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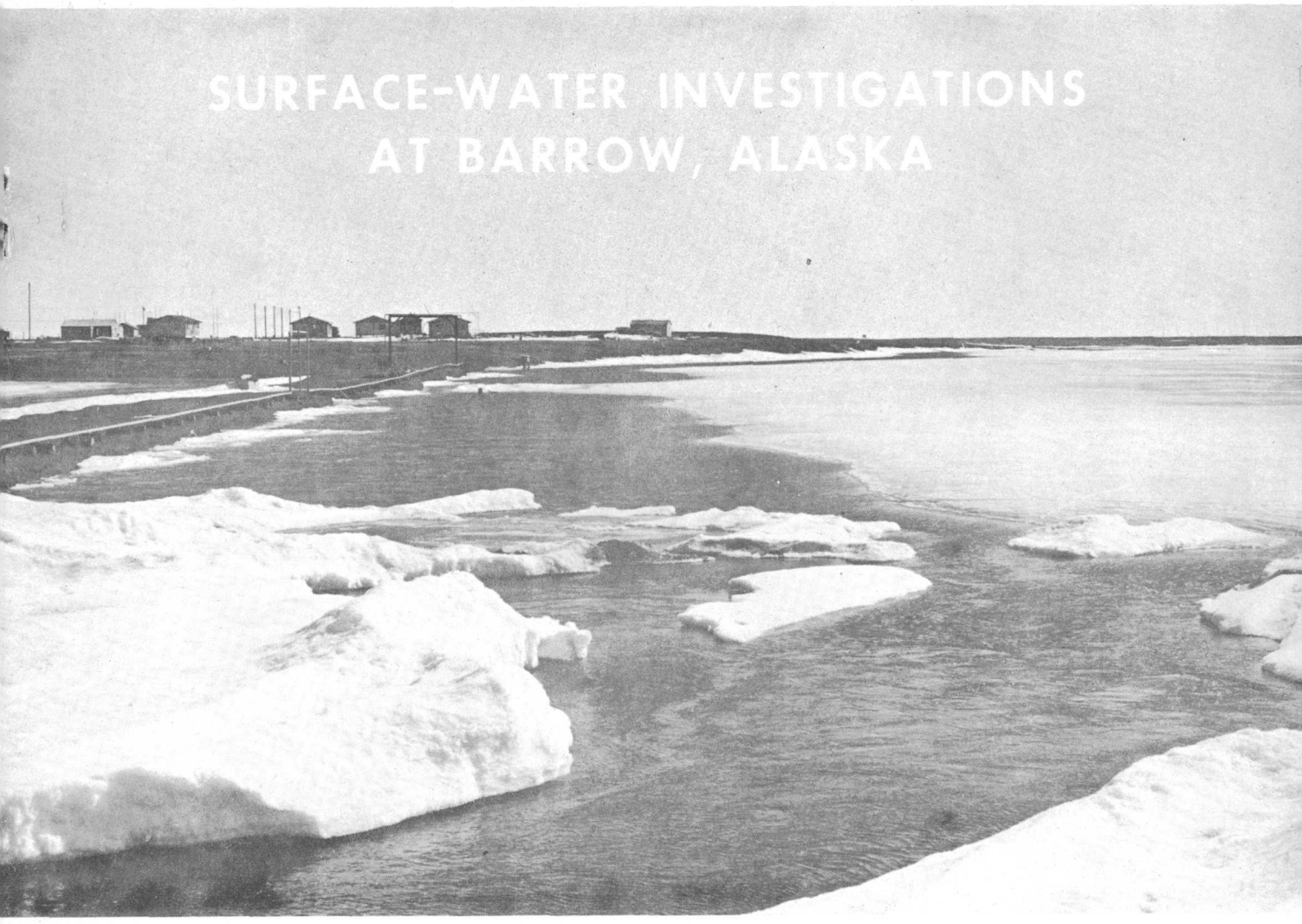
SURFACE-WATER INVESTIGATIONS AT BARROW, ALASKA



1972

Prepared by the UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY - Water Resources Division - Alaska District
in cooperation with the UNITED STATES PUBLIC HEALTH SERVICE

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GEOLOGICAL SURVEY
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By

Stanley H. Jones

Prepared in cooperation with the
United States Public Health Service

BASIC-DATA REPORT

Anchorage, Alaska
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SURFACE-WATER INVESTIGATIONS AT BARROW, ALASKA

By Stanley H. Jones

INTRODUCTION

The U.S. Public Health Service is currently developing plans for a long-term water supply and sewage treatment system for the village of Barrow, Alaska. To assist in planning, the U.S. Geological Survey was requested to initiate a cooperative streamflow data-collection program with the U.S. Public Health Service in June 1972 to determine the availability of surface water and the areal distribution of runoff in the Barrow area. This basic-data report summarizes the streamflow data collected from June 1 through July 10, 1972, at three gaging stations in the Barrow area (fig. 1) and discusses the future data-collection program.

