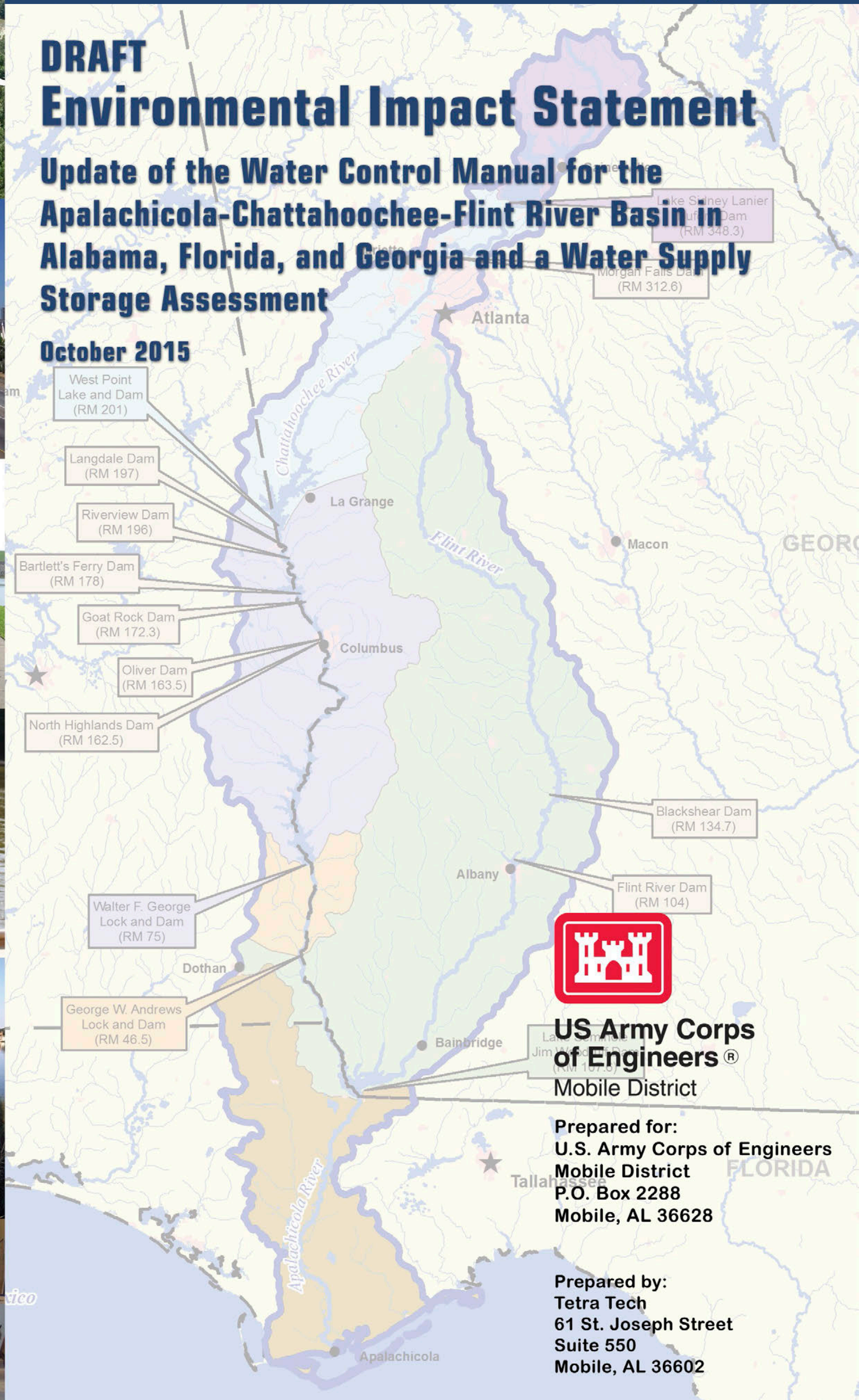
DRAFT
Environmental Impact Statement

Update of the Water Control Manual for the Apalachicola-Chattahoochee-Flint River Basin in Alabama, Florida, and Georgia and a Water Supply Storage Assessment

October 2015





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WATER CONTROL MANUAL

APPENDIX C

WALTER F. GEORGE LOCK AND DAM AND LAKE

CHATTAHOOCHEE RIVER
GEORGIA AND ALABAMA

U.S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
MOBILE, ALABAMA

APRIL 1965

Revised February 1993 and XXX 2016

Walter F. George Lock and Dam and Lake

NOTICE TO USERS OF THIS MANUAL

Regulations specify that this Water Control Manual be published in a hard copy binder with loose-leaf form and only those sections, or parts thereof requiring changes, will be revised and printed. Therefore, this copy should be preserved in good condition so that inserts can be made to keep the manual current. Changes to individual pages must carry the date of revision, which is the South Atlantic Division's approval date.

REGULATION ASSISTANCE PROCEDURES

If unusual conditions arise, the following contact information can be used:

- Mobile District Water Management Section Chief (251) 690-2737 (office), (251) 509-5368 (cell)
- Mobile District Water Management Branch Chief (251) 690-2718 (office), (251) 459-3378 (cell)
- Mobile District Engineering Division Chief (251) 690-2709 (office), (251) 656-2178 (cell)
- Walter F. George Site Manager Office (229) 768-2516 during regular duty hours
- Walter F. George Powerhouse (229) 768-2635
- Walter F. George Lockmaster (229) 723-3482.

METRIC CONVERSION

Although values presented in the text are shown in English units only, a conversion table is listed in Exhibit B for your convenience.

VERTICAL DATUM

All vertical data presented in this manual are referenced to the project's historical vertical datum, National Geodetic Vertical Datum of 1929 (NGVD29 or NGVD). It is the U.S. Army Corps of Engineers (herein referred to as USACE or Corps) policy that the designed, constructed, and maintained elevation grades of projects be reliably and accurately referenced to a consistent nationwide framework, or vertical datum—i.e., the National Spatial Reference System (NSRS) or the National Water Level Observation Network (NWLON) maintained by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration. The current orthometric vertical reference datum within the NSRS in the continental United States is the North American Vertical Datum of 1988 (NAVD88). The current NWLON National Tidal Datum Epoch is 1983–2001. The relationships among existing, constructed, or maintained project grades that are referenced to local or superseded datums (e.g., NGVD29, msl), the current NSRS, and/or hydraulic/tidal datums, have been established per the requirements of Engineering Regulation 1110-2-8160 and in accordance with the standards and procedures as outlined in Engineering Manual 1110-2-6056. A Primary Project Control Point has been established at this project and linked to the NSRS. Information on the Primary Project Control Point, designated 13-2M, and the relationship between current and legacy datums are in Exhibit B.

WATER CONTROL MANUAL

APPENDIX C

WALTER F. GEORGE LOCK AND DAM AND LAKE
CHATTAHOOCHEE RIVER, GEORGIA AND ALABAMA

CONTENTS

CONTENTS (Cont'd)

CONTENTS (Cont'd)

CONTENTS (Cont'd)

CONTENTS (Cont'd)

LIST OF TABLES

CONTENTS (Cont'd)

LIST OF FIGURES

CONTENTS (Cont'd)

LIST OF EXHIBITS

CONTENTS (Cont'd)

LIST OF PLATES

CONTENTS (Cont'd)

LIST OF PLATES

PERTINENT DATA

(see Exhibit A, page E-A-1 for Supplementary Pertinent Data)

GENERAL

Location (damsite), miles above mouth of Chattahoochee River (Spanning AL-GA border with features in Henry County, AL, and Clay County, GA)	75.0
Drainage area above damsite – square miles	7,460
Drainage area between damsite and West Point – square miles	4,020

RESERVOIR

Length – river miles	85.0
Top of conservation storage elevation summer – feet, NGVD29	190.0
Top of conservation storage elevation winter – feet, NGVD29	188.0
Peak pool for standard project flood – feet, NGVD29	200.1
Peak pool for spillway design flood – feet, NGVD29	206.6
Area at static full pool (elev. 190 feet NGVD29) – acres	45,181
Total volume at static full pool (elev. 190 feet NGVD29) – acre feet	934,400
Shore line length at static full pool (elev. 190 feet NGVD29) – miles	640

TAILWATER ELEVATIONS

Normal, one turbine operating (5,500 cfs)– feet, NGVD29	103.2
Normal, full powerhouse flow (26,000 cfs) – feet, NGVD29	113.0
Bankfull (65,000 cfs) – feet, NGVD29	130.2

DAM/EARTH DIKES

Total length – feet	12,128
Top elevation – feet, NGVD29	215.0

SPILLWAY SECTION

Total length including end piers – feet	708
Type of gates	Tainter
Size of gates, width x height – feet	42 x 29
Number of gates	14

LOCK

Maximum lift – feet	88.0
Chamber width – feet	82.0
Nominal chamber length – feet	450.0

POWER PLANT

Generating capacity (declared*) MW (4 units @ 42 MW)	168

* Declared generating capacity is defined as the plant's operational capacity declared on a weekly basis to the power marketing agency. The value may vary slightly from week to week depending on factors such as head and cooling capabilities; values shown are the nominal values reported.

I - INTRODUCTION

1-01. Authorization. Section 7 of the Flood Control Act of 1944 instructed the Secretary of the Army to prescribe regulations for the use of storage allocated for flood control (later termed flood risk management) or navigation at all U.S. Army Corps of Engineers (Corps) reservoirs. Therefore, this water control manual has been prepared as directed in the Corps' Water Management Regulations, specifically Engineering Regulation (ER) 1110-2-240, *Water Control Management (8 October 1982)*. That regulation prescribes the policies and procedures to be followed in carrying out water management activities, including establishment and updating of water control plans for Corps and non-Corps projects, as required by federal laws and directives. This manual is also prepared in accordance with pertinent sections of the Corps' Engineering Manual (EM) 1110-2-3600, *Management of Water Control Systems (30 November 1987)*; under the format and recommendations described in ER 1110-2-8156, *Preparation of Water Control Manuals (31 August 1995)*; and ER 1110-2-1941, *Drought Contingency Plans (15 September 1981)*. Revisions to this manual are to be processed in accordance with ER 1110-2-240. Section 310.(b) of the Water Resources Development Act of 1990 expanded the requirements for public meetings and public involvement in preparing water control plans.

1-02. Purpose and Scope. This individual project manual describes the water control plan for the Walter F. George Lock and Dam and Lake Project (Walter F. George Project). The description of the project's physical components, history of development, water control activities, and coordination with others are provided as supplemental information to enhance the knowledge and understanding of the water control plan. The Walter F. George Project water control regulations must be coordinated with the multiple projects in the Apalachicola-Chattahoochee-Flint (ACF) Basin to ensure consistency with the purposes for which the system was authorized. In conjunction with the *ACF Basin Master Water Control Manual*, this manual provides a general reference source for Walter F. George water control regulation. It is intended for use in day-to-day, real-time water management decision making and for training new personnel.

1-03. Related Manuals and Reports

Other manuals related to the Walter F. George Project water control regulation activities include the *Operation and Maintenance Manual* for the project and the *ACF Basin Master Water Control Manual*.

One master manual and five individual project manuals, which are incorporated as appendices, compose the complete set of water control manuals for the ACF Basin:

Appendix A - Jim Woodruff Lock and Dam and Lake Seminole

Appendix B - Buford Dam and Lake Sidney Lanier

Appendix C - Walter F. George Lock and Dam and Lake

Appendix D - George W. Andrews Lock and Dam and Lake George W. Andrews

Appendix E - West Point Dam and Lake

The original water control manual for Walter F. George Lock and Dam and Lake was published in April of 1965. A revised water control manual was published in February of 1993. This revision supersedes any prior editions.

The Walter F George emergency action plan (EAP) entitled *Emergency Action Plan, Walter F. George Project* serves to consolidate guidance documents regarding actions to be taken by project personnel should a emergency situation be identified. Guidance includes training for identification of indicators, notification procedures, remedial action scenarios, reservoir dewatering procedures, inventory of emergency repair equipment, and a list of local repair forces.

Historical, definite project reports and design memoranda (see Section 3-02 for listing of design memoranda) also contain useful information. This includes the preliminary master plan which was updated in the document *Master Plan for Walter F. George Lake. 1985.*

Prior to the issuance of the ACF Basin Master Manual and the individual water control plans as appendices, the Corps considered the environmental impacts of its revised operations with the preparation of an Environmental Impact Statement (EIS). The EIS was prepared in compliance with the National Environmental Policy Act (1969), Council on Environmental Quality guidelines, and Corps implementing regulations. Access to the final document is available by request from the Mobile District.

1-04. Project Owner. The Walter F. George Lock and Dam and Lake Project is a federally owned project entrusted to the Corps, South Atlantic Division (SAD), Mobile District.

1-05. Operating Agency. Operation and maintenance of the Walter F. George Project is the responsibility of the Mobile District Operations Division. Supervision and direction for this effort is provided by the project's Operations Project Manager in Eufaula, Alabama, and the project's Site Manager at Fort Gaines, Georgia.

1-06. Regulating Agencies. Authority for water control regulation of the Walter F. George Project has been delegated to the SAD Commander. Water control regulation activities are the responsibility of the Mobile District, Engineering Division, Water Management Section (Mobile District). Water control actions for the Walter F. George Project are regulated in a system-wide, balanced approach to meet the federally authorized purposes. It is the responsibility of the Mobile District to develop water control regulation procedures for the ACF Basin federal projects for all foreseeable conditions. The regulating instructions presented in the basin water control plan are prepared by the Mobile District with the approval from the SAD Commander. The Mobile District monitors the project for compliance with the approved water control plan and makes water control regulation decisions on the basis of that plan. The Mobile District advises project personnel on an as-needed basis regarding water control regulation procedures to perform during normal, as well as abnormal or emergency situations.

II - DESCRIPTION OF PROJECT

2-01. Location. The Walter F. George Lock and Dam Project is on the Chattahoochee River approximately one mile north of Fort Gaines, Georgia, and approximately 1.6 miles upstream from the Georgia Highway 37 Bridge. The dam crosses the Alabama-Georgia border with the earth dike on the west bank entirely in Henry County, Alabama, and the earth dike on the east entirely in Clay County, Georgia (Plate 2-1). The drainage area above the Walter F. George Project is 7,460 square miles. The location of the project, at mile 75.0 on the Chattahoochee River, is indicated on Plates 2-1 to 2-3.

2-02. Purpose. Walter F. George Lock and Dam and Lake is a multiple-purpose project, originally authorized by the Rivers and Harbors Acts of 1945 and 1946 (under the original name of Fort Gaines) to be operated in conjunction with the other federal works of improvement in the ACF Basin for the authorized system purposes. The Walter F. George Project is operated to provide benefits for authorized purposes of navigation, hydropower water quality, recreation, and fish and wildlife conservation. The increased flow in dry seasons also provides for an increased water supply and water quality for municipal and industrial (M&I) uses and it permits increased production of hydroelectric energy downstream.

2-03. Physical Components. The Walter F. George Project (Figure 2-1), which is approximately 2.5 miles long, consists of a powerhouse, a gated spillway, a lock, and earth dikes extending to high ground on both banks. The lock is 82 by 450 feet with a maximum lift of 88 feet. The project has a 168,000-kilowatt (kW) power plant with appurtenances and a reservoir extending up the Chattahoochee River 85 miles to Columbus, Georgia, and Phenix City, Alabama. Walter F. George Lake (also known locally as Lake Eufaula) provides a 9-foot minimum depth for navigation from the dam to Columbus and Phenix City. The principal features of the structure, described in detail in subsequent paragraphs are, from east to west, an earth dike, the navigation lock, the concrete gated spillway, the powerhouse with intake section constituting part of the dam, and an earth dike. The switchyard is on the right bank downstream from the powerhouse. A 50-foot concrete non-overflow section is between the spillway and the lock, and a 210-foot concrete non-overflow section ties the powerhouse into the earth dike on the west bank. The structure's overall length including the lock and powerhouse sections is 13,585 feet. Sections and plan of the lock and dam and appurtenant works are shown on Plate 2-4.

Figure 2-1. Walter F. George Lock and Dam

a. Gated Spillway. The gated spillway (Figure 2-2) occupies the east half of the river channel, extending to a 50-foot concrete non-overflow section separating it from the lock on the east bank. On the west side, it ties into the powerhouse. The spillway is a reinforced concrete structure with crest at elevation 163 feet NGVD29. Fourteen tainter gates, 29 feet high and 42 feet wide, provide a clear spillway length of 588 feet. There are 15 piers, each 8 feet wide that support a roadway bridge across the top of the spillway. The gates are operated by individual electric hoists just under the roadway bridge.

Figure 2-2. Gated Spillway

They can also be operated from a remote control board in the powerhouse. A gate operating schedule and spillway discharge values are shown in Plates 2-5 through 2-11. The spillway rating curve for one gate is shown in Plate 2-12; the tailwater rating curve is shown in Plate 4-17.

Figure 2-3. Earth dikes during construction of cutoff wall

b. Earth Dikes. The earth dikes (Figure 2-3) on the east and west overbank areas are of rolled-fill construction with 24 inches of dumped riprap on 9 inches of filter blanket on the upstream slope and a grassy downstream slope. The crest of the dikes is at elevation 215 feet NGVD29 with a 30-foot top width providing a 20-foot access roadway to the powerhouse and lock. The dike on the west overbank, 6,124 feet in length, ties into the 210-foot concrete non-overflow section separating it from the powerhouse. The dike on the east overbank, 6,004 feet in length, ties into the lock wall.

c. Powerhouse. The powerhouse (Figure 2-4) and intake structure, in the west half of the river channel, as shown in Plate 2-4, constitute part of the dam. The powerhouse is a reinforced concrete structure with overall outside dimensions of 335 by 168 feet. There are four generating unit bays, each 67 feet wide, and an erection bay. The power installation consists of four generating units each rated at 42 megawatts (MW). The units are numbered 1 through 4 beginning at the erection bay. A section through the powerhouse is shown in Plate 2-4 and turbine performance curves are shown in Plate 2-13.

Figure 2-4. Powerhouse

In March 1995, the *Walter F. George Powerhouse Major Rehabilitation Evaluation Report* was published. Excerpts from the report follow. Rehabilitation of unit 1 was completed in December 2006, unit 2 in November 2007, unit 3 in March 2009 and unit 4 in December 2010.

Originally, the main units were rated at 36.111 MVA at 90 percent power factor, making the units rated at about 32.5 MW each. The four rehabilitated units are rated at 46.666 kVA at 90 percent power factor, making the units rated about 42 MWs each. This provides a capacity of 168 MW however the plant is often limited to 160 MW due to low head when all four units are operating.

The transformers in the powerhouse switchyard were also replaced. This work consisted of replacing the two existing, dual-wound transformers (two generating units per transformer, total of two transformers) with unit-connected transformers (one generating unit per transformer, total of four transformers). The replacement of transformers also included moving the transformer location from the powerhouse draft tube deck to the switchyard.

d. Lock. The lock (Figure 2-5) is on the east overbank between the gated spillway and the earth dike. A section through the lock is shown in Plate 2-4. The lock chamber is 82 feet wide by 505 feet long, center to center of pintles. The chamber provides 454.5 feet of usable length between the miter posts of the open lower gate leaves and the farthest downstream face of the upper miter sill. At a maximum lock lift of 88 feet, the lock has the highest lift of any Corps lock in the South Atlantic Division. The top of the upper sill is at elevation 172 feet NGVD29, 12 feet below the minimum operating pool, elevation 184 feet NGVD29. The top of the lower sill is at elevation 89 feet NGVD29, 13 feet below the minimum tailwater, elevation 102 feet NGVD29. The top of the upstream lock wall is at elevation 208 feet NGVD29, and the top of the downstream lock wall is at elevation 197 feet NGVD29. The tops of the upstream guard and guide walls are at elevation 197 feet NGVD29 and the tops of the downstream guard and guide wall are at elevation 147 feet NGVD29. The lock filling and emptying system consists of two intake ports in the upstream face of the upper gate sill, a 12-foot-square culvert in each lock wall, and an outlet structure on the river side of the lock below the lower gate sill. The filling and emptying operation is controlled by reverse tainter valves in the culverts. To determine the volume of water in cubic feet per second (cfs) for one hour, discharged each time the lock is emptied, the gross head in feet is multiplied by 11.4.

Figure 2-5. Walter F. George Lock

e. Lock Control Station. The lock control station is a single-story reinforced concrete structure on the upper river side valve monolith. It is 53 feet 4 inches long, and the maximum width is 26 feet. All the primary lock equipment is installed in the control station. The floor of the building is 6 inches above the top of the lock wall, at elevation 208.5 feet NGVD29.

f. Switchyard. The switchyard is on the west bank, downstream from the powerhouse and just downstream from the east end of the west bank earth dike. It contains the high-voltage equipment required for switching and metering of the high-voltage energy delivered to the Georgia Power Company, the Alabama Power Company, and the Alabama Electric Cooperative, Inc. As part of the major rehabilitation work, the transformers were relocated from the powerhouse draft tube deck to the switchyard.

g. Reservoir. The reservoir (Figure 2-6) at maximum summer operating level, elevation 190 feet NGVD29, covers an area of 45,181 acres and has a total storage of 934,400 acre-feet. The pool extends up the Chattahoochee River 85 miles to Columbus, Georgia. At the minimum operating level, elevation 184 feet NGVD29, the reservoir covers an area of 36,375 acres and has a total storage of 690,000 acre-feet. Area and capacity curves and tabulated values are shown in Plate 2-14.

Figure 2-6. Dam and Reservoir

2-04. Related Control Facilities. Not applicable to Walter F. George Lock and Dam.

2-05. Real Estate Acquisition. The criteria for establishing the basic taking line required all the land that would be inundated by floods of all magnitudes up to and including the 50-year flood and that otherwise would not have been flooded under natural conditions, with the exception that increased flooding of some small amount would be accepted as of insignificant damaging effect. In addition, the taking line was required to be at least three feet above normal pool elevation 190.0 feet NGVD29 to allow for the effects of a permanent body of water on surrounding land. Of the 91,599 acres within the guide taking line, 51,540 acres were acquired in fee simple, the right to inundate was acquired by easement for 27,809 acres, 9,350 acres are within the Fort Benning military reservation, and 2,900 acres were riverbed.

2-06. Public Facilities. In addition to the land acquired for project operations in the normal blockout of the reservoir, the project also includes 23 public recreation areas with 10 located in Georgia and 13 in Alabama. Those areas are indicated on Plate 2-15. In Georgia, 7 recreation areas are under Corps management, 2 state parks, and 1 leased to a local public agency. In Alabama, 7 areas are under Corps management, 1 state park, 3 areas under local public agency management, 1 leased to the U.S. Army at Fort Rucker, and 1 leased to a concessionaire. The concession facility on the project is a marina. The state parks, recreation areas managed by the Corps, and the areas managed by local public agencies provide such facilities as access roads, boat ramps, parking areas, picnic areas, and campsites.

The Corps developed the east bank of the damsite area, which includes the Site Manager's office. The area has visitor facilities including an audiovisual room, overlook terrace, public restrooms, watercraft launching ramp, parking area, and picnic sites.

A large area north of Eufaula, Alabama, between river miles 104 and 116, containing 11,160 acres is reserved for the Eufaula National Wildlife Refuge. The U.S. Fish and Wildlife Service (USFWS), Department of the Interior, maintains the area principally for migratory waterfowl. Several sub-impoundments have been constructed in the reservoir to control water depths for waterfowl and wildlife enhancement.

III - HISTORY OF PROJECT

3-01. Authorization. The Corps first considered navigation locks and dams for the Apalachicola River Basin in the early 1930s in a report on the Apalachicola River System in accordance with House Document No. 308, 69th Congress, First Session. The report, which had a general plan for the overall development of the basin was submitted to Congress in 1934 but was immediately recalled to consider additional information. The Rivers and Harbors Act of 1945 approved the general plan presented in House Document No. 342, 76th Congress, First Session, and authorized the initiation and partial accomplishment of that plan by constructing two locks and dams, one of which was the Junction Project. No work was accomplished on the project authorized by the Rivers and Harbors Act of 1945.

The Rivers and Harbors Act of 1946, House Document No. 300, 80th Congress (Public Law 79-525) approved modification of the general plan including the substitution for the authorized lock and dam at Junction of a higher lock and dam with normal pool elevation 77.0 feet NGVD29 and with provisions for a hydroelectric power plant. The modification also included an increase in the size of the locks at all navigation dams from 45 by 450 feet to 82 by 450 feet. On 19 May 19, 1953, the House of Representatives Committee on Public Works approved a plan consisting of a low navigation dam near Columbia, Alabama, and a high navigation and power dam near Fort Gaines, Georgia, in lieu of the Fort Benning Lock and Dam and the upper Columbia projects.

In March 1958, the 85th Congress, Second Session, enacted Public Law 85-363 officially designating Fort Gaines Lock and Dam as the Walter F. George Lock and Dam in honor of the Senator Walter F. George of Georgia.

3-02. Planning and Design. Design Memorandum No. 1. *Basic Hydrology* was submitted on 14 August 1953, and approved by the Chief of Engineers on 12 November 1953. Design Memorandum No. 2 was submitted on 9 October 1953, and approved 10 November 1953, subject to the outcome of additional studies. Additional design memoranda for the Walter F. George Project are listed in Table 3-1. The *Operation and Maintenance Manual* for Walter F. George Lock and Dam was issued in 1962.

Table 3-1. Design Memoranda

Letter Report - Report on Development of Chattahoochee River Between Upper Limits of Jim Woodruff Pool and Columbus, Georgia	November 29, 1952
DM No. 1 - Basic Hydrology	August 14, 1953
DM No. 2 - Determination of Site location and Reservoir Level at Fort Gaines Dam, Chattahoochee River	October 8, 1953
DM No. 3 - General Design	June 29, 1954
DM No. 4 - Non-overflow Dike, West Bank	October 5, 1955
DM No. 5 - Real Estate Requirements, Construction Area, Right Bank	July 7, 1955
DM No. 6 - Real Estate Requirements, Construction Area, Left Bank	January 19, 1956
DM No. 7 - Staffing and Operating Requirements	December 21, 1956
DM No. 10 - Geology	November 1, 1956
DM No. 11 - Fort Gaines Lock and Dam, Chattahoochee River, Alabama - Georgia	June 28, 1956
DM No. 12 - Relocations	August 12, 1957
DM No. 13 - Design of Lock and Control Station	September 3, 1958
DM No. 14 - Sources of Aggregate and Riprap	November 20, 1956
DM No. 15 - Reservoir Clearing, Mosquito Control and Floatage Removal	November 18, 1959
DM No. 16-A - Preliminary Master Plan - Part of the Master Plan	August 24, 1956
DM No. 16-B - Construction Design Memo, Public Use and Access Facilities	March 1, 1961

3-03. Construction. Construction began in September 1955 under a contract awarded to Moss Construction Company for the earth dike on the Alabama side of the river. In December 1956, a contract for construction of the spillway was awarded to Hardaway Contracting Company and in September 1958, Thomason and Associates was awarded the contract for the earth dike on the Georgia side. Perini, Inc., was awarded the contract for the lock in December 1959, and in January 1961, Hardaway Contracting Company was awarded the contract for the powerhouse. The powerhouse was completed in June 1963, essentially completing the project. The total cost of the project, including $1,300,000 for recreational development, was $87,100,000.

Filling of the reservoir began on 11 May 1962, and the pool reached the spillway crest (elevation 163 feet NGVD29) on 15 November 1962. The pool was held at approximately elevation 167 feet NGVD29 until early in March 1963 when high inflows caused it to rise to elevation 184 feet NGVD29. It was lowered to elevation 178 feet NGVD29 and held at or slightly below that level until clearing of the reservoir was completed in mid-July. After clearing was complete, filling was resumed and the pool reached elevation 183 feet NGVD29 on 27 July when it was lowered to 180 feet NGVD29 because of foundation problems with the earth dikes. On 9 August, the restrictions on the pool level were removed, and the reservoir was filled to normal operating level.

The first generating unit was placed in operation on 13 March 1963, the second unit was declared commercially available on 29 June, the third unit on 25 September, and the fourth unit on 2 November. The lock was opened to navigation in mid-1963. However, navigation was limited by channel conditions until October 1963 when dredging was completed in the upper Andrews (Columbia) pool just below the Walter F. George Lock and in the upper reaches of the Walter F. George Lake.

The Walter F. George Project is underlain by coastal plain sediments of Tertiary age. The floodplain at the project was covered with recent aged alluvium, and pockmarked with sinkholes. The sinkholes occurred in definite lines, which indicate they are controlled by jointing the Tertiary-aged strata. Foundation rock for the concrete structures is the Clayton Formation. That formation is predominately limestone and is approximately 165 feet thick. Locally, three distinct units are recognized in the Clayton. They are, in descending order, Earthy Limestone, Shell Limestone, and Sandy Limestone. Compressive strengths generally range about 200 to 450 pounds per square inch (psi) for the Earthy Limestone, 300 to 1,000 psi for the Shell Limestone, and less than 100 to more than 15,000 psi for the Sandy Limestone.

Foundation problems in the embankment area were noted near the end of construction, and seepage problems developed at the beginning of impoundment of the reservoir. The permeability of the alluvial overburden materials, and existing jointing and cavernous conditions in the Earthy Limestone caused the initial seepage problems in the embankment areas. Grouting and other remedial measures were attempted; although, the problem was not solved until concrete cutoff walls were installed through the earth embankments in the 1980s.

Limestone formations, caverns, and sinkholes (shown in Figures 3-1, 3-2, and 3-3) were an initial cause of seepage from the project. Extensive grouting (Figures 3-4 and 3-5) managed to reduce some areas of seepage. Later, a cutoff wall was installed along the center of the earthen dikes.

In October 1981, construction began on a concrete diaphragm cutoff wall placed vertically in the dikes and extending down to an impervious layer of rock. The cutoff wall consisted of 364 panels that measured 2 feet wide, the average panel length was 22.5 feet, and the average panel depth was 117.3 feet. Construction of the cutoff wall was completed in March 1985 at a total cost of $10.8 million. Seepage underneath the powerhouse section of the dam has also occurred. Conventional drilling and grouting occurred from 1982 to 1983 and was successful. Foundation drains are closely monitored for any unusual increases in seepage. Since construction of the cutoff wall, relief well and piezometer monitoring at the project has revealed that the cutoff wall has been successful, stopping seepage beneath the dikes. Figures 3-6 and 3-7 show construction of the cutoff wall.

Figure 3-1. Man Standing in Sinkhole

Figure 3-2. Cavern in Foundation Area

Figure 3-3. Early Excavation to Prevent Seepage

Figure 3-4. Grouting Crew

Figure 3-5. Boom Supplying Grouting Operation

Figure 3-6. Trench Excavation for Cutoff Wall

Figure 3-7. Cutoff Wall Construction

As the cutoff walls were solving the seepage problems through the alluvium and Earthy Limestone materials beneath the embankments, seepage became evident in the Shell Limestone foundation beneath the powerhouse and spillway. Seepage through the Shell Limestone is more complicated than that under the embankments. Construction features (inadequately grouted construction piezometers along the upstream toe) and natural features (joints in the Earthy Limestone overlying joints in the Shell Limestone) combined to provide seepage paths to lower portions of the Shell Limestone. The lower portions contain some strata in which the shell fragments are very poorly cemented. High hydraulic gradients that developed in the strata caused piping, which ultimately developed direct connections with the lower pool. In the early 1980s, a flow of about 30,000 gallons per minute (gpm) developed beneath the powerhouse, and again in 1991 a flow of about 3,000 gpm (and climbing) developed beneath the spillway. During the 1990s event, up to one and one-quarter-inch diameter limestone fragments piped from the foundation were collected from the drainage system discharge.

Investigation methods used over the years to define and attempt to control the seepage were multibeam hydrographic surveys, lake bottom and borehole camera inspections, doppler sonar surveys, dye testing, temperature studies, diving inspections, side-scan sonar surveys, bottom profiling sonar inspections, coring, and drilling and grouting (both cement and chemical).

In the summer of 2002, work began on a concrete cutoff wall construction along the upstream toe (through the reservoir) of the concrete structures. A secant pile wall (overlapping 50-inch in diameter piles) was installed through about 100 feet of water upstream of the spillway and powerhouse structures, and through the upstream lock guide and guard walls. Connecting concrete diaphragm walls were installed at the structure abutments, with excavation by hydromill. A hydromill was also used to cut through the lock concrete walls and the reinforced retaining wall upstream of the powerhouse, for the subsequent installation of the secant piles. The cutoff wall contract was completed in December 2004. Piezometric levels beneath much of the powerhouse and spillway have dropped from 50 to 60 feet and now are near tailwater level.

The seepage problem has been largely addressed by the secant wall, however the lock chamber has still been observed to leak water through old drainage systems. After anchoring the lock floor in the 1970's the lock chamber (peripheral) drainage system was determined to be no longer required and plugs were installed in the discharge pipes. Many of these plugs have failed, releasing water into the main downstream channel. This issue will need to be addressed before the next lock dewatering, however it is not believed to pose any risk to the structure. There also appears to be leakage through an old contact drainage system in the lock floor. Lock operation was monitored and it was noted that there appears to be continuous flow through this drainage system. It also discharges into the downstream channel through numerous grates on the riverside lock wall. Flow through these grates was noted the entire time the lock was kept at any elevation above the lower pool. This is also not believed to pose any risk to the structure.

3-04. Related Projects. Walter F. George Lock and Dam is one of five Corps reservoir projects in the ACF Basin. Buford Dam and West Point Dam are upstream, while George W. Andrews Lock and Dam and Jim Woodruff Lock and Dam are downstream of the project. The Corps reservoirs on the Chattahoochee River are operated as a system to accomplish authorized functions as described in the *ACF Basin Master Water Control Manual (with Appendices)*. Outflows from Walter F. George Dam are influenced by the Master Manual and requirements at other Corps projects. In addition, six privately owned dams are upstream on the Chattahoochee River in the vicinity of Columbus, Georgia, between Walter F. George Dam and West Point Dam. The privately owned reservoirs on the Chattahoochee River are primarily run-of-river projects containing very little storage capacity and, consequently, do not significantly influence flows in the river or the operation of the Corps projects.

3-05. Modifications to Regulations. From the time the Walter F. George Project became operational in 1963, changes in needs and conditions in the ACF Basin have influenced certain modifications to the regulation of the dam. The following describe the modifications to regulations that have occurred at the Walter F. George Project.

a. Hydropower. The Southeastern Power Administration (SEPA) negotiates contracts for the sale of power from the Walter F. George Hydropower Project in accordance with the Flood Control Act of 1944. Under the provisions of the Act, the Corps determines the amount of energy available at Walter F. George each week and advises SEPA of the amount available, and SEPA arranges the sale. Walter F. George Dam is within SEPA's Georgia-Alabama-South Carolina system, which also contains Buford Dam and West Point Dam on the Chattahoochee River, four projects in the ACT Basin, and three projects on the Savannah River. SEPA began dispatching (scheduling) power in 1996. Before that, Southern Company scheduled peaking generation from Corps projects. SEPA's scheduling provided more flexibility to meet customer needs. Hydropower generation in the 1960s and 1970s was a driving force in releases from Walter F. George Dam, and days of six to eight hours of generation were common. During the 1980s, several droughts occurred and resulted in a philosophical change to more conservative hydropower operations. This led to a decrease of about 9% in hydropower generation at Walter F. George from the 1960s and 1970s to the 1980s and 1990s. SEPA values the capacity at each project and supports conservative use of the resource (water). As a result, power generation demands have been balanced between the projects weekly to enhance long-term generating capability of the entire system and to provide for the needs of other project purposes in the system.

b. Navigation. A major factor influencing reservoir regulation was the additional flow required to maintain the authorized 9.0-foot navigation depth on the Apalachicola River. At the time the ACF system of projects was constructed, a discharge from Jim Woodruff Dam of 9,300 cfs, together with dredging, provided a 9.0-foot deep navigation channel in the Apalachicola

River. A discharge of 20,600 cfs from Jim Woodruff Dam is currently required for a 9.0-foot channel without dredging. The increase of 11,300 cfs to support a 9.0-foot channel is equivalent to 4.1 feet of storage at Lanier, 5.6 feet of storage from West Point, or 3.6 feet of storage from Walter F. George over a one week period. In practice any use of storage to support navigation would be distributed between the three ACF storage projects with consideration to the current action zone of each reservoir. The increasing flow requirements to achieve suitable navigation channel depth in the Apalachicola River are attributable to (1) channel degradation and (2) escalating flow diversion through Chipola Cutoff. In response to those changing conditions, it became necessary to periodically schedule the release of increased flows from Jim Woodruff Dam for periods of a few days to as long as two weeks to accommodate commercial river traffic. Those periods were known as navigation windows. During navigation windows, water was released in varying amounts from the upstream reservoirs, stored in the downstream reservoirs, and then released through Jim Woodruff Lock and Dam to provide sufficient flow in the Apalachicola River to achieve suitable navigation depths. In preparation for navigation windows, releases were made from Walter F. George Dam to help supply sufficient water in storage downstream to successfully implement the navigation window. A discharge of 20,600 cfs from Jim Woodruff Dam is currently required for a 9.0-foot channel without dredging.

Increasing flow requirements plus the loss of water quality certification from Florida, which prevents the Corps from dredging the Apalachicola River, effectively closed commercial navigation on the Apalachicola River. Coordination with waterway users identified the need for changes in the Corps' water control operations to provide a more reliable flow regime, without dredging, to support at least a 7.0-foot navigation channel in the Apalachicola River. Through an iterative hydrologic modeling process, it was determined that a 5-month navigation season, January through May each year, can be provided that will improve navigation reliability without significantly affecting other project purposes. The 5-month navigation season included in the current water control plan can, in the absence of maintenance dredging, improve the total reliability of a 7.0-foot navigation channel in the Apalachicola River from 21 percent to as much as 42 percent. Releases made from Walter F. George Dam during hydropower operations contribute to the needed downstream navigation flows.

c. <u>Revised Water Control Plan</u>. Since the initiation of project operations, Walter F. George Dam has operated with a seasonally varied conservation pool. From completion of the project until 1978, the conservation pool was maintained at 185 feet NGVD29 from December through April and 190 feet NGVD29 from June through October. In May and November, the levels transitioned between the summer and winter pool levels. This lower winter pool level was intended to provide sufficient storage space to contain the pool elevation in the upper reaches of the reservoir within the project limits during high-flow periods and to provide storage for high inflows that could gradually be released through the turbines for hydropower generation rather than through the spillway.

After West Point Dam became operational in 1975, the Corps reviewed the Walter F. George Dam seasonal water control operations. It was determined that using the flood risk management storage in West Point Lake had changed the timing of high inflows into Walter F. George Lake. Further, using the West Point Lake flood risk management storage in combination with a higher winter pool and an early start of continuous power generation at Walter F. George Dam during high-flow periods would accomplish the same control of downstream flows as previously provided by maintaining the Walter F. George Lake winter pool elevation of 185 NGVD29. The evaluation of proposed changes to the Walter F. George Dam water control operations concluded that a winter pool elevation of 188 feet NGVD29 would provide increased economic benefits for hydropower and recreation. Using flood risk management storage at West Point Dam, combined with the two feet of storage provided by the

188 feet NGVD29 winter pool elevation at Walter F. George Lake and the early start to continuous power generation at Walter F. George Dam meant that most of the water evacuated from the reservoir during high-flow periods was released through the turbines, rather than through the spillway, which resulted in increased power generation. Maintaining a winter pool elevation of 188 feet NGVD29, rather than the previous 185 feet NGVD29, gave greater assurance that the summer conservation pool elevation of 190 feet NGVD29 could be reached, particularly during years when less than normal rainfall occurred during the winter and spring months, to the benefit of recreation. Consequently, those new operating guidelines were implemented for Walter F. George Dam.

d. Revised Interim Operating Plan. The Revised Interim Operating Plan (RIOP) was implemented in June 2008 and modified in May 2012. The purpose of the RIOP was to support compliance with the Endangered Species Act of 1973 for federally listed threatened and endangered species and their federally designated critical habitat in the Apalachicola River and to avoid or minimize potential adverse effects associated with discretionary operations at Jim Woodruff Lock and Dam. The RIOP directly affected flows and fall rates in the Apalachicola River and prescribed the minimum flow releases to be made from Jim Woodruff Dam under specific hydrologic conditions. However, the releases made from Jim Woodruff Dam in accordance with the RIOP used the composite conservation storage of all the upstream reservoirs in the ACF System. The Corps operates five federal reservoirs on the ACF as a system, and releases made from Jim Woodruff Dam under the RIOP reflected the downstream end-result for system wide operations measured by daily releases from Jim Woodruff Dam into the Apalachicola River. The RIOP did not describe operational specifics at any of the four federal reservoirs upstream of Jim Woodruff Lock and Dam or other operational parameters at those reservoirs. Instead, the RIOP described the use of the composite conservation storage of the system and releases from the upstream reservoirs as necessary to assure that the releases made from Jim Woodruff Dam would comply with the Endangered Species Act of 1973 by minimizing effects on federally listed threatened and endangered species and federally designated critical habitat.

3-06. Principal Regulation Problems. To maintain the structural integrity of the dam and powerhouse, a head differential between the Walter F. George Lake and the tailwater elevation must not exceed 88 feet at any time. When the tailwater elevation is less than 102 feet NGVD29 and the pool elevation of Walter F. George Lake is greater than 190 feet NGVD29, a constant release of water must occur from the project sufficient enough to raise the tailwater elevation above 102 and maintain a head differential of less than 88 feet.

IV - WATERSHED CHARACTERISTICS

4-01. General Characteristics. The Chattahoochee River drainage basin above Walter F. George Lock and Dam has a long, narrow shape with an average width of 28 miles and a maximum width of 55 miles. The drainage area for the entire Chattahoochee River Basin is 8,708 square miles of which 7,460 square miles are above Walter F. George Lock and Dam. The Chattahoochee River is formed in the Blue Ridge Mountains of north Georgia near the westernmost tip of South Carolina. The river flows southwest for 235 miles to West Point, Georgia, on the Alabama-Georgia line. Turning south there, it continues to the Walter F. George Dam, constituting the boundary between Georgia on the east and Alabama on the west. The average slope is about 2.7 feet per mile for the area above West Point and about 0.9 feet per mile for the river below West Point. From Columbus, Georgia, to the mouth of the Chattahoochee River at Jim Woodruff Lock and Dam and the Florida state line, the slope varies from 1.2 to 0.6 feet per mile. The entire ACF Basin is shown on Plate 2-1.

4-02. Topography. The Walter F. George Project is in the Coastal Plain south of the Fall Line, but much of the drainage area is in the Piedmont Region. The Piedmont Region consists of moderate- to high-grade metamorphic rocks, such as schists, amphibolites, gneisses and migmatites, and igneous rocks like granite. Topographically, the Piedmont Region mostly consists of rolling hills, although faulting has produced the impressive ridge of Pine Mountain near Warm Springs, Georgia. The Coastal Plain Region consists of Cretaceous and Cenozoic sedimentary rocks and sediments. Those strata dip toward the southeast, and so they are younger nearer the coast. Near the Fall Line, they are underlain by igneous and metamorphic rocks like those of the Piedmont. The sedimentary rocks of the Coastal Plain partly consist of sediment eroded from the Piedmont over the last 100 million years, and partly of limestones generated by marine organisms and processes at sea.

4-03. Geology and Soils. Soils in the Coastal Plain are often porous permitting flow through the ground. Geologic hazards in the Coastal Plain are sinkholes and coastal erosion. Sinkholes can form in areas of limestone bedrock when subsurface dissolution of rock leads to collapse of the earth surface. There is some evidence that Lake Seminole contributes significant inflow to the groundwater and to downstream flows. Limestone caves were discovered during construction near the eastern side of the dam.

A major geologic resource in the Coastal Plain is groundwater. The less porous rocks of the northern regions provide less groundwater, but the aquifers of the Coastal Plain provide groundwater for domestic consumption, for industry, and for agricultural irrigation. The USGS actively monitors groundwater conditions in Georgia.

Limestone is quarried in southwest Georgia. However, its quality as aggregate is not as high as that of the limestone in the Valley and Ridge. The reasons are largely because of the greater porosity of the relatively Coastal Plain limestones, whereas the older limestones of the Valley and Ridge have lost nearly all their fine-scale porosity.

4-04. Sediment. In general, the quantity and size of sediment transported by rivers is influenced by the presence of dams. Impoundments behind dams serve as sediment traps where particles settle in the lake headwaters because of slower flows. Large impoundments typically trap coarser particles plus some of the silt and clay. Often releases from dams scour or erode the streambed downstream. Plans have been developed to measure the reservoir effects of sedimentation and retrogression at each of the government dams.

In 1960, the Corps established sedimentation ranges at the Walter F. George Project to monitor changes in reservoir volume and channel degradations. The sedimentation ranges established in 1960 for the George W. Andrews Project serve as the retrogression ranges for the Walter F. George Project. Reservoirs tend to slow river flow and accelerate deposition. The history of the surveys and the number of ranges surveyed are shown in Table 4-1. The locations of the sedimentation ranges for the Walter F. George Project are shown on Plate 4-1.

Table 4-1. Sedimentation Ranges

Year Surveyed	No. of Ranges Surveyed	Total No. of Ranges Established
1960-1962	44	44
1988	44	44
1999	44	44
2009	Hydrographic bathymetric surface	N/A

The survey conducted in 2009 was a hydrographic bathymetric survey of the entire lake which allowed all previously established sedimentation ranges to be analyzed. Descriptive analyses are performed to determine the level of sedimentation occurring in the main body of the reservoir and to examine shoreline erosion. Detailed reports are written after each re-survey to determine changes in reservoir geometry. Those reports include engineering analysis of the range cross-sections to estimate reservoir storage loss by comparing to the earlier surveys of the existing ranges. The data provide the ability to compute new area/capacity curves for the reservoirs.

Maintenance of the sedimentation and retrogression ranges typically occur when they are resurveyed. Sediment data collection and results are discussed further in Section 5-03, Sediment Stations.

4-05. Climate. Chief factors that control the climate of the ACF Basin are its geographical position in the southern end of the temperate zone and its proximity to the Gulf of Mexico and South Atlantic Ocean. Another factor is the range in altitude from almost sea level at the southern end to higher than 3,000 feet in the Blue Ridge Mountains to the north. Frontal systems influence conditions throughout the year. During the warmer months, thunderstorms are a major producer of rainfall. Tropical disturbances and hurricanes also affect the region.

a. Temperature. The normal annual temperature for the Chattahoochee Basin above Walter F. George Lock and Dam is about 64.1 degrees Fahrenheit (°F). That is based on an arithmetic mean of the normal annual temperature at six stations in or near the basin for the period 1981 - 2010. The average monthly normals vary from a low of 46.0 °F in January to a high of 80.5 °F in July. Table 4-2 shows the monthly and annual normals for each of the stations. The stations are Clayton, Eufaula Wildlife Refuge, and Opelika, Alabama; and Blakely, Columbus Airport, and Cuthbert, Georgia. Climatologists define a climatic normal as the arithmetic average of a climate element, such as temperature, over a prescribed 30-year time interval. The National Climatic Data Center (NCDC) uses a homogenous and complete dataset with no changes to the collection site or missing values to determine the 30-year normal values. When developing this 30-year normal dataset, the NCDC has standard methods available to them to make adjustments to the dataset for any inhomogeneities or missing data before computing normal values. Extreme temperatures events for the six stations are presented in Table 4-3. Recorded temperatures have been as low as –7 °F at Opelika, Alabama, to as high as 110 °F at Blakely, Georgia.

b. Precipitation. The Chattahoochee River Basin above Walter F. George Lock and Dam is in a region of heavy rainfall that is fairly well distributed throughout the year. The average normal annual precipitation over the basin in and around the Walter F. George Project is 51.49 inches, of which 24 percent occurs in the spring, 28 percent in the winter, 27 percent in the summer, and 21 percent in the fall. Normal monthly and annual precipitation in inches for selected stations in or near the basin are shown in Table 4-4. Light snowfall can occur in the basin from November through March, but it seldom covers the ground for more than a few days and has never been a contributing factor in any major flood.

Flood-producing storms can occur over the basin at any time, but they are much more frequent in the winter and early spring. Major storms in the winter are usually of the frontal type. Summer storms consist mainly of convective thundershowers with occasional tropical storms affecting southern sections of the basin.

Table 4-5 presents extreme rainfall events of record for six stations in or near the basin. Shown is the highest monthly rainfall, the lowest monthly rainfall, and the one-day highest rainfall. Annual values are also included.

