US Army Corps
of Engineers ®
Mobile District

ALABAMA-COOSA-TALLAPOOSA RIVER BASIN WATER CONTROL MANUAL

Final Draft
APPENDIX A

ALLATOONA DAM AND LAKE
ETOWAH RIVER, GEORGIA

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

MARCH 1952
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REVISED XXX 2013

Allatoona Dam and Lake

NOTICE TO USERS OF THIS MANUAL

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

REGULATION ASSISTANCE PROCEDURES

If unusual conditions arise, contact can be made with the Water Management Section, Mobile District Office by phoning (251) 690-2737 during regular duty hours and (251) 490-9535 during non-duty hours. The Allatoona Powerhouse personnel can be reached at (678) 721-6700 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.

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 U.S. Army Corps of Engineers' policy that the designed, constructed, and maintained elevation grades of projects be reliably and accurately referenced to a consistent nationwide framework, or vertical datum - i.e., the National Spatial Reference System (NSRS) or the National Water Level Observation Network (NWLON) maintained by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration. The current orthometric vertical reference datum within the NSRS in the continental United States is the North American Vertical Datum of 1988 (NAVD88). The current NWLON National Tidal Datum Epoch is 1983 - 2001. The relationships among existing, constructed, or maintained project grades that are referenced to local or superseded datums (e.g., NGVD29, MSL), the current NSRS, and/or hydraulic/tidal datums, have been established per the requirements of Engineering Regulation 1110-2-8160 and in accordance with the standards and procedures as outlined in Engineering Manual 1110-2-6056. A Primary Project Control Point has been established at this project and linked to the NSRS. Information on the Primary Project Control Point, designated BM1, and the relationship between current and legacy datums are in Exhibit B.

ALLATOONA DAM AND LAKE

WATER CONTROL MANUAL
ETOWAH RIVER, GEORGIA
U.S. Army Corps of Engineers, Mobile District, South Atlantic Division

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PERTINENT DATA

GENERAL

Location – Bartow County, Georgia, Etowah River, river mile 47.86	
Drainage area above damsite – square miles	1,122
Drainage area between damsite and Rome, GA – square miles	750

RESERVOIR

Length – river miles	28.0
Full pool elevation – feet NGVD29	840.0
Peak pool for standard project flood – feet NGVD29	864.7
Peak pool for spillway design flood – feet NGVD29	872.1
Area at static full pool (elev. 840) – acres	11,862
Total volume at static full pool – acre feet	367,471
Total volume (between elev. 823-840) – acre feet	164,702
Total volume at elev. 823 – acre feet	202,769
Total Inactive volume (below elev. 800) – acre feet	82,891
Shore line length at static full pool – miles	270

TAILWATER ELEVATIONS

Normal, (minimum outflow 240 cfs) – feet NGVD29	690.0
Normal, one turbine operating (outflow 3,250 cfs) – feet NGVD29	692.6
Normal, full powerhouse flow (outflow 6,500 cfs) – feet NGVD29	694.7
Bankfull (9,500 cfs)	696.5

DAM/EARTH DIKES

Total length – feet	1,250
Top elevation, dam – feet NGVD29	880.0
Top elevation, earth dike – feet NGVD29	875.0

SPILLWAY SECTION

Total length – feet (net length 400 ft)	500
Number of piers, including end piers	12
Elevation of crest – feet NGVD29	835.0
Type of gates	Tainter
Size of gates – feet	9@40 x 26 2 @ 20 x 26
Elevation top of gates – feet NGVD29	860.0
Number of gates	11

POWER PLANT AND DATA

Number of units	3
Generator rating, two units @ 40,000 each; 1 small unit @ 2,200 – kW (declared values)	82,200
Plant output at rated net head	
Installed capacity at rated power factor – kW	86,800
Installed capacity at unity power factor – kW	96,400

I - INTRODUCTION

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

Other manuals related to the Allatoona Project water control regulation activities include the *Operation and Maintenance* manual for the project, and the ACT Master Manual for the entire basin.

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

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 Allatoona Project is a federally owned project entrusted to the Corps, South Atlantic Division (SAD), Mobile District.

1-05. Operating Agency. Operation and maintenance of the Allatoona Project is the responsibility of the Mobile District Operations Division. Supervision and direction for this effort is provided by the project's Operations Project Manager.

1-06. Regulating Agencies. Authority for the water control regulation of the Allatoona 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 Allatoona 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.

II - DESCRIPTION OF PROJECT

2-01. Location. Allatoona Dam and Lake is located in Georgia on the Etowah River in Bartow, Cobb and Cherokee Counties, about 32 miles northwest of Atlanta and 26 miles northeast of Rome, Georgia. An aerial view of the Allatoona Project is shown in Figure 2-1. The location of the project, 47.86 river miles above the mouth of the Etowah River, is indicated on Plate 2-1. Detailed hydrology of the area is shown in Plate 2-2. The 1,122 square miles drainage area lies on the southern slopes of the Blue Ridge Mountains and consists of steep sloping mountain terrain.

Figure 2-1. Allatoona Dam and Lake

2-02. Purpose. Allatoona Dam and Lake is a multiple purpose project, originally authorized for hydropower, flood risk management and navigation. The original congressional authorization has been modified and expanded by later legislation to include the additional project purposes of public recreation, water quality, fish and wildlife conservation, conservation of federally listed threatened and endangered species and their critical habitat, and water supply.

2-03. Physical Components. The project consists of a lake extending 28 miles up the Etowah River at full summer conservation pool of 840 feet NGVD29, a concrete gravity-type dam with gated spillway, earth dikes, an 82,200 kilowatt (kW) (declared value) power plant and appurtenances. 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. The dam under construction is shown in Figure 2-2 and the completed structure in Figure 2-3.

a. Dam. The dam is a concrete gravity-type structure with curved axis convex upstream, having a top elevation of 880 feet NGVD29 and an overall length of approximately 1,250 feet. The maximum height above the existing river bed is 190 feet. An 18-foot wide roadway is provided across the entire length of the dam. Sections and plans of the dam and appurtenant works are shown on Plate 2-3. The dam is located east of Interstate 75 approximately 30 miles northwest of downtown Atlanta, Georgia.

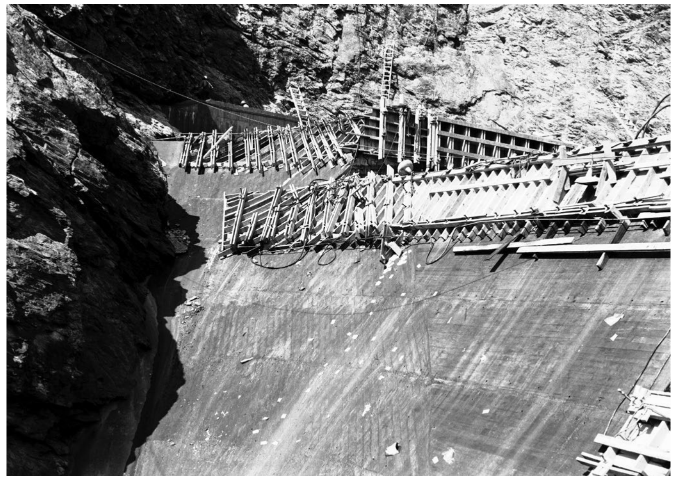

Figure 2-2. Dam under construction

Figure 2-3. Completed project

b. Earth Dikes. The left bank (south) basin divide at the dam site between Allatoona and Pumpkinvine Creeks has three low saddle dikes. In order to prevent overflow into the Pumpkinvine Creek drainage basin, it was necessary to construct earth dikes at these locations. These dikes are designated on Plate 2-4 as plug dam (3.25 miles south of dam), saddle dike No. 1 (one mile east-southeast of plug dam), and saddle dike No. 2 (1.5 miles southwest of No. 1). Built along the abandoned line of the Western and Atlantic Railroad near the divide, the dikes have been constructed to elevation 875 feet with a top width of 12 feet and side slopes of

1:3 on the water side and 1:2.5 on the land side. The side facing the reservoir is completely covered with two feet of riprap on a one-foot gravel blanket. The total length of the two dikes is about 4,200 feet. The plug dam is built similarly.

c. Reservoir. The drainage area into the Allatoona Project is 1,122 square miles. The reservoir has a total storage capacity of 670,047 acre-feet at full flood-control pool (elevation 860 feet NGVD29). At elevation 860, the reservoir covers a surface area of 19,201 acres (30.0 square miles) or 2.7 percent of the dam site drainage area.

At full summer-level conservation pool (elevation 840 feet NGVD29), the reservoir covers 11,862 acres and has a total storage capacity of 367,471 acre-feet. At minimum conservation pool (elevation 800 feet NGVD29), the reservoir covers 3,251 acres and has a total storage capacity of 82,891 acre-feet. Area-capacity curves and tables are shown on Plate 2-5.

Allatoona Creek, a major arm of the lake, extends southward into Cobb County near Acworth, Georgia, is used as a source of water by the Cobb County-Marietta Water Authority for its Wyckoff Water Treatment Plant. Water is returned to Allatoona Lake at the sewage treatment plants located on Noonday Creek and on Little River, which are near the Cobb - Cherokee County line. The Howell-Bunger sluice, located in Allatoona dam, is presently used by the city of Cartersville, Georgia, for its water intake.

d. Spillway. The spillway section of the dam, with a crest elevation of 835 feet NGVD29, has a total flow length of 500 feet, a net length of 400 feet, and a discharge capacity of 184,000 cubic feet per second (cfs) at elevation 860 feet, full flood-control pool. It is equipped with 11 tainter gates, nine of which are 40 feet wide by 26 feet high and two gates are 20 feet wide by 26 feet high. In closed position, the top of the gates are at elevation 860 feet NGVD29 and the bottom of the gates are at elevation 834 feet NGVD29, one foot below the crest. Protection against erosion below the spillway is provided by a concrete apron which will produce the depth required for a hydraulic jump at a discharge of about 65,000 cfs. The spillway rating curves are shown on Plates 2-7 and 2-8. Figure 2-4 shows the gate platforms under construction.

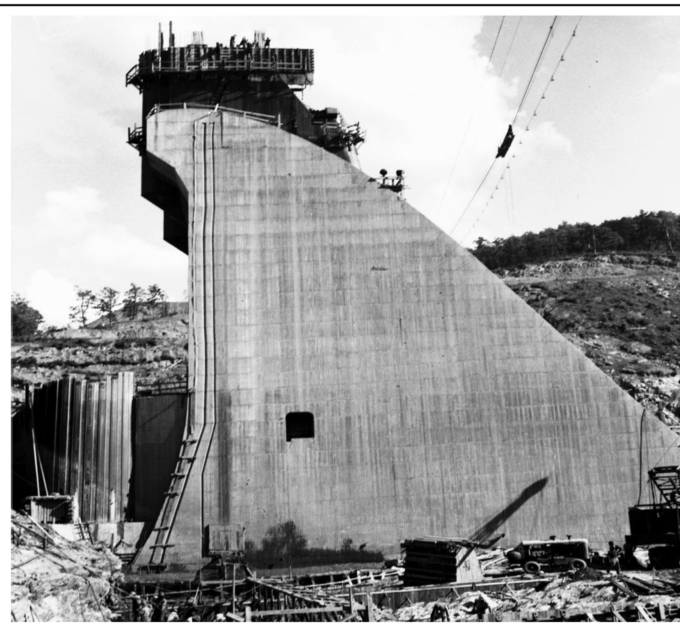

Figure 2-4. Gate platform under construction

e. Sluices. There are four sluices, 5.67 feet wide by 10 feet high, and one sluice, the 48-inch diameter Howell-Bunger valve. The sluices were designed to be used to release water when the lake level is below the spillway crest elevation of 835 feet NGVD29. However, the Howell-Bunger valve was replaced with the raw-water intake for the City of Cartersville in early 1969. The capacity of each sluice with a one foot gate opening is 4,500 cfs (total 16,200 cfs) at elevation 840 feet NGVD29, as shown on Plate 2-9.

Figure 2-5. City of Cartersville Raw-water Intake

f. Powerhouse and Penstocks. The powerhouse and penstock intakes are located on the left (south) bank of the river and consists of two 40,000 kW main units and one 2,200 kW small unit, for a total power installation of 82,200 kW (declared value). The penstocks are steel-lined and are controlled by a hoist operated tractor-type head gates. The penstock to the small unit has a diameter of 5.5 feet and the penstocks to the main units are 20 feet in diameter at the intake and reduce to 18 feet at an elbow under the switchyard. Space has been allotted for a future unit of 36,000 kW capacity. However, the channel capacity would have to be increased to allow the operation of a third large unit. Discharge rating curves

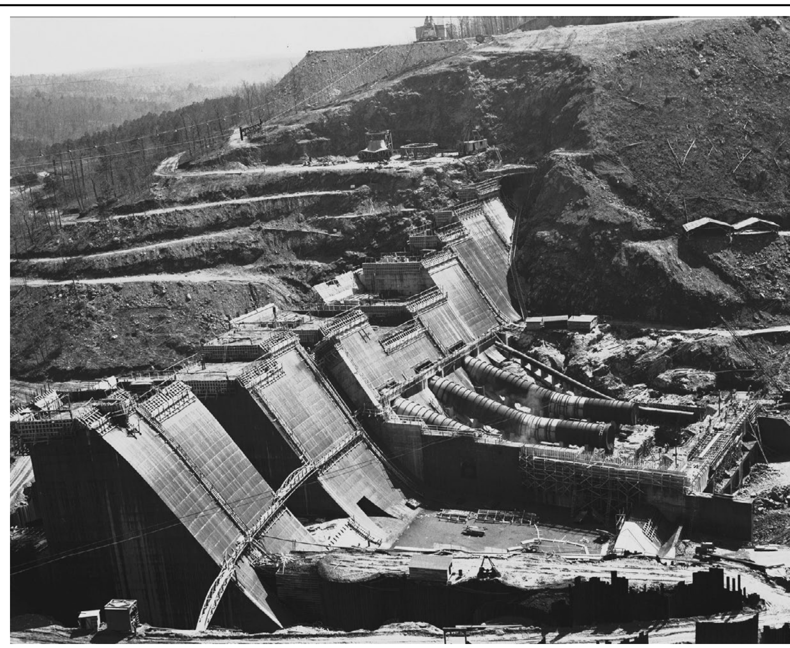

Figure 2-6. Dam and penstocks under construction

for the main units are shown on Plate 2-10 and for the small unit on Plate 2-11. Plates 2-12 and 2-13 show the historical hydropower production for the power plant. The location of the penstocks is shown in Figure 2-6.

g. Switchyard and Transformer Substation. The switchyard and transformer substation are located in the area between the dam and powerhouse. The main transformer gallery with deck at elevation 744 feet NGVD29 is immediately adjacent to the switchyard deck. The switchyard deck is at elevation 744 feet NGVD29 and adjoins the downstream face of the dam. There are two 50,000kVA, 13.8/115kV three phase transformers. Full provision has been made for the installation of an additional transformer. A ring bus has been installed complete with switching equipment, protective devices, relays, and accessories which could ultimately extend to include the additional transformer and a second line. At present, the busses extend over only two transformer bays and one line bay.

h. Acworth Sub-impoundment. The Acworth development is situated on the Proctor Creek arm of Allatoona Lake, as shown on Plate 2-6, and enhances the Allatoona Project purposes for recreation and conservation of fish and wildlife. All structures associated with Acworth Dam are owned and maintained by the Corps. The sub-impoundment dam, shown in Figure 2-7, provides a generally unfluctuating level for the 325 acre lake and provides a road across Allatoona Lake, connecting the city of Acworth, Georgia, with U.S. Highway 41. The earth filled dam is 1,500 feet long with a 60-foot concrete spillway flanked on each side by concrete non-overflow sections 61 feet long. The maximum height of the earth fill is 45 feet and the slopes are covered with one foot of riprap on a six-inch gravel filter blanket. The ungated spillway, shown in Figure 2-8, has its crest at elevation 848 feet NGVD29 and is bridged in a single span by the road crossing the dam. Stilling action at the toe is accomplished by means of a bucket which deflects the water upward. Two 24-inch sluices, one at each end of the spillway, are provided to allow fluctuation of the upper pool during low flow for mosquito control and to drain the reservoir.

Figure 2-7 Acworth Sub-impoundment

Figure 2-8. Acworth Sub-impoundment, Ungated Spillway

2-04. Related Control Facilities. Operation of the Allatoona Powerhouse (as well as Buford) is remotely controlled from the Carters pumped storage facility in nearby Carters, Georgia. This is accomplished through a microwave network between Carters and Allatoona. The spillway gates at Allatoona can only be operated locally. The Allatoona Powerhouse can also be locally operated if conditions require.

2-05. Real Estate Acquisition. Beginning in the 1940's, the Federal Government acquired lands for Allatoona Lake and flowage easements for flood-prone areas. The criteria for establishing the basic taking line required all the land within the pool at the top of the flood risk management storage of elevation 860 feet NGVD29, plus three feet of freeboard. This elevation of 863 feet NGVD29 provides for wave run up on the dam and adds to the safety of preventing overtopping. The main dam, the plug dam, and the two saddle dikes along the divide with Pumkinvine Creek, were designed to incorporate this additional three feet in elevation. These land purchases are referred to as fee simple and have a building restriction of elevation 863 feet NGVD29 for any structures used for human habitation. The total fee acquisition for the project was 37,742 acres.

The Government leases 6,291 acres for park and campground uses and 11,663 acres to the State of Georgia as a wildlife area. Flowage easements are used in flooding areas where the government does not own the land but wants to prevent structures from being built in flood-prone areas. The Government pays the owner a fee (flow easements) which allows the owner to use the land without holding the government liable for flood damages. There are 208 acres of flowage easements consisting of small parcels in the Canton area, the recreational cottage areas, and downstream of the dam. Plate 2-6 shows project property lines and recreation sites.

2-06. Public Facilities. The Acworth sub-impoundment forms one of the developed areas for a variety of recreational activities. The Acworth sub impoundment, with a constant pool level, is leased to the Acworth Lake Authority and Cobb County Parks Department which operates the area as a public park. Other areas, designated for second, third, and fourth priority use, have been leased to organized nonprofit groups, semi-public organized groups and to private clubs.

Additional development has been provided by the Corps at 30 public access areas to meet demands for picnicking, camping, sight-seeing, boating, and fishing. Tracts on the north bank and on Little River have been licensed to the Georgia Department of Natural Resources (GADNR) for game management. The recreation development plan on Plate 2-6 shows the distribution of recreational areas around the reservoir.

III - HISTORY OF PROJECT

3-01. Authorization. The first official recognition that the present dam site on the Etowah River near Cartersville, Georgia, was a prime location for a hydropower project was in a document entitled, "Reports on Examination and Survey of Etowah, Coosa, Tallapoosa and Alabama Rivers", prepared in 1910 by the U. S. Army Corps of Engineers. The site was considered suitable for a dam of any height up to 200 feet. It is interesting to note that Allatoona Dam rises 190 feet above the river bed.

a. In the late 1920s, the Georgia Power Company expressed interest in the Allatoona site and conducted extensive surveys and studies. In 1934, the Corps, under the provisions of House Document No. 306, 69th Congress, 1st Session, developed a general plan for overall development of the Alabama-Coosa River System. That report, published in House Document No. 66, 74th Congress, 1st Session, included the Allatoona Project but the economic aspect of the project appeared unfavorable at that time.

b. Further studies were directed by Congress in resolutions adopted by the Committee on Rivers and Harbors, House of Representatives, on 1 April 1936 and 26 April 1936, and by the Committee on Commerce, United States Senate, on 18 January 1939. In response to those resolutions, an interim report on Allatoona Dam was submitted to Congress in 1940. That report, published in House Document No. 674, 76th Congress, 3rd Session, recommended the construction of Allatoona Dam and Reservoir as a dual purpose flood control and power project with an estimated total storage capacity of 630,000 acre-feet to be utilized as follows: flood control storage, 422,500 acre-feet between elevations 821 and 855 feet NGVD29; conservation storage, 182,500 acre-feet between elevations 771 and 821 feet NGVD29; and inactive storage of 25,000 acre-feet below elevation 771 feet NGVD29. The Allatoona Project was authorized by the Flood Control Act of 1941 (Public Law (P.L.) 77-228) as a multipurpose project for flood risk management, hydropower, and navigation. An early concept of the plan for Allatoona Dam is shown in Figure 3-1.

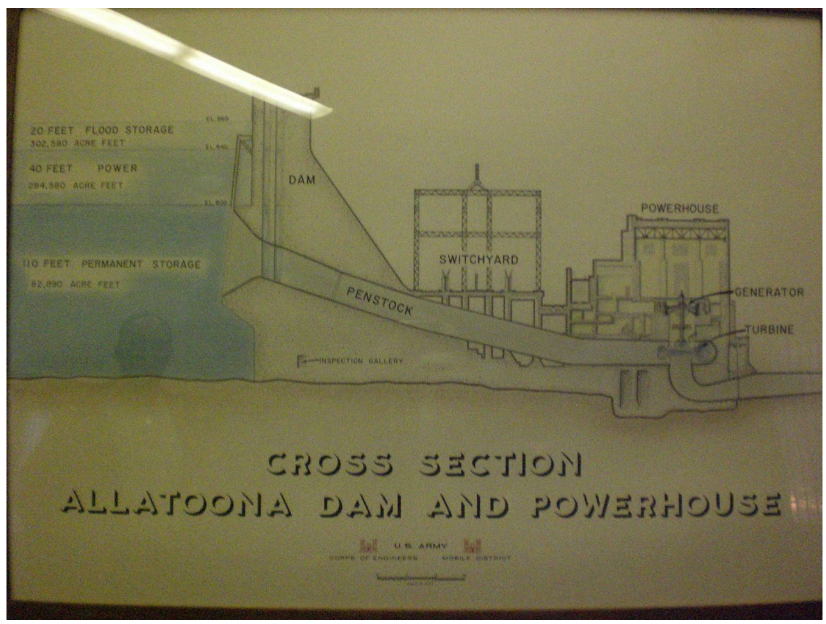

Figure 3-1. Early depiction of proposed project

c. Other congressional authorities were authorized in other legislation for federal projects similar to Allatoona. Those additional authorities are described below:

<u>P.L. 78-534, Flood Control Act of 1944</u> - Provides authority to add recreation as a purpose and to contract for use of surplus water for domestic purposes;

P.L. 85-500, Title III, Water Supply Act of 1958 - Provides authority to include storage for municipal and industrial water supply;

P.L. 85-624, Fish and Wildlife Coordination Act of 1958 - Provides authority to modify projects to conserve fish and wildlife;

P.L. 92-500, Federal Water Pollution Control Act Amendments of 1972 - Establishes goal to restore and maintain the quality of the Nation's waters;

P.L. 93-205, Endangered Species Act of 1973 - Provides authority for operating projects to protect threatened or endangered fish/wildlife.

The authorized and operating purposes of Allatoona are shown in Table 3-1.

Table 3-1. Project Purposes at Allatoona Dam and Lake

ALLATOONA DAM AND LAKE Project Purposes		
Operating Purposes	Authorized Purposes	Authorizing Laws
Flood risk management	Flood risk management	PL 77-228
Recreation	Recreation	PL 78-534
Water Quality	Water Quality	PL 92-500
Water Supply	Water Supply	PL 85-500
Fish/Wildlife	Fish/Wildlife	PL 85-624
#	Navigation	PL 77-228
Hydroelectric Power	Hydroelectric Power	PL 77-228
# There are no specific operations for navigation since releases are captured by APC Projects downstream. However, the redistribution of flows benefits this purpose.		

3-02. Planning and Design. In December 1941, the District Engineer submitted to the Chief of Engineers a report entitled "Definite Project Report, Allatoona Dam and Reservoir, Etowah River, in the Alabama-Coosa River Basin, Georgia", and work was initiated on plans and specifications. The proposals presented in the definite project report were substantially in agreement with those described in the interim report except that the estimated total storage was increased to 722,000 acre-feet by raising the full flood control pool from elevation 855 to 860 feet NGVD29 and making a number of changes in the design of the structure.

3-03. Construction. Construction was authorized in the Flood Control Act of 18 August 1941, now known as Public Law No. 228, 77th Congress, 1st Session, H. R. 4911. Project construction was delayed during World War II and was restarted on 8 February 1946, using hired labor. The contract for the construction of the main dam was awarded on 29 April 1946 to National Constructors, Inc. The main dam was essentially complete in late 1949, and filling the reservoir commenced 27 December 1949. The reservoir pool reached elevation 835 feet NGVD29 in June 1950 and normal reservoir operation began at that time. Hydropower generation began in January 1950. Figure 3-2 pictures the project during early construction.

Figure 3-2. Early Construction

3-04. Related Projects. Allatoona Dam and Lake is one of five Corps reservoir projects in the ACT Basin. Carters Dam and Lake (with Reregulation Dam) is on the Coosawattee River and Robert F. Henry, Millers Ferry and Claiborne Lock and Dam Projects are located on the Alabama River downstream. The Corps reservoirs are operated as a system to accomplish the authorized purposes of the projects. Outflows from Allatoona Dam are defined by the Water Control Plan and requirements at the downstream Corps reservoirs. In addition, 11 privately owned dams are located in Alabama on the Coosa and Tallapoosa Rivers and operate mainly for the production of hydropower. The Corps has flood control authority over 4 of these 11 privately owned dams; Weiss, H. Neely Henry, Logan Martin these are all on the Coosa, and Harris dam located on the Tallapoosa.

3-05. Modifications to Regulations. Shortly after construction began, the storage allocation was reconsidered and the top of the conservation pool was changed to elevation 835 feet NGVD29, with estimated storages of 389,000 acre-feet between elevation 835 and 860 feet NGVD29 allocated for flood risk management, and 253,000 acre-feet between elevations 800 and 835 feet NGVD29 reserved for power generation and conservation. The inactive storage below minimum conservation pool, elevation 800 feet NGVD29, was estimated at 80,000 acre-feet.

The storage curve previously used was revised in 1950 as a result of more detailed data. According to this revised curve, the total storage in the reservoir at elevation 860 feet NGVD29 is 670,047 acre-feet. Of this total, 587,156 acre-feet between elevations 860 and 800 feet NGVD29 is usable storage and 82,891 acre acre-feet below elevation 800 feet NGVD29 is inactive storage.

Studies conducted in 1952 revealed that overall benefits from the project could be increased appreciably by varying the storage allocations in Allatoona Lake on a seasonal basis. Raising the top of conservation pool during the summer months with a drawdown prior to the flood season would result in a considerable increase in power revenue with no reduction in flood risk management benefits. An operating plan based on seasonal variation of storage allocations was approved by the Chief of Engineers in November 1956. Under this plan, 840 feet NGVD29 is the top of conservation pool during the months May through August, transitions down from 840 to 820 feet NGVD29 during September through December, and then transitions back up from 820 to 840 feet NGVD29 during January through April. The flood risk management storage at elevation 840 feet NGVD29 is 302,580 acre-feet, and at elevation 820 feet NGVD29 is 489,060 acre-feet. The conservation storage is 284,580 acre-feet at elevation 840 feet NGVD29 and 98,100 acre-feet at elevation 820 feet NGVD29.

In 1967, another study of the top of conservation pool was made to determine the desirability of allowing the pool level to remain at elevation 840 feet NGVD29 until the end of September whenever flow conditions are favorable. Such an operation would be particularly desirable from the standpoint of recreation and would provide additional benefits to hydropower, low-flow control, and navigation. Another change considered was the elimination of the steep drawdown and immediate refilling in late December and early January. The study showed that the changes could be made without depreciating flood risk management benefits. On 28 March 1968, the Chief of Engineers approved a revised top of conservation curve which has a top level at elevation 840 feet NGVD29 during the months May through September, varies uniformly from elevation 840 to 823 feet NGVD29 during 1 October through 15 December, remains at elevation 823 feet NGVD29 from 15 December through January, then varies uniformly from 823 feet NGVD29 on 15 January to 840 feet NGVD29 at the end of April. The flood risk management storage at elevation 823 feet NGVD29 is 467,278 acre-feet and the conservation storage is 119,878 acre-feet. The curve delineating the current top of conservation pool is shown on Plate 3-1 adopted XXX 2013. The curve remains steady at 840 feet NGVD29 between 1 May to Labor Day; then the pool is drawn down uniformly from 840 feet NGVD29 to 835 feet NGVD29 beginning the day after Labor Day to 1 October; the curve is held steady at 835 feet NGVD29 from 1 October to 15 November, then transitions uniformly down to 823 feet NGVD29 by 31 December; then held steady at 823 feet NGVD29 between 31 December to 15 January; and then transitions uniformly between 16 January to 1 May back to 840 feet NGVD29. Table 3-2 summarizes the historical changes in Allatoona storage allocation.

