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HYDROLOGIC RECONNAISSANCE OF THE  
STONY RIVER BASIN, ALASKA, 1983-84

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## TABLE OF CONTENTS

	<u>Page</u>
Project description.....	1
Explanation of graphics.....	2
Acknowledgements.....	3
References cited.....	4

## LIST OF GRAPHICS

Figure 1	Index of USGS topographic maps
Figure 2	Generalized physiography
Figure 3	River profiles
Figure 4	Channel cross-sections
Table 1	Summary of observed data
Table 2	Summary of calculated data
Table 3	Water-quality data

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Alaska DCGS personnel reconnoitered the Stony River basin in southwestern Alaska in August 1983 and March 1984 to collect hydrologic data to describe the flow characteristics and quality of the surface water in the basin under both summer (high-flow) and winter (low-flow) conditions.

The 180-mi-long Stony River drains approximately 3,300 mi<sup>2</sup> of southwestern Alaska. The river drops 3,750 ft from its glacial headwaters in the Alaska Range to its confluence with the Kuskokwim River. Poorly-drained soils with a peaty surface layer over a shallow permafrost table predominate within the basin (Selkregg, 1976). Spruce-hardwood forest is the dominant vegetation, with alpine tundra at the higher elevations. Bedrock is exposed in the upper basin.

The Stony River basin straddles parts of the Holitna Lowland, Nushagak-Big River Hills and Southern Alaska Range as described by Wahrhaftig (1965). The Stony River is one of several large, braided glacial streams which rise from glaciers in the Alaska Range and flow across the moraine-mantled lowlands. Pleistocene alluvial deposits border the lower river, and Permian limestone and volcanic rock occur in the Lime Hills, conspicuous isolated steep-sided ridges which rise to an altitude of 1000-2000 ft. Mountains in the basin consist of Tertiary and Cretaceous granitic rocks, Cretaceous and Jurassic sedimentary and volcanic rocks, and pre-Cretaceous sedimentary, volcanic and igneous rocks (Beikman, 1974). Numerous morainal and thaw lakes occur throughout the lowland.

The Stony River basin lies within the continental climatic zone of Alaska, characterized by cold winters and hot summers. The weather station at Sparrevohn, on the southwest margin of the basin, records a mean summer temperature of 40° to 61°F, mean winter temperature of 0° to 20°F, and extremes of -47°F and 82°F over a 10-year period. Average annual precipitation at the station is 21 in. including 81 in. of snow (Selkregg, 1976). Regional variations should be expected within the basin.

DCGS personnel floated the Necons River from Two Lakes to its confluence with

the Stony River, then the Stony River to its mouth in August 1983 and obtained discharge, water-quality and stream-channel measurements at 11 sites. In March 1984 the sites were revisited by helicopter.

Information in this report can be used to assess runoff and baseflow conditions of the river system and to estimate the year-round regimen of this southwestern Alaska river basin.

#### EXPLANATION OF GRAPHICS

Figure 1 is an index of U.S. Geological Survey (USGS) 1:250,000- and 1:63,360-scale topographic maps of the Stony River basin.

Figure 2 shows the generalized physiography of the basin superimposed over a diagrammatic representation of the riverine system.

Figure 3 is a profile of the Stony River and selected tributaries compiled from USGS 1:63,360-scale topographic maps. Comparative gradients along river segments and the position of tributaries and data-collection sites are shown.

Figure 4 contains a channel cross section of each data-collection site. Cross sections were developed from survey measurements taken during the August 1983 reconnaissance. Bankfull channel stage was determined from the flood-plain surface and the lower limits of permanent vegetation (Childers and Kernodle, 1983); maximum-evident-flood (MEF) stage was extrapolated from high-water marks found on the riverbanks.

Table 1 is a summary of the channel geometry and discharge measurements taken during the two reconnaissance trips and the calculated unit runoff based on these measurements. Unit runoff, obtained by dividing stream discharge by drainage area, can be used to compare seasonal water yields in a basin or subbasin (Childers and Kernodle, 1983).

