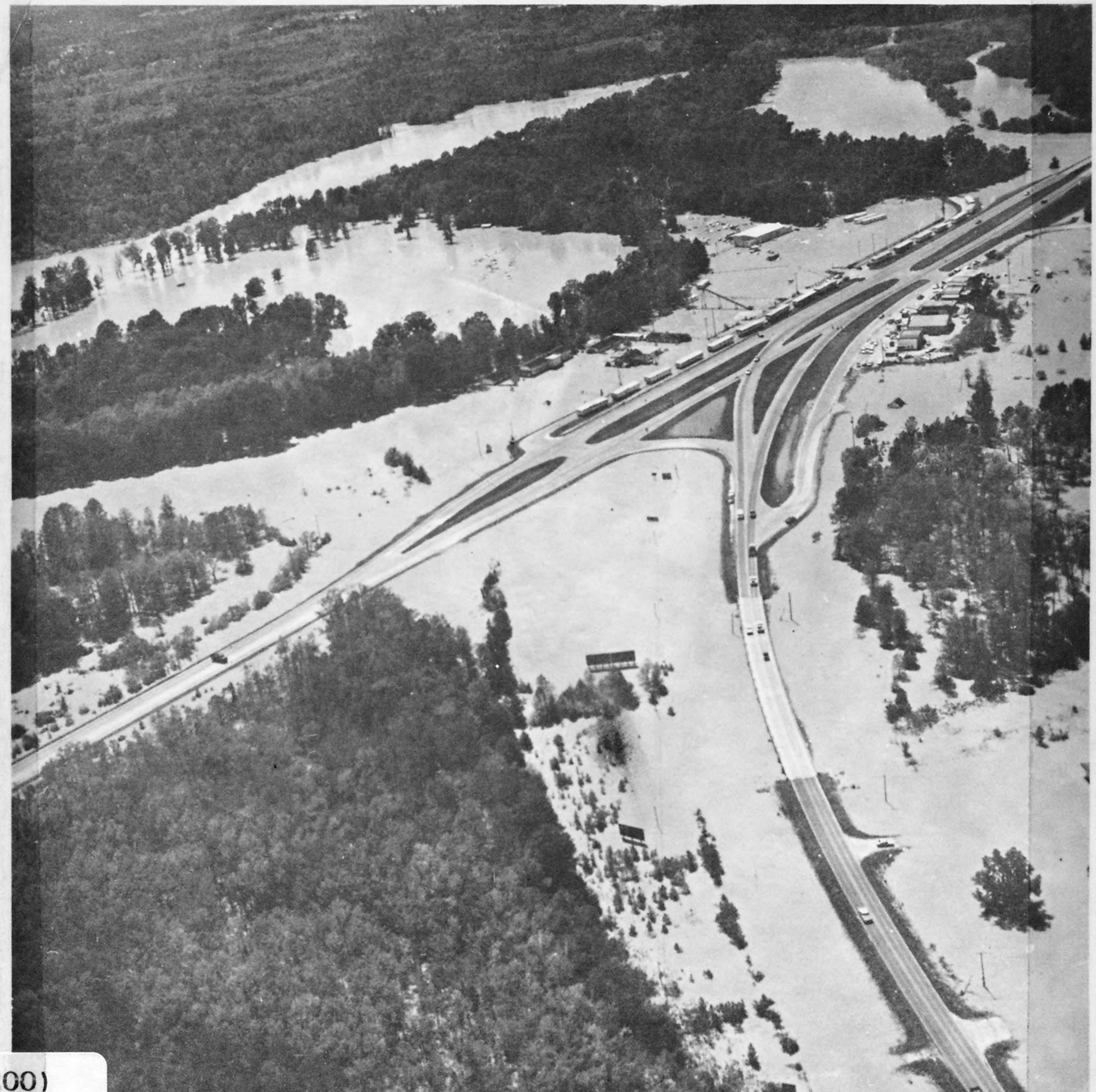
Flood Frequency of Mississippi Streams



Prepared by the

U. S. GEOLOGICAL SURVEY

for the

Mississippi State Highway Department

In Cooperation with the

Federal Highway Administration

Department of Transportation

1976

FLOOD FREQUENCY OF MISSISSIPPI STREAMS

by

B. E. Colson and J. W. Hudson

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16\. Abstract

Techniques have been developed for estimating future flood magnitudes having recurrence intervals as great as 100 years. Estimates for gaged sites were obtained by application of the log-Pearson Type III frequency distribution. Estimates for ungaged sites are defined by mathematical relations which may be solved using data from topographic maps. Nomographs were designed for making rapid estimates for flood-frequency values. Synthetic records generated by a digital computer model of the rainfall-runoff process for drainage areas ranging from 0.04 to 4.35 square miles (0.1 to 11.3 square kilometres) were combined with long-term observed records to define the relation of basic characteristics to flood frequency on drainage areas as great as 6,630 square miles (17,200 square kilometres). Multiple-regression techniques indicated that drainage area, slope, and length were the most significant variables affecting flood frequency.

17. Key Words
Flood Frequency, Hydrology, Highway Drainage, Rainfall-runoff, Basin Characteristics, Drainage Area, Drainage Slope, Drainage Length.

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INTRODUCTION

The economic design of drainage structures, the management of flood-prone lands, and the establishment of realistic flood insurance rates require estimates of magnitude and frequency of future floods. This report provides a means of estimating future floods up to a 100-year recurrence interval on any stream not significantly affected by urbanization or regulation. It supersedes earlier flood-frequency analyses for Mississippi.

Streamflow records form the principal basis for analyzing statistical characteristics of floods. It is logically assumed that the past record is the best indicator of the probability of the future occurrence of a flow of a given magnitude. The reliability of flood-frequency estimates is directly related to the length of available record. Therefore, a long record of streamflow is desirable for defining floodflow characteristics. Over 10,000 station-years of observed and synthetic data were analyzed during preparation of this report. Results of frequency analysis for gaged sites are presented in table 1. Transfer techniques are described for obtaining results on streams between gaged sites and where only a single gaged site is available. Through a multiple-regression model these results are used to define equations for estimating flood frequency at ungaged sites. Graphical solutions are presented (figs. 2-7) for making rapid approximations. The reliability of a regression model is measured by the standard error which is the standard deviation of the distribution of residuals about the regression line.

ACKNOWLEDGMENTS

This report was prepared under the cooperative highway research program with the Mississippi State Highway Department and the Federal Highway Administration. The opinions, findings, and conclusions expressed in this report are not necessarily those of the Federal Highway Administration. Long-term daily precipitation records and storm reductions to 5-minute increments were obtained from the National Oceanic and Atmospheric Administration. Some of the data were collected through cooperation with the U.S. Army Corps of Engineers and other agencies, State and local.

ESTIMATING TECHNIQUES

Application for Gaged Streams

Flood-frequency estimates based on analyses of long-term gaging records are commonly more reliable than those based on regression estimates. The recommended minimum years of record needed to define events of selected recurrence interval are listed below.

Recurrence interval, in years	10	25	50	100
Minimum years of record	10	15	20	25

These extension limits generally were used in developing table 1. Magnitudes of floods listed in table 1 will have reliability at least equal to that defined by regional relations at gage sites. The availability of gage data may be determined from figure 1 and table 1. At gaged sites where sufficient data are available to define the desired flood magnitude, the values from table 1 may be used directly. At ungaged sites on gaged streams, values can be interpolated on the basis of drainage area between two gaged values in table 1. A flood-frequency value for a site that is not between gaged sites but is near one on the same stream can be calculated by a combined use of the

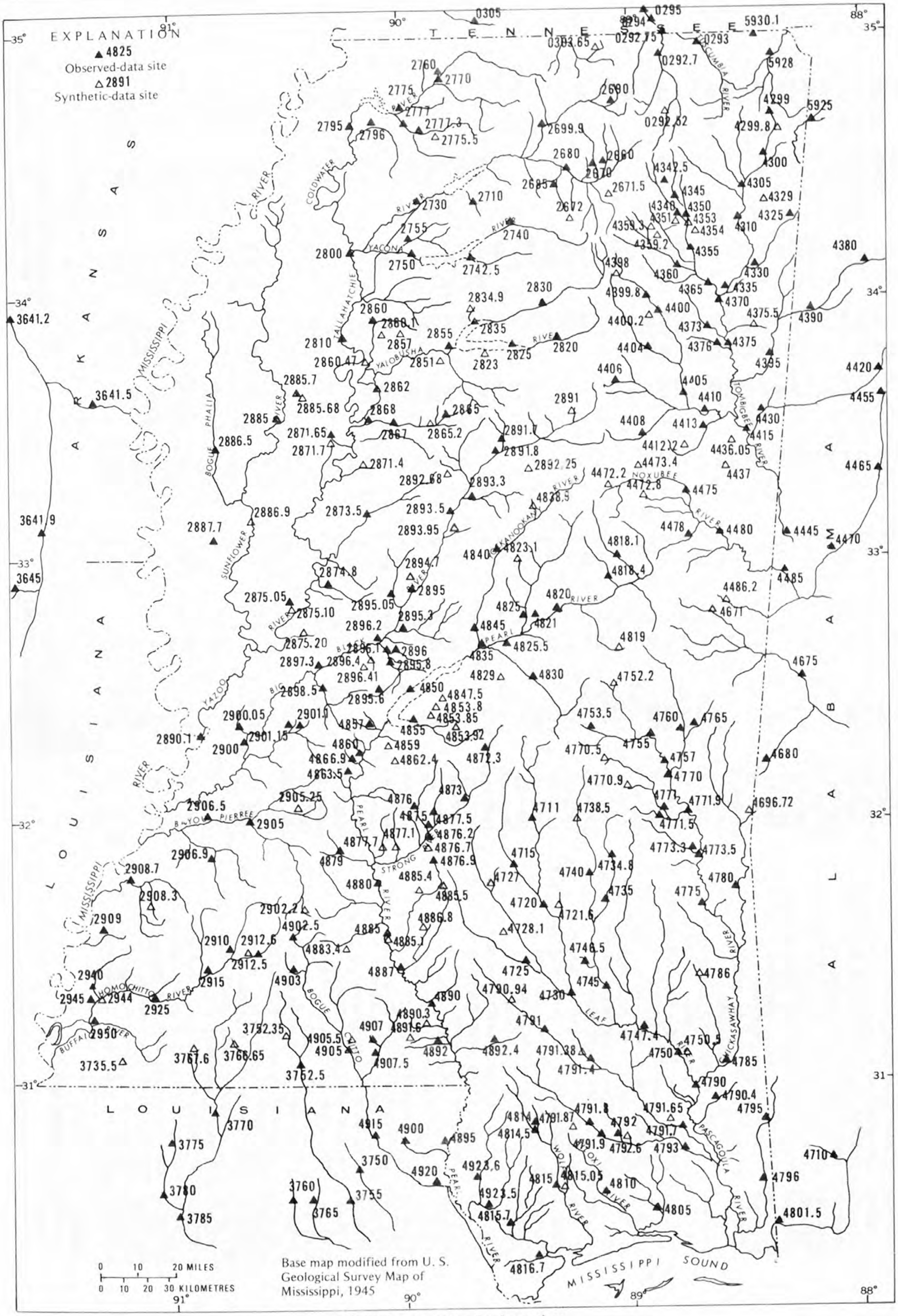

Figure 1. - - Location of gaging stations.