DESCRIPTION OF GAGING-STATION SITES

Three stream-gaging stations were installed June 1-5, 1972, prior to spring breakup, to determine the runoff into Esatkuat Lagoon from Esatkuat Creek, the outflow from Esatkuat Lagoon, and the runoff from the Emaiksoun Lake drainage (fig. 1). These drainage basins are low-relief, tundra-covered basins underlain by permafrost (fig. 4) and contain numerous lakes and ponds, interconnected by polygon troughs, deep ruts, or gullies. The gaging station on Nunavak Creek, located seven-tenths of a mile below Emaiksoun Lake, (table 1) includes all runoff from Emaiksoun Lake drainage and the intervening drainage area below the lake outlet.

Runoff from Esatkuat Creek was measured 1,000 feet above the upper end of Esatkuat Lagoon (table 2). The outflow from Esatkuat Lagoon was measured at the spillway of the dam and the lake stage was recorded at the gaging station located 1,000 feet above the spillway (table 3). An arbitrary gage datum was used for Nunavak and Esatkuat Creeks. The gage height for no flow from Esatkuat Lagoon is the lowest point on the spillway at one-half foot.

SUMMARY OF STREAMFLOW DATA

The following events occurred as snow began melting on June 8 and continued to saturate the snowpack in the main channels. On June 11, runoff began on the saturated snow at Nunavak and Esatkuat Creeks (figs. 2 and 3). Runoff over the spillway started on June 12 and by June 15 all the runoff into Esatkuat Lagoon was flowing along the sides of the lagoon (figs. 5 and 6) over 6 feet of ice. During June 11 through July 10, the runoff was 79 million gallons in Nunavak Creek, 67 million gallons in Esatkuat Creek, and 173 million gallons over the spillway at Esatkuat Lagoon.

The discharge hydrographs for the three gaging stations (fig. 7) show the sustained high base flow recession in Nunavak Creek because of the large lake storage and continued melting of ice in Emaiksoun Lake.

Specific conductance and water temperatures were also measured periodically at each gaging-station site (table 4).

FUTURE STUDIES

The stream-gaging program at the three sites will be continued through the 1973 water year. Water-quality samples collected on July 10, 1972, at each site will be analyzed and additional water-quality samples will be collected on each of the visits to the gaging stations. In addition, an effort will be made during the spring runoff of 1973 to define the drainage areas of the three basins being studied.