Table 2 contains calculations based on the observed data. From the channel cross sections, the approximate discharge for bankfull and MEF conditions are calculated with the simplified slope-area method (Riggs, 1979). The bankfull discharge indicates the maximum amount of flow that may be expected without flooding, and the MEF discharge indicates the maximum instantaneous peak discharge at the site in recent years (Childers and Kernodle, 1983). Drainage-basin characteristics are used to calculate predicted 2-yr and 50-yr floods using Lamke's (1979) method. (A 2-yr flood has a 50 percent chance of being exceeded in a particular year, whereas a 50-yr flood has a 2 percent chance of being exceeded; these values are based on multiple regression analysis of streamflow records, which are very scanty in Alaska.) The Froude number is a mathematical relationship between mean velocity, mean depth, and the gravitational constant and is used to compare states of flow at the sites. (In a rectangular channel, flow is tranquil if the Froude number is less than 1.0 and is rapid if greater than 1.0 [Dalrymple and Benson, 1968]). Observed summer stage was used as a basis in calculating discharge using the simplified slope-area method and may be compared to the actual discharge values in Table 1. Site-specific conditions, such as local variations in slope due to a nonideal channel reach, cause discrepancies between calculated and measured discharge values.

Table 3 is a summary of water-quality data gathered at all sites during the 1983 and 1984 reconnaissance trips.

#### ACKNOWLEDGEMENTS

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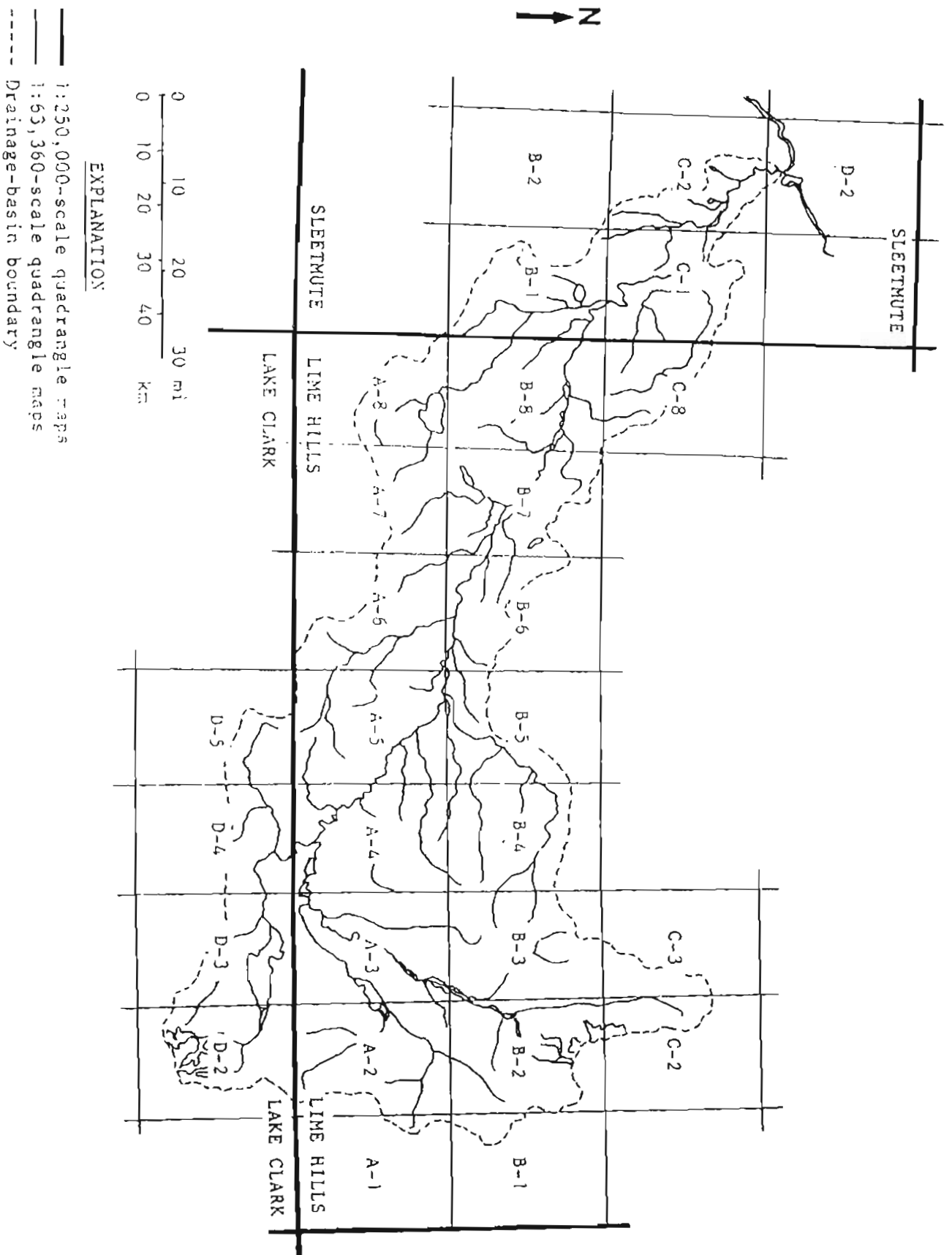


