrologic variables in the formulas.

This study of the stream-gaging program in Alaska has shown that most of the streamgaging has been done to provide data for planning and design of a specific project on a specific stream. The U.S. Geological Survey operated the stations and included them as part of the general hydrologic coverage of Alaska, but did not systematically design a regional network. Some stations were operated long after they had provided adequate information but, on the other hand, most areas of the State and many kinds of hydrologic conditions were totally unsampled.

Data from 63 complete-record gaging stations in Alaska and from 12 stations in Canada on streams flowing into Alaska were analyzed. These records were selected to include all stations on unregulated streams having a minimum of 10 years of record. Annual peak-discharge records for 183 stations having a minimum of 5 water years of record were used in this study. The gaging stations used in the analyses and the values of the physical and climatic characteristics of their drainage basins are listed in table 5. Also shown are the values of a selected set of flow characteristics as computed from the station records. These characteristics are given in the definitions. The complete set of all flow characteristics for all the stations is available for reference in the Alaska District Office in Anchorage.

The results of the regression analyses are shown in table 6. Equations that relate each flow characteristic to significant physical and climatic characteristics are defined. The standard error of estimate for each equation is also given. For example, the relation for the mean annual flow is

$$Q_a = 0.245 \cdot A^{0.91} \cdot (Gl+1)^{0.16} \cdot P^{0.81}$$

The standard error of estimate is 39 percent. The regression equations can be used to estimate the flow characteristics for any site on any stream by substituting the appropriate values of the hydrologic variables in the formulas. The standard errors achieved in the regression are compared with the accuracy goals for each flow characteristic in table 7. None of the accuracy goals are met.

Table 5.--Basin characteristics and selected streamflow characteristics.

Station no.	A	S	L	St	E	G	P	$I_{24,2}$	Q_a	Q_2	Q_{50}	$M_{30,2}$	$V_{15,50}$
						SOUTHEAST SUBREGION							
15-0080.00	84	70	4.0	5	3.60	33	80	4	-	15,500	-	-	-
100.00	80	197	14.5	0	3.40	12	80	5	920	11,700	-	73.3	3,0[illegible]
105.00	8.58	375	5.5	0	2.14	0	80	5	-	1,970	-	-	-
115.00	45.3	107	10.7	0	1.70	0	90	5	-	7,930	-	-	-
120.00	15.5	130	7.6	.5	1.73	0	95	7	160	1,140	3,620	30.2	717
140.00	12	12.6	5.7	27	1.31	0	100	7	-	493	-	-	-
180.00	18	315	6.1	11	.17	0	120	5	-	1,980	-	-	-
190.00	16.5	114	6.2	2	1.07	0	140	4	-	2,480	-	-	-
201.00	16.1	254	8.4	4	2.62	2	110	5	-	1,280	-	-	-
220.00	67.4	857	18.8	0	2.40	10	120	7	744	6,710	-	105	3,230
260.00	23	30.6	9.8	4	3.16	0	100	4	251	1,620	3,240	27.2	997
300.00	27	59	13.5	7	2.11	1	80	4	-	2,280	-	-	-
340.00	32.5	161	11.1	9	2.40	23	52	6	463	3,110	6,980	49.1	1,800
360.00	226	148	17	0	3.10	26	50	6	2,730	18,800	-	216	14,200
380.00	11.4	248	5.0	1	2.59	29	80	4	-	1,950	-	-	-
400.00	15.2	234	8.5	15	3.10	17	100	5	143	840	1,970	14.8	655
420.00	22.3	246	7.6	0	2.30	12	100	3	-	4,530	-	-	-
440.00	24.3	219	8.5	0	2.20	11	100	3	340	3,810	-	21.0	1,300
480.00	4.57	232	3.4	0	1.90	2	100	3	48.9	464	947	5.09	236
500.00	9.76	541	4.9	0	2.40	9	100	3	103	1,240	2,910	3.2	535
520.00	12.1	500	5.3	0	3.43	68	100	3	155	1,520	-	3.12	964
538.00	2.5	555	3.6	0	1.17	0	100	3	-	671	-	-	-
540.00	3.96	536	3.6	0	1.20	0	120	5	-	170	-	-	-
561.00	145	192	19.0	0	3.90	18	60	5	-	3,520	-	-	-
562.00	43.2	439	12.1	0	3.40	27	40	5	-	2,010	-	-	-
564.00	190	17.3	23.0	1	4.82	37	120	6	-	8,150	-	-	-
580.00	6.8	0	4.2	37	.86	0	90	5	-	480	-	-	-
600.00	2.81	540	2.0	11	1.34	0	150	5	37.2	439	678	6.03	166
620.00	14.0	276	6.1	7	1.04	0	150	5	-	1,350	-	-	-
640.00	13.5	164	6.5	9	1.28	0	150	5	-	2,490	-	-	-
660.00	5.8	312	4.2	9	1.63	0	150	5	-	1,210	-	-	-
680.00	5.7	770	4.2	9	1.68	0	150	5	109	1,320	-	175	437
700.00	36.5	51	12.3	6	1.80	0	150	5	460	3,130	5,410	89.3	1,950
720.00	32.1	40.6	16.3	19	1.30	0	150	5	427	2,860	4,900	92.6	2,370
722.00	18.6	35.7	7.4	10	.72	0	150	5	-	2,910	-	-	-
740.00	19.7	115	8.1	16	.90	0	150	5	244	1,180	-	50.7	1,010
760.00	33.9	40	10.1	12	1.30	0	160	5	476	2,830	4,770	155	1,820
780.00	30.2	133	13	10	1.50	0	160	5	420	2,810	-	102	1,580
798.00	5.96	345	3.9	0	1.40	0	120	7	-	791	-	-	-
800.00	59	45.2	19.4	3	1.70	0	120	7	-	4,690	-	-	-
820.00	5.7	235	5.2	21	1.60	0	120	5	-	328	-	-	-
840.00	3.9	675	2.1	5	.90	0	140	5	-	205	-	-	-
851.00	5.9	351	5.5	8	1.00	0	120	5	37.1	629	-	5.61	185
852.00	16.8	195	5.4	1	1.20	0	120	5	-	1,740	-	-	-
856.00	8.82	292	5.4	0	1.00	0	160	5	85.8	1,980	-	8.17	422
857.00	28.7	51	13.1	0	1.40	0	160	5	256	4,640	-	43.8	1,280
858.00	15.1	125	6.4	0	1.12	0	160	5	136	2,200	-	23.9	710
860.00	49.5	28.4	13.6	6	1.00	0	160	5	-	3,310	-	-	-
865.00	17	115	7.1	11	.50	0	80	4	-	1,060	-	-	-
866.00	11.2	82.9	5.3	9	6.80	0	80	4	-	1,200	-	-	-
880.00	39	95.5	11.2	3	2.40	3	120	6	477	3,980	8,280	68	1,920
920.00	26	25.2	13.4	15	1.50	0	160	6	-	1,950	-	-	-
940.00	7.41	33.7	5.4	24	1.30	0	160	6	155	559	-	50.5	642
980.00	32	93.8	12.1	9	2.00	13	120	6	438	2,760	-	59.9	1,440
1000.00	17.5	446	7.4	7	2.30	20	120	6	266	2,220	-	32.8	1,130
1020.00	56.2	21.4	12.5	11	1.20	1	160	4	322	1,360	-	83.4	1,040
1080.00	24.3	27.8	9.7	1	.90	0	110	4	170	1,830	-	35.8	680
1090.00	13.6	289	6.9	0	1.60	0	100	3	79.2	1,550	-	10.6	348
						SOUTH-CENTRAL SUBREGION							
2000.00	620	35.9	78	8	3.03	8	12	3	907	5,040	-	86.8	5,720
2010.00	11.4	28	14.2	9	1.70	0	12	1.5	-	100	-	-	-
2019.00	7.12	31.2	8.6	35	1.60	0	12	1.5	-	51.5	-	-	-
2020.00	2,670	43.5	84	5	3.45	12	20	3	4,200	25,600	-	280	30,600
2060.00	880	16.1	62	4	3.50	12	18	1.5	1,720	7,030	-	181	8,110
2080.00	420	71	46	4	3.60	12	19	1.5	888	5,340	-	85.1	6,340
2081.00	70.5	119	17.9	4	3.10	0	60	3	-	439	-	-	-
2120.00	20,600	14.4	178.4	0	3.62	18	24	2	37,400	154,000	-	4,200	158,000
2125.00	9.8	538	4.7	29	4.30	0	24	2	-	169	-	-	-
2160.00	20.5	219	11	0	2.00	33	100	5	249	2,870	6,330	29.1	1,460
2191.00	4.22	381	2.8	0	1.20	0	80	5	-	387	-	-	-
2260.00	19	343	9.5	2	2.40	29	80	5	-	1,600	-	-	-
2380.00	7.96	246	8.1	2	2.21	0	80	5	-	271	-	-	-
2390.00	54	191	13.3	6	2.80	37	32	5	390	2,530	-	31.1	2,100
2400.00	226	51	28	4	.97	0	26	2.5	299	1,880	-	88.7	2,000
2416.00	131	12.7	21	6	.67	0	25	2.5	-	470	-	-	-
2420.00	738	68.3	55	17	1.81	29	26	2	2,420	8,130	-	460	12,200

Table 5.--Basin characteristics and selected streamflow characteristics--continued.