When the project went into operation in 1949, the top of conservation pool was at elevation 835 feet NGVD29 and the regulation plan called for evacuation of flood waters stored above that level as soon as practicable by releasing at rates not to exceed the downstream bankfull capacity estimated at 12,000 cfs. Through actual operating experience, the channel capacity below Allatoona Dam has been determined to be about 9,500 cfs. A survey and real estate appraisal was made to determine the acreage involved and the cost of acquiring easements to permit emptying releases up to 12,000 cfs. This higher release rate, which would expedite the evacuation of flood storage, would be necessary to permit operation of the power plant at full capacity if the third generating unit was installed. Until such easements are acquired, flood storage will be emptied at a maximum rate of 9,500 cfs, except in induced surcharge operations.

The induced surcharge operation during floods which exceed the available flood storage is a departure from the operating plan outlined in the Definite Project Report. In that report, the pool level would be maintained at elevation 860.0 feet NGVD29 by regulating the gates to make outflow equal to inflow until all spillway gates were opened, after which the outflow becomes uncontrolled until the pool level dropped back to elevation 860 feet. A study of induced surcharge operation was conducted in February 1947 to determine the most desirable plan for Allatoona Dam. Since Allatoona Dam was under construction at the time, induced surcharge operation was limited by the pool elevation-gate opening curve, shown on Plate 2-8, so that the maximum pool for the spillway design flood could be held to a level that would not necessitate major changes in the structure. The gate operating machinery is provided with limit switches which will open gates in 0.5-foot increments up to a 12-foot opening. In following the induced surcharge schedule, the gates will be opened as uniformly as practicable with no gate opening more than 0.5-foot larger than any other gate opening.

Table 3-2. Revisions to Available Storage at Allatoona

Allatoona Available Storage in Acre-Feet					
Approval by	Year Authorized	Available Storage** (acre-feet)	Purpose	Elevation Range (Ft-NGVD29)	Period
HD674,76th,3rd +	1940	422,500	Flood risk management	821-855	Jan-Dec
		182,500	Power&	771-821	Jan-Dec
		25,000	Inactive	Below 771	Jan-Dec
Flood Control Act +	1941	212,000	Flood risk management	848-860	Jan-Dec
		456,000	Power&	788-848	Jan-Dec
		54,000	Inactive	Below 788	Jan-Dec
OCE*	1946	389,000	Flood risk management	835-860	Jan-Dec
		253,000	Power&	800-835	Jan-Dec
		80,000	Inactive	Below 800	Jan-Dec
OCE*	1956	489,100	Flood risk management	820-860	Sep-Apr
		302,600		840-860	May-Aug
		98,100	Power&	800-820	Sep-Apr
		284,600		800-840	May-Aug
		82,900	Inactive	Below 800	Jan-Dec
OCE*	1968	467,300	Flood risk management	823-860	Oct-Apr#
		302,600		840-860	May-Sep#
		119,900	Power&	800-823	Oct-Apr#
		284,600		800-840	May-Sep
		82,900	Inactive	Below 800	Jan-Dec
OCE*	2012	467,278	Flood risk management	823-860	16 Nov-30 Apr
		358,582		835-860	6 Sep-15 Nov
		302,576		840-860	1 May-5 Sep
		119,878	Power&	800-823	16 Nov-30 Apr
		228,574		800-835	6 Sep-15 Nov
		284,580		800-840	1 May-5 Sep
		82,890	Inactive	Below 800	Jan-Dec
* Congress					
* Office of Chief of Engineers, COE					
& Power becomes conservation with other purposes.					
# Conservation is set at 823 feet-NGVD29 from 15 Dec-15 Jan.					
** Total storage is 630,000 acre-feet (1940), 722,000 (1941&46) and 670,100. (1956&1968)					

3-06. Principal Regulation Problems. The initial regulation plan called for evacuation of flood waters stored above the conservation pool as soon as practicable by releasing at rates not to exceed the downstream bankfull capacity estimated at 12,000 cfs. However, through actual operating experience, particularly the April 1964 flood, the channel capacity below Allatoona Dam was reevaluated and reduced from 12,000 cfs to 9,500 cfs. A survey and real estate appraisal was made to determine the acreage involved and the cost of acquiring easements to permit emptying releases up to 12,000 cfs. This higher release rate, which would expedite the evacuation of flood storage, would be necessary to permit operation of the power plant at full capacity if the third generating unit was installed. Until such easements are acquired, flood storage will continue to be emptied at a maximum rate of 9,500 cfs.

IV - WATERSHED CHARACTERISTICS

4-01. General Characteristics. Etowah River and its upstream tributaries originate in the Blue Ridge Mountains of northern Georgia, near the western tip of South Carolina. The northern boundary of the Allatoona drainage area is along a high ridge varying from elevation 1,300 to 3,800 feet NGVD29. Creeks along the upper Etowah River have steep mountainous slopes which produce rapid runoff. Amicalola Creek is a major tributary and begins at the divide with the Carters Project drainage area. The main stem of the Etowah River above the reservoir is more than 70 miles long. Rain storms produce large flood inflows that can persist for several days.

The Etowah River Basin below Allatoona Dam is about 30 miles wide and has 700 square miles of uncontrolled runoff. The Etowah River drops from elevation 687 feet NGVD29 at the toe of the dam to 562 feet NGVD29 at Rome, Georgia. This lower portion of the basin has a wider floodplain and flatter stream slope than the upper basin. The drainage area and river miles (from Mobile Bay) for important locations of interest within the basin are shown in Table 4-1. The entire ACT Basin is shown on Plate 2-1.

Table 4-1. 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	**River**	**Location**	**Drainage Area (Square Miles)**	**Owner**
693	Etowah	Allatoona Dam	1,122	COE
683.4	Etowah	Cartersville, GA (Hwy 61)	1,345	
666.6	Etowah	Kingston, GA	1,634	
645.2	Etowah	Mouth	1,810	
672	Coosawattee	Carters Dam	374	COE
670.2	Coosawattee	Carters Reregulation	521	COE
645.2	Oostanaula	Mouth	2,200	
645.5	Oostanaula	Rome, GA (Hwy 27)	2,149	
638.1	Coosa	Mayo's Bar	4,040	
585.1	Coosa	Weiss Dam	5,284	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	9,776	APC
378.3	Coosa	Jordan Dam	10,102	APC
497.4	Tallapoosa	R. L. Harris	1,453	APO
420	Tallapoosa	Martin Dam	2,984	APC
412.1	Tallapoosa	Yates Dam	3,293	APC
409.1	Tallapoosa	Thurlow Dam	3,308	APC
281.2	Alabama	Robert F Henry Dam*	16,233	COE
178	Alabama	Millers Ferry Dam*	20,637	COE
117.5	Alabama	Claiborne Dam*	21,473	COE
* Navigation Lock at Project				
COE - Corps of Engineers; APC - Alabama Power Company				

4-02. Topography. The Blue Ridge Province comprises much of the drainage basin above Allatoona Dam. This province is characterized by irregular divides formed by isolated and poorly connected masses of highly metamorphosed and igneous rocks. The western boundary of this province is determined largely by the extent of over thrust of resistant crystalline rocks on the weaker sedimentary formations of the Valley and Ridge Province. The drainage area above Allatoona is composed of mountainous streams with steep slopes.

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

Piedmont soils consist of kaolinite and halloysite (aluminosilicate clay minerals) and iron oxides. They result from the intense weathering of feldspar-rich igneous and metamorphic rocks. Such intense weathering dissolves or alters nearly all minerals and leaves behind a residue of aluminum-bearing clays and iron-bearing iron oxides because of the low solubilities of aluminum and iron at earth-surface conditions. Those iron oxides give the red color to the clay-rich soil that has come to be synonymous with north and central Georgia.

4-04. Sediment. The streams in the northern part of the Etowah River Basin have been severely impacted by past and present urban development. Urban development generally increases the peak and volume of rainfall events, which increases the velocity and erosion potential of rainfall runoff. Results are generally a down-cutting and widening of the stream, which creates bank caving and further erosion. Other significant sources of sediment within the basin are agricultural land erosion, unpaved roads, and sliviculture, and variation in land uses that result in conversion of forests to lawns or pastures.

In general, the quantity and size of sediment transported by rivers is influenced by the presence of dams. Impoundments behind dams serve as sediment traps where particles settle in the lake headwaters because of slower flows. Large impoundments typically trap coarser particles plus some of the silt and clay. Often releases from dams scour or erode the streambed downstream.

In 1960, the Corps established sedimentation and retrogression ranges to monitor changes in reservoir volume and channel degradations. Reservoirs tend to slow river flow and accelerate deposition. The locations of the ranges for the Allatoona Project are shown in Plate 2-4. Descriptive analyses are performed after periodic re-surveys of the ranges to determine the level of sedimentation occurring in the main body of the reservoir and to examine shoreline erosion. Detailed reports are written after each re-survey to determine changes in reservoir geometry. Those reports include engineering analysis of the range cross-sections to estimate reservoir storage loss by comparing to the earlier surveys of the existing ranges. The data provide the ability to compute new area/capacity curves for the reservoirs. Area/capacity curves have not been updated since construction of the project. Maintenance of the sedimentation and retrogression ranges, which could include reestablishing or relocating ranges, typically occurs when they are resurveyed.

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

a. Temperature. The Blue Ridge Mountains protect the Etowah River Basin in the vicinity of Allatoona Dam from the more rigorous winters prevailing across the divide in the Tennessee Valley and tend to assure a milder climate. The average annual temperature in the vicinity of the Allatoona Project is about 60 degrees Fahrenheit (^{o}F), based on records at six stations averaged for the 30-year period of 1981 - 2010, inclusive. The stations are Gainesville, Dahlonega, Jasper, Cedartown, Cartersville and Rome, Georgia. The maximum temperature recorded during this time period was 109 ^{o}F at Rome, Georgia. The minimum temperature recorded was -14 ^{o}F at Jasper, Georgia. The average summer temperature is about 76 ^{o}F and the average winter temperature is about 42 °F. The normal frost-free period lasts from April through October and extended periods of below freezing temperature are unusual. Table 4-2 presents the monthly maximum, minimum and mean temperatures for selected stations in the basin.

Table 4-2. Normal 30-year Air Temperature for Selected Sites in/near Allatoona Basin

Normal Temperature Based on 30-Year Period – 1981 Through 2010 (degrees Fahrenheit)														
Station		**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUNE**	**JULY**	**AUG**	**SEPT**	**OCT**	**NOV**	**DEC**	**ANNUAL**
Gainesville	Max	49.8	54.2	62.5	70.6	77.3	84.1	87.2	86.0	79.9	70.8	61.8	51.9	69.7
	Mean	40.8	44.2	51.5	59.2	66.8	77.4	77.9	76.9	70.5	60.6	51.7	43.1	60.1
	Min	31.7	34.2	40.5	47.8	56.4	64.7	68.6	67.9	61.2	50.5	41.6	34.4	50.0
Dahlonega	Max	50.3	54.9	61.8	70.3	77.4	83.1	86.3	85.2	79.4	71.2	62.3	52.2	64.9
	Mean	38.4	41.9	48.3	55.8	63.2	70.6	74.5	74.0	67.3	57.9	48.7	40.4	56.8
	Min	26.4	28.9	34.7	41.3	49.1	58.1	62.7	62.8	55.2	44.5	35.2	28.6	37.1
Jasper	Max	47.8	52.0	60.6	69.0	76.1	82.7	85.6	84.9	79.2	69.5	60.0	50.3	68.1
	Mean	39.0	42.7	50.3	57.8	65.5	73.0	76.1	75.6	69.6	59.3	50.4	42.0	58.4
	Min	30.2	33.4	40.1	46.1	54.9	63.2	66.7	66.2	59.9	49.0	40.9	33.7	48.7
Cedartown	Max	51.7	55.8	64.6	72.8	79.6	86.6	89.4	88.9	83.0	73.5	63.6	53.6	65.7
	Mean	40.0	43.6	51.1	59.3	67.1	75.0	78.3	77.7	71.0	60.2	50.5	42.3	59.7
	Min	28.3	31.3	37.6	45.8	54.6	63.4	67.3	66.5	59.0	46.9	37.5	31.0	44.0
Cartersville	Max	53.2	58.6	67.3	74.9	81.7	88.6	91.5	91.1	85.2	75.5	65.9	55.5	74.1
	Mean	41.4	45.9	53.1	60.7	68.7	76.4	79.7	79.3	73.3	62.1	52.7	43.9	61.4
	Min	29.6	33.2	38.8	46.5	55.7	64.2	67.8	67.5	61.5	48.8	39.6	32.3	48.8
Rome	Max	52.1	56.8	65.7	73.6	80.5	86.9	89.7	89.1	83.3	73.6	64.1	54.2	72.5
	Mean	41.6	45.6	53.2	61.0	68.9	76.6	80.1	79.4	72.9	61.9	52.4	44.1	61.5
	Min	31.1	34.3	40.8	48.3	57.3	66.3	70.5	69.6	62.4	50.1	40.7	34.0	50.5
Basin	Max	50.8	55.4	63.8	71.9	78.8	85.3	88.3	87.5	81.7	72.4	63.0	53.0	69.2
	Mean	40.2	44.0	51.3	59.0	66.7	74.8	77.8	77.2	70.8	60.3	51.1	42.6	59.7
	Min	29.6	32.6	38.9	46.0	54.7	63.3	67.3	66.8	59.9	48.3	39.3	32.3	46.5

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, Alabama, to Montgomery, Alabama, to Rome, Georgia, and subtropical moisture was continuously drawn along the line producing an extended period of heavy rain. The normal monthly precipitation above Allatoona Dam is based on the 1981 - 2010 normal rainfall at six National Weather Service (NWS) stations; Cumming, Dahlonega, Cartersville, Jasper, Canton and Woodstock, Georgia. Table 4-3 lists the normal precipitation at these 6 stations. Extreme rainfall events of record are shown in Table 4-4. About 40 percent of the normal annual precipitation occurs from January through April, while only about 30 percent occurs during the dry period August through November. The average annual snowfall is three to four inches, usually in January and February, but is of minor importance in producing runoff.

Table 4-3. Normal Rainfall Based on 30-Year Period – 1981 Through 2010

Normal Rainfall Based on 30-Year Period – 1981 Through 2010 (inches)														
Station		**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUNE**	**JULY**	**AUG**	**SEPT**	**OCT**	**NOV**	**DEC**	**ANNUAL**
Gainesville		5.17	5.10	5.23	3.69	3.80	4.13	4.22	4.39	4.55	3.88	4.34	4.66	53.16
Dahlonega		6.00	5.84	5.55	4.36	4.46	5.06	4.63	4.77	4.93	4.59	5.09	6.15	61.43
Jasper		5.45	5.18	5.31	4.56	4.07	4.81	5.48	4.41	4.07	3.88	4.87	4.89	52.58
Cedartown		4.60	4.89	5.01	3.92	4.29	3.96	4.83	3.91	3.63	3.44	4.51	4.39	51.38
Cartersville		3.24	4.35	4.12	3.43	2.88	3.25	3.92	3.84	2.81	2.62	3.29	4.30	42.05
Rome		4.76	4.84	5.35	4.28	4.11	4.76	4.98	4.49	3.56	3.25	4.58	4.61	54.07
Basin		4.87	5.03	5.10	4.04	3.94	4.33	4.68	4.30	3.93	3.61	4.45	4.83	52.45

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

4-06. Storms and Floods. Frontal systems influence conditions throughout the year. During the warmer months, thunderstorms are a major producer of rainfall. Tropical disturbances and hurricanes also impact the region. The autumn months are usually dryer but flood producing storms can occur any time of the year.

Allatoona Project began filling on 27 December 1949, and the pool reached elevation 835 feet NGVD29 in June 1950. Because Allatoona has a seasonally varied conservation level, and other operational reasons, the maximum pool elevation does not always correspond with the maximum inflow. A long series of floods could cause the pool to rise steadily above elevation 840 feet NGVD29 because releases are limited by the downstream flood conditions. Then, an average flood inflow towards the end of the flood series could produce the maximum pool for that event. As a rule, the extended, larger volume floods normally impact the reservoir elevation more than short, high inflow flood events. The maximum pool elevation of record (elevation 861.19 feet NGVD29) occurred during the April 1964 flood while the maximum daily inflow (prior to the September 2009 flood) of 45,845 cfs over a 24-hour period (day-second-feet (dsf)) occurred during February 1982 with a resulting peak pool of elevation 848.01 feet NGVD29. The September 2009 flood exceeded previous inflow records producing a daily inflow of 53,534 cfs and a peak pool elevation of 853.04 feet NGVD29.

The April 1964 event was a series of storms which occurred during early 1964, and caused the local runoff below the dam to stay near bankfull through most of the period. The flood waters into the dam could not be evacuated without causing flood damages downstream. Thus, the pool elevations were high for several weeks. The April 1964 peak inflow occurred during the period of maximum elevation and produced a higher elevation than would have been expected

Table 4-4. Extreme Rainfall Within and Near the Basin (in inches)

Station: (093621) GAINESVILLE From 1891 To 2010						
MONTH	HIGH	YEAR	LOW	YEAR	1-DAY MAX	DATE
JAN	11.70	1936	0.74	1907	4.15	25/1964
FEB	11.85	1961	0.21	1906	4.45	21/1961
MAR	15.47	1980	1.02	1910	5.33	26/1964
APR	14.03	1964	0.25	1915	4.15	30/1963
MAY	12.23	1923	0.20	1914	4.00	12/1942
JUN	13.48	1963	0.50	1988	4.62	24/1980
JUL	13.47	1916	0.12	1952	3.92	15/1949
AUG	16.40	1969	0.26	1925	5.62	16/1969
SEP	16.80	2004	0.13	1978	6.04	02/2004
OCT	10.74	1977	0.00	1963	4.40	09/1977
NOV	13.75	1948	0.15	1901	4.15	11/2009
DEC	15.37	1932	0.69	1980	4.27	06/1983
ANN	80.39	2009	20.96	1904	6.04	20040902

Station: (092475) DAHLONEGA From 1874 To 2010						
MONTH	HIGH	YEAR	LOW	YEAR	1-DAY MAX	DATE
JAN	14.33	1946	0.93	1981	5.72	27/1996
FEB	14.11	1903	0.60	1906	5.17	03/1982
MAR	19.70	1980	1.38	1910	6.28	30/1977
APR	13.62	1979	0.55	1915	4.9	17/1998
MAY	14.65	1976	0.68	1914	5.49	15/1976
JUN	13.01	1900	0.97	1925	4.12	03/1995
JUL	16.67	1916	0.62	1952	4.18	12/1948
AUG	18.16	1978	0.34	1925	7.34	16/1895
SEP	14.49	1929	0.11	1954	5.44	27/1942
OCT	11.29	1918	0.00	1904	5.41	26/1997
NOV	13.97	1948	0.51	1924	3.63	11/2009
DEC	20.63	1932	0.97	1896	5.89	12/1961
ANN	62.02	1929	38.82	1904	7.34	18950816

Station: (094648) JASPER From 1937 To 2010						
MONTH	HIGH	YEAR	LOW	YEAR	1-DAY MAX	DATE
JAN	11.35	1947	1.19	1981	4.43	27/1996
FEB	11.18	1944	0.72	1978	5.78	17/1942
MAR	16.67	1980	1.94	1985	5.1	04/1979
APR	13.57	1979	1.05	1942	5.32	08/1938
MAY	10.15	1976	0.00	2009	4.35	15/1976
JUN	12.83	1989	0.55	1986	3.82	27/1994
JUL	11.62	2003	0.52	1957	3.98	02/1992
AUG	11.30	1969	0.15	1953	5.55	09/0977
SEP	10.57	2004	0.44	2005	7.41	17/2004
OCT	9.12	1997	0.00	1938	5.38/	26/1997
NOV	12.60	1948	0.53	1939	4.22	11/2009
DEC	15.45	1961	1.07	1980	5.75	12/1961
ANN	80.95	1989	36.08	2007	7.41	20040917

Station: (091732) CEDARTOWN From 1896 To 2010						
MONTH	HIGH	YEAR	LOW	YEAR	1-DAY MAX	DATE
JAN	9.91	1947	0.99	1981	4.35	26/1996
FEB	11.14	1944	0.52	1898	4.10	03/1982
MAR	15.68	1980	1.35	1985	6.45	04/1979
APR	14.61	1979	0.43	2007	5.05	13/1979
MAY	9.01	2003	0.80	2007	3.17	14/1972
JUN	11.77	1989	0.58	2009	3.65	21/1961
JUL	14.83	2003	0.41	1993	5.04	07/1962
AUG	10.72	1992	0.71	1955	3.43	24/1967
SEP	10.04	1957	0.09	1998	3.77	17/2004
OCT	10.80	1995	0.00	1938	5.08	04/1995
NOV	15.29	1948	0.57	1949	4.90	09/2000
DEC	13.01	1961	0.09	2010	4.61	12/1961
ANN	71.21	1989	28.41	2007	6.45	19790304

Station: (091665) CARTERSVILLE From 1891 To 2010						
MONTH	HIGH	YEAR	LOW	YEAR	1-DAY MAX	DATE
JAN	8.69	1947	0.44	1981	3.38	26/1976
FEB	10.05	1944	0.00	1996	3.58	22/1974
MAR	13.66	1976	1.19	1983	6.00	18/1990
APR	13.34	1964	0.81	1986	4.56	03/1979
MAY	8.76	1946	0.00	1899	3.29	20/1973
JUN	7.08	1963	0.15	1984	3.64	19/1976
JUL	11.94	2001	0.95	1983	4.21	16/1897
AUG	9.77	1942	0.32	1997	4.50	16/1955
SEP	9.34	1898	0.00	2008	4.20	01/1898
OCT	8.66	1975	0.00	1963	4.11	01/1958
NOV	12.50	1948	0.23	1939	3.62	19/2003
DEC	13.19	1961	0.17	1980	4.85	12/1961
ANN	68.45	1964	19.84	1998	6.00	19900318

Station: (097600) ROME From 1893 To 2010						
MONTH	HIGH	YEAR	LOW	YEAR	1-DAY MAX	DATE
JAN	12.42	1947	0.85	1981	4.65	16/1954
FEB	13.45	1903	0.74	1906	5.30	09/1921
MAR	17.98	1980	1.07	1918	6.22	26/1901
APR	13.60	1979	0.30	1915	4.30	05/1957
MAY	11.33	2003	0.22	2007	2.99	03/1964
JUN	10.85	1989	0.23	1988	3.31	06/1930
JUL	14.76	1916	0.87	1960	4.05	12/1999
AUG	14.54	1992	0.49	1987	4.92	22/1992
SEP	11.33	1957	0.00	1897	4.95	25/1997
OCT	10.37	1995	0.00	1938	6.67	26/1997
NOV	16.26	1948	0.36	1924	5.58	19/1906
DEC	16.47	1932	0.58	1980	5.96	12/1961
ANN	77.65	1932	28.71	2007	6.67	19971026

based on single storm inflow alone. The bankfull capacity below the dam was reevaluated due to the flooding at Cartersville, Georgia, and farther downstream. At that time, the defined stream capacity was reduced from 12,000 cfs to 9,500 cfs due to flood damages of the April 1964 flood. With this change in channel capacity, a repeat of the events of the April 1964 flood would produce a higher pool level than occurred in 1964. The April 1964 operation is shown on Plates 4-1 and 4-2.

The April 1979 and March 1990 flood events were large areal storms which caused the pool to be in the top five of maximum annual pools. The April 1979 and March 1990 floods are typical flood events that occurred with current rule curves, storage allocation and basin conditions. Plates 4-3 and 4-5 present the pool inflow and outflow and Plates 4-4 and 4-6 presents the downstream stages.

The storm of September 2009 occurred at the end of a severe drought and Allatoona Lake was lower than normal for that time of year (837 feet NGVD29). The storms resembled a tropical event, but in reality were caused by steady rain for eight days. Between 15 – 18 September 2009, there was constant rainfall, but not in unusual amounts. Most areas only had about an inch or less of accumulated rainfall during this time. On 19 September, the rainfall increased, with three to five inches falling that day. Some of the heaviest rainfall occurred above Allatoona Lake. The storing of runoff in Allatoona Lake significantly reduced downstream flows and stages. Plates 4-7 and 4-8 show the pool inflow and outflow and graphs of the downstream flows.

4-07. Runoff Characteristics. Runoff characteristics of the Etowah River and its major tributaries above the dam site are those of mountain streams with rapid rise and recession of the flood hydrographs. Peak flood discharges at Rome, Georgia are usually caused by local inflow from tributary streams downstream of Allatoona Dam.

The retention of floodwaters in Allatoona Lake essentially reduces flood stages in the latter portion of a flood and prevents the Oostanaula River from causing a secondary flood peak. Carters Dam and Lake Project, located in the Oostanaula River Basin, has some flood risk management capacity for the upper Oostanaula and is operated to reduce flood peaks at Resaca and Calhoun, Georgia. The Carters Project also provides some flood risk management benefits at Rome, Georgia. Of the 4,010 square miles of drainage area at Rome, Georgia, 374 square miles are controlled by the Carters Dam and 1,122 square miles are controlled by Allatoona Dam. This leaves 63 percent of the drainage area at Rome, Georgia, unregulated. A levee system was completed in 1939 that, along with flood risk management operations at the Allatoona and Carters Projects, has protected the city of Rome. A locality map of the Rome, Georgia levee system is shown on Figure 4-1 and a portion of the levee along the Oostanaula River is shown on Figure 4-2.

In the ACT Basin, rainfall occurs throughout the year but is less abundant from August through November. Only a portion of rainfall actually runs into local streams to form the major rivers. Factors that determine the percent of rainfall that runs into the streams include the intensity of the rain, antecedent conditions, ground cover and time of year (plants growing or dormant). Intense storms will have high runoff potential regardless of other conditions while a slow rain can produce little measurable runoff. Table 4-5 and Figure 4-3 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.

