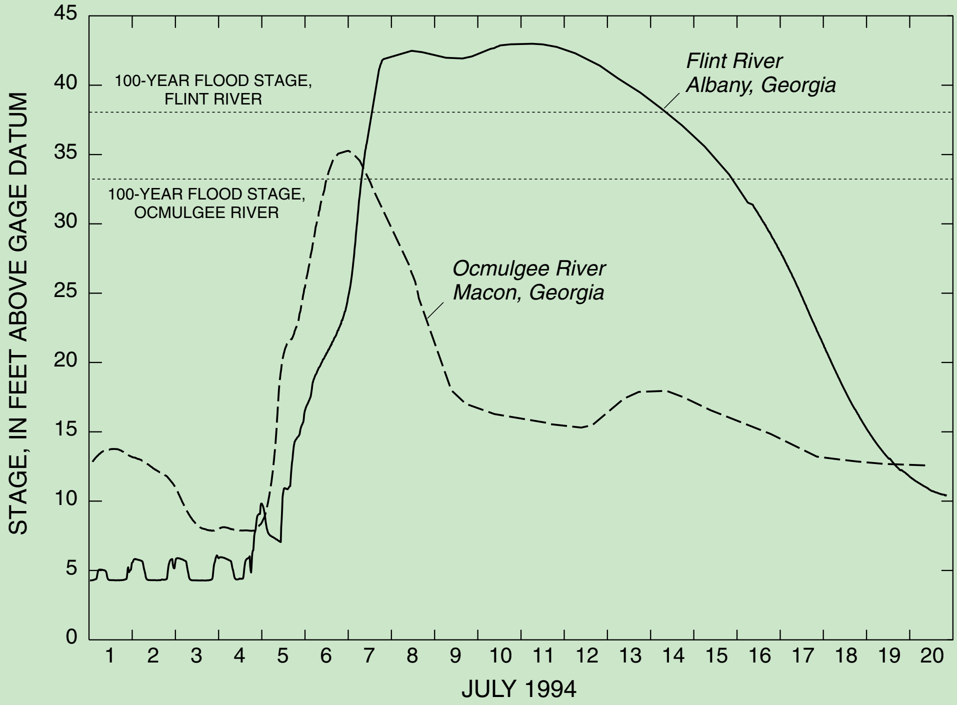
SUMMARY OF DATA-COLLECTION ACTIVITIES AND EFFECTS OF FLOODING FROM TROPICAL STORM ALBERTO IN PARTS OF GEORGIA, ALABAMA, AND FLORIDA, JULY 1994



U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the

GEORGIA DEPARTMENT OF TRANSPORTATION

Open-File Report 96-228

SUMMARY OF DATA COLLECTION ACTIVITIES AND EFFECTS OF FLOODING FROM TROPICAL STORM ALBERTO IN PARTS OF GEORGIA, ALABAMA, AND FLORIDA, JULY 1994

By Timothy C. Stamey

U.S. GEOLOGICAL SURVEY

Open-File Report 96-228

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GEORGIA DEPARTMENT OF TRANSPORTATION

Atlanta, Georgia
1996

U.S. DEPARTMENT OF THE INTERIOR

BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY

Gordon P. Eaton, Director

For additional information write to:

District Chief
U.S. Geological Survey
3039 Amwiler Road
Peachtree Business Center,
Suite 130
Atlanta, GA 30360

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CONVERSION FACTORS

Multiply	by	to obtain
Length		
inch (in.)	25.4	millimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
Volume		
square mile (mi^2)	2.590	square kilometer
cubic feet (ft^3)	0.02832	cubic meter
cubic feet per second (ft^3/s)	0.02832	cubic meter per second

ACRONYMS AND ABBREVIATIONS

Corps	U.S. Army Corps of Engineers
EPD	Environmental Protection Division
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
GDOT	Georgia Department of Transportation
NAWQA	National Water Quality Assessment
NWS	National Weather Service
USGS	U.S. Geological Survey

VERTICAL DATUM

Sea level: In this report, “sea level” refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)—a geodetic datum derived from a general adjustment of the first order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

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ABSTRACT

Parts of central and southwestern Georgia, southeastern Alabama, and the western panhandle of Florida were devastated by floods resulting from rainfall produced by Tropical Storm Alberto in July 1994. As tributary floodwaters combined and moved downstream in the Flint, Ocmulgee, and Choctawhatchee Rivers, peak discharges exceeded the 100-year flood discharges along most stream reaches. Along the Flint River, the 100-year flood stage was exceeded at Montezuma by 3.7 ft; at Albany, by 5.1 ft; at Newton, by 3.9 ft; and at Bainbridge by 2.2 ft. Along the Ocmulgee River, the 100-year flood was exceeded at Juliette, by 5.4 ft; at Macon, by 2.2 ft; and at Hawkinsville by 3.9 ft. Peak discharges exceeded the 100-year flood discharges along the Choctawhatchee River from Newton, Ala., to Bruce, Fla.

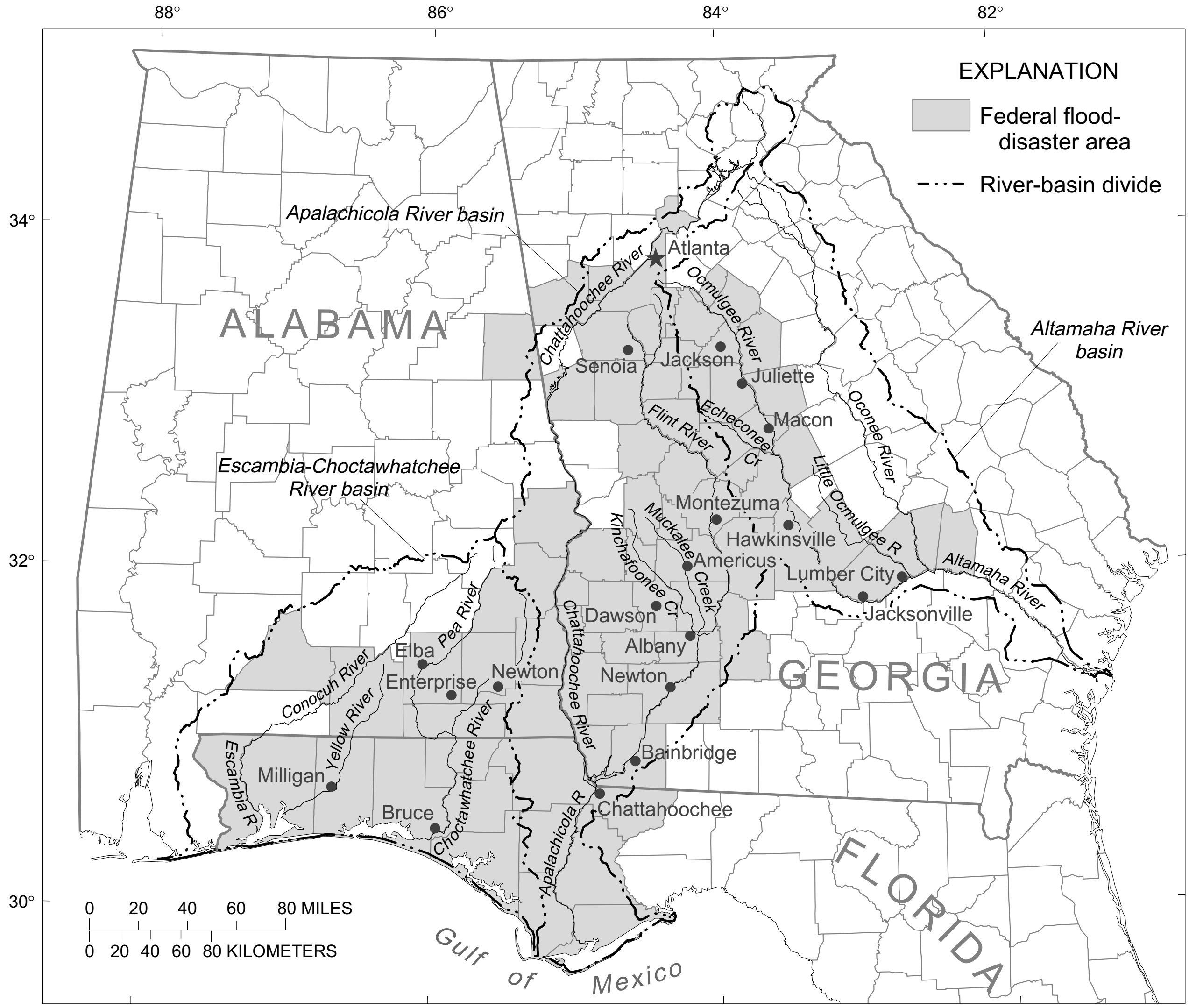
Discharge measurements were made at many gaging stations throughout the area of flooding. Streamflow velocities are obtained during the process of making the discharge measurement. Velocity data are given for selected gaging stations on two streams in Georgia. Scour around pier and abutment foundations caused settling or washout at most bridge failures. Scour mechanisms at these bridges include local scour, contraction scour, and scour plus bank instability of the general stream reach where the bridge is located. Eighteen feet of predominantly contraction scour was measured during the flood at the U.S. Highway 82 crossing of Flint River at Albany, Ga.

INTRODUCTION

Tropical Storm Alberto produced record-breaking floods that wreaked devastation in parts of central and southwestern Georgia, southeastern Alabama, and the western panhandle of Florida in July 1994. As a result of the severe flood damage, President Clinton declared 78 counties as Federal disaster areas: 55 in Georgia, 10 in Alabama, and 13 in Florida (fig. 1).

Whole communities were inundated by floodwaters as numerous streams reached peak stages and discharges far higher than previous floods in the Flint, Ocmulgee, and Choctawhatchee River basins. The flooding resulted in 33 fatalities in towns and small communities along or near the swollen streams (Federal Emergency Management Agency (FEMA), 1994 a, b, c,). The towns of Montezuma and Newton, Ga., were almost entirely encompassed by floodwaters from the Flint River. Several municipal-, industrial-, and private-water systems were inundated and rendered unusable for three or more weeks. In Macon, Ga., the municipal water-system operations were flooded, leaving about 150,000 people without a water supply for three weeks (Federal Emergency Management Agency, 1994a).

Travel and commerce were disrupted as railroad and highway bridges and culverts were overtopped and, in many cases, washed out. The Georgia Department of Transportation (GDOT) checked the structural stability of more than 2,100 bridges during the flood. About 1,000 highway bridges were closed during the flooding, 140 bridges remained closed for several weeks for



Base modified from U.S. Geological Survey digital files

Figure 1. Federal flood-disaster area and streams affected by severe flooding from Tropical Storm Alberto in Georgia, Alabama, and Florida.

extensive repairs, and 125 were closed for replacement. Parts of the main travel routes of Interstate Highways 75 and 16 near Macon, Ga., were closed for several days, and estimates of road and bridge damage in Georgia were in excess of 130 million dollars. This figure for highway damages does not include commercial losses associated with closed highways and lengthy detours. In comparison with 1994 highway damages in Georgia, the 1993 upper Midwest flood caused highway damages estimated at 178 million dollars, damaged over 2,500 bridges, and caused nearly 50 bridges to collapse (Georgia Department of Transportation, written commun., 1995).

Many of the fatalities associated with the Georgia flooding were related to incidents of vehicles being swept from flooded roadways. However, none of the fatalities occurred because of bridge failures; thus reflecting the extensive efforts of GDOT in bridge inspections and closures during the flood (Georgia Department of Transportation, written commun., 1995).

