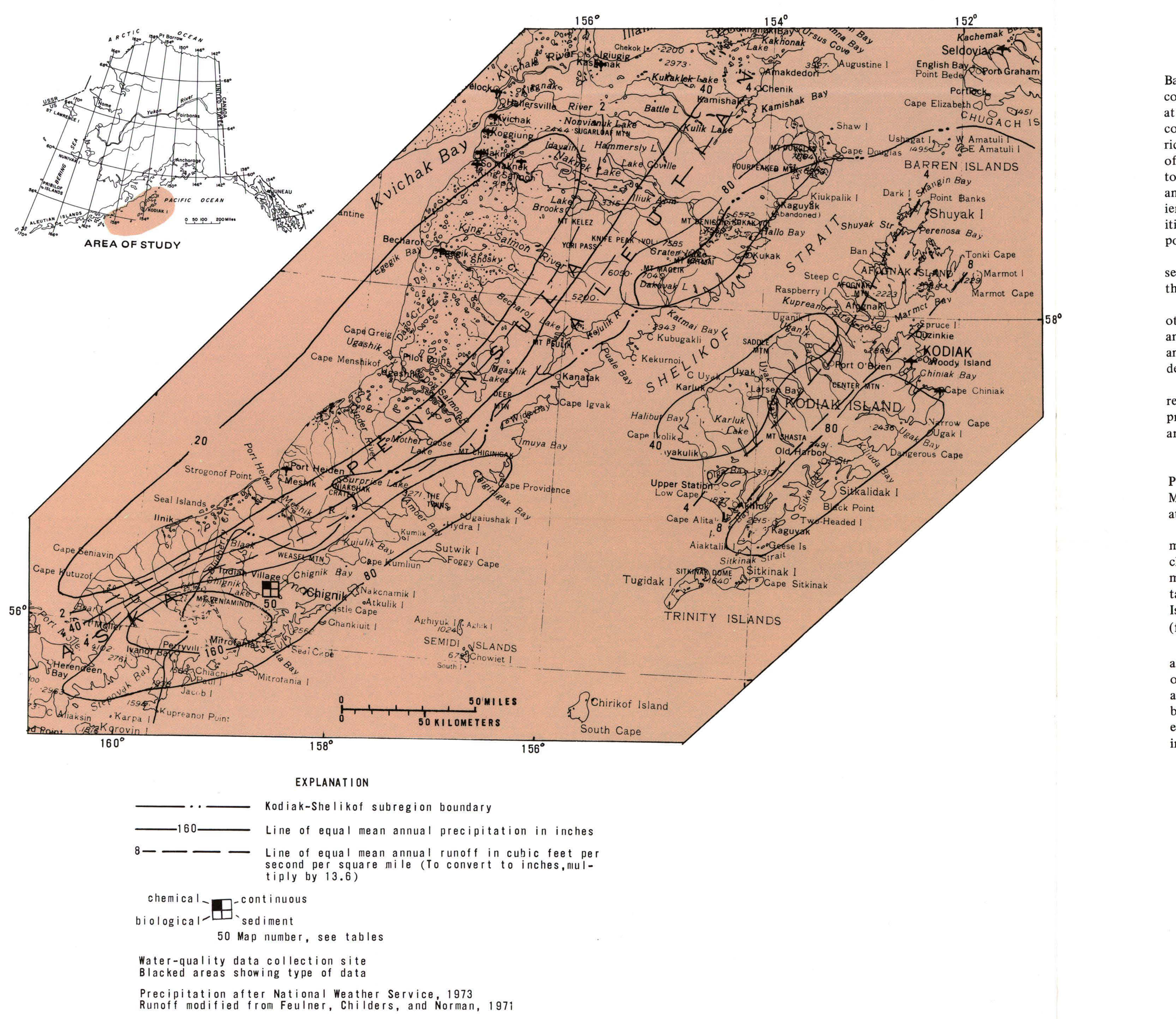
Prepared in cooperation with the
STATE OF ALASKA, DEPARTMENT OF
ENVIRONMENTAL CONSERVATION AND DEPARTMENT
OF NATURAL RESOURCES, DIVISION OF
GEOLOGICAL AND GEOPHYSICAL SURVEYS

SURFACE WATER



INTRODUCTION

The Kodiak-Shelikof subregion of south-central Alaska includes the Kodiak, Trinity, Barren, and Semidi Island groups, numerous small outlying islands, and the south and east coastal slopes of the Alaska Peninsula from Stepovak Bay northeastward to Cape Douglas at the north entrance of Shelikof Strait. Steep, rugged and extensively glaciated terrain comprises most of the 11,000 mi² land area of the subregion. On the Alaska Peninsula, ridges range in altitude from 1,000 to 4,000 ft, and some volcanic peaks reach altitudes of 7,000 ft. Altitudes of mountainous parts of the island groups range from about 2,000 to about 4,000 ft. Coastlines of the islands are extremely irregular. Streams on the islands and in the Pacific Ocean drainage of the Alaska Peninsula are short and have steep gradients. The small population of the area is oriented almost exclusively to water-based activities – marine fisheries, seafood canning and processing industries, commercial water transportation, and recreational fishing and boating.

The bedrock of the Kodiak-Shelikof subregion is predominantly metamorphosed sedimentary and volcanic rocks. Only limited amounts of unconsolidated material occur, thus restricting the availability of ground water.

