Lloyd Shoals Hydroelectric Project
FERC Project Number 2336-094

Volume 1

Public

Initial Statement & 18 CFR § 5.18

Exhibit A

Exhibit B

Exhibit C

Prepared by

Southern Company Generation Hydro Services

December 2021

Lloyd Shoals Hydroelectric Project
FERC Project Number 2336-094

Initial Statement &
18 CFR § 5.18 Requirements

Public

Prepared by
Southern Company Generation Hydro Services

December 2021

BEFORE THE FEDERAL ENERGY REGULATORY COMMISSION

Application for License for Major Project – Existing Dam
18 CFR §§ 4.51 and 5.18

18 CFR § 4.51(a)(1) The Georgia Power Company (Georgia Power) **applies to the Federal Energy Regulatory Commission for a** new license **for the** Lloyd Shoals **water power project, as described in the attached exhibits.** The project number is P-2336.

18 CFR § 4.51(a)(2) The location of the project is:

State or territory: Georgia
County: Butts, Henry, Jasper and Newton Counties, Georgia
Township or nearby town: Jackson
Stream or other body of water: Ocmulgee River

18 CFR § 4.51(a)(3) The exact name and business address of the applicant are:

Georgia Power Company
241 Ralph McGill Boulevard N.E.
Atlanta, Georgia 30308-3374

The exact name and business address of each person authorized to act as agent for the applicant in this application are:

Georgia Power Company
c/o Mr. Herbie N. Johnson
241 Ralph McGill Boulevard N.E.
Bin 10193
Atlanta, Georgia 30308-3374

18 CFR § 4.51(a)(4) The applicant is a domestic corporation **and** is not **claiming preference under section 7(a) of the Federal Power Act. See 16 U. S. C. 796.**

18 CFR § 4.51(a)(5)(i) The statutory or regulatory requirements of the states(s) in which the project would be located that affect the project as proposed, with respect to bed and banks and to the appropriation, diversion, and use of water for power purposes, and with respect to the right to engage in the business of developing, transmitting, and distributing power and in any other business necessary to accomplish the purposes of the license under the Federal Power Act, are:

There are no special requirements in the State of Georgia pertaining to the operation of the project.

Georgia Power has the land and water rights necessary to accomplish the purposes of the license under the Federal Power Act. Under the laws of the state of Georgia (see Georgia Code of 1933), a corporation owning or controlling lands of any non-navigable stream as designated by the Georgia Code authorized to construct and maintain a dam across such stream for the development of water power. The water rights are vested in the lands along the stream.

Georgia Power is a corporation organized and existing under the general laws of the State of Georgia and has, by its charter, the right to engage in the business of developing, transmitting and distributing power and any other business necessary to accomplish the purposes of the license.

18 CFR § 4.51(a)(5)(ii) The steps which the applicant has taken or plans to take to comply with each of the laws cited above are:

There are no steps that the applicant needs to take with regards to compliance with the Georgia Code as described above.

18 CFR § 4.51(a)(6) The applicant must provide the name and address of the owner of any existing project facilities. If the dam is federally owned or operated, provide the name of the agency.

Georgia Power owns all the project facilities at the station. The mailing address has been provided above in the response to the requirements of 18 CFR § 4.51(a)(3).

18 CFR § 5.18 (a) General Content Requirements. Each license application filed pursuant to this part must:

18 CFR § 5.18 (a)(1) Identify every person, citizen, association of citizens, domestic corporation, municipality, or state that has or intends to obtain and will maintain any proprietary right necessary to construct, operate, or maintain the project;

Georgia Power Company (Georgia Power) is the only entity that has and will maintain any proprietary rights necessary to operate or maintain the project.

18 CFR § 5.18 (a)(2) Identify (providing name and mailing addresses):

18 CFR § 5.18(a)(2)(i) Every county in which any part of the project, and any Federal facilities that would be used by the project, would be located;

Counties Within the Project (there are no Federal Facilities in the Project)

County	Contact Name	Mailing Address
Butts County	Mr. Brad Johnson Chief Administrative Officer	625 West 3rd Street Jackson, GA 30233 Phone: 770-775-8200 bjohnson@buttscounty.gov
Henry County	Chairwoman Carlotta Harrell	140 Henry Parkway McDonough, GA 30253 Phone: 770-288-6001 charrell@co.henry.ga.us
Jasper County	Chairman Bruce Henry	126 W. Greene St., Suite 18 Monticello, GA 31046 Phone: 762-435-9766 bhenry@jaspercountyga.org
Newton County	Chairman Marcello Banes	1124 Clark Street Covington, GA 30014 Phone: 678-625-1201 mbanes@co.newton.ga.us

18 CFR § 5.18(a)(2)(ii)(A) Every city, town, or similar local political subdivision: In which any part of the project, and any Federal facilities that would be used by the project, would be located; or

The Lloyd Shoals Project is not located within any city or town limits.

18 CFR § 5.18(a)(2)(ii)(B) Every city, town, or similar local political subdivision: That has a population of 5,000 or more people and is located within 15 miles of the project dam

Cities and Towns with 5,000 or More Population Within 15 Miles of the Dam

City/Town	Contact Name	Mailing Address
City of Jackson	Mayor Kay Pippin	P.O. Box 838 Jackson, GA 30233 Phone: 770-328-1251 kay.pippin@cityofjacksonga.com
City of Locust Grove	Mayor Robert Price	3644 Highway 42 Locust Grove, GA 30248 Phone: 770-692-2311 rprice@locustgrove-ga.gov

18 CFR § 5.18(a)(2)(iii)(A) Every irrigation district, drainage district, or similar special purpose political subdivision: In which any part of the project, and any Federal facilities that would be used by the project, would be located; or

Irrigation, Drainage, or Other Special Political Subdivision Within the Project

Political Subdivision	Contact Name	Mailing Address
Georgia Soil and Water Conservation Commission	Mr. Mitch Attaway, Executive Director	4310 Lexington Road Athens, GA Phone: 706-552-4470 mitch.attaway@gaswcc.ga.gov
Metropolitan North Georgia Water Planning District (Metro Water District)	Mr. Daniel Johnson Manager	229 Peachtree Street, NE Suite 100 Atlanta, GA 30303 Phone: 470-378-1552 djohnson@atlantaregional.org
Middle Ocmulgee Water Planning Region	Mr. James A. Capp Branch Chief	Georgia Environmental Protection Division 2 MLK Jr. Drive S.W. Suite 1152 Atlanta, GA 30334 Phone: 404-463-4911 james.capp@dnr.ga.gov

18 CFR § 5.18(a)(2)(iii)(B) Every irrigation district, drainage district, or similar special purpose political subdivision: That owns, operates, maintains, or uses any project facilities that would be used by the project;

None

18 CFR § 5.18(a)(2)(iv) Every other political subdivision in the general area of the project that there is a reason to believe would likely be interested in, or affected by, the application; and

Other Political Subdivisions Interested in the Project

Other Political Subdivisions	Contact Name	Mailing Address
City of Flovilla	Mayor Beth Burns Ogletree	308 Heard St. Flovilla, GA 30216 Phone: 770-775-5661 info@flovilla.org
City of Jenkinsburg	Mayor Eddie Ford	211 Maple Drive Jenkinsburg, GA 30234 Phone: 770-775-4850 cityclerk@cityofjenkinsburg.com
City of Monticello	Mayor Bryan Standifer City Manager Doug White	123 West Washington Street P.O. Box 269 Monticello, GA 31064 Phone: 706-468-6062

		bstandifer@bellsouth.net dwhite@monticelloga.org
City of McDonough	Mayor Billy Copeland	136 Keys Ferry St. McDonough, GA 30253 Phone: 678-782-6210 bcopeland@mcdonoughga.org
City of Covington	Mayor Ronnie Johnston	P.O. Box 1527 Covington, GA 30015 Phone: 770-262-1001 rjohnston@cityofcovington.org

Additional Interested Agencies

Interested Agency	**Contact Name**	**Mailing Address**
U.S. Fish and Wildlife Service	Dr. Eric Bauer	355 East Hancock Avenue, Room 320, Box 7Athens, GA 30601Phone: 706-208-7519 eric_bauer@fws.gov
U.S. Environmental Protection Agency Region 4	Ms. Maria Clark	61 Forsyth Street, S.W. Atlanta, GA 30303 Phone: 404-562-9513 Clark.Maria@epa.gov
National Marine Fisheries Service	Ms. Twyla Cheatwood	101 Pivers Island Rd. Beaufort, NC 28516 Phone: 252-728-8758 Twyla.cheatwood@noaa.gov
Georgia Department of Natural Resources - Environmental Protection Division	Dr. Elizabeth Booth	2 MLK, Jr. Drive, S.W., Suite 1152 Atlanta, GA 30334 Phone: 404-675-6232 elizabeth.booth@dnr.state.ga.us
Georgia Department of Natural Resources - Wildlife Resources Division	Mr. Scott Robinson	2070 U.S. Highway 278, S.E. Social Circle, GA 30025 Phone: 770-557-3236 Scott.Robinson@dnr.ga.gov
Georgia Department of Community Affairs - Historic Preservation Division	Ms. Jennifer Dixon	60 Executive Park South, NE Atlanta, GA 30329 Phone: 404-486-6376 Jennifer.Dixon@dca.ga.gov
U.S. Forest Service, Chattahoochee-Oconee National Forest	Mr. Derek Fusco	1755 Cleveland Highway Gainesville, GA 30501 Phone: 770-297-3033 derek.fusco@usda.gov

18 CFR § 5.18(a)(2)(v) All Indian tribes that may be affected by the project

Note: There are no extant federally recognized tribal lands in the State of Georgia. (U.S. Department of the Interior, 1993). There are. however, a number of federally recognized tribes (Federal Register. Vol. 73, No. 66, April 4, 2008) that occupied the project region historically. The following list includes Indian tribes that may have an interest in the relicensing of the Wallace Dam Project.

<u>Indian Tribes that May Be Affected by the Project</u>

Tribe	Contact Name	Mailing Address
Muskogee (Creek) Nation	Principal Chief David Hill	Muskogee (Creek) Nation P.O. Box 580 Okmulgee, OK 74447
Alabama-Quassarte Tribal Town	Chief Wilson Yargee	Alabama-Quassarte Tribal Town P.O. Box 187 Wetumka, OK 74883
Alabama-Coushatta Tribe of Texas	Chairperson Nita Battise	Alabama-Coushatta Tribe of Texas 571 State Park Road 56 Livingston, TX 77351
Coushatta Tribe of Louisiana	Chairman David Sickey	Coushatta Tribe of Louisiana P.O. Box 818 Elton, LA 70532
Kialegee Tribal Town	Town King Brian Givens	Kialegee Tribal Town P.O. Box 332 Wetumka OK 74883
Thlopthlocco Tribal Town	Town King Ryan Morrow	Thlopthlocco Tribal Town P.O. Box 188 Okemah, OK 74859
Poarch Band of Creek Indians	Tribal Chair Stephanie A. Bryan	Poarch Band of Creek Indians 5811 Jack Springs Road Atmore, AL 36502

18 CFR § 5.18(a)(4)(i) As to any facts alleged in the application or other materials filed, be subscribed and verified under oath in the form set forth in paragraph (a)(3)(B) of this section by the person filing, an officer thereof, or other person having knowledge of the matters set forth. If the subscription and verification is by anyone other than the person filing or an officer thereof, it must include a statement of the reasons therefore.

Verification is provided on the following page.

VERIFICATION

18 CFR § 5.18(a)(4)(ii) This application is executed in the:

State of:	Georgia
County of:	Fulton
By:	
Name:	Mr. Herbie N. Johnson
Address:	241 Ralph McGill Boulevard N.E. Bin 10193 Atlanta, Georgia 30308-3374

being duly sworn, deposes and says that the contents of this application are true to the best of his knowledge or belief. The undersigned Applicant has signed the application this 17th day of December, 2021.

(Applicant) ______________________

By: Connie H. Darby

Subscribed and sworn to before me, a Notary Public, this 17th day of December, 2021.

STATE OF NOTARY PUBLIC ALABAMA
CONNIE H DARBY
My Commission Expires
August 26, 2024

/SEAL

Lloyd Shoals Hydroelectric Project
FERC Project Number 2336-094

Exhibit A

Public

Prepared by

Southern Company Generation Hydro Services

December 2021

18 CFR § 4.51(b) Exhibit A is a description of the project. This exhibit need not include information on project works maintained and operated by the U. S. Army Corps of Engineers, the Bureau of Reclamation, or any other department or agency of the United States, except for any project works that are proposed to be altered or modified. If the project includes more than one dam with associated facilities, each dam and the associated component parts must be described together as a discrete development. The description for each development must contain:

This section has subsections which follow this introduction. Each of these subsections is keyed to the appropriate corresponding requirements of 18 CFR § 4.51(b).

The Lloyd Shoals Hydroelectric Project (Lloyd Shoals Project, Lloyd Shoals or Project) consists of one development with one powerhouse and one dam. The following table provides an overview of the project works and its prominent features, including their lengths in feet (ft).

Lloyd Shoals Project Features
West concrete non-overflow section (143 ft)
Powerhouse intake section (198 ft)
Concrete spillway section with Obermeyer gates and one trash gate (728.5 ft)
East earth embankment tie-in to bank (530 ft)

18 CFR § 4.51(b)(1) The physical composition, dimensions, and general configuration of any dams, spillways, penstocks, powerhouses, tailraces, or other structures, whether existing or proposed, to be included as part of the project;

The Project consists of a reservoir (Lake Jackson), a concrete gravity dam founded on rock, a powerhouse integral with the dam, a spillway section with Obermeyer gates and a trash gate, an approximately 2,000-ft-long tailrace, voltage transformation with connection directly to the primary transmission system, appurtenant structures, and recreation facilities.

Lloyd Shoals Dam has a spillway crest elevation of 525.2 ft plant datum[1] (PD) (elevation at bottom of the Obermeyer gates), a maximum height, from riverbed to spillway crest, of about 105 ft, and a length of 1,599.5 ft.

The project works across the main dam consist of the following components (and their length) from west to east (Figure 4):

- West concrete non-overflow section (143 ft);
- Powerhouse intake section (198 ft);
- Concrete spillway section with Obermeyer gates and one trash gate (728.5 ft); and
- East earth embankment tie-in to bank (530 ft)

The west non-overflow section and powerhouse have a crest elevation of 540 ft PD. There are twelve 7-ft, 9in by 11-ft intake openings on the upstream face of the powerhouse, two openings at the entrance of each unit's penstock, each having a designated headgate. The intake section contains six, 12-ft by 12-ft octagonal, cast-in-place concrete water passages (penstocks) that supply water to the turbines. The invert elevation of the intake is 495 ft PD, which is 35 ft below the normal full-pool elevation of Lake Jackson. Steel trash racks in front of the intake consist of vertical bars with clear spacing between bars of 1.3 inches.

The concrete-and-brick powerhouse contains six turbine-generator units, numbered 1 through 6 from east to west. The turbines are horizontal, Francis-type, double-runner units each rated 5,650 horsepower (hp) at 96.8 ft of head. The turbine runner diameter is 52.4 inches for Units 1-4 and 54.5 inches for Units 5 and 6. The rated normal turbine speed of all six units is 300 revolutions per minute (rpm). The maximum hydraulic capacity of each turbine unit is 620 cfs, for a total powerhouse maximum hydraulic capacity of 3,720 cfs. The most efficient/best gate hydraulic capacity of each turbine unit is 410 cfs.

The spillway section contains from west to east a 30-ft-wide trash bay with a bottom-hinged 19-

[1] Lloyd Shoals plant datum = mean sea level elevation (NAVD88) + 0.45 ft

ft by 12-ft trash gate; a 98.5-ft-wide section of 2-ft-high Obermeyer gates; a 420-ft-wide section of 5-ft-high Obermeyer gates; and a 180-ft-wide section of 2-ft-high Obermeyer gates. The top of the spillway gates is elevation 530 ft PD. The crest of the concrete spillway is elevation 525.2 ft PD at the bottom of the 5-ft-high Obermeyer gates, elevation 528.2 ft PD at the bottom of the 2-ft-high Obermeyer gates, and 518.0 ft PD at the trash gate. The east earth embankment has a crest elevation of 542.0 ft PD.

A 2,100-ft-long saddle dike with a crest elevation of 545.0 ft PD is located adjacent to and east of Jackson Lake Road (County Road 364) about 3,000 ft upstream of the east end of the main dam.

A 500-ft-long auxiliary spillway is located about 900 ft southwest of the main dam (Figure 4). The auxiliary spillway contains 10-ft-high flashboards maintained in the dry by a 6-ft-high 560-ft-long sacrificial earth embankment. The top of these flashboards is 536.0 ft PD and the crest of the auxiliary spillway is 526.0 ft PD.

Lake Jackson covers a surface area of 4,750 acres (Ac) at the normal full-pool elevation of 530 ft PD. The full-reservoir gross storage capacity is approximately 107,000 acre-feet (AcFt). The upstream drainage area of the Ocmulgee River basin at Lloyd Shoals Dam is about 1,400 square miles (sq mi).

The nameplate rating generating capacity of the Lloyd Shoals Project is 18 MW. The dependable capacity of the Project is 22.5 MW in the summertime, the most critical power-demand season. Dependable capacity is defined as average simulated capacity available for 8 hours each day for 5 consecutive days using a 20-year average summer inflow. Average annual generation for the years 2013 through 2020 was 70,600 megawatt-hours.

There are no transmission lines included in the Lloyd Shoals Project. Two 2.3-kilovolt (kV) project generator leads exit the powerhouse to two, three-phase outdoor step-up transformers rated 10/12-megavoltampere (MVA) and 10-MVA, located in the substation at the west dam abutment. Connection to existing 69-kV and 115-kV transmission lines is made within the substation.

18 CFR § 4.51(b)(2) The normal maximum surface area and normal maximum surface elevation (mean sea level), gross storage capacity, and useable storage capacity of any impoundments to be included as part of the project;

Metric	Value
Conversion MSL to PD	PD = MSL + 0.45 ft
Normal Maximum Surface Elevation (MSL)	529.55
Normal Maximum Surface Elevation (PD)	530.00
Normal Maximum Surface Area (Ac)	4,750
Normal Maximum Volume (Gross Storage) (AcFt)	107,000
Elevation Range for Useable Storage (ft PD)	506-530
Useable Storage (AcFt)	74,750

18 CFR § 4.51(b)(3) The number, type, and rated capacity of any turbines or generators, whether existing or proposed, to be included as part of the project;

The nameplate generating capacity of the Lloyd Shoals Project is 18 MW, which is based on the most efficient or best gate setting, and the maximum turbine hydraulic capacity is 3,720 cfs. There are six horizontal, double runner, Francis-type turbine generators at the Lloyd Shoals powerhouse. All of the turbines were originally manufactured by S. Morgan Smith and rehabilitated by American Hydro with turbine runner and wicket gate replacements. All the generators are manufactured by Westinghouse.

The details of the Lloyd Shoals turbines are presented in Table A1, titled Lloyd Shoals Turbine Information.

The details of the Lloyd Shoals generators are presented in Table A2, titled Lloyd Shoals Generator Information.

18 CFR§ 4.51(b)(4) The number, length, voltage, and interconnections of any primary transmission lines, whether existing or proposed, to be included as part of the project (see 16 U.S.C. 796(11));

There are no transmission lines included in this project. Power generated at Lloyd Shoals powerhouse is connected to the primary transmission system via existing 69 kV and 115kV transmission lines that receive power within the Lloyd Shoals substation. The Lloyd Shoals substation is project-owned and within the project boundary, located on the western abutment of the powerhouse and earthen dam.

18 CFR§ 4.51(b)(5) The specifications of any additional mechanical, electrical, and transmission equipment appurtenant to the project; and

The following table presents the additional mechanical and electrical equipment appurtenant to the Project. The equipment is grouped by the general area of the project (dam, intake, etc.) where it is located.

Category	Equipment	Description
Mechanical Equipment	Intake Headgates	Lloyd Shoals powerhouse headworks contains 12 headgates, one for each of the two intake openings per unit. Each gate consists of a 12-ft by 7-ft 9-inch (in) structural steel frame with a skin plate welded to the upstream side. Because the gate is sometimes underwater it was covered in a coal tar epoxy coating at the time of fabrication. An approximate 2-ft-wide by 2.5-ft-high opening in the center of the headgate is controlled by a cast steel filler valve. During an outage, a headgate is in the closed position and the unit is drained of all water. When the unit is being prepared to be placed back in service, the filler valve is opened to refill the unit. This allows the equalization of water pressure on each side of the headgate so that the headgate can be lifted back into its docked position. A structural steel frame connects the gate to the lifting mechanism.
Mechanical Equipment	Intake Trash racks	The upstream face of the dam has 12 inlet openings, each covered by 4 steel trash racksInlet openings are 10.5 ft wide and 19.4 ft in height. Trashracks rest on a 6in high sill that is integral to the powerhouse and are supported by a guide structure. The guide structure is composed of (3) 12 in #50 steel horizontal I beam members and (3) 1 ¾ in vertical guides. Trashracks are 21 ft long and 2 ft 4 $\frac{10}{16}$ in wide. Each trashrack has (17) 3 in x $\frac{1}{4}$ flat bar vertical members, (2) 3inx $\frac{3}{8}$ in on vertical members on each end and 9 horizontal 2.5 in rod members.
Mechanical Equipment	Intake Gantry Crane	The gantry crane has a 20-ton capacity with two 10-ton hoists, which can be operated independently or in synchronized mode. The hoists serve as a lifting and

Category	Equipment	Description
		lower mechanism for headgates and a lifting mechanism for trashracks.
Mechanical Equipment	Powerhouse Bridge Crane	The powerhouse contains a 20-ton bridge crane.
Mechanical Equipment	Aeration	Lloyd Shoals Units 2, 3, and 4 are equipped with draft tube aeration systems. Each aeration system utilizes two 6-in-diameter intake pipes, which open to the atmosphere inside the powerhouse at elevation 442 ft. Air is pulled into the system through aspiration when system valves are in the open position and units are passing water. From there, aeration pipes are routed adjacent to the draft tube where the piping is reduced to 4 in. Two 4 in ring headers each deliver air to four 4 in injector ports which introduce air into turbine discharge water at a point just below the turbine blades. The injector ports were fitted with deflector plates during the install of the aeration systems.
Mechanical Equipment	Spillway Gates	The spillway gates are an Obermeyer gate system. From west to east, the dam has three major, separate zones of spillway gates: Zone 1, Zone 2 and Zone 3. Zone 1 includes a 2-ft-high, 98.5-ft-wide Obermeyer-gated spillway section with a concrete crest elevation of 528.2 ft PD. Zone 2 includes a 5-ft-high, 420-ft-wide Obermeyer-gated spillway section with a concrete crest elevation of 525.2 ft PD. Zone 3 includes a 2-ft-high, 180-ft-wide Obermeyer-gated spillway section with a concrete crest elevation of 528.2 ft PD. The top elevation of all three Obermeyer gates is equivalent to the normal full-pool elevation of 530 ft PD. The Obermeyer gates are bottom-hinged, each consisting of a 20-ft-wide steel gate panel supported by an inflatable rubber bladder, which acts as a pneumatically-operated spillway gate. The system includes a controlled source of compressed air to inflate and deflate rubber bladders to control the water level in the upstream reservoir.
Mechanical	Trash gate	The trash gate is operated by a cable drum hoist and is

Category	**Equipment**	**Description**
Equipment		utilized for passing drift material as it collects at the dam and as a flow control gate. The dimensions of the trash gate are 19 feet (ft) wide by 12 ft high. The bottom elevation of the gate opening is at elevation 518 ft plant datum (PD)1 and the top is at elevation 530 ft PD. This gate can only be operated locally.
Mechanical Equipment	Trashgate Stoplog	Two steel trashgate stoplog panels approximately 20 ft wide and 6 ft deep can be positioned into a trashgate stoplog slot upstream of the trashgate to provide safe, dry conditions for trashgate maintenance.
Mechanical Equipment	Miscellaneous	All other mechanical equipment required for a complete hydroelectric generating plant, including cooling water and sanitary water supply systems, station sump, station ventilation systems, station compressed air systems. Wicket gates are controlled through a Hydraulic Power Unit (HPU).
Electrical Equipment	Circuit Breakers	The station has six (6) generator circuit breakers, rated at 2.3 KV and 3,000 KVA and which have interrupting capacity.
Electrical Equipment	Switchboards	There are a set of complete switchboards for controls of: the generators, station service, incoming and outgoing transmission lines, instruments, indicating devices, and protective relays. Obermeyer gates and trash gate have separate stand-alone controls.
Electrical Equipment	Miscellaneous	Miscellaneous electrical equipment includes: current and potential transformers, generator busses, generator surge protection equipment, storage batteries and battery charger, station service transformers and switchgear, lighting system, telephone system, supervisory control equipment, and solid state static exciters.
Emergency Power	Power Source	The station has one emergency power propane engine driven generator for station service and another as backup supply for the trash gate. The generators are 240 volts, 3 phase, 60 hertz machines. The plant emergency station service generator is rated 75 KVA. The trash gate generator is rated 37.5 KVA.

18 CFR§ 4.51(b)(6) All lands of the United States that are enclosed within the project boundary described under paragraph (h) of this section (Exhibit G), identified and tabulated by legal subdivisions of a public land survey of the affected area or, in the absence of a public land survey, by the best available legal description. The tabulation must show the total acreage of the lands of the United States within the project boundary.

There are no federal lands within the Lloyd Shoals project boundary.