Station no.	A	S	L	St	E	G	P	$I_{24,2}$	Q_a	Q_2	Q_{50}	$M_{30,2}$	$V_{15,50}$
SOUTH-CENTRAL SUBREGION--continued													
15-2439.00	16.8	316	7.4	0	2.30	5	80	5	-	641	-	-	-
2440.00	32.6	220	14.6	6	2.80	13	80	5	111	528	-	13.2	748
2460.00	44.2	460	12.8	10	2.90	19	80	5	193	911	-	17.4	1,450
2480.00	181	89	28	2	2.47	12	80	6	791	3,500	7,630	81.4	3,980
2540.00	31.7	136	14.7	13	2.70	0	80	5	75.8	296	-	16.4	486
2580.00	634	268	60	5	2.65	11	40	3	2,740	10,300	23,000	321	14,800
2600.00	31.8	194	9.9	16	2.40	6	60	3	-	293	-	-	-
2605.00	8.6	459	4.8	0	3.20	0	60	3	-	174	-	-	-
2610.00	48	74.1	13.5	10	2.50	4	60	3	-	402	-	-	-
2640.00	61.8	116	23.5	8	2.10	13	60	3	-	460	-	-	-
2701.00	6.03	409	5.9	0	3.20	0	80	5	-	78	-	-	-
2740.00	30.4	246	11.5	0	2.53	0	13	1.5	39.6	207	841	7.02	239
2750.00	20	226	11.4	9	.80	0	13	1.5	-	64	-	-	-
2760.00	90.5	119	19	0	3.10	0	17	2	149	852	1,760	14.0	887
2765.00	113	121	23	0	2.60	0	17	2	-	687	-	-	-
2800.00	119	265	18	3	3.70	18	12	1.5	-	1,500	-	-	-
2810.00	1,180	183	43	4	4.00	55	12	1.5	-	236,000	-	-	-
2820.00	289	13.6	30	0	4.19	0	12	1.5	322	4,490	-	18.3	4,660
2824.00	8.51	679	3.7	0	3.00	0	12	1.5	-	17	-	-	-
2840.00	2,070	79.7	77	0	4.00	13	18	1.5	3,990	23,500	40,600	461	20,000
2860.00	28.5	44	11.4	10	.50	0	20	1.5	-	32	-	-	-
2900.00	61.9	187	14.9	0	3.70	5	20	1.5	209	2,030	5,230	16.0	1,690
2910.00	950	56.6	51	0	4.51	26	24	2	-	15,100	-	-	-
2912.00	280	133	23	1	4.52	20	20	1.5	-	5,980	-	-	-
2915.00	4,140	10	107	0	3.56	7	24	1.5	-	35,200	-	-	-
2920.00	6,160	10.2	189	0	3.42	5	25	2	10,100	49,300	-	990	63,600
2924.00	2,570	23	87	1	3.76	28	18	1.6	-	38,700	-	-	-
2928.00	164	114	25	0	1.93	0	28	2.2	-	3,560	-	-	-
2930.00	19.6	53.8	12.3	21	.40	0	28	1.5	-	111	-	-	-
2943.00	2,250	30.6	98	5	2.81	17	20	2	-	32,900	-	-	-
2945.00	1,120	48.8	54.5	4	3.90	31	22	2	-	16,300	-	-	-
2956.00	15	126	8.9	3	2.30	1	60	3	-	2,230	-	-	-
2960.00	123	31.2	23	3	1.83	0	60	3	639	5,740	-	98.3	3,570
2972.00	4.74	105	5.1	0	.70	0	60	3	-	794	-	-	-
SOUTHWEST SUBREGION													
2980.00	200	54	28	4	2.70	6	24	3	-	2,810	-	-	-
3000.00	3,300	5.7	106	8	2.16	8	23	3	9,350	27,200	-	1,600	33,800
3020.00	1,490	12.5	76	16	1.10	0	26	3	5,760	18,300	-	1,530	27,300
3030.00	1,110	1.35	92	25	.69	0	26	3	4,710	13,000	-	1,290	22,700
3036.00	11,700	2.39	251	4	1.85	0	16	1.5	-	56,700	-	-	-
3040.00	31,100	1.14	456	3	1.48	1	18	1.5	44,900	177,000	-	9,870	329,000
YUKON SUBREGION													
3059.00	2.93	187	2.1	0	3.00	0	12	1.5	-	34	-	-	-
3560.00	113,500	2.49	657	1	3.34	3	12	1.0	80,800	297,000	-	14,300	586,000
3895.00	9,330	9.9	208	0	3.16	1	8	1.3	-	50,200	-	-	-
4680.00	199,400	2.31	1,024	5	2.81	2	11	1.0	129,000	540,000	-	17,100	1,010,000
4700.00	3,280	25.40	121	0	3.73	0	12	1.3	2,360	7,720	-	726	9,660
4739.50	37.1	225	12.6	0	4.30	0	12	3	-	416	-	-	-
4760.00	8,550	8.93	230	1	3.86	0	11	1.5	8,000	28,900	-	2,100	31,600
4760.50	3.32	828	4.2	0	3.30	0	10	3	-	113	-	-	-
4762.00	11	169	7.1	4	2.00	0	12	3	-	103	-	-	-
4763.00	65.1	223	19.1	1	3.20	5	12	3	-	774	-	-	-
4764.00	57.6	185	12.9	4	3.10	0	12	3	-	1,090	-	-	-
4780.00	13,500	2.78	346	2	3.44	6	11	1.5	-	48,900	-	-	-
4780.10	50.3	74	12.8	1	4.20	10	20	2	-	839	-	-	-
4785.00	5.32	351	5.7	0	3.30	0	12	1.5	-	98	-	-	-
4840.00	2,170	19.4	124	2	2.52	0	12	1.6	1,800	19,700	-	163	22,900
5140.00	1,980	12.6	119	2	1.77	0	12	1.3	1,490	10,500	57,900	243	14,400
5155.00	27,500	4.12	489	6	3.92	6	11	1.4	-	85,000	-	-	-
5158.00	36.2	169	10.2	2	3.40	0	12	1.5	-	1,130	-	-	-
5160.00	710	48.7	52	0	3.47	2	16	2	1,240	6,990	-	162	7,150
5180.00	1,910	21.2	88	0	3.50	4	14	1.5	3,740	22,800	-	415	21,500
5190.00	12.6	88	5.9	0	1.00	0	12	1.0	-	446	-	-	-
5300.00	61.1	95.2	16.8	0	2.80	0	12	1.8	-	1,030	-	-	-
5646.00	2,693	2.9	184	3	1.41	0	14	1.3	-	22,700	-	-	-
5648.00	259,000	2.03	1,212	5	2.64	1	12	1.0	165,000	654,000	-	8,450	1,040,000
5649.00	18,700	18.8	262	4	2.20	0	13	1.5	-	162,000	-	-	-
NORTHWEST SUBREGION													
7120.00	1,720	20.2	68	16	.70	0	14	1.4	-	17,100	-	-	-

Table 5.--Basin characteristics and selected streamflow characteristics--concluded.

Station no.	A	S	L	St	E	G	P	$I_{24,2}$	Q_a	Q_2	Q_{50}	$M_{30,2}$	$V_{15,50}$
							CANADA						
15-0242.00	1,360	41	72	0	4.80	2	18	1.2	-	15,600	-	-	-
243.00	7,300	5.6	166	0	4.30	0	16	1.0	-	55,600	-	-	-
244.00	616	63	49	0	3.90	0	16	1.0	-	4,260	-	-	-
245.00	1,360	28	98	1	3.80	0	13	1.0	-	15,000	-	-	-
246.00	11,300	15.5	224	0	4.20	0	20	1.3	-	93,400	-	-	-
247.00	3,610	22.7	140	1	3.50	6	32	2.5	-	72,300	-	-	-
410.00	770	69.4	58	2	4.80	45	20	1.5	-	2,110	-	-	-
411.00	6,000	15.8	155	1	3.80	4	20	1.3	-	50,800	-	-	-
1200.00	1,620	12.6	106	4	4.10	0	12	1.0	519	2,520	-	135	4,270
1202.00	249	32	27	8	4.20	0	12	1.0	-	1,620	-	-	-
1205.00	3,200	10.3	130	5	3.90	0	12	1.0	1,590	6,270	-	434	9,220
3045.20	650	18	35	4	3.20	0	12	1.0	-	317	-	-	-
3045.50	269	32.3	33	27	4.40	0	16	1.0	-	559	-	-	-
3046.00	2,520	7.5	70	9	3.50	6	16	1.0	3,210	7,930	-	931	10,700
3046.50	104	67	24	5	4.40	10	20	1.5	-	1,230	-	-	-
3047.00	289	89	33	5	4.60	16	20	1.5	-	3,710	-	-	-
3047.50	366	38	42	6	4.00	1	12	1.0	-	2,180	-	-	-
3048.00	92	230	16	3	3.90	9	20	1.0	361	1,750	-	20.2	1,880
3048.50	337	50	40	0	4.50	0	12	1.0	-	1,570	-	-	-
3049.20	31	140	12.5	0	3.30	0	12	1.0	-	45	-	-	-
3049.50	597	47	36	1	3.50	0	12	1.0	-	1,950	-	-	-
3050.00	7,500	.4	184	7	3.80	5	12	1.0	8,590	18,800	23,500	2,350	23,300
3050.30	1,570	14.3	75	6	4.60	5	12	1.0	-	7,320	-	-	-
3050.50	2,640	10.6	107	4	4.40	3	12	1.0	2,230	8,010	16,000	340	13,900
3051.00	12,000	.7	252	6	3.80	4	12	1.0	11,500	24,900	-	3,600	30,800
3051.50	1,280	24.5	61	1	4.30	0	14	1.0	-	8,120	-	-	-
3052.00	737	7.8	49	5	4.00	0	12	1.0	-	1,880	-	-	-
3052.50	11,700	6.3	180	3	3.80	0	13	1.0	10,700	37,500	69,800	2,360	69,600
3052.60	13,700	4.6	276	2	3.80	0	13	1.0	-	41,700	-	-	-
3053.00	2,640	7.5	112	2	4.10	0	14	1.0	-	9,790	-	-	-
3053.50	33,600	1.8	364	4	4.00	1	12	1.0	26,400	66,800	-	7,230	110,000
3053.90	2,800	10.1	144	3	3.80	0	17	1.0	-	16,700	-	-	-
3054.00	7,670	9.5	162	1	3.90	0	16	1.0	7,070	38,200	-	1,580	153,000
3054.20	19,700	5.9	340	1	3.70	0	17	1.0	-	71,100	-	-	-
3054.50	58,400	2.0	520	3	3.80	1	13	1.0	-	145,000	-	-	-
3055.00	2,500	66	107	7	5.00	12	16	1.0	-	9,270	-	-	-
3055.90	12,100	7.8	276	1	4.10	0	14	1.0	13,600	80,700	147,000	1,120	131,000
3056.20	13,500	6.5	308	1	3.90	0	14	1.0	-	90,500	-	-	-
3056.50	19,700	4.5	420	1	3.60	0	13	1.0	-	85,400	-	-	-
3056.70	97,300	2.0	547	2	4.00	2	15	1.2	-	267,000	-	-	-
3057.00	106,000	2.1	603	2	3.90	2	15	1.1	78,400	255,000	495,000	14,400	501,000
3889.50	20,900	5.3	304	1	1.90	0	9	1.0	-	171,000	-	-	-

Table 6--Summary of Regression Equations

Model is $Y = aA^{b_1}S^{b_2}L^{b_3}(St+1)^{b_4}E^{b_5}(Gl+1)^{b_6}P^{b_7}I_{24,2}^{b_8}$