Table 4-2. Normal Mean Temperature (1981–2010)

Station		°F												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Clayton, AL (011725)		44.9	48.9	55.8	62.1	70.1	76.9	79.3	78.6	73.8	64.3	55.6	47.4	63.2
Eufaula NWR, AL (012730)		48.2	52.0	58.7	64.7	72.8	79.7	82.3	81.7	76.7	66.7	57.8	50.3	66.0
Opelika, AL (016129)		43.5	47.0	53.9	60.6	69.0	75.9	79.2	78.6	73.0	62.7	53.8	45.8	62.0
Blakely, GA (090979)		48.0	51.7	57.9	64.6	72.9	79.0	81.0	80.6	76.1	67.1	58.3	50.0	65.7
Columbus WSO AP, GA (092159)		45.8	49.6	56.0	63.5	72.1	78.5	81.5	80.9	75.4	65.4	55.9	47.3	64.4
Cuthbert, GA (092450)		45.8	49.1	55.5	62.8	71.0	77.4	79.9	79.3	74.6	64.8	55.6	47.6	63.7
Average		46.0	49.7	56.3	63.1	71.3	77.9	80.5	80.0	74.9	65.2	56.2	48.1	64.1

Table 4-3. Extreme Temperatures in the Basin (°F)

CLAYTON, ALABAMA (11/1928-04/2012)

	Monthly Averages			Daily Extremes			
	Max	Min.	Mean	High	Date	Low	Date
Jan	56.8	35.5	46.1	82	30/1959	-6	21/1985
Feb	60.4	37.6	49.0	84	07/1957	11	10/1979
Mar	68.7	45.2	56.9	88	11/1974	13	03/1980
Apr	76.9	52.7	64.8	94	23/1987	27	19/1983
May	82.7	60.6	71.7	98	20/1962	38	01/1996
Jun	88.1	66.9	77.5	101	15/1963	48	03/1956
Jul	89.9	69.3	79.6	101	15/1980	57	15/1967
Aug	89.7	68.9	79.2	102	02/2010	57	16/1983
Sep	86.0	64.4	75.2	102	02/1957	43	30/1967
Oct	77.0	53.5	65.2	97	04/1959	31	26/1982
Nov	68.4	45.2	56.8	87	03/1971	17	24/1970
Dec	60.6	38.3	49.4	84	27/1987	4	13/1962
Annual	**75.4**	**53.2**	**64.3**	**102**	**09/02/1957**	**-6**	**01/21/1985**
Winter	59.2	37.1	48.2	84	02/07/1957	-6	01/21/1985
Spring	76.1	52.8	64.5	98	05/20/1962	13	03/03/1980
Summer	89.2	68.4	78.8	102	08/02/2010	48	06/03/1956
Fall	77.1	54.4	65.7	102	09/02/1957	17	11/24/1970

EUFAULA WILDLIFE REFUGE, ALABAMA (3/1967-4/2012)

	Monthly Averages			Daily Extremes			
	Max.	Min.	Mean	High	Date	Low	Date
Jan	57.4	34.3	45.8	81	30/1975	5	21/1985
Feb	61.9	36.8	49.4	82	03/1989	8	05/1996
Mar	69.8	44.0	56.9	89	13/1967	17	14/1993
Apr	77.2	50.0	63.6	93	30/1985	27	01/1987
May	83.3	58.4	70.9	99	23/2011	36	04/1971
Jun	89.7	65.6	77.7	105	05/1985	44	02/1972
Jul	91.6	69.2	80.4	104	14/1980	55	16/1967
Aug	90.9	68.6	79.7	103	07/1980	56	14/1967
Sep	87.0	63.5	75.2	101	16/1980	33	30/1967
Oct	78.1	51.0	64.6	94	05/1986	26	29/1987
Nov	68.9	42.3	55.6	90	01/1984	14	25/1970
Dec	61.2	37.2	49.2	82	05/1977	8	24/1989
Annual	**76.4**	**51.7**	**64.1**	**105**	**06/05/1985**	**5**	**01/21/1985**
Winter	60.1	36.1	48.1	82	12/05/1977	5	01/21/1985
Spring	76.8	50.8	63.8	99	05/23/2011	17	03/14/1993
Summer	90.7	67.8	79.3	105	06/05/1985	44	06/02/1972
Fall	78.0	52.2	65.1	101	09/16/1980	14	11/25/1970

OPELIKA, ALABAMA (3/1957-4/2012)

	Monthly Averages			Daily Extremes			
	Max.	Min.	Mean	High	Date	Low	Date
Jan	54.8	31.3	43.0	80	30/1975	-7	21/1985
Feb	58.7	33.2	45.9	84	24/1980	5	12/1981
Mar	67.1	40.3	53.7	89	11/1974	12	03/1980
Apr	75.5	47.6	61.5	91	16/1972	25	01/1987
May	82.2	55.8	69.0	97	22/1960	33	04/1976
Jun	88.1	63.6	75.9	101	30/1978	37	02/1984
Jul	90.1	67.3	78.7	103	13/1980	48	01/1958
Aug	89.6	67.0	78.3	101	21/1983	52	23/1957
Sep	85.1	62.0	73.5	99	01/1957	36	30/1967
Oct	75.8	49.1	62.4	91	02/1959	26	28/1957
Nov	67.0	40.7	53.9	88	01/1961	16	24/1970
Dec	58.1	34.1	46.1	81	17/1971	1	13/1962
Annual	**74.3**	**49.3**	**61.8**	**103**	**07/13/1980**	**-7**	**01/21/1985**
Winter	57.2	32.9	45.0	84	02/24/1980	-7	01/21/1985
Spring	75.0	47.9	61.4	97	05/22/1960	12	03/03/1980
Summer	89.3	66.0	77.6	103	07/13/1980	37	06/02/1984
Fall	76.0	50.6	63.3	99	09/01/1957	16	11/24/1970

BLAKELY, GEORGIA (9/1889-4/2012)

	Monthly Averages			Daily Extremes			
	Max.	Min.	Mean	High	Date	Low	Date
Jan	61.0	39.3	50.2	85	22/1911	6	06/1924
Feb	63.9	41.0	52.4	85	18/1911	-1	13/1899
Mar	71.3	47.1	59.1	96	21/1907	17	03/1980
Apr	78.6	53.5	66.1	97	30/1906	30	06/1920
May	85.9	61.2	73.5	102	28/1904	34	04/1903
Jun	91.1	68.0	79.6	108	16/1911	47	01/1984
Jul	91.5	70.3	80.9	107	11/1930	50	04/1901
Aug	91.5	70.0	80.8	105	07/1911	56	31/1986
Sep	88.2	65.9	77.0	110	05/1925	40	29/1967
Oct	79.9	55.3	67.7	101	06/1911	29	24/1917
Nov	69.9	45.5	57.7	92	09/1986	15	25/1950
Dec	62.5	40.0	51.2	89	17/1906	6	13/1962
Annual	**77.9**	**54.8**	**66.4**	**110**	**19250905**	**-1**	**02/13/1899**
Winter	62.5	40.1	51.3	89	12/17/1906	-1	02/13/1899
Spring	78.6	53.9	66.2	102	05/28/1904	17	03/03/1980
Summer	91.4	69.4	80.4	108	06/16/1911	47	06/01/1984
Fall	79.4	55.5	67.5	110	09/05/1925	15	11/25/1950

COLUMBUS WSO AP, GEORGIA (7/1948-4/2012)

	Monthly Averages			Daily Extremes			
	Max.	Min.	Mean	High	Date	Low	Date
Jan	57.6	36.5	47.0	83	11/1949	-2	21/1985
Feb	61.5	38.9	50.2	83	13/1962	10	05/1996
Mar	68.9	45.1	57.0	89	10/1974	16	03/1980
Apr	77.1	52.2	64.6	94	30/2012	28	07/1950
May	84.0	61.1	72.6	97	27/1953	39	02/1963
Jun	89.8	68.7	79.2	104	29/1978	44	03/1956
Jul	91.6	71.9	81.7	104	24/1952	59	01/1950
Aug	91.1	71.3	81.2	104	10/2007	57	05/1950
Sep	86.1	66.2	76.1	100	07/1990	38	30/1967
Oct	77.2	54.3	65.8	96	05/1954	24	30/1952
Nov	67.7	44.2	55.9	86	02/1961	10	25/1950
Dec	59.4	38.1	48.8	82	16/1971	4	13/1962
Annual	**76.0**	**54.0**	**65.0**	**104**	**07/24/1952**	**-2**	**01/21/1985**
Winter	59.5	37.8	48.7	83	01/11/1949	-2	01/21/1985
Spring	76.7	52.8	64.7	97	05/27/1953	16	03/03/1956
Summer	90.8	70.6	80.7	104	07/24/1952	44	06/03/1956
Fall	77.0	54.9	65.9	100	09/07/1990	10	11/25/1950

CUTHBERT, GEORGIA (11/1904-4/2012)

	Monthly Averages			Daily Extremes			
	Max.	Min.	Mean	High	Date	Low	Date
Jan	60.4	38.5	49.4	84	12/1949	-2	21/1985
Feb	63.3	40.3	51.8	85	28/1962	9	05/1996
Mar	71.6	46.6	59.1	93	21/1907	15	03/1980
Apr	79.0	53.4	66.2	95	23/1976	29	18/2001
May	85.7	61.6	73.7	100	28/1962	42	18/2011
Jun	90.6	68.3	79.4	105	04/1984	49	03/1956
Jul	91.8	70.7	81.3	105	14/1980	57	25/1911
Aug	91.6	70.3	80.9	104	23/1968	56	16/2000
Sep	87.5	66.0	76.8	103	04/1951	41	29/1967
Oct	79.1	55.2	67.2	100	05/1954	25	20/2009
Nov	69.6	46.0	57.9	91	01/1951	13	25/1950
Dec	61.9	40.1	51.0	82	07/1978	5	13/1962
Annual	**77.7**	**54.8**	**66.2**	**105**	**07/14/1980**	**-2**	**01/21/1985**
Winter	61.9	39.6	50.7	85	02/28/1962	-2	01/21/1985
Spring	78.8	53.9	66.3	100	05/28/1962	15	03/03/1980
Summer	91.3	69.8	80.5	105	07/14/1980	49	06/03/1956
Fall	78.8	55.8	67.3	103	09/04/1951	13	11/25/1950

Table 4-4. Normal Rainfall in Inches (1981–2010)

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Clayton, AL (011725)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Eufaula NWR, AL (012730)		4.51	4.53	5.74	3.61	3.26	4.60	5.15	3.57	3.62	2.96	4.10	4.49	50.14
Opelika, AL (016129)		4.79	5.32	6.23	4.30	3.38	4.61	5.28	4.06	3.58	3.60	4.74	4.84	54.73
Blakely, GA (090979)		5.50	4.82	5.32	3.51	3.33	5.09	4.16	4.53	3.86	2.67	3.75	4.51	51.05
Columbus WSO AP, GA (092159)		4.34	4.80	5.61	3.70	3.34	4.18	4.86	3.94	3.32	2.91	4.15	4.47	49.62
Cuthbert, GA (092450)		4.86	4.78	5.10	3.66	2.95	4.90	6.77	4.61	3.55	2.75	3.51	4.46	51.90
Average		4.80	4.85	5.60	3.76	3.25	4.68	5.24	4.14	3.59	2.98	4.05	4.55	51.49

NA = Data not available

Table 4-5. Extreme Rainfall Within and Near the Basin (Inches)

	CLAYTON, ALABAMA (011725)						
	Record: 11/1928 – 4/2012						
	Mean	High	Year	Low	Year	1 Day Max.	
January	4.89	21.62	1936	0.75	1941	7.77	19/1936
February	4.72	16.12	1995	0.00	1954	8.34	17/1975
March	6.13	16.68	1990	0.51	1955	11.20	17/1990
April	4.22	12.62	1944	0.40	1987	4.60	14/1955
May	4.00	10.31	1932	0.36	1962	3.55	04/1957
June	4.26	13.40	1989	0.27	1968	4.27	10/1975
July	5.91	21.90	1994	0.34	1993	8.00	04/1994
August	4.54	11.80	1939	0.35	1990	7.27	01/1936
September	4.08	12.97	1956	0.21	1978	8.55	25/1956
October	2.49	9.39	1929	0.00	1944	8.03	01/1929
November	3.49	14.13	1948	0.07	1956	4.05	12/1937
December	4.55	13.20	1953	0.21	1955	5.42	06/1972
Annual	**53.29**	**81.28**	**1936**	**24.52**	**1954**	**11.20**	**03/17/1990**
Winter	14.17	38.15	1936	4.99	1989	8.34	02/17/1975
Spring	14.35	28.99	1944	4.47	1963	11.20	03/17/1990
Summer	14.71	32.37	1994	6.78	1954	8.00	07/04/1994
Fall	10.06	23.58	1930	3.08	1990	8.55	09/25/1956

	EUFAULA WILDLIFE REFUGE, ALABAMA (012730)						
	Record: 3/1967 – 4/2012						
	Mean	High	Year	Low	Year	1 Day Max.	
January	5.20	10.29	1991	1.11	1981	3.70	25/1978
February	4.36	11.14	1975	0.96	2009	6.75	17/1975
March	6.19	16.83	1990	1.46	1967	11.27	17/1990
April	3.56	10.17	1973	0.64	1987	3.58	26/1973
May	4.04	10.21	2009	1.05	1992	4.30	18/2009
June	4.11	10.33	1994	1.35	1968	4.56	19/1985
July	5.14	16.20	1994	0.90	1980	5.41	04/1994
August	3.65	8.59	1978	0.84	1973	2.84	18/1994
September	3.25	8.27	1979	0.10	1978	3.32	02/1986
October	2.61	7.49	1995	0.00	1978	5.15	30/1993
November	3.94	11.11	1992	0.99	1969	4.35	04/1977
December	5.13	13.95	2009	0.69	1980	6.80	06/1972
Annual	**51.17**	**69.50**	**1975**	**37.55**	**1968**	**11.27**	**03/17/1990**
Winter	14.69	22.68	1975	5.91	1989	6.80	12/06/1972
Spring	13.79	25.00	1990	5.86	1967	11.27	03/17/1990
Summer	12.90	32.63	1994	3.80	1973	5.41	07/041994
Fall	9.80	16.31	1992	2.95	1978	5.15	10/30/1993

	OPELIKA, ALABAMA (016129)						
	Record: 3/1957 – 4/2012*						
	Mean	High	Year	Low	Year	1 Day Max.	
January	5.18	9.73	1960	1.52	2011	3.13	14/1992
February	5.08	14.86	1961	0.98	1968	6.30	25/1961
March	6.99	13.94	1980	1.53	1982	6.33	17/1990
April	4.75	16.54	1964	0.33	1986	5.90	01/1981
May	3.80	9.47	2010	0.88	1992	3.28	15/1969
June	4.11	12.24	1989	0.35	1977	4.50	19/1963
July	5.64	12.64	1971	0.98	2010	5.50	03/1988
August	3.82	9.06	1970	0.00	2011	3.75	24/1970
September	4.17	9.41	2011	0.11	1978	4.07	13/1966
October	3.32	15.41	1995	0.00	1963	6.80	01/1965
November	4.10	12.83	1986	1.26	1969	3.84	17/1986
December	5.27	12.02	1961	1.74	1960	4.45	21/1972
Annual	**56.23**	**80.77**	**1975**	**41.84**	**1968**	**6.80**	**10/01/1965**
Winter	15.52	24.08	1973	8.06	2011	6.30	02/25/1961
Spring	15.54	29.52	1980	7.30	1965	6.33	03/17/1990
Summer	13.57	25.18	1989	7.48	1980	5.50	07/03/1988
Fall	11.60	23.85	1986	3.89	1978	6.80	10/01/1965

	BLAKELY, GEORGIA (090979)						
	Record: 9/1889 – 4/2012						
	Mean	High	Year	Low	Year	1 Day Max.	
January	4.95	14.10	1925	0.40	1909	5.57	19/1936
February	5.27	12.35	1939	0.77	1980	4.57	19/1962
March	5.64	15.86	1929	0.10	2006	10.88	15/1929
April	4.43	14.85	1928	0.24	1967	5.17	23/1928
May	3.87	12.66	1976	0.15	1965	5.69	25/1961
June	4.53	11.65	1965	0.72	1931	7.00	12/1906
July	6.48	30.23	1916	0.00	1900	9.90	08/1916
August	5.47	14.64	2008	0.96	1914	5.90	24/2008
September	3.95	14.54	1957	0.10	1904	7.50	10/2006
October	2.40	8.68	1959	0.00	1961	5.80	08/1894
November	3.03	10.11	1947	0.02	1931	4.76	01/1932
December	4.60	12.92	1953	0.55	1946	8.50	11/2008
Annual	**54.62**	**81.94**	**1948**	**28.74**	**1954**	**10.88**	**03/15/1929**
Winter	14.82	27.73	1973	5.88	1950	8.50	12/11/2008
Spring	13.93	28.25	1947	5.20	1925	10.88	03/15/1929
Summer	16.48	37.79	1916	7.46	2006	9.90	07/08/1916
Fall	9.38	24.43	1957	1.19	1931	7.50	09/10/2006

	COLUMBUS WSO AP, GEORGIA (092166))						
	Record: 7/1948 – 4/2012						
	Mean	High	Year	Low	Year	1 Day Max.	
January	4.14	8.35	1978	0.72	1989	3.21	13/1992
February	4.50	9.41	1961	1.20	2000	5.54	10/1981
March	5.66	13.30	2001	0.56	2004	5.38	16/1990
April	3.98	11.67	1953	0.10	1986	5.74	01/1981
May	3.75	8.45	1959	0.22	1962	4.77	03/2010
June	3.92	10.83	1967	0.51	2000	3.88	01/1959
July	5.28	13.24	1971	1.74	1957	5.45	03/1989
August	3.98	10.11	1991	0.80	1988	5.32	03/1977
September	3.30	9.47	2004	0.22	1984	4.15	17/1971
October	2.28	8.41	1995	0.00	1963	5.00	04/1964
November	3.62	12.45	1948	0.31	1956	5.44	10/2009
December	4.53	13.62	2009	0.43	1955	4.33	23/1956
Annual	**48.92**	**80.20**	**2009**	**26.39**	**1999**	**5.74**	**04/01/1981**
Winter	13.16	22.52	2010	6.93	2000	5.54	02/10/1981
Spring	13.39	24.33	2009	5.51	1995	5.74	04/01/1981
Summer	13.17	24.68	2005	6.31	1990	5.45	07/03/1989
Fall	9.20	18.44	2009	2.30	1961	5.44	11/10/2009

	CUTHBERT, GEORGIA (092450)						
	Record: 11/1904 – 4/2012						
	Mean	High	Year	Low	Year	1 Day Max.	
January	4.70	13.35	1991	0.30	2003	7.60	06/1962
February	4.70	10.51	1998	0.36	2009	4.60	11/1995
March	5.24	12.16	1980	0.29	2004	7.25	27/2005
April	4.16	12.43	1912	0.27	1986	5.20	16/1910
May	3.64	10.05	1953	0.03	2000	5.18	21/1987
June	4.39	11.89	1991	0.80	1968	4.90	09/1990
July	6.18	31.46	1994	1.58	1972	8.74	04/1994
August	4.21	11.14	2008	0.52	1954	4.90	08/2010
September	3.77	12.69	1998	0.18	1978	5.00	29/1998
October	2.42	9.97	1959	0.00	1961	6.00	01/1989
November	3.19	10.14	1992	0.15	2010	5.53	04/1977
December	4.74	17.04	2009	0.01	2010	6.70	11/2008
Annual	**51.34**	**78.62**	**1994**	**26.77**	**1954**	**8.74**	**07/041994**
Winter	14.14	34.07	2010	6.82	2002	7.60	01/06/1962
Spring	13.04	22.62	1947	5.45	2007	7.25	03/27/2005
Summer	14.78	40.61	1994	5.21	1986	8.74	07/041994
Fall	9.37	20.69	1976	2.28	1909	6.00	10/01/1989

4-06. Storms and Floods. Frontal systems influence conditions throughout the year. During the warmer months, thunderstorms are a major producer of rainfall. Tropical disturbances and hurricanes also affect the region. The autumn months are usually dryer but flood producing storms can occur any time of the year. Two of the major floods before construction of Walter F. George Lock and Dam are the July 1916 and the March 1929 events.

The storm of 5 - 10 July 1916, resulted from a tropical hurricane, which formed in the Caribbean Sea and moved northwest across the Gulf of Mexico to enter the United States east of the mouth of the Mississippi River on the evening of 5 July. The disturbance continued inland across western Mississippi, turned eastward on the 7th and from the 8th to the 10th moved northeastward across Alabama. The heavy precipitation covered a remarkably large area. The 9-inch isohyet on the total-storm isohyetal map includes practically all of Alabama, the northwestern part of Florida, and large areas in Mississippi and Georgia. At the center of greatest intensities, the following amounts of precipitation were recorded over a 3½-day period: Bonifay, Florida, 24 inches; Robertsdale, Alabama, 22.6 inches; and Clanton, Alabama, 18.6 inches. The storm produced general flood conditions throughout the southeastern states and, because it occurred during the middle of the growing season, caused significant damage. The heaviest recorded rainfall in the ACF Basin was 23 inches at Blakeley, Georgia. A total of 22.7 inches fell at Alaga, Alabama, where 12.7 inches were recorded in one day. Flood stages were exceeded throughout the basin.

The March 1929 storm resulted from a widely extending low pressure area that developed over eastern Colorado. The system moved rapidly to the east causing heavy rainfall in Mississippi, Alabama, and Georgia. Some areas experienced nearly 30 inches of rain in a 3-day period. The March 1929 flood is discussed further in the *ACF Master Water Control Manual*.

A significant flood after construction of Walter F. George Lock and Dam was the flood of July 1994. Tropical Storm Alberto formed in the Southeastern Gulf of Mexico between the Yucatan Peninsula and the western tip of Cuba on 30 June 1994. Alberto was near hurricane strength when it made landfall near Ft. Walton, Florida on 3 July. The storm moved to the Atlanta, Georgia area and then meandered southward. Up to 26 inches of rainfall occurred in areas between the Chattahoochee River and the Flint River. Record stages were recorded on some streams. The MDO prepared a special report on the storm titled, *Flood of July 1994 Apalachicola-Chattahoochee-Flint River Basin*. The *ACF Master Water Control Manual* also describes the storm.

4-07. Runoff Characteristics. In the ACF Basin, rainfall occurs throughout the year but is less abundant from August through November. Only a portion of rainfall actually runs into local streams to form the major rivers. Factors that determine the percent of rainfall that runs into the streams include the intensity of the rain, antecedent conditions, ground cover and time of year (plants growing or dormant). Intense storms will have high runoff potential regardless of other conditions while a slow rain can produce little measurable runoff. The average monthly rainfall and average stream flow entering the river between Columbus, Georgia and Blountstown, Florida are presented in Figure 4-1 to demonstrate the average variation in runoff. This information was computed by comparing flows with rainfall over the basin using the unimpaired flow dataset from 1939 to 2011. The percent of rainfall appearing as stream runoff is presented for each month. Similar rainfall runoff comparisons for the upper basin are presented in the *ACF Basin Master Water Control Manual*.

While commonly referred to as observed data, reservoir inflows are actually calculated from pool elevations and project discharges. A reservoir elevation-storage relationship results in an inflow calculated for a given pool level change and outflow (total discharge) by using the continuity relationship. The reservoir continuity equation described below maintained the flow volume:

INFLOW = OUTFLOW + CHANGE IN STORAGE
where: INFLOW is in units of cfs/day
OUTFLOW is in units of cfs/day
CHANGE OF STORAGE is in units of cfs/day

The reservoir discharge value, OUTFLOW, is the total discharge from turbines, sluice gates, or spillway gates. Its associated value comes from rating tables for these structures. The CHANGE IN STORAGE comes from subtracting the daily storage on day two from day one as seen below.

$$\text{CHANGE IN STORAGE} = \text{STORAGE}_i - \text{STORAGE}_{i-1}$$

where: STORAGE_i = storage at midnight of the current day in units of cfs/day
STORAGE_{i-1} = storage at midnight of the previous day in units of cfs/day

The daily storage value comes from the storage-elevation tables using the adjusted midnight pool elevation for each day. Negative inflow calculations can occur when there is a decrease in storage which exceeds the project's outflow. Evaporative losses, direct reservoir withdrawals, wind affecting the lake level reading, and losses to groundwater are several causes of negative inflow calculations.

Streamflows have been measured in the vicinity of Walter F. George Dam since 1928. Some measurements began an early as 1925 at Columbus, Georgia. A complete record exists for the Columbus site from 1928 through March 1953. Records are available at Fort Gaines from March 1953 until records began at Walter F. George Lake in 1963. Plates 4-2 through 4-14 show the flow records since the project was completed. It shows the daily inflows, outflows, and pool elevations. The West Point, Columbus, and Fort Gaines gages are used to estimate inflows into the reservoir. Their rating curves are shown on Plates 4-15, 4-16, and 4-18 respectively. The tailwater rating curve for Walter F. George is shown on Plate 4-17. Average monthly inflows since the project was completed are shown on Plates 4-19 and 4-20.

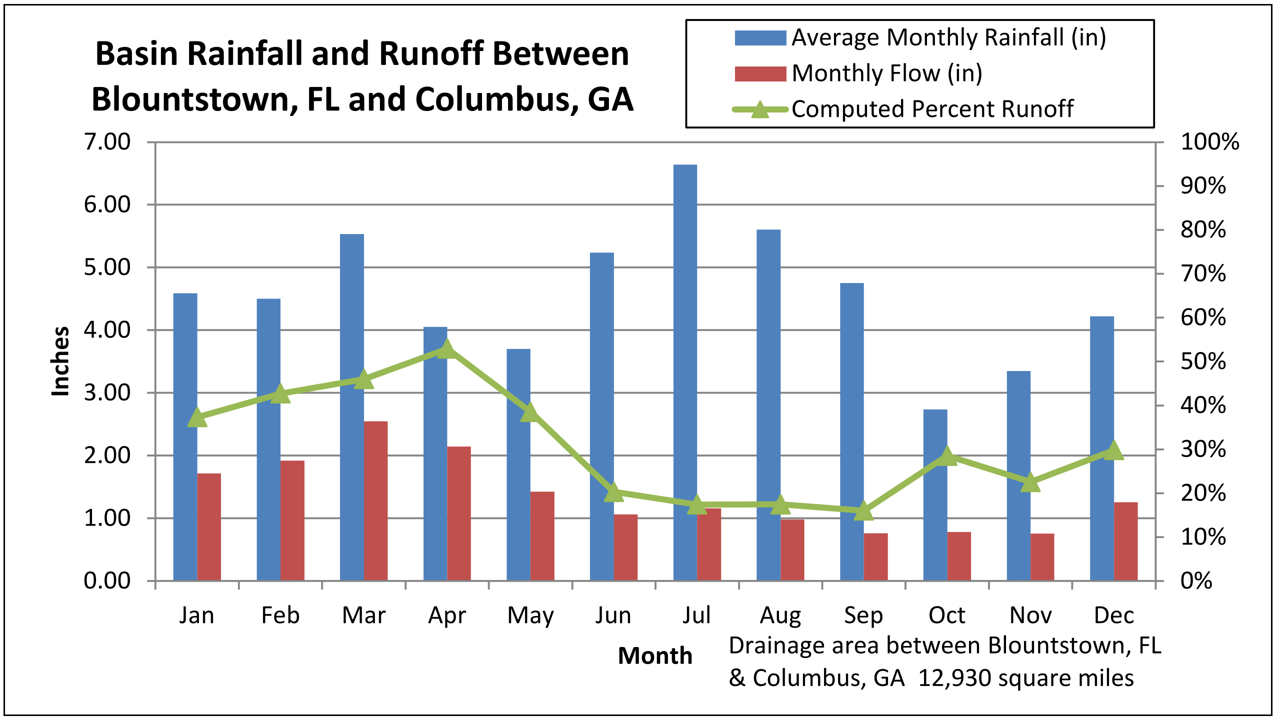


Figure 4-1. Basin Rainfall and Runoff between Blountstown, FL and Columbus, GA

4-08. Water Quality. The pool and mid-lake behind the Walter F. George Dam are both supporting their designated water uses according to Georgia's 2014 draft integrated 305(b)/303(d) list. A total maximum daily load (TMDL) investigation was completed in 1998 for polychlorinated biphenyls (PCBs), and because PCBs are no longer used in Georgia, reduction of the contaminants was listed at zero percent. Georgia Environmental Protection Division (GAEPD) collected nutrient and water quality data at compliance points in the lake, and measurements have not exceeded the standards. Walter F. George Lake has site-specific nutrient criteria, and the chlorophyll a growing season average must be less than 18 micrograms per liter (µg/l). While the growing season average has been less than 18 µg/l, chlorophyll *a* measurements have equaled 18 µg/l. In accordance with the state water plan, GAEPD is developing a three-dimensional hydrodynamic and water quality model that will further examine nutrient criteria in Walter F. George Lake.

The Corps monitors water quality in the tailrace of Walter F. George Dam. A two-mile area in the tailrace of Walter F. George Dam is not supporting its designated water uses because of low dissolved oxygen and high fecal coliforms according to Georgia's 2014 draft integrated 305(b)/303(d) list. A TMDL investigation was completed in 2000 for dissolved oxygen and in 2008 for fecal coliforms. If, during those periods of low dissolved oxygen, fish appear to be in distress, the Corps releases additional water to assist fish assemblages in the tailrace.

The MeadWestvaco Corporation withdraws water from the Chattahoochee River at river mile 230, near Pittsview, Russell County, Alabama, and is required to meet special water quality criteria with its discharge water. The plant's water intake is at elevation 178.8 feet NGVD29. When the Walter F. George pool elevation reaches 184.75 feet NGVD29, the pumping capacity reduces to 75 percent. MeadWestvaco has installed emergency pumps at the intake to operate at or below pool elevation 178.8 feet NGVD29 to maintain pumping capacity.

4-09. Channel and Floodway Characteristics

a. General. The Chattahoochee River below Walter F. George Lock and Dam is the pool formed by George W. Andrews Dam. It is relatively stable except during flood events. Upstream the lake extends to near the Fall Line where existing dams have been constructed to use the steep slope of the river.

b. Damage Centers and Key Control Points. Flooding and flood damages occur in the vicinity of Fort Gaines, Georgia adjacent to Walter F. George Lake. The tailwater gage (USGS #02343241) provides an indication of flooding in the Fort Gaines area and downstream. A gage reading of 134 feet NGVD29 or higher indicates minor lowland flooding. With the river above elevation 145 feet NGVD29, houses on the bluffs below the Columbia Bridge near Gilbert Drive become isolated. Above elevation 150 feet NGVD29, extensive bottomland flooding occurs with several flooded roads. At elevation 160 feet NGVD29, the entire natural floodplain is inundated. Table 4-6 lists several of the historical peak river stages at Fort Gaines.

Flooding and flood damages also occur at George W. Andrews Lock and Dam. Extensive lowland flooding begins at elevation 113 feet NGVD29. At elevation 115 feet NGVD29, water reaches the top of the lock walls, and George W. Andrews Lock and Dam is evacuated. Significant erosion can be expected at elevation 118 feet NGVD29 and above. Roads near Georgia Pacific Paper Mill are flooded at elevation 119 feet NGVD29. Above elevation 125 feet NGVD29, railroad tracks between George W. Andrews and the railroad bridge are flooded. Above elevation 130 feet NGVD29, Georgia Highway 62 is flooded. Table 4-7 lists the historical peak river stages at George W. Andrews Lock and Dam. The expected flood impacts and historical crests information is taken from the Southeast River Forecast Center (SERFC) website.

Table 4-6. Historical Crests at Fort Gaines, Georgia (USGS Gage #02343241)

(1) 158.50 ft on 03/17/1929
(2) 153.56 ft on 03/18/1990
(3) 149.60 ft on 07/06/1994
(4) 149.20 ft on 04/10/1964
(5) 145.70 ft on 01/27/1978
(6) 144.14 ft on 04/15/1975
(7) 143.80 ft on 03/06/1966
(8) 143.18 ft on 03/09/1998
(9) 142.70 ft on 03/06/1971
(10) 140.60 ft on 02/19/1975

Table 4-7. Historical Crests at George W. Andrews L&D (USGS Gage #02343801)

(1) 128.28 ft on 03/18/1929
(2) 122.10 ft on 03/19/1990
(3) 121.80 ft on 12/03/1948
(3) 121.80 ft on 12/01/1948
(5) 121.70 ft on 03/24/1943
(6) 119.40 ft on 12/01/1964
(7) 118.90 ft on 04/12/1936
(8) 118.60 ft on 01/20/1943
(9) 118.12 on 01/27/1929
(10) 117.28 on 10/02/1929

4-10. Upstream Structures. In the drainage area above Walter F. George Lock and Dam are eight power developments and two multiple-purpose dams. The Georgia Power Company owns and operates seven of the power projects. They are Morgan Falls, Langdale, Riverview, Bartletts Ferry, Goat Rock, Oliver, and North Highlands. The Habersham Mill Dam is a small project above Buford Dam. Buford and West Point Dams are federal projects operated by the Corps and are multiple-purpose dams that provide flood risk management, production of hydroelectric power, water supply, recreation, water quality, fish and wildlife conservation, and navigation during low-flow seasons. The locations of these projects are shown on Plate 2-1.

4-11. Downstream Structures. Walter F. George Lock and Dam is the northernmost structure in the navigation network for the ACF River System. The system provides navigable depths to Columbus, Georgia. The system consists of three lock and dams - Jim Woodruff Lock and Dam on the Apalachicola River; and George W. Andrews Lock and Dam, and Walter F. George Lock and Dam, both on the Chattahoochee River.

4-12. Economic Data. The watershed above and the river basin below Walter F. George Lake are largely rural. The watershed above Walter F. George Lake extends to West Point Dam and Lake in the Chattahoochee River Basin and consists of seven Georgia counties and five Alabama counties. The river basin below Walter F. George Lake consists of one county in Alabama and one county in Georgia and extends to the George W. Andrews Lock and Dam.

a. Population. The 2010 population of the 14 counties composing the Walter F. George Lake watershed and basin below totaled 533,122 persons. Table 4-8 shows the 2010 population and the 2010 per capita income for each of the counties. The two major cities in the Walter F. George Lake watershed and their 2010 populations are Columbus, Georgia – 189,885, and Phenix City, Alabama – 32,831.

Table 4-8. Population and per Capita Income

County	2010 Population	2010 Per Capita Income
Alabama		
Barbour	27,457	$ 15,875
Bullock	10,914	20,289
Henry	17,302	19,716
Lee	140,247	22,794
Macon	21,452	16,380
Russell	52,947	17,415
Georgia		
Chattahoochee	11,267	21,739
Clay	3,183	16,123
Early	11,008	15,989
Harris	32,024	28,753
Muscogee	189,885	21,717
Quitman	2,513	16,327
Stew art	6,058	12,681
Talbot	6,865	16,855
Total Population	533,122	

Source: U.S. Census Bureau, 2010

b. Agriculture. The Walter F. George Lake watershed and basin below consist of approximately 3,200 farms averaging 372 acres per farm. In 2012 the area produced $583 million in farm products sold (including livestock). Agriculture in the Walter F. George Lake watershed and basin consists primarily of row crops, which account for 65 percent of the value of farm products sold. Cotton, peanuts, soybeans, and corn are the principle row crops. Livestock production consists primarily of beef cattle and poultry operations.

c. Industry. The leading industrial sectors that provide non-farm employment are wholesale and retail trade, services, and manufacturing. The sectors account for a combined 66.1 percent of the non-farm employment in the basin. The remaining non-farm employment is provided by construction, finance, insurance, real estate, transportation, and public utilities. In 2005 the Walter F. George Lake area counties contained 375 manufacturing establishments that provided 28,240 jobs with total earnings of almost $1.4 billion. Additionally, the value added by the area manufactures totaled more than $3.0 billion. Table 4-9 shows information on the manufacturing activity for each of the counties within the Walter F. George Lake watershed and basin below.

Table 4-9. Manufacturing Activity

County	No. of Manufacturing Establishments	Total Manufacturing Employees	Total Earnings ($1,000)	Value Added by Manufactures ($1,000)
Alabama				
Barbour	40	4,404	$ 151,005	$ 311,384
Bullock	5	(D)	(D)	(D)
Henry	20	1,418	62,988	106,061
Lee	100	7,112	343,344	890,988
Macon	(NA)	160	5,087	(NA)
Russell	35	2,683	172,529	140,830
Georgia				
Chattahoochee	(NA)	5	$ 52	(NA)
Clay	(NA)	-	-	(NA)
Early	13	981	87,631	356,744
Harris	21	1,042	26,640	(D)
Muscogee	141	10,346	530,817	1,213,141
Quitman	(NA)	(D)	(D)	(NA)
Stewart	(NA)	79	1,721	(NA)
Talbot	(NA)	10	52	(NA)
Totals	375	28,240	$ 1,381,866	$ 3,019,148

(NA) Not available
(D) Data withheld to avoid disclosure

Source: U.S. Census Bureau, County and City Data Book: 2007

d. Employment. According to the 2012 American Community Survey, more than 90 percent of all jobs in the Walter F George Project area are provided by the private sector. The primary sources of employment are management and professional occupations and sales and office occupations; together, they account for, on average, over 50 percent of the total employment in the project area. Barbour and Quitman Counties have manufacturing establishments that provide for more than 20 percent of the employment in the counties. Table 4-10 gives information on the employment by county for each county in the Walter F George watershed and basin below.

Table 4-10. Employment

	Percent distribution by occupation					Percent in selected industries		Percent government workers (local state, or federal)
	Management, professional, and related occupations	Service occupations	Sales and office occupations	Construction, extraction, and maintenance occupations	Production transportation, and material moving occupations	Agriculture, forestry, fishing and hunting	Manufacturing	
Alabama								
Barbour	28.1	16.7	23.8	10.7	20.8	3.5	24	7.4
Bullock	20.2	12.8	18.7	17.7	30.5	11.2	19.5	6.2
Henry	28.6	17.5	23.8	12.6	17.5	3.9	16.5	3.8
Lee	36.4	16.5	24	10	13	1.1	11.9	4.3
Macon	25.6	25.3	25.2	10.2	13.7	1.3	10.5	7.2
Russell	24.4	22.9	26.5	11.6	14.8	1	11.1	7.3
Georgia								
Chattahoochee	26.7	24.8	22.6	9.8	16.2	3.1	5.3	15.2
Clay	27.9	26.1	15	18.8	12.3	14.9	11.5	14.8
Early	29.1	18.3	20.9	11.6	20.1	4.5	18	7
Harris	43.5	11.3	25.2	10.5	9.5	0.9	9.8	5.9
Muscogee	33.8	20.4	26.8	7.1	11.9	0.3	9.2	6.8
Quitman	11.8	16.6	32.2	13.6	25.7	4.2	23.6	8.8
Stewart	21.1	23.9	18.6	12.3	24.1	7.9	19	12.7
Talbot	25.9	19.2	20.2	10.5	24.1	3.3	14.8	4.5

e. Flood Risk Management. Walter F. George Lake does not contain any flood risk management storage; however, water control guidelines are followed during high-flow periods that provide some flood risk management benefits for downstream areas. The floodplain of the Chattahoochee River downstream of Walter F. George Lake is largely undeveloped and consists primarily of forest and agricultural lands.

V - DATA COLLECTION AND COMMUNICATION NETWORKS

5-01. Hydrometeorological Stations

a. Facilities. Management of water resources requires continuous, real-time knowledge of hydrologic conditions. The Mobile District contracts out the majority of basin data collection and maintenance to the U.S. Geological Survey (USGS) and National Weather Service (NWS) through cooperative stream gaging and precipitation network programs. The USGS, in cooperation with other federal and state agencies, maintains a network of real-time gaging stations throughout the ACF Basin. The stations continuously collect various types of data including stage, flow, and precipitation. The data are stored at the gage location and are transmitted to orbiting satellites. Figure 5-1 shows a typical encoder with wheel tape housed in a stilling well used for measuring river stage or lake elevation. Figure 5-2 shows a typical precipitation station, with rain gage, solar panel, and Geostationary Operational Environmental Satellite (GOES) antenna for transmission of data. The gage locations are discussed in Chapter VI related to hydrologic forecasting.

Reservoir project data are obtained through each project's Supervisory Control and Data Acquisition (SCADA) system and provided to the Mobile District both daily and in real-time.

Figure 5-1. Encoder with Wheel Tape for Measuring the River Stage or Lake Elevation in the Stilling Well

Figure 5-2. Typical Field Installation of a Precipitation Gage

Through the Corps-USGS Cooperative stream gage program, the Mobile District and the USGS operate and maintain stream gages throughout the ACF Basin. The Mobile District also partners with the USGS and the NWS for the majority of basin data collection and gage maintenance.

Tables 5-1 and 5-2 list the stations along with pertinent information. Plate 5-1 displays the location of the gages.

Table 5-1. Rainfall Only Reporting Network, W.F. George

Station	Agency ID	Latitude	Longitude	Elevation (ft. NGVD29)
West Point Dam	WETG1	32° 55’	85° 11’	652
West Point, GA	99291	32° 52'	85° 11'	575
Hurtsboro, AL	14080	32° 15'	85° 24'	400
Columbus Metro AP, GA	92166	32° 30'	84° 56'	392
Opelika, AL	16129	32° 39'	85° 26'	640
W.F. George L&D	FOGGI	31°38'	85°05'	162
Clayton, AL	11725	31° 53'	85° 28'	500
Eufaula Wildlife Refuge, AL	12730	32° 00'	85° 05'	215
Cuthbert, GA	92450	31° 46'	84° 47'	461
Chipley, GA	2340324 (USGS)	32° 50'	84° 51'	780
Hamilton, GA	2341200 (USGS)	32° 41'	84° 34'	N/A
Lumpkin, GA	2343208 (USGS)	32° 3'	84° 47'	N/A
Bleeker, AL	323542085101101 (USGS)	32° 36'	85° 10'	N/A

Table 5-2. River-Stage and Rainfall Reporting Network, W.F. George

Stream	Station	Station number	River miles above mouth	Drainage area (sq. mi.)	Gage zero (ft. NGVD29)	Flood stage (ft.)	Operating agency	Rain Gage
Chattahoochee River	W. F. George tailwater	2343241	75.1	7,460	0	134	USGS	N
Chattahoochee River	Ft. Gaines	23432415	73.38	7,460	0		USGS	N
Chattahoochee River	Lake George Andrews and tailwater	2343801	46.53	8,210	0	113	USGS	Y
Chattahoochee River	Columbia	2343805	46.5	8,213	0		USGS	N
Sawhatchee Creek	Cedar Springs	2343940	35.27	64.2	109.9		USGS	Y
Chattahoochee River	Lake Seminole	2357500	107.58	17,164	0		USGS	Y

b. Reporting. The Mobile District operates and maintains a Water Control Data System (WCDS) that integrates large volumes of hydrometeorological and project data so the basin can be regulated to meet the operational objectives of the system. The WCDS, in combination with the new Corps Water Management System (CWMS), together automate and integrate data acquisition and retrieval to best meet all Corps water management activities. Much of the historic and current project hydrologic data are available to the public via the Mobile District website.

Data are collected at Corps sites and throughout the ACF Basin through a variety of sources and integrated into one verified and validated central database. The basis for automated data collection at a gage location is the data collection platform. The data collection platform is a computer microprocessor at the gage site. The data collection platform has the capability to interrogate sensors at regular intervals to obtain real-time information (e.g., river stage, reservoir elevation, water and air temperature, precipitation). The data collection platform then saves the information, performs simple analysis of it, and then transmits the information to a fixed geostationary satellite. Data collection platforms transmit real-time data at regular intervals to the Geostationary Operational Environmental Satellite (GOES) System operated by the National Oceanic and Atmospheric Administration (NOAA). The GOES Data Collection System (DCS) sends the data directly down to the NOAA Satellite and Information Service in Wallops Island, Virginia. The data are then rebroadcast over a domestic communications satellite (DOMSAT). The Mobile District operates and maintains a Local Readout Ground Station (LRGS), which collects the data collection platform-transmitted, real-time data from the DOMSAT. Figure 5-3 depicts a typical schematic of how the system operates.

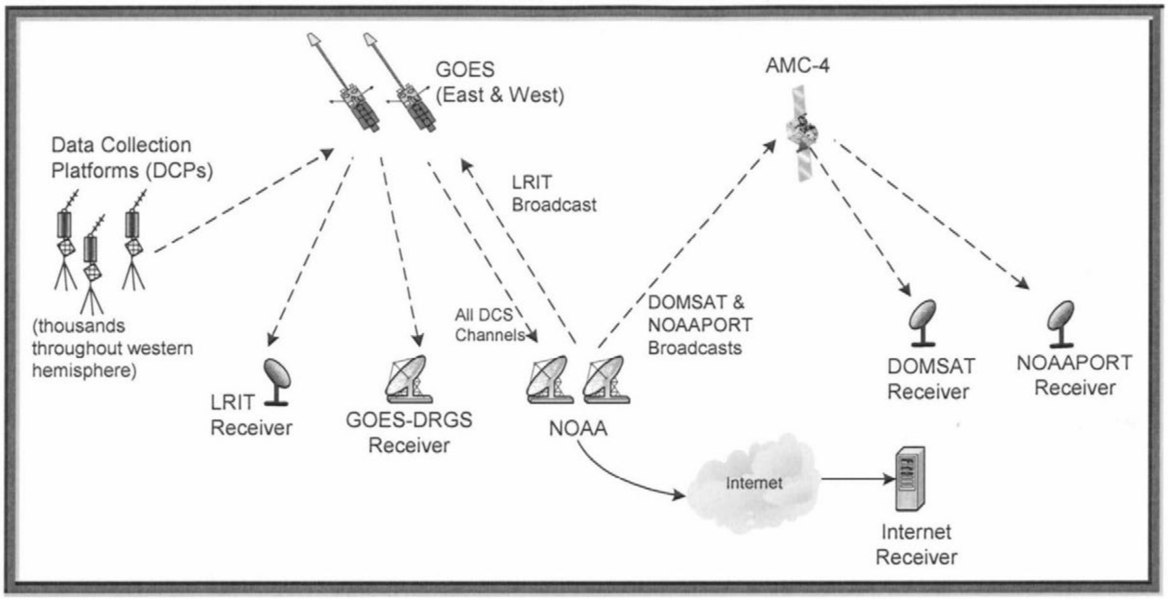


Figure 5-3. Typical Configuration of the GOES System

Typically, reporting stations log 15-minute data that are transmitted every hour. A few remaining gages report every four hours, but they are being transitioned to the hourly increment. All river stage and precipitation gages equipped with a data collection platform and GOES antenna are capable of being part of the reporting network.

Other reservoir project data are obtained directly at a project is collected through each project's SCADA system. The Mobile District downloads the data both daily and hourly through the Corps' server network.

c. Maintenance. Maintenance of data reporting equipment is a cooperative effort among the Corps, the USGS, and the NWS. The USGS, in cooperation with other federal and state agencies, maintains a network of real-time data collection platform stream gaging stations throughout the ACF Basin. The USGS is responsible for the supervision and maintenance of the real-time data collection platform gaging stations and the collection and distribution of streamflow data. In addition, the USGS maintains a systematic measurement program at the stations so the stage-discharge relationship for each station is current. Through cooperative arrangements with the USGS, discharge measurements at key ACF Basin locations are made to maintain the most current stage-discharge relationships at the stations. The NWS also maintains precipitation data for the flood control precipitation (FC-1) network.

If gages appear to be out of service, the following agencies can be contacted for repair:

U.S. Army Corps of Engineers, Mobile District, 109 Saint Joseph Street, Mobile, AL 36602-3630
Phone: (251) 690-2737 Web: http://water.sam.usace.army.mil

USGS South Atlantic Water Science Center - Georgia, 1770 Corporate Dr., Suite 500, Norcross, GA 30093; Phone: (678) 924-6700 Web: http://ga.water.usgs.gov

USGS Lower Mississippi-Gulf Water Science Center - Alabama, 75 TechnaCenter Drive, Montgomery, Alabama 36117 Phone: (334) 395-4120 Web: http://al.water.usgs.gov

USGS Florida Water Science Center, 4446 Pet Lane, Suite 108, Lutz, FL 33559, Phone: (813) 498-5000 Web: http://fl.water.usgs.gov

NWS Southern Region, 819 Taylor Street, Room 10E09, Fort Worth, TX 76102 Phone: (817) 978-1100 Web: http://www.srh.noaa.gov/

5-02. Water Quality Stations. Water quality monitoring by the Corps is limited in the ACF Basin. In most cases, other federal and state agencies maintain water quality stations for general water quality monitoring within the ACF Basin. In addition, real-time water quality parameters are collected at some stream gage locations maintained by the USGS.

The Corps operates a water quality monitoring station on the Chattahoochee River downstream from Walter F. George Lock and Dam. Dissolved oxygen levels immediately downstream from the Walter F. George Lock and Dam are routinely monitored and other water quality parameters, such as temperature, pH, and conductivity are monitored less frequently for project specific purposes. The water quality data are collected monthly by project personnel and submitted to the Mobile District, Planning Division, Inland Environment (PD-EI) team.

5-03. Sediment Stations. In order to provide an adequate surveillance of sedimentation, a network of sediment ranges were established for Walter F. George Lake in 1960 and 1962. Quantitative computations can be made from these ranges to determine the extent and degree of sedimentation and erosion. General conditions and changes have been measured and recorded using this network. The network of sediment stations is shown on Plate 4-1.

Sediment surveys were conducted in 1988, 1999, and 2009. Tetra Tech, Inc. was retained to conduct an analysis of the data and determine the extent and degree of sedimentation and erosion that has occurred in the lake and its tributaries over the years, and where appropriate, to speculate on the causes of those changes. This analysis and results are presented in a report entitled; "Sedimentation and Erosion Analysis for Walter F. George Lake".

Because sediment is delivered via the Chattahoochee River and other tributaries to Walter F. George Lake, the sedimentation and erosion impacts are dependent on the small tributaries scattered throughout the reservoir. Within the main pool of Walter F. George Lake, there has been very little deposition. Deposition has occurred within the tributaries when they enter the lake and at the head of the Walter F. George pool. At these locations, velocities slow, allowing sediment to be removed from suspension. The Chattahoochee River experienced sedimentation, likely from the high volume of sediment entering the river from urban and agricultural land uses within its contributing area. Erosion and deposition has occurred within the Walter F. George pool and along the shorelines of all the tributaries.

5-04. Recording Hydrologic Data. The WCDS/CWMS is an integrated system of computer hardware and software packages readily usable by water managers and operators as an aid for making and implementing decisions. An effective decision support system requires efficient data input, storage, retrieval, and capable information processing. Corps-wide standard software and database structure are used for real-time water control. Time series hydrometeorological data are stored and retrieved using the CWMS Oracle database. In the event this database is unavailable, data can alternately be stored in the Hydrologic Engineering Center Data Storage System (HEC-DSS).

To provide stream gage and precipitation data needed to support proper analysis, a DOMSAT Receive Station (DRS) is used to retrieve DCP data from gages throughout the ACF Basin. The DRS equipment and software then receives the DOMSAT data stream, decodes the DCPs of interest and reformats the data for direct ingest into a HEC-DSS database. Reservoir data is received through a link with the SCADA system which monitors and records reservoir conditions and operations in real time.

Most reservoir data are transmitted in hourly increments for inclusion in daily log sheets that are retained indefinitely. Gage data are transmitted in increments of 15 minutes, 1 hour, or other time intervals. Reservoir data are examined and recorded in water control models every morning (or other times when needed). The data are automatically transferred to forecast models.

Automated timed processes also provide provisional real-time data needed for supporting real-time operational decisions. Interagency data exchange has been implemented with the USGS and the SERFC. A direct link to SERFC is maintained to provide real-time products generated by NWS offices. Information includes weather and flood forecasts and warnings, tropical storm information, NEXRAD radar rainfall, graphical weather maps and more. Likewise, a direct link to USGS gages in the field allows for direct downloading of USGS data to Corps databases.

5-05. Communication Network. The global network of the Corps consists of Voice over IP (VoIP) connections between every division and district office worldwide. The VoIP allows all data and voice communications to transverse through the Corps' internet connection. The reliability of the Corps' network is considered a command priority and, as such, supports a dedicated 24-hours-per-day Network Operations Center. Additionally, the use of satellite data acquisition makes for a very reliable water control network infrastructure.

The Mobile District has a critical demand for emergency standby for operation of the ACF Basin and to ensure that data acquisition and storage remain functional. Water Management must be able to function in cases of flooding or other disasters, which typically are followed by the loss of commercial electricity. The WCDS/CWMS servers and LRGS each have individual uninterruptable power supply (UPS) and a large UPS unit specifically for the portion of MDO in which Water Management resides to maintain power for operational needs.

In the event of a catastrophic incident that causes loss of communication or complete loss of access to the MDO and the WCDS and CWMS servers located on site, a Continuity of Operations Program (COOP) site is being set up as a backup to these systems. This site will have servers that mirror the WCDS and CWMS servers located at the MDO allowing Water Managers to continue operating with no interruption or loss of data. It is currently planned that the COOP site will be located at the South Atlantic Division office in Atlanta, Georgia.

The primary communication network of the Walter F. George Project is a SCADA system network. The SCADA network includes a microwave link between Walter F. George, George W. Andrews, and West Point Dam. The SCADA network also monitors powerhouse conditions and digitally records real-time project data hourly. Computer servers at Walter F. George are connected to the Mobile District through the Corps Network, permitting data transfer at any time. The data include physical conditions at each of the reservoirs such as pool elevations, outflow, river stages, generation, and rainfall. Special instructions or deviations are usually transmitted by e-mail, telephone, or fax.

Emergency communication is available at the following numbers:

Water Management Section	251-690-2737
Chief of Water Management	251-690-2730 or 251-509-5368
Walter F. George Powerhouse	229-768-2635
Walter F. George Site Manager Office	229-768-2516

5-06. Communication with Project

a. Regulating Office with Project Office. The Water Management Section is the regulating office for the Corps' projects in the ACF Basin. Communication between the Water Management Section and project offices is normally through daily hydropower generation schedules issued by Southeastern Power Administration (SEPA). In addition, electronic mail, telephone, and facsimile are used daily for routine communication with the projects. During normal conditions on weekends, hydropower generation schedules can be sent out on Friday to cover the weekend period of project regulation, but they can change if deemed appropriate. If loss of network communication occurs, orders can be given via telephone.

During critical reservoir regulation periods and to ensure timely response, significant coordination is often conducted by telephone between the project office and the Water Management Section. That direct contact ensures that issues are completely coordinated, and concerns by both offices are presented and considered before final release decisions are made. The Chief of the Water Management Section is available by cell phone during critical reservoir operation periods.

b. Between Project Office and Others. Each reservoir project office is generally responsible for local notification and for maintaining lists of those individuals who require notification under various project regulation changes. In addition, the project office is responsible for notifying the public using project recreation areas, campsites, and other facilities that could be affected by various project conditions.

5-07. Project Reporting Instructions. In addition to automated data, project operators maintain record logs of gate position, water elevation, and other relevant hydrological information including inflow and discharge. That information is stored and available to the Mobile District through the Corps' network. Operators have access to Mobile District Water Managers via email, land line and cell phone and notify the Water Management Section if changes in conditions occur. Unforeseen or emergency conditions at the project that require unscheduled manipulations of the reservoir should be reported to the Mobile District as soon as possible.

If the automatic data collection and transfer are not working, projects are required to fax or email daily or hourly project data to the Mobile District. Water Management staff will manually input the information into the database. In addition, Mobile District Power Projects must verify pool level gage readings each week, in accordance with *Standard Operating Procedure, Weekly Verification of Gauge Readings, Mobile District Power Projects* dated 19 February 2008, and CESAD SOP 1130-2-6 dated 21 July 2006. Those procedures require that powerhouse operators check the accuracy of pool monitoring equipment by verifying readings of the equipment against gage readings at each plant. That information is logged into the Official Log when completed and furnished to the master plant. A Trouble Report to management communicates any discrepancies with the readings. Operations Division, Hydropower Section will be notified by e-mail when verification is complete. The e-mail notification will include findings of the verification.

Project personnel or the Hydropower Section with Operations Division, or both, are responsible for requesting any scheduled system hydropower unit outages in excess of two hours. The out-of-service times for the hydropower units are reported back to Water Management upon completion of outages. Forced outages are also reported with an estimated return time, if possible. Any forced or scheduled outages causing the project to miss scheduled water release targets must be immediately reported to the Mobile District and to SEPA. In such cases, minimum flow requirements can be met through spilling.

5-08. Warnings. During floods, dangerous flow conditions or other emergencies, the proper authorities and the public must be informed. In general flood warnings are coupled with river forecasting. The NWS has the legal responsibility for issuing flood forecast to the public and that agency will have the lead role for disseminating the information. For emergencies involving the Walter F. George Project the operator on duty should notify the Water Management Section, Operations Division, and the Operations Project Manager at the project. A coordinated effort among those offices and the District's Emergency Management Office will develop notifications for local law enforcement, government officials, and emergency management agencies. The Water Management Section should then notify the Mobile District Chief of Engineering and the Hydraulics and Hydrology Branch Chief. The District Water Management staff should also notify the SAD Water Management staff as soon as possible.

The Emergency Action Plan (EAP) for Walter F. George Dam identifies the notification for rapid dissemination of emergency actions to take place prior to and/or following the failure of the Walter F. George Project. Refer to the EAP for the details.

5-09. Role of Regulating Office. The Water Management Section of the MDO is responsible for developing operating procedures for both flood and non-flood conditions. Plans are developed to most fully use the water resources potential of each project to meet the authorized purposes. Those plans are presented in water control manuals such as this one. Water control manual preparation and updating is a routine operation of the Water Management Section. In addition, the Water Management Section maintains information on current and anticipated conditions, precipitation, and river-stage data to provide the background necessary for best overall operation. The Water Management Section arranges communication channels to the Power Project Manager and other necessary personnel. Instructions pertaining to reservoir regulation are issued to the Power Project Manager; however, routine instructions are normally issued directly to the powerhouse operator on duty.

5-10. Role of Power Project Manager. The Power Project Manager should be completely familiar with the approved operating plans for the Walter F. George and George W. Andrews Projects. The Power Project Manager is responsible for implementing actions under the approved water control plans and carrying out special instructions from the Mobile District. The Power Project Manager is expected to maintain and furnish records requested from him by the Mobile District. Training sessions should be held as needed to ensure that an adequate number of personnel are informed of proper operating procedures for reservoir regulation. Unforeseen or emergency conditions at the project that require unscheduled manipulation of the reservoir should be reported to the Mobile District as soon as practicable.

VI - HYDROLOGIC FORECASTS

6-01. General. Reservoir operations are scheduled by the Mobile District in accordance with forecasts of reservoir inflow and pool stages. The NWS's River Forecast Center prepares river forecasts for the general public and for use by the Corps. In addition, the Mobile District maintains the capability to prepare forecasts for internal use only. Because the five federally owned reservoirs in the ACF Basin are operated as a system for conservation purposes, knowledge of total basin inflow is required.

ACF Basin inflow is computed by summing the daily local flow into the four federal reservoirs: Lake Sidney Lanier, West Point Lake, Walter F. George Lake, and Lake Seminole. Basin inflow is not the natural flow into the ACF Basin because basin inflow incorporates influences of reservoir evaporative losses, inter-basin water transfers, and consumptive water uses, such as municipal water supply and agricultural irrigation.

Expressed as a mathematical formula, the ACF Basin Inflow = Buford Local Flow + West Point Local Flow + Walter F. George Local Flow + Jim Woodruff Local Flow

"Local Flow" = Computed Inflow – Upstream Dam Discharge (with appropriate time lag)
"Computed Inflow" = Dam Discharge + Change in Reservoir Storage

Buford Local Flow $_{i}$ = Buford Computed Inflow $_{i}$
West Point Local Flow $_{i}$ = West Point Computed Inflow $_{i}$ – Buford Discharge $_{i-3}$
Walter F. George Local Flow $_{i}$ = Walter F. George Computed Inflow $_{i}$ – West Point Discharge $_{i-2}$
Jim Woodruff Local Flow $_{i}$ = Jim Woodruff Computed Inflow $_{i}$ – Walter F. George Discharge $_{i-1}$

where *i* is the current daily time step.

Flow requirements at the lower end of the basin, below Jim Woodruff Lock and Dam, are determined by conditions in the basin. On the Chattahoochee River, the observed inflows and outflows of upstream projects provide an estimate of future flows and requirements in the Apalachicola River. The Flint River is less developed, and a continuous monitoring of river gages and rainfall is necessary to predict total flow for that river. Authorized navigation functions require knowledge of river depths (or stages) at Blountstown, Florida. During stable flow conditions, accurate forecasts permit relatively uniform releases into the Apalachicola River. In addition, rapid decreases in river stages are to be avoided to prevent stranding endangered species. That requires forecasting the recession of high-flow events.

The Corps has developed techniques to conduct forecasting in support of the regulation of the ACF Basin. In addition, the Corps has a strong reliance on other federal agencies such as the NWS and the USGS to help maintain accurate data and forecast products to aid in making the most prudent water management decisions. The regulation of multipurpose projects requires scheduling releases and storage on the basis of both observed and forecasted hydrologic events throughout the basin. The existing conditions include current inflows to the project, current lake elevation and current releases. The forecasted future conditions include future inflows from water which is already on the ground, future operations of upstream projects, and future expected releases all of which contribute to the future expected lake elevation. Meteorological and hydrologic forecasts can influence the projected release forecasts that are adjusted based on actual observed conditions.

During both normal and below-normal runoff conditions, releases through the power plants are scheduled on the basis of water availability, to the extent reasonably possible, during peak periods to generate electricity during periods of greatest demand. The release level and schedules are dependent on current and anticipated hydrologic events. The most efficient use of water is always a goal, especially during the course of a hydrologic cycle when below-normal streamflow is occurring. Reliable forecasts of reservoir inflow and other hydrologic events that influence streamflow are critical to efficiently regulate the ACF Basin.

a. Role of the Corps. The Water Management Section maintains real-time observation of river and weather conditions data in the Mobile District. The Mobile District has capabilities to make forecasts for several areas in the ACF Basin. Observation of real-time stream conditions guides the accuracy of the forecasts. The Corps maintains contact with the River Forecast Center to receive forecast and other data as needed. Daily operation of the ACF River Basin during normal, flood risk management, and drought conservation regulation requires accurate, continual short-range and long-range elevation, streamflow, and river-stage forecasting. These short-range inflow forecasts are used as input in computer model simulations so that project release determinations can be optimized to achieve the regulation objectives stated in this manual. The Mobile District continuously monitors the weather conditions occurring throughout the basin and the weather and hydrologic forecasts issued by the NWS. The Mobile District then develops forecasts to meet the regulation objectives of the ACF projects. The Mobile District prepares 5-week inflow and lake elevation forecasts weekly based on estimates of rainfall and historical observed data in the basin. These projections assist in maintaining system balance and providing project staff and the public lake level trends based on the current hydrology and operational goals of the period. In addition, the Mobile District provides weekly hydropower generation forecasts based on current power plant capacity, latest hydrological conditions, and system water availability.

b. Role of Other Agencies. The NWS is responsible for the preparation and public dissemination of forecasts relating to precipitation, temperatures, and other meteorological elements in the ACF Basin. The Mobile District use the NWS weather forecasts as a key source of information considered critical to its water resources management mission. The 24- and 48-hour Quantitative Precipitation Forecasts (QPFs) are invaluable in providing guidance for basin release determinations. The use of precipitation forecasts and subsequent runoff directly relates to project release decisions.

