DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
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PREPARED IN COOPERATION WITH THE
STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT
ROBERT A. ROE, COMMISSIONER

HYDROLOGIC INVESTIGATIONS
ATLAS HA-378

FLOODS IN BEDEN BROOK BASIN IN SOMERSET AND MERCER COUNTIES, NEW JERSEY

This atlas presents hydrologic data on the extent, depth, and frequency of flooding in the Beden Brook basin in Somerset and Mercer Counties, New Jersey. It has been prepared to give individuals, organizations, and governmental agencies a technical basis for making decisions on the use of flood-plain lands.

The areal extent of flooding is shown for a hypothetical 50-year flood along Beden Brook, Rock Brook, and Pike Run. Flood boundaries shown on Back Brook are those of the March 7, 1967, flood. Backwater from a 50-year flood on Pike Run is shown between stations 0 and 500 in Back Brook. Areal extent of flooding was delineated on the basis of floodmarks identified in the field and from profiles developed from these floodmarks. Depths of inundation and overflow limits of floods of lesser magnitude than those shown on the map can be estimated by using the relations presented.

Cooperation.—This atlas was prepared as part of an investigative program financed through a cooperative agreement between the U.S. Geological Survey and the New Jersey Department of Conservation and Economic Development, Division of Water Policy and Supply. The cooperative program is administered on behalf of the Department of Conservation and Economic Development by Robert A. Roe, Commissioner, and is directly coordinated by George R. Shanklin, Director and Chief Engineer of the Division of Water Policy and Supply. The report was prepared by the U.S. Geological Survey under the direction of John E. McCall, district chief, and under the immediate supervision of Alexander C. Lendo, supervising hydraulic engineer.

Flood height.—Flood heights at the crest-stage gage sites were collected in terms of gage height or stage, which is the height of the water surface above a selected datum plane. Gage heights were converted to elevations above mean sea level, datum of 1929, by adding the gage height to the appropriate datum of gage at each site.

Flood discharge.—The rate of discharge of a stream is the volume of flow that passes a specific location in a given period of time. Discharge rates are usually expressed in units of cubic feet per second (cfs). Peak discharge is the maximum discharge attained by a flood. The peak discharge during a flood generally occurs at the time of maximum height of the flood, but if a stream is affected by variable backwater, the peak discharge may not coincide with maximum stage.

Flood frequency.—Frequencies of floods in the basin were derived from regional flood-frequency relations defined by Thomas (1964) or correlation of peak discharges with those at Millstone River at Blackwells Mills (1921-67). Stage-discharge frequency relations are shown for four sites in the basin in figure 1.

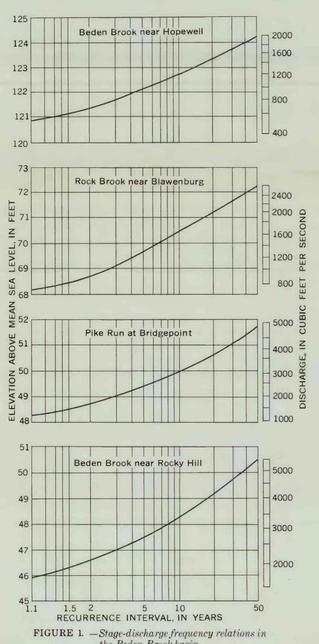


FIGURE 1.—*Stage-discharge frequency relations in the Beden Brook basin.*

The relation between frequency and stage is dependent upon the relation of stage to discharge. Changes in the stage-discharge relation caused by enlarging, filling, or straightening of the channel, and building of floodwalls in the immediate vicinity of the gages could alter stage-discharge relations and stage-frequency relations. Changes upstream, including those mentioned above and the building of reservoirs, will alter discharge-frequency relations. Extrapolation of the curves beyond the 50-year frequency could lead to large errors and is not recommended.