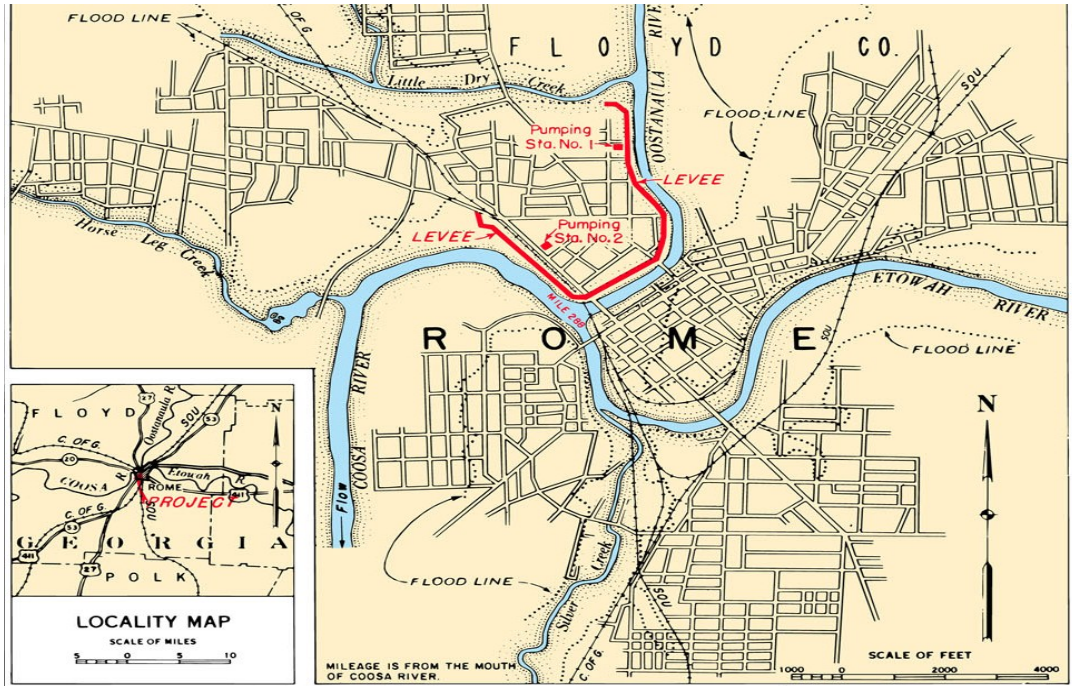

Figure 4-1. Levee Locality Map for Rome, Georgia

Figure 4-2. Portion of Levee Along Oostanaula River at Rome, Georgia

Table 4-5
Average Monthly Runoff in ACT Basin Measured at Rome Georgia

	JAN	FEB	MAR	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
AVG MONTHLY FLOW AT ROME	6525	9602	11652	12828	10565	7038	4636	4234	3188	2778	2867	4162
AVG RUNOFF IN INCHES AT ROME	1.86	2.47	3.33	3.54	3.01	1.94	1.32	1.21	0.88	0.79	0.79	1.19
AVG RAINFALL IN INCHES	5.15	4.97	5.96	4.79	4.22	3.92	4.89	3.77	3.82	3.05	3.90	4.87
PERCENT OF RAINFALL AS RUNOFF	36	50	56	74	71	50	27	32	23	26	20	24

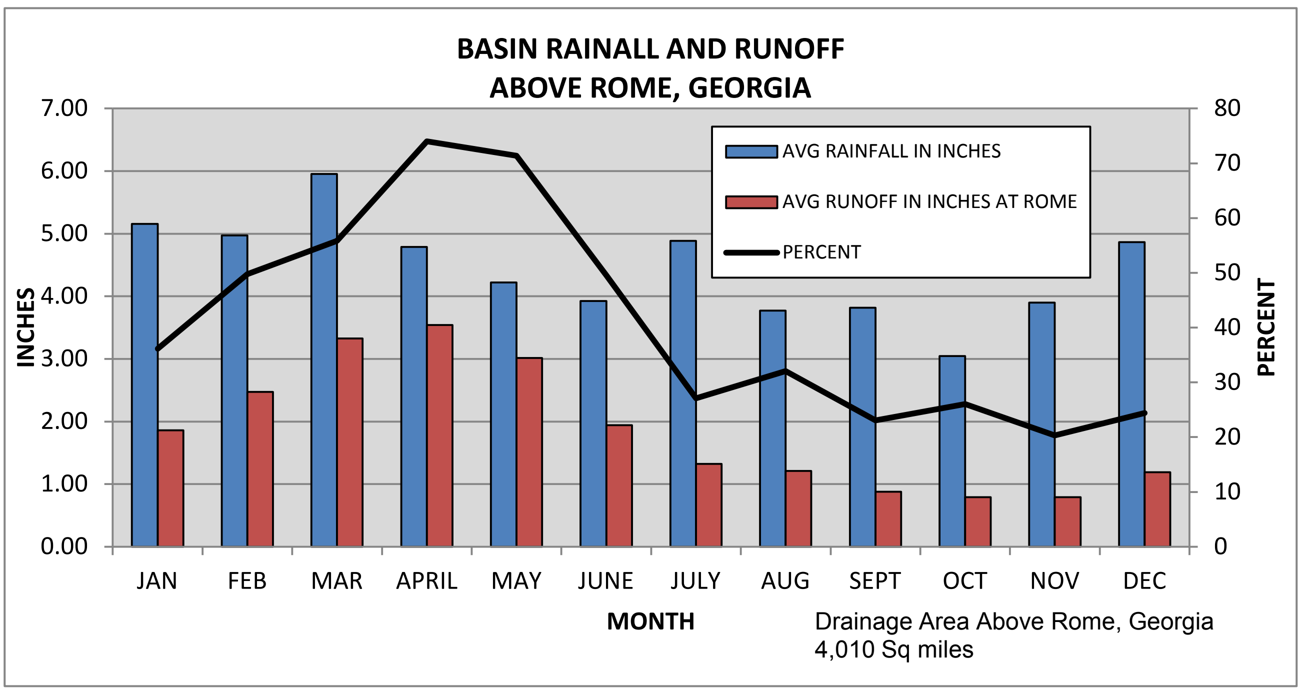

Figure 4-3. Basin Rainfall and Runoff above Rome, Georgia

Streamflow has been measured at the Allatoona gage site since September 1938. The station was operated by the Mobile District until the late 1970's when the U. S. Geological Survey (USGS) took over operation and maintenance of the gage. Other gages in the region have been in existence since the late 1800's and can be used to estimate flows at Allatoona. Since 1950, the inflow and outflow have been measured at Allatoona Dam by the COE. The inflows at the dam are computed by combining the change in storage with the measured outflow that accounts for evaporation and withdrawals. Travel time for water released from Carters Dam and Reregulation Dam 38 Project to reach Rome, Georgia, is approximately 32 hours. Monthly flows for 1896 through 1949 are shown on Plates 4-9 and 4-10. The monthly inflows at the dam are shown on Plates 4-11 and 4-12. A set of unimpaired inflows that have been corrected for evaporation, increase runoff from rain directly on the reservoir, and other factors are shown on Plates 4-13 through 4-30.

4-08. Water Quality. The mid-lake and dam forebay portions of Allatoona Lake meet all designated water use criteria established by the State of Georgia. Both the Etowah River and Little River embayment sections of Allatoona Lake are listed on the 2012 draft Integrated 305(b) and 303(d) list because of chlorophyll *a* impairment. A draft Total Maximum Daily Load (TMDL) for chlorophyll *a* was completed in 2009, and a fecal coliform TMDL was completed in 2004. The lake is transitioning from mesotrophic to eutrophic due to the influx of phosphorus nutrients. Phosphorus levels have increased in the lake and its tributaries because of increases in urban lands and broiler and beef cattle production. Dissolved oxygen levels in the tailwaters below Allatoona Dam drops below four mg/L during the summer and through early fall, and can reach as low as one mg/L.

a. Water Quality Needs. Georgia Department of Natural Resources has classified various portions of the Etowah River above Allatoona Dam as drinking water, recreation, and fishing. Etowah River below the dam has been classified as suitable for fishing, in accordance with Georgia Water Quality Control laws. Georgia has promulgated water quality criteria for various water use classifications. The principal specific criteria related to the use classifications are as follows:

Drinking Water:

- Bacteria: Fecal coliform not to exceed a geometric mean of 200 colonies per 100 milliliters (ml) during May – October; 4,000 per 100 ml November – April (instantaneous maximum).
- 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: Less than 90 degrees Fahrenheit.

Recreation:

- Bacteria: Fecal coliform not to exceed a geometric mean of 200 colonies per 100 ml.
- 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: Less than 90 degrees Fahrenheit.

Fishing:

- Bacteria: Fecal coliform not to exceed a geometric mean of 500 colonies per 100 ml during May – October; 4,000 per 100 ml November – April (instantaneous maximum).
- 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: Less than 90 degrees Fahrenheit.

The following criteria apply to all use classifications:

- 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 become 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.
- No material in concentration that after treatment would exceed Georgia Environmental Protection Division (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. Note that Allatoona Dam was constructed in the late 1940s, before specific water quality standards were established. Achievement of standards in release water is viewed as a goal rather than a strict legal requirement.

b. Lake Water Quality Conditions. Georgia's 2012 draft integrated 305(b)/303(d) list of impaired waters designates the dam pool and the mid-lake reaches in Allatoona Lake as supporting designated uses. Two reaches, the Etowah River arm and the Little River embayment, were identified as impaired. The Allatoona Creek arm was identified as pending because growing season average chlorophyll *a* exceeded the criteria. Chlorophyll *a* standards for Allatoona Lake, set according to the growing season (April through October) average less than 10 micrograms per liter (µg/l) upstream from the dam, mid-lake downstream from Kellogg Creek, and at Allatoona Creek upstream from I-75; less than 15 µg/l in Little River upstream from Highway 205; and less than 12 µg/l in Etowah River upstream from Sweetwater Creek. In April 2009, GAEPD developed a draft nutrient TMDL for Allatoona Lake which was the first TMDL in the ACT Basin that identified the need for reductions in total nitrogen and phosphorus to achieve in-lake chlorophyll *a* standards. Reductions of 16 percent and 20 percent nitrogen and 20 percent and 40 percent phosphorus in the Etowah River and Allatoona Creek arms, respectively, have been proposed. Measured data at compliance points for dissolved oxygen, total nitrogen, and pH are in compliance with Georgia's standards. The state collects profile data at compliance points in the reservoir for dissolved oxygen, pH, conductivity, and water temperature during the growing season. It also collects grab samples of nitrogen, phosphorus, chlorophyll *a*, and bacteria.

Georgia has begun efforts to identify sources contributing to high chlorophyll *a* by developing a total maximum daily load. As part of the state's water planning effort, it is also modeling the Coosa River Basin, including the Etowah River portion downstream of Allatoona Dam.

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

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

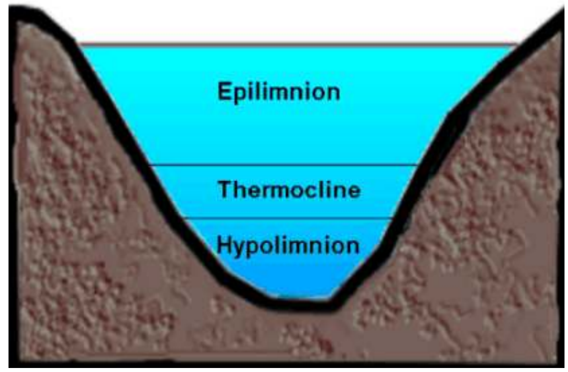

Figure 4-4. Lake stratification

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) bottom layer, becomes isolated and no longer mixes with the warm, oxygenated epilimnion. Oxygen is not produced in the hypolimnion because the cold, deep layer does not receive sunlight and is devoid of phytoplankton production. Early in the lake stratification process, the hypolimnion still contains some oxygen but declines through the summer as biological and chemical processes consume oxygen. By summer's end, the lake is strongly stratified. The epilimnion is warm and well oxygenated. Water temperature and oxygen concentrations in the thermocline are both lower but still often provide acceptable habitat for cool-water fish species. In the hypolimnion, the water is cold and low in oxygen (less than 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. This event is called *lake turnover*, and generally occurs around November - December each year. After mixing, no layers exist, and the entire lake has a relatively uniform temperature and oxygen levels.

During the 1960's an extensive field test was made of an air diffuser system for destratifying the reservoir. The method included a system of pipes and mechanical pumping of air to the lower levels of the lake. Partial success was achieved; dissolved oxygen levels in downstream releases increased on the order of 2-3 mg/l in late summer. Maintenance issues relating to design of the equipment resulted in frequent equipment breakdowns, associated financial costs and eventual discontinuance.

d. Downstream Water Quality Conditions. Water quality conditions in the releases from Allatoona 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 Etowah River below Allatoona Dam is *fishing*, with corresponding water quality standards as described in section 4-08.a. above. TMDLs for dissolved oxygen, fecal coliforms, and polychlorinated biphenyls (PCBs) have been established for the Etowah River below Allatoona 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.

4-09. Channel and Floodway Characteristics.

a. General. Allatoona Dam is a headwater project with only one reservoir located upstream. The Hickory Log Creek Project was constructed in 2007 and is located approximately 25 miles northeast of Allatoona Dam. Hickory Log Creek Reservoir is a pump back reservoir for water supply that, when full covers 411 acres and has a capacity of 18,646 acre-feet. The drainage area for Hickory Log Creek Reservoir is 8.3 square miles. There is also a sub-impoundment (Lake Acworth) within Allatoona Lake at Acworth, Georgia. The channel capacity of the Etowah River below Allatoona Dam is 9,500 cfs.

b. Damage Centers and Key Control Points. There are major flood damage reaches both above Allatoona Lake and downstream on the Etowah River. Urban flood damages occur above the lake at Dawsonville, and Canton, Georgia. This flooding is due to flood flows exceeding the channel capacity. However, Allatoona Lake can affect flood heights at Canton, Georgia, due to backwater effects, so the Corps has acquired the property which may be affected. Since the drainage area has a long travel reach, the flood hydrograph peaks at Canton, Georgia, occur one or two days after the maximum rainfall, and the high flows tend to continue for many days.

The city of Cartersville, Georgia, located below Allatoona Dam, experiences flooding if the local runoff plus the outflow from the dam becomes too large. Rome, Georgia, is the major flood damage area protected by the Allatoona Project. The USGS gages for the Etowah River at Rome 5th Avenue and Coosa River at Mayo’s Bar (Weiss Lake) are used to guide operations of Allatoona Dam to insure maximum flood reductions. Travel time for water released from Allatoona Dam to reach Rome, Georgia, is approximately 12 hours.

The Carters Dam and Reregulation Dam Project is located northeast of Rome, Georgia, on the Coosawattee River and its operation also provides some flood risk management benefits for Rome, Georgia. 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.

Tables 4-6 through 4-10 provide details for river stages and flood damages at Dawsonville, Canton, Cartersville, and Rome, Georgia. Tables 4-11 through 4-15 give the dates and heights of historical floods for these locations.

Table 4-6. Flood impacts at Dawsonville, Georgia (upstream of any project, USGS# 02389150)

Stages (feet)	Impacts
11	Bankfull is reached on the river in south Dawson County. Some minor flooding begins in pasture lands of northwest Forsyth County and water approaches low areas of Nicholson Road.
12	Minor flooding of Nicholson Road in northwest Forsyth County begins.
13	Flood Stage is reached and minor flooding begins in south Dawson County. Minor flood continues on Nicholson Road in northwest Forsyth County.
14	Moderate flooding begins in northwest Forsyth County. Old Federal Road begins to flood and Nicholson Road is closed off to residents. Minor flooding continues in south Dawson County.
16	Moderate flood begins in south Dawson County and continues in northwest Forsyth County. Widespread flooding of pasture land and horse stables occur. Old Federal and Nicholson Roads are closed in northwest Forsyth County.
21	Major flooding occurs. Highway 9 goes underwater in low areas in south Dawson County and Nicholson and Old Federal Roads are closed in northwest Forsyth County to residents.

Table 4-7. Flood impacts at Canton, Georgia
(upstream end of Allatoona, USGS# 0239200)

Stages (feet)	Impacts
15	Bankfull is reached. Water begins to spill out of the Etowah River banks in Canton.
16	Flood Stage is reached. Minor flooding begins in Boiling Park in Canton. Soccer fields and Lady Warriors' ball fields begin to flood. This is located behind the Canton High School which is on higher ground. Canton Greenway begins to flood.
17	Minor flooding continues to expand. Parking lot and road to Boiling Park begins to flood. Flooding of lowlands begins to increase.
18	Minor flooding expands. Mill Industrial Way Road floods.
19	Flood waters reach base of water treatment plant near Highway 140 and Boiling Park.
22	Moderate flooding begins. Old Canton Textile Plant Number 1 begins to flood.
23	Moderate flooding expands. Several buildings near the Canton Textile Plant flood...secondary roads and access roads to the river flood...as well as farm lands.
25	Moderate flooding expands. Buildings along Railroad Street flood.
26	Major flooding begins. Electrical power station floods near Waleska Street. River Place Shopping Center begins to flood. Flooding affects several businesses. Economic losses begin to mount.
28	Railroad tracks of L&N are inundated. Some warehouses and small industrial buildings are also affected...but without serious damage. The gage house elevation is at 27.8 feet above datum. Instrument shelf is at 31.3 feet.
30	Major flooding continues in Canton. The lowest part of Highway 140 is inundated and many businesses near the river and a few houses flood.

Table 4-8. Flood impacts at Cartersville, Georgia
(immediately downstream of Allatoona Dam, UGS# 02394670)

Stages (feet)	Impacts
16	Bankfull Stage is reached. Impacts are minimal to none. Some water enters far backyard edges of homes along Riverside Court Southeast.
18	Flood Stage is reached. Minor flooding develops as flood waters reach through backyards of homes right up to homes on Riverside Court Southeast. Farmland and farm building floods downstream of Old River Road.
19	Moderate flooding begins. Old River Road Southeast floods near Highway 41.
20	Major flooding begins. Flood waters enter Seaboard Coastline Railroads buildings.
22	Major flooding expands. CIMBAR company floods along Old River Road. Allatoona Dam Road Southeast has a building that floods. Two (2) homes flood near Highway 293 and Old River Road.
34	Widespread flooding occurs. Highway 41 bridge has water to under-supports. Many homes and businesses are underwater.

Table 4-9. Flood impacts at Rome – Etowah River (downstream of Allatoona Dam, USGS# 02395980)

Stage (feet)	Impacts
28	Bankfull and Action Stage is reached on the river.
32	Flood Stage is reached and minor flooding begins of open fields on the right bank.
34	Minor flooding continues. Grizzard Park athletic fields begin to flood on the right bank.
36	Moderate flooding begins. The concession stand and other maintenance buildings at the Grizzard Park athletic fields begin to flood.
40	Major flooding begins. Grizzard Park athletic fields & buildings completely inundated.

Table 4-10. Flood impacts at Rome – Oostanaula River (downstream of Allatoona Dam, USGS# 02388525)

Stage (feet)	Impacts
19	Action Stage is reached. Heritage Park Rome Greenway floods within floodplain.
22	Drainage valve must be closed at 2nd 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 2nd 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. 5th Avenue Bridge closed. Water overflows onto 2nd Avenue between railroad & 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 40.30 feet on April 1, 1886.
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 4-11
Historical Crests for Etowah River near Dawsonville
(1) 16.20 ft on 01/07/1946 (2) 16.03 ft on 01/16/1954 (3) 15.78 ft on 09/17/2004 (4) 15.72 ft on 03/11/1952 (5) 15.19 ft on 03/06/2003 (6) 15.02 ft on 09/06/1949 (7) 14.56 ft on 09/21/2009 (8) 14.31 ft on 03/13/1950 (9) 14.20 ft on 04/05/1957 (10) 14.05 ft on 11/11/2009 (11) 14.00 ft on 11/16/2006 (12) 13.73 ft on 03/29/1951 (13) 13.31 ft on 01/06/2009 (14) 13.13 ft on 12/09/2009
Low Water Records
(1) 2.92 ft on 09/13/2002 (2) 3.01 ft on 10/01/2007

Table 4-12	
Historical Crests for Etowah River at Canton, Georgia	
(1) 26.70 ft on 01/07/1946 (2) 26.30 ft on 12/10/1919 (3) 25.90 ft on 07/10/1916 (4) 25.33 ft on 03/17/1990 (5) 25.20 ft on 12/12/1932 (6) 25.20 ft on 12/22/1918 (7) 25.00 ft on 01/01/1892 (8) 24.70 ft on 03/26/1964 (9) 24.45 ft on 02/03/1982 (10) 24.38 ft on 04/30/1963 (11) 24.20 ft on 10/02/1989 (12) 23.80 ft on 12/13/1961 (13) 23.57 ft on 04/14/1979 (14) 23.56 ft on 03/31/1977 (15) 23.30 ft on 03/23/1952 (16) 23.20 ft on 02/05/1936 (17) 23.20 ft on 02/26/1961 (18) 23.20 ft on 02/09/1921 (19) 22.76 ft on 03/31/1976 (20) 22.72 ft on 01/28/1996 (21) 22.67 ft on 03/04/1966 (22) 22.40 ft on 04/08/1938 (23) 22.40 ft on 11/29/1948 (24) 22.39 ft on 09/17/2004 (25) 22.20 ft on 12/29/1901 (26) 22.20 ft on 03/16/1899 (27) 22.00 ft on 02/17/1903 (28) 21.96 ft on 11/06/1977 (29) 21.70 ft on 01/17/1954 (30) 21.70 ft on 04/05/1957 (31) 21.60 ft on 05/21/1901 (32) 21.32 ft on 08/25/1967 (33) 21.20 ft on 03/15/1912 (34) 21.20 ft on 02/17/1942 (35) 21.20 ft on 01/21/1947 (36) 21.00 ft on 03/07/1996 (37) 20.73 ft on 09/22/2009 (38) 20.50 ft on 01/03/1937 (39) 20.41 ft on 01/11/1972 (40) 20.20 ft on 03/07/1930	(41) 20.17 ft on 03/09/1980 (42) 20.10 ft on 02/07/1955 (43) 19.82 ft on 02/05/1998 (44) 19.81 ft on 02/04/1998 (45) 19.60 ft on 03/24/1917 (46) 19.50 ft on 03/14/1909 (47) 19.50 ft on 03/05/1929 (48) 19.20 ft on 04/05/1974 (49) 19.04 ft on 03/14/1975 (50) 19.00 ft on 12/18/1922 (51) 19.00 ft on 03/20/1944 (52) 18.91 ft on 08/23/1969 (53) 18.56 ft on 12/16/1972 (54) 18.47 ft on 01/07/2009 (55) 18.43 ft on 03/06/2003 (56) 18.43 ft on 03/01/1987 (57) 18.40 ft on 12/30/1942 (58) 18.30 ft on 12/03/1905 (59) 18.24 ft on 01/11/1968 (60) 18.05 ft on 12/07/1983 (61) 18.05 ft on 10/27/1997 (62) 17.67 ft on 03/09/1998 (63) 17.60 ft on 05/24/1928 (64) 17.60 ft on 01/22/1922 (65) 17.50 ft on 01/10/1895 (66) 17.30 ft on 03/31/1932 (67) 17.28 ft on 12/17/1992 (68) 17.20 ft on 04/05/1911 (69) 17.11 ft on 11/11/2009 (70) 17.00 ft on 10/06/1995 (71) 16.60 ft on 04/25/1908 (72) 16.50 ft on 02/14/1927 (73) 16.20 ft on 02/12/1900 (74) 16.11 ft on 03/01/1997 (75) 16.10 ft on 01/19/1925 (76) 16.10 ft on 03/14/1950 (77) 16.10 ft on 08/05/1948 (78) 16.04 ft on 03/25/1965 (79) 16.00 ft on 08/13/1940
Low Water Records for Etowah River at Canton	
(1) 0.20 ft on 10/02/1927 (2) 0.70 ft on 09/14/1924 (3) 0.70 ft on 10/02/1931 (4) 0.78 ft on 10/01/2007	(5) 0.80 ft on 09/13/2002 (6) 0.86 ft on 09/09/2007 (7) 0.90 ft on 10/09/1935 (8) 1.00 ft on 09/24/1941

Table 4-13
Historical Crests for Etowah River near Cartersville
(1) 37.00 ft on 04/01/1886 (2) 31.00 ft on 12/19/1919 (3) 30.40 ft on 01/08/1946 (4) 30.00 ft on 11/29/1948 (5) 29.90 ft on 04/08/1938 (6) 25.80 ft on 01/27/1947 (7) 24.80 ft on 12/30/1942 (8) 24.50 ft on 03/22/1942 (9) 22.60 ft on 03/30/1944 (10) 21.98 ft on 07/11/2005 (11) 20.76 ft on 02/03/1982 (12) 20.70 ft on 03/04/1979 (13) 20.10 ft on 04/10/1964 (14) 19.80 ft on 08/14/1940 (15) 19.70 ft on 05/28/1981 (16) 19.50 ft on 12/06/1983 (17) 19.35 ft on 03/22/1952 (18) 19.20 ft on 03/01/1939 (19) 19.00 ft on 08/03/1948 (20) 18.85 ft on 04/14/1980 (21) 18.40 ft on 03/29/1977 (22) 18.00 ft on 02/21/1961 (23) 18.00 ft on 07/02/1941 (24) 18.00 ft on 03/06/2003
Low Water Records
(1) 3.80 ft on 10/01/1949 (2) 4.60 ft on 10/01/2007 (3) 4.66 ft on 09/26/2007

Table 4-14
Historical Crests for Etowah River at Rome, Georgia
(1) 37.50 ft on 04/09/1938 (2) 37.40 ft on 11/30/1948 (3) 36.77 ft on 03/17/1990 (4) 36.70 ft on 01/21/1947 (5) 36.20 ft on 01/09/1946 (6) 36.05 ft on 02/04/1998 (7) 33.44 ft on 03/06/2003 (8) 33.25 ft on 02/26/1964 (9) 32.81 ft on 02/04/1982 (10) 32.10 ft on 12/30/1942 (11) 31.17 ft on 01/27/1996 (12) 30.70 ft on 03/30/1994 (13) 30.10 ft on 02/22/1961 (14) 29.81 ft on 07/12/2005 (15) 28.97 ft on 05/03/1997 (16) 28.20 ft on 03/20/2001
Low Water Records
(1) 12.43 ft on 10/01/2007

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

4-10. Upstream Structures. Allatoona Dam is a headwater project with only one reservoir located upstream. The Hickory Log Creek Project was constructed in 2007 and is located approximately 25 miles northeast of Allatoona Dam. There is also a sub-impoundment within Allatoona Lake at Acworth, Georgia.

The Acworth development is situated on the Proctor Creek arm of Allatoona Lake as shown on Plate 2-6, and enhances Allatoona Lake's purposes for recreation and conservation of fish and wildlife. The sub-impoundment dam provides a generally unfluctuating level for the 325 acre lake and provides a road across Allatoona Lake, connecting Acworth with U.S. Highway 41. The dam is 1,500 feet long and consists of earth fill with a 60-foot concrete spillway flanked on each side by concrete non-overflow sections 61 feet long, which form a transition and connection between the earth fill and spillway. The maximum height of the earth fill is 45 feet and the slopes are covered with one foot of riprap on a six-inch gravel filter blanket. The ungated spillway has a crest elevation of 848 feet NGVD29 and is bridged in a single span by the road crossing the dam. Stilling action at the toe is accomplished by means of a bucket which deflects the water upward. Two, 24-inch sluices, one at each end of the spillway, are provided to allow fluctuation of the upper pool during low flow for mosquito control and to drain the reservoir.

4-11. Downstream Structures. Allatoona Lake is one of a number of reservoirs in the ACT Basin which include Corps projects at Allatoona, Carters, Robert F. Henry, Millers Ferry, and Claiborne. These projects provide flood risk management, water supply, water quality, hydropower, recreation, navigation, and fish and wildlife enhancement. Also, Alabama Power Company (APC) has hydropower plants at Weiss, H. Neely Henry, Logan Martin, Lay, Mitchell, Bouldin and Jordan on the Coosa River and R. L. Harris, Martin, Yates, and Thurlow Dams on the Tallapoosa River. The Corps has flood control authority over Weiss, H. Neely Henry, Logan Martin, and R.L. Harris. The Alabama River is navigable to Montgomery, Alabama, near river mile 342.0. Locations of these projects are shown on Plate 2-1. The Thompson-Weinman Dam which is no longer in operation is a low head structure located about three miles downstream of Allatoona Dam.

4-12. Economic Data. The general economics of the region are represented by the nine counties in Table 4-16. Eight of the counties are located within Georgia and one county in Alabama. The watershed includes both developed urban and residential land uses and more rural land uses within the watershed.

a. Population. The 2010 population estimates for the nine counties composing the Allatoona Project watershed and basin below was 641,529 persons. Table 4-16 shows the 2010 population and the 2006 per capita income for each county. The most recent data available is provided.

Table 4-16. Population and Per Capita Income

	2010	2006
		Per Capita
	Population	Income
Bartow	96,082	$ 27,649
Cherokee	217,186	$ 33,700
Dawson	22,358	$ 30,710
Floyd	96,531	$ 29,730
Haralson	29,019	$ 25,445
Paulding	138,097	$ 26,851
Polk	42,256	$ 22,617

	2010	2006
		Per Capita
	Population	Income
Carroll	110,527	24,244
Cleburne	14,972	23,997

*US Census Bureau, 2010
*US Census Bureau, County and City Data Book, 2007

b. Agriculture. The watershed and basin consists of approximately 4,403 farms averaging 107 acres per farm. In 2005 the area produced $379 million in farm products sold and total farm earnings of more than $125 million. Agriculture in the Allatoona Project watershed and basin consists primarily of livestock, which accounts for a little less than 92 percent of the value of farm products sold. Livestock production consists primarily of poultry operations in the counties in the immediate vicinity of the project. Livestock operations consist predominately of beef cattle in 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 Allatoona Project watershed and basin are shown in Table 4-17.