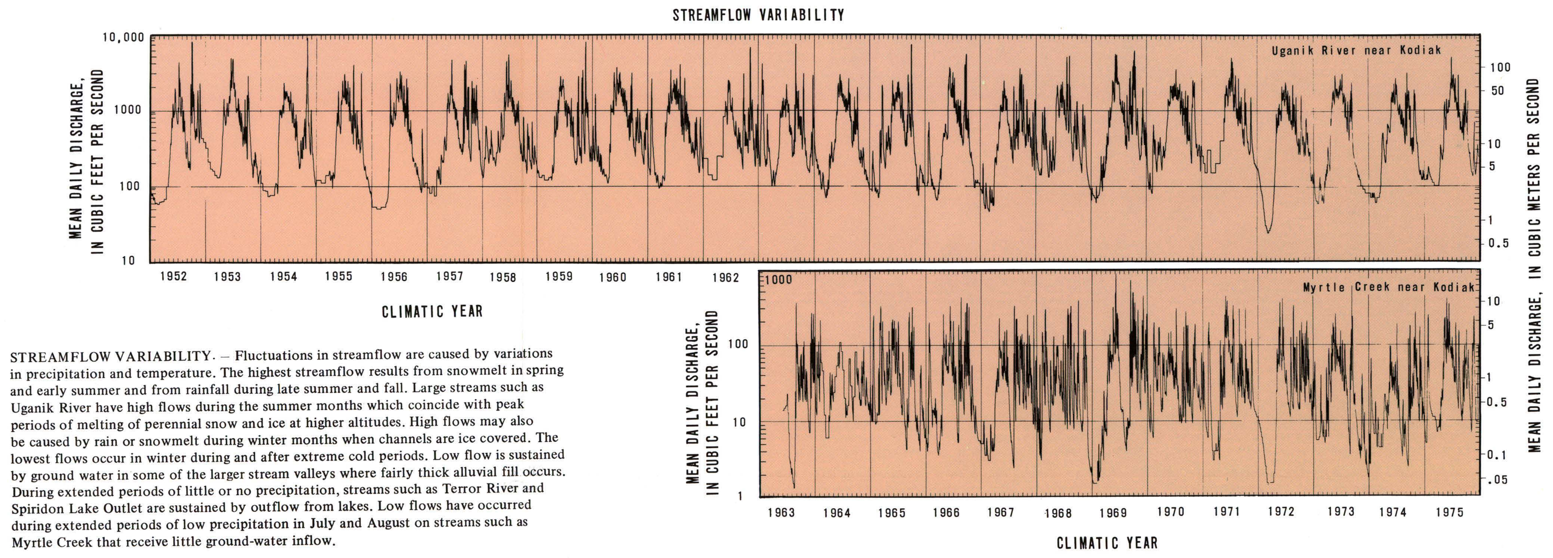
Surface water is the primary source of water supplies for the City of Kodiak and other communities. The impending development of offshore petroleum reserves within and bordering the subregion will affect existing communities and create new settlements and coastal operation bases for the industry. Population and industry growth will increase demands on the area's water resources.

This report summarizes water-resources information for the Kodiak-Shelikof subregion and provides a basis for planning water-resources development, identifying water-problem areas, making environmental impact studies, and evaluating existing water quality and availability.

PRECIPITATION AND RUNOFF. – The Kodiak-Shelikof subregion lies entirely in the Maritime climatic zone of Alaska (Searby, 1968). Average annual precipitation, measured at a few coastal locations, ranges from 23 in. at Larsen Bay to 127 in. at Chignik.

Mean annual runoff for the Kodiak Island group ranges from about 4 to 8 (ft³/s)/mi². Mean annual runoff for ungaged streams on the Alaska Peninsula was estimated using climatic and topographic factors and the method given by Childers (1970b). Estimated mean annual runoff for the subregion is 54,200 ft³/s (Balding, 1976). A maximum instantaneous runoff of 457 (ft³/s)/mi² has been determined from a small basin on Kodiak Island. Measured low-runoff rates for the Kodiak Island group range from no-flow to 0.91 (ft³/s)/mi².

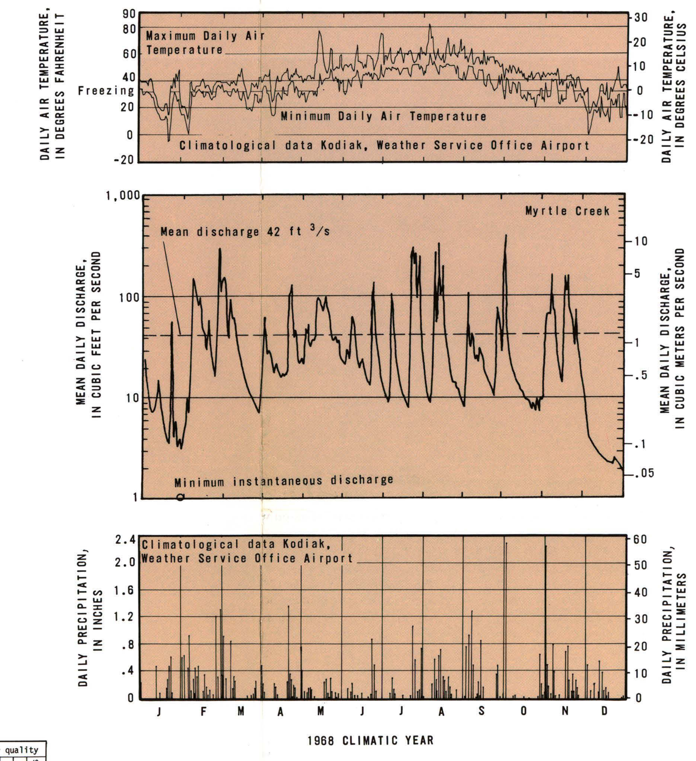
All streamflow data presented have been collected on Kodiak and Afognak Islands and are summarized in the table at right. No streamflow measurements have been made on the Alaska Peninsula part of the subregion. Discharge measurements have been made at ungaged miscellaneous stream sites to relate streamflow to concurrent flows at a nearby gaging station and to define their low-flow characteristics. The drainage area and estimated average discharge of the three largest streams on the Alaska Peninsula are given in the table.