Figure 1. Index of U.S. Geological Survey topographic maps by quadrangle for the Stony River basin, Alaska.

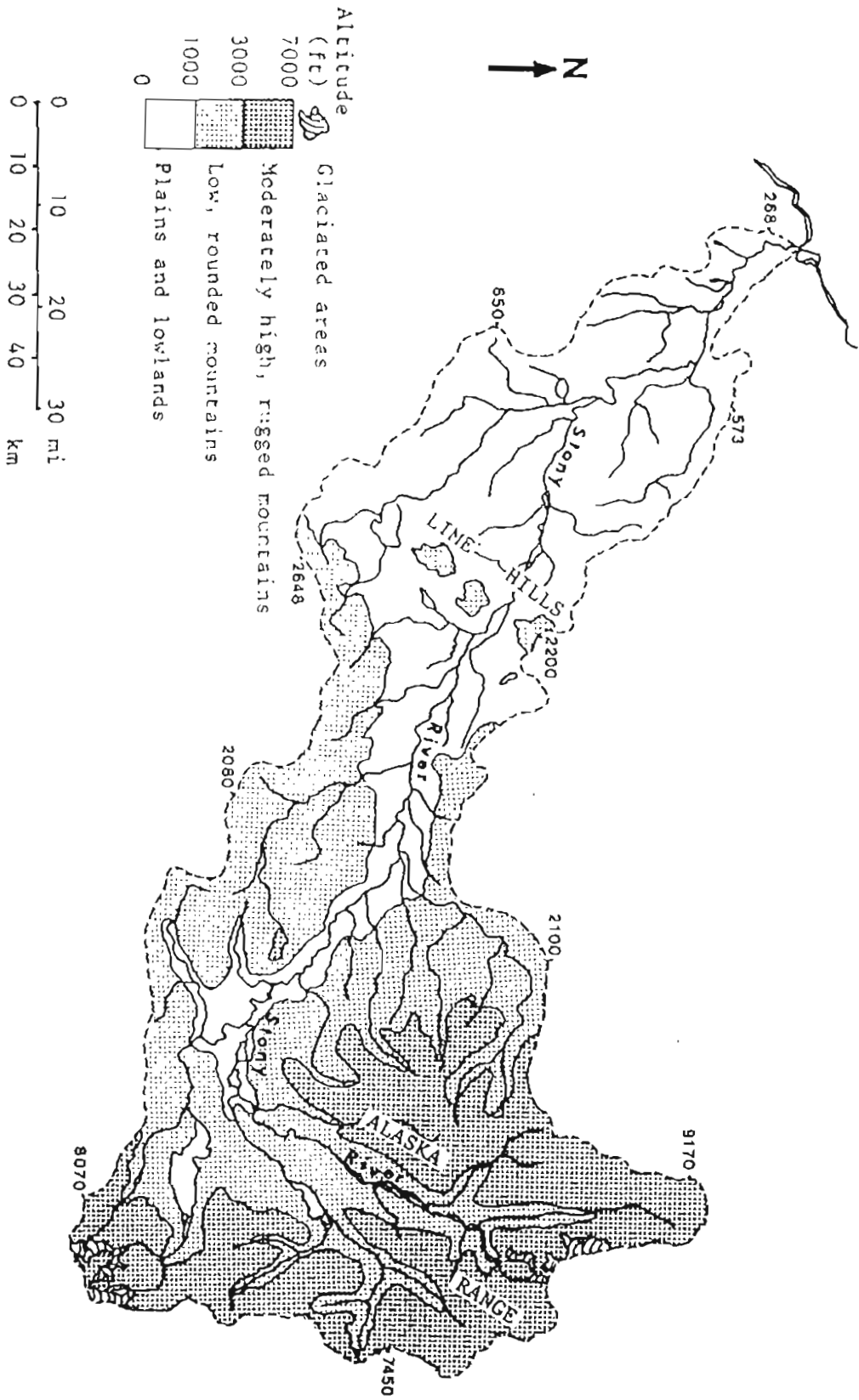


Figure 2. Generalized physiography, Stony River basin, Alaska.



