FLOOD OF APRIL 1977 IN THE APPALACHIAN REGION OF KENTUCKY, TENNESSEE, VIRGINIA, AND WEST VIRGINIA

Report prepared jointly by the U.S. Geological Survey
and the National Oceanic and Atmospheric Administration

U.S. DEPARTMENT OF THE INTERIOR • U.S. DEPARTMENT OF COMMERCE

GEOLOGICAL SURVEY PROFESSIONAL PAPER 1098

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By GERALD S. RUNNER, U.S. Geological Survey, and EDWIN H. CHIN,
National Weather Service, National Oceanic and Atmospheric Administration

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FOREWORD

The U.S. Geological Survey and the National Weather Service have a long history of cooperation in monitoring and describing the Nation's water cycle—the movement of water as atmospheric moisture, as precipitation, as runoff, as streamflow, and as ground water, and finally, through evaporation, its return to the atmosphere to begin the cycle over again. The cooperative effort has been a natural blending of technical talent and responsibility. The National Weather Service is the Federal agency responsible for monitoring and predicting atmospheric moisture and precipitation, for forecasting riverflow, and for issuing warnings of destructive weather events. The U.S. Geological Survey is the primary agency for monitoring the quantity and quality of the earthbound water resources, including both ground water and surface water.

This report represents another step in the growth of our cooperative efforts. The working arrangement has been accelerated by many major flood disasters that have struck the Nation in the last few years, including hurricane Agnes in 1972, which has been called the worst natural disaster in the United States. Hundreds of lives have been lost, thousands of people have been made homeless, millions of acres of land have been inundated, and several billions of dollars in property damage in urban and industrial areas have been caused by floods.

A tidal storm surge along the coast of Maine, February 2, 1976, caused by hurricane-force winds, resulted in a water-surface elevation more than 10 feet higher than the predicted astronomical tide at Bangor, Maine. The business section of Bangor was severely damaged. Roads, docks, and beaches along the coast between Eastport and Brunswick were also heavily damaged.

These disasters emphasize the need for increased knowledge and respect of the force and flow of floodwater. The documentation of the flood in Bangor, Maine, in February 1976 should aid the understanding of such flood disasters and will help improve human preparedness for coping with future floods of similar catastrophic magnitudes.

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Inch-pound	to	Metric	Metric	to	Inch-pound
		Length			
inch (in.)	=	25.4 mm	millimeter (mm)	=	0.03937 in.
foot (ft)	=	0.3048 m	meter (m)	=	3.2808 ft
mile (mi)	=	1.6093 km	kilometer (km)	=	0.6214 mi
		Area			
square mile (mi^2)	=	2.5900 km^2	square kilometer (km^2)	=	0.3861 mi^2
acre	=	4046.86 m^2	square meter (m^2	=	0.000247 acre
		Volume			
cubic foot (ft^3)	=	0.0283 m^3	cubic meter (m^3)	=	35.3147 ft^3
acre-foot (acre-ft)	=	1233 m^3	m^3	=	0.00081 acre-ft
		Velocity			
mile per hour (mph)	=	1.6093 km/h	kilometer per hour (km/h)	=	0.6214 mph
knot	=	1.8533 km/h	km/h	=	0.5396 knot
		Flow rate			
cubic foot per second (ft^3/s)	=	0.02832 m^3/s	cubic meter per second (m^3/s)	=	35.3147 ft^3/s
(ft^3/s)/mi^2	=	0.01094 (m^3/s)/km^2	(m^3/s)/km^2	=	91.40768 (ft^3/s)/mi^2
		Pressure			
		[The National Weather Service uses millibar (mb) as customary unit for atmospheric pressure]			
inch of mercury at 32°F (in. Hg)	=	33.8639 mb	mb	=	0.02953 in. Hg

GLOSSARY

Acre-foot (acre-ft). The volume of water required to cover 1 acre to a depth of 1 ft. It equals 43,560 ft^3 (cubic feet), 325,851 gal (gallons), or 1,233 m^3 (cubic meters).

Contents. The volume of water in a reservoir or lake. Content is computed on the basis of a level pool or reservoir backwater profile and does not include bank storage.

Convection cloud. A cloud which owes its vertical development, and possibly its origin, to convection.

Cubic feet per second (ft^3/s). A rate of discharge. One cubic foot per second is equal to the discharge of a stream of rectangular cross section 1 ft wide and 1 ft deep, flowing at an average velocity of 1 ft/s. It equals 28.32 L/s (liters per second) or 0.02832 m^3/s (cubic meters per second).

Cubic feet per second per square mile [(ft^3/s)/mi^2]. The average number of cubic feet per second flowing from each square mile of area drained by a stream, assuming that the runoff is distributed uniformly in time and area. One (ft^3/s)/mi^2 is equivalent to 0.0733 (m^3/s)/km^2 (cubic meters per second per square kilometer).

Dew point (or dew point temperature). The temperature to which a given parcel of air must be cooled at constant pressure and constant water-vapor content in order for saturation to occur.

Drainage area of a stream at a specific location. The area, measured in a horizontal plane, bounded by topographic divides. Drainage area is given in square miles. One square mile is equivalent to 2.590 km^2 (square kilometers).

Flash flood. A local and sudden flood which usually follows brief heavy precipitation within a few hours.

Flood. Any high streamflow that overtops natural or artificial banks of a stream and overflows onto land not usually underwater or ponding caused by precipitation at or near the point it fell.

Flood peak. The highest value of the stage or discharge attained by a flood.

Flood profile. A graph of the elevation of water surface of a river in a flood—plotted as ordinate, against distance—plotted as abscissa.

Flood stage. The approximate elevation of the stream when overbank-flooding begins.

Front. The interface or transition zone between two airmasses of different density.

Gaging station. A particular site on a stream, canal, lake, or reservoir where systematic observations of gage height or discharge are made.

Jet stream. High-velocity strong winds concentrated within a narrow stream high in the atmosphere.

K Index. A measure of the airmass moisture content and static stability given by:

$$K=(T_{850}-T_{500})+T_{d,850}-(T_{700}-T_{d,700})$$

where T and T_d are temperature and dewpoint, respectively, in degrees Celsius; and the subscripts denote pressure level in millibars. The larger the K index of the airmass, the more unstable it is.

Mean sea level. The annual mean sea level is the average of hourly heights of the tide from a calendar year of tidal record. This is referenced to the National Geodetic Vertical Datum of 1929.

Millibar (mb). A unit of pressure equal to 1,000 dynes per square centimeter.

National Geodetic Vertical Datum (NGVD). Formerly called **Sea Level Datum of 1929.** A geodetic datum derived from a general adjustment of the first order level nets of both the United States and Canada. In the adjustment, sea levels from selected Tide stations in both countries were held as fixed. The year indicates the time of the last general adjustment. This datum should not be confused with **mean sea level.**

N-year precipitation (rain). A precipitation amount which can be exepected to occur, on the average, once every N years.

Precipitable water. The total atmospheric water vapor contained in a vertical column of unit cross-sectional area extending from the surface up to a specified pressure level, usually 500 mb.

Recurrence interval. As applied to flood events, recurrence interval is the average number of years within which a given flood peak will be exceeded once.

Ridge. An elongated area of high atmospheric pressure.

Suspended sediment. The sediment that at any given time is maintained in suspension by the upward components of turbulent currents or that exists in suspension as a colloid.

Suspended sediment discharge (tons/day). The rate at which dry weight of sediment passes a section of a stream, or the quantity of sediment, as measured by dry weight or by volume, that passes a section in a given time.

Time of day is expressed in 24-hour time. For example, 12:30 a.m. is 0030 hours, 1:00 p.m. is 1300 hours.

Total-total index. A measure of air mass static stability, *TT*, given by:

$$TT = T_{850} + T_{d,850} - 2T_{500}$$

where T and T_d are temperature and dewpoint, respectively, in degrees Celsius; and the subscripts denote pressure level in millibars. A total-total index exceeding 50 favors the occurrence of severe thunderstorms.

FLOOD OF APRIL 1977 IN THE APPALACHIAN REGION OF KENTUCKY, TENNESSEE, VIRGINIA, AND WEST VIRGINIA

By GERALD S. RUNNER, U.S. Geological Survey, and EDWIN H. CHIN,
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ABSTRACT

Heavy rains fell over the Appalachian region of Kentucky, Tennessee, Virginia and West Virginia during the period of April 2–5, 1977, causing record flooding. Rainfall amounts of 4 to 15.5 in. were observed. The maximum amount of 15.5 in. occurred at Jolo, W. Va., in about 30 hours. This was more than twice the amount which would be expected for a 100-year recurrence-interval storm.

Flood discharges along the upper Guyandotte River, Tug Fork and Levisa Fork in the Big Sandy River basin, Cumberland River, and Clinch River and Powell River in the Tennessee River basin exceeded those previously known. Severe flooding also occurred along the Holston River and along the North Fork Kentucky River. Recurrence intervals of observed flood discharges were greater than those for 100 years at 29 streamflow-measurement sites.

Substantial reductions in peak stages and discharges on Levisa Fork, North Pound River, and Guyandotte River, attained as a result of reservoir storage, were reported by U.S. Army Corps of Engineers. Maximum daily suspended-sediment discharges on April 5, 1977, on Guyandotte River near Baileysville, W. Va., and Tug Fork at Glenhayes, W. Va., were 54,800 tons/day and 290,000 tons/day, respectively. Twenty-two lives were lost and total property damages reportedly exceed $400 million in the four-State area.

INTRODUCTION

Widespread rains fell in the period April 2–5, 1977, over the Appalachian region of Kentucky, Tennessee, Virginia and West Virginia. Heaviest rain fell on April 4 over the headwater areas of many tributaries of the Ohio River. Record floods occurred along the upper Guyandotte River, Tug Fork, and Levisa Fork, which are headwater tributaries of the Big Sandy River, the upper Cumberland River, Clinch and the Powell Rivers. Severe flooding occurred along the Holston River and along the upper North Fork Kentucky River.

The maximum observed rainfall of 15.5 in. in about 30 h occurred at Jolo, W. Va., in the headwater region of Tug Fork. Communities along the Tug Fork were under more than 20 ft of water from Welch to Fort Gay. Several small towns, including Matewan, Tacker, and Lobata, in West Virginia, were completely inundated. Twenty-two people were killed by the flood and property damages were estimated to be more than $400 million. The affected region in the four-State area is shown by county in figure 1. Figure 2 shows the gaging stations locations for the study area. A total of 47 counties (table 1) were declared disaster areas by the Federal Government.

The objective of this report is to present the meteorological setting, the precipitation distribution, and hydrologic data associated with the flood. Supplementary precipitation data collected in field surveys are presented. The hydrologic data includes maximum flood stages and discharges at 92 sites, discharge hydrographs for selected sites, and water-surface profiles. Factors for converting from the inch-pound system of measurement to metric units are given in the Contents section.

ACKNOWLEDGMENTS

Surface air and upper air analyses were made by the National Weather Service, National Meteorological Center. Supplementary precipitation data were furnished by Donald G. Close, Assistant Regional Hydrologist, National Weather Service, Eastern Region headquarters. Satellite pictures were provided by National Environmental Satellite Service of the National Oceanic and Atmospheric Administration (NOAA).

Flood data in this report were collected as part of cooperative programs between the U.S. Geological Survey and the States of Kentucky, Tennessee, Virginia, and West Virginia, county and municipal agencies within these States, and agencies of the Federal Government. Other Federal and State agencies, municipalities, universities, corporations and individuals assisted in the data-collection effort. Credit for this assistance is given in appropriate

FIGURE 1.—Area affected by the Appalachian flood, April 2–5, 1977. Counties outlined were declared Federal disaster areas (see table 1).

places in the text. Photographs for the report were obtained from Federal and State agencies, newspapers, and individuals; where appropriate, photograph sources are listed.

The following hydrologists in the following district offices of the U.S. Geological Survey prepared data tables of the flood and provided general textual material: Curtis H. Hannum, Kentucky; Bernard J. Frederick, Tennessee; Earley M. Miller, Virginia.

METEOROLOGICAL SETTING

A Low with central pressure 992 mb was initially located over Iowa at 0700 e.s.t., April 2, 1977. Steered by strong upper airflow, it progressed northeastward rapidly. By 1900 e.s.t. the Low was over the Great Lakes with pressure of 989 mb (fig. 3). The associated cold front extended from eastern Ohio, through central Tennessee, to northern Louisiana. The continued movement of the cold front through the Appalachians brought moderate rainfall. Showers were first triggered over northeastern Tennessee and southeastern Kentucky around 2000 e.s.t. April 2, and then spread quickly into neighboring Virginia and West Virginia. These showers did not persist long. By early morning of April 3, most rain had stopped. There was no significant amount

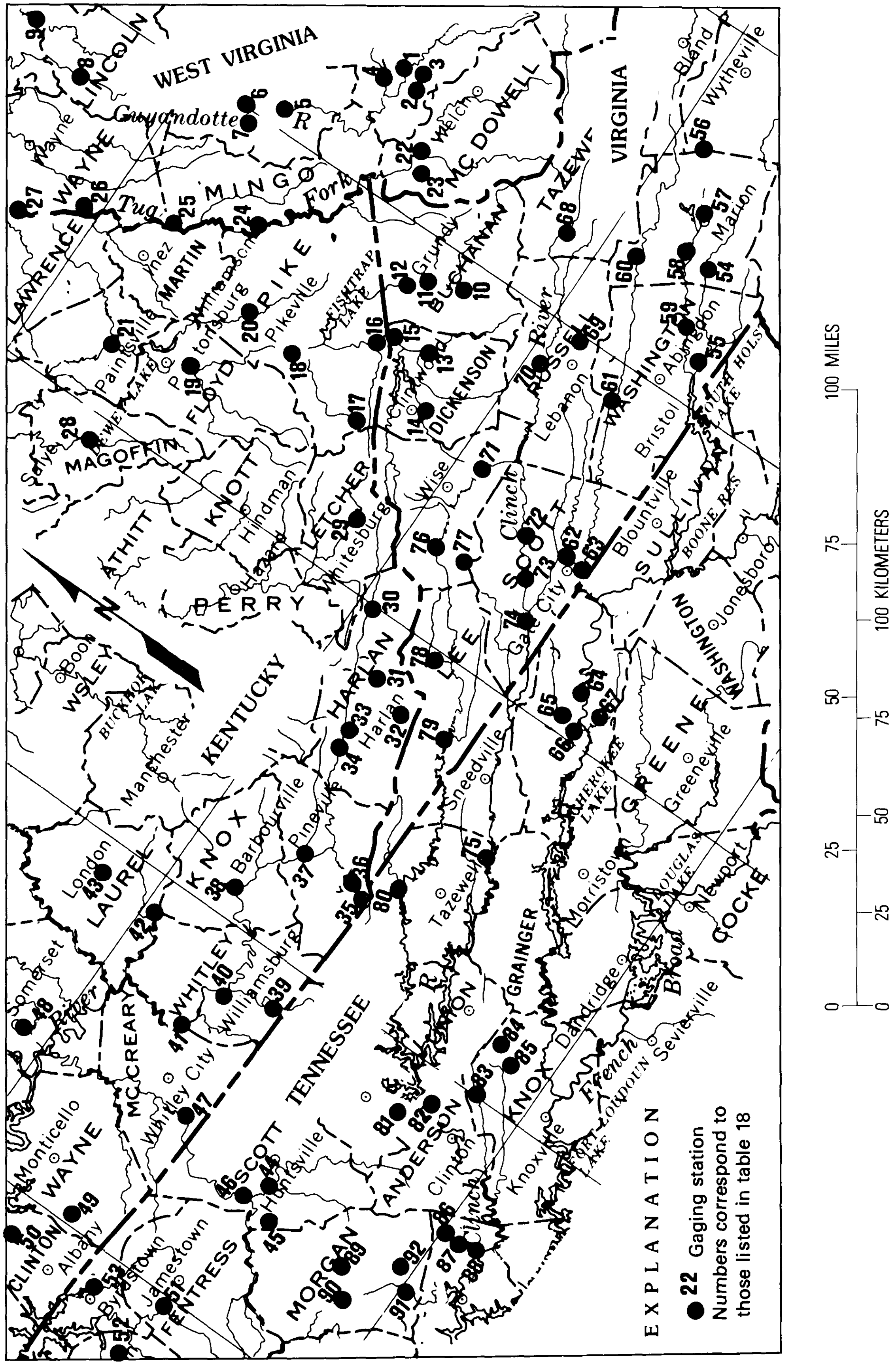


FIGURE 2.—Flood area showing gaging-station locations.

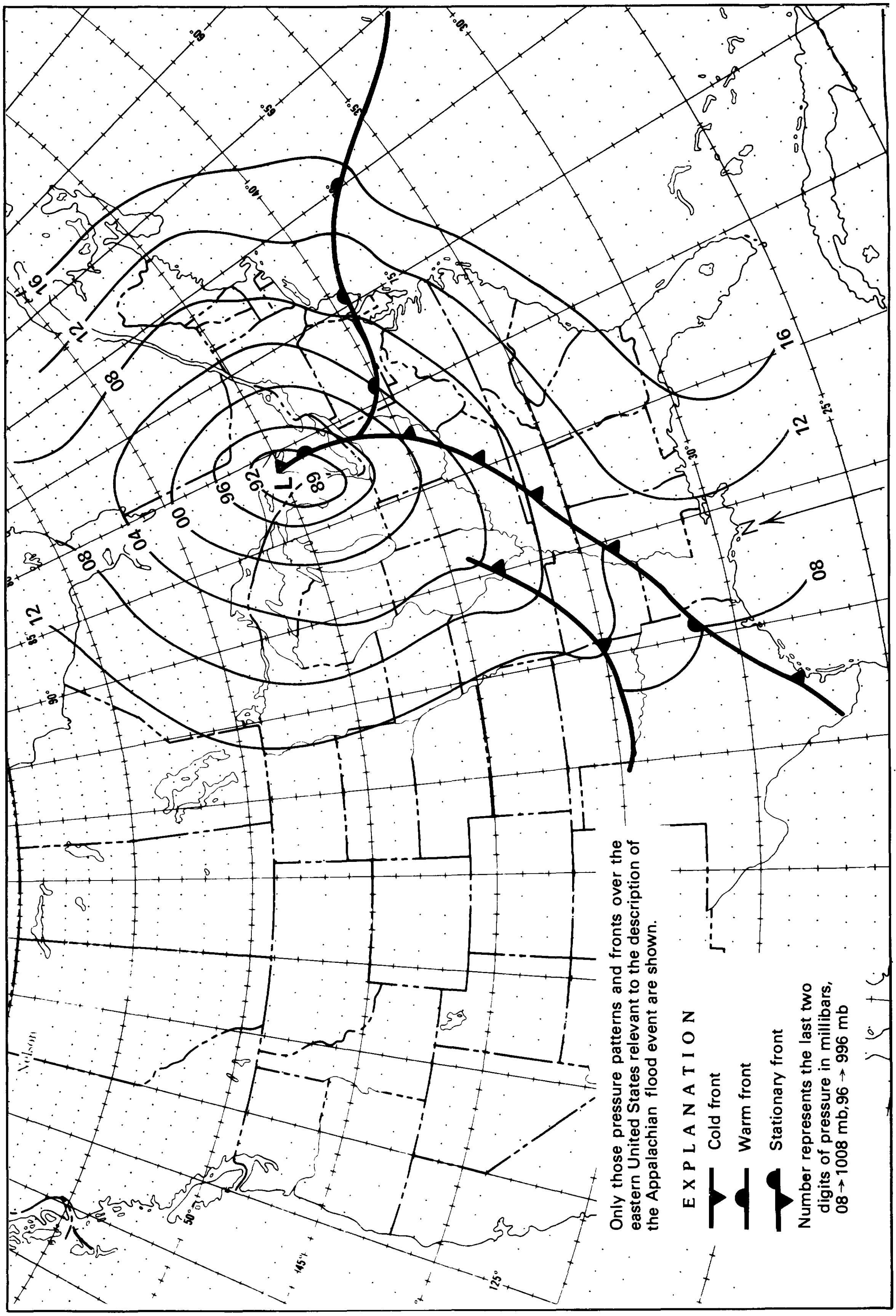


FIGURE 3.—Pressure patterns and fronts for Appalachian flood area at 1900 e.s.t., April 2, 1977.