Numerous small earthen dams failed after being overtopped, particularly in an area near Americus, Ga., and water from small recreational lakes and farm ponds quickly flowed into local streams. Sinkholes formed in the Albany, Ga., area which is underlain by cavernous limestone formations. Many homes located on or near these sinkholes were destroyed or condemned for occupancy by local agencies.

Summer crops were severely damaged or destroyed by intense rainfall and floodwaters. Nearly 500,000 acres of cropland were impacted by the flood, resulting in estimated damages of about 100 million dollars (FEMA, 1994a, b, c).

About 18,000 homes were flooded and many were substantially damaged, and several were destroyed. Total flood damages to public and private property were estimated at over 1 billion dollars (FEMA, 1994a, b, c). The death and suffering caused by this storm serve to emphasize, once again, the high costs imposed upon life and property by flood disasters; and thus, the importance to prepare, monitor, and document such occurrences.

Purpose and Scope

This report provides specific flood documentation data for Tropical Storm Alberto in parts of Georgia, Florida, and Alabama. The report includes (1) rainfall data from Tropical Storm Alberto, (2) peak-stage and discharge data for selected gaging stations and miscellaneous sites, (3) recurrence intervals of peak discharges, (4) limited bridge-scour data, and (5) available water-quality information.

Acknowledgments

Rainfall data and rainfall distribution map were provided by the U.S. Department of Commerce, National Weather Service (NWS). The author thanks the personnel of the U.S. Army Corps of Engineers (Corps) for providing historical flood information at several sites. Alabama Department of Environmental Management, Alabama Department of Transportation, Georgia Department of Natural Resources, Georgia Department of Transportation, and Northwest Florida Water Management District provided funds through joint-funding agreements with the USGS for the long-term gaging station operations. The U.S. Army Corps of Engineers also provided funds for long-term gaging station operations.

TROPICAL STORM ALBERTO

Tropical Storm Alberto grew from a tropical depression which formed in the Gulf of Mexico on June 30, 1994. Alberto first came over land on the morning of July 3, near Fort Walton Beach, Fla., rapidly lost energy, and was downgraded to a tropical depression by mid-afternoon of that day. Alberto drifted northward and was centered near southwestern Atlanta early on July 5. The storm then changed course and moved in a southwesterly direction before dissipating about two days later. Slow movement of the storm and abundant tropical moisture combined to produce historic rainfalls (Curnutt and others, 1994).

Storm-rainfall totals of more than 13 inches (in.) commonly were recorded in the areas of the heaviest rainfall throughout central and southwestern Georgia, southeastern Alabama, and the western Florida panhandle (fig. 2). Precipitation data collected by the National Weather Service (NWS) for selected rainfall stations in the affected areas are shown in table 1 for the period July 3–7, 1994. The greatest total rainfall of 27.6 in. (July 3–7) and the greatest 24-hour total rainfall of 21.1 in. (24-hour period ending at 7 a.m. on July 6) were recorded in Americus, Ga. The 24-hour rainfall total was nearly 2.5 times greater than the area’s estimated 100-year recurrence interval for a 24-hour rainfall (U.S. Department of Commerce, 1961). The maximum 5-day total rainfall recorded in Alabama was 15.0 in., at Elba.

DATA COLLECTION

USGS personnel monitored and reported flood information to other Federal, State, and local agencies from the onset of the storm until floodwaters receded. Stage and discharge data were collected from many streams and reported to the U.S. Army Corps of Engineers, the National Weather Service, the Federal Emergency Management Agency, the Federal Highway Administration (FHWA), various State natural resource and transportation departments, electrical power companies, and numerous county and city officials. The information provided to these groups was essential to their work to minimize loss of life and property. Using flood data provided by USGS, the NWS provided updated flood warnings to the general public in flood-affected areas. Flooding was so severe and widespread that 18 USGS gaging stations in Georgia were severely damaged or destroyed, requiring much of the data to be collected manually and reported by cellular telephone. At the height of the flooding, about 50 USGS personnel were working in the field to collect and provide hydrologic information vital to protecting life and property.

Despite the extraordinary effort to collect and document onsite hydrologic and flood information as it occurred, it was impossible to visit every site where data were needed. In some instances, bridges and roadways were inundated and floodwaters were too dangerous to work from boats. In other cases, personnel could not travel to the point of interest until floodwaters receded. Therefore, immediately following the flood, field crews were dispatched to flag and document high-water marks along the Flint, Ocmulgee, and Choctawhatchee Rivers and many tributaries. This data collection and documentation served as a basis for determining flood-elevation profiles and indirect measurements of peak discharge at several key locations. By the end of September 1994, gaging stations damaged or destroyed by floodwaters at 18 sites were repaired or temporarily restored to operation.

Peak Stage

Peak-stage elevations were obtained at many ungaged points along streams by leveling to floodmarks identified during or immediately following the floods.

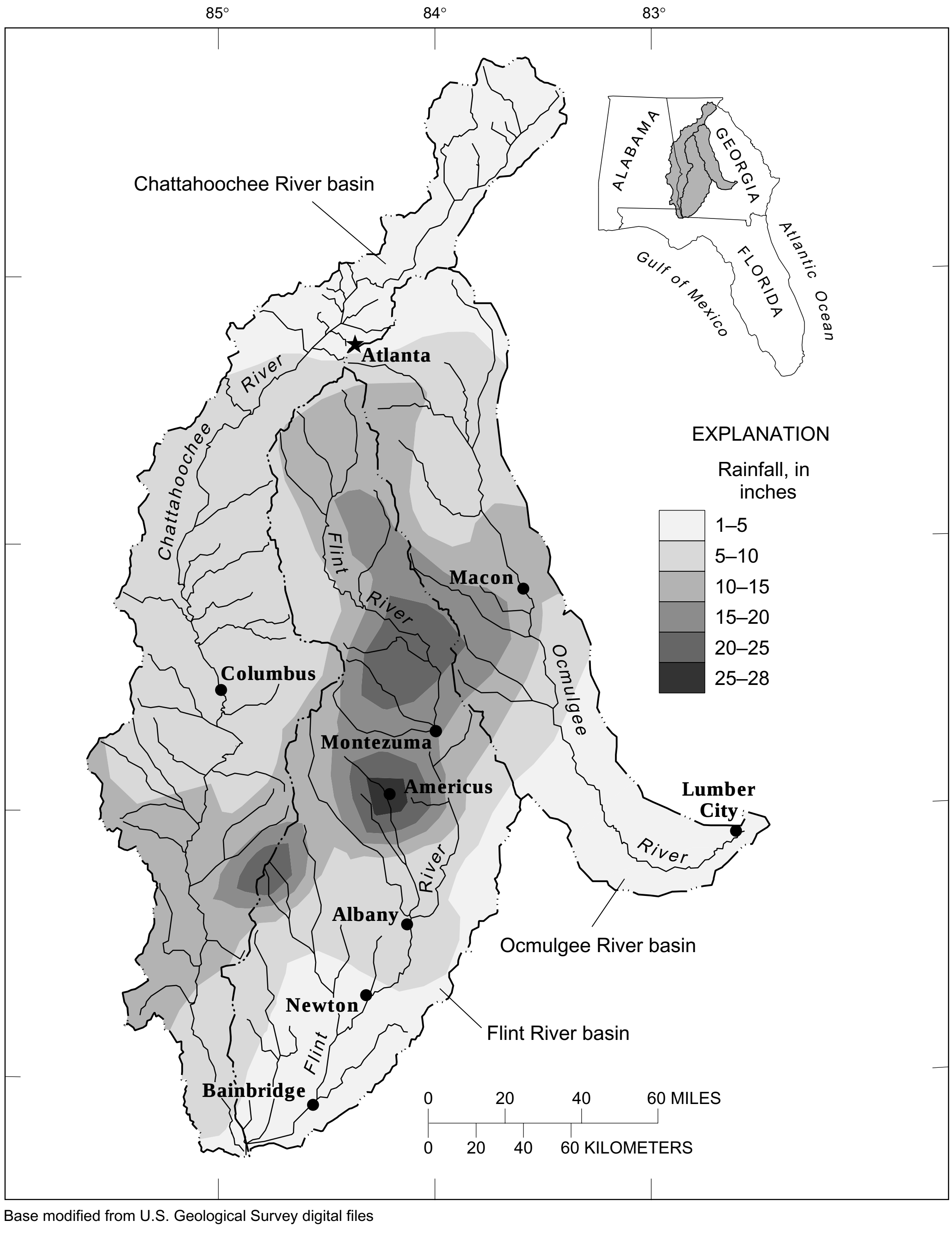


Figure 2. Rainfall amounts from Tropical Storm Alberto, July 3–7, 1994 (data from U.S. Department of Commerce, National Weather Service).

Table 1. Daily precipitation at selected observation sites in Georgia, Alabama, and Florida, July 3–7, 1994
[National Weather Service, written communication]

Station name	Precipitation for indicated day in July 1994 and period total, in inches					
	July 3	July 4	July 5	July 6	July 7	**Total**
Americus 3 SW, Ga.	0.00	2.58	3.13	21.10	0.80	**27.61**
Buena Vista, Ga.	0.12	2.99	4.73	5.47	0.34	**13.65**
Butler, Ga.	0.00	1.80	12.15	7.73	1.95	**23.63**
Byron Experiment Station, Ga.	0.00	0.95	3.46	12.14	0.06	**16.61**
Crestview, Fla.	0.22	4.78	0.01	0.66	6.46	**12.13**
Cuthbert, Ga.	0.35	8.74	7.45	7.00	0.33	**23.87**
Dothan, Ala.	0.00	2.82	0.33	5.47	4.91	**13.53**
Elba, Ala.	1.67	3.67	0.55	0.44	8.71	**15.04**
Griffin, Ga.	0.02	0.40	10.50	3.18	0.20	**14.30**
Geneva Experiment Station, Ala.	0.31	2.29	0.02	1.18	7.73	**11.53**
W.F. George Lock & Dam, Ga.	0.00	5.11	0.46	4.17	3.59	**13.33**
Headland, Ala.	0.07	3.32	0.89	9.08	1.38	**14.74**
Jonesboro, Ga.	0.00	0.72	9.07	3.87	0.13	**13.79**
Macon Weather Service Office, Ga.	0.15	0.65	2.44	9.73	0.00	**12.97**
Montezuma, Ga.	0.00	2.30	1.97	10.74	0.06	**15.07**
Ozark, Ala.	0.00	2.72	1.66	3.93	6.05	**14.36**
Plains, Ga.	1.64	3.50	7.19	12.69	0.06	**25.08**
Preston, Ga.	0.08	3.02	1.01	8.31	0.94	**13.36**
Thomaston, Ga.	0.53	1.56	6.36	5.98	0.14	**14.57**
Sanford, Ga.	0.19	4.91	0.63	4.82	0.78	**11.33**
Warner Robins, Ga.	0.40	0.67	8.62	0.96	0.22	**10.87**

