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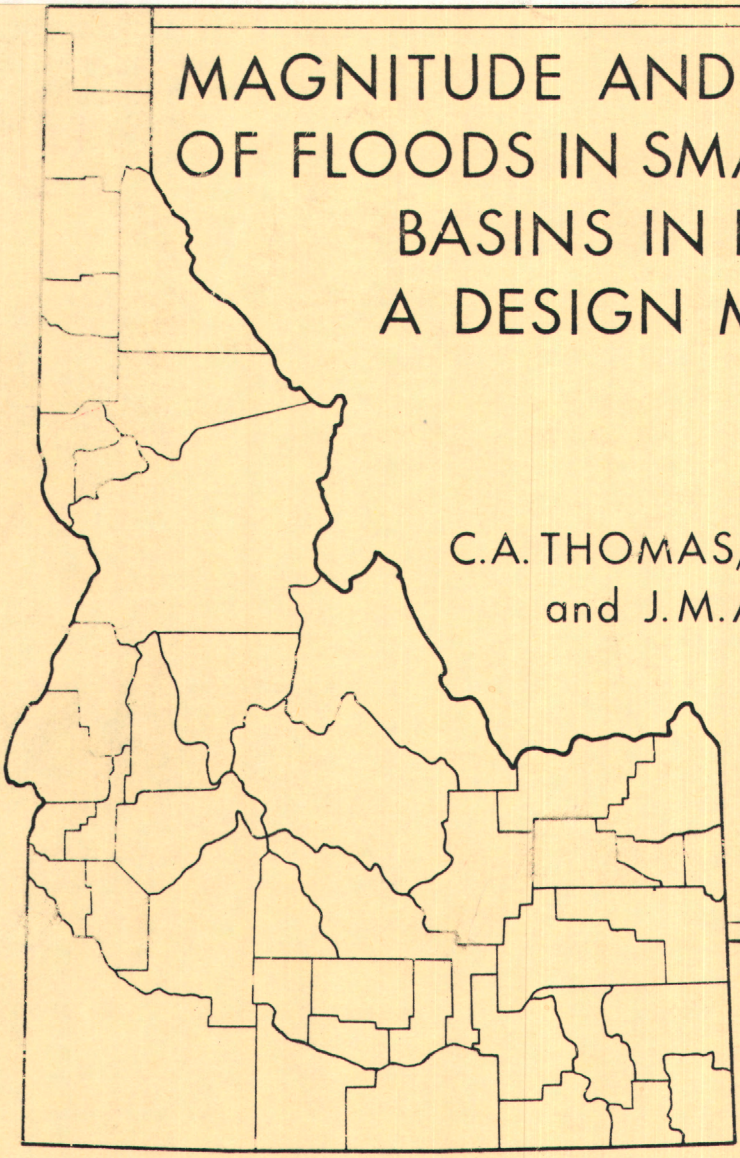

# MAGNITUDE AND FREQUENCY OF FLOODS IN SMALL DRAINAGE BASINS IN IDAHO-- A DESIGN METHOD

By
C.A. THOMAS, W.A. HARENBERG, and J.M. ANDERSON

OPEN-FILE REPORT

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Prepared in cooperation with the
IDAHO DEPARTMENT OF HIGHWAYS,
IDAHO DEPARTMENT OF WATER ADMINISTRATION,
AND THE U.S. FOREST SERVICE

Boise, Idaho
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## INTRODUCTION

This report describes a method for estimating peak discharges at 10-, 25-, and 50-year recurrence intervals for most small streams in Idaho. Reliable estimates can be obtained using this method, but there are significant limitations and variations which should be considered.

The method of estimating peak discharges developed for this report is for sites on streams with natural flow. Therefore, for sites on regulated streams, the effect of the regulation must be superimposed on results obtained from the method described herein. Regulation may be caused either by works of man or by interaction with ground-water systems. Estimates of peak discharge may be poor for streams draining basins on or flowing across extensive areas of deep, coarse alluvium or lava flows; for streams whose basins are urbanized; for streams draining irrigated agricultural lands; and for streams draining basins having less than about 30 percent forest cover. Computed flows in those parts of the State subject to recurrent high intensity thunderstorms over small areas may be too low to be acceptable as reasonable estimates. Some anomalous areas have been identified where the method developed does not apply. A determination of peak discharge should not be considered complete until an assessment of the limitations has been made.

# DESIGN METHOD

Subject to the limitations outlined beginning on page 9 peak discharges at selected recurrence intervals can be determined for small streams as follows:

1. Locate the site on the map of figure 1 and determine if a gage has been operated nearby on the same stream. An explanation of the gaging-station-numbering system used by the U.S. Geological Survey is on page 15 and, for convenience, on figure 1. If a gage site is located nearby on the same stream and the basin characteristics above the gaged and ungaged sites are relatively homogeneous, check table A-2 for a peak discharge at the desired recurrence interval at the gaged site and adjust the peak to the ungaged site on the basis of drainage area. If the stream has not been gaged nearby, inspect figure 1 to determine if the basin is outside the undefined areas, and if so, determine in which region the site is located.

2. By inspection of the applicable regression equation in table A-1, determine which basin characteristics are needed. A description of the equation symbols and methods of determining the basin characteristics starts on page 3.

3. Determine the required basin characteristics from the best available topographic map. A U.S. Geological Survey 7½-minute topographic map is suggested. Complete coverage of the State is available in the U.S. Geological Survey 1:250,000 scale map series. Determine the forest cover (F) which is needed for evaluation purposes, even though it may not appear in the equation.

4. Having determined the basin characteristics, use the appropriate nomograph, figures A-1 to A-8, or the regression equation from table A-1 to compute the peak discharges at 10-, 25-, and 50-year recurrence intervals.

Nomographs are provided for computing peak discharges for small basins between 1 and 50 square miles. Regression equations are valid for drainage basins from 0.5 to 200 square miles.

5. Investigate further to determine if limitations apply that invalidate use of the regression equation or if adjustments to the discharge should be made which would improve the design discharge (p. 9-14). Check peak discharges for reasonableness by comparing with peak discharges of record for nearby streams. See examples pages 4-8.

## Basin Characteristics

Descriptions and methods of determination of the five basin characteristics used in the regression equations are given below:

Drainage area (A), in square miles, is determined by outlining on the best available topographic map the surface-water divide upstream from the point of interest on the stream, and determining the area from the map using a planimeter. U.S. Geological Survey 7½- or 15-minute quadrangle maps are recommended when available.

Forest cover (F) is expressed as the percentage plus 1 percent of the drainage area covered by forests and is determined from a U.S. Geological Survey 1:250,000 scale map. A recommended procedure is to lay a grid over the basin outline, count the number of grid intersections lying within the forested (green) areas and the number of grid intersections within unforested areas, and from this calculate the percentage of the basin that is forested.

Area of lakes and ponds (La) is expressed as the percentage plus 1 percent of the drainage area covered by water (lakes, ponds, or swamps), and is determined by the grid method. See forest cover (F) above. U.S. Geological Survey 7½- or 15-minute quadrangle maps are recommended when available.

Latitude (N) is the latitude of the centroid of the basin, in decimal degrees minus 40 degrees. It is determined from inspection of the basin as outlined on a U.S. Geological Survey 1:250,000 scale map.

Longitude (W) is the longitude of the centroid of the basin in decimal degrees minus 110 degrees. It is determined from inspection of the basin as outlined on a U.S. Geological Survey 1:250,000 scale map.

## Relative Magnitude of Floods

Comparison of estimates of floods at ungaged sites with the maximum floods known is useful in evaluating the relative magnitude and to ascertain the credibility of the estimates. The maximum known flood is often used as the design flood. Relative magnitudes of floods are desirable for use in both planning and design.

The maximum discharges of record for streams in Idaho which are significant for comparative purposes are plotted against drainage areas in figure 3. The plot includes significant maximum discharges at miscellaneous sites as well as at short-term gaging stations. The plot also shows the wide range of peak discharges which have been recorded. Peak discharges as computed by the outlined method should be checked for credibility by plotting on the graph and comparing with the flows experienced at nearby stations. Only the stations with maximums of record greater than 100 cfsm (cubic feet per second per square mile) have been identified by station number. A specific site in tables A-2 and A-3 can be identified on the graph using the drainage area and maximum discharge from the tables.

For comparative purposes, three curves are shown in figure 3. The Matthai curve (Matthai, 1969, p. B6) is an average through the highest known floods recorded in the United States up to 1965. The Hoyt and Langbein curve (Matthai, 1969, p. B6) is an average through the maximum floods recorded prior to 1950, and the Creager, Justin, and Hinds curve (Matthai, 1969, p. B6) is an average through the maximum known flood data available in 1890. Concerning the increase between the 1890 and 1950 curves, Hoyt and Langbein stated (Matthai, 1969, p. B6) "This is no evidence that flood conditions are changing. The upward shift of the curves ... is due entirely to an increased number of gaging stations and increased period of record."

As more records become available, the upper limits of the maximum known flood plot will move upward as additional rare floods are measured. Nevertheless, figure 3 is indicative of what can be expected in the future.

Generalizations regarding magnitude and frequency of floods in Idaho can be made from figure 3. Floods greater than about 300 cfsm have rarely been observed on basins greater than 4 square miles. Most floods having rates greater than 300 cfsm occur in unforested basins, a few of which have been denuded by range fires. This large a flow has been recorded at only one site on a forested basin, Canyon Creek tributary near Lowman (M13234215), and there the forest cover was light. All floods greater than 300 cfsm were from intense thunderstorms and were unassociated with snowmelt. All basins with floods greater than 100 cfsm have drainage areas less than 40 square miles, and only five of these floods were not caused by intense thunderstorms. Conversely, a flood greater than 100 cfsm has not yet been recorded in Idaho on a basin larger than about 40 square miles. Evidently, floods which plot to the left of any of the three curves in figure 3 have long recurrence intervals and are rare.

## Examples

The following examples illustrate the application of the design method.

Example 1

Determine the 10-, 25-, and 50-year floods for Bloom Creek at the mouth near Bovill.

Step 1. The mouth of Bloom Creek is in sec. 3, T. 41 N., R. 1 E., and the basin is entirely on the U.S. Geological Survey Bovill 15-minute quadrangle map. A continuous-record gage (station 13341300) was operated at the site (fig. 1). Records are available from 1959 to 1971. Figures of peak discharge through the 20-year flood computed by the log-Pearson Type III method (Water Resources Council, 1967) are listed in table A-2. A check of figure 1 indicates the design method applies. The site and basin are in Region 1.

Step 2. Table A-1 indicates drainage area (A) is the only basin characteristic that needs to be determined for the Region 1 regression equation. Forest cover (F) also should be determined for evaluation purposes.

Step 3. The drainage area for Bloom Creek as previously determined by planimetering from the Bovill quadrangle is 3.15 square miles. Forest cover (F) is determined to be 101.

Step 4. Using either the nomograph or the regression equation and the ratios for Region 1, the 10-year flood is found to be about 135 cfs, the 25-year flood is about 175 cfs, and the 50-year flood is about 200 cfs.

From table A-2, $Q_{10}$ by the modified log-Pearson Type III method for Bloom Creek is 133 cfs, which closely checks the figure from the nomograph and the equations.

Step 5. No limitations appear to apply to this stream. None of the basin is urbanized. Forest cover index is 101, well above the recommended minimum requirement of 30 (see p. 9) for application of the $Q_{25}/Q_{10}$ and $Q_{50}/Q_{10}$ ratios. No regulation or diversion which affects the peaks is known. Base flow (the flow after direct runoff from rain or snowmelt has stopped) as observed in late summer is low, indicating no significant effect from ground-water runoff. Alluvium, lava flows, or intense thunderstorms do not appear to affect this area significantly. Also, there are no anomalous areas nearby. Discharge plotted against drainage area in figure 3 appears reasonable compared with plots for nearby streams. For example, a crude check of the data is provided by plotting the 175 cfs ($Q_{25}$ for Bloom Creek) against its drainage area (3.15 square miles) and comparing it with a plot of $Q_{25}$ versus drainage area for East Fork Potlatch River (13341400) and other basins nearby. They appear to plot near the same position with respect to the 100 cfsm line.

Example 2

Determine the 25-year flood for a site on Targhee Creek below the confluence of the East Fork with Targhee Creek.

Step 1. The site is located in NE¼NE¼ sec. 21, T. 16 N., R. 43 E., which is on the U.S. Geological Survey Targhee Pass 7½-minute quadrangle map. The basin lies on Targhee Pass and Targhee Peak 7½-minute quadrangle maps and the Hebgen Dam 15-minute quadrangle map. A crest-stage gage (station 13038900) was operated from 1963-70 at a site 5 miles downstream (fig. 1). From figure 1, the site and basin are in Region 6.

Step 2. Table A-1 indicates the basin characteristics to be determined are area (A), area of lakes and ponds (La), and latitude of the basin centroid (N). Forest cover should be determined for evaluation purposes.

Step 3. $A = 10.5$

$La = 0.4 + 1.0 = 1.4$

$N = 4.7$

$F = 44 + 1 = 45$

Step 4. Using the appropriate nomograph (fig. A-6) or the regression equation, a 25-year flood of 136 cfs is indicated. The details of the computation using the regression equation are as follows:

$$Q_{10} = 188\ A^{0.873}\ La^{0.773}\ N^{-1.82}$$

$$= 188 \times 10.5^{0.873} \times 1.4^{0.773} \times 4.7^{-1.82}$$

$$= 188 \times 7.79 \times 1.30 \times 0.060 = 113 \text{ cfs}$$

$$Q_{25} = 113 \times 1.2 = 136 \text{ cfs}$$

The peak discharges should be rounded to two significant figures but were used as computed for ease of checking.

Urbanization or regulation do not affect the peaks. Small diversions for irrigation probably do not affect the peaks because peaks normally occur before the irrigation season. Base flow as observed in late summer is low, indicating no significant effect from ground-water runoff. Alluvium and lava flows do not appear to alter the peak characteristics.