Table 1.--Data for gaged streams

Identi-fication number	Name and location	Basin characteristics: Period of record	Drainage area (mi^2)	Channel length (mi)	Slope (ft/mi)	Peak discharge in cubic feet per second, for indicated recurrence interval, in years: 2	5	10	25	50	100
02429900	Big Brown Creek near Booneville	1961-73	30.7	9.7	12.5	2,840	3,450	3,730	--	--	--
02429980	Pollard Mill Branch at Paden	Synthetic	2.05	2.8	42.3	319	504	628	782	892	1,030
02430000	Mackeys Creek near Dennis	1939-73	66	15.7	9.3	2,180	4,080	5,820	8,680	11,400	14,600
02430500	Tombigbee River near Marietta	1938-73	305	26.7	4.5	9,090	14,300	18,900	26,300	--	--
02431000	East Fork Tombigbee River near Fulton	1929-73	605	40.7	4.6	17,500	28,400	36,800	48,500	58,100	68,300
02432500	Bull Mountain Creek at Tremont	1941-64	120	26.5	13.1	5,120	8,900	11,700	15,600	18,600	--
02432900	Red Boot Creek near Fulton	Synthetic	.13	.83	79.2	82	112	132	156	176	196
02433000	Bull Mountain Creek near Smithville	1941-73	335	41.5	9.0	11,400	21,400	29,400	41,200	51,200	62,000
02433500	Tombigbee River at Bigbee	1946-73	1,190	66.5	3.2	27,800	46,600	63,400	90,700	116,000	--
02434000	Town Creek at Tupelo	1939-73	112	22.5	10.7	8,520	13,200	16,300	20,300	23,200	26,100
02434250	Tishomingo Creek near Saltillo	1950-63	30.8	15.5	12.9	3,000	4,110	4,830	--	--	--
02434500	Euclautubba Creek at Saltillo	1952-73	19.7	9.5	14.1	2,790	3,900	4,660	5,650	6,410	--
02435000	Mud Creek at Tupelo	1939-47	92	27.5	8.7	4,350	6,400	7,780	--	--	--
02435100	Truck Stop Ditch near Tupelo	Synthetic	.22	.68	47.5	155	208	244	291	326	362
02435300	Cow Pike Pass near Tupelo	Synthetic	.14	.57	127	136	178	206	240	266	291
02435400	Clear Branch near Tupelo	Synthetic	.75	1.38	63.4	164	246	304	380	438	499
02435500	Oldtown Creek near Verona	1941-61	263	32.3	7.8	13,800	22,100	28,500	37,700	45,400	--
02435920	Cotton Gin Branch near Tupelo	Synthetic	.30	1.05	42.2	87	126	152	186	211	236
02435930	Shell Creek near Tupelo	Synthetic	.20	.80	42.2	60	82	97	118	134	152
02436000	Chiwapa Creek at Shannon	1950-73	136	23.5	7.4	11,400	17,600	23,000	31,600	39,700	--
02436500	Town Creek near Nettleton	1940-73	617	43.3	5.8	26,700	42,900	58,100	84,000	109,000	141,000
02437000	Tombigbee River near Amory	1939-73	1,940	69.4	3.3	35,900	60,400	81,500	115,000	145,000	181,000
02437300	Mattubby Creek near Aberdeen	1952-73	91	18.5	8.0	7,440	10,300	11,800	13,300	14,200	--
02437500	Tombigbee River near Aberdeen	1892-1973	2,210	84.9	2.8	28,600	49,000	65,800	90,900	113,000	137,000
02437550	Nichols Creek at Quincy	Synthetic	.54	1.43	79.2	187	274	332	408	464	521
02437600	James Creek at Aberdeen	1964-73	28.9	8.4	11.1	3,090	3,970	4,510	--	--	--
02438000	Buttahatchie River near Hamilton	1951-70	284	44.8	6.2	15,000	20,000	22,600	25,000	--	--
02439000	Buttahatchie River near Sulligent, Ala.	1939-59	472	64	4.8	12,700	23,100	30,600	40,300	47,600	--
02439500	Buttahatchie River near Caldonia	1929-51	823	84.1	5.2	16,600	27,000	33,600	41,200	--	--
02439800	Cowbell Creek near Houlka	Synthetic	.46	1.28	26.4	177	251	304	367	418	468
02439980	Chuquatonchee Creek near Okolona	1964-73	68.5	14.3	9.3	5,110	8,370	11,100	--	--	--
02440000	Chuquatonchee Creek near Egypt	1950-74	170	27.4	4.4	10,400	16,500	21,900	30,500	38,500	48,000
02440020	Chuquatonchee Creek near Trebloc	Synthetic	.72	1.28	47.5	427	612	730	872	974	1,080
02440400	Houlka Creek near McCondy	1963-73	185	26.2	4.6	9,560	16,600	23,500	--	--	--
02440500	Chuquatonchee Creek near West Point	1941-73	514	45.7	3.5	18,400	29,800	38,000	48,900	57,400	66,200
02440600	Line Creek near Maben	1952-73	6.5	4.6	41.5	1,150	1,730	2,200	2,880	3,470	--
02440800	Trim Cane Creek near Starkville	1952-73	39.6	12.9	17.4	4,430	6,160	7,320	8,800	9,910	--
02441000	Tibbee River at Tibbee	1929-73	928	53.7	3.0	33,100	51,100	61,700	73,200	80,500	87,000
02441220	Sand Creek Trib. near Mayhew	Synthetic	.44	1.1	42.2	156	222	267	328	374	424
02441300	Catalpa Creek at Mayhew	1963-73	98.2	15.9	8.4	6,490	10,100	12,600	--	--	--
02441500	Tombigbee River at Columbus	1892-1973	4,490	123	2.4	47,100	78,500	105,000	145,000	181,000	223,000
02442000	Luxapalila Creek near Fayette, Ala.	1945-70	127	25.4	14.6	5,630	7,900	9,370	11,200	12,600	13,900
02443000	Luxapalila Creek at Steens	1940-73	309	56.4	6.1	7,090	10,100	12,200	15,100	17,400	19,900
02443605	Mayo Slough Trib. near Columbus	Synthetic	.24	.70	42.2	126	172	203	243	274	304
02443700	Cedar Creek near Brooksville	Synthetic	.49	1.17	21.1	196	278	320	391	440	496
02444500	Tombigbee River near Cochrane, Ala.	1939-70	5,990	170	1.7	53,900	83,200	106,000	137,000	163,000	191,000
02445500	Sipsey River at Fayette, Ala.	1939-59	276	57.9	3.6	8,440	14,100	18,000	22,800	26,200	--
02446500	Sipsey River near Elrod, Ala.	1930-70	518	114	2.7	8,400	14,000	18,200	24,100	28,900	33,900
02447000	Sipsey River near Pleasant Ridge, Ala.	1939-59	753	175	2.3	8,060	13,000	16,900	22,600	27,300	--
02447220	Bogue Fallah Creek Trib. near Ackerman	Synthetic	.34	1.08	73.8	116	160	191	226	262	280

Table 1.--Data for gaged streams -continued

Identification number	Name and location	Basin characteristics: Period of record	Drainage area (mi^2)	Channel length (mi)	Slope (ft/mi)	Peak discharge in cubic feet per second, for indicated recurrence interval, in years: 2	5	10	25	50	100
02447280	Lawson Branch near Betheden	Synthetic	1.11	2.16	47.5	404	590	706	842	934	1,020
02447340	Cypress Creek Trib. at Bradley	Synthetic	.60	1.86	47.5	96	137	166	205	236	269
02447500	Noxubee River near Brooksville	1940-73	440	38.3	4.2	9,320	18,200	25,400	36,000	44,900	54,500
02447800	Hashuqua Creek near Macon	1952-70	95.1	20.3	12.4	3,010	5,520	7,440	10,100	--	--
02448000	Noxubee River at Macon	1929-73	812	58.1	3.0	12,500	22,400	30,500	42,300	52,300	63,300
02448500	Noxubee River near Geiger, Ala.	1940-70	1,140	85.0	2.7	13,600	21,500	27,500	35,800	42,600	49,800
02448620	Flat Scooba Creek Trib. near Scooba	Synthetic	.44	1.03	31.6	120	168	202	248	284	322
02467100	Hamilton Branch near DeKalb	Synthetic	.97	1.53	37.0	344	502	602	721	804	884
02467500	Sucarnoochee River at Livingston, Ala.	1939-70	606	49.5	6.5	7,210	12,900	17,600	24,800	30,900	37,800
02468000	Alamuchee Creek near Cuba, Ala.	1955-70	63	15.5	13.4	1,410	3,700	6.660	13,400	--	--
02469672	Little Okatuppa Creek near Quitman	Synthetic	4.35	3.69	47.5	1,020	1,460	1,770	2,175	2,490	2,820
02471000	Chickasaw Creek near Whistler, Ala.	1952-70	123	22.8	8.1	4,250	8,330	11,900	17,400	--	--
02471100	Leaf River near Raleigh	1940-74	143	26.5	6.0	3,660	7,110	10,300	15,700	20,800	--
02471500	Oakahay Creek at Mize	1942-73[a]	217	29.3	7.7	5,560	8,430	9,920	11,400	--	--
02472000	Leaf River near Collins	1939-74	752	51.2	4.9	13,300	22,400	30,100	42,200	53,000	65,600
02472160	Big Creek near Laurel	Synthetic	.17	.63	79.2	116	159	188	224	252	279
02472500	Bowie Creek near Hattiesburg	1939-74	304	42.6	10.0	5,380	10,400	15,600	25,300	35,500	49,000
02472700	Okatoma Creek Trib. at Mt. Olive	Synthetic	.33	1.01	52.8	87	138	169	202	224	244
02472810	Okatoma Creek Trib. near Collins	Synthetic	.21	.78	31.7	115	160	191	230	259	289
02473000	Leaf River at Hattiesburg	1905-74	1,760	87.6	3.3	24,800	39,800	52,200	70,900	87,200	106,000
02473460	Tallahattah Creek near Waldrup	1965-71	30.7	12.8	12.5	1,290	2,590	3,630	--	--	--
02473500	Tallahala Creek at Laurel	1939-73	233	40.2	6.0	5,210	10,000	13,800	19,000	23,200	27,600
02473850	Tallahoma Creek Trib. at Lake Como	Synthetic	3.21	3.47	42.2	1,068	1,470	1,750	2,120	2,410	2,700
02474000	Tallahoma Creek near Laurel	1941-61	149	27.4	4.9	4,630	8,020	10,500	--	--	--
02474500	Tallahala Creek near Runnelstown	1940-73	612	71.8	4.1	7,780	13,100	17,500	23,900	29,500	35,700
02474650	Buck Creek near Runnelstown	1951-71	19.1	9.1	8.8	869	2,420	4,030	6,780	--	--
02474740	Leaf River at Beaumont	1941-61	3,120	130	2.3	34,700	56,200	74,400	103,000	128,000	--
02475000	Leaf River near McLain	1940-74	3,510	139	2.1	35,300	56,500	73,500	98,800	120,000	145,000
02475050	Waterfall Branch near McLain	Synthetic	.65	1.0	63.4	213	300	361	442	505	570
02475220	Little Rock Creek Trib. near Little Rock	Synthetic	.22	.66	116	57	96	122	150	170	188
02475350	Tarlow Creek near Newton	1953-70	15.9	5.9	24.0	1,800	2,280	2,560	2,900	--	--
02475500	Chunky River near Chunky	1939-73	368	35.5	5.6	7,950	14,200	19,300	26,700	32,900	39,700
02475700	Chunky Creek at Enterprise	1950-61[a]	517	53.0	3.7	6,500	19,700	29,000	--	--	--
02476000	Okatibbee Creek near Meridian	1939-67	239	30.9	5.6	4,590	8,570	14,200	21,700	28,600	36,900
02476500	Sowashee Creek at Meridian	1939-73	51.9	11.9	11.2	2,520	4,540	6,300	9,080	11,600	14,600
02477000	Chickasawhay River at Enterprise	1905-73	913	51.0	4.2	14,900	25,400	33,500	44,700	53,800	63,600
02477050	Souinlovey Creek near Baxter	Synthetic	1.14	1.62	79.2	473	671	790	956	1,080	1,210
02477090	Powers Creek near Rose Hill	Synthetic	.45	1.10	148	276	372	438	522	584	647
02477100	Souinlovey Creek near Pachuta	1956-70	174	24.6	9.6	5,170	12,000	18,400	28,700	--	--
02477150	Pachuta Creek at Pachuta	1952-70	23	6.0	20	2,010	4,120	5,730	7,880	--	--
02477190	Chickasawhay River near Quitman	1939-61	1,210	76.1	3.4	15,200	30,500	46,800	--	--	--
02477330	Shubuta Creek near Shubuta	1963-70[a]	95	17.1	13.7	2,000	5,300	9,200	--	--	--
02477350	Chickasawhay River at Shubuta	1905-61	1,460	86.8	3.1	18,600	33,600	46,300	65,900	83,200	103,000
02477500	Chickasawhay River near Waynesboro	1900-61	1,660	107	2.5	16,600	28,700	40,000	58,800	76,900	99,300
02478000	Buckatunna Creek at Denham	1939-61	468	65	4.3	8,520	13,400	17,200	--	--	--
02478500	Chickasawhay River at Leakesville	1938-73	2,680	165	1.8	21,700	33,600	43,200	57,700	70,100	84,300
02478600	Granny Branch at Piave	Synthetic	.69	1.20	47.5	382	524	620	744	839	936
02479000	Pascagoula River at Merrill	1905-73	6,600	191	1.6	61,900	96,100	122,000	159,000	189,000	221,000
02479040	Big Creek near Lucedale	1952-70	22.1	6.6	20.4	1,010	2,440	3,880	6,350	--	--
02479094	Blown Pine Creek near Hattiesburg	Synthetic	1.6	2.74	37	429	677	844	1,056	1,210	1,370

