TABLE 1.—*Discharge, flood-plain velocities, and stream-channel velocities at four selected sites for 10-, 25-, and 50-year floods on Little Buffalo Creek.*

Station name	Discharge of floods at indicated recurrence intervals (cubic feet per second)			Velocities at indicated recurrence intervals (feet per second)								
				10 years			25 years			50 years		
	10 years	25 years	50 years	Left plain	Main channel	Right plain	Left plain	Main channel	Right plain	Left plain	Main channel	Right plain
Little Buffalo Creek at State Highway 88	1050	1540	2060	0.78	6.32	2.35	1.21	6.67	4.06	1.74	6.45	4.06
Little Buffalo Creek 1000 feet above State Highway 88	1050	1540	2060	3.43	10.7	1.29	4.78	14.4	1.15	5.05	15.4	1.61
Little Buffalo Creek 1000 feet above State Highway 88	660	980	1300	No flood plain	6.87	1.24	No flood plain	9.06	1.36	No flood plain	9.77	1.48
Little Buffalo Creek at Norfolk & Western Railway	660	980	1300	No flood plain	5.44	3.64	No flood plain	6.18	3.10	No flood plain	9.55	2.71

TABLE 2.—*Reference marks along Little Buffalo Creek, West Jefferson, N.C., from State Highway 88 to U.S. Highway 221.*

Reference point	Elevation above mean sea level (feet)	Description
RM 1	2858.5	At bridge over Little Buffalo Creek at State Highway 88. A brass disk stamped "U.S. Geological Survey, Reference Mark, 1967, 2858.5 MSL," and set in center of upstream concrete headwall.
RM 2	2941.5	At bridge over Little Buffalo Creek at private road, 500 feet above sewage disposal plant and 30 feet west of U.S. Highway 221. A brass disk stamped "U.S. Geological Survey, Reference Mark, 1967, 2941.5 MSL," and set in center of upstream hand rail.
RM 3	2951.2	At culvert over Little Buffalo Creek at U.S. Highway 221. A brass disk stamped "U.S. Geological Survey, Reference Mark, 1967, 2951.2 MSL," and set in center of downstream concrete culvert headwall.
RM 4	2974.0	At culvert over Little Buffalo Creek at State Highway 194 and U.S. Highway 221. A brass disk stamped "U.S. Geological Survey, Reference Mark, 1967, 2974.0 MSL," and set in top of downstream concrete culvert.
32 ATA	2976.255	In northwest part of West Jefferson 27 ft. E. of intersection of Main Street and Norfolk and Western Railway; 12 ft NE. of RR. crossing sign; 4 ft NE. of telephone pole; in concrete post; standard tablet stamped "32ATA 1956 2976."

Uncontrolled photomosaic base prepared from photographs (1965) furnished by North Carolina State Highway Commission

FLOODS ON LITTLE BUFFALO CREEK AT WEST JEFFERSON, NORTH CAROLINA

This report was prepared by the U.S. Geological Survey to further the objectives of the Appalachian Regional Commission. It provides technical guidance for those who plan the economic uses of flood plain lands. Hydrologic data are presented that can be used to evaluate the extent, depth, and frequency of flooding expected on Little Buffalo Creek in the vicinity of West Jefferson, North Carolina. The approximate boundaries of inundation by floods having average recurrence intervals of 10, 25, and 50 years are outlined on a photomosaic map.

West Jefferson is in the Kanawha River basin of Ashe County in the mountainous region of northwestern North Carolina. The 1.7-mile reach of Little Buffalo Creek covered by this study begins in West Jefferson at U.S. Highway 221, extends in a northerly direction along the eastern edge of the city and ends at State Highway 88. The drainage area is 0.63 square mile at the upper end of the reach and 3.56 square miles at the lower end. The bed slope is rather steep and has an average fall of about 67 feet per mile in the reach. The steep slope causes destructive water velocities during large floods. Areas adjacent to the stream are partly developed within West Jefferson but the area for greatest potential future development along the stream is from the city limits north to State Highway 88.

The steep slopes and high banks along the reach permit very little flooding in lateral areas and results in a small difference in areal extent between the highest and lowest floods delineated on the map. The range in discharge, however, is great.

The general procedures used in defining flood boundaries for Little Buffalo Creek were as follows:

1. Determine the discharge of floods having recurrence intervals of 10, 25, and 50 years.
2. Utilizing the step-backwater method, compute profiles for these floods with an electronic computer and manually.
3. Delineate the horizontal extent of flooding on a photomosaic map.