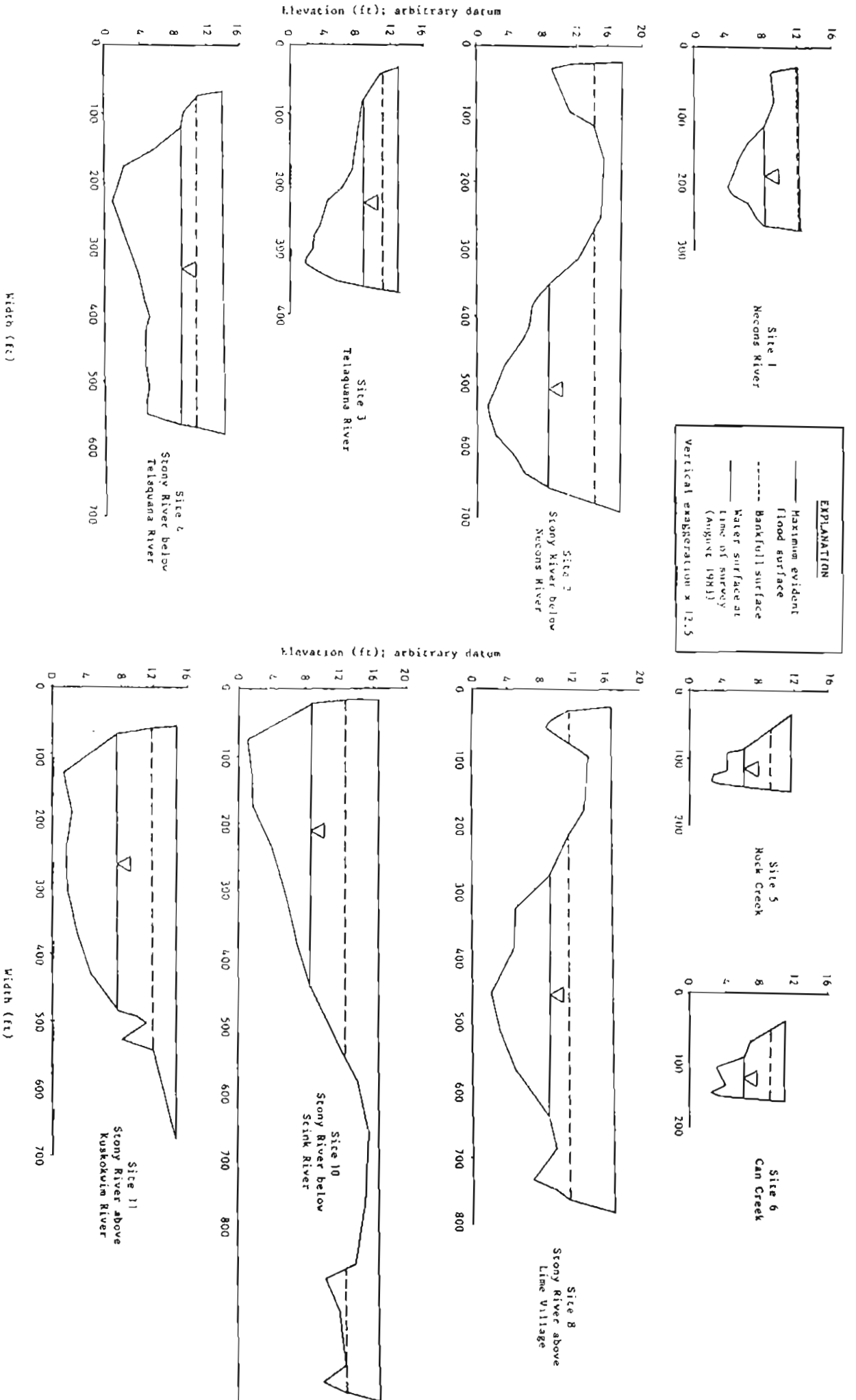


Figure 4. Channel cross-sections, Stony River basin, Alaska, August 1983.