Table 4-17. Farm Earnings and Agricultural Production

County	2005 Farm Earnings ($1,000)	Number of Farms	Total Farm Acres (1,000)	Acres Per Farm	Value of Farm Products Sold ($1,000)	Percent Crops	From Livestock
Georgia							
Bartow	9,983	586	82	139	49,000	15.1	84.9
Carroll	35,700	975	94	97	106,000	4.6	95.4
Cherokee	20,321	606	36	60	51,000	10.7	89.3
Dawson	11,500	222	20	91	40,000	2.5	97.5
Floyd	8,416	663	91	138	29,000	7.9	92.1
Haralson	5,391	332	40	120	19,000	3.4	96.6
Paulding	25	265	17	63	14,000	20.5	79.5
Polk	6,296	428	52	122	19,000	5.6	94.4
Alabama							
Cleburne	27,633	326	44	136	52,000	2.6	97.4

*US Census Bureau, City and County Data Books, 2007

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 Allatoona Lake project area counties contained 679 manufacturing establishments that provided 38,400 jobs with total earnings of more than $2.1 billion. Additionally, the value added by the area manufactures was more than $3.7 billion. Table 4-18 contains information on the manufacturing activity for each of the counties in the Allatoona Project watershed and basin.

d. Flood Damages. Allatoona Lake provides flood damage protection for existing development in along the Etowah and Coosa River Floodplain. The floodplain below Allatoona Lake consists of 1,132 residential structures, nine public structures, and 189 commercial structures totaling over $280 million in value. The tax assessor appraised values of residential structures and contents total about $65.8 million, public structures more than $847 thousand, and commercial structures over $213 million. The values for each category of structures in the upper area of the ACT River Floodplain below Allatoona Lake are shown in Table 4-19.

Table 4-18. Manufacturing Activity

County	No. of Manufacturing Establishments	Total Manufacturing Employees	Total Earnings ($1,000)	Value Added by Manufactures ($1,000)
Georgia				
Bartow	119	8,435	490,437	1,421,853
Carroll	123	7,616	518,749	738,564
Cherokee	167	4,846	199,411	267,277
Dawson	21	687	39,212	55,509
Floyd	119	9,484	585,524	735,657
Haralson	33	1,939	88,086	145,833
Paulding	48	1,186	50,778	93,799
Polk	37	3,292	144,540	258,971
Alabama				
Cleburne	12	915	37,185	60,310

*US Census Bureau, City and County Data Books, 2007

Table 4-19. Allatoona Lake Floodplain Value Data

	Structure ($)	Content ($)	Inventory ($)	Equipment ($)
Residential	65,804,000	29,149,000	-	-
Public	847,000	-	169,000	741,000
Commercial	213,691,000	-	25,066,000	54,389,000
Total	**280,342,000**	**29,149,000**	**25,235,000**	**55,130,000**

The Corps' Water Management Office has developed an Annual Damage Reduction Summary that estimates the flood damages prevented by the Allatoona Lake flood reduction project in the ACT Basin. Table 4-20 shows the Allatoona Project flood damages prevented by year from 1986 through 2009.

Table 4-20. Flood Damages prevented Allatoona Lake

Year	Allatoona Dam
1986	$0
1987	$2,626,000
1988	$0
1989	$0
1990	$14,620,100
1991	$0
1992	$142,580
1993	$0
1994	$0
1995	$433,046
1996	$33,200
1997	$0
1998	$628,127
1999	$0
2000	$0
2001	$0
2002	$0
2003	$21,706,008
2004	$11,002,375
2005	$20,033,559
2006	$0
2007	$0
2008	$0
2009	$32,666,192
2010	$20,974,000
2011	$18,355,000

*All Dollar Values are in CY 2011

V - DATA COLLECTION AND COMMUNICATION NETWORKS

5-01. Hydrometeorological Stations.

a. Facilities. Management of water resources requires continuous, real-time knowledge of hydrologic conditions. The Mobile District contracts out the majority of basin data collection and maintenance to the USGS and National Weather Service (NWS) through cooperative stream gaging and precipitation network programs. The USGS, in cooperation with other federal and state agencies, maintains a network of real-time gaging stations throughout the 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 VI related to hydrologic forecasting.

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

Figure 5-1. Encoder with wheel tape for measuring the river stage or lake elevation in the stilling well

Figure 5-2. Typical field installation of a precipitation gage

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. Corps personnel also maintain precipitation gages at project locations over 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 30 stations listed in Table 5-1 and shown on Plate 2-2 are considered the rainfall reporting network for the Allatoona Dam project. Because Allatoona Dam regulates flood flows to downstream locations, the reporting network extends to Rome, Georgia. Allatoona Dam regulation of peak flows does not affect areas below Weiss Dam on the Coosa River but does reduce flood inflows to that project.

Table 5-1. Rainfall Reporting Network (above Rome, Georgia)

Station	Latitude		Longitude		Elevation	Operating Agency	Agency ID	Type*
	Degrees	Minutes	Degrees	Minutes	NGVD			
Etowah River Basin								
Cleveland	34	36	83	46	1570	NWS	92006	Non-Recording
Dahlonega	34	32	83	59	1430	NWS	92475	Non-Recording
Amicacola	34	33	84	15	1350	COE	AMIG1	Recording
Wahsega	34	38	84	5	1600	COE	WAHG1	Recording
Mountaintown	34	46	84	32	1520	COE	MTNG1	Recording
Dawsonville	34	25	84	7	1370	NWS	92578	Recording
Jasper 1 NNW	34	29	84	27	1465	NWS	94648	Non Recording
Ball Ground	34	21	84	23	1175	NWS	90603	Non Recording
Waleska	34	19	84	33	1100	NWS	99077	Non Recording
Canton	34	14	84	30	870	COE	CTNG1	Recording
Woodstock	34	7	84	31	1055	NWS	99524	Non Recording
Allatoona Dam	34	9	84	43	832	COE	CVLG1	Recording
Allatoona Dam 2	34	10	84	44	975	NWS	90181	Non Recording
Carters Dam	34	36	84	40	852	COE	CTRG1	Recording
Cartersville #2	34	10	84	47	730	NWS	91670	Non Recording
Dallas 7NE	33	59	84	45	1100	NWS	92485	Recording
Taylorsville	34	5	84	59	710	NWS	98600	Non Recording
Kingston	34	14	84	56	720	NWS	94854	Non Recording
Oostanaula River Basin								
Dalton	34	46	84	57	720	NWS	92493	Non Recording
Chatsworth 2	34	46	84	47	765	NWS	91863	Recording
Ellijay	34	42	84	29	1300	NWS	93115	Non Recording
Carters 1 WSW	34	33	84	42	740	NWS	91657	Non Recording
Fairmont	34	26	84	42	735	NWS	93295	Non Recording
Resaca	34	34	84	57	650	NWS	97430	Non Recording
Adairsville 5 SE	34	21	84	56	720	NWS	90044	Non Recording
Curryville 3W	34	27	85	6	650	NWS	92429	Non Recording
Rome WSO Arpt	34	21	85	10	637	NWS	93801	Recording
Rome	34	15	85	10	610	NWS	97600	Non Recording
Coosa River Basin								
Summerville	34	29	85	22	780	NWS	98436	Non Recording
Lafayette 4SSSW	34	38	85	18	890	NWS	94941	Recording
Cedartown	34	1	85	15	785	NWS	91732	Recording

***The "type" of gage indicates if rainfall is collected and transmitted electronically (recording) or read by a human observer and transmitted by that observer to the appropriate agency (non-recording).**

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 Allatoona and Carters Dams. The locations of river stage stations are shown on Plate 2-2.

Table 5-2. River Stage Reporting Network (above Rome, Georgia)

River Stage Reporting Network above Rome, Georgia					
Stream	**Station**	**River Mile above Rome**	**Drainage Area Sq. Mi**	**Datum Elev NGVD29**	**Flood Stage**
Etowah River					
Etowah	Dawsonville	129.17	107	1,050	
Etowah	Canton	77.8	613	844.55	16
Etowah	Allatoona (Pool)	47.8	1,119	686.92	
Etowah	Allatoona (TW)	47.73	1,122	0	
Etowah	Allatoona	47	1,120	686.92	
Etowah	Cartersville	38.22	1,330	650.81	
Etowah	Euharlee	30.54	1,598	638.15	
Etowah	Kingston	21.4	1,630	609.97	
Two Run Creek	Kingston	NA	33.1	723.1	
Etowah	Rome (SRR)	1.8	1,810	561.7	
Etowah	Rome (2nd Ave)	0.9	1,819	561.7	
Oostanaula River					
Coosawattee	Ellijay	93.3	236	1,216.04	
Coosawattee	Carters (Pool)	73.75	374	0.05 NAVD88	
Coosawattee	Carters (TW)	73.55	374	0	
Talking Rock Creek	Hinton	NA	119	890	
Coosawattee	Carters Rereg	72.25	520	0	
Coosawattee	Carters (411)	71.86	521	650.67	
Coosawattee	Pine Chapel	53.55	831	616.16	
Conasauga	Eton	89.62	252	672.64	
Holly Creek	Chatsworth	NA	64	689.25	
Conasauga	Tilton	59.09	682	622.28	
Oostanaula	Resaca	43.16	1,600	604.14	22
Oostanaula	Rome	0.5	2,115	561.7	
Oostanaula	Rome (5th AVE)	0.35	2,150	561.7	25

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.

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

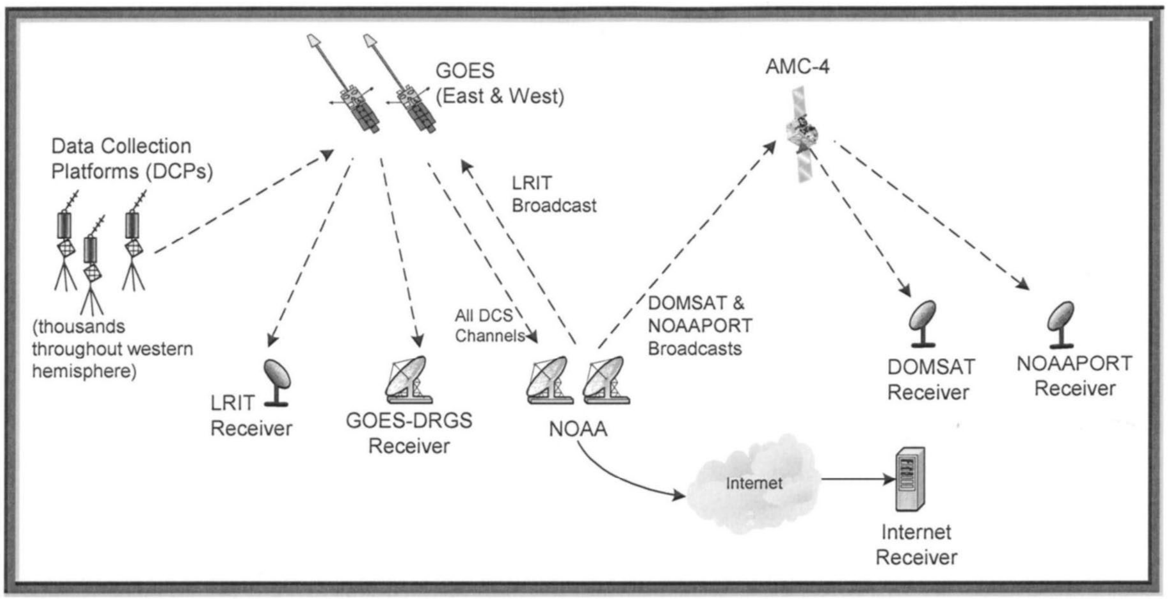

Figure 5-3. Typical configuration of the GOES System

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.

The power plant at Allatoona Dam is operated remotely from the control room at the Carters Dam powerhouse via a microwave link between the two projects. The remote system also produces visual observations of the project. Data from Allatoona Dam are automatically collected at the project and transmitted through the project's SCADA system and the Internet to Carters Dam and the Mobile District. Telephone is an option for other communications. Data for the project and the DCPs are downloaded both daily and hourly through the Corps' server network to the Water Management Section.

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 FC-13 precipitation network. The Corps maintains a few gages and the communications systems between the projects and the Mobile District. For Corps-maintained facilities in the ACT, gages are typically visited six to eight times per year to validate stage, flow, and accuracy of gage equipment.

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

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

USGS Georgia Water Science Center, 3039 Amwiler Road, Suite 130, Atlanta, GA 30022-5803
Phone: (770) 903-9100 Web: http://ga.water.usgs.gov

USGS Alabama Water Science Center, 75 Technacenter Drive, Montgomery, AL 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. The Corps' local ranger staff maintains a water quality monitoring station at Riverside Park. The water quality parameters monitored are dissolved oxygen, temperature, pH, and conductivity. The data are not reported in real-time; the project staff collects the data and periodically reports the data to the Mobile District Office.

There are also 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. In order to provide an adequate surveillance of sedimentation, a network of sediment ranges were established for Allatoona Lake. 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 2-4. In order to monitor degradation and gradation of the Etowah River below Allatoona Dam, a network of tailwater ranges were established before operations began. Sedimentation and retrogression surveys were conducted in 1956, with resurveys conducted on a periodic basis. The first resurvey (using the same cross-section locations) was made in 1960 and showed no large deposits in the principal reservoir. Although the June 1960 study of the tailwater ranges concluded the channel below the dam to be fairly stable, some isolated areas of bank caving were noted.

Sediment surveys were conducted in 2010. 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 Allatoona Dam and Lake". 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 (sq-ft) divided by the height of shore erosion zone (ft). 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 classes as "Acute," the middle 50 percent in bank retreat were classes as "Moderate," and the 25 percent with the least bank retreat were classified as "Slight." Shorelines in the depositional group were classes as "Deposition."

Analysis revealed that sedimentation within the channel is classified as heavy in the head and mid-upper sections of tributaries, specifically those with urban areas upstream. Tributaries with forested contributing areas, such as Clear Creek, had little or no sedimentation within the channel. Sedimentation occurred with the channel at the head and mid-upper sections because the river velocity slows upon entering the pool, and the sediment is removed from suspension. Sediment deposition also tended to be heavier in sections where the lake channel widens, slowing the velocity and allowing additional sediment to be removed from suspension. Most sediment is removed from suspension in the tributaries; therefore little to no sedimentation occurs in the downstream ranges in the main pool, as seen in the downstream ranges on the Etowah River and Allatoona Creek. Overall, sediment deposition was heaviest in the Little River and upper Etowah River due to the large sediment loads both rivers carry.

Erosion along the summer pool shoreline was pervasive in Allatoona Lake and typically occurred in the downstream sections of tributaries and the main rivers. Acute erosion was typically seen in the main body of Allatoona Lake and at the mouth of tributaries to the lake. This was potentially caused by increased boat traffic in the main body. Erosion also appeared to be more sever when the shoreline slope was greater. At these steep slopes, mass wasting of the bank appeared to be the main cause of shoreline erosion. The site visit indicated that some shorelines, specifically those with slight to moderate erosion, were fairly stable. These shorelines often exhibited lower slopes or exposed bedrock. Shorelines with lower slope allowed for greater wave dissipation, preventing wave erosion, and were also less prone to mass wasting. At shorelines with exposed bedrock, the unconsolidated material had been eroded, likely immediately after Allatoona Lake was constructed, but the shorelines appeared to have stabilized due to the presence of the hard rock or saprolitic material.

Shoreline deposition typically occurred in the heads of tributaries at the summer pool level, and at the heads of mid section of tributaries at the winter pool level. Deposition appeared to be more severe in tributaries with upstream urban areas.

5-04. Recording Hydrologic Data. The Water Control Data Support System (WCDSS) is an integrated system of computer hardware and software packages readily usable by water managers and operators as an aid for making and implementing decisions. An effective decision support system requires efficient data input, storage, retrieval, and capable information processing. Corps-wide standard software and database structure are used for real-time water control. Time series hydrometeorological data are stored and retrieved using Hydrologic Engineering Center (HEC) Data Storage System (DSS) databases and programs.

To provide the data needed to support proper analysis, a DOMSAT Receive Station (DRS) is used to retrieve DCP data from gages throughout the ACT Basin. The DRS equipment and software then receives the DOMSAT data stream, decodes the DCPs of interest and reformats the data for direct ingest into a HEC-DSS database.

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, NEXRAD radar rainfall, graphical weather maps and more. Likewise, a direct link to USGS gages in the field allows for direct downloading of USGS data to Corps databases.

5-05. Communication Network. The global network of the Corps consists of 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 servers and the LRGS each have individual UPS (uninterruptable power supply) 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.

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

Emergency communication is available at the following numbers:

Water Management Section	251-690-2737
Chief of Water Management	251-690-2730 or 251-509-5368 (cell)
Carters Powerhouse*	706-334-2906
Allatoona Resource Office	678-721-6700

* Allatoona Dam is operated remotely from Carters Dam

5-06. Communication with Project Office.

a. <u>Regulating Office With Project Office</u>. The Water Management Section is the regulating office for the Corps' projects in the ACT Basin. Daily routine communication between the Water Management Section and project offices occur thru electronic mail, telephone, and facsimile. Daily hydropower generation schedules are issued by SEPA. During normal conditions on weekends, hydropower generation schedules can be sent out on Friday to cover the weekend period of project regulation, but it can change if deemed appropriate. If loss of network communications occurs, orders can be given via telephone.

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

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

5-07. Project Reporting Instructions. In addition to automated data, project operators maintain record logs of gate position, water elevation, and other relevant hydrological information including inflow and discharge. That information is stored and available to the Water Management Section through the Corps' network. 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 gauge readings each week, in accordance with *Standard Operating Procedure, Weekly Verification of Gauge Readings, Mobile District Power Projects* dated 19 February 2008, and CESAD SOP 1130-2-6 dated 21 July 2006. Those procedures require that powerhouse operators check the accuracy of pool monitoring equipment by verifying readings of the equipment against gage readings at each plant. That information is logged into the Official Log 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 e-mail notification will include findings of the verification.

Project personnel or the Hydropower Section within the Operations Division or both are responsible for requesting any scheduled System hydropower unit outages in excess of two hours. The Water Management Section out-of-service times are reported back to the Water Management Section on 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. In such cases, minimum flow requirements can be met through spill.

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 Allatoona Project, the operator on duty should notify the Water Management Section, Operations Division and the Operations Project Manager at the project. A coordinated effort among those offices and the District's Emergency Management Office will develop notifications to make available to 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 most fully use the water resources potential of each project with 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 Allatoona and Carters Projects. 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.

VI - HYDROLOGIC FORECASTS

6-01. General. Reservoir operations for Allatoona Dam are scheduled by the Water Management Section in accordance with forecasts of reservoir inflow and river stages. Operations at Carters Dam are coordinated with Allatoona Dam 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 has a strong reliance on other federal agencies such as the NWS and the USGS to help maintain accurate data and forecast products to aid in making the most prudent water management decisions. The regulation of multipurpose projects requires scheduling releases and storage on the basis of both observed and forecasted hydrologic events throughout the basin. 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 enhance revenue returned to the Federal Government. 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 the Corps. 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. The Water Management Section then develops forecasts that are to meet the regulation objectives of regulating the ACT projects. 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.

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 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.

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). 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 what if scenario.

b. Methods. In determining the expected inflow into the Allatoona Lake, it is necessary to forecast the flows of the Etowah River above Allatoona 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, the affected county emergency management officials, and the public can obtain this vital information in a timely fashion. When hydrologic conditions exist so that all or portions of the 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 storm water that has accumulated from significant rainfall events must be evacuated following the event and as downstream conditions permit to provide effective flood risk management. Flood risk management carries the highest priority during significant runoff events that pose a threat to human health and safety. The accumulation and evacuation of storage for the authorized purpose of flood risk management is accomplished in a manner that will prevent, insofar as possible, flows exceeding those which will cause flood damage downstream. During periods of significant basin flooding, the frequency of contacts between the 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.

Allatoona is located 48 river miles above the primary damage point at Rome, Georgia. The forecasting procedure requires routing Allatoona releases and adding the local runoff at Rome, 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 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.

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Table 6-1. 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
Wet condition	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
	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
Normal condition	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
	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
Dry condition	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
	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 6-2. Unit Hydrographs in Etowah River Basin

6-hour unit hydrographs in Etowah River basin				
	Allatoona	Cartersville	Kingston	Rome
Area between gages (square miles)	1,122	230	290	180
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			

c. Downstream Forecasts. Table 6-3 gives estimates of the time for releases from Allatoona Dam to reach downstream locations, and the increased flow over time. This table can be used to maximize use of the power plant during flood event without causing additional damages.

In addition to locations below Allatoona Dam, it is important to know conditions in the Oostanaula River Basin. Table 6-4 presents unit hydrographs for Carters Dam, Carters Reregulation Dam, Redbud, Tilton, Resaca, and flows from the Oostanaula 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. Flood waters stored at Carters are not released until after the stage at Rome has receded to below flood stage, unless induced surcharge operations are required at Carters.

Table 6-3. Effect of Allatoona Power Releases at Downstream Locations

Effect of Allatoona power releases at downstream locations Cartersville, and Rome, Georgia								
Release rate at dam in cfs		2000	4000	6000	7000	8000	8500	8900
Number of hours units are running	Hours since releases began to reach peak	Increase in flow						
At Cartersville, river begins to rise two hours after releases start								
1	4	800	1440	2040	2380	2720	2810	2940
2	4.5	1400	2560	3540	4200	4960	5360	5610
3	5	1680	3200	4620	5530	6480	6800	7120
4	6	1960	3680	5340	6230	7120	7570	7920
5	7	2000	3880	5700	6650	7600	8080	8280
6	8		4000	5880	6830	7760	8250	8630
7	9			6000	6930	7920	8420	8810
8	10				7000	8000	8500	8900
At Kingston, river begins to rise seven hours after releases start								
1	9	520	960	1320	1540	1760	1870	1960
2	10	940	1760	2460	2870	3360	3570	3740
3	11	1240	2320	3300	3850	4480	4760	4980
4	12	1420	2720	3900	4550	5200	5530	5790
5	13	1580	3040	4380	5110	5840	6210	6500
6	14	1700	3280	4740	5460	6160	6550	6850
7	15	1960	3680	4980	5770	6560	6970	7300
8	16	2000	3880	5160	6020	6880	7310	7650
9	17		4000	5640	6720	7840	8330	8720
10	18			6000	6970	7920	8420	8810
11	19				7000	8000	8500	9000
At Rome, river begins to rise 12 hours after releases start								
1	14	300	460	670	770	880	940	980
2	15	550	900	1320	1510	1720	1830	1900
3	16	780	1300	1920	2230	2540	2700	2830
4	17	980	1720	2520	2910	3320	3530	3690
5	18	1160	2080	3050	3500	4010	4250	4450
6	19	1320	2400	3510	4050	4630	4920	5150
7	20	1460	2680	3900	4590	5240	5570	5830
8	21	1580	2940	4280	5030	5740	6100	6390
9	22	1760	3350	4880	5670	6490	6890	7210
10	23	1880	3630	5300	6150	7020	7460	7810
11	24	1950	3820	5620	6510	7460	7910	8280
12	25	1980	3940	5840	6780	7740	8230	8620
13	26	2000	3980	5960	6920	7900	8400	8790
14	27		4000	6000	7000	7980	8480	8880
15	28					8000	8500	8900

Table 6-4. 6-hour Unit Hydrographs in Etowah River Basin

6-hour unit hydrographs in Etowah River Basin						
	Coosawattee River			Conasauga - Oostanaula Rivers		
	Carters Main Dam	Carters Reregulation Dam	Redbud	Tilton	Resaca	Rome
Area between gages (square miles)	374	154	335	682	72	510
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		

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

a. Requirements. The ACT projects are typically regulated for normal or below normal runoff conditions. Therefore, the majority of the forecasting and runoff modeling simulation is for conservation regulation decisions. Conservation requirements are the same as for flood conditions with the additional emphasis to ensure the minimum flow requirement of 240 cfs is maintained from the project.

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.

a. Requirements. The Corps utilizes available information from the NWS to develop long-range forecasts to aid in the operation of the system and for planning studies. These long-range forecasts vary from the five-week forecast to six-month forecasts.

b. Methods. During normal conditions, the current long-range outlook produced by the Corps is a five-week forecast. For normal operating conditions, a forecast longer than this incorporates a greater level of uncertainty and reliability. In extreme conditions, three-month and six-month forecasts can be produced based on 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 reservoir projects.

6-05. Drought Forecast.

a. Requirements. ER 1110-2-1941, Drought Contingency Plans, dated 15 September 1981, 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 drought reference. However, the index requires detailed data and cannot reflect an operation of a reservoir system. The Alabama Office of State Climatologist also produces a Lawn and Garden Index which gives a basin-wide ability to determine the extent and severity of drought. The runoff forecasts developed for both short and long-range time periods reflect drought conditions when appropriate. There is also a heavy reliance on latest ENSO (El Niño/La Niña-Southern Oscillation) forecast modeling to represent the potential impacts of La Nina on drought conditions and spring inflows. Long-range models are used with greater frequency during drought conditions to forecast potential impacts to reservoir elevations, ability to meet minimum flows, and water supply availability. A long-term, numerical model, Extended Streamflow Prediction developed by the NWS, provides probabilistic forecasts of streamflow on the basis of climatic, streamflow, and soil moisture. Extended Streamflow Prediction results are used in projecting possible future drought conditions. Other parameters and models can indicate a lack of rainfall and runoff and the degree of severity and continuance of a drought. Models using data of previous droughts or a percent of current to mean monthly flows with several operational schemes have proven helpful in planning. Other parameters are the ability of Allatoona Lake to meet the demands placed on its storage, the probability that Allatoona Lake pool elevation will return to normal seasonal levels, the conditions at other basin impoundments, basin streamflows, basin groundwater table levels, and the total available storage to meet hydropower marketing system demands.

c. Reference Documents. The drought contingency plan for the Allatoona Project is summarized in Section 7-12 below. The complete ACT Drought Contingency Plan is provided in the *Master Water Control Manual for the ACT River Basin, Exhibit C*.

VII - WATER CONTROL PLAN

7-01. General Objectives. The Congressionally authorized purposes for the Allatoona Project as specified in the original project authorizing documents are flood risk management, hydropower, and navigation. Several other project purposes have been authorized at Allatoona through nationwide authorizing legislation. Those purposes are water quality, recreation, conservation of threatened and endangered species, fish and wildlife enhancement, and water supply. The regulation plan seeks to balance the needs of all project purposes at the Allatoona 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.

7-02. Constraints. Physical constraints of the project are generally limited to available powerhouse capacity, sluice capacity, and downstream channel capacity. As the project approaches the bottom of conservation pool, the powerhouse turbines can no longer effectively run and discharge will be limited to sluice operation. Allatoona Dam has a minimum flow requirement of 240 cfs immediately downstream of the dam for water quality purposes. That flow is met with the small hydropower unit that is operated 24 hours a day. If the small unit is out of service, a spillway gate or sluice gate will be opened or one of the main hydropower units will be operated to meet minimum flow requirements.

7-03. Overall Plan for Water Control.

a. General Regulation. The water control operations of Allatoona Dam are in accordance with the regulation schedule as outlined in the following paragraphs. The Corps operates the Allatoona Dam and Lake to provide for the authorized project purposes of the project. All authorized project purposes are considered when making water control regulation decisions, and those decisions affect how water is stored and released from the project. Deviations from the prescribed instructions, which can occur due to planned or unplanned events as described in section 7-15, will be at the direction of the 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.

b. Conservation Pool. Allatoona Lake's conservation storage pool was designed to provide the necessary capacity to store water for subsequent use to meet the multiple conservation purposes for which the project was constructed. The top of conservation pool elevation is the reservoir's normal maximum operating level for conservation storage purposes. If the elevation is higher than the conservation limit, the reservoir level is in the flood pool. The conservation pool is regulated between a minimum elevation of 800 feet NGVD29 and a seasonal variable top-of-conservation pool ranging between elevations 823 to 840 feet NGVD29. The top-of-conservation pool guide curve and minimum conservation pool are shown in Plate 7-1 along with other operating action zones. The flood risk management plan drawdown to elevation 823 feet NGVD29 in advance of flood season provides 467,278 acre-feet (elevation 823 to 860 feet NGVD29) of flood risk management storage.

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 Allatoona does not prioritize any project function but seeks to balance all project authorized purposes. Howerver, during a flood event, flood damage reduction does clearly govern the operation of Allatoona. A seasonal conservation pool regulation guide curve and conservation storage action zones have been developed to guide the water control management decisions in meeting the balanced strategy. Table 7-1 provides key elevations of the top of conservation pool and action zones. Area Capacity Curves for the Allatoona reservoir, which indicate the amount of storage and the surface area of the reservoir for the complete range of possible pool elevations, are shown on Plate 2-5.

