FLOOD OF JULY 12, 1983
ON THE ILLECILLEWAET RIVER
BRITISH COLUMBIA

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ABSTRACT

This report documents a major flood on the Illecillewaet River. On July 11 and 12, 1983 heavy precipitation fell over the Revelstoke-Golden area of the interior of British Columbia. Heavy precipitation coming on top of snowmelt and concentrated over the entire Illecillewaet basin produced an estimated 40 year flood. An instantaneous maximum discharge of 440 cubic metres per second was estimated by the slope-area measurement technique at the Water Survey of Canada stream gauging station "Illecillewaet River at Greeley." This value is 35 percent lower than that obtained previously by extending a rating curve beyond the elevation of overbank flow. Over bank flow must be defined either by velocity meter or by indirect measurements.

Large quantities of bed material were carried through this reach during the flood.

Washouts occurred on both the Trans-Canada Highway and the mainline CPR through Rogers Pass. Numerous other washouts and slides affected the general area.

1. Introduction

The Illecillewaet River rises in the Selkirk Mountains northeast of Revelstoke. The gauging site is located 10 kilometres from its confluence with Arrow Reservoir southeast of Revelstoke. The basin at the gauging station has a drainage area of 1170 square kilometres (km^2).

This report has been written to document a major flood, provide an understanding of the causes of floods in the area and to present an analysis of the basic data. It provides a general description of events leading up to the flood, description of the storm event, the extent of flooding and flood damage. The frequency characteristics are presented to indicate the probability of the flood event of July 12, 1983.

The slope-area measurement technique is used to provide a reliable estimate of flow when the stage-discharge relationship cannot be extended with any degree of confidence. This relationship cannot be extended into overbank flow conditions without being defined by measurements. Usually by this time the measurement site is inaccessible, and there is danger of the cableway towers collapsing and there is also excessive debris in the river channel.

2. Description of Rainstorm

A major rainstorm occurred in the Revelstoke-Rogers Pass area of British Columbia during the second week of July, 1983. The meteorological situation associated with the heavy rainfall consists of a series of frontal waves driven across British Columbia from the Pacific by a west-southwesterly jet stream aloft. Continuous rainfall accompanied each of two successive waves. Unstable air produced showers and thundershowers following passage of the second wave. Daily rainfalls for five selected stations in the area are shown in Figure 1.

The main features revealed by Figure 1 include the heavy continuous rainfall extending from the morning of July 11 to the early morning of July 12, the heavy continuous rainstorm extending from early morning to just after noon on July 13 and the thunderstorm rainfall shown on the Revelstoke curve between 4 and 6 p.m. P.S.T. on July 13.

Runoff records indicate that for small to medium basins in the area the initial period of continuous rainfall was of greater significance than the 3-day accumulations even though the latter were indicative of a greater return period.

The rainstorm occurred at a time when snowmelt was still in progress and the river was already at medium stage.

3. Description of Flood Damage

The rainstorm which occurred in the Revelstoke-Rogers Pass area from July 10 to 15 caused washouts on both the Trans-Canada Highway and the CPR mainline through Rogers Pass. Numerous other washouts and slides affected the general area. Duncan Lake experienced its highest inflows on record. Some photographs of the Illecillewaet River at the gauging station are shown in Figure 3.

4. Analysis of Flood Data

4.1 Description of Gauging Station

This station was established in 1963 with a wood stave well, float-operated A-35 recorder and cableway. A Telemark, Memomark, and D.C.P. have been installed at the station and referenced to the inside gauge. High water measurements are made from the cableway and low water measurements by wading at various locations near the cableway. Twenty-two years of instantaneous discharge data have been obtained for this station.

4.2 Field Data

A field survey was undertaken on July 25, 1983. Four cross sections were obtained with high water marks taken from silt and erosion marks on the banks and on trees in the floodplain. Each section was located at a distance of 60 metres from each other. One section was located at the cableway, two above and one below. The cross sections are shown in Figure 2. Table 1 lists the data used for the slope-area computation.

Table 1

Slope Survey Data

CROSS SECTION	HIGH WATER MARK (left bank)	DIFFERENCE IN ELEVATION	WATER SURFACE SLOPE
Section #4 120 metres above cableway	104.18		
Section #3 60 metres above Cableway	104.02	0.16	0.00267
Section #2 at Cableway	103.77	0.25	0.00417
Section #1 60 Metres below Cableway	103.45	0.32	.0053

4.3 Description of Channel Geometry

It is assumed that as the flow increases, velocity increases and the subsequent movement of the bed commences once friction has been overcome. Friction reaches a maximum immediately before the bed starts to move and then decreases to a constant value. Degradation continues in the stream channel and the area of the section increases as does the volume of discharge with a moderate increase in stage.

