US Army Corps of Engineers ®

Mobile District

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN WATER CONTROL MANUAL

Final

APPENDIX H

CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM COOSAWATTEE RIVER, GEORGIA

JULY 1979
REVISED MAY 2015
REVISED APRIL 2022

WATER CONTROL MANUAL

APPENDIX H
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM
ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

U.S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT/SOUTH ATLANTIC DIVISION
MOBILE, ALABAMA

July 1979
Revised May 2015
Revised April 2022

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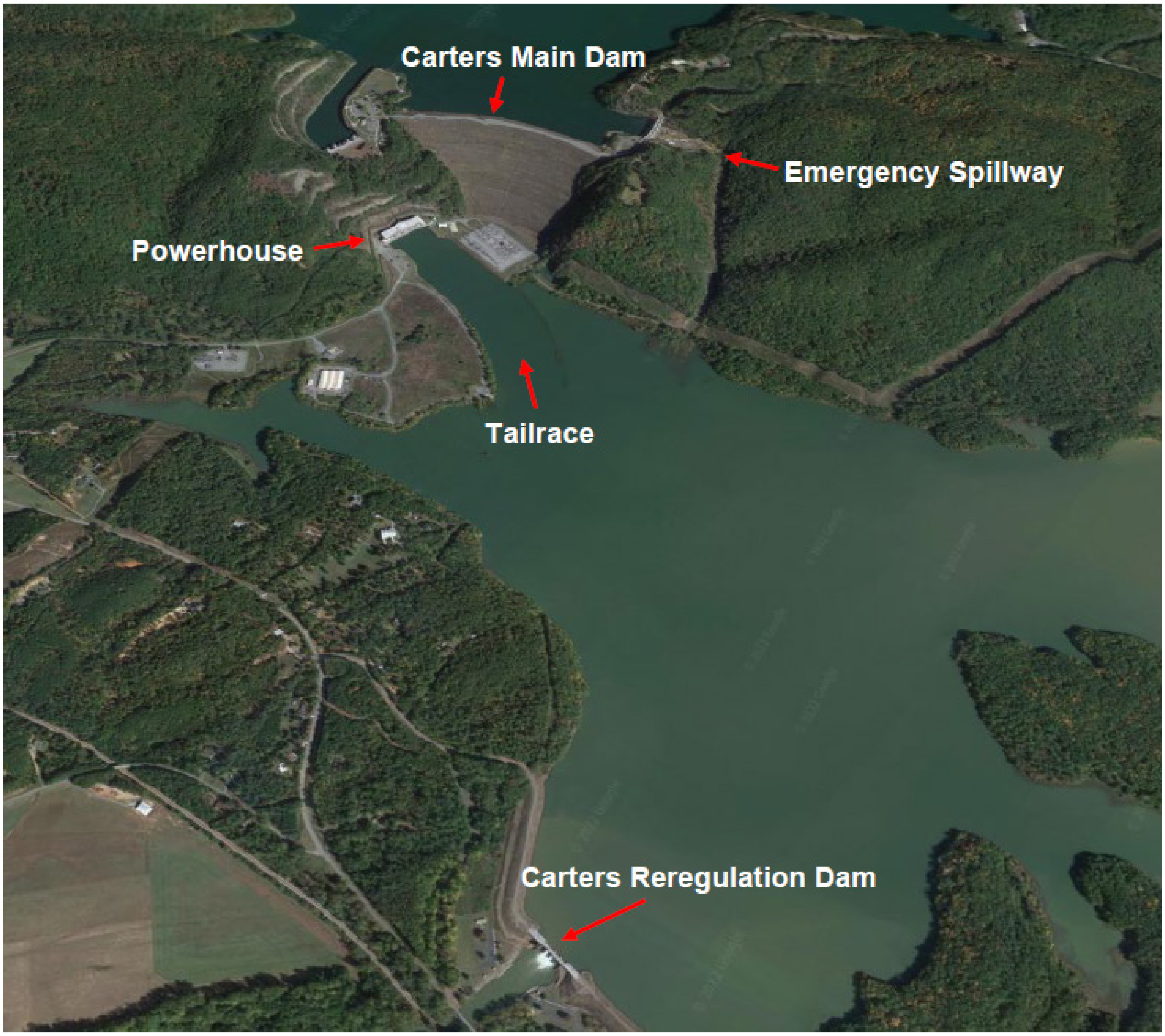
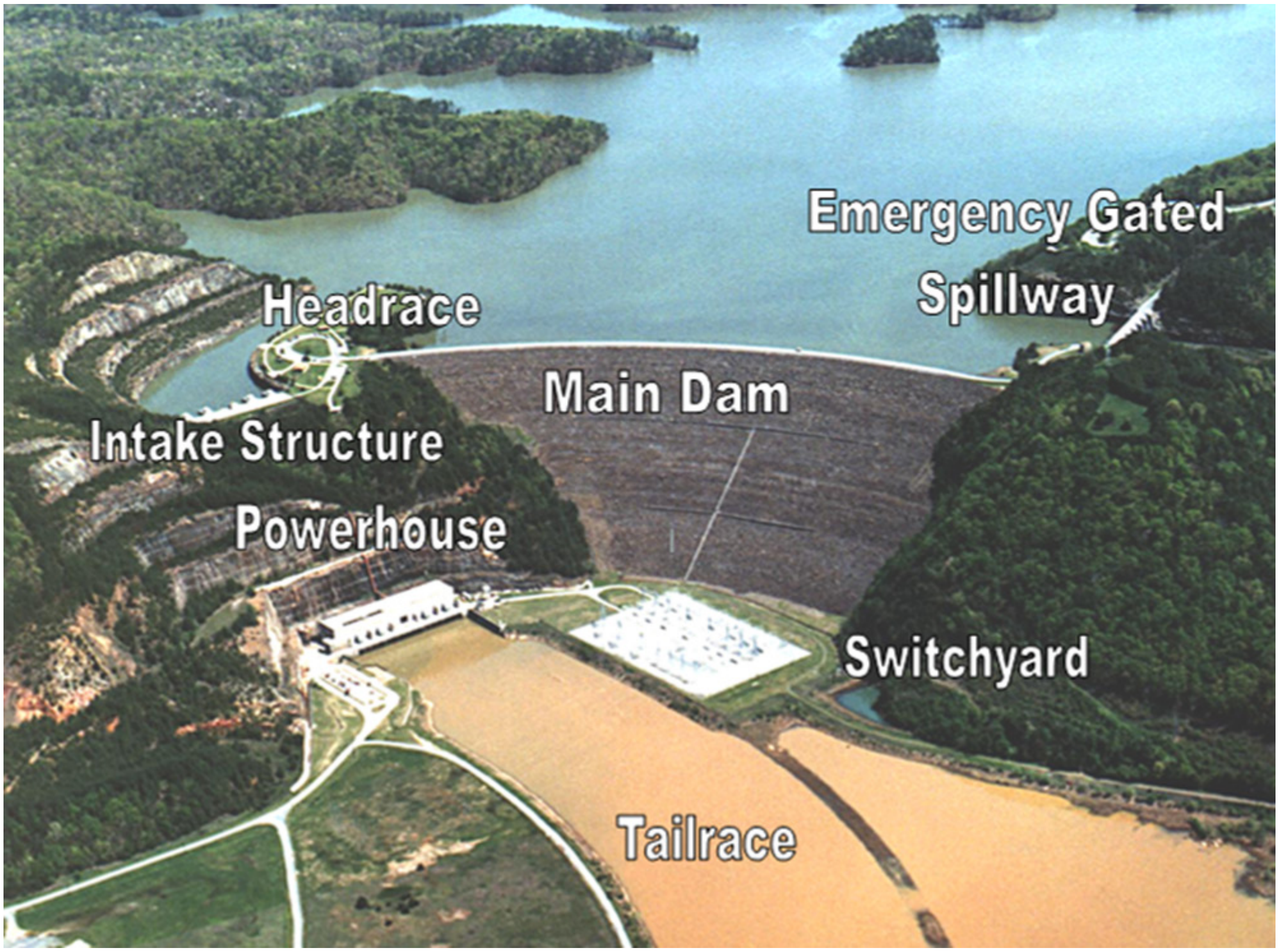


Source: Google Earth

Carters Project

Coosawattee River, Georgia



Carters Main Dam

Coosawattee River, Georgia

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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.

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If unusual conditions arise, contact can be made with the Mobile District Office by phoning (251) 690-2737, during regular duty hours and (251) 509-5368 during non-duty hours. The Carters' Dam Project Manager's Office can be reached at (706) 334-2640 or (706) 334-2906 during non-regular duty hours. The Carters Powerhouse personnel can be reached at (706) 334-2906 during regular duty hours.

METRIC CONVERSION

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

U.S. Army Corps of Engineers, Mobile District, South Atlantic Division

April 2022

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PERTINENT DATA

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

GENERAL

Location – Murray, Gilmer, & Gordon Counties, GA; Coosawattee River, river mile 26.8

Main Dam Drainage Area, square mile (sq. mi.)	374
Reregulation Dam Local Drainage Area, sq. mi.	146
Total Project Drainage Area, sq. mi.	520
Primary flood control pool elevation, feet NGVD29	1,099
Max. power pool elev. (dry season), feet NGVD29	1,074
Area of primary flood control pool, acres	3,880
Area of maximum power pool, acres	3,275
Flood storage volume, acre-feet (1,099-1,074 feet NGVD29)	89,191
Power storage volume, acre-feet (1,074-1,022 feet NGVD29)	141,402
Operational storage volume, reregulation pool, acre-feet (698–674 feet NGVD29)	16,000

MAIN DAM AND DIKES

ROCKFILL DAM

Top elevation, feet NGVD29	1,112.3
Top width, feet	40
Length, feet	2,053

EARTHFILL SADDLE DIKES

Top elevation, feet NGVD29	1,112.3
Total length, feet	700
Number of dikes	3

EMERGENCY GATED SPILLWAY

Total length, including end piers, feet (net length 210 feet (ft)	262
Elevation of crest, feet NGVD29	1,070.0
Type of gates	tainter
Number of gates	5
Length of Gates	42
Height of Gates	36.58

POWER DATA

Number of units	4
Capacity: 2 @ 140,000 and 2 @ 160,000 kW (declared values)	600,000
Operating head at maximum power pool, feet	396
Minimum head at full drawdown, feet	324

1 - INTRODUCTION

1-01. Authorization for Manual. 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 Corps reservoirs. Therefore, this water control manual has been prepared as directed in the Corps' Water Management Regulations, specifically Engineering Regulation (ER) 1110-2-240, *Water Control Management* (date enacted 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' Engineering Manual (EM) 1110-2-3600, *Management of Water Control Systems* (date enacted 10 October 2017); under the format and recommendations described in ER 1110-2-8156, *Preparation of Water Control Manuals* (date enacted 30 September 2018); and ER 1110-2-1941, *Drought Contingency Plans* (date enacted 02 February 2018). Revisions to this manual are to be processed in accordance with ER 1110-2-240.

1-02. Purpose and Scope. This individual project manual describes the water control plan for the Carters Dam and Lake and Carters Reregulation Dam Project (Carters 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 Carters Project water control plan must be coordinated with the multiple projects in the Alabama-Coosa-Tallapoosa (ACT) Basin to ensure consistency with the purposes for which the projects were authorized. In conjunction with the ACT Basin master water control manual, this manual provides a general reference source for Allatoona 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. The *Alabama-Coosa-Tallapoosa River Basin Water Control Manual*, of which this is Appendix H, contains general information for the entire basin. Appendices to the basin master water control manual are prepared for all reservoir projects within the basin when one or more project functions are the responsibility of the Corps. Other manuals published for use by project personnel include *Carters Dam Operation and Maintenance Manual*, and CESAM Plan 500-1-4, *Emergency Notification Procedures*. A list of all the appendices for the Alabama-Coosa-Tallapoosa (ACT) Basin and the master water control manual are listed below.

Alabama-Coosa-Tallapoosa River Basin Master Water Control Manual

Appendix A - Allatoona Dam and Lake

Appendix B - Weiss Dam and Lake (Alabama Power Company)

Appendix C - Logan Martin Dam and Lake (Alabama Power Company)

Appendix D - H. Neely Henry Dam and Lake (Alabama Power Company)

Appendix E - Millers Ferry Lock and Dam and William “Bill” Dannelly Lake

Appendix F - Claiborne Lock and Dam and Lake

Appendix G - Robert F. Henry Lock and Dam and R. E. “Bob” Woodruff Lake

Appendix H - Carters Dam and Lake and Carters Reregulation Dam

Appendix I - Harris Dam and Lake (Alabama Power Company)

Other pertinent information regarding the ACT River Basin development is in operation and maintenance manuals and emergency action plans for each project. Historical, definite project reports and design memoranda also have useful information

1-04. Project Owner. The Carters Project is a federally owned project entrusted to the U.S. Army Corps of Engineers (herein referred to as USACE or Corps), South Atlantic Division (SAD), Mobile District.

1-05. Operating Agency. Authority for the water control regulation of the Carters Project has been delegated to the SAD Commander. Water control regulation activities are the responsibility of the Mobile District, Engineering Division, Water Management Section. Water control actions for the Carters Project are regulated in a system-wide, balanced approach to meet the federally authorized purposes. It is the responsibility of the Water Management Section to develop water control regulation procedures for the ACT Basin federal projects. The regulating instructions presented in the basin water control plan are issued by the Water Management Section with approval of SAD. The Water Management Section monitors the project for compliance with the approved water control plan and makes water control regulation decisions on the basis of that plan. When necessary, the Water Management Section instructs the project personnel regarding normal procedures and emergencies for unusual circumstances.

1-06. Regulating Agency. Authority for the water control regulation of the Carters Project has been delegated to the SAD Commander. Water control regulation activities are the responsibility of the Mobile District, Engineering Division, Water Management Section. Water control actions for the Carters Project are regulated in a system-wide, balanced approach to meet the federally authorized purposes. It is the responsibility of the Water Management Section to develop water control regulation procedures for the ACT Basin federal projects. The regulating instructions presented in the basin water control plan are issued by the Water Management Section with approval of SAD. The Water Management Section monitors the project for compliance with the approved water control plan and makes water control regulation decisions on the basis of that plan. When necessary, the Water Management Section instructs the project personnel regarding normal procedures and emergencies for unusual circumstances.

1-07. 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). It is the 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 (NOAA). 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, mean sea level [MSL]), the current NSRS, and/or hydraulic/tidal datums, have been established per the requirements of Engineering Regulation 1110-2-8160 and in accordance with the standards and procedures as outlined in Engineering Manual 1110-2-6056. A Primary Project Control Point has been established at this project and linked to the NSRS. Information on the Primary Project Control Point, designated BM1, and the relationship between current and legacy datums are in Exhibit B.

2 - DESCRIPTION OF PROJECT

2-01. Location. The Carters Project is located on the Coosawattee River approximately 1.5 miles upstream of Carters in northwest Georgia. It is about 60 miles north of Atlanta, Georgia, and approximately 50 miles southeast of Chattanooga, Tennessee. The Carters Reregulation Dam (Reregulation Dam) was constructed about 1.8 miles downstream from the Main Dam. Both dams are located in Murray County with a large portion of the main reservoir extending into Gilmer County. The upper reaches of the Reregulation Dam pool extend into both Gordon and Gilmer Counties. A vicinity map and location map are shown in Figure 2-1 and Figure 2-2. A basin map is shown on Plate 2-1.

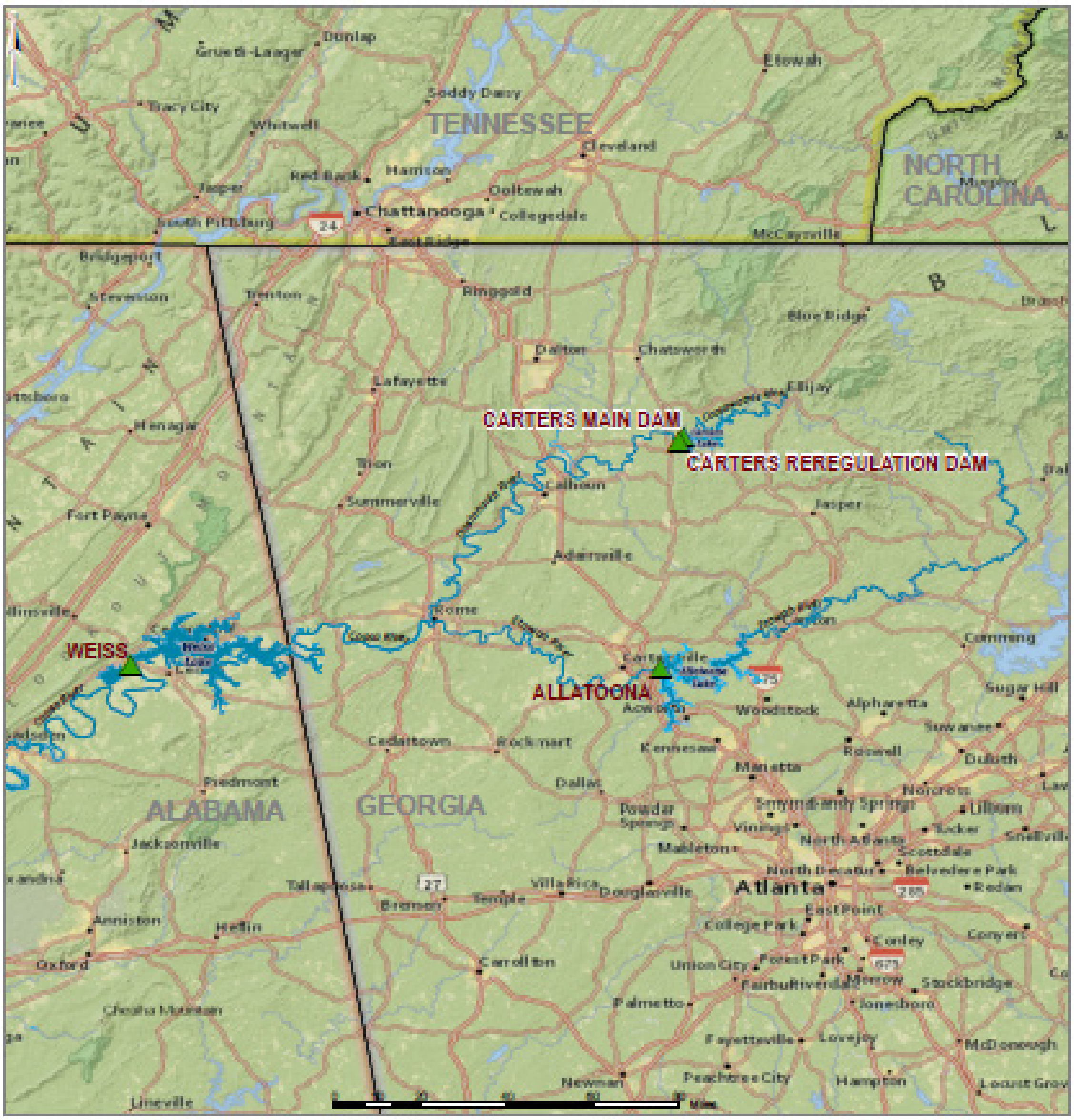

Figure 2-1 Vicinity Map

Figure 2-2 Location Map

2-02. Purpose. The Carters Project is designed primarily for flood risk management and hydroelectric power. Water supply, flow regulation, recreation, fish and wildlife conservation, and water quality are additional benefits of the project. Carters Lake provides additional flood risk management to the rich farmlands along the Coosawattee and Oostanaula River. Peak flood stages are reduced as far downstream as Rome, Georgia, about 72 river miles downstream from the project. Average monthly power generation over the period August 1975 through March 2021 has been 37,9074 megawatt hours (MWh), and an annual average of 450,046 MWh. About 29 percent of this total annual generation is from natural stream flow and about 71 percent is from “pumped back” water. A minimum downstream flow of 240 cubic feet per second (cfs) is maintained by releases from the Reregulation Dam. The 240 cfs represents the 7-day average 10-year frequency low flow (7Q10) at the Reregulation Dam site. Areas below the project are assured of this minimum flow during dry periods as long as sufficient water exists at the project.

2-03. Physical Components.

a. Dam. The Main Dam is a massive rolled-rock structure built across the deep Coosawattee River gorge. It rises 445 feet above the foundation and contains nearly 15 million cubic yards of material. The dam has a length of 2,053 feet along the arch of the axis. The radius of the arch is 2,100 feet. Minimum top elevation is 1,112.3 feet NGVD29 at both ends of the dam with a sloping overbuild to 1,115.3 feet NGVD29 at the center of the dam. Sides slopes are generally one vertical to two horizontal. The upper cofferdam was constructed to form a 30-foot berm on the upstream face at elevation 671.5 feet NGVD29. An impervious earth core, grout curtain, and a core trench excavated to sound rock provide seepage control. A 22-foot wide roadway extends across the top of the dam giving easy access to both ends of the structure. A typical section through the dam is shown on Plate 2-2. An aerial photograph of the Main Dam area is shown below in Figure 2-3 followed by a general plan of the area including the Reregulation Dam in Figure 2-4.

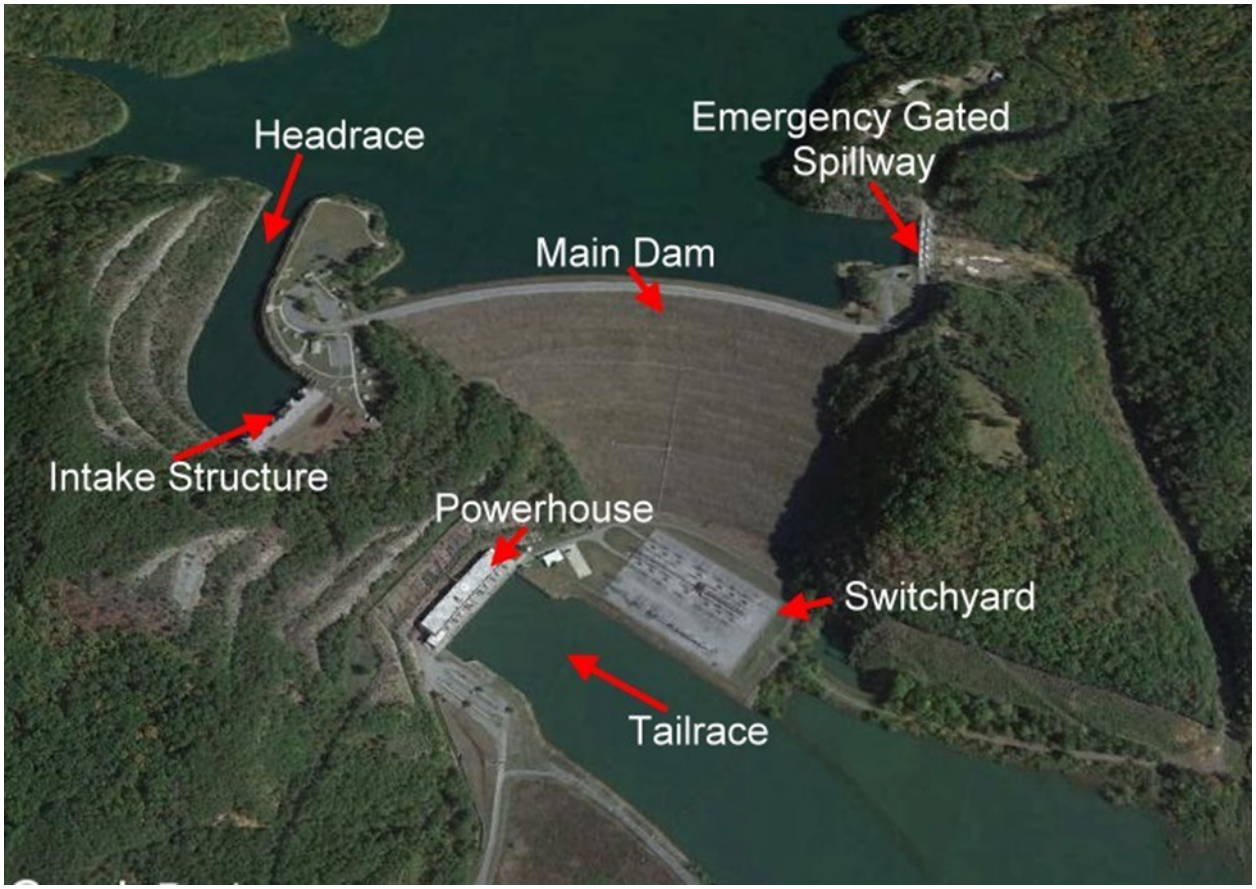

Figure 2-3 Carters Aerial Photo and Features

Figure 2-4 Carters Site Plan

b. Reservoir. The Carters Dam forms Carters Lake, which has a full summer pool at elevation 1074.0 feet NGVD29 covering an area of 3,275 acres with a total storage volume of 383,565 acre-feet and conservation storage of 141,402 acre-feet. The Carters Project has created a scenic mountain lake, 11 miles long with 62.7 miles of shoreline. The lake is about 400 feet deep at the dam. The 10 public use and access areas at the project provide for a variety of activities.

c. Saddle Dikes. Three earth and rock-fill saddle dikes were required on the left bank rim of the main reservoir about 6,000 feet upstream from the Main Dam. The maximum height of the dikes is about 40 feet with a top elevation of 1,112.3 feet NGVD29. Top width of the dikes is 30 feet and side slopes are 1 vertical to 2.5 horizontal. A typical section through the saddle dikes is shown on Plate 2-3.

d. Emergency Spillway. The level of the main reservoir can normally be controlled by releasing water through the powerhouse turbines. However, unusually high inflows are possible. The emergency gated spillway is designed to help maintain control of the level of the Main Dam during these critical periods. Also, if the powerhouse is forced out of service, it may become necessary to use the emergency spillway. Discharge through the emergency spillway is not preferred due to the potential for erosion in the spillway channel, specifically around the emergency sluice access road located below the spillway. Figure 2-5 shows the emergency spillway with releases. Figure 2-6 shows a downstream view from the emergency spillway with the vegetation cleared.

Figure 2-5 Emergency Gated Spillway with Releases

Figure 2-6 Emergency Gated Spillway Downstream View with Vegetation Cleared

The concrete gravity-type structure has a gross length of 262 feet long, consisting of five gate bays each 42 feet wide, two end piers 10 feet wide, and four intermediate piers 8 feet wide. The crest of the spillway is at elevation 1,070 feet NGVD29 and the top of gates in a closed position is 1,106.58 feet NGVD29. Flow over the crest is controlled by five tainter gates 42 feet wide and 36.58 feet high. The gates are moved by individual electric hoists located at elevation 1,120.0 feet NGVD29 on top of the piers. Stop logs are not required for repair and maintenance of the gates since the pool level is allowed to drop below the spillway crest during normal power operations. About 25% of the time, from normal operation, the project is below elevation 1,070 feet NGVD29.

The service building is located about 80 feet west of the spillway and houses the emergency engine generator, air compressor, and electrical substation. The spillway is shown below in Figure 2-7 and Figure 2-8. Plan, downstream elevation, and section of the emergency gated spillway are shown on Plate 2-4 and Plate 2-5.

Figure 2-7 Emergency Gated Spillway (Looking Downstream)

Figure 2-8 Emergency Gated Spillway (Looking Upstream)

e. Carters Dam Emergency Spillway Test. As the Carters Project experienced a near record pool elevation of 1,099.2 feet during the December 2015 flood, the forecasted pool elevation during the flood event based on precipitation and inflow forecasts projected a potential new record elevation greater than 1,100.0 feet. With two hydropower units out-of-service and only two units available to make releases, it was likely the emergency spillway would be needed for releases from the main reservoir during induced surcharge flood operations had the forecasted rainfall occurred. The emergency spillway had never been utilized to evacuate water.

With hydrologic conditions and El Niño climate conditions continuing to forecast a wetter than normal 2015–2016 winter flood season, the Water Management Section requested that Operations Division test the emergency spillway by opening the gates and monitoring the releases for a short period of time. Operations Division's concerns were related to potential downstream erosion that would cause major debris to flow into the reregulation pool. With Operations Division and Engineering Dam Safety concurrence, the emergency spillway gates were tested on Monday, 4 January 2016 (reference Figure 2-9 through Figure 2-15). Gates were raised to pass nearly 4,000 cfs, which is equivalent to one hydropower unit generation discharge release. Operation of the gates was successful, and demonstrated that the gates are operable, if needed, during the flood season. In the future, the Water Management Section will request testing the emergency spillway by releasing water on a routine basis to ensure availability and reduce vegetation growth in the channel.

Figure 2-9 Upstream View, Emergency Spillway and Channel Prior to Spillway Test

Figure 2-10 East View, Emergency Spillway Releasing Approximately 4,000 cfs

Figure 2-11 Upstream View, Emergency Spillway Releasing Approximately 4,000 cfs

Figure 2-12 Downstream View, Emergency Spillway Releasing Approximately 4,000 cfs

Figure 2-13 Emergency Spillway Channel Downstream Outlet, Adjacent to the Sluice Tunnel Outlet During Test Release

Figure 2-14 East View, Emergency Spillway and Channel After Test

Figure 2-15 Downstream View, Emergency Spillway Channel After Test

<u>e. Intake Structures and Penstock.</u> There are two reinforced concrete intake structures at Carters. Each is 94 feet long and 51 feet wide at the base. Elevation at the base is 981 feet NGVD29. Each structure has two reinforced concrete towers 138.5 feet high that contain the gate machinery and other devices to regulate flow into the penstocks. Flow into each of the four intake passages is controlled by a 14-foot by 20.5-foot tractor-type head-gate with upstream seals. Each gate is equipped with an electric hoist and an auxiliary hydraulic lowering device for emergency closure located on the tower deck at elevation 1,112.5 feet NGVD29. An enclosed substation on the tower deck provides the power used at the intake structure.

Each tower has a work bay at elevation 1,080 feet NGVD29 for servicing the head gates. A portable electric manlift is used to inspect the gates and penstocks and is operated in the recess immediately downstream from the gate. A road crane is provided to service the removable-type trash racks that protect the entrance to each intake passage. This crane can also be used to insert and remove the one set of steel stoplogs provided at the structure, when dewatering of the intake is required. An aerial photograph of the intake structure during construction is shown below on Figure 2-16. A typical section is shown on Plate 2-6.

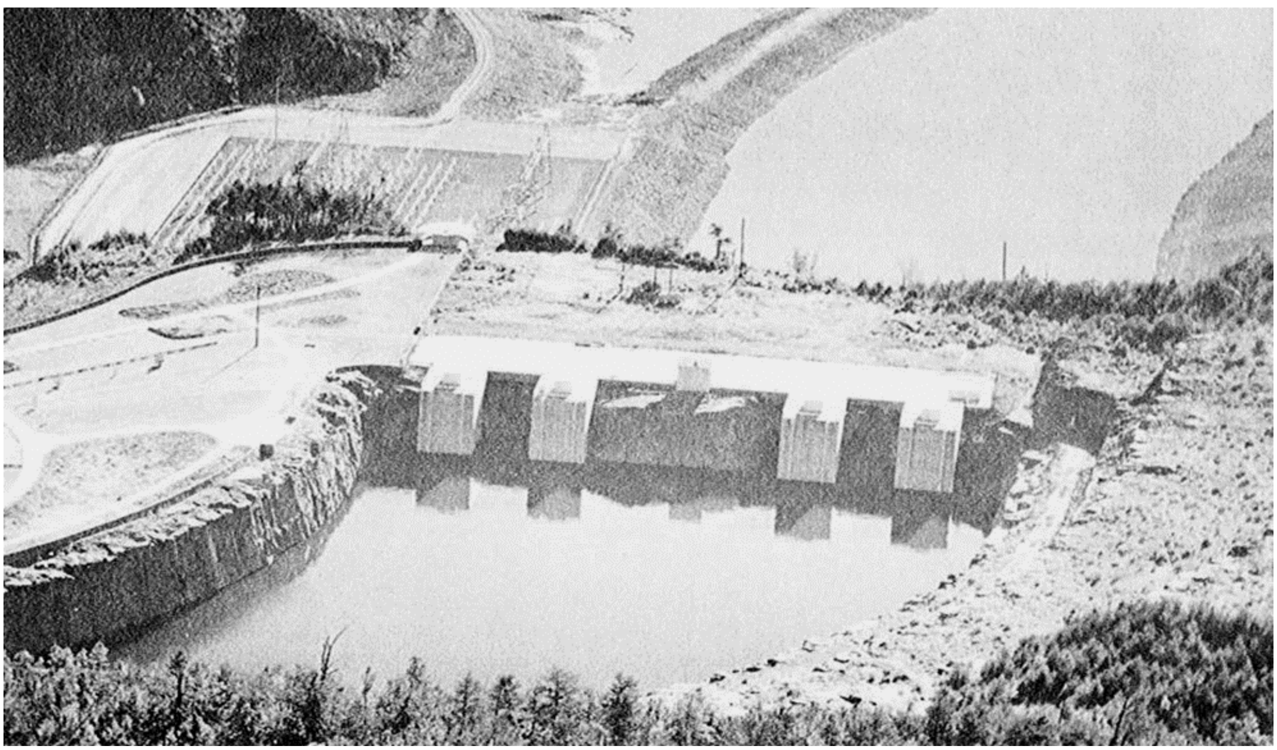

Figure 2-16 Aerial View of Intake Structures, Circa 1974

Photographs of the intake structures taken during construction and prior to filling are shown in Figure 2-17 and in Figure 2-18. A recent photograph is shown in Figure 2-19.

Figure 2-17 Upstream of Intake during Construction, Circa 1974

Figure 2-18 Right Bank Intake Prior to Filling, Circa 1974

Figure 2-19 Intake Structure Looking Downstream

Four steel-lined penstocks extend from the intake structures to the powerhouse through 23-foot diameter tunnels cut through solid rock. The length of each penstock is about 835 feet. Inside diameter of the steel lining is 18 feet and the area between the steel and rock walls is filled with concrete and grouted. The penstocks were designed to be as much alike as possible. The slight differences are due to the characteristics of the conventional versus the pump-turbine units. The penstocks for the pump-turbines have a thicker liner plate to handle greater waterhammer pressures provided by these units. Also, the exit end of the penstocks for the two pump-turbine units transition to a diameter of 13.5 feet. Centerline profiles and typical sections of the penstocks are shown on Plate 2-7.

f. Powerhouse and Switchyard. The powerhouse is located on a rock bench cut into the right riverbank about 200 feet below the toe of the Main Dam. The reinforced concrete structure is 390 feet long and 115 feet wide. The powerhouse contains two conventional 140,000 kilowatts (kW) (declared value) hydrogenerator units (units 1 and 2), two reversible 160,000 kW (declared value) pump-turbine units (units 3 and 4), erection bay, unloading bay, and entrance wing. Declared power 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. A photograph of the powerhouse is shown below in Figure 2-20 and longitudinal and transverse sections are shown on Plate 2-8 and Plate 2-9.

Figure 2-20 Carters Powerhouse at Tailrace

The Allis-Chalmers Manufacturing Company produced the generators and the Newport News Ship Building Company produced the turbines for the conventional units 1 and 2. General Electric manufactured the generators and Allis-Chalmers produced the turbines for the reversible units 3 and 4.

The control room, located in the erection bay at elevation 708.00 feet NGVD29, governs the generation, as well as the Reregulation Dam gates (up to a two foot opening, then must dispatch onsite personnel) and emergency spillway gate settings at the project. The Carters Project also governs generation at the Corps' Buford and Allatoona Projects from the Carters control room via remote control. Operators from Carters are dispatched to Allatoona or Buford to operate the generators in the advent of loss of communication between the facilities. Local maintenance personnel at Allatoona and Buford operate the spillway and sluice gates at Allatoona and the sluice gates at Buford when needed.

The distributor centerline of the conventional units 1 and 2 is located at elevation 658.0 feet NGVD29. A generator floor at elevation 691 feet NGVD29 and a turbine floor at elevation 676 feet NGVD29 provide access to the units. The distributor centerline for pump-turbine units 3 and 4 is at elevation 649 feet NGVD29 and the generator floor is at elevation 676 feet NGVD29. There is no floor at elevation 691 feet NGVD29 over units 3 or 4 nor is there a turbine floor. Access to the pump-turbines is provided by a passage from the service bay floor at elevation 660 feet NGVD29. A 400-ton overhead crane provides the lifting power for installation and maintenance of all four units. The crane has two trolleys, each with a 200-ton sister hook and a 25-ton auxiliary hook.

The service bay is located on the downstream side of the structure below the draft tube deck and houses the sewage treatment plant, water treatment, oil storage and other services. An extensive collector drain system along the upstream wall of the powerhouse reduces the pore pressures against the powerhouse to a differential head of 10 feet.

The switchyard is located at the center of the downstream base of the Main Dam. The ground elevation of 708.75 feet NGVD29 reflects approximately 10 feet of freeboard above the 699.0 feet NGVD29 maximum Reregulation Dam pool elevation. The fenced area containing the switching apparatus is approximately 592 feet long by 343 feet wide. The switching equipment and structures are designed to operate at 230 kilovolts (kV). A photograph of the switchyard is shown below in Figure 2-21.

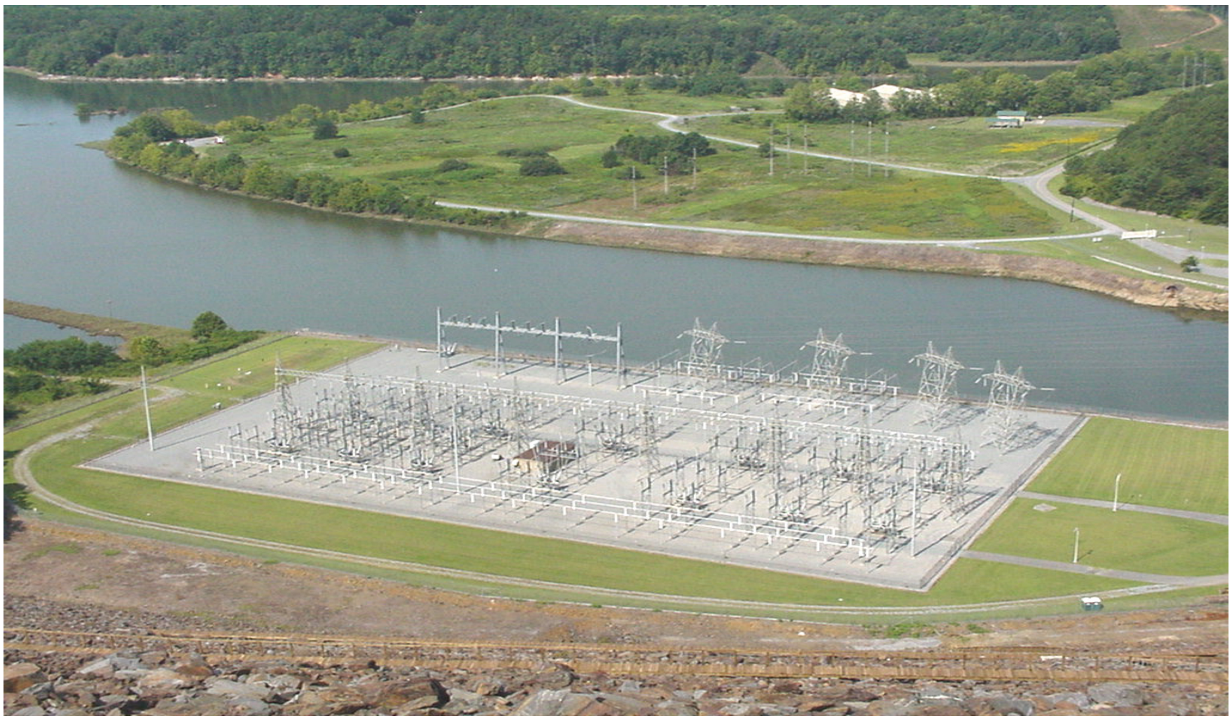

Figure 2-21 Switchyard

g. Emergency Low Level Sluice. The gate-controlled low level sluice was constructed to evacuate water from the main reservoir if repairs to the Main Dam are required or if aid in controlling the pool elevation is needed. The 2,712-foot long tunnel is located below the left bank abutment of the Main Dam. The location of the sluice is shown on Figure 2-4.

A circular, concrete-lined 16.5-foot diameter tunnel extends from the upstream portal to the tandem gate machinery. The downstream section is a 22-foot unlined horseshoe-shaped tunnel except that the 200-foot portion immediately downstream from the gate structure has concrete sides and bottom to prevent erosion of the rock. Elevation of the tunnel floor varies from 725 feet NGVD29 at the upstream entrance to 710 feet NGVD29 at the downstream exit. The upstream portal is slotted for the placement of stop logs used for de-watering the tunnel. However, the stop logs and floating plant for placing them do not exist.

The gate structure has two water passages each five feet wide and 10 feet tall. Flow in each passage is controlled by tandem slide gates. A vertical 10-foot diameter shaft extends approximately 335 feet from the gate structure to the surface between the Main Dam and the emergency gated spillway. A plan and profile of the sluice are shown on Plate 2-10 and sections are shown on Plate 2-11. Gate sections are shown on Plate 2-12. A photograph of the exit end of the tunnel is shown below in Figure 2-22.

Figure 2-22 Downstream Opening of the Emergency Sluice Tunnel

A small building covering the shaft contains a remote panel for operation of the gates and provides space for an elevator used for access to the gate structure. The building is shown in Figure 2-23. As of the date of this report, the emergency low level sluice has never been used.

Figure 2-23 Low Level Sluice Control Building

h. Diversion Tunnel. Construction of the Main Dam at Carters required the Coosawattee River to be rerouted at the dam site. A 23-foot high, 23-foot wide unlined horseshoe-shaped diversion tunnel was drilled approximately 2,407 feet long through the left ridge of the river valley. After completion of the Main Dam the upstream entrance (shown below in Figure 2-22) was sealed with steel stoplogs and plugged with concrete. Location of the tunnel is shown on Figure 2-24. A plan and profile are shown on Plate 2-13, and sections of the tunnel are shown on Plate 2-14.

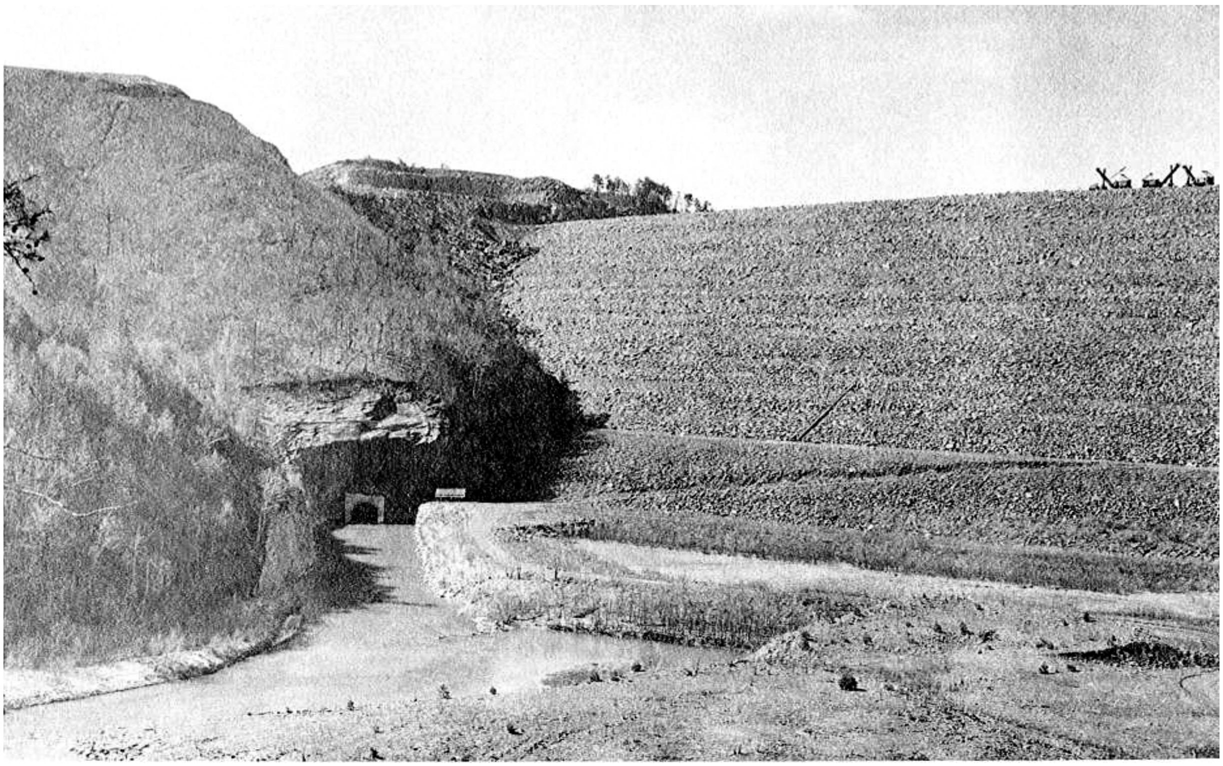

Figure 2-24 Diversion Tunnel Upstream Entrance Prior to Filling, Circa 1974

2-04. Related Control Facilities. The Reregulation Dam was constructed about 1.8 miles downstream from the Main Dam to store water for pump back operations, to regulate the intermittent releases from the power plant, and to control minimum flow downstream. The dam consists of a gated spillway with earth and rock-fill dikes extending on either side to higher ground. Photographs of the Reregulation Dam taken from upstream of the dam and taken from old US Highway (Hwy) 411, looking upstream and downstream from old US Hwy 411 are shown on Figure 2-25, Figure 2-26, and Figure 2-27. A layout of the Reregulation Dam is shown in Figure 2-28.

Figure 2-25 Reregulation Dam, Looking Downstream

Figure 2-26 Reregulation Dam, Looking Upstream From Old US Hwy 411

Figure 2-27 Looking Downstream From Old US Hwy 411

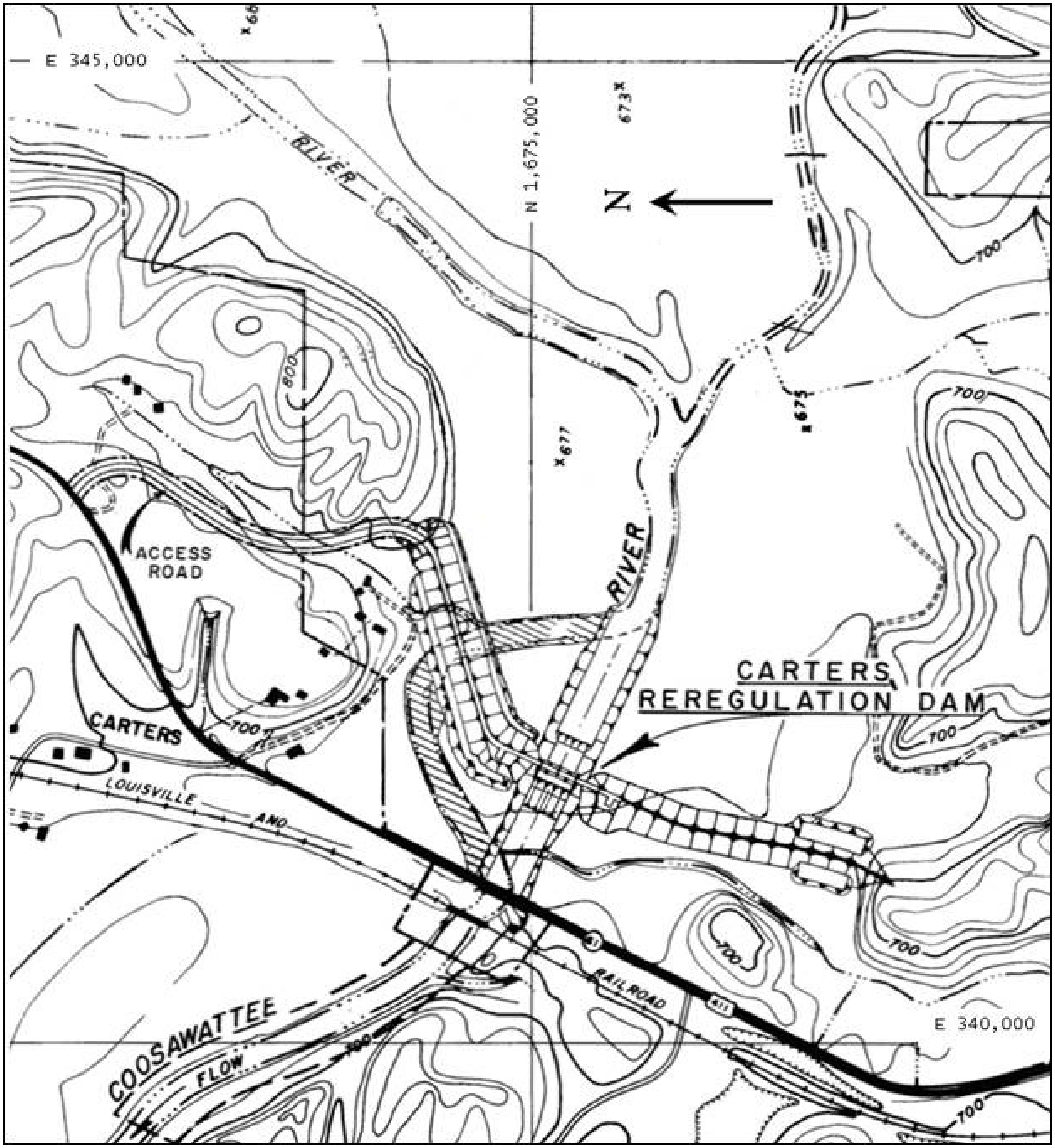

Figure 2-28 Reregulation Dam Plan

a. Reservoir. The operational storage volume of the reregulation pool (698–674 feet NGVD29) is 16,571 acre-feet covering an area of 990 acres.

b. Gated Spillway. The gated spillway is a concrete gravity-type structure with a gross length of 208 feet, consisting of four gate bays 42 feet wide, three intermediate piers 8 feet wide, and two end piers 8 feet wide. The spillway crest is at elevation 662.5 feet NGVD29. Top of gate elevation in a closed position is 699.0 feet at NGVD29. Flow through the dam is controlled by four tainter gates 42 feet wide and each rising 36.5 feet above contact with the sill. The gates are raised and lowered by individual electrical hoists located on top of the piers at elevation 707.0 feet NGVD29. The floor of the basin is at elevation 647.5 feet NGVD29, reinforced, cantilever-type training walls are built on each side of the stilling basin with the top of the walls at elevation 672 feet NGVD29. The Reregulation Dam spillway gates are typically controlled from within the powerhouse. If there is the need to open any gate more than two feet, project staff must be dispatched to the spillway to operate the gates on site. A plan and elevation are shown on Plate 2-15 and a typical section through the spillway is shown on Plate 2-16. The operating house on the right bank end pier monolith houses the controls and equipment necessary to operate the dam. A spillway bridge with a 20-foot roadway (crest elevation 717 feet NGVD29) was constructed to provide easy access to the structure and to enable stoplogs to be placed with a road crane. Access to the gate hoists is provided by a catwalk under the service bridge. A concrete, gravity-type, non-over-flow wall, 112 feet long is provided on each side of the spillway to permit transition to the embankment section.

c. Regulation Dam Embankment Dikes. Earth and rock-fill embankment dikes form the damming structures on the overbanks from the non-overflow walls of the gated spillway to high ground. The dikes have a combined length of about 2,855 feet. The top elevation of the dikes, 703.0 feet NGVD29, makes overtopping highly improbable. Left and right dike sections are shown on Plate 2-17. Location of the embankment dikes is shown in Figure 2-26.

2-05. Real Estate Acquisition. Real estate requirements for the Carters Project include the reservoir areas, public use and access areas, construction areas, and road right-of-way easements. Hydraulic studies indicate that induced surcharge operations will contain the pool near or below elevation 1,107 feet NGVD29. A one-foot free board is considered sufficient to accommodate the adverse effects of saturation and wave action so the acquisition line for the main reservoir was set at elevation 1,108 feet NGVD29. In establishing this line, however, the acquisition of property along minor land subdivisions in accordance with existing policy is generally controlled by the requirement for a 300-foot horizontal clearance from the static full pool rather than by acquisitions directly related to the 1,108 feet NGVD29 contours.

Fee lands were acquired for the construction area, reservoir, and public use areas. Road easements were acquired primarily for access to the project and the public use areas. According to the Tract Register and the Real Estate Management Information System (REMIS), 8,900.13 acres, more or less, are currently recorded in Fee Simple Estate.

In addition, as delineated in the acreage breakdown chart, 170.57 acres, more or less, were acquired in various easement estates, and 6.07 acres, more or less, by virtue of a license for use of an existing county roadway in addition to provision of channel improvement works on the railroad right-of-way of the Louisville and Nashville Railroad.

Temporary interests such as rights-of-entry and leasehold estates are not factored into current estimates but are reflected in the Acquisition Tract Registers for historical reference purposes. Historical records indicate boundary resets were performed by survey crews at Carters Lake in 2014 and 1987–1988 timeframe for portions of the fee boundary.

Fee Simple Estate	8,900.13 acres, more or less Per Tract Register, no Fee disposals identified of record
Road Easement Including Utility Right-of-Way	132.1 acres, more or less. Per Tract Register, figureaccounts for 18.96 ac previously disposed to State of GA and Gilmer Co.)
Flowage Easement	27.11 acres, more or less. Per Tract Register, at a later date, Flowage Easement was reserved over an additional 5.3acres as captioned in a disposal deed to State of GA.
Sloughing Easement	11.2 acres, more or less Per Tract Register
Drainage Ditch Easement	0.16 of an acre, more or less Per Tract Register
License	6.07 acres, more or less Per Tract Register

The acquisition policy for purchasing lands for Carters Lake is described as follows: 1) All lands below elevation 1,108 feet NGVD or 300 foot horizontal distance landward from the full pool elevation of 1,099 feet NGVD were acquired for the main lake, whichever criterion resulted in the acquisition of more land; and 2) all lands below elevation 703 feet NGVD, except for several small flowage easement parcels south of GA Highway 136, were acquired for the reregulation pool. For those areas above 1,108 feet NGVD for the main lake and above 703 feet NGVD for the reregulation pool, the acquisition policy was to purchase flowage easements to provide the right to temporarily store flood waters. Road easements were also purchased to develop ingress and egress into operational and recreational areas.

Per Assistant Chief, Engineering Division memo dated 15 September 1965, "Acquisition of downstream flowage easements for the subject area is [was] justified by the fact that the banks will be subject to sloughing during time of flood. Although the spillway for the re-regulation dam will normally be used to reregulate the power releases and maintain a more-or-less constant within banks flow in the downstream channel, it will be necessary to increase the outflow considerably in time of flood when the inflow of Talking Rock Creek must be passed. The energy of velocity of this increased outflow will be greater than is obtained under present conditions. It is [was] estimated that the effect of the spillway would extend for a distance of about 2,000 feet downstream of the Highway 411 bridge. Since the banks of the stream are made up primarily of alluvial material, the increased velocity of the flow will probably cause the banks to slough…". The general limits of land acquisition are shown on Plate 2-18. A profile of Alabama Power Company (APC) land acquisition for the upstream portion of Weiss Dam is shown on Plate 2-19.

2-06. Public Facilities. The public use areas around Carters Lake are shown on Plate 2-19. The two areas at the Reregulation Dam are counted as one in Table 2-1. The recreation facilities at each public use area are listed in Table 2-1.

Table 2-1 Public Use Area Recreation Facilities

Public Use Areas / Recreation Facilities	Visitors Center	Project Management Office	Overlook	Boat Ramp	Drinking Water	Comfort Station	Picnic Area	Campfire Circles	Tent & Trailer Camping	Tent Camping Only	Wash House w/ Comfort Sta.	Swimming Beach	Change House	Foot Trails	Fishing Deck	Marina
Dam Site	O	O	O	O	O	O	O							O		
Carters Lake Marina					O											O
Harris Branch					O	O	O	O		O	O	O	O	O		
Doll Mountain				O	O	O	O	O	O		O				O	
Ridgeway				O	O	O	O	O		O				O		
Woodring Branch				O	O	O	O	O	O					O		
North Bank			O		O	O	O							O		
Reregulation Dam Site					O	O	O							O	O	

3 - GENERAL HISTORY OF PROJECT

3-01. Authorization for Project. Authority for development of a dam on the Coosawattee River near Carters, Georgia, is contained in Section 2 of the River and Harbor Act adopted 2 March 1945 (Public Law 12, 79th Congress, 1st Session). This Act approved the initial and ultimate development of the Alabama-Coosa River and tributaries for flood risk management, power generation, navigation and other purposes as outlined in House Document 414, 77th Congress.

House Document No. 414, 77th Congress, 1st Session, did not prescribe a specific plan for the development of the Coosawattee River. At that time the comprehensive plan for the basin provided for an upper and lower dam on the Coosawattee River with an impounding dam on the Cartecay River. As a result of subsequent studies, a more complete development of the river by a single high dam at the lower site was found to be warranted. Modification of the two-dam plan was therefore authorized.

3-02. Planning and Design. Early studies limited the location of a project on the Coosawattee River to the reach between miles 26 and 35. The possibilities of a single dam, two dams, and a single dam with a long tunnel to develop the full head in the reach were investigated. At the suggestion of the Federal Power Commission (FPC), the pumped-storage potential of these dams to develop a greater peaking power capacity was also studied. The results of these analyses and a description of the various plans are given in the "Site Selection Report" submitted on 31 March 1961.

After a single dam was established for the development of the reach, studies were made of the major structures. The basic types of dams investigated included a rock-fill type with separate fixed-crest and gated spillways and the concrete gravity type with a gated spillway. Straight and U-shaped fixed-crest spillways of various length were considered, and various types of gated structures were investigated. Power plant and diversion tunnel locations were studied on both banks. The results of these studies were submitted in August 1962 and discussed at a conference with representatives of the Chief of Engineers, the Division Engineer, SAD, and special consultants on 26–27 September 1962. A description of the alternative plans is given in Appendix IV of Design Memorandum No. 5 and the minutes of the meeting in regard to them is given in Appendix V.

Design Memorandum No. 5, "General Design", dated 22 July 1963, presented plans for a dam at mile 26.8 on the Coosawattee River. Maximum and minimum power pools would be at elevations 1,072 and 1,022 feet NGVD29 respectively and maximum flood risk management pool would be at elevation 1,099 feet NGVD29. This project would have a powerhouse containing two 52,000 kW units.

Approval for installation of 250,000 kW of generating capacity at Carters Dam on the Coosawattee River together with a Reregulation Dam to limit power discharges to the downstream channel capacity was given by the Secretary of the Army on 25 July 1964 in response to a memorandum from the Office of the Chief of Engineers (OCE) dated 6 July 1964 on the subject: Carters Dam and Reservoir, Georgia. The results of investigations made in planning the changed facilities for the project were prepared as a supplement to Design Memorandum No. 5 and was submitted on 30 September 1964.

This plan provided for an intake structure for two powerhouse units. Subsequently, major modifications of the plan were authorized by the following correspondence:

In a letter dated 12 April 1966, from OCE to SAD, subject: "Carters Dam - Proposed Addition of Two More Units Initially in the Power Plant", four 125 MW units were approved as a basis for further planning.

In a 2nd Endorsement dated 22 April 1966 (basic letter SAMEN-D, 15 April 1966), from OCE to SAD, Subject: "Carters Project - Comparative Costs for 4-Unit Installation - 50-Foot versus 80-Foot Drawdown Provision", a 50-foot drawdown was approved.

In a 2nd Endorsement dated 29 August 1966 (basic letter SAMEN-D, 17 August 1966), from OCE to SAD, subject: "Carters Project - Pump Turbine Studies", the design of the intakes for four 18-foot-diameter penstocks was approved.

At a time when the original design was essentially complete the addition of two pump-turbine units was authorized and a decision was reached to construct the entire powerhouse and associated switchyard under a single contract. Design Memorandum No. 22 was prepared to present the design considerations involved with the addition of the two units.

Table 3-1 lists the design publications pertaining to the Carters Project.

Table 3-1 List of Design Memoranda

Design Memorandum Number	Title	Date of Submittal
1	Site Selection Report	31 Mar 1961
2	Basic Hydrology	7 Nov 1961
3A	Preliminary Master Plan – Part of the Master Plan	16 Mar 1962
3-B(C-1)	Public Use and Administrative Facilities	15 Mar 1966
4	Hydroelectric Power Capacity Letter Report – Hydraulic Design of Diversion Tunnel	25 Apr 1962 18 Jan 1963
5	General Design Supplement to General Design Memorandum Number 5	22 Jul 1963 30 Sep 1964
6	Access Road, Right Bank Supplement to Design Memorandum No. 6 – Access Road, Right Bank	23 Feb 1962 3 Aug 1964
7	Reservoir, Additional Construction and Public Use Areas	17 Sep 1963
8	Main Dam and Saddle Dikes; Excavations for Spillway, Headrace, and Powerhouse	18 Sep 1964
9	Emergency Gated Spillway	17 Feb 1965
10	Powerhouse Structure	10 Sep 1965
11	Supervisory Control System	16 Jun 1965
12	Real Estate – Reregulation Dam and Reservoir	5 May 1965
13	Sources of Construction Material	5 Nov 1965
14	Penstocks	1 Dec 1965
15	Gated Spillway for Reregulation Dam	2 Aug 1966
16	Reregulation Dam - Rock and Earth	1 May 1968
17	Intake Structures for Powerhouse	11 Oct 1966
19	Relocations - Georgia Highway 156	19 Jun 1967

Design Memorandum Number	Title	Date of Submittal
20	Relocations - Georgia Power Co. Lines	28 Feb 1969
22	Powerhouse and Appurtenances, Units 3 and 4	1 Dec 1967
23	Buildings, Grounds and Utilities	5 Mar 1970

3-03. Construction. The first of a long series of contracts, for the Carters Project was awarded in 1962. Table 3-2 lists some of the major contracts, the contractors and the dates of issuance.

Table 3-2 List of Construction Contracts

Contract	Contractor	Date
Right Bank Access Rd., Site Clearing and Test Fills	Ledbetter Bros., Inc.	3 Nov 1962
Excavation of Diversion Tunnel Portals	Ledbetter Bros., Inc.	20 Feb 1963
Excavation of Diversion Tunnel	Cowin and Co., Inc	1 Mar 1964
Construction of Main Dam Phase I	Roy Tyan Sons Co., Inc.	23 Dec 1964
Construction of Main Dam Phase II	Clement Bros. Co.	15 Mar 1968
Construction of Left Bank Access Rd., & Saddle Dikes	Phillips & Jordan, Inc.	1 Sep 1966
Excavation of Penstock Tunnels	W.L. Hailey & Co., Inc.	23 Apr 1969
Construction of Intake Structure and Penstock Liners	Al Johnson Constr. Co.	26 May 1972
Construction of Emergency Gated Spillway	Rosiek Constr. Co. Inc.	1 Jun 1972
Construction of Carters Reregulation Dam	Kandy, Inc.	15 Nov 1972
Construction of Emergency Low Level Sluice	Al Johnson Constr. Co.	2 Mar 1972
Construction of Powerhouse	Al Johnson Constr. Co.	31 Aug 1975

Figure 3-1 and Figure 3-2 are photographs of the Carters Main Dam and Reregulation Dam construction site.

Design Memorandum No. 5, General Design, Appendix V considered the minimum flows from Talking Rock Creek adequate to meet low flow requirements downstream. Twenty years of flow records indicated the minimum monthly discharge from Talking Rock Creek was about 100 cfs.

In August of 1970, the Georgia State Water Quality Control Board expressed concern over possible effects of operation of Carters Dam on water quality on the upper Coosa River and requested increased minimum flows at Mayo's Bar. The Mobile District Office, in a letter dated 12 August 1971 to the Georgia State Water Control Board, stated that a guaranteed minimum continuous release of 240 cfs would be provided from the Reregulation Dam. This had been determined to be the seven-day average low flow with a 10-year return frequency (typically referred to the 7Q10) at that point.

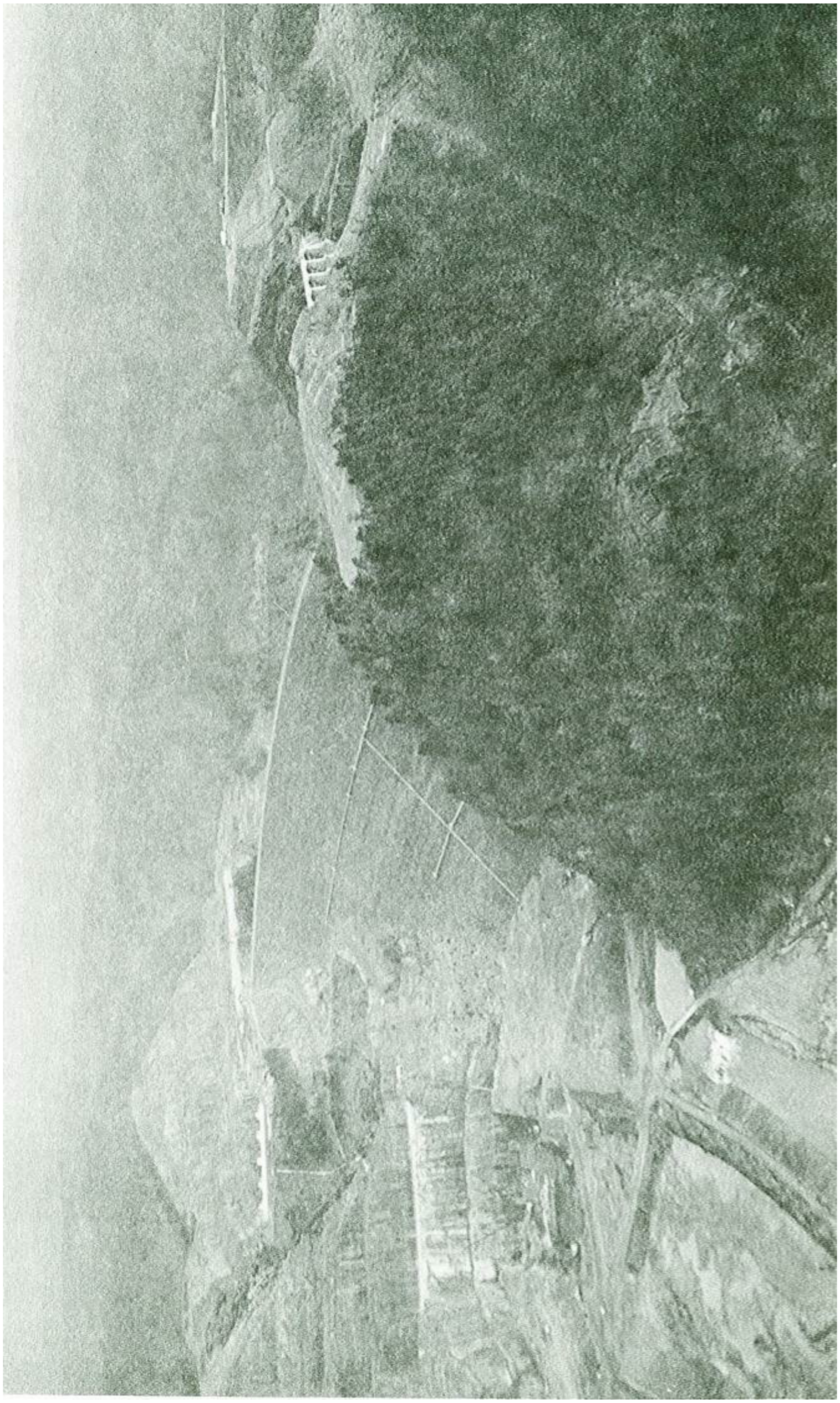

Figure 3-1 Main Dam Site During Construction, Circa 1974

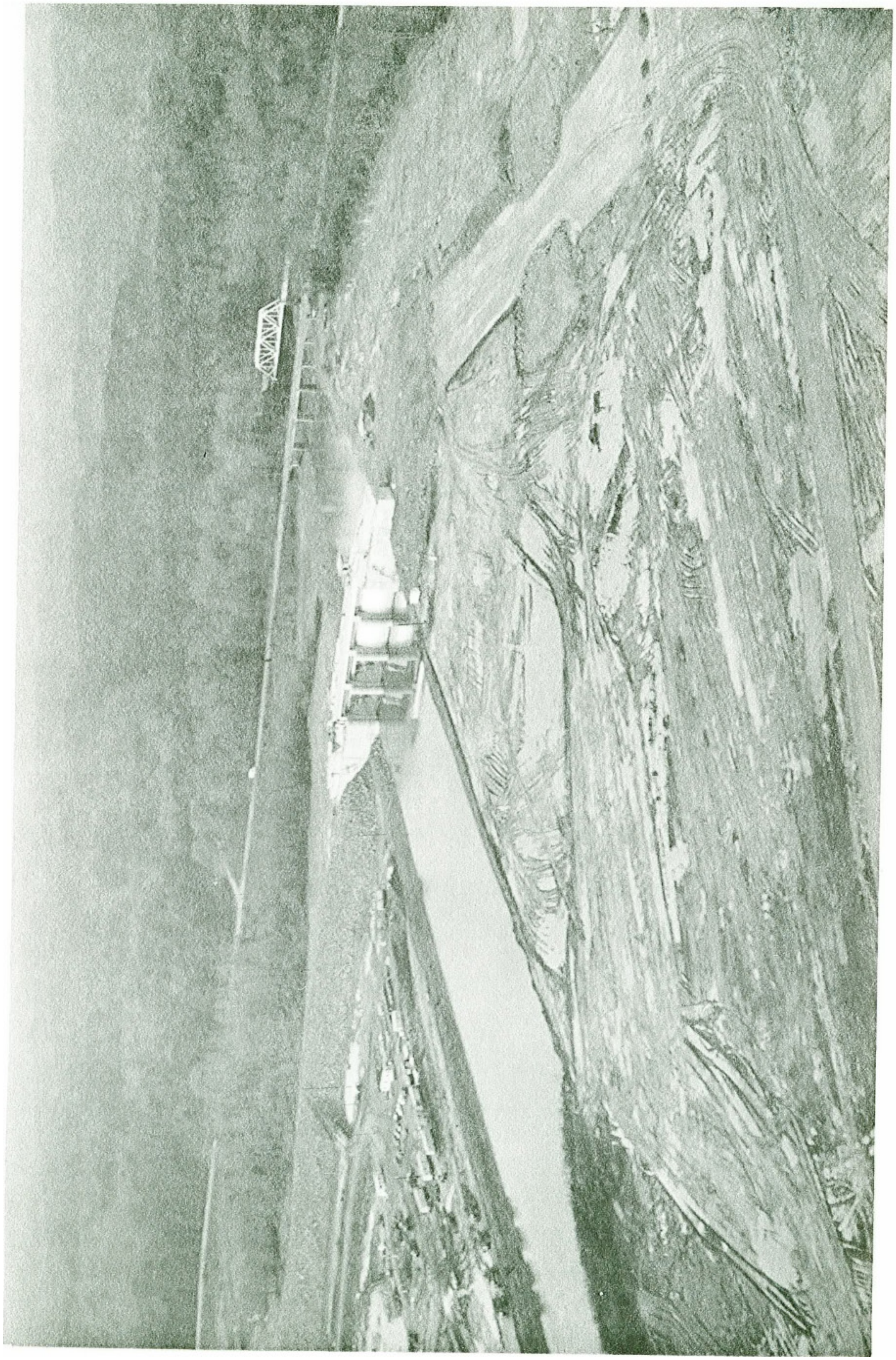

Figure 3-2 Reregulation Dam Site During Construction, Circa 1974

The pool level reached elevation 725 feet NGVD29 on 16 November 1974. After this date, a minimum continuous flow of 240 cfs was maintained below the Reregulation Dam to support downstream water quality flow requirements. After the pool reached elevation 800 feet NGVD29 on 16 December 1974, the rate of rise was slowed by releasing water through the low-level sluice so that workers in the diversion tunnel would not be endangered. The diversion tunnel was completely sealed with a concrete plug by the middle of January 1975, and the pool was again allowed to rise freely. The pool reached minimum power pool, elevation 1,022 feet NGVD29, on 17 March 1975.

The conventional generating units 1 and 2 were declared commercially available on 17 November and 23 July 1975, respectively. The pump turbine units 4 and 3 became commercially available on 13 June and 8 September 1977, respectively.

A graph of the initial filling rate of the main pool at Carters is shown below in Figure 3-3.

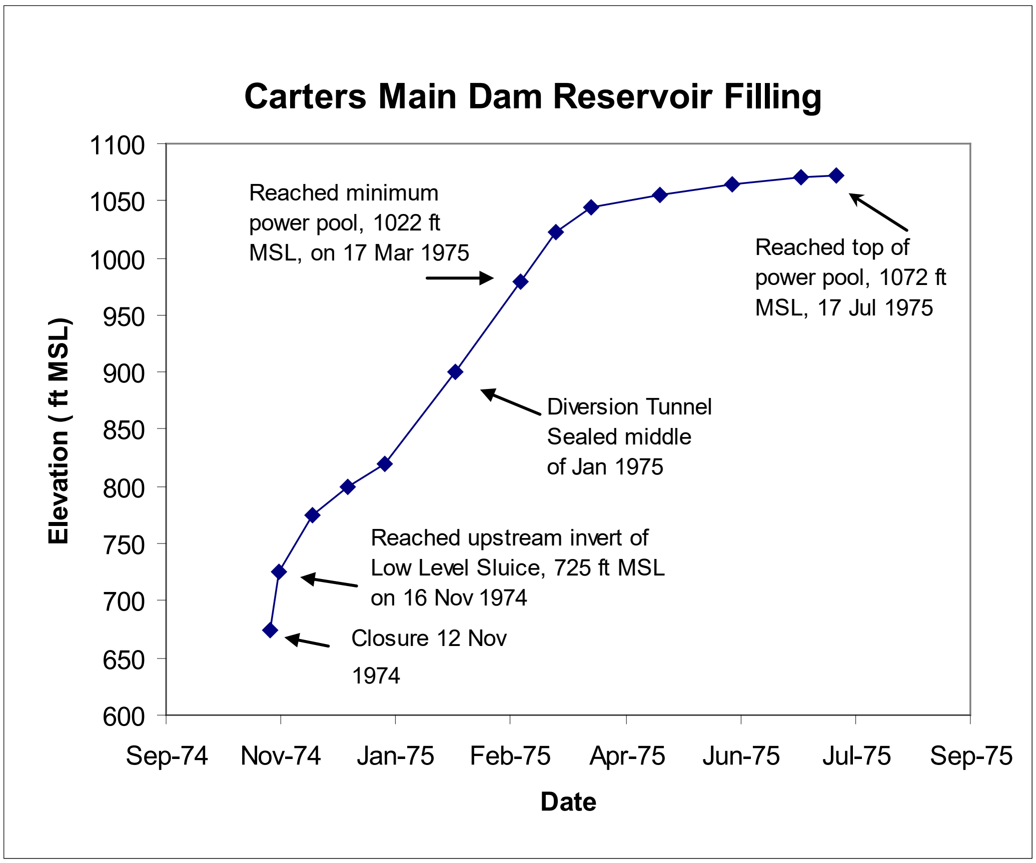

Figure 3-3 Carters Dam Reservoir Filling

3-04. Related Projects. Except for the two dams at the Carters Project there are no other structures within the Coosawattee River Basin requiring special coordination. There is, however, a large multiple purpose reservoir outside the basin on the Etowah River operated by the Corps. This project, Allatoona Dam, affects river stages at Rome, Georgia where the Etowah and Oostanaula Rivers meet to form the Coosa River. Operations at the Carters Project also affect stages at Rome.

Since the Carters Project is equipped with reversible pump-turbines and because a minimum flow of 240 cfs is maintained from the Reregulation Dam at all times, little coordination in the reservoir operations of Carters and Allatoona is normally needed during periods of low to moderate flows. Under extreme low flow conditions, additional water may be released from Carters and/or Allatoona for water supply purposes in the Rome area. During periods when flood waters are being evacuated from Carters and/or Allatoona, releases will be planned and monitored to help prevent aggravating flood conditions near Rome.

Other projects (Corps and non-Corps) in the ACT System that affect water control objectives to varying degrees are Allatoona, Weiss, Logan Martin, H Neely Henry, Millers Ferry, Claiborne, R. F. Henry, R. L. Harris, Richland Creek Reservoir, and Hickory Log Creek Reservoir.

3-05. Dam Safety History/Issues. A dam's hazard classification is based on incremental loss of life potential in the event of project mis-operation or dam failure. Any project for which the loss of one or more lives is probable because of mis-operation or failure is classified as having a high hazard potential. Both Carters Dam and Carters Reregulation Dam are classified as a high hazard potential project and assessed as low risk. USACE conducted the first risk assessment for both facilities in November 2014. The most recent inspection was in December 2017 (https://nid.usace.army.mil). Project dam safety risk is assessed every 10 years. Project related dam safety risk is considered low.

Carters Dam and Carters Reregulation Dam are regularly monitored and inspected to track project conditions and ensure there have been no significant changes. Historically, the main dam has performed well. The concrete in the reregulation dam is of poor quality causing concrete growth that at times causes difficulty raising the spillway gates. This has resulted in hydropower generation impacts. Measures are undertaken from time-to-time to restore reliable gate operations.

An Emergency Action Plan (EAP) with inundation maps was updated in September 2020. Inundation mapping was distributed to state and local emergency management agencies for dam incident preparedness and response purposes. An EAP exercise was executed in April 2021.

3-06. Principal Regulation Issues. The most significant problems at the project involve the swelling and fracturing of the concrete used in construction of the Reregulation Dam, which is caused by alkali aggregate reaction (AAR). Material for construction of the Reregulation Dam came from Vulcan Material's quarry in Dalton, Georgia. There was reportedly a bed of reactive aggregate in the Dalton Quarry during the time of construction of the Reregulation Dam. Aggregate was apparently obtained from this bed and shipped to the Carters site at least twice during construction of the Reregulation Dam. There is no record that the first shipment of bad aggregate was noted, but some of the concrete placed prior to 22 June 1971 has been affected by an intense alkali aggregate reaction. The second shipment of bad aggregate was recognized, and a sample of aggregate and ledge rock from the quarry was sent to the SAD lab in late September 1971. Petrographic examination identified both the sample as containing an excessive amount of "soft and potentially deleterious" particles, and the ledge rock as "fine grained argillaceous dolomitic limestone" that should be avoided because "it is soft….as well as being deleteriously reactive". Intense alkali reacted concrete from this second shipment can be found in concrete placed between 11 August 1971 and 9 November 1971. The referenced petrographic report recommended that selective quarrying be utilized at the quarry to eliminate production of the bad aggregate. Concrete placed subsequent to 9 November 1971 only shows occasional cracking due to AAR. AAR cracking is shown in Figure 3-4 and Figure 3-5.

Because of the AAR, cracking and displacement of the bridge across the spillway has resulted in weakening of the bridge to the degree that it is considered no longer safe to withstand the weight of the crane used to place stoplogs on the upstream face. However, under the American Recovery and Reinvestment Act of 2009, temporary repairs were made to the bridge to allow for a crane to be able to place the stoplogs. In addition, displacement of the abutment and intermediate pier at monolith D9 has resulted in the inability to raise gate number 4 fully. Operation of the gate is limited because there was difficulty in the past closing the gate once it was opened. Further efforts are currently underway to allow for full opening of all gates.

A second is the limitation on head for pump back operations. Whenever the power head reaches 395 feet, excessive vibration occurs in the hydropower units and pumping must be discontinued unless the reregulation pool is over 690 feet NGVD29, then the maximum head is 397 feet.

Figure 3-4 Close-up of the Crack on the Upstream Side of Gate No. 4

Figure 3-5 Close-up of Crack on Upstream Side (East Bridge End) of Gate No. 4

3-07. Modifications to Regulations. During the flood of spring 2019, release tests were performed from the Reregulation Dam to reexamine the channel capacity. Observations were performed from the Reregulation Dam to Resaca. Releases were gradually increased from 5,000 to 5,800 cfs with no impacts. Discharge at all observed locations remained within bank. The test also determined discharge can be increased to 6,000 cfs during sunny day conditions. Rangers may have to be deployed to Carters Road crossing of Willbanks Branch downstream of the Reregulation Dam to ensure backwater does not submerge the road. The backwater is caused from Willbanks Branch that merges into the Coosawattee River 1.15 miles downstream from the Reregulation Dam. Consequently, the channel capacity below the Reregulation Dam changed from 5,000 cfs to 5,800 cfs.

Based on 2009 resurvey, Reregulation Dam area-capacity curves were updated as a result of changes in sedimentation in the lake and area-capacity curves. Section 5-03 provides a more detailed discussion of the sedimentation findings.

During the 2015 update in consultation with the U.S. Fish and Wildlife Service (USFWS), the Corps adopted specific seasonal minimum flow from the Reregulation Dam, varying monthly over a range from 240 to 865 cfs when the Main Dam is in Zone 1. If the reservoir level drops into Zone 2 then the minimum release will be 240 cfs. Section 7-08 provides a more detailed discussion of the minimum flow requirement.

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4 - WATERSHED CHARACTERISTICS

4-01. General Characteristics. The Carters Project, Carters Main Dam, and Coosawattee River drainage basins are shown below in Figure 4-1. The Carters Main Dam drainage area does not include Talking Rock Creek Basin, which flows into the Reregulation Dam pool below the Main Dam. Talking Rock Creek is included in the Carters Project Basin.

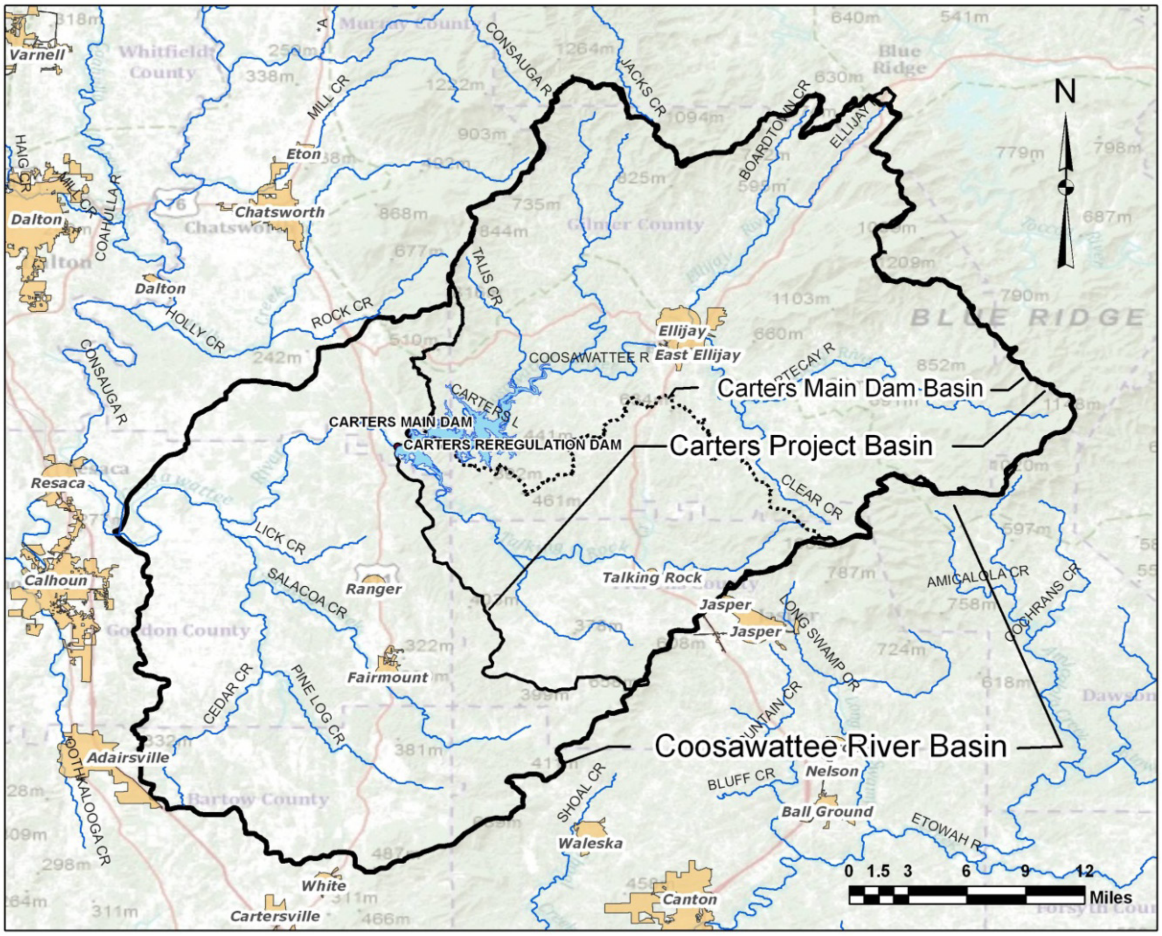

Figure 4-1 Carters Project, Main Dam, and Coosawattee River Basins

The Coosawattee River Basin is located at the northern end of the Alabama-Coosa River Basin. It is roughly rectangular in shape, draining an area of approximately 862 square miles. Maximum length and width of the basin are approximately 40 and 25 miles, respectively. The Coosawattee River is formed by the juncture of the Ellijay and Cartecay Rivers at Ellijay, Georgia, about 21 miles upstream from the Carters Project. These tributary streams rise in the Blue Ridge Mountains, which have peaks up to 4,000 feet NGVD29. The southern boundary of the basin is shared with the northern boundary of the Allatoona Dam Basin, which drains into the Etowah River. The 48-mile long Coosawattee River has a total fall of 650 feet, or an average of about 13.5 feet per mile. The slope of the river below Carters Project is approximately 1.5 feet per mile. The slope above the project to the confluence of the Ellijay and Cartecay Rivers is approximately 23.5 feet per mile. Above the Carters Main Dam, the drainage basin is approximately 374 square miles of forest area. Above the Reregulation Dam the total drainage basin is 520 square miles. The large increase in drainage area is due to the addition of Talking Rock Creek Basin joining the Coosawattee River in the Reregulation Dam Basin.

4-02. Topography. From its source the Coosawattee River flows in a southwest direction through an elevated semi-plateau section for about 10 miles, then about 13 miles through a gorge section, and finally, after emerging from the gorge, about 25 miles through a broad plateau to join the Conasauga River and form the Oostanaula River. Elevations in the Coosawattee River Basin range from approximately 4,000 feet NGVD29 at the basin divide to 600 feet NGVD29 at the mouth. Channel capacity below the Carters Project is estimated to be about 5,800 cfs. A river bottom profile of the Coosawattee and Oostanaula Rivers is shown below in Figure 4-2.

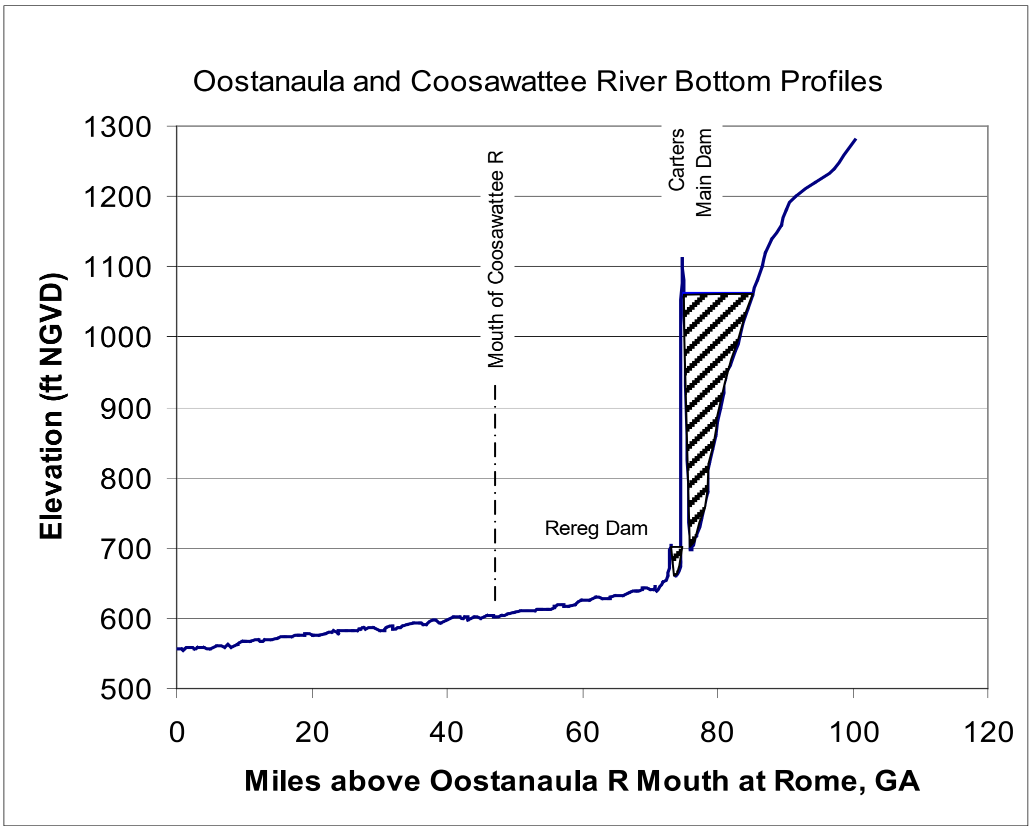

Figure 4-2 River Bottom Profile of the Coosawattee and Oostanaula Rivers

4-03. Geology and Soils. The Carters Project is located in the irregular escarpment, which separates the Piedmont Province from the Appalachian Valley Province. The Main Dam is about one-half mile upstream from the escarpment in a 600-foot deep gorge. Specifically, the Main Dam and reservoir are in the Dahlonega Plateau Subdivision of the Piedmont Province. This region is characterized by rugged, mountainous terrain. One of the major thrust faults of the United States, the Cartersville Fault, is located along the boundary escarpment. The escarpment is the result of this fault and of differential erosion between the harder crystalline rocks of the Piedmont and the softer sedimentary rocks of the Appalachian Valley. The Reregulation Dam is located within the Appalachian Valley Province and about 1.8 miles downstream from the Main Dam. Broad valley lands with occasional north-trending ridges typify this province.

4-04. Sediment. Sediment ranges have been established in the Reregulation and Main Dam pools as well as below the Reregulation Dam to Pine Chapel Road. Surveys have been performed above the Main and Reregulation Dams in 1973 and 1992 at the locations shown on Plate 4-1, although they extended no deeper than 200 feet in the Main Dam pool. Retrogression range locations below the Reregulation Dam are shown in Figure 4-3. All locations above and below the project were re-surveyed in September 2009, with ranges in the Main Dam pool surveyed to the bottom of the pool. Area-capacity curves for the Reregulation Dam were updated as a result of changes in sedimentation in the lake. Area-capacity curves and tables are shown on Plate 7-5. Section 5-03 provides a more detailed discussion of the sedimentation findings. The basin above Carters Project remains largely forested with little development or erosion basin-wide. Erosion downstream of the Reregulation Dam has not been noted in periodic inspections and does not appear to be a problem.