Table 1.--Data for gaged streams --continued

Identification number	Name and location	Basin characteristics				Peak discharge in cubic feet per second, for indicated recurrence interval, in years					
		Period of record	Drainage area (mi^2)	Channel length (mi)	Slope (ft/mi)	2	5	10	25	50	100
02479100	Black Creek near Purvis	1957-70	154	31.2	6.3	3,190	6,270	9,230	--	--	--
02479138	Walls Creek Trib. near Brooklyn	Synthetic	.37	1.25	58.1	131	201	251	315	365	417
02479140	Walls Creek near Brooklyn	1951-70	22.3	10.3	12.8	1,200	3,020	4,850	8,000	--	--
02479165	Mosquito Branch at Benndale	Synthetic	.22	.68	121	76	111	136	171	198	226
02479170	Black Creek near Benndale	1949-70	760	90.6	3.6	9,870	20,400	28,500	39,500	--	--
02479180	Red Creek at Lumberton	1951-70	15.6	6.3	15.6	898	1,850	2,730	4,180	5,540	--
02479187	Red Creek Trib. near Wiggins	Synthetic	.22	.90	106	102	145	175	214	245	276
02479190	Red Creek near Wiggins	1952-70	168	25.2	7.7	4,640	7,890	10,700	15,300	--	--
02479200	Flint Creek near Wiggins	1953-68	24.8	8.4	7.9	1,380	2,450	3,220	--	--	--
02479260	Bluff Creek near Whites Crossing	Synthetic	.82	1.12	37.0	235	344	423	529	613	701
02479300	Red Creek at Vestry	1959-73	416	58.3	3.4	8,530	13,600	17,800	24,100	--	--
02479500	Escatawpa River near Wilmer, Ala.	1946-67	506	59.0	2.7	10,100	16,700	22,100	30,100	36,900	--
02479600	Escatawpa River near Hurley	1959-70	639	78.8	2.5	9,990	15,000	18,400	--	--	--
02480150	Franklin Creek near Grand Bay, Ala.	1959-70	16.4	6.5	3.7	784	1,550	2,260	--	--	--
02480500	Tuxachanie Creek near Biloxi	1953-73	92.4	24.1	6.1	4,620	7,690	10,500	15,000	19,200	--
02481000	Biloxi River at Wortham	1953-73	98.3	26.2	8.1	4,680	6,550	7,690	9,010	9,910	--
02481400	Wolf River near Poplarville	1952-70	71	19.2	6.1	2,110	4,100	6,210	10,200	--	--
02481450	Murder Creek near Poplarville	1952-70	21.6	8.8	23.8	1,230	2,050	2,920	4,580	--	--
02481500	Wolf River near Lyman	1945-70[a]	253	41.0	6.2	8,370	13,700	17,900	--	--	--
02481505	Mill Creek Trib. near Lizana	Synthetic	2.29	2.35	42.2	504	793	1,006	1,297	1,531	1,770
02481570	Catahoula Creek near Santa Rosa	1962-66	155	26.0	7.2	3,900	11,000	16,400	--	--	--
02481670	Bayou LaCrox near Clearmont Harbor	1960-70[a]	47.3	8.0	1.2	1,710	2,500	2,960	--	--	--
02481810	Tallahaga Creek near Noxapater	1953-70	53	15.5	6.9	2,800	5,080	6,940	9,660	--	--
02481840	Noxapater Creek near Noxapater	1952-70	33.1	11.2	10.7	1,680	2,690	3,530	4,790	--	--
02481900	Coonshuck Creek Trib. near House	Synthetic	.20	.62	73.9	88	127	152	184	207	230
02482000	Pearl River at Edinburg	1909-73	898	56.4	1.7	10,800	17,800	22,200	27,100	30,300	33,200
02482100	Indian Branch near Edinburg	1965-72	1.92	2.68	37	253	422	542	--	--	--
02482310	Lobutcha Creek Trib. at Wamba	Synthetic	.94	1.21	31.7	177	292	372	479	560	643
02482500	Lobutcha Creek near Carthage	1938-70	313	39.9	3.7	6,180	10,700	13,500	16,800	19,000	21,000
02482550	Pearl River near Carthage	1962-73[a]	1,350	73.9	1.6	15,900	24,400	27,900	--	--	--
02482900	Tallabogue Creek Trib. near Harperville	Synthetic	.12	.44	68.6	54	79	95	113	126	138
02483000	Tuscolameta Creek at Walnut Grove	1939-73	411	32.0	3.3	9,730	15,900	20,000	25,100	28,700	32,200
02483500	Pearl River near Lena	1937-53	2,000	83.4	1.4	23,500	38,000	46,300	55,000	--	--
02483890	Yockanookany River Trib. near McCool	Synthetic	.34	.96	73.9	136	190	226	273	308	345
02484000	Yockanookany River near Kosciusko	1933-73	314	36.4	5.1	6,480	10,600	13,600	17,500	20,600	23,800
02484500	Yockanookany River near Ofahoma	1938-73	484	62.1	3.0	7,130	11,000	13,200	15,600	17,000	18,200
02484750	Red Cane Creek Trib. near Pisgah	Synthetic	.10	.53	58.1	58	80	96	116	131	146
02485000	Pearl River at Meeks Bridge near Canton	1933-63	2,780	113	1.4	27,700	46,900	59,400	74,200	84,500	94,000
02485380	Hollybush Creek Trib. No.1 near Pisgah	Synthetic	.59	1.20	26.4	176	249	302	371	426	484
02485385	Hollybush Creek Trib. No.2 near Pisgah	Synthetic	.25	.58	37.0	114	164	194	230	255	278
02485392	Clear Creek Trib. at Pelahatchie	Synthetic	.12	.56	148	87	120	143	172	192	214
02485500	Pelahatchie Creek near Fannin	1938-63	205	22.5	4.7	7,310	13,600	17,900	23,200	--	--
02485700	Hanging Moss Creek at Jackson	1953-73	16	7.1	12.2	2,080	2,900	3,520	4,370	5,070	--
02485900	Neely Creek on Airport Road near Brandon	Synthetic	1.09	1.45	42.2	250	372	454	559	638	716
02486000	Pearl River at Jackson	1900-74	3,100	145	1.4	[b]26,700	[b]40,000	[b]50,000	[b]65,000	[b]77,200	[b]90,000
02486240	Richland Creek Trib. near Brandon	Synthetic	.12	.58	68.6	32	52	64	80	91	102
02486350	Cany Creek at Jackson	1961-70	8.3	5.8	30.0	2,090	2,700	3,140	--	--	--
02486690	Rhodes Creek near Terry	1948-70[a]	20.8	9.6	12.7	1,650	2,780	3,520	4,480	5,150	--
02487230	Strong River near Morton	1962-69	16.1	5.0	17.3	1,740	2,650	3,290	--	--	--
02487300	Strong River near Puckett	1950-74[a]	260	27.8	4.3	5,200	9,750	14,000	21,100	27,900	--

Table 1.--Data for gaged streams --continued

Identification number	Name and location	Basin characteristics: Period of record	Drainage area (mi²)	Channel length (mi)	Slope (ft/mi)	Peak discharge in cubic feet per second, for indicated recurrence interval, in years: 2	5	10	25	50	100
02487500	Strong River at Dlo	1929-74	429	38.7	4.1	7,930	12,600	16,200	21,400	25,700	30,300
02487600	Dabbs Creek near Mendenhall	1948-69	55.1	18.5	6.6	1,800	2,850	3,980	6,160	8,550	--
02487620	Riles Creek near Mendenhall	1949-70	25.3	9.5	22.5	1,880	3,690	5,390	8,250	--	--
02487670	Boggans Ditch near Mendenhall	Synthetic	.91	1.18	68.6	178	325	419	525	595	656
02487690	Baking Powder Draw near Prentiss	1955-73	.82	1.28	79.2	147	260	356	501	--	--
02487710	Barrets Branch near Pinola	Synthetic	.88	2.04	42.4	201	295	360	448	514	585
02487750	Big Creek near Pinola	1948-69	44.0	14.5	9.9	2,100	3,910	5,520	8,100	10,500	--
02487770	Bradley's Ditch near Pinola	Synthetic	.54	1.52	58.1	157	226	272	331	375	419
02487900	Copiah Creek near Hazlehurst	1950-73	48.6	9.5	5.6	4,990	8,520	11,200	15,000	--	--
02488000	Pearl River near Rockport	1938-51	4,600	204	1.2	36,500	49,100	56,000	--	--	--
02488340	Small Pine Ditch near Monticello	Synthetic	.16	.54	148.0	109	154	182	214	236	257
02488500	Pearl River near Monticello	1925-74	5,040	234	1.1	34,800	48,100	56,400	66,200	73,100	79,700
02488510	Roadside Park Ditch near Monticello	Synthetic	.25	.77	148	100	153	188	232	264	296
02488540	New Hebron Gulley at New Hebron	Synthetic	2.5	2.20	58.1	792	1,140	1,380	1,700	1,950	2,200
02488550	Goines Draw near Prentiss	Synthetic	.34	.74	95.0	98	173	220	273	308	339
02488680	Plum Ditch near Prentiss	Synthetic	.23	.92	63.4	100	147	178	216	244	270
02488700	Whitesand Creek near Oakvale	1966-70	131	23.5	13.2	2,490	4,200	5,120	--	--	--
02489000	Pearl River at Columbia	1905-73	5,690	283	.99	36,000	48,900	56,900	66,400	73,200	79,700
02489030	Elmer's Draw near Columbia	Synthetic	.91	1.23	63.4	363	526	633	769	870	971
02489160	Kokomo Draw at Kokomo	Synthetic	1.26	1.40	68.6	388	686	890	1,138	1,310	1,480
02489200	Ten Mile Creek near Columbia	1953-70	39.9	12.2	15.2	1,650	4,200	6,900	11,600	--	--
02489240	Lower Little Creek near Baxterville	1961-70	82.6	10.0	17.3	3,370	6,760	9,310	--	--	--
02489500	Pearl River near Bogalusa, La.	1939-74	6,630	338	.95	41,300	58,400	69,000	81,600	90,500	98,900
02490000	Bogue Lusa near Franklinton, La.	1949-68	12.1	5.4	15.9	1,790	4,100	5,920	8,380	--	--
02490250	Bogue Chitto near Brookhaven	1953-70	30.0	10.0	13.3	2,330	4,650	6,780	10,300	--	--
02490300	Big Creek at Bogue Chitto	1952-70	55.2	12.1	8.8	3,800	7,550	10,000	13,100	--	--
02490500	Bogue Chitto near Tylertown	1945-73	502	42.2	4.7	12,700	24,100	32,200	42,700	50,500	58,000
02490550	Middle Fork Hickory Flat near Tylertown	Synthetic	1.37	2.18	42.4	427	646	809	1,030	1,210	1,410
02490700	Union Creek near Tylertown	1953-69	12.6	5.8	25.6	890	2,440	4,320	8,240	--	--
02490750	McGees Creek at Tylertown	1953-69	151	20.0	7.6	4,140	8,230	11,100	14,800	--	--
02491500	Bogue Chitto at Franklinton, La.	1922-58	985	65.3	4.4	21,900	37,700	48,800	62,800	73,200	83,500
02492000	Bogue Chitto near Bush, La.	1938-70	1,210	92.4	4.0	16,700	29,800	39,400	52,400	62,400	72,500
02492350	East Hobolochitto Creek at Picayune	1957-70	108	26.9	7.2	3,300	5,100	6,300	--	--	--
02492360	West Hobolochitto Creek near McNeill	1966-70	175	28.9	5.1	[b]3,300	[b]5,500	[b]7,000	--	--	--
03592500	Bear Creek at Bishop, Ala.	1927-70	667	114	3.8	16,100	23,600	28,600	34,900	39,500	44,000
03592800	Yellow Creek near Doskie	1938-61	143	16.5	3.2	4,620	8,270	11,400	16,300	20,700	--
03593010	Chambers Creek at Kendrick	1940-61	21.1	7.7	12.2	2,360	4,620	6,370	8,800	10,700	--
07029252	Pool Branch near Ripley	Synthetic	1.24	2.02	58.1	772	1,090	1,290	1,540	1,720	1,880
07029270	Hatchie River near Walnut	1947-58	270	32.5	4.5	7,930	14,300	19,500	--	--	--
07029275	Hatchie River near Pocahontas, Tenn.	1941-52	300	46.3	3.4	7,270	12,500	16,000	--	--	--
07029300	Tuscumbia River near Corinth	1950-70	277	24.8	4.8	8,800	13,500	17,100	22,000	26,000	--
07029400	Hatchie River at Pocahontas, Tenn.	1942-70	837	49.1	2.47	14,600	23,200	29,800	39,400	47,300	55,900
07029500	Hatchie River near Bolivar, Tenn.	1930-67	1,480	90.8	1.26	17,100	28,300	36,800	48,700	58,300	68,500
07030365	Wesley Branch near Walnut	Synthetic	2.17	2.43	63.4	401	615	767	967	1,120	1,280
07030500	Wolf River at Rossville, Tenn.	1930-67	503	58.9	3.03	9,890	16,600	21,000	26,300	29,900	33,400
07266000	Cane Creek near New Albany	1939-73	22.2	9.5	14.1	2,970	4,570	5,560	6,720	7,500	8,220
07267000	Hell Creek near New Albany	1939-73	27.3	11.5	11.6	2,520	3,350	3,970	4,840	5,550	--
07267150	Jones Creek near New Albany	Synthetic	.34	1.0	58.1	178	246	292	353	398	444
07267200	Cracker Ditch near Pontotoc	Synthetic	.23	.82	121	100	136	161	193	218	243
07268000	Tallahatchie River at Etta	1938-73	526	32.9	5.3	27,100	40,100	49,000	60,500	69,200	78,000