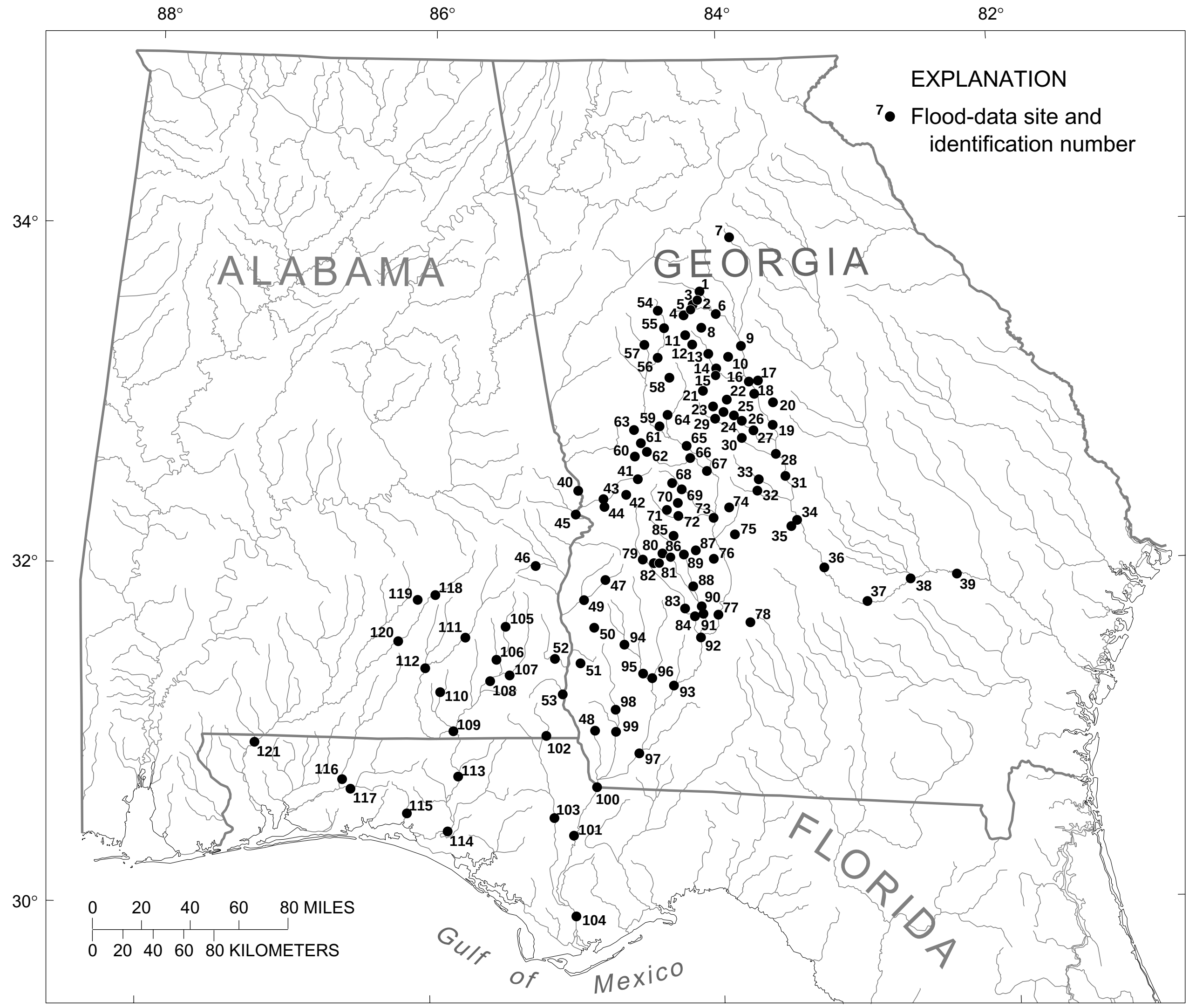
These flood-crest stages provide a means to determine the extent of overflows and are useful to planners and designers in floodplain land-use management.

Peak-stage determinations also were made at additional locations to supplement the flood data for gaging stations presented in table 2 (in back of report) and figure 3. During or immediately after the 1994 flood, peak stages were identified and marked along approximately 1,000 miles of rivers and streams in flood-affected areas. Peak-stage determinations were based primarily on high-water marks or other evidence of the highest stage reached by the flood (Benson and Dalrymple, 1967). Flood evidence, such as seed and mud lines, debris, and wash-lines, were identified as high-water marks and were later surveyed to a local datum at temporary reference marks on highway bridges or culverts. The temporary reference marks on the highway bridges or culverts allow the high-water marks to be tied to sea-level datum at a later date. Most high-water marks were flagged by USGS personnel, and high-water mark elevations were later surveyed in by a joint effort from personnel of the USGS, GDOT, and COE. High-water elevations are based on the average of two or more individual marks. Some peak-stage profile data for the Chattahoochee, Flint, Apalachicola, and Choctawhatchee Rivers are described in a report by the U.S. Army Corps of Engineers (1995).

Indirect Measurements

At many USGS gaging stations and other key locations in the flooded area, bridges and roadways were inundated and not accessible by personnel to obtain current-meter discharge measurements. After the floodwaters receded, 32 additional locations were selected where peak-stage and discharge data were needed to document the flood.

Following the procedures outlined by Benson and Dalrymple (1967), high-water marks were flagged and later surveyed along with pertinent stream-channel and floodplain cross sections; and bridge geometry was surveyed, where needed. Channel-roughness coefficients were selected and photographs were obtained.



Base modified from U.S. Geological Survey digital files

Figure 3. Data sites for the flood of July 4–16, 1994, in Georgia, Alabama, and Florida.

The surveyed field data were input into selected computational computer programs or used in specific computational procedures to determine peak discharges by indirect methods. Data from 32 indirect computations are integrated with the peak-discharge data obtained at other sites by direct methods (table 2). Peak-discharge indirect measurements were computed for 32 sites; 20 using contracted opening methods; 8 using culvert methods; 2 using slope-conveyance methods; and 2 using flow-over-dam computation methods.

Streamflow Velocity

Velocity changes in time and stage when a flood wave passes in streams are of great interest to hydrologists and engineers. Maximum streamflow velocities usually occur just before the peak discharge and stage. Generally, streamflow velocities are higher near the center and lower near the edges of a stream. Velocities also vary in the vertical water column and usually are higher near the surface and lower near the streambed. Most streamflow measurements made by USGS are obtained from bridges using velocity meters.

The velocity distribution is an integral part of a velocity-meter discharge measurement of flow. Discharge measurements at selected bridge sites were selected for analyses to determine velocity distributions. Velocity data obtained at many other sites during the flood are available and may be obtained from the U.S. Geological Survey offices in Atlanta, Ga., Montgomery, Ala., or Tallahassee, Fla.

Streamflow velocities measured at or near flood crests exceeded 12 feet per second at many sites. Velocity distributions in natural streams are spatially non-uniform, varying in vertical and horizontal directions. Velocities typically accelerate at bridge crossings because of floodway constriction. Velocity variations in the channel at a bridge crossing are caused by bridge and channel geometry, the magnitude of channel (or floodplain) contraction at the bridge, and the type and extent of vegetation near and in the contraction. Maximum velocities at bridge openings are typically 1.5 to 2 times the average streamflow velocity.

Measured maximum-flow velocity-distribution diagrams and channel-cross sections are shown for the Flint River at U.S. Highway 19 bypass bridge at Albany, Ga., and Ocmulgee River at Fifth Street bridge at Macon, Ga. (figs. 4, 5). Velocity diagrams for highly contracted bridges show higher velocities near the abutments than in mid-channels. Velocity distributions are not available for overtopped bridges because unsafe conditions prevented personnel from obtaining current-meter measurements.

Bridge Scour

Highway bridges are the infrastructure most frequently found in a river environment. Channel-bed scour around bridge foundations is the leading cause of bridge failure in the United States (Shirhole and Holt, 1991). The primary mechanism of bridge damage as a result of Tropical Storm Alberto was erosion and washout of the approach roadway and embankments. Of the approximately 1,000 bridges that were closed, about 360 bridges had damage to the approach roadway, but usually were repaired and quickly returned to service.

Scour around pier and abutment foundations caused settling or washout at most of the bridges requiring replacement. Scour mechanisms at these bridges include local scour, contraction scour, and scour plus bank instability of the general stream reach where the bridge is located. Contraction scour was probably the dominant failure mechanism, because of the flow magnitude being constricted through the bridge openings. A channel-cross section measured at the Flint River at U.S. Highway 82 at Albany, Ga. on July 16, 1994, indicated as much as 18 ft of scour when compared to a 1992 channel-cross section, and 6 ft of scour when compared to a January 1995 channel-cross section measurement. A channel-cross section measured on the Flint River at the Broad Street bridge at Albany, Ga., in July 1994, indicated as much as 17 ft of scour when compared to a 1993 channel-cross section, and about 5 ft of scour as compared to a January 1995 channel-cross section measurement (Georgia Department of Transportation and Federal Highways Administration, written commun., 1995).

The benefits of a scour-inspection program during floods is highlighted by the 1994 flood in Georgia. The magnitude of this flood confirms the use of the 500-year flood magnitude recommended by FHWA in evaluations of scour susceptibility. Analyses of scour data and bridge-failure mechanisms from this flood can assist in evaluating methods to more accurately predict bridge-scour depths for bridge design and evaluation.

Aerial Photography

Aerial photographs were taken at or near the crest of the flood on several streams in the affected areas. The photographs are useful in identifying inundated areas and analyzing hydraulic conditions. Unfortunately, heavy cloud cover obscured significant detail of many of the photographs. Aerial photographs of selected flooded areas were obtained by the Corps, GDOT, Georgia Department of Natural Resources, and Georgia Power Company.

HYDROLOGIC EFFECTS OF FLOODING

Stream flooding from Tropical Storm Alberto was as extreme as the rainfall that caused the flooding. The most significant flooding in Georgia occurred along the Flint and Ocmulgee Rivers and their tributaries (figs. 1, 3). Major flooding in Alabama primarily was in the Choctawhatchee River basin. Flooding in Florida principally was along the Apalachicola River and its tributaries.

Tributary Flooding

Damaging flash floods occurred in a region from the southern suburbs of Atlanta to Macon, Ga., on the night of July 4 and morning of July 5. The gaging station at Line Creek near Senoia, Ga., recorded a peak discharge of about 28,400 cubic feet per second (ft^3/s), which was about 2.4 times the 100-year flood discharge (Stamey and Hess, 1993). The maximum stage at the Senoia gaging station was about 5.2 feet higher than any other recorded flood stage during the 30-year period of record from 1964–94.

As the heaviest rains continued to move south, more destructive flash flooding occurred in the Americus, Ga., area on the evening of July 5 and morning of July 6. Muckalee Creek at Americus, Ga., peaked on July 6 at a discharge of about 33,500 ft^3/s (about 4.0 times greater than the 100-year flood discharge) that was likely affected by numerous local dam failures. On July 6, Echeconnee Creek near Macon, Ga., peaked at an estimated discharge of 64,700 ft^3/s, which is about 3.2 times the 100-year flood discharge.