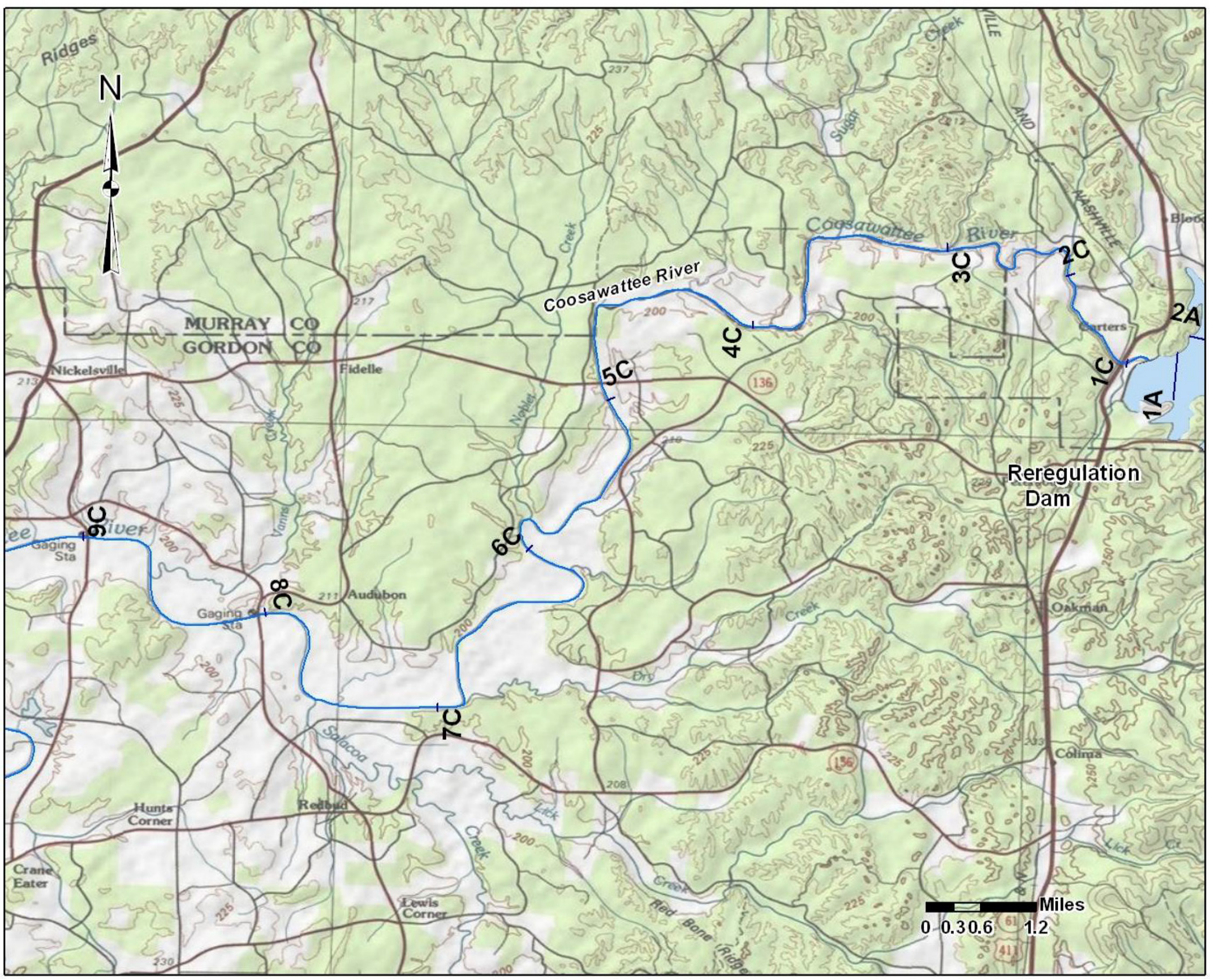

Figure 4-3 Retrogression Ranges Below the Reregulation Dam

4-05. Climate.

a. Temperature. The average annual temperature in the Coosawattee River Basin above Carters Dam for the time period 1991 – 2020 is 59.6 degrees Fahrenheit (°F). This is based on averages at seven stations near the basin boundary. These stations, Calhoun Experiment Station, Dahlonega, Jasper, Dalton, Cartersville, Lafayette, and Rome are considered representative of the area. Average monthly temperatures range from 41 °F in January, the coldest month to about 78 °F in July and August, the warmest months. Extreme temperatures recorded in the area range from 109 °F to -14 °F and the frost-free period normally lasts from mid-April to early October.

A map showing the seven representative stations is shown below in Figure 4-4.

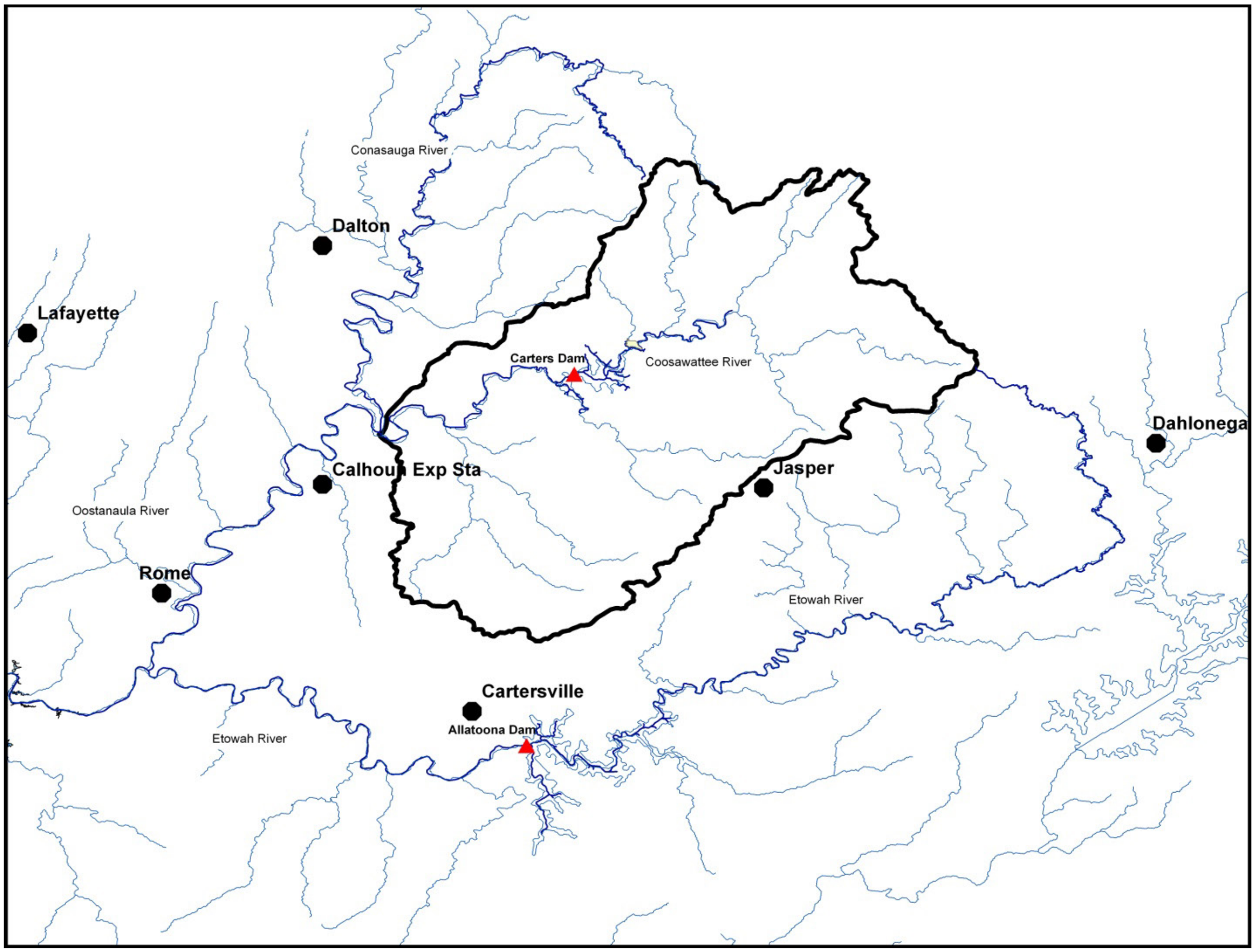

Figure 4-4 Representative Temperature Stations for the Coosawattee Basin

Normal monthly maximum, minimum, and mean temperatures for the selected stations in the basin are shown below in Table 4-1. Climatologists define a climatic normal as the arithmetic average of a climate element, such as temperature, over a prescribed 30-year time interval. The National Climatic Data Center (NCDC) uses a homogenous and complete dataset with no changes to the collection site or missing values to determine the 30-year normal values. When developing this 30-year normal dataset, the NCDC has standard methods available to them to make adjustments to the dataset for any inhomogeneities or missing data before computing normal values.

Table 4-1 Normal Monthly Temperature (1991 – 2020)

NORMAL MONTHLY TEMPERATURE (ºF) FOR UPPER ACT BASIN (AX, MIN, AND AVE), 1991-2020														
		Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
CALHOUN EXP STATION, GA USC00091474	MAX	50.70	56.30	62.80	72.80	79.70	86.10	90.70	88.00	82.50	72.50	60.30	53.50	71.30
	MIN	30.70	32.30	38.00	45.20	55.00	63.70	68.30	67.00	59.90	47.50	37.70	33.20	48.20
	AVG	40.70	44.30	50.40	59.00	67.30	74.90	79.50	77.50	71.20	60.00	49.00	43.40	59.80
DAHLONEGA 4WSW, GA USC00092475	MAX	52.00	56.30	62.60	70.90	78.30	82.50	87.60	85.60	81.10	72.50	61.40	54.00	70.40
	MIN	28.70	29.40	33.70	40.90	49.00	58.60	63.10	62.10	55.80	43.40	34.00	28.90	44.00
	AVG	40.30	42.80	48.10	55.90	63.60	70.50	75.40	73.80	68.50	58.00	47.70	41.40	57.20
JASPER 1 NNW, GA USC00094648	MAX	47.80	52.00	59.80	68.40	75.30	81.40	84.60	83.70	78.90	69.10	59.10	50.80	67.60
	MIN	31.60	34.20	40.20	47.20	55.50	63.30	67.00	66.20	60.80	49.80	40.20	34.60	49.20
	AVG	39.70	43.10	50.00	57.80	65.40	72.40	75.80	75.00	69.80	59.40	49.60	42.70	58.40
DALTON, GA USC00092493	MAX	49.30	53.50	63.20	71.30	78.30	83.60	88.80	87.00	82.80	72.60	60.20	51.80	70.20
	MIN	31.20	33.10	39.70	46.80	56.50	64.20	68.80	67.40	61.00	48.40	40.20	34.20	49.30
	AVG	40.20	43.30	51.40	59.00	67.40	73.90	78.80	77.20	71.90	60.50	50.20	43.00	59.70
CARTERSVILLE, GA USAC00091665	MAX	53.90	58.10	67.70	75.10	81.50	87.90	91.10	90.00	84.30	75.70	64.60	56.20	73.80
	MIN	27.90	30.40	36.70	44.30	53.90	61.60	65.20	64.30	59.00	45.70	36.60	30.30	46.30
	AVG	40.90	44.20	52.20	59.70	67.70	74.80	78.10	77.20	71.60	60.70	50.60	43.30	60.10
ROME, GA USC00097600	MAX	52.90	57.00	65.80	73.80	80.70	86.30	89.90	88.90	84.30	74.10	63.10	55.30	72.70
	MIN	30.60	33.10	39.10	46.00	55.00	63.70	67.90	66.70	60.60	48.60	37.40	34.00	48.60
	AVG	41.80	45.10	52.40	59.90	67.80	75.00	78.90	77.80	72.40	61.40	50.30	44.60	60.60
LAFAYETTE 2W, AL USC00014502	MAX	55.50	60.10	67.70	75.00	82.00	87.40	90.10	89.70	84.60	75.40	66.20	57.30	74.30
	MIN	30.50	34.00	39.70	46.20	55.90	63.80	67.60	66.70	60.80	49.10	37.80	32.90	48.80
	AVG	43.00	47.00	53.70	60.60	69.00	75.60	78.90	78.20	72.70	62.30	52.00	45.10	61.50
BASIN AVG	MAX	51.73	56.19	64.23	72.47	79.40	85.03	88.97	87.56	82.64	73.13	62.13	54.13	71.47
	MIN	30.17	32.36	38.16	45.23	54.40	62.70	66.84	65.77	59.70	47.50	37.70	32.59	47.77
	AVG	40.94	44.26	51.17	58.84	66.89	73.87	77.91	76.67	71.16	60.33	49.91	43.36	59.61

Source: NOAA, High Plains Regional Climate Center

b. Precipitation. Due to the topographic lift of the Blue Ridge Mountains, the upland slopes are subject to intense local storms and to general storms of heavy rainfall lasting days. Heavy rains may occur at any time during the year but are most frequent between late fall and mid-spring, when the majority of the large floods in the basin have been recorded. The large flood of

March 1990 occurred when a storm front extended from Mobile to Montgomery to Rome and subtropical moisture was continuously drawn along the line producing an extended period of heavy rain. The normal monthly precipitation in the vicinity of the Carters Project is based on the 1991–2020 means of the National Weather Service (NWS) gages at Resaca, Dahlonega Ellijay, Jasper, Cartersville, Rome, Summerville, and Lafayette. The Coosawattee River above Carters Dam lies in a region of moderately heavy annual precipitation. The average annual rainfall is 58.32 inches of which 55 percent occurs in the winter and spring, 24 percent in the summer, and 21 percent in the fall. January is the wettest month averaging 5.82 inches while October is the driest averaging about 3.83 inches. The terms "wet season," "dry season," and "agricultural growing season" are frequently referred to within this manual. The agricultural growing season refers to spring, summer, and early fall when crops are planted within the floodway. Summary precipitation data for the basin is shown below in Table 4-2.

Table 4-2 Normal Monthly Rainfall (1991 – 2020)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
RESACA USC00097430	5.40	5.52	6.5	4.5	3.78	3.65	3.84	4.15	4.15	3.6	4.1	5.04	54.23
DAHLONEGA 4WSW, GA USC00092475	7.70	6.55	6.43	5.17	4.49	5.25	4.57	5.1	4.54	4.95	5.13	6.4	66.28
ELLIJAY USC0009115	6.45	5.35	6.48	5.67	4.66	4.95	4.64	4.4	4.6	3.45	4.74	6.94	62.33
JASPER 1 NNW, GA USC00094648	6.23	5.53	6.39	5.07	4.31	4.88	5.28	4.59	4.18	4.01	4.55	6.13	61.15
CARTERSVILLE #2, GA USAC00091670	4.87	5	4.96	4.27	4.05	4.36	5.18	3.85	3.87	3.45	4.08	3.95	51.89
ROME, GA USC00097600	5.08	4.81	5.42	4.88	4.11	4.79	4.89	4.2	3.66	3.78	4.27	5.60	55.49
SUMMERVILLE USC00098436	5.11	5.47	6.14	4.95	4.37	4.93	4.29	4.32	4.24	3.75	4.64	6.42	58.63
LAFAYETTE 2W, AL USC00014502	5.7	5.33	5.7	4.8	4.4	4.48	4.8	4.23	3.53	3.63	4.31	5.61	56.52
BASIN AVG	5.82	5.45	6.00	4.91	4.27	4.66	4.69	4.36	4.10	3.83	4.48	5.76	58.32

Source: NOAA, National Centers for Environmental Information

Representative precipitation station locations are shown on Plate 5-1.

4-06. Storms and Floods.

a. General. Major flood-producing storms over the ACT Watershed are usually of the frontal type, occurring in the winter and spring and lasting from two to four days, with their effect on the basin depending on their magnitude and orientation. The axes of the frontal-type storms generally cut across the long, narrow basin. Frequently a flood in the lower reaches is not accompanied by a flood in the upper reaches and vice versa. Occasionally, a tropical storm or hurricane, such as the storms of July 1916 and July 1994, will cause major floods over practically the entire basin. However, summer storms are usually of the thunderstorm type with high intensities over small areas producing serious local floods. With normal runoff conditions, from five to six inches of intense and general rainfall are required to produce widespread flooding, but on many of the minor tributaries three to four inches are sufficient to produce local floods.

b. Record Floods. The pre-record flood of March 1886 was the greatest known on the Oostanaula River and, in all probability, was equally severe in that portion of the basin above Carters Dam site. Other major floods of record resulted from the storms of April 1938, January 1947, March 1951, and April 1977. As of August 2021, the highest pool in the Main Dam, 1,099.20 feet NGVD29, occurred on 3 March 2019. April 1938 is remarkable because of the even distribution of rainfall over the area. It produced the maximum stage of record at Ellijay and near record stages throughout the Oostanaula River Basin. The storm of January 1947, while not producing as large a peak discharge as some of the other storms, lasted for several days and would have caused a larger volume of water to be held in storage at Carters Dam during flood risk management operations. The storm of March 1951 resulted in record stages at Pine Chapel and Resaca below the Carters site and was of considerable severity in the basin above Carters Dam site.

4-07. Runoff Characteristics. The steep slopes of the mountains and channel gradients of the upper reaches of the tributaries of the Oostanaula River are conducive to flashy storm runoff. Flash floods, resulting from local storms, occurring on the smaller of these streams have endangered lives in the past.

In contrast, the runoff characteristics of the tributary streams in the lower reaches and the main stream itself are more moderate. The wider valleys and relatively flat slopes of the stream channels are the principal factors in effecting moderation in the rate of change in stages. The lower base flows and higher peak discharges are characteristics of streams with valleys underlain to a considerable extent with limestone and with contributing areas that are largely cleared for cultivation. Seasons for extremes of storm runoff rates are uniform throughout the basin with low values occurring in late summer and early fall and high values occurring in winter and early spring. However, the variation is much greater in the lower reaches of the tributaries and along the main stream, with runoff of about 30 percent and 60 percent in the respective seasons. Runoff during floods for the same periods in the upper reaches is about 25 percent and 40 percent. Annual runoff from the basin above Carters Dam site averages approximately 27 inches or about 47 percent of the average rainfall.

Table 4-3 shows monthly and annual inflows to the Carters Project, along with minimums, maximums, and averages. Inflows are determined from the relationship “inflow minus outflow equals the change in storage” where outflows and change of storage are measurable quantities. Inflow values can be calculated as negative amounts mainly due to evaporation from the lake. Figure 4-5 present the average monthly runoff for the ACT Basin above Rome, Georgia. This information was computed by comparing unregulated flows with rainfall over the basin. The percent of rainfall appearing as streamflow is presented for each month.

Table 4-3 Average Monthly Inflow (cfs)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1975								498	527	730	765	779
1976	1413	969	1697	1350	1413	1117	1370	569	391	466	439	789
1977	830	638	1764	2359	926	572	426	345	493	665	1250	848
1978	1594	966	1103	851	938	594	394	496	256	170	290	604
1979	1260	1267	2040	2093	1073	872	766	630	510	444	974	605
1980	868	927	2845	1926	1320	769	447	294	340	317	329	275
1981	204	804	531	628	513	624	247	195	220	196	274	525
1982	1718	1986	1284	968	748	482	569	541	351	544	659	1635
1983	861	1153	960	1432	1314	845	846	361	403	256	690	1380

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1984	1008	1033	1582	1385	1666	706	825	631	315	314	300	445
1985	476	978	515	510	455	380	371	403	230	323	334	434
1986	346	514	527	331	248	127	41	100	148	306	665	634
1987	906	980	1098	731	481	418	254	87	64	75	124	197
1988	587	401	374	525	269	63	82	114	195	143	412	263
1989	840	905	1330	1215	896	1564	1058	543	768	1036	990	964
1990	1699	3652	3120	1344	1029	615	749	397	382	448	341	1164
1991	951	1317	1532	1284	1429	832	625	593	414	297	464	956
1992	876	1109	1375	1011	598	675	665	485	453	424	1037	1600
1993	1531	1023	1277	1136	743	407	221	213	109	94	236	443
1994	639	888	1505	1824	774	752	768	580	390	641	475	683
1995	849	1463	1362	784	536	467	237	238	247	778	968	553
1996	1747	1353	1712	1247	996	625	380	328	404	258	527	861
1997	957	1089	1587	1414	1501	1024	607	400	366	558	448	502
1998	1054	1389	1438	1947	1066	735	378	333	111	126	293	435
1999	825	1052	773	533	836	474	801	273	113	183	184	188
2000	377	340	470	1122	371	296	153	88	143	27	273	223
2001	601	615	857	646	419	562	419	350	257	173	209	408
2002	808	535	709	649	800	360	234	82	337	302	573	917
2003*	605	1193	1102	910	1780	1038	1422	1104	710	351	578	659
2004	654	871	607	504	501	611	485	276	1622	372	1212	1614
2005	752	1201	1200	1329	778	762	1195	772	355	275	316	550
2006	813	615	528	674	542	297	156	100	187	294	424	272
2007	548	326	448	317	151	109	125	25	-18	-2	36	111
2008	143	325	639	385	272	176	245	195	21	88	53	622
2009	974	471	788	815	1045	393	281	241	807	762	952	1238
2010**	1078	1320	899	803	948	464	277	241	97	165	211	271
2011	374	358	1254	1155	563	312	133	47	179	74	363	577
2012	888	673	1075	473	385	234	278	115	150	103	80	447
2013	1533	1042	945	1419	1655	1157	1109	971	592	353	575	1502
2014	1253	1091	926	1065	760	614	403	213	296	377	330	509
2015	788	611	697	1017	593	425	587	424	254	475	847	2908
2016	1410	1400	1049	823	513	327	218	168	71	46	56	139
2017	308	183	387	599	653	738	598	352	383	469	409	561
2018	405	1530	1510	1084	927	881	719	747	452	454	979	1645
2019	1729	2746	2211	1690	1028	706	485	348	150	414	405	813
2020	1205	2609	2059	1628	1096	805	637	592	415	774	565	820
Min	143	183	374	317	151	63	41	25	-18	-2	36	111
Max	1747	3652	3120	2359	1780	1564	1422	1104	1622	1036	1250	2908
Avg	919	1101	1217	1083	840	609	527	380	360	358	504	786

*Average is missing a day value in October 2003 and December 2003
**Average is missing a day value in April 2010

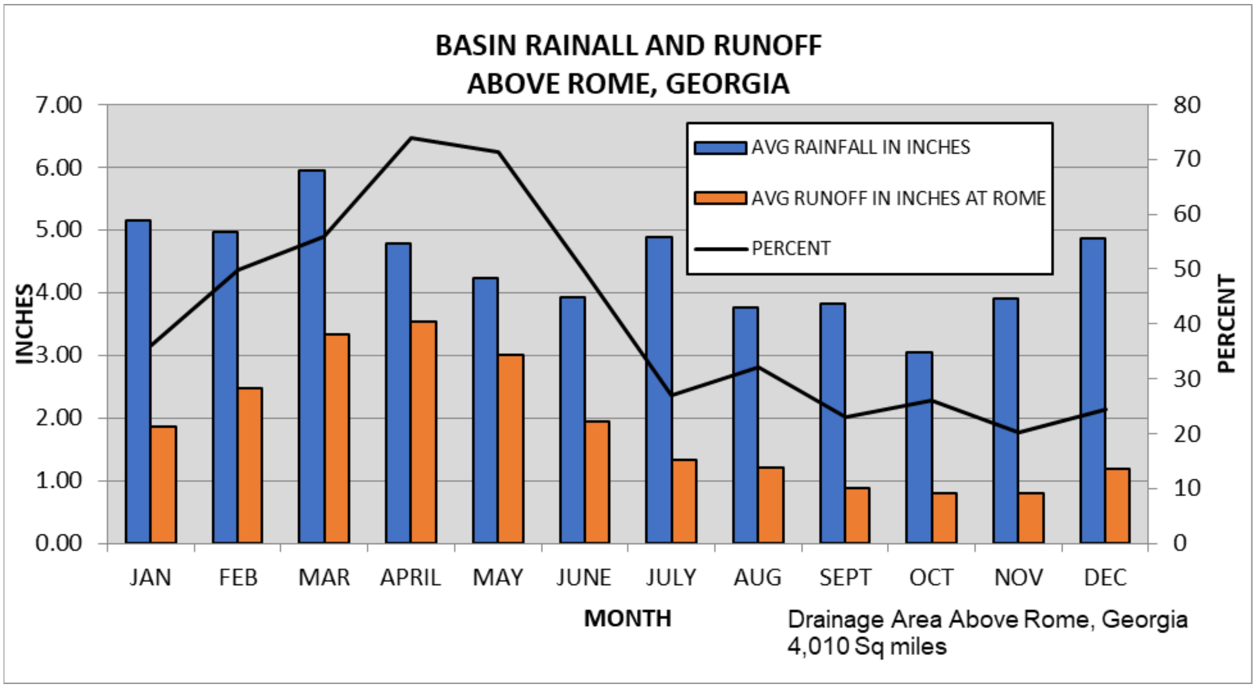

Figure 4-5 Basin Rainfall and Runoff above Rome, Georgia

4-08. Water Quality. Section 305(b) of the Clean Water Act (CWA) requires states assess their water quality every two years. Section 303(b) of the CWA requires states submit a list of all waters not supporting their designated uses, as well as develop Total Maximum Daily Load(s) (TMDLs) (Georgia Department of Natural Resources Environmental Protection Division [GAEPD], n.d.). For waters of Carters Lake, the Coosawattee River Embayment, US Woodring Branch/Midlake segments of the lake and Carters Lake Reregulation Reservoir are listed in the Georgia's 2020 Integrated 305(b)/303(d) List of Waters (GAEPD, 2020).

GAEPD, in accordance with Georgia Water Quality Control laws, classified uses of the Coosawattee River Embayment and US Woodring Branch/Midlake as drinking water, recreation, and fishing. Carters Lake Reregulation Reservoir's classified use is fishing.

Both the Coosawattee River Embayment and US Woodring Branch/Midlake reaches are identified as Category 3 and assessment pending due to insufficient data to determine whether or not the water supports its designated use. TMDLs for total phosphorus and chlorophyll *a* were completed in 2016. Coosawattee River Embayment and US Woodring Branch/Midlake waters are classified as Category 3 because the growing season average for chlorophyll *a* exceeded the criteria once in the last five years. The Carters Lake Reregulation Reservoir is identified as Category 1 because it supports its designated use.

Information regarding water quality in the State of Georgia is available at https://epd.georgia.gov/watershed-protection-branch/watershed-planning-and-monitoring-program/water-quality-georgia.

a. Water Quality Needs. Georgia has promulgated water quality criteria for various water use classifications in the Summary of Specific Water Quality Criteria for Georgia's Waters – March 2020 and Rules and Regulations of the State of Georgia Rule 391-3-6.03). The principal specific criteria related to the use classifications are as follows:

Drinking Water:

- Bacteria: Fecal coliform not to exceed a 30-day geometric mean of 200 colonies per 100 milliliters (mL) during May – October; fecal coliform not to exceed a 30-day geometric mean of 1,000 per 100 mL November – April; and not to exceed an instantaneous maximum of 4,000 colonies per 100 mL November – April.
- Dissolved oxygen: A daily average greater or equal to 5.0 milligrams per liter (mg/L) and no less than 4.0 mg/L at all times.
- pH: Within the range of 6.0–8.5.
- Temperature: Not to exceed 90 ºF.

Fishing:

- Bacteria: Fecal coliform not to exceed a 30-day geometric mean of 200 colonies per 100 mL during May – October; fecal coliform not to exceed a 30-day geometric mean of 1,000 per 100 mL November – April; and not to exceed an instantaneous maximum of 4,000 colonies per 100 mL November – April.
- Dissolved oxygen: A daily average greater or equal to 5.0 mg/L and no less than 4.0 mg/L at all times.
- pH: Within the range of 6.0–8.5.
- Temperature: Not to exceed 90 ºF.

Recreation:

- Bacteria: Fecal coliform not to exceed a 30-day geometric mean of 126 colony forming units (CFU) per 100 mL of E. coli or a statistical threshold value 410 CFU of E. coli.
- Dissolved oxygen: A daily average greater or equal to 5.0 mg/L and no less than 4.0 mg/L at all times.
- pH: Within the range of 6.0–8.5.
- Temperature: Not to exceed 90 ºF.

The following general criteria apply to all waters of the State of Georgia:

- All waters shall be free from materials associated with municipal or domestic sewage, industrial waste, or any other waste, which will settle to form sludge deposits that becomes putrescent, unsightly or otherwise objectionable.
- All waters shall be free from oil, scum, and floating debris associated with municipal or domestic sewage, industrial waste, or other discharges in amounts sufficient to be unsightly or to interfere with legitimate water uses.
- All waters shall be free from material related to municipal, industrial, or other discharges, which produce turbidity, color, odor or other objectionable conditions which interfere with legitimate water uses.
- All waters shall be free from turbidity, which results in a substantial visual contrast in a waterbody due to a man-made activity.

- All waters shall be free from toxic, corrosive, acidic, and caustic substances discharged from municipalities, industries, or other sources, such as nonpoint sources, in amounts, concentrations or combinations which are harmful to humans, animals or aquatic life.
- No toxic pollutants or chemical constituents in concentrations that after treatment would exceed GAEPD and Federal drinking water standards.

The above listing is not intended to be all-inclusive, and Georgia Water Quality Control regulations and standards should be consulted as necessary.

b. Lake Water Quality Conditions. The State of Georgia prepared an initial TMDL Evaluation for Carters Lake (Chlorophyll *a*) in February 2016. The TMDL Evaluation is applicable to the Coosawattee River Embayment and the US Woodring Branch/Midlake area. It included Environmental Fluid Dynamics Code (EFDC) hydrodynamic water quality modeling to simulate the fate and transport of nutrients into and out of the embayment and the uptake by phytoplankton, where the growth and death of phytoplankton is measured through the surrogate parameter chlorophyll *a*.

Source assessments characterized known and suspected nutrient sources in the watershed, identified impaired segments of the waterbodies, and identified potential sources of impairment. Per the February 2016 TMDL Evaluation "…[National Pollutant Discharge Elimination System] NPDES permittees discharging treated wastewater effluent from biological treatment systems that meet their nutrient permit limits is not expected to contribute significantly to nutrient loads…". Through water quality modeling, it has been determined that the nutrient loading found in these segments needs to be reduced. This nutrient loading may be due to activities including, but not limited to, fertilizers (residential, commercial), agriculture, impervious surfaces, failing septic tanks, and others. It is believed that if nutrient loads are not reduced, these segments will continue to degrade over time…".

The specific criteria for chlorophyll *a* and phosphorous in Carters Lake, as stated in Georgia's Rules and Regulations for Water Quality Control Chapter 391-3-6-.03(17)(f) and reiterated in the TMDL Evaluation for Carters Lake are:

Chlorophyll *a*: For the months of April through October, the average of monthly mid-channel photic zone composite samples shall not exceed the chlorophyll *a* concentrations at the locations listed below more than once in a five-year period:

- Carters Lake upstream from Woodring Branch: 10 micrograms per liter (μg/L)
- Carters Lake at Coosawattee River embayment mouth: 10 μg/L

Phosphorous: The annual total phosphorous loading at the compliance monitoring location shall not exceed the following:

- Coosawattee River at Old Highway 5: 151,500 pounds
- Mountaintown Creek at U.S. Highway 76: 16,000 pounds

The state collects profile data at compliance points in Carters Lake for dissolved oxygen, pH, conductivity, and water temperature during the growing season. The state also collects grab samples of nitrogen, phosphorus, chlorophyll *a*, and bacteria. Historically, algal blooms result in reports of bad tasting or bad smelling drinking water in the City of Chatsworth, which withdraws its water supply from Carters Lake, and in the downstream Town of Calhoun, which draws water from the Coosawattee River.

c. Lake Stratification. Carters Lake is unusual because of its extreme water depth of approximately 400 feet in places, resulting in the very lowest levels not mixing with the higher more oxygenated waters. The deepest levels remain anoxic and in a temperature range of 40–50 ºF throughout the year. However, the lake does exhibit typical seasonal mixing in the upper zones.

During the colder winter months, the water in Carters Lake is generally cold, relatively clear, and with similar temperatures from the top to the bottom. Water on the top and bottom of the lake has similar densities. Wind action keeps the lake well mixed, resulting in adequate dissolved oxygen levels throughout the water column. During winter, 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 Coosawattee River below the dam, is cold, relatively clear, and typically low in dissolved oxygen.

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 4-6 shows the typical summer stratification layers; however, in Carters there is also a fourth layer described below.

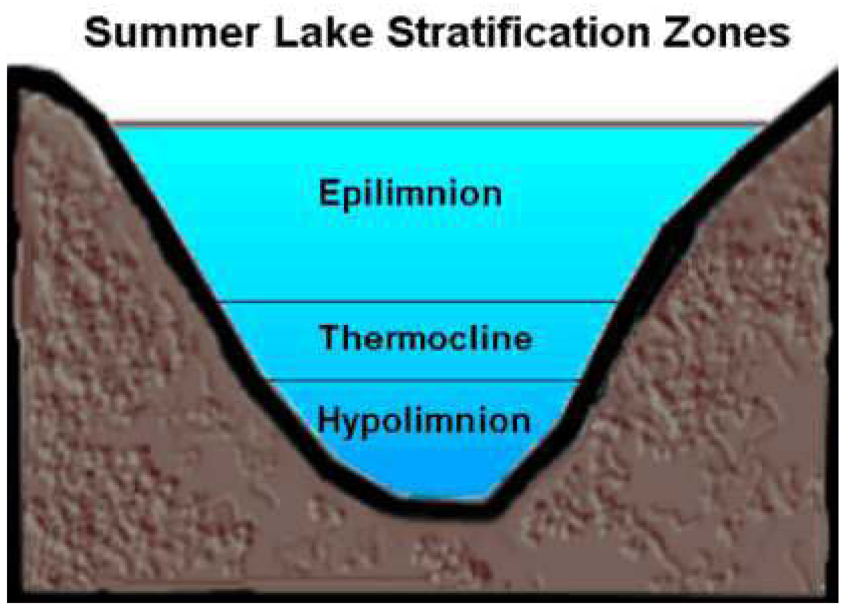

Figure 4-6 Generalized Lake Stratification

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

The hypolimnion, the cold (45 to 55 °F) third 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 throughout 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 3 mg/L). As oxygen levels fall, 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. The event is called lake turnover, and generally occurs around November – December each year. After mixing, the upper three layers cease to exist, and the entire lake has relatively uniform temperature and oxygen levels.

Regardless of the natural process of thermal stratification, Carters Lake has a "permanent layer" that does not mix with the upper three layers of the lake, thus serving as a unique fourth layer. This layer has a higher concentration of dissolved inorganic compounds that has developed due to extended periods of anoxic conditions. For example, the concentrations of iron and manganese approach 140 and 16 mg/L, respectively, in the deepest areas. This phenomenon is described by John Hains in the article "Southeastern Lakes - Changing Impacts, Issues, Demands." This permanent deep chemical zone (monimolimnion) never mixes because the high chemical content increases the water's density. It appears that this layer, which exists at an approximate depth of 280 feet, resists mixing during the fall turnover. The monimolimnion is characterized by high conductivity and a rapid change in pH, devoid of oxygen, and contains high levels of iron, manganese, and other constituents and permanently low temperatures in the range of 40 to 50 ºF as modeled by the Corps. The headgate and headrace channel are located at elevation 979 feet NGVD29, or about 100 feet below the normal pool elevation. This would indicate that normal operation would not draw water from the monimolimnion. On the other hand, the emergency low level sluice intake is located at elevation 725 feet NGVD29, or about 350 feet below normal pool elevation. Any use of this low-level sluice could have adverse impacts on downstream water quality as it would draw water directly from the monimolimnion.

d. Downstream Water Quality Conditions. Water quality conditions in the releases from Carters Dam are typical for hydropower projects in the southeast, i.e., cold water year-round with low dissolved oxygen levels during summer-time lake stratification periods and high dissolved oxygen levels during winter-time lake destratification periods. Turbidity is relatively low year-round. The potential for suspended metals occurs during lake stratification periods when the hypolimnion reaches anoxic conditions. The water use classification established by the State of Georgia for the Coosawattee River below Carters Dam is fishing, with corresponding water quality standards as described in paragraph 4-08.a. above. TMDLs for dissolved oxygen, fecal coliforms, and polychlorinated biphenyls (PCBs) have been established for the Coosawattee River below Carters Dam. Due to PCB levels in fish tissue, the fishery advisories of one meal per week for spotted bass and one meal per month for smallmouth buffalo have been established by the State of Georgia.

Release water quality from the reregulation dam was monitored for several years from October 1974 and parameters measured were dissolved oxygen, temperature, pH, and conductivity. These data showed that dissolved oxygen consistently exceeded State water quality standards. While dissolved oxygen levels are periodically depressed in the releases from the Main Dam, exposure to the atmosphere in the reregulation pool together with reaeration which occurs in the spillway discharge from the Reregulation Dam is sufficient to elevate levels above State of Georgia standards. The monitoring is no longer being done by the Corps although the U.S. Geological Survey (USGS) collected water quality data at the site from 2005–2007.

4-09. Channel and Floodway Characteristics.

a. General. Carters Dam and Reregulation Dam Project is a headwater project with no other reservoirs located upstream. The channel capacity of the Coosawattee River downstream from the Carters Reregulation Dam is 5,800 cfs. Low lying areas on both banks of the lower reaches of the Coosawattee, Conasauga, and the beginning of the Oostanaula Rivers are cultivated during the spring, summer, and early fall. It is estimated that a downstream flow of 5,800 cfs can be maintained during the planting and growing season without causing appreciable damage in these low lying areas. A downstream flow of 5,800 cfs can be maintained during the non-growing season without causing damages to these same areas.

During moderate to high flows, the backwater effects from the Coosawattee River increases flooding along the Conasauga River at Tilton, Georgia. When possible, releases from Carters Reregulation Dam are reduced during these periods to avoid increasing backwater flooding downstream in these areas.

b. Damage Centers and Key Control Points. In addition to the agricultural areas downstream from Carters Dam and Reregulation Dam Project, there are major flood damage reaches downstream on the Oostanaula River at Resaca and Rome, Georgia. The towns are shown in Figure 4-7.

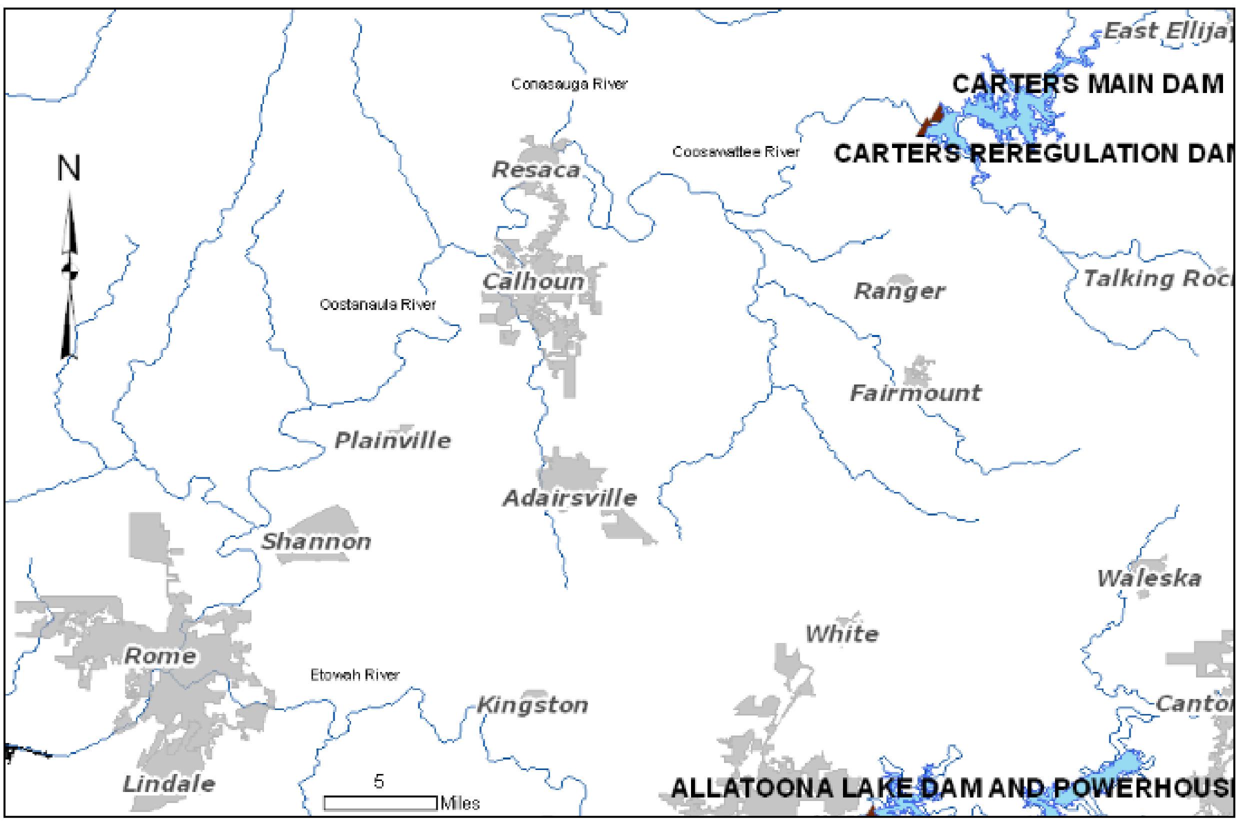

Figure 4-7 Location of Towns below Carters Project

This flooding is due to flood flows exceeding the channel capacity. Since the drainage area has a long travel reach, the flood hydrograph peaks at Rome, Georgia occur three to four days after the maximum rainfall, and the high flows tend to continue for many days.

The City of Resaca, Georgia, located below Carters Dam and Reregulation Dam Project, experiences flooding when the Oostanaula River stage reaches 22 feet.

The Carters Dam and Reregulation Dam Project is located northeast of Rome, Georgia on the Coosawattee River and its operation provides some flood damage reduction benefits for Rome. However, Carters Dam controls runoff from less than 10 percent of the drainage area above Rome, Georgia, so flood reductions at Rome due to the Carters Project are relatively small. Travel time for water released from Carters Dam and Reregulation Dam Project to reach Rome is approximately 32 hours. Rome, Georgia is also the major flood damage area protected by the Allatoona Project. Travel time for water released from Allatoona Dam and Lake Project to reach Rome, Georgia is approximately 12 hours. Efforts are made to coordinate Carters Dam and Reregulation Dam and Allatoona projects when making releases for flood operations. Usually, flood releases will not be made from Allatoona until after the peak flood from the Oostanaula River have peaked at Rome. The USGS gages for the Oostanaula River at Rome US 27 and Coosa River at Mayo's Bar (Weiss Lake) are used to guide operations of Carters Dam and Reregulation Dam Project to ensure maximum flood reductions. The locations of the USGS gages around Rome, Georgia, are shown in Figure 4-8.

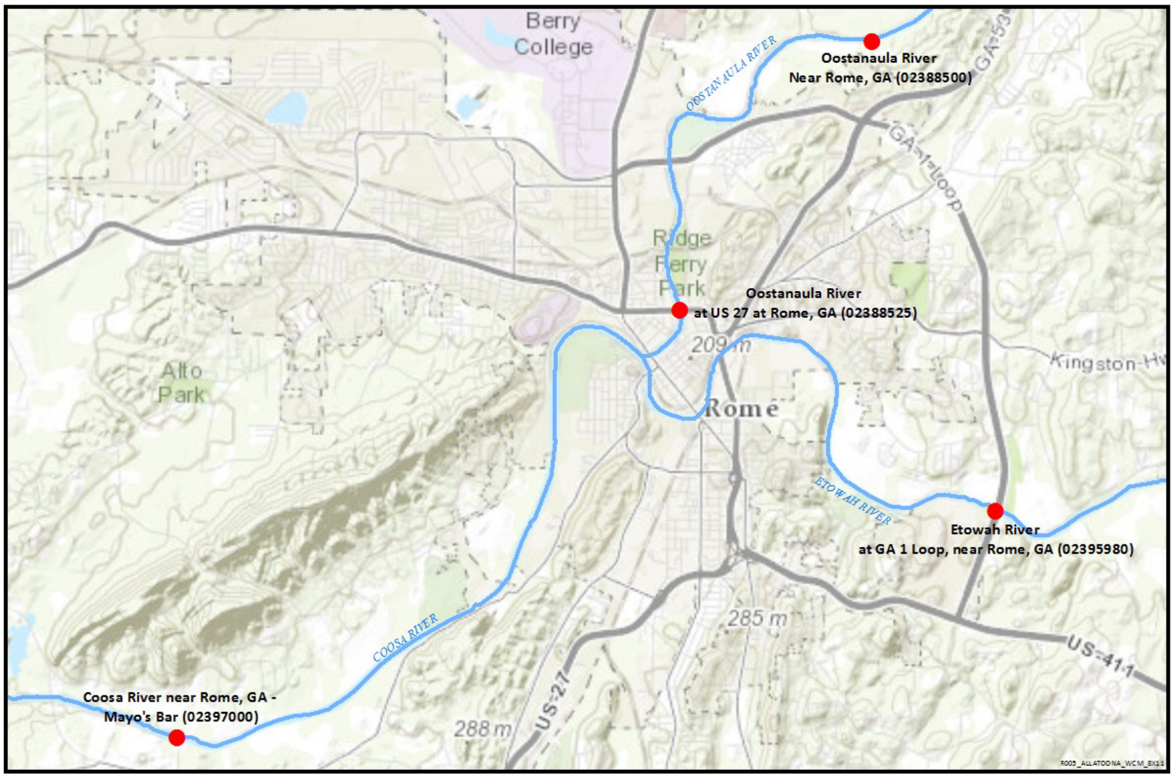

Figure 4-8 USGS Gages in the Vicinity of Rome, Georgia

Table 4-4 and Table 4-5 provide details for river stages and flood damages at Rome and Resaca, Georgia. Table 4-6 and Table 4-7 provide the dates and heights of historical floods for these locations and the lowest stages on record.

Table 4-4 Flood Impacts for Varying Stage of Oostanaula River at Rome, Georgia (USGS Gage# 02388525)

Stage (feet)	Flood impacts at Rome – Oostanaula River
0	Gage datum is 561.9 feet NAVD88
19	Bankfull conditions occur along the river upstream and downstream from the gage on the Turner McCall bridge or U.S. Highway 27. Action Stage is reached with the Heritage Park Rome Greenway beginning to flood within the floodplain.
22	Drainage valve must be closed at Second Avenue and Avenue A Pump station outfalls.
24	Drainage valves must be closed at American Legion Outfall and Police Station Outfall.
25	Flood Stage is reached. Mainly minor flooding will develop.
28	Moderate flooding begins. Water will enter basements of lower two city blocks near the gage site. Flood gates on Second Avenue and Avenue A must be closed.
30	Moderate flooding expands. Water enters Georgia Power Maintenance Yard at Etowah River.
32	Major flooding begins. Flooding of Rome Sewage Treatment Plant begins. Fifth Avenue Bridge is closed. Water overflows onto Second Avenue between railroad and bridge.
34.5	Major flooding continues. Six city blocks of basements in Rome near the Oostanaula River will flood. Water will cover the 200 block of East Second Avenue.
36	Major flooding continues. Water overflows at the lowest point of Summerville Road.
38	Major flooding expands. Water will reach Broad Street. This is the 100-year flood.
40.29	The record crest was 40.29 feet on April 1, 1892.
42	The levee of the Oostanaula will reach the top of the city levee. This is a very serious situation. Floyd Medical Center, Law Enforcement Center, and numerous businesses flood.
46	Highway 27 / 5th Avenue bridge floods. Many businesses and homes flooded.

Table 4-5 Flood Impacts for Varying Stage of Oostanaula River at Resaca, Georgia (USGS# Gage 02387500)

Stage (feet)	Flood impacts at Resaca – Oostanaula River
0	Gage datum is 604.14 feet NGVD29
19	Action Stage is reached
22	Mainly flooding of agricultural and pasture lands are affected when flood stage is reached.
28	High water will cause extensive flooding of farmlands in the area.
33.5	When the river rises to 33.5 feet, flooding of a textile mill in Calhoun will develop. Widespread flooding will occur.
36	The flood of record was 36.3 feet on April 1, 1886. Widespread flooding will occur. In Calhoun, just downstream, will flood on North River Street and South River Street. A recreational area on South River Street will flood. Mills near the area will not flood because these locations have a higher elevation.

Table 4-6 Historical Crests for Oostanaula River at Rome, Georgia (USGS Gage# 02388525)

Historical Crests for Oostanaula River at Rome	
(1) 40.30 ft on 04/01/1886	(22) 29.70 ft on 02/23/2019
(2) 37.20 ft on 01/15/1892	(23) 29.60 ft on 03/22/1980
(3) 34.50 ft on 01/22/1947	(24) 29.55 ft on 12/30/2015
(4) 34.30 ft on 07/12/1916	(25) 29.00 ft on 01/04/1982
(5) 34.26 ft on 03/18/1990	(26) 28.90 ft on 03/08/1996
(6) 34.10 ft on 02/12/1946	(27) 28.82 ft on 02/05/1998
(7) 33.90 ft on 11/30/1948	(28) 28.00 ft on 01/20/1925
(8) 33.80 ft on 12/30/1932	(29) 27.72 ft on 03/26/2021
(9) 33.80 ft on 01/09/1946	(30) 27.70 ft on 05/07/2003
(10) 33.70 ft on 04/08/1936	(31) 27.57 ft on 02/14/2020
(11) 33.30 ft on 02/06/1936	(32) 27.00 ft on 11/29/1929
(12) 33.00 ft on 04/14/1979	(33) 26.90 ft on 03/10/1998
(13) 32.80 ft on 12/11/1919	(34) 26.50 ft on 04/14/1980
(14) 32.64 ft on 02/27/1990	(35) 26.20 ft on 10/04/1989
(15) 32.00 ft on 12/14/1932	(36) 25.98 ft on 05/04/1997
(16) 31.80 ft on 04/05/1977	(37) 25.85 ft on 02/07/2020
(17) 31.80 ft on 12/18/1932	(38) 25.70 ft on 04/01/2021
(18) 30.50 ft on 03/27/1964	(39) 25.65 ft on 01/07/2009
(19) 30.50 ft on 04/05/1920	(40) 25.60 ft on 03/07/2003
(20) 30.50 ft on 03/30/1951	(41) 25.10 ft on 03/01/1987
(21) 29.90 ft on 01/28/1996	(42) 25.04 ft on 01/13/1993
Low Water Records	
(1) 1.75 ft on 10/08/2007	
(2) 1.82 ft on 09/27/2007	

Table 4-7 Historical Crests for Oostanaula River at Resaca, Georgia (USGS# Gage 02387500)

Historical Crests for Oostanaula River at Resaca, Georgia	
(1) 36.30 ft on 04/01/1886	(53) 26.70 ft on 01/13/1901
(2) 34.50 ft on 03/31/1951	(54) 26.54 ft on 02/24/2019
(3) 33.20 ft on 01/21/1947	(55) 26.50 ft on 12/31/1901
(4) 32.70 ft on 02/11/1921	(56) 26.50 ft on 01/05/1937
(5) 32.59 ft on 02/18/1990	(57) 26.40 ft on 03/11/1895
(6) 32.50 ft on 02/12/1946	(58) 26.20 ft on 01/11/1895
(7) 32.20 ft on 02/11/1946	(59) 26.20 ft on 10/04/1989
(8) 32.00 ft on 04/14/1920	(60) 26.20 ft on 02/20/1995
(9) 32.00 ft on 04/08/1892	(61) 26.20 ft on 05/10/2003
(10) 31.90 ft on 01/22/1922	(62) 26.18 ft on 05/10/2003
(11) 31.70 ft on 03/14/1909	(63) 26.09 ft on 12/25/1967
(12) 31.70 ft on 04/07/1892	(64) 26.00 ft on 03/15/1897
(13) 31.70 ft on 04/04/1920	(65) 25.70 ft on 03/10/1996
(14) 31.20 ft on 04/09/1938	(66) 25.70 ft on 02/19/1995
(15) 31.10 ft on 11/30/1948	(67) 25.60 ft on 03/16/1913
(16) 30.90 ft on 12/29/1932	(68) 25.50 ft on 04/16/1980
(17) 30.80 ft on 02/04/1957	(69) 24.80 ft on 04/20/1924
(18) 30.60 ft on 04/03/1936	(70) 24.80 ft on 03/31/1912
(19) 30.20 ft on 03/06/1917	(71) 24.80 ft on 12/29/1926
(20) 30.20 ft on 01/18/1954	(72) 24.40 ft on 02/09/2020
(21) 30.10 ft on 03/17/1964	(73) 24.34 ft on 01/09/2009
(22) 30.10 ft on 03/15/1950	(74) 24.29 ft on 04/22/1998
(23) 30.00 ft on 11/21/1906	(75) 24.20 ft on 03/25/1952
(24) 29.80 ft on 12/31/1942	(76) 24.15 ft on 05/09/2013
(25) 29.80 ft on 12/29/1942	(77) 24.10 ft on 11/21/1957
(26) 29.70 ft on 11/20/1906	(78) 24.00 ft on 12/06/1982
(27) 29.40 ft on 12/14/1961	(79) 23.80 ft on 01/03/1974
(28) 29.20 ft on 02/27/1961	(80) 23.75 ft on 01/19/2013
(29) 28.70 ft on 03/17/1899	(81) 23.74 ft on 04/06/2000
(30) 28.65 ft on 03/30/1994	(82) 23.60 ft on 02/14/1900
(31) 28.58 ft on 03/24/1980	(83) 23.58 ft on 04/02/1976
(32) 28.50 ft on 11/27/1930	(84) 23.50 ft on 02/05/1998
(33) 28.40 ft on 03/19/1973	(85) 23.42 ft on 04/16/2020
(34) 28.40 ft on 04/06/1977	(86) 23.40 ft on 02/09/1955
(35) 28.40 ft on 02/15/1948	(87) 23.20 ft on 12/16/1931
(36) 28.40 ft on 03/31/1944	(88) 23.20 ft on 01/31/1918
(36) 28.40 ft on 02/15/1948	(89) 23.12 ft on 04/02/1975
(37) 28.40 ft on 03/31/1944	(90) 23.07 ft on 01/13/1972
(38) 28.20 ft on 03/31/1994	(91) 23.02 ft on 03/28/2020
(39) 28.20 ft on 11/17/1929	(92) 23.00 ft on 03/12/1987
(40) 28.00 ft on 03/06/1979	(93) 22.87 ft on 03/07/1989
(41) 27.65 ft on 01/06/1982	(94) 22.85 ft on 04/03/2021
(42) 27.63 ft on 02/05/1969	(95) 22.79 ft on 03/02/1987
(43) 27.40 ft on 03/28/1965	(96) 22.70 ft on 03/10/1998
(44) 27.30 ft on 03/06/1934	(97) 22.60 ft on 02/19/1942
(45) 27.30 ft on 03/20/1994	(98) 22.60 ft on 04/28/1956
(46) 27.20 ft on 05/02/1963	(99) 22.32 ft on 05/04/1997
(47) 27.10 ft on 03/02/1903	(100) 22.26 ft on 02/23/1991
(48) 27.10 ft on 03/29/1965	(101) 22.10 ft on 05/25/2003
(49) 27.00 ft on 03/06/1966	(102) 22.06 ft on 01/11/2009
(50) 27.00 ft on 07/12/1916	(103) 22.00 ft on 03/25/1929
(51) 26.89 ft on 03/28/2021	(104) 22.00 ft on 02/22/1905
(52) 26.72 ft on 01/29/1996	

Historical Crests for Oostanaula River at Resaca, Georgia
Low Water Records
(1) 1.11 ft on 10/17/2007 (2) 1.15 ft on 09/27/2007 (3) 1.40 ft on 10/25/1954 (4) 1.50 ft on 10/30/1978 (5) 1.70 ft on 09/04/1977 (6) 1.70 ft on 09/30/1947 (7) 1.70 ft on 09/23/1956 (8) 1.80 ft on 10/05/1959 (9) 1.80 ft on 10/07/1970 (10) 1.90 ft on 09/03/1962

4-10. Upstream Structures. Carters Dam is a headwater project with no other reservoirs located upstream.

4-11. Downstream Structures. The entire ACT Basin is extensively developed with nine reservoir projects (10 dams) located downstream from Carters Dam. In addition to reservoirs downstream, there are five reservoirs on parallel streams. Reservoir regulation procedures at Carters are not dependent on other projects except for Allatoona Dam. Both Allatoona and Carters are located upstream from Rome, Georgia requiring coordination of flood risk management activities.

The drainage area and river mile for important locations of interest within the basin are shown in Table 4-8. The entire ACT Basin is shown on Plate 2-1.

Table 4-8 River Mile and Drainage Area for Selected Sites in ACT Basin

River Mile and Drainage Area for Important Sites in the ACT Basin				
River Mile above mouth of ACT system	**River**	**Location**	**Drainage Area (sq mi)**	**Owner**
693	Etowah	Allatoona Dam	1,122	CORPS
645.2	Etowah	Mouth	1,861	
672	Coosawattee	Carters Dam	374	CORPS
645.2	Oostanaula	Mouth	2,150	
638.1	Coosa	Mayos Bar	4,040	
585.1	Coosa	Weiss Dam	5,270	APC
506.2	Coosa	H Neely Henry Dam	6,596	APC
457.4	Coosa	Logan Martin Dam	7,743	APC
410.2	Coosa	Lay Dam	9,053	APC
396.2	Coosa	Mitchell Dam	9,778	APC
378.3	Coosa	Jordan Dam	10,102	APC
305	Coosa	Mouth	10,200	
497.4	Tallapoosa	R. L. Harris Dam	1,454	APC
420	Tallapoosa	Martin Dam	2,984	APC
412.1	Tallapoosa	Yates Dam	3,293	APC
409.1	Tallapoosa	Thurlow Dam	3,308	APC

River Mile and Drainage Area for Important Sites in the ACT Basin				
River Mile above mouth of ACT system	River	Location	Drainage Area (sq mi)	Owner
281.2	Alabama	Robert F Henry Dam*	16,233	CORPS
178	Alabama	Millers Ferry Dam*	20,637	CORPS
117.5	Alabama	Claiborne Dam*	21,473	CORPS

* Navigation Lock at Project
COE - Corps of Engineers; APC - Alabama Power Company

4-12. Economic Data. The Carters Dam Watershed extends to the headwaters of the Oostanaula River and consists of eight Georgia counties. The watershed transitions from developed urban and residential land uses to more rural land use within the watershed. The Oostanaula River transitions into the Coosa River at Rome, Georgia, which is considered the edge of the Carters Dam Watershed Basin.

a. Population. The 2020 population estimates for the eight counties composing the Carters Dam project watershed and basin below was 456,153 persons. Table 4-9 shows the 2020 population per capita income and percentage of the population living in poverty for each county. The most recent data available from the U.S. Census Bureau are provided.

Table 4-9 Population and Per Capita Income

County	Population	Per Capita Income	Persons Living in Poverty (Percentage)
Chattooga	24,965	$18,523	18.8%
Floyd	98,584	$27,418	18.4%
Gilmer	31,353	$27,789	14.0%
Gordon	57,544	$25,114	11.8%
Murray	39,973	$23,208	15.9%
Pickens	33,216	$32,501	10.5%
Walker	67,654	$25,157	14.1%
Whitfield	102,864	$23,361	13.0%

Source: US Census Bureau 2020 (reference: https://www.census.gov)

Rome, Georgia, is the most populated city within the Carters Dam Project Watershed and Basin. Rome is located within Floyd County and had a population of 37,713 in 2020.

b. Agriculture. The Carters Dam Project Watershed and Basin consist of approximately 3,486 farms averaging 121 acres per farm. In 2017, the area produced $1 billion in farm products sold and total farm earnings of more than $376 million. Agriculture in the Carters Dam Project Watershed and Basin consists primarily of livestock, which account for around 97 percent of the value of farm products sold. Livestock production consists primarily of poultry operations and beef cattle within the basin. The principal crops consist of nursery and greenhouse ornamentals, floriculture, and sod, along with vegetable farms and orchards. Agricultural production information and farm earnings for each of the counties in the Carters Dam Project Watershed and Basin below are shown in Table 4-10.

Table 4-10 Farm Earnings and Agricultural Production

County	Farm Earnings ($1,000)	Number of Farms	Total Farm Acres (1,000)	Acres Per Farm	Value of Farm Products Sold ($1,000)	Percent From	
						Crops	Livestock
Georgia							
Chattooga	19,510	323	55	171	74,237	3	97
Floyd	12,169	547	75	137	53,441	10	90
Gilmer	84,096	330	28	86	205,435	1	99
Gordon	100,858	740	75	101	294,164	3	97
Murray	48,077	278	47	170	122,717	3	97
Pickens	22,632	258	17	64	77,101	1	99
Walker	51,605	624	91	145	51,605	3	97
Whitfield	37,057	386	37	95	136,811	1	99

Source: U.S. Department of Agriculture, National Agriculture Statistics, Census of Agriculture, County Profile, 2017

c. Industry. The leading industrial sectors that provide non-farm employment are wholesale and retail trade, services, and manufacturing. The remaining non-farm employment is provided by construction, finance, insurance, real estate, transportation, and public utilities. In 2005, the Carters Project area counties contained 835 manufacturing establishments that provided 62,953 jobs with total earnings of just under $3.1 billion. Additionally, the value added by the area manufactures was just under $5.6 billion. Table 4-11 contains information on the manufacturing activity for each of the counties in the Carters Dam Project Watershed and Basin.

Table 4-11 Manufacturing Activity per County

County	No. of Manufacturing Establishments	Total Manufacturing Employees	Total Earnings ($1,000)	Value Added by Manufactures ($1,000)
Georgia				
Chattooga	22	3,541	135,303	320,027
Floyd	119	9,484	585,524	735,657
Gilmer	31	2,892	106,838	129,857
Gordon	109	8,994	464,194	932,129
Murray	94	6,327	254,046	300,660
Pickens	35	814	38,836	69,577
Walker	71	5,343	235,639	538,472
Whitfield	354	25,558	1,277,433	2,563,777

d. Flood Damages. Carters Lake provides flood damage protection for existing development in along the Oostanaula and Coosa River Floodplain. The Corps' Water Management Office has developed an Annual Damage Reduction Summary that estimates the flood damages prevented by the Carters Lake flood reduction project in the ACT Basin. Table 4-12 shows the Carters Dam and Lake flood damages prevented by Fiscal Year (FY) from 1986 through 2020

Table 4-12 Flood Damages Prevented – Carters Lake*

Year	Carters Dam	Year	Carters Dam
1986	$0	2004	$22,625
1987	$0	2005	$0
1988	$0	2006	$0
1989	$0	2007	$0
1990	$21,900	2008	$0
1991	$22,881	2009	$8,800
1992	$0	2010	$285,474
1993	$13,000	2011	$28,286
1994	$20,100	2012	$0
1995	$20,100	2013	$255,367
1996	$22,340	2014	$10,104,165
1997	$0	2015	$324,055
1998	$0	2016	$273,497
1999	$0	2017	$307,337
2000	$0	2018	$955,243
2001	$0	2019	$2,841,171
2002	$0	2020	$2,595,446
2003	$0		

*Dollar values are estimated for each Federal fiscal year (1 Oct - 30 Sept) using the Consumer Price Index

5 - DATA COLLECTION AND COMMUNICATION NETWORKS

5-01. Hydrometeorologic Stations.

<u>a. Facilities.</u> Management of water resources requires continuous, real-time knowledge of hydrologic conditions. The Mobile District contracts out the majority of basin data collection and maintenance to the USGS and 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 ACT Basin. The stations continuously collect various types of data including stage, flow, and precipitation. The data are stored at the gage location and are transmitted to orbiting satellites. Figure 5-1 shows a typical encoder with wheel tape housed in a stilling well used for measuring river stage or lake elevation. Figure 5-2 shows a typical precipitation station, with rain gage, solar panel, and Geostationary Operational Environmental Satellite (GOES) antenna for transmission of data. The gage locations are discussed in Chapter 6 related to hydrologic forecasting.

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

Figure 5-2 Typical Field Installation of Precipitation Gage

The Water Management Section employs a staff of hydrologic field technicians and contract work to USGS to operate and maintain Corps' gages throughout the ACT Basin. All rainfall gages equipped as Data Collection Platforms (DCPs) are capable of being part of the reporting network. Data are available from many stations in and adjacent to the ACT Basin. The 13 stations listed in Table 5-1 and shown on Plate 5-1 are considered the rainfall reporting network for the Carters Project. Because Carters Dam regulates flood flows to downstream locations, the reporting network extends to Rome, Georgia. Carters Dam regulation of peak flows does not affect areas below Weiss Dam on the Coosa River but does reduce flood inflows to that project. All river stage gages equipped as DCPs are capable of being part of the reporting network. Data are available from many stations in and adjacent to the ACT Basin. The stations listed in Table 5-2 are in the ACT Basin and provide information for operations for both Carters and Allatoona Dams. The locations of river stage stations are also shown on Plate 5-2. River stage – river flow relationship curves for representative river gages are shown on Plates 5-3 through 5-12.

Table 5-1 Corps and NOAA Gages Reporting only Rainfall

Name	Agency	Agency ID	Latitude	Longitude
Wahsega, GA	Corps	WAHG1	34.69028	-84.0644
Amicalola, GA	Corps	AMIG1	34.54583	-84.2772
Mountaintown, GA	Corps	MTNG1	34.77361	-84.5392
Carters Dam	Corps	CTRG1	34.61417	-84.6747
Allatoona Dam	Corps	CVLG1	34.16278	-84.7278
Chatsworth, GA	NOAA	91863	34.7589	-84.765
Rome, GA	NOAA	97600	34.34778	-85.1611
Summerville, GA	NOAA	98436	34.4546	-85.39
Lafayette, GA	NOAA	94941	34.6638	-85.3203
Jasper, GA	NOAA	94648	34.4758	-84.4461
Cartersville, GA	NOAA	91670	34.2043	-84.7925

Table 5-2 Gages Reporting Rainfall and River Stage

USGS Gage	Name	Lat	Long	Drainage Area (sq miles)	River Mile Above Rome, GA	Datum	Flood Stage	Rain Gage
02389150	Etowah River At Ga 9, Near Dawsonville	34.3572	-84.1136	131	131	1022	13	Y
02394670	Etowah River At Ga 61, Near Cartersville	34.1428	-84.8389	1345	38.22	650.81	18	Y
02395000	Etowah Near Kingston	34.2089	-84.9787	1634	21.4	609.97		Y
02395120	Two Run Creek Near Kingston, Ga	34.2428	-84.8897	33.1	NA	723.1		N
02395980	Etowah River At Ga 1 Loop, Near Rome	34.2322	-85.1169	1801	1.47	561.7	32	N
02380500	Coosawattee River Near Ellijay, Ga	34.675	-84.5086	236	93.3	1216.04	8	Y
02382200	Talking Rock Creek Near Hinton, Ga	34.5228	-84.6111	119	NA	893.69		Y
02382500	Coosawattee River At Carters, Ga	34.6036	-84.6956	520	71.86	650.67		Y
02383500	Coosawattee River Near Pine Chapel	34.5642	-84.8331	831	53.55	616.16		Y
02383520	Coosawattee River at Pine Chapel	34.5764	-84.8603	847	53.35	616.16		N
02384500	Conasauga River At Ga 286, Near Eton	34.8278	-84.8508	252	89.62	672.64	12	Y
02385800	Holly Creek Near Chatsworth, Ga	34.7167	-84.77	64	NA	689.25		Y
02387000	Conasauga River At Tilton, Ga	34.6667	-84.9283	687	59.09	622.28	18	N
02387500	Oostanaula River At Resaca, Ga	34.5771	-84.9419	1602	43.16	604.14	22	Y
02387520	Oostanaula River At Calhoun Ga	34.5189	-84.9544	1624	36.7		20	Y
02388500	Oostanaula River Near Rome, Ga	34.2983	-85.1381	2115	5	561.7	30	N
02388525	Oostanaula River At US 27 At Rome Ga	34.2606	-85.1708	2149	0.65	561.7	25	Y
02397000	Coosa River Near Rome - Mayo’s Bar	34.2003	-85.2567	4040		553.05		Y
02392000	Etowah River At Canton, Ga	34.2398	-84.4947	613	77.8	844.55	16	N
02393500	Allatoona Lake Near Cartersville, Ga	34.1628	-84.7278	1122	47.8	0		Y
02393501	Etowah River Allatoona Dam Tw, Abv Cartersville, Ga	34.1639	-84.7281	1122	47.73	0		N
02394000	Etowah River At Allatoona Dam, Abv Cartersville, Ga	34.1631	-84.7411	1119	47	686.92		N
02381400	Carters Lake Near Carters, Ga	34.6139	-84.6711	374	73.76	0		Y
02381401	Carters Lake Tailrace Near Carters, Ga	34.6142	-84.6747	374	73.75	0		N
02382400	Carters Re-Regulation Lake Near Carters, Ga	34.6042	-84.6914	520	72.25	651		N

b. Reporting. The Water Management Section operates and maintains a Water Control Data System (WCDS) for the Mobile District 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. The rainfall reporting network and the river stage reporting network are shown on Plate 5-1.

Data from the Carters Project such as pool, tailwater, and other pertinent data, as well as the same data from the Allatoona Project, are used to operate the Carters Project and to remotely operate the Allatoona Project. A microwave system between Carters Dam and Allatoona Dam provides for continuous monitoring and regulation of the Allatoona Project. Information such as pool, tailwater, and other pertinent data needed for regulation are continuously transmitted through the microwave system to Carters Project. Computer systems at the projects store and organize the data and transmit the information to the Water Management Section in Mobile. Forms and river bulletins are automatically formatted, printed and transmitted to other parties.

A system of automatic reporting rainfall and river stage stations has been installed covering the drainage basin above both Carters and Allatoona Dams, and extending downstream to Rome, Georgia. These reporting stations, along with thousands throughout the nation, are part of a comprehensive data gathering system. The basis for automated data collection is the satellite DCP. The DCP is a computer microprocessor physically located at the gage sites. A DCP has the capability to interrogate sensors at regular intervals to obtain real-time information (e.g., river stages, reservoir elevations, water and air temperatures, and precipitation), save the information, perform simple analyses of this information, and then transmit this information to a fixed geostationary satellite. DCPs transmit real-time data at regular intervals to the GOES system operated by NOAA. The GOES system sends this data directly down to the NOAA Satellite and Information Service in Wallops Island, Virginia. These data are then re-broadcast over a Domestic Communications Satellite (DOMSAT). The Mobile District maintains a Local Readout Ground Station (LRGS) that collects the DCP-transmitted, real-time data from the DOMSAT. Figure 5-3 depicts a typical schematic of how the system operates.

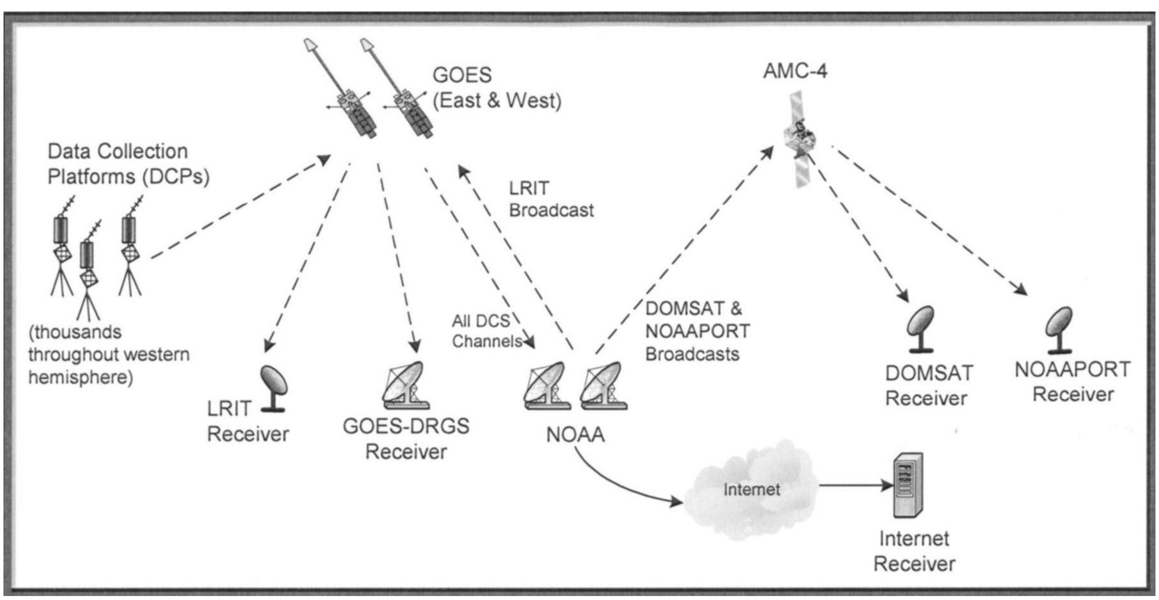

Figure 5-3 Typical Configuration of the GOES System

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

Other reservoir project data are obtained directly at a project is collected through each project's Supervisory Control and Data Acquisition (SCADA) system. The Water Management Section downloads the data both daily and hourly through the Corps' server network. Telephone is an option for other communications.

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 DCP stream gaging stations throughout the ACT Basin. The USGS is responsible for the supervision and maintenance of the real-time DCP 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 ACT 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) 690-2730 Web: https://www.sam.usace.army.mil/Missions/Civil-Works/Water-Management/

USGS South Atlantic Water Science Center - Georgia, 1770 Corporate Dr., Suite 500, Norcross, Georgia 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

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. There are no Corps operated or maintained water quality stations in the Carters Project area. However, there are some real-time water quality parameters collected at several of the stream gages maintained by the USGS for general water quality monitoring purposes.

5-03. Sediment Stations. To provide an adequate surveillance of sedimentation, a network of sediment ranges was established for Carters Lake and the Reregulation pool. Quantitative computations can be made from these ranges to compute storage depletion rates. The network also serves as an index of any bank sloughing that may occur. General conditions and changes have been measured and recorded using this network. The network of sediment stations is shown on Plate 4-1. In order to monitor degradation and gradation of the Coosawattee River below the Reregulation Dam, a network of retrogression ranges was established to Pine Chapel Road downstream of the Reregulation Dam. This network is shown on Figure 4-3. Sedimentation ranges in the Carters Lake were conducted in 2009, and the sedimentation and retrogression ranges for the reregulation pool and downstream were conducted in 1973, with resurveys conducted on a periodic basis. Two such periodic surveys were made in 1992 and in 2009 for the Reregulation Dam. The Carters Lake has only been surveyed in 2009.

Sediment surveys were conducted 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 Carters Lake, Carters Dam and Lake and Reregulation Pool, GA". Sedimentation and erosion classifications were developed for each range. Based on the percentage change for the entire cross section, range cross sections were classified for sedimentation as "Heavy" (greater than 15 percent change), "Medium" (5 to 15 percent change), "Light" (0 to 5 percent), and "None" (0 or negative change). Erosion classifications were also developed from bank retreat and advance rates. A bank retreat or advance rate is the average change in location, measured in feet, of the shoreline. It is the area bounded between two cross section profiles at the shore erosion zone (square feet) divided by the height of shore erosion zone (feet). The shorelines were separated into two groups, erosional and depositional. The erosional group was further divided into three classes by percentile. The 25 percent of shorelines showing the greatest bank retreat were classed as "Acute," the middle 50 percent in bank retreat were classed as "Moderate," and the 25 percent with the least bank retreat were classed as "Slight." Shorelines in the depositional group were classed as "Deposition."

Analysis revealed that the reregulation pool has undergone sedimentation primarily along the Talking Rock Creek arm with deposits limited primarily to the historic, now-submerged, stream channel. "Acute" erosion is found only on the left bank of range 3A with "Slight" and "Moderate" erosion noted on both shorelines of ranges 1A and 2A. Although the pool has large portion of bedrock shoreline, the large and frequent fluctuation in pool elevation promote continued erosion above the bedrock. The Talking Rock Creek embayment has undergone several feet of overbank sedimentation between elevations 687 and 689 feet NGVD29.

Bathymetry was obtained for Carters Lake for the first time during 2009 to provide a base for monitoring of Carters lake sedimentation. No sedimentation analysis was performed for Carters Lake; however, a qualitative shoreline erosion analysis was made from observations and photographs. Thirteen of 18 locations were stable due to bedrock and boulder shorelines. Historically the erosion rates have been high shortly after the lake was impounded, but presently these locations appear stable. Four locations were classified as "Slight" and one as "Acute" for bank erosion. All these locations are characterized as shorelines composed of unconsolidated soil materials or bedrock weathered to the point of being friable. One extended shoreline between rangelines was noted for active mass wasting.

In summary, Talking Rock Creek is the dominant sediment source for the Reregulation Pool, and the Coosawattee River is the dominant sediment source for Carters Lake with present and potential land use activities driving sediment load. The amount of sediment deposition that has occurred has not affected the operation of the project and it is not expected to in the near future. The revised area-capacity curves for Carters Reregulation Pool have been included in this manual update and are found on Plate 7-3.

5-04. Recording Hydrologic Data. The WCDS, in combination with the new CWMS, automate and integrate data acquisition and retrieval to best meet all Corps water management activities. 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.

To provide stream gage and precipitation data needed to support proper analysis, a DOMSAT Receive Station (DRS) is used to retrieve DCP data from gages throughout the ACF Basin. The DRS equipment and software then receives the DOMSAT data stream, decodes the DCPs of interest, and reformats the data for direct ingest into a CWMS Oracle database. Reservoir data are 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 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 support of real-time operational decisions. Interagency data exchange has been implemented with the USGS and NWS Southeast River Forecast Center (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, Next Generation Weather Radar (NEXRAD) rainfall, graphical weather maps and more. Likewise, a direct link to USGS gages in the field allows for direct downloading of USGS data to Corps databases.

5-05. Communication Network. The global network of the Corps consists of private, dedicated, leased lines between every Division and District office worldwide. Those lines are procured through a minimum of two General Services Administration-approved telephone vendors, and each office has a minimum of two connections, one for each vendor. The primary protocol of the entire Corps network is Ethernet. The reliability of the Corps' network is considered a command priority and, as such, supports a dedicated 24 hours per day Network Operations Center. The use of multiple telephone companies supplying the network connections minimizes the risk of a one cable cut causing an outage for any office. Such dual redundancy, plus the use of satellite data acquisition, makes for a very reliable water control network infrastructure.

The Water Management Section has a critical requirement to be available during emergency situations for operation of the ACT Basin and to ensure data acquisition and storage remain functional. The Water Management Section must be able to function in cases of flooding or other disasters, which typically are followed by the loss of commercial electricity. The WCDS and CWMS servers and the LRGS each have individual uninterruptable power supply (UPS) and a large UPS unit specifically for the portion of Mobile District Office in which the Water Management Section 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 Mobile District Office 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 Mobile District Office 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 primary communication network of the Carters Project is a SCADA system network. The SCADA network includes a microwave link between Carters, Allatoona, and Buford. The SCADA network also monitors powerhouse conditions and digitally records real-time project data hourly. Computer servers at Carters are connected to the Mobile District through the Corps network, permitting data transfer at any time. The data include physical conditions at each of the reservoirs such as pool elevations, outflow, river stages, generation, and rainfall. Special instructions or deviations are usually transmitted by email, 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 (cell)
Carters Powerhouse	706-334-2906

5-06. Communication with Project.

a. Between Regulating Office and Project Office. The Carters Powerhouse should be contacted regarding any operational issues regarding Carters, Allatoona, and Buford. There are a variety of methods for communication between the Mobile District and Carters Dam. Satellite communication is available for some data transmission. Telephone and fax communication are available. Computer servers at Carters Dam are connected to the Mobile District through the Internet, permitting data transfer at any time. The data includes physical conditions at each of the reservoirs that include pool elevations, outflow, river stages, generation, and rainfall. Special instructions or deviations are usually transmitted by telephone, email, or fax. For local communication in the reservoir area above and below the Carters Dam, there are two fixed base station remotes and several mobile units and handheld two-way radios. The fixed VHF base station is located in the Reservoir Manager's office map building and the mobile stations are located in boats and motor vehicles. For communication between Carters Dam, Reregulation Dam and other elements of the Carters Project, there is a private Mitel PBX telephone system installed which allows direct dialing between any and all elements of the project.

Data from the Carters and Allatoona Projects are automatically collected at the Carters Project and transmitted through the network to the Mobile District. Telephone is another communications option if there are problems receiving the data over the network. Data for the project and the DCPs are downloaded to the Mobile District's computer system. Daily reports are automatically generated for review.

b. Between Regulating/Project Office and Others. The Water Management Section communicates daily with the NWS and APC to exchange data and forecasting information. The data exchange is made by computer and is supplemented by telephone and facsimile when necessary. The Water Management Section also has a computer link with the NWS's Advanced Weather Interactive Processing System (AWIPS) communication system via the River Forecast Center in Atlanta, Georgia. Water resources information is available to the public at the Corps' web site, https://www.sam.usace.army.mil/Missions/Civil-Works/Water-Management/. The site contains real-time information, historical data and general information that may be of interest to the public.

To warn the public at the start of a hydropower release downstream, when an operator initiates a generator start, a warning horn sounds. An audio detector verifies the horn has sounded and allows the unit start-up sequence to continue. The horn will continue to sound for one minute. The Reregulation Dam does not have a downstream warning horn system because the routine releases are small and gradual. If there was a large single gate change, the rangers would notify individuals in the recreation area immediately downstream of the dam.

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. The Water Management Section maintains constant contact with project operators. Operators 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 Water Management Section 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 Water Management Section. 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 Gage 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 upon completion 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 electronic mail when verification is complete. The email notification will include findings of the verification.

Project personnel or the Hydropower Section within 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 Water Management Section and to SEPA. In such cases, minimum flow requirements can be met through spilling.

5-08. Warnings. During floods, dangerous flow conditions or other emergencies, the proper authorities and the public must be informed. In general flood warnings are coupled with river forecasting. The NWS has the legal responsibility for issuing flood forecast to the public and that agency will have the lead role for disseminating the information. For emergencies involving the project the operator on duty should notify the Water Management Section, Operations Division and the Operations Project Manager at the project. If needed the Operations Project Manager will notify local law enforcement, government officials and emergency management agencies.

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

5-10. Role of Power Project Manager. The Power Project Manager should be completely familiar with the approved operating plans for the Carters Project. The Power Project Manager is responsible for implementing actions under the approved water control plans and carrying out special instructions from the Water Management Section. The Power Project Manager is expected to maintain and furnish records requested from him by the Water Management Section. 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 Water Management Section as soon as practicable.

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6 - HYDROLOGIC FORECASTS

6-01. General. Reservoir operations for the Carters Project are scheduled by the Water Management Section in accordance with forecasts of reservoir inflow and river stages. Operations at the Carters Project are coordinated with the Allatoona Project to reduce the flood damage at Rome, Georgia.

The Corps has developed techniques to conduct forecasting in support of the regulation of the ACT Basin. In addition, the Corps relies on other federal agencies such as the NWS and 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. 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 the efficient regulation of the ACT System.

a. Role of USACE. The Water Management Section maintains real-time observation of river and weather conditions in the Mobile District. The Water Management Section has capabilities to make forecasts for several areas in the ACT Basin. Those areas include all the Federal projects and other locations. Observation of real-time stream conditions provides guidance of 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 ACT River Basin during normal, flood risk management, and drought conservation regulation requires accurate, continual short-range and long-range elevation, streamflow, and river-stage forecasting. These short-range inflow forecasts are used as input in computer model simulations so that project release determinations can be optimized to achieve the regulation objectives stated in this manual. The Water Management Section continuously monitors the weather conditions occurring throughout the basin and the weather and hydrologic forecasts issued by the NWS. Whenever possible, the NWS weather and hydrologic forecasts are used. The Water Management Section develops forecasts that are used to meet the regulation objectives of the Corps ACT Reservoirs. In addition, the Water Management Section provides weekly hydropower generation forecasts using current power plant capacity, latest hydrological conditions, and system water availability.

b. Role of Other Agencies. The NWS is responsible for preparing and publicly disseminating forecasts relating to precipitation, temperatures, and other meteorological elements related to weather and weather-related forecasting in the ACT Basin. The Water Management Section uses the NWS as a key source of information for weather forecasts. The meteorological forecasting provided by the Birmingham, Alabama and Peachtree City, Georgia offices of the NWS is considered critical to the Corps' 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.

1) The NWS is the Federal agency responsible for preparing and issuing streamflow and river-stage forecasts for public dissemination. That role is the responsibility of the Southeast River Forecast Center (SERFC) co-located in Peachtree City, Georgia with the

Peachtree City Weather Forecast Office. 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. SERFC routinely prepares and distributes five-day streamflow and river-stage forecasts at key gaging stations along the Alabama, Coosa, and Tallapoosa Rivers. Streamflow forecasts are available at additional forecast points during periods of 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 Water Management Section with flow forecasts for selected locations on request. Table 6-1 lists the forecast stations in the Alabama-Coosa-Tallapoosa River Basin.

Table 6-1 Southeast River Forecast Center Forecast Locations for ACT River Basin

Daily Stage/Elevation Forecasts (Feet NGVD29)				
	Station	**Station ID**	**Action Stage**	**Flood Stage**
	Montgomery	MGMA1	26	35
	R. F. Henry TW	TYLA1	122	122
	Millers Ferry TW	MRFA1	61	66
	Claiborne TW	CLBA1	35	42
Daily 24-hour Inflow in Morning (10 a.m.) State Forecast Discussion				
Reservoir		**Station ID**		
R. F. Henry		TYLA1		
Millers Ferry		MRFA1		
Additional Stage Forecasts Only for Significant Rises				
River/Creek	**Station**	**Station ID**	**Action Stage**	**Flood Stage**
Coosawattee	Ellijay	ELIG1	6	8
Conasauga	Tilton	TLNG1	15	18
Coosawattee	Carters Lake	CTRG1	1074	
Coosawattee	Pine Chapel	PING1	19	22
Oostanaula	Resaca	RSCG1	19	22
Oostanaula	Rome	RTMG1	19	25
Etowah	Rome GA 1 Loop	ROEG1	28	32
Coosa	Mayo	RMBG1	21	24
Coosa	Weiss Dam	CREA1		564
Coosa	Gadsden	GAPA1	511	511
Coosa	Logan Martin Dam	CCSA1		465
Coosa	Childersburg	CHLA1		402
Coosa	Wetumpka	WETA1	40	45
Tallapoosa	Wadley	WDLA1	13	13
Tallapoosa	Milstead	MILA1	15	40
Tallapoosa	Tallapoosa Water Plant	MGYA1	15	25
Catoma Creek	Montgomery	CATA1	16	20
Alabama	Selma	SELA1	30	45
Cahaba	Cahaba Heights	CHGA1		14
Cahaba	Centreville	CKLA1	20	23
Cahaba	Suttle	SUTA1	28	32
Cahaba	Marion Junction	MNJA1	15	36

2) 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 SERFC. Taking release decision data, coupled with local inflow forecasts at forecast points along the ACT, SERFC can provide inflow forecasts into Corps projects. Having revised inflow forecasts from SERFC, the Corps has up-to-date forecast data to make the following days' release decisions.

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). Proactive decisions can be made on the basis of known events and what if scenarios. The Water Management Section 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. Six-hour unit hydrographs for several sub-basins around the Carters Project are shown on Plate 6-1. The historical data for inflow, outflow, and pool curves for Carters Lake from July 1975 through December 2020 are shown on Plates 6-2 through 6-9.

b. Methods. In determining the expected inflow into the Carters Lake, it is necessary to forecast the flows of the Coosawattee River above Carters 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. The rainfall excess is distributed over the area by using the unit hydrograph shown in Table 6-2. 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.

The Corps provides a link to the NWS website so that the Water Management Section, affected county emergency management officials, and public can obtain this vital information in a timely fashion. When hydrologic conditions exist so that all or portions of the ACT 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 stormwater 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 Water Management Section 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.

Carters is located about 72 river miles above the primary damage points at Rome, Georgia and 17.9 river miles above Resaca, Georgia. The forecasting procedure requires routing Carters releases and adding the local runoff at Rome and Resaca, Georgia. Forecasting stage at Rome, Georgia is further complicated by being located at the junction of the Etowah and Oostanaula Rivers. Flood events lasting several days produce double flood peaks and, at times, the two rivers are at different water surface elevations. The first peak at Rome, Georgia is a result of runoff in the Etowah River Basin. Allatoona Lake controls runoff from 1,122 square miles or about 61 percent of the Etowah River Basin. Releases from the Allatoona Project take approximately 12 hours to reach Rome, Georgia. The area above Carters Lake is 374 square miles or about 17 percent of the Oostanaula River Basin. Releases from Carters take about 32 hours to reach Rome, Georgia. Releases from Carters are typically timed until after the first peak at Rome from the Etowah River has receded.

In determining the expected inflow into Carters Lake, current conditions must be examined. The runoff from rainfall varies significantly depending on antecedent conditions. For very dry conditions, initial runoff can be near zero and then increase as rainfall continues. During wet conditions, most of the rainfall appears as runoff into the lake. During the next several hours and days, the observed inflow is compared to the forecasts and adjustments are applied. Additional rainfall/runoff is accumulated with the continuing forecasts. Table 6-1 and Figure 6-1 are used as a guide to estimate runoff and its impact on Carters Lake. This runoff value is applied to the unit hydrograph in Table 6-2 and added to the present inflow. Table 6-2 presents unit hydrographs for Carters Dam, Carters Reregulation Dam, Redbud, Tilton, Resaca, and flows from the Oostanaula River at Rome. Outflow from the Carters Project is determined at the Reregulation Dam. A combination of local flows, generation, and pump-back determines the outflow from the Reregulation Dam. During the next several hours and days, the observed inflow is compared to the forecasts and adjustments are applied. Additional rainfall/runoff is accumulated with the continuing forecasts.

Table 6-2 Rainfall - Runoff Relationship for Basin above Rome, Georgia

		Runoff - Etowah Basin							**Runoff - Oostanaula Basin**				
	Rainfall	**0**	**0.20**	**0.4**	**0.6**	**0.8**		**Rainfall**	**0**	**0.2**	**0.4**	**0.6**	**0.8**
	0	0.00	0.10	0.30	0.05	0.08		0	0.00	0.04	0.90	0.15	0.21
	1	0.12	0.16	0.20	0.24	0.30		1	0.28	0.36	0.44	0.54	0.64
	2	0.37	0.44	0.51	0.58	0.66		2	0.74	0.84	0.96	1.08	1.22
Wet condition	3	0.75	0.84	0.53	1.02	1.14		3	1.37	1.52	1.67	1.81	1.97
	4	1.27	1.44	1.62	1.80	1.98		4	2.12	2.27	2.41	2.56	2.71
	5	2.16	2.34	2.52	2.70	2.88		5	2.85	3.00	3.15	3.30	3.45
	6	3.06	3.26	3.46	3.66	3.86		6	3.60	3.75	3.89	4.04	4.19
	0	0.00	0.01	0.02	0.04	0.06		0	0.00	0.03	0.06	0.08	0.11
	1	0.08	0.10	0.13	0.16	0.20		1	0.14	0.18	0.22	0.26	0.30
	2	0.24	0.30	0.36	0.42	0.47		2	0.36	0.40	0.44	0.50	0.58
Normal condition	3	0.53	0.59	0.67	0.72	0.77		3	0.65	0.73	0.81	0.90	0.98
	4	0.83	0.90	0.97	1.05	1.14		4	1.07	1.14	1.21	1.29	1.38
	5	1.22	1.32	1.43	1.56	1.68		5	1.46	1.56	1.67	1.80	1.92
	6	1.80	1.94	2.08	2.22	2.36		6	2.04	2.18	2.32	2.48	2.60
	0	0.00	0.00	0.01	0.02	0.04		0	0.00	0.02	0.04	0.05	0.06
	1	0.05	0.07	0.08	0.09	0.11		1	0.08	0.10	0.12	0.14	0.16
	2	0.13	0.15	0.18	0.20	0.23		2	0.18	0.20	0.23	0.27	0.32
Dry condition	3	0.25	0.28	0.31	0.34	0.37		3	0.36	0.44	0.50	0.57	0.64
	4	0.40	0.43	0.46	0.49	0.52		4	0.72	0.80	0.88	0.96	1.04
	5	0.56	0.60	0.64	0.69	0.75		5	1.12	1.20	1.29	1.37	1.45
	6	0.82	0.90	0.98	1.06	1.14		6	1.54	1.60	1.70	1.76	1.86

Table 6-3 6-hour Unit Hydrographs in Oostanaula River Basin

	Coosawattee River			Conasauga - Oostanaula Rivers		
	Carters Main Dam (02381400)	**Carters Reregulation Dam (02382400)**	**Redbud 02383500)**	**Tilton (02387000)**	**Resaca (02387500)**	**Rome (02388525)**
Area between gages (square miles)	**374**	**146**	**311**	**687**	**84**	**547**
Time in hours	**Flow in cfs**					
6	1740	960	2470	190	1810	820
12	5900	3100	7740	690	2800	2170
18	9050	4190	9830	1360	1500	4200
24	8260	3290	7090	2120	780	6400
30	5530	1990	3940	2910	400	8040
36	3550	1200	2190	3710	210	8160
42	2280	720	1220	4460	110	6990
48	1470	440	680	5050	60	5390
54	940	260	380	5420	30	3880
60	610	160	210	5590		2720
66	390	100	120	5560		1920
72	250	60		5300		1370
78	160	40		4730		990
84	100			4020		720
90				3410		520
96				2880		370
102				2440		270
108				2070		200
114				1750		150
120				1480		120
126				1250		90
132				1060		60
138				900		30
144				760		
150				640		
156				550		
162				460		
168				390		
174				330		
180				280		
186				240		
192				210		
198				180		
204				150		
210				120		
216				100		
222				80		
228				60		

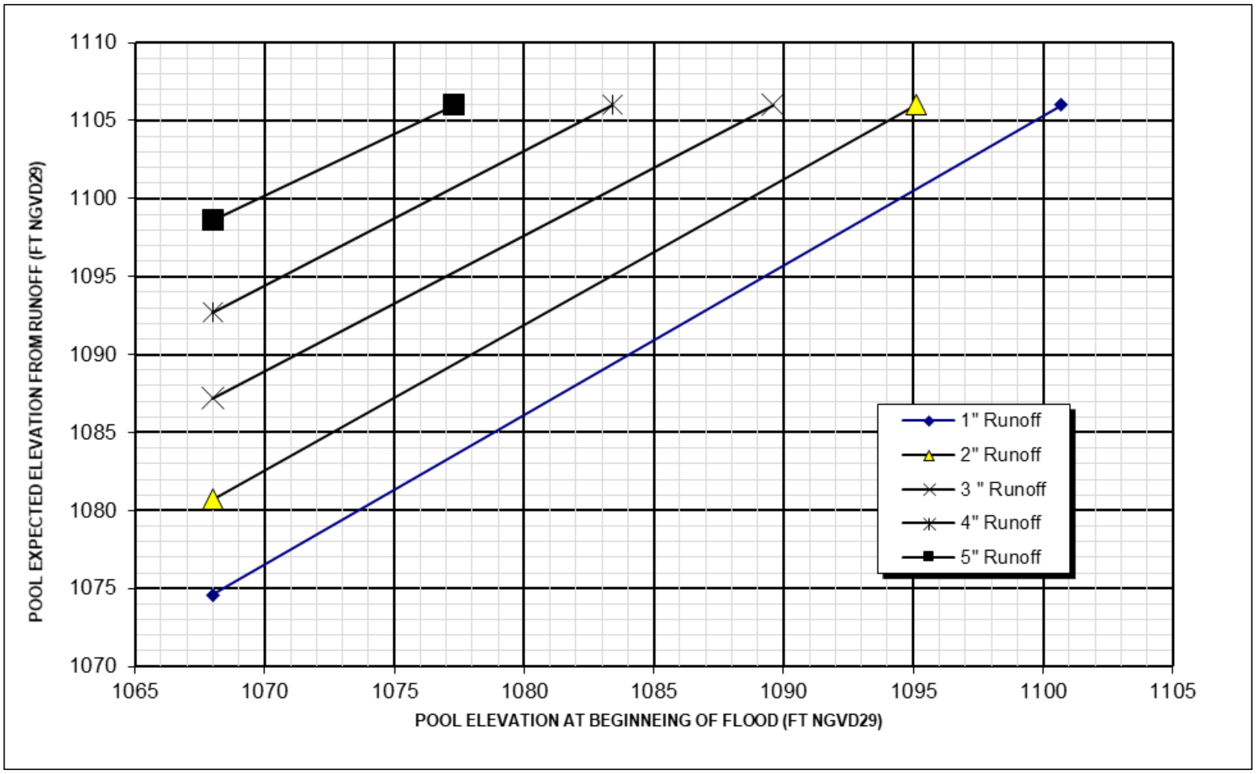

Figure 6-1 Rainfall Runoff versus Expected Pool Elevation

c. Downstream Forecasts. In addition to locations below Carters Dam, it is important to know conditions in the Etowah River Basin. Table 6-3 presents unit hydrographs for the Allatoona Dam, Cartersville, Kingston, and Etowah River at Rome. The values from Table 6-3 and Table 6-4 can be applied to the Rainfall - Runoff Relationship from Table 6-1.