The SERFC is responsible for the supervision and coordination of streamflow and river-stage forecasting services provided by the NWS Weather Service Forecast Office in Peachtree City, Georgia, and Tallahassee, Florida. The SERFC routinely prepares and distributes 5-day streamflow and river-stage forecasts at key gaging stations along the Chattahoochee, Flint, and Apalachicola Rivers. Streamflow forecasts are available at additional forecast points during periods above normal rainfall. In addition, the SERFC provides a revised regional QPF on the basis of local expertise beyond the NWS Hydrologic Prediction Center QPF. The SERFC also provides the Mobile District with flow forecasts for selected locations on request. The SERFC prepares 7-day and longer forecasts for Bainbridge, Georgia, on the Flint River and for George Andrews on the Chattahoochee River and Blountstown, Florida, on the Apalachicola River. These forecasts can be compared to those prepared by the Mobile District.

The Corps and SERFC have a cyclical procedure for providing forecast data between federal agencies. As soon as reservoir release decisions have been planned and scheduled for the proceeding days, the release decision data are sent to the SERFC. Taking release decision data coupled with local inflow forecasts at forecast points along the ACF Basin, the SERFC can provide inflow forecasts into Corps projects. Having revised inflow forecasts from the SERFC, the Corps has up-to-date forecast data to make the following day's release decisions. The Mobile District monitors observed conditions and routinely adjust release decisions based on observed data.

The USGS is responsible for maintaining and operating the network of river based gages that measure stage, flow, rainfall and often other parameters essential for the operation and monitoring of the ACF River Basin. This includes the critical gages at all flood risk management locations as well as all gages located at the federal projects on the ACF. The gage data is provided by the USGS through their website which updates each gage hourly. The Corps also retrieves USGS gage data directly from the gage DCP through the GOES system discussed in Chapter V of this manual. The Corps uses this near real-time data to make decisions on operations ranging from flood releases to daily hydropower releases during normal conditions. This data is also used by the Corps and SERFC in model calibration for forecasting flood releases and river stages.

USGS offices in Norcross, Georgia, and Montgomery, Alabama, are responsible for the maintenance of the gages located in the Walter F. George Project area. In the event that a gage becomes inoperable, the Corps will inform the USGS office of responsibility by phone or email. The USGS will then deploy a team to perform maintenance on the gage, if they have not already done so. When any gage associated with flood risk management operations or a critical gage at a federal storage project malfunctions, the USGS will usually send a team to perform maintenance immediately upon becoming aware of the malfunction.

6-02. Flood Condition Forecasts. During flood conditions, forecasts are made for two conditions: rainfall that has already fallen, and for potential rainfall (or expected rainfall). Decisions can be made on the basis of known events and *what if* scenarios. The Mobile District prepares forecasts and receives the official forecasts from SERFC.

a. Requirements. Accurate flood forecasting requires a knowledge of antecedent conditions, rainfall and runoff that has occurred, and tables or unit hydrographs to apply the runoff to existing flow conditions. Predictive QPF data are needed for what if scenarios.

b. Methods. In determining the expected inflow into the Walter F. George Lake, it is necessary to forecast the flows of the Chattahoochee River below West Point Dam and combine the flows with the expected outflow from West Point Dam. Runoff or rainfall excess for the area between West Point and Walter F. George is estimated using the seasonal correlation values shown in Table 6-1. The rainfall excess is distributed over the area by using the unit hydrograph shown in Table 6-2. The expected West Point Dam release is lagged approximately one day and combined with the discharge hydrograph for the area to obtain the inflow into Walter F. George Lake. Actual flows at gaging stations can be determined by using rating curves and tables. Rating curves for West Point, Columbus, and Fort Gaines gages are shown on Plates 4-15, 4-16, and 4-18 respectively. The tailwater rating curve for Walter F. George is shown in Plate 4-17.

For short-range flood forecasting the Water Management Section has begun utilizing the Corps Water Management System (CWMS) models developed to perform short term forecasts for the ACF basin. The CWMS model suite includes hydrologic modeling system (HEC-HMS) and reservoir simulation (HEC-ResSim) models to determine the anticipated reservoir operations based on the QPF provided by the SERFC. It also includes the capability to estimate inundation at downstream flood damage reduction locations using HEC-RAS (River Analysis System) and the ability to estimate damages at those locations using HEC-FIA (Flood Impact Analysis).

The Corps provides a link to the NWS website so that the Mobile District, the affected county emergency management officials, and the public can obtain this vital information in a timely fashion. When hydrologic conditions exist so that all or portions of the ACF Basin are considered to be flooding, existing Corps streamflow and short and long-range forecasting runoff models are run on a more frequent, as-needed basis. Experience demonstrates that the sooner a significant flood event can be recognized and the appropriate release of flows scheduled, an improvement in overall flood risk management can be achieved. Stored storm water that has accumulated from significant rainfall events must be evacuated following the event and as downstream conditions permit to provide effective flood risk management. Flood risk management carries the highest priority during significant runoff events that pose a threat to human health and safety. The accumulation and evacuation of storage for the authorized purpose of flood risk management is accomplished in a manner that will prevent, insofar as possible, flows exceeding those which will cause flood damage downstream. During periods of significant basin flooding, the frequency of contacts between the Mobile District and SERFC staff are increased to allow a complete interchange of available data upon which the most reliable forecasts and subsequent project regulation can be based.

In determining the expected inflow into Walter F. George Lake, current conditions must be examined. The runoff from rainfall varies significantly depending on antecedent conditions. For very dry conditions, initial runoff can be near zero and then increase as rainfall continues. During wet conditions, most of the rainfall appears as runoff into the lake. During the next several hours and days, the observed inflow is compared to the forecasts and adjustments are applied. Additional rainfall/runoff is accumulated with the continuing forecasts. Table 6-1 is used as a guide to estimate runoff as follows. Select a runoff value from Table 6-1 based on antecedent conditions. This runoff value is applied to the unit hydrograph in Table 6-2 and added to the observed inflow ((Table 6-1 Runoff Value * Table 6-2 hydrograph value) + observed inflow). During the next several hours and days, the observed inflow is compared to the forecasts and adjustments are applied. Additional rainfall/runoff is accumulated with the continuing forecasts.

Table 6-1. Rainfall Runoff in Inches

Antecedent conditions	Average basin rainfall, storm total (inches)	Average runoff (inches)									
		0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Wet											
	0	0.00	0.02	0.04	0.05	0.07	0.09	0.11	0.13	0.16	0.18
	1	0.20	0.23	0.25	0.28	0.31	0.35	0.38	0.43	0.47	0.52
	2	0.56	0.61	0.67	0.72	0.78	0.84	0.89	0.95	1.00	1.06
	3	1.12	1.17	1.24	1.29	1.35	1.40	1.47	1.53	1.59	1.65
	4	1.71	1.77	1.83	1.90	1.96	2.02	2.08	2.14	2.21	2.27
	5	2.34	2.40	2.47	2.54	2.60	2.67	2.74	2.80	2.87	2.94
	6	3.00									
Normal											
	0	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.09	0.10
	1	0.11	0.12	0.14	0.15	0.16	0.18	0.19	0.20	0.22	0.23
	2	0.25	0.26	0.27	0.29	0.30	0.32	0.33	0.35	0.36	0.38
	3	0.39	0.41	0.42	0.44	0.46	0.47	0.49	0.50	0.52	0.54
	4	0.55	0.57	0.59	0.60	0.62	0.64	0.65	0.67	0.69	0.70
	5	0.72	0.74	0.75	0.77	0.79	0.80	0.82	0.84	0.86	0.87
	6	0.89									
Dry											
	0	0.00	0.00	0.01	0.02	0.02	0.03	0.04	0.04	0.05	0.06
	1	0.06	0.07	0.08	0.09	0.09	0.10	0.11	0.12	0.13	0.14
	2	0.15	0.16	0.17	0.18	0.18	0.19	0.20	0.21	0.22	0.24
	3	0.25	0.26	0.28	0.29	0.30	0.32	0.34	0.35	0.37	0.38
	4	0.40	0.42	0.43	0.45	0.47	0.48	0.50	0.52	0.54	0.56
	5	0.58	0.60	0.62	0.64	0.66	0.68	0.70	0.72	0.74	0.77
	6	0.79									

Table 6-2. 24-Hour Unit Hydrograph

Time (days)	24-hour unit hydrograph (cfs)	
	Reservoir area	Local area Walter F. George to West Point Dam
0	0	0
1	1,900	42,000
2	0	28,300
3		5,100
4		2,000
5		0

6-03. Conservation Purpose Forecasts. Forecasts for conservation operations are accomplished similarly to flood condition forecasts. Releases from West Point Dam are applied with a 1-day lag and combined with runoff and other local inflows. This inflow forecast is then used to create a 7-day forecast of releases from Walter F. George Dam.

a. Requirements. The ACF projects are typically regulated for normal or below normal runoff conditions. Therefore, the majority of the forecasting and runoff modeling simulation is for conservation regulation decisions. Whenever possible, the NWS weather and hydrologic forecasts are used.

b. Methods. The Mobile District prepares 5-week inflow and lake elevation forecasts weekly based on estimates of rainfall and historical observed data in the basin. These projections assist in maintaining system balance and providing project staff and the public lake level trends based on the current hydrology and operational goals of the period. In addition, the Mobile District provides weekly hydropower generation forecasts based on current power plant capacity, latest hydrological conditions, and system water availability. The Mobile District has also begun testing CWMS for short term forecasts in normal conditions. These forecasts are typically no longer than five days, provide forecasting reservoir inflow, outflow and pool elevation, and assist in the planning of reservoir releases for the coming week. These forecasts incorporate the current observed conditions and a 48-hour QPF provided by SERFC.

6-04. Long-Range Forecasts

a. Requirements. The Corps utilizes available information from the NWS to develop long-range forecasts to aid in the operation of the system and for planning purposes. These projections can vary from a 5-week forecast to a 6-month forecast.

b. Methods. During normal conditions, the current long-range outlook produced by the Corps is a 5-week forecast. For normal operating conditions, a forecast longer than this incorporates a greater level of uncertainty and reliability. In extreme conditions, 3-month and 6-month forecasts can be produced based on observed hydrology and comparative percentage hydrology inflows into the ACF Basin. One-month and three-month outlooks for temperature and precipitation produced by the NWS Climate Prediction Center are used in long-range planning for prudent water management of the ACF reservoir projects.

6-05. Drought Forecast

a. Requirements. ER1110-2-1941, *Drought Contingency Plans*, dated 15 September 1981, called for developing drought contingency plans for Corps' reservoirs. Drought recognition and drought forecast information can be used in conjunction with the drought contingency plan, which is further discussed in Chapter VII.

b. Methods. Various products are used to detect the extent and severity of basin drought conditions. One key indicator is the U.S. Drought Monitor. The Palmer Drought Severity Index is also used as a regional drought indicator. The index is a soil moisture algorithm calibrated for relatively homogeneous regions and may lag emerging droughts by several months. The Alabama Office of State Climatologist also produces a Lawn and Garden Index which gives a basin-wide ability to determine the extent and severity of drought. The runoff forecasts developed for both short and long-range time periods reflect drought conditions when appropriate. There is also a heavy reliance on latest ENSO (El Niño/La Niña-Southern Oscillation) forecast modeling to represent the potential impacts of La Nina on drought conditions and spring inflows. Long-range models are used with greater frequency during drought conditions to forecast potential impacts to reservoir elevations, ability to meet minimum flows, and water supply availability. A long-term, numerical model, Extended Streamflow Prediction developed by the NWS, provides probabilistic forecasts of streamflow on the basis of climatic conditions, streamflow, and soil moisture. Extended Streamflow Prediction results are used in projecting possible future drought conditions. Other parameters and models can indicate a lack of rainfall and runoff and the degree of severity and continuance of a drought.

Models using data of previous droughts or a percent of current to mean monthly flows with several operational schemes have proven helpful in planning. Other parameters are the ability of Walter F. George Lake to meet the demands placed on its storage, the probability that Walter F. George Lake pool elevation will return to normal seasonal levels, the conditions at other basin impoundments, basin streamflows, basin groundwater table levels, and the total available storage to meet hydropower marketing system demands.

c. Drought Analysis. The top of conservation pool within Walter F. George Reservoir varies seasonally from elevation 188 to 190 feet NGVD29. The bottom of conservation pool remains at elevation 184 feet NGVD29 for the entire year. Reservoir storage between elevations 190 and 184 feet NGVD29 is 244,400 acre-feet. Between 188 and 184 feet NGVD29, the storage is 157,100 acre-feet. In a normal non-drought period, that storage is intended to supplement needs during the low-flow months. During prolonged low-flow or drought periods, this storage may be completely depleted meeting basin-wide water needs. As this lake is much smaller than Lanier, with a much larger drainage basin, the critical period for Walter F. George Reservoir is less than one year. Figure 6-1 presents a graph of annual rainfall above Walter F. George Lock and Dam since 1939. The actual rainfall, average, and 10-year running average years are shown. A cyclical pattern of higher rainfall periods and droughts, both long-term and short-term, have occurred in the period. Figure 6-2 also shows the basin rainfall in the basin above Walter F. George Lock and Dam, along with the annual flow at the dam for the same period. The average flow is also presented to demonstrate the drought periods. Figure 6-3 presents the Walter F. George Lock and Dam flow along with the percent of rainfall appearing as runoff. Considering the limited storage and the long durations of some droughts, a drought plan is needed to best manage the water resources.

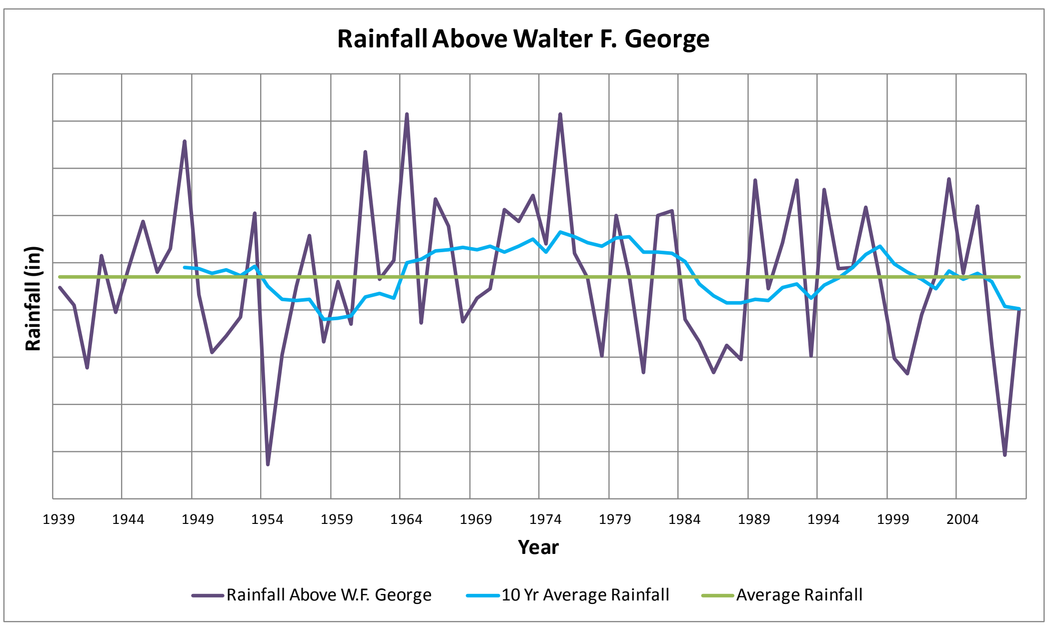
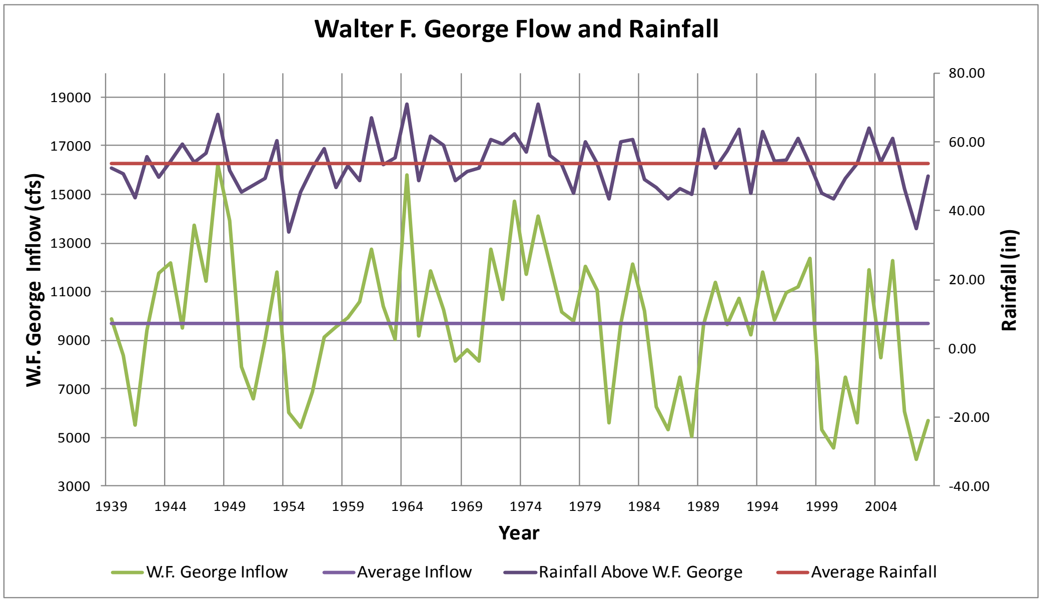


Figure 6-1. Rainfall Averaged Over Years



Note: The unimpaired inflow at Walter F. George was used for Walter F. George Inflow. Annual rainfall averaged from various gages in the headwaters of Walter F. George.

Figure 6-2. Walter F. George Dam Flow and Rainfall

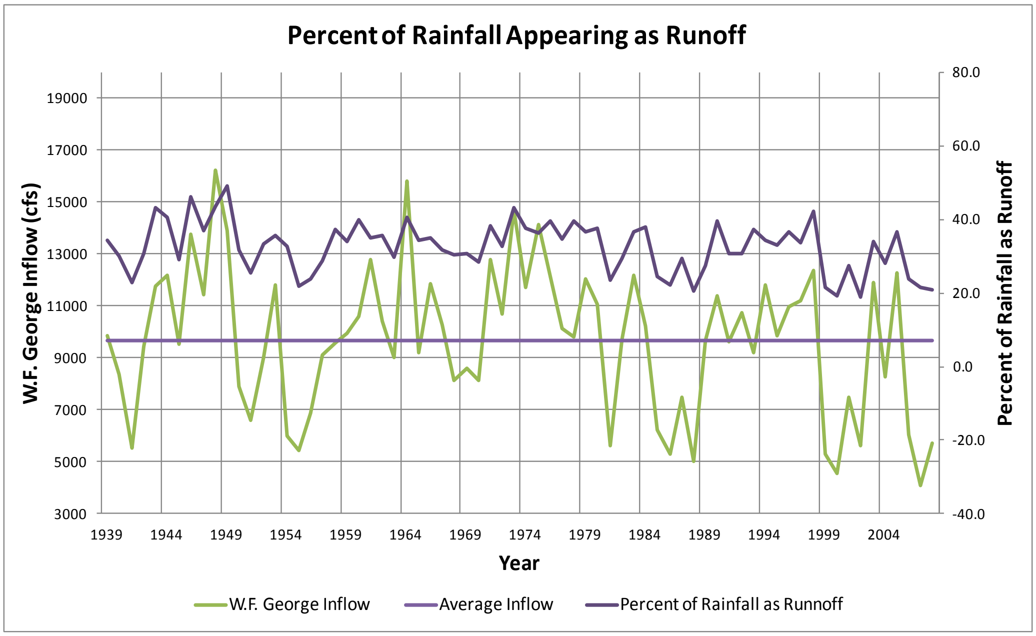


Figure 6-3. Percent of Rainfall Appearing as Runoff

d. Reference Documents. The drought contingency plan for the Walter F. George Project is summarized in Section 7-12 below. The complete ACF Drought Contingency Plan is provided in Exhibit D.

VII - WATER CONTROL PLAN

7-01. General Objectives. The authorized purposes for the Walter F. George Lock and Dam and Lake as specified in the authorizing documents are hydroelectric power and navigation. Several other project purposes have been authorized at Walter F. George through nationwide authorizing legislation. Those purposes are water quality, recreation, conservation of threatened and endangered species, fish and wildlife conservation, and water supply. Flood risk management is not an authorized function; however, peak flows downstream are reduced by normal reservoir regulation operations providing flood-reduction benefits. The regulation plan seeks to balance the needs of all project purposes at the Walter F. George Project.

7-02. Constraints. The tailwater at Walter F. George Dam must not, at any time, be more than 88 feet below the headwater, so as not to exceed the project design-head limitation. In particular, the Walter F. George tailwater must not be allowed to fall, below elevation 102 feet NGVD29, when the headwater is at summer operating pool, elevation 190 feet NGVD29. Tailwater elevation 102 feet NGVD29 is also required to provide a controlling navigation depth of nine feet (with normal maintenance dredging) in the upper reaches of Lake George W. Andrews. It is important that operators coordinate any drawdown at George W. Andrews Project pool with releases through the powerhouse to prevent excessive lowering of the tailwater. It is important to note that during summer and fall conditions, a constant tailwater of 102 feet NGVD29 might not be possible, thereby limiting the ability to reach full summer pool of 190 feet NGVD29 under certain situations. If the tailwater elevation falls below 102 feet NGVD29 and the pool elevation is at or slightly above 190 feet NGVD29, operating one hydropower unit will return the tailwater elevation to above 102 feet NGVD29 and maintain a net head of less than 88 feet.

7-03. Overall Plan for Water Control

a. General Regulation. The water control operations of the Walter F. George Project are in accordance with the regulation schedule as outlined in the following paragraphs. The Corps operates the Walter F. George Project to provide for the authorized project purposes of the project. All authorized project purposes are considered when making water control regulation decisions, and those decisions affect how water is stored and released from the project. Deviations from the prescribed instructions, which can occur due to planned or unplanned events as described in Section 7-15, will be at the direction of the Mobile District. Additionally, if communication between the district office and the dam is interrupted, the operator will follow the emergency operation schedule found at Exhibit C, Instructions to the Damtenders for Water Control.

b. Conservation Pool. The Walter F. George pool is regulated between a minimum elevation of 184 and a top-of-conservation elevation of 188 to 190 feet NGVD29. The top-of-conservation pool guide curve and minimum conservation pool are shown in Figure 7-1 along with other operating zones.

c. Guide Curves and Action Zones. The Corps operates the ACF system of reservoirs to provide for all the authorized project purposes. Each of the authorized project purposes is considered when making operational decisions, and those decisions affect how water is stored and released from the projects. The multiple water demands in the basin require that the Corps operate the system in a balanced manner in an attempt to meet all authorized purposes, while continuously monitoring the total system water availability to ensure that project purposes can at least be minimally satisfied during critical drought periods. The balanced water management strategy for the Corps reservoirs in the ACF Basin does not prioritize any project function but seeks to balance all project authorized purposes. Flow support might be required from Walter F. George Dam to support downstream requirements.

The *ACF Master Water Control Manual* and project appendices (to include this manual) prescribe guide curves to facilitate the water control regulation of the three major storage projects in the ACF Basin, Buford Dam/Lake Sidney Lanier, West Point, and Walter F. George. Figure 7-1 and Plate 7-1 depicts the guide curve and action zones for Walter F. George Lake in graphical form. The reservoir storage zones' elevation and volume associated with each guide curve are shown on Plates 7-2 and 7-3 respectively. Table 7-1 depicts the action zones in tabular form. The guide curve defines the top of conservation storage water surface elevation associated with the storage limits, which guide the regulation for authorized purposes. The water control plan also establishes action zones within the conservation storage for each project. The zones are used to manage the lakes at the highest level possible while balancing the needs of all the authorized purposes. Zone 1, the highest zone, defines a reservoir condition where all authorized project purposes should be met. As lake levels decline, Zones 2 through 4 define increasingly critical system status where purposes can no longer be fully met. The action zones also provide guidance on meeting minimum hydroelectric power needs at each project. Table 7-2 below shows the typical hydropower at full plant generation by action zone that can be expected at Walter F. George.

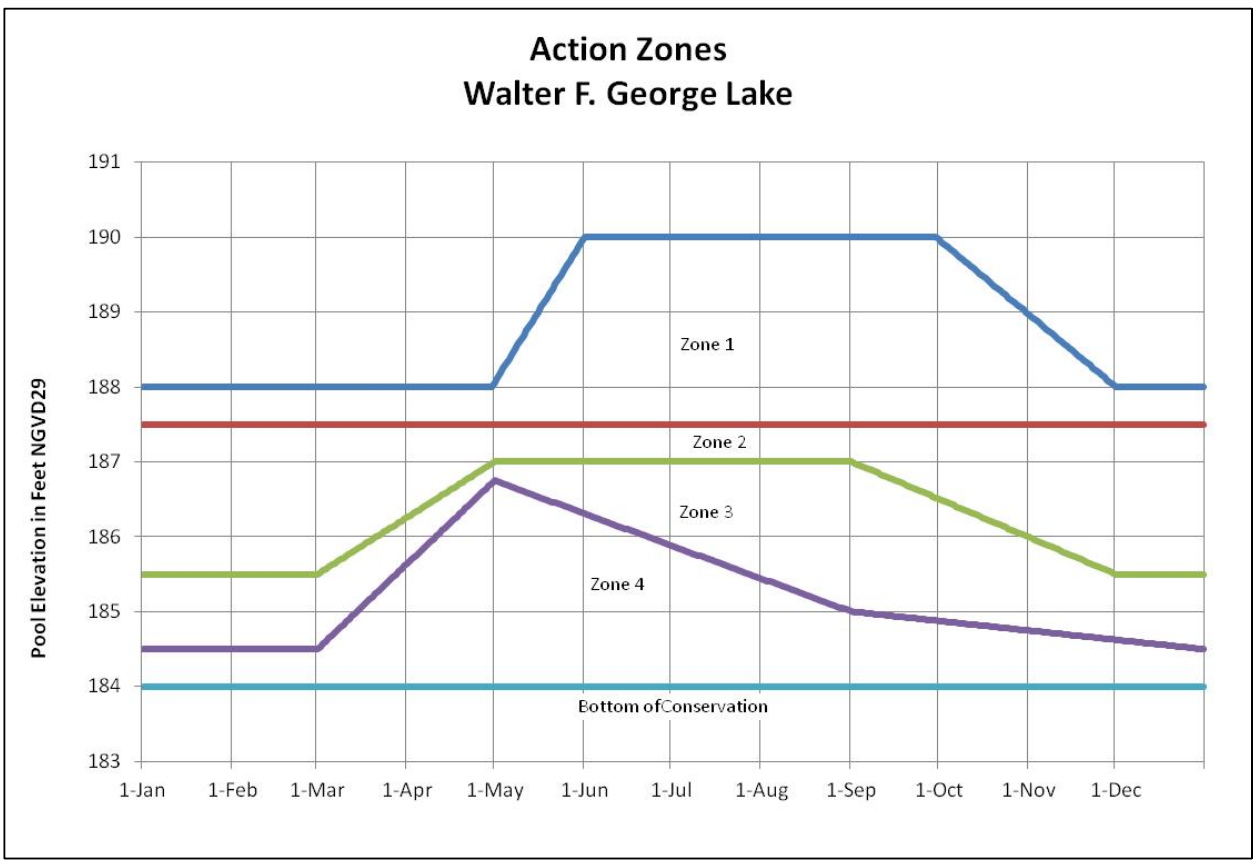


Figure 7-1. Action Zones for Walter F. George Lake

Table 7-1. Top of Conservation and Action Zone Elevations, Walter F. George Lake

Date	Elevation (feet NGVD29)			
	Top of Zone 1	Top of Zone 2	Top of Zone 3	Top of Zone 4
1 Jan	188.00	187.50	185.50	184.50
1 Mar	188.00	187.50	185.50	184.50
1 May	188.00	187.50	187.00	186.75
1 Jun	190.00	187.50	187.00	186.31
1 Sep	190.00	187.50	187.00	185.00
1 Oct	190.00	187.50	186.51	184.88
1 Dec	188.00	187.50	185.50	184.62
31 Dec	188.00	187.50	185.50	184.50

Table 7-2. Typical Hours of Peaking Hydropower Generation at Walter F. George

Action zone	Walter F. George (hours of operation)
Zone 1	Up to 4
Zone 2	Up to 2
Zone 3	Up to 2
Zone 4	0

While hydropower would still be generated in Zone 4, it could not be generated on a regular peaking schedule under severe drought conditions.

The zones were derived on the ability of the reservoirs to refill (considering hydrology, watershed size, and physical constraints of each reservoir), recreation effects and hazard levels, and the proportionality of zone drawdown between projects. Other factors or activities might cause the lakes to operate differently than the action zones described. Examples of the factors or activities include exceptional flood risk management measures, fish spawn operations, maintenance and repair of turbines, emergency situations such as a drowning and chemical spills, draw-downs because of shoreline maintenance, releases made to free grounded barges, and other circumstances.

The storage projects are operated to maintain their lake level in the same zones concurrently. However, because of the hydrologic and physical characteristics of the river system and other factors that can influence lake levels, there might be periods when one lake is in a higher or lower zone than another. When that occurs, the Corps makes an effort to bring the lakes back into balance with each other as soon as conditions allow. By doing so, effects on the river basin are shared equitably among the projects.

The action zones are integral to the system-wide regulation of the ACF Basin through the concept of composite conservation storage. Composite conservation storage is calculated by combining the conservation storage of Lake Sidney Lanier, West Point Lake, and Walter F. George Lake. Composite conservation storage is shown in Figure 7-2. Each of the individual storage reservoirs consists of four action zones. The composite conservation storage uses the four zone concepts as well; i.e., Zone 1 of the composite conservation storage represents the combined storage available in Zone 1 for each of the three storage reservoirs. When composite conservation storage is in Zones 1 and 2, a less conservative operation is in place. When composite conservation storage is in Zone 3, hydropower is supported at a reduced level, water supply and water quality releases are met, and drought contingency operations are triggered. When composite conservation storage is in Zone 4, severe drought conditions exist and hydropower is likely generated only during concurrent uses. Navigation is not supported.

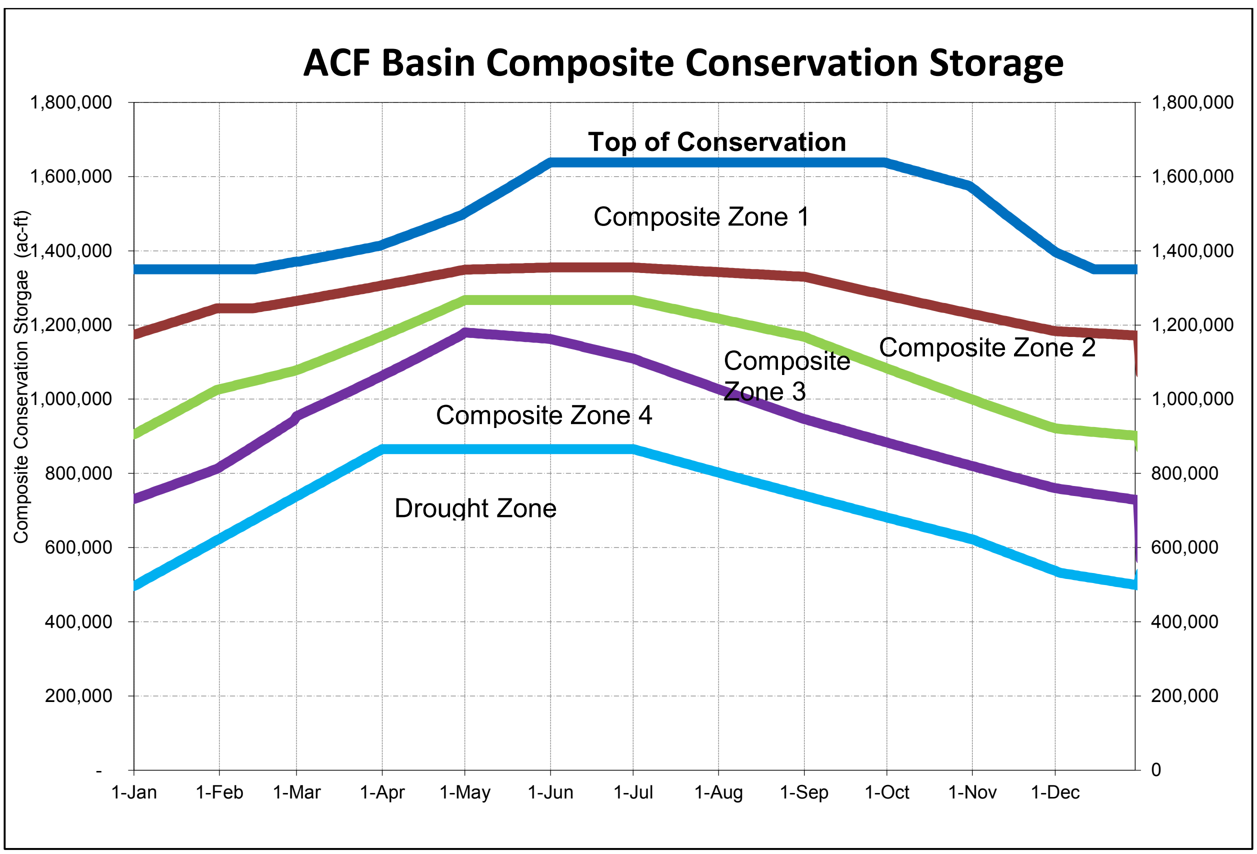


Figure 7-2. ACF Basin Composite Conservation and Flood Storage

The following definitions apply to the composite action zones:

Zone 1: If all the lakes are in Zone 1 or above, the river system would operate in a fairly normal manner. Releases can be made for hydroelectric power, water supply, and water quality. If system composite conservation storage is in Zone 1, releases can be made in support of a navigation season (January to April or May). Drought contingency operations cease when levels return to composite action Zone 1.

Zone 2: Hydroelectric power generation is supported at the same or a reduced level. Water supply and water quality releases are met. Minimum flow targets are met. If system composite conservation storage is in Zone 2, releases can be made in support of a navigation season (January to April or May).

Zone 3: Hydroelectric power generation is supported at a reduced level. Water supply and water quality releases are met. Minimum flow targets are met. If system composite conservation storage is in Zone 3, navigation is not supported. Drought contingency operations are triggered when levels drop to Zone 3.

Zone 4: Hydroelectric power demands will be met at a minimum level and might occur for concurrent uses only. Water supply and water quality releases are met. Minimum flow targets are met. If system composite conservation storage is in Zone 4, navigation is not supported.

Drought Zone: Hydroelectric power will only be met as a result of meeting other project purposes. Water supply and water quality releases are met. Minimum flow targets are met but are reduced to their lowest level. If system composite conservation storage is in the Drought Zone, navigation is not supported and the emergency drought operations are triggered. This reduces the minimum discharge from Jim Woodruff Dam to 4,500 cfs.

7-04. Standing Instructions to Damtender. During normal operations, the powerhouse operators will operate the Walter F. George Project in accordance with the daily hydropower schedule. Any deviation from the schedule must come through the Mobile District. Normally, flood risk management instructions are issued by the Mobile District. However, if a storm of flood-producing magnitude occurs and all communications are disrupted between the Mobile District and the powerhouse operators, the operators will follow instructions in Exhibit C Standing Instructions to the Damtender for Water Control.

7-05. Flood Risk Management. The Walter F. George Project does not have flood risk management as one of its congressionally authorized purposes, but there are guidelines to follow during high-flow periods that provide flood risk management benefits. The operation of the Walter F. George Project for these flood risk management benefits in accordance with instructions issued by the Mobile District, and releases depend on the Walter F. George pool level and expected conditions.

a. <u>Flood Regulation Plan</u>

(1) During high flows, the pool will be regulated by passing inflow through the turbines to the extent possible. When the pool is below elevation 190 feet NGVD29 (and expected to rise above that level) and the inflow exceeds the capacity of the turbines (approximately 26,000 cfs) a discharge of 30,000 cfs or that indicated by the induced surcharge schedule, whichever is greater, will be maintained by passing the outflow through the turbines or spillway gates, or both, allowing the pool to rise.

(2) When the pool reaches elevation 190 feet NGVD29, the required discharge will be determined by the induced surcharge schedule as shown in Plate 7-4. When the pool peaks and begins to fall, the discharge rate indicated in Plate 7-4 will be followed unless other instructions are issued from the Mobile District. The Operations Project Manager and the Site Manager will be advised when the lake is expected to rise above 190.0 feet NGVD29 so necessary actions can be taken. If communications loss occurs, the powerhouse operator will refer to Exhibit C. The discharge will be released through the turbines or spillway gates or both. The spillway gates will be operated in accordance with instructions and the gate opening schedule shown on Plates 2-5 through 2-11.

b. Induced Surcharge Schedule. If current pool levels and inflow rates indicate that runoff from a storm will appreciably exceed the storage capacity below nearly 192.00 feet NGVD29 (top of gates in the closed position) flood risk management operations will be directed by the induced surcharge curves shown on Plate 7-4. As gates are open to meet the induced surcharge release, the available flood risk management pool increases as the top of gate elevation increases. Table 7-3 describes the induced surcharge operating procedures as well as emptying instructions for after the pool has peaked and begun to fall. Modifications to this operation can only be made at the direction of the Mobile District. This schedule follows the objectives set forth in EM 1110-2-3600 as follows:

1) Peak rate of reservoir release during damaging floods should not exceed peak rates of the corresponding floods that would have occurred under runoff conditions prevailing before construction of the reservoir.

2) The rate of increase in reservoir releases during significant increment of time should be limited to values that would not constitute a major hazard to downstream interests.

Table 7-3. Induced Surcharge Operating Procedures

Flood Regulation Schedule

I. Increasing Inflows (Pool Rising)

A. Check induced surcharge schedule on Plate 7-4 each hour. If pool level and 3-hour average inflow require a release based on the induced surcharge schedule, commence making combined powerhouse and spillway releases that are equal to that required by the induced surcharge schedule. If the discharge value taken from the induced surcharge schedule is less than the previous hour's discharge, maintain the previous hour's discharge.

B. If no release is required from the induced surcharge schedule and the pool elevation is above 189.0 feet NGVD29 and the 3-hour average inflow is between 40,000 cfs and 50,000 cfs, begin making a discharge that is 8,000 cfs less than the 3-hour average inflow. If inflows rise above 50,000 cfs, follow the induced surcharge schedule.

II. Pool at Crest. Maintain the maximum gate setting reached for 6 hours to ensure that inflow has peaked.

III. Emptying Instructions (Pool Falling)

A. If peak outflow as determined by induced surcharge schedule is greater than 125,000 cfs, maintain peak outflow until pool falls below elevation 191 feet NGVD29. Then follow a or b below.

a. If peak outflow is more than double the 3-hour average inflow, begin reducing outflow by 5,000 cfs per hour. When the outflow falls below 70,000 cfs reduce outflow by 2,000 cfs per hour. When the outflow is greater than 10,000 cfs more than the 3-hour average inflow and the pool elevation is below 189 (190.5) feet NGVD29, begin reducing outflow by 1,000 cfs per hour until the pool falls to 188.5 (189.5) feet NGVD29. Then revert to normal operations.

b. If peak outflow is less than double the 3-hour average inflow, reduce outflow to 65,000 cfs or to inflow plus 10,000 cfs, whichever is greater. If this results in an outflow greater than 65,000 cfs, continue passing inflow plus 10,000 cfs until outflow reaches 65,000 cfs. When outflow reaches 65,000 cfs begin reducing outflow at a rate of 1,000 cfs per hour until the pool falls to 188.5 (189.5) feet NGVD29. Then revert to normal operations

B. If peak outflow as determined by induced surcharge schedule is between 125,000 cfs and 65,000 cfs, maintain outflow until pool falls below 190 feet NGVD29. Then follow a or b below.

a. If peak outflow is more than double the 3-hour average inflow, begin reducing outflow by 5,000 cfs per hour. When the outflow falls below 70,000 cfs reduce outflow by 2,000 cfs per hour. When the outflow reaches 10,000 cfs greater than the 3-hour average inflow and the pool is below 189 (190.5) feet NGVD29, begin reducing outflow by 1,000 cfs per hour until the pool falls to 188.5 (189.5) feet NGVD29. Then revert to normal operations

b. Otherwise, reduce outflow to 65,000 cfs or to inflow plus 10,000 cfs, whichever is greater. If this results in an outflow greater than 65,000 cfs, continue passing inflow plus 10,000 cfs until outflow reaches 65,000 cfs. When outflow reaches 65,000 cfs begin reducing outflow 1,000 cfs per hour until the pool falls to 188.5 (189.5) feet NGVD29. Then revert to normal operations

C. If peak outflow, as determined by induced surcharge schedule, is less than 65,000 cfs, continue passing peak outflow until pool falls to 190 feet NGVD29; if pool is already below 190 feet NGVD29, continue peak outflow until pool begins to drop. Then, reduce outflow by 1,000 cfs per hour until pool recedes to 188.5 (189.5) feet NGVD29. Then revert to normal operations.

Note: In the event the 3-hour average inflow begins increasing again after emptying commences, refer back to the increasing inflows instructions at the top of this page. During emptying, when elevation 188.5 (189.5) feet NGVD29 is reached, revert to normal operations.

Note: Elevations in parentheses are for May thru November; all other elevations are year-round values.

c. Gate Operating Schedule. The gate opening schedule and the approximate discharge at each opening for varying pool elevations are shown in Plates 2-5 through 2-11. All gate operations, except for special operations, will be operated in the order and at the increments specified on those plates. The 14 spillway gates are numbered in sequence beginning at the left or east bank, adjacent to the lock. The gates will normally be operated only during floods or at times when the required release cannot be discharged through the powerhouse.

The Walter F. George Project is designed to pass the Standard Project Flood without exceeding the elevation of 200.1 feet NGVD29. In this flood, inflow would equal discharge as the pool approached 199.0 feet NGVD29 and no reduction in flows downstream would be provided by the project. The Spillway Design Flood has an expected elevation of 206.6.4 feet NGVD29. In this flood, the spillway gates would be fully opened at elevation 199.0 feet NGVD29 and the pool would continue to rise to its peak elevation of 206.4. The peak pool elevation of 194.72 feet NGVD29 occurred on March 1990. This storm is shown on Plate 8-7. The flood risk management operations at Walter F. George reduced the peak flood wave by over 230,000 cfs.

Constraints: During and after high-flow periods, bank sloughing can become an issue downstream of the project when large release reductions area made in short periods. While there is no maximum rate of release change from Walter F. George, consideration should be given when reducing releases from the project.

7-06. Recreation. Most recreational activities at Walter F. George Lake occur during the summer when the reservoir is at its full conservation pool elevation of 190.0 feet NGVD29. When the lake recedes several feet below the top of conservation pool, access to the water and beaches becomes progressively limited. Conversely, lake levels above top of conservation pool begin to flood certain public use areas and facilities. Water management personnel are aware of recreational effects caused by reservoir fluctuations at Walter F. George Lake and attempt to maintain reasonable lake levels during the peak recreational use periods; however, other authorized purposes are also served by the project which often conflict with the ability to maintain a stable pool. To classify recreation effects associated with conservation storage usage at Walter F. George Lake, various impact levels have been identified. They are briefly described below.

The effects of the Walter F. George Dam water control operations on recreation facilities and use at Walter F. George Lake are described as impact levels - Initial Impact Level, Recreation Impact Level, and Water Access Limited Level. The impact levels are defined as pool elevations with associated effects on recreation facilities and exposure to hazards within the lake. The following are general descriptions of each impact level:

a. Initial Impact Level - The Initial Impact Level is defined at lake elevation 187.0 feet NGVD29. The swim areas are only marginally usable when the pool level falls below this impact level. Docks must be shifted to deeper water, if allowable. Unmarked recreational navigation hazards begin to appear. Approximately 30 percent of private docks become marginally usable with only two feet of water beneath them. Lanes of boat ramps can become partially silted in at some areas.

b. Recreation Impact Level - The lake elevation of 185.0 feet NGVD29 is defined as the Recreation Impact Level. At this level, all swimming areas become unusable. Public docks will need to be moved to deeper water if possible. Approximately 40 to 50 percent of private docks become unusable. Unmarked navigation hazards continue to emerge. Activities such as water skiing and wakeboarding become unsafe in some areas. Four project boat launch ramps become unusable. All other boat launch ramps are affected by silt buildup. Approximately 50 percent of courtesy ramps become unusable.

c. Water Access Impact Level - The lake elevation of 184.0 feet NGVD29 is defined as the Water Access Impact level. It is at this level that the most severe effects on recreation begin to occur. At this level, water is 50 to 100 feet from the normal shoreline, and access to water is limited by extensive mud flats. Recreational navigation hazards continue to emerge, and waterborne activities such as boating and water skiing are limited to the main bodies of the lake. Silt buildup and drop-offs continue to increase at boat ramps. Approximately 75 percent of the boat launch ramps and 85 to 90 percent of private boat docks are unusable at this level.

The water control plan takes the effects on recreation facilities into account in developing action zones for Walter F. George Lake. In dry periods, the lake will often drop to or below the impact levels and Water Management personnel will keep the Operations Project Manager at Walter F. George informed of projected pool levels through the district's weekly water management meetings. The Operations Project Manager is responsible for contacting various lakeshore interests and keeping the public informed of lake conditions during drawdown periods. The Operations Project Manager closes beaches and boat ramps as necessary, patrols the lake, marks hazards and performs other necessary tasks to mitigate the effects of low lake levels.

7-07. Water Quality. Water control regulation of the ACF projects is not performed to meet specific water quality standards. However, the objective of water quality sustainability of the rivers is a goal the Corps attempts to meet through specific continuous minimum releases and other incidental releases that provide benefits to water quality in the basin. During periods of low dissolved oxygen in the tailwater, special releases are made through the spillway to assist the fish population downstream. Such special releases are made when there is evidence of low dissolved oxygen or of fish in distress below the dam. Spillage siphons have also been constructed on the dam that can be used in lieu of spillway gate discharges. The siphons provide a gravity-fed, typically continuous, minimum flow that benefits dissolved oxygen levels below the dam. Additionally, a water quality monitor was installed in 1971 that measures dissolved oxygen, pH, turbidity, and conductivity. Records of those parameters are available for 1971 through 1976 and 1981 to date.

7-08. Fish and Wildlife. During the reproduction period for bass and crappie and during the nesting period for Canada geese, the fluctuation of the pool will be limited to no more than one-half foot when practicable. The beginning and ending of the spawning and nesting seasons will be determined by Mobile District fishery biologists in cooperation with fish and game personnel from the states concerned and the USFWS.

15 March to 15 May is the expected timing for fish spawning at Walter F. George Lake. The length of the spawning period depends on how rapidly temperatures increase after spawning begins, but in general, it varies from one to three weeks. During that period, the pool level should not be lowered more than six inches. Fish spawning operations are described in Division Regulation 1130-2-16, *Lake Regulation and Coordination for Fish Management Purpose*, dated 31 May 2010, and Mobile District's draft Standard Operating Procedure 1130-2-9, *Lake Reservoir Regulation and Coordination for Fish Management Purposes*, dated February 2005.

The USFWS has relocated Canada geese into the Eufaula National Wildlife Refuge, which is in the reservoir. During the nesting period of the geese and migrant shore birds, which usually begins in March and continues until June, USFWS personnel monitor the location and elevation of new nests, which are usually a few feet above the reservoir level. If the pool is above elevation 188 feet NGVD29, normally no special operation is required. However, if the pool is low, 184 - 187 feet NGVD29, special operations might be required if practicable to keep from flooding the nests. Also, the transition month for the top of conservation pool is May, which must also be taken into consideration for special operations.

Operations for fish and wildlife do not supersede the normal operating procedure of maintaining the pool within the top of conservation. During a high-flow event, it might be necessary to decrease the pool by more than six inches to return the pool to within normal operating levels. Additionally, during periods of high flows or drought conditions, it may be necessary to reduce lake levels more than the six inches.

7-09. Water Supply. The Water Supply Act of 1958 authorizes the Corps to allocate water supply contracts from Walter F. George for water supply. Currently, no water supply contracts have been issued for project storage in the Walter F. George Lake.

7-10. Hydroelectric Power. Reservoir releases required for conservation, or flood risk management operations in Paragraphs 7-03 through 7-09 will normally be used to produce hydropower. Such production is scheduled during peak energy demand hours throughout the week. The level of hydropower support is determined by the reservoir's condition as well as its zone in relation to the other two federal storage projects in the ACF Basin. Typically, the Walter F. George Project provides generation five days a week at plant capacity throughout the year, as long as their respective lake levels are in Zone 1 and drought operations have not been triggered. The minimum hours represent releases that normally meet water system demands and provide the capacity specified in marketing arrangements. During dry periods, generation could be eliminated or limited to conjunctive releases. The typical, but not required, hours of operation by action zone are presented in Table 7-2. Historical hydropower production is shown in Plates 7-5 and 7-6. Actual monthly and annual production is tabulated. The average annual production from 1964 through 2013 is 428,881 megawatt hours (MWH).

In addition to hydroelectric power generation being governed by action zone, there are also physical limitations that factor into the power generation decisions. During high flow conditions, the reduction in the difference in headwater and tailwater may cause the hydropower units at Walter F. George Dam to become inoperable due to loss of head. A reduction in the generation capacity of a unit can also occur as a result of extremely low lake levels during droughts. Scheduled and unscheduled unit outages can also occur throughout the year affecting the ability to release flow through some or all the turbines.

SEPA markets the energy generated at Walter F. George Dam to the government's preference customers, and enters into and administers the contracts with those entities to deliver that energy. The generation (and water release) is based on a weekly declaration of energy and capacity forecasted to be available that is updated daily by the Mobile District on the basis of the overall ACF water control plan and changing basin conditions. The declarations, which are designed to keep the ACF reservoir elevations balanced by zone, where practicable, are prepared by the Mobile District and furnished to the SAD office for coordination of the hydropower projects within the Alabama-Georgia-South Carolina Power Marketing System. Actual daily and hourly scheduling of generation is coordinated by the Mobile District, SEPA, and the hydropower customers. Local restraints can dictate generation during certain hours.

In addition to the weekly declaration, the Mobile District periodically prepares extended forecasts for all the hydropower plants in the District. Interactive weekly forecasting is often done to project operations for the coming weeks to determine generation and downstream flow support that is consistent with the ACF Water Control Plan. The extended forecast is usually prepared weekly and is intended for use as a guide to determine where and when any problem might be developing in the system and to assist in making the weekly power declaration.

7-11. Navigation. The existing project authorizes a 9-foot deep by 100-foot wide waterway from Apalachicola, Florida, to Columbus, Georgia, on the Chattahoochee River, and to Bainbridge, Georgia, on the Flint River. Conditions on the Apalachicola River have been such in recent years that a 9-foot deep channel has not been available for much of the year. Dredging on the Apalachicola River has been reduced since the 1980s because of a lack of adequate disposal area capacity in certain reaches of the river. No dredging has been conducted on the Apalachicola River since 2001 for a variety of reasons related to flow or funding levels and has been indefinitely deferred because of denial of a Section 401 water quality certificate from the State of Florida. Also, the Apalachicola River was designated as a low use navigation project in FY2005 which greatly reduces the likelihood of receiving funding for maintenance dredging. The lack of dredging and routine maintenance has led to inadequate depths in the Apalachicola River navigation channel.

When supported by ACF Basin hydrologic conditions, the Corps will provide a reliable navigation season. The water management objective is to ensure a predictable minimum navigable channel in the Apalachicola River for a continuous period that is sufficient for navigation use.

Assuming basin hydrologic conditions allow, a typical navigation season would begin in January of each year and continue for 4 to 5 consecutive months (January through April or May). Figure 7-3 graphically represents the navigation season and its relationship to composite conservation storage. During the navigation season, the flows at the Blountstown, Florida, gage (USGS # 02358700) should be adequate to provide a minimum channel depth of 7 feet. The most recent channel survey and discharge-stage rating was used to determine the flow required to sustain a minimum navigation depth during the navigation season. Flows of 16,200 cfs provide a channel depth of 7 feet. Flows of 20,600 cfs provide a channel depth of 9 feet. The Corps' capacity to support a navigation season will be dependent on actual and projected system-wide conditions in the ACF Basin before and during January, February, March, April and May. Those conditions include the following:

- A navigation season can be supported only when ACF Basin composite conservation storage is in Zone 1 or Zone 2.
- A navigation season will not be supported when the ACF Basin composite conservation storage is in Zone 3 and below. Navigation support will resume when basin composite conservation storage level recovers to Zone 1.
- A navigation season will not be supported when drought operations are in effect. Navigation will not be supported until the ACF Basin composite conservation storage recovers to Zone 1.
- The determination to extend the navigation season beyond April will depend on ACF Basin inflows, recent climatic and hydrologic conditions, meteorological forecasts, and basin-wide model forecasts. On the basis of an analysis of those factors, the Corps will determine if the navigation season will continue through part or all of May.
- Down-ramping of flow releases will adhere to the Jim Woodruff Dam fall rate schedule for federally listed species during the navigation season.

- Releases that augment the flows to provide a minimum 7-foot navigation depth will also be dependent on navigation channel conditions that ensure safe navigation.

When it becomes apparent that downstream flows and depths must be reduced due to diminishing inflows, navigation bulletins will be issued to project users. The notices will be issued as expeditiously as possible to give barge owners, and other waterway users, sufficient time to make arrangements to light load or remove their vessels before action is taken at Jim Woodruff Lock and Dam to reduce releases.

Although special releases will not be standard practice, they could occur for a short duration to assist navigation during the navigation season. For instance, releases can be requested to achieve up to a 9-foot channel. The Corps will evaluate such request on a case by case basis, subject to applicable laws and regulations and the conditions above.

