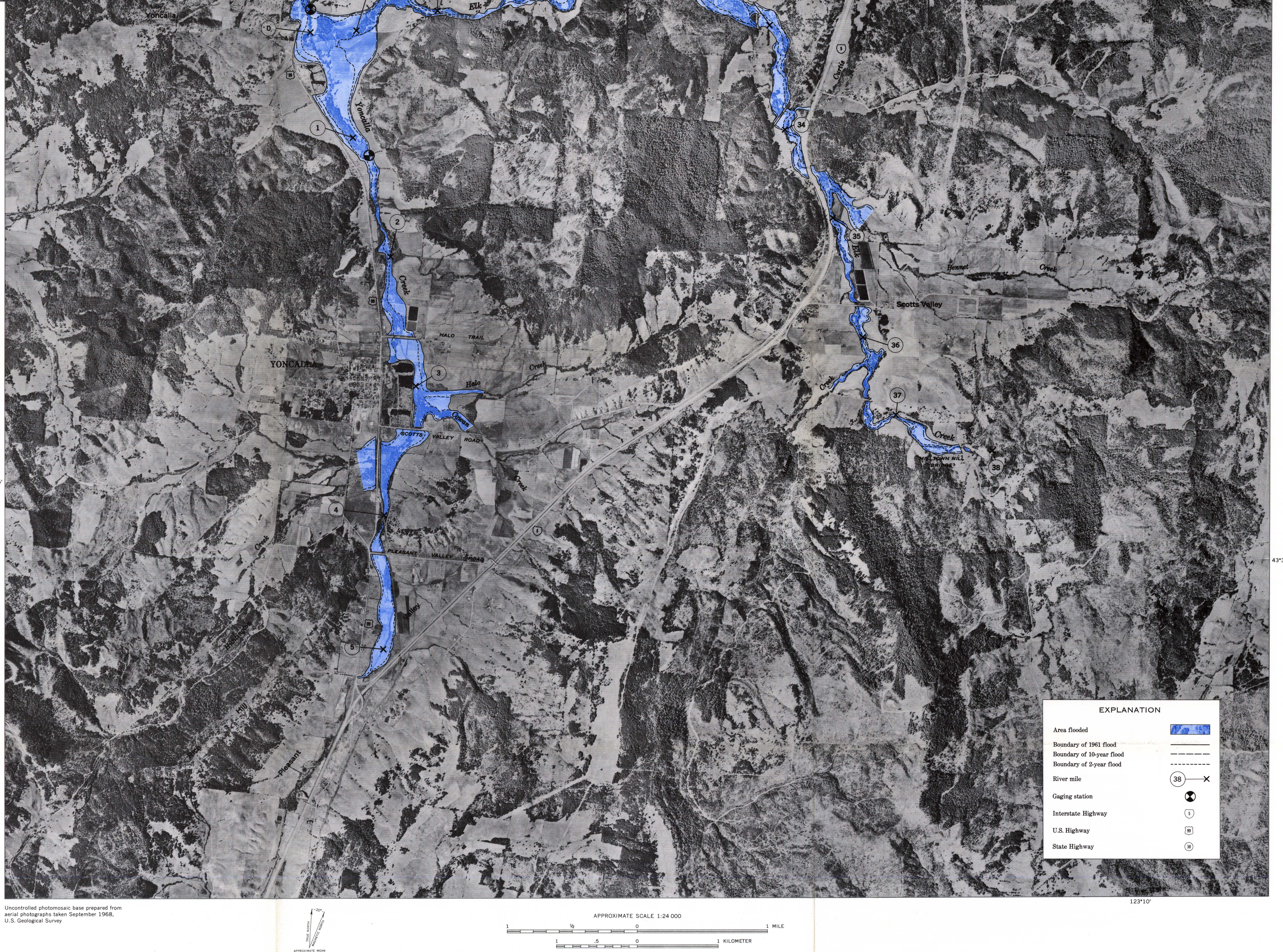
PREPARED IN COOPERATION WITH THE
OREGON STATE WATER RESOURCE BOARD
AND DOUGLAS COUNTY

FLOODS ON SELECTED REACHES OF ELK CREEK DOUGLAS COUNTY, OREGON

At the request of the Oregon State Water Resources Board and Douglas County, the U.S. Geological Survey made a study of the channel capacity and flood characteristics for selected reaches of Elk Creek and two of its tributaries, Pass and Yoncalla Creeks. Specifically, water-surface profiles and the area inundated by floods with 2-year and 10-year recurrence intervals, and by the maximum flood of record, which occurred February 10, 1961, were requested.

