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ORIGINALS

Flood Frequencies, Elevations, and Durations in the Sumas Lake Area

Prepared for the

Fraser River Joint Program Committee

by

Engineering Division, Pacific Region

Water Planning & Operations Branch

Department of the Environment

Vancouver, B.C.

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REPORT ON FLOOD FREQUENCIES, ELEVATIONS, AND DURATIONS IN THE SUMAS LAKE AREA

OBJECTIVES

To provide data on the frequencies, elevations, and durations of floods to allow evaluation of the benefits of improving the dykes protecting the Sumas Lake area from flooding by the Sumas River.

This report does not cover flooding caused by high water in the Fraser River, the Vedder Canal, or the Vedder River.

AVAILABLE DATA

The peak stage caused by flooding in the lake area was recorded for the 1935 flood (1). Daily stages of the floodwater in the lake area during the 1951 flood period were available along with estimates of the daily inflow into the lake area (1). Data on pre-1957 pumping capacity and present capacity were also available (1) and (2). Streamflow data for the Sumas River at Huntingdon were available covering the period 1951 to 1970, not including the 1951 flood, except that the peak stage reached by the flood was recorded. Elevations of the Sumas River and Sumas Canal at the pump station were available from 1948 to 1970.

An earlier report prepared for the Committee (3) summarized the flood problem in general and outlined the particular difficulties of this area.

INTRODUCTION

Figure 1 shows the general layout of the area.

Flooding of the Sumas Lake area is caused by a combination of two factors. One factor is the elevation of the Sumas River at the dam, the other is the combined flow of the Sumas River and the Sumas Canal at the dam. The two factors are not directly related and, for damaging flooding to occur, it is necessary for both factors to be high at the same time. The elevation of the river determines whether the dykes will fail whilst the flow in the river, together with the flow in the Sumas

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(1) Report on "Sumas River Floods" by V. Raudsepp, B.C. Water Rights Branch, 1951-52.

(2) Report "Sumas River Pump Station" by Associated Engineering Services Limited, 1970.

(3) Report "The Problem of Flooding of Sumas Lake Area from the Sumas River", Engineering Division, January 1971.

Lake Canal, determines if the dykes do fail, whether there would be sufficient flow of water to overload the pumps and cause flooding.

The elevation of the Sumas River at the dam is governed by the elevation of the Fraser River at the mouth of the Sumas River. Only during the extremely widespread storms does the Fraser River reach high stage at the same time as the Sumas River reaches high flows. Such conditions occurred in 1935 and 1951 when the dykes did fail and serious flooding did occur.

METHOD

As the flooding problem is caused by the coincidence of high values of two different parameters, Sumas River flow and Fraser River elevation, and the historic record of the combined data was short, a conventional frequency analysis of the occurrence of flooding events was not feasible. Even a frequency analysis of a single parameter to obtain values in the 50-year recurrence interval range could be very inaccurate if based only on a 20-year record. An analysis of the frequency of the combination of two events on a 20-year record would be extremely unreliable.

It was therefore considered that the only meaningful method of estimating annual damages under present conditions was to assume that flood events over the period of record constituted a representative sample of the long term population of events and that, in any future period of the same duration, similar damages would occur. Since the dyking system was built in 1922, extremely severe floods were recorded in January 1935 and February 1951. Over the past 20 years since 1951, the only period for which flow records were available, conditions severe enough to cause flooding, had the dykes failed, occurred only on two occasions; in November 1954 and November 1955. Conditions necessary to cause flooding were considered to be that the Sumas River elevation above the dam must have exceeded the confidence level of the existing dykes, estimated at 85.0' Sumas Datum (4), and also that the combined flow of the Sumas River and Sumas Canal must have exceeded the present pumping capacity, approximately 1,150 cfs. The selection of the confidence limit was based on a comparison of existing dyke grades and design water levels.