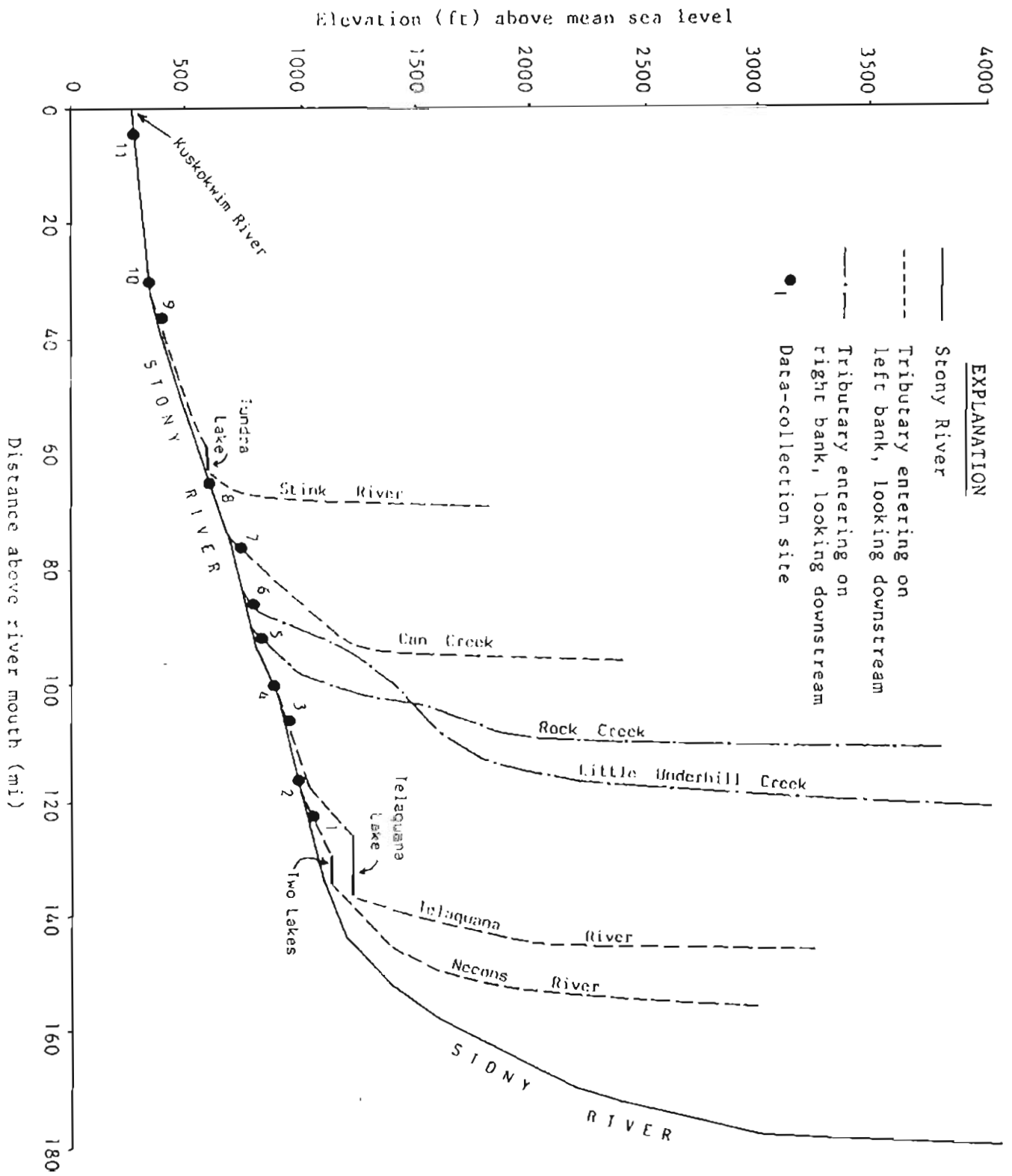


Figure 3. Profile of Stony River and selected tributaries, Alaska.

Table 1. Summary of observed discharge and cross-sectional data, Stony River basin, Alaska, 1983-84.

Data collection site	Slope (ft/ft)	Cross-sectional area-ft <sup>2</sup>		Water-surface width (ft)		Mean depth (ft)		Maximum depth (ft)		Mean velocity (fps)		Maximum velocity (fps)		Discharge (cfs)		Unit runoff (cfs/mi <sup>2</sup> )	
		winter <sup>a</sup>	summer	winter	summer	winter	summer	winter	summer	winter	summer	winter	summer	winter	summer	winter	summer
1. Necons River	0.0018	138	412	160	150	0.9	2.8	2.0	5.2	1.6	2.5	2.5	4.0	201	1,290	0.56	3.58
2. Stony River below Necons River	0.0008	559	1,020	152	287	3.7	3.8	6.1	7.7	1.0	2.8	1.6	4.6	514	3,140	0.73	4.49
3. Telaquana River	0.0001	266	827	217	282	1.2	3.3	2.8	6.8	0.9	1.3	1.2	2.2	212	1,420	0.48	3.19
4. Stony River below Telaquana River	0.0004	425	2,130	445	460	1.0	4.4	3.7	7.0	1.2	2.1	2.3	3.2	479	5,050	0.40	4.21