Dependent variable	Regression constant	Regression coefficients and independent variables								Standard error of estimate (percent)
Y	a	b_1	b_2	b_3	b_4	b_5	b_6	b_7	b_8	
Q_a	.245	.91					.16	.81		39
SD_a	.126	.90						.45	.36	39
q_1	.171	.85	-.16			-.58		1.01		53
q_2	.120	.88	-.15			-.72		1.04		58
q_3	.128	.87	-.16			-.74		1.00		54
q_4	.0525	.94				-.84		1.08		50
q_5	.697	.94			-.18	-.38		.58	.42	52
q_6	1.18	.90					.17	.56		58
q_7	1.15	.90					.39	.47		55
q_8	1.06	.92					.40	.33	.38	48
q_9	2.90	1.09	-.15	-.54			.32	.45	.41	40
q_{10}	1.19	1.14	-.18	-.64		-.44	.21	.92		48
q_{11}	.564	1.11	-.21	-.60		-.48	.14	1.05		48
q_{12}	.320	1.18	-.16	-.68		-.56		1.06		49
SD_1	.190	1.15	-.27	-.76		-.53		.92	.67	56
SD_2	.0398	.78	-.18			-.72		1.27		67
SD_3	.160	1.16	-.18	-.77		-.97		1.04		62
SD_4	.0324	.88				-.79		.86	.52	55
SD_5	.294	.90			-.16			.45	.50	60
SD_6	.627	.90						.45		50
SD_7	.574	.86					.14	.42		52
SD_8	.301	.85					.17	.59		58
SD_9	1.17	.80				-.36	.28	.29	.39	43
SD_{10}	.208	.79	-.13			-.45	.25	.93		47
SD_{11}	.0447	.76	-.16		-.19		.18	1.19		57
SD_{12}	.0479	1.17	-.24	-.78	.14			1.22	.43	52
Q_2	1.99	.90			-.24			.74	.53	80
Q_5	3.92	.87			-.25			.66	.60	80
Q_{10}	5.57	.86			-.26			.61	.65	81
Q_{25}	9.25	.85			-.35			.53	.81	72
Q_{50}	14.0	.75			-.20			.76	--	53
$M_{7,2}$	.132	.85	-.20		.22			.65		55
$M_{7,20}$	.00264	1.06			.45			.88		190
$M_{30,2}$	.126	.82	-.23		.20			.79		54
$M_{30,20}$	.901	.78	-.36						1.25	128
$V_{1,2}$	3.52	.81						.71		54
$V_{1,50}$	9.70	.79			-.17			.72		61
$V_{3,2}$	2.79	.83			.10			.68		49
$V_{3,50}$	9.42	.80						.60		56
$V_{7,2}$	2.48	.85					.11	.63		46
$V_{7,50}$	6.14	.84					.10	.56		50
$V_{15,2}$	2.20	.86					.15	.59		45
$V_{15,50}$	4.36	.87					.11	.55		48

$$Y = a \times A^{b_1} \times S^{b_2} \times L^{b_3} \times (St+1)^{b_4} \times E^{b_5} \times (Gl+1)^{b_6} \times P^{b_7} \times I_{24,2}^{b_8}$$

Table 7.--Comparison of standard errors of estimate from regression equations with the accuracy goals for minor streams having natural flow.

Streamflow characteristics	Standard error (percent)	
	(Accuracy goals) 10-year record	Regression equation
Mean annual flow	5	39
Standard deviation of annual flow	22	39
Mean monthly flow (average)	12	51
Standard deviation of monthly flow	22	55
50-year peak flow	22	53
50-year 7-day high flow	13	50
2-year 7-day low flow	12	55
20-year 7-day low flow	18	190

Applicability of Regression Equations

The standard error of estimate for each equation does not give a complete evaluation of reliability of estimates. The equations are mathematically fitted to an incomplete sample of physical and climatic features in Alaska and adjacent parts of Canada. The range and distribution of these features are indicated in figures 2-4. Estimates using the equations should be considered less reliable for sites having combinations of physical and climatic features not sampled.

The basis for computing the physical parameters was the U.S. Geological Survey and Canadian topographic maps and these are recommended for use with the equations. The climatic parameters were computed using figures 5 and 6 and these are recommended for use with the equations. Mean annual precipitation is highly significant in the equations because it is the principal indicator of regional climatic differences. The map of mean annual precipitation is very inexact. A comparison between mean annual runoff

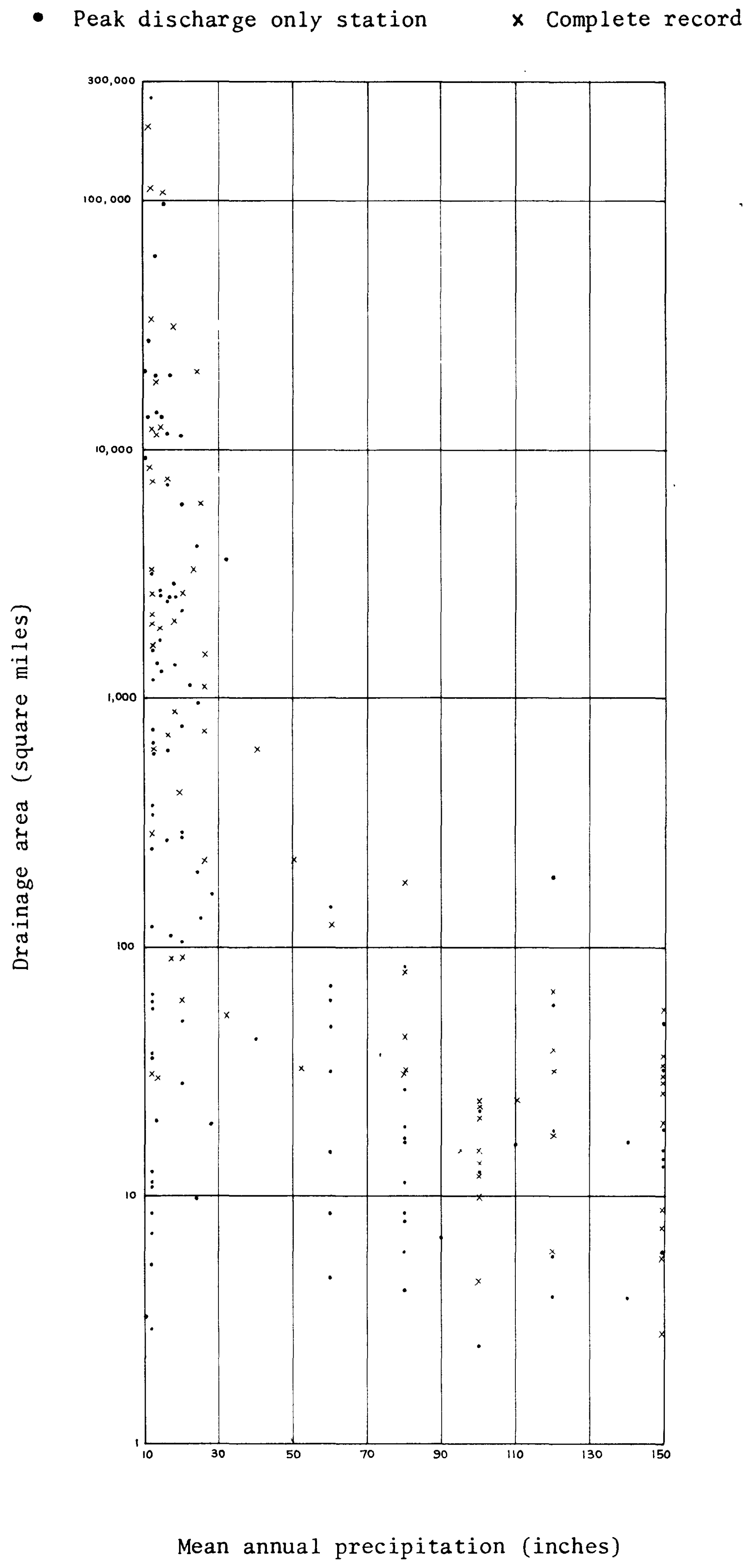

Figure 2.--Combinations of mean annual precipitation and drainage area.

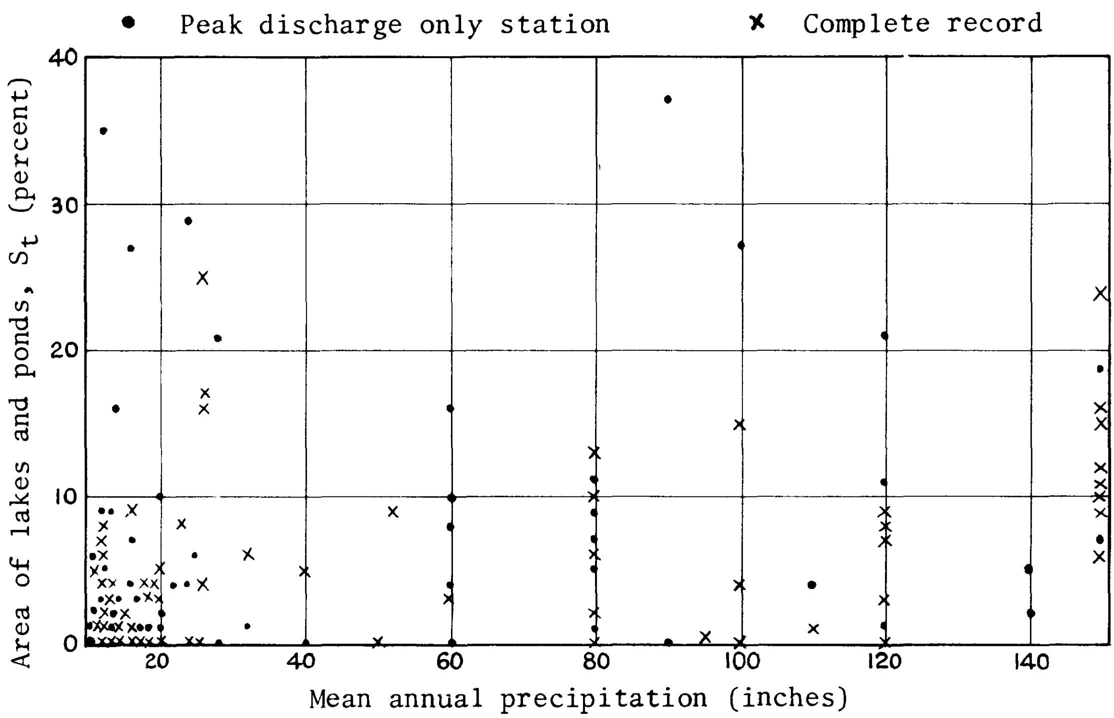

Figure 3.--Combinations of mean annual precipitation and areas of lakes and ponds.