On Elk Creek, the reach extends from river mile 17.78 at the new Cunningham Road bridge near the lower end of Putnam Valley to river mile 37.70 at the Milltown Hill bridge near the upper end of Scotts Valley. The reach on Pass Creek extends from its mouth to river mile 1.17 at the mouth of Krewson Creek near the north city limits of Drain. The reach on Yoncalla Creek extends from its mouth to river mile 5.36 at the Interstate Highway 5 interchange south of Yoncalla.

Work was performed under the general direction of Stanley F. Kapustka, district chief of the Water Resources Division in Oregon, and D. D. Harris, chief, hydrologic investigations section.

Acknowledgments.—Douglas County provided the field party which ran the level line establishing vertical control for this project. Their assistance expedited the cross-section surveys and is gratefully acknowledged.

A word of appreciation is due C. H. Swift, III, who did the frequency analysis, computed the project discharges, and contributed much other valuable work to this project.

DESCRIPTION OF THE AREA

Elk Creek heads in the Calapooya Mountains at an elevation of about 1,200 feet. The upper end of the reach, at the head of Scotts Valley, is at 480 feet elevation. Scotts Valley is about 1½ to 2 miles wide. Elk Creek then flows through a valley generally less than a quarter of a mile wide. From the mouth of Yoncalla Creek, Elk Creek flows through a narrow canyon to Drain, where Pass Creek enters. Three miles west of Drain the stream enters Putnam Valley, which is about three-fourths of a mile wide. Below Putnam Valley it flows through a narrow rugged canyon and empties into the Umpqua River at Elkton.

Yoncalla Creek heads on Rice Hill at an elevation of about 550 feet. The upper end of the reach, in Pleasant Valley, is at 390 feet elevation. The channel of Yoncalla Creek is generally less than 50 feet wide and is lined with brush on both banks. The valley through which the creek flows varies from ¼ mile to 1 mile in width. The confluence with Elk Creek is at 320 feet elevation.

Pass Creek heads on the divide between Drain and Cottage Grove at an elevation of about 700 feet. It flows through a valley generally less than a quarter of a mile wide. The surrounding mountains are steep and densely forested. The stream enters Elk Creek at Drain at an elevation of 290 feet.

Except for the towns of Drain and Yoncalla, the areas subject to flooding are primarily agricultural.

OCCURRENCE OF FLOODS

Annual precipitation in the Elk Creek basin averages about 50 inches and is uniformly distributed over the area. Flood runoff is closely related to the intensity and duration of rainfall. The most severe storms usually occur during the late fall and winter. Because of low elevations and mild temperatures, snowmelt is not usually a significant contributor to storm runoff.

GENERAL PROCEDURE

The flood profiles shown in this report were developed by the step-backwater method described in U.S. Geological Survey Water-Supply Paper 1869-A (Bailey and Ray, 1966). Basically, the method involves solving a uniform-flow formula through a series of channel cross sections with the assumption that uniform-flow formulas are applicable to gradually varied flow conditions. Using this method, a water-surface profile corresponding to any discharge may be computed. Data required are a survey of channel geometry, channel roughness coefficients, and a starting stage-discharge relation at the downstream end of the reach. It is not essential that the initial stage-discharge relation be precisely known, because several water-surface profiles of the same discharge starting with different water-surface elevations at the initial section will converge to a single profile if the reach is of adequate length. For this reason, the survey of channel geometry and the computation of profiles were started 3,500 feet downstream from the initial cross section of the project reach.

Stream cross sections were surveyed to obtain channel geometry at intervals averaging a third of a mile along the channel. Spirit levels were used to maintain vertical control, and all elevations were established in feet above mean sea level. Horizontal control was maintained by magnetic azimuth and stadia distance to points identifiable on aerial photographs at a scale of about 1:24,000.

Detailed information on channel geometry and water-surface profiles is available in U.S. Geological Survey open-file report, "Channel Capacity and Flood Characteristics for Selected Reaches of Elk Creek and Tributaries, Douglas County, Oregon" (Oster and Swift, 1969).

The profile elevations were plotted on the cross sections of the stream channel (fig.1). From these the width of the water surface was measured and the flood boundaries were transferred to the map.

Inundated area.—The areas inundated by floods with 2-year and 10-year recurrence intervals, and the flood of February 10, 1961, are shown on the map.

Although there is a marked difference in the elevation of the three floods, at some places the boundaries of the 10-year flood and the 1961 flood very nearly coincide. At other places, the boundaries of the 2-year flood and 10-year flood nearly coincide. Where the stream is confined to a deep, narrow canyon, only the boundaries of the highest flood (1961) are shown.