Summary Table
Location of Tables
Table Locations

Table A1: Lloyd Shoals Turbine Information

Unit Number	Shaft Orientation and Runner Type	Nameplate Rating	Rotational Speed (rpm)	Manufacturer	Rated Flow[2]	
					Best Gate Generation Flow at 96.8 feet net head (cfs)	Full Gate Generation Flow at 96.8 feet net head (cfs)
1	Horizontal – Double Runner, Francis	5,650 HP at 96.8 Feet Net Head	300	American Hydro	390	595
2	Horizontal – Double Runner, Francis	5,650 HP at 96.8 Feet Net Head	300	American Hydro	390	595
3	Horizontal – Double Runner, Francis	5,650 HP at 96.8 Feet Net Head	300	American Hydro	390	595
4	Horizontal – Double Runner, Francis	5,650 HP at 96.8 Feet Net Head	300	American Hydro	390	595
5	Horizontal – Double Runner, Francis	5,650 HP at 96.8 Feet Net Head	300	American Hydro	390	595
6	Horizontal – Double Runner, Francis	5,650 HP at 96.8 Feet Net Head	300	American Hydro	390	595

[2] Net head with one unit operating under normal conditions is greater than the net head condition during unit rating (96.8 ft). An estimated 103.2 ft net head exists with full pool and normal tailrace conditions. Under full pool normal conditions, each unit has an individual hydraulic capacity of 620 cfs for full gate operation and 410 cfs for best gate operation.

Table A2: Lloyd Shoals Generator Information

Unit Number	Shaft Orientation	Generator KVA	KW Rating at Indicated Power Factor	Rotational Speed (rpm)	Output Voltage (KV)	Manufacturer	Phase and Cycles
1	Horizontal	3,000	3,000 KW at 1.0 pf	300	2.3	Westinghouse	3 phase 60 cycles
2	Horizontal	3,000	3,000 KW at 1.0 pf	300	2.3	Westinghouse	3 phase 60 cycles
3	Horizontal	3,000	3,000 KW at 1.0 pf	300	2.3	Westinghouse	3 phase 60 cycles
4	Horizontal	3,000	3,000 KW at 1.0 pf	300	2.3	Westinghouse	3 phase 60 cycles
5	Horizontal	3,000	3,000 KW at 1.0 pf	300	2.3	Westinghouse	3 phase 60 cycles
6	Horizontal	3,000	3,000 KW at 1.0 pf	300	2.3	Westinghouse	3 phase 60 cycles

Lloyd Shoals Hydroelectric Project
FERC Project Number 2336-094

Exhibit B

Public

Prepared by

Southern Company Generation Hydro Services

December 2021

18 CFR § 4.51(c) Exhibit B is a statement of project operation and resource utilization. If the project includes more than one dam with associated facilities, the information must be provided separately for each such discrete development.

This section has subsections which follow this introduction. Each of these subsections is keyed to the appropriate corresponding requirements of 18 CFR 4.51(c).

The Lloyd Shoals Hydroelectric Project (Lloyd Shoals Project, Lloyd Shoals, or Project) consists of one development with one powerhouse and one dam. The following table provides an overview of prominent operational characteristics of the Project.

Operational Characteristics	**Lloyd Shoals Project**
Manual or Automatic Operation	Manual
Annual Plant Factor	44.8%
Dependable Capacity	22.5 MW
Average Annual Energy 2013-2020	70,600 MWhrs
Period of Record for Flow Data	2001-2020
Minimum Monthly Average Calculated Inflow	218 cfs
Mean Recorded Annual Inflow at Dam – Calculated	1,823 cfs
Maximum Recorded Inflow at Dam – Calculated	38,039 cfs
Normal Max Storage Capacity	107,000 Ac-Ft
Useable Storage Capacity	74,750 Ac-Ft
Elevation Range for Useable Storage	530 - 506 Ft PD
Maximum Hydraulic Capacity of Station (Full Gate, cfs)	3,720
Most Efficient Hydraulic Capacity of Station (Best Gate, cfs)	2,460
Maximum Gross Head[1]	103.2

[1] Maximum, normal and minimum gross head specified are the difference between the normal maximum, normal and normal minimum headwater elevations and tailwater elevation, with no headloss removed, with all units operating at best gate. See Figure 22. This differs from the rated head (96.8 ft), which is an

Operational Characteristics	**Lloyd Shoals Project**
Normal Gross Head	102.0
Minimum Gross Head	100.2

adjusted net head based on headwater and tailwater elevations measured during an index test conducted in 1997 and thus includes actual headloss.

The following table presents a list of Figures used for this Exhibit.

18 CFR§ 4.51(c)(1) A statement whether operation of the powerplant will be manual or automatic, an estimate of the annual plant factor, and a statement of how the project will be operated during adverse, mean, and high water years;

Lloyd Shoals Dam is manned from 7:00 A.M. until 3:00 P.M. Monday through Friday. When the dam is unmanned, its generating units are controlled and flows are monitored by an operator in the control room (manned 24/7) at Wallace Dam. The first open spillway gate must be operated manually at the Lloyd Shoals powerhouse; when the plant is not manned and the gages upstream of the dam indicate that inflows may exceed plant capacity, a team is dispatched to operate spillway gates. The plant is manual with some remote capabilities.

The annual plant factor for Lloyd Shoals is estimated at 44.8%.

Georgia Power Company operates the Lloyd Shoals Project in a modified run-of-river mode. On a rolling 7-day average basis the inflow is equal to the discharge, as can be seen from Figure 1. The reservoir is operated to maintain reservoir elevations between 530 and 527 ft plant datum (PD) year-round, excluding drawdowns and drought. The reservoir rises slightly as inflow is temporarily stored during periods outside of peak power demand (i.e., off-peak hours). As power demand increases into the peak power demand period, Lloyd Shoals is operated to release water through the powerhouse turbines to produce energy from the plant generators. This cycle repeats daily and varies seasonally with peak power demands.

The primary project purpose is to provide power generation. Table 1 below summarizes monthly and annual Lloyd Shoals project generation for the 8-year period 2013 through 2020. 2013 was the first year after the Obermeyer gates were fully functional. Generation typically is highest during late winter and early spring (February-April), when project inflow is also the highest. During the summer, Georgia Power usually operates Lloyd Shoals generating units throughout the afternoon peak demand period, about seven to eight hours. During fall and winter, peak generation typically lasts five to six hours split between a morning and evening peak, when energy demand is highest.

Table 1: Monthly and Annual Lloyd Shoals Project Generation (MWHrs)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
2013	5,843	8,587	9,289	9,142	9,060	9,134	11,237	6,990	2,937	2,215	2,323	7,539	84,296
2014	8,051	9,034	8,621	10,126	6,198	3,167	3,044	2,737	2,705	2,905	3,261	5,396	65,245
2015	7,658	7,438	8,517	10,701	6,565	5,411	3,186	4,079	3,490	5,669	10,701	5,998	79,413
2016	8,714	10,171	9,987	7,769	4,508	2,155	1,762	1,618	782	873	753	2,312	51,404
2017	7092	5316	4129	7,108	4,622	6,619	6,064	3,698	3,733	3,953	3,007	4,605	59,946
2018	5067	8357	8454	7,158	6,190	6,436	5,182	4,598	1,365	6,112	7,150	8,076	74,145
2019	8290	9262	10012	8515	5075	5075	4041	2929	706	970	2,618	6,318	63,811
2020	11,519	1,242	11,351	10,058	7,402	5,469	3,700	7,038	6,579	7,790	5,846	8,548	86,542
Average	7,779	7,426	8,795	8,822	6,203	5,433	4,777	4,211	2,787	3,811	4,457	6,099	

Lloyd Shoals Dam discharges directly into the Ocmulgee River. During normal conditions, when the plant is not operating to generate peaking energy, the Project releases a continuous minimum flow of 400 cfs, or inflow, whichever is less, according to a calculated inflow, into the Ocmulgee River downstream for the protection and enhancement of fish and wildlife resources and other downstream uses.

There are differences in the way the plant operates related to high flow events and drought. The variances in Lloyd Shoals operations are illustrated by Figures 2, 3, and 4 showing daily calculated inflows, hourly surface water elevations of Lake Jackson, and hourly discharges from Lloyd Shoals dam for three varying climatic conditions or weather events.

Figure 2 shows a medium range inflow week (approximately equal to the mean annual inflow of 1,823 cfs) running from Sunday to Sunday with a daily peaking discharge.

Figure 3 shows a two-week high flow condition. This graph illustrates that Lloyd Shoals operates as a run-of-river plant under high inflow conditions. During high inflow conditions the plant matches inflows and releases them as they arrive. The lake does not have adequate storage to store excess storm flows and thus does not provide flood control.

During high-flow events at the Lloyd Shoals Project, flows are first run through all of the turbine/generator units, where electricity is generated. Plant operators monitor stream gages (South River, Honey Creek, Yellow River, Big Haynes Creek, and Alcovy River) upstream of Lake Jackson. When Lake Jackson is near the full pool elevation and these gages show flows exceeding the hydraulic capacity of the turbines, the operators increase hydropower generation to utilize the available inflow up to the maximum turbine flow of approximately 3,720 cfs. Water is not released in advance of a storm because oftentimes predicted storms do not materialize. The operators use actual flows observed in the basin to make operating decisions. As inflow to the Project exceeds the maximum hydraulic capacity of the turbines, spillway gates are opened incrementally to approximate inflow. The Obermeyer gate system installed in 2012 provides Georgia Power the ability to make incremental adjustments to flows released from the spillway, enhancing control of the reservoir level during the course of high-flow operations. These gates allow the plant discharges to be closely matched with inflows into the Project.

Figure 4 shows a week with low inflows due to drought conditions. This graph shows that inflow to Lake Jackson is between 100 and 200 cfs, but 250 cfs minimum flow continues to be released from Lloyd Shoals and the surface water elevation of Lake Jackson slowly declines over the week as flow is supplemented in the river downstream from the small storage in Lake Jackson.

During low-flow periods or extended drought at Lloyd Shoals Dam, calculated inflows often drop below the 400-cfs minimum flow requirement. When calculated project inflow falls below 250 cfs, Georgia Power operates Lloyd Shoals to release a continuous flow of 250-cfs into the Ocmulgee River downstream to supplement stream flows for downstream uses. During the refill period after a drought, Georgia Power continues to release 250-cfs supplemental flow to raise the elevation of Lake Jackson prior to increasing discharges from the Project. Figure 5 shows the drawdown that Lake Jackson experienced during recent droughts as a result of low inflow and supplemental flow releases.

Based on the period 2001-2020, daily average discharge from the Project to the Ocmulgee River downstream exceeded 250 cfs on 99 percent of the days, 400 cfs on 86 percent of the days, and 1,000 cfs on 54 percent of the days.

18 CFR§ 4.51(c)(2) An estimate of the dependable capacity and average annual energy production in kilowatt-hours (or mechanical equivalent) supported by the following data:

The dependable eight-hour generating capacity of the Lloyd Shoals Project is estimated as shown in the table below:

8 Hour Capacity	Summer Full Gate (KW)	Summer Best Gate (KW)	Winter Full Gate (KW)	Winter Best Gate (KW)	Spring Full Gate (KW)	Fall Full Gate (KW)	Fall Best Gate (KW)
Lloyd Shoals	22,500	19,600	22,500	19,900	22,500	22,500	19,500

The ratings are eight-hour capability ratings and are the average simulated generation during eight consecutive hours occurring on five consecutive weekdays using the average inflows and generation from the previous 20-year period. The calculated dependable capacities are for use in the Southern Company Intercompany Interchange Contract (IIC). A spring best gate rating is not produced for the dependable capacity because Georgia Power uses full gate operation for spring high flows.

The table below presents the seasonal breakdowns and the months which correspond to these seasons.

Season	Months
Summer	June, July, August
Fall	September, October, November
Winter	December, January, February
Spring	March, April, May

The value of the average annual energy produced by the Lloyd Shoals Project development over an 8-year period of 2013 through 2020 is 70,600 MWHrs. A shorter period (8 years vs the 20 year) from 2013-2020 was used to calculate the average annual energy produced because of the improved operational control of Lake Jackson following the installation of Obermeyer spillway gates in 2012. A simulated generation based on 20-years of inflow records is used to develop the dependable capacity to capture enough hydrologic years for drought and wet years to be factored into the simulation.

18 CFR§ 4.51 (c)(2)(i) The minimum, mean, and maximum recorded flows in cubic feet per second of the stream or other body of water at the power plant intake or point of diversion, with a specification of any adjustments made for evaporation, leakage, minimum flow releases (including duration of releases) or other reductions in available flow; monthly flow duration curves indicating the period of record and the gauging stations used in deriving the curves; and a specification of the period of critical stream flow used to determine the dependable capacity;

The table below presents the minimum daily average calculated inflow, mean calculated inflow, and maximum calculated inflows at the station. There is no adjustment made for evaporation or minimum flow releases. The streamflow data is for the period of 1/1/2001 to 12/31/2020.

Month	Minimum Daily Average Calculated Inflow (cfs)	Mean Daily Calculated Inflow (cfs)	Maximum Daily Calculated Inflow (cfs)
Jan	295	2,318	26,304
Feb	988	2,815	24,125
Mar	846	2,819	21,134
Apr	924	2,346	27,330
May	490	1,654	22,700
Jun	256	1,502	20,914
Jul	233	1,479	24,783
Aug	532	1,003	9,087
Sept	473	1,152	27,328
Oct	244	1,007	11,463
Nov	218	1,460	21,267
Dec	564	2,321	38,039

Flow duration curves are presented in Figures 6 through 19. Figure 6 is the composite of all the monthly flow duration curves and the period of record curve. Figures 7 through 18 are the monthly flow duration curves for each month during the period of record. Figure 19 is the flow duration curve for the period of record.

Dependable capacity calculations are based on river flow and generation from the previous 20 years.

18 CFR§ 4.51 (c)(2)(ii) An area-capacity curve showing the gross storage capacity and useable storage capacity of the impoundment, with a rule curve showing the proposed operation of the impoundment and how the useable storage capacity is to be utilized;

An area capacity curve is attached as Figure 20. For ease of use, the following data is also provided in the tables below.

Metric	Value
Normal Maximum Surface Elevation (PD)	530.00
Normal Maximum Surface Area (Ac)	4,750
Normal Maximum Volume (Gross Storage) (AcFt)	107,000
Elevation Range for Useable Storage (ft PD)	506-530
Useable Storage (AcFt)	74,750

Elevation (ft PD)	Area (Ac)	Volume (AcFt)
440	1	1
450	60	1,000
460	150	2,000
470	260	4,000
480	470	7,000
490	860	12,500
500	1,430	23,000
501	1,500	24,542
502	1,570	26,083
503	1,640	27,625
504	1,710	29,167
505	1,780	30,708
506	1,850	32,250
507	1,920	34,188
508	1,990	36,125
509	2,060	38,063
510	2,130	40,000
511	2,247	42,670
512	2,364	45,340
513	2,481	48,010
514	2,598	50,680
515	2,715	53,350
516	2,832	56,020
517	2,949	58,690
518	3,066	61,360
519	3,183	64,030
520	3,300	66,700
521	3,445	70,730

522	3,590	74,760
523	3,735	78,790
524	3,880	82,820
525	4,025	86,850
526	4,170	90,880
527	4,315	94,910
528	4,460	98,940
529	4,605	102,970
530	4,750	107,000

The Lloyd Shoals Project does not operate on a rule curve but will be operated to maintain elevations between 527 and 530 ft plant datum (PD) year-round, excluding drawdowns and drought.

18 CFR§ 4.51 (c)(2)(iii) The estimated hydraulic capacity of the power plant (minimum and maximum flow through the power plant) in cubic feet per second;

The table below presents the maximum hydraulic capacities of the individual units as well as the hydraulic capacity of the entire powerhouse during full and best gate operations.

Unit	Type	Manufacturer	Maximum Hydraulic Capacity Full Gate (cfs)	Most Efficient Hydraulic Capacity Best Gate (cfs)	Minimum Hydraulic Capacity (cfs)
1	Horizontal – Double Runner Francis	American Hydro	**620**	**410**	*
2	Horizontal – Double Runner Francis	American Hydro	**620**	**410**	*
3	Horizontal – Double Runner Francis	American Hydro	**620**	**410**	*
4	Horizontal – Double Runner Francis	American Hydro	**620**	**410**	*
5	Horizontal – Double Runner Francis	American Hydro	**620**	**410**	*
6	Horizontal – Double Runner Francis	American Hydro	**620**	**410**	*
Total			**3,720**	**2,460**	*

* The minimum hydraulic capacity is unknown; however the units are capable of operating at the 250 cfs supplemental flow

18 CFR§ 4.51 (c)(2)(iv) A tailwater rating curve; and

A tailwater rating curve is presented as Figure 21.

18 CFR§ 4.51 (c)(2)(v) A curve showing power plant capability versus head and specifying maximum, normal, and minimum heads;

A curve showing plant capability versus head and specifying the maximum, normal, and minimum heads is presented in Figure 22. Figure 23 shows plant capability versus headwater elevation.

18 CFR§ 4.51 (c)(3) A statement, with load curves and tabular data, if necessary, of the manner in which the power generated at the project is to be utilized, including the amount of power to be used on-site, if any, the amount of power to be sold, and the identity of any proposed purchasers; and

Typically, approximately 0.3 percent of the power generated at the Lloyd Shoals Project is utilized to provide electric service to the powerhouse and appurtenant facilities. The remainder of the power produced is supplied to the Southern Company system and is used to help meet customer demand. Figure 24 is based on data from 2016-2020 but it exemplifies the shape of the power load curves for the Southern Electric System in a summer week. In 2016-2020, all the Georgia Power hydros provided approximately 1.734% of the energy generated for the system. The difference between the curve showing the total demand and the total demand minus the GPC hydro contribution shows the times when hydros are supplying power, which is during the daily peak shown on the graph. Even though the plant has a continuous minimum flow requirement, the plant typically only operates at full or close to full plant hydraulic capacity during peak power periods, and thus is dispatched as a peaking power plant.

18 CFR§ 4.51(c)(4) A statement of the applicant's plans, if any, for future development of the project or of any other existing or proposed water power project on the stream or other body of water, indicating the approximate location and estimated installed capacity of the proposed development.

Georgia Power is not planning any additional capacity at this time for Lloyd Shoals Plant.

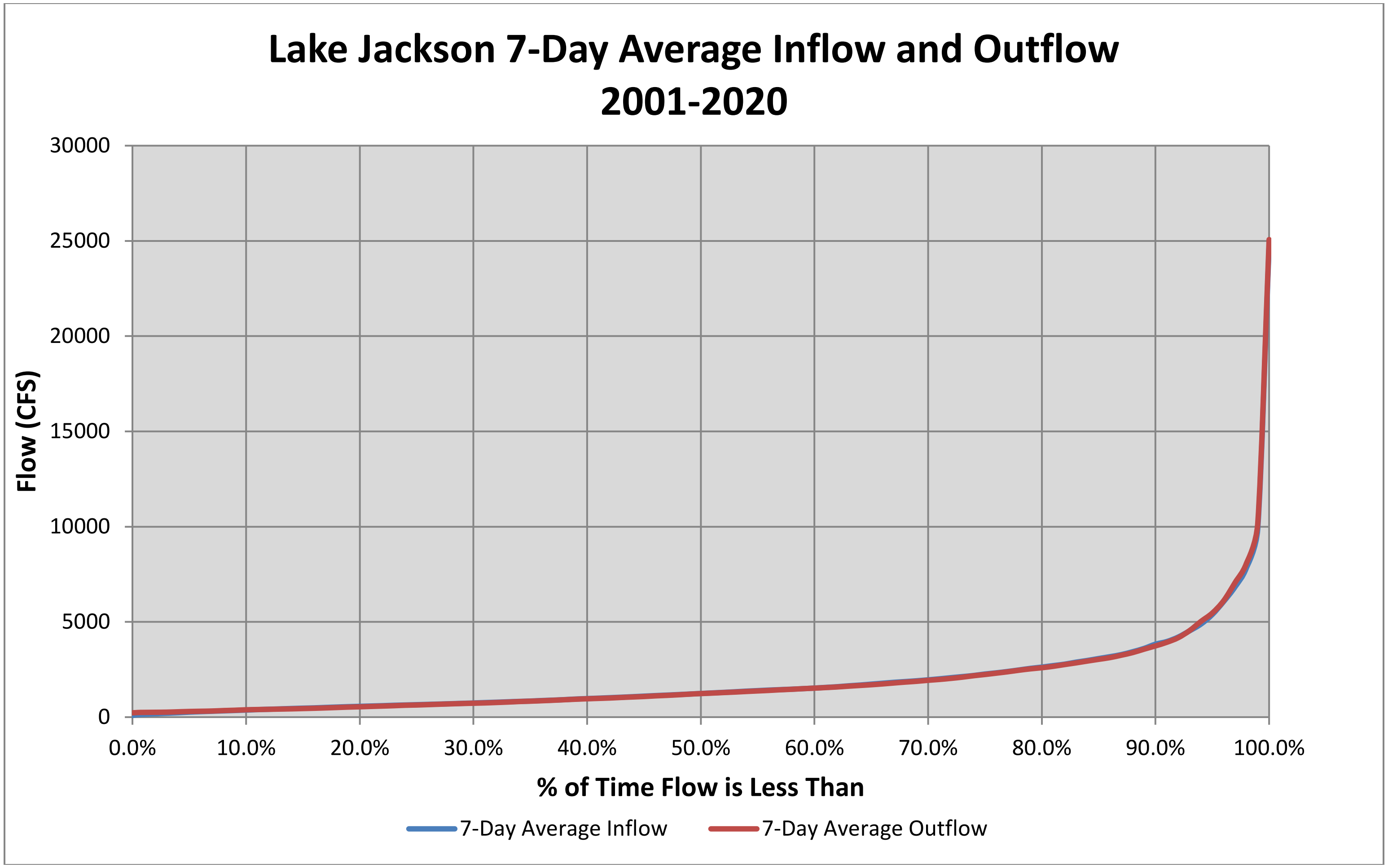

Figure 1: Lake Jackson, 7 Day Average Inflow and Outflow, 2001-2020

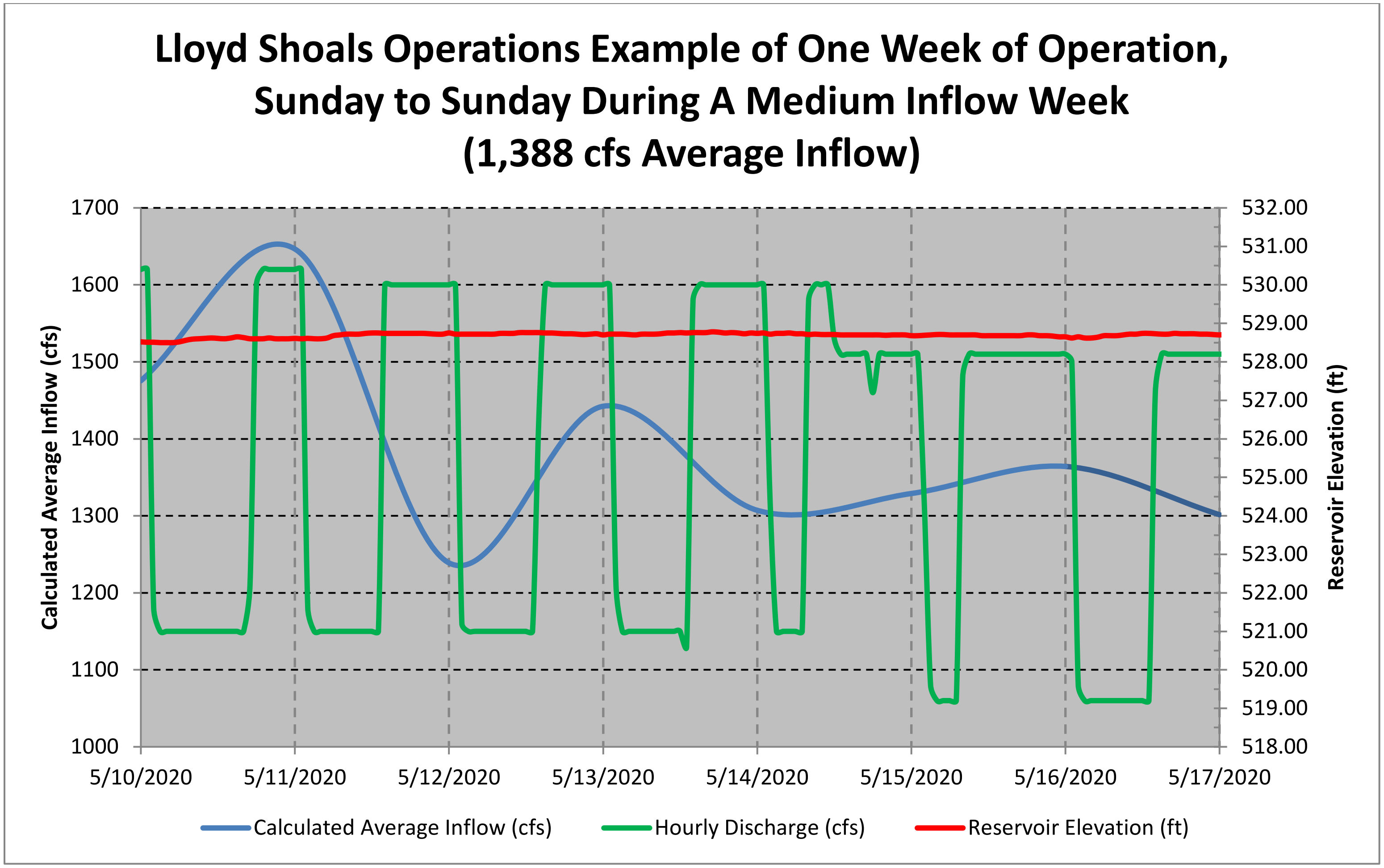

Figure 2: Lake Jackson, Example of One Week of Operation, Sunday to Sunday, Medium Inflow (1,388 cfs Average Inflow)