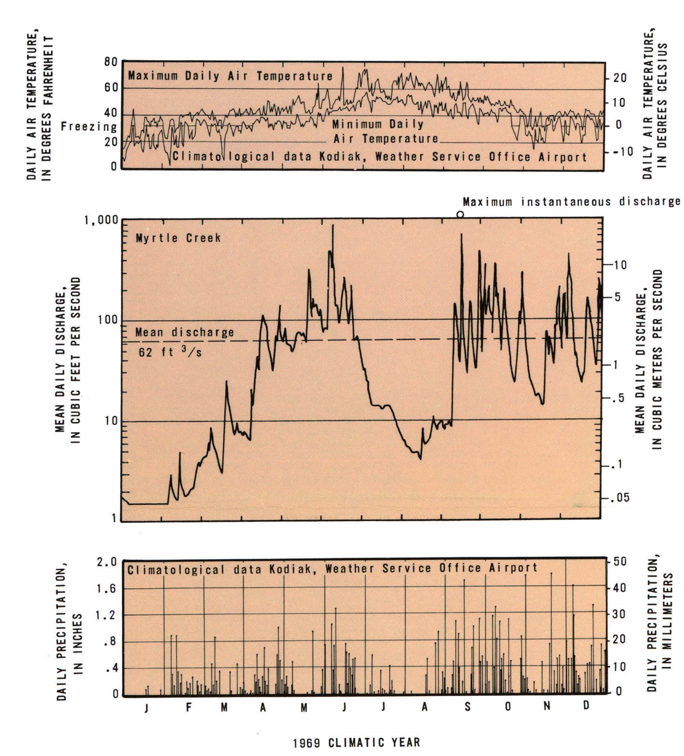


STREAMFLOW VARIABILITY. – Fluctuations in streamflow are caused by variations in precipitation and temperature. The highest streamflow results from snowmelt in spring and early summer and from rainfall during late summer and fall. Large streams such as Uganik River have high flows during the summer months which coincide with peak periods of melting of perennial snow and ice at higher altitudes. High flows may also be caused by rain or snowmelt during winter months when channels are ice covered. The lowest flows occur in winter during and after extreme cold periods. Low flow is sustained by ground water in some of the larger stream valleys where fairly thick alluvial fill occurs. During extended periods of little or no precipitation, streams such as Terror River and Spiridon Lake Outlet are sustained by outflow from lakes. Low flows have occurred during extended periods of low precipitation in July and August on streams such as Myrtle Creek that receive little ground-water inflow.

FACTORS FOR CONVERTING U.S. CUSTOMARY UNITS TO SI UNITS

Multiply U.S. customary units	by	to obtain SI units
inches (in)	25.4	millimeters (mm)
feet (ft)	.3048	meters (m)
miles (mi)	1.609	kilometers (km)
square miles (mi²)	2.590	square kilometers (km²)
acres	.4047	square hectometers (hm²)
gallons (gal)	3.785	liters (L)
cubic feet (ft³)	.003785	cubic meters (m³)
cubic feet per second (ft³/s)	.02832	cubic meters per second (m³/s)
cubic feet per second per square mile [(ft³/s)/mi²]	.01093	cubic meters per second per square kilometer [(m³/s)km²]
degrees Fahrenheit (°F)	5/9(°F-32)	degrees Celsius (°C)





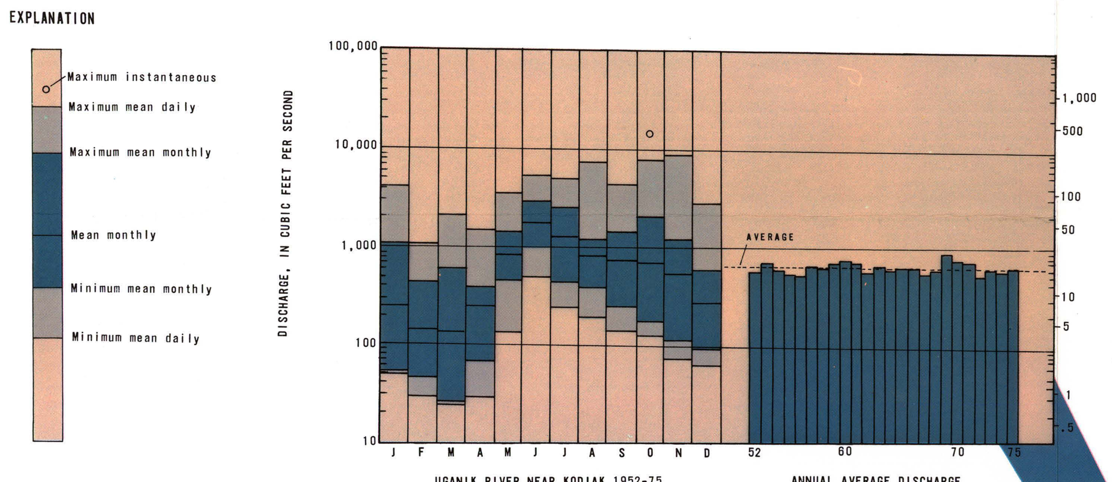
STREAMFLOW VARIABILITY. – The seasonal variability of mean daily discharge for Myrtle Creek near Kodiak is typical of small streams on Kodiak Island. The hydrographs for 1968 and 1969 climatic years (Jan-Dec) typify conditions on a stream whose flow is derived largely from direct runoff of precipitation. Precipitation was distributed uniformly during 1968; temperatures were high during the winter of 1967-68 so there was direct runoff from precipitation throughout the year. There was little direct runoff during the prolonged winter of 1968-69 because temperatures were low and precipitation generally fell as snow. As the snowpack melted in the spring of 1969, there was a sustained flow in runoff. Following the period of low precipitation in July and August, the amount of rainfall was high for the remainder of the year.