TABLE 1.—*Counties declared Federal disaster areas, in Appalachian flood, April 2–5, 1977 (see fig. 1)*

	Kentucky	
Bell	Knott	Magoffin
Breathitt	Knox	Martin
Floyd	Lawrence	Perry
Harlan	Leslie	Pike
Johnson	Letcher	Whitely
	Tennessee	
Anderson	Claiborne	Roane
Campbell	Hancock	Scott
	Virginia	
Bland	Grayson	Smyth
Buchanan	Lee	Tazewell
Carroll	Pulaski	Washington
Dickenson	Russell	Wise
Giles	Scott	Wythe
	West Virginia	
Cabell	Logan	Raleigh
Greenbrier	McDowell	Summers
Lincoln	Mercer	Wayne
	Mingo	Wyoming

observed. For example, Huntington, W. Va., had 0.82 in. However, the rain premoistened the soil and facilitated the subsequent direct runoff from the main storm on April 4. For approximately an 18-h period beginning early morning April 3, little or no rain fell over the region even though the sky was overcast. By 1900 e.s.t., April 3, the Low had moved to eastern Quebec with an associated cold front extending through the Carolinas becoming a stationary front extending from Georgia to eastern Texas (fig. 4). This front separated the polar continental airmass to the north from the tropical maritime airmass to the south. The average temperature was 15°F higher and dew point was 10°F higher in the maritime airmass compared with those in the continental airmass. By early morning of April 4, the southwesterly flow throughout the lower troposphere increased in strength, and this stationary front started to move northward and became a warm front. The warm moist airmass which originated in the Gulf of Mexico began to move into the Appalachian region. The mean relative humidity from surface to 500 mb over this region had increased from less than 40 percent 24 h earlier to more than 80 percent by 0700 e.s.t. on April 4, and it exceeded 90 percent over large areas of West Virginia. The precipitable water over the region also more than doubled in the same 24 h to values exceeding 1.00 in., compared to a climatological April monthly mean of 0.59 in. (Lott, 1976).

There was also large scale rising motion over the Appalachian region. At 0700 e.s.t. on April 4, the rising exceeded 2.2 cm/s over the region. It exceeded 4.5 cm/s over eastern Kentucky and eastern Tennessee. The cumulative net vertical displacement in the 12-h period ending 0700 e.s.t. as forecasted by the trajectory model for air parcels terminating at 700 mb over the region exceeded 120 mb. This corresponds to a total lift of 1.34 km. This extreme lift was by far the highest for April 1977 and exceeded the next highest by more than 50 percent.

As a measure of the airmass moisture content and static stability, analysis indicated that the K index, as described in the glossary of this report, exceeded 30 throughout the region at 0700 e.s.t. on April 4. The computed K index for Huntington, W. Va., on April 4 was 32, indicating the high instability of the airmass. In general, a K index greater than 35 is associated with numerous thunderstorms. Another useful stability index is the total-total index (*TT*) the equation for which is given in the glossary. A *TT* exceeding 50 is favorable to the occurrence of severe thunderstorms. The analyzed *TT* over the region was about 47 at 0700 e.s.t. April 4.

The 0700 e.s.t. April 4 surface analysis is shown in figure 5, and the upper air analyses at 850, 700, and 500 mb are shown in figure 6. The Appalachian region was under a trough-to-ridge upper flow pattern while strong warm advection existed from surface up to 700 mb.

The conditions essential to the production of considerable rainfall over a region can be summarized as follows:

1. The atmosphere is very moist through a deep layer.
2. The atmosphere is unstable or conditionally unstable.
3. Warm advection, low level convergence, and consequent time-integrated large scale rising motion exist for a long time. All these conditions were met.

About the same time the warm front moved into the region, an upper air shortwave disturbance also moved through the area. Heavy rain started to fall shortly after 1800 e.s.t. on April 3 and continued through April 4 with only short respite in the late morning or early afternoon, depending on the location.

The 0300 and 0500 e.s.t. April 4 Geostationary Operational Environmental Satellite (GOES) infrared images of the Eastern United States and Canada are shown in figure 7. At 0300 e.s.t. (fig. 7*A*), two lines of thundershowers were oriented southwest to northeast. One line extended from central Kentucky

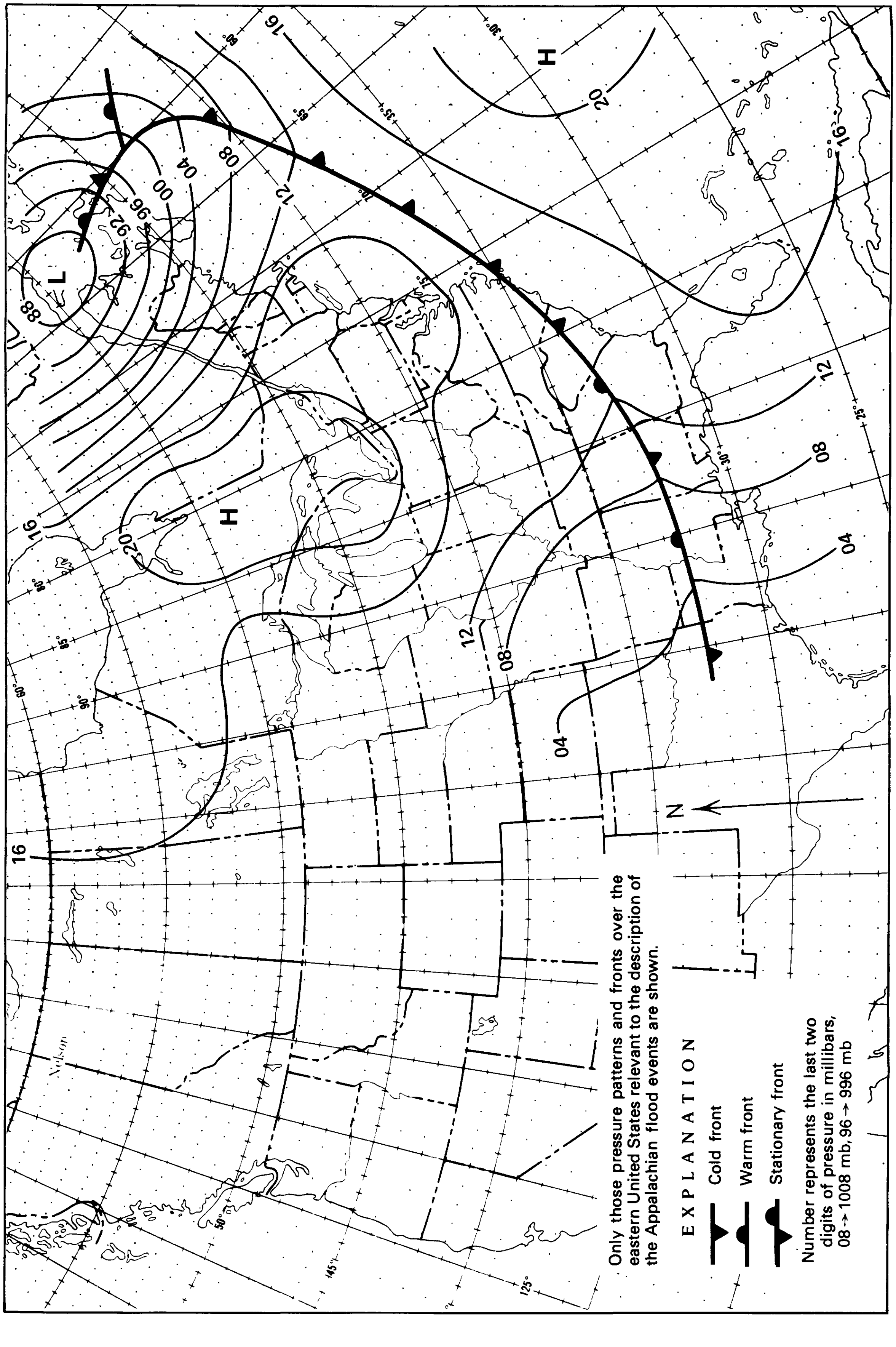


FIGURE 4.—Pressure patterns and fronts for Appalachian flood area at 1900 e.s.t., April 3, 1977.

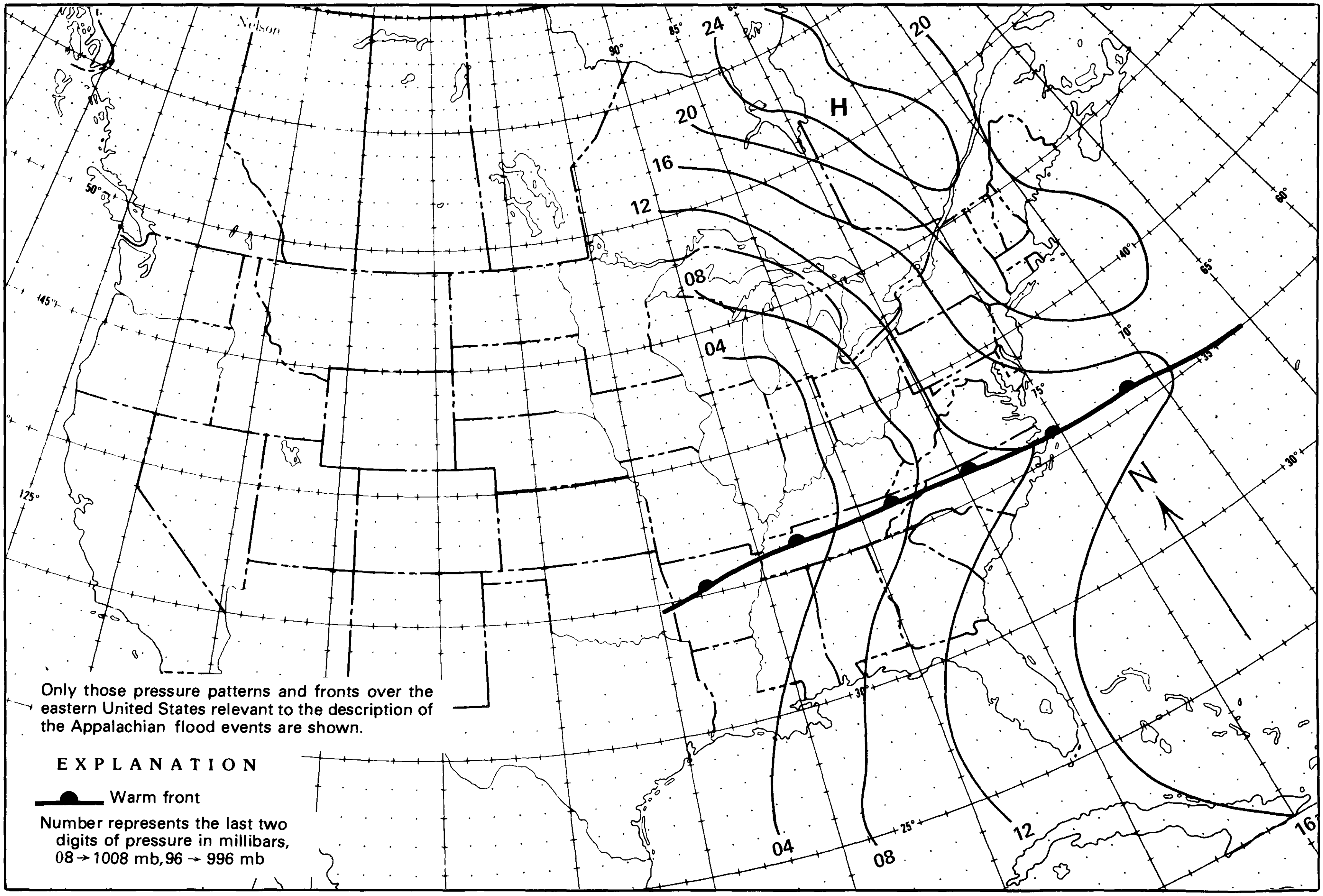
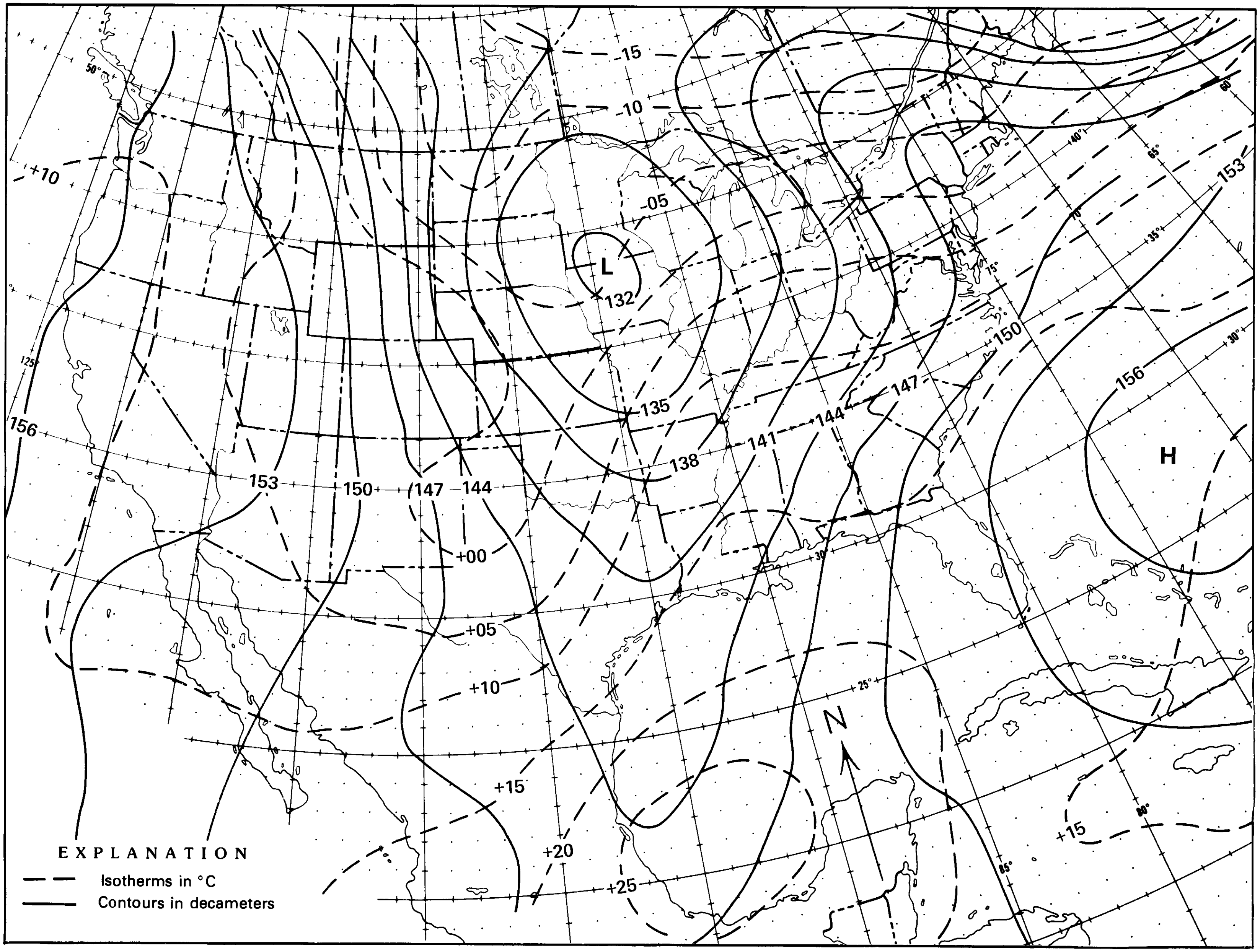
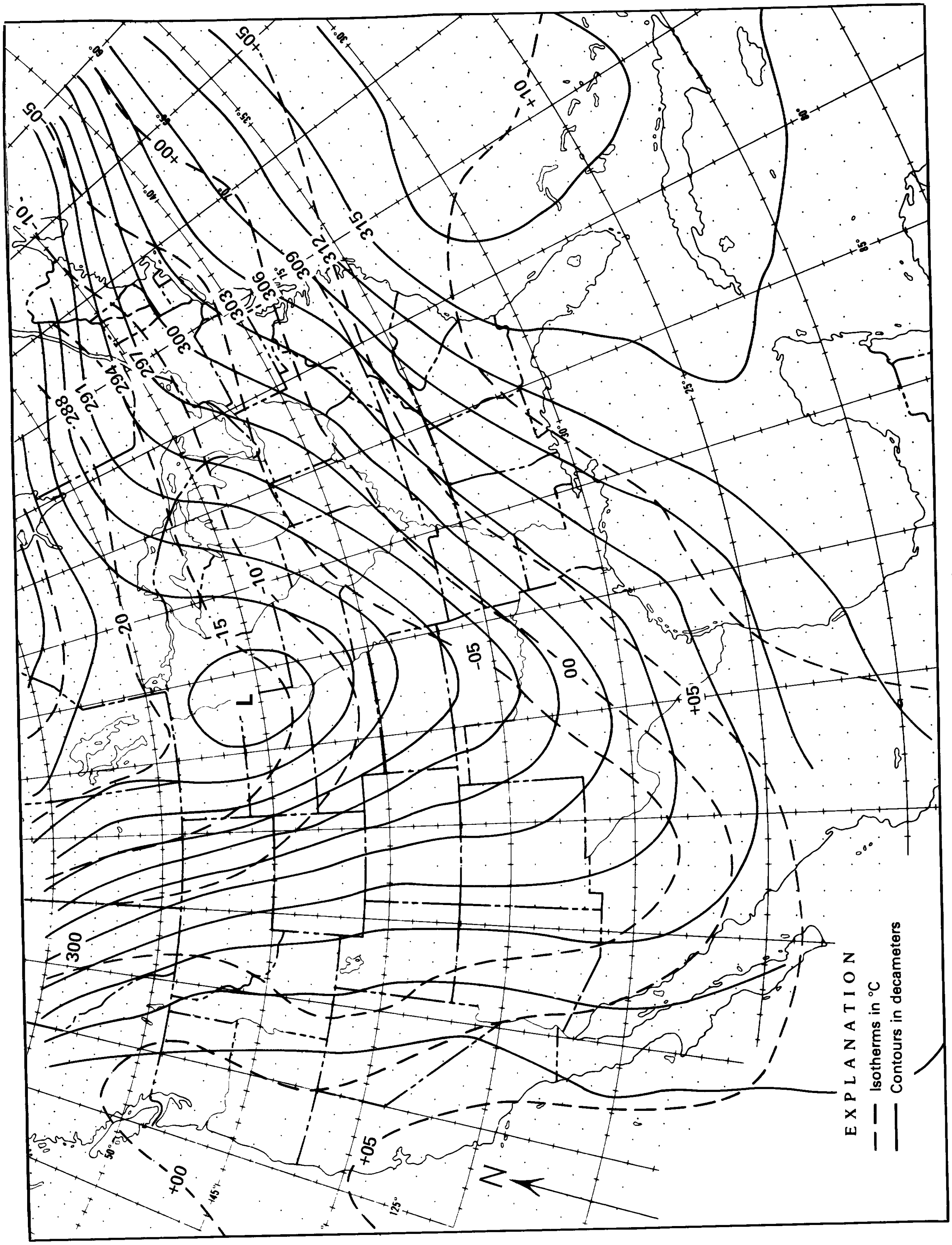


FIGURE 5.—Pressure patterns and fronts for Appalachian flood area 0700 e.s.t., April 4, 1977.



