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HYDRAULIC DATA FOR COOSA RIVER IN VICINITY OF WALTER BOULDIN AND JORDAN DAMS NEAR WETUMPKA, ALABAMA

By G. H. Nelson, Jr., and C. O. Ming

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ABSTRACT

This report is a supplement to the original report published in January 1980. Basic hydraulic data have been obtained and assembled for the Coosa River in the vicinity of Alabama Power Company's Jordan and Walter Bouldin Dams and hydroelectric plants.

Data have been collected along the Coosa River in the vicinity of Parker Island and are included in this report. Data presented consist of three separate float studies, vertical velocity observations, estimates of discharge, stage and discharge hydrographs, and maximum water-surface profiles.

INTRODUCTION

The Alabama Power Company operates seven hydroelectric plants at dams along the Coosa River in Alabama. In downstream order and year of completion, the dams are: Weiss (1961),H. Neely Henry (1966), Logan Martin (1964), Lay (1914), Mitchell (1923), Jordan (1929), and Walter Bouldin (1967). As part of their water-resources development program for Alabama, the U.S. Army Corps of Engineers, Mobile District, is currently investigating the feasibility of installing navigation locks at six of these dams between the cities of Wetumpka and Leesburg, Ala.

Development of Alabama's major rivers results in variations and trends in basic hydraulic conditions of the rivers. A distinct and important part of the U.S. Geological Survey programs is to evaluate stream systems for aiding in determining effects of various alternatives of development and management of the streams. Basic hydraulic data are important parts of the stream evaluation system.

The Corps of Engineers is presently studying the effects of a navigation lock at Walter Bouldin Dam on the Coosa River in the vicinity of Parker Island. To aid in their study, the Corps of Engineers requested the U.S. Geological Survey to collect and make accessible basic hydraulic data for the river in the vicinity of Jordan and Walter Bouldin Dams near Wetumpka. Basic hydraulic data for portions of the Coosa and Tallapoosa Rivers have also been collected in the vicinity of Parker Island. Hydraulic data for a short reach of the Alabama River between Parker and Gun Islands are included.

This report presents a compilation of the basic hydraulic data which consist of three separate float studies, measurements of velocity, estimates of discharge, stage and discharge hydrographs and profiles of maximum water-surface elevations.

Elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD of 1929): A geodetic dataum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "Mean Sea Level."

River miles are those obtained from "Stream Mileage Tables," published by the U.S. Army Corps of Engineers, May 1972.

USE OF METRIC UNITS OF MEASUREMENT

The compilations in this report are in Inch-pound units of measurement. Conversion factors for metric units from Inch-pound units are listed below. Multiply the Inch-pound units by the conversion factor to obtain metric units.

Inch-pound units	Conversion factor	Metric units
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)
cubic feet per second (ft^3/s)	0.02832	cubic meters per second (m^3/s)

COOSA RIVER AND AREA OF STUDY

The Coosa River is formed by the confluence of the Oostanaula and Etowah Rivers near Rome, Georgia. The river flows westward into Alabama for approximately 20 miles and then southward approximately 176 miles through the towns of Gadsden, Childersburg, and Wetumpka. A map showing the study area for the Coosa River basin and location of each dam is given in figure 1.

The river flows from Floyd County, Georgia, through Cherokee and Etowah Counties in Alabama and continues through Alabama forming the boundaries of counties St. Clair/Calhoun, Shelby/Talladega, Chilton/Coosa, and ending in Elmore County, where it joins with the Tallapoosa River to form the Alabama River. The entire Coosa River upstream from Jordan Dam has been developed by the Alabama Power Company for the production of electric power. The development resulted in a series of lakes and reservoirs along the Coosa River upstream from Jordan Dam.

The Coosa River below Jordan Dam flows southeastward along an outcrop of metamorphic rocks that comprise the Fall Line with many shoals and rapids in the streambed. The river channel in this area is steep, narrow, and rugged. The river flows south-southwestward through Wetumpka and then flows westward through a broad flood plain. A pronounced change in the topography occurs immediately downstream from Wetumpka. The reach from Wetumpka to the junction of the Coosa and Tallapoosa Rivers is characterized by relatively low river banks and wide, flat, overflow areas. The banks are covered with trees of various types. Most of the overflow area is cultivated or used for pasture. At about mile 5.8, there is a channel connecting the Coosa and Tallapoosa Rivers. This channel along with the Coosa and Tallapoosa Rivers forms the boundary of Parker Island (fig. 2).