Table 1.--Data for gaged streams --continued

Identification number	Name and location	Basin characteristics: Period of record	Drainage area (mi^2)	Channel length (mi)	Slope (ft/mi)	Peak discharge in cubic feet per second, for indicated recurrence interval, in years: 2	5	10	25	50	100
07268500	Cypress Creek near Etta	1948-73	28.5	8.0	15.0	4,090	6,540	8,340	10,800	12,700	14,700
07269000	North Tippah Creek near Ripley	1939-73	20.0	7.5	17.0	2,290	3,860	5,190	7,230	9,040	11,100
07269990	Tippah Creek near Potts Camp	1943-58	359	42.0	3.6	12,900	17,100	19,500	22,300	--	--
07271000	Clear Creek near Oxford	1939-72	10.3	4.0	23.3	2,830	4,150	5,050	6,210	7,090	7,990
07273000	Tallahatchie River near Sardis	1929-39	1,680	80.7	2.6	23,000	38,600	50,000	--	--	--
07274000	Yocona River near Oxford	1947-73	262	28.5	7.5	10,100	17,800	24,800	36,300	47,200	60,400
07274250	Otuckalofa Creek at Water Valley	1952-73	84.1	19.5	7.1	3,850	5,970	7,670	10,100	12,300	--
07275000	Yocona River at Enid Dam	1929-51	560	54.0	4.4	16,600	23,800	28,100	33,100	36,500	--
07275500	Long Creek at Courtland	1940-73	66.2	11.9	16.9	9,210	15,500	20,500	27,800	33,800	40,500
07276000	Coldwater River near Lewisburg	1940-58	218	37.9	6.3	[b]10,200	[b]16,300	[b]20,400	[b]25,500	--	--
07277000	Pigeon Roost Creek near Lewisburg	1940-58	228	27.8	8.2	6,860	9,730	11,800	14,700	--	--
07277500	Coldwater River near Coldwater	1929-42	617	52.4	4.6	18,000	35,100	49,000	--	--	--
07277550	James Wolf Creek near Looxahoma	Synthetic	.29	.61	143.0	232	314	368	436	487	536
07277700	Hickahala Creek near Senatobia	1943-58	121	19.6	9.6	9,220	14,500	18,700	24,800	--	--
07277730	Senatobia Creek near Senatobia	1943-58	82	15.2	11.0	14,600	17,300	18,700	20,100	--	--
07279500	Coldwater River at Savage	1909-41	1,220	78.4	3.4	12,100	24,600	35,300	--	--	--
07279600	Arkabutla Creek near Arkabutla	1947-58	97	18.5	6.5	11,800	14,100	15,300	--	--	--
07280000	Tallahatchie River near Lambert	1936-41	1,980	110	2.25	7,850	16,500	26,100	--	--	--
07281000	Tallahatchie River at Swan Lake	1930-39	5,130	144	1.62	26,100	42,600	54,100	--	--	--
07282000	Yalobusha River at Calhoun City	1951-73	305	24.1	4.4	13,900	24,300	31,200	39,400	45,100	--
07282300	Sabougla Creek Trib. at Sabougla	Synthetic	.50	1.01	58.1	174	250	302	369	420	472
07282500	Yalobusha River at Graysport	1940-49	607	44.7	3.0	18,100	30,900	40,900	--	--	--
07283000	Skuna River at Bruce	1948-73	254	31.6	4.2	10,900	17,600	24,100	35,600	47,100	62,000
07283490	Caney Creek near Coffeeville	Synthetic	1.97	2.89	26.4	755	1,130	1,350	1,600	1,770	1,920
07283500	Skuna River near Coffeeville	1940-49	435	50.2	3.2	15,200	24,800	33,400	--	--	--
07285100	Tie Plant Branch near Grenada	Synthetic	.13	.41	47.5	94	128	152	182	204	227
07285500	Yalobusha River at Grenada	1909-53	1,550	65.4	2.6	23,800	41,700	55,800	75,800	92,300	110,000
07285700	Long Creek near Cascilla	Synthetic	1.64	1.62	47.5	936	1,300	1,550	1,860	2,100	2,340
07286000	Askalmore Creek near Charleston	1941-58	31	10.4	14.1	8,980	11,000	12,200	--	--	--
07286010	Brushy Creek Trib. near Oxberry	Synthetic	1.49	2.0	79.2	648	952	1,140	1,360	1,500	1,640
07286047	Tippo Bayou at Phillip	Synthetic	.04	.30	31.7	23	32	37	44	50	55
07286200	Yalobusha River at Whaley	1938-53	1,960	102	1.8	16,800	32,800	47,100	69,900	--	--
07286500	Thompson Creek at McCarley	1950-56	14.4	7.5	14.3	2,470	3,040	3,420	3,910	--	--
07286520	Big Sand Creek Trib. near North Carrollton	Synthetic	.09	.61	84.5	54	76	91	110	126	140
07286700	Big Sand Creek near North Carrollton	1952-70	74.1	11.6	12.7	9,150	15,000	19,100	24,500	--	--
07286800	Big Sand Creek at Valley Hill	1947-58	110	20.1	9.9	17,700	23,500	27,400	--	--	--
07287140	Martin Lake Trib. near Sidon	Synthetic	.26	.69	26.4	86	116	138	166	188	210
07287165	Mosquito Lake Trib.No.1 at Itta Bena	1965-72	.11	.53	10.6	45	58	66	--	--	--
07287170	Mosquito Lake Trib.No.2 at Itta Bena	Synthetic	.13	.64	10.6	73	102	121	146	164	184
07287350	Fannegusha Creek near Tchula	1947-71[a]	100	23.0	7.5	8,900	15,300	21,000	30,000	--	--
07287480	Piney Creek near Yazoo City	1953-70	70	18.0	12.2	7,450	10,800	12,600	14,600	--	--
07287505	Broad Lake Trib.No.1 near Yazoo City	1966-71	.11	.40	10.6	19	23	26	--	--	--
07287510	Broad Lake Trib.No.2 near Yazoo City	Synthetic	.05	.45	10.6	24	34	41	50	56	62
07287520	Short Creek Trib. near Yazoo City	Synthetic	1.49	2.63	58.1	800	1,130	1,355	1,650	1,880	2,100
07288500	Sunflower River at Sunflower	1936-73	767	131	.64	6,200	8,710	10,200	11,900	13,100	14,100
07288568	Quiver River Trib. near Schlater	Synthetic	.18	.47	31.7	29	40	48	58	66	74
07288570	Quiver River near Doddsville	1938-60	292	44.2	.73	2,560	3,730	4,610	5,850	6,860	--
07288650	Bogue Phalia near Leland	1961-70	484	58.2	.82	[b]9,600	[b]10,500	[b]11,100	--	--	--
07288690	Mills Bayou Trib. near Hollandale	Synthetic	.08	.57	10.6	22	31	38	45	52	58
07288770	Deer Creek at Hollandale	1946-58	98	69.5	.69	576	753	846	--	--	--

Table 1.--Data for gaged streams --continued

Identi-fication number	Name and location	Basin characteristics				Peak discharge in cubic feet per second, for indicated recurrence interval, in years					
		Period of record	Drainage area (mi^2)	Channel length (mi)	Slope (ft/mi)	2	5	10	25	50	100
07289010	Durden Creek near Vicksburg	1935-58	5.50	5.1	28.0	1,700	2,700	3,460	--	--	--
07289100	Big Black River near Eupora	Synthetic	2.29	2.58	37.0	774	1,130	1,380	1,715	1,960	2,230
07289170	Mulberry Creek at Kilmichael	1946-53	40	12.0	9.5	7,520	10,500	13,000	--	--	--
07289180	Big Black River near Kilmichael	1937-58	549	41.2	2.3	14,200	23,200	29,400	37,500	43,500	--
07289225	Downing Branch near French Camp	Synthetic	1.74	2.48	26.4	523	716	854	1,040	1,190	1,340
07289268	Hays Creek Trib. near Vaiden	Synthetic	.40	.81	58.1	318	444	527	632	708	786
07289330	Zilpha Creek near Kosciusko	1953-70	90	14.9	8.9	4,070	7,640	10,900	16,300	--	--
07289350	Big Black River at West	1937-58	985	62.0	2.2	21,100	31,600	38,900	48,300	55,500	--
07289395	Sharkey Creek Trib. near West	Synthetic	.30	1.03	63.4	134	186	222	268	304	342
07289470	Tacketts Creek Trib. near Pickens	Synthetic	.15	.55	111	92	127	150	180	201	223
07289500	Big Black River at Pickens	1937-71	1,460	87.6	2.3	17,900	30,700	39,700	51,400	60,100	68,800
07289505	Big Cypress Creek near Vaughn	1960-70	89.3	19.2	4.9	6,200	8,800	11,200	--	--	--
07289530	Doaks Creek near Canton	1948-70	161	21.6	6.6	5,840	8,540	10,300	12,400	13,800	--
02289560	Bear Creek near Madison	1948-58	24.2	7.4	11.6	1,730	3,100	4,490	--	--	--
07289580	Bear Creek at Canton	1951-58[a]	86	14.4	6.5	4,500	5,700	6,550	--	--	--
07289600	Tilda Bogue near Canton	1948-73	19.2	8.9	12.7	2,600	4,480	5,610	6,830	7,600	8,260
07289610	Bachelor Creek at Canton	1953-70	3.11	2.9	16.8	698	826	902	990	--	--
07289620	Bear Creek near Canton	1950-58	154	22.4	6.2	6,850	8,250	8,900	--	--	--
07289640	Panther Creek near Flora	Synthetic	.26	.74	68.6	181	248	292	347	388	428
07289641	Panther Creek Trib. near Flora	Synthetic	.07	.34	195	64	89	105	124	138	152
07289730	Big Black River near Bentonia	1929-72	2,340	133	1.8	28,300	42,500	52,100	64,500	73,900	83,200
07289850	Bogue Chitto near Flora	1953-70	127	18.2	6.6	5,420	10,500	14,400	19,400	--	--
07290000	Big Black River near Bovina	1936-73	2,810	172	1.8	23,600	37,500	46,700	57,900	65,800	73,400
07290005	Clear Creek at Bovina	1953-73	36	8.5	21.9	5,390	9,710	13,800	20,600	27,200	--
07290110	Fleetwood Creek near Bolton	1960-70	13.8	6.2	18.1	1,960	3,550	4,440	--	--	--
07290115	Unnamed Creek near Bolton	1960-70	3.1	2.7	31.0	763	1,110	1,300	--	--	--
07290220	Dry Draw near Brookhaven	Synthetic	.20	.56	68.6	105	151	182	223	253	283
07290500	Bayou Pierre near Carpenter	1945-70	371	37.9	7.4	16,700	24,000	28,000	32,000	34,200	--
07290525	White Oak Creek Trib. near Utica	Synthetic	1.36	2.39	37.0	532	748	898	1,100	1,250	1,400
07290650	Bayou Pierre near Willows	1959-70	653	52.6	4.3	19,100	24,900	28,200	--	--	--
07290690	Clarks Creek near Pattison	1961-70	77.4	17.5	16.0	5,760	9,600	11,900	--	--	--
07290830	Little Creek near Fayette	Synthetic	1.71	1.98	47.5	688	1,050	1,290	1,580	1,800	2,000
07290870	Coles Creek near Fayette	1961-70	257	26.5	7.0	29,000	36,500	39,400	--	--	--
07290900	St. Catherine Creek near Natchez	1950-58	53	13.0	15.5	11,400	21,300	29,600	--	--	--
07291000	Homochitto River at Eddiceton	1939-74	180	28.1	9.0	16,400	25,900	32,000	39,500	44,800	50,000
07291250	McCall Creek at Lucien	1952-71	60	13.0	12.9	7,100	12,000	15,300	20,100	--	--
07291260	Beaver Run near McCall Creek	Synthetic	2.61	3.41	47.5	541	941	1,226	1,600	1,890	2,170
07291500	Homochitto River near Bude	1942-50	399	34.9	7.3	28,200	37,900	44,900	--	--	--
07292500	Homochitto River at Rosetta	1952-74	750	58.7	3.9	48,700	94,900	129,000	174,000	207,000	--
07294000	Second Creek near Sibley	1952-59	55.3	19.5	8.8	10,400	16,500	20,500	--	--	--
07294400	Observer's Draw near Doloroso	Synthetic	.22	1.14	153	150	208	245	290	323	356
07294500	Homochitto River near Doloroso	1940-58	1,120	77.8	3.6	30,200	46,400	59,800	80,100	--	--
07295000	Buffalo River near Woodville	1942-74	182	25.0	9.6	24,200	38,100	46,300	55,300	61,000	66,100
07364120	Bayou Bartholomew near Star City, Ark.	1942-68	215	81.7	.59	1,690	2,360	2,770	3,260	3,600	--
07364150	Bayou Bartholomew near McGehee, Ark.	1930-68[a]	592	167	.53	3,280	4,600	5,240	6,100	6,800	7,300
07364190	Bayou Bartholomew at Wilmot, Ark.	1926-68	1,170	269	.43	4,930	6,340	6,800	7,200	7,700	--
07364500	Bayou Bartholomew near Beekman, La.	1927-68	1,640	318	.41	6,900	9,400	10,600	12,600	14,000	--
07373550	Moore's Branch near Woodville	Synthetic	.21	.65	58.0	188	248	287	335	370	404
07375000	Tchefuncte River near Folsom, La.	1944-70	95.5	24.4	6.5	3,940	9,500	15,100	25,000	34,600	46,500
07375235	Tangipahoa River Trib. near McComb	Synthetic	2.71	2.51	37.0	477	772	991	1,290	1,530	1,770