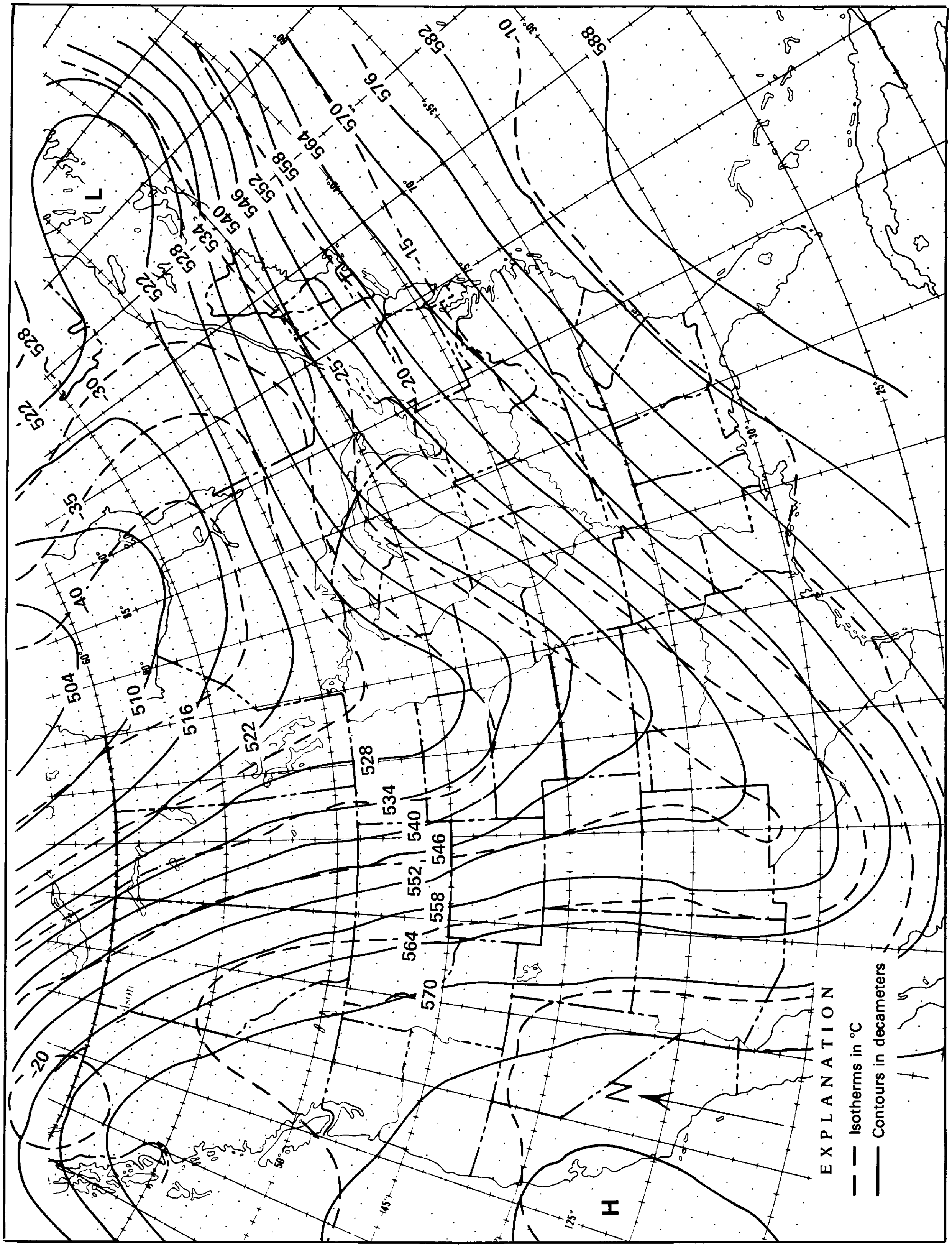
A. 850–mb chart

FIGURE 6.—Charts showing upper air analysis for the United States at 0700 e.s.t. on April 4, 1977. Height contours in decameters; isotherms in °C. *A*, 850 mb.



B. 700-mb chart

FIGURE 6.—Continued. *B*, 700 mb.



C. 500–mb chart

FIGURE 6.—Continued. C, 500 mb.

to southern Ohio. A second line extended from southeastern Kentucky to West Virginia. At 0500 e.s.t. (fig. 7*B*) only the second line had persisting high cloud tops. Southeastern Kentucky, extreme western Virginia, and southwestern West Virginia were covered with cumulonimbus clouds with cloud-top temperatures of less than −53°C. This corresponded to cloud-top heights much greater than 6 mi. Heavy showers were falling over this region by that time.

Comparisons of meteorological conditions were made with those of the Black Hills–Rapid City storm of June 9–10, 1972, and the Big Thompson River storm of July 31, 1976. Extremely weak upper air flow was a marked feature of both the Black Hills–Rapid City and Big Thompson River storms. Wind speed at 500 mb in those storms over the affected areas were only 10 to 20 knots prior to or during the early part of both storms. This phenomena of very light wind in the cloud layer coupled with strong winds in the subcloud layer created a condition of inverse wind shear. Such wind structures hold the cumulonimbus towers over the high terrains, permitting them to release torrential rains for long durations over limited areas. The situation with the Appalachian storm was very different. The region was under strong southwesterly flow, and 500 mb winds were typically 80 to 90 knots on April 3–4, 1977. The jet stream was directly to the northwest of the region. The precipitation was associated with warm front passage and warm-sector convection. The precipitation maximum near Jolo, W. Va., was near the Stateline Ridge which divides West Virginia and Virginia. The prevailing southwesterly winds carrying warm moist air upslope maximized the rainfall there. But the Appalachians storm itself was a large scale event encompassing areas in five States (including North Carolina), while the Black Hills–Rapid City and Big Thompson River storms were much more limited in terms of geographical areas covered (Schwarz and others, 1975, Maddox and others, 1977).

DISTRIBUTION OF PRECIPITATION

The storm of April 2–April 5 consisted of two stages. The antecedent storm brought rainfalls typically less than 1 in. over the region. This was due to the rapid cold frontal passage in the late afternoon of April 2. The time of rain was restricted to the late evening of April 2 and the very early morning of April 3. The second stage, the main storm, began in the evening of April 3 and extended to the morning of April 5. Rainfall was heavy and almost continuous over large areas of the Appalachian region.

Mass rainfall curves for three stations are shown in figure 8. The total storm rainfall distribution is shown in figure 9. The 4-inch isohyetal enclosed an elongated area extending in a direction of east-northeast to west-southwest. This enclosed area contains the headwaters of many tributaries of the Ohio River. An enlarged isohyetal map covering the headwaters of several severely flooded tributaries is presented as figure 10. Supplementary rainfall data from a survey conducted by the National Weather Service in McDowell County, W. Va., and Buchanan County, Va., is shown in table 2.

The rainfall beginning in the evening of April 3 was caused by the invasion of a warm moist unstable maritime airmass into the region. In this environment of widespread rainfall, intense convective thunderstorms were triggered in locations where orography further enhanced development. The precipitation maximum on the dividing ridge between McDowell County, W. Va., and Buchanan County, Va., could be partially accounted for since the prevailing low level winds were southwesterly during

TABLE 2.—*Supplementary precipitation data, Appalachian flood April 2–5, 1977*

[Latitudes and longitudes and elevations were estimated and are only approximations. Data collected by Donald Willson, National Weather Service Forecast Office, Pittsburgh, Pa.]

County and State	Location No. [1]	Lat	Long	Elev. (ft)	Rainfall (in.)	Type container or gage
McDowell, W. Va	Jolo (0.2 mi N.E. of PO)	37°21′	81°48′	1320	6.00+	Can, 5-in. diam.
McDowell, W. Va	Jolo (1.2 mi S.SW. of PO)	37°18′	81°50′	1920	5.50+	Barrel, 14-in diam.
McDowell, W. Va	Bradshaw (1.4 mi S.SW. of PO)	37°20′	81°49′	1280	5.35	Tube
McDowell, W. Va	Panther	37°27′	81°55′	1300	5.25	Wedge-shaped gage
McDowell, W. Va	Panther State Park, W. Va	37°26′	81°53′	2000	3.50+	Do.
Buchanan, Va	Near Jolo, W. Va. (3.9 mi SE. of PO)	37°16′	81°47′	2840	8.00	Plastic pool
Buchanan, Va	Near Jolo, W. Va. (3.8 mi SW. of PO)	37°17′	81°52′	2560	6.50+	Tin can, 5-in. diam.
McDowell, W. Va	Jolo (3.1 mi SW. of PO)	37°17′	81°50′	2610	10.00	Tub, 19-in. diam. 13-in depth
McDowell, W. Va	Jolo (2.5 mi W.NW. of PO)	37°20′	81°52′	2080	10.00	Swimming pool, 41 x 21 ft
McDowell, W. Va	Jolo (2.8 mi SW. of PO)	37°18′	81°51′	2300	15.50+	Washing machine
McDowell, W. Va	Bradshaw (1.0 mi N. of PO)	37°22′	81°50′	1100	7.00	Wedge-shaped gage
McDowell, W. Va	Caretta (1.6 mi NE. of PO)	37°21′	81°40′	1500	13.00	Plastic bucket, 11-in. diam., 13-in. depth
McDowell, W. Va	Coalwood (1.3 mi E.SE. of PO)	37°23′	81°38′	1550	7.00	Aluminum cooking pot, 18-in. diam., 19-in. depth
McDowell, W. Va	Jewel Ridge	37°17′	81°50′	2600	6.80+	Bucket

[1] PO, U.S. Post Office at locality.

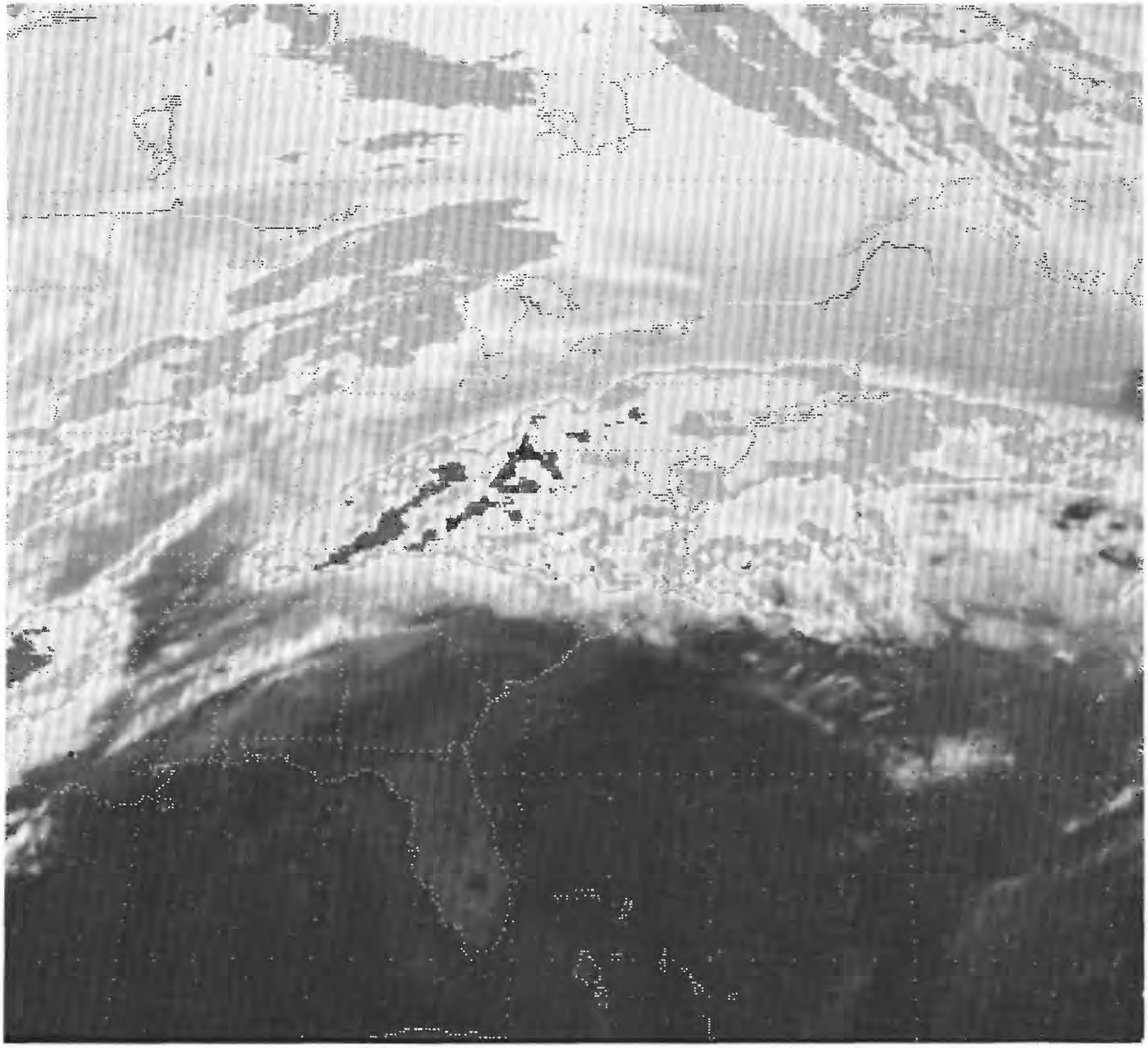


FIGURE 7.—Infrared photographs taken from Geostationary Operational Environmental Satellite (GOES) of eastern North America, April 4, 1977. *A*, 0300 e.s.t.

the main storm. The maximum observed rainfall of 15.5 in. in about 30 h occurred at Jolo, McDowell County, W. Va., in the headwater region of Tug Fork. This was more than twice the amount which would be expected for a 100-year recurrence interval storm.

The last major flood over the Appalachian region occurred January 29–February 6, 1957. The isohyetal pattern had a similar orientation, but was distributed further to the southwest (U.S. Geological Survey, 1963), most 1957 flood damage occurring in southeastern Kentucky. One of the precipitation maxima of this flood was very near the 1977 flood maximum and was also over the headwaters of Tug and Levisa Forks.

Due to the mountainous terrain, the headwater streams of Guyandotte River, Tug and Levisa Forks rose and crested rapidly in response to the heavy rain. The flood had the characteristics of a flash flood. Timely warnings prevented casualties from becoming much higher.

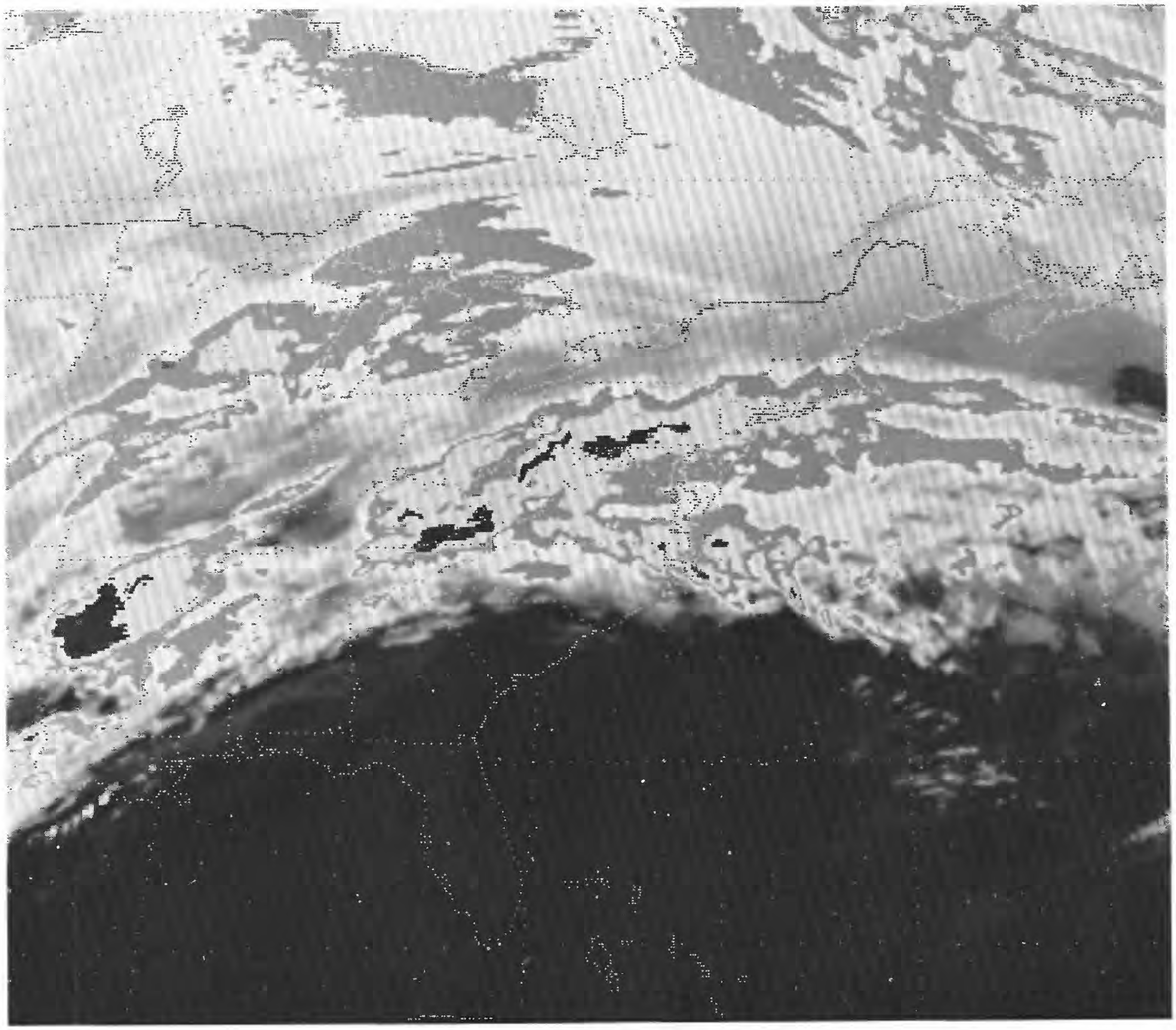


FIGURE 7.—Continued. *B*, 0500 e.s.t.

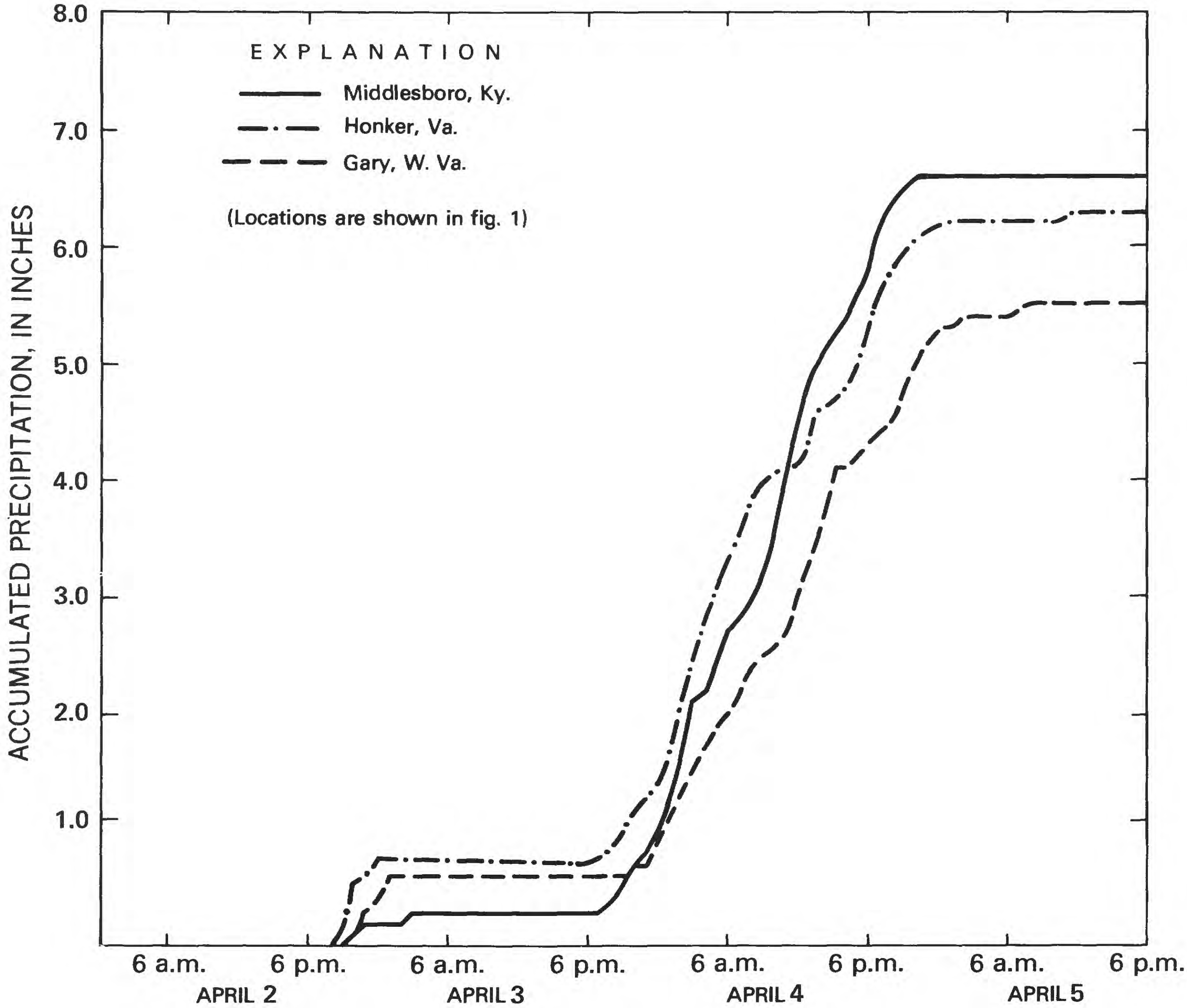


FIGURE 8.—Mass rainfall curves for three selected stations in the storm of April 2–5, 1977.