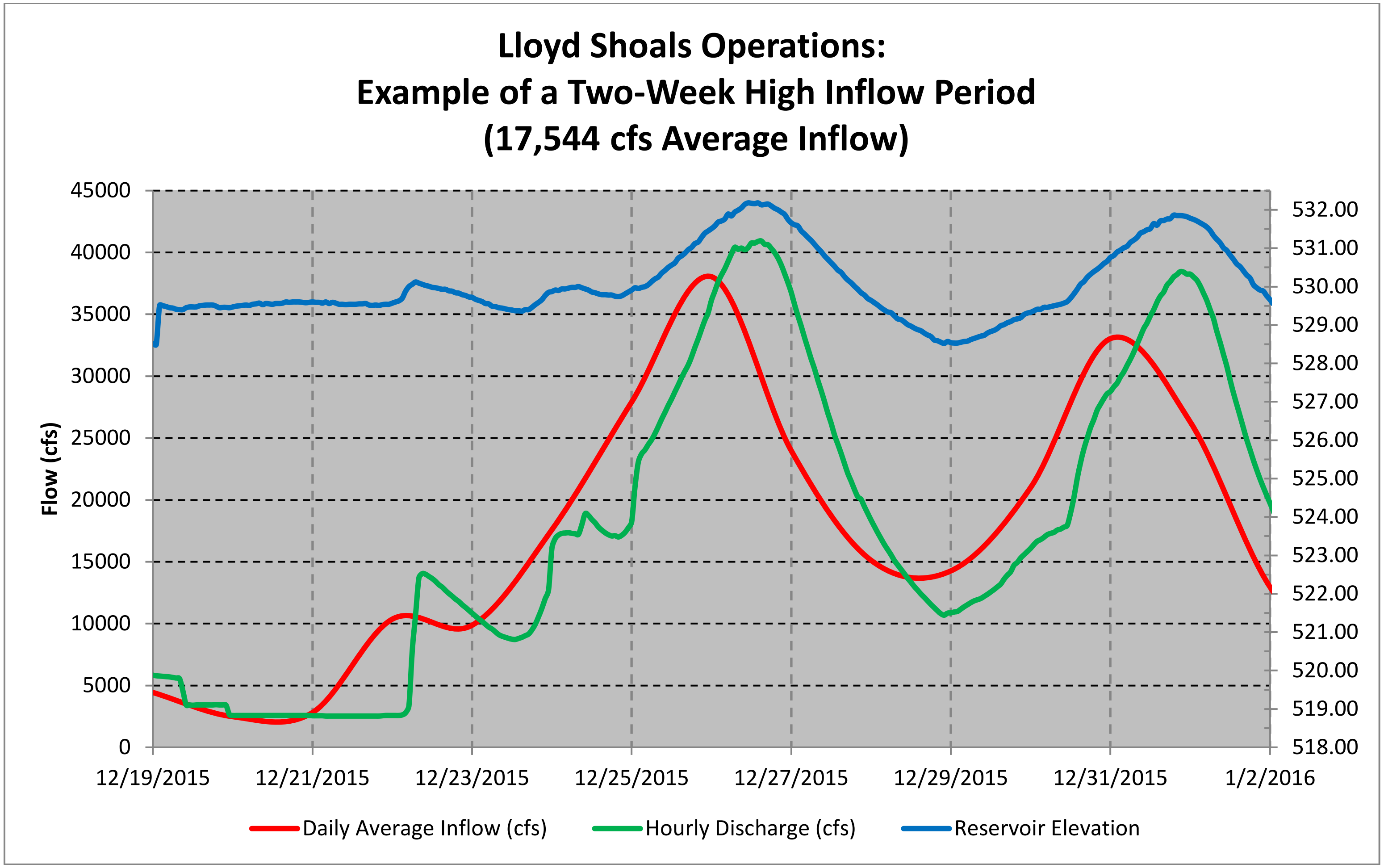

Figure 3: Lake Jackson, Example of Two Weeks of Operation, Sunday to Sunday, High Inflow (17,544 cfs Average Inflow)

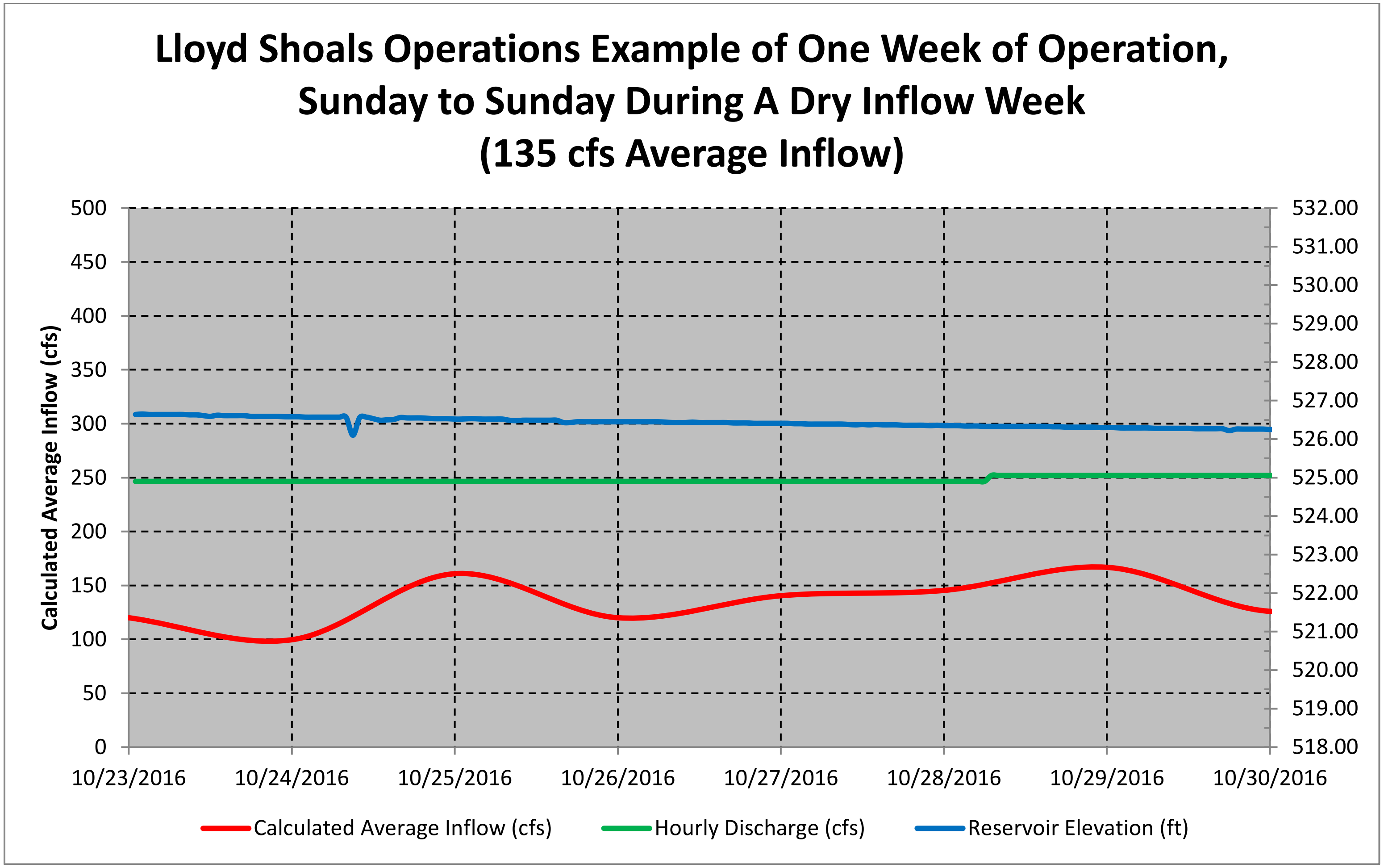

Figure 4: Lake Jackson, Example of One Week of Operation, Sunday to Sunday, Low Inflow (135 cfs Average Inflow)

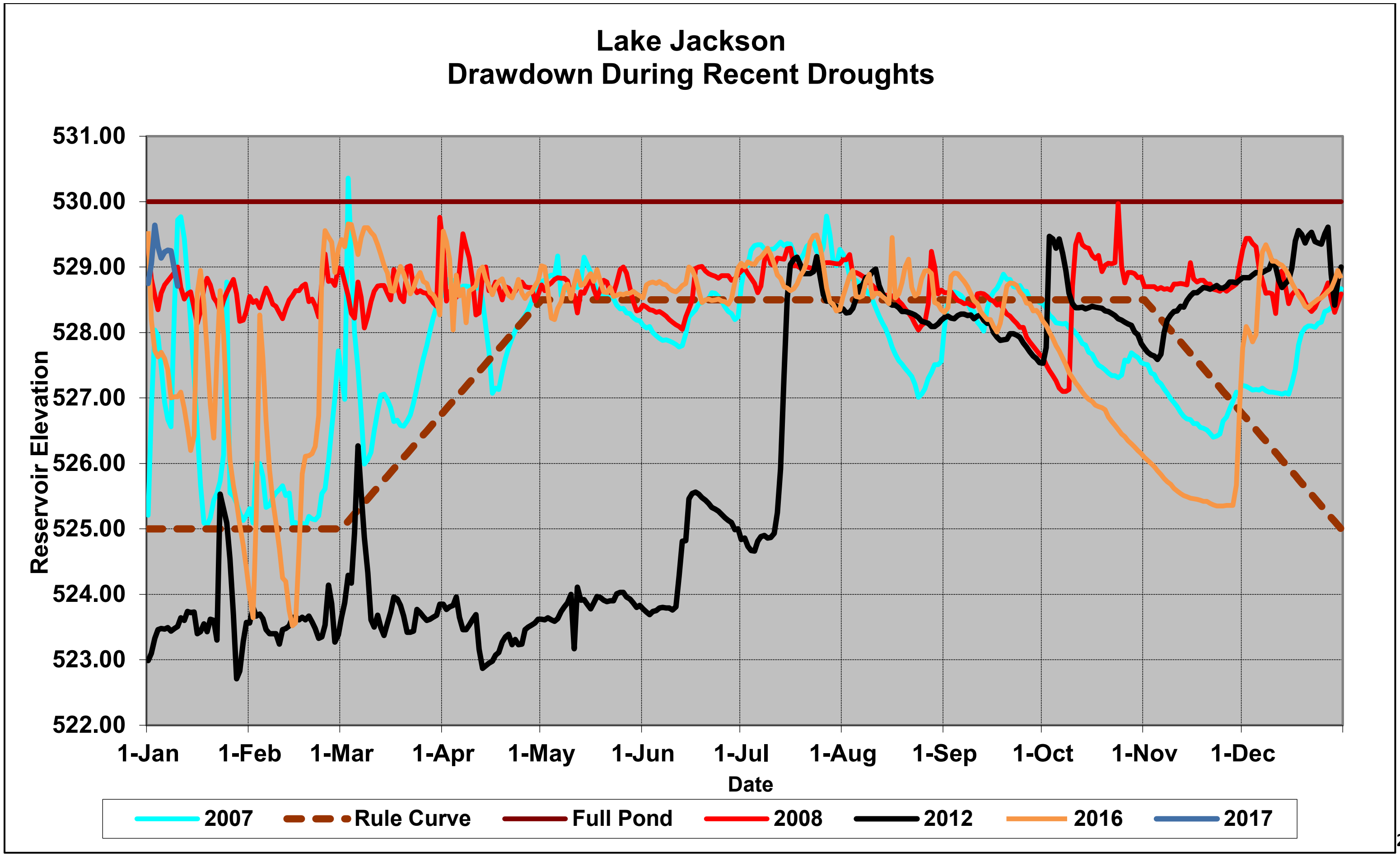

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Figure 5: Lake Jackson Drawdown During Recent Droughts

[2] The initial drawdown in 2012 was planned for the purpose of installing the Obermeyer spillway gates, but prolonged due to drought conditions.
[3] Management of Lake Jackson to the rule curve (which was included in the prior relicensing Exhibit B) was no longer necessary following the installation of the Obermeyer spillway gates.