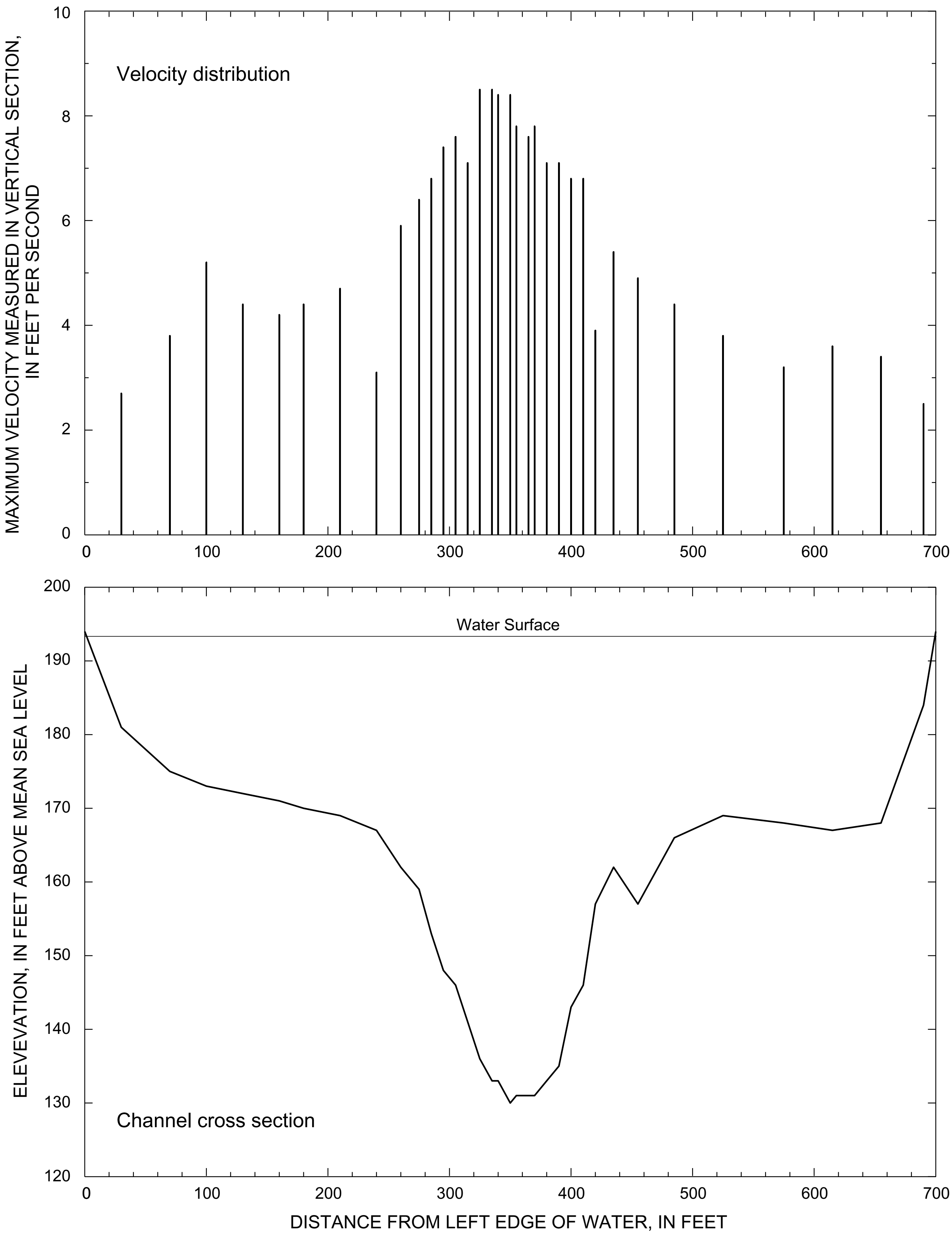


Figure 4. Velocity distribution and channel cross section of Flint River at U.S. Highway 19 Bypass bridge at Albany, Georgia, July 10, 1994.

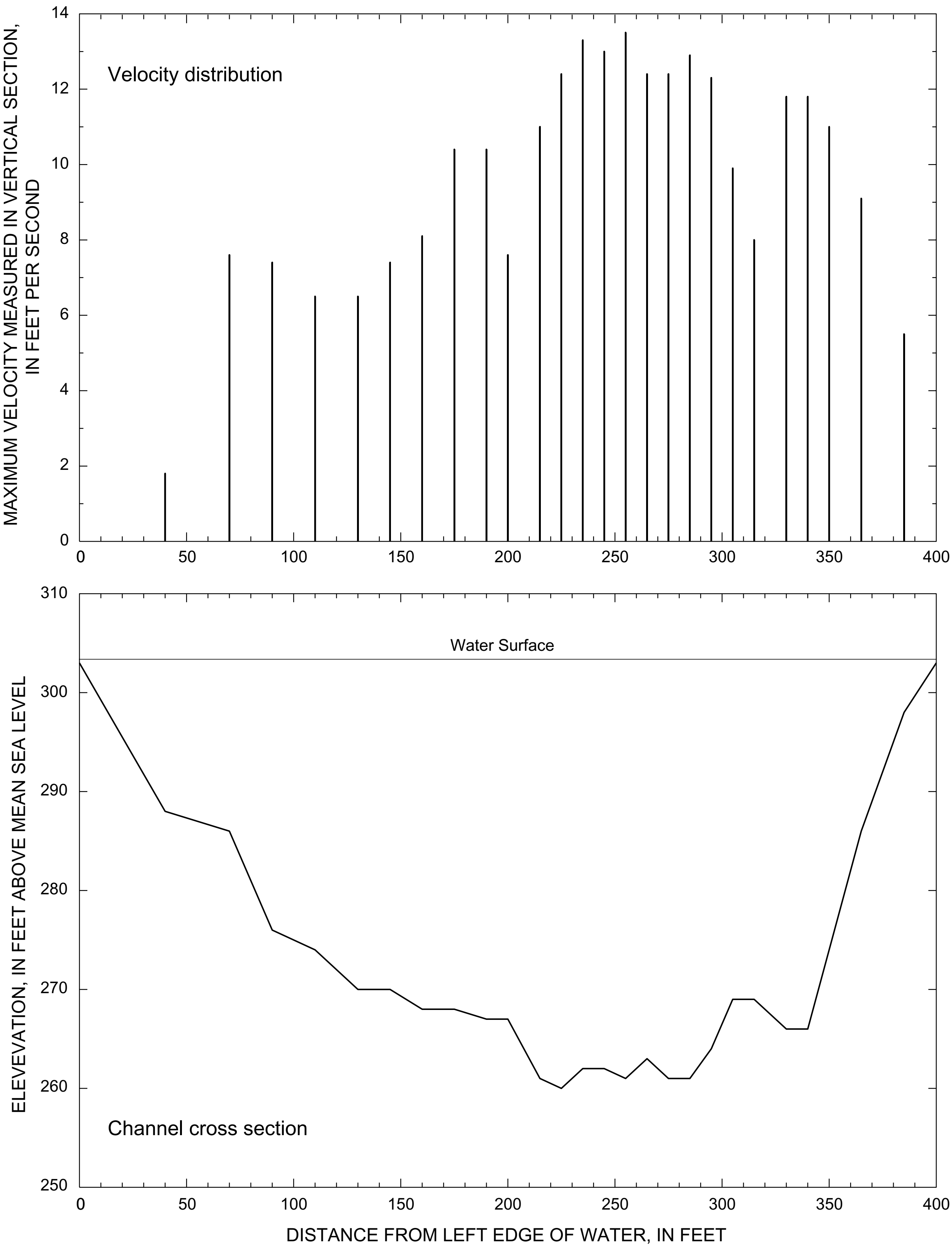


Figure 5. Velocity distribution and channel cross section of Ocmulgee River at Fifth Street bridge at Macon, Georgia, July 6, 1994.

Little Double Bridges Creek, near Enterprise, Ala., peaked on July 6 at a discharge of 15,000 ft^3/s, which is about 2.5 times the 100-year flood discharge (Olin, 1984). At the gaging station on the Kinchafoonee Creek near Dawson, Ga., a peak discharge of about 24,000 ft^3/s was recorded on July 7, which is about 1.4 times greater than the 100-year flood discharge. Floodwaters at this gaging station remained above the 100-year flood level for about 48 hours.

Mainstem Flooding

Tributary floodwaters combined and moved downstream in the Flint and Ocmulgee Rivers contributing to mainstem flooding in Georgia. Peak discharges greater than the 100-year flood discharge were recorded at all USGS Flint River gaging stations from about 20 mi south of Atlanta to Bainbridge, Ga. (fig. 1). At Montezuma, the Flint River peaked on July 8 at a stage about 6.7 ft higher than the 1929 flood, the largest previously recorded flood at this gaging station. At Albany, the Flint River peaked on July 11 at a stage of about 43 ft, about 5 ft higher than the 1925 flood, which was the previous maximum flood at this gaging station. The stage records for the Flint River at Albany showed that floodwaters exceeded the 100-year flood stage from about 1300 hours on July 7 to 0600 hours on July 14 (fig. 6). At Montezuma, the flood exceeded the estimated 100-year flood stage by 3.7 ft; at Albany, by 5.1 ft; at Newton, by 3.9 ft; and at Bainbridge, by 2.2 ft. Water-surface elevations for the 100-year flood and the July 1994 flood at selected sites on the mainstems of the Ocmulgee and Flint Rivers are shown on table 3. A summary of peak stages and discharges for 121 selected sites in the flooded areas are shown on table 2 (map numbers correspond to numbers on figure 3, showing the location of each site). Flood-discharge hydrographs for Flint River gaging stations at Montezuma, Albany, and Newton are shown in figure 7.

Peak discharges on the Ocmulgee River in Georgia exceeded the 100-year flood discharge at all USGS gaging stations from near Juliette, about 25 mi north of Macon, to Jacksonville. At Macon, the Ocmulgee River peaked on July 6 at a stage of about 35.4 ft, which was about 5.4 ft higher than the 1990 flood, and the highest recorded stage since 1887. The peak discharge of the Ocmulgee River at Macon was about 107,000 ft^3/s, exceeding the previous record high of 83,500 ft^3/s in 1948 by 23,500 ft^3/s. The stage hydrograph (fig. 8) for Ocmulgee River at Macon show that flood stages for the July 1994 flood exceeded the 100-year flood stage from about 1200 hours on July 6 to about 1200 hours on July 7. At U.S. Highway 341 at Hawkinsville, the Ocmulgee River peaked at a stage of about 40.9 ft, which is about 4.4 ft higher than the previous high of 1925 and probably was the highest since 1841. At Juliette, the 1994 flood exceeded the 100-year flood stage by 5.4 ft; at Macon, by 2.2 ft; and at Hawkinsville, by 3.9 ft. Flood-discharge hydrographs for gaging stations on the Ocmulgee River at Jackson, Macon, and Lumber City are shown in figure 9.

Peak discharges greater than those of the 100-year flood occurred on the Choctawhatchee River at Newton, Ala., on July 6 and all along the mainstem to Bruce, Fla., on July 11. Peak discharges equivalent to the 40-year flood (Bridges, 1982) occurred on the Apalachicola River at Chattahoochee, Fla., and the Yellow River at Milligan, Fla. The peak discharges on July 10 on the Apalachicola River, which is formed by the confluence of the Flint and Chattahoochee River at the Georgia-Florida State line, were caused principally by peak flooding on the Chattahoochee River on July 7–8. The lower Flint River peak flooding did not occur until July 14.

As shown in table 2, gaging stations at 58 locations had record peak discharges in July 1994. Record peak discharges were observed at 33 locations having long-term periods of record (40 or more years), and 66 locations had peak discharges with recurrence intervals equal to or greater than 100 years.

It is noted that the estimated 100-year flood discharges given herein are based on recent flood-frequency studies (Bridges, 1982; Olin, 1984; and Stamey and Hess, 1993). The estimated 100-year flood discharges do not include data from the July 1994 flood. However, stages given for these 100-year flood discharges are based on current stage-discharge relations that reflect changes in the these relations resulting from the July 1994 flood.