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

a. Requirements. Conservation requirements are the same as for flood conditions with the added need to respond to the basin-wide drought plan. Existing basin conditions and expected inflows are needed for meeting the water control plan.

b. Methods. The Water Management Section 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 Water Management Section provides weekly hydropower generation forecasts based on current power plant capacity, latest hydrological conditions, and system water availability.

6-04. Long-Range Forecasts. During normal conditions, the long-range outlook produced by the Corps is a five-week forecast. For normal operating conditions, a forecast longer than that incorporates a greater level of uncertainty and less reliability. In extreme conditions, three-month and six-month forecasts can be produced on the basis of observed hydrology and comparative percentage hydrology inflows into the ACT 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 ACT System.

Table 6-4 6-hour Unit Hydroglraphs in Etowah River Basin

	Allatoona (02394000)	Cartersville (02394670)	Kingston (02395000)	Rome (02395980)
Area between gages (square miles)	**1,122**	**223**	**289**	**167**
Time in hours	**Flow in cfs**			
6	15600	2600	1660	2860
12	20000	4370	5110	5550
18	17000	3640	6340	4320
24	14000	3400	4980	2610
30	11400	2920	3620	1580
36	9100	2300	2620	960
42	7100	1760	1900	570
48	5550	1320	1380	350
54	4300	920	1000	210
60	3400	600	730	130
66	2600	360	530	80
72	2100	240	380	40
78	1700	160	280	
84	1350	100	200	
90	1000	40	150	
96	800	10	110	
102	600		80	
108	500		60	
114	400			
120	300			
126	200			
132	150			
138	100			
144	70			
150	50			
156	20			

6-05. Drought Forecast.

a. Requirements. ER 1110-2-1941, *Drought Contingency Plans*, dated 02 February 2018, called for developing drought contingency plans for all Corps' reservoirs. Drought recognition and drought forecast information can be used in conjunction with the drought contingency plan.

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 El Niño/La Niña-Southern Oscillation (ENSO) forecast modeling to represent the potential impacts of La Niña 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.

c. Reference Documents. The drought contingency plan for the Carters Project is summarized in Section 7-12. The complete ACT Drought Contingency Plan is provided in Exhibit D.

7 - WATER CONTROL PLAN

7-01. General Objectives. Carters Project is a multipurpose project authorized for flood risk management, hydropower, recreation, fish and wildlife conservation, navigation, water quality, and water supply. The Carters Project is a pumped-storage peaking facility. The Reregulation Dam serves three purposes: as a lower pool for the pumped storage operation, to reregulate peaking flows from Carters Lake to provide a more stable downstream flow, and to temporarily provide flood storage between elevation 677 to 696 feet NGVD29. The regulation plan seeks to balance the needs of all project purposes at the Carters Project and at other projects in the ACT Basin and is intended for use in day-to-day, real-time water management decision making and for training new personnel.

The Carters Project authorizing legislation (River and Harbor Act of 1945) 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 Carters 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. The most significant problems at the project involve the swelling and fracturing of the concrete used in construction of the Reregulation Dam, which was caused by AAR. Because of the AAR, cracking and displacement of the bridge across the Reregulation Dam spillway resulted in weakening of the bridge to the degree that it was considered unsafe to withstand the weight of the crane used to place stoplogs on the upstream face. However, under the American Recovery and Reinvestment Act of 2009, temporary repairs were made to the bridge to allow for a crane to be able to place the stoplogs.

Displacement of the abutment and intermediate pier at monolith D9 of the Reregulation Dam has resulted in the inability to raise gate number 4 fully. Operation of the gate is limited because there was difficulty in the past closing the gate once it was opened. Further efforts are currently underway to allow for full opening of all gates. This is considered a temporary problem.

In addition, pumping will discontinue when the Reregulation Dam pool falls below elevation 677 feet NGVD29.

Whenever the power head reaches 395 feet excessive vibration occurs in the hydropower units and pumping must be discontinued unless the reregulation pool is over 690 feet NGVD29, then the maximum head is 397 feet (reference Figure 7-1).

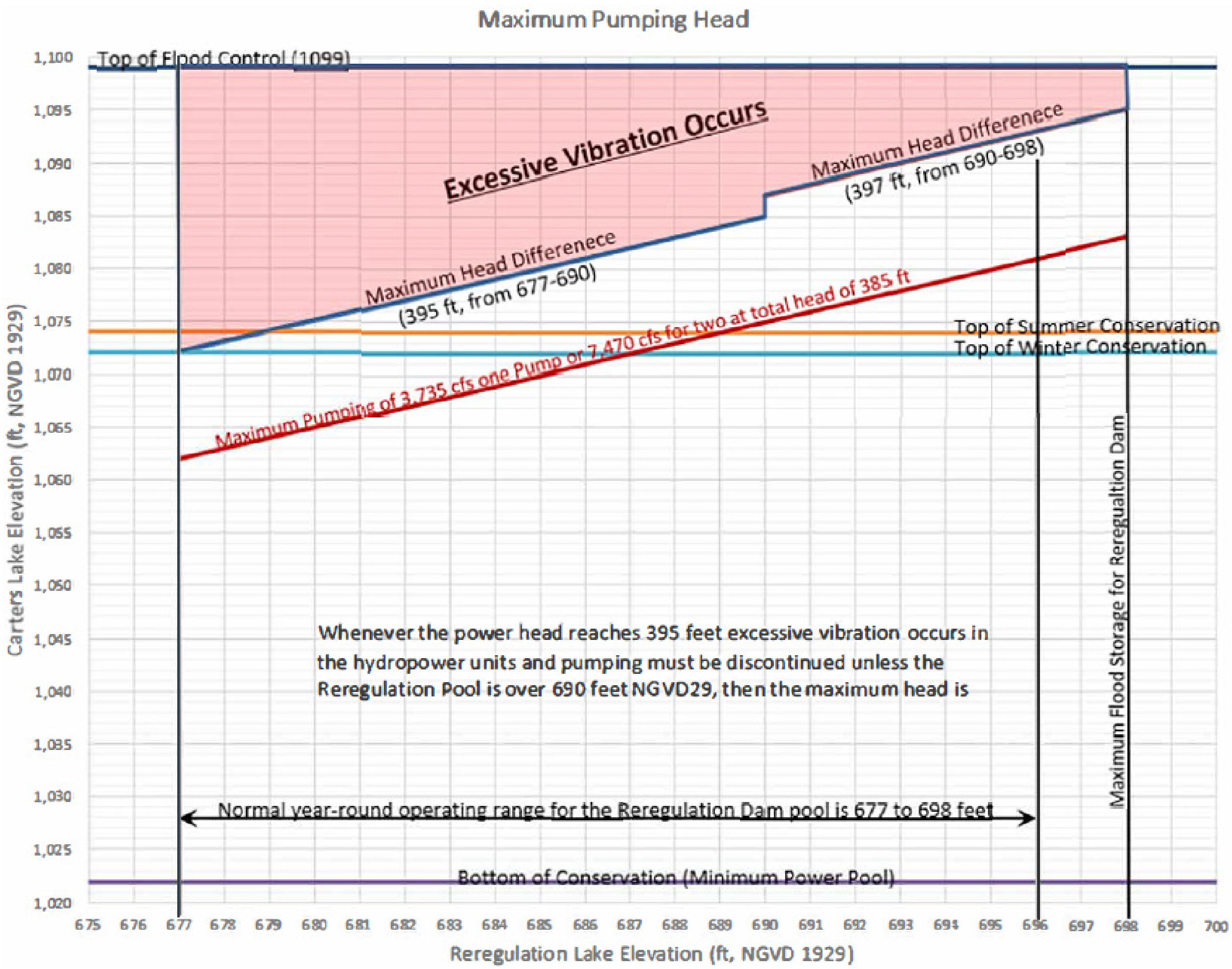

Figure 7-1 Carters Dam Maximum Pumping Head

7-03. Overall Plan for Water Control.

a. General Regulation. The water control regulation of the Carters Project is in accordance with the regulation schedule as outlined in the following paragraphs. The Corps regulates the Carters main reservoir and reregulation pool to provide for the authorized project purposes of the project. All authorized project purposes are considered when making water control regulation decisions, and those decisions affect how water is stored and released from the project. Deviations from the prescribed water control plan, which can occur due to planned or unplanned events as described in Paragraph 7-15, will be at the direction of the Water Management Section. Additionally, if communication between the District office and the dam is interrupted, the operator will follow an emergency operation schedule, Exhibit C Instructions to the Damtenders for Water Control. The Reregulation Dam provides a minimum continuous flow of 240 cfs to the Coosawattee River when in Zone 2 and seasonally varying amount when in Zone 1 (see Figure 7-2).

b. Conservation Pool. The Carters Lake 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 conservation pool elevation, shown on Plate 7-1, is the lake's normal maximum operating level for conservation storage purposes. If the elevation is higher than the conservation limit, the lake level is in the flood pool.

Area-Capacity Curves for Carters Lake and the Reregulation pool, 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 7-2 and Plate 7-3, respectively. The stage-storage curve for the reregulation pool was revised in this manual update based on resurvey performed in 2009.

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 Carters does not prioritize any project function but seeks to balance all project authorized purposes. A seasonal guide curve (representing the top of conservation pool) 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. The action zones are shown on Plate 7-1.

1) A regulation guide curve for the Carters main pool has been prescribed to facilitate the water control regulation of the project. The guide curve defines the water surface elevation at the seasonal top of conservation storage. Water management operational decisions strive to maintain the pool elevation at the top of conservation elevation or at the highest elevation possible while meeting project purposes. Normally, the pool elevation will be lower than the guide curve as available conservation storage is utilized to meet project purposes except when storing flood waters or during conservative lake level regulation when drought conditions exist within the project watershed. Carters Lake is regulated between the minimum year-round conservation pool elevation of 1,072 feet NGVD29 and a seasonal maximum conservation pool elevation of 1,074 feet NGVD29 during 1 May to 1 November and 1,072 feet NGVD29 from 1 December to 1 April, with four-week transition periods in April and November. The normal year-round operating range for the reregulation pool is 677 to 696 feet NGVD29.

2) The water control plan also establishes action zones within the conservation storage pool. The action zones are used to manage the lake at the highest level possible within the conservation storage pool while balancing the needs of all authorized purposes with water conservation as a national priority used as a guideline. Carters Lake conservation pool includes two action zones. These zones are used as a general guide to determine the minimum discharge release available from the Reregulation Dam. The action zones were based on the general ability of the project to meet seasonal environmental flows below the Reregulation Dam. Other factors or activities might cause the lakes to operate differently than the action zones described. Examples of the factors or activities include exceptional flood risk management measures; fish spawn operations; maintenance and repair of turbines; emergency situations such as a drowning or chemical spill; drawdowns because of shoreline maintenance; drought recovery; increased or decreased hydropower demand; and other circumstances. Carters Project is unique from other Mobile District projects in that the Main Dam pool level or zone does not often determine the hours of daily hydropower generation. This is due to the pumping capabilities from the Reregulation Dam. The following provides a general description of each zone.

Zone 1: Hydrologic conditions are likely to be normal to wetter than normal. Within Zone 1, a seasonally variable release will be made from the Reregulation Dam as shown in Figure 7-2.

Zone 2: Hydrologic conditions are likely to indicate severe drought conditions. Careful, long range analyses and projections of inflows, pool levels, and upstream and downstream water needs will be made when pool levels are in Zone 2. The seasonally-varying minimum flow is suspended, and a continuous minimum flow of 240 cfs is released from the Reregulation Dam.

Table 7-1 Top of Conservation and Action Zone Table for Carters Lake

Date	Elevation (ft NGVD29)	
	Top of Conservation	Top of Zone 2
1 January	1,072	1,066
1 April	1,072	1,070
1 May	1,074	1,071
1 September	1,074	1,070
15 October	1,074	1,066
1 November	1,074	1,066
1 December	1,072	1,066
31 December	1,072	1,066

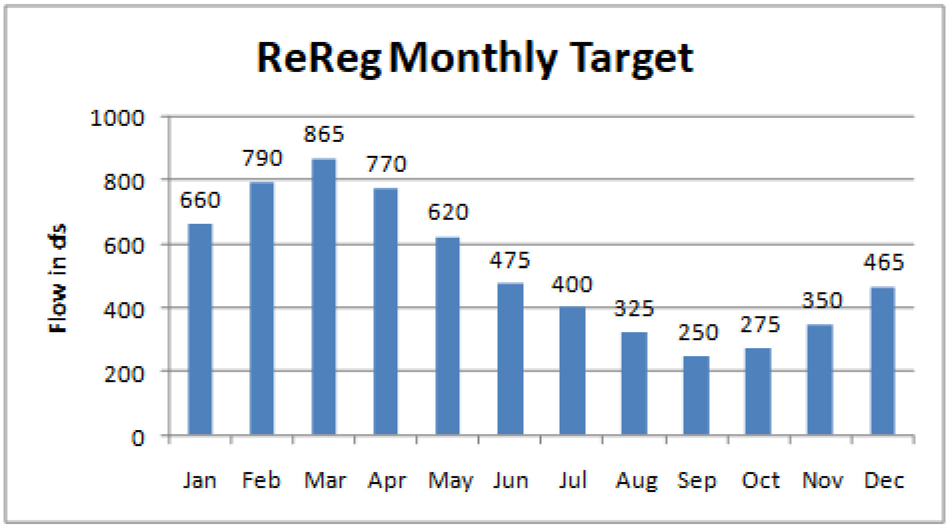

Figure 7-2 Seasonal Reregulation Dam Releases

1) <u>Normal Operations</u>. Under normal flow conditions the main reservoir level is controlled by discharges through the generators. The Carters Project is operated by the "balance point method" to account for the composite storage in the Main Dam and Reregulation Dam. When the Main Dam and Reregulation Dam pools are "balanced," there is just enough water in the Reregulation Dam pool between its present elevation and elevation 677 feet NGVD29 to allow the pumping units to restore the main reservoir to the top of conservation pool. In a balanced state it would be necessary to release all inflows into the project through the Reregulation Dam to maintain balance.

For example, if the reregulation pool were at elevation 685 feet NGVD29 and the main pool was at 1072.48 feet NGVD29 (in August), then they would be "in balance" as the reregulation pool would contain 4,950 acre-feet of storage above elevation 677 feet NGVD29 and this volume (4,950 acre-feet), would fill the main pool from elevation 1072.48 feet NGVD29 to 1074 feet NGVD29.

2) <u>Reregulation Dam</u>. The normal year-round operating range for the Reregulation Dam pool is 677 to 698 feet NGVD29. The pool level is managed by releases through the Reregulation Dam gates. Gate discharge capabilities are shown on Plates 7-4 and 7-5.

Pumping ceases below elevation 677 feet NGVD29 but the storage between elevations 674 to 677 feet NGVD29 is available to provide a minimum flow of 240 cfs downstream for a three-day period. Excessive vibration occurs in the hydropower pumping units when the power head reached a differential of 395 feet. Pumping must be discontinued unless the Reregulation Pool is over 690 feet NGVD29, then the maximum head is 397 feet.

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

7-05. Flood Risk Management.

a. Flood Risk Management Operations. Operation of the Carters Project for flood risk management is in accordance with instructions issued by the Water Management Section in the Mobile District Office, and releases depend on the Carters Main Dam and Reregulation Dam pool levels and forecasted inflows. Flood risk management operations at the Carters Project utilize storage in both the Main Dam and Reregulation Dam. Releases of stored flood water from the Carters Dam will usually not be evacuated until the flood stage at the USGS “Oostanaula River near Rome, GA” (gage # 02388500) has receded or is expected to recede below flood stage.

The top of flood pool for the Main Dam is 1,099 feet NGVD29. The induced surcharge schedule will be followed once elevation 1,099 feet NGVD29 is reached. In the event that water must be evacuated from the Main Dam during a flood (such as during induced surcharge operation), the hydropower units will be used first. Additional water may be discharged through the emergency spillway or as a last resort, the emergency sluice should be considered. Releases through the emergency spillway and emergency sluice have potential to result in erosion and water quality issues. Therefore, it is extremely important that the hydropower units be consistently available during high inflow periods. The Reregulation Dam pool is also used for temporary flood storage from elevation 677 to 696 feet NGVD29, with elevation 696 feet NGVD29 allowing a two-foot reaction period, in the case of a fast rising pool, before reaching the maximum storage elevation of 698 feet NGVD29. If the Reregulation Dam pool is forecast to reach elevation 696 feet NGVD29, pumping operations may be used to stabilize the Reregulation Dam pool instead of increasing releases through the Reregulation Dam gates. The maximum total discharge through the two pumpback units is 7,470 cfs at a total head of 385 feet. A discharge rating table for a pump-turbine unit is shown on Plate 7-6.

The gated spillway for the Carters Reregulation Dam was designed to pass the standard project flood (SPF) peak inflow of 90,400 cfs without the headwater overtopping the dam and without exposing the structures to damage from high velocity flow or undesirable current patterns. The earth dikes have their top elevation at 703 feet NGVD29, which would provide a five-foot freeboard above the maximum reregulation pool level of 698 feet NGVD29. The top of the earth dikes would be subject to overtopping only by floods having a peak inflow about 30 percent great than the SPF (reference Carters Dam, Design Memorandum No. 15, Gated Spillway for Reregulation Dam, dated August 1966).

In flood conditions the balance point method of operation will be discontinued. During the early stages of a flood event, the hydropower generation schedule from Main Dam and outflows from the Reregulation Dam are planned (on the basis of forecasts) to control, or limit, the peak outflow as the flood develops. The inflow and reservoir levels will be monitored continuously along with stages at the USGS stream gage 02387500 at Resaca on the Oostanaula River, and the USGS stream gage 02388500 near Rome on the Oostanaula River. The Carters Project will be operated to minimize flooding at these gages. The Flood Stage (FS) is established by the NWS River Forecast Center and currently is 18 feet for the Resaca gage and 25 feet for the Rome gage. To minimize backwater flooding at Tilton on the Conasauga River, normally, evacuation of flood water from the Carters Project will not be made until after the Conasauga River has peaked at Tilton. Releases will also be coordinated with those from Allatoona to minimize flooding in the Rome area. Normally, evacuation of flood storage from Carters will not occur until the stage at the Rome gage is below FS.

Flood evacuation will normally extend over a period of about one to two weeks, until the pools are within one foot of balance. The normal (non-flood) operating plan will then go into effect. When the Main Dam and Reregulation Dam pools approach the balance point daily power declarations from the Main Dam and discharges from the Reregulation Dam will be reduced slowly.

Bankfull is defined as 5,800 cfs year-round. Normally, the ramp down rate for reregulation flows is 400 cfs every six hours to mitigate erosion and sloughing along stream banks of farmlands downstream. However, under certain conditions the Water Management Section in the Mobile District Office may depart from this ramp down rate.

<u>b. Induced Surcharge Schedule.</u> If the Main Dam pool rises above elevation 1,099 feet NGVD, the induced surcharge schedule shown in Table 7-2 will be followed. The Water Management Section could issue other instructions if current forecasts indicate a need. The plan is not dependent on downstream stages at Resaca or Rome, Georgia, but has been developed to provide optimum protection for the integrity of the dam.

The required outflow would be discharged through the turbines up to their capacity, and then any additional discharges required would be made through the emergency gated spillway following the schedule in Table 7-2 and Table 7-3. Discharges through the low-level sluice would be used in addition to the gated spillway only as a last resort. The low level sluice discharge rating is shown in Table 7-4. As of the date of this report, the low level sluice has never been tested. The emergency gated spillway has been exercised once during a gate test under load on 4 January 2016. This test resulted in a recommendation that the emergency gated spillway be tested every 4–5 years after coordination with Operations Division, Dam Safety and Planning and Environmental Division. The test is to ensure working order and preclude accumulation of debris, vegetative matter, etc. in the spillway that might impact downstream operations under emergency conditions.

The surcharge outflow will be adjusted each hour on the basis of the average inflow for the preceding three hours and the current reservoir elevation. Gate settings will not be reduced as long as the pool is rising. The maximum gate setting will be maintained until the main pool recedes to 1,099.00 feet NGVD29. Outflow will then be reduced to the inflow or 5,800 cfs, whichever is greater. Once the inflow has dropped to 5,800 cfs or lower, surcharge operations will cease. The spillway gates will be operated in accordance with the gate regulation schedule to ensure that the top of the gates remain out of the water.

Carters Lake contains 89,191 acre-feet of flood risk management storage space between pool levels 1,074 and 1,099 feet NGVD29 in which flood water is stored and later released in moderate amounts to prevent downstream flooding. Since the beginning of operations, the maximum one-day inflow was 22,498 cfs which occurred on 16 February 1990. The observed maximum pool elevation was 1,099.69 feet NGVD29 on 4 March 2019.

Table 7-2 Surcharge Schedule for Carters Main Dam

POOL ELEV (FT NGVD 29)	INFLOW IN 1000 CFS (AVERAGE FOR PREVIOUS 3 HOURS)											
	20	30	40	50	60	70	80	90	100	120	140	160
	Required Surcharge Release in 1000 CFS											
1099.0				5.50	8.10	11.20	15.00	19.00	23.30	33.50	44.90	56.00
1099.1				5.90	8.30	11.40	15.30	19.40	23.70	34.20	45.20	56.40
1099.2				6.00	8.50	11.80	15.60	19.80	24.20	34.60	45.80	57.20
1099.3				6.20	8.90	12.00	16.00	20.20	24.40	35.10	46.30	57.80
1099.4				6.30	9.00	12.20	16.20	20.50	25.00	35.50	46.80	58.20
1099.5				6.40	9.10	12.50	16.50	20.80	25.30	36.00	47.20	58.80
1099.6				6.60	9.30	12.80	16.80	21.20	25.80	36.30	47.90	59.50
1099.7				7.00	9.80	13.10	17.20	21.50	26.20	37.00	48.30	60.20
1099.8				7.20	10.00	13.30	17.40	22.00	26.60	37.30	49.00	60.60
1099.9				7.30	10.20	13.60	17.70	22.30	27.10	37.90	49.40	61.20
1100.0				7.50	10.40	14.00	18.00	22.80	27.40	38.30	50.00	61.80
1100.1			0.00	7.70	10.60	14.20	18.30	23.00	28.00	38.80	50.40	62.30
1100.2			5.20	7.90	10.90	14.40	18.70	23.30	28.30	39.30	51.00	62.90
1100.3			5.30	8.00	11.10	14.80	19.00	23.80	28.80	39.90	51.40	63.50
1100.4			5.40	8.10	11.30	15.10	19.30	24.20	29.20	40.30	52.00	64.20
1100.5			5.50	8.30	11.60	15.30	19.80	24.50	29.70	40.80	52.50	64.60
1100.6			5.80	8.50	11.80	15.80	20.20	25.00	30.30	41.30	53.20	65.40
1100.7			6.00	8.90	12.00	16.10	20.30	25.30	30.60	41.80	53.50	66.00
1100.8			6.10	9.00	12.30	16.40	20.80	25.90	31.10	42.30	54.20	66.70
1100.9			6.20	9.10	12.60	16.70	21.10	26.30	31.60	42.90	54.90	67.30
1101.0			6.30	9.30	12.90	17.10	21.50	26.60	32.00	43.40	55.40	68.00

POOL ELEV (FT NGVD 29)	INFLOW IN 1000 CFS (AVERAGE FOR PREVIOUS 3 HOURS)											
	20	30	40	50	60	70	80	90	100	120	140	160
	Required Surcharge Release in 1000 CFS											
1101.1			6.50	9.80	13.20	17.30	21.90	27.00	32.30	43.90	56.00	68.80
1101.2			6.75	10.00	13.50	17.80	22.30	27.50	33.00	44.30	56.50	69.30
1101.3			6.90	10.30	13.80	18.20	22.60	28.00	33.30	45.00	57.10	70.10
1101.4		0.00	7.10	10.50	14.20	18.40	23.00	28.40	34.00	45.50	57.80	70.80
1101.5		5.00	7.20	10.90	14.40	18.80	23.30	28.90	34.40	46.20	58.30	71.40
1101.6		5.20	7.40	11.20	14.80	19.10	23.90	29.30	35.00	46.80	59.00	72.10
1101.7		5.30	7.75	11.30	15.00	19.50	24.20	30.00	35.40	47.30	59.80	72.90
									36.00	47.90	60.20	73.50
1101.9		5.80	8.10	11.90	15.90	20.30	25.20	31.00	36.40	48.40	61.00	74.30
1102.0		5.90	8.30	12.10	16.10	20.70	25.70	31.30	37.00	49.00	61.50	75.10
1102.1		6.00	8.80	12.40	16.40	21.20	26.20	32.00	37.50	49.70	62.30	75.90
1102.2		6.25	9.00	12.80	16.80	21.80	26.50	32.30	38.20	50.30	63.10	76.80
1102.3		6.40	9.20	13.00	17.10	22.10	27.00	33.00	38.80	51.00	63.80	77.40
1102.4		6.75	9.40	13.30	17.60	22.50	27.50	33.50	39.30	51.70	64.30	78.20
1102.5		7.00	9.80	13.80	18.00	23.00	28.00	34.00	39.80	52.20	65.20	79.00
1102.6		7.20	10.00	14.20	18.30	23.50	28.70	34.70	40.40	53.00	66.00	80.00
1102.7		7.30	10.20	14.40	18.80	24.00	29.00	35.20	41.00	53.60	66.80	80.60
1102.8	0.00	7.50	10.30	14.80	19.30	24.30	29.50	36.00	41.60	54.30	67.50	81.50
1102.9	5.00	7.80	10.80	15.00	19.80	25.00	30.20	36.30	42.30	55.20	68.30	82.30
1103.0	5.20	8.00	11.10	15.30	20.20	25.40	30.80	37.10	43.00	55.70	69.20	83.00
1103.1	5.30	8.25	11.30	16.00	20.50	26.10	31.30	37.80	43.70	56.30	70.00	84.00
1103.2	5.50	8.40	11.80	16.20	21.00	26.50	32.00	38.30	44.30	57.20	70.80	84.80
1103.3	5.80	9.00	12.20	16.60	21.50	27.00	32.50	39.20	44.90	58.00	71.70	85.80
1103.4	6.00	9.10	12.40	17.20	22.10	27.50	33.20	39.80	45.70	58.80	72.50	86.50
1103.5	6.25	9.40	12.80	17.50	22.50	28.10	33.80	40.40	46.30	59.80	73.50	87.30

POOL ELEV (FT NGVD 29)	INFLOW IN 1000 CFS (AVERAGE FOR PREVIOUS 3 HOURS)											
	20	30	40	50	60	70	80	90	100	120	140	160
	Required Surcharge Release in 1000 CFS											
1103.6	6.50	9.80	13.10	18.00	23.10	28.90	34.50	41.00	47.20	60.50	74.30	88.20
1103.7	6.75	10.10	13.30	18.30	23.70	29.40	35.20	41.80	48.00	61.20	75.20	89.10
1103.8	7.00	10.30	14.00	18.80	24.00	30.10	36.00	42.40	48.80	62.20	76.20	90.20
1103.9	7.25	10.75	14.30	19.30	24.70	30.80	36.80	43.30	49.30	63.00	77.20	91.00
1104.0	7.50	11.10	14.60	19.90	25.30	31.40	37.20	44.00	50.30	63.80	78.30	92.20
1104.1	8.00	11.40	15.10	20.20	25.90	32.00	38.20	44.80	51.00	64.90	79.20	93.20
1104.2	8.25	11.80	15.50	20.80	26.50	32.80	39.00	45.40	51.90	65.60	80.20	94.20
1104.3	8.50	12.25	16.20	21.40	27.10	33.20	39.70	46.30	52.80	66.60	81.30	95.20
1104.4	8.80	12.50	16.50	22.00	27.70	34.20	40.50	47.20	53.40	67.50	82.40	96.30
1104.5	9.10	13.00	17.00	22.50	28.50	35.00	41.30	48.00	54.30	68.80	83.30	97.50
1104.6	9.25	13.50	17.80	23.20	29.20	35.80	42.30	49.00	55.40	69.90	84.30	98.60
1104.7	10.00	14.00	18.10	24.00	30.10	36.40	43.10	50.00	56.20	71.00	85.50	99.80
1104.8	10.30	14.30	18.60	24.60	31.00	37.30	44.00	50.80	57.20	71.80	86.70	101.20
1104.9	10.70	15.00	19.30	25.30	31.70	38.20	45.00	51.80	58.30	73.20	87.80	102.50
1105.0	11.00	15.40	20.00	26.00	32.50	39.00	46.00	52.70	59.30	74.50	89.00	103.80
1105.1	11.70	16.10	20.90	26.60	33.50	40.00	46.80	54.00	60.30	75.50	90.20	105.20
1105.2	12.30	16.50	21.60	27.60	34.30	41.00	48.00	55.20	61.40	77.00	91.50	106.50
1105.3	13.00	17.25	22.30	28.50	35.50	42.00	49.00	56.30	62.50	78.30	92.60	108.20
1105.4	14.00	17.80	23.00	29.50	36.50	43.00	50.20	57.50	63.80	79.50	94.00	109.50
1105.5	14.60	18.30	24.00	30.50	37.70	44.30	51.50	59.00	65.20	81.00	95.50	111.20
1105.6	15.50	19.30	25.00	31.30	38.80	45.40	52.80	60.50	66.50	82.40	96.80	113.00
1105.7	16.80	20.50	26.00	32.50	40.20	46.50	54.30	62.10	67.90	83.70	98.30	114.50
1105.8	17.80	21.80	27.30	33.60	41.50	48.30	56.00	63.50	69.80	85.30	100.00	116.50
1105.9	20.00	22.50	28.50	35.10	43.00	49.60	57.50	65.30	71.20	86.80	101.40	118.30
1106.0		24.00	30.30	36.50	44.40	51.30	59.50	67.30	73.00	88.50	102.80	120.20

POOL ELEV (FT NGVD 29)	INFLOW IN 1000 CFS (AVERAGE FOR PREVIOUS 3 HOURS)											
	20	30	40	50	60	70	80	90	100	120	140	160
	Required Surcharge Release in 1000 CFS											
1106.1		26.00	32.00	39.30	46.30	52.80	61.20	69.50	74.50	90.10	104.50	122.30
1106.2		30.00	34.00	40.50	48.00	54.80	63.50	71.50	76.50	92.00	106.30	124.80
1106.3			36.00	43.00	50.20	56.60	66.00	74.00	78.80	93.60	108.20	127.30
1106.4			40.00	46.30	53.20	59.30	68.80	76.50	80.50	95.80	110.70	130.00
1106.5				50.00	56.00	62.50	71.80	78.50	83.30	97.80	113.00	132.50
1106.6					60.00	66.50	74.20	82.00	86.00	100.20	115.60	136.20
1106.7						70.00	79.00	86.00	89.00	103.00	118.50	140.00
1106.8							80.00	90.00	94.00	107.00	121.20	144.00
1106.9									100.00	112.00	127.00	150.50
1107.0										120.00	140.00	160.00

Note: Discharge through all four hydropower units at full pool is approximately 22.34

Table 7-3 Emergency Spillway Discharge Rating for Carters Main Dam

EMERGENCY GATED SPILLWAY DISCHARGE RATING IN CFS (ALL FIVE GATES OPEN TO INDICATED SETTING) MAIN POOL ELEVATION IN FEET NGVD 29										
OPEN IN FEET	1,099	1,100	1,101	1,102	1,103	1,104	1,105	1,106	1,107	11,08
0.5	2,780	2,830	2,870	2,920	2,960	3,010	3,050	3,100		
1.0	5,570	5,670	5,760	5,850	5,950	6,030	6,120	6,210		
2.0	11,140	11,340	11,530	11,720	11,900	12,080	12,260	12,440	12,610	
4.0	22,260	22,660	23,060	23,450	23,830	24,200	24,570	24,940	25,300	25,650
6.0	33,250	33,880	34,490	35,090	35,680	36,270	36,840	37,400	37,960	38,510
8.0	44,110	44,970	45,810	46,640	47,460	48,260	49,050	49,820	50,590	51,340
10.0	54,730	55,840	56,930	58,000	59,050	60,080	61,100	62,100	63,080	64,050
13.0	70,300	71,820	73,310	74,770	76,210	77,610	79,000	80,350	81,690	83,000
16.0	85,400	87,380	89,320	91,210	93,070	94,880	96,670	98,420	100,150	101,840
20.0	104,290	106,950	109,550	112,090	114,570	117,000	119,380	121,710	124,000	126,250
24.0	121,700	125,150	128,520	131,800	135,000	138,120	141,180	144,170	147,100	149,970
28.0	131,200	139,000	146,070	150,210	154,240	158,170	162,010	165,750	169,410	173,000
32.0			147,000	155,100	163,500	172,000	180,500	187,170	191,700	196,120
36.0								189,000	197,700	206,500

Table 7-4 Low Level Sluice Discharge Rating for Carters Main Dam

OPEN IN FEET	(FOR BOTH GATES OPEN TO INDICATED SETTING) MAIN POOL ELEVATION IN FEET NGVD29															
	800	**820**	**840**	**860**	**880**	**900**	**920**	**940**	**960**	**980**	**1,000**	**1,020**	**1,040**	**1,060**	**1,080**	**1,100**
	DISCHARGE IN CFS															
0.5	257	288	316	343	367	390	411	431	451	469	487	505	521	538	553	569
1.0	514	577	633	685	734	779	822	862	901	939	974	1,009	1,042	1,075	1,106	1,137
1.5	770	864	949	1,027	1,099	1,167	1,232	1,293	1,351	1,403	1,460	1,512	1,562	1,611	1,658	1,704
2.0	1,026	1,151	1,264	1,368	1,464	1,555	1,640	1,721	1,799	1,874	1,945	2,014	2,080	2,145	2,208	2,269
2.5	1,288	1,446	1,588	1,719	1,840	1,954	2,062	2,163	2,261	2,354	2,444	2,531	2,615	2,696	2,775	2,852
3.0	1,554	1,744	1,915	2,073	2,219	2,357	2,486	2,609	2,727	2,840	2,948	3,052	3,152	3,252	3,347	3,440
3.5	1,808	2,031	2,230	2,414	2,584	2,743	2,892	3,038	3,175	3,306	3,462	3,554	3,672	3,787	3,897	4,004
4.0	2,062	2,315	2,541	2,752	2,945	3,128	3,300	3,464	3,620	3,770	3,914	4,053	4,187	4,317	4,443	4,566
4.5	2,329	2,613	2,871	3,107	3,327	3,532	3,728	3,912	4,089	4,258	4,420	4,577	4,728	4,875	5,015	5,157
5.0	2,597	2,914	3,202	3,465	3,708	3,938	4,156	4,363	4,558	4,747	4,928	5,104	5,273	5,439	5,595	5,749
5.5	2,882	3,238	3,553	3,846	4,115	4,372	4,615	4,843	5,062	5,272	5,473	5,666	5,854	6,037	6,213	6,385
6.0	3,173	3,560	3,910	4,231	4,530	4,810	5,079	5,331	5,570	5,801	6,023	6,237	6,444	6,644	6,838	7,027
6.5	3,444	3,865	4,245	4,594	4,917	5,221	5,512	5,787	6,048	6,297	6,539	6,770	6,996	7,212	7,422	7,628
7.0	3,714	4,170	4,578	4,953	5,304	5,633	5,947	6,242	6,523	6,794	7,053	7,303	7,544	7,779	8,007	8,228
7.5	4,006	4,498	4,937	5,345	5,722	6,077	6,416	6,735	7,039	7,329	7,608	7,873	8,140	8,394	8,639	8,879
8.0	4,300	4,825	5,302	5,737	6,141	6,522	6,890	7,230	7,555	7,868	8,169	8,459	8,738	9,009	9,273	9,529
8.5	4,592	5,156	5,667	6,129	6,562	6,968	7,361	7,723	8,075	8,406	8,728	9,038	9,337	9,626	9,907	10,181
9.0	4,887	5,489	6,025	6,521	6,981	7,409	7,831	8,220	8,592	8,947	9,289	9,615	9,933	10,242	10,540	10,832
9.5	5,126	5,755	6,318	6,838	7,318	7,774	8,214	8,622	9,009	9,383	9,740	10,085	10,418	10,741	11,056	11,363
10.0	5,360	6,016	6,606	7,150	7,653	8,125	8,571	9,016	9,421	9,810	10,186	10,544	10,895	11,232	11,562	11,884

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 Section 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.

The effects of the Carters Project water control operations on recreation facilities and use at Carters Lake are described as impact levels – Initial Impact Level, Recreation Impact Level, and Water Access Limited Level. The impact levels are defined as pool elevations with associated effects on recreation facilities and exposure to hazards within the lake. The following are general descriptions of each impact level for low water conditions.

a. Initial Impact Level. The Initial Impact Level is defined at lake elevation 1,068 feet NGVD29. At this level impacts are first observed and there is adequate time available to notify the public should the lake level continue to drop. Action is taken to prevent more serious and lasting impacts. Swimming area buoys at Harris Branch Beach are set out at approximately elevation 1,068 feet NGVD29 when the lake is at normal summer pool level of 1,074 feet NGVD29. At the initial impact level, gate attendants issue oral messages and written warnings to the public.

b. Recreation Impact Level. The lake elevation of 1,060 feet NGVD29 is defined as the Recreation Impact Level. At this level action must be taken to prevent significant impacts from occurring. At the level of 1,060 feet NGVD29, the dangers to those participating in water based recreation activities would increase due to hazardous conditions. Steps are taken to alert the marina staff and public of existing dangers. Woodring Campground and Doll Mountain Day Use boat ramps are closed to the public when water level is below 1,060 feet NGVD29. At elevation 1,060 feet NGVD29, the Harris Branch Beach is closed. The designated swimming area buoys are completely out of the water and cannot be moved.

c. Water Access Limited Level. The lake elevation of 1,055 feet NGVD29 is defined as the Water Access Impact level. At this elevation, public access to the water is severely limited. Action is taken to retain this limited access. If navigational hazards appear, they will be temporarily marked with buoys or signs for boater safety. Marina slips are still usable, but dock walkways slope severely from the shoreline. At elevation 1,055 feet NGVD29, Ridgeway boat ramp, Woodring Branch day use area boat ramp and damsite boat ramps are closed.

The water control plan takes the effects on recreation facilities into account in developing action zones for Carters Lake. In dry periods, the lake will often drop to or below the impact levels and Water Management Section personnel 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 will close beaches and boat ramps as necessary, patrol the lake, and mark hazards and perform other necessary tasks to mitigate the effects of low lake levels.

7-07. Water Quality. The Corps operates the project with the objective of maintaining water quality standards while accepting operational and physical constraints that may limit the ability to do so. Because most water quality concerns occur during periods of low flow, usually during summer and early fall when there is greater stress on biological resources and wastewater discharge assimilation requirements, establishing a continuous minimum release of water is an important consideration. Because of the existence of the Reregulation Dam and the pump back operation previously discussed, minimum flows are considered from the Reregulation Dam, rather than from the Main Dam.

Continuous minimum flows from the Carters Project are provided depending on the Action Zone in which the lake level is in, previously discussed in Section 7-03. When in Action Zone 1, a varying monthly flow ranging from 250–865 cfs is provided as shown in Figure 7-2. When in Action Zone 2, the minimum flow of 240 cfs is provided, regardless of month.

The pump back operation associated with the project allows the flexibility of providing the continuous minimum flow by using the four large turbine-generator units, two of which are capable of pumping. The existence of the reregulation pool allows smoothing of downstream releases and avoids high-pulse flows in many cases.

7-08. Fish and Wildlife. The Carters Lake presents a unique problem to the management of fishery resources within the lake as well as in the tailwaters. Due to the type of project (pump storage), the depth of the reservoir (average depth of about 380 feet, maximum depth of 410 feet), and the makeup of fish populations occurring within the watershed prior to impoundment, a situation exists unlike that anywhere else within the District. Because of the demands and the nature of other project purposes, regulation of the project for fish and wildlife is not possible. However, in consultation with the USFWS, the Corps has adopted specific seasonal minimum flows, varying monthly over a range from 250 to 865 cfs when in Zone 1. Figure 7-2 summarizes the monthly minimum flows recommended by the USFWS for the Coosawattee River below Carters Reregulation Dam for each month of the year.

7-09. Water Conservation/Water Supply. Under the authority of the Water Supply Act of 1958, the Corps allocated storage in Carters Lake in 1991 for municipal and industrial water supply by entering into a storage contract (Contract Number DACW01-9-91-481) with the city of Chatsworth, Georgia. The contract provides for the use of an undivided 0.61 percent (estimated to contain 818 acre-feet after adjustment for sediment deposits) of the conservation storage space between elevations 1,022–1,072 feet NGVD29 (134,900 acre-feet) for water supply. This amount of storage stated in the contract was estimated, at the time the contract was executed, to yield 2.0 million gallons per day (mgd) during the critical drought, i.e., during the worst drought on record at the time the contract was executed. The severity and frequency of droughts change over time, however, and more recent storage-yield analysis by the Corps has indicated that the estimated yield of Carters Lake storage has decreased. For the purpose of managing water supply storage, the Mobile District has employed a systematic storage accounting methodology that tracks multiple storage accounts, applying a proportion of inflows and losses (e.g. evaporation), 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 storage, which will naturally change over time.

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. This accounting is especially critical during drought, when available water supply storage is reduced and conservation measures or alternative sources may be necessary. The formula used to calculate water supply storage is shown below:

Users Ending Storage = Users Beginning Storage + Inflow Share – Loss Share – User's Usage.

(with constraint that "Users Ending Storage" cannot be larger than User's total storage)

The conservation pool is drawn down as water usage exceeds inflow. The entire pool is drawn down and the individual accounts are also drawn down at different rates based on their usage. Users will be notified on a weekly basis of the available storage remaining once their storage account balance drops below 30 percent.

7-10. Hydroelectric Power. The Carters Project is a pumped storage project operated as a peaking plant for producing hydroelectric power. The term “peak generation” is defined as using the full plant capacity for generating hydroelectric power.

a. Except in the most unusual circumstances, reservoir releases required for conservation or flood risk management operations will be used to produce hydropower. Such production is normally scheduled during peak energy demand hours throughout the week. The historical Average Monthly Hydroelectric Power Generation is shown in Table 7-5. The typical operations for non-flood conditions are illustrated on Plates 7-7 and 7-8.

b. Each week, the Water Management Section makes a forecast of expected inflows into the Carters Project. On the basis of that forecast, the present pool elevation, downstream requirements, and other pertinent needs, the Water Management Section determines the volume of water to be released and the corresponding hydropower available to be generated. That energy is scheduled by the receiving utility throughout the following week. There could be needs for certain timing of releases but, in general, the utility makes the schedule and generation is spread across the week during the peak hours. The Water Management Section constantly monitors climatic conditions and can adjust the volume of hydropower available daily. Energy is marketed to the government’s preference customers under terms of contracts negotiated and administered by SEPA. Those declarations, which are designed to keep the pools within the established seasonal and pondage limits, when practicable, are prepared by the Water Management Section of the Mobile District.

c. Typical operation during non-flood conditions are as follows:

1. Generation during the weekdays normally occurs between the hours of 6 a.m. and 10 p.m. In general, little or no generation occurs during the weekend. However, generation can occur on the weekends if warranted by power demands.

2. Pumpback normally occurs between the hours of 10 p.m. and 6 a.m. during both the weekdays and weekends but can occur outside this time period.

3. The Reregulation Dam pool will likely reach both the maximum elevation 696 feet NGVD29 and the minimum elevation 677 feet NGVD29 at least once during the course of the week.

4. The Reregulation Pool is at its peak late on Friday and is at its low-point early Monday morning because of the significant pumping over the weekend. The total downward fluctuation of the Reregulation Pool is up to 20 feet over a weekend.

5. The main pool is at its high point early Monday morning and at its low-point mid to late week. The typical fluctuation of the main pool ranges from two to four feet during the week.

Power operations, including pumping, can continue throughout a flood event as long as storage space can safely be allocated in the main pool and pumping energy is available to keep the Reregulation Dam pool at or below 696 feet NGVD29. In addition, pumping will discontinue when the Reregulation Dam pool falls below 677 feet NGVD29 or to the minimum elevation necessary to maintain the constant discharge downstream to ensure an orderly and timely evacuation of stored flood waters.

Table 7-5. Average Monthly Hydroelectric Power Generation

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Min	Max	Avg
1975							345	375	393	520	504	631	345	631	461
1976	871	639	1144	1082	876	810	1129	510	248	178	274	427	178	1144	682
1977	542	380	835	1957	779	1352	1455	1555	1313	1533	2127	1486	380	2127	1276
1978	2267	2173	1748	1009	1372	1552	720	1274	1126	601	614	601	601	2267	1255
1979	1551	1466	2287	1645	1133	1150	1276	1769	1079	1247	1354	1005	1005	2287	1414
1980	1442	1841	2252	3388	2279	2040	2311	2255	2267	1407	1081	1247	1081	3388	1984
1981	1608	1734	1167	1235	1051	1792	2189	1927	1764	1416	1218	1095	1051	2189	1516
1982	1526	1878	1633	1330	1618	1478	1676	1534	1472	1347	1480	2522	1330	2522	1624
1983	1225	1258	1450	2034	1801	1767	1772	1977	1436	1293	1577	2179	1225	2179	1648
1984	1362	1287	1949	1958	2148	1752	1124	1870	1099	1204	1610	1148	1099	2148	1543
1985	981	1353	1469	1216	1315	1571	1405	1511	1136	1256	1082	1148	981	1571	1287
1986	1106	1026	889	1045	1132	1218	1922	1431	1829	915	1286	1399	889	1922	1267
1987	1634	1375	1705	1428	1382	1511	1775	2000	1358	559	726	542	542	2000	1333
1988	564	667	910	752	572	1100	1199	1299	1176	610	566	775	564	1299	849
1989	1066	1016	1850	1188	1252	1414	1642	1240	801	1330	1227	1231	801	1850	1271
1990	1548	2632	2626	1054	816	405	541	601	464	469	369	443	369	2632	997
1991	664	404	899	1255	1230	516	619	716	761	587	413	374	374	1255	703
1992	602	566	1013	843	920	1746	1889	1867	874	424	1037	1600	424	1889	1115
1993	1366	682	906	797	765	1783	1858	1598	1567	1143	1468	989	682	1858	1243
1994	804	864	798	1629	756	1661	1514	1660	945	768	800	848	756	1661	1087
1995	891	1037	1118	667	837	1586	1532	1949	845	839	900	764	667	1949	1080
1996	781	1612	1057	1097	783	1273	1384	1488	638	719	527	861	527	1612	1018
1997	898	1123	1224	1057	1098	870	794	967	722	732	785	779	722	1224	921
1998	959	1483	1061	1383	842	775	717	1064	945	931	1193	1079	717	1483	1036
1999	913	883	1028	1002	1132	1198	1382	1178	1209	1343	1264	1193	883	1382	1144
2000	1305	973	818	848	1161	1047	1107	1323	1174	1144	1103	905	818	1323	1076
2001	834	1172	1217	1060	1085	1156	1073	1188	956	1035	1021	1030	834	1217	1069
2002	1033	1168	958	1199	1099	968	1088	1010	1014	996	812	964	812	1199	1026
2003	1080	982	928	576	1383	1061	1255	1277	1163	1204	1412	1193	576	1412	1126
2004	1455	1418	1232	1236	1267	1226	1358	1535	1420	1111	930	1405	930	1535	1299
2005	1062	889	1136	1191	1119	1505	1286	1429	1197	1000	1047	1005	889	1505	1156
2006	1165	1197	1266	1161	1295	1406	1385	1246	1098	1032	914	908	908	1406	1173
2007	1114	1132	1218	1105	1267	1292	1834	2084	2014	1728	1343	1343	1105	2084	1456
2008	1618	1416	1128	1070	1481	1544	961	2063	1861	1618	1450	1459	961	2063	1472
2009	1524	1505	1385	1345	1371	1624	2033	1861	1804	1399	1235	1402	1235	2033	1541
2010	1156	1775	1631	2103	1541	1659	2448	1827	1990	1606	1135	1274	1135	2448	1679
2011	1459	1350	1674	1115	1656	1467	1383	2133	1817	1432	1111	1187	1111	2133	1482
2012	1495	1225	1081	1011	1286	1475	1207	1600	1486	1512	1279	1402	1011	1600	1338
2013	1360	1293	1396	1411	1596	1155	1618	1116	1110	1301	1001	1161	1001	1618	1293
2014	1617	1306	894	973	1084	1296	1699	1779	1490	1284	961	1236	894	1779	1302
2015	1445	1246	1214	1282	1329	1381	1587	1658	1576	1253	862	1586	862	1658	1368
2016	2048	1154	1129	953	1228	1494	1413	1636	1314	1349	1165	1135	953	2048	1335
2017	1107	1150	1388	1066	1302	1405	1281	1502	1444	1118	1201	1031	1031	1502	1250
2018	1093	1417	1408	1081	1101	1186	1240	1332	1693	1225	1060	869	869	1693	1225
2019	1509	1032	2592	1101	1058	893	1538	1878	1596	1642	1095	1220	893	2592	1430
2020	1128	1940	1450	1359	868	1254	1461	1705	1492	992	776	1114	776	1940	1295
2021	633	1109	1252	1477	1119	1447	1122						633	1477	1166
Min	542	380	798	576	572	405	345	375	248	178	274	374	178	631	461
Max	2267	2632	2626	3388	2279	2040	2448	2255	2267	1728	2127	2522	1330	3388	1984
Avg	1205	1244	1335	1256	1208	1332	1395	1496	1265	1095	1052	1113	818	1803	1241

Performance curves for the pump back operation are shown on Plate 7-9. Performance curves for the conventional unit are shown on Plate 7-10. Performance curves for the pump-turbine unit are shown on Plate 7-11.

The Main Dam Discharge Rate-Tailwater relationship for Various Reregulation Pool elevations is shown on Plate 7-12. The Pumping Rate-Tailwater relationship for various reregulation pools is shown on Plate 7-13

7-11. Navigation. Allatoona Dam and Carters Dam, while originally authorized to support downstream navigation, are not regulated for navigation purposes because they are distant from the navigation channel, and any releases for that purpose would be captured and reregulated by APC reservoirs downstream. Downstream navigation in the Alabama River benefits indirectly from the operation of the Allatoona and Carters Projects for the other authorized purposes.

7-12. Drought Contingency Plan. ER1110-2-1941, *Drought Contingency Plans*, dated 02 February 2018, called for developing drought contingency plans for Corps' reservoirs. For the Carters Project, the Corps will coordinate water management during drought with other federal agencies, private power companies, navigation interests, states, and other interested state and local parties as necessary. Drought operations will be in compliance with the plan for the entire ACT Basin as outlined in Exhibit D approved in May 2015 and summarized below. The plan includes operating guidelines for drought conditions and normal conditions.

In response to the 2006 - 2008 drought, APC worked closely with the State of Alabama to develop the APC draft *Alabama Drought Operations Plan* (ADROP) that specified operations at APC projects on the Coosa and Tallapoosa Rivers. The plan included the use of composite system storage, state line flows, and basin inflow as triggers to drive drought response actions. Similarly, in response to the 2006–2008 drought, the Corps recognized that a basin-wide drought plan must incorporate variable hydropower generation requirements from its headwater projects in Georgia (Allatoona and Carters), a reduction in the level of navigation service provided on the Alabama River as storage across the basin declines, and that environmental flow requirements must still be met to the maximum extent practicable.

Based upon experience gained during previous droughts, and in particular the 2006–2008 drought, a basin-wide drought plan composed of three components has been developed: headwater operations at Allatoona and Carters Projects in Georgia; operations at APC projects on the Coosa and Tallapoosa Rivers; and downstream operations at Corps projects below Montgomery. The concept is graphically depicted in Figure 7-3 with the specifics shown on Table 7-6.

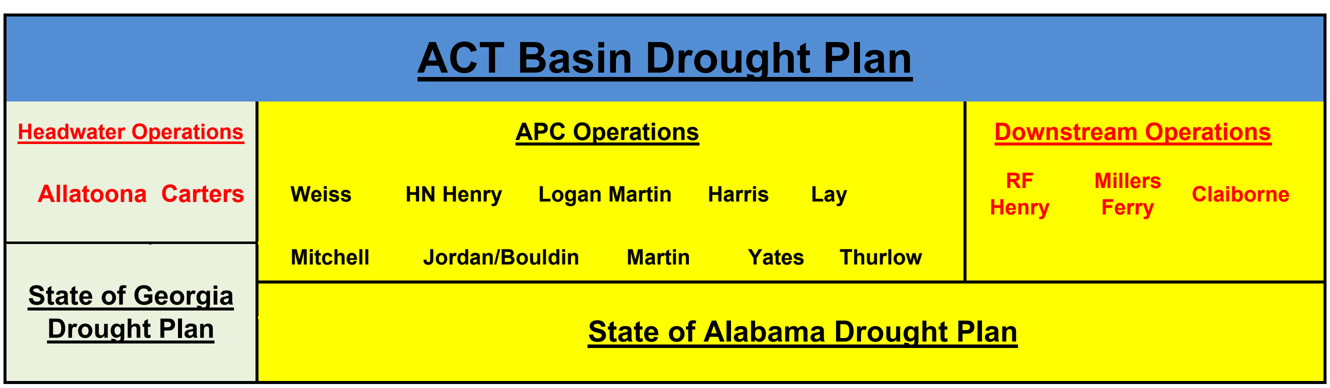

Figure 7-3 Schematic of the ACT Basin Drought Plan

Table 7-6 ACT Basin Drought Management Matrix

<table>
<tr><th></th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th colspan="2">Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td rowspan="4">Drought Level Response[a]</td><td colspan="13">Normal Operations</td></tr>
<tr><td colspan="13">DIL 1: Low Basin Inflows or Low Composite or Low State Line Flow</td></tr>
<tr><td colspan="13">DIL 2: DIL 1 criteria + (Low Basin Inflows or Low Composite or Low State Line Flow)</td></tr>
<tr><td colspan="13">DIL 3: Low Basin Inflows + Low Composite + Low State Line Flow</td></tr>
<tr><td rowspan="4">Coosa River Flow[b]</td><td colspan="3">Normal Operation: 2,000 cfs</td><td colspan="2">4,000 (8,000)</td><td colspan="2">4,000 – 2,000</td><td colspan="6">Normal Operation: 2,000 cfs</td></tr>
<tr><td colspan="3">Jordan 2,000 +/-cfs</td><td colspan="3">4,000 +/- cfs</td><td>6/15 Linear Ramp down</td><td colspan="3">Jordan 2,000 +/-cfs</td><td colspan="3">Jordan 2,000 +/-cfs</td></tr>
<tr><td colspan="3">Jordan 1,600 to 2,000 +/-cfs</td><td colspan="3">2,500 +/- cfs</td><td>6/15 Linear Ramp down</td><td colspan="3">Jordan 2,000 +/-cfs</td><td colspan="3">Jordan 1,600 to 2,000 +/-cfs</td></tr>
<tr><td colspan="3">Jordan 1,600 +/-cfs</td><td colspan="4">Jordan 1,600 to 2,000 +/-cfs</td><td colspan="3">Jordan 2,000 +/-cfs</td><td colspan="2">Jordan 1,600 to 2,000 +/-cfs</td><td>Jordan 1,600 +/-cfs</td></tr>
<tr><td rowspan="4">Tallapoosa River Flow[c]</td><td colspan="13">Normal Operations: 1200 cfs</td></tr>
<tr><td colspan="4">Greater of 1/2 Yates Inflow or
2 x Heflin Gage (Thurlow releases > 350 cfs)</td><td colspan="6">1/2 Yates Inflow</td><td colspan="3">1/2 Yates Inflow</td></tr>
<tr><td colspan="4">Thurlow 350 cfs</td><td colspan="6">1/2 Yates Inflow</td><td colspan="3">Thurlow 350 cfs</td></tr>
<tr><td colspan="7">Maintain 400 cfs at Montgomery WTP
(Thurlow release 350 cfs)</td><td colspan="3">Thurlow 350 cfs</td><td colspan="3">Maintain 400 cfs at Montgomery WTP (Thurlow release 350 cfs)</td></tr>
<tr><td rowspan="4">Alabama River Flow[d]</td><td colspan="13">Normal Operation: Navigation or 4,640 cfs flow</td></tr>
<tr><td colspan="4">4,200 cfs (10% Cut) - Montgomery</td><td colspan="6">4,640 cfs - Montgomery</td><td colspan="3">Reduce: Full – 4,200 cfs</td></tr>
<tr><td colspan="5">3,700 cfs (20% Cut) - Montgomery</td><td colspan="5">4,200 cfs (10% Cut) - Montgomery</td><td colspan="3">Reduce: 4,200 cfs-> 3,700 cfs Montgomery (1 week ramp)</td></tr>
<tr><td colspan="4">2,000 cfs
Montgomery</td><td colspan="3">3,700 cfs
Montgomery</td><td colspan="3">4,200 cfs (10% Cut) - Montgomery</td><td colspan="3">Reduce: 4,200 cfs -> 2,000 cfs Montgomery (1 month ramp)</td></tr>
<tr><td rowspan="4">Guide Curve Elevation</td><td colspan="13">Normal Operations: Elevations follow Guide Curves as prescribed in License (Measured in Feet)</td></tr>
<tr><td colspan="13">Corps Deviations: As Needed; FERC Deviation for Lake Martin</td></tr>
<tr><td colspan="13">Corps Deviations: As Needed; FERC Deviation for Lake Martin</td></tr>
<tr><td colspan="13">Corps Deviations: As Needed; FERC Deviation for Lake Martin</td></tr>
</table>

a. Note these are base flows that will be exceeded when possible.
b .Jordan flows are based on a continuous +/- 5% of target flow.
c. Thurlow flows are based on continuous +/- 5% of target flow: flows are reset on noon each Tuesday based on the prior day's daily average at Heflin or Yates.
d. Alabama River flows are 7-Day Average Flow.

a. Headwater Operations for Drought at Carters and Allatoona Projects. Drought operations at Carters and Allatoona Projects consist of progressively reduced generation and discharges as pool levels decline. For instance, as Carters Lake pool level drops into Zone 2, minimum flows would be reduced from seasonal varying values to 240 cfs. However, due to pumpback capability, the Carters pool will most likely return to full pool each year. When Allatoona Lake is operating in normal conditions (Zone 1 operations), hydropower generation would be zero to four hours per day. However, as the pool level drops to lower action zones during drought conditions, generation would be reduced to zero to two hours per day.

b. Operations at APC Projects on the Coosa, Tallapoosa, and Alabama Rivers. Under current operations, APC provides a combined minimum flow of 4,640 cfs (seven-day average) from the Bouldin, Jordan, and Thurlow Projects on the Tallapoosa and Coosa Rivers. The minimum flow target of 4,640 cfs was originally derived from the 7Q10 flow at Claiborne Lake of 6,600 cfs. Those flows were established with the understanding that if APC provided 4,640 cfs, the Corps and intervening basin inflow would be able to provide the remaining water to meet 6,600 cfs at Claiborne Lake. However, as dry conditions continued in 2007, water managers realized that, if the basin inflows from rainfall were insufficient, the minimum flow target would not likely be achievable. Therefore, in coordination with APC, drought operations for the middle reaches of the ACT Basin have been revised and are described below.

The ADROP served as the initial template for developing proposed drought operations for the APC Drought Operation Plan (APCDOP) and ACT Basin. APCDOP operational guidelines for the Coosa, Tallapoosa, and Alabama Rivers have been defined in a matrix, on the basis of a Drought Intensity Level (DIL). The DIL is a drought indicator, ranging from one to three. The DIL is determined on the basis of three basin drought criteria (or triggers). The DIL increases as more of the drought indicator thresholds (or triggers) occur. The APCDOP matrix defines monthly minimum flow requirements for the Coosa, Tallapoosa, and Alabama Rivers as a function of DIL and time of year. Such flow requirements are modeled as daily averages.

The combined occurrences of the drought triggers determine the DIL. Three intensity levels for drought operations are applicable to APC projects.

- DIL1 - (moderate drought) one of three triggers occur
- DIL2 - (severe drought) two of three triggers occur
- DIL3 - (exceptional drought) all three triggers occur

The indicators used in the APCDOP to determine drought intensity include the following:

- Low basin inflow
- Low state line flow
- Low composite conservation storage

Each of the indicators is described in detail below.

The DIL is computed on the first and third Tuesday of each month. Once a drought operation is triggered, the DIL can only recover from drought condition at a rate of one level per period. For example, as the system begins to recover from an exceptional drought with DIL=3, the DIL must be stepped incrementally back to normal operations. In that case, even if the system triggers return to normal quickly, it will still take at least a month before normal operations can resume - conditions can improve only to DIL=2 for the next 15 days, then DIL=1 for the next 15 days, before finally returning to normal operations.

For normal operations, the matrix shows a Coosa River flow between 2,000 cfs and 4,000 cfs with peaking periods up to 8,000 cfs occurring. The required flow on the Tallapoosa River is a constant 1,200 cfs throughout the year. The navigation flows on the Alabama River are applied to the APC projects. The required navigation depth on the Alabama River is subject to the basin inflow.

For DIL=1, the Coosa River flow varies from 2,000 cfs to 4,000 cfs. On the Tallapoosa River, part of the year, the required flow is the greater of one-half of the inflow into Yates Lake and twice the Heflin USGS gage. For the remainder of the year, the required flow is one-half of Yates Lake inflow. The required flows on the Alabama River are reduced from the normal operation levels.

For DIL=2, the Coosa River flow varies from 1,600 cfs to 2,500 cfs. On the Tallapoosa River, the minimum is 350 cfs for part of the year and one-half of Yates Lake inflow for the remainder of the year. The requirement on the Alabama River is between 3,700 cfs and 4,200 cfs.

For DIL=3, the flows on the Coosa River range from 1,600 cfs to 2,000 cfs. A constant flow of 350 cfs on the Tallapoosa River is required. It is assumed an additional 50 cfs will occur between Thurlow Lake and the City of Montgomery’s water supply intake. Required flows on the Alabama River range from 2,000 cfs to 4,200 cfs

In addition to the APCDOP, the DIL affects the navigation operations. During normal operations, APC projects are operated to meet the navigation flow target or 4,640 cfs flow. Once DIL is greater or equal to one, drought operations will occur, and navigation operations are suspended

c. Low Basin Inflow Trigger. The total basin inflow needed for navigation is the sum of the total filling volume plus 4,640 cfs. Table 7-7 lists the monthly low basin inflow criteria. All numbers are in cfs-days. The basin inflow value is computed daily and checked on the first and third Tuesday of the month. If computed basin inflow is less than the value required, the low basin inflow indicator is triggered.

The basin inflow is the total flow above the APC projects excluding Allatoona Lake and Carters Lake. It is the sum of local flows, minus lake evaporation and diversions. Figure 7-4 illustrates the local inflows to the Coosa and Tallapoosa River Basin. The basin inflow computation differs from the navigation basin inflow because it does not include releases from Allatoona Lake and Carters Lake. The intent is to capture the hydrologic condition across APC projects in the Coosa and Tallapoosa Basins.

d. Low State Line Flow Trigger. A low state line flow trigger occurs when the Mayo’s Bar USGS gage measures a flow below the monthly historical 7Q10 flow. The 7Q10 flow is defined as the lowest flow over a seven-day period that would occur once in 10 years. Table 7-8 lists the Mayo’s Bar 7Q10 value for each month determined from observed flows from 1949–2006. The lowest seven-day average flow over the past 14 days is computed and checked at the first and third Tuesday of the month. If the lowest seven-day average value is less than the Mayo’s Bar 7Q10 value, the low state line flow indicator is triggered. If the result is greater than or equal to the trigger value from Table 7-8, the flow is considered normal, and the state line flow indicator is not triggered.

Table 7-7 Low Basin Inflow Guide (in cfs-days)

Month	Coosa Filling Volume	Tallapoosa Filling Volume	Total Filling Volume	Minimum JBT Target Flow	Required Basin Inflow
January	628	0	628	4,640	5,268
February	626	1,968	2,594	4,640	7,234
March	603	2,900	3,503	4,640	8,143
April	1,683	2,585	4,269	4,640	8,909
May	248	0	248	4,640	4,888
June			0	4,640	4,640
July			0	4,640	4,640
August			0	4,640	4,640
September	–612	–1,304	–1,916	4,640	2,724
October	–1,371	–2,132	–3,503	4,640	1,137
November	–920	–2,748	–3,667	4,640	973
December	–821	–1,126	–1,946	4,640	2,694

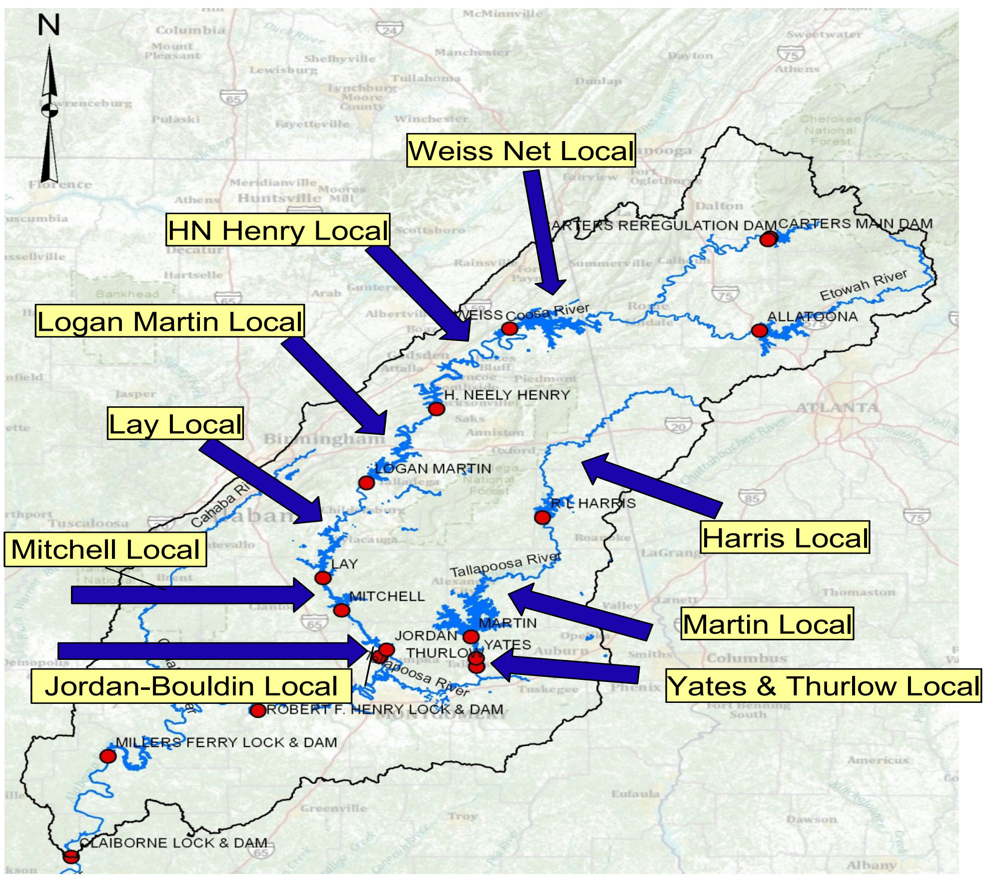

Figure 7-4 ACT Basin Inflows

Table 7-8 APC Drought Operations Plan State Line Flow Trigger

Month	Mayo's Bar (7Q10 in cfs)
January	2,544
February	2,982
March	3,258
April	2,911
May	2,497
June	2,153
July	1,693
August	1,601
September	1,406
October	1,325
November	1,608
December	2,043

Note: Based on USGS Coosa River at Rome Gage
(Mayo's Bar, USGS 02397000) observed flow from 1949 to 2006

The term state line flow is used in developing the drought management plan because of the proximity of the Mayo's Bar gage to the Alabama-Georgia state line and because it relates to flow data upstream of the Alabama-based APC reservoirs. State line flow is used only as a source of observed data for one of the three triggers and does not imply that targets exist at that geographic location. The APCDOP does not include or imply any Corps operation that would result in water management decisions at Carters Lake or Allatoona Lake.

e. Low Composite Conservation Storage in APC Projects Trigger. Low composite conservation storage occurs when the APC projects' composite conservation storage is less than or equal to the storage available within the drought contingency curves for the APC reservoirs. Composite conservation storage is the sum of the amounts of storage available at the current elevation for each reservoir down to the drought contingency curve at each APC major storage project. The reservoirs considered for the trigger are R. L. Harris Lake, H. Neely Henry Lake, Logan Martin Lake, Lake Martin, and Weiss Lake projects. Figure 7-5 plots the APC composite zones. Figure 7-6 plots the APC low composite conservation storage trigger.

If the actual active composite conservation storage is less than or equal to the active composite drought zone storage, the low composite conservation storage indicator is triggered. The computation is performed on the first and third Tuesday of each month and is compared to the low state line flow trigger and basin inflow trigger.

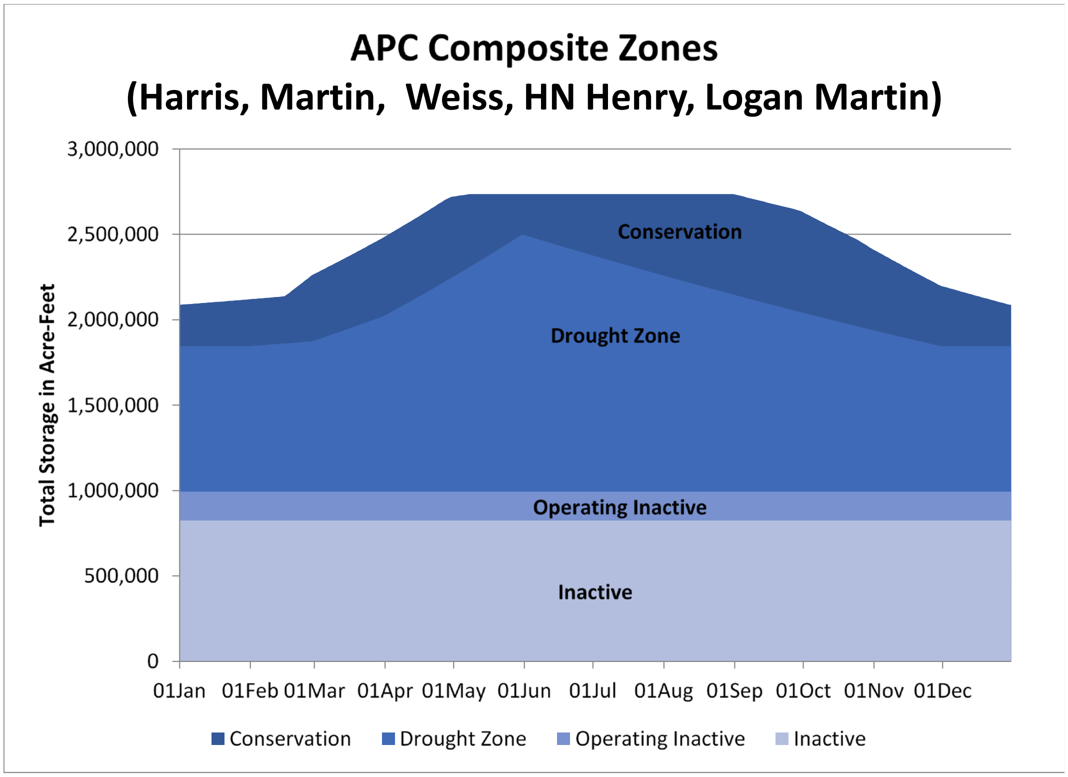

Figure 7-5 APC Composite Zones

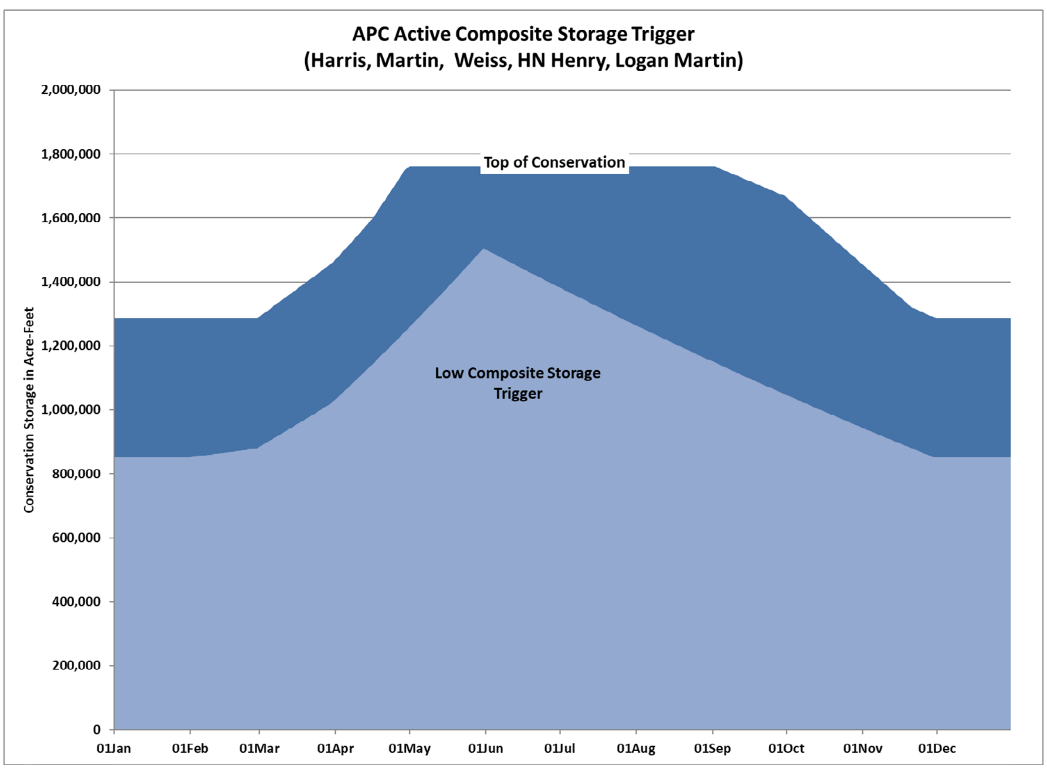

Figure 7-6 APC Low Composite Conservation Storage Drought Trigger

f. Operations for Corps Projects Downstream of Montgomery. Drought operations of the Corps' Alabama River projects (R. E. "Bob" Woodruff Lake [Robert F. Henry Lock and Dam], and William "Bill" Dannelly Lake [Millers Ferry Lock and Dam]) will respond to drought operation of the APC projects. When combined releases from the APC projects are reduced to 4,640 cfs, the Corps' Alabama River projects will operate to maintain a minimum flow of 6,600 cfs below Claiborne Lake. When the APCDOP requires flows less than 4,640 cfs, the minimum flow at Claiborne Lake is equal to the inflow into Millers Ferry Lock and Dam. There is inadequate storage in the Alabama River projects to sustain 6,600 cfs, when combined releases from the APC projects are less than 4,640 cfs.

g. Summary of Potential Drought Management Measures. Management measures developed for ACT Basin-wide drought operations consist of three major components:

- Headwater operations at Allatoona Lake and Carters Lake in Georgia
- Operations at APC projects on the Coosa and Tallapoosa Rivers
- Operations at Corps projects downstream of Montgomery

7-13. Flood Emergency Action Plans. The Corps is responsible for developing Flood Emergency Action Plans for the ACT System. The plans are included in the Operations and Maintenance Manuals for each system project. Example data available include emergency contact information and flood inundation information.

7-14. Other.

a. Correlation with Other Projects. Flood operations at Carters will be coordinated with Allatoona Dam to provide maximum flood protection at Rome, Georgia downstream. Flood releases from Carters will also be coordinated with the APC projects downstream. During lower flows and droughts, the Carters Project releases will follow the basin-wide drought plan.

7-15. Deviation from Normal Regulation. The District Commander is occasionally requested to deviate from normal regulation. Prior approval for a deviation is required from the Division Engineer except as noted in subparagraph a below.

Deviation requests usually fall into the following categories:

a. Emergencies. Examples of some emergencies that can be expected to occur at a project are drowning and other accidents, failure of the operation facilities, chemical spills, treatment plant failures, and other temporary pollution problems. Water control actions necessary to abate the problem are taken immediately unless such action would create equal or worse conditions. The Mobile District will notify the SAD 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 Mobile District Office 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 SAD Operations Branch of the declared emergency. The Division Operations Branch should then coordinate with SEPA, District Water Management, and 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. Normally, the ramp down rate for Reregulation Dam flows is 400 cfs every four hours to mitigate erosion and sloughing along stream banks of farmlands downstream. However, under certain conditions the Water Management Section in the Mobile District Office may adjust this ramp down rate.

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8 - EFFECT OF WATER CONTROL PLAN

8-01. General. The Carters Dam and Reregulation Dam is a multi-purpose project authorized for flood risk management, hydropower, recreation, fish and wildlife conservation, navigation, water quality, and water supply.

Authority for development of a dam on the Coosawattee River near Carters, Georgia, is contained in Section 2 of the River and Harbor Act adopted 2 March 1945 (Public Law 12, 79th Congress, 1st Session). This Act approved the initial and ultimate development of the Alabama-Coosa River and Tributaries for flood risk management, power generation, navigation and other purposes as outlined in House Document 414, 77th Congress. House Document No. 414, 77th Congress, 1st Session, did not prescribe a specific plan for the development of the Coosawattee River. At that time the comprehensive plan for the basin provided for an upper and lower dam on the Coosawattee River with an impounding dam on the Cartecay River. As a result of subsequent studies, a more complete development of the river by a single high dam at the lower site was found to be warranted. Modification of the two-dam plan was therefore authorized.

To provide for the authorized purposes, Carters Lake has a total storage capacity of 472,756 acre-feet at elevation 1,099 feet NGVD29. Of that, 141,402 acre-feet are usable for conservation purposes, 89,191 acre-feet are reserved for flood damage reduction, and 242,163 acre-feet are inactive storage. The top of conservation pool is at elevation 1,074 feet NGVD29 from 1 May to 1 November; transitioning to 1,072 feet NGVD29 from 1 November to 1 December; at elevation 1,072 feet NGVD29 from 1 December to 1 April; then transitioning back to elevation 1,074 feet NGVD29 between 1 April and 1 May. The benefits and effects of the project are described in the Sections below.

The impacts of the ACT Master Water Control Manual and its Appendices, including this water control manual have been fully evaluated in a Feasibility Report and Integrated Supplemental Environmental Impact Statement (FR/SEIS) that was published in November 2020. A Record of Decision (ROD) for the action was signed in August 2021. During the preparation of the FR/SEIS, a review of all direct, secondary and cumulative impacts was made. As detailed in the FR/SEIS, 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 FR/SEIS 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 of Carters is flood damage reduction. Carters Lake contains 89,191 acre-feet of flood risk management storage space between 1,099 and 1,074 feet NGVD29, 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 ACT Basin. While most of those events are of minor significance, on occasion, major storms produce widespread flooding or unusually high river stages. The main benefits of the flood risk management operations of the Carters Project are at Resaca and Rome, Georgia.

a. Spillway Design Flood. A spillway design flood series was adopted as the criteria in establishing the top of dam. The flood of January 1947, one of the largest volume floods of record, was assumed to precede the spillway design flood with its peak occurring five days before the peak of the spillway design flood. When routed through the five-gate spillway, this series reached a peak pool elevation of 1,107.3 feet NGVD29 with a maximum discharge of 197,800 cfs. Inflow-outflow-pool stage relationships for the routing of this flood using the five-gate emergency spillway are shown on Plate 8-1.

b. Standard Project Flood. Routing of the standard project flood required use of the spillway gate regulation schedule, when the pool exceeded elevation 1,099 feet NGVD29, but it was not necessary to utilize the spillway to its full capacity for this flood. When routed, the flood reached a peak pool elevation of 1,106.5 feet NGVD29 with a maximum discharge of 54,000 cfs. Inflow-outflow-pool stage relationship for this flood is shown on Plate 8-2.

c. Other Floods. The pre-record flood of March 1886 was the greatest known on the Oostanaula River and, in all probability, was equally severe in that portion of the basin above Carters Dam site. Other major floods of record resulted from the storms of April 1938, January 1947, March 1951, and April 1977. The flood of April 1938 is remarkable because of the even distribution of rainfall over the area. It produced the maximum stage of record at Ellijay and near record stages throughout the Oostanaula River Basin. The storm of January 1947, while not producing as large a peak discharge as some of the other storms, lasted for several days and would have caused a larger volume of water to be held in storage at Carters Dam during flood risk management operations. The storm of March 1951 resulted in record stages at Pine Chapel and Resaca below the Carters site and was of considerable severity in the basin above Carters Dam site. All floods of record, if Carters Dam would have been present, would have been confined to full power plant discharge (approximately 21,000 cfs) or less. Typical inflow-outflow-pool stage relationships for the January 1947 and March 1951 floods, two of the larger floods volume and peak-wise, are shown on Plates 8-3 and 8-4. The flood of March 2019, the largest since the completion of the project, produced a peak pool of 1,099.7 feet NGVD29 as shown on Plate 8-5.

Unlike previous storms summarized in this section, the high flows experienced in the upper ACT basin in February and March 2019 were not the result of a singular event but the result of unseasonably high rainfall that began in November 2018 and continued through early March 2019. The storm of February 2019 occurred at the end of a winter season marked by warmer than normal temperatures and well above normal rainfall in the northern ACT basin. As a result, the soils were saturated and there were low losses of rainfall into the soil from the storm. Instead, the rainfall converted largely into direct runoff, and high inflows to the northern projects were seen from approximately 19 until 24 February. By the time the rain ended, the northern ACT basin had received between 5 to 11 inches of rain, with the heaviest rain falling in the easternmost portion of the basin above the Allatoona project and in the vicinity of Calhoun, Georgia below the confluence of the Coosawattee and Conasauga Rivers (reference Figure 8-1). An isohyetal map of precipitation in February 2019 is at Figure 8-2.

Several gages in the upper ACT basin saw their levels rise into the minor flood zones and the critical downstream points at Rome, Georgia reached levels in the minor and moderate flood zones. Oostanaula River at Rome reached 29.7 feet about 5 feet above flood stage. Etowah River at GA Loop 1 barely reached its flood stage of 32 feet.

What made this rainfall period significant was the extended period of extremely wet weather and the new peak elevation of 1099.69 set at Carters Lake on March 4, 2019. The previous record peak at Carters was 1099.2 in April 1977.

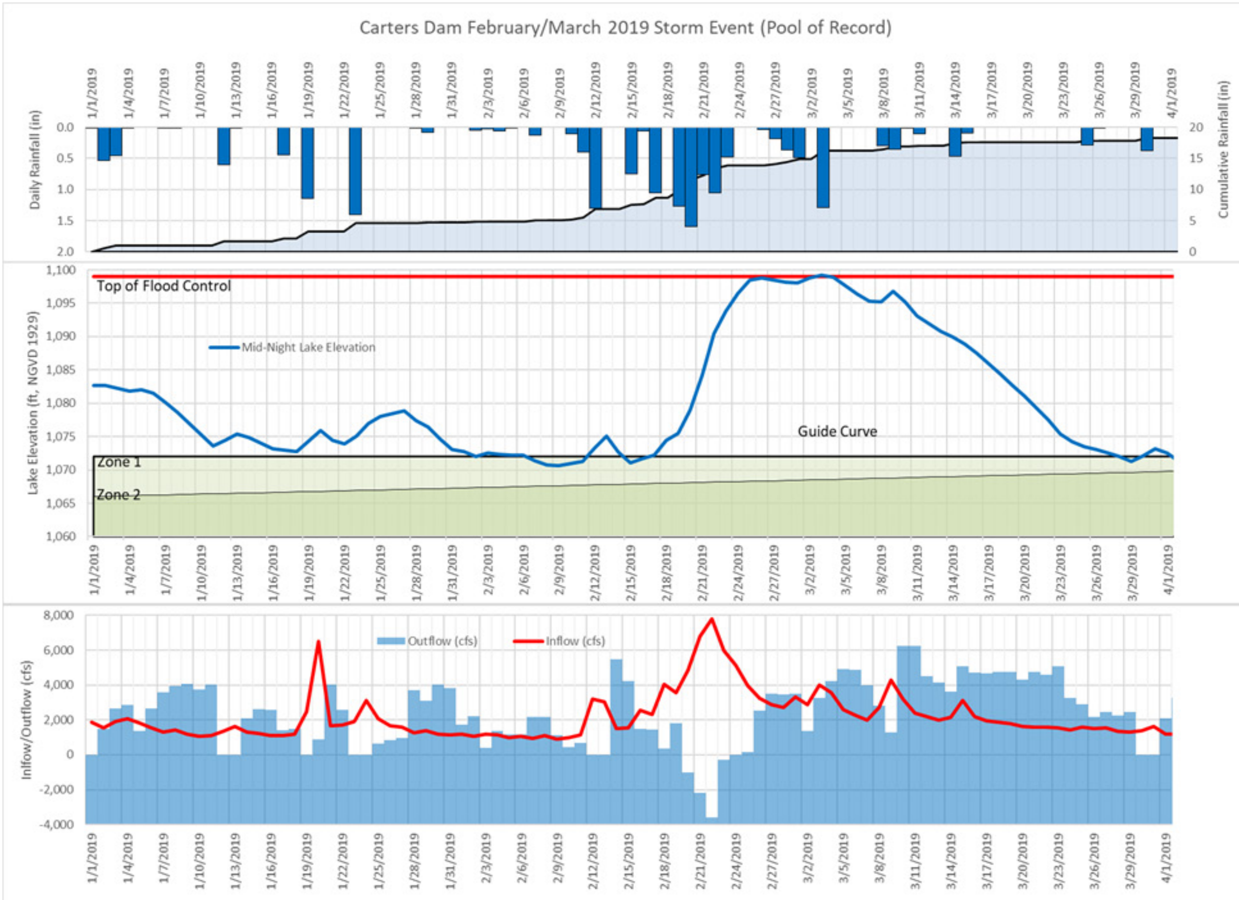

Figure 8-1 Carters Dam Inflow Outflow and Reservoir Level (1 January 2019–1 April 2019)

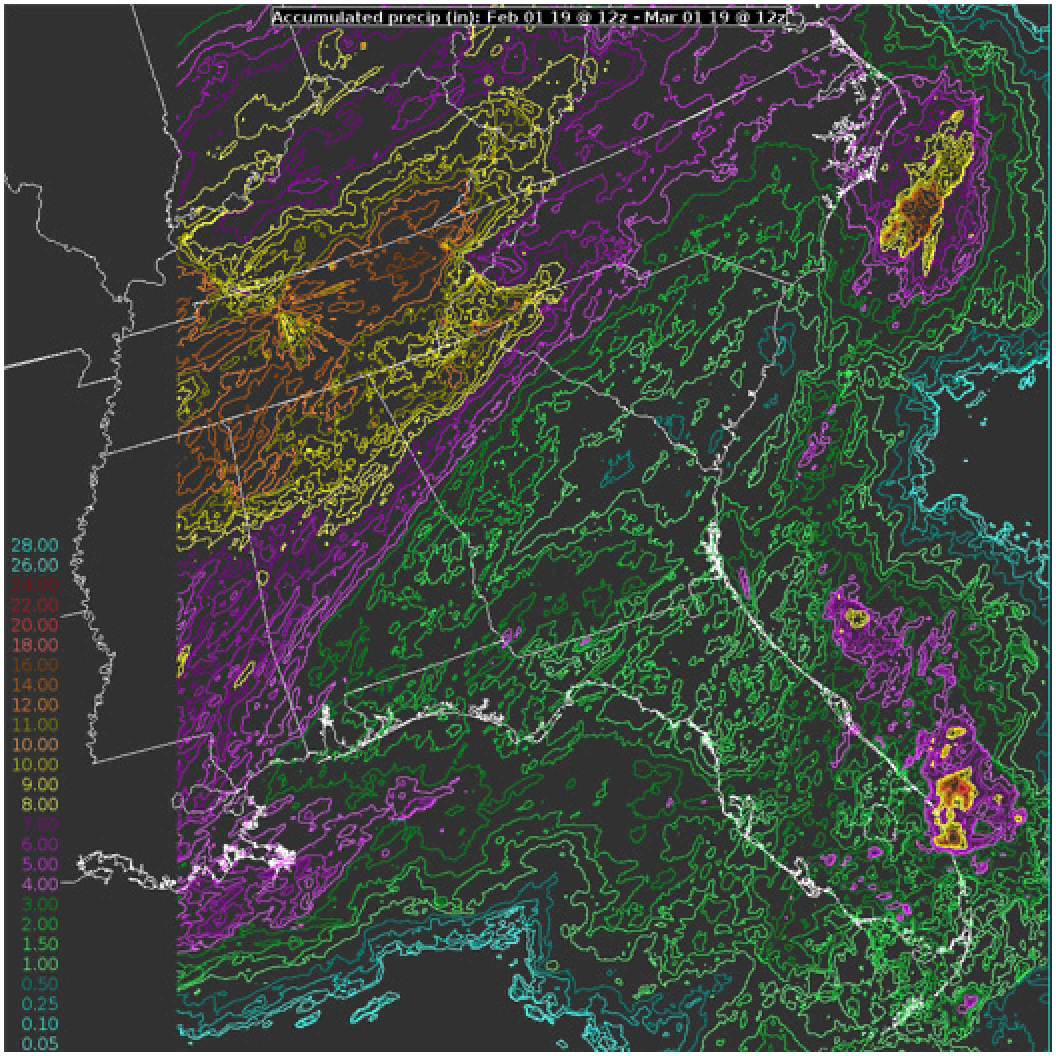

Figure 8-2 Precipitation Isohyetal (1 February 2019–1 March 2019)

8-03. Recreation. Carters Lake is a valued recreational resource, providing significant economic and social benefits for the region and the nation. The project contains 3,275 acres of water at summer conservation pool elevation of 1,074 feet NGVD29, plus an additional 8,514 acres of land, most of which is available for public use. A wide variety of recreational opportunities are provided at the lake including boating, fishing, camping, picnicking, water skiing, hunting, and sightseeing. Mobile District park rangers and other project personnel conduct numerous environmental and historical education tours and presentations, as well as water safety instructional sessions each year for the benefit of area students and project visitors.