Figure 3 shows the stream channel at the cableway before and after the flood. When equilibrium of the bed is reached, the stage then increases at a constant rate as the discharge increases. At a given stage, the channel downstream of the cableway begins to act as a restriction to the flow and starts to cause backwater. The water surface slope decreases as more water is entering the reach than can be passed through.

This is not the usual condition where overbank flow causes the rating curve to deviate abruptly to the right. The rating curve is generally never defined by velocity measurements in overbank flow conditions because of the reasons stated earlier.

4.4 Estimation of Flood Discharge

The slope-area technique was used to estimate the peak discharge of the channel. It is based on Manning's Uniform-flow equation. All of the hydraulic parameters are obtained from cross section surveys except for Manning's n which was estimated from photographs of the stream channel. The estimated instantaneous discharge for the flood of July 12, 1983 was estimated to be 440 m^3/s.

The previous maximum instantaneous discharge for the flood was obtained from an extended rating curve and estimated to be 591 m^3/s.

4.5 Flood Frequency Analysis

The Log Pearson III distribution has been fitted to the data by the method of maximum likelihood. This distribution appears to fit the maximum instantaneous data fairly well as shown in figure 5.

5. <u>Conclusions and Recommendations</u>

The flood of July 12, 1983 was due to several factors:

1. antecedent conditions - the basin was already charged with snowmelt runoff and the streamflow preceding the rainstorm was at medium stage .
2. heavy precipitation - rainfall from the storm was concentrated over the basin.

The frequency analysis based on the Log Pearson III distribution indicates that the maximum instantantaneous discharge of July 12, 1983 has an estimated return period of 40 years.

The previous maximum instantaneous flow estimated for this flood at 591 m^3/s is nearly 35 percent higher than the figure computed by the slope-area technique.

Water surface slopes should be obtained at the same cross sections for other periods of high flow to confirm the value of Manning's n and the finding in this study.

ACKNOWLEDGEMENTS

The author would like to acknowledge the contributions of the field staff from the Water Survey of Canada sub-office of Revelstoke who conducted the slope-area survey and provided the photographs of the flood.

BIBLIOGRAPHY

Dalrymple, T and M.A. Benson. Slope-Area Method. United States Department of the Interior. 1956.