1) A regulation guide curve for Allatoona Lake has been prescribed to facilitate the water control regulation of the project. The guide curve defines the seasonal top of conservation storage water surface elevation. 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 during the spring refill period. The top of conservation elevation from 1 May to 5 Sep is 840-feet NGVD29; transitions to elevation 835 feet NGVD29 by 1 Oct; is elevation 835 feet NGVD29 through 15 November; drawn down to elevation 823 feet NGVD29 by 31 Dec for additional flood storage; and begins the refill period 16 Jan.

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. The actions zones at Allatoona provide water control regulation guidance to meet this water conservation plan while balancing the use of available conservation storage to meet the project purposes. These zones are used as a general guide to the hydropower peaking generation available from the Allatoona project to help meet system hydropower commitments. Table 7-2 shows the typical peak generation hours available for each zone. The following provides a general description of each zone.

Zone 1: While Allatoona is in Zone 1, the project conditions are likely to be normal to wetter than normal during the late summer and fall months. Most likely, other projects in the basin and within the federal hydropower system will be in similar condition. Full consideration will be given to meeting hydropower demand by typically providing up to four hours of peak generation. Peak generation could exceed four hours based on various factors or activities, such as, maintenance and repair of turbines; emergency situations such as a drowning or chemical spill; draw-downs because of shoreline maintenance; drought operations; increased or decreased hydropower demand; and other circumstances.

Zone 2: While in Zone 2, a reduced amount of peaking generation will be provided to meet system hydropower demand. The typical peak generation schedule will provide up to three hours of peak generation. Peak generation could exceed three hours based on various factors or activities, such as, maintenance and repair of turbines; emergency situations such as a drowning or chemical spill; draw-downs because of shoreline maintenance; drought operations; increased or decreased hydropower demand; and other circumstances.

Zone 3: Zone 3 will typically indicate drier than normal conditions or impending 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 3. While in Zone 3 during the months of Jan-Apr, a reduced amount of peaking generation will be provided to meet system hydropower demand while making water control regulation decisions to ensure refilling the reservoir to elevation 840 feet NGVD29 by 1 May. Should drier than normal hydrologic conditions exist or persist, the reduced peak generation will continue until the reservoir level rises to a higher action zone. The typical peak generation schedule will provide up to two hours of peak generation. Peak generation could exceed two hours based on various factors or activities, such as, maintenance and repair of turbines; emergency situations such as a drowning or chemical spill; draw-downs because of shoreline maintenance; drought operations; increased or decreased hydropower demand; and other circumstances.

Zone 4: Reservoir elevations in Zone 4 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 4. Peak generation will typically be suspended. Continuous operation of the small unit will continue in order to maintain the 240 cfs minimum flow release.

Table 7-1. Top of Conservation and Action Zone Elevations, Allatoona Lake

Date	Elevation (feet NGVD29)			
	Top of Zone 1	Top of Zone 2	Top of Zone 3	Top of Zone 4
1 Jan	823.00	823.00	823.00	818.00
16 Jan	823.00	823.00	823.00	818.00
1 Feb	825.59	825.59	825.59	818.00
1 Mar	830.29	830.29	830.29	824.00
30 Apr	840.00	840.00	840.00	831.83
1 Jun	840.00	840.00	838.49	836.00
1 Jul	840.00	840.00	837.02	828.00
1 Sep	840.00	835.34	834.00	824.29
5 Sep	840.00	835.04	833.58	824.05
1 Oct	835.00	833.09	830.86	822.49
15 Nov	835.00	829.71	826.14	819.80
15 Dec	827.17	823.00	823.00	818.00
31 Dec	823.00	823.00	823.00	818.00

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

Action zone	Allatoona (hours of operation)
Zone 1	up to 4
Zone 2	up to 3
Zone 3	up to 2
Zone 4	0

7-04. Standing Instructions to Damtender. During normal operations, the powerhouse operators will operate the Allatoona Project in accordance with the daily hydropower schedule. Any deviation from the schedule must come through the Water Management Section. Normally, flood control 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. The prime objective of flood risk management is to retain flood waters in Allatoona when the Rome, Georgia, stage is above the flood stage of 25 feet at the USGS “Oostanaula River Near Rome, GA” (gage # 02388500), and to release stored waters without causing or unduly prolonging downstream flood damages, and to manage the release/storage options to minimize flooding whether actions are prior to an event or after an event while utilizing all available information.

The basic plan for flood risk management is defined by flood action zones within the flood risk management storage of the pool similar to how the conservation storage is defined by action zones to guide operations. Figure 7-1 provides guidance for initiating induced surcharge releases and Table 7-4 describes the operating procedures. The induced surcharge schedule is implemented whenever it is apparent that 100 percent of the flood risk management storage will be used. The induced surcharge operation is a rationale operation which protects the structural integrity of the dam while providing reasonable downstream flood protection. There are five flood actions zones defined above the top of the conservation storage identified as zones A through E. These action zones are shown on Plate 7-2. Table 7-3 contains a detailed description of the flood risk management regulations based on the action zones when above the top of conservation.

When the reservoir is in the lowest flood zone, (Zone A), releases can be controlled to the minimum flow needed from the small unit. As the reservoir rises to higher flood zones, flood risk management may diminish depending on inflow forecasts. For the larger floods, induced surcharge releases may be required.

Releases are scheduled based on the Allatoona pool level and stages at Rome, Georgia. Usually this provides optimum protection for Cartersville and Kingston, Georgia, and the upper Coosa River. If conditions dictate, other restraints may influence releases.

During the rising phase of a flood, normal power operation as a peaking plant will be permitted unless predictions indicate that the power releases added to the uncontrolled area runoff will cause or aggravate damaging flood stages along the lower Etowah River and at Rome, Georgia. Runoff is retained in the flood storage space when releases are restricted to prevent flooding downstream. When the flood is receding downstream, the water in flood storage will be released in accordance with the rules in Table 7-3 and on Plate 7-2 without exceeding the bankfull capacity downstream. There may be minor alterations to the evacuation rules when the pool approaches the top of conservation pool in order to permit realistic scheduling of power generation. This scheduling of power releases is on a weekly basis and is reviewed each day. Often daily changes are necessary when the downstream flow is near bankfull capacity or weather conditions are unstable.

Table 7-3. Flood Regulations above Top of Conservation

Flood Regulations Above Top of Conservation Pool

Flood Zone E (highest) - Only minimum continuous release will ordinarily be made while Rome stage is above or expected to rise above 27 feet. However, if inflows are predicted to exceed flood control space before Rome has crested, then powerhouse releases which are less than inflow will be made until either the stage at Rome has peaked or until greater (surcharge) releases are required (Figure 7-1 and Plate 7-3). Assuming that surcharge releases do not govern, after Rome has crested, peaking power will be made if the releases do not reverse the falling trend at Rome. Increasing releases will be made as the stage at Rome drops below 27 feet. Releases of channel capacity (about 9,500 cfs) will be made whenever such a release does not reverse the falling trend at Rome. Surcharge Releases: Infrequently inflows into Allatoona will be of such magnitude that the stage at Rome does not govern the operation of Allatoona but rather the structural stability of the dam will govern. Whenever this happens, surcharge releases will be made. Figure 7-1 shows the relationship of the last 3-hour Allatoona inflow and the current pool elevation and also indicates the required release strategy. If a surcharge release is required then Plate 7-3 defines the required release (see also para. 7-05.a. and Table 7-4). This surcharge requirement is pertinent in Zones B, C, D, and E as a function of pool elevation and last 3-hour inflow.

Flood Zone D - Only minimum continuous release will ordinarily be made while Rome stage is above or expected to rise above 27 feet. However, if inflows are predicted to exceed flood control space before Rome has crested, powerhouse releases which are less than inflow may be made until either the stage at Rome has peaked or greater (surcharge) releases are required (see Flood Zone E). Once Rome has fallen below 27 feet, up to full channel capacity (about 9,500 cfs) will be discharged. The release of powerhouse capabilities (about 6,500 cfs) may follow if consideration of downstream conditions and expected weather conditions make this prudent.

Flood Zone C - Only minimum continuous release will ordinarily be made while Rome stage is above or expected to rise above 27 feet. However, if inflows are predicted to exceed flood control space before Rome has crested, powerhouse releases which are less than inflow may be made until either the stage at Rome has peaked or greater (surcharge) releases are required (see Flood Zone E). After Rome has receded below 25 feet, releases will be up to channel capacity (about 9,500 cfs). Generally, releases will be at turbine capacity (about 6,500 cfs). Scheduled peak power releases of less than 6,500 dsf/day may be used if the scheduled releases sufficiently lower the pool in light of expected weather conditions.

Flood Zone B - Only minimum continuous release will ordinarily be made while Rome stage is above or expected to rise above 25 feet. However, if inflows are predicted to exceed flood control space before Rome has crested, powerhouse releases which are less than inflow and do not violate the Rome 25 foot stage may be made until either the stage at Rome has peaked or greater (surcharge) releases are required (see Flood Zone E) to protect the structure. Floodwaters will be evacuated by regular scheduled hydropower releases which do not violate bankfull flows. Normally, the schedule will be to remove the floodwater within two weeks. A faster evacuation may be scheduled if additional rainfall is expected in the next several days.

Flood Zone A (lowest) - Only minimum continuous release will ordinarily be made while Rome stage is above or expected to rise above 25 feet. This zone has the least urgency for being evacuated. It is allowable to take several weeks to evacuate zone A. The pool is allowed to rise to elevation 842 feet NGVD29 in the summer weekends without releases above the minimum 240 cfs. During dry periods, water may be retained indefinitely in zone A as a precaution for possible droughts.

a. Induced Surcharge Operations. If current pool levels and inflow rates indicate that runoff from a storm will appreciably exceed the storage capacity remaining below elevation 860 feet NGVD29; the flood risk management operation will be directed by the induced surcharge curves shown on Plate 7-3. Figure 7-1 provides guidance for initiating induced surcharge releases and Table 7-4 describes the operating procedures. This schedule follows the objectives set forth in EM 1110-2-3600 as follows:

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

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

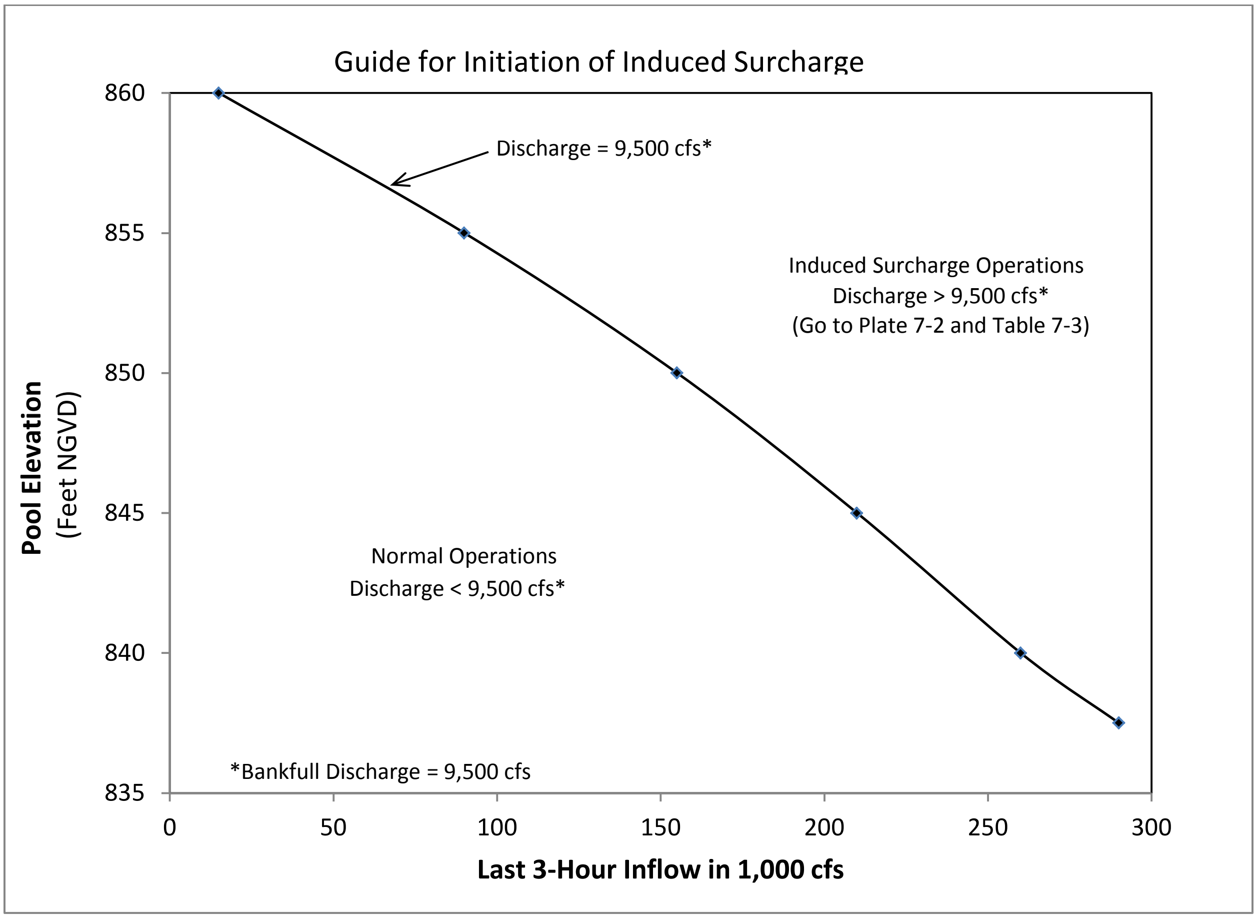

Figure 7-1. Guide for Initiation of Induced Surcharge

Table 7-4. Induced Surcharge Operating Instructions

(1) Follow regular flood risk management regulation schedule until larger releases are required by this schedule.

(2) Adjust the outflow each hour on the basis of the average inflow for the preceding 3 hours and the current reservoir elevations indicated by the curves. The 3-hour inflow may be increased if the forecasted inflows increase appreciably and would cause a flood wave downstream due to much higher releases in the next hour. When pool rises to 859.5 feet NGVD29, pass the inflow up to 9,500 cfs (channel capacity), unless larger releases are required by the surcharge schedule. Do not decrease gate settings as long as pool is rising.

(3) After the reservoir elevation starts to fall, maintain the current gate opening until the pool level recedes to elevation 859.5 feet NGVD29, then pass inflow or release at the maximum allowable rate under the regular flood risk management regulation schedule, whichever is greater. Normal operations should be followed once the inflow drops below 9,500 cfs.

(4) Discharge may be made through turbines and/or spillway. The two large turbines release a combined discharge of 6,500 cfs.

A lower outflow can be released in the earlier stages of the flood event if there is a possibility that the flood wave would create a hazard downstream; however, a release up to channel capacity of 9,500 cfs would be feasible before the actual use of the induced surcharge curve if weather and flow conditions indicate a need to postpone the rapid increase of discharge shown in the induced surcharge curve.

The gate operating machinery is provided with limit switches which will open gates in 0.5 foot increments up to a 12-foot opening. In following the induced surcharge schedule, the gates will be opened as uniformly as practicable with no gate opening more than 0.5 foot larger than any other gate opening.

An example of induced surcharge operations is the routing of the spillway design flood through the reservoir. This is shown on Plate 7-4. The maximum pool elevation is 872.1 feet NGVD29 as compared with 870.2 feet NGVD29 for the original induced surcharge plan and 868.4 feet NGVD29 for the constant pool operating plan. Special considerations of spillway gate openings after a probable maximum flood (PMF) are based upon concerns about the safety of Allatoona Dam. Under current induced surcharge operations, the last gate openings are maintained until pool levels recede to 859.5 feet NGVD29. Then, the greater of the inflow or the maximum allowable under the regular flood risk management schedule, are released.

The routing of another large flood, the Standard Project Flood, (SPF) is shown on Plate 7-5 and is an example of the induced surcharge operation which is less severe than the PMF. The SPF will exceed the maximum flood stage of 863 feet NGVD29 for buildings on federal lands within Allatoona Lake.

Allatoona has only been in an induced surcharge operation one time since the project was constructed. This occurred in 1964 as a result of a series of floods with very little flood evacuation between the storms. The resulting pool level reached elevation 861.19 feet NGVD29. The April 1979, March 1990, and September 2009 floods are examples where induced surcharge operations were not used. The 16-18 March 1990, flood at Rome, Georgia, is a good example of the usage of the flood storage pool at the Allatoona Project to reduce flood damages downstream. The retention of the 40,700 cfs daily peak inflow into Allatoona Lake reduced the natural Rome, Georgia, river stage by seven feet and by 17 feet at Kingston, Georgia. The rainfall of 5.3 inches on 16-17 March 1990, and the storing of water within the Allatoona Lake resulted in the inflow exceeding the releases from 17-23 March 1990. The resulting Allatoona pool reached elevation 855.82 feet NGVD29 and induced surcharge operations were not used. To date, the maximum one-day inflow into Allatoona Lake was 53,534 cfs, which occurred on 22 September, 2009. The second highest one-day inflow was 45,845 cfs, which occurred on 3 February 1982. Examples of project operation during flood events are shown on Plates 4-1 thru 4-8.

b. <u>Instructions for Spillway Gates and Sluices</u>. When it is necessary to release water other than through the turbines, the following instructions apply:

1) If pool is above elevation 835.0 feet NGVD29 (spillway crest), the discharge will be made preferably through spillway gates. Discharge uniformly across spillway (or as nearly so as possible) by setting gates so that no gate opening is more than 0.5 foot larger or smaller than any other gate opening. Gates will be opened in the following order: 11, 1, 6, 8, 4, 10, 2, 7, 5, 3, 9: this order of operation will be reversed when closing. Gates are numbered in order across the spillway commencing with number 1 adjacent to the powerhouse. The gate operating schedule is shown on Plate 7-6.

2) When the pool is above elevation 835.0 feet NGVD29 and the required discharge cannot be maintained through spillway gates, or if the pool is below elevation 835.0 feet NGVD29, it will be necessary to discharge through the sluices. The four, 5'-8"x 10'-0" sluices will be opened in steps not exceeding five feet so that no sluice is opened more than five feet until all sluices are opened that amount. The sluices may be operated in any order. Sluice outflow capacity is shown on Plate2-9. Short-time releases of 11,200 cfs may be made using the sluice gate as long as the tailwater does not exceed elevation 697.0 feet NGVD29 or causes overtopping of the sump wall in the future Unit #3 draft tube.

Flood risk management operations at Allatoona Dam reduce peak stages of the Etowah River below the dam downstream to its confluence with the Oostanaula River at Rome, Georgia. Releases of stored flood waters will not be made until Rome, Georgia, stage falls below flood stage which can take several weeks. During that period, the threat of additional rainfall may delay some releases.

Flood level reductions at Rome are primarily affected by the Allatoona Project with the Carters Project usually providing incidental flood stage reductions at Rome, Georgia. The flood operation also provides assistance in the flood risk management operation at Weiss Dam on the Coosa River by reducing the inflow into that project. Weiss Dam is described in detail in Appendix B of the Alabama-Coosa River Basin Master Manual and Carters regulation is described in Appendix H.

The extent that Allatoona can provide protection from a given storm depends on the rainfall distribution and movement, storm centering and flood characteristics, and the elevation of Allatoona Lake at the beginning of the flood event. Local area storms tend to be better managed since the local runoff below Allatoona Dam will have flowed through Weiss Dam before the flood evacuation releases are required from Allatoona Dam.

The flood risk management storage between pool levels 840 and 860 feet NGVD29 (302,580 acre-feet or 5.11 inches of runoff) would completely control a flood equal to 40 percent of the standard project flood. If the initial Allatoona pool were at elevation 823 feet NGVD29 (467,280 acre-feet or 7.89 inches of runoff) a flood equal to 62 percent of the standard project flood could be completely controlled at the dam. Since the beginning of operations, the maximum one-day inflow of 53,534 cfs occurred on 21 September, 2009. Effects of reservoir regulation on the September, 2009 flood are shown on Plates 4-7 and 4-8. The second highest one-day inflow was 45,845 cfs, which occurred on 3 February 1982.

The observed maximum pool was 861.19 feet NGVD29 on 10 April 1964. This maximum elevation was reached in part because of a series of floods that limited the flood evacuation releases. For floods larger than the April, 1964 event, there is always the possibility that the induced surcharge curve (high pool and inflows) would be required to pass large flows downstream. In such a case, the project would provide less than maximum flood risk management at Rome and there could be flood damages around the lake since many facilities have been built based upon the 863 feet NGVD29 level. Effects of reservoir regulation on the April 1964 flood are shown on Plates 4-1 and 4-2.

Flood records since 1891 indicate that the highest pool level that would have occurred before 1950 would have been elevation 860.3 feet NGVD29 in July 1916.

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

a. Initial Impact Line. The Initial Impact Line is defined at lake elevation 837.0 feet NGVD29. This is the elevation at which the recreational usage and recreation-related economy will begin to notice impact. Swimming areas will be reduced in size. Private docks will need adjusting and some boating hazards may become evident in some areas of the reservoir. Marina concessionaires will begin to need to move docks and water related business will decline.

b. Recreation Impact Line. The lake elevation of 835.0 feet NGVD29 is defined as the Recreation Impact Line. Recreation will be more severely affected at this level. All regular swimming areas will be exposed. Two boat ramps will be closed. Almost half of the private docks will be affected. Marina business will be severely reduced.

c. Water Access Impact Line. The lake elevation of 828.0 feet NGVD29 is defined as the Water Access Impact line. It is at this line that the most severe effects on recreation begin to occur. At this level, only half of boat ramps will be usable. Private docks will be totally unusable. Hazards to navigation will be numerous. Marinas will have severe problems such as gas docks being grounded and some slips being unusable. There will be reduction in recreational business activity.

The Water Control Plan takes the effects on recreation facilities into account in developing action zones for Allatoona Lake. In dry periods, the lake will often drop to or below the impact levels and Water Management personnel will keep the resource 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.

Many of the boat ramps become unusable as the lake level recedes. Table 7-5 lists end of ramp elevations for all boat ramps. Some work to extend and improve boat ramps has occurred when pool levels have been lowered during droughts, but much more work remains both by the Corps and local interests to retain lake access during periods of extreme drawdown.

Table 7-5. Elevation Where Boat Ramps Become Unusable

Public Ramps at Park Areas	Lowest ramp elevation at end of concrete	Public Ramps at Park Areas	Lowest ramp elevation at end of concrete
Allatoona Landing L&R	825.78	McKaskey	823.34
Bartow Carver	828.35	McKinney	822.75
Bartow C. Pk L	829.51	Old Hwy 41 #1 L	827.68
Bartow C. Pk R	822.01	Old Hwy 41 #1 R	822.43
Blockhouse L	812.79	Old Hwy 41 #3	828.83
Blockhouse C	816.39	Payne L	817.34
Blockhouse R	821.29	Payne C	821.36
Cherokee Co. Park	825.82	Payne R	830.39
Cherokee Mills L	819.04	Red Top Mtn. B/BR L	817.49
Cherokee Mills C	823.19	Red Top Mtn. B/BR R	822.39
Cherokee Mills R	818.84	Sweetwater Camp/G	831.00
Clark Creek L & R	825.53	Tanyard	832.14
Cooper Branch L&R	822.71	Upper Stamp Ck.	832.50
Dallas Rd	831.43	Stamp Ck. D/U L&R	818.74
Galts Ferry L	822.41	Victoria (New) L&R	832.72
Galts Ferry C&R	816.59	Victoria Old L	829.77
Holiday Marina	826.75	Victoria Old R	824.31
Glade Marina	821.74	Websters Ferry	821.79
Knox Bridge	830.8	Wilderness Camp L&R	821.34
Little River	823.9		

7-07. Water Quality. The minimum required continuous release from Allatoona Dam is 240 cfs. This minimum release is accomplished by operating the small turbine-generator unit continuously. If the small unit is out of service, a spillway gate or sluice gate will be opened or one of the main hydropower units will be operated to meet minimum flow requirements. During long periods of only minimum flow release, it is advisable to periodically release some water from the large turbines. Doing so will help the turbine-generators stay in good operating condition. Current leakage from the powerhouse amounts to about 40 to 60 cfs and is not included in the minimum releases through the turbines. The resultant total continuous flow from the project ranges from 280 to 300 cfs.

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

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

b. Operations for fish and wildlife do not supersede the normal operating procedure of maintaining the pool within the top of conservation. During a high-flow event, it might be necessary to decrease the pool by more than six inches to return the pool to within normal operating levels.

7-09. Water Supply. The Water Supply Act of 1958 authorizes the Corps to allocate water supply storage contracts from Allatoona for water supply. There are two entities that withdraw water from Allatoona Lake; the city of Cartersville under contracts DACW01-67-RE-002 (dated 12 July 1966) and DACW01-9-91-120 (dated 18 October 1991) and the Cobb County-Marietta Water Authority (CCMWA) under contract DA-01-076-CIVENG-64-116 (dated 10 October 1963). Below are the state permitted withdrawals and contracted amounts.

Entity	State Permit	Contract Amount/Expected Yield
Cartersville	18 mgd	6,371 acre-feet/16.76 mgd
CCMWA	78 mgd	13,140 acre-feet/34.5 mgd

7-10. Hydroelectric Power. The Allatoona Project is operated as a peaking plant for producing hydroelectric power, and, during off-peak periods, maintains a continuous flow of 240 cfs. The starting and stopping of hydropower turbines at Allatoona Dam is controlled remotely from the Carters Powerhouse. The Allatoona Project is manned with minimum personnel needed for maintenance and emergency operations. Provisions are made to operate the project on site should control or communications equipment be inoperative.

a. Reservoir releases required for conservation, or flood risk management operations in sections 7-03 through 7-09 will normally be used to produce hydropower. Such production is scheduled during peak energy demand hours throughout the week. Additional hydropower can be supplied according to the reservoir's zone. Table 7-2 describes the minimum number of hours for hydropower production. If releases for other purposes do not equal the minimum number of hours, additional releases can be scheduled. Historical hydropower production is shown in Plates 2-12 and 2-13. Actual monthly and annual production is tabulated. The average annual production from 1961 through 2010 is approximately 157,000 megawatt hours (MWH).

b. The powerhouse at Allatoona Dam is operated to furnish peak energy. The energy is marketed to the government's preference customers under terms of contracts negotiated and administered by the Southeastern Power Administration (SEPA). The generation (and water release) is based on a declaration of energy and capacity available that is prepared weekly by the Mobile District on the basis of the *ACT Water Control Plan*. The declarations, which are designed to keep the pools within the established seasonal and pondage limits, where practicable, are prepared by the Water Management Section of the Mobile District and furnished to the South Atlantic Division (SAD) office for coordination of the hydropower projects within the Alabama-Georgia-South Carolina Power Marketing System. Actual daily and hourly scheduling of generation is coordinated by the Water Management Section, SEPA, and the hydropower customers. Local restraints can dictate generation during certain hours.

c. The weekly power declaration may be modified by the Mobile District during the week. Special emergency requirements for downstream flow for structural stability, water quality emergencies or other reasons can usually be met by quickly arranged powerhouse releases. However, when a powerhouse release cannot be arranged, spillway releases can be made to meet the requirement.

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

7-11. Navigation. There are no specific reservoir regulation requirements to support navigation at Allatoona Dam. The seasonal variation in reservoir storage does redistribute downstream flows providing benefits to navigation.

7-12. Drought Contingency Plan. ER 1110-2-1941, *Drought Contingency Plans*, dated 15 September 1981, called for developing drought contingency plans for Corps' reservoirs. For the Allatoona Project, the Corps will coordinate water management during drought with other federal agencies, private power companies, navigation interests, the states, and other interested state and local parties as necessary. Drought operations will be in compliance with the plan for the entire ACT Basin as outlined in the *ACT Master Water Control Manual, Exhibit C,* 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 Lake and Carters Lake), 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 - headwater operations at Allatoona Lake and Carters Lake in Georgia; operations at APC projects on the Coosa and Tallapoosa Rivers; and downstream operations at Corps projects below Montgomery, Alabama, has been developed. The concept is graphically depicted in Figure 7-2 with the specifics shown on Table 7-6. Color coding schemes are used to distinguish project location and owners. Green boxes denote reservoirs located in Georgia, while yellow boxes indicate reservoirs within Alabama, USACE-owned reservoirs are denoted in red text.