The relative magnitude of the $Q_{25}$ from the nomograph can be compared with a $Q_{25}$ for the crest-stage gage on Targhee Creek (station 13038900). From table A-2, $Q_{10}$ for Targhee Creek is 335 cfs. Using the regional ratio for $Q_{10}/Q_{25}$ of 1.2, $Q_{25}$ equals 335 x 1.2 = 402 cfs. The ratio of the drainage areas at the subject site and the crest-stage gage site is 10.5/20.8 or 0.50. On the basis of the drainage area ratio and the record at the crest-stage gage, $Q_{25}$ at the subject site would be 402 x 0.50 = 201 cfs. This is 48 percent greater than the 136 cfs from the nomograph. In region 6, $Q_{50}$ is only 1.1 times $Q_{25}$; therefore, the design flood might be chosen on basis of maximum discharges at nearby sites rather than that for a selected recurrence interval. In figure 3, maximum discharges at nearby stations, including stations 13113000, 13047800, and 13051500, plot above and below the $Q_{25}$ of 136 cfs. Because the relation with the gaging station on Targhee Creek indicates a higher discharge and since maximum discharges at several nearby sites are considerably higher, a conservative discharge may be obtained by increasing the $Q_{10}$ discharge by one standard error, or 41 percent. See table A-1.

Design discharge = 1.41 (113) 1.2 = 192 cfs

Example 3

Determine the 50-year flood for Cottonwood Creek at the mouth near Horseshoe Bend.

Step 1. The site is in sec. 3, T. 6 N., R. 2 E., which is on the Horseshoe Bend 7½-minute quadrangle map. The basin lies on the Horseshoe Bend and Cartwright Canyon 7½-minute quadrangle maps. A crest-stage gage (station 13248900) was operated at this site from 1961 to 1971. From figure 1 the site is in Region 3.

Step 2. Table 1 indicates the basin characteristics to be computed are area (A), forest cover (F), and latitude of the basin centroid (N).

Step 3. A = 6.53 square miles

F = 0 + 1.0 = 1.0

N = 3.85

Step 4. The nomograph gives a $Q_{50}$ flood of 440 cfs. Using the regression equation, the 10-year flood is

$$Q_{10} = 3.81\ A^{0.875}\ F^{-0.216}\ N^{2.02}$$

$$= 3.81 \times 6.53^{0.875} \times 1.0^{-0.216} \times 3.85^{2.02}$$

$$= 3.81 \times 5.16 \times 1.0 \times 15.2 = 300 \text{ cfs}$$

and $Q_{50} = 300 \times 1.5 = 450$ cfs.

Step 5. Urbanization or regulation do not affect the peaks. Field inspection indicates that some flow will bypass the site during extreme floods. Peaks generally occur during the winter and would not be affected by irrigation diversions.

The channel is dry for long periods indicating that no large springs feed the stream. The generalized geologic map of Idaho (Ross, 1947) shows that about 40 percent of the basin is on granitic rock, which is relatively impermeable and about 60 percent is on the weakly consolidated sedimentary rocks which are variable in permeability from one location to another. Coarse alluvium or fractured lava deposits are not extensive. Extreme floods from thunderstorms have been recorded within 20 miles to the southeast (fig. 2). There is no significant forest cover on the basin, and forest cover (F) is 0 + 1 = 1. A $Q_{10}$ of 220 cfs by the modified log-Pearson Type III method is reasonably well defined by 10 years of record. However, the $Q_{50}/Q_{10}$ ratio is not well defined for this or other unforested basins in any region of the State. Comparison with plots of discharge for nearby streams in figure 3 also indicates a wide divergence of peak flows for this area.

Because of uncertainties of the definition of discharges at long recurrence intervals, the designer should consider several alternatives. No intense thunderstorms have been recorded in the immediate area, although some have been experienced just over the ridge to the south [see site M13207650 (fig. 2 and table A-3) and others on the Boise front, near Boise (fig. 2)]. In addition to the thunderstorm floods nearby, maximums for Big Willow Creek near Emmett, Fourmile Creek near Emmett, Bryans Run near Boise, Spring Valley Creek near Eagle, and the magnitude and frequency data for the subject site should be considered in assessing the flood potential and risk at long recurrence intervals.

A reasonable design discharge for all but the extremely rare events could be determined by increasing the $Q_{50}$ discharge by percentages equivalent to one standard error as follows: $Q_{50}$ at the site was determined to be 450 cfs. Standard error for Region 3 is 51 percent. Increasing 450 by 51 percent gives a more conservative discharge of 680 cfs. If damage would be extreme from a structural failure, a discharge equivalent in percent to some larger multiple of the standard error may be added to the discharge from the nomograph.

## UNDEFINED AREAS WHERE REGRESSION RELATIONS DO NOT APPLY

Regional regression relations should apply to areas which are homogeneous with respect to variables which affect the flow. Regression equations may not apply to basins in which the basin, or flow, characteristics are outside the range of those characteristics used to define the regional regression relations. Variations in topography, climate, geology, land use, and regulation of streamflow in Idaho often result in abrupt changes in flow and basin characteristics. Some of these variations are inadequately defined by available data. The following sections describe the poorly defined areas and discuss the reasons the regression relations are inapplicable.

Areas in which regional regression relations are not defined total about 20,000 square miles and are outlined in figure 1. In addition to these areas, smaller undelineated areas are scattered throughout the State.

In general, the undefined areas are mostly arid or semiarid. Streamflow in small streams is usually ephemeral (flowing only in direct response to precipitation or short-lived snowmelt) or intermittent (flowing only part of the time, such as during the snowmelt period or during wet periods in winter). Records are sparse and short in length. Therefore, floodflow magnitudes and frequencies have not been defined.

In addition to areas of poor definition, peak flows in many small basins are affected by urbanization, regulation, significant quantities of ground-water runoff, large losses or gains associated with alluvial valleys and lava flows, intense thunderstorms, unusual climatic or physical basin characteristics, or a combination of these factors.

### Unforested areas

Most of the unforested areas of the State are in the arid or semiarid areas where precipitation is too low to support forestation. Nearly all of the area designated as undefined in figure 1 is unforested. Small streams are usually ephemeral or intermittent, and the volume of runoff is low. Only a few records are available to define the magnitude and frequency of floods on these areas, and very few records are available to define the $Q_{25}/Q_{10}$ and $Q_{50}/Q_{10}$ ratios.

Because a small percentage of forest cover appears to be indicative of the ephemerality of streams in small basins, basins with less than 30 percent forest cover ($F < 30$) are assumed not defined by methods used in this report.

Judgment and the maximum unit discharge of record for nearby streams, as shown in figure 2, are the best bases that can be recommended for the determination of discharge in unforested basins.

## Urbanized Areas

Urbanization drastically changes basin features of which increase in paved areas and the addition of sewerage are the most obvious. Both decrease the concentration time of the basin, which increases the intensity of floods and the frequency of flooding. Climates have been observed to change in or near large cities. Precipitation, temperature, humidity, cloudiness, and wind speed may be altered to some degree in urban areas. Also, urbanization is often accompanied by infringements on the natural flood channel and the flood plain, thus increasing flood heights. On the other hand, storm sewers may bypass surface flows past some sites, thus reducing peaks in natural channels.

Studies in other parts of the country indicate that for a basin of 1 square mile that is completely storm sewered and whose surface is completely or 100 percent impervious, the mean annual flood (approximately the 2-year flood) is about eight times larger than for the natural basin. The mean annual flood from a basin of 1 square mile that is completely storm sewered but zero percent impervious is about 1.7 times as large as for the natural basin. The mean annual flood for a basin which is completely impervious but not sewered is about 2.5 times as large as for the natural basin (Leopold, 1968). Very little information of this type is available regarding discharges from urbanized areas in Idaho.

## Regulated Streams

South of about 45°30' north latitude, most agriculture, except grazing and dry farming, requires irrigation. Roughly 5,500 square miles, or nearly 7 percent of the total area of the State, is irrigated, of which nearly 80 percent is irrigated from surface streams. Irrigated areas in the State are shown in figure 1.

Streams which reach the irrigated lands may be affected by one or a combination of the following: Regulation, diversion, consumptive use, and return flow from irrigation. The impact on natural flood peaks is significant. Peak flows in many natural channels are drastically reduced, and regional regression equations usually do not apply directly.

Determination of realistic design discharges requires that manmade effects be considered. Sources of data for estimating peak flows in these streams include records of performance of existing structures such as canals, bridges, ditches, drains, etc.; watermaster records of water use; streamflow records; verbal reports from local residents; and estimates of natural peak flows using basin characteristics. Contributing areas upstream during flood periods are sometimes difficult to define because of storage in reservoirs or upstream diversions which may divert flood water outside the basin. Composite effects from works of man including canals, roads, levees, dams, and storage behind fills during floods are difficult to evaluate. Only a few floods have been measured in channels of this type and most of these have been on large streams. Flows in Morse Creek (13301800), Twelvemile Creek (13302200), Spring Valley Creek (13207000), and Robbers Roost Creek (13073700) in table A-2 are known to be affected by diversions above the gaging sites. Likewise, floods in "D" drain tributary (M13084800) and "F" drain and some others listed in table A-3 may be affected in varying degrees by works of man.

## Streams with Losing or Gaining Reaches

A large number of streams, both large and small, gain or lose flow by interaction with the ground-water system. Streams flowing over permeable formations tend to gain in discharge if they are below adjacent ground-water tables and lose if above them. These streams are especially common in the areas marked "undefined" in figure 1. The characteristics of floods in such streams can be very different from streams fed more directly by overland flow.

Peaks in gaining reaches may be greatly subdued because all or part of the peak flow originates from ground water runoff which is regulated by slowly changing water tables. For example, the discharge of Birch Creek near Reno (13117000) is practically all ground-water runoff which originates a few miles above the gage. The maximum flow in 15 years of record is 220 cfs (table A-3). This peak flow is only 2.8 times the average discharge for the period of record. The channel is usually dry over the alluvium above the reach of discharge from ground water. The stream then loses below the gage, never flowing past the Birch Creek Sinks, about 30 miles downstream. A more normal stream nearby, Sawmill Creek near Goldburg (13117300), had a maximum flow of 651 cfs in 10 years of record, which is 13.4 times its average flow for the period.

Other streams, such as Cub River near Preston (10093000), and Birch Creek near Downey (13074000) are fed by large underground flows from solution cavities in limestone mountains and respond relatively quickly to changing rates of snowmelt. They may drain areas much larger or smaller than their surface drainages indicate. Floodflows in such streams may be at high rates while the flooding in adjacent streams may be considerably smaller.

A decrease in flood discharge occurs in many small streams as they flow from the impervious rocks of the mountain ranges onto the alluvial valleys. Peak flows are often further decreased by diversion for irrigation. For example, the maximum discharge of record for Morse Creek above diversions, near May (13301700) is 230 cfs, while the maximum for Morse Creek near May (13301800), 2.7 miles downstream, across an alluvial fan, and below irrigation diversions, is 81 cfs.

Stream channels known to be affected by significantly large gains or losses are shown in figure 1. Data other than, or in addition to, the discharge determined by regional regression equations are needed in these areas.

## Alluvial Valleys and the Snake Plain

Closely related to the streams with losing or gaining reaches discussed previously are streams draining basins entirely in alluvial or glacial valleys or on the Snake Plain. Other basins include both mountain and valley areas. Large areas of intermontane valleys and lowlands are underlain by deep alluvium. Other areas, especially the Snake Plain, are underlain by fractured basalt, and both types of formation can absorb large quantities of flood water. Percolation rates are considerably reduced by deep soil cover or by lacustrine deposits, both of which vary considerably in thickness, extent, and permeability.

In most years, floods are not generated on the alluvial valleys and plains because the rate of infiltration greatly exceeds the snowmelt or precipitation rate. Natural streams are ephemeral unless the channel intercepts the ground-water table, in which case the stream is intermittent or perennial. Large parts of the Snake Plain are unchannelized or have very poorly developed channels, indicating that overland flow may be rare and short lived.

Occasionally as snow melts, the melt water freezes in place, and a glaze is formed over the permeable alluvial or basaltic surfaces, making the surface very impermeable. If more snow accumulates and a quick snowmelt then occurs, high rates of runoff result. The floods of February 1962, February 1963, and December 1964 resulted from this sequence of hydrologic conditions, and caused extensive flooding on the lowland areas of southern Idaho. Many miscellaneous measurements of these flood discharges were obtained and are shown within basin boundaries (fig. 2). The measurement results are listed in table A-3. No frequency data are available for this type of flood, but the data are indicative of the size of flood which can be expected from this type of event.

Much of the irrigated land in the State is in this area, and natural streams are usually affected by regulation, diversions, return flow, or changing land use. (See section on regulation and figure 1.).

## Intense Thunderstorm-Prone Areas

Intense thunderstorms may produce rates of runoff in small basins which are much higher than those computed using the regression equation. Of the peak discharges listed in table A-3, those which were summer floods and were not associated with snowmelt were assumed to be caused by intense thunderstorms. Of these, 11 discharges exceeded 1,000 cfsm of which three were higher than 5,000 cfsm. Five more measurements showed rates between 500 and 1,000 cfsm, and 13 showed rates between 100 and 500 cfsm. Reference to figures 2 and 3 and the "Relative magnitude of floods" section indicates that most of the extremely high rates of runoff of record in Idaho are caused by intense thunderstorms. Storm cells are often small and may be confined to a small part of the basin.

All of the intense thunderstorm-prone areas measured to date are essentially unforested except Canyon Creek tributary near Lowman, which is only sparsely forested. Practically all of the extreme floods caused by thunderstorms which have been documented are in southern Idaho near the Snake Plain except for a few floods near Lewiston. Areas near the Boise front, in the Portneuf-Bear River section, and near American Falls, Murphy, Bruneau, and Lewiston appear to be prone to flooding of this type. Most intense thunderstorms appear to occur near the foothills or the base of the mountains adjacent to extensive valley areas such as the Snake Plain, Cache Valley, or Columbia Basin.

No series of annual peak flows has been established for any of these intense thunderstorm-produced floods, and recurrence intervals have not been established. Probably the best basis for establishment of recurrence intervals at a design site would be from newspaper or other local accounts. Hazard from this type of flood does exist and should be considered when designing structures for several areas of the State.