Other Flood Documentation

USGS personnel are conducting additional field- and office-work activities to further document information pertinent to the July 1994 flood. Hydrologic data collected and analyzed by the USGS are needed by agencies responsible for future land-use activities and minimizing potential flood damages. As in the past, flood-related data collected, analyzed, and documented by the USGS are made available to Federal, State, local agencies, and to the public. Curnutt and others (1994) presented stage hydrographs for selected USGS gaging stations in flooded areas on the Flint River. The U.S. Army Corps of Engineers (1995) presented stage hydrographs for selected USGS gaging stations and peak-stage profiles for selected streams in the Apalachicola, Chattahoochee, and Flint River Basins.

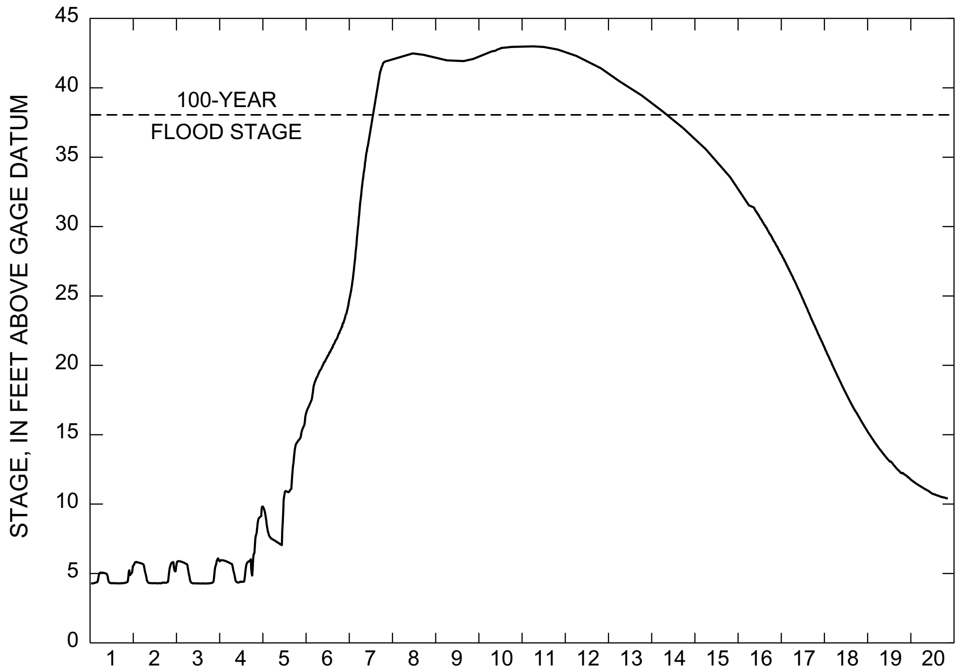


Figure 6. Stage hydrograph for Flint River at Albany, Georgia, July 1994.

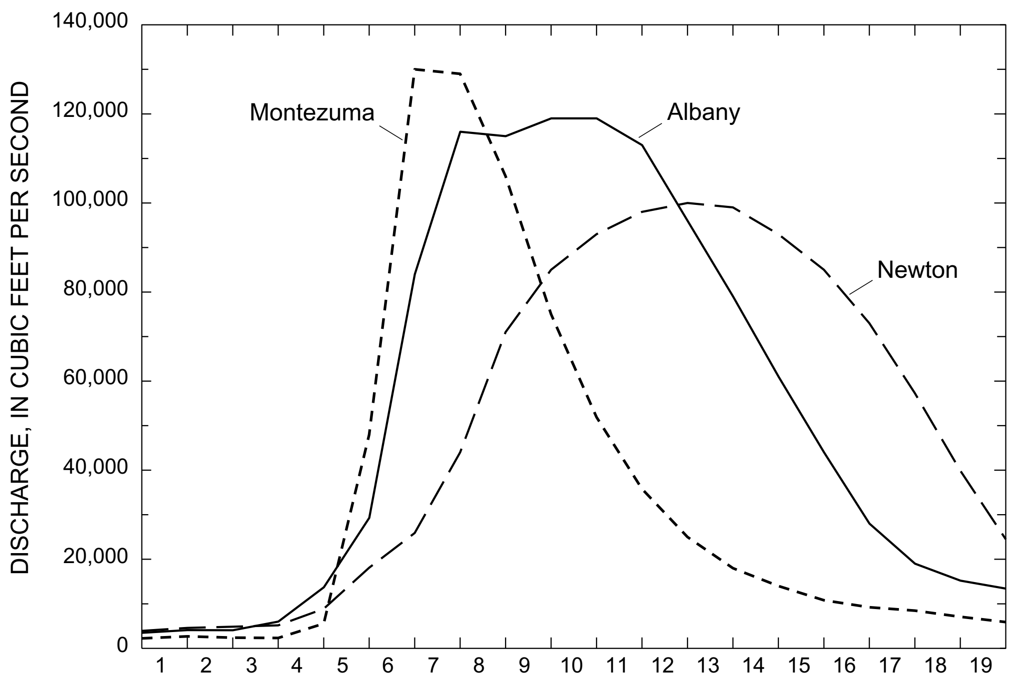


Figure 7. Daily-mean discharge hydrographs for gaging stations on the Flint River at Montezuma, Albany, and Newton, Georgia, July 1994.

Table 3. Water-surface elevations for the estimated 100-year flood and July 1994 flood, at selected locations on the mainstem of the Ocmulgee and Flint Rivers in Georgia

[sea level elevations determined from U. S. Geological Survey and Georgia Department of Transportation level runs; elevations without decimal may be accurate only to within one foot; NA, not available]

Station number	Stream Name and location	County	Estimated 100-year flood elevation[1/] (sea level)	July 1994 flood peak elevations (sea level)	Stream miles above mouth
02210500	Ocmulgee River at SR 16 near Jackson	Butts	445.0	446.2	241.0
02211205	Ocmulgee River at SR 83 at Berner	Monroe	394.4	399.6	227.8
02212495	Ocmulgee River (Memorial Bridge) at Juliette	Monroe	NA	NA	223.5
02212500	Ocmulgee River at Juliette	Monroe	377.0	382.4	222.5
02212735	Ocmulgee River at SR 18 at Dames Ferry	Monroe	356.5	359.4	214.9
02213000	Ocmulgee River at Fifth St. at Macon	Bibb	302.9	305.1	198.1
02214265	Ocmulgee River at US 96 near Bonaire	Houston	247	250.2	157.0
02215000	Ocmulgee River at US 341 at Hawkinsville	Pulaski	226.6	230.5	135.1
02215260	Ocmulgee River at US 280 at Abbeville	Wilcox	183	185.2	81.9
02215320	Ocmulgee River at US 441 near Jacksonville	Telfair	144	144.3	37.0
02215500	Ocmulgee River US 341 at Lumber City	Telfair	112.5	112.1	11.4
02344160	Flint River (Upper Riverdale Road) near Riverdale	Clayton	829	830.0	341.2
02344165	Flint River (Valley Hill Road) near Riverdale	Clayton	821	821.8	339.8
02344180	Flint River at SR 138 near Jonesboro	Clayton	817	818.0	338.1
02344190	Flint River at SR 54 near Fayetteville	Clayton	792	792.7	333.7
02344343	Flint River (McDonough Road) near Lovejoy	Clayton	788	789.1	330.6
02344350	Flint River at Hampton Road at Lovejoy	Clayton	781.2	782.3	325.7
02344380	Flint River at Hill Bridge Road near Inman	Fayette	766	767.5	322.3
02344396	Flint River (Woolsey Road) near Woolsey	Fayette	761	762.5	319.4
02344400	Flint River at SR 92 above Griffin	Fayette	748	749.0	313.2
02344435	Flint River (McIntosh Road) near Brooks	Fayette	738	740.9	308.3
02344500	Flint River at SR 16 near Griffin	Spalding	731.3	735.7	304.4
02344518	Flint River (Hollonville Road) near Hollonville	Pike	724	728.9	297.4
02344773	Flint River at SR 362 near Alvaton	Meriwether	720	724.9	295.3
02344870	Flint River at Flat Shoals Road near Concord	Pike	692	694.2	284.5
02345000	Flint River at SR 18 near Molena	Meriwether	675.3	676.4	278.0
02346180	Flint River at SR 36 near Thomaston	Talbot	511.8	511.8	258.5
02346250	Flint River at PoBiddy Road near Thomaston	Upson	421	423.7	252.5
02347500	Flint River at US 19 near Culloden	Taylor	376.5	380.3	238.4
02348060	Flint River at SR 128 near Roberta	Crawford	342	345.9	226.9
02348350	Flint River at SR 96 near Reynolds	Taylor	314	316.8	209.1
02348440	Flint River at SR 127 near Marshallville	Macon	301	305.1	196.1
02349500	Flint River at SR 49 at Montezuma	Macon	286.2	289.9	180.6
02350001	Flint River at SR 27 at Vienna	Sumter	248	250	154.1
02350170	Flint River at SR 280 at Cobb	Crisp	247	248.9	143.9
02350512	Flint River at SR 32 near Oakfield	Worth	221.4	226.0	120.8
02352495	Flint River at US 19 bypass at Albany	Dougherty	189.0	194.0	103.7
02352500	Flint River at Albany	Dougherty	188.0	193.1	103.1
02353000	Flint River at SR 37 at Newton	Baker	151.6	155.5	69.5
02356000	Flint River at US 27 Business at Bainbridge	Decatur	93.1	95.3	29.0

[1/] Flood-discharge data from Stamey and Hess (1993) were used to determine estimated 100-year flood elevations.

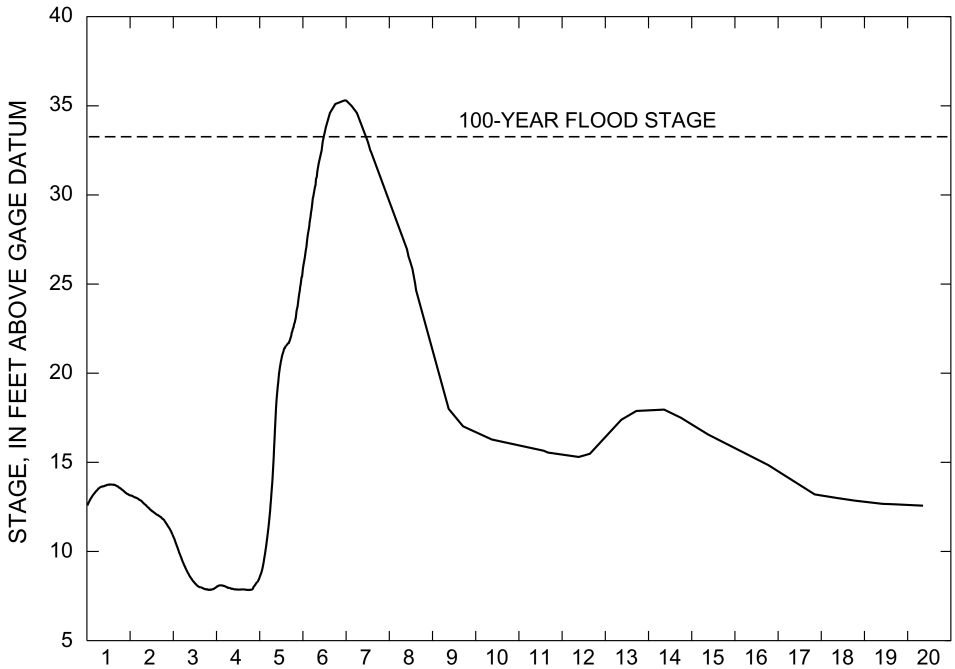


Figure 8. Stage hydrograph for Ocmulgee River at Macon, Georgia, July 1994.