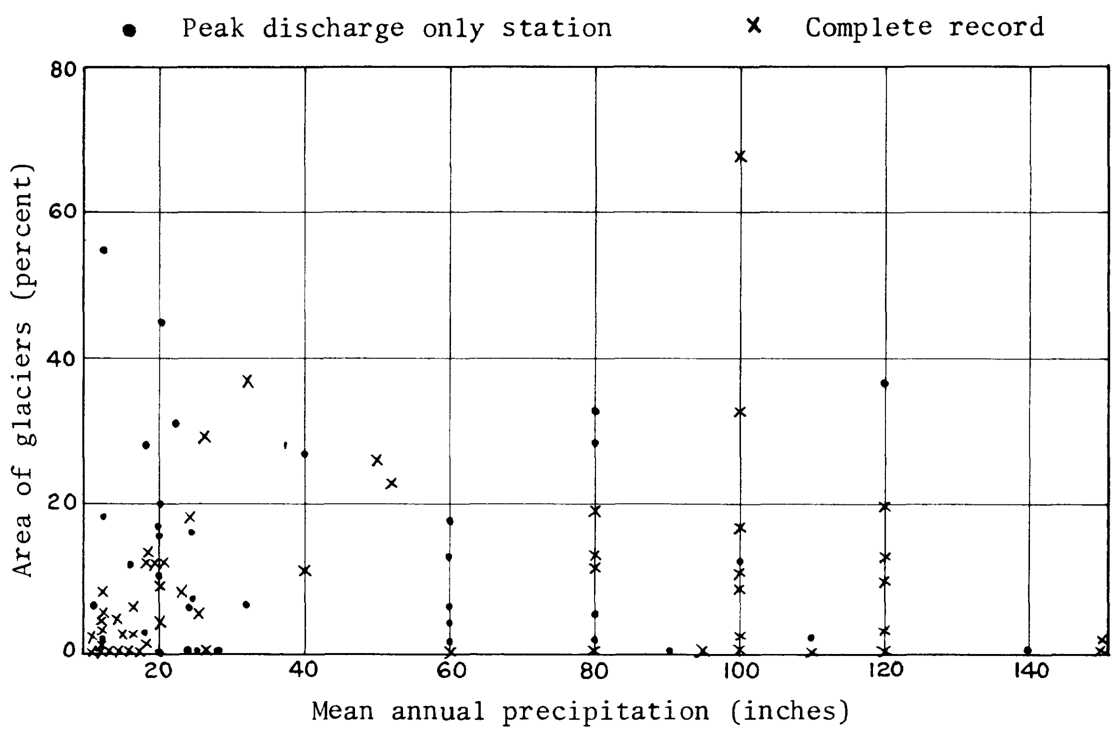

Figure 4.--Combinations of mean annual precipitation and glaciers.

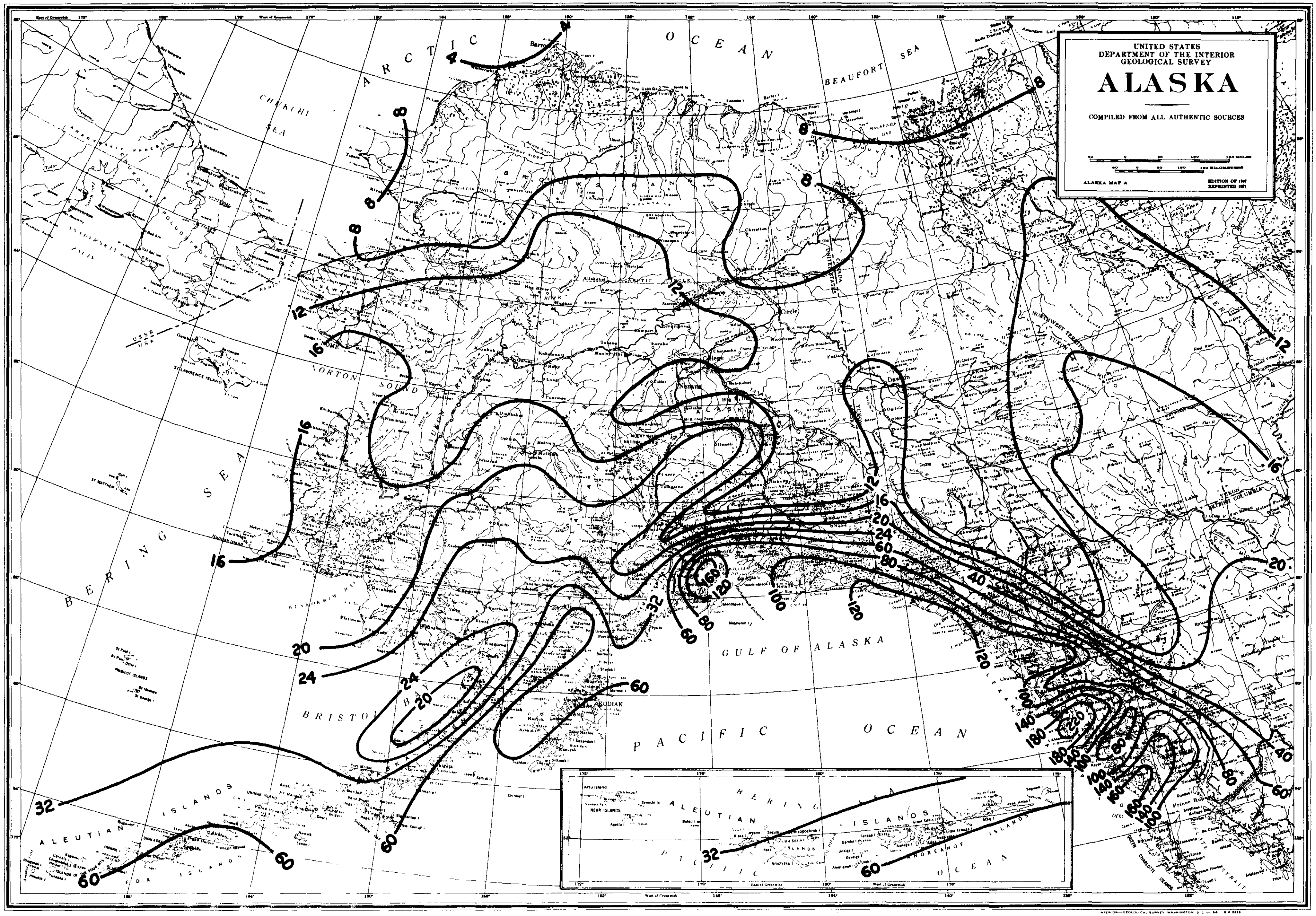

Figure 5.--Mean annual precipitation in inches (1931-1955).

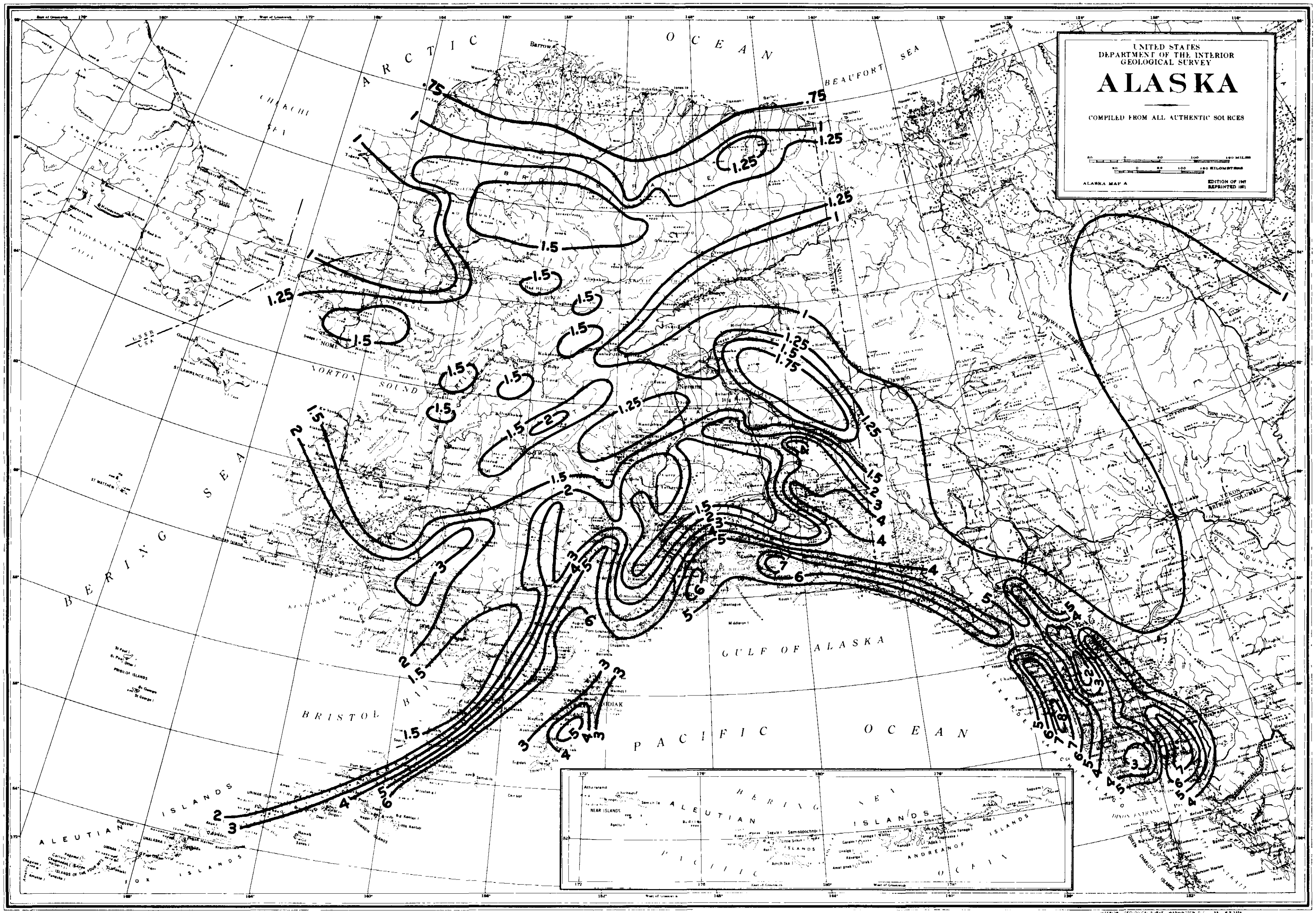

Figure 6.--Two-year 24-hour rainfall in inches.

for Alaskan gaging stations and mean annual precipitation for the corresponding gaging-station drainage basins determined from figure 5 shows that for 60 percent of the gaging stations, the gaged runoff exceeds the computed precipitation. The differences are as high as 193 inches of gaged runoff corresponding to 52 inches of computed precipitation. Thus, the regression equations are limited in reliability chiefly by inadequate climatic maps.