A routing computation was carried out for these four events to estimate what flooding might occur under present conditions. The following assumptions were made:

1. that, once the river level exceeded 85.0' Sumas Datum, the dykes no longer afforded any protection and the total river flow would enter the lake area. Although this latter assumption might be conservative for the case of a minor breach, it is quite possible in the case of a major breach. In fact, a major breach might cause drawdown of the Upper Sumas River sufficient to cause inflow from the Fraser River. In such a case, the gates in the dam would be closed and there would be no doubt that all the river flow would have to enter the lake.

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(4) Sumas Datum = Geodetic Survey of Canada Datum + 69.7 ft.

2. that the pumping capacity was that existing today.

Flows for the Sumas River and Sumas Canal were estimated by the unit hydrograph method except that, where recorded flows at Huntingdon were available, these were used. Estimated inflows into the Sumas River Basin resulting from overflow from the Nooksack River were included in the flow estimates and thus the effect of the Nooksack River need not be considered separately.

In order to be able to estimate the damages which would be prevented if the dykes were rehabilitated, routing computations were carried out for the four events to estimate what flooding might occur under improved conditions. The following assumptions were made:

1. that the dykes were improved to safely withstand elevations equivalent to those of the 1935 flood,

2. that the pumping capacity would not be increased beyond that existing today.

RESULTS

Results of the routing computations are shown as hydrographs of water elevations in the lake area in Figures 2-5 and are summarized in Table 1.

TABLE 1

Flood Elevations, Areas and Durations

Flood	Existing Conditions			Improved Conditions		
	Peak Elevation	Area Flooded	Duration of Flooding Above 70.0'	Peak Elevation	Area Flooded	Duration of Flooding Above 70.0'
	Sumas Datum	Acres	Days	Sumas Datum	Acres	Days
1935	80.7	10,000	47	74.0	4,200	11
1951	77.6	8,200	28	73.1	3,000	7
1954	72.7	2,500	11	No Flooding		
1955	72.0	1,800	5	No Flooding		

Flooding under improved conditions would be a result of runoff from the area draining directly into the lake and not as a result of any dyke failure. This flooding could only be reduced by means of increased pumping capacity.

The benefits of dyke improvement could be considered to be equivalent to the difference between damages under existing conditions and those under improved conditions, assuming that any future 20-year period would include floods equivalent to those of 1951, 1954 and 1955, and that any 50-year period would also include one flood equivalent to that of 1935.