## Anomalous Areas

Variations in topography, geology, climate, and land use are extreme in the State. The basin characteristics determined do not define all combinations of these variables, and the effects of the variables on floodflows have not been defined by the limited number of sites where flow data have been collected. The discharges given by the simplified equations proposed do not fit all the records of discharge within reasonable limits. The actual discharge for a given recurrence interval for some ungaged streams will likewise be more or less than the discharge given by the regression equations of this report.

Table A-4 is a list of the gaged sites for which the $Q_{10}$, determined by the modified log-Pearson Type III method, exceeds or is less than the $Q_{10}$ from the regression equations by more than 70 percent. Reasons for departures from regional data are not always apparent; but at nearly all sites listed in table A-4, several flood events have been recorded that exceeded or were less than the regional 10- or even 50-year peaks as determined by the applicable regional equations. Reference to table A-4 will enable users to determine areas where peaks of record are well above or below the estimated discharges using the regional equations.

The percentage of departure of an anomalous area from the regional data can be used as a guide in the application of the regional data to ungaged small streams. Estimates of peak flow for streams within anomalous basins, or for nearby basins which appear to have similar flow or basin characteristics can be raised or lowered accordingly, especially if under-designing or over-designing would result in extensive damage or prohibitive costs.

## STREAMFLOW INFORMATION

### Sources of Information

The U.S. Geological Survey publishes streamflow data for Idaho and is the major source of streamflow information. Each volume of the series of Geological Survey water-supply papers entitled "Surface Water Supply of the United States" contains a listing of the numbers of all water-supply papers in which records of surface-water data were published for the area covered by that volume. Each volume also contains a list of water-supply papers that give detailed information on major floods for the area.

Records through September 1950 for the State have been compiled and published in Water-Supply Papers 1314, 1316, and 1317; records for October 1950 to September 1960 have been compiled and published in Water-Supply Papers 1734, 1736, and 1737. These reports contain summaries of monthly and annual discharge or monthend storage for all previously published records, as well as some records not contained in the annual series of water-supply papers. The yearly summary table for each gaging station lists the numbers of the water-supply papers in which daily records were published for that station.

The new series of water-supply papers containing daily surface-water records for the 5-year period October 1, 1960, to September 30, 1965 (Water-Supply Papers 1927, 1933, and 1935) also contain lists of annual and special reports published as water-supply papers.

Records since October 1, 1965, are published in annual volumes entitled "Water Resources Data for Idaho."

Discharge measurements made at miscellaneous sites and peak discharges at partial-record stations are compiled for the period 1894-1967 in a special basic-data report "Miscellaneous Streamflow Measurements in Idaho, 1894-1967."

Special reports on major floods or droughts or other hydrologic studies for the area have been issued in publications other than water-supply papers. Information relative to these reports may be obtained from the district office in Boise.

## Gaging-Station-Numbering System

Each gaging station and partial-record station has been assigned a number in downstream order in accordance with the permanent numbering system used by the Geological Survey. Numbers are assigned in a downstream direction along the main stream, and stations on tributaries between main-stream stations are numbered in the order they enter the main stream. A similar order is followed on other ranks of tributaries. The complete 8-digit number, such as 13038900, includes the part number "13" plus a 6-digit station number. Miscellaneous-measurement sites are designated by the letter "M" preceding the station number.

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APPENDIX

Table A-1. Summary of regression equations by region for peak discharges in Idaho.

| Region | Regression equation for $Q_{10}$ | Standard error of estimate (percent) | $Q_{25}/Q_{10}$ ratio | $Q_{50}/Q_{10}$ ratio |
|---|---|---|---|---|
| 1 | $Q_{10} = 49.8\ A^{0.862}$ | 41 | 1.3 | 1.5 |
| 2 | $Q_{10} = 66.5\ A^{0.801} F^{-0.236}$ | 61 | 1.3 | 1.5 |
| 3 | $Q_{10} = 3.81\ A^{0.875} F^{-0.216} N^{2.02}$ | 51 | 1.3 | 1.5 |
| 4 | $Q_{10} = 43.4\ A^{0.857} F^{-0.210}$ | 62 | 1.4 | 1.8 |
| 5 | $Q_{10} = 13.0\ A^{0.918}$ | 61 | 1.3 | 1.5 |
| 6 | $Q_{10} = 188\ A^{0.873} La^{0.773} N^{-1.82}$ | 41 | 1.2 | 1.3 |
| 7 | $Q_{10} = 20.6\ A^{0.806} W^{-1.05}$ | 59 | 1.2 | 1.4 |
| 8 | $Q_{10} = 193\ A^{0.758} F^{0.222} N^{-4.25}$ | 45 | 1.4 | 1.7 |

EXPLANATION

A = Drainage area in square miles.
F = Percentage of forest cover plus 1 percent.
La = Percentage of area of lakes and ponds on the basin plus 1 percent.
N = Latitude of centroid of basin in degrees minus 40 degrees.
W = Longitude of centroid of basin in degrees minus 110 degrees.

Table A-2. Drainage areas, flood discharges at selected frequencies, and maximum flows of record for streams draining less than 50 square miles with 8 years or more of record.

| Station No. | Station name | Drainage area (square miles) | Discharge (cfs) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Recurrence interval (years) | | | | | | Maximum of record |
| | | | 2 | 5 | 10 | 20 | 25 | 50 | |
| | **Missouri River Basin** | | | | | | | | |
| 06011900 | Red Rock River trib. | 1.0 | 4.2 | 8.7 | 15 | 21 | - | - | 15 |
| | **Bear River basin** | | | | | | | | |
| 10040000 | Thomas Fork | 45.3 | 147 | 262 | 337 | - | 505 | - | 418 |
| 10040500 | Salt Creek | 37.6 | 169 | 294 | 377 | - | 476 | - | 382 |
| 10043350 | Sheep Cr. trib. No. 2 | .34 | 3.2 | 6.1 | 8.3 | 11 | - | - | 5.4 |
| 10047500 | Montpelier Creek | 50.9 | 105 | 155 | 186 | - | 222 | 253 | 224 |
| 10058600 | Bloomington Creek | 24.4 | 140 | 187 | 215 | 245 | - | - | 222 |
| 10072800 | Eightmile Creek | 23.3 | 98 | 128 | 145 | 157 | - | - | 144 |
| 10090800 | Battle Creek trib. | 4.5 | 43 | 81 | 104 | 121 | - | - | 98 |
| 10093000 | Cub River | 19.4 | 564 | 657 | 705 | - | 753 | - | 715 |
| 10099000 | High Creek | 16.2 | 204 | 231 | 245 | 250 | - | - | 250 |
| 10125000 | Deep Creek | 30.1 | 59 | 102 | 136 | - | 178 | - | 172 |
| | **Tributaries between Great Salt Lake Desert and Bear River** | | | | | | | | |
| 10172930 | Right Hand Fk. Dove Cr. | 12.2 | 4.1 | 13 | 25 | 40 | - | - | 32 |
| 10172940 | Dove Creek | 33.2 | 7.5 | 30 | 72 | - | 170 | - | 275 |
| 10172960 | West Fork Tenmile Cr. | 5.93 | 83 | 210 | 380 | 700 | - | - | 460 |
| 10172970 | Rock Creek | 44.0 | 167 | 437 | 741 | 1,100 | - | - | 1,390 |
| | **Kootenai River basin** | | | | | | | | |
| 12304250 | Whitetail Creek | 2.61 | 27 | 42 | 53 | 64 | - | - | 49 |
| 12304300 | Cyclone Creek | 5.66 | 127 | 163 | 190 | 216 | - | - | 220 |
| 12304400 | Fourth of July Creek | 7.70 | 197 | 233 | 242 | 280 | - | - | 258 |
| 12310800 | Trail Creek | 16.1 | 175 | 284 | 390 | 520 | - | - | 341 |
| 12316800 | Mission Creek | 23.0 | 333 | 470 | 560 | - | 660 | - | 528 |

Table A-2. Drainage areas, flood discharges at selected frequencies, and maximum flows of record for streams draining less than 50 square miles with 8 years or more of record--Continued.

| Station No. | Station name | Drainage area (square miles) | Discharge (cfs) Recurrence interval (years) 2 | 5 | 10 | 20 | 25 | 50 | Maximum of record |
|---|---|---|---|---|---|---|---|---|---|
| | **Pend Oreille River basin** | | | | | | | | |
| 12345800 | Camas Creek | 6.01 | 149 | 230 | 280 | - | 360 | - | 265 |
| 12347500 | Blodgett Creek | 26.4 | 637 | 753 | 814 | - | 880 | - | 836 |
| 12350200 | Gash Creek | 3.37 | 107 | 157 | 195 | - | 250 | - | 200 |
| 12350500 | Kootenai Creek | 28.9 | 830 | 1,100 | 1,330 | - | 1,400 | - | 1,300 |
| 12353800 | Thompson Creek | 12.2 | 60 | 101 | 132 | 165 | - | - | 190 |
| 12353850 | East Fork Timber Cr. | 2.72 | 35 | 52 | 65 | 78 | - | - | 66 |
| 12354100 | N. Fk. Little Joe Cr. | 14.7 | 190 | 210 | 220 | 225 | - | - | 212 |
| 12392100 | Trapper Creek | 1.12 | 34 | 47 | 56 | 65 | - | - | 52 |
| 12392800 | Hornby Creek | 2.2 | 37 | 44 | 48 | 56 | - | - | 48 |
| 12393600 | Binarch Creek | 10.7 | 64 | 104 | 132 | 160 | - | - | 117 |
| 12394300 | Benton Creek | 1.48 | 13 | 18 | 20 | - | 24 | 27 | 22.5 |
| | **Spokane River basin** | | | | | | | | |
| 12413100 | Boulder Creek | 3.13 | 97 | 130 | 150 | 173 | - | - | 144 |
| 12413200 | Montgomery Creek | 4.53 | 75 | 132 | 178 | 230 | - | - | 155 |
| 12415100 | Cherry Creek | 7.07 | 97 | 168 | 222 | 280 | - | - | 247 |
| 12415200 | Plummer Creek trib. | 2.10 | 57 | 92 | 120 | 155 | - | - | 122 |
| 12416000 | Hayden Creek | 22.0 | 377 | 620 | 800 | - | 1,050 | - | 790 |
| 12423550 | Hangman Creek trib. | 2.18 | 40 | 117 | 184 | 250 | - | - | 155 |
| 12423700 | S. Fk. Rock Cr. trib. | .59 | 27 | 34 | 39 | 43 | - | - | 41 |
| 12423900 | Stevens Creek trib. | 2.02 | 22 | 44 | 68 | - | 117 | - | 125 |
| 12429600 | Deer Creek | 31.9 | 136 | 250 | 360 | 490 | - | - | 391 |
| 12430370 | Bigelow Gulch | 2.07 | 19 | 61 | 120 | 260 | - | - | 1,510 |
| | **Tributaries to Snake River above Henrys Fork** | | | | | | | | |
| 13027200 | Bear Canyon | 3.30 | 45 | 84 | 112 | 140 | - | - | 180 |
| 13030000 | Indian Creek | 36.8 | 204 | 267 | 306 | - | 354 | - | 350 |

Table A-2. Drainage areas, flood discharges at selected frequencies, and maximum flows of record for streams draining less than 50 square miles with 8 years or more of record--Continued.

| Station No. | Station name | Drainage area (square miles) | Discharge (cfs) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Recurrence interval (years) | | | | | | Maximum of record |
| | | | 2 | 5 | 10 | 20 | 25 | 50 | |
| | **Henrys Fork basin** | | | | | | | | |
| 13038900 | Targhee Creek | 20.8 | 235 | 300 | 335 | 370 | - | - | 340 |
| 13050700 | Mail Cabin Creek | 3.27 | 36 | 50 | 61 | 77 | - | - | 81 |
| 13050800 | Moose Creek | 21.4 | 285 | 360 | 410 | 450 | - | - | 390 |
| 13054400 | Milk Creek | 17.9 | 98 | 400 | 833 | 1,500 | - | - | 1,350 |
| | **Tributaries to Snake River between Henrys Fork and Blackfoot River** | | | | | | | | |
| 13057600 | Homer Creek | 26.4 | 220 | 410 | 550 | 700 | - | - | 448 |
| 13061100 | Snake River trib. | 7.64 | 58 | 175 | 322 | 510 | - | - | 450 |
| | **Blackfoot River basin** | | | | | | | | |
| 13062700 | Angus Creek | 13.9 | 188 | 272 | 334 | 400 | - | - | 375 |
| 13063500 | Little Blackfoot River | 38.8 | 140 | 209 | 275 | - | 318 | - | 292 |
| | **Portneuf River basin** | | | | | | | | |
| 13073700 | Robbers Roost Creek | 5.70 | 14 | 21 | 26 | 29 | - | - | 24 |
| 13074000 | Birch Creek | 6.56 | 24 | 35 | 56 | - | 94 | - | 95 |
| 13075300 | East Fork Mink Creek | 14.7 | 28 | 45 | 54 | 63 | - | - | 49 |
| 13075600 | N. Fk. Pocatello Cr. | 14.0 | 23 | 42 | 58 | 76 | - | - | 57 |
| 13075700 | S. Fk. Pocatello Cr. | 4.3 | 2.3 | 5.0 | 8.0 | 13 | - | - | 9 |
| | **Raft River basin** | | | | | | | | |
| 13077700 | George Creek | 7.84 | 67 | 102 | 124 | 150 | - | - | 146 |
| 13079000 | Clear Creek | 20.2 | 120 | 185 | 225 | - | 375 | 490 | 386 |
| 13079800 | Heglar Canyon trib. | 7.72 | 185 | 360 | 580 | 900 | - | - | 1,930 |

Table A-2. Drainage areas, flood discharges at selected frequencies, and maximum flows of record for streams draining less than 50 square miles with 8 years or more of record--Continued.