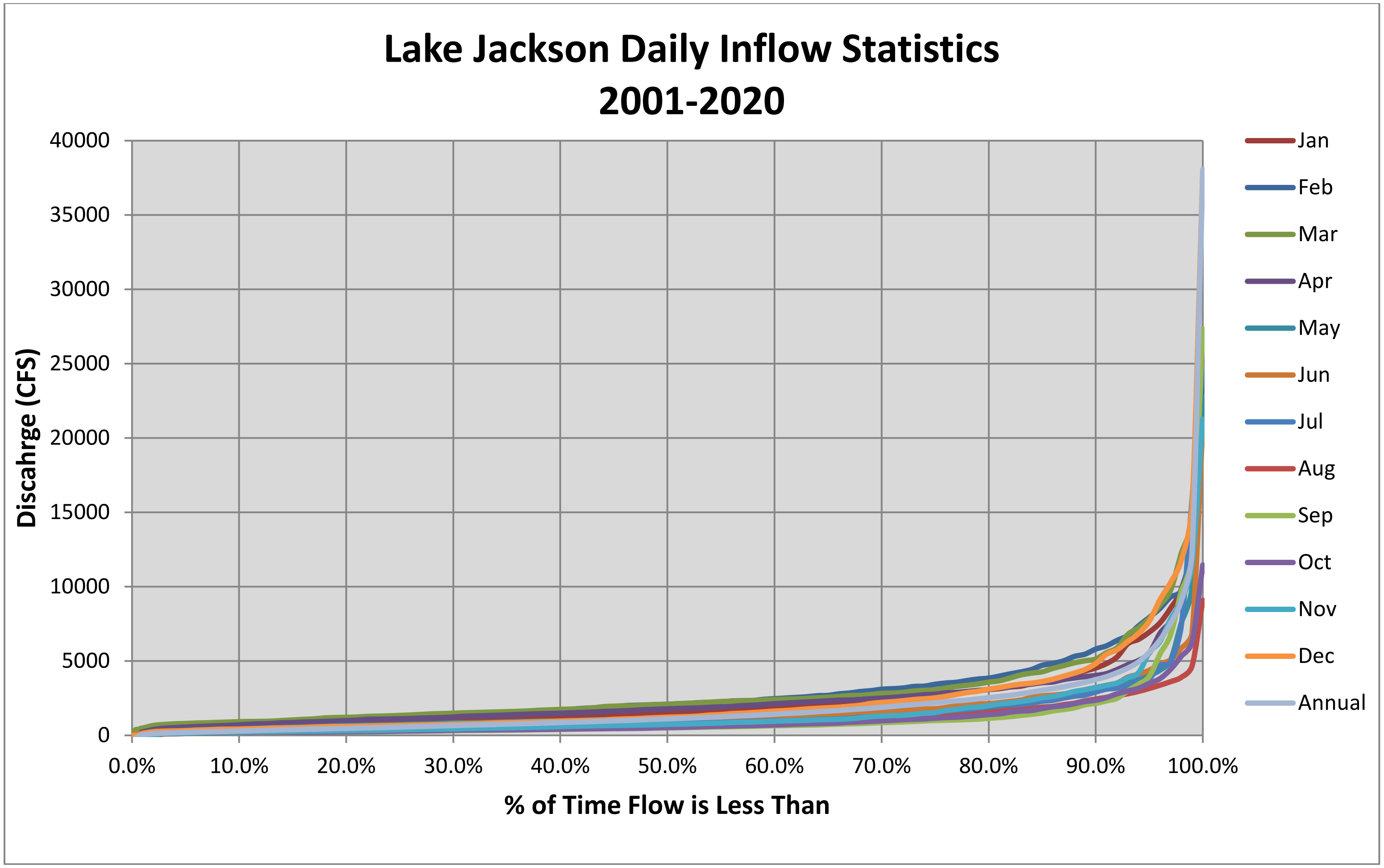

Figure 6: Lloyd Shoals Composite Flow Duration Curve

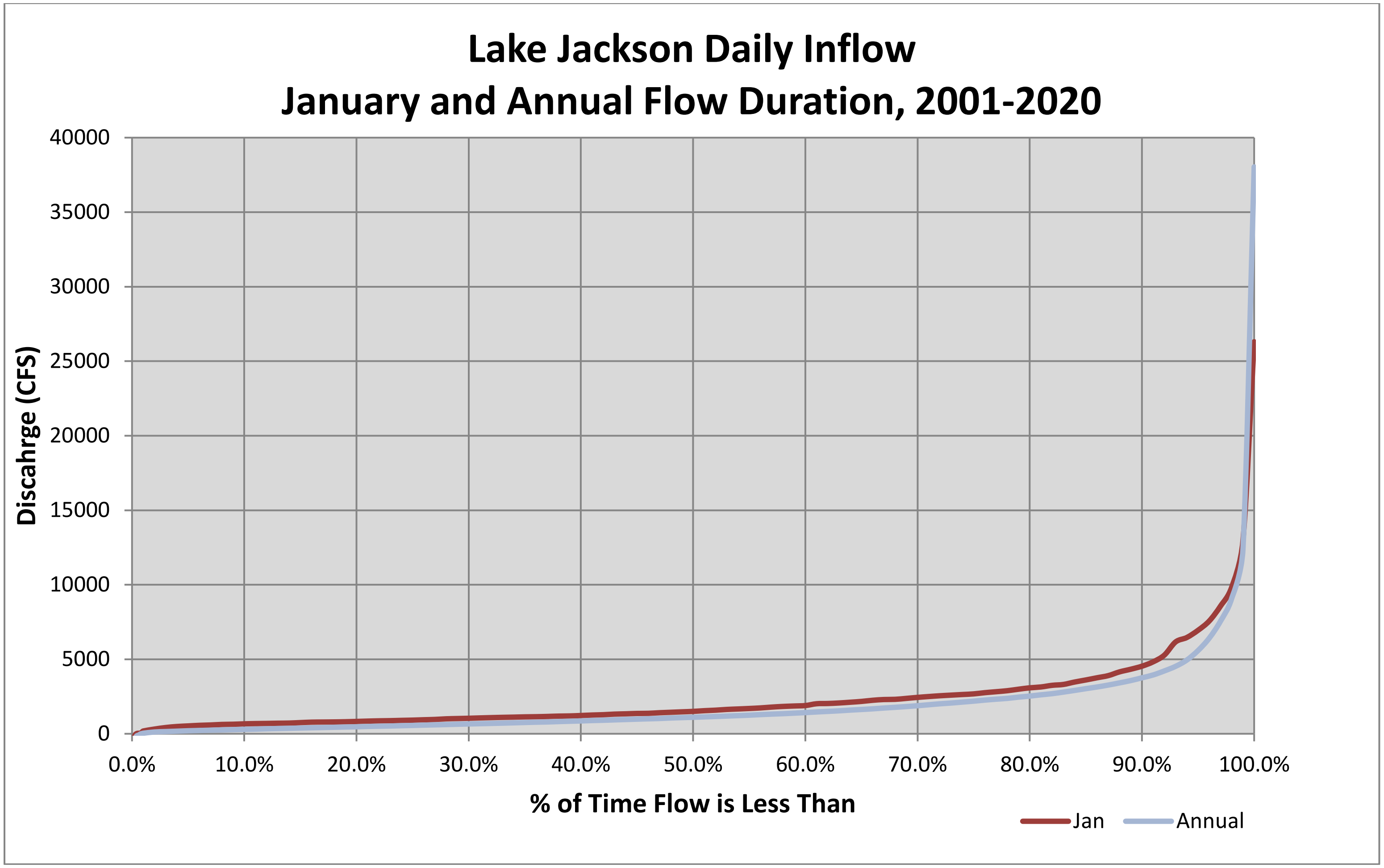

Figure 7: Lloyd Shoals January Flow Duration Curve and Period of Record

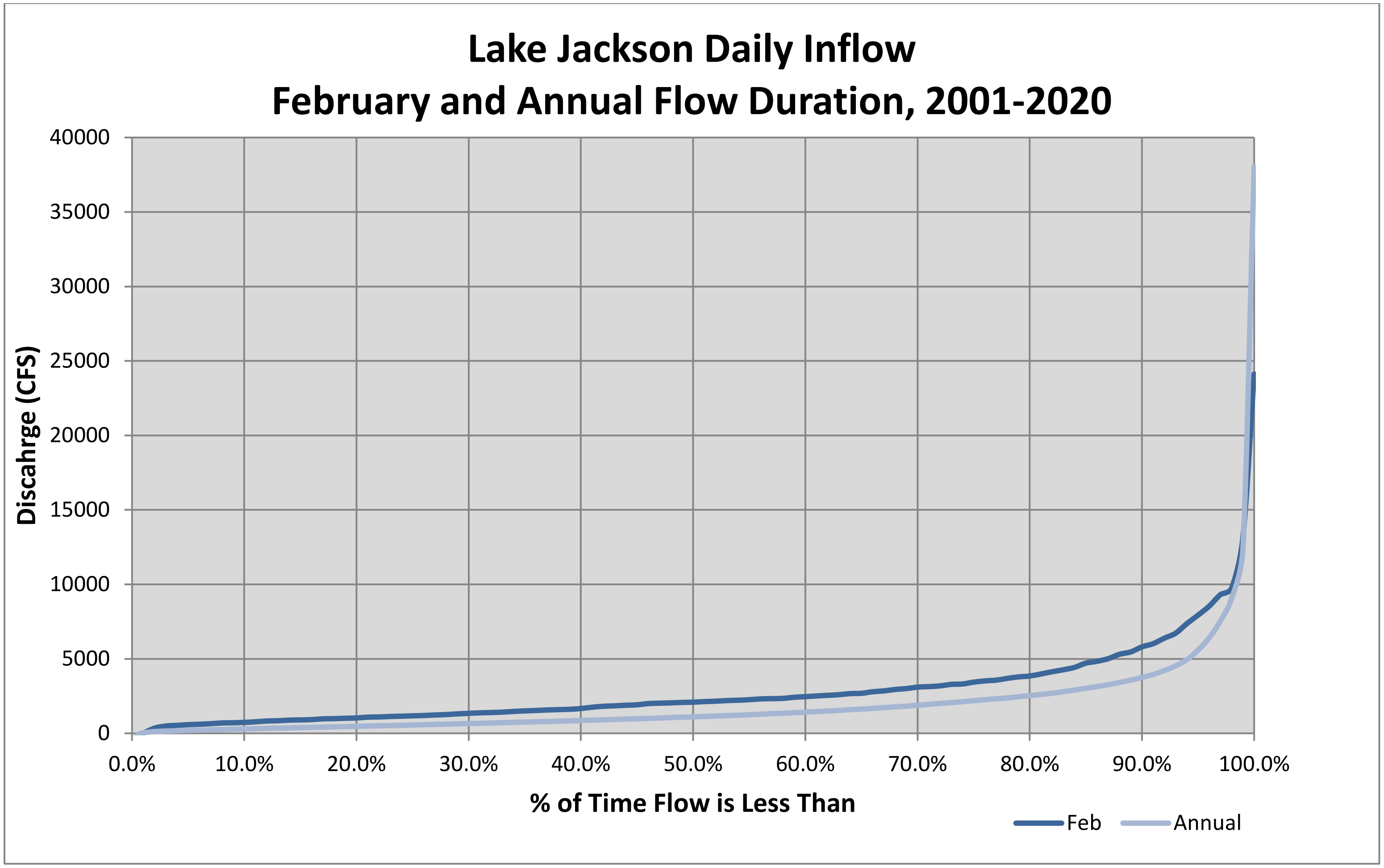

Figure 8: Lloyd Shoals February Flow Duration Curve and Period of Record

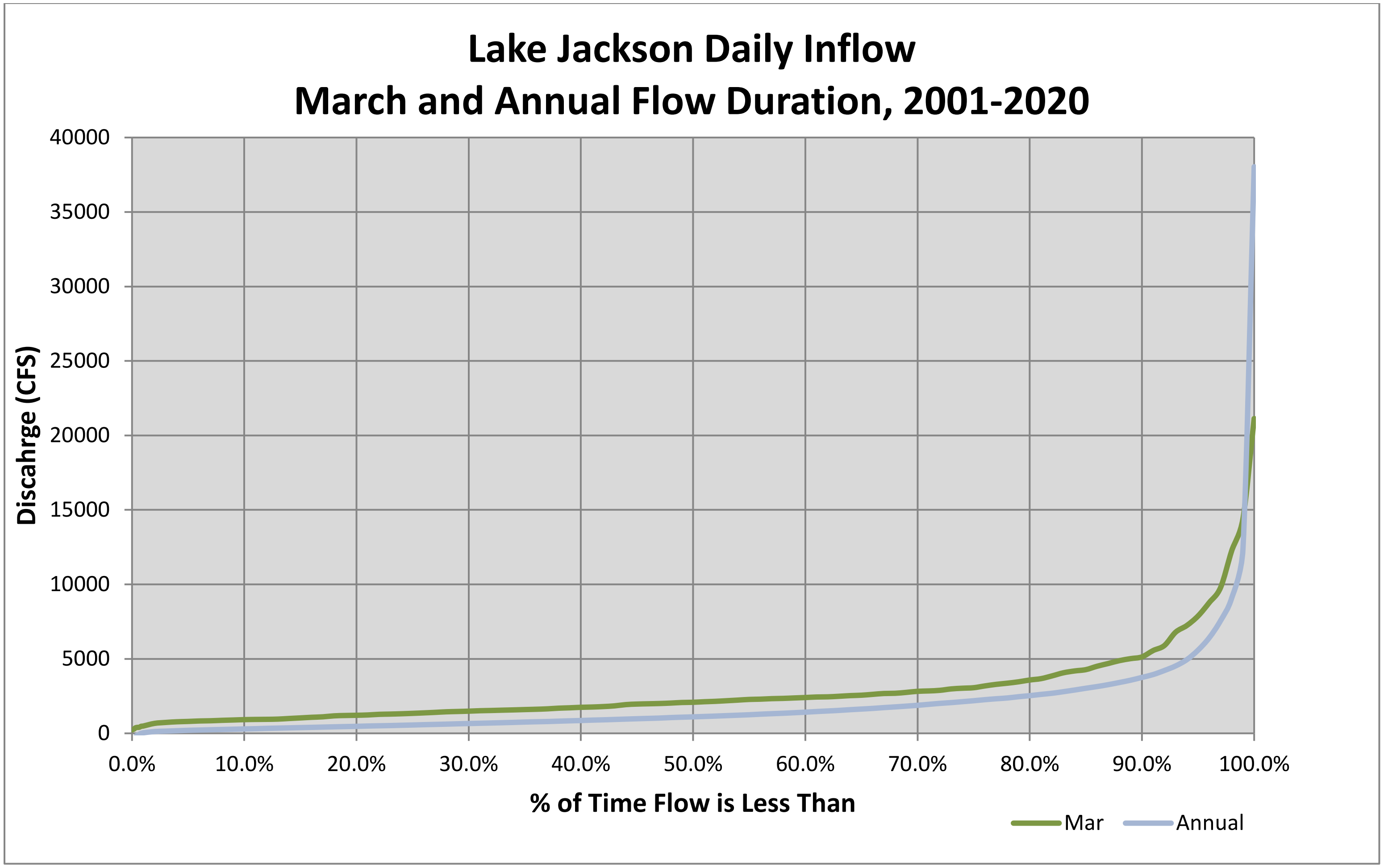

Figure 9: Lloyd Shoals March Flow Duration Curve and Period of Record

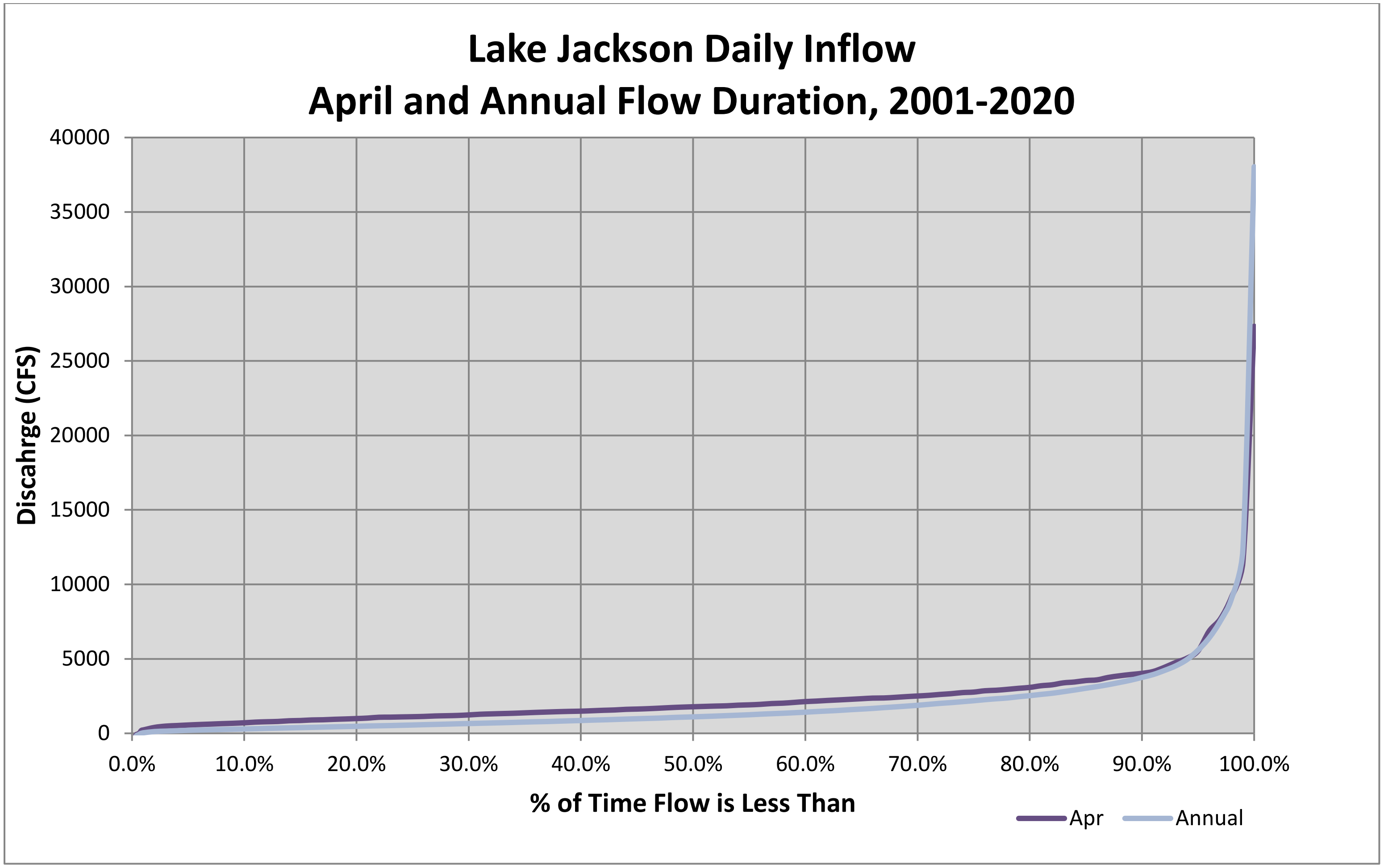

Figure 10: Lloyd Shoals April Flow Duration Curve and Period of Record

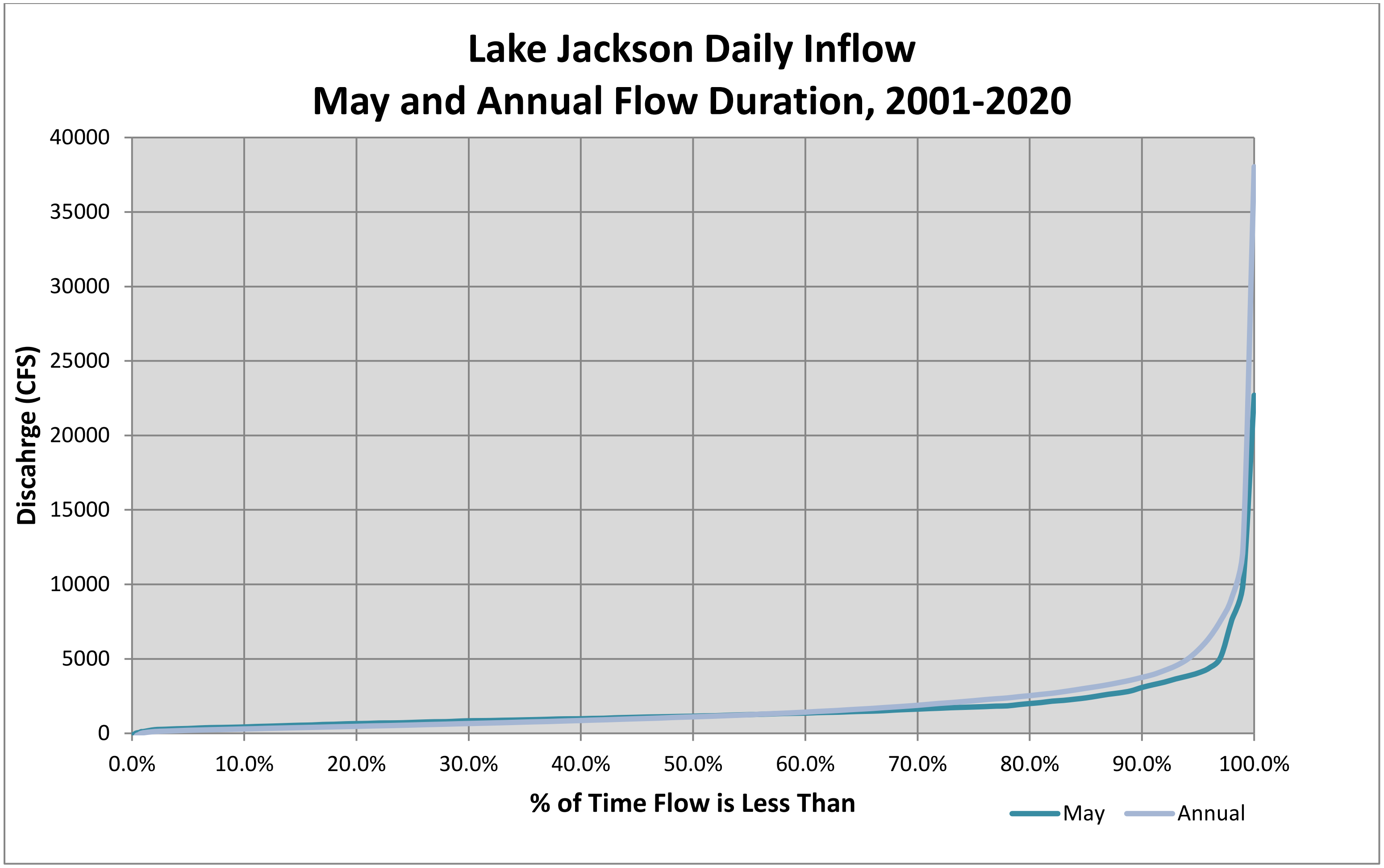

Figure 11: Lloyd Shoals May Flow Duration Curve and Period of Record

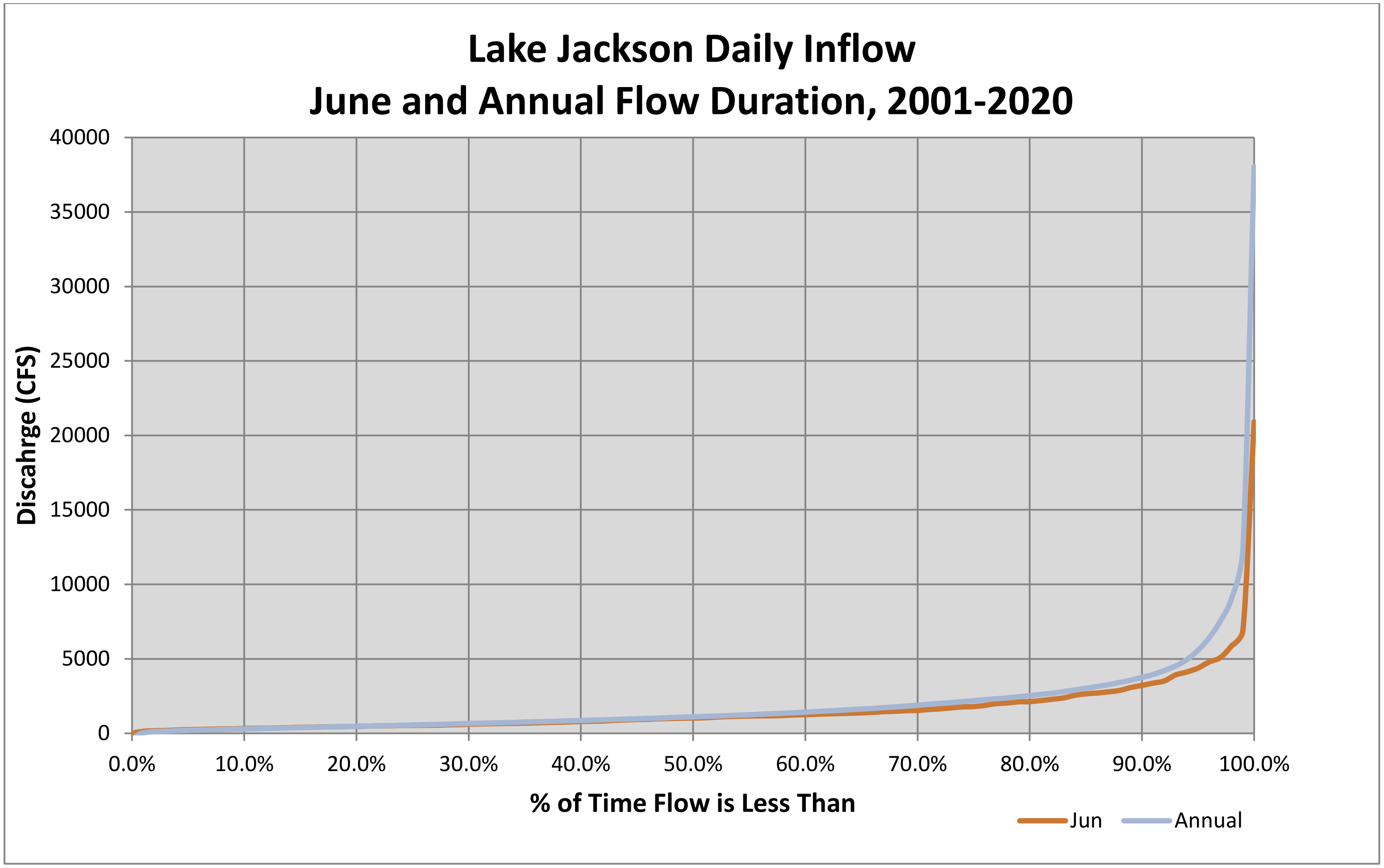

Figure 12: Lloyd Shoals June Flow Duration Curve and Period of Record

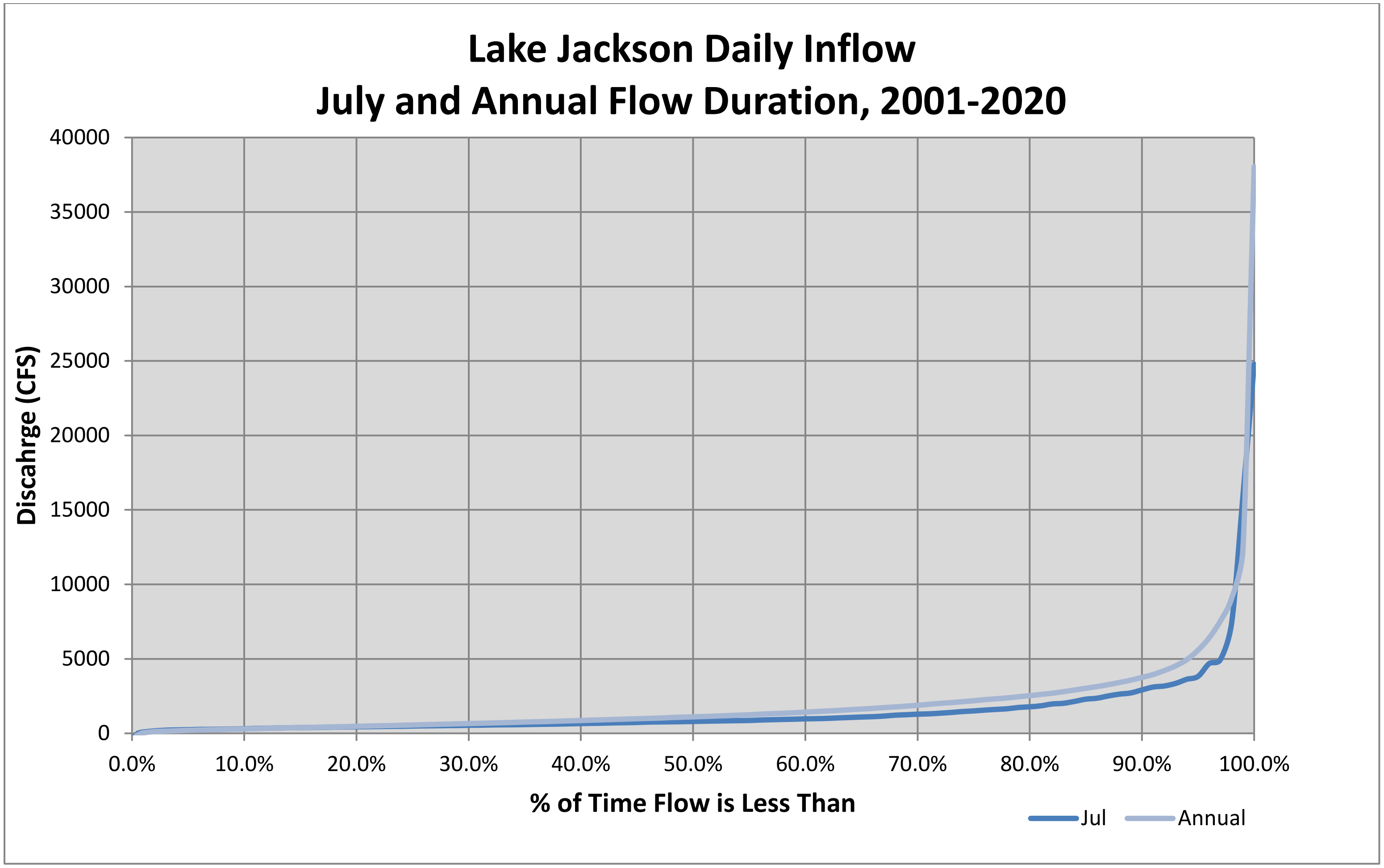

Figure 13: Lloyd Shoals July Flow Duration Curve and Period of Record

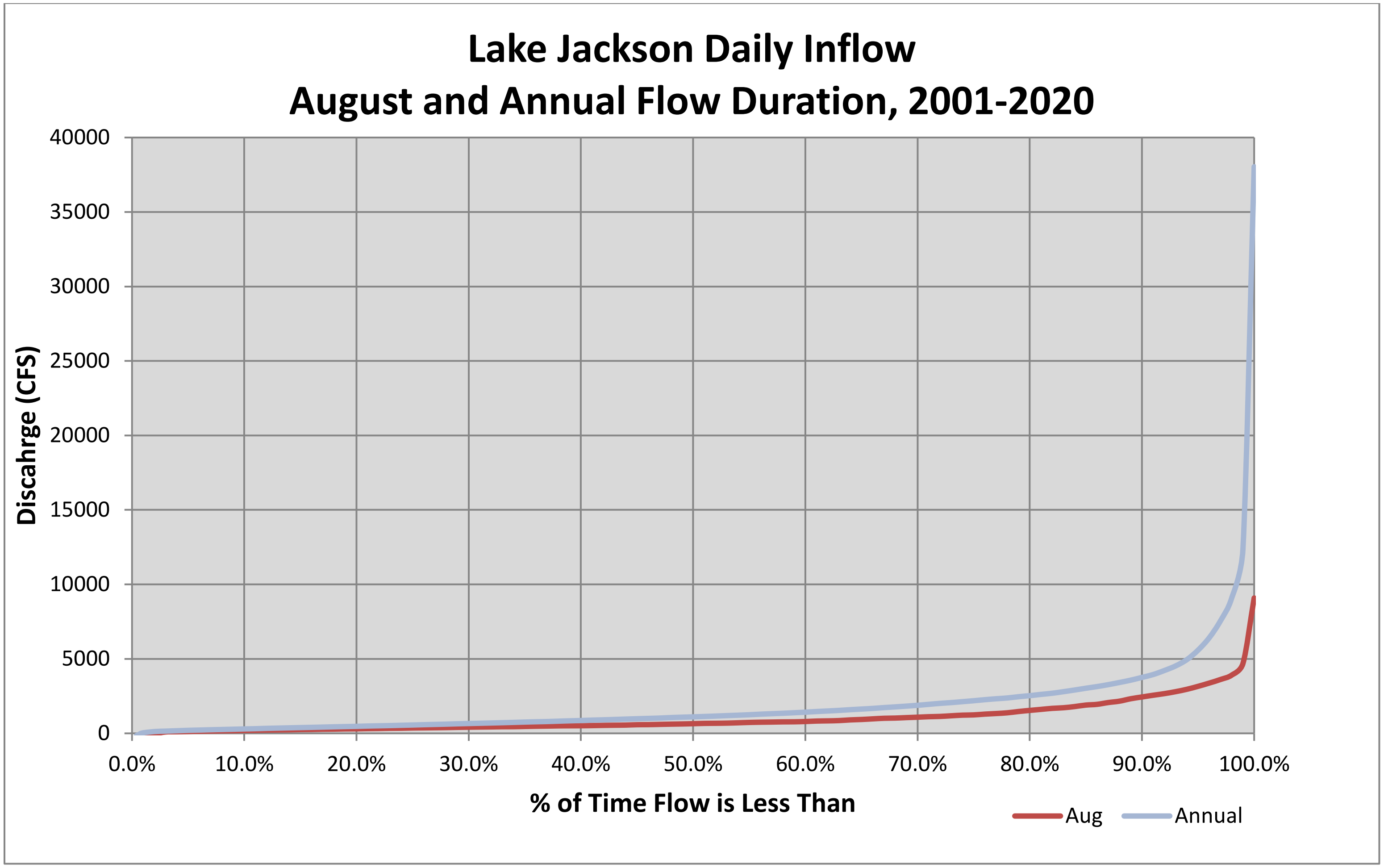

Figure 14: Lloyd Shoals August Flow Duration Curve and Period of Record

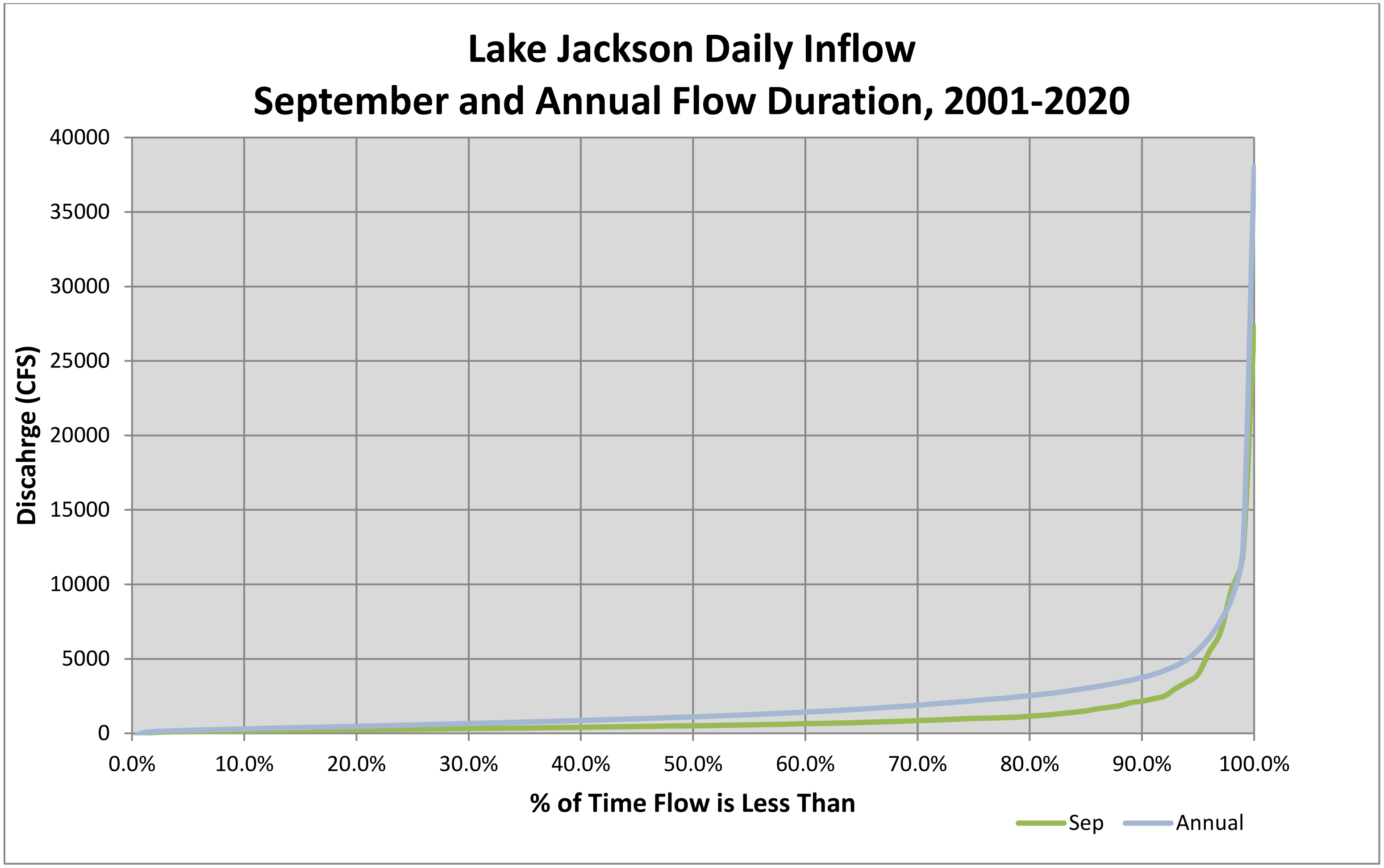

Figure 15: Lloyd Shoals September Flow Duration Curve and Period of Record

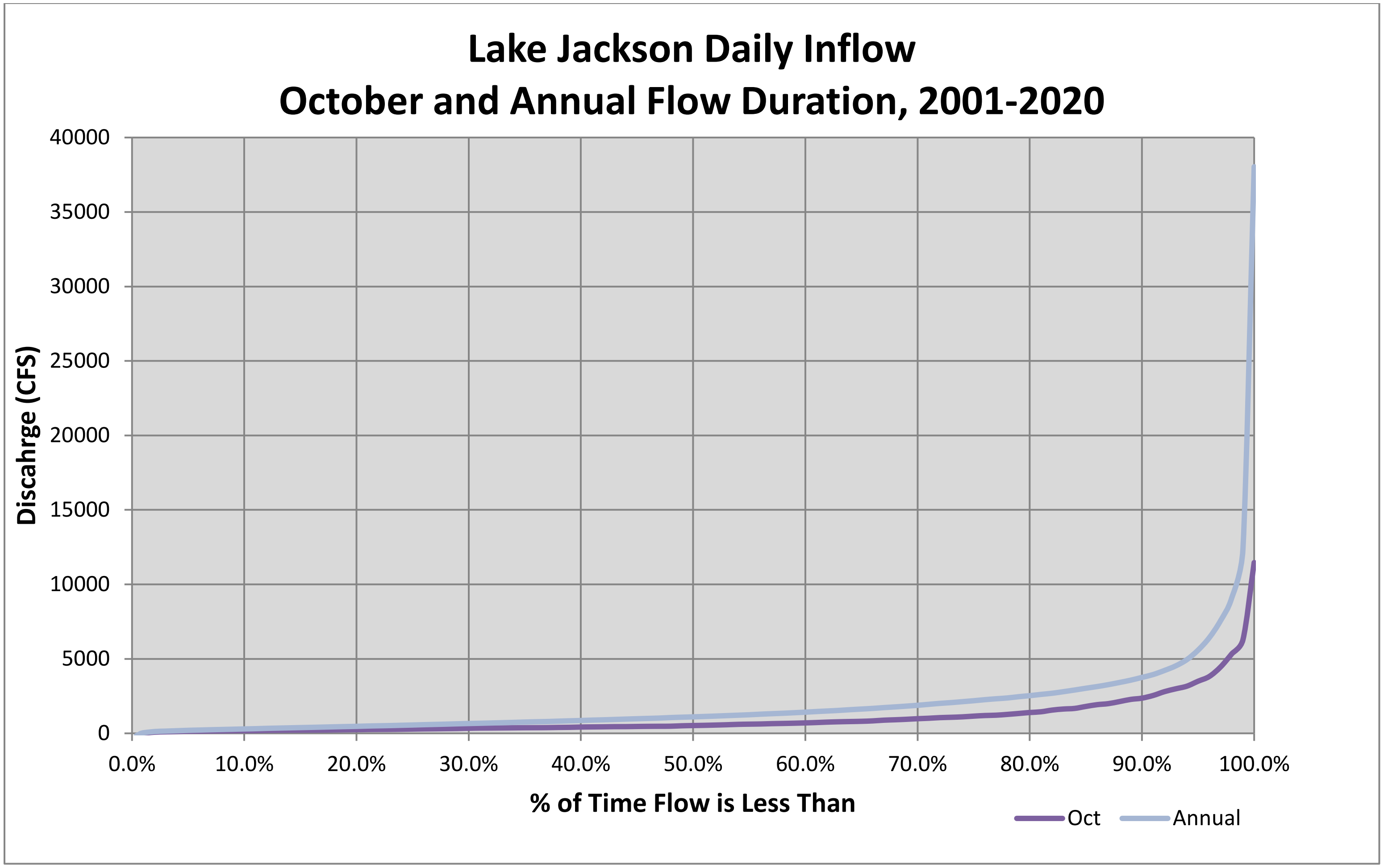

Figure 16: Lloyd Shoals October Flow Duration Curve and Period of Record

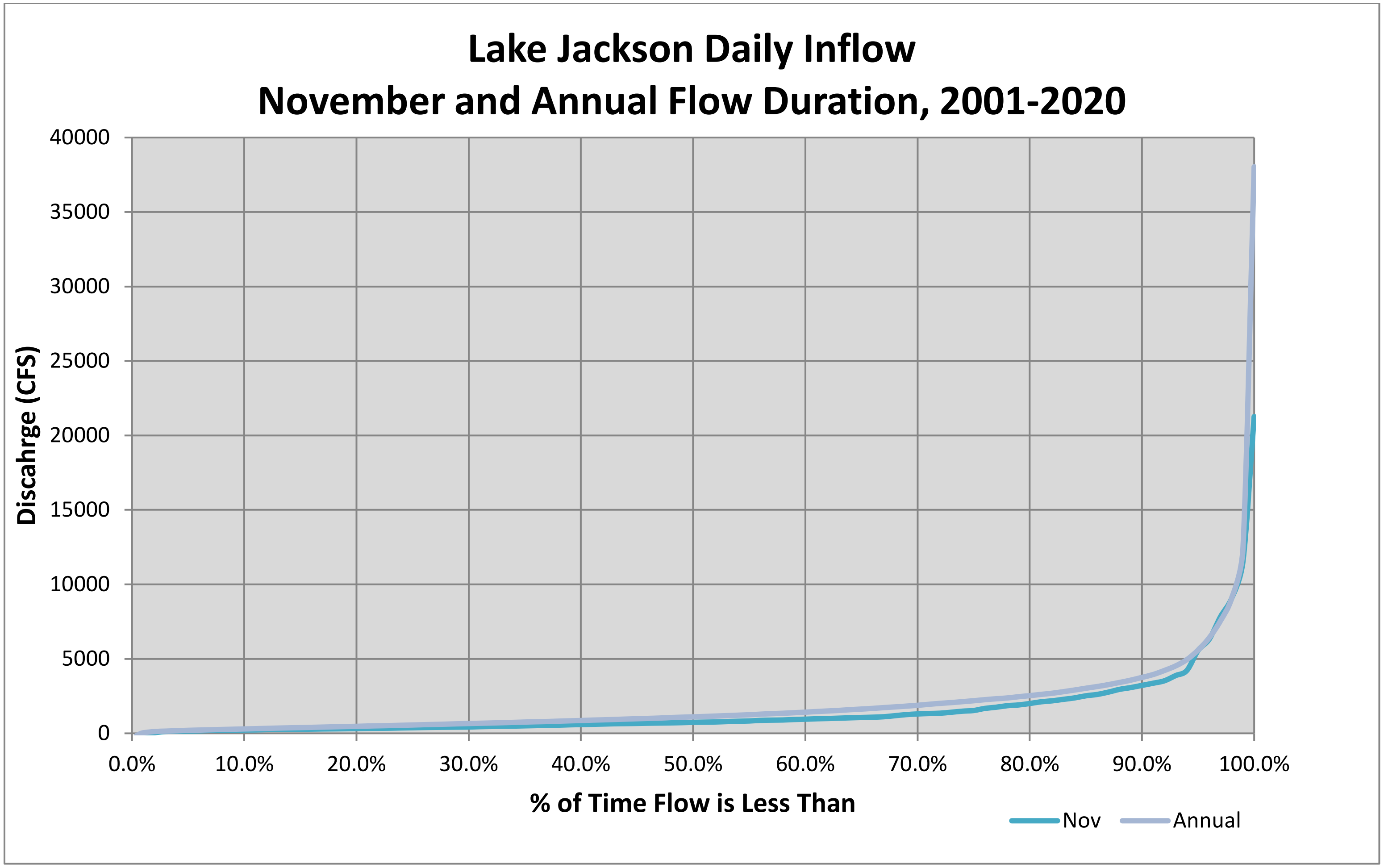

Figure 17: Lloyd Shoals November Flow Duration Curve and Period of Record

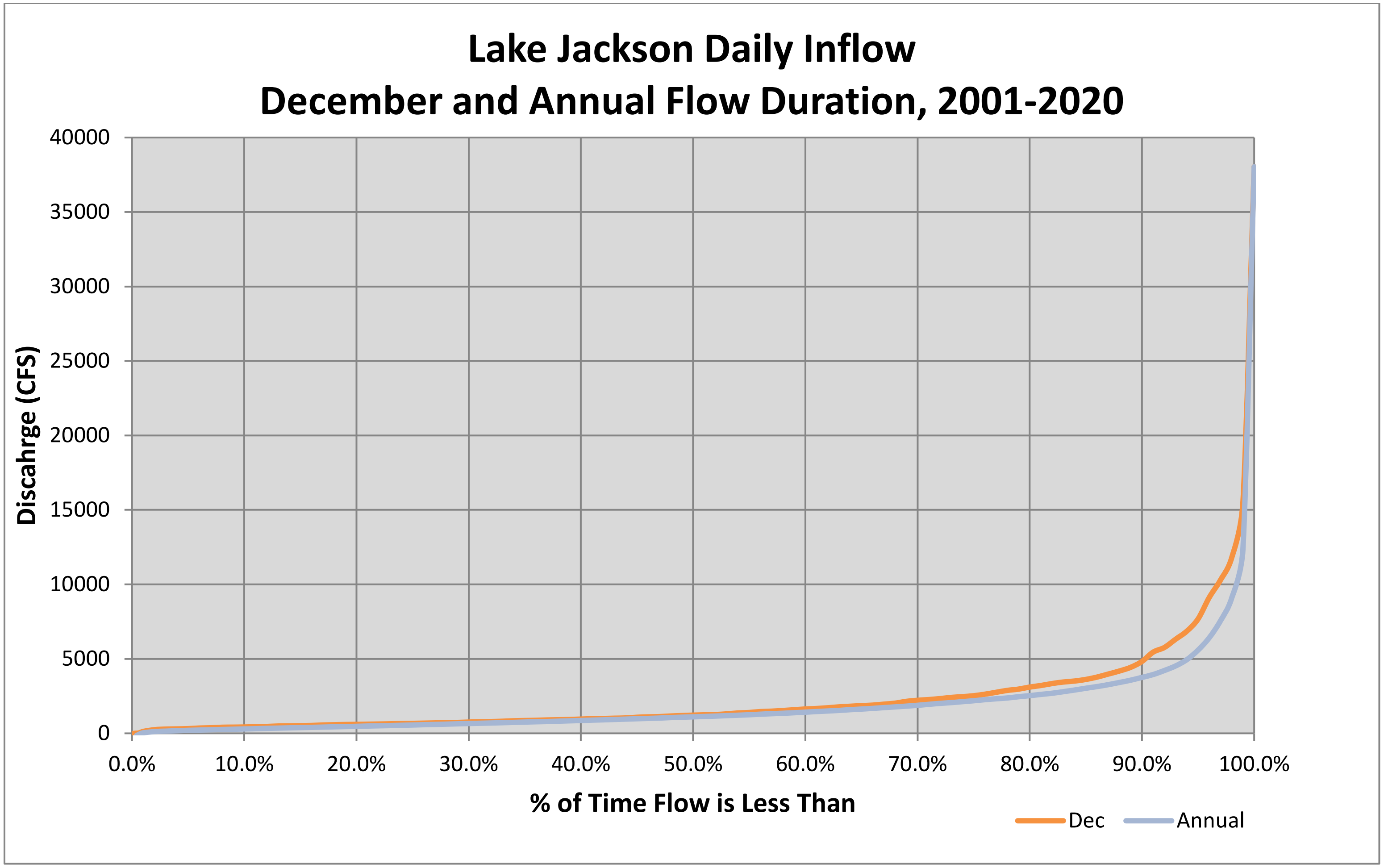

Figure 18: Lloyd Shoals December Flow Duration Curve and Period of Record

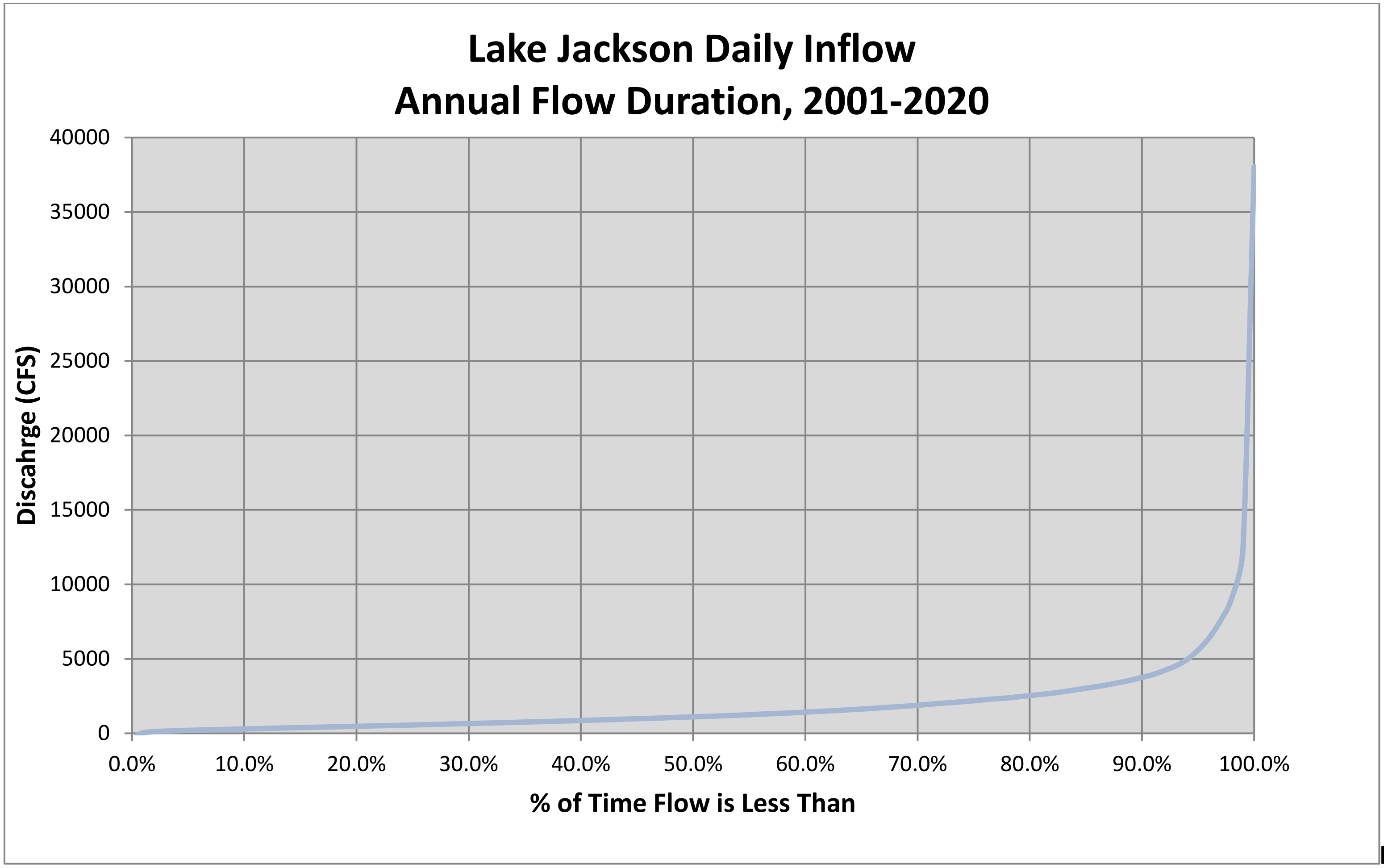

Figure 19: Lloyd Shoals Period of Record Flow Duration Curve

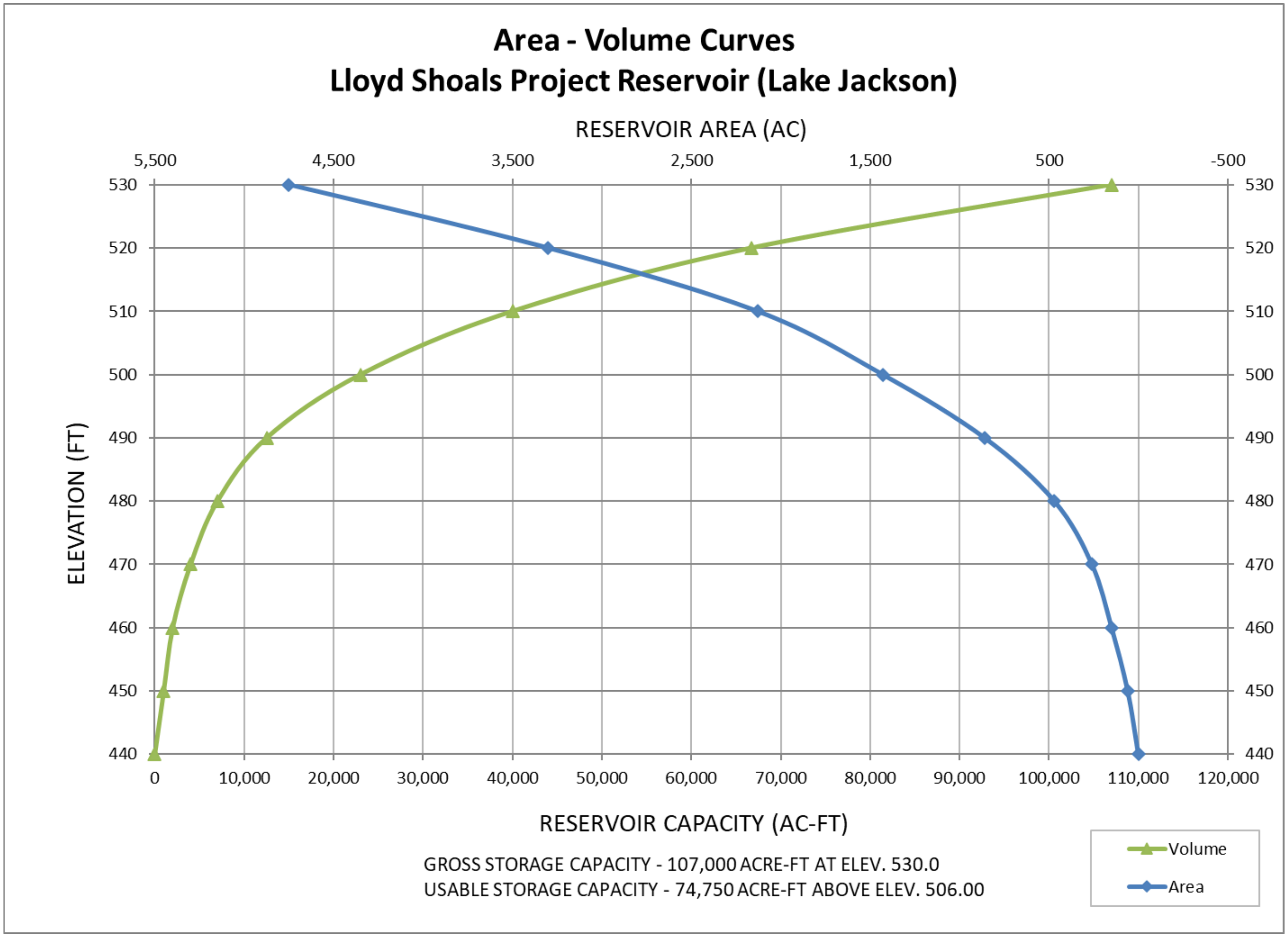

Figure 20: Lloyd Shoals Area Volume Curve

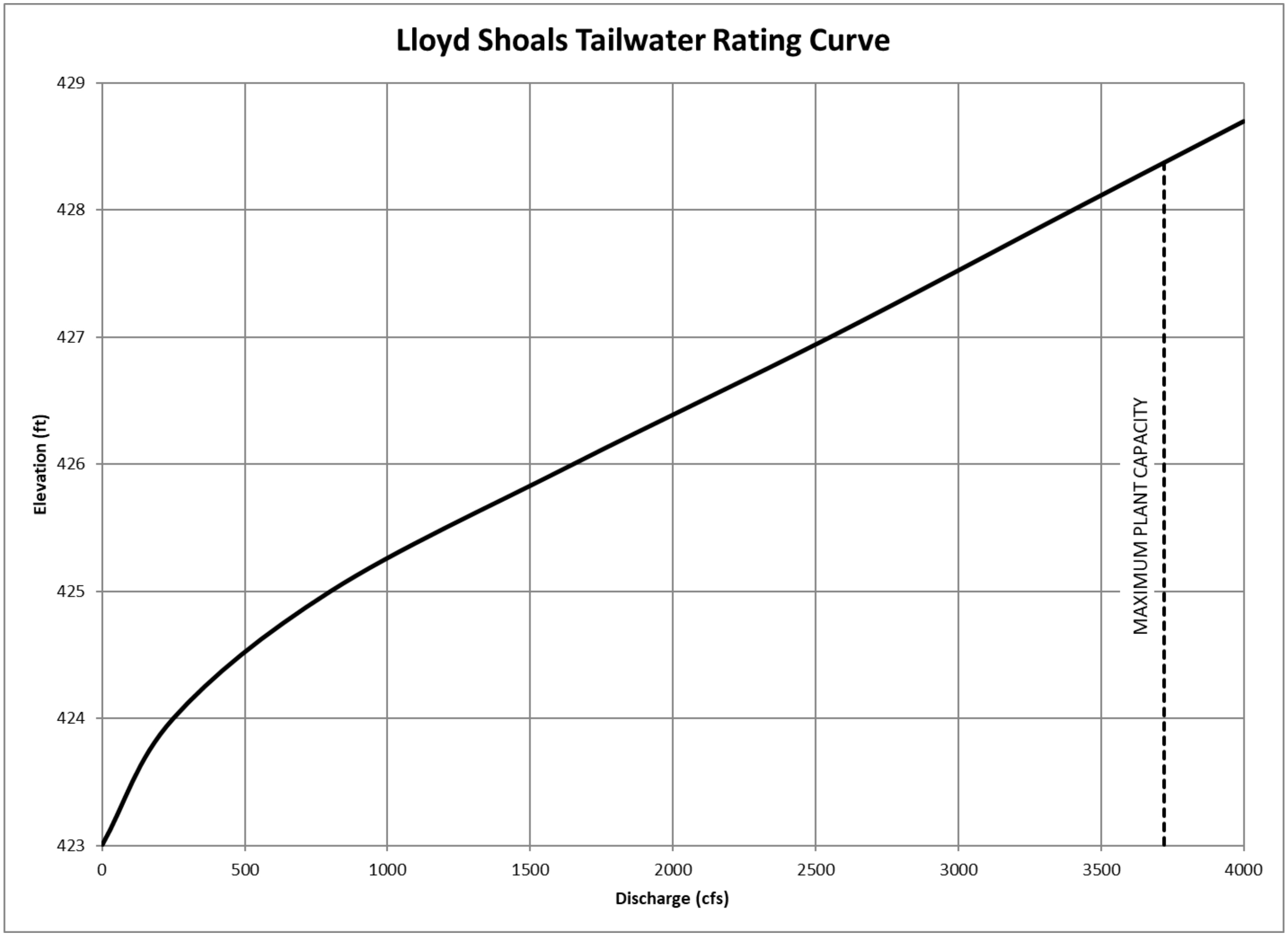

Figure 21: Lloyd Shoals Tailwater Rating Curve

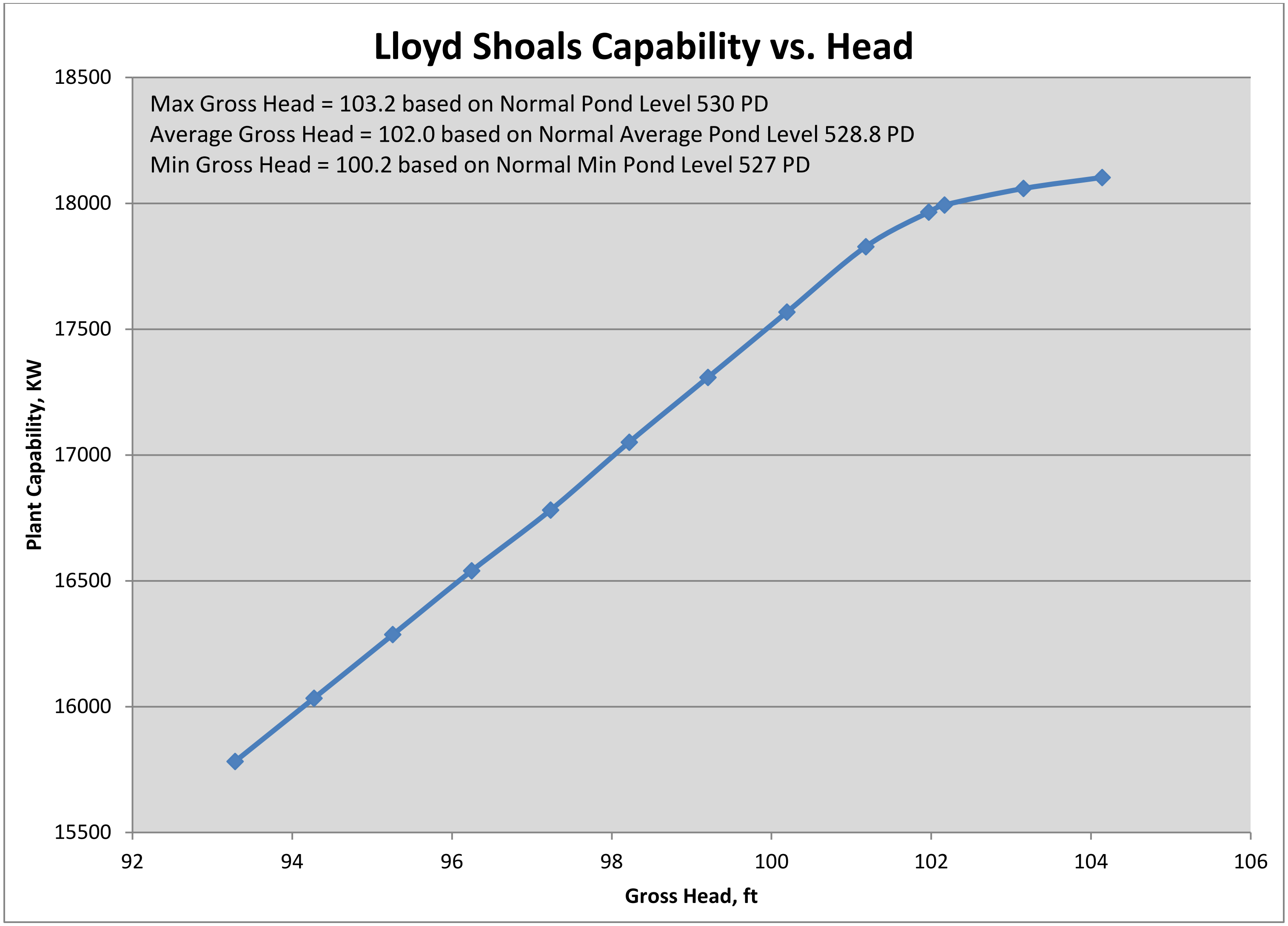

Figure 22: Lloyd Shoals Capability vs. Head

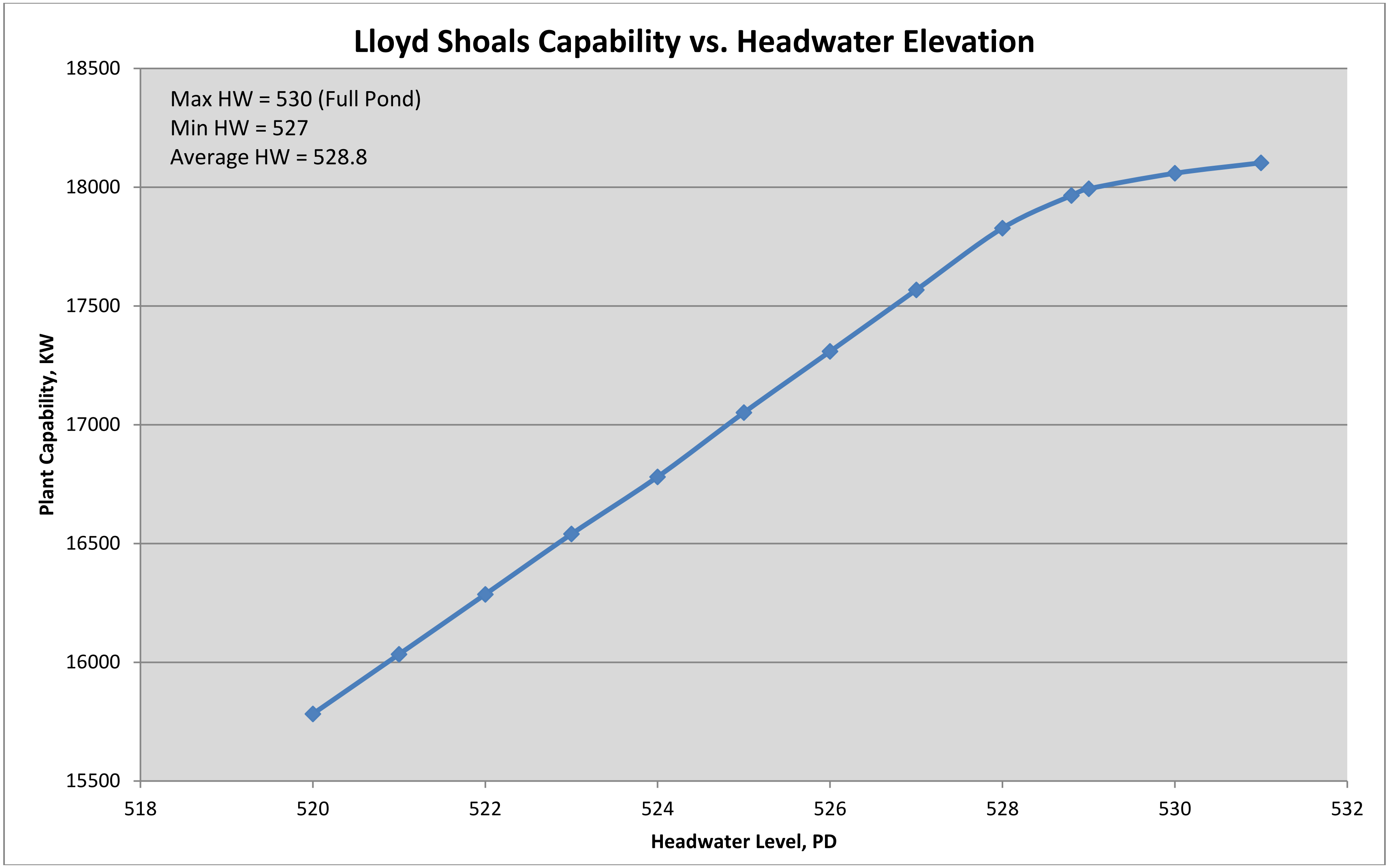

Figure 23: Lloyd Shoals Capability vs. Headwater Elevation

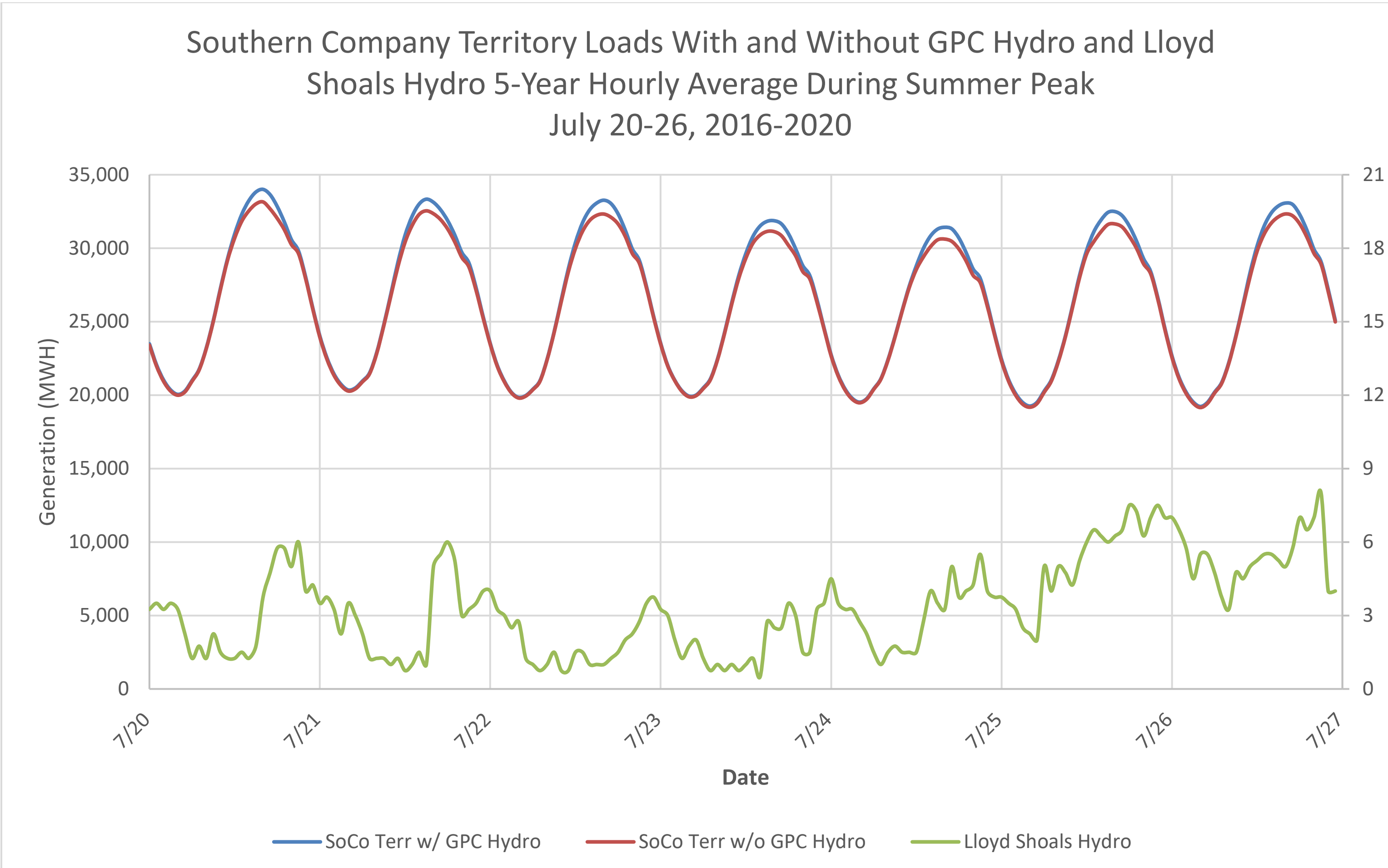

Figure 24: Southern Company Territory Loads with and Without GPC Hydro and Lloyd Shoals Hydro, 5-Year Hourly Average During Summer Peak, July 20-26, 2016-2020

Lloyd Shoals Hydroelectric Project
FERC Project Number 2336-094

Exhibit C

Public

Prepared by

Southern Company Generation Hydro Services

December 2021

18 CFR§ 4.51 (d) Exhibit C is a construction history and proposed construction schedule for the Project. The construction history and schedules must contain:

The requested information is presented in the following sections.
There are a number of places where information that meets the requirements of Exhibit C is provided. Exhibit C itself has a section that contains written documentation and photos.

18 CFR§ 4.51 (d)(1) If the application is for an initial license, a tabulated chronology of construction for the existing Project structures and facilities described under paragraph (b) of this section (Exhibit A), specifying for each structure or facility, to the extent possible, the actual or approximate dates (approximate dates must be identified as such) of:

Since this application is not for an initial license, this section is not applicable.

18 CFR§ 4.51 (d)(1)(i) Commencement and completion of construction or installation;

Since this application is not for an initial license, this section is not applicable.

18 CFR§ 4.51 (d)(1)(ii) Commencement or commercial operation; and

Since this application is not for an initial license, this section is not applicable.

18 CFR§ 4.51 (d)(1)(iii) Any additions or modifications other than routine maintenance; and

Since this application is not for an initial license, this section is not applicable.

18 CFR§ 4.51 (d)(2) If any new development is proposed, a proposed schedule describing the necessary work and specifying the intervals following issuance of a license when the work would be commenced and completed.

Since no new development is proposed, this section is not applicable. However, in order to provide a comprehensive description of the Project's construction, a history of the Project is presented below.

1.1 Nomenclature

During the period of time covered by this report, some noted entities changed names. A typical example occurs with the Federal agency now known as the Federal Energy Regulatory Commission (FERC). Initially, this government agency was called the Federal Power Commission (FPC).

Depending on the section of the report under consideration, alternative names for an entity performing essentially the same function may be used somewhat interchangeably. In other sections, for the convenience of the reader, an entity may be identified with a name by which it would be known at the time this report was written, and not with the name it had at the actual point in time being described.

Much of the information for the construction period comes from a review of .jpg picture files from Georgia Power archives and some are screen shots of photographs found in an online Internet reference. In some cases, where a construction detail is discussed in the report, the underlying .jpg image was called up and then a zoom feature was used to more clearly capture the issue under discussion. Typically, a screen shot was taken of the zoomed in area, saved as a new .jpg figure, and then used in the report.

Given the age of the original photographs, the resolution/sharpness of the resulting .jpg file is sometimes not clear. In the case where a screen shot is secured from an Internet reference, the quality of the resulting .jpg is a direct function of the scan resolution used to scan the original document. If a low scan resolution was used, the picture will not have the sharpness or crispness of a .jpg scanned directly from a high resolution glossy photograph. Also, in the case where a figure is presented that is a .jpg of a 'zoomed in image', this may have a grainier consistency than the underlying .jpg.

It is likely that the source of many of the original photographs used in this Construction History are from the Resident Engineer during the original construction. His name was Mr. George F. Harley. See **Figure 1**, titled **Photograph of Mr. George F. Harley.**

1.2 Major Time Divisions

This report has two major time divisions. The dividing line between these two periods is when the station was determined to be jurisdictional under the Federal Power Act. Prior to 1962, the station was grandfathered and was not subject to meeting regulations and directives from the Federal Power Act. In the report, this period is termed the Pre-Federal Jurisdictional Period Pre-1907 to 1962.

In the report, during the period termed the Federal Jurisdictional Period 1962 to the Present, the station has been subject to the Federal Power Act and its implementing regulations. Many of the construction activities in this time period stemmed from Federal oversight and regulations.

1.3 Report Format

This report has two different styles or formats, depending on the activities occurring in either of the two major time periods. For events or items occurring during or before 1962, the report format is the format of events/activities within a chronological framework (e.g., "Between 1/2/1909 and 1/18/1909, construction personnel had increased the number of derricks in the cofferdam area from 3 to 6. The East Batch Plant, if not already completed, was very near completion. Carpenters were erecting the concrete formwork for the first concrete pour." For events or items after 1962, the format is reversed: an event or activity is presented and a series of chronological items within that event or activity is presented. This reversal was done because after 1962, many of the items discussed are discrete projects. The description of these projects provides the chronological unfolding of the progress of the particular project.

2.0 Pre-Federal Jurisdictional Period Pre-1907 to 1962

The Pre-Federal Jurisdictional Period can be divided into roughly three major sub periods. The first period involves the initial construction of the major structures of the station. However, in this period the station was not developed to its full potential. In the report, this period is termed the Initial Construction Period Pre-1907 to 1911. The second period starts at the start of 1912 and runs to 1916. In this period of time the station was developed to its full design capacity. In the report, this period is termed the Full Station Development Period 1911 to 1916. The third and final major sub period runs from 1917 to 1962. This period in the report is termed the Post-Full Development Period 1917 to 1962.