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

a. Initial Impact Level. The Initial Impact Level is defined at lake elevation 1,068 feet NGVD29. At this level impacts are first observed and there is adequate time available to notify the public should the lake level continue to drop. Action is taken to prevent more serious and lasting impacts. Swimming area buoys at Harris Branch Beach are set out at approximately elevation 1,068 feet NGVD29 when the lake is at normal summer pool level of 1,074 feet NGVD29. At the initial impact level, gate attendants issue oral messages and written warnings to the public.

b. Recreation Impact Level. The lake elevation of 1,060 feet NGVD29 is defined as the Recreation Impact Level. At this level action must be taken to prevent significant impacts from occurring. At the level of 1,060 feet NGVD29, the dangers to those participating in water-based recreation activities would increase due to hazardous conditions. Steps are taken to alert the marina staff and public of existing dangers. Woodring Campground and Doll Mountain Day Use boat ramps are closed to the public when water level is below 1,060 feet NGVD29. At elevation 1,060 feet NGVD29, the Harris Branch Beach is closed. The designated swimming area buoys are completely out of the water and cannot be moved.

c. Water Access Limited Level. The lake elevation of 1,055 feet NGVD29 is defined as the Water Access Impact level. At this elevation, public access to the water is severely limited. Action is taken to retain this limited access. If navigational hazards appear, they will be temporarily marked with buoys or signs for boater safety. Marina slips are still usable, but dock walkways slope severely from the shoreline. At elevation 1,055 feet NGVD29, Ridgeway boat ramp, Woodring Branch day use area boat ramp and Damsite boat ramps are closed. At elevation 1,060 feet NGVD29, the Harris Branch Beach is closed. The designated swimming area buoys are completely out of the water and cannot be moved.

Table 8-1 shows the lake elevation for each impact level and the percent of time over a 70-year simulation of the proposed operation that each impact level would be reached at Carters Lake.

Table 8-1 Carters Lake Recreational Impact Levels

	Number of Triggered Events Over Period of Record	**Percent of time pool level falls below level**
Initial Impact level (1,068 ft NGVD29)	679	2.7%
Recreation Impact level (1,060 ft NGVD29)	58	0.2%
Water Access Limited level (1,055 ft NGVD29)	0	0.0%

Carters Lake also has a High Water Action Plan that establishes guidelines to determine areas impacted by high water levels during the normal recreation season and the actions to be taken by Operations personnel for each stage. The facilities affected from high lake levels are described in Table 8-2.

Table 8-2 High Water Impacts on Recreation Facilities

Elevation (feet)	Recreation Facility
1074.0	Full Pool
1076.0	Harris Beach – Sand on lower beach covered
1078.0	Doll Day Use – Water above concrete wall in lower picnic area
1083.0	Woodring Campground – Site 15 water on power pedestal; turn off power to Sites 9, 11, 13 and 15
1087.0	Woodring Camping – Road to Sites 16 – 42 unaffected Sites 9, 11, 13 and 15 – Power turned off at 1,083' Sites 15, 30, 40, and 42 flooded
1087.7	Woodring Camping – Road to Sites 16 – 42 under water 2-3" deep Harris Branch and Doll Mountain Campgrounds – All campsites unaffected Woodring Day Use Ramp – 2-3" water in lower parking lot near picnic tables; ramp unaffected Woodring Day Use Picnic Shelter – 6" water on access trail
1088.5	Woodring Day Use Area ramp closed
1088.7	Damsite Ramp – Water covering low spot near fee vault; upper parking lot access covered by 1-3" water Doll Day Use Ramp – Turn around to launch unaffected Woodring Day Use Ramp – Lower parking lot covered with water 2-6" deep; ramp and upper parking lot unaffected
1089.0	Damsite Park is closed
1090.0	Doll Day Use Ramp – Turn around covered, launching possible by backing in from upper parking lot Woodring Day Use Ramp – Launching area covered, lower parking lot under water Doll Mountain Campground – Water on Site 20 tent pad Damsite – Call Georgia Power to have power turned off before water covers road or boat will be needed to access transformer
1093.8	Damsite Georgia Power Transformer – Water at base of transformer box

8-04. Water Quality. In the main reservoir, water quality is typically better in the middle of the reservoir than in the more enclosed inlets and upper arms. Sediment and nutrient concentrations are greatest in the upper tributaries and decrease towards the main body of the pool. As with other reservoirs, Carters Lake acts as a sink removing sediments and nutrients from downstream reaches. During the summer, thermal and dissolved oxygen stratification occurs. Both are greatest in the upper levels of the water column and colder, oxygen depleted water occurs at lower levels. Chlorophyll *a* concentrations tend to be greatest during the warm summer months. Because of the nature of the lake and its associated stratification, hydropower generation can release cold, oxygen depleted water to downstream reaches of the river. In addition, drought conditions can result in reduced hydropower generation and lowered downstream flows at a time when such flows are critically needed by downstream organisms.

The proposed operational procedures are designed to help reduce water quality impacts. By varying the minimum flow releases throughout the year, water quality will be improved due to greater aeration in the water column and changes in water temperature. Aeration is needed because it increases dissolved oxygen levels which have a direct impact on flora and fauna. The variable month to month minimum flow releases would provide adequate flow for water quality and aquatic ecosystems while allowing water conservation during critical periods. Those improved flows would provide both improved water quality and additional spawning and migration habitat during spring and early summer when many organisms are most active.

8-05. Fish and Wildlife. Because of the type of project and the depth of the reservoir (average depth of about 380 feet, maximum depth of 410 feet), and the makeup of fish populations occurring within the watershed prior to impoundment, regulation of the project for fish and wildlife within the main lake is not possible. The daily fluctuations of the main reservoir can be up to four feet which may have a detrimental effect on fish spawning in the lake.

However, project operations do enhance the aquatic ecosystem in the Coosawattee River downstream of the Carters Reregulation Dam. In 2000, 2003, and in the Planning Aid Letter for the Environmental Impact Statement (EIS) prepared for the update to the ACT Water Control Manuals, USFWS identified a seasonal varying minimum flow from the Reregulation Dam. As a result, seasonal minimum releases shown on Figure 7-2 were incorporated into the operation and two Action Zones added to the conservation storage. In action Zone 1, minimum flow releases at Carters Reregulation Dam would be equal to or greater than the seasonal minimum shown on Figure 7-2. If Carters Lake were in action Zone 2, minimum flow releases from the Carters Reregulation Dam would be 240 cfs. The project is operated to comply with the Endangered Species Act of 1973. The USFWS by letter dated 20 March 2014, concurred that operation of the project, along with the other ACT projects would either have no effect or may affect but is not likely to adversely affect listed species in the basin.

8-06. Water Conservation/Water Supply. Under the authority of the Water Supply Act of 1958, the Corps allocated storage in Carters Lake in 1991 for municipal and industrial water supply by entering into a storage contract (Contract Number DACW01-9-91-481) with the City of Chatsworth, Georgia (Figure 8-3). The contract provides for the use of an undivided 0.61 percent (estimated to contain 818 acre-feet after adjustment for sediment deposits) of the conservation storage space between elevations 1,022 - 1,072 feet NGVD29 (134,900 acre-feet) for water supply. This amount of storage stated in the contract was estimated, at the time the contract was executed, to yield 2.0 mgd during the critical drought, i.e., during the worst drought on record at the time the contract was executed. The severity and frequency of droughts change over time, however, and more recent storage-yield analysis by the Corps has indicated that the estimated yield of Carters Lake storage has decreased. For the purpose of managing water supply storage, the Mobile District has employed a systematic storage accounting methodology that tracks multiple storage accounts, applying a proportion of inflows and losses (e.g. evaporation), 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 storage, which will naturally change over time.

The necessary data to determine water supply storage availability are received daily, with computations performed weekly during normal conditions and daily under extreme drought conditions. This accounting is especially critical during drought, when available water supply storage is reduced and conservation measures or alternative sources may be necessary. The formula used to calculate water supply storage is shown below:

Users Ending Storage = Users Beginning Storage + Inflow Share – Loss Share – User's Usage.

(with constraint that "Users Ending Storage" cannot be larger than User's total storage)

The conservation pool is drawn down as water usage exceeds inflow. The entire pool is drawn down and the individual accounts are also drawn down at different rates based on their usage. Users will be notified on a weekly basis of the available storage remaining once their storage account balance drops below 30 percent.

Figure 8-3 The City of Chatsworth Water Intake Structure

8-07. Hydroelectric Power. The Carters Dam Hydropower Project, along with nine other hydropower dams located in Georgia, Alabama, and South Carolina comprise the GA-AL-SC System, one of SEPA's four power systems providing energy throughout the Southeastern United States. Other projects within the GA-AL-SC System include Allatoona, Buford, West Point, W.F. George, R.F. Henry, Millers Ferry, Hartwell, Russell, and Thurmond. SEPA sells hydroelectric power generated at Carters 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.

From FY 2000-2011, the Carters Project has provided generation of 5,650,244 MWh of the total generation in the GA-AL-SC System of 37,720,506 MWh, or approximately 15 percent of the system generation.

The projects with hydropower capability provide three principal power generation benefits:

1. Hydropower helps to ensure the reliability of the electrical power system in the SEPA service area by providing dependable capacity to meet annual peak power demands. For most plants, this 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.

2. The 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 burning of fossil fuels, thereby reducing air pollution. The value of the energy and capacity produced at Carters Project was estimated at $27 million in 2021.

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

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

8-08. Navigation. Specific releases from the Carters Project to meet navigation flows are not part of the routine regulation plan. The seasonal variation in reservoir storage does redistribute downstream flows providing benefits to navigation.

8-09. Drought Contingency Plans. The importance of drought contingency plans has become increasingly obvious as more demands are placed on the water resources of the basin. During low-flow conditions, the system might not be able to fully support all project purposes. 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. For the Carters Project, the Corps will coordinate water management during drought with other federal agencies, private power companies, navigation interests, states, and other interested state and local parties as necessary. Drought operations will be in compliance with the plan for the entire ACT Basin as outlined in the ACT Master Water Control Manual. The plan includes operating guidelines for drought conditions and normal conditions. It is important to recognize that Carters Dam would be operated as an element of the total water control plan for the basin. Outflows from the project would be determined by total basin-wide needs, both upstream and downstream.

Drought operations at Carters would consist of progressively reduced hydropower generation as the lake level declines due to lower inflows. When the lake level drops into Action Zone 2, the minimum flows from the Reregulation Dam would be reduced from the seasonal varying flows to the minimum flow of 240 cfs.

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

8-11. Frequencies. The Carters Main Pool Peak Pool Frequency and Peak Inflow Frequency for the operation plan are shown on Figure 8-4 and Figure 8-5. Figure 8-6 shows the Carters Pool Elevation Annual Duration Curve, which represents the percent of days in the period of record in which the elevation, recorded at midnight, was higher than a specific elevation. The period of record for Figure 8-4 through Figure 8-6 is 1975–2010.

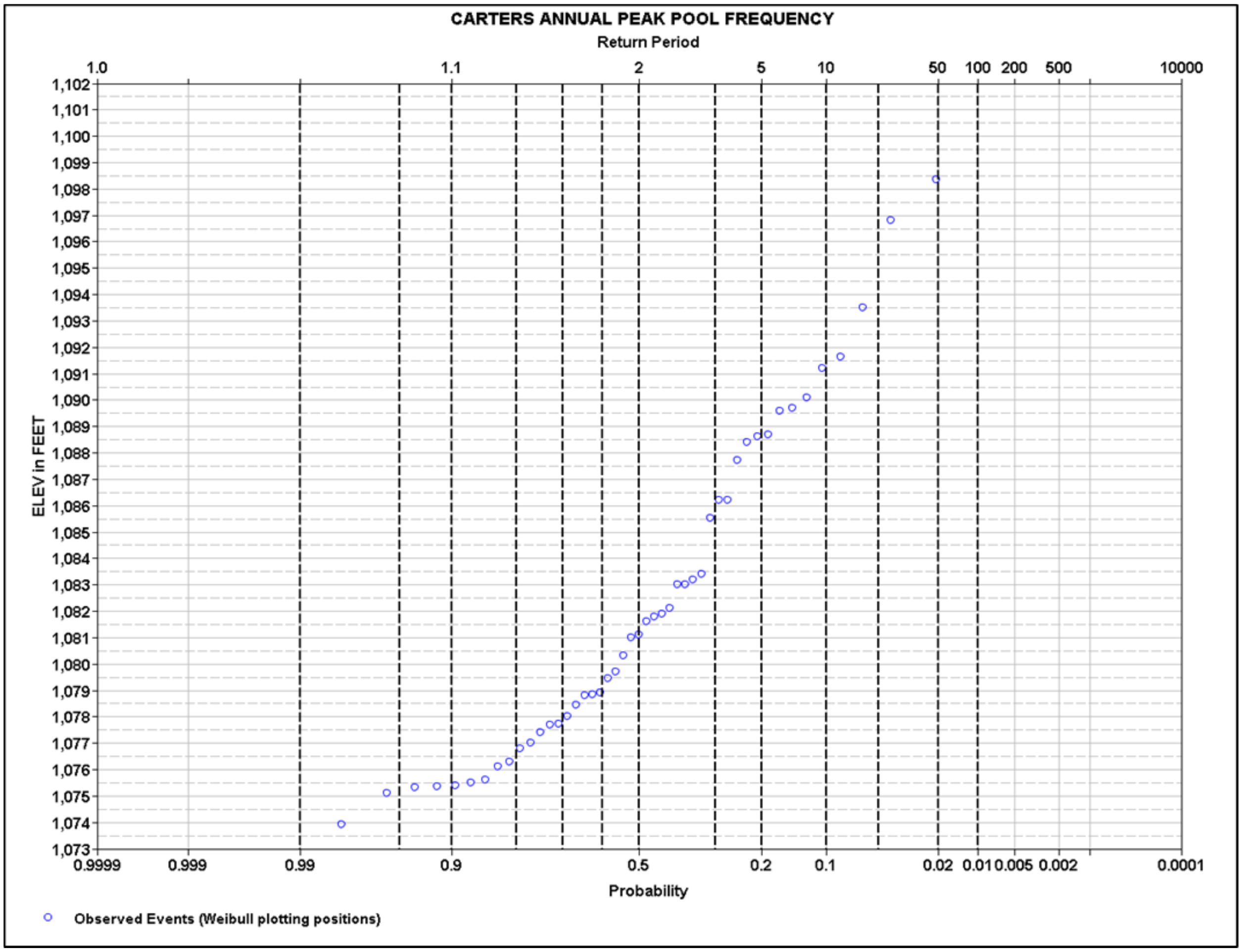

Figure 8-4 Carters Annual Peak Pool Frequency, Period of Record 1975-2021

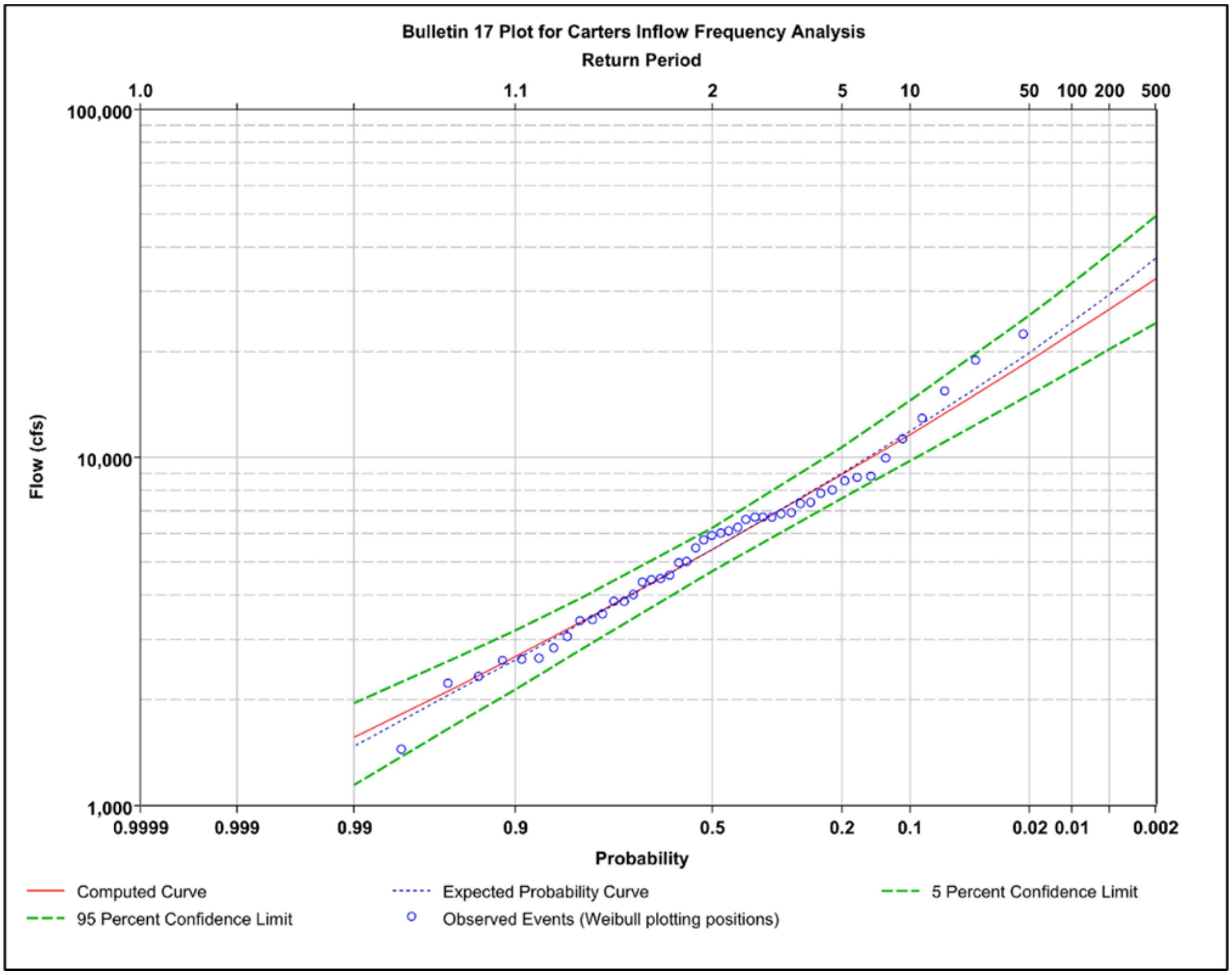

Figure 8-5 Carters Peak Inflow Frequency (1975–2021)

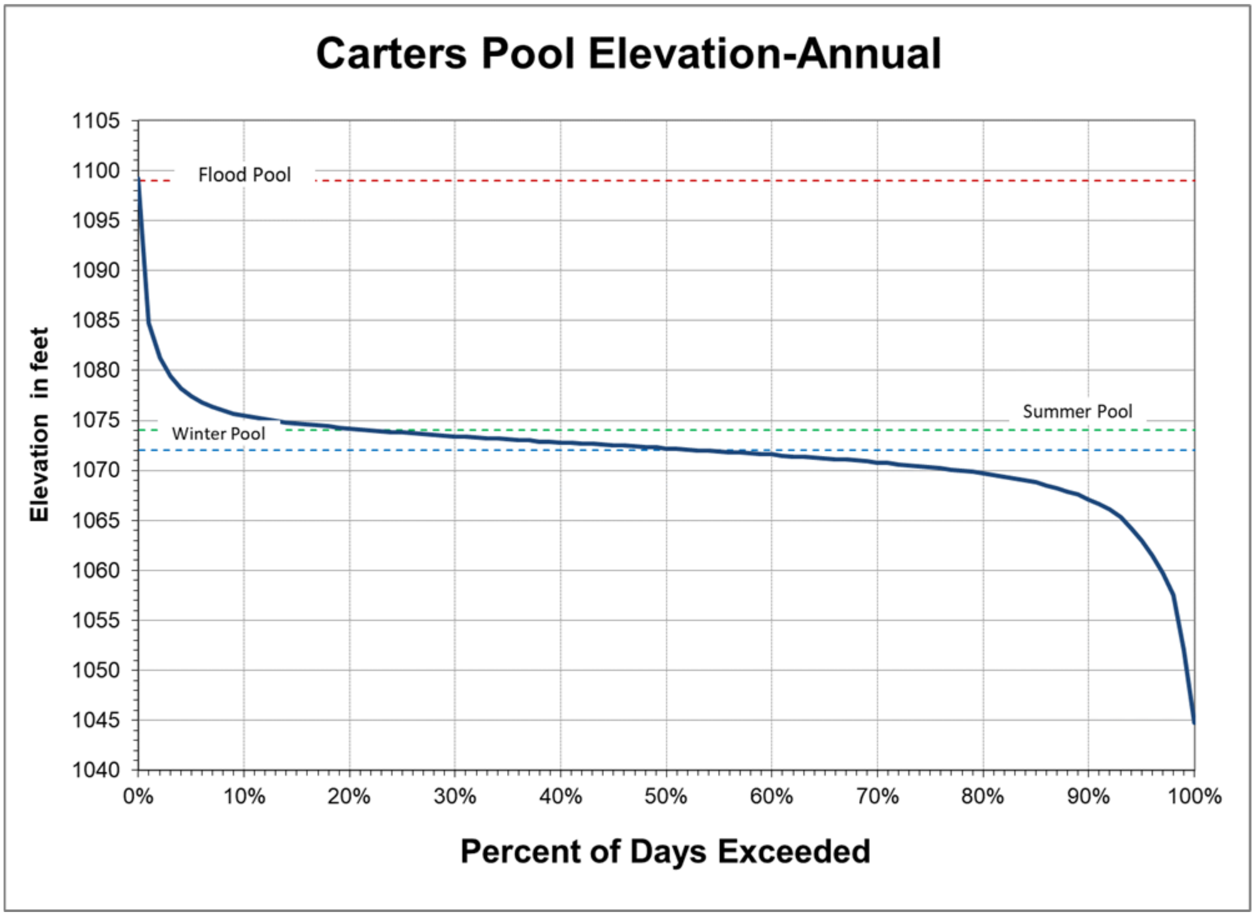

Figure 8-6 Carters Pool Elevation Annual Duration (1975–2021)

The influence of the Reregulation Dam is shown in the Headwater and Tailwater rating curves for the Reregulation Dam area shown on Plate 8-6.

The estimated frequencies of peak flow at Pine Chapel, and Resaca with the Carters regulation plan are shown on Plates 8-7 and Plate 8-8. Frequencies of peak flow at Rome (Oostanaula River) and Rome (Coosa River at Mayo's Bar) are shown on Plate 8-9 and Plate 8-10. Annual maximum and minimum pool elevations and pool frequencies for the Carters Main Dam are shown on Plates 8-11 through Plate 8-13.

8-12. Other Studies. In early 2010, the Corps, Mobile District, developed updated critical yields for the Allatoona and Carters Projects in the ACT Basin in response to the following language in the FY 2010 Energy & Water Development Appropriations Bill, 111th Congress, 1st Session:

> Alabama-Coosa-Tallapoosa [ACT], Apalachicola-Chattahoochee-Flint [ACF] Rivers, Alabama, Florida, and Georgia - The Secretary of the Army, acting through the Chief of Engineers, is directed to provide an updated calculation of the critical yield of all federal projects in the ACF River Basin and an updated calculation of the critical yield of all federal projects in the ACT River Basin within 120 days of enactment of this act.

Robert F. Henry Lock and Dam, Millers Ferry Lock and Dam and Claiborne Lock and Dam are federal projects in the ACT Basin that were excluded from the critical yield analyses because they are run-of-river impoundments with little or no usable water storage and cannot significantly contribute to critical yield.

Critical yield provides the basis from which water stored in a reservoir is allocated to various project purposes. The volume of water stored in a reservoir can be allocated to a specific project purpose (e.g., hydropower or water supply) based on a percent of critical yield. A change in critical yield may result in modification of the allocations for a project purpose.

The impacts of the river withdrawals on the critical yield can be quantified by computing the critical yield with and without diversions. Withdrawals for the year 2006 was used in the analyses and showed that river withdrawals had a measurable impact, reducing critical yield as much as 5 percent at Allatoona Dam but only 0.8 percent at Carters Dam. The critical yield for Carters was determined to be 390 cfs without diversions and 387 cfs with diversions. The critical drought for the period of record occurred in 2007.

In 2000, 2003, and in the Planning Aid Letter for the EIS (USFWS 2010a), USFWS identified the need for a seasonal varying minimum flow from the Reregulation Dam. As a result, seasonal minimum releases were incorporated into the operation and two Action Zones added to the conservation storage and are shown on Figure 7-2.

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9 - WATER CONTROL MANAGEMENT

9-01. Responsibilities and Organization. Many agencies in Federal and State governments are responsible for developing and monitoring water resources in the ACT Basin. Some of the Federal agencies are 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. In addition to the Federal agencies, each State has agencies involved: GAEPD, the Coosa-North Georgia Regional Water Planning Council, and the Alabama Department of Environmental Management, Alabama Office of Water Resources.

a. USACE. Authority for water control regulation of the Carters Project has been delegated to the SAD Commander. The responsibility for water control regulation activities has been entrusted to the Mobile District. Water control actions for the Carters Project are regulated to meet the federally authorized project purposes at Carters in coordination with other authorized projects in the ACT Basin. It is Mobile District's responsibility to develop water control regulation procedures for the Carters Project. The Water Management Section monitors the project for compliance with the approved water control plan. In accordance with the water control plan, the Water Management Section performs water control regulation activities that include determination of project water releases, daily declarations of water availability for hydropower generation and other purposes; daily and weekly reservoir pool elevation and release projections; weekly river basin status reports; tracking basin composite conservation storage and projections; determining and monitoring daily and seven-day basin inflow; managing high-flow operations and regulation; and coordination with other District elements and basin stakeholders. When necessary, the Water Management Section instructs the project operator regarding normal water control regulation procedures and emergencies, such as flood events. Personnel at Carters Dam are under the direct supervision of a Power Project Manager and Operations Project Manager. The Water Management Section communicates directly with the powerhouse operators at the Carters Dam Powerhouse and with other project personnel as necessary. The Water Management Section is also responsible for collecting historical project data and disseminating water control information, such as historical data, lake level and flow forecasts, and weekly basin reports within the agency, to other federal, state, and local agencies and to the general public. The web address for water management data is http://www.sam.usace.army.mil/Missions/CivilWorks/WaterManagement.aspx.

b. Other Federal Agencies.

1) The NWS is the federal agency in NOAA that is responsible for weather warnings and weather forecasts. With support from the Corps NWS Cooperative Gaging program, the NWS forecast offices, along with SERFC, maintain a network of rainfall and flood reporting stations throughout the Carters Watershed and the ACT Basin. It continuously provides weather conditions and forecasts. The SERFC prepares river forecasts and provides the official flood stage forecasts along the ACF Rivers. Often, it prepares predictions on the basis of what if scenarios, such as QPF – a prediction of the spatial precipitation across the United States and the region. The Corps, NWS, and SERFC share information regarding rainfall, project data, and streamflow forecasts. In addition, the NWS provides information on hurricane forecasts and other severe weather conditions. It monitors drought conditions and provides the information to the public.

2) The USGS is an unbiased, multidisciplinary science organization that focuses on biology, geography, geology, geospatial information, and water. The agency is responsible for

the timely, relevant, and impartial study of the landscape, natural resources, and natural hazards. Through the Corps–USGS Cooperative Gaging program, the USGS maintains a comprehensive network of gages in the ACT Basin.

3) 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 nearly 500 preference customers in Georgia, Florida, Alabama, Mississippi, southern Illinois, Virginia, Tennessee, Kentucky, North Carolina, and South Carolina.

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

b. 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.

c. SEPA schedules the hourly generation for the Carters power project at the direction of the Corps on the basis of daily and weekly water volume availability declarations and water release requirements.

4) The USFWS is an agency within 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 Corps also coordinates with the USFWS on water resource actions under the auspices of the Fish & Wildlife Coordination Act. The Corps, Mobile District, with support from the Water Management Section, coordinates water control actions and management with USFWS in accordance with both laws.

c. State, County and Local Agencies.

1) 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.

1) Alabama. The Alabama Office of Water Resources (OWR) administers programs for river basin management, river assessment, water supply assistance, water conservation, flood

mapping, the National Flood Insurance Program, and water resources development. Further, OWR serves as the state liaison with Federal agencies on major water resources related projects, conducts any special studies on instream flow needs, and administers environmental education and outreach programs to increase awareness of Alabama's water resources.

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

d. Stakeholders. Many non-federal stakeholder interest groups are active in the ACT Basin. The groups include lake associations, municipal and industrial (M&I) water users, navigation interests, environmental organizations, and other basin-wide interest groups. Coordinating water management activities with the 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 ACT Master Water Control Manual includes a list of state and Federal agencies and active stakeholders in the ACT Basin that have participated in the ACT Basin water management teleconferences and meetings.

e. APC. The APC owns and operates hydropower projects downstream of Carters Project throughout the Coosa Basin. These projects are discussed in the ACT Master Water Control Manual.

9-02. Interagency Coordination.

a. Local press and USACE Bulletins. The local press consists of periodic publications in or near the Carters watershed and the ACT Basin. Montgomery, Gadsden, Anniston, and Birmingham, Alabama and Rome and Atlanta, Georgia have some of the larger daily papers. The papers often publish articles related to the rivers and streams. Their representatives have direct contact with the Corps through the Public Affairs Office. In addition, they can access the Corps Web pages. 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 Districts' Water Management homepage https://www.sam.usace.army.mil/Missions/Civil-Works/Water-Management/. The Mobile District Public Affairs Office issues press releases as necessary to provide the public with information regarding Water Management issues and activities. During the hurricane season, the Water Management Section posts tropical updates to District and Division elements. The Mobile District Public Affairs Office issues press releases as necessary to provide the public with information regarding Water Management issues and activities. During floods, the Water Management Section prepares daily flood notices in cooperation with the Emergency Management Branch of Operations Division of the Mobile District Office.

b. NWS. Interagency data exchange has been implemented with the SERFC and real-time products generated by NWS offices are provided to the Corps via the network discussed in Section 5-04. Since the NWS has the legal responsibility for issuing flood forecast to the public and for disseminating the information to the public, the Corps relies heavily on these products in their operation of the ACT River system, especially during high water events. Data collected by the Corps and information regarding the daily operational activities at Corps projects may be shared with the SERFC to aid in their stage forecast development. The Corps also provides funding for a network of rainfall gages that are maintained by the NWS.

c. USGS. The Corps interacts with the USGS through the Corps–USGS Cooperative stream gage program in which the Corps provides funding for numerous river stage gages throughout the ACT basin. This involves periodic exchange of stream and rainfall gage data and service calls to the USGS when necessary. The Corps and USGS meet on an annual basis to review the gage program, explore opportunities to improve the program, and address any issues or needs.

d. SEPA. Interaction between the Corps and SEPA occurs typically on a weekly basis but can occur more often when variations to power schedules or changes to discharge requirements at a specific project occur. The Corps prepares a weekly declaration for the power projects on both the ACT and ACF Basins based on operational needs at these projects and to meet the weekly system power allocation for the Mobile District projects. As hydrologic conditions or other demands on the system change, a request to SEPA may be made to adjust generation schedules. Consequently, SEPA may contact Water Management to get approval on changes they may need at a specific project to meet the system power needs.

9-03. Interagency Agreements. Refer to the Master Manual for discussion of interagency agreements for the ACT basin projects.

9-04. Commissions, River Authorities, Compacts, and Committees. Refer to the Master Manual for discussion of these subjects.

9-05. Non-Federal Hydropower. Refer to the Master Manual for discussion of non-federal hydropower in the ACT basin.

9-06. Reports.

a. As early as possible every day (preferably between 4:00 and 6:00 a.m.), and at other times upon request, the Project Operator operating agency shall provide to the CESAM Water Management Section the Operational Data Requirements. Data shall be distributed via automatic electronic transmittal. The operational data may include midnight pool elevation, 24-hour average inflow and discharge, 4-hour (midnight to 4:00 a.m.) inflow and discharge, 4:00 a.m. pool elevation, gross and estimated generation.

b. An After-Action Report will be generated after each flood event. These reports will be archived, utilized to provide narrative for annual flood damage reports and made available upon request to SAD.

c. Automated reports are generated daily/weekly/monthly and made available through the Corps server; ACT Basin Daily Report, ACT 10-day Forecast, River Bulletin, ACT-ACT Report Summary, Lake Level 4-Week Forecast, and Average Daily Inflow to Lakes by Month.

d. The District River System Status – Weekly summary of activities on the Mobile District river systems is updated weekly and published to the webpage.

e. The hourly power generation schedule is generated and posted to by 4:00 p.m. CT. Available for viewing are tomorrow’s schedule, plus the previous 5 days.

f. Any Corps-requested information, such as monthly charts, short-term hydrologic reports, emergency regulation reports, graphical and tabular summaries, and flood situation reports shall be provided in a timely manner.

9-07. Framework for Water Management Changes. Special interest groups often request modifications of the basin water control plan or project specific water control plan. The Carters Project and other ACT 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 evaluating reservoir regulations and reservoir systems to ensure their most efficient use. Within the constraints of Congressional authorizations and engineering regulations, the water control plan and operating techniques are often reviewed to see if improvements are possible without violating authorized project functions. When deemed appropriate, temporary deviations to the water control plan approved by SAD can be implemented to provide the most efficient regulation while balancing the multiple purposes of the ACT Basin-wide System.

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EXHIBIT A

SUPPLEMENTARY PERTINENT DATA

EXHIBIT A

SUPPLEMENTARY PERTINENT DATA

LOCATION AND PURPOSE

Location. The project site is located on the Coosawattee River in Gordon County, Georgia. The Main Dam is located at mile 26.8 and the downstream Reregulation Dam is located at mile 25.3. Carters Project is designed primarily for flood risk management and hydroelectric power. Flow regulation, recreation, fish and wildlife conservation, and water quality control are additional benefits of the project.

GENERAL

Main Dam Drainage Area, sq. mi.	374
Reregulation Dam Drainage Area, sq. mi.	520
Talking Rock Creek Drainage Area, sq. mi.	146
Primary flood risk mgt. pool elevation, feet NGVD29	1,099
Winter top of conservation pool elevation, feet NGVD29	1,072
Summer top of conservation pool elevation, feet NGVD29	1,074
Bottom of conservation pool elevation, feet NGVD 29	1,022
Maximum drawdown, feet	52
Area of primary flood risk management pool, acres (1,099 ft NGVD29)	3,880
Area of maximum power pool, acres (1,074 ft NGVD29)	3,275
Area of minimum power pool, acres (1,072 ft NGVD29)	2,196
Shoreline miles (@ elevation 1,074 ft NGVD29)	62.7
Flood storage volume, acre-feet (1,099 – 1,074 ft NGVD29)	89,191
Power storage volume, acre-feet (1,074 – 1,022 ft NGVD29)	141,402
Inactive storage volume, acre-feet (below 1,022 ft NGVD29)	242,163
Maximum elevation of clearing, feet NGVD29	1075

SPILLWAY DESIGN FLOOD

Natural peak discharge at dam site, cfs	194,200
Peak inflow to full reservoir, cfs	203,100
Regulated peak outflow, cfs	197,800
Regulated peak headwater, feet NGVD 29	1,107.2

STANDARD PROJECT FLOOD

Natural peak discharge at dam site, cfs	97,600
Natural peak stage at dam site, feet NGVD29	716.8
Peak inflow to full reservoir, cfs	102,000
Peak inflow to reregulation pool, cfs	90,400
Regulated peak outflow, cfs	54,000
Regulated peak headwater, feet NGVD29	1,106.5
Regulated peak tailwater, feet NGVD29	707.0

MAIN DAM AND DIKES

ROCKFILL DAM	
Top elevation, feet NGVD29	1,112.3
Top width, feet	40
Length, feet	2,053
Maximum height, feet above foundation	445
Upstream slope	1 on 1.9
Downstream slope	1 on 1.8
Freeboard, top of dam above Spillway Design Flood, feet	5.1
EARTHFILL SADDLE DIKES	
Top elevation, feet NGVD29	1,112.3
Top width, feet	30
Number of dikes	3
Total length, feet	700
Maximum height, feet	40
Side slopes	1 on 2.5
Upstream slope protection	dumped rock
Freeboard, top of dikes above Spillway Design Flood, feet	5.1

EMERGENCY GATED SPILLWAY

GENERAL	
Total length, including end piers, feet	262
Net length, feet	210
Elevation of crest, feet NGVD29	1,070.0
Type of gates	tainter
Number of gates	5
Length of Gates, feet	42
Height of Gates, feet	36.5
Top of Gates, Closed, elevation feet NGVD29	1,106.0

DIVERSION TUNNEL

GENERAL	
Length, feet	2,407
Shape	horseshoe
Lining	none
Bottom width, feet	23
Maximum height, feet	23

EMERGENCY LOW LEVEL SLUICE

GENERAL	
Number of sluices	1
Total length of tunnel, feet	2,712
TUNNEL UPSTREAM OF GATE STRUCTURE	
Length of tunnel, feet	1,198
Shape	circular
Lining	concrete
Nominal diameter of excavated tunnel, feet	19.5
Diameter of lined tunnel, feet	16.5
Invert elevation at upstream portal, feet NGVD29	725
GATE STRUCTURE	
Length of structure, feet	62
Number of water passages	2
Invert elevation of water passages, feet NGVD29	723
Number of gates per passage	2
Total number of gates	4
Type of gates	slide
Height of gates, feet	10
Width of gates, feet	5
Type of operating machinery	hydraulic
Nominal diameter of excavated shaft for combined emergency access and air vent, feet	10
TUNNEL DOWNSTREAM OF GATE STRUCTURE	
Length of tunnel, feet	1,452
Shape	horseshoe
Lining	none
Bottom width, feet	22
Maximum height, feet	22
Length of concrete splash apron, feet	200
Invert elevation at downstream portal, feet NGVD29	710
DOWNSTREAM CHANNEL	
Length, feet	640
Maximum bottom width, feet	50
Side slopes:	
Sound rock	4 on 1
Weathered rock	1 on 1
Overburden	1 on 2
Bottom elevation at downstream end of channel, feet NGVD29	700

POWER INTAKE

GENERAL	
Number of intake structures	2
HEADRACE	
Length (approximate), feet	1,600
Width (minimum section), feet	200
Side slopes	4 on 1
Bottom elevation, feet NGVD29	979.0
INTAKE STRUCTURES	
Top elevation, feet NGVD29	1,112.5
Width of each structure, feet	94
Length of base, feet (excluding transition)	51
Maximum height, feet	138.5
Type of head gate	tractor
Number of head gates, each structure	2
Height of gate, feet	20.5
Width of gate, feet	14
Type of operation	fixed hoist
Elevation of operating deck, feet NGVD29	1,112.5
PENSTOCKS	
Number	4
Length of conventional unit penstocks, feet	835
Length of pump-turbine unit penstocks, feet	838
Nominal diameter of excavated tunnel, feet	23
Inside diameter of steel-lined penstock, feet	18
Minimum thickness of concrete liner, inches	30

POWER DATA

GENERAL	
Number of units	4
Capacity: 2 @ 140,000 and 2 @ 160,000 kW (declared values)	600,000
Capacity: 4 @ 144,000 kW (nameplate values)	575,000
Dependable plant output during critical period, kW	500,000
Operating head at maximum power pool, feet	396
Minimum head at full drawdown, feet	324
Maximum head loss at 115% generator rating, feet	4.8
Maximum discharge per unit at 115% generator rating (conventional unit), cfs	5,400
Maximum discharge per unit at 115% generator rating (pump-turbine unit), cfs	5,400
Discharge each pump-turbine unit at 385 feet total head, cfs	3,765
Maximum discharge at minimum power pool, elev. 1022, (estimated for 4 units), cfs	20,900

GENERATING UNITS 1 AND 2 ONLY	
Speed-RPM	163.6
Spacing of units, center to center, feet	63
Turbines	
Type	Francis, clockwise rotation
Capacity, guaranteed at 345.0 feet net head, HP, each	172,000
Capacity, guaranteed at 393.0 feet net head, HP, each	199,000
Spiral cases	Plate steel
Draft tubes	Concrete elbow, three discharge/intake passages
Generators	
Type – Vertical shaft, with combined thrust and guide bearing below rotor and with air enclosure for self-ventilation.	
Ratings	
Continuous at 60^{o}C. rise	125,000 kW; 131,579 kVA
Continuous capability at 1.15 rating	143,750 kW; 151,516 kVA
Power factor	0.95
Voltage, 60 hertz, 3-phase	13,800
Short circuit ratio, not less than	1.175
Fly wheel effect (WK^2 LBS-FT^2)	95,700,000
Ratio, Xq"/Xd"' not more than	1.35

GENERATOR/MOTOR UNITS 3 AND 4 ONLY	
Speed-RPM	150
Spacing of units, center to center, feet	63
Pump/Turbines	
Type – Francis, clockwise rotation as turbine; counter-clockwise	
rotation as pump	173,000
Capacity, guaranteed at 345.0 ft. net head, HP, each, as a	209,000
turbine	87.6%
Capacity, guaranteed at 376.0 ft. net head, HP, each, as a	87.2%
turbine	plate steel
Capacity, guaranteed at 347 feet total head, eff	Concrete elbow, three
Capacity, guaranteed at 383 feet total head, eff	discharge/intake passages
Spiral cases	
Draft tubes	
Generator/Motors	
Type – Vertical shaft, with thrust-bearing above and below rotor, and with air enclosure for self-ventilation.	
Ratings	
As Generator	
Continuous at 60^{o}C. rise	125,000 kW; 131,576 kVA
Continuous capability at 1.15 rating	143,750 kW; 151,316 kVA

Power factor	0.95
Voltage, 60 hertz, 3-phase	13,800
Short circuit ratio, not less than	1.175
Fly wheel effect (WK^2 $LBS\text{-}FT^2$)	90,000,000
As Motor	
Output, rated, horsepower	185,000
Power factor	0.95
Voltage, 60 hertz, 3-phase	13,800
Speed rpm	150

POWERHOUSE

GENERAL

Location right bank about 200 feet below the downstream toe of the Main Dam and 700 feet northward from the river channel

Size of Building	
Length, feet (including unloading bay)	361.5
Width, feet (including draft tube deck)	114.25
Entrance wing	"L" shaped

ELEVATIONS, FEET NGVD29

Bottom of Structure	603.2
Low point of draft tube (Units 1 & 2)	620.0
(Units 3 & 4)	615.67
Centerline of distributor (Units 1 & 2)	658.0
(Units 3 & 4)	649.0
Turbine room floor (Units 1 & 2)	676.0
Generator room floor (Units 1 & 2)	691.0
(Units 3 & 4)	676.0
Control room	708.0
Erection floor	708.0
Unloading floor	708.0
Draft tube deck	708.0
Crane runway rail	737.5
Roof, high point	758.08
Top of parapet	761.92

DRAFT TUBE GATES

Type	Vertical Life, Slide
Number	3
Size, Ft (Approx.)	13' 9-1/2" X 20' 1-1/2"
Method of Handling	Gantry Crane

DRAFT TUBE TRASH RACKS (Units 3 & 4 Only)

Type	Vertical Life, Slide
Number	6
Size, Ft (Approx.)	13' 9-1/2" X 21' 8-1/2"
Method of Handling	Gantry Crane

MAIN POWER TRANSFORMERS

Units 1 and 2	
Location	On draft tube deck
Number	2
Type	3-phase, FOA
Rating	140/156.8 mVA, 55/60°C. temp. rise
Low voltage delta connected	13.2 kV
High voltage, wye connected, grounded	230 kV
Taps, Full capacity, above normal	1-2 1/2 % & 1-5%
below normal	1-2 1/2 % & 1-5%
Fire Protection, permanent Installation	water, fog
Units 3 and 4	
Location	On draft tube deck
Number	2
Rating	158/176.96 mVA, 55/65°C. temp. rise
Low voltage delta connected	13.2 kV
High voltage, wye connected, grounded	230 kV
Taps, Full capacity, above normal	1-2 1/2 % & 1-5%
below normal	1-2 1/2 % & 1-5%
Fire Protection, permanent Installation	water, fog

STATION DRAINAGE

Unwatering Sumps, for unwatering draft tubes and spiral cases

Location	Erection Bay and Unloading Bay
Number of Sumps	2
Pumps	
Number	6
Capacity, each	2 @ 300GPM and 4@1,500 GPM
Control	water level automatic

STATION DRAINAGE SUMPS

Location	Erection Bay and Unloading Bay
Number of Sumps	2
Pumps	
Number	4
Capacity, each	300GPM
Control	water level automatic

STATION SERVICE SYSTEM

Normal Supply	From generator step-up transformer leads through two 1000/1333 kVA, 3- phase, self-cooled, forced air ventilated, dry type (Class AA/FA) transformers, 13,800-480 volts, delta- delta connected, with two 2.5% full capacity taps above and below 13,800 volts.
Emergency Supply	Diesel engine driven generator

Main 480 Volt Distribution	Metal-enclosed low voltage power circuit breaker switchgear, with 2-section bus and bus tie circuit breaker. Circuit breakers withdrawal type, those in mains and bus ties electrically operated, those in branches manually operated.
Subsidiary Centers	Metal-enclosed power distribution and motor control centers and panel boards, with molded case circuit breakers.
DIRECT CURRENT SYSTEM	
Station Battery	125 volt, 58 cell, valve regulated lead acid, 1400 ampere- hours capacity at 8-hour discharge rate.
Battery Chargers for 125-Volt Station Battery	Two static chargers, AC Inputs: 416-506 volts; 60 amperes, 3- phase, 60 HZ. DC Output: 120-147 volts; 250 amperes.
Switchyard Battery	125 volt, 60 cell, valve regulated lead acid, 150 ampere-hours capacity at 8 hour discharge rate
Battery Chargers for 125-Volt Switchyard Battery	Static type, rack mounted, 125 volt battery charger; AC Input 208 volts 29 amperes, single phase, 60 Hz. DC output 130 volts, 25 amperes.
CRANES	
Type	Powerhouse, traveling, with two trolleys and lifting beam
Number	1
Capacity of each main hoist, tons	200
Capacity of each auxiliary hoist, tons	25
Capacity, main hoist and lifting beam, tons	400
Span, ft	61’-6”
RAW WATER	
Cooling Water	
Units 1 and 2	
Pumps	
Number	3
Type	Horizontal, centrifugal, single stage, single suction
Capacity	1435 GPM
Motor	50 HP, 1750 RPM
Units 3 and 4	
Pumps; Number	3
Type	Horizontal, centrifugal, single stage, single suction
Capacity	1800 GPM
Motor	60 HP, 1750 RPM
Station Service	
Standby Pump; Number	1
Type	Horizontal, centrifugal, single stage, single suction
Capacity	335 GPM
Motor	25 HP, 3500 RPM

COMPRESSED AIR	
Service Air	
Compressors; Number	2
Type	Gardner-Denver, screw type
Capacity	100 SCFM at 100 PSIG
Motor	25 HP, 1750 RPM
Main Receiver; Number	1
Capacity	96 CF
Air Brake Receiver; Number	4
Capacity	19 CF
GOVERNOR AIR	
Compressors; Number 1	
Type	Air cooled, vertical, two stage
Capacity	22.3 SCFM at 350 PSIG
Motor	10 HP, 1750 RPM
TAILWATER DEPRESSION	
Compressors; Number	2
Type	Sullair, screw type
Capacity	683 SCFM at 125 PSIG
Motor	150 HP
Receiver Tanks	6 at 651 CF each

REREGULATION DAM

GENERAL	
Dam site, miles above mouth of Coosawattee River	25
Drainage area above dam site, square miles	520
Drainage area of reregulation dam only, square miles	146
RESERVOIR	
Maximum storage pool elevation, feet NGVD29	698
Maximum normal operating pool elevation, feet NGVD29	696
Minimum normal operating pool elevation, feet NGVD29	677
Minimum operating pool elevation, feet NGVD29	674
Minimum pool elevation, feet NGVD29	662.5
Area at maximum storage pool, acres	990
Area at minimum pool, acres	25.5
Usable storage, acre-feet (elevation 674 to 698 ft NGVD29)	16,571
Inactive storage, acre-feet (elevation 662.5 ft NGVD29)	135
Area acquired, acres	1,373
Maximum elevation of clearing, feet NGVD29	700
Area cleared, acres	320
SPILLWAY	
Total length, including end piers, feet	208
Net length, feet	168
Elevation of crest, feet NGVD29	662.5

Number of piers, including end piers	5
Width of piers, feet	8
Type of gates	tainter
Number of gates	4
Length of gates, feet	42
Height of gates, feet	36.5
Elevation of top of gates in closed position, feet NGVD29	699.0
Elevation of low steel of gates in fully open position, feet NGVD29	699.0
Elevation of trunnion, feet NGVD29	675.0
Elevation of access bridge, feet NGVD29	717.0
Elevation of stilling basin apron, feet NGVD29	647.5
Length (parallel to dam) of stilling basin, feet	192
Height of end sill, feet	4

EARTH DIKES

Top elevation, feet NGVD29	703.0
Length, feet	2,855
Top width of right dike, feet	32
Top width of left dike, feet	12
Side slopes	1 on 3
Thickness of riprap, inches	24
Thickness of filter material, inches	9
Thickness of dumped rock, inches	60

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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	6.27×10^6	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

LEVEL ABSTRACT

SURVEY OF CARTERS LAKE
ORDER 3rd
DATE
9/1/2009

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					
	TURNS		BS	FS	ELEV	UNADJUSTED	CORRECTION	ADJUSTED	MEAN	REMARKS	
CARTERS DAM HEADWATER											
LOOP 1									MEAN F & B		
9B-2A						1111.907	0.000	1111.907	1111.907	Elevation Held OPUS DB	New Aluminium CORPS Monument (Right Side Dam)
	1	B	6.309	4.825	1.484				MEAN F & B		
TP-7				MEAN	1.484	1113.391	0.000	1113.391	1113.391		Turning Point
	1	B	5.627	4.371	1.256				MEAN F & B		
TP-6				MEAN	1.256	1114.647	-0.001	1114.646	1114.647		Turning Point
	1	B	4.724	4.702	0.022				MEAN F & B		
TP-5				MEAN	0.022	1114.669	-0.001	1114.668	1114.668		Turning Point
	1	B	4.961	4.479	0.482				MEAN F & B		
TP-4				MEAN	0.482	1115.151	-0.002	1115.149	1115.151		Turning Point
	1	B	4.571	5.002	-0.431				MEAN F & B		
TP-3				MEAN	-0.431	1114.720	-0.002	1114.718	1114.719		Turning Point
	1	B	4.432	3.255	1.177				MEAN F & B		
9B-2B				MEAN	1.177	1115.897	-0.003	1115.894	1115.894273		New Aluminium CORPS Monument (Right Side Dam)
	1	F	3.431	4.604	-1.173						
TP-3				MEAN	-1.173	1114.724	-0.003	1114.721			Turning Point
	1	F	5.032	4.6	0.432						
TP-4				MEAN	0.432	1115.156	-0.004	1115.152			Turning Point
	1	F	4.561	5.044	-0.483						
TP-5				MEAN	-0.483	1114.673	-0.004	1114.669			Turning Point
	1	F	4.726	4.746	-0.02						
TP-6				MEAN	-0.020	1114.653	-0.005	1114.648			Turning Point
	1	F	4.488	5.745	-1.257						
TP-7				MEAN	-1.257	1113.396	-0.005	1113.391			Turning Point
	1	F	5.106	6.59	-1.484						
9B-2A				MEAN	-1.484	1111.912	-0.005	1111.907		Elevation Held OPUS DB	New Aluminium CORPS Monument (Right Side Dam)
	11	Sum Turns									

SURVEY DATASHEET (Version 1.0)

PID: BBBL97
Designation: 9B-2A
Stamping: 9B-2A 2009
Stability: Monument will probably hold position well
Setting: Light structures (other than listed below)
Description: THE MARK IS NEAR A PARKING AREA AT THE SOUTH END OF CARTERS DAM.

LOCATED ON THE WEST SIDE OF CARTERS DAM ROAD, MARK IS 59.5'NW OF END POST OF GUARD RAIL, 113.1'NW OF WATER SAFETY SIGN, AND 47.3' SW OF CENTERLINE OF CARTERS DAM ROAD

Observed: 2009-09-09T12:21:00Z
Source: OPUS - page5 0909.08

Close-up View

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

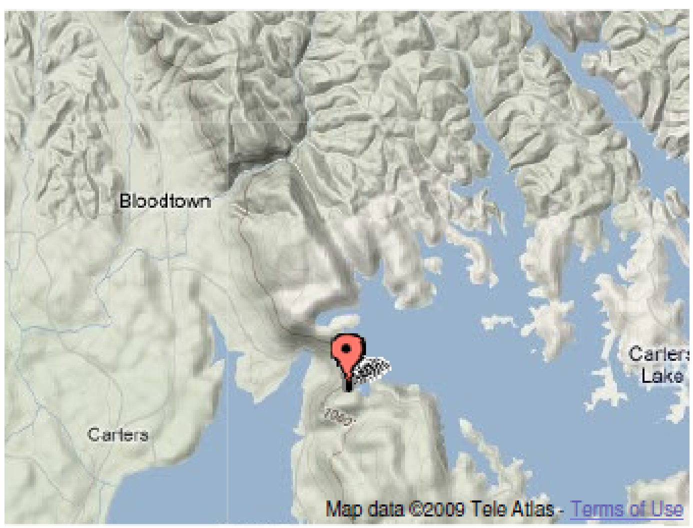
LAT:	34° 36' 39.78335"	± 0.004	m
LON:	-84° 40' 14.05014"	± 0.015	m
ELL HT:	309.545	± 0.060	m
X:	488123.963	± 0.014	m
Y:	-5232592.531	± 0.052	m
Z:	3602613.531	± 0.030	m
ORTHO HT:	338.910	± 0.073	m

	UTM 16	**SPC** 1002(GA W)
NORTHING:	3832378.439m	511394.948m
EASTING:	713586.356m	653787.437m
CONVERGENCE:	1.32362311°	-0.28622312°
POINT SCALE:	1.00016232	0.99992631
COMBINED FACTOR:	1.00011372	0.99987773

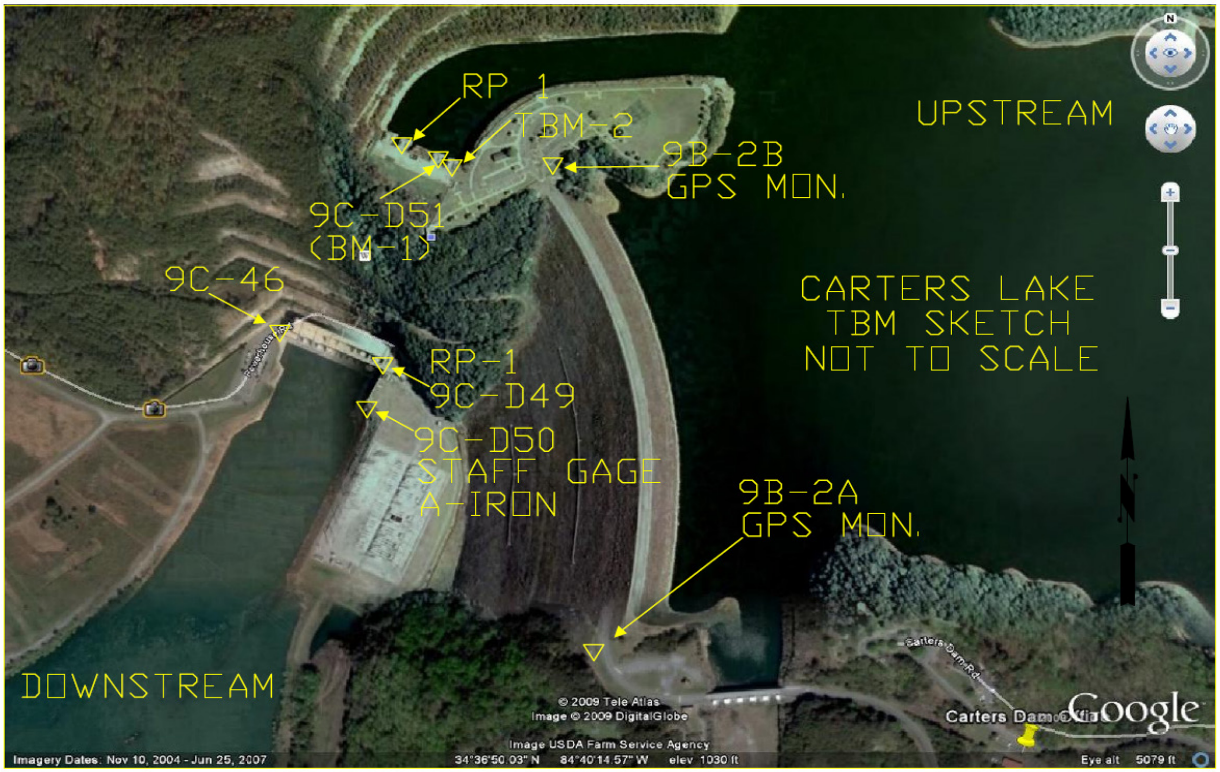
CONTRIBUTED BY

walker
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.



CARTERS LAKE MAIN DAM

CARTERS LAKE REREGULATION DAM

EXHIBIT C
STANDING INSTRUCTIONS TO THE DAMTENDERS
FOR WATER CONTROL

EXHIBIT C

STANDING INSTRUCTIONS TO THE POWERHOUSE OPERATOR FOR WATER CONTROL

CARTERS PROJECT

1. BACKGROUND AND RESPONSIBILITIES

a. General Information. These “Standing Instructions to the Powerhouse 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*, 8 October 1982). 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 Carters 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 ACT River System.

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

(3) Structure. The Project Site is located on the Coosawattee River in Murray County, Georgia. The Main Dam is located at mile 26.8 and the downstream Reregulation Dam is located at mile 25.3. The drainage area above Carters Main Dam is 374 square miles and the local drainage area for the Carters Reregulation Dam 146 square miles, for a total of 520 square miles for the Carters Project.

(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 Carters Operations Project Manager.

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

(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 hourly generation schedule updates. This daily communication will be increased to an hourly basis if the need develops. Daily generation schedules and updates are provided to the Water Management Section. The Water Control Manager will coordinate the daily water control actions regarding Reregulation Dam releases with the Carters powerhouse personnel. The required releases will be based on flows and stage as measured at USGS 02382500 Coosawattee River at Carters, Georgia.

(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 Water Management Section are cut off, the Project Operator will continue to follow the water control plan as outlined in Section 7-05 and contact the Water Management Section as soon as communication is reestablished.

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

(1) Pool elevation in feet above mean sea level at 4 am and 12 midnight (0400 and 2400) for the period since the last report.

(2) 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.

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

(4) 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.

(5) Average pumpback in cubic feet per second and megawatt-hours 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. Gage Verification. In accordance with the USACE Guidance Memorandum for Critical Gage Instrumentation dated 15 Dec 2006, the Carters Powerhouse personnel will perform gage reading verifications by providing the pool level automated instrumentation gage reading and staff gage readings. Weekly reports are sent to the Water Management Section which provide gage verification readings for all projects so that potential gage equipment issues can be addressed. In the event that the automated gage equipment malfunctions or if the difference in stage readings is greater than 0.3 feet, the Project Operator will report readings from the staff gage until the automated gage is rectified.

d. Regional Hydro-meteorological Conditions. 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. Normal Conditions. During normal conditions, all releases will be made through the turbine units. The Project Operator will follow the Carters Dam Water Control Manual for normal water control actions and will report directly to the Water Control Manager.

b. Emergency Conditions. 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. Inquiries. 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. Water Control Problems. 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.

EXHIBIT D
ALABAMA-COOSA-TALLAPOOSA (ACT) RIVER BASIN
DROUGHT CONTINGENCY PLAN

DROUGHT CONTINGENCY PLAN

FOR

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

ALLATOONA DAM AND LAKE

CARTERS DAM AND LAKE

ALABAMA POWER COMPANY COOSA RIVER PROJECTS

ALABAMA POWER COMPANY TALLAPOOSA RIVER PROJECTS

ALABAMA RIVER PROJECTS

US Army Corps of Engineers ®

South Atlantic Division

Mobile District

April 2022

DROUGHT CONTINGENCY PLAN

FOR THE

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

I – INTRODUCTION

1-01. Purpose of Document. The purpose of this Drought Contingency Plan (DCP) is to provide a basic reference for water management decisions and responses to water shortage in the Alabama-Coosa-Tallapoosa (ACT) River Basin induced by climatological droughts. As a water management document, it is limited to those drought concerns relating to water control management actions for Federal U.S. Army Corps of Engineers (Corps) and Alabama Power Company (APC) dams. This DCP does not prescribe all possible actions that might be taken in a drought situation due to the long-term nature of droughts and unique issues that may arise. The primary value of this DCP is in documenting the overall ACT Basin Drought Management Plan for the system of Corps and APC projects; in documenting the data needed to support water management decisions related to drought regulation; and in defining the coordination needed to manage the ACT project's water resources to ensure that they are used in a manner consistent with the needs which develop during a drought. This DCP addresses the water control regulation of the five Corps impoundments and the APC Coosa and Tallapoosa projects (Table 1) in regard to water control regulation during droughts. Details of the drought management plan as it relates to each project and its water control regulation during droughts are provided in the water control manual within the respective project appendix to the ACT Basin Master Water Control Manual.

II – AUTHORITIES

2-01. Authorities. The following list provides the policies and guidance that are pertinent to the development of drought contingency plans and actions directed therein.

A. ER 1110-2-1941, "Drought Contingency Plans", dated 02 Feb 2018. This regulation provides policy and guidance for the preparation of drought contingency plans as part of the Corps of Engineers' overall water management activities.

B. ER 1110-2-8156, "Preparation of Water Control Manuals", dated 30 Sep 2018. This document provides a guide for preparing water control manuals for individual water resource projects and for overall river basins to include drought contingency plans.

C. ER 1110-2-240, "Water Control Management", dated 30 May 2016. This regulation prescribes the policies and procedures to be followed in water management activities including special regulations to be conducted during droughts. It also sets the responsibility and approval authority in development of water control plans.

D. EM 1110-2-3600, "Management of Water Control Systems", dated 10 Oct 2017. This guidance memorandum requires that the drought management plan be incorporated into the project water control manuals and master water control manuals. It also provides guidance in formulating strategies for project regulation during droughts.

Table 1. Reservoir impoundments within the ACT River Basin

River/Project Name	Owner/State/ Year Initially Completed	Total storage at Full Pool (acre-feet)	Conservation Storage (acre-feet)	Percentage of ACT Basin Conservation Storage (%)
Coosawattee River				
Carters Dam and Lake	Corps/GA/1974	383,565	141,402	5.9
Carters Reregulation Dam	Corps/GA/1974	17,380	16,571	0.1
Etowah River				
Allatoona Dam and Lake	Corps/GA/1949	338,253	270,247	10.3
Hickory Log Creek Dam	CCMWA/Canton/2007	17,702	NA	NA
Coosa River				
Weiss Dam and Lake	APC/AL/1961	306,655	263,417	10.0
H. Neely Henry Dam and Lake	APC/AL/1966	120,853	118,210	4.5
Logan Martin Dam and Lake	APC/AL/1964	273,467	141,897	5.5
Lay Dam and Lake	APC/AL/1914	262,887	92,352	3.5
Mitchell Dam and Lake	APC/AL/1923	170,783	51,577	1.9
Jordan Dam and Lake	APC/AL/1928	236,130	19,057	0.7
Walter Bouldin Dam	APC/AL/1967	236,130	NA	--
Tallapoosa River				
Harris Dam and Lake	APC/AL/1982	425,721	207,318	7.9
Martin Dam and Lake	APC/AL/1926	1,628,303	1,202,340	45.7
Yates Dam and Lake	APC/AL/1928	53,908	6,928	0.3
Thurlow Dam and Lake	APC/AL/1930	17,976	NA	--
Alabama River				
Robert F. Henry Lock and Dam/ R.E. “Bob” Woodruff Lake	Corps/AL/1972	247,210	36,450	1.4
Millers Ferry Lock and Dam/ William “Bill” Dannelly Lake	Corps/AL/1969	346,254	46,704	1.8
Claiborne Lock and Dam and Lake	Corps/AL/1969	102,480	NA	--

III – DROUGHT IDENTIFICATION

3-01. Definition. Drought can be defined in different ways - meteorological, hydrological, agricultural, and socioeconomic. In this DCP, the definition of drought used in the *National Study of Water Management During Drought* is used:

> “Droughts are periods of time when natural or managed water systems do not provide enough water to meet established human and environmental uses because of natural shortfalls in precipitation or streamflow.”

That definition defines drought in terms of its impact on water control regulation, reservoir levels, and associated conservation storage. Water management actions during droughts are intended to balance the water use and water availability to meet water use needs. Because of hydrologic variability, there cannot be 100 percent reliability that all water demands are met.

Droughts occasionally will be declared and mitigation or emergency actions initiated to lessen the stresses placed on the water resources within a river basin. Those responses are tactical measures to conserve the available water resources (USACE 2009).

3-02. <u>Drought Identification</u>. There is no known method of predicting how severe or when a drought will occur. There are, however, indicators that are useful in determining when conditions are favorable: below normal rainfall; lower than average inflows; and low reservoir levels, especially immediately after the spring season when rainfall and runoff conditions are normally the highest. When conditions indicate that a drought is imminent, the Corps Water Management Section (WMS) and APC will increase the monitoring of the conditions and evaluate the impacts on reservoir projects if drought conditions continue or become worse for 30-, 60-, or 90-day periods. Additionally, WMS and APC will determine if a change in operating criteria would aid in the total regulation of the river system and if so, what changes would provide the maximum benefits from any available water.

Various products are used to detect and monitor the extent and severity of basin drought conditions. One key indicator is the U.S. Drought Monitor available through the U.S. Drought Portal, www.drought.gov. The National Weather Service (NWS) Climate Prediction Center (CPC) also develops short-term (6- to 10-day and 8- to 14-day) and long-term (1-month and 3-month) precipitation and temperature outlooks and a U.S. Seasonal Drought Outlook, which are useful products for monitoring dry conditions. The Palmer Drought Severity Index is also used as a drought reference. The Palmer index assesses total moisture by using temperature and precipitation to compute water supply and demand and soil moisture. It is considered most relevant for non-irrigated cropland and primarily reflects long-term drought. However, the index requires detailed data and cannot reflect an operation of a reservoir system. The Alabama Office of the State Climatologist also produces a Lawn and Garden Moisture Index for Alabama, Florida, Georgia, and South Carolina, which gives a basin-wide ability to determine the extent and severity of drought conditions. The runoff forecasts developed for both short- and long-range periods reflect drought conditions when appropriate. There is also a heavy reliance on the latest El Niño Southern Oscillation (ENSO) forecast modeling to represent the potential effects of La Niña on drought conditions and spring inflows. Long-range models are used with greater frequency during drought conditions to forecast potential effects on 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 and reservoir stages 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. For example, models using data of previous droughts or a percent of current to mean monthly flows with several operational schemes have proven helpful in forecasting reservoir levels for water management planning purposes. Other parameters considered during drought management are the ability of the various lakes to meet the demands placed on storage, the probability that lake elevations will return to normal seasonal levels, basin streamflows, basin groundwater table levels, and the total available storage to meet hydropower marketing system demands.

3-03. <u>Historical Droughts</u>. Drought events have occurred in the ACT Basin with varying degrees of severity and duration. Five of the most significant historical basin wide droughts occurred in 1940-1941, 1954-1958, 1984-1989, 1999-2003, and 2006-2009. The 1984 to 1989 drought caused water shortages across the basin in 1986. This resulted in the need for the Corps to make adjustments in the water management practices. Water shortages occurred again from 1999 through 2002 and during 2007 through 2008. The 2006 to 2009 drought was the most devastating recorded in Alabama and western Georgia. Precipitation declines began in December 2005. These shortfalls continued through winter 2006-07 and spring 2007, exhibiting the driest winter and spring in the recorded period of record. The Corps and APC had water levels that were among the lowest recorded since the impoundments were constructed. North Georgia received less than 75 percent of normal precipitation (30-year average). The drought reached peak intensity in 2007, resulting in a D-4 Exceptional Drought Intensity (the worst measured) throughout the summer of 2007.

3-04. Severity. Water shortage problems experienced during droughts are not uniform throughout the ACT River Basin. Even during normal, or average, hydrologic conditions, various portions of the basin experience water supply problems. The severity of the problems is primarily attributed to the pattern of human habitation within the basin; the source of water utilized (surface water vs. ground water); and the characteristics of the water resources available for use. During droughts, these problems can be intensified. A severe drought in the basin develops when a deficiency of rainfall occurs over a long time period and has a typical duration of 18 to 24 months. The number of months of below normal rainfall is more significant in determining the magnitude of a drought in the basin than the severity of the deficiency in specific months. However, the severity of the rainfall deficiency during the normal spring wet season has a significant impact on the ability to refill reservoirs after the fall/winter drawdown period. Another confounding factor which influences droughts in the basin is the variability of rainfall over the basin, both temporarily and spatially.

IV – BASIN AND PROJECT DESCRIPTION

4-01. Basin Description. The headwater streams of the Alabama-Coosa-Tallapoosa (ACT) River Basin rise in the Blue Ridge Mountains of Georgia and Tennessee and flow southwest, combining at Rome, Georgia, to form the Coosa River. The confluence of the Coosa and Tallapoosa Rivers in central Alabama forms the Alabama River near Wetumpka, Alabama. The Alabama River flows through Montgomery and Selma and joins with the Tombigbee River at the mouth of the ACT Basin to form the Mobile River about 45 miles above Mobile, Alabama. The Mobile River flows into Mobile Bay at an estuary of the Gulf of Mexico. The total drainage area of the ACT Basin is approximately 22,739 square miles: 17,254 square miles in Alabama; 5,385 square miles in Georgia; and 100 square miles in Tennessee. A detailed description of the ACT River Basin is provided in the ACT Master Water Control Manual, Chapter 4 – Watershed Characteristics.

4-02. Project Description. The Corps operates five projects in the ACT Basin: Allatoona Dam and Lake on the Etowah River; Carters Dam and Lake and Reregulation Dam on the Coosawattee River; and Robert F. Henry Lock and Dam, Millers Ferry Lock and Dam, and Claiborne Lock and Dam on the Alabama River. Claiborne is a lock and dam without any appreciable water storage behind it. Robert F. Henry and Millers Ferry are operated as run-of-river projects and only very limited pondage is available to support hydropower peaking and other project purposes. APC owns and operates eleven hydropower dams in the ACT Basin: seven dams on the Coosa River and four dams on the Tallapoosa River. Figure 1 depicts the percentage of conservation storage of each project in the ACT Basin. Figure 2 shows the project locations within the basin. Figure 3 provides a profile of the basin and each project.

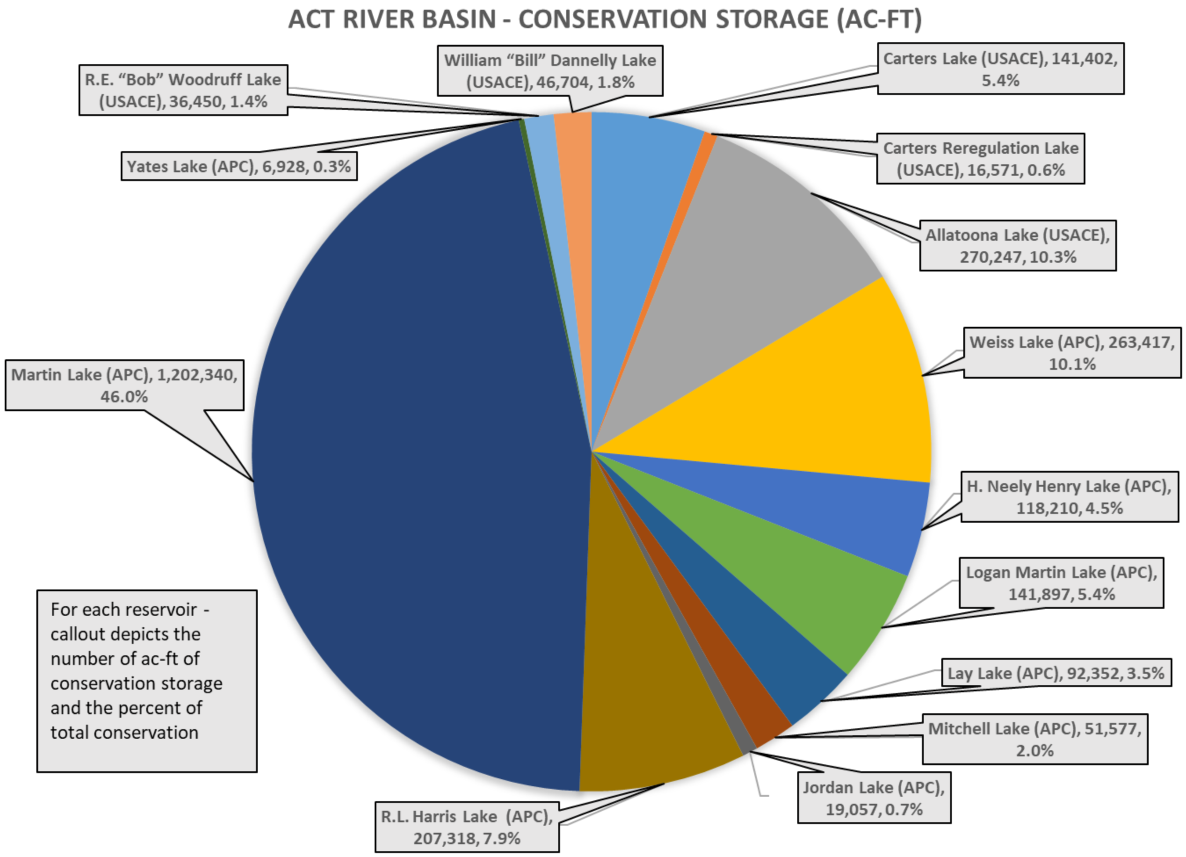


Figure 1. ACT Basin Reservoir Conservation Storage

A. **General.** Of the 16 reservoirs (considering Jordan Dam and Lake and Bouldin Dam as one reservoir and Carters Lake and Carters Reregulation Dam as one reservoir), Lake Martin on the Tallapoosa River has the greatest amount of storage, containing 45.9 percent of the conservation storage in the ACT Basin. Allatoona Lake, R.L. Harris Lake, Weiss Lake, and Carters Lake are the next four largest reservoirs in terms of storage. APC controls approximately 80 percent of the available conservation storage; Corps projects (Robert F. Henry Lock and Dam, Millers Ferry Lock and Dam, Allatoona Lake, and Carters Lake) control approximately 20 percent. The two most upstream Corps reservoirs, Allatoona Lake and Carters Lake, account for 15.7 percent of the total basin conservation storage.

Figure 2. Alabama-Coosa-Tallapoosa River Basin Project Location Map

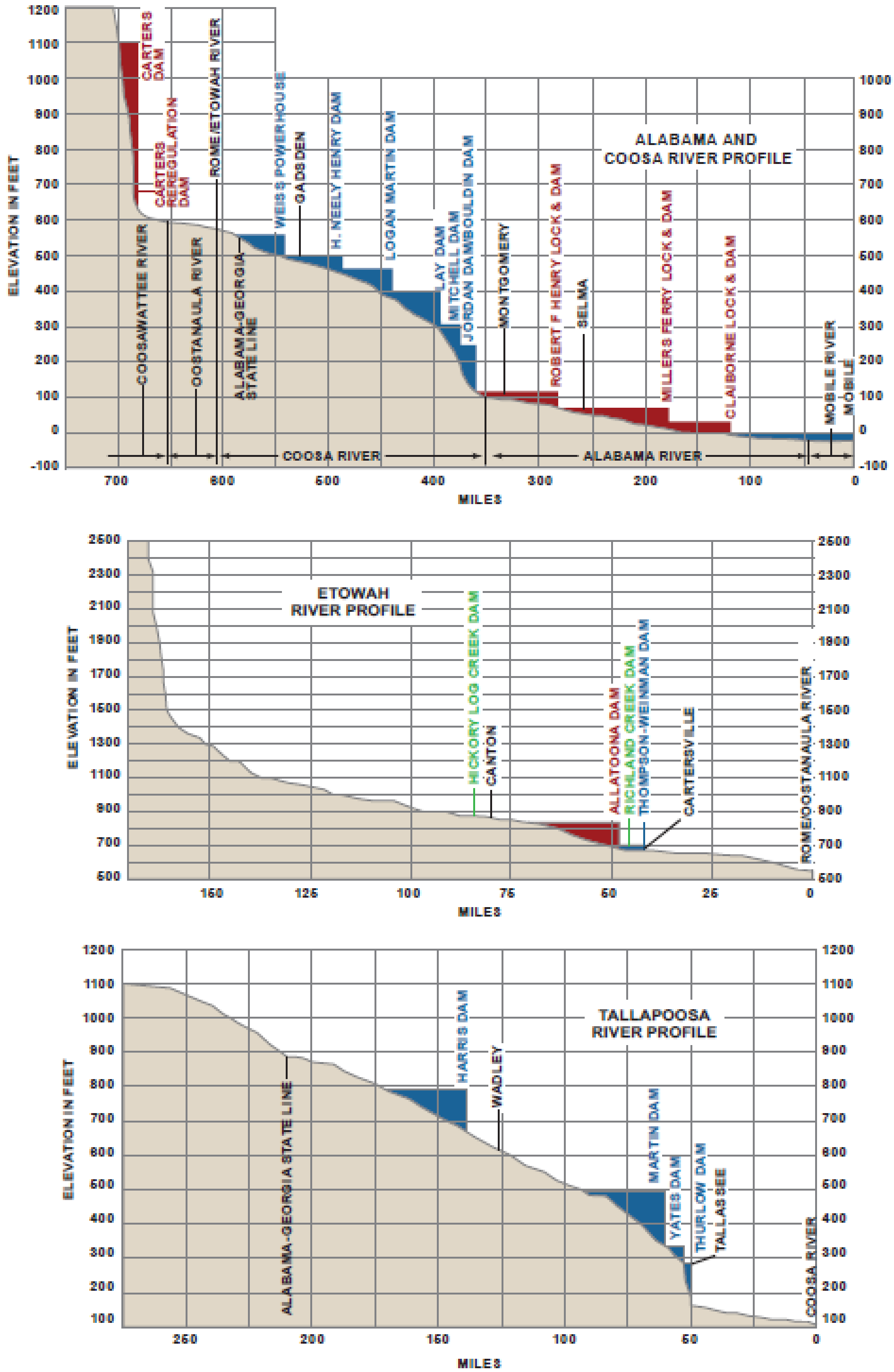


Figure 3. Alabama-Coosa-Tallapoosa River Basin Profile Map

B. **Allatoona Dam and Lake**. The Corps' Allatoona Dam on the Etowah River creates the 11,164 acres Allatoona Lake. The project's authorization, general features, and purposes are described in the Allatoona Dam and Lake Water Control Manual. The Allatoona Lake top of conservation pool is elevation 840 feet NGVD29 during the late spring and summer months (May through August); transitions to elevation 835 feet NGVD29 in the fall (October through mid-November); transitions to a winter drawdown to elevation 823 feet NGVD29 (1-15 January); and refills back to elevation 840 feet NGVD29 during the winter and spring wet season as shown in the water control plan guide curve (Figure 4). However, the lake level may fluctuate significantly from the guide curve over time, dependent primarily upon basin inflows but also influenced by project operations, evaporation, withdrawals, and return flows. A minimum flow of about 240 cfs is continuously released through a small unit, which generates power while providing a constant flow to the Etowah River downstream. Under drier conditions when basin inflows are reduced, project operations are adjusted to conserve storage in Allatoona Lake while continuing to meet project purposes in accordance with four action zones as shown on Figure 4.

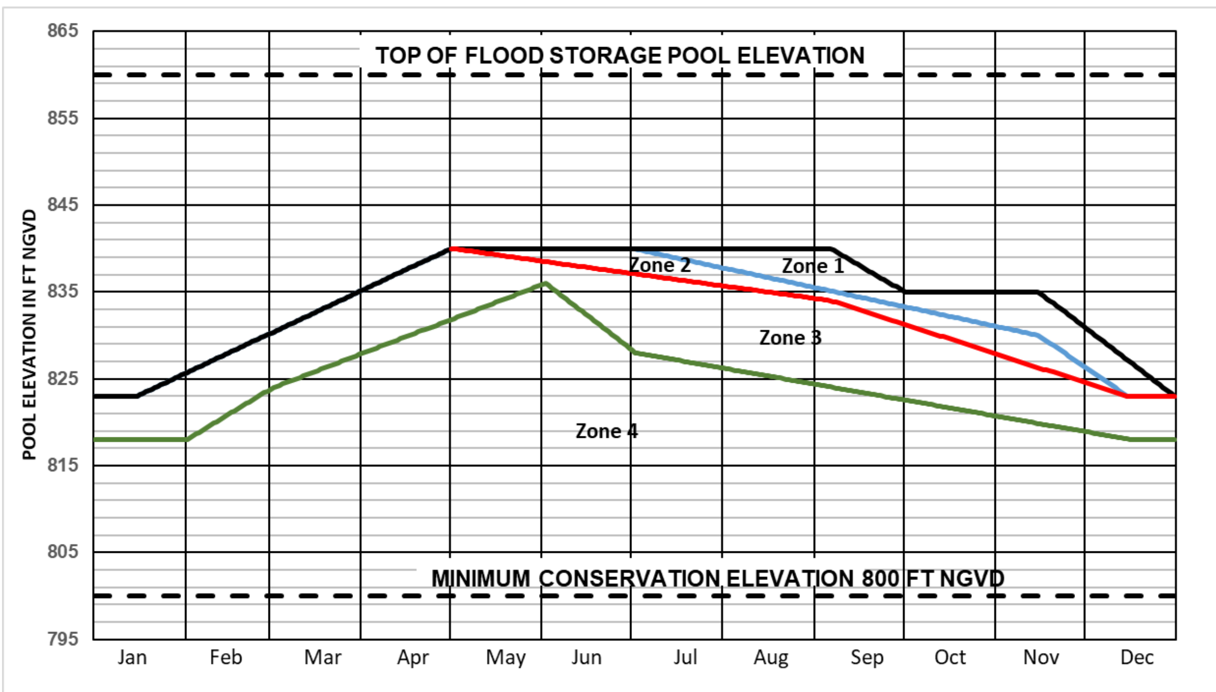


Figure 4. Allatoona Lake Guide Curve and Action Zones

C. **Carters Dam and Lake and Reregulation Dam**. Carters Lake is formed by Carters Dam, a Corps' reservoir on the Coosawattee River in northwest Georgia upstream of Rome, Georgia. The Carters project is a pumped-storage peaking facility that utilizes a Reregulation Dam and storage pool in conjunction with the Main Dam and lake. The project's authorization, general features, and purposes are described in the Carters Dam and Lake and Regulation Dam water control manual. The Carters Lake top of conservation pool is elevation 1,074 feet NGVD29 from 1 May to 1 November; transitioning to elevation 1,072 feet NGVD29 between 1 November and 1 December; remains at elevation 1,072 feet NGVD 29 from 1 December to April; then transitioning back to 1,074 feet NGVD29 between 1 April and 1 May. This is shown in the water control plan guide curve (Figure 5). As expected with a peaking/pumped storage operation, both Carters Lake and the reregulation pool experience frequent elevation changes. Typically, water levels in Carters Lake vary no more than 1 to 2 feet per day. The reregulation pool will routinely fluctuate by several feet (variable) daily as the pool receives peak hydropower discharges from Carters Lake and serves as the source for pumpback operations into Carters Lake during non-peak hours. The reregulation pool will likely reach both its normal maximum elevation of 696 feet NGVD29 and minimum elevation of 677 feet NGVD29 at least once each week. However, the general trend of the lake level may fluctuate significantly from the guide curve over time, dependent primarily upon basin inflows but also influenced by project operations and evaporation. Carters Regulation Dam provides a seasonal varying minimum release to the Coosawattee River for downstream fish and wildlife conservation. Under drier conditions when basin inflows are reduced, project operations are adjusted to conserve storage in Carters Lake while continuing to meet project purposes in accordance with action zones as shown on Figure 5. In Zone 2, Carters Regulations Dam releases are reduced to 240 cfs.

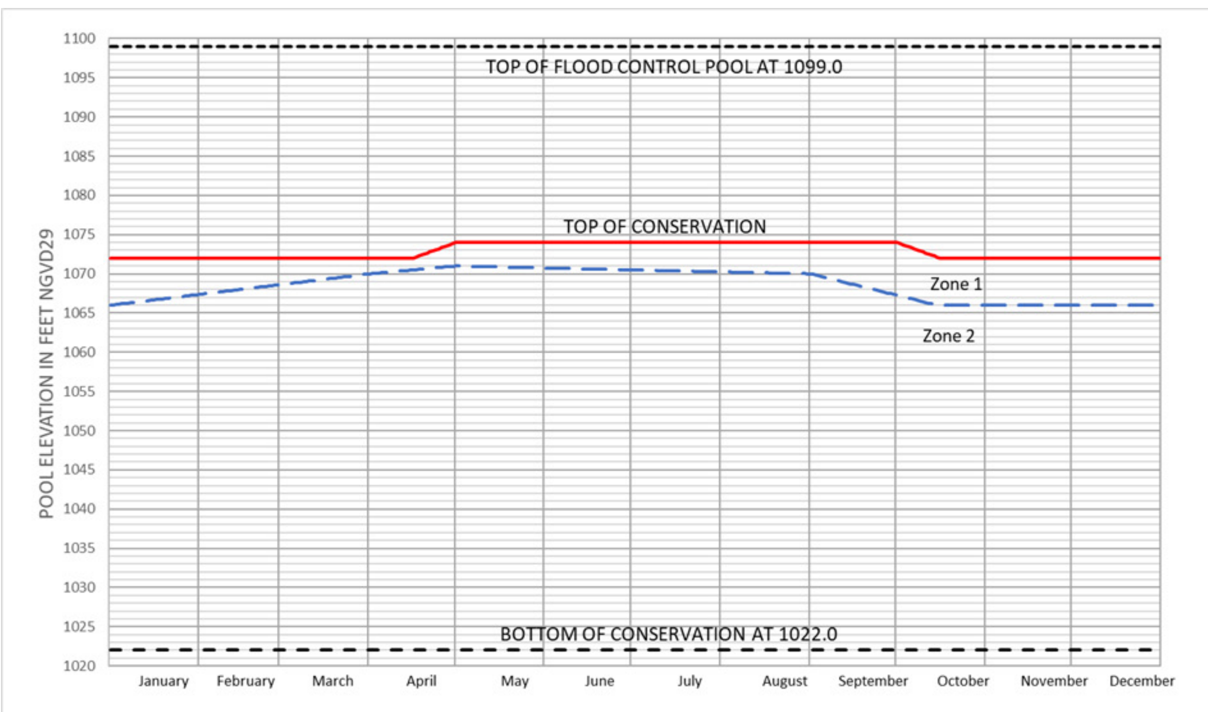


Figure 5. Carters Lake Guide Curve and Action Zones

D. **APC Coosa River Projects**. APC owns and operates the Coosa Hydro system of projects at Weiss Lake, H. Neely Henry Lake, Logan Martin Lake, Lay Lake, Mitchell Lake, and Jordan/Bouldin Dam and Lake on the Coosa River in the ACT Basin. APC Coosa River projects function mainly to generate electricity by hydropower. In addition, the upper three projects (Weiss, H. Neely Henry, and Logan Martin) operate pursuant to Public Law 83-436 regarding the requirement for the projects to be operated for flood risk management and navigation in accordance with reasonable rules and regulations of the Secretary of the Army. The rules and regulations are addressed in a memorandum of understanding between the Corps and APC (Exhibit B of the *Master Water Control Manual, Alabama-Coosa-Tallapoosa (ACT) River Basin, Alabama, Georgia*), in individual water control manuals for the three projects, and in this ACT Basin DCP. The Weiss Lake is on the Coosa River in northeast Alabama, about 80 mi northeast of Birmingham, Alabama, and extends into northwest Georgia for about 13 miles upstream on the Coosa River. The dam impounds a 30,027 acres reservoir (Weiss Lake) at the normal summer elevation of 564 feet NGVD29 as depicted in the regulation guide curve shown in Figure 6 (source APC). The H. Neely Henry Lake is on the Coosa River in northeast Alabama, about 60 miles northeast of Birmingham, Alabama. The dam impounds an 11,200 acres reservoir at the normal summer elevation of 508 feet NGVD29 as depicted in the regulation guide curve shown in Figure 7 (source APC). The Logan Martin Lake is in northeast Alabama on the Coosa River, about 40 miles east of Birmingham, Alabama. The dam impounds a 15,269-acre reservoir at the normal summer elevation of 465 feet NGVD29 as depicted in the regulation guide curve shown in Figure 8 (source APC). The projects' authorizations, general features, and purposes are described in the Weiss, H. Neely Henry, and Logan Martin water control manual appendices to the ACT Basin Master Water Control Manual.