At normal stages on the rivers, Parker Island has a surface area of about 3 square miles. Land-surface elevations of the island range from approximately 130 feet to 160 feet. The island is believed to have been formed by floods late in the 19th century. Research of old publications of the area produced an old map published in the Atlas "Office Records of the War of Rebellion," Plate 148, vol. 2 or 3, 1855 (revised 1965). The old map does not show Parker Island. An Alabama geologic map dated 1926 shows the island much as it appears today.

Stage and discharge in the vicinity of Parker Island are affected by operations at Jordan and Walter Bouldin Dams on the Coosa River, Thurlow Dam on the Tallapoosa River, and Jones Bluff lock and dam on the Alabama River. Location of Thurlow and Jones Bluff dams is shown on inset in figure 1.

DESCRIPTION OF DAMS

Jordan Lake is formed by Jordan Dam on the Coosa River (river mile 18.9) five miles northwest of Wetumpka (fig. 2). Figure 3 gives a view of the downstream side of Jordan Dam. The drainage area upstream from the dam is approximately 10,200 mi^2. The hydroelectric plant located on the left bank, at the east end of the dam, has four generating turbine units, each having a maximum discharge capacity of approximately 2,066 feet in length and a reservoir regulating spillway having two sets of flood gates. The larger set consists of 17 gates, each 30 feet wide and 18 feet high. The smaller set consists of 18 gates, each 34 feet wide and 8 feet high. The dam was completed and power production begun in December 1928.

Flow from the Coosa River is diverted from Jordan Lake through a 1.3 mile long intake canal which leads southwest into an auxiliary impoundment. The impoundment is about two miles west of the Coosa River mainstem. The impoundment is created by Alabama Power Company's Walter Bouldin Dam. Figure 4 gives an aerial view of Walter Bouldin Dam. Discharges from Walter Bouldin Dam re-enter the Coosa River at river mile 4.2 by way of a 4.5 mile long tailrace canal. This arrangement allows Walter Bouldin hydroelectric plant to utilize the head and storage on Jordan Lake. Normal pool elevation for both Jordan and Walter Bouldin Reservoirs is 252 feet with a minimum pool elevation of 242 feet.

Original construction of Walter Bouldin Dam was completed in July 1967. In February 1975, the dam failed when a portion of earth dike collapsed, draining the reservoir, but leaving the powerhouse and concrete section intact. Reconstruction was completed and the power production resumed in September 1980. The hydroelectric plant, located at the west end of Bouldin Dam, is equipped with three generating turbine units, each having a maximum discharge capacity of approximately 9,600 ft^3/s. The dam is composed of gravity concrete and earth-filled dikes. Total length of all earth dikes is approximately 10,950 feet, which includes a 228-foot length of concrete dam section. The hydroelectric plant functions as an auxiliary generation unit to the Jordan hydroelectric plant and has no spillway or reservoir regulation capacity, other than a small amount caused by power generation.

DIRECTION AND PATTERN OF RIVER CURRENTS

Float studies were made to obtain data to aid in determination of velocities, directions, and patterns of the river current upstream from Jordan and Walter Bouldin Dams, and at the point where the Bouldin tailrace canal joins the Coosa River. The field studies were made on October 21, 1980, and March 30, 1981. The float study for Jordan Lake scheduled for February 6, 1981, was cancelled because of severe wind conditions on the reservoir. The float study in the tailrace was completed, however. The time periods selected for the float studies provide a varied range of river stage and discharge.

Results of the studies are given in six panels of recent aerial photographs. The aerial photographs were made sometime prior to the float studies. Location of each panel is shown on an index map in figure 5. Because of the lack of adequately detailed maps of the area surrounding Walter Bouldin Dam, results of the float studies are shown on aerial photograph panels (figs. 6-23).