Engineering Division, Pacific Region
Water Planning and Operations Branch
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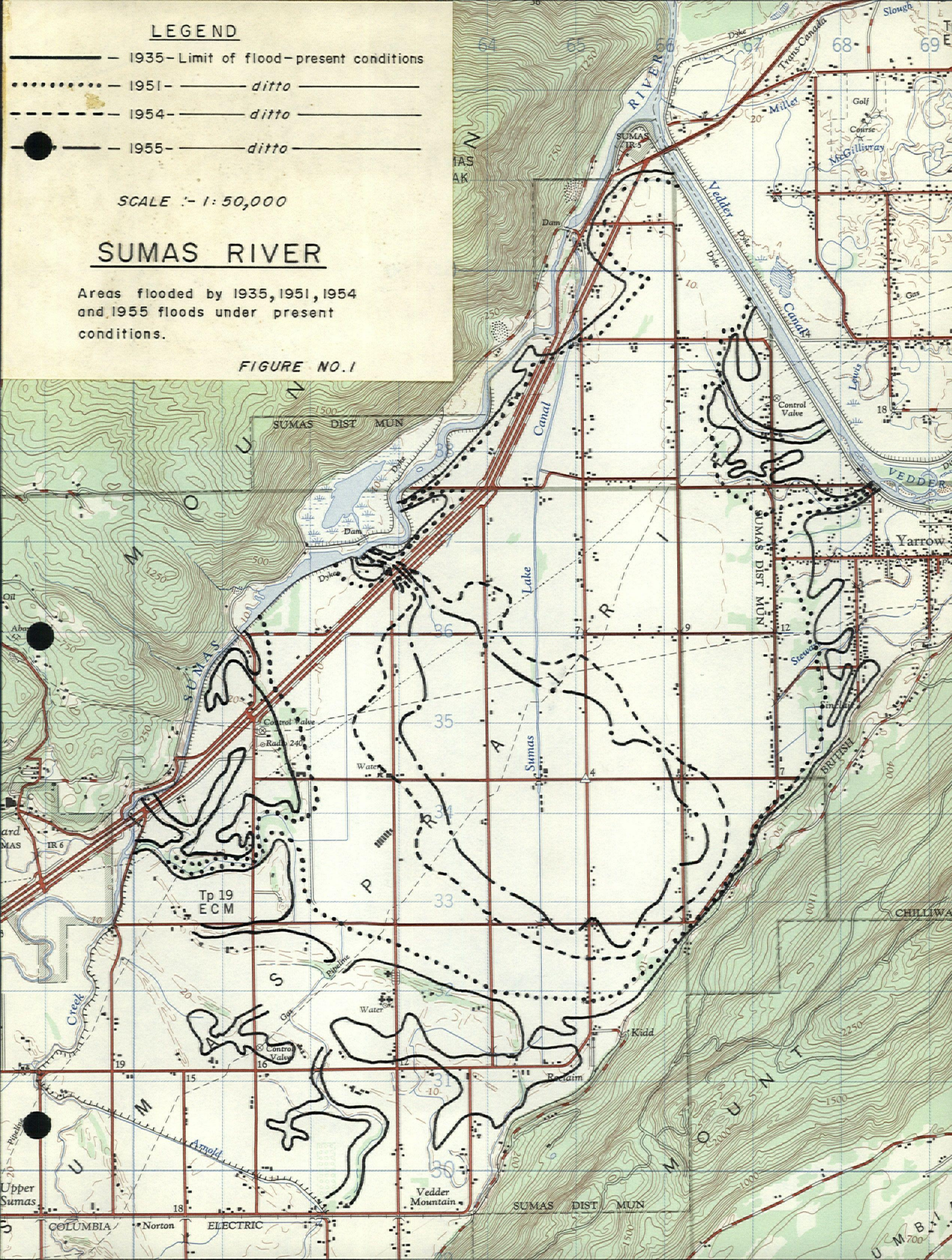
LEGEND
1935 - Limit of flood - present conditions
1951 - ditto
1954 - ditto
1955 - ditto
SCALE :- 1:50,000
SUMAS RIVER
Areas flooded by 1935, 1951, 1954 and 1955 floods under present conditions.
FIGURE NO. 1
SUMAS DIST MUN
Yarrow
Vedder Canal
Sumas Lake
Control Valve
Radio 240
Water
Tp 19 ECM
Kidd
Reclaim
Vedder Mountain
Upper Sumas
COLUMBIA
Norton
ELECTRIC
CHILLIWA
BRITISH
Trans-Canada
Golf Course
McGillivray
Miller
Dam
Dyke
Pipeline
Gas
Amold
Creek
Oil
Stewart
Sinclair
Lewis
Slough
SUMAS IR 5
IR 6
SUMAS RIVER
SUMAS MOUNT

BRUNING 40-8500
10x10 TO THE INCH
MADE IN U.S.A.