It must be emphasized that these flood boundaries are based on open-channel conditions existing at the time of the field survey. Debris jams during a flood could cause varying amounts of backwater that are impossible to predict. Channel changes or the construction of dikes could also change the flood boundaries in the affected reach.

Flood height.—The height of a flood at a gaging station is usually stated in terms of the gage height, or stage, which is the elevation of the water surface above a selected datum plane. Elevations in this report are shown in feet above mean sea level. The stages of the annual floods above bankfull at three gaging stations are shown in figure 2 for the period 1956–67. The gaging station Pass Creek near Drain is outside the project area and is not shown on the map. Stage hydrographs for the flood of February 10, 1961, are shown in figure 3 for Elk Creek near Drain and Pass Creek at the "B" Street bridge in Drain.

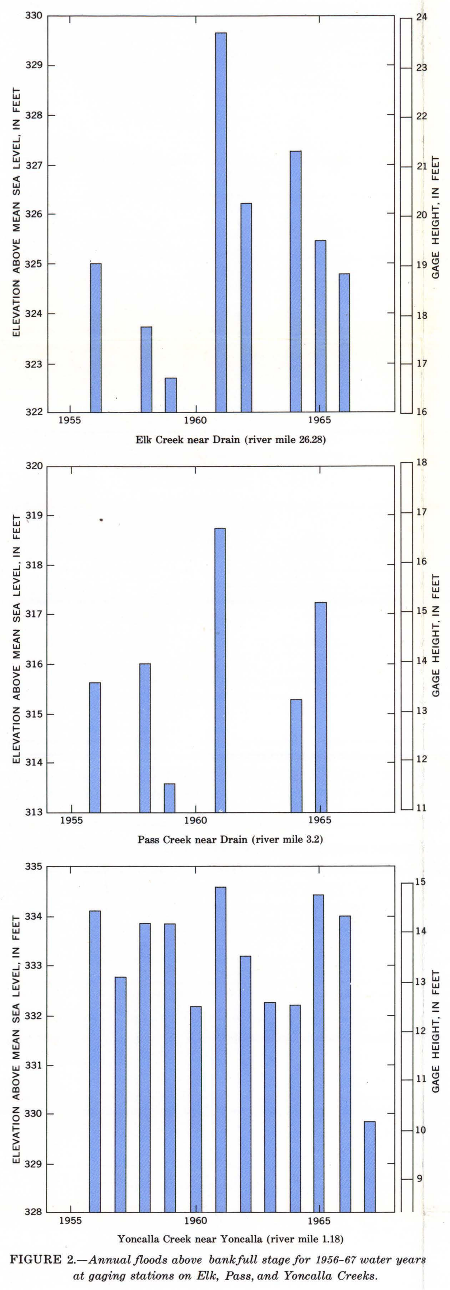


FIGURE 2.—*Annual floods above bankfull stage for 1956–67 water years at gaging stations on Elk, Pass, and Yoncalla Creeks.*

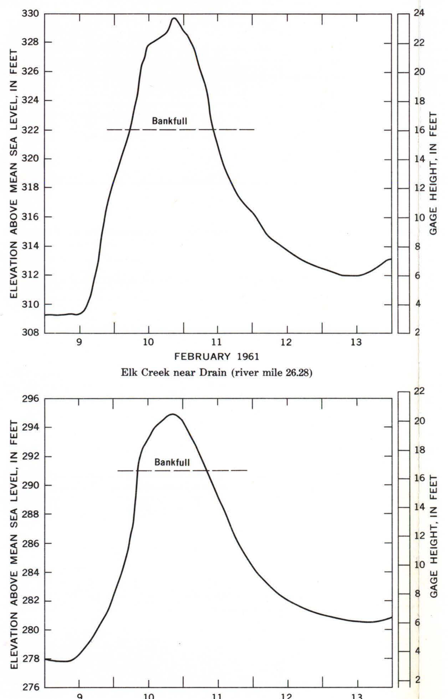


FIGURE 3.—*Stage hydrographs for flood of February 10, 1961, at gaging stations on Elk and Pass Creeks.*

Flood frequency.—There are four gaging stations with records of annual flood peaks in the Elk Creek basin—12 years each for Elk, Yoncalla, and Pass Creeks, and 15 years for Bear Creek, a tributary not included in the profile survey. These records of peak discharged were analyzed by the Log-Pearson Type III method. The discharge-frequency curves derived were converted to stage frequency (fig. 4) by using the stage-discharge relations based on present channel conditions. Future channel conditions may define different stage-frequency curves. A stage-frequency graph was not drawn for Pass Creek at the "B" Street bridge because this site is affected by backwater from Elk Creek.

