STREAMFLOW CHARACTERISTICS AT SELECTED SITES IN SOUTHWESTERN GEORGIA, SOUTHEASTERN ALABAMA, AND NORTHWESTERN FLORIDA, NEAR LAKE SEMINOLE

U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the

GEORGIA DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

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by Timothy C. Stamey

ABSTRACT

Flow durations, low-flow and mean-flow analyses of daily mean discharges are compiled for 12 streamflow stations in southwestern Georgia, southeastern Alabama, and northwestern Florida for three selected periods. The selected periods include pre-Lake Seminole (1929-53); post-Lake Seminole and pre-irrigation (1958-70); and post-Lake Seminole and post-irrigation (1976-93); or as noted for partial periods. The analyses yield information on how inflow to and outflow from Lake Seminole and flows for three tributary streams varies over the three selected periods.

Streamflow characteristics for two of the tributary streams—Ichawaynochaway Creek and Milford, Ga., and Chipola River near Altha, Fla.—vary similarly from the period 1944-53 to 1958-70, with mean-low flows decreasing by about 12 percent and 2 percent, respectively. This decreasing trend continued from the period 1958-70 to 1976-93—mean-low flows decreased by about 30 percent at Ichawaynochaway Creek and decreased at Chipola River by about 5 percent. Mean-low flows at Spring Creek near Iron City, Ga., show only a slight increase from the period 1944-53 to 1958-70.

Streamflow characteristics for inflow to and outflow from Lake Seminole vary similarly from the period 1929-53 to 1958-70 to 1976-93. Mean 30-day low-flows for inflow and outflow of Lake Seminole increases by about 24 to 11 percent, respectively, from the period 1929-53 to 1958-70; and then returns to near 1929-53 low-flow values for the 1976-93 period.

INTRODUCTION

The Apalachicola-Chattahoochee-Flint (ACF) River basin drains about 19,600 square miles (mi^2) and covers parts of Georgia, Alabama, and Florida (fig. 1). The basin stretches from the headwaters northeast of Atlanta, Ga., to Apalachicola Bay in the Gulf of Mexico in northwestern Florida. The Chattahoochee River and Flint River converge below Bainbridge, Ga., at Lake Seminole, formerly called Jim Woodruff Reservoir. Lake Seminole was formed in 1954 at the confluence of the Chattahoochee and Flint Rivers by an earth-and-concrete dam, constructed by the U.S. Army Corps of Engineers for navigation and power-generation purposes. The Apalachicola River flows out of Lake Seminole near Chattahoochee, Fla., through northwestern Florida, into Apalachicola Bay, and then discharges into the Gulf of Mexico.