2.1 Initial Construction Period Pre-1907 to 1911

2.1.1 Pre-1907

The Lloyd Shoals site had been the subject of evaluations since the late 1800s, as it was located on one of the major rivers draining the interior of the State of Georgia. An 1885 report from the Georgia State Department of Agriculture noted that at the Lloyd Shoals site there was a solid rock reef which extended entirely across the river and which formed a natural dam. The fall in the river bed was rapid. The climate was mild and inexpensive frame structures '. . . costing but a trifle . . .' could be built. Additionally, there was an abundance of building materials such as granite and timber. The area for miles was the best cotton producing portions in the State of Georgia. During the spring and winter months the supply of water was superabundant. However, a report by the Census Office of the Department of the Interior in 1885 noted that the flow of the Ocmulgee could be quite variable. The freshets were noted to be very heavy and sometimes the stream would rise 22 feet at Macon. The Census Office report stated that at the Lloyd Shoals site the bottom of the shoals is solid rock and the banks are generally high except that there is a bottom near the foot of the shoal. Both reports noted that the principal drawback to developing the site was the lack of cheap transportation.

In 1902, the United States Government Printing Office published the United States Geological Survey's (USGS) 22nd Annual Report for the fiscal year ending 6/30/1901. The USGS reported that they had made a survey of the Ocmulgee River from Constitution, Georgia, to Macon, Georgia. The survey work consisted of setting stakes or using other reference points, procuring a profile (elevations of the stakes were determined), and making a continuous sketch of the river, bluffs, shoals, mills, bridges, mouths of tributaries and land lines. **Figure 2**, titled **1901 Ocmulgee River Profile**, shows part of what was presented in the report, with the area of Lloyd Shoals highlighted. Anyone reviewing the report with an eye towards hydropower development would immediately have their attention drawn to the vicinity of Lloyd Shoals.

In October of 1902, the Macon Railway & Light Company was incorporated. It was a consolidation of the then existing electric railway, light and power companies operating in Macon and its suburbs. It owned a steam power station with a generating capacity of 3,000 horsepower which was sufficient to supply the needs of the city.

2.1.2 1907

2.1.2.1 Overview

By 1907 the city of Macon, Georgia was the premier manufacturing and railroad center of Central Georgia. It had a population of 56,000. Other towns within a 35-mile radius of the Lloyd Shoals site included Covington, Madison, Monroe, Monticello, and Eatonton, with an aggregate population of more than 250,000 people. Among them, these cities contained 25 cotton mills which employed 6,000 workers and these cotton mills were capitalized at $5,000,000. They used over 10,000 horsepower which was generated by steam to power their manufacturing efforts. Within the same territory there were 15 cotton-oil mills as well as other industries such as lumber and wood working plants, brick yards, vehicle factories, railway shops, foundries and machine shops, just to mention a few. The cotton oil industry was estimated to need 5,000 horsepower for their operations. Within Macon, one of the larger companies was the Macon Railway and Light Company. The company was capitalized at $2,200,000. With regards to Macon's banking sector, it included three national and five state banks, with a total capitalization of $1,250,000, deposits of $6,000,000 and annual clearings for 1907 of $35,466,698.

The Bibb Power Company was organized under the laws of the State of Georgia on 3/4/1907, for the purpose of engaging in the production, distribution and sale of electrical energy. Mr. W. J. Massee was the president and Mr. William Tusch was the secretary of the company. As of the writing of this report, the company's business plan has not been found in any references or archives. One reference from the early 1900s stated that the Macon Railway & Light Company had become closely allied with the power company ". . . the controlling interests of both companies being identical. . . . ". From the references, it appears that Mr. W. J. Massee was the president of both the Bibb Power Company and the Macon Railway & Light Company.

Since both companies had the same officers, there would be synergy between the two companies. The Macon Railway and Light Company would provide an immediate outlet for any hydropower that would be developed. The company was already operating a turbo-generator steam plant which was powering its fleet and city lighting. Were cheap hydroelectric power to be supplied to the railway company, this could displace the more expensive steam coal costs. The steam plant would still be used to supplement the hydroelectric energy and would enable the secondary power to be sold as primary power. The cotton mills would provide another steady outlet for cheap hydroelectric power which could reduce the mills' energy costs. So, it would appear that there was a ready and probably a growing market for hydroelectric energy within a reasonable distance from the Lloyd Shoals site.

But what of the site itself? The amount of fall in the river has been previously discussed: it was very good. The site was also attractive because of the naturally available construction materials. With the river there, there was plenty of water available. The riverbed in the vicinity of the site contained sand and rocks. The foundation material at the site was competent granite. The land was rural and forested. The sand, rocks, and water could be used to make concrete. All that would be needed was to supply cement. The timber would need to be cut in portions of the reservoir area, but this timber could be used to make concrete forms, scaffolding/shoring/supports, and used in other ways.

One drawback to the site was its remoteness. It was approximately 43 miles north west of Macon, approximately 7 miles east of Jackson, Georgia, approximately 10 miles west of Monticello, Georgia, and approximately 6 miles north east of Flovilla, Georgia. Building a modern hydroelectric station would require a small army of workers to carry out the construction. The surrounding towns would be too far away to serve as places for them to stay, given the state of transportation facilities. The workforce would also have to be fed. Additionally, the logistical problem of getting 'heavy' construction equipment and weighty materials (e.g. hydro turbines, electrical generators, etc.) to the job site would need to be solved.

2.1.2.2 1907 Land Acquisitions

Land acquisitions for the new hydroelectric facility began in 1907.

2.1.3 1908

2.1.3.1 Overview

By 2/6/1908, the Bibb Power Company changed its name to the Central Georgia Power Company. The president of the company was Mr. W. J. Massee and the chief engineer for the company was Mr. Charles F. Howe. The company stated that the development of the Lloyd Shoals project was estimated to cost $1,850,000.

On 3/21/1908, the Georgia Railroad Commission approved the issuance of 40,000 shares of common stock of the company at a par value of $100.00/share for a total value of $4,000,000.

To date, the available records and research materials have not disclosed much information on a company called the Georgia Construction Company. What is known is that Mr. Massee was the president and Mr. Tusch was the secretary of the Georgia Construction Company. It is assumed that the Georgia Construction Company was formed in 1908.

By 3/26/1908, the Central Georgia Power Company had completed arrangements for financing construction activities. A. B. Leach & Co. of New York agreed to underwrite the company's securities by issuing bonds totaling $16,000,000 and stock totaling $20,000,000.

By 4/2/1908, the Central Georgia Power Company had made its appropriations of the funds described above. The Lloyd Shoals appropriation was for $3,000,000 in bonds and $4,000,000 in common stock.