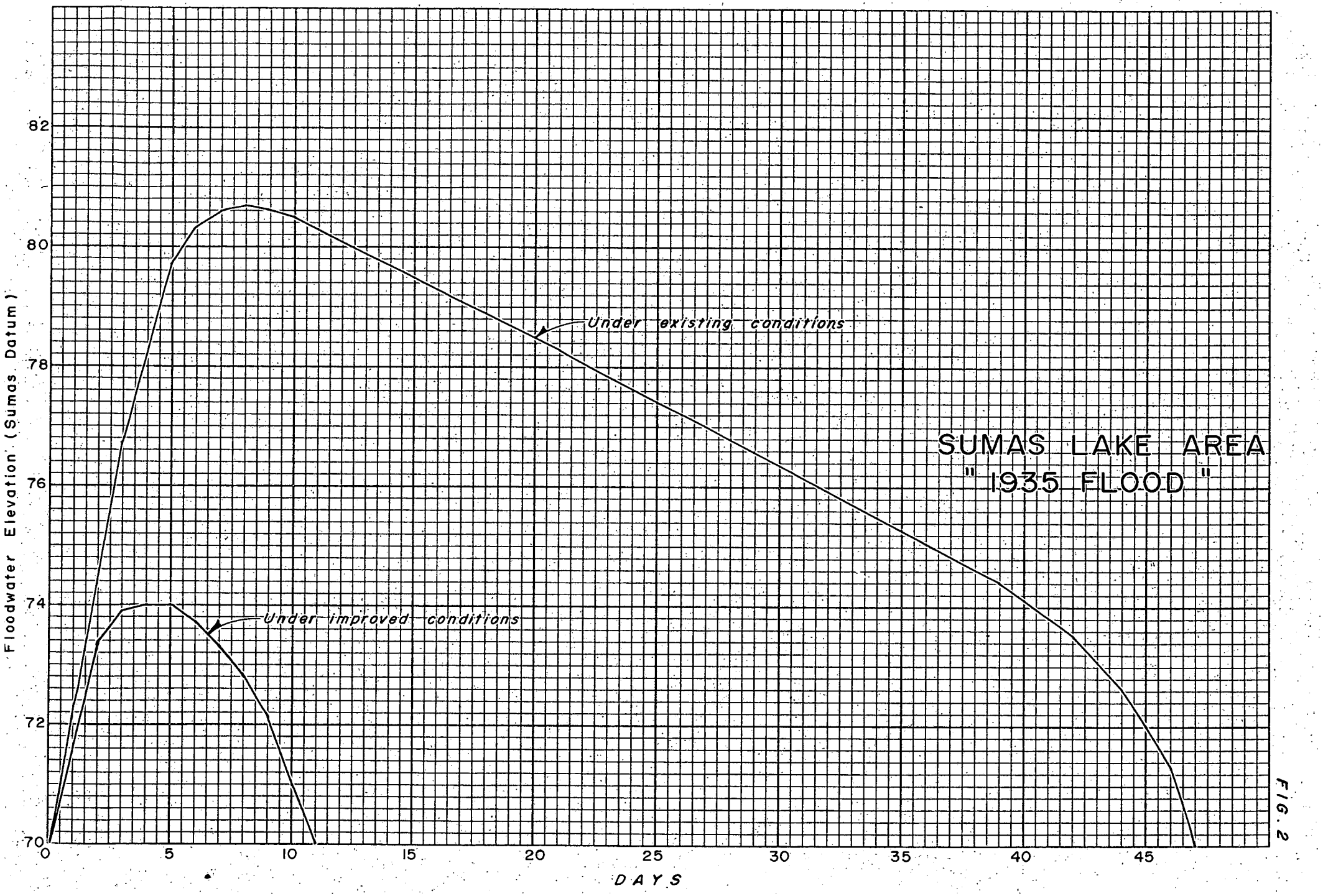

FIG. 2

BRUNING 40-8500
10x10 TO THE INCH
MADE IN U.S.A.