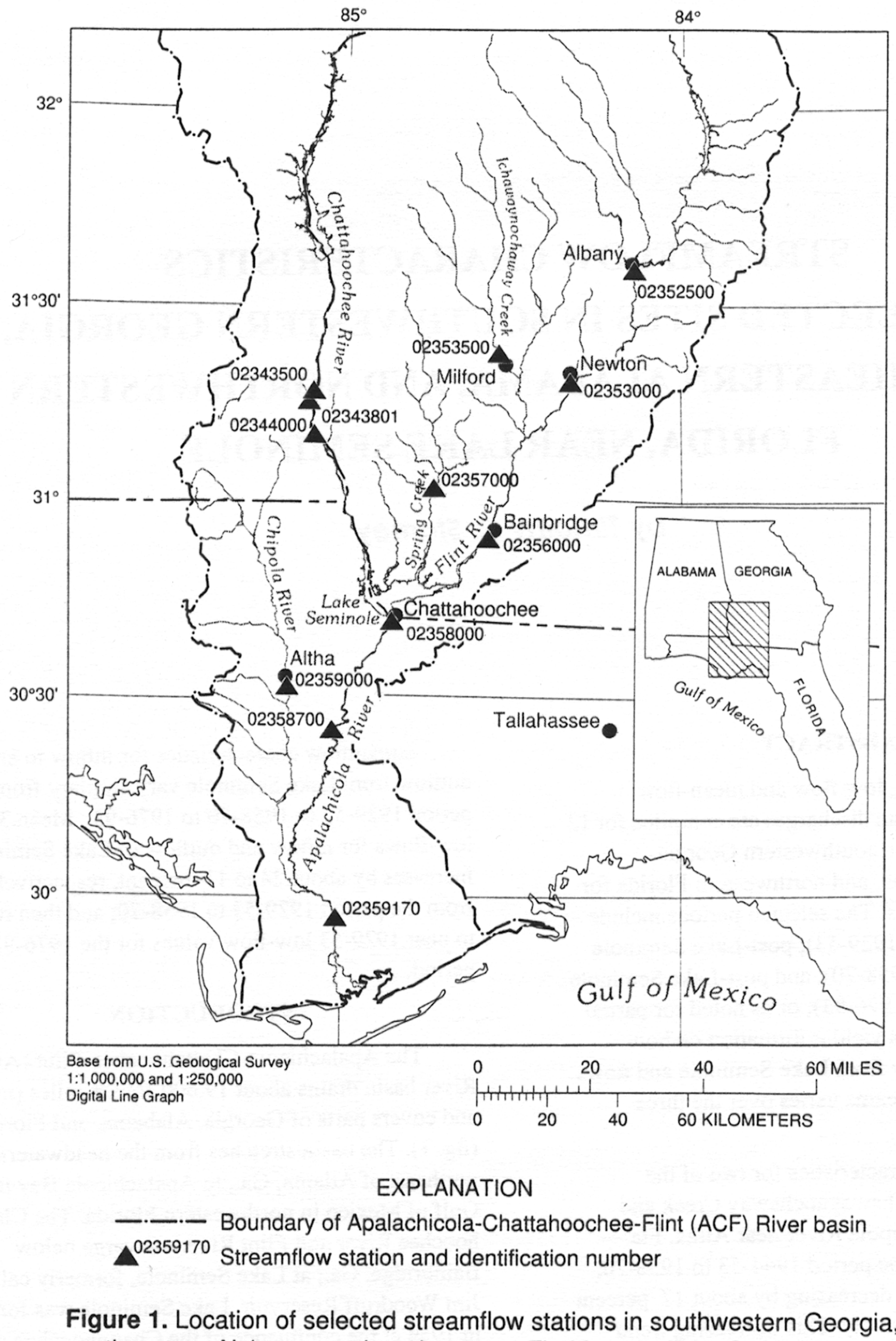

Figure 1. Location of selected streamflow stations in southwestern Georgia, southeastern Alabama, and northwestern Florida near Lake Seminole.

Increased and competing demands for water and the recent droughts of 1980-81, 1986, and 1988 in the ACF River basin have focused the attention of water managers and users in Georgia, Alabama, and Florida on the water resources of the basin. Of particular interest are the surface-water resources of the Chattahoochee, Flint, and Apalachicola Rivers and their major tributaries in the vicinity of Lake Seminole in southwestern Georgia (fig. 1). The U.S. Geological Survey (USGS) entered into a cooperative agreement with the Georgia Department of Natural Resources, Environmental Protection Division (EPD) to compile streamflow data for selected stations in the vicinity of Lake Seminole; compute streamflow characteristics using the compiled data for selected periods; and compare observed changes in flow characteristics of tributary streams, as well as inflow and outflow of Lake Seminole.

Purpose and Scope

This report presents results of flow-duration, low-flow, and mean-flow analyses of daily mean discharges for 12 streamflow stations in the lower part of the ACF River basin; comparison of streamflow characteristics of Ichawaynochaway Creek at Milford, Ga., to those of Chipola River at Altha, Fla.; and a similar comparison of Lake Seminole inflow and outflow characteristics. The purpose of these data computations and comparisons is to determine if flow characteristics of streams upstream from Lake Seminole vary over time in a similar or dissimilar manner to those downstream from the lake.

The three periods of greatest interest to water managers are for streamflows prior to the impoundment of Lake Seminole in 1954; after the impoundment of Lake Seminole, but prior to the advent of intensive agricultural irrigation in the early 1970's; and after the widespread initiation of agricultural irrigation around 1976. To the extent possible, streamflow records were analyzed to characterize the pre-Lake Seminole conditions using data for 1929 through 1953 (period 1); post-Lake Seminole, and pre-irrigation conditions using data for 1958 through 1970 (period 2); and post-irrigation conditions using data for 1976 through 1993 (period 3).

Streamflow Station Numbering System

Streamflow stations are identified by a numbering system used by USGS since October 1, 1950. The order of listing stations is in a downstream direction along the mainstream. All stations on a tributary entering upstream of a mainstream station are listed before that station. Each streamflow station is assigned a unique 8- to 14-digit number. The station number, such as 02353000, includes the 2-digit number "02," which refers to the regional basin identifier, plus the 6- to 12-digit downstream order number "353000."

STREAMFLOW DATA COMPILATIONS

Twelve streamflow stations in the lower ACF River basin were identified as having daily mean streamflow records of sufficient length to be useful in this study (fig. 1). The names, drainage areas, and periods of streamflow record for the 12 stations are listed in table 1. Daily streamflow data for these 12 stations were retrieved from the USGS National Water Information System (NWIS) data base using the Automated Data Processing System (ADAPS) (U.S. Geological Survey, 1990) and USGS National Water Data Storage and Retrieval System (WATSTORE) (U.S. Geological Survey, 1975). Data were compiled using standard USGS programs and statistical procedures as part of the data retrieval process. Only one station shown in table 1 has data available for all three periods of interest—Apalachicola River at Chattahoochee, Fla. (02358000). Flint River at Albany, Ga. (02352500) has all years except 1929 available for analysis. Many stations listed in table 1 have data for parts of only one or two periods.

Unless otherwise noted, references to a particular year of record in this report (for example, 1953) are for a water year. A water year begins on October 1 and ends on September 30 of the following year. For example, water year 1953 begins on October 1, 1952 and ends on September 30, 1953. Other year-date conventions such as climatic years, which begin on April 1 and end on March 31 of the following year, and calendar years are noted when used. Throughout this report, the term *daily mean discharge* is referred to as *streamflow* or *discharge* without the modifying term of *daily mean*.