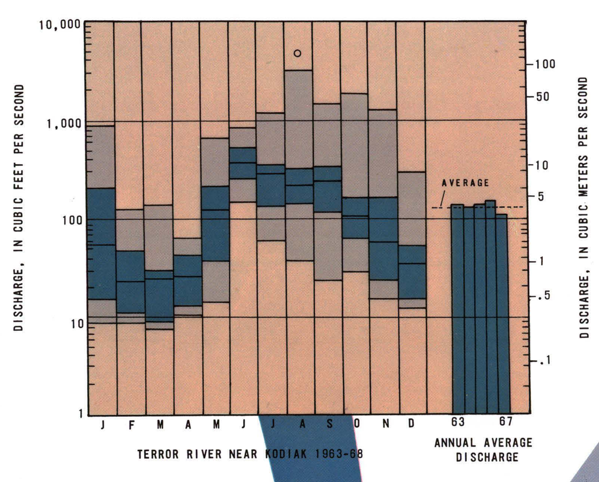
The high seasonal variability of runoff suggests the probable usefulness of impoundments that would provide increased storage to supplement water supplies during periods of little or no flow.

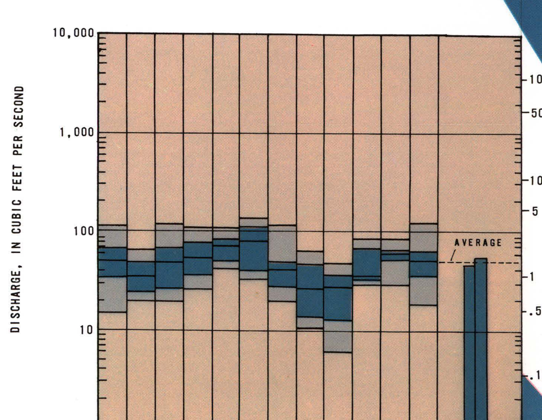
SUMMARY OF SURFACE-WATER GAGING STATIONS, PARTIAL-RECORD STATIONS, AND SITES OF MISCELLANEOUS MEASUREMENTS OF STREAMFLOW.

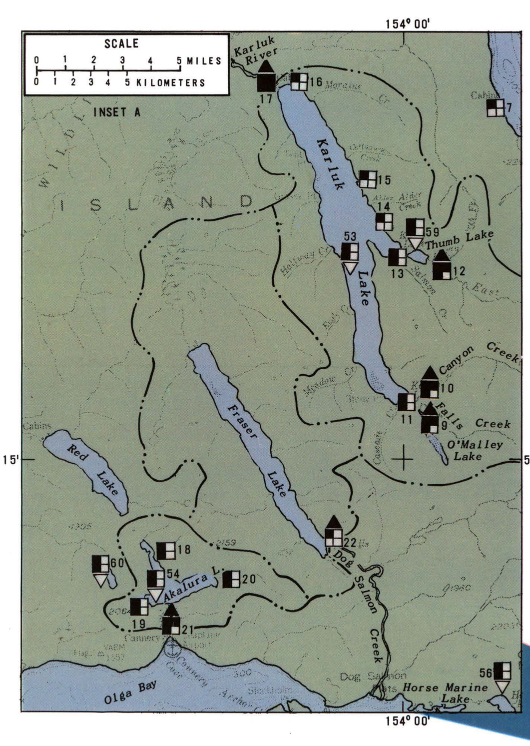
[a-regulated; b-minimum measured discharge; e-estimated; I-intermittent; C-continuous; d-no data collected at site; G-gaging station; M-miscellaneous measurements; P-crest-stage partial-record station; Q-water-quality sample]