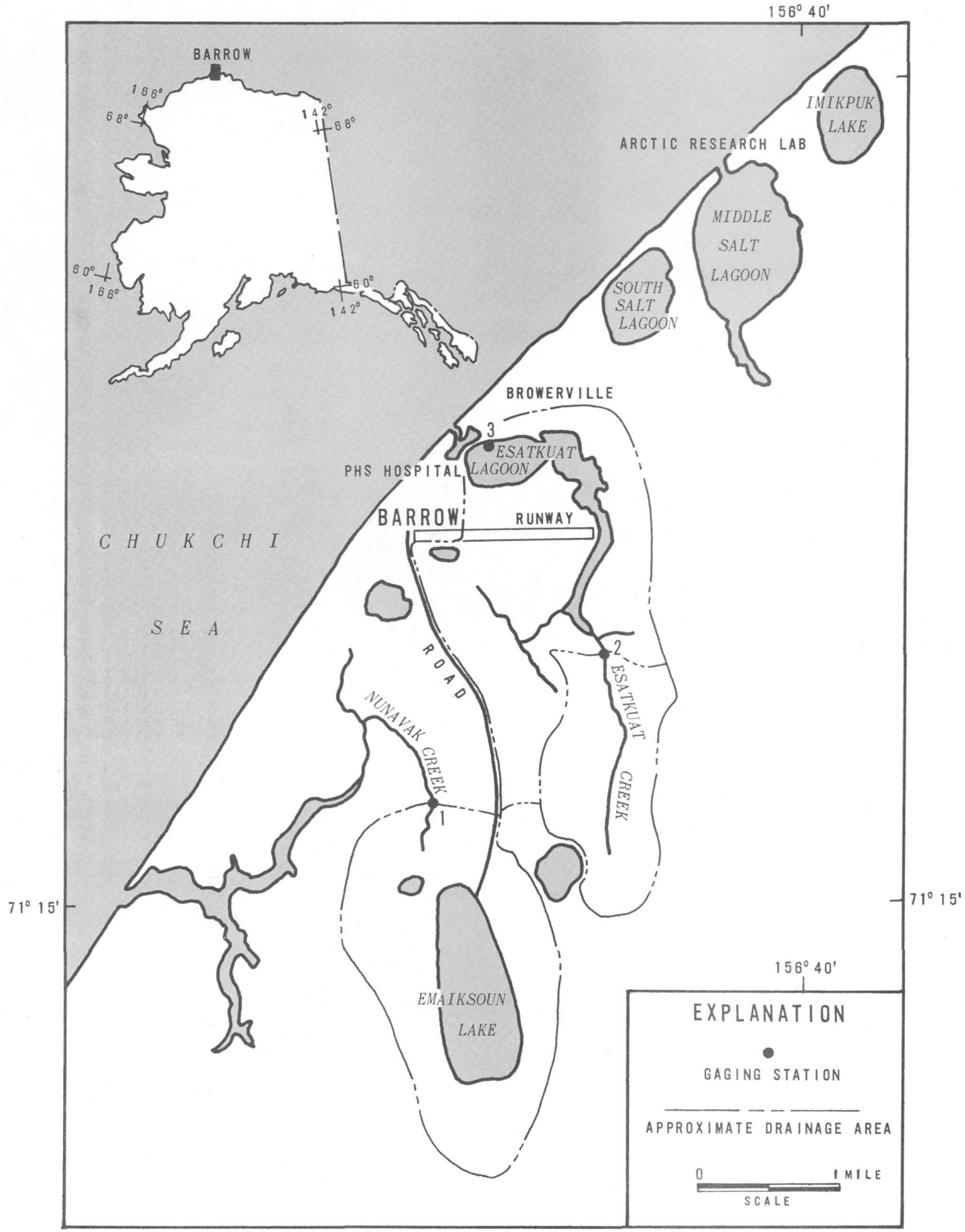

Figure 1.--Location of gaging stations at Barrow.

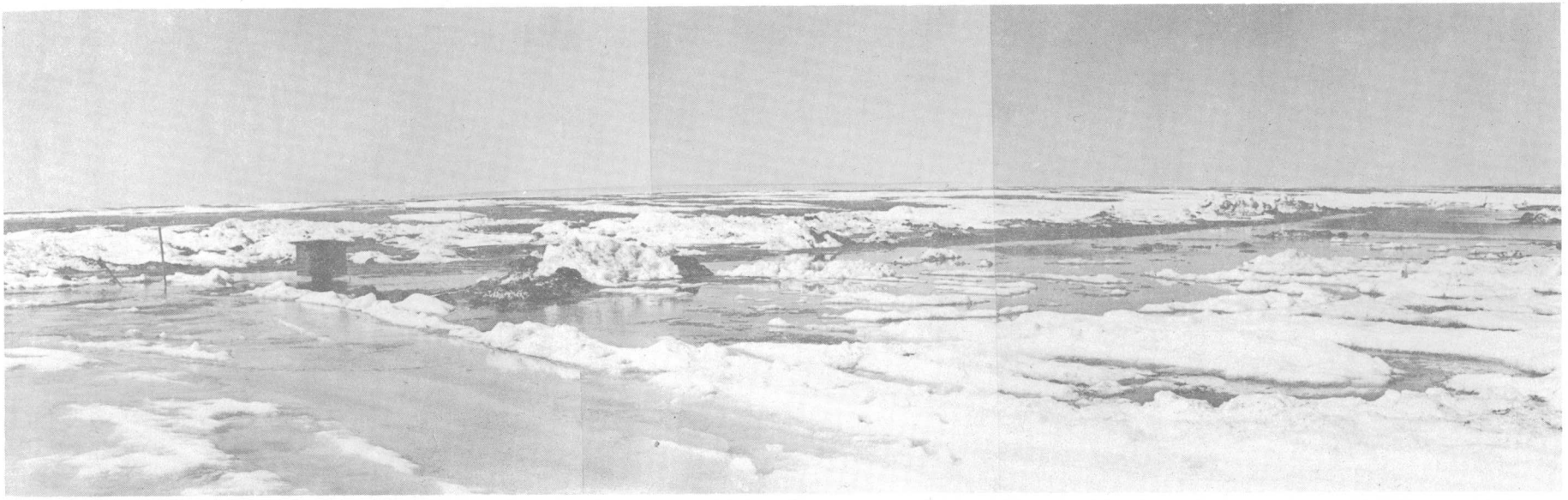

Figure 2.--Nunavak Creek gaging station, June 12, 1972.