Table 1. Selected streamflow stations in the lower Apalachicola-Chattahoochee-Flint River basin in parts of Georgia, Alabama, and Florida; and periods of daily mean streamflow data available for analysis
[mi^2, square miles]

Station number	Station name	Drainage area (mi^2)	Available data
02343500	Chattahoochee River at Columbia, Ala.	8,040	October 1, 1928 to September 30, 1960
02343801	Chattahoochee River near Columbia, Ala.	8,210	October 1, 1975 to September 30,1993
02344000	Chattahoochee River at Alaga, Ala.	8,340	May 1, 1938 to December 31, 1944 October 1, 1960 to September 30, 1970
02352500	Flint River at Albany, Ga.	5,310	October 1, 1929 to September 30, 1993
02353000	Flint River at Newton, Ga.	5,740	April 1, 1938 to September 30, 1945 October 1.1946 to September 30,1947 January 1, 1949 to September 30, 1950 October 1, 1956 to September 30, 1993
02353500	Ichawaynochaway Creek at Milford, Ga.	620	October 1, 1939 to September 30, 1993
02356000	Flint River at Bainbridge. Ga.	7,570	October 1, 1928 to September 30, 1971
02357000	Spring Creek near Iron City, Ga.	485	June 11, 1937 to April 30, 1971 December 20, 1976 to September 30, 1978 June 7, 1982 to September 30, 1993
02358000	Apalachicola River at Chattahoochee. Fla.	17,200	October 1, 1928 to September 30, 1993
02358700	Apalachicola River at Blountstown, Fla.	17,600	October 1, 1957 to September 30,1993
02359000	Chipola River near Altha, Fla.	781	August 1, 1929 to September 30, 1931 March 1, 1943 to September 30, 1993
02359170	Apalachicola River near Sumatra, Fla.	19,200	September 1, 1977 to September 30, 1993

STREAMFLOW CHARACTERISTICS

Computations of streamflow characteristics include determinations of mean values for consecutive low-flow days, monthly and annual data, as well as selected flow-duration and low-flow frequency values. Streamflow characteristics and statistical values were computed using USGS standard applications (U.S. Geological Survey, 1975, 1990).

Mean low-flow characteristic data were computed, as available flow data permitted, for the three periods at 12 streamflow stations. Low-flow data computed from daily mean streamflows include: mean discharges for consecutive 1-, 3-, 7-, 14-, 30-, 60-, 90-, 120-, and 183-day period; (table 2); normal mean monthly and mean annual streamflow values (table 3); and estimates of low flows corresponding to 4 selected recurrence intervals along with flow-duration information for selected percent time flow is equaled or exceeded values (table 4).

The daily, monthly, and annual streamflow values shown in tables 2 and 3 are easily understood. However, the low-flow and flow-duration statistics shown in table 4 are less intuitive. The low-flow values shown in table 4 are the minimum streamflows that occur on average over the specified times. For instance, a 7Q10 value is the lowest 7 consecutive-day flow that occurs on average once in 10 years. The 10-, 30-, 50-, 70-, and 90-percent exceedence flow values shown in table 4 are the daily flows that are equalled or exceeded for the specified percent of time during the period analyzed. For example, a 10-percent flow-duration value for a station is the flow that is equalled or exceeded 10-percent of the time during the period of analysis. Low-flow and flow-duration computation methods are explained in greater detail in (Riggs, 1972) and (Stedinger and Thomas, 1985).

Table 2. Mean low-flow characteristics for various consecutive days at selected streamflow stations in the Apalachicola-Chattahoochee-Flint River basin in parts of Georgia, Alabama, and Florida
[—, insufficient or no data]

Period number (climatic years)	Years analyzed	Consecutive low-flow periods, in cubic feet per second								
		1-day	3-day	7-day	14-day	30-day	60-day	90-day	120-day	183-day
02343500 Chattahoochee River at Columbia, Alabama										
1	1929-53	2,780	2,940	3,170	3,310	3,620	4,170	4,670	5,000	6,070
2	1958-70	—	—	—	—	—	—	—	—	—
3	1976-93	—	—	—	—	—	—	—	—	—
02343801 Chattahoochee River near Columbia, Alabama										
1	1929-53	—	—	—	—	—	—	—	—	—
2	1958-70	—	—	—	—	—	—	—	—	—
3	1976-93	689	1,680	3,080	3,720	4,170	4,870	5,350	5,690	6,410
02344000 Chattahoochee River at Alaga, Alabama										
1	1929-53	—	—	—	—	—	—	—	—	—
[1/]2	1961-70	2,260	3,070	4,020	4,530	5,020	5,840	6,360	6,700	7,700
3	1976-93	—	—	—	—	—	—	—	—	—
02352500 Flint River at Albany, Georgia										
[1/]1	1930-53	820	1,350	1,640	1,820	2,010	2,370	2,620	2,880	3,220
2	1958-70	1,030	1,220	1,570	1,780	1,980	2,280	2,730	2,870	3,380
3	1976-93	962	1,100	1,250	1,400	1,610	1,770	1,970	2,170	2,330
02353000 Flint River at Newton, Georgia										
1	1929-53	—	—	—	—	—	—	—	—	—
2	1958-70	1,720	1,860	2,170	2,340	2,540	2,820	3,280	3,440	3,950
3	1976-93	1,490	1,600	1,720	1,870	2,070	2,250	2,470	2,660	3,120
02353500 Ichawaynochaway Creek at Milford, Georgia										
[1/]1	1944-53	270	276	286	313	341	377	431	484	538
2	1958-70	238	242	255	270	295	341	391	404	467
3	1976-93	158	163	177	197	231	264	294	321	383
02356000 Flint River at Bainbridge, Georgia										
1	1929-53	3,170	3,330	3,500	3,620	3,820	4,240	4,530	4,850	5,360
2	1958-70	2,620	2,920	3,290	3,560	3,830	4,140	4,640	4,820	5,410
3	1976-93	—	—	—	—	—	—	—	—	—
02357000 Spring Creek near Iron City, Georgia										
[1/]1	1944-53	67.7	68.8	70.4	73.9	80.1	94.8	123	151	221
2	1958-70	68.5	69.9	72.8	75.9	85.1	104	124	141	191
3	1976-93	—	—	—	—	—	—	—	—	—
02358000 Apalachicola River at Chattahoochee, Florida										
1	1929-53	8,150	8,330	8,620	8,880	9,350	10,230	11,050	11,960	13,420
2	1958-70	8,940	9,170	9,600	9,830	10,420	11,190	12,190	12,660	14,180
3	1976-93	8,350	8,480	8,710	8,990	9,490	10,070	10,600	11,080	12,450
02358700 Apalachicola River at Blountstown, Florida -										
1	1929-53	—	—	—	—	—	—	—	—	—
2	1958-70	9,250	9,450	9,830	10,100	10,620	11,440	12,530	12,960	14,500
3	1976-93	9,210	9,320	9,540	9,750	10,150	10,740	11,270	11,700	13,120
02359000 Chipola River near Altha, Florida										
[1/]1	1944-53	642	665	680	697	732	804	886	953	1,090
2	1958-70	636	658	673	693	731	800	875	929	1,030
3	1976-93	615	624	636	658	689	751	806	847	984
02359170 Apalachicola River near Sumatra, Florida										
1	1929-53	—	—	—	—	—	—	—	—	—
2	1956-70	—	—	—	—	—	—	—	—	—
[1/]3	1978-93	10,140	10,270	10,490	10,820	11,470	12,480	13,110	14,060	16,170