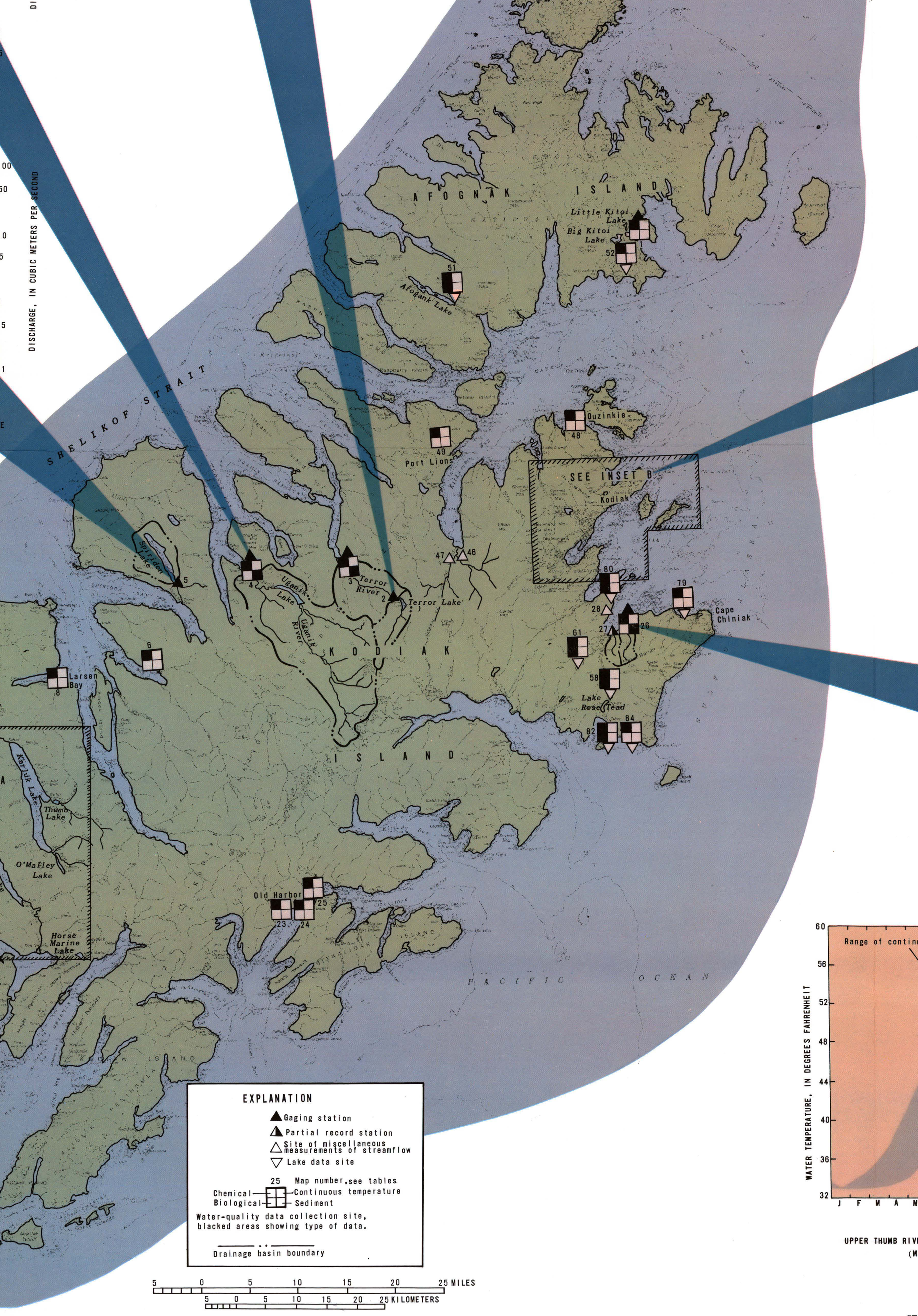
Map No.	Station No.	Stream	Drainage area, in square miles	Period of record Climatic year	Average flow: Cubic feet per second	Average flow: Runoff, in inches per year	Maximum observed discharge: Date	Maximum: Discharge, in Cubic feet per second	Maximum: Discharge, in Cubic feet per second per square mile	Minimum observed discharge: Date	Minimum: Discharge, in Cubic feet per second	Minimum: Discharge, in Cubic feet per second per square mile	Chemical	Temperature	Sediment	Biological	Minor elements
		AFOGNAK ISLAND															
1	15295500	Little Kitoi Creek near Afognak	2.63	G 1960,1961	a8.04	--	Jan. 20, 1961	42	16.0	June, July 1961	aNo flow	--	I	I			
		KODIAK ISLAND															
2	15295600	Terror River near Kodiak	15.0	G 1962-68	132	119	Aug. 29, 1963	4,590	306	Mar. 13-24, 1966	8.0	0.53					
3	15295700	Terror River at mouth near Kodiak	46.0	G 1964-68	263	77.6	Sept. 26, 1966	3,820	83.0	Feb. 23; Mar. 1, 1967	19	0.41	I	I	I		
4	15296000	Uganik River near Kodiak	123	G 1951-76	660	72.9	Oct. 3, 1952	13,700	111	Mar. 10-18, 1972	24	0.20	I	I	I		
5	15296300	Spiridon Lake Outlet near Larsen Bay	23.3	G 1962-65	50.6	29.6	June 22, 1965	137	5.88	Sept. 17, 1962	6.0	0.26					
6		Unnamed Creek at Zacher Bay		Q 1966									I	I			
7		Unnamed Creek near Uyuk Bay		Q 1966									I	I			
8		Unnamed Creek at Larsen Bay		Q 1966,1969									I	I			
9	15296500	Falls Creek near Larsen Bay	5.67	G 1974-75	18.7	44.9	Sept. 25, 1974	174	30.7	Aug. 23, 1974	0.07	0.01	I	C		I	I
10	15296520	Canyon Creek near Larsen Bay	8.82	G 1974-76	41.4	63.7	Sept. 17, 1976	450	51.0	Mar. 28 - Apr. 5, 1976	6.0	0.68	I	C		I	I
11		O'Malley River near Larsen Bay		Q 1975									I	I		I	
12	15296550	Upper Thumb River near Larsen Bay	18.8	G 1974-76	78.2	56.6	Sept. 18, 1976	1,000	53.2	Mar. 19; Apr. 3, 1975	8.1	0.43	I	C		I	I
13		Thumb River below Thumb Lake near Larsen Bay		Q 1975									I	I		I	
14		Lagoon Spring near Larsen Bay		Q 1975									I	I			I
15		Bear Creek at Karluk Lake near Larsen Bay		Q 1975									I	I			
16		Spring Creek near Larsen Bay		Q 1975									I	I			I