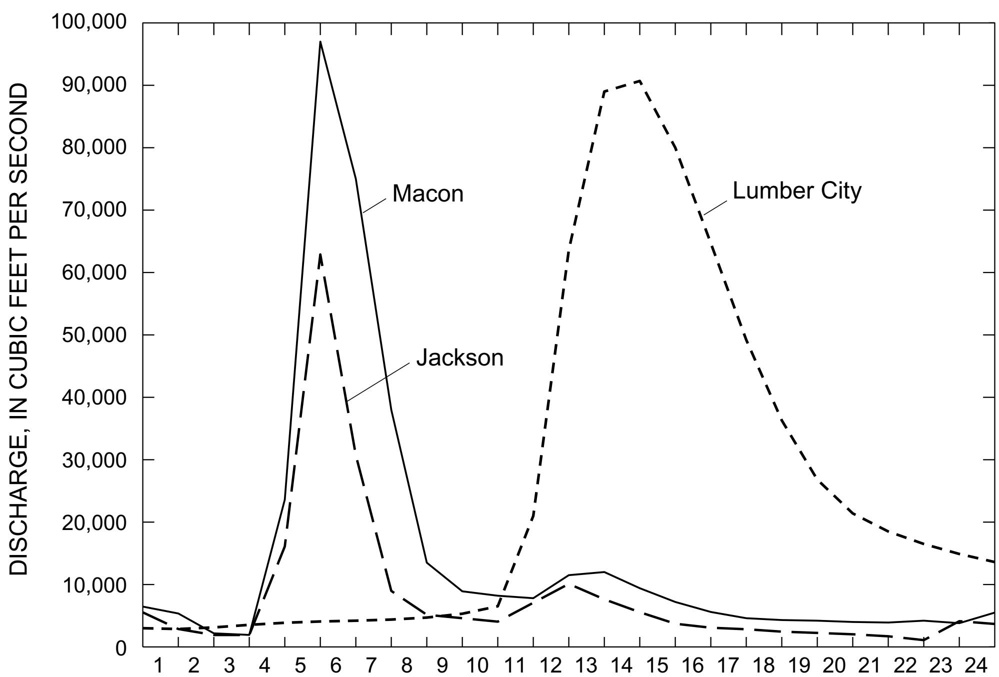


Figure 9. Daily-mean discharge hydrographs for gaging stations on the Ocmulgee River at Jackson, Macon, and Lumber City, Georgia, July 1994.

General Water-Quality Information

Hippe and others (1994), as part of the National Water-Quality Assessment Program (NAWQA), being conducted by the USGS, presented preliminary information on water quality in the Flint and Ocmulgee River basins during the July 1994 flood. The report compares the types and concentrations of selected pesticides in surface waters and presents preliminary information on the occurrence of nitrates and commonly used pesticides in shallow ground water. The abstract from that report follows:

> This report presents preliminary information on water quality in the Flint, Apalachicola, and Ocmulgee River basins during record flooding caused by tropical storm Alberto, July 1994. It also compares the types and concentrations of pesticides present in surface waters draining predominantly agricultural and urban watersheds, and presents preliminary information on the occurrence of nitrate and commonly used pesticides in the shallow ground water associated with agricultural land use in the southern Apalachicola-Chattahoochee-Flint (ACF) River basin.
>
> During the period July 3–7, 1994, tropical storm Alberto as much as 28 inches of rain fell onto parts of southwestern and central Georgia and southeastern Alabama causing record flooding on the Flint and Ocmulgee Rivers and several of their tributaries. Much of the topsoil eroded during intensive rainfall and flooding probably was redeposited in extensive floodplains within the river basins. The suspended sediment transported from the basins was comprised mostly of silt- and clay-sized material. Total nitrogen concentrations were lower, and total phosphorus concentrations were higher than median concentrations in samples collected prior to the flood. Much of the nitrogen load was in the form of organic nitrogen generally derived from organic detritus, rather than nitrate derived from other sources, such as fertilizer. Floodwaters transported a large part of the mean annual load of total phosphorus and organic nitrogen and a lessor part of the mean annual load of nitrite plus nitrate. Fourteen herbicides, five insecticides, and one fungicide commonly used in agricultural and urban areas were detected in floodwaters of the Flint, Apalachicola, and Ocmulgee Rivers. Concentrations of nitrate nitrogen and detected pesticides were below EPA standards and guidelines for drinking water. However, concentrations of the insecticides chlorpyrifos, carbaryl, and diazinon approached or exceeded guidelines for protection of aquatic life.
>
> Water-quality samples were collected at nearly weekly intervals from March 1993 through April 1994 from one urban and two agricultural watersheds in the ACF River basin, and the samples analyzed for 84 commonly used pesticides. More pesticides were detected and at generally higher concentrations in water from the urban watershed than the agricultural watersheds. A greater number of pesticides were detected throughout much of the year in the urban watershed than the agricultural watersheds. Median concentrations of all pesticides detected in water from each watershed were below EPA drinking-water standards and guidelines. However, median concentrations of the insecticides chlorpyrifos and diazinon exceeded guidelines for protection of aquatic life.
>
> Thirty-eight wells were installed in surficial aquifers adjacent to and downgradient of farm fields within agricultural areas of southwestern Georgia and adjacent areas of Alabama and Florida. Four reference wells were installed in forested areas to represent background water-quality conditions. The surficial aquifers were selected for sampling rather than deeper, regional aquifer systems because they are the uppermost water-bearing zones and are more susceptible to contamination. Even though regional aquifers are generally used for domestic- and public-water supplies, and for irrigation, degradation of water quality in the surficial aquifers serves as an early warning of potential contamination of regional aquifers. Nitrate concentrations were less than 3 mg/L as N (indicating minimal effect of human activities) in water from about two-thirds of the wells in agricultural areas. Water from the remaining agricultural wells had elevated nitrate concentrations in one or two samples, probably the result of human activity, and nitrate concentrations in two of these wells exceeded the EPA drinking-water standards. Water samples from eight agricultural wells had pesticide concentrations above method detection limits, but maximum concentrations were below EPA drinking-water standards or guidelines.

SUMMARY

Parts of central and southwestern Georgia, southeastern Alabama, and the western panhandle of Florida were devastated by floods resulting from rainfall produced by Tropical Storm Alberto in July 1994. President Clinton declared 78 counties as Federal disaster areas: 55 in Georgia, 10 in Alabama, and 13 in Florida.

Whole communities were inundated by floodwaters as streams reached peak stages and discharges far beyond previously known floods. The severe flooding resulted in 33 human deaths in towns and small communities along or near the flooding streams in Georgia and Alabama. Over 18,000 homes were flooded, many substantially damaged, and several were destroyed. Several municipal-, industrial-, and private-water systems were inundated and rendered unusable for three or more weeks.

Travel was disrupted as railroad and highway bridges and culverts were overtopped and, in many cases, washed out. About 1,000 bridges were closed during the flooding, and about 500 bridges remained closed for several days while temporary repairs were made. Parts of the main travel routes of Interstate Highways 75 and 16 near Macon, Ga., were closed for several days; estimates of road and bridge damage in Georgia were in excess of 130 million dollars. Total damages to public and private property were estimated at over 1 billion dollars.

As tributary floodwaters combined and moved downstream in the Flint, Ocmulgee, and Choctawhatchee Rivers, peak discharges exceeded the 100-year flood discharges along most stream reaches. Along the Flint River, the 100-year flood stage was exceeded at Montezuma by 3.7 ft; at Albany, by 5.1 ft; at Newton, by 3.9 ft; and at Bainbridge by 2.2 ft. Along the Ocmulgee River, the 100-year flood was exceeded at Juliette, by 5.4 ft; at Macon, by 2.2 ft; and at Hawkinsville by 3.9 ft. Peak discharges exceeded the 100-year flood discharges along the Choctawhatchee River from Newton, Ala., to Bruce, Fla.

Peak-stage elevations at numerous gaged and ungaged locations were obtained by leveling to floodmarks identified during or immediately following the flood. Peak data are presented at selected key locations for 32 indirect-discharge measurements where current-meter discharge measurements could not be obtained.

Discharge measurements were made at many gaging stations throughout the area of flooding. Streamflow velocities are obtained during the process of making the discharge measurement. Velocity data are given for selected gaging stations on two streams in Georgia.

Scour around pier and abutment foundations caused settling or washout at most bridge failures. Scour mechanisms at these bridges include local scour, contraction scour, and scour plus bank instability of the general stream reach where the bridge is located. Eighteen feet of predominantly contraction scour was measured during the flood at the U.S. Highway 82 crossing of Flint River at Albany, Ga.

U.S. Geological Survey (USGS) personnel monitored and reported flood information to other Federal, State, and local agencies from the onset of the storm until floodwaters receded. Stage and discharge data were collected from many streams and reported to the U.S. Army Corps of Engineers, the National Weather Service, the Federal Emergency Management Agency, the Federal Highway Administration, various State natural resource and highway departments, electrical power companies, and numerous county and city officials as these groups worked to minimize loss of life and property. Flooding was so severe and widespread that 18 USGS gaging stations in Georgia were severely damaged or destroyed, requiring much of the data to be collected manually and reported by cellular telephone. At the height of the flooding, about 50 USGS personnel were working in the field to collect and provide hydrologic information vital to protecting life and property.

The availability of information about the flood effects on stream- and ground-water quality is discussed. Preliminary results indicate that concentrations of the insecticides chlorpyrifos, carbaryl, and diazinon approached or exceeded guidelines for protection of aquatic life along reaches in the Flint, Ocmulgee, and Apalachicola Rivers.