| Station No. | Station name | Drainage area (square miles) | Discharge (cfs) Recurrence interval (years) 2 | 5 | 10 | 20 | 25 | 50 | Maximum of record |
|---|---|---|---|---|---|---|---|---|---|
| | | | Bruneau River basin--Continued | | | | | | |
| 13152500 | Columbet Creek | 3.37 | 15 | 27 | 35 | 44 | - | - | 35 |
| 13170100 | Sugar Creek trib. | 3.04 | 28 | 56 | 78 | 105 | - | - | 105 |
| | | | Tributaries to Snake River between Bruneau River and Boise River | | | | | | |
| 13172200 | Fossil Creek | 19.7 | 22 | 135 | 175 | 240 | - | - | 195 |
| 13172668 | ARS, W-13 | .16 | 3.6 | 6.6 | 8.8 | 11 | - | - | 5.9 |
| 13172735 | ARS, W-2 | 14.0 | 87 | 279 | 524 | 900 | - | - | 1,007 |
| 13172800 | Little Squaw Cr. trib. | 1.81 | 12 | 44 | 75 | 115 | - | - | 93 |
| | | | Boise River basin | | | | | | |
| 13184200 | Roaring River | 23.3 | 370 | 500 | 580 | 660 | - | - | 575 |
| 13184800 | Beaver Creek | 9.3 | 103 | 149 | 181 | 218 | - | - | 195 |
| 13185500 | Cottonwood Creek | 20.9 | 74 | 190 | 310 | 475 | - | - | 166 |
| 13196500 | Bannock Creek | 5.75 | 12 | 23 | 32 | - | 45 | - | 46 |
| 13200500 | Robie Creek | 15.8 | 59 | 106 | 160 | - | 255 | - | 274 |
| 13207000 | Spring Valley Creek | 20.9 | 50 | 129 | 206 | - | 336 | - | 244 |
| 13210300 | Bryans Run | 7.94 | 68 | 180 | 290 | 430 | - | - | 420 |
| | | | Payette River basin | | | | | | |
| 13234300 | Fivemile Creek | 7.8 | 158 | 214 | 247 | 280 | - | - | 290 |
| 13235100 | Rock Creek | 14.6 | 144 | 275 | 390 | 530 | - | - | 400 |
| 13237300 | Danskin Creek | 10.1 | 36 | 60 | 76 | 94 | - | - | 71 |
| 13237600 | Cabin Creek | .42 | 3.2 | 7.8 | 12 | 17 | - | - | 18 |
| 13237700 | Control Creek | .59 | 3.8 | 11 | 18 | 27 | - | - | 6.6 |
| 13238300 | Deep Creek | 4.38 | 337 | 430 | 499 | 620 | - | - | 540 |
| 13240000 | Lake Fork Payette R. | 48.9 | 1,380 | 1,750 | 1,980 | - | 2,260 | 2,460 | 2,600 |

Table A-2. Drainage areas, flood discharges at selected frequencies, and maximum flows of record for streams draining less than 50 square miles with 8 years or more of record--Continued.

| Station No. | Station name | Drainage area (square miles) | Discharge (cfs) Recurrence interval (years) 2 | 5 | 10 | 20 | 25 | 50 | Maximum of record |
|---|---|---|---|---|---|---|---|---|---|
| | **Salmon Falls Creek basin** | | | | | | | | |
| 13105300 | Salmon Falls Cr. trib. | 4.0 | 0 | 14 | 22 | 32 | - | - | 18 |
| | **Mud Lake-Lost River basins** | | | | | | | | |
| 13112900 | Huntley Canyon | 4.0 | 9.0 | 17 | 24 | 34 | - | - | 36 |
| 13117200 | Main Fork | 15.6 | 135 | 218 | 276 | 340 | - | - | 273 |
| 13118400 | Wet Creek | 11.2 | 40 | 66 | 85 | 105 | - | - | 83 |
| 13128900 | Lower Cedar Creek | 8.26 | 148 | 190 | 215 | 240 | - | - | 213 |
| | **Big Wood River basin** | | | | | | | | |
| 13135200 | Prairie Creek | 18.0 | 180 | 260 | 310 | 370 | - | - | 293 |
| 13135800 | Adams Gulch | 10.5 | 38 | 82 | 126 | 180 | - | - | 124 |
| 13141400 | Deer Creek | 13.2 | 51 | 86 | 115 | 150 | - | - | 150 |
| 13145700 | Schooler Creek | 2.22 | 20 | 40 | 56 | 76 | - | - | 68 |
| 13147300 | Muldoon Creek | 12.2 | 105 | 152 | 185 | 220 | - | - | 160 |
| | **Tributaries to Snake River between Big Wood River and Bruneau River** | | | | | | | | |
| 13155200 | Burns Gulch | .76 | 6.1 | 13 | 19 | 25 | - | - | 22 |
| 13155300 | Little Canyon Creek | 14.2 | 87 | 180 | 272 | 410 | - | - | 500 |
| | **Bruneau River basin** | | | | | | | | |
| 13161100 | Bruneau River | 41.1 | 15 | 108 | 385 | 1,300 | - | - | 1,890 |
| 13161200 | Seventy Six Creek | 3.52 | 17 | 49 | 83 | 130 | - | - | 45 |
| 13161600 | McDonald Creek | 10.8 | 39 | 54 | 65 | 75 | - | - | 61 |
| 13152200 | Jarbidge River | 22.6 | 425 | 600 | 730 | 840 | - | - | 570 |
| 13162400 | Buck Creek | 20.2 | 76 | 210 | 315 | 450 | - | - | 315 |

Table A-2. Drainage areas, flood discharges at selected frequencies, and maximum flows of record for streams draining less than 50 square miles with 8 years or more of record--Continued.

| Station No. | Station name | Drainage area (square miles) | Discharge (cfs) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Recurrence interval (years) | | | | | | Maximum of record |
| | | | 2 | 5 | 10 | 20 | 25 | 50 | |
| | **Payette River basin--Continued** | | | | | | | | |
| 13245400 | Tripod Creek | 8.63 | 80 | 118 | 144 | 175 | - | - | 183 |
| 13248900 | Cottonwood Creek | 6.53 | 80 | 142 | 220 | 300 | - | - | 303 |
| 13250600 | Big Willow Creek | 47.4 | 890 | 1,600 | 2,140 | 2,700 | - | - | 2,100 |
| 13250650 | Fourmile Creek | 6.5 | 120 | 320 | 510 | 760 | - | - | 500 |
| 13250700 | Langley Gulch | 3.88 | 0 | 3.3 | 32 | 62 | - | - | 39 |
| | **Weiser River basin** | | | | | | | | |
| 13251300 | West Branch Weiser R. | 3.96 | 34 | 53 | 76 | 103 | - | - | 84 |
| 13251500 | Weiser River | 36.5 | 460 | 660 | 790 | - | 1,020 | 1,200 | 1,320 |
| 13252500 | East Fk. Weiser River | 2.0 | 53 | 70 | 80 | 91 | - | - | 77 |
| 13257500 | Johnson Creek | 4.81 | 132 | 179 | 211 | 248 | - | - | 222 |
| 13267100 | Deer Creek | 4.6 | 67 | 112 | 140 | 170 | - | - | 156 |
| | **Tributaries to Snake River between Weiser River and Salmon River** | | | | | | | | |
| 13289600 | East Brownlee Creek | 7.97 | 78 | 190 | 290 | 420 | - | - | 325 |
| | **Salmon River basin** | | | | | | | | |
| 13292400 | Beaver Creek | 15.0 | 138 | 176 | 200 | 230 | - | - | 225 |
| 13293000 | Alturas Lake Creek | 35.7 | 475 | 610 | 680 | - | 785 | - | 633 |
| 13297100 | Peach Creek | 7.62 | 26 | 62 | 95 | 136 | - | - | 105 |
| 13298300 | Malm Gulch | 9.38 | 85 | 300 | 471 | 600 | - | - | 440 |
| 13301700 | Morse Creek | 18.0 | 132 | 200 | 245 | 290 | - | - | 230 |
| 13301800 | Morse Creek | 19.9 | 18 | 70 | 105 | 246 | - | - | 90 |
| 13302200 | Twelvemile Creek | 22.0 | 41 | 61 | 75 | 89 | - | - | 70 |
| 13305700 | Dahlonega Creek | 32.0 | 95 | 162 | 216 | 273 | - | - | 235 |

Table A-2. Drainage areas, flood discharges at selected frequencies, and maximum flows of record for streams draining less than 50 square miles with 8 years or more of record--Continued.

| Station No. | Station name | Drainage area (square miles) | Discharge (cfs) Recurrence interval (years) 2 | 5 | 10 | 20 | 25 | 50 | Maximum of record |
|---|---|---|---|---|---|---|---|---|---|
| | Salmon River basin--Continued | | | | | | | | |
| 13305800 | Hughes Creek | 15.7 | 146 | 193 | 218 | 240 | - | - | 220 |
| 13311000 | E.Fk. S.Fk. Salmon R. | 19.5 | 177 | 252 | 298 | - | 358 | - | 369 |
| 13311500 | E.Fk. S.Fk. Salmon R. | 42.5 | 340 | 510 | 620 | - | 780 | - | 783 |
| 13313800 | Tailholt Creek | 2.46 | 7.7 | 13 | 20 | - | 33 | - | 27 |
| 13315500 | Mud Creek | 15.8 | 200 | 290 | 350 | - | 435 | 510 | 395 |
| 13316000 | Boulder Creek | 5.84 | 160 | 220 | 265 | 307 | - | - | 244 |
| 13316800 | N.Fk. Skookumchuck Cr. | 15.3 | 130 | 240 | 360 | - | 580 | - | 471 |
| 13317200 | Johns Creek | 6.67 | 96 | 240 | 380 | 580 | - | - | 400 |
| | Tributaries to Snake River between Salmon River and Clearwater River | | | | | | | | |
| 13335200 | Critchfield Draw | 1.8 | 19 | 245 | 500 | - | 1,300 | - | 705 |
| | Clearwater River basin | | | | | | | | |
| 13336600 | Swiftwater Creek | 6.19 | 83 | 114 | 133 | 145 | - | - | 150 |
| 13336650 | E. Fk. Papoose Creek | 4.51 | 77 | 114 | 135 | 147 | - | - | 125 |
| 13336850 | Weir Creek | 12.2 | 270 | 440 | 550 | 660 | - | - | 470 |
| 13337200 | Red Horse Creek | 9.13 | 92 | 141 | 185 | 220 | - | - | 200 |
| 13337700 | Peasley Creek | 14.2 | 79 | 120 | 158 | 220 | - | - | 240 |
| 13338200 | Sally Ann Creek | 13.9 | 191 | 251 | 284 | 320 | - | - | 305 |
| 13339700 | Canal Gulch Creek | 5.9 | 112 | 167 | 210 | 270 | - | - | 291 |
| 13339900 | Deer Creek | 6.8 | 79 | 215 | 350 | 550 | - | - | 485 |
| 13341100 | Cold Springs Creek | 8.25 | 59 | 140 | 215 | 310 | - | - | 200 |
| 13341300 | Bloom Creek | 3.15 | 51 | 94 | 133 | 175 | - | - | 151 |
| 13341400 | E. Fk. Potlatch River | 41.6 | 610 | 936 | 1,200 | 1,580 | - | - | 1,740 |

Table A-2. Drainage areas, flood discharges at selected frequencies, and maximum flows of record for streams draining less than 50 square miles with 8 years or more of record--Continued.

| Station No. | Station name | Drainage area (square miles) | Discharge (cfs) Recurrence interval (years) 2 | 5 | 10 | 20 | 25 | 50 | Maximum of record |
|---|---|---|---|---|---|---|---|---|---|
| | | | **Palouse River basin** | | | | | | |
| 13344700 | Deep Creek trib. | 2.90 | 54 | 82 | 104 | 130 | - | - | 157 |
| 13344800 | Deep Creek | 36.6 | 799 | 1,220 | 1,480 | 1,730 | - | - | 1,700 |
| 13346300 | Crumarine Creek | 2.41 | 13 | 19 | 24 | 28 | - | - | 24 |
| 13348400 | Missouri Flat Cr. trib. | .88 | 30 | 90 | 190 | - | 430 | - | 234 |
| 13348500 | Missouri Flat Creek | 27.1 | 315 | 520 | 940 | - | 1,600 | - | 1,500 |

Table A-3. Maximum discharges at selected sites.

| Station No. | Stream name | Drainage area (sq.mi.) | Date | Discharge (cfs) |
|---|---|---|---|---|
| | **Bear River basin** | | | |
| 10041000 | Thomas Fork near Wyoming-Idaho State line | 113 | 5-18-50 | 869 |
| 10047000 | Montpelier Cr. near Montpelier | 28.2 | 4-24-43 | 224 |
| 10071500 | Skinner Creek near Nounan | 5.41 | 6- 8-44 | 60 |
| 10087500 | Mink Creek below Dry Fork | 19.3 | 5-29-48 | 600 |
| M10091030 | Battle Creek tributary No. 2 | a2 | 8-21-61 | 1,600 |
| 10119000 | Little Malad River | 120 | 2-10-62 | 1,450 |
| M10120030 | Little Danish Canyon | 1.25 | 8-25-61 | 1,170 |
| 10091200 | Deep Creek near Clifton | 119 | 3-31-69 | 152 |
| 10120500 | Little Malad River | 223 | 2-11-62 | 1,720 |
| M10122550 | Devil Creek | 15 | 2- 1-63 | 585 |
| M10172966 | Deep Creek | a72 | 2-11-62 | 1,220 |
| | **Tributaries to Great Basin between Great Salt Lake Desert and Bear River** | | | |
| M10172973 | Rock Creek | 93 | 2-10-62 | 1,630 |
| M10172974 | Wood Canyon | a1.3 | 2-10-62 | 29 |
| | **Kootenai River basin** | | | |
| 12305500 | Boulder Creek | 53 | 5-30-69 | 2,720 |
| 12309000 | Cow Creek near Bonners Ferry | 14.7 | 6- 9-33 | 60 |
| 12311000 | Deep Creek at Moravia | 133 | 5-18-54 | 1,670 |
| 12311500 | Snow Creek near Moravia | 19.5 | 6-14-33 | 572 |
| 12312000 | Caribou Creek near Moravia | 14.0 | 6-15-33 | 376 |
| 12313000 | Myrtle Creek near Bonners Ferry | a37 | 6- 5-33 | 1,260 |
| 12313500 | Ball Creek near Bonners Ferry | a27 | 6-15-33 | 644 |
| 12315200 | Rock Creek near Copeland | 14.3 | 4-26-23 | 86 |
| 12315400 | Trout Creek near Copeland | a20 | 6-16-33 | 533 |
| 12317000 | Mission Creek at Copeland | a31 | 5-22-32 | 370 |
| 12317500 | Brush Creek near Copeland | a7.2 | 4-26-33 | 68 |
| 12319500 | Parker Creek near Copeland | 16.5 | 6-15-33 | 400 |
| 12320500 | Long Canyon Creek near Porthill | a29 | 5-27-48 | 1,300 |
| 12321000 | Smith Creek near Porthill | a70 | 6-23-55 | 3,810 |
| 12321500 | Boundary Creek near Porthill | a97 | 6-23-55 | 3,280 |
| | **Pend Oreille River basin** | | | |
| M12392120 | East Fork Creek | 20.4 | 6- 8-64 | 903 |
| M12392150 | Lightning Creek | 90 | 5-27-48b | 5,100 |
| 12392300 | Pack River | 124 | 5-30-69 | 4,370 |
| 12392400 | Rapid Lightning Creek | 45 | 4-20-65 | 718 |
| M12392950 | Indian Creek | 20 | 5-27-48b | 800 |

