




FINAL
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

December 2016

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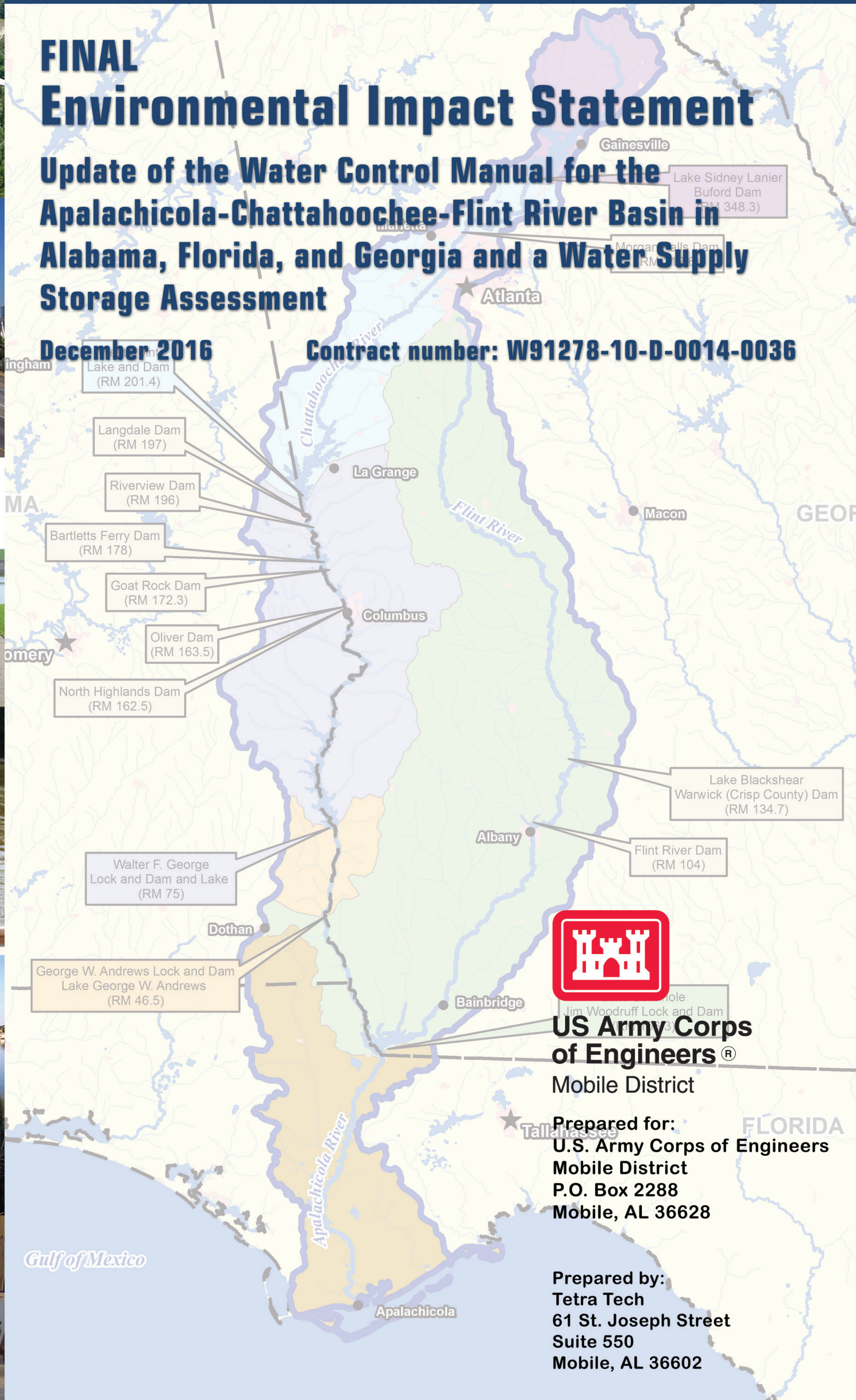

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WATER CONTROL MANUAL

APPENDIX B

BUFORD DAM AND LAKE SIDNEY LANIER

CHATTAHOOCHEE RIVER, GEORGIA

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

DECEMBER 1959

Revised February 1991 and XXX 2016

Buford Dam and Lake Sidney Lanier

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)
- Mobile District Operations Division Chief (251) 690-2576 (office), (251) 689-2394 (cell)
- Buford Dam Project Manager's Office (770) 945-9531 during regular duty hours, (770) 780-6224 during non-regular duty hours.
- South Atlantic Division Senior Water Manager (404) 562-5128 (office), (404) 242-1700 (cell)

METRIC CONVERSION

Although values presented within this text are shown with 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 Engineer Regulation 1110-2-8160 and in accordance with the standards and procedures as outlined in Engineer 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 GC-862, and the relationship between current and legacy datums are in Exhibit B.

APALACHICOLA RIVER BASIN

WATER CONTROL MANUAL

APPENDIX B

BUFORD DAM AND LAKE SIDNEY LANIER
CHATTAHOOCHEE RIVER, GEORGIA

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PERTINENT DATA

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

GENERAL

Location (damsite) – Gwinnett and Forsyth Counties, GA, miles above mouth of Chattahoochee River	348.3
Drainage area above damsite - square miles	1,034

RESERVOIR

Length at elevation 1,070 feet NGVD29 - river miles Chattahoochee River/Chestatee River	44/19
Top of conservation pool elevation, summer/winter - feet NGVD29	1,071/1,070
Peak pool for standard project flood – feet NGVD29	1,085
Peak pool for spillway design flood – feet NGVD29	1,100
Top of flood risk management pool - feet NGVD29	1,085
Bottom of conservation pool elevation – feet NGVD29	1,035
Area at top of conservation (elevation 1,071) – acres	38,425
Conservation storage elevation 1,071 – 1,035 – acre feet	1,074,645
Length of shoreline (elevation 1,071) – miles	692

TAILWATER ELEVATIONS

Normal, service unit only – feet NGVD29	912.2
Normal, one large unit and service unit operating (outflow 6,000 cfs) – feet NGVD29	917.0
Normal, 3 units operating (outflow 11,200 cfs) – feet NGVD29	920.3

DAM/EARTH DIKES

Dam total length - feet	1,630
top elevation - feet NGVD29	1,106
Saddle Dikes (1, 2, and 3), total length - feet	6,600
top elevation - feet NGVD29	1,106

EMERGENCY SPILLWAY

Type	Uncontrolled chute
Total Width - feet	100
Crest elevation – feet NGVD29	1,085

FLOOD RISK MANAGEMENT SLUICE

Number of sluices / Number of gates (each gate has jet valve)	1 / 2
Discharge capacity of jet valve – cfs	600
Discharge capacity at elevation 1,085 / 1,070 NGVD29 - cfs	11,590 / 11,030

POWER PLANT

Generating capacity (declared*) - MW (2 units @ 60, 1 unit @ 7)	127

* 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 (now 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 Engineer Regulation (ER) 1110-2-240, *Water Control Management (30 May 2016)*. 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' Engineer 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 Buford Dam and Lake Sidney Lanier Project (Buford 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 Buford Project water control plan must be coordinated with the multiple projects in the Apalachicola-Chattahoochee-Flint (ACF) River Basin to ensure consistency with the purposes for which the projects were authorized. In conjunction with the ACF Basin Master Water Control Manual, this manual provides a general reference source for Buford 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 Buford Project water control regulation activities include the *Operation and Maintenance Manual* for the project and the *ACF Basin Master Water Control Manual* for the entire basin.

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 Buford Dam and Lake Sidney Lanier was published in December of 1959. A revised water control manual was published in February of 1991. This revision supersedes any prior editions.

The Buford emergency action plan (EAP) entitled *Emergency Action Plan, Buford Dam, April 2013* serves to consolidate guidance documents regarding actions to be taken by project personnel should an 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.

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 Buford Project is a Federally-owned project entrusted to the USACE.

1-05. Operating Agency. Operation and maintenance of the Buford Project is the responsibility of the USACE Mobile District's Operations Division. An Operations Project Manager and necessary staff members are assigned to the project to provide daily oversight and direction.

1-06. Regulating Agencies. Authority for water control regulation of the Buford Project has been delegated to the USACE South Atlantic Division (SAD) Commander. Day-to-day water control regulation activities are the responsibility of the USACE Mobile District, Engineering Division, Water Management Section (Mobile District). The Buford Project is regulated using a system-wide, balanced approach to meet the Federally authorized purposes for the Buford Project as well as the other Federal projects within the ACF Basin. 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 issued by the Mobile District with approval of the SAD. 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. Buford Dam is on the Chattahoochee River in Gwinnett and Forsyth Counties, Georgia, about 50 miles northeast of Atlanta, Georgia, and 4.5 miles northwest of the city of Buford, Georgia. The normal pool of the lake is within Gwinnett, Forsyth, Hall, Dawson, and Lumpkin Counties. The Chestatee and Chattahoochee Rivers combine in the upper reservoir pool and compose about 85 percent of the 1,034 square miles of drainage. The drainage area of Buford Dam is on the southern slope of the Blue Ridge Mountains and is characterized by the steep slopes of mountain streams. The location of the project, at mile 348.3 on the Chattahoochee River and at mile 456.1 on the ACF System, along with a river profile is shown on Plates 2-1 to 2-3.

2-02. Purpose. The Buford Project is a multiple-purpose project, originally authorized by the Rivers and Harbors Act of 24 July 1946, to be operated in conjunction with the other Federal works of improvement in the ACF Basin for the authorized system purposes. Buford Dam is operated to provide benefits for authorized purposes of hydropower, flood risk management, navigation, water supply, water quality, fish and wildlife conservation, and recreation. The increased flow in dry seasons also provides municipal and industrial (M&I) water supply and water quality benefits in the metropolitan area of Atlanta, Georgia; it benefits fish and wildlife in the Chattahoochee River and further downstream below Jim Woodruff Lock and Dam; and it permits increased production of hydroelectric energy at downstream plants. An aerial view of the Buford Project is shown in Figure 2-1.

Figure 2-1. Aerial View of Buford Dam

2-03. Physical Components. The project consists of an earth dam supplemented by earth saddle dikes and an unpaved chute spillway, a 127,000-kilowatt (kW) power plant and appurtenances, and a reservoir extending about 44 miles up the Chattahoochee River and about 19 miles up the Chestatee River at full conservation pool. The principle features of the dam, described in detail in subsequent paragraphs are (from right to left bank looking downstream): two low earth dikes; a switchyard; the powerhouse and outlet works consisting of a concrete intake structure, penstocks, flood risk management sluice, and tailrace channel; a transformer substation; the rolled-fill earth dam; an uncontrolled chute type emergency spillway;

and a low earth saddle dike. Plan and sections of the dam, powerhouse, and appurtenant works are shown on Plate 2-4.

a. Dam. The main dam, 1,630 feet long and 192 feet high at maximum section, is an earth-fill structure with a rock section on the upstream side. The crest at elevation 1,106 feet NGVD29 is 40 feet wide. Periodic surveys show that minor settlement of less than one foot has occurred across portions of the main dam. Upstream slope of the earth fill is 1 vertical to 2 horizontal with the rock section, which extends from just below the crest to the toe, bringing the finish slope of the upstream face to 1 vertical to 2.5 horizontal. The downstream slope is 1 vertical to 2.5 horizontal, broken by a berm at elevation 962.5 feet NGVD29, which carries a 40-foot roadway and a parking area, thus providing access across the dam to the powerhouse. The parking area is on a rock fill, and a rock toe is below the roadway that extends to elevation 945 feet NGVD29. The downstream slope is grassed below that elevation to prevent erosion. A core trench extending to rock and a grout curtain are in place to prevent seepage. A downstream drainage blanket extends to the rock to keep the saturation line well within the dam.

b. Saddle Dikes. Three saddle dikes are on the reservoir rim - two on the right bank and one on the left bank. The saddle dikes are constructed of earth fill with a rock section on the crest and upstream face. Side slopes are 1 vertical to 2.5 horizontal and the downstream side slopes are grassed. Saddle dikes No. 1 and No. 2 (Figure 2-2) extend for nearly one mile from near the right abutment to the further end of saddle dike No. 1. Those dikes, each about 2,300 feet long, have a maximum height of 47 feet and a top width of 25 feet at crest elevation 1,106 feet NGVD29. Saddle dike No. 3 (Figure 2-3), about 2,000 feet long, is on the left bank about one mile from the left abutment. It has a maximum height of 67 feet and a top width of 16 feet at crest elevation 1,106 feet NGVD29. There is a small amount of seepage that occurs at saddle dike No. 3 during periods of high lake levels. While this is not currently a major issue constraint that could change reservoir operations, the saddle dike is monitored more frequently as the lake level rises (see High Water Action Plan in Exhibit C). The monitoring protocol is outlined in the *Buford Saddle Dike 3 Subsurface Investigation Report* dated May 2013. It is important to note that this monitoring schedule will likely be updated as more information becomes available.

Figure 2-2. Saddle Dikes No. 1 and No. 2.

Figure 2-3. Saddle Dike No. 3 and Emergency Spillway

c. <u>Reservoir</u>. Lake area at elevation 1,070 feet NGVD29 composes about five percent of the drainage area. The lower portion of the lake is about 3 miles wide and 12 miles long. The upper portion is split into two arms that extend 44 and 19 miles along the Chattahoochee and Chestatee Rivers, respectively. The reservoir has a total storage capacity of 2,551,064 acre-feet at full-flood risk management pool, elevation 1,085 feet NGVD29, and it covers an area of 48,176 acres. At full conservation pool, elevation 1,071 feet NGVD29, the reservoir covers 38,425 acres and has a total storage capacity of 1,948,913 acre-feet. At minimum conservation pool, elevation 1,035 feet NGVD29, the area covered is 22,293 acres with storage capacity of 874,268 acre-feet, giving the total conservation storage between elevation 1,035 and 1,071 of 1,074,645 acre-feet. Area-capacity curves and tabulation are shown in Plate 2-5. A total of

58,007 acres were originally included in the taking line of which 56,155 acres were purchased in fee simple, 719 acres were right to inundate easements, and 1,133 acres lie within the riverbed. This includes all acreage below the guide taking line of 1,085 feet NGVD29 as well as some additional land acquisition due to the creation of small islands and peninsulas within the lake. This acquisition was considered necessary for the efficient operation and management of the project. Subsequent disposals have reduced the total acreage to 55,188.352 acres in fee simple and 692 acres with right to inundate easements (2016 data). Further details are included in the real estate portion of the Definite Project Report (Paragraph 1-24 of that report).

d. Emergency Spillway. The emergency spillway shown in Figure 2-4 is an unpaved, uncontrolled chute with a crest at elevation 1,085 feet NGVD29 on the left bank about one mile southeast of the main dam and about 500 feet west of the saddle dike No. 3. The crest of the spillway and the downstream portion are 100 feet wide. It has a downstream slope of 0.0134. Upstream from the crest, the chute is flared. The side slopes of the cut are 6 vertical to 1 horizontal in the rock and 1 vertical to 2 horizontal in the earth. A 10-foot-wide berm is at the top of rock. The earth cuts in the approach channel are protected by riprap. The emergency spillway rating curve is shown in Plate 2-6. Because any flow over the spillway would be a rare event (highest recorded lake level to date is 1077.15 feet NGVD29 on 14 April 1964), it is also used as a boat ramp. The downstream area is paved and used as a parking area. Immediately downstream of the parking area, the 100-foot-wide spillway chute is formed.

Figure 2-4. Spillway and Uncontrolled Chute

Releases from the emergency spillway follow a channel back to the Chattahoochee River. Residential development has encroached upon the spillway outlet channel easement and is at risk in the event that flow issues from the spillway. When it is certain that the spillway will be used, local emergency management authorities and residents near the spillway channel should be alerted. (See Section 7-05 “Notification of Potential Discharge over the Emergency Spillway” for more information on notifications and responsibilities).

Figure 2-5. Intake Structure

e. Intake Structure. The concrete intake structure (Figure 2-5) in an excavated channel on the right bank contains gates and operating equipment for regulating the flow through two power penstocks and the flood-control sluice. The main structure is about 195 feet high by 139.5 feet long and is flanked by concrete retaining walls. Two, 22-foot diameter steel penstocks in concrete-lined tunnels provide water from the intake to the two large units in the powerhouse. A Y-branch from the unit No. 2 penstock contains a 10-foot-diameter steel penstock, which serves the small unit. A 13.25-foot-diameter, concrete-lined, flood-control sluice tunnel provides water from the intake structure to the sluice stilling basin 350 feet downstream. Hoisting machinery and controls for the tractor-type penstock head gates and for the Broome-type sluice gates are on the intake structure deck at elevation 1,106 feet NGVD29. The location of the intake structure is shown in Figure 2-9.

f. Flood Risk Management Sluice. One sluice, 13.25 feet in diameter, is available for whenever it is necessary to release water other than by the turbines. The sluice has a dual entrance, and the flow is regulated by two broome-type gates, each 6.5 feet wide by 13.25 feet high. SteelFab Incorporated designed and manufactured two new broome-type sluice gates for installation into the existing gate slots at Buford Dam. Each gate featured an integral jet flow gate designed to solve a long standing vibration problem during minimum flow releases. The broome-type gates are supported along either side by an endless train of rollers, and the gate seals by the rollers disengaging from support of the leaf when the gate is completely closed, allowing hydrostatic forces to seal the gate. The new broome-type gates are shown in Figure 2-6. The location of the sluice is shown in Figure 2-9.

Figure 2-6. Broome-type Sluice Gate

The discharge capacity of the sluice with the pool at full, flood risk management pool of 1,085 feet NGVD29 is 11,590 cubic feet per second (cfs). Releases can be made through the flood-control sluice down to elevation 919 feet NGVD29. Sluice rating curves are shown in Plate 2-7. Normal discharge up to 600 cfs is accomplished through one of two 36-inch jet valves installed in the sluice gates. Discharge in excess of 600 cfs requires raising the broome-type gates as described above. Use of the sluice is not uncommon. It is often used to supplement flows for minimum flow requirements when the smaller hydropower unit is out of service. It is also used to help evacuate water out of the flood pool in the event that one of the large hydropower units is out of service. Occasionally, requests are made to open the sluice to improve the dissolved oxygen downstream of the dam. It is believed that the water spraying out of the jet flow gate aerates the water and raises the dissolved oxygen level. There is yet to be any concrete evidence that discharges through the sluice gates actually improve dissolved oxygen in the river and requests of this nature are considered on a case by case basis. The frequency of operation of the sluice can vary widely from 0 to 4 or more times annually and can remain opened for a duration of a matter of hours up to many days in the event of a prolonged hydropower unit outage.

g. Powerhouse. The powerhouse is in a deep-rock cut at the west end of the earth dam, just downstream from the intake structure. The powerhouse is a concrete structure, 205 feet long by 94.5 feet wide, and consists of three generating bays and an erection bay. A 7,000-kW unit is at the west end, two 60,000-kW units in the center, and the erection bay is at the east end of the powerhouse. The flood-control sluice passes through the substructure of the erection bay. The control room, all auxiliary services, public spaces, and offices are downstream from the units and erection space. Performance curves for the turbine discharge are shown in Plates 2-8 and 2-9 and the average monthly energy production is shown in Plates 2-10 and 2-11. The powerhouse is shown in Figure 2-7. Its location at the dam is depicted in Figure 2-9.

In March 1996, the *Powerhouse Major Rehabilitation Evaluation Report* was published. Excerpts from the report follow. This major rehabilitation evaluation of the three hydropower generation units at Buford Powerhouse was completed with the goal of restoring lost reliability and efficiency to the plant. Rehabilitation of unit 1 was completed in July 2003 and unit 2 in August 2004. Rehabilitation of the service unit (unit 3) was complete in September 2004.

Originally, the main units were rated at 44,444 kilovolt-ampere (kVA) at 90 percent power factor, making the units 40 megawatts (MW) each. The rehabilitated units 1 and 2 are rated at 69,333 kVA at 90 percent power factor, making the units about 62 MWs each. They are normally declared at 60 MW because cavitation seems to occur at generation levels above that. The rehabilitated Unit 3 is rated at 7,870 kVA at 90 percent power factor, or 7 MW. The total declared plant capacity including all three units is 127 MW.

Figure 2-7. Powerhouse and Discharge Channel

All units have vents for air entrainment into the released water to increase dissolved oxygen levels in the releases from Buford Dam during the severe lake-stratification period (August-December).

h. Switchyard and Transformer Substation. The switchyard is located to the west of the powerhouse on a hill overlooking the site. The step-up transformers are located east of the powerhouse. The transformer yard is connected to the powerhouse by a short power cable tunnel. Figure 2-8 is an example of an access tunnel at the project. The switchyard is connected to the transformers by overhead lines spanning the tailrace. Control cables are extended to the switchyard through a vertical cable shaft and an underground duct. The location of the switchyard is shown in Figure 2-9.

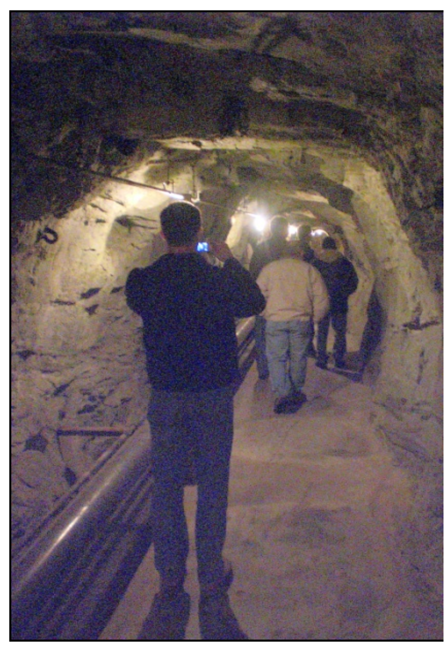


Figure 2-8. Access Tunnel

Figure 2-9. Aerial View of Buford Dam with Physical Components

2-04. Related Control Facilities. Operation of the Buford Powerhouse is regularly remotely controlled by the Carters pumped storage facility in nearby Carters, Georgia. Remote operation is accomplished through a microwave network between the Carters, Buford, and Allatoona Projects. The Buford Powerhouse can be locally operated if conditions require. The Buford Project operates as part of a system along with other Federal reservoirs within the ACF Basin. Privately owned dams along the Chattahoochee River receive headwater benefits from redistributed flows. Morgan Falls Dam, a Georgia Power Company (GPC) facility near Atlanta, Georgia, reregulates power releases from Buford Dam providing more stable flows in the Chattahoochee River, which supports both water supply and water quality.

2-05. Real Estate Acquisition. Real estate acquisition for the Buford Project required purchasing all land permanently inundated by the normal lake levels and the land temporary flooded for flood risk management operations. At elevation 1,085 feet NGVD29 (top of flood risk management pool), the pool covers 48,176 acres. However, additional land above 1,085 feet NGVD29 was acquired due to the creation of small islands and peninsulas within the lake which were considered necessary for the efficient operation and management of the project. A total of 58,007 acres are within the taking line for the project. Land acquired includes 56,155 acres in fee simple, 719 acres in right to inundate easements, and 1,133 acres in the original river bed. Subsequent disposals and acquisitions have reduced the total acreage to 55,188.352 acres in fee simple and increased the total easement acreage to 2,692.268 acres (2016 data), including the flowage easements acquired downstream of Buford Dam to near Medlock Bridge Road. These flowage easements below the dam have been acquired to permit steady releases of water up to 10,000 cfs for emptying flood storage and short-time releases up to 12,000 cfs for peaking power operations if necessary.

2-06. Public Facilities. A master plan for the recreational development of the Buford Project has been prepared by the Corps and coordinated with other Federal agencies and state, county, and municipal governments. Plate 2-12 shows the recreational development for Lake Sidney Lanier.

To accommodate the substantial number of visitors who pursue all types of recreational activities - including boating, camping, swimming, fishing, and picnicking – 77 parks, 16 marinas, and 16 campgrounds are provided around the lake (OMBIL 2016).

More than 6.5 million people visited Lake Sidney Lanier in 2012. With more than 692 miles of shoreline, the lake is well known for its aqua-blue colored water, spectacular scenery, and variety of recreational activities. Lake Sidney Lanier is one of 422 lakes across the country that the Corps constructed and operates. It won the best operated lake of the year award in 1990, 1997, and 2002.

III - HISTORY OF PROJECT

3-01. Authorization. Congress authorized Buford Dam for construction in 1946 as part of the overall development of the Nation's waterways after World War II. The Rivers and Harbors legislation during the period was targeted at developing the Nation's rivers systems for national defense, flood risk management, power production, navigation, and water supply. The Corps was involved in hundreds of projects across the United States, as the scope of this massive undertaking was unprecedented. Funding for construction first appeared on the horizon for the project in late 1949 as part of a multimillion dollar public works appropriation for Georgia, which saw $750,000 go to Buford Dam. That funding was used to complete the initial planning and design phases of the project such as the powerhouse design and for starting construction. The groundbreaking was held on the Gwinnett County side of the future dam site on 1 March 1950.

The Buford Dam site was investigated and its possibilities considered by the Corps at least as far back as the early 1930s when a report on the Apalachicola River Basin was being prepared in accordance with House Document No. 308, 69th Congress, First Session. It was first recommended for construction in a report by the District Engineer dated 20 November 1945, with a modification of a previously approved comprehensive plan for basin-wide development. That report proposed a dam at the Buford site with conservation pool at elevation 1,065 feet NGVD29, but it had no flood risk management purposes. The report was returned by the Chief of Engineers for revision to give further consideration to flood risk management and navigation to Atlanta, Georgia.

On 20 March 1946, the Division Engineer, South Atlantic Division (SAD), submitted to the Chief of Engineers a report based on data in the November 1945 report. It included the same plan for Buford but recommended reservation of a storage prism between elevations 1,065 and 1,080 feet NGVD29 for the purpose of flood risk management. That report - later published as House Document No. 300, 80th Congress, First Session - proposed for the Buford Dam Project a concrete gravity-type dam 1,626 feet long with top elevation 1,090 feet NGVD29, a 616-foot gated spillway with crest at elevation 1,061 feet NGVD29, and a powerhouse on the left bank with two 16,000-kilovolt-ampere (kVA) units.

The Rivers and Harbors Act of 24 July 1946, approved the modified plan of improvement for the basin presented in House Document No. 300 and authorized construction of the proposed project.

3-02. Planning and Design. Studies made in 1949 for a Definite Project Report showed that the Buford site was especially favorable for an earth dam and that considerable savings (more than $2 million) could be affected by constructing an earth dam instead of a concrete dam. Also, the power market was such that the Corps, in cooperation with the Federal Power Commission, decided that the power installation should be increased over that originally recommended.

The Definite Project Report prepared by the Corps' Mobile District proposed an earth dam supplemented by saddle dikes and an unpaved chute spillway, an 86,000-kW power plant and appurtenances and a reservoir at elevation 1,075 feet NGVD29, the top of the primary flood risk management storage pool. On 3 February 1950, the Chief of Engineers approved the Definite Project Report dated 1 December 1949, subject to certain modifications and considerations proposed by that office and SAD.

Basic design of the Buford Dam Project is in the published Definite Project Reports. A list of existing Design Memorandums for the project is as follows:

- I Hydroelectric Power
- II Geology
- III Soils
- IV Alternative Plans
- V Spillway
- VI Hydrology
- VII Flood Control (now termed flood risk management
- VIII Intake Structure, Tunnels, Outlet Works, and Stream Diversion
- IX Access Roads and Administration Facilities
- X Real Estate
- XI Sources of Construction Materials
- XII Relocations
- XIII Main Dam
- XIV Powerhouse
- XV Reservoir Management (including Recreation, Fish and Wildlife, and Malaria Control)

3-03. Construction. Construction was initiated in March 1950 under a contract awarded to H. N. Rodgers and Son for the emergency spillway and saddle dike No. 3. Other contracts for the various project features followed. The contract for the main dam was awarded to J.W. Moorman and Son in March 1954, and for the powerhouse and switchyard to Ivey Brothers Construction Company, Inc., in May 1955. The main dam was completed late in 1955, and the entire project was essentially complete by the end of June 1957 when the first power unit was placed in operation. Estimated total cost of the project was $52,860,828. Figure 3-1 shows an early view of the lake and dedication. Figures 3-2 through 3-6 show some of the construction phases.

Figure 3-1. Early 1950's Lake View

During the period, the government acquired the rights to more than 56,000 acres of land and relocated more than 700 families in order to prepare the land for a 38,000-acre reservoir. The government followed strict guidelines spelled out in the Rivers and Harbors Act legislation in acquiring private property for public use. The government paid careful attention in removing homes, barns, wells, fencing, and other physical property to prevent navigation hazards on the lake in the future. Land costs exceeded $19 million with most property purchased between $25 and $75 per acre.

Figure 3-2. Excavation in 1953

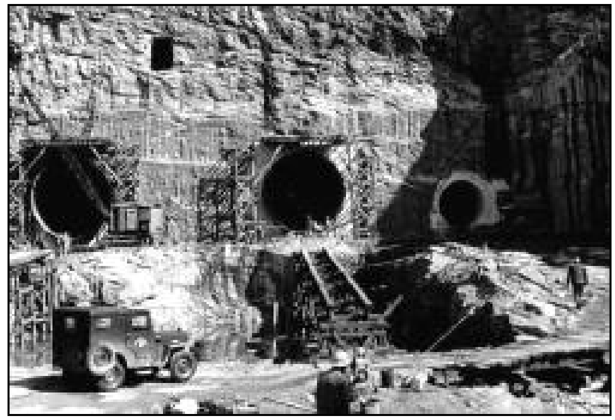


Figure 3-3. Penstock Construction, 1953

Figure 3-4. Steel Penstock and Scroll Case, 1953

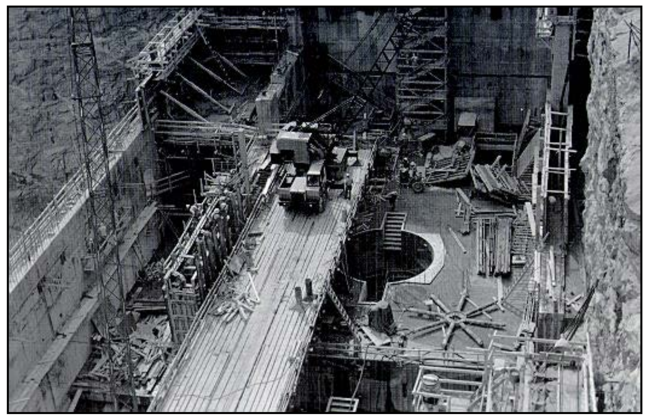


Figure 3-5. Powerhouse Construction, 1953

On 1 February 1956, the gates of the intake structure were closed on the lakeside of the dam starting the slow process of filling the reservoir. It took more than three years for the lake to record its normal elevation of 1,070 feet NGVD29 for the first time on 25 May 1959. On 29 March 1956, the President signed House Resolution No. N6961 officially naming the reservoir Lake Sidney Lanier; after the Georgia-born poet and musician Sidney Lanier. The dam maintained the name Buford Dam.

Figure 3-6. Main Dam Construction, 1952

The project dedication was held on top of the intake structure parking lot on 9 October 1957.

Studies made by the Mobile District in 1953 showed it to be economically feasible and desirable from a power standpoint to raise the top of conservation pool five feet. The studies showed that such an increase in the conservation pool level would have no adverse effect on the flood-control benefits provided by the project. On

11 September 1953, the Chief of Engineers approved raising the top of conservation and top of flood risk management pools from elevations 1,065 to 1,070 and 1,080 to 1,085 feet NGVD29 respectively. Since February 1976, the top of conservation pool has been raised to elevation 1,071 feet from May through September with transitions starting 15 April and ending 30 November. The latest top of conservation pool is shown in Figure 7-1. A 1981 report by the Metropolitan Atlanta Water Resources Study, created by U.S. Senate Public Works Committee in 1972, proposed holding the conservation pool at elevation 1,071 feet throughout the year. The Mobile District has performed studies, which show no increase in yield by raising the pool higher year-round. The seasonal top of conservation pool still applies to Lake Sidney Lanier, as approved by Division Engineer in February 1976.

Power generation began on a limited scale on 20 June 1957, when unit 2 (40,000 kW) was released for commercial operation. Unit 3 (6,000 kW) was placed in operation on 26 July 1957, and unit 1 was ready for commercial operation on 10 October 1957. Beginning in March 1958, the generation schedule was gradually increased, and the power plant went into full-scale operation in July 1958. The turbine units were rehabilitated in 2004 and, as a result, units 1 and 2 generate 60,000 kW each and unit 3 generate 7,000 kW, for a plant capacity of 127,000 kW

3-04. Related Projects. Buford Dam and Lake Sidney Lanier is one of five government reservoir projects within the ACF Basin. In addition, seven privately owned dams are on the Chattahoochee River between Walter F. George Lock and Dam and Buford Dam. The USACE reservoirs on the Chattahoochee River are operated as a system to accomplish their authorized purposes as described in the ACF Basin Master Water Control Manual. The privately owned reservoirs on the Chattahoochee River do not alter flows longer than a few days.

3-05. Modifications to Regulations. From the time the Buford Dam Project became operational in 1957, changes in needs and conditions in the ACF Basin have influenced certain modifications to the regulation of releases from the dam. The following describe the modifications to regulations that have occurred at Buford Dam.

a. Population Growth. The significant population growth and resulting increased demand for M&I water supply in metropolitan Atlanta has resulted in changes to water control operations at Buford Dam. Initially, the two municipalities of Buford and Gainesville, Georgia, withdrew a total 10 million gallons per day (mgd) of M&I water supply directly from Lake Sidney Lanier via water withdrawal contracts. The contracts, referred to as relocation contracts, were issued to the two municipalities as partial compensation for the relocation of their water treatment facilities resulting from project construction. As the population of Atlanta and the surrounding areas grew over the years, the demands for M&I water supply increased significantly. As a result, new water supply withdrawal contracts for Gainesville, Cumming, and Gwinnett Counties were executed to allow additional M&I water withdrawals directly from Lake Sidney Lanier. The 2006 M&I water supply withdrawals directly from Lake Sidney Lanier totaled 132.2 mgd.

The project authorization required minimum releases of up to 600 cfs from Buford Dam, which when combined with local inflow to the river downstream of the project would provide at least 650 cfs at Atlanta for water supply purposes. In 1976, the State of Georgia determined that a minimum flow of 750 cfs was required in the Chattahoochee River at Peachtree Creek for water quality purposes. The increase in demands for M&I water supply downstream of the project combined with the 750 cfs Chattahoochee River flow requirement, led to a 1979 agreement among the Corps, Atlanta, and GPC. The 1979 agreement included a project operational change to accomplish the needed downstream flows. The Corps agreed to provide sufficient releases from Lake Sidney Lanier that, when combined with intervening flows, would ensure that the required withdrawals could be made and also allowed for flows of 750 cfs to be maintained just upstream of the junction of the Peachtree Creek with the Chattahoochee River. The GPC committed to schedule a portion of its weekly power generation on the weekend. The two commitments allowed for increased downstream water supply withdrawals while providing for the 750 cfs in-stream flow requirement in the Chattahoochee River near the confluence with Peachtree Creek. Figure 3-7 shows a schematic of the Chattahoochee River from Buford Dam to Peachtree Creek.

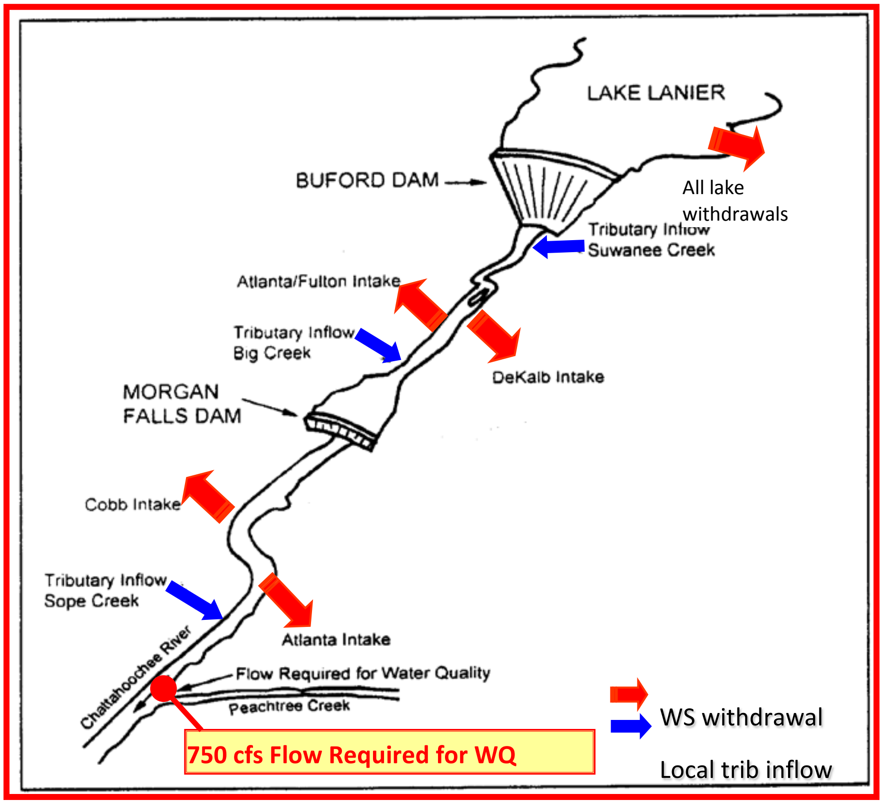


Figure 3-7. Schematic of the Chattahoochee River from Buford Dam to Peachtree Creek

On occasions during drought conditions, the Georgia Environmental Protection Division (GAEPD) has requested that minimum flows at Peachtree Creek be reduced to 650 cfs during the colder months of the year. As a result, the current goal for minimum flows from Buford Dam is to provide a minimum flow of 750 cfs between May to October and 650 cfs between November to April, measured 40 miles downstream from Buford Dam in the Chattahoochee River, just upstream of the confluence with Peachtree Creek.

b. 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.

c. 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 from Lake Sidney Lanier, 5.6 feet of storage from West Point Lake, or 3.6 feet of storage from Walter F. George Lake 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 the 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 Buford Dam to help supply sufficient water in storage downstream to successfully implement the navigation window.

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 of 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, in the absence of maintenance dredging, improves the total reliability of a 7.0-foot navigation channel in the Apalachicola River from 21 percent to as much as 44 percent. Releases made from Buford Dam during hydropower operations contribute to the needed downstream navigation flows.

d. Hydropower. The Southeastern Power Administration (SEPA) negotiates contracts for the sale of power from the Buford Dam 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 Buford each week and advises SEPA of the amount available, and SEPA arranges the sale. Buford Dam is within SEPA's Georgia-Alabama-South Carolina system, which includes four projects on the Chattahoochee River 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 during the relatively wetter years of the 1960's - 1970s averaged about 217,000 MW-hours/year (MWH/yr) and was a driving force in releases from Buford Dam, with days of six to eight hours of generation common. During the 1980s, several droughts occurred which resulted in a philosophical change to more conservative hydropower operations with average generation about 163,000 MWH/yr or about a 16 percent decrease in hydropower generation at Buford 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). In the early years of the project, power generation was conducted for a set number of hours per day as long as sufficient water was in conservation storage to accommodate the hydropower operation. In dry years, conservation storage was depleted to the point that release requirements for other project purposes could not be met. The Corps modified its regulation plan to account for dryer hydrology in response to water control regulation lessons learned during early to mid 1980's drought periods. Pursuant to its engineer regulations and engineer manuals, the Corps now relies on action zones within the conservation storage pool at each of the Federal storage reservoirs to determine the amount of appropriate hydropower generation during certain hydrological conditions. The Corps first applied these action zones at each of the ACF storage reservoirs as a result of the draft 1989 ACF Water Control Plan. As a result, power generation demands have been balanced between the projects on a weekly basis to enhance long-term generating capability of the entire system and to provide for the needs of other project purposes in the system.

e. Critical Yield. The critical yield at the Buford project has been evaluated many times throughout the project's lifetime. Yield values have been updated as more observed hydrologic data has become available. It's difficult to make direct comparisons to difference critical yield evaluations throughout the projects history as many of the variables in determining the yield have changed. These include the range of the conservation storage pool, the critical period, changes in water use, and the methodology used to calculate the yield.

The first critical yield analysis was done as part of the *Buford Definite Project Report, 1949*. It considered a conservation pool ranging from elevation 1065-1030 Feet NGVD29 and produced a yield of 1,600 cfs or 1034 mgd. The conservation pool of 1070-1035 NGVD29 was first considered in the report titled *Cost Allocation Studies Report, (May 1959; revised 27 Oct 1960)* and also produced a yield of 1,600 cfs or 1,034 mgd. The most recent critical yield analysis is titled *Federal Storage Reservoir Critical Yield Analysis, Apalachicola-Chattahoochee-Flint (ACF) River Basin, July 2014*. This analysis considers the seasonal top of conservation (1,070-1,071 feet NGVD29) at Buford when determining the critical yield. The report utilizes two different methodologies for computing the critical yield at Buford with the main difference between the two being the consideration of river diversions. The methodology which allows for downstream diversions is the most realistic assessment of the critical yield for Buford and thus is considered the preferable method. This calculated a critical yield of 1,393 cfs or 900 mgd.

3-06. Principal Regulation Problems. The main problem affecting regulation at Buford Dam is encroachment within the floodplain downstream of the project. Residential and other developments in the floodplain have necessitated a change in how stored flood waters are evacuated from the reservoir. Before encroachments, waters stored in the flood risk management pool during major flood events were evacuated by running the turbines 24 hours a day until the reservoir returned to its normal conservation pool elevation. Now, to avoid inducing flooding of downstream development, flood waters are released through the turbines at a lower rate by generating less than 24 hours a day.

A potential regulation problem has developed on saddle dike 3. At elevations above 1,072 feet NGVD29, wet spots form on the downstream side of the dike. The condition is being monitored and has not resulted in a change to flood risk management operations. However, the dike has not experienced extended periods with the pool elevation above elevation 1,072 feet NGVD29. Therefore, potential problems from prolonged elevations at or above elevation 1,072 feet NGVD29 have not been detected.

IV - WATERSHED CHARACTERISTICS

4-01. General Characteristics. Buford Dam site is located 50 miles northeast of central Atlanta, Georgia, on the Chattahoochee River, 348.3 river miles above the mouth of the Chattahoochee River. Above Buford Dam, the Chattahoochee River Basin has a length of 52 miles and an average width of 20 miles, with extreme widths ranging from a maximum of 36 miles in the headwater area to a minimum of 12 miles in the vicinity of the dam site. The basin width of 10 miles below the dam site continues 30 river miles downstream to the Roswell gage. The basin widens with an average width of 25 miles between Roswell and West Point, Georgia, 150 river miles below the dam site. Location of the Buford Project is shown on Plate 2-1.

The upper reaches of the basin are characterized by the steep slopes of mountain streams. The upper Chattahoochee River (157 square miles) is joined by the Soque River (166 square miles) about 60 miles northeast of Atlanta, Georgia, and 11 miles upstream of the limits of the pool at elevation 1,071 feet NGVD29. The Chestatee River, a major tributary, formerly flowed into Chattahoochee River above the dam site but now forms an arm of Lake Sidney Lanier, as shown on Plate 2-2. The Chattahoochee and Chestatee Rivers have drainage areas of 565 and 318 square miles, respectively. Below their junction is a drainage area of 115 square miles into the lake. Chattahoochee and Chestatee Rivers compose 85 percent of the dam site drainage, the reservoir pool composes five percent, and the remaining area is composed of minor streams that drain directly into the pool.

4-02. Topography. The Chattahoochee River and its upstream tributaries originate in the Blue Ridge Mountains of northern Georgia, near the western tip of South Carolina. The upper reaches of the basin are characterized by the steep slopes of mountain streams. Elevations in the basin range from near 800 feet NGVD29 at Buford Dam to between 3,000 and 3,500 feet in the northern part of the basin. Buford Dam controls the runoff from 1,034 square miles and reduces flood peaks at Atlanta, Georgia. The slope of the Chattahoochee River from the headwaters to the upstream limit of Lake Sidney Lanier (about 25 miles) is approximately 9 feet per mile. From the upstream limit of Lake Sidney Lanier to Buford Dam (about 40 miles) the slope is approximately four feet per mile.

4-03. Geology and Soils. Many of the rocks of the Blue Ridge appear to be the metamorphosed equivalents of Proterozoic or Paleozoic (or both) sedimentary rocks. Others are metamorphosed igneous rocks, such as the Corbin Metagranite, the Fort Mountain Gneiss, various mafic and ultramafic rocks, and the metavolcanic rocks of the Gold Belt. Geologic resources of the Blue Ridge include marble, much of which is mined. Talc has been mined in the western Blue Ridge just east of Chatsworth, Georgia. Gold was mined at Dahlonega, Georgia, in the early 1800s, and the U.S. Mint produced gold coins there from 1830 to 1861. A sample of rock formation downstream from the powerhouse is shown in Figure 4-1.

4-04. Sediment. The streams in the northern part of the basin, and especially metropolitan Atlanta area have been severely affected by past and present urban development. Urban development generally increases the peak and volume of runoff from rainfall events, which increases the velocity and erosion potential of rainfall runoff. Results are generally a down-cutting and widening of the stream, which creates bank-caving and further erosion.

Other significant sources of sediment in the basin are agricultural land erosion, unpaved roads, and silviculture and variation in land uses that result in converting forests to lawns or pastures. Rivers and streams in the basin have always carried silt and other particles downstream. The Chattahoochee River is known for its muddy red color during high-flow periods.

Figure 4-1. Rock sample below the Buford Dam Powerhouse

Lake Sidney Lanier and other reservoirs in the ACF Basin typically act as a sink, removing pollutant loads and sediment resulting in decreased nutrient loads in the reservoirs and in the releases from the dams. This decrease is caused by the settling of sediments and associated phosphorus and detritus, lower nutrient concentrations in the inflow from tributaries, and uptake of nutrients from phytoplankton in the reservoirs.

In 1956, the Corps established sedimentation and retrogression ranges at the Buford Project to monitor changes in reservoir volume and channel degradations. Reservoirs tend to slow river flow and accelerate deposition. The locations of the ranges within Lake Sidney Lanier are shown on Plate 4-1, Sedimentation/Retrogression Ranges Map.

After the sedimentation and retrogression ranges were established in 1956, periodic resurveys occurred for the sedimentation ranges and the retrogression ranges (see Tables 4-1 and 4-2). In 2009, a hydrographic bathymetric survey of the entire lake was completed 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 resurvey 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. The area-capacity curves generated using the 2009 data have been incorporated into this manual. Maintenance of the sedimentation and retrogression ranges typically occurs when they are resurveyed. Sediment data collection and results are discussed further in Section 5-03, Sediment Stations.

Table 4-1. Sedimentation Ranges

Year Surveyed	Number of Ranges Surveyed	Total Number of Ranges Established
1956	57	61
1981	21	61
1983	32	61
1989-1990	59	61
2009	Hydrographic bathymetric surface	N/A

Table 4-2. Retrogression Ranges

Year Surveyed	Number of Ranges Surveyed	Total Number of Ranges Established
1956	8	8
1957	5	13
1963	11	13
1964	11	13
1965	11	13
1968	11	13
1971	11	13
1987	12	13

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 the 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. <u>Precipitation</u>. The Chattahoochee River Basin above Buford Dam is in a region of heavy rainfall that is fairly well distributed throughout the year. The average annual precipitation over the basin is about 60 inches of which 27 percent occurs in the spring, 28 percent in the winter, 23 percent in the summer, and 22 percent in the fall. Monthly and annual precipitation for the period of record for selected stations in or near the basin are shown in Table 4-3. Gage locations are shown on Plate 5-1. 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. Table 4-4 presents extreme rainfall events of record for seven stations in or near the basin. Shown are the highest monthly rainfall, the lowest monthly rainfall, and the one-day highest rainfall. Annual values are also included.

b. Temperature. The historical mean temperature for the Chattahoochee River Basin above the Buford Dam drainage is 58 degrees Fahrenheit (°F). That is based on an arithmetic mean of the annual temperature at six stations in or near the basin for their period of record. The average monthly temperatures vary from a low of 40 °F in January to a high of 76.5 °F in July. Table 4-5 shows the monthly and annual means for each of the stations. The stations are Cumming, Blairsville Experiment Station, Helen, Gainesville, Dahlonega, and Cleveland, Georgia. Extreme temperatures events for the six stations are also presented in Table 4-5. Recorded daily temperatures have been as low as –16 °F to as high as 107 °F.

c. Evaporation and Wind: The presence of man-made reservoirs in the ACF Basin have affected the volume of surface water through increased evaporation and increased rainfall-runoff. At Lake Sidney Lanier, the annual evaporation is 36.7 inches and the predominant wind direction is east-northeast. The monthly distribution of annual reservoir evaporation is shown on Table 4-6.

Table 4-3. Average Monthly Rainfall (Inches) for Period of Record

Station, NOAA ID, (period of record)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Cumming, Georgia, #92408, (6/1937-4/2012)	5.61	4.94	6.29	4.65	4.07	3.97	4.70	3.91	4.03	3.48	4.14	4.98	54.77
Blairsville Exp Sta, Georgia, #90969, (6/1892-4/2012)	5.33	5.01	5.96	4.59	4.31	4.44	4.99	4.55	4.00	3.44	4.29	4.92	55.83
Helen, Georgia, #94230, (4/1956-4/2012)	6.65	5.85	7.16	5.43	5.47	5.38	6.02	6.10	5.92	4.84	5.72	6.27	70.82
Gainesville, Georgia, #93621, (10/1891-4/2012)	5.20	5.04	5.86	4.18	4.03	4.01	4.84	4.14	4.01	3.40	3.70	4.87	53.27
Dahlonega, Georgia, #92475, (4/1874-4/2011)	6.17	5.86	6.51	4.99	4.78	4.45	5.68	5.24	4.24	3.86	4.28	5.98	62.04
Cleveland, Georgia, #92006, (4/1943-4/2012)	6.17	5.81	6.93	5.07	4.84	4.71	5.58	5.36	4.88	4.28	4.95	5.73	64.31
Basin average	5.86	5.25	6.45	4.82	4.60	4.49	5.30	4.88	4.51	3.88	4.51	5.46	60.17

Table 4-4. Mean and Extreme Rainfall (Inches) Events in the Buford Basin

	CUMMING, GEORGIA (Station 92408)						
	Record: 1937 To Year=2012						
	Mean	High	Year	Low	Year	1 Day Max.	
January	5.61	10.45	1947	0.96	1981	4.22	25/1964
February	4.94	15.69	1961	0.77	1978	6.05	21/1961
March	6.29	15.63	1980	1.38	2004	5.55	26/1964
April	4.65	13.19	1964	1.05	1992	4.48	5/1957
May	4.07	10.38	1966	0.39	1962	3.21	27/1981
June	3.97	10.33	1963	0.26	1988	5.06	24/1980
July	4.70	15.52	2005	0.57	1952	3.72	31/2001
August	3.91	10.42	2005	0.25	1953	3.37	08/2005
September	4.03	12.38	2004	0.13	1978	5.22	17/2004
October	3.48	10.36	2009	0.00	1938	4.25	09/1977
November	4.14	13.82	1948	0.56	1939	3.87	11/2009
December	4.98	16.15	1961	0.72	1980	5.70	12/1961
Annual	54.77	82.12	1964	39.45	1987	6.05	1961
Winter	15.53	27.87	1962	7.76	1981	6.05	1961
Spring	15.00	29.70	1964	5.63	2004	5.55	1964
Summer	12.59	34.31	2005	5.44	1986	5.06	1980
Fall	11.65	28.28	2009	3.96	1939	5.22	2004

	BLAIRSVILLE EXP STA, GEORGIA (Station 90969)						
	Record: 1892 To Year=2012						
	Mean	High	Year	Low	Year	1 Day Max.	
January	5.33	10.95	1996	1.24	1981	4.50	27/1996
February	5.01	11.05	1939	0.67	1938	3.83	13/1966
March	5.96	13.91	2011	1.16	1985	5.50	11/1952
April	4.59	11.19	1957	1.12	1975	4.80	05/1957
May	4.31	12.21	1976	0.60	2007	5.47	15/1976
June	4.44	10.48	1989	0.91	1936	4.75	30/2001
July	4.99	14.91	1938	0.68	1993	3.50	22/1938
August	4.55	12.98	1967	0.63	1951	4.35	23/2010
September	4.00	11.96	2004	0.00	1931	5.30	17/2004
October	3.44	10.72	1964	0.00	1963	4.26	04/1964
November	4.29	13.56	1948	0.40	1939	4.70	11/2009
December	4.92	13.51	1931	0.52	1965	3.94	12/1961
Annual	55.83	76.81	1989	37.77	1987	5.50	1952
Winter	15.26	28.06	1932	6.35	1938	4.50	1996
Spring	14.86	25.70	1980	6.29	2007	5.50	1952
Summer	13.97	27.07	2005	5.70	1987	4.75	2001
Fall	11.73	26.39	2009	3.59	1939	5.30	2004

	HELEN, GEORGIA (Station 94230)						
	Record: 1956 To Year=2012*						
	Mean	High	Year	Low	Year	1 Day Max.	
January	6.65	14.23	1996	1.61	1986	3.60	27/1996
February	5.85	13.32	1961	0.05	1996	4.50	13/1966
March	7.16	15.24	1977	2.06	1985	7.72	06/1996
April	5.43	11.97	1964	0.17	1976	4.45	05/1957
May	5.47	14.80	1976	1.41	2007	4.50	28/1973
June	5.38	12.70	1989	1.11	1964	4.02	15/1965
July	6.02	16.75	1984	1.16	1993	4.09	31/1968
August	6.10	19.55	1967	0.98	1968	8.12	23/1967
September	5.92	16.18	2009	0.45	1984	8.05	17/2004
October	4.84	13.91	1959	0.00	1963	6.00	26/1997
November	5.72	12.92	1992	1.73	1960	4.08	01/1969
December	6.27	16.19	1961	0.87	1965	5.51	12/1961
Annual	70.82	87.88	1992	45.71	2007	8.12	1967
Winter	18.77	29.85	1962	6.67	1986	5.51	1961
Spring	18.06	29.34	1973	8.12	2007	7.72	1996
Summer	17.50	40.62	2005	8.79	1986	8.12	1967
Fall	16.48	33.10	2009	7.99	2008	8.05	2004

	GAINESVILLE, GEORGIA (Station 93621)						
	Record: 1891 To Year=2012						
	Mean	High	Year	Low	Year	1 Day Max.	
January	5.20	11.70	1936	0.74	1907	4.15	25/1964
February	5.04	11.85	1961	0.21	1906	4.45	21/1961
March	5.86	15.47	1980	1.02	1910	5.33	26/1964
April	4.18	14.03	1964	0.25	1915	4.15	30/1963
May	4.03	12.23	1923	0.20	1914	4.00	12/1942
June	4.01	13.48	1963	0.50	1988	4.62	24/1980
July	4.84	13.47	1916	0.12	1952	3.92	15/1949
August	4.14	16.40	1969	0.26	1925	5.62	16/1969
September	4.01	16.80	2004	0.13	1978	6.04	02/2004
October	3.40	10.74	1977	0.00	1963	4.40	09/1977
November	3.70	13.75	1948	0.15	1901	4.15	11/2009
December	4.87	15.37	1932	0.69	1980	4.27	06/1983
Annual	53.27	80.25	2009	20.96	1904	6.04	2004
Winter	15.11	27.02	1932	4.44	1986	4.45	1961
Spring	14.07	29.89	1964	6.12	1904	5.33	1964
Summer	12.98	23.88	1912	2.53	1925	5.62	1969
Fall	11.11	28.95	2009	2.68	1904	6.04	2004

	DAHLONEGA, GEORGIA (Station 92475)						
	Record: 1874 To Year=2012						
	Mean	High	Year	Low	Year	1 Day Max.	
January	6.17	14.33	1946	0.93	1981	5.72	27/1996
February	5.86	14.11	1903	0.60	1906	5.17	03/1982
March	6.51	19.70	1980	1.38	1910	6.28	30/1977
April	4.99	13.62	1979	0.55	1915	4.90	17/1998
May	4.78	14.65	1976	0.68	1914	5.49	15/1976
June	4.45	13.01	1900	0.97	1925	4.12	03/1995
July	5.68	16.67	1916	0.62	1952	4.18	12/1948
August	5.24	18.16	1978	0.34	1925	7.34	16/1895
September	4.24	14.49	1929	0.11	1954	5.44	27/1942
October	3.86	11.29	1918	0.00	1904	5.41	26/1997
November	4.28	13.97	1948	0.51	1924	3.63	11/2009
December	5.98	20.63	1932	0.97	1896	5.89	12/1961
Annual	62.04	86.12	1929	38.82	1904	7.34	1895
Winter	18.01	32.77	1932	6.56	1986	5.89	1961
Spring	16.28	29.52	1976	8.10	1925	6.28	1977
Summer	15.37	30.89	1967	5.38	1925	7.34	1895
Fall	12.38	28.44	1929	3.09	1904	5.44	1942

	CLEVELAND, GEORGIA (Station 92006)						
	Record: 1943 To Year=2012						
	Mean	High	Year	Low	Year	1 Day Max.	
January	6.17	15.19	1946	1.11	1981	5.10	27/1996
February	5.81	12.93	1944	0.96	1978	5.31	13/1966
March	6.93	17.74	1980	1.38	1985	5.36	13/1963
April	5.07	14.27	1979	1.03	1976	4.16	05/1957
May	4.84	12.93	1976	0.96	2007	5.68	28/1973
June	4.71	12.52	1989	0.20	1990	3.88	16/1949
July	5.58	15.93	1958	0.92	1993	4.84	02/2003
August	5.36	14.99	1967	0.74	1980	6.02	23/1967
September	4.88	13.58	2004	0.12	1984	4.40	17/2004
October	4.28	12.77	1959	0.00	1963	5.65	20/1950
November	4.95	15.80	1948	0.74	1950	4.73	03/1948
December	5.73	14.79	1961	0.88	1965	5.72	12/1961
Annual	64.31	82.34	2009	45.77	2000	6.02	1967
Winter	17.71	34.18	1946	6.66	1986	5.72	1961
Spring	16.84	28.75	1964	7.82	2007	5.68	1973
Summer	15.65	33.68	1967	6.40	2002	6.02	1967
Fall	14.11	31.68	2009	5.30	1954	5.65	1950

Table 4-5. Temperature Data (°F) for the Buford Basin—(max, min, mean, extreme)

CUMMING, GEORGIA #92408 (1937-2012)

	Monthly Averages			Daily Extremes			
	Max.	Min.	Mean	High	Date	Low	Date
Jan	51.0	29.8	40.4	77	30/2002	6	24/2003
Feb	52.9	31.1	42.0	76	01/2002	12	05/2009
Mar	64.1	40.1	52.1	88	26/2007	16	01/2002
Apr	72.5	46.0	59.3	87	19/2002	25	08/2007
May	77.8	55.1	66.5	91	31/2006	34	05/2011
Jun	85.3	63.8	74.5	97	22/2006	49	06/2006
Jul	87.2	67.1	77.2	96	29/2006	54	20/2009
Aug	88.4	67.3	77.9	100	17/2007	53	14/2004
Sep	82.1	60.1	71.1	95	11/2002	41	29/2003
Oct	71.6	48.6	60.1	87	06/2006	29	28/2001
Nov	63.1	38.9	51.0	82	01/2004	15	22/2008
Dec	52.9	32.0	42.4	77	11/2007	12	14/2010
Annual	**70.7**	**48.3**	**59.5**	**100**	**2007**	**6**	**2003**
Winter	52.3	30.9	41.6	77	2002	6	2003
Spring	71.5	47.1	59.3	91	2006	16	2002
Summer	87.0	66.1	76.5	100	2007	49	2006
Fall	72.3	49.2	60.7	95	2002	15	2008

BLAIRSVILLE EXP STA, GEORGIA #90969 (1892-2012)

	Monthly Averages			Daily Extremes			
	Max.	Min.	Mean	High	Date	Low	Date
Jan	49.0	25.0	37.0	76	13/1932	-16	28/1940
Feb	52.1	27.2	39.7	76	28/1996	-8	05/1996
Mar	59.7	33.7	46.7	89	23/1935	-5	15/1993
Apr	68.8	41.1	54.9	89	30/1942	16	11/1960
May	76.1	49.3	62.7	94	29/1941	25	03/1961
Jun	82.3	57.4	69.8	100	29/1936	34	15/1933
Jul	84.7	61.3	73.0	100	23/1934	40	03/1937
Aug	84.3	60.6	72.4	98	07/1933	42	29/1968
Sep	79.2	54.4	66.8	95	28/1941	26	30/1967
Oct	70.7	42.1	56.4	90	06/1941	14	21/1952
Nov	60.4	33.2	46.8	83	03/2003	0	25/1950
Dec	51.7	27.3	39.5	74	20/1931	-9	13/1962
Annual	**68.2**	**42.7**	**55.5**	**100**	**1934**	**-16**	**1940**
Winter	51.0	26.5	38.7	76	1932	-16	1940
Spring	68.2	41.4	54.8	94	1941	-5	1993
Summer	83.8	59.8	71.8	100	1934	34	1933
Fall	70.1	43.2	56.7	95	1941	0	1950

HELEN, GEORGIA #94230 (1956-2012)

	Monthly Averages			Daily Extremes			
	Max.	Min.	Mean	High	Date	Low	Date
Jan	50.6	29.3	40.0	84	01/1985	-12	21/1985
Feb	54.4	30.7	42.6	80	26/1996	-1	17/1958
Mar	62.6	37.0	49.9	85	31/1963	6	15/1993
Apr	72.0	43.8	57.9	92	19/2002	21	11/1960
May	78.2	52.0	65.1	96	19/1962	27	02/1963
Jun	83.9	59.8	71.9	99	21/1964	36	01/1984
Jul	86.5	63.7	75.1	100	19/1986	49	27/1962
Aug	85.7	63.3	74.5	99	04/1986	44	29/1968
Sep	80.0	57.4	68.7	97	03/2011	29	30/1967
Oct	71.3	45.8	58.5	89	02/1986	19	20/2009
Nov	61.7	37.2	49.4	84	03/2003	10	24/1970
Dec	52.8	31.2	41.9	76	08/1956	-6	13/1962
Annual	**70.0**	**45.9**	**58.0**	**100**	**1986**	**-12**	**1985**
Winter	52.6	30.4	41.5	84	1985	-12	1985
Spring	71.0	44.3	57.6	96	1962	6	1993
Summer	85.4	62.3	73.8	100	1986	36	1984
Fall	71.0	46.8	58.9	97	2011	10	1970

GAINESVILLE, GEORGIA #93621 (1891-2012)

	Monthly Averages			Daily Extremes			
	Max.	Min.	Mean	High	Date	Low	Date
Jan	50.9	31.8	41.4	79	11/1949	-8	30/1966
Feb	54.1	33.1	43.6	79	24/1930	-6	13/1899
Mar	62.6	39.8	51.2	88	24/1929	7	04/1943
Apr	71.7	47.5	59.6	93	24/1925	22	01/1942
May	78.9	55.7	67.3	98	29/1941	33	14/1917
Jun	85.6	63.6	74.6	107	27/1952	41	12/1913
Jul	87.8	67.1	77.4	107	28/1952	49	01/1937
Aug	86.9	66.5	76.7	104	19/1925	49	13/1931
Sep	81.4	60.9	71.2	105	16/1925	34	30/1967
Oct	71.8	49.3	60.6	96	04/1954	20	30/1910
Nov	61.7	39.9	50.8	86	07/1899	4	25/1950
Dec	52.4	33.3	42.9	78	07/1988	-1	25/1983
Annual	**70.5**	**49.0**	**59.8**	**107**	**1952**	**-8**	**1966**
Winter	52.5	32.7	42.6	79	1930	-8	1966
Spring	71.1	47.7	59.4	98	1941	7	1943
Summer	86.8	65.7	76.2	107	1952	41	1913
Fall	71.7	50.0	60.8	105	1925	4	1950

DAHLONEGA, GEORGIA #92475 (1874-2011)

	Monthly Averages			Daily Extremes			
	Max.	Min.	Mean	High	Date	Low	Date
Jan	50.4	30.9	40.6	76	11/1949	-12	21/1985
Feb	53.4	31.9	42.6	78	28/1998	-11	13/1899
Mar	61.5	38.2	49.8	88	20/1907	0	07/1899
Apr	70.8	45.6	58.2	92	24/1925	23	01/1900
May	78.3	53.4	65.9	96	29/1941	30	10/1906
Jun	84.4	61.2	72.8	101	25/1914	39	01/1894
Jul	86.7	64.7	75.7	103	29/1952	50	09/1896
Aug	85.5	64.2	74.8	102	20/1925	49	23/1930
Sep	80.4	59.1	69.7	100	4/1954	32	30/1967
Oct	70.9	47.6	59.3	92	6/1941	21	30/1910
Nov	60.5	38.2	49.4	83	02/1935	3	25/1950
Dec	52.0	32.1	42.0	78	11/1896	-3	13/1962
Annual	**69.6**	**47.3**	**58.4**	**103**	**1952**	**-12**	**1985**
Winter	51.9	31.6	41.8	78	1896	-12	1985
Spring	70.2	45.7	58.0	96	1941	0	1899
Summer	85.5	63.4	74.5	103	1952	39	1894
Fall	70.6	48.3	59.5	100	1954	3	1950

CLEVELAND, GEORGIA #92006 (1943-2012)

	Monthly Averages			Daily Extremes			
	Max.	Min.	Mean	High	Date	Low	Date
Jan	50.9	25.9	38.4	75	30/2002	5	09/2010
Feb	52.7	27.6	40.2	75	20/2011	7	05/2009
Mar	62.6	35.7	49.1	84	26/2007	9	01/2002
Apr	70.9	42.1	56.5	88	11/2001	21	08/2007
May	76.4	50.1	63.2	90	23/2011	30	04/2004
Jun	84.3	59.4	71.9	96	10/2008	44	02/2003
Jul	85.4	62.8	74.1	95	22/2008	50	24/2003
Aug	85.9	63.2	74.6	96	05/2006	50	07/2004
Sep	79.4	56.4	67.9	94	03/2011	37	26/2001
Oct	70.2	44.4	57.3	85	06/2002	21	28/2001
Nov	62.8	34.6	48.7	82	03/2003	12	22/2008
Dec	52.6	28.0	40.3	74	02/2001	10	14/2010
Annual	**69.5**	**44.2**	**56.8**	**96**	**2006**	**5**	**2010**
Winter	52.1	27.2	39.6	75	2002	5	2010
Spring	70.0	42.6	56.3	90	2011	9	2002
Summer	85.2	61.8	73.5	96	2006	44	2003
Fall	70.8	45.1	58.0	94	2011	12	2008

Table 4-6. Monthly Distribution of Annual Reservoir Evaporation (inches)

Month	Lake Sidney Lanier
January	1.24
February	1.94
March	2.70
April	3.71
May	4.47
June	4.70
July	4.81
August	4.23
September	3.55
October	2.64
November	1.63
December	1.08
Total	36.67

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 drier, but flood-producing storms can occur at any time of the year.

Buford Dam operates to reduce peak flows immediately downstream to West Point, Georgia. Buford Dam substantially reduces peak stages at Atlanta, Georgia, and above, while decreasing stages progressively downstream so that at West Point, Georgia, peak stages are only slightly reduced.

One of the major floods before construction of Buford Dam was the January 1946 event. This event was centered west of Cornelia Georgia. It produced record stages at the USGS Norcross (#02335000) and Vinings (#02336000) gages (see Plate 5-1 for gage locations) and would have produced inflows in excess of 70,000 cfs into Lake Sidney Lanier. Plates 8-3 and 8-4 show the effects of reservoir regulation on the 1946 flood. The peak pool elevation was produced by a succession of three events in the spring of 1964 producing a peak pool elevation of 1077.2 feet NGVD29. Plate 8-5 shows the inflow, outflow and pool elevation for this event.

A significant recent flood is the storm of September 2009. That flood occurred at the end of a severe drought and heavy rainfall occurred above and below Buford Dam. In this event, rain began falling on 15 September with the heavier rain beginning to fall on 17 September. On the night of 20 September through the night of 21 September, over 20 inches of rain fell in areas around the City of Atlanta. This extreme rainfall was the result of a stationary front that stalled over the southern Plains, fed by moisture swept up from the Atlantic Ocean and Gulf of Mexico. This intense rain caused the Chattahoochee River below Buford Dam to rise higher than it has since the construction of the dam. The worst flooding from this event occurred in the western and northern parts of the metropolitan Atlanta area including Douglas, Cobb, Paulding, Carroll and Gwinnett Counties. Plate 8-6 shows the effects of reservoir regulation on the 2009 flood. Flood reductions from operations of the Buford Project are shown in Table 4-7. The small 7 MW service unit at the Buford Powerhouse continued to release approximately 670 cfs throughout the flood event to protect the integrity of the stream immediately below the dam. That resulted in some internal discussion of the merits of continued releases during a flood event. The water control plan does not call for any reduction in releases from the small service unit due to downstream flooding. This is due to the overall minimal impact the release has on downstream flood risk management as well as potential to harm the integrity of the streambed immediately downstream of the dam by completely stopping the dam discharge and thereby shutting the river off. However, it was determined that the potential does exist to reduce or discontinue the 670 cfs release in extreme events. This reduction would have to be considered on a case-by-case basis by evaluation of the conditions at flood risk management locations downstream as well as the conditions immediately below the dam. Coordination and notification of this reduction should include the National Park Service and Georgia Department of Natural Resources, both of who operate facilities downstream of Buford Dam. Table 4-8 shows the maximum impact at the USGS Norcross (#02335000) and Vinings (#02336000) gages from the continued releases. Away from the main river and along tributary streams, the impact would be negligible. The flood can serve as a reference or benchmark for comparison. Peak stages and flows throughout the basin are shown in Table 4-9 and photographic scenes from September 2009 are shown in Figure 4-2.

Table 4-7. Flood Reduction for September 2009 Flood Event

Location (USGS Gage #)	Peak date and time	Observed flow (cfs)	Observed stage (ft)	Computed natural flow (cfs)	Computed natural stage (ft)	Stage reduction (ft)
Norcross (02335000)	9/21/2009 @ 2030	14,940	14.5	38,500	22	7.5
Vinings (02336000)	9/21/2009 @ 1830	40,300	28.1	79,400	32	3.9
West Point (02339500)	9/25/2009	54,600	18.91	62,718	20.66	1.75

Table 4-8. Impact of Small Unit on Peak Stage

Location (USGS Gage #)	Flow (cfs)	Stage (ft)	Stage (inches)
Norcross, (#02335000)	670	0.4	4.8
Vinings, (#02336000)	670	0.2	2.4

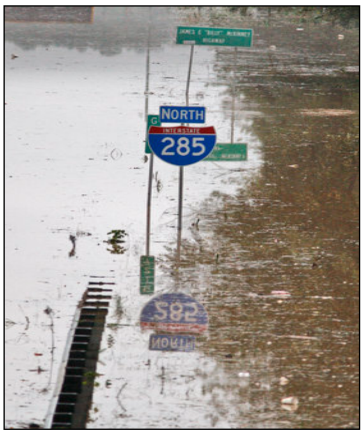
Table 4-9. Peak Flows and Stages at Selected ACF Stations for September 2009

USGS Gage #	Station	Peak flow (cfs)	Peak gage height (ft)	Date of peak	Lat	Long	Gage datum NGVD29
02334480	Richland Creek At Suwanee Dam Road, Near Buford, GA	1,610	7.27	9/21/2009	34.1326	84.0699	920
02334578	Level Creek At Suwanee Dam Road, Near Suwanee, GA	1,830	11.6	9/21/2009	34.0965	84.0796	985
02334620	Dick Creek At Old Atlanta Rd, Near Suwanee, GA	1,480	11.72	9/21/2009	34.0715	84.1302	920
02334885	Suwanee Creek At Suwanee, GA	7,870	14.3	9/21/2009	34.0323	84.0894	909.71
02335000	Chattahoochee River Near Norcross, GA	14,900	14.51	9/21/2009	33.9972	84.2019	878.14
02335350	Crooked Creek Near Norcross, GA		14.59	9/22/2009	33.9651	84.2649	869.4
02335450	Chattahoochee River Above Roswell, GA	21,100	11.96	9/21/2009	33.9859	84.3160	858.01
02335757	Big Creek Below Hog Wallow Creek At Roswell, GA	6,370	15.41	9/22/2009	34.0175	84.3533	940
02335815	Chattahoochee River Below Morgan Falls Dam, GA	30,900	826.96	9/21/2009	33.9681	84.3828	843.48
02335870	Sope Creek Near Marietta, GA	9,400	18.29	9/21/2009	33.9539	84.4433	881.37
02335910	Rottenwood Cr At Interstate N Pkwy, Nr Smyrna, GA	4,840	11.74	9/21/2009	33.8937	84.4577	843.15
02336000	Chattahoochee River At Atlanta, GA	40,900	28.12	9/22/2009	33.8592	84.4544	750.1
02336030	N.F. Peachtree Creek At Graves Rd, Nr Doraville, GA	3,590	12.93	9/21/2009	33.9057	84.2249	950
02336120	N.F. Peachtree Creek, Buford Hwy, Near Atlanta, GA	6,140	18.57	9/21/2009	33.8315	84.3427	809.57
02336300	Peachtree Creek At Atlanta, GA	9,050	22.91	9/21/2009	33.8194	84.4078	763.96
02336360	Nancy Creek At Rickenbacker Drive, At Atlanta, GA		14.69	9/21/2009	33.8692	84.3789	810
02336490	Chattahoochee River At GA 280	42,300	35.98	9/22/2009	33.8169	84.4800	736.35
02336526	Proctor Creek At Jackson Parkway, At Atlanta, GA	6,240	14.93	9/22/2009	33.7943	84.4744	756.39
02336635	Nickajack Creek At Us 78/278, Near Mableton, GA	5,090	19.85	9/21/2009	33.8033	84.5214	745
02336728	Utoy Creek At Great Southwest Parkway		27.89	9/22/2009	33.7434	84.5683	736.48
02396870	Powder Springs Creek Near Powder Springs, GA	8,420	19.82	9/21/2009	33.8593	84.6880	940
02336968	Noses Creek At Powder Springs Rd, Powder Springs, GA		23.2	9/22/2009	33.8593	84.6527	882.8
02336986	Olley Creek At Clay Road, Near Austell, GA		27.4	9/22/2009	33.8362	84.6316	885
02337000	Sweetwater Creek Near Austell, GA	31,500	30.8	9/22/2009	33.7729	84.6147	857.01
02337170	Chattahoochee River Near Fairburn, GA	63900	30.65	9/22/2009	33.6567	84.6736	719.07
02337185	No Business Creek At Lee Road, Below Snellville, GA		8.83	9/21/2009	33.7782	84.0380	735
02337410	Dog River At GA 5, Near Fairplay, GA	59,900	33.8	9/21/2009	33.6538	84.8210	855
02337500	Snake Creek Near Whitesburg, GA	10,900	17.3	9/21/2009	33.5296	84.9283	832.75
02338000	Chattahoochee River Near Whitesburg, GA	60,900	29.84	9/23/2009	33.4771	84.9008	682.06

View on MLK Drive. Water was less than two feet below the bridge

Azalea Drive Roswell, GA

Boat dock several days before September (drought conditions)



Chattahoochee River at I-285 (James McKenney Highway)

Sweetwater Creek, Austell, GA

Chattahoochee River flooded the R.M. Clayton Water Reclamation Center. The center is in northwest Atlanta near Cobb County

Countryside Village subdivision in Lawrenceville. Water had covered the stop sign earlier

Storm drain overflow, Roswell, GA

Sweetwater Creek flooding

Figure 4-2. Scenes from the September 2009 Flood

4-07. Runoff Characteristics. In the ACF Basin, rainfall occurs throughout the year but is less abundant from August to November. The amount (or percentage) of the rainfall that actually contributes to streamflow varies on a seasonal basis. Several factors such as plant growth and the seasonal rainfall patterns contribute to the volume of runoff. During extreme droughts, runoff from a 2 to 3-inch rainfall event can be as low as 10 percent. Figure 4-3 presents the average monthly runoff for the basin above Atlanta, Georgia. Figure 4-4 presents the same information for the area between Atlanta and Columbus, Georgia. 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. Plate 4-2 shows the monthly inflow frequencies above Buford Dam.

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.

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

where: $\text{STORAGE}_{\mathbf{i}}$ = storage at midnight of the current day in units of cfs/day
$\text{STORAGE}_{\mathbf{i-1}}$ = 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.

Stream flow has been measured at Strickland Bridge, 2.6 miles below Buford Dam, since January 1942. The USGS gaging station is called the *Chattahoochee River near Buford, Georgia,* (02334430). The stage-discharge rating curve for the Buford gage is shown on Plate 4-3. The Corps has maintained a gage 0.2 mile below the dam since June 1950. Flows for the pre-record period, 1903 through 1941, have been estimated from records at Norcross, 18 miles below the dam. The stage-discharge rating curves for the Norcross, Roswell, and Atlanta gages are shown on Plates 4-4 to 4-6 respectively. Average monthly flows at the dam for 1903 through 1957 are shown on Plates 4-7 and 4-8. Since beginning of operations at Buford Dam, the outflow has been regulated through the turbines or the sluice. Inflow is computed by change in storage plus outflow. Average monthly inflow for July 1957 - December 2015 is shown on Plates 4-9 and 4-10. Average monthly outflow for July 1957 - December 2015 is shown on Plates 4-11 and 4-12. Unimpaired flows have been computed for the Buford site for 1939 - 2011. Average monthly unimpaired flows are shown on Plates 4-13 and 4-14.

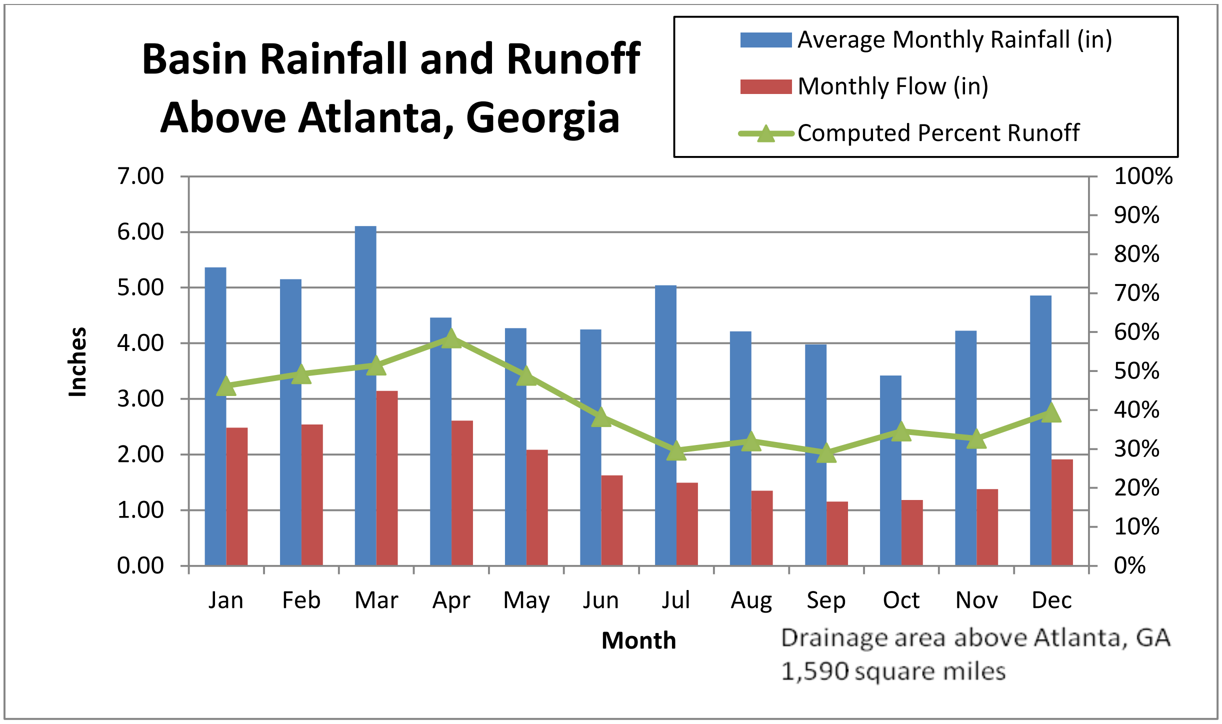


Figure 4-3. Basin Rainfall and Runoff above Atlanta, Georgia

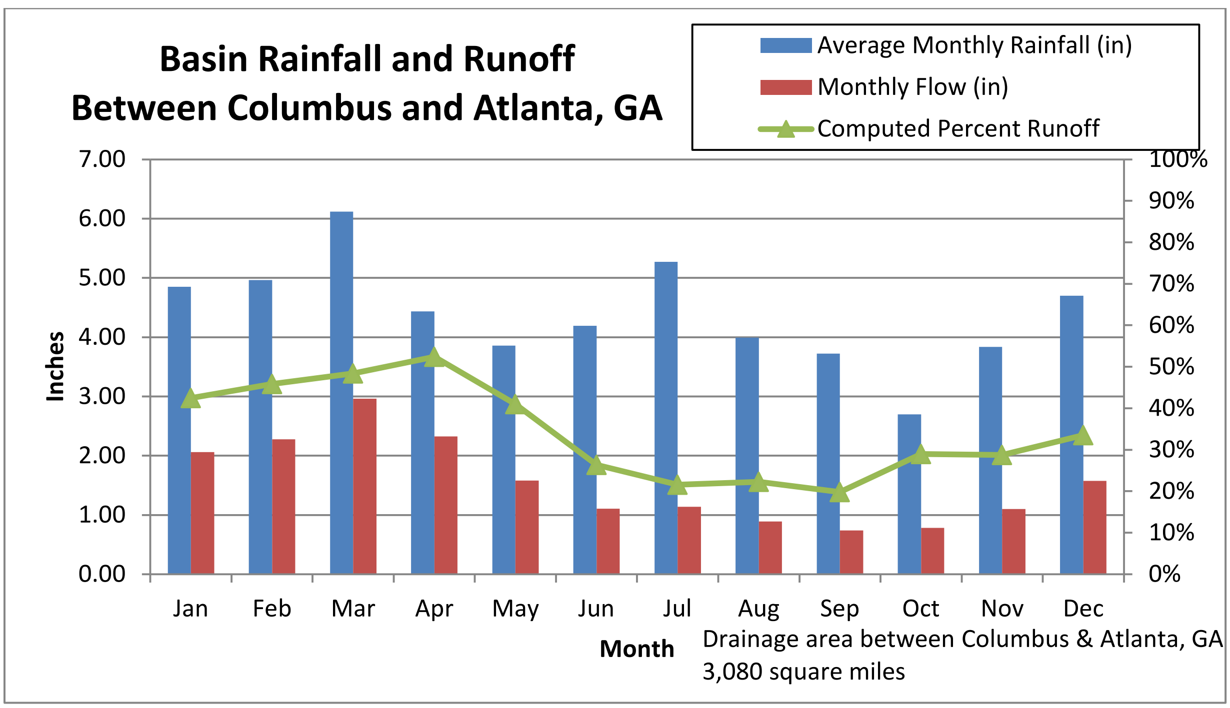


Figure 4-4. Basin Rainfall and Runoff between Columbus and Atlanta, Georgia

4-08. Water Quality. Water quality in the forested headwaters of the Chattahoochee River Basin was historically very good. After Buford Dam was built in the 1950s, water quality in the tailrace of the dam in the Chattahoochee River diminished. Water released from the reservoir was high in iron and manganese due to summer-time lake stratification resulting in several large fish kills at the Buford Trout Hatchery located approximately one mile downstream of Buford Dam. Overall water quality conditions have improved in both the reservoir and the releases since project completion and are discussed below.

a. Water Quality Needs. Georgia Department of Natural Resources (GADNR) has classified the Chattahoochee River from Buford Dam to Atlanta (Peachtree Creek) for drinking water and recreation in accordance with Georgia Water Quality Control laws. GADNR has designated the stretch of river from Buford Dam to I-285 west as a trout stream (secondary), which means it is a put and take fishery that must be stocked periodically. The principal specific criteria related to the use classifications below Buford Dam are as follows:

- Bacteria: Fecal coliform not to exceed a geometric mean of 200 count per 100 milliliters.
- Dissolved oxygen: A daily average of 6.0 milligrams per liter (mg/l) and no less than 5.0 mg/l at all times for trout streams.
- pH: Within the range of 6.0–8.5.
- Temperature: A maximum rise of 2 °F above natural stream temperature may be permitted for secondary trout waters.
- Toxic wastes, other deleterious materials: None in concentrations that would harm man, fish and game, or other beneficial aquatic life.

A 1976 Corps study identified low dissolved oxygen as the primary adverse water quality impact associated with the release waters of Buford Dam. The low dissolved oxygen problems result from the seasonal stratification, which produces anoxic and later anaerobic conditions in the lake's hypolimnion. Flow regulation for water quality is discussed in Chapter VII (Water Control Plan). Reaeration rates downstream are relatively high, but dissolved oxygen levels can be impacted by the oxygen demand in the point and non-point source flows entering the river.

b. Lake Water Quality Conditions. Georgia's 2014 draft integrated 305(b)/303(d) list of impaired waters designates five of six reaches in Lake Sidney Lanier as supporting designated uses, including the area of the dam forebay. Water quality monitoring in Lake Sidney Lanier by the Georgia Environmental Protection Division (GAEPD) has shown that conditions exceeded the water quality standard for chlorophyll *a* at times since 2001. In the State's draft 2014 assessment, the reach near Browns Bridge Road (State Route 369) was identified as not supporting designated uses for chlorophyll *a*. Chlorophyll *a* standards for Lake Sidney Lanier are set as a growing season (April through October) average less than 5 micrograms per liter (µg/l) upstream of Buford Dam forebay, less than 5 µg/l upstream from Flowery Branch confluence, less than 5 µg/l at Browns Bridge Road, less than 10 µg/l at Boiling Bridge on the Chestatee River, and less than 10 µg/l at Lanier Bridge on the Chattahoochee River. The State collects profile data at compliance points in the reservoir for dissolved oxygen, pH, conductivity, and water temperature during the growing season. It also collects grab samples of nitrogen, phosphorus, chlorophyll *a*, and bacteria. Measured data at compliance points for dissolved oxygen, total nitrogen, and pH are consistent with Georgia's standards.

Georgia has begun efforts to identify sources contributing to high chlorophyll *a* by developing a total maximum daily load. As part of the State's water planning effort, it is also modeling the Chattahoochee River downstream of Buford Dam.

c. Lake Stratification. During the colder winter months, the water in Lake Sidney Lanier is generally cold, relatively clear, and the same temperature from the top to the bottom. Wind action keeps the lake well mixed, resulting in adequate dissolved oxygen levels throughout the water column. During winter-time, water temperature and oxygen concentrations do not limit fish movement in the lake. Lake water, which is released through the hydropower units from near the bottom of the lake into the Chattahoochee River below the dam, is cold, oxygenated, and relatively clear.

During spring and early summer, the lake warms and stratifies into three distinct layers: a surface layer called the epilimnion, a bottom layer called the hypolimnion, and a layer between the two called the metalimnion, or the thermocline. Figure 4-5 shows the summer stratification layers.

The warm, upper layer is fairly uniform in temperature and varies from 15 to 30 feet thick throughout the summer. It is oxygenated from wind action and photosynthesis.

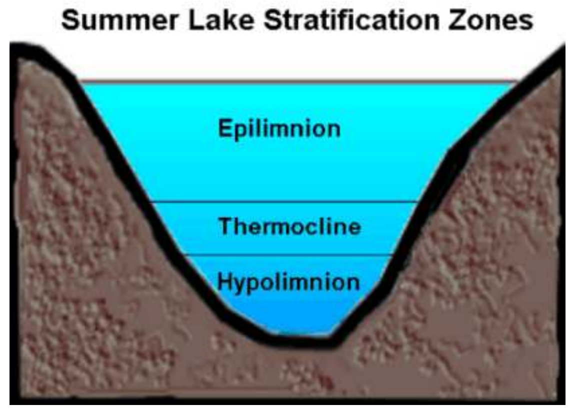


Figure 4-5. Lake Stratification

The hypolimnion, the cold (45 to 55 °F) dense bottom layer, becomes isolated and no longer mixes with the warm, oxygenated epilimnion. Oxygen is not produced in the hypolimnion because the cold, deep layer does not receive sunlight and is devoid of phytoplankton production. Early in the lake stratification process, the hypolimnion still contains some oxygen but declines through the summer as biological and chemical processes consume oxygen. By summer's end, the lake is strongly stratified. The epilimnion is warm and well oxygenated. Water temperature and oxygen concentrations in the thermocline are both lower but still often provide acceptable habitat for cool-water fish species. In the hypolimnion, the water is cold and low in oxygen (less than 1 mg/l). As oxygen levels fall to anoxic conditions, some metals and sulfides in the lake sediments become soluble. They dissolve in the water and can be released downstream, entering the river. The river water becomes re-aerated rapidly as it flows downstream, thus releasing the metals and sulfides that have become soluble.

In the fall, the lake begins to lose heat, and the process of destratification begins. The warm water of the epilimnion cools and becomes deeper and denser. As the epilimnion's density approaches the density of the hypolimnion, mixing of the layers occurs and the stratification is broken. This event is called *lake turnover*, and generally occurs around November - December each year. After mixing, no layers exist, and the entire lake has a relatively uniform temperature and oxygen levels, until the next summer season.

d. Downstream Water Quality Conditions. Water quality downstream of Buford Dam in the metropolitan Atlanta area and the 70 miles immediately downstream of metropolitan Atlanta, was notoriously poor from the 1940s to the 1970s. Raw sewage and industrial effluent were routinely discharged directly into the Chattahoochee River. Wastewater typically received only primary treatment before being discharged to the river. River flows generally diluted the wastewater, but low flows and warm water temperatures during summer months decreased dissolved oxygen. From 1968 to 1974, dissolved oxygen was regularly less than 1 mg/l in the metropolitan Atlanta area. Phosphorus levels were also very high in rivers because phosphates were still being used in laundry detergent. Fish kills were common in the metropolitan Atlanta area due to the poor water quality in the river.

Environmental laws of the 1970s, including the 1972 Clean Water Act and the 1973 Atlanta Metropolitan River Protection Act, established requirements for improving water quality. Following improvements to wastewater treatment plants, dissolved oxygen concentrations increased by approximately 5–7 mg/l in the Chattahoochee River and its tributaries. There were significant reduction in ammonia and total suspended solids being discharged, and phosphorus levels decreased in part because of laws passed that regulated phosphate detergent. Biochemical oxygen demand concentrations also steadily decreased.

e. Historical Water Quality Control Operations. Selective withdrawal facilities for water quality were not included when Buford Dam was designed and constructed in the 1950s. However, the large and small turbines have been used for weekend water quality releases. Additionally, self-aspirating turbines were installed at Buford Dam in 2005 to improve dissolve oxygen levels downstream. The small turbine unit is run continuously to provide a minimum flow of approximately 550 – 660 cfs from the dam.

4-09. Channel and Floodway Characteristics

a. General. Above the Buford Dam site, the Chattahoochee River Basin has a length of 52 miles and an average width of 20 miles. Below the dam, the basin is approximately 10 miles wide to the USGS Roswell gage. Below Rowell, the basin widens to an average width of 25 miles above West Point, Georgia. Downstream of West Point, the basin varies in width between 30 to 40 miles until Jim Woodruff Lock and Dam, where the Flint and Chattahoochee Rivers combine to form the Apalachicola River. Above Buford, the terrain is mountainous and steep. From Buford Dam to the USGS Roswell gage, the slope averages about 2.7 feet per mile. Morgan Falls Dam is above Atlanta and reregulates power releases from Buford. Travel time from Buford Dam to the USGS Norcross gage is approximately 8 to 10 hours and to the USGS Roswell gage is 15 to 18 hours. Figures 4-6 and 4-7 show the downstream effects of releases from the Buford Powerhouse. Shown are the releases from the dam and the stages at the USGS Norcross, Roswell and Vinings gages downstream. The low-flow period of May 2008 and the higher-flow period of November 2009 are shown. Reregulation of the power waves at Atlanta can easily be seen. Rating curves for downstream USGS gage locations (Buford, Norcross, Roswell, and Vinings) are shown on Plates 4-3 through 4-6.

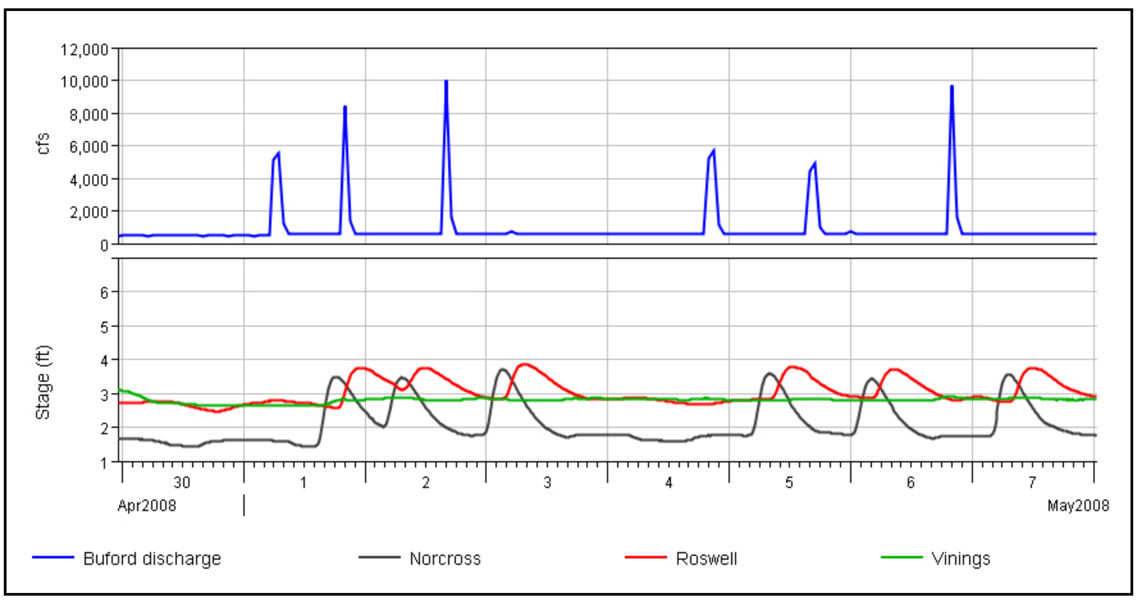


Figure 4-6. Effects of Buford Releases

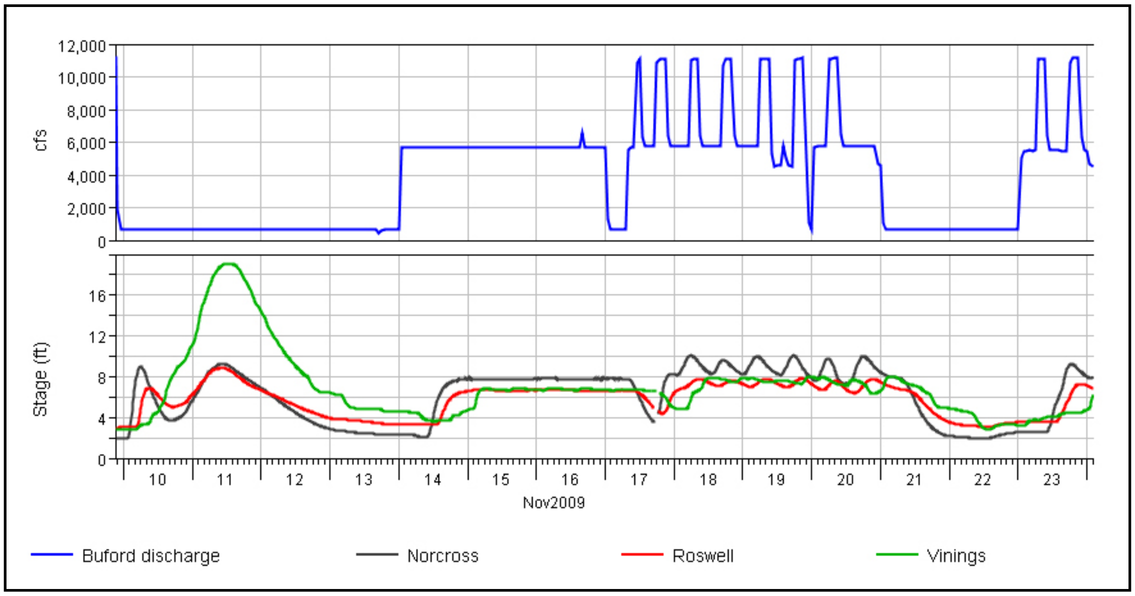


Figure 4-7. Effects of Buford Releases

b. Damage Centers and Key Control Points. Flood damages occur throughout the ACF Basin, both above Buford Dam and downstream. USGS gages on the Chattahoochee River at Norcross, Roswell, and Vinings reflect flooding from the river and are used in planning releases from Buford Dam. Other USGS gages on tributaries also provide insight into flooding conditions. Austell on Sweetwater Creek (#02337000), Alpharetta on Big Creek (#02335700), and Suwanee on Suwanee Creek (#02334885) are indicators of flooding conditions. Tables 4-10 through 4-15, provide flood damage information for these locations as reported on the Southeast River Forecast Center (SERFC) website. Table 4-16 presents historical gage reading for these locations also reported on the SERFC website.

Table 4-10. Flood Damages at Norcross, Georgia

Gage height (feet)	Flood impacts at USGS Gage 02335000
9	Water goes to the top of the boat ramp of the Chattahoochee River National Recreation Area.
10	ACTION STAGE
12	FLOOD STAGE: Flood stage is reached, and minor flooding begins. Flood waters begin to cover Chattahoochee River National Recreation Area parking lot at Medlock Bridge Park. In addition, bottomland flooding increases in the floodplain.
16	MODERATE FLOOD STAGE: Moderate flooding begins. Extensive flooding of lowlands and access roads to the river occurs. Water also begins to enter some homes.
20	MAJOR FLOOD STAGE: Major flooding begins. Some homes will be submerged with flood waters.
24	Major flooding expands. Flood waters will cover the road bed of Georgia Highway 141 Medlock Bridge.
27.7	Major flooding inundates area. Many homes and roads submerged by flood waters. This is the peak flood crest of record, which occurred on 8 January 1946.

Table 4-11. Flood Damages at Roswell, Georgia

Gage height (feet)	Flood impacts at USGS Gage 02335450
8	ACTION STAGE: River begins to come out of its banks in low lying areas, especially near the Ace Sand Company. River level reaches boardwalk and fishing pier at Don White Memorial Park under Georgia Highway 400, two miles downstream from the gage. River reaches top of boat ramp at Azalea Park on Azalea Drive, west of GA Highway 9.
9	FLOOD STAGE: Water reaches bottom of Ace Sand Company office and begins to flood parking lot of Don White Memorial Park on Riverside Road and parking lot at Azalea Park on Azalea Drive west of Roswell Road. Water begins to flood the road leading to horse stables. Storm drains no longer function properly at Riverside Road and Northcliff Trace.
10	Minor flooding continues. Water is one foot deep in Ace Sand Company office and begins to flood a warehouse. Flooding expands into parking lots of Don White Memorial Park on Riverside Road and Azalea Park on Azalea Drive west of Roswell Road. Water begins to flood tennis courts at Huntcliff Club across from Azalea Park and is one foot deep over road leading to horse stables. Storm drains stop functioning at Riverside Road and Northcliff Trace.
11	Minor flooding continues with water two feet deep in Ace Sand Company office and a warehouse. Flooding expands into parking lots of Don White Memorial Park on Riverside Road and Azalea Park on Azalea Drive west of Roswell Road. Water floods tennis courts at Huntcliff Club and is two feet deep over road leading to horse stables. Riverside Road at Northcliff Trace begins to flood.
12	Minor flooding expands with water three feet deep in Ace Sand Company office and a warehouse. Water covers parking lots of Don White Memorial Park and Azalea Park. Water floods tennis courts at Huntcliff Club and approaches swimming pool. Water is three feet deep over road leading to horse stables which begin to flood. Riverside Road at Northcliff Trace is flooded with one foot of water. These conditions occurred in September 2009.
13	MODERATE FLOOD STAGE: Moderate flooding begins. Extensive flooding of yards, walkways, access roads, and some homes along parts of Riverside Road, Old Riverside Road, and Azalea Drive. Water floods tennis courts, swimming pool, and lower portions of club house at Huntcliff Club. Water is four feet deep over road leading to horse stables which are flooded with up to two feet of water. Water level is around one half foot below the gage house which may affect stage readings.
14	Moderate flooding expands in yards, walkways, access roads, and some homes along portions of Riverside Road, Old Riverside Road, and Azalea Drive. Tennis courts, swimming pool, and lower portions of club house are flooded at Huntcliff Club. Water is around three feet deep in horse stables. Water level floods gage house and automated stage readings are unlikely.
17	MAJOR FLOOD STAGE: Major flooding begins. The Fulton County Water Pollution Control Facility will flood between 17 and 17.5 feet. Eves Road begins to flood. Numerous homes are flooded along Riverside Road and Old Riverside Road.
20	Extensive flooding of many homes and businesses occurs on Riverside Road. Sections of Riverside Road are under water.

Table 4-12. Flood Damages at Atlanta (Vinings Gage)

Gage height (feet)	Flood impacts at USGS Gage 02336000
12	ACTION STAGE
13	The low-lying areas of the Lovett School athletic fields begin to flood.
14	FLOOD STAGE: Flood stage is reached and minor flooding begins. Some backyards of homes near the river begin to flood.
18	MODERATE FLOOD STAGE: Moderate flooding begins. Considerable flooding of homes near the river can occur. Other homes and businesses are surrounded by flood waters.
20	MAJOR FLOOD STAGE: Major flooding begins. Many homes, shops, restaurants, and Lovett School are flooded. Homes flood along Paces Ferry Southeast Drive.
22	Major flooding expands. Vinings on the River parking lot floods. The Canoe Restaurant begins to flood, and Paces Ferry Drive Southeast Road is flooded.
23	Extensive flooding occurs. The 100-year flood is between 23 and 24 feet. Many homes and business are flooded.
28	Extensive and serious flooding continues with many homes and businesses flooded.
30	Old Paces Ferry bridge over the river is flooded.
34	Serious flooding. Paces Ferry Road bridge over Chattahoochee River is flooded.
35	Serious flooding. Paces Ferry Bridge sidewalk over Chattahoochee River is flooded.

Table 4-13. Flood Damages at Austell (Sweetwater Creek)

Gage height (feet)	Flood impacts at USGS Gage 02337000
8	ACTION STAGE: Bankfull conditions are reached upstream and downstream from the gage near the Interstate 20 bridge. Water begins to flow into low areas of the floodplain.
10	FLOOD STAGE: Minor flooding begins. Mainly forested bottomland is flooded. Athletic fields in Woodrow Wilson Recreation Park upstream floods because of water backing up in ditches. Water begins to flood yards of four elevated homes along Mount Vernon Road.
12	Minor flooding continues in woodlands and fields upstream and downstream from gage near I-20 bridge. Portions of a paintball playing field just downstream of bridge and athletic fields in Woodrow Wilson Park on Mount Vernon Road are flooded with one to two feet of water. Water also floods yards of four elevated homes along Mount Vernon Road. A portion of Wren Circle in Douglas County, the County Iron Works, and Sunlight Drive in Cobb County begin to flood.
13	MODERATE FLOOD STAGE: Moderate flooding begins. Significant flooding occurs in woodlands and fields upstream and downstream from gage near I-20 bridge. Portions of a paintball playing field just downstream of bridge and athletic fields in Woodrow Wilson Park on Mount Vernon Road are flooded with 2 to 3 feet of water. Water begins to flood a few mobile homes on Brook Forest Road and homes on Wren Circle in Douglas County. Portions of Sunlight Drive in Cobb County are flooded.
15	Significant flooding continues in woodlands and fields upstream and downstream from gage by I-20 bridge. Portions of a paintball playing field just downstream of bridge and athletic fields in Woodrow Wilson Park on Mount Vernon Road are flooded with 4 to 5 feet of water. Several homes on Wren Circle and Robin Road and portions of Brook Forest and Beech Gum Mobile Home Parks in Douglas Co., and Sunlight Drive and Old Marietta Road in Cobb Co. are flooded.
17	MAJOR FLOOD STAGE: Major flooding begins. Extensive flooding occurs upstream and downstream from gage by I-20 bridge. Large portions of paintball playing field just downstream of bridge and athletic fields in Woodrow Wilson Park are flooded with 6 to 7 feet of water. Numerous homes on Mount Vernon Road, Wren Circle, Robin Road, and portions of Brook Forest and Beech Gum Mobile Home Parks in Douglas Co., and Sunlight Drive, Old Marietta Road, and Brooks Drive in Cobb County are flooded.

Table 4-13 (Cont'd). Flood Damages at Austell (Sweetwater Creek)

Gage height (feet)	Flood impacts at USGS Gage 02337000
18	Major flooding expands upstream and downstream from gage by I-20 bridge. Paintball playing field just downstream of the bridge and athletic fields in the Woodrow Wilson Park are flooded with 7 to 8 feet of water. Numerous homes on Mount Vernon Road, Wren Circle, Robin Road, and portions of Brook Forest and Beech Gum Mobile Home Parks in Douglas County, and Sunlight Drive, Old Marietta Road, and Brooks Drive in Cobb County are flooded.
20	Widespread inundation flooding occurs from the gage by Interstate 20. A paintball playing field near the bridge and athletic fields in the Woodrow Wilson Park are flooded with 10 feet of water. Numerous homes on Mount Vernon Road, Wren Circle, Robin Road, and the Brook Forest and Beech Gum Mobile Home Parks in Douglas County, and Old Marietta Road, Old Alabama Road, and Maxham Road in Cobb County are flooded. Powder Springs, Noses, and Olley Creeks backup and flood neighborhoods close to them.
23	Widespread inundation flooding continues to expand around Austell. A paintball playing field near the gage and athletic fields in the Woodrow Wilson Park are completely flooded. Numerous homes on Mount Vernon Road, Wren Circle, Robin Road, and the Brook Forest and Beech Gum Mobile Home Parks in Douglas County, and Old Marietta Road, Old Alabama Road, and Maxham Road in Cobb County are flooded. Powder Springs, Noses, and Olley Creeks backup and flood neighborhoods close to them.
26	Widespread inundation flooding expands around Austell. Portion of I-20 over creek begins to flood. Numerous homes and businesses on Mount Vernon Rd., Wren Circle, Bankhead and Veterans Memorial Hwys. and Brook Forest and Beech Gum Mobile Home Parks in Douglas Co., and Old Marietta Rd., Old Alabama Rd., and Maxham Rd. in Cobb Co. are flooded. Powder Springs, Noses, & Olley Creeks backup & flood neighborhoods nearby with several feet of water.
28	Massive inundation flooding affects the infrastructure around Austell. A portion of I-20 over the creek will be flooded. Numerous homes and businesses on Mount Vernon Road, Wren Circle, Bankhead and Veterans Memorial Highways, and the Brook Forest and Beech Gum Mobile Home Parks in Douglas County, and Old Marietta Road, Old Alabama Road, and Maxham Road in Cobb County are flooded.
30	Near record flooding occurs around Austell affecting its infrastructure. Sections of I-20 are flooded with a few feet of water. Thornton Road bridge begins to flood on the east side of Lithia Springs. A catastrophic and massive flood event occurs similar to the Epic Flood of 2009. Numerous homes, businesses, and roads are affected with water up to 20 feet deep in some locations. Transportation in and out of Austell and Lithia Springs is difficult due to road closures.
32	Flooding never seen before affects all of Austell and its infrastructure. Sections of Interstate 20 are flooded with several feet of water. The Thornton Road bridge floods on the east side of Lithia Springs. This catastrophic and massive flood event is worse than the Epic Flood of 2009. Numerous homes, businesses, and roads are affected with over 20 feet of water in some locations. Transportation in and out of Austell and Lithia Springs is difficult due to road closures.

Table 4-14. Flood Damages at Alpharetta, Georgia (Big Creek)

Gage height (feet)	Flood impacts at USGS Gage 02335700
6	ACTION STAGE: Bankfull conditions are reached along creek between Cumming in Forsyth Co. to Alpharetta and Roswell in North Fulton Co. Low lying spots along Big Creek Greenway begin to flood with a few inches of water upstream and downstream from the gage on Kimball Bridge Road. Water begins to enter low portions of the YMCA Campground off Preston Ridge Road.
7	FLOOD STAGE: Minor flooding of woodlands and fields begin along the creek between Cumming in Forsyth County to Alpharetta and Roswell in North Fulton County. Flooding starts to affect portions of Big Creek Greenway near Alpharetta and some portions may close with around one foot of water, especially upstream and downstream from the gage on Kimball Bridge Road and near Rock Hill Park. Portions of the YMCA Campground off Preston Ridge Road begin to flood.
8	Minor flooding continues to expand further into woodlands and fields along creek from near Cumming in south Forsyth County to Alpharetta and Roswell in north Fulton County. Additional portions of Big Creek Greenway have minor flooding with 1 to 2 feet of water. Most walking and biking paths are closed, especially upstream and downstream from gage on Kimball Bridge Road and near Rock Hill Park. Portions of the YMCA Campground off Preston Ridge Road flood.
9	Minor flooding continues to expand further into woodlands and fields along creek from near Cumming in south Forsyth County to Alpharetta and Roswell in north Fulton County. Big Creek Greenway experiences significant flooding which results in closure of most walking and biking paths. This especially occurs upstream and downstream from the gage on Kimball Bridge Road and Rock Hill Park. A large portion of the YMCA Campground off Preston Ridge Road is flooded.
10	Minor flooding continues upstream and downstream from gage on Kimball Bridge Road. Flood waters expand further into woodlands along creek and begins to affect some residential yards between Cumming in Forsyth County through Alpharetta and Roswell in North Fulton County. Big Creek Greenway is closed and completely flooded with up to 4 feet of water in some areas.
11	MODERATE FLOOD STAGE: Big Creek Greenway completely flooded with 1 to 5 feet of water. Water level approaches bottom of foot bridge just downstream of Kimball Bridge Road where the gage is located. Portions of the Rock Hill Park is flooded. A large portion of the YMCA Campground off Preston Ridge Road is flooded.
12	Big Creek Greenway is closed and flooded with 2 to 6 feet of water. Water reaches the bottom of the foot bridge just downstream of Kimball Bridge Road where the gage is located. Flooding expands over portions of Rock Hill Park and the YMCA Campground off Preston Ridge Road. The water level reaches the foundation of a storage shed at the campground.
13	MAJOR FLOOD STAGE: Big Creek Greenway is closed and flooded with 3 to 7 feet of water. Water reaches bottom of foot bridge just downstream of Kimball Bridge Road where gage is located. Large portion of Rock Hill Park is flooded and lower end of parking lot is affected. YMCA Campground off Preston Ridge Road is flooded and water enters a storage shed at campground.
14	Record flooding occurs with widespread inundation along creek. Big Creek Greenway floods with 4 to 8 feet of water. Water reaches bottom of Webb Bridge Road and county officials may close it. Foot bridge begins to flood just downstream of Kimball Bridge Road. Flooding expands in Rock Hill Park with the water covering the concrete pad of the square pavilion and more of the parking lot. The YMCA Campground off Preston Ridge Road is flooded including a large storage shed.
15	Record flooding continues with widespread inundation along creek. Big Creek Greenway floods with 5 to 9 feet of water. Portions of Webb Bridge Road begin to flood and county officials will likely close it. Foot bridge just downstream of Kimball Bridge Road is flooded. Flooding expands in Rock Hill Park with water covering concrete pad of the square pavilion and more of the parking lot. The YMCA Campground off Preston Ridge Road is flooded including a large storage shed.
17	Record flooding never seen before affect portions of Alpharetta along the creek. The Big Creek Greenway is under 7 to 11 feet of water. Portions of Webb Bridge Road are under 1 to 2 feet of water. The foot bridge just downstream of Kimball Bridge Road is under water. The Rock Hill Park is flooded with water covering the concrete pad of the octagon pavilion and half of the parking lot. The YMCA Campground and playground off Preston Ridge Road is completely flooded.
19	Record flooding never seen before affects portions of Alpharetta near the creek. Big Creek Greenway is under 13 feet of water. Portions of Webb Bridge Road is under 4 feet of water. Rock Hill Park & most of parking lot flooded with water reaching foundation of restrooms. Water level reaches bottom of Kimball Bridge & Haynes Bridge Roads and city officials may need to close them.

Table 4-15. Flood Damages at Suwanee (Suwanee Creek)

Gage height (feet)	Flood impacts at USGS Gage 02334885
6	Bankfull conditions are reached along the creek behind the Suwanee Elementary School and George Pierce Park. Portions of the Suwanee Creek Greenway in this area begin to flood.
7	ACTION STAGE: Bankfull conditions are reached along the creek upstream and downstream from the gage at U S Highway 23 or Buford Highway. Portions of the Suwanee Creek Greenway and trails in the park to Martin Farm Road begin to flood. This also includes the low lying areas behind the Suwanee Elementary School and the George Pierce Park.
8	FLOOD STAGE: Minor flooding begins along the creek upstream and downstream from the gage at U S Highway 23 or Buford Highway. Portions of the Suwanee Creek Park off of Suwanee Creek Trail begin to flood to Martin Farm Road. This includes areas behind the Suwanee Elementary School and the George Pierce Park.
10	Minor flooding expands further into flood plain from Suwanee Creek Park through Martin Farm Park to George Pierce Park. Suwanee Creek Greenway and trails are completely flooded with water approaching the Swift Atlanta Company parking lot. Suwanee Creek Road begins to flood in low areas near Bennett Creek Bridge. In addition, yards begin to flood off Bend Creek Trail and Mill Creek Run. Portions of the playground behind the Suwanee Elementary School are flooded.
11	MODERATE FLOOD STAGE: Moderate flooding begins in Suwanee Creek, Martin Farm, and George Pierce Parks. Suwanee Creek Greenway flooded with 1 to 3 feet of water. Water reaches Swift Atlanta Company parking lot. Portions of Suwanee Creek Road flood near Bennett Creek bridge. A large portion of the playground behind the Suwanee Elementary School floods. Water levels reach the bottom of the Martin Farm Road bridge.
12	Moderate flooding continues in Suwanee Creek, Martin Farm, and George Pierce Park. Suwanee Creek Greenway is completely flooded. Low portions of the parking lot behind the Swift Atlanta Company begin to flood. Portions of Suwanee Creek Road near the Bennett Creek bridge and the yards off Bend Creek Trail and Mill Creek Run are flooded. Playground behind Suwanee Elementary School is flooded. Portions of Martin Farm Road near the bridge begin to flood.
13	Significant flooding expands in the Suwanee Creek, Martin Farm, and George Pierce Parks. The Suwanee Creek Greenway and a portion of the parking lot behind the Swift Atlanta Company are flooded. Suwanee Creek Road near the Bennett Creek bridge and yards off Bend Creek Trail and Mill Creek Run are flooded. The playground is flooded behind the Suwanee Elementary School. Martin Farm Road near the bridge is flooded with up to one foot of water. Flood waters approach the structures on Sharon Industrial Way.
14	MAJOR FLOOD STAGE: Major flooding begins in the Suwanee Creek, Martin Farm, and George Pierce Parks. The Suwanee Creek Greenway is flooded out. Suwanee Creek Road near the Bennett Creek bridge and yards off Bend Creek Trail and Mill Creek Run are flooded. The playground is flooded behind the Suwanee Elementary School. Martin Farm Road near the bridge is flooded with up to 3 feet of water. Flood waters cover the parking lots behind the Swift Atlanta Company and some of the structures on Sharon Industrial Way.
15	Record flooding occurs in Suwanee Creek, Martin Farm, and George Pierce Parks. Suwanee Creek Greenway floods out. Suwanee Creek Road near Bennett Creek bridge and yards off Bend Creek Trail and Mill Creek Run are flooded. Playground is flooded behind Suwanee Elementary School. Martin Farm Road near bridge is flooded with up to 4 feet of water. Flood waters approach Swift Atlanta Company building and some structures on Sharon Industrial Way.
16	Record flooding continues in Suwanee Creek, Martin Farm, and George Pierce Parks. Suwanee Creek Greenway, Suwanee Creek Road near Bennett Creek bridge, and yards off Bend Creek Trail and Mill Creek Run are flooded. Martin Farm Road near bridge is flooded with up to 5 feet of water. The Swift Atlanta Company building and some of the structures on Sharon Industrial Way begin to flood. The water reaches the bottom of the U S Highway 23 or Buford Highway bridge.
18	Widespread record flooding continues in the Suwanee Creek, Martin Farm, and George Pierce Parks. Portions of Suwanee Creek Road, Martin Farm Road, and yards off Bend Creek Trail and Mill Creek Run are flooded with several feet of water. The Swift Atlanta Company building and some of the structures on Sharon Industrial Way are flooded. Portions of the U S Highway 23 or Buford Highway near the bridge begin to flood.

Table 4-16. Historical Crests for Damage Areas

Norcross (#02335000)	Roswell (#02335450)	Austell (#02337000)
Historical crests	**Historical crests**	**Historical crests**
(1) 27.70 ft on 01/08/1946	(1) 20.70 ft on 01/08/1946	(1) 30.82 ft on 09/22/2009
(2) 27.10 ft on 12/13/1919	(2) 19.20 ft on 03/13/1952	(2) 21.81 ft on 07/12/2005
(2) 27.10 ft on 12/10/1919	(3) 17.90 ft on 01/07/1949	(3) 20.00 ft on 07/08/1916
(4) 23.40 ft on 04/01/1886	(4) 17.80 ft on 01/22/1947	(4) 19.90 ft on 02/04/1982
(5) 22.20 ft on 04/07/1936	(5) 17.70 ft on 01/18/1954	(5) 19.30 ft on 03/18/1990
(6) 22.00 ft on 03/12/1952	(6) 15.90 ft on 03/30/1944	(6) 18.73 ft on 03/15/1975
(7) 21.40 ft on 12/30/1915	(7) 14.40 ft on 08/06/1948	(7) 18.40 ft on 11/29/1948
(8) 21.30 ft on 12/23/1918	(8) 14.20 ft on 02/09/1955	(8) 18.20 ft on 02/26/1961
(9) 20.60 ft on 03/24/1903	(9) 14.00 ft on 01/11/1953	(9) 17.65 ft on 03/31/1977
(10) 20.40 ft on 02/10/1921	(10) 14.00 ft on 12/31/1943	(10) 17.48 ft on 04/14/1979
Low water records	**Low water records**	**Low water records**
(1) 0.05 ft on 08/25/1925	(1) 2.40 ft on 08/11/1957	(1) -0.90 ft on 10/09/1954
(2) 0.60 ft on 10/02/1925	(2) 2.50 ft on 08/12/1999	(2) -0.20 ft on 07/21/1989
(3) 1.51 ft on 09/26/2007	(3) 2.57 ft on 09/27/2007	(2) -0.15 ft on 10/21/2007
(3) 1.53 ft on 08/18/1999	(4) 2.60 ft on 09/08/2007	(4) 0.01 ft on 09/13/2007
		(5) 0.10 ft on 09/09/1999

Alpharetta (#02335700)	Suwanee (#02334885)
Historical crests	**Historical crests**
(1) 13.05 ft on 02/03/1982	(1) 14.30 ft on 09/21/2009
(2) 12.81 ft on 03/17/1990	(2) 12.04 ft on 10/05/1996
(3) 12.54 ft on 02/21/1961	(3) 11.42 ft on 03/17/1990
(4) 12.50 ft on 09/22/2009	(4) 11.22 ft on 10/13/2009
(5) 12.30 ft on 12/06/1983	(5) 11.10 ft on 09/17/2004
(6) 12.20 ft on 03/30/1977	(6) 10.78 ft on 07/02/2003
(7) 11.97 ft on 12/31/1961	(7) 10.77 ft on 10/02/2012
(8) 11.93 ft on 09/17/2004	(8) 10.73 ft on 03/08/1998
(9) 11.82 ft on 03/26/1964	(9) 10.70 ft on 11/11/2009
(10) 11.71 ft on 01/13/1993	
Low water records	**Low water records**
(1) 0.90 ft on 10/11/1974	(1) 0.08 ft on 07/21/1988
(2) 1.00 ft on 09/09/1999	(2) 0.66 ft on 10/02/2007
(3) 1.08 ft on 09/30/2007	(3) 0.68 ft on 09/11/2007
(4) 1.1 ft on 09/12/2007	

4-10. Upstream Structures. The only reservoir project upstream from Buford Dam is on the Soque River. Habersham Mills Dam powered mill operations until it closed in 1999.

4-11. Downstream Structures. Buford Dam, in the headwaters of the Chattahoochee River, is one of five Corps dams within the ACF River Basin. The four structures downstream are West Point Dam, Walter F. George Lock and Dam, George W. Andrews Lock and Dam, and Jim Woodruff Lock and Dam.

Conservation flows can be maintained from each of the projects to help maintain equilibrium in the system. Flood risk management storage is provided in both Buford and West Point Projects. The Walter F. George Project does not have designated flood storage, but it provides some flood reduction downstream.

Below Buford Dam and upstream from Atlanta is Morgan Falls Dam. The GPC owns Morgan Falls, which reregulates releases from Buford Dam to provide a dependable flow past Atlanta. Further downstream, between the West Point and Walter F. George Dams, GPC owns and operates the Langdale, Riverview, Bartletts Ferry, Goat Rock, Oliver, and North Highlands Dams.

4-12. Economic Data. The watershed above Buford Dam extends to the headwaters of the Chattahoochee River and consists of eight Georgia counties. The watershed transitions from developed urban and residential land uses surrounding the Buford Project to more rural land use in the upper reach of the watershed. The Chattahoochee River Basin below Buford Dam consists of ten counties in Georgia and two Alabama counties, which compose the Chattahoochee River Watershed downstream to the West Point Project.

a. <u>Population</u>. The 2010 population of the 20 counties composing the Buford Dam Project watershed and basin below was 4,473,625 persons. Table 4-17 shows the 2010 population and the 2010 per capita income for each county.

Eight major cities, all in Georgia, are in the Buford Dam Project watershed and basin below. The cities and their 2010 populations are LaGrange - 29,588; East Point – 33,712; Atlanta - 420,003; Smyrna – 51,271; Marietta – 56,579; Roswell - 88,346; Alpharetta - 57,551; and Gainesville - 33,804.

b. <u>Agriculture</u>. The Buford Dam Project watershed and basin below consist of approximately 7,823 farms averaging 104 acres per farm. In 2012 the area produced $3.7 billion in farm products sold (including livestock). Agriculture in the Buford Dam Project watershed and basin below consists primarily of livestock, which account for 95 percent of the value of farm products sold. Livestock production consists primarily of poultry operations in the counties in the immediate vicinity of the project and in the upper portion of the watershed. Livestock operations consist predominately of beef cattle in the Chattahoochee River Basin below Buford Dam. The principal crops consist of nursery and greenhouse ornamentals, floriculture, and sod. Some vegetable farms and orchards are also operated.

c. <u>Industry</u>. The leading industrial sectors that provide non-farm employment are wholesale and retail trade, services, and manufacturing. Those 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 Buford Dam Project area counties contained 3,981 manufacturing establishments that provided 172,596 jobs with total earnings of more than $12.0 billion. Additionally, the value added by the area manufactures was more than $21.8 billion. Table 4-18 contains information on the manufacturing activity for each of the counties in the Buford Dam Project watershed and basin below.

Table 4-17. Population and per Capita Income

County	2010 Population	2010 Per Capita Income ($)
Georgia		
Cherokee	214,346	30,001
Dawson	22,330	24,750
Forsyth	175,511	36,098
Habersham	43,041	19,629
Hall	179,684	23,004
Lumpkin	29,966	20,094
Union	27,153	23,750
White	27,144	22,471
Carroll	110,527	20,551
Cobb	688,078	32,713
Coweta	127,317	25,730
Dekalb	691,893	28,064
Douglas	132,403	24,516
Fulton	920,581	36,412
Gwinnett	805,321	27,301
Heard	11,834	16,706
Paulding	142,324	23,022
Troup	67,044	19,314
Alabama		
Chambers	34,215	16,626
Randolph	22,913	19,844
Total Population	4,473,625	

Source: U.S. Census Bureau, 2010

Table 4-18. Manufacturing Activity

County	No. of Manufacturing Establishments	Total Manufacturing Employees	Total Earnings ($1,000)	Value Added by Manufactures ($1,000)
Georgia				
Cherokee	167	4,846	$ 199,411	$ 267,277
Dawson	21	687	39,212	55,509
Forsyth	169	8,087	464,419	815,225
Habersham	67	4,069	161,637	270,093
Hall	240	16,637	870,389	1,777,531
Lumpkin	16	1,164	47,672	49,712
Union	(NA)	305	10,663	(NA)
White	31	900	37,253	58,134
Carroll	123	7,616	518,749	738,564
Cobb	597	23,067	1,719,686	3,057,777
Coweta	84	4,609	234,481	530,239
Dekalb	588	20,181	1,480,731	4,006,557
Douglas	112	3,650	163,711	302,349
Fulton	794	35,448	3,388,450	6,126,659
Gwinnett	762	27,045	1,986,058	2,350,716
Heard	(NA)	(D)	(D)	(NA)
Paulding	48	1,186	50,778	93,799
Troup	100	7,315	392,048	899,387
Alabama				
Chambers	37	4,033	$ 171,665	$ 334,859
Randolph	25	1,751	65,961	74,644
Totals	3,981	172,596	$ 12,002,974	$ 21,809,031

(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 ACF Basin 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 over 50 percent of the total employment in the Buford region. Manufacturing accounts for over 20 percent of the employment in Habersham, Banks, and Troup Counties. Table 4-19 provides a breakdown of employment in percentages by general occupations for the Buford region counties.

Table 4-19. Employment

	Percent distribution by occupation					Percent in selected industries		
	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	Percent government workers (local state, or Federal)
Georgia								
Cherokee	39.2	14.8	28.5	9.4	8.2	0.5	9.9	3.1
Dawson	29.7	16.4	29.4	11.2	13.4	1.3	11.7	3
Forsyth	45.5	13.4	27.7	6.4	7.1	0.4	10.6	2.4
Habersham	27.4	16.1	26.3	10.9	19.3	3.2	19.1	6.6
Hall	29.5	16.2	22.2	12	20	1.7	20	3.3
Lumpkin	29.9	16.8	30.8	9.9	12.6	0.7	11.1	2.6
Banks	25.4	13.3	22.5	17.4	21.4	6.5	21.8	2.3
White	31.3	16.2	26.9	11.7	13.9	1.1	12.9	7.6
Carroll	29.6	15.9	24	11.3	19.2	0.8	15.5	3.8
Cobb	44	14.3	26.6	7.3	7.8	0.3	8.2	3.4
Coweta	32.5	15.1	25.9	11.5	15.1	0.7	15	5.2
De Kalb	42.4	16.1	24.8	6.9	9.8	0.2	6.4	6.1
Douglas	32.3	13.4	29.3	10.1	14.8	0.2	10.2	5.3
Fulton	48	15.2	24.6	4.8	7.4	0.3	6.3	3.6
Gwinnett	37.7	15.1	27.2	10.1	9.9	0.2	9.2	3.2
Heard	21.7	16.9	23.2	15.3	22.8	1.3	19.5	11.5
Paulding	33.3	15.3	27	12.3	12.2	0.3	10.1	5.1
Troup	28.2	17.6	24	8.8	21.4	0.6	22.8	4.2
Alabama								
Chambers	24.2	14.3	27.6	12.3	21.6	1	22	3.6
Randolph	25.1	14.5	21	12.2	27.1	4.3	24.9	5.8

U.S. Census Bureau, 2012 American Community Survey

e. Flood Damages. Two of the Federal projects in the ACF Basin, Buford Dam and West Point Dam, provide flood damage protection for existing development in the Chattahoochee River floodplain. The floodplain below Buford Dam consists of 5,108 residential structures, 16 public structures, and 218 commercial structures totaling almost $1.9 billion in value. The tax assessor appraised values of residential structures and contents total more than $1.5 billion, public structures more than $56 million, and commercial structures $352 million. The values for each category of structures in the Chattahoochee River floodplain below Buford Dam are shown in Table 4-20 (USACE 1998 data).

Table 4-20. Buford Dam Floodplain Value Data

Category	Structure Value	Contents Value	Inventory Value	Equipment Value	Totals
Residential	$ 1,048,486,000	$ 466,014,000	$ -	$ -	$ 1,514,500,000
Public	30,642,000	-	19,723,000	5,653,000	56,018,000
Commercial	109,238,000	-	34,000,000	208,647,000	351,885,000
Totals	$ 1,188,366,000	$ 466,014,000	$ 53,723,000	$ 214,300,000	$ 1,922,403,000

The Mobile District has developed an Annual Flood Risk Management Summary that estimates the flood damages prevented by Buford Dam. Table 4-21 shows the Buford Dam flood damages prevented by year from 1989 through 2015.

Table 4-21. Flood Damages Prevented by Buford Dam

Year	Flood Damages Prevented*
1989	$0
1990	$20,919,000
1991	$0
1992	$196,318
1993	$12,500
1994	$248,539
1995	$675,200
1996	$11,289,730
1997	$137,415
1998	$6,101,224
1999	$0
2000	$0
2001	$0
2002	$0
2003	$5,671,734
2004	$228,571
2005	$0
2006	$0
2007	$0
2008	$0
2009	$128,188,756
2010	$1,107,000
2011	$238,346
2012	$0
2013	$774,500
2014	$2,434,800
2015	$1,443,600

Note: Years with zero values are for drought or non-flood years in the ACF Basin.

*Dollar values are indexed to each FY using Consumer Price Index

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 partners for the majority of basin data collection and maintenance to the 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. Those stations continuously collect various types of data including stage, flow, and precipitation. The data are stored at the gage and 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 further in Chapter VI related to hydrologic forecasting.

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

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. Also, the pool elevation at Lake Sidney Lanier is displayed in real time on a digital sign located along the roadway that crosses the top of the dam for easy monitoring by the public.

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.

Plate 5-1 shows the locations of rainfall and stream gage stations used to monitor conditions in the ACF Basin. Tables 5-1 and 5-2 list the stations along with pertinent information.

Table 5-1. Rainfall Only Reporting Network, Buford

Station	Agency Station ID	Latitude	Longitude	Elevation (ft NGVD29)
Blairsville Exp. Sta	90969	34° 51'	83° 56'	1,917
Cleveland, GA	92006	34° 35'	83° 46'	1,590
Cornelia, GA	92283	34° 31'	83° 31'	1,470
Helen, GA	94230	34° 42'	83° 43'	1,440
Cumming 2N, GA	92408	34° 11'	84° 10'	1,295
Dahlonega 1W, GA	92475	34° 31'	84° 00'	1,260
Gainesville, GA	93621	34° 18'	83° 51'	1,170
Buford Dam, GA	CMMG1	34° 16'	84° 07'	1,150

Table 5-2. River-Stage and Rainfall Reporting Network, Buford

Stream	Station	Station number	River miles above mouth	Drainage area (sq. mi.)	Gage zero (ft. NGVD29)	Flood stage (ft.)	Operating agency	Rain gage
Above Buford Dam								
Chattahoochee River	Helen	2330450	421.58	44.7	1404.04	6	USGS	Y
Chattahoochee River	Leaf	2331000	405.64	150	1219.47		USGS	Y
Soque River	Clarkesville	23312495	402.5	93.9	1300	12	USGS	Y
Chattahoochee River	Cornelia	2331600	401.43	315	1128.53	14	USGS	Y
Chestatee River	Dahlonega	2333500	29.2	153	1128.6	19	USGS	Y
Chattahoochee River	Lake Sidney Lanier	02334400	348.3	1,034	0		USGS	Y
Buford Dam to Columbus								
Chattahoochee River	Buford tailwater	2334401	347.9	1,034	0		USGS	N
Chattahoochee River	Buford	2334430	348.1	1,040	912.04	12	USGS	N
Chattahoochee River	Norcross	2335000	330.77	1,170	878.14	12	USGS	Y
Chattahoochee River	Roswell	2335450	320.6	1,220	858.6	9	USGS	N
Big Creek	Roswell	2335757	2.11	103	940	10	USGS	N
Chattahoochee River	Morgan Falls	2335810	312.62	1,370	-12.52		USGS	Y
Chattahoochee River	Morgan Falls TW	2335815	312.62	1,370	-12.52	821	USGS	N
Chattahoochee River	Atlanta (Vinings)	2336000	302.97	1,450	750.1	14	USGS	N
Peachtree Creek	Atlanta	2336300	4	86.8	763.96	17	USGS	Y
Chattahoochee River	GA 280	2336490	298.77	1,590	736.35	24	USGS	N
Sweetwater Creek	Austell	2337000	5.5	246	857.01	10	USGS	Y
Chattahoochee River	Fairburn	2337170	281.79	2,060	718.3	20	USGS	Y
Chattahoochee River	Columbus, 14th St.	2341460	160.64	4,630	224	27	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. A 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 GOES System operated by the National Oceanic and Atmospheric Administration (NOAA). The GOES Satellite's Data Collection System 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 System (LRGS) that collects the data collection platform-transmitted, real-time data from the DOMSAT. Figure 5-3 depicts a typical schematic of how the system operates.

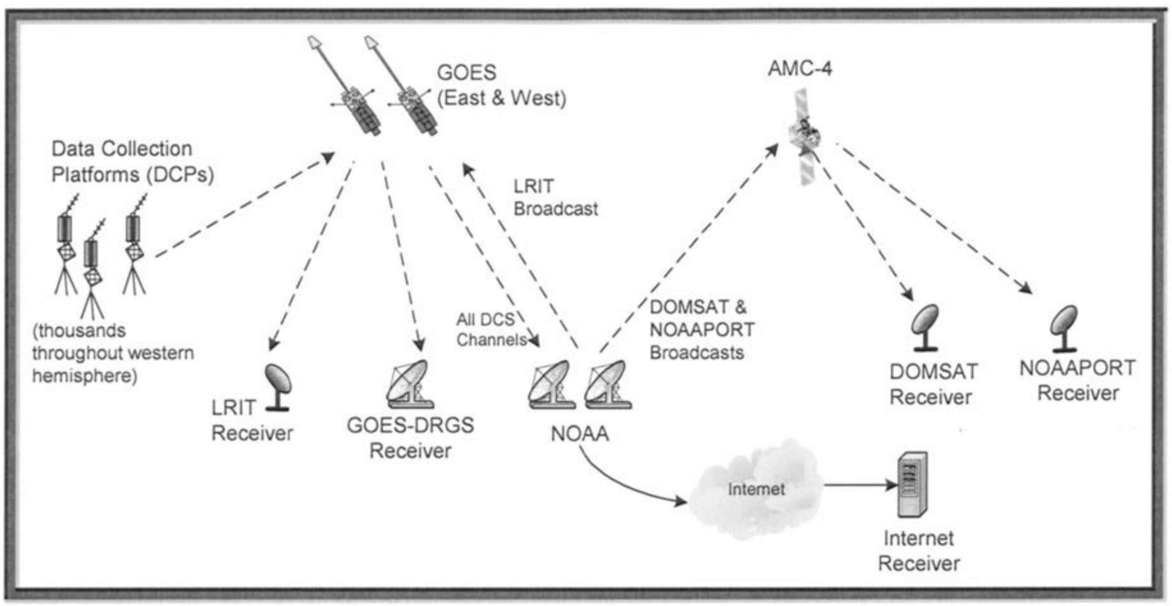


Figure 5-3. Typical Configuration of GOES System

Typically, reporting stations log 15-minute data that are transmitted hourly. 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 are 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, USGS, and 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 in the ACF Basin. In addition, real-time water quality parameters are collected at some stream gage locations maintained by the USGS.

The Corps operated a water quality monitoring station on the Chattahoochee River below Buford Dam from 1981 to 2008. The water quality parameters monitored were dissolved oxygen, temperature, pH, and conductivity. The water quality data collected is maintained in the Mobile District, Planning Division, Inland Environment (PD-EI) Office. GAEPD installed two water quality monitors in 2014, one immediately below Buford Dam and one at the Buford Trout Hatchery. The monitors are maintained by GAEPD on a regular basis.

5-03. Sediment Stations. In order to provide an adequate surveillance of sedimentation, a network of sediment ranges were established for Lake Sydney Lanier in 1956. 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 1981-1983, 1989-1990, and in 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 Lake Sydney Lanier”.

Overall, Lake Sidney Lanier has consistently undergone light to no sedimentation in the main body of the Lake. Locations undergoing the greatest sedimentation are along the main stem of the Chattahoochee River, and at the heads of bays including Two Mile Creek, Balus Creek, and Wahoo Creek. In general, the shorelines on the main lake body or on the embayment mouths adjacent to the main lake body are the most strongly impacted by erosion. The proposed reason is that the mouths are the historic transition from the tributary valley to the valley of the Chattahoochee River. The valley wall topography is of higher relief and is steeper for the larger Chattahoochee compared to that of the smaller tributaries. The now submerged steeper topography near and along the Chattahoochee Valley are more susceptible to severe erosion than are the less steep and lower relief tributary valleys.

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 data collection platform data from gages throughout the ACF Basin. The DRS equipment and software then receives the DOMSAT data stream, decodes the data collection platforms 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.

For the purpose of maintaining an accurate record at the project, the water supply contract holder will furnish records of all water withdrawals from the project daily. The records will include total daily withdrawals metered at the intake location. For the purpose of managing water supply storage, the Mobile District has employed a storage accounting methodology that tracks multiple storage accounts, applying a proportion of inflows and losses, as well as direct withdrawals by specific users, to each account. The necessary data to determine water supply storage availability is received daily with computations performed weekly during normal conditions, and daily under extreme drought conditions.

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 Mobile District Office (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 SAD office in Atlanta, Georgia.

The power plant at Buford Dam is operated remotely from the control room at Carters Dam. The primary communication network of the Buford Project is a SCADA system network. The SCADA network is owned and operated by USACE and includes a microwave link between Buford, Carters Dam, and Allatoona Dam (both in the Alabama-Coosa-Tallapoosa [ACT] System). The SCADA network also monitors powerhouse conditions and digitally records real-time project data hourly. The remote system provides a live video feed displaying the upper and lower pools of the Buford Project. That allows the operator at Carters to observe real-time water elevation measured by the staff gage. Computer servers at Carters Dam are connected to the Mobile District through the Corps network, permitting data transfer at any time. The data provided is critical to system operations and includes 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
Carters Powerhouse*	706-334-2906
Lake Sidney Lanier/Buford Powerhouse	770-945-9531 or 770-780-6224 (non-duty hours)

*Buford Dam is operated remotely from Carters Dam

5-06. Communication with Project

a. <u>Regulating Office with Project Office</u>. The Water Management Section is the regulating office for the Corps projects in the ACF Basin. Communication between the Mobile District and project offices is normally through daily hydropower generation schedules issued by 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 it can change if deemed appropriate. If loss of network communications occurs, orders can be given via telephone.

During critical reservoir regulation periods and to assure timely response, significant coordination is often conducted by telephone between the project office and the Mobile District. 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. <u>Between Project Office and Others</u>. 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 Water Management Section 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 sluicing. Scheduled sluice outages should be coordinated with Mobile District prior to actual outage. In the event of an unscheduled sluice outage, the Mobile District should be notified as soon as possible, with an estimated return to service time, if available.

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 Buford 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 authorities. 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 South Atlantic Division (SAD) Water Management staff as soon as possible.

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

The Corps also maintains an audio warning system consisting of a series of four horn stations with two horns each, one facing upstream and one facing downstream. The horns are immediately downstream of Buford Dam extending approximately 2.4 miles downstream. Immediately before beginning hydropower operations, the horns sound to alert downstream recreational users of rapidly increasing flows and rising water elevations. The horns blast sequentially from upstream to downstream on 15-second intervals, followed by initiation of hydropower generation.

Daily water release schedules can be obtained by calling (770) 945-1466 or, if in the vicinity of Buford Dam by tuning the radio to 1610 AM.

The Corps has also evaluated travel times for the releases from Buford Dam to inform the public on when the water will begin to rise at key locations downstream after a Buford Dam hydropower release has been made. Table 5-3 shows the travel times of hydropower release at Buford Dam to these locations. This, along with the daily hydropower schedule, will allow the public to be prepared for the rapid changes in river levels that occur as a result of peaking hydropower releases from Buford Dam.

Table 5-3. Travel Times for Releases from Buford Dam

Location on the Chattahoochee River	River Mile	River Miles from Buford Dam	Water Travel Time From Dam (hh:mm)
Below Buford Dam - USGS Gage #02334430	348.1	0.2	Less Than 0:15
Hwy 20 Bridge	345.8	2.5	0:30 - 1:00
Settles Bridge	343.6	4.7	0:45 - 1:30
McGinnis Ferry Road - USGS gage #02334653	339.8	8.5	1:45 - 2:00
Rogers Bridge	336.9	11.4	2:30 - 3:15
Abbotts Bridge	335.3	13.0	3:15 - 4:30
Medlock Bridge/Norcross - USGS Gage #02335000	330.8	17.5	3:30 - 4:45
Jones Bridge	328.7	19.6	3:45 - 6:00
Garrard Landing/Holcomb Bridge Road	325.4	22.9	5:15 - 7:30
Island Ford/Roswell - USGS Gage #02335450	320.6	27.7	6:30 - 8:45
SR 400 Bridge near Roswell, GA	318.4	29.9	8:00 - 11:45

5-09. Role of Regulating Office. The Mobile District 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 Mobile District. In addition, the Mobile District maintains information on current and anticipated conditions, precipitation, and river-stage data to provide the background necessary for best overall operation. The Mobile District 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 Buford Project. 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
"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 $\boldsymbol{i}$ 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. Per USACE water management policy, releases are based on observed conditions and not on forecasts. However, 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 Corps. The Mobile District maintains real-time observation of river and weather conditions data across its civil works boundary, including the ACF Basin, and 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 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 that to meet the regulation objectives of the ACF projects. The Mobile District prepares five-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 publicly disseminating 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 proactive management of basin release determinations. Using 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. 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, SERFC provides a revised regional QPF on the basis of local expertise beyond the NWS Hydrologic Prediction Center QPF. 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 adjusts 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.

The USGS office in Norcross, Georgia is responsible for the maintenance of the gages located in the Buford Project area. In the event that a gage becomes inoperable, the Corps will inform the USGS office 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 reviewing "what if" scenarios.

b. Methods. In determining the expected inflow into Lake Sidney Lanier, it is necessary to forecast the flows above Buford Dam. Runoff or rainfall excess for the area is estimated using the seasonal correlation values shown in Table 6-1, 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. 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.

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.

Table 6-1. Rainfall and Runoff

Antecedent conditions	Rainfall (inches) Storm Total	Average basin rainfall (inches)									
		0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90
		Average runoff (inches)									
Wet	0	0.00	0.02	0.02	0.04	0.05	0.07	0.08	0.10	0.12	0.12
	1	0.14	0.16	0.19	0.21	0.24	0.26	0.30	0.33	0.36	0.41
	2	0.45	0.50	0.54	0.60	0.64	0.70	0.75	0.80	0.86	0.92
	3	0.98	1.04	1.10	1.16	1.22	1.29	1.35	1.42	1.48	1.55
	4	1.62	1.69	1.76	1.82	1.90	1.96	2.04	2.10	2.17	2.24
	5	2.31	2.38	2.44	2.52	2.58	2.66	2.72	2.80	2.86	2.94
	6	3.00									
Normal	0	0.00	0.00	0.02	0.03	0.04	0.04	0.06	0.06	0.08	0.08
	1	0.10	0.10	0.12	0.13	0.14	0.15	0.16	0.18	0.19	0.20
	2	0.22	0.23	0.24	0.26	0.28	0.30	0.31	0.33	0.34	0.36
	3	0.38	0.40	0.42	0.44	0.46	0.48	0.50	0.52	0.54	0.56
	4	0.58	0.60	0.62	0.65	0.68	0.70	0.72	0.74	0.76	0.78
	5	0.82	0.84	0.87	0.90	0.92	0.96	0.98	1.02	1.04	1.08
	6	1.10									
Dry	0	0.00	0.00	0.02	0.02	0.03	0.04	0.04	0.05	0.06	0.06
	1	0.07	0.08	0.09	0.10	0.11	0.12	0.14	0.14	0.16	0.16
	2	0.18	0.20	0.21	0.22	0.24	0.25	0.26	0.28	0.30	0.31
	3	0.32	0.34	0.36	0.38	0.38	0.40	0.42	0.44	0.46	0.48
	4	0.50	0.52	0.53	0.55	0.58	0.59	0.61	0.63	0.66	0.68
	5	0.70	0.72	0.75	0.78	0.80	0.83	0.86	0.88	0.92	0.94
	6	0.97									
Note: At full summer pool (1,071 ft NGVD29, one inch of runoff will produce a lake rise of 1.43 ft.											

Table 6-2. Unit Hydrograph of Reservoir Inflow at Buford Dam

Time (hours)	6-hour unit hydrograph (cfs)	24-hour unit hydrograph (cfs)
0	0	0
6	28,400	
12	23,900	
18	16,900	
24	10,900	20,000
30	7,000	
36	4,700	
42	3,600	
48	3,100	4,600
54	2,700	
60	2,400	
66	2,000	
72	1,700	2,150
78	1,400	
84	1,100	
90	900	
96	700	1,020
102	500	
108	300	
114	0	
120		200
126		
132		
138		
144		0

Table 6-3. Unit Hydrographs for Chattahoochee River at Norcross and Atlanta Excluding Releases from Buford

	Norcross (USGS #02335000)		Atlanta (USGS #02336000)	
Time (hours)	6-hour unit hydrograph (cfs)	24-hour unit hydrograph (cfs)	6-hour unit hydrograph (cfs)	24-hour unit hydrograph (cfs)
0	0	0	0	0
6	2,860		3,570	
12	3,630		6,550	
18	2,970		6,800	
24	1,870	2,830	6,600	5,880
30	1,320		5,540	
36	880		4,090	
42	660		2,890	
48	550	850	2,260	3,700
54	220		1,850	
60	100		1,540	
66	0		1,120	
72		80	670	12,190
78			370	
84			140	
90			110	
96		0	0	150
102				
108				
114				
120				0

c. Downstream Forecasts. Discharge hydrographs of the Chattahoochee River at Norcross (USGS gage #02335000) and Atlanta (USGS gage #02336000), assuming no release from Buford Dam, are determined by applying the unit hydrographs for the drainage area below the dam to the estimated rainfall excess for that area and adding the baseflow. The unit hydrograph for inflows into Lake Sidney Lanier is shown in Table 6-2. The unit hydrographs adopted for the drainage area between the dam and the Norcross gage and between the dam and Atlanta, Georgia, are shown in Table 6-3. Rating curves for downstream locations (Buford (USGS gage #02334430), Norcross (USGS gage #02335000), Roswell (USGS gage #02335450), and Atlanta (USGS gage #02336000)) are shown on Plates 4-3 through 4-6.

6-03. Conservation Purpose Forecasts. Forecasts for conservation operations are accomplished similarly to flood condition forecasts.

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. Conservation requirements are the same as for flood conditions with the additional emphasis to ensure the minimum flow requirements downstream are supported by the project.

b. Methods. The Mobile District prepares five-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 September 15, 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 Lake Sidney Lanier to meet the demands placed on its storage, the probability that Lake Sidney Lanier 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 Lake Sidney Lanier varies seasonally from elevation 1,070 to 1,071 feet NGVD29. The bottom of conservation pool remains at elevation 1,035 feet NGVD29 for the entire year. Reservoir storage between elevations 1,071 and 1,035 feet NGVD29 is 1,074,645 acre-feet. Between 1,070 and 1,035 feet NGVD29, the storage is 1,036,532 acre-feet. Compared to the observed river flow at the dam from 1957 – 2013 of 1,914 cfs, this storage is equal to 78 and 76 percent respectively, of the average annual inflow. 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, the storage might be needed to manage water resources for multiple years. The critical period for Lake Sidney Lanier can be as long as 5 to 10 years for large yields (withdrawals) before normal operations are resumed. Figure 6-1 presents a graph of annual rainfall in the basin from 1939 - 2009. The actual rainfall, average, and running averages for multiple 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 at Gainesville, Georgia, along with the annual flow at Buford Dam for the same period. The average flow is also presented to demonstrate the drought periods. Figure 6-3 presents the Buford 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.

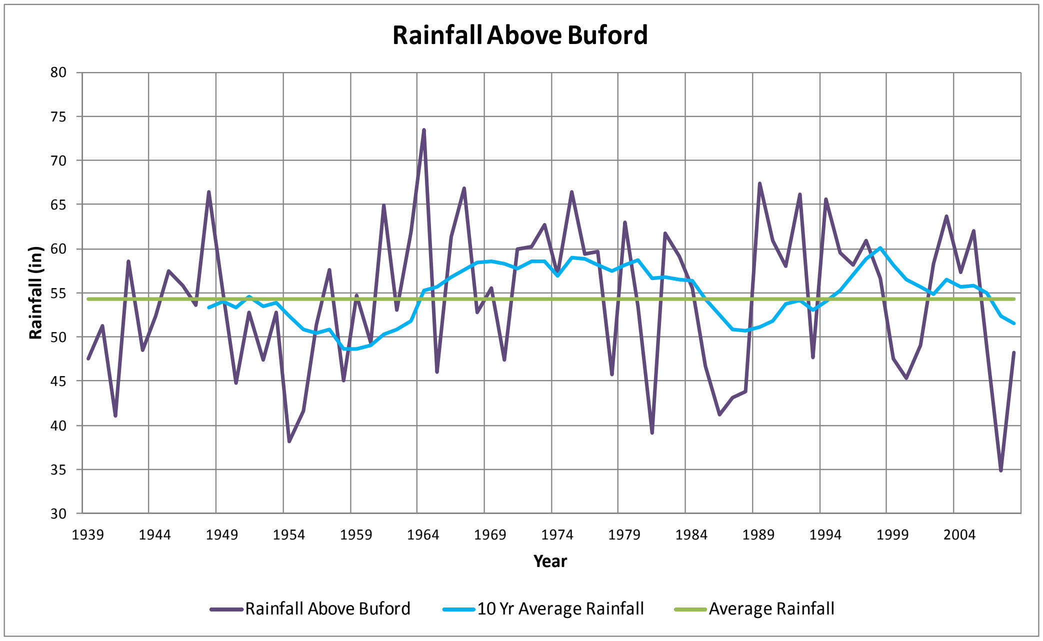
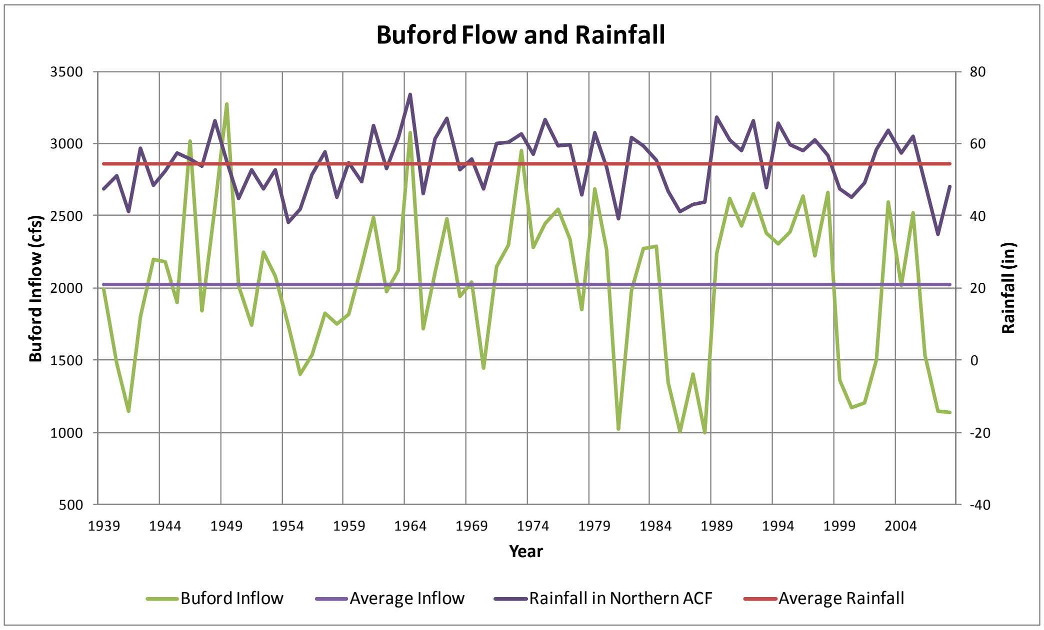


Figure 6-1. Average Rainfall above Buford, 1939 - 2009



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

Figure 6-2. Buford Dam Flow and Rainfall

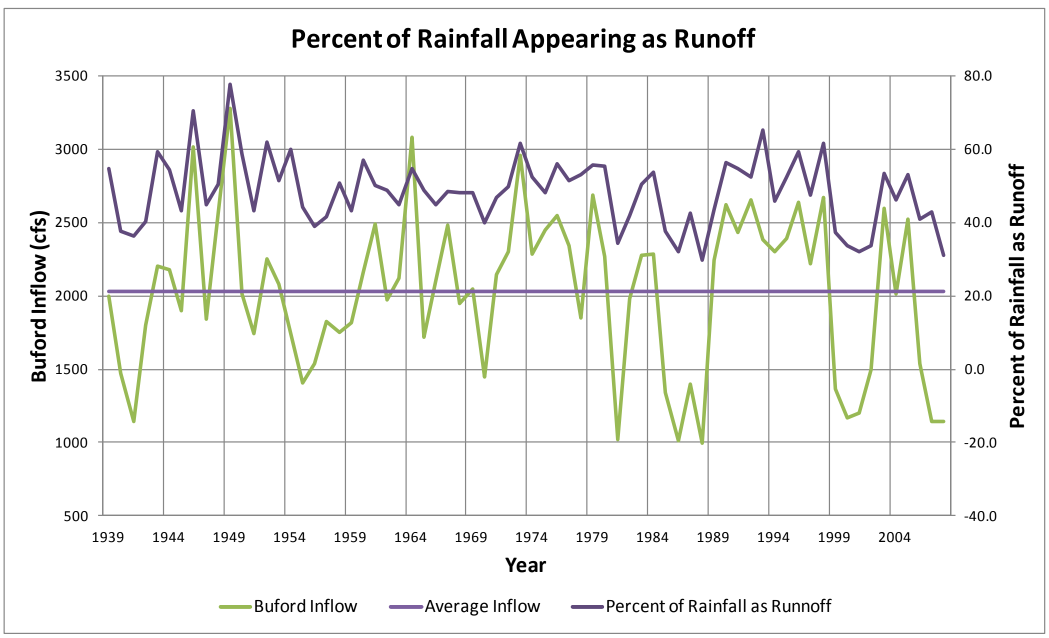


Figure 6-3. Percent of Rainfall appearing as Runoff

d. <u>Reference Documents</u>. The drought contingency plan for the Buford Project is summarized in Section 7-12 below. The complete ACF Drought Contingency Plan is provided in Exhibit E.

VII - WATER CONTROL PLAN

7-01. General Objectives. The congressionally authorized purposes for Buford Dam and Lake Sidney Lanier are flood risk management, hydroelectric power, navigation, recreation, water quality, water supply, and fish and wildlife conservation. The regulation plan seeks to meet project purposes in a balanced manner at the Buford Project and at other projects in the ACF Basin and is intended for use in day-to-day, real-time water management decision making and for training new personnel.

The Buford Project authorizing legislation (Rivers and Harbors Act of 24 July 1946) did not specify allocations or priorities within conservation storage, and left it to the discretion of the Corps how to operate conservation storage to fulfill the authorized purposes of the Buford Project. Conservation purposes are not fundamentally in competition. Mobile District seeks to attain balanced operations to achieve all authorized purposes and take into account other considerations to the extent possible.

7-02. Constraints. Physical constraints of the project are generally limited to available powerhouse capacity, sluice capacity, and downstream channel capacity. As the project approaches the bottom of conservation pool, the powerhouse turbines can no longer effectively run and discharge will be limited to sluice operation. Also, channel capacity limitations downstream constrains peaking operations from both peaking units to four hours followed by a two hour period of only one peaking unit. Then the 4-hour/2-hour operation can be repeated. Before generation can commence, a series of four horn stations must sound to alert downstream recreational users of rapidly increasing flows and rising water levels. The horns blast sequentially from upstream to downstream on 15-second intervals, followed by initiation of hydropower generation.

7-03. Overall Plan for Water Control

a. General Regulation. The water control operations of the Buford Project are in accordance with the regulation schedule as outlined in the following paragraphs. The Corps operates the Buford Dam and Lake Sidney Lanier to provide for the authorized 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 D, Instructions to the Damtenders for Water Control.

b. Conservation Pool. The Lake Sidney Lanier conservation storage pool was designed to provide the necessary capacity to store water for subsequent use to meet the multiple conservation purposes for which the project was constructed. The top of conservation pool elevation is the reservoir's normal maximum operating level for conservation storage purposes. If the elevation is higher than the conservation limit, the reservoir level is in the flood pool. The conservation pool is regulated between a minimum elevation of 1,035 feet NGVD29 and a seasonal variable top-of-conservation pool ranging between elevations 1,070 to 1,071 feet NGVD29. The top-of-conservation pool guide curve and minimum conservation pool are shown on Figure 7-1 and Plate 7-1 along with other operating action zones. The flood risk management plan drawdown to elevation 1,070 feet NGVD29 in advance of flood season provides 640,264 acre-feet (elevation 1,070 to 1,085 feet NGVD29) of flood risk management storage.

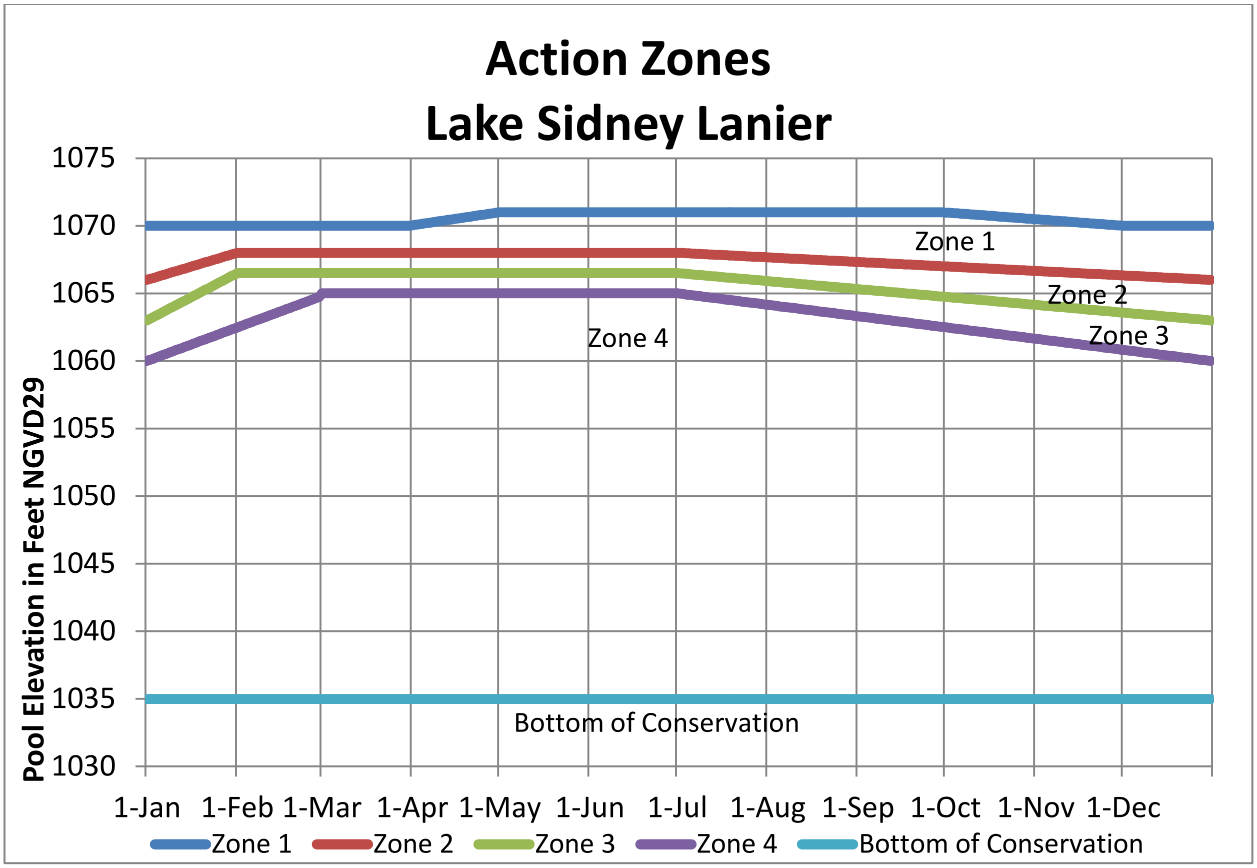


Figure 7-1. Action Zones for Lake Sidney Lanier

c. Guide Curves and Action Zones. Multiple project purposes and water demands in the basin require that the Corps regulate the use of conservation storage in a balanced manner in an attempt to meet all authorized purposes, while continuously monitoring the climatological conditions to ensure that project purposes can at least be minimally satisfied during critical drought periods. The balanced water management strategy for Buford does not prioritize any project function but seeks to balance all project authorized purposes. However, during a flood event, flood risk management does clearly govern the operation of the Buford Project. A seasonal conservation pool regulation guide curve and conservation storage action zones have been developed to guide the water control management decisions in meeting the balanced strategy. Table 7-1 provides key elevations of the top of conservation pool and action zones. Area-capacity curves for Lake Sidney Lanier, which indicate the amount of storage and the surface area of the lake for the complete range of possible pool elevations, are shown on Plate 2-5. 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. Top of Conservation and Action Zone Elevations, Lake Sidney Lanier

Date	Elevation (feet NGVD29)			
	Top of Zone 1	Top of Zone 2	Top of Zone 3	Top of Zone 4
1 Jan	1070.00	1066.00	1063.00	1060.00
1 Feb	1070.00	1068.00	1066.50	1062.48
1 Mar	1070.00	1068.00	1066.50	1065.00
1 Apr	1070.00	1068.00	1066.50	1065.00
1 May	1071.00	1068.00	1066.50	1065.00
1 Jul	1071.00	1068.00	1066.50	1065.00
1 Oct	1071.00	1066.99	1064.74	1062.49
1 Dec	1070.00	1066.33	1063.57	1060.82
31 Dec	1070.00	1066.00	1063.00	1060.00

Action zones are used to manage the lake at the highest level possible within the conservation storage while balancing the needs of all authorized purposes with water conservation as a national priority used as a guideline. The action zones within Lake Sidney Lanier provide water control regulation guidance to meet this water conservation plan while balancing the use of available conservation storage to meet the project purposes. Zone 1, the highest level, 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 fully be met. The action zones also provide guidance on meeting minimum hydroelectric power needs at each project. Table 7-2 below shows the typical hydropower by action zone that can be expected at Buford Dam.

Table 7-2. Typical Hours of Peaking Hydroelectric Power Generation at Buford Dam

Action zone	Buford hours of operation for normal operations / drought operations
Zone 1	3 / 2
Zone 2	2 / 1
Zone 3	2 / 1
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 include exceptional flood risk management measures, fish spawn operations, approved deviations, 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.

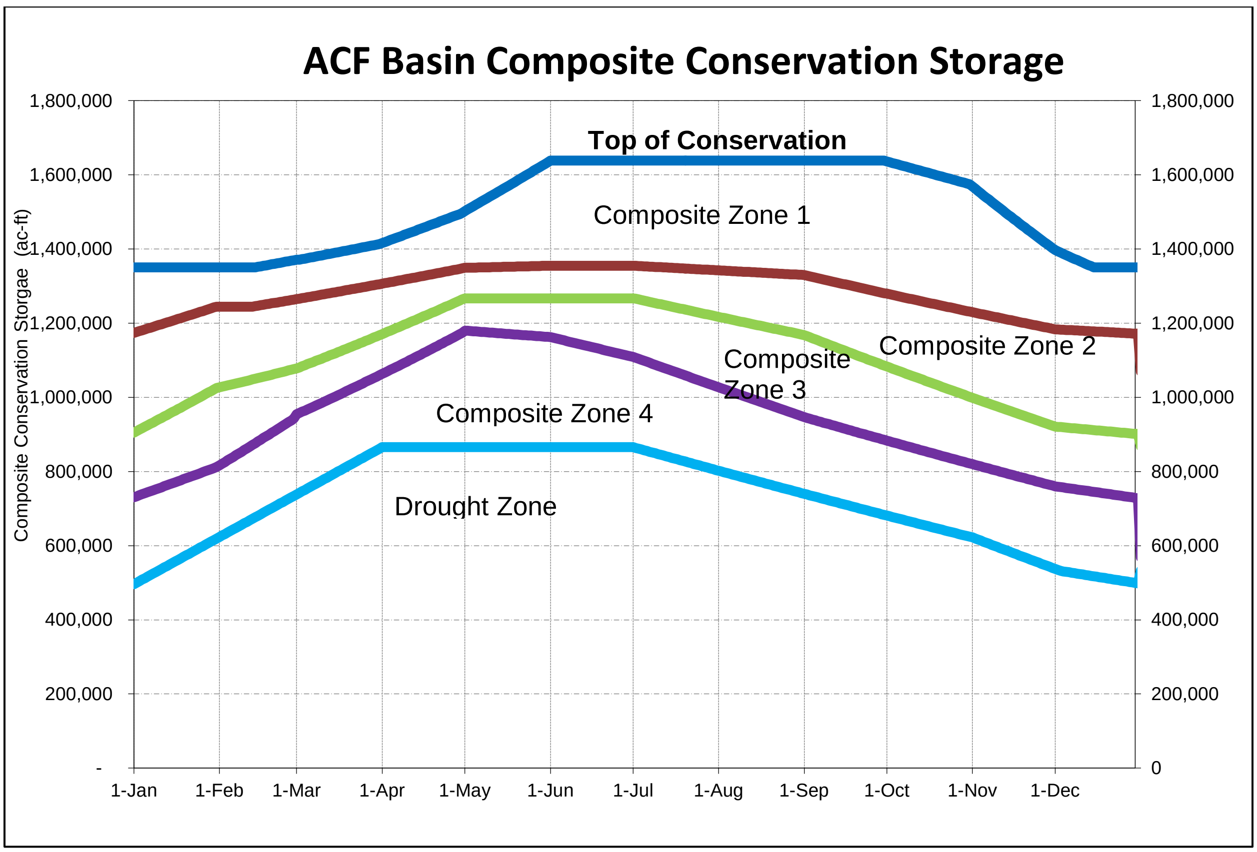


Figure 7-2. ACF Basin Composite Conservation Storage

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 Buford Project in accordance with the daily hydropower schedule. Any deviation from the schedule must come through the Mobile District. Normally, flood control instructions are issued by the Water Management Section. 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 D - Standing Instructions to the Damtender for Water Control.

7-05. Flood Risk Management. Operation of the Buford Dam Project for flood risk management is in accordance with instructions issued by the Mobile District, and releases depend on downstream conditions, the pool elevation, expected near-future weather conditions, and inflows.

The flood risk management plan provides for the reservoir to be drawn down in the fall from elevation 1,071 to 1,070 feet NGVD29 and remain at elevation 1,070 feet NGVD29 during the critical flood season from December through mid-April, subject to temporary variations resulting from floods. During the last half of April, the reservoir will be allowed to fill to elevation 1,071 feet NGVD29 for the summer and, if possible, stay at that level until the end of September. The available storage between elevations 1,070 and 1,071 feet NGVD29 is 38,200 acre-feet.

The Mobile District constantly monitors climatic conditions and if, in the opinion of the section, threatening weather appears to be approaching the Buford Dam Project or downstream areas that would be affected by releases from Buford Dam, releases will be reduced or discontinued, except for the small 7 MW service unit. The service unit discharge is maintained to protect the integrity of the stream immediately below the dam and has negligible impacts on downstream flood risk management. Any reduction of discharge from the small 7 MW service unit would be considered on a case-by-case basis by evaluation of the conditions at flood risk management locations downstream as well as the conditions immediately below Buford Dam. Coordination and notification of this reduction should include the National Park Service and Georgia Department of Natural Resources, both of who operate facilities downstream of the dam. Because Buford discharges take 15 to 18 hours to reach the Atlanta (Vinings) gage near the major flood damage center, the Buford releases need to be timed to minimize the flood stages by reducing releases so as not to compound flooding caused by runoff from the area downstream of Buford Dam. Weather is closely monitored so that releases from Buford can be curtailed before the storm occurs. The NWS develops forecasts, and the Mobile District develops predictions accordingly and uses them in timing the actions taken at Buford. If a forecast of rainfall indicates possible flooding, the Corps will closely monitor the Norcross (USGS # 02335000), Roswell (USGS #02335450), and Vinings gages (USGS #02336000). In the event that forecasted rainfall along with anticipated releases from Buford Dam will cause any of these three gages to rise above action stage, releases from Buford Dam are discontinued with the exception of the small 7 MW service unit. Consideration is given to water travel time to these locations when determining the proper timing of discontinuing releases based on the forecast. In the event that unexpected precipitation causes any of these gages to rise above action stage, releases from Buford Dam are discontinued immediately. When flooding has peaked and fallen below action stage in the Norcross, Roswell, and Vinings area and the NWS forecast indicates favorable weather conditions, releases at Buford will resume as long as these releases are not expected to push river levels back above action stage at these locations. A typical operation during a storm is as follows: Once it is seen that the stage at Vinings is consistently falling, two units will be run for several hours at a time or one unit could be run continuously. Evacuating stored flood waters is a very critical period. During such periods, weather conditions are closely observed. Because of the condition of the river, usually flowing bank-full from the releases from Buford, another heavy period of rain could result in flooding. As stages from Buford to Vinings continue to fall and weather conditions continue to remain favorable, flood waters are released from storage through the turbines as quickly as practicable, not exceeding bank-full capacity (10,000 cfs), and increasing stages any of the three previously mentioned gage locations back above action stage. This evacuation would continue until normal operating levels are reached. Careful consideration should be given to the downstream channel capacity as long periods of continuous generation from the hydroelectric units have been known to cause minor flooding. These capacity restrictions as well as recommended operation during flood water evacuation are discussed in the SOP *Procedure for Limitation of Hydropower Peaking Operations during Flood Control Operations, September 2001*. Expected weather conditions, time of year, and downstream beneficial use of water will be considerations in evacuating the last two feet of flood storage.

In the original design for Buford Dam, it was determined that the Standard Project Flood could be contained in the allocated flood risk management pool. That is, the pool elevation would not exceed elevation 1,085 feet NGVD29. Later revisions in computing the Standard Project Flood indicate that the pool would peak at elevation 1,086.78 feet NGVD29, or 1.78 feet over the fixed spillway. If a flood near that magnitude or larger were to occur and the pool rises above the top of flood risk management pool, elevation 1,085 feet NGVD29, the power plant and the flood risk management sluice would begin operating at full capacity as soon as flow over the spillway becomes imminent. In designing the dam, reservoir operation for the spillway design flood series assumed the power plant to be inoperative with discharge over the spillway and through the sluice only. In actual operation, turbine discharge will supplement the spillway and sluice discharge. Any discharges that exceed channel capacity (such as a full-power capacity release) will cause downstream flooding, and efforts should be made to notify affected parties.

As the pool drops below elevation 1,085 feet NGVD29 and the inflows fall to an amount equivalent to downstream channel capacity, the combined releases through the sluice and turbines will be reduced to downstream channel capacity. The 1,416,000 acre-feet of storage between elevations 1,070 and 1,100 feet NGVD29, is essentially a substitute for spillway capacity and is required to control the spillway design flood series. That means that as greater amounts of flood waters are in storage above elevation 1,070 feet NGVD29, greater emphasis must be placed on rapidly evacuating such flood storage. Whenever the pool is above elevation 1,085 feet NGVD29, the limited discharge capacity of the project (sluice and turbines in addition to the small uncontrolled spillway) should be fully used.

Notification of Potential Discharge over the Emergency Spillway. The channel for the emergency spillway at Buford Dam goes through residential areas and therefore there is the potential for damages of property as a result of a release. In the event that it becomes possible that the lake will reach elevation 1,085 feet NGVD29 and begin discharging over the emergency spillway, Water Management staff should immediately notify the Operations Project Manager at the Buford Project Office. The Operations Project Manager will then notify the local emergency management offices of the situation. It is the responsibility of the local emergency management authorities (EMAs) to contact residents located near the spillway channel that could be affected by the discharge. The Water Management Section should then notify the Mobile District Chief of Engineering and Operations Divisions as well as the Hydraulics and Hydrology Branch Chief. The District Water Management staff should also notify the South Atlantic Division (SAD) Water Management staff as soon as possible. The Project Office as well as the Water Management Section are both responsible for keeping updated lists of EMA contacts in the event of an emergency spillway discharge. The names and numbers of local EMAs are also available in the Emergency Action Plan (EAP) for Buford Dam under Plan Element B.

Emergency Flood Risk Management Regulation. Normally, all flood risk management operations are directed by the Mobile District Office. If, however, a storm of flood-producing magnitude occurs and all communications are disrupted between the District Office and Buford Dam, emergency operating procedures, as described in this section, 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.

Emergency operations at Buford Dam are the responsibility of the Buford Power Plant Manager. It is his responsibility to obtain the gage readings at Norcross (USGS # 02335000), Roswell (USGS #02335450), and Atlanta (Vinings) (USGS #02336000) gages by whatever means possible before making any power releases other than that required for station service. If rainfall of 2 to 3 inches is predicted or has occurred in the Atlanta area as measured at Vinings and Norcross, discharge will be limited to 2 hours at full powerhouse capability (about 700 day-second-feet) per day. If the Vinings gage is 11 feet and rising, the Buford Power Plant Manager will discontinue all discharge except from the small 7 MW service unit until the gage indicates that the stage has peaked and is below 14 feet. With a falling Vinings gage between 11 and 14 feet, 2 hours of generation at powerhouse capability can be scheduled. After the stage has fallen to below 11 feet and is still falling with no rain anticipated, previous scheduled power generation can occur. At Norcross, flood-prone areas begin to become inundated at the action stage of 10.0 feet. At Roswell, flood-prone areas begin to become inundated as the river approaches the action stage of 8.0 feet.

If a flood-producing storm has reached or is approaching the Buford Project during the evacuation of floodwater of a previous storm and the pool elevation is above 1,085 feet NGVD29, releases will continue until the pool elevation is drawn down to 1,085 feet NGVD29, at which time, releases will be curtailed or stopped. Readings at Norcross and Vinings should be monitored as closely as possible. If it is impossible to obtain stages at either location, all outflow from the dam will be stopped as soon as practicable, except that needed for generation to supply station service, until the pool exceeds elevation 1,085 feet NGVD29, at which time, outflow from the dam will resume.

7-06. Recreation. Recreational activities are best served by maintaining a full conservation pool. Lake levels above top of conservation pool invade the camping and park sites. When the lake recedes several feet below the top of conservation pool access to the water and beaches becomes limited. Water management personnel are aware of recreational effects caused by reservoir fluctuations and attempt to maintain reasonable lake levels, especially during the peak recreational use periods, but there are no specific requirements relative to maintaining recreational levels. Other project functions usually determine releases from the dam and the resulting lake levels. To classify recreation effects associated with conservation storage usage at Lake Sidney Lanier, various impact levels have been identified. Those levels are briefly described below:

- Initial Impact Level 1,066.0 feet—This is the level at which effects on recreation begin. The most seriously impacted recreation facilities are swimming areas. Most other facilities are marginally affected.
- Recreation Impact Level 1,063.0 feet—This is the level at which major effects on concessionaires and recreation are observed. All beaches are unusable, and dock facilities have more serious problems.
- Water Access Limited Level 1,060.0 feet—This is the level at which nearly all boat ramps will be out of service, numerous navigation problems will exist, and many coves will be dry land.

The Water Control Plan takes these effects into account in developing action zones for Lake Sidney Lanier. In dry periods, the lake will often drop to or below the impact levels, and Mobile District employees will keep the Operations Project Manager informed of projected pool levels through the district's weekly water management meetings. The Operations Project Manager will be 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.

Many facilities, both public and private, have been developed around the lakeshore. Much of the development cannot function at the full range possible between elevations 1,070 feet NGVD29 and 1,035 feet NGVD29. Many of the boat ramps become unusable as the lake level recedes. Table 7-3 lists end of ramp elevations for all boat ramps. Some work to extend and improve boat ramps has occurred when pool levels have been lowered during droughts, but much more work remains both by the Corps and local interests to retain lake access during periods of extreme drawdown.

Table 7-3. Elevation Where Boat Ramps Become Unusable

Public ramps at park areas	Lowest ramp elevation end of concrete	Public ramps at park areas	Lowest ramp elevation end of concrete
Aqualand	1058.4	LUMPKIN COUNTY PARK	1060.3
Bald Ridge Campground	1054.6	MARY ALICE LEFT	1055.0
Bald Ridge Marina Left	1055.0	MARY ALICE MID LEFT	1057.0
Bald Ridge Marina Right	1064.6	MARY ALICE MID RIGHT	1057.0
Balus Creek Left	1052.8	Mary Alice Right	1057.0
Balus Creek Mid Left	1049.5	Mountain View	1058.6
Balus Creek Mid Right	1049.6	Nix Bridge	1061.0
Balus Creek Right	1049.7	Old Federal	1061.5
Belton Bridge	1064.1	Old Federal D/U (Single Lane)	1051.5
Bethel Left	1060.4	Old Federal D/U (3 Lane)	1059.2
Bethel Right	1060.4	River Forks	1062.3
Big Creek (East) Left	1057.4	Robinson Left	1060.7
Big Creek (East) Right	1050.7	Robinson Right	1060.7
Big Creek (West) Left	1058.9	Sardis Creek Left	1053.3
Big Creek (West) Right	1058.9	Sardis Creek Middle	1060.4
Bolding Mill	1055.9	Sardis Creek Right	1060.4
Burton Mill (Curbed)	1058.5	Sawnee	1058.5
Burton Mill (Uncurbed)	1060.5	Shady Grove	1059.8
Charleston Left	1050.7	Shoal Creek	1061.4
Charleston Middle	1046.2	SHOAL CREEK D/U (Left)	1056.0
Charleston Right	1045.8	SHOAL CREEK D/U (Right)	1050.1
Chestnut Ridge	1055.0	Simpson	1061.0
Clarks Bridge Left	1052.0	Six Mile Creek Left	1054.5
Clarks Bridge Middle	1052.0	Six Mile Creek Right	1054.7
Clarks Bridge Right	1055.0	Starboard	1055.0
Duckett Mill Day Use	1060.1	Sunrise	1055.0
East Bank Left	1055.0	Thompson Bridge	1055.0
East Bank Middle Left	1055.0	Thompson Creek Left	1056.5
East Bank Middle Right	1051.0	Thompson Creek Middle	1056.5
East Bank Right	1051.0	Thompson Creek Right	1056.5
Gainesville	1055.0	Tidwell Left	1055.2
Holly Park	1055.0	Tidwell Middle	1055.2
Keith's Bridge Left	1055.0	Tidwell Right	1048.2
Keith's Bridge Right	1057.1	Toto Creek Left	1058.0
Lake Lanier Islands Bridge	1055.0	Toto Creek Mid Left	1058.0
Lake Lanier Islands Cove	1060.0	Toto Creek Mid Right	1058.0
Lanier Park Left	1058.7	Toto Creek Right	1060.4
Lanier Park Middle	1058.7	Two Mile Creek	1058.6
Lanier Park Right	1058.7	Van Pugh North Left	1057.5
Lanier Point	1062.2	Van Pugh North Right	1051.3

Table 7-3 (Cont'd). Elevation Where Boat Ramps Become Unusable

Laurel Park 4-Lanes	1048.0	Van Pugh South	1060.7
Little Hall Left	1051.0	Vanns Tavern Left	1053.1
Little Hall Middle Left	1051.0	Vanns Tavern Middle	1057.1
Little Hall Middle Right	1055.0	Vanns Tavern Right	1057.1
Little Hall Right	1055.0	Wahoo Creek	1056.4
Little Ridge Left	1055.3	War Hill Left	1053.2
Little Ridge Right	1055.3	War Hill Mid Left	1057.5
Little River Left	1060.7	War Hill Mid Right	1057.5
Little River Right	1052.7	War Hill Right	1057.5
Long Hollow Left	1062.9	Young Deer Left	1058.0
Long Hollow Right	1060.0	Young Deer Middle	1058.0
Lula	1061.2	Young Deer Right	1055.0

Note: Facing lake; left to right

In addition to boat ramps, swimming areas can also be affected by conservation storage depletion during the recreation season. Swim areas are designated generally within the 1,064 contour, and there is little opportunity to extend swim areas as the lake levels drop. When the lake level drops to elevation 1,064 feet NGVD29, no water is left in the swim areas.

Lower lake levels reveal boating hazards that are unknown to the boaters. Some hazards are permanently marked, but as the lake falls, additional hazards are exposed.

Both private and commercial boat docks are affected by drawdowns. Because the conservation pool in Lake Sidney Lanier has historically not been fully used, many boat docks are in places that will be dry during major drawdowns. Floating docks are a standard for Lake Sidney Lanier, but many are in coves or inlets such that the facilities cannot be moved into deeper water as the lake level declines.

The Corps has also evaluated travel times for the releases from Buford Dam to inform the public on when the water will begin to rise at key locations downstream after a Buford Dam hydropower release has been made. Table 5-3 (repeated below for user convenience) shows the travel times of hydropower release at Buford Dam to these locations. This, along with the daily hydropower schedule, will allow the public to be prepared for the rapid changes in river levels that occur as a result of peaking hydropower releases from Buford Dam.

Table 5-3. Travel Times for Releases from Buford Dam

Location on the Chattahoochee River	River Mile	River Miles from Buford Dam	Water Travel Time From Dam (hh:mm)
Below Buford Dam - USGS Gage #02334430	348.1	0.2	Less Than 0:15
Hwy 20 Bridge	345.8	2.5	0:30 - 1:00
Settles Bridge	343.6	4.7	0:45 - 1:30
McGinnis Ferry Road - USGS gage #02334653	339.8	8.5	1:45 - 2:00
Rogers Bridge	336.9	11.4	2:30 - 3:15
Abbotts Bridge	335.3	13.0	3:15 - 4:30
Medlock Bridge/Norcross - USGS Gage #02335000	330.8	17.5	3:30 - 4:45
Jones Bridge	328.7	19.6	3:45 - 6:00
Garrard Landing/Holcomb Bridge Road	325.4	22.9	5:15 - 7:30
Island Ford/Roswell - USGS Gage #02335450	320.6	27.7	6:30 - 8:45
SR 400 Bridge near Roswell, GA	318.4	29.9	8:00 - 11:45

7-07. Water Quality. Selective withdrawal facilities (multi-level intake structures) for water quality were not included when Buford Dam was designed and constructed in the 1950s. However, the large turbines have been used for weekend water quality releases. After massive fish kills occurred at the Buford Trout Hatchery in 1976, the state requested and has obtained special weekend water releases. High iron and manganese concentrations from seasonal stratification and hypolimnetic discharge appear to cause the hatchery mortality. The low-flow water releases from the small turbine appeared more toxic than the high turbine releases because of the entrainment of water from the thermocline and the epilimnion during power generation. Paragraph 4-08(c) describes lake stratification, and Figure 4-5 shows the typical summer lake stratification in the Lake Sidney Lanier pool. The significance of the related effect on river aquatic organisms has not been well defined.

Also in 1976, the State of Georgia determined that a minimum flow of 750 cfs was required in the Chattahoochee River at Peachtree Creek for water quality purposes. In 1978 and 1979, extensive data collection of water quality and biological parameters was conducted in the reservoir and river. In 1979, the Corps agreed to provide sufficient releases from Lake Sidney Lanier that, when combined with intervening flows, would ensure that the required withdrawals could be made and also allowed for flows of 750 cfs to be maintained just upstream of the junction of the Peachtree Creek with the Chattahoochee River. In 1981, the Corps established an automatic device to measure the released water's dissolved oxygen, temperature, conductivity, pH, and turbidity or oxidation-reduction potential. The operation of these monitors was discontinued in 2008. In April 1987, the Corps completed a study indicating that the fish hatchery water quality could be solved by adding water-hardening chemicals as a least-cost alternative. The hatchery experimented in the 1980s with adding hardening chemicals to address that, but the practice proved inconclusive and the process was discontinued. Occasional special releases are made at Buford Dam to ensure adequate dissolved oxygen and water temperature at the fish hatchery. GAEPD installed two water quality monitors in 2014, one immediately below Buford Dam and one at the Buford Trout Hatchery. The monitors are maintained by GAEPD on a regular basis but this water quality data is currently not being made available to, nor used by the Corps for real-time operations.

On occasions during drought conditions, the GAEPD has requested that minimum flows at Peachtree Creek be reduced to 650 cfs during the colder months of the year. As a result, the current goal for minimum flows from Buford Dam is to provide a minimum flow of 750 cfs between May to October and 650 cfs between November to April, measured 40 miles downstream from Buford Dam in the Chattahoochee River, just upstream of the confluence with Peachtree Creek.

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

1 April to 1 June is the expected timing for fish spawning at Lake Sidney Lanier. 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.

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. M&I entities withdraw water from both the reservoirs and the rivers that comprise the ACF System. Two M&I entities withdraw water directly from Lake Sidney Lanier under relocation agreements, and others withdraw directly from the Chattahoochee River downstream of Lake Sidney Lanier. At Lake Sidney Lanier, water withdrawals from the reservoir are made pursuant to the existing relocation contracts for the Cities of Gainesville, Georgia, and Buford, Georgia, at rates not exceeding 8 (net) and 2 mgd, respectively. Buford intakes are at elevations 1,062, 1,052, 1,042, and 1,032 feet NGVD29. Gainesville has three intake structures, each with multiple intake ports ranging from elevation 1,063 down to 1,025 feet NGVD29.

Pursuant to the Water Supply Act of 1958, the Corps has allocated 252,950 acre-feet in Lake Sidney Lanier for water supply in accordance with a water storage agreement with the State of Georgia. The amount of storage was estimated to yield 222 mgd during the critical drought, i.e., during the worst drought on record at the time the agreement was executed. The severity and frequency of droughts change over time, therefore, the yield of this storage may change over time.

For the purpose of managing water supply storage, the Mobile District has employed a storage accounting methodology that applies a proportion of inflows and losses, as well as direct withdrawals by specific users, to each account. The amount of water that may actually be withdrawn is ultimately dependent on the amount of water available in the storage account, which will naturally change over time.

Other M&I entities withdraw water directly from the Chattahoochee River for water supply. Water withdrawals in Georgia are made pursuant to water withdrawal permits issued by GADNR.

Releases from Buford Dam through the hydroelectric power units and the sluice gates are discharged into the Chattahoochee River which flows downstream to the Atlanta area municipal water intakes downstream. Peaking hydroelectric power generation generally occurs between 5:00 a.m. to 9:00 a.m. Central time and 3:00 p.m. to 10:00 p.m. Central time on Monday through Friday between 1 October and 31 March and between 1:00 p.m. to 7:00 p.m. on Monday through Friday between 1 April and 30 September. A by-product of these peaking releases is the accommodation of most water withdrawal supply needs for the City of Atlanta. However, under the 1946 Rivers and Harbors Act, generation might occur outside those time frames to specifically meet the City of Atlanta water supply needs, not to exceed 379 mgd.

Georgia and the GPC have agreements to reregulate power releases from Buford Dam to provide a more dependable flow below Morgan Falls Dam. Morgan Falls Dam maintains a continuous minimum seasonal flow to provide a set flow at Peachtree Creek. The GPC releases include anticipated withdrawals by Cobb County-Marietta Water Authority and Atlanta.

7-10. Hydroelectric Power. The Buford Dam Project is generally operated as a peaking plant for producing hydroelectric power according to a weekly power schedule. During off-peak periods, a continuous flow of approximately 500 to 660 cfs is maintained by running the small 7 MW service unit. If the service unit becomes unavailable, water can be spilled through the sluice. Peaking releases from Buford Dam are reregulated by GPC's Morgan Falls Reservoir to maintain a more dependable, low flow in the river. In addition, increased releases during low-flow periods are used by the Corps at West Point, Walter F. George, and Jim Woodruff Projects for hydropower and to aid navigation.

Reservoir releases required for conservation, or flood risk management operations in Sections 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. Table 7-2 describes the typical number of hours for hydropower production at Buford Dam. Historical hydropower production is shown on Plates 2-10 and 2-11. Actual monthly and annual production is tabulated. The average annual production from 1960 through 2015 is 180,745 megawatt hours (MWH). The annual production ranged from a low of 62,940 MWH in 2002 to a high of 276,271 MWH in 1973.

SEPA markets the energy generated at Buford 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 Mobile 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.

Due to the loss of capacity in the downstream channel, peaking hydropower releases are usually limited to four hours when peaking with both main units. This limitation allows for the Chattahoochee River downstream to settle out before reaching a critical elevation where out of bank flows may occur at some downstream locations. This operation is discussed in more detail in Section 8-12.

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.

When the composite conservation storage drops below Zone 4 into the drought zone, the flows from Jim Woodruff Dam will be reduced to 4,500 cfs at a ramp down rate of 0.25 feet/day.

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.

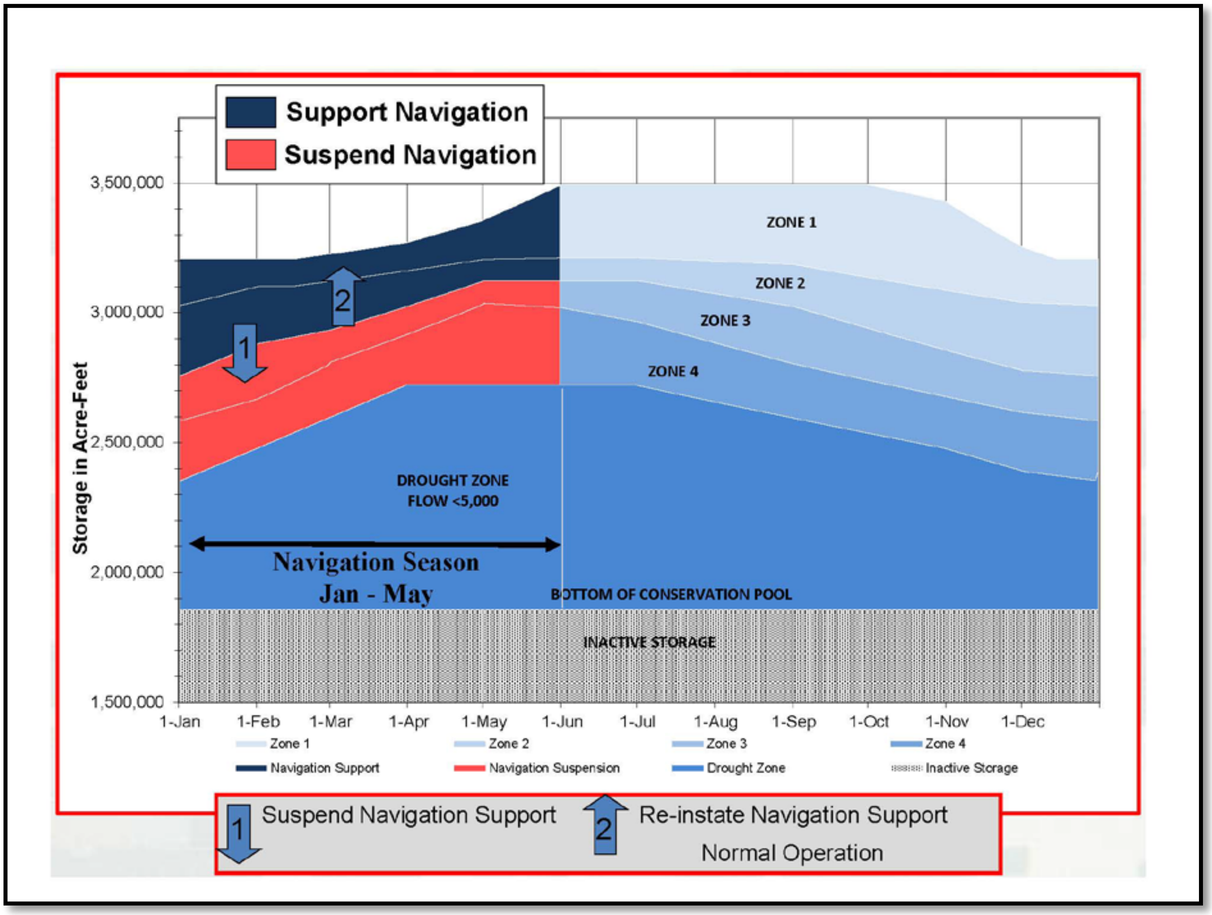


Figure 7-3. Composite Conservation Storage for Navigation

7-12. Drought Contingency Plans. ER 1110-2-1941, *Drought Contingency Plans*, dated 15 September 1981, called for developing drought contingency plans for Corps' reservoirs. For the Buford Project, the USACE will coordinate water management during drought with other Federal, state and local 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 E*,* 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 Walter F. George and West Point Projects 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.

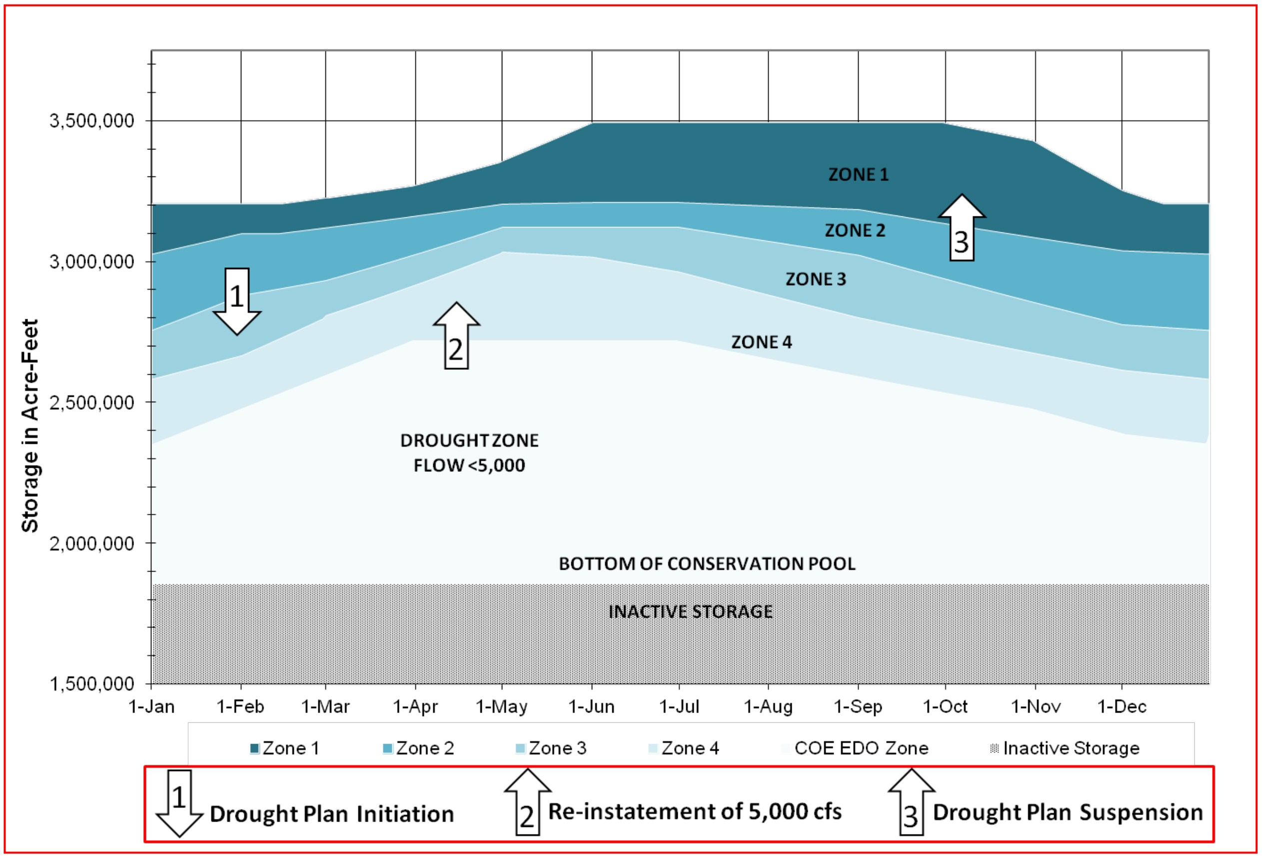


Figure 7-4. Drought Operation Triggers

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 Lake Sidney Lanier, West Point Lake, and Walter F. George Lake plus Zone 4 storage in Lake Sidney Lanier. 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 will be implemented that tracks composite conservation storage to determine the water management operations (the first day of each month will represent a decision point) that will be implemented and to determine which operational triggers, if any, should be applied. There is a special provision for the month of March under drought operation. If recovery conditions are achieved in February (after the 1st), drought plan provisions will not be suspended until 1 April, unless the level of composite conservation storage reaches the top of zone 1 (i.e. all Federal reservoirs are full) prior to 1 March. 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 Lock and 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.

Low pool levels or low outflows affect a number of interests in the ACF Basin and around and downstream of Lake Sidney Lanier. The following procedures will be used to notify various groups of impending and long-range water management actions during a drought. The Buford Operations Project Manager will be the key party for keeping the public and various interest groups around Lake Sidney Lanier informed. He/she will arrange briefings or meetings between interested groups and the Mobile District water managers will assist with news releases and advise the Mobile District about any specific drought notification procedures that would serve the public interest around the lake.

(1) Water supply utilities in the reach of the river between Buford Dam and Peachtree Creek have a vital interest in the operation of Lake Sidney Lanier. Four major withdrawal points are on the Chattahoochee River with current (2012) monthly average permitted withdrawal allocations of 497 mgd. Coordination of water management with the utilities will generally be through the staff of the Atlanta Regional Commission.

(2) Water management during drought may also impact the various wastewater treatment plants along the Chattahoochee River. The flow in the river provided by Buford Dam is essential to assimilating effluents from the plants. Coordination of water management during drought, because it will affect the plants, will generally be through the GAEPD.

(3) The National Park Service operates the Chattahoochee River National Recreational Area. Generally, river float trips and other activities are best suited to low river flow conditions. However, periodic coordination of special operations may be needed between the National Park Service and the Corps.

(4) Another major interest in the reach of the river between Buford Dam and the West Point Lake is GPC, which operates four thermal-electric generating plants along the river and the

Morgan Falls Hydropower Plant. The thermal plants are dependent on the river for cooling water. Unusual operations of Buford Dam would be coordinated with the GPC's Engineering Department or Power Dispatching Office.

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*, 31 March 2014. The Buford Project Emergency Action Plan, dated April 2013 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. <u>Extraordinary Drawdown of Lake Sidney Lanier</u>. Droughts experienced in late 1980s and in the 2000s 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. Lake Sidney Lanier contains more than 860,000 acre-feet of water below the conservation pool between elevations 1,035 and 919 feet NGVD29, which is the crest of low level sluice. Use of that available, but normally inactive, storage would be a serious decision requiring higher headquarters approval. The prerequisites for the Mobile District Commander to recommend such an action would be as follows:

- Other reservoirs are nearly depleted.
- There is a clear public interest such as a water supply, water quality, or public safety need, for a release from Lake Sidney Lanier, which would draw it below elevation 1,035 feet NGVD29.
- The need for release of water 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 Commander will have performed the following tasks:

- A public notice will be issued describing as best as possible the expected drawdown and the circumstances that could 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.

b. <u>Correlation with Other Projects</u>. Releases from Buford Dam pass through several reservoirs on the way to the Gulf of Mexico. Morgan Falls Dam reregulates inflows received from Buford Dam to provide a more dependable flow past Atlanta. Other downstream projects including privately owned and government dams receive headwater benefits from the redistribution of flows above Buford Dam. When stored water is released to augment navigation flows, there is a coordinated plan to balance releases from the Corps reservoirs - Buford, West Point, Walter F. George, and Jim Woodruff Projects.

c. 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. Critical elevations are discussed in detail in the High Water Action Plan provided in exhibit C.

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 and policies with coordination as necessary 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 at a project are drowning and other accidents, failure of the operation facilities, failure of another ACF project, 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 reasonably be expected to 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 immediately. 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 South Atlantic Division 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 SAD for review and approval.

7-16. Rate of Release Change. Gradual changes are important when releases are being decreased and downstream conditions are very wet, resulting in saturated riverbank conditions. The Corps acknowledges that a significant reduction in basin releases over a short period can result in some bank sloughing, and release changes are scheduled accordingly when a slower rate of change does not significantly affect downstream flood risk. Overall, streambank erosion has been reduced by capturing peak basin runoff in the reservoirs and metering the flows out more slowly than what would have occurred under natural conditions.

VIII - EFFECT OF WATER CONTROL PLAN

8-01. General. Buford Dam and Lake Sidney Lanier was authorized as part of the general plan for the full development of the ACF River Basin by the Rivers and Harbors Act of 24 July 1946, in accordance with the general plan presented in House Document No. 300, 80th Congress, First Session. The Buford Project is operated to provide benefits for authorized purposes including hydropower, flood risk management, navigation, water supply, water quality, fish and wildlife conservation, and recreation.

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. One of the major benefits of the water control operations in the ACF System is flood risk management. Lake Sidney Lanier contains flood risk management storage space in which flood water is stored and later released in moderate amounts to prevent downstream flooding. During most years, one or more flood events occur in the ACF Basin. While most of those events are of minor significance, on occasion, major storms produce widespread flooding or unusually high river stages. Before project construction, the record storm of December 1919 and major flooding events in July 1916, March 1929, and February 1961 resulted in extensive damage and loss of life in the basin. More recently, major floods have occurred in February 1990, January 1996, May 2003, and September 2009. While those four floods also resulted in considerable damage, a total of more than $209 million in estimated damages was prevented by the Buford Dam Project from all flooding events between 1989 and 2015 as a result of flood risk management operations.

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 about 20 miles northeast of the dam as described in the National Weather Service Hydrometeorological Reports Nos. 51 and 52. This flood is also often referred to as the Probable Maximum Flood (PMF). The storm used for the Buford Project has a 72-hour duration with a basin average precipitation depth of 30.67 inches. The pattern was computed by centering the elliptical (1:2.5) storm on the centroid of the drainage area above the dam site and rotating the axis to get the largest runoff at the dam site. The previous SDF was a transposed December 1919 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. SDF routing was started at 1,070 feet NGVD29 elevation because the larger floods tend to occur early in the year. The latest spillway design flood has a peak pool elevation of 1,100.03 feet NGVD29 with a maximum inflow and discharge of 581,300 and 40,400 cfs. That elevation is 15.0 feet above the crest of the uncontrolled chute spillway at elevation 1,085.0 feet NGVD29 and 6.0 feet below top of the dam and saddle dikes at elevation 1,106.0 feet NGVD29. Maximum flows at Norcross (USGS # 02335000), Roswell (USGS #02335450), and Vinings gages (USGS #02336000) would be 61,000, 70,100, and 112,300 cfs, respectively, and would occur the day before the maximum reservoir pool and result from a rainfall of 30.67 inches over the basin. The SDF outflow was restricted in the earlier part of the storm to prevent additional flooding at Norcross (11,000 cfs) and Vinings (17,000 cfs). Effects of the reservoir regulation of the spillway design flood are depicted on Plate 8-1 and summarized in Table 8-1. Updated guidance requires the SDF be routed with an antecedent pool elevation at the top of the flood risk management pool or by routing the SPF five 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. 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 basis of the Standard Project Flood (SPF) is one-half of the flow of the SDF. The previous SPF was based on a transposed storm of September 25 through October 7, 1929, according to the observed rainfall, selected centering and orientation, and adjusted runoff volume, to provide a flood that was considered to be of that magnitude. The SPF cannot be assigned a frequency of occurrence and was not used in any discharge-frequency analysis. Standard Project Flood routing started at pool level 1,070 feet NGVD29. The SPF has a peak inflow and pool elevation of 290,600 cfs and 1,086.78 feet NGVD29 with a maximum discharge of 17,000 cfs. That pool elevation is 1.8 feet above the crest of the uncontrolled chute spillway at elevation 1,085.0 feet NGVD29 and 20.8 feet below top of the dam and saddle dikes at elevation 1,106.0 feet NGVD29. Flows at Norcross, Roswell, and Vinings gages would be 22,900, 26,400 and 49,400 cfs, respectively. The SPF outflow was restricted in the earlier part of the storm to prevent additional flooding at Norcross (11,000 cfs) and Vinings (17,000 cfs). Effects of the reservoir regulation of the SPF are depicted in Plate 8-2 and summarized in Table 8-1.

Table 8-1. Design Floods

Flood Event	Reservoir Inflow (cfs)	Emergency Spillway Outflow (cfs)	Power Plant Outflow (cfs)	Sluice Outflow (cfs)	Peak Pool Elevation (ft. NGVD29)
Spillway Design	581,300	16,100	12,000	12,300	1,100.03
Standard Project	290,600	600	12,000	4,400	1,086.78

c. Historic Floods. Several floods were routed through the Buford Dam Project to determine the peak pools and hourly discharges starting at elevation 1,070 feet NGVD29. The storm of January 5-6, 1946, west of Cornelia, produced 3.6 inches of rain and a peak flow of 55,700 cfs at Buford. If the project had been in place, the inflow for the storm is estimated at 71,700 cfs. The flood of January 1946 would have caused a peak pool elevation of 1,074.2 feet NGVD29 with a maximum hourly outflow of 10,000 cfs. The stages at the downstream gages at Norcross and Vinings are included because the Buford flood releases are restricted to produce no greater than bankfull flows of 11,000 and 17,000 cfs, respectively. Projected regulation for the January 1946 flood is shown on Plates 8-3 and 8-4.

The spring of 1964 produced the peak pool elevation at Lake Sidney Lanier. This was not the result of one high inflow event but three separate inflow events through March and April of that year. There was not enough time to evacuate flood water from the lake in between events due to the limited discharge capacity of the project and the high river stages downstream. This caused the pool to rise higher with each inflow event leading to a peak pool elevation of 1077.2 feet NGVD29 on April 14th 1964. It took until late May 1964 to evacuate all the flood water from this succession of events. Projected regulation for the Spring 1964 flood is shown on Plate 8-5.

The flood of September 2009 is of significance because of its magnitude and it occurred at the end of a major drought. The lake level was low, permitting maximum flood storage. Plate 8-6 shows inflow, outflow, and pool elevations at Buford Dam as the lake rose from near 1,064 feet NGVD29 to above 1,069 feet NGVD29 in two weeks for the September 2009 flood. Downstream stages are also shown at Norcross, Roswell, and Vinings. The effects of the storm are discussed in Chapter IV, and several photographs are included.

8-03. Recreation. Lake Sidney Lanier is an important recreational resource, providing significant economic and social benefits for the region and the Nation. The project contains 38,425 acres of water at the summer conservation pool elevation of 1071 feet NGVD29, plus an additional 19,465 acres of land, most of which is available for public use. A wide variety of recreational opportunities are provided by the 77 parks, 16 marinas, and 16 campgrounds (OMBIL 2016) located in and around the reservoir. Lake Sidney Lanier 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. Lake Sidney Lanier is one of the most visited Corps lake in the United States; receiving a total of 6.5 million recreational visitors in 2012. The local and regional economic benefits of recreation at Lake Sidney Lanier are significant. Annual recreational visitor spending within 30 miles of the project totals $253.3 million.

The effects of the Buford Dam water control operations on recreation facilities and use at Lake Sidney Lanier 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. <u>Initial Impact Level</u> - Reduced swim areas, some recreational navigation hazards are marked, boat ramps are minimally affected, a few private boat docks are affected.

b. <u>Recreation Impact Level</u> - 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. <u>Water Access Limited Level</u> - 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 8-2 shows the lake elevation for each impact level and the percent of time during the summer season (May - September), over a 73-year simulation of the proposed operation, that each impact level would be reached at Lake Sidney Lanier.

Table 8-2. Reservoir impact levels, Lake Sidney Lanier, Georgia

1,066.0 Feet Initial Impact Level (percent time reached)	**1,063.0 Feet Recreation Impact Level (percent time reached)**	**1,060.0 Feet Water Access Limited Level (percent time reached)**
27.1%	9.1%	3.3%

8-04. Water Quality. The water quality conditions that are generally present in Lake Sidney Lanier are typical of water quality conditions and trends that exist in relatively deep reservoirs throughout the southeast. Water quality conditions in the main body of the reservoir are typically better than in the arms of the reservoir because of nutrient and sediment-rich, riverine inflows. Sediment and phosphorus concentrations are also highest in the upper arms and decrease toward the main pool as velocity is lowered and sediment is removed from suspension. During summertime thermal stratification of Lake Sidney Lanier, dissolved oxygen levels and water temperatures are typically highest in the top 15 feet of the reservoir, with colder, anoxic or nearly anoxic conditions existing near the bottom. Additionally, chlorophyll *a* concentrations vary both seasonally and spatially and are highest from July to October during periods of low flow. Point and nonpoint sources from urban areas increase sediment and pollutant loads in the rivers immediately downstream. Reservoirs in the ACF Basin, including Lake Sidney Lanier, typically act as a sink, removing pollutant loads and sediment. Lake Sidney Lanier currently meets all designated water use criteria except for the area around Browns Bridge Road (State Route 369) which is listed on Georgia's 2014 draft Integrated 305(b)/303(d) list of impaired waters because of chlorophyll *a* impairment.

The Corps operates the Buford Project for the objective of improving water quality. Water releases made during hydropower generation at Buford Dam during Monday through Friday provide Chattahoochee River flows sufficient to achieve the required minimum flows at Peachtree Creek at Atlanta, Georgia. At Buford Dam, self-aspirating turbines were recently installed to improve dissolved oxygen levels downstream. Minimum continuous flow releases from Buford Dam are made through the small turbine-generator that provides a minimum flow from the dam between 550 – 660 cfs. Occasional special releases are also made at Buford Dam to ensure adequate dissolved oxygen and water temperature at the Buford Trout Hatchery downstream of the dam. Such continuous releases provide a benefit to water quality in the ACF Basin.

On occasions during drought conditions, the Georgia Environmental Protection Division (GAEPD) has requested that minimum flows at Peachtree Creek be reduced to 650 cfs during the colder months of the year. As a result, the current goal for minimum flows from Buford Dam is to provide a minimum flow of 750 cfs between May to October and 650 cfs between November to April, measured 40 miles downstream from Buford Dam in the Chattahoochee River, just upstream of the confluence with Peachtree Creek.

8-05. Fish and Wildlife. The water control plan benefits fish and wildlife, including threatened and endangered species, by maintaining steady reservoir levels during the spring fish spawning period, providing a gradual ramp down of river levels to prevent stranding endangered species, and to prevent effects on Federally listed threatened and endangered species, and ensuring adequate flows in the Apalachicola 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 1 April to 1 June fish spawning period at Lake Sidney Lanier, 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. By operating pursuant to the plan described herein, the ACF system of reservoirs, including Lake Sidney Lanier, is in compliance with the Endangered Species Act of 1973 and related Biological Opinion provided by the U.S. Fish and Wildlife Service during the preparation of this water control manual. Such compliance will include all Terms and Conditions and Reasonable and Prudent Measures that would minimize impacts to specific Threatened and Endangered Species and their critical habitat and avoid jeopardy to their continued existence. Water releases from 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 those 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.

8-06. Water Supply. The ACF Basin projects and water control operations provide benefits for M&I water supply. M&I water supply withdrawals are made directly from Lake Sidney Lanier amounting to an average annual gross amount of 242 mgd (20 mgd relocation contract, 222 mgd Water Supply Act). Entities that withdraw water from Lake Sidney Lanier include Habersham, White, Lumpkin, Dawson, Forsyth and Gwinnett Counties, and the Cities of Gainesville, Buford, and Cumming.

Of the total M&I water supply withdrawals from Lake Sidney Lanier, 10 mgd are authorized via water withdrawal relocation contracts: the Cities of Buford (2 mgd) and Gainesville (18 mgd gross, 8 mgd net). The relocation contracts were issued as partial compensation for the relocation of the respective water supply intakes and treatment facilities as a result of project construction.

Downstream of Buford Dam are four metro Atlanta water utilities that withdraw a combined average annual maximum amount not to exceed 379 mgd from the Chattahoochee River. The residential water supply needs of a total estimated population of three million persons are served by those utilities, plus numerous commercial, industrial, and institutional enterprises. A total of up to 379 mgd is supplied through releases from Buford Dam's peaking hydropower operations. This downstream water supply need is normally met as a by-product of peaking hydropower releases that occur Monday through Friday. However, under the 1946 Rivers and Harbors Act generation might occur outside peaking hydropower operations time frames to specifically meet the City of Atlanta water supply needs, not to exceed 379 mgd.

8-07. Hydroelectric Power. The Buford Dam hydropower project, along with 22 other hydropower dams in the southeastern United States, composes the SEPA service area. SEPA sells hydroelectric power generated at Buford Dam 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 Buford Dam, i.e., power is generated during the hours that the demand for electrical power is highest, causing significant variations in downstream flows. The hydropower units are rated to releases about 600 cfs during off-peak periods with the small service unit to as much as 11,200 cfs with all three units. However, observed tailwater gage data shows the three units can produce nearly 12,000 cfs with all three units running at maximum capacity. Peaking releases typically occur Monday – Friday during peak demand hours; however, peaking is often scheduled on the weekends during the drier, summer months to help support downstream flow requirements.

Buford Dam provides 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. 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 1960 and 2015, Buford powerhouse produced an annual average of 180,745 MWH per calendar year, with a minimum of 62,940 and a maximum of 276,271 MWH, dependent upon water availability (see Plates 2- 10 and 2-11).

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 loading and unloading, and rapid power availability for emergencies on the power grid.

8-08. Navigation. Generally, water releases made from Buford Dam that benefit navigation on the ACF System are incidental to its hydropower operations and releases for other downstream authorized project purposes. 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.

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 reservoirs within the system may not be able to fully support all project purposes. Several drought periods have occurred since construction of Buford Dam in 1957. The duration of low flows can be seasonal or they can last for several years. Some of the more extreme droughts occurred in the mid 1950s, the early and mid 1980s, and most of the time period between late1998 to mid-2009. There were periods of high flows during these droughts but the lower than normal rainfall trend continued. Lake Sidney Lanier has a high conservation storage to average annual inflow ratio which indicates that it is much harder to refill than a project like Allatoona Lake, which has a low storage to inflow ratio.

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 Buford Dam and conservation efforts strengthen the ability to supply water supply needs.

For the Buford Dam Project, the Corps will coordinate water management during 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 Mobile District and Buford Dam, emergency operating procedures, as described in Exhibit D, Standing Instructions to Damtenders for Water Control, will begin. If communication is broken after some instructions have been received from the Mobile District, those instructions will be followed for as long as they are applicable.

Flood emergency operations at Buford Dam are the responsibility of the Buford Power Plant Manager. It is his responsibility to obtain the gage readings at Norcross (USGS #02335000) and Vinings (USGS #02336000) by whatever means possible before making any power releases other than that required for station service. If rainfall of two to three inches is predicted or has occurred in the Atlanta area as measured at Vinings and Norcross, discharge will be limited to two hours at full powerhouse capability (about 700 day-second-feet) per day. If the Vinings gage is 11 feet and rising, the Power Plant Manager will have all discharge, except the continuous flow turbine, discontinued until the gage indicates that the stage has peaked and is below 14 feet. With a falling Vinings gage between 11 and 14 feet, two hours of generation at powerhouse capability may be scheduled. After the stage has fallen to below 11 feet and is still falling with no rain anticipated, previous scheduled power generation can occur.

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 impacts 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.

8-11. Frequencies

a. Peak Inflow Frequency. The peak inflow frequency for Lake Sidney Lanier is shown in Figure 8-1 and is based on the peak annual calculated project inflow from 1960 - 2013. The reservoir is the northernmost storage project in the ACF Basin and therefore its inflows are unregulated by any upstream impoundments.

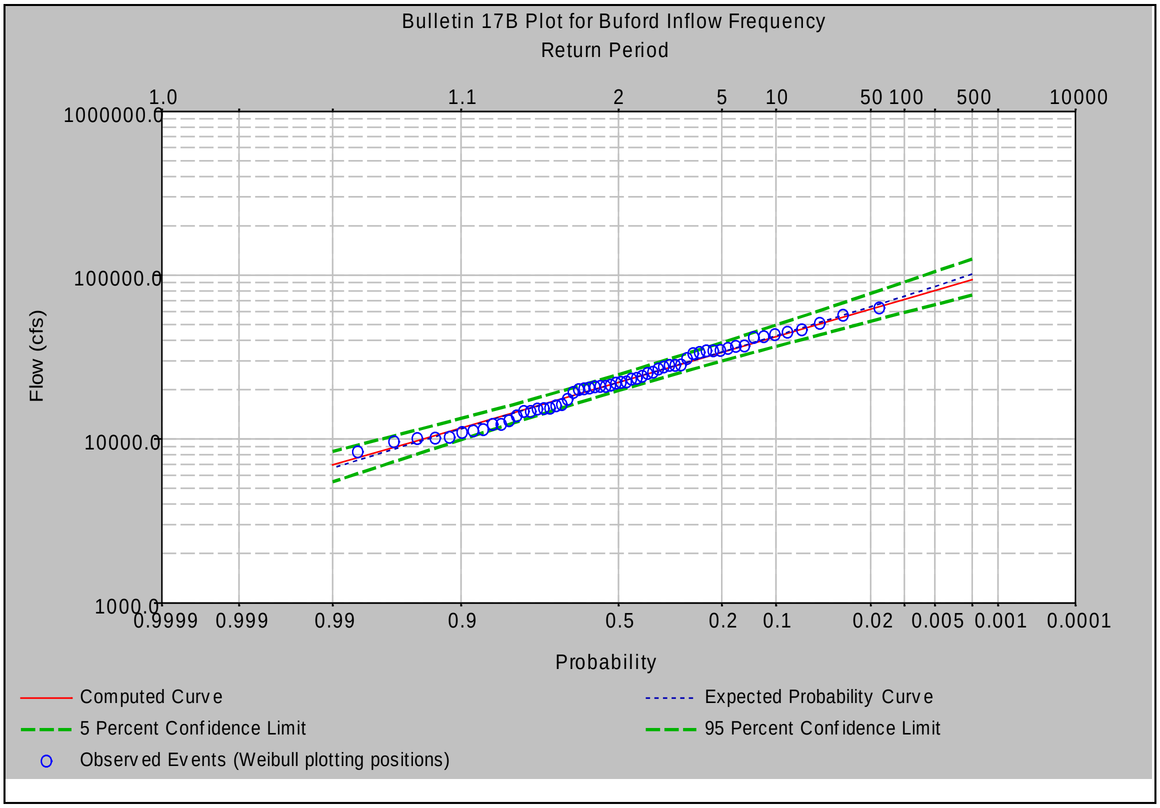


Figure 8-1. Inflow Frequency at Lake Sidney Lanier

b. <u>Pool Elevation Duration and Frequency</u>. The Water Control Plan for the ACF Basin influences the Reservoir levels at Buford Dam. Since the Federal reservoirs in the ACF Basin are operated as a system, changes in the operations of downstream projects can have a direct effect on the Buford pool elevation. The top of conservation of the reservoir ranges from 1,070 feet NGVD29 in the winter months to 1,071 feet NGVD29 in the summer months. However, the pool is typically drawn down below the top of conservation to meet basin wide needs. Pool duration curves for the historic observed data, previous regulation plan, and updated regulation plan as described in this manual are presented in Figure 8-2. Pool duration curves for operation under the previous regulation plan and the current regulation plan were modeled using the Reservoir Simulation (ResSim) model developed by the Hydrologic Engineering Center in Davis, California. Recreation impact levels are also shown. The observed and modeled period used in the analysis is January 1958 through December 2011.

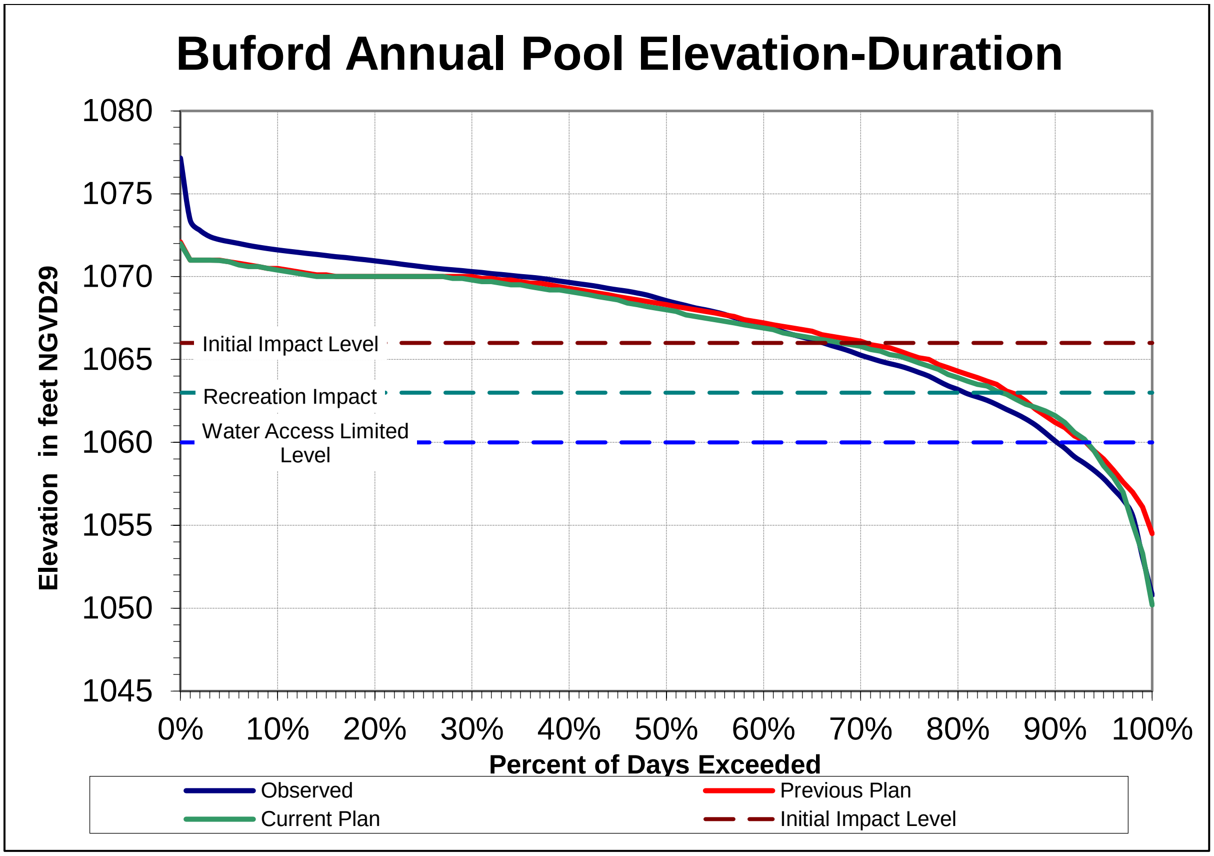


Figure 8-2. Lake Sidney Lanier Annual Elevation-Duration Curves for Observed Data and Modeled Data for the Pervious and Updated Water Control Plans

c. Peak Flow Frequencies. Downstream locations are heavily affected by the presence of Buford Dam. Plates 8-22 and 8-23 show the peak flow frequencies for the Norcross (USGS #02335000) and Vinings (USGS #02336000) gages for the pre-dam and post-dam periods. The figure indicates that the higher flows are far less frequent since the filling of the project in 1957.

8-12. Other Studies - Examples of Regulation. Streamflow has been measured in the vicinity of Buford Dam since 1903; at Norcross beginning in 1903, Strickland Bridge beginning in 1945, and 0.2 mile below the dam site beginning in 1956. An analysis of daily flows during the period of concurrent records indicates that values are in proportion to the drainage areas.

During design of the project, daily flows at the dam site were computed using drainage area ratios. For the period of October 1903 through September 1945, daily flows at Norcross were multiplied by 0.9 and transferred to the Buford site. From October 1945 through September 1949, flows were obtained from Strickland Bridge 2.6 miles below Buford Dam. The gage at Buford 0.2 mile downstream was used from 1949 until the dam was constructed. Plates 4-7 and 4-8 present the monthly and annual flows from 1903 through April 1957.

Since construction, inflows to the lake have been computed by measuring the outflow and change in storage in the lake. The daily change in storage is added to the outflow to indicate the inflow. In general, computing the inflow produced accurate data; however, there are periods when substantial error can occur. Wind can cause false reading at the reservoir gage so that the computed change in storage is erroneous. During droughts and low-flow periods, evaporation, withdrawals, and other losses can indicate inflows much lower than without project conditions. Often, net inflows are computed as less than zero. An alternative technique includes estimating gross inflow by measuring cumulative flow from the main river and tributaries to the lake and then estimating losses from withdrawals and evaporation. When losses exceed the gross inflow, the net inflow is truly negative. Plates 4-9 and 4-10 present the monthly and annual flows from July 1957 through December 2015 as reported in the project records. The daily inflows, outflows, and pool elevations are plotted in Plates 8-7 through 8-21.

During study processes with Alabama, Georgia, and Florida for future water management in both the ACF and the ACT Basins, a set of unimpaired flows - flows that would have occurred in the basin in the absence of any project development and consumptive use of water - were developed to account for some historical alterations in streamflow. Plates 4-13 and 4-14 show the monthly and annual unimpaired flows at Buford for 1939 through 2011.

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. Evaporative losses for the 38,000-acre lake and direct rainfall on the surface have altered the flow to some extent. Also, water supply withdrawals from the lake occur. Water is stored during high-flow periods and released during lower-flow periods. Figure 8-3 shows the inflow compared to the unimpaired flow at the dam site.

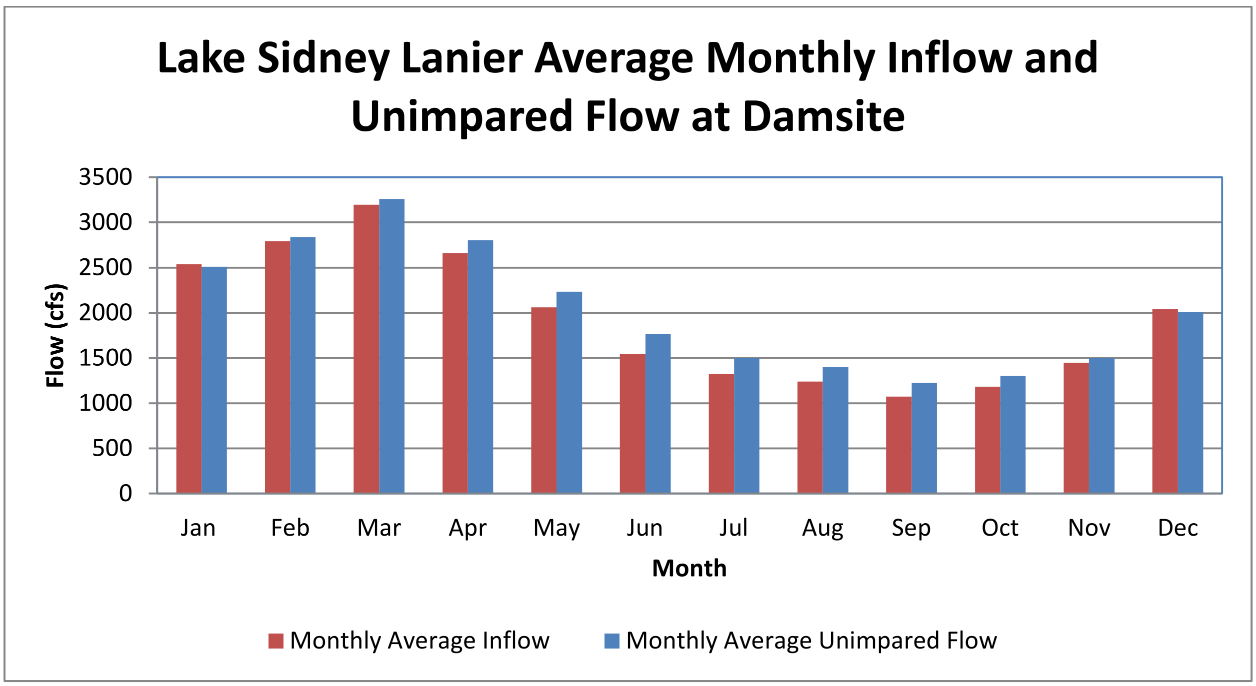


Figure 8-3. Lake Sidney Lanier Observed Inflow and Unimpaired Flow at the Damsite

Table 8-3 and Figure 8-4 compare the monthly observed and unimpaired flows below Buford at Atlanta, Georgia. This illustrates the redistribution of water downstream of the dam as a result of water use, evaporation and reregulation of water at Buford. Figure 8-5 shows the reregulation of flows at the dam by comparing observed inflow to observed outflow.

Table 8-3. Atlanta Average Flow for 1960 - 2011 (cfs)

	Observed avg flow	Unimpaired avg flow	Avg daily gain or loss due to redistribution and losses
Jan	2,585	3,533	-948
Feb	2,889	3,895	-1,006
Mar	3,179	4,440	-1,260
Apr	3,152	3,808	-656
May	2,741	3,001	-259
June	2,322	2,428	-106
July	2,281	2,054	227
Aug	2,421	1,926	495
Sept	2,321	1,739	582
Oct	2,147	1,782	365
Nov	2,193	2,103	90
Dec	2,198	2,789	-591
Total	30,429	33,497	-3,068
Average	2,536	2,791	-256

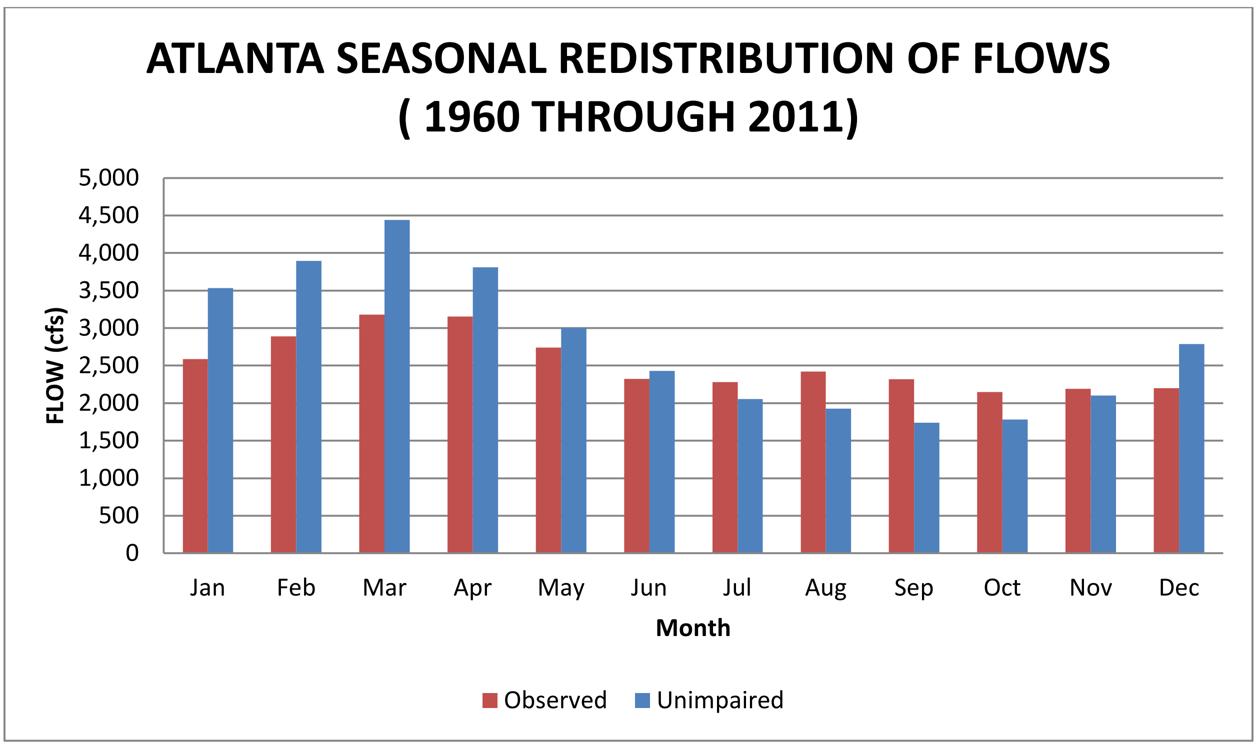


Figure 8-4. Atlanta (USGS Gage #02336000) Average Flow for 1960 - 2011 (cfs)

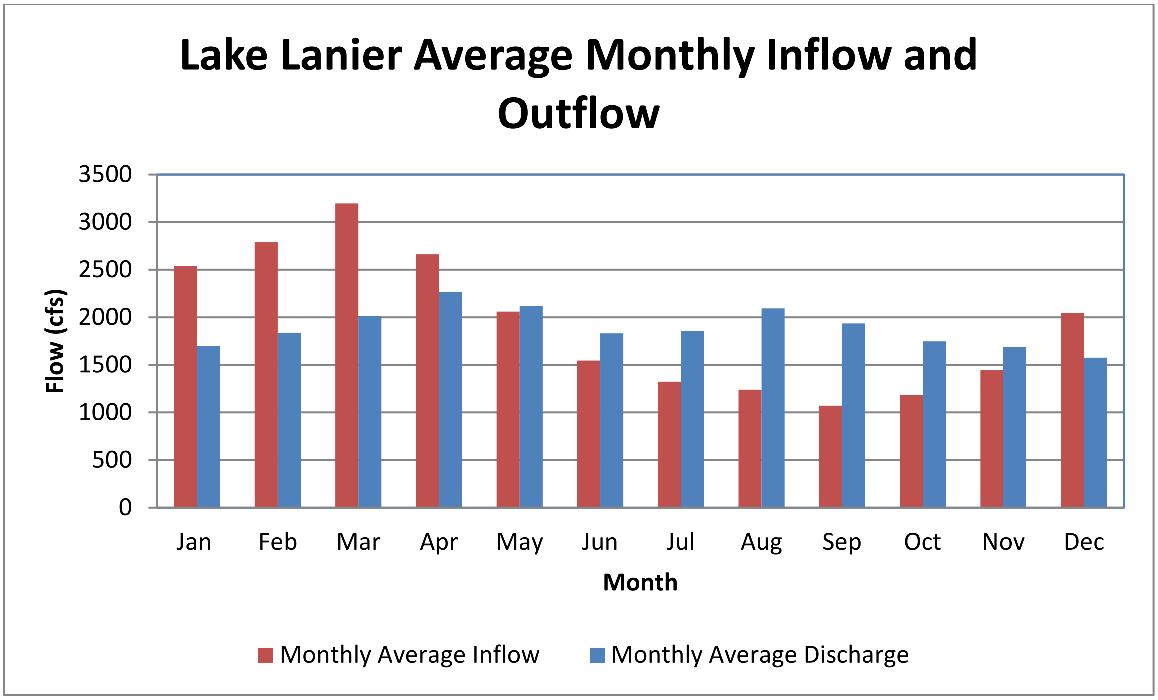


Figure 8-5. Lake Sidney Lanier Inflow and Outflow

More recently there has been an issue with normal hydropower releases with longer durations exceeding bank-full capacity downstream of the dam. The channel was known to have a capacity of about 10,000 cfs when the project was created, however, in the last 10 years there has been evidence presented that flows around 10,000 cfs are causing minor flooding issues. While a detailed study has not been performed, it is assumed that the loss of channel capacity is due to siltation in the river bed as well as encroachment of the floodplain through residential development. To try and help alleviate this issue, the Mobile District developed a release schedule that limits the amount of continuous generation that should be scheduled at Buford Dam. This special operation is described in detail in the draft SOP *Standard Operating Procedure for Limitation of Hydropower Peaking Operations during Flood Control Operations, September 2011*. To develop this SOP, the downstream effects of different peaking schedules were evaluated to determine what kinds of releases would keep the water within the banks, or at least reduce the impact as much as reasonably possible. Table 8-4 shows an example of this study. In scenario 1 and 2 the releases are split up and there is not an issue with downstream flooding. In scenario 3 and 4, the total daily release is identical however scenario 3 caused minor flooding due to the continuous high release with both main units that occurred throughout the day. Scenario 4 split the release up by shutting off one main unit, allowing the river to settle out downstream and not reach 10,000 cfs or greater. Therefore scenarios 1, 2 and 4 are acceptable hydropower release schedules and scenario 3 is unacceptable and would not normally be permitted.

Table 8-4. Example of Four Daily Hydropower Schedules for Buford Dam

SCHEDULE DATE:	BUFORD Scenario 1	BUFORD Scenario 2	BUFORD Scenario 3	BUFORD Scenario 4
	Previous Guidance	Add 67 MW continuously	Reduce plant capacity at channel capacity	Split schedule at channel capacity
CENTRAL TIME	SCH	SCH	SCH	SCH
0000-0100	7	67	67	67
0100-0200	7	67	67	67
0200-0300	7	67	67	67
0300-0400	7	67	67	105
0400-0500	127	127	67	105
0500-0600	127	127	67	105
0600-0700	127	127	67	105
0700-0800	127	127	105	105
0800-0900	7	67	105	105
0900-1000	7	67	105	67
1000-1100	7	67	105	67
1100-1200	7	67	105	67
1200-1300	7	67	105	67
1300-1400	7	67	105	67
1400-1500	7	67	105	67
1500-1600	127	127	105	105
1600-1700	127	127	105	105
1700-1800	127	127	105	105
1800-1900	127	127	105	105
1900-2000	7	67	67	105
2000-2100	7	67	67	105
2100-2200	7	67	67	67
2200-2300	7	67	67	67
2300-2400	7	67	67	67
TOTALS	1128	2088	2064	2064
DAILY AVERAGE FLOW (cfs)	4,790	8,870	8,770	8,770
Operator:				
Date:				
Time:				

Note: Scenarios 1, 2, and 4 are acceptable while scenario 3 may cause minor downstream flooding

IX - WATER CONTROL MANAGEMENT

9-01. Responsibilities and Organization. Responsibilities for developing and monitoring water resources and the environment at the Buford 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 Buford Dam 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 the Buford Project are regulated to meet its Federally authorized project purposes at Buford in coordination with other authorized projects in the ACF Basin. It is Mobile District's responsibility to develop water control regulation procedures for the Buford 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 power plant at Buford Dam is operated remotely from the control room at the Carters Dam Powerhouse under direct supervision of the power project manager. The Mobile District communicates directly with the powerhouse operators at the Carters 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. The NWS along with its River Forecast Center maintains a network of reporting stations throughout the nation. It continuously provides current weather conditions and forecasts. It prepares river forecasts for many locations including the ACF Basin. Often, it prepares predictions on the basis of *what if* scenarios. Those include rainfall that is possible but has not occurred. In addition, the NWS provides information on hurricane tracts and other severe weather conditions. It monitors drought conditions and provides the information though the National Integrated Drought Information System 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 a 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 Georgia and Florida 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. SEPA's objectives 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 Buford power project at the direction of the Corps on the basis of daily and weekly water volume availability declarations and water release requirements.

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 Mobile District, coordinates water control actions and management with USFWS in accordance with both laws.

c. <u>State Agencies</u>

1) Alabama. 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 Environmental Management 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 Soils and Water Conservation Society fosters the science and the art of soil, water, and related natural resource management to achieve sustainability.

2) Georgia. 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.

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 GPC is an electric utility headquartered in Atlanta, Georgia. It is the largest of the four electric utilities owned and operated by Southern Company. GPC 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 Buford Watershed and the ACF Basin. Gainesville and Atlanta, Georgia, have some of the larger daily newspapers, which often publish articles about the Buford Project and the ACF Basin. 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 Buford 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 engineer 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.

9-04. Reports. There are various monthly charts, short-term hydrologic reports, emergency regulation reports, graphical and tabular summaries, flood situation reports and other quarterly, seasonal, or annual reports that are developed and used in the management of the water resources in the ACF Basin. Many of these reports are available on the Mobile District's water management website at http://water.sam.usace.army.mil/. Examples of reports and data used by water management personnel are shown in Table 9-1 below:

Table 9-1. Reports and Data Used in Water Management

Today's Project Data	Lake Elevation and Five Week Forecast
Hourly Stage, Chattahoochee and Flint Rivers	Average Daily Inflow to Lakes by Month
ACF Basin 7-Day Average Inflow	ACF Basin Conservation Storage Chart
Historic Project Data	Record Levels for Rivers and Lakes
Mobile District River Bulletin	Hydropower Generation Schedule
After Action Flood Reports	District River System Status
Annual Flood Damage Reduction Report	

EXHIBIT A

SUPPLEMENTARY PERTINENT DATA

EXHIBIT A

SUPPLEMENTARY PERTINENT DATA

STREAM FLOW

Drainage area at dam site-square miles	1,034
Minimum mean monthly flow before construction (1903–1956) (September 1925)-cfs	264
Estimated minimum daily flow before construction (1903–1956) (August 1925)-cfs	119
Average annual flow Before construction (1903–1956)-cfs	2,042
Maximum mean monthly flow before construction (December 1932)-cfs	8,642
Maximum recorded flow before construction (January 8, 1946)-cfs	55,700

Minimum mean monthly and daily flows after construction can only be estimated because of measuring techniques. Unimpaired flows were developed to estimate flows with no reservoir (and other) effects.

Average annual flow after construction (1957–2013) measured at the dam-cfs	1,914
Discharge at bankfull stage-cfs	10,000
With reservoir in place, peak flow estimated (September 9, 2009)-cfs	71,700
Minimum mean monthly flow after construction (1956–2011) based on unimpaired flows occurred July 1986-cfs	195
Average annual flow after construction (1956–2011) based on unimpaired flows-cfs	2,034

SPILLWAY-DESIGN FLOOD

National Weather Service 72-hour storm at Longitude 85°47' Latitude 35°34’

Total rainfall-inches	30.67
Initial loss-inches	0.00
Average infiltration rate-inches per hour	0.04
Total storm runoff-inches	28.52
Total volume of storm runoff-acre feet	1,581,600
Peak rates of flow	
Inflow to full reservoir-cfs	581,300
Total reservoir outflow-cfs	40,400
Spillway discharge-cfs	28,400
Duration of flood-days	5

RESERVOIR

Pool elevations-(feet NGVD29)	
Maximum pool, spillway design flood	1,100
Top of flood risk management pool	1,085
Top of conservation pool	
Summer	1,071
Winter	1,070
Minimum conservation pool	1,035
Streambed (bottom of flood risk management sluice)	919
Storage volumes-(acre feet)	
Maximum pool, spillway design flood	3,332,000
Total storage-elev 1,085	2,551,064
Flood risk management storage, elev 1,085 to 1,070 (11.48”)	640,264
Flood risk management storage, elev 1,085 to 1,071 (10.80”)	598,800
Conservation storage, elev 1,071 to 1,035 (19.61”)	1,074,645
Conservation storage, elev 1,070 to 1,035 (18.92”)	1,036,532
Inactive storage, below elev 1,035	874,268
Reservoir areas-(acres)	
Maximum pool, spillway design flood	57,601
Top of flood risk management pool, elev 1,085	48,176
Top of conservation pool, elev 1,070	37,871
Top of inactive storage, elev 1,035	22,293
Area (within taking line elev 1,085 plus small islands/peninsulas)-acres	
Purchased in fee simple	56,155
Right to inundate acquired by easement	719
River bed	1,133
Total	58,007
Length of shoreline-(miles)	
Top of flood risk management pool, elev 1,085	760
Top of conservation pool, elev 1,070	540
Length of reservoir at elevation 1,070-(river miles)	
Chattahoochee River	44
Chestatee River	19

DAM

Type	Rolled-fill earth
Length along crest of main dam-feet	1,630
Top width-feet	40

Base width-feet	1,000
Height of main dam above river bed-feet	192
Total length of saddle dikes-feet	6,600
Elevation, top of dam and saddle dikes-feet NGVD29	1,106

SPILLWAY

Type	Uncontrolled chute
Width of chute-feet	100
Crest elevation-feet NGVD29	1,085

FLOOD RISK MANAGEMENT SLUICE

Number of sluices	1
Number of gates	2
Type of gates	Broome
Size of gate	6.5 x 13.25
Number of jet valves per gate	1
Size of jet valve-inches diameter	36
Discharge capacity through jet valve-cfs each	600
Discharge capacity at elev. 1,085-cfs	11,590
Discharge capacity at elev. 1,070-cfs	11,030
Discharge capacity at elev. 1,035-cfs	10,080
Discharge capacity at elev. 919 (Invert)-cfs	0

POWERHOUSE

Size of building	
Length-feet	205
Width-feet	94.5
Type-Indoor, reinforced concrete and structural steel const.	
Elevation-feet NGVD29	
Bottom of substructure	885
Low point of draft tube	888
Centerline of distributer, 60,000 kw units	927
Centerline of distributer, 7,000 kw units	922.5
Generating units-kw	
One 7,000 kw unit	
Speed rpm	277
Turbines	
Type	Francis
Rotation	counter-clockwise

Guaranteed capacity at best gate, and 157.4 foot net head-hp	9,700
Two 60,000-kw units	
Spacing, center to center-feet	62
Speed-rpm	100
Turbines	
Type	Francis
Rotation	Clockwise
Guaranteed capacity at best gate, and 136-foot net head-hp (no air inflow)	79,500
Guaranteed capacity at best gate, and 136-foot net head-hp (with air inflow)	73,140
Generators	
One service unit	
Rated capacity, continuous kVA	7,870
Power factor	0.90
Voltage	13,800
Two large units each	
Rated capacity, continuous kVA	69,333
Power factor	0.90
Voltage	13,800

POWER DATA

Drawdown for storage-feet	35
Volume in power storage (elev. 1,035–1,070)-acre-feet	1,036,532
Rated net head, feet (2 Main Units)	148.4
Rated net head, feet (1 Small Unit)	157.4
Observed Tailwater elevations, feet NGVD29	
Normal, 3 units operating-outflow 11,200 cfs	920.3
Normal, 1 large unit and service unit 6,000	917.0
Service unit only	912.2
Plant output	
Average annual energy produced (1960–2013)-mwh	182,202

EXHIBIT B

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

LENGTH CONVERSION

UNIT	cm	m	km	in.	ft	yd	mi
cm	1	0.01	0.0001	0.3937	0.0328	0.0109	6.21×10^{-6}
m	100	1	0.001	39.37	3.281	1.094	6.21×10^{-4}
km	10^{5}	1000	1	39,370	3281	1093.6	0.621
in.	2.54	0.0254	2.54×10^{-5}	1	0.0833	0.0278	1.58×10^{-5}
ft	30.48	0.3048	3.05×10^{-4}	12	1	0.33	1.89×10^{-4}
yd	91.44	0.9144	9.14×10^{-4}	36	3	1	5.68×10^{-4}
mi	1.01×10^{5}	1.61×10^{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	3.05×10^{6}	70.05	1.58×10^{4}	2.28×10^{7}	22.824
m^3/day	1.16×10^{-5}	1	0.0116	4.09×10^{-4}	35.31	8.1×10^{-4}	0.1835	264.17	2.64×10^{-4}
l/s	0.001	86.4	1	0.0353	3051.2	0.070	15.85	2.28×10^{4}	2.28×10^{-2}
ft^3/s	0.0283	2446.6	28.32	1	8.64×10^{4}	1.984	448.8	6.46×10^{5}	0.646
ft^3/day	3.28×10^{-7}	1233.5	3.28×10^{-4}	1.16×10^{-5}	1	2.3×10^{-5}	5.19×10^{-3}	7.48	7.48×10^{-6}
ac-ft/day	0.0143	5.451	14.276	0.5042	43,560	1	226.28	3.26×10^{5}	0.3258
gal/min	6.3×10^{-5}	0.00379	0.0631	2.23×10^{-3}	192.5	4.42×10^{-3}	1	1440	1.44×10^{-3}
gal/day	4.3×10^{-8}	3785	4.38×10^{-4}	1.55×10^{-6}	11,337	3.07×10^{-6}	6.94×10^{-4}	1	10^{-6}
mgd	0.0438		43.82	1.55	1.34×10^{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	8.1×10^{-7}	2.64×10^{-7}
m^3	1000	1	61,023	35.31	264.17	8.1×10^{-4}	2.64×10^{-4}
in^3	1.64×10^{-2}	1.64×10^{-5}	1	5.79×10^{-4}	4.33×10^{-3}	1.218×10^{-8}	4.33×10^{-9}
ft^3	28.317	0.02832	1728	1	7.48	2.296×10^{-5}	7.48×10^{6}
gal	3.785	3.78×10^{-3}	231	0.134	1	3.07×10^{-6}	10^{6}
ac-ft	1.23×10^{6}	1233.5	75.3×10^{6}	43,560	3.26×10^{5}	1	0.3260
million gallon	3.785×10^{6}	3785	2.31×10^{8}	1.34×10^{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

LEVEL ABSTRACT

SURVEY OF LAKE LANIER
ORDER 3rd
DATE
9/23/2009

ABSTRACTED BY SCN
ADJUSTED BY SCN
CHECK BY SCN
RUN BY TRD

VERTICAL DATUM NAVD88

STATION	# OF	F OR B	SUM OF ROD READINGS		DIFF OF	ELEVATIONS - STATIC			MEAN		
	TURNS		BS	FS	ELEV	UNADJUSTED	CORRECTION	ADJUSTED	STATIC	REMARKS	
Buford Dam Headwater											
LOOP 1									MEAN F & B		
GC-862						1106.530	0.000	1106.530	1106.530	Elevation Held OPUS DB	G County Brass Disk
	1	B	5.494	4.879	0.615				MEAN F & B		
4				MEAN	0.615	1107.145	0.000	1107.145	1107.144		
	1	B	4.898	4.783	0.115				MEAN F & B		
5				MEAN	0.115	1107.260	-0.001	1107.259	1107.260		
	1	B	4.609	5.424	-0.815				MEAN F & B		
GC-861				MEAN	-0.815	1106.445	-0.001	1106.444	1106.444		G County Brass Disk
	1	B	5.861	6.332	-0.471				MEAN F & B		
DB-A7				MEAN	-0.471	1105.974	-0.001	1105.973	1105.972		COE Brass Disk
	1	B	6.185	7.657	-1.472				MEAN F & B		
DB-B6				MEAN	-1.472	1104.502	-0.001	1104.501	1104.500		COE Brass Disk
	1	B	7.352	5.195	2.157				MEAN F & B		
TBM-1				MEAN	2.157	1106.659	-0.002	1106.657	1106.657		PK at End PS
	1	B	5.551	1.333	4.218				MEAN F & B		
14-554				MEAN	4.218	1110.877	-0.002	1110.875	1110.875		Deep Rod
	1	F	1.184	5.403	-4.219						
TBM-1				MEAN	-4.219	1106.658	-0.002	1106.656			PK at End PS
	1	F	5.075	7.231	-2.156						
DB-B6				MEAN	-2.156	1104.502	-0.003	1104.499			COE Brass Disk
	1	F	7.908	6.437	1.471						
DB-A7				MEAN	1.471	1105.973	-0.003	1105.970			COE Brass Disk
	1	F	6.02	5.546	0.474						
GC-861				MEAN	0.474	1106.447	-0.003	1106.444			G County Brass Disk
	1	F	5.586	4.77	0.816						
5				MEAN	0.816	1107.263	-0.003	1107.260			
	1	F	4.613	4.729	-0.116						
4				MEAN	-0.116	1107.147	-0.004	1107.143			
	1	F	4.759	5.372	-0.613						
GC-862				MEAN	-0.613	1106.534	-0.004	1106.530			G County Brass Disk
	14	Sum Turns									
LOOP 2											
TBM-1						1106.657	0.000	1106.657		Elevation from Loop 1	
	1	F	5.162	2.753	2.409				MEAN F & B		
BPP-1				MEAN	2.409	1109.066	0.000	1109.066	1109.066		Top of silver 2-inch disk located at top of stilling well
	1	F	2.539	2.562	-0.023				MEAN F & B		
RP-2				MEAN	-0.023	1109.043	0.001	1109.043	1109.043		Bottom lip of stilling well notated with arrow. Located approximately 6 inches to left of BPP1
	1	F	2.735	5.122	-2.387						
TBM-1				MEAN	-2.387	1106.656	0.001	1106.657			
	3	Sum Turns									
LOOP 3											
TBM-1						1106.657	0.000	1106.657		Elevation from Loop 2	
	1	F	3.018	12.686	-9.668				MEAN F & B		
1				MEAN	-9.668	1096.989	0.000	1096.988	1096.987		
	1	F	1.196	12.524	-11.328				MEAN F & B		
2				MEAN	-11.328	1085.661	-0.001	1085.660	1085.660		
	1	F	0.543	10.195	-9.652				MEAN F & B		
3				MEAN	-9.652	1076.009	-0.001	1076.007	1076.007		
	1	F	4.213	1.677	2.536				MEAN F & B		
BPP-2				MEAN	2.536	1078.545	-0.002	1078.543	1078.542		COE A-Disk
	1	F	1.752	1.763	-0.011				MEAN F & B		
BPP-3				MEAN	-0.011	1078.534	-0.002	1078.531	1078.531		COE A-Disk
	1	F	1.815	1.873	-0.058				MEAN F & B		
RP-1				MEAN	-0.058	1078.476	-0.003	1078.473	1078.473		Chiseled notch on left upstream (East) guard wall approximately 7 ft. downstream of intake headwall and 6 ft. upstream of old Corps of Engineers staff gage
	1	B	1.959	1.901	0.058						
BPP-3				MEAN	0.058	1078.534	-0.003	1078.531			COE A-Disk
	1	B	1.723	1.713	0.010						
BPP-2				MEAN	0.010	1078.544	-0.003	1078.540			COE A-Disk
	1	B	1.861	4.395	-2.534						
3				MEAN	-2.534	1076.010	-0.004	1076.006			
	1	B	10.15	0.496	9.654						
2				MEAN	9.654	1085.664	-0.004	1085.659			
	1	B	12.478	1.151	11.327						

LEVEL ABSTRACT

SURVEY OF LAKE LANIER
ORDER 3rd
DATE
9/23/2009

ABSTRACTED BY SCN
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RUN BY TRD

VERTICAL DATUM NAVD88

STATION	# OF	F OR B	SUM OF ROD READINGS		DIFF OF	ELEVATIONS - STATIC			MEAN		
	TURNS		BS	FS	ELEV	UNADJUSTED	CORRECTION	ADJUSTED	STATIC	REMARKS	
1				MEAN	11.327	1096.991	-0.005	1096.986			
	1	B	13.171	3.5	9.671						
TBM-1				MEAN	9.671	1106.662	-0.005	1106.657		Elevation from Loop 2	
	12	Sum Turns									
LOOP 4											
DB-B6						1104.499	0.000	1104.499		Elevation from Loop 1	
	1	F	4.641	9.25	-4.609				MEAN F & B		
7				MEAN	-4.609	1099.890	0.000	1099.890	1099.890		Mart at Cconcrete Seam at Fence Line DS Edge
	1	F	0.733	11.092	-10.359				MEAN F & B		
8				MEAN	-10.359	1089.531	0.000	1089.531	1089.531		Mart at Cconcrete Seam at Fence Line DS Edge
	1	F	0.303	13.252	-12.949				MEAN F & B		
TBM-2				MEAN	-12.949	1076.582	0.000	1076.582	1076.582		Top Aluminium Bar at Wall at New Gage
	1	B	12.997	0.047	12.950						
8				MEAN	12.950	1089.532	-0.001	1089.532			Mart at Cconcrete Seam at Fence Line DS Edge
	1	B	11.652	1.293	10.359						
7				MEAN	10.359	1099.891	-0.001	1099.891			Mart at Cconcrete Seam at Fence Line DS Edge
	1	B	10.338	5.729	4.609						
DB-B6				MEAN	4.609	1104.500	-0.001	1104.499		Elevation from Loop 1	
	6	Sum Turns									

STATION	# OF	F OR B	SUM OF ROD READINGS		DIFF OF	ELEVATIONS - STATIC			MEAN		
	TURNS		BS	FS	ELEV	UNADJUSTED	CORRECTION	ADJUSTED	STATIC	REMARKS	
LOOP 5									MEAN F & B		
BPP3						1078.531	0.000	1078.531	1078.531		2" ALUM DISK
	1	F	2.47	2.75	-0.280				MEAN F & B		
T-GAGE				MEAN	-0.280	1078.251	0.000	1078.251	1078.251		TOP GAGE AT 1078.00
	1	B	2.55	2.27	0.280						
BPP-3				MEAN	0.280	1078.531	0.000	1078.531			2" ALUM DISK
	2	Sum Turns									

Buford Dam Tailwater

Lake Lanier Dam Headwater Final Elevations

Point	ELEVATION	ELEVATION	DIFF	DESCRIPTION
	NAVD88	Furnished	NAVD88	
	Feet	NGVD29	NGVD29	
		Feet	Feet	
GC-862	1106.530			G County Brass Disk
4	1107.144			0.000
5	1107.260			0.000
GC-861	1106.444			G County Brass Disk
DB-A7	1105.972			COE Brass Disk
DB-B6	1104.500			COE Brass Disk
TBM-1	1106.657			PK at End PS
14-554	1110.875			Deep Rod
BPP-1	1109.066	1108.832	0.234	Top of silver 2-inch disk located at top of stilling well
RP-2	1109.043	1108.734	0.309	Bottom lip of stilling well notated with arrow. Located approximately 6 inches to left of BPP1
1	1096.987			0.000
2	1085.660			0.000
3	1076.007			0.000
BPP-2	1078.542			COE A-Disk
BPP-3	1078.531			COE A-Disk
RP-1	1078.473	1078.23	0.243	Chiseled notch on left upstream (East) guard wall approximately 7 ft. downstream of intake headwall and 6 ft. upstream of old Corps of Engineers staff gage
7	1099.890			Mart at Cconcrete Seam at Fence Line DS Edge
8	1089.531			Mart at Cconcrete Seam at Fence Line DS Edge
TBM-2	1076.582			Top Aluminium Bar at Wall at New Gage
T-GAGE	1078.251			TOP GAGE AT 1078.00

METHOD	READING	DATE/TIME
VISABLE	1068.98	9/29/09 @ 2:50 PM
ELECTRONIC	1069.01	9/29/2009 14:45

1078.251	TOP OF GAGE ELEVATION (NAVD88)
1078.000	ELEVATION ON EXISTING VISABLE GAGE

STATION	# OF	F OR B	SUM OF ROD READINGS		DIFF OF	ELEVATIONS - STATIC			MEAN		

LEVEL ABSTRACT

SURVEY OF LAKE LANIER
ORDER 3rd
DATE
9/23/2009

ABSTRACTED BY SCN
ADJUSTED BY SCN
CHECK BY SCN
RUN BY TRD

VERTICAL DATUM NAVD88

STATION	# OF	F OR B	SUM OF ROD READINGS		DIFF OF	ELEVATIONS - STATIC			MEAN		
	TURNS		BS	FS	ELEV	UNADJUSTED	CORRECTION	ADJUSTED	STATIC	REMARKS	
	TURNS		BS	FS	ELEV	UNADJUSTED	CORRECTION	ADJUSTED	STATIC	REMARKS	
LOOP 6											
									MEAN F & B		
GPS-2						963.9902	0.000	963.9902	963.990		PK NAIL
	1	F	5.702	5.229	0.473				MEAN F & B		
GPS-1				MEAN	0.473	964.463	-0.001	964.463	964.463		PK NAIL
	1	F	5.598	7.007	-1.409				MEAN F & B		
TP-1				MEAN	-1.409	963.054	-0.001	963.053	963.055		PK NAIL
	1	F	0.505	8.993	-8.488				MEAN F & B		
TP-2				MEAN	-8.488	954.566	-0.002	954.565	954.566		PK NAIL
	1	F	5.417	5.462	-0.045				MEAN F & B		
TP-3				MEAN	-0.045	954.521	-0.002	954.519	954.518		MK ON FLOOR
	1	F	4.455	13.07	-8.615				MEAN F & B		
TP-4				MEAN	-8.615	945.906	-0.003	945.904	945.903		MK ON STEP
	1	F	1.069	5.428	-4.359				MEAN F & B		
TP-5				MEAN	-4.359	941.547	-0.003	941.544	941.544		MK ON FLOOR
	1	F	5.45	5.447	0.003				MEAN F & B		
TP-6				MEAN	0.003	941.550	-0.004	941.547	941.547		MK ON FLOOR
	1	F	5.23	5.253	-0.023				MEAN F & B		
BPP-7				MEAN	-0.023	941.527	-0.004	941.523	941.523		2" ALUM DISK
	1	B	5.328	5.304	0.024						
TP-6				MEAN	0.024	941.551	-0.005	941.547			MK ON FLOOR
	1	B	5.44	5.443	-0.003						
TP-5				MEAN	-0.003	941.548	-0.005	941.543			MK ON FLOOR
	1	B	5.445	1.085	4.360						
TP-4				MEAN	4.360	945.908	-0.006	945.903			MK ON STEP
	1	B	13.055	4.44	8.615						
TP-3				MEAN	8.615	954.523	-0.006	954.517			MK ON FLOOR
	1	B	4.349	4.299	0.050						
TP-2				MEAN	0.050	954.573	-0.007	954.567			PK NAIL
	1	B	9.059	0.569	8.490						
TP-1				MEAN	8.490	963.063	-0.007	963.056			PK NAIL
	1	B	6.819	5.411	1.408						
GPS-1				MEAN	1.408	964.471	-0.008	964.464			PK NAIL
	1	B	5.15	5.623	-0.473						
GPS-2				MEAN	-0.473	963.998	-0.008	963.9902			PK NAIL
	16	Sum Turns									
LOOP 7									MEAN F & B		
BPP-7						941.5232	0.000	941.523	941.523		2" COE ALUM DISK
	1	F	4.945	4.929	0.016				MEAN F & B		
BPP-6				MEAN	0.016	941.539	0.001	941.540	941.540		2" COE ALUM DISK
	1	B	5.006	5.023	-0.017						
BPP-7				MEAN	-0.017	941.522	0.001	941.5232			2" COE ALUM DISK
	2	Sum Turns									
LOOP 8									MEAN F & B		
BPP-7						941.5232	0.000	941.5232	941.523		2" COE ALUM DISK
	1	F	2.75	12.857	-10.107				MEAN F & B		
TOP-G				MEAN	-10.107	931.416	-0.001	931.415	931.415		SAW CUT TOP GAGE
	1	B	12.994	2.885	10.109						
BPP-7				MEAN	10.109	941.525	-0.002	941.5232			2" COE ALUM DISK
	2	Sum Turns									
LOOP 9									MEAN F & B		
TOP-G						931.4152	0.000	931.4152	931.415		Top Gage
	1	F	3.482	2.204	1.278				MEAN F & B		
TBM-3				MEAN	1.278	932.693	0.000	932.693	932.693		BOLT ON METAL PLATE
	1	F	2.222	1.816	0.406				MEAN F & B		
TBM-4				MEAN	0.406	933.099	0.000	933.099	933.099		CUT ON METAL PLATE
	1	B	1.662	2.068	-0.406						
TBM-3				MEAN	-0.406	932.693	-0.001	932.692			BOLT ON METAL PLATE
	1	B	1.953	3.23	-1.277						
TOP-G				MEAN	-1.277	931.416	-0.001	931.4152			Top Gage
	4	Sum Turns									
LOOP 10											
BPP-6						941.540	0.000	941.540			2" ALUM DISK
	1	F	4.56	14.67	-10.110				MEAN F & B		
T GAGE				MEAN	-10.110	931.430	-0.005	931.425	931.425		TOP GAGE AT SAW MKS , APPROX 0.01 ABOVE 931.00

LEVEL ABSTRACT

SURVEY OF LAKE LANIER
ORDER 3rd
DATE
9/23/2009

ABSTRACTED BY SCN
ADJUSTED BY SCN
CHECK BY SCN
RUN BY TRD

VERTICAL DATUM NAVD88

STATION	# OF	F OR B	SUM OF ROD READINGS		DIFF OF	ELEVATIONS - STATIC			MEAN		
	TURNS		BS	FS	ELEV	UNADJUSTED	CORRECTION	ADJUSTED	STATIC	REMARKS	
	1	B	14.97	4.85	10.120						
BPP-6				MEAN	10.120	941.560	-0.010	941.540			2" ALUM DISK
	2	Sum Turns									

Lake Lanier Dam Headwater Final Elevations

Point	ELEVATION	ELEVATION	DIFF	DESCRIPTION
	NAVD88	Furnished	NAVD88	
	Feet	NGVD29	NGVD29	
		Feet	Feet	
GPS-2	963.990			PK NAIL
GPS-1	964.463			PK NAIL
TP-1	963.055			PK NAIL
TP-2	954.566			PK NAIL
TP-3	954.518			MK ON FLOOR
TP-4	945.903			MK ON STEP
TP-5	941.544			MK ON FLOOR
TP-6	941.547			MK ON FLOOR
BPP-7	941.523	941.202	0.321	2" COE ALUM DISK
BPP-6	941.540	941.219	0.321	2" COE ALUM DISK
TOP-G	931.415	931.108	0.307	SAW CUT TOP GAGE
TBM-3	932.693			BOLT ON METAL PLATE
TBM-4	933.099			CUT ON METAL PLATE
T GAGE	931.425			TOP GAGE AT SAW MKS , APPROX 0.01 ABOVE 931.00

METHOD	READING	DATE/TIME
VISABLE	912.22	9/29/09 @ 3:37 PM
ELECTRONIC	912.24	9/29/09 @ 3:30 PM

931.425	TOP OF GAGE ELEVATION (NAVD88)
931.000	ELEVATION ON EXISTING VISABLE GAGE (GAGE IS WARPED)

Note: The level abstract details a survey loop that was run to all major Benchmarks (BM) and Reference Marks (RP) at the Buford Dam project site in NAVD88 and where available, was referenced back to NGVD29. The 6 locations where adjustments from NGVD29 to NAVD88 are provided vary from +0.23 to +0.32 feet. To convert historic reservoir levels from NGVD29 to NAVD88, a +0.23 adjustment from the stilling well RP BPP-1 is used.

SURVEY DATASHEET (Version 1.0)

PID: BBBM57
Designation: GC 862
Stamping: 1994-862
Stability: Monument will probably hold position well
Setting: Object surrounded by mass of concrete
Description: THE MARK IS LOCATED NEAR THE NORTH END OF BUFORD DAM ON LAKE SIDNEY LANIER

LOCATED ON THE EAST SIDE OF BUFORD DAM ROAD, THE MARK IS 3.8' SW OF A GUARD RAIL, 4' NE OF THE E EDGE OF BUFORD DAM ROAD, 33' NE OF A LIGHT POLE, AND 3.2' SW OF A WITNESS POST.

Observed: 2009-09-29T14:15:00Z
Source: OPUS - page5 0909.08

Close-up View

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

LAT:	34° 9' 32.97982"	± 0.026	m
LON:	-84° 4' 22.70903"	± 0.012	m
ELL HT:	307.694	± 0.035	m
X:	545595.641	± 0.010	m
Y:	-5255375.152	± 0.034	m
Z:	3561242.055	± 0.033	m
ORTHO HT:	337.271	± 0.055	m

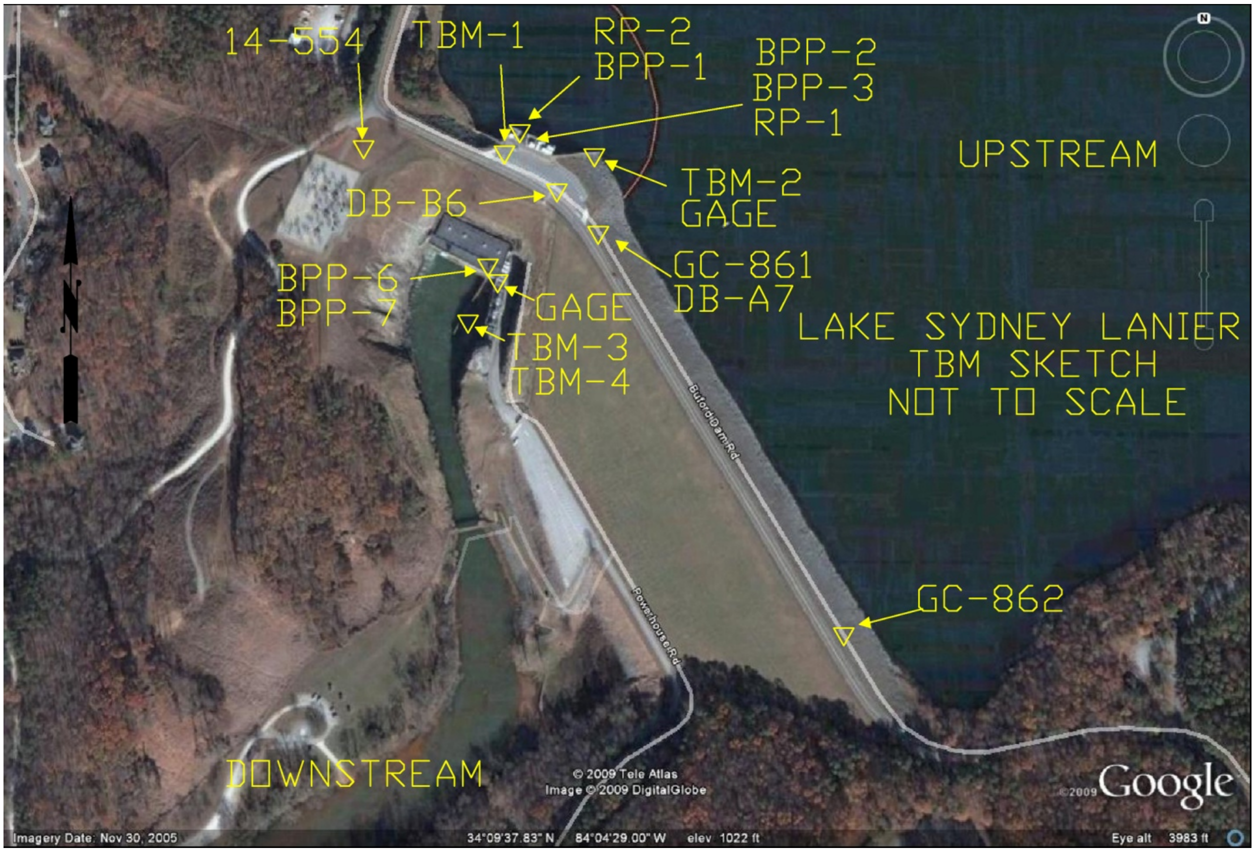
	UTM 16	**SPC** 1002(GA W)
NORTHING:	3783675.852m	461160.643m
EASTING:	769842.963m	708638.670m
CONVERGENCE:	1.64449940°	0.05260747°
POINT SCALE:	1.00049768	0.99990092
COMBINED FACTOR:	1.00044936	0.99985262

CONTRIBUTED BY

waller
Lowe Engineers, LLC

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.



Buford Dam and Lake Sidney Lanier

EXHIBIT C

HIGH WATER ACTION PLAN

Buford Dam and Lake Sidney Lanier

High Water Action Plan

The following action will be taken by project staff at the various lake pool levels listed below.

1. LAKE LEVEL 1073 - 1074 NGVD29

a. **CAMPGROUNDS:** Inspect all open campgrounds for safety hazards. Flag off dangerous campsites and block off roadways to sites that are flooded.

b. **DAY USE PARKS:** Flag off entrances to the walking path around West Bank Park. Close boat ramp areas at Toto Creek, Nix Bridge and Thompson Creek Parks.

2. LAKE LEVEL 1074 - 1075 NGVD29

a. **CAMPGROUNDS:** Inspect all open campgrounds for safety hazards. Flag off dangerous campsites and block off roadways to sites that are flooded. Post "Beach Area Closed" signs at the designated swimming areas in the campgrounds. Close the boat ramp area at Old Federal Campground.

b. **DAY USE PARKS:** Post "Beach Area Closed" signs at the designated swimming areas within the following day use areas: Van Pugh North, Old Federal, Duckett Mill, Little Hall, Bolding Mill, Toto Creek, Keith's Bridge, Burton Mill and West Bank. Close and post gate to beach at Buford Dam Park.

Close the boat ramp areas at Van Pugh South, Little River, Thompson Bridge, Bolding Mill, Little Hall, Keith Bridge and Two Mile.

Close the following parks: Sardis Creek, Little Ridge, Lula, Long Hollow, Simpson and Robinson.

c. **LEASED AREAS:** Contact Hall County Recreation Department, 770-535-8267, about Clarks Bridge boat ramp area.

Contact Hall County Public Works Road Maintenance, Stacey Caudell 770/531-6824 or Emergency Dispatch 770/531-6768 after hours, about Belton Bridge Road for possible flooding.

Contact Lumpkin County Parks and Recreation, 706/864-3622, about Lumpkin County boat ramp area and Auroria.

Contact Forsyth County Parks and Recreation, 770/781-2215, about Young Deer, Charleston, Six Mile and Shady Grove boat ramp areas.

Contact Dawson County Parks and Recreation, 706/344-3600, about War Hill boat ramp area.

Contact City of Cumming, 770/781-2010, about Mary Alice boat ramp area.

Contact Lake Lanier Islands, 770/932-7250, about Big Creek and Shoal Creek boat ramp areas.

3. LAKE LEVEL 1075 - 1076 NGVD29

a. **CAMPGROUNDS:** Inspect all open campgrounds for safety hazards. Flag off dangerous campsites and block off roadways to sites that are flooded. Close the boat ramp areas at Bald Ridge and Sawnee Campgrounds.

b. **DAY USE PARKS:** Close the boat ramp areas at Old Federal, Mountain View, Bolding Mill and Tidwell. Close the following parks completely: Balus Creek, Little River, Thompson Bridge, Thompson Creek and Keith's Bridge.

4. LAKE LEVEL 1076 NGVD29 AND ABOVE

Project Management will determine what actions will be taken at the project if the lake level exceeds above 1076.

5. DAM MONITORING

Additional monitoring may be required of the main dam and saddle dikes at higher than full lake levels. Monitoring efforts will be coordinated according to the direction of the Chief, EN-GG.

EXHIBIT D

STANDING INSTRUCTIONS TO THE DAMTENDERS FOR WATER CONTROL

STANDING INSTRUCTIONS TO THE DAMTENDER

FOR WATER CONTROL

BUFORD DAM AND LAKE SIDNEY LANIER

1. BACKGROUND AND RESPONSIBILITIES

a. General Information. These Standing Instructions to the Project Operator for Water Control are written in compliance with Paragraph 9-2 of EM-1110-2-3600 (Engineering and Design, *Management of Water Control Systems*, 30 November 1987) and with ER-1110-2-240 (Engineering and Design, *Water Control Management*, 30 May 2016). A copy of these Standing Instructions must be kept on hand at the project site at all times. Any deviation from the Standing Instructions will require approval of the District Commander.

(1) **Project Purposes**. The Buford Project is operated for flood risk management, navigation, hydropower, recreation, fish and wildlife conservation, water quality and water supply. Water Control actions are in support of these project purposes and for purposes of the ACF River System.

(2) **Chain of Command**. The Project Operator is responsible to the Water Control Manager for all water control actions.

(3) **Structure**. The Buford Dam is located on the Chattahoochee River at river mile 348.3 approximately 50 miles northeast of Atlanta, Georgia. The dam and Lake Sidney Lanier are located within Gwinnett, Forsyth, Hall, Dawson, and Lumpkin Counties. The drainage area above Buford Dam is approximately 1,034 square miles, with 85 percent of the drainage area deriving from the Chattahoochee and Chestatee Rivers.

(4) **Operation and Maintenance (O&M)**. All O&M activities are the responsibility of the U.S. Army Corps of Engineers under the supervision of the Mobile District, Operations Division, and the direction of the Buford Dam (Lake Sidney Lanier) Operations Project Manager.

b. Role of the Project Operator. The term Project Operator refers to both the Carters powerhouse operator and to the Buford powerhouse personnel. Operation of the hydropower units and data reporting is the responsibility of the Carters powerhouse operator. Operation of the sluice gate is the responsibility of the Buford powerhouse personnel.

(1) **Normal Conditions (dependent on day-to-day instruction)**. The Water Control Manager will coordinate the daily water control actions regarding hydropower releases with the Southeastern Power Administration (SEPA), and will notify the Project Operator of these changes. The Project Operator will then receive instructions from SEPA via generation schedule updates. This communication will be increased to an hourly basis if the need develops. Daily generation schedules and updates are provided to the Mobile District. The Water Control Manager will coordinate the daily water control actions regarding sluice releases with the Buford powerhouse personnel and will provide the gate step information to the Carters powerhouse operator.

(2) **Emergency Conditions (flood, drought, or special operations)**. During emergency conditions, the Project Operator will be instructed by the Water Control Manager on a daily or hourly basis for all water control actions. In the event that communications with Mobile District are cut off, the Project Operator will continue to follow the Water Control Plan and contact the

Mobile District as soon as communication is reestablished. In the event that flooding occurs and communications with Mobile District are cut off, the Project Operator will use the following instructions as a guide until communications with the Mobile District are restored. If communication is lost after some instructions are issued, follow those instructions as long as they are applicable.

I. Pool elevations below 1,085 feet NGVD29

   a. Reduce to minimum releases with the small hydropower unit if any one of the four conditions below is met. The information below can be obtained by going to the USGS website http://waterdata.usgs.gov/ga/nwis/current?type=flow and by contacting the Southeast River Forecast Center at 770-486-0028.

      1. The USGS gage #02335000, Chattahoochee River near Norcross, has exceeded or is forecast to exceed the action stage of 10 feet.
      2. The USGS gage #02336000, Chattahoochee River above Roswell, has exceeded or is forecast to exceed the action stage of 8 feet.
      3. The USGS gage #02335450, Chattahoochee River at Atlanta, has exceeded or is forecast to exceed the action stage of 12 feet.
      4. More than 3 inches of rain has fallen or is forecast to fall from Buford dam to Atlanta, Georgia within 24 hours.

   b. In the event that no forecast or observed data at the USGS gages can be obtained, reduce releases to near 600 cfs through the small hydropower unit and cancel any planned peaking hydropower operation using the two main units until such time as contact with the Water Management Section is restored.

II. Pool elevations above 1,085 feet NGVD29

   a. Pool Crest. If the pool appears to be cresting within one foot above elevation 1,085 feet NGVD29 and no rain is forecast within the next 48 hours, maintain minimum release of near 600 cfs through the small hydropower unit until such time as contact with the Water Management Section is restored. If the pool has crested but more rain is forecasted within the next 24 hours, begin releasing the maximum amount possible from the three hydropower units and the sluice gates.

   b. Rising Pool. If the pool exceeds elevation 1,085 feet NGVD29 and continues to rise, begin releasing the maximum amount of water capable from the three hydropower units and the sluices. Continue release until the pool begins to decline; then follow the Pool Falling directions below.

   c. Pool Falling. Once the pool has crested and begins falling, maintain the current release until the pool recedes to elevation 1,075 feet NGVD29 or until such time as contact is restored with the Water Management Section. Then, normal hydropower operations may resume.

2. DATA COLLECTION AND REPORTING

a. General. Report hourly the pool elevation, tailwater elevation, turbine discharge, spillway discharge, capacity, and general project status on the computer and have it accessible to the Water Control Manager by computer network.

b. <u>Daily Reporting</u>. The Project Operator will record the following items daily and will report them by 6:30 AM (0630) Central Time to the Mobile District either by computer network, by fax machine (251-694-4058), or by telephone conversation (251-690-2737):

(1) Pool elevation in feet above mean sea level at 6 am and 12 midnight (0600 and 2400) for the period since the last report.

(2) Precipitation in hundredths of an inch.

(3) Average plant discharge in cubic feet per second for the first 4 hours of each day and for the 24 hours of the previous day.

(4) Average turbine discharge for the 24 hours of the previous day.

(5) Inflow to the lake in cubic feet per second for the first 4 hours of each day and for the 24 hours of the previous day.

(6) Current day's generation schedule and previous day's actual generation in megawatt-hours. Include the schedule for the current day's generation.

(7) Total current generating capacity of the plant in megawatts.

c. <u>Gage Verification</u>. In accordance with the USACE Guidance Memorandum for Critical Gage Instrumentation dated 15-Dec 2006, the Buford powerhouse personnel will perform gage reading verifications by providing the pool level automated instrumentation gage reading and staff gage readings. In the event that the automated gage equipment malfunctions or if the difference in stage readings is greater than 0.1 ft, the Project Operator will report readings from the staff gage until the automated gage is rectified.

d. <u>Regional Hydro-meteorological Conditions</u>. The Project Operator will be informed by the Water Control Manager of any regional hydro-meteorological conditions that may impact water control actions.

3. WATER CONTROL ACTION AND REPORTING

a. <u>Normal Conditions</u>. During normal conditions, all releases will be made through the turbine units. The Project Operator will follow the Buford Dam and Lake Sidney Lanier Water Control Manual for normal water control actions and will report directly to the Water Control Manager.

b. <u>Emergency Conditions</u>. During high flows, the Project Operator will follow the instructions from the Water Control Manager and SEPA generation schedule updates regarding the suspension of releases during flood events and for resuming releases. If needed, the Project Operator will follow the instructions for sluice gate settings to achieve the desired release rate.

c. <u>Inquiries</u>. All significant inquiries received by the Project Operator from citizens, constituents, or interest groups regarding water control procedures or actions must be referred directly to the Water Control Manager.

d. <u>Water Control Problems</u>. The Project Operator must immediately notify the Water Control Manager, by the most rapid means available, in the event that an operational malfunction, erosion, or other incident occurs that could impact project integrity in general or water control capability in particular.

e. <u>Potential Discharge over the Emergency Spillway.</u> In the event that it becomes possible that the lake will reach elevation 1,085 feet NGVD29 and begin discharging over the emergency spillway at Buford, the Project Operator should immediately notify the Operations Project Manager at the Buford Project Office as well as the Water Management Section. The Operations Project Manager will then notify the local emergency management offices of the situation. It is the responsibility of the local emergency management authorities to contact residents that could be affected by the discharge. The Water Management Section should notify the Mobile District Chief of Engineering and Operations Divisions as well as the Hydraulics and Hydrology Branch Chief for situational awareness. The District Water Management staff should also notify the CESAD Water Management staff as soon as possible.

EXHIBIT E

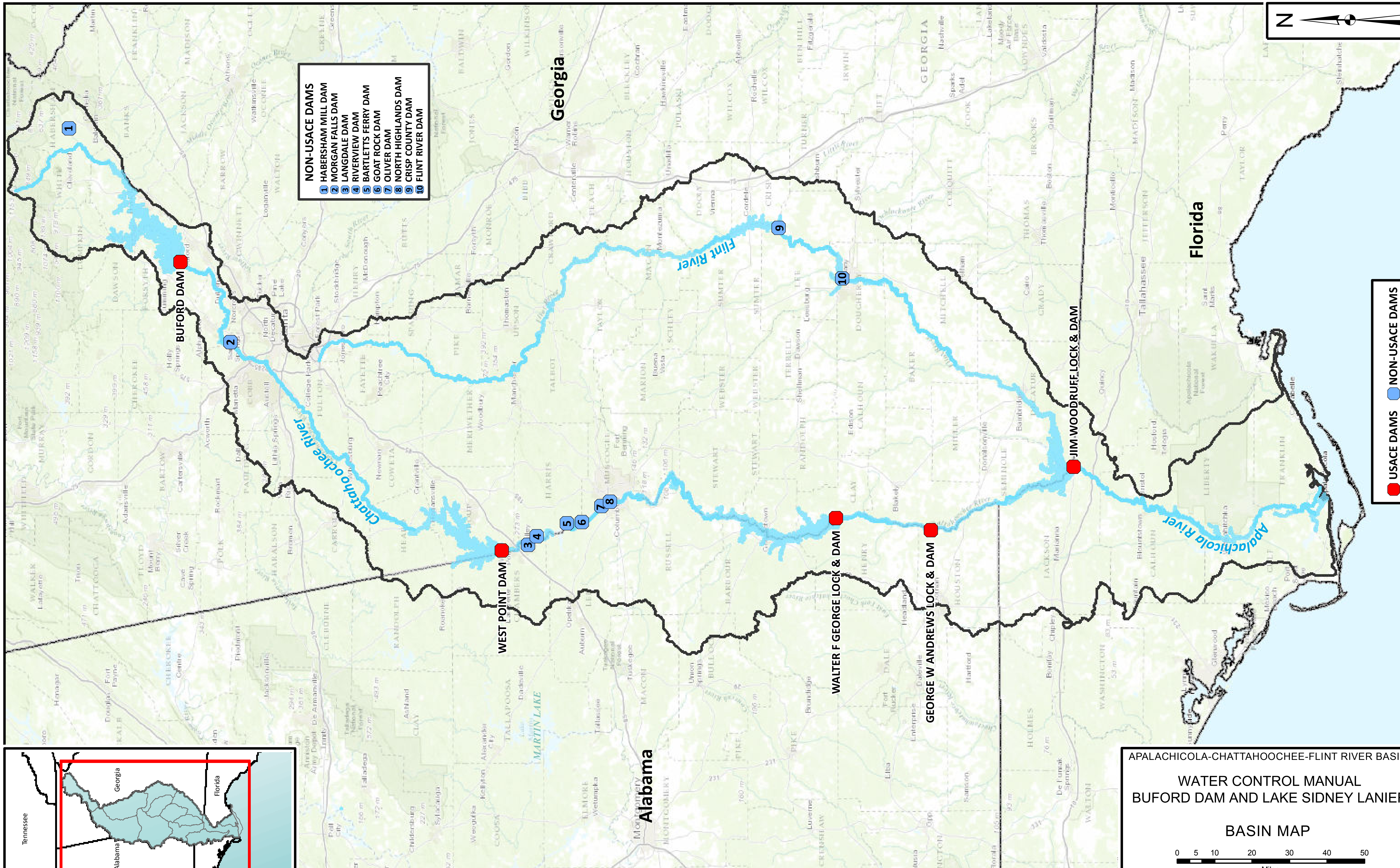
DROUGHT CONTINGENCY PLAN

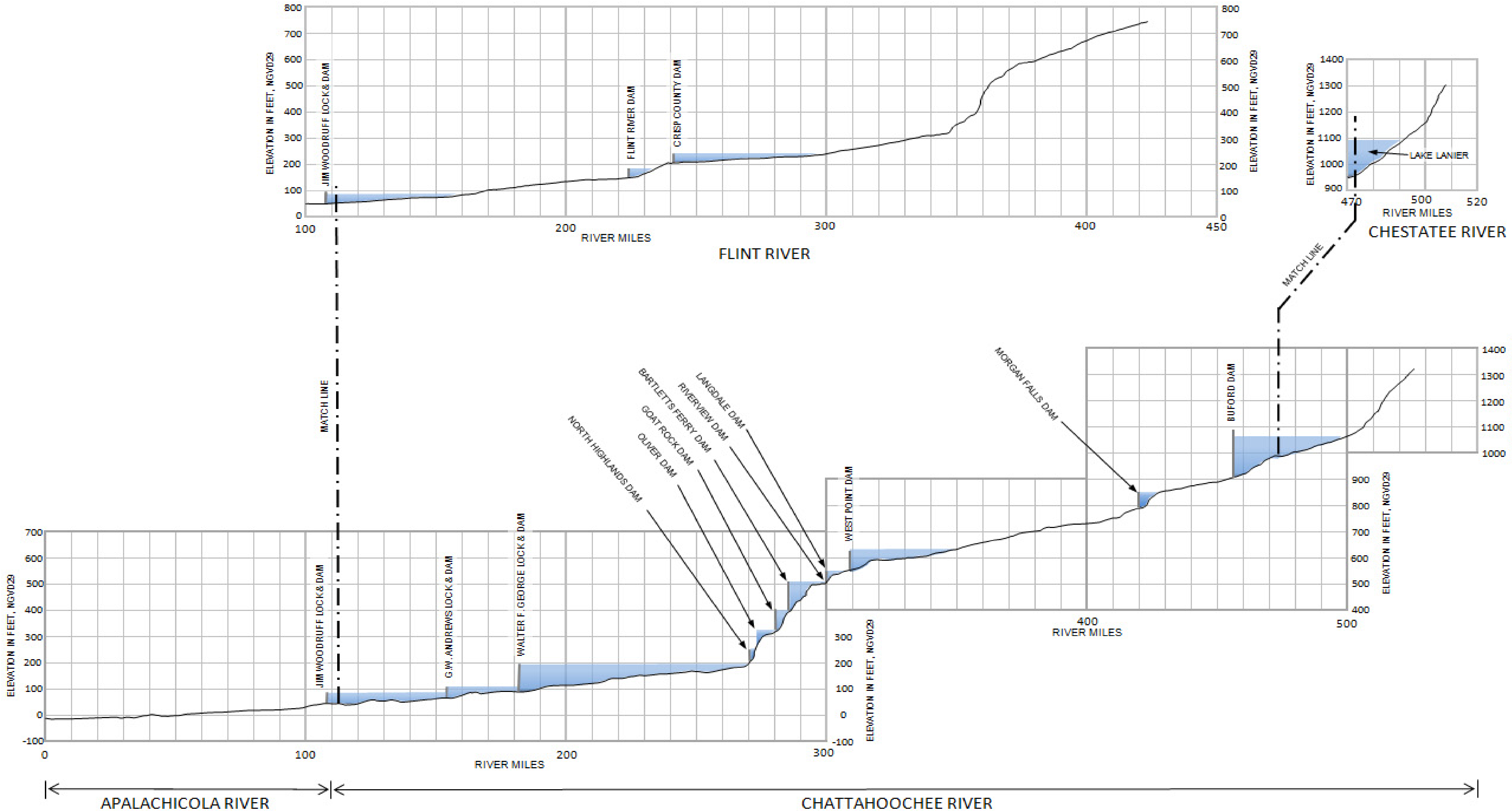
(See Master Manual for draft DCP. Will be added to each appendix before final printing)

PLATES

CORPS OF ENGINEERS

U.S. ARMY

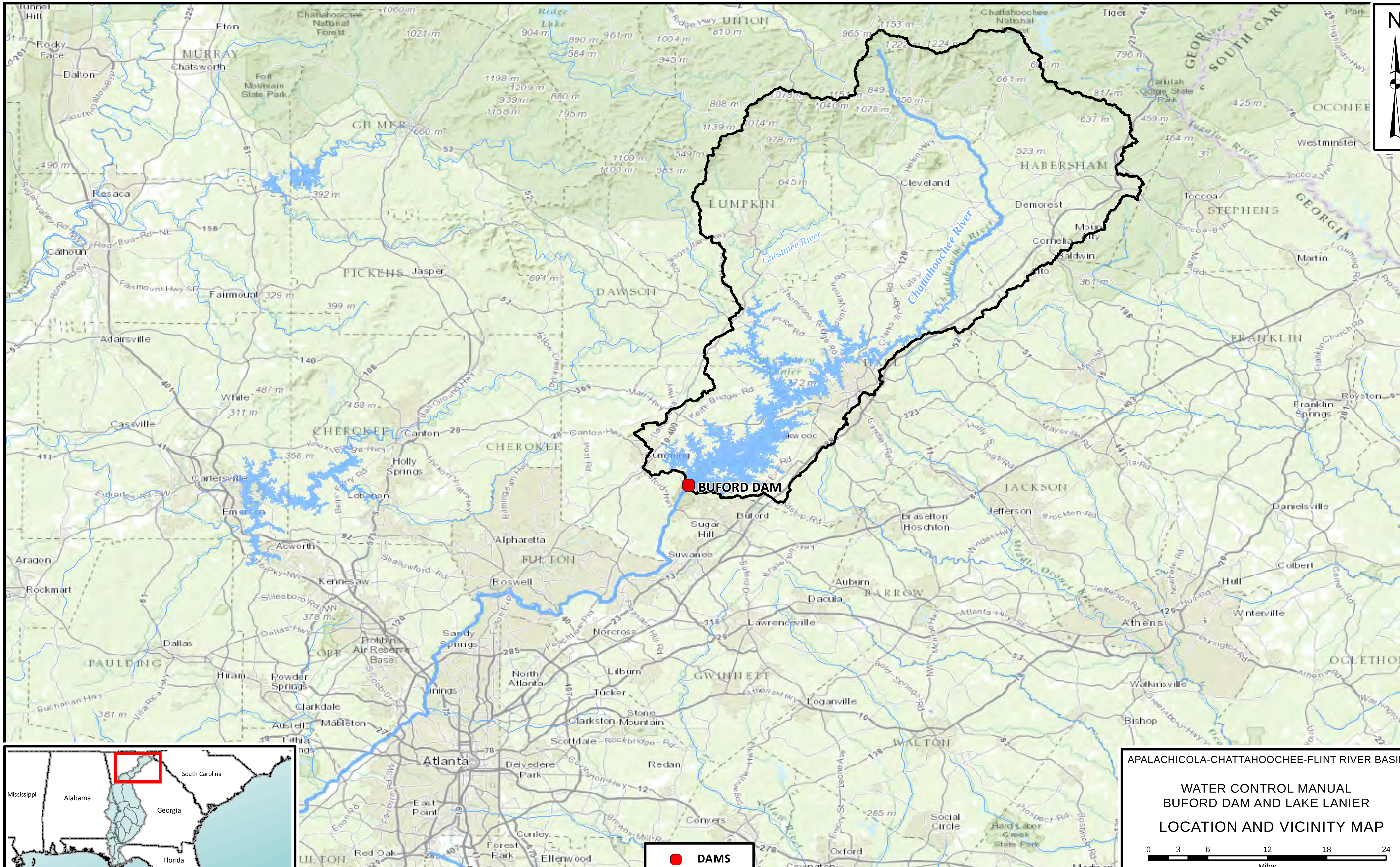




APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

RIVER PROFILE AND RESERVOIR DEVELOPMENT



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE LANIER

LOCATION AND VICINITY MAP

0 3 6 12 18 24
Miles

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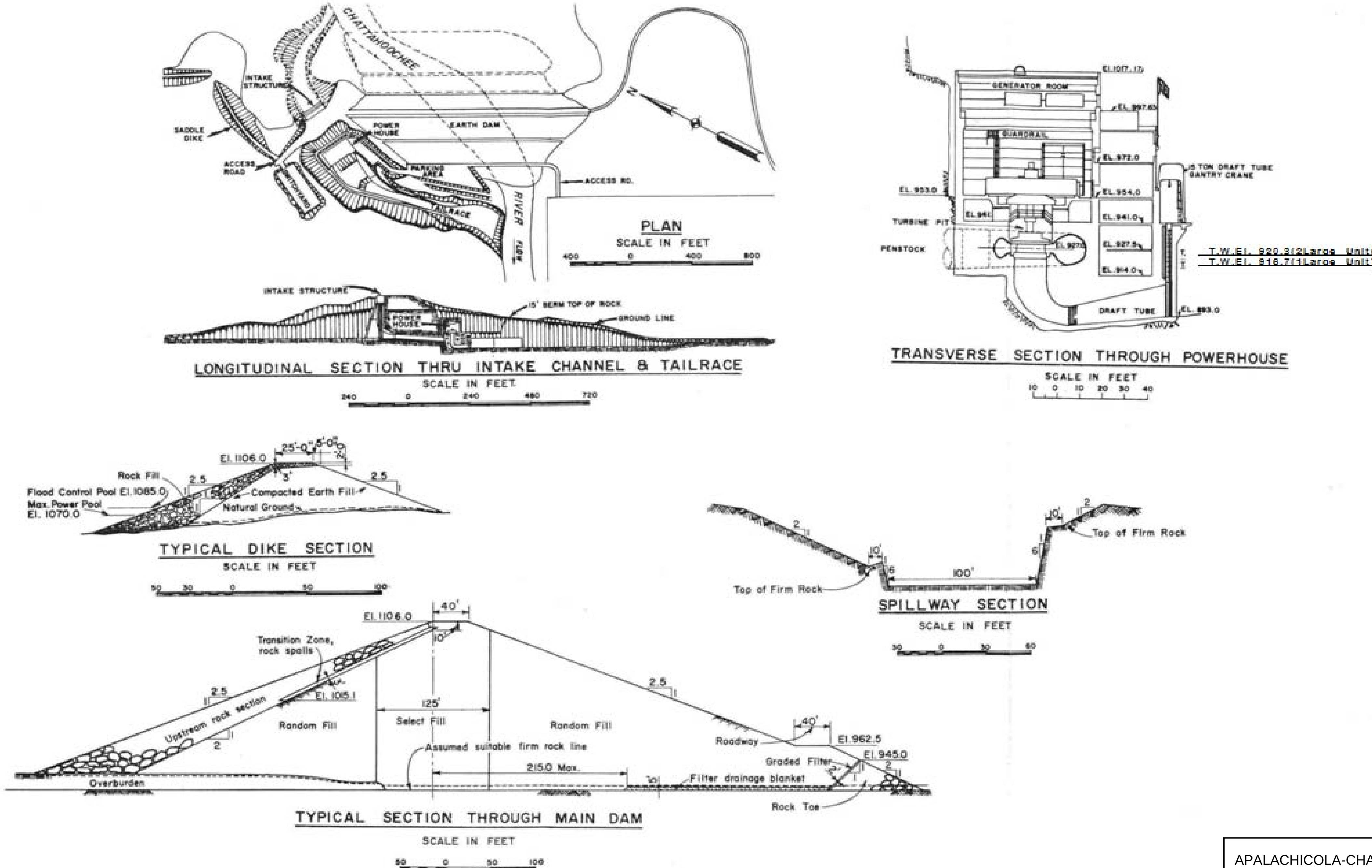
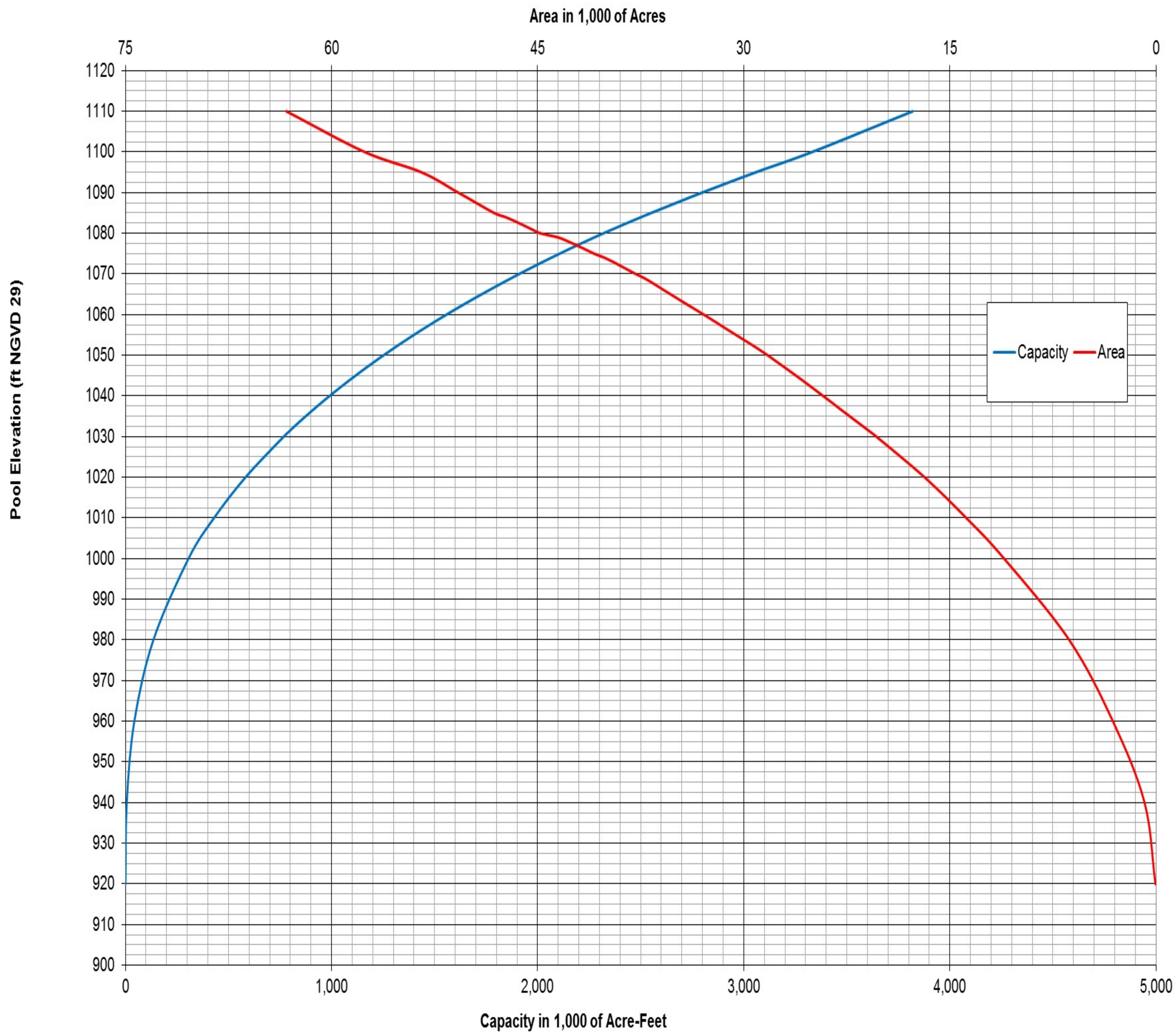


APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

PLAN AND SECTION



AREA CAPACITY TABLE

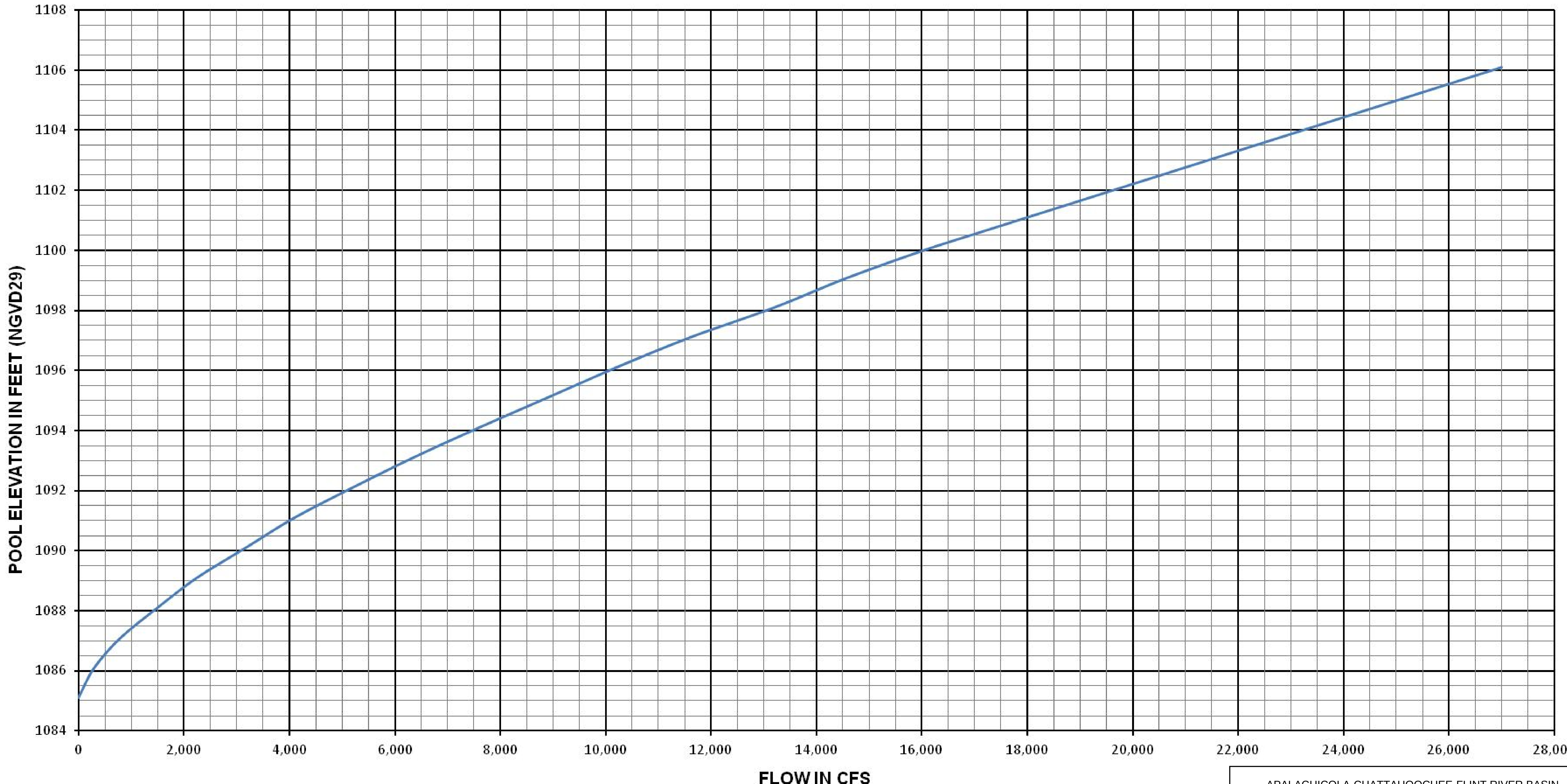
Pool Elevation feet NGVD	Total Area Acres	Total Storage Acre-Feet		Pool Elevation feet NGVD	Total Area Acres	Total Storage Acre-Feet
920	42	95		1057	31,509	1,461,162
940	831	6,256		1058	31,969	1,492,878
960	3,134	43,107		1059	32,436	1,525,056
980	6,316	135,503		1060	32,914	1,557,706
1000	11,052	305,933		1061	33,397	1,590,836
1010	13,805	429,804		1062	33,883	1,624,451
1020	16,842	582,456		1063	34,370	1,658,555
1030	20,352	767,841		1064	34,853	1,693,147
1031	20,728	788,353		1065	35,332	1,728,222
1032	21,119	809,245		1066	35,806	1,763,777
1033	21,509	830,529		1067	36,276	1,799,806
1034	21,897	852,203		1068	36,753	1,836,307
1035	22,293	874,268		1069	37,257	1,873,292
1036	22,681	896,728		1070	37,871	1,910,800
1037	23,068	919,575		1071	38,425	1,948,913
1038	23,449	942,809		1072	38,974	1,987,580
1039	23,833	966,424		1073	39,533	2,026,797
1040	24,223	990,425		1074	40,148	2,066,587
1041	24,617	1,014,817		1075	40,896	2,107,015
1042	25,006	1,039,602		1076	41,514	2,148,182
1043	25,399	1,064,778		1077	42,138	2,189,968
1044	25,795	1,090,348		1078	42,785	2,232,382
1045	26,200	1,116,316		1079	43,536	2,275,460
1046	26,613	1,142,692		1080	44,794	2,319,345
1047	27,019	1,169,481		1081	45,440	2,364,423
1048	27,433	1,196,678		1082	46,057	2,410,136
1049	27,850	1,224,294		1083	46,678	2,456,466
1050	28,262	1,252,328		1084	47,352	2,503,423
1051	28,698	1,280,779		1085	48,176	2,551,064
1052	29,149	1,309,672		1090	50,783	2,798,297
1053	29,616	1,339,020		1095	53,459	3,058,485
1054	30,094	1,368,838		1100	57,601	3,332,548
1055	30,569	1,399,137		1110	63,300	3,820,000
1056	31,043	1,429,913				

APALACHICOLA-CHATTAHOOCHEE-FLINT BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

AREA-CAPACITY CURVES
AND TABLE

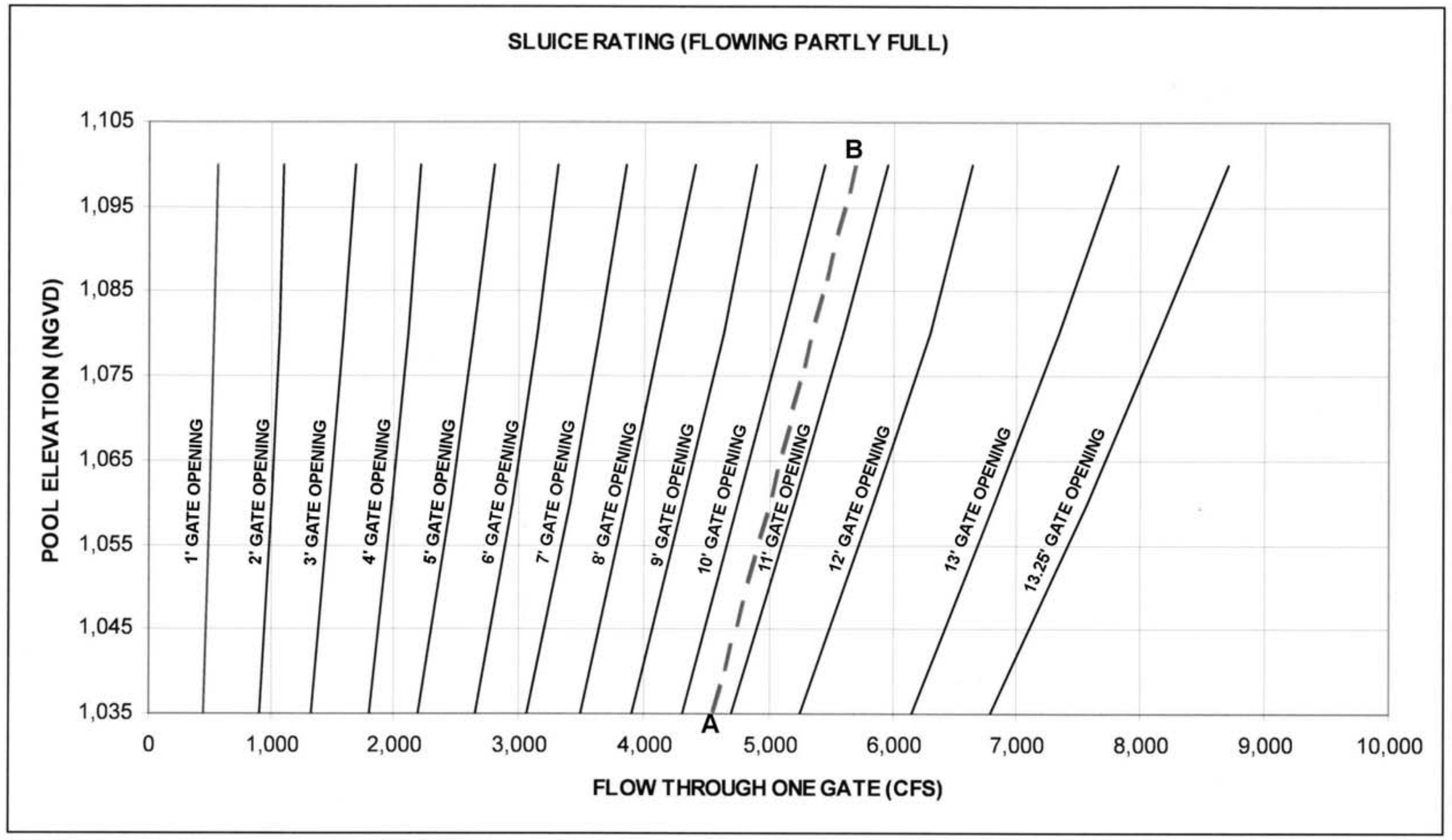
SPILLWAY RATING CURVE

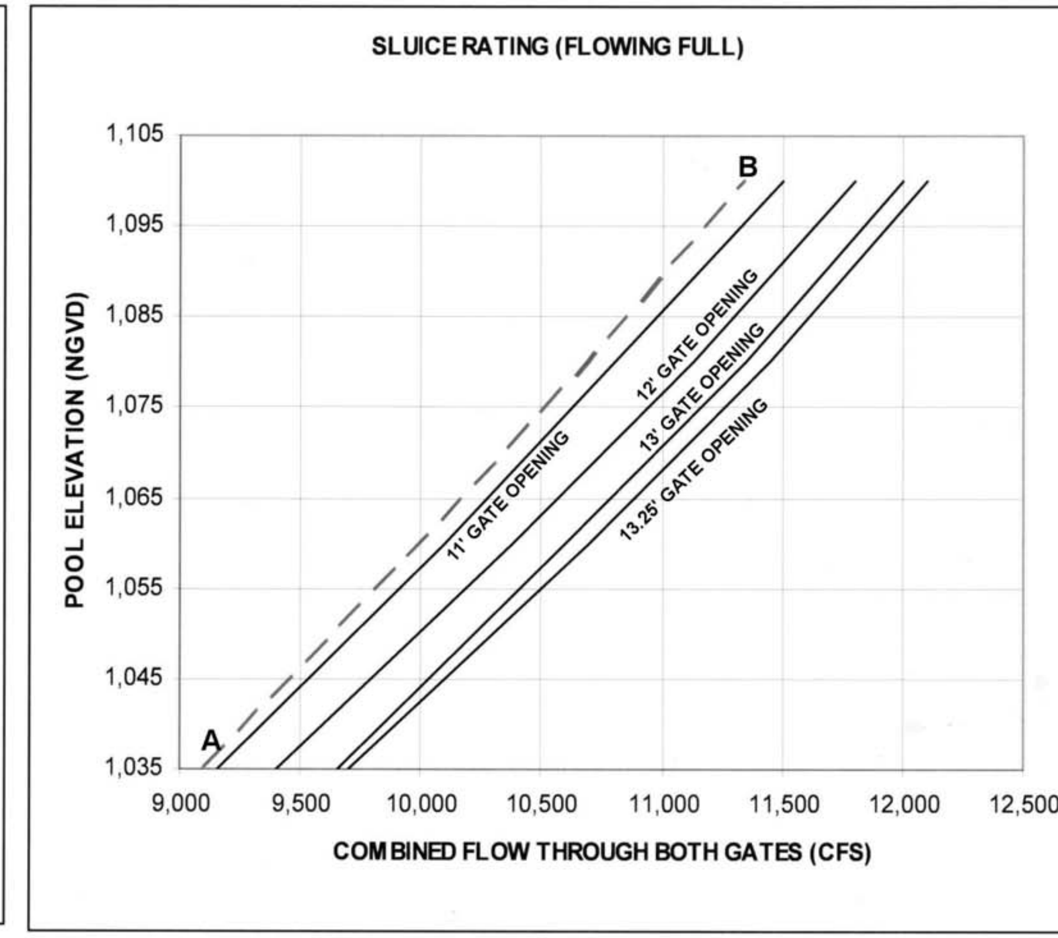


APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

SPILLWAY RATING CURVE





NOTES:

Sluice flowing partly full: For gate openings equal to or less than line AB, sluice will flow partly full. Total discharge equals the sum of discharges through two gates as determined from curves left of line AB.

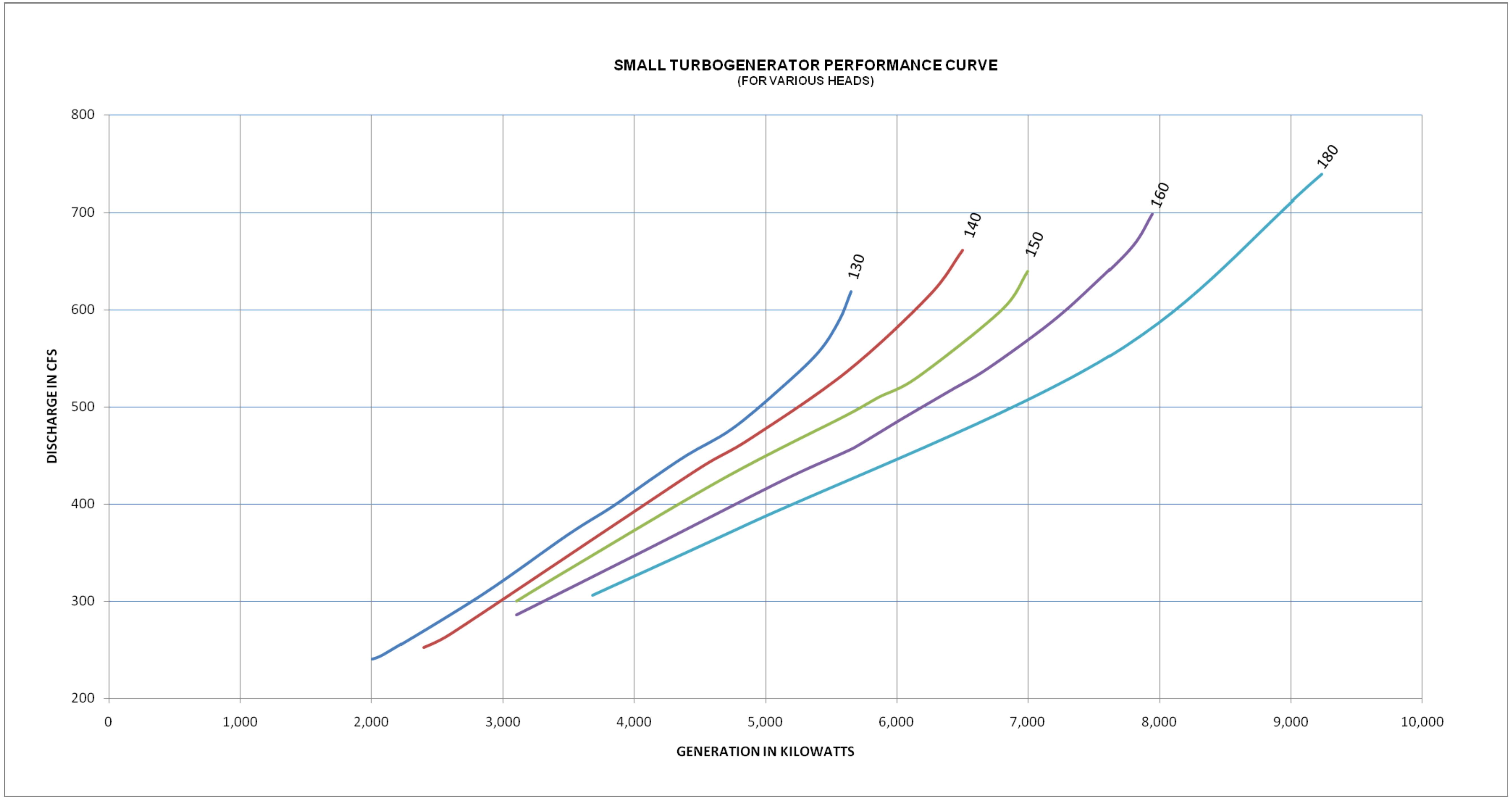
Unstable flow: For gate openings between line AB and a 12-foot opening, the sluice is subject to incomplete priming with intermittent admission of air through vents and pulsating flow through sluice making the discharge difficult to determine. Operation in this zone should be avoided.

Sluice flowing full: When both gates are opened 12 feet or more, the sluice will flow full (no air through vents). Discharges can be determined from curves labeled “Sluice Rating flowing full,” which are valid for equal openings of the gates only. (Operator should check air vents to verify priming before using these curves.)

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

SLUICE RATING CURVES

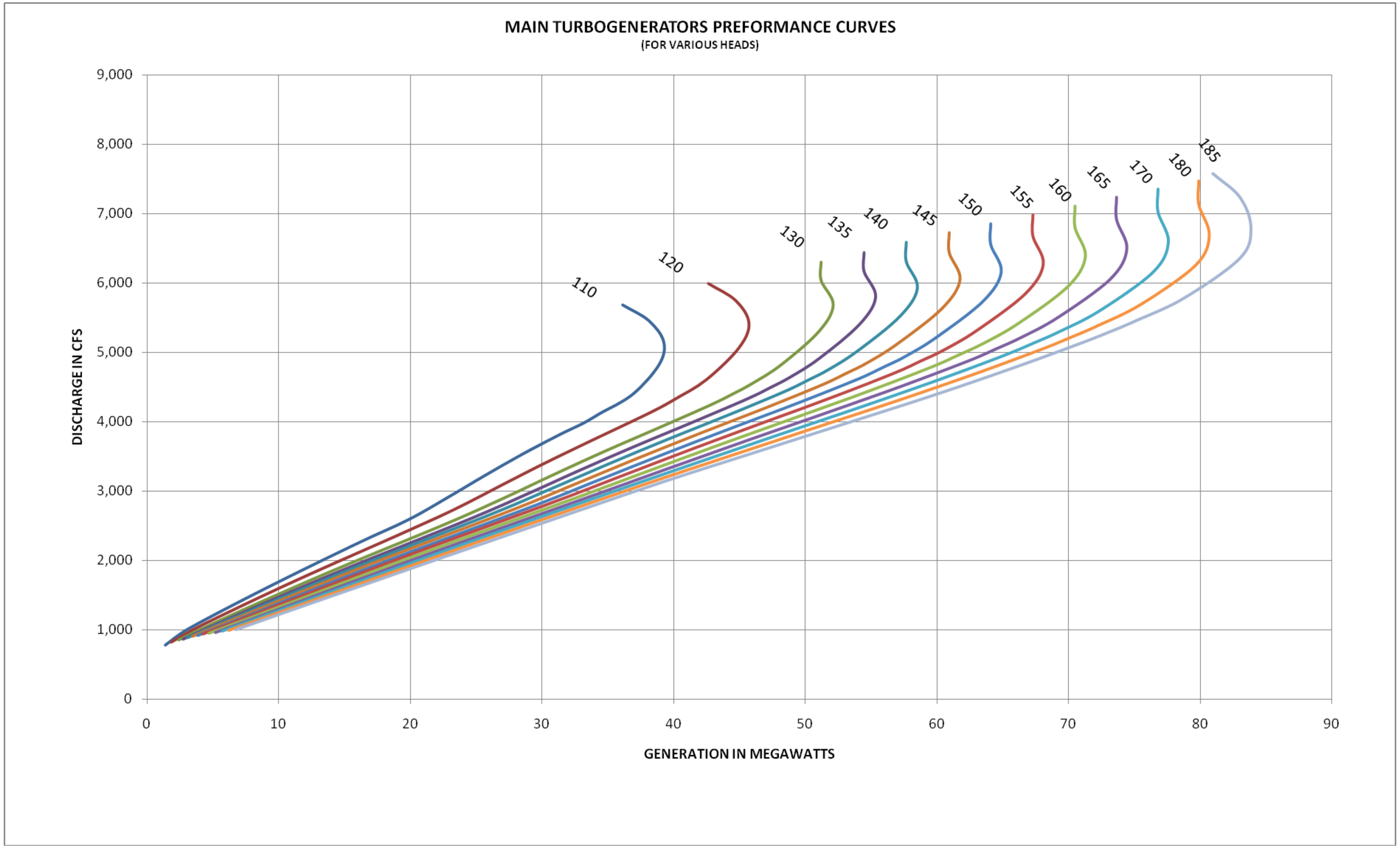


Note: The number on the graph above each line represents gross head. Gross head is the difference between the lakes headwater elevation at the dam and tailwater elevation directly below the dam measured in feet.

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

SMALL TURBOGENERATOR
PERFORMANCE CURVES



Note: The number on the graph above each line represents gross head. Gross head is the difference between the lakes headwater elevation at the dam and tailwater elevation directly below the dam measured in feet.

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

MAIN TURBOGENERATOR
PERFORMANCE CURVES

MONTHLY HYDROPOWER GENERATION AT BUFORD DAM MWHs

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Min	Max	Total
1959					7,947	17,874	18,639	21,231	14,328	10,756	10,171	16,956		7,947	21,231	117,902
1960	11,330	25,079	21,682	32,504	15,990	18,523	16,137	21,469	19,615	9,354	18,732	15,951		9,354	32,504	226,366
1961	13,247	6,630	18,510	25,806	17,546	16,008	20,206	21,125	14,547	15,602	14,368	19,307		6,630	25,806	202,902
1962	28,138	12,848	33,961	33,178	16,631	17,430	10,904	16,153	16,023	15,606	27,432	5,743		5,743	33,961	234,047
1963	5,737	5,167	6,231	21,110	30,379	11,522	27,088	23,367	10,870	13,711	18,098	9,009		5,167	30,379	182,289
1964	13,276	23,506	37,232	38,275	42,361	15,955	14,752	13,030	11,776	21,295	23,685	16,724		11,776	42,361	271,867
1965	13,016	9,958	23,323	24,929	18,697	16,101	14,733	13,909	15,330	10,822	9,960	8,923		8,923	24,929	179,701
1966	9,077	13,893	34,665	14,172	27,542	9,127	13,998	16,016	15,854	10,946	7,808	9,794		7,808	34,665	182,892
1967	17,009	11,326	12,965	8,924	13,437	25,408	17,689	24,045	33,328	28,035	19,721	29,366		8,924	33,328	241,253
1968	36,351	19,672	19,391	19,091	16,666	14,907	18,768	24,495	22,135	14,412	8,726	7,337		7,337	36,351	221,951
1969	9,238	8,115	11,234	24,033	16,098	12,137	22,395	15,449	20,083	12,241	26,836	17,551		8,115	26,836	195,410
1970	8,684	7,742	7,246	5,507	6,739	14,267	15,738	23,062	23,135	24,082	9,150	8,375		5,507	24,082	153,727
1971	7,683	5,620	5,951	8,259	13,151	10,512	13,727	29,463	16,092	21,963	19,878	10,658		5,620	29,463	162,957
1972	27,025	28,079	21,653	11,424	20,206	16,697	16,590	24,762	29,372	23,929	8,284	7,304		7,304	29,372	235,325
1973	7,993	27,314	29,010	34,107	32,972	40,906	20,685	20,685	15,142	16,809	20,516	10,132		7,993	40,906	276,271
1974	30,208	24,558	11,346	32,427	21,714	15,127	14,066	19,301	14,648	29,494	30,842	8,669		8,669	32,427	252,400
1975	8,558	9,628	28,667	31,477	22,927	14,591	11,471	15,440	14,498	13,883	16,952	18,485		8,558	31,477	206,577
1976	23,196	21,048	21,923	46,989	30,730	32,011	22,101	20,584	16,110	10,536	10,199	8,150		8,150	46,989	263,577
1977	10,419	7,852	21,432	51,114	18,612	15,954	17,527	21,563	14,668	8,601	10,888	20,307		7,852	51,114	218,937
1978	34,193	27,246	19,398	14,055	16,698	12,581	16,701	22,012	19,845	24,782	17,957	8,447		8,447	34,193	233,915
1979	8,763	7,272	10,666	41,146	32,224	18,696	13,914	17,565	12,631	18,010	16,528	12,079		7,272	41,146	209,494
1980	23,577	15,577	32,472	48,188	28,132	16,664	18,252	18,025	15,286	14,378	8,025	7,603		7,603	48,188	246,179
1981	7,804	6,988	7,818	6,421	6,836	7,888	11,986	16,826	15,949	16,310	14,802	8,617		6,421	16,826	128,245
1982	7,270	5,869	6,955	7,714	7,983	7,922	8,769	10,963	13,219	9,780	8,058	16,727		5,869	16,727	111,229
1983	17,315	20,574	22,816	31,221	22,398	16,990	18,332	23,399	12,412	11,914	13,629	11,133		11,133	31,221	222,133
1984	22,967	22,002	25,106	24,778	35,836	16,304	16,891	28,800	17,614	15,444	13,677	8,689		8,689	35,836	248,108
1985	8,216	6,935	9,465	7,834	8,051	11,509	15,674	14,400	16,229	10,703	9,646	9,882		6,935	16,229	128,544

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

HISTORICAL HYDROPOWER
PRODUCTION

PAGE 1 OF 2

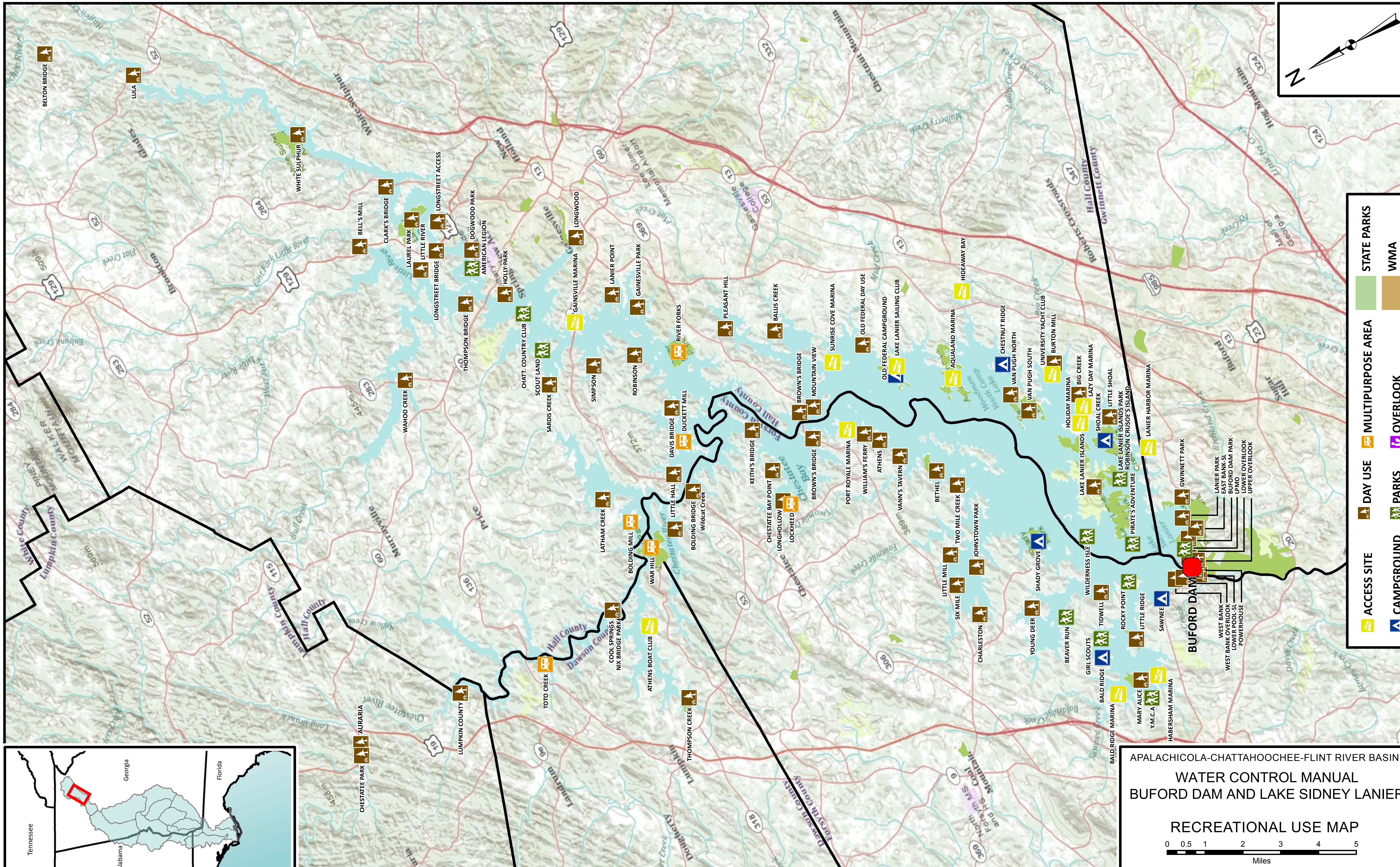
MONTHLY HYDROPOWER GENERATION AT BUFORD DAM MWHs

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Min	Max	Total
1986	8,430	5,443	7,781	7,677	8,015	8,600	17,664	9,631	7,558	7,205	7,254	7,502	5,443	17,664	102,760
1987	6,295	4,319	5,059	11,732	8,490	9,268	13,696	22,597	19,368	13,698	9,239	7,304	4,319	22,597	131,065
1988	5,417	5,187	6,820	6,269	7,233	8,352	9,215	8,778	7,802	7,245	6,947	6,671	5,187	9,215	85,936
1989	5,747	4,870	5,238	4,826	5,761	5,209	9,402	19,047	16,522	20,059	17,665	15,530	4,826	20,059	129,876
1990	25,498	43,977	41,162	31,460	18,087	16,062	18,667	22,093	16,362	16,603	12,816	10,107	10,107	43,977	272,894
1991	7,835	6,955	4,441	8,710	30,975	14,984	17,686	19,305	27,472	32,147	12,275	7,896	4,441	32,147	190,681
1992	8,986	7,342	16,044	16,068	17,874	11,640	20,439	13,200	10,108	19,013	15,943	42,628	7,342	42,628	199,285
1993	50,613	26,982	29,682	32,257	20,557	18,511	20,321	15,693	14,680	12,500	7,891	8,475	7,891	50,613	258,162
1994	7,224	6,550	5,921	5,770	8,273	14,092	10,975	30,347	23,254	9,479	11,462	16,638	5,770	30,347	149,985
1995	17,395	24,295	31,574	8,175	15,929	13,920	16,877	16,805	18,383	10,634	11,398	13,502	8,175	31,574	198,887
1996	22,807	48,834	33,751	19,521	22,450	17,126	17,277	19,146	13,439	12,357	8,711	7,837	7,837	48,834	243,256
1997	7,944	11,331	25,524	16,812	18,541	19,369	13,371	13,128	19,281	14,319	9,468	10,971	7,944	25,524	180,059
1998	21,401	37,945	36,996	27,505	30,699	18,939	21,673	14,138	13,196	10,430	9,137	7,326	7,326	37,945	249,385
1999	6,222	5,486	6,973	7,186	7,895	11,921	4,892	10,279	10,815	8,079	6,218	7,050	4,892	11,921	93,016
2000	5,548	6,346	6,847	6,444	8,398	14,585	14,342	14,699	4,126	6,820	5,179	6,218	4,126	14,699	99,552
2001	6,510	6,510	3,835	4,268	5,686	4,668	7,393	8,402	5,992	4,631	3,836	3,494	3,494	8,402	65,225
2002	3,979	3,869	3,633	3,901	4,392	5,786	6,808	7,895	6,817	6,122	4,581	5,157	3,633	7,895	62,940
2003	7,698	11,477	27,387	16,004	29,888	21,097	25,500	18,159	11,692	9,452	12,597	15,782	7,698	29,888	206,733
2004	12,365	3,273	3,005	1,929	1,763	2,063	7,994	7,516	17,545	14,479	7,133	25,602	1,763	25,602	104,667
2005	10,867	11,727	19,627	25,146	15,171	22,583	27,347	28,116	14,817	10,280	10,394	18,555	10,280	28,116	214,630
2006	19,042	11,889	13,052	14,424	18,196	12,149	9,723	10,034	8,847	8,783	7,171	7,886	7,171	19,042	141,196
2007	7,225	6,153	7,676	7,823	9,869	12,617	12,737	11,027	11,895	14,016	15,336	7,486	6,153	15,336	123,860
2008	5,619	4,027	2,064	4,025	5,819	7,258	7,097	7,696	7,243	7,220	6,795	4,830	2,064	7,696	69,693
2009	4,718	4,090	3,001	4,027	4,942	6,943	8,068	7,787	6,732	11,771	29,640	43,213	3,001	43,213	134,932
2010	27,188	39,790	28,617	12,376	23,401	11,630	10,846	12,285	4,717	10,232	9,700	8,376	4,717	39,790	199,158
2011	8,834	9,453	26,904	24,649	21,857	15,162	10,297	10,730	13,388	14,392	13,162	7,200	7,200	26,904	176,028
2012	5,417	3,156	3,898	11,706	8,560	7,989	8,911	8,902	7,943	9,764	20,802	9,295	3,156	20,802	106,343
2013	5,067	4,039	4,573	11,903	36,633	21,002	29,000	26,831	17,576	13,738	9,218	32,833	4,039	36,633	212,413
2014	31087	20296	12702	26125	17914	11164	11095	13951	9434	9441	10523	8550	8,550	31,087	182,282
2015	9,899	11,612	14,535	14,747	14,814	14,461	13,889	10,458	10,080	12,900	18,468	17,496	9,899	18,468	163,359
Avg	13,985	13,888	16,776	18,538	17,484	14,434	15,280	17,120	14,699	13,881	13,079	12,690	6,810	29,249	180,745
Max	50,613	48,834	41,162	51,114	42,361	40,906	29,000	30,347	33,328	32,147	30,842	43,213	11,776	51,114	276,271
Min	3,979	3,156	2,064	1,929	1,763	2,063	4,892	7,516	4,126	4,631	3,836	3,494	1,763	7,696	62,940

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

HISTORICAL HYDROPOWER PRODUCTION



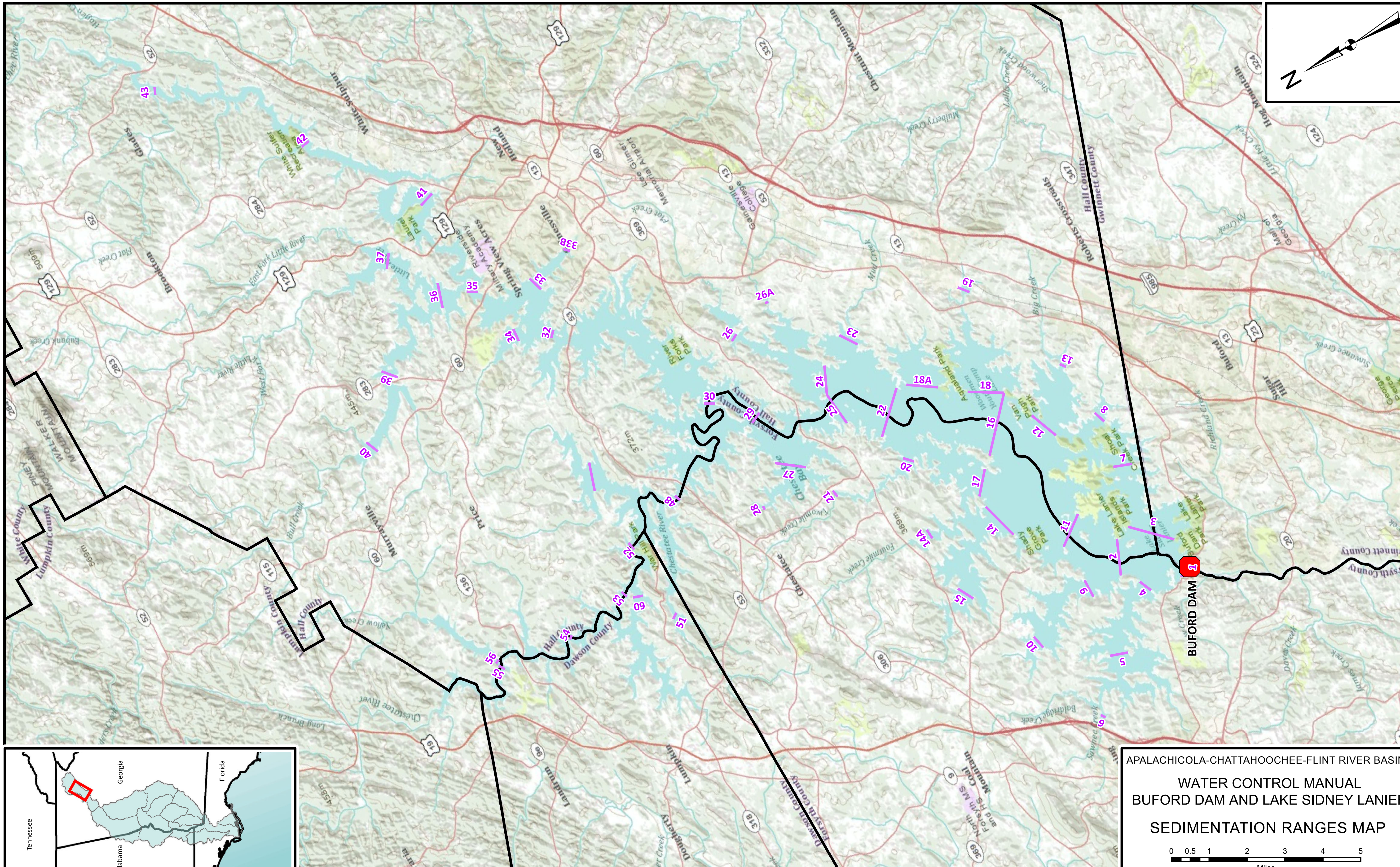
APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

RECREATIONAL USE MAP

0 0.5 1 2 3 4 5
Miles

R004_28JULY10_RECREATIONAL_USE_MAP_11X17.mxd

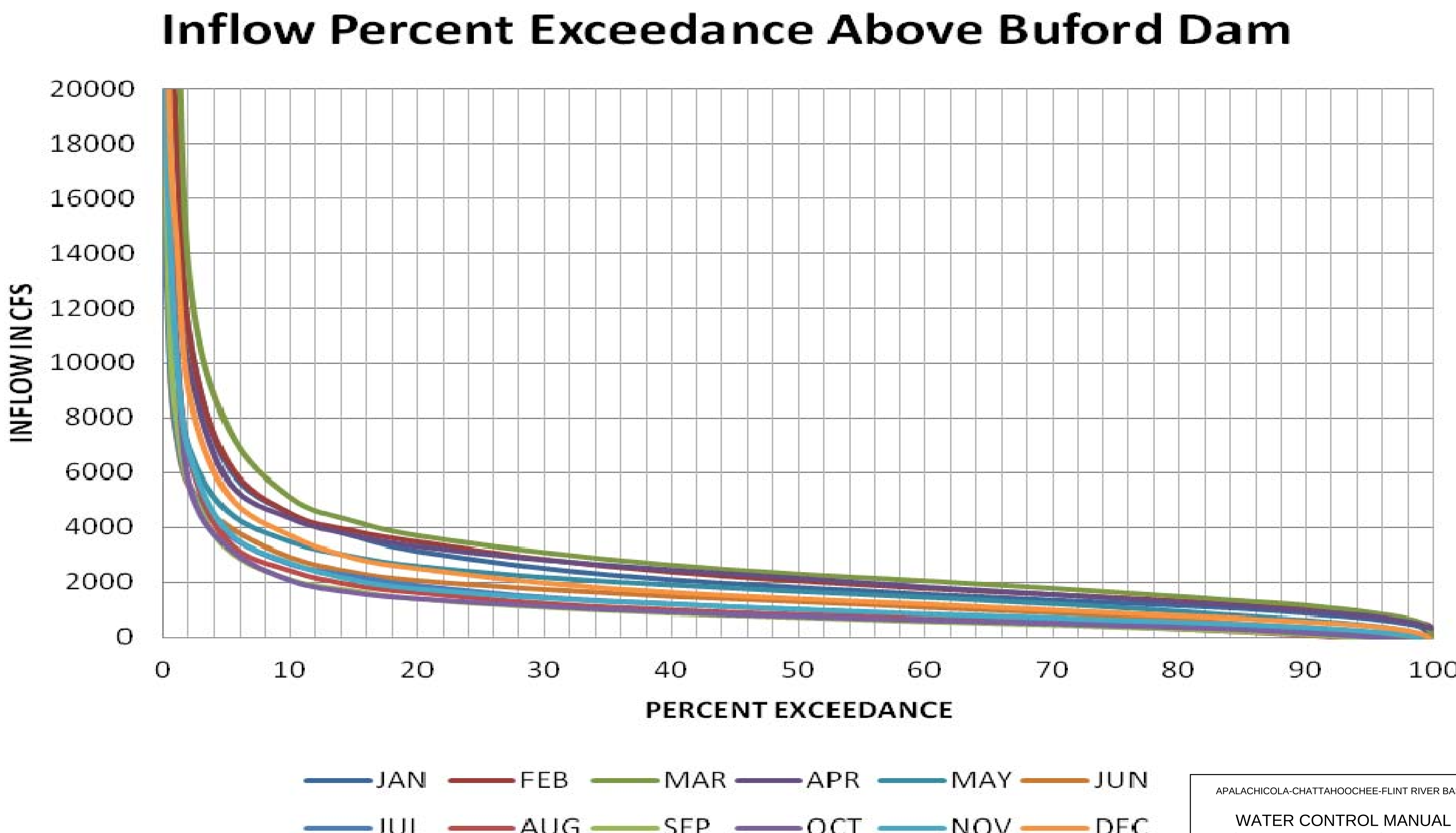


APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

SEDIMENTATION RANGES MAP

R004_28JULY10_SEDIMENTATION_RANGES_MAP_11X17.mxd

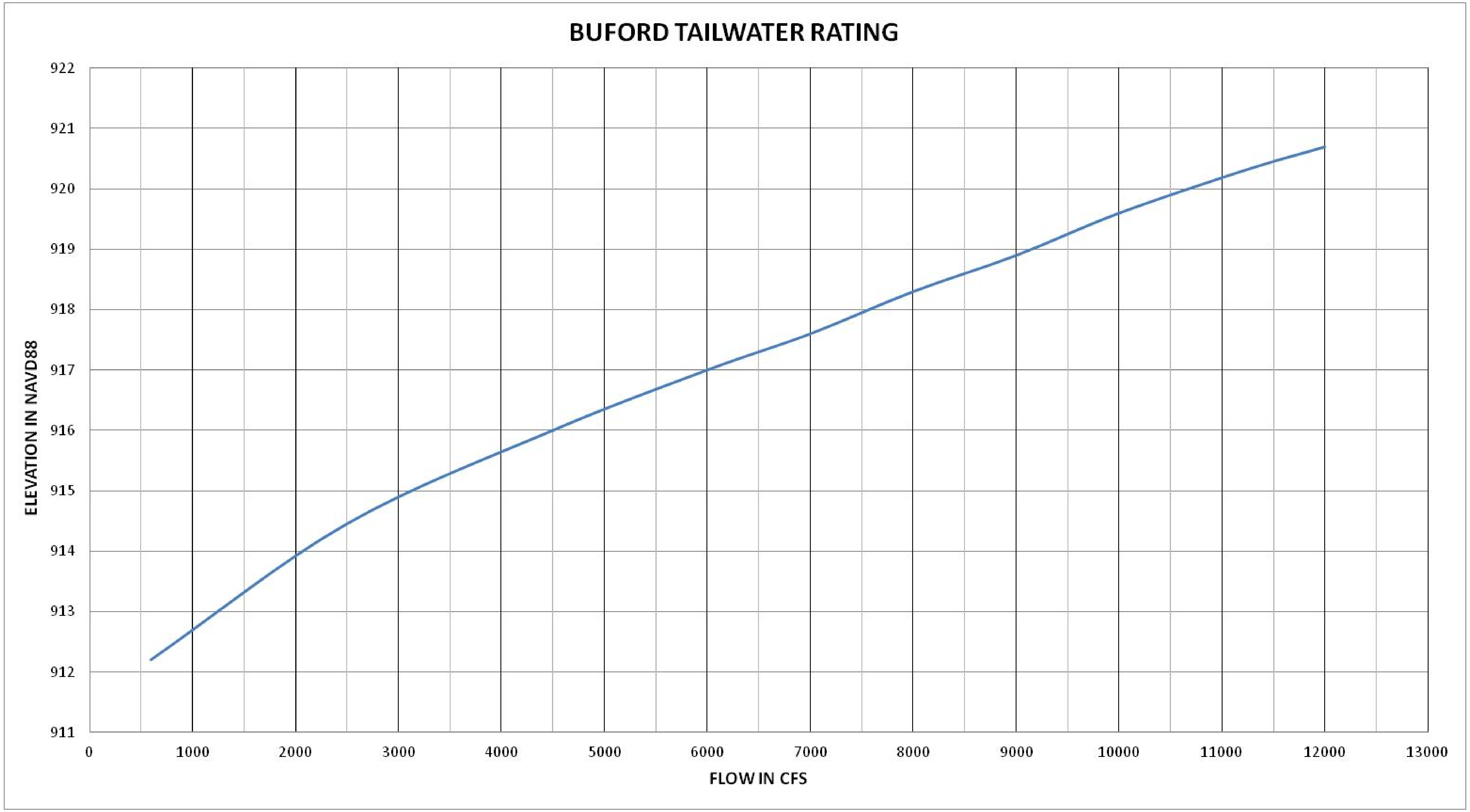


Note: Inflows from Buford observed project data 1957—2013.

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

INFLOW PERCENT EXCEEDANCE
BUFORD DAM

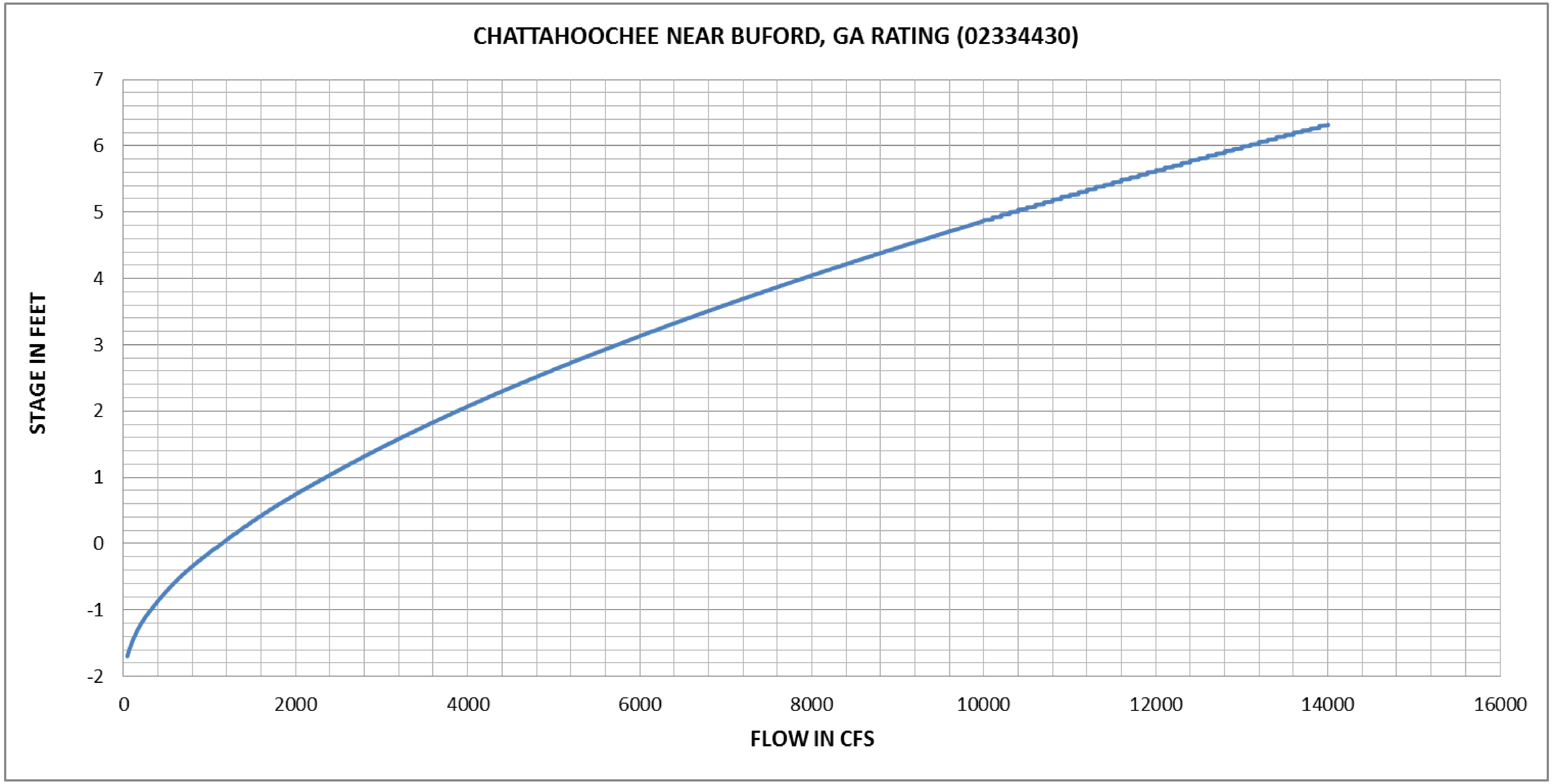


Buford Tailwater rating	
Stage (in feet)	**Elevation (in cfs)**
600	912.2
2,500	914.45
4,500	916
6,000	917
7,000	917.6
8,000	918.3
9,000	918.9
10,000	919.6
11,200	920.3
12,000	920.7

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

BUFORD TAILWATER RATING
CHATTAHOOCHEE RIVER
USACE RATING
DRAINAGE AREA 1,040 SQUARE MILES
GAGE ZERO 0.00 FEET NAVD88

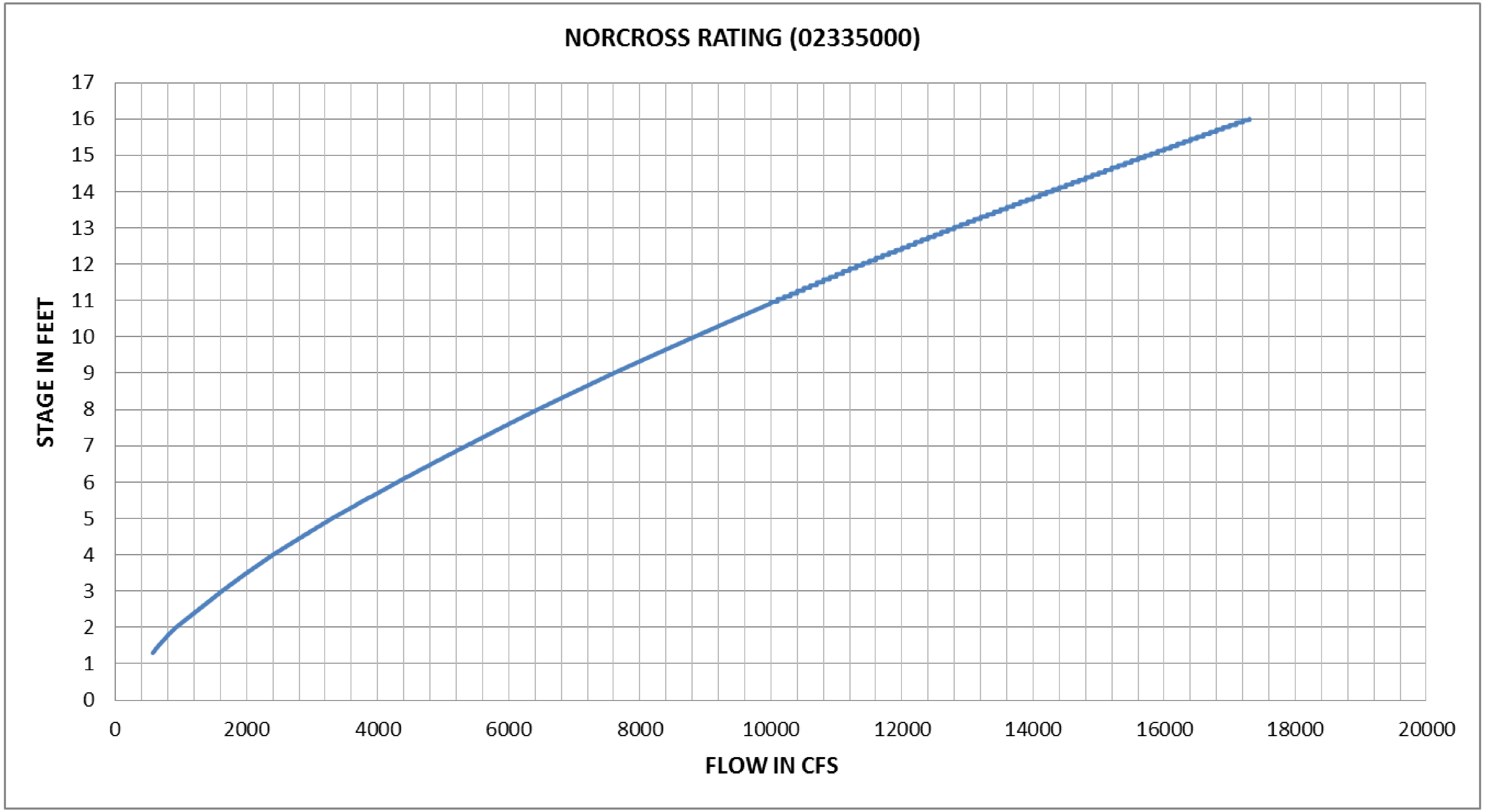


Chattahoochee Near Buford, Ga rating	
Stage (in feet)	Flow (in cfs)
-1.7	43
-1.6	67
-1.5	94
-1.4	127
-1.3	163
-1.2	207
-1.1	257
-1	318
-0.5	660
0	1,140
0.5	1,690
1	2,350
2	3,880
6.32	14,000

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

CHATTAHOOHEE NEAR BUFORD,GA
CHATTAHOOCHEE RIVER
USGS # 02334430
DATE of RATING #14: 23-JUL-2014
DRAINAGE AREA 1,040 SQUARE MILES
GAGE ZERO 912.04 FEET NGVD29

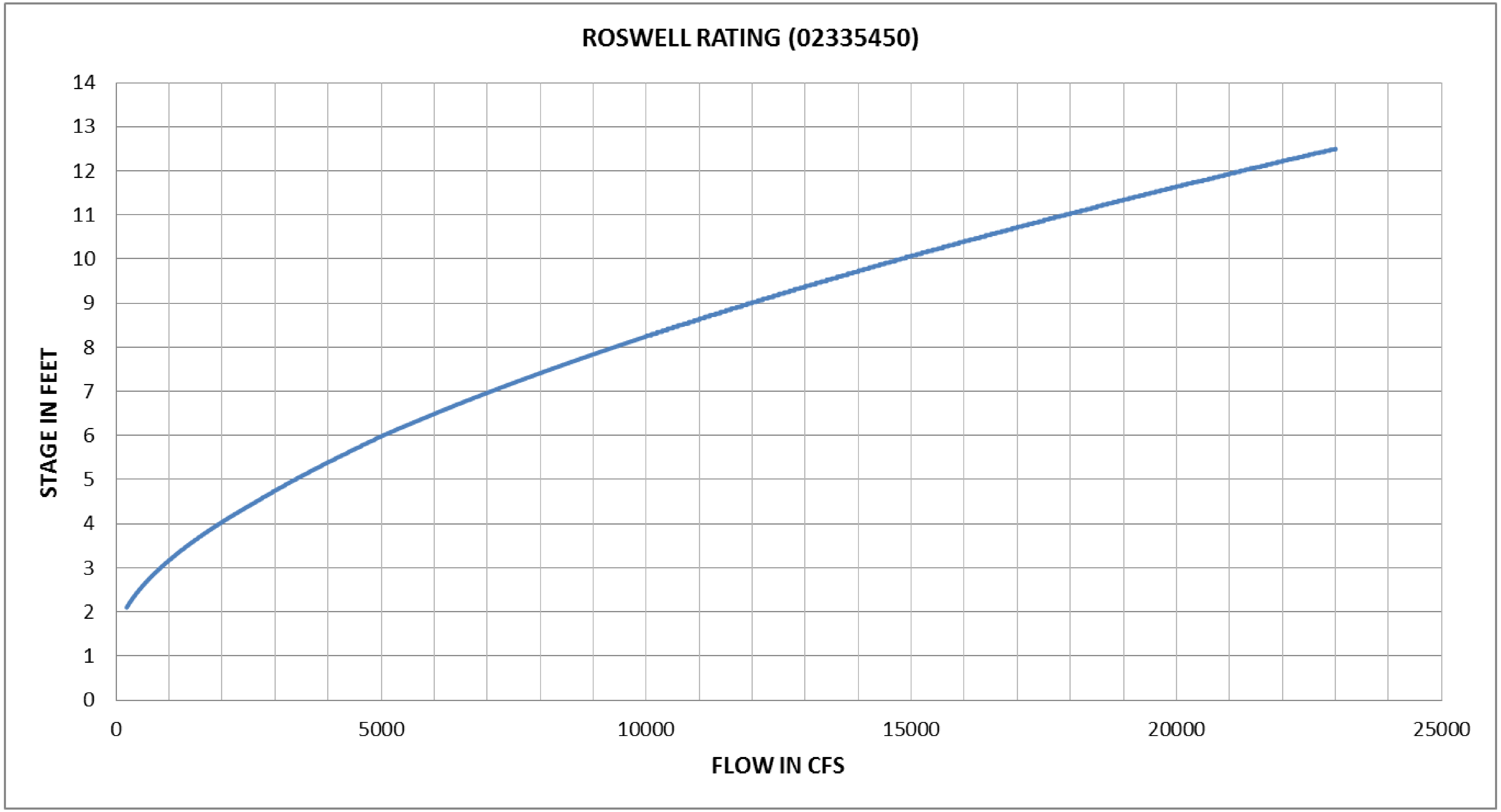


Norcross rating	
Stage (in feet)	**Flow (in cfs)**
1.3	570
2	920
3	1,620
4	2,400
5	3,300
6	4,300
7	5,350
8	6,440
9	7,600
10	8,830
11	10,100
12	11,400
13	12,800
14	14,300
15	15,800
16	17,300

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

NORCROSS RATING
CHATTAHOOCHEE RIVER
USGS # 02335000
DATE OF RATING #15.1: 23-JUL-2014
DRAINAGE AREA 1,170 SQUARE MILES
GAGE ZERO 878.14 FEET NGVD29

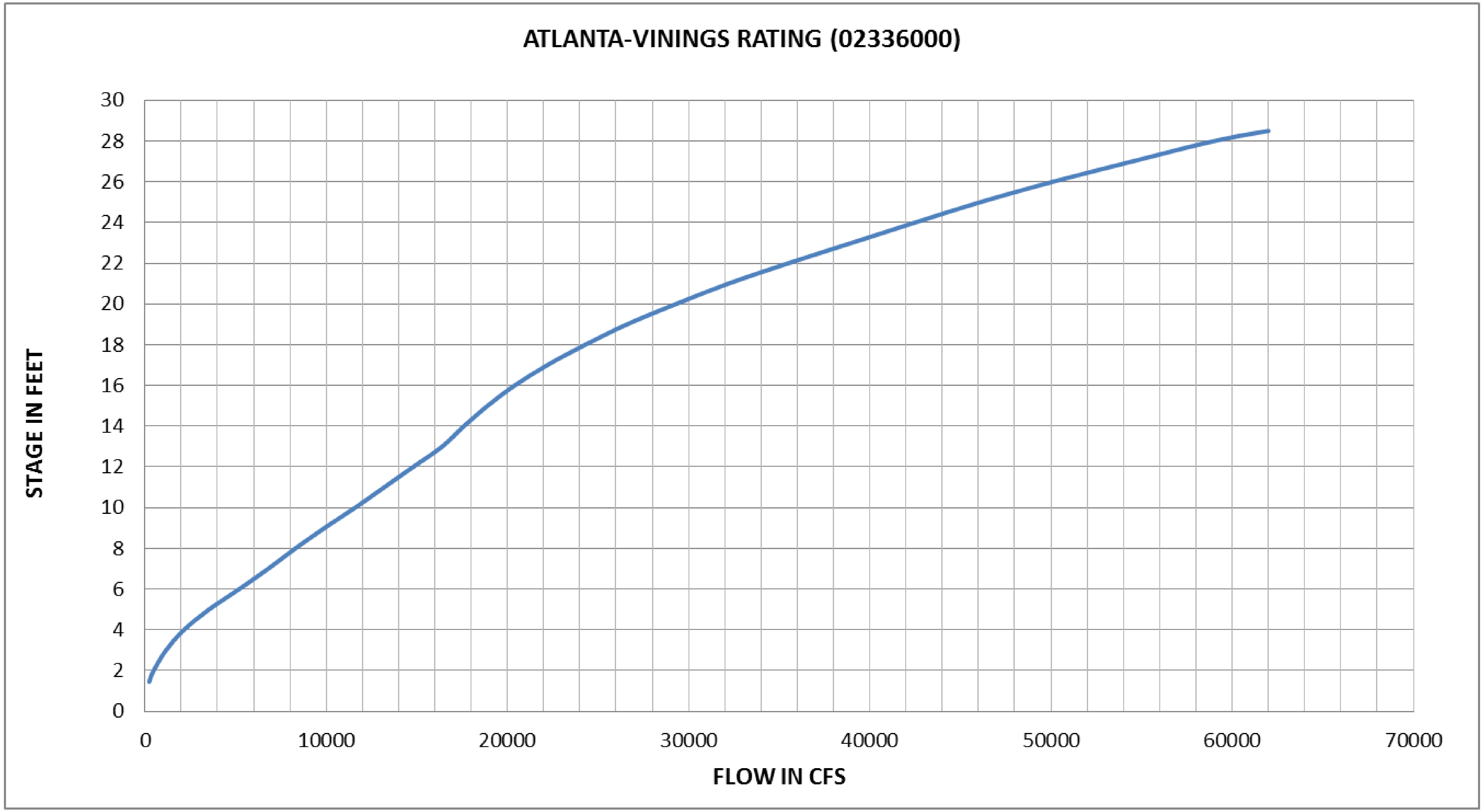


Roswell rating	
Stage (in feet)	Flow (in cfs)
2.1	200
2.2	252
2.4	370
2.5	437
3	838
4	1,950
5	3,380
6	5,040
8	9,390
10	14,800
12.5	23,000

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

ROSWELLRATING
CHATTAHOOCHEE RIVER
USGS # 02335450
DATE OF RATING #9.1: 13-DEC-2012
DRAINAGE AREA 1,220 SQUARE MILES
GAGE ZERO 858.6 FEET NAVD88



Atlanta-Vinings rating	
Stage (in feet)	Flow (in cfs)
1.45	230
2	476
3	1,160
4	2,150
5	3,530
6	5,200
7	6,800
8	8,300
9	9,900
10	11,600
11	13,200
12	14,800
13	16,400
14	17,600
15	18,900
16	20,400
17	22,200
18	24,300
19	26,600
20	29,300
21	32,200
22	35,500
23	39,000
24	42,500
25	46,100
26	50,100
27	54,500
28	59,000
28.5	62,000

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

ATLANTA-VININGS RATING
CHATTAHOOCHEE RIVER
USGS # 02336000
DATE OF RATING #6.1: 23-JUL-2014
DRAINAGE AREA 1,450 SQUARE MILES
GAGE ZERO 750.10 FEET NGVD29

Mean Monthly and Annual Buford Inflow in cfs (Prior to project)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Min	Max	Average
1903	1,973	5,804	7,350	4,692	2,630	4,016	2,108	1,868	1,318	992	1,099	998		992	7,350	2,904
1904	1,175	1,770	2,004	1,556	1,359	888	732	1,902	694	477	619	1,006		477	2,004	1,182
1905	2,014	3,378	1,708	1385n	2,296	1,242	2,507	1,467	745	891	804	2,902		745	3,378	1,814
1906	4,196	1,892	4,358	2,479	1,885	1,841	3,549	3,798	4,358	4,205	2,417	2,717		1,841	4,358	3,141
1907	2,640	2,591	2,639	2,213	1,945	1,665	1,357	1,110	1,251	876	2,061	2,904		876	2,904	1,938
1908	2,926	4,315	3,421	3,990	2,699	1,772	1,567	1,641	1,118	1,220	1,151	2,560		1,118	4,315	2,365
1909	2,489	3,871	5,001	2,634	4,106	3,429	2,367	1,925	1,681	1,512	1,142	1,843		1,142	5,001	2,667
1910	1,681	1,995	1,908	1,637	3,164	2,441	2,281	1,433	1,486	1,147	918	1,429		918	3,164	1,793
1911	1,799	1,320	1,295	3,259	1,526	1,015	1,188	1,082	740	1,319	1,601	2,080		740	3,259	1,519
1912	2,608	3,638	5,496	4,035	2,720	3,362	2,792	1,809	1,542	1,763	1,330	1,383		1,330	5,496	2,707
1913	2,299	2,694	4,819	2,340	1,762	1,502	1,245	1,248	948	914	787	1,090		787	4,819	1,804
1914	1,023	1,451	1,148	1,977	922	697	718	874	539	1,472	1,306	4,049		539	4,049	1,348
1915	3,589	3,612	2,359	1,592	2,202	1,416	1,283	1,003	903	2,555	1,311	4,576		903	4,576	2,200
1916	2,433	2,645	1,974	1,508	1,591	1,412	6,496	2,254	1,303	1,210	1,181	1,707		1,181	6,496	2,143
1917	2,286	4,002	5,687	3,623	2,088	1,860	1,631	1,663	1,687	1,245	1,127	1,271		1,127	5,687	2,348
1918	2,740	2,254	1,429	1,755	1,383	1,137	1,111	1,104	947	2,334	2,327	4,565		947	4,565	1,924
1919	3,783	3,517	4,099	2,664	2,381	1,933	2,067	1,328	981	1,319	1,284	5,108		981	5,108	2,539
1920	3,030	2,938	4,240	5,944	3,443	2,506	2,283	3,251	2,050	1,226	1,499	2,875		1,226	5,944	2,940
1921	2,666	6,095	2,438	2,171	2,172	1,271	1,618	1,148	875	894	1,464	1,566		875	6,095	2,032
1922	2,952	3,294	4,100	3,750	3,477	3,195	2,456	1,569	1,056	997	902	2,359		902	4,100	2,509
1923	1,929	2,806	2,551	2,258	3,767	2,786	1,787	1,725	1,254	783	1,016	2,120		783	3,767	2,065
1924	2,486	2,164	2,006	2,675	2,171	1,543	1,505	761	1,559	980	782	1,262		761	2,675	1,658
1925	4,805	1,715	1,785	1,345	1,186	744	790	313	264	811	1,500	1,199		264	4,805	1,371
1926	3,133	2,203	2,362	2,047	1,191	896	888	1,489	844	699	1,245	2,755		699	3,133	1,646
1927	1,500	2,529	2,318	1,999	1,254	1,132	1,191	1,003	641	663	710	2,069		641	2,529	1,417
1928	1,536	1,648	1,986	2,411	3,062	2,176	2,796	3,211	2,373	1,543	1,260	1,175		1,175	3,211	2,098
1929	1,735	3,169	8,155	3,398	4,269	2,879	2,249	1,802	3,864	2,619	4,375	2,467		1,735	8,155	3,415
1930	2,423	2,592	3,114	2,039	2,144	1,339	945	777	959	767	1,669	1,507		767	3,114	1,690

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

AVERAGE MONTHLY
FLOW AT BUFORD SITE PRIOR TO
CONSTRUCTION

PAGE 1 OF 2

Mean Monthly and Annual Buford Inflow in cfs (Prior to project)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Min	Max	Average
1931	1,525	1,457	1,498	2,340	1,840	967	937	773	496	420	799	4,742		420	4,742	1,483
1932	3,887	3,860	2,559	2,827	2,358	2,186	1,497	1,319	1,233	2,050	2,465	8,642		1,233	8,642	2,907
1933	4,063	3,894	2,626	2,699	2,413	1,580	1,308	994	974	708	780	984		708	4,063	1,919
1934	1,382	1,924	3,807	1,545	1,851	2,408	1,327	1,359	857	2,412	1,022	1,516		857	3,807	1,784
1935	2,102	1,647	2,270	2,971	2,041	1,232	1,498	1,480	805	674	2,215	1,179		674	2,971	1,676
1936	6,937	5,361	2,828	7,814	2,064	1,490	1,064	1,297	1,263	2,404	1,011	2,325		1,011	7,814	2,988
1937	6,173	3,777	2,393	3,266	2,241	1,434	1,188	1,378	1,272	2,216	1,248	1,294		1,188	6,173	2,323
1938	1,317	1,188	2,437	3,154	1,636	1,540	3,358	1,717	1,069	746	1,094	980		746	3,358	1,686
1939	1,731	4,593	3,500	2,428	2,129	1,703	1,201	2,301	968	664	673	838		664	4,593	1,894
1940	1,181	1,790	1,865	1,894	1,176	1,142	1,010	2,376	1,239	680	977	1,286		680	2,376	1,385
1941	1,366	1,056	1,411	1,233	808	658	2,478	861	517	401	587	1,363		401	2,478	1,062
1942	1,213	2,544	3,294	1,667	1,711	1,445	1,115	1,443	1,287	1,091	992	2,624		992	3,294	1,702
1943	2,965	2,823	3,206	3,163	2,319	1,778	2,203	1,701	1,222	1,008	1,116	1,137		1,008	3,206	2,053
1944	1,919	3,953	5,172	3,828	2,412	1,536	1,157	1,011	832	760	933	1,090		760	5,172	2,050
1945	1,473	2,702	2,172	2,229	1,818	1,173	1,265	1,460	1,570	1,255	1,309	2,735		1,173	2,735	1,763
1946	6,754	5,751	5,255	3,584	3,551	2,221	1,735	1,140	1,035	1,095	1,077	1,080		1,035	6,754	2,857
1947	4,025	1,853	2,115	2,385	1,564	1,648	990	799	522	809	1,832	1,457		522	4,025	1,667
1948	1,241	3,511	3,203	2,587	1,727	1,445	2,525	2,628	1,191	948	4,112	3,116		948	4,112	2,353
1949	4,494	4,292	3,053	3,297	3,208	3,095	3,415	2,520	3,278	2,127	2,000	2,060		2,000	4,494	3,070
1950	2,521	2,371	2,962	2,189	1,690	2,233	1,880	1,349	1,814	1,682	1,201	1,477		1,201	2,962	1,947
1951	1,314	1,471	2,473	2,863	1,751	1,600	1,201	688	754	796	1,311	3,686		688	3,686	1,659
1952	2,371	2,692	7,726	3,255	2,118	1,440	899	1,365	798	643	931	1,298		643	7,726	2,128
1953	3,314	3,278	2,901	1,963	2,658	1,437	1,766	921	1,073	853	964	2,757		853	3,314	1,990
1954*	4,878	2,451	2,775	2,809	1,846	1,605	914	671	403	354n	641	1,199		403	4,878	1,836
1955*	1,501	3,135	1,836	2,113	1,949	1,230	1,245	953	481	508	714	717		481	3,135	1,365
1956*	718n	2,427	2,467	3,105	1,837	1,121	1,260	666	861	747	761	1,691		666	3,105	1,540
1957*	2,068	3,015	2,115	3,896	1,504	1,275								1,275	3,896	2,312
Min	1,023	1,056	1,148	1,233	808	658	718	313	264	401	587	717				
Max	6,937	6,095	8,155	7,814	4,269	4,016	6,496	3,798	4,358	4,205	4,375	8,642				
Avg	2,659	2,922	3,121	2,761	2,164	1,722	1,740	1,476	1,218	1,229	1,327	2,163				2,042

* Flows during construction

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

AVERAGE MONTHLY
FLOW AT BUFORD SITE PRIOR TO
CONSTRUCTION

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Buford Average Monthly Inflow in cfs (Period of Record)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Min	Max	Avg
1957							877	492	664	1,019	2,403	2,130	492	2,403	1,264
1958	1,702	2,311	2,506	2,808	2,072	1,091	2,920	1,099	1,069	745	734	1,017	734	2,920	1,673
1959	1,663	2,089	2,109	2,250	2,147	1,791	1,210	753	1,340	2,684	1,256	1,690	753	2,684	1,748
1960	2,857	3,543	3,529	3,439	1,922	1,604	1,302	1,517	1,601	1,547	997	1,212	997	3,543	2,089
1961	1,287	5,995	3,080	3,101	2,091	2,297	1,813	1,656	976	565	961	5,912	565	5,995	2,478
1962	2,729	3,400	3,798	4,169	1,803	1,424	1,096	721	919	661	1,246	1,136	661	4,169	1,925
1963	1,826	1,551	5,786	3,512	2,082	2,792	1,837	853	1,231	584	1,080	1,618	584	5,786	2,063
1964	4,248	2,740	6,630	7,745	3,438	1,708	1,740	1,265	1,086	2,361	1,327	2,312	1,086	7,745	3,050
1965	2,008	2,726	3,570	2,873	1,766	1,803	1,174	715	605	1,054	836	662	605	3,570	1,649
1966	1,522	5,129	3,928	2,561	3,184	1,473	1,045	937	754	1,224	1,639	1,496	754	5,129	2,074
1967	2,167	2,077	2,016	1,639	1,797	2,392	2,662	4,571	1,841	1,452	2,887	3,674	1,452	4,571	2,431
1968	3,876	2,107	3,510	2,802	1,999	1,491	1,156	652	852	680	1,528	1,864	652	3,876	1,876
1969	2,736	3,574	2,198	3,286	1,963	1,406	837	2,763	1,388	827	1,411	1,502	827	3,574	1,991
1970	1,609	1,641	2,238	2,106	1,302	1,699	804	1,007	658	1,140	1,046	996	658	2,238	1,354
1971	2,157	3,190	3,244	2,129	1,601	1,136	2,264	2,411	1,289	1,004	1,219	3,219	1,004	3,244	2,072
1972	4,944	2,471	2,543	2,006	3,041	1,905	1,513	992	762	923	1,637	3,832	762	4,944	2,214
1973	2,958	3,608	4,659	4,371	4,914	3,555	2,034	1,608	1,756	936	1,220	3,012	936	4,914	2,886
1974	4,227	3,620	2,603	3,322	2,578	1,625	1,527	2,287	992	730	1,119	1,753	730	4,227	2,199
1975	2,523	4,480	4,829	2,552	2,792	1,618	1,317	1,049	2,037	1,861	1,687	1,937	1,049	4,829	2,390
1976	3,317	2,244	5,685	2,595	4,951	2,415	2,098	939	688	1,264	1,134	2,094	688	5,685	2,452
1977	2,197	1,526	5,397	3,854	2,118	1,096	708	631	1,150	2,420	3,784	2,226	631	5,397	2,259
1978	4,811	2,276	2,624	1,840	1,925	1,020	767	2,506	587	358	741	1,395	358	4,811	1,738
1979	3,232	3,249	4,252	6,547	2,752	1,840	1,861	1,184	1,649	1,303	2,445	1,289	1,184	6,547	2,634
1980	2,743	1,907	7,560	3,775	2,842	2,220	909	612	1,063	984	919	717	612	7,560	2,188
1981	638	2,355	1,305	1,150	1,226	1,173	374	333	350	355	487	1,272	333	2,355	918
1982	3,431	4,836	2,065	2,248	1,349	935	909	994	570	1,368	1,285	3,149	570	4,836	1,928
1983	1,926	3,257	2,944	4,077	2,744	1,517	824	508	1,008	841	1,800	4,997	508	4,997	2,204
1984	2,565	3,034	3,162	3,410	3,918	1,646	2,761	1,977	668	816	970	1,385	668	3,918	2,193
1985	1,235	2,978	1,315	1,217	1,207	728	1,434	1,286	421	596	1,322	1,058	421	2,978	1,233

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

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BUFORD DAM AND LAKE SIDNEY LANIER

AVERAGE MONTHLY INFLOW
(OUTFLOW PLUS CHANGE IN STORAGE)
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Buford Average Monthly Inflow in cfs (Period of Record)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Min	Max	Avg
1986	800	901	1,140	598	619	163	-97	132	587	1,655	1,834	2,032	-97	2,032	864
1987	2,355	2,840	2,883	1,911	1,143	1,059	597	276	269	87	547	1,027	87	2,883	1,249
1988	2,173	1,277	925	1,645	489	133	438	266	663	804	649	611	133	2,173	839
1989	1,735	1,971	2,456	1,776	1,444	3,205	2,449	1,301	1,988	3,311	1,915	2,289	1,301	3,311	2,153
1990	3,889	5,490	6,700	2,938	2,189	1,082	1,275	1,022	1,360	1,398	1,011	1,694	1,011	6,700	2,504
1991	2,490	2,231	3,129	3,247	3,579	2,192	2,026	2,657	1,631	1,101	1,451	1,900	1,101	3,579	2,303
1992	2,094	3,179	3,362	2,054	1,468	1,917	1,426	2,016	1,783	1,943	4,167	5,019	1,426	5,019	2,536
1993	5,965	3,712	4,398	3,474	2,500	1,482	817	854	546	633	1,268	1,256	546	5,965	2,242
1994	1,822	2,466	3,307	2,599	1,413	1,956	1,926	3,377	1,538	1,895	1,652	1,908	1,413	3,377	2,155
1995	2,889	3,973	3,448	1,899	1,467	1,621	733	1,631	914	3,181	3,294	1,765	733	3,973	2,235
1996	4,889	4,366	5,254	3,080	2,285	1,777	1,020	1,111	1,263	844	1,235	2,536	844	5,254	2,472
1997	2,608	3,279	2,964	2,650	2,355	2,120	1,423	842	977	2,317	1,410	1,828	842	3,279	2,064
1998	4,000	5,888	4,553	5,075	3,368	1,731	978	1,263	498	542	882	1,181	498	5,888	2,497
1999	1,902	2,236	1,379	1,290	1,192	982	758	160	105	1,441	1,093	944	105	2,236	1,123
2000	1,665	1,282	1,853	2,141	811	534	265	565	617	40	795	695	40	2,141	939
2001	1,499	1,286	2,245	1,275	793	1,125	994	658	416	317	409	775	317	2,245	983
2002	1,801	1,037	1,763	1,107	1,142	357	233	-36	1,131	1,293	2,252	3,392	-36	3,392	1,289
2003	1,686	3,033	3,404	2,684	3,481	3,033	3,650	1,900	1,415	1,056	1,976	1,707	1,056	3,650	2,419
2004	1,523	2,456	1,452	1,214	1,033	1,464	1,167	609	4,258	1,198	2,031	3,251	609	4,258	1,805
2005	1,818	2,723	3,132	2,899	1,653	3,187	3,420	3,370	1,106	1,197	1,153	2,152	1,106	3,420	2,318
2006	2,468	2,029	1,816	1,581	1,067	721	390	434	774	1,121	1,707	1,208	390	2,468	1,276
2007	2,537	1,344	2,153	1,078	622	535	625	124	49	260	329	814	49	2,537	872
2008	872	1,689	2,246	1,139	825	294	429	1,379	163	254	363	1,618	163	2,246	939
2009	2,419	1,112	2,491	2,357	1,938	1,047	473	697					473	2,491	1,567
2010	3,876	4,418	3,257	2,586	2,287	1,515	948	1,306	916	811	1,094	1,458	811	4,418	2,039
2011	1,359	2,021	3,928	2,896	1,519	1,039	680	240	516	520	1,208	1,807	240	3,928	1,478
2012	2,239	1,345	1,842	1,165	1,025	541	658	663	511	1,676	619	1,659	511	2,239	1,162
2013	3,706	2,854	2,402	3,360	4,115	2,369	3,952	3,586	1,570	1,242	1,720	4,460	1,242	4,460	2,945
2014	2,880	2,560	2,343	3,453	1,824	1,396	1,041	829	608	1,105	1,142	1,531	608	3,453	1,726
2015	2,443	1,898	1,573	2,572	1,377	949	1,098	1,026	718	2,130	4,335	5,321	718	5,321	2,120
Min	638	901	925	598	489	133	-97	-36	49	40	329	611	-97	7,745	382
Max	5,965	5,995	7,560	7,745	4,951	3,555	3,952	4,571	4,258	3,311	4,335	5,912	3,311	7,745	5,176
Avg	2,544	2,773	3,153	2,675	2,044	1,533	1,322	1,243	1,021	1,169	1,443	2,040	1,021	4,460	1,913

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Buford Average Monthly Discharge in cfs (Period of Record)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Min	Max	Avg
1957							493	429	455	390	459	350	350	493	429
1958	350	489	347	535	501	661	950	2,124	2,654	1,447	1,163	1,461	347	2,654	1,057
1959	2,143	632	400	380	981	2,191	2,245	2,617	1,859	1,328	1,296	2,071	380	2,617	1,512
1960	1,374	3,183	2,554	3,918	1,930	2,296	2,152	2,596	2,493	1,149	2,389	1,982	1,149	3,918	2,335
1961	1,636	902	2,184	3,177	2,100	1,921	2,371	2,476	1,779	1,869	1,783	2,263	902	3,177	2,038
1962	3,321	1,675	3,932	3,983	1,946	2,115	1,298	1,923	2,005	1,897	3,542	712	712	3,983	2,362
1963	698	691	732	2,436	3,508	1,382	3,076	2,688	1,309	1,614	2,187	1,061	691	3,508	1,782
1964	1,543	2,912	4,542	6,747	6,520	1,931	1,694	1,535	1,409	2,467	2,891	1,959	1,409	6,747	3,013
1965	1,524	1,303	2,674	2,934	2,150	1,924	1,711	1,630	1,877	1,265	1,210	1,049	1,049	2,934	1,771
1966	1,100	1,797	3,942	1,681	3,158	2,605	1,644	1,872	1,930	1,301	960	1,149	960	3,942	1,928
1967	1,968	1,454	1,501	1,083	1,555	3,010	2,046	2,747	3,902	3,269	2,382	3,317	1,083	3,902	2,353
1968	4,205	2,431	2,237	2,293	1,922	1,777	2,200	2,859	2,777	1,767	1,104	896	896	4,205	2,206
1969	1,113	1,067	1,314	2,899	1,857	1,451	2,597	1,771	2,429	1,451	3,334	2,114	1,067	3,334	1,950
1970	1,037	1,010	843	651	791	1,691	1,811	2,696	2,857	2,975	1,150	1,021	651	2,975	1,544
1971	935	748	700	977	1,505	1,254	1,563	3,361	1,921	2,563	2,438	1,251	700	3,361	1,601
1972	3,096	3,446	2,508	1,400	2,312	1,962	1,897	2,867	3,584	2,920	1,046	884	884	3,584	2,327
1973	933	3,491	3,355	4,058	3,765	4,788	2,381	2,380	1,823	1,955	2,494	1,209	933	4,788	2,719
1974	3,521	3,144	1,312	3,812	2,488	1,798	1,618	2,202	1,733	3,428	3,827	1,057	1,057	3,827	2,495
1975	1,030	1,266	3,245	3,678	2,614	1,732	1,321	1,787	1,748	1,607	2,036	2,158	1,030	3,678	2,018
1976	2,665	2,594	2,506	5,453	3,503	3,752	2,538	2,388	1,986	1,257	1,254	973	973	5,453	2,572
1977	1,227	1,027	2,453	5,914	2,131	1,894	2,034	2,529	1,798	1,027	1,311	2,317	1,027	5,914	2,139
1978	3,892	3,438	2,226	1,656	1,907	1,478	1,922	2,538	2,391	2,993	2,289	1,027	1,027	3,892	2,313
1979	1,062	976	1,219	4,948	3,818	2,180	1,576	1,994	1,491	2,132	1,971	1,394	976	4,948	2,063
1980	2,732	1,906	3,812	6,147	3,373	2,226	2,217	2,265	2,136	1,816	979	1,005	979	6,147	2,551
1981	929	918	975	794	814	955	1,401	2,013	2,007	2,033	1,970	1,113	794	2,033	1,327
1982	908	819	845	945	937	960	1,019	1,272	1,594	1,144	980	1,937	819	1,937	1,113
1983	2,011	2,603	2,626	3,728	2,555	1,985	2,114	2,719	1,520	1,425	1,687	1,274	1,274	3,728	2,187
1984	2,607	2,684	2,823	2,915	4,045	1,917	1,934	3,260	2,130	1,807	1,677	1,040	1,040	4,045	2,403
1985	995	893	1,109	953	933	1,364	1,908	1,718	1,966	1,265	1,185	1,176	893	1,966	1,289

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Min	Max	Avg
1986	1,004	851	929	947	957	1,070	2,174	1,210	1,004	936	961	946		851	2,174	1,082
1987	792	640	612	1,419	973	1,092	1,565	2,613	2,393	1,685	1,217	932		612	2,613	1,328
1988	756	722	824	805	894	1,064	1,171	1,124	1,035	917	916	860		722	1,171	924
1989	857	844	756	717	799	758	1,232	2,434	2,204	2,543	2,344	1,854		717	2,543	1,445
1990	3,233	6,079	5,298	4,057	2,285	2,166	2,403	2,875	2,260	2,265	1,813	1,426		1,426	6,079	3,013
1991	1,104	1,071	825	1,186	3,849	1,976	2,244	2,479	3,596	4,168	1,716	1,086		825	4,168	2,108
1992	1,214	1,102	2,033	2,152	2,274	1,521	2,610	1,729	1,371	2,432	2,131	5,309		1,102	5,309	2,157
1993	6,275	3,756	3,742	4,142	2,591	2,435	2,610	2,091	2,024	1,985	1,151	1,191		1,151	6,275	2,833
1994	1,021	1,016	846	815	1,094	1,875	1,420	3,797	3,054	1,242	1,591	2,282		815	3,797	1,671
1995	2,367	3,404	4,050	1,331	1,991	1,830	2,179	2,234	2,499	1,404	1,566	1,775		1,331	4,050	2,219
1996	2,830	6,472	4,224	2,514	2,879	2,258	2,258	2,476	1,833	1,645	1,265	1,077		1,077	6,472	2,644
1997	1,059	1,624	3,214	2,140	2,314	2,522	1,781	1,926	2,579	1,890	1,299	1,496		1,059	3,214	1,987
1998	2,736	5,626	4,636	3,553	3,794	2,450	2,770	1,849	1,829	1,424	1,300	1,036		1,036	5,626	2,750
1999	861	846	936	989	1,043	1,607	986	1,389	1,504	1,153	1,047	1,111		846	1,607	1,123
2000	877	928	932	916	1,118	1,975	1,922	2,057	1,102	1,111	924	986		877	2,057	1,237
2001	938	820	617	641	804	693	1,028	1,162	981	907	827	791		617	1,162	851
2002	617	628	537	587	630	833	933	1,060	1,193	1,061	864	839		537	1,193	815
2003	1,039	1,619	3,382	2,169	4,197	3,164	3,735	2,336	1,678	1,460	1,862	2,167		1,039	4,197	2,401
2004	2,178	1,335	1,184	852	822	866	1,585	1,531	3,129	2,563	1,490	3,893		822	3,893	1,786
2005	1,977	1,821	2,518	3,118	1,902	2,852	3,288	3,405	2,112	1,283	1,350	2,302		1,283	3,405	2,327
2006	2,526	1,859	1,631	1,845	2,237	1,584	1,229	1,347	1,256	1,227	995	1,053		995	2,526	1,566
2007	950	959	1,001	1,041	1,268	1,653	1,316	1,470	1,717	1,909	2,243	1,050		950	2,243	1,381
2008	790	699	612	586	798	1,044	983	1,077	1,059	1,007	998	672		586	1,077	860
2009	654	731	612	564	649	926	1,047	1,022	893	1456	3676	5171		564	5171	1450
2010	3282	5303	3469	1582	2848	1491	1364	1565	1143	1304	1283	1074		1074	5303	2142
2011	1126	1306	3245	3088	2678	2010	1325	1389	1917	1975	1915	988		988	3245	1914
2012	730	713	636	1565	1118	1077	1176	1182	1160	1329	2984	1409		636	2984	1257
2013	707	588	600	1501	4303	2587	3724	3177	2230	1666	1459	3886		588	4303	2202
2014	3719	2911	1996	3201	2185	1422	1370	1735	1202	1195	1381	1135		1135	3719	1954
2015	1237	1616	1763	1849	1814	1846	1737	1351	1392	1659	2322	2141		1237	2322	1727
Min	350	489	347	380	501	661	493	429	455	390	459	350		347	661	442
Max	6,275	6,472	5,298	6,747	6,520	4,788	3,735	3,797	3,902	4,168	3,827	5,309		3,735	5,070	5,070
Avg	1,724	1,852	2,010	2,275	2,116	1,825	1,846	2,074	1,914	1,735	1,693	1,579		1,579	1,887	1,887

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Buford Average Monthly Unimpaired Inflow in cfs															
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Min	Max	Avg
1939	1,845	4,841	3,698	2,577	2,264	1,816	1,288	2,416	1,020	722	732	905	722	4,841	2,010
1940	1,266	1,907	1,987	2,016	1,262	1,226	1,087	2,656	1,139	739	1,053	1,377	739	2,656	1,476
1941	1,462	1,136	1,509	1,322	874	716	2,627	925	560	443	641	1,458	443	2,627	1,139
1942	1,299	2,726	3,302	1,660	1,681	1,493	1,206	1,529	1,446	1,189	1,091	3,024	1,091	3,302	1,804
1943	3,287	3,060	3,301	3,362	2,576	1,874	2,394	1,843	1,321	1,034	1,187	1,212	1,034	3,362	2,204
1944	2,103	4,151	5,647	4,026	2,566	1,633	1,214	1,034	867	809	1,002	1,189	809	5,647	2,187
1945	1,635	2,934	2,369	2,274	1,914	1,240	1,338	1,620	1,798	1,371	1,395	3,004	1,240	3,004	1,908
1946	7,267	6,121	5,580	3,694	3,658	2,313	1,889	1,240	1,088	1,164	1,165	1,192	1,088	7,267	3,031
1947	4,374	1,989	2,146	2,580	1,624	1,887	1,216	990	729	992	1,999	1,556	729	4,374	1,840
1948	1,438	3,795	3,575	2,819	1,927	1,703	2,857	2,893	1,292	978	4,588	2,968	978	4,588	2,569
1949	4,607	4,551	3,221	3,551	3,270	3,414	3,842	2,841	3,692	2,073	2,117	2,193	2,073	4,607	3,281
1950	2,629	2,465	3,141	2,315	1,772	2,307	1,899	1,486	1,787	1,713	1,189	1,473	1,189	3,141	2,015
1951	1,331	1,506	2,673	2,838	1,746	1,659	1,269	794	863	843	1,354	3,995	794	3,995	1,739
1952	2,404	2,719	7,724	3,445	2,401	1,637	1,036	1,534	911	772	1,048	1,335	772	7,724	2,247
1953	3,413	3,461	2,957	2,001	2,690	1,486	1,923	1,007	1,176	933	1,039	2,907	933	3,461	2,083
1954	4,918	2,361	2,701	2,780	1,800	1,596	992	793	534	469	739	1,278	469	4,918	1,747
1955	1,476	3,454	1,860	2,063	1,975	1,190	1,265	1,064	592	599	737	737	592	3,454	1,418
1956	739	2,381	2,444	3,196	2,006	1,365	1,333	837	915	827	798	1,638	739	3,196	1,540
1957	2,010	3,006	2,178	3,950	1,682	1,431	972	603	668	1,100	2,350	2,115	603	3,950	1,839
1958	1,737	2,287	2,537	2,858	2,335	1,316	2,845	1,330	1,191	784	849	989	784	2,858	1,755
1959	1,643	2,090	2,092	2,354	2,223	1,985	1,407	962	1,442	2,629	1,314	1,682	962	2,629	1,819
1960	2,703	3,571	3,559	3,543	2,129	1,776	1,458	1,681	1,633	1,625	1,034	1,269	1,034	3,571	2,165
1961	1,295	5,636	3,110	3,175	2,255	2,412	1,968	1,749	1,141	716	988	5,615	716	5,636	2,505
1962	2,675	3,352	3,816	4,204	2,049	1,609	1,207	855	990	751	1,208	1,123	751	4,204	1,987
1963	1,796	1,609	5,723	3,493	2,264	2,748	2,005	1,062	1,290	746	1,078	1,579	746	5,723	2,116
1964	4,101	2,727	6,462	7,594	3,696	1,914	1,798	1,410	1,199	2,362	1,363	2,250	1,199	7,594	3,073
1965	1,996	2,727	3,523	2,812	1,968	1,938	1,354	926	768	1,077	883	711	711	3,523	1,724
1966	1,456	4,999	3,945	2,684	3,214	1,714	1,189	1,110	874	1,192	1,637	1,467	874	4,999	2,123
1967	2,121	2,072	2,111	1,718	1,918	2,486	2,708	4,596	2,003	1,541	2,792	3,595	1,541	4,596	2,472
1968	3,814	2,188	3,562	2,862	2,108	1,661	1,321	831	948	773	1,442	1,810	773	3,814	1,943
1969	2,672	3,576	2,257	3,356	2,133	1,658	1,007	2,658	1,511	953	1,409	1,463	953	3,576	2,054
1970	1,638	1,715	2,257	2,217	1,468	1,893	945	1,146	818	1,137	1,113	1,035	818	2,257	1,449
1971	2,155	3,156	3,232	2,261	1,795	1,392	2,382	2,551	1,330	1,122	1,259	3,161	1,122	3,232	2,150
1972	4,782	2,525	2,599	2,170	3,126	2,099	1,712	1,224	897	995	1,647	3,732	897	4,782	2,292
1973	2,913	3,652	4,583	4,429	4,955	3,758	2,254	1,811	1,794	1,076	1,278	2,969	1,076	4,955	2,956
1974	4,072	3,648	2,689	3,448	2,725	1,845	1,721	2,410	1,184	870	1,163	1,696	870	4,072	2,289

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

AVERAGE MONTHLY INFLOW
UNIMPAIRED FLOWS

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Buford Average Monthly Unimpaired Inflow in cfs															
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Min	Max	Avg
1975	2,486	4,395	4,802	2,750	2,879	1,812	1,499	1,230	2,065	1,924	1,721	1,923	1,230	4,802	2,457
1976	3,269	2,333	5,527	2,817	4,988	2,630	2,284	1,158	875	1,307	1,188	2,057	875	5,527	2,536
1977	2,172	1,592	5,325	3,982	2,319	1,342	939	820	1,255	2,355	3,688	2,229	820	5,325	2,335
1978	4,691	2,412	2,713	1,992	2,105	1,268	949	2,570	812	504	794	1,389	504	4,691	1,850
1979	3,185	3,222	4,295	6,466	2,929	2,046	1,977	1,318	1,731	1,395	2,417	1,357	1,318	6,466	2,695
1980	2,629	1,973	7,318	3,953	2,969	2,308	1,192	834	1,100	1,070	992	797	797	7,318	2,261
1981	712	2,333	1,379	1,319	1,353	1,410	626	475	496	457	561	1,271	457	2,333	1,033
1982	3,337	4,723	2,165	2,245	1,567	1,153	1,077	1,177	745	1,404	1,324	3,057	745	4,723	1,998
1983	1,927	3,258	2,944	4,189	2,910	1,753	1,106	758	1,110	952	1,832	4,664	758	4,664	2,284
1984	2,532	3,054	2,944	3,490	4,107	1,918	2,869	2,195	925	969	1,013	1,412	925	4,107	2,286
1985	1,256	2,957	1,493	1,404	1,372	887	1,540	1,446	651	750	1,338	1,146	651	2,957	1,353
1986	887	1,025	1,281	839	863	478	195	328	704	1,664	1,828	2,025	195	2,025	1,010
1987	2,332	2,867	2,960	2,195	1,456	1,240	893	547	471	288	617	1,051	288	2,960	1,410
1988	2,175	1,389	1,071	1,775	781	465	672	468	871	887	749	699	465	2,175	1,000
1989	1,765	1,999	2,568	1,964	1,640	3,294	2,611	1,548	1,989	3,399	1,950	2,157	1,548	3,399	2,240
1990	3,817	5,455	6,669	3,174	2,415	1,448	1,559	1,200	1,523	1,498	1,122	1,750	1,122	6,669	2,636
1991	2,496	2,312	3,197	3,320	3,745	2,430	2,221	2,753	1,882	1,302	1,524	1,922	1,302	3,745	2,425
1992	2,136	3,189	3,435	2,326	1,770	2,127	1,698	2,102	1,976	2,058	4,130	4,935	1,698	4,935	2,657
1993	5,866	3,770	4,474	3,674	2,712	1,767	1,136	1,082	771	751	1,315	1,307	751	5,866	2,385
1994	1,874	2,520	3,328	2,816	1,672	2,173	2,124	3,567	1,766	2,006	1,791	2,000	1,672	3,567	2,303
1995	2,818	4,077	3,587	2,156	1,764	1,875	1,110	1,879	1,162	3,221	3,310	1,862	1,110	4,077	2,402
1996	4,797	4,462	5,258	3,259	2,594	2,109	1,359	1,391	1,460	1,071	1,287	2,618	1,071	5,258	2,639
1997	2,609	3,312	3,142	2,734	2,617	2,338	1,641	1,143	1,234	2,464	1,497	1,987	1,143	3,312	2,226
1998	4,016	5,934	4,677	5,070	3,594	2,100	1,340	1,522	833	845	1,045	1,272	833	5,934	2,687
1999	1,981	2,377	1,596	1,611	1,519	1,318	1,071	580	430	1,597	1,238	1,095	430	2,377	1,368
2000	1,731	1,476	2,006	2,428	1,176	928	669	800	781	332	910	840	332	2,428	1,173
2001	1,608	1,441	2,337	1,563	1,113	1,358	1,211	983	698	588	633	914	588	2,337	1,204
2002	1,860	1,233	1,911	1,426	1,433	754	658	325	1,281	1,411	2,292	3,377	325	3,377	1,497
2003	1,813	3,094	3,531	2,889	3,643	3,256	3,851	2,193	1,682	1,351	2,072	1,823	1,351	3,851	2,600
2004	1,659	2,575	1,640	1,480	1,368	1,721	1,480	957	4,477	1,468	2,147	3,314	957	4,477	2,024
2005	1,857	2,939	3,264	3,132	2,012	3,418	3,555	3,537	1,500	1,443	1,339	2,247	1,339	3,555	2,520
2006	2,548	2,184	2,025	1,860	1,443	1,162	822	803	1,045	1,316	1,865	1,380	803	2,548	1,538
2007	2,629	1,540	2,400	1,402	1,046	906	963	536	403	475	510	906	403	2,629	1,143
2008	1,012	1,770	2,361	1,392	1,110	617	760	1,569	460	459	498	1,670	459	2,361	1,140
2009	2,464	1,254	2,544	2,549	2,174	1,375	809	951	3,576	3,083	3,425	4,862			
2010	3,926	4,543	3,401	2,842	2,524	1,782	1,298	1,521	1,137	1,013	1,226	1,524	1,013	4,543	2,228
2011	1,463	2,139	3,929	3,069	1,822	1,385	1,028	545	748	723	1,281	1,864	545	3,929	1,666
Min	712	1,025	1,071	839	781	465	195	325	403	288	498	699			
Max	7,267	6,121	7,724	7,594	4,988	3,758	3,851	4,596	4,477	3,399	4,588	5,615			
Avg	2,536	2,933	3,281	2,811	2,215	1,771	1,580	1,460	1,208	1,201	1,446	1,945			

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

AVERAGE MONTHLY INFLOW
UNIMPAIRED FLOWS

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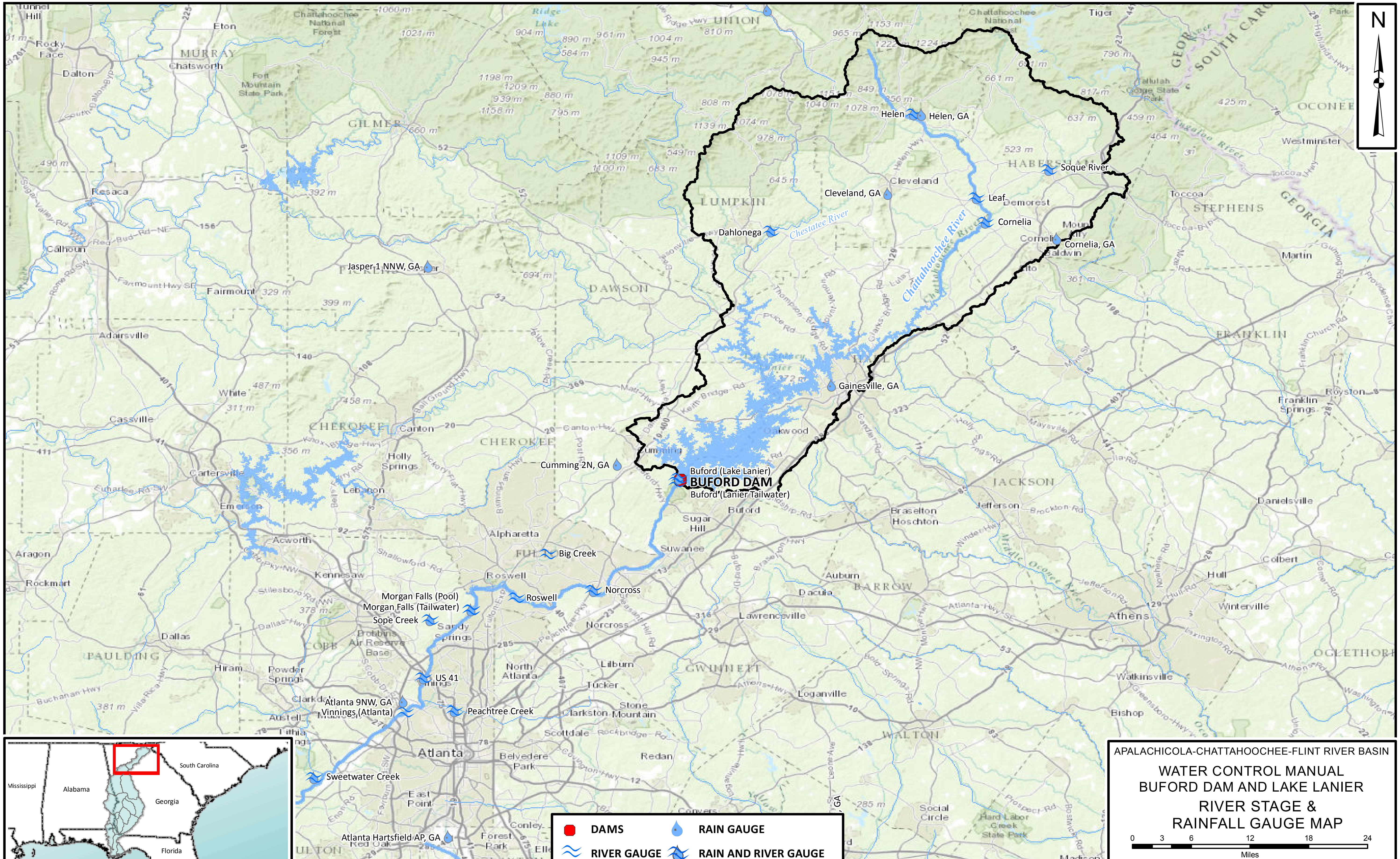
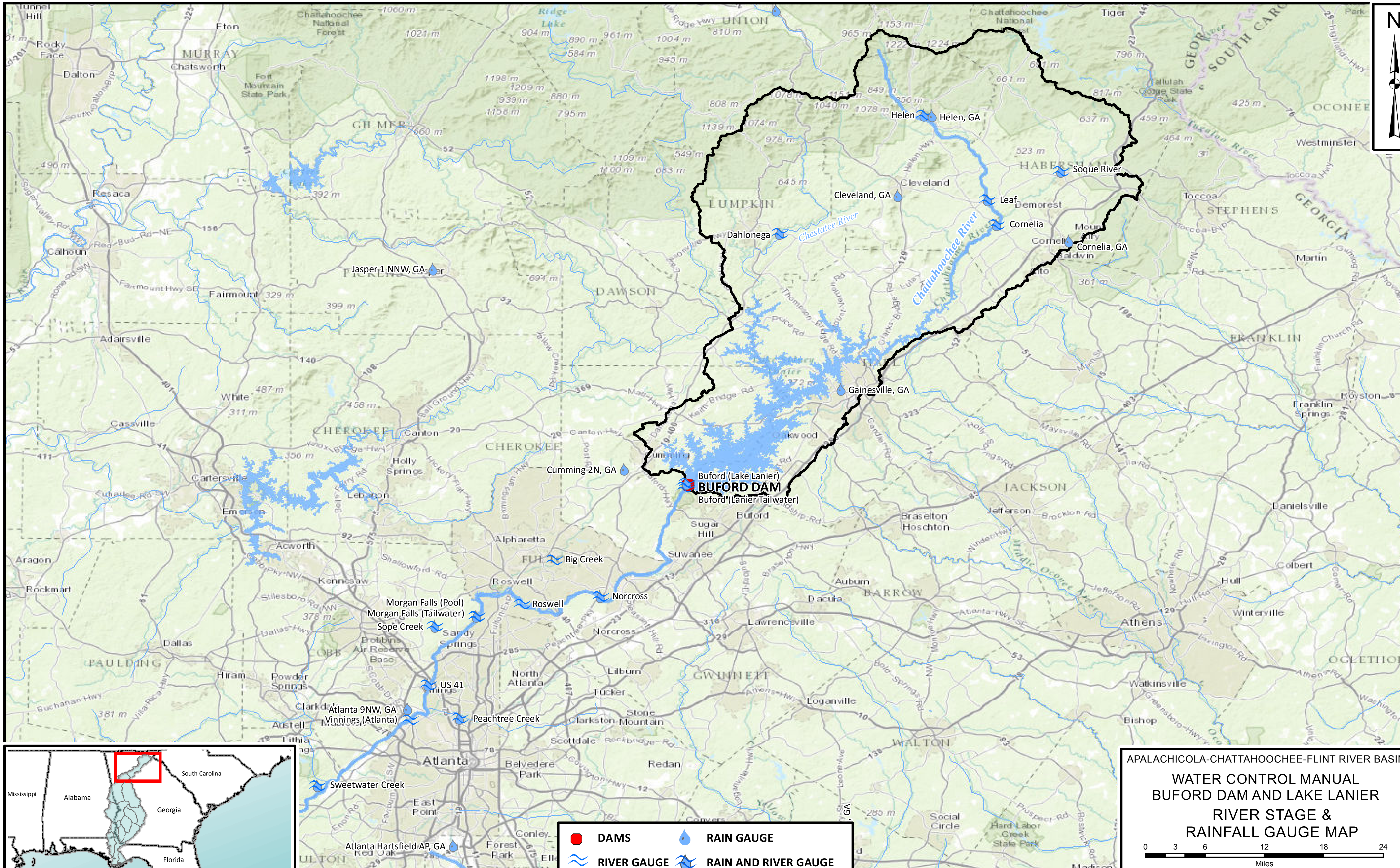
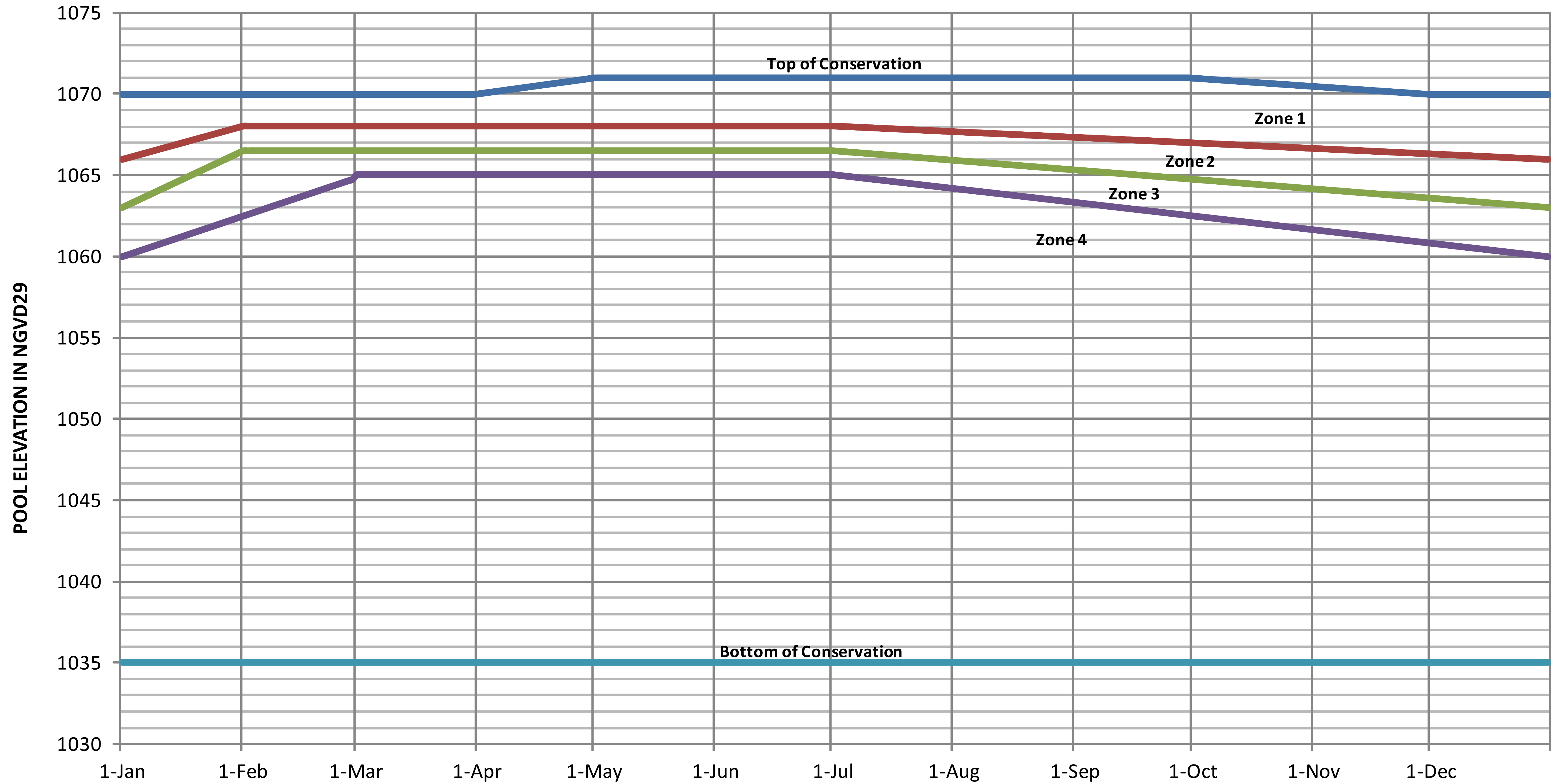

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN
WATER CONTROL MANUAL
BUFORD DAM AND LAKE LANIER
RIVER STAGE &
RAINFALL GAUGE MAP
0 3 6 12 18 24
Miles
DAMS
RAIN GAUGE
RIVER GAUGE
RAIN AND RIVER GAUGE
N
BUFORD DAM
Buford (Lake Lanier)
Buford (Lanier Tailwater)
Helen, GA
Soque River
Cleveland, GA
Leaf
Cornelia
Cornelia, GA
Dahlonega
Chestatee River
Chattahoochee River
Gainesville, GA
Jasper 1 NNW, GA
Cumming 2N, GA
Big Creek
Norcross
Roswell
Morgan Falls (Pool)
Morgan Falls (Tailwater)
Sope Creek
US 41
Atlanta 9NW, GA
Vinnings (Atlanta)
Peachtree Creek
Sweetwater Creek
Atlanta Hartsfield AP, GA
Atlanta
Mississippi
Alabama
Georgia
South Carolina
Florida

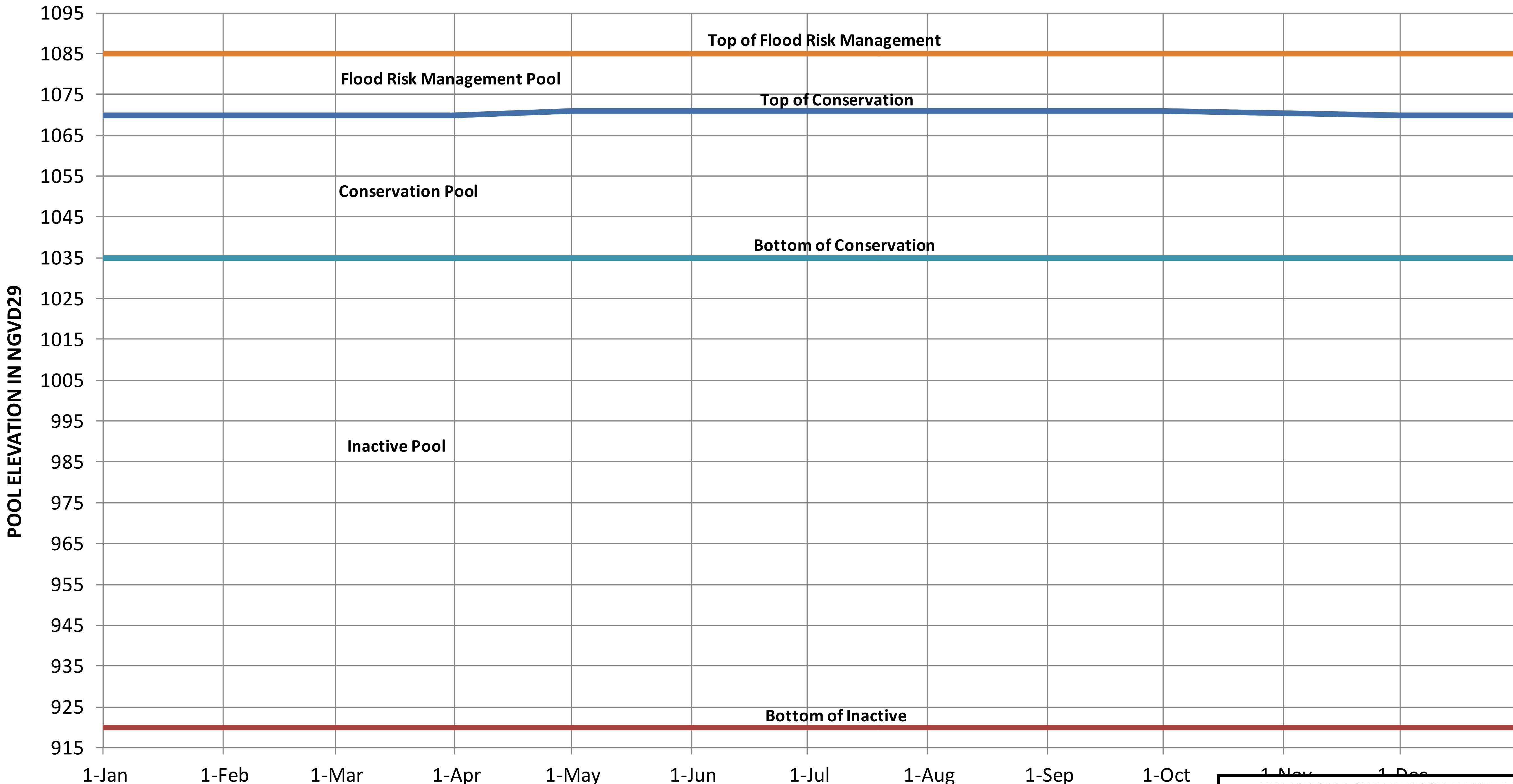

N
Helen, GA
Soque River
Cleveland, GA
Leaf
Cornelia
Cornelia, GA
Dahlonega
Chestatee River
Chattahoochee River
Jasper 1 NNW, GA
Gainesville, GA
Cumming 2N, GA
Buford (Lake Lanier)
BUFORD DAM
Buford (Lanier Tailwater)
Big Creek
Norcross
Roswell
Morgan Falls (Pool)
Morgan Falls (Tailwater)
Sope Creek
US 41
Atlanta 9NW, GA
Vinnings (Atlanta)
Peachtree Creek
Sweetwater Creek
Atlanta Hartsfield AP, GA
Atlanta
Mississippi
Alabama
Georgia
South Carolina
Florida
DAMS
RAIN GAUGE
RIVER GAUGE
RAIN AND RIVER GAUGE
APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN
WATER CONTROL MANUAL
BUFORD DAM AND LAKE LANIER
RIVER STAGE &
RAINFALL GAUGE MAP
0 3 6 12 18 24
Miles



APALACHICOLA-CHATTAHOOCHEE-FLINT BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

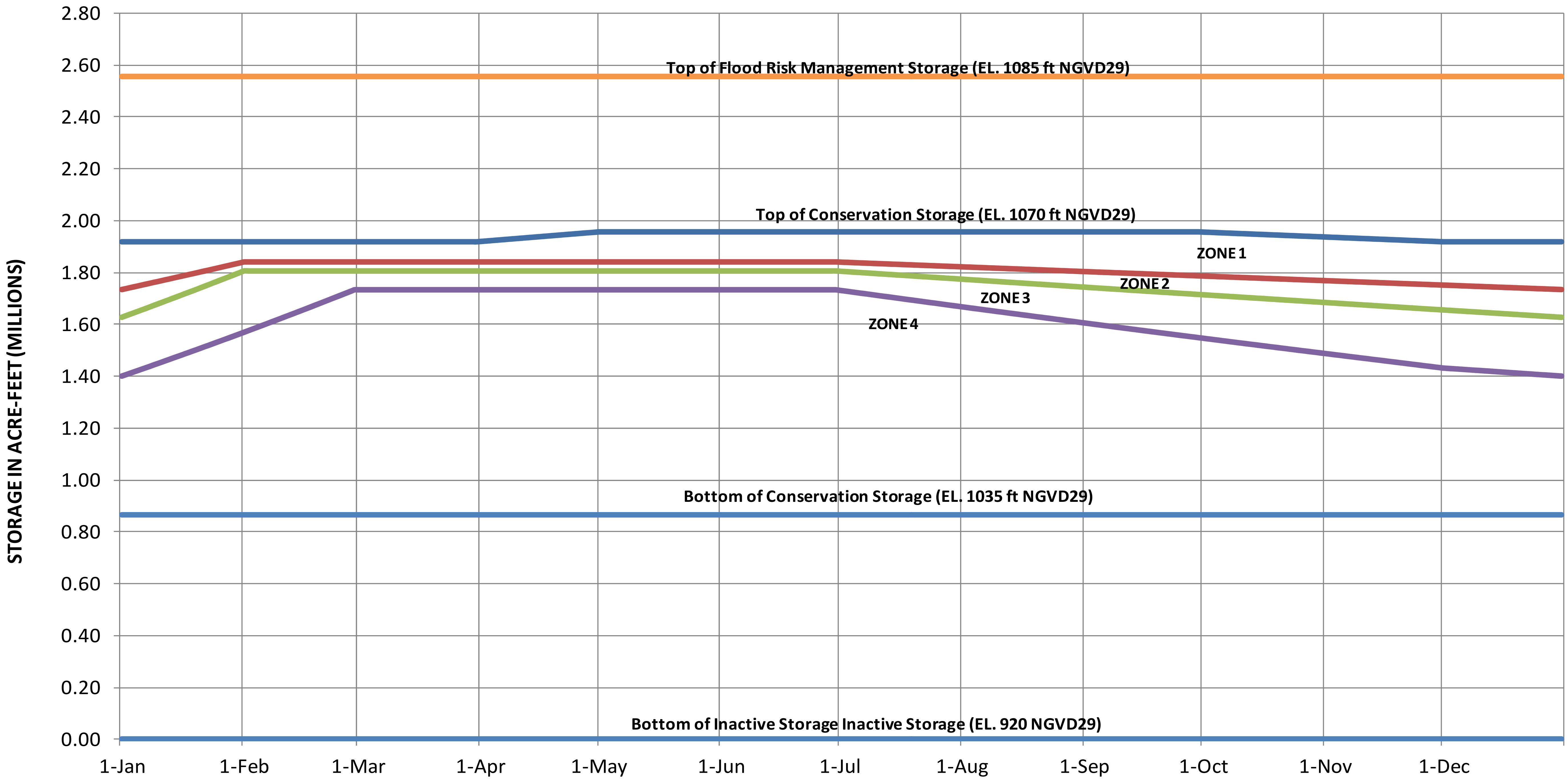
ACTION ZONES



APALACHICOLA-CHATTAHOOCHEE-FLINT BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

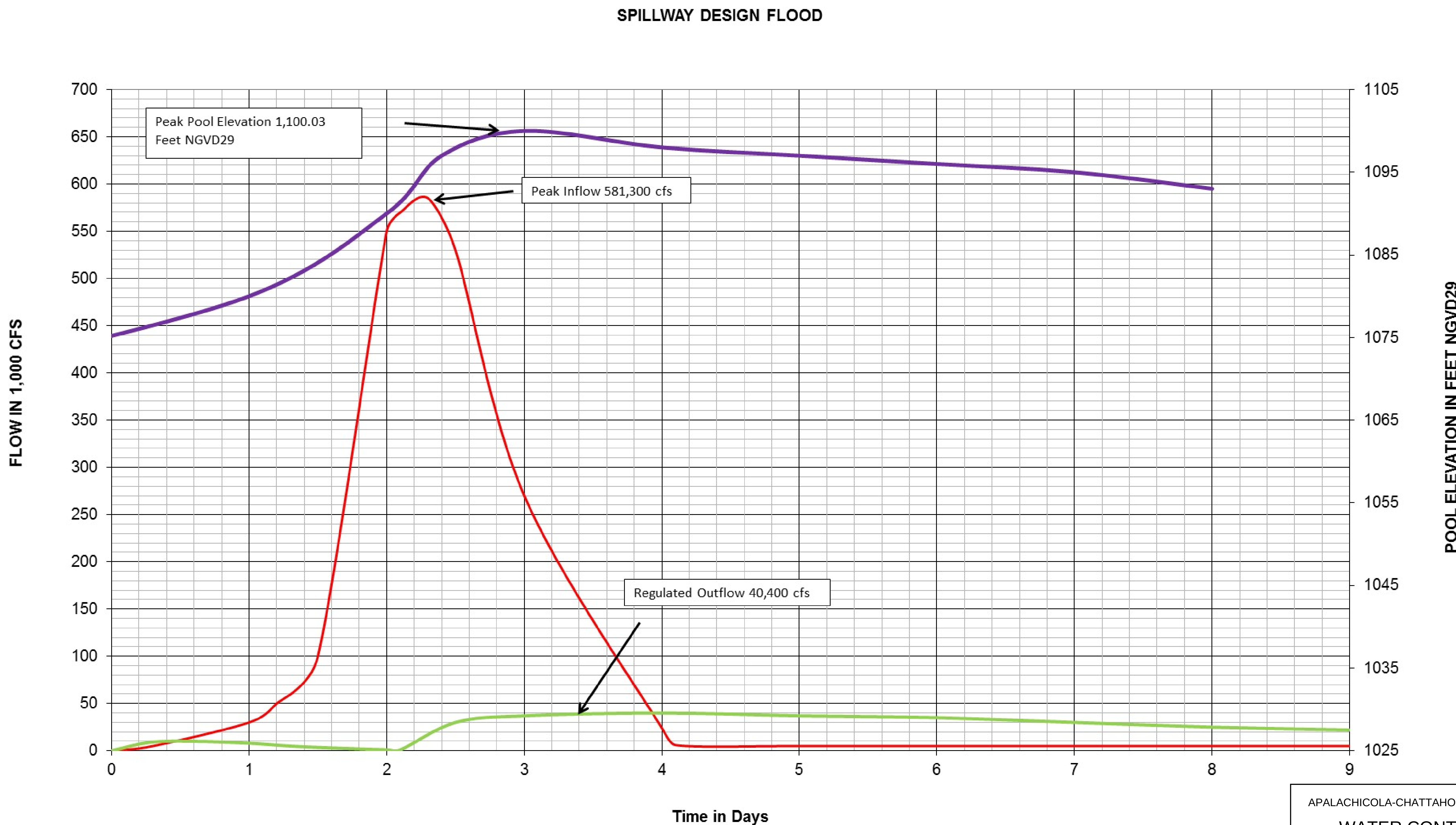
RESERVOIR STORAGE ZONES
IN FEET NGVD29



APALACHICOLA-CHATTAHOOCHEE-FLINT BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

RESERVOIR STORAGE ZONES
BY VOLUME



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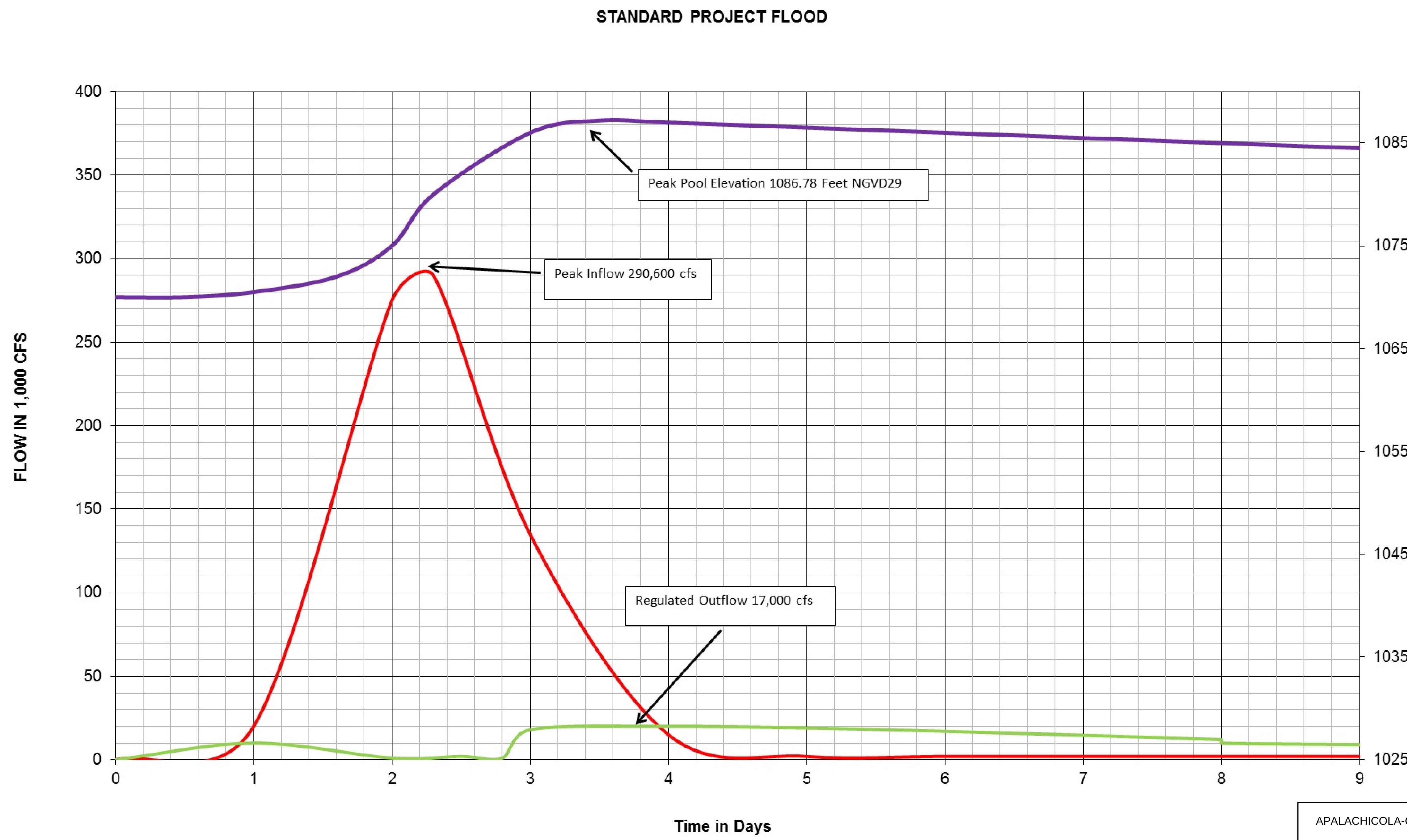
WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

SPILLWAY DESIGN FLOOD



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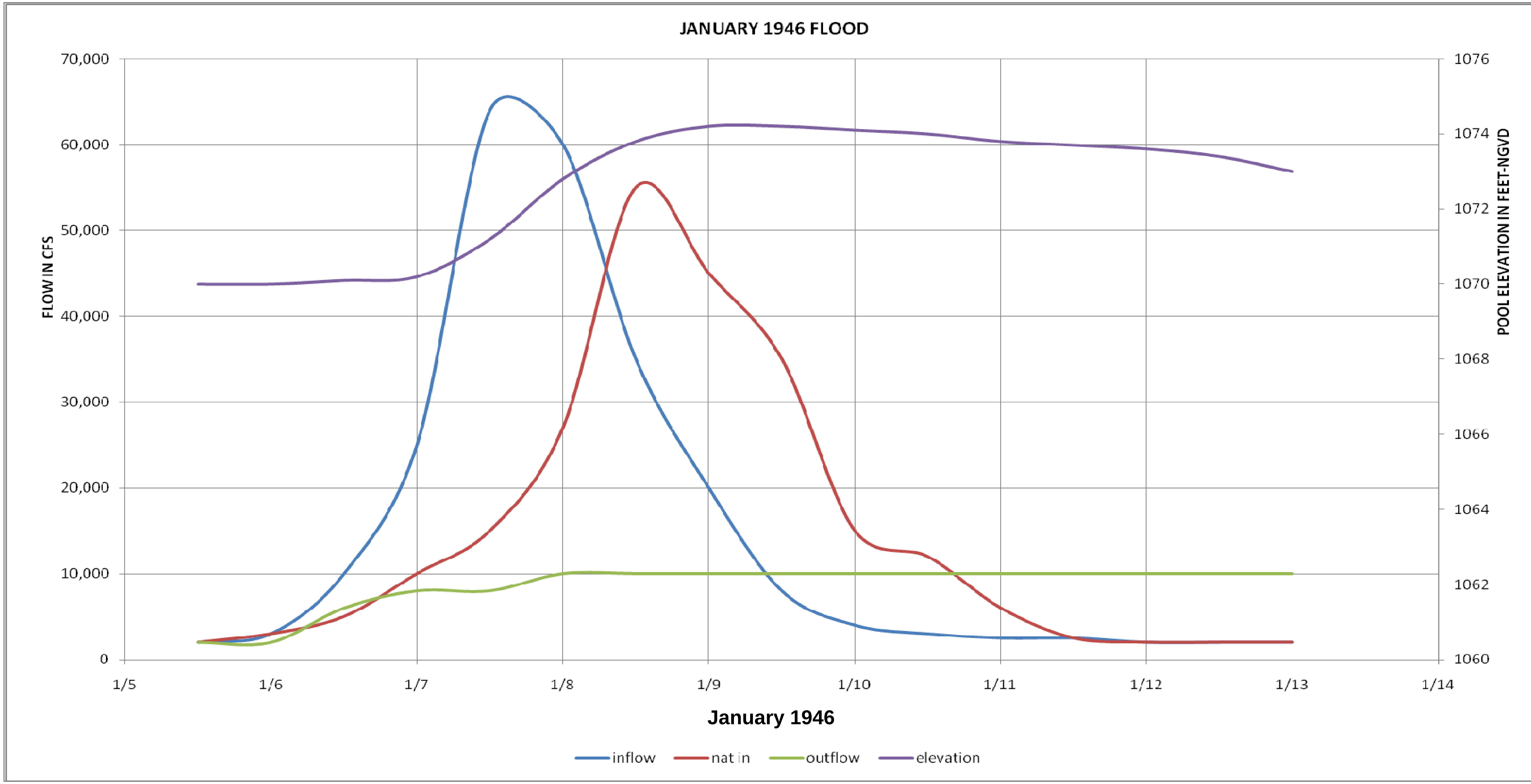
WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

STANDARD PROJECT FLOOD



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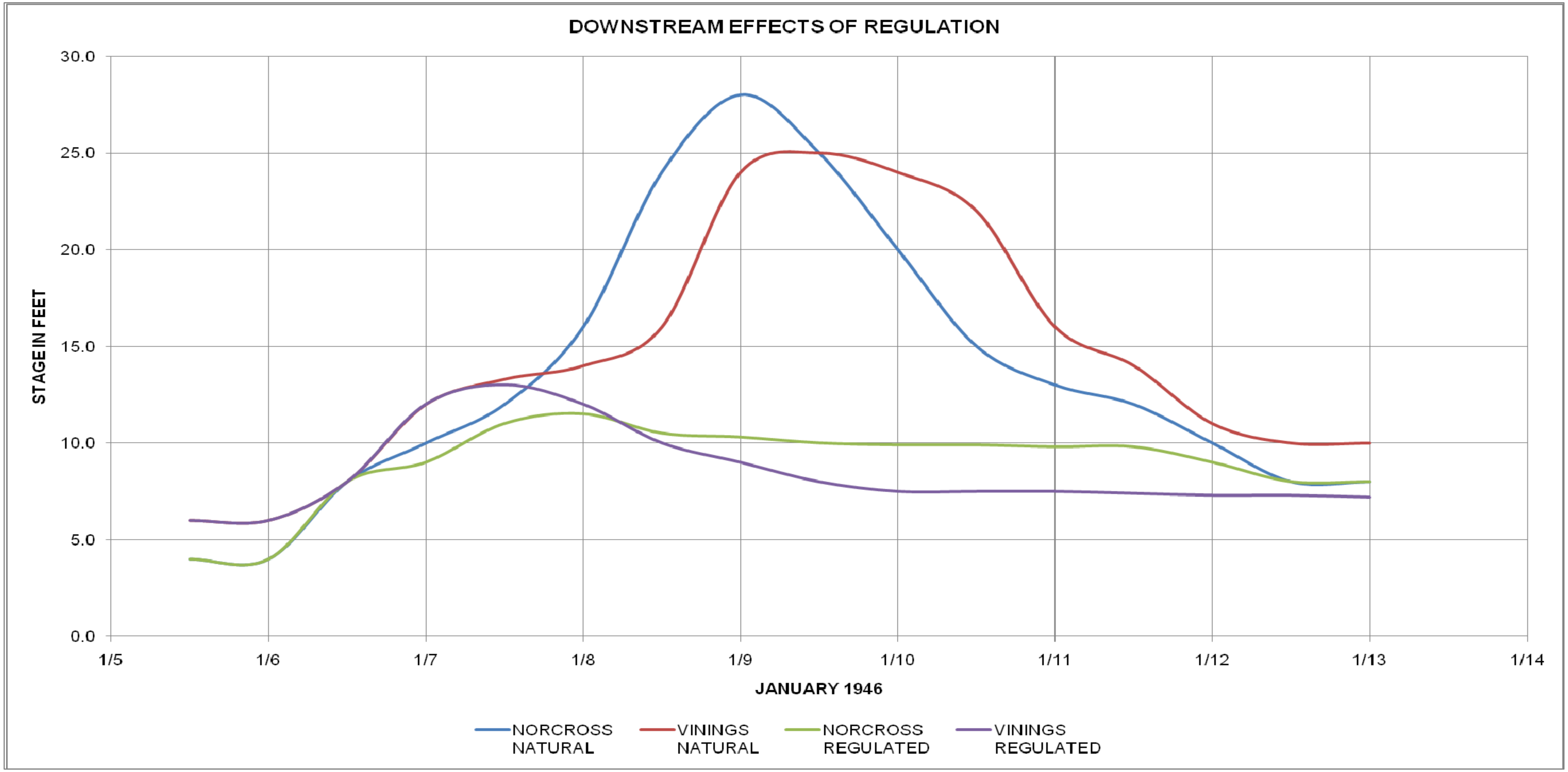
WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

JANUARY 1946 FLOOD

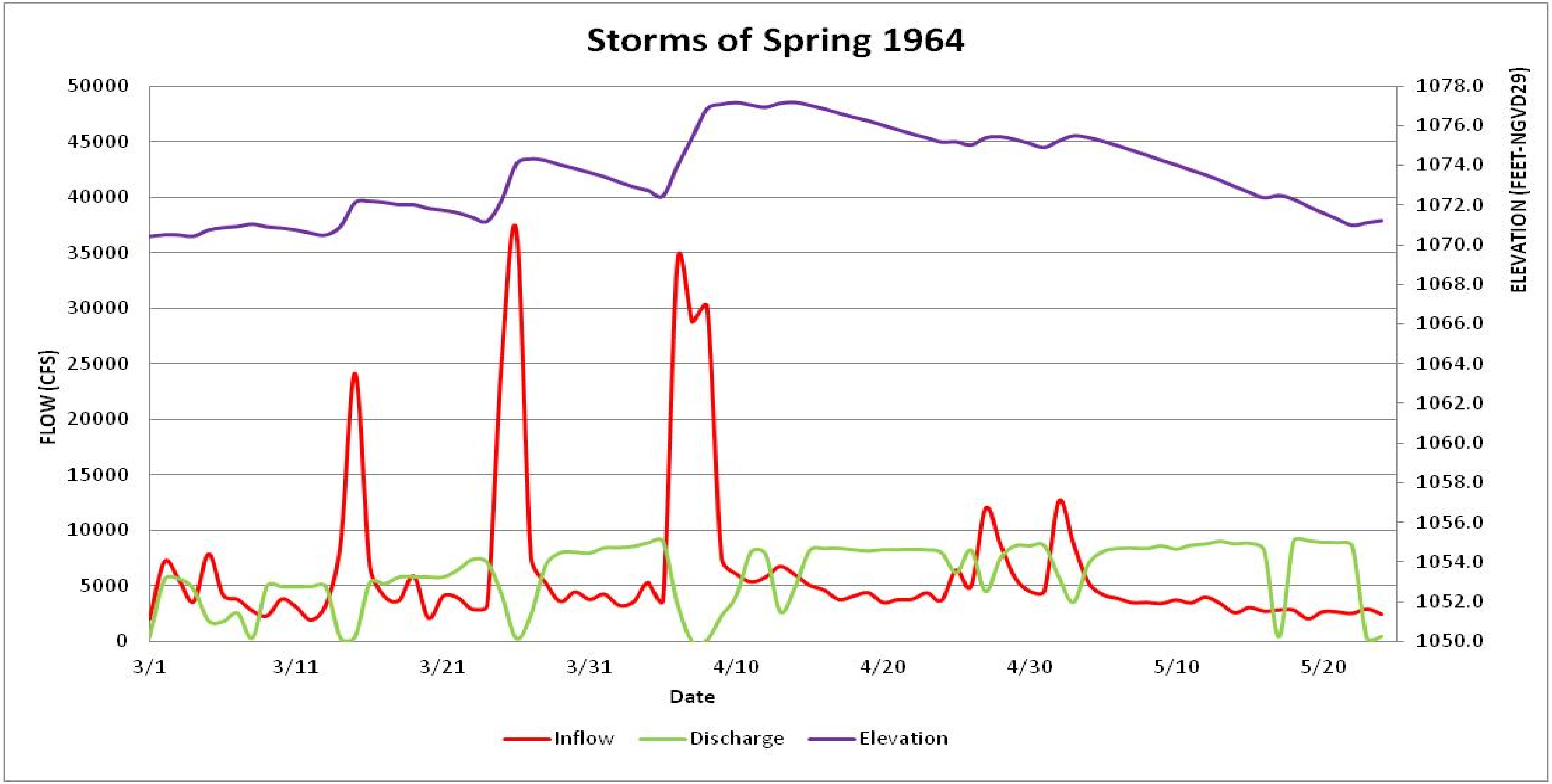


APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

DOWNSTREAM EFFECTS OF REGULATION

JANUARY 1946 FLOOD



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

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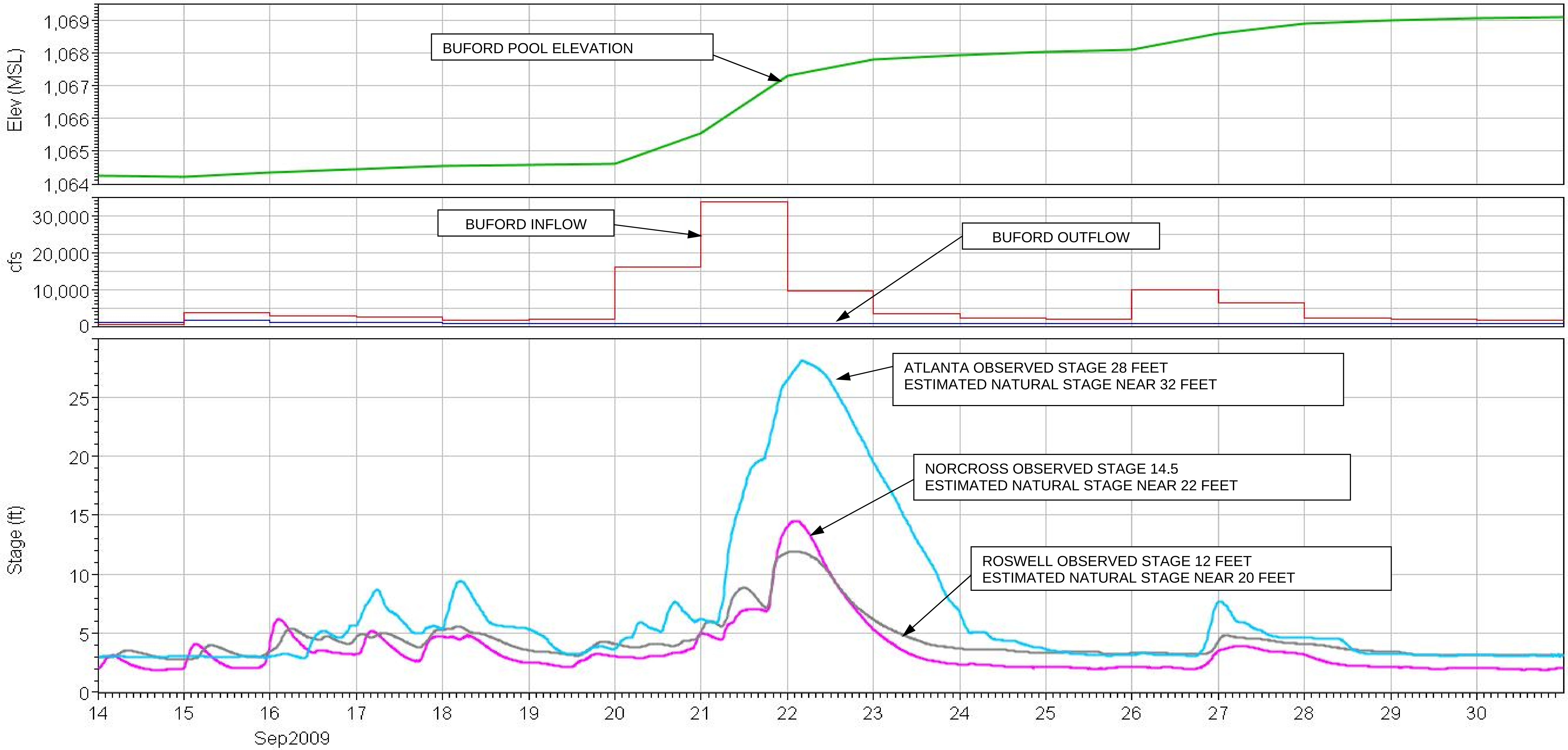
BUFORD DAM AND LAKE SIDNEY LANIER

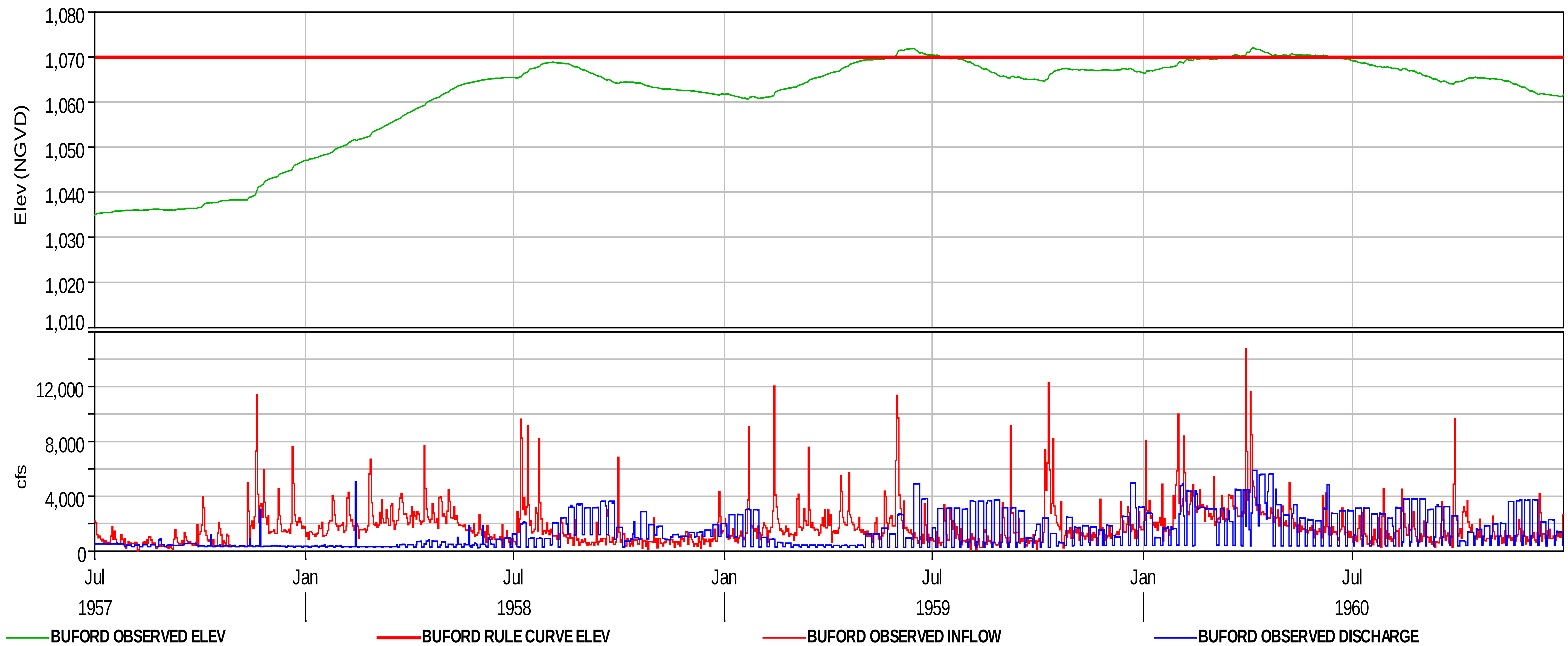
SPRING 1964 FLOOD



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

STORM OF SEPTEMBER 2009



APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL

BUFORD DAM AND LAKE SIDNEY LANIER

POOL ELEVATION-INFLOW-DISCHARGE HYDROGRAPHS

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APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

POOL ELEVATION-INFLOW-DISCHARGE HYDROGRAPHS

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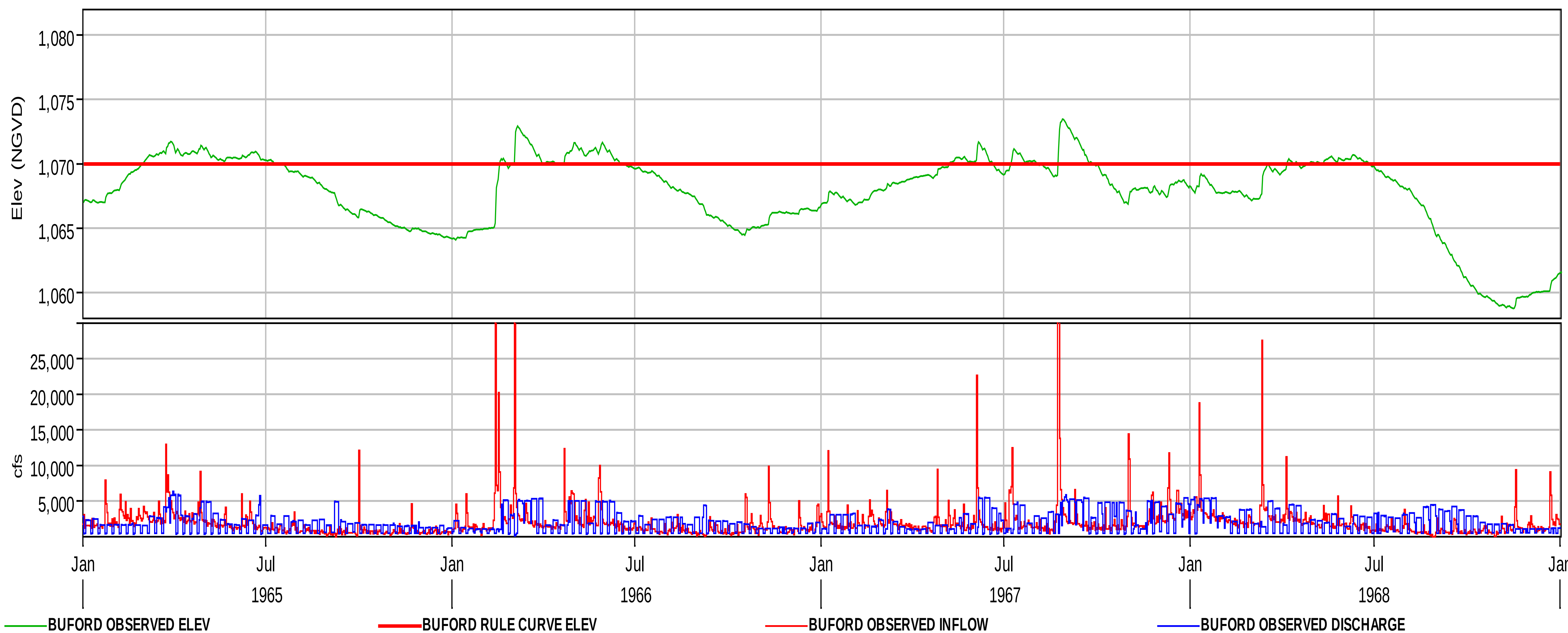

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WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

POOL ELEVATION-INFLOW-DISCHARGE HYDROGRAPHS
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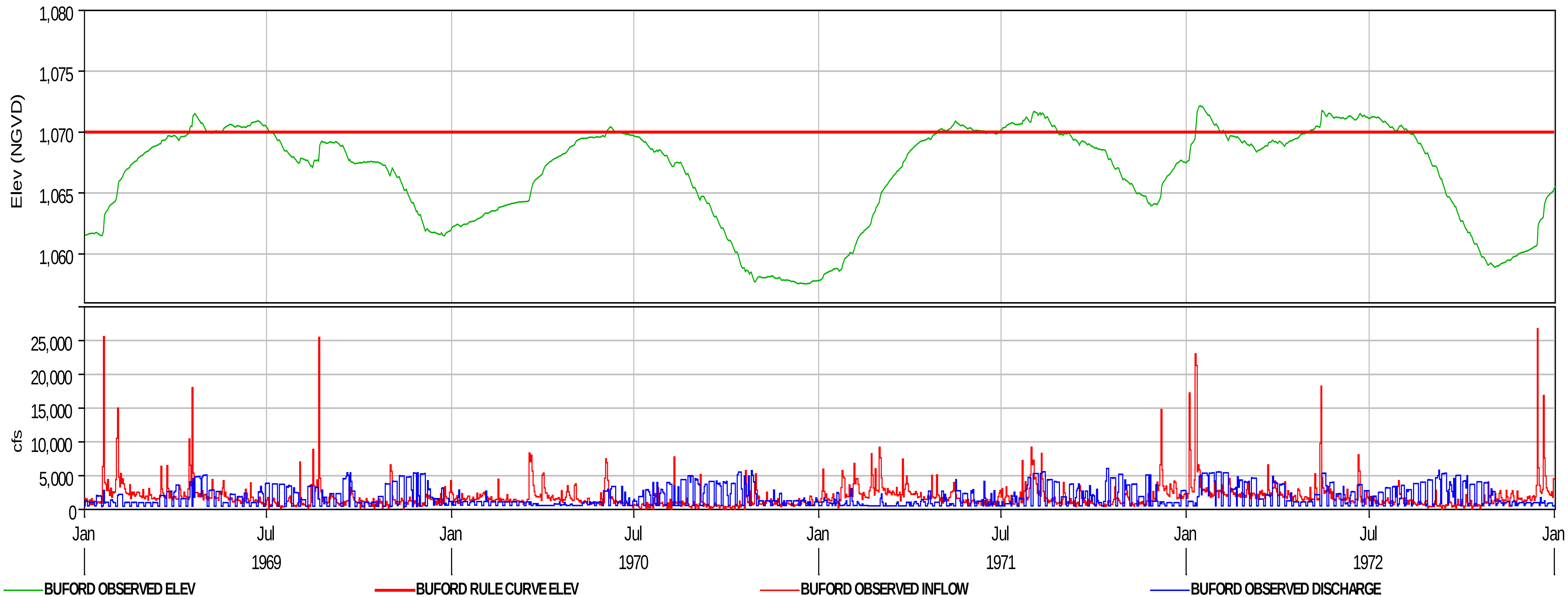

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WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

POOL ELEVATION-INFLOW-
DISCHARGE HYDROGRAPHS

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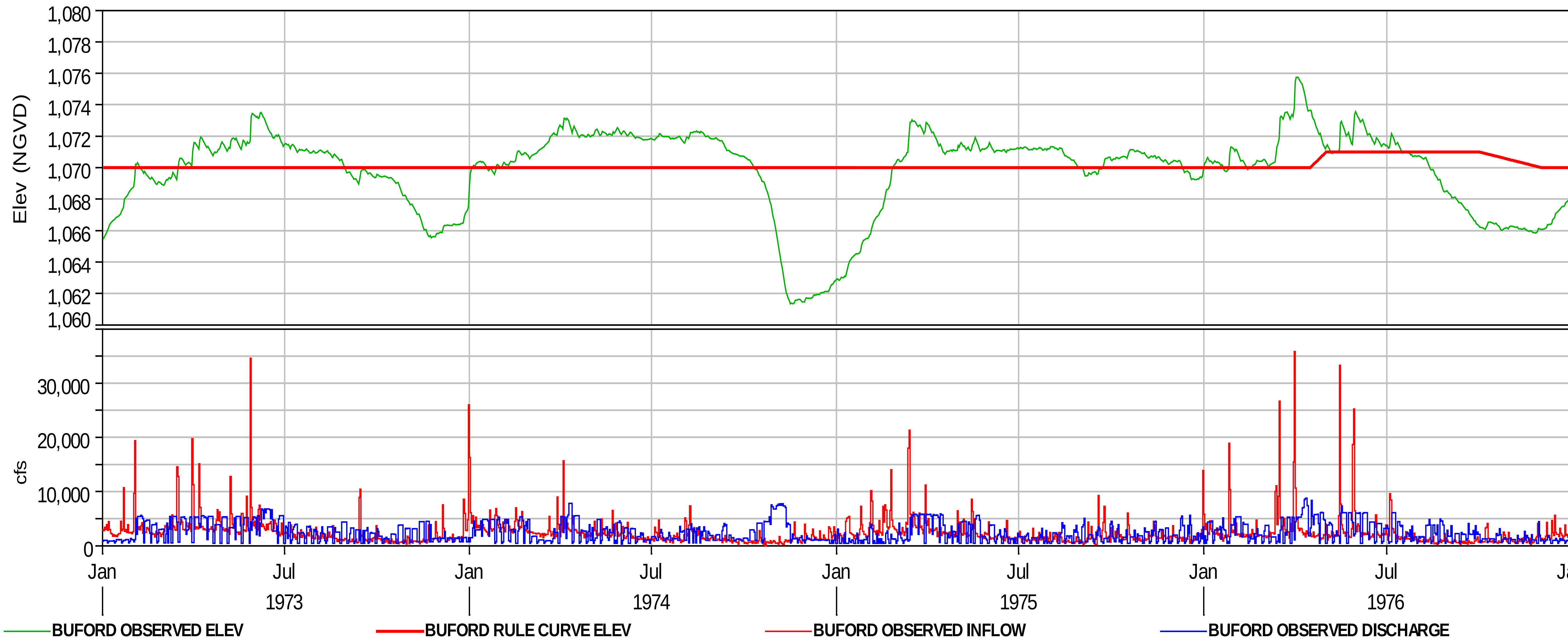

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

POOL ELEVATION-INFLOW-
DISCHARGE HYDROGRAPHS

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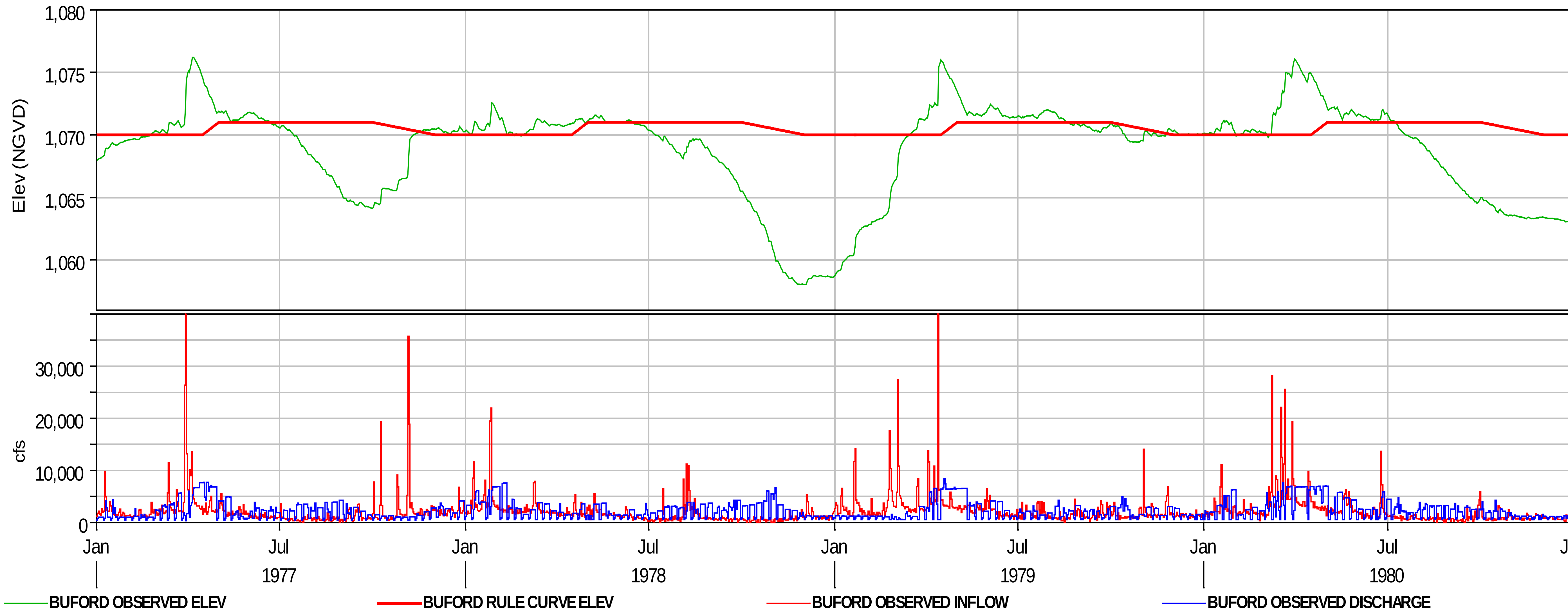

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

POOL ELEVATION-INFLOW-DISCHARGE HYDROGRAPHS

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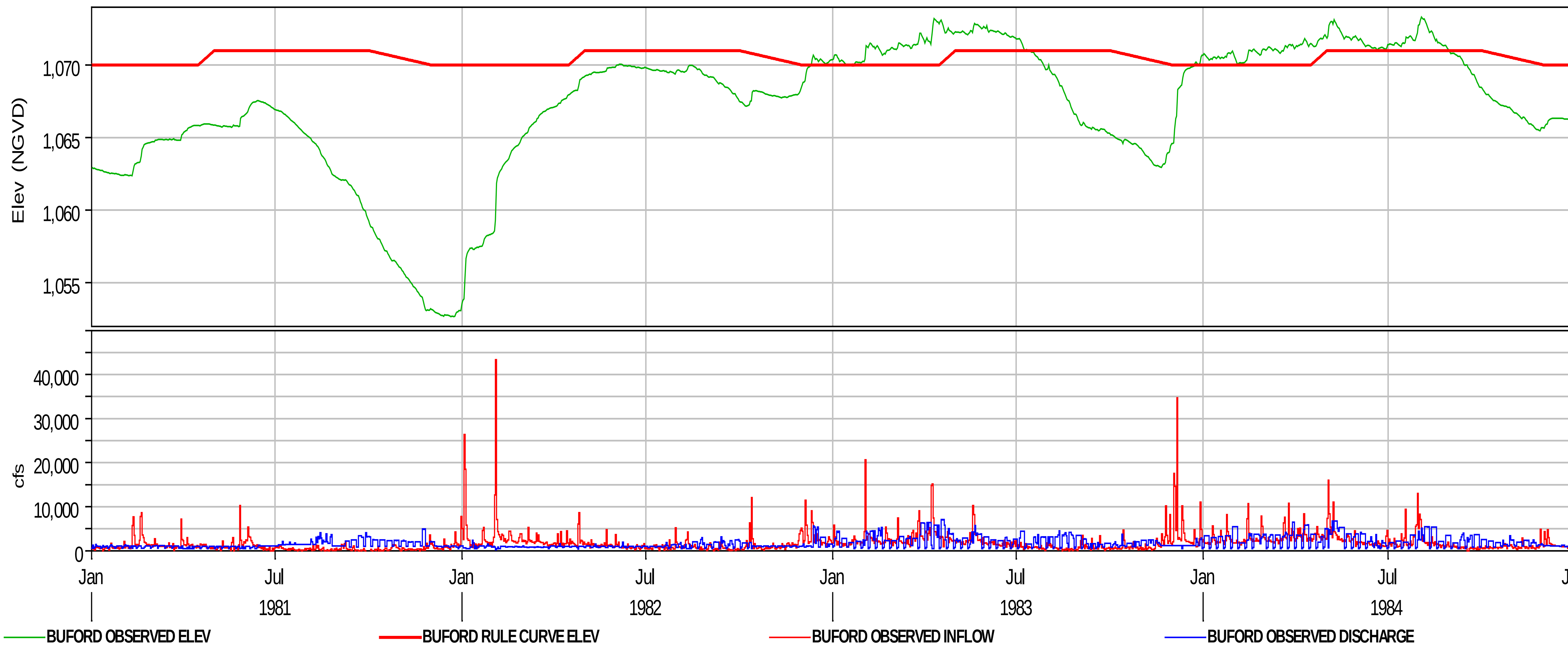

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

POOL ELEVATION-INFLOW-DISCHARGE HYDROGRAPHS
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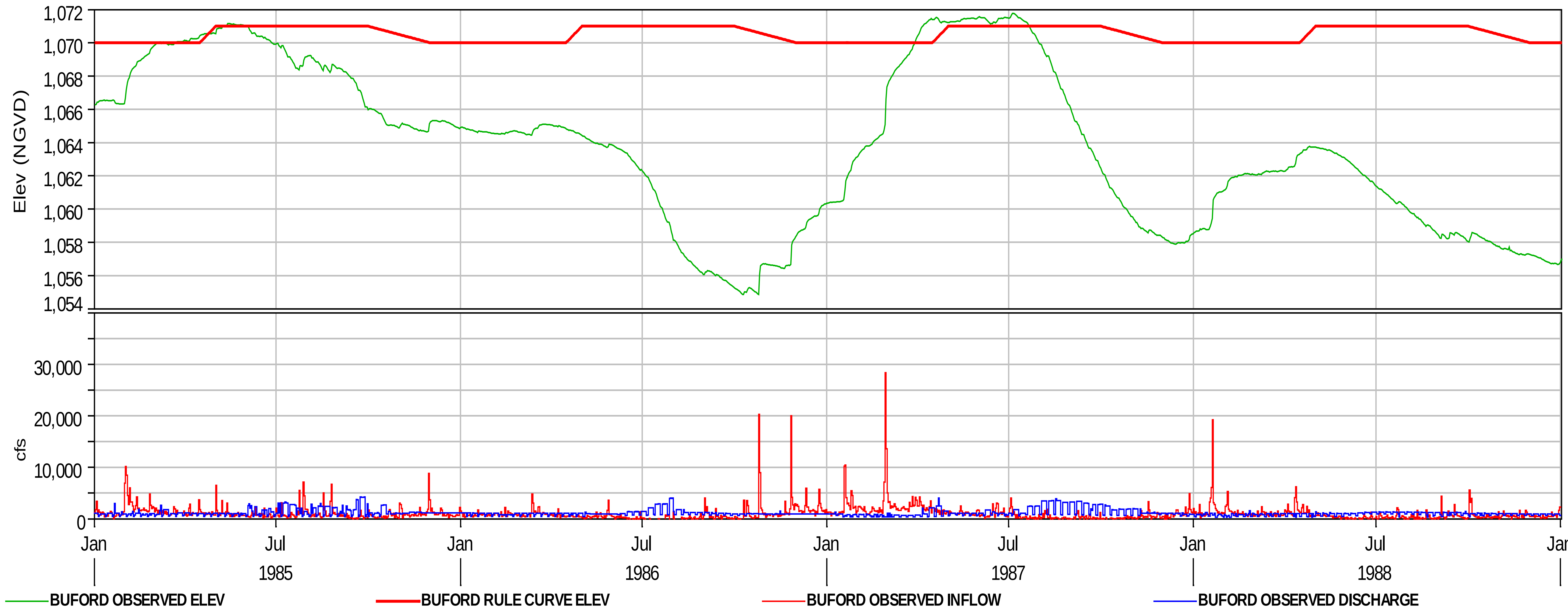
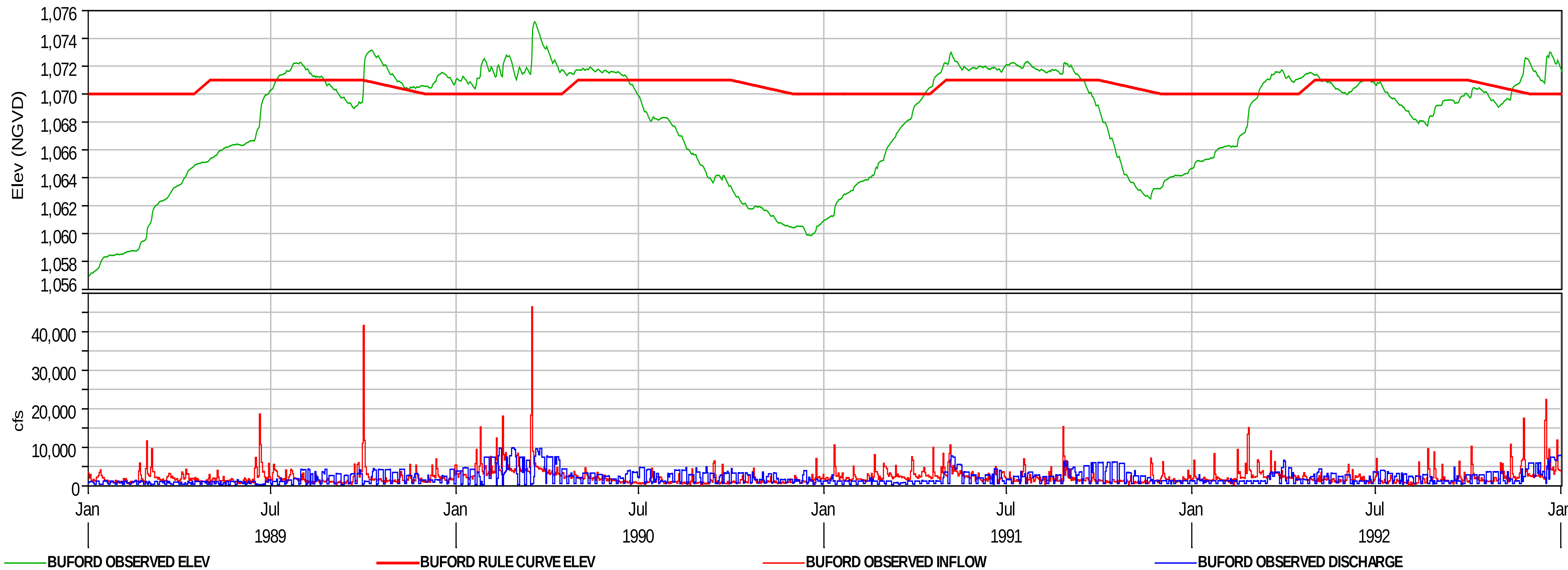


APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

E POOL ELEVATION-INFLOW-
DISCHARGE HYDROGRAPHS
PAGE 8 OF 15



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WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

POOL ELEVATION-INFLOW-
DISCHARGE HYDROGRAPHS

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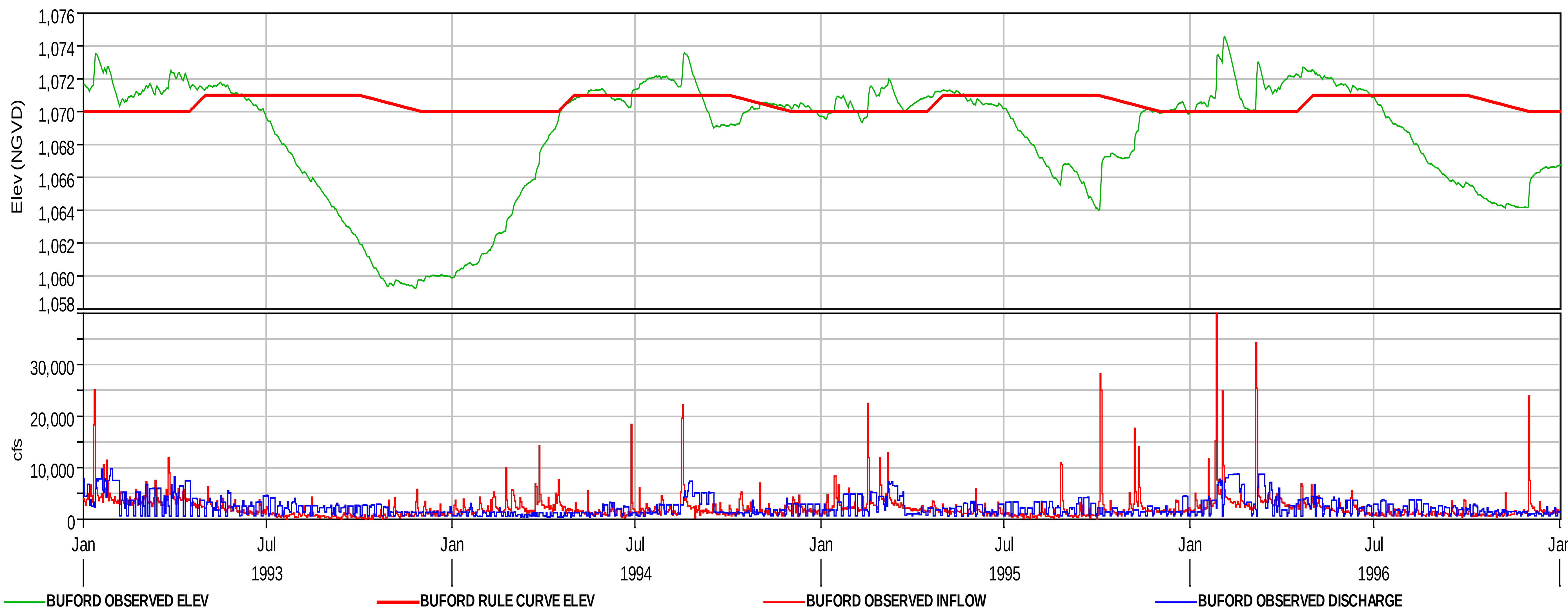

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

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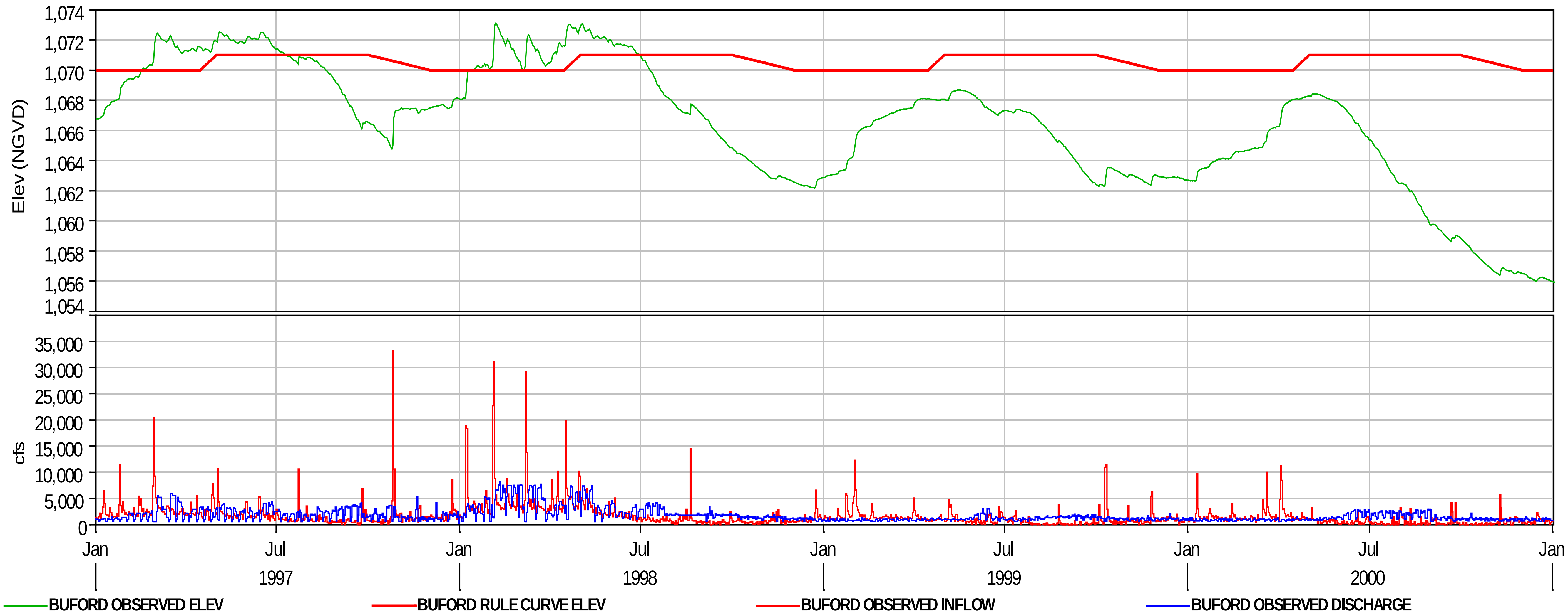

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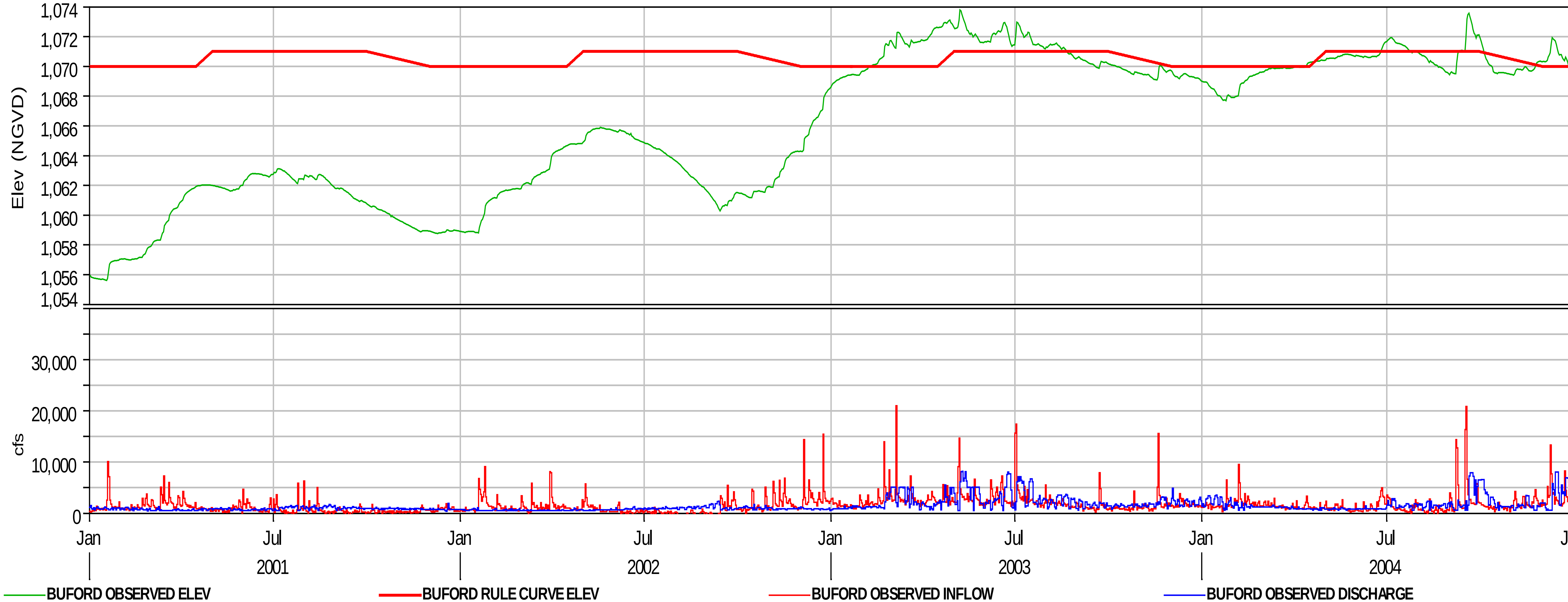

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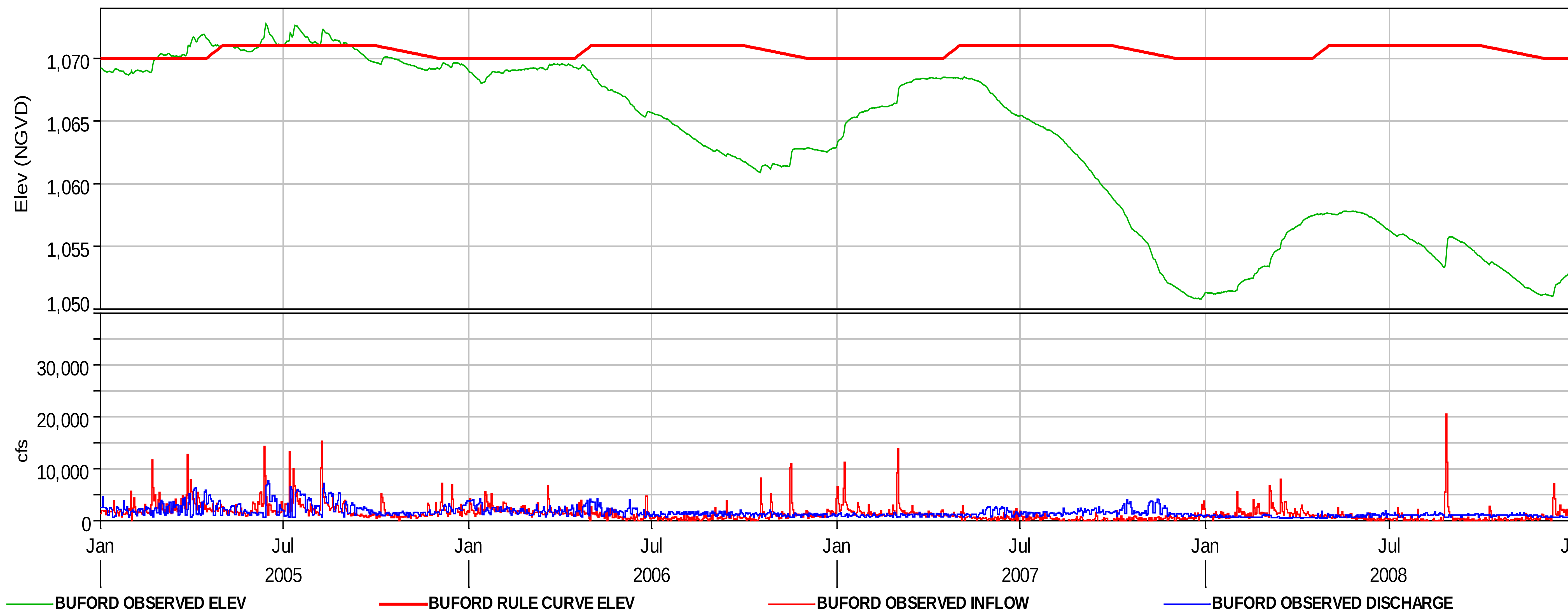

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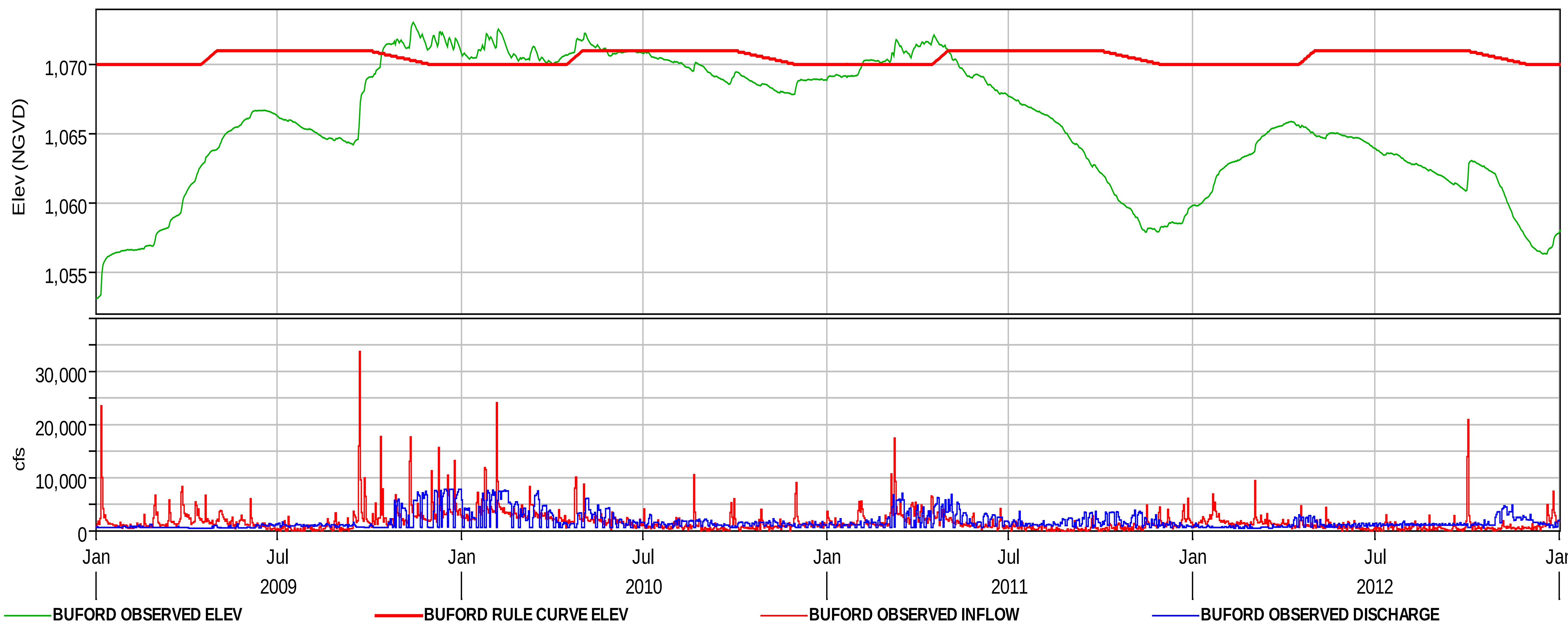

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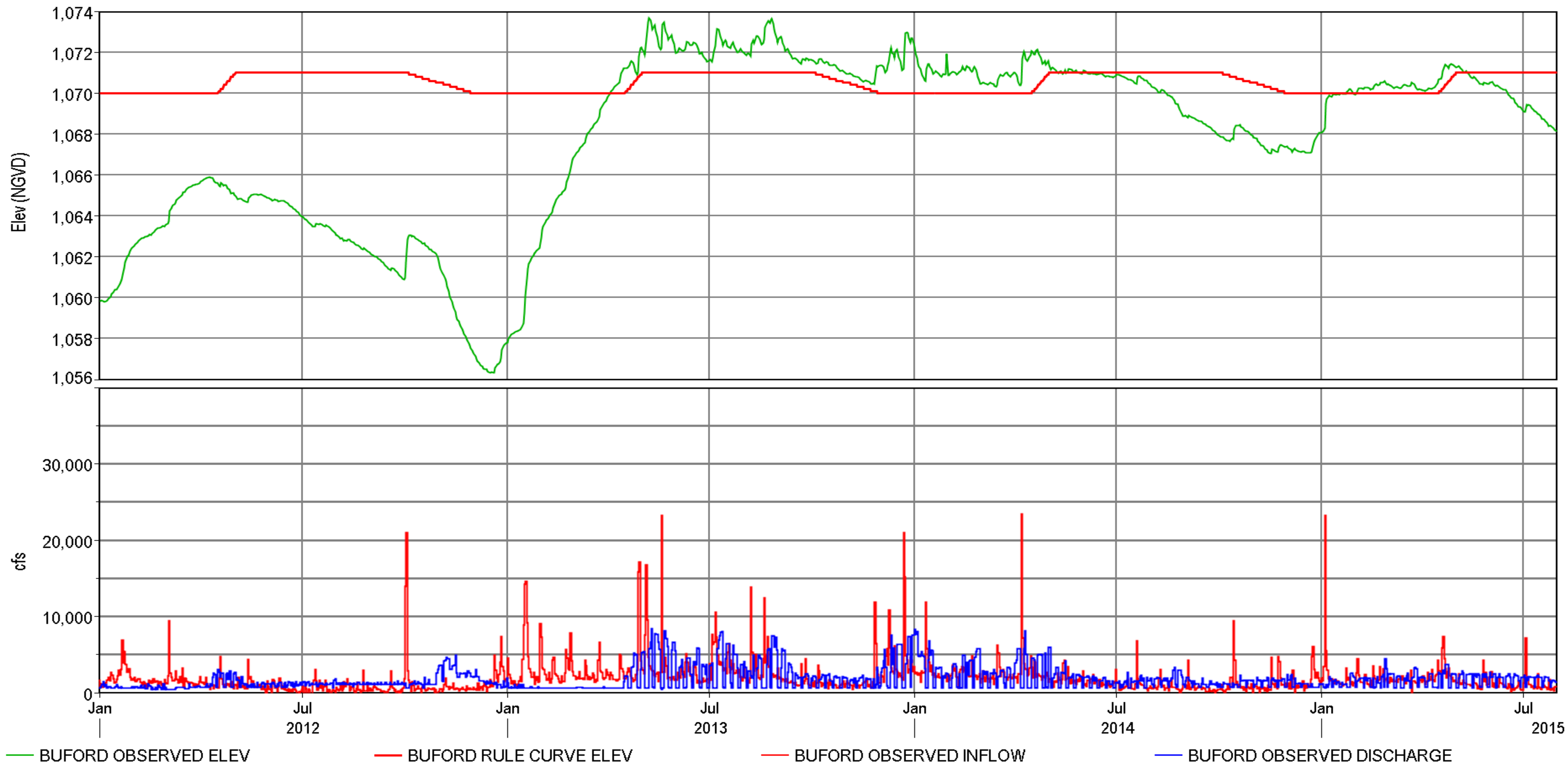

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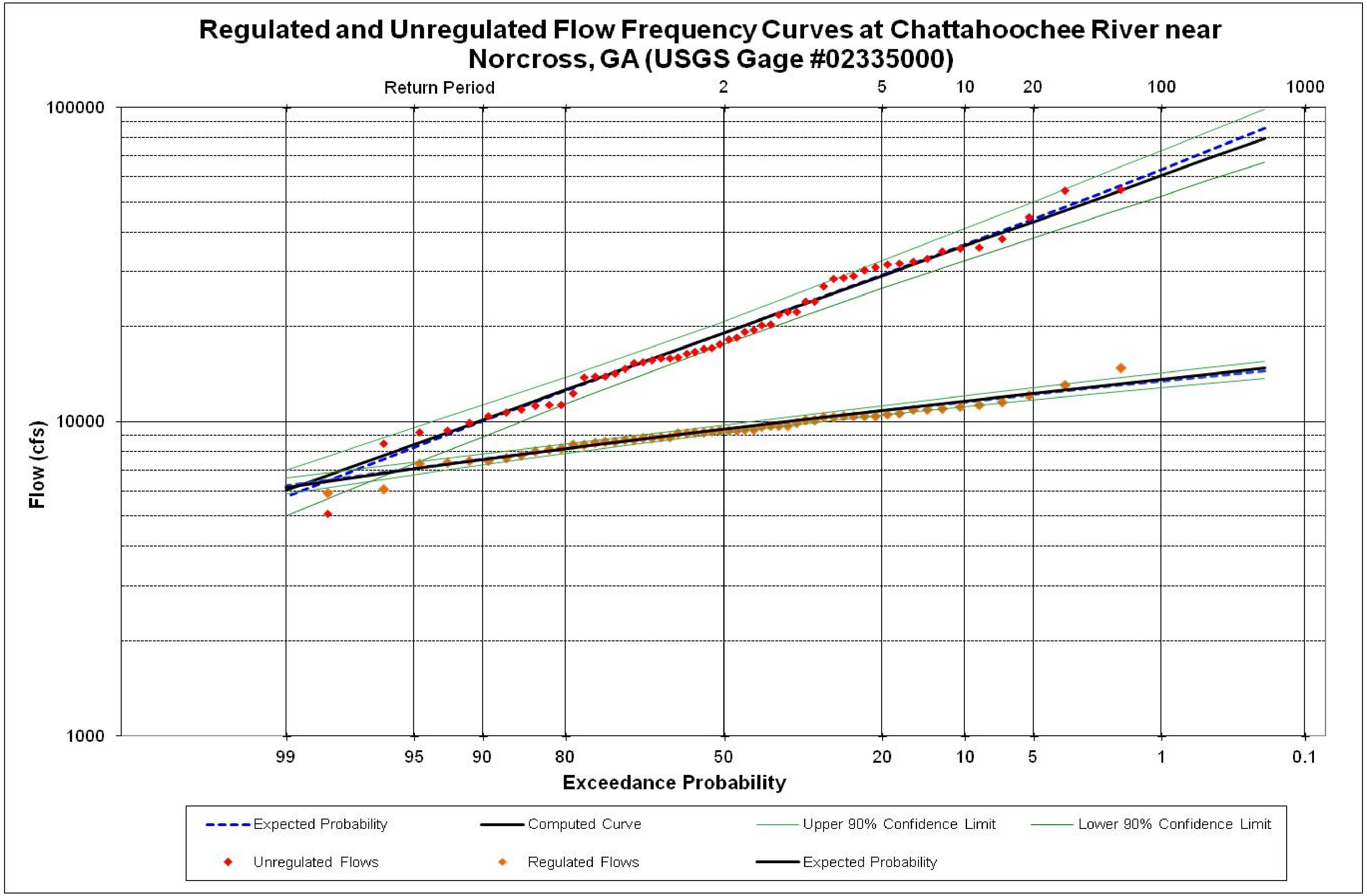

Unregulated period: 1901 -1957
Regulated period: 1957 – 2013

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

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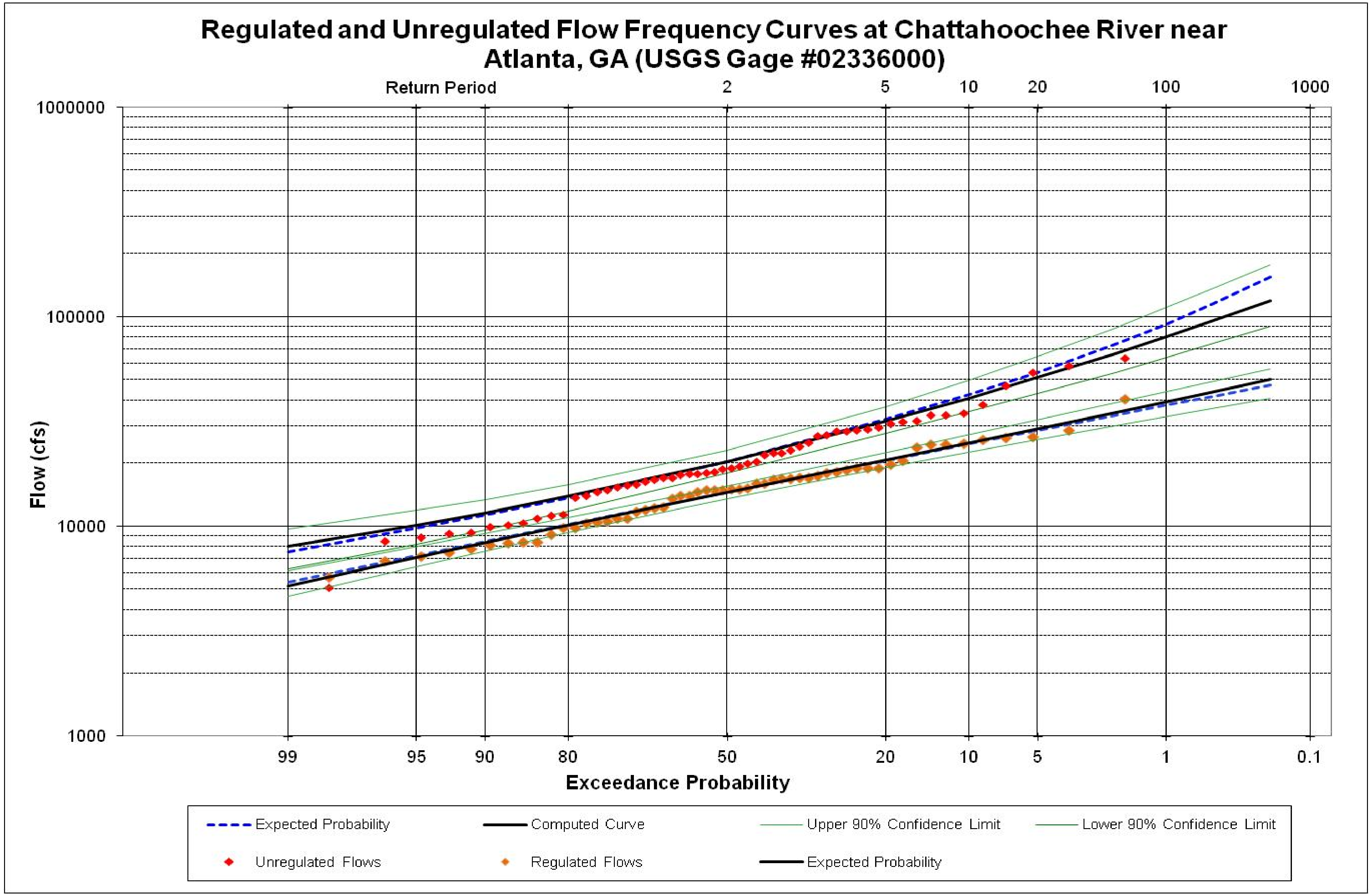
BUFORD DAM AND LAKE SIDNEY LANIER

REGULATED AND UNREGULATED FLOW ON CHATTAHOOCHEE RIVER NEAR NORCROSS, GA



Unregulated period: 1901 -1957
Regulated period: 1957 – 2013

APALACHICOLA-CHATTAHOOCHEE-FLINT RIVER BASIN

WATER CONTROL MANUAL
BUFORD DAM AND LAKE SIDNEY LANIER

REGULATED AND UNREGULATED FLOW ON CHATTAHOOCHEE RIVER NEAR ATLANTA, GA