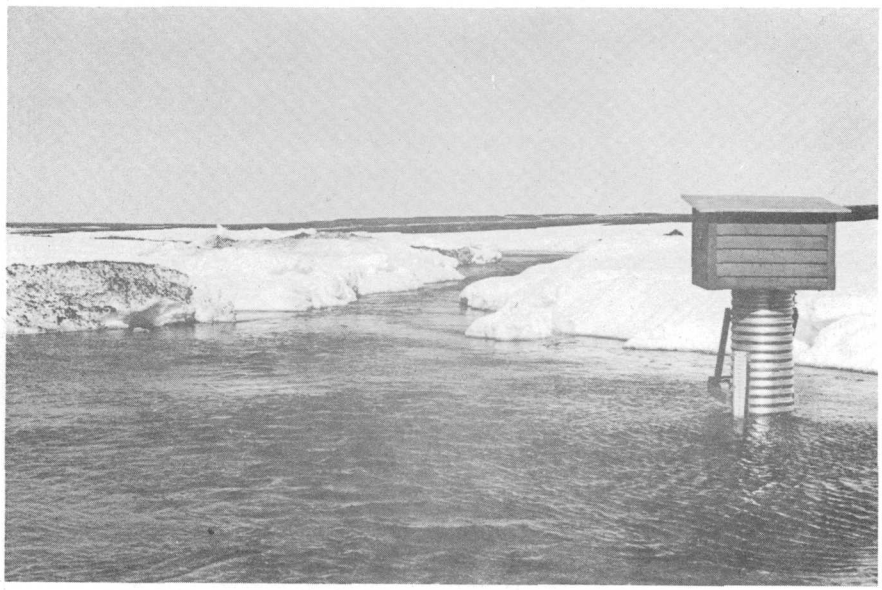

Figure 3.--Esatkuat Creek gaging station, June 12, 1972.

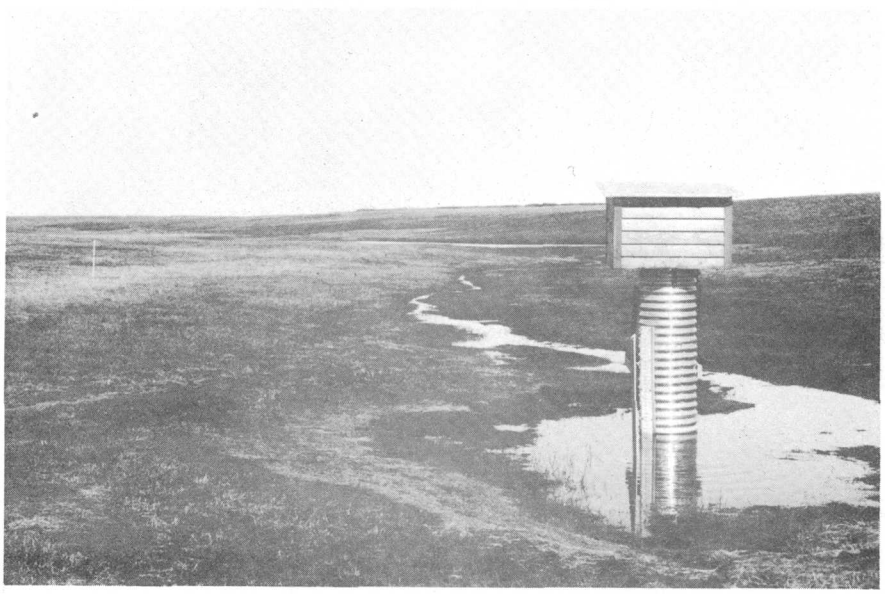

Figure 4.--Esatkuat Creek gaging station, July 10, 1972.