[1/]Only a part of period analyzed.

Table 3. Normal mean monthly and mean-annual streamflow data at selected streamflow stations in parts of Georgia, Alabama, and Florida
[—, insufficient or no data]

Period number	Years analyzed	Normal mean monthly streamflow, in cubic feet per second												Mean annual streamflow
		October	November	December	January	February	March	April	May	June	July	August	September	
02343500 Chattahoochee River at Columbia, Alabama														
1	1929-53	5,260	6,670	9,900	14,770	16,310	22,950	17,350	11,220	7,280	8,470	7,370	5,490	11,070
2	1958-70	—	—	—	—	—	—	—	—	—	—	—	—	—
3	1976-93	—	—	—	—	—	—	—	—	—	—	—	—	—
02343801 Chattahoochee River near Columbia, Alabama														
1	1929-53	—	—	—	—	—	—	—	—	—	—	—	—	—
2	1958-70	—	—	—	—	—	—	—	—	—	—	—	—	—
3	1976-93	6,588	8,280	11,550	14,350	16,120	19,370	14,930	10,380	7,744	7,051	7,290	6,411	10,810
02344000 Chattahoochee River at Alaga, Alabama														
1	1929-53	—	—	—	—	—	—	—	—	—	—	—	—	—
[1/]2	1961-70	7,475	8,217	12,550	16,480	18,950	21,410	19,720	11,880	8,760	8,095	8,019	7,223	12,360
3	1976-93	—	—	—	—	—	—	—	—	—	—	—	—	—
02352500 Flint River at Albany, Georgia														
[1/]1	1930-53	3,159	3,603	5,948	8,390	9,150	11,470	9,878	5,753	3,911	4,487	4,002	2,945	6,047
2	1958-70	3,279	3,294	5,313	8,664	11,060	12,860	10,920	5,722	4,734	4,300	3,775	2,612	6,353
3	1976-93	2,522	3,340	5,605	8,465	10,050	11,510	8,589	5,156	3,280	3,154	2,817	2,109	5,529
02353000 Flint River at Newton, Georgia														
1	1929-53	—	—	—	—	—	—	—	—	—	—	—	—	—
2	1958-70	3,773	3,681	5,563	9,105	11,510	13,800	11,970	6,586	5,468	5,002	4,441	3,268	6,990
3	1976-93	2,928	3,552	5,846	8,534	10,420	11,980	9,213	5,798	3,971	3,801	3,356	2,620	5,980
02353500 Ichawaynochaway Creek at Milford, Georgia														
[1/]1	1944-53	447	558	858	1,054	1,156	1,442	1,218	815	570	761	654	515	837
2	1958-70	502	467	705	1,055	1,253	1,423	1,223	623	595	574	486	380	771
3	1976-93	360	473	715	1,136	1,272	1,408	903	650	462	481	386	319	711
02356000 Flint River at Bainbridge, Georgia														
1	1929-53	5,240	5,325	7,660	10,680	11,870	16,320	14,040	9,237	6,473	6,700	6,370	4,984	8,730
2	1958-70	5,393	5,075	7,343	11,040	13,890	16,990	15,260	8,776	7,354	6,700	6,016	4,530	9,000
3	1976-93	—	—	—	—	—	—	—	—	—	—	—	—	—
02357000 Spring Creek near Iron City, Georgia														
[1/]1	1944-53	199	241	425	608	763	1,227	949	552	319	304	351	295	514
2	1958-70	307	201	349	670	965	1,192	1,000	433	333	283	253	159	510
3	1976-93	—	—	—	—	—	—	—	—	—	—	—	—	—
02358000 Apalachicola River at Chattahoochee, Florida														
1	1929-53	12,400	13,340	19,190	27,360	30,260	42,230	35,450	23,740	16,440	17,390	16,150	12,630	22,190
2	1958-70	13,940	13,430	19,640	28,480	35,690	42,350	38,460	21,910	18,160	16,560	15,050	12,630	22,950
3	1976-93	12,440	14,520	22,070	29,390	34,780	40,580	32,220	20,480	15,680	13,970	13,350	11,390	21,680
02358700 Apalachicola River at Blountstown, Florida														
1	1929-53	—	—	—	—	—	—	—	—	—	—	—	—	—
2	1958-70	14,370	13,570	19,540	28,650	32,350	42,580	38,570	22,090	18,600	16,880	15,520	13,240	23,180
3	1976-93	13,090	14,590	22,080	29,370	35,290	40,660	32,450	20,920	16,240	14,750	13,910	11,910	22,040
02359000 Chipola River near Altha, Florida														
[1/]1	1944-53	1,126	1,184	1,486	1,607	1,751	2,368	2,491	1,549	1,158	1,281	1,363	1,240	1,575
2	1958-70	1,185	936	1,170	1,848	2,080	2,425	2,229	1,387	1,143	1,168	1,184	989	1,476
3	1976-93	941	1,014	1,340	1,910	2,417	2,648	1,952	1,302	1,282	1,205	1,043	1,006	1,500
02359170 Apalachicola River near Sumatra, Florida														
1	1929-53	—	—	—	—	—	—	—	—	—	—	—	—	—
2	1956-70	—	—	—	—	—	—	—	—	—	—	—	—	—
[1/]3	1978-93	15,030	16,500	26,640	32,850	40,720	46,540	39,340	25,140	20,300	18,840	18,570	16,190	26,320