On 4/29/1908, the Central Georgia Power Company entered into a contract with the Georgia Construction Company for the construction of the first four units of the Lloyd Shoals plant. What is not entirely clear from the available record and sources is the business plan for the Georgia Construction Company. What seems to be indicated from the available documents is that the Georgia Construction Company was to be an intermediary between the Central Georgia Power Company and the entities who would actually be doing the construction of the Lloyd Shoals station. This conclusion is based on the fact that apparently the Central Georgia Power Company would periodically turn over to the Georgia Construction Company some of the 5% first mortgage gold bonds and shares of the issued stock so as to finance the construction program at Lloyd Shoals. On 5/1/1908, the Central Georgia Power Company issued $3,000,000 face value of 5% first mortgage gold bonds.

On 5/1/1908, a contract was entered into with the J. G. White & Company to serve as the general contractor for the building of the station. They would be responsible for the layout, design, engineering, and supervision of the construction. They would ultimately be paid $75,000 for their work. What is not entirely clear from the available records and research is the name of the contracting counterparty. Given that the Georgia Construction Company was apparently tasked to serve as the paymaster for the project's construction, it is assumed that the contract was with the Georgia Construction Company.

The scheme of development was to build a number of structures, the majority of which would be constructed out of concrete or masonry and structural steel. Moving from east to west, the structures were:

1. An East Earth Embankment with a concrete core wall. The East Earth embankment also contained a training wall complex. The west end of training wall complex, at the crest, abutted onto the east end of the Spillway Section. The core wall would be of concrete and the upstream and downstream embankment slopes would be constructed of earth fill with the upstream face rip rapped. The East Earth Embankment was to be 500 feet in length and extended from the east abutment to well above the high-water line on the east side of the valley. The topography of the site was such that this embankment was to be built on a curve that carried its end 400 feet upstream from the spillway of the dam.

2. A Spillway Section. In a sectional view, the Spillway Section had a vertical upstream face, a crest with two separate crest elevations, and an ogee shaped downstream face. The width of the spillway at the crest was to be 7 feet. This width would be increased by the ogee curve on the downstream face of the spillway to a maximum of 93 feet at the bottom in the tallest part of the dam. The two separate crest elevations essentially divided the spillway into three sections. Starting from the west end of the East Earth Embankment training walls, the Spillway Section extended westward a distance of 180 feet. Its crest elevation was elevation 528.0. At the end of this run, the spillway joined the eastern edge of the second Spillway Section. In this section, the crest of the spillway was at elevation 525.0. This second section of the spillway extended to the west for a length of 420.0 feet. The western edge of the Second Spillway Section joined to the third and final section of the Spillway Section. This third section extended westward for a distance of 128.5 feet. In this third section, the spillway's crest elevation was elevation 528.0. All the spillway sections were constructed of concrete. The western end of the third section of the spillway extended to a point near the center of the original river channel.

3. An Intake/Powerhouse. The Powerhouse was built integrally with the Intake section and on the downstream face of the Intake Section. The Intake/Powerhouse section's east wall abutted onto the west wall of the third section of the Spillway Section. The Intake section measured 198.0 feet east to west. The Powerhouse substructure was constructed of concrete. The superstructure was a combination of structural steel elements and brick masonry exterior curtain walls.

4. A West Nonoverflow Section. This section joined to the west end of the Intake. It measured 143.0 feet east to west and had its crest elevation at elevation 540.0. At the west end of the West Nonoverflow there was a retaining wall complex on the west abutment. The Nonoverflow and retaining wall complex were made of concrete.

The preliminary estimates contemplated that 160,000 cu. yd. of concrete masonry would be required to complete the project. The entire portion of the dam between abutments was to be built directly on the granite bed rock; the core walls in the embankment at both ends would also have the same foundation.

By 5/21/1908, as a result of design changes in the size of the powerhouse and changes in the extent of the machinery equipment, the cost of the Lloyd Shoals station was now estimated at $2,500,000.

On 7/30/1908, the Georgia Construction Company entered into two contracts with the Lane Brothers Company of Altavista, Virginia. The first contract was for the construction of a single-track railroad. This would ultimately cost $36,982.72. The second contract was for the construction of the dam and powerhouse substructure. This would ultimately cost $749,593.12. Mr. C. W. Lane, general manager of Lane Bros. Co., laid out and directed the installation of the construction plant, and had immediate supervision of the construction from its inception.

On 10/22/1908, a contract was issued to the Westinghouse Electric and Manufacturing Company for the purchase of four turbine driven generators together with exciters, transformers, switchboards and other equipment. Ultimately this cost $108,750.00. It is assumed that the Georgia Construction Company was the counter party to the contract.

On 11/2/1908, a contract was issued to Lockwood, Green and Company for consulting engineering services. This would ultimately cost $13,932.55. It is assumed the counter party to the contract was the Georgia Construction Company.

On 11/14/1908, a contract was issued to the S. Morgan Smith Company for the purchase of four turbines with runners, governors, and other related equipment. The ultimate cost was $49,150.00. It is assumed the counter party to the contract was the Georgia Construction Company.

2.1.3.2 1908 Land Acquisitions

Land acquisition activities continued in 1908.

2.1.3.3 1908 Construction Activities

2.1.3.3.1 Overview

The available records indicate that construction of the Lloyd Shoals station started in 1908, but no definitive time is given. It is assumed that no construction would be initiated until after a construction contract was in place. Thus, the start of construction activities had to occur after 7/30/1908.

When the workforce arrived on the site, they would find it pretty much in agreement with the general summary of the site which was presented in the 1885 Census Office report. Both sides of the valley were solid gray granite, which was continuous across the bed of the stream, with only a slight cover in the channel and practically no breaks or crevices in its surface. The outcropping of this granite was unbroken on both sides of the river for some distance above the dam, and also downstream on the west side. Below the site, the east bank receded rapidly from the channel, however, resulting in a broad, low area on that side, directly downstream from the dam. The west bank of the river rose to a height of 120 feet at a distance of only 150 feet from the edge of the channel. The opposite bank was less steep, although the abutment extended only 600 feet from the water's edge. The nominal width of the river was about 300 feet. **Figure 3**, titled **4/14/1908 Dam Site**, is believed to show the appearance of the site prior to any construction.

Prior to construction, the ordinary depth of the river was 3 to 4 feet with velocities in the range of 3 to 5 feet per second. The average low-water flow approximated 1,500 cu. feet per second. The extreme flood-stage-of-record involved a rise of about 15 feet above low water at the site, while the usual rises were from 5 to 10 feet. With a flood of over 8 feet, the stream would leave the channel, and under the worst conditions may extend to the east of the latter for 200 to 250 feet; but the abrupt slope of the west bank confined the flow on that side under all conditions. The normal depth and velocity numbers cited are supported by an undated photograph of some of the construction workers. **Figure 4**, titled **Ocmulgee River Conditions**, shows four men in the river and one man in a long boat. The water depth where the men are appears to be only waist high. Another undated construction era photograph shows what appears to be a smaller version of the larger boat shown in **Figure 4**. This boat is on dry land and presented as **Figure 5**, titled **One-Woman Boat**.