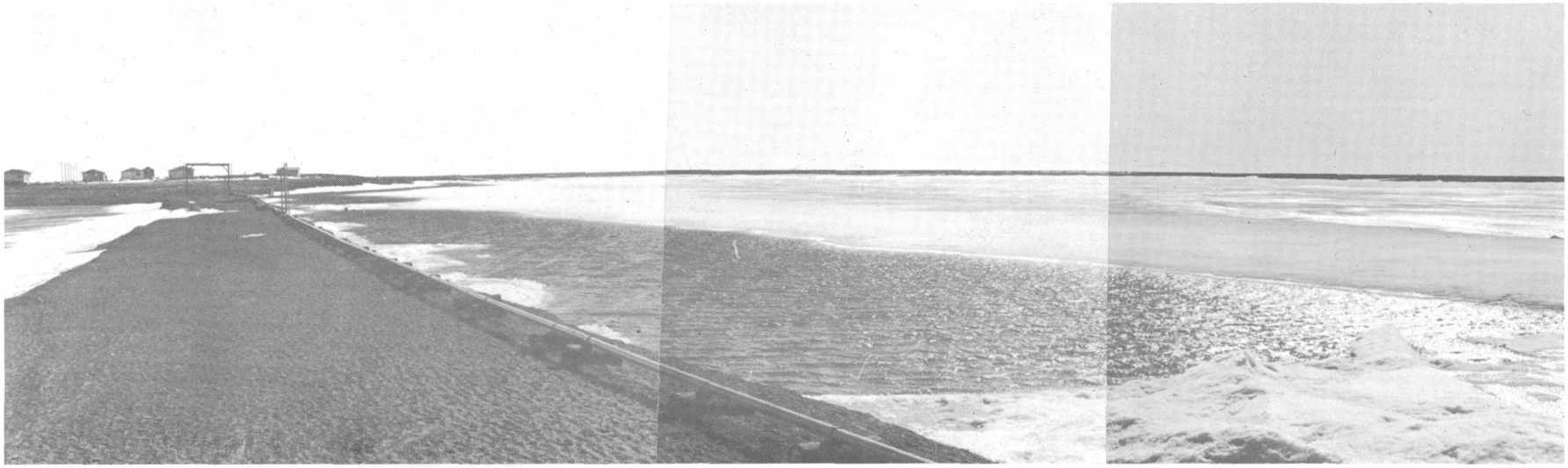

Figure 5.--Esatkuat Lagoon, June 15, 1972.

Figure 6.--Esatkuat Lagoon dam, June 15, 1972.