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TABULAR DATA

Table 2. Peak stages and discharges at selected stream locations in Georgia, Alabama, and Florida, July 4–16, 1994

[mi^2, square miles; ft, feet above an arbitrary datum; ft^3/s, cubic feet per second; —, not determined or not applicable; <, less than; >, greater than; number in ( ) is the ratio of the peak discharge to the 100-year flood discharge; number in [ ] is the year the maximum stage occurred, if different than maximum year shown.
Source: Recurrence intervals calculated from U.S. Geological Survey data through 1990 water year; other data from U.S. Geological Survey reports or data bases]

Map number (fig. 3)	Station number	Stream and place of determination	Drainage area (mi^2)	Period of record	Maximum prior to July 1994			Maximum in July 1994			
					Year	Peak stage (ft)	Peak discharge (ft^3/s)	July (day)	Peak stage (ft)	Peak discharge (ft^3/s)	Discharge recurrence interval (years)
		OCMULGEE RIVER BASIN									
1	02204070	South River at Klondike Road, Ga.	182	1961,1963, 1983-94	1961	—	17,000	5	10.61	7,110	Urban
2	02204135	Camp Creek tributary near Stockbridge, Ga.	0.28	1977-94	1992	8.51	169	5	9.02	““/190	10
3	02204230	Big Cotton Indian Creek near Stockbridge, Ga.	46.4	1994	—	—	—	5	25.36	8,580	100
4	02204285	Pates Creek near Flippen, Ga.	11.9	1978-84, 1990, 1994	1990	8.82	837	5	16.20	[1/]4,400	>100 (1.2)
5	02204300	Little Cotton Indian Creek near Stockbridge, Ga.	50.0	1951-71, 1994	1961	12.37	3,640	5	18.84	[1/]8,600	100
6	02204500	South River near McDonough, Ga.	456	1940-82, 1994	1946	24.70	34,500	6	28.7	[1/]41,000	>100 (1.1)
7	02207500	Yellow River near Covington, Ga.	378	1936, 1945-65, 1976-94	1936	29.90	30,000	6	13.46	4,530	<2
8	02209610	Tussahaw Creek near McDonough, Ga.	3.90	1994	—	—	—	5	9.71	1,550	50
9	02210500	Ocmulgee River near Jackson, Ga.	1,420	1912, 1920, 1940-1965, 1976-82, 1988-94	1919	26.80	69,000	6	26.87	68,500	Regulated
10	02211157	Big Sandy Creek at Indian Springs State Park, Ga.	19.6	1994	—	—	—	5	8.2	4,770	100
11	02211258	Towaliga River near Hampton, Ga.	10.9	1994	—	—	—	5	23.60	2,960	70
12	02211262	Towaliga River near Towaliga, Ga.	33.0	1994	—	—	—	5	19.80	8,100	>100 (1.2)
13	02211300	Towaliga River near Jackson, Ga.	105	1961-83, 1990, 1994	1990	19.05	9,300	5	26.5	[1/]20,000	>100 (1.9)
14	02211450	Towaliga River at High Falls, Ga.	206	1994	—	—	—	5	15.11	42,000	>100 (2.1)
15	02211485	Little Towaliga Creek (Interstate 75) near High Falls, Ga.	[2/]56	1994	—	—	—	5	33.35	27,400	>100 (3.0)
16	02212500	Ocmulgee River at Juliette, Ga.	1,960	1886, 1916-21, 1949, 1975-88, 1990, 1994	1948	33.10	78,000	6	41.45	[1/]100,000	>100 (1.2)
17	02212600	Falling Creek near Juliette, Ga.	72.2	1965-94	1971	23.00	7,700	5	23.25	[1/]7,920	25
18	02212770	Rum Creek near Dames Ferry, Ga.	[2/]37	1994	—	—	—	5	20.07	5,020	25
19	02213000	Ocmulgee River at Macon, Ga.	2,240	1887, 1893-1994	1948	29.90	83,500	6	35.4	[1/]107,000	>100 (1.2)
20	02213050	Walnut Creek near Gray, Ga.	29.0	1962-94	1964	23.80	15,500	6	14.82	7,100	25
21	02213280	Tobesofkee Creek near Barnesville, Ga.	5.48	1994	—	—	—	5	9.80	1,200	25
22	02213350	Tobesofkee Creek below Forsyth, Ga.	53.4	1963-87, 1990, 1994	1971	10.10	9,160	6	11.99	[1/]13,000	>100 (1.4)

Table 2: Peak stages and discharges at selected stream locations in Georgia, Alabama, and Florida, July 4–16, 1994 (Continued)
[mi^2, square miles; ft, feet above an arbitrary datum; ft^3/s, cubic feet per second; —, not determined or not applicable; <, less than; >, greater than; number in ( ) is the ratio of the peak discharge to the 100-year flood discharge; number in [ ] is the year the maximum stage occurred, if different than maximum year shown.
Source: Recurrence intervals calculated from U.S. Geological Survey data through 1990 water year; other data from U.S. Geological Survey reports or data bases]

					Maximum prior to July 1994			Maximum in July 1994			
Map number (fig. 3)	Station number	Stream and place of determination	Drainage area (mi^2)	Period of record	Year	Peak stage (ft)	Peak discharge (ft^3/s)	July (day)	Peak stage (ft)	Peak discharge (ft^3/s)	Discharge recurrence interval (years)
		OCMULGEE RIVER BASIN—Continued									
23	02213400	Little Tobesofkee Creek near Forsyth, Ga.	16.8	1951-61, 1990, 1994	1953	10.67	4,040	6	11.00	[1]4,900	20
24	02213420	Little Tobesofkee Creek near Russellville, Ga.	30.5	1994	—	—	—	6	472.5	8,900	>100 (1.4)
25	02213450	Little Tobesofkee Creek near Bolingbroke, Ga.	56.2	1994	—	—	—	6	22.14	16,500	>100 (1.8)
26	02213470	Tobesofkee Creek above Macon, Ga.	156	1967-78, 1990, 1994	1990	14.78	9,620	6	26.0	30,000	>100 (1.9)
27	02213500	Tobesofkee Creek near Macon, Ga.	182	1929, 1938-94	1929	25.40	12,700	6	39.5	[3]54,000	>100 (3.5)
28	02213700	Ocmulgee River near Warner Robins, Ga.	2,690	1973-94	1990	15.85	81,000	8	21.75	[1]105,000	>100 (1.2)
29	02213880	Echeconee Creek (State Route 74) near Culloden, Ga.	27.9	1994	—	—	—	6	471.0	12,300	>100 (2.1)
30	02214000	Echeconee Creek near Macon, Ga.	147	1938-43, 1951-78, 1990, 1994	1964	15.84	18,500	6	20.00	[1]64,700	>100 (3.2)
31	02214265	Ocmulgee River near Bonaire, Ga.	3,350	1925, 1949, 1979, 1994	1925	—	77,000	8	27.58	[1]106,000	>100 (1.2)
32	02214500	Big Indian Creek at Perry, Ga.	108	1944-77, 1981, 1994	1966	11.52	4,820	6	21.0	[1,4]25,000	>100 (4.2)
33	02214820	Mossy Creek near Perry, Ga.	92.9	1979-94	1981	8.27	788	6	19.86	[1,4]24,000	>100 (4.7)
34	02215000	Ocmulgee River at Hawkinsville, Ga.	3,800	1877, 1909-80, 1983-94	1925	36.50	79,000	9	40.91	[1]100,000	>100 (1.2)
35	02215100	Tucsawhatchee Creek near Hawkinsville	163	1984-94	1991	14.13	4,740	7	15.17	[1]5,960	25
36	02215260	Ocmulgee River at Abbeville, Ga.	4,460	1902-65, 1988-94	1925	19.40	88,000	11	23.10	[1]100,000	>100 (1.2)
37	02215320	Ocmulgee River near Jacksonville, Ga.	4,890	1948, 1969-72, 1975-77, 1994	1948	17.29	70,000	13	19.79	[1]96,000	100
38	02215500	Ocmulgee River at Lumber City, Ga.	5,180	1909-94	1925	26.30	98,400	15	24.59	92,900	85
39	02225000	Altamaha River near Baxley, Ga.	11,600	1925-51, 1971-94	1925	30.00	230,000	16	22.58	98,800	7
		CHATTAHOOCHEE RIVER BASIN									
40	02341500	Chattahoochee River at Columbus, Ga.	4,670	1841, 1986, 1913, 1916, 1920-94	1929	55.20	198,000	7	31.24	69,000	Regulated
41	02341600	Juniper Creek near Geneva, Ga.	47.4	1963-94	1990	11.78	4,300	6	8.62	1,620	7
42	02341723	Pine Knot Creek near Juniper, Ga.	31.3	1979-94	1990	9.43	1,960	6	6.35	449	2
43	02341800	Upatoi Creek near Columbus, Ga.	342	1969-94	1990	32.12	46,300	6	13.47	6,690	2

Table 2: Peak stages and discharges at selected stream locations in Georgia, Alabama, and Florida, July 4–16, 1994 (Continued)
[mi^2, square miles; ft, feet above an arbitrary datum; ft^3/s, cubic feet per second; —, not determined or not applicable; <, less than; >, greater than; number in ( ) is the ratio of the peak discharge to the 100-year flood discharge; number in [ ] is the year the maximum stage occurred, if different than maximum year shown.
Source: Recurrence intervals calculated from U.S. Geological Survey data through 1990 water year; other data from U.S. Geological Survey reports or data bases]

					Maximum prior to July 1994			Maximum in July 1994			
Map number (fig. 3)	Station number	Stream and place of determination	Drainage area (mi^2)	Period of record	Year	Peak stage (ft)	Peak discharge (ft^3/s)	July (day)	Peak stage (ft)	Peak discharge (ft^3/s)	Discharge recurrence interval (years)
		CHATTAHOOCHEE RIVER BASIN—Continued									
44	02341900	Ochille Creek near Cusseta, Ga.	53.3	1979-94	1990	16.00	11,000	6	11.83	1,760	7
45	02342500	Uchee Creek near Fort Mitchell, Ala.	322	1947-94	1964	26.45	55,100	8	23.35	25,600	25
46	02342933	South Fork Cowikee Creek near Batesville, Ala.	112	1964-94	1990	43.40	28,200	4	31.17	13,100	30
47	02343200	Pataula Creek near Lumpkin, Ga.	70	1949-78, 1990, 1994	1948	—	12,500	6	12.3	[1/]17,500	>100 (1.3)
48	02343219	Bluff Springs near Lumpkin, Ga.	2.98	1977-94	1990	4.70	568	6	2.42	182	2
49	02343225	Pataula Creek near Georgetown, Ga.	295	1949-78, 1990, 1994	1949	11.80	42,000	6	14.3	[1/]65,000	>100 (2.6)
50	02343244	Cemochechobee Creek near Coleman, Ga.	15.3	1984-94	1984	7.46	965	4	11.84	[1/]5,160	>100 (2.7)
51	02343267	Temple Creek near Blakely, Ga.	2.78	1978-94	1978	2.59	110	6	6.13	[1/]746	>100 (1.2)
52	02343300	Abbie Creek near Haleburg, Ala.	146	1958-94	1970	23.84	7,590	6	37.00	[1/]35,000	>100 (3.5)
53	02343801	Chattahoochee River at Andrews Lock & Dam, Ga.	8,210	1975-94	1990	123.29	195,000	7	123.98	[1/]202,000	Regulated
		FLINT RIVER BASIN									
54	02344300	Camp Creek near Fayetteville, Ga.	17.2	1961-73, 1994	1961	9.90	2,800	5	13.89	[1/]6,300	>100 (1.6)
55	02344350	Flint River near Lovejoy, Ga.	130	1986-94	1990	17.76	8,090	5	23.60	[1/]19,000	>100 (1.2)
56	02344500	Flint River near Griffin, Ga.	272	1929, 1937-94	1929	17.90	15,300	6	24.22	[1/]31,500	>100 (1.9)
57	02344700	Line Creek near Senoia, Ga.	101	1965-94	1977	14.88	9,580	5	20.1	[1/]28,400	>100 (2.4)
58	02345180	Elkins Creek near Zebulon, Ga.	13.2	1994	—	—	—	6	20.8	[1/]5,030	>100 (1.2)
59	02346180	Flint River near Thomaston, Ga.	1,220	1900-29, 1939-56, 1961, 1964-94	1929	—	62,000	6	21.83	55,000	100
60	02346193	Scot Creek near Talbotton, Ga.	3.36	1969-87, 1990, 1994	1981	8.07	1,960	6	7.48	1,350	25
61	02346195	Lazer Creek near Talbotton, Ga.	81.3	1981-94	1990	24.10	36,100	6	16.17	19,600	>100 (1.7)
62	02346210	Kimborough Creek near Talbotton, Ga.	6.62	1969-87, 1990, 1994	1990	8.55	3,050	6	6.48	1,900	25
63	02346217	Coleoatchee Creek near Manchester, Ga.	2.82	1969-94	1990	8.31	1,750	6	5.44	1,170	20
64	02346500	Potato Creek near Thomaston, Ga.	186	1938-73, 1990, 1994	1990	9.19	12,300	6	12.0	[1/]28,000	>100 (1.9)
65	02347500	Flint River near Culloden, Ga.	1,850	1913-31, 1937-94	1929	38.40	92,000	6	45.73	[1/]100,000	>100 (1.2)
66	02348288	Patsiliga Creek (State Route 208) near Butler, Ga.	81.2	1994	—	—	—	6	20.34	15,500	>100 (1.3)
67	02348300	Patsiliga Creek near Reynolds, Ga.	139	1963-84, 1994	1964	9.09	3,320	6	—	[1/]25,000	>100 (1.5)