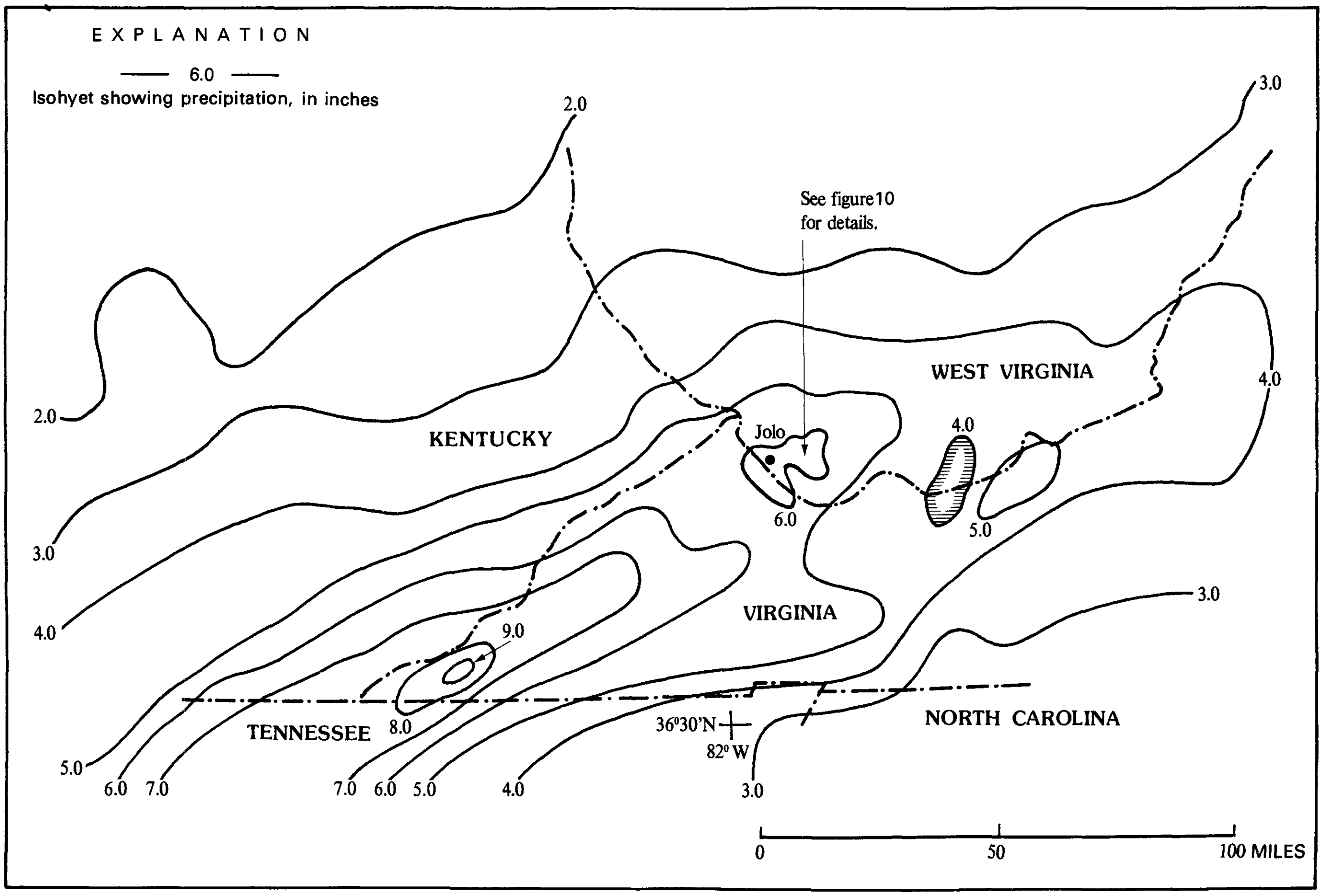


FIGURE 9.—Isohyets of total storm rainfall, April 2–5, 1977.

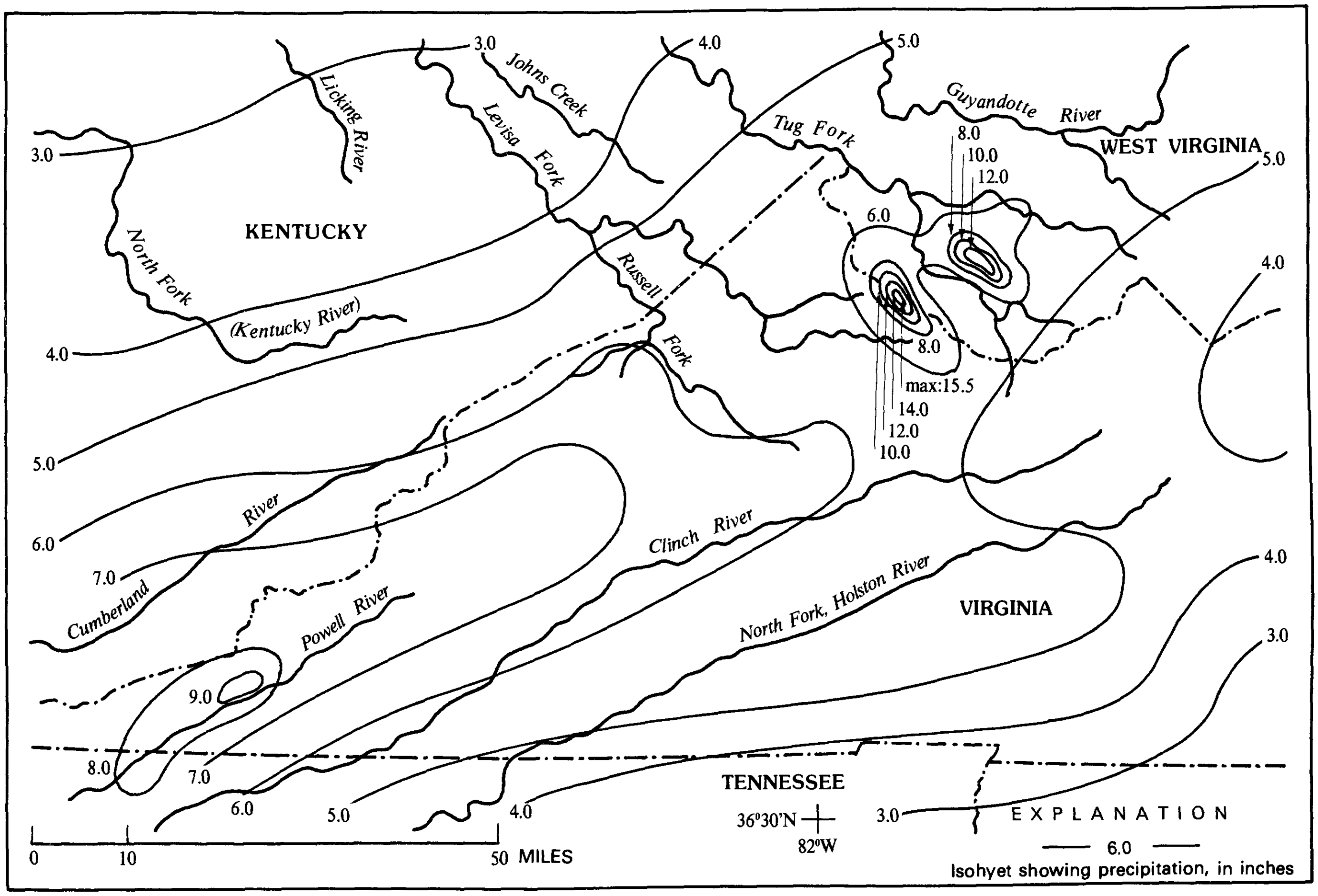


FIGURE 10.—Isohyets showing in more detail total storm rainfall in the Tug Fork headwater area.

GENERAL DESCRIPTION OF THE FLOOD

KENTUCKY

The flood of April 2–5, 1977, in southeastern Kentucky caused record damages in the upper Cumberland River basin and along the Tug Fork, a tributary to the Big Sandy River. Major damages occurred along Levisa Fork, the headwater tributary to the Big Sandy River, along Russell Fork, a major tributary to Levisa Fork, and along the North Fork Kentucky River. Officials of the Small Business Administration estimated the damage to be in excess of $100 million.

In the Big Sandy River basin, the April 1977 flood was the greatest known on Levisa Fork upstream from Pikeville, Ky., and on Tug Fork upstream from Glenhayes, W. Va. At Pikeville the peak discharge of 81,600 ft^3/s and stage of 51.46 ft was 1.26 ft lower than the maximum stage of 52.72 ft recorded in 1957. Figure 11 is a photograph of flood damage in Pikeville, Ky.

Downstream on Levisa Fork, peak stages at Prestonburg and Paintsville were 45.71 and 42.19 ft respectively, about 3 ft below the 1957 flood stages, the highest known since 1928. The Big Sandy River at Louisa, below the confluence of Levisa and Tug Forks, crested at 45.00 ft, 1.4 ft lower than the 1957 peak, which was the greatest since 1938 when the records began. In 1977, although most tributaries to Levisa Fork did not exceed peaks of record, the discharge of 54,200 ft^3/s (stage 24.80 ft) recorded on Russell Fork at Elkhorn City, Ky., was the greatest since at least 1957. Unit discharges ($ft^3/s/mi^2$) decreased considerably as the drainage area increased in the downstream part of the basin. In addition, the U.S. Army Corp of Engineers reported substantial reductions in peak stages as a result of reservoir storage in Fishtrap Lake near Millard, Ky., North Fork Pound Lake at Pound, Va., and John W. Flannigan Reservoir near Haysi, Va. Peak stages on Russell Fork at Elkhorn City, Ky., and on Levisa Fork at Pikeville, Ky., reportedly were reduced 1.2 ft and 13 ft, respectivley, as a result of flood control operations.

In the Cumberland River basin, the flood exceeded previously known discharges at eight gaging stations

FIGURE 11.—Aerial view, looking westward, of Pikeville, Ky., on Levisa Fork on April 5, 1977 (Copyright Courier-Journal and Louisville Times).

TABLE 3.—*Gage height, in feet, and discharge, in cubic feet per second, for the flood of April 1977 at gaging station 03403500, Cumberland River at Barbourville, Ky.*

Date in April	Time	Gage height	Discharge
1	2400	3.75	1,480
2	1200	3.69	1,420
	2400	3.65	1,380
3	0200	3.67	1,400
	0600	3.85	1,570
	1200	4.29	1,960
	1800	4.53	2,170
	2400	4.75	2,370
4	0300	5.50	3,100
	0600	9.40	6,390
	0900	16.00	11,300
	1200	22.53	17,000
	1500	26.90	22,500
	1800	30.36	27,300
	2100	33.13	31,400
	2400	35.57	35,200
5	0300	37.12	37,700
	0600	39.47	41,600
	0900	42.20	46,700
	1200	42.80	47,900
	1500	43.97	50,200
	1800	44.82	51,900
5	2000	45.22	52,700
	2200	45.56	53,400
	2300	----	54,700
	2400	----	56,000
6	0100	----	56,100
	0200	----	55,700
	0300	----	54,100
	0600	----	49,500
	0900	----	43,600
	1200	----	38,500
	1500	----	34,100
	1800	----	30,500
	2100	----	28,200
	2400	----	25,300
7	0300	----	23,200
	0600	----	21,300
	0900	----	19,800
	1200	----	18,500
8	----	----	10,000
9	----	----	4,500
10	----	----	2,900

FIGURE 12.—Aerial view, looking northward, of Pineville, Ky., Cumberland River on April 5, 1977 (Copyright Courier-Journal and Louisville Times).

TABLE 4.—*Gage height, in feet, and discharge, in cubic feet per second, for the flood of April 1977 at gaging station 03209500 Levisa Fork at Pikeville, Ky.*

Date in April	Time	Gage height	Discharge
2 ------	2000	3.45	622
	2400	3.56	673
3 ------	1200	3.97	819
	1800	4.87	1,270
	2400	5.63	1,680
4 ------	0300	6.58	2,220
	0600	9.18	4,040
	0900	14.39	8,370
	1200	20.08	13,700
	1500	26.77	23,000
	1800	34.22	37,100
	2100	41.94	55,100
	2400	47.45	69,900
5 ------	0300	50.71	79,400
	0600	51.46	81,600
	0900	50.46	79,100
	1200	49.02	74,300
	1500	46.83	68,100
	1800	44.01	60,400
	2100	40.96	52,500
	2400	37.87	45,100
6 ------	0300	34.89	38,500
	0600	31.96	32,400
	0900	29.04	26,900
	1200	26.22	22,000
6 ------	1500	23.43	17,600
	1800	20.64	14,300
	2100	17.97	11,500
	2400	15.36	9,160
7 ------	0300	12.84	7,070
	0600	10.69	5,240
	0900	9.16	4,000
	1200	8.25	3,320
	1500	7.76	2,970
	1800	7.44	2,750
	2000	7.31	2,660
	2200	8.16	3,250
	2400	11.21	5,690
8 ------	0300	14.22	8,200
	0600	15.60	9,370
	0900	16.23	9,920
	1200	17.09	10,700
	1500	18.38	11,900
	1800	19.88	13,500
	2100	20.91	14,600
	2400	21.41	15,200
9 ------	0600	21.97	15,800
	2100	22.01	15,900
	2400	21.86	15,700
10 ------	1200	21.55	15,300
	2400	21.30	15,000

and was second greatest at two others. Flows in all tributaries entering the Cumberland River above Cumberland Falls were high, particularly Yellow Creek at Middlesboro, Ky., and Clear Fork at Saxton, Ky.

Poor Fork, the main headwater tributary of the Cumberland River (discharge, 10,700 ft^3/s) crested at 15.88 ft, 0.6 ft lower than in 1957 becoming the second highest flood since at least 1927. Peak discharges on Martins Fork near Smith, Ky., 9,000 ft^3/s (stage 24.24 ft), and on Clover Fork at Evarts, Ky., 18,100 ft^3/s (stage 14.87 ft), were the highest, since records began, in 1968 and 1959, respectively.

Below the confluence of Poor and Clover Forks, peak discharges in April 1977 on the main stem of the Cumberland River in Kentucky were the greatest recorded at Harlan, Pineville, and Barbourville. On April 4, the levees and floodwall at Pineville were overtopped and the city was inundated with about 15 ft of water (figs. 12 and 13).

The city of Barbourville was evacuated as a precautionary measure even though the area was protected by a levee reinforced with sandbags. At Williamsburg, the discharge of 46,600 ft^3/s was less than that in 1957 but the peak stage on April 7 was 1.2 ft and 0.5 ft, higher than the peak stages in 1957 and 1975, respectively. Downstream at Cumberland Falls, peak flow 48,500 ft^3/s, April 5, the peak stage of 13.26 ft was 2.2 ft, lower than that of the 1918 flood. The river remained above the 12-ft stage there for 96 h, from 1800 h April 4 to 1800 h April 8. The peak flow decreased as the flood wave moved downstream and did not approach the magnitude of previous maximum floods below Cumberland Falls, Ky. Discharge hydrographs of Cumberland River at Barbourville, Ky., and Levisa Fork at Pikeville, Ky., are shown in figure 14 and data are presented in tables 3 and 4.

FIGURE 13.—Aerial view, looking westward, of Pineville, Ky., on April 5, 1977 (Copyright Courier-Journal and Louisville Times).

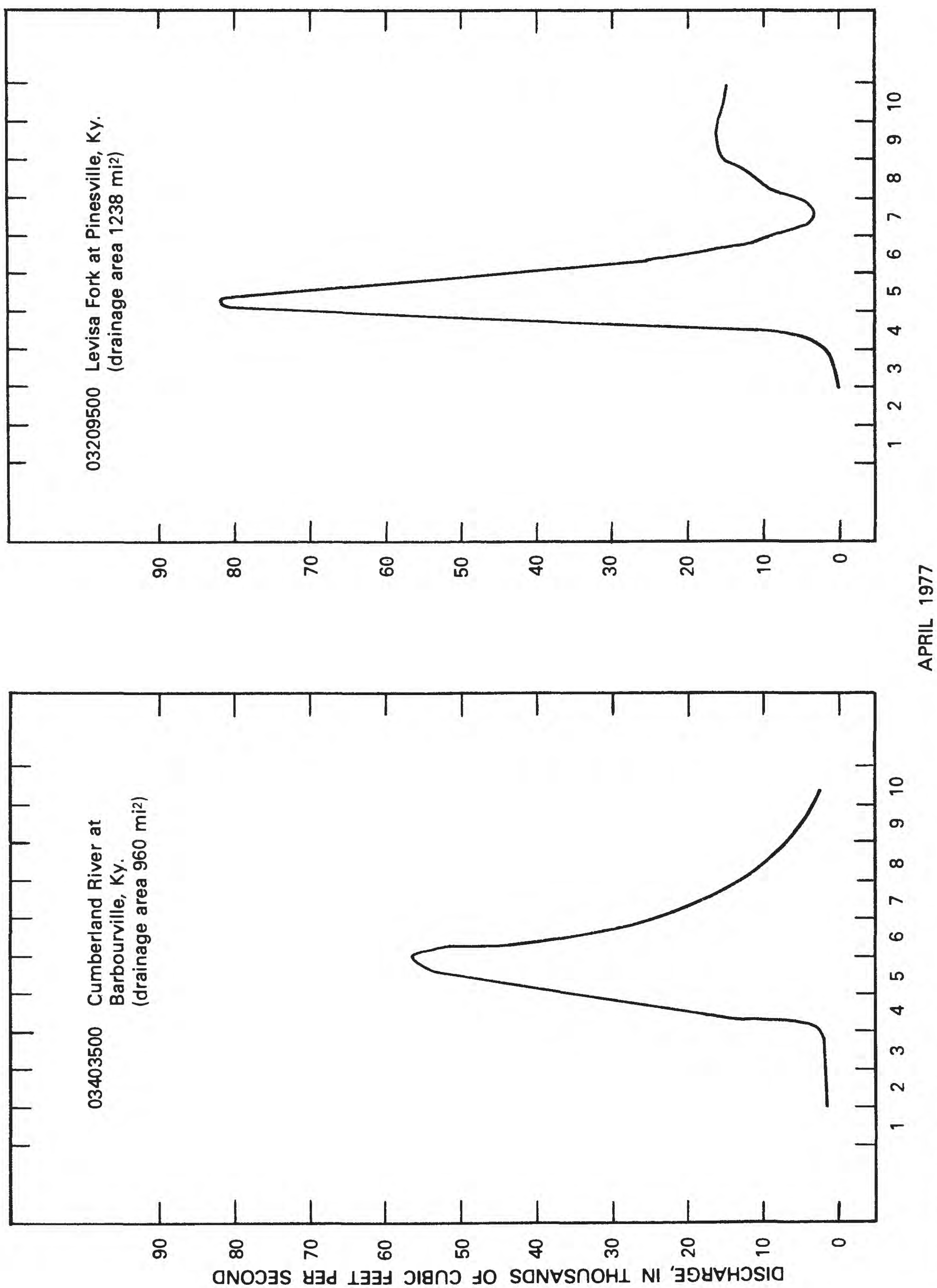


FIGURE 14.—Hydrographs showing rates of discharge of the Cumberland River at Barbourville, Ky., and Levisa Fork at Pineville, Ky., April 1–10, 1977.

TENNESSEE

Rainfall occurred over most of the State on March 29–31 and April 2–5, 1977, resulting in record flooding in the Clinch and Powell River basins, in the north-central part of the State. Total damages were estimated at $15 million by the State Highway Department of Tennessee, divided about equally between public damage (roads, bridges, utilities) and private damage (homes, businesses).