ACT Basin Drought Plan		
Headwater Operations Allatoona Carters	APC Operations Lay, Weiss Mitchell, Henry Jordan, Logan Bouldin, Martin Merlin, Harris Yates, Thurlow	Downstream Operations RF Henry Millers Ferry Claiborne
State of Georgia Drought Plan	State of Alabama Drought Plan	

Figure 7-2. Schematic of the ACT Basin Drought Plan

a. Headwater Operations for Drought at Allatoona Lake and Carters Lake. Drought operations at Carters Lake and Allatoona Lake consist of progressively reduced hydropower generation as pool levels decline. For instance, 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 drops to lower action zones during drought conditions, generation would be reduced to zero to two hours per day. As Carters Lake pool level drops into Zone 2, minimum target flows would be reduced from seasonal varying values to 240 cfs.

b. Operations at APC Projects on the Coosa, Tallapoosa, and Alabama Rivers. Under current operations, APC provides a minimum flow at Montgomery, Alabama, of 4,640 cfs (seven-day average) based on the combined flows from 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 zero to three. The DIL is determined on the basis of three basin drought criteria (or triggers). A DIL=0 indicates normal operations, while 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 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.

- DIL0 - (normal operation) no triggers occur
- DIL1 - (moderate drought) one of three triggers occur
- DIL2 - (severe drought) two of three triggers occur
- DIL3 - (exceptional drought) all three triggers occur

1

Table 7-6. APC Drought Operations Plan

<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">DIL 0 - 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 1,800 +/-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 1,800 +/-cfs</td></tr>
<tr><td colspan="3">Jordan 1,600 +/-cfs</td><td colspan="3">Jordan 1,800 +/-cfs</td><td colspan="3">Jordan 2,000 +/-cfs</td><td colspan="2">Jordan 1,800 +/- 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 7Q10 flow</td></tr>
<tr><td colspan="4">4,200 cfs (10% 7Q10 Cut) - Montgomery</td><td colspan="5">7Q10 - Montgomery (4,640 cfs)</td><td colspan="3">Reduce: Full – 4,200 cfs</td></tr>
<tr><td colspan="5">3,700 cfs (20% 7Q10 Cut) - Montgomery</td><td colspan="4">4,200 cfs (10% 7Q10 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% 7Q10 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 Variances: As Needed; FERC Variance for Lake Martin</td></tr>
<tr><td colspan="12">Corps Variances: As Needed; FERC Variance for Lake Martin</td></tr>
<tr><td colspan="12">Corps Variances: As Needed; FERC Variance 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 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.

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

1. Low basin inflow
2. Low state line flow
3. Low composite conservation storage

Each of the indicators is described in detail below.

The DIL is computed on the 1st and 15th 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 DIL=0.

For DIL=0, 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 amounts when DIL=0.

For DIL=2, the Coosa River flow varies from 1,800 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. When the DIL is equal to zero, APC projects are operated to meet the navigation flow target or the 7Q10 flow. Once DIL is greater than zero, 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 the 7Q10 flow (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 1st and 15th 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 7-3 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.

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

Month	Coosa Filling Volume	Tallapoosa Filling Volume	Total Filling Volume	7Q10 flow	Required Basin Inflow
Jan	629	0	629	4,640	5,269
Feb	647	1,968	2,615	4,640	7,255
Mar	603	2,900	3,503	4,640	8,143
Apr	1,683	2,585	4,268	4,640	8,908
May	242	0	242	4,640	4,882
Jun			0	4,640	4,640
Jul			0	4,640	4,640
Aug			0	4,640	4,640
Sep	–602	–1,304	–1,906	4,640	2,734
Oct	–1,331	–2,073	–3,404	4,640	1,236
Nov	–888	–2,659	–3,547	4,640	1,093
Dec	–810	–1,053	–1,863	4,640	2,777

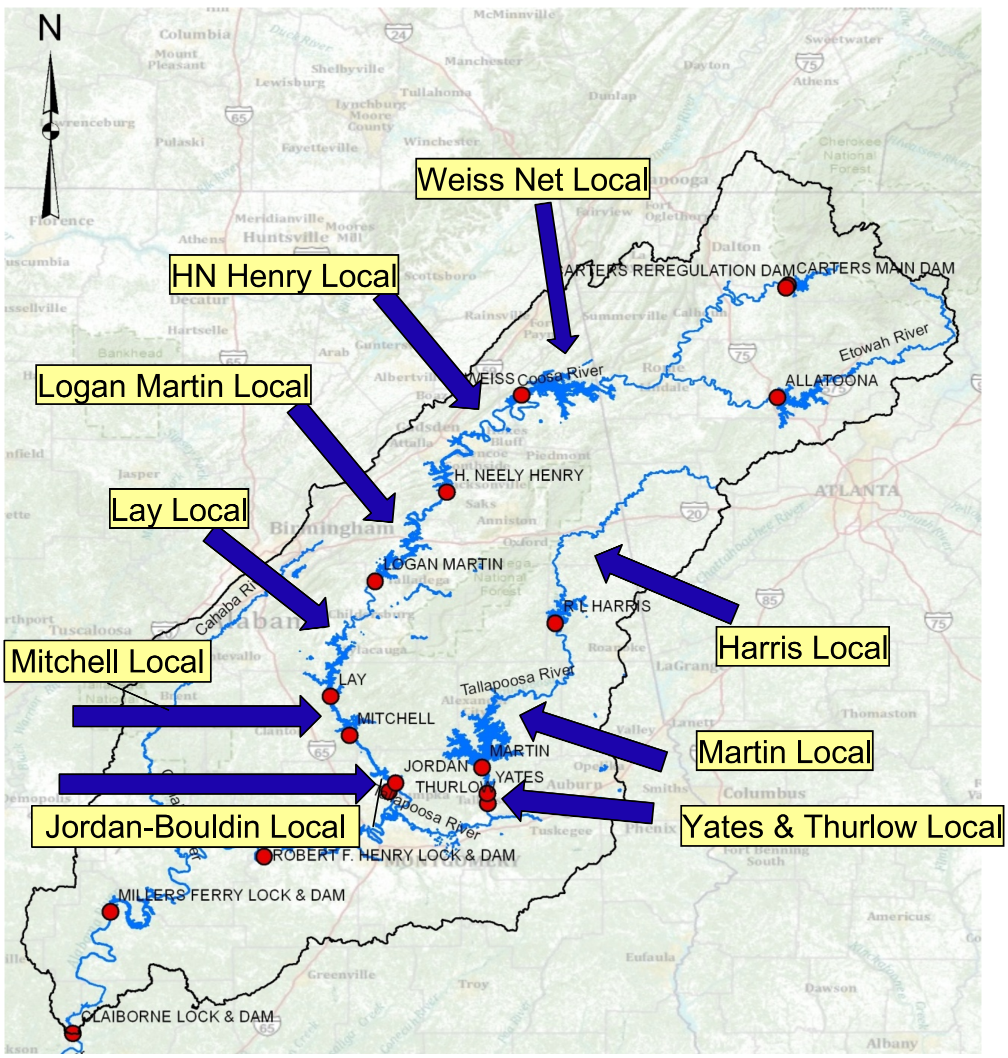

Figure 7-3. ACT Basin Inflows

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. The lowest seven-day average flow over the past 14 days is computed and checked at the 1st and 15th 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.

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.

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

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

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 7-4 plots the APC composite zones. Figure 7-5 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 1st and 15th of each month, and is compared to the low state line flow trigger and basin inflow trigger.

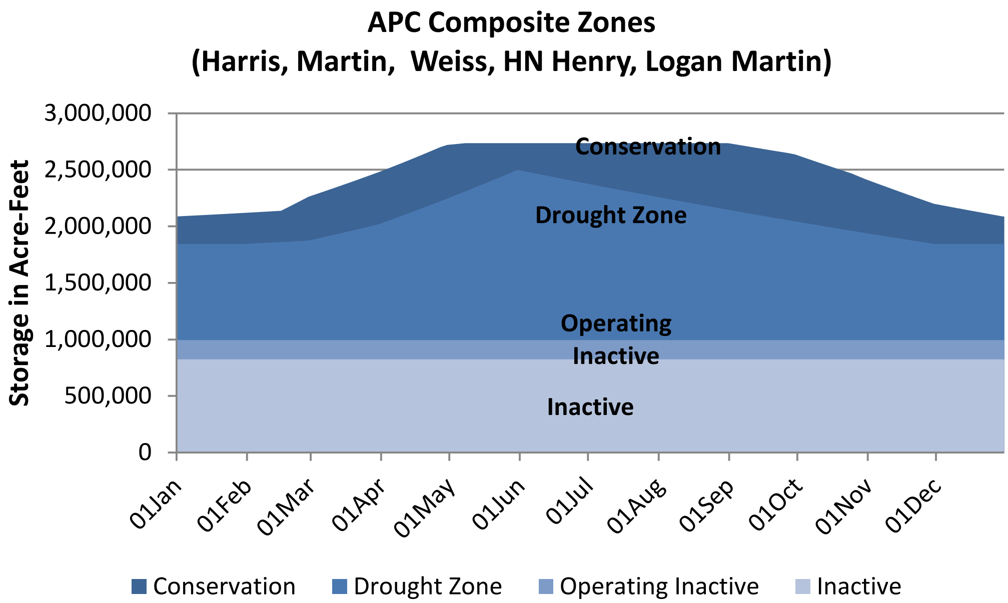

Figure 7-4. APC Composite Zones

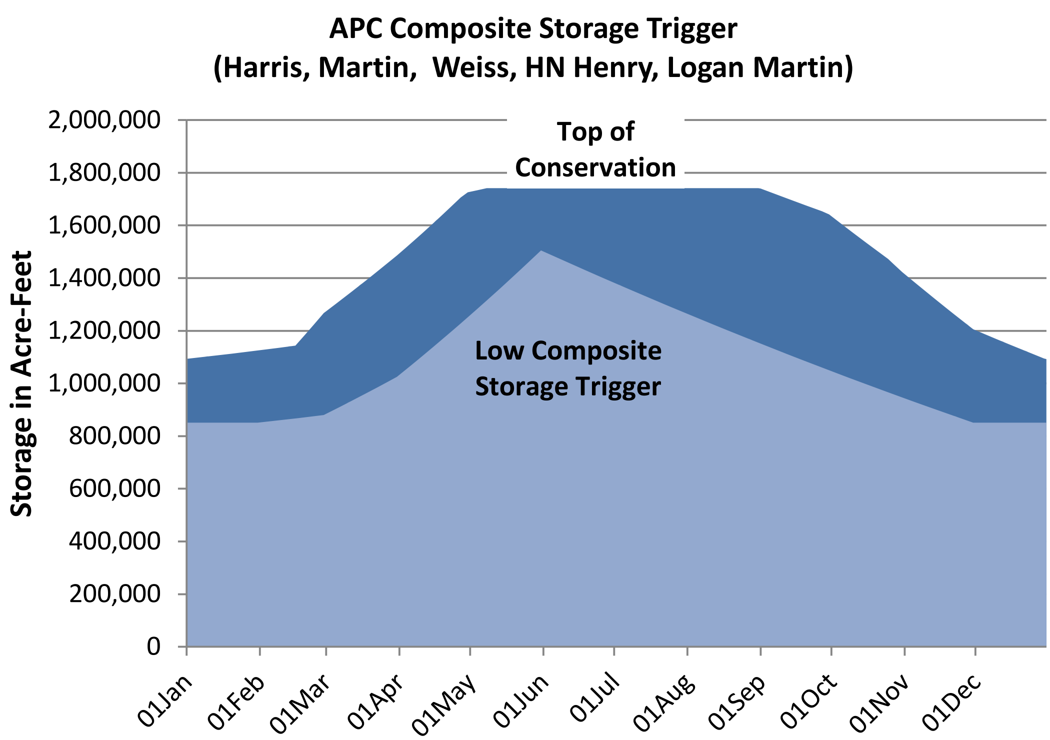

Figure 7-5. APC Low Composite Conservation Storage Drought Trigger

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 the 7Q10 flow of 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 are emergency contact information, flood inundation information, and such.

7-14. Other. Other considerations than just serving the authorized project purposes must be served from the basin as needed. Adjustments are made to system regulation at times for downstream construction, to aid in rescue or recovery from drowning accidents, environmental studies, or cultural resource investigation.

a. Mosquito Control Operation. Operation of Allatoona Lake for producing hydroelectric power does not permit the degree and timing of pool fluctuations, which would be ideal for mosquito control. Mosquito control will be accomplished mainly by applying larvicides by aerial or surface methods, or both, during mosquito production season from early May to late September.

b. Regulation during Low Flows. There is a 240 cfs minimum release requirement at the Allatoona Project. With normal seepage from the project, the actual minimum flow released to meeting the minimum flow is around 300 cfs.

c. Correlation with Other Projects. Weiss Dam below Rome, Georgia, the levee system in the Rome area, and Carters Dam above Rome are affected in varying degrees by operations at Allatoona Dam. Flood risk management operations at Allatoona, Carters and Weiss Dams during the rising phase of a flood will normally be independent of each other. Following a flood, the emptying of flood storage at Allatoona may prolong the time required to evacuate flood storage at Weiss Dam. Allatoona releases will be made so as to minimize any undesirable conditions that might be created by the emptying operation and maintain its flood risk management objective at Rome. The Corps and APC have established regular and rapid exchange of data concerning the two projects to ensure the fullest coordination of operations.

The levee system at Rome, Georgia was built by the Corps for the protection of the Fourth Ward in Rome and the floodplain area north of the Coosa and west of the Oostanaula Rivers. The top of the levee is at elevation 605 feet NGVD29, corresponding to a stage of 43.3 feet on the NWS gage at the 5th Avenue Bridge across the Oostanaula River. Since flow from Allatoona Dam will ordinarily be curtailed whenever a stage of 25 feet or higher is expected, close coordination between outflows from the Allatoona and Carters projects is required. As a general rule, the Allatoona flood inflows will be stored longer than the Carters flood inflows because Allatoona has a larger flood risk management storage and a shorter routing time to Rome, Georgia.

A major thermal-electric generating facility is located on the Etowah River near Euharlee, Georgia, about 16 miles downstream of Allatoona Lake. Plant Bowen generates a large portion of the power supply of Georgia. The Etowah River is the source of cooling water for the plant and during very dry periods, water releases from Allatoona may be necessary to assure sufficient flow in the Etowah River to allow for cooling water withdrawals. Under extreme low flow conditions, hydropower operations may be made over a 7-day period to keep Rome, Georgia Etowah River water intake submerged over the weekend

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. <u>Emergencies</u>. 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. <u>Unplanned Deviations</u>. 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.

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

7-16. Rate of Release Change. Gradual changes are important when releases are being decreased and downstream conditions are very wet, resulting in saturated riverbank conditions. The Corps acknowledges that a significant reduction in basin releases over a short period can result in some bank sloughing, and release changes are scheduled accordingly when a slower rate of change does not significantly affect downstream flood risk. Overall, the effect of basin regulation on streambank erosion has been reduced by the regulation of the basin because higher peak-runoff flows into the basin are captured and metered out more slowly.

VIII - EFFECT OF WATER CONTROL PLAN

8-01. General. Allatoona Dam and Lake was authorized as part of the general plan for the full development of the ACT River Basin as described in House Document No. 674, 76th Congress, 3rd Session, published in 1940. That report recommended the construction of Allatoona Dam and Reservoir as a multipurpose project including flood control, hydropower, and navigation. Along with the purposes specified in its authorizing documents, several other project purposes have been authorized at Allatoona through other congressional legislation including recreation, fish and wildlife, water quality, and municipal and industrial (M&I) water supply.

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

8-02. Flood Risk Management. One of the major benefits of the water control operations at the Allatoona Project is flood risk management. Allatoona Lake contains storage space in which flood water is stored and later released in moderate amounts to prevent downstream flooding. During most years, one or more flood events occur in the ACT Basin. While most of those events are of minor significance, on occasion, major storms produce widespread flooding or unusually high river stages. Major flooding has occurred in April 1964 (reached maximum pool elevation of record of 861.19 feet NGVD29), April 1979, March 1990, and September 2009. Flood risk management operations at Allatoona Dam reduce the peak stages of the Etowah River below the dam downstream to its confluence with the Oostanaula River at Rome, Georgia. While those four floods also resulted in considerable damage, a total of more than $104 million in estimated damages was prevented by Allatoona Lake from all flooding events between 1986 and 2009 as a result of flood risk management operations.

a. Spillway Design Flood. Spillway Design Floods (SDF) is the criteria used by the Corps to design the spillway on a dam to prevent its overtopping due to the occurrence of an extremely rare flood event. The basis of the SDF is the Probable Maximum Precipitation (PMP) defined in the National Weather Service Hydrometeorological Report Nos. 51 and 52. The pattern was computed by centering the hypothetical storm over the drainage area above the dam site to get the largest runoff at the dam site. The SDF is not assigned a frequency of occurrence. The PMP was started with the pool at elevation 859.5 feet NGVD29 with only the spillway gates being used to pass inflows. After the pool starts to fall, the gate openings are maintained until the pool reaches elevation 859.5 feet NGVD29. At that point, the outflows are gradually reduced until the channel capacity of 9500 cfs is reached. The SDF has a peak pool elevation of 872.1 feet NGVD29 feet with a maximum inflow and discharge of 382,000 and 333,000 cfs. This elevation is 37.1 feet above the crest of the spillway at elevation 835.0 feet NGVD29 and 7.9 feet below the top of the dam at elevation 880.0 feet NGVD29. Effects of reservoir regulation on the spillway design flood are shown on Plate 7-4.

b. Standard Project Flood. The Standard Project Flood (SPF) is a theoretical flood, based on rainfall criteria, that would be reasonably possible and has been used in hydrologic analyses of reservoirs and river reaches. The basis of the SPF is one-half of the flow of the Spillway

Design Flood. The routing of the SPF assumes a normal flood risk management operation in which flood waters are retained and discharged as downstream channel capacity permits. A large flood was assumed to have occurred a week before the SPF. Thus, surcharge releases would occur early in the SPF. The SPF is not assigned a frequency of occurrence and is only used as a comparison in any discharge-frequency analysis. The SPF has a peak inflow of 183,700 cfs and produces a pool elevation of 864.7 feet NGVD29. The maximum discharge is 180,000 cfs. This pool elevation is 29.1 feet above the crest of the spillway at elevation 835.0 feet NGVD29 and 15.9 feet below the top of the dam at elevation 880.0 feet NGVD29. Maximum flows at Cartersville, Kingston, and Rome 5th Avenue gages would be near 192,000 cfs. The antecedent flood added 6,000 cfs to the baseflow of the SPF and started the pool at elevation 854.0 feet NGVD29. The effects of reservoir regulation on the SPF are depicted on Plate 7-5. Table 8-1 presents data for both the SDF and the SPF floods. In Table 8-1, natural flows are those flows that would occur without the presence of Allatoona Dam. The reservoir inflows account for the presence of the dam and reservoir. These flows are slightly higher because the reservoir is an impervious surface and increases the amount of run-off measured at the dam site.

Table 8-1. Design Floods

Design floods							
Flood Event	Natural Inflow	Reservoir Inflow	Reservoir Outflow	Pool Elevation	Cartersville Flow	Kingston Flow	Rome Flow
Spillway Design	280,000	382,000	333,000	872.1	342,000	343,000	345,000
Standard Project	140,000	184,000	180,000	864.7	192,000	192,000	192,000

c. Historic Floods. Significant floods occurred in April 1964, April 1979, March 1990 and September 2009. Effects of flood risk management operations for three of these floods are shown in Table 8-2. The effects of reservoir regulation on the 1964, 1979, 1990, and 2009 floods are shown on Plates 4-1 through 4-8.

Table 8-2. Historic Floods

Historic Floods							
Allatoona		Cartersville		Kingston		Rome	
Peak Inflow (cfs)	Peak outflow (cfs)	Observed Stage Feet	Natural Stage Feet	Observed Stage Feet	Natural Stage Feet	Observed Stage Feet	Natural Stage Feet
Flood of April 1964							
34,000	12,000	18	28	18	25	28	33
Flood of April 1979							
41,000	7,800			20	33	33	40
Flood of March 1990							
46,000	9,000			22	38	35	38

The September 2009 flood is of special interest for a variety of reasons. It occurred at the end of an extended low flow period, the lake level was relatively low, the storm was large, and the greatest rainfall was above the dam. The daily inflow for this flood is the highest of record (53,534 cfs). Reservoir regulation reduced downstream flows to about a third of natural flow.

Table 8-3 lists the reductions for this flood. Plates 4-7 and 4-8 show the reservoir regulation and downstream effects for the 2009 flood event.

Table 8-3. Effects of Reservoir Regulation on September 2009 Flood

Effects of reservoir regulation on flood of September 2009						
Location	Peak Date & Time	Observed Flow (cfs)	Observed Stage (ft)	Computed Natural Flow (cfs)	Computed Natural Stage (ft)	Stage Reduction (ft)
Kingston	9/22/2009 @ 0300	19,100	16.7	75,200	32.5	15.8
Resaca	9/25/2009 @ 0500	13,300	18.9	62,700	20.7	1.75
Rome-Etowah	9/21/2009 @ 1830	19,700	29.9	70,100	57.2	27.75
Rome-Coosa	9/22/2009 @ 1800	28,200	23.9	77,800	38.5	14.6

8-03. Recreation. Allatoona Lake is an important recreational resource, providing significant economic and social benefits for the region and the nation. The project contains 11,862 acres of water at the summer conservation pool elevation of 840.0 feet, plus an additional 25,882 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. Allatoona Lake is one of the most visited Corps lake in the United States; averaging almost seven million recreational visits per year. The local and regional economic benefits of recreation at Allatoona Lake are significant. Annual recreational visitor spending within 30 miles of the project totals $144.66 million.

The effects of the Allatoona Lake water control operations on recreation facilities and use at the project are described as impact lines: Initial Impact Line, Recreation Impact Line, and Water Access Limited Line. The impact lines 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 line:

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

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

c. Water Access Impact Line. Most water-based recreational activities are severely restricted, most boat ramps are unusable, and navigation hazards become more numerous, 50 percent of private boat docks are affected. Table 8-4 shows the lake elevation for each impact line and the percent of time over a 70-year simulation of the proposed operation that each impact line would be reached at Allatoona Lake.

Table 8-4. Reservoir Impact Lines – Allatoona Lake

837.0 Feet initial impact line	835.0 Feet recreation impact line	828.0 Feet water access limited impact line
68%	56%	20.4%

8-04. Water Quality. The water quality conditions that are generally present in Allatoona Lake are typical of water quality conditions and trends that exist in reservoirs throughout the ACT Basin. Water quality conditions in the main body of the reservoir is typically better than in the arms of the reservoir because of nutrient and sediment-rich, riverine inflows. Sediment and phosphorus concentrations are also highest in the upper arms and decrease toward the main pool as velocity is lowered and sediment is removed from suspension. During summertime thermal stratification of Allatoona Lake, dissolved oxygen levels and water temperatures are typically highest in the top 15 feet of the reservoir, with colder, anoxic or nearly anoxic conditions existing near the bottom. Additionally, chlorophyll *a* concentrations vary both seasonally and spatially and are highest from July to October during periods of low flow. Point and nonpoint sources from urban areas increase sediment and pollutant loads in the rivers immediately downstream. Reservoirs in the ACT Basin, including Allatoona Lake, typically act as a sink, removing pollutant loads and sediment. The mid-lake and dam forebay portions of Allatoona Lake meet all designated water use criteria. Both the Etowah River and Little River embayment sections of Allatoona Lake are listed on the 2012 draft Integrated 305(b) and 303(d) list because of chlorophyll *a* impairment. The chlorophyll *a* draft TMDL was completed in 2009, and a fecal coliform TMDL was completed in 2004. The reservoir is transitioning from mesotrophic to eutrophic because of the influx of phosphorus nutrients. Phosphorus levels have increased in the reservoir and its tributaries because of increases in urban lands and broiler and beef cattle production. Dissolved oxygen in the tailwaters of Allatoona Lake drops below 4 mg/L during the summer and through early fall, and can reach as low 1 mg/L in the tailwaters.

8-05. Fish and Wildlife.

a. Fish Spawning. In developing the action zones for Allatoona Lake's water control plan, the needs of fish spawning was a factor influencing the selected elevations for each zone. The plan improves the ability to maintain steady reservoir levels during the spring fish spawning period, provide a gradual ramp down of river levels to prevent stranding endangered species, and to ensure adequate flows in the river to support threatened and endangered species. The Corps operates the ACT System to provide favorable conditions for annual fish spawning, both in the reservoirs and in the rivers. During the fish spawning period for Allatoona Lake, March 15 to May 15, the Corps' goal is to operate for a generally stable or rising lake level and a stable or gradually declining river stage for approximately four to six weeks during the designated spawning period. When climatic conditions preclude a favorable operation for fish spawning, the Corps consults with the state fishery agencies and the USFWS on balancing needs in the system and minimizing the effects of fluctuating lake or river levels. Operations for fish spawning help to increase the population of fish in the basin and attempt to offset the changed hydrology resulting from the installation of the dams.

b. Threatened and Endangered Species. The ACT System of reservoirs, including Allatoona Lake, will be operated to comply with the Endangered Species Act of 1973 and related Biological Opinions provided by the U.S. Fish and Wildlife Service including the Biological Opinion prepared by them during the preparation of this Water Control Manual. Such compliance will include all Terms and Conditions and Reasonable and Prudent Alternatives that would minimize impacts to specific Threatened and Endangered species and their critical habitat and avoid jeopardy to their continued existence. The Etowah River originates as a high-gradient stream in the Blue Ridge province of the Southern Appalachian Mountains and flows approximately 69 miles westward through Piedmont upland to Allatoona Lake. Habitat loss and modifications resulting from impoundments, timbering, agriculture, gold mining, and urban development have caused at least 35 mussel species and seven fish species to be extirpated from the Etowah River sub-basin. The upper mainstem and tributaries of the Etowah River support the federally endangered Amber darter and Etowah darter, and the federally threatened Cherokee darter.

The lower Etowah River extends 48.6 miles from the Allatoona Dam and Lake to its confluence with the Oostanaula River, forming the Coosa River in Rome, Georgia. Historically, the lower Etowah River contained more than 91 native fish species, including lake sturgeon and at least 51 mussel species. Most federal and state endangered fish species are found in the upper Etowah River (above Allatoona Lake) and to a lesser extent in the lower Etowah River. Nevertheless, the Cherokee darter, listed as threatened by the USFWS, has been documented in several tributaries of the lower Etowah River.

In 1996, American Rivers' list of the top 10 most endangered river systems in the United States included the Etowah River. The diversity of fish and mussels in the Etowah River is equal to the Conasauga River, which was considered to have the highest biodiversity in the Coosa River drainage area.

8-06. Water Supply. The Allatoona Project water control operations provide both direct and incidental benefits for M&I water supply. Allatoona Lake is a source of water supply storage for Cobb-Marietta Water Authority (CCMWA) and the city of Cartersville, Georgia. Contracts for this water supply are based on daily withdrawals and the storage needed to provide the anticipated yield as depicted in Table 8-5. Water supply storage accounting is a systematic accounting record to track valid storage users when the lake is in the conservation pool. Users get a proportion of any inflow and any losses as well as measured use. To assure that one contracted water user is not encroaching on the rights of other contracted users. This accounting is especially critical during drought. A component of the accounting is to notify users of the need for conservation measures or the need for additional water supply sources, when available water supply storage drops below 30%. Formula used to calculate water supply storage: Ending Storage – Beginning Storage + Inflow Share – Loss Share – User's Usage. 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 base once the storage account drops below 30%.

Table 8-5. Water Supply from Allatoona Lake

Contract/Permit Holder	COE Storage Contract Amount (Expected Yield)	State Permit Limit Maximum/day	State Permit Limit Monthly Average
City of Cartersville	6,371 ac-ft (16.76 mgd)	21.42 mgd	18.0 mgd
CCMWA	13,140 ac-ft (34.5 mgd)	86.0 mgd	78.0 mgd

During droughts there is serious concern about protecting water supplies. The use of contracted water supply storage space will be carefully monitored to ensure contracted storage volumes are not exhausted. From a physical perspective, the CCMWA's intake can be operable down to elevations between 805 and 810 feet NGVD29. The city of Cartersville's intake is located on the face of Allatoona Dam and can operate down to the minimum conservation level of 800 feet NGVD29.