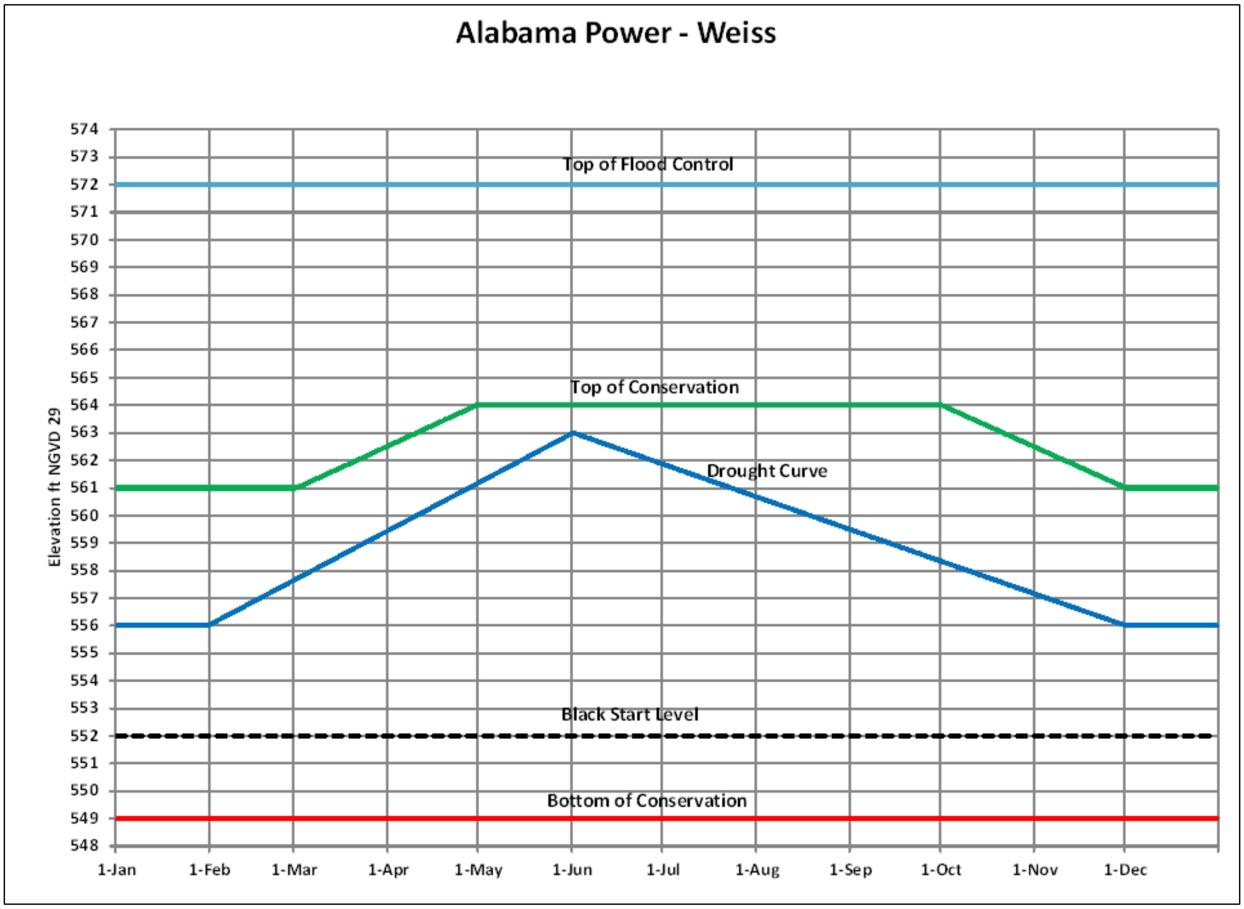


Figure 6. Weiss Lake Guide Curve

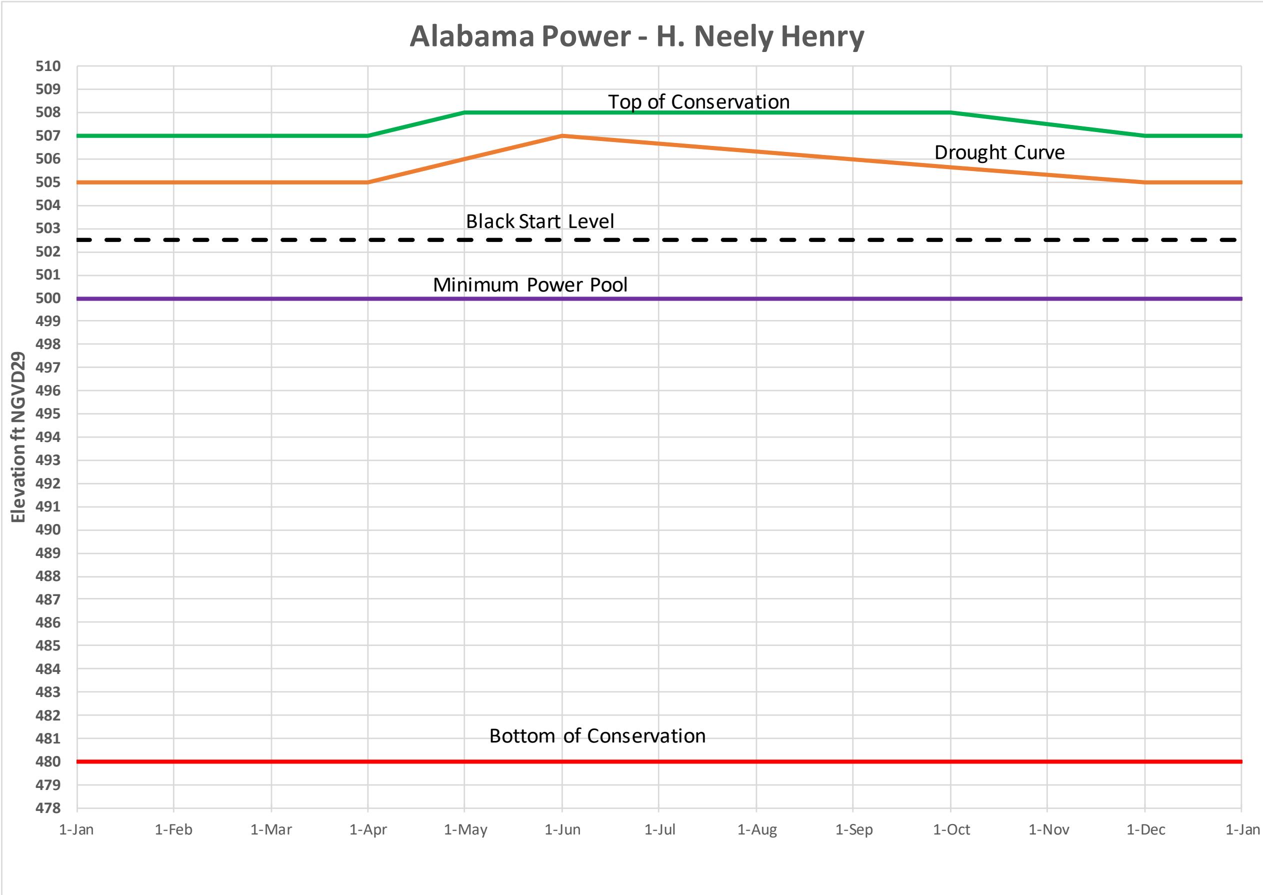


Figure 7. H. Neely Henry Lake Guide Curve

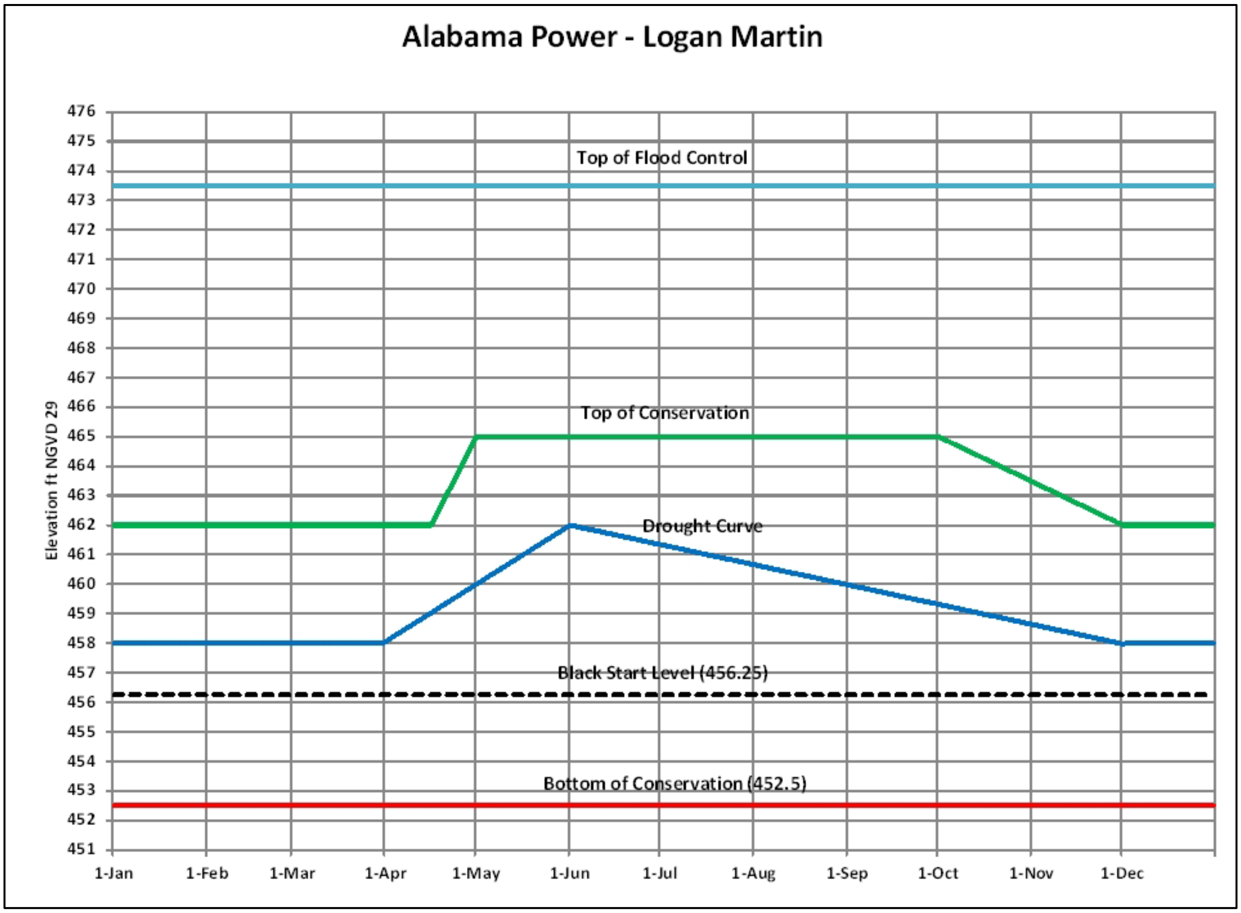


Figure 8. Logan Martin Lake Guide Curve

The downstream Coosa River APC run-of-river hydropower projects (Lay Dam and Lake, Mitchell Dam and Lake, and Jordan/Bouldin Dams and Lake) have no appreciable storage and are operated in conjunction with the upstream Coosa projects to meet downstream flow requirements and targets in support of the ACT Basin Drought Plan and navigation.

E. **APC Tallapoosa River Projects**. APC owns and operates the Tallapoosa River system of projects at Harris Dam and Lake, Martin Dam and Lake, Yates Dam, and Thurlow Dam in the ACT Basin. APC Tallapoosa River projects function mainly to generate electricity by hydropower. In addition, the Robert L. Harris Project operates pursuant to 33 CFR, Chapter II, Part 208, Section 208.65 regarding the requirement for the project to be operated for flood risk management and navigation in accordance with reasonable rules and regulations of the Secretary of the Army. The rules and regulations prescribed are described in a memorandum of understanding between the Corps and APC, individual water control manuals for the APC projects, and this DCP.

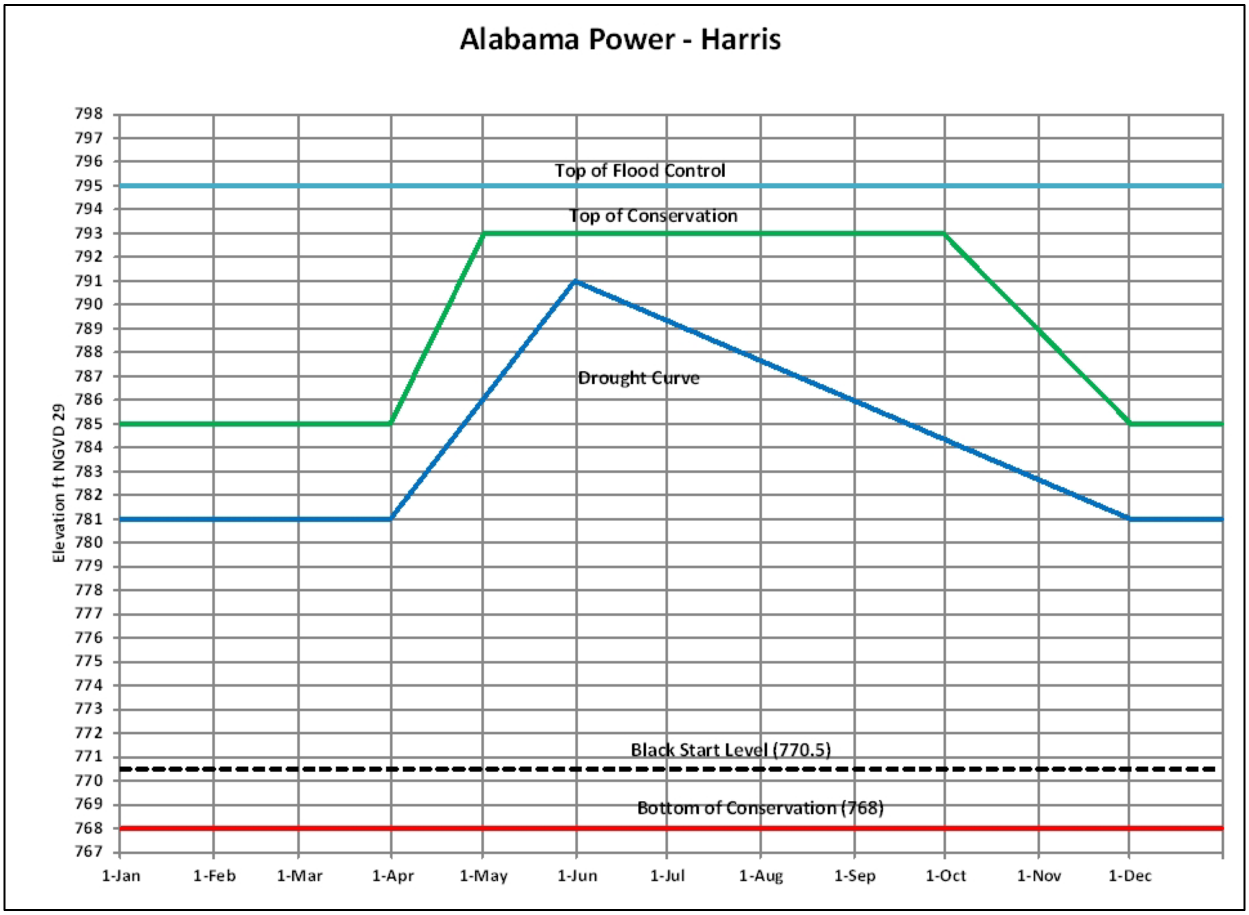


Figure 9. Robert L. Harris Lake Guide Curve

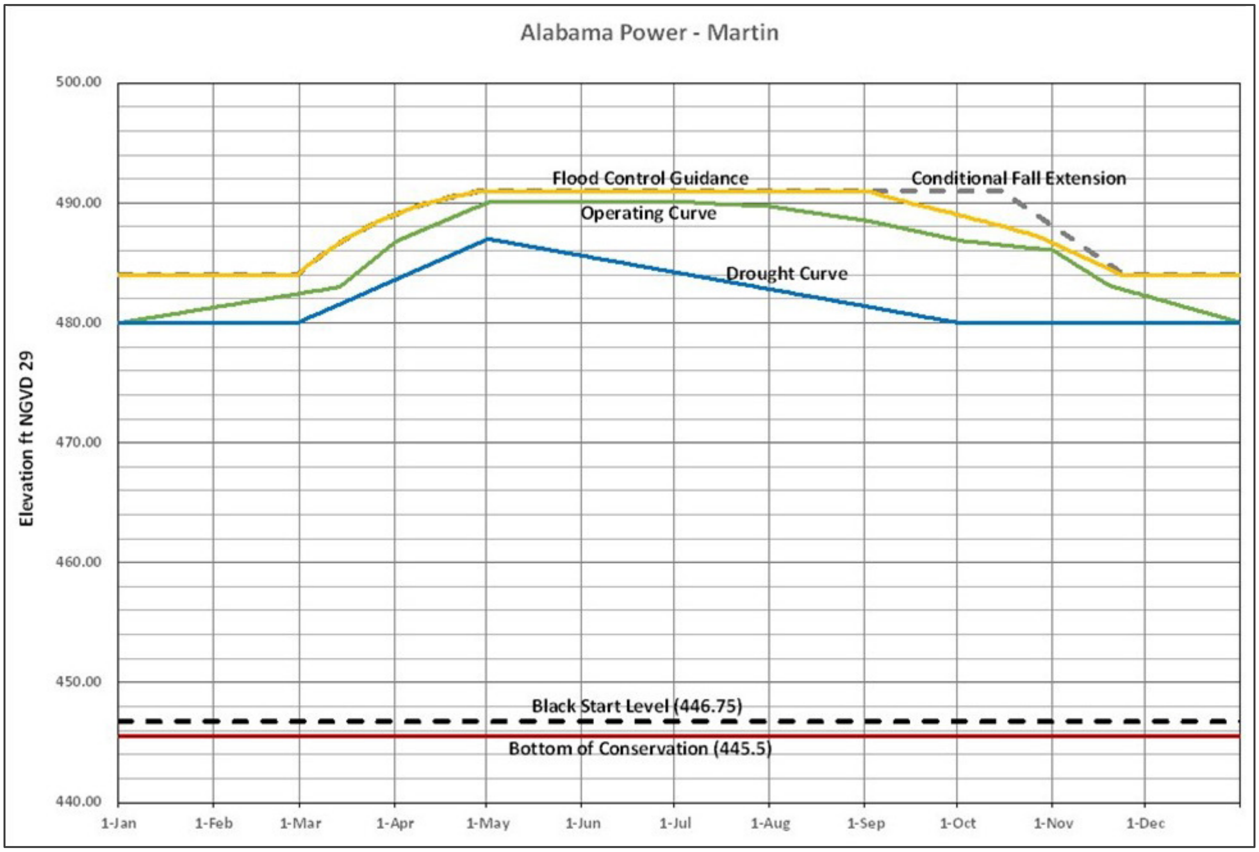


Figure 10. Martin Lake Guide Curve

F. **Corps Alabama River Projects**. The Corps operates three run-of-river lock and dam projects (Robert F. Henry, Millers Ferry, Claiborne) on the Alabama River in the lower ACT Basin to support commercial navigation. Claiborne Lake, together with R.E. "Bob" Woodruff Lake and William "Bill" Dannelly Lake, are collectively referred to as the Alabama River Lakes. The primary location used for communicating the available reliable navigation depth is the Claiborne Lock and Dam tailwater elevation. The water surface elevation is related to the available navigation depth based on the latest hydrographic surveys of the lower Alabama River reach downstream of Claiborne.

(1) Robert F. Henry. The R.E. "Bob" Woodruff Lake is created by the Robert F. Henry Lock and Dam on the Alabama River at river mile 236.3. R.E. "Bob" Woodruff Lake extends from the Robert F. Henry Lock and Dam upstream to the Walter Bouldin Dam. In addition to hydropower and navigation, R.E. "Bob" Woodruff Lake provides recreation and fish and wildlife conservation. R.E. "Bob" Woodruff Lake is 77 miles long and averages 1,300 feet wide. It has a surface area of 12,510 acres and a storage capacity of 234,211 acre-feet at a normal pool elevation of 125 feet NGVD29. Lake levels are typically fairly stable with minimal fluctuation between the operating pool elevation limits, 123 feet NGVD29 to 126 feet NGVD29. The emergency drawdown pool elevation is 122 feet NGVD29. An authorized 9-foot-deep by 200-foot-wide navigation channel exists over the entire length of the lake. The Jones Bluff hydropower plant generating capacity is 82 MW (declared value). The lake is a popular recreation destination, receiving up to two million visitors annually.

(2) Millers Ferry. The William "Bill" Dannelly Lake is created by the Millers Ferry Lock and Dam on the Alabama River at river mile 133. William "Bill" Dannelly Lake is 103 miles long and averages almost 1,400 feet wide. The reservoir has a surface area of 18,528 acres and a storage capacity of 346,254 acre-feet at the upper level of the operating range of the normal pool elevation of 80.8 feet NGVD29. Lake levels remain fairly stable on a day-to-day basis with minimal fluctuation between the operating pool elevation limits, 78 feet NGVD29 to 80.8 feet NGVD29. It has an authorized 9-foot-deep by 200-foot-wide navigation channel which extends the entire length of the reservoir. The facility is a multipurpose reservoir constructed by the Corps for both navigation and hydropower. The reservoir also provides recreational benefits and has lands managed for wildlife mitigation. The Millers Ferry hydropower plant generating capacity is 90 MW (declared value). The reservoir provides ample recreation opportunities. Recreation visitors number three million annually.

(3) Claiborne. Claiborne Lake is created by the Claiborne Lock and Dam on the Alabama River at river mile 72.5. The lake is similar to a wide river, averaging about 800 feet wide, with a surface area of 5,930 acres. Claiborne Lake extends 60 miles upstream to the Millers Ferry Lock and Dam. Storage capacity in the lake is 96,360 acre-feet at a normal pool elevation of 35 feet NGVD29. The operating pool elevation limits are between 32 feet NGVD29 and 36 feet NGVD29. The lake has an authorized 9-foot-deep, 200-foot-wide navigation channel extending its entire length. The primary purpose of the Corps project is navigation. No hydropower generating capability exists at the project. The lake also provides recreation benefits and lands managed for wildlife mitigation.

G. As other ACT water management objectives are addressed, lake levels might decline during prime recreation periods. Drought conditions will cause further drawdowns in lake levels. While lake levels will be slightly higher than what would naturally occur if no specific drought actions are taken, reservoir levels will decline thus triggering impacts associated with reaching initial recreation and water access limited levels. Large reservoir drawdowns impact recreational use: access to the water for boaters and swimmers is inhibited; submerged hazards (e.g., trees, shoals, boulders) become exposed or nearly exposed, posing safety issues; and exposed banks and lake bottoms become unsightly and diminish the recreation experience. Consequently, certain levels are identified in each Corps impoundment at which recreation would be affected. The *Initial Impact level* (IIL) represents the level at which recreation impacts are first observed (i.e., some boat launching ramps are unusable, most beaches are unusable or minimally usable, and navigation hazards begin to surface). The *Recreation Impact level* (RIL) defines the level at which major impacts on concessionaires and recreation are observed (more ramps are not usable, all beaches are unusable, boats begin having problems maneuvering in and out of marina basin areas, loss of retail business occurs). The level at which severe impacts are observed in all aspects of recreational activities is called the *Water Access Limited level* (WAL). At this point, all or almost all boat ramps are out of service, all swimming beaches are unusable, major navigation hazards occur, channels to marinas are impassable and/or wet slips must be relocated, and a majority of private boat docks are unusable. The individual project water control manuals describe the specific impact levels at each project and provide information regarding the effects of the water control plans on recreation.

V – WATER USES AND USERS

5-01. Water Uses and Users.

A. Uses – The ACT Basin rivers and lakes provide for wastewater dilution, M&I water supply, fish and wildlife propagation, hydropower generation, and recreational boating and fishing.

B. Users – The following tables list the surface water uses and water users within Georgia and Alabama in the ACT Basin.

Table 2. Surface water use: ACT Basin (Georgia 2005)

Water use category	Quantity (mgd)	% of total
Total Use	2,231	100%
Public Supply	839.9	38%
Domestic and Commercial	3.21	0%
Industrial and Mining	286.7	13%
Irrigation	174.4	7%
Livestock	87.9	4%
Thermoelectric Power Generation	839.8	38%

Table 3. M&I surface water withdrawal permits in the ACT Basin (Georgia)

River basin	Permit holder	Permit number	County	Source water	Permit limit max day (mgd)	Permit limit monthly average (mgd)
Coosa River Basin (Georgia)—upstream counties to downstream counties						
Coosa	Dalton Utilities, Conasauga R	155-1404-01	Whitfield	Conasauga River	49.400	40.300
Coosa	Dalton Utilities, Mill Creek	155-1404-02	Whitfield	Mill Creek	13.200	7.500
Coosa	Dalton Utilities, Coahulla Cr	155-1404-03	Whitfield	Coahulla Creek	6.000	5.000
Coosa	Dalton Utilities, Freeman Springs	155-1404-04	Whitfield	Freeman Springs	2.000	1.500
Coosa	Dalton Utilities - River Road	155-1404-05	Whitfield	Conasauga River	35.000	18.000
Coosa	Chatsworth WW Commission	105-1405-01	Murray	Holly Creek	1.100	1.000
Coosa	Chatsworth WW Commission	105-1405-02	Murray	Eton Springs	1.800	1.800
Coosa	Chatsworth WW Commission	105-1409-01	Murray	Carters Lake	2.550	2.300
Coosa	Chatsworth, City of	105-1493-02	Murray	Coosawattee River	2.200	2.000
Coosa	Ellijay, City of - Ellijay R	061-1407-01	Gilmer	Ellijay River	0.550	0.450
Coosa	Ellijay - Gilmer County W & S Authority	061-1408-01	Gilmer	Cartecay River	4.000	4.000
Coosa	Calhoun, City of	064-1411-03	Gordon	Big Spring	7.000	6.000
Coosa	Calhoun, City of	064-1412-01	Gordon	City Of Calhoun Spring	0.638	0.537
Coosa	Calhoun, City of	064-1492-02	Gordon	Oostanaula River	6.200	3.000
Coosa	Calhoun, City of	064-1493-01	Gordon	Coosawattee River	18.000	16.000
Coosa	Jasper, City of	112-1417-02	Pickens	Long Swamp Creek	1.000	1.000
Coosa	Bent Tree Community, Inc.	112-1417-03	Pickens	Chestnut Cove Creek and unnamed creek	0.250	0.230

Table 3 (continued). M&I surface water withdrawal permits in the ACT Basin (Georgia)

River basin	Permit holder	Permit number	County	Source water	Permit limit max day (mgd)	Permit limit monthly average (mgd)
Coosa	Bent Tree Community, Inc.	112-1417-04	Pickens	Lake Tamarack	0.250	0.230
Coosa	Big Canoe Utilities Company, Inc.	112-1417-05	Pickens	Lake Petit	1.000	1.000
Coosa	Big Canoe Utilities Company, Inc.	112-1417-06	Pickens	Blackwell Creek	2.650	2.650
Coosa	Etowah Water & Sewer Authority	042-1415-01	Dawson	Etowah River	5.500	4.400
Coosa	Cherokee County Water & Sewerage Auth	028-1416-01	Cherokee	Etowah River	43.200	36.000
Coosa	Gold Kist, Inc	028-1491-03	Cherokee	Etowah River	5.000	4.500
Coosa	Canton, City of	028-1491-04	Cherokee	Etowah River	23.000	18.700
Coosa	Canton, City of (Hickory Log Creek)	028-1491-05	Cherokee	Etowah River	39.000	39.000
Coosa	Bartow County Water Department	008-1411-02	Bartow	Bolivar Springs	0.800	0.800
Coosa	Adairsville, City of	008-1412-02	Bartow	Lewis Spring	5.100	4.100
Coosa	New Riverside Ochre Company, Inc.	008-1421-01	Bartow	Etowah River	5.000	5.000
Coosa	New Riverside Ochre Company, Inc.	008-1421-02	Bartow	Etowah River	6.000	6.000
Coosa	Emerson, City of	008-1422-02	Bartow	Moss Springs	0.630	0.500
Coosa	Gerdau AmeriSteel US, Inc. – Cartersville Steel Mill	008-1423-01	Bartow	Pettit Creek	2.000	1.500
Coosa	Baroid Drilling Fluids, Inc.	008-1423-02	Bartow	Etowah River	3.400	2.500
Coosa	Cartersville, City of	008-1423-04	Bartow	Etowah River	26.420	23.000
Coosa	Georgia Power Co. - Plant Bowen	008-1491-01	Bartow	Etowah River	520.000	85.000
Coosa	CCMWA	008-1491-05	Bartow	Allatoona Lake	86.000	78.000
Coosa	Cartersville, City of	008-1491-06	Bartow	Allatoona Lake	21.420	18.000
Coosa	La Fayette, City of Dry Creek	146-1401-01	Walker	Dry Creek	1.000	0.900
Coosa	La Fayette, City of Big Spring	146-1401-02	Walker	Big Spring	1.650	1.310
Coosa	Mount Vernon Mills - Riegel Apparel Div.	027-1401-03	Chattooga	Trion Spring	9.900	6.600
Coosa	Summerville, City of	027-1402-02	Chattooga	Raccoon Creek	3.000	2.500
Coosa	Summerville, City of	027-1402-04	Chattooga	Lowe Spring	0.750	0.500
Coosa	Mohawk Industries, Inc.	027-1402-05	Chattooga	Chattooga R./ Raccoon Cr.	4.500	4.000
Coosa	Oglethorpe Power Corp.	057-1402-03	Floyd	Heath Creek	3,838.000	3,030.000
Coosa	Floyd County - Brighton Plant	057-1414-02	Floyd	Woodward Creek	0.800	0.700
Coosa	Cave Spring, City of	057-1428-06	Floyd	Cave Spring	1.500	1.300
Coosa	Floyd County	057-1428-08	Floyd	Old Mill Spring	4.000	3.500
Coosa	Berry Schools, The (Berry College)	057-1429-01	Floyd	Berry (Possum Trot) Reservoir	1.000	0.700
Coosa	Inland-Rome Inc.	057-1490-01	Floyd	Coosa River	34.000	32.000
Coosa	Georgia Power Co. - Plant Hammond	057-1490-02	Floyd	Coosa River	655.000	655.000
Coosa	Rome, City of	057-1492-01	Floyd	Oostanaula & Etowah R	18.000	16.400

Table 3 (continued). M&I surface water withdrawal permits in the ACT Basin (Georgia)

River basin	Permit holder	Permit number	County	Source water	Permit limit max day (mgd)	Permit limit monthly average (mgd)
Coosa	Rockmart, City of	115-1425-01	Polk	Euharlee Creek	2.000	1.500
Coosa	Vulcan Construction Materials, L.P.	115-1425-03	Polk	Euharlee Creek	0.200	0.200
Coosa	Cedartown, City of	115-1428-04	Polk	Big Spring	3.000	2.600
Coosa	Polk County Water Authority	115-1428-05	Polk	Aragon, Morgan, Mulco Springs	1.600	1.100
Coosa	Polk County Water Authority	115-1428-07	Polk	Deaton Spring	4.000	4.000
Tallapoosa River Basin (Georgia)						
Tallapoosa	Haralson County Water Authority	071-1301-01	Haralson	Tallapoosa River	3.750	3.750
Tallapoosa	Bremen, City of	071-1301-02	Haralson	Beech Creek & Bremen Reservoir (Bush Creek)	0.800	0.580
Tallapoosa	Bowdon, City of Indian	022-1302-01	Carroll	Indian Creek	0.400	0.360
Tallapoosa	Southwire Company	022-1302-02	Carroll	Buffalo Creek	2.000	1.000
Tallapoosa	Villa Rica, City of	022-1302-04	Carroll	Lake Paradise & Cowens Lake	1.500	1.500
Tallapoosa	Carrollton, City of	022-1302-05	Carroll	Little Tallapoosa River	12.000	12.000
Tallapoosa	Bowdon, City of Lake Tysinger	022-1302-06	Carroll	Lake Tysinger	1.000	1.000

Source: GAEPD 2009a

Table 4. M&I surface water withdrawals in the ACT Basin (Georgia)

Basin (subbasin)	Withdrawal by	County	Withdrawal (mgd)
Coosa River Basin (Georgia)			
Coosa (Conasauga)	Dalton Utilities	Whitfield	35.38
Coosa (Conasauga)	City of Chatsworth	Murray	1.26
Coosa (Coosawattee)	Ellijay-Gilmer County Water System	Gilmer	3.12
Coosa (Coosawattee)	City of Fairmount	Gordon	0.06
Coosa (Oostanaula)	City of Calhoun	Gordon	9.10
Coosa (Etowah)	Big Canoe Corporation	Pickens	0.48
Coosa (Etowah)	City of Jasper	Pickens	1.00
Coosa (Etowah)	Bent Tree Community	Pickens	0.07
Coosa (Etowah)	Lexington Components Inc (Rubber)	Pickens	0.01
Coosa (Etowah)	Etowah Water and Sewer Authority	Dawson	1.50
Coosa (Etowah)	Town of Dawsonville	Dawson	0.10
Coosa (Etowah)	City of Canton	Cherokee	2.83
Coosa (Etowah)	Cherokee County Water System	Cherokee	15.81
Coosa (Etowah)a	Gold Kist, Inc.	Cherokee	1.94
Coosa (Etowah)	City of Cartersville	Bartow	13.26
Coosa (Etowah)	New Riverside Ochre Company, Inc (Chemicals)	Bartow	1.67

Basin (subbasin)	Withdrawal by	County	Withdrawal (mgd)
Coosa (Etowah)	Gerdau AmeriSteel US, Inc. – Cartersville Steel Mill (Primary metals)	Bartow	0.16
Coosa (Etowah)	Georgia Power Co – Plant Bowen	Bartow	38.92
Coosa (Etowah)	CCMWA	Bartow	44.42
Coosa (Upper Coosa)	City of Lafayette	Walker	1.20
Coosa (Upper Coosa)	City of Summerville	Chattooga	2.05
Coosa (Upper Coosa)	Mount Vernon Mills – Riegel Apparel Division (Textiles)	Chattooga	2.74
Coosa (Oostanaula)	City of Cave Spring (Domestic/Commercial)	Floyd	0.30
Coosa (Etowah / Oostanaula)	City of Rome	Floyd	9.98
Coosa (Upper Coosa)	Floyd County Water System	Floyd	2.57
Coosa (Upper Coosa)	Inland-Rome Inc. (Paper)	Floyd	25.74
Coosa (Upper Coosa)	Georgia Power Co - Plant Hammond	Floyd	535.00
Coosa (Upper Coosa)	Polk County Water Authority	Polk	2.22
Coosa (Etowah)	Vulcan Construction Materials	Polk	0.09
Tallapoosa River Basin (Georgia)			
Tallapoosa (Upper)	City of Bremen	Haralson	0.32
Tallapoosa (Upper)	Haralson County Water Authority	Haralson	2.05
Tallapoosa (Upper)	City of Bowdon	Carroll	0.75
Tallapoosa (Upper)	Southwire Company	Carroll	0.09
Tallapoosa (Upper)	City of Carrollton	Carroll	5.37
Tallapoosa (Upper)	City of Temple	Carroll	0.26
Tallapoosa (Upper)	City of Villa Rica	Carroll	0.58
Tallapoosa (Upper)	Carroll County Water System	Carroll	4.08

Table 5. Surface water use - ACT Basin (Alabama, 2005) (mgd)

ACT subbasin	HUC	Public supply	Industrial	Irrigation	Livestock	Thermo-electric	Total, by Subbasin
Upper Coosa	03150105	2.12	0	3.10	0.40	0	5.62
Middle Coosa	03150106	33.24	65.83	7.91	0.87	142.68	250.53
Lower Coosa	03150107	10.96	0.89	5.10	0.35	812.32	829.62
Upper Tallapoosa	03150108	0.90	0	0.15	0.40	0	1.45
Middle Tallapoosa	03150109	19.09	0	0.52	0.32	0	19.93
Lower Tallapoosa	03150110	38.22	2.23	4.22	0.28	0	44.95
Upper Alabama	03150201	10.40	30.63	3.84	0.84	4.14	49.85
Cahaba	03150202	52.90	0	3.49	0.25	0	56.64
Middle Alabama	03150203	0	21.04	1.73	0.48	0	23.25
Lower Alabama	03150204	0	54.61	0.64	0.02	0	55.27
Total - By Use Category		167.83	175.23	30.70	4.21	959.14	1337.11

Source: Hutson et al. 2009

Table 6. M&I surface water withdrawals in the ACT Basin (Alabama)

Basin (subbasin)	Withdrawal by	County	Withdrawal (mgd)
Coosa River Basin (Alabama)			
Coosa (Upper)	Centre Water Works & Sewer Board	Cherokee	1.19
Coosa (Upper)	Piedmont Water Works & Sewer Board	Calhoun	0.93
Coosa (Middle)	Jacksonville Water Works & Sewer Board	Calhoun	1.34
Coosa (Middle)	Anniston Water Works & Sewer Board	Calhoun	0.08
Coosa (Middle)	Fort Payne Water Works Board	DeKalb	8.10
Coosa (Middle)	Goodyear Tire and Rubber Company	Etowah	9.87
Coosa (Middle)	Gadsden Water Works & Sewer Board	Etowah	14.86
Coosa (Middle)	Alabama Power Co – Gadsden Steam Plant	Etowah	142.68
Coosa (Middle)	SIC 32 – Unnamed Stone, Glass, Clay, and/or Concrete Products	St. Clair	3.49
Coosa (Middle)	Talladega/Shelby Water Treatment Plant	Talladega	6.44
Coosa (Middle)	Talladega County Water Department	Talladega	0.81
Coosa (Middle)	Talladega Water Works & Sewer Board	Talladega	1.62
Coosa (Middle)	Bowater Newsprint, Coosa Pines Operation	Talladega	52.47
Coosa (Lower)	Sylacauga Utilities Board	Talladega	3.25
Coosa (Lower)	SIC 22 – Unnamed Textile	Talladega	0.89
Coosa (Lower)	Goodwater Water Works & Sewer Board	Coosa	0.46
Coosa (Lower)	Alabama Power Co – E.C. Gaston Plant	Shelby	812.32
Coosa (Lower)	Clanton Waterworks & Sewer Board	Chilton	1.79
Coosa (Lower)	Five Star Water Supply	Elmore	5.46
Tallapoosa River Basin (Alabama)			
Tallapoosa (Upper)	Heflin Water Works	Cleburne	0.51
Tallapoosa (Upper)	Wedowee Gas, Water, and Sewer	Randolph	0.39
Tallapoosa (Middle)	Roanoke Utilities Board	Randolph	1.29
Tallapoosa (Middle)	Clay County Water Authority	Clay	1.87
Tallapoosa (Middle)	Lafayette	Chambers	0.53
Tallapoosa (Middle)	Central Elmore Water & Sewer Authority	Elmore	4.83
Tallapoosa (Middle)	Alexander City Water Department	Tallapoosa	10.57
Tallapoosa (Lower)	West Point Home, Inc	Lee	2.23
Tallapoosa (Lower)	Opelika Water Works Board	Lee	2.61
Tallapoosa (Lower)	Auburn Water Works Board	Lee	5.75
Tallapoosa (Lower)	Tallassee	Tallapoosa	1.98
Tallapoosa (Lower)	Tuskegee Utilities	Macon	2.71
Tallapoosa (Lower)	Montgomery Water Works & Sewer Board	Montgomery	25.17
Alabama River Basin			
Alabama (Upper)	Montgomery Water Works & Sewer Board	Montgomery	10.40
Alabama (Upper)	International Paper	Autauga	30.63
Alabama (Upper)	Southern Power Co – Plant E. B. Harris	Autauga	4.14
Alabama (Cahaba)	Birmingham Water Works & Sewer Board	Shelby	52.90
Alabama (Middle)	International Paper – Pine Hill	Wilcox	21.04
Alabama (Lower)	Alabama River Pulp Company	Monroe	54.61

Source: Hutson et al. 2009

VI. – CONSTRAINTS

6-01. **General.** The availability of water resources in the ACT Basin is constrained by existing water supply storage contracts, Corps water control manuals, minimum flow requirements from Allatoona and Carters Dams, APC FERC licenses, Corps-APC Memorandum of Understanding, and industrial water quality flow needs. Existing water supply storage contracts do not include the use of the inactive storage pool and would require developing and implementing an emergency storage contract in order to access this water resource. Each Corps project has a water control manual that specifies operational requirements for varying basin conditions and requires a deviation approval to operate outside the parameters established by the manual. The Allatoona Project has a minimum flow release requirement of 240 cfs for downstream purposes. The Carters Project has a seasonally varying minimum flow release requirement that ranges from 250 – 865 cfs during normal conditions and a minimum of 240 cfs during low flow conditions. The APC projects are operated under FERC licenses which define specific operational requirements for each project and require approval from FERC and possibly the Corps and State agencies before any revised operations could be implemented. The Corps and APC projects are also operated under the rules and regulations found in the Corps-APC Memorandum of Understanding, which describes operational requirements for flood conditions and navigation within the ACT Basin. Some industrial NPDES permits within the ACT Basin have water quality discharge limitations which are impacted by the volume of water flow in the river.

VII – DROUGHT MANAGEMENT PLAN

7-01. **General**. The Drought Contingency Plan (DCP) for the ACT Basin implements drought conservation actions on the basis of composite system storage, state line flows, and basin inflow as triggers to drive drought response actions. The DCP also recognizes that a basin-wide drought plan must incorporate variable hydropower generation requirements from its headwater projects in Georgia (Allatoona Dam and Carters Dam), a reduction in the level of navigation service provided on the Alabama River as storage across the basin declines, and that environmental flow requirements must still be met to the maximum extent practicable. The ACT basin-wide drought plan is composed of three components — Headwater regulation at Allatoona Lake and Carters Lake in Georgia; Regulation at APC projects on the Coosa and Tallapoosa Rivers; and Downstream Alabama River regulation at Corps projects downstream of Montgomery, Alabama.

A. **Headwater Regulation for Drought at Allatoona Lake and Carters Lake**. Drought regulation at Allatoona Lake and Carters Lake consists of progressively reduced hydropower generation as pool levels decline in accordance with the conservation storage action zones established in the projects' water control plans. For instance, when Allatoona Lake is operating in normal conditions (Conservation storage Zone 1); hydropower generation typically ranges from 0 to 4 hours per day. However, as the pool drops to lower action zones during drought conditions, generation could be reduced to 0 to 2 hours per day. As Carters Lake pool level might drop into a conservation storage Zone 2, seasonal varying minimum target flows would be reduced to 240 cfs. The water control manual for each project describes the drought water control regulation plan in more detail.

B. **Drought Regulation at APC Projects on the Coosa, Tallapoosa, and Alabama River**. Regulation guidelines for the Coosa, Tallapoosa, and Alabama Rivers have been defined in a drought regulation matrix (Table 7) on the basis of a Drought Intensity Level (DIL). The DIL is a drought indicator, ranging from one to three. The DIL is determined on the basis of three basin drought criteria (or triggers). A DIL from 1 to 3 indicates some level of drought conditions. The

DIL increases as more of the drought indicator thresholds (or triggers) occur. The drought regulation matrix defines minimum average daily flow requirements on a monthly basis for the Coosa, Tallapoosa, and Alabama Rivers as a function of the DIL and time of year. The combined occurrences of the drought triggers determine the DIL. Three intensity levels for drought operations are applicable to APC projects.

DIL 1 — (moderate drought) 1 of 3 triggers occur
DIL 2 — (severe drought) 2 of 3 triggers occur
DIL 3 — (exceptional drought) all 3 triggers occur

(1) Drought Indicators. The indicators used to determine drought intensity include the following:

1. **Low basin inflow**. The total basin inflow needed is the sum of the total filling volume plus 4,640 cfs. The total filling volume is defined as the volume of water required to return the pool to the top of the conservation guide curve and is calculated using the area-capacity tables for each project. Table 8 lists the monthly low basin inflow criteria. The basin inflow value is computed daily and checked on the first and third Tuesday of the month. If computed basin inflow is less than the value required, the low basin inflow indicator is triggered. The basin inflow is total flow above the APC projects excluding Allatoona Lake and Carters Lake. It is the sum of local flows, minus lake evaporation and diversions. Figure 11 illustrates the local inflows to the Coosa and Tallapoosa Basins. The basin inflow computation differs from the navigation basin inflow because it does not include releases from Allatoona Lake and Carters Lake. The intent is to capture the hydrologic condition across APC projects in the Coosa and Tallapoosa Basins.

Table 7. ACT Basin Drought Regulation Plan Matrix

<table>
<tr><th></th><th>Jan</th><th>Feb</th><th>Mar</th><th>Apr</th><th>May</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th></tr>
<tr><td rowspan="4">Drought Level Response[a]</td><td colspan="12">Normal Operations</td></tr>
<tr><td colspan="12">DIL 1: Low Basin Inflows or Low Composite or Low State Line Flow</td></tr>
<tr><td colspan="12">DIL 2: DIL 1 criteria + (Low Basin Inflows or Low Composite or Low State Line Flow)</td></tr>
<tr><td colspan="12">DIL 3: Low Basin Inflows + Low Composite + Low State Line Flow</td></tr>
<tr><td rowspan="4">Coosa River Flow[b]</td><td colspan="3">Normal Operation: 2,000 cfs</td><td colspan="2">4,000 (8,000)</td><td>4,000 – 2,000</td><td colspan="6">Normal Operation: 2,000 cfs</td></tr>
<tr><td colspan="3">Jordan 2,000 +/-cfs</td><td colspan="2">4,000 +/- cfs</td><td>6/15 Linear Ramp down</td><td colspan="3">Jordan 2,000 +/-cfs</td><td colspan="3">Jordan 2,000 +/-cfs</td></tr>
<tr><td colspan="3">Jordan 1,600 to 2,000 +/-cfs</td><td colspan="2">2,500 +/- cfs</td><td>6/15 Linear Ramp down</td><td colspan="3">Jordan 2,000 +/-cfs</td><td colspan="3">Jordan 1,600 to 2,000 +/-cfs</td></tr>
<tr><td colspan="3">Jordan 1,600 +/-cfs</td><td colspan="3">Jordan 1,600 to 2,000 +/-cfs</td><td colspan="3">Jordan 2,000 +/-cfs</td><td colspan="2">Jordan 1,600 to 2,000 +/-cfs</td><td>Jordan 1,600 +/-cfs</td></tr>
<tr><td rowspan="4">Tallapoosa River Flow[c]</td><td colspan="12">Normal Operations: 1200 cfs</td></tr>
<tr><td colspan="4">Greater of 1/2 Yates Inflow or 2 x Heflin Gage (Thurlow Lake releases > 350 cfs)</td><td colspan="5">1/2 Yates Inflow</td><td colspan="3">1/2 Yates Inflow</td></tr>
<tr><td colspan="4">Thurlow Lake 350 cfs</td><td colspan="5">1/2 Yates Inflow</td><td colspan="3">Thurlow Lake 350 cfs</td></tr>
<tr><td colspan="6">Maintain 400 cfs at Montgomery WTP (Thurlow Lake release 350 cfs)</td><td colspan="3">Thurlow Lake 350 cfs</td><td colspan="3">Maintain 400 cfs at Montgomery WTP (Thurlow Lake release 350 cfs)</td></tr>
<tr><td rowspan="4">Alabama River Flow[d]</td><td colspan="12">Normal Operation: Navigation or 4,640 cfs flow</td></tr>
<tr><td colspan="4">4,200 cfs (10% Cut) - Montgomery</td><td colspan="5">4,640 cfs - Montgomery</td><td colspan="3">Reduce: Full – 4,200 cfs</td></tr>
<tr><td colspan="5">3,700 cfs (20% Cut) - Montgomery</td><td colspan="4">4,200 cfs (10% Cut) - Montgomery</td><td colspan="3">Reduce: 4,200 cfs-> 3,700 cfs Montgomery (1 week ramp)</td></tr>
<tr><td colspan="4">2,000 cfs Montgomery</td><td colspan="2">3,700 cfs Montgomery</td><td colspan="3">4,200 cfs (10% Cut) - Montgomery</td><td colspan="3">Reduce: 4,200 cfs -> 2,000 cfs Montgomery (1 month ramp)</td></tr>
<tr><td rowspan="4">Guide Curve Elevation</td><td colspan="12">Normal Operations: Elevations follow Guide Curves as prescribed in License (Measured in Feet)</td></tr>
<tr><td colspan="12">Corps Deviations: As Needed; FERC Deviation for Lake Martin</td></tr>
<tr><td colspan="12">Corps Deviations: As Needed; FERC Deviation for Lake Martin</td></tr>
<tr><td colspan="12">Corps Deviations: As Needed; FERC Deviation for Lake Martin</td></tr>
</table>

a. Note these are based on flows that will be exceeded when possible.
b .Jordan flows are based on a continuous +/- 5% of target flow.
c. Thurlow Lake flows are based on continuous +/- 5% of target flow: flows are reset on noon each Tuesday based on the prior day's daily average at Heflin or Yates.
d. Alabama River flows are 7-Day Average Flow.

Table 8. Low Basin Inflow Guide (in cfs-days)

Month	Coosa Filling Volume	Tallapoosa Filling Volume	Total Filling Volume	Minimum JBT Target Flow	Required Basin Inflow
Jan	0	0	0	4,640	4640
Feb	0	120	120	4,640	4760
Mar	643	2900	3543	4,640	8183
Apr	1606	2585	4191	4,640	8831
May	5	0	5	4,640	4645
Jun	0	0	0	4,640	4640
Jul	0	0	0	4,640	4640
Aug	0	0	0	4,640	4640
Sep	0	-1304	-1304	4,640	3336
Oct	-1167	-2132	-3299	4,640	1341
Nov	-1067	-2186	-3253	4,640	1387
Dec	-3	0	-3	4,640	4637

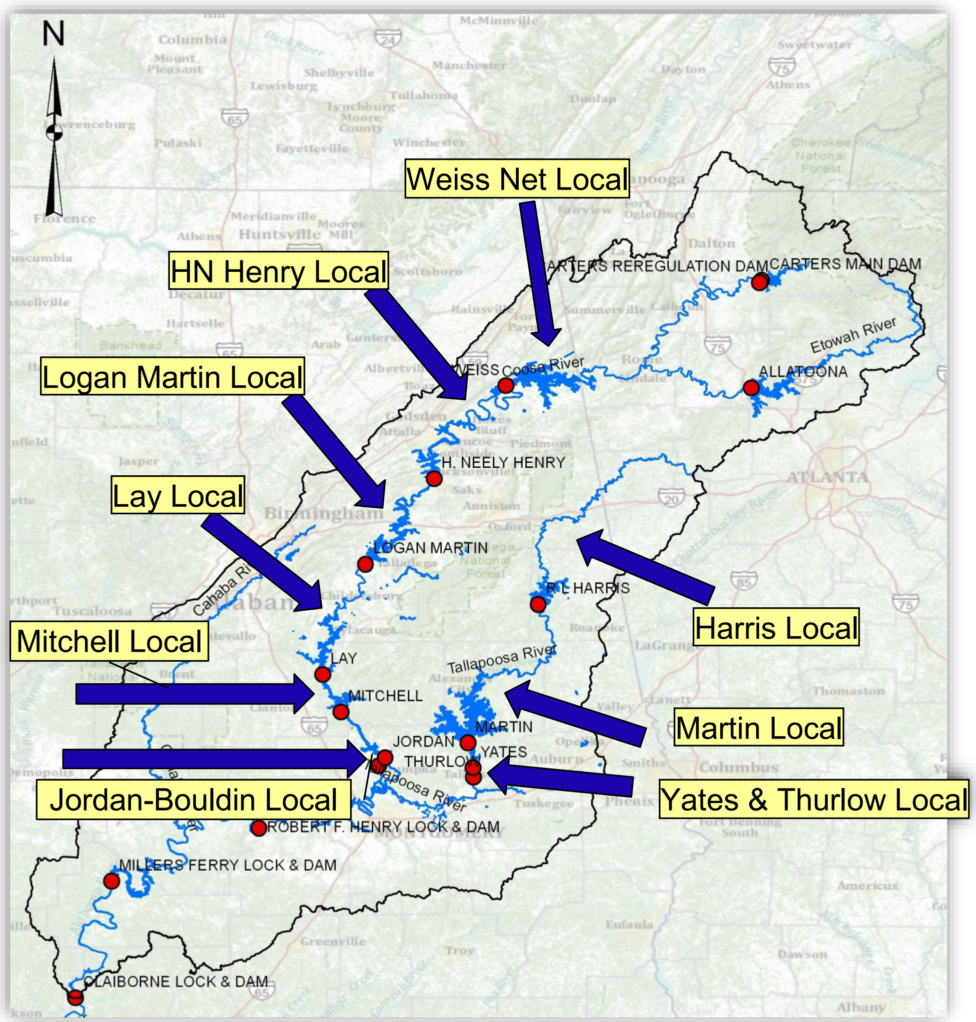


Figure 11. ACT Basin Inflows

2. **Low composite conservation storage**. Low composite conservation storage occurs when the APC projects' composite conservation storage is less than or equal to the storage available within the drought contingency curves for the APC reservoirs. Composite conservation storage is the sum of the amounts of storage available at the current elevation for each reservoir down to the drought contingency curve at each APC major storage project. The reservoirs considered for the trigger are R.L. Harris Lake, H. Neely Henry Lake, Logan Martin Lake, Lake Martin, and Weiss Lake. Figure 12 plots the APC composite zones. Figure 13 plots the APC low composite conservation storage trigger. If the actual active composite conservation storage is less than or equal to the active composite drought zone storage, the low composite conservation storage indicator is triggered. That computation is performed on the first and third Tuesday of each month and is considered along with the low state line flow trigger and basin inflow trigger.

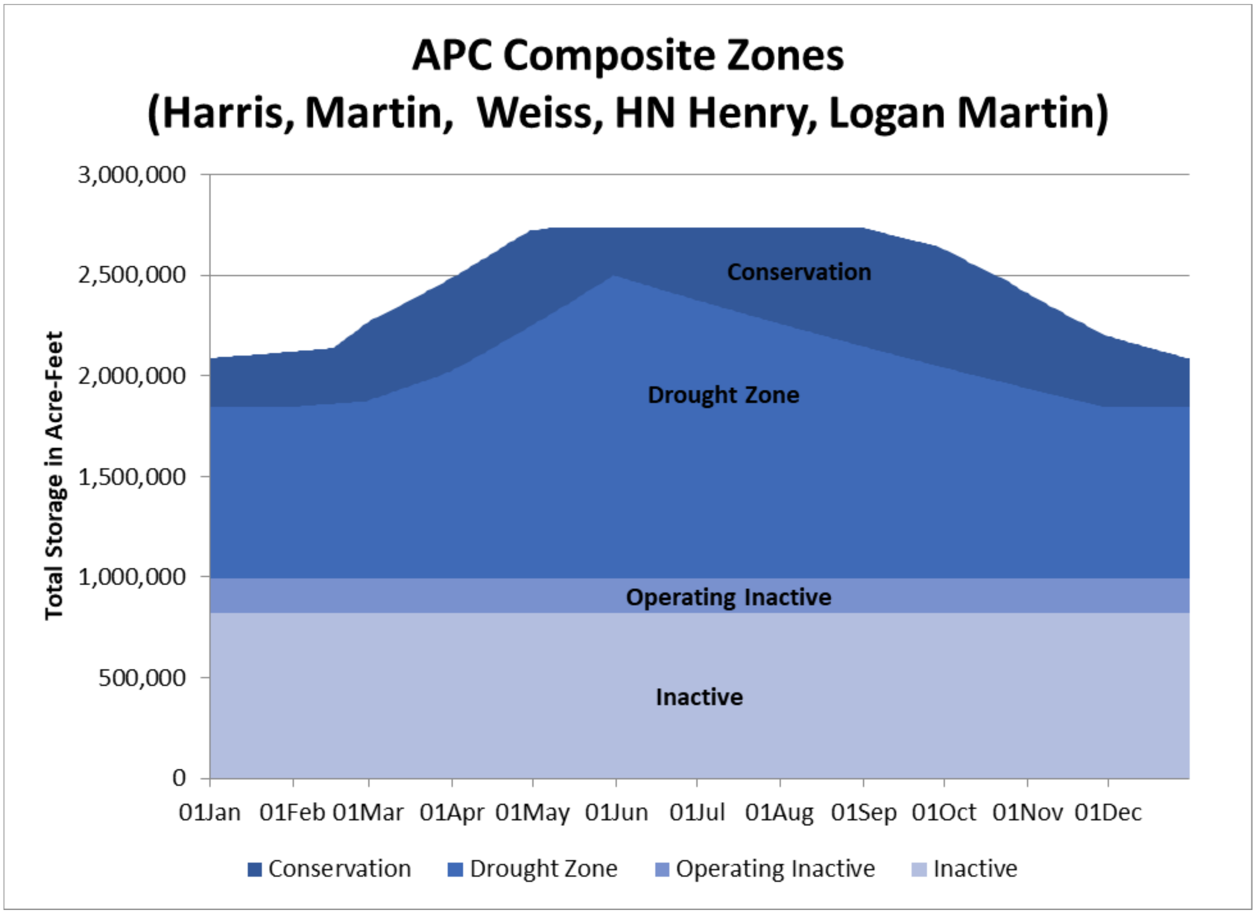


Figure 12. APC Composite Zones

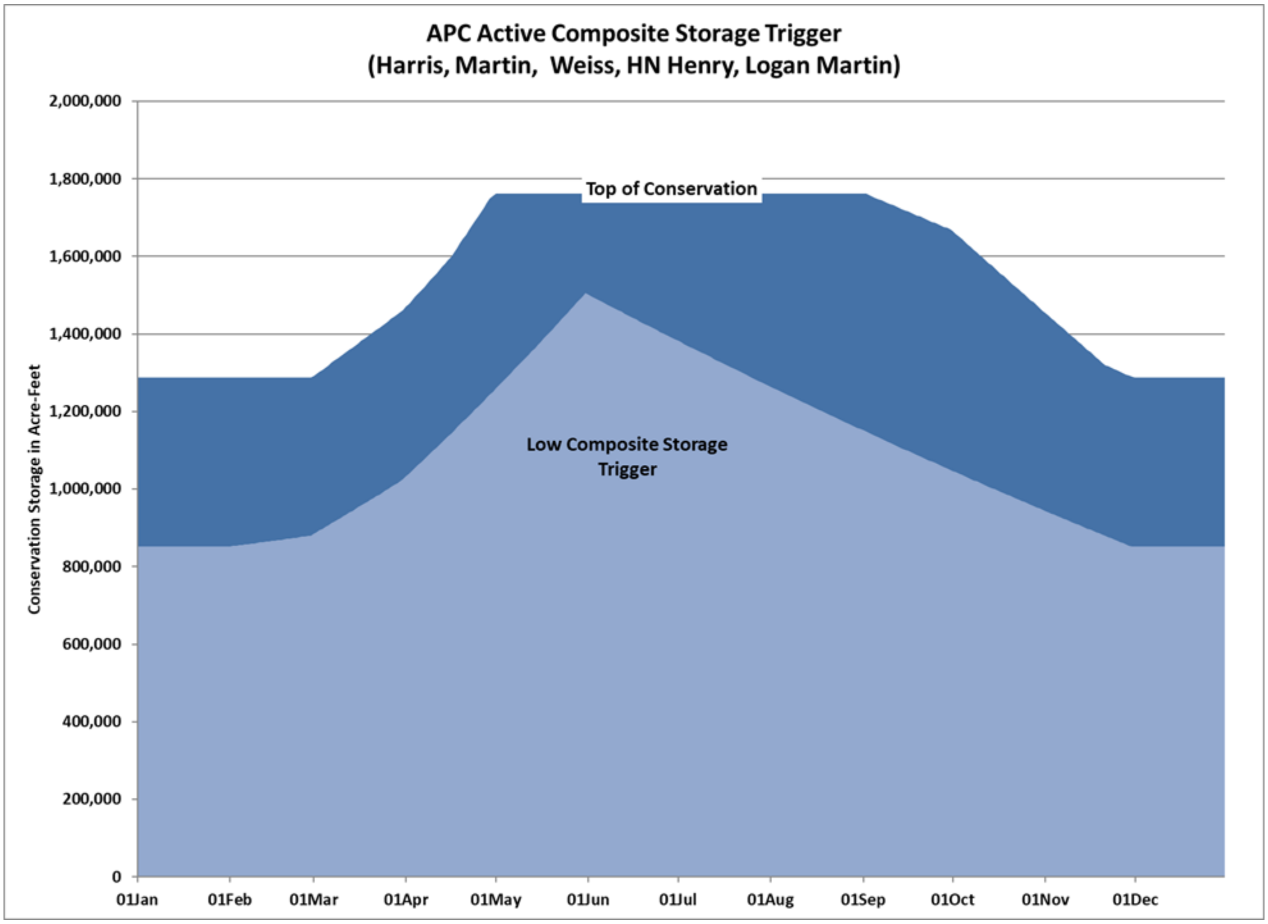


Figure 13. APC Low Composite Conservation Storage Drought Trigger

3. **Low state line flow**. A low state line flow trigger occurs when the Mayo's Bar USGS gage measures a flow below the monthly historical 7Q10 flow. The 7Q10 flow is defined as the lowest flow over a 7-day period that would occur once in 10 years. Table 9 lists the Mayo's Bar 7Q10 value for each month (determined from observed flows from 1949 – 2006). The lowest 7-day average flow over the past 14 days is computed and checked at the first and third Tuesday of the month. If the lowest 7-day average value is less than the Mayo's Bar 7Q10 value, the low state line flow indicator is triggered. If the result is greater than or equal to the trigger value from Table 9, the flow is considered normal, and the state line flow indicator is not triggered. The term state line flow is used in developing the drought management plan because of the proximity of the Mayo's Bar gage to the Alabama-Georgia state line and because it relates to flow data upstream of the Alabama-based APC reservoirs. State line flow is used only as a source of observed data for one of the three triggers and does not imply that flow targets exist at that geographic location. The ACT Basin drought matrix does not include or imply any Corps regulation that would result in water management decisions at Carters Lake or Allatoona Lake.

Table 9. State Line Flow Triggers

Month	Mayo's Bar (7Q10 in cfs)
Jan	2,544
Feb	2,982
Mar	3,258
Apr	2,911
May	2,497
Jun	2,153
Jul	1,693
Aug	1,601
Sep	1,406
Oct	1,325
Nov	1,608
Dec	2,043

Note: Based on USGS Coosa River at Rome Gage (Mayo's Bar, USGS 02397000) observed flow from 1949 to 2006

(2) Drought Regulation. The DIL is computed on the first and third Tuesday of each month. Once a drought operation is triggered, the DIL can only recover from drought condition at a rate of one level per period. For example, as the system begins to recover from an exceptional drought with DIL 3, the DIL must be stepped incrementally back to zero to resume normal operations. In that case, even if the system triggers return to normal quickly, it will still take at least a month before normal operations can resume - conditions can improve only to DIL 2 for the next 15 days, then DIL 1 for the next 15 days, before finally returning to normal operating conditions.

For normal operations, the matrix shows a Coosa River flow between 2,000 cfs and 4,000 cfs with peaking periods up to 8,000 cfs occurring. The required flow on the Tallapoosa River is a constant 1,200 cfs throughout the year. The navigation flows on the Alabama River are applied to the APC projects. The required navigation depth on the Alabama River is subject to the basin inflow.

For DIL 1, the Coosa River flow varies from 2,000 cfs to 4,000 cfs. On the Tallapoosa River, the required flow is the greater of one-half of the inflow into Yates Lake or twice the Heflin USGS gage from January through April. For the remainder of the year, the required flow is one-half of Yates Lake inflow. The required flows on the Alabama River are reduced from the amounts required for DIL 0.

For DIL 2, the Coosa River flow varies from 1,600 cfs to 2,500 cfs. On the Tallapoosa River, the minimum is 350 cfs for part of the year and one-half of Yates Lake inflow for the remainder of the year. The requirement on the Alabama River is between 3,700 cfs and 4,200 cfs.

For DIL 3, the flows on the Coosa River range from 1,600 cfs to 2,000 cfs. A constant flow of 350 cfs on the Tallapoosa River is required. It is assumed an additional 50 cfs will occur between Thurlow Lake and the City of Montgomery water supply intake. Required flows on the Alabama River range from 2,000 cfs to 4,200 cfs

In addition to the flow regulation for drought conditions, the DIL affects the flow regulation to support navigation operations. Under normal operations, the APC projects are operated to meet the needed navigation flow target or 4,640 cfs flow as defined in the navigation measure section. Once drought operations begin, flow regulation to support navigation operations is suspended.

7-02. **Extreme Drought Conditions**. An extreme drought condition exists when the remaining composite conservation storage is depleted, and additional emergency actions may be necessary. When conditions have worsened to this extent, utilization of the inactive storage must be considered. Such an occurrence would typically be contemplated in the second or third year of a drought. Inactive storage capacities have been identified for the two Federal projects with significant storage (Figures 14 and 15). The operational concept established for the extreme drought impact level and to be implemented when instituting the use of inactive storage is based on the following actions:

(1) Inactive storage availability is identified to meet specific critical water use needs within existing project authorizations.

(2) Emergency uses and users will be identified in accordance with emergency authorizations and through stakeholder coordination. Typical critical water use needs within the basin are associated with public health and safety.

(3) Weekly projections of the inactive storage water availability to meet the critical water uses in the ACT Basin will be utilized when making water control decisions regarding withdrawals and water releases from the Federal reservoirs.

(4) The inactive storage action zones will be developed and instituted as triggers to meet the identified priority water uses (releases will be restricted as storage decreases).

(5) Dam safety considerations will always remain the highest priority. The structural integrity of the dams due to static head limitations will be maintained.

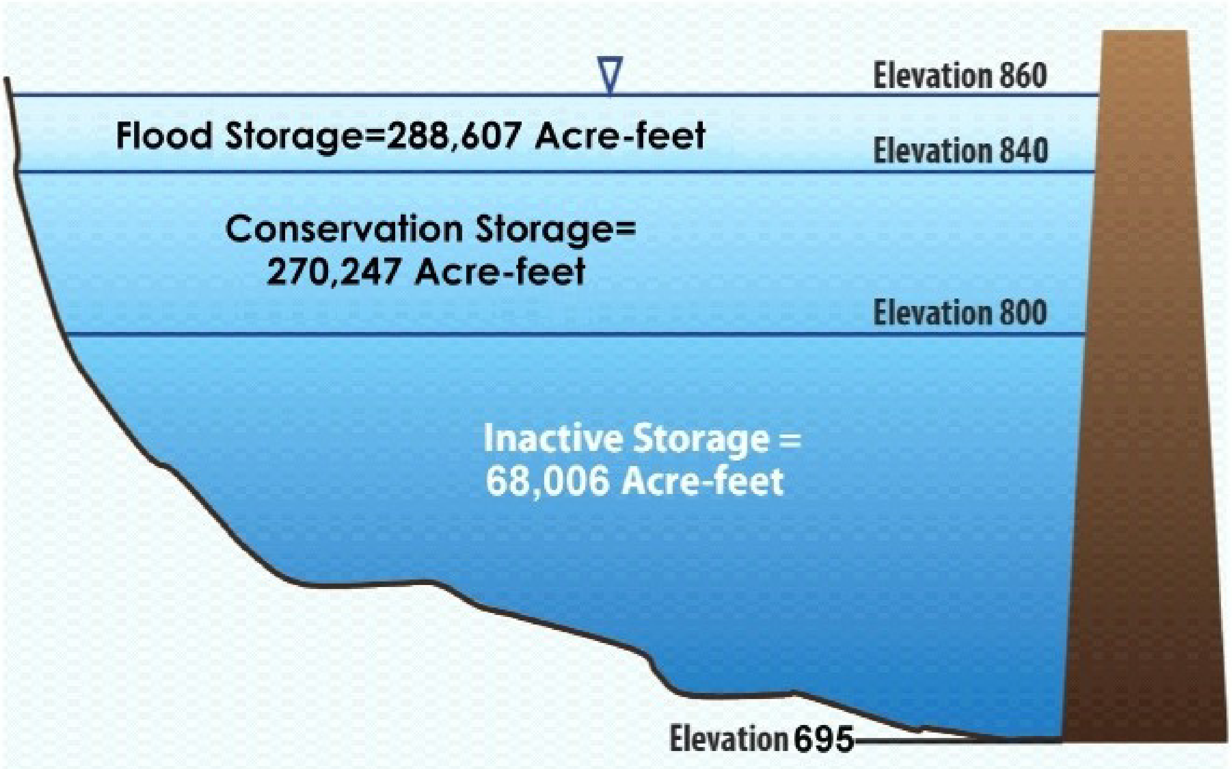


Figure 14. Storage in Allatoona Lake

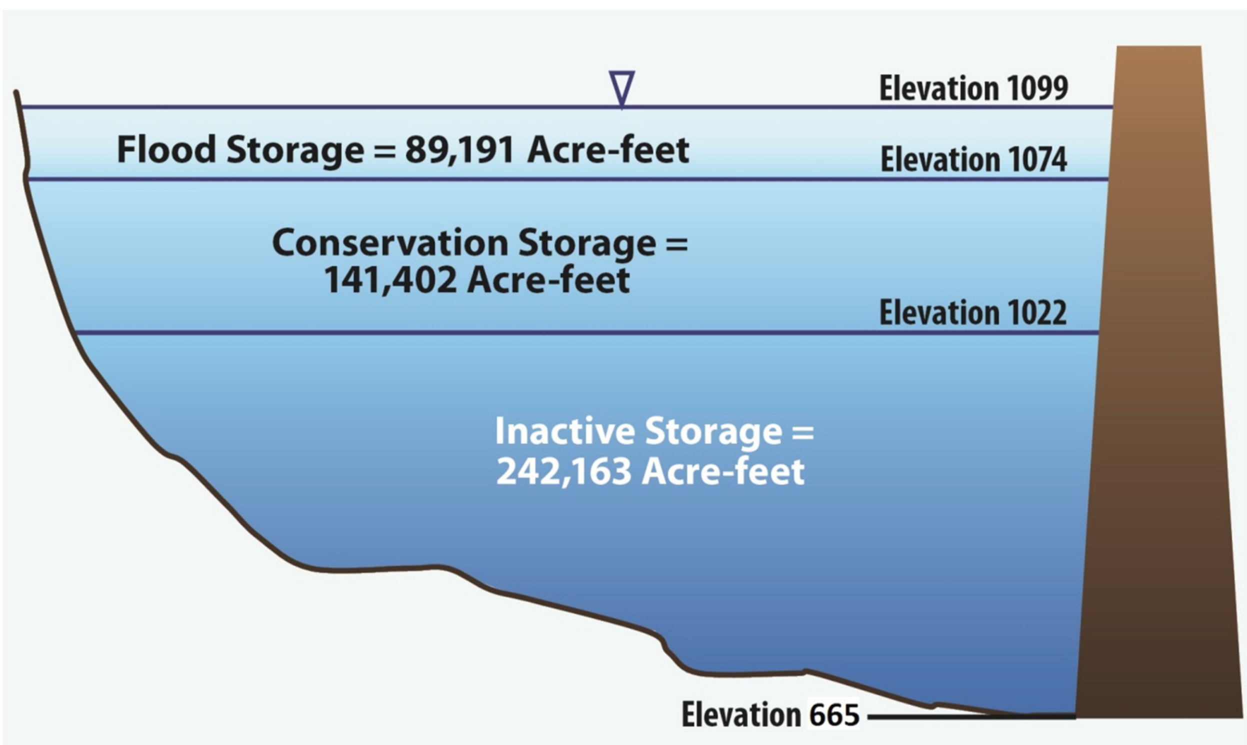


Figure 15. Storage in Carters Lake (excluding reregulation pool)

VIII – DROUGHT MANAGEMENT COORDINATION AND PROCEDURES

8-01. USACE Coordination. It is the responsibility of the Mobile District Water Management Section and APC to monitor climatological and hydrometeorological conditions at all times to make prudent water management decisions. The Water Management Section makes daily decisions and coordinates with APC every two weeks or more often if conditions warrant and with other district representatives from the various areas for which the river systems are operated -- hydropower, recreation, navigation, environmental, and others to exchange information concerning the operation of the river system. This coordination includes conducting weekly meetings with these other district elements. Daily water management decisions regarding water availability, lake level forecasts, and storage forecasts are determined using the information obtained along with current project and basin hydrometeorological data. A weekly District River System Status report is prepared that summarizes the conditions in each of the river basins. When conditions become evident that normal low flow conditions are worsening, the Water Management Section will elevate the district coordination to a heightened awareness. When drought conditions are imminent, Emergency Management representatives will be notified of the conditions and will be included in the regular coordination activities.

8-02. Interagency Coordination. The Water Management Section will support the environmental team regarding actions that require coordination with the U.S. Fish and Wildlife Service (USFWS) for monitoring threatened and endangered species and with the Environmental Protection Agency (EPA), Georgia Environmental Protection Division (GAEPD), and Alabama Department of Environmental Management (ADEM) regarding requests to lower minimum flow targets below Claiborne Dam.

8-03. Public Information and Coordination. When conditions determine that a change in the water control actions from normal regulation to drought regulation is imminent, it is important that various users of the system are notified so that any environmental or operational preparations can be completed prior to any impending reduction in reservoir discharges, river levels, and reservoir pool levels. In periods of severe drought within the ACT Basin it will be within the discretion of the Division Commander to approve the enactment of ACT Basin Water Management conference calls. The purposes of the calls are to share ongoing water management decisions with basin stakeholders and to receive stakeholder input regarding needs and potential impacts to users within the basin. Depending upon the severity of the drought conditions, the calls will be conducted at regular monthly or bi-weekly intervals. Should issues arise, more frequent calls would be implemented.

a. Local Press and Corps Bulletins. The local press consists of periodic publications in or near the ACT Basin. Montgomery, Columbus, and Atlanta have some of the larger daily papers. The papers often publish articles related to the rivers and streams. Their representatives have direct contact with the Corps through the Public Affairs Office. In addition, they can access the Corps Web pages for the latest project information. 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 https://www.sam.usace.army.mil/Missions/Civil-Works/Water-Management/. The Mobile District Public Affairs Office issues press releases as necessary to provide the public with information regarding Water Management issues and activities and also provides information via the Mobile District web site.

IX – REFERENCES

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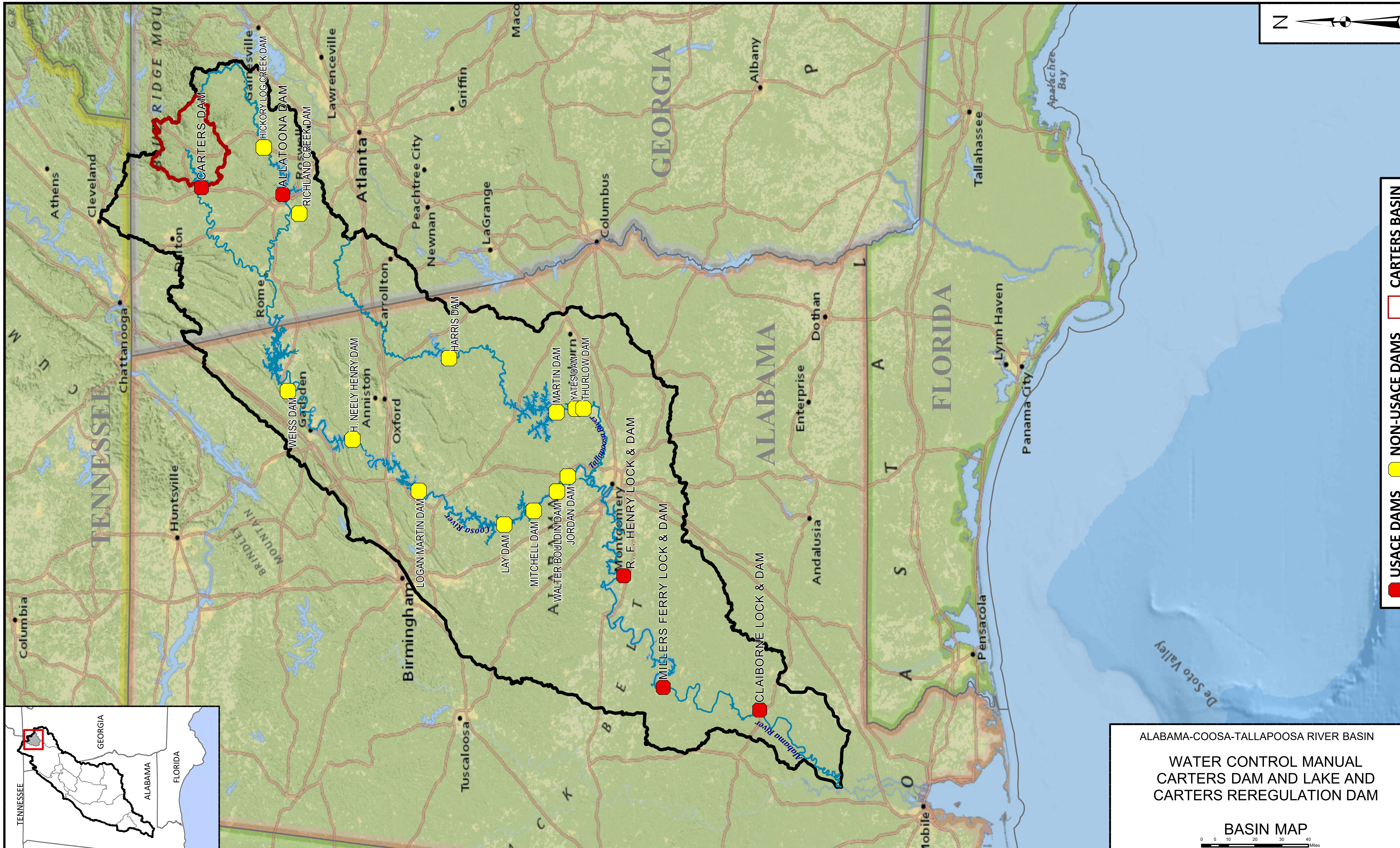
PLATES


ALABAMA-COOSA-TALLAPOOSA RIVER BASIN
WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND
CARTERS REREGULATION DAM
BASIN MAP
USACE DAMS
NON-USACE DAMS
CARTERS BASIN
CARTERS DAM
HICKORY LOG CREEK DAM
ALLATOONA DAM
RICHLAND CREEK DAM
WEISS DAM
H. NEELY HENRY DAM
LOGAN MARTIN DAM
LAY DAM
MITCHELL DAM
WALTER BOULDIN DAM
JORDAN DAM
HARRIS DAM
MARTIN DAM
YATES DAM
THURLOW DAM
R. F. HENRY LOCK & DAM
MILLERS FERRY LOCK & DAM
CLAIBORNE LOCK & DAM
Coosa River
Tallapoosa River
Alabama River
GEORGIA
ALABAMA
FLORIDA
TENNESSEE
Atlanta
Birmingham
Montgomery
Mobile
Tallahassee
Chattanooga
Columbus
Rome
Gadsden
Anniston
Oxford
Tuscaloosa
Huntsville
Dalton
Cleveland
Athens
Carrollton
Newnan
Peachtree City
Griffin
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Lawrenceville
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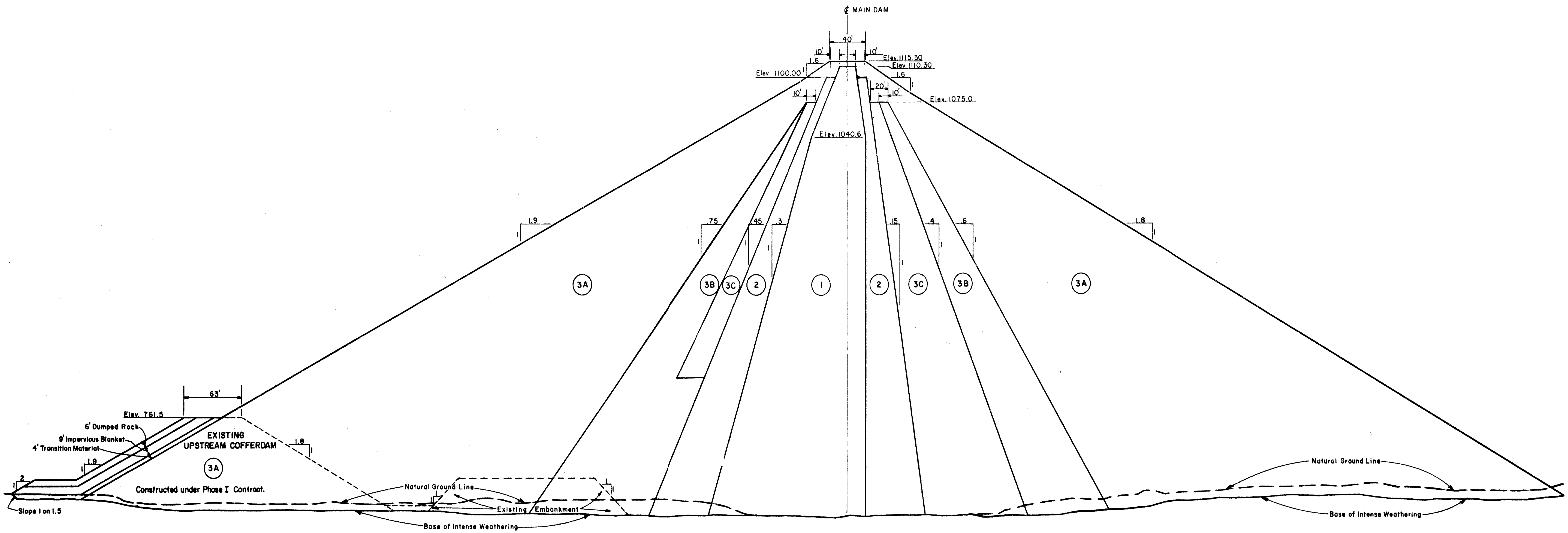
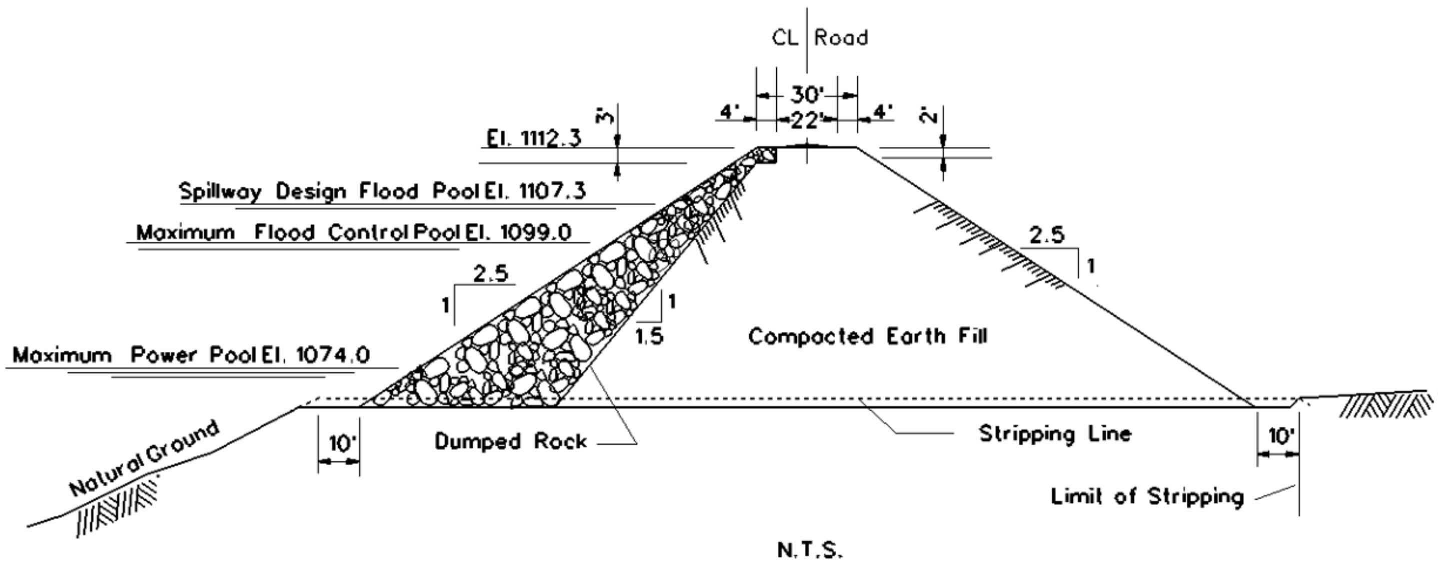


ZONE I - IMPERVIOUS CORE – HIGHLY WEATHERED AND DISINTEGRATED ROCK
ZONE 2 - TRANSITION MATERIAL – WEATHERED ROCK
ZONE 3A - BEST QUALITY ROCK – SOUND QUARTZITE WITH UP TO 30% ARGILLITE AND/OR PHYLLITE
ZONE 3B - INTERMEDIATE QUALITY ROCK – SLIGHTLY WEATHERED ROCK WITH UP TO 40% ARGILLITE AND/OR PHYLLITE.
ZONE 3C - RANDOM ROCK

ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND
CARTERS REGULATION DAM

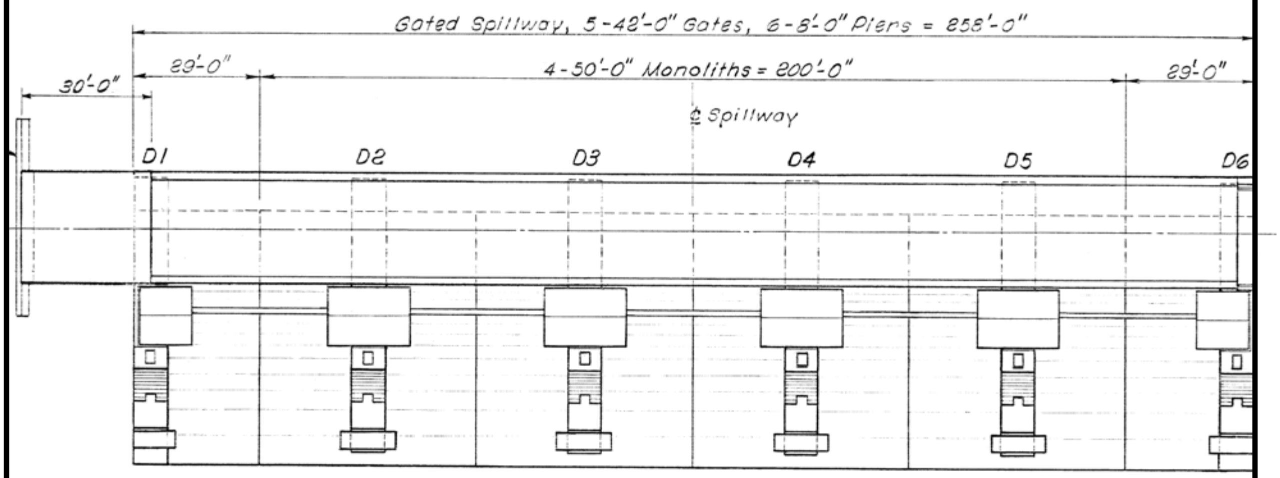
MAIN DAM ROCK FILL SECTION



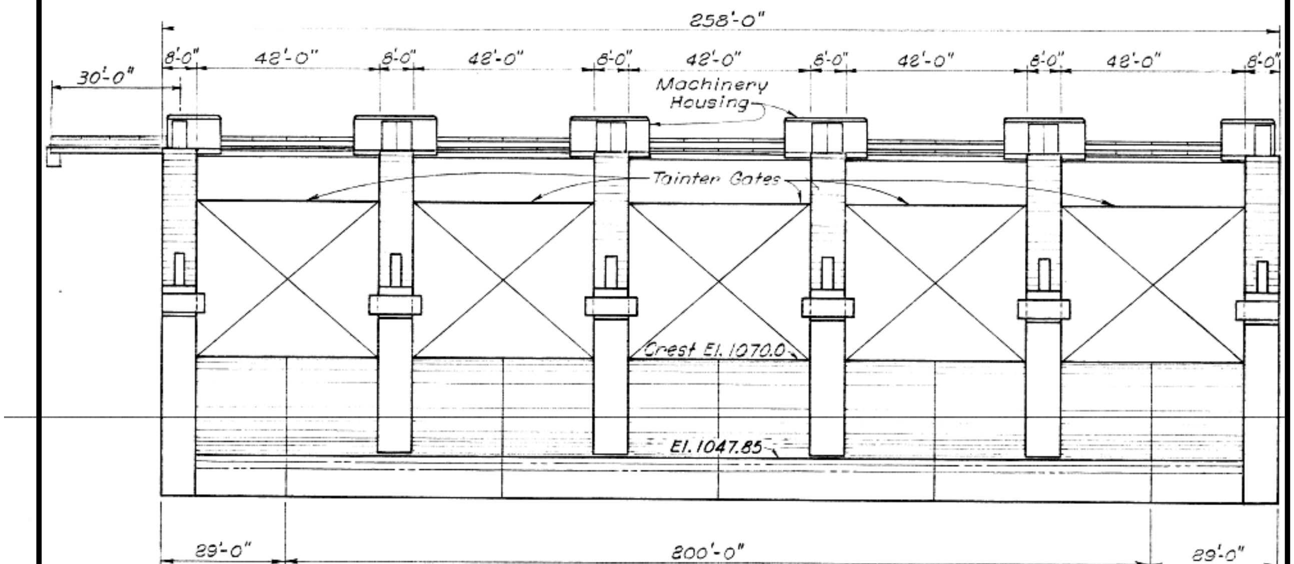
ALABAMA-COOSA-TALLAOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS
REREGULATION DAM

SADDLE DIKE SECTION



EMERGENCY SPILLWAY PLAN

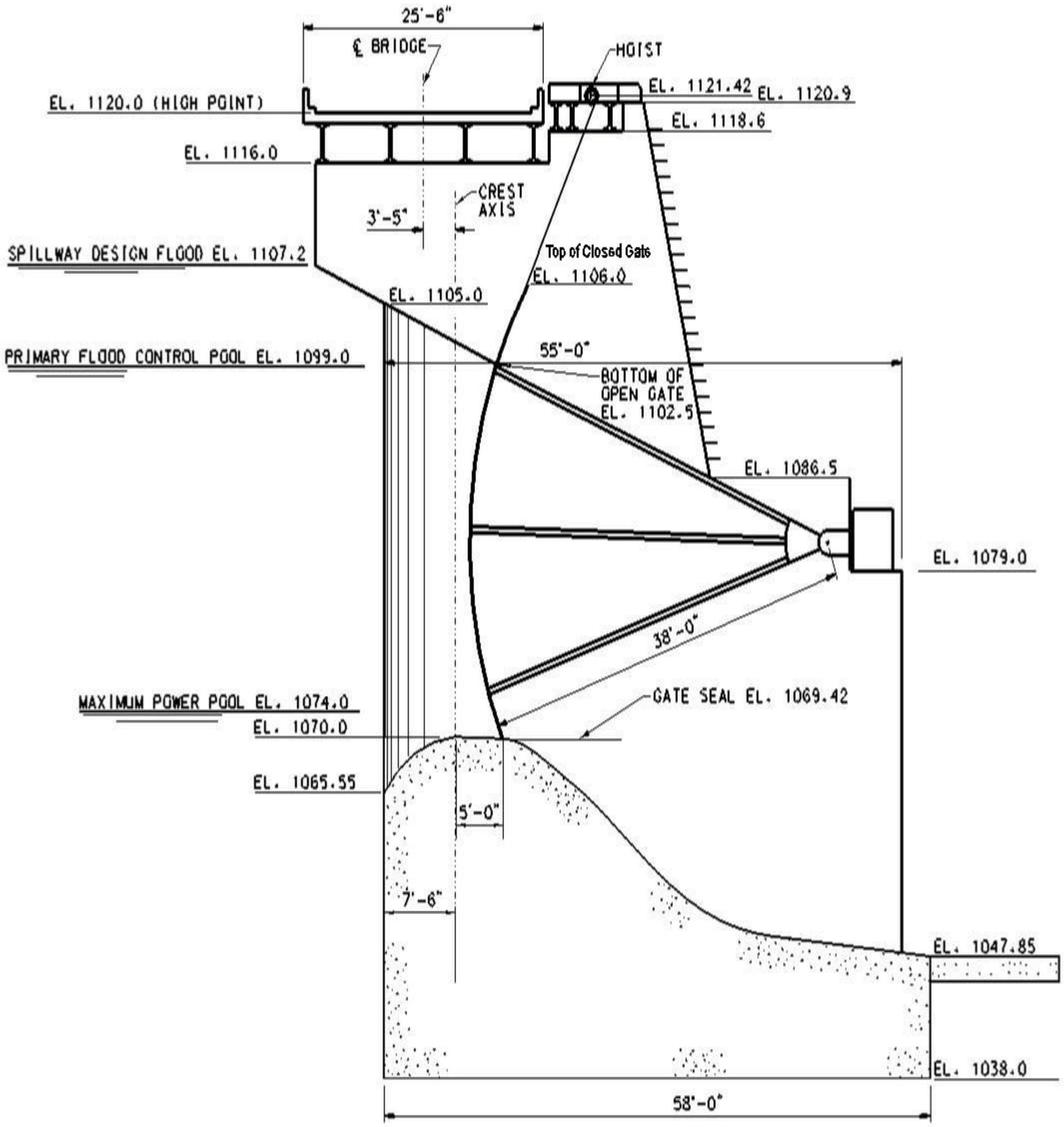


EMERGENCY SPILLWAY DOWNSTREAM ELEVATION

ALABAMA-COOSA-TALLAOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS
REREGULATION DAM

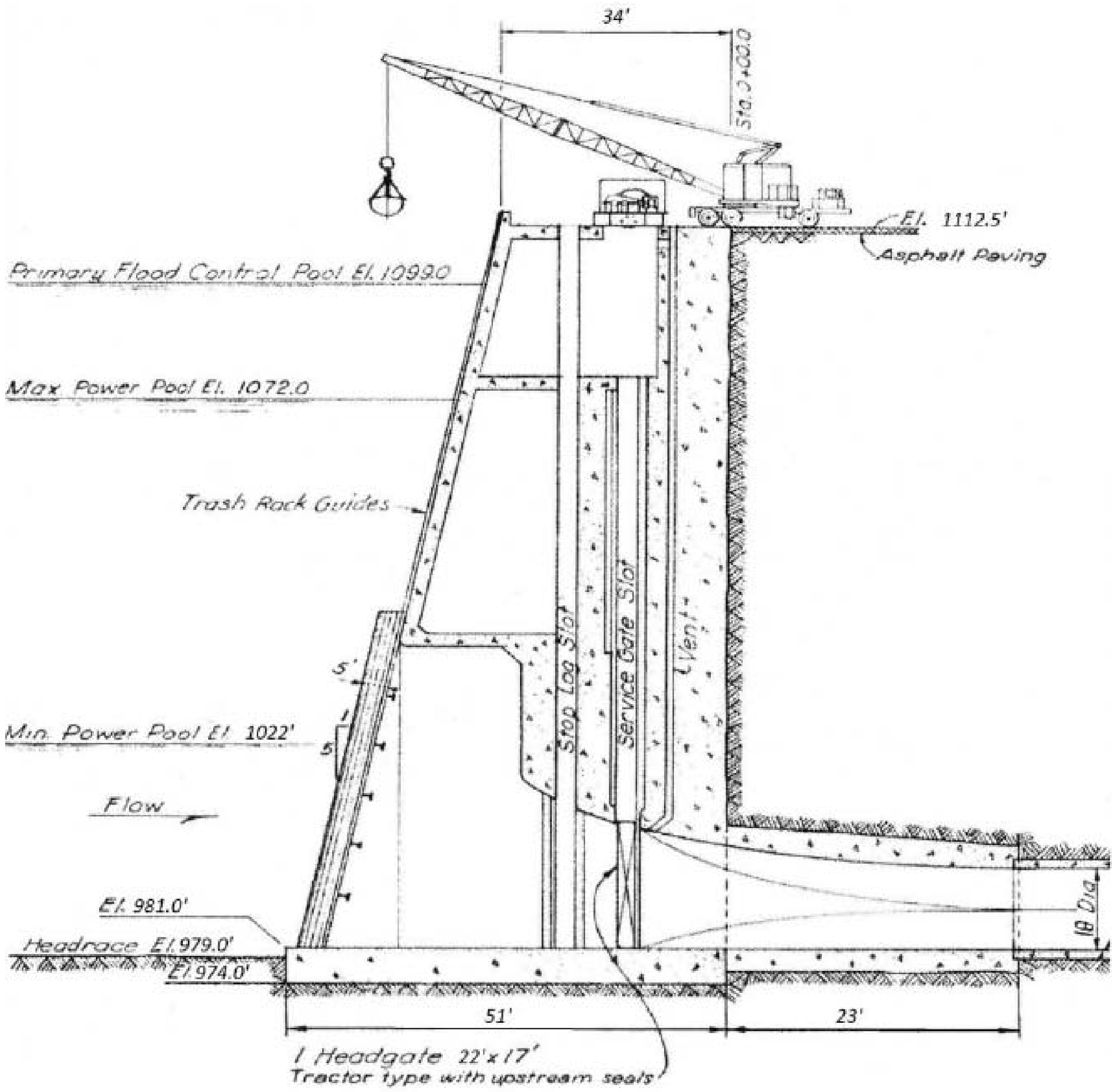
EMERGENCY SPILLWAY PLAN & DOWNSTREAM ELEVATION



ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS
REREGULATION DAM

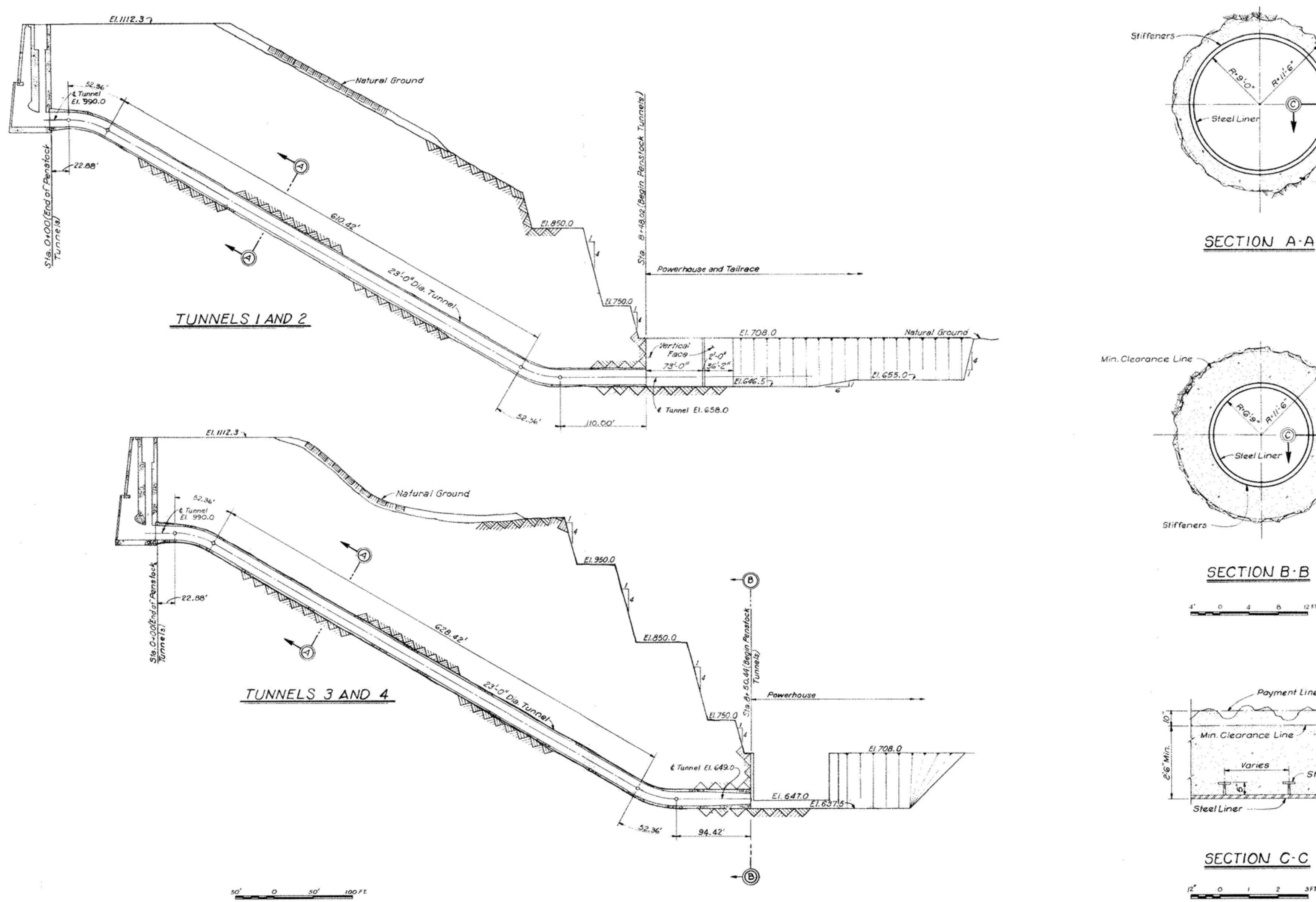
TYPICAL EMERGENCY GATED SPILLWAY SECTION



ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS
REREGULATION DAM

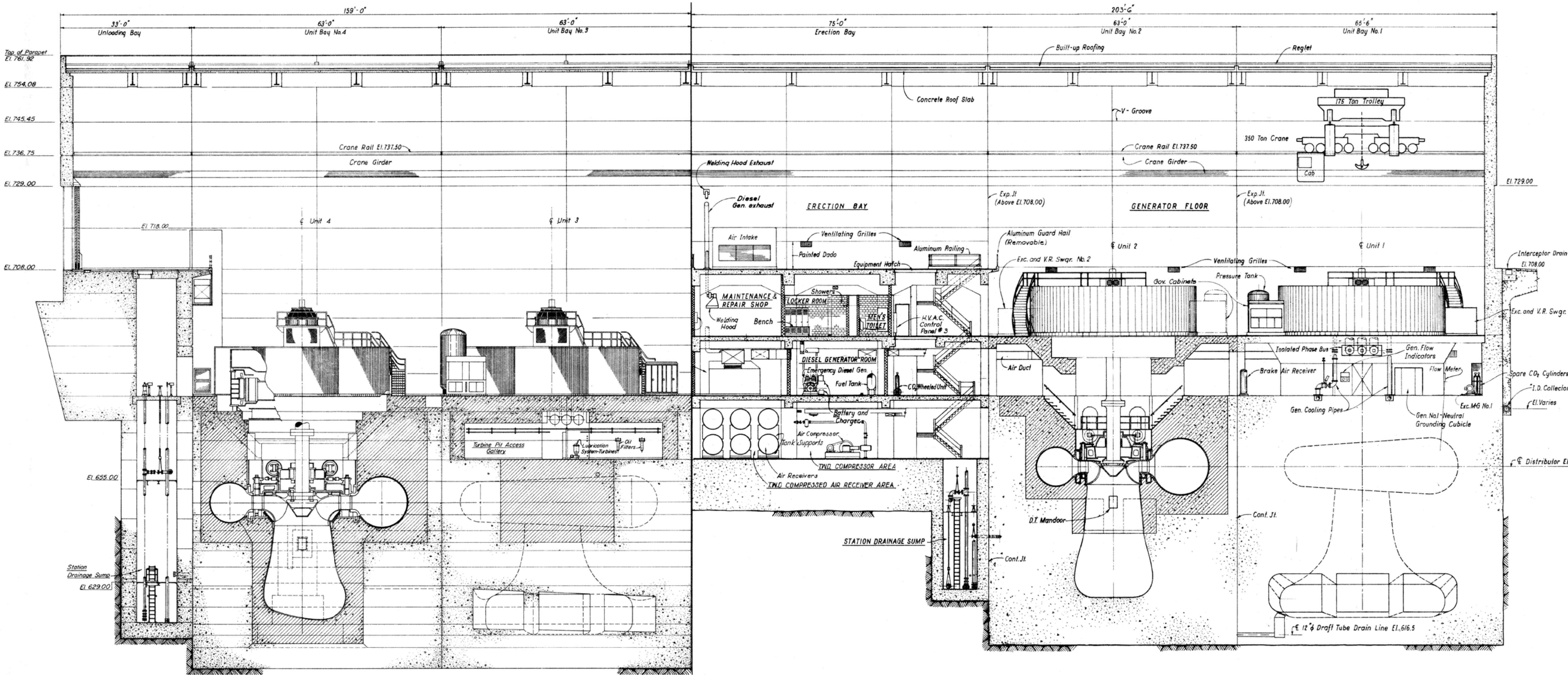
SECTION AT POWERHOUSE INTAKE



ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

PENSTOCK CENTERLINE PROFILES AND SECTIONS



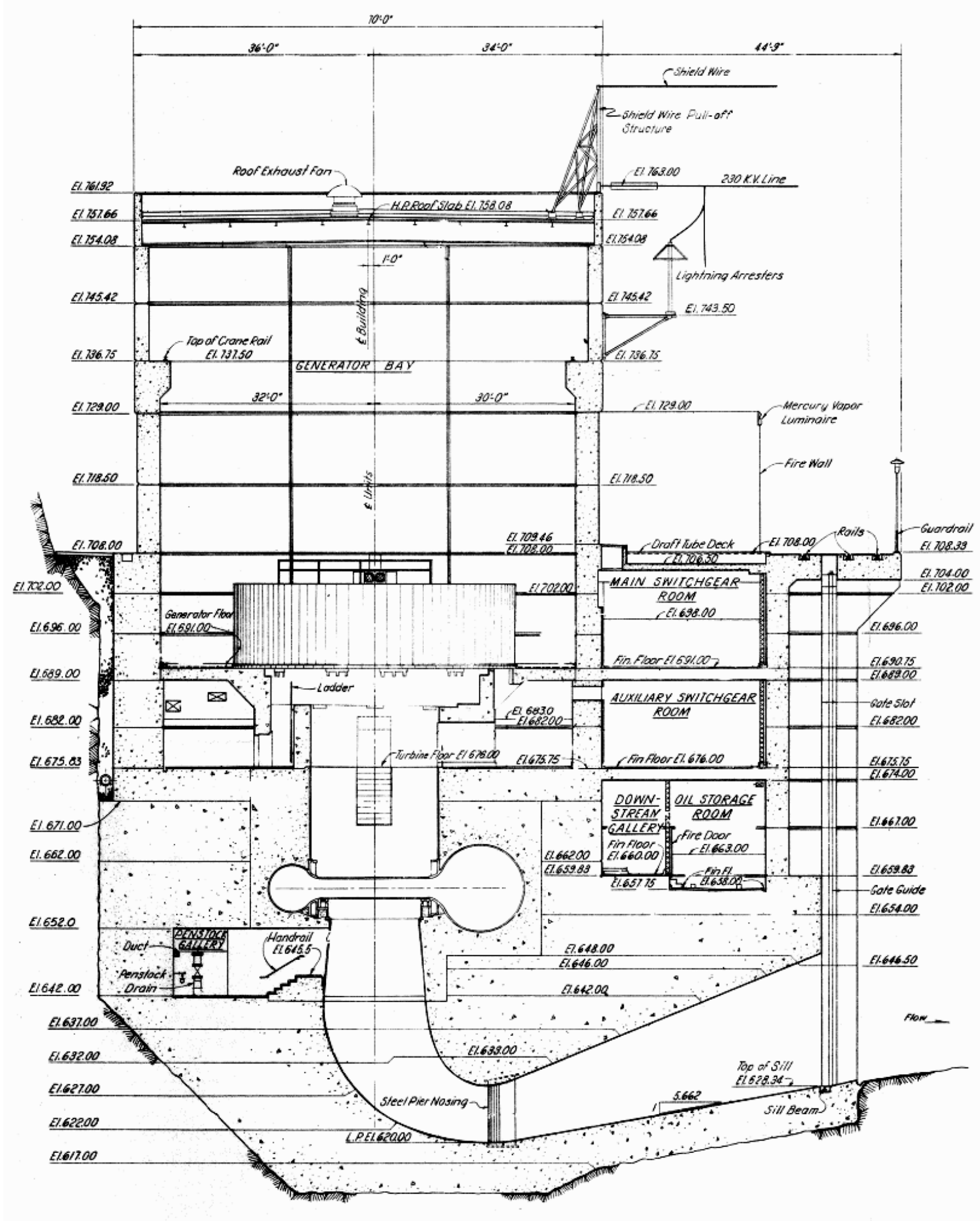
LONGITUDINAL SECTION UNITS 3 & 4

LONGITUDINAL SECTION UNITS 1 & 2

ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

LONGITUDINAL SECTIONS AT POWERHOUSE UNITS



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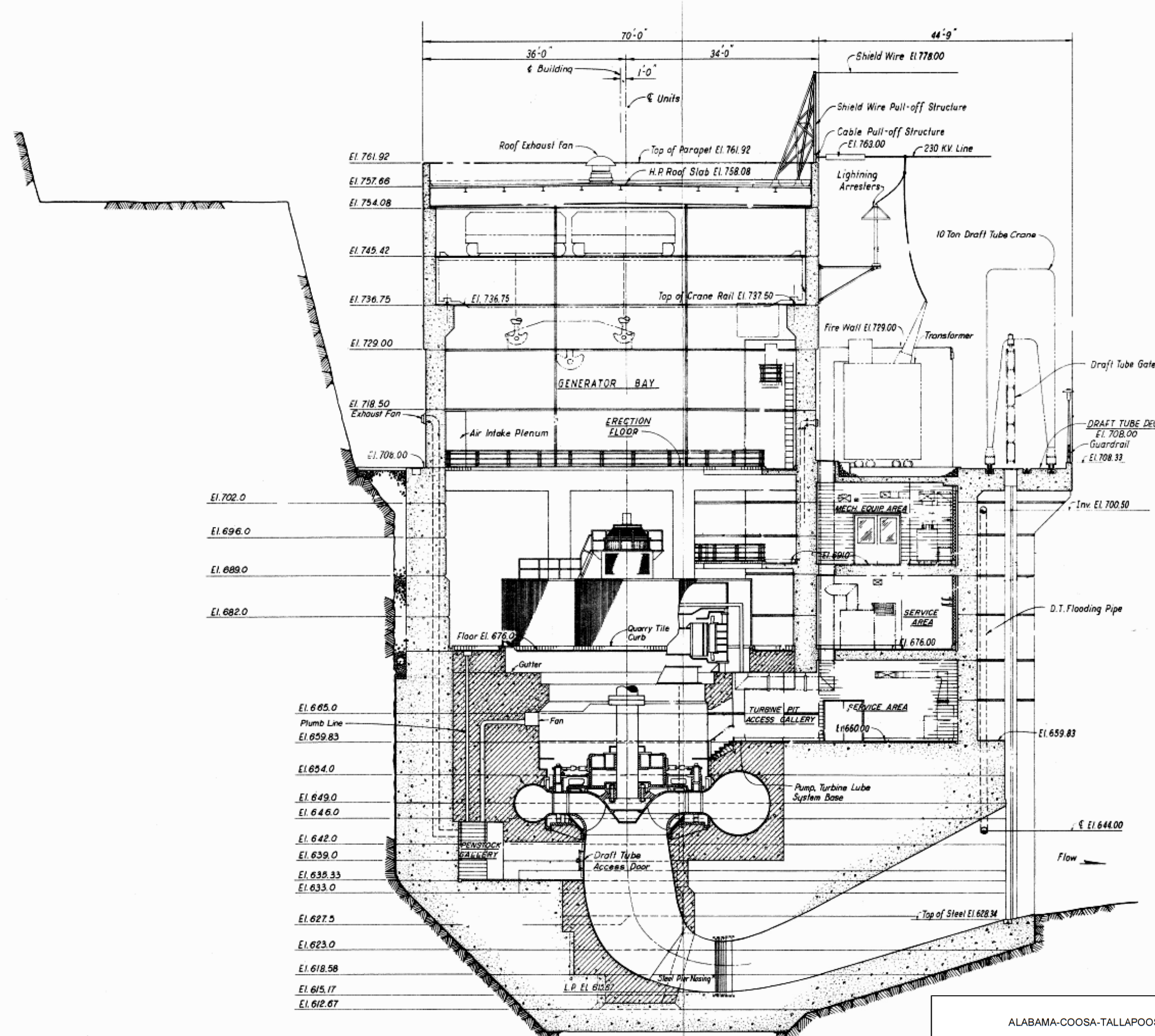
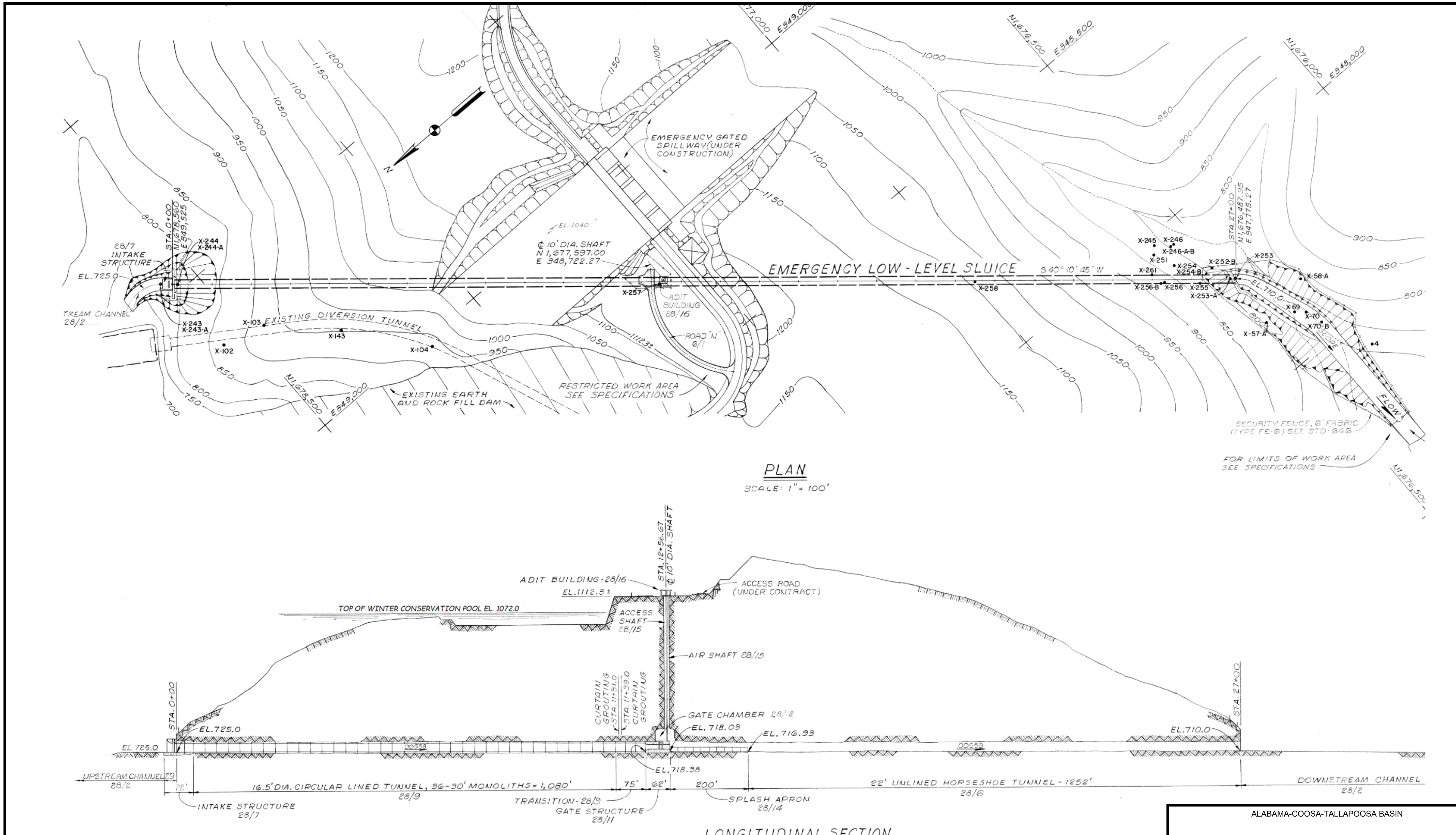


TRANSVERSE SECTION UNITS 3 & 4

ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

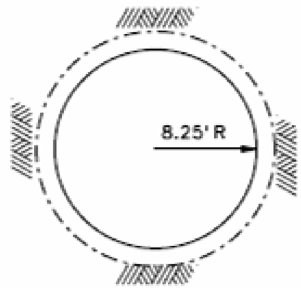
TRANSVERSE SECTIONS AT POWERHOUSE UNITS



ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

EMERGENCY LOW LEVEL SLUICE PLAN AND LONGITUDINAL SECTION



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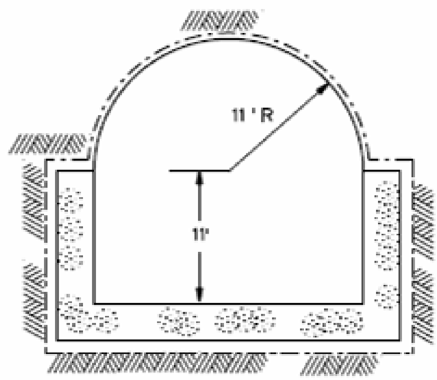
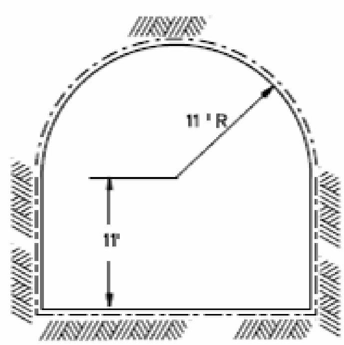
CIRCULAR CONCRETE-LINED
TUNNEL TO STATION 11+51



TYPICAL SECTION
CONCRETE-LINED HORSE-SHOE
TUNNEL D/S OF GATE
TO STATION 14+74

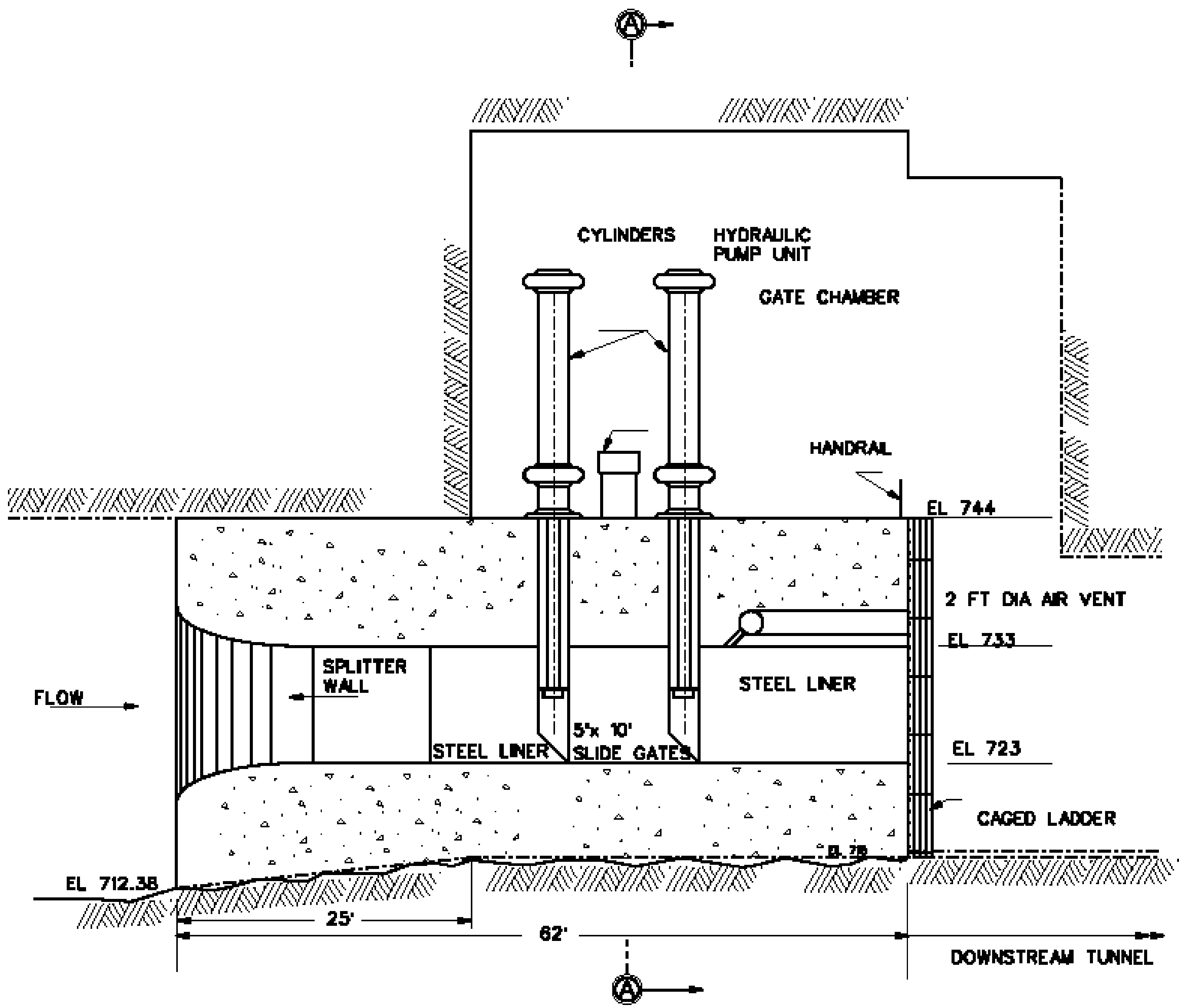


TYPICAL SECTION
UNLINED HORSE-SHOE
TUNNEL D/S OF GATE
TO STATION 27+41

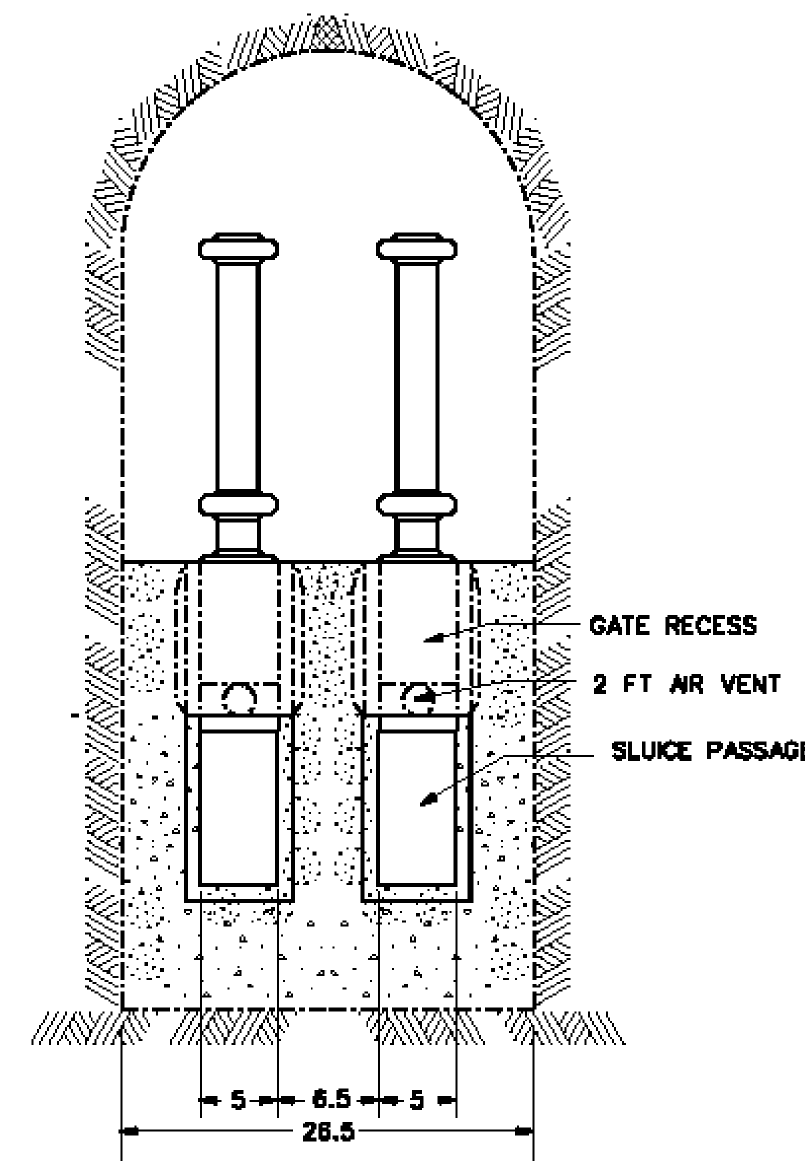
ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS
REREGULATION DAM

LOW LEVEL SLUICE TUNNEL SECTIONS



LONGITUDINAL SECTION

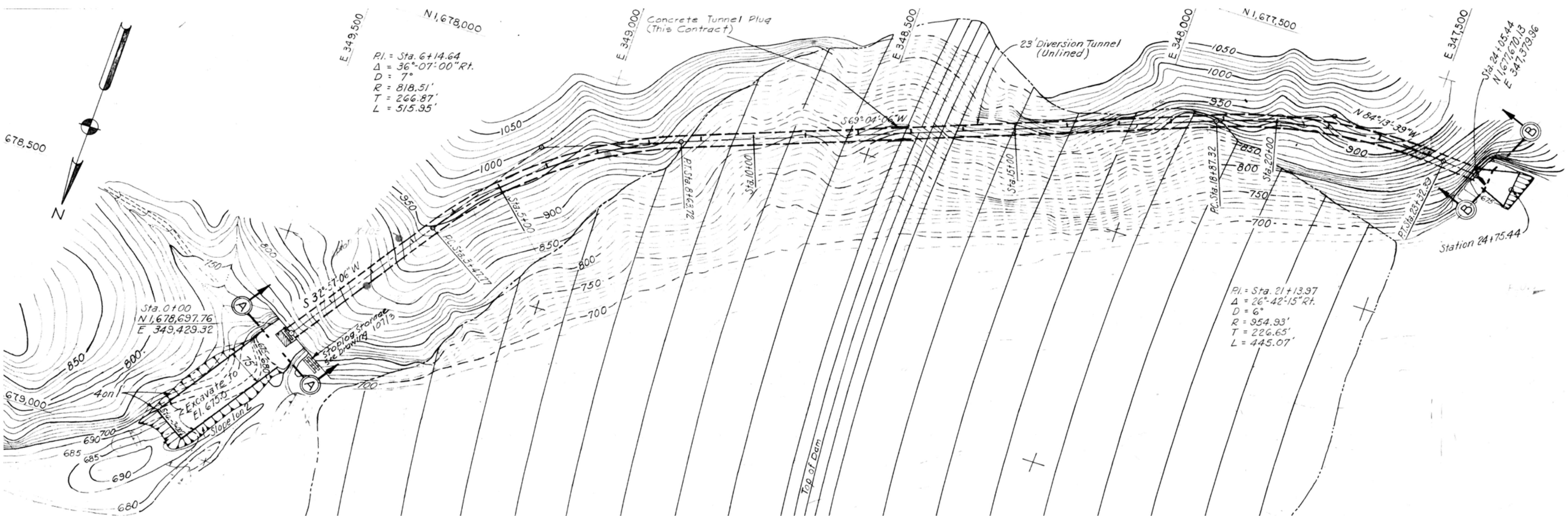


SECTION A-A

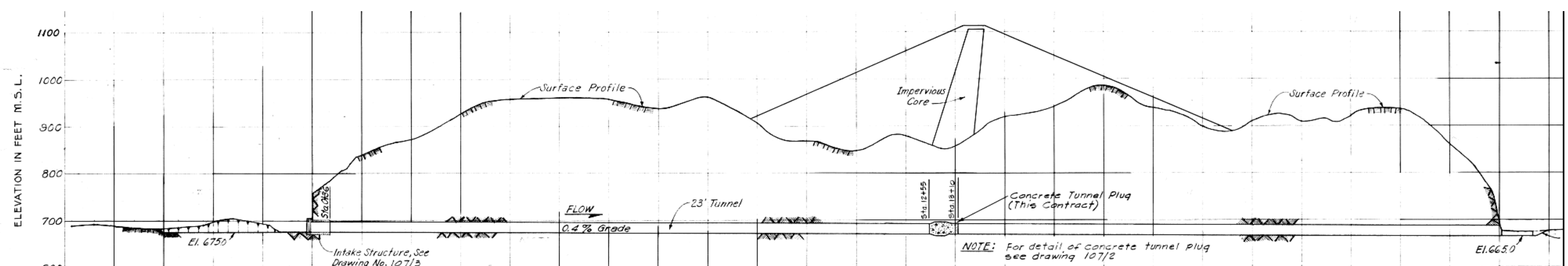
ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND
REREGULATION DAM

LOW LEVEL SLUICE GATE SECTIONS



DIVERSION TUNNEL PLAN

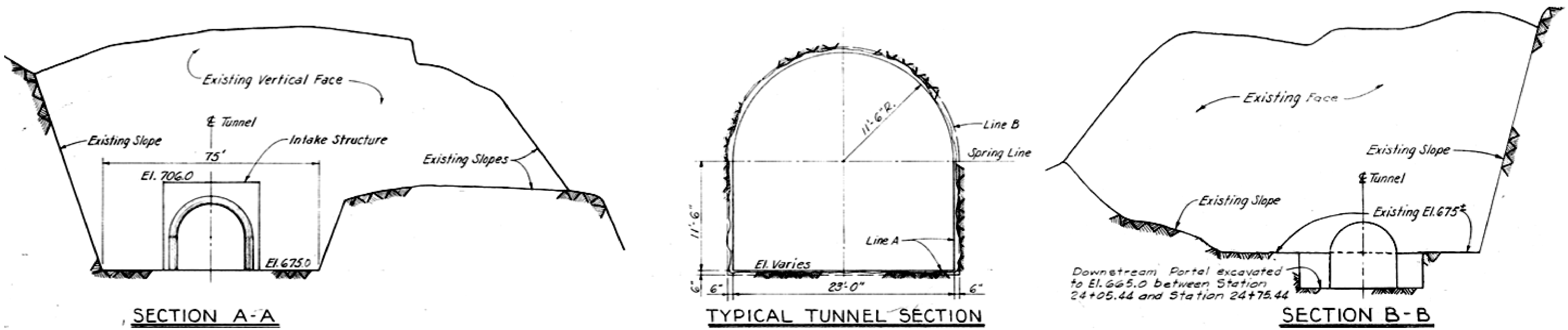


DIVERSION TUNNEL PROFILE

ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND
CARTERS REREGULATION DAM

DIVERSION TUNNEL PLAN AND PROFILE

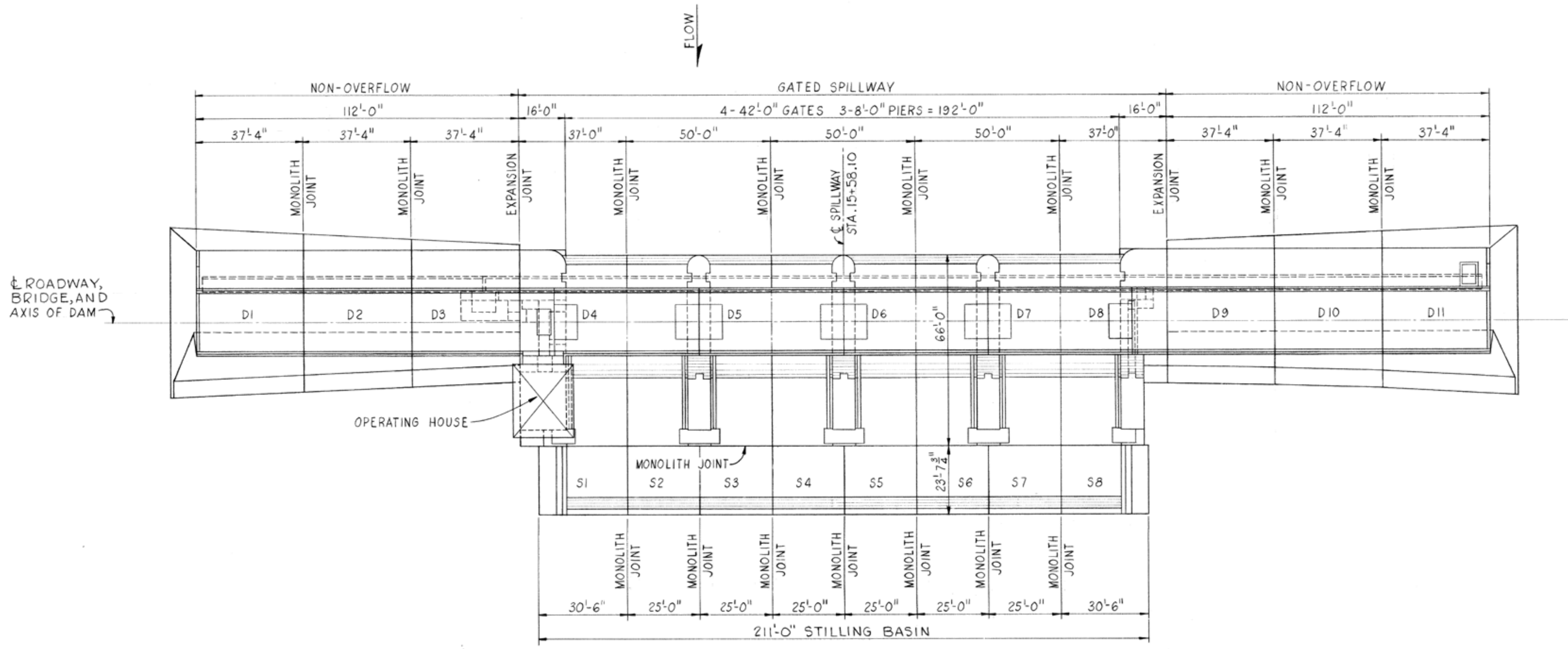


DIVERSION TUNNEL SECTIONS

ALABAMA-COOSA-TALLAPOOSA BASIN

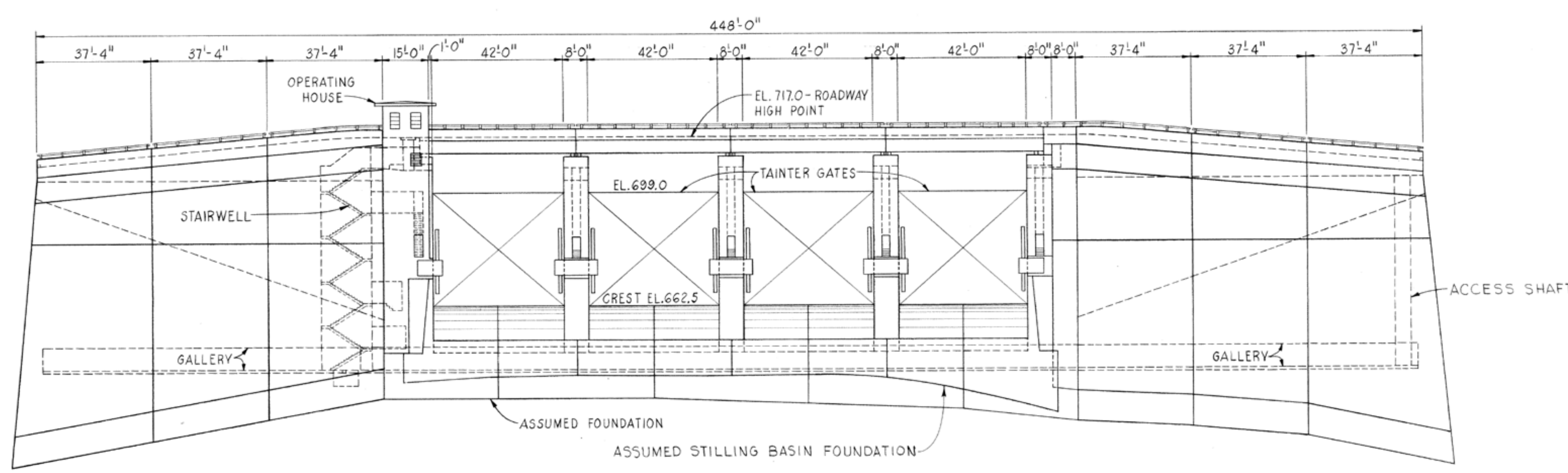
WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND
CARTERS REREGULATION DAM

DIVERSION TUNNEL PLAN AND PROFILE



PLAN

SCALE: 1" = 20'

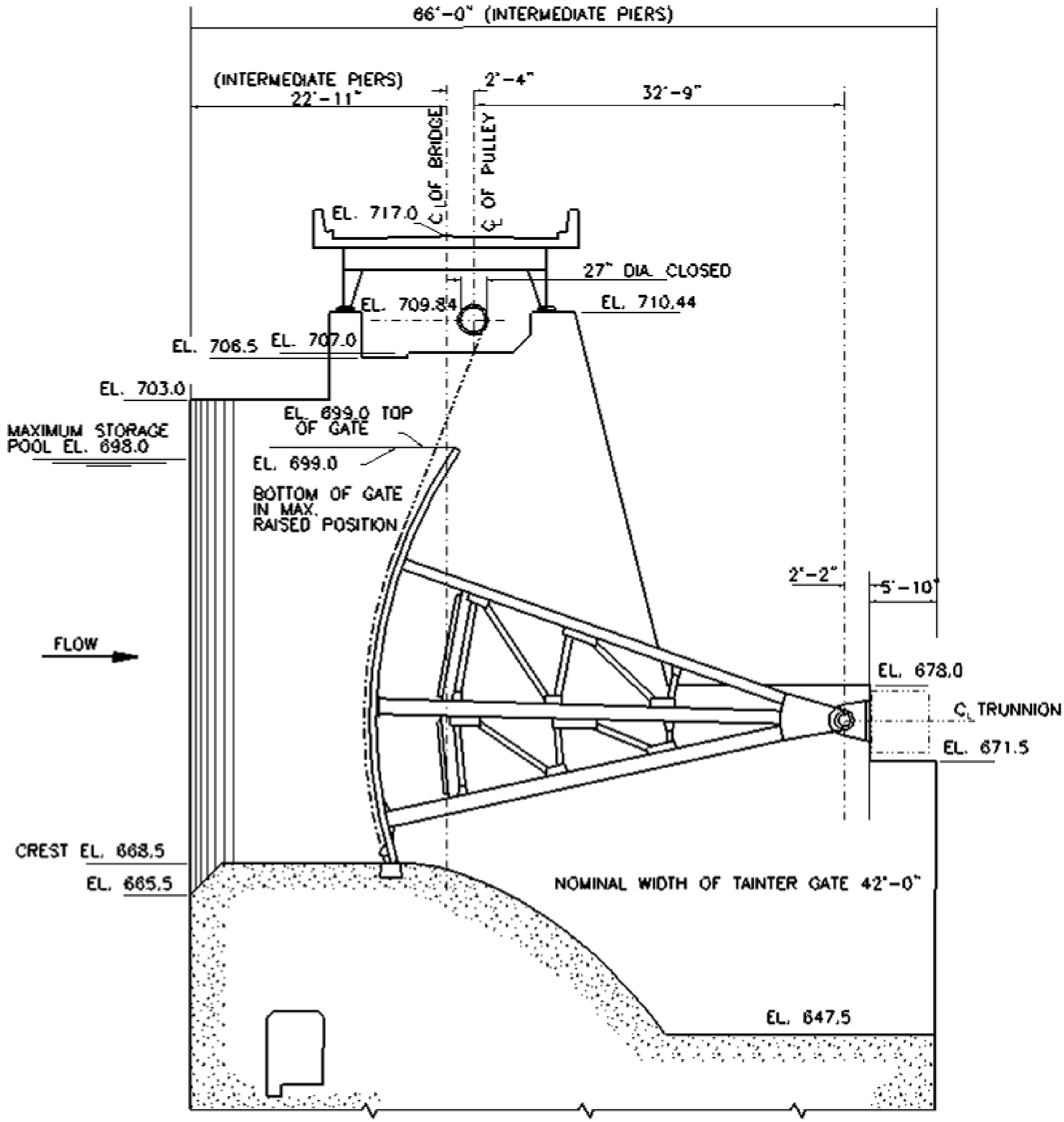


DOWNSTREAM ELEVATION

ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND
CARTERS REREGULATION DAM

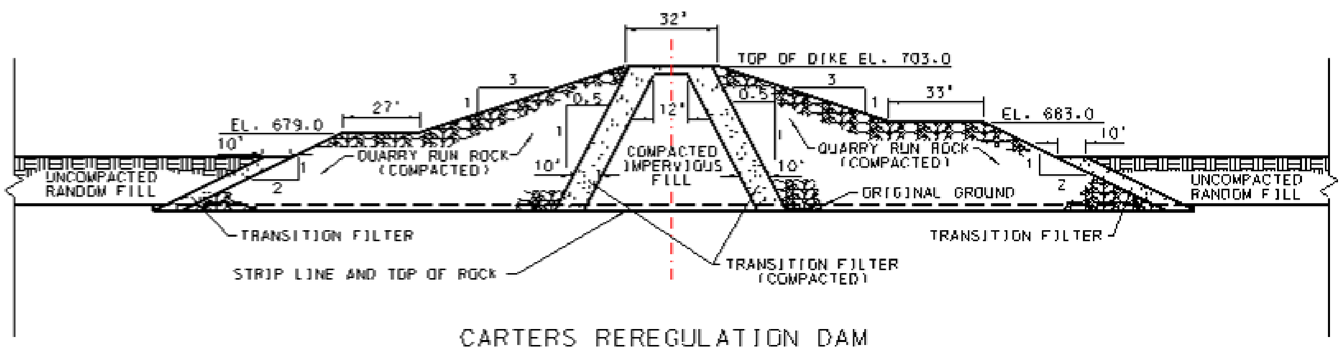
REREGULATION DAM PLAN AND ELEVATION



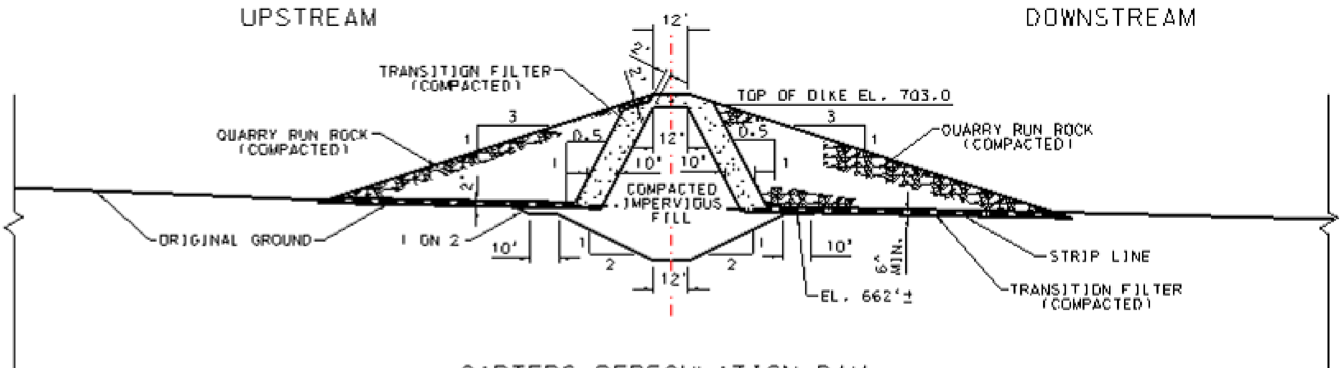
ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

REREGULATION DAM GATED SPILLWAY SECTION



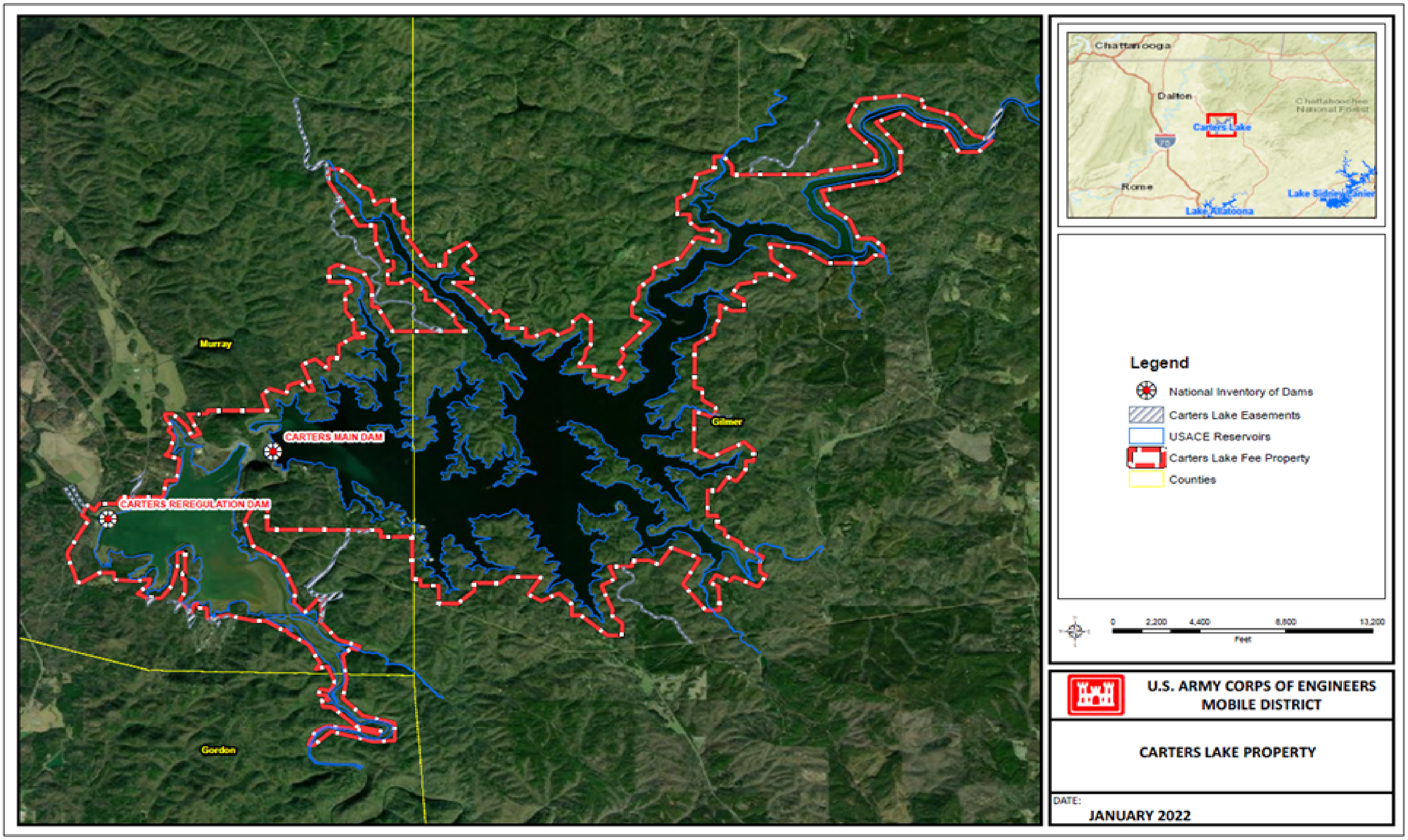
CARTERS REREGULATION DAM
RIGHT EMBANKMENT SECTION



CARTERS REREGULATION DAM
LEFT EMBANKMENT SECTION

ALABAMA-COOSA-TALLAPOOSA BASIN

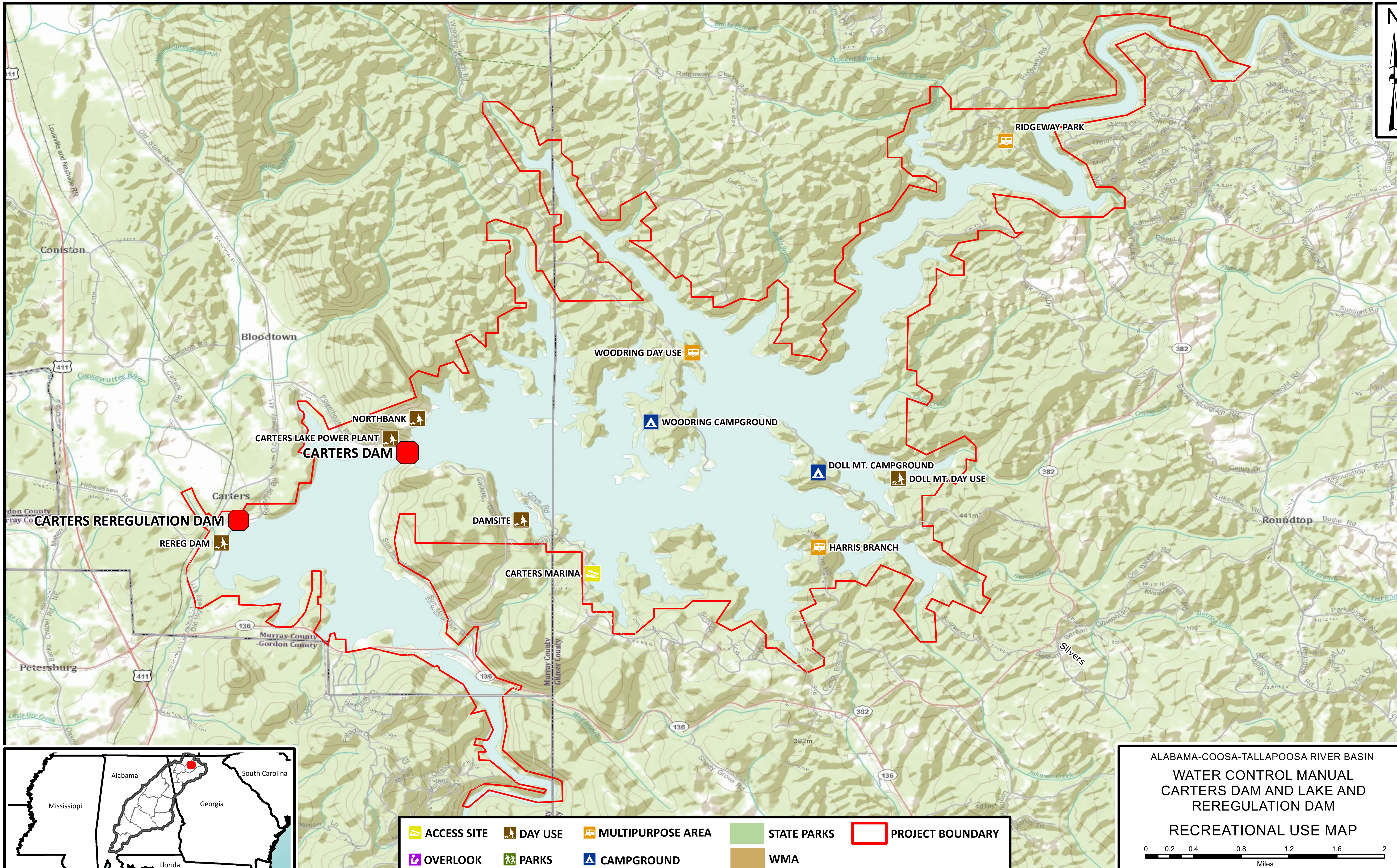
WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM
REREGULATION DAM EMBANKMENT SECTIONS



ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

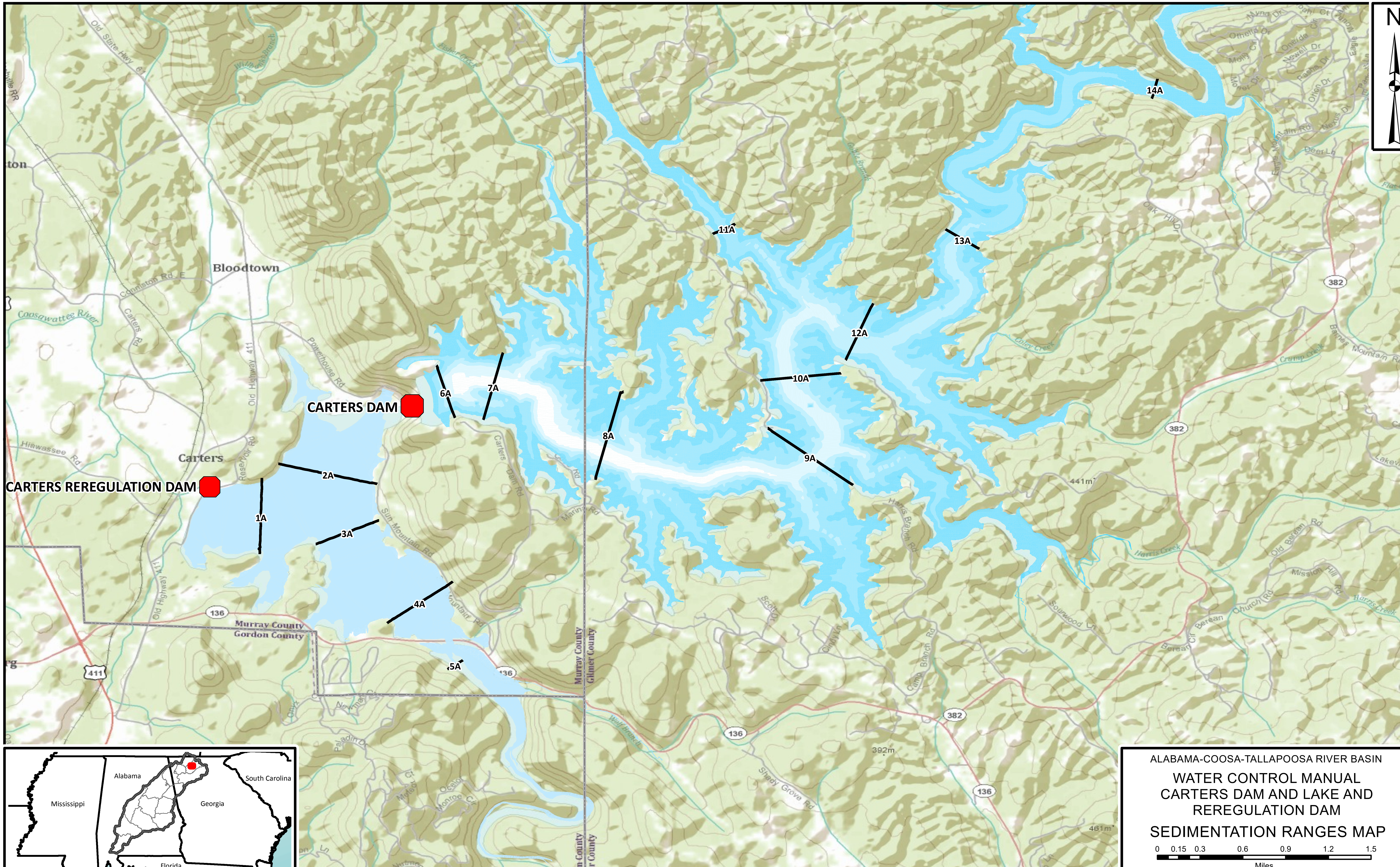
REAL ESTATE ACQUISITIONS



ALABAMA-COOSA-TALLAPOOSA RIVER BASIN
WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND
REREGULATION DAM

RECREATIONAL USE MAP

0 0.2 0.4 0.8 1.2 1.6 2
Miles

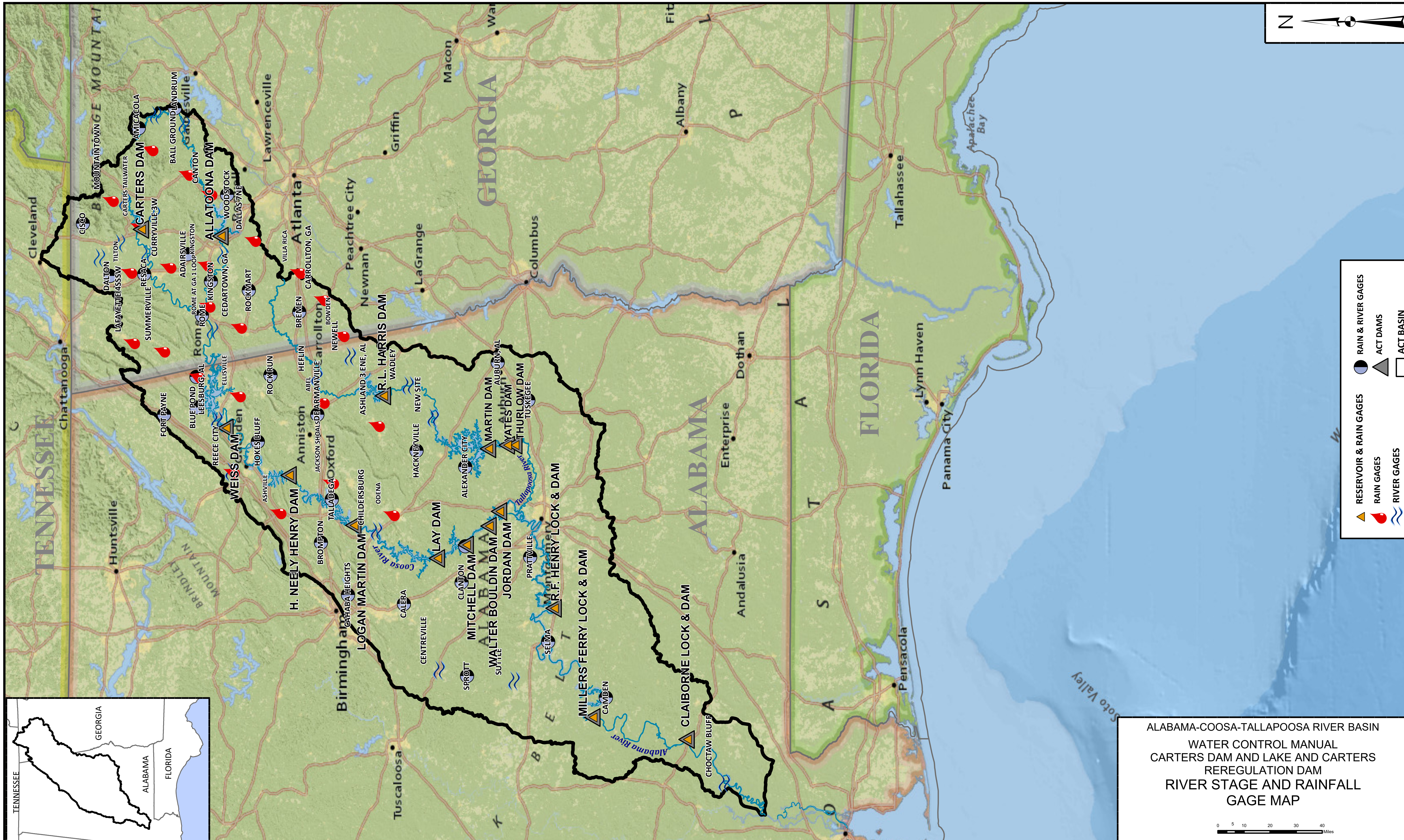


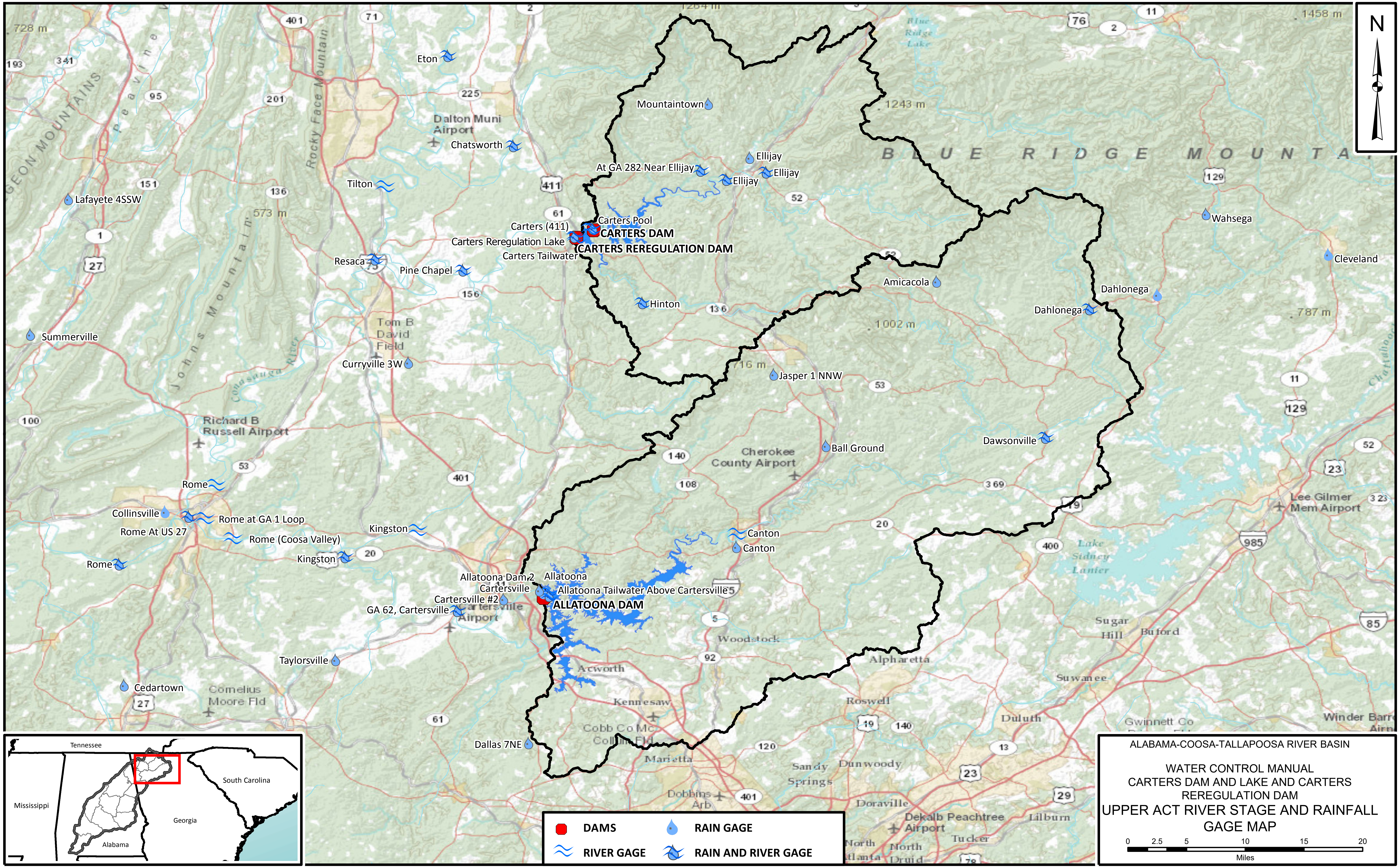
ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND
REREGULATION DAM

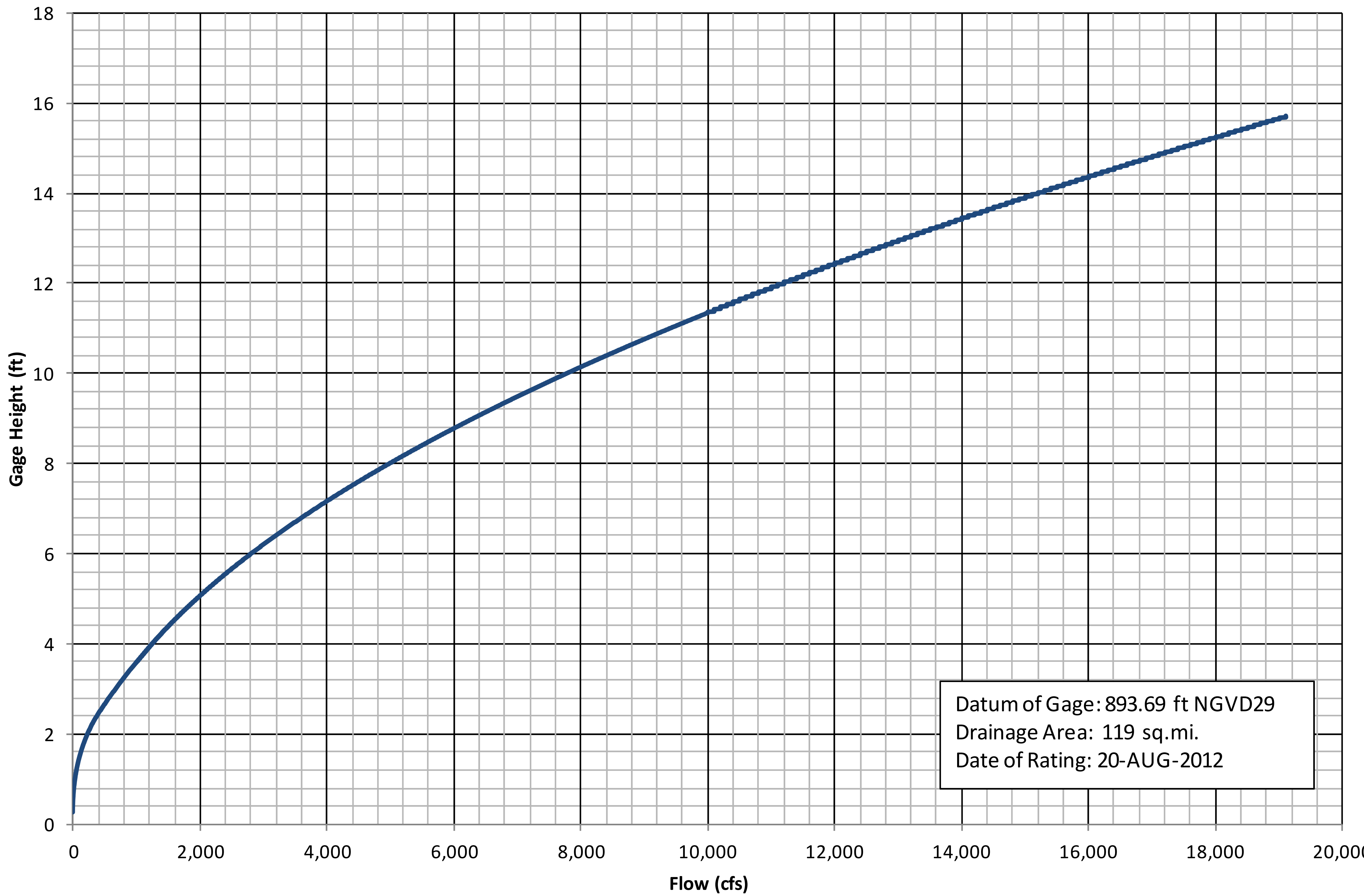
SEDIMENTATION RANGES MAP

0 0.15 0.3 0.6 0.9 1.2 1.5
Miles


ALABAMA-COOSA-TALLAPOOSA RIVER BASIN
WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM
RIVER STAGE AND RAINFALL GAGE MAP
RAIN & RIVER GAGES
ACT DAMS
ACT BASIN
RESERVOIR & RAIN GAGES
RAIN GAGES
RIVER GAGES
Miles
TENNESSEE
GEORGIA
ALABAMA
FLORIDA
CARTERS DAM
ALLATOONA DAM
WEISS DAM
H. NEELY HENRY DAM
LOGAN MARTIN DAM
LAY DAM
MITCHELL DAM
JORDAN DAM
WALTER BOULDIN DAM
R.L. HARRIS DAM
MARTIN DAM
YATES DAM
THURLOW DAM
R.F. HENRY LOCK & DAM
MILLERS FERRY LOCK & DAM
CLAIBORNE LOCK & DAM
Coosa River
Tallapoosa River
Alabama River
Atlanta
Birmingham
Montgomery
Tuscaloosa
Columbus
Macon
Tallahassee
Pensacola
Panama City
Chattanooga
Huntsville
Cleveland
R005_19MAY11_RAINGAUGE_11X17.MXD


N
Eton
Mountaintown
Dalton Muni Airport
Chatsworth
Ellijay
At GA 282 Near Ellijay
Ellijay
Ellijay
Tilton
Lafayete 4SSW
Carters Pool
Carters (411)
CARTERS DAM
Carters Reregulation Lake
CARTERS REREGULATION DAM
Carters Tailwater
Resaca
Pine Chapel
Wahsega
Cleveland
Amicacola
Dahlonega
Dahlonega
Hinton
Summerville
Curryville 3W
Jasper 1 NNW
Richard B Russell Airport
Ball Ground
Dawsonville
Cherokee County Airport
Rome
Collinsville
Rome at GA 1 Loop
Rome At US 27
Rome (Coosa Valley)
Kingston
Kingston
Rome
Canton
Canton
Lee Gilmer Mem Airport
Allatoona Dam 2
Allatoona
Cartersville
Allatoona Tailwater Above Cartersville
Cartersville #2
ALLATOONA DAM
GA 62, Cartersville
Taylorsville
Cedartown
Dallas 7NE
BLUE RIDGE MOUNTAINS
Tennessee
South Carolina
Mississippi
Georgia
Alabama
DAMS
RAIN GAGE
RIVER GAGE
RAIN AND RIVER GAGE
ALABAMA-COOSA-TALLAPOOSA RIVER BASIN
WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM
UPPER ACT RIVER STAGE AND RAINFALL GAGE MAP
0 2.5 5 10 15 20
Miles
R005_19MAY11_RAINGAUGE_11X17.MXD

Talking Rock Creek near Hinton
(USGS GAGE 02382200)



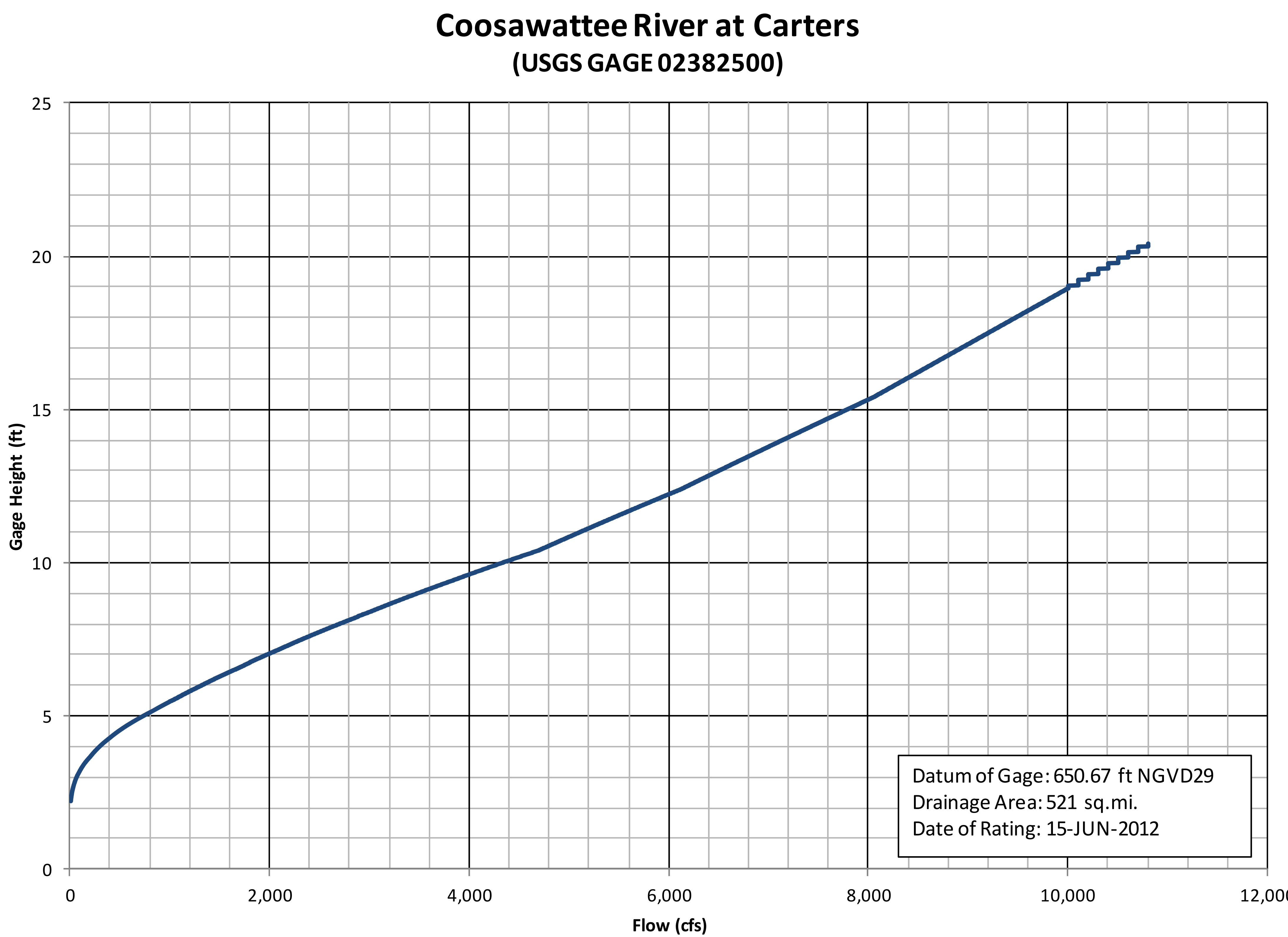
USGS GAGE 02382200

FLOW (cfs)	GAGE HT (ft)
0.66	0.25
1.2	0.3
2.9	0.4
5.6	0.5
9.5	0.6
15	0.7
21	0.8
29	0.9
39	1
113	1.5
238	2
432	2.5
685	3
960	3.5
1260	4
1960	5
3840	7
5000	8
6320	9
7800	10
9430	11
11200	12
13100	13
15200	14
17500	15
19100	15.7

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS
REREGULATION DAM

USGS GAGE 02382200
RATING



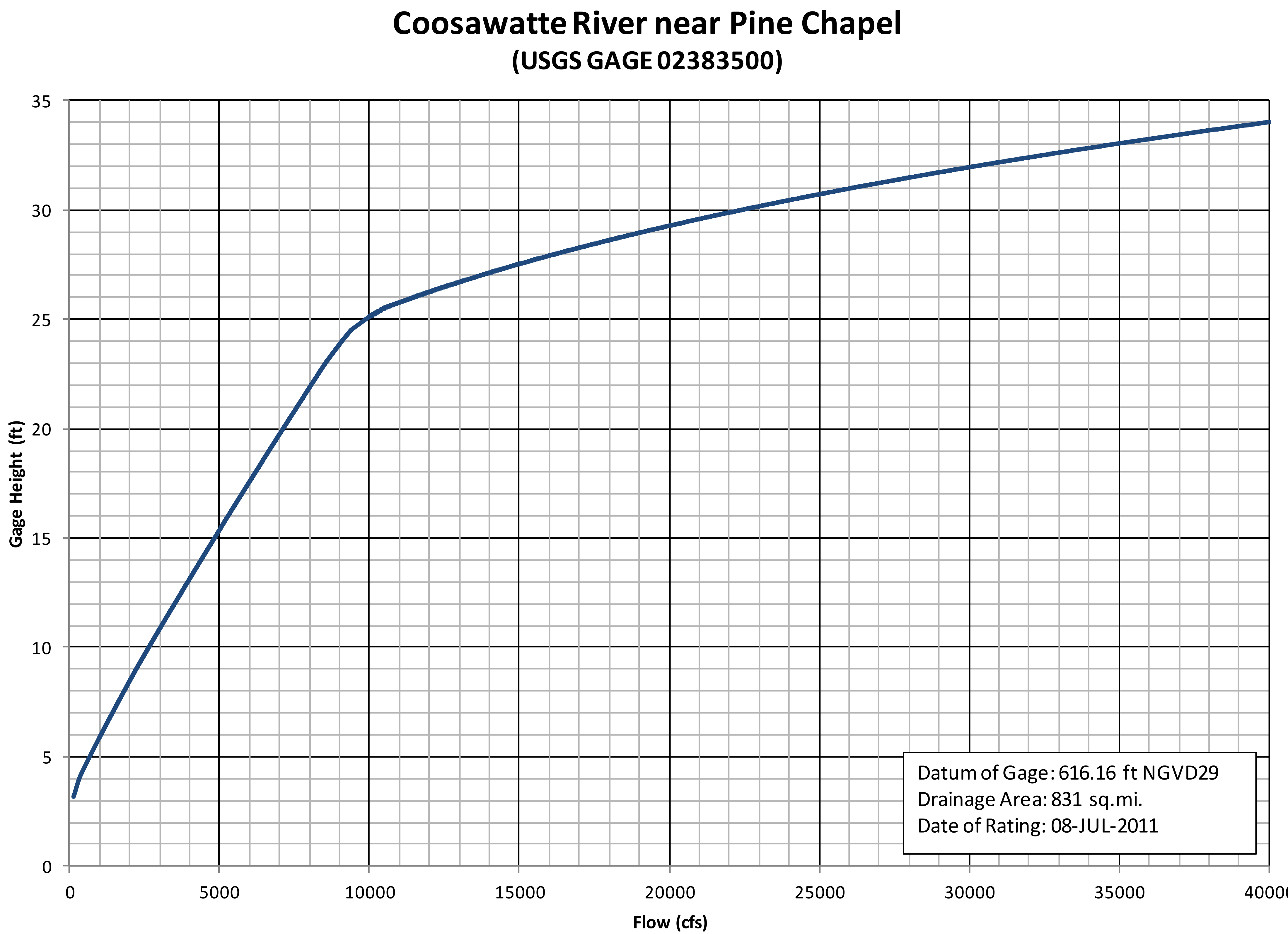
USGS GAGE 02382500

FLOW (cfs)	GAGE HT (ft)
7	2.24
8.7	2.3
12	2.4
17	2.5
31	2.7
62	3
93	3.2
130	3.4
178	3.6
231	3.8
290	4
477	4.5
725	5
1310	6
1960	7
2690	8
3470	9
4330	10
5110	11
5820	12
6500	13
7140	14
7790	15
8380	16
8930	17
9480	18
10000	19
10600	20
10800	20.4

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

USGS GAGE 02382500 RATING



USGS GAGE 02383500

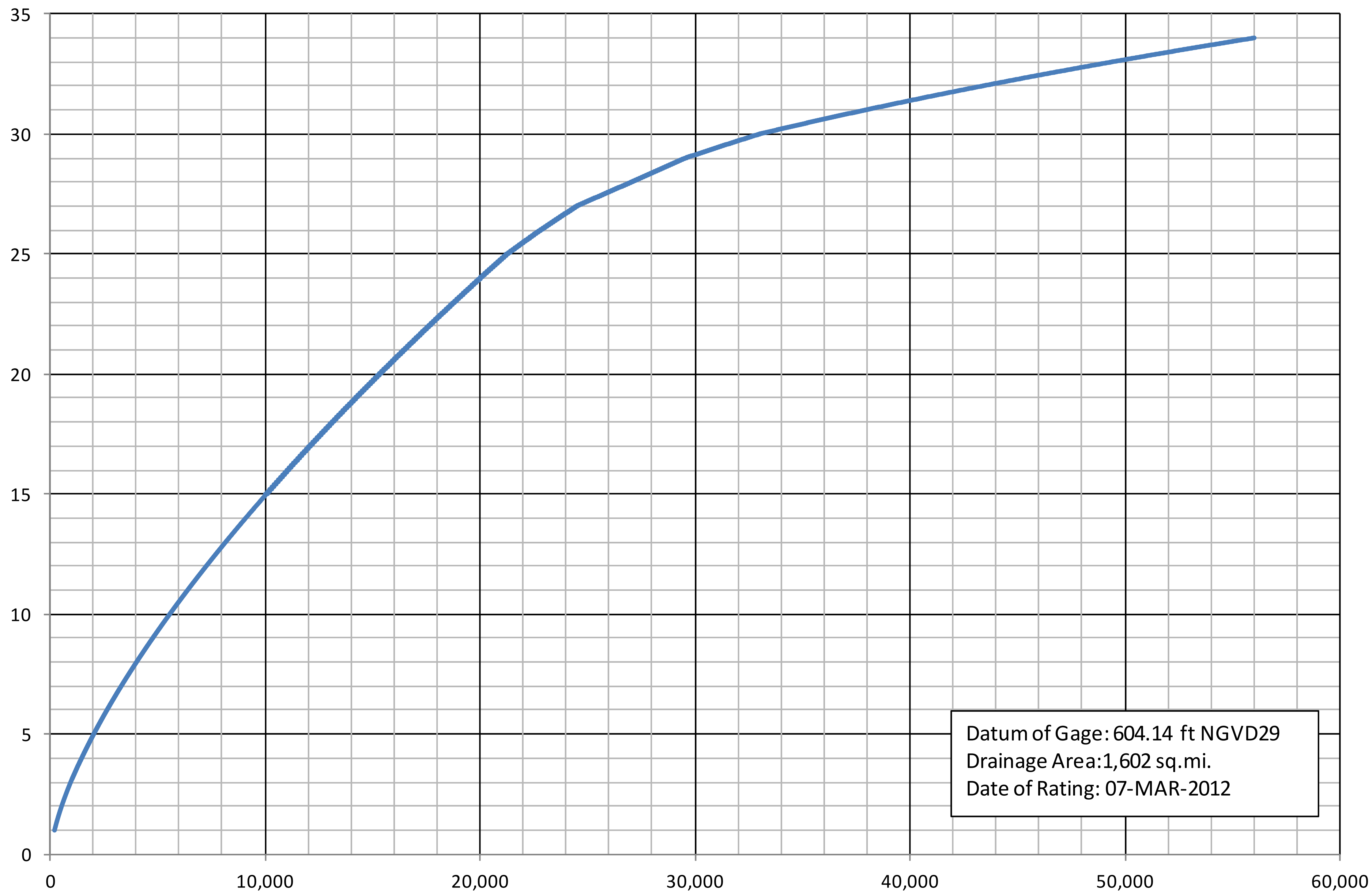
FLOW (cfs)	GAGE HT (ft)
161	3.21
182	3.3
205	3.4
226	3.5
341	4
508	4.5
690	5
1060	6
1450	7
1840	8
2660	10
3520	12
4850	15
6210	18
7610	21
9100	24
9400	24.5
9900	25
10500	25.5
11500	26
13700	27
22500	30
30300	32
34900	33
40000	34

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

USGS GAGE 02383500 RATING

Oostanaula River at Resaca, GA
(USGS GAGE 02387500)



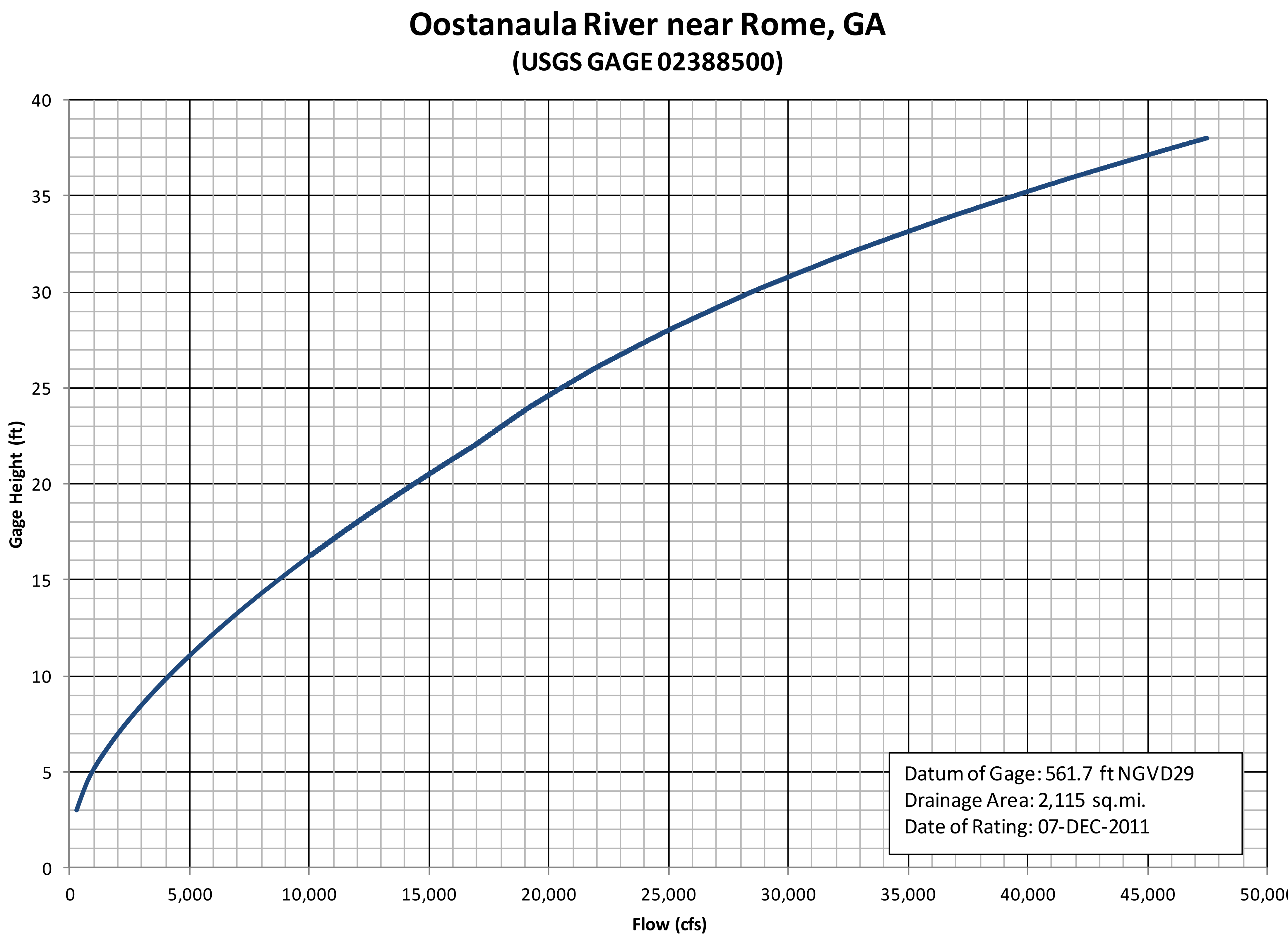
USGS GAGE 02387500

FLOW (cfs)	GAGE HT (ft)	FLOW (cfs)	GAGE HT (ft)
193	1.01	9080	14
218	1.1	11000	16
342	1.5	13100	18
520	2	15300	20
720	2.5	17600	22
940	3	20000	24
1450	4	21200	25
2010	5	22800	26
2630	6	27000	28
3290	7	29600	29
4000	8	33000	30
4760	9	37900	31
5550	10	43400	32
6380	11	49400	33
7250	12	56000	34

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

USGS GAGE 02387500 RATING



USGS GAGE
02388500

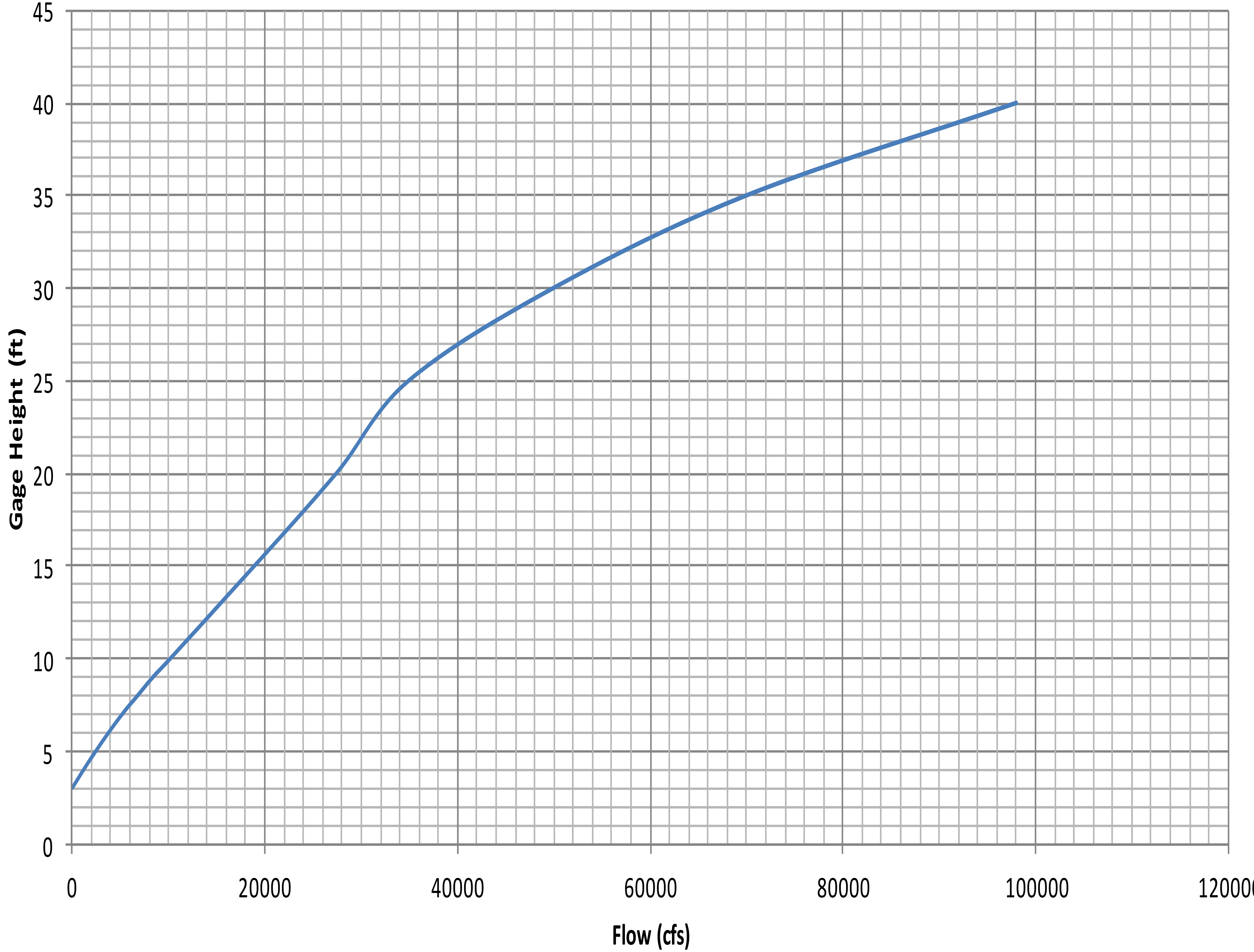
FLOW (cfs)	GAGE HT (ft)	FLOW (cfs)	GAGE HT (ft)
260	3	9760	16
400	3.5	12000	18
550	4	14400	20
710	4.5	15600	21
910	5	16900	22
1150	5.5	18000	23
1420	6	19200	24
2000	7	21900	26
2650	8	25000	28
3360	9	28500	30
4120	10	32500	32
4940	11	37000	34
5810	12	42000	36
6730	13	47500	38
7700	14		

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

USGS GAGE 02388500 RATING

OOSTANAULA GAGE AT US 27 vs. FLOW AT OOSTANAULA/ETOWAH CONFLUENCE



OOSTANAULA GAGE AT US 27 vs. FLOW AT OOSTANAULA/ETOWAH CONFLUENCE

GAGE HT (ft)	FLOW (cfs)
3	100
4	1300
5	2550
6	3900
7	5300
8	6900
9	8500
10	10300
15	19000
20	27500
25	35000
30	50000
35	70000
40	98000

STAGE FROM USGS GAGE 02388525
OOSTANAULA RIVER AT US 27
DA 2149 sq. mi. Datum 561.70 ft NGVD29

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

OOSTANAULA GAGE AT US 27 vs. FLOW AT OOSTANAULA/ETOWAH CONFLUENCE

USGS GAGE 02388500

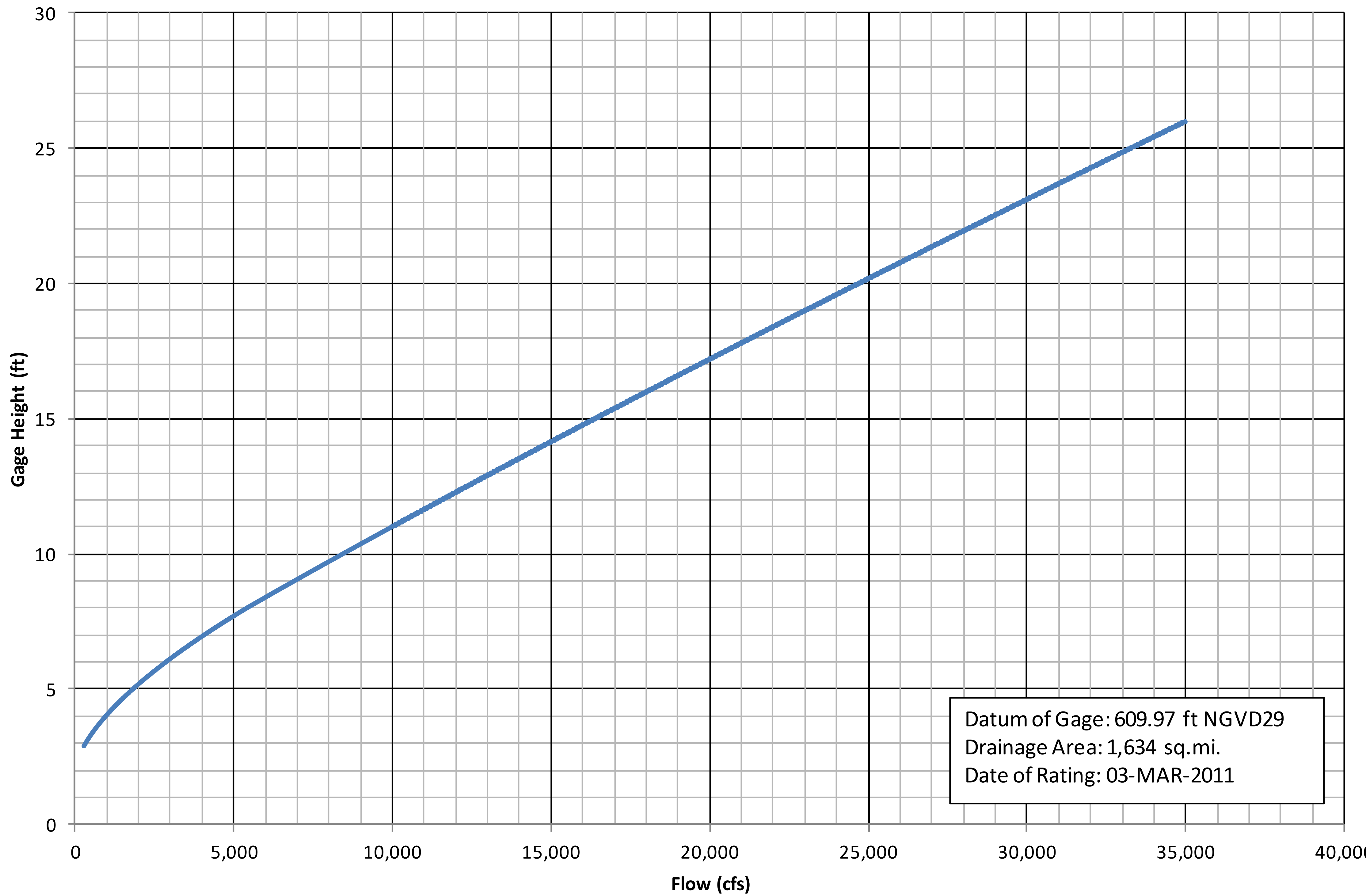
FLOW (cfs)	GAGE HT (ft)
5.3	1.51
9.1	1.6
23	1.8
46	2
154	2.5
325	3
533	3.5
756	4
1220	5
1760	6
2930	8
4220	10
5580	12
7080	14
8660	16
10400	18
10900	18.5
11500	19
12700	20
15400	22
18800	24
23200	26
29500	28
37500	30

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS
REREGULATION DAM

**USGS GAGE 02387000
RATING**

Etowah River near Kingston
(USGS GAGE 02395000)



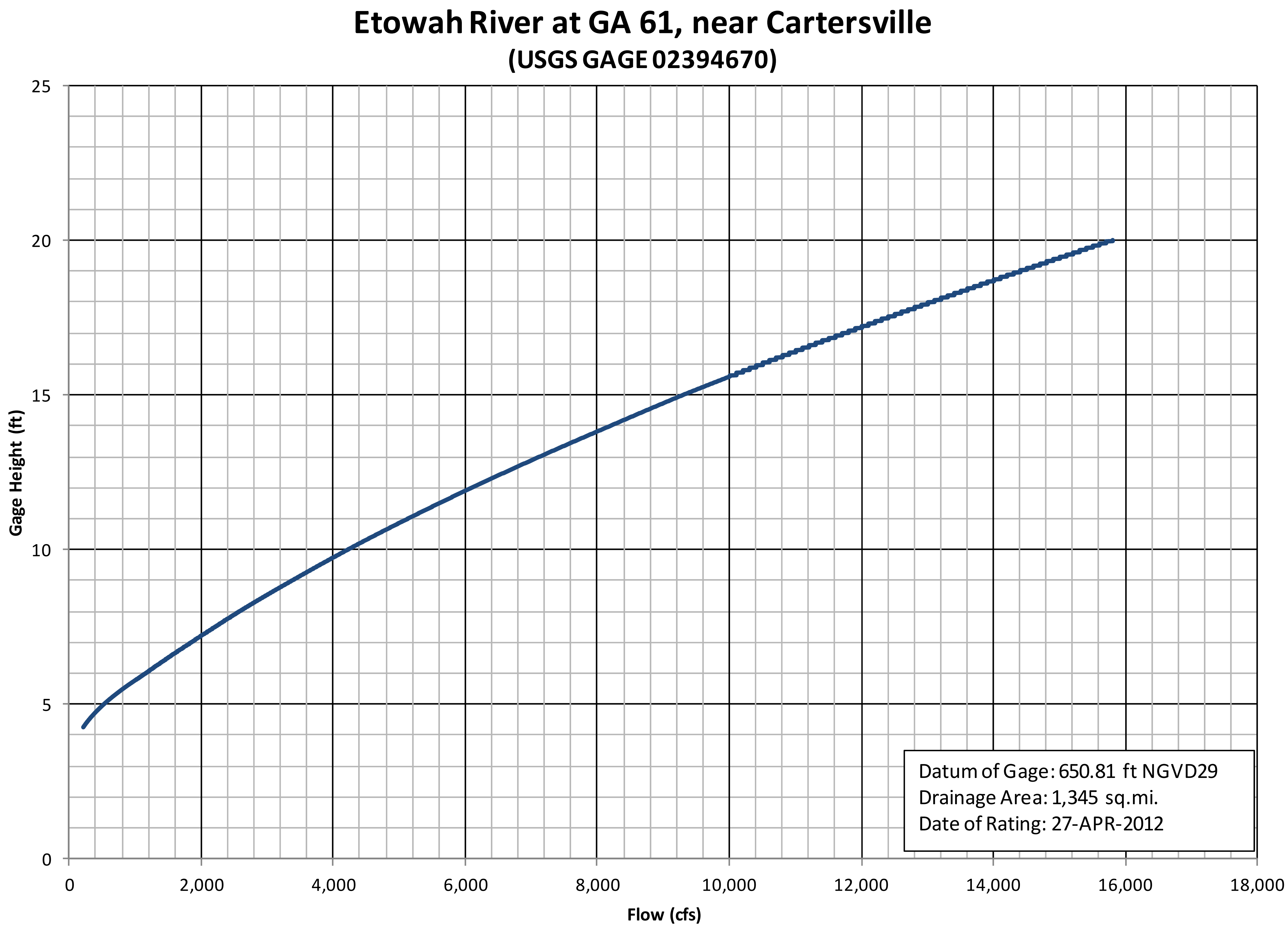
USGS GAGE
02395000

FLOW (cfs)	GAGE HT (ft)
270	2.9
319	3
605	3.5
953	4
1810	5
2850	6
4050	7
5400	8
6900	9
8420	10
11500	12
14700	14
18000	16
21300	18
24700	20
28100	22
31500	24
35000	26

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS
REREGULATION DAM

USGS GAGE 02395000
RATING



USGS GAGE 02394670

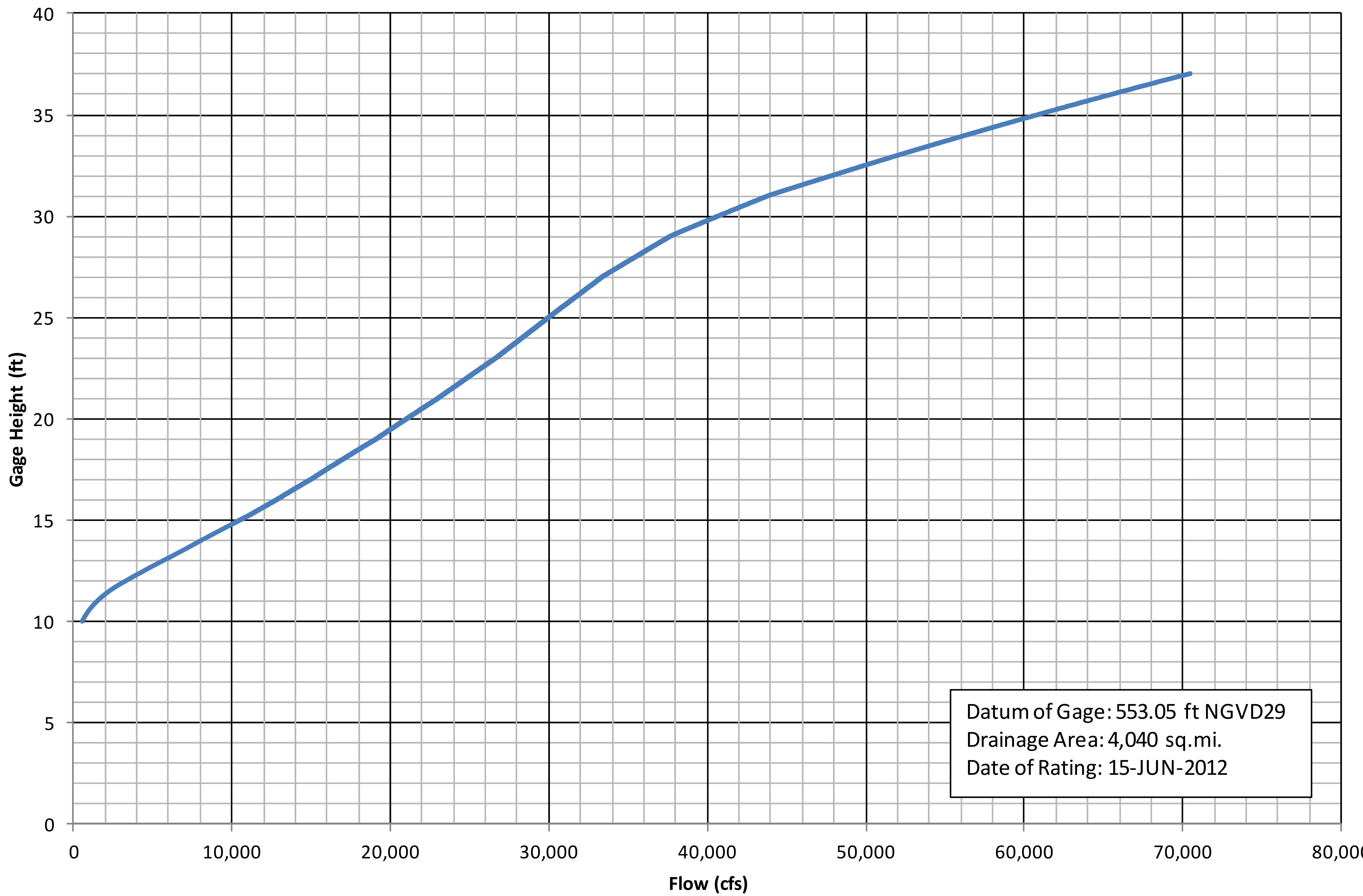
FLOW (cfs)	GAGE HT (ft)
259	4.4
525	5
817	5.5
1160	6
1850	7
2580	8
3380	9
4220	10
5130	11
6100	12
7130	13
8200	14
9300	15

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

USGS GAGE 02394670 RATING

Coosa River near Rome, GA
(USGS GAGE 02397000)



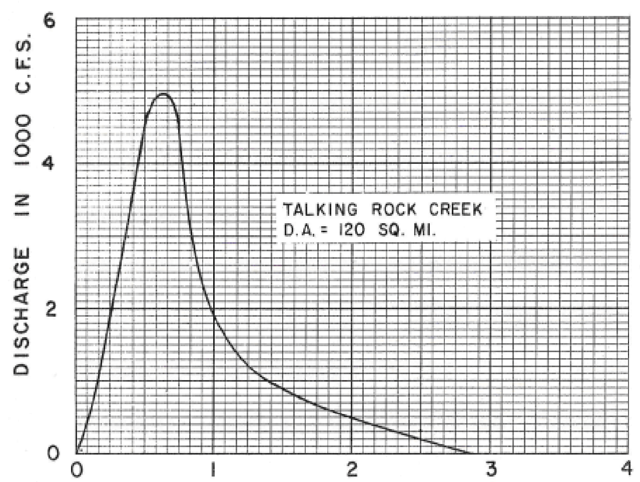
USGS GAGE
0397000

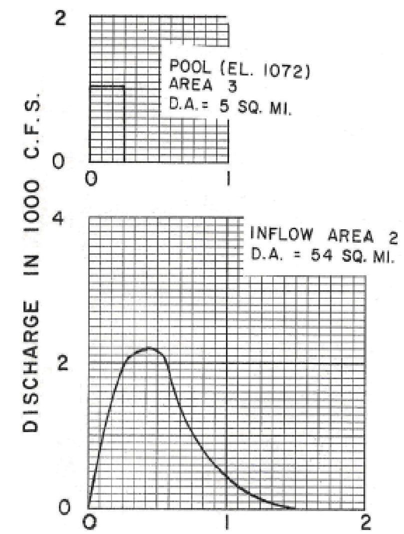
FLOW (cfs)	GAGE HT (ft)	FLOW (cfs)	GAGE HT (ft)
510	10	21000	20
722	10.3	24800	22
894	10.5	28300	24
1090	10.7	31700	26
1450	11	33400	27
1890	11.3	35500	28
2230	11.5	37700	29
2610	11.7	40800	30
3280	12	48000	32
5640	13	56500	34
8050	14	65700	36
12800	16	70500	37
17000	18		

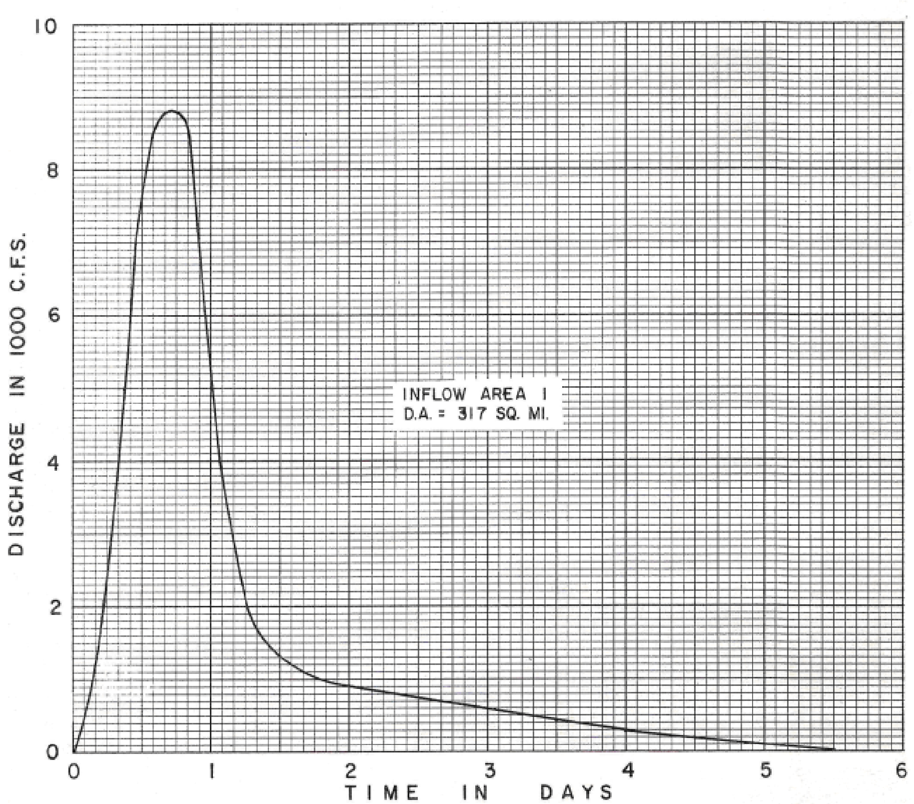
ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

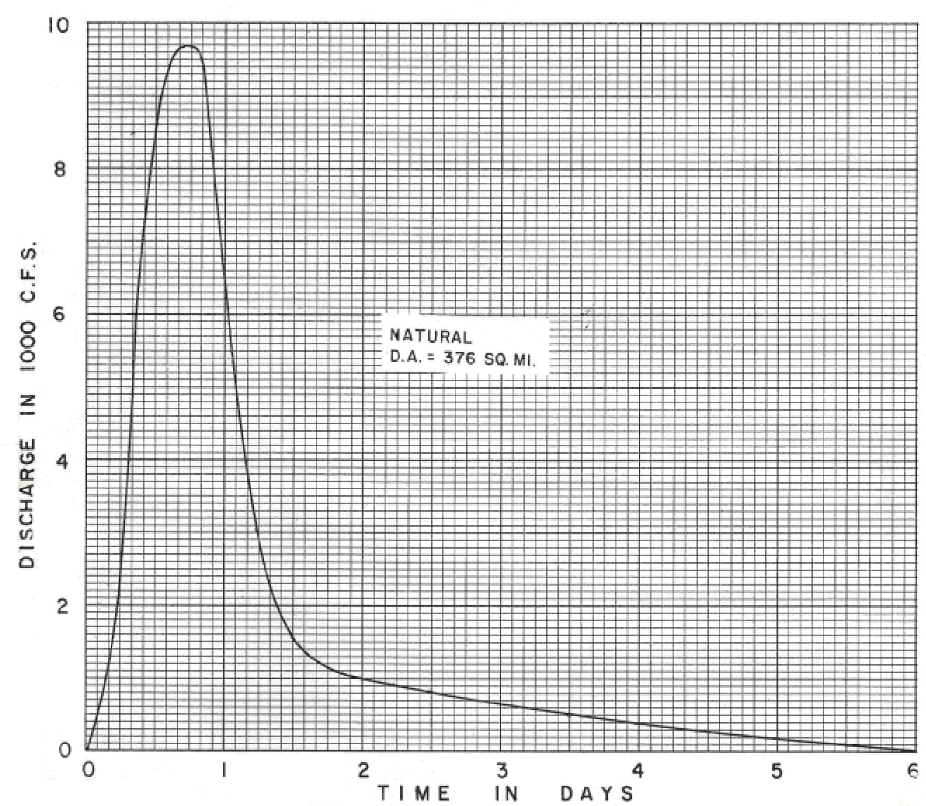
WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS
REREGULATION DAM

USGS GAGE 02397000
RATING









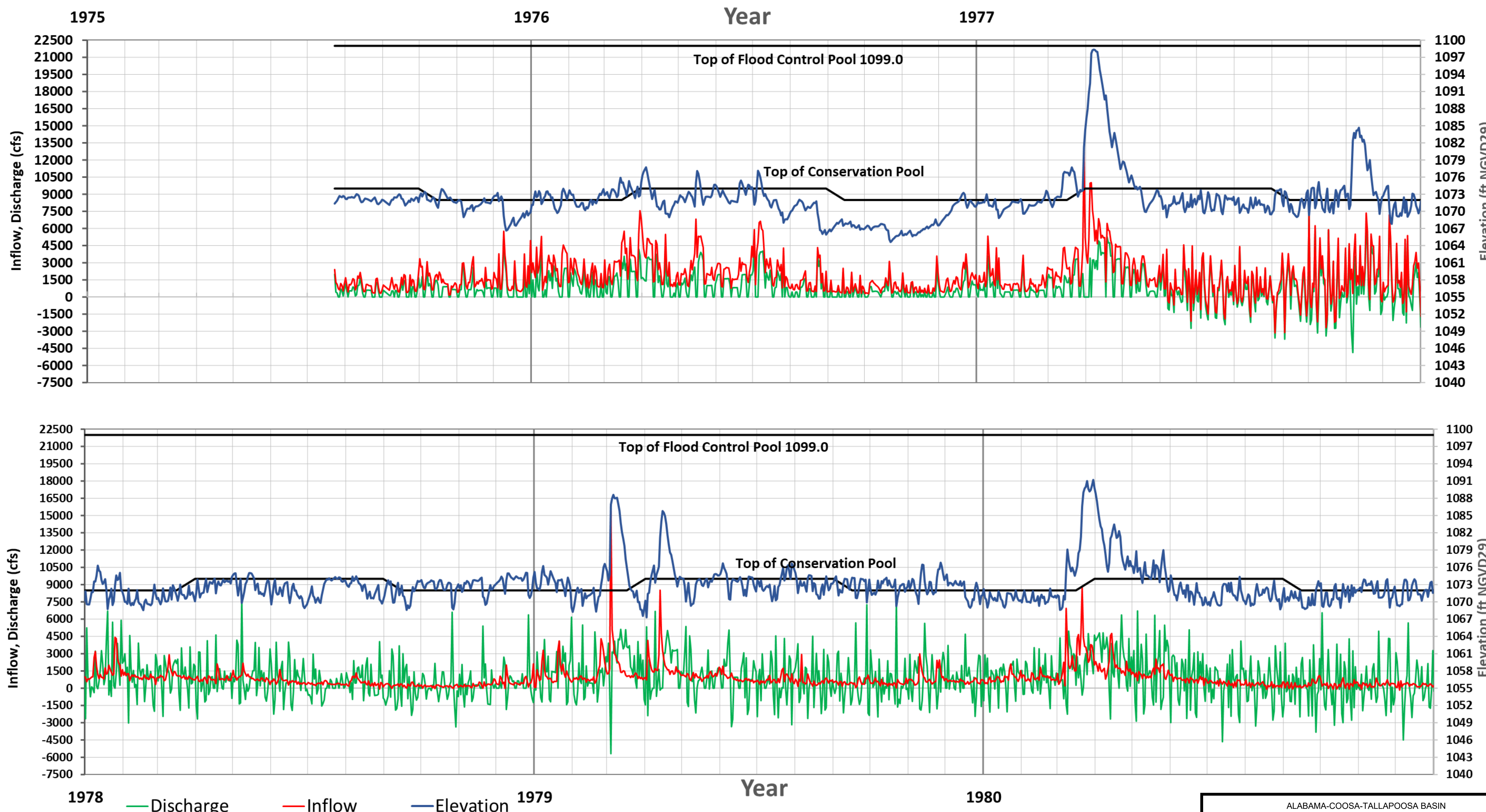
Carters Project 6-Hour Unit Hydrographs

	Area 1 DA=317 (sq mi)	Area 2 DA=54 (sq mi)	Area 3 DA=5 (sq mi)	Natural (Pre-Project) DA=376	Talking Rock Cr DA=120 (sq mi)
Time (hrs)	Flow (1000 cfs)	Flow (1000 cfs)	Flow (1000 cfs)	Flow (1000 cfs)	Flow (1000 cfs)
0	0	0	1.1	0	0
6	2.45	1.9	1.1	2.4	1.9
12	7.65	2.8		8.6	4.52
18	8.8	1.4		9.7	4.4
24	5.25	0.43		6.45	1.9
30	2.08	0.13		2.9	1.2
36	1.33	0		1.55	0.89
42	1.03			1.15	0.68
48	0.91			1	0.46
54	0.83			0.9	0.33
60	0.75			0.81	0.2
66	0.68			0.72	0.075
72	0.6			0.66	0
78	0.51			0.59	
84	0.44			0.51	
90	0.38			0.46	
96	0.3			0.39	
102	0.23			0.32	
108	0.19			0.28	
114	0.14			0.22	
120	0.1			0.18	
126	0.07			0.12	
132	0			0.09	
138				0.05	
144				0	

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

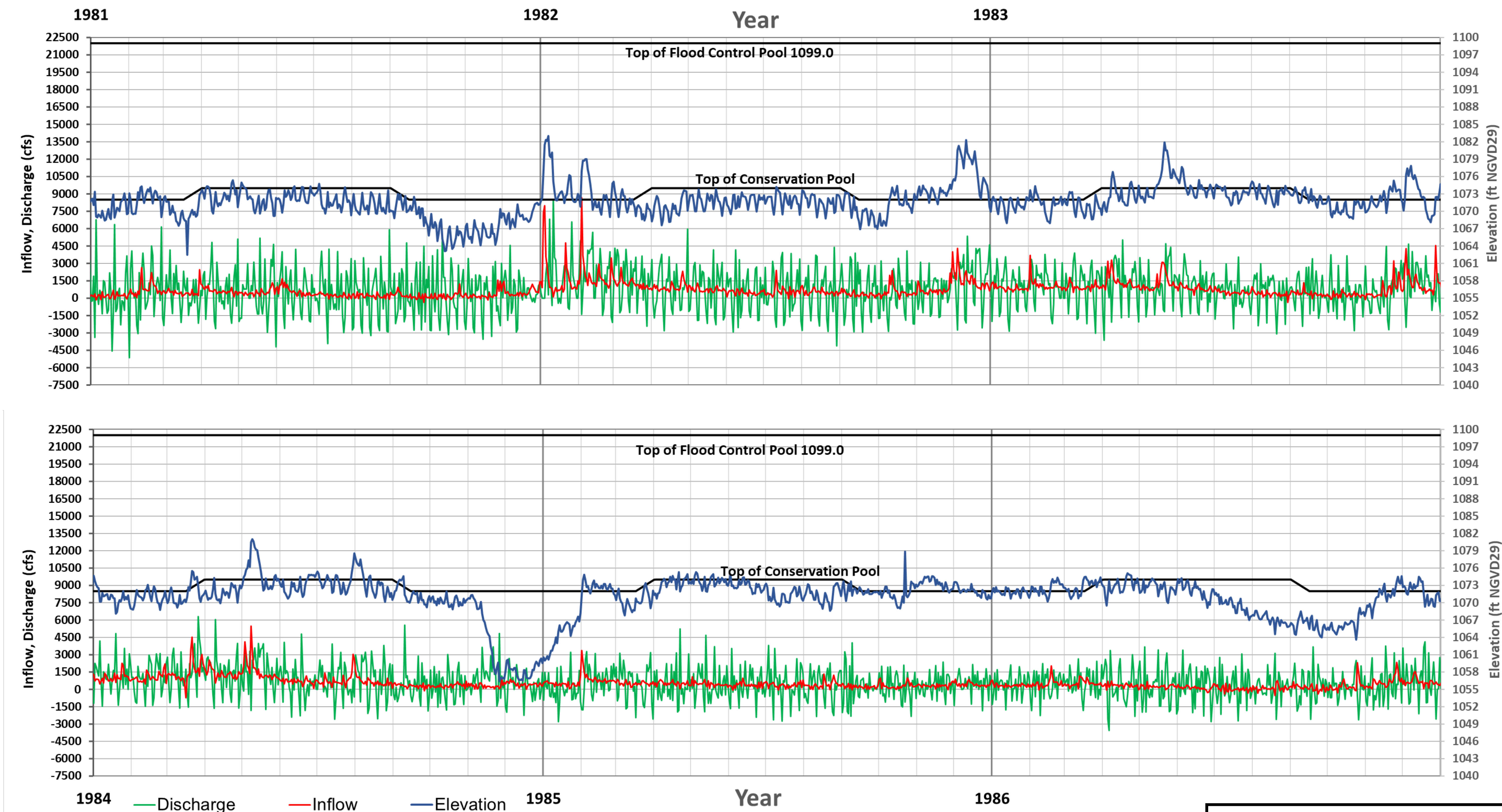
6-HOUR UNIT HYDROGRAPHS



ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS
REREGULATION DAM

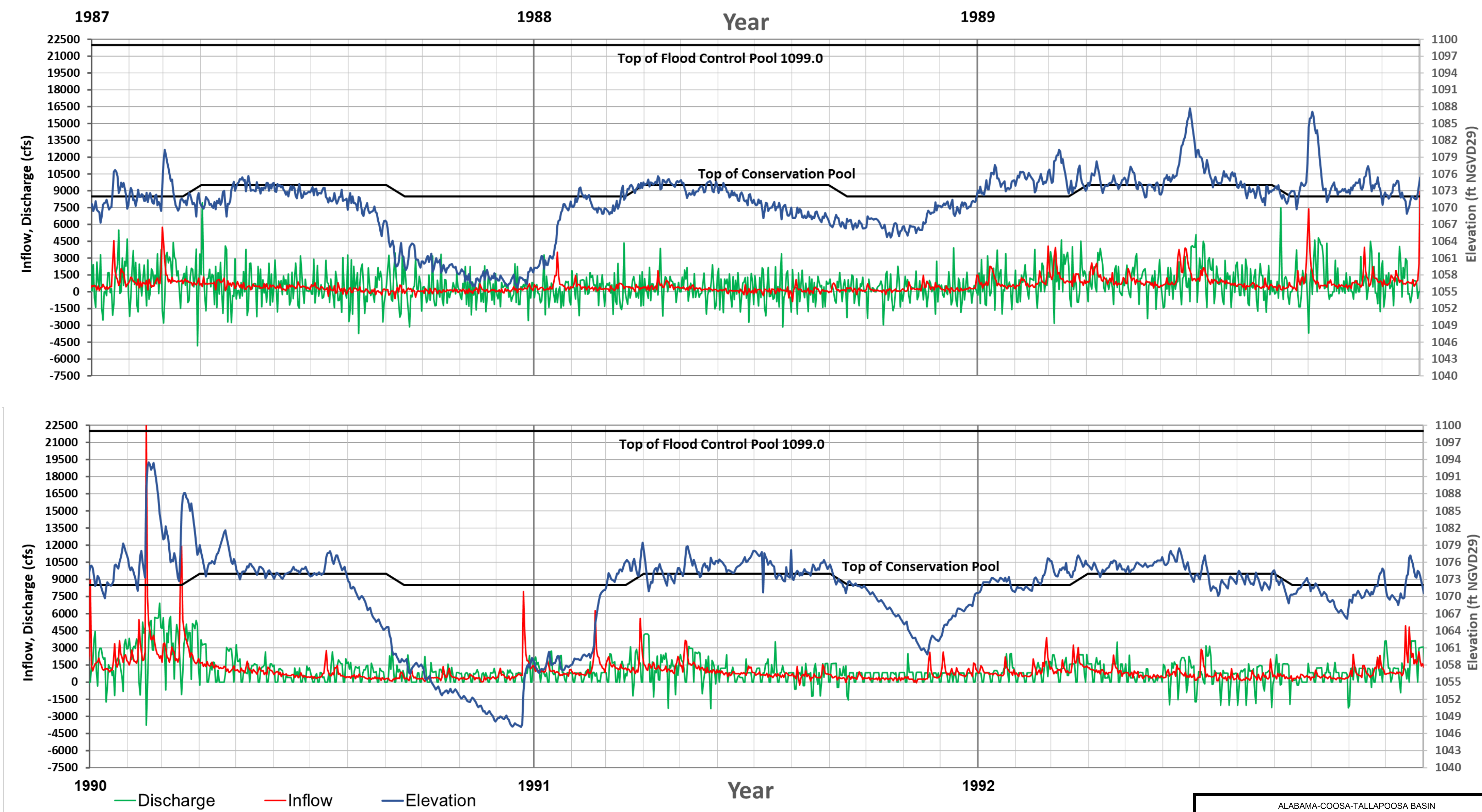
INFLOW-OUTFLOW-POOL CURVES



ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

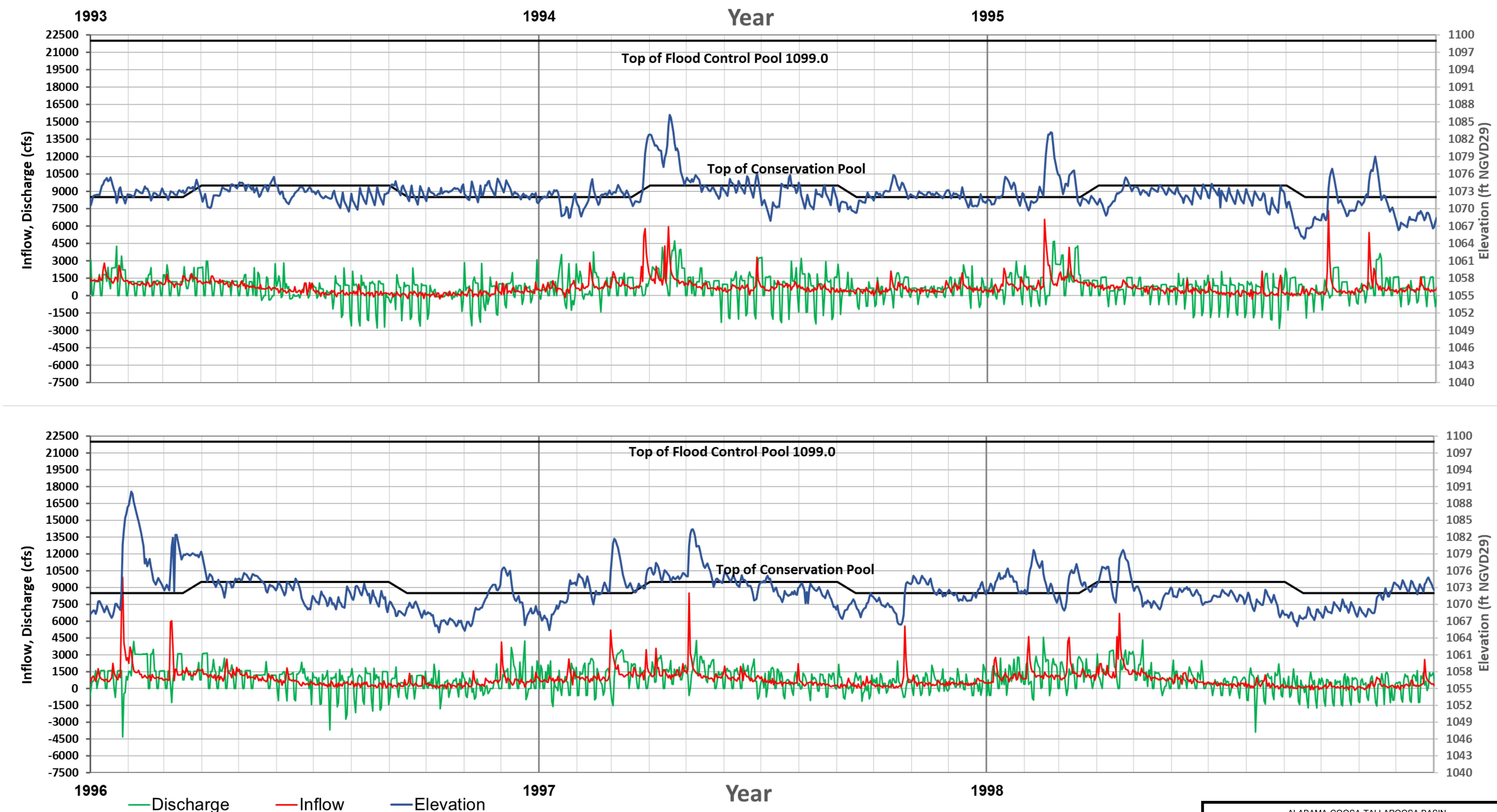
INFLOW-OUTFLOW-POOL CURVES



ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

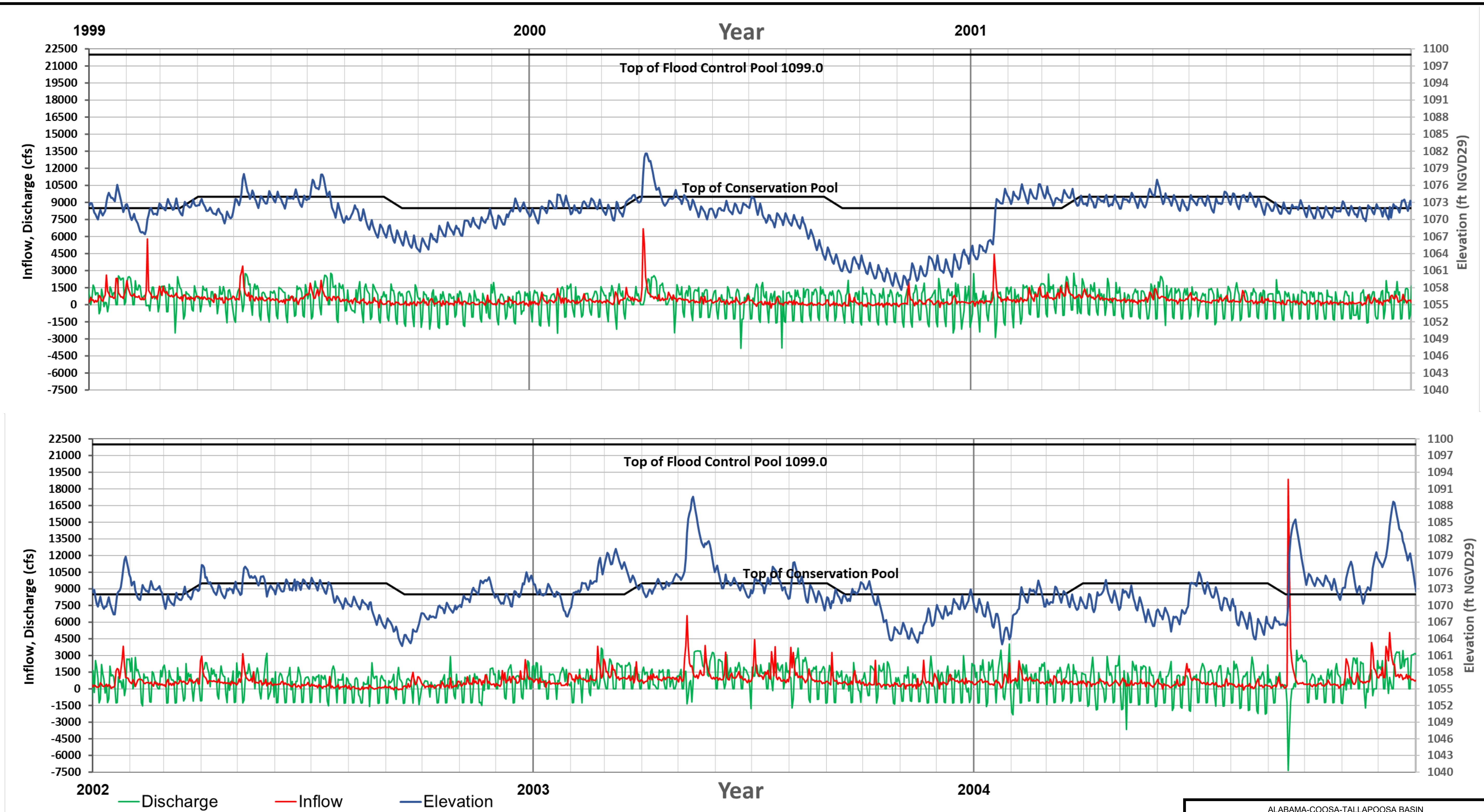
INFLOW-OUTFLOW-POOL CURVES



ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

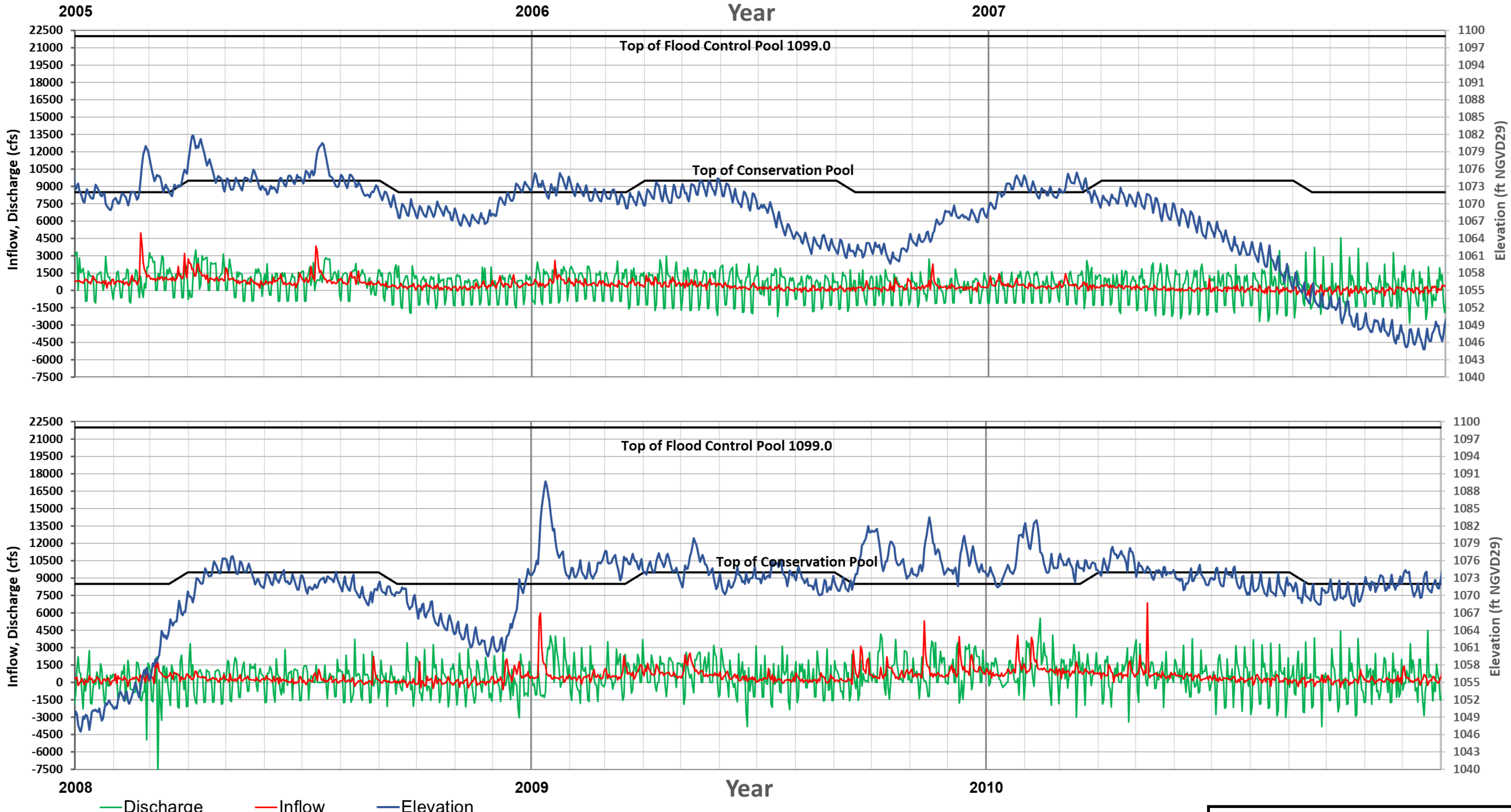
INFLOW-OUTFLOW-POOL CURVES



ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

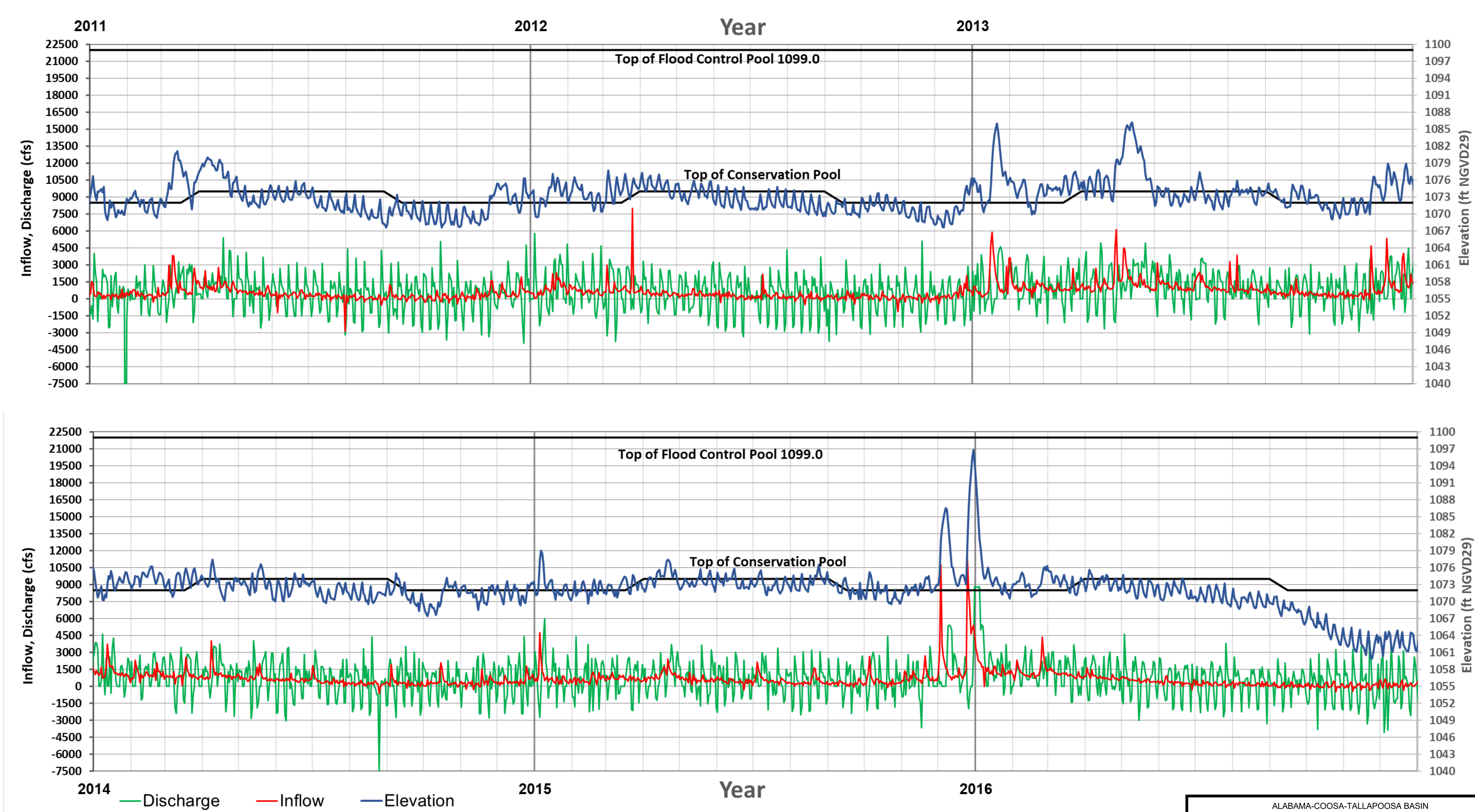
INFLOW-OUTFLOW-POOL CURVES



ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

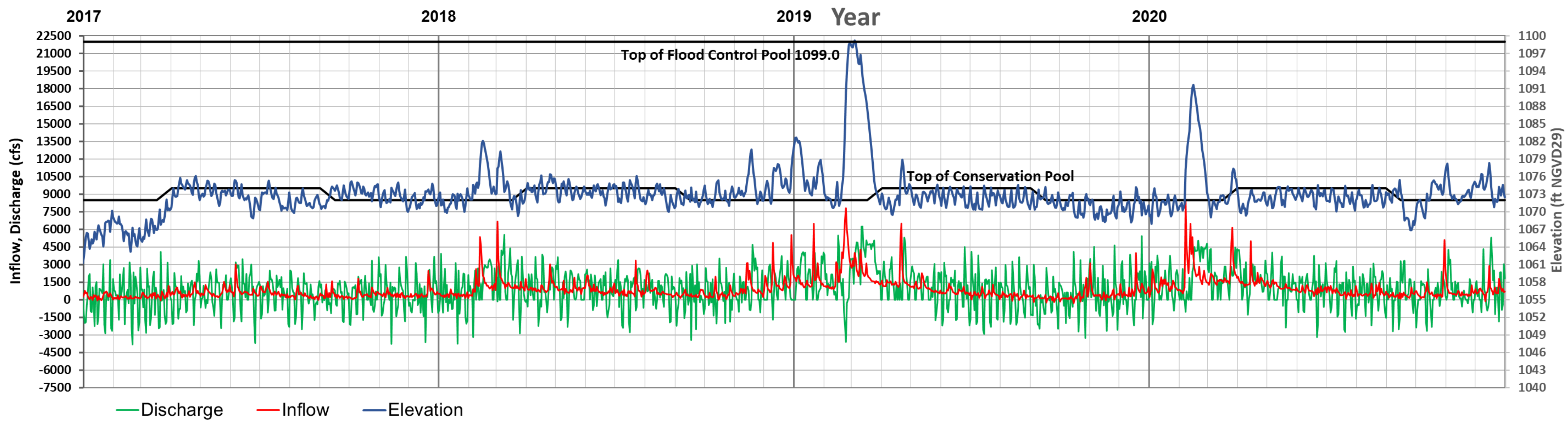
INFLOW-OUTFLOW-POOL CURVES



ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

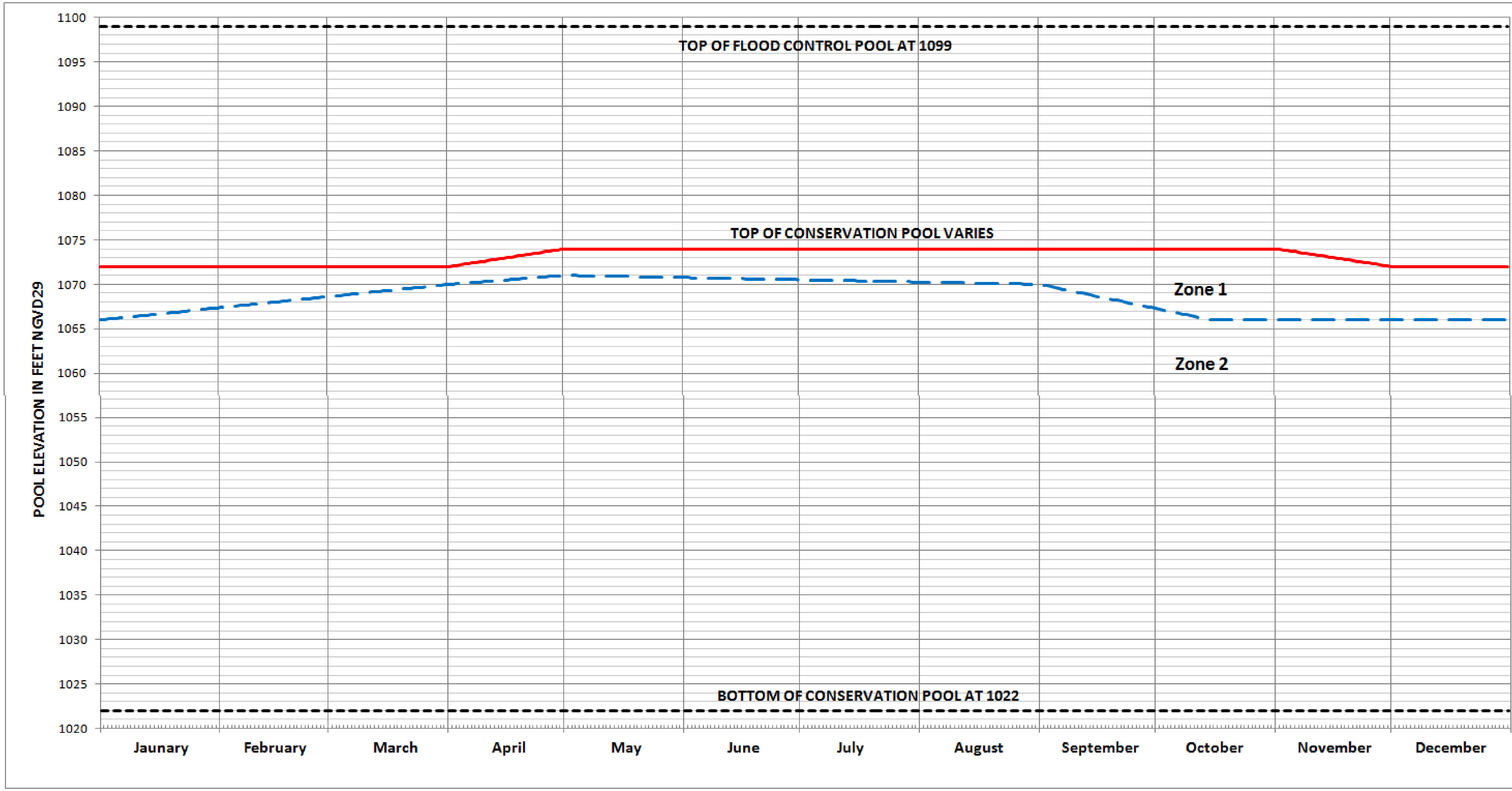
INFLOW-OUTFLOW-POOL CURVES



ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS
REREGULATION DAM

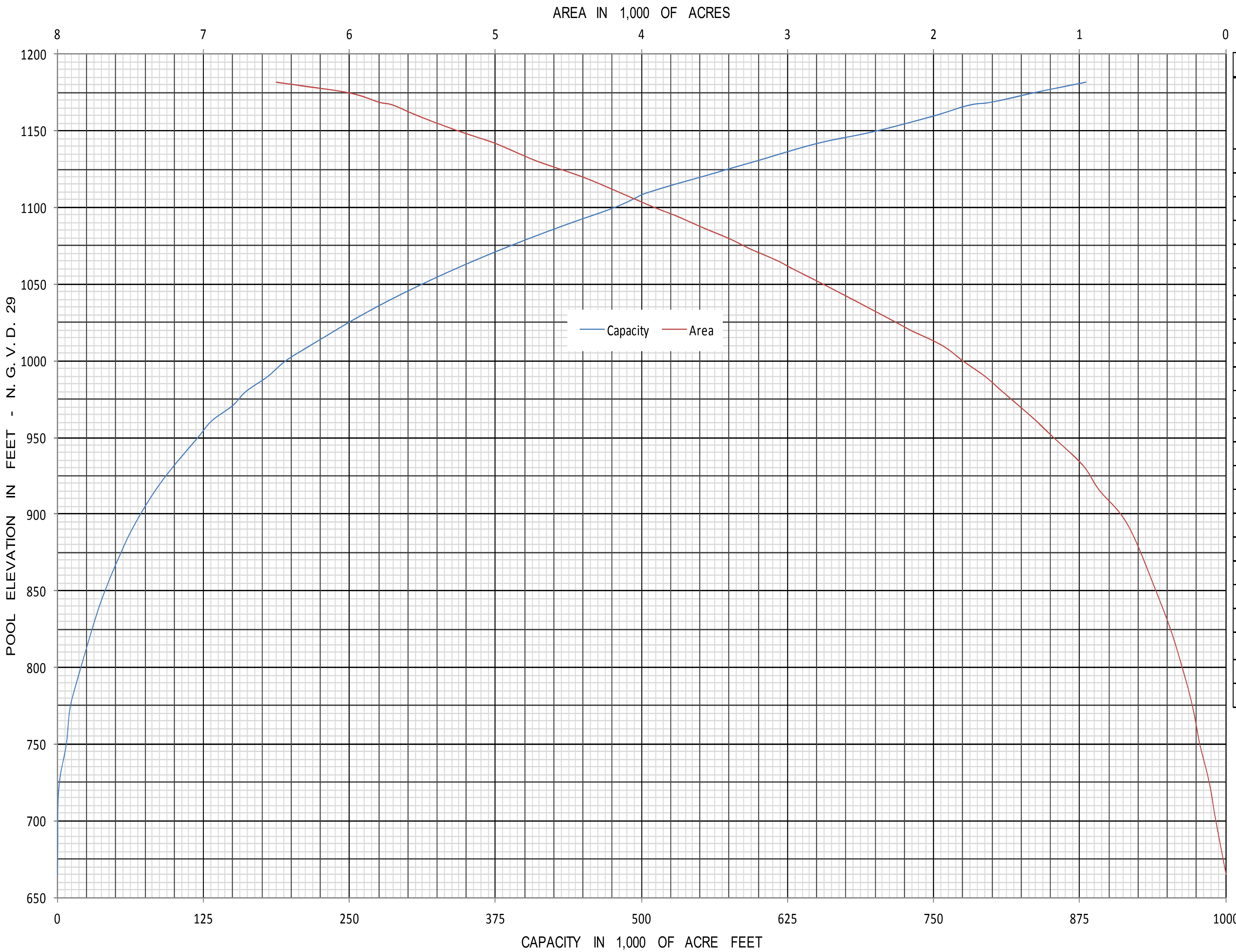
INFLOW-OUTFLOW-POOL CURVES



ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

WATER CONTROL ZONES



AREA CAPACITY TABLE

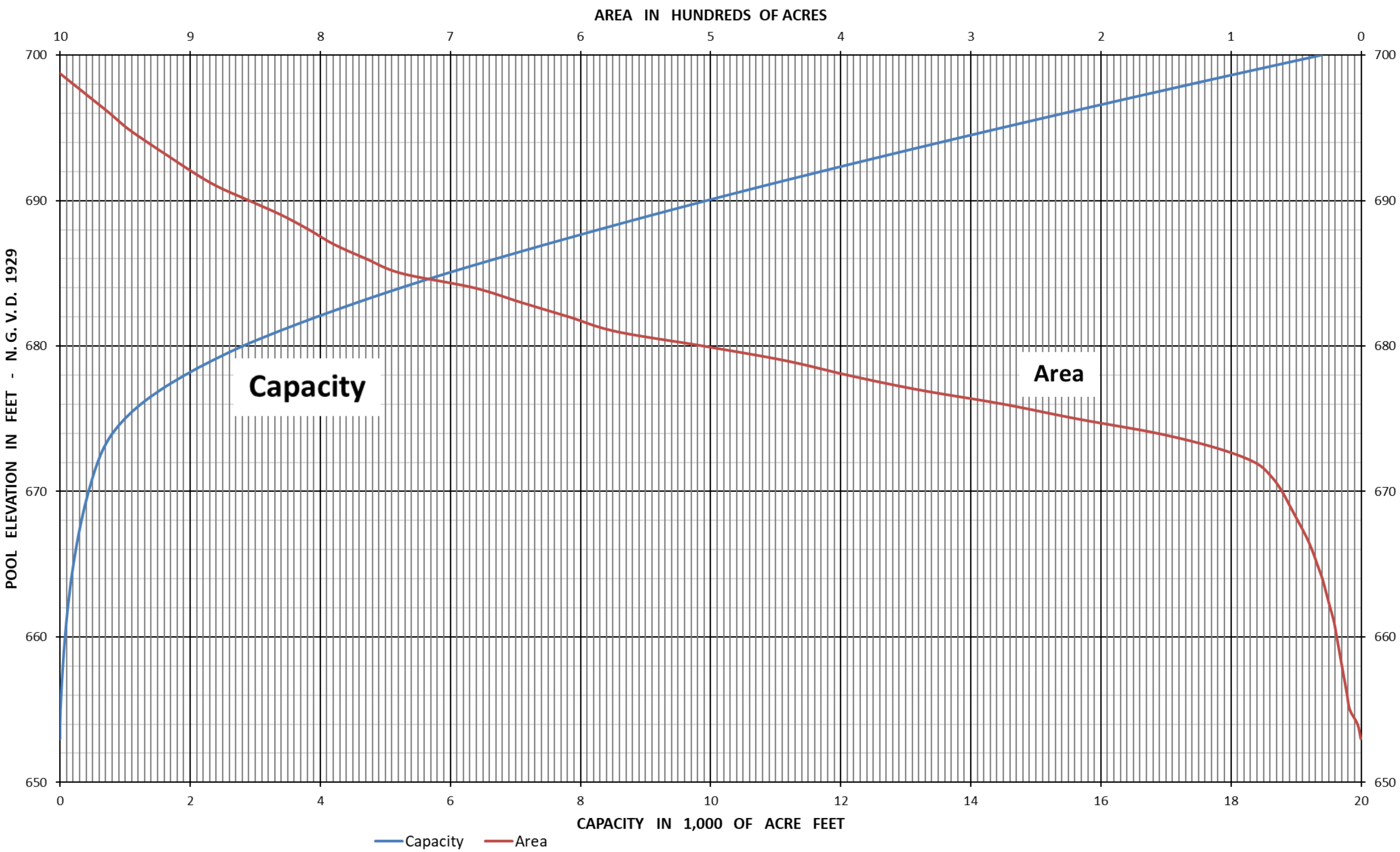
Pool Elevation (Feet)	Total Area (Acres)	Total Storage (Acre-Feet)	Pool Elevation (Feet)	Total Area (Acres)	Total Storage (Acre-Feet)
665	0	0	1050	2754	311403
700	70	200	1060	2962	339972
725	115	1500	1065	3060	355050
750	180	7500	[4]1070	3179	370671
775	230	11000	1072	3230	377073
800	300	20000	[2]1074	3275	383565
825	380	29500	1080	3402	403588
850	480	40500	1085	3530	420923
883	620	59000	1090	3651	438870
900	720	71000	1095	3770	457442
916	870	84000	[1]1099	3880	472756
932	980	100000	1105	4030	491030
950	1180	120000	[5]1106	4045	496000
961	1300	132000	1110	4150	505000
971	1420	150000	1120	4400	550000
980	1530	161000	1131	4730	600000
990	1650	180000	1142	5000	650000
1000	1800	195000	1150	5250	700000
1010	1940	216000	1160	5530	750000
1020	2158	237810	1167	5700	780000
[3]1022	2196	242163	1169	5800	800000
1030	2353	260355	1175	6000	835000
1040	2552	284880	1182	6500	880000

[1] Top of flood control
[2] Top of conservation
[3] Minimum conservation
[4] Spillway crest elevation
[5] Top of gates – closed position

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS
REREGULATION DAM

MAIN DAM
AREA CAPACITY CURVE



AREA CAPACITY TABLE					
Pool Elevation (Feet)	Total Area (Acres)	Total Storage (Acre-Feet)	Pool Elevation (Feet)	Total Area (Acres)	Total Storage (Acre-Feet)
653	0.5	2.4	677	341	1553
654	3	4	678	395	1921
655	9	10	679	443	2341
656	11	21	680	506	2813
657	13	33	681	573	3356
658	15	47	682	609	3947
659	17	62	683	646	4574
660	19	80	684	682	5238
661	21	100	685	738	5949
662	24	122	686	765	6702
[3]662.5	26	135	687	790	7480
663	27	148	688	809	8280
664	30	176	689	830	9099
665	34	209	690	855	9941
666	38	245	691	880	10809
667	43	286	692	899	11699
668	49	332	693	916	12606
669	55	383	694	933	13531
670	61	441	695	949	14472
671	69	506	696	962	15428
672	82	581	697	976	16397
673	112	675	[1]698	990	17380
[2]674	157	809	[4]699	1004	18377
675	219	998	700	1018	19388
676	275	1244			

(1) Top of conservation
(2) Minimum conservation
(3) Spillway crest elevation
(4) Top of gates – closed position

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND
CARTERS REREGULATION DAM

REREGULATION DAM AREA CAPACITY CURVES

	GATE NUMBER				POOL ELEVATION																													
	1	2	3	4	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699
STEP NO.	GATE OPENING (FEET)				DISCHARGE (CFS)																													
1	0.00	0.05	0.00	0.00	16	17	18	19	20	21	21	22	23	24	24	25	26	27	27	28	28	29	30	30	31	31	32	32	33	34	34	35	35	36
2	0.00	0.10	0.00	0.00	32	34	36	38	40	42	43	45	47	48	50	51	52	54	55	56	57	59	60	61	62	63	64	66	67	68	69	70	71	72
3	0.00	0.15	0.00	0.00	49	52	55	58	60	63	66	68	70	73	75	77	79	81	83	85	87	89	90	92	94	96	97	99	100	102	104	105	107	108
4	0.00	0.20	0.00	0.00	65	70	74	77	81	84	88	91	94	97	100	103	106	108	111	113	116	118	121	123	126	128	130	132	134	136	139	141	143	145
5	0.00	0.25	0.00	0.00	93	99	104	110	115	120	125	129	134	138	142	146	150	154	158	161	165	168	172	175	178	181	185	188	191	194	197	200	203	205
6	0.00	0.30	0.00	0.00	140	150	158	166	174	182	189	196	202	209	215	221	227	233	238	244	249	255	260	265	270	275	280	284	289	293	298	302	307	311
7	0.00	0.35	0.00	0.00	154	164	176	182	190	199	206	214	221	228	235	242	248	255	261	267	273	278	284	290	295	300	306	311	316	321	326	330	335	340
8	0.00	0.40	0.00	0.00	186	198	209	220	230	240	249	258	267	276	284	292	300	308	315	322	329	336	343	350	356	363	369	375	381	388	393	399	405	411
9	0.00	0.45	0.00	0.00	224	239	252	265	278	290	301	312	323	333	353	353	362	371	380	389	398	406	414	422	430	438	446	453	461	468	475	482	489	496
10	0.00	0.50	0.00	0.00	264	281	297	312	327	341	354	367	380	392	404	415	426	437	448	458	468	478	488	497	507	516	525	534	542	551	559	568	576	584
11	0.00	0.55	0.00	0.00	281	299	316	332	348	363	377	391	404	417	430	442	454	465	477	488	498	509	519	529	539	549	559	568	577	586	595	604	613	621
12	0.00	0.60	0.00	0.00	309	329	348	366	384	400	416	431	446	460	474	487	500	513	525	529	549	561	572	584	594	605	616	626	636	646	656	666	676	685
13	0.00	0.65	0.00	0.00	361	334	407	428	448	467	485	503	520	537	553	569	584	599	613	627	641	655	668	684	694	706	719	731	743	754	766	777	788	799
14	0.00	0.70	0.00	0.00	384	409	433	455	476	497	516	535	553	571	588	605	621	637	625	667	682	696	711	724	738	751	764	777	790	802	815	827	839	851
15	0.00	0.75	0.00	0.00	421	449	474	499	522	545	566	587	607	627	645	664	681	699	716	732	748	764	780	795	810	824	839	853	867	880	894	907	920	933
16	0.00	0.80	0.00	0.00	436	464	491	516	541	564	586	608	628	648	668	687	705	723	741	758	774	791	807	822	838	853	868	883	897	911	925	939	952	966
17	0.00	0.85	0.00	0.00	567	604	639	672	703	733	762	790	817	843	869	893	917	940	963	985	1007	1028	1049	1070	1090	1110	1129	1148	1167	1185	1203	1221	1239	1256
18	0.00	0.90	0.00	0.00	586	624	661	695	727	759	789	818	845	872	899	924	949	973	997	1020	1042	1064	1086	1107	1128	1148	1163	1188	1207	1226	1245	1264	1282	1300
19	0.00	0.95	0.00	0.00	604	644	681	717	750	782	813	843	872	900	927	953	979	1004	1028	1052	1075	1098	1120	1142	1163	1184	1205	1225	1245	1265	1284	1303	1322	1341
20	0.00	1.00	0.00	0.00	622	663	701	738	772	805	837	868	898	926	954	981	1007	1033	1058	1083	1106	1130	1153	1175	1197	1219	1240	1261	1282	1302	1322	1342	1361	1380
21	0.00	1.00	0.05	0.00	644	687	726	764	800	834	867	899	930	959	988	1016	1044	1070	1096	1121	1146	1170	1194	1218	1240	1263	1285	1307	1328	1349	1370	1390	1410	1430
22	0.00	1.00	0.10	0.00	666	709	751	790	827	862	896	929	961	992	1022	1050	1079	1106	1133	1159	1185	1210	1234	1258	1282	1305	1328	1351	1373	1394	1416	1437	1457	1478
23	0.00	1.00	0.15	0.00	720	768	812	854	892	933	970	1006	1040	1073	1106	1137	1167	1197	1226	1255	1282	1309	1336	1362	1388	1413	1437	1462	1486	1509	1532	1555	1577	1600
24	0.00	1.00	0.20	0.00	742	791	837	880	922	962	1000	1036	1072	1106	1139	1172	1203	1234	1264	1293	1322	1349	1377	1404	1430	1456	1481	1506	1531	1555	1579	1603	1626	1649
25	0.00	1.00	0.25	0.00	775	826	874	920	963	1004	1044	1083	1120	1155	1190	1224	1257	1289	1320	1341	1381	1410	1438	1467	1494	1521	1548	1574	1600	1625	1650	1674	1698	1722
26	0.00	1.00	0.30	0.00	810	863	914	961	1006	1050	1091	1131	1170	1208	1244	1279	1314	1347	1380	1412	1443	1474	1503	1533	1562	1590	1618	1645	1672	1698	1724	1750	1775	1800
27	0.00	1.00	0.35	0.00	813	871	922	970	1016	1059	1101	1142	1181	1219	1255	1291	1326	1360	1393	1425	1456	1487	1517	1547	1576	1605	1633	1660	1687	1714	1740	1766	1792	1817
28	0.00	1.00	0.40	0.00	823	877	928	976	1022	1066	1109	1150	1189	1227	1264	1300	1335	1369	1402	1434	1466	1497	1528	1558	1587	1616	1644	1672	1699	1726	1752	1778	1804	1829
29	0.00	1.00	0.45	0.00	827	882	933	981	1028	1072	1115	1156	1195	1233	1271	1307	1342	1376	1409	1442	1474	1505	1536	1566	1595	1624	1653	1680	1708	1735	1765	1788	1814	1839
30	0.00	1.00	0.50	0.00	902	961	1017	1070	1121	1169	1215	1260	1303	1345	1386	1425	1463	1501	1537	1573	1607	1642	1675	1708	1740	1771	1802	1833	1863	1892	1921	1950	1978	2006
31	0.00	1.00	0.55	0.00	927	989	1046	1101	1153	1202	1250	1296	1341	1384	1425	1466	1505	1544	1581	1618	1654	1689	1723	1757	1790	1822	1854	1885	1916	1946	1976	2006	2035	2063
32	0.00	1.00	0.60	0.00	953	1016	1075	1132	1185	1236	1285	1333	1378	1422	1465	1507	1548	1587	1626	1663	1700	1736	1771	1806	1840	1873	1906	1938	1970	2001	2032	2062	2092	2121
33	0.00	1.00	0.65	0.00	980	1044	1105	1163	1218	1270	1321	1369	1416	1462	1506	1549	1591	1631	1671	1709	1747	1784	1821	1856	1891	1925	1959	1992	2025	2057	2088	2120	2150	2180
34	0.00	1.00	0.70	0.00	997	1063	1125	1183	1239	1293	1344	1394	1442	1488	1533	1576	1619	1660	1701	1740	1779	1816	1853	1889	1925	1960	1994	2028	2061	2094	2126	2158	2189	2219
35	0.00	1.00	0.75	0.00	1010	1077	1140	1199	1256	1310	1362	1412	1461	1508	1553	1598	1641	1683	1723	1763	1802	1841	1878	1915	1951	1986	2021	2055	2089	2122	2154	2187	2218	2249
36	0.00	1.00	0.80	0.00	1028	1096	1160	1220	1278	1333	1386	1438	1487	1535	1581	1626	1670	1712	1754	1795	1834	1873	1912	1949	1986	2022	2057	2092	2126	2160	2193	2226	2258	2289
37	0.00	1.00	0.85	0.00	1048	1118	1183	1245	1304	1360	1415	1467	1517	1566	1613	1659	1704	1747	1790	1831	1872	1912	1950	1989	2026	2063	2099	2134	2169	2204	2238	2271	2304	2336
38	0.00	1.00	0.90	0.00	1118	1192	1261	1327	1390	1450	1508	1564	1617	1669	1720	1769	1816	1863	1908	1952	1996	2038	2080	2120	2160	2199	2238	2276	2313	2350	2386	2421	2456	2491
39	0.00	1.00	0.95	0.00	1140	1215	1286	1353	1418	1479	1538	1595	1649	1702	1754	1804	1852	1900	1946	1991	2035	2078	2121	2162	2203	2243	2282	2321	2359	2396	2433	2469	2505	2540
40	0.00	1.00	1.00	0.00	1161	1238	1310	1379	1444	1507	1567	1625	1681	1735	1787	1838	1888	1936	1983	2029	2074	2118	2161	2204	2245	2286	2326	2365	2404	2442	2480	2516	2553	2589
41	0.25	1.00	1.00	0.00	1271	1356	1435	1510	1582	1651	1717	1780	1842	1901	1958	2014	2069	2122	2173	2224	2273	2322	2369	2415	2461	2506	2550	2593	2635	2677	2718	2759	2799	2838
42	0.25	1.00	1.00	0.25	1428	1523	1613	1697	1778	1856	1930	2001	2070	2137	2202	2265	2326	2386	2444	2501	2556	2611	2664	2716	2767	2818	2867	2916	2964	3011	3057	3103	3148	3192
43	0.50	1.00	1.00	0.25	1532	1634	1731	1822	1909	1992	2072	2149	2223	2295	2365	2432	2498	2562	2625	2686	2746	2804	2862	2918	2973	3027	3080	3132	3184	3234	3284	3333	3382	3429
44	0.50	1.00	1.00	0.50	1727	1843	1952	2056	2154	2248	2338	2425	2509	2590	2669	2746	2820	2893	2963	3032	3100	3166	3231	3294	3356	3418	3478	3537	3595	3652	3708	3764	3818	3872
45	0.75	1.00	1.00	0.50	1806	1928	2042	2150	2254	2352	2447	2538	2626	2711	2794	2871	2952	3028	3102	3174	3245	3314	3382	3449	3514	3578	3641	3703	3764	3823	3882	3940	3998	4054
46	0.75	1.00	1.00	0.75	1925	2055	2177	2293	2403	2509	2610	2707	2801	2892	2980	3066	3149	3230	3309	3387	3462	3536	3609	3680	3749	3818	3885	3951	4016	4080	4143	4205	4266	4326
47	1.00	1.00	1.00	0.75	2142	2288	2424	2554	2677	2794	2907	3016	3121	3222	3321	3416	3509	3600	3688	3774	3858	3941	4022	4101	4179	4255	4330	4404	4476	4548	4618	4687	4755	4822
48	1.00	1.00	1.00	1.00	2328	2486	2635	2776	2910	3038	3161	3279	3393	3504	3611	3715	3816	3915	4011	4105	4197	4287	4375	4461	4546	4629	4710	4791	4869	4947	5024	5099	5173	5246
49	1.25	1.00	1.00	1.00	2469	2637	2796	2946	3088	3225	3355	3481	3603	3720	3834	3945	4052	4157	4259	4359	4457	4552	4646	4738	4828	4916	5003	5088	5172	5254	5336	5416	5494	5572
50	1.25	1.25	1.00	1.00	2610	2788	2956	3115	3266	3411	3549	3683	3812	3936	4057	4174	4288	4399	4507	4613	4716	4818	4917	5014	5109	5203	5295	5385	5474	5561	5647	5732	5816	5898
51	1.25	1.25	1.25	1.00	2750	2939	3116	3284	3444	3597	3743	3884	4020	4152	4279	4403	4523	4641	4755	4867	4976	5083	5187	5290	5391	5489	5587	5682	5776	5868	5959	6048	6137	6224

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

CARTERS REREGULATION DAM SPILLWAY DISCHARGE TABLE

STEP NO.	GATE NUMBER 1	2	3	4	POOL ELEVATION 670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699
	GATE OPENING (FEET)				DISCHARGE (CFS)																													
52	1.25	1.25	1.25	1.25	2890	3089	3276	3453	3621	3782	3936	4085	4228	4367	4501	4632	4758	4882	5002	5120	5235	5348	5458	5566	5672	5776	5878	5979	6077	6175	6270	6365	6457	6549
53	1.50	1.25	1.25	1.25	3029	3238	3435	3621	3798	3967	4129	4285	4436	4582	4723	4860	4993	5123	5249	5373	5494	5612	5728	5841	5953	6062	6169	6275	6379	6481	6581	6680	6778	6874
54	1.50	1.50	1.25	1.25	3168	3387	3594	3789	3975	4152	4322	4486	4644	4796	4944	5088	5228	5364	5496	5626	5753	5876	5998	6117	6233	6348	6461	6571	6680	6787	6892	6996	7098	7199
55	1.50	1.50	1.50	1.25	3306	3536	3752	3956	4151	4336	4514	4685	4851	5010	5165	5315	5462	5604	5743	5878	6011	6140	6267	6392	6514	6634	6751	6867	6981	7093	7203	7311	7418	7524
56	1.50	1.50	1.50	1.50	3443	3684	3910	4123	4326	4520	4706	4885	5057	5224	5386	5543	5695	5844	5989	6131	6269	6404	6537	6667	6794	6919	7042	7163	7281	7398	7513	7627	7738	7848
57	1.75	1.50	1.50	1.50	3581	3832	4067	4290	4502	4704	4898	5084	5264	5438	5606	5770	5929	6084	6235	6382	6527	6668	6806	6941	7074	7204	7332	7458	7582	7704	7823	7942	8058	8173
58	1.75	1.75	1.50	1.50	3717	3979	4224	4456	4676	4887	5089	5283	5470	5651	5826	5997	6162	6323	6481	6634	6784	6931	7075	7215	7354	7489	7622	7753	7882	8009	8133	8256	8377	8497
59	1.75	1.75	1.75	1.50	3853	4125	4381	4622	4851	5070	5279	5481	5676	5864	6046	6223	6395	6563	6726	6885	7041	7194	7343	7489	7633	7774	7912	8048	8182	8314	8443	8571	8696	8820
60	1.75	1.75	1.75	1.75	3989	4272	4537	4787	5025	5252	5470	5679	5881	6076	6266	6449	6628	6801	6971	7136	7298	7456	7611	7763	7912	8058	8202	8343	8482	8618	8753	8885	9015	9144
61	2.00	1.75	1.75	1.75	4124	4417	4692	4952	5199	5434	5660	5877	6086	6289	6485	6675	6860	7040	7216	7387	7555	7719	7879	8037	8191	8342	8491	8637	8781	8923	9062	9199	9334	9467
62	2.00	2.00	1.75	1.75	4459	4562	4847	5116	5372	5616	5849	6074	6291	6500	6703	6900	7092	7278	7460	7638	7811	7981	8147	8310	8470	8626	8780	8932	9080	9227	9371	9513	9653	9790
63	2.00	2.00	2.00	1.75	4393	4707	5002	5280	5545	5797	6039	6271	6495	6712	6922	7125	7324	7516	7704	7888	8067	8243	8414	8583	8748	8910	9069	9226	9379	9531	9680	9826	9971	10113
64	2.00	2.00	2.00	2.00	4526	4851	5156	5444	5717	5978	6227	6468	6699	6923	7140	7350	7555	7754	7948	8138	8323	8504	8682	8855	9026	9193	9358	9519	9678	9834	9988	10140	10289	10436
65	4.00	2.00	2.00	2.00	5575	5987	6373	6736	7081	7410	7725	8027	8318	8600	8873	9137	9394	9645	9889	10127	10359	10587	10809	11027	11241	11451	11658	11860	12059	12255	12448	12638	12825	13010
66	4.00	4.00	2.00	2.00	6590	7091	7559	8000	8418	8816	9197	9563	9915	10255	10584	10904	11214	11516	11810	12097	12377	12651	12920	13182	13440	13693	13941	14185	14425	14661	14893	15122	15347	15569
67	4.00	4.00	4.00	2.00	7569	8162	8716	9236	9728	10197	10645	11075	11489	11888	12275	12649	13013	13367	13712	14048	14377	14698	15012	15320	15622	15918	16209	16494	16775	17051	17323	17590	17854	18113
68	4.00	4.00	4.00	4.00	8511	9200	9841	10442	11010	11551	12067	12563	13039	13499	13943	14374	14792	15199	15595	15981	16358	16727	17088	17441	17787	18127	18460	18788	19109	19426	19737	20044	20346	20643
69	6.00	4.00	4.00	4.00	9417	10204	10934	11618	12265	12879	13465	14026	14566	15087	15590	16077	16550	17010	17458	17895	18321	18738	19145	19544	19935	20319	20695	21065	21428	21785	22137	22483	22823	23159
70	6.00	6.00	4.00	4.00	10284	11172	11995	12765	13490	14179	14836	15465	16069	16652	17215	17759	18288	18802	19302	19790	20265	20730	21185	21630	22066	22494	22914	23326	23731	24129	24521	24906	25286	25660
71	6.00	6.00	6.00	4.00	11112	12105	13023	13880	14687	15452	11681	16879	17549	18194	18817	19420	20005	20573	21126	21665	22191	22705	23207	23698	24180	24652	25116	25571	26018	26457	26889	27315	27734	28146
72	6.00	6.00	6.00	6.00	11900	13002	14017	14964	15855	16698	17600	18267	19004	19713	20397	21059	21701	22324	22930	23521	24097	2460	25211	25749	26277	26794	27301	27799	28288	28769	29424	29708	30166	30618
73	8.00	6.00	6.00	6.00		13860	14977	16016	16992	17915	18792	19630	20434	21208	21954	22676	23375	24054	24715	25358	25985	26598	27196	27782	28356	28918	29470	30011	30543	31066	31580	32086	32584	33075
74	8.00	8.00	6.00	6.00		14631	15902	17036	18099	19103	20057	20968	21840	22679	23488	24270	25028	25764	26479	27175	27854	28516	29164	29797	30418	31026	31622	32207	32782	33347	33902	34449	34987	35516
75	8.00	8.00	8.00	6.00		15461	16791	18022	19175	20262	21294	22278	23221	24126	24999	25843	26659	27452	28222	28972	29703	30416	31113	31795	32462	33116	33757	34386	35004	35611	36208	36796	37374	37943
76	8.00	8.00	8.00	8.00		16201	17642	18975	20220	21392	22504	23563	24576	25549	26487	27393	28269	29119	29945	30749	31532	32297	33043	33774	34488	35189	35875	36549	37210	37860	38499	39128	39746	40355
77	10.00	8.00	8.00	8.00					21232	22492	23684	24820	25906	26948	27951	28979	29857	30765	31648	32506	33343	34158	34955	35735	36497	37244	37976	38695	39400	40093	40774	41444	42103	42752
78	10.00	10.00	8.00	8.00					22212	23561	24836	26050	27209	28321	29391	30423	31422	32390	33329	34243	35133	36001	36849	37677	38488	39282	40060	40824	41573	42309	43033	43744	44444	45134
79	10.00	10.00	10.00	8.00					23158	24598	25959	27252	28485	29669	30807	31904	32965	33992	34990	35959	36903	37824	38723	39601	40461	41302	42127	42936	43729	44509	45275	46029	46770	47500
80	10.00	10.00	10.00	10.00					24070	25604	27052	28426	29737	30992	32198	33361	34485	35573	36629	37655	38654	39628	40578	41507	42415	43305	44176	45031	45869	46693	47502	48298	47081	49851
81	12.00	10.00	10.00	10.00						26578	28115	29572	30960	32289	33565	34795	35982	37132	38247	39330	40384	41412	42414	43394	44352	45289	46208	47109	47992	48860	49713	50551	51376	52187
82	12.00	12.00	10.00	10.00						27519	29147	30688	32156	33560	34907	36204	37456	38668	39843	40984	42094	43176	44231	45262	46270	47256	48222	49169	50098	51011	51907	52788	53655	54507
83	12.00	12.00	12.00	10.00						28426	30147	31775	33324	34804	36223	37589	38904	40182	41417	42617	43784	44920	46029	47111	48169	49205	50219	51213	52188	53145	54085	55009	55913	56812
84	12.00	12.00	12.00	12.00						29299	31116	32832	34464	36021	37514	38949	40334	41673	42970	44228	45453	46644	47807	48941	50050	51135	52198	53239	54260	55262	56247	57214	58166	59102
85	14.00	12.00	12.00	12.00								33859	35575	37211	38779	40285	41737	43141	44500	45819	47100	48348	49565	50752	51913	53047	54158	55247	56315	57363	58392	59403	60397	61375
86	14.00	14.00	12.00	12.00								34855	36657	38374	40017	41596	43116	44585	46008	47387	48727	50032	51303	52544	53756	54941	56101	57238	58353	59446	60520	61575	62613	63633
87	14.00	14.00	14.00	12.00								35819	37709	39508	41229	42881	44471	46007	47493	48934	50333	51695	53022	54316	55580	56816	58026	59211	60373	61513	62632	63731	64812	65875
88	14.00	14.00	14.00	14.00								36752	38731	40614	42414	44140	45801	47404	48955	50458	51918	53337	54720	56068	57385	58673	59933	61166	62376	63562	64727	65871	66996	68102
89	16.00	14.00	14.00	14.00										41692	43571	45373	47107	48778	50394	51960	53480	54958	56398	57801	59171	60511	61821	63104	64361	65595	66805	67994	69163	70312
90	16.00	16.00	14.00	14.00										42740	44701	46580	48387	50128	51810	53440	55021	56559	58055	59514	60938	62330	63691	65023	66329	67610	68866	70101	71314	72506
91	16.00	16.00	16.00	14.00										43758	45803	47761	49641	51453	53203	54897	56540	58138	59692	61207	62685	64129	65542	66924	68279	69607	70911	72190	73443	74684
92	16.00	16.00	16.00	16.00										44747	46877	48914	50870	52753	54571	56331	58037	59695	61308	62879	64412	65910	67374	68807	70211	71587	72938	74263	75566	76846
93	18.50	16.00	16.00	16.00													52369	54343	56248	58091	59877	61612	63298	64941	66544	68109	69638	71135	72601	74038	75447	76831	73190	79526
94	18.50	18.50	16.00	16.00													53826	55894	57887	59815	61682	63494	65256	66971	68644	70277	71873	73434	74962	76460	77930	79372	80788	82180
95	18.50	18.50	18.50	16.00													55242	57404	59488	61501	63450	65342	67180	68969	70712	72414	74077	75703	77295	78855	80385	81886	83360	84808
96	18.50	18.50	18.50	18.50													56614	58874	61049	63150	65183	67154	69070	70933	72749	74521	76251	77943	79599	81222	82812	84373	85905	87411

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

CARTERS REREGULATION DAM SPILLWAY DISCHARGE TABLE

PUMP-TURBINE UNIT DISCHARGE RATING TABLE WHEN PUMPING

HEAD RANGE 325-412*

HEAD	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90
	DISCHARGE IN CFS									
325	4861	4859	4857	4855	4853	4851	4849	4848	4846	4844
326	4842	4840	4838	4836	4834	4833	4831	4829	4827	4825
327	4823	4821	4819	4818	4816	4814	4812	4810	4808	4806
328	4804	4803	4801	4799	4797	4795	4793	4791	4789	4788
329	4786	4784	4782	4780	4778	4776	4774	4773	4771	4769
330	4767	4765	4763	4761	4759	4758	4756	4754	4752	4750
331	4748	4746	4744	4743	4741	4739	4737	4735	4733	4731
332	4729	4727	4726	4724	4722	4720	4718	4716	4714	4712
333	4711	4709	4707	4705	4703	4701	4699	4697	4696	4694
334	4692	4690	4688	4686	4684	4682	4681	4679	4677	4675
335	4673	4671	4669	4667	4666	4664	4662	4660	4658	4656
336	4654	4652	4651	4649	4647	4645	4643	4641	4639	4637
337	4636	4634	4632	4630	4628	4626	4624	4622	4621	4619
338	4617	4615	4613	4611	4609	4607	4606	4604	4602	4600
339	4598	4596	4594	4592	4591	4589	4587	4585	4583	4581
340	4579	4577	4575	4574	4572	4570	4568	4566	4564	4562
341	4560	4559	4557	4555	4553	4551	4549	4547	4545	4544
342	4542	4540	4538	4536	4534	4532	4530	4529	4527	4525
343	4523	4521	4519	4517	4515	4514	4512	4510	4508	4506
344	4504	4502	4500	4499	4497	4495	4493	4491	4489	4487
345	4485	4484	4482	4480	4478	4476	4474	4472	4470	4469
346	4467	4465	4463	4461	4459	4457	4455	4454	4452	4450
347	4448	4446	4444	4442	4440	4439	4437	4435	4433	4431
348	4429	4427	4425	4423	4422	4420	4418	4416	4414	4412
349	4410	4408	4407	4405	4403	4401	4399	4397	4395	4393
350	4392	4390	4388	4386	4384	4382	4380	4378	4377	4375
351	4373	4371	4369	4367	4365	4363	4362	4360	4358	4356
352	4354	4352	4350	4348	4347	4345	4343	4341	4339	4337
353	4335	4333	4332	4330	4328	4326	4324	4322	4320	4318
354	4317	4315	4313	4311	4309	4307	4305	4303	4302	4300
355	4298	4296	4294	4292	4290	4288	4287	4285	4283	4281
356	4279	4277	4275	4273	4271	4270	4268	4266	4264	4262
357	4260	4258	4256	4255	4253	4251	4249	4247	4245	4243
358	4241	4240	4238	4236	4234	4232	4230	4228	4226	4225
359	4223	4221	4219	4217	4215	4213	4211	4210	4208	4206
360	4204	4202	4200	4198	4196	4195	4193	4191	4189	4187
361	4185	4183	4181	4180	4178	4176	4174	4172	4170	4168
362	4166	4165	4163	4161	4159	4157	4155	4153	4151	4150
363	4148	4146	4144	4142	4140	4138	4136	4135	4133	4131
364	4129	4127	4125	4123	4121	4119	4118	4116	4114	4112
365	4110	4108	4106	4104	4103	4101	4099	4097	4095	4093
366	4091	4089	4088	4086	4084	4082	4080	4078	4076	4074
367	4073	4071	4069	4067	4065	4063	4061	4059	4058	4056
368	4054	4052	4050	4048	4046	4044	4043	4041	4039	4037
369	4035	4033	4031	4029	4028	4026	4024	4022	4020	4018

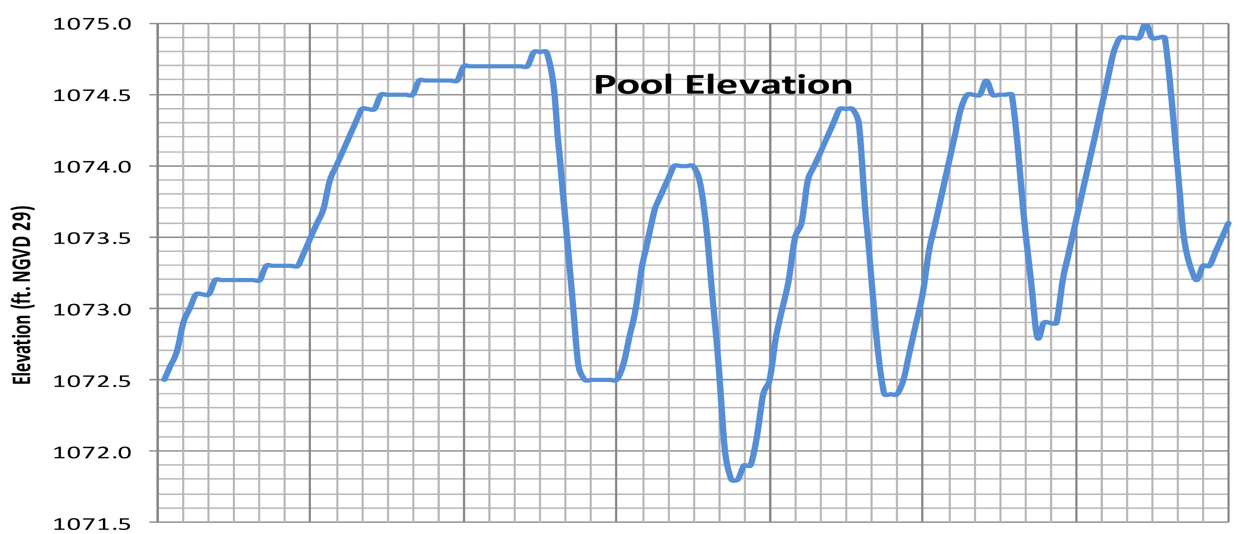
HEAD	0.00	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90
	DISCHARGE IN CFS									
370	4016	4014	4013	4011	4009	4007	4005	4003	4001	3999
371	3998	3996	3994	3992	3990	3988	3986	3984	3983	3981
372	3979	3977	3975	3973	3971	3969	3967	3966	3964	3962
373	3960	3958	3956	3954	3952	3951	3949	3947	3945	3943
374	3941	3939	3937	3936	3934	3932	3930	3928	3926	3924
375	3922	3921	3919	3917	3915	3913	3911	3909	3907	3906
376	3904	3902	3900	3898	3896	3894	3892	3891	3889	3887
377	3885	3883	3881	3879	3877	3876	3874	3872	3870	3868
378	3866	3864	3862	3861	3859	3857	3855	3853	3851	3849
379	3847	3846	3844	3842	3840	3838	3836	3834	3832	3831
380	3829	3827	3825	3823	3821	3819	3817	3815	3814	3812
381	3810	3808	3806	3804	3802	3800	3799	3797	3795	3793
382	3791	3789	3787	3785	3784	3782	3780	3778	3776	3774
383	3772	3770	3769	3767	3765	3763	3761	3759	3757	3755
384	3754	3752	3750	3748	3746	3744	3742	3740	3739	3737
385	3735	3733	3731	3729	3727	3725	3724	3722	3720	3718
386	3716	3714	3712	3710	3709	3707	3705	3703	3701	3699
387	3697	3695	3694	3692	3690	3688	3686	3684	3682	3680
388	3679	3677	3675	3673	3671	3669	3667	3665	3663	3662
389	3660	3658	3656	3654	3652	3650	3648	3647	3645	3643
390	3641	3639	3637	3635	3633	3632	3630	3628	3626	3624
391	3622	3620	3618	3617	3615	3613	3611	3609	3607	3605
392	3603	3602	3600	3598	3596	3594	3592	3590	3588	3587
393	3585	3583	3581	3579	3577	3575	3573	3572	3570	3568
394	3566	3564	3562	3560	3558	3557	3555	3553	3551	3549
395	3547	3545	3543	3542	3540	3538	3536	3534	3532	3530
396	3528	3527	3525	3523	3521	3519	3517	3515	3513	3511
397	3510	3508	3506	3504	3502	3500	3498	3496	3495	3493
398	3491	3489	3487	3485	3483	3481	3480	3478	3476	3474
399	3472	3470	3468	3466	3465	3463	3461	3459	3457	3455
400	3453	3451	3450	3448	3446	3444	3442	3440	3438	3436
401	3435	3433	3431	3429	3427	3425	3423	3421	3420	3418
402	3416	3414	3412	3410	3408	3406	3405	3403	3401	3399
403	3397	3395	3393	3391	3390	3388	3386	3384	3382	3380
404	3378	3376	3375	3373	3371	3369	3367	3365	3363	3361
405	3359	3358	3356	3354	3352	3350	3348	3346	3344	3343
406	3341	3339	3337	3335	3333	3331	3329	3328	3326	3324
407	3322	3320	3318	3316	3314	3313	3311	3309	3307	3305
408	3303	3301	3299	3298	3296	3294	3292	3290	3288	3286
409	3284	3283	3281	3279	3277	3275	3273	3271	3269	3268
410	3266	3264	3262	3260	3258	3256	3254	3253	3251	3249
411	3247	3245	3243	3241	3239	3237	3235	3233	3231	3229
412	3227	3225	3223	3221	3219	3217	3215	3213	3211	3209

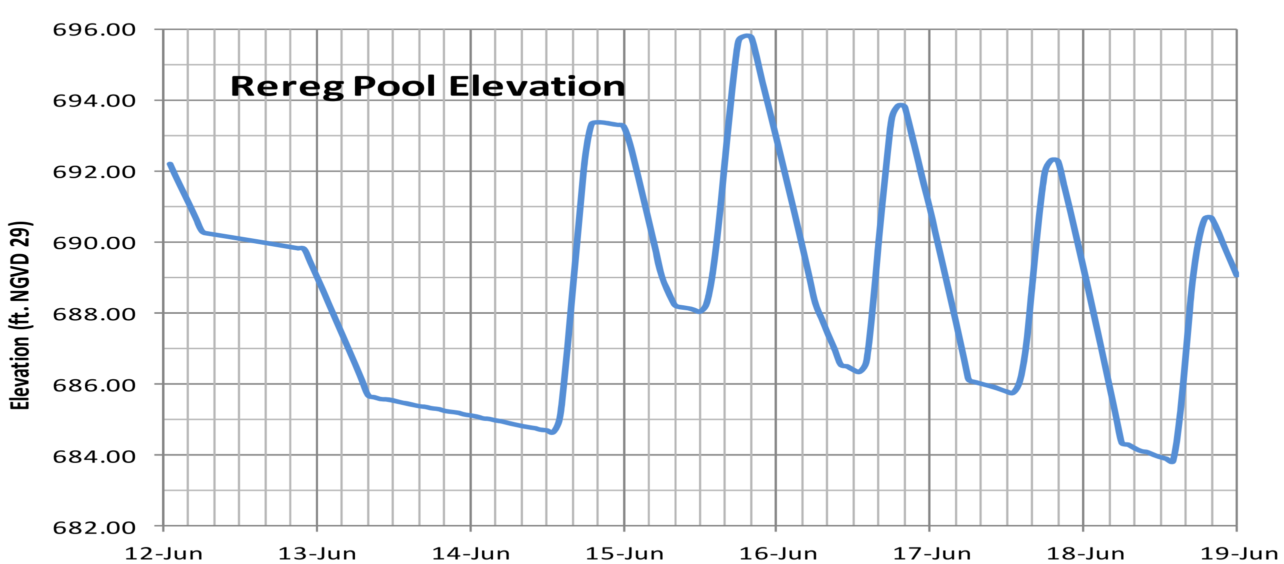
* Pumping is limited to a head of 395 due to excessive vibration

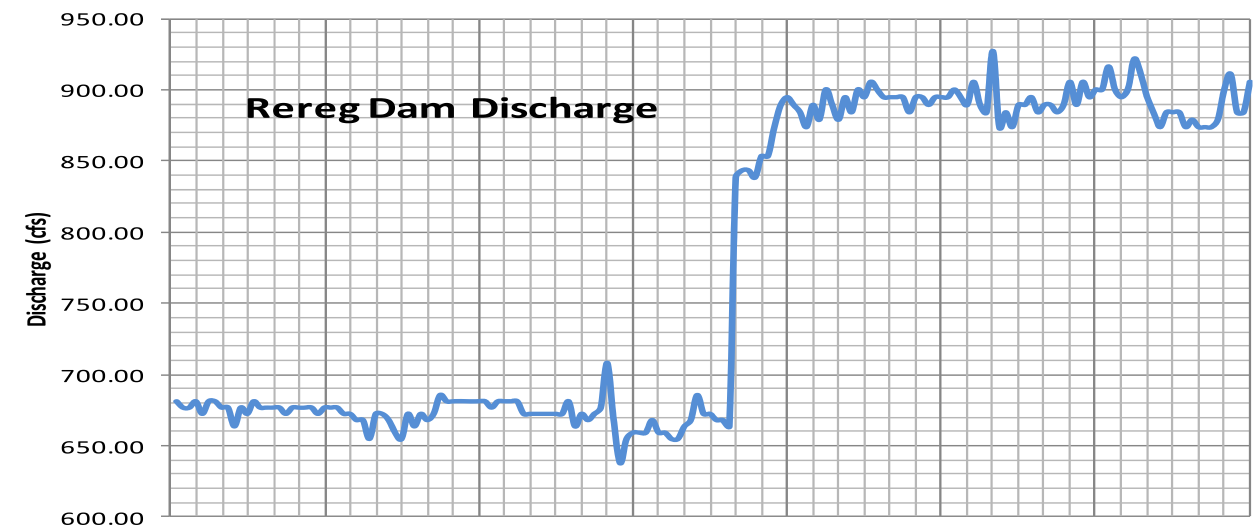
ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

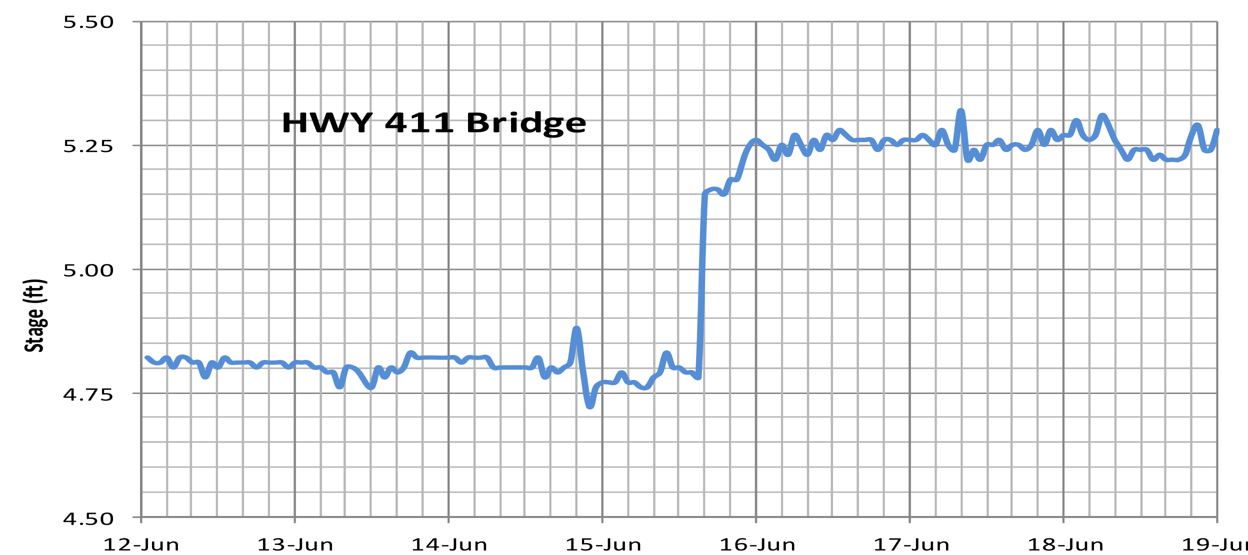
WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS
REREGULATION DAM

PUMP-TURBINE UNIT DISCHARGE RATING TABLE







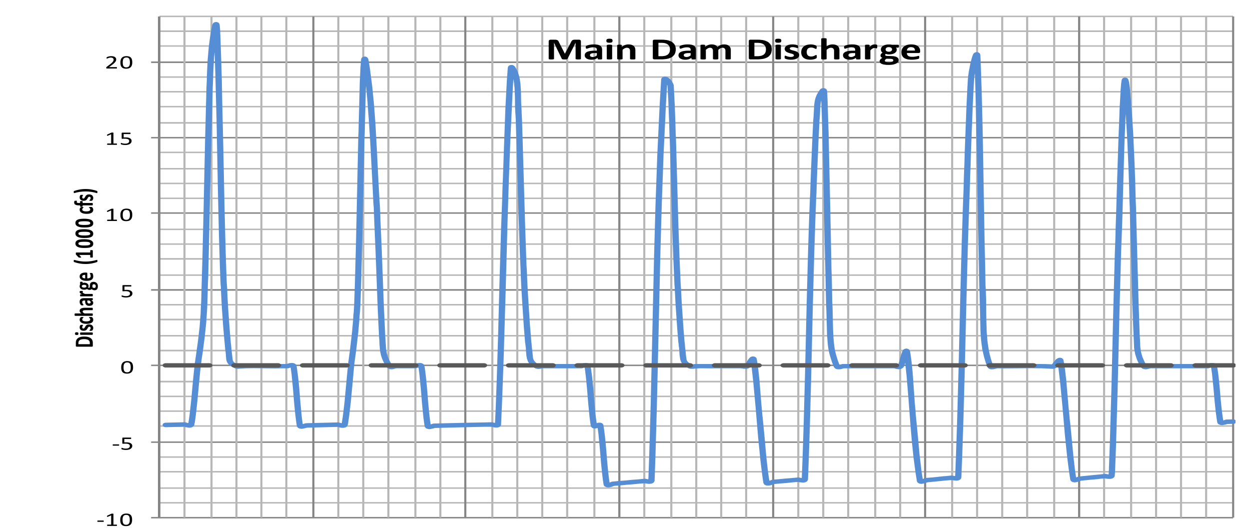


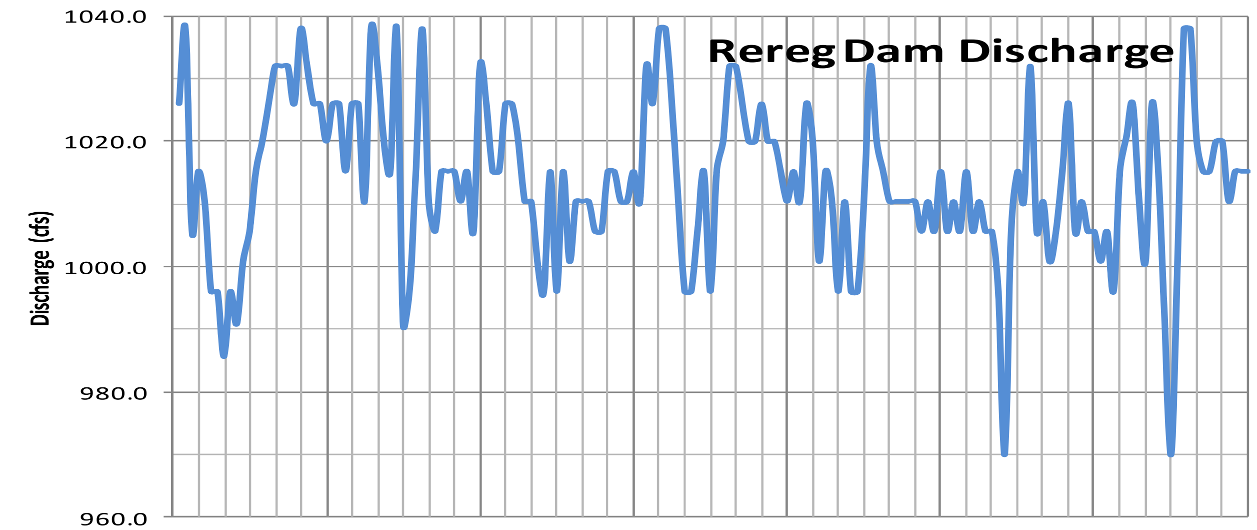
*The data shown here is from June 12-18, 2010, and represents typical weekly operation when the main pool is near the summer pool elevation of 1074 NGVD.

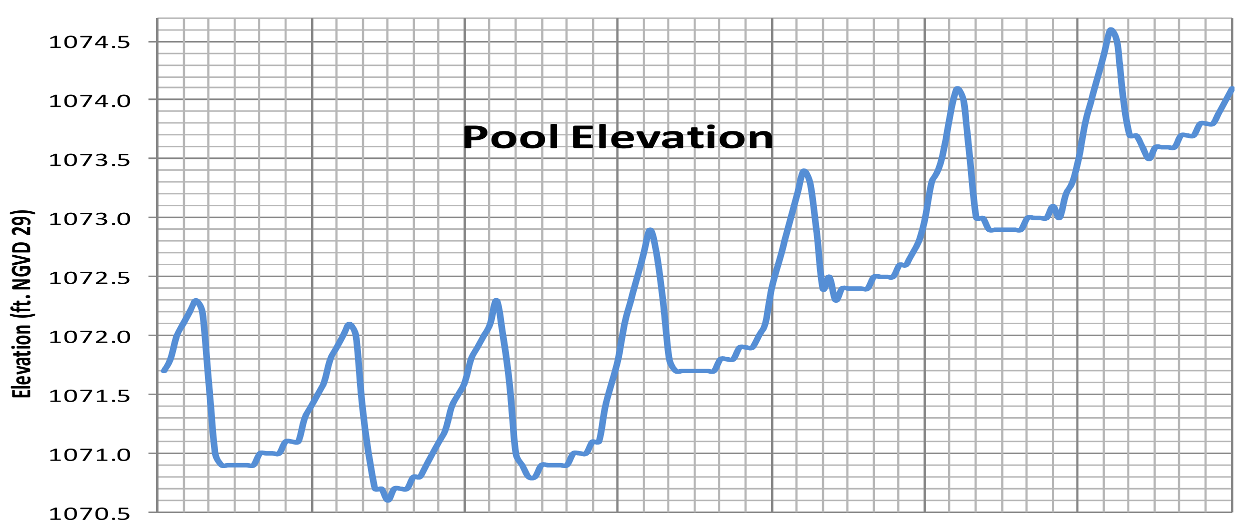
ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

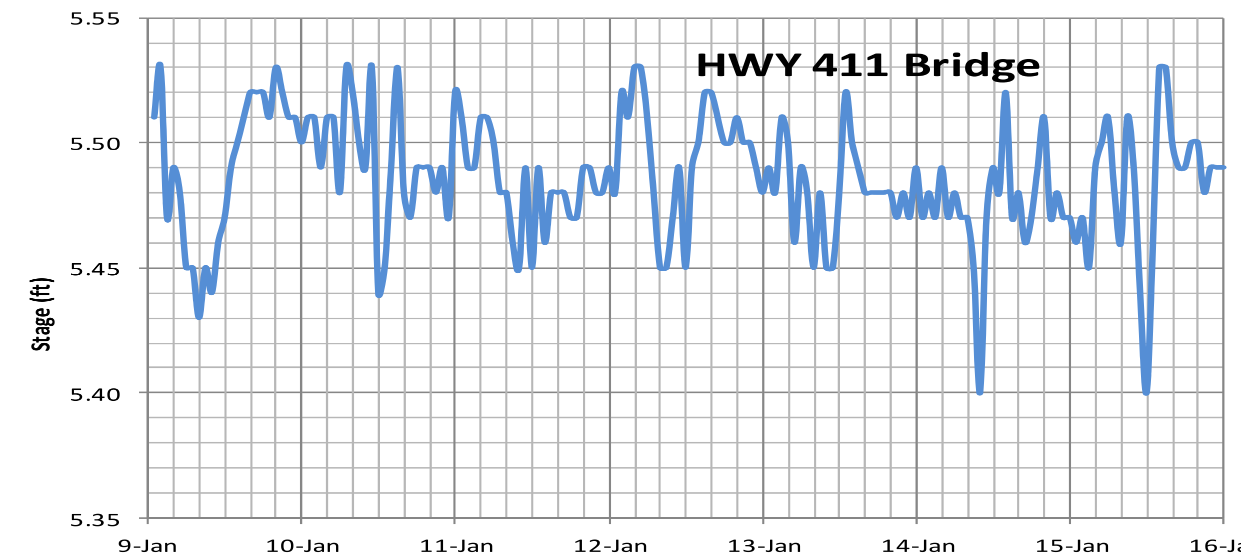
WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

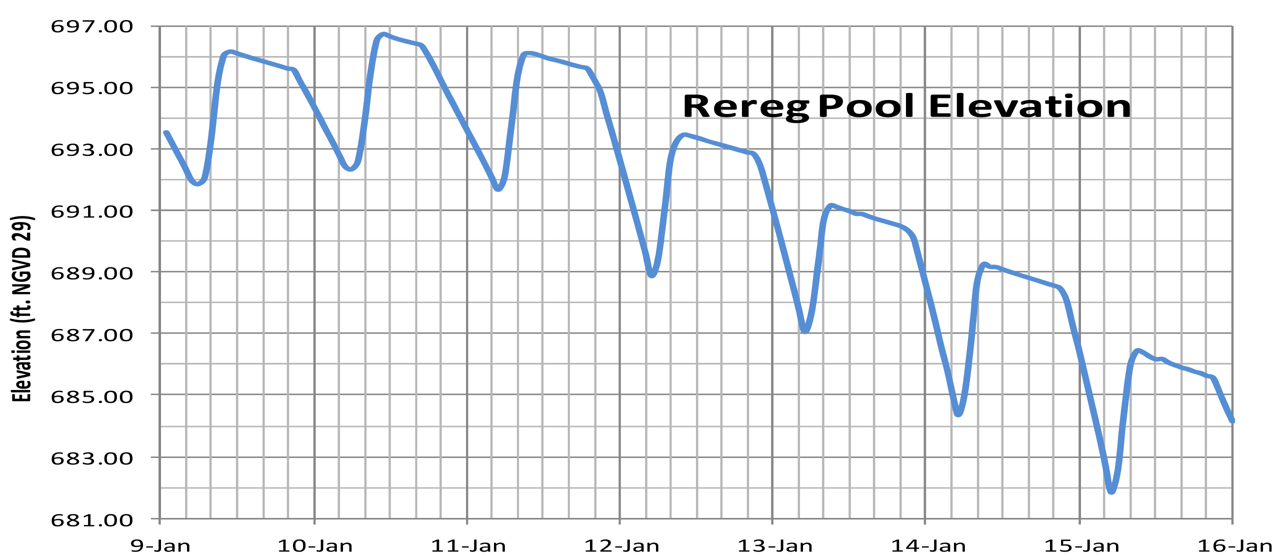
TYPICAL WEEKLY OPERATION FOR ELEVATIONS NEAR 1074 FT NGVD









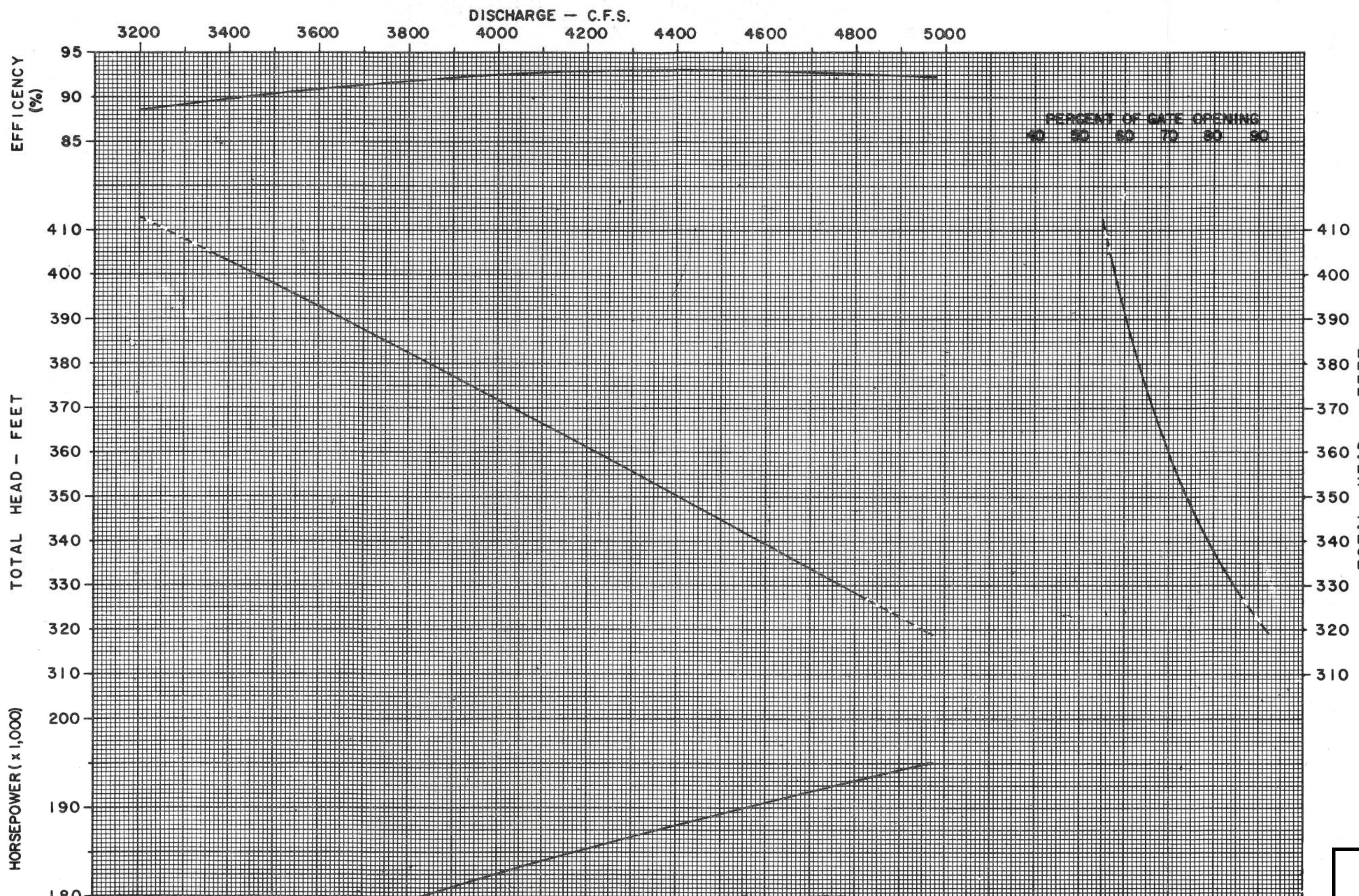


*The data shown here is from January 9 -15, 2010, and represents typical weekly operation when the main pool is near the winter pool elevation of 1072 NGVD.

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

TYPICAL WEEKLY OPERATION AT ELEVATIONS NEAR 1072 FEET NGVD



Notes:

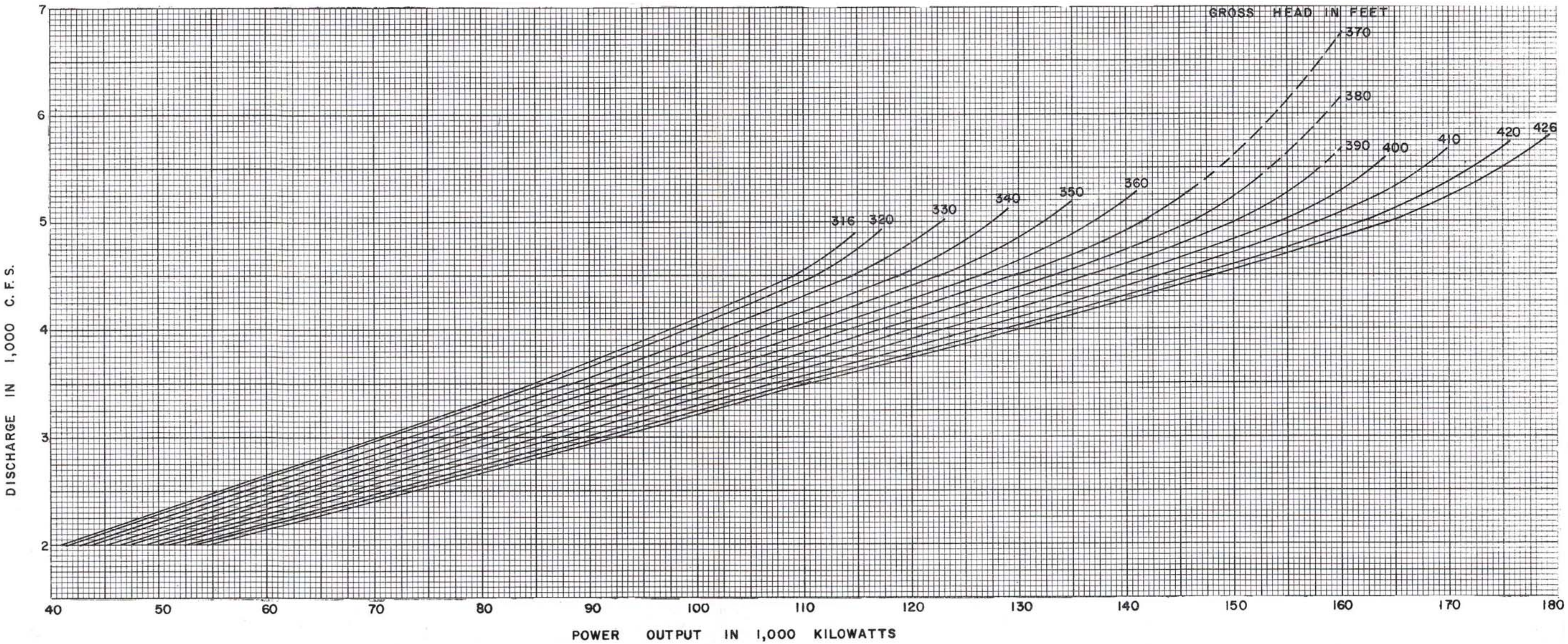
Data fom Allis-Chalmers Manfacturing Co., Hydraulics Products Div. Oct 1969

Pump Performance Rated For Pump/Turbine at 150RPM for Total Head Range 327-405 ft.

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

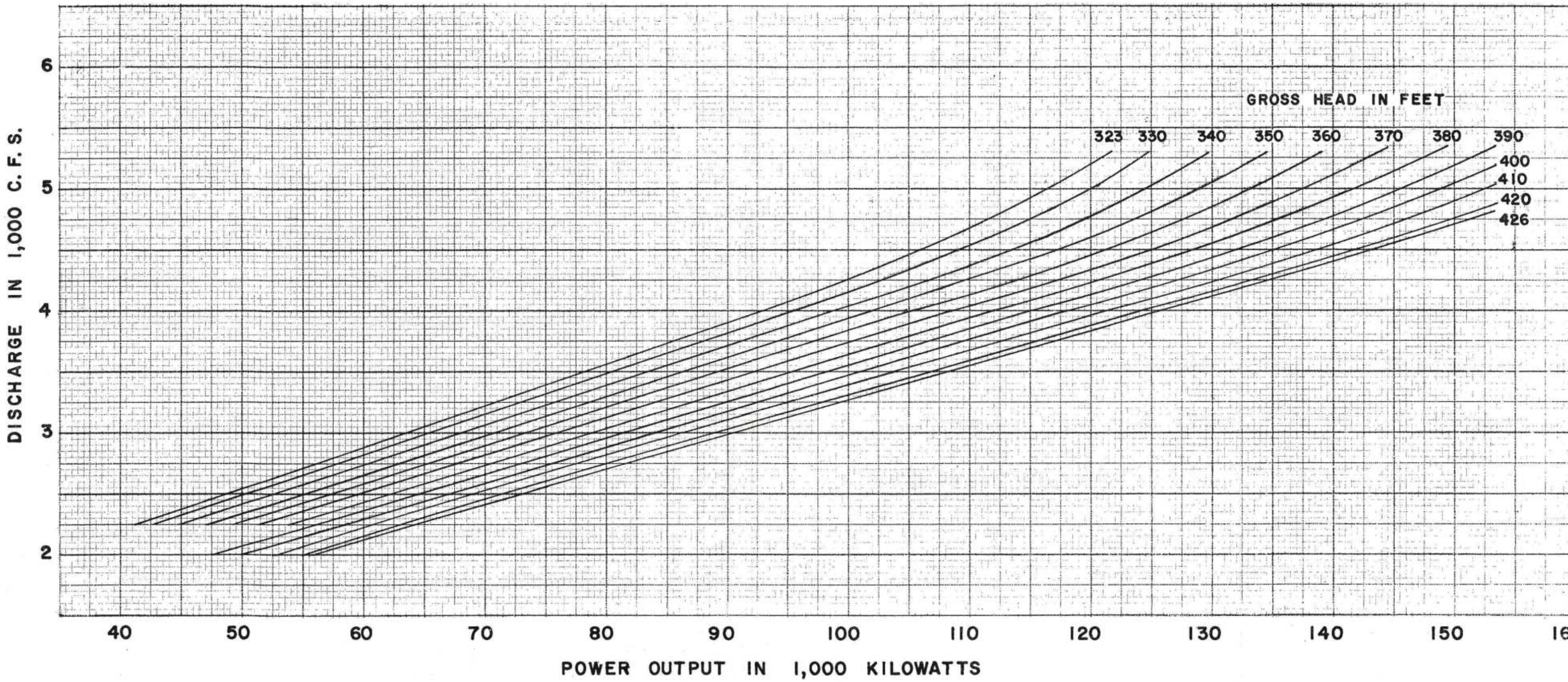
PERFORMANCE CURVES
PUMP BACK OPERATION



ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS
REREGULATION DAM

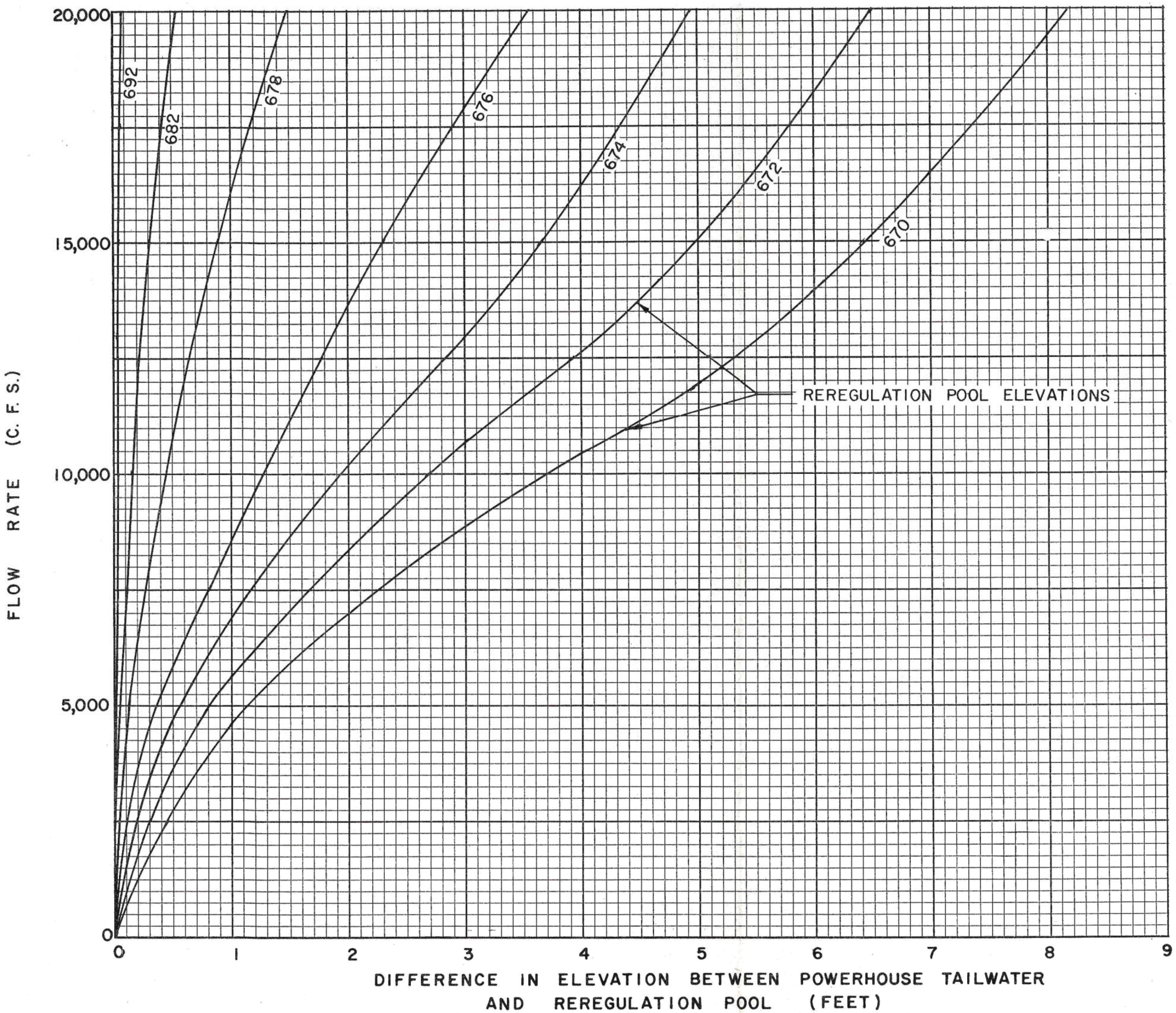
PERFORMANCE CURVES
CONVENTIONAL UNIT



ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

PERFORMANCE CURVES
PUMP-TURBINE UNIT



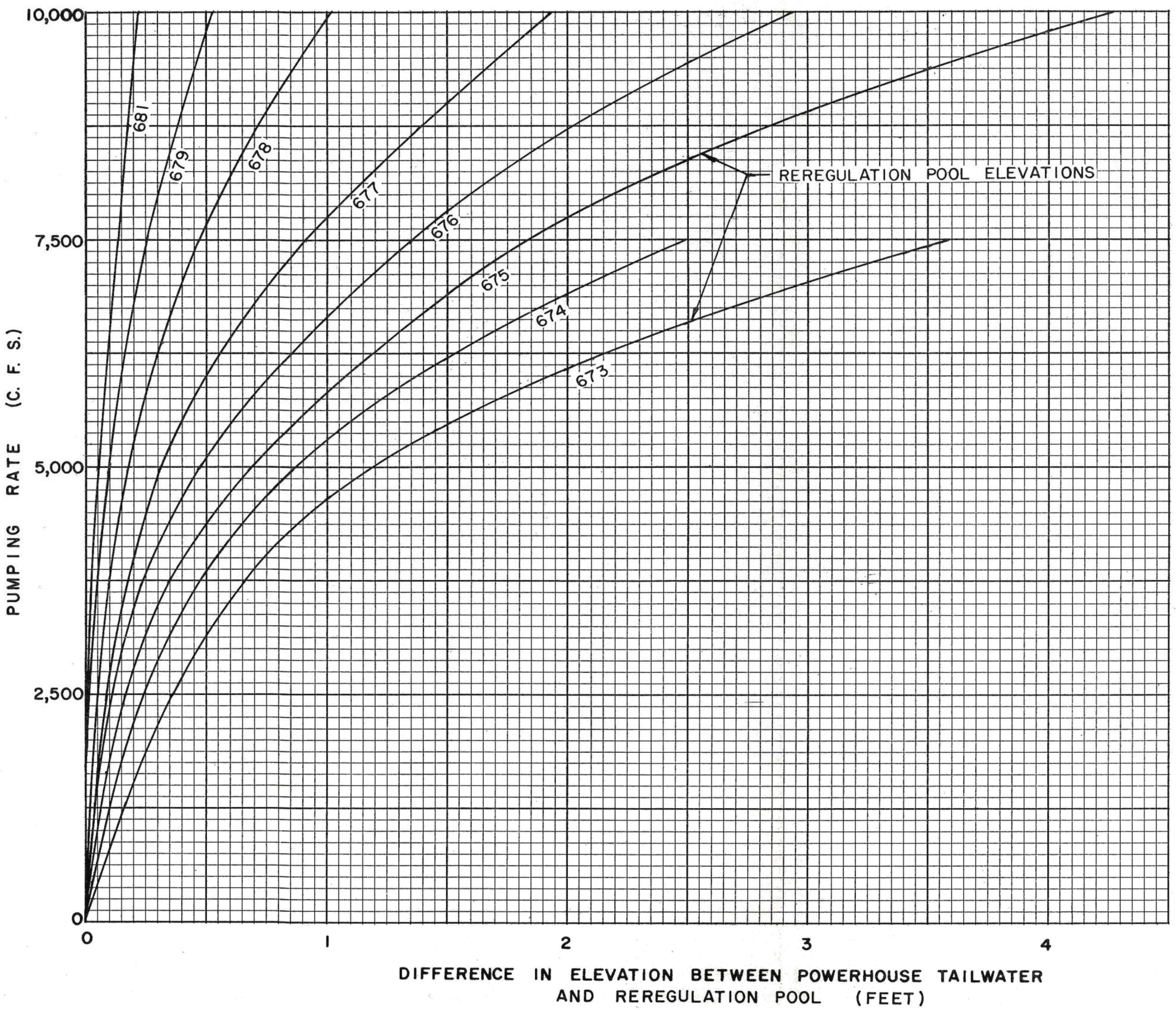
NOTE:

TO OBTAIN CARTERS MAIN DAM TAIL WATER ELEVATIONS, ADD THE VALUES ACQUIRED FROM THESE CURVES TO THE POOL ELEVATION AT THE REREGULATION DAM

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

MAIN DAM DISCHARGE RATE – TAILWATER RELATIONSHIP FOR VARIOUS REREGULATION POOLS



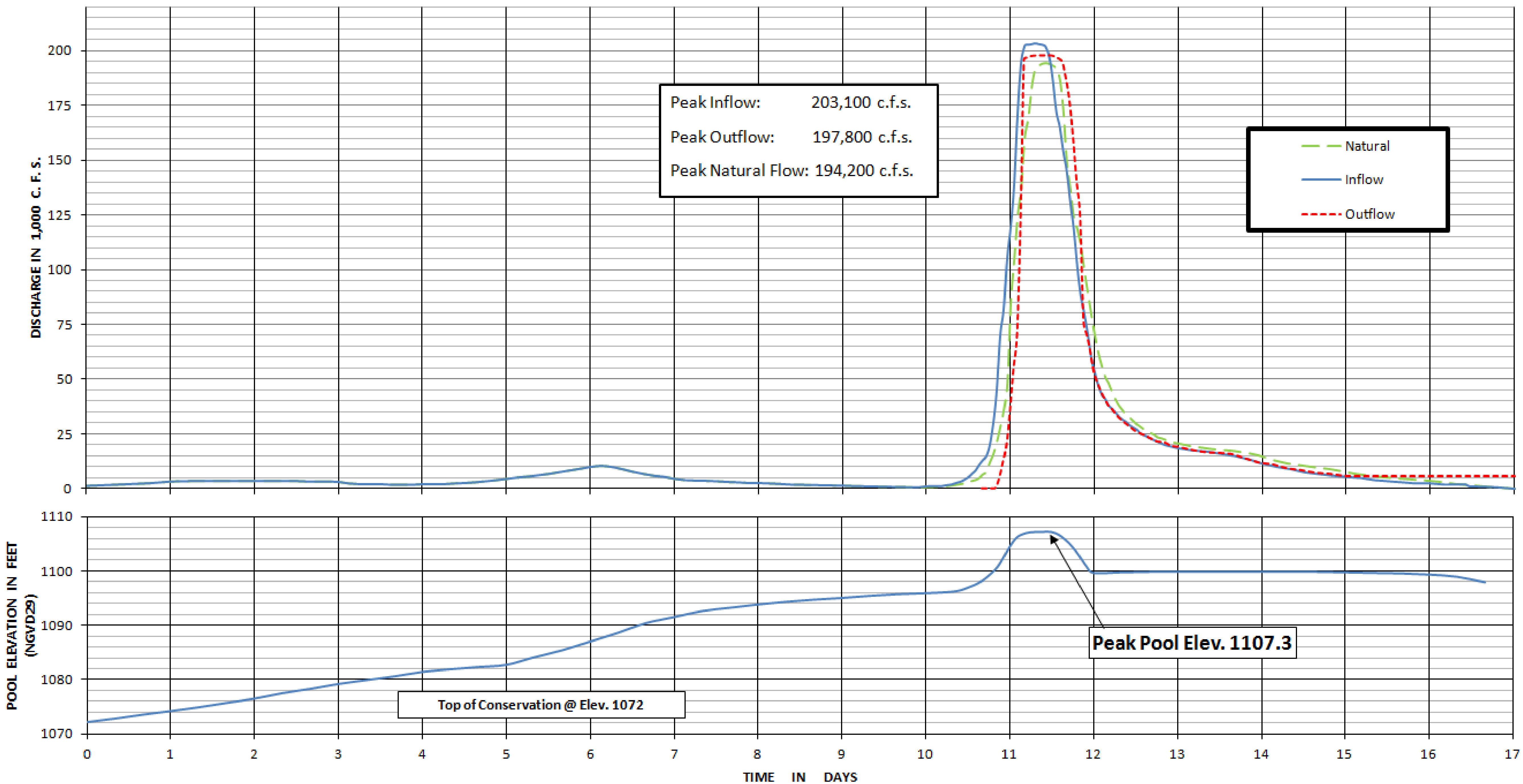
NOTE:

TO OBTAIN CARTERS MAIN DAM TAIL WATER ELEVATIONS, SUBTRACT THE VALUES ACQUIRED FROM THESE CURVES FROM THE POOL ELEVATION AT THE REREGULATION DAM

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

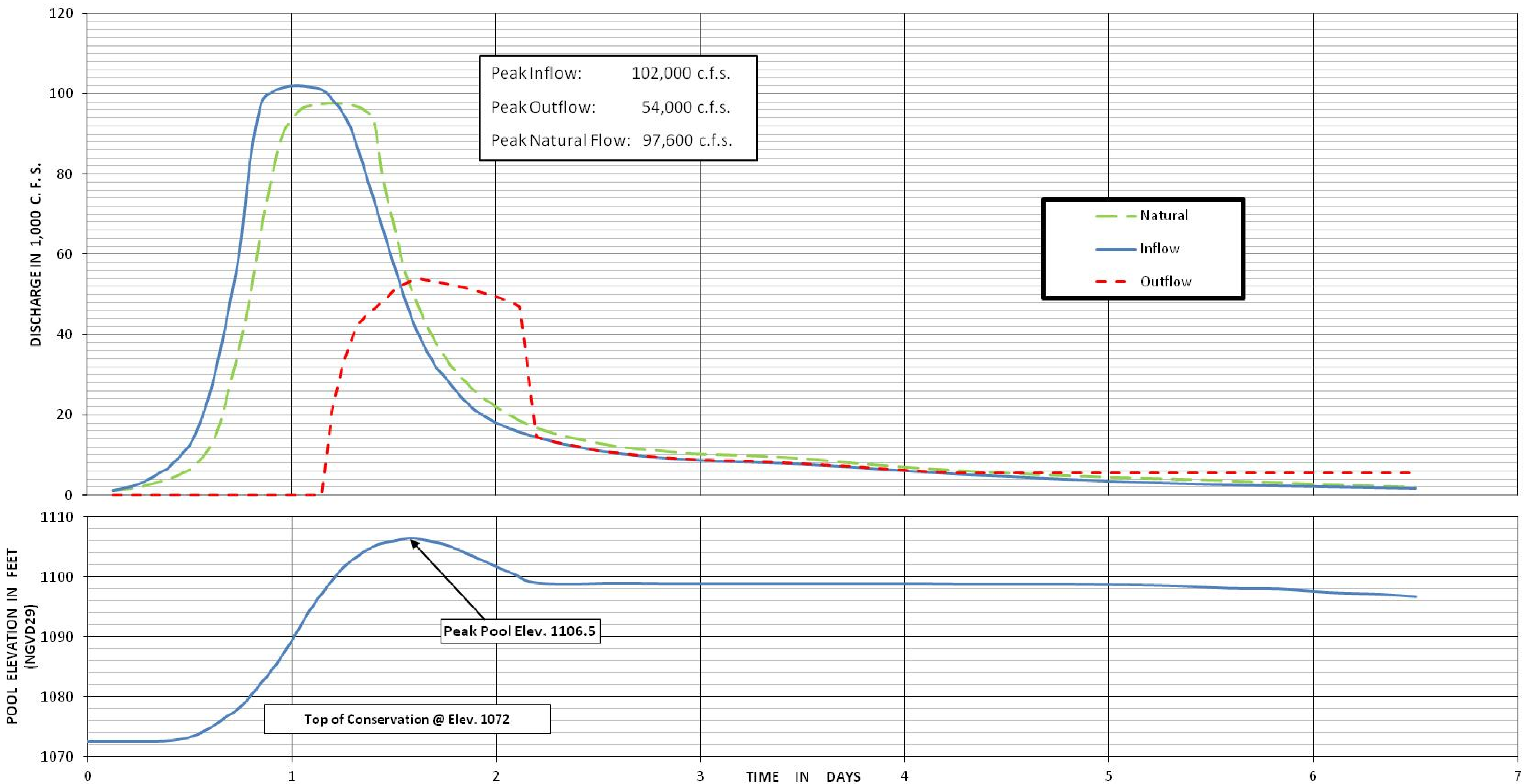
PUMPING RATE – TAILWATER RELATIONSHIP FOR VARIOUS REREGULATION POOLS



ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

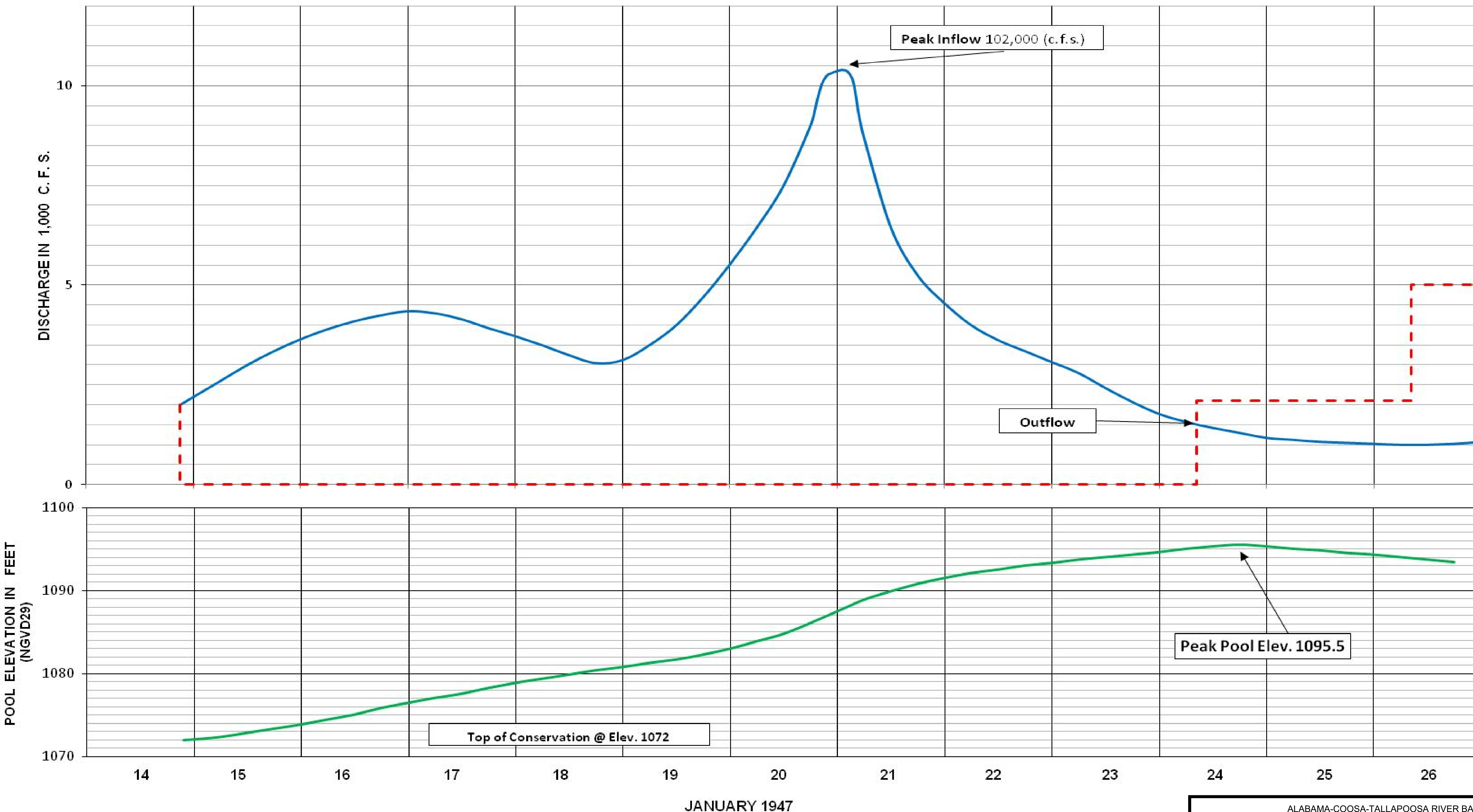
INFLOW-OUTFLOW-POOL RELATIONSHIP FOR SPILLWAY DESIGN FLOOD



ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS
REREGULATION DAM

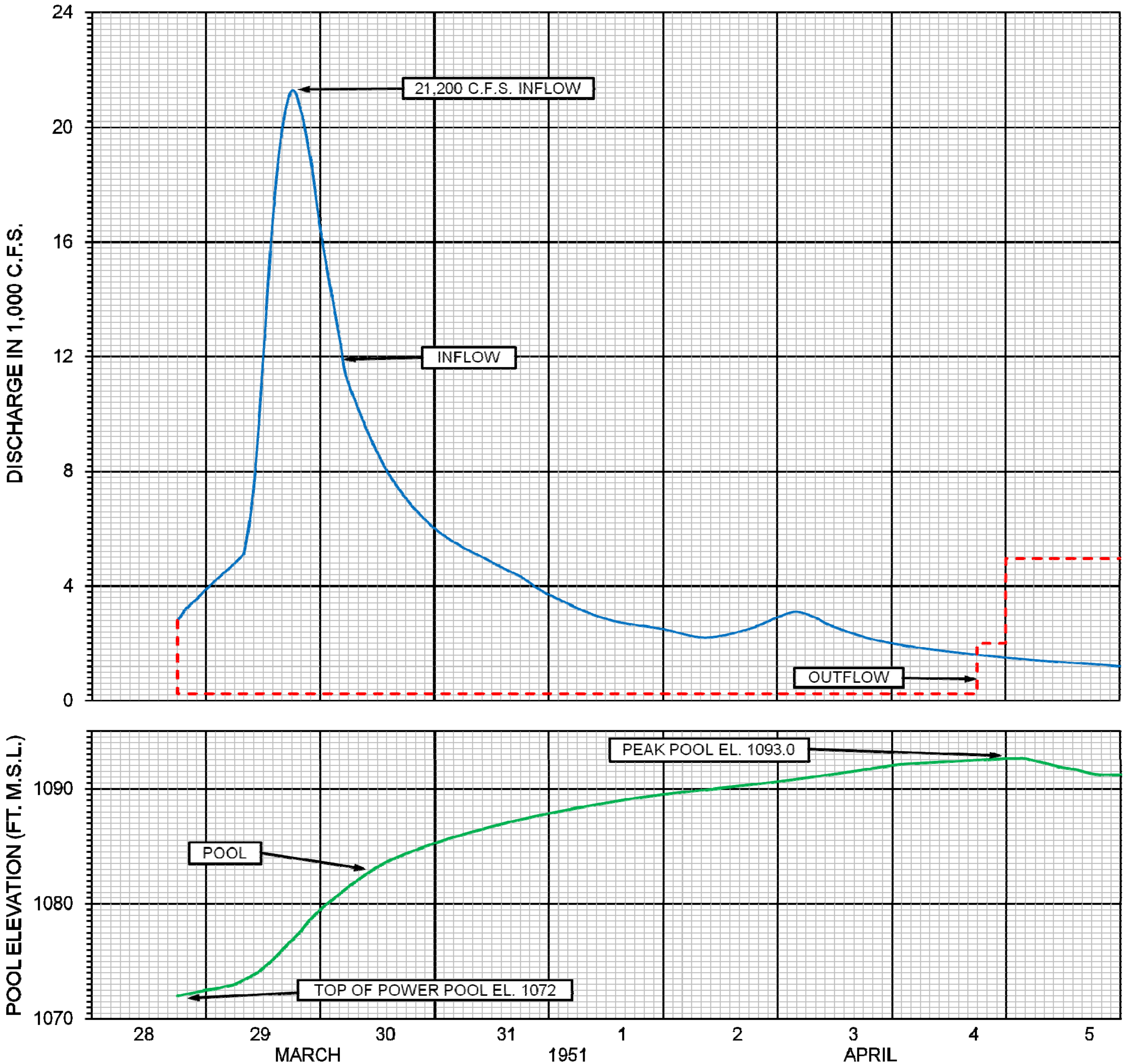
INFLOW-OUTFLOW-POOL RELATIONSHIP FOR STANDARD PROJECT FLOOD



ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

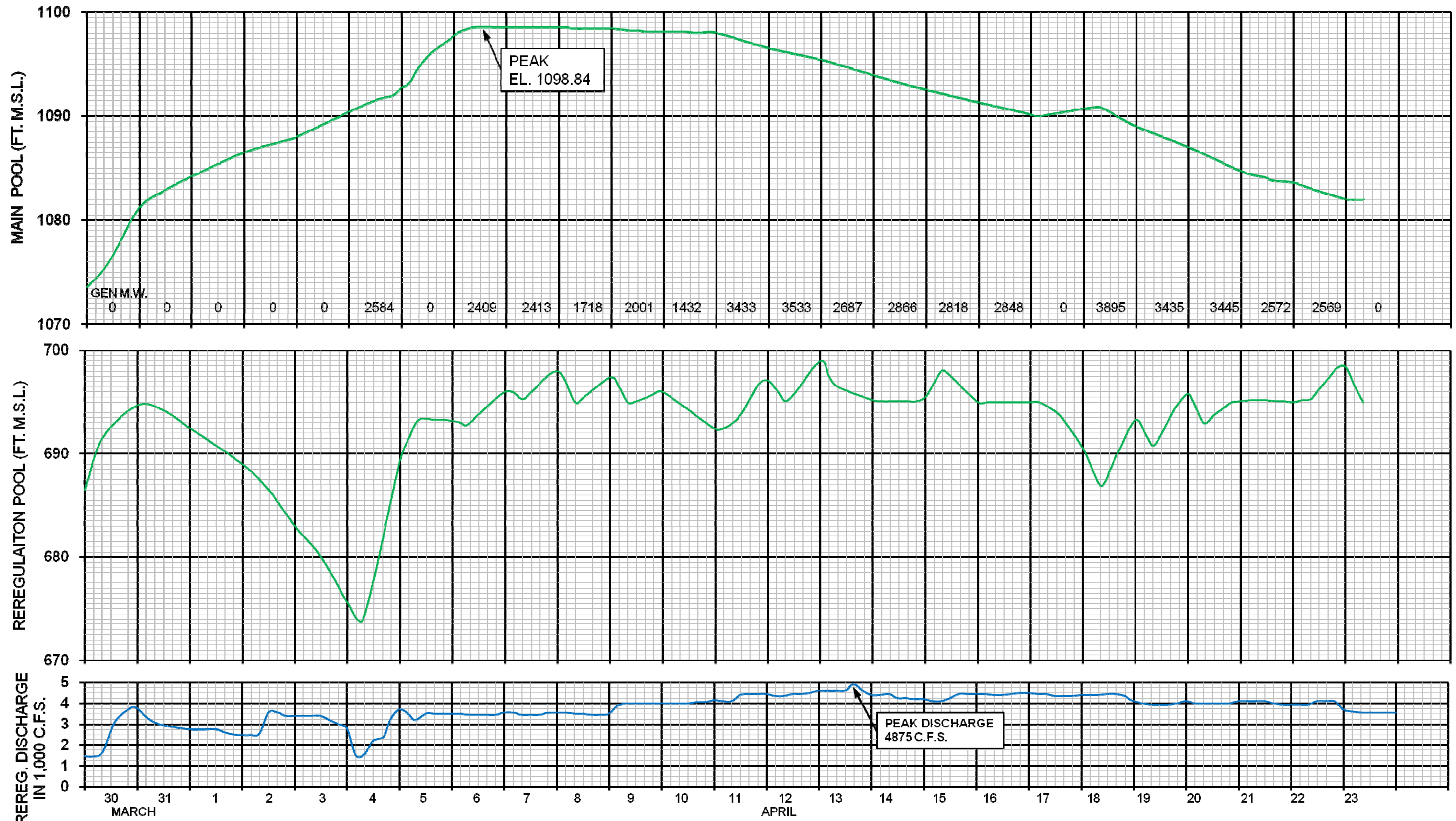
INFLOW-OUTFLOW-POOL RELATIONSHIP FOR FLOOD OF JANUARY 1947



ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

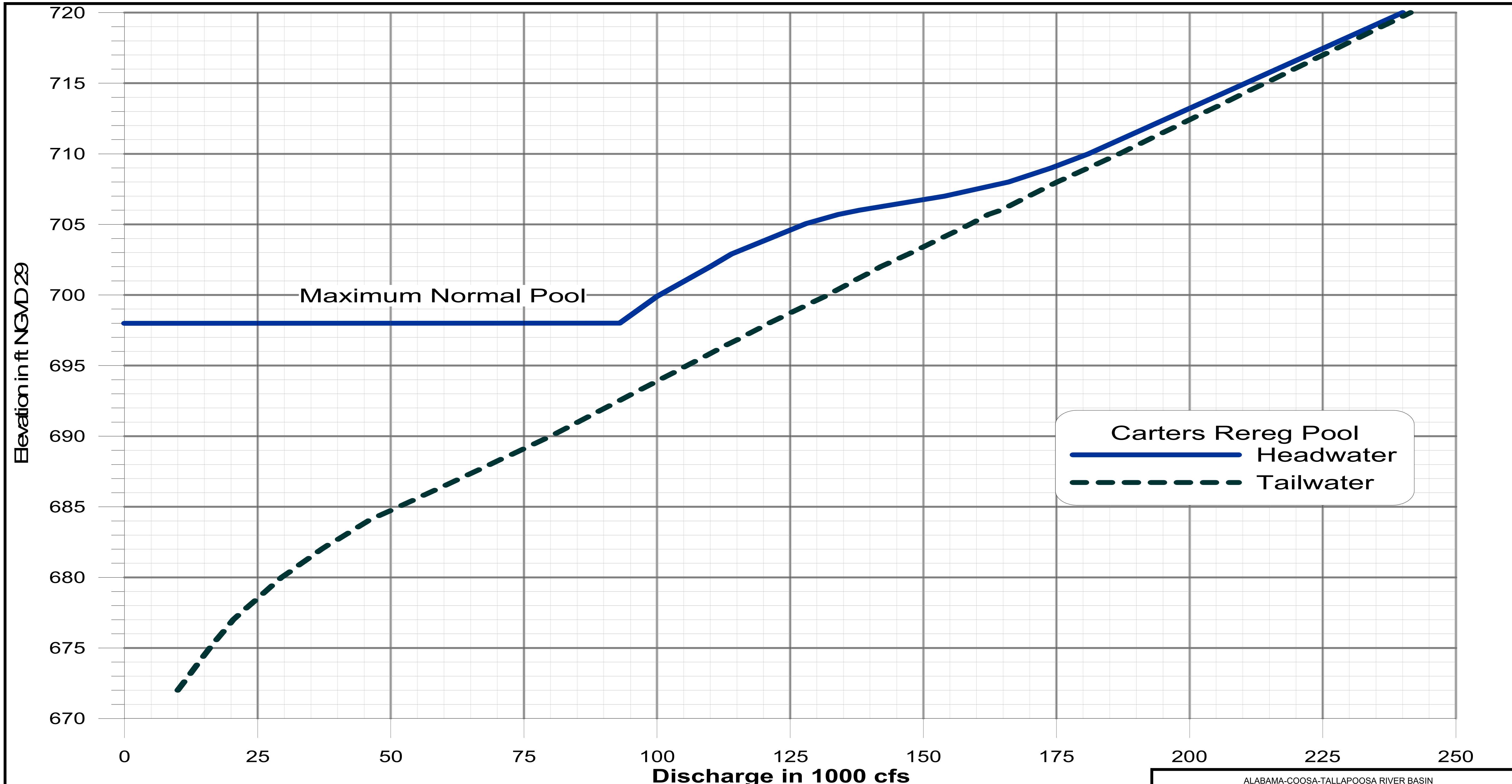
INFLOW-OUTFLOW-POOL RELATIONSHIPS FOR FLOOD OF MARCH 1951



ALABAMA-COOSA-TALLAPOOSA BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS
REREGULATION DAM

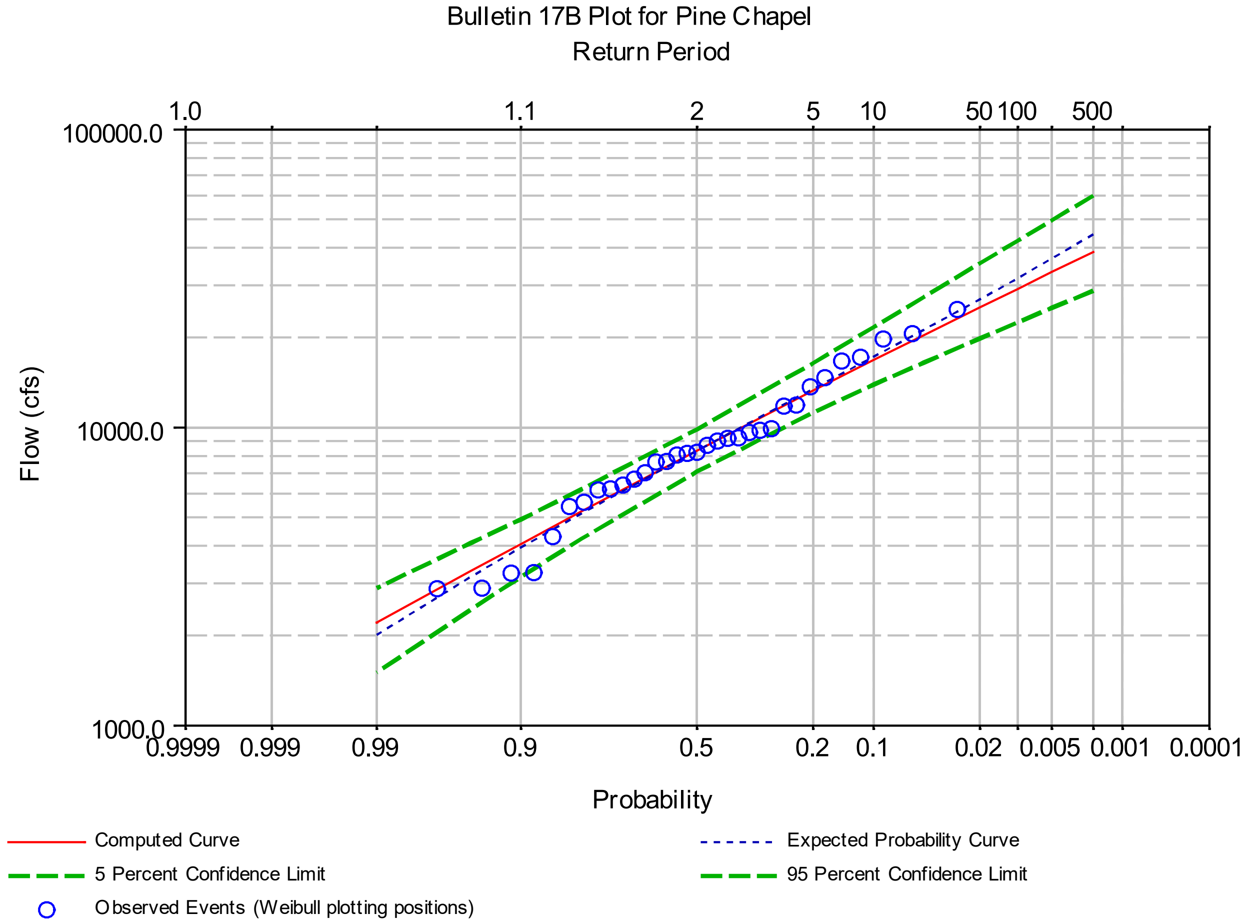
POOL ELEVATIONS GENERATION, AND REREGULATION DISCHARGE FOR FLOOD OF APRIL 1977



ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS
REREGULATION DAM

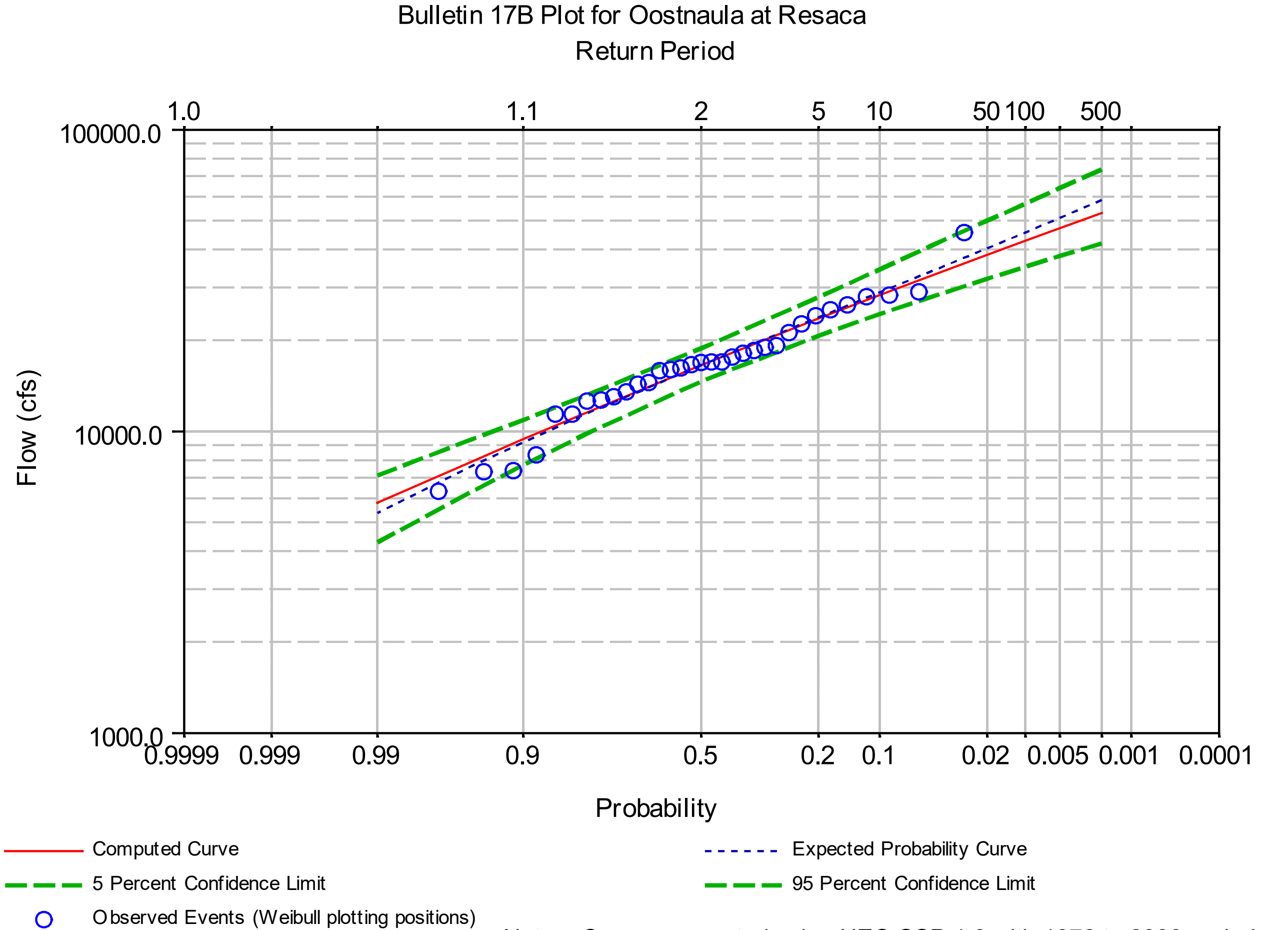
REREGULATION DAM HEADWATER AND TAILWATER RATING CURVES



Note : Curves computed using HEC-SSP 1.0 with 1976 to 2008 period and weighted skeW
Regional skew of 0.0 and Reg. Skew MSE of 0.302

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN
WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

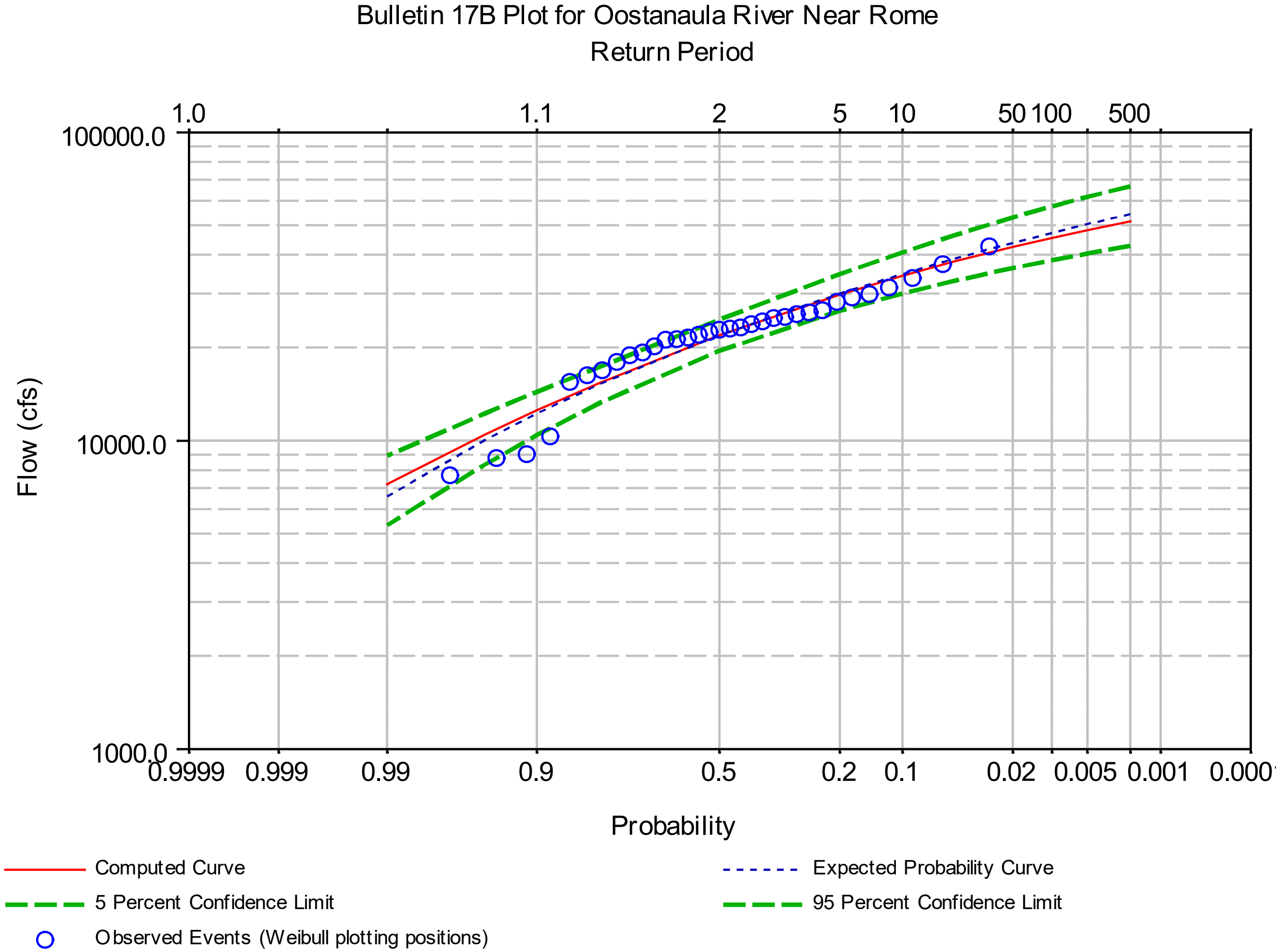
PEAK FLOW FREQUENCY
AT USGS GAGE 02383500 COOSAWATTEE RIVER NEAR PINE CHAPEL



Note : Curves computed using HEC-SSP 1.0 with 1976 to 2008 period and weighted skew. Regional skew of 0.0 and Reg. Skew MSE of .302

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN
WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

PEAK FLOW FREQUENCY
AT USGS GAGE 02387500 OOSTANAULA RIVER AT RESACA



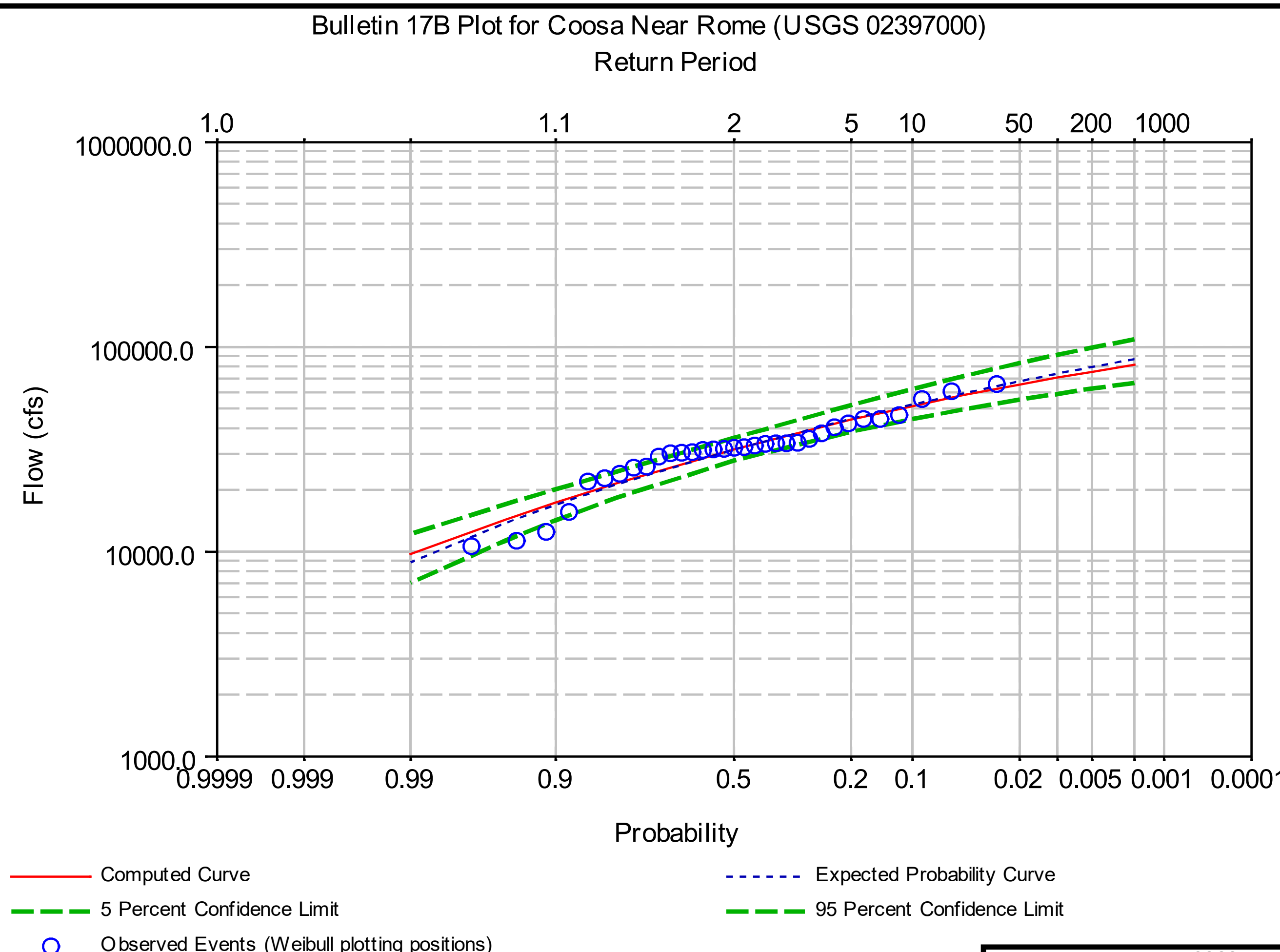
Note : Curves computed using HEC-SSP 1.0 with 1976 to 2008 period and weighted skew.
Regional skew of 0.0 and Reg. Skew MSE of 0.302

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN
WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

PEAK FLOW FREQUENCY
AT USGS GAGE 02388500 OOSTANAULA RIVER NEAR ROME

CORPS OF ENGINEERS

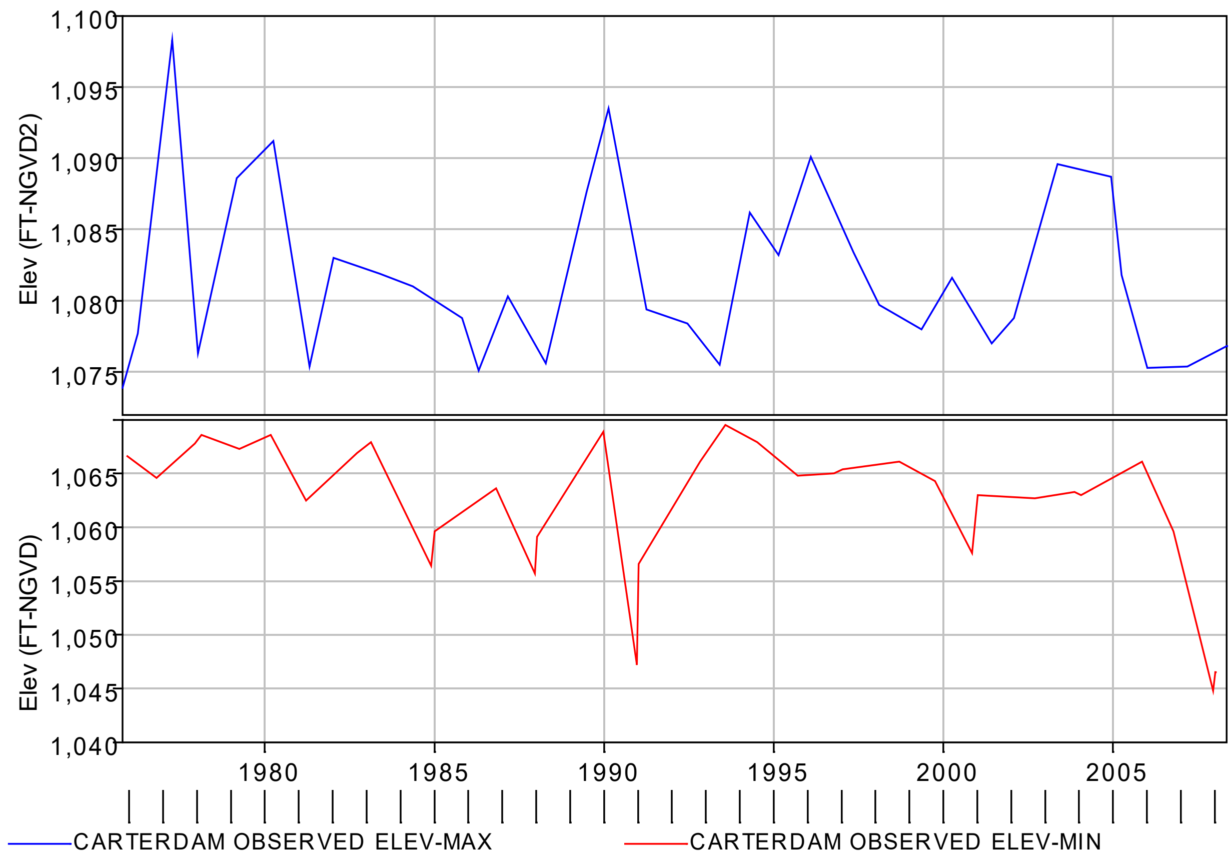
U. S. ARMY



Note : Curves computed using HEC-SSP 1.0 with 1976 to 2008 period and weighted skew.
Regional skew of 0.0 and Reg. Skew MSE of 0.302

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN
WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

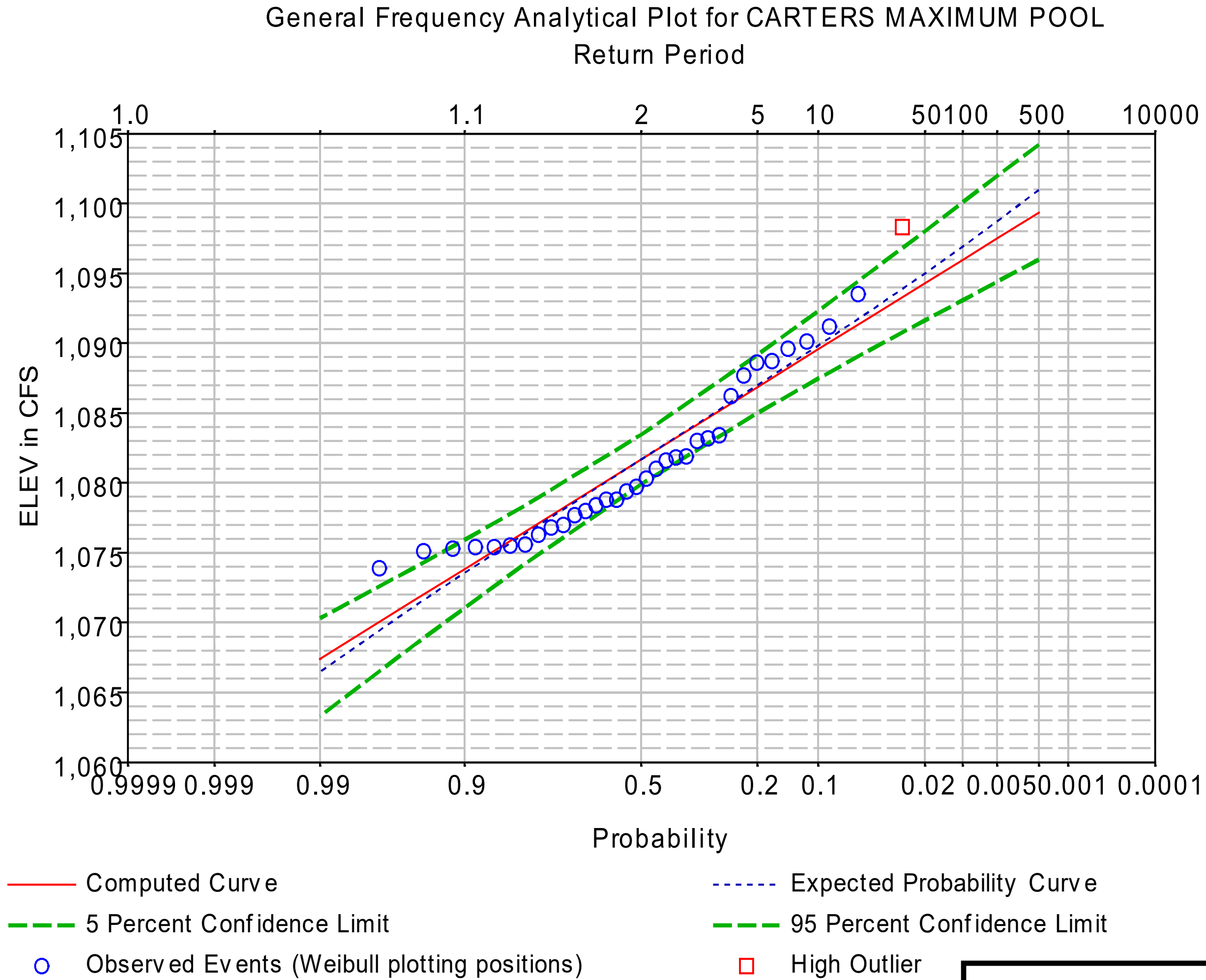
PEAK FLOW FREQUENCY
AT USGS GAGE 02397000 COOSA RIVER NEAR ROME RIVER NEAR ROME



ALABAMA-COOSA-TALLAPOOSA RIVER BASIN

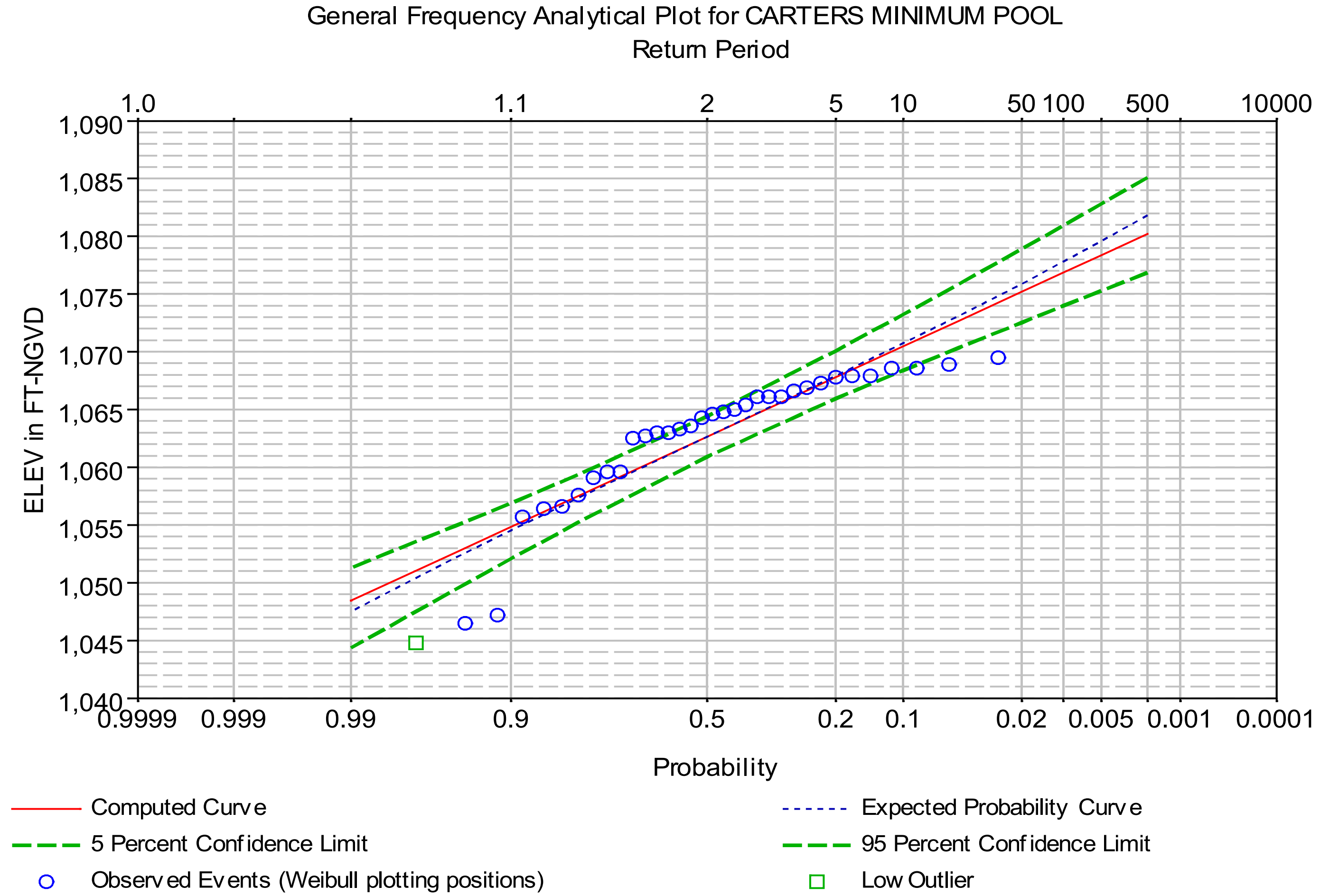
WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

MAIN DAM ANNUAL PEAK POOL ELEVATIONS



ALABAMA-COOSA-TALLAPOOSA RIVER BASIN
WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

MAIN DAM MAXIMUM POOL ELEVATION FREQUENCY



ALABAMA-COOSA-TALLAPOOSA RIVER BASIN
WATER CONTROL MANUAL
CARTERS DAM AND LAKE AND CARTERS REREGULATION DAM

ANNUAL MINIMUM POOL ELEVATION FREQUENCY