[1/]Only a part of period analyzed.

Table 4. Selected low-flow and flow-duration characteristics for selected streamflow stations for three selected periods in the Apalachicola-Chattahoochee-Flint River basin in parts of Georgia, Alabama, and Florida
[—, insufficient or no data]

Period number (climatic years)	Years analyzed	Flow computed for selected low-flow statistics, in cubic feet per second				Percent time flow equaled or exceeded for selected exceedence values, in cubic feet per second				
		7QIO	30Q2	60Q2	90Q2	10	30	50	70	90
02343500 Chattahoochee River at Columbia, Alabama										
1	1929-53	1,910	3,480	3,980	4,480	20,410	10,920	7,700	5,330	3,410
2	1958-70	—	—	—	—	—	—	—	—	—
3	1976-93	—	—	—	—	—	—	—	—	—
02343801Chattahoochee River near Columbia, Alabama										
1	1929-53	—	—	—	—	—	—	—	—	—
2	1958-70	—	—	—	—	—	—	—	—	—
3	1976-93	1,854	4,116	4,935	5,311	22,480	12,120	8,510	5,660	1,410
02344000 Chattahoochee River at Alaga, Alabama										
1	1929-53	—	—	—	—	—	—	—	—	—
[1/]2	1961-70	1,807	4,864	5,501	5,901	24,610	13,500	9,410	6,530	4,000
3	1976-93	—	—	—	—	—	—	—	—	—
02352500 Flint River at Albany, Georgia										
[1/]1	1930-53	1,095	1,945	2,290	2,550	12,280	6,130	4,050	3,000	1,880
2	1958-70	911	1,849	2,120	2,404	13,800	6,440	4,250	2,900	1,770
3	1976-93	809	1,570	1,729	1,903	12,500	6,050	3,570	2,240	1,360
02353000 Flint River at Newton, Georgia										
1	1929-53	—	—	—	—	—	—	—	—	—
2	1958-70	1,440	2,362	2,586	2,914	14,380	7,240	4,840	3,580	2,350
3	1976-93	1,129	2,026	2,216	2,394	12,480	6,760	4,230	2,840	1,810
02353500 Ichawaynochaway Creek at Milford, Georgia										
[1/]1	1944-53	167	318	356	407	1,710	961	658	489	312
2	1958-70	157	285	332	361	1,530	786	530	390	268
3	1976-93	87.0	233	268	291	1,490	754	486	328	208
02356000 Flint River at Bainbridge, Georgia										
1	1929-53	2,480	3,690	4,074	4,372	15,860	9,020	6,550	5,040	3,490
2	1958-70	2,260	3,610	3,840	4,150	17,820	9,510	6,550	4,980	3,480
3	1976-93	—	—	—	—	—	—	—	—	—
02357000 Spring Creek near Iron City, Georgia										
[1/]1	1944-53	22.4	68.3	80.7	97.4	1,380	573	281	148	74.4
2	1958-70	23.7	80.4	94.4	106	1,160	476	246	147	72.5
3	1976-93	—	—	—	—	—	—	—	—	—
02358000 Apalachicola River at Chattahoochee, Florida										
1	1929-53	6,157	9,036	9,860	10,700	40,630	23,100	16,600	12,610	8,720
2	1958-70	7,194	10,000	10,400	11,000	45,580	24,080	16,610	12,630	9,880
3	1976-93	5,209	9,489	9,994	10,400	46,100	22,860	15,170	11,820	8,860
02358700 Apalachicola River at Blountstown, Florida										
1	1929-53	—	—	—	—	—	—	—	—	—
2	1958-70	7,097	10,400	10,800	11,500	45,410	24,510	17,130	13,140	10,240
3	1976-93	6,160	10,200	10,700	11,200	44,540	24,060	15,720	12,450	9,400
02359000 Chipola River near Altha, Florida										
[1/]1	1944-53	474	716	769	795	3,060	1,850	1,200	910	698
2	1958-70	425	706	768	825	2,670	1,600	1,140	866	634
3	1976-93	458	677	725	778	2,980	1,740	1,130	815	619
02359170 Apalachicola River near Sumatra, Florida										
1	1929-53	—	—	—	—	—	—	—	—	—
2	1958-70	—	—	—	—	—	—	—	—	—
[1/]3	1978-93	6,843	11,200	11,900	12,600	48,980	33,060	19,750	13,810	9,800

[1/]Only a part of period analyzed.