5. Rock Creek	0.0048	15	67	21	59	0.7	1.1	1.4	1.8	1.4	3.3	2.1	4.1	21	218	0.32	3.35
6. Little Underhill Creek	b	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7. Can Creek	0.0024	21	88	27	59	0.8	1.5	1.5	2.2	2.7	2.0	4.0	3.0	51	179	0.28	0.99
8. Stony River 4 mi above Lime Village	0.0014	654	1,590	355	368	1.8	3.7	3.5	7.0	2.3	5.2	4.0	5.6	1,360	8,260	0.64	3.90
9. Stink River	-	40	274	114	108	0.4	2.7	2.3	4.0	0.2	0.4	0.3	0.9	6	142	0.02	0.37
10. Stony River below Stink River	0.0008	510	1,740	350	420	1.5	3.9	4.0	7.5	1.7	3.9	2.5	4.8	805	6,860	0.28	2.37
11. Stony River above Kuskokwim River	0.0005	1,110	1,880	235	420	4.7	3.9	12.1	6.0	1.0	2.8	1.7	4.5	1,010	7,150	0.31	2.20

<sup>a</sup> 'Winter' refers to reconnaissance of March 1984; 'summer' to August 1983.  
<sup>b</sup> No measurements made.

Table 2. Summary of calculated discharge and cross-sectional data, Stony River basin, Alaska, 1963-64.