Figures 1 - 5

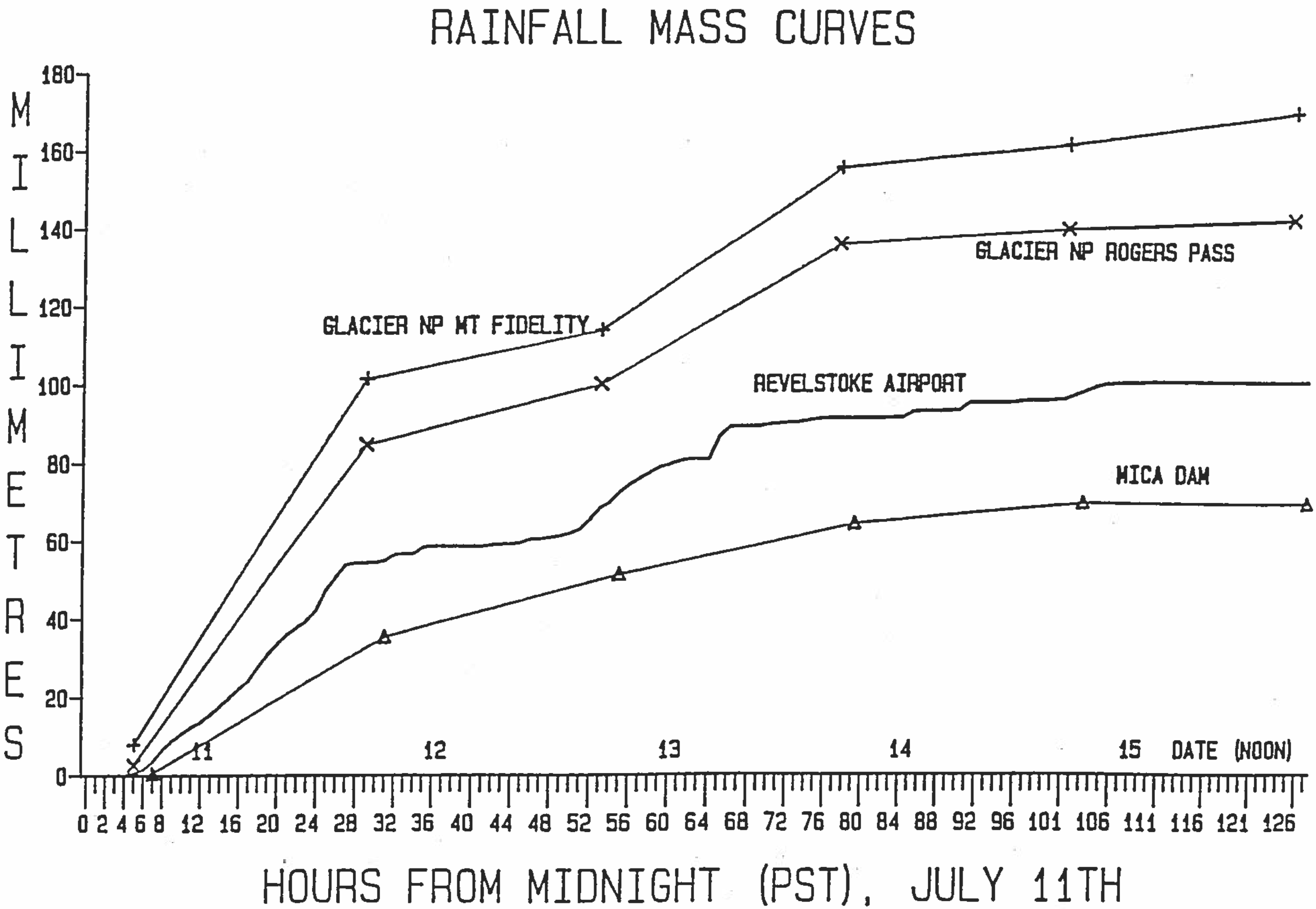

Figure 1 Mass Curve of Rainfall for Selected Stations

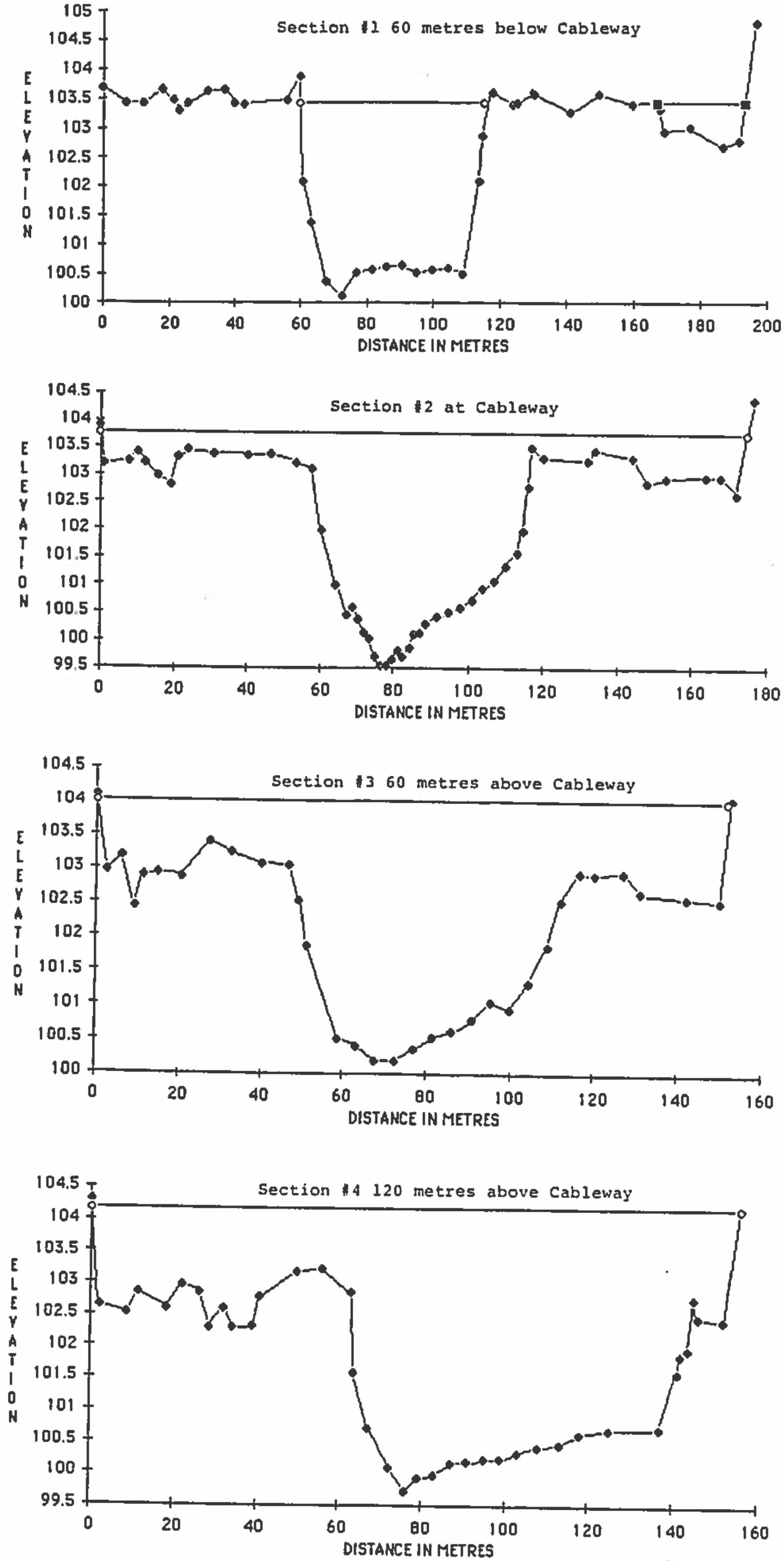