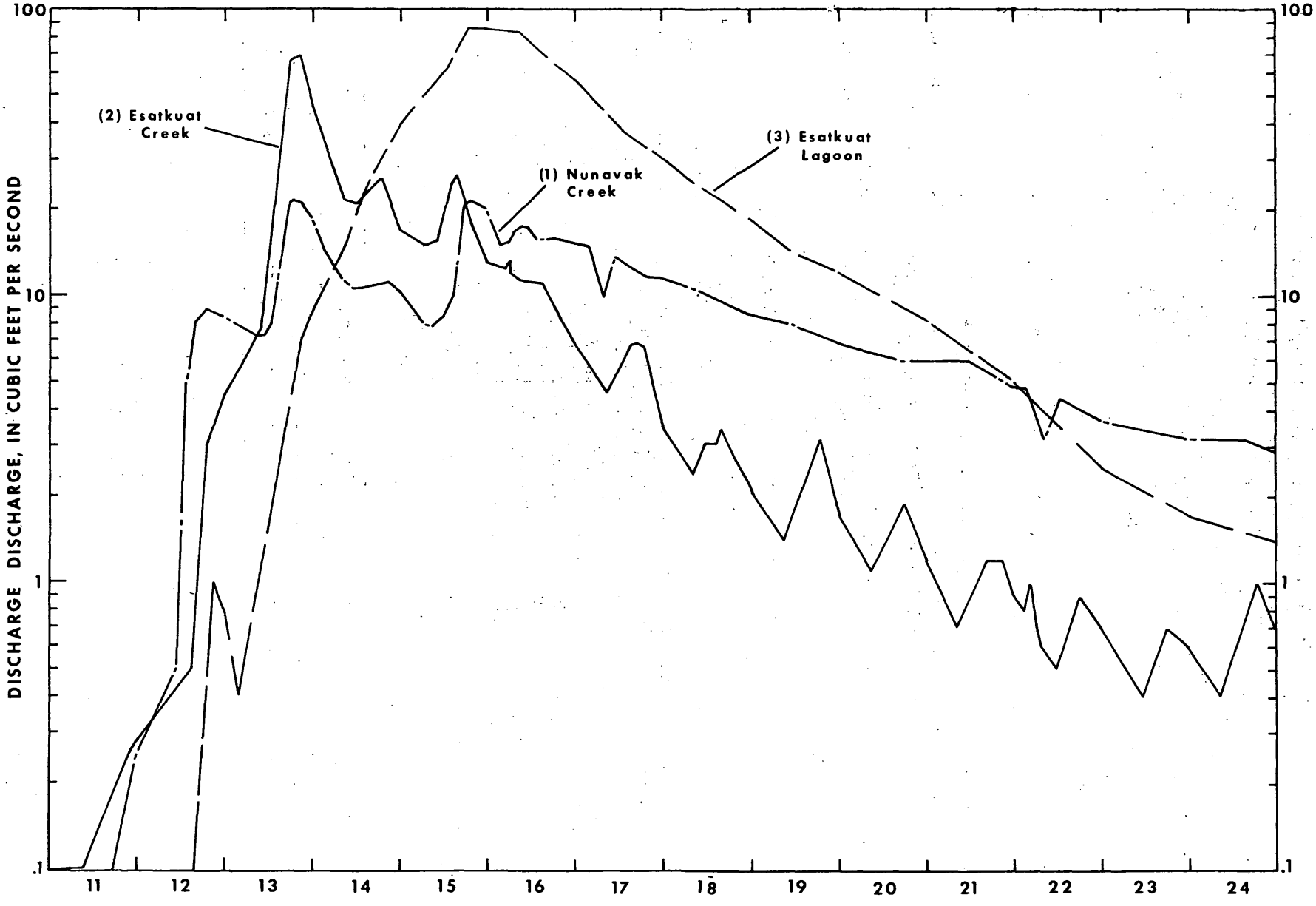

Figure 7.--Discharge hydrograph of Nunavak and Esatkuat Creeks and Esatkuat Lagoon.

Table 1.--Summary of streamflow data.

(1) 15798700 Nunavak Creek near Barrow

Location.--Lat 71°15'35", long 156°46'57", in SE1/4 sec.18, T.22 N., R.18 W., 2.3 miles south of Barrow Post Office, 0.7 mile below Emaiksoun Lake, and 1.2 miles upstream from Nunavak Bay.

Drainage area.--2.79 sq mi, approximately.

Gage-height record.--Water-stage recorder graph. Elevation of gage is 19 ft (from topographic map).

Discharge record.--Discharge during period of backwater from snow determined using frequent current-meter measurements and stage record. Stage-discharge relation afterwards defined by current-meter measurements.

Extremes.--Maximum discharge, 21.9 cfs June 13 (gage height, 2.71 ft, backwater from snow), maximum gage height 3.28 ft, June 12 (backwater from snow).

Mean discharge, in cubic feet per second, 1972

Day	June	July	Day	June	Day	June
1--	0	1.1	11-	0.10	21-	5.5
2--	0	1.0	12-	4.0	22-	4.0
3--	0	1.0	13-	12.5	23-	3.6
4--	0	0.90	14-	12.1	24-	3.2
5--	0	.90	15-	12.8	25-	2.8
6--	0	.70	16-	16.4	26-	2.0
7--	0	.70	17-	12.9	27-	1.7
8--	0	.60	18-	10.4	28-	1.5
9--	0	.50	19-	8.0	29-	1.2
10-	0	.50	20-	6.2	30-	1.1
					31-	--

Monthly mean discharge, in cubic feet per second	4.07
Runoff, in inches	1.63
Runoff, in acre-feet	242
Runoff, in gallons	78,870,000

Table 1.--Summary of streamflow data--Continued.

Gage height, in feet and discharge, in cubic feet per second, at indicated time, 1972, of Nunavak Creek near Barrow--Continued.

Date	Hour	Gage height	Discharge	Date	Hour	Gage height	Discharge	Date	Hour	Gage height	Discharge
June 10	2400	*1.58	0.00	June 14	2400	*1.54	10.5	June 17	2000	1.57	11.8
									2400	1.57	11.8
11	1800	*2.17	.10	15	0700	*1.44	8.0				
	2400	*2.52	.20		0900	*1.42	7.9	18	1000	1.55	10.7
					1200	*1.41	8.5		2400	1.48	8.8
12	1100	*2.83	.50		1500	*1.53	10.3				
	1400	*3.28	5.0		1800	*1.74	21.0	19	1000	1.46	8.2
	1600	--	8.0		1900	*1.75	21.3		2400	1.41	6.9
	1900	--	9.0		2100	*1.80	21.3				
	2400	--	8.5		2400	*1.83	20.0	20	1800	1.38	6.0
									2400	1.38	6.0
13	0900	*3.03	7.3	16	0200	*1.78	17.5				
	1100	*2.97	7.3		0400	*1.55	15.0	21	1200	1.38	6.0
	1300	*2.88	8.0		0600	*1.67	15.5		2400	1.34	4.9
	1800	*2.77	21.5		0800	*1.67	17.0				
	1900	*2.71	21.9		1000	*1.75	17.7	22	0400	1.34	4.9
	2100	*2.70	21.5		1100	*1.75	17.7		1000	1.26	3.2
	2400	*2.43	18.5		1400	*1.76	15.8		1300	1.32	4.4
					1900	*1.70	16.0		2400	1.29	3.7
14	0300	*2.22	14.5		2400	1.68	15.5				
	0800	*1.91	11.5					23	2400	1.26	3.2
	1100	*1.85	10.8	17	0400	1.65	15.0				
	1400	*1.79	10.8		0800	1.52	10.0	24	1600	1.26	3.2
	2100	*1.62	11.2		1100	1.62	13.9		2400	1.24	2.9