17	15296600	Karluk River Outlet near Larsen Bay	100	M 1974, G 1975-76	359	48.8	June 14, 1976	843	8.43	April 5, 1976	102	1.02	I	C	I	I	I
18		Falls Creek at Akalura Lake near Larsen Bay		Q 1975									I	I		I	I
19		Eagle Creek at Akalura Lake near Larsen Bay		Q 1975									I	I		I	
20		Crooked Creek at Akalura Lake near Larsen Bay		Q 1975									I	I		I	
21	15296950	Akalura Creek at Olga Bay	18.4	G 1975-76	60.8	45.0	Sept. 29, 1976	158	8.59	Mar. 26, 1976	2.0	0.11	I			I	
22	15297000	Dog Salmon Creek near Ayakulik	72.9	G 1960,1961, M 1962	252	46.9	Sept. 24, 1961	777	10.7	Mar. 17-19, 1961	33	0.45	I	I			
23	15297050	Unnamed Creek near Old Harbor		M 1970									I	I			I
24		Unnamed Creek at Old Harbor		Q 1966-69									I	I			
25	15297060	Unnamed Creek near Old Harbor		M 1970									I	I			
26	15297200	Myrtle Creek near Kodiak	4.74	G 1963-76	43.7	125	Sept. 14, 1969	1,110	234	Jan.31,1968; Mar.3-18,1972	1.0	0.21	I	I	I		
27	15297300	Frank Creek near Kodiak	2.35	P 1963-69	e14	81	Sept. 14, 1969	250	106	Annually	No flow	--					
28	15297400	Black Canyon Creek near Kodiak	2.20	P 1963-71						July 16, 1963	b2.0	0.91					
29	15297420	Salonie Creek near Kodiak		M 1968									I	I			
30	15297425	Russian Creek near Kodiak		M 1968,1972						Feb. 24, 1972	b1.1		I	I			
31	15297430	Sargent Creek near Kodiak		M 1968									I	I			
32		Unnamed Creek North of Buskin Lake near Kodiak		Q 1956									I	I			
33		Buskin River below Lake near Kodiak		Q 1969									I	I			
34	15297439	Devils Creek near Kodiak	3.56	M 1968,1970						Mar. 26, 1968	b7.9		I	I			
35	15297440	Buskin River near Kodiak	24.6	M 1959,1968-73						Feb. 25, 1972	b10	0.41	I	I			
36		Pillar Creek near Kodiak		Q 1966									I	I			
37	15297450	Middle Fork Pillar Creek near Kodiak	2.02	G 1968-70	11.9	80.1	June 8, 1969	364	180	Jan.20-Feb.5, 1969	0.8	0.40	I	I			
38		North Fork Pillar Creek near Kodiak		Q 1966									I	I			
39		Pillar Creek below Dam near Kodiak		Q 1966									I	I			
40		Pillar Creek at mouth near Kodiak		Q 1966									I	I			
41		South Fork Monashka Creek near Kodiak		Q 1966													
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					