Comparison of Tributary Streamflow Characteristics

Streamflow characteristics for Ichawaynochaway Creek at Milford, Ga. (02353500), and Chipola River near Altha, Fla. (02359000) (tables 2, 3, and 4) vary similarly between period 1 and period 2. Data comparisons from table 2 suggest that there is a general decrease in low-flow characteristics from period 1 to period 2 for streamflow stations 02353500 and 02359000. The decrease in streamflow for the consecutive low-flow periods for station 02353500 averaged about 12 percent, while station 02359000 averaged about 2 percent. However, Spring Creek near Iron City, Ga. (02357000) showed a small average increase in streamflow for consecutive low-flow periods of about 1 percent. Station 02353500 also showed a decrease in low-flow characteristics from period 2 to period 3 of about 30 percent, while station 02359000 showed a much smaller decrease of about 5 percent from period 2 to period 3.

Comparison of data from table 3 indicate that mean-monthly streamflows during summer months (July-September) declined from period 1 to period 2 for all three tributary stations (02353500, 02357000, and 02359000). Summer streamflows continued to decline from period 2 to period 3 at station 02353500, while station 02359000 showed only a decline for August.

Data comparisons from table 4 indicate that from period 1 to period 2, 7Q10 values for Ichawaynochaway Creek at Milford, Ga. (02353500) decreased about 6 percent, and for Chipola River near Altha, Fla. (02359000) decreased about 10 percent. The 7Q10 values for Spring Creek near Iron City, Ga. (02357000), increased about 6 percent from period 1 to period 2. The 7Q10 for Ichawaynochaway Creek at Milford, Ga. (02353500) declined 45 percent from period 2 to period 3, while the 7Q10 at Chipola River near Altha, Fla. (02359000) increased by 8 percent from period 2 to period 3.

A regression analysis was performed to further investigate the similarities and dissimilarities of streamflows at Ichawaynochaway Creek at Milford, Ga. (02353500), to streamflow at Chipola River near Altha, Fla. (02359000). Daily flows at Ichawaynochaway Creek were regressed against those at Chipola River for period 1 (1944-53, only) and then for period 2 using least-square linear regression techniques (SAS Institute, 1992). The intent was to test the statistical significance of any differences in the two regression equations. The resulting coefficients of determination (that is, r-squared values) of the regression equations computed for periods 1 and 2 were 0.51 and 0.58, respectively. These coefficients are low, which indicates that reliable estimates of changes in long-term trends of streamflows cannot be determined based on these regression equations. Therefore, further testing for statistically significant differences in the two regression equations was not performed.

Comparison of Inflow to and Outflow from Lake Seminole

Comparisons of inflow to and outflow from Lake Seminole for periods 1, 2, and 3 are quite difficult because of the inconsistency of streamflow record lengths. As stated earlier, the outflow from Lake Seminole (Apalachicola River at Chattahoochee, Fla., 02358000) is the only station analyzed in this study having complete record for all three periods. Records for the three inflow stations Flint River at Bainbridge, Ga. (02356000), Spring Creek near Iron City, Ga. (02357000), and Chattahoochee River at Alaga, Ala. (02344000), are incomplete or missing for one or more years of data for the three periods of interest.

In order to make comparisons of inflows to and outflows from Lake Seminole, inflow records consisting of the sum of recorded or estimated streamflows Flint River at Bainbridge, Ga. (02356000) and Chattahoochee River at Alaga, Ala. (02344000) for periods 1, 2, and 3 were synthesized from available data. Streamflow at Chattahoochee River at Columbia, Ala. (02343500) and near Columbia, Ala. (02343801), are assumed to be equivalent to flow at Chattahoochee River at Alaga, Ala. Drainage areas of these 3 stations vary only about 4 percent (8,040 to 8,340 square miles) (table 1). Streamflow records for Flint River at Bainbridge, Ga. (02356000) do not exist past 1971. Flint River at Newton, Ga. (02353000) and Ichawaynochaway Creek at Milford, Ga. (02353500) account for all but 16 percent of the drainage area at Bainbridge; 6,360 square miles (mi^2) out of 7,570 mi^2 (table 1). A least-squares linear regression (PSTAT, Inc., 1989) equation using daily streamflow from Flint River at Newton, Ga. (02353000), and Ichawaynochaway Creek at Milford, Ga. (02353500), was developed having an acceptable r-squared of 0.95, and was used to estimate the streamflow of Flint River at Bainbridge, Ga. (02356000) for periods when Bainbridge streamflow records were not available. Finally, the recorded or estimated streamflows at Flint

River at Bainbridge, Ga. (02356000) and Chattahoochee River at Alaga, Ala. (02344000) were summed to produce a synthetic inflow record suitable for comparing to outflows at Apalachicola River at Chattahoochee, Fla. (02358000).

The same low-flow characteristics were computed for the synthetic inflow data and the outflow station, Apalachicola River at Chattahoochee, Fla. (02358000) as for the stations listed in tables 2, 3, and 4, and are shown in tables 5, 6, and 7. Flow duration curves for periods 1, 2, and 3 for the synthetic inflow data and Apalachicola River at Chattahoochee, Fla. (02358000) are shown in figures 2 and 3, respectively.