The determination of flood discharges and profiles was based on the following assumptions:

1. Field conditions would remain as they existed at the time the field study was made in 1967.
2. Bridges and culverts would not be clogged with debris nor otherwise be inoperative during the floods.
3. The selected floods would be of equal magnitude throughout the basin.

Flood history. — Newspaper reports and records of nearby streams indicate that the flood of August 14, 1940, is the highest known at West Jefferson, exceeding the large floods of both 1916 and 1878. In addition to causing major property damages the flood of 1940 took the lives of several persons in Ashe County. Although some destruction resulted from flooding, the high velocity of flow was the major cause of property damages. The flood of 1940 was the result of a tropical hurricane that affected a large part of the southeastern States. Flow data for this flood in the West Jefferson area are not available but the recurrence interval has been estimated on a regional basis to exceed 100 years. Eight inches of rain fell in Ashe County during this storm. The resulting flow washed in debris that blocked many culverts and bridges. Since then road and flood plain elevations have been raised and many culverts have been enlarged.

Determination of discharge. — Little Buffalo Creek is an ungaged stream and no records of streamflow are available. Flood discharge values for this study were computed by using methods defined by Hinson (1965). Drainage areas and the magnitude and velocity of floods having selected recurrence intervals were determined at four selected sites along the channels. These data are listed in table 1.

Recurrence interval. — Recurrence interval is defined as the average interval of time within which a given flood will be equaled or exceeded once. The date of occurrence of a flood of a given magnitude cannot be predicted, but the probable number of such floods during a long period of time can be estimated with reasonable accuracy. For example, 50 floods of at least the magnitude of a 2-year flood can be expected to occur in a 100-year period, and 4 floods of at least the magnitude of a 25-year flood can be expected to occur in a 100-year period. Stated differently, a 50-year flood has 1 chance in 50, the 25-year flood has 1 chance in 25, and the 10-year flood has 1 chance in 10 of being equaled or exceeded in any one year.

The relation between recurrence interval and flood elevation at the four selected sites is shown graphically in figure 1 and the relation between recurrence interval and discharge for these same sites is shown graphically in figure 2. These two figures can be used to determine the peak elevation and discharge for floods having recurrence intervals ranging from 5 to 50 years. For example, from figure 1, a flood having a recurrence interval of 30 years on Little Buffalo Creek at State Highway 88 would reach an elevation of 2857.5 feet, and from figure 2, the instantaneous peak discharge would be 1,660 cubic feet per second (cfs).

Confidence in the accuracy of flood-frequency relations declines as the recurrence interval becomes longer. Extrapolation of the frequency curves beyond the limits shown is not advisable.

Flood profiles.— The elevations and discharges shown on figures 1 and 2 relate only to the selected sites. The flood profile in figure 3 shows the elevation of the 50-year flood at all points in the reach and was derived from computed elevations. Differences in elevations of the 10-, 25-, and 50-year floods generally are so small that only the 50-year flood profile is shown.

Extent and depth of flooding. — Areas adjacent to streams become inundated when the flow of the stream exceeds the capacity of its channel to convey water. The elevation of the flood depends upon the amount of floodwater and upon the capacity of the channel. Roadfills, landfills, bridges, culverts, buildings, and other structures that obstruct the flow cause increased flooding upstream. Flood computations were made assuming all bridge and culvert openings to be unobstructed. Should an opening become blocked during a flood, the water upstream would be higher than that shown on the map.

Depth of flooding at any point can be estimated for floods of each recurrence interval from combined use of the map, flood profile, and the typical cross sections, figures 4-8. More accurate elevations can be obtained by leveling from any point in question to one of the reference marks described in table 2. The depth of flooding shown on the illustrations and the flooded areas delineated on the map reflect present channel and flow conditions (1967). The inundation pattern of future floods may be affected by new highways and bridges, by new building or by relocation or excavation of stream channels.

Velocity. — Velocities of floodflow in both the main channel and on the flood plain vary considerably. Generally the velocities on the flood plain are less than those in the main channel. Representative flood velocities on Little Buffalo Creek are listed in table 1. The velocities are average figures and were obtained by dividing the instantaneous peak discharge by the cross-sectional area of the selected sites. The high velocities shown in the table are the result of steep slopes and high flows. The high velocities may cause damage or even destroy buildings, embankments, and pavements and thus be more damaging than inundation alone.