2.1.3.3.2 Infrastructure Construction

As previously mentioned, the Lloyd Shoals project site was remote. One of the first tasks the construction forces were probably engaged in was the construction of infrastructure. Infrastructure construction is divided into two categories, indirect and direct. Indirect infrastructure does not have a direct connection with the actual construction of the station but would include things that would be essential to the physical work force present at the site, such as shelter and water supplies. Direct infrastructure are those items which are built to facilitate actual construction activities. These could include items such as roads, bridges, warehouses, etc.

2.1.3.3.2.1 Indirect Infrastructure

2.1.3.3.2.1.1 Construction Camp and Medical Care

Because of the remoteness of the site, a construction camp was needed to house construction personnel. The exact location of the construction camp is unknown. Evidence from construction era photographs seems to indicate that at least part, if not all of the construction camp was located on the east side of the river, on a ridge line. **Figure 6**, titled **Late Construction Era Camp Buildings,** indicates where some of the buildings were located.

When the camp was first constructed, the living conditions were rather rustic. The men slept in tents. **Figure 7**, titled **Camp Tents**, shows an example of the tents. As time moved on, the living quarters were gradually upgraded to cabins, apparently sided with tar paper. With the establishment of the cabins, men could bring their families to live with them. It is conjectured that **Figure 8**, titled **Family Cabin,** represents one such family. It is believed that this is a family. because the man and woman in the picture appear quite relaxed and there appears to be a swing for a small child. This appears to be made from a wooden box and it is located below the window on the left of the photograph.

Ultimately, electric generators were installed to furnish electricity for lighting the large number of houses that had been built to provide quarters for the laborers employed in constructing the dam. The contractor also maintained a well-equipped hospital on site.

2.1.3.3.2.1.2 Water Supplies

In addition to providing housing for the work force, there was the need to provide a source of drinking water. This necessitated the construction of catchments/storage tanks. **Figure 9**, titled **Water Storage Tank/Catchment**, shows one of these being built.

2.1.3.3.2.1.3 Mess Halls/Commissaries

To date, no documented evidence has been found in the archives showing a mess hall or a commissary. However, based on other contemporaneous hydroelectric construction histories, it is reasonable to assume these sorts of facilities would have been present.

2.1.3.3.2.2 Direct Infrastructure

2.1.3.3.2.2.1 Downstream Construction Bridge

It is conjectured that one of the first items constructed was a construction bridge over the Ocmulgee river, downstream from the proposed dam site. **Figure 10**, titled **Construction of Assumed Downstream Construction Bridge**, shows a bridge being built. **Figure 11**, titled **Constructed Assumed Downstream Construction Bridge**, shows the bridge when it was finished.

2.1.3.3.2.2.2 Sawmill

Figures 12, and **13** also imply that another piece of infrastructure was present at the site: at least one sawmill. In **Figure 12**, all the structural timbers seem to be dressed (i.e., they are prismatic in shape). While this could have occurred by using adzes and planes, a more likely interpretation is that the available trees at the site were cut down and run through a sawmill to give them a uniform shape.

2.1.3.3.2.2.3 Machine Shops/Blacksmith Shops

The contractor installed two combined machine and blacksmith shops, one on each side of the river. These would allow the construction forces to make practically all of the repairs to the equipment that would be required.

2.1.3.3.2.2.4 Rail Line

Another piece of infrastructure which needed to be established was a way to get materials and construction equipment easily to the jobsite. The materials probably also included foodstuffs for a commissary and/or mess hall for the workers. However, this is conjecture on the part of the author. Initially, all materials, foodstuffs, etc. would have had to have been transported to the jobsite via mule-drawn wagons. **Figure 12** titled **Loaded Wagon**, appears to show a mule-drawn wagon loaded with material. What is of interest is that the wagon also appears to be transporting bales of hay. It is assumed that this was being sent to the jobsite to help provision the mules and horses. However, clearly, the use of mule drawn wagons would not be a sustainable method to supply the needs of construction nor of a large construction camp.

To remedy the situation, a standard-gage railroad spur line, 6 miles in length, was constructed from the Southern Railroad line at Flovilla, Georgia, to the west side of the construction site. This appears to have been done pursuant to the 7/30/1908 contract with Lane Brothers Company which has been previously discussed. It is not conclusively known just when construction on the line started, but it is logical to conclude that construction would not have started prior to the 7/30/1908 contract going into effect.

From construction photographs (one undated and two dated 12/10/1908) which are believed to show portions of the track area, it can be concluded that the scope of the railroad construction work was not trivial in nature. The intervening country along the 6-mile route was quite rolling, but the line had a practically straight location, with maximum grades of 3 percent at a few points. The construction of the railroad connection involved a large amount of grading and one heavy timber trestle 500 ft. in length over a stream valley that was crossed. The railroad reached the west bank of the river at the site of the work on the axis of the dam and then swung off to a switchback and loop upstream, by means of which descent was made to the upstream construction bridge (discussed later in this report) going across the river. On the opposite side of the river, tracks were extended to various parts of the work, with switchbacks reaching the portion of the plant located on the hillside.

Figure 13, titled **Railroad Cut Section** shows where the rail line went through a small hill. **Figure 14**, titled **Railroad Trestle**, shows the rail line going over a small valley. **Figure 15**, titled **Railroad Straight Line Section**, shows a section of the track on more or less level ground.

<u>2.1.3.3.2.2.5 Upstream Construction Bridge</u>

The construction activities which were initially occurring involved the construction of an upstream construction bridge. This bridge spanned the river and the bridge was rather wide at its crest. The upstream construction bridge was designed to be approximately 600 feet in length. It was located directly upstream of the heel of the dam and parallel to the dam's east-west axis. The ultimate purpose of this bridge was to allow rail lines to be installed on its deck for reasons which will be explained in subsequent sections. The deck of the construction bridge was set so its deck elevation would be above the greatest known flood stage. From the observed construction photographs, the deck elevation appears to be reasonably level. This deck carried two standard-gage tracks, arranged so cars could be placed on one for the delivery of materials directly to the dam without interfering with through traffic on the other track. The west half of the construction bridge would ultimately have two 36-in.-gage tracks on which concrete could be delivered from the mixing plant on the adjacent bank.

In order to construct the upstream construction bridge, the first thing that needed building were the elements which would support the bridge deck. The method of support was through the use of rock filled timber cribs.

<u>2.1.3.3.3 August to October 1908</u>

<u>2.1.3.3.3.1 Overview</u>

As was mentioned above, it is assumed that construction forced would not have mobilized to the site prior to the contract of 7/30/1908. The first picture showing constructed infrastructure at the site is dated 11/1/1908 (see the section below titled November 1908). What is concluded from a series of undated construction photographs is that infrastructure work at the site was ongoing in the period of August to October 1908.

For some reason which is not entirely clear, some of the initial 'construction' activities seemed to start on the east abutment area and then worked their way towards the west abutment area. Some hypotheses as to why this may have occurred include:

1. The east abutment area (as has previously been noted) was much less steep than the west abutment. There was also a greater extent of dry land on this abutment. This dry land area would have allowed an unskilled labor force to gain experience erecting infrastructure ‘in the dry’ before they would have to start infrastructure erection ‘in the wet’ (with its complicating elements of not only water depth but also currents).

2. The east abutment area was where the construction camp was set up. This would have allowed the construction workers an easier and quicker access to the construction area (as opposed to having to walk from the construction camp, across the downstream construction bridge, and around to the west side of the site.).

3. Due to the terrain, timber would have been easier to harvest, transport, and shape. Once the trees were felled, the mules could easily be hitched to the timber and then drag it over reasonably level ground to either the construction area, or to a sawmill for processing.

No detailed construction plans have been found in the archives to date.

2.1.3.3.3.2 Selection of First Structure for Construction

At some time in the August to October, 1908 time period, the deck work on the upstream construction bridge was completed. The builders needed to make a decision on what part of the project’s components they were going to construct first. The Spillway Section was the largest structure, measuring approximately 728.5 feet east to west.

The first and second sections of the Spillway Section were characterized by monoliths. The third section also had monoliths, but it would also include permanent and temporary sluiceways. **Figure 16**, titled **Plan of Spillway Section**, shows the three sections, the monoliths, and the original shoreline. To date, no evidence has been found in the archives indicating how the monoliths were numbered. For ease of discussion, the monoliths have been arbitrarily consecutively numbered on **Figure 16**, from east to west. As can be seen from the figure, not all the monoliths were of the same width. The following table presents a summary of the monolith widths.

Spillway Section	**Monolith Number**	**Width (ft.)**
Section 1	1	20
	2	40
	3	40
	4	40
	5	40
Section 2	6	40
	7	40
	8	40
	9	40
	10	40
	11	40
	12	40
	13	40

Spillway Section	Monolith Number	Width (ft.)
	14	50
	15	50

From **Figure 16**, it can be seen that the vast majority of the spillway monoliths could be constructed either in dry conditions or in near-dry conditions. The monoliths containing the sluiceway section were in the river channel. The various monoliths were built as if each of them was a separate pier, although the work in general was carried on so each part facilitated all other construction operations. The initial design called for the Spillway Section to be socketed into the foundation rock in two areas. The first was a keyway just downstream of the upstream face of the structure. The keyway was to be socketed into the rock for a depth of 4 feet and it was to extend in an upstream-downstream direction for 8 feet. The second keyway was at the toe where it was to be socketed 4 feet into the bedrock. This keyway extended in an upstream direction for 10 feet. At the end of the 10 foot run, the keyway sloped upward and upstream over a distance of 15 feet to tie into the rock surface at the foundation level.

What this meant was that for Spillway Monoliths 1 through 14, and perhaps including Spillway Monolith 15, standard construction techniques could be employed. This would include removing any earth overburden in the footprint of the Spillway Section so as to expose the foundation rock. Limited blasting would be required to construct the keyways. In contrast, for the monoliths in the Sluiceway Section of the spillway, since they would be underwater, it was conceivable that the foundation rock would be in a nearly exposed condition. Only limited amounts of sediment would need to be removed. However, in order to do the keyway constructions, these would have to be done in the dry. That would require the construction of a cofferdam.

<u>2.1.3.3.3.3 Cofferdam Construction</u>
The cofferdam used to unwater the east side of the channel had an upstream section which measured 230 feet in an east-west direction. This upstream section of the cofferdam was against the downstream side of the upstream construction bridge and parallel to it. The shore (easternmost) end of this east-west section of the cofferdam was 50 feet back from the east edge of the channel. Its westernmost extension reached about to the middle of the stream. At this westernmost end of the cofferdam, a second section of the cofferdam was created. This was set roughly perpendicular to the east-west leg and parallel to the channel. This north-south leg extended downstream for 150 feet, or 30 feet beyond the toe of the Spillway Section.

One question the designers had to answer regarding the cofferdams was “How high should they be?”. They could build the cofferdams sufficiently high so as to protect the construction area from the largest reasonable floods, or they could build the cofferdams less high but run the risk of having the cells overtopped in some floods. They selected the last option apparently based on the belief that overtopping would occur only once or twice each year. The cost of constructing a lower height cofferdam was much less than the expense of a higher height cofferdam, and this, along with other factors, played into the decision to go with the lower height option.

But regardless of the ultimate length, the cofferdam would be built using a familiar construction technique: rock filled timber cribs, although with a slight variation.

Figure 17, titled **Filling Downstream Rock Filled Timber Crib Cofferdam Section**, gives an overall view of the filling of the first downstream sections of the first cofferdam. **Figure 18**, titled **Detail View of Filling of Downstream Rock Filled Timber Crib Cofferdam Section**, gives a closer view of the operation. What these two pictures show is that rock from the west side of the river would be transported by rail carts to the cofferdam location. The contents of the carts would be poured out such that it flowed down the ramps and into the downstream section of the cofferdam. It is presumed that the ramps would be moved east to west as one section of the cofferdam was filled, so as to fill up the next section of the coffer dam. It should be noted from **Figure 18** that the westernmost section of the cofferdam structure not only is not totally filled with stone, but the cribbing is being extended to the west as the construction progresses.

Once the rock filled timber cribs in the cofferdam sections were filled, the puddle zone could be constructed. **Figure 19**, titled **First Cofferdam Puddle Zone Construction**, shows the two zones of the cofferdam as well as other supplementary elements. Note the vertical boards on either side of the puddle zone. It is believed that the soil material in the puddle zone was just end dumped; there was no effort made at any mechanical compaction of the soil as it was placed in the zone.

From an undated construction photograph, it appears that the east-west extension of the first cofferdam extended about halfway across the original river. At this point, the first cofferdam construction made a 90° turn and headed downstream. **Figure 20**, titled **First Cofferdam North-South Leg Construction**, shows the east-west leg of the first cofferdam, and the construction of the north-south leg of the cofferdam. **Figure 21**, titled **First Cofferdam Completed North-South Leg**, shows the completed north-south leg of the cofferdam. What is to be noted is the vertical boards on the east face of the cofferdam structure. This would appear to be the east face of the puddle. The contrast between the construction elements of the two legs of the first cofferdam is seen more clearly in **Figure 22**, titled **First Cofferdam Interior Faces**. In the figure, the downstream face of the east-west leg of the cofferdam is a rock filled timber crib construction. In contrast, the east face of the north-south leg of the cofferdam is a wooden face composed of vertical boards.

The construction area now consisted of the original east bank of the river, the upstream east-west leg of the first cofferdam, and the north-south leg of the first cofferdam. To secure the construction area, all that was needed was to tie the south end of the north-south leg of the first cofferdam to the original east bank of the river. The fall of the bottom between the southernmost point of the north-south leg of the cofferdam and the east side of the river channel required only a low earth embankment running west to east to enclose the area and keep out the water. This earth embankment was protected on both sides by heavy riprap. The completed cofferdam enclosed over half the width of the river channel. Construction personnel also installed two 10-in. Van Wie centrifugal pumps to help control any seepage through the cofferdam. The cofferdam ultimately proved remarkably tight and the pumps operated a very small portion of the time.

Completion of construction of the first cofferdam apparently did not occur until after the completion of the railroad spur line from Flovilla, Georgia, to the construction site. An undated construction photo presented as **Figure 23**, titled **Partial First Cofferdam and Construction Locomotive**, shows the north-south leg of the first cofferdam in the center of the picture, and in the background on the right of the photograph, is a steam locomotive. While it could be argued that the locomotive was transported to the site in pieces and assembled, a more likely explanation is that it arrived at the site under its own power along the Flovilla spur line.

While the cofferdam construction was ongoing by some members of the construction force, others were engaged at relatively the same time in other activities such as derrick construction, preparation for excavations, and preparations for concreting operations.

2.1.3.3.3.4 Derrick Construction

Construction of derrick elements started approximately when the first couple of cells of the first cofferdam were being built, but prior to any earth moving activities. The reason for this appears to be that the area where earth excavations were required was the same area on the east bank of the original river which was being used as a laydown/fabrication area. **Figure 24**, titled **Derrick Construction Area**, shows the approximate location of this area.

At the inception, the derricks were erected on the cofferdam, or on the side of the excavation, but later cribs were built up in the bottom to carry them; finally, when the concrete in a section had been brought up 10 or 12 ft. above the bottom, one of the derricks would be placed on the masonry to handle the materials for the adjacent sections. Until the masonry had reached a point above high water, the derricks were raised as rapidly as the height of a section advanced. After that, by working alternately, the derricks were moved only when they were operated to a disadvantage in delivering concrete and stone from the cars on the trestles to place in the dam. The shifting of a derrick was done very readily by means of one of the other adjacent derricks. Such a shift could be done in half a day.

2.1.3.3.3.5 Earth and Rock Excavation

While the construction area in the cofferdam section was not totally secured, this did not mean that no work was being performed in sections both inside and outside of the cofferdam area. **Figure 25**, titled **Apparent Extension of Upstream Construction Bridge and Potential Start of Earth Excavation**, appears to indicate that the construction forces were expanding a section of the upstream construction bridge. This extension was in a downstream direction. This was apparently in anticipation of erecting additional rail lines which would connect this area of the first cofferdam with batch plant facilities. In addition, there is a potential indication that the excavation of surface soils may have been occurring just east of the original east shore of the original river bank.

As soon as the cofferdam was completed, the rock excavation required to prepare the foundation in the enclosed area was started immediately. Except where one clay seam 15 feet deep was found, only 4 to 8 ft. of rock had to be stripped to uncover a ledge entirely free from fissures. Ingersoll-Rand and Sullivan tripod drills were used to make the necessary blast holes, which were placed very carefully to avoid damage to the remaining rock. Guyed derricks, with 80-foot booms and masts, were erected at convenient points to pick up large stone out of the pit and pile them at one side for use later in the Cyclopean masonry, and to load the small pieces in cars on the trestle so they could be delivered to the crusher plants.

2.1.3.3.3.6 Batch Plants

The initial design of the station called for a concrete core wall for the East Earth Embankment, a concrete gravity Spillway Section, a concrete Intake Structure, a concrete Powerhouse substructure, a concrete West Nonoverflow and a concrete West Retaining Wall. Since there were no ready-mix batch plants at the time of construction, construction forces had to build their own on-site batch plants so as to have the necessary concrete to build these structures.

Ultimately, there would be two separate batch plants at the construction site, one on each side of the river. The one on the west bank was at the end of the upstream construction bridge and immediately upstream from the dam, in the vicinity of where the rock for the cofferdams is believed to have been procured. A second batch plant would be constructed on the east side of the river. This plant was downstream from the dam and back slightly from being in line with the end of the upstream construction bridge. The concrete mixing plants were each in a tower arranged according to the same general plan, the only difference between the two being on account of the local conditions.

The installation of two concrete mixing plants on opposite sides of the river, one on the upstream and the other on the downstream side of the work, facilitated concrete placement operations. Because a Cyclopean construction technique was to be used, consideration had to be given to being able to place the plumbstones in relatively the same time that the concrete was being placed. Were a concrete pour to be made on the west side of the construction site, the West Batch Plant could provide the concrete from the upstream construction bridge rail system, while the plumbstones could be provided from the rail system on the downstream side. Likewise, were a pour to be made on the east side of the construction area, the East Batch Plant could provide the concrete using the downstream side rail line, while the plumbstones could be provided from the west side using the upstream construction bridge rail lines. The materials would be placed using derricks which were placed in two rows parallel with the axis of the dam and so arranged that all of them could be in service at the same time.

Figure 26, titled **Start of West Batch Plant Construction**, shows the start of construction of one of the walls of the West Batch Plant. **Figure 27**, titled **Completed West Batch Plant**, shows the completed installation.

<u>2.1.3.3.4 November 1908</u>

By November 1908, it is believed that construction of the Flovilla, Georgia railroad spur line was completed. **Figure 28**, titled **Construction Locomotive**, was taken sometime in November of 1908. Highlighted in the picture in the background is a construction locomotive on the west side of the river.

Figure 29, titled **Construction Site November 1908**, contains a number of interesting points. On the west bank of the river, excavations appear to have started and form work has been set for the concrete batch plant on that side of the river (in the picture, just to the right of the upstream curve of the upstream construction bridge). The upstream construction bridge appears to have all of its decking installed along with railroad lines extending from the west side of the river to the east side of the river. The east-west section of the first cofferdam appears to be in place as is the north-south leg of the cofferdam. Earth is apparently being removed from the east side of the river, possibly in preparation for exposing the rock surface. In the rock area which is exposed between the north-south leg of the cofferdam and the east shore, the rock surface appears to have a number of pipes drilled into it. These are believed to be blast holes into which explosives will be placed to excavate the rock foundation to its design grade.

Further evidence of the presence of at least one sawmill can be found by examining the wood in the foreground of the figure. The long poles which are running left to right on the ground have their upstream edges shaped in a wedge shape, as if they had been cut with axes. However, just to the right of the long poles there are shorter poles which are round. These have seemingly smooth, flush-cut ends. Southwest of the pile of timber, at the foot of a tree, there is a pile of what appear to be cut boards. Such boards were used in the construction of the cofferdam.

An undated construction photograph, believed to be from the November 1909 time frame, shows that railroad construction in the construction area was now extending upstream on the east side of the river. This is in the approximate location of what is believed to be one of the two upstream quarries. **Figure 30**, titled **East Quarry Site and Railroad Extension**, shows the rail line and the quarry location. The same undated construction photo appears to show a quarry location on the west side of the river, also upstream in what will be the reservoir area. **Figure 31**, titled **West Quarry Site**, shows the believed location of this quarry area.

<u>2.1.3.3.5 December 1908</u>
By 12/14/1908 at the first cofferdam area, excavation and removal of overburden had occurred in the vicinity of the easternmost two temporary sluice gates. Two rock filled timber cribs were apparently placed on the exposed rock surface in this area and the cribs were built up from the foundation rock surface to approximately the elevation of the bottom of the east-west leg of the first cofferdam. The derricks were sitting on these two rock filled cribs. Just downstream of these two derricks, near where the toe of the spillway section would be located, blasting and excavation of the foundation rock was underway. Some of the rock spoil appears to have been wasted downstream of the rock excavation area. Additionally, some of the earth overburden which had been removed appeared to have been used in constructing the downstream east west leg of the cofferdam area. Essentially, the construction area was now definitely coffered off.

Just to the east of the two derricks, a third derrick was also erected. This is believed to be in the vicinity of Spillway Monoliths 13 to 15. Like the other two derricks, this one also appears to be sitting on a cribwork structure on rock, although the cribwork is not as tall as the other two timber filled cribs. It is possible that this derrick was being used to help laborers clear off remaining soil overburden from the foundation rock surface in this area.

For all the derricks, it appears that there are stockpiles of large stones which have been stored near them. One of the formerly present construction rail lines has been removed and a new rail line is being added from the West Batch Plant to near the middle of the upstream east-west leg of the cofferdam. The east side batch plant is still under construction. **Figure 32**, titled **Cofferdam Area 12/14/1908**, shows a number of the above-mentioned construction activities.

As had been previously mentioned in the discussion of the 1885 report by the Census Office of the Department of the Interior, the Ocmulgee river could experience heavy freshets. On 12/23/1908, a Wednesday, the construction area experienced one of these freshets. It is not known if the flood waters reached to top of the upstream construction bridge’s deck elevation. What the documentation does show is that the flood stage at least over topped the upstream east-west leg of the first cofferdam structure. From the documentation, it appears that the west face of the north-south leg of the cofferdam helped channel the Ocmulgee’s flood waters downstream without the north-south leg becoming overtopped.

Unfortunately, when the flood waters overtopped the upstream east-west leg of the cofferdam, the flood flow poured into the construction area. The flow filled up the soil and rock excavation areas until they were completely inundated. With no more available storage from the excavation areas, the flood flow started spreading out across the construction area looking for a way to move down gradient. When the flood flows hit the puddle zone on the east face of the north-south leg of the cofferdam, the flow was redirected in a downstream direction, toward the downstream east-west leg of the cofferdam. As was mentioned, this element of the cofferdam appeared to be composed basically of dumped earth. As such, it eroded away, potentially exposing the flooded construction area to backflows from the main river channel. **Figure 33**, titled **Freshet of 12/23/1908**, shows the overtopping of the upstream east-west leg of the cofferdam, the flooding of the construction area, and the overtopping/submergence of the downstream east-west leg of the cofferdam. The excavated areas remained filled with water up through the end of 1908.

2.1.4 1909

2.1.4.1 Overview

During 1909, the Central Georgia Power Company turned over to the Georgia Construction Company 38,083 shares of common stock to finance the construction program.

The evidence in the available references indicates that in 1909 the J. G. White Company were finalizing the design drawings for the station. However, the record of the dates for the designs is rather fragmentary and somewhat counter intuitive. The earliest design drawing that has been found dates from 2/20/1909 and it is an upstream/downstream section through the powerhouse. Typically, what is developed first is a plan view of a structure, and then sections are cut through the plan to become the section views. While a plan view of the powerhouse was found in the archives, the copy of the original is in such poor shape that the date of the drawing can not be determined. Suffice to say, it is probably at least as old as 2/20/1909, and perhaps earlier. A limited number of other design drawings for the original construction were found in the archives. The date of the last one found was 3/5/1910.

By 7/8/1909, the Council Committee on Electricity in Atlanta, Georgia, had voted favorably on the application of the Central Georgia Power Company for a franchise to sell power for lights and manufacturing purposes in Atlanta. The Central Georgia Power Company's president, Mr. W. Jordan Massee, stated that the company had $1,500,000 available for the construction work.

On 7/15/1909, Mr. Massee stated the company's headquarters would be moved from Macon to Atlanta. The reason for the move was to take advantage of the larger market of large manufacturing companies in Atlanta. Mr. Massee stated that the construction of the Lloyd Shoals station and the erection of transmission lines on steel towers into Atlanta would cost $3,500,000. He also stated that the Central Georgia Power Company had received a franchise in Griffin, Georgia.

On 7/16/1909, a contract was issued to the Niles-Bement-Pond Co. The contract covered the purchase of one, 20-ton, Niles standard, hand powered, traveling crane. It was for $1,100.

By 7/31/1909, the aldermanic board of the City of Atlanta, Georgia, granted to the Central Georgia Power Company a franchise to enter the city. The franchise empowered the company to bring power from the Lloyd Shoals station to Atlanta for lighting, heating, and power purposes.

On 9/28/1909 , the Lane Brothers Company was awarded another contract for the construction of a dike dam which cost $16,548.01

On 10/28/1909, a contract was issued to the Virginia Bridge and Iron Co. The contract covered the purchase of structural steel and cast iron items including: roof trusses and purlins, penstock gate guides, racks, and supporting beams, columns, girders, floor beams, etc. It was for $12,840. It is assumed that the counterparty to the contract was the Georgia Construction Company.

2.1.4.2 1909 Land Acquisitions

Land acquisition activities continued in 1909.