Table 1.--Data for gaged streams --continued

Identi-fication number	Name and location	Basin characteristics				Peak discharge in cubic feet per second, for indicated recurrence interval, in years					
		Period of record	Drainage area (mi^2)	Channel length (mi)	Slope (ft/mi)	2	5	10	25	50	100
07375250	Little Tangipahoa River at Magnolia	1961-70	39.7	12.9	7.7	2,820	5,820	8,000	--	--	--
07375500	Tangipahoa River at Robert, La.	1939-70	646	66.0	6.0	12,200	22,900	31,500	43,700	53,700	64,300
07376000	Tickfaw River at Holden, La.	1941-70	247	49.3	6.3	4,890	8,150	10,300	12,800	14,500	16,200
07376500	Natalbany River at Baptist, La.	1944-70	79.5	30.9	6.6	3,100	5,120	6,590	8,550	10,100	11,600
07376665	Stock Pond Draw near Liberty	Synthetic	.38	1.17	63.4	194	286	349	428	486	546
07376760	CRS Draw near Liberty	Synthetic	.80	1.33	47.5	317	446	536	655	746	840
07377000	Amite River near Darlington, La.	1949-70	580	46.5	6.3	16,800	34,400	48,200	67,100	82,000	--
07377500	Comite River near Olive Branch, La.	1943-70	145	24.4	8.1	5,950	11,400	15,600	21,600	26,500	31,700
07378000	Comite River near Comite, La.	1944-70	284	46.4	5.2	9,040	14,800	18,500	23,100	26,400	29,500
07378500	Amite River near Denham Springs, La.	1939-70	1,280	79.5	5.2	23,500	40,300	52,300	68,100	80,200	92,300

[a]Record not continuous.
[b]Determined graphically.

regression results and the nearby station data. The station value can be transferred upstream or downstream by the equation

$$Q_t = \left(\frac{Au}{Ag}\right)^{0.6} Q_g,$$

and a weighted value can be calculated by the equation

$$Q_{t(w)} = \frac{2\Delta A}{Ag} Q_r + \left(1 - \frac{2\Delta A}{Ag}\right) Q_t$$

where

Q_t is the discharge at the site for the selected recurrence interval;

Q_g is the discharge for the selected recurrence interval from table 1;

Q_r is the discharge at the site from regression results for selected recurrence interval;

$Q_{t(w)}$ is the weighted discharge at the site for the selected recurrence interval;

A_u is the drainage area of the ungaged site;

A_g is the drainage area of the gaged site; and

ΔA is the difference between the drainage areas of the gaged and ungaged sites.

Where the drainage area at a site on a gaged stream differs by more than 50 percent from that for the gaged site, a regional result should be used.

Application for Ungaged Streams

As a result of analysis of data for Mississippi, the following equations are presented for estimating flood frequency for ungaged natural drainage basins:

Equation	Standard error of estimate (percent)	
$Q_2 = 189\ A^{0.91}\ S^{0.31}\ (L+2)^{-0.50}$	44	(1)
$Q_5 = 326\ A^{0.96}\ S^{0.34}\ (L+3)^{-0.59}$	37	(2)
$Q_{10} = 459\ A^{0.98}\ S^{0.36}\ (L+4)^{-0.65}$	36	(3)
$Q_{25} = 883\ A^{0.99}\ S^{0.32}\ (L+5)^{-0.74}$	33	(4)
$Q_{50} = 1120\ A\ S^{0.34}\ (L+6)^{-0.77}$	33	(5)
$Q_{100} = 2260\ A\ S^{0.25}\ (L+6)^{-0.88}$	32	(6)

where

Q_t is the estimated peak discharge, in cubic feet per second, for a recurrence interval of t years;

A is the drainage area, in square miles, as planimetered from topographic maps;

S is the channel slope, in feet per mile--which is the difference in altitude in feet at points 10 percent and 85 percent of the distance along the channel from the point of discharge to the watershed divide divided by the channel length in miles between the two points as determined from topographic maps; and

L is the main-channel length, in miles, from the point of discharge to the watershed divide as measured in 0.1-mile increments on topographic maps. At stream junctions the branch draining the largest area is considered the main channel.

Computation of slope and channel length is described in detail by Benson (1962). Flood-frequency values may be approximated from nomographs (figs. 2-7) or may be computed by means of a slide rule or calculator. Step-by-step procedure for calculation depends on the type of calculator used. An example is given below for approximating the 2-year (or average) flood peak by use of the nomograph in figure 2.

The method of solution is the same for the 5; 10; 25; 50; and 100-year floods (figs. 3-7).

For purpose of illustration, assume that the 2-year (mean annual) flood is desired at a site where:

Drainage area = 30 mi^2 (78 km^2)
Slope = 9 ft/mi (1.7 m/km)
Channel length = 10 mi (16 km)

Step 1. Using figure 2, connect a straight line between 9 ft/mi on the slope scale and 12 mi (channel length + 2) on the length scale, to intersect the isopleth (ungraduated solid line).

Step 2. Using the point on the isopleth as a pivot, extend a straight line through 30 mi^2 on the area scale to intersect the discharge scale.

Step 3. Read 2,400 ft^3/s, which is the discharge of the mean annual flood.

The above equations and graphs are based on English units of measurement. Metric units cannot be used in the equations or nomographs. To obtain the discharge in cubic metres per second, multiply the answer by the factor 0.02832.

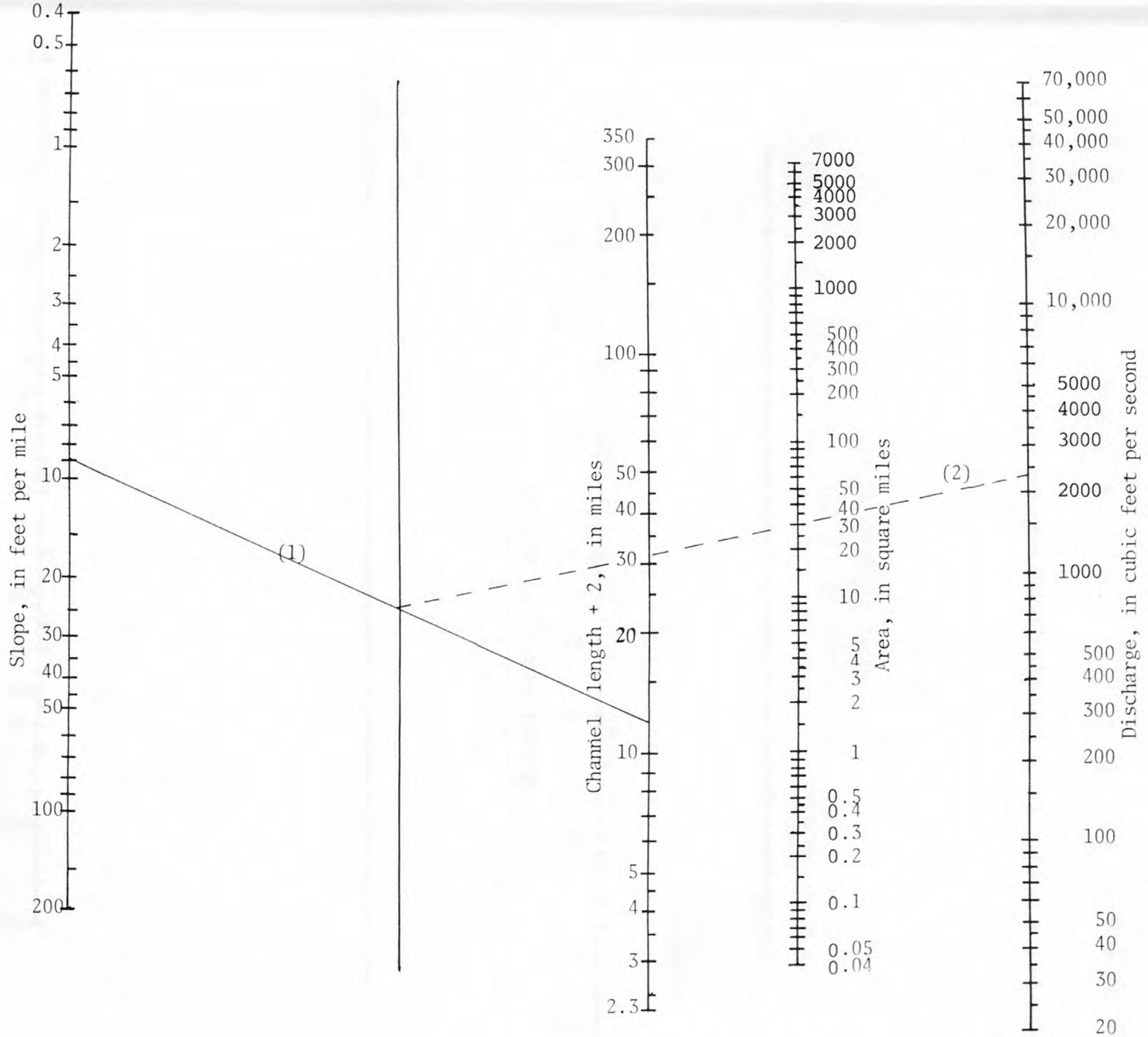

Figure 2.--Graphical solution for 2-year flood.

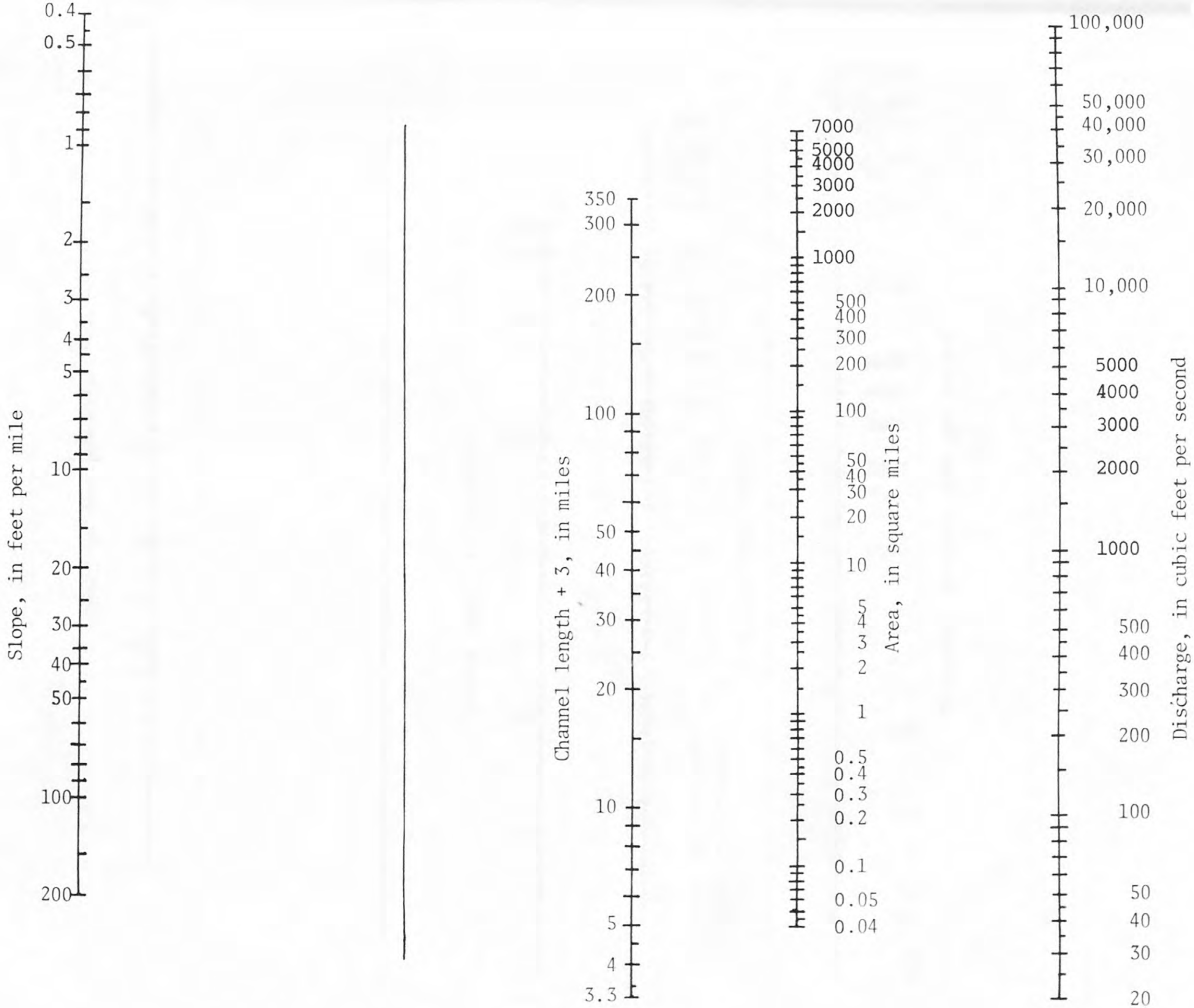

Figure 3.--Graphical solution for 5-year flood.