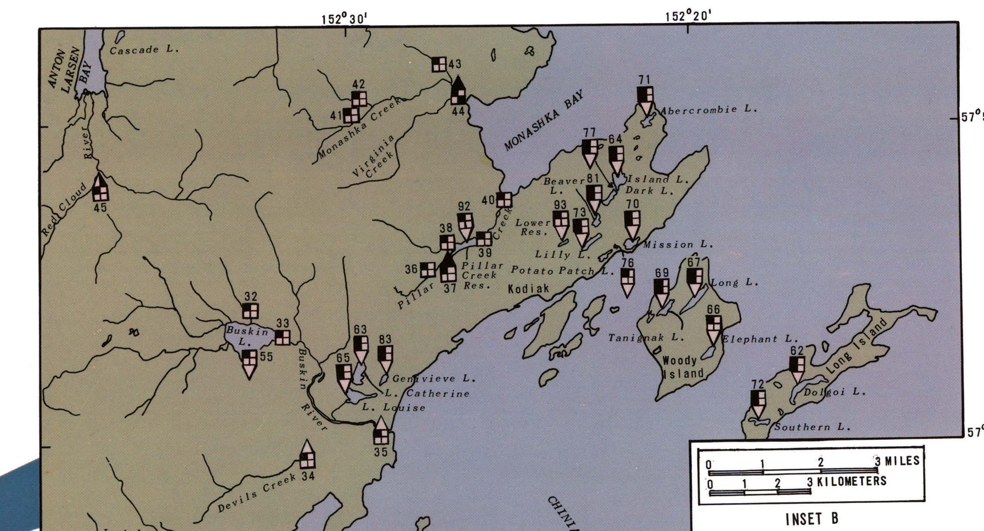


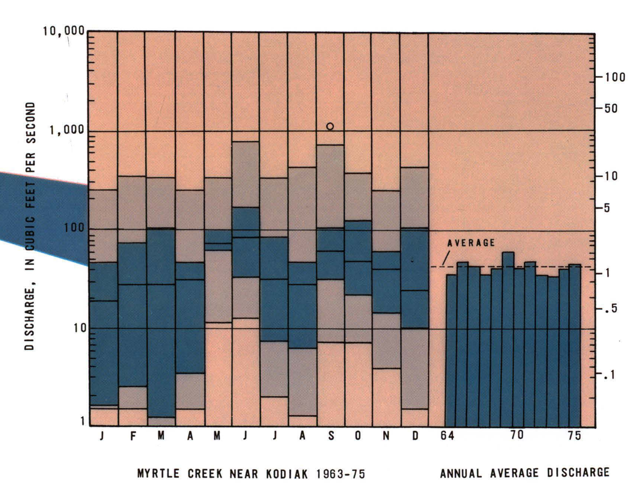












SELECTED LAKE DATA

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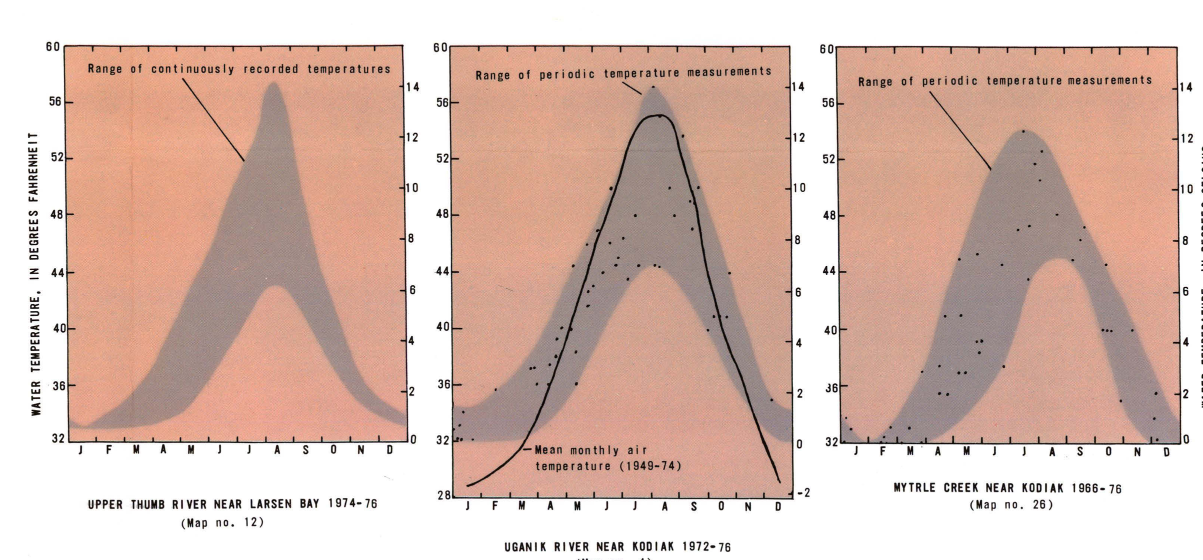
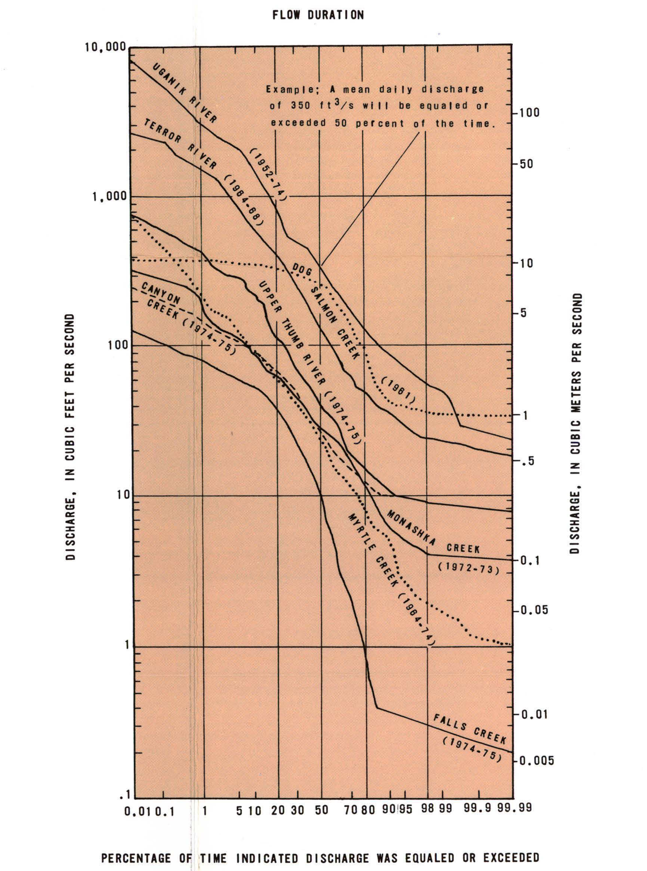
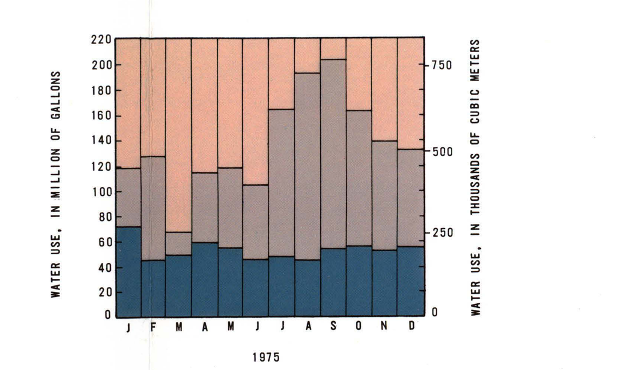
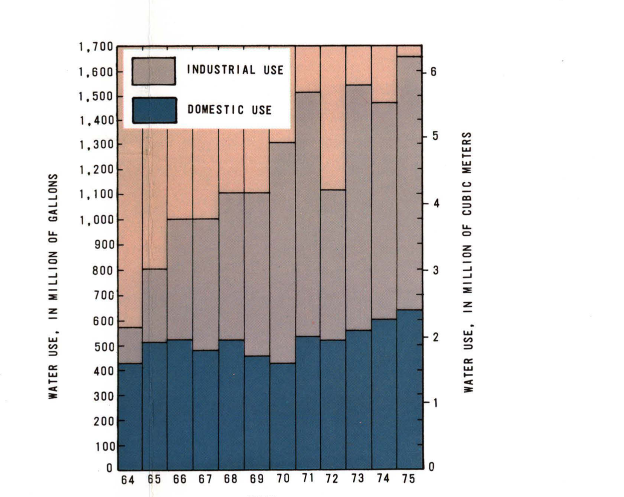


SEASONAL VARIABILITY OF WATER TEMPERATURES.--Surface water temperature is strongly influenced by maritime-island environment.