Figure 2 Cross Section of Illecillewaet River used for Indirect Measurement

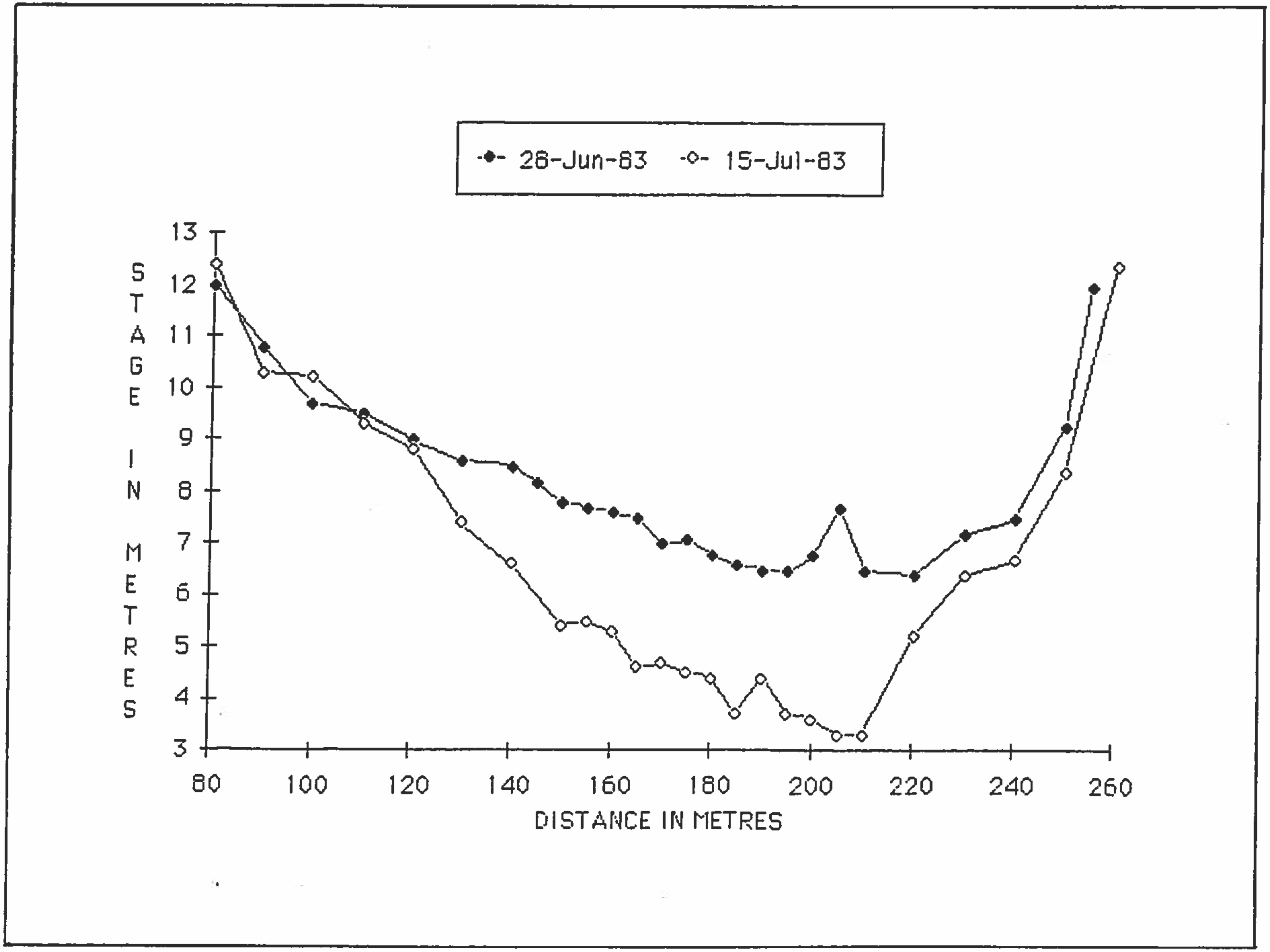

Figure 3 Cross Section