Acknowledgments.— The selection of the site for this project was made in collaboration with the Appalachian Regional Commission. Coordination of planning with the District Office of the U.S. Army Corps of Engineers was accomplished through the Office of Appalachian Studies, Corps of Engineers.

Additional information. — Supporting data and computations pertaining to this report are in the files of the U.S. Geological Survey, Raleigh, N.C. Additional information on flooding in the general area can be obtained from the following published reports:

Hinson, H. G., 1965, Floods on small streams in North Carolina, probable magnitude and frequency: U.S. Geol. Survey Circ. 517, 7 p.
Water Resources Branch, 1949, Floods of August 1940 in the Southeastern States: U.S. Geol. Survey Water-Supply Paper 1066, 554 p.

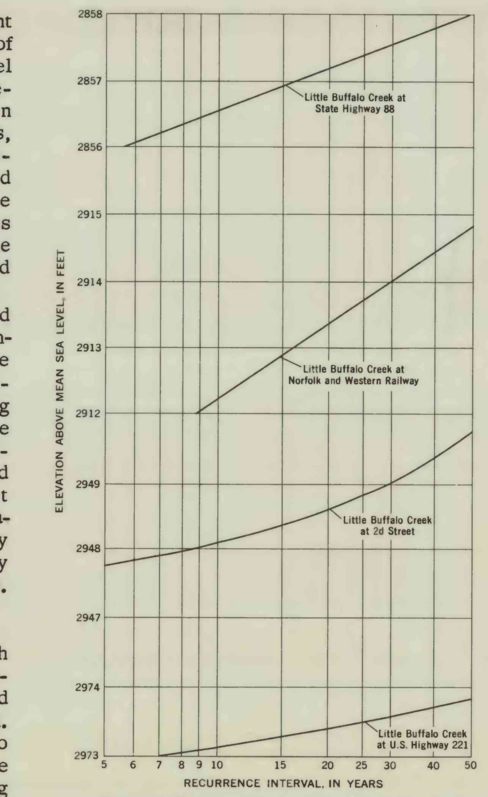

FIGURE 1.—*Frequency of floodstages on Little Buffalo Creek.*

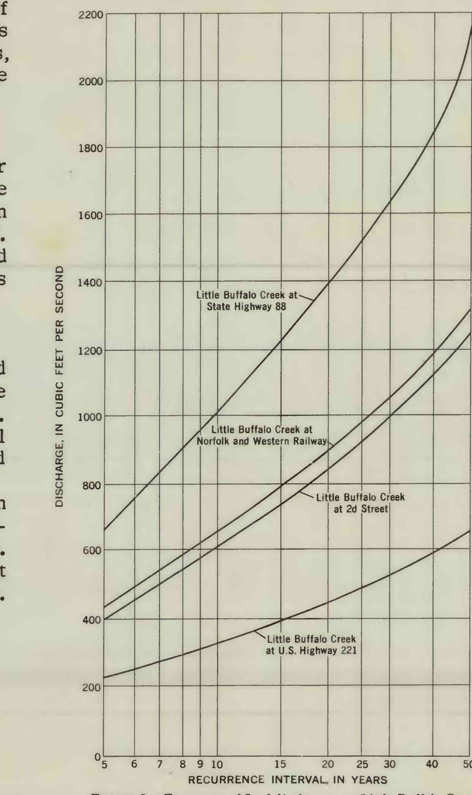

FIGURE 2.—*Frequency of flood discharges on Little Buffalo Creek.*

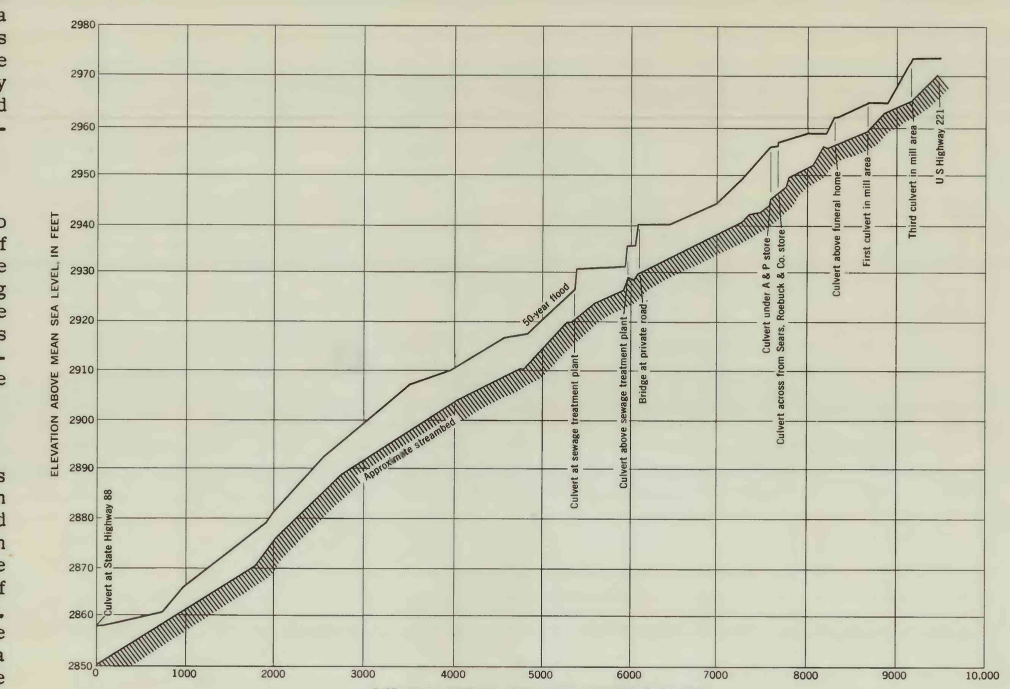

FIGURE 3.—*Profile of 50-year flood on Little Buffalo Creek.*

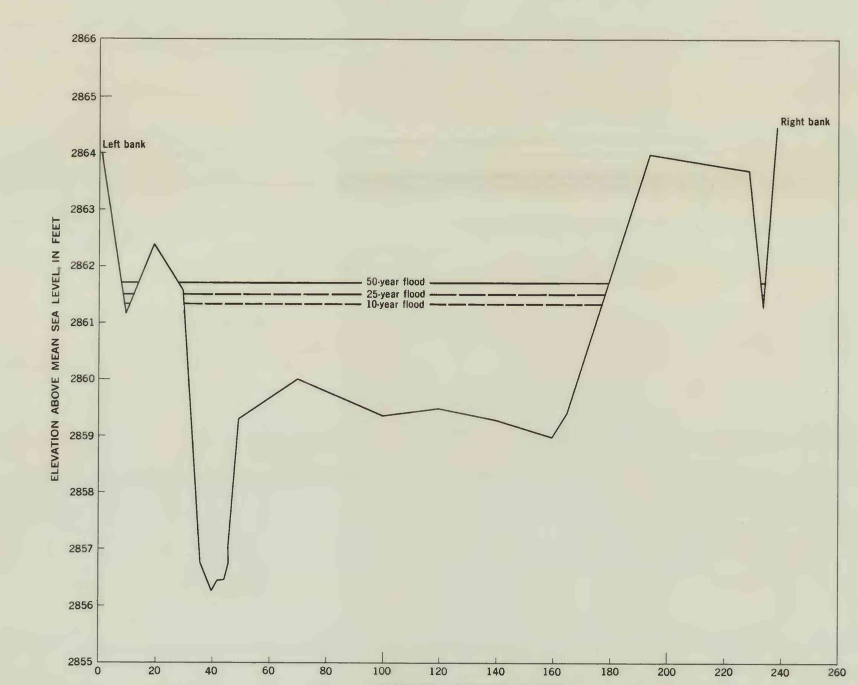

FIGURE 4.—*Cross section 1 on Little Buffalo Creek 600 feet upstream from State Highway 88.*