Comparisons of data from table 5 suggest that there is a general increase in low-flow characteristics from period 1 to period 2 for inflow to and outflow from Lake Seminole. Further comparisons indicate an overall decrease in low-flow characteristics for period 3 to levels below period 2, and near or below period 1.

Data comparisons from table 6 indicate similar differences in mean-monthly streamflow for inflow and outflow of Lake Seminole for all three periods, except for months of March and September for periods 1 and 2 and January for period 2 and 3. Similar differences also are indicated for the mean-annual streamflow data for all three periods.

Data comparisons from table 7 indicate a general increase in low-flow durations from period 1 to period 2, and a decrease from period 2 to period 3 to near or below period 1 conditions. A graphical plot of the flow duration data are shown in figures 2 and 3 for all three periods, and are used for visual comparisons of the period data.

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Table 5. Mean low-flow characteristics for inflow to and outflow from Lake Seminole for various consecutive days

Period number (climatic years)	Years analyzed	Consecutive low-flow periods, in cubic feet per second								
		1-day	3-day	7-day	14-day	30-day	60-day	90-day	120-day	183-day
Synthetic inflow data to Lake Seminole from Chattahoochee and Flint Rivers, Alabama and Georgia										
1	1929-53	6,100	6,400	6,740	6,960	7,440	8,390	9,140	9,970	11,240
2	1958-70	6,300	7,720	8,140	8,540	9,230	10,190	11,100	11,500	12,870
3	1976-93	3,570	4,980	6,810	7,360	7,820	8,590	9,200	9,680	10,870
02358000 Apalachicola River at Chattahoochee, Florida										
1	1929-53	8,150	8,330	8,620	8,880	9,350	10,230	11,050	11,960	13,420
2	1958-70	8,940	9,170	9,600	9,830	10,420	11,190	12,190	12,660	14,180
3	1976-93	8,350	8,480	8,710	8,990	9,490	10,070	10,600	11,080	12,450

Table 6. Normal mean-monthly and mean annual streamflows for inflow to and outflow from Lake Seminole

Period number	Years analyzed	Normal mean monthly streamflow, in cubic feet per second												Mean annual streamflow
		October	November	December	January	February	March	April	May	June	July	August	September	
Synthetic inflow to Lake Seminole from Chattahoochee and Flint Rivers, Alabama and Georgia														
1	1929-53	10,490	12,020	17,860	25,150	28,530	39,200	31,040	20,290	13,480	15,130	13.700	10,520	19,760
2	1958-70	12,570	13,020	18,800	26,180	32,910	38,210	34,980	19,740	16,240	14,670	13,690	11,470	20,970
3	1976-93	10,700	13,110	19,260	25,260	29,330	34,260	26,510	18,030	13,150	12,310	11,920	10,140	18,620
02358000 Apalachicola River at Chattahoochee, Florida														
1	1929-53	12,400	13,340	19,190	27,360	30,260	42,230	35,450	23,740	16,440	17,390	16,150	12,630	22,190
2	1958-70	13,940	13,430	19,640	28,480	35,690	42,350	38,460	21,910	18,160	16,560	15,050	12,630	22,950
3	1976-93	12,440	14,520	22,070	29,390	34,780	40,580	32,220	20,480	15,680	13,970	13,350	11,390	21,680

Table 7. Selected low-flow characteristics and flow-duration values for inflow to and outflow from Lake Seminole
[—, insufficient or no data]

Period number (climatic years)	Years analyzed	Flow computed for selected low-flow statistics, in cubic feet per second				Flow equaled or exceeded for selected exceedence values, in cubic feet per second				
		7QIO	30Q2	60Q2	90Q2	10	30	50	70	90
Synthetic inflow to Lake Seminole from Chattahoochee and Flint Rivers, Alabama and Georgia										
1	1929-53	—	—	—	—	35,520	19,590	14,050	10,470	6,940
2	1958-70	—	—	—	—	41,120	22,230	15,290	11,700	8,390
3	1976-93	—	—	—	—	38,800	20,480	13,890	10,250	5,650
02358000 Apalachicola River at Chattahoochee, Florida										
1	1929-53	6,157	9,036	9,860	10,700	40,630	23,100	16,600	12,610	8,720
2	1958-70	7,194	10,000	10,400	11,000	45,580	24,080	16,610	12,630	9,880
3	1976-93	5,209	9,489	9,994	10,400	46,100	22,860	15,170	11,820	8,860

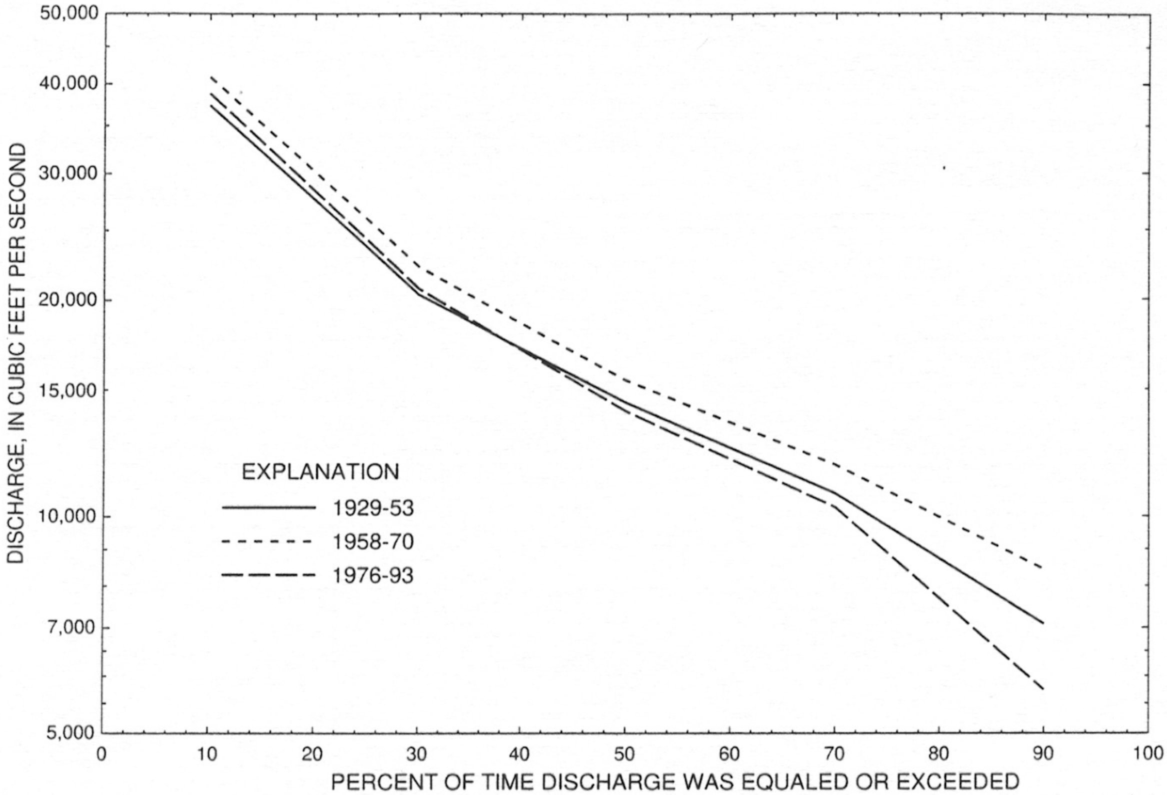

Figure 2. Flow-duration curves of inflow data for Lake Seminole near Chattahoochee, Florida.

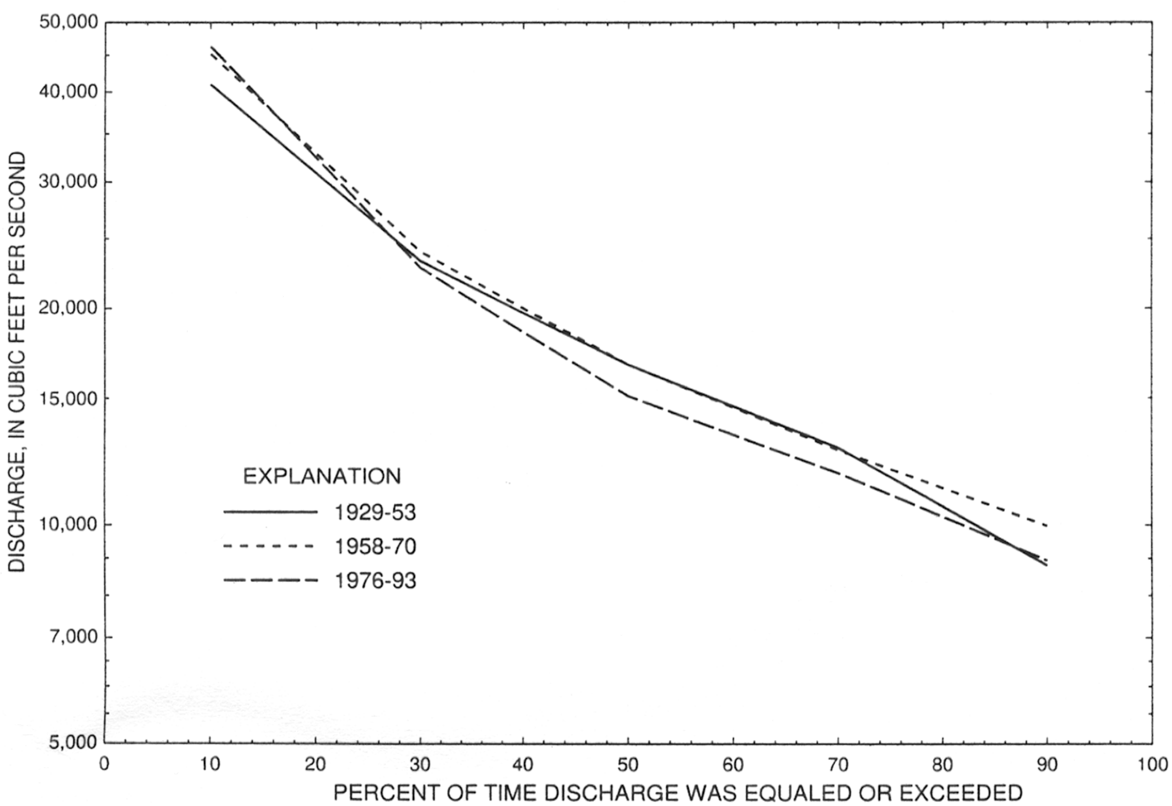

Figure 3. Flow-duration curves of outflow data for Lake Seminole near Chattahoochee, Florida.