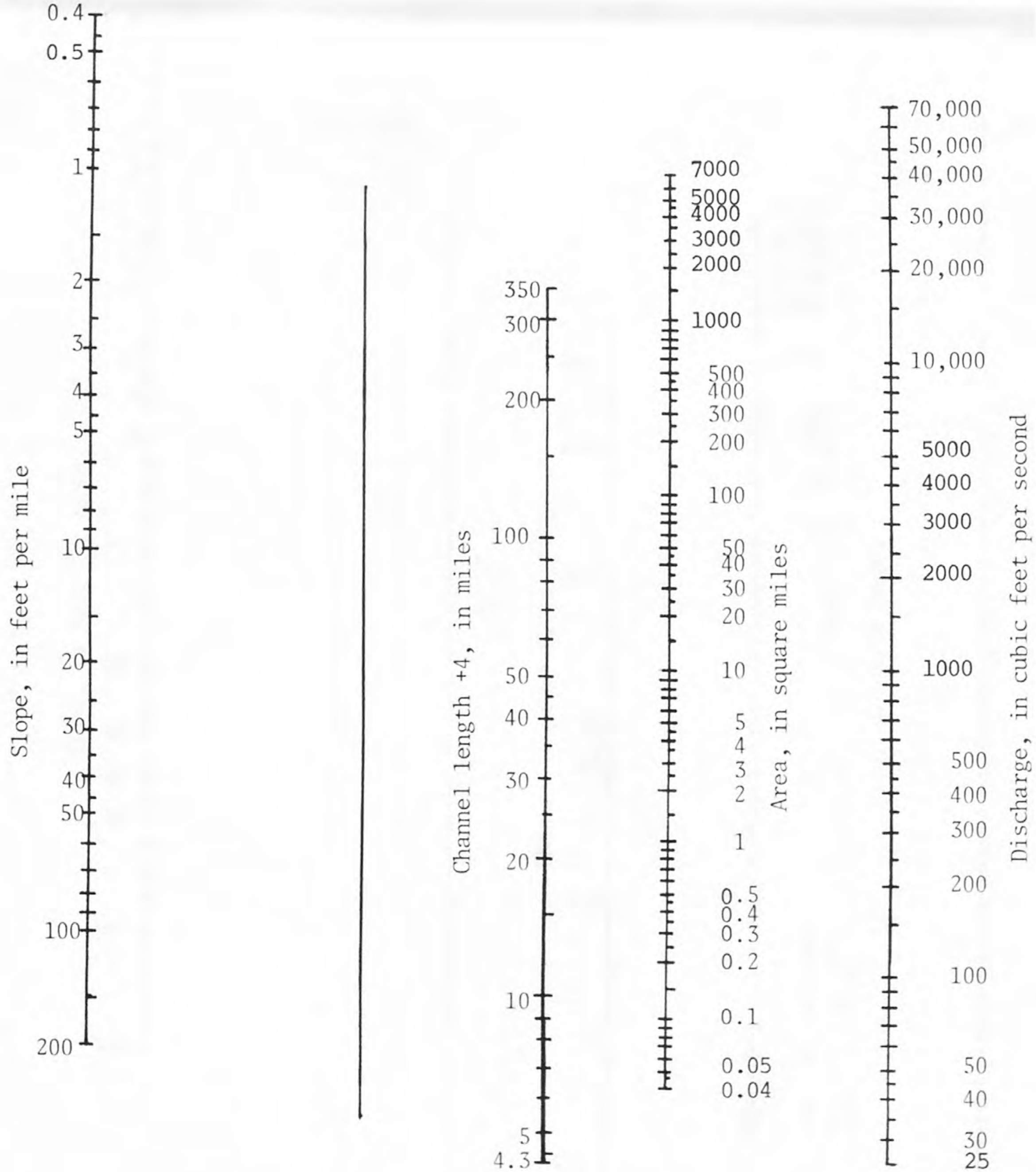

Figure 4 .--Graphical solution for 10-year flood.

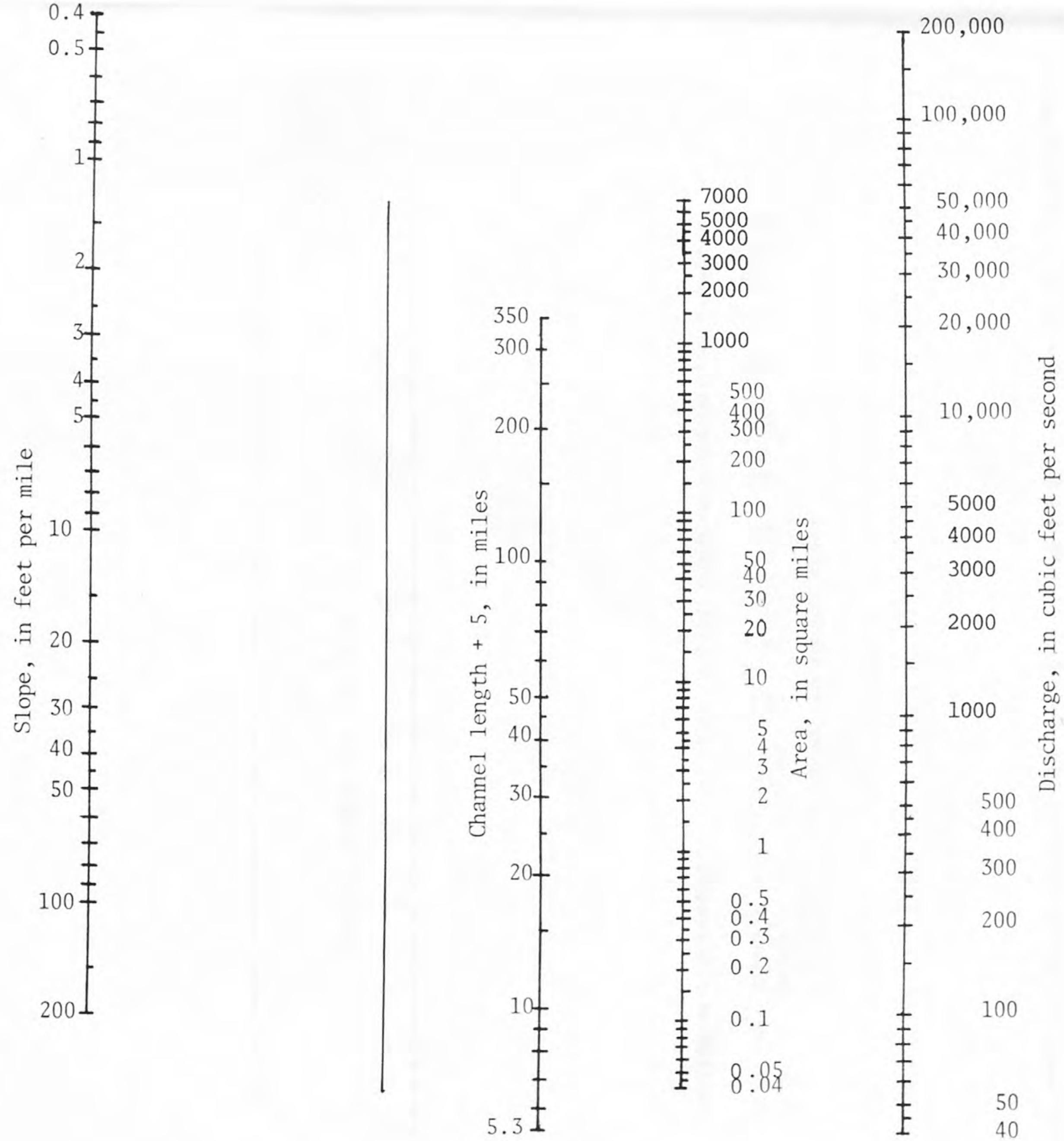

Figure 5.--Graphical solution for 25-year flood.

Figure 6.--Graphical solution for 50-year flood.

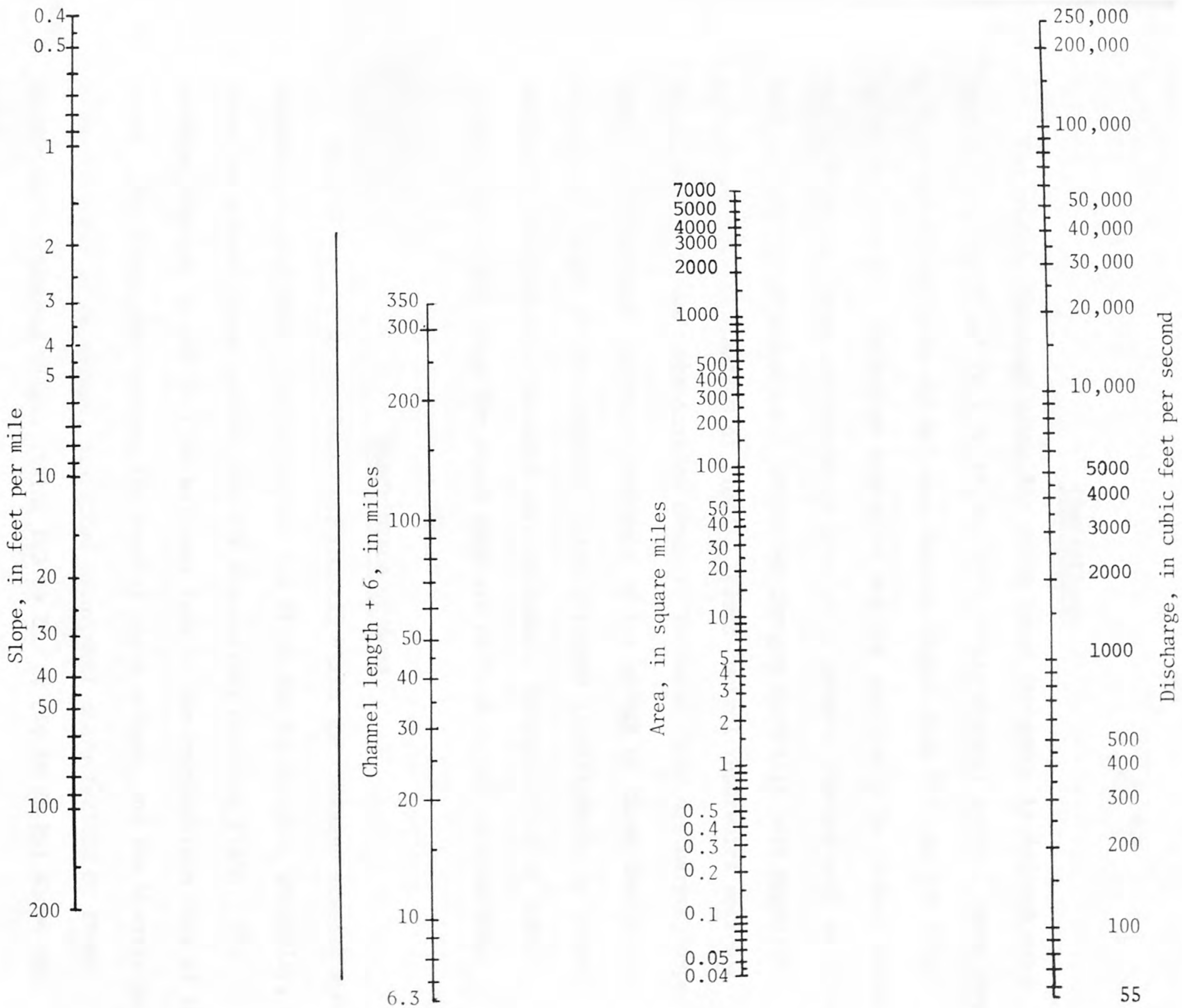

Figure 7.--Graphical solution for 100-year flood.

Limitations

The natural drainage areas for which flood frequency is defined range from 0.04 to 6,630 mi^2 (0.1 to 17,200 km^2). Main-channel lengths range from 0.13 to 261 mi (0.02 to 420 km) and channel slopes from 0.41 to 148 ft/mi (0.08 to 30 m/km). Relations presented are not applicable to streams where the drainage has been significantly altered by manmade changes such as flood-control dams or urbanization. These two changes generally have opposite effects on the distribution of floods. Flood-control reservoirs decrease flood magnitude, and urbanization tends to increase flood discharges, especially for low-order floods. Treatment of the effect of these changes is outside the scope of this report. Sites affected significantly by urbanization or flood-control measures were excluded. Extrapolation of these results beyond the range for which they are defined is not recommended.

ANALYSIS

Description of Area

Mississippi is in the East Gulf Coastal Plain and contains several subordinate physiographic districts, but the State may be divided, generally, into the coastal plain uplands and the Mississippi Alluvial Plain. The maximum altitude is 806 ft (246 km) near Iuka in the northeastern part of the State. The transition between the coastal plain uplands and the Mississippi Alluvial Plain is an abrupt, dissected escarpment characterized by steep slopes and pronounced ridges rising 150 to 250 ft (46 to 76 km) above the plain.