The regression equations are fitted to the entire data set from all the sample-gaging stations. This was done (1) to provide regional information for any site on any stream in Alaska, (2) because the total gaging-station sample is small, and (3) because the boundaries for subdividing Alaska for subregional analysis are indefinite. Geographical distribution of gaging stations used in the regressions is shown in figure 7. By comparing the basin physical and climatic characteristics with the gaging-station locations, the following weaknesses in the sample network may be seen:

1. Most of the gaging stations are in southeast Alaska, on the Kenai Peninsula, or near Anchorage; the rest of Alaska is mostly ungaged.
2. The gaging stations in southeast Alaska are mostly on streams having lake storage (for hydroelectric power studies) and the data obtained at these stations are thus biased toward streams having lake storage.
3. Interior gaging stations are almost all on large streams and the data from these stations are not indicative of small streams.
4. The regressions for peak discharge were based on peak-flow characteristics for only as much as twice the length of record. For example, if a station had only 5 years of record, only the 2-year, 5-year, and 10-year flood characteristics were used in the regression. The result is that only 24 gaging stations with a minimum of about 25 years of record are available on which to develop a 50-year-flood regression equation. This equation is especially weak because none of the sample stations on streams having drainage-basin areas smaller than about 1,500 square miles were north of the Alaska Range.

Principal Streams of Alaska

The accuracy goal for principal streams is the accuracy equivalent to that of a 25-year record. Although the regression equations can be applied to principal streams, they do not meet the accuracy goals for any flow characteristic. The accuracy goal can be met by operating gaging stations at selected points. This evaluation consisted of identifying the principal streams in Alaska and then reviewing the stream gaging accomplished on the principal streams.

There are 175 streams in Alaska that drain basins of about 1,000 square miles or larger. Of these, 26 drain basins of 5,000 square miles or more. Table 8 lists these 26 largest streams. Many of these streams are in practically uninhabited areas. Communities, mostly small, have been settled along some of the streams. The streams provide access to Alaska's interior. Also, the streams are valuable fish and wildlife habitat, have hydroelectric power potential, and large cooling-water potential. Economic development planning will require information on streamflow characteristics of the principal streams.

Thirty-five gaging stations are currently operated on 26 principal streams in Alaska. None of the gaging stations have 25 years of record, although 10 have records of about 20 years. Location of these gaging stations is shown in figure 7. Seven gaging stations on principal streams have been discontinued, although the records were less than 25 years long.

Regulated Streams

Several minor streams in Alaska are regulated for hydroelectric power generation, industrial use, and domestic water supply. Some are mostly or completely regulated. In several cases, streamgaging records prior to regulation are available for evaluating the natural streamflow characteristics. Records are not being collected for evaluating the characteristics of regulated streamflow under present pattern of regulation on these streams.

Table 8.--Twenty-six largest streams of Alaska.

Drainage area at mouth (sq mi)	Stream name	Tributary to-	Drainage area at gaging station (sq mi)	Gaging-station name	Years of record (1969)	Year discontinued
327,600	Yukon R	Bering Sea	113,500	Yukon R at Eagle (at Canada Boundary)	21	
			199,400	Yukon R at Rampart	12	1967
			259,000	Yukon R at Ruby	13	
			296,000	Yukon R at Kaltag	10	1967
49,000	Kuskokwim R	Bering Sea	11,700	Kuskokwim R at McGrath	6	
			31,100	Kuskokwim R at Crooked Creek	18	
45,000	Porcupine R	Yukon R	29,500	Porcupine R nr Fort Yukon	5	
44,000	Tanana R	Yukon R	3,280	Chisana R at Northway Jct. (head of Tanana River)	20	
			6,800	Tanana R nr Tok	3	1953
			8,550	Tanana R nr Tanacross	16	
			13,500	Tanana R at Big Delta	8	1957
			27,500	Tanana R at Nenana	7	
32,400	Koyukuk R	Yukon R	18,700	Koyukuk R at Hughes	9	
24,000	Copper R	Pacific Ocean	20,600	Copper R nr Chitina	14	
23,300	Colville R	Arctic Ocean				
20,000	Stikine R	Pacific Ocean	8,200	Stikine R nr Telegraph Creek, B.C. (Canadian station)		
20,000	Susitna R	Pacific Ocean	950	Susitna R nr Denali	10	
			4,140	Susitna R nr Cantwell	8	
			6,500	Susitna R at Gold Creek	20	
12,000	Innoko R	Yukon R				
12,000	Noatak R	Arctic Ocean	12,000	Noatak R nr Noatak (No winter records)	4	
11,000	Alsek R	Pacific Ocean				
10,700	Kobuk R	Arctic Ocean	6,570	Kobuk R at Ambler	4	
10,000	Nushagak R	Bering Sea				
9,900	Chandalar R	Yukon R	9,330	Chandalar R nr Venetie	6	

Table 8.--Twenty-six largest streams of Alaska--concluded.

Drainage area at mouth (sq mi)	Stream name	Tributary to-	Drainage area at gaging station (sq mi)	Gaging-station name	Years of record (1969)	Year discontinued
9,000	Kvichak R	Bering Sea	6,500	Kvichak R at Igiugig	2	
8,000	Chitina R	Copper R				
7,500	Kantishna R	Tanana R				
6,600	Taku R	Pacific Ocean	6,000	Taku R nr Tulsequah, B.C (Canadian station)		
6,500	Yentna R	Susitna R				
6,200	Black R	Porcupine R				
6,000	Fortymile R	White R				
5,800	East Fork Chandalar	Chandalar R				
5,500	Nowitna R	Yukon R				
5,000	Holitna R	Kuskokwim R				
5,000	Sagavanirktok R	Arctic Ocean				

Long-Term Streamflow Data

Long-term natural changes in mean flow or in the variability of flow can be monitored by a very small network of both complete- and partial-record stations on natural-flow streams. These stations must be placed on streams draining basins that have undergone no significant manmade changes during the period of record and that are expected to remain so in the future. These stations should be well distributed areally and should be located in basins having differing physical characteristics.

Two gaging stations have been designated as benchmark stations, but this number is inadequate for Alaska. These stations are indicated in table 4 under column 1 "B." Four stations in the existing Alaska network could serve as long-term trend stations. These are indicated by underscoring "B" in column 1 of table 4.

Environmental Data

The goals for this type of data cannot be met by existing information, because very little attention has been given to collection and compilation of data on the environment. Environmental data should be included in future programming to satisfy the needs for such data in research, planning, design, and operation of water-related facilities.

THE PROPOSED PROGRAM

The information developed in different segments of this study has been merged to plan a streamflow-information program that will eventually attain as many of the goals as possible within the limits of available funds. For the optimum program, a balance must be maintained between data collection and data analysis. Continuous interaction between the two is needed, not only to gain a better understanding of the hydrologic system, but also to guide future evaluation of the program in meeting ever-changing needs and in adapting to changing technology.

Data for Current Use

The operation of 45 stations identified as current-purpose stations in table 4 will be continued as long as specific needs dictate. The changing needs will be assessed continuously, and the data-collection network will be modified by adding or discontinuing stations as required. The data requirements for each site will be examined to determine whether a continuous record of discharge is needed or whether measurement of specific-flow characteristics, such as peak flow or instantaneous flow, will suffice.

Changes planned in the current-purpose station network indicated in table 4, include:

1. The two stations, 15-0520.00 and 15-2190.00, shown in table 4 as no longer needed for current-use data are planned for continuing operation as planning and design stations (minor streams) for a minimum of 20 years of record each.
2. The six stations on Amchitka Island, Nos. 15- 2976.40, 2976.50, 2976.55, 2976.60, 2976.80, and 2976.90, will be discontinued from the Alaska District U.S. Geological Survey network because of loss of financing.
3. Five new gaging stations are planned for installation within two years for the Corps of Engineers' needs for current-use data for flood-control operations in the Chena River basin.
4. Gaging-station 15-2766.00 will be installed for the Air Force to provide current-use data for cooling-water management.
5. Nine new and two discontinued stations will be installed during 1970 for the Alaska District U.S. Geological Survey to provide current-use data for assessing environmental impacts of the Trans-Alaska Pipeline System.

Data for Planning and Design

Natural Flow, Minor Streams

Some method of regionalization is required to define streamflow characteristics for minor streams. Thus, to provide an adequate basis for future regionalization, the data-collection program must sample streams representing each combination of conditions that most affect the spatial variability of streamflow characteristics. Also, an adequate length of record must be collected at each sample site to provide adequate time-sampling accuracy. This study indicates that the Alaska network sampling the spatial variability is inadequate. Also, it shows that 20-year records of streamflow data are generally adequate. In table 4, column 6, "H" indicates stations that provide planning and design information on minor streams..

The minor streams planning and design network should sample a range of basin sizes from less than 10 to about 1,000 square miles in mountains, plateaus, and lowlands (Wahrhaftig, 1965) in each subregion of Alaska as designated by the Water Resources Council, 1968. Also, each climatic zone should be sampled (Searby, 1968). Table 8 is a network design framework for minor stream sampling in Alaska. The combination of conditions indicated by each cell in the matrix could be expected to produce different streamflow characteristics from the others. The cells containing symbols show that the indicated streamflow conditions exist and should be sampled if the regionalization is to apply to those conditions.

Forty-two new gaging stations are proposed for addition to the planning and design network of minor streams. They include some currently operated crest-stage gages, previously discontinued short-term stations, and a few sites where some reconnaissance indicates a gaging station might be successfully operated. As reconnaissance experience is gained in the Southwest, Northwest, and Arctic Slope subregions, additional gaging stations will be proposed for addition to the network. Twelve gaging stations in this network have provided at least 20 years of record and are considered to have sufficient record for this purpose. Several, however, also provide data for other purposes, some of which have not been satisfied. Ten other stations have a minimum of 20 years of record and have already been discontinued.