Table A-3. Maximum discharges at selected sites--Continued.

| Station No. | Stream name | Drainage area (sq.mi.) | Date | Dis-charge (cfs) |
|---|---|---|---|---|
| | Spokane River basin | | | |
| M12411800 | East Fork Eagle Creek | 9.13 | 6- 8-64 | 457 |
| M12411900 | Cottonwood Creek | 2.05 | 6- 8-64 | 328 |
| M12413120 | Canyon Creek | 18.1 | 6- 8-64 | 817 |
| 12413140 | Placer Creek at Wallace | 14.9 | 12-23-64 | a1,300 |
| 12413700 | Latour Creek near Cataldo | 24.8 | 2-19-68 | 1,400 |
| M12413450 | Pine Creek | 74.0 | 12-23-64 | 5,290 |
| M12413470 | South Fork Coeur d'Alene River | 310 | 2-21-61 | 9,440 |
| M12413900 | St. Joe River | 472 | 5-29-48 | 13,400 |
| M12413950 | North Fork St. Joe River | 111 | 5-28-48 | 3,500 |
| 12415000 | St. Maries River | 437 | 12-22-33 | 23,800 |
| | Salt River basin | | | |
| 13025500 | Crow Creek near Fairview, Wyo. | 114 | 4-19-46 | 236 |
| 13026000 | Stump Creek near Auburn, Wyo. | 103 | 5-18-48 | 490 |
| | Tributaries to Snake River between Salt River and Henrys Fork | | | |
| M13034900 | Snake River tributary No. 7 | .23 | 6- 1-63 | 729 |
| 13035500 | Pine Creek near Swan Valley | 63.2 | 5-16-36 | 799 |
| M13037600 | Birch Creek | 21 | 2-11-62 | 980 |
| M13038410 | Lyons Creek | a18 | 2-11-62b | 1,560 |
| | Henrys Fork basin | | | |
| 13041500 | Sheridan Creek near Island Park | 82.1 | 5-31-38 | 447 |
| 13047800 | N. Fk. Squirrel Cr. near Squirrel | 2.40 | 5-16-64 | 184 |
| 13051000 | Trail Creek near Victor | 47.6 | 6- 7-52 | 445 |
| 13051500 | Teton Creek near Driggs | 33.8 | 6- 6-52 | 1,030 |
| 13052500 | Horseshoe Creek near Driggs | 11.7 | 5- 3-52 | 81 |
| 13053000 | Packsaddle Creek near Tetonia | 5.7 | 5-19-49 | 58 |
| M13054600 | Canyon Creek | a76 | 2-11-62b | 814 |
| M13-55320 | Moody Creek | a88 | 2-11-62b | 2,700 |
| | Willow Creek basin | | | |
| 13058000 | Willow Creek | 622 | 2-11-62 | 5,080 |
| | Tributaries to Snake River between Shelley and Blackfoot | | | |
| M13059100 | Snake River tributary No. 5 | 5.2 | 2-11-62 | 114 |
| M13059200 | Snake River tributary No. 4 | 3.55 | 2-11-62 | 270 |
| M13059300 | Snake River tributary No. 3a | 3.5 | 2-11-62 | 120 |
| M13059400 | Snake River tributary No. 3 | 16 | 2-11-62 | 632 |
| M13062600 | Snake River tributary No. 6 | 63.5 | 2-11-62 | 1,540 |

Table A-3. Maximum discharges at selected sites--Continued.

| Station No. | Stream name | Drainage area (sq.mi.) | Date | Dis-charge (cfs) |
|---|---|---|---|---|
| | **Blackfoot River basin** | | | |
| M13066600 | Sand Creek tributary | a9.8 | 2-11-62 | 1,210 |
| M13066700 | Black Canyon | 7.29 | 8- 9-63 | 1,940 |
| M13066800 | Henrys Creek | a29 | 2-11-62 | 716 |
| M13066900 | Cedar Creek | 10.5 | 2-11-62 | 194 |
| | **Portneuf River basin** | | | |
| 13071500 | Topons Creek near Chesterfield | 45.7 | 5-21-12 | 355 |
| M13072100 | Portneuf River tributary | a130 | 2- 1-63 | 574 |
| M13072300 | Portneuf River | 332 | 2-11-62b | 2,380 |
| M13072750 | Fish Creek | 20.1 | 2- 1-63 | 1,360 |
| M13072900 | Dempsey Creek | 42 | 2- 1-63 | 400 |
| M13073100 | Jenkins Canyon | 5.50 | 8- 1-60 | 2,350 |
| M13073710 | Green Canyon tributary | 2.82 | 8-12-61 | 3,060 |
| M13073720 | Portneuf River | 650 | 2-13-62 | 4,380 |
| M13073750 | Marsh Creek | a68 | 2-12-62 | 573 |
| 13074000 | Birch Creek near Downey | 6.56 | 7-15-38 | 95 |
| M13075100 | Rapid Creek | 57.2 | 2- 1-63 | 526 |
| M13075400 | Gibson Jack Creek | 10.3 | 2-12-62 | 57 |
| | **Bannock Creek basin** | | | |
| 13076000 | Bannock Creek | 227 | 12-24-64 | 7,790 |
| M13076100 | Rattlesnake Creek | a77 | 2-11-62b | 1,170 |
| M13076200 | Bannock Creek | 413 | 2-11-62 | 4,010 |
| | **Rock Creek basin** | | | |
| M13077100 | Trail Creek | a11 | 9- 9-61 | 487 |
| M13077200 | Rock Creek | 96 | 2-11-62 | 1,770 |
| M13077400 | Rock Creek | 156 | 2- 1-63 | 5,100 |
| M13077550 | Rock Creek | 216 | 2-11-62 | 2,120 |
| M13077630 | Spring Canyon tributary | 6.77 | 8-18-61 | 152 |
| M13077640 | Rocky Hollow tributary | 2.26 | 5-30-63 | 498 |
| M13077650 | Rock Creek | 320 | 12-23-64 | 7,950 |
| | **Tributaries to Snake River between Rock Creek and Raft River** | | | |
| M13077652 | Dairy Canyon | 26.2 | 1-17-71 | 750 |
| M13077655 | Fall Creek | 14.2 | 7-10-70 | 3,700 |

Table A-3. Maximum discharges at selected sites--Continued.

| | Stream name | Drainage area (sq.mi.) | Date | Discharge (cfs) |
|---|---|---|---|---|
| | **Raft River basin** | | | |
| 13079070 | Meadow Creek near Sublett | 37.7 | 5- 9-71 | 626 |
| 13079100 | Cassia Creek above Stinson Creek | 7.2 | 6-24-69 | 32 |
| 13079200 | Cassia Creek near Elba | a84 | 12-23-64 | 982 |
| M13079750 | Heglar Canyon | a45 | 2-11-62 | 153 |
| M13079820 | Heglar Canyon | 62.0 | 1-17-71 | 471 |
| M13079890 | Calder Creek | 23.6 | 1-17-71 | 735 |
| | **Tributaries to Snake River between Raft River and Big Wood River** | | | |
| 13082300 | Marsh Creek near Albion | a86 | 1-17-71 | 828 |
| 13083000 | Trapper Creek near Oakley | 53.7 | 8-17-41 | 270 |
| M13084800c | "D" drain tributary | 5.0 | 12-23-64 | 86 |
| M13084900c | "F" drain | 64.7 | 12-23-64 | 2,990 |
| 13088500 | Big Cottonwood Creek near Oakley | a29 | 5-30-12 | 125 |
| 13092000 | Rock Creek near Rock Creek | a80 | 5-19-70 | 461 |
| 13108500 | Camas Creek at Eighteenmile shearing corral | a210 | 5- 8-69 | 2,590 |
| 13113000 | Beaver Creek at Spencer | a120 | 4-24-69 | 642 |
| 13114000 | Beaver Creek at Camas | 510 | 4-21-62 | 229 |
| 13116000 | Medicine Lodge Creek | 165 | 4-15-62 | 361 |
| 13117000 | Birch Creek near Reno | 320 | 4- 1-62 | 220 |
| 13117300 | Sawmill Creek near Goldburg | 74.3 | 6-12-65 | 651 |
| 13119000 | Little Lost River near Howe | 703 | 8-11-36 | 450 |
| 13120000 | N. Fk. Big Lost R. at Wild Horse | 114 | 6-12-65 | 1,420 |
| 13129800 | Alder Creek below South Fork | 27.6 | 5-24-67 | 165 |
| 13130900 | Antelope Creek above Willow Creek | 93.4 | 5-24-67 | 829 |
| M13132540 | Big Lost tributary | a20 | 2-11-62 | 190 |
| M13132555 | Big Lost River tributary No. 2 | a8.7 | 2-11-62 | 424 |
| | **Big Wood River basin** | | | |
| 13135500 | Big Wood River near Ketchum | 137 | 5-24-67 | 1,690 |
| 13136500 | Warm Springs Creek at Guyer Hot Springs | a96 | 5-21-58 | 961 |
| M13142850 | Big Wood River tributary | 15.8 | 2-12-62 | 226 |
| M13145800 | Thorn Creek | a46 | 2-11-62 | 647 |
| M13145900 | Preacher Creek | a26 | 12-23-64 | 2,210 |
| M13147100 | Dry Creek | a84 | 12-22-64d | 8,050 |
| 13150500 | Silver Creek | a88 | 2- 4-63 | 757 |

Table A-3. Maximum discharges at selected sites--Continued.

| No. | Stream name | Drainage area (sq.mi.) | Date | Discharge (cfs) |
|---|---|---|---|---|
| | **Clover Creek basin** | | | |
| M13153800 | Clover Creek | 71.2 | 12-23-64 | 7,000 |
| M13153900 | Calf Creek | 39.4 | 12-23-64 | 6,400 |
| 13154000 | Clover Creek near Bliss | 140 | 2-13-70 | 4,500 |
| M13154400 | Clover Creek | 265 | 12-23-64 | 10,100 |
| | **Tributaries to Snake River between Clover Creek and Bruneau River** | | | |
| 13155000 | King Hill Creek near King Hill | 78.9 | 2- 1-63 | 2,320 |
| M13155100 | Rosevear Gulch | 55.9 | 8-31-63 | 1,160 |
| 13155400 | Little Canyon Cr. at Berry Ranch | 26.9 | 12-23-64 | 1,330 |
| 13156500 | Bennett Creek near Bennett | 21.3 | 4- 2-43 | 204 |
| 13157000 | Bennett Creek near Hammett | 68.6 | 2-16-13 | 550 |
| M13161050 | Squaw Creek | 61.5 | 9-16-61 | 368 |
| | **Bruneau River basin** | | | |
| 13163200 | Sheep Creek | a180 | 6- 5-63 | 2,760 |
| M13168380 | Hot Creek | 42.2 | 8-13-68 | 772 |
| M13169250 | Bruneau River tributary | .63 | 8-13-68 | 208 |
| 13169500 | Big Jacks Creek | 253 | 1-21-43 | 2,100 |
| 13170000 | Little Jacks Creek | 100 | 1-21-43 | 908 |
| M13170200 | Sugar Creek | 33.6 | 8-13-68 | 1,300 |
| | **Tributaries to Snake River between Bruneau River and Boise River** | | | |
| M13172100 | Browns Creek | a31 | 8-13-68 | 967 |
| M13172300 | Sinker Creek | a74 | 12-23-64 | 1,500 |
| M13172600 | Rabbit Creek | a45 | 6-19-62 | 3,640 |
| M13172620 | Rabbit Creek tributary | 4.3 | 6-19-62 | 1,140 |
| M13172640 | West Rabbit Creek | 27.0 | 6-20-62 | 3,740 |
| M13172700 | Nancy Gulch | a4 | 6-19-62 | 375 |
| 13172720 | Macks Creek | 12.3 | 1-28-65 | 390 |
| 13172725 | Reynolds Creek tributary | .32 | 6-19-69 | 50.7 |
| 13172740 | Reynolds Creek | 90.2 | 12-23-64 | 3,800 |
| 13173500 | Sucker Creek | 413 | 2- 1-63 | 13,300 |
| 13178000 | Jordan Creek | 440 | 12-24-64 | 7,530 |
| | **Boise River basin** | | | |
| M13184950 | Sheep Creek | 28.2 | 12-23-64 | 3,590 |
| 13187000 | Fall Creek | 55.3 | 4-27-52 | 1,150 |
| M13192400 | Rattlesnake Creek | 37.8 | 12-23-64 | 1,320 |
| M13192900 | Willow Creek | 57.0 | 12-23-64 | 1,820 |
| 13198000 | Elk Creek | 13.1 | 8-17-41 | 172 |

Table A-3. Maximum discharges at selected sites--Continued.