The March 29–31 storm saturated the soil, enabling a high percentage of the April rainfall to reach the streams as surface runoff, causing record-breaking floods on some large drainage areas. At the gaging station on Clinch River above Tazewell Tenn., the peak discharge of 98,100 ft^3/s was the greatest since at least 1862. At the gaging station on Powell River near Arthur, Tenn., the peak discharge of 59,500 ft^3/s was the highest experienced since 1826. The peak stage of 38.96 ft exceeded that in 1826 by 9.4 ft.

The flood on Clinch River at Sneedville, Tenn., is shown in the photograph in figure 15. Discharge hydrographs for selected streams in Tennessee are shown in figures 16 and 17 and data are listed in tables 5–8.

FIGURE 15.—Flood conditions on April 5, 1977, looking southeast toward Hancock County high school at Clinch River, Sneedville, Tenn.

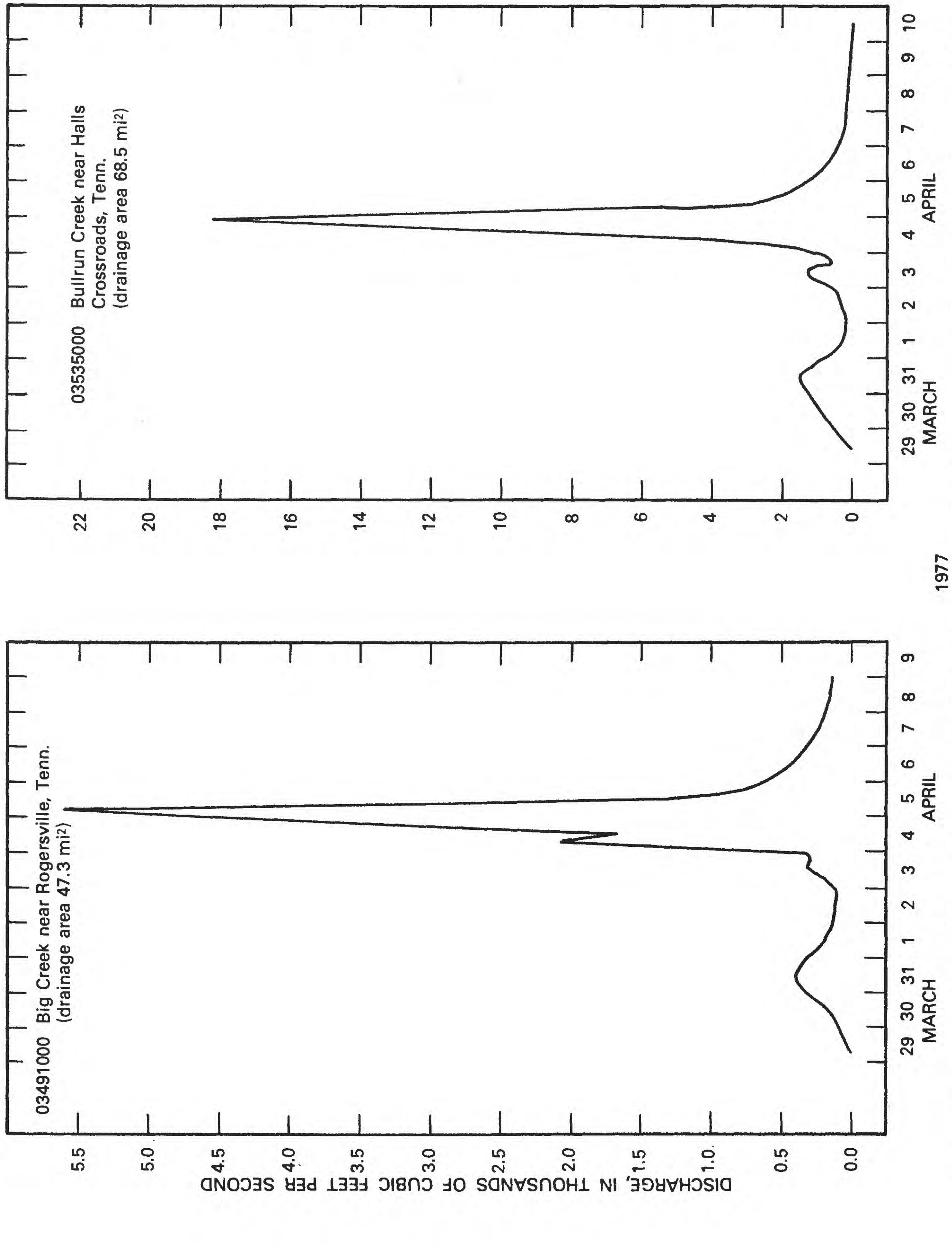


FIGURE 16.—Hydrographs showing rates of discharge of Big Creek near Rogersville, Tenn., and Bullrun Creek near Halls Crossroads, Tenn., March 29–April 9, 1977.

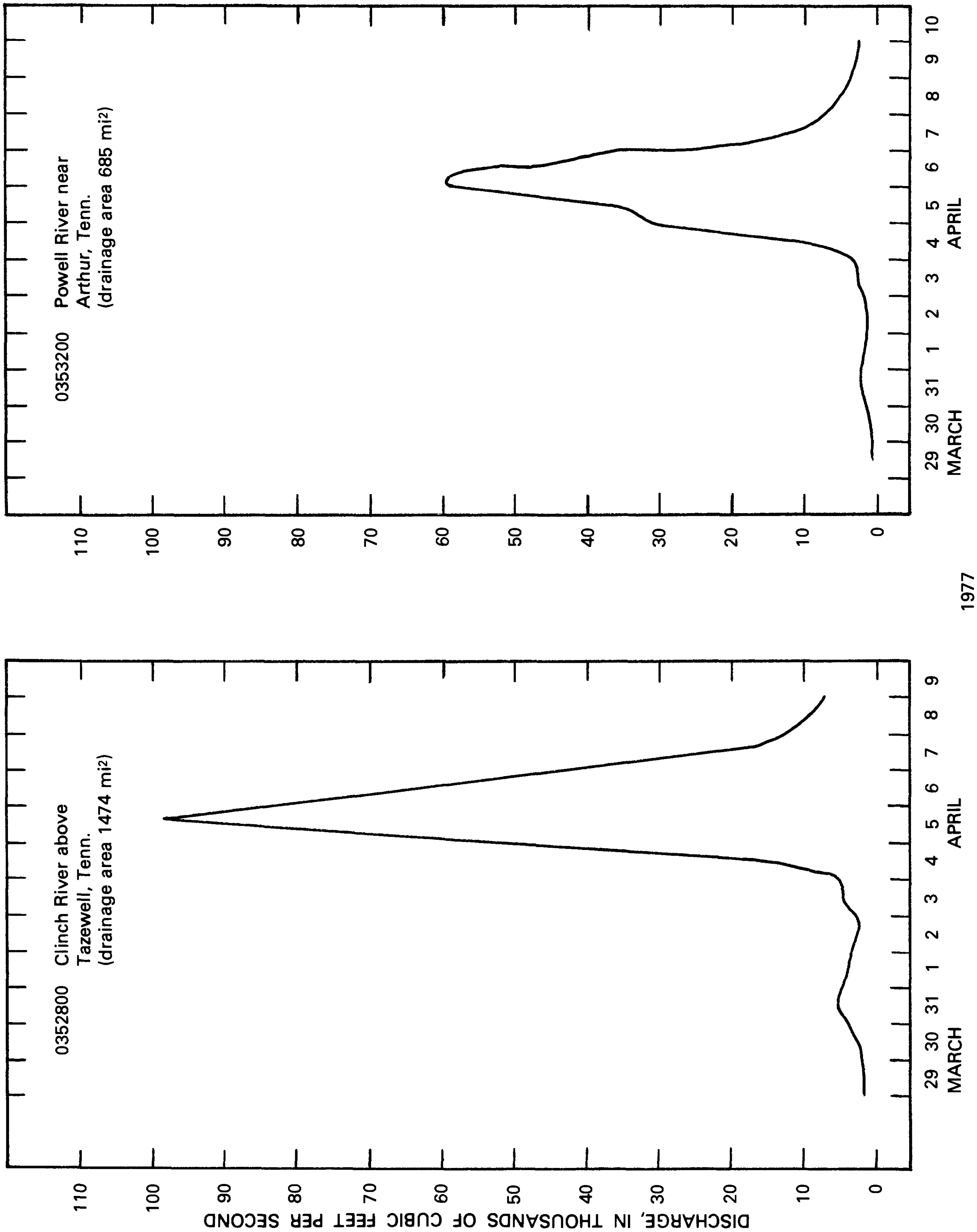


FIGURE 17.—Hydrographs showing rates of discharge of Clinch River above Tazewell, Tenn., and Powell River near Arthur, Tenn., March 29–April 9, 1977.

TABLE 5.—*Gage height, in feet, and discharge, in cubic feet per second, for the flood of April 1977 at gaging station 03491000, Big Creek near Rogersville, Tenn.*

Date in April	Time	Gage height	Discharge
2 ------	2400	2.68	120
3 ------	0600	2.83	152
	1200	3.24	278
	1800	3.37	332
	2400	3.35	324
4 ------	0600	3.71	513
	1200	5.65	2,080
	1800	5.20	1,670
	2400	7.71	4,060
5 ------	0215	9.25	5,600
	0600	7.29	3,630
	1200	4.97	1,470
	1800	4.29	920
	2400	3.94	660
6 ------	0600	3.73	526
	1200	3.62	460
	1800	3.44	365
	2400	3.34	319
7 ------	0600	3.27	290
	1200	3.21	267
	1800	3.15	246
	2400	3.10	228
8 ------	----	3.01	198
9 ------	----	2.84	154
10 ------	----	2.70	124

TABLE 6.—*Gage height, in feet, and discharge, in cubic feet per second, for the flood of April 1977 at gaging station 03535000 Bullrun Creek near Halls Crossroads, Tenn.*

Date in April	Time	Gage height	Discharge
2 ------	2400	5.73	532
3 ------	0600	7.51	1,230
	1200	7.61	1,310
	1800	6.33	682
	2400	6.71	802
4 ------	0600	8.63	2,470
	1200	9.64	4,350
	1800	11.96	12,100
	2130	13.28	18,300
	2400	12.41	14,100
5 ------	0600	10.19	5,770
	1200	8.93	2,760
	1800	8.32	1,870
	2400	7.89	1,440
6 ------	0600	7.48	1,120
	1200	7.01	854
	1800	6.43	639
	2400	5.86	485
7 ------	0600	5.47	389
	1200	5.20	335
	1800	4.99	293
	2400	4.82	263
8 ------	----	4.55	217
9 ------	----	4.15	159
10 ------	----	3.90	130

TABLE 7.—*Gage height, in feet, and discharge, in cubic feet per second, for the flood of April 1977 at gaging station 03528000 Clinch River above Tazewell, Tenn.*

Date in April	Time	Gage height	Discharge
2 ------	2400	3.59	2,760
3 ------	0600	4.47	3,980
	1200	4.76	4,420
	1800	4.80	4,480
	2400	5.01	4,810
4 ------	0600	6.85	7,990
	1200	10.03	14,700
	1800	15.32	29,800
	2400	20.34	48,300
5 ------	0600	----	71,500[a]
	1200	----	93,200[a]
	1800	29.32	98,100[a]
	2400	----	92,500[a]
6 ------	0600	----	76,400[a]
	1200	----	64,300[a]
	1800	----	52,500[a]
	2400	----	42,600[a]
7 ------	0600	----	33,500[a]
	1200	----	25,600[a]
	1800	11.64	18,800
	2400	9.60	13,700
8 ------	----	7.72	9,680
9 ------	----	5.90	6,280
10 ------	----	4.98	4,770

[a] Approximately.

TABLE 8.—*Gage height, in feet, and discharge, in cubic feet per second, for the flood of April 1977 at gaging station 03532000 Powell River near Arthur, Tenn.*

Date in April	Time	Gage height	Discharge
2 ------	2400	4.78	1,580
3 ------	0600	5.37	1,940
	1200	5.97	2,330
	1800	5.90	2,290
	2400	6.04	2,380
4 ------	0600	9.07	4,800
	1200	14.45	10,000
	1800	23.27	22,000
	2400	28.18	30,900
5 ------	0600	29.65	33,900
	1200	30.35	35,400
	1800	33.45	43,200
	2400	37.63	55,300
6 ------	0400	38.96	59,500[a]
	0600	----	59,100[a]
	1200	----	53,000[a]
	1800	----	42,800[a]
	2400	----	33,400[a]
7 ------	0600	----	20,300[a]
	1200	----	13,100[a]
	1800	14.38	8,800
	2400	11.47	7,040
8 ------	----	9.60	5,180
9 ------	----	7.54	3,360
10 ------	----	6.41	2,500

[a] Approximately.

VIRGINIA

Record-breaking floods occurred in southwestern Virginia as a result of rainfall which fell on April 2–5. In Virginia, the most severe flooding occurred in the Big Sandy, Clinch, Holston, and Powell River basins, with less flooding in the New River basin. Eighteen gaging stations experienced floods with recurrence intervals equal to or greater than 100 years. Flooding on Clinch River at Clinchport, Va., and St. Paul, Va., is shown in the photographs in figures 18 and 19.

At the gaging station Levisa Fork near Grundy having continuous records since 1942, the peak discharge of 52,000 ft^3/s had a recurrence interval greater than 100 years. The peak stage of 24.77 ft was 5.71 ft higher than the previously recorded maximum in 1957. Levisa Fork at Big Rock, Va., crested at 27.38 ft, which was about 11 ft higher than any peak recorded since records began in 1967. The peak discharge of 56,000 ft^3/s on April 4 also had a recurrence interval greater than 100 years.

The peak discharge of 89,000 ft^3/s on Clinch River at Speers Ferry, Va., was the greatest since 1862 and exceeded the previous record discharge by more than 40,000 ft^3/s. The Guest River at Coeburn, Va., crested at a peak flow of 18,000 ft^3/s and stage of 20.95 ft. That stage is about 5 ft higher than the previously recorded maximum in 1957 and 4 ft higher than the flood of 1918. The peak discharge of 57,000 ft^3/s on Powell River near Jonesville, Va.,

FIGURE 18.—Aerial view, looking southwestward, of Clinch River at Clinchport, Va., on April 15, 1977 (Courtesy Kingsport Times News).

FIGURE 19.—Aerial view, looking northward, of Clinch River at St. Paul, Va., on April 5, 1977 (Courtesy Bristol Herald Courier).

was almost twice that of the previously known maximum. The peak stage of 44.32 ft was about 11 ft higher than the flood of 1963 which was the maximum known since 1918. The recurrence intervals of peak flows at Speers Ferry, Coeburn, and Jonesville were greater than 100 years.

Discharge hydrographs at selected gaging stations where recurrence intervals were greater than 100 years are shown in figures 20 and 21 and the data are listed in tables 9–12. Damages estimated by the Virginia Office of Emergency Services were about $243 million.

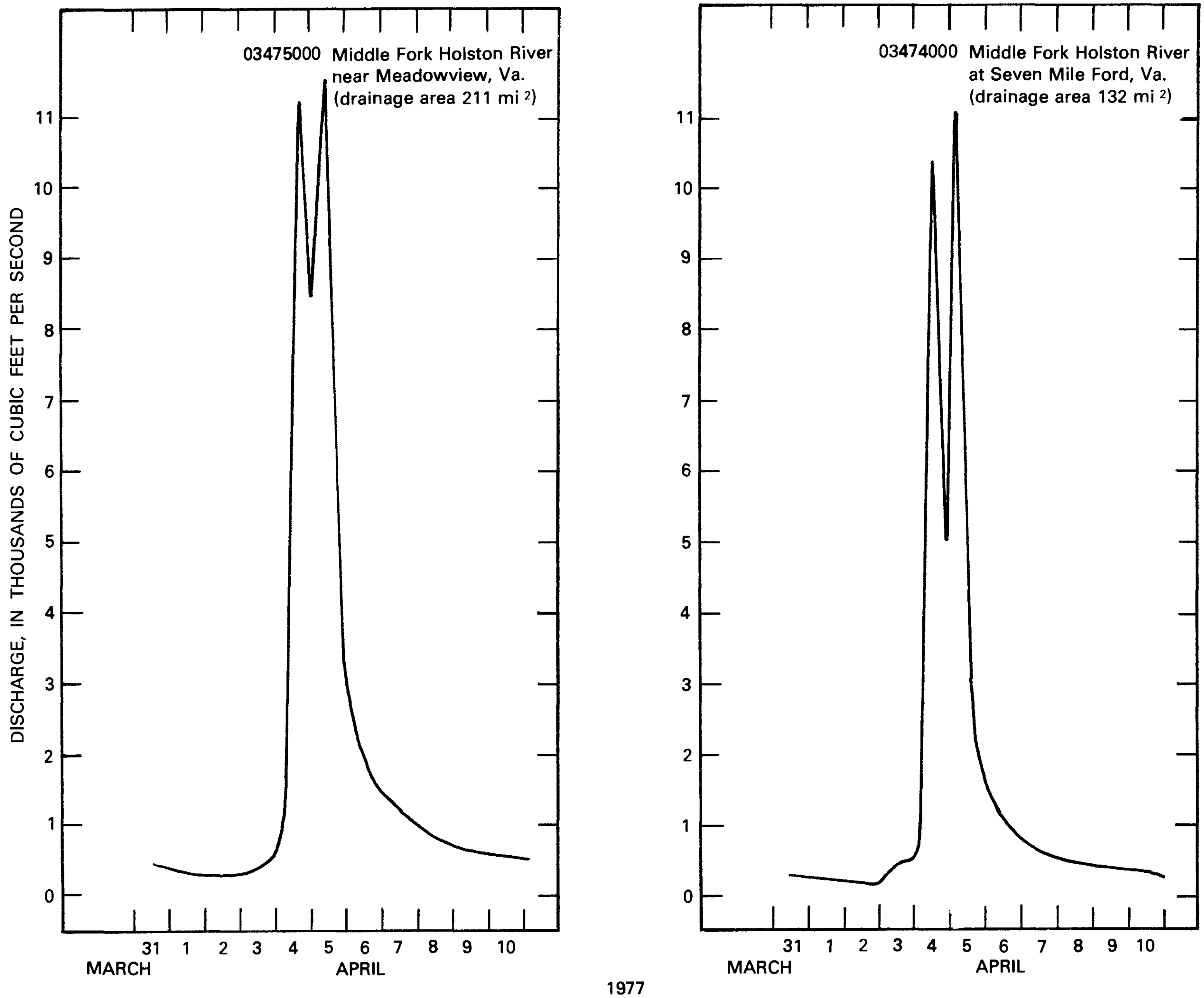


FIGURE 20.—Hydrographs showing rates of discharge of Middle Fork Holston River near Meadowview, Va., and at Seven Mile Ford, Va., March 31–April 10, 1977.