Table 9.--Alaska region planning and design network (minor streams).

X - Gaging station needed but not yet proposed.
A - Number of 20-year gaging station records.
B - Number of current gaging stations.
C - Number of proposed additional gaging stations.

Water Resources Council subregion		Drainage-area size class											
		mountains						plateaus & lowlands					
		0-10-20-50-100-500-1,000						0-10-20-50-100-500-1,0					
Southeast	A	5	2	8									
	B	10	6	6	6	2		2	3	2			
	C	1									X		
South-central	A			2	2	1	2						1
	B	4		3	5	7	2			2	2	2	1
	C	2	4	1	2	3		1	1			1	
Southwest	A												
	B												
	C	4	X	1	X	1	1	X	2	X	X	X	X
Yukon	A												
	B	1	1	1	1	2	4			1			
	C	2	1	1		6	1	2	1		X	1	X
Northwest	A												
	B				1								
	C		X	X		X	X	X	X	1		X	
Arctic Slope	A												
	B												
	C		X	X	X	X	X	X	X	X	X		X

Research is needed into short-cut methods of obtaining preliminary planning and design data in areas where time and funds do not permit conventional stream gaging. Channel geometry analysis is proposed as a method that might provide this kind of information.

A network of crest-stage gages is currently operated to provide additional flood data on small streams. This network will be expanded as funds permit and will supplement the complete-record gaging-station network.

The regression analysis has shown that not only are more gaging stations needed but also better definition of climatic conditions is necessary to improve regionalization of streamflow characteristics. It is proposed that precipitation records also be collected at selected gaging stations. These precipitation records could significantly improve the definition of climatic conditions that affect streamflow.

Natural Flow, Principal Streams

The objectives for principal streams are proposed to be attained by sampling progressively doubled increments of drainage area from a lower limit of about 1,000 square miles. The accuracy goal of 25 years of record has not been met at any principal stream-gaging station in Alaska. The 35 gaging stations on principal streams are proposed to be operated for 25 years each. Three discontinued gaging stations on principal streams are proposed for reactivation.

Priority for proposing additional principal stream-gaging stations should be based on:

1. Drainage-basin size
2. Economic development potential
3. International boundary streamflow
4. Gaging costs

At this time, 19 additional gaging stations are proposed on principal streams, as shown in table 4. As hydrologic experience is gained, many additional gaging stations should be proposed to reach our objectives.

Regulated-Flow Streams

The future data program should include provisions to collect records of inflow, outflow, reservoir contents, diversions, and other pertinent hydrologic data at the major reservoirs in the regulated-stream systems. The gaging station 15-0340.00, Long River near Juneau, is the only gaging station now in this category. Others will be proposed.

Data to Define Long-Term Trends in Streamflow

Benchmark stations 15-0220.00, Harding River near Wrangell, and 15-2927.00, Talkeetna River near Talkeetna, should be contined. Two benchmark stations should be operated in each of the six Water Resources Council subregions as a minimum. Where a subregion is in more than one climatic zone or physiographic province, additional long-term trend stations should be operated. Seven additional long-term trend stations are now proposed and more will be proposed as hydrologic experience is gained.

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Appendix 1.--Surface-water stations in Alaska.

Sta. No. 15-	Station Name	Drainage Area (Sq.Mi.)	Record length in years (Dates are last continuous period of record) Daily	Peak
			SOUTHEAST SUBREGION	
0080.00	Salmon R nr Hyder	84	6(1963-	
0100.00	Davis R nr Hyder	80	10(1930-40)	
0105.00	Halibut Bay trib nr Hyder	8.58		6(1963-
0115.00	Red R nr Metlakatla	45.3	6(1963-	
0119.00	Cabin C nr Ketchikan	8.80		5(1964-
0120.00	Winstanley C nr Ketchikan	15.5	24(1947-	
0140.00	Punchbowl L O nr Ketchikan	12	7(1923-30)	
0156.00	Klahini R nr Bell Island	58.0	2(1967-	
0160.00	Short C nr Bell Island	20	3(1922-25)	
0180.00	Shelokum L O nr Bell Island	18	10(1915-25)	
0190.00	Black Bear C nr Meyers Chuck	16.5		6(1963-
0200.00	Tyee C nr Wrangell	14	4(1924-27)	
0201.00	Tyee C at mouth nr Wrangell	16.1	6(1963-69)	
0220.00	Harding R nr Wrangell	67.4	18(1951-	
0240.00	Mill C nr Wrangell	37	5(1927-28)	
0260.00	Cascade C nr Petersburg	23.0	34(1946-	
0280.00	Scenery C nr Petersburg	30.0	4(1953-54)	
0300.00	Sweetheart Falls C nr Juneau	27	11(1918-27)	
0310.00	Long R ab Long L nr Juneau	8.29	4(1965-	
0317.00	Long Lake nr Juneau	30.2	2(1913-15)	
0320.00	Long L O nr Juneau	30.2	2(1913-15)	
0340.00	Long R nr Juneau	32.5	34(1951-	
0360.00	Speel R nr Juneau	226	11(1960-	
0380.00	Crater C nr Juneau	11.4	15(1927-32)	
0400.00	Dorothy C nr Juneau	15.2	40(1929-67)	
0420.00	Carlson C, Sunny Cv nr Juneau	22.3	6(1914-20)	
0440.00	Carlson C nr Juneau	24.3	10(1951-61)	
0460.00	Grindstone C nr Juneau	3.6	4(1916-20)	
0480.00	Sheep C nr Juneau	4.57	29(1946-	
0500.00	Gold C at Juneau	9.76	25(1950-	
0520.00	Lemon C nr Juneau	12.1	18(1951-	
0525.00	Mendenhall R nr Auke Bay	85.1	4(1965-	
0528.00	Montana C nr Auke Bay	15.5	4(1965-	
0538.00	Lake C at Auke Bay	2.50	6(1963-	
0540.00	Auke C at Auke Bay	3.75	10(1962-	

Appendix 1.--Surface-water stations in Alaska

Sta. No. 15-	Station Name	Drainage Area (Sq.Mi.)	Record length in years (Dates are last continuous perio of record) Daily	Peak
0542.00	Herbert R nr Auke Bay	56.9	3(1966-	
0545.00	Bessie C nr Auke Bay	1.35		3(1966-
0549.90	Davies C nr Auke Bay	15.2	0(1969-	
0560.00	Sherman C at Comet	3.65	2(1914-16)	
0560.90	Pullen C at Skagway	4.0		1(1968-
0561.00	Skagway R at Skagway	145	6(1963-	
0562.00	West C nr Skagway	43.2	7(1962-	
0564.00	Chilkat R at Gorge nr Klukwan	190	6(1962-68)	
0565.00	Chilkat R nr Klukwan	760	2(1959-61)	
0575.00	William Henry C nr Auke Bay	1.58		3(1966-
0580.00	Purple L O nr Metlakatla	6.8	9(1947-56)	
0595.00	Whipple C nr Ward Cove	5.29	1(1968-	
0600.00	Perseverance C nr Wacker	2.81	30(1946-68)	
0620.00	Ward C nr Wacker	14.0	10(1948-58)	
0640.00	Ketchikan C at Ketchikan	13.5	10(1964-67)	
0660.00	Beaver Falls C nr Ketchikan	5.8	11(1927-32)	
0680.00	Mahoney C nr Ketchikan	5.70	24(1947-58)	
0700.00	Falls C nr Ketchikan	36.5	29(1946-59)	
0720.00	Fish C nr Ketchikan	32.1	51(1938)	
0722.00	Sea Level C nr Ketchikan	18.6		6(1963-
0740.00	Ella C nr Ketchikan	19.7	22(1947-58)	
0760.00	Manzanita C nr Ketchikan	33.9	32(1947-67)	
0780.00	Grace C nr Ketchikan	30.2	15(1963-68)	
0800.00	Orchard C nr Bell Island	59	12(1915-27)	
0805.00	Traitors R nr Bell Island	20.8	5(1964-68)	
0815.00	Staney C nr Craig	51.6	5(1964-	
0818.00	N B Trocadero C nr Hydaburg	17.4	2(1967-	
0820.00	Reynolds C nr Hydaburg	5.7	5(1951-56)	
0840.00	Myrtle C at Niblack	3.9	4(1917-21)	
0850.00	Saltery C nr Kasaan	5.53	2(1962-64)	
0851.00	Old Tom C nr Kasaan	5.90	20(1949-	
0852.00	Dog Salmon C nr Hollis	16.8		6(1963-
0853.00	Cabin C nr Kasaan	8.83	2(1962-64)	
0854.00	Virginia C nr Kasaan	3.08	2(1962-64)	
0856.00	Indian C nr Hollis	8.82	15(1949-64)	
0857.00	Harris R nr Hollis	28.7	15(1949-64)	
0858.00	Maybeso C at Hollis	15.1	14(1949-63)	
0860.00	Karta R nr Kasaan	49.5	7(1915-22)	
0865.00	Neck C nr Point Baker	17.0	7(1960-67)	
0866.00	Big C nr Point Baker	11.2	6(1963-	