* Stage-discharge relation affected by snow.

Table 2.--Summary of streamflow data.

(2) 15799000 Esatkuat Creek near Barrow

Location.--Lat 71°16'30", long 156°43'44", in NE1/4 sec.8, T.22 N., R.18 W., 1.7 miles southeast of Barrow Post Office and 1,000 feet upstream from Esatkuat Lagoon.

Drainage area.--1.46 sq mi, approximately.

Gage-height record.--Water-stage recorder graph. Elevation of gage is 8 ft (from topographic map).

Discharge record.--Discharge during period of backwater from snow determined using frequent current-meter measurements and stage record. Stage-discharge relation afterwards defined by current-meter measurements.

Extremes.--Maximum discharge, 66.9 cfs June 13 (gage height, 2.90 ft, backwater from snow).

Mean discharge, in cubic feet per second, 1972

Day	June	July	Day	June	Day	June
1--	0	0.60	11-	0.1	21-	1.0
2--	0	.30	12-	1.3	22-	0.70
3--	0	.30	13-	30.1	23-	0.60
4--	0	.10	14-	26.4	24-	0.60
5--	0	.10	15-	18.1	25-	0.50
6--	0	.10	16-	10.8	26-	0.60
7--	0	.10	17-	5.8	27-	0.40
8--	0	.04	18-	2.9	28-	0.30
9--	0	.03	19-	2.1	29-	0.20
10-	0	.02	20-	1.5	30-	0.40
					31-	--

Monthly mean discharge, in cubic feet per second	3.48
Runoff, in inches	2.66
Runoff, in acre-feet	207
Runoff, in gallons	67,460,000

Table 2.--Summary of streamflow--Continued.

Gage height, in feet and discharge, in cubic feet per second, at indicated time, 1972, of Esatkuat Creek near Barrow--Continued.

Date	Hour	Gage height	Dis-charge	Date	Hour	Gage height	Dis-charge	Date	Hour	Gage height	Dis-charge
June 10	2400	*0.89	0.0	June 15	2000	1.58	17.4	June 20	1000	0.83	1.1
					2400	1.40	13.0		1800	.90	1.9
11	1000	*1.07	.1						2400	.84	1.2
	2200	*1.15	.3	16	0500	1.38	12.5				
	2400	*1.29	.3		0600	1.41	13.2	21	1000	.78	0.70
					0600	1.34	12.0		1600	.84	1.2
12	1500	*1. 7	.5		0900	1.30	11.3		2000	.84	1.2
	1900	*2.12	3.0		1500	1.32	11.1		2400	.80	0.90
	2400	*2.41	4.5		2000	1.23	8.5				
					2400	1.13	6.8	22	0200	.79	.80
13	1000	*2.63	7.7						0400	.82	1.0
	1800	*2.80	66.0	17	0900	1.05	4.6		0600	.78	0.70
	2100	*2.90	66.9		1500	1.13	6.8		0800	.76	.60
	2400	2.50	45.0		1700	1.14	6.9		1200	.74	.50
					1900	1.11	6.7		1800	.80	.90
14	0600	2.06	27.5		2400	1.00	3.5		2400	.77	.70
	0900	1.95	21.8								
	1200	1.87	21.0	18	0900	0.94	2.4				
	1500	1.92	23.6		1200	.98	3.1	23	1100	.72	.40
	1900	1.88	25.9		1500	.98	3.1		1800	.78	.70
	2400	1.65	17.0		1600	1.00	3.5		2400	.76	.60
					2400	0.91	2.1				
15	0700	1.58	15.0					24	1000	.72	.40
	1000	1.60	15.6	19	0900	.86	1.4		1900	.82	1.0
	1400	1.70	24.7		1900	.96	3.2		2400	.77	0.70
	1500	1.76	26.5		2400	.89	1.7				

* Stage-discharge relation affected by snow.