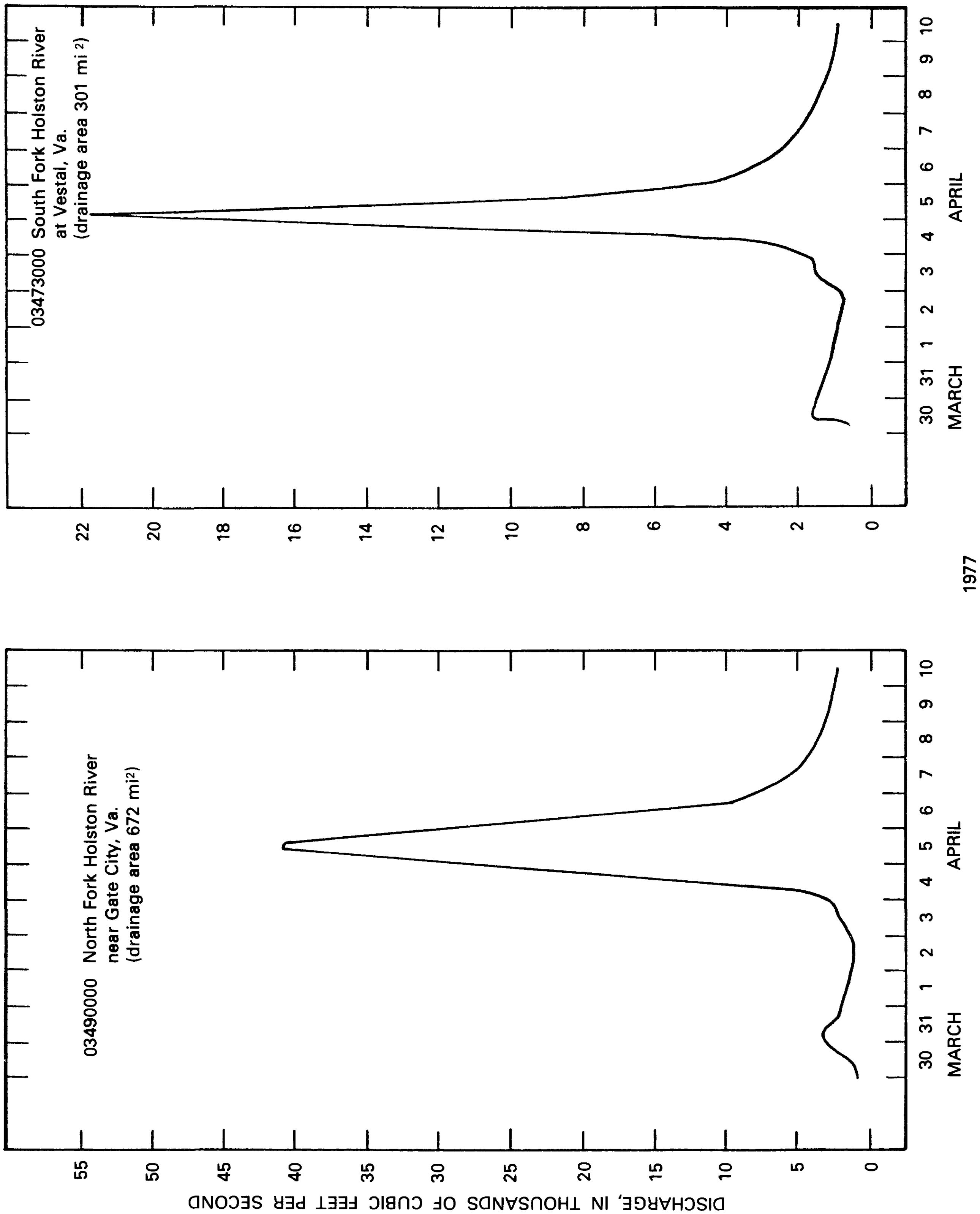


FIGURE 21.—Hydrographs showing rates of discharge of North Fork Holston River near Gate City, Va., and South Fork Holston River at Vestal, Va., March 30–April 10, 1977.

TABLE 9.—*Gage height, in feet, and discharge, in cubic feet per second, for the flood of April 1977 at gaging station 03475000 Middle Fork Holston River near Meadowview, Va.*

Date	Time	Gage height	Discharge
March 31	1200	3.20	472
	2400	3.05	410
April 1	1200	2.94	368
	2400	2.86	333
2	1200	2.81	314
	2400	2.81	314
3	1200	3.13	441
	2400	3.41	557
4	0300	3.75	725
	0600	4.77	1,310
	0900	6.74	2,790
	1200	8.85	5,090
	1500	11.10	8,720
	1700	12.25	10,900
	1800	12.40	11,200
	1900	12.40	11,200
	2000	12.40	11,200
	2100	12.35	11,100
	2300	11.85	10,100
	2400	11.56	9,540
5	0300	11.02	8,580
	0600	11.73	9,860
	0900	12.45	11,300
	1000	12.50	11,400
	1030	12.55	11,500
	1200	12.35	11,100
	1500	11.20	8,900
	1800	9.69	6,300
	2100	8.38	4,450
	2400	7.56	3,560
6	1200	5.81	2,050
	2400	5.07	1,500
7	1200	4.60	1,210
	2400	4.30	1,500
8	1200	4.07	895
	2400	3.85	776
9	1200	3.70	700
	2400	3.57	634
10	1200	3.46	580
	2400	3.39	547

TABLE 10.—*Gage height, in feet, and discharge, in cubic feet per second, for the flood of April 1977 at gaging station 03474000 Middle Fork Holston River at Seven Mile Ford, Va.*

Date	Time	Gage height	Discharge
March 31	1200	1.91	292
	2400	1.84	252
April 1	1200	1.79	227
	2400	1.75	208
2	1200	1.71	190
	2400	1.72	194
3	0500	1.94	311
	1200	2.08	407
	2400	2.11	429
4	0100	2.10	419
	0300	2.52	797
	0600	3.99	2,840
	1100	8.14	10,100
	1200	8.23	10,300
	1300	8.18	10,200
	1500	7.69	9,180
	1800	6.16	6,480
	2100	5.27	5,060
	2200	5.77	5,830
	2400	7.21	8,280
5	0100	7.83	9,470
	0300	8.45	10,800
	0400	8.55	11,000
	0500	8.45	10,800
	0600	8.23	10,300
	0900	6.54	7,110
	1200	5.13	4,850
	1800	3.88	2,610
	2400	3.35	1,690
6	1200	2.82	1,100
	2400	2.55	826
7	1200	2.39	671
	2400	2.29	579
8	1200	2.19	493
	2400	2.10	422
9	1200	2.04	378
	2400	1.98	337
10	1200	1.94	311
	2400	1.90	286

TABLE 11.—*Gage height, in feet, and discharge in cubic feet per second, for the flood of April 1977 at gaging station 03490000 North Fork Holston River near Gate City, Va.*

Date	Time	Gage height	Discharge
March 30	1200	3.27	1,190
	2400	4.85	2,770
31	0300	5.05	3,010
	0400	5.08	3,040
	0600	5.03	2,980
	2400	4.14	1,980
April 1	1200	3.81	1,660
	2400	3.59	1,460
2	1200	3.44	1,330
	2100	3.35	1,260
	2400	3.44	1,330
3	1200	3.99	1,830
	2400	4.41	2,260
4	0300	5.08	3,040
	0600	6.97	5,750
	0900	9.07	9,890
	1200	10.24	12,400
	1500	11.50	15,500
	1800	12.90	19,300
	2100	14.60	24,100
	2400	16.85	31,000
5	0300	18.13	35,200
	0600	18.81	35,200
	0900	19.12	38,600
	1200	19.47	39,800
	1430	19.65	40,500
	1500	19.51	40,000
	1800	18.86	37,700
	2100	17.77	34,000
	2400	16.72	30,600
6	0300	15.73	27,500
	0600	14.76	24,600
	0900	13.46	20,800
	1200	11.72	16,100
	1500	10.24	12,400
	1800	9.26	10,300
	2100	8.58	8,840
	2400	8.04	7,730
7	0600	7.24	6,210
	1200	6.72	5,320
	1800	6.29	4,640
	2400	5.95	4,160
8	1200	5.42	3,480
	2400	5.01	2,960
9	1200	4.66	2,540
	2400	4.40	2,250

TABLE 12.—*Gage height, in feet, and discharge, in cubic feet per second, for the flood of April 1977 at gaging station 03473000 South Fork Holston River at Vestal, Va.*

Date	Time	Gage height	Discharge
March 30	0300	3.51	434
	0900	3.85	582
	1200	4.59	985
	1500	5.40	1,500
	1600	5.46	1,540
	2400	5.34	1,450
31	1200	5.13	1,310
	2400	4.84	1,140
April 1	1200	4.63	1,010
	2400	4.43	893
2	1200	4.31	823
	2400	4.22	771
3	1200	5.35	1,460
	2400	5.46	1,540
4	0300	6.01	1,970
	0600	7.05	2,900
	0900	7.98	3,820
	1200	8.71	4,650
	1500	9.08	5,100
	1800	9.22	5,270
	2100	10.54	7,050
	2400	15.23	16,300
5	0300	17.01	21,700
	0600	16.06	18,700
	0900	15.10	16,000
	1200	13.56	12,300
	1500	11.91	9,180
	1800	10.73	7,320
	2100	9.74	5,950
	2400	9.07	5,080
6	1200	7.52	3,340
	2400	6.71	2,590
7	1200	6.15	2,090
	2400	5.77	1,780
8	1200	5.50	1,570
	2400	5.24	1,380
9	1200	5.07	1,270
	2400	4.88	1,160

WEST VIRGINIA

The storm of April 2–5, 1977, which precipitated from 4 to 10 in. of rainfall on the Tug Fork basin and upper Guyandotte River basin, caused severe flooding throughout southern West Virginia. Towns along Tug Fork were under 20 to 25 ft of water from Welch to Fort Gay. Some small communities were almost completely inundated. The U.S. Army Corps of Engineers estimated the flood damage at more than $50 million in the Tug Fork basin. Estimated flood damages in the Guyandotte River basin were in excess of $10 million, and damages in the Kanawaha River basin were estimated at about $2 million.

Peak flows on Tug Fork at Litwar, Williamson, and Kermit, W. Va., were the greatest of record. Estimated recurrence intervals were greater than 100 years. Flood photographs along Tug Fork are shown in figures 22 and 23. At Litwar, the discharge of 54,500 ft^3/s was the greatest since records began in 1930 and the peak stage, 27.37 ft, was 5.7 ft higher than previous maximum recorded in 1957. In April 1977, a maximum discharge of 94,000 ft^3/s occurred at Williamson. The peak stage of 52.56 ft was the highest recorded since 1926 and about 8 ft higher than that in 1963. The Williamson main business district is protected by floodwalls to about an elevation of 44 ft. At Kermit, the peak discharge on Tug Fork increased to 104,000 ft^3/s, the greatest since at least 1934. The peak stage there exceeded the 1963 maximum by more than 7 ft.

The rainfall distribution, shown in figures 9 and 10, resulted in high unit discharges over the middle

FIGURE 22.—View looking southwest, Tug Fork at Welch, W. Va., on April 4, 1977. (Courtesy Welch Daily News).

FIGURE 23.—Aerial view of flood looking northwestward, Tug Fork at Williamson, W. Va., on April 5, 1977 (Courtesy Charleston Daily Mail).

and upper reaches of the Tug Fork basin. Unit discharges at Tug Fork at Williamson, W. Va., and at Litwar, W. Va., were 101 and 109 $ft^3/s/mi^2$, respectively. The smaller unit discharge, 33.3 $ft^3/s/mi^2$ at the station farthest downstream (Tug Fork at Glenhayes) reflects the reduction in precipitation over the lower portion of the basin, plus the effects of channel and overbank storage in the lowermost 40 mi of river valley.

Record flooding also occurred in the upper Guyandotte River basin where the National Weather Service gage at Pineville, W. Va., read 17.76 ft, about 2.5 ft higher than the previous maximum recorded in 1963. At the U.S. Geological Survey gage near Baileysville, the recurrence interval of the peak discharge of 36,600 ft^3/s is estimated to be greater than 100 years. Lesser flooding occurred downstream due to the impoundment of flood water in the reservoir behind the almost completed R. D. Bailey Dam at Justice, W. Va. Along the Guyandotte River in West Virginia, the U.S. Army Corps of Engineers estimated that peak stages downstream from R. D. Bailey Dam would have been 4 to 10 ft higher without reservoir storage regulation. Flood damages were reduced by as much as 60 percent owing to the presence of the dam. The peak flow of Guyandotte River at Logan was 43,900 ft^3/s at a stage of 30.55 ft, about 4.4 ft lower than the record flood of March

TABLE 13.—*Gage height, in feet, and discharge, in cubic feet per second, for the flood of April 1977 at gaging station 03202400, Guyandotte River near Baileysville, W. Va.*

Date	Time	Gage height	Discharge
March 29 ------	1200	4.01	374
	2400	3.99	366
30 ------	1200	3.96	354
	2400	3.97	358
31 ------	1200	3.93	342
	2400	3.86	314
April 1 -------	1200	3.81	294
	2400	3.78	282
2 -------	1200	3.77	278
	2400	3.81	294
3 -------	1200	4.06	394
	2400	4.32	498
4 -------	0300	4.52	590
	0600	5.11	885
	0900	6.54	1,780
	1200	9.69	4,390
	1500	14.63	10,000
	1800	19.33	17,800
	2100	24.23	29,100
	2400	26.76	36,300
5 -------	0100	26.88	36,600
	0300	26.58	35,700
	0600	24.86	30,600
	0900	22.14	23,800
	1200	18.47	16,200
	1500	14.96	10,400
	1800	12.76	7,710
	2100	11.38	6,120
	2400	10.36	5,060
6 -------	0600	8.89	3,600
	1200	7.99	2,840
	2400	6.94	2,060
7 -------	1200	6.40	1,680
	2400	6.09	1,460
8 -------	1200	5.82	1,290
	2400	5.53	1,120
9 -------	1200	5.34	1,000
	2400	5.19	925

TABLE 14.—*Gage height, in feet, and discharge, in cubic feet per second, for the flood of April 1977 at gaging station 03214900, Tug Fork near Glenhayes, W. Va.*

Date	Time	Gage height	Discharge
March 29 ------	1200	5.46	1,600
	2400	5.39	1,560
30 ------	1200	5.28	1,500
	2400	5.18	1,450
31 ------	1200	5.14	1,430
	2400	5.06	1,380
April 1 -------	1200	4.96	1,330
	2400	4.82	1,250
2 -------	1200	4.70	1,190
	2400	4.64	1,150
3 -------	1200	4.70	1,190
	2400	4.84	1,260
4 -------	1200	5.27	1,500
	1500	6.34	2,090
	1800	9.11	3,450
	2100	15.69	6,080
	2400	20.73	8,170
5 -------	0300	24.02	9,920
	0600	27.05	12,600
	0900	30.01	22,500
	1200	32.74	29,100
	1500	35.13	32,700
	1800	37.02	36,000
	2100	38.44	38.900
	2400	39.71	41,400

TABLE 14.—*Gage height, in feet, and discharge, in cubic feet per second, for the flood of April 1977 at gaging station 03214900, Tug Fork near Glenhayes, W. Va.*—Continued

Date	Time	Gage height	Discharge
April 6 -------	0300	40.91	43,800
	0600	41.92	45,800
	0900	42.72	47,400
	1200	43.42	48,800
	1500	43.90	49,800
	1700	44.00	50,000
	1800	43.99	50,000
	2100	43.89	49,800
	2400	43.54	49,100
7 -------	0300	42.96	47,900
	0600	42.13	46,300
	0900	41.09	44,200
	1200	39.86	41,700
	1500	38.48	39,000
	1800	36.81	35,600
	2100	35.04	32,600
	2400	33.00	29,500
8 -------	0300	31.00	25,500
	0600	28.87	18,400
	0900	26.71	12,200
	1200	24.67	10,400
	1500	22.70	9,150
	1800	20.80	8,200
	2100	18.98	7,390
	2400	17.41	6,760
9 -------	0300	16.02	6,210
	0600	14.90	5,760
	0900	13.98	5,390
	1200	13.30	5,120
	1500	12.78	4,920
	1800	12.35	4,770
	2100	11.97	4,640
	2400	11.62	4,500

TABLE 15.—*Mean discharge and suspended-sediment discharge data in April 1977 for gaging station 03202400 at Guyandotte River near Baileysville, W. Va., and gaging station 03214900 at Tug Fork, Glenhayes, W. Va.*

Day in April	Gaging station 03202400		Gaging station 03214900	
	Mean discharge (ft^3/s)	Suspended sediment discharge (tons/day)	Mean discharge (ft^3/s)	Suspended sediment discharge (tons/day)
1	298	2.4	1,330	194
2	286	7.7	1,190	183
3	406	41	1,200	191
4	11,100	29,900	2,700	7,170
5	17.900	54,800	25,800	290,000
6	3,480	5,370	47,600	271,000
7	1,840	1,210	40,800	91,400
8	1,380	510	13,600	41,500
9	1,090	227	5,250	15,200
10	904	112	4,160	7,950
11	760	57	3,650	5,370
12	655	41	3,250	3,820
13	580	25	2,930	3,120
14	520	15	2,660	2,440
15	475	9.0	2,430	1,510

1963. On Guyandotte River at Branchland, the crest of 39.09 ft was about 5 ft lower than previous maximum in 1963, and peak flow was 36,500 ft^3/s.

Discharge hydrographs for Guyandotte River at Baileysville and Tug Fork at Glenhayes, W. Va., are shown in figure 24 and data are presented in tables 13 and 14. Mean daily discharge and suspended sediment discharge data are given in table 15.

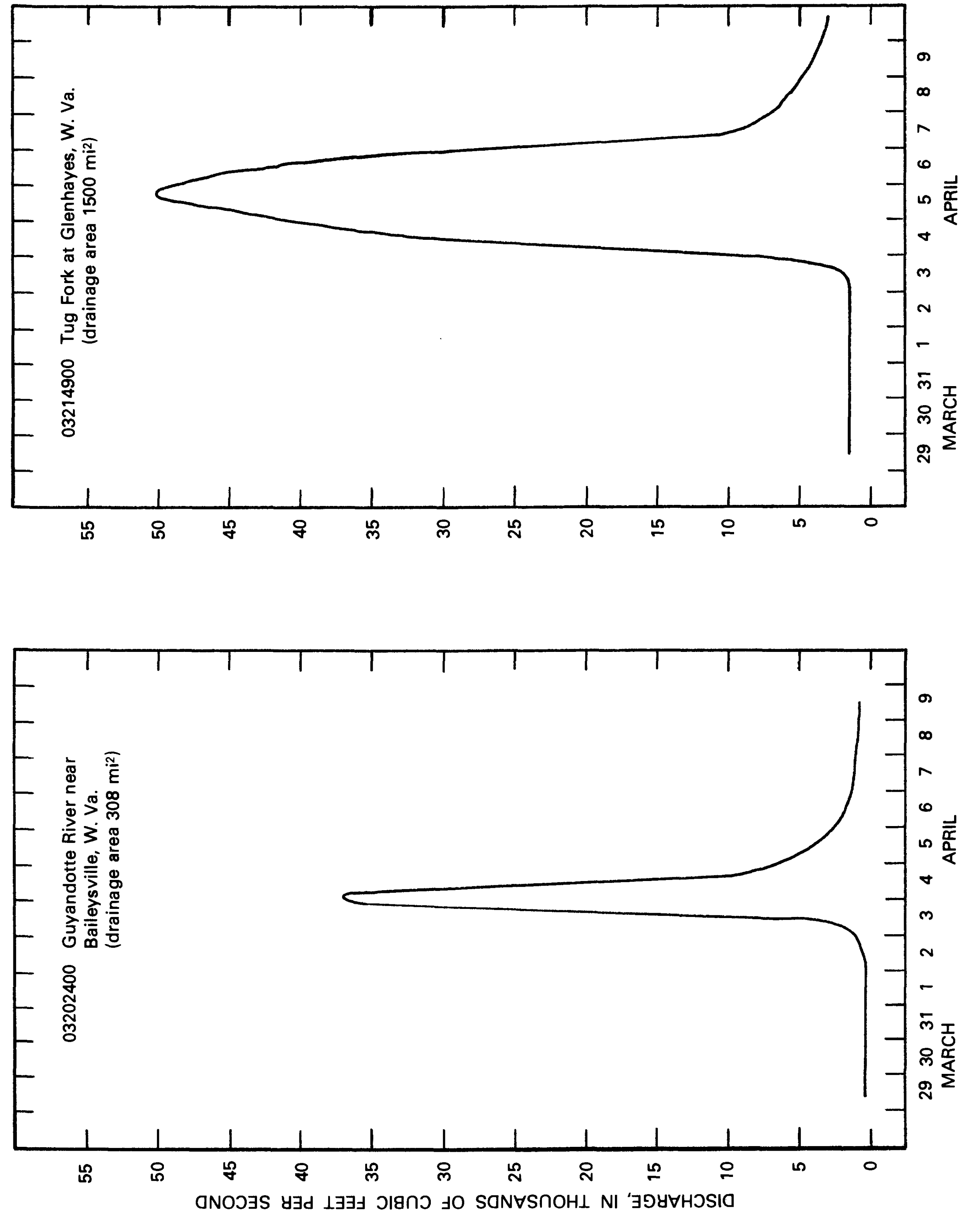


FIGURE 24.—Hydrographs showing rates of discharge of GuyandotteRiver near Baileysville, W. Va., and Tug Fork at Glenhayes, W. Va., March 29–April 9, 1977.