Recurrence interval.—Recurrence interval, as applied to flood events, is the average interval of time within which a given flood will be equaled or exceeded. Thus, on the average, ten 10-year floods will occur in 100 years. They will not necessarily occur every tenth year and may even occur more than once in a 10-year period.

For any given flood, recurrence intervals are not necessarily the same at different sites within the basin as can be seen in the tabulation for crest-stage gage sites given above:

Date	Beden Brook near Hopewell		Beden Brook near Rocky Hill		Rock Brook near Blawenburg	
	Discharge (cfs)	Recurrence interval	Discharge (cfs)	Recurrence interval	Discharge (cfs)	Recurrence interval
Sept. 21, 1966	340	. . .	1,230	0.5	460	. . .
Oct. 19, 1966	450	0.8	1,490	.8	490	0.5
Mar. 7, 1967	1,200	9.5	3,260	9.0	1,100	3.6
Aug. 27, 1967	1,550	22.0	2,270	2.5	720	1.2
Dec. 3, 1967	600	1.5	2,130	2.0	860	1.8
Jan. 14, 1968	790	2.7	2,270	2.5	880	1.9
Mar. 18, 1968	410	.7	1,160	.5	370	. . .
May 29, 1968	860	3.5	2,670	4.4	1,080	3.4
June 12, 1968	800	2.9	2,100	1.9	800	1.5

However, for a general flood of large magnitude, it is assumed that frequencies in the basin will be virtually identical on Beden Brook, Rock Brook, Pike Run, and Back Brook.

Flood profiles.—Water-surface profiles of a hypothetical 50-year flood, the March 7, 1967, flood and the October 19, 1966, flood on Beden Brook, Rock Brook, and Pike Run are shown in figures 2-4. Water-surface profiles of the March 7, 1967, flood and the October 19, 1966, flood on Back Brook are shown in figure 4. Distances along the channel were measured upstream from the mouth. Station 0 (zero) for each stream is that point at which the centerline of the tributary stream intersects the centerline of the receiving stream.

An abrupt change in profile is shown at some bridges to indicate the difference in upstream and downstream water-surface elevations. Manmade changes in channel capacity or accumulations of debris in the bridge opening could significantly alter the drop through the bridge and may also affect the areal extent of flooding.

Flood depths.—Depth of flooding at any given point can be estimated by subtracting the ground elevation from the water-surface elevation indicated by the profiles in figures 2-4. Ground elevations should be determined by leveling from bench marks. Cross sections (figs. 5-7) are shown to illustrate the depth of flooding at selected sites in the basin.

Extent of flooding.—Flood boundaries are shown for a hypothetical 50-year flood. Because the flood plain is relatively narrow, only the 50-year flood is shown. The flood boundaries were defined by plotting the ground position of the water-surface elevation obtained from the profiles in figures 2-4. Boundaries of other floods can be similarly determined from water-surface elevations corresponding to the desired recurrence interval. Flood boundaries shown on the map reflect channel conditions existing in 1967. Any channel changes made later may modify the areal extent of future floods.

Future conditions.—The data in this atlas are based on channel conditions and runoff characteristics as they existed in 1967. Changes in the channel such as excavation, filling, and construction of floodwalls could alter the areal extent of flooding. At the present (1967), the basin is in a rural area. Large-scale urbanization of the area would change discharge-frequency relations in the basin.

Additional data.—Information in this atlas is presented in greater detail in an open-file report by Ross (1969). Additional data on floods in the Millstone River basin and in New Jersey may be obtained at the office of the U.S. Geological Survey, Trenton, N.J., and from the following reports:

Bettendorf, J. A., 1967, Floods on Millstone River and Stony Brook in vicinity of Princeton, New Jersey: U.S. Geol. Survey Hydrol. Inv. Atlas HA-245.

Farlekas, G. M., 1967, Floods at Easton, Pennsylvania-Phillipsburg, New Jersey: U.S. Geol. Survey Hydrol. Inv. Atlas HA-246.