| No. | Stream name | Drainage area (sq.mi.) | Date | Discharge (cfs) |
|---|---|---|---|---|
| | Boise River basin--Continued | | | |
| M13201400 | Sheep Creek | 0.40 | 8-20-59 | 210 |
| M13203520 | Highland Valley Gulch | .39 | 8-20-59 | 2,100 |
| M13203530 | Highland Valley Gulch | 1.69 | 8-20-59 | 3,370 |
| M13203600 | Maynard Gulch | 2.25 | 8-20-59 | 9,540 |
| M13203750 | Squaw Creek | 1.47 | 8-20-59 | 7,320 |
| M13203800 | Warm Springs Creek | 3.84 | 8-20-59 | 9,390 |
| M13204600 | Orchard Gulch | .73 | 8-20-59 | 1,500 |
| M13204700 | Picket Pin Creek | 2.50 | 8-20-59 | 7,720 |
| M13204800 | Cottonwood Gulch | 12.0 | 8-20-59 | 1,580 |
| M13204900 | Curlew Gulch | 3.95 | 8-20-59 | 2,300 |
| M13205650 | Ussery Street Gulch | .06 | 6-21-67 | 90 |
| M13205700 | Stuart Gulch | 9.04 | 1-29-65 | 412 |
| M13205750 | Polecat Gulch | 1.01 | 6-21-67 | 210 |
| M13205800 | Boise River tributary | .25 | 6-21-67 | 9.8 |
| M13205850 | Pierce Gulch | 1.18 | 6-21-67 | 12 |
| M13206100 | Seaman Gulch | 1.76 | 6-21-67 | 12 |
| M13207650 | Goose Creek | 1.42 | 5-20-68 | 195 |
| | Payette River basin | | | |
| M13234215 | Canyon Creek tributary | a.25 | 7- 9-68 | 1,550 |
| 13234500 | Clear Creek | 59.6 | 5-31-43 | 754 |
| 13235500 | Deadwood River | 10.4 | 6-15-52 | 354 |
| 13236500 | Deadwood River | 112 | 5-26-28 | 2,150 |
| M13237820 | Lightning Creek | 24.4 | 12-23-64 | 864 |
| M13237840 | Scriver Creek | 27.3 | 12-22-55 | 406 |
| M13237900 | Anderson Creek | 34.0 | 12-22-55 | 690 |
| 13247000 | Porter Creek | 21.2 | 8-11-41 | 181 |
| M13248800 | Shafer Creek | 74.6 | 12-22-55 | 1,240 |
| M13249050 | Cottonwood Creek | 29.6 | 12-22-55 | 722 |
| M13249100 | Little Squaw Creek | 75.3 | 12-22-55 | 1,000 |
| M13249200 | Squaw Creek | 345 | 12-22-64 | 12,000 |
| M13250680 | Big Willow Creek | 138 | 1-15-56 | 1,640 |
| | Weiser River basin | | | |
| 13253000 | East Fork Weiser River | 31.6 | 12-22-55 | 821 |
| 13253500 | Weiser River at Starkey | 106 | 3-27-40 | 2,450 |
| M13260100 | West Fork Pine Creek | a29 | 12-22-55 | 499 |
| 13255500 | Hornet Creek near Council | 107 | 12-22-55 | 2,090 |
| 13257000 | Middle Fork Weiser River | 86.5 | 12-22-55 | 1,710 |
| 13259500 | Rush Creek | 32.0 | 3-16-38 | 582 |
| 13260000 | Pine Creek | a54 | 2-25-58 | 850 |
| 13261000 | Little Weiser River | 81.9 | 2-24-25 | a1,840 |
| M13261600 | Little Weiser River | 206 | 12-22-55 | 4,800 |

Table A-3. Maximum discharges at selected sites--Continued.

| No. | Stream name | Drainage area (sq.mi.) | Date | Discharge (cfs) |
|---|---|---|---|---|
| | Weiser River basin--Continued | | | |
| M13261650 | Weiser River | 952 | 12-22-55 | 16,600 |
| M13263700 | Crane Creek | a120 | 12-22-55 | 4,120 |
| M13263750 | Hog Creek | a25 | 12-22-55 | 338 |
| M13263800 | Mill Creek | a10 | 12-22-55 | 305 |
| M13263950 | South Fork Crane Creek | a52 | 1-17-70 | 1,240 |
| 13267000 | Mann Creek | a56 | 3-27-40 | 1,540 |
| 13268500 | Monroe Creek | a32 | 2-27-40 | a650 |
| | Tributaries to Snake River between Weiser River and Salmon River | | | |
| M13269230 | Hog Creek | 22.5 | 1-17-70 | 681 |
| M13289650 | Brownlee Creek | a62 | 12-22-55 | 159 |
| M13289900 | Wildhorse Creek | a120 | 12-22-55 | 2,550 |
| M13289950 | Wildhorse Creek | a140 | 12-22-55 | 2,990 |
| 13290190 | Pine Creek | a230 | 2-21-68 | 2,110 |
| | Salmon River basin | | | |
| 13292500 | Salmon River | 94.7 | 5-29-52 | 721 |
| 13295000 | Valley Creek | 147 | 5-24-56 | 2,000 |
| 13296000 | Yankee Fork Salmon River | 195 | 6-12-21 | 3,360 |
| M13297200 | Slate Creek | a28 | 8- 9-63 | 1,580 |
| 13297300 | Holman Creek | 6.10 | 6-13-65 | a25 |
| 13297450 | Little Boulder Creek | 18.4 | 6-25-71 | 279 |
| 13299200 | Challis Creek | 91.2 | 6-12-65 | 918 |
| 13302000 | Pahsimeroi River | 845 | 6- 8-57 | 796 |
| 13306000 | North Fork Salmon River | 214 | 6-13-33 | 901 |
| 13308500 | Middle Fork Salmon River | 138 | 5-24-56 | 2,980 |
| 13309000 | Bear Valley Creek | 180 | 5-27-56 | 3,860 |
| 13310000 | Big Creek | 470 | 6- 3-48 | 5,800 |
| 13310500 | South Fork Salmon River | 92 | 5-27-56 | 1,620 |
| M13310700 | South Fork Salmon River | 324 | 5-28-48 | 5,200 |
| 13312000 | East Fork South Fork Salmon River | 104 | 6-14-33 | 2,050 |
| 13312500 | Johnson Creek | 54.7 | 5-27-48 | 1,510 |
| 13313000 | Johnson Creek | 213 | 5-27-56 | 5,440 |
| M13313200 | East Fork South Fork Salmon River | 424 | 5-28-48 | 10,400 |
| 13313500 | Secesh River | 104 | 6- 3-48 | 2,500 |
| 13314500 | Warren Creek | 37 | 6- 3-48 | 1,100 |
| M13315800 | Little Salmon River | 189 | 6- 1-48 | 3,300 |
| M13316200 | Little Salmon River | 345 | 12-22-55 | 4,480 |
| M13316300 | Indian Creek | 2.66 | 5-20-70 | 34 |
| M13316400 | Rapid River | 122 | 5-29-48 | 1,600 |
| M13316450 | Little Salmon River | 550 | 6- 1-48 | 9,200 |

Table A-3. Maximum discharges at selected sites--Continued.

| No. | Stream name | Drainage area (sq.mi.) | Date | Dis-charge (cfs) |
|---|---|---|---|---|
| | Salmon River basin--Continued | | | |
| M13316600 | Slate Creek | 127 | 6- 1-48 | 2,600 |
| M13317050 | White Bird Creek | a96 | 5-22-48 | 3,500 |
| 13317500 | Deer Creek | 19.1 | 4-16-56 | 209 |
| | Tributaries to Snake River between Salmon River and Clearwater River | | | |
| M13335250 | Snake River tributary No. 8 | 1.0 | 6- 8-64e | 622 |
| | Clearwater River basin | | | |
| M13335420 | Selway River | 211 | 5-28-48 | 3,700 |
| M13336620 | White Sand Creek | 244 | 5-29-48 | 8,100 |
| M13336630 | Crooked Fork | 172 | 5-29-48 | 5,700 |
| 13336800 | Warm Springs Creek | 74.7 | 6-13-59 | 2,260 |
| 13336900 | Fish Creek | 89.2 | 5-20-64 | 2,280 |
| M13337550 | South Fork Clearwater River | 434 | 5-29-48 | 6,600 |
| M13338300 | Cottonwood Creek | 81.7 | 1-29-65 | 1,740 |
| M13338950 | Lawyer Creek | 208 | 1-29-65 | 2,460 |
| 13339500 | Lolo Creek | 243 | 6- 8-64 | 3,430 |
| M13340200 | North Fork Clearwater River | 201 | 5-28-48b | 9,900 |
| M13340400 | Kelly Creek | 380 | 5-28-48b | 13,000 |
| M13340800 | Little North Fork Clearwater R. | 414 | 5-29-48 | 14,000 |
| M13341140 | Big Canyon Creek | 225 | 1-29-65 | 8,360 |
| 13341500 | Potlatch River | 425 | 1-29-65 | 16,000 |
| M13341800 | Lapwai Creek | 37.9 | 1-29-65 | 2,190 |
| 13342000 | Mission Creek | a16 | 1-29-65 | a400 |
| M13342400 | Lapwai Creek | 235 | 1-29-65 | 4,380 |
| M13343020 | Lindsay Creek tributary No. 1 | .10 | 7-16-64 | 40.6 |
| M13343040 | Lindsay Creek tributary No. 2 | .28 | 7-16-64 | 176 |
| M13343060 | Lindsay Creek tributary No. 3 | 4.25 | 7-16-64 | 300 |
| 13345000 | Palouse River | 317 | 1- -48 | 12,000 |

a Approximately.
b Date may have been day following that indicated.
c Flood discharge may be affected by canals, drains, or other works of man.
d Date may have been 12-24-64.
e Date may have been 7-16-64.

Table A-4. Gaging stations at which the $Q_{10}$ determined by the modified log-Pearson method differs by more than 70 percent from the $Q_{10}$ determined by the regional equation.

| Region | Station No. | Station name | Difference (percent) |
|---|---|---|---|
| 2 | 13302200 | Twelvemile Creek near Salmon | -72 |
| 2 | 13336100 | Meadow Creek near Lowell | 206 |
| 2 | 13348400 | Missouri Flat Creek tributary near Pullman, Wash. | 208 |
| 3 | 13154000 | Clover Creek near Bliss | 97 |
| 3 | 13155000 | King Hill Creek near King Hill | 142 |
| 3 | 13238300 | Deep Creek near McCall | 203 |
| 3 | 13240000 | Lake Fork above Jumbo Creek, near McCall | 80 |
| 3 | 13240500 | Lake Fork above reservoir, near McCall | 75 |
| 3 | 13249000 | Squaw Creek near Gross | 214 |
| 3 | 13290150 | North Fork Pine Creek near Homestead, Oreg. | 218 |
| 3 | 13335200 | Critchfield Draw near Clarkston, Wash. | 156 |
| 4 | 13172680 | Reynolds Creek station W4 | 143 |
| 4 | 13172725 | Reynolds Creek station W12 | 323 |
| 4 | 13172730 | Reynolds Creek station W11 | 121 |
| 4 | 13172740 | Reynolds Creek station W1 | 135 |
| 4 | 13235100 | Rock Creek at Lowman | 137 |
| 5 | 13293000 | Alturas Lake Creek near Obsidian | 96 |
| 5 | 13297300 | Holman Creek near Clayton | -75 |
| 5 | 13298300 | Malm Gulch near Clayton | 364 |
| 6 | 13027200 | Bear Canyon near Freedom | 130 |
| 6 | 13057600 | Homer Creek near Herman | 85 |
| 7 | 13075700 | South Fork Pocatello Creek near Pocatello | -70 |
| 7 | 10084500 | Cottonwood Creek near Cleveland | 122 |
| 7 | 10090800 | Battle Creek tributary near Treasureton | 164 |
| 7 | 10096500 | Maple Creek near Franklin | 98 |
| 7 | 10099000 | High Creek near Richmond | 120 |
| 7 | 13062700 | Angus Creek near Henry | 262 |
| 8 | 13161300 | Meadow Creek near Rockland, Nev. | 106 |
| 8 | 13162200 | Jarbidge River at Jarbidge, Nev. | 120 |