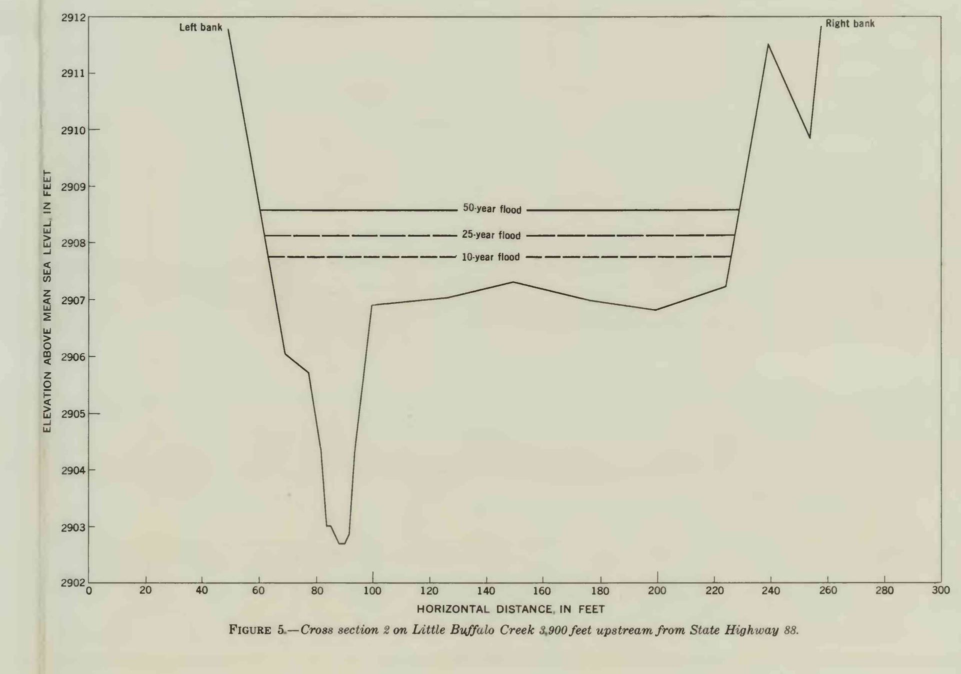

FIGURE 5.—*Cross section 2 on Little Buffalo Creek 3,900 feet upstream from State Highway 88.*

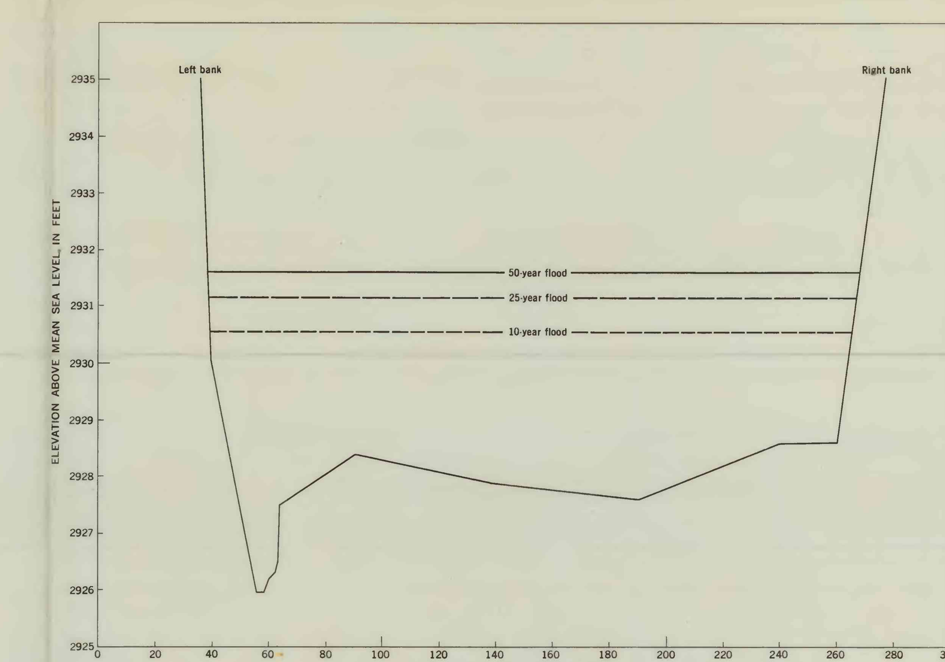

FIGURE 6.—*Cross section 3 on Little Buffalo Creek 5,600 feet upstream from State Highway 88.*