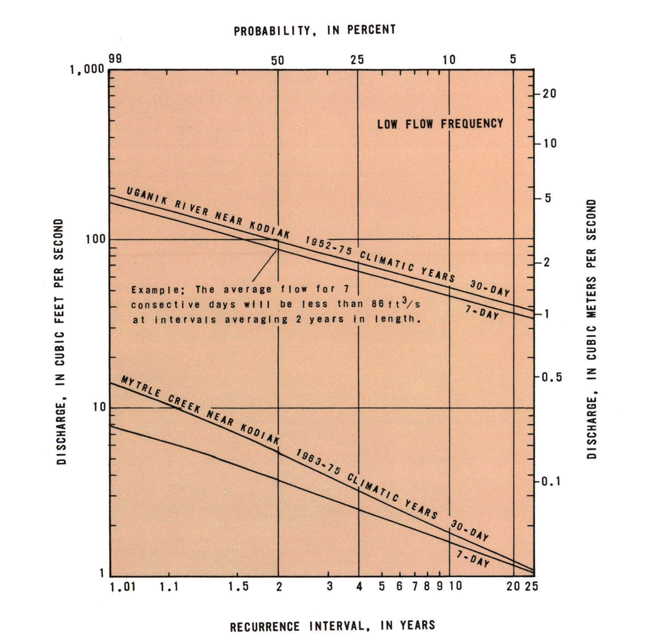


FLOW DURATION. – Flow-duration curves can be used to determine streamflow and basin characteristics. The flow-duration curve is a cumulative frequency distribution of average daily flows for the period of record and shows percentage of time that specified discharges were equaled or exceeded. Slope of a flow-duration curve is a measure of the variability of streamflow. Slope of the upper or high-flow end of the curve shows surface-storage characteristics of the basin. A gentle slope at the upper end as on Dog Salmon Creek reflects considerable lake storage in the basin. A steep slope at the upper end of the duration curve, as at Myrtle Creek, indicates rapid runoff. The lower end of the curve is indicative of lake and ground-water storage and is a function of the basin geology. The more gentle the slope, the greater is the storage capacity of the basin. The relatively steep slope for Myrtle Creek reflects negligible runoff from ground-water storage, whereas the more gentle slope for Uganik River indicates a greater contribution from lake and ground-water storage.



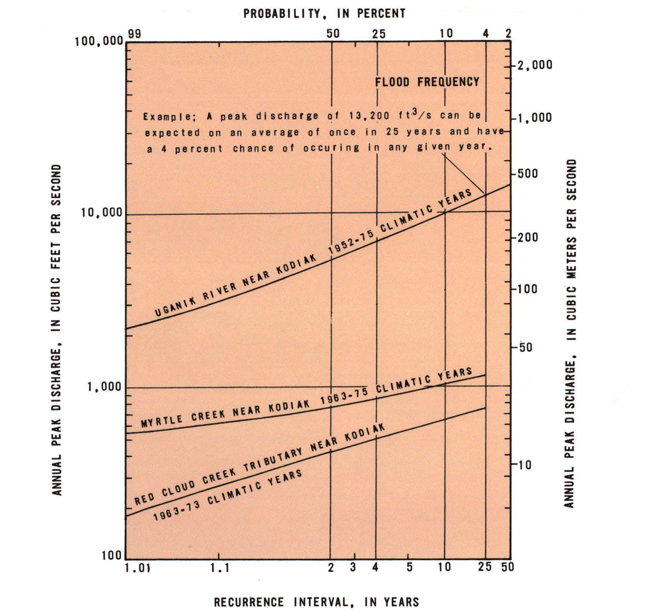


WATER USE.--Pillar and Monashka Creeks are the current sources of the Kodiak municipal water supply. Seafood processing is the largest industrial water use in the City of Kodiak. Surface water is also the primary source for domestic water supplies in other small communities of the study area.



LOW FLOW. – Low-flow frequency curves show lowest mean discharges for indicated number of consecutive days for various recurrence intervals. Effects of runoff from ground water and release from lake storage on low flows are reflected in the frequency curves above. Large streams draining areas that contain lakes and which flow through alluvium-filled valleys (such as Uganik River) have sustained low flows. Smaller streams whose drainage areas include negligible storage in lakes or as ground water have highly variable low-flow conditions which are related to seasonal variations in temperature and precipitation.

The lowest measured discharge from streams on Kodiak Island range from no flow to 0.91 (ft³/s)/mi². Streams in basins of less than 10 mi² may have no flow during periods of no precipitation or extended cold periods. Low but persistent flow occurs in streams which receive ground-water discharge.



FLOODS. – The flood-magnitude and frequency curves above show recurrence interval or frequency of a given flood discharge for selected streams on Kodiak Island. Recurrence interval is defined as the average interval of time within which a flood of specified magnitude will be equaled or exceeded once. For a specified recurrence interval, the probability of a specified magnitude occuring in any one year can be estimated. For example, if the recurrence interval of a flood of specified magnitude is 25 years, the probability that such a flood will occur in any one year is 4 percent (1 chance in 25).

For ungaged streams within the study area, flood discharges for selected frequencies can be estimated using the method given in Childers (1970a).

The primary causes of floods in the Kodiak-Shelikof subregion are spring snowmelt or summer and fall rainstorms. Rain or snowmelt in the winter, when channels are ice covered, also causes flooding, and flood stages then may be higher than those during open-water periods.

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WATER RESOURCES OF THE KODIAK-SHELIKOF SUBREGION, SOUTH-CENTRAL ALASKA

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