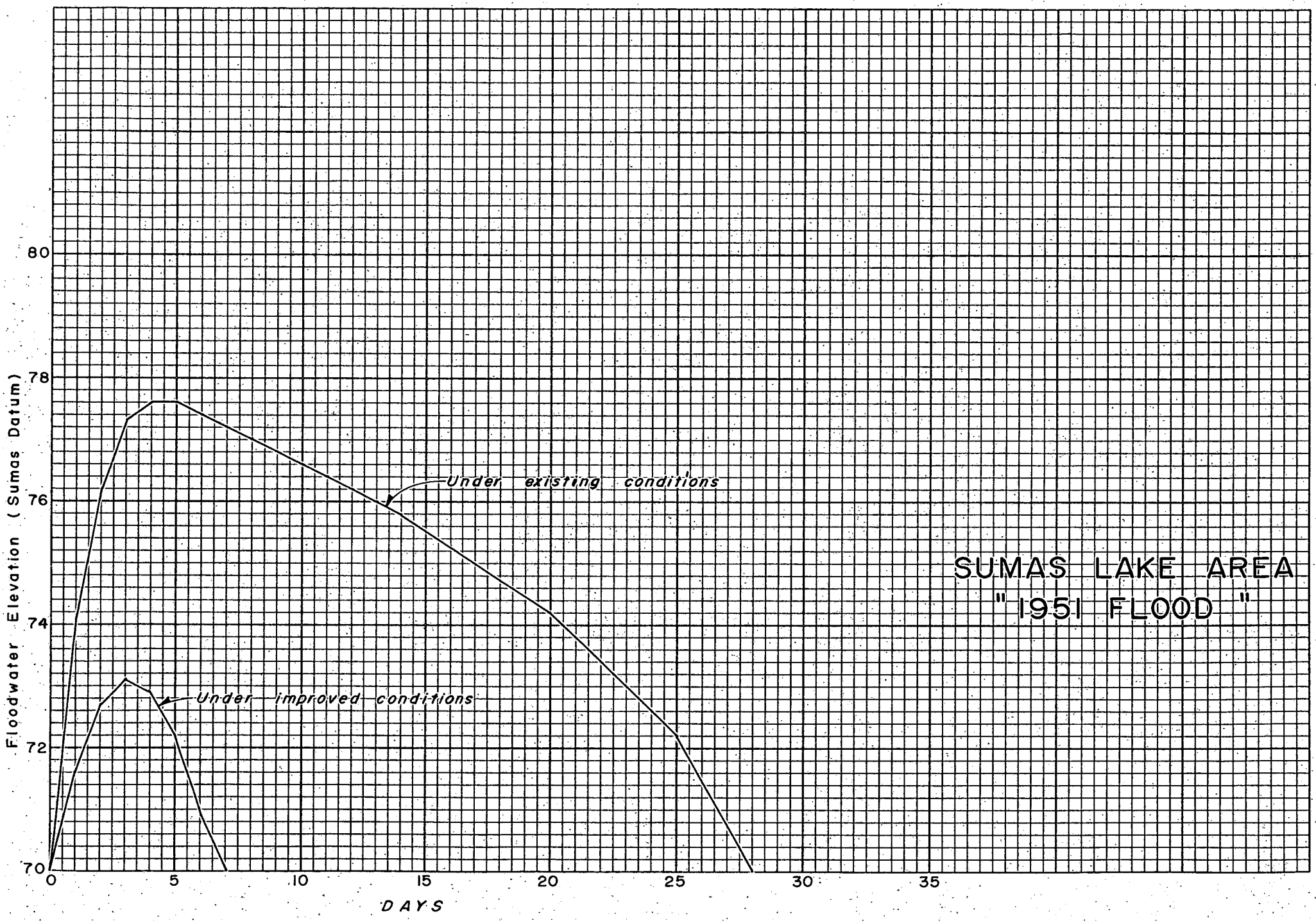

FIG. 3

BRUNING 40-8500
10x10 TO THE INCH
MADE IN U.S.A.