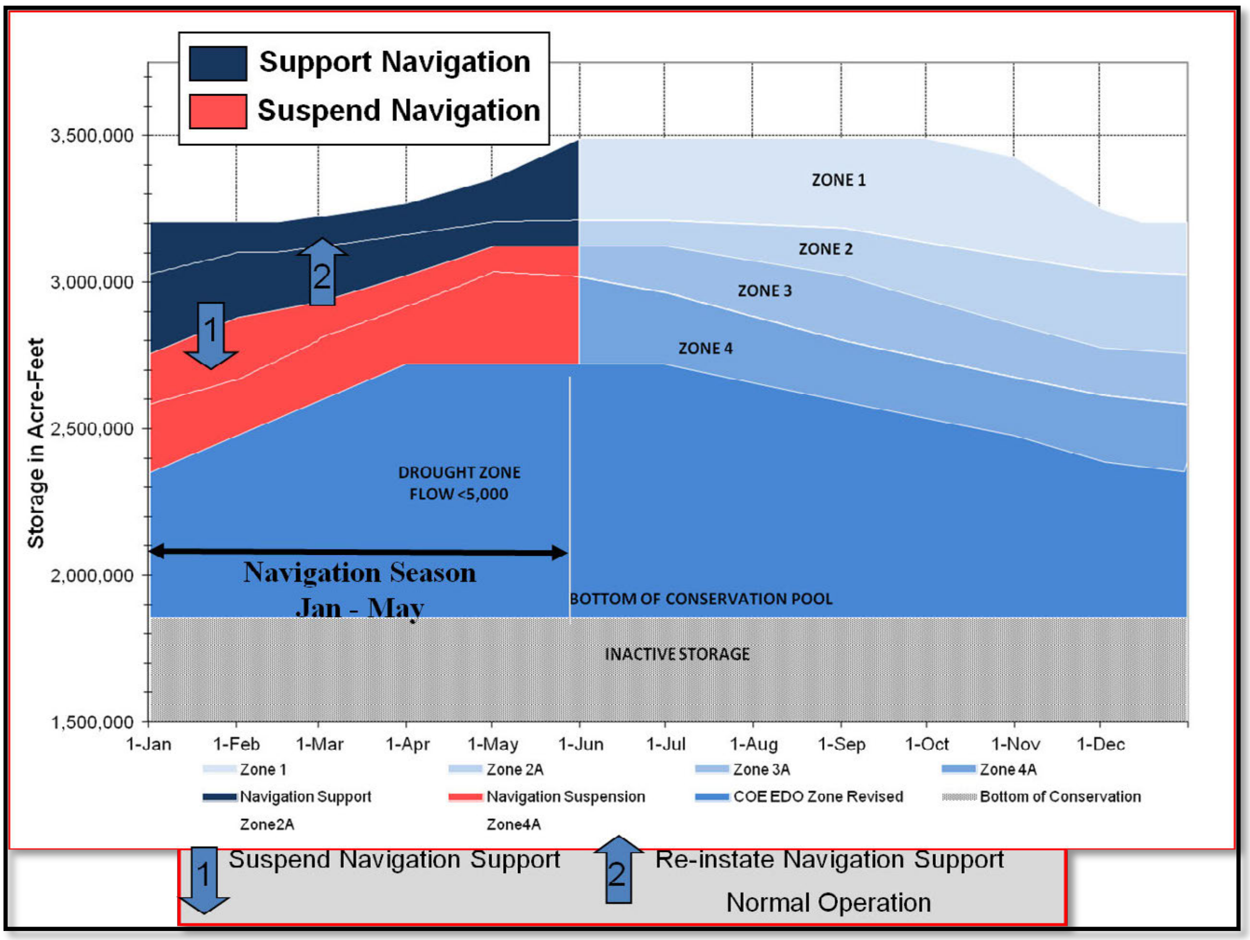


Figure 7-3. Composite Conservation Storage for Navigation

A tailwater elevation of 102 feet NGVD29 is required at Walter F. George Dam to provide the 9-foot navigation depth in the upper reaches of the Lake George W. Andrews. Normally, the Walter F. George and George W. Andrews dams will be operated to assure the minimum tailwater of 102 feet NGVD29 at Walter F. George Dam, but conditions could occasionally arise that cause a temporary drawdown below elevation 102 feet NGVD29. Shoaling in the upper reaches could also reduce depths in the navigation channel to less than 9 feet. If it is necessary to raise the upstream portion of Lake George W. Andrews pool for navigation, it can be accomplished by making special releases from the Walter F. George Dam. When such releases are required, the Lockmaster or the Power Project Manager will contact the Mobile District. The powerhouse will be the preferred method of release to float grounded vessels in the Lake George W. Andrews pool.

7-12. Drought Contingency Plan. ER 1110-2-1941, *Drought Contingency Plans*, dated 15 September 1981, called for developing drought contingency plans for Corps' reservoirs. For the Walter F. George Project, the Corps will coordinate water management during drought with other federal and state agencies, private power companies, navigations interests, and other interested stakeholders. Drought operations will be in compliance with the plan for the entire ACF Basin as outlined in Exhibit D*,* and summarized below.

Drought operations are triggered on the first day of the month following the day that ACF composite conservation storage enters Zone 3, from Zone 2 (Figure 7-4). At that time, all the composite conservation storage Zone 1 - 3 provisions (seasonal storage limitations, maximum fall rate schedule, and minimum flow thresholds) are suspended and management decisions are based on the provisions of the drought plan. Under the drought plan, the minimum discharge is determined in relation to composite conservation storage only. The drought plan for the ACF Basin specifies a minimum release from Jim Woodruff Dam and temporarily suspends the other minimum release and maximum fall rate provisions until composite conservation storage in the basin is replenished to a level that can support the minimum releases and maximum fall rates. The drought plan also includes a temporary waiver from the water control plan to allow temporary storage above the winter pool guide curve at the West Point Project if the opportunity presents itself. There is also an opportunity to begin spring refill operations at an earlier date to provide additional conservation storage for future needs.

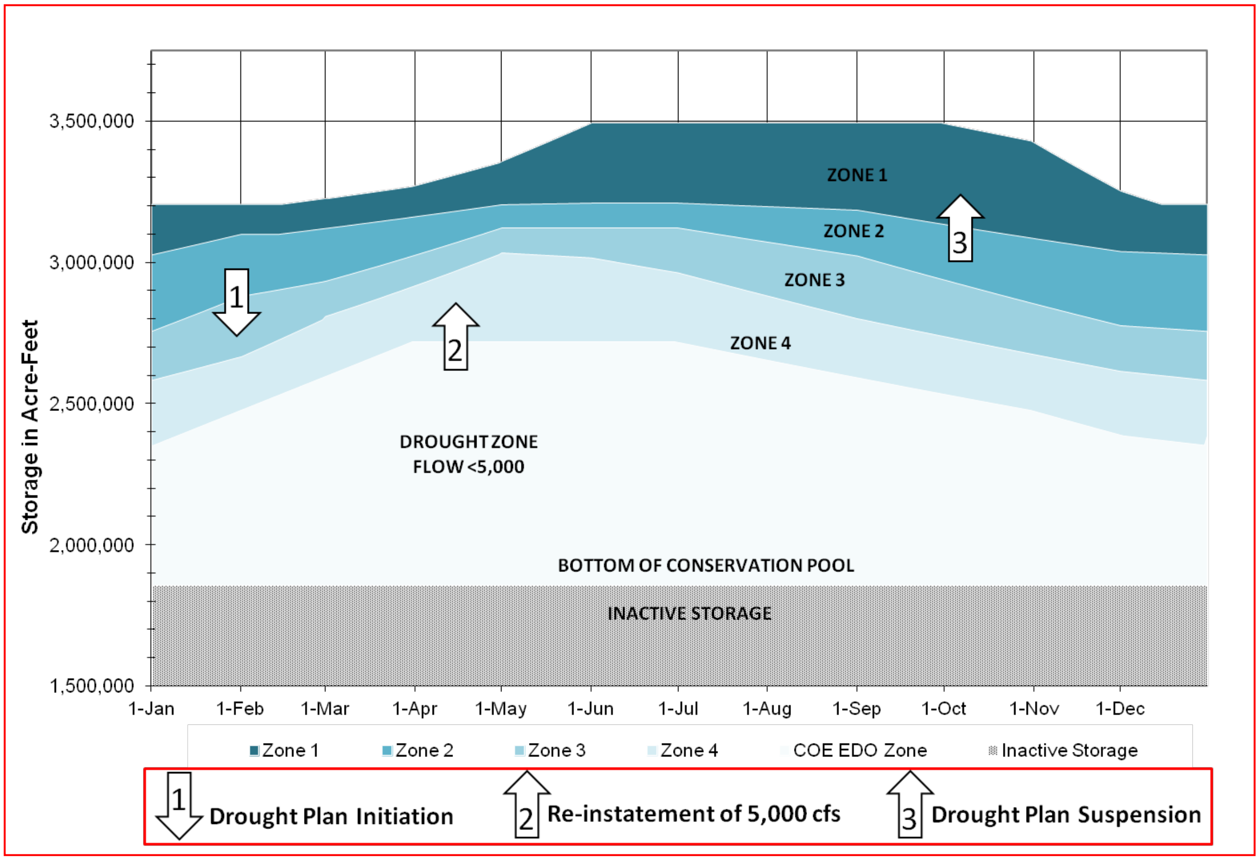


Figure 7-4. Drought Operation Triggers

The drought plan prescribes two minimum releases based on composite conservation storage in Zones 3 and 4 and an additional zone referred to as the Drought Zone. The Drought Zone delineates a volume of water roughly equivalent to the inactive storage in Buford, West Point and Walter F. George reservoirs plus Zone 4 storage in Buford. The Drought Zone line has been adjusted to include a smaller volume of water at the beginning and end of the calendar year. When the composite storage is within Zone 4 and above the Drought Zone, the minimum release from Jim Woodruff Dam is 5,000 cfs, and all basin inflow above 5,000 cfs that is capable of being stored may be stored. Once the composite conservation storage falls into the Drought Zone, the minimum release from Jim Woodruff Dam is 4,500 cfs and all basin inflow above 4,500 cfs that is capable of being stored may be stored. When transitioning from a minimum release of 5,000 to 4,500 cfs, fall rates will be limited to a 0.25-ft/day drop. The 4,500 cfs minimum release is maintained until composite conservation storage returns to a level above the top of the Drought Zone, at which time the 5,000-cfs minimum release is reinstated.

The drought plan provisions remain in place until conditions improve such that the composite conservation storage reaches Zone 1. At that time, the temporary drought plan provisions are suspended, and all the other provisions are reinstated. During the drought contingency operations, a monthly monitoring plan that tracks composite conservation storage to determine water management operations (the first day of each month will represent a decision point) will be implemented to determine which operational triggers are applied. In the event the composite conservation storage has not recovered to Zone 1 by 1 March, drought operations will be extended to the end of March unless all the Federal reservoirs are full. The month of March usually provides the highest inflows into the reservoirs, but also has some of the highest flow requirements for release from Jim Woodruff Dam. This extension of drought operations allows for the full recovery of the federal storage projects in preparation for the spawning and spring refill period that occur from April through June.

7-13. Flood Emergency Action Plans. The Corps is responsible for developing Flood Emergency Action Plans for the ACF System, in accordance with ER 1110-2-1156, *Engineering and Design Safety of Dams – Policy and Procedures*, 28 October 2011. The Walter F. George Project Emergency Action Plan, undated, is a stand-alone document retained on site and in the MDO. Example data available are emergency contact information, flood inundation information, management responsibilities, and procedures for use of the plan.

7-14. Other. Other considerations, in addition to the authorized project purposes, may be accommodated on an as needed basis. Adjustments are made to system regulation at times for downstream construction, to aid in rescue or recovery from drowning accidents, environmental studies, or cultural resource investigations.

a. Regulation during Low Flows. There is no minimum release requirement at the Walter F. George Project. The tailwater at Walter F. George Dam is maintained during periods of non-generation by the headwater of the George W. Andrews Project downstream. However, downstream water requirements for navigation will be carefully considered in preparing weekly power declarations. Any special releases that might be required in emergencies will be included in a revised power declaration when possible. Also, the releases from Jim Woodruff Dam required for the protection of federally listed threatened and endangered species will be supported.

b. Constraints. Walter F. George has a maximum head limitation of 88 feet between the pool and the tailwater. That can become an issue during low-flow periods, and additional releases might be needed to maintain the tailwater at the desired level.

c. Extraordinary Drawdown of Walter F. George Lake. Droughts experienced in 1986 and 1988 were extreme throughout the ACF Basin and caused water managers to consider what plans could be followed if the basin's total conservation storage, about 1.7 million acre-feet, were to be depleted or seriously threatened with depletion. Such an occurrence could be contemplated in the second or later year of a severe drought. Fortunately, the three storage reservoirs on the Chattahoochee River contain a significant volume of storage below the minimum conservation pool. The Walter F. George Lake contains 271,000 acre-feet of water below the conservation pool between elevations 184 and 175, which is the expected lower operating limit for the powerhouse. An additional 222,300 acre-feet is between elevation 175 and 163, which is the gated spillway crest elevation. Use of that usable, but normally inactive, storage would be a serious decision requiring SAD approval. The prerequisites for the Mobile District Engineer to recommend such an action would be as follows:

- Upstream reservoirs are nearly depleted (i.e., Lake Sidney Lanier below elevation 1,045 feet NGVD29 and West Point Dam below elevation 622 feet NGVD29).
- There is a clear public interest such as a water supply, water quality, or public safety need, for a release from Walter F. George Lake, which would draw it below elevation 184 feet NGVD29.
- The need for water release outweighs the adverse impact caused by the drawdown. Alternatives to the proposed release will be investigated.

To help ensure that those requirements are fulfilled, the District Engineer will have performed the following tasks:

- A public notice will be issued describing as best as possible the expected drawdown and the circumstances that might make such a drawdown necessary.
- Congressional interests are notified.
- One or more public meetings will be held to explain the necessity for the drawdown.
- In-lake interests are given adequate time to prepare for the effects of the drawdown.

d. High Water Action Plan. During periods of high inflow when the pool is expected to exceed its top of conservation, certain actions are taken by the project staff to prepare areas around the project for rising pool levels and to ensure public safety. In the event abnormally high releases (usually exceeding turbine capacity) are forecast to be made from the project, the project staff will also notify the downstream interests of potential flooding as a result of operations at the dam. Critical elevations and releases are discussed in detail in the High Water Action Plan provided in Exhibit E.

When a flood inducing storm is forecast, Water Management will contact the project site office and provide a forecast of daily peak pool elevations and releases from the project based on the best data available for the extent of the potential high inflow event. Anytime a change is made to this forecast, Water Management will inform the project site office as promptly as possible to allow project staff the time to make any additional preparations dictated by the High Water Action Plan. Details on communication with the project are discussed in more detail in Paragraph 5-06.

7-15. Deviation From Normal Regulation. Water management inherently involves adapting to unforeseen conditions. The development of water control criteria for the management of water resource systems is carried out throughout all phases of a water control project. The water control criteria are based on sound engineering practice utilizing the latest approved models and techniques for all foreseeable conditions. There may be further refinements or enhancements of the water control procedures, in order to account for changed conditions resulting from unforeseen conditions, new requirements, additional data, or changed social or economic goals. However, it is necessary to define the water control plan in precise terms at a particular time in order to assure carrying out the intended functional commitments in accordance with the authorizing documents (EM 1110-2-3600 Management of Water Control Systems). Adverse impacts of the water control plan may occur due to unforeseen conditions. When this occurs, actions will be taken within applicable authority, policies, and coordination to address these conditions when they occur through the implementation of temporary deviations to the water control plan, such as interim operation plans. Such deviations may require additional environmental compliance prior to implementation.

The Corps is occasionally requested to deviate from the water control plan. Prior approval for a deviation is required from the Division Commander except as noted in subparagraph a. Deviation requests usually fall into the following categories:

a. Emergencies. Examples of some emergencies that can be expected to occur at a project are drowning and other accidents, failure of the operation facilities, chemical spills, treatment plant failures and other temporary pollution problems. Water control actions necessary to abate the problem are taken immediately unless such action would create equal or worse conditions. The Mobile District will notify the division office as soon as practicable.

b. Declared System Emergency. A Declared System Emergency can occur when there is a sudden loss of power within the electrical grid and there is an immediate need of additional power generation capability to meet the load on the system. In the Mobile District, a system emergency can be declared by the Southern Company or the Southeastern Power Administration's Operation Center. Once a system emergency has been declared, the requester will contact the project operator and request generation support. The project operator will then lend immediate assistance within the projects operating capabilities. Once support has been given, the project operator should inform the MDO. The responsibilities and procedures for a Declared System Emergency are discussed in more detail in Division Regulation Number 1130-13-1, *Hydropower Operations and Maintenance Policies*. It is the responsibility of the District Hydropower Section and the Water Management Section to notify SAD Operations Branch of the declared emergency. The Division Operations Branch should then coordinate with SEPA, District Water Management, and the District Hydropower Section on any further actions needed to meet the needs of the declared emergency.

c. Unplanned Deviations. Unplanned instances can create a temporary need for deviations from the normal regulation plan. Unplanned deviations may be classified as either major or minor but do not fall into the category of emergency deviations. Construction accounts for many of the minor deviations and typical examples include utility stream crossings, bridge work, and major construction contracts. Minor deviations can also be necessary to carry out maintenance and inspection of facilities. The possibility of the need for a major deviation mostly occurs during extreme flood events. Requests for changes in release rates generally involve periods ranging from a few hours to a few days, with each request being analyzed on its own merits. In evaluating the proposed deviation, consideration must be given to impacts on project and system purposes, upstream watershed conditions, potential flood threat, project condition, and alternative measures that can be taken. Approval for unplanned deviations, either major or minor, will be obtained from the division office by telephone or electronic mail prior to implementation.

d. Planned Deviations. Each condition should be analyzed on its merits. Sufficient data on flood potential, lake and watershed conditions, possible alternative measures, benefits to be expected, and probable effects on other authorized and useful purposes, together with the district recommendation, will be presented by letter or electronic mail to the division office for review and approval.

7-16. Rate of Release Change. There are no restrictions on releases from Walter F. George during normal operations. There are restrictions on the rate of change below Jim Woodruff that could require releases from Walter F. George. During high flows, it is desirable to uniformly lower discharge downstream as allowable by conditions and equipment to lessen the impacts of the erosive nature of high flows.

VIII - EFFECT OF WATER CONTROL PLAN

8-01. General. Walter F. George Lock and Dam was authorized as part of the general plan for the full development of the ACF River Basin by the Rivers and Harbors Acts of 1945 and 1946, in accordance with the general plan presented in House Document No. 300, 80th Congress, First Session. The Walter F. George Project is operated to provide benefits for authorized purposes including navigation, hydropower water quality, recreation, and fish and wildlife conservation.

The impacts of the *ACF Master Water Control Manual* and its Appendices, including this water control plan have been fully evaluated in an Environmental Impact Statement (EIS) that was published on (date). A Record of Decision (ROD) for the action was signed on (date). During the preparation of the EIS, a review of all direct, secondary and cumulative impacts was made. As detailed in the EIS, the decision to prepare the water control manual and the potential impacts was coordinated with federal and state agencies, environmental organizations, Indian tribes, and other stakeholder groups and individuals having an interest in the basin. The ROD and EIS are public documents and references to their accessible locations are available upon request.

8-02. Flood Risk Management. The Walter F. George Project does not contain designated flood risk management storage; however, the project has the capability to store flood waters in a surcharge area above the minimum operating pool elevation of 188.0 feet NGVD29. The surcharge area, which generally is between reservoir elevations 188.0 feet NGVD29 and 199.0 feet NGVD29, is used to temporarily store inflows to the project during flood events and from which regulated releases are made to reduce the peak flows downstream of the dam. When flood waters are stored in the surcharge area during flood events, releases from Walter F. George Dam are regulated by an induced surcharge schedule that specifies the amount of the releases to be made on the basis of a combination of inflow amounts to the project and the existing pool elevation. The induced surcharge schedule of releases is designed to ensure that the downstream peak flows in the river will not exceed those that would have occurred under natural conditions.

a. Spillway Design Flood. Spillway Design Flood (SDF) is the criteria used by the Corps to design the spillway on a dam to prevent its overtopping due to the occurrence of an extremely rare flood event. The basis of the SDF is the Probable Maximum Precipitation (PMP) centered and oriented in a manner that produces maximum runoff. This flood is also often referred to as the Probable Maximum Flood (PMF). The SDF for Walter F. George is the transposed March 1929 storm based on the observed rainfall, selected centering and orientation, and adjusted runoff volume to provide a flood that was considered to be of Probable Maximum Flood magnitude. The SDF cannot be assigned a frequency of occurrence and was not used in any frequency analysis. The Walter F. George Dam Spillway Design Flood is shown on Plate 8-1 and summarized in Table 8-1. The storm had an average storm depth of 16.1 inches with 13.3 inches of runoff volume over the 7,460 square mile basin. The duration of the SDF is approximately 9 days with a peak inflow of 767,800 cfs and a peak outflow of 653,000 cfs. Lake levels rise about 5 feet per day and peak at 206.6 feet NGVD29. Updated guidance requires the PMP be developed using Hydrometerological Report (HMR) 51 and 52 and that the SDF be routed with an antecedent pool elevation at the top of the flood risk management pool or by routing the Standard Project Flood 5 days before the SDF. The SDF is currently being reevaluated using this guidance and any changes to the SDF will be incorporated into the water control manual when available.

b. The Standard Project Flood. The Standard Project Flood (SPF) is a theoretical flood, based on rainfall criteria, that would be reasonably possible and has been used in hydrologic analyses of reservoirs and river reaches. The SPF cannot be assigned a frequency of occurrence and was not used in any discharge-frequency analysis. The SPF is shown in Plate 8-2. The SPF would cause a peak pool elevation of 200.1 feet NGVD29 and a maximum discharge of 269,000 cfs. Peak inflow is 380,300 cfs. Effects of the reservoir regulation of the standard project flood are depicted on Plate 8-2 and summarized in Table 8-1.

Table 8-1. Design Floods

Flood Event	Reservoir Inflow (cfs)	Reservoir Outflow (cfs)	Peak Pool Elevation (ft. NGVD29)
Spillway Design	767,800	653,000	206.6
Standard Project	380,300	269,000	200.1

c. Historic Floods. The flood of July 1916 was routed through the reservoir with an assumed beginning pool elevation of 190.0 feet NGVD29 and reached a peak pool elevation of 194.20 feet NGVD29 and peak outflow of 123,000 cfs. The effects of reservoir regulation are shown on Plate 8-3. The routed historic floods of 1925 and 1929 are shown in Plates 8-4 and 8-5, respectively. Three floods that occurred 1978, 1990, and 1994, after completion of the dam, are shown on Plates 8-6 through 8-8. The March 1990 flood was the largest since the dam has been in place. The peak, 1-hour, observed inflow was 403,800 cfs and the maximum pool elevation was 194.72 feet NGVD29. Plates 4-2 through 4-14 show the entire historical record for reservoir regulation. Table 8-2 shows peak hourly inflow, peak hourly outflow, and peak pool elevations for the six historic flood events at the project.

Table 8-2. Historic Floods at Walter F. George Lock and Dam

Historic Flood	Peak inflow (hourly value) (cfs)	Peak outflow (hourly value) (cfs)	Peak pool elevation (feet NGVD29)
July 1916	188,200	123,000	194.2
January 1925	177,000	149,300	195.6
March 1929	294,900	204,000	197.7
January 1978	142,100	116,100	190.8
March 1990	403,800	172,600	194.72
July 1994	287,115	123,162	192.19

8-03. Recreation. Walter F. George Lake is an important recreational resource, providing significant economic and social benefits for the region and the Nation. The project contains 45,181 acres of water at the summer conservation pool elevation of 190.0 feet NGVD29, plus an additional 49,325 acres of land, most of which is available for public use. A wide variety of recreational opportunities are provided at the lake including boating (4 marinas and 29 boat ramps), fishing (2 fishing docks), camping (730 camping sites), picnicking (379 picnic sites), water skiing, hunting, and sightseeing (36 trail miles). Mobile District park rangers and other project personnel conduct numerous environmental and historical education tours and presentations, as well as water safety instructional sessions each year for the benefit of area students and project visitors. Walter F. George Lake is one of the most visited Corps lake in the United States; having almost 3.27 million recreational visitors during 2012. The local and regional economic benefits of recreation at Walter F. George Lake are significant. Annual recreational visitor spending within 30 miles of the project totals $135.1 million.

The effects of the Walter F. George Lake water control operations on recreation facilities and use at the project are described as impact levels - Initial Impact Level, Recreation Impact Level, and Water Access Limited Level. The impact levels are defined as pool elevations with associated effects on recreation facilities and exposure to hazards within the lake. The following are general descriptions of each impact level:

a. Initial Impact Level - Reduced swim areas, some recreational navigation hazards are marked, boat ramps are minimally affected, a few private boat docks are affected.

b. Recreation Impact Level - All swim areas are unusable, recreational navigation hazards become more numerous, boat ramps are significantly affected, 20 percent of private boat docks are affected.

c. Water Access Impact Level - Most water-based recreational activities are severely restricted, most boat ramps are unusable, navigation hazards become more numerous, 50 percent of private boat docks are affected.

Table 8-3 shows the lake elevation for each impact level and the percent of time during the recreational season (May thru July) over the 73-year period of record that each impact level would be reached at Walter F. George Lake.

Table 8-3. Reservoir impact levels - Walter F. George Lake

187.0 Feet NGVD29 initial impact level	185.0 Feet NGVD29 recreation impact level	184.0 Feet NGVD29 water access limited impact level
4.5%	0.4%	0.0%

8-04. Water Quality. The Corps operates Walter F. George for the objective of water quality. Water releases made during hydropower generation at Walter F. George Dam normally provide sufficient flows to maintain acceptable downstream water quality levels in the river. However, the Corps monitors water quality in the tailrace of Walter F. George Dam because dissolved oxygen levels there are periodically less than 3 mg/l during the late summer and early fall months. If, during periods of low dissolved oxygen, fish appear to be in distress, the Corps releases additional water to assist fish assemblages in the tailrace. Spillage siphons have also been constructed on the dam that can be used in lieu of spillway gate discharges. The siphons provide a gravity-fed, typically continuous, minimum flow that benefits dissolved oxygen levels below the dam. The pool and mid-lake behind the Walter F. George Dam are both supporting their designated water use for recreation according to Georgia’s 2014 draft integrated 305(b)/303(d) list.

8-05. Fish and Wildlife. The water control plan improves the ability of the Corps to maintain steady reservoir levels during the spring fish spawning period, provides for a gradual ramp down of river levels to prevent stranding species, and prevents effects on federally listed threatened and endangered species and their federally designated critical habitat by ensuring adequate flows in the river.

a. Fish Spawning. The Corps operates the ACF System to provide favorable conditions for annual fish spawning, both in the reservoirs and in the Apalachicola River. Operations for fish spawning help to increase the population of fish in the basin. During the 15 March to 15 May fish spawning period at Walter F. George Lake, the goal of the Corps is to operate for a generally stable or rising lake level for approximately four to six weeks. When climatic conditions preclude a favorable operation for fish spawning, the Corps consults with the state fishery agencies and the USFWS on balancing needs in the system and minimizing the effects of fluctuating lake or river levels.

b. Threatened and Endangered Species. The ACF system of reservoirs, including Walter F. George Lake, is operated such that sufficient quantities of water are available to support compliance with the Endangered Species Act of 1973 by preventing effects on federally listed threatened and endangered species and their federally designated critical habitat in the ACF Basin. Water releases from the downstream Jim Woodruff Dam directly support the federally threatened Gulf sturgeon (*Acipenser oxyrinchus desotoi*), endangered fat threeridge (*Amblema neislerii*), threatened purple bankclimber (*Elliptoideus sloatianus*), and threatened Chipola slabshell (*Elliptio chipolaensis*), and areas designated as critical habitat for these species in the Apalachicola River. The releases provide a benefit by assuring a minimum flow necessary to protect and support the species and their habitats.

c. Canadian Geese. The USFWS has relocated Canada geese into the Eufaula National Wildlife Refuge, which is in the reservoir. During the nesting period of the geese and migrant shore birds, which usually begins in March and continues until June, USFWS personnel monitor the location and elevation of new nests, which are usually a few feet above the reservoir level. If the pool is above elevation 188 feet NGVD29, normally no special operation is required. However, if the pool is low, elevation 184 – 187 feet NGVD29, special operations might be required if practicable to keep from flooding the nests. Also, the transition month for the top of conservation pool is May, which must also be taken into consideration for special operations.

8-06. Water Supply. No M&I water supply releases are made from the project specifically for downstream M&I water supply purposes. Water released from Walter F. George Dam for hydropower generation purposes, particularly during dry periods, help to ensure a reasonably stable and reliable flow in the Chattahoochee River to the benefit of downstream M&I water supply users. The MeadWestvaco Corporation withdraws water from the Chattahoochee River at river mile 230, near Pittsview in Russell County, Alabama. The plant's water intake is at elevation 178.8 feet NGVD29. When the Walter F. George pool elevation reaches 184.75 feet NGVD29, the pumping capacity reduces to 75 percent. MeadWestvaco has installed emergency pumps at the intake to operate at or below pool elevation 178.8 feet NGVD29 to maintain pumping capacity.

8-07. Hydroelectric Power. The Walter F. George Dam hydropower project, along with 22 other hydropower dams in the southeastern United States, composes the SEPA service area. SEPA sells hydroelectric power generated by Corps plants to a number of cooperatives and municipal power providers, referred to as preference customers. Hydroelectric power is one of the cheaper forms of electrical energy, and it can be generated and supplied quickly as needed in response to changing demand.

Hydropower is produced as peak energy at Walter F. George, i.e., power is generated during the hours that the demand for electrical power is highest, causing significant variations in downstream flows. Daily hydropower releases from the dam vary from zero during off-peak periods to as much as 26,000 cfs, which is turbine capacity. Often, the weekend releases are lower than those during the weekdays. Figure 8-1 shows effects of a typical release pattern from the powerhouse.

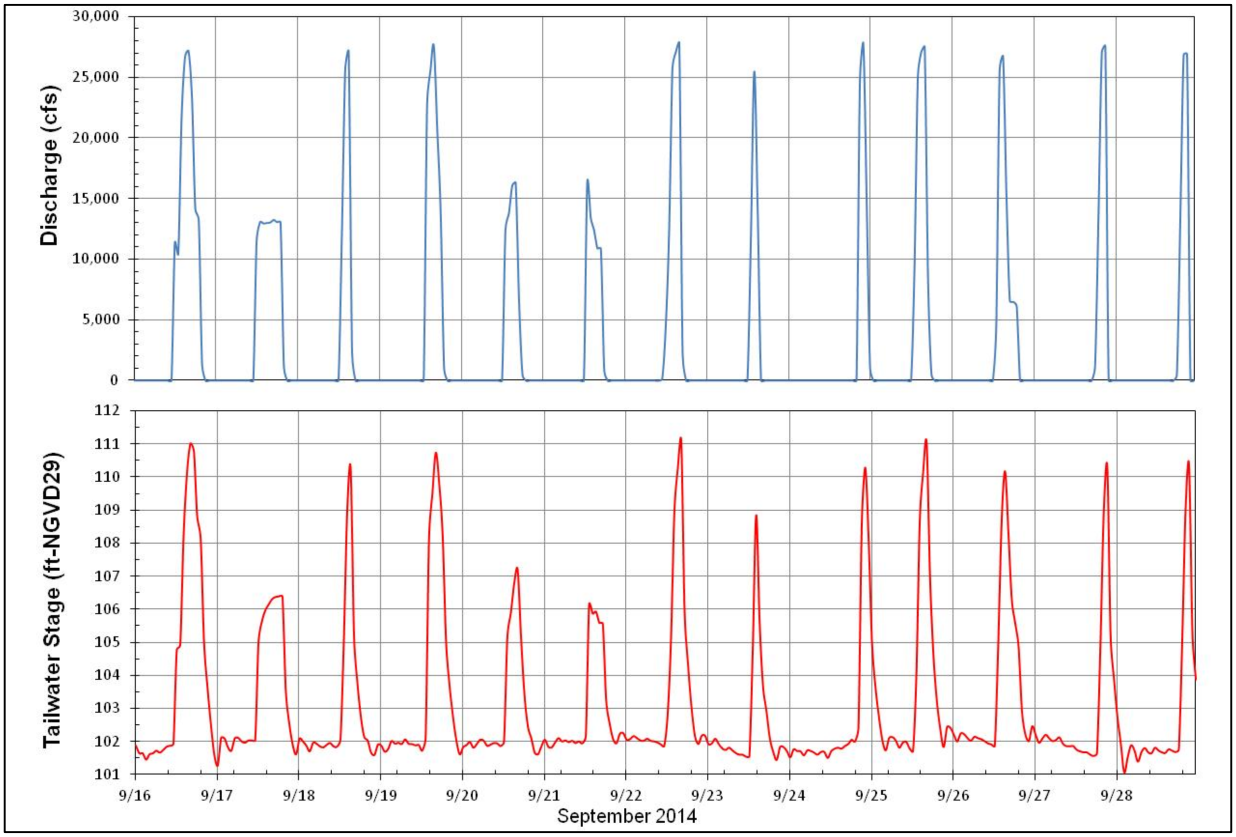


Figure 8-1. Discharges and Tailwater Stages at the Walter F. George Powerhouse

Projects with hydropower capability provide three principal power generation benefits:

a. Hydropower helps to ensure the reliability of the electrical power system in the SEPA service area by providing dependable capacity to meet annual peak power demands. For most plants, that condition occurs when the reservoir is at its maximum elevation. Dependable capacity at hydropower plants reduces the need for additional coal, gas, oil, or nuclear generating capacity.

b. Hydropower projects provide a substantial amount of energy at a small cost relative to thermal electric generating stations, reducing the overall cost of electricity. Hydropower facilities reduce the burning of fossil fuels, thereby reducing air pollution. Between 1964 and 2013, the Walter F. George powerhouse produced an annual average of 420,994 megawatt hours (MWH) per calendar year, with a minimum of 19,755 and a maximum of 616,655 MWH, dependent upon water availability.

c. Hydropower has several valuable operating characteristics that improve the reliability and efficiency of the electric power supply system, including efficient peaking, a rapid rate of unit unloading, and rapid power availability for emergencies on the power grid.

Hydropower generation by the Walter F. George Dam hydropower plant, in combination with the other hydropower power projects in the ACF Basin, helps to provide direct benefits to a large segment of the basin's population in the form of relatively low-cost power and the annual return of revenues to the Treasury of the United States. Hydropower plays an important role in meeting the electrical power demands of the region.

8-08. Navigation. The Walter F. George Lock and Dam Project supports the authorized navigation purpose of the ACF System by providing a 9.0-foot navigation depth to Columbus, Georgia, and by water releases from the dam to support navigation depths downstream of the project. Navigation depths in the Walter F. George Lake usually result from maintaining the reservoir elevation at or above minimum operating level of 188.0 feet NGVD29. Although the project does not make releases specifically for navigation purposes, generally, water releases made from Walter F. George Lock and Dam that benefit navigation on the ACF System are incidental to its hydropower operations. The operation of all the ACF Basin reservoirs as a coordinated and balanced system provides for the current capabilities to support navigation on the ACF Waterway.

Construction of the 9.0-foot navigation channel in the ACF Basin, including construction of bendway easings, cutoffs, and training dike structures, began in 1957. Over the years and through the 1970s, additional cutoffs and river training structures were constructed to increase the ease and safety of barge tows navigating the river channel and to reduce costs of maintaining the system. The project authorization required local interests, consisting of six Florida counties bordering the Apalachicola River, to provide public port facilities and all lands, easements, rights-of-way and disposal areas for construction and maintenance of the navigation channel in the Apalachicola River. However, in 1988 the counties formally rescinded their commitments to provide local sponsorship for the project because of financial concerns. Subsequently, the Corps' efforts to maintain the navigation channel was largely through the use of within-bank disposal areas subject to federal navigation servitude, which required no easements from local sponsors. Because of sustained drought conditions, dredging was not conducted in 2000, only limited dredging was completed in 2001, and no dredging has been conducted since 2001 because of a combination of flow conditions, funding restrictions and, as of October 2005, the lack of water quality certification from Florida.

As much as 1.2 million tons of cargo moved on the ACF Waterway as recently as 1985. The principal commodity was sand and gravel, which is not dependent on navigable depths on the Apalachicola River and can move economically at shallower depths than can some other commodities. The next most important products were petroleum products and fertilizers. Commercial waterborne traffic has continually declined in recent years as difficulties in maintaining the project and providing a reliable channel have increased. Repeated drought conditions since the 1980s resulted in dramatic reductions in commercial traffic on the waterway. More recently, since 2000, a reliable channel has not been provided and channel availability has been dependent on available flows. As a result, commercial barge commodity shipments have fallen from near 600,000 tons before the start of drought conditions in 1998 to none in 2006 and later. No reported commercial navigation use occurs on the ACF waterway below Jim Woodruff Lock and Dam since the waterway users have negotiated contractual agreements for truck or rail transportation.

In 2012, in accordance with the Corps Inland Marine Transportation System guidance, Walter F. George Lock was classified as Level of Service (LOS) 6. Level of Service 6 requires that the lock be operated for commercial traffic by appointment only. However, maintenance staff mans the lock 10 hours per day, 5 days per week. Table 8-4 contains calendar years 2005 - 2013 lock usage information from the Corps' Lock Performance Monitoring System regarding navigation activity through Walter F. George Lock and Dam. The system contains the numbers of lockages for commercial and non-commercial vessels and tonnages of various commodities passing through the lock.

Table 8-4. Navigation Activity at Walter F. George Lock and Dam

Lockages/vessels (number)	**CY2013**	**CY2012**	**CY2011**	**CY2010**	**CY2009**	**CY2008**	**CY2007**	**CY2006**	**CY2005**
Barges Empty									
Barges Loaded						1			
Commercial Lockages						2			
Commercial Vessels	1					3	96	1	4
Non-Commercial Lockages	7	11	10	20	21	24	10	13	13
Non-Commercial Vessels	7	11	10	20	21	24	10	13	13
Recreational Lockages	173	183	231	313	278	226	246	279	254
Recreational Vessels	335	359	531	648	611	321	486	591	294
Total Lockages	180	194	241	333	299	252	256	292	267
Total Vessels	343	370	541	668	632	348	592	605	311
Commodities (tons)									
Crude Material Except Fuels									
Equipment and Machinery						50			
Total, All Commodities						50			

Coordination with the previous waterway users in the ACF Basin identified the need for changes in the Corps' water control operations to provide a more reliable flow regime, without dredging, to support at least a 7.0-foot navigation channel in the Apalachicola River. Based upon Apalachicola River navigation channel surveys, a flow of 16,200 cfs at the Blountstown gage, about 20 miles below Jim Woodruff Lock and Dam, is required to provide for a 7.0-foot channel. This flow requirement assumes no maintenance dredging is performed in the navigation channel. Through an iterative hydrologic modeling process, it was determined that a five month navigation season, January thru May of each year, could be provided that would improve navigation reliability without significantly affecting other project purposes. The 5-month navigation season recommended for implementation on the ACF Waterway can, in the absence of maintenance dredging, improve the total reliability of a 7.0-foot navigation channel in the Apalachicola River from 21 percent to as much as 42 percent. For a 7.0-foot channel that is at least 90 percent reliable for any single navigation season, the total reliability over the period of record would improve from the present 36 percent to 54 percent during the navigation season.

8-09. Drought Contingency Plans. The importance of drought contingency plans has become increasingly obvious as more demands are placed on the water resources of the basin. During low-flow conditions, the system might not be able to fully support all project purposes. Several drought periods have occurred since construction of Walter F. George Dam in 1963. The duration of low flows can be seasonal or they can last for several years. Some of the more extreme droughts occurred in the early and mid 1980's, and most recent time period between late1998 to mid-2009. There were periods of high flows during these droughts but the lower than normal rainfall trend continued.

The purpose of drought planning is to minimize the effect of drought, to develop methods for identifying drought conditions, and to develop both long- and short-term measures to be used to respond to and mitigate the effects of drought conditions. During droughts, reservoir regulation techniques are planned to preserve and ensure the more critical needs. Minimum instream flows protect the area below Walter F. George Dam and conservation efforts strengthen the ability to supply water supply needs.

For the Walter F. George Project, the Corps will coordinate water management during a drought with other federal agencies, private power companies, navigation interests, the states, and other interested state and local parties as necessary. Drought operations will be in compliance with the plan for the entire ACF Basin.

8-10. Flood Emergency Action Plans. Normally, all flood risk management operations are directed by the MDO. If, however, a storm of flood-producing magnitude occurs and all communications are disrupted between the district office and project personnel at the Walter F. George powerhouse, emergency operating procedures, as described in Exhibit C, Standing Instructions to Damtenders for Water Control, will begin. If communication is broken after some instructions have been received from the district office, those instructions will be followed for as long as they are applicable.

Flood emergency operations at Walter F. George Dam are the responsibility of the Walter F. George Power Plant Manager and powerhouse operators. It is their responsibility to follow the Emergency Action Plan for the Walter F. George Project. The plans are intended to serve only as temporary guidance for operating a project in an emergency until Mobile District staff can assess the results of real-time hydrologic model runs and issue more detailed instructions to project personnel. The benefits of Flood Emergency Action Plans are to minimize uncertainties in how to operate a project in a flood emergency, to facilitate quick action to mitigate the adverse effects of a flood event, and to provide for emergency action exercises to train operating personnel on how to respond in an actual emergency flood situation.

The Walter F. George Project is not a flood risk management project, however actions occur that are related to flood risk management. The project has an induced surcharge schedule that is followed during large flood events. The induced surcharge schedule is designed to ensure that the project does not create downstream flood flows that are greater than those that would have occurred under natural conditions.

8-11. Frequencies

a. Peak Inflow Probability. The annual peak inflow frequency curve for inflow into Walter F. George Lake is shown on Figure 8-2.

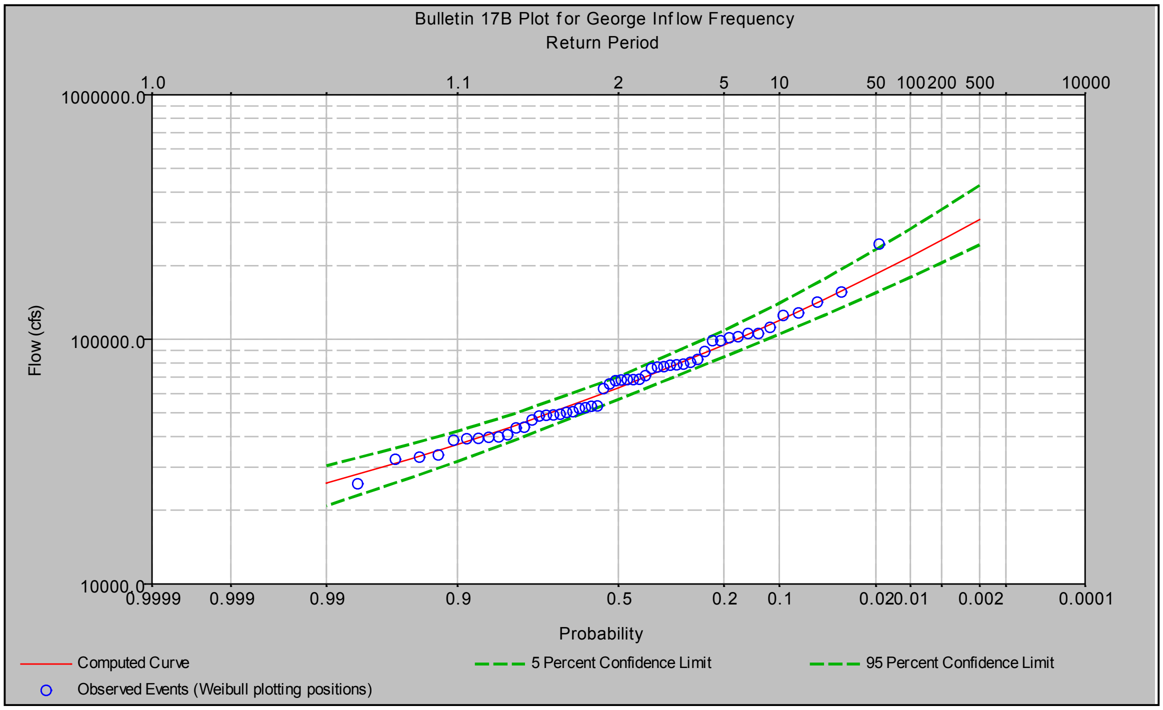


Figure 8-2. Annual Peak Inflow Frequency Curve at Walter F George Lake

b. Pool Elevation Duration and Frequency. The Water Control Plan for the ACF Basin influences the lake levels at Walter F. George Lake. Normal seasonal operating levels range from elevation 188 feet NGVD29 in the winter to elevation 190 feet NGVD29 in the summer. Figure 8-3 shows the annual pool elevation duration. Three curves are presented: the observed data from the project, as well as model results from the previous water control plan and the updated water control plan presented in this manual.

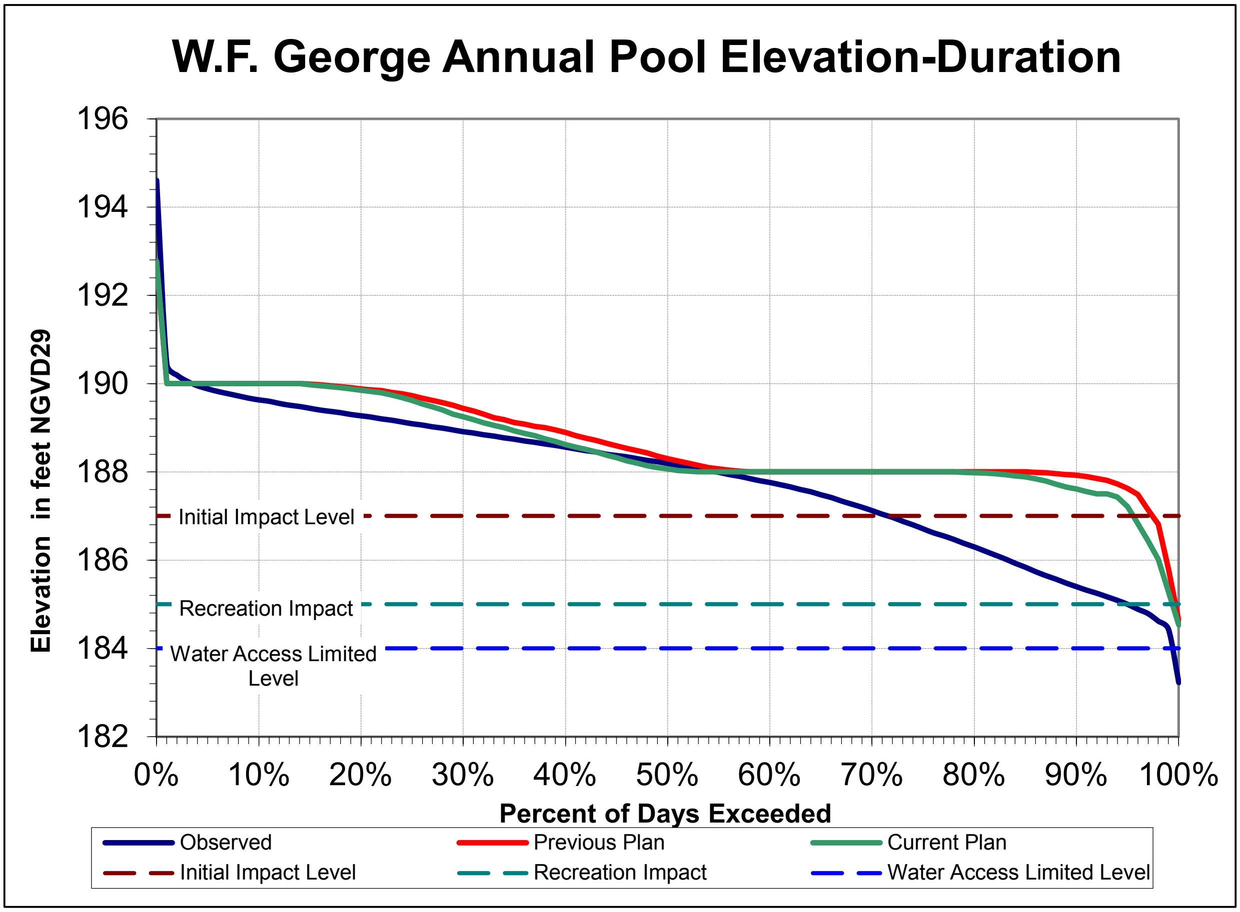


Figure 8-3. Walter F. George Pool Elevation Duration for Observed and Modeled Data

8-12. Other Studies - Examples of Regulation. The inflow, outflow, and pool elevations at the Walter F. George Project are plotted on Plates 4-2 through 4-14. The plots present the daily regulation for the project. An examination of the information presented reveals both short-term and seasonal redistribution of flows.

Reservoir development and other water uses in the ACF Basin contribute to an altered flow regimen. Consumptive uses and the existence of reservoirs have altered the volume and timing of flows. Table 8-5 and Figure 8-4 compare the monthly observed and unimpaired flows above the Walter F. George Project at Columbus, Georgia. The effects of West Point, Buford, and other uses are reflected in those displays. Table 8-6 and Figure 8-5 present the same data for the Blountstown gage on the Apalachicola River. Effects throughout the basin are reflected in those displays.

Table 8-5. Columbus Average Flow for 1960 - 2011 (cfs)

	Observed avg flow	Unimpaired avg flow	Avg daily gain or loss due to redistribution and losses
Jan	8,315	9,233	-918
Feb	10,371	10,826	-455
Mar	11,466	12,477	-1,011
Apr	9,341	10,255	-914
May	6,607	7,428	-821
June	5,233	5,599	-366
July	5,171	5,065	106
Aug	4,921	4,421	500
Sept	4,433	3,895	538
Oct	4,367	4,153	213
Nov	5,319	5,407	-87
Dec	7,174	7,210	-35
Total	82,717	85,968	-3,251
Average	6,893	7,164	-271

Notes:
There are average yearly losses of 3,251 month-second-feet (average flow for a month in cfs).
Reservoir redistribution reduces flows from February through July and December. Flows increased from August through November.

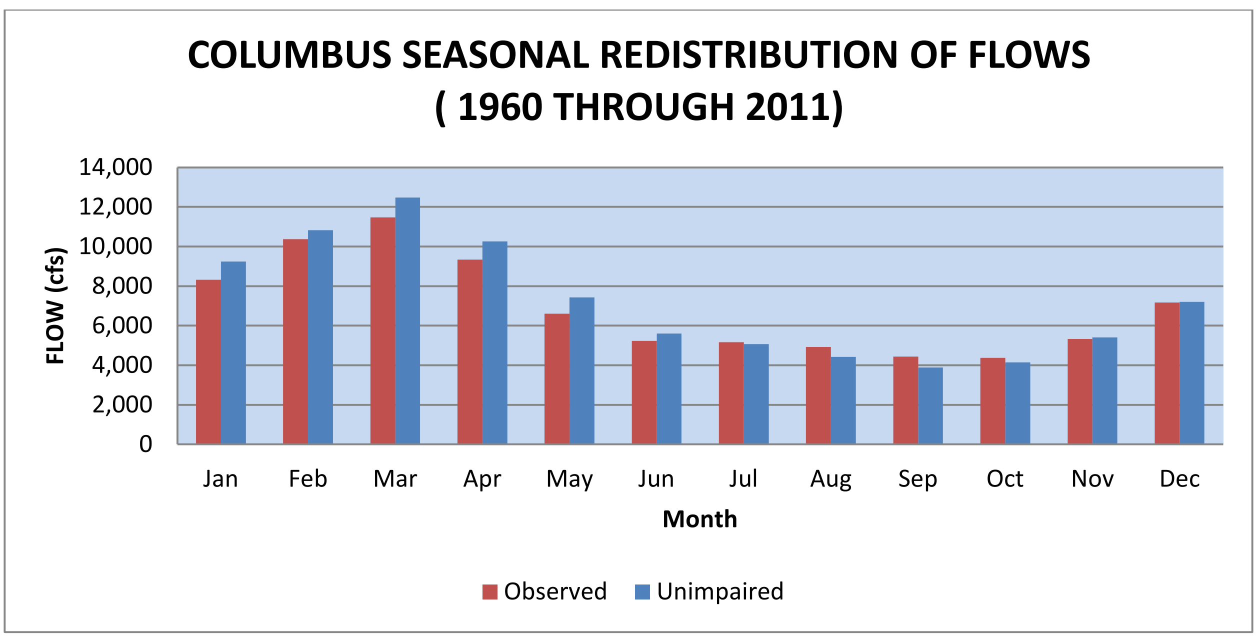


Figure 8-4. Seasonal Redistribution of Flows, Columbus, Georgia, 1960 – 2011

Table 8-6. Blountstown Average Flow for 1960 - 2011 (cfs)

	Observed avg flow	Unimpaired avg flow	Avg daily gain or loss due to redistribution and losses
Jan	27,887	28,914	-1,027
Feb	35,173	35,628	-455
Mar	39,636	41,043	-1,407
Apr	32,950	34,328	-1,379
May	20,849	22,419	-1,570
June	16,662	17,626	-964
July	17,088	17,721	-633
Aug	14,868	14,928	-61
Sept	12,645	12,343	301
Oct	12,550	12,747	-197
Nov	13,662	14,152	-491
Dec	20,758	20,804	-46
Total	264,726	272,654	-7,928
Average	22,060	22,721	-661

Notes: There are average yearly losses of 7,928 month-second-feet (average flow for a month in cfs)
Reservoir redistribution reduces flows from May through October and increases flows from November through April.

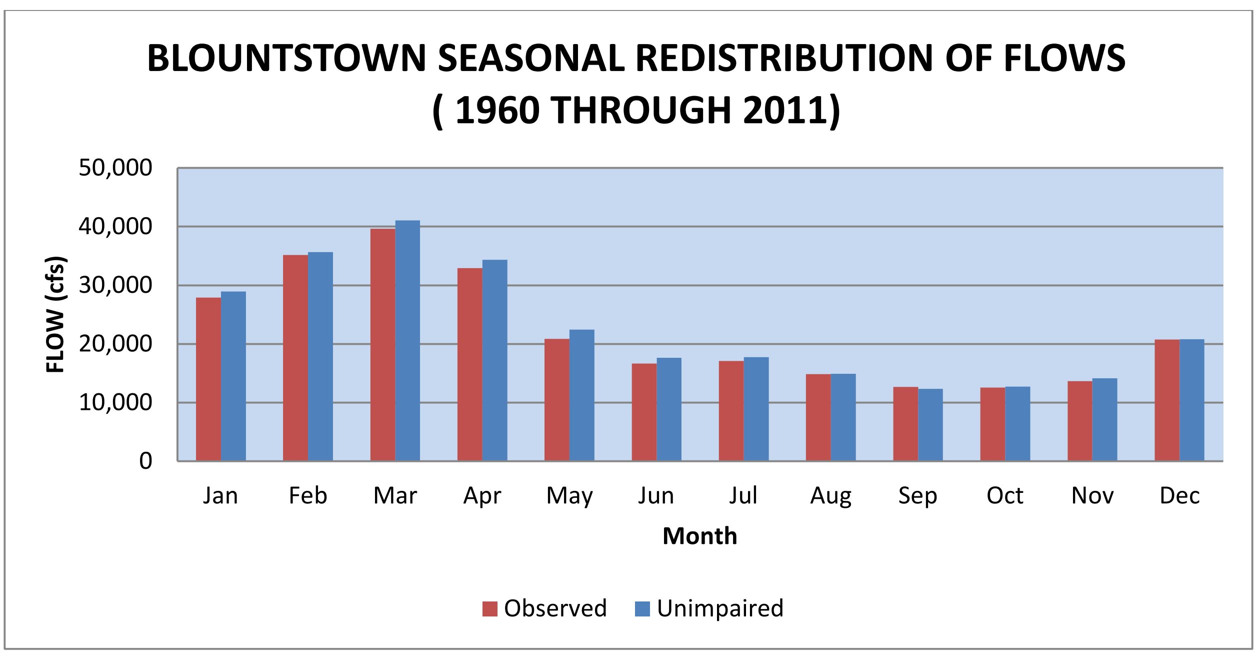


Figure 8-5. Seasonal Redistribution of Flows, Blountstown, Florida 1960 - 2011

IX - WATER CONTROL MANAGEMENT

9-01. Responsibilities and Organization. Responsibilities for developing and monitoring water resources and the environment at the Walter F. George Project are shared by many federal and state agencies including the Corps, U.S. Environmental Protection Agency, National Parks Service, U.S. Coast Guard, USGS, U.S. Department of Energy, U.S. Department of Agriculture, USFWS, and NOAA. Interested state agencies include GAEPD, Georgia Wildlife Resources Division, Alabama Department of Environmental Management (ADEM), Alabama Office of Water Resources (OWR), Northwest Florida Water Management District, Florida Department of Environmental Protection, and Florida Fish and Wildlife Conservation Commission.

a. U.S. Army Corps of Engineers. Authority for water control regulation of the Walter F. George Project has been delegated to the SAD Commander. The responsibility for day-to-day water control regulation activities has been entrusted to the Mobile District. Water control actions for Walter F. George are regulated to meet its federally authorized project purposes at Walter F. George in coordination with other authorized projects in the ACF Basin. It is Mobile District's responsibility to develop water control regulation procedures for the Walter F. George Project. The Mobile District monitors the project for compliance with the approved water control plan. In accordance with the water control plan, the Mobile District performs water control regulation activities that include: determining project water releases, declaring water availability for authorized purposes daily, projecting daily and weekly reservoir pool levels and releases, preparing weekly river basin status reports, tracking and projecting basin composite conservation storage, determining and monitoring daily and 7-day basin inflow, managing high-flow regulation and coordinating internally within the Mobile District and externally with basin stakeholders. When necessary, the Mobile District instructs the project operator regarding normal water control regulation procedures, as well as abnormal or emergency situations, such as floods. The project is tended by operators under direct supervision of the Power Project Manager and the Walter F. George Site Manager. The Mobile District communicates directly with the powerhouse operators at the Walter F. George powerhouse and with other project personnel as necessary. The Mobile District is responsible for collecting historical project data, such as lake levels, flow forecasts and weekly basin reports with other federal, state, and local agencies; and the general public. The Mobile District website where this data is provided is: http://www.sam.usace.army.mil/.

b. Other Federal Agencies.