Table 3.--Summary of streamflow data.

(3) 15799300 Esatkuat Lagoon Outlet at Barrow

Location.--Lat 71°17'40", long 156°46'06", in SW1/4 sec.32, T.23 N., R.18 W., 0.4 mile northeast of Barrow Post Office and 1,000 feet above dam on Esatkuat Lagoon.

Drainage area.--3.52 sq mi, approximately.

Gage-height record.--Water-stage recorder graph. Elevation of gage is 3 ft (from topographic map).

Discharge record.--Discharge during period of backwater from snow determined using frequent current-meter measurements and stage record. Stage-discharge relation afterwards defined by current-meter measurement.

Extremes.--Maximum discharge, 86.0 cfs June 15 (gage height, 1.74 ft, backwater from snow), maximum gage height 2.02 ft, June 14 (backwater from snow).

Mean discharge, in cubic feet per second, 1972

Day	June	July	Day	June	Day	June
1--	0	0.40	11-	0.00	21-	5.5
2--	0	.40	12-	.20	22-	4.1
3--	0	.40	13-	3.0	23-	2.5
4--	0	.30	14-	21.3	24-	1.4
5--	0	.30	15-	63.1	25-	1.4
6--	0	.20	16-	74.4	26-	1.1
7--	0	.20	17-	41.0	27-	.70
8--	0	.10	18-	24.1	28-	.50
9--	0	.10	19-	14.4	29-	.50
10-	0	.10	20-	8.2	30-	.40
					31-	--

Monthly mean discharge, in cubic feet per second	8.93
Runoff, in inches	2.83
Runoff, in acre-feet	531
Runoff, in gallons	173,100,000

Table 3.--Summary of streamflow data.--Continued

Gage height, in feet and discharge, in cubic feet per second, at indicated time, 1972, of Esatkuat Lagoon Outlet at Barrow--Continued

Date	Hour	Gage height	Discharge	Date	Hour	Gage height	Discharge	Date	Hour	Gage height	Discharge
June 11	2400	*1.18	0.00	June 14	2400	*1.88	39.5	June 18	1100	*0.95	24.0
									2400	*0.88	18.8
12	1600	*1.25	.10	15	0900	*1.86	54.1				
	2100	*1.33	1.0		1400	*1.80	63.2	19	1100	*0.84	14.4
	2400	*1.34	.80		1900	*1.74	86.0		2400	*0.82	12.0
					2400	*1.63	85.0				
13	0600	*1.35	.40					20	2400	*0.76	8.2
	1500	*1.34	2.8	16	0900	*1.47	82.6				
	2100	*1.57	7.2		2000	*1.28	62.0	21	2400	*0.74	5.0
	2400	*1.68	9.0		2400	*1.23	56.5				
								22	2400	*0.71	2.5
14	0900	*1.92	15.0	17	1300	*1.07	37.3				
	1400	*2.02	22.9		2400	*0.99	30.7	23	2400	*0.68	1.7
	1900	*1.91	30.4								
								24	2400	*0.67	1.4

* Stage-discharge relation affected by snow and ice.

Table 4.--Summary of water temperature and specific conductance.

Date	Time	Water Temperature (°C)	Discharge (cfs)	Specific conductance (micromhos)
(1) 15798700 NUNAVAK CREEK NEAR BARROW				
June 13, 1972	1915	1.7	21.9	80
14	2055	1.1	11.2	60
17	1030	5.0	13.9	100
18	1000	3.3	10.7	220
July 10, 1972	1410	13.0	0.54	145
(2) 15799000 ESATKUAT CREEK NEAR BARROW				
June 11, 1972	2120	0	0.26	120
13	1020	0	7.74	80
13	2025	0	66.9	60
14	915	0	21.8	60
14	1930	0	25.9	70
17	915	0	4.61	70
18	900	0.6	2.43	70
July 10, 1972	1240	4.5	.02	77
(3) 15799300 ESATKUAT LAGOON OUTLET AT BARROW				
June 12, 1972	1625	0	0.07	330
13	2115	0	7.16	380
14	1345	0	22.9	2,000
15	845	0	54.1	2,000
16	2010	0	62.0	700
17	1315	0	37.3	1,500
18	1100	0	24.0	1,200
19	1115	0.3	14.4	700
July 10, 1972	1940	5.0	.05	1,250