Data collection site	Calculated bankfull characteristics				Calculated MEF characteristics				Drainage basin characteristics				Predicted flood Q (cfs) 72-year 50-year flood	Flood number (Aug. 1983) (low)	Calculated slope-area discharge at observed August 1983 stage (cfs)			
	Cross-sectional area (sq ft)	Water surface width (ft)	Mean depth (ft)	Mean velocity (ft/s)	Cross-sectional area (sq ft)	Discharge (cfs)	Unit (cfs/ft)	Area (sq mi)	Mean annual precipitation (in.)	Mean minimum January temperature (°F)	I of basin forested	I of basin under lakes				Q (cfs) 72-year flood	Q (cfs) 50-year flood	
1. Necona River	780	235	3.3	10.2	5.8	4,500	12.50	780	4,500	360	22	-8	30	3	2,450	6,360	0.76	1,930
2. Stony River below Necona River	2,600	510	5.1	17.8	6.3	16,400	47.16	4,036	24,500	700	27	-3	40	1	4,980	11,960	0.39	5,740
3. Telaquana River	1,460	335	4.3	9.8	7.1	2,960	5.39	1,870	4,160	445	22	-6	65	8	2,300	3,740	0.13	1,410
4. Stony River below Telaquana River	2,960	695	6.0	10.0	5.0	14,700	21.33	4,500	25,600	1,200	22	-2	50	4	6,730	14,900	0.18	9,450
5. Rock Creek	135	95	1.6	3.5	6.7	730	21.08	750	1,370	65	22	-6	55	0	590	1,930	0.56	239
6. Little Underhill Creek	-	-	-	-	-	-	-	-	-	285	27	-8	60	2	1,890	5,040	-	-
7. Can Creek	160	105	1.5	7.2	3.8	605	8.11	310	1,440	180	27	-8	20	1	1,550	4,430	0.29	273
8. Stony River 4 mi above Lime Village	2,850	635	4.6	9.2	8.1	23,300	32.65	6,450	68,800	2,120	22	-8	55	3	11,800	26,200	0.48	10,600
9. Slink River	-	-	-	-	-	-	-	-	-	385	22	-8	50	7	2,130	5,430	0.04	-
10. Stony River below Slink River	3,860	770	5.0	13.2	7.2	28,000	21.72	7,140	63,000	2,900	22	-8	60	4	14,900	29,400	0.35	9,640
11. Stony River above Kuskoobuk River	3,890	450	8.6	9.2	6.0	23,700	11.54	5,580	37,500	3,250	22	-8	55	4	16,800	32,700	0.25	8,840

\* No measurements made.

Table 3. Field water quality at data collection sites, Stony River basin, Alaska, 1983-84.

Data collection site	Water temperature (°C)		Specific conductance (umhos/cm @ 25°C)		Dissolved oxygen (mg/l)		pH	
	winter <sup>a</sup>	summer	winter	summer	winter	summer	winter	summer
1. Necons River	-0.1	11.0	81	58	13.0	<sup>b</sup> -	6.7	-
2. Stony River below Necons River	-0.2	10.0	84	49	12.3	12.2	6.0	-
3. Telaquana River	-0.2	12.0	73	54	12.5	-	5.6	-
4. Stony River below Telaquana River	-0.2	12.0	80	56	11.8	-	6.0	-
5. Rock Creek	-0.2	6.8	53	32	13.1	-	6.6	-
6. Little Underhill Creek	-	7.0	-	32	-	-	-	-
7. Can Creek	-0.2	11.5	81	75	11.9	-	5.5	-
8. Stony River 4 mi above Lime Village	-0.2	10.0	75	86	11.8	-	6.2	-
9. Stink River	-0.2	12.0	233	100	0.0	-	6.2	-
10. Stony River below Stink River	-0.2	11.2	95	72	10.8	-	5.9	-
11. Stony River above Kuskokwim River	-0.1	12.0	41	58	10.0	-	5.6	-

<sup>a</sup> 'Winter' refers to reconnaissance of March 1984; 'summer' to August 1983.

<sup>b</sup> No measurements made.