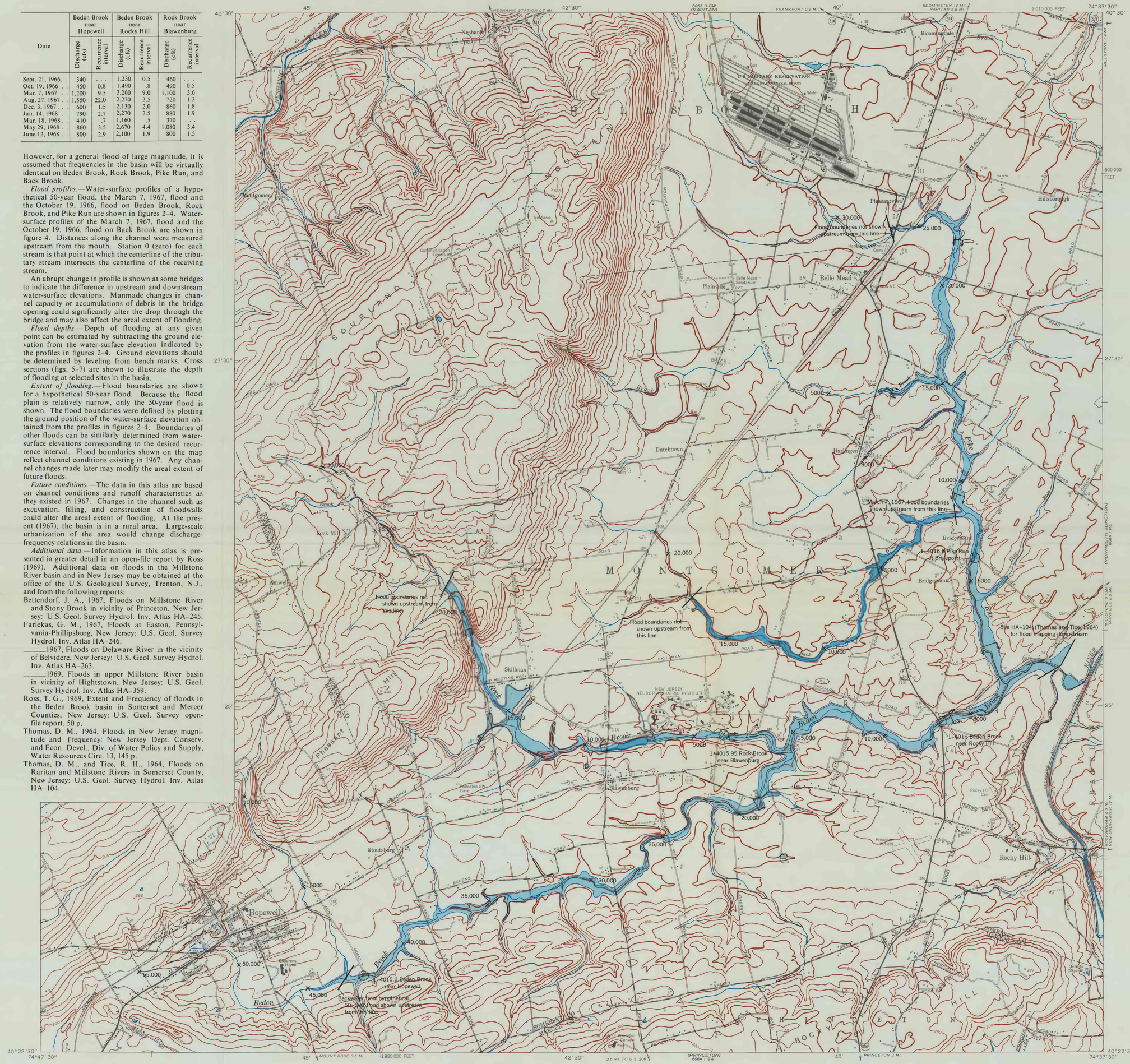
———1967, Floods on Delaware River in the vicinity of Belvidere, New Jersey: U.S. Geol. Survey Hydrol. Inv. Atlas HA-263.