of Illecillewaet River used for Indirect Measurement

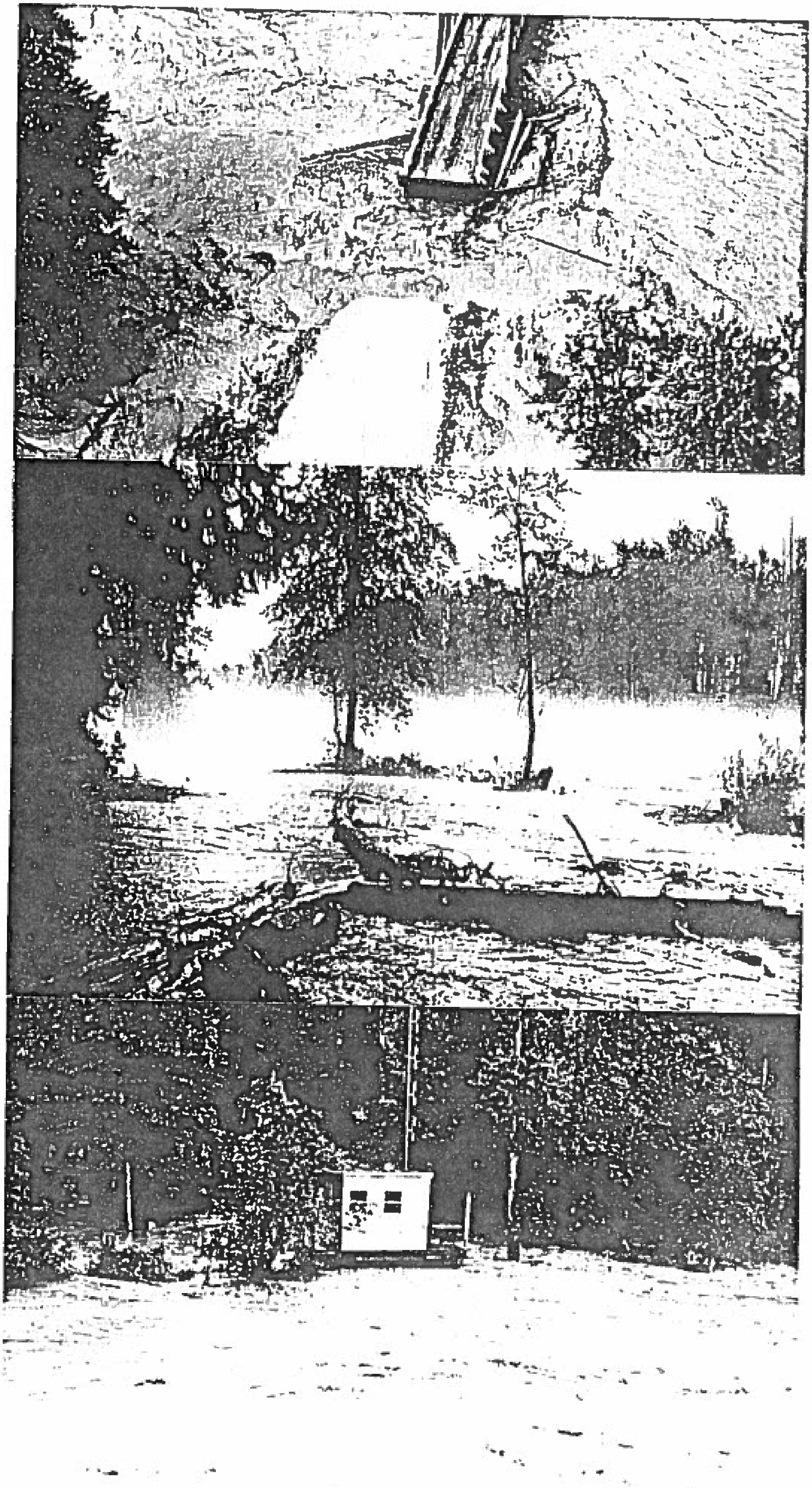

Figure 4 Photographs of Flood of July 12 [illegible]