The regulation and permitting of surface water withdrawals for M&I use is a state responsibility. No M&I water supply releases are made from Allatoona Dam specifically for downstream M&I water supply purposes. However, water released from Allatoona Dam for its authorized project purposes, particularly during dry periods, help to ensure a reasonably stable and reliable water flow in the river to the benefit of downstream M&I water supply users. The most significant water use within the Georgia portion of the ACT Basin is for thermoelectric power generation (72.8 percent), while public water supply represents about 20 percent of the surface water withdrawals.

8-07. Hydroelectric Power. The Allatoona Dam hydropower project, along with 23 other hydropower dams in the southeastern United States, composes the SEPA service area. SEPA sells hydroelectric power generated by Corps plants to a number of cooperatives and municipal power providers, referred to as preference customers. Hydroelectric power is one of the cheaper forms of electrical energy, and it can be generated and supplied quickly as needed in response to changing demand.

Hydropower is produced as peak energy at Allatoona Dam, i.e., power is generated during the hours that the demand for electrical power is highest, causing significant variations in downstream flows. Daily hydropower releases from the dam vary from zero during off-peak periods to as much as 6,500 cfs, which is turbine capacity. Often, the weekend releases are lower than those during the weekdays. Figure 8-1 shows effects of a typical release pattern from the powerhouse. Tailwater stages may vary significantly daily because of peaking hydropower operations at Allatoona Dam, characterized by a rapid rise in river stage immediately after generation is initiated and a rapid fall in stage as generation is ceased, generally from two to several hours later, depending on available basin inflows. Figure 8-2 depicts river stages immediately downstream of Allatoona Dam over a typical one-week period in late summer under normal conditions. River stages rise and fall by 2.5 to 3.0 feet before, during, and following peak hydropower generation. Except during high flow conditions when hydropower may be generated for more extended periods of time, this peaking power generation scenario with daily fluctuating stages downstream is repeated nearly every week day (not generally on weekends).

Projects with hydropower capability provide three principal power generation benefits:

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

b. Hydropower projects provide a substantial amount of energy at a small cost relative to thermal electric generating stations, reducing the overall cost of electricity. Hydropower facilities reduce the burning of fossil fuels, thereby reducing air pollution. Between 2000 and 2009, Allatoona powerhouse produced an average of 108,000 megawatt hours per fiscal year, with a minimum of 40,000 and a maximum of 219,000 MWH, dependent upon water availability.

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

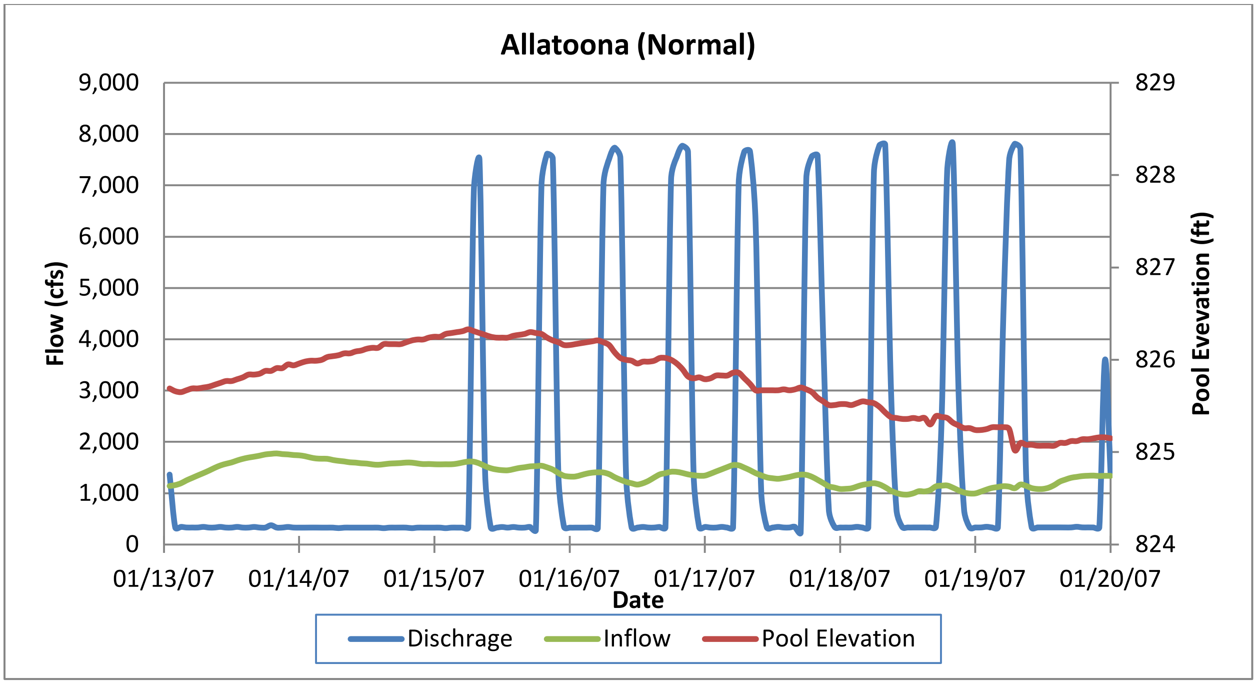

Figure 8-1. Allatoona Lake, Typical Release Pattern, Normal Conditions

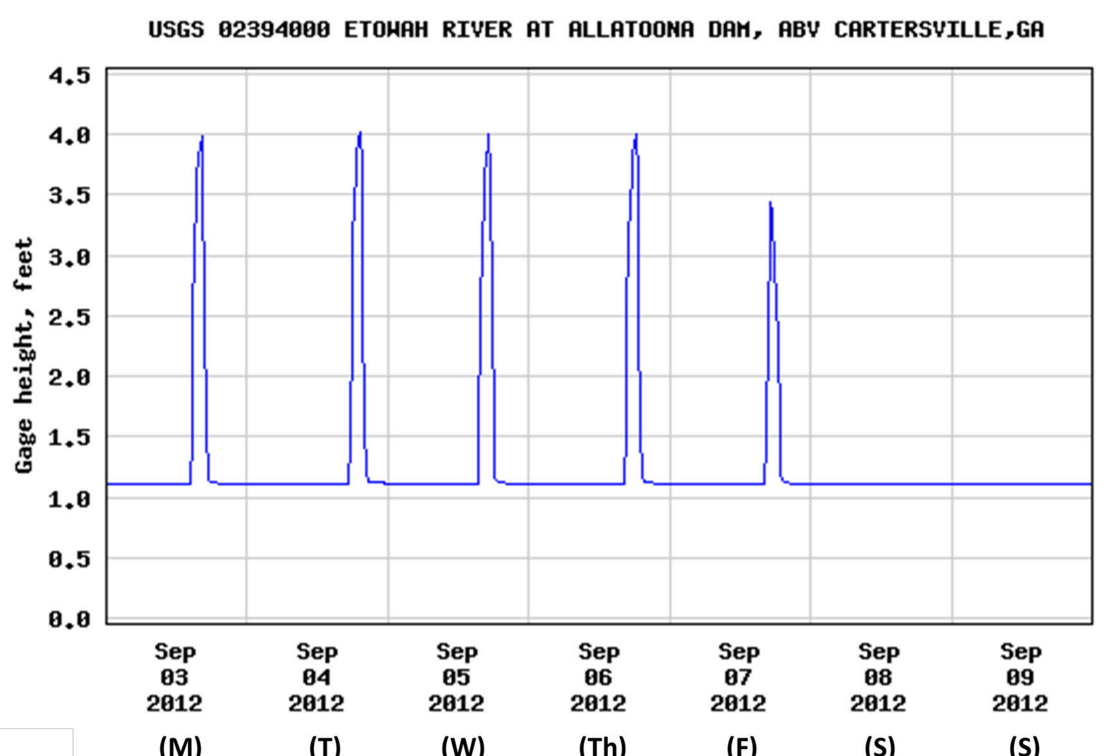

Figure 8-2. Etowah River at Allatoona Dam, above Cartersville, Georgia (USGS02394000), Tailrace Gage Height

8-08. Navigation. Specific releases from Allatoona Lake to meet navigation flows are not part of the routine regulation plan. The seasonal redistribution of flows for other purposes does have a positive affect for maintaining navigation flows, as well as the minimum flow releases.

8-09. Drought Contingency Plans. The importance of drought contingency plans has become increasingly obvious as more demands are placed on the water resources of the basin. During low flow conditions, the reservoirs within the basin may not be able to fully support all project purposes. Several drought periods have occurred since construction of Allatoona Dam in 1949. The duration of low flows can be seasonal or they can last for several years. Some of the more extreme droughts occurred in the mid 1950s, the early and mid 1980's, and most of the time period between late1998 to mid-2009. There were periods of high flows during these droughts but the lower than normal rainfall trend continued. Allatoona monthly inflows and percent of monthly inflows to the long-term average monthly flows for 1954-56, 1980-81, 1985-86 and 1998-2009 are shown on Table 8-6. Allatoona conservation storage of approximately 285,000 acre-feet is 22 percent of the average annual inflow. This low storage to inflow ratio indicates that it is much *easier* to refill Allatoona Lake than a project like Lake Lanier, which has a storage to inflow ratio of 130 percent.

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

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

Table 8-6. Average and Actual Inflows into Allatoona During Droughts

Allatoona - Average Monthly Inflow vs Actual Inflow during drought periods (Period of record: Jan 1950 - Dec 2011)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Average flow	**2389**	**2685**	**3173**	**2695**	**1882**	**1292**	**1125**	**873**	**837**	**921**	**1183**	**1754**
1954 flow	3867	1702	2152	2115	1460	925	560	441	217	236	499	947
% of Avg.	162	63	68	78	78	72	50	51	26	26	42	54
1955 flow	1322	3114	1761	2293	1332	779	917	641	253	400	669	649
% of Avg.	55	116	55	85	71	60	82	73	30	43	56	37
1956 flow	630	2293	2466	2691	2021	793	1048	455	541	557	600	1596
% of Avg.	26	85	78	100	107	61	93	52	65	60	51	91
1980 flow	2768	2192	8326	4057	2987	1884	915	571	742	928	792	665
% of Avg.	116	82	262	151	159	146	81	65	89	101	67	38
1981 flow	620	2601	1394	1282	1446	1177	327	482	343	342	391	984
% of Avg.	26	97	44	48	77	91	29	55	41	37	33	56
1985 flow	1156	3094	1383	1185	1316	720	1040	1149	428	589	762	1060
% of Avg.	48	115	44	44	70	56	92	132	51	64	64	60
1986 flow	828	941	1186	644	727	284	162	174	431	1085	1135	1448
% of Avg.	35	35	37	24	39	22	14	20	52	118	96	83
1998 flow	3283	4949	4174	4703	3012	1526	795	840	370	397	787	1049
% of Avg.	137	184	132	175	160	118	71	96	44	43	67	60
1999 flow	1884	2162	1610	1017	1117	730	870	152	103	784	674	693
% of Avg.	79	81	51	38	59	57	77	17	12	85	57	40
2000 flow	1643	1175	1527	2353	688	316	221	484	1166	260	1228	755
% of Avg.	69	44	48	87	37	24	20	55	139	28	104	43
2001 flow	1965	1674	2884	1648	996	1936	1395	563	604	420	392	737
% of Avg.	82	62	91	61	53	150	124	64	72	46	33	42
2002 flow	2029	1200	2011	1365	1371	481	270	11	587	967	1913	3537
% of Avg.	85	45	63	51	73	37	24	1	70	105	162	202
2003 flow	1558	2803	3903	2054	3810	2677	3201	1504	893	743	1603	1521
% of Avg.	65	104	123	76	202	207	285	172	107	81	135	87
2004 flow	1602	2337	1378	1629	1128	1174	966	673	3481	867	1973	2607
% of Avg.	67	87	43	60	60	91	86	77	416	94	167	149
2005 flow	1529	3028	3240	3019	1546	1907	4051	1508	613	803	710	1510
% of Avg.	64	113	102	112	82	148	360	173	73	87	60	86
2006 flow	2171	2018	1850	1546	821	473	273	415	591	741	1513	935
% of Avg.	91	75	58	57	44	37	24	48	71	80	128	53
2007 flow	2556	1320	1523	892	470	285	396	58	-5	92	213	609
% of Avg.	107	49	48	33	25	22	35	7	-1	10	18	35
2008 flow	677	1435	2054	1072	713	291	513	619	125	192	212	1250
% of Avg.	28	53	65	40	38	22	46	71	15	21	18	71
2009 flow	2600	1151	2252	2326	1846	772	341	542	5244	3273	3409	4440
% of Avg.	109	43	71	86	98	60	30	62	626	355	288	253
2010 flow	3344	3928	3559	2358	2034	1142	802	490	256	373	473	771
% of Avg.	140	146	112	87	108	88	71	56	31	40	40	44
2011 flow	931	1480	3112	2249	846	590	356	113	386	181	667	1199
% of Avg.	39	55	98	83	45	46	32	13	46	20	56	68

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

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

The reservoir discharge value, OUTFLOW, is the total discharge from turbines, spillway gates, or navigation locks. Its associated value comes from rating tables for these structures. The CHANGE IN STORAGE comes from subtracting the daily storage on day two from day one. The daily storage value comes from the storage-elevation tables using the adjusted midnight pool elevation for each day. CHANGE IN STORAGE = STORAGEi - STORAGEi+1. Negative inflow calculations can occur when there is a decrease in storage which exceeds the project's outflow. Evaporative losses, direct reservoir withdrawals, and losses to groundwater are several causes of negative inflow calculations.

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

Flood emergency operations at Allatoona Dam are the responsibility of the Allatoona Power Plant Manager. It is his responsibility to obtain the gage readings at Rome, Georgia by whatever means possible before making any power releases other than that required for station service. The plans are intended to serve only as temporary guidance for operating a project in an emergency until Mobile District staff can assess the results of real-time hydrologic model runs and issue more detailed instructions to project personnel. The benefits of Flood Emergency Action Plans are to minimize uncertainties in how to operate a project in a flood emergency, to facilitate quick action to mitigate the adverse impacts of a flood event, and to provide for emergency action exercises to train operating personnel on how to respond in an actual emergency flood situation.

8-11. Frequencies.

a. Peak Inflow Probability. An percent chance exceedance curve for inflow into Allatoona Lake is shown on Figure 8-3.

b. Pool Elevation Duration and Frequency. The Water Control Plan for the ACT Basin influences the lake levels at Allatoona. Normal seasonal operating levels range from elevation 823 feet NGVD29 in the higher flow months to elevation 840 feet NGVD29 in the summer. Pool duration curves for the historic observed data, previous regulation plan, and current regulation plan as described in this manual are presented in Figure 8-4. Pool duration curves for operation under the previous regulation plan and the current regulation plan were modeled using the Reservoir Simulation (ResSim) model developed by the Hydrologic Engineering Center in Davis, California. Recreation impact levels are also shown. The observed and modeled period used in the analysis is January 1958 through December 2008.

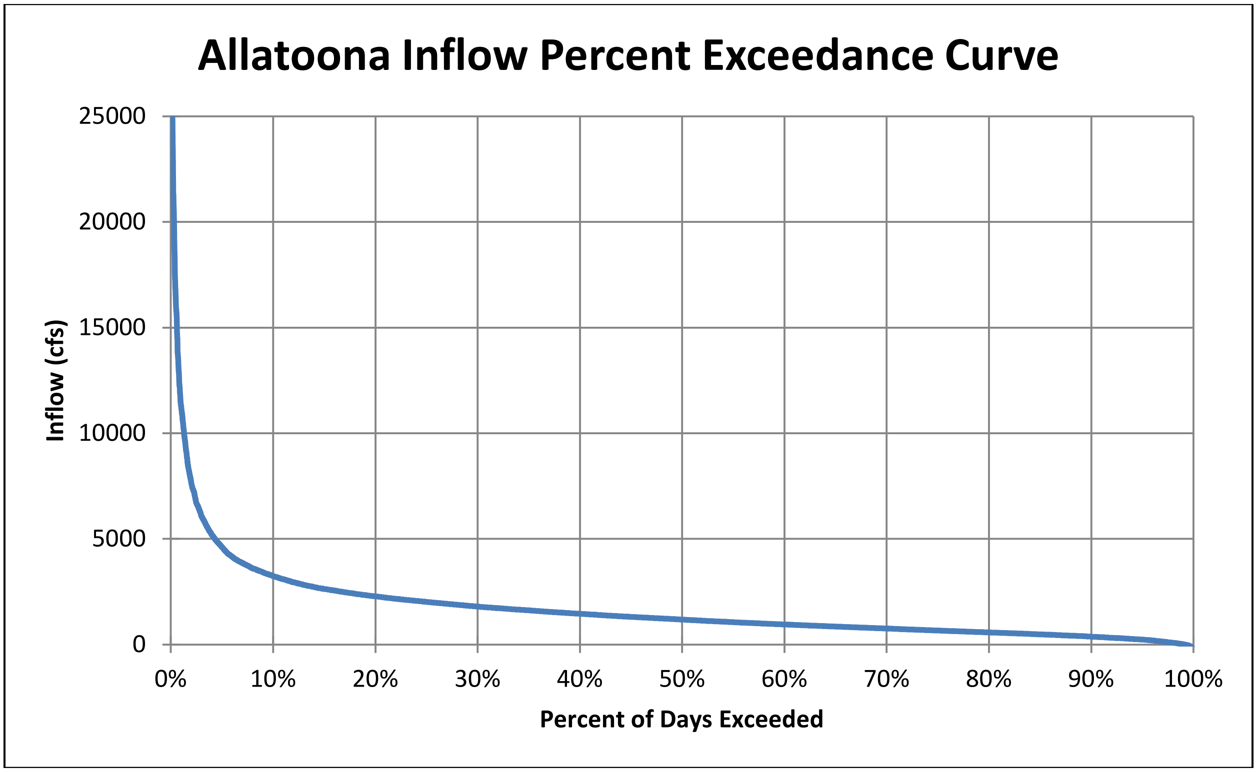

Figure 8-3. Allatoona Lake Inflow Percent Exceedance Curve Over the Modeled Period (1939-2008)

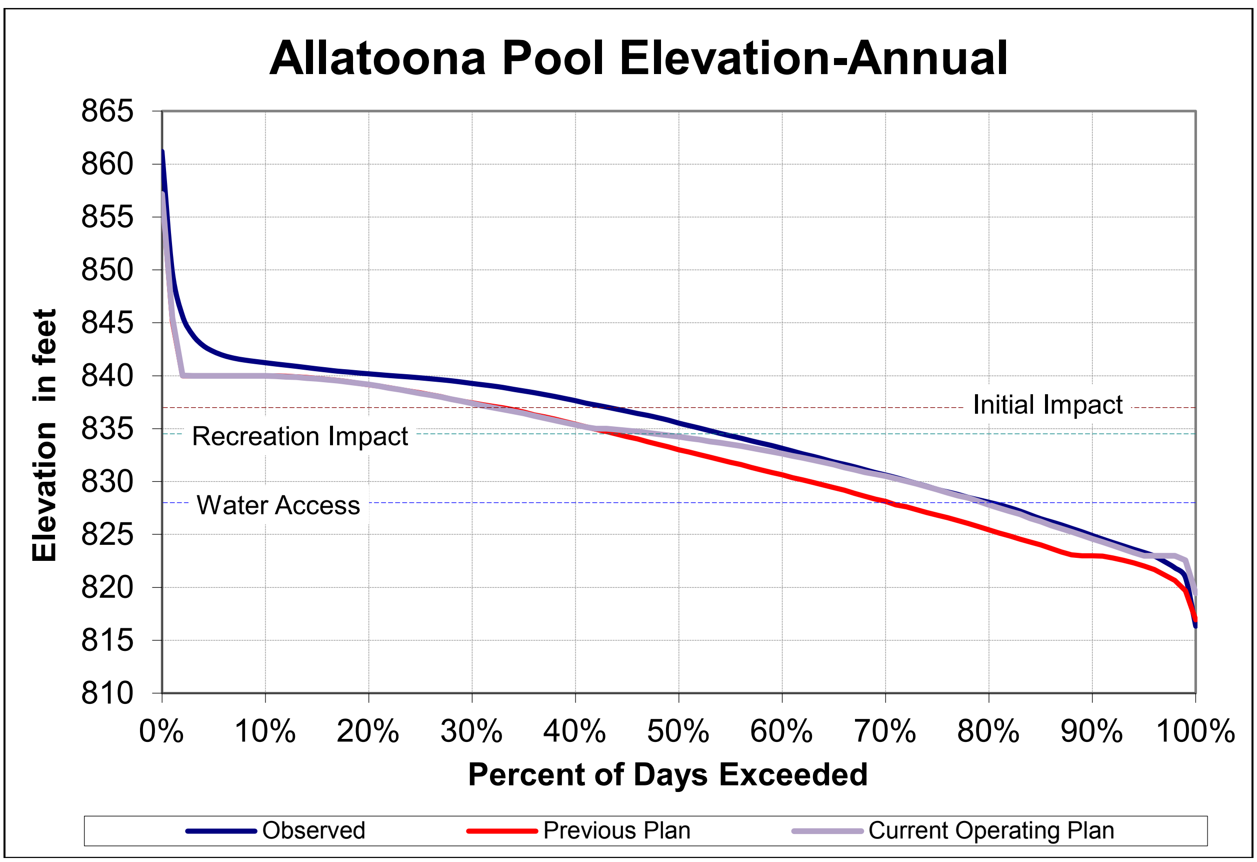

Figure 8-4. Allatoona Pool Elevation Duration Curves

8-12. Other Studies – Examples of Regulation. In early 2010 the Corps, Mobile District, developed updated critical yields for the Allatoona and Carters Projects in the ACT Basin (Federal Storage Reservoir Critical Yield Analysis, Alabama-Coosa-Tallapoosa (ACT) and Apalachicola-Chattahoochee-Flint (ACF) River Basins, February 2010) 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 five percent at Allatoona Dam but only 0.8 percent at Carters Dam. The critical yield for Allatoona was determined to be 729 cfs without diversions and 693 cfs with diversions. The critical drought for the period of record occurred in 2007.

IX - 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. U.S. Army Corps of Engineers. Authority for water control regulation of the Allatoona 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 Allatoona Project are regulated to meet the federally authorized project purposes at Allatoona in coordination with other authorized projects in the ACT Basin. It is Mobile District's responsibility to develop water control regulation procedures for the Allatoona Project, including all foreseeable conditions. 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. The power plant at Allatoona Dam is operated remotely from the control room at the Carters Dam Powerhouse under direct supervision of the power project manager. The Water Management Section communicates directly with the powerhouse operators at the Carters 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 main mechanism for such data dissemination is the internet through web pages and computer-to-computer data transfers. The web address for water management data is http://www.sam.usace.army.mil/Missions/CivilWorks/WaterManagement.aspx

b. Other Federal Agencies.

1) National Weather Service (NWS). NWS is the federal agency in NOAA that is responsible for weather and weather forecasts. The NWS along with its River Forecast Center maintains a network of reporting stations throughout the nation. It continuously provides current weather conditions and forecasts. It prepares river forecasts for many locations including the ACT Basin. Often, it prepares predictions on the basis of *what if* scenarios. Those include rainfall that is possible but has not occurred. In addition, the NWS provides information on hurricane tracts and other severe weather conditions. It monitors drought conditions and provides the information. Information is available through the Internet, the news, and the Mobile District's direct access.

2) U.S. Geological Survey (USGS). The USGS is an unbiased, multidisciplinary science organization that focuses on biology, geography, geology, geospatial information, and water.

The agency is responsible for the timely, relevant, and impartial study of the landscape, natural resources, and natural hazards. Through the Corps-USGS Cooperative Gaging program, the USGS maintains a comprehensive network of gages in the Allatoona Watershed and ACT Basin. The USGS Water Science Centers in Georgia and Alabama publish real-time reservoir levels, river and tributary stages, and flow data through the USGS NWIS web site. The Water Management Section uses the USGS to operate and maintain project water level gaging stations at each federal reservoir to ensure the accuracy of the reported water levels.

3) Southeastern Power Administration (SEPA). SEPA was created in 1950 by the Secretary of the Interior to carry out the functions assigned to the Secretary by the Flood Control Act of 1944. In 1977, SEPA was transferred to the newly created U.S. Department of Energy. SEPA, headquartered in Elberton, Georgia, is responsible for marketing electric power and energy generated at reservoirs operated by the Corps. The power is marketed to more than 491 preference customers in Georgia, Florida, Alabama, Mississippi, southern Illinois, Virginia, Tennessee, Kentucky, North Carolina, and South Carolina.

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

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

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

4) U.S. Fish and Wildlife Service (USFWS). The USFWS is an agency of the Department of the Interior whose mission is working with others to conserve, protect and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people. The USFWS is the responsible agency for the protection of federally listed threatened and endangered species and federally designated critical habitat in accordance with the Endangered Species Act of 1973. The USFWS also coordinates with other federal agencies under the auspices of the Fish and 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. <u>State and County Agencies</u>

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.

2) Georgia. GAEPD conducts water resource assessments to determine a sound scientific understanding of the condition of the water resources, in terms of the quantity of surface water and groundwater available to support current and future in-stream and off-stream uses and the capacity of the surface water resources to assimilate pollution. Regional water planning councils in Georgia prepare recommended Water Development and Conservation Plans. Those regional plans promote the sustainable use of Georgia's waters by selecting 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.

d. Stakeholders. Many non-federal stakeholder interest groups are active in the ACT Basin. The groups include lake associations, M&I water users, navigation interests, environmental organizations, and other basin-wide interests groups. Coordinating water management activities with 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 Master 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.

9-02. Interagency Coordination.

Local Press and Corps Bulletins. The local press includes any periodic publications in or near the Allatoona Watershed and the ACT Basin. Montgomery, Alabama, and Atlanta, Georgia, have some of the larger daily papers. These 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 web sites. Complete, real-time information is available at the Mobile District's Water Management homepage http://water.sam.usace.army.mil/. The Mobile District Public Affairs Office issues press releases as necessary to provide the public with information regarding Water Management issues and activities.

9-03. Framework for Water Management Changes. Special interest groups often request modifications of the basin water control plan or project specific water control plan. The Allatoona 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 insure their most efficient use. Within the constraints of Congressional authorizations and engineering regulations, the water control plan and operating techniques are often reviewed to see if improvements are possible without violating authorized project functions. When deemed appropriate, temporary variances to the water control plan approved by SAD can be implemented to provide the most efficient regulation while balancing the multiple purposes of the ACT Basin-wide system.