———1969, Floods in upper Millstone River basin in vicinity of Hightstown, New Jersey: U.S. Geol. Survey Hydrol. Inv. Atlas HA-359.

Ross, T. G., 1969, Extent and Frequency of floods in the Beden Brook basin in Somerset and Mercer Counties, New Jersey: U.S. Geol. Survey open-file report, 50 p.

Thomas, D. M., 1964, Floods in New Jersey, magnitude and frequency: New Jersey Dept. Conserv. and Econ. Devel., Div. of Water Policy and Supply, Water Resources Circ. 13, 145 p.

Thomas, D. M., and Tice, R. H., 1964, Floods on Raritan and Millstone Rivers in Somerset County, New Jersey: U.S. Geol. Survey Hydrol. Inv. Atlas HA-104.



Base from U.S. Geological Survey:
Hopewell, Rocky Hill, 1954

SCALE 1:24 000
1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 0 1 KILOMETER
CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

EXPLANATION

- Area inundated by hypothetical 50-year flood
- Area inundated by flood of March 7, 1967
- Boundary of area inundated by hypothetical 50-year flood
- Boundary of area inundated by flood of March 7, 1967
- Cross section location
- Distance above mouth of stream, in feet (× 5000)
- Crest-stage gage

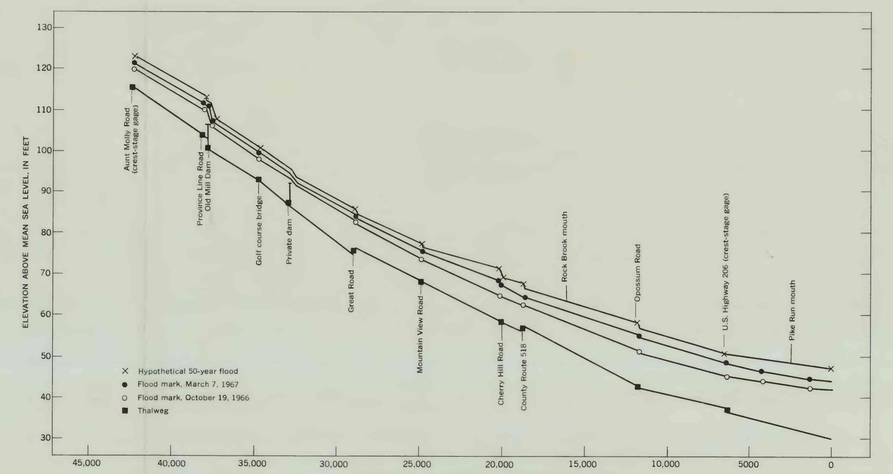


FIGURE 2.—*Profiles of Beden Brook.*

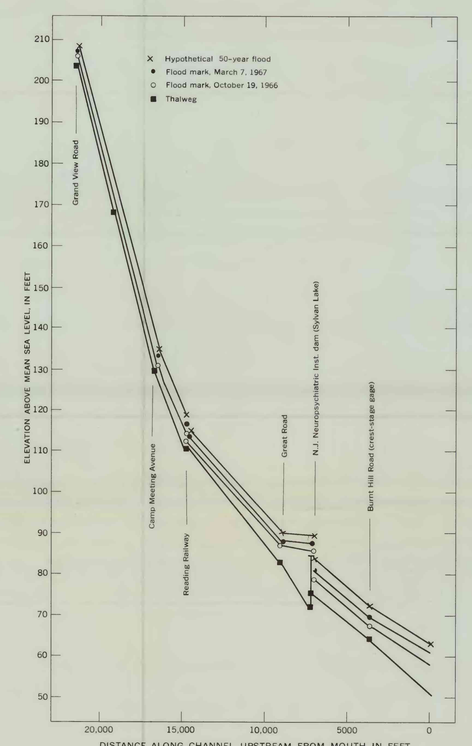


FIGURE 3.—*Profiles of Rock Brook.*

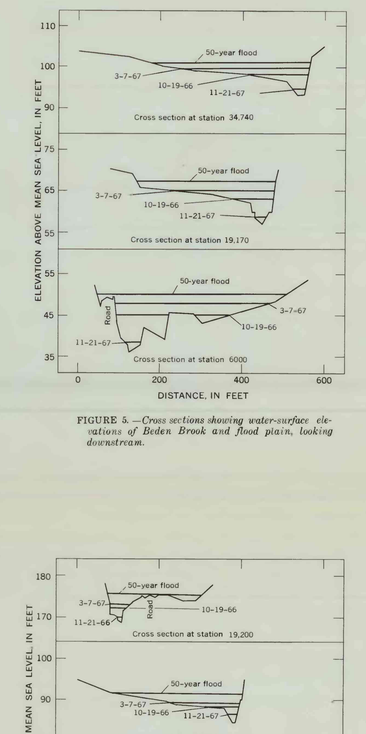


FIGURE 5.—*Cross sections showing water-surface elevations of Beden Brook and flood plain, looking downstream.*

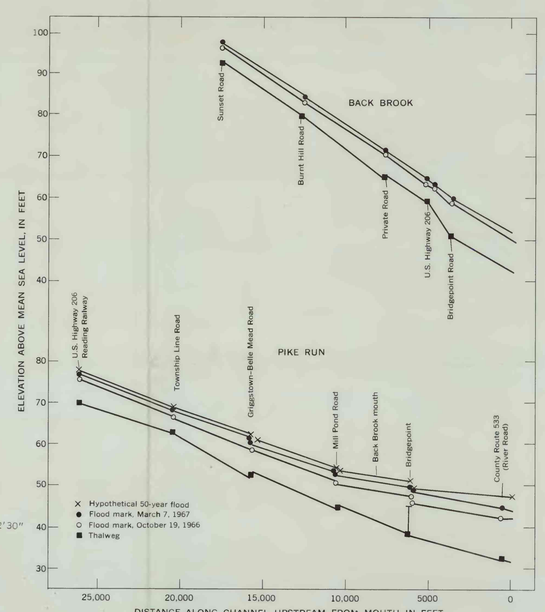


FIGURE 4.—*Profiles of Pike Run and Back Brook.*

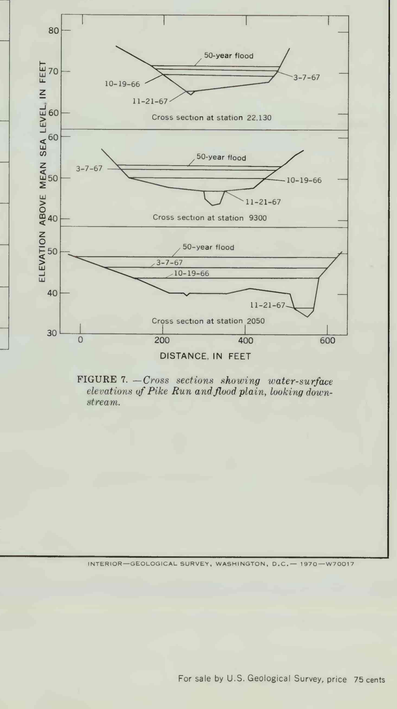


FIGURE 7.—*Cross sections showing water-surface elevations of Pike Run and flood plain, looking downstream.*

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FLOODS IN BEDEN BROOK BASIN IN SOMERSET AND MERCER COUNTIES, NEW JERSEY

By
Thomas G. Ross

1970

For sale by U.S. Geological Survey, price 75 cents