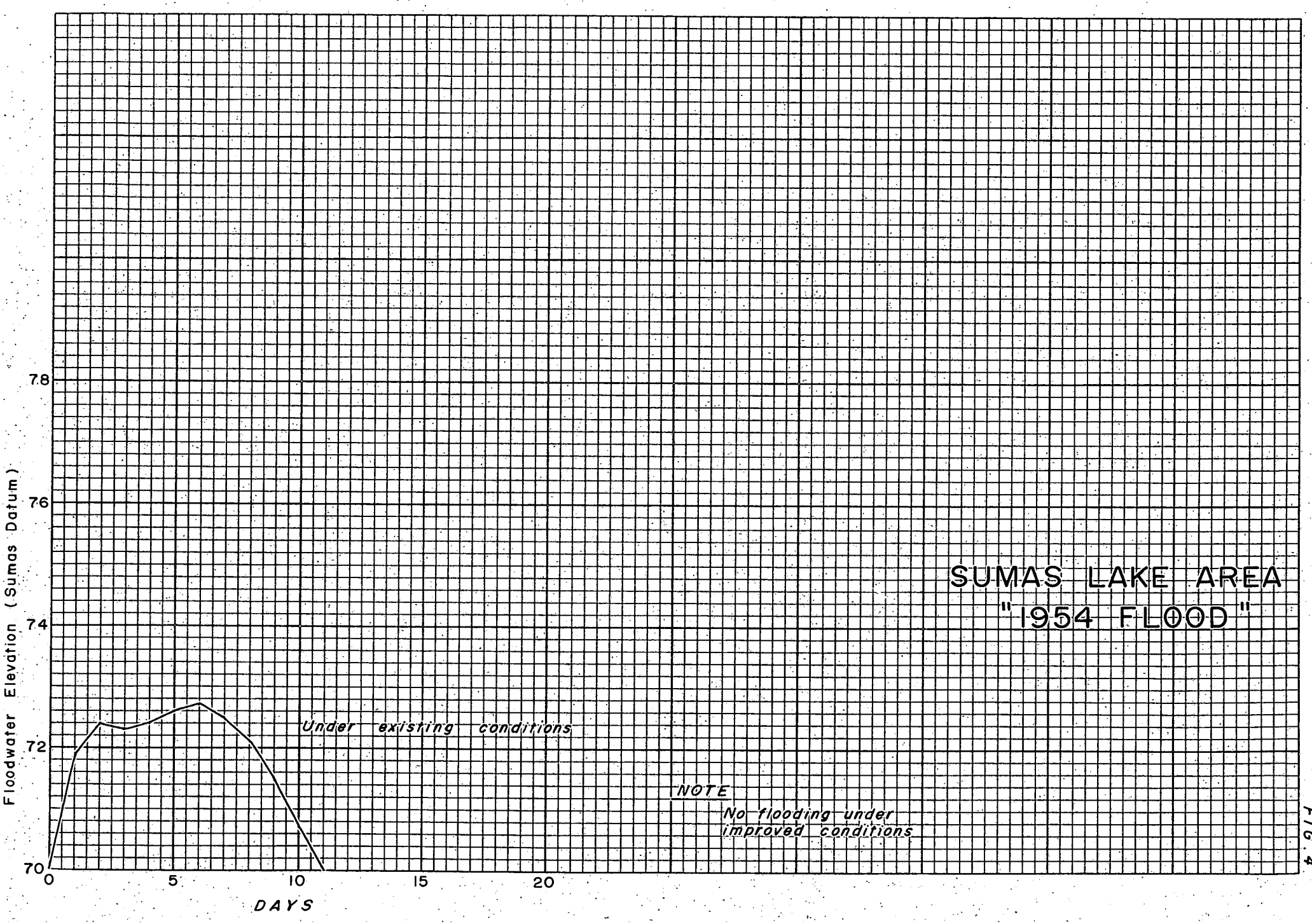

FIG. 4

BRUNING 40-8500
10x10 TO THE INCH
MADE IN U.S.A.