EXHIBIT A

SUPPLEMENTARY PERTINENT DATA

EXHIBIT A
SUPPLEMENTARY PERTINENT DATA

STREAM FLOW

Drainage area at dam site-square miles	1,122
Minimum mean monthly flow prior to construction (Oct 1931)-cfs	240
Minimum mean monthly flow after construction based on unimpaired flows (September 2007)-cfs	148
Minimum mean monthly flow after construction based on flows computed at the project without correcting for losses (Sept. 2007)-cfs	-5
Maximum mean monthly flow prior to construction (Dec 1932)-cfs	9,360
Maximum mean monthly flow after construction based on unimpaired flows (March 1980)-cfs	8249
Maximum mean monthly flow after construction based on flows computed at the project without correcting for losses (March 1980)-cfs	8326
Average daily flow (1896 – 1949 Prior to construction)-cfs	2257
Average daily flow (1950 – 2008) unimpaired flows)-cfs	1796
Average daily flow (1950 – 2008) computed at the project-cfs	1734
Discharge at bankfull stage-cfs	9,500
Maximum recorded daily flow (Sept 2009)-cfs	53,534

SPILLWAY-DESIGN FLOOD

National Weather Service 72-hr storm at Long. 84^{o} 23’ and Lat, 34^{o} 18’	
Total rainfall-inches	30.7
Total storm runoff-inches	25.3
Total volume of storm runoff-acre feet	1,496,000
Peak rates of flow	
Reservoir inflow-cfs	382,000
Reservoir outflows	333,000
Duration of flood-days	9
Maximum pool elevation feet-NGVD29	872.1
Top of flood risk management pool feet-NGVD29	860.0

RESERVOIR

Summer top of conservation, Apr 30-Sep	840.0
Winter top of conservation pool, Dec 15-Jan	823.0
Bottom of conservation pool	800.0
Storage volumes-acre feet	
Maximum pool, spillway design flood; (elevation 872.1)	886,200
Total storage,-(elevation 860)	670,047
Total storage,-(elevation 840)	367,471
Total storage,-(elevation 823)	202,769

Inactive storage, below elev. 800	82,891
Summer flood risk management storage,	840-860 (5.11" of runoff)
Summer conservation storage,	800-840 (4.81" of runoff)
Winter flood risk management storage,	823-860 (7.89" of runoff)
Winter conservation storage,	800-823 (2.03" of runoff)
Reservoir areas-acres Area within taking line-acres	
Maximum pool, spillway design flood, elev 872.1	25,670
Top of flood risk management pool, elev 860	19,201
Top of conservation pool, elev 840, summer pool	11,862
Top of conservation pool, elev 823, winter pool	7,606
Top of inactive storage, elev 800	3,251
Purchased in fee simple	37,742
River bed	500
Total	38,242
Flowage easement	208
Parks and campgrounds	
Wildlife areas	11,683
Length of shore line-miles	
Top of conservation pool, elev 840, summer pool	270
Length of reservoir at elevation 840-river miles	28

<u>DAM</u>

Type, main dam	Concrete gravity
Length overall-feet	1,250
Length non-overflow section-feet	750
Height of main dam above river bed-fee	190
Elevation, top of dam-feet-NGVD29	880
Elevation, top of earth dikes-feet-NGVD29	875

<u>SPILLWAY</u>

Net length-feet	400
Crest elevation feet-NGVD29	835.0
Crest tainter gates	9@40'x26'; 2@20'x26'
Elevation, top of spillway gates, closed-feet-NGVD29	860.0
Total discharge capacity – (pool elev. 870.3)-cfs	321,000
Total discharge capacity – (pool elev. 860.0)-cfs	184,000

FLOOD RISK MANAGEMENT SLUICE

Number of sluices-5’8”x10’0”	4
Discharge capacity at elev. 860-cfs	17,300
Discharge capacity at elev. 840-cfs	16,200
Discharge capacity at elev. 823-cfs	15,100
Discharge capacity at elev. 800-cfs	13,600

POWER PLANT

Present installation-kw	
Two units at 42,000 each and 1 small unit at 2,400 (nameplate)	86,400
Two units at 40,000 each and 1 small unit at 2,200 (declared)	82,200
Penstocks three-20’ and one-5.5’ dia. Steel pipes	

POWER DATA

Gross static head-feet at full pool	150.0
Minimum gross (bottom of conservation) head-feet	110.0
Average designed head-feet	138.0
Tailwater elevations, feet-NGVD29	
Maximum, design storm-outflow 321,000 cfs	733.1
Sump Wall Limit, Turbines and Sluice-outflow 11,200	697.0
Downstream bankfull capacity-outflow 9,500 cfs	696.5
Normal, 2 large units operating-outflow 6,500 cfs	694.7
Normal, 1 large unit operating-outflow 3,250 cfs	692.6
Minimum, outflow 203 cfs	690.0
Plant output	
Installed capacity, at rated power factor-kw	86,800
Installed capacity, at unity power factor-kw	96,400
Designed dependable capacity-kw	82,200
Overload capacity, at unity power factor-kw	96,4000
Historical average annual energy kwh	153,477,000

1

EXHIBIT B

UNIT CONVERSIONS

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 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 = 0.737 cubic feet per second for one year

VERTICAL DATUM CONVERSION INFORMATION

LEVEL ABSTRACT

SURVEY OF LAKE ALLATOONA — ABSTRACTED BY SCN
ORDER 3rd — ADJUSTED BY SCN — VERTICAL DATUM NAVD88
DATE — CHECK BY SCN
9/23/2009 — RUN BY TRD

STATION	# OF TURNS	FOR B	SUM OF ROD READINGS BS	FS	DIFF OF ELEV	ELEVATIONS-STATIC UNADJUSTED	CORRECTION	ADJUSTED	MEAN STATIC	REMARKS	
Lake Allatoona Dam Headwater											
LOOP 1									MEAN F & B		
BM-1						879.923	0.000	879.923	879.923	Elevation Held Static Solution	Brass disk just inside the entrance gate to the top of the dam
	1	F	4.997	4.786	0.211						
TP-1				MEAN	0.211	880.134	0.000	880.134	880.134		Turning Point
	1	F	4.129	4.061	0.068						
RP-2				MEAN	0.068	880.202	0.000	880.202	880.202		Bolt in sidewalk closest to the gage house door
	1	B	4.163	4.23	-0.067						
TP-1				MEAN	-0.067	880.135	-0.001	880.134			Turning Point
	1	B	4.834	5.045	-0.211						
BM-1				MEAN	-0.211	879.924	-0.001	879.923	879.923		Brass disk just inside the entrance gate to the top of the dam
	4	Sum Turns									
LOOP 2									MEAN F & B		
BM-1						879.923	0.000	879.923	879.923	Elevation Held	Brass disk just inside the entrance gate to the top of the dam
	1	F	4.629	1.304	3.325						
RP-1				MEAN	3.325	883.248	0.000	883.248	883.249		Chiseled square on right end of bridge railing near the entrance gate
	1	F	1.117	1.042	0.075						
RP-4				MEAN	0.075	883.323	0.000	883.323	883.323		Angle iron used for tape downs left of entrance gate on bridge railing. Held on top (vertical leg) of the angle
	1	F	1.344	4.526	-3.182						
BM-2				MEAN	-3.182	880.141	0.000	880.141	880.141		Brass disk in the center upstream side of the top of the dam
	1	F	4.61	4.555	0.055						
TBM-1				MEAN	0.055	880.196	0.000	880.196	880.193		Chiseled square used for making tape downs at the old staff. Located on a half oval shaped extension of the dam over the railing, left of the door to the gage room and right of the old staff
	1	F	4.843	5.336	-0.493						
TP-2				MEAN	-0.493	879.703	0.000	879.703	879.703		Turning Point
	1	F	4.976	4.829	0.147						
BM-3				MEAN	0.147	879.850	0.000	879.850	879.850		Brass disk in center of road at the far left side of the dam
	1	B	4.65	4.797	-0.147						
TP-2				MEAN	-0.147	879.703	-0.001	879.702			Turning Point
	1	B	5.256	4.768	0.488						
TBM-1				MEAN	0.488	880.191	-0.001	880.190			Chiseled square used for making tape downs at the old staff. Located on a half oval shaped extension of the dam over the railing, left of the door to the gage room and right of the old staff
	1	B	4.496	4.548	-0.052						
BM-2				MEAN	-0.052	880.139	-0.001	880.138			Brass disk in the center upstream side of the top of the dam
	1	B	4.644	1.459	3.185						
RP-4				MEAN	3.185	883.324	-0.001	883.323	883.323		Angle iron used for tape downs left of entrance gate on bridge railing. Held on top (vertical leg) of the angle
	1	B	1.371	1.444	-0.073						
RP-1				MEAN	-0.073	883.251	-0.001	883.250			Chiseled square on right end of bridge railing near the entrance gate
	1	B	1.216	4.543	-3.327						
BM-1				MEAN	-3.327	879.924	-0.001	879.923	879.923	Elevation Held	Brass disk just inside the entrance gate to the top of the dam
	12	Sum Turns									

LEVEL ABSTRACT

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ORDER 3rd — ADJUSTED BY SCN — VERTICAL DATUM NAVD88
DATE — CHECK BY SCN
9/23/2009 — RUN BY TRD

STATION	# OF TURNS	FOR B	SUM OF ROD READINGS		DIFF OF	ELEVATIONS-STATIC			MEAN		
			BS	FS	ELEV	UNADJUSTED	CORRECTION	ADJUSTED	STATIC	REMARKS	
LOOP 3									MEAN F & B		
BM-1						879.923	0.000	879.923	879.923	Elevation Held	Brass disk just inside the entrance gate to the top of the dam
	1	F	4.978	5.019	-0.041						
RP-3				MEAN	-0.041	879.882	0.000	879.882	879.882		Square bolt closest to the road on downstream side of the end of the curb in parking area outside of gate to the top of the dam. Near guy wire and solitary pine tree
	1	F	1.278	12.971	-11.693						
TP-3				MEAN	-11.693	868.189	0.000	868.189	868.190		Turning Point
	1	F	0.215	10.898	-10.683						
E-1				MEAN	-10.683	857.506	0.000	857.507	857.507		Leaning brass disk downhill towards lake from parking area, 20 ft. upstream and 30-40 ft. downhill from RP 3. Not a stable starting point
	1	B	11.253	0.57	10.683						
TP-3				MEAN	10.683	868.189	0.001	868.190			Turning Point
	1	B	12.702	1.01	11.692						
RP-3				MEAN	11.692	879,881	0.001	879.882			Square bolt closest to the road on downstream side of the end of the curb in parking area outside of gate to the top of the dam. Near guy wire and solitary pine tree
	1	B	5.245	5.204	0.041						
BM-1				MEAN	0.041	879.922	0.001	879.923		Elevation Held	Brass disk just inside the entrance gate to the top of the dam
	6	Sum Turns									
LOOP 4											
RP-3						879.882	0.000	879.882		Elevation from Loop 3	Square bolt closest to the road on downstream side of the end of the curb in parking area outside of gate to the top of the dam. Near guy wire and solitary pine tree
	1	F	2.96	7.49	-4.530				MEAN F & B		
TP-4				MEAN	-4.530	875.532	-0.002	875.350	875.350		Turning Point
	1	F	0.46	22.37	-21.910				MEAN F & B		
RP-5				MEAN	-21.910	853.442	-0.004	853.438	853.438		Rock with a Bolt
	1	F	22.31	21.91	0.400				MEAN F & B		
Gage @ 854				MEAN	0.400	853.842	-0.006	853.836	853.836		Gage at 854.00
	1	F	22.06	0.53	21.530				MEAN F & B		
TP-6				MEAN	21.530	875.372	-0.008	875.364	875.364		Turning Point
	1	F	7.67	3.15	4.520						
RP-3				MEAN	4.520	879.892	-0.010	879.882		Elevation from Loop 3	Brass disk just inside the entrance gate to the top of the dam
	5	Sum Turns									

LEVEL ABSTRACT

SURVEY OF LAKE ALLATOONA ABSTRACTED BY SCN
ORDER 3rd ADJUSTED BY SCN VERTICAL DATUM NAVD88
DATE CHECK BY SCN
9/23/2009 RUN BY TRD

STATION	# OF TURNS	FOR B	SUM OF ROD READINGS		DIFF OF	ELEVATIONS-STATIC			MEAN		
			BS	FS	ELEV	UNADJUSTED	CORRECTION	ADJUSTED	STATIC	REMARKS	

Lake Allatoona Dam Headwater Final Elevations

Point	ELEVATION NAVD88 Feet	ELEVATION Furnished NGVD29 Feet	DIFF NAVD88 NGVD29 Feet	DESCRIPTION
BM-1	879.923	880.059	-0.136	Brass disk just inside the entrance gate to the top of the dam
TP-1	880.134			Turning Point
RP-2	880.202	880.377	-0.175	Bolt in sidewalk closest to the gage house door
RP-1	883.249	883.383	-0.134	Chiseled square on right end of bridge railing near the entrance gate
RP-4	883.323	883.455	-0.132	Angle iron used for tape downs left of entrance gate on bridge railing. Held on top (vertical leg) of the angle.
BM-2	880.140	880.029	0.111	Brass disk in the center upstream side of the top of the dam
TBM-1	880.193	880.323	-0.130	Chiseled square used for making tape downs at the old staff. Located on a half oval shaped extension of the dam over the railing, left of the door to the gage room and right of the old staff
TP-2	879.703			Turning Point
BM-3	879.850	879.98	-0.130	Brass disk in center of road at the far left side of the dam
RP-3	879.882	880.029	-0.147	Square bolt closest to the road on downstream side of the end of the curb in parking area outside of gate to the top of the dam. Near guy wire and solitary pine tree
TP-3	868.190			Turning Point
E-1	857.507	857.641	-0.135	Leaning brass disk downhill towards lake from parking area, 20 ft. upstream and 30-40 ft. downhill from RP 3. Not a stable starting point
TP-4	875.350			Turning Point
RP-5	853.438			Rock with a Bolt
GAGE & 854	853.836			Gage at 854.00
TP-6	875.364			Turning Point

METHOD	READING	DATE/TIME
VISABLE	852.36	9/25/2009 @ 9:55:00 AM
ELECTRONIC	852.40	9/25/2009 @ 10:00:00 AM

853.836	NAVD88 Elevation on Gage @ 854.00'
854.000	Actual gage reading
-0.164	Difference (NAVD88 & Staff Gage)

LEVEL ABSTRACT

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ORDER 3rd ADJUSTED BY SCN VERTICAL DATUM NAVD88

DATE CHECK BY SCN

9/23/2009 RUN BY TRD

STATION	# OF TURNS	FOR B	SUM OF ROD READINGS		DIFF OF	ELEVATIONS-STATIC			MEAN		
			BS	FS	ELEV	UNADJUSTED	CORRECTION	ADJUSTED	STATIC	REMARKS	
Lake Allatoona Dam Tailwater											
LOOP 4									MEAN F & B		
D-4						736.579	0.000	736.579	736.579	Elev establish from COE Mon	Bronze tablet set in concrete pad 30 feet downstream and 40 feet shoreward of powerhouse entrance door. Origin of level run
	1	F	6.88	0.45	6.430				MEAN F & B		
BM-RW				MEAN	6.430	743.009	-0.001	743.008	743.009		4-inch bronze tablet set in curb located 100 feet upstream and 18.5 feet shoreward of powerhouse entrance door
	1	F	1.183	7.993	-6.810				MEAN F & B		
BM-K9				MEAN	-6.810	736.199	-0.002	736.198			2-inch bronze tablet set in pad located 102 feet upstream and 24 feet streamward of powerhouse entrance door
	1	B	8.118	1.306	6.812						
BM-RW				MEAN	6.812	743.011	-0.002	743.009			4-inch bronze tablet set in curb located 100 feet upstream and 18.5 feet shoreward of powerhouse entrance door
	1	B	1.027	7.456	-6.429						
D-4				MEAN	-6.429	736.582	-0.003	736.579		Elev establish from COE Mon	Bronze tablet set in concrete pad 30 feet downstream and 40 feet shoreward of powerhouse entrance door. Origin of level run
	4	Sum Turns									
LOOP 5									MEAN F & B		
D-4						736.579	0.000	736.579	736.579	Elev establish from COE Mon	Bronze tablet set in concrete pad 30 feet downstream and 40 feet shoreward of powerhouse entrance door. Origin of level run
	1	F	4.343	1.72	2.623				MEAN F & B		
RM-2				MEAN	2.623	739.202	0.000	739.202	739.202		Chiseled square in concrete shelf at gage house
	1	B	1.841	4.463	-2.622						
D-4				MEAN	-2.622	736.580	-0.001	736.579		Elev establish from COE Mon	Bronze tablet set in concrete pad 30 feet downstream and 40 feet shoreward of powerhouse entrance door. Origin of level run
	2	Sum Turns									

LEVEL ABSTRACT

SURVEY OF LAKE ALLATOONA ABSTRACTED BY SCN

ORDER 3rd ADJUSTED BY SCN VERTICAL DATUM NAVD88

DATE CHECK BY SCN

9/23/2009 RUN BY TRD

STATION	# OF TURNS	FOR B	SUM OF ROD READINGS		DIFF OF	ELEVATIONS-STATIC			MEAN		
			BS	FS	ELEV	UNADJUSTED	CORRECTION	ADJUSTED	STATIC	REMARKS	
LOOP 6									MEAN F & B		
D-4						736.579	0.000	736.579	736.579	Elev establish from COE Mon	Bronze tablet set in concrete pad 30 feet downstream and 40 feet shoreward of powerhouse entrance door. Origin of level run
	1	F	4.14	12.63	-8.490				MEAN F & B		
2				MEAN	-8.490	728.089	-0.001	728.088	728.088		Turning Point
	1	F	0.458	12.948	-12.490				MEAN F & B		
3				MEAN	-12.490	715.599	-0.001	715.598	715.598		Turning Point
	1	F	1.243	5.43	-4.187				MEAN F & B		
RP-1				MEAN	-4.187	711.412	-0.002	711.410	711.410		Outside most end of vertical angle iron leaded to left side of tailrace wing wall
	1	F	5.298	6.516	-1.218				MEAN F & B		
GAGE				MEAN	-1.218	710.194	-0.003	710.192	710.192		Top Gage (710.00)
	1	B	6.422	5.203	1.219						
RP-1				MEAN	1.219	711.413	-0.003	711.410			Outside most end of vertical angle iron leaded to left side of tailrace wing wall
	1	B	5.324	1.136	4.188						
3				MEAN	4.188	715.601	-0.004	715.597			Turning Point
	1	B	12.716	0.226	12.490						
2				MEAN	12.490	728.091	-0.004	728.087			Turning Point
	1	B	12.616	4.123	8.493						
D-4				MEAN	8.493	736.584	-0.005	736.579		Elev establish from COE Mon	Bronze tablet set in concrete pad 30 feet downstream and 40 feet shoreward of powerhouse entrance door. Origin of level run
	8	Sum Turns									
LOOP 7									MEAN F & B		
BM-K9						736.198	0.000	736.198	736.198	Elevation from Loop 4	2-inch bronze tablet set in pad located 102 feet upstream and 24 feet streamward of powerhouse entrance door
	1	F	3.465	5.433	-1.968				MEAN F & B		
BM-K6				MEAN	-1.968	734.230	0.000	734.229	734.229		2-inch bronze tablet set in sidewalk located 103 feet upstream and 110 feet streamward of powerhouse entrance door
	1	F	5.453	3.885	1.568				MEAN F & B		
BM-C1				MEAN	1.568	735.798	-0.001	735.797	735.797		2-inch bronze tablet set in sidewalk located 124 feet upstream and 247 feet streamward of powerhouse entrance door
	1	B	3.95	5.518	-1.568						
BM-K6				MEAN	-1.568	734.230	-0.001	734.229			2-inch bronze tablet set in sidewalk located 103 feet upstream and 110 feet streamward of powerhouse entrance door
	1	B	5.42	3.451	1.969						
BM-K9				MEAN	1.969	736.199	-0.001	736.198		Elevation from Loop 4	2-inch bronze tablet set in pad located 102 feet upstream and 24 feet streamward of powerhouse entrance door
	4	Sum Turns									

LEVEL ABSTRACT

SURVEY OF LAKE ALLATOONA — ABSTRACTED BY SCN
ORDER 3rd — ADJUSTED BY SCN — VERTICAL DATUM NAVD88
DATE — CHECK BY SCN
9/23/2009 — RUN BY TRD

STATION	# OF TURNS	FOR B	SUM OF ROD READINGS		DIFF OF	ELEVATIONS-STATIC			MEAN		
			BS	FS	ELEV	UNADJUSTED	CORRECTION	ADJUSTED	STATIC	REMARKS	

Lake Allatoona Dam Tailwater Final Elevations

Point	ELEVATION	ELEVATION	DIFF	DESCRIPTION
	NAVD88	Furnished	NAVD88	
	Feet	NGVD29	NGVD29	
		Feet	Feet	
D-4	736.579	736.286	0.293	Bronze tablet set in concrete pad 30 feet downstream and 40 feet shoreward of powerhouse entrance door. Origin of level run
BM-RW	743.009	742.71		4-inch bronze tablet set in curb located 100 feet upstream and 18.5 feet shoreward of powerhouse entrance door
BM-K9	736.198	735.898	0.299	2-inch bronze tablet set in pad located 102 feet upstream and 24 feet streamward of powerhouse entrance door
RM-2	739.202	738.892	0.310	Chiseled square in concrete shelf at gage house
2	728.088			Turning Point
3	715.598			Turning Point
RP-1	711.410	711.114	0.296	Outside most end of vertical angle iron leaded to left side of tailrace wing wall
GAGE	710.192			Top Gage (710.00)
BM-K6	734.229	733.924	0.305	2-inch bronze tablet set in sidewalk located 103 feet upstream and 110 feet streamward of powerhouse entrance door
BM-C1	735.797	735.924	-0.127	2-inch bronze tablet set in sidewalk located 124 feet upstream and 247 feet streamward of powerhouse entrance door

METHOD	READING	DATE/TIME
VISABLE	695.33	9/25/2009 @ 9:55:00 AM
ELECTRONIC	695.32	9/25/2009 @ 10:00:00 AM

710.192	NAVD88 Elevation on Gage @ 710.00'
710.00	Actual gage reading
0.191	Difference (NAVD88 & Staff Gage)

SURVEY DATASHEET (Version 1.0)

PID: BBBM47
Designation: BM1
Stamping: 1
Stability: Most reliable; expected to hold position well
Setting: Massive structures (other than listed below)
Mark Condition: G
Description: THE MARK IS FOUND ON THE NORTH END OF ALLATOONA DAM WHERE SR 120 SPUR TERMINATES.

LOCATED NEAR CENTERLINE OF DAM, MARK IS 33.2' NE OF A LIGHT POLE, 41.4' SE OF THE S CORNER OF A CONCRETE STAIRWELL. AND 30.8' SW OF THE CENTERLINE OF AN ACCESS GATE TO THE NORTH END OF THE DAM.

Observed: 2009-09-29T12:30:00Z See Also 2009-10-06
Source: OPUS - page5 0909.08

Close-up View

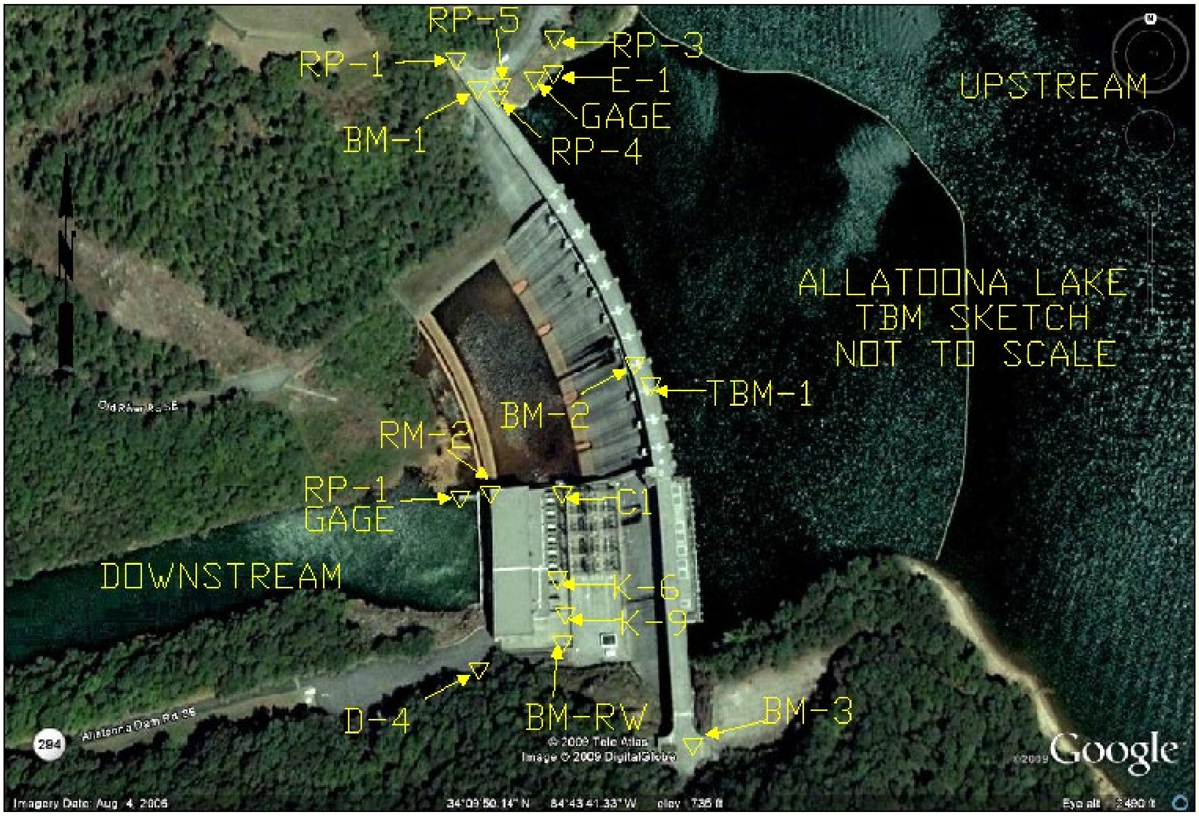
REF_FRAME: NAD_83 (CORS96)	EPOCH: 2002.0000	SOURCE: NAVD88 (Computed using GEOID03)	UNITS: m	SET PROFILE	DETAILS

LAT:	34° 9' 55.17435"	± 0.013	m
LON:	-84° 43' 43.62824"	± 0.018	m
ELL HT:	238.778	± 0.041	m
X:	485367.359	± 0.017	m
Y:	-5260836.485	± 0.041	m
Z:	3561769.250	± 0.013	m
ORTHO HT:	268.201	± 0.059	m

	UTM 16	**SPC** 1002(GA W)
NORTHING:	3782818.246m	461983.251m
EASTING:	709354.925m	648174.457m
CONVERGENCE:	1.27593869°	-0.31568334°
POINT SCALE:	1.00014031	0.99993310
COMBINED FACTOR:	1.00010282	0.99989562

SURVEY DATASHEET (Version 1.0) Page 1 of 1

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.



Allatoona Dam and Lake

EXHIBIT C

STANDING INSTRUCTIONS TO THE DAMTENDERS FOR WATER CONTROL

STANDING INSTRUCTIONS TO THE DAMTENDER
FOR WATER CONTROL
ALLATOONA DAM AND LAKE

1. BACKGROUND AND RESPONSIBILITIES

a. General Information. These Standing Instructions to the Project Operator for Water Control are written in compliance with Section 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 Allatoona Project is operated for flood risk management, hydropower, recreation, fish and wildlife, water quality, water supply and navigation (only incidental benefits due to reregulation of flow by APC projects downstream). Water Control actions are in support of these project purposes and for purposes of the ACT River system.

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

(3) **Structure**. Allatoona Dam is located on the Etowah River, 48 river miles above Rome, Georgia. Allatoona Dam and Lake are located within Bartow, Cherokee, and Cobb Counties. The drainage area above Allatoona Dam is approximately 1,122 square miles.

(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 Allatoona Dam (Allatoona Lake) Operations Project Manager.

b. Role of the Project Operator. The term Project Operator refers to both the Carters Powerhouse Operator and to the Allatoona Powerhouse Personnel. Operation of the hydropower units and data reporting is the responsibility of the Carters Powerhouse Operator. Operation of the spillway and sluice gates is the responsibility of the Allatoona Powerhouse Personnel.

(1) **Normal Conditions (dependent on day-to-day instruction)**. The Water Control Manager will coordinate the daily water control actions regarding hydropower releases with the Southeastern Power Administration (SEPA), and will notify the Project Operator of these changes. The Project Operator will then receive instructions from SEPA via 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. In the event that water cannot be passed through the hydropower units or if additional releases in excess of hydropower capacity are needed, the Water Control Manager will coordinate releases through the spillway and/or sluice gates with the powerhouse operator at the Carters Powerhouse.

(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 and contact the Water Management Section as soon as communication is reestablished. Specific operator instructions are shown below:

Operator instructions in the event of lost communications with Water Management Section	
Condition	Action
II. Rome stage is above 20' and rising. Pool is below Elevation 850 feet-NGVD29	Halt scheduled releases
II. Rome stage is above 20' and rising. Pool is above Elevation 850 feet-NGVD29	Continue scheduled releases
III. Rome stage is below 22' and falling.	Make scheduled releases
IV. Rome is above 25'. or Kingston is above11'. or Cartersville is above 18'.	Make no releases unless called for in Condition V.
V. Releases are required by the Induced Surcharge Schedule. See Plate 7-2.	Release the greater of: requirements from Induced Surcharge Schedule, or releases from condition III,

NOTES:

Bankfull stages at Rome, Kingston and Cartersville are 20, 9, and 15 feet, respectively.

If Rome stage cannot be obtained, then make projection by using the rate of change of the last known 3 hours to estimate the current stage.

If a rainfall of 4 inches or greater occurs the rate of rise at Rome should be in the range of one foot per three hours.

If Rome stage is expected to exceed 25 feet and Induced Surcharge Schedule does not call for release, then halt generation.

Condition II implies a previous flood condition and the pool should be lowered.

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

(2) Precipitation in hundredths of an inch.

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

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

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

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

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

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

d. Regional Hydrometeorological 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 Allatoona Dam and Lake 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 the spillway and/or 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.