Table 2: Peak stages and discharges at selected stream locations in Georgia, Alabama, and Florida, July 4–16, 1994 (Continued)
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Source: Recurrence intervals calculated from U.S. Geological Survey data through 1990 water year; other data from U.S. Geological Survey reports or data bases]

Map number (fig. 3)	Station number	Stream and place of determination	Drainage area (mi^2)	Period of record	Maximum prior to July 1994: Year	Maximum prior to July 1994: Peak stage (ft)	Maximum prior to July 1994: Peak discharge (ft^3/s)	Maximum in July 1994: July (day)	Maximum in July 1994: Peak stage (ft)	Maximum in July 1994: Peak discharge (ft^3/s)	Maximum in July 1994: Discharge recurrence interval (years)
		FLINT RIVER BASIN—Continued									
68	02348485	Whitewater Creek (State Route 137) near Butler, Ga.	17.3	1979-94	1981	8.74	248	6	10.79	[1/]518	3
69	02349000	Whitewater Creek near Butler, Ga.	93.4	1944-77, 1981, 1994	1957	7.01	2,160	6	7.00	2,150	50
70	02349030	Cedar Creek near Rupert, Ga.	41.1	1979-94	1979	4.72	580	6	7.50	[1/]2,400	>100 (1.1)
71	02349330	Buck Creek tributary near Tazwell, Ga.	0.40	1977-94	1989	4.37	103	6	3.38	63	5
72	02349350	Buck Creek near Ellaville, Ga.	146	1979-94	1990	9.67	3,730	6	11.31	[1/]7,800	>100 (1.1)
73	02349500	Flint River at Montezuma, Ga.	2,900	1897, 1905-94	1897	26.00	97,000	8	34.11	[1/]136,000	>100 (1.4)
74	02349695	Horsehead Creek near Montezuma, Ga.	0.72	1977-94	1991	6.82	194	6	6.96	[1/]200	25
75	02349900	Turkey Creek near Byromville, Ga.	45.0	1951-94	1981	13.82	4,820	6	14.29	[1/]5,820	>100 (1.2)
76	02350072	Little Lime Creek (State Route 27) near DeSoto, Ga.	[2/]3.0	1994	—	—	—	6	21.17	1,040	>100 (1.5)
77	02350512	Flint River at Oakfield, Ga.	3,880	1967-75, 1988-94	1990	27.37	50,200	10	40.1	[1/]112,000	>100 (1.4)
78	02350520	Little Abrams Creek near Doles, Ga.	3.77	1965-75, 1994	1967	5.99	652	6	7.06	[1/]840	>100 (1.1)
79	02350600	Kinchafoonee Creek near Preston, Ga.	197	1943, 1948-78, 1987-94	1990	12.16	14,500	6	11.66	12,400	100
80	02350670	Choctahatchee Creek near Plains, Ga.	[2/]13.0	1994	—	—	—	6	19.24	4,520	>100 (2.6)
81	02350685	Choctahatchee Creek tributary near Plains, Ga.	0.32	1977-94	1982	2.42	73	6	9.25	[1/]625	>100 (3.1)
82	02350690	Choctahatchee Creek near Preston, Ga.	35.0	1994	—	—	—	6	25.0	[4/]12,300	>100 (3.9)
83	02350900	Kinchafoonee Creek near Dawson, Ga.	527	1943, 1948-66, 1973, 1985-94	1943	23.00	15,000	7	26.56	[1/]29,500	>100 (1.7)
84	02351000	Kinchafoonee Creek near Leesburg, Ga.	586	1907-09, 1943, 1948, 1994	1943	—	15,500	6	29.7	[1/]32,000	>100 (1.7)
85	02351352	Little Muckalee Creek near Ellaville, Ga.	[2/]12.4	1994	—	—	—	6	5.80	3,770	>100 (2.3)
86	02351500	Muckalee Creek (State Route 49) near Americus, Ga.	140	1948, 1963-83, 1994	1948	12.50	9,000	6	19.50	[1/ 4/]33,500	>100 (4.0)
87	02351522	Town Creek (State Route 49) near Americus, Ga.	[2/]0.5	1994	—	—	—	6	9.23	146	50
88	02351700	Muckalee Creek near Smithville, Ga.	265	1929, 1948, 1951-66, 1994	1948	14.00	15,000	6	22.72	[1/ 4/]35,000	>100 (3.1)
89	02351755	Muckaloochee Creek near Plains, Ga.	[2/]2.3	1994	—	—	—	6	18.75	1,470	>100 (2.5)
90	02351890	Muckalee Creek (State Route 195) near Leesburg, Ga.	362	1943, 1948, 1980-94	1943	—	18,000	6	29.1	[1/ 4/]64,400	>100 (5.0)

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Map number (fig. 3)	Station number	Stream and place of determination	Drainage area (mi^2)	Period of record	Maximum prior to July 1994			Maximum in July 1994			
					Year	Peak stage (ft)	Peak discharge (ft^3/s)	July (day)	Peak stage (ft)	Peak discharge (ft^3/s)	Discharge recurrence interval (years)
		FLINT RIVER BASIN—Continued									
91	02351900	Muckalee Creek near Leesburg, Ga.	405	1948-65, 1994	1948	19.70	16,000	7	29.83	[1/] [4/]72,000	>100 (5.1)
92	02352500	Flint River at Albany, Ga.	5,310	1893-1994	1925	37.80	92,000	11	43.0	[1/]120,000	>100 (1.3)
93	02353000	Flint River at Newton, Ga.	5,740	1925, 1929, 1938-94	1925	41.30	94,000	13	45.25	[1/]100,000	>100 (1.2)
94	02353400	Pachitla Creek near Edison, Ga.	188	1916, 1928, 1948-78, 1981, 1989-1994	1916	11.88	11,800	6	14.22	[1/]43,000	>100 (3.3)
95	02353500	Ichawaynochaway Creek at Milford, Ga.	620	1906-07, 1916, 1925, 1940-94	1916	17.20	15,500	7	23.20	[1/]53,000	>100 (3.0)
96	02354500	Chickasawhatchee Creek at Elmodel, Ga.	320	1940-83, 1994	1978	12.38	4,300	8	20.0	[1/]16,000	>100 (1.8)
97	02356000	Flint River at Bainbridge, Ga.	7,570	1897, 1905-94	1925	40.90	101,000	14	37.20	[1/]108,000	>100 (1.1)
98	02356640	Spring Creek at Colquitt, Ga.	281	1981-94	1982	11.23	6,240	6	12.92	[1/]13,800	>100 (1.3)
99	02357000	Spring Creek near Iron City, Ga.	485	1938-78, 1983-94	1975	19.43	17,700	8	19.95	12,900	25
		APALACHICOLA RIVER BASIN									
100	02358000	Apalachicola River at Chattahoochee, Fla.	17,200	1920-94	1929	79.55	293,000	10	76.21	206,000	40
101	02358700	Apalachicola River near Blountstown, Fla.	17,600	1920-94	1990	28.6 [1929]	185,000	10	27.39	[1/]225,000	50
102	02358785	Cowarts Creek near Cottonwood, Ala.	103	1971-80, 1994	1975	12.59	14,400	7	10.77	9,000	10
103	02359000	Chipola River near Altha, Fla.	781	1921-94	1926	33.35	25,000	11	29.60	14,200	30
104	02359170	Apalachicola River at Sumatra, Fla.	19,200	1977-94	1990	13.82	179,000	13	15.05	[1/]221,000	55
		CHOCTAWHATCHEE RIVER BASIN									
105	02360000	West Fork Choctawhatchee River near Blue Springs,	86.8	1944-71, 1990, 1994	1990	17.32	25,000	5	10.20	6,800	25
106	02360275	Judy Creek near Ozark, Ala.	102	1951-77, 1990, 1994	1990	22.29	25,000	6	19.02	13,000	40
107	02360500	East Fork Choctawhatchee River near Midland City, Ala.	291	1953-63, 1966-70, 1990, 1994	1990	28.18	35,000	6	29.30	[1/]43,000	>100 (2.1)
108	02361000	Choctawhatchee River at Newton, Ala.	686	1922-27, 1935-94	1990	40.30	87,500	7	37.78	60,800	>100 (1.5)
109	02362000	Choctawhatchee River near Geneva, Ala.	1,346	1928-94	1929	46.9	—	8	42.42	—	—
110	02362240	Little Double Bridges Creek near Enterprise, Ala.	21.4	1986-94	1990	13.90	7,950	6	16.45	[1/]14,200	>100 (2.5)

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Map number (fig. 3)	Station number	Stream and place of determination	Drainage area (mi^2)	Period of record	Maximum prior to July 1994			Maximum in July 1994			
					Year	Peak stage (ft)	Peak discharge (ft^3/s)	July (day)	Peak stage (ft)	Peak discharge (ft^3/s)	Discharge recurrence interval (years)
CHOCTAWHATCHEE RIVER BASIN—Continued											
111	02363000	Pea River near Ariton, Ala.	498	1939-94	1990	24.87	47,700	8	19.53	17,100	10
112	02364000	Pea River near Elba, Ala.	966	1900-94	1929	43.5	53,000	7	38.33	—	—
113	02365500	Choctawhatchee River at Caryville, Fla.	3,499	1929-94	1929	27.10	206,000	9	23.85	164,000	>100 (1.3)
114	02366500	Choctawhatchee River near Bruce, Fla.	4,384	1931-82, 1985-94	1929	29.20	220,000	11	26.76	165,000	>100 (1.5)
115	02367006	Alaqua Creek near Portland, Fla.	83.7	1980-94	1989	16.03	10,800	7	11.77	3,430	3
YELLOW RIVER BASIN											
116	02368000	Yellow River at Milligan, Fla.	624	1938-94	1990	19.00	51,500	8	17.55	40,200	40
117	02369000	Shoal River near Crestview, Fla.	474	1938-94	1975	15.58	25,200	8	14.82	24,400	25
ESCAMBIA RIVER BASIN											
118	02371000	Conecuh River near Troy, Ala.	257	1944-68, 1990, 1994	1990	19.41	33,000	8	15.58	16,500	10
119	02371200	Indian Creek near Troy, Ala.	8.87	1959-86, 1990, 1994	1975	7.75	3,950	6	5.93	660	2
120	02371500	Conecuh River at Brantley, Ala.	500	1938-94	1990	24.44	25,700	9	22.37	17,000	10
121	02375500	Escambia River near Century, Fla.	3,817	1934-94	1990	24.35	103,000	15	18.92	42,700	2

1/ New peak fo record.
2/ Approximately.
3/ Affected by dam release.
4/ Discharge may have been affected by dam break.