SUMAS LAKE AREA
"1955 FLOOD"

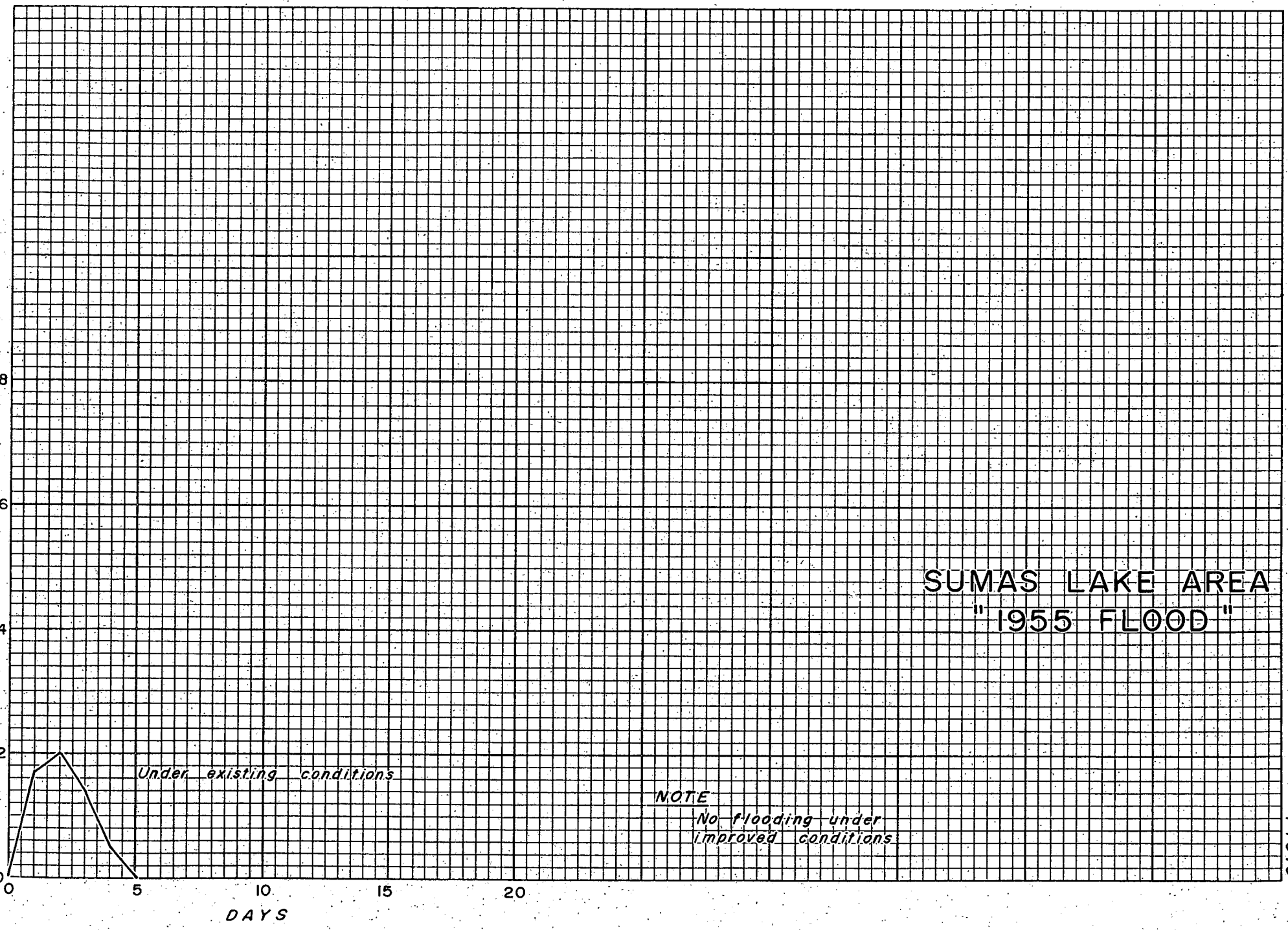

FIG. 5