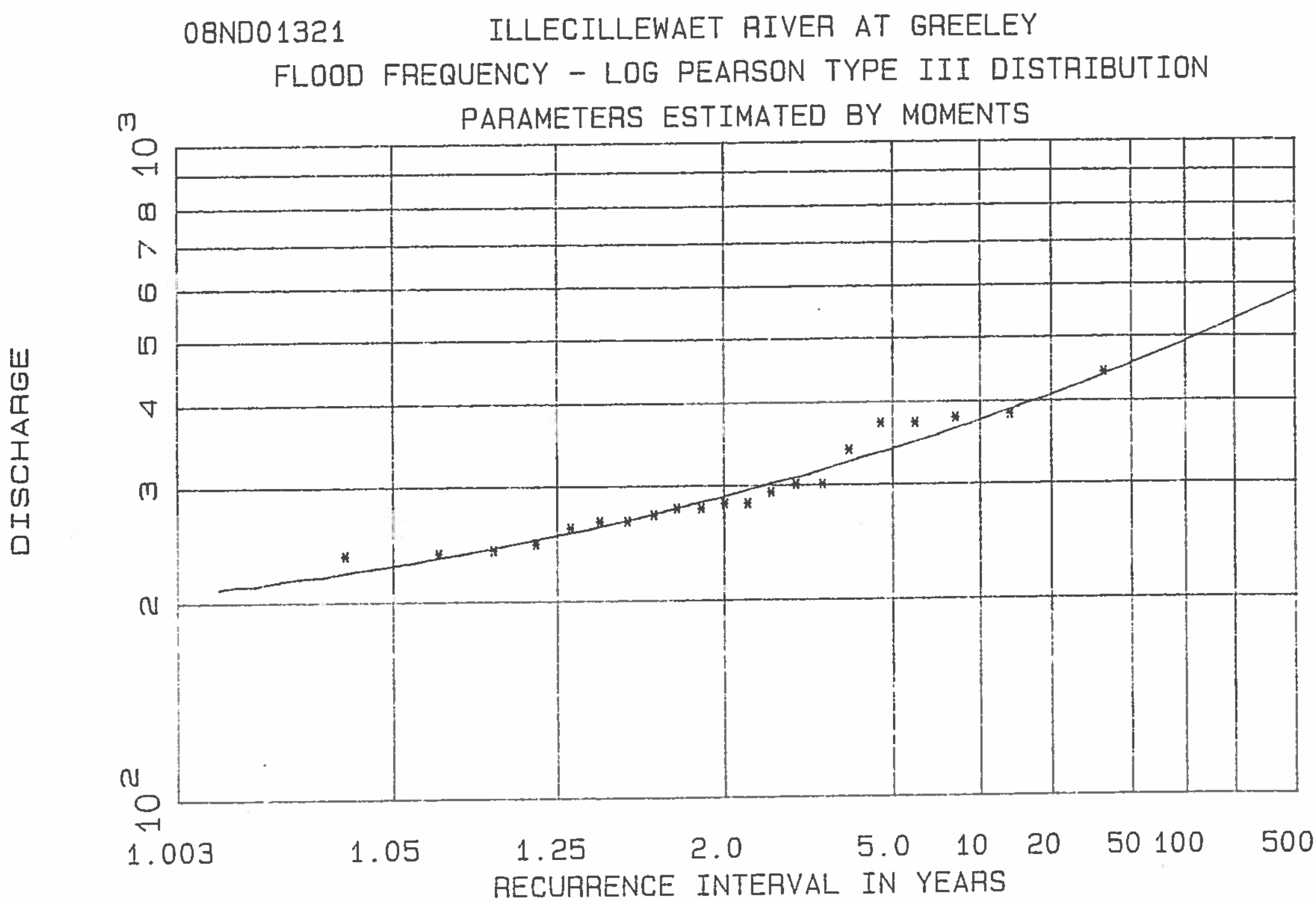

Figure 5 Flood Frequency Curve