Extrapolation of the frequency curves beyond the limits shown may result in large errors and should be avoided.

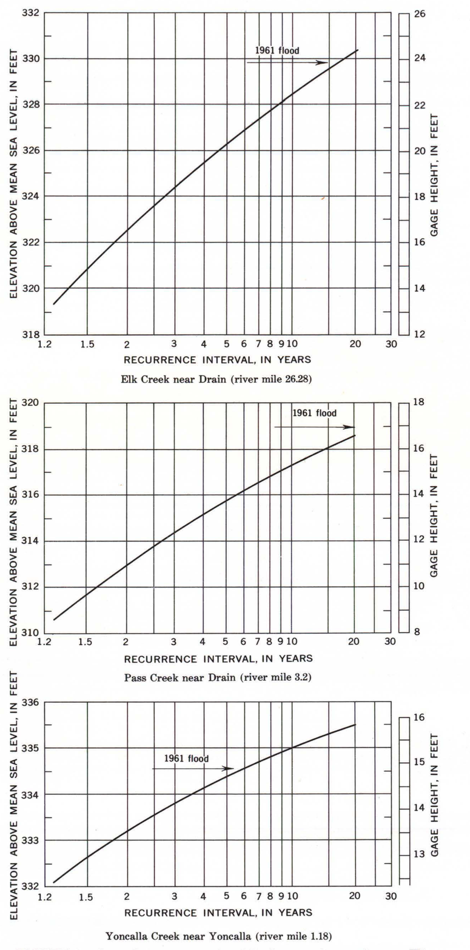


FIGURE 4.—*Stage-frequency graphs of floods at gaging stations on Elk, Yoncalla , and Pass Creeks.*

Recurrence interval, as applied to flood events, is the average interval of time within which a given flood will be equaled or exceeded once. Frequency can also be stated as a probability, which is the reciprocal of the recurrence interval. For example, a 20-year flood would have one chance in 20, or a 5-percent chance, of being equaled or exceeded in any year. Because the 20-year flood can occur in any year, or even in successive years, any inference that such a flood will occur at regular intervals would be misleading.

Flood profiles.—Profiles of the 2-year flood and the 1961 flood are shown in figure 5. A profile of the thalweg (low point of the channel) is included to give a concept of depth.

On Elk Creek below Yoncalla Creek the 10-year flood profile (not shown) is generally about 0.8 foot lower than the 1961 flood profile; above Yoncalla Creek it is generally about 0.5 foot lower. On Pass Creek, the 10-year flood is about 1.1 feet lower than the 1961 flood. On Yoncalla Creek, the 10-year flood is very nearly equal to, or slightly higher than, the 1961 flood, and the 2-year flood is generally about 0.5 foot lower than the 1961 flood, except for the first mile above the mouth, where the stage is affected by backwater from Elk Creek.

REFERENCES

Bailey, J. F., and Ray, H. A., 1966, Definition of stage-discharge relation in natural channels by step-backwater analysis: U.S. Geol. Survey Water-Supply Paper 1869-A, 24 p.

Oster, E.A., and Swift, C. H., III, 1969, Channel capacity and flood characteristics for selected reaches of Elk Creek and tributaries, Douglas County, Oregon: U.S. Geol. Survey open-file rept., 284 p.