Floodmarks along the Tug Fork and Guyandotte River identified in the field during and immediately after the flood were referenced to National Geodetic Vertical datum. The elevations are listed in tables 16 and 17 and presented in figures 25 and 26. Selected water-surface elevations for the 1963 flood on the Guyandotte River are also listed in table 17.

TABLE 16.—*Flood-crest stages, Tug Fork basin, April 1977*

Location in West Virginia	Miles above mouth	April 1977 water surface elevation in feet, above mean sea level
Mouth of Tug Fork	0.0	559.3
0.5 mi above State Route 37 highway bridge at Fort Gay	0.7	565.4
3.7 mi above State Route 37 highway bridge at Fort Gay	3.9	573.7
1.3 mi below mouth of Rockcastle Creek on Tug Fork	9.1	578.5
Geological Survey gaging station at Glenhayes	10.0	580.6
0.6 mi below mouth of Horse Creek on Tug Fork	13.4	586.0
Mouth of Camp Creek on Tug Fork	17.9	595.2
0.1 mi below mouth of Bull Creek on Tug Fork	22.6	605.1
0.4 mi above mouth of Big Elk Creek on Tug Fork	25.6	611.5
0.2 mi below mouth of Silver Creek on Tug Fork	28.2	615.3
1.7 mi below toll bridge at Kermit	33.3	625.7
Toll bridge at Kermit	35.0	628.4
Geological Survey gaging station near Kermit	38.1	634.7
Mouth of Pigeon Creek on Tug Fork	41.4	640.9
1.9 mi above mouth of Pigeon Creek on Tug Fork	43.3	643.1
5.4 mi above mouth of Pigeon Creek on Tug Fork	46.8	652.4
0.5 mi above Norfolk and Western Railroad bridge at Nolan	48.9	657.0
2.1 mi above Norfolk and Western Railroad bridge at Nolan	50.5	659.3
Mouth of Buffalo Creek on Tug Fork	52.3	663.8
1.9 mi below U.S. Route 119 highway bridge at Williamson	54.9	669.7
Geological Survey gaging station at Williamson	56.5	673.5
2.0 mi above U.S. Route 119 highway bridge at Williamson	58.8	676.4
2.1 mi above U.S. Route 119 highway bridge at Williamson	58.9	677.3
1.4 mi above Norfolk and Western Railroad bridge near Matewan	70.2	708.0
1.7 mi below State Route 49 highway bridge at Edgarton	75.6	723.1
0.3 mi below State Route 49 highway bridge at Edgarton	77.0	729.0
2.2 mi above State Route 49 highway bridge at Edgarton	79.5	738.5
0.1 mi below mouth of Ben Creek on Tug Fork	93.4	827.5
0.3 mi below State Secondary Route 2 highway bridge at Mohawk	99.2	921.3
1.2 mi above State Secondary Route 2 highway bridge at Mohawk	100.7	933.2
State Secondary Route 1 highway bridge at Panther	102.2	943.8
3.8 mi above State Secondary Route 1 highway bridge at Panther	106.0	963.0
Geological Survey gaging station at Litwar	106.1	963.7
1.2 mi above State Secondary Route 1 highway brdge at Litwar	108.2	973.3
0.4 mi below U.S. Route 52 highway bridge at Iaeger	109.1	980.5
U.S. Route 52 highway bridge at Iaeger	109.5	981.1
2.4 mi above U.S. Route 52 highway bridge at Iaeger	111.9	988.3
4.3 mi above U.S. Route 52 highway bridge at Iaeger	113.8	1,020.3
6.2 mi above U.S. Route 52 highway bridge at Iaeger	115.7	1,053.0
7.1 mi above U.S. Route 52 highway bridge at Iaeger	116.6	1,058.3
1.4 mi below Norfolk and Western Railroad bridge at Roderfield	117.6	1,073.1
Norfolk and Western Railroad Bridge at Roderfield	119.0	1,095.4
1.2 mi below State Secondary Route 7 highway bridge at Davy	124.3	1,166.4
0.4 mi above State Secondary Route 7 highway bridge at Davy	125.8	1,184.4
1.3 mi above State Secondary Route 7 highway bridge at Davy	126.7	1,201.7
2.1 mi above State Secondary Route 7 highway bridge at Davy	127.5	1,216.3
2.7 mi above State Secondary Route 7 highway bridge at Davy	128.1	1,229.2
3.2 mi above State Secondary Route 7 highway bridge at Davy	128.6	1,236.5
Norfolk and Western Railroad bridge near Capels	129.3	1,250.1
1.1 mi above Norfolk and Western Railroad bridge near Capels	130.4	1,266.0
Norfolk and Western Railroad bridge at Hempill	131.5	1,282.2
Norfolk and Western Railroad bridge at Hempill	132.2	1,288.7
U.S. Route 52 highway bridge near Welch	134.1	1,309.8
0.9 mi above U.S. Route 52 highway bridge near Welch	135.0	1,318.4
2.9 mi above U.S. Route 52 highway bridge near Welch	137.0	1,354.0
3.6 mi above U.S. Route 52 highway bridge near Welch	137.7	1,367.2
5.6 mi above U.S. Route 52 highway bridge near Welch	139.7	1,400.8
0.1 mi below Norfolk and Western Railroad bridge at Thorpe	141.9	1,430.4
Norfolk and Western Railroad bridge near Thorpe	143.3	1,466.4

TABLE 17.—*Comparison of flood-crest stages, Guyandotte River basin, April 1977 and March 1963*

Location in West Virginia	Miles above mouth	April 1977 water surface elevation in feet, above mean sea level	March 1963 water surface elevation in feet, above mean sea level
Geological Survey gaging station at Branchland	34.9	587.0	591.7
Geological Survey gaging station at Midkiff	39.0	592.1	599.9
State Route 10 highway bridge at Pecks Mill	72.6	650.3	657.3
1.0 mi above State Route 10 highway bridge at Pecks Mill	73.6	651.5	----
0.2 mi below U.S. Route 119 highway bridge at Logan	79.1	667.0	670.7
Geological Survey gaging station at Logan	80.5	670.6	675.0
2.0 mi above U.S. Route 119 highway bridge at Logan	81.3	673.0	677.3
Mouth of Rum Creek on Guyandotte River	85.0	686.7	690.9
1.6 mi above State Secondary Route 4 highway bridge at Earling	90.9	717.6	721.6
Geological Survey gaging station at Man	92.8	730.6	735.7
Mouth of Huff Creek on Guyandotte River	93.6	736.5	----
2.0 mi below State Route 80 highway bridge at Verner	97.3	748.0	----
0.1 mi below State Route 80 highway bridge at Verner	99.2	759.0	768.3
1.1 mi above State Route 80 highway bridge at Verner	100.4	766.9	776.4
2.1 mi above State Route 80 highway bridge at Verner	101.4	771.9	780.9
State Route 80 highway bridge at Tomcliff	103.4	789.5	796.8
1.0 mi above State Route 80 highway bridge at Tomcliff	104.4	803.6	809.7
0.1 mi above U.S. Route 52 highway bridge at Gilbert	105.8	821.4	828.5
1.0 mi above U.S. Route 52 highway bridge at Gilbert	106.7	833.5	841.0
2.1 mi below U.S. Route 52 highway bridge at Justice	108.0	849.4	857.5
1.1 mi below U.S. Route 52 highway bridge at Justice	109.0	860.7	867.9
U.S. Route 52 highway bridge at Justice	110.1	880.3	887.3
0.3 mi above mouth of Clear Fork on Guyandotte River	122.2	1,119.4	----
2.3 mi above mouth of Clear Fork on Guyandotte River	124.2	1,136.3	----
3.7 mi above mouth of Clear Fork on Guyandotte River	125.6	1,139.4	----
0.7 mi below State Secondary Route 9 highway bridge at Baileysville	126.7	1,149.8	----
0.9 mi above State Secondary Route 9 highway bridge at Baileysville	128.3	1,158.2	----
1.6 mi above State Secondary Route 9 highway bridge at Baileysville	129.0	1,161.1	----
Geological Survey gaging station near Baileysville	130.5	1,166.9	----
7.8 mi above State Secondary Route 9 highway bridge at Baileysville	135.2	1,199.8	----
6.1 mi below State Route 16 highway bridge at Pineville	136.2	1,214.2	----
4.1 mi below State Route 16 highway bridge at Pineville	138.2	1,227.6	----
3.0 mi below State Route 16 highway bridge at Pineville	139.3	1,239.0	----
2.6 mi below State Route 16 highway bridge at Pineville	139.7	1,243.8	----
1.0 mi below State Route 16 highway bridge at Pineville	141.3	1,269.3	----
State Route 16 highway bridge at Pineville	142.3	1,286.8	1,285.5

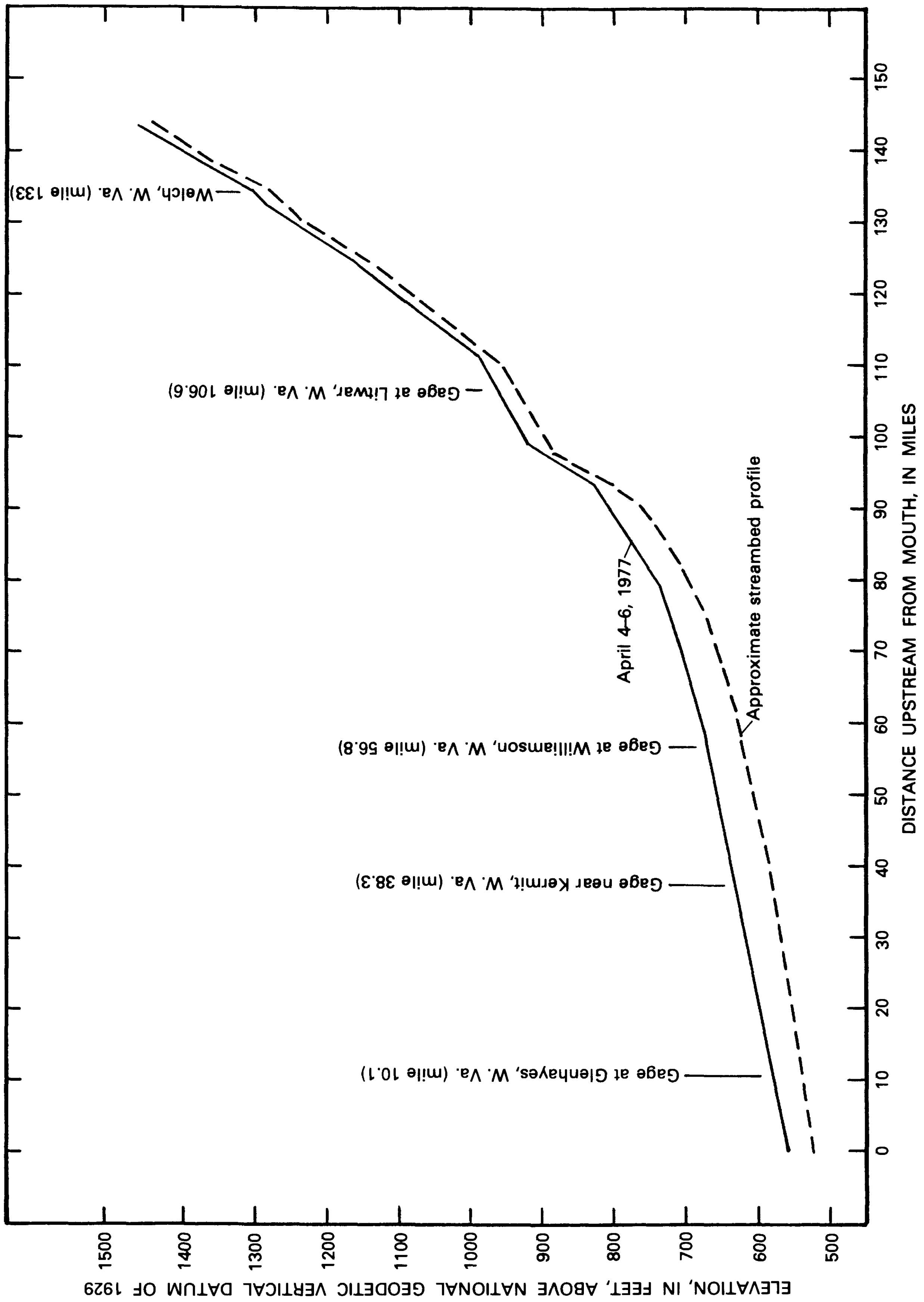


FIGURE 25.—Chart showing floodmark elevations of Tug Fork during the Appalachian flood of Aprill 1977.

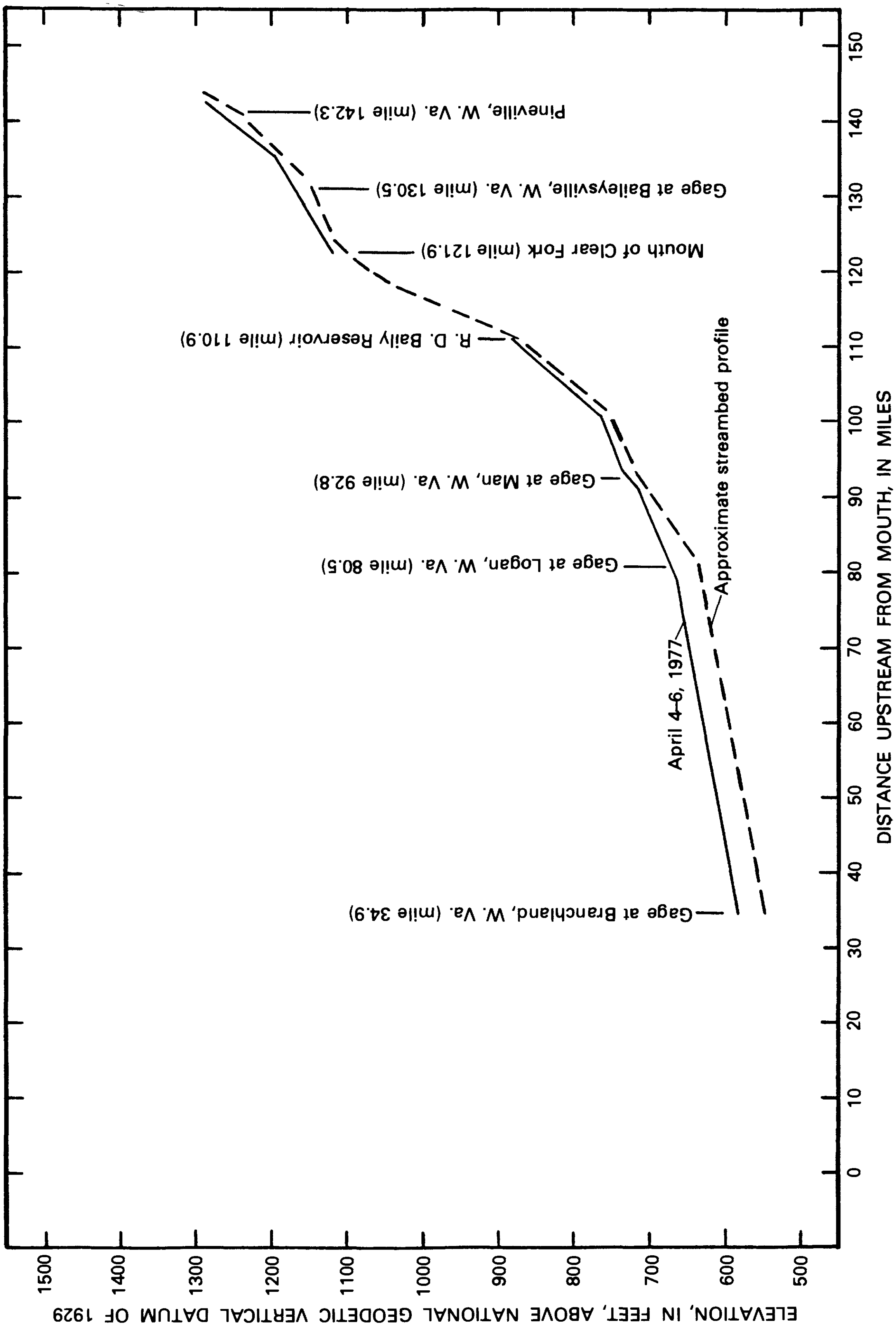


FIGURE 26.—Chart showing floodmark elevations for the Guyandotte River during the Appalachian flood of April 1977.

SUMMARY

Heavy rains on April 2–5, 1977, associated with warm front passage and warm sector convection, over the Appalachian region of Kentucky, Tennessee, Virginia, and West Virginia, resulted in severe flooding along upstream tributaries in the Ohio River basin. Maximum observed rainfall of 15.5 in. in about 30 h occurred at Jolo, W. Va. This is more than twice the amount expected for a storm with 100-year recurrence interval. Floods were the greatest of record along the upper Guyandotte River, Tug Fork and Levisa Fork in the Big Sandy River basin, Cumberland River, and Clinch River and Powell River in the Tennessee River basin. Table 18 gives a summary of flood stages and discharges in the 1977 Appalachian flood area. Recurrence intervals of peak discharges exceeded 100 years at 29 streamflow gaging stations shown in figure 27.

Flood control operations in reservoirs located on Levisa Creek and North Fork Pound River reportedly reduced the peak stage on Russell Fork at Elkhorn, Ky., 1.2 ft, and on Levisa Creek at Pikeville, Ky., 13 ft. Along the Guyandotte River in West Virginia, peak stages downstream from R. D. Bailey Dam reportedly would have been 4 to 10 ft higher without reservoir storage.

Maximum daily suspended-sediment discharges on Guyandotte River near Baileysville, W. Va., and on Tug Fork at Glenhayes, W. Va., were 54,800 tons/day and 290,000 tons/day respectively.

Flood damage was widespread and severe. Twenty-two lives were lost. Communities along Tug Fork between Welch and Fort Gay, W. Va., were inundated to depths of more than 20 ft. The towns of Matewan, Tacker, and Lobata, W. Va., were practically destroyed. Estimated property damages in the four States totaled more than $400 million.