Appendix 1.--Surface-water stations in Alaska

Sta. No. 15-	Station Name	Drainage Area (Sq.Mi.)	Record length in years (Dates are last continuous period of record)	
			Daily	Peak
0870.00	Mill C at Wrangell	0.09	3(1964-67)	
0872.00	Hammer Slough at Petersburg	1.46	3(1964-67)	
0875.00	Twin C nr Petersburg	3.82		3(1966-
0880.00	Sawmill C nr Sitka	39.0	28(1945-57)	
0900.00	Green L O nr Sitka	31	10(1915-25)	
0920.00	Maksoutof R nr Port Alexander	26	5(1951-56)	
0934.00	Sashin C nr Big Port Walter	2.68	4(1965-	
0936.00	E B Lovers Cv C nr Bg Pt Wal	-	4(1965-	
0940.00	Deer L O nr Port Alexander	7.41	16(1951-67)	
0960.00	Coal C nr Baranof	28.5	4(1922-26)	
0980.00	Baranof R at Baranof	32.0	25(1957-	
1000.00	Takatz C nr Baranof	17.5	17(1951-68)	
1020.00	Hasselborg C nr Angoon	56.2	17(1951-68)	
1040.00	Porcupine R nr Chichagof	7.12	2(1918-20)	
1060.00	Falls C nr Chichagof	6.48	2(1918-20)	
1069.20	Kadashan R ab Hook C nr Tenake	10.4	0(1968-	
1069.40	Hook C ab trib nr Tenakee	4.90	1(1967-	
1069.60	Hook C ab Kadashan R nr Tenake	7.59	2(1966-	
1069.80	Tonalite C nr Tenakee	14.1	0(1968-	
1070.00	Kadashan R nr Tenakee	37.7	3(1965-	
1080.00	Pavlof R nr Tenakee	24.3	11(1957-	
1086.00	Hilda C nr Douglas	2.62	2(1966-	
1088.00	Lawson C at Douglas	2.98	2(1966-	
1090.00	Fish C nr Auke Bay	13.6	10(1958-	
	SOUTH-CENTRAL SUBREGION			
1990.00	Copper R trib nr Slana	4.32		5(1963-
2000.00	Gakona R at Gakona	620	20(1949-68)	
2010.00	Dry C nr Glennallen	11.4		5(1963-
2011.00	L Nelchina R trib nr Eureka	7.81		4(1964-
2019.00	Moose C trib at Glennallen	7.12		5(1963-
2020.00	Tazlina R nr Glennallen	2,670	17(1952-	
2060.00	Klutina R at Copper Center	880	19(1949-67)	
2080.00	Tonsina R at Tonsina	420	18(1950-	
2081.00	Squirrel C at Tonsina	70.5	3(1965-	2(1963-65)
2082.00	Rock C nr Tonsina	14.3		2(1966-
2085.00	Fivemile C nr Chitina	13.2		5(1963-
2115.00	Tebay R nr Chitina	55.4	3(1962-65)	
2120.00	Copper R nr Chitina	20,600	15(1955-	
2125.00	Boulder C nr Tiekel	9.80		5(1963-
2128.00	Ptarmigan C trib nr Valdez	0.44		3(1965-

Appendix 1.--Surface-water stations in Alaska

Sta. No. 15-	Station Name	Drainage Area (Sq.Mi.)	Record length in years (Dates are last continuous perio of record)	
			Daily	Peak
2160.00	Power C nr Cordova	20.5	21(1947-	
2190.00	W F Olsen Bay C nr Cordova	4.78	4(1964-	
2191.00	Control C nr Cordova	4.22		4(1964-
2260.00	Solomon Gulch nr Valdez	19	8(1948-56)	
2362.00	Shakespeare C at Whittier	3.05		0(1969-
2369.00	Wolverine C nr Lawing	9.61	2(1966-	
2370.00	Nellie Juan R nr Hunter	125	5(1960-65)	
2374.00	Chalmers R nr Cordova	6.32		1(1967-
2377.00	Resurrection R nr Seward	169	4(1964-68)	
2378.00	Bear C trib nr Seward	1.63	2(1966-68)	
2380.00	Lost C nr Seward	7.96	2(1948-50)	5(1963-
2385.00	Lowell C at Seward	4.02	3(1965-68)	
2386.00	Spruce C nr Seward	9.26	1(1967-	
2390.00	Bradley R nr Homer	54.0	12(1957-	
2395.00	Fritz C nr Homer	10.4		5(1963-
2398.00	Diamond C nr Homer	5.35		5(1963-
2399.00	Anchor R nr Anchor Point	133	3(1965-	
2400.00	Anchor R at Anchor Point	226	13(1953-66)	
2405.00	Cook Inlet trib nr Ninilchik	1.69		2(1966-
2416.00	Ninilchik R at Ninilchik	131	5(1963-	
2420.00	Kasilof R nr Kasilof	738	19(1949-	
2435.00	Snow R nr Divide	99.8	5(1960-65)	
2439.50	Porcupine C nr Primrose	16.8		5(1963-
2440.00	Ptarmigan C at Lawing	32.6	11(1947-58)	
2460.00	Grant C nr Moose Pass	44.2	11(1947-58)	
2480.00	Trail R nr Lawing	181	21(1947)	
2500.00	Falls C nr Lawing	11.8		5(1963-
2518.00	Quartz C at Gilpatricks	9.41		5(1963-
2530.00	Crescent C nr Moose Pass	21.4	3(1957-60)	
2540.00	Crescent C nr Cooper Landing	31.7	17(1949-66)	2(1966-
2580.00	Kenai R at Cooper Landing	634	21(1947-	
2600.00	Cooper C nr Cooper Landing	31.8	10(1949-59)	
2605.00	Stetson C nr Cooper Landing	8.6	5(1958-63)	
2610.00	Cooper C at mth nr Cooper Lan	48.0	7(1957-64)	
2640.00	Russian R nr Cooper Landing	61.8	7(1947-54)	
2663.00	Kenai R at Soldotna	2,010	3(1965-	
2665.00	Beaver C at Kenai	51	0(1968-	
2679.00	Resurrection C nr Hope	149	1(1967-	
2680.00	Resurrection C at Hope	162	2(1949-51)	
2695.00	Granite C nr Portage	28.2		1(1967-

Appendix 1.--Surface-water stations in Alaska

Sta. No. 15-	Station Name	Drainage Area (Sq.Mi.)	Record length in years (Dates are last continuous period of record) Daily	Peak
2701.00	Fresno C at Shield	6.03		5(1963-
2704.00	Donaldson C nr Wibel	4.07		5(1963-
2719.00	Cub C nr Sunrise	1.80		3(1965-
2725.30	California C at Girdwood	6.96		0(1968-
2725.50	Glacier C at Girdwood	62.0	3(1965-	
2728.00	Rainbow C nr Anchorage	4.18		3(1965-
2731.00	L Rabbit C nr Anchorage	6.22		2(1966-
2739.00	S F Campbell C at Canyon Mth	25.2	2(1966-	
2740.00	S F Campbell C nr Anchorage	30.4	21(1947-	
2743.00	N F Campbell C nr Anchorage	13.4		1(1967-
2745.00	L Campbell C nr Anchorage	2.68		0(1968-
2746.00	Campbell C nr Spenard	69.1	2(1966-	
2747.00	Sand Lake nr Spenard		1(1967-	
2748.00	SB of SF Chester C nr Anchora	10.8		1(1967-
2750.00	Chester C at Anchorage	20.0	10(1958-	
2751.00	Chester C at Arctic Blvd.	29.3	2(1966-	
2760.00	Ship C nr Anchorage	90.5	22(1946-	
2765.00	Ship C at Elmendorf AFB	113	5(1963-	
2771.00	Eagle R at Eagle River	192	2(1966-	
2772.00	Meadow C at Eagle River	7.43		3(1965-
2776.00	E F Eklutna C nr Palmer	38	2(1960-62)	
2778.00	W F Eklutna C nr Palmer	26	2(1960-62)	
2780.00	Eklutna L nr Palmer	119	16(1946-62)	
2800.00	Eklutna C nr Palmer	119	16(1946-62)	
2810.00	Knik R nr Palmer	1,180	9(1959-	
2815.00	Camp C nr Sheep Mtn Inn	1.09		3(1965-
2820.00	Caribou C nr Sutton	289	13(1955-	
2823.00	Pinochle C nr Sutton	7.99		3(1965-
2824.00	Puriton C nr Sutton	8.51		5(1963-
2835.00	Eska C nr Sutton	13.4		3(1965-
2840.00	Matanuska R at Palmer	2,070	19(1949-	
2860.00	Cottonwood C nr Wasilla	28.5	5(1949-54)	
2900.00	L Susitna R nr Palmer	61.9	20(1948-	
2910.00	Susitna R nr Denali	950	10(1968-	
2911.00	Raft C nr Denali	4.33		5(1963-
2912.00	Maclaren R nr Paxson	280	10(1958-	
2915.00	Susitna R nr Cantwell	4,140	7(1961-	
2920.00	Susitna R at Gold Creek	6,160	19(1949-	
2924.00	Chulitna R nr Talkeetna	2,570	10(1958-	
2927.00	Talkeetna R nr Talkeetna	2,006	4(1964-	
2928.00	Montana C nr Montana	164		5(1963-

Appendix 1.--Surface-water stations in Alaska

Sta. No. 15-	Station Name	Drainage Area (Sq.Mi.)	Record length in years (Dates are last continuous peri of record) Daily	Peak
2929.00	Goose C nr Montana	14.5		5(1963-
2930.00	Caswell C nr Caswell	19.6		5(1963-
2943.00	Skwentna R nr Skwentna	2,250	9(1959-	
2945.00	Chakachatna R nr Tyonek	1,120	9(1959-	
2954.00	L Kitoi L nr Afognak	2.63	1(1960-61)	
2955.00	L Kitoi C nr Afognak	2.63	1(1960-61)	
2956.00	Terror R nr Kodiak	15.0	6(1962-68)	
2957.00	Terror R at mouth nr Kodiak	46.0	4(1964-68)	
2960.00	Uganik R nr Kodiak	123	17(1951-	
2963.00	Spiradon L O nr Larsen Bay	23.3	3(1962-65)	
2970.00	Dog Salmon C nr Ayakulik	72.9	1(1960-61)	
2972.00	Myrtle C nr Kodiak	4.74	5(1963-	
2974.00	Black Canyon C nr Kodiak	2.20		5(1963-
2974.50	M F Pillar C nr Kodiak	2.02	0(1968-69)	
2975.00	Red Cloud C trib nr Kodiak	1.51		5(1963-
	SOUTHWEST SUBREGION			
2976.40	Limpet C on Amchitka Island	1.69	1(1967-	
2976.50	Falls C on Amchitka Island	1.0	0(1968-	
2976.55	Clevenger C on Amchitka Island	0.5	0(1968-	
2976.60	Constantine Spring on Amchitka	-	1(1967-	
2976.80	Bridge C on Amchitka Island	3.03	1(1967-	
2976.90	White Alice C on Amchitka Is	1.0	0(1968-	
2979.00	Eskimo C at King Salmon	16.1		4(1964-
2980.00	Tanalian R nr Port Alsworth	200	5(1951-56)	
3000.00	Newhalen R nr Iliamna	3,300	16(1951-67)	1(1967-
3005.00	Kvichak R at Igiugig	6,500	1(1967-	
3015.00	Allen R nr Aleknagik	270.0	3(1963-66)	
3020.00	Nuyakuk R nr Dillingham	1,490	15(1953-	
3028.00	Grant L O nr Aleknagik	47	6(1959-65)	
3029.90	Moody C at Aleknagik	1.28		0(1968-
3030.00	Wood R nr Aleknagik	1,110	11(1957-	
3030.10	Silver Salmon C nr Aleknagik	10.2		4(1964-
3036.00	Kuskokwim R at McGrath	11,700	5(1963-	
3040.00	Kuskokwim R at Crooked Creek	31,100	17(1951-	
	YUKON SUBREGION			
3059.00	Dennison Fork nr Tetlin Jct.	2.93		5(1963-
3059.20	W F trib nr Tetlin Junction	1.02		2(1966-
3059.50	Taylor C nr Chicken	38.4		2(1966-
3560.00	Yukon R at Eagle	113,500	20(1950-	
3650.00	Discovery F Amer C nr Eagle	5.53		5(1963-