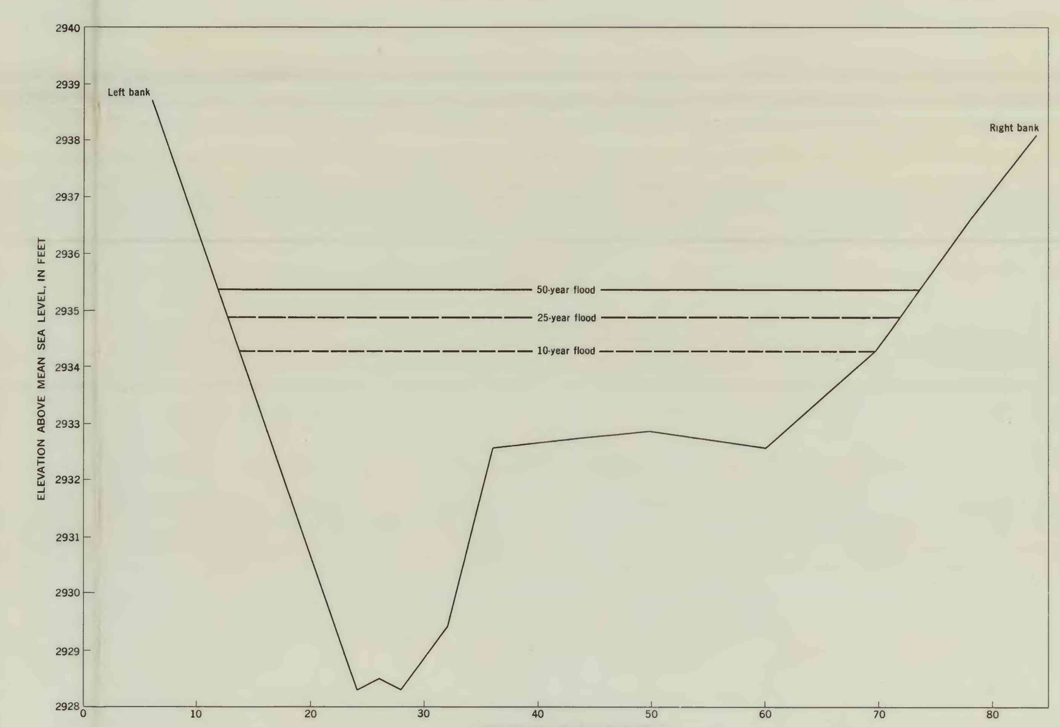

FIGURE 7.—*Cross section 4 on Little Buffalo Creek 6,000 feet upstream from State Highway 88.*

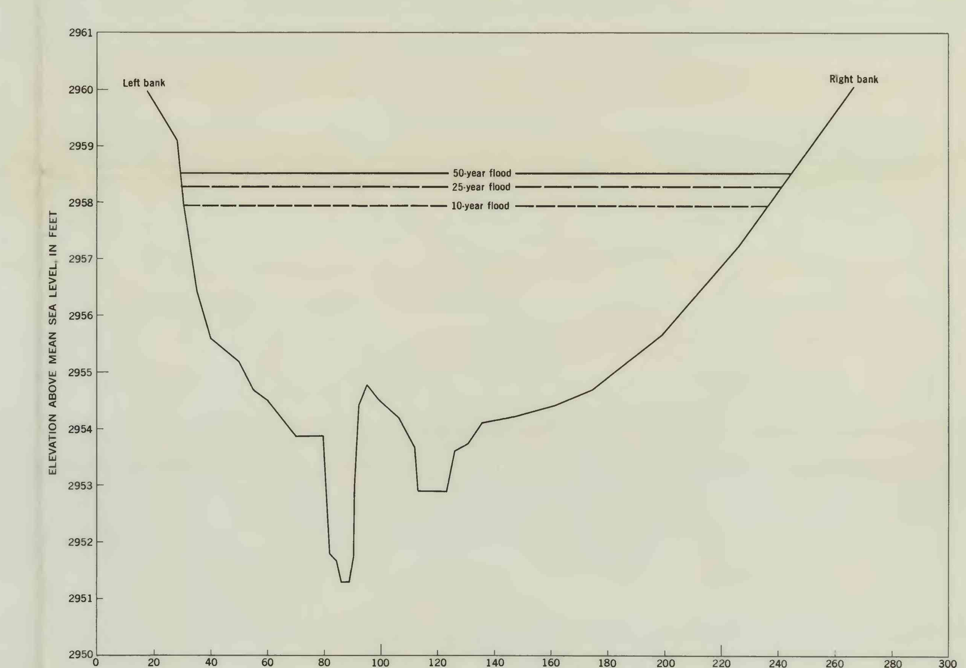

FIGURE 8.—*Cross section 5 on Little Buffalo Creek 7,700 feet upstream from State Highway 88.*

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By
William J. Haire
1969