The floats used in the study were 2-inch diameter plastic pipes permanently capped at the bottom. Lengths of the pipes varied from 4 feet to 10 feet; the top of each pipe was painted with fluorescent paint. For ease in identification during the study, each float was coded with a different color of surveyor's flagging tape. Each float was filled with water so that the top painted portion extended about one foot above the water surface. The floats were capped and released at pre-selected sites and times as shown on figures 6 through 23, and their course of travel recorded using boats. All floats released in Jordan Lake were 10 feet long.

Vertical velocity observations were obtained at three separate points along each section. (See panels 1-6, figs. 6-23.) The velocity observations were taken from left to right bank usually prior to the release of the floats. The observations were obtained at two depths, one at 20 percent of the depth, and the other at 80 percent. Water-surface elevations and results of the velocity observations, where available, are given in panels 1 through 6.

Location of each float is shown as a small dot onthe float-study panels. The figure beside each dot represents the time the float was sighted at that specific location. The solid lines joining the dots are for clarity only and do not represent actual paths of travel by the floats.

Except for March 30, 1981, tailrace elevations and discharges at Jordan and Walter Bouldin Dams are listed in table 1.

ESTIMATES OF DISCHARGE IN THE VICINITY OF PARKER ISLAND DURING THE RISE OF MARCH 30 TO APRIL 2, 1981

To aid in the determination of the quantity and distribution of flow in the vicinity of Parker Island during this rise, estimates of discharge were made at selected sites upstream and downstream from major channel separations along both the Coosa and Tallapoosa Rivers around the island. The estimates were made March 30, 31, and April 2, 1981, and cover a range in river stage from 131 feet to 146 feet. Table 2 gives a summary of discharge and other related information obtained during the period. Maps of the area, showing sites where estimates were made, the date of the estimate, and a brief summary of each, are given on figures 24, 25, and 26.

Estimates were made using conventional type current meters from boats. Depending on the channel width and velocity, three to five vertical points were taken at each site of measurement with two observations at each vertical, one at 20 percent of the depth and the other at 80 percent. Distance across the measuring sites were determined by stadia readings using a level. To verify the depth soundings for each measurement, fathometer graphs of the cross-sections were made at each site.

Estimate of discharge was not obtained at site 8 on April 2, 1981, because the river had overflowed its banks making it impossible to measure the total flow. However, point velocities were taken in the main channel of the river, and they are shown on figure 26.

In conjunction with the data collected on April 2, 1981, a measurement of discharge was made on the Tallapoosa River from U.S. Highway 231 crossing just north of Montgomery. This measurement is shown on figure 26 and listed in table 2.

STAGE AND DISCHARGE HYDROGRAPHS FOR WALTER BOULDIN AND JORDAN DAMS

Hourly recordings of tailwater elevations and discharge for both Jordan and Walter Bouldin Dams for March 30 to April 5, 1981, were supplied by the Alabama Power Company, and they are given in table 3. A stage and discharge hydrograph for each dam tailrace is presented in figures 27-30.

MAXIMUM WATER-SURFACE ELEVATIONS AND PROFILES

Floodmarks were obtained for the maximum water surface following the crest on April 1, 1981, on the Coosa River and April 3, 1981, on the Tallapoosa River. Floodmarks were obtained from river mile 1 along the Coosa River to river mile 11. Floodmarks along the Walter Bouldin Dam tailrace canal were obtained for its entire length. The crest on the Tallapoosa River was defined by floodmarks determined by level survey from bench marks established in the area by the Corps of Engineers. A map of the area showing river mile and site location where floodmarks were obtained is given in figure 31. Site number, river mile, maximum water-surface elevations, and remarks are given in table 4.

Flood profiles, based on the floodmarks, are shown on figures 32 and 33.

STAGE RECORD AT U.S. GEOLOGICAL SURVEY GAGING STATIONS

The U.S. Geological Survey operates three gaging stations in the area. The stations are: Coosa River at Wetumpka, Alabama River above Montgomery (Mud Island gage), and Tallapoosa River near Montgomery (Montgomery water plant). Station location with numbers are shown in figure 31. All three gages are equipped with continuous water-stage recorders and record stage only.

Hourly stage readings for each station are listed in table 5. Stage hydrographs using these readings are shown in figures 34, 35, and 36.