Appendix 1.--Surface-water stations in Alaska

Sta. No. 15-	Station Name	Drainage Area (Sq.Mi.)	Record length in years (Dates are last continuous period of record) Daily	Peak
3675.00	Bluff C nr Eagle	3.38		5(1963-
3890.00	Porcupine R nr Fort Yukon	29,500	4(1964-	
3895.00	Chandalar R nr Venetie	9,330	5(1963-	
4385.00	Bedrock C nr Miller House	9.94		2(1966-
4398.00	Boulder C nr Central	31.5	3(1965-	
4680.00	Yukon R at Rampart	199,400	12(1955-67)	
4699.00	Silver C nr Northway Junction	11.7		5(1963-
4700.00	Chisana R at Northway Junction	3,280	19(1949-	
4710.00	Bitters C nr Northway Junction	15.4		4(1964-
4715.00	Tanana R trib nr Tetlin Junc	2.43		3(1965-
4720.00	Tanana R nr Tok Junction	6,800	3(1950-53)	
4736.00	Log Cabin C nr Log Cabin Inn	10.7		3(1965-
4739.50	Clearwater C nr Tok	37.1		5(1963-
4740.00	Tok R nr Tok Junction	930	3(1951-54)	
4760.00	Tanana R nr Tanacross	8,550	18(1953-	
4760.50	Tanana R trib nr Tanacross	3.32		5(1963-
4762.00	Tanana R trib nr Dot Lake	11.0		4(1964-
4763.00	Berry C nr Dot Lake	65.1	0(1969-	6(1963-69)
4764.00	Dry C nr Dot Lake	57.6	4(1965-69)	1(1969-
4780.00	Tanana R at Big Delta	13,500	9(1948-57)	
4780.10	Rock C nr Paxson	50.3		5(1963-
4780.40	Phelan C nr Paxson	12.2	2(1966-	
4780.50	McCallum C nr Paxson	15.5		2(1966-
4780.90	Lower Susie Q C nr Rapids	1.28		5(1963-
4785.00	Ruby C nr Donnelly	5.32		5(1963-
4800.00	Banner C at Richardson	20.5		5(1963-
4810.00	Tanana R nr Harding Lake	17,240	0(1968-	
4840.00	Salcha R nr Salchaket	2,170	20(1948-	
4850.00	Moose C at Eielson AFB	136	1(1964-65)	
4852.00	Garrison Slough at Eielson AFB	6.24	1(1964-65)	
4930.00	Chena R nr Two Rivers	941	0(1968-	
5110.00	L Chena R nr Fairbanks	356	2(1966-	
5120.00	Chena Slough nr Fairbanks	20	4(1948-52)	
5140.00	Chena R at Fairbanks	1,980	21(1947-	
5145.00	Wood R nr Fairbanks	855	0(1968-	
5155.00	Tanana R at Nenana	27,500	6(1962-	
5158.00	Seattle C nr Cantwell	36.2	3(1965-	1(1963-64)
5159.00	Lily C nr Cantwell	5.63		3(1965-
5160.00	Nenana R nr Windy	710	16(1958-	
5161.00	Nenana R trib nr Cantwell	1.62		3(1965-

Appendix I.--Surface-water stations in Alaska

Sta. No. 15-	Station Name	Drainage Area (Sq.Mi.)	Record length in years (Dates are last continuous perio of record) Daily	Peak
5162.00	Slime C nr Cantwell	6.90		3(1965-
5180.00	Nenana R nr Healy	1,910	18(1950-	
5181.00	L Panguingue C nr Lignite	3.44		3(1965-
5182.00	Rock C nr Ferry	8.17		4(1964-
5182.50	Birch C nr Rex	4.10		4(1964-
5183.00	Nenana R nr Rex	2,450	4(1964-68)	
5183.50	Teklanika R nr Lignite	489	4(1964-	
5190.00	Bridge C nr Livengood	12.6		5(1963-
5192.00	Tolovana R trib nr Livengood	7.81		4(1964-
5200.00	Idaho C nr Miller House	5.31		5(1963-
5300.00	Faith C nr Chena Hot Springs	61.1		5(1963-
5350.00	Caribou C nr Chatanika	9.0	0(1969-	
5416.00	Globe C nr Livengood	26.3		4(1964-
5416.50	Globe C trib nr Livengood	9.01		5(1963-
5418.00	Washington C nr Fox	46.7		5(1963-
5646.00	Melozitna R nr Ruby	2,693	7(1961-	
5648.00	Yukon R at Ruby	259,000	12(1956-	
5649.00	Koyukuk R at Hughes	18,700	8(1960-	
5652.00	Yukon R at Kaltag	296,000	11(1956-67)	
	NORTHWEST SUBREGION			
6210.00	Snake R nr Nome	85.7	3(1965-	
6250.00	Arctic C nr Nome	1.76		0(1968-
6330.00	Washington C nr Nome	6.34		4(1964-
6680.00	Kruzgamepa R nr Iron C	84	4(1906-10)	
6681.00	Star C nr Nome	3.91		4(1964-
6682.00	Crater C nr Nome	22.1		4(1964-
7120.00	Kuzitrin R nr Nome	1,720	6(1962-	
7430.00	June C nr Kotzebue	10.9	2(1965-67)	
7440.00	Kobuk R at Ambler	6,570	3(1965-	
7460.00	Noatak R at Noatak	12,000	3(1965-	
7480.00	Ogotoruk R nr Point Hope	35	4(1958-62)	
	ARCTIC SLOPE SUBREGION			
9750.00	Chamberlin C nr Barter Island	1.46		
9760.00	Neruokpukkoonga C nr Barter I	123		

Appendix 2.--Surface-water stations in Canada included in regional analysis.

Station number	Station name	Drainage area (sq mi)	Daily record length in years*
	STIKINE RIVER BASIN		
15-0242.00	Klappan R nr Telegraph C, B.C.	1,360	7(1961-
0243.00	Stikine R ab Grand Canyon nr Telegraph C, B.C.	7,300	12(1957-
0244.00	Tanzilla R nr Telegraph C, B.C.	616	8(1958-66)
0245.00	Tuya R nr Telegraph C, B.C.	1,360	7(1962-
0246.00	Stikine R at Telegraph C, B.C.	11,300	15(1953-
0247.00	Iskut R bl Johnson R, B.C.	3,610	10(1958-
	TAKU RIVER BASIN		
0410.00	Sloko R nr Atlin, B.C.	180	12(1958-
0411.00	Taku R nr Tulsequah, B.C.	6,000	16(1952-
	ALSEK RIVER BASIN		
1200.00	Aishihik R nr Whitehorse, Y.T.	1,620	19(1949-
1202.00	Kathleen R nr Haines Jct., Y.T.	249	6(1958-64)
1205.00	Dezedeash R at Haines Jct., Y.T.	3,200	16(1952-
	YUKON RIVER BASIN		
3045.20	Lubbock R nr Atlin, Y.T.	650	14(1954-
3045.50	Pine C nr Atlin, B.C.	269	13(1963-
3046.00	Atlin R nr Atlin, B.C.	2,520	18(1950-
3046.50	Wann R nr Atlin, B.C.	104	12(1956-
3047.00	Fantail R at O of Fantail L nr Atlin, B.C.	289	12(1956-
3047.50	Tutshi R at O of Tutshi L nr Atlin, B.C.	366	12(1956-
3048.00	Lindeman R nr Bennett, B.C.	92	14(1954-
3048.50	Wheaton R nr Carcross, Y.T.	337	13(1955-
3049.20	Tagish C nr Carcross, Y.T.	31	11(1965-
3049.50	MaClintock R nr Whitehorse, Y.T.	597	13(1955-
3050.00	Yukon R at Whitehorse, Y.T.	7,500	25(1943-
3050.30	Takhini R at O of Kusawa L, Y.T.	1,570	16(1951-
3050.50	Takhini R nr Whitehorse, Y.T.	2,640	21(1947-
3051.00	Yukon R ab Frank C, Y.T.	12,000	16(1952-

* Dates are last continuous period of record.

Appendix 2.--Surface-water stations in Canada included in regional analysis.--cont.

Station number	Station name	Drainage area (sq mi)	Daily record length in years*
	YUKON RIVER BASIN--cont.		
15-3051.50	Swift R nr Swift R, B.C.	1,280	13(1955-
3052.00	Gladys R at O of Gladys L nr Atlin, B.C.	737	12(1956-
3052.50	Teslin R nr Teslin, Y.T.	11,700	23(1947-
3052.60	Teslin R nr Whitehorse, Y.T.	13,700	13(1955-
3053.00	Big Salmon R nr Carmacks, Y.T.	2,640	13(1961-
3053.50	Yukon R at Carmacks, Y.T.	33,600	18(1950-
3053.90	Ross R at Ross R, Y.T.	2,800	7(1961-
3054.00	Pelly R at Ross R, Y.T.	7,670	15(1953-
3054.20	Pelly R at Pelly Crossing, Y.T.	19,700	17(1951-
3054.50	Yukon R ab White R nr Dawson, Y.T.	58,400	12(1955-
3055.00	Kluane R at O of Kluane L, Y.T.	1,730	16(1952-
3055.90	Stewart R at Mayo, Y.T.	12,100	20(1948-
3056.20	Stewart R at Stewart Crossing, Y.T.	13,500	8(1960-
3056.50	Stewart R at mouth, Y.T.	19,000	5(1963-
3056.70	Yukon R at Stewart R, Y.T.	97,300	10(1955-65)
3057.00	Yukon R at Dawson, Y.T.	106,000	22(1955-
3889.50	Porcupine R at Old Crow, Y.T.	20,900	8(1960-

*Dates are last continuous period of record.