1) National Weather Service (NWS). The NWS is the federal agency in NOAA that is responsible for weather warnings and weather forecasts. With support from the Corps-NWS Cooperative Gaging Program, the NWS forecast offices, along with the Southeast River Forecast Center (SERFC), maintain a network of rainfall and flood reporting stations throughout the ACF Basin. NWS continuously provides current weather conditions and forecasts. The SERFC prepares river forecasts for many locations throughout the ACF Basin and provides the official flood stage forecasts along the ACF Rivers. Often, the SERFC prepares predictions on the basis of *what if scenarios*, such as Quantitative Precipitation Forecasts (QPFs). The QPF is a prediction of the spatial precipitation across the United States and the region. The Corps, NWS, and SERFC share information regarding rainfall, project data, and streamflow forecasts. In addition, the NWS provides information on hurricane forecasts and other severe weather conditions. They monitor drought conditions and provide the information to the public. The National Integrated Drought Information System is available for the ACF Basin at website www.drought.gov. This website provides a single source of information regarding drought

conditions by sharing information gathered from the NOAA Climate Prediction Center, the Corps, state agencies, universities, and other pertinent sources of data through the drought portal.

2) U.S. Geological Survey (USGS). The USGS is an unbiased, multidisciplinary science organization that focuses on biology, geography, geology, geospatial information, and water. The agency is responsible for the timely, relevant, and impartial study of the landscape, natural resources, and natural hazards. Through the Corps USGS Cooperative Gaging program, the USGS maintains a comprehensive network of gages in the ACF Basin. The USGS Water Science Centers in Alabama, Florida, and Georgia publish real-time reservoir levels, river and tributary stages, and flow data through the USGS National Weather Information Service Web site. The Mobile District uses the USGS to operate and maintain project water level gaging stations at each federal reservoir to ensure the accuracy of the reported water levels.

3) Southeastern Power Administration (SEPA). SEPA was created in 1950 by the Secretary of the Interior to carry out the functions assigned to the secretary by the Flood Control Act of 1944. In 1977, SEPA was transferred to the newly created U.S. Department of Energy. SEPA, headquartered in Elberton, Georgia, is responsible for marketing electric power and energy generated at reservoirs operated by the Corps. The power is marketed to almost 500 preference customers in Georgia, Florida, Alabama, Mississippi, southern Illinois, Virginia, Tennessee, Kentucky, North Carolina, and South Carolina.

i. The objectives of SEPA are to market electricity generated by the federal reservoir projects, while encouraging its widespread use at the lowest possible cost to consumers. Power rates are formulated using sound financial principles. Preference in the sale of power is given to public bodies and cooperatives, referred to as preference customers. SEPA does not own transmission facilities and must contract with other utilities to provide transmission, or *wheeling* services, for the federal power.

ii. SEPA's responsibilities include the negotiation, preparation, execution, and administration of contracts for the sale of electric power; preparation of repayment studies to set wholesale rates; the provision, by construction, contract or otherwise, of transmission and related facilities to interconnect reservoir projects and to serve contractual loads; and activities pertaining to the operation of power facilities to ensure and maintain continuity of electric service to its customer.

iii. SEPA schedules the hourly generation for the Walter F. George power project at the direction of the Corps on the basis of daily and weekly water volume availability declarations.

4) U.S. Fish and Wildlife Service (USFWS). The USFWS is an agency of the Department of the Interior whose mission is working with others to conserve, protect and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people. The USFWS is the responsible agency for the protection of federally listed threatened and endangered species and their federally designated critical habitat in accordance with the Endangered Species Act of 1973. The USFWS also coordinates with other federal agencies under the auspices of the Fish & Wildlife Coordination Act. The Corps, Mobile District, with support from the Water Management Section, coordinates water control actions and management with USFWS in accordance with both laws.

c. State Agencies

1) Alabama. The Alabama Office of Water Resources (OWR) administers programs for river basin management, river assessment, water supply assistance, water conservation, flood mapping, the National Flood Insurance Program and water resources development. Further, OWR serves as the state liaison with federal agencies on major water resources related projects, conducts any special studies on instream flow needs, and administers environmental education and outreach programs to increase awareness of Alabama's water resources.

i. The Alabama Department of Environment Management (ADEM) Drinking Water Branch works closely with the more than 700 water systems in Alabama that provide safe drinking water to four million citizens.

ii. The Alabama Chapter of the Soil and Water Conservation Society fosters the science and the art of soil, water, and related natural resource management to achieve sustainability.

iii. The Alabama Department of Conservation and Natural Resources has responsibility for both freshwater and saltwater fisheries in the state.

2) Georgia. The Department of Natural Resources (GADNR) has statewide responsibilities for the management and conservation of Georgia's natural and cultural resources. Within GADNR, the Georgia Environmental Protection Division (GAEPD) conducts water resource assessments to determine a sound scientific understanding of the condition of the water resources, in terms of the quantity of surface water and groundwater available to support current and future in-stream and off-stream uses and the capacity of the surface water resources to assimilate pollution. Regional water planning councils in Georgia prepare recommended Water Development and Conservation Plans. Those regional plans promote the sustainable use of Georgia's waters through the selection of an array of management practices, to support the state's economy, to protect public health and natural systems, and to enhance the quality of life for all citizens. Georgia Wildlife Resources Division protects non-game and endangered wildlife in the state.

3) Florida. The Northwest Florida Water Management District stretches from the St. Marks River Basin in Jefferson County to the Perdido River in Escambia County. The district is one of five water management districts in Florida created by the Water Resources Act of 1972. In the district's 11,305-square-mile area are several major hydrologic (or drainage) basins: Perdido River and Bay System, Pensacola Bay System (Escambia, Blackwater, and Yellow rivers), Choctawhatchee River and Bay System, St. Andrew Bay System, Apalachicola River and Bay System, and St. Marks River Basin (Wakulla River). The district is a cooperating agency with the Corps and USGS for operating and maintaining the Apalachicola River at Chattahoochee, Florida stream gage downstream of the Jim Woodruff Project.

i. The Florida Department of Environmental Protection has the primary role of regulating public water systems in Florida.

ii. The Florida Fish and Wildlife Conservation Commission has responsibility for both freshwater and saltwater fisheries in the state.

d. Georgia Power Company. The Georgia Power Company is an electric utility headquartered in Atlanta, Georgia. It is the largest of the four electric utilities owned and operated by Southern Company. Georgia Power Company is an investor-owned, tax-paying public utility serving more than 2.25 million customers in all but four of Georgia's 159 counties.

It employs approximately 9,000 workers. It owns and operates 20 hydroelectric dams, 14 fossil fueled generating plants, and two nuclear power plants that provide electricity to more than two million customers.

e. Stakeholders. Many non-federal stakeholder interest groups are active in the ACF Basin. The groups include lake associations, M&I water users, navigation interests, environmental organizations, and other basin-wide interests groups. Coordinating water management activities with these interest groups, state and federal agencies, and others is accomplished as required on an ad-hoc basis and on regularly scheduled water management teleconferences that occur during unusual flood or drought conditions to share information regarding water control regulation actions and gather stakeholder feedback. The Master Manual includes a list of state and federal agencies and active stakeholders in the ACF Basin that have participated in the ACF Basin water management teleconferences and meetings.

9-02. Interagency Coordination

Local Press and Corps Bulletins. The local press includes any periodic publications in or near the West Point Watershed and the ACF Basin. Montgomery, Alabama, and Columbus, Georgia, have some of the larger daily newspapers which often publish articles related to the rivers and streams in the vicinity of the project. Their representatives have direct contact with the Corps through the Public Affairs Office. The Corps and the Mobile District publish e-newsletters regularly which are made available to the general public via email and postings on various websites. Complete, real-time information is available at the Mobile District's Water Management homepage http://water.sam.usace.army.mil/. The Mobile District Public Affairs Office issues press releases as necessary to provide the public with information regarding Water Management issues and activities.

9-03. Framework for Water Management Changes. Special interest groups often request modifications of the basin water control plan or project specific water control plan. The Walter F. George Project and other ACF Basin projects were constructed to meet specific, authorized purposes, and major changes in the water control plans would require modifying, either the project itself or the purposes for which the projects were built. However, continued increases in the use of water resources demand constant monitoring and evaluation of reservoir regulations and systems to ensure their most efficient use. Within the constraints of congressional authorizations and engineering regulations, the water control plan and operating techniques are often reviewed to see if improvements are possible without violating authorized project functions. When deemed appropriate, temporary variances to the water control plan approved by SAD can be implemented to provide the most efficient regulation while balancing the multiple purposes of the ACF Basin-wide System.

EXHIBIT A

SUPPLEMENTARY PERTINENT DATA

EXHIBIT A
SUPPLEMENTARY PERTINENT DATA

STREAM FLOW

Drainage area at dam site - square miles	7,460
Drainage area (dam to West Point Dam) - square miles	4,020
Minimum mean daily discharge, 19 October 1954, (affected by upstream regulation at existing power dams) - cfs	980
Minimum mean monthly flow (Oct. 1931) - cfs	1,758
Maximum mean monthly pre dam flow (Mar. 1929) - cfs	92,600
Maximum known pre dam flow (17 Mar. 1929) - cfs	203,000
Average annual pre dam flow (Aug. 1928 - Dec. 1961) - cfs	9,992
Average annual flow since dam completed (Apr. 1963 - Dec. 2013) - cfs	9,155
Discharge at bankfull stage (above George A. Andrews) - cfs	65,000
Discharge at bankfull stage (George A. Andrews to Jim Woodruff) - cfs	40,000
Minimum mean monthly flow at damsite post construction (Jul. 2008) - cfs	1,540
Maximum mean monthly flow at damsite post construction (Apr. 1964) - cfs	42,137
Maximum known flow at damsite post construction (17 Mar. 1990) - cfs	403,800

SPILLWAY DESIGN FLOOD

Total rainfall, Buford Dam to Walter F. George Dam - inches	16.10
Initial loss – inches	0.00
Average infiltration rate - inches per hour	0.05
Total storm runoff - inches	13.30
Total volume of storm runoff - acre feet	5,291,626
Peak rates of flow	
Natural flow at dam site - cfs	542,000
Inflow to full reservoir - cfs	767,800
Reservoir outflow - cfs	653,000
Base flow - cfs	13,000
Duration of flood - days	9

STANDARD PROJECT FLOOD

Total rainfall, Buford Dam to Walter F. George Dam - inches	8.37
Initial loss - inches	0.00
Average infiltration rate - inches per hour	0.05
Total storm runoff - inches	6.69
Total volume of storm runoff - acre feet	2,305,000
Peak rates of flow	
Natural flow at dam site - cfs	261,000
Inflow to full reservoir - cfs	380,300
Reservoir outflow - cfs	269,000
Base flow - cfs	13,000
Duration of flood - days	6

PERTINENT DATA (Cont'd)

RESERVOIR

Pool elevations - feet NGVD29	
Maximum pool, spillway design flood (initial pool, elevation 190).	206.6
Maximum pool, standard project flood (initial pool elevation 190).	200.1
Top of Conservation Pool	
Summer	190.0
Winter	188.0
Minimum conservation pool	184.0
Storage volumes - acre feet	
Total volume at full summer pool (elevation 190 feet NGVD29)	934,400
Total volume at full winter pool (elevation 188 feet NGVD29)	847,100
Conservation storage, (190 to 184 feet NGVD29)	244,400
Total Inactive storage, (below elevation 184 feet NGVD29)	690,000
Reservoir areas - acres	
Full summer pool, (elevation 190 feet NGVD29)	45,181
Full winter pool, (elevation 188 feet NGVD29)	42,210
Bottom of conservation pool, (elevation 184 feet NGVD29)	36,375
Area within taking line - acres	
Purchased in fee simple	51,540
Right to inundate acquired by easement	27,809
Within Fort Benning military reservation	9,350
Riverbed	2,900
Total	91,599
Maximum elevation of clearing - feet NGVD29	192.0
Minimum elevation of clearing - feet NGVD29l	175.0
Area cleared - acres	14,630
Length of shoreline at elevation 190 - miles	640
Length of reservoir at elevation 190 - miles	85

TAILWATER ELEVATIONS

Normal, no flow - feet NGVD29	102.0
Normal, one turbine operating (5,500 cfs) - feet NGVD29	103.2
Normal, full powerhouse flow (26,000 cfs)- feet NGVD29	113.0
Bankfull (65,000 cfs) - feet NGVD29	130.0
Highest known flood - feet NGVD29	158.0

DAM/EARTH DIKES

Total length - feet	12,128
Length on right bank - feet	6,124
Length on left bank - feet	6,004
Top elevation - feet NGVD29	215.0
Maximum height - feet	68.0
Top width - feet	30.0

PERTINENT DATA (Cont'd)

SPILLWAY SECTION

Total length including end piers - feet	708
Net length - feet	588
Number of piers, including end piers	15
Width of piers - feet	8
Elevation of crest - feet NGVD29	163.0
Elevation of service bridge - feet NGVD29	208.08
Type of gates	Tainter
Size of gates - feet	42 X 29
Elevation top of gates - feet NGVD29	192.0
Number of gates	14
Elevation of high level apron - feet NGVD29	99.0
Number of bays, high level apron	8
Elevation of low level apron - feet NGVD29	94.0
Number of bays, low level apron	6
Length of high level apron - feet	89.5
Length of low level apron - feet	86.0
Maximum allowable head differential - feet	88.0

LOCK

Maximum lift - feet	88.0
Chamber width - feet	82.0
Nominal chamber length - feet	450
Distance center to center of pintles - feet	505
Freeboard at lower guide and guard was when lock becomes inoperative - feet	1
Percent of time lock will be inoperative	58
Type of gates	Miter
Height of upper gate - feet	36.0
Height of lower gate - feet	108.0
Type of culvert valves	Reverse Tainter
Dimensions of culverts - feet	12 X 12
Elevations - feet NGVD29	
Top of upper guide and guard walls	197.0
Top of walls at upper gate blocks	208.0
Top of chamber walls	197.0
Top of lower guide and guard walls	147.0
Top of upper miter sill	172.0
Top of lower miter sill	89.0
Chamber floor	88.0
Elevation top of stoplogs, downstream	89.0
Elevation top of stoplogs, upstream	172.0
Total time required to fill lock chamber, starting with valves closed - minutes	13.0
Total time required to empty lock chamber, starting with valves closed - minutes	12.5

PERTINENT DATA (Cont'd)

POWER PLANT

Length of foundation - feet	335
Width of foundation of powerhouse and intake - feet	168
Number of units	4
Spacing of units - feet	67
Type of turbines	Adjustable blade, propeller/type
Type of scroll case	Concrete
Elevation of distributor - feet NGVD29	103.0
Elevation of bottom of draft tube - feet NGVD29	57.5
Length of draft tube - feet	66.5
Type of draft-tube gate	Sliding
Number of draft-tube gates per unit	2
Size of draft-tube gates - feet	24 x 22
Type of operation for draft-tube gates	Gantry Crane
Generator rating, each unit - kW	42,000
Generator rating, each unit - kVA	46,666
Generator speed - rpm	112.5
Generator electrical characteristics	3 phase, 60 cycle 13,800 volts
Location of switchyard	Right bank, downstream
Elevation of switchyard - feet NGVD29	160.5
Transmission voltage - kV	115

POWER DATA

Rated net head - feet	88.0
Rated net head - test	70.0
Minimum net head - feet	37.0
Plant output at rated net head	
Installed capacity at rated power factor - MW	168
Installed capacity at unity power factor - MW	184
Average annual energy (1964 – 2013) - MWH	428,881
Tailwater elevations - feet NGVD29	
All turbines 168 MW (26,000 cfs)	113.0
Three turbines 126 MW (19,500 cfs)	109.0
Two turbines 84 MW (12,000 cfs)	107.0
One turbine 42 MW (5,500 cfs)	104.0
No flow	102.0

EXHIBIT B

UNIT CONVERSIONS
AND
VERTICAL DATA CONVERSION INFORMATION

AREA CONVERSION

UNIT	m^2	km^2	ha	in^2	ft^2	yd^2	mi^2	ac
1 m^2	1	10^{-6}	10^{-4}	1550	10.76	1.196	3.86 X 10^{-7}	2.47 X 10^{-4}
1 km^2	10^{6}	1	100	1.55 X 10^{9}	1.076 X 10^{7}	1.196 X 10^{6}	0.3861	247.1
1 ha	10^{4}	0.01	1	1.55 X 10^{7}	1.076 X 10^{7}	1.196 X 10^{4}	3.86 X 10^{-3}	2,471
1 in^2	6.45 X 10^{-4}	6.45 X 10^{10}	6.45 X 10^{-8}	1	6.94 X 10^{-3}	7.7 X 10^{-4}	2.49 X 10^{-10}	1.57 X 10^{7}
1 ft^2	.0929	9.29 X 10^{-8}	9.29 X 10^{-6}	144	1	0.111	3.59 X 10^{-8}	2.3 X 10^{-5}
1 yd^2	0.8361	8.36 X 10^{-7}	8.36 X 10^{-5}	1296	9	1	3.23 X 10^{-7}	2.07 X 10^{-4}
1 mi^2	2.59 X 10^{6}	2.59	259	4.01 X 10^{9}	2.79 X 10^{7}	3.098 X 10^{6}	1	640
1 ac	4047	0.004047	0.4047	6. 27 X 10^{6}	43560	4840	1.56 X 10^{-3}	1

LENGTH CONVERSION

UNIT	cm	m	km	in.	ft	yd	mi
cm	1	0.01	0.0001	0.3937	0.0328	0.0109	6.21 X 10^{-6}
m	100	1	0.001	39.37	3.281	1.094	6.21 X 10^{-4}
km	10^{5}	1000	1	39,370	3281	1093.6	0.621
in.	2.54	0.0254	2.54 X 10^{-5}	1	0.0833	0.0278	1.58 X 10^{-5}
ft	30.48	0.3048	3.05 X 10^{-4}	12	1	0.33	1.89 X 10^{-4}
yd	91.44	0.9144	9.14 X 10^{-4}	36	3	1	5.68 X 10^{-4}
mi	1.01 X 10^{5}	1.61 X 10^{3}	1.6093	63,360	5280	1760	1

FLOW CONVERSION

UNIT	m^3/s	m^3/day	l/s	ft^3/s	ft^3/day	ac-ft/day	gal/min	gal/day	mgd
m^3/s	1	86,400	1000	35.31	3.05 X 10^{6}	70.05	1.58 X 10^{4}	2.28 X 10^{7}	22.824
m^3/day	1.16 X 10^{-5}	1	0.0116	4.09 X 10^{-4}	35.31	8.1 X 10^{-4}	0.1835	264.17	2.64 X 10^{-4}
l/s	0.001	86.4	1	0.0353	3051.2	0.070	15.85	2.28 X 10^{4}	2.28 X 10^{-2}
ft^3/s	0.0283	2446.6	28.32	1	8.64 X 10^{4}	1.984	448.8	6.46 X 10^{5}	0.646
ft^3/day	3.28 X 10^{-7}	1233.5	3.28 X 10^{-4}	1.16 X 10^{-5}	1	2.3 X 10^{-5}	5.19 X 10^{-3}	7.48	7.48 X 10^{-6}
ac-ft/day	0.0143	5.451	14.276	0.5042	43,560	1	226.28	3.26 X 10^{5}	0.3258
gal/min	6.3 X 10^{-5}	0.00379	0.0631	2.23 X 10^{-3}	192.5	4.42 X 10^{-3}	1	1440	1.44 X 10^{-3}
gal/day	4.3 X 10^{-8}	3785	4.38 X 10^{-4}	1.55 X 10^{-6}	11,337	3.07 X 10^{-6}	6.94 X 10^{-4}	1	10^{-6}
mgd	0.0438		43.82	1.55	1.34 X 10^{5}	3.07	694	10^{6}	1

VOLUME CONVERSION

UNIT	liters	m^3	in^3	ft^3	gal	ac-ft	million gal
liters	1	0.001	61.02	0.0353	0.264	8.1 X 10^{-7}	2.64 X 10^{-7}
m^3	1000	1	61,023	35.31	264.17	8.1 X 10^{-4}	2.64 X 10^{-4}
in^3	1.64 X 10^{-2}	1.64 X 10^{-5}	1	5.79 X 10^{-4}	4.33 X 10^{-3}	1.218 X 10^{-8}	4.33 X 10^{-9}
ft^3	28.317	0.02832	1728	1	7.48	2.296 X 10^{-5}	7.48 X 10^{6}
gal	3.785	3.78 X 10^{-3}	231	0.134	1	3.07 X 10^{-6}	10^{6}
ac-ft	1.23 X 10^{6}	1233.5	75.3 X 10^{6}	43,560	3.26 X 10^{5}	1	0.3260
million gallon	3.785 X 10^{6}	3785	2.31 X 10^{8}	1.34 X 10^{5}	10^{6}	3.0684	1

COMMON CONVERSIONS

1 million gallons per day (MGD) = 1.55 cfs
1 day-second-ft (DSF) = 1.984 acre-ft = 1 cfs for 24 hours
1 cubic foot per second of water falling 8.81 feet = 1 horsepower
1 cubic foot per second of water falling 11.0 feet at 80% efficiency = 1 horsepower
1 inch of depth over one square mile = 2,323,200 cubic feet
1 inch of depth over one square mile = 0.0737 cubic feet per second for one year.

VERTICAL DATUM CONVERSION INFORMATION

Walter F. George Coordinate Comparisions

Mobile District Survey No. 09-026

Note: All State Plane Coordinates are in the North American Datum of 1983 (NAD83), Georgia West Zone, U.S. Survey Foot

Designation	OPUS Results						from NGS Data Sheets			PICES	USGS	USCOE	Desc.
	Northing	Easting	NAVD 88 Elev.				Northing	Easting	NAVD 88 Elev.	NGVD 29 Elev.	NGVD 29 Elev.	NGVD 29 Elev.	
13-2M	593316.769	2018395.881	216.965										SBD
13-502	586284.523	2011297.641	246.853							246.764			FAD COE
JMB III	591791.851	2016665.432	214.471								214.641		FBD COE
PBM-WFG1	593089.644	2017273.397	196.738										FBD Coe
WFG LR	592291.670	2018002.768	196.700										FBC
WFG UR			207.810								207.767		FBC
WFG UL			207.840										FBC
0+00 HD-2			196.860										FBC
Gage Information													
Upper Pool			188.3									188.5	Normal Elev.
Lower Pool			102.3									102.5	Normal Elev.
NGS Control Information													
34 32				591170.928	1985898.831	482.480	591170.985	1985898.793	482.220				FCM AIDOT
34 33				592559.867	1985260.030	496.920	592559.938	1985259.980	496.922				FCM AIDOT

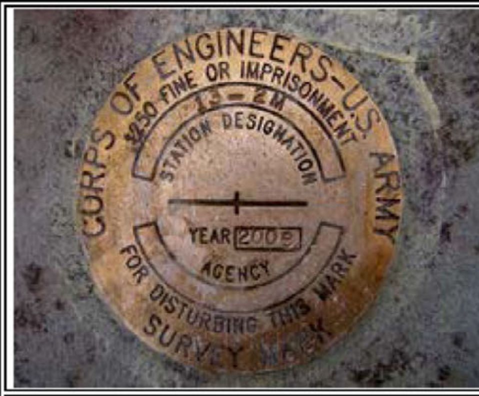
Legend

SBD COE= Set Brass Disc, US Army Corps of Engineers
SBC = Set Brass Cap, GCT LB3501
FBDWD = Found War Department Brass Disc
FBC = Found Brass Cap, Deformation Monitoring Station
FAD COE = Found Aluminum Disc, US Army Corps of Engineers
FBD COE = Found Brass Disc, US Army Corps of Engineers
FCM COE = Found Concrete Monument, US Army Corps of Engineers
FCM USCGS = Found Concrete Monument, United States Coast & Geodetic Survey
FSR USCGS = Found Stainless Steel Rod, United States Coast & Geodetic Survey
FCM Jack = Found Concrete Monument, Jackson County, FL

Geomap Technologies, Inc. / GCT, Inc. *11/24/2009*

SURVEY DATASHEET (Version 1.0)

PID: BBBL68
Designation: 13-2M
Stamping: 13-2M 2009
Stability: Monument will probably hold position well
Setting: Mat foundation or concrete slab other than pavement
Description: 13-2M, Begin at the U.S. Post Office, Fort Gaines, GA; thence go northerly along Hwy. No.39 Â±0.9 miles to paved road to Lock & Dam on left; thence go westerly along said road Â±1.0 miles to "Y" in road. Station is standard COE disc set in the northern side of first concrete deformation structure Â±50' west of "Y' intersection along the northern paved road on the southern side of said northern paved road.
Observed: 2009-09-17T13:35:00Z
Source: OPUS - page5 0909.08



Close-up View

REF_FRAME: NAD_83 (CORS96)	EPOCH: 2002.0000	SOURCE: NAVD88 (Computed using GEOID03)	UNITS: m	SET PROFILE	DETAILS

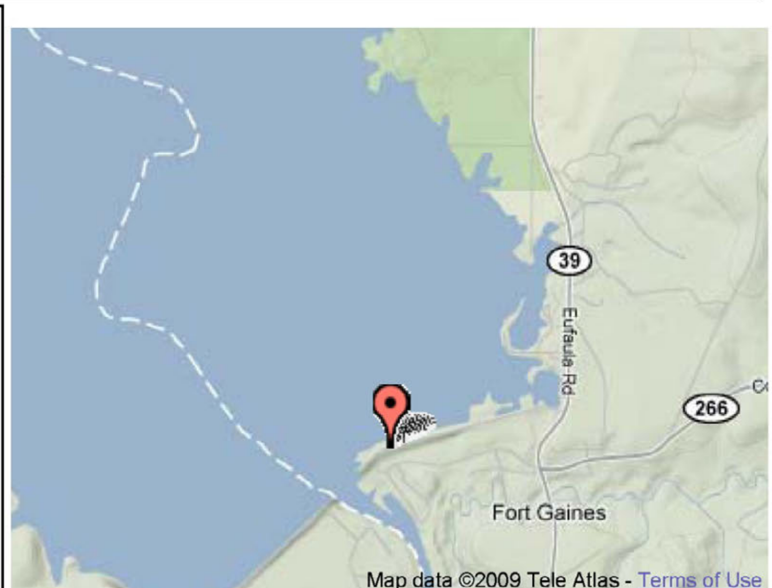
LAT:	31° 37' 41.58460"	± 0.025	m
LON:	-85° 3' 37.74223"	± 0.014	m
ELL HT:	39.738	± 0.044	m
X:	468046.568	± 0.016	m
Y:	-5415636.301	± 0.050	m
Z:	3325421.268	± 0.006	m
ORTHO HT:	66.131	± 0.062	m

	UTM 16	**SPC** 1002(GA W)
NORTHING:	3500860.745m	180843.313m
EASTING:	683948.944m	615208.295m
CONVERGENCE:	1.01737840°	-0.46875051°
POINT SCALE:	1.00001735	0.99998865
COMBINED FACTOR:	1.00001111	0.99998241

CONTRIBUTED BY

wwalker
GCT, Inc.

Horizon View



The numerical values for this position solution have satisfied the quality control criteria of the National Geodetic Survey. The contributor has verified that the information submitted is accurate and complete.

Walter F. George Lock and Dam

EXHIBIT C

STANDING INSTRUCTIONS TO THE DAMTENDERS FOR WATER CONTROL

WALTER F. GEORGE DAM

EMERGENCY FLOOD REGULATION SCHEDULE FOR POWERPLANT OPERATORS

Note: Elevations in parentheses are for May thru November. All other elevations are year-round values.

If any 3-hour average inflow; is not a result of pool surges (which are defined as large fluctuations in pool elevation resulting from wave action due to high winds, a sloshing lake or equipment malfunction) exceeds 40,000 cfs and the reservoir pool rises above elevation 188.0 feet NGVD29, contact Water Management Section personnel as soon as possible if no other prior instructions have been provided. The instructions provided below are to be followed **only** if communications with Water Management Section personnel are not possible.

I. Increasing Inflows

A. Check induced surcharge schedule on Plate 7-4 each hour. If pool level and 3-hour average inflow require a release based on the induced surcharge schedule, commence making combined powerhouse and spillway releases that are equal to that required by the induced surcharge schedule. If the discharge value taken from the induced surcharge schedule is less than the previous hour's discharge, maintain the previous hour's discharge.

B. If no release is required from the induced surcharge schedule and the pool elevation is above 189.0 feet NGVD29 and the 3-hour average inflow is between 40,000 cfs and 50,000 cfs, begin making a discharge that is 8,000 cfs less than the 3-hour average inflow. If inflows rise above 50,000 cfs, follow the induced surcharge schedule.

II. Pool at Crest. Maintain the maximum gate setting reached for 6 hours to ensure that inflow has peaked.

III. Emptying Instructions

A. If peak outflow as determined by induced surcharge schedule is greater than 125,000 cfs, maintain peak outflow until pool falls below elevation 191 feet NGVD29. Then follow a or b below.

a. If peak outflow is more than double the 3-hour average inflow, begin reducing outflow by 5,000 cfs per hour. When the outflow is greater than 10,000 cfs more than the 3-hour average inflow and the pool elevation is below 189 (190.5) feet NGVD29, begin reducing outflow by 1,000 cfs per hour until the pool falls to 188.5 (189.5) feet NGVD29. Then revert to normal operations.

b. If peak outflow is less than double the 3-hour average inflow, reduce outflow to 65,000 cfs or to inflow plus 10,000 cfs, whichever is greater. If this results in an outflow greater than 65,000 cfs, continue passing inflow plus 10,000 cfs until outflow reaches 65,000 cfs. When outflow reaches 65,000 cfs begin reducing outflow at a rate of 1,000 cfs per hour until the pool falls to 188.5 (189.5) feet NGVD29. Then revert to normal operations.

B. If peak outflow as determined by induced surcharge schedule is between 125,000 cfs and 65,000 cfs, maintain outflow until pool falls below 190 feet NGVD29. Then follow a or b below.

a. If peak outflow is more than double the 3-hour average inflow, begin reducing outflow by 5,000 cfs per hour. When the outflow falls below 70,000 cfs reduce outflow by 2,000 cfs per hour. When the outflow reaches 10,000 cfs greater than the 3-hour average inflow and the pool is below 189 (190.5) feet NGVD29, begin reducing outflow by 1,000 cfs per hour until the pool falls to 188.5 (189.5) feet NGVD29. Then revert to normal operations

b. Otherwise, reduce outflow to 65,000 cfs or to inflow plus 10,000 cfs, whichever is greater. If this results in an outflow greater than 65,000 cfs, continue passing inflow plus 10,000 cfs until outflow reaches 65,000 cfs. When outflow reaches 65,000 cfs begin reducing outflow 1,000 cfs per hour until the pool falls to 188.5 (189.5) feet NGVD29. Then revert to normal operations

C. If peak outflow, as determined by induced surcharge schedule, is less than 65,000 cfs, continue passing peak outflow until pool falls to 190 feet NGVD29; if pool is already below 190 feet NGVD29, continue peak outflow until pool begins to drop. Then, reduce outflow by 1,000 cfs per hour until pool recedes to 188.5 (189.5) feet NGVD29. Then revert to normal operations.

Note: In the event the 3-hour average inflow begins increasing again after emptying commences, refer back to the increasing inflows instructions on the previous page. During emptying, when elevation 188.5 (189.5) feet NGVD is reached, revert to normal operations.

Note: Elevations in parentheses are for May thru November; all other elevations are year-round value

EXHIBIT D

DROUGHT CONTINGENCY PLAN

(See Master Manual for draft DCP. Will be added to each appendix before final printing)

EXHIBIT E

HIGH WATER ACTION PLAN

WALTER F. GEORGE LAKE
PLAN FOR HIGH WATER LEVELS
DURING RECREATION SEASON
April 2013

1. **Purpose:** This plan identifies actions necessary to help ensure the public's safe access to the resources and recreational facilities located at Walter F. George Lake, during periods of high water. The actions listed below are to be taken during the recreation season.

2. **Recreation Facilities:** Twenty-four public recreation areas surround the reservoir, including 10 leased areas, four of which contain marinas, four designated swimming areas, six campgrounds, and public 24 boat launching ramps. Thirteen of these recreation areas are Corps operated. There are approximately 1,100 privately-owned boat docks on the reservoir.

3. **Significant Reservoir Levels:** Water levels considered to adversely affect recreational use of Walter F. George Lake, are as follows:

   a. Pool Elevation -189.5 ft., NGVD
   b. Pool Elevation -190.0 ft., NGVD
   c. Pool Elevation -191.0 ft., NGVD
   d. Pool Elevation -192.0 ft., NGVD

4. Potential adverse effects to swimming areas, campgrounds, marinas, boat launching ramps, navigation, and private boat docks, with actions to be taken at each of these pool elevations follow:

   a. <u>Pool Elevation (189.5 ft NGVD)</u>

Recreational impacts caused by high reservoir levels become significant at or near this level. Actions to be taken primarily involve cautioning the public about potential hazards and preparation for worsening conditions.

Conditions	Actions
1. Designated swimming areas may have deeper waters than usual.	1. Advise swimmers of deeper depths and potential hazards. Monitor swimming areas for hazards.
2. Marina operators and other lake users are concerned about changing conditions and projections for future levels.	2. Notify marina operators and other lessees of water level forecast, in coordination with Water Management Officials in District Office. Issue news releases as appropriate.

b. <u>Pool Elevation (190.0 ft NGVD)</u>

Adverse affects to recreation and public safety increase in at this level, and actions are to be taken to identify hazards and inform the public of potentially dangerous conditions.

Conditions	Actions
1. Some designated swimming areas may be affected. Waters may be deeper and beaches may be underwater.	1. Continue to monitor swimming areas for hazards and advise visitors to use caution.
2. Some docks may be affected if adverse weather conditions occur, such as high winds or large waves.	2. Coordinate with District Water Management officials on issuance of news releases to inform the public of water level forecasts and local issues such as boating and swimming hazards.
3. Unmarked navigation hazards such as logs, damaged docks, etc. may be dislodged into the waters.	3. Continue to monitor project area on weekend boat patrol. Mark hazards as necessary. Begin removal of floating hazards as appropriate and feasible.
4. * Some campsites may need to be closed due to water levels. Other campsites will have to be closed due to electrical issues.	4. * Monitor conditions at all campgrounds. Move campers, report status, close facilities and post closure notices as appropriate.

c. <u>Pool Elevation (191.0 ft NGVD)</u>

Conditions worsen at this elevation, severely restricting boat ramp use, camping, and water-related recreation activities. Access to the reservoir may be limited.

Conditions	Actions
1. All swimming areas will be affected. Waters will be deeper and most beaches will be underwater.	1. Continue to monitor swimming areas for hazards and advise visitors to use caution. Floating and sinking debris may wash into designated swimming areas.
2. **Some docks and boat ramps will be affected due to high water levels.	2. **Continue to monitor project area. Closures of some docks and boat ramps may be required.
3. * More campsites may need to be closed.	3. * Monitor conditions at all campgrounds. Move campers, report status, close facilities and post closure notices as appropriate.
4. Marina operations may be affected.	4. Expand distribution for news releases beyond local area. Stress available recreation activities and access points, along with the need for caution, in releases.

Notes:

* Campsites that we have closed in the past due to high water levels.
  Bluff Creek – Sites 83, 84, 85
  Cotton Hill – Sites 19, 20, 72, 73, 74, 75, 76, 77, 78, 79
  Hardridge – 11, 40, 41
  White Oak – 41, 42, 43, 44, 45, 46, 47, 54, 74, 77, 78, 80, 88, 90, 91, 92, 93, 94, 95, 96, 103, 104, 105, 106

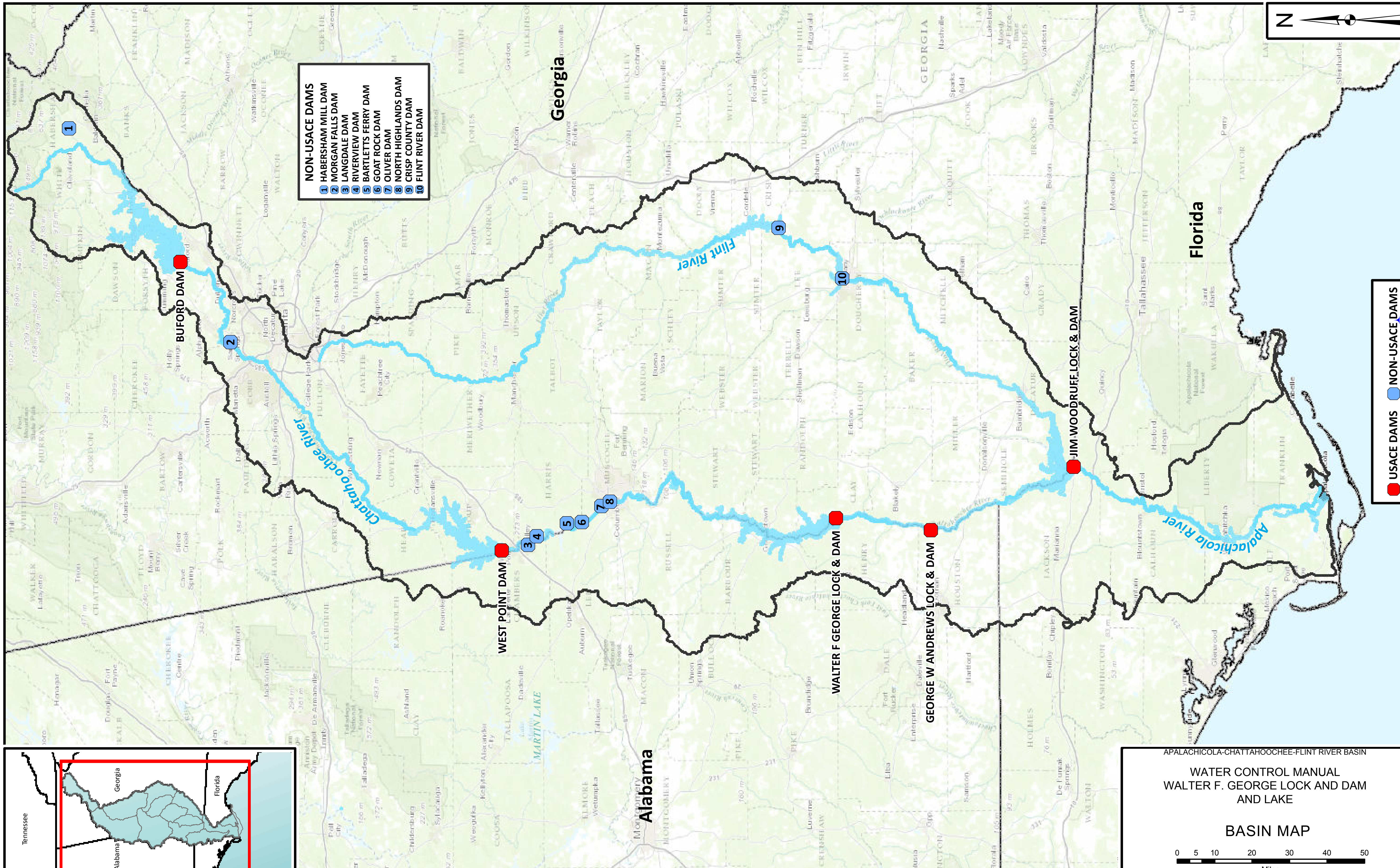
** Boat Ramps that we commonly close due to impacts from high water levels.
  White Oak Boat Ramp
  East Bank Ramp
  Hardridge Creek Day Use Ramp

d. <u>Pool Elevation >192.0 ft NGVD</u>

Conditions at elevations above 191.0, severely impact dock structures and parks and water-related recreation activities. Access to the reservoir is limited.

Conditions	Actions
1. All swimming areas affected. Waters will be deeper and most beaches will be underwater.	1. Close all swimming areas. Floating and sinking debris may wash into designated swimming areas.
2. Docks and boat ramps will be affected due to high water levels.	2. Continue to monitor project area. Closures of most docks and boat ramps required for safety.
3. More campsites, electrical panels and pedestals will be inundated.	3. Continue to monitor conditions at all campgrounds. Move campers, report status, close facilities, deactivate all impacted electrical panels and post closure notices as appropriate. Entire parks may be closed due to flooding and associated dangers.
4. Marina operations affected.	4. Expand distribution for news releases beyond local area. Stress available recreation activities and access points if any, along with the need for extreme caution, in releases.

PLATES


NON-USACE DAMS
1 HABERSHAM MILL DAM
2 MORGAN FALLS DAM
3 LANGDALE DAM
4 RIVERVIEW DAM
5 BARTLETTS FERRY DAM
6 GOAT ROCK DAM
7 OLIVER DAM
8 NORTH HIGHLANDS DAM
9 CRISP COUNTY DAM
10 FLINT RIVER DAM
USACE DAMS
NON-USACE DAMS
N
BUFORD DAM
WEST POINT DAM
WALTER F GEORGE LOCK & DAM
GEORGE W ANDREWS LOCK & DAM
JIM WOODRUFF LOCK & DAM
Chattahoochee River
Flint River
Apalachicola River
Georgia
Florida
Alabama
Tennessee
APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN
WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE
BASIN MAP
0 5 10 20 30 40 50
Miles
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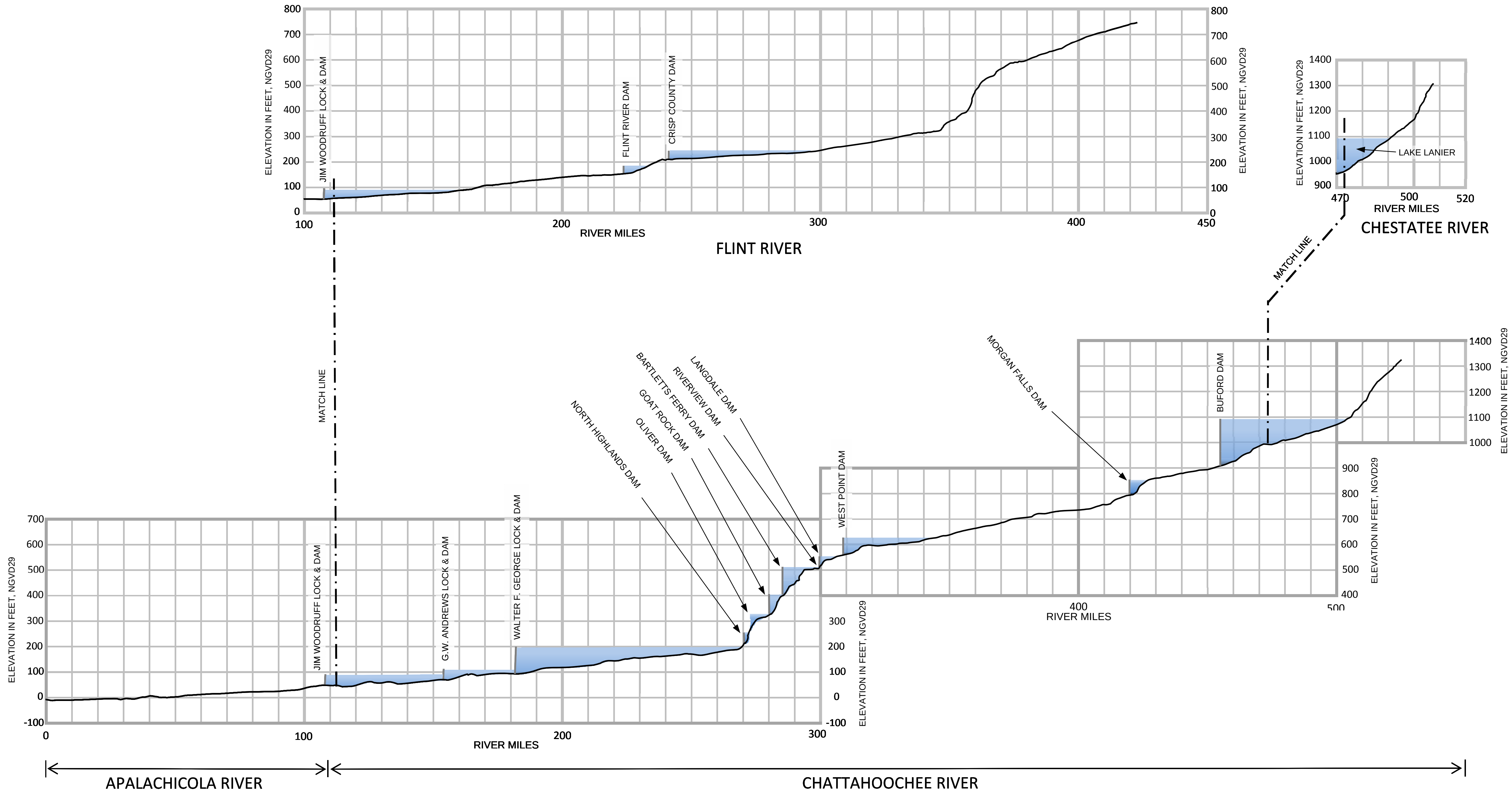

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL

WALTER F. GEORGE LOCK AND DAM AND LAKE

RIVER PROVILE AND RESERVOIR DEVELOPMENT

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN
WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE
LOCATION AND VICINITY MAP

0 5 10 20 30 40
Miles

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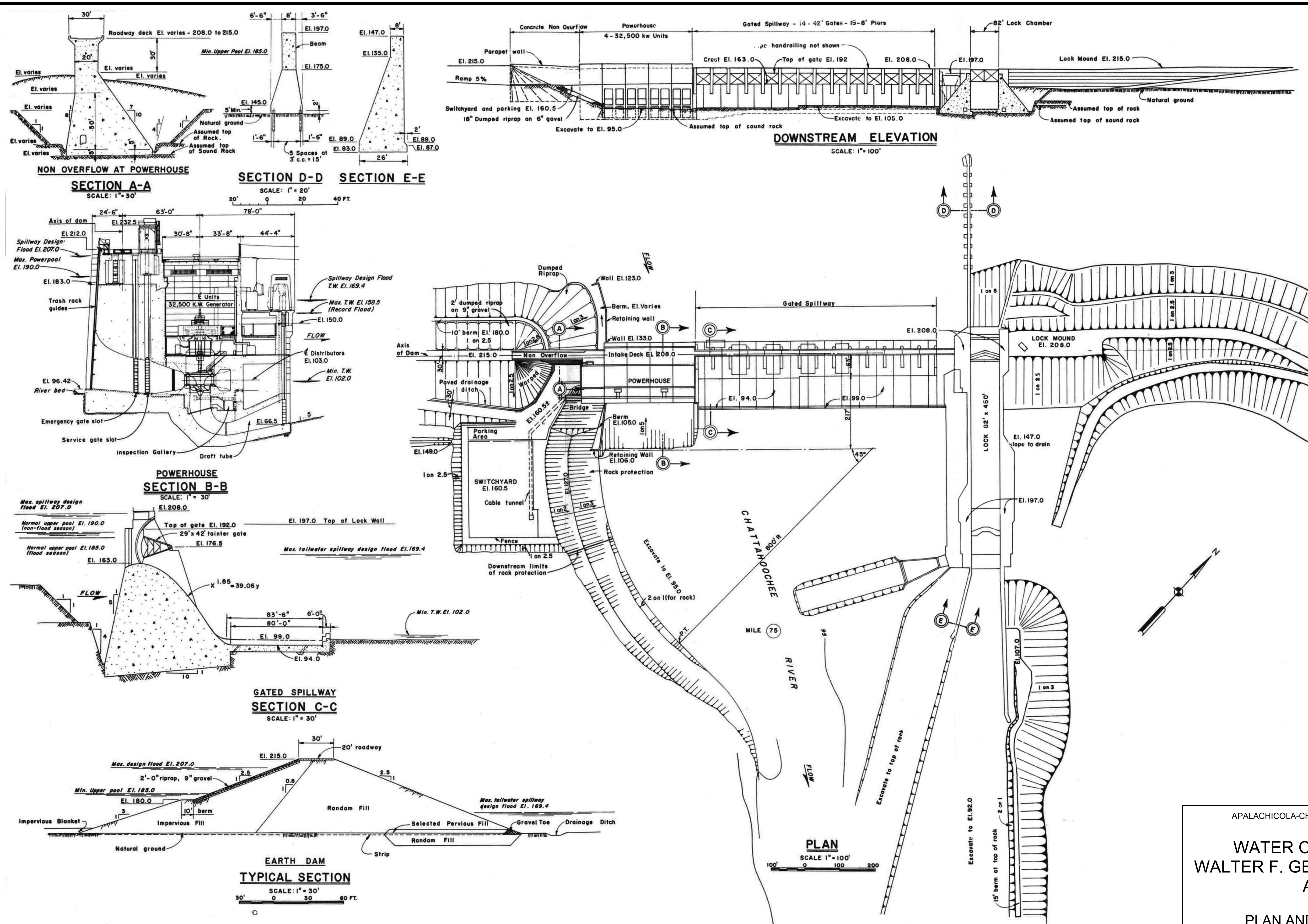


APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

PLAN AND SECTION OF DAM,
POWERHOUSE, AND LOCK

Step number	Gate opening (feet)														Spillway discharge (cfs)												
	Gate number														Pool elevation												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	184	185	186	187	188	189	190	191	192	193	194	195	196
1	0	0	0	0	0	0	0	0	0	0	0	**0.5**	0	0	450	460	470	480	490	500	510	520					
2	0	0	0	0	0	0	0	0	0	**0.5**	0	0.5	0	0	900	920	940	960	980	1,000	1,020	1,040					
3	0	0	0	0	0	0	0	0	0	0.5	0	0.5	**0.5**	0	1,350	1,390	1,420	1,450	1,480	1,500	1,530	1,560					
4	0	0	0	0	0	0	0	0	0	0.5	**0.5**	0.5	0.5	0	1,810	1,850	1,890	1,930	1,970	2,010	2,040	2,080					
5	0	0	0	0	0	0	0	0	**0.5**	0.5	0.5	0.5	0.5	0	2,260	2,310	2,360	2,410	2,460	2,510	2,550	2,600					
6	0	0	0	0	0	0	0	0	0.5	0.5	0.5	0.5	0.5	**0.5**	2,710	2,770	2,830	2,890	2,950	3,010	3,060	3,120					
7	0	0	0	**0.5**	0	0	0	0	0.5	0.5	0.5	0.5	0.5	0.5	3,160	3,230	3,300	3,370	3,440	3,510	3,580	3,640					
8	0	0	0	0.5	0	**0.5**	0	0	0.5	0.5	0.5	0.5	0.5	0.5	3,610	3,690	3,780	3,860	3,930	4,010	4,090	4,160					
9	0	0	0	0.5	0	0.5	0	**0.5**	0.5	0.5	0.5	0.5	0.5	0.5	4,060	4,160	4,250	4,340	4,430	4,510	4,600	4,680					
10	0	**0.5**	0	0.5	0	0.5	0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	4,510	4,620	4,720	4,820	4,920	5,010	5,110	5,200					
11	0	0.5	0	0.5	0	0.5	**0.5**	0.5	0.5	0.5	0.5	0.5	0.5	0.5	4,970	5,080	5,190	5,300	5,410	5,510	5,620	5,720					
12	0	0.5	0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	**0.5**	0.5	0.5	5,420	5,540	5,660	5,780	5,900	6,020	6,130	6,240					
13	0	0.5	0.5	0.5	**0.5**	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5,870	6,000	6,140	6,270	6,390	6,520	6,640	6,760					
14	**0.5**	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	6,320	6,470	6,610	6,750	6,880	7,020	7,150	7,280					
15	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	**1**	0.5	0.5	6,770	6,930	7,080	7,230	7,380	7,520	7,660	7,800					
16	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	**1**	0.5	1	0.5	0.5	7,230	7,390	7,560	7,720	7,870	8,030	8,180	8,330					
17	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	1	**1**	0.5	7,680	7,860	8,030	8,200	8,370	8,530	8,690	8,850					
18	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	**1**	1	1	0.5	8,130	8,320	8,510	8,690	8,860	9,040	9,210	9,380					
19	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	**1**	1	1	1	1	0.5	8,590	8,790	8,980	9,170	9,360	9,540	9,720	9,900					
20	0.5	0.5	0.5	0.5	0.5	5	0.5	0.5	1	1	1	1	1	**1**	9,040	9,250	9,460	9,660	9,860	10,050	10,240	10,420					
21	0.5	0.5	0.5	**1**	0.5	0.5	0.5	0.5	1	1	1	1	1	1	9,490	9,720	9,930	10,140	10,350	10,550	10,750	10,950					
22	0.5	0.5	0.5	1	0.5	**1**	0.5	0.5	1	1	1	1	1	1	9,950	10,180	10,410	10,630	10,850	11,060	11,270	11,470					
23	0.5	0.5	0.5	1	0.5	1	0.5	**1**	1	1	1	1	1	1	10,400	10,640	10,880	11,110	11,340	11,560	11,780	12,000					
24	0.5	**1**	0.5	1	0.5	1	0.5	1	1	1	1	1	1	1	10,860	11,110	11,360	11,600	11,840	12,070	12,300	12,520					
25	0.5	1	0.5	1	0.5	1	**1**	1	1	1	1	1	1	1	11,310	11,570	11,830	12,080	12,330	12,570	12,810	13,040					
26	0.5	1	0.5	1	**1**	1	1	1.0.	1	1	1	1	1	1	11,760	12,040	12,310	12,570	12,830	13,080	13,330	13,570					
27	0.5	1	**1**	1	1	1	1	1	1	1	1	1	1	1	12,220	12,500	12,780	13,050	13,320	13,580	13,840	14,090					
28	**1**	1	1	1	1	1	1	1	1	1	1	1	1	1	12,670	12,970	13,250	13,540	13,820	14,090	14,350	14,620					
29	1	1	1	1	1	1	1	1	1	1	1	**1.5**	1	1	13,120	13,430	13,730	14,020	14,310	14,590	14,870	15,140					
30	1	1	1	1	1	1	1	1	1	**1.5**	1	1.5	1	1	13,580	13,890	14,200	14,510	14,810	15,100	15,390	15,670					

NOTES:

1. Gates will be opened in order shown and will close in reverse order. A box around the gate opening indicates the gate being opened in that step.
2. If any gate is out of service, the gate used in the following step should be operated next.
3. When finer adjustments of outflow are required, any opening smaller than the indicated step or half-step may be used on the gate last operated.

APALACHICOLA-CHATTAHOOCHEE-FLINT BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM AND LAKE

GATE OPERATING SCHEDULE AND SPILLWAY DISCHARGE

PAGE 1 OF 7

Step	Gate opening (in feet)														Spillway discharge (in cfs)												
number	Gate number														Pool elevation												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	184	185	186	187	188	189	190	191	192	193	194	195	196
31	1	1	1	1	1	1	1	1	1	1.5	1	1.5	1.5	1	14,030	14,360	14,680	14,990	15,300	15,610	15,900	16,190					
32	1	1	1	1	1	1	1	1	1	1.5	1.5	1.5	1.5	1	14,480	14,820	15,150	15,480	15,800	16,110	16,420	16,720					
33	1	1	1	1	1	1	1	1	1.5	1.5	1.5	1.5	1.5	1	14,940	15,290	15,630	15,970	16,290	16,620	16,930	17,240					
34	1	1	1	1	1	1	1	1	1.5	1.5	1.5	1.5	1.5	1.5	15,390	15,750	16,100	16,450	16,790	17,120	17,450	17,770					
35	1	1	1	1.5	1	1	1	1	1.5	1.5	1.5	1.5	1.5	1.5	15,840	16,220	16,580	16,940	17,290	17,630	17,960	18,290					
36	1	1	1	1.5	1	1.5	1	1	1.5	1.5	1.5	1.5	1.5	1.5	16,300	16,680	17,050	17,420	17,780	18,130	18,480	18,820					
37	1	1	1	1.5	1	1.5	1	1.5	1.5	1.5	1.5	1.5	1.5	1.5	16,750	17,140	17,530	17,910	18,280	18,640	19,000	19,350					
38	1	1.5	1	1.5	1	1.5	1	1.5	1.5	1.5	1.5	1.5	1.5	1.5	17,200	17,610	18,000	18,390	18,770	19,150	19,510	19,870					
39	1	1.5	1	1.5	1	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	17,650	18,070	18,480	18,880	19,270	19,650	20,030	20,400					
40	1	1.5	1	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	18,110	18,540	18,950	19,360	19,770	20,160	20,540	20,920					
41	1	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	18,560	19,000	19,430	19,850	20,260	20,660	21,060	21,450					
42	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	19,010	19,460	19,900	20,340	20,760	21,170	21,580	21,970	22,360				
43	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2	1.5	1.5	19,470	19,930	20,380	20,820	21,250	21,680	22,090	22,500	22,900				
44	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2	1.5	2	1.5	1.5	19,920	20,400	20,860	21,310	21,750	22,190	22,610	23,030	23,440				
45	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2	1.5	2	2	1.5	20,380	20,860	21,330	21,800	22,250	22,690	23,130	23,560	23,980				
46	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2	2	2	2	1.5	20,830	21,330	21,810	22,280	22,750	23,200	23,650	24,090	24,520				
47	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2	2	2	2	2	1.5	21,290	21,790	22,290	22,770	23,250	23,710	24,170	24,610	25,050				
48	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	2	2	2	2	2	2	21,740	22,260	22,760	23,260	23,740	24,220	24,690	25,140	25,590				
49	1.5	1.5	1.5	2	1.5	1.5	1.5	1.5	2	2	2	2	2	2	22,190	22,720	23,240	23,750	24,240	24,730	25,200	25,670	26,130				
50	1.5	1.5	1.5	2	1.5	2	1.5	1.5	2	2	2	2	2	2	22,650	23,190	23,720	24,230	24,740	25,240	25,720	26,200	26,670				
51	1.5	1.5	1.5	2	1.5	2	1.5	2	2	2	2	2	2	2	23,100	23,650	24,190	24,720	25,240	25,740	26,240	26,730	27,210				
52	1.5	2	1.5	2	1.5	2	1.5	2	2	2	2	2	2	2	23,560	24,120	24,670	25,210	25,740	26,250	26,760	27,260	27,750				
53	1.5	2	1.5	2	1.5	2	2	2	2	2	2	2	2	2	24,010	24,590	25,150	25,700	26,230	26,760	27,280	27,790	28,280				
54	1.5	2	1.5	2	2	2	2	2	2	2	2	2	2	2	24,460	25,050	25,620	26,180	26,730	27,270	27,800	28,310	28,820				
55	1.5	2	2	2	2	2	2	2	2	2	2	2	2	2	24,920	25,520	26,100	26,670	27,230	27,780	28,320	28,840	29,360				
56	2	2	2	2	2	2	2	2	2	2	2	2	2	2	25,370	25,980	26,580	27,160	27,730	28,290	28,830	29,370	29,900				
57	2	2	2	2	2	2	2	2	2	2	2	3	2	2	26,280	26,910	27,530	28,130	28,720	29,300	29,870	30,430	30,980				
58	2	2	2	2	2	2	2	2	2	3	2	3	2	2	27,180	27,840	28,480	29,110	29,720	30,320	30,910	31,490	32,060				
59	2	2	2	2	2	2	2	2	2	3	2	3	3	2	28,090	28,770	29,430	30,080	30,710	31,340	31,950	32,550	33,130				
60	2	2	2	2	2	2	2	2	2	3	3	3	3	2	28,990	29,700	30,380	31,050	31,710	32,350	32,980	33,600	34,210				

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

GATE OPERATING SCHEDULE
AND SPILLWAY DISCHARGE

PAGE 2 OF 7

Step number	Gate opening (in feet)														Spillway discharge (in cfs)												
	Gate number														Pool elevation												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	184	185	186	187	188	189	190	191	192	193	194	195	196
61	2	2	2	2	2	2	2	2	3	3	3	3	3	2	29,900	30,620	31,330	32,030	32,710	33,370	34,020	34,660	35,290				
62	2	2	2	2	2	2	2	2	3	3	3	3	3	3	30,800	31,550	32,280	33,000	33,700	34,390	35,060	35,720	36,370	37,010			
63	2	2	2	3	2	2	2	2	3	3	3	3	3	3	31,710	32,480	33,240	33,970	34,700	35,400	36,100	36,780	37,450	38,100			
64	2	2	2	3	2	3	2	2	3	3	3	3	3	3	32,610	33,410	34,190	34,950	35,690	36,420	37,140	37,840	38,530	39,200			
65	2	2	2	3	2	3	2	3	3	3	3	3	3	3	33,520	34,340	35,140	35,920	36,690	37,440	38,170	38,900	39,600	40,300			
66	2	3	2	3	2	3	2	3	3	3	3	3	3	3	34,420	35,270	36,090	36,900	37,680	38,460	39,210	39,950	40,680	41,400			
67	2	3	2	3	2	3	3	3	3	3	3	3	3	3	35,330	36,190	37,040	37,870	38,680	39,470	40,250	41,010	41,760	42,500			
68	2	3	2	3	3	3	3	3	3	3	3	3	3	3	36,230	37,120	37,990	38,840	39,670	40,490	41,290	42,070	42,840	43,600			
69	2	3	3	3	3	3	3	3	3	3	3	3	3	3	37,140	38,050	38,940	39,820	40,670	41,510	42,330	43,130	43,920	44,690			
70	3	3	3	3	3	3	3	3	3	3	3	3	3	3	38,040	38,980	39,900	40,790	41,670	42,520	43,360	44,190	45,000	45,790			
71	3	3	3	3	3	3	3	3	3	3	3	4	3	3	38,940	39,910	40,850	41,760	42,660	43,540	44,400	45,250	46,080	46,900			
72	3	3	3	3	3	3	3	3	3	4	3	4	3	3	39,850	40,830	41,800	42,740	43,660	44,560	45,440	46,310	47,160	48,000			
73	3	3	3	3	3	3	3	3	3	4	3	4	4	3	40,750	41,760	42,740	43,710	44,650	45,580	46,480	47,370	48,250	49,100			
74	3	3	3	3	3	3	3	3	3	4	4	4	4	3	41,650	42,680	43,690	44,680	45,650	46,600	47,520	48,430	49,330	50,210			
75	3	3	3	3	3	3	3	3	4	4	4	4	4	3	42,550	43,610	44,640	45,660	46,650	47,620	48,570	49,500	50,410	51,310			
76	3	3	3	3	3	3	3	3	4	4	4	4	4	4	43,450	44,540	45,590	46,630	47,640	48,630	49,610	50,560	51,490	52,410			
77	3	3	3	4	3	3	3	3	4	4	4	4	4	4	44,350	45,460	46,540	47,600	48,640	49,650	50,650	51,620	52,580	53,520			
78	3	3	3	4	3	4	3	3	4	4	4	4	4	4	45,250	46,390	47,490	48,580	49,630	50,670	51,690	52,680	53,660	54,620	55,560		
79	3	3	3	4	3	4	3	4	4	4	4	4	4	4	46,150	47,310	48,440	49,550	50,630	51,690	52,730	53,740	54,740	55,720	56,690		
80	3	4	3	4	3	4	3	4	4	4	4	4	4	4	47,050	48,240	49,390	50,520	51,630	52,710	53,770	54,810	55,820	56,830	57,810		
81	3	4	3	4	3	4	4	4	4	4	4	4	4	4	47,960	49,160	50,340	51,500	52,620	53,730	54,810	55,870	56,910	57,930	58,930		
82	3	4	3	4	4	4	4	4	4	4	4	4	4	4	48,860	50,090	51,290	52,470	53,620	54,740	55,850	56,930	57,990	59,030	60,060		
83	3	4	4	4	4	4	4	4	4	4	4	4	4	4	49,760	51,020	52,240	53,440	54,610	55,760	56,890	57,990	59,070	60,140	61,180		
84	4	4	4	4	4	4	4	4	4	4	4	4	4	4	50,660	51,940	53,190	54,410	55,610	56,780	57,930	59,050	60,160	61,240	62,300		
85	4	4	4	4	4	4	4	4	4	4	4	5	4	4	51,550	52,860	54,130	55,380	56,600	57,790	58,960	60,110	61,240	62,340	63,430		
86	4	4	4	4	4	4	4	4	4	5	4	5	4	4	52,440	53,780	55,080	56,350	57,590	58,810	60,000	61,170	62,320	63,440	64,550		
87	4	4	4	4	4	4	4	4	4	5	4	5	5	4	53,330	54,690	56,020	57,310	58,580	59,820	61,040	62,230	63,400	64,540	65,670		
88	4	4	4	4	4	4	4	4	4	5	5	5	5	4	54,230	55,610	56,960	58,280	59,570	60,840	62,070	63,290	64,480	65,650	66,790		
89	4	4	4	4	4	4	4	4	5	5	5	5	5	4	55,120	56,530	57,900	59,250	60,560	61,850	63,110	64,340	65,560	66,750	67,920		
90	4	4	4	4	4	4	4	4	5	5	5	5	5	5	56,010	57,440	58,850	60,210	61,550	62,860	64,150	65,400	66,640	67,850	69,040		

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM AND LAKE

GATE OPERATING SCHEDULE AND SPILLWAY DISCHARGE

PAGE 3 OF 7

	Gate opening (in feet)														Spillway discharge (in cfs)													
number	Gate number														Pool elevation													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	184	185	186	187	188	189	190	191	192	193	194	195	196	197
91	4	4	4	5	4	4	4	4	5	5	5	5	5	5	56,900	58,360	59,790	61,180	62,540	63,880	65,180	66,460	67,720	68,950	70,160			
92	4	4	4	5	4	5	4	4	5	5	5	5	5	5	57,790	59,280	60,730	62,150	63,530	64,890	66,220	67,520	68,800	70,050	71,280			
93	4	4	4	5	4	5	4	5	5	5	5	5	5	5	58,680	60,200	61,670	63,110	64,520	65,900	67,250	68,580	69,880	71,150	72,410			
94	4	5	4	5	4	5	4	5	5	5	5	5	5	5	59,570	61,110	62,610	64,080	65,510	66,920	68,290	69,640	70,960	72,250	73,530			
95	4	5	4	5	4	5	5	5	5	5	5	5	5	5	60,470	62,030	63,560	65,050	66,500	67,930	69,330	70,700	72,040	73,360	74,650			
96	4	5	4	5	5	5	5	5	5	5	5	5	5	5	61,360	62,950	64,500	66,010	67,490	68,940	70,360	71,750	73,120	74,460	75,770	77,070		
97	4	5	5	5	5	5	5	5	5	5	5	5	5	5	62,250	63,870	65,440	66,980	68,490	69,960	71,400	72,810	74,200	75,560	76,900	78,210		
98	5	5	5	5	5	5	5	5	5	5	5	5	5	5	63,140	64,780	66,380	67,950	69,480	70,970	72,440	73,870	75,280	76,660	78,020	79,350		
99	5	5	5	5	5	5	5	5	5	5	5	6	5	5	64,020	65,690	67,320	68,900	70,460	71,980	73,460	74,920	76,350	77,760	79,140	80,490		
100	5	5	5	5	5	5	5	5	5	6	5	6	5	5	64,900	66,590	68,250	69,860	71,440	72,980	74,490	75,980	77,430	78,860	80,260	81,630		
101	5	5	5	5	5	5	5	5	5	6	5	6	6	5	65,780	67,500	69,180	70,820	72,420	73,990	75,520	77,030	78,500	79,950	81,380	82,770		
102	5	5	5	5	5	5	5	5	5	6	6	6	6	5	66,660	68,410	70,110	71,780	73,400	74,990	76,550	78,080	79,580	81,050	82,490	83,910		
103	5	5	5	5	5	5	5	5	6	6	6	6	6	5	67,540	69,310	71,040	72,730	74,380	76,000	77,580	79,130	80,650	82,150	83,610	85,050		
104	5	5	5	5	5	5	5	5	6	6	6	6	6	6	68,420	70,220	71,970	73,690	75,370	77,010	78,610	80,190	81,730	83,240	84,730	86,190		
105	5	5	5	6	5	5	5	5	6	6	6	6	6	6	69,290	71,120	72,910	74,650	76,350	78,010	79,640	81,240	82,800	84,340	85,850	87,330		
106	5	5	5	6	5	6	5	5	6	6	6	6	6	6	70,170	72,030	73,840	75,600	77,330	79,020	80,760	82,290	83,880	85,440	86,970	88,470		
107	5	5	5	6	5	6	5	6	6	6	6	6	6	6	71,050	72,940	74,770	76,560	78,310	80,020	81,700	83,340	84,950	86,540	88,090	89,610		
108	5	6	5	6	5	6	5	6	6	6	6	6	6	6	71,930	73,840	75,700	77,520	79,290	81,030	82,730	84,400	86,030	87,630	89,210	90,750		
109	5	6	5	6	5	6	6	6	6	6	6	6	6	6	72,810	74,750	76,630	78,480	80,280	82,040	83,760	85,450	87,100	88,730	90,320	91,890		
110	5	6	5	6	6	6	6	6	6	6	6	6	6	6	73,690	75,650	77,570	79,430	81,260	83,040	84,790	86,500	88,180	89,830	91,440	93,030		
111	5	6	6	6	6	6	6	6	6	6	6	6	6	6	74,570	76,560	78,500	80,390	82,240	84,050	85,820	87,550	89,250	90,920	92,560	94,170	95,760	
112	6	6	6	6	6	6	6	6	6	6	6	6	6	6	75,450	77,460	79,430	81,350	83,220	85,050	86,850	88,610	90,330	92,020	93,680	95,310	96,920	
113	6	6	6	6	6	6	6	6	6	6	6	8	6	6	77,170	79,250	81,270	83,240	85,170	87,050	88,890	90,700	92,470	94,210	95,920	97,590	99,240	
114	6	6	6	6	6	6	6	6	6	8	6	8	6	6	78,900	81,030	83,110	85,130	87,110	89,050	90,940	92,800	94,610	96,400	98,150	99,870	101,560	
115	6	6	6	6	6	6	6	6	6	8	6	8	8	6	80,630	82,810	84,950	87,030	89,060	91,040	92,990	94,890	96,760	98,590	100,380	102,150	103,890	
116	6	6	6	6	6	6	6	6	6	8	8	8	8	6	82,350	84,600	86,780	88,920	91,000	93,040	95,030	96,980	98,900	100,780	102,620	104,430	106,210	
117	6	6	6	6	6	6	6	6	8	8	8	8	8	6	84,080	86,380	88,620	90,810	92,950	95,040	97,080	99,080	101,040	102,960	104,850	106,710	108,530	
118	6	6	6	6	6	6	6	6	8	8	8	8	8	8	85,800	88,160	90,460	92,700	94,890	97,030	99,120	101,170	103,180	105,150	107,090	108,990	110,860	
119	6	6	6	8	6	6	6	6	8	8	8	8	8	8	87,530	89,950	92,300	94,600	96,840	99,030	101,170	103,270	105,330	107,340	109,320	111,270	113,180	
120	6	6	6	8	6	8	6	6	8	8	8	8	8	8	89,260	91,730	94,140	96,490	98,780	101,020	103,220	105,360	107,470	109,530	111,560	113,550	115,500	117,420

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

GATE OPERATING SCHEDULE
AND SPILLWAY DISCHARGE

Step number	Gate opening (in feet)														Spillway discharge (in cfs)																
	Gate number														Pool elevation																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
121	6	6	6	8	6	8	6	8	8	8	8	8	8	8	90,980	93,510	95,980	98,380	100,730	103,020	105,260	107,460	109,610	111,720	13,790	115,830	117,820	119,790			
122	6	8	6	8	6	8	6	8	8	8	8	8	8	8	92,710	95,300	97,820	100,270	102,670	105,020	107,310	109,550	111,750	113,910	16,030	118,100	120,150	122,160			
123	6	8	6	8	6	8	8	8	8	8	8	8	8	8	94,430	97,080	99,660	102,170	104,620	107,010	109,350	111,650	113,890	116,100	18,260	120,380	122,470	124,520			
124	6	8	6	8	8	8	8	8	8	8	8	8	8	8	96,160	98,860	101,490	104,060	106,560	109,010	111,400	113,740	116,040	118,290	20,490	122,660	124,790	126,890			
125	6	8	8	8	8	8	8	8	8	8	8	8	8	8	97,880	100,650	103,330	105,950	108,510	111,000	113,450	115,840	118,180	120,480	122,730	124,940	127,120	129,250			
126	8	8	8	8	8	8	8	8	8	8	8	8	8	8	96,610	102,430	105,170	107,840	110,450	113,000	115,490	117,930	120,320	122,660	124,960	127,220	129,440	131,620			
127	8	8	8	8	8	8	8	8	8	8	8	10	8	8	101,270	104,150	106,960	109,690	112,350	114,960	117,500	119,990	122,430	124,830	127,170	129,480	131,740	133,970			
128	8	8	8	8	8	8	8	8	8	10	8	10	8	8	102,940	105,880	108,740	111,530	114,250	116,910	119,510	122,050	124,550	126,990	129,390	131,740	134,050	136,320	138,560		
129	8	8	8	8	8	8	8	8	8	10	8	10	10	8	104,600	107,610	110,530	113,380	116,150	118,870	121,520	124,120	126,660	129,150	131,600	134,000	136,360	138,670	140,950		
130	8	8	8	8	8	8	8	8	8	10	10	10	10	8	106,260	109,330	112,310	115,220	118,060	120,820	123,530	126,180	128,770	131,310	133,810	136,260	138,660	141,020	143,350		
131	8	8	8	8	8	8	8	8	10	10	10	10	10	8	107,930	111,060	114,100	117,070	119,960	122,780	125,540	128,240	130,880	133,480	136,020	138,510	140,970	143,380	145,740		
132	8	8	8	8	8	8	8	8	10	10	10	10	10	10	109,590	112,780	115,890	118,910	121,860	124,730	127,550	130,300	133,000	135,640	138,230	140,770	143,270	145,730	148,140		
133	8	8	8	10	8	8	8	8	10	10	10	10	10	10	111,250	114,510	117,670	120,750	123,760	126,690	129,560	132,360	135,110	137,800	140,440	143,030	145,580	148,080	150,540		
134	8	8	8	10	8	10	8	8	10	10	10	10	10	10	112,920	116,230	119,460	122,600	125,660	128,650	131,570	134,420	137,220	139,960	142,650	145,290	147,880	150,430	152,930		
135	8	8	8	10	8	10	8	10	10	10	10	10	10	10	114,580	117,960	121,240	124,440	127,560	130,600	133,580	136,480	139,330	142,120	144,860	147,550	150,190	152,780	155,330		
136	8	10	8	10	8	10	8	10	10	10	10	10	10	10	116,250	119,690	123,030	126,290	129,460	132,560	135,590	138,550	141,450	144,290	147,070	149,810	152,490	155,130	157,720		
137	8	10	8	10	8	10	10	10	10	10	10	10	10	10	117,910	121,410	124,820	128,130	131,360	134,510	137,590	140,610	143,560	146,450	149,280	152,060	154,800	157,480	160,120	162,720	
138	8	10	8	10	10	10	10	10	10	10	10	10	10	10	119,570	123,140	126,600	129,970	133,260	136,470	139,600	142,670	145,670	148,610	151,490	154,320	157,100	159,830	162,520	165,160	
139	8	10	10	10	10	10	10	10	10	10	10	10	10	10	121,240	124,860	128,390	131,820	135,160	138,430	141,610	144,730	147,780	150,770	153,700	156,580	159,410	162,180	164,910	167,600	
140	10	10	10	10	10	10	10	10	10	10	10	10	10	10	122,900	126,590	130,170	133,660	137,060	140,380	143,620	146,790	149,890	152,930	155,910	158,840	161,710	164,530	167,310	170,040	
141	10	10	10	10	10	10	10	10	10	10	10	12	10	10	124,490	128,250	131,900	135,450	138,910	142,290	145,590	148,810	151,970	155,060	158,100	161,070	163,990	166,860	169,680	172,460	
142	10	10	10	10	10	10	10	10	10	12	10	12	10	10	126,080	129,910	133,620	137,240	140,760	144,200	147,550	150,830	154,040	157,190	160,280	163,300	166,270	169,190	172,060	174,880	
143	10	10	10	10	10	10	10	10	10	12	10	12	12	10	127,670	131,560	135,340	139,020	142,610	146,100	149,520	152,850	156,120	159,320	162,460	165,530	168,550	171,520	174,440	177,310	
144	10	10	10	10	10	10	10	10	10	12	12	12	12	10	129,260	133,220	137,070	140,810	144,450	148,010	151,480	154,870	158,200	161,450	164,640	167,760	170,830	173,850	176,810	179,730	
145	10	10	10	10	10	10	10	10	12	12	12	12	12	10	130,850	134,880	138,790	142,600	146,300	149,920	153,450	156,900	160,270	163,580	166,820	169,990	173,110	176,180	179,190	182,150	
146	10	10	10	10	10	10	10	10	12	12	12	12	12	12	132,440	136,540	140,520	144,380	148,150	151,820	155,410	158,920	162,350	165,700	169,000	172,230	175,400	178,510	181,570	184,580	
147	10	10	10	12	10	10	10	10	12	12	12	12	12	12	134,030	138,200	142,240	146,170	150,000	153,730	157,380	160,940	164,420	167,830	171,180	174,460	177,680	180,840	183,950	187,000	190,010
148	10	10	10	12	10	12	10	10	12	12	12	12	12	12	135,620	139,860	143,960	147,960	151,850	155,640	159,340	162,960	166,500	169,960	173,360	176,690	179,960	183,170	186,320	189,430	192,480
149	10	10	10	12	10	12	10	12	12	12	12	12	12	12	137,210	141,510	145,690	149,740	153,690	157,550	161,300	164,980	168,570	172,090	175,540	178,920	182,240	185,500	188,700	191,850	194,950
150	10	12	10	12	10	12	10	12	12	12	12	12	12	12	138,800	143,170	147,410	151,530	155,540	159,450	163,270	167,000	170,650	174,220	177,720	181,150	184,520	187,830	191,080	194,270	197,420

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

GATE OPERATING SCHEDULE
AND SPILLWAY DISCHARGE

Step		Gate opening (in feet)														Spillway discharge (in cfs)																			
number		Gate number														Pool elevation																			
		1	2	3	4	5	6	7	8	9	10	10	12	13	14	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203
151		10	12	10	12	10	12	12	12	12	12	12	12	12	12	140,390	144,830	149,130	153,320	157,390	161,360	165,230	169,020	172,720	176,350	179,900	183,380	186,800	190,150	193,450	196,700	199,890			
152		10	12	10	12	12	12	12	12	12	12	12	12	12	12	141,980	146,490	150,860	155,100	159,240	163,270	167,200	171,040	174,800	178,470	182,080	185,610	189,080	192,480	195,830	199,120	202,360			
153		10	12	12	12	12	12	12	12	12	12	12	12	12	12	143,570	148,150	152,580	156,890	161,090	165,170	169,160	173,060	176,870	180,600	184,260	187,840	191,360	194,810	198,210	201,540	204,830			
154		12	12	12	12	12	12	12	12	12	12	12	12	12	12	145,170	149,810	154,310	158,680	162,930	167,080	171,130	175,080	178,950	182,730	186,440	190,070	193,640	197,140	200,580	203,970	207,290			
155		12	12	12	12	12	12	12	12	12	12	12	16	12	12	148,130	152,930	57,580	162,100	166,490	170,780	174,950	179,030	183,020	186,930	190,750	194,500	198,170	201,780	205,330	208,820	212,250			
156		12	12	12	12	12	12	12	12	12	16	12	16	12	12	151,100	156,060	160,860	165,520	170,060	174,470	178,780	182,990	187,100	191,120	195,060	198,920	202,710	206,430	210,080	213,670	217,200	220,670		
157		12	12	12	12	12	12	12	12	12	16	12	16	16	12	154,070	159,180	164,130	168,940	173,620	178,170	182,610	186,940	191,170	195,310	199,370	203,340	207,240	211,070	214,830	218,520	222,150	225,720		
158		12	12	12	12	12	12	12	12	12	16	16	16	16	12	157,040	162,310	167,410	172,360	177,180	181,860	186,430	190,890	195,250	199,510	203,680	207,770	211,780	215,710	219,570	223,370	227,100	230,780		
159		12	12	12	12	12	12	12	12	16	16	16	16	16	12	160,000	165,430	170,690	175,780	180,740	185,560	190,260	194,840	199,320	203,700	207,990	212,190	216,310	220,350	224,320	228,220	232,060	235,830		
160		12	12	12	12	12	12	12	12	16	16	16	16	16	16	162,970	168,560	173,960	179,210	184,300	189,250	194,080	198,790	203,390	207,890	212,300	216,610	220,840	224,990	229,070	233,070	237,010	240,880	244,690	
161		12	12	12	16	12	12	12	12	16	16	16	16	16	16	165,940	171,680	177,240	182,630	187,860	192,950	197,910	202,740	207,470	212,090	216,610	221,040	225,380	229,630	233,820	237,920	241,960	245,930	249,840	
162		12	12	12	16	12	16	12	12	16	16	16	16	16	16	168,910	174,810	180,520	186,050	191,420	196,640	201,730	206,700	211,540	216,280	220,920	225,460	229,910	234,280	238,560	242,770	246,910	250,980	254,990	
163		12	12	12	16	12	16	12	16	16	16	16	16	16	16	171,880	177,930	183,790	189,470	194,980	200,340	205,560	210,650	215,620	220,480	225,230	229,880	234,440	238,920	243,310	247,620	251,860	256,030	260,140	
164		12	16	12	16	12	16	12	16	16	16	16	16	16	16	174,840	181,060	187,070	192,890	198,540	204,040	209,380	214,600	219,690	224,670	229,540	234,300	238,980	243,550	248,060	252,470	256,820	261,080	265,290	
165		12	16	12	16	12	16	16	16	16	16	16	16	16	16	177,810	184,190	190,350	196,310	202,100	207,730	213,210	218,550	223,770	228,860	233,850	238,730	243,510	248,200	252,800	257,330	261,770	266,140	270,430	
166		12	16	12	16	16	16	16	16	16	16	16	16	16	16	180,780	187,310	193,620	199,730	205,660	211,430	217,040	222,500	227,840	233,060	238,160	243,150	248,040	252,840	257,550	262,180	266,720	271,190	275,580	
167		12	16	16	16	16	16	16	16	16	16	16	16	16	16	183,750	190,440	196,900	203,150	209,220	215,120	220,860	226,460	231,920	237,250	242,470	247,570	252,580	257,480	262,300	267,030	271,670	276,240	280,730	
168		16	16	16	16	16	16	16	16	16	16	16	16	16	16	186,720	193,560	200,170	206,580	212,780	218,820	224,690	230,410	235,990	241,440	246,780	252,000	257,110	262,130	267,050	271,880	276,620	281,290	285,880	
169		16	16	16	16	16	16	16	16	16	16	16	20	16	16	187,880	195,310	202,590	209,680	216,050	222,250	228,270	234,140	239,860	245,460	250,920	256,270	261,510	266,650	271,690	276,640	281,500	286,280	290,980	
170		16	16	16	16	16	16	16	16	16	20	16	20	16	16	189,040	197,050	205,010	212,780	219,320	225,680	231,850	237,870	243,740	249,470	255,070	260,550	265,920	271,180	276,340	281,400	286,380	291,270	296,080	300,820
171		16	16	16	16	16	16	16	16	16	20	16	20	20	16	190,210	198,790	207,430	215,870	222,590	229,110	235,440	241,600	247,610	253,480	259,210	264,820	270,320	275,700	280,980	286,170	291,260	296,260	301,180	306,020
172		16	16	16	16	16	16	16	16	16	20	20	20	20	16	191,370	200,540	209,840	218,970	225,860	232,540	239,020	245,330	251,480	257,490	263,360	269,100	274,720	280,230	285,630	290,930	296,140	301,250	306,280	311,230
173		16	16	16	16	16	16	16	16	20	20	20	20	20	16	192,530	202,280	212,260	222,070	229,130	235,960	242,600	249,060	255,360	261,500	267,510	273,380	279,120	284,750	290,280	295,690	301,010	306,240	311,380	316,440
174		16	16	16	16	16	16	16	16	20	20	20	20	20	20	193,690	204,030	214,680	225,170	232,400	239,390	246,190	252,790	259,230	265,510	271,650	277,650	283,530	289,280	294,920	300,460	305,890	311,230	316,480	321,650
175		16	16	16	20	16	16	16	16	20	20	20	20	20	20	194,860	205,770	217,090	228,270	235,680	242,820	249,770	256,520	263,100	269,530	275,800	281,930	287,930	293,810	299,570	305,220	310,770	316,220	321,580	326,860
176		16	16	16	20	16	20	16	16	20	20	20	20	20	20	196,020	207,520	219,510	231,370	238,950	246,250	253,350	260,250	266,980	273,540	279,940	286,200	292,330	298,330	304,210	309,980	315,650	321,210	326,680	332,060
177		16	16	16	20	16	20	16	20	20	20	20	20	20	20	197,180	209,260	221,930	234,470	242,220	249,680	256,930	263,980	270,850	277,550	284,090	290,480	296,730	302,860	308,860	314,750	320,530	326,200	331,790	337,270
178		16	20	16	20	16	20	16	20	20	20	20	20	20	20	198,350	211,000	224,340	237,570	245,490	253,110	260,520	267,720	274,730	281,560	288,230	294,750	301,130	307,380	313,510	319,510	325,410	331,200	336,890	342,480
179		16	20	16	20	16	20	20	20	20	20	20	20	20	20	199,510	212,750	226,760	240,670	248,760	256,540	264,100	271,450	278,600	285,570	292,380	299,030	305,540	311,910	318,150	324,270	330,280	336,190	341,990	347,690
180		16	20	16	20	20	20	20	20	20	20	20	20	20	20	200,670	214,490	229,180	243,770	252,030	259,970	267,680	275,180	282,470	289,580	296,520	303,310	309,940	316,430	322,800	329,040	335,160	341,180	347,090	352,900

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

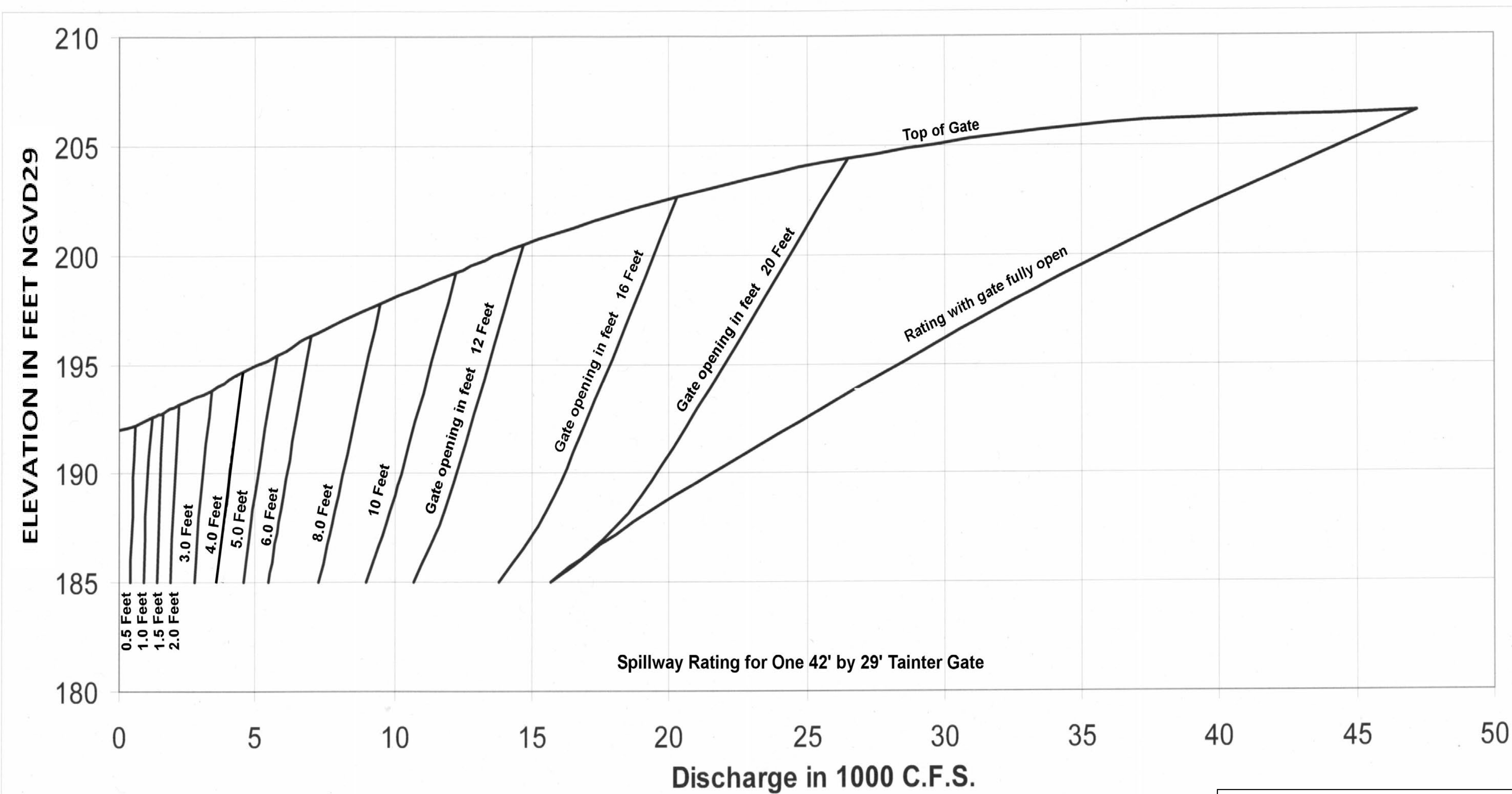
GATE OPERATING SCHEDULE
AND SPILLWAY DISCHARGE

Step	Gate opening (in feet)														Spillway discharge (in cfs)																			
number	Gate number														Pool elevation																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203
181	16	20	20	20	20	20	20	20	20	20	20	20	20	20	201,840	216,240	231,590	246,870	255,300	263,400	271,270	278,910	286,350	293,600	300,670	307,580	314,340	320,960	327,440	333,800	340,040	346,170	352,190	358,110
182	20	20	20	20	20	20	20	20	20	20	20	20	20	20	203,000	217,980	234,010	249,970	258,570	266,830	274,850	282,640	290,220	297,610	304,820	311,860	318,740	325,490	332,090	338,560	344,920	351,160	357,290	363,310
183	20	20	20	20	20	20	20	20	20	20	20	F.O.	20	20	203,000	217,980	234,010	249,970	259,170	268,060	276,790	285,300	293,670	310,890	309,980	317,940	325,760	333,490	341,120	348,660	356,070	363,510	370,800	378,040
184	20	20	20	20	20	20	20	20	20	F.O.	20	F.O.	20	20	203,000	217,980	234,010	249,970	259,770	269,280	278,720	287,970	297,120	306,160	315,130	324,020	332,780	341,490	350,150	358,760	367,220	375,850	384,320	392,770
185	20	20	20.0.	20	20	20	20	20	20	F.O.	20	F.O.	F.O.	20	203,000	217,980	234,010	249,970	260,370	270,510	280,660	290,640	300,570	310,440	320,290	330,100	339,790	349,490	359,180	368,870	378,360	388,200	397,830	407,500
186	20	20	20	20	20	20	20	20	20	F.O.	F.O.	F.O.	F.O.	20	203,000	217,980	234,010	249,970	260,970	271,730	282,600	293,300	304,020	314,720	325,450	336,180	346,810	357,490	368,210	378,970	389,510	400,550	411,350	422,230
187	20	20	20	20	20	20	20	20	F.O.	F.O.	F.O.	F.O.	F.O.	20	203,000	217,980	234,010	249,970	261,570	272,960	284,540	295,970	307,470	319,000	330,610	342,260	353,830	365,500	377,240	389,070	400,660	412,900	424,860	436,960
188	20	20	20	20	20	20	20	20	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	203,000	217,980	234,010	249,970	262,170	274,180	286,480	298,640	310,920	323,270	335,760	348,330	360,850	373,500	386,260	399,170	411,810	425,240	438,370	451,680
189	20	20	20	F.O.	20	20	20	20	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	203,000	217,980	234,010	249,970	262,770	275,410	288,410	301,300	314,370	327,550	340,920	354,410	367,870	381,500	395,290	409,270	422,960	437,590	451,890	466,410
190	20	20	20	F.O.	20	F.O.	20	20	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	203,000	217,980	234,010	249,970	263,370	276,640	290,350	303,970	317,820	331,830	346,080	360,490	374,880	389,500	404,320	419,380	434,100	449,940	465,400	481,140
191	20	20	20	F.O.	20	F.O.	20	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	203,000	217,980	234,010	249,970	263,970	277,860	292,290	306,640	321,270	336,100	351,230	366,570	381,900	397,500	413,350	429,480	445,250	462,280	478,920	495,870
192	20	F.O.	20	F.O.	20	F.O.	20	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	203,000	217,980	234,010	249,970	264,580	279,090	294,230	309,300	324,720	340,380	356,390	372,650	388,920	405,500	422,380	439,580	456,400	474,630	492,430	510,600
193	20	F.O.	20	F.O.	20	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	203,000	217,980	234,010	249,970	265,180	280,310	296,170	311,970	328,170	344,660	361,550	378,730	395,940	413,500	431,410	449,680	467,550	486,980	505,940	525,330
194	20	F.O.	20	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	203,000	217,980	234,010	249,970	265,780	281,540	298,100	314,640	331,620	348,930	366,700	384,810	402,960	421,500	440,440	459,780	478,700	499,320	519,460	540,060
195	20	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	203,000	217,980	234,010	249,970	266,380	282,760	300,040	317,300	335,070	353,210	371,860	390,890	409,970	429,500	449,470	469,890	489,840	511,670	532,970	554,790
196	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	F.O.	203,000	217,980	234,010	249,970	266,980	283,990	301,980	319,970	338,520	357,490	377,020	396,970	416,990	437,500	458,500	479,990	500,990	524,020	546,490	569,520

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

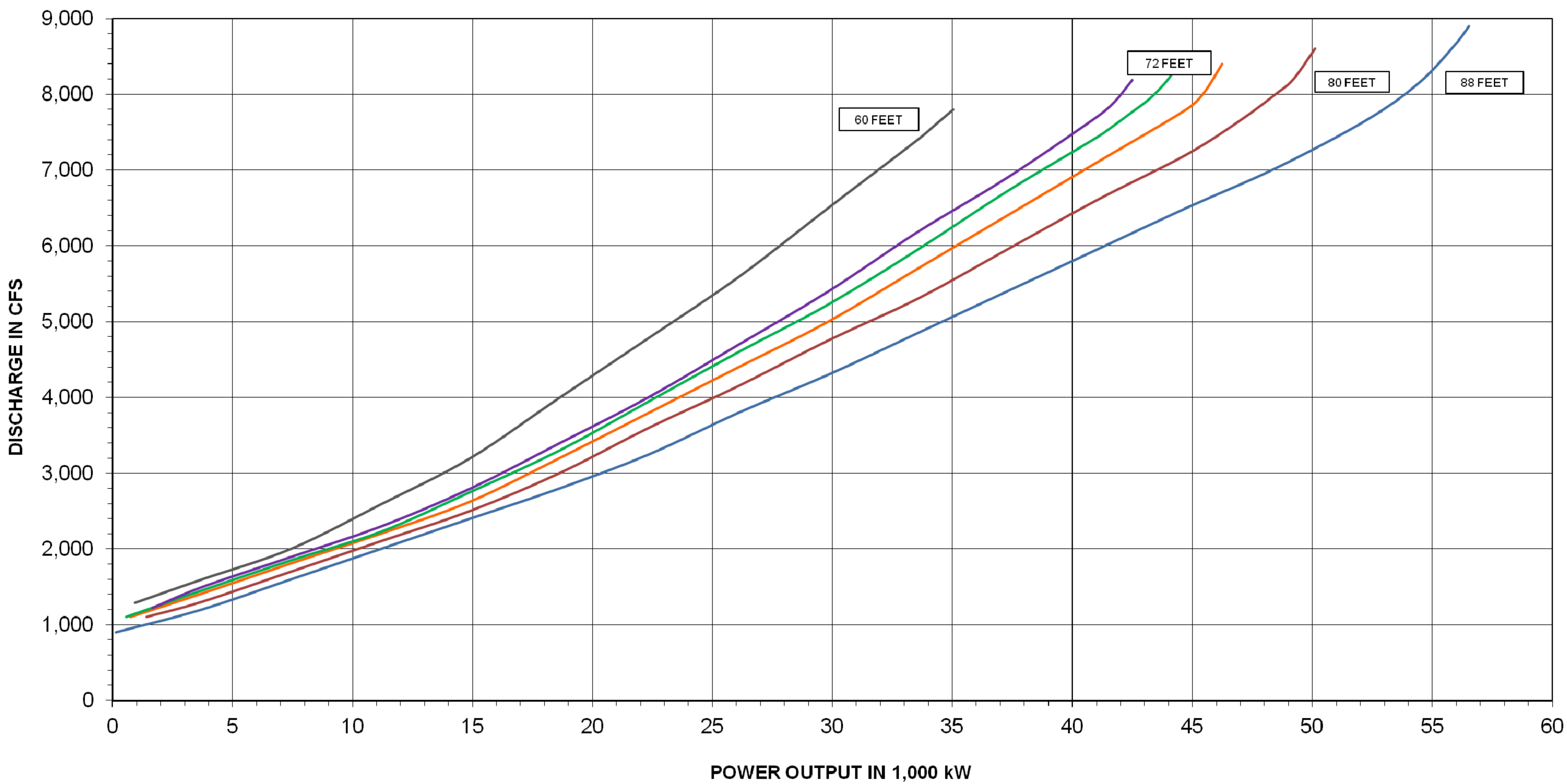
GATE OPERATING SCHEDULE
AND SPILLWAY DISCHARGE



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

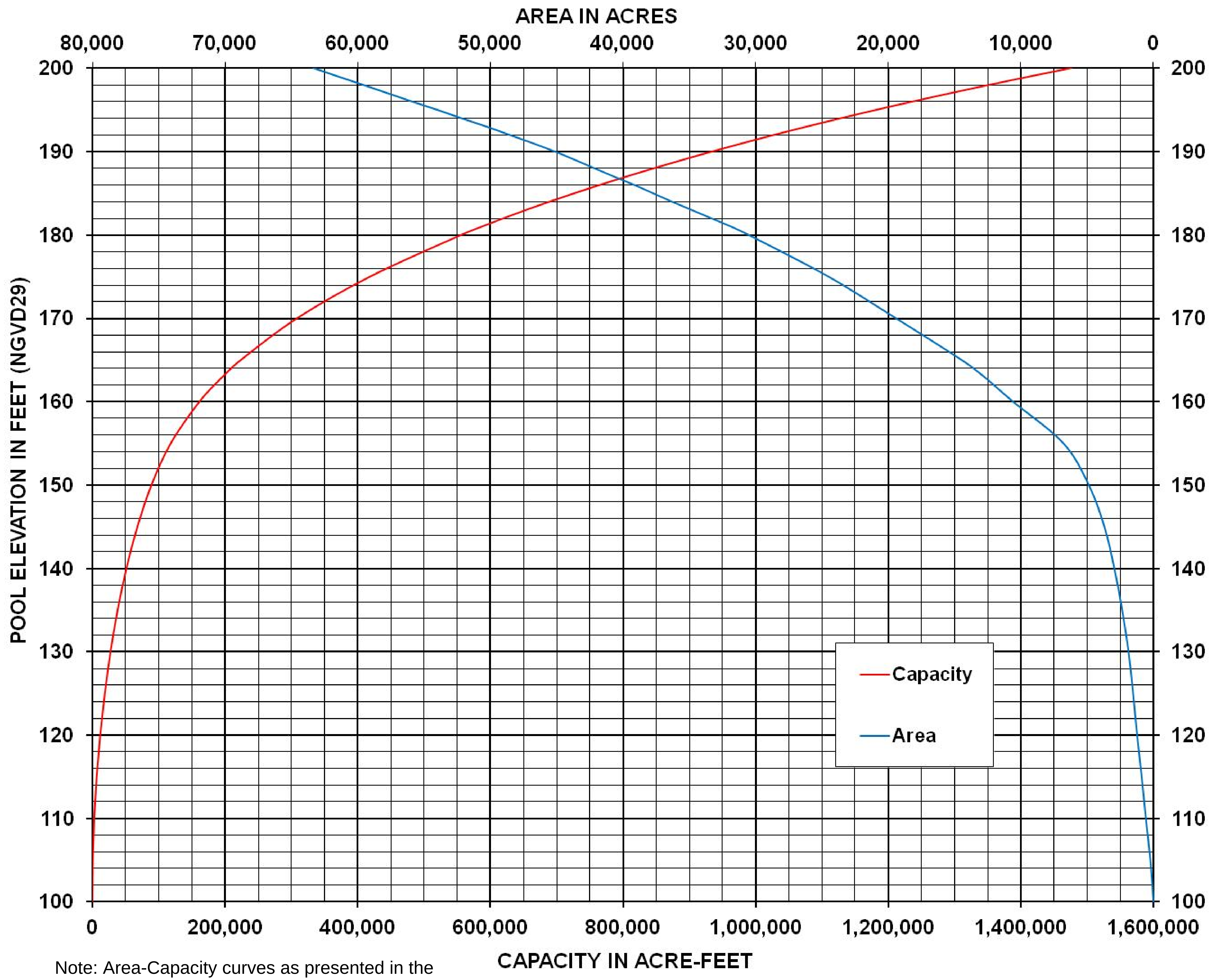
SPILLWAY RATING CURVE
FOR ONE GATE



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

PERFORMANCE CURVES
TURBOGENERATOR UNIT
GROSS HEAD 60 FEET TO 88 FEET



Note: Area-Capacity curves as presented in the April 1965 Walter F. George water control manual.

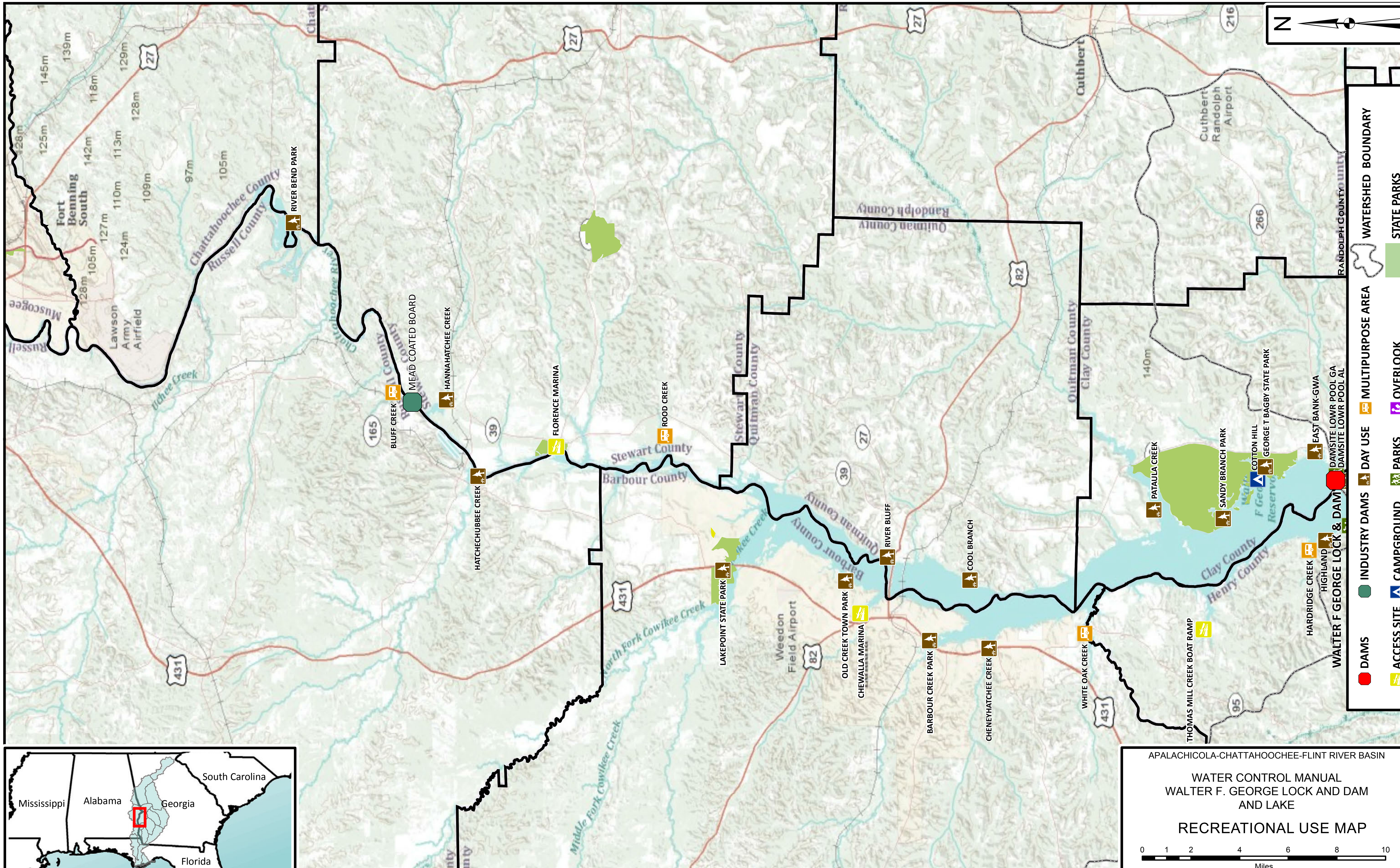
AREA-CAPACITY TABLE

Elevation (ft, NGVD29)	Total area (acres)	Total Storage (acre-feet)
100	8	10
105	248	550
110	587	2,610
115	902	6,340
120	1,248	11,680
125	1,550	18,670
130	1,894	27,240
135	2,375	37,920
140	2,966	51,210
145	3,720	67,830
150	4,895	89,100
155	6,815	118,140
160	10,624	161,500
163	12,815	196,700
165	14,501	224,000
170	19,457	308,700
175	24,556	419,000
180	30,577	556,300
181	31,897	587,600
182	33,396	620,200
183	34,880	654,400
184	36,375	690,000
185	37,784	727,100
186	39,210	765,600
187	40,735	805,500
188	42,210	847,100
189	43,665	890,000
190	45,181	934,400
191	46,850	980,500
192	48,615	1,028,100
193	50,356	1,077,600
194	52,250	1,129,000
195	54,045	1,182,100
196	55,975	1,237,100
197	57,800	1,294,000
198	59,650	1,352,700
199	61,528	1,413,300
200	63,375	1,475,800

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM AND LAKE

AREA-CAPACITY CURVES AND TABLE



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

RECREATIONAL USE MAP

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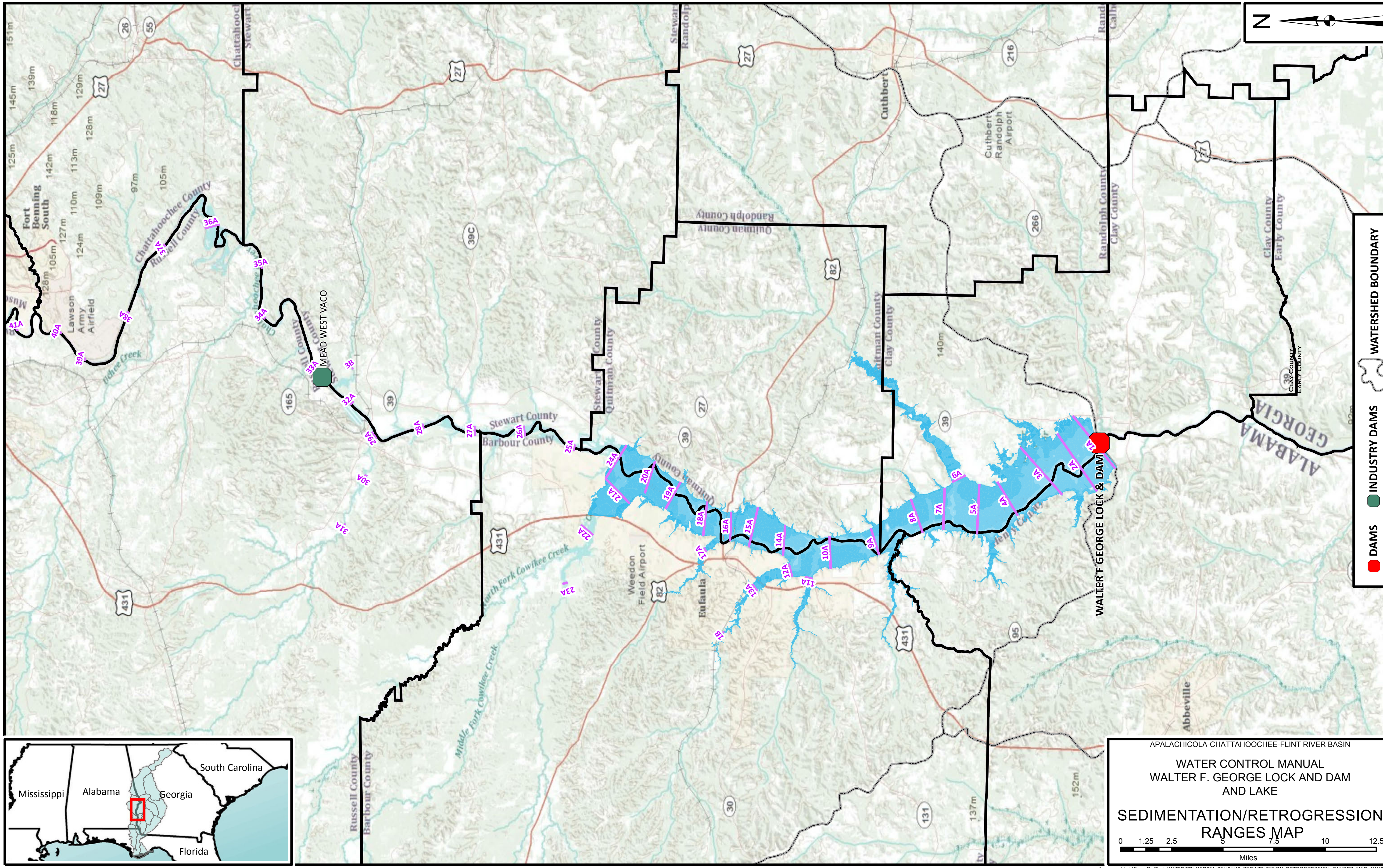
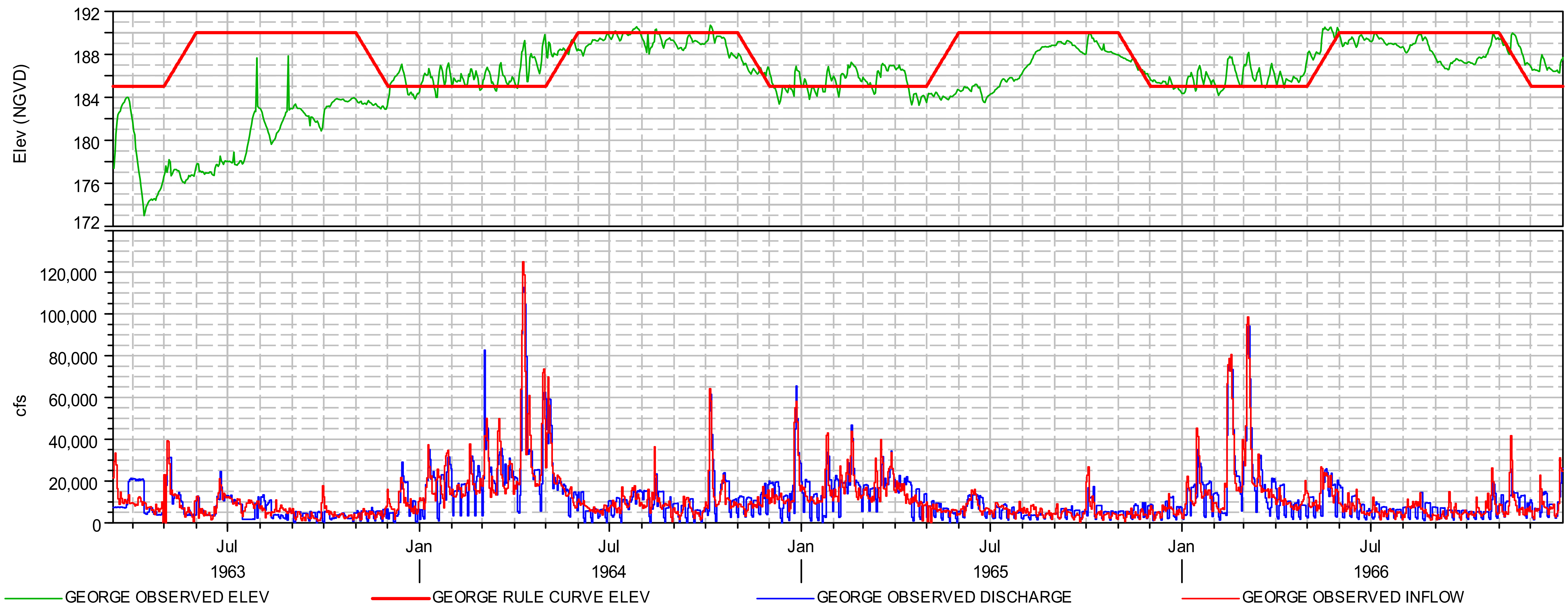
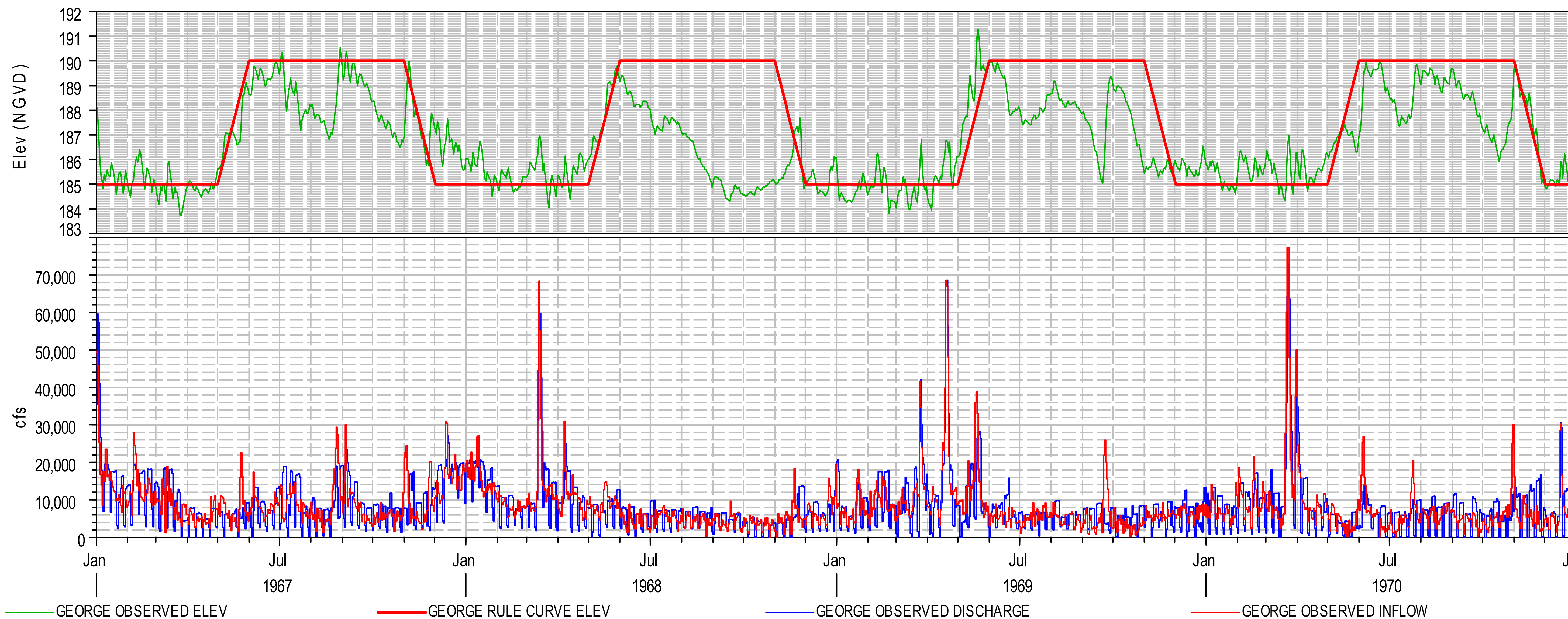

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN
WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE
SEDIMENTATION/RETROGRESSION
RANGES MAP
0 1.25 2.5 5 7.5 10 12.5
Miles
WATERSHED BOUNDARY
INDUSTRY DAMS
DAMS
WALTER F. GEORGE LOCK & DAM
MEAD WEST VACO
Mississippi
Alabama
Georgia
South Carolina
Florida
GEORGIA
ALABAMA
Stewart County
Barbour County
Randolph County
Quitman County
Clay County
Early County
Russell County
Chattahoochee County
Eufaula
Cuthbert
Abbeville
Fort Benning South
Lawson Army Airfield
Weedon Field Airport
Cuthbert Randolph Airport
North Fork Cowikee Creek
Middle Fork Cowikee Creek
1A 2A 3A 4A 5A 6A 7A 8A 9A 10A 11A 12A 13A 14A 15A 16A 17A 18A 19A 20A 21A 22A 23A 24A 25A 26A 27A 28A 29A 30A 31A 32A 33A 34A 35A 36A 37A 38A 39A 40A 41A 1B 3B
\\sam-apgis\gis\Sam_Gis\Tools\MXD\DISPLAY\R004_28JULY10_SEDIMENTATION_RETROGRESSION_RANGES_MAP_11X17.mxd



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM AND LAKE

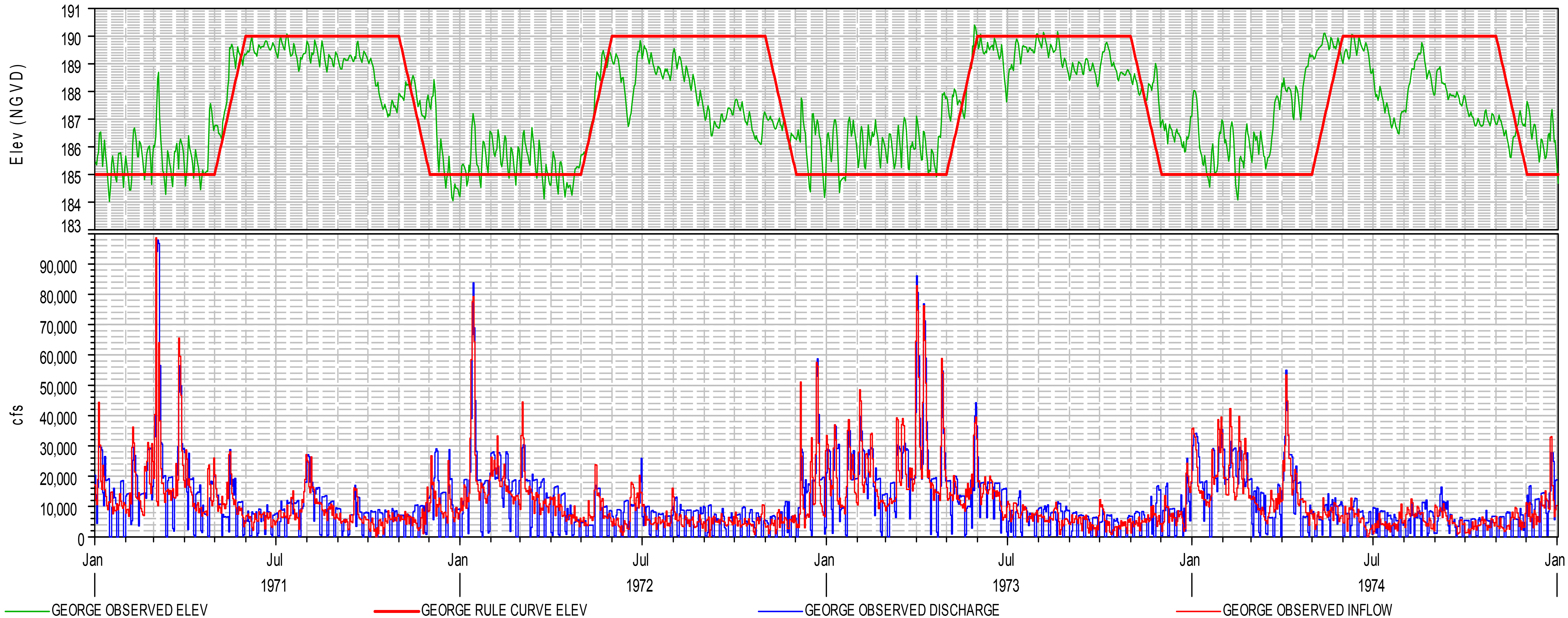
POOL ELEVATION-INFLOW-DISCHARGE HYDROGRAPHS
1963–1966



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM AND LAKE

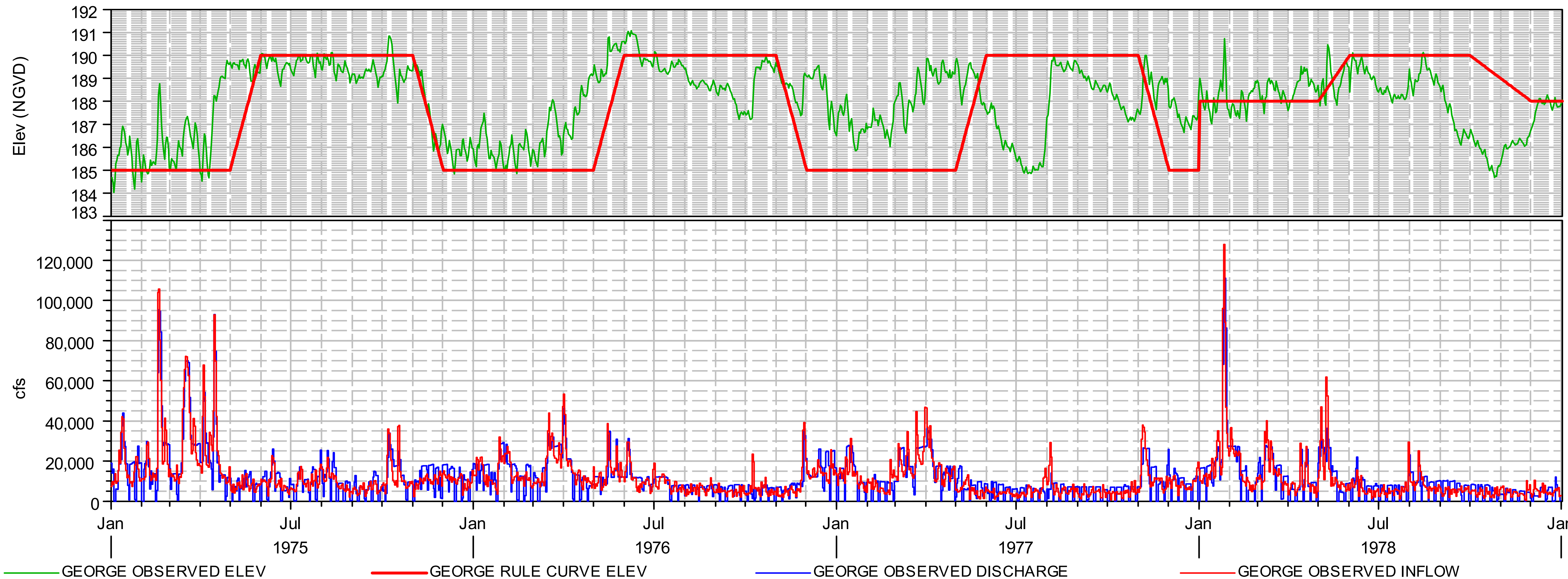
POOL ELEVATION-INFLOW-DISCHARGE HYDROGRAPHS
1967–1970



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

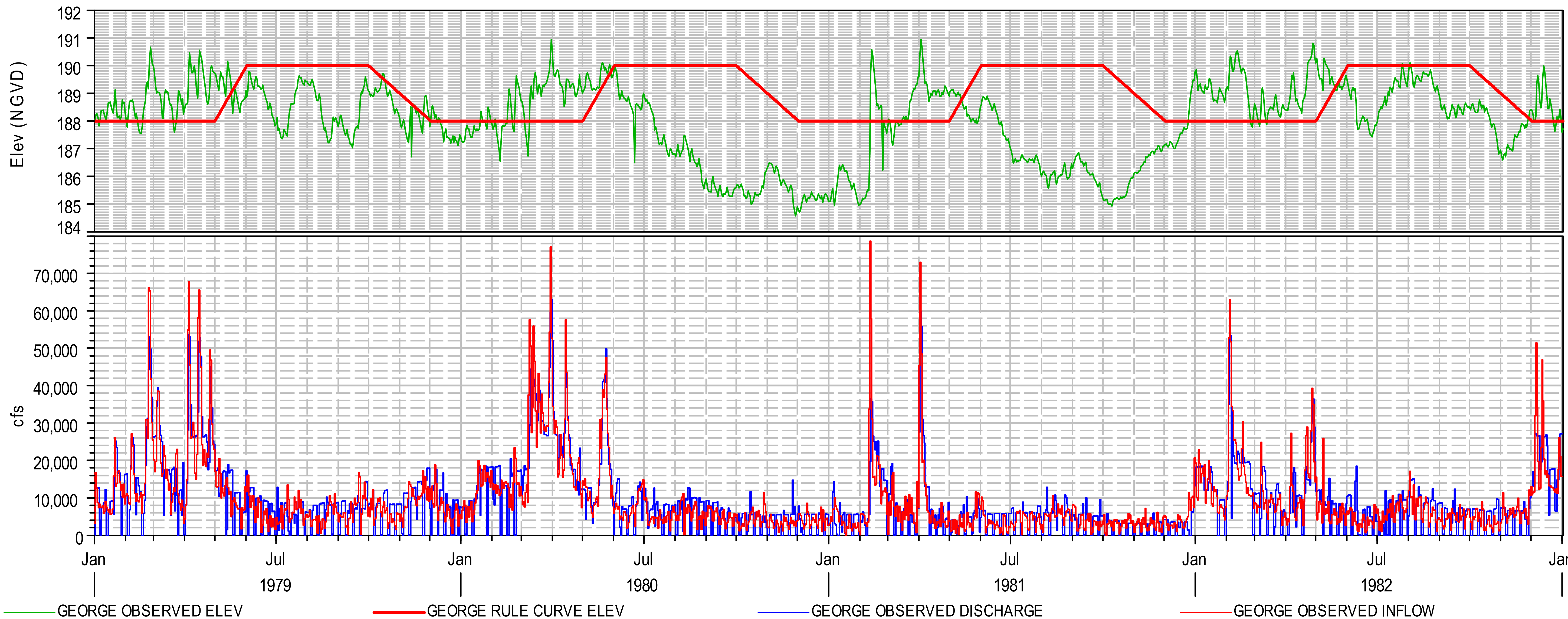
POOL ELEVATION-INFLOW-
DISCHARGE HYDROGRAPHS
1971–1974



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM AND LAKE

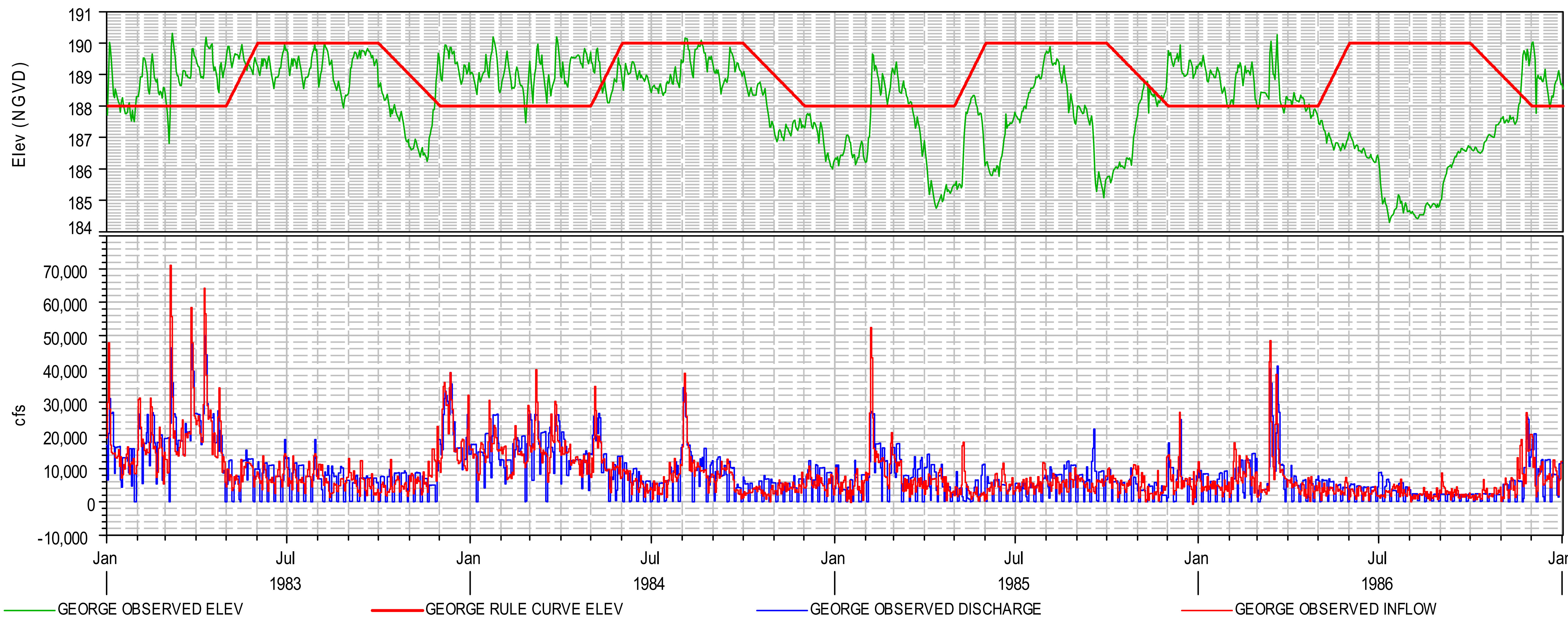
POOL ELEVATION-INFLOW-DISCHARGE HYDROGRAPHS
1975–1978



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

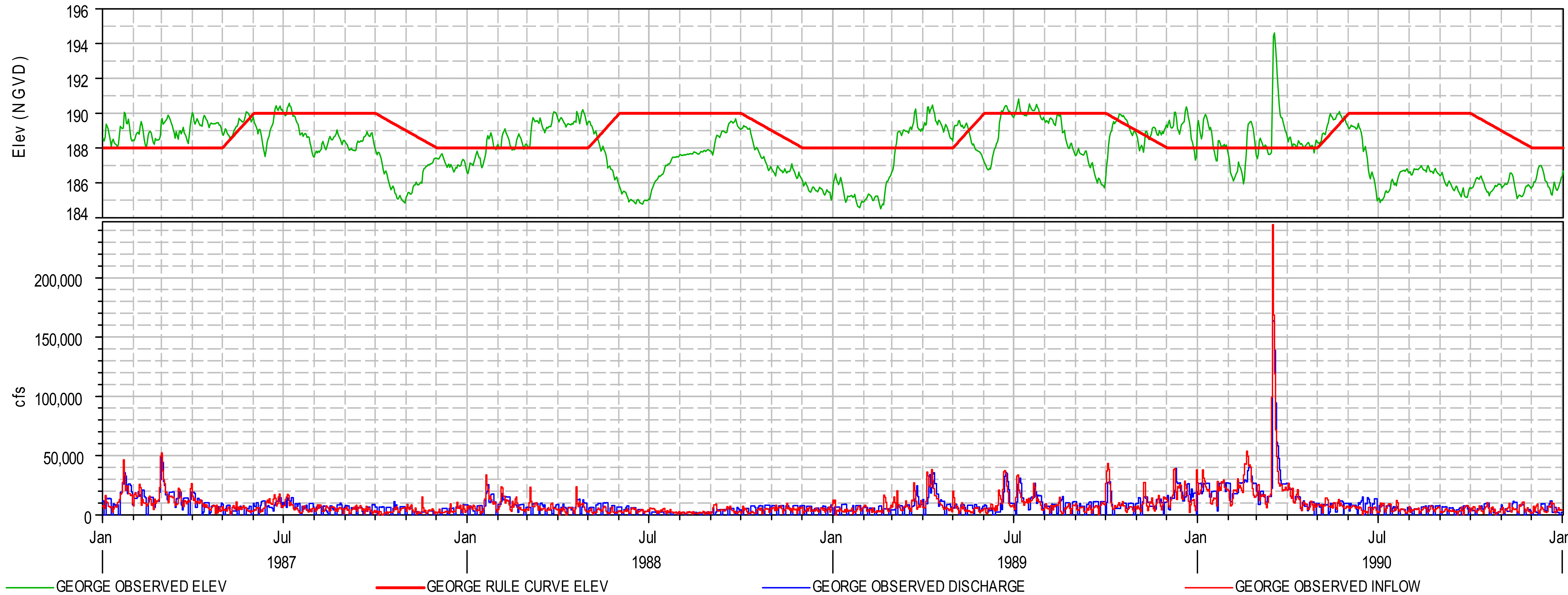
POOL ELEVATION-INFLOW-
DISCHARGE HYDROGRAPHS
1979–1982



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

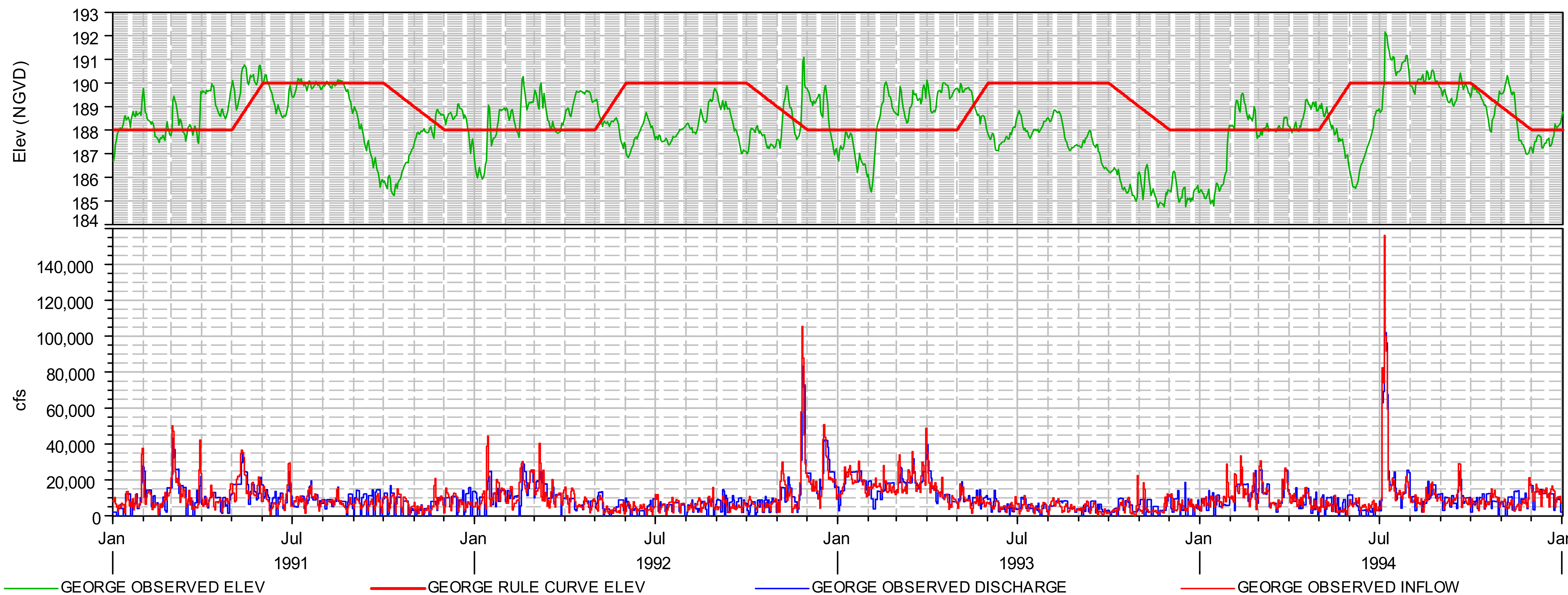
POOL ELEVATION-INFLOW-
DISCHARGE HYDROGRAPHS
1983–1986



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

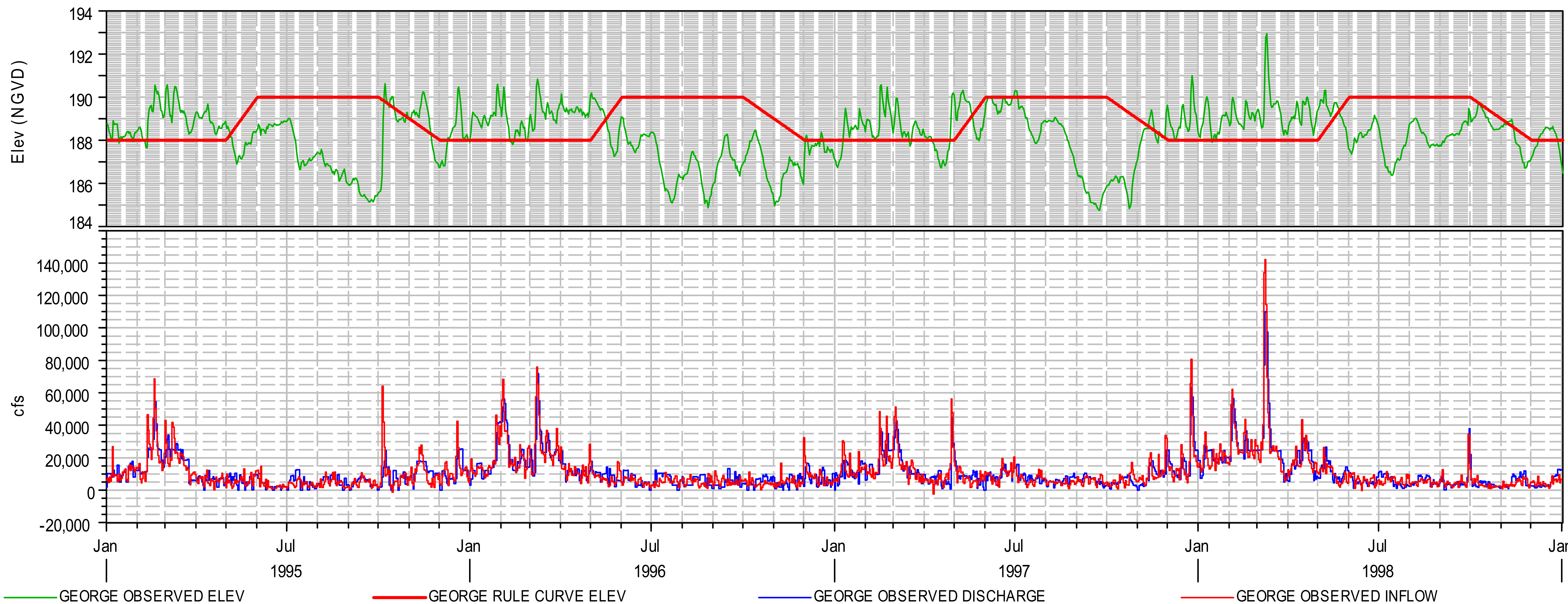
POOL ELEVATION-INFLOW-
DISCHARGE HYDROGRAPHS
1987–1990



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

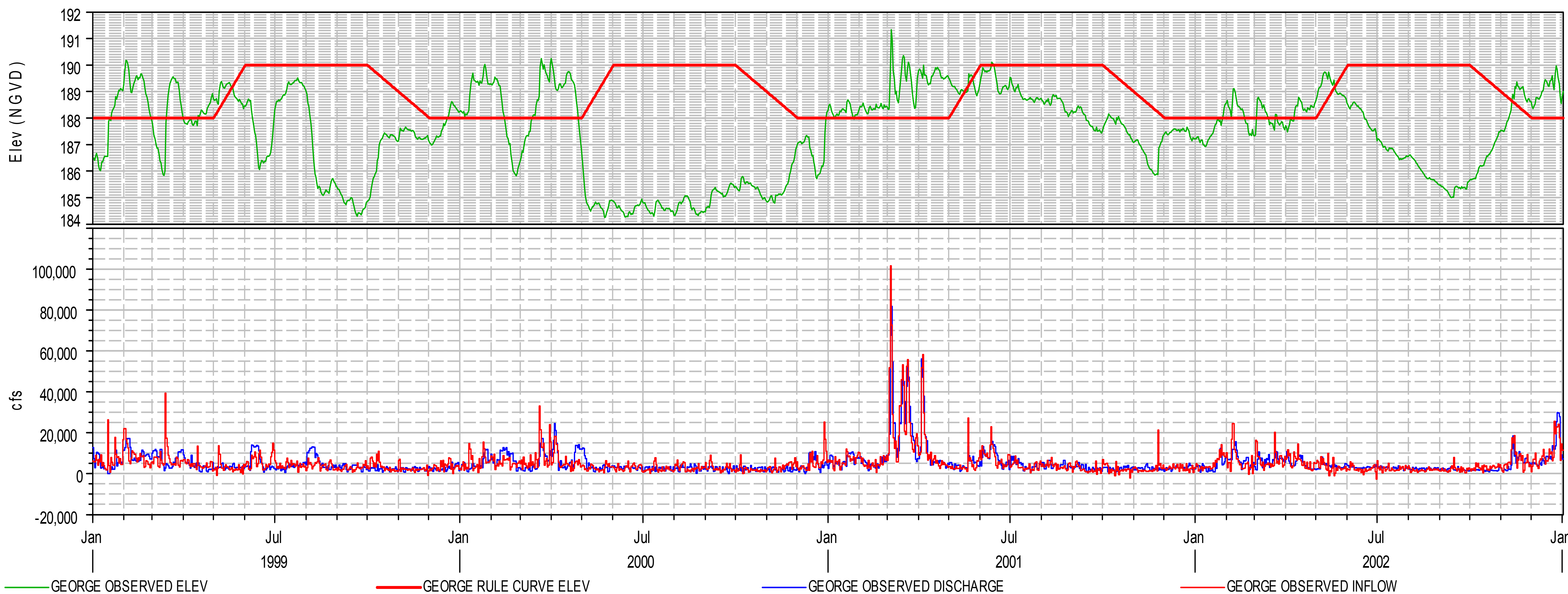
POOL ELEVATION-INFLOW-
DISCHARGE HYDROGRAPHS
1991–1994



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM AND LAKE

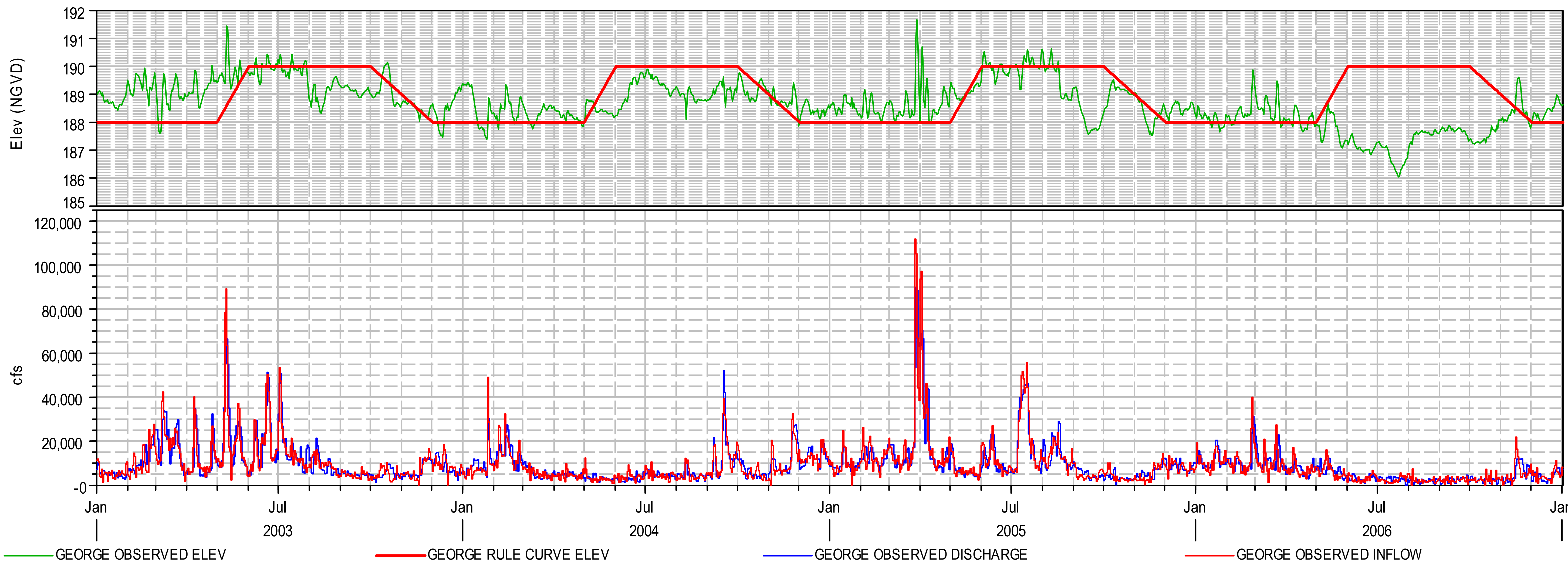
POOL ELEVATION-INFLOW-DISCHARGE HYDROGRAPHS
1995–1998



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM AND LAKE

POOL ELEVATION-INFLOW-DISCHARGE HYDROGRAPHS
1999–2002



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

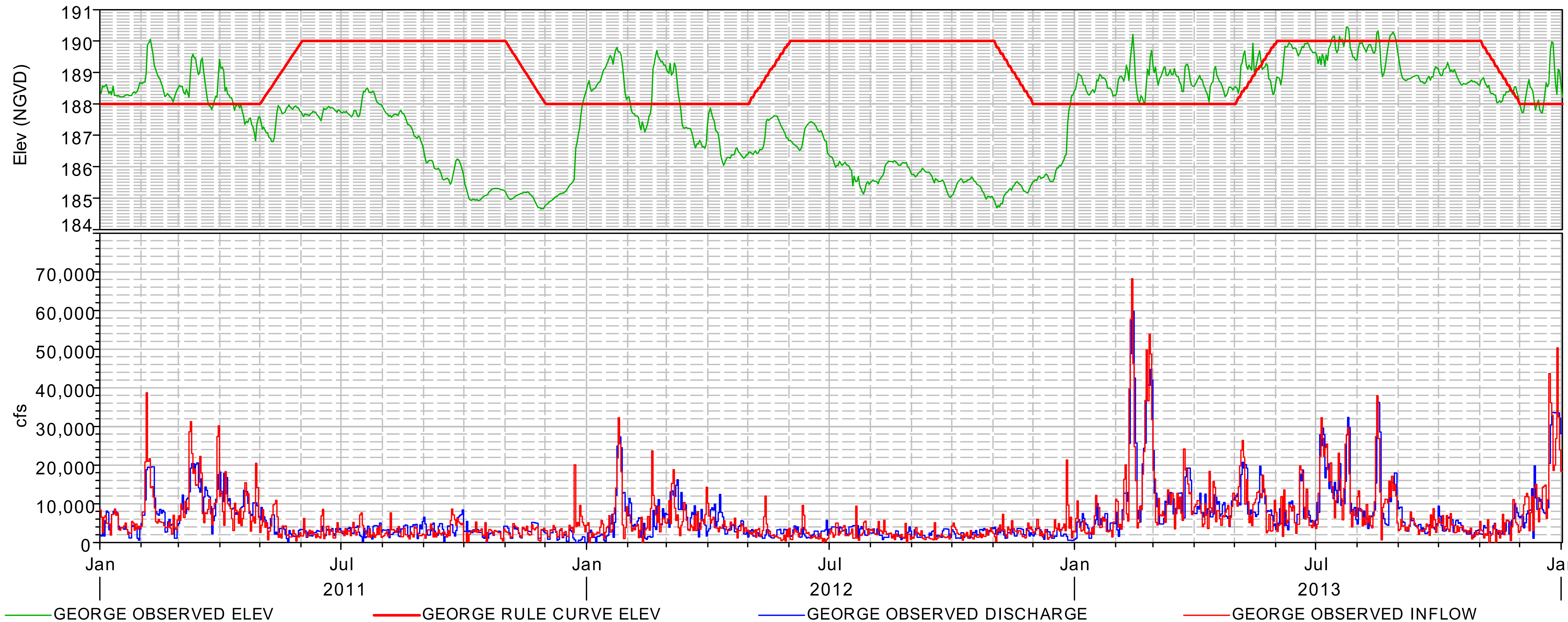
WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM AND LAKE

POOL ELEVATION-INFLOW-DISCHARGE HYDROGRAPHS
2003–2006

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM AND LAKE

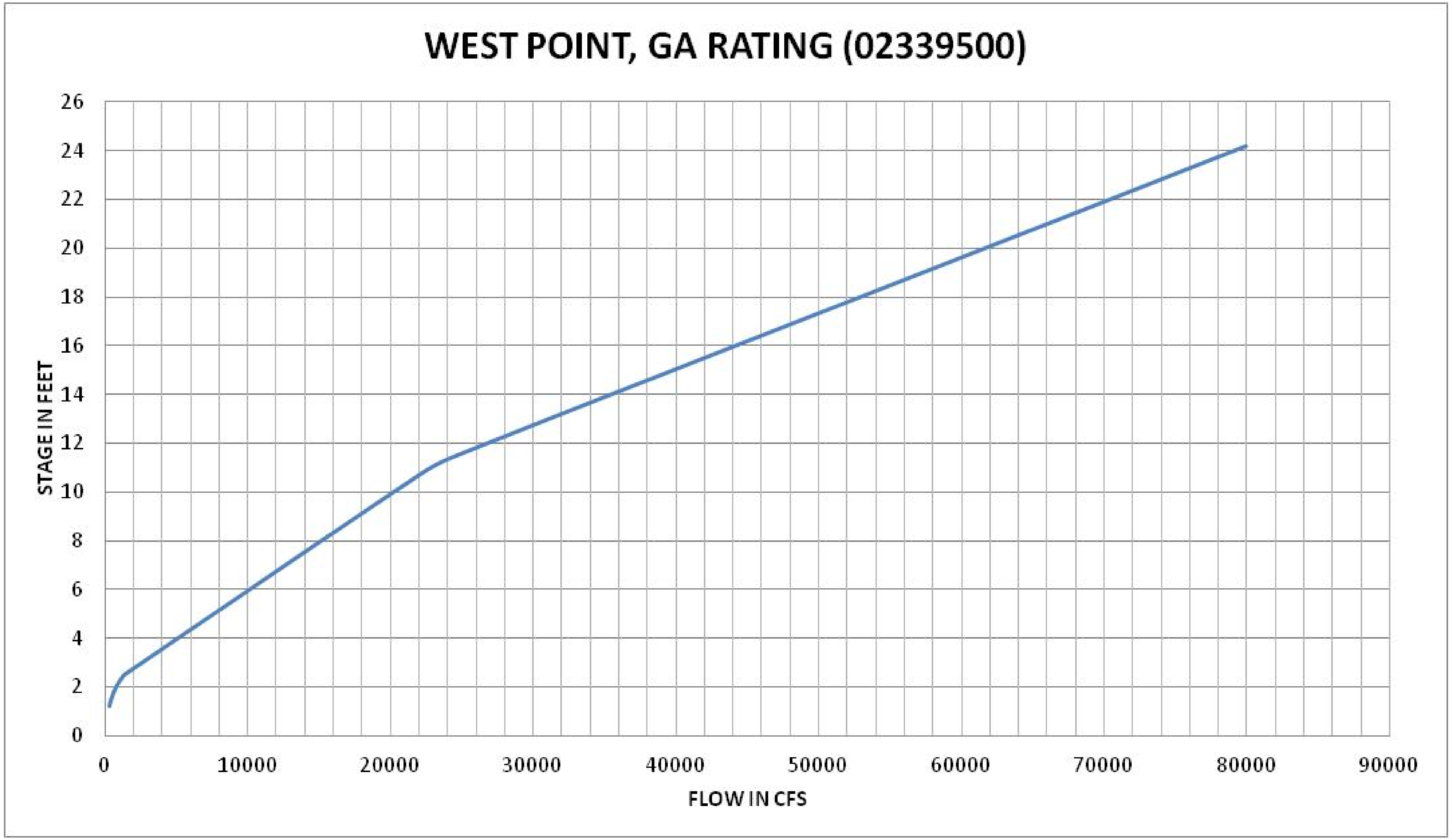
POOL ELEVATION-INFLOW-DISCHARGE HYDROGRAPHS
2007–2010



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

POOL ELEVATION-INFLOW-
DISCHARGE HYDROGRAPHS
2011–2013

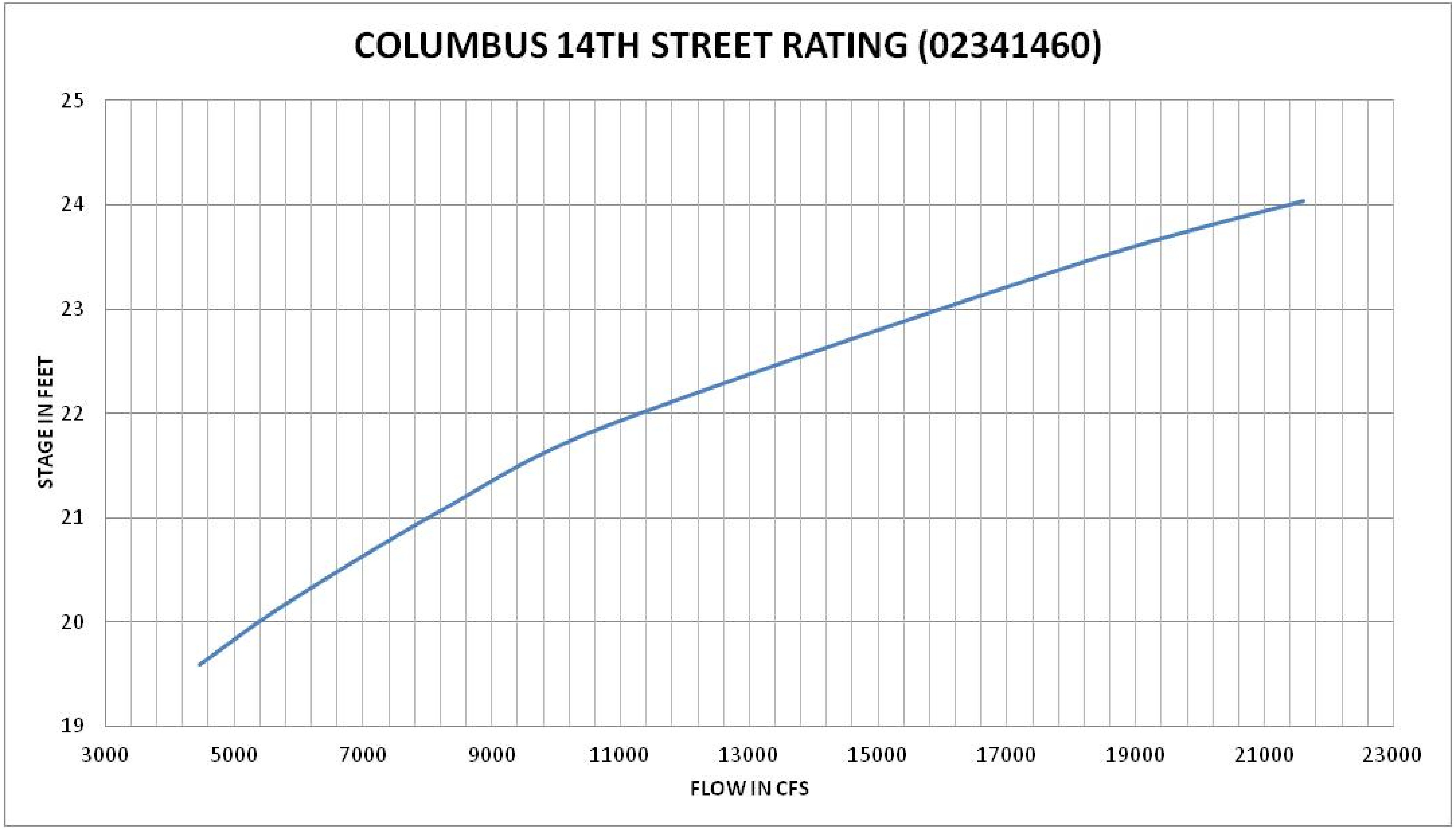


West Point rating	
USGS # 02339500	
Stage (in feet)	Flow (in cfs)
1.2	270
1.3	310
1.4	355
1.5	405
1.6	460
1.7	520
1.8	590
1.9	665
2	750
2.1	845
2.2	950
2.3	1065
2.4	1190
2.5	1330
10.5	21500
11.5	24600
24.2	80000

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

WEST POINT RATING
CHATTAHOOCHEE RIVER
UGSG # 02339500
Rating #15.1
DRAINAGE AREA 3,550 SQUARE MILES
GAGE ZERO 551.67 FEET NGVD

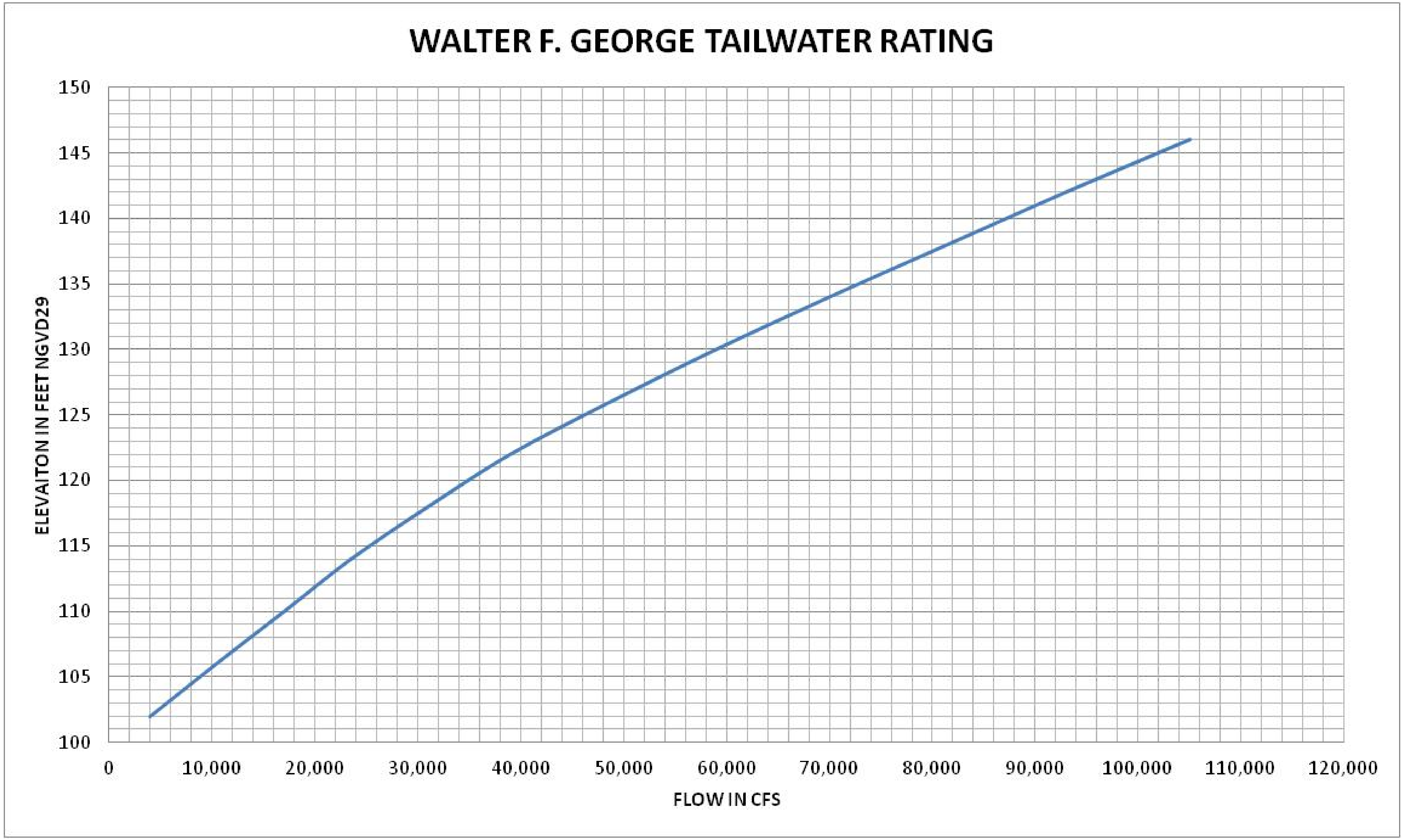


Columbus 14th Street rating	
USGS # 02341460	
Stage (in feet)	Flow (in cfs)
16.05	819.4
17.91	2178.22
18.84	3309.08
19.59	4458.2
20.19	5837.32
21.1	8293.93
21.88	10773.82
23.41	17962.75
24.04	21603.16

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

COLUMBUS RATING
CHATTAHOOCHEE RIVER
UGSG # 02341460
Rating #1.0
DRAINAGE AREA 4,630 SQUARE MILES
GAGE ZERO 190.0 FEET NAVD 88

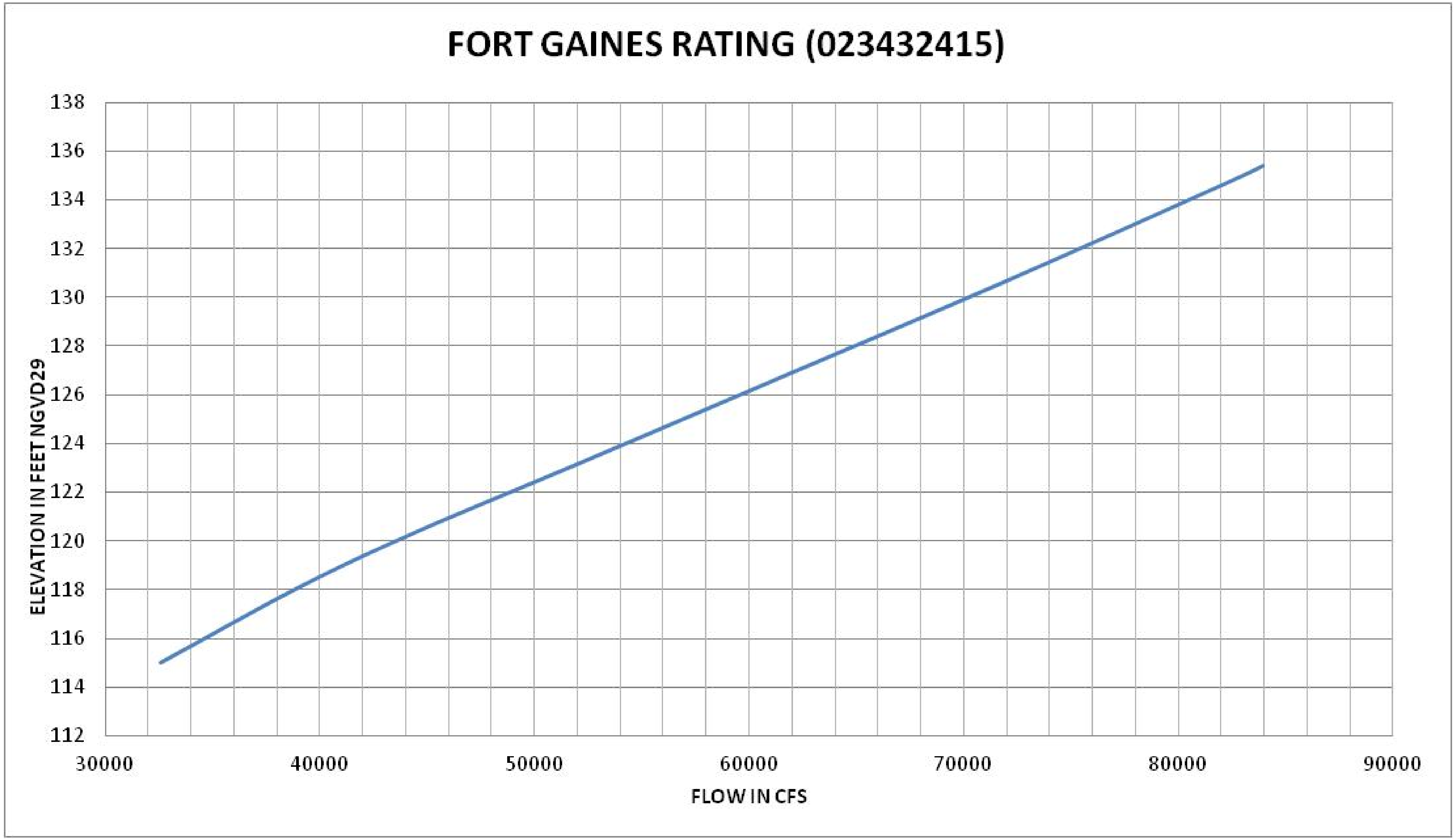


Walter F. George tailwater rating	
Elevation (in feet NGVD)	Flow in cfs)
102	4,000
106	10,400
110	17,000
114	23,500
118	31,000
122	39,000
126	48,700
130	59,000
134	70,000
138	81,500
142	93,000
146	105,000

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM AND LAKE

TAILWATER RATING



Ft Gaines rating	
Elevation (in feet NGVD)	Flow in cfs)
114.99	32600
118.15	39175
120.43	44685
123.26	52310
126.57	61102
130.63	71869
135	83000
135.4	83920

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM AND LAKE

FT GAINES RATING
CHATTAHOOCHEE RIVER
UGSG # 023432415
Rating #2.0
DRAINAGE AREA 7,460 SQUARE MILES
GAGE ZERO 0.0 FEET NGVD29

Walter F. George average monthly inflow period of record

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Min	Max	Avg
1963				7,824	11,735	8,205	9,144	5,783	3,480	4,042	4,091	9,196	3,480	11,735	
1964	18,446	17,321	25,271	42,137	21,719	6,964	10,224	10,054	5,867	15,708	9,196	17,184	5,867	42,137	16,674
1965	14,827	19,457	22,284	11,921	5,727	8,273	6,127	7,540	4,139	6,383	3,816	5,414	3,816	22,284	9,659
1966	14,793	27,086	27,614	10,002	14,443	7,310	4,928	6,257	4,597	7,221	9,155	9,115	4,597	27,614	11,877
1967	16,696	13,187	8,934	5,532	7,562	8,340	9,002	9,282	8,784	5,687	9,216	16,037	5,532	16,696	9,855
1968	15,925	8,254	15,778	10,715	9,098	4,570	5,395	4,430	4,296	3,503	5,252	7,235	3,503	15,925	7,871
1969	7,319	9,515	11,838	17,531	13,105	5,341	5,436	4,801	6,539	3,255	5,868	6,602	3,255	17,531	8,096
1970	7,147	9,831	18,707	9,213	4,502	7,458	5,704	6,231	4,259	6,710	5,488	8,280	4,259	18,707	7,794
1971	14,283	17,518	26,078	13,650	11,935	5,897	9,111	11,698	6,773	4,657	6,032	10,688	4,657	26,078	11,527
1972	22,396	17,691	14,786	7,993	8,796	7,943	5,864	5,417	4,878	4,976	4,678	17,026	4,678	22,396	10,204
1973	19,787	20,906	21,033	32,503	16,746	13,645	7,877	5,967	4,566	4,441	5,403	8,847	4,441	32,503	13,477
1974	21,685	21,828	10,137	17,840	7,536	5,643	4,270	6,486	5,906	3,690	4,778	10,714	3,690	21,828	10,043
1975	16,219	28,690	29,255	27,533	7,746	9,282	9,859	9,857	6,181	13,978	9,959	10,505	6,181	29,255	14,922
1976	14,761	13,923	20,002	15,369	14,672	11,607	8,689	5,855	4,905	6,325	8,174	14,728	4,905	20,002	11,584
1977	13,220	8,083	21,104	17,951	5,754	4,026	5,465	7,260	4,144	4,278	13,976	9,068	4,026	21,104	9,527
1978	26,598	15,592	15,783	9,198	16,397	6,465	5,683	8,719	5,160	4,132	4,391	4,814	4,132	26,598	10,244
1979	10,378	20,132	16,596	30,926	10,538	6,575	6,251	5,141	6,963	6,008	9,836	7,267	5,141	30,926	11,384
1980	11,141	13,072	32,714	22,559	18,134	7,226	4,997	5,919	5,021	7,328	3,189	4,066	3,189	32,714	11,281
1981	3,750	15,802	6,956	11,173	3,899	3,293	4,113	5,531	3,568	3,212	3,050	4,992	3,050	15,802	5,778
1982	12,048	21,594	8,551	13,843	6,680	4,141	6,238	7,313	4,848	3,744	6,122	19,130	3,744	21,594	9,521
1983	14,680	17,740	23,934	23,497	8,042	7,880	7,796	5,848	5,793	4,347	7,945	20,889	4,347	23,934	12,366
1984	16,006	14,127	18,445	12,890	12,756	5,837	6,132	12,808	6,890	2,878	4,240	5,724	2,878	18,445	9,894
1985	4,758	15,018	6,749	5,396	3,874	4,910	5,293	5,795	5,341	6,501	3,780	7,104	3,780	15,018	6,210
1986	4,806	8,369	11,638	4,163	3,707	2,703	3,003	1,900	2,791	2,374	8,402	8,492	1,900	11,638	5,196
1987	13,996	14,459	16,778	7,727	4,878	8,273	6,420	5,158	4,448	2,950	3,893	3,624	2,950	16,778	7,717
1988	9,039	9,229	6,645	5,731	3,246	3,236	3,052	1,628	4,137	3,251	5,003	4,213	1,628	9,229	4,868
1989	4,469	5,064	9,150	13,519	5,188	11,744	13,427	6,190	5,817	11,036	10,118	17,105	4,469	17,105	9,402
1990	21,024	25,911	39,734	11,595	8,122	4,929	5,371	4,673	3,602	4,260	4,909	4,808	3,602	39,734	11,578

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM AND LAKE

MONTHLY FLOWS
AVERAGE-MAXIMUM-MINIMUM

PAGE 1 OF 2

Walter F. George average monthly inflow period of record															
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Min	Max	Avg
1991	8,921	8,952	15,945	8,595	17,864	9,699	8,997	7,401	6,857	7,996	5,891	7,465	5,891	17,864	9,549
1992	12,762	15,607	12,859	7,757	4,572	4,255	6,429	6,414	5,397	6,307	20,893	20,816	4,255	20,893	10,339
1993	19,101	16,048	21,416	13,328	8,437	5,737	4,891	5,031	3,617	4,707	4,618	6,121	3,617	21,416	9,421
1994	9,051	14,414	13,298	8,449	4,672	5,869	29,211	9,932	9,805	8,131	7,146	11,844	4,672	29,211	10,985
1995	10,354	22,773	19,446	6,130	5,885	3,724	3,923	4,729	4,553	10,228	10,559	11,796	3,724	22,773	9,508
1996	17,004	24,535	27,831	11,941	8,264	5,480	5,332	5,250	5,382	4,303	5,053	8,459	4,303	27,831	10,736
1997	12,678	17,900	16,277	10,241	7,834	9,982	7,170	4,438	5,878	5,889	11,151	18,790	4,438	18,790	10,686
1998	19,479	29,947	33,843	19,057	10,313	6,212	5,910	4,788	6,566	3,726	4,278	4,803	3,726	33,843	12,410
1999	6,917	8,767	7,648	4,580	2,984	6,135	4,105	3,976	2,796	3,657	2,309	3,405	2,309	8,767	4,773
2000	5,551	5,570	8,368	6,138	2,904	2,997	2,229	2,905	2,902	1,970	3,403	5,664	1,970	8,368	4,217
2001	6,439	5,246	28,874	11,179	4,348	8,329	3,629	3,795	2,199	2,187	2,701	2,696	2,187	28,874	6,802
2002	5,060	6,661	6,649	5,829	3,393	2,159	2,507	1,820	2,074	3,003	6,603	10,077	1,820	10,077	4,653
2003	5,721	11,530	17,703	12,215	22,036	18,490	16,628	9,360	4,644	4,951	6,803	8,715	4,644	22,036	11,566
2004	8,607	14,570	5,448	4,490	3,148	3,872	4,751	4,310	13,471	5,908	10,787	12,793	3,148	14,570	7,680
2005	9,062	12,902	22,662	23,327	7,061	11,114	22,223	13,215	4,695	3,762	5,317	8,246	3,762	23,327	11,966
2006	11,013	11,890	10,353	6,947	6,387	3,122	2,489	2,295	2,414	2,784	5,513	4,602	2,295	11,890	5,818
2007	8,827	6,531	7,803	4,825	2,247	2,441	2,254	2,292	2,395	2,153	2,760	3,523	2,153	8,827	4,004
2008	4,494	10,432	8,530	6,248	3,227	1,545	1,540	5,342	1,664	2,414	4,950	10,431	1,540	10,432	5,068
2009	6,872	4,408	21,241	18,140	9,400	3,862	2,289	3,129	12831	13853	20295	38084	2,289	38,084	12,867
2010	23,938	23,083	19,615	6,789	13,351	5,642	3,250	3,116	2031	2468	3502	4781	2,031	23,938	9,297
2011	4,783	8,926	13,412	9,123	3,812	2,789	3,009	2,498	3545	2317	2862	3956	2,317	13,412	5,086
2012	6,669	5,756	6,550	4,310	2,560	2,167	2,849	2,303	1617	2236	2987	3874	1,617	6,669	3,657
2013	4,687	23,797	10,777	8,556	11,331	7,748	15,806	11,342	4313	3655	3661	16020	3,655	23,797	10,141
Min	3,750	4,408	5,448	4,163	2,247	1,545	1,540	1,628	1,617	1,970	2,309	2,696			
Max	26,598	29,947	39,734	42,137	22,036	18,490	29,211	13,215	13,471	15,708	20,893	38,084			
Avg	11,964	14,793	16,861	12,512	8,482	6,374	6,790	5,946	5,007	5,205	6,549	9,801			

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

MONTHLY FLOWS
AVERAGE-MAXIMUM-MINIMUM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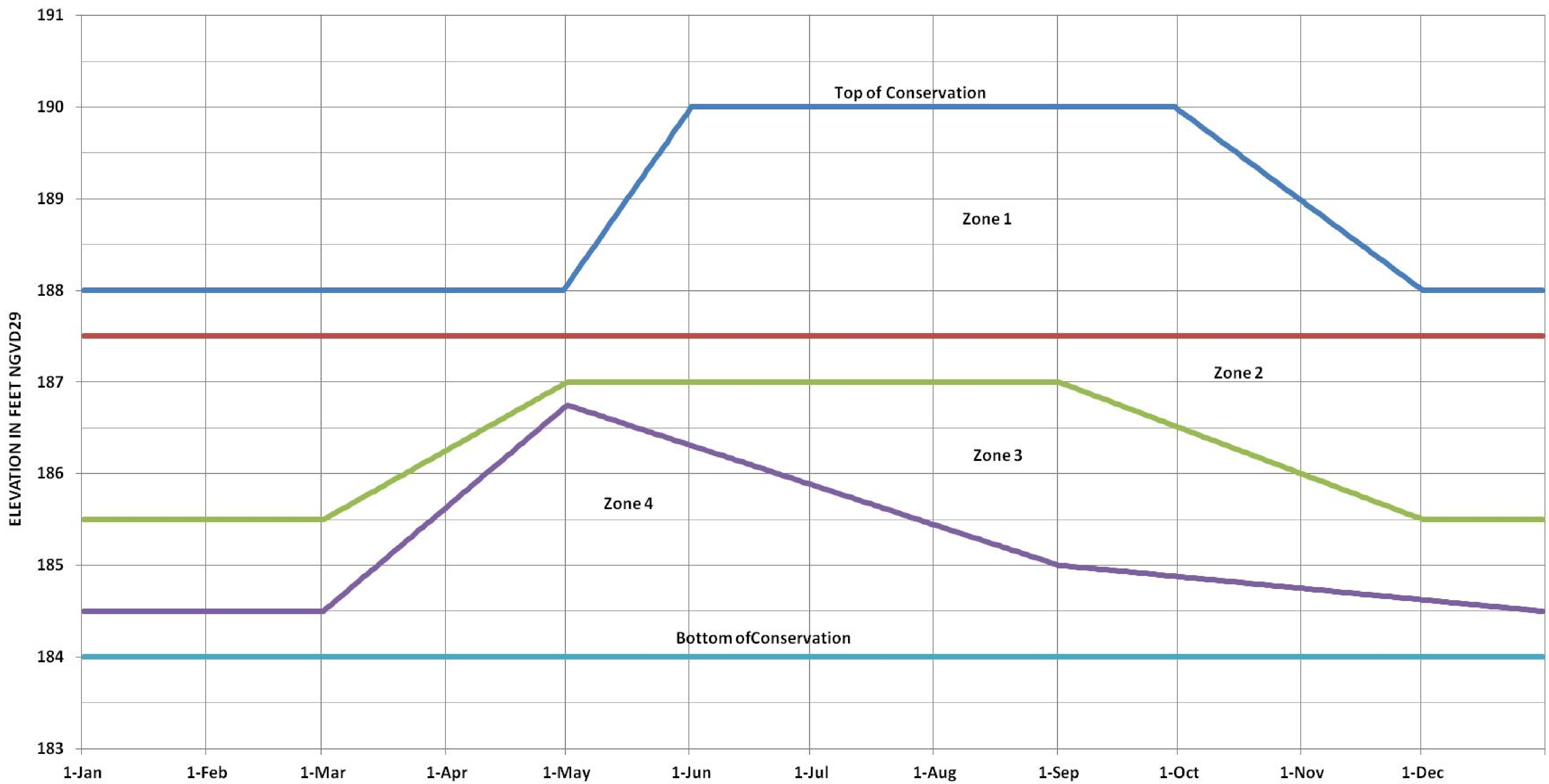
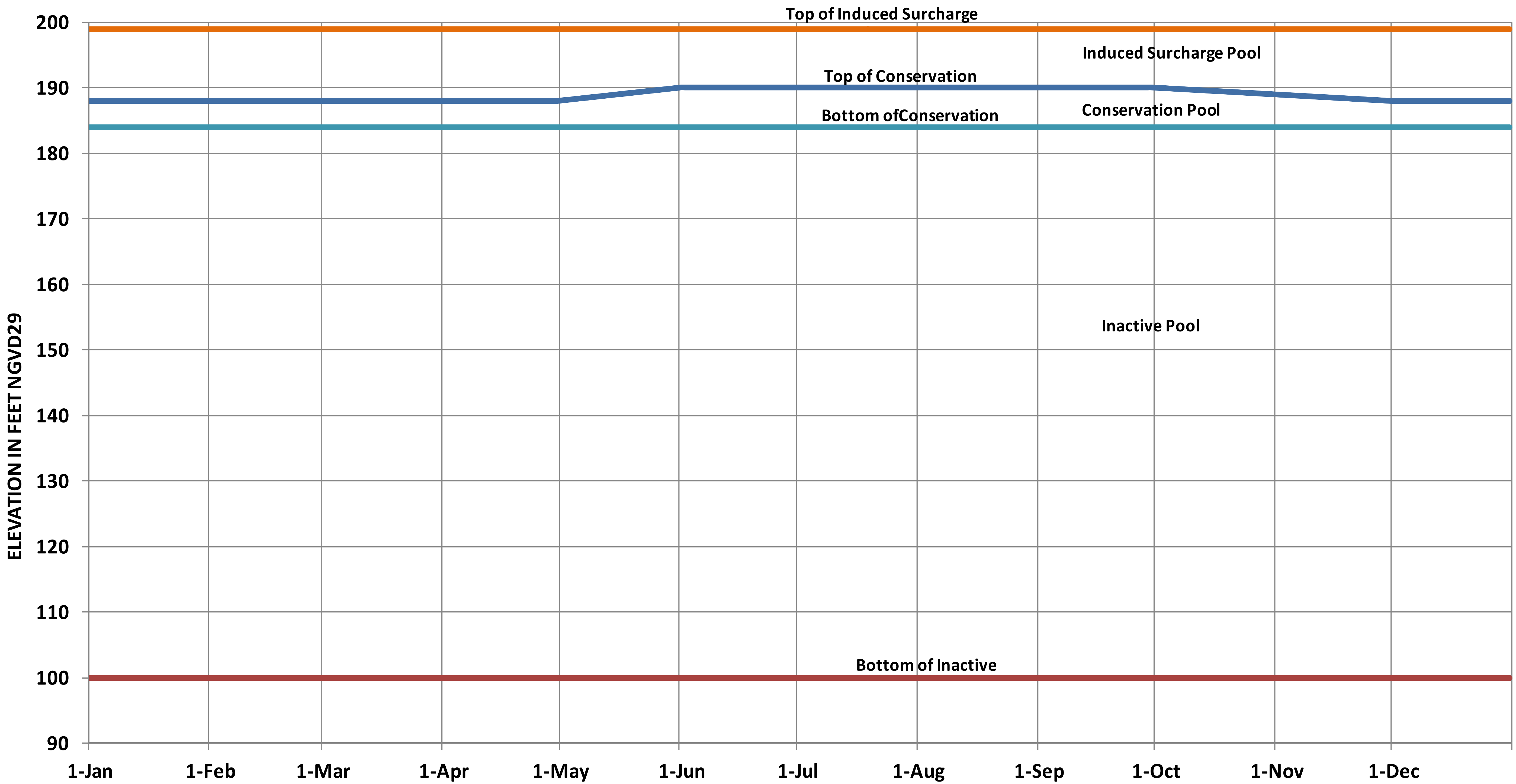
APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN
WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
RIVER STAGE &
RAINFALL GAUGE MAP
0 5 10 20 30 40
Miles
DAMS
RAIN GAUGE
RIVER GAUGE
RAIN AND RIVER GAUGE
LaGrange 1N, GA
West Point Lake
WEST POINT DAM
West Point (Tailwater)
West Point
West Point, GA
Opelika, AL
Columbus Metro AP, GA
Columbus
Upatoi Creek
Hurtsboro, AL
Hannahatchee Creek
Eufaula Wildlife Refuge, AL
Clayton, AL
Pataula Creek
Cuthbert, GA
Walter F. George Reservoir
WALTER F GEORGE LOCK & DAM
Walter F. George (Tailwater)
Fort Gaines
Andrews (Pool)
GEORGE W ANDREWS LOCK & DAM
Andrews (Tailwater)
Chattahoochee River
Flint River
Mississippi
Alabama
Georgia
South Carolina
Florida



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

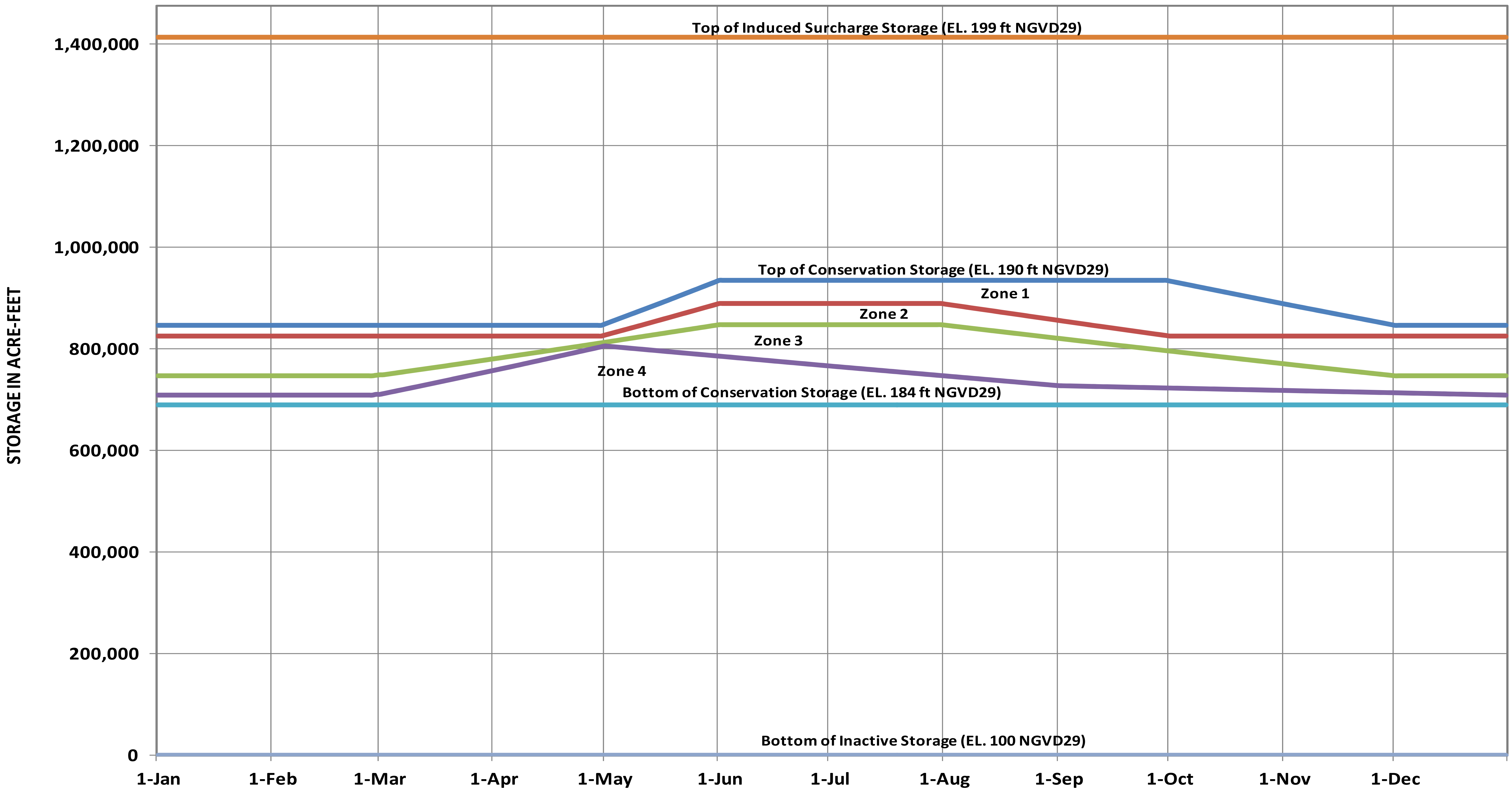
ACTION ZONES



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

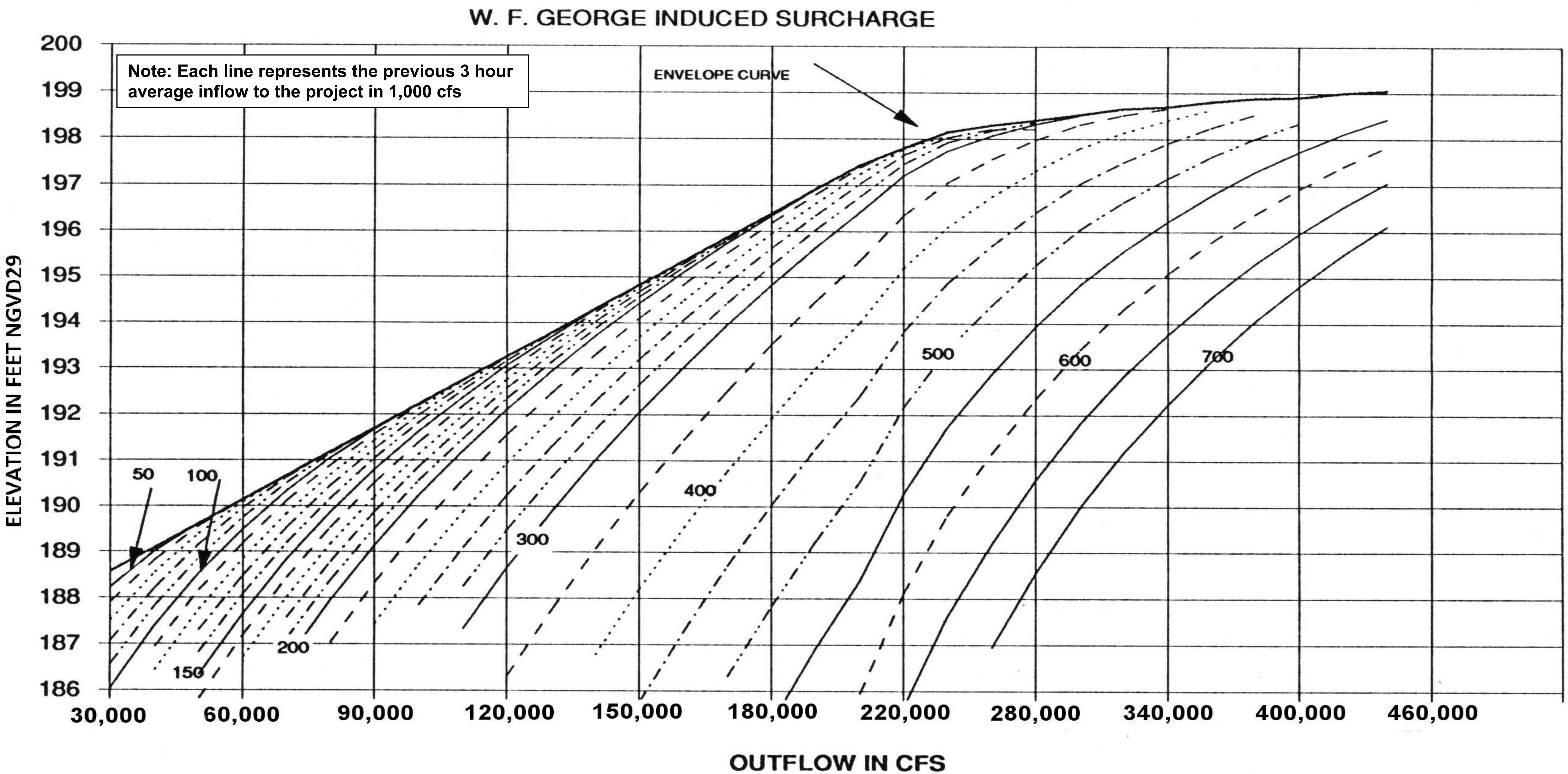
RESERVOIR STORAGE ZONES
IN FEET NGVD29



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

RESERVOIR STORAGE ZONES
BY VOLUME



INSTRUCTIONS FOR INDUCED SURCHARGE

I. Pool Rising. Adjust the outflow each hour on the basis of the average inflow for the preceding three hours and current reservoir elevation as indicated on schedule. If the discharge value taken from the induced surcharge schedule is less than the previous hour's discharge, maintain the previous hour's discharge.

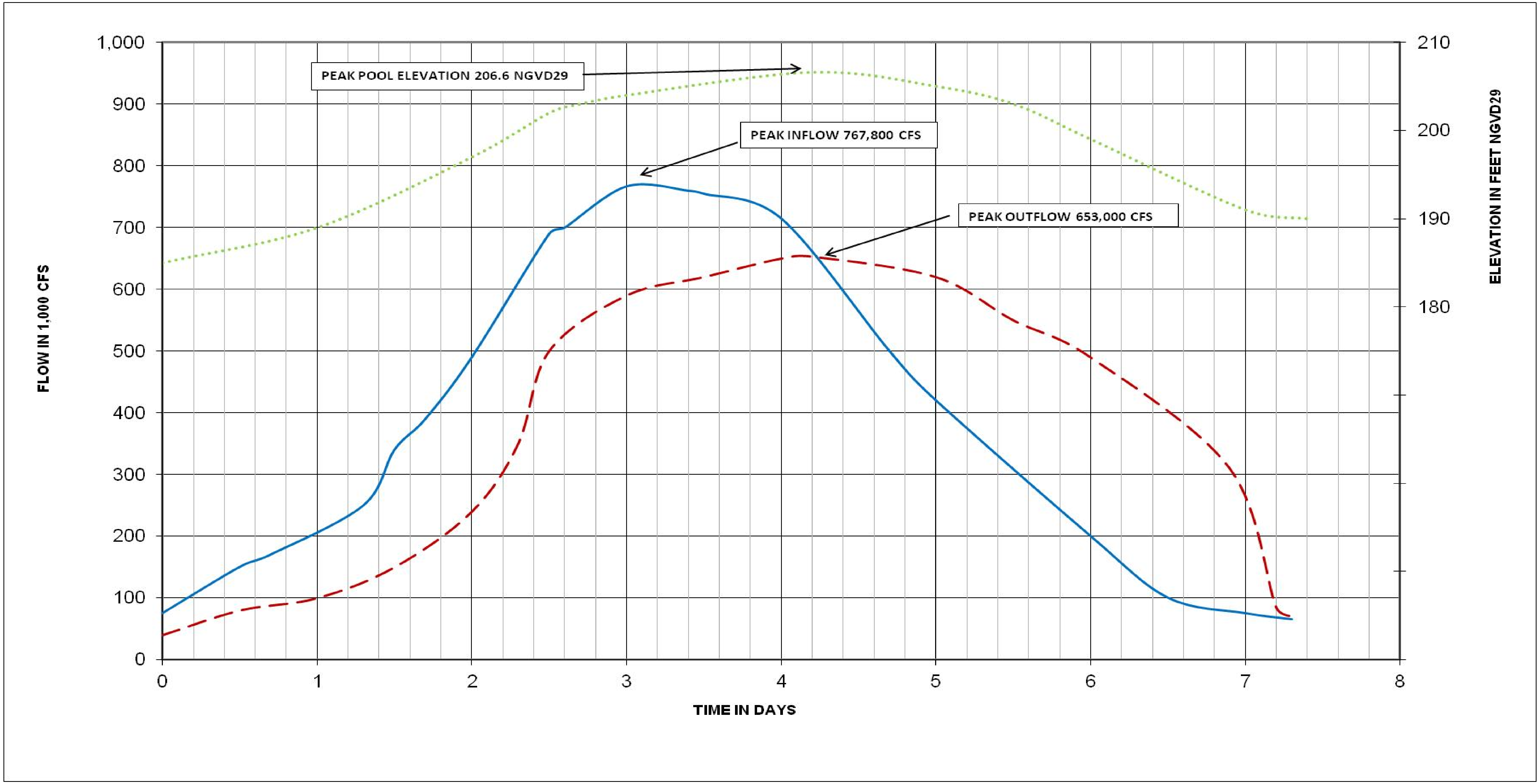
II. Pool at Crest. Maintain maximum gate opening for six (6) hours to ensure that inflow has peaked.

III. Pool Falling. Follow Emptying Instructions on page E-C-2 or table 7-3.

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM AND LAKE

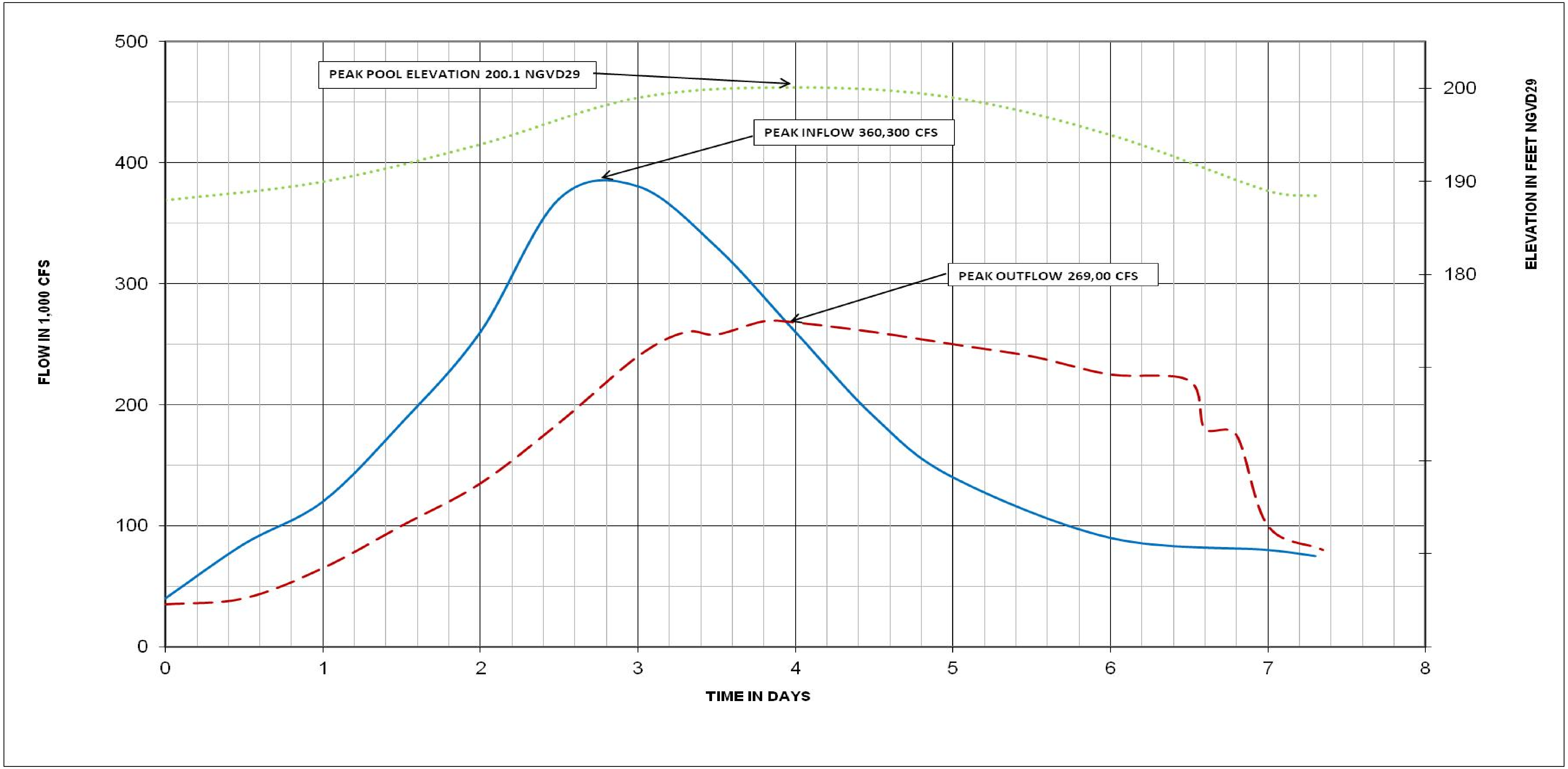
INDUCED SURCHARGE SCHEDULE



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

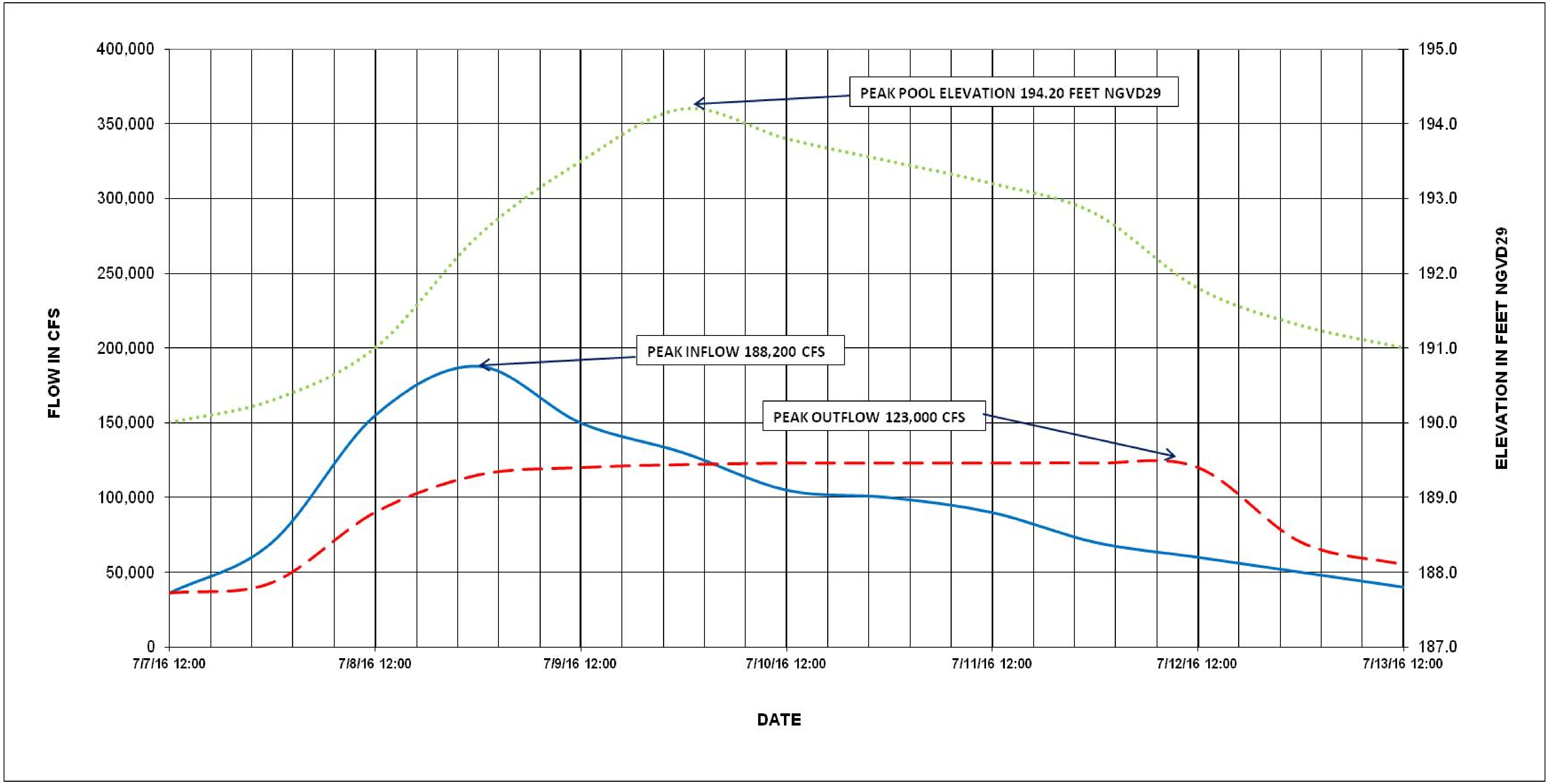
SPILLWAY DESIGN FLOOD



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

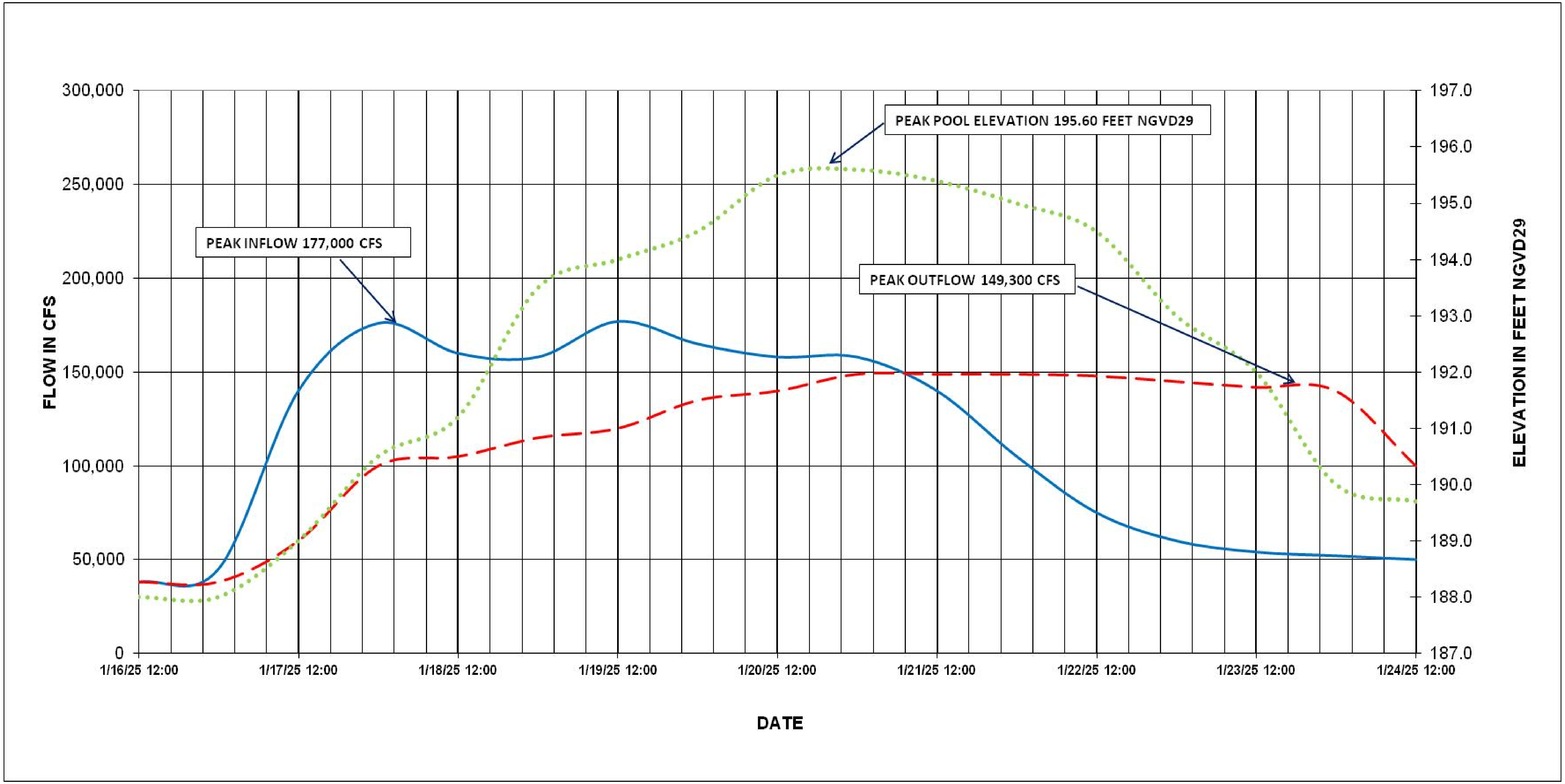
STANDARD PROJECT FLOOD



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

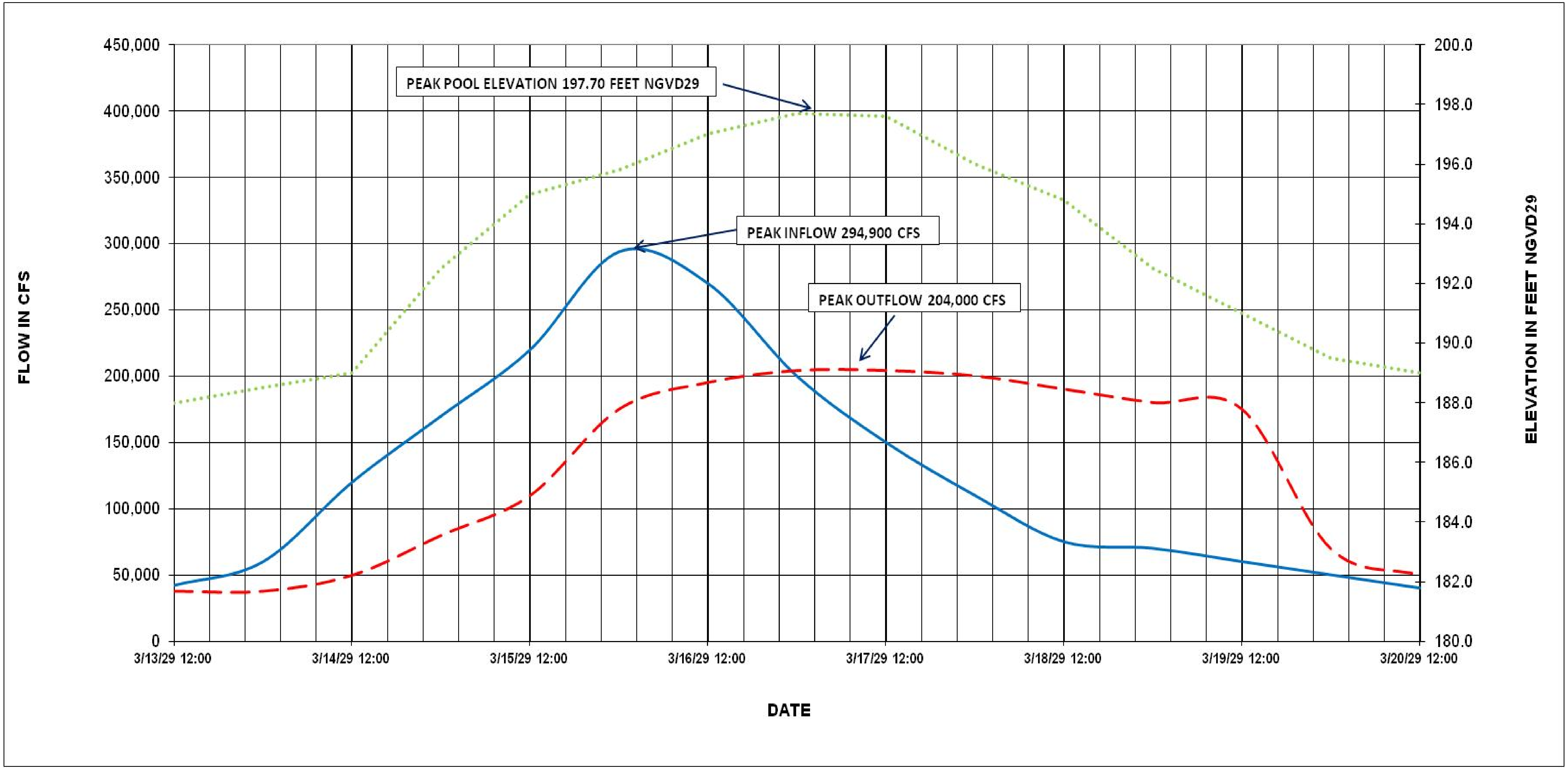
FLOOD OF JULY 1916
INFLOW – OUTFLOW – POOL ELEVATION



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM AND LAKE

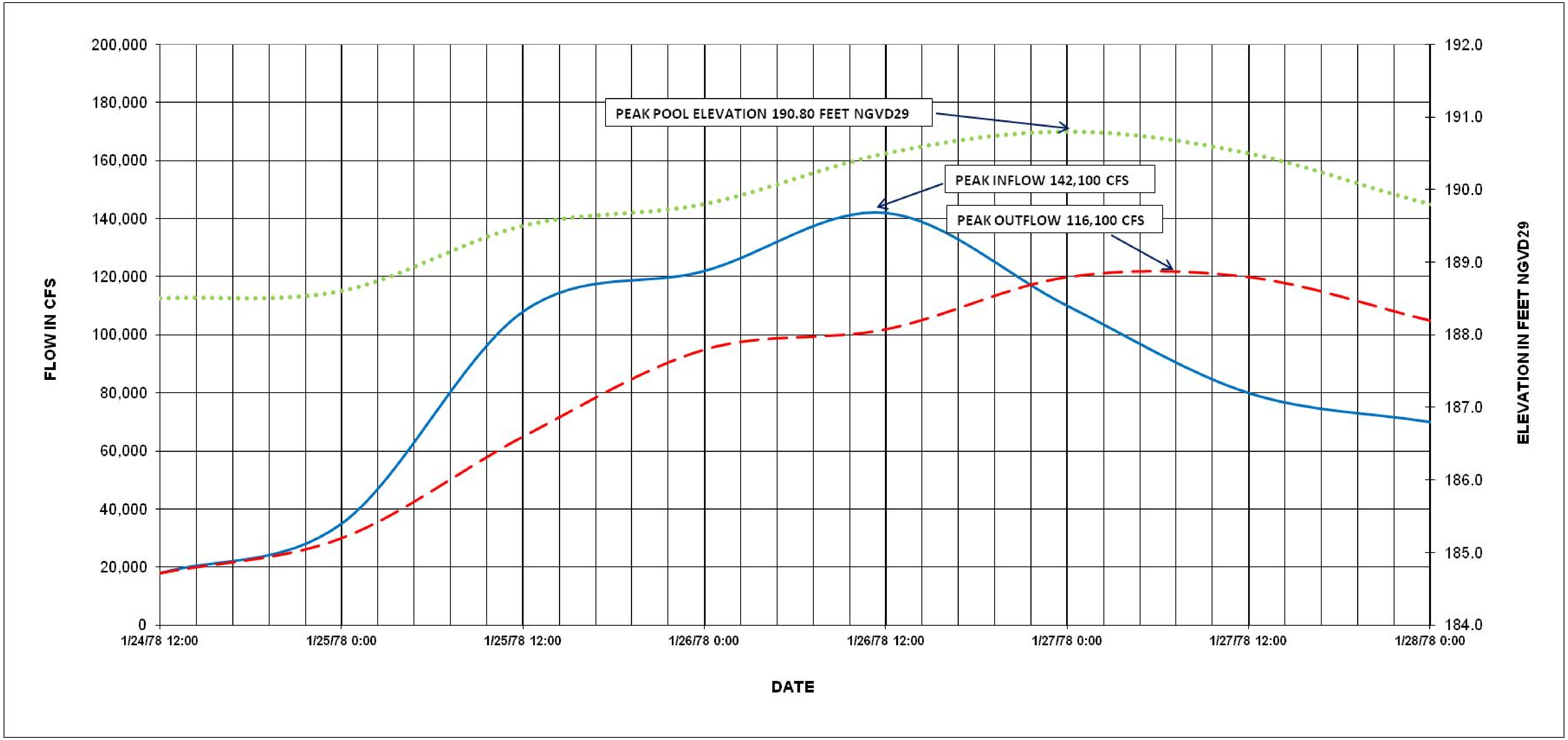
FLOOD OF JANUARY 1925
INFLOW – OUTFLOW – POOL ELEVATION



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM AND LAKE

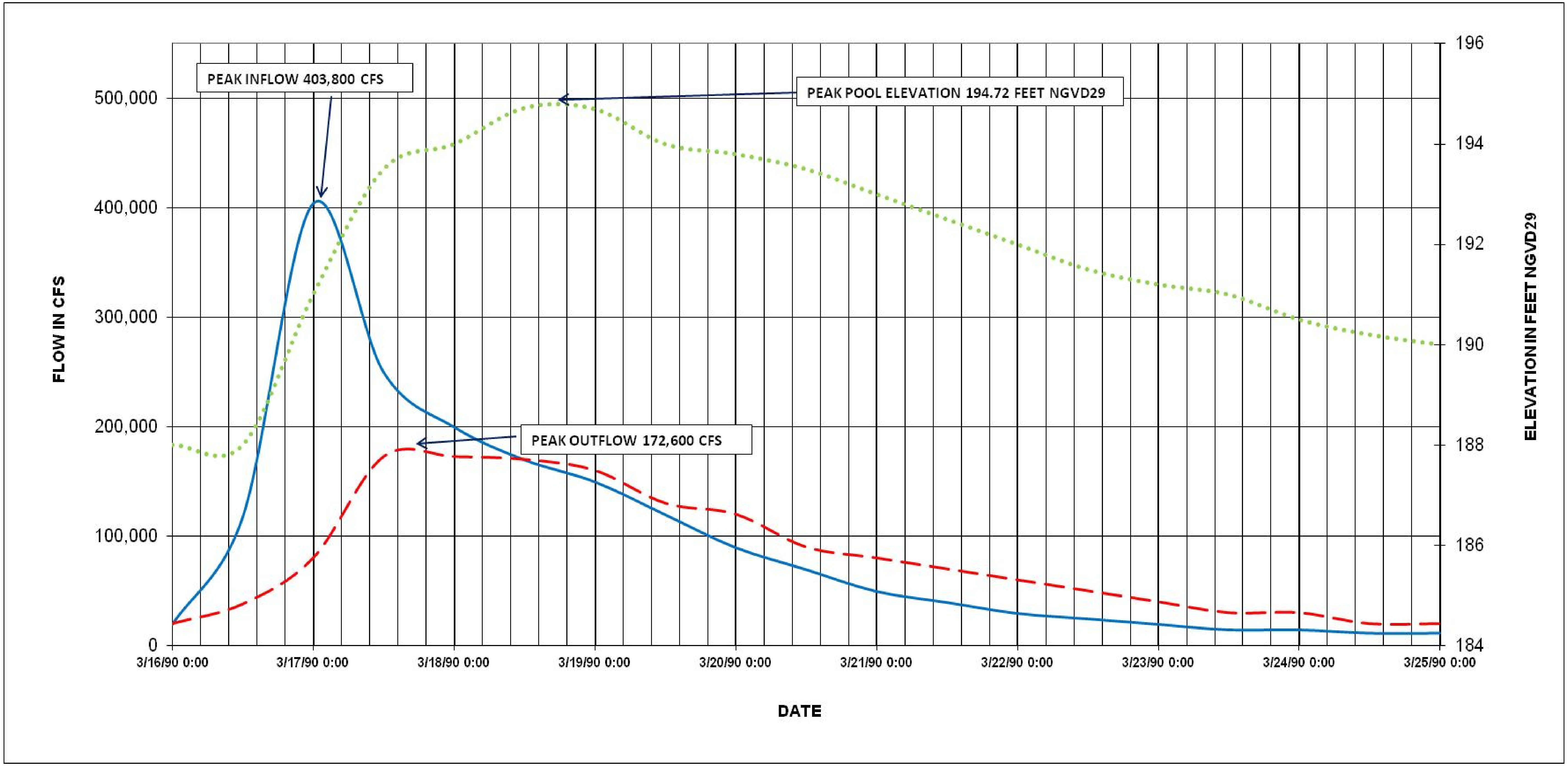
FLOOD OF MARCH 1929
INFLOW – OUTFLOW – POOL ELEVATION



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM AND LAKE

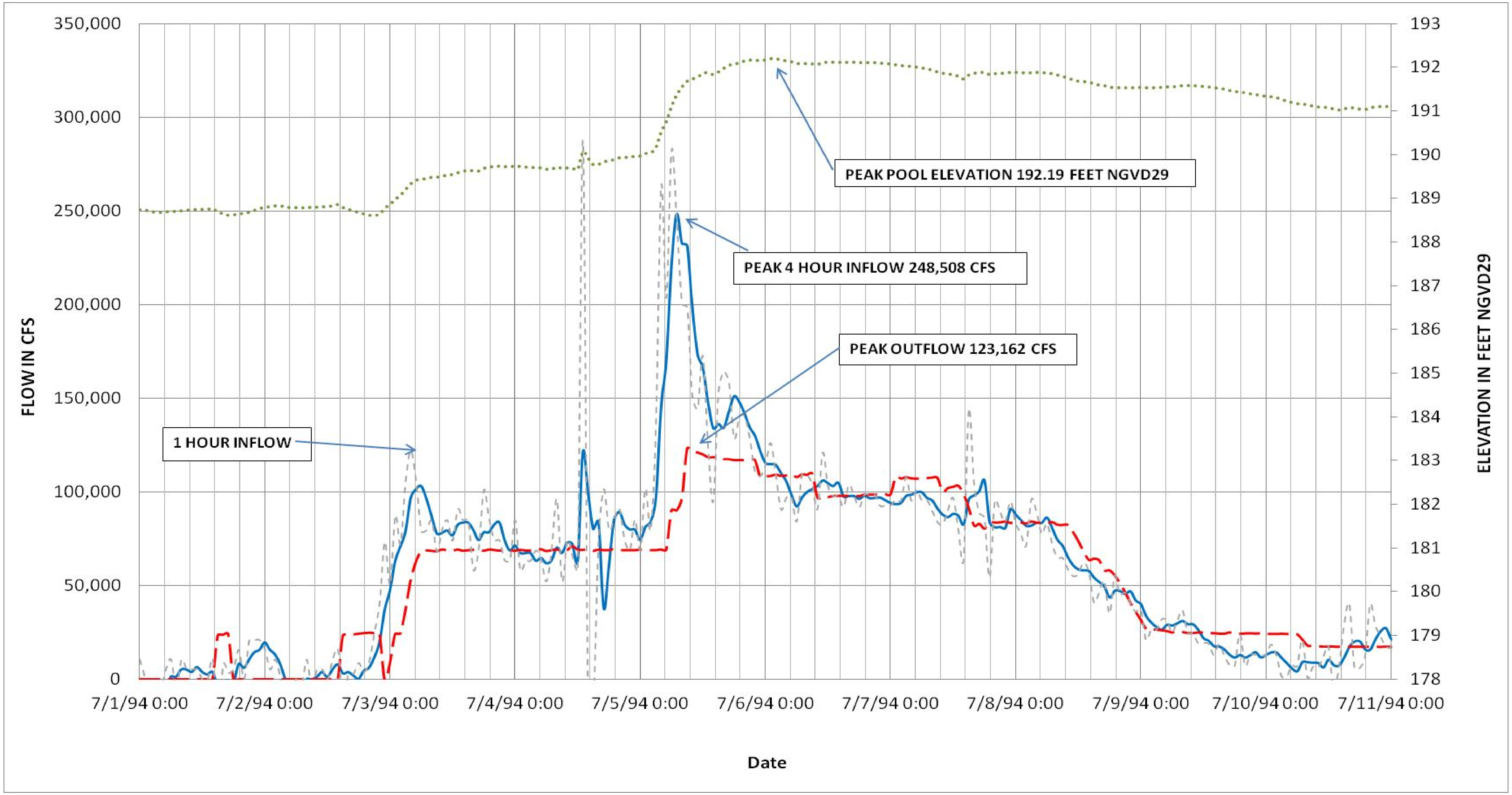
FLOOD OF JANUARY 1978
INFLOW – OUTFLOW – POOL ELEVATION



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM
AND LAKE

FLOOD OF MARCH 1990
INFLOW – OUTFLOW – POOL ELEVATION



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
WALTER F. GEORGE LOCK AND DAM AND LAKE

FLOOD OF JULY 1994
INFLOW – OUTFLOW – POOL ELEVATION