2.1.4.3 1909 Construction Activities

2.1.4.3.1 January 1909

By 1/2/1909, construction personnel had been able to remove the flood waters from the construction area and had restored the downstream east-west leg of the cofferdam. Work on the East Batch Plant was continuing. Materials were being assembled in preparation for the start of concreting operations. **Figure 34**, titled **Large Stone Stockpiles**, shows some large stones from what is believed to be the West Quarry Areas, being stockpiled. While it is not known definitively, these stones could be used either as plumb stones, or crushed into coarse aggregates for the concrete.

Sand for the concrete was dredged from the river channel by a 10-in. centrifugal pump, which was mounted on a scow so it can be operated at any stage of the river. It was transported for processing by rail lines in one of three methods. In the first method, a rail line was constructed parallel to the riverbank and the sand dredge would place its material directly on a railroad dump car sitting on the rail line. A construction locomotive would then haul the car away. **Figure 35**, titled **Direct Sand Transfer**, shows this process. The second method was to put a railroad dump car on a small barge, move the barge to the sand dredge, and when the railroad dump car was full, bring it back to shore where the construction locomotive could haul it away. **Figure 36**, titled **Railroad Dump Car, Barge, and Dredge**, shows this method. The third method was for the dredge to pump the sand to storage piles on the shore, and the sand was loaded from these piles into 6-yd., standard-gage, dump cars by a 1-yd. Hayward orange-peel bucket, swung from an 80-ft. guyed derrick. The 6-yd. cars were handled in trains by 20-ton Porter locomotives operating over tracks that led to both mixer plants.

Between 1/2/1909 and 1/18/1909, construction personnel had increased the number of derricks in the cofferdam area from 3 to 6. The East Batch Plant, if not already completed, was very near completion. Carpenters were erecting the concrete formwork for the first concrete pour.

On 1/26/1909, the first concrete pour at the station was made. This occurred in the Spillway Section at the easternmost two temporary sluiceways. **Figure 37**, titled **First Concrete Pour**, documents this concrete placement. In the figure, not only is the bucket with the concrete shown (apparently suspended from one derrick), but a large plumbstone is being supported from a second derrick nearby. The two hollow sluiceways are clearly shown, as well as what appears to be a portion of one of the keyways which were cast into the monoliths.

Through the end of the month, construction personnel continued concrete form erection in the Spillway Section at the easternmost two sluiceways and near Spillway Monolith 13.

2.1.4.3.2 February 1909

Between 1/31/1909 and 2/2/1909, something appears to have happened to the East Batch Plant. **Figure 38**, titled **East Batch Plant 1/31/1909**, shows what appears to be a virtually constructed structure. However, a construction photo dated 2/2/1909 shows that the highest sections of the batch plant have apparently disappeared. It is not clear from the 2/2/1909 photograph if there was a fire that partially destroyed parts of the structure. **Figure 39**, titled **East Batch Plant on 2/2/1909**, shows the condition of the structure as of the date of the photograph. Some of the structural members appear noticeably black, as if charred by a fire.

On 2/10/1909, a Wednesday, a second freshet arrived at the construction area. As in the case of the first freshet, it is not known just how high the water rose. However, the flood flows once again overtopped the east-west leg of the upstream cofferdam structure. Flood waters poured into the construction area. The north-south leg of the first cofferdam appeared to not be overtopped, but once again it appeared to channel the flood flows downstream to overtop the downstream east-west leg of the cofferdam. While the construction area was flooded, the flood flows appeared to not be sufficiently high to adversely impact the concrete structures and forms at the east Sluiceway Section or those in the vicinity of Spillway Monolith 13**. Figure 40**, titled **Freshet of 2/10/1909**, shows the construction area with the flood flows flowing over the upstream east-west cofferdam section.

The flood inflows ceased by 2/12/1909 and the downstream east-west leg of the cofferdam was re-established, although flood waters remained inside the cofferdam area. At the same time, reconstruction work on the East Batch Plant continued and by 2/26/1909, the East Batch Plant superstructure had its roof installed.

2.1.4.3.3 March 1909

By 3/7/1909 there were still some areas of standing water inside the cofferdam area. Formwork was continuing to be added to the monolith near Spillway Monolith 13. On 3/10/1909, a Wednesday, a third freshet arrived at the construction site. However, unlike the previous two freshets, this one seemed to have greater flood flows and a longer duration of flooding. On 3/10/1909, the upstream east-west leg of the cofferdam was overtopped with flood waters rushing into the construction area and overtopping the downstream east-west leg of the cofferdam. The north south leg of the cofferdam was barely above the river elevation. By 3/12/1909, the flood flows had increased. The north-south leg of the cofferdam was overtopped. Flood flows into the construction area extended to near the base of the north-south railroad embankment at the East Batch Plant. **Figure 41**, titled **Freshet of 3/10/1909 On 3/12/1909**, shows the condition of the jobsite on this date.

On 3/15/1909, the flood wave appears to have crested and the flood flows were on the receding limb of the inflow. However, while the inflows were apparently not as much as on 3/12/1909, the were still sufficient to overtop the upstream east-west leg of the cofferdam. The top of the north-south leg of the cofferdam was just above the level of the river. **Figure 42**, titled **Freshet of 3/10/1909 On 3/15/1909**, shows the condition of the construction area as of this date. By 3/20/1909, flood flows had stopped overtopping the upstream east-west leg of the cofferdam, but the construction area remained flooded.

Between 3/15/1909 and 3/20/1909, while the cofferdam area still remained flooded, construction personnel were not idle. On the east abutment area, they started construction of a trestlework moving upslope and to the east. This would ultimately be used in the construction of the East Earth Embankment Core Wall. **Figure 43**, titled **Start of East Trestlework**, shows the location of this construction.

By 3/27/1909, the cofferdam area had been dried out. Construction personnel were extending the trestlework to the west. They were also building a roadway from the East Batch Plant, moving westward, along the toe of the already poured structures. **Figure 44**, titled **Construction Site as of 3/27/1909**, shows this construction progress

2.1.4.3.4 April 1909

By 4/4/1909, in the Spillway Section, base slab work on the two middle sluiceway was underway as well as concreting operations on Spillway Monolith 14. Additional form up work and concreting in these two areas continued through 4/17/1909. By 4/17/1909, more than 15,000 cubic yards of concrete had been placed. At this same time, the construction rail line on the trestlework had extended further to the east where a derrick and boiler unit were now installed. By 4/26/1909, the construction elevation of Spillway Monolith 14 was about 1 ½ times as high as the construction elevation of Spillway Monolith 13. In the Spillway Section, the base slab for the easternmost of the two permanent sluiceways had been partially poured and the wall separating the two westernmost sluiceways was approximately half way done in an upstream to downstream extent. While the wall was not at its full design height, ¾ of the access gallery penetration in the wall had been formed up and poured. **Figure 45**, titled **Construction Site as of 4/26/1909**, shows the progress of construction and the gallery penetration in the wall. A derrick was now located on top of the separation wall, downstream of the gallery opening.

2.1.4.3.5 May 1909

On 5/1/1909, in the Spillway Section, the base slab for the westernmost of the two permanent sluiceways was formed up,as was the base slab for the easternmost monolith of the Intake Structure. The easternmost upstream monolith for the Intake Structure was just west of the westernmost permanent sluiceway in the Spillway Section. The construction elevation of Spillway Monolith 14 was the highest of any of the Spillway Section structures constructed to date. On 5/5/1909, the cast iron venturi-shaped sluice members for the easternmost of the two permanent sluiceways had been set on concrete cradles in the sluiceway section and temporarily braced in position. **Figure 46**, titled **Easternmost Permanent Sluiceway Cast Iron Members**, shows these members. Just beyond (in the downstream direction) are the cast iron members for the westernmost of the two permanent sluiceways. By 5/8/1909, form-up work had started on the base slab area of Spillway Monolith 11. Form up work continued on the easternmost monolith of the Powerhouse substructure, with the forms being just below the elevation of the upstream construction bridge.

By 5/9/1909, construction personnel had extended a construction rail line to the vicinity of the East Embankment where the core wall would be built. **Figure 47**, titled **Plan View of East Earth Embankment Core Wall**, shows a segment of the design drawing for the East Earth Embankment. **Figure 48**, titled **Cross Section of East Earth Embankment Core Wall**, shows how the core wall was to be constructed. It appears that as of 5/9/1909, actual construction of the core wall had not started. **Figure 49**, titled **East Earth Embankment on 5/9/1909**, shows the status of the construction as of this date.

Also on 5/9/1909, the first lift of the easternmost monolith of the Intake Structure had been poured. Forming was underway for the second lift.

On 5/17/1909, in the Spillway Section, the cast iron venturi shaped sections of the westernmost of the permanent sluiceways had been set and its supporting concrete slab had been poured and the forms stripped off. **Figure 50**, titled **Westernmost Permanent Sluiceway Venturi Members**, shows this. The easternmost monolith of the Intake Structure had additional concrete pours made and the formed elevation of the structure was now above the elevation of the deck of the upstream construction bridge. Also by this date, in the Spillway Section, the construction elevation of the two middle temporary sluiceway's section and Spillway Monolith 14 were approximately equal. The construction elevation of the two easternmost temporary sluiceway's section, Spillway Monolith 13, and Spillway Monolith 12 were all approximately equal and lower than the construction elevation of Spillway Monolith 14.

While on 5/9/1909 it did not appear that any construction actually occurred on the East Earth Embankment core wall, by 5/17/1909 a short section of the wall had been formed, poured, and the forms had been stripped off. The core wall was most likely constructed in the following steps, as based off available construction photo documentation:

1. Based on the construction photographs, it is believed that the core wall started at its most northeast portion. (See **Figure 51**.)

2. The line of construction is believed to have proceeded on a southwest path towards the main construction area.

3. The start of the wall would have had a vertical face.

4. While the symbology of the design is somewhat enigmatic regarding the cross section (due to the use of only hash marks), it is believed that the design envisioned an excavation, from the existing ground surface, vertically downward, to the top of rock. (See **Figure 50**).

5. A keyway would be excavated in the top of rock upon which the foundation of the wall would bear.

6. The completed excavation (8 feet in width) would be backfilled with concrete up to the existing ground surface.

7. The actual wall would start between 6 inches to 12 inches back from the faces of the footing. (just when the wall made these transitions is believed to have been 'field done' by the supervisor supervising the construction crew).

8. The wall would have both its upstream and downstream face battered on a 1H to 12 V batter up to elevation 538.

9. The wall would then have been encased in an earth fill as shown on **Figure 50.**

Figure 51, titled **Start of Core Wall Construction**, appears to show the first section of the constructed core wall with the laborers excavating for the next extension of the wall. In comparing the height of the wall to the supervisor standing in front of it, it would appear that the first section of the wall was rather high (over twice the height of the supervisor).

By 5/21/1909, apparently due to the increased demand for plumbstones, coarse aggregate for concrete, fill for new coffercell construction, and the need for riprap for the East Earth Embankment's upstream face, quarrying operations were expanding both on the west side of the reservoir near the West Batch Plant, and on the east side of the river, north of the East Batch Plant. On 5/21/1909, formwork erection for the easternmost monolith of the Intake Structure was extending downstream. Construction forces were also building more crib works. **Figure 52**, titled **Form Work Extension and Crib Work Erection**, shows these construction activities. The construction roadway which came from the East Batch Plant, and ran east to west at the toe of the Spillway Sections, had now been extended almost to Spillway Monolith 14.

On 5/22/1909, initial slope grading was occurring at the East Earth Embankment, at least on the downstream slope. **Figure 53**, titled **Initial Slope Grading East Earth Embankment Downstream Slope**, shows some of the slope grade boards used to establish the slope of the embankment. The seated gentleman in the picture, who has removed his cap, has been identified from historical records as Mr. "Little Steve Cox of Macon, Georgia.".

In reviewing the original construction photographs, indications of the previously mentioned electrical service were noted. It is not known from whence this service came (e.g. from offsite sources or potentially generated on site via generators hooked up to steam boilers or compressed air machines). **Figure 54**, titled **Potential Light Fixtures**, shows some items which could be construed as light fixtures. However, the resolution on the photograph is not sufficient to confirm this. A clearer indication of potential electrification at the site comes from **Figure 55**, titled **East Earth Embankment Upstream Slope Potential Electrical Lines**. This figure appears to show a series of rough-and-ready poles with cross members, insulators, and wires strung from the insulators.

By 5/25/1909, in the Spillway Section, the westernmost of the two permanent sluiceways had been formed up and concrete was being poured over the cast iron venturi sections. **Figure 56**, titled **Cast Iron Venturi Section Suction Form Up**, shows the formwork used to transition the upstream square opening of the westernmost permanent sluiceway to the circular shape of the venturi section. **Figure 57**, titled **Concreting Westernmost Permanent Sluiceway Section on 5/25/1909**, shows the concreting efforts.

2.1.4.3.6 June 1909

By 6/1/1909, construction forces were building a new series of timber cribs. In the Spillway Section, these cribs extended from the downstream toe of the westernmost of the two permanent sluice ways in a downstream (north-south) direction. This new cribwork was to the east of the original north-south leg of the first cofferdam. This new cribwork would be rock filled and would form the north-south leg of the second cofferdam.

By 6/6/1909, form up work and concreting operations were proceeding in the Spillway Section on the monolith with the westernmost of the two permanent sluiceways, including forming up the access gallery. **Figure 58**, titled **Project Construction Site as of 6/6/1909**, shows the progress of construction.

Between 6/6/1909 and 6/21/1909, construction efforts appeared to be concentrated in three areas: 1) raising the construction height of the Spillway Section monolith with the westernmost two permanent sluiceways, 2) extending the East Earth Embankment Core Wall downstream [**Figure 59**, titled **East Earth Embankment Core Wall as of 6/21/1909**, shows this construction progress], 3) raising the construction height of Spillway Monolith 11, and 4) continuing the construction of the new north-south leg of the second cofferdam section. Construction personnel had also extended the construction roadway along the toe of the spillway monoliths in a westward direction to near the west edge of Spillway Monolith 14.

The increased demand for stone required an extension of the East Quarry Area to a location further upstream in the reservoir. This, in turn, required an extension of the East Quarry Rail Line. **Figure 60**, titled **East Quarry Rail Line Extension**, shows this extension.

By 6/25/1909, in the Spillway Section, the construction elevation of the monolith with the westernmost two permanent sluiceways was approximately equal to the construction elevation of the monolith with the middle two temporary sluice ways. These two monoliths had their construction elevation above the construction elevation of Spillway Monolith 14. The construction elevation of Spillway Monolith 14 was approximately the same as the construction elevation of Spillway Monolith 12. The construction elevation of Spillway Monolith 13 was just slightly below the construction elevation of Spillway Monolith 11. Spillway Monoliths 12 and 14 had the highest construction elevations of the numbered Spillway Section monoliths. The construction elevation of the monolith with the two easternmost temporary sluiceways was approximately equal to the construction elevation of Spillway Monolith 11. **Figure 61**, titled **Construction Progress as of 6/25/1909**, shows the construction progress as of this date.

<u>2.1.4.3.7 July 1909</u>

By 7/2/1909, construction forces had successfully constructed the timber cribwork for the northwest-to-southeast leg of the of the upstream second cofferdam. This section of the second cofferdam connected the west shore of the river to the upstream area of the easternmost Intake Section monolith. **Figure 62**, titled **Construction of Second Cofferdam, Northwest-to-Southeast Upstream Leg**, shows this construction progress.

Between 7/2/1909 and 7/7/1909, construction forces were demolishing the upstream east-west leg of the first cofferdam. This allowed the river’s flow to pass through all six of the sluiceways, and also through the foundation area for Spillway Monolith 15. **Figure 63**, titled **Spillway Monolith 15 and Sluiceway Flows**, shows the redirected flows. **Figure 64**, titled **Partially Demolished First Cofferdam Upstream East-West Leg**, shows the process of demolition of the upstream east-west leg of the first cofferdam. By 7/10/1909, construction forces were also working on extending cribwork westward from the easternmost monolith of the Intake Structure.

On 7/10,1909, a Saturday, a portion of the timber cribwork for the northwest-to-southeast leg of the of the upstream second cofferdam failed. The available records reviewed to date do not provide any indication as to the triggering event for the failure. Some possible causes could have been: 1) a minor freshet passed through the station, 2) unanticipated hydraulic loadings on the structure resulting from the removal of the original east-west leg of the original cofferdam, 3) a failure to adequately secure crib sections together, 4) insufficient ballast in the lower section of the crib to hold it down, or 5) any combination of the above or another undetermined cause. **Figure 65**, titled **Second Cofferdam, Northwest-to-Southeast Cribwork Failure**, shows the failed section.

By 7/14/1909, construction personnel had built and installed a replacement cribwork section for the failed section of the northwest-to-southeast leg of the of the upstream second cofferdam. Rather than try to remove the rock debris from the failed area, they offset the reconstructed section such that its downstream end was approximately mid-way between the un-failed sections. In this manner, they could use the rock from the failed area as a 'stop', or 'blocking', for their new cribwork. **Figure 66**, titled **Replacement Cribwork**, shows this construction effort.

While some of the construction forces were working on the second cofferdam structure, other construction forces were continuing construction efforts on all the existing structures at the station. By 7/17/1909, the construction elevations of the Spillway Section sluiceway monoliths had been heightened. Now the monolith containing the westernmost two permanent sluiceways had the highest construction elevation. The Spillway Section monolith containing the middle two temporary sluiceways was just below the construction elevation of the Spillway Section monolith containing the easternmost two temporary sluiceways. Construction personnel appeared to have shifted their construction efforts to increasing the construction elevation of Spillway Monolith 11. As of 7/17/1909, this monolith had the highest construction elevation of any of the Spillway Monoliths 11 through 14. Spillway Monolith 11 was virtually at the same construction elevation as the monolith with the easternmost two temporary sluiceways. **Figure 67**, titled **Construction Progress as of 7/17/1909**, shows the construction progress of all the monoliths.

Also by 7/17/1909, construction forces had filled virtually all of the replacement timber cribs in the northwest-to-southeast leg of the of the upstream second cofferdam with rock, and they were in the process of laying down a construction rail line on top of the coffercells. Work was also continuing on the north-south leg of the second cofferdam. By 7/21/1909, construction personnel were working on building the timber cribs which would form the puddle zone in the repaired section of the northwest-to-southeast leg of the upstream second cofferdam. The puddle zone cribwork was installed downstream of the already installed rock filled timber cribs in the repair zone, and it was located in the offset area of the repair. **Figure 68**, titled **Upstream Second Cofferdam Puddle Zone Construction**, shows the installed crib work. By 7/25/1909, virtually all of the vertical boards for the upstream and downstream sides of the puddle zone in the repair area had been installed.

Between 7/17/1909 and 7/25/1909, in the Spillway Section, construction forces focused their efforts on extending the construction height of the monolith containing the middle two temporary sluices and Spillway Monolith 11. By 7/31/1909, this work effort resulted in the monolith with the two middle temporary sluiceways having the highest construction elevation of any of the other constructed structures at the site. The construction elevation of the monolith with the two permanent sluiceways was slightly above the construction elevation of the monolith with the easternmost two temporary sluiceways, although it was much below the construction elevation of the monolith with the two middle temporary sluiceways. The construction elevation of Spillway Monoliths 12, 13, and 14 were roughly the same, with Spillway Monolith 13 being slightly higher in elevation. All three of these monoliths had their construction elevation much below the construction elevation of Spillway Monolith 11. Spillway Monolith 11's construction elevation was below the construction elevation of the monolith with the two middle temporary sluiceways, but it was above the construction elevation of the monoliths with the other sluiceways. **Figure 69**, titled **Construction Progress on 7/31/1909**, shows the progress of construction on that date.

Also by 7/31/1909, construction personnel had completed installing the puddle zone fill in the repaired area of the northwest-to-southeast leg of the of the upstream second cofferdam. This greatly reduced seepage into the Intake/Powerhouse foundation area and allowed construction personnel to access the area prior to 7/31/1909 and start cleanup efforts. **Figure 70**, titled **Intake/Powerhouse Foundation Area as of 7/30/1909**, shows construction personnel in this foundation level.

<u>2.1.4.3.8 August 1909</u>

Between 7/31/1909 and 8/13/1909, in the Spillway Section, construction personnel dedicated themselves to raising the construction elevation of the monolith containing the two easternmost sluiceways, and in raising the construction elevation of Spillway Monolith 13. By 8/13/1909, in the Spillway Section, the construction elevation of the monolith containing the two easternmost temporary sluiceways was just slightly higher than the monolith containing the middle two temporary sluiceways. At the same time, the construction elevation of Spillway Monolith 13 was essentially the same as the construction elevation of Spillway Monolith 11. **Figure 71**, titled **Construction Status as of 8/13/1909**, shows the construction progress in these areas.

By 8/14/1909, construction personnel had started constructing a portion of the west side, north-south leg of the second cofferdam structure in the downstream foundation area of the Powerhouse Structure. This construction had some similarities to the previous rock filled timber crib construction but also had some rather remarkable differences. Like the rock filled timber crib construction, the framework for the construction appears to have been built generally in the dry and floated into position. Unlike the rock filled timber crib construction, this new construction seemed to be made of a series of hollow, wooden, solid-sided boxes. These would seem to essentially be 'puddle zone' boxes without any rock filled timber cribbing components. What provoked this construction change is not apparent in any of the records reviewed to date. Suffice to say, that the structures were apparently constructed hollow, and floated out to an assembly area. **Figure 72**, titled **Second Cofferdam West Wall, North-South Leg**, documents this construction sequence.

As was the case of the Spillway monoliths, to date, no evidence has been found in the archives indicating how the Intake monoliths were numbered**.** **Figure 73**, titled **Intake Monoliths**, shows a late-construction photograph of the upstream face of the Intake Structure. For ease of discussion, the monoliths have been arbitrarily consecutively numbered on **Figure 73**, from east to west. From the available original construction photographs, it appears that Intake Monoliths 2 through 4 may have been equal in their east-west extent, while Intake Monoliths 1 and 5 were shorter than the others in their east-west extent.

By 8/21/1909, the second cofferdam had been sufficiently completed so as to allow construction forces to start blasting and excavating foundation rock in the vicinity of Intake Monoliths 1 and 2. For some reason which is not entirely clear, the downstream northwest-to-southeast leg of the second cofferdam was not of the 'open box' construction. Rather, it appears that timbering was set and then vertical boards were attached to the timber scaffolding. **Figure 74**, titled **Powerhouse Foundation Excavation**, shows the foundation excavation and the completed second cofferdam structure.

While parts of the construction forces were working on the second cofferdam structure and in doing foundation excavation work in the Powerhouse/Intake area, other segments of the construction forces were working on the monoliths in the spillway area. By 8/21/1909, in the Spillway Section, the construction elevation of the monolith with the easternmost two temporary sluiceways had been raised such that it was approximately level with the construction elevation of the monolith with the middle two temporary sluiceways. The monolith with the westernmost two permanent sluiceways also had its construction elevation raised, although it was substantially below the construction elevation of the other two sluiceway monoliths. The construction elevation of Spillway Monoliths 11 and 13 had been substantially raised, and these two monoliths were approximately at the same construction elevation. Work also occurred on Spillway Monoliths 12 and 14. Their construction elevations were approximately equal although substantially below the construction elevations of Spillway Monoliths 11 and 13. **Figure 75**, titled **Construction Progress as of 8/21/1909**, shows the relative construction elevations of these monoliths.

<u>2.1.4.3.9 September 1909</u>
Between 8/21/1909 and 9/24/1909, the available original construction photographs do not have any dated photographs. No reason for this one-month lapse in the photo documentation has been found in the materials reviewed to date, however, it appears that in this period of time substantial progress had been made in the construction efforts at the site.

By 9/24/1909, construction forces had formed and poured additional lifts in Intake Monoliths 2 and 3, thus raising their construction elevation. In the case of Intake Monolith 2, the forms had been stripped. These two monoliths had essentially the same construction elevation as Intake Monolith 1.

At the same time, in the Spillway Section containing the sluiceways, the two monoliths containing the four temporary sluiceways had reached their final design elevation and construction personnel were forming up the top of the ogee crest section. The westernmost monolith containing the two permanent sluices had additional pours placed. While this raised the construction elevation for this monolith, it was still below the final design elevation of the other two monoliths.

Also as of 9/24/1909, construction forces greatly added to Spillway Monolith 14. Its construction elevation was the highest construction elevation for Spillway Monoliths 10 through 14. Spillway Monolith 12's construction elevation was also greatly augmented. As of 9/24/1909, Spillway Monoliths 11 through 13 were at approximately the same construction elevation, but still below the construction elevation of Spillway Monolith 14. Construction forces had added pours to Spillway Monolith 10, however it had the lowest construction elevation of any of the Spillway Monuments 10 through 14. **Figure 76**, titled **Construction Progress as of 9/24/1909**, shows the relative construction elevations of these monoliths.

Between 9/24/1909 and 9/28/1909, construction personnel resumed work on the East Earth Embankment Core Wall. They had formed up and presumably had poured another extension of the wall. **Figure 77**, titled **East Earth Embankment Core Wall Extension as of 9/28/1909**, documents this construction activity.

While the 9/28/1909 contract which had been issued to the Land Brothers Company for construction of a dike, the construction was for two saddle dikes. These saddle dikes were to be located on the east side of the reservoir area, approximately 4,000 feet north of the main dam structures. **Figure 78**, titled **Upstream Saddle Dikes**, shows a plan view of the two dikes. Again, it is assumed the counter party to the construction contract was the Georgia Construction Company.

2.1.4.3.10 October 1909

By 10/3/1909, the extension to the East Embankment Core Wall had its forms removed. In the Powerhouse/Intake area, the second cofferdam system had been modified. An upstream east-to-west leg of coffering had been added. Downstream of this, some of the former 'hollow box' cells that had been downstream of Intake Monolith 3, had been repositioned such that they now ran east-to-west rather than north-to-south as they had previously been arranged. This now formed the downstream east-to-west leg of the revised second cofferdam. This re-arrangement of the cofferdam components allowed