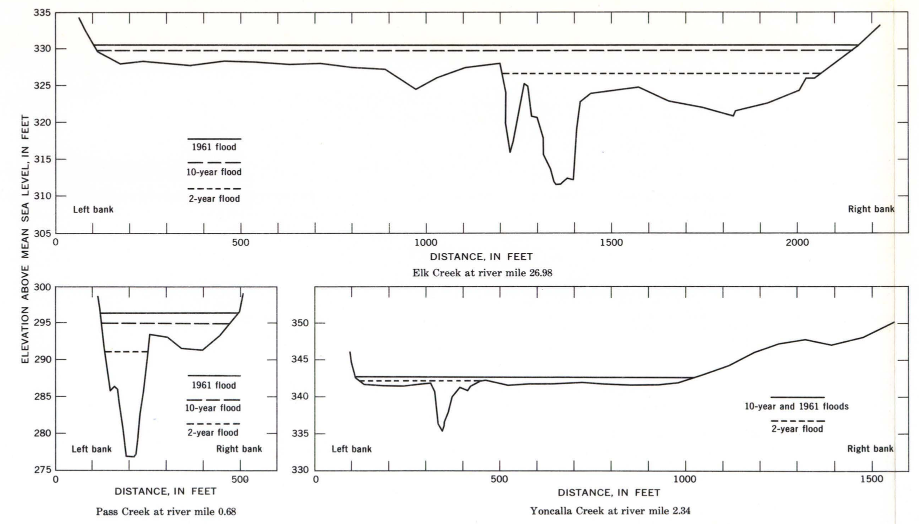
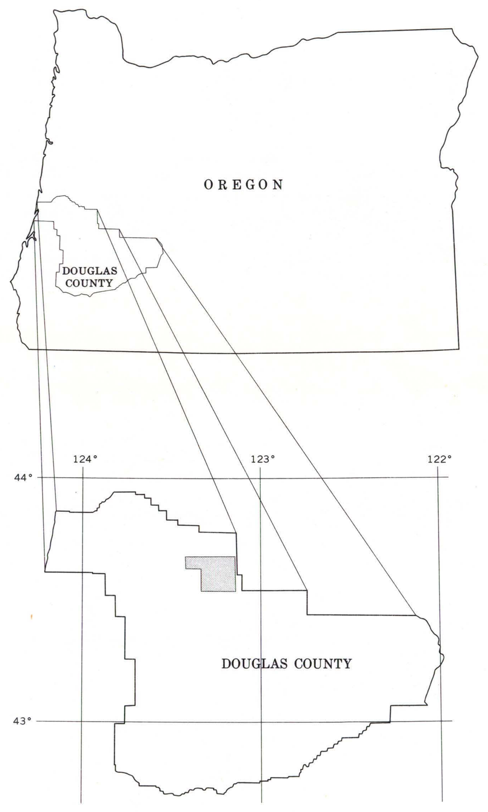


FIGURE 1.—*Representative cross sections of Elk, Pass, and Yoncalla Creeks.*



MAPS SHOWING AREA OF THIS REPORT

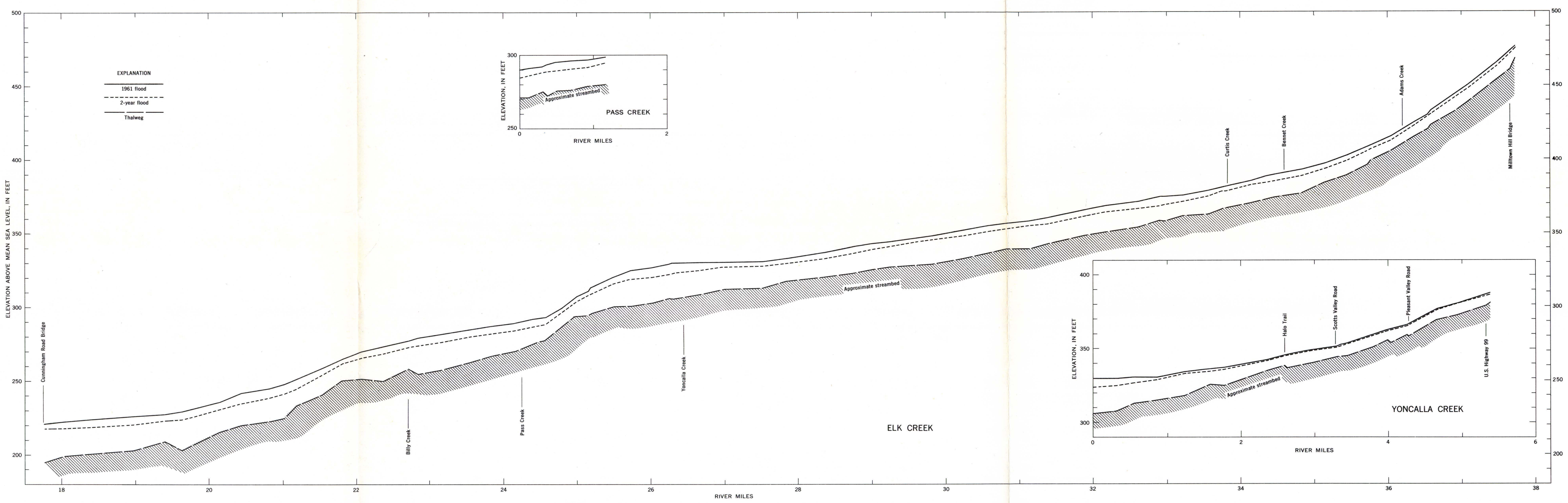


FIGURE 5.—*Profiles of thalweg, 2-year flood and 1961 flood for Elk, Pass, and Yoncalla Creeks.*

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1971

For sale by U.S. Geological Survey, price $1.00