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TABLE 18.—*Summary of flood stages and discharges*

Site No.	Permanent station No.	Stream and place of determination	Drainage area (mi²)	Datum of gage above NGVD (ft)	Period of flood record	Maximum previously known: Date	Maximum previously known: Gage height (ft)	Maximum previously known: Discharge (ft³/s)	Maximum during flood April 1977: Date in April	Maximum during flood April 1977: Gage height (ft)	Maximum during flood April 1977: Discharge (ft³/s)	Maximum during flood April 1977: Discharge (ft³/s/mi²)	Maximum during flood April 1977: Recurrence interval (years)
		Guyandotte River basin											
1	03202400	Guyandotte River near Baileysville, W. Va	308.0	1,140.00	1968–77	1–11–74	17.31	18,600	5	26.89	36,600	119.0	>100
2	03202480	Brier Creek at Fanrock, W. Va	7.2	[a]1,220	1969–77	8–18–72	6.62	806	4	[b]7.29	980	136	25
3	03202490	Indian Creek at Fanrock, W. Va	40.7	[a]1,210	1974–77	------	----	------	4	[b]18.67	6,300	155	[c]>100
4	03202750	Clear Fork at Clear Fork, W. Va	123	[a]1,160	1974–77	------	----	------	5	18.64	9,900	80.5	[c]30
5	03203000	Guyandotte River at Man, W. Va	762	710.88	1929–74	3–12–63	24.78	49,000	4	19.70	[d]33,000	43.3	---
6	03203600	Guyandotte River at Logan, W. Va	836	640	1960–77	3–12–63	34.98	55,000	5	30.55	[d]43,900	52.5	---
7	03203670	Whitman Creek at Whitman, W. Va	10.9	[a]760	1969–77	10–21–70	4.66	583	4	4.69	592	54.3	10
8	03204000	Guyandotte River at Branchland, W. Va	1,226	547.91	1915–22	[e]1907	[f]44	43,500					
		Do.			1928–77	3–13–63	43.83	44,500	6	39.09	[d]36,500	29.9	---
9	03204500	Mud River near Milton, W. Va	256	572.64	1938–77	2–27–62	28.60	15,100	5	23.18	7,940	31.0	5
		Big Sandy River basin											
10	03207400	Prater Creek at Vansant, Va	19.8	[a]1,180	1951–77	1–29–57	9.45	4,550	4	13.49	[f]8,000	404	>100
11	03207500	Levisa Fork near Grundy, Va	235	988.50	1942–77	1–29–57	19.06	33,200	4	24.77	52,000	221	>100
12	03207800	Levisa Fork at Big Rock, Va	297	866.37	1967–77	1–11–74	15.90	19,200	4	27.38	56,000	189	>100
13	03208500	Russell Fork at Haysi, Va	286	1,237.61	1926–77	1–29–57	23.17	46,600	4	28.24	59,000	206	>100
14	03208950	Cranes Nest River near Clintwood, Va	66.5	1,440.30	1963–77	3–07–67	19.86	7,120	4	26.09	18,000	271	>100
15	03209200	Russell Fork at Bartlick, Va	526	1,165	1962–77	3–12–63	24.83	47,000	4	27.55	[g]50,000	95.1	---
16	03209300	Russell Fork at Elkhorn City, Ky	554	773	1957–77	1–29–57	24.21	51,200	4	24.80	[g]54,200	97.8	---
17	03209440	Shelby Creek at Dorton, Ky	12.6	1,000.69	1971–77	5–17–75	[h]9.00	3,000	4	7.63	1,060	84.1	---
18	03209500	Levisa Fork at Pikeville, Ky	1,238	632.88	1937–77	1–30–57	52.72	85,500	5	51.46	[i]81,700	65.9	---
19	03209800	Levisa Fork at Prestonburg, Ky	1,702	588.12	1957	1–30–57	48.78	69,700					
		Do.			1963–77	3–08–67	40.02	44,000	5	[j]45.71	[i]45,500	26.7	---
20	03210000	Johns Creek near Meta, Ky	56.3	715.66	1941–77	3–12–63	[k]17.38	7,380	4	18.52	5,050	89.7	9
21	03212500	Levisa Fork at Paintsville, Ky	2,144	566.84	1928–77	1–31–57	45.92	69,700	6	42.19	[i]43,700	20.3	---
22	03213000	Tug Fork at Litwar, W. Va	502	936.36	1930–77	1–29–57	21.60	35,700	4	[b]27.37	54,500	109	>100
23	03213500	Panther Creek near Panther, W. Va	30.8	[a]1,050	1946–77	3–07–67	10.71	4,600	4	[b]12.10	6,600	214	> 50
24	03213500	Tug Fork at Williamson, W. Va	932	620.90	1967–77	1–12–74	37.37	29,200	5	[b]52.56	94,000	101	>100
25	03214000	Tug Fork at Kermit, W. Va	1,185	581.82	1934–77	3–13–63	45.65	69,600	6	[b]52.91	104,000	88	>100
26	03214900	Tug Fork at Glenhayes, W. Va	1,500	536.57	1976–77	------	----	------	6	43.95	49,900	33.3	[c]35
27	03215000	Big Sandy River at Louisa, Ky	3,893	512.81	1938–76	3–02–55	----	89,400	7	45.00	[i]84,200	21.6	---
		Licking River basin											
28	03248500	Licking River near Salyersville, Ky.	140	823.80	1938–77	2–03–39	25.4	14,300	5	20.90	4,860	35.6	3
		Kentucky River basin											
29	03277300	North Fork Kentucky River at Whitesburg, Ky	66.4	1,128.92	1957–77	1–29–57	14.7	7,730	4	11.01	4,610	69.4	11
		Cumberland River basin											
30	03400500	Poor Fork at Cumberland, Ky	82.3	1,410.15	1940–77	1–29–57	16.50	11,800	4	15.88	10,700	130	23
31	03400700	Clover Fork at Evarts, Ky	82.4	1,280.93	1959–77	3–12–63	12.37	14,100	4	14.87	18,100	220	31
32	03400800	Martins Fork near Smith, Ky	55.8	1,259.00	1968–77	12–30–69	[h]17.04	8,390	4	24.24	9,000	161	---
33	03400990	Clover Fork at Harlan, Ky	222	1,155.70	1977	------	----	------	4	29.4	44,000	198	---
34	03401000	Cumberland near Harlan, Ky	374	1,140.10	1940–77	12–31–69	24.90	43,200	5	30.26	64,500	172	>100
35	03401500	Yellow Creek Bypass at Middlesboro, Ky	35.3	1,136.76	1941–77	7–24–65	6.16	10,900	4	4.64	6,240	177	10
36	03402000	Yellow Creek near Middlesboro, Ky	60.6	1,097.99	1940–77	11–28–73	20.24	9,980	4	23.35	11,700	193	85
						1– 8–46	49.31	57,900					
37	03403000	Cumberland River near Pineville, Ky	809	955.10	1938–75	12–31–69	49.77	56,200	5	54.86	80,500	99.5	100
38	03403500	Cumberland River at Barbourville, Ky	960	942.97	1922–31								
		Do.			1948–77	11–29–73	42.65	49,500	6	45.91	56,100	58.4	33
39	03403910	Clear Fork at Saxton, Ky	331	921.83	1929	1929	41.7						
		Do.			1968–77	5–28–73	40.92	22,200	5	41.51	22,800	68.9	---

TABLE 18.—*Summary of flood stages and discharges*—Continued

Site No.	Permanent station No.	Stream and place of determination	Drainage area (mi^2)	Datum of gage above NGVD (ft)	Period of flood record	Maximum previously known: Date	Maximum previously known: Gage height (ft)	Maximum previously known: Discharge (ft^3/s)	Maximum during flood April 1977: Date in April	Maximum during flood April 1977: Gage height (ft)	Discharge (ft^3/s)	Discharge ($ft^3/s/mi^2$)	Recurrence interval (years)
		Cumberland River basin—Continued											
40	03404000	Cumberland River at Williamsburg, Ky	1,607	891.52	1950–77	1–31–57	33.78	49,700					
		Do.			1963–77	3–15–75	34.54	45,600	7	35.03	46,600	29.0	25
41	03404500	Cumberland River at Cumberland Falls, Ky.	1,977.00	825.49	1914–77	1–28–18	15.5	59,600	5	13.26	48,500	24.5	9
42	03404820	Laurel River at Municipal Dam near Corbin, Ky	140	1,000.00	1973–77	3–13–75	26.12	12,400	5	24.75	7,740	53.5	---
43	03406000	Wood Creek near London, Ky	3.89	1,123.50	1953–77	4–28–70	6.32	524	4	5.19	338	86.9	3
44	03408500	New River at New River, Tenn	382	1,092.43	1929	3–23–29	[h]41.2	74,700					
		Do.			1935–77	5–27–73	37.91	63,700	5	32.25	47,100	123	22
45	03409000	White Oak Creek at Sunbright, Tenn	13.5	1,294.05	1929	3–23–29	17.45	4,900	4	10.88	1,830	136	2
		Do.			1955–57	5–27–73	17.24	5,560					
46	03409500	Clear Fork near Robbins, Tenn	272	1,081.46	1929	3–23–29	[k]22.1	------					
		Do.			1931–71	2–03–39	[k]18.5	34,000					
		Do.			1973	5–27–73	18.92	35,700					
		Do.			1976–77	11–12–75	14.44	19,700	4	16.82	27,800	102	13
47	03410500	South Fork Cumberland River near Stearns, Ky	954	764.81	1929	1929	52.9						
					1942–77	5–28–73	45.31	93,200	5	40.52	75,900	79.6	12
48	03412500	Pitman Creek at Somerset, Ky	31.3	867.34	1953–77	2–27–62	9.95	3,460	4	6.11	1,670	53.4	2
49	03413200	Beaver Creek near Monticello, Ky	43.4	804.72	1968–77	3–13–75	7.60	6,850	4	8.04	8,160	188	---
50	03414000	Cumberland River near Rowena, Ky	5,700	540.81	1826	3–26–1826	69.5	62,000	9	22.77	[m]29,900	5.2	---
					1939–77	1–09–46	64.82						
51	03414500	East Fork Obey River near Jamestown, Tenn	196	680.30	1929	Mar. 1929	[n]30.7	44,800	4	23.06	24,700	126	7
					1943–77	5–27–73	6.23	1,170	4				
52	03415700	Big Eagle Creek near Livingston, Tenn	4.77	770	1955–77	2–27–62				5.84	1,110	233	6
53	03416000	Wolf River near Byrdstown, Tenn.	106	707.54	1929	Mar. 1929	10.8	22,600	4	10.08	18,100	171	13
					1943–77	1–29–57	10.84						
		Tennessee River basin											
54	03471500	South Fork Holston River near Chilhowie, Va	76.1	2,106.77	1920–31								
					1942–77	6–12–23	9.0	6,000	5	8.91	4,330	56.9	25
55	03473000	South Fork Holston River at Vestal, Va	301	1,792.30	1931–77	1–29–57	15.35	15,100	5	17.11	22,000	73.1	>100
56	03473500	Middle Fork Holston River at Groseclose, Va	7.39	2,442.86	1948–77	7–06–53	7.42	813	4	5.03	314	42.5	5
57	03473800	Staley Creek near Marion, Va	8.33	[a]2,330	1951–77	12–07–50	4.3	460	4	4.52	515	61.8	>100
58	03474000	Middle Fork Holston River at Seven Mile Ford, Va	132	1,960.00	1942–77	1–29–57	10.75	7,680	5	8.54	11,000	83.3	100
59	03475000	Middle Fork Holston River near Meadowview, Va	211.0	1,820.22	1931–77	1–29–57	11.8	10,000	5	12.56	11,500	54.5	>100
60	03488000	North Fork Holston River near Saltville, Va	222	1,703.53	1907–08								
					1920–77	1–29–57	13.20	16,500	5	12.98	14,900	67.1	30
61	03488500	North Fork Holston River at Holston, Va	402	1,437.11	1952–77	1–29–57	16.50	24,300	5	18.60	27,000	67.2	50
62	03489900	Big Moccasin Creek near Gate City, Va	79.6	1,267.64	1953–77	3–12–63	10.15	4,900	5	9.88	4,580	57.5	25
63	03490000	North Fork Holston River near Gate City, Va	672	1,197.56	1931–77	3–12–63	16.42	30,000	5	19.79	41,000	61.0	100
64	03490500	Holston River at Surgoinsville, Tenn	2,874	1,088.46	1941–77	2–18–44	17.48	59,600	5	15.98	[b]53,500	18.6	---
65	03491000	Big Creek near Rogersville, Tenn	47.3	1,128.90	1942–49								
					1955–77	3–12–63	9.40	5,760	5	9.25	5,600	118	48
66	03491200	Big Creek tributary near Rogersville, Tenn	2.0	[a]1,130	1955–57	4–27–70	7.78	810	4	6.45	265	132	3
						3–12–63	14.6	------					
67	03491300	Beech Creek at Kepler, Tenn	47.0	1,107.83	1963–77	3–30–75	13.38	3,480	5	12.43	2,860	60.9	---
68	03521500	Clinch River at Richlands, Va	139	1,924.08	1945–77	1–29–57	19.3	9,640	5	16.06	7,340	52.8	30
69	03523000	Cedar Creek near Lebanon, Va	51.3	1,928.96	1953–77	3–12–63	5.26	3,320	5	5.83	[f]4,000	78.0	>100

See footnotes at end of table (p. 42).

TABLE 18.—*Summary of flood stages and discharges*—Continued

No. Site	Permanent station No.	Stream and place of determination	Drainage area (mi²)	Datum of gage above NGVD (ft)	Period of flood record	Maximum previously known: Date	Maximum previously known: Gage height (ft)	Maximum previously known: Discharge (ft³/s)	Maximum during flood April 1977: Date in April	Maximum during flood April 1977: Gage height (ft)	Maximum during flood April 1977: Discharge (ft³/s)	Maximum during flood April 1977: Discharge (ft³/s/mi²)	Recurrence interval (years)
		Tennessee River basin—Continued											
70	03524000	Clinch River at Cleveland, Va	528	1,500.24	1920–77	1–30–57	24.40	31,000	5	26.40	34,500	65.3	>100
71	03524500	Guest River at Coeburn, Va	87.3	1,925.80	1950–77	3–12–63	15.87	7,720	5	20.95	18,000	206	>100
72	03525000	Stony Creek at Fort Blackmore, Va.	41.1	1,270.17	1950–77	3–12–63	8.46	10,100	5	8.29	9,520	232	40
73	03526000	Copper Creek near Gate City, Va	106	1,301.95	1948–77	3–30–75	13.17	7,040	5	13.57	7,660	72.3	35
74	03527000	Clinch River at Speers Ferry, Va	1,126	1,196.52	1920–77	3–12–63	29.93	46,800	5	36.69	89,000	79.0	>100
75	03528000	Clinch River above Tazewell, Tenn.	1,474	1,060.70	1862	Feb. 1862	24	66,000					
					1919–77	3–13–63	22.27	56,700	5	29.32	98,100	66.6	>100
76	03529500	Powell River at Big Stone Gap, Va.	112	1,459.07	1945–77	3–12–63	13.72	16,800	5	16.50	24,000	214	>100
77	03530000	South Fork Powell River at Big Stone Gap, Va	40	[a]1,470	1945–77	3–12–63	9.94	4,800	5	12.43	8,000	200	>100
78	03530500	North Fork Powell River at Pennington Gap, Va	70	[a]1,365	1945–77	3–12–63	13.65	13,100	5	16.14	17,000	243	>100
79	03531500	Powell River near Jonesville, Va	319	1,259.08	1931–77	3–12–63	33.36	31,100	5	44.32	57,000	179	>100
80	03532000	Powell River near Arthur, Tenn	685	1,043.84	1826	Mar. 1826	[q]29.5	34,000					
					1918–77	1– 9–46	29.2	33,000	6	38.96	59,500	86.9	>100
81	03534000	Coal Creek at Lake City, Tenn	24.5	842.91	1929	3–23–29	17.5	[q]8,400	--	----	-----	-----	---
					1933	12–30–69	----	6,120	--	----	-----	-----	---
					1955–77	11–27–73	8.70	------	5	10.57	8,100	331	>100
82	03534500	Buffalo Creek at Norris, Tenn	9.92	901.71	1955–77	2–16–64	10.07	1,460	5	10.07	1,460	147	20
83	03535000	Bullrun Creek near Halls Crossroads, Tenn	68.5	854.91	1958–77	3–16–73	11.78	12,500	4	13.28	18,300	267	>100
84	03535140	South Fork Beaver Creek at Harbison, Tenn	1.23	1,076.35	1967–77	4–12–72	5.26	514	4	2.39	81	65.9	[f]2
85	03535180	Willow Fork near Halls Crossroads, Tenn	3.23	1,027.82	1967–77	3–16–73	8.08	860	4	7.19	560	173	6
86	03538225	Poplar Creek near Oak Ridge, Tenn	82.5	743.50	1961–77	11–28–73	27.1	9,780	5	27.93	11,400	138	42
87	03538250	East Fork Poplar Creek near Oak Ridge, Tenn	19.5	754.16	1961–77	11–28–73	16.0	4,100	5	16.0	[f]4,000	205	50
88	03538275	Bear Creek near Oak Ridge, Tenn.	7.15	753.92	1960–77	11–28–73	8.15	------	5	7.25	760	106	10
89	03538500	Emory River near Wartburg, Tenn.	83.2	1,003.06	1929	3–23–29	[q]32	30,000					
					1935–77	3–03–39	25.62	18,700	4	22.05	13,200	159	10
90	03539800	Obed River near Lancing, Tenn	518	891.91	1929								
					1957–68	3–23–29	[q]33.9	------					
					1973–77	5–27–73	30.5	105,000	4	23.5	60,600	117	11
91	03540500	Emory River at Oakdale, Tenn	764	761.38	1857								
					1928–77	3–23–29	41.2	195,000	4	34.05	107,000	140	19
92	03541100	Bitter Creek near Camp Austin, Tenn	5.53	[a]870	1967–77	11–26–73	8.76	3,710	4	7.82	2,700	488	17

> Greater than
[a] Altitude from topographic map
[b] From floodmark
[c] Defined by regional flood-frequency relation
[d] Flow regulated by R. D. Bailey Lake
[e] Maximum flood known
[f] Approximately
[g] Flow regulated by North Fork Pound River Lake and John W. Flannagan Reservoir
[h] At different datum
[i] Flow regulated by Fishtrap Lake, North Fork Pound River Lake, John W. Flannagan Reservoir, and Dewey Lake
[j] Occurred April 6.
[k] Site and datum then in use
[m] Flow regulated by Lake Cumberland
[n] From information furnished by U.S. Army Corps of Engineers
[p] Flow regulated by reservoirs upstream
[q] From information furnished by Tennessee Valley Authority

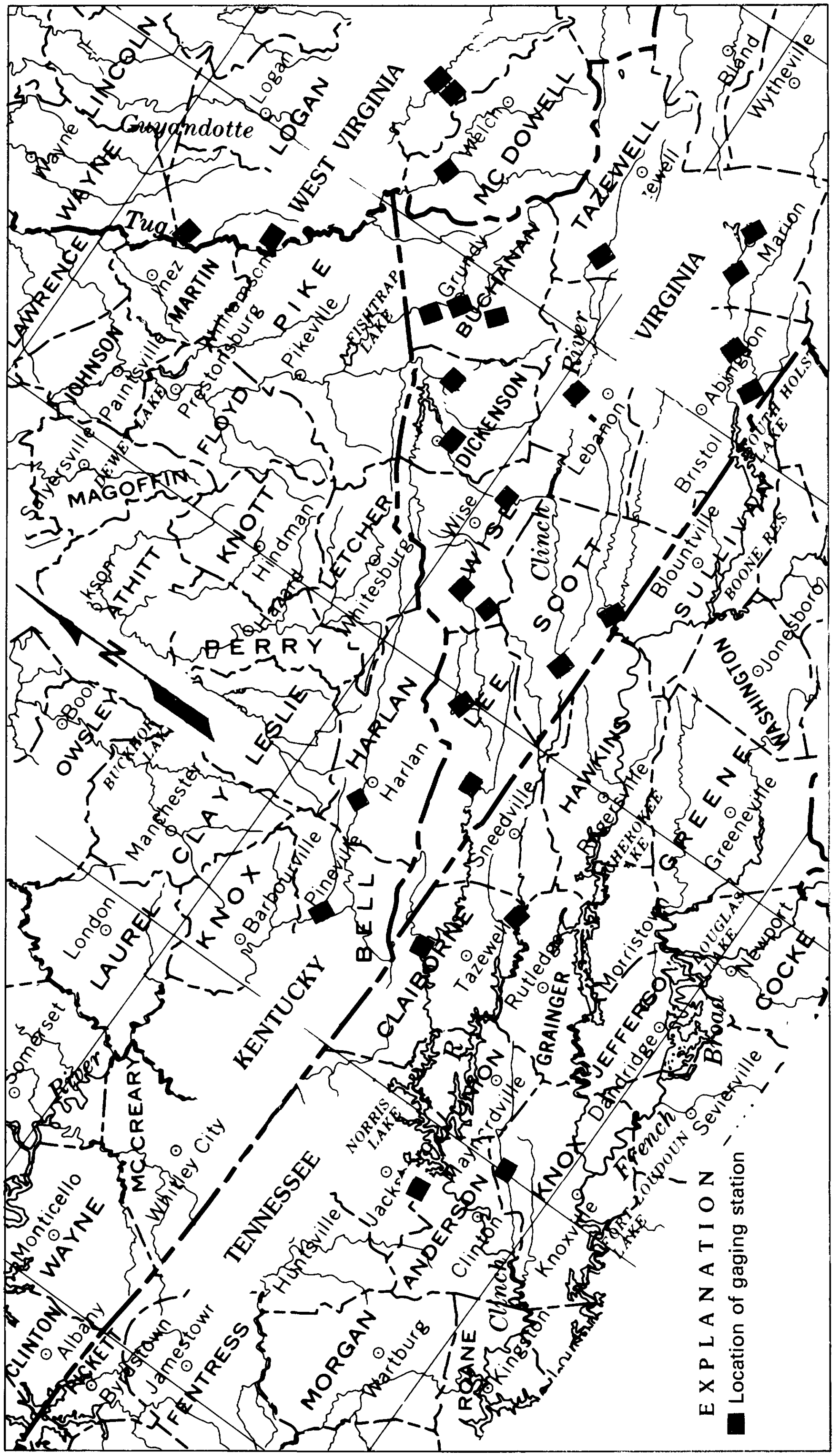

FIGURE 27.—Location of gaging stations where recurrence intervals of peak discharges during April 1977 flood equaled or exceeded 100 years.

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