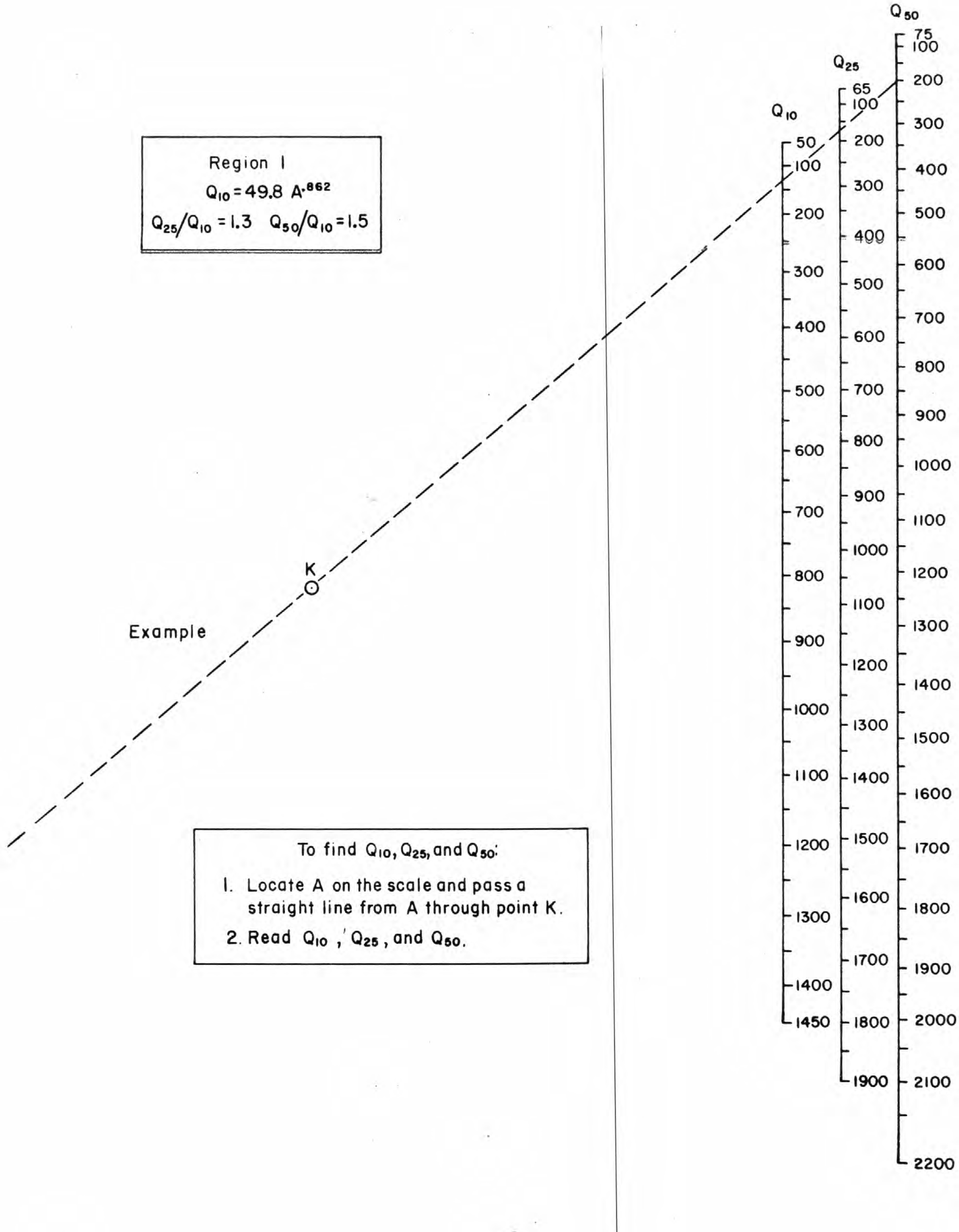


FIGURE A-1. Nomograph for computing floods in Region 1

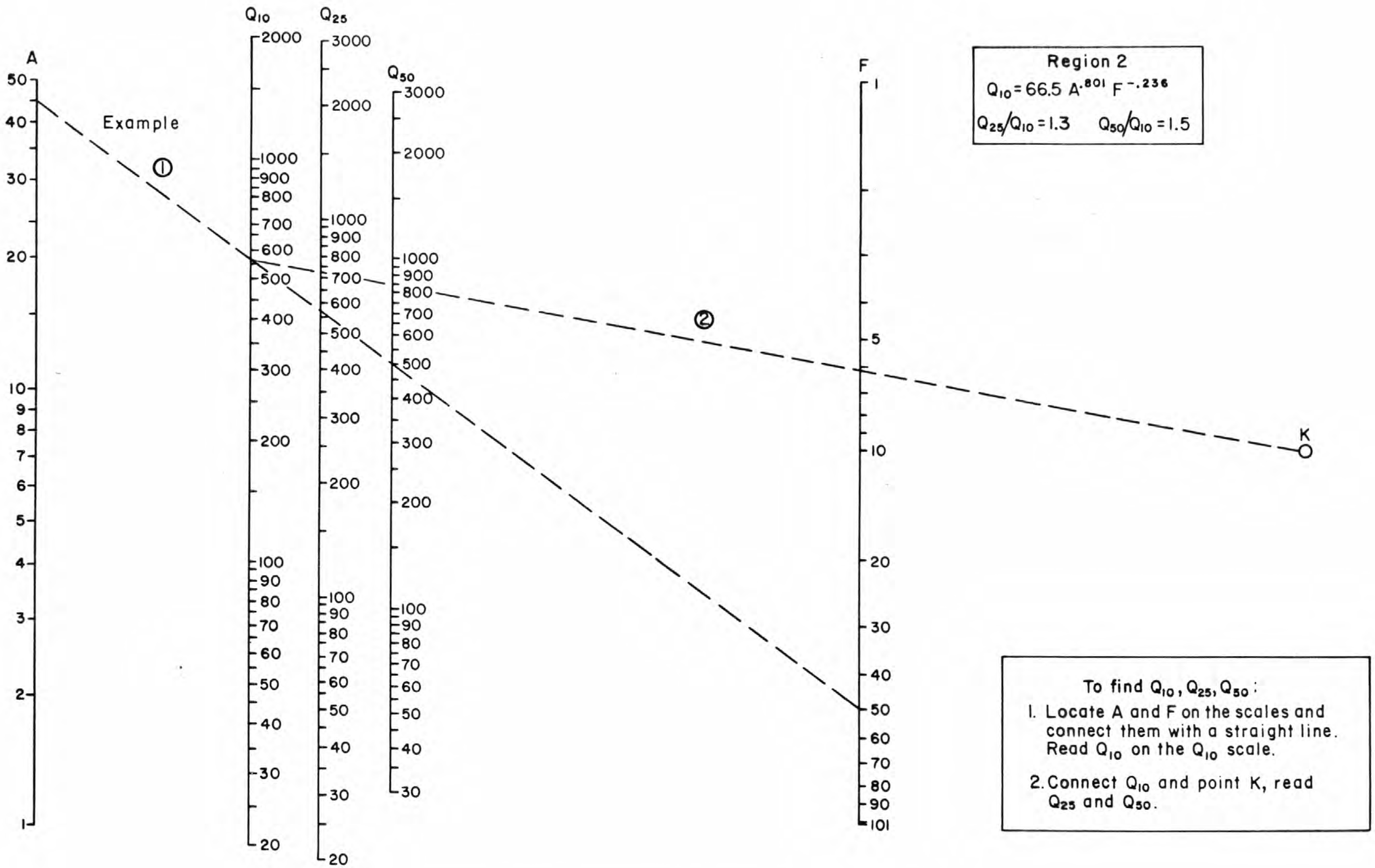


FIGURE A-2. Nomograph for computing floods in Region 2.

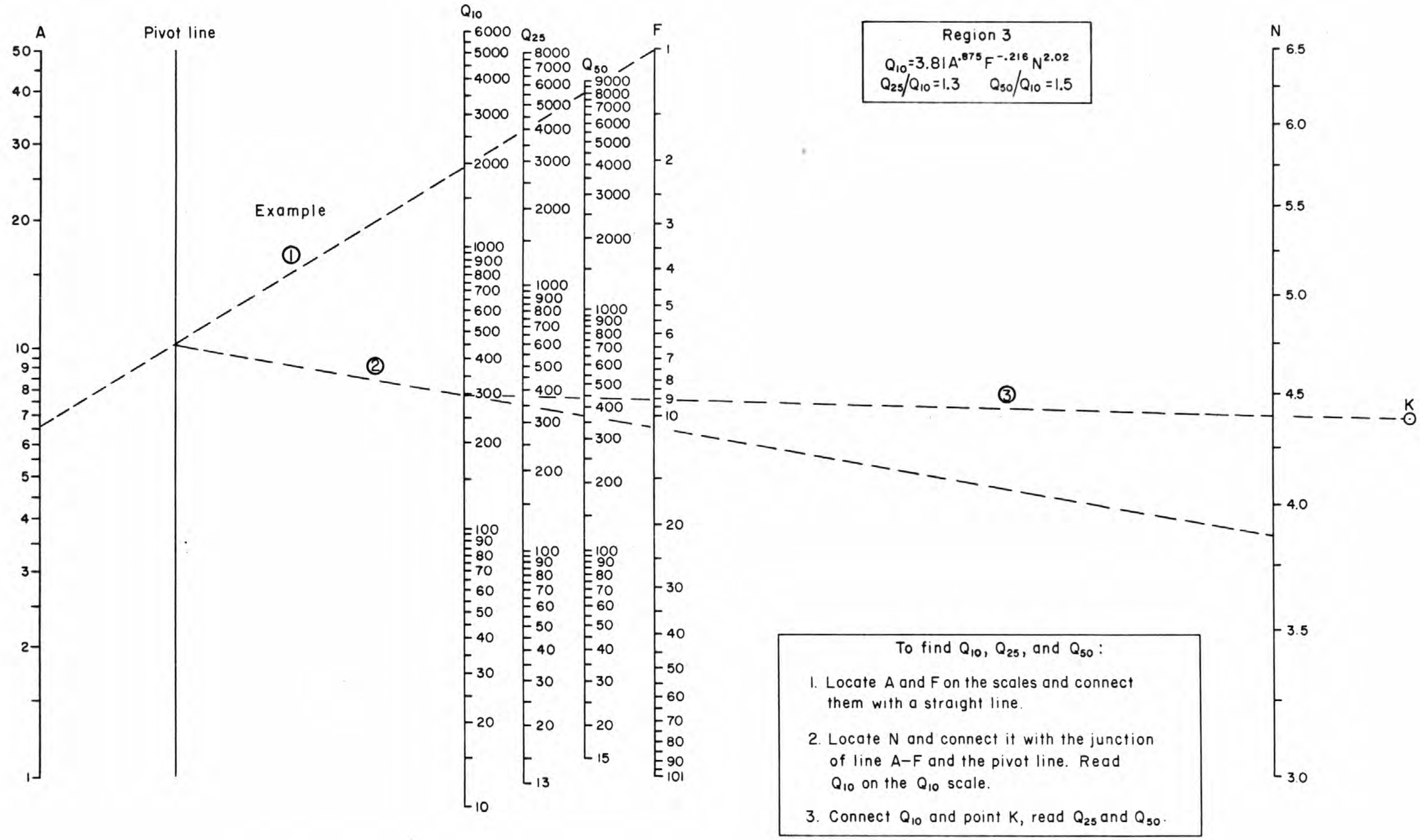


FIGURE A-3. Nomograph for computing floods in Region 3.

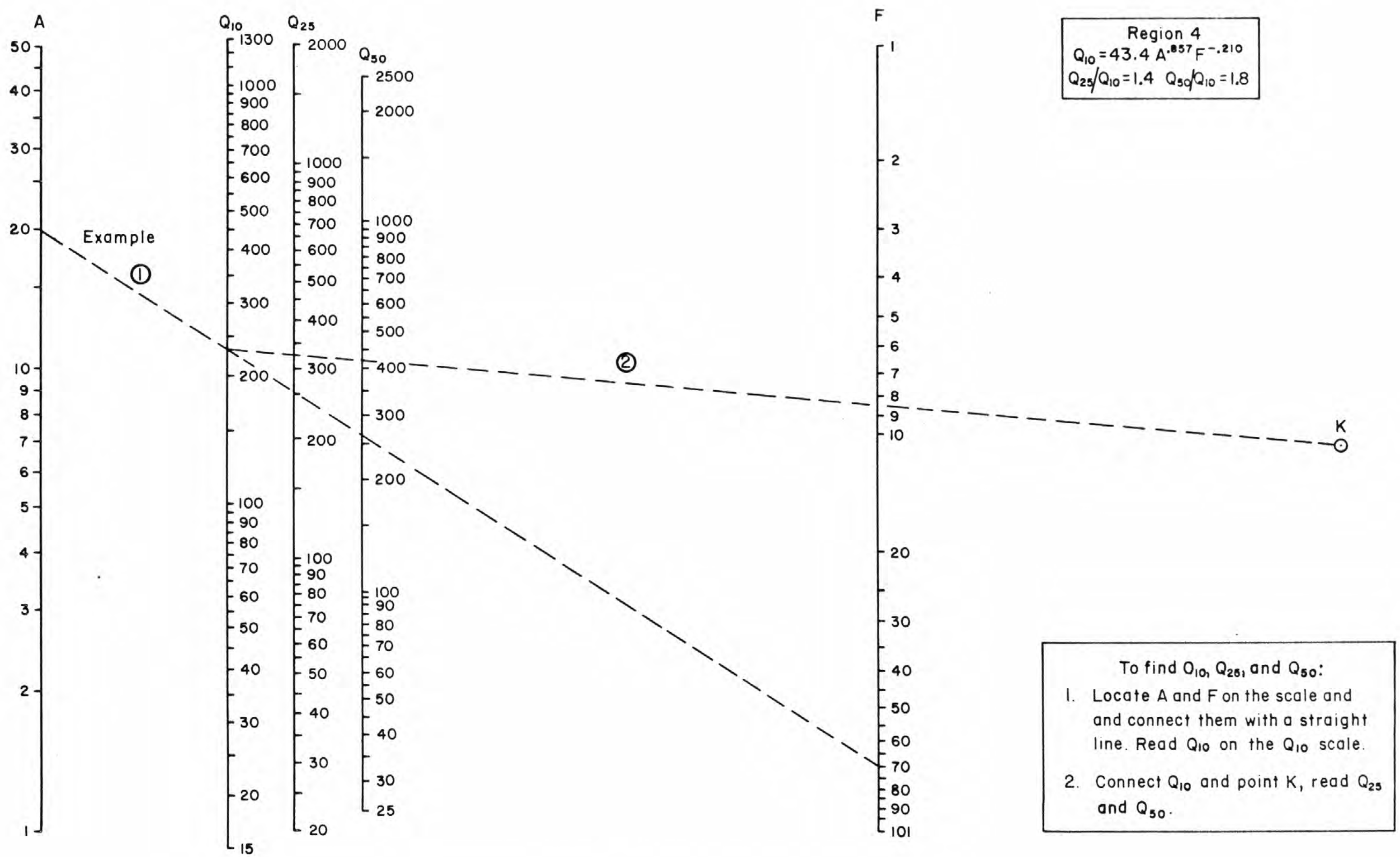


FIGURE A-4. Nomograph for computing floods in Region 4.