The Mississippi Alluvial Plain, in the northwestern part of the State, is a flat, lens-shaped basin having a maximum width of 65 mi (105 km). Drainage in the basin is complex. Streams have widely meandering interconnected channels, and drainage areas are not clearly defined. Natural levees generally occur along the channel banks that are overtopped only by unusual floods. Extensive levees built by the Corps of Engineers and others protect all but the southern part of the alluvial plain from floodwaters of the Mississippi River.

Four stream systems--the Yazoo, Big Black, Buffalo-Homochitto, and Bayou Pierre-Coles Creek--drain the western part of Mississippi into the Mississippi River. The northeast corner of Mississippi lies in the Tennessee River basin. The northern margin of the State is drained by the Hatchie-Wolf-Tuscumbia system. The remainder of the State drains southward into Lake Pontchartrain and the Gulf of Mexico, through the Amite, Pearl, Biloxi-Jourdan-Wolf, Pascagoula, and Tombigbee River systems.

There is no significant regulation on principal streams in Mississippi, except for four flood-control reservoirs constructed by the Corps of Engineers on tributaries to the Yazoo River. Sardis Dam on the Tallahatchie River began impoundment in August 1939, Arkabutla Dam on the Coldwater River in August 1941, Enid Dam on the Yocona River in July 1951, and Grenada Dam on the Yalobusha River in June 1953. Ross Barnett Reservoir on the Pearl River upstream from Jackson is primarily for water supply and recreation and has minor effect on flood flows. The Soil Conservation Service of the Department of Agriculture and others have undertaken numerous flood-control measures on small drainage basins. The main stem of the Mississippi River is significantly affected by regulation in the upper valley.

Climate

Mississippi lies in the temperate zone, which is characterized by a generally humid and mild climate. The average annual precipitation (fig. 8) ranges from 48 in (1,240 mm) in the north to 64 in (1,630 mm) along the Gulf of Mexico. Flood-producing rains are generally associated with three types

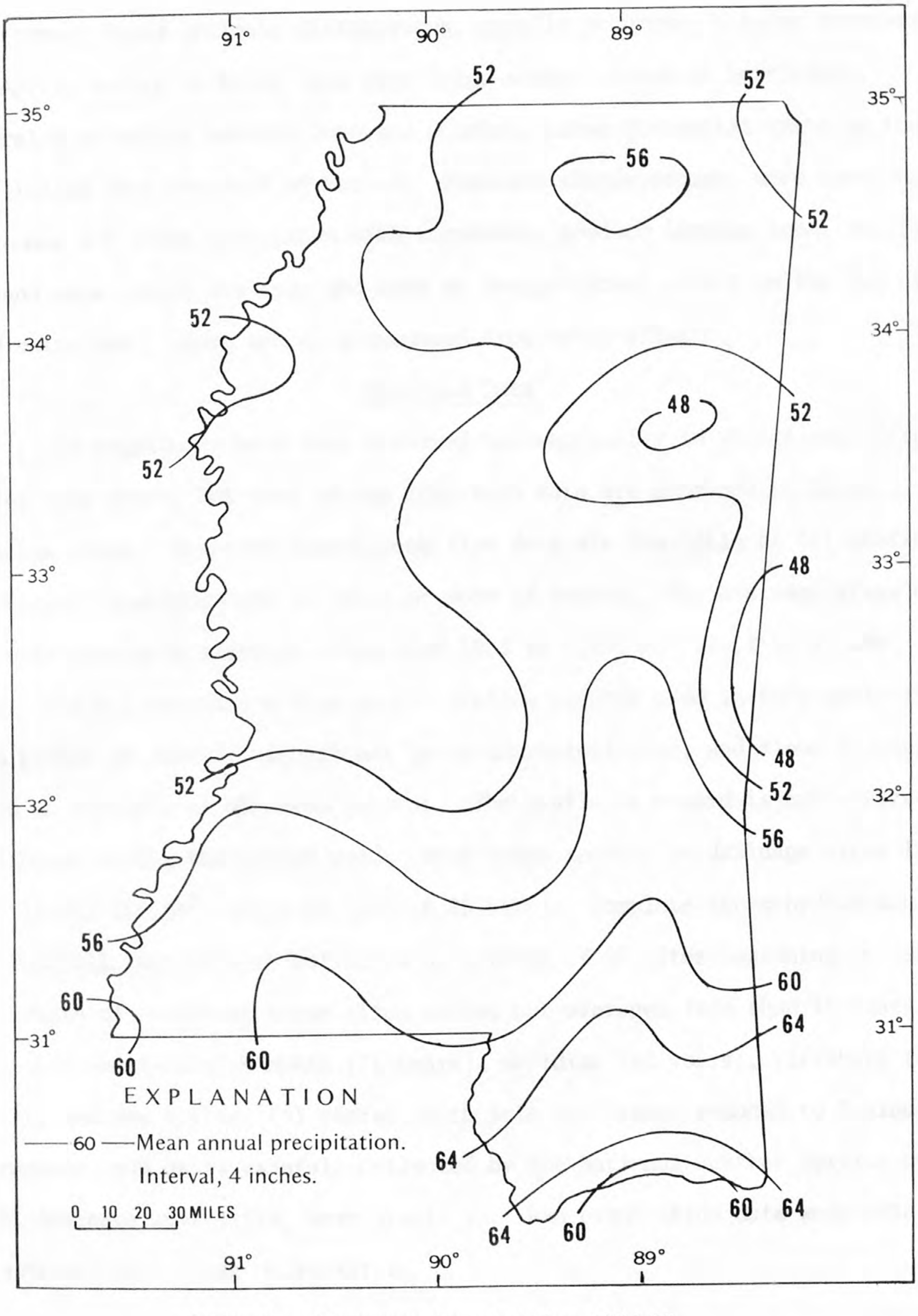

Figure 8. - - Mean annual precipitation, 1931-55.
(Data from U.S. Weather Service-NOAA)

of storms. Broad cyclonic disturbances, usually occurring between November and April, result in heavy rain over large areas. Tropical hurricanes, generally occurring between June and October, cause torrential rains as they move inland from the Gulf of Mexico. Frequent thunderstorms, more numerous in summer and often associated with tornadoes, produce intense local rainfall. Ice and snow storms are rare and have an insignificant effect on the hydrology of Mississippi. There are no pronounced orographic effects.

Observed Data

Flood magnitudes have been observed systematically in Mississippi (fig. 1) for many years, but most of the long-term data are confined to large drainage areas. Observed annual peak-flow data are available at 221 stations, of which 82 stations have 25 years or more of record. The drainage areas of these 82 long-term stations range from 10.3 to 6,630 mi^2 (26.7 to 17,200 km^2). Table 1 contains a list of all station records used in this analysis, with period of record, significant basin characteristics, and flood discharges based on analysis of observed records. The available record is not always continuous during the period used. Peak-stage records on drainage areas less than 10 mi^2 (26 km^2) began in 1955 at 25 sites. Complete storm hydrograph and rainfall records were collected at a total of 95 sites beginning in 1964. The length of record at these sites varied but averaged less than 10 years. Long-term rainfall at Memphis (71 years), Meridian (68 years), Vicksburg (67 years), and New Orleans (61 years), with selected storms reduced to 5-minute increments, and daily rainfall collected by the National Weather Service near small drainage area sites, were available. Pan-evaporation data were obtained from Mississippi State University.

Synthetic Data

It was deemed undesirable, for economic reasons, to wait for the collection of long-term flood records on small streams before beginning a new analysis of flood frequency in Mississippi. One of the alternatives was to use available climatic records in a runoff model to generate synthetic flood peaks. The model used in this study was developed by the Geological Survey specifically for the purpose of modeling flood hydrographs from small watersheds (Dawdy, Lichty, and Bergmann, 1972). This model optimizes 10 parameters (table 2) using concurrent precipitation and runoff records for a given site. Careful screening of precipitation and discharge hydrographs to delete anomalous data resulted in 1,178 storms for use in model calibration (table 3). Parameters were optimized, based on data collected at 10-minute intervals at 65 stations and on 5-minute intervals at 24 stations. At 9 of the 65 stations, data were collected subsequently at 5-minute intervals and a second set of parameters was obtained. Each set of parameters (table 3) was then used in the model with long-term climatic records collected by the National Weather Service at Memphis, Meridian, Vicksburg, and New Orleans, and with pan-evaporation data, to generate synthetic records. For the 9 stations having 2 sets of parameters the synthetic frequency curves were essentially equal and the average of the generated values was used. This gave four synthetic records for each of the 89 gage sites. A weighted average of these four synthetic frequency curves was obtained for each site based on an isohyetal map of Mississippi (fig. 8) and the individual site location. Each of the four long-term records was given a weight sufficient to obtain a mean-annual rainfall equal to that for the site location. The synthetic flood peaks generated using New Orleans rainfall were consistently the highest, and flood peaks generated using Memphis rainfall were the lowest. The synthetic flood

Table 2.--The 10 model parameters and their applications in the modeling process

Parameter	Units	Definition and application
		Antecedent moisture component
EVC -----	-----------------	Coefficient to convert pan evaporation to potential evapotranspiration values.
RR ------	-----------------	Proportion of daily rainfall that infiltrates the soil.
BMSM ----	Inches-----------	Soil moisture storage volume at field capacity.
DRN -----	-----------------	Drainage parameter for redistribution of soil moisture (fraction of KSAT).
		Infiltration component
PSP -----	Inches-----------	Product of moisture deficit and suction at the wetted front for soil moisture at field capacity.
KSAT ----	Inches per hour--	The minimum (saturated) hydraulic conductivity used to determine infiltration rates.
RGF -----	------------------	Ratio of the product of moisture deficit and suction at the wetted front for soil moisture at wilting point to that at field capacity.
		Surface runoff component (routing)
KSW -----	Hours------------	Time characteristic for linear reservoir routing.
TC ------	Minutes-----------	Length of the base of the triangular translation hydrograph.
TP/TC----	------------------	Ratio of time to peak to base length of the triangular translation hydrograph.

Table 3.--Summary of model parameters

Station number	PSP (in)	KSAT (in/hr)	DRN	RGF (in)	BMSM (in)	EVC	RR	KSW (hrs)	TC (min.)	TP/TC	Data interval (min.)	Number storms used
02429980	4.20	0.070	1	10.70	5.16	0.7	0.8	2.86	224	0.5	05	19
02430800	.456	.014	1	5.468	3.95	.7	.8	.966	54.0	.5	10	9
02435100	1.15	.011	1	7.503	2.31	.7	.8	.529	120	.5	10	5
02435300	.41	.012	1	2.012	1.82	.7	.8	.54	44.6	.5	10	6
02435400	2.70	.049	1	15.60	3.07	.7	.8	2.44	224	.5	05	28
02435920	2.43	.024	1	20.92	5.91	.7	.8	1.52	276	.5	10	3
02435930	1.03	.012	1	6.08	2.73	.7	.8	1.68	420	.5	10	3
02437550	4.52	.030	1	9.842	4.00	.7	.8	1.20	129	.5	05	31
02439800	2.16	.026	1	12.96	5.40	.7	.8	.924	231	.5	10	2
02440020	3.03	.018	1	20.25	5.40	.7	.8	.50	40.0	.5	05	15
02441220	1.01	.034	1	10.15	2.70	.7	.8	1.50	75.0	.5	05	23
02443605	1.01	.010	1	2.00	7.38	.7	.8	1.08	47.2	.5	10	13
02443700	.665	.017	1	11.38	2.99	.7	.8	1.50	150	.5	10	10
02447220	1.14	.022	1	4.345	3.72	.7	.8	2.16	131	.5	10	5
02447280	3.04	.030	1	18.22	7.42	.7	.8	1.13	125	.5	10	3
02447340	1.16	.024	1	14.98	2.25	.7	.8	4.39	469	.5	10	9
02448620	1.22	.018	1	8.10	4.50	.7	.8	2.75	84.0	.5	05	32
02467100	1.72	.034	1	19.58	9.39	.7	.8	1.04	176	.5	10	13
02469672	2.16	.031	1	9.214	5.51	.7	.8	2.77	212	.5	10	14
02472160	1.37	.020	1	9.48	8.55	.7	.8	.44	151	.5	10	4
02472700	4.96	.049	1	19.50	8.96	.7	.8	1.82	92.9	.5	10	11
02472810	1.02	.045	1	18.0	3.60	.7	.8	1.0	60.0	.5	05	12
02473850	1.14	.024	1	4.253	9.92	.7	.8	2.02	250	.5	05	13
02475050	1.05	.012	1	3.038	6.08	.7	.8	3.16	316	.5	10	6
02475220	4.72	.142	1	8.201	9.93	.7	.8	1.41	62.8	.5	10	8
02477050	1.03	.027	1	10.74	5.78	.7	.8	2.27	73.1	.5	10	8
02477090	.864	.019	1	7.56	5.67	.7	.8	1.35	60.3	.5	10	19
02477090	.878	.016	1	8.91	7.42	.7	.8	.858	143	.5	05	7
02478600	.85	.023	1	10.10	1.86	.7	.8	1.16	125	.5	05	11
02479094	4.32	.057	1	10.24	7.90	.7	.8	2.10	184	.5	05	7
02479138	3.63	.047	1	14.74	3.19	.7	.8	1.62	174	.5	10	10
02479165	2.84	.036	1	7.90	1.14	.7	.8	1.95	243	.5	10	15
02479187	2.37	.030	1	8.898	1.51	.7	.8	.169	320	.5	10	18
02479260	1.73	.016	1	17.32	7.72	.7	.8	4.20	125	.5	10	10
02481505	3.13	.054	1	12.87	3.15	.7	.8	3.60	243	.5	05	12
02481900	3.00	.029	1	18.86	4.75	.7	.8	1.03	103	.5	10	10
02482310	4.86	.108	1	10.24	1.82	.7	.8	1.91	137	.5	10	7
02482900	3.34	.059	1	10.02	5.23	.7	.8	.990	33.1	.5	10	5
02483890	1.68	.022	1	6.189	5.52	.7	.8	1.70	83.4	.5	10	6
02484750	1.30	.018	1	7.898	3.04	.7	.8	.504	136	.5	10	5
02485380	2.09	.026	1	7.896	3.16	.7	.8	1.95	181	.5	10	13
02485385	2.54	.030	1	15.24	9.46	.7	.8	.869	103	.5	10	8
02485392	1.72	.032	1	5.746	4.65	.7	.8	.484	66.6	.5	10	13
02485900	3.41	.044	1	8.170	13.8	.7	.8	2.34	278	.5	10	9
02485900	2.05	.052	1	8.716	1.94	.7	.8	2.10	165	.5	05	9
02486240	3.72	.060	1	18.06	3.54	.7	.8	.894	159	.5	10	7
02487670	4.99	.104	1	19.80	9.36	.7	.8	1.05	99.0	.5	05	8
02487710	2.76	.037	1	12.21	5.47	.7	.8	2.87	266	.5	10	12
02487710	2.95	.045	1	9.059	3.26	.7	.8	2.30	250	.5	05	16
02487770	2.94	.031	1	12.50	5.51	.7	.8	2.50	105	.5	10	11