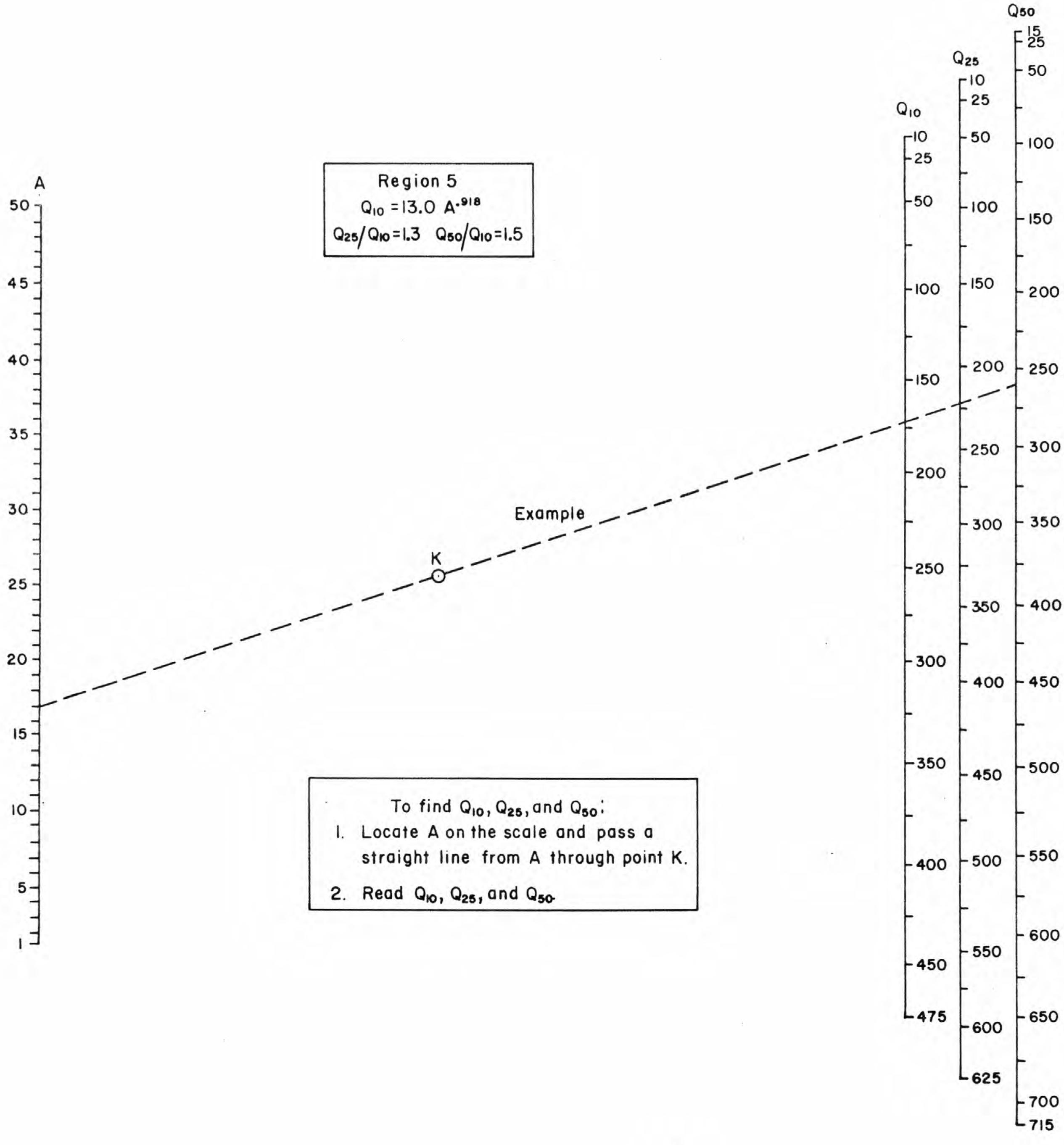


FIGURE A-5. Nomograph for computing floods in Region 5.

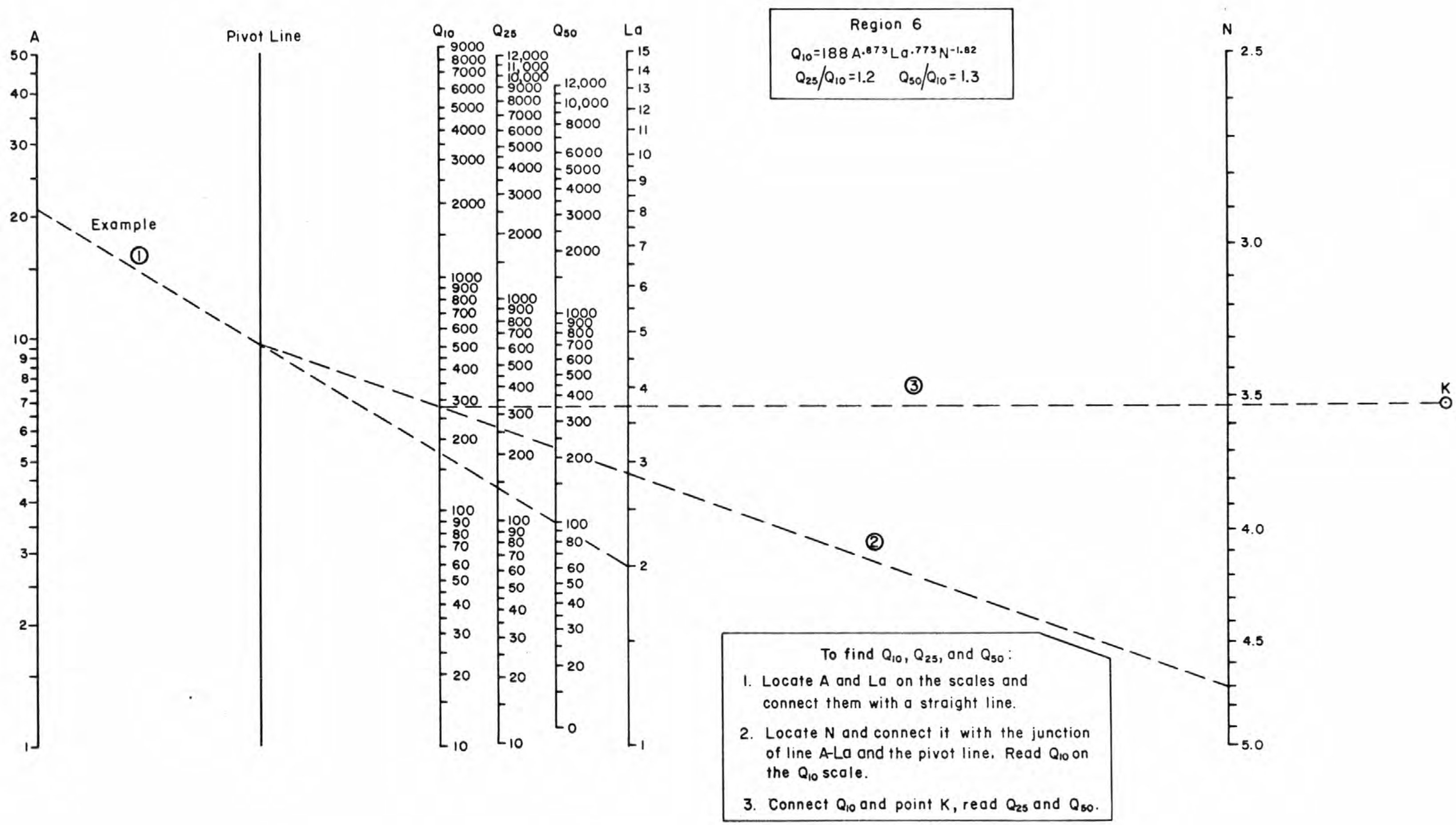


FIGURE A-6. Nomograph for computing floods in Region 6.

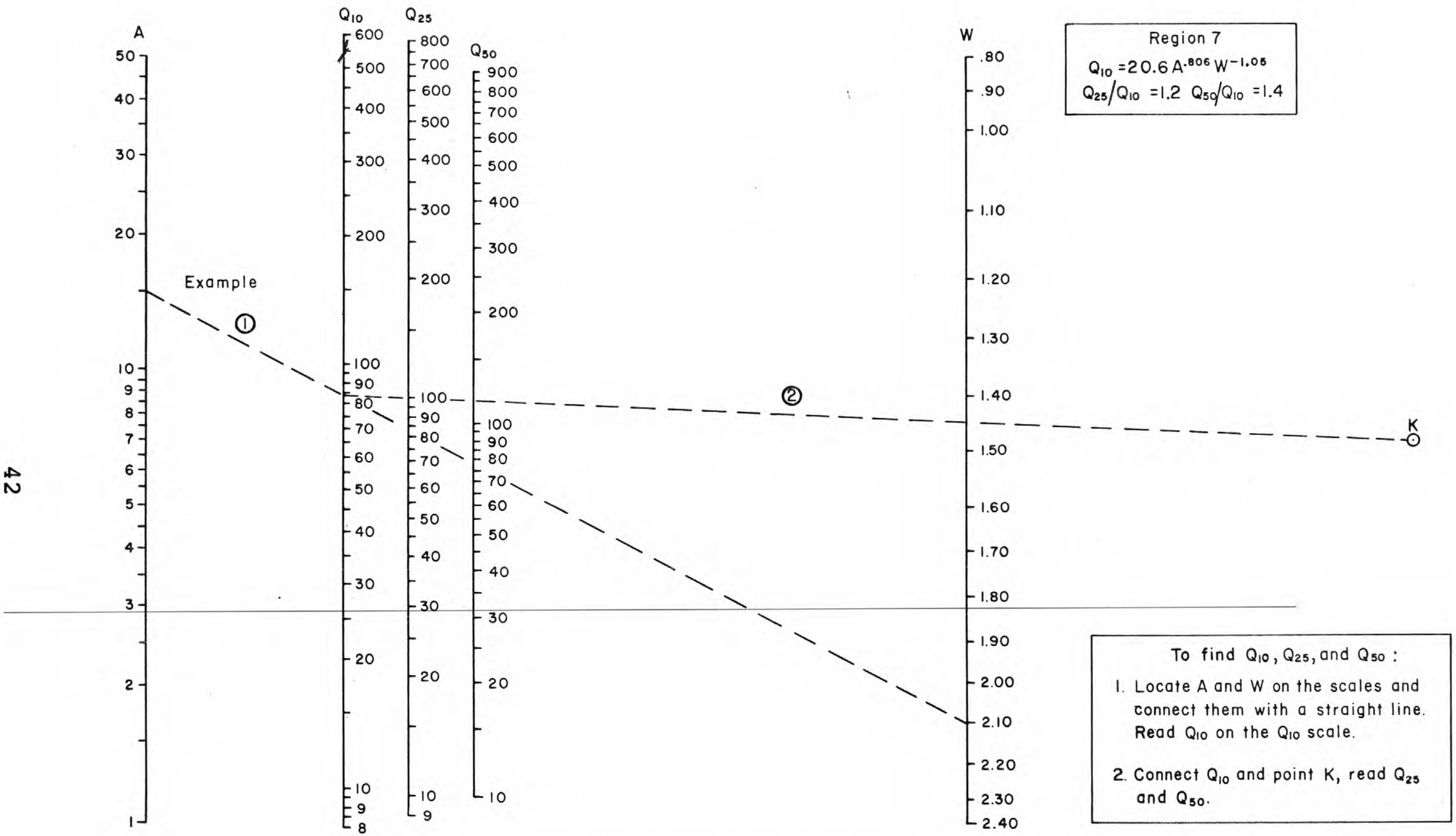


FIGURE A-7. Nomograph for computing floods in Region 7.

*Binding Edge*

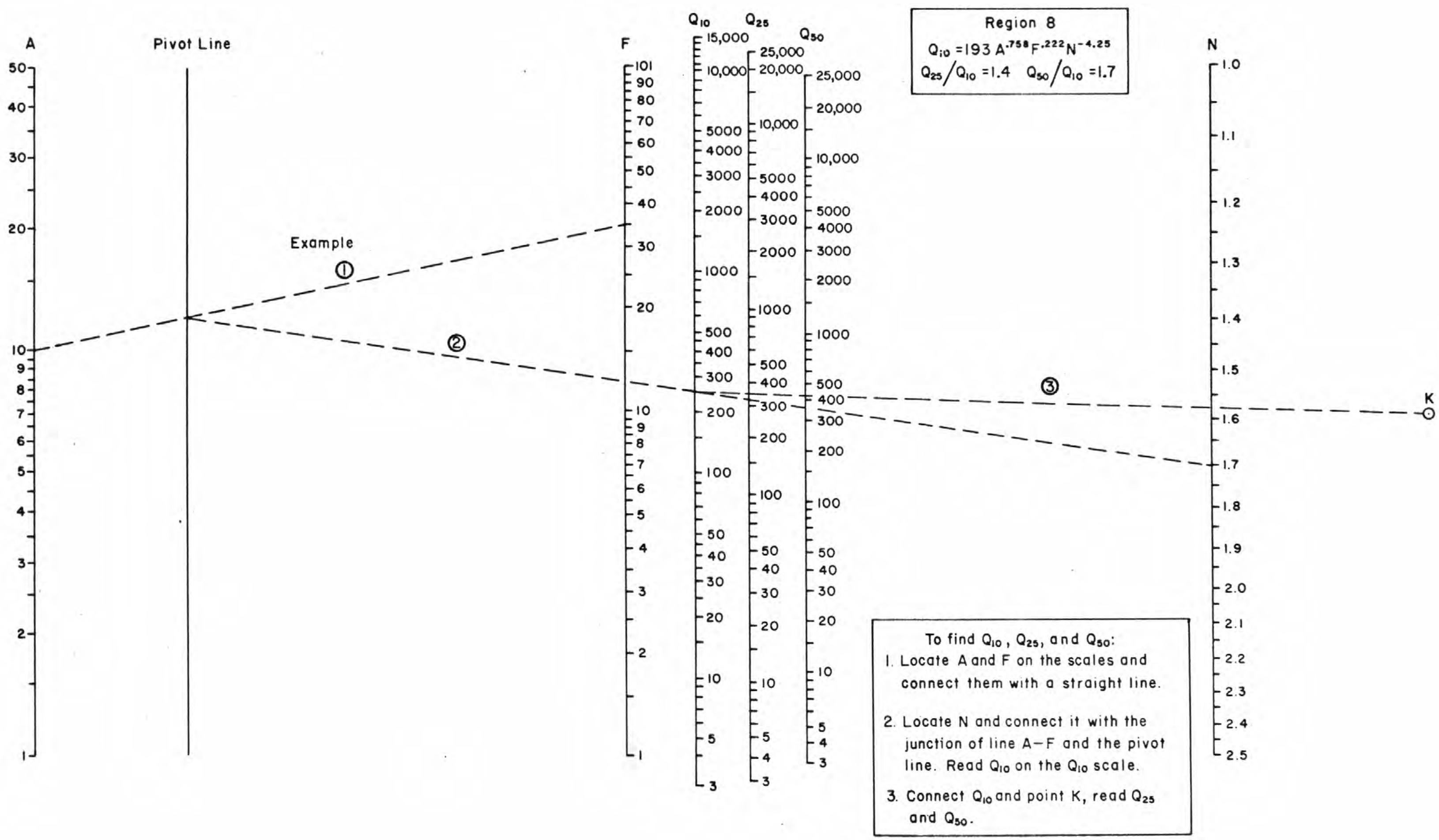


FIGURE A-8. Nomograph for computing floods in Region 8.



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