Table 3.--Summary of model parameters --continued

Station number	PSP (in)	KSAT (in/hr)	DRN	RGF (in)	BMSM (in)	EVC	RR	KSW (hrs)	TC (min.)	TP/TC	Data interval (min.)	Number storms used
02488340	2.94	.032	1	15.26	9.37	.7	.8	.880	17.6	.5	05	15
02488510	2.87	.043	1	18.91	5.95	.7	.8	.719	143	.5	10	6
02488510	5.44	.065	1	19.8	4.05	.7	.8	.588	126	.5	05	18
02488540	3.87	.025	1	11.10	3.52	.7	.8	1.83	158	.5	10	18
02488550	5.75	.073	1	30.00	6.30	.7	.8	.575	113	.5	15	9
02488680	3.42	.074	1	6.891	5.96	.7	.8	.875	109	.5	10	12
02489030	3.24	.033	1	16.70	1.82	.7	.8	1.80	39.0	.5	05	26
02489160	4.96	.108	1	17.21	6.52	.7	.8	.743	129	.5	10	4
02490550	2.07	.050	1	13.35	1.04	.7	.8	2.03	241	.5	10	9
07029252	2.94	.047	1	8.775	6.48	.7	.8	.769	43.2	.5	10	7
07030365	3.60	.056	1	11.69	3.13	.7	.8	2.88	248	.5	05	22
07267150	1.78	.033	1	8.859	2.73	.7	.8	1.20	57.8	.5	05	19
07267200	1.40	.018	1	5.906	4.86	.7	.8	1.89	83.3	.5	10	10
07277550	1.13	.016	1	1.9444	1.22	.7	.8	.50	40.0	.5	10	22
07277550	1.13	.012	1	2.43	1.22	.7	.8	.820	40.0	.5	05	3
07282300	1.96	.044	1	11.35	3.77	.7	.8	1.80	36.0	.5	05	22
07283490	3.24	.035	1	19.3	7.94	.7	.8	.614	162	.5	10	3
07285100	1.14	.019	1	6.103	3.04	.7	.8	.438	92.8	.5	10	10
07285700	2.32	.028	1	3.446	6.96	.7	.8	.681	108	.5	10	21
07286010	2.81	.050	1	9.525	9.89	.7	.8	.752	118	.5	10	8
07286047	1.05	.012	1	2.430	3.96	.7	.8	1.20	42.0	.5	05	5
07286520	1.35	.035	1	11.02	1.35	.7	.8	.517	95.8	.5	10	13
07287140	1.05	.013	1	2.633	6.44	.7	.8	2.70	108	.5	05	12
07287170	1.14	.026	1	9.039	5.30	.7	.8	.592	126	.5	10	11
07287510	1.86	.026	1	16.97	5.98	.7	.8	.869	93.6	.5	10	3
07287520	1.83	.029	1	14.33	3.24	.7	.8	.510	91.4	.5	10	9
07287520	1.37	.023	1	16.71	2.02	.7	.8	1.05	72.0	.5	05	19
07288568	1.05	.018	1	3.291	3.34	.7	.8	7.20	234	.5	05	11
07288690	1.32	.027	1	7.425	3.34	.7	.8	2.88	117	.5	05	5
07289100	2.37	.057	1	4.698	6.86	.7	.8	.844	232	.5	10	9
07289225	1.13	.014	1	3.038	4.01	.7	.8	1.80	333	.5	10	9
07289268	1.80	.029	1	7.166	2.66	.7	.8	.096	96.0	.5	10	11
07289395	1.56	.015	1	13.82	2.34	.7	.8	1.61	14.1	.5	05	29
07289470	.865	.019	1	7.986	8.70	.7	.8	.743	89.1	.5	10	4
07289640	2.79	.013	1	7.77	5.57	.7	.8	.60	22.0	.5	05	13
07289640	1.15	.016	1	9.411	6.48	.7	.8	.435	149	.5	10	16
07289641	1.50	.022	1	4.707	3.12	.7	.8	.232	68.8	.5	10	16
07290220	3.02	.040	1	8.637	4.14	.7	.8	.874	119	.5	10	14
07290525	1.40	.028	1	15.16	3.76	.7	.8	1.33	171	.5	10	23
07290830	4.60	.074	1	11.83	2.39	.7	.8	.975	39.8	.5	05	15
07291260	2.95	.172	1	9.90	5.14	.7	.8	1.46	248	.5	05	19
07294400	3.28	.048	1	11.26	3.64	.7	.8	.875	17.1	.5	10	12
07294400	1.94	.022	1	7.176	8.07	.7	.8	1.01	21.6	.5	05	11
07373550	1.36	.023	1	7.66	3.59	.7	.8	.787	44.6	.5	10	5
07375235	4.84	.048	1	9.900	5.67	.7	.8	4.66	300	.5	10	19
07376665	2.10	.048	1	10.43	8.48	.7	.8	1.11	168	.5	10	24
07376665	4.92	.034	1	14.14	7.35	.7	.8	1.20	69.3	.5	05	13
07376760	1.37	.028	1	3.950	6.81	.7	.8	2.23	230	.5	10	20

peaks based on Meridian and Vicksburg fell in between, with Meridian usually higher for the low-order floods. Graphical comparisons of observed and synthetic records were made for all sites. Frequency curves for both ob-served and synthetic data were plotted. Values of observed versus synthetic results for various frequency levels showed no bias with size of drainage area. Most of the sites had 10 or more years of observed peaks available. These data were considered adequate to define the mean-annual flood. A statistical comparison of the mean-annual flood with data values obtained from the synthetic record indicated no bias in the synthetic results. Therefore, these 89 synthetic records were used, along with observed records on larger streams, to analyze flood frequency.

Flood-Frequency Analysis

A Pearson Type III distribution, a three-parameter distribution defined by the mean, the standard deviation, and the skew, were fitted to the logarithims of flood discharges. With a zero skew it is identical to the normal distribution. A more detailed description of this distribution is available in most texts on statistics.

The parameter values for the Pearson Type III distribution were computed from the logarithms of the observed data for each site. Graphical curves were examined for all sites to assess the adequacy of the mathematical fit of the observed data and any historical information. Values of the 2-, 5-, 10-, 25-, 50-, and 100-year flood discharges were obtained directly from the Pearson Type III distribution, except for four sites where an extreme value or historical information led to a significant change in flood discharge values. In these cases, a graphic best-fit curve drawn through the data points was used, as described by Riggs (1968b). Using the criterion recommended for length of record, 310 stations qualified for defining the 2- and

10-year floods, 252 stations for the 25-year flood, 205 stations for the 50-year flood, and 167 stations for the 100-year flood (table 1).

Regression Analysis

One specific purpose of this study was to provide estimates of flood frequency at ungaged sites.

The true distribution of floods at a site depends on a great many factors, the principal ones being basin characteristics such as size, topography, geology, land use, and climate. Thus, the variability among flood-frequency curves is made up of two components--chance variation due to time-sampling error and variation due to differences in basin characteristics. It was assumed that the available records were sufficiently independent to provide a representative time sample and a representative sample of stream basin characteristics.

A multiple regression model, utilizing the basin parameters, provides a method of averaging the chance variation and relating a given frequency level to basin characteristics. Hydrologic studies have shown that peak-flow discharges are linearly related to most basin characteristics if the logarithms of each are used (Thomas and Benson, 1970). Therefore, discharge and basin characteristics were transformed to logarithms before calculations were performed. During the course of this analysis 16 indices of basin characteristics were studied, including area, length, slope, soil, forest, altitude, and various rainfall indices. The only ones to show a highly significant relation to basin-to-basin variations in flood frequency were basin size, slope, and length. The index of basin size used was the drainage area measured in square miles. Initially the data were divided, on the basis of basin size, into three groups--less than 5 mi^2 (13 km^2), 5 to 40 mi^2 (13 to 104 km^2), and greater than 40 mi^2 (104 km^2). Basins were grouped by size to study the effect of various characteristics. Soil type could be easily and reliably obtained for small areas. Forest cover ranged from 0 to 100 percent, and much higher values of slope were found on drainage areas less than 5 mi^2 (13 km^2). Thunderstorm activity often causes the annual peak discharge from small basins, while large basins are affected more by broad frontal systems, indicating that different rainfall indices might apply. The 1-hour and 6-hour rainfall of various recurrence intervals and the mean annual rainfall were found not to be significant in defining flood frequency for any of the three groups. Soil type was indexed as a dimensionless number ranging from 0.2 for coarse sand to 1.2 for tight clay for drainage areas less than 5 mi^2 (13 km^2) from data supplied by the Soil Conservation Service of the Department of Agriculture. No relation of soil type to flood frequency for small basins was defined, so this index was dropped from further consideration.

Forest cover was used both as an index ranging from 0.90 to 1.05 and as a percent of forested area. Plots of these indices indicated that the relation to flood frequency might be spurious, and since the inclusion reduced the standard error less than 2 percent for small drainage areas no index of forest cover was computed for large basins.

The index of slope developed by Benson (1962, 1964) was used sucessfully. This index is the average slope, in feet per mile, of the main channel between points 10 and 85 percent of the distance upstream from the site to the basin border. Altitudes at the 10- and 85-percent points as determined from topographic maps were used in this study. Length and area were found to be significant basin characteristics. A constant ranging from 2 to 6 was added to all lengths prior to logarithmic transformation. Length used as an independent variable with drainage area provides a shape factor which was found by Wilson and Trotter (1961) in Mississippi, Hains (1973) in Alabama, and

Patterson (1971) in Arkansas to be a significant factor affecting flood distribution. Hydraulic theory indicates length should be inversely related to peak flow. Graphical plots verified that the hypothesis of a log linear model was unbiased areally and over the range of variables sampled.

The standard error of estimate is given as an index of the accuracy of the relations, but it must be recognized that it is not a true indication of the accuracy of the estimates at ungaged sites. Hardison (1971) gives a detailed analysis of the relation between accuracy and the standard error of estimate of a regression equation. The decrease in the standard error of estimate as the recurrence interval increases may be due to convergence toward a common time sample; however, there is a possibility that fewer factors significantly influence the larger floods, or that the reduced sample of observed records limits variability.

SUMMARY

A method of computing estimates of the 2-, 5-, 10-, 25-, 50-, and 100-year floods for a natural drainage basin of any size in Mississippi is presented in one set of equations. A graphical method of solving the equations gives a quick approximation of flood estimates. Synthetic records of annual peaks were used for 89 basins ranging in area from 0.04 to 4.35 mi^2 (0.1 to 11.3 km^2). Observed annual peaks were used for 221 stations, giving a total of 310 station records for this analysis. The analysis does not include regulated or urbanized basins. Regression techniques were used to average the chance variability of the data and relate flood frequency to basin characteristics. The standard error of estimate ranging from 32 to 44 percent is considered a good fit of the observed data. The ability to use one set of basin characteristics to describe flood frequency for both large and small drainage areas without other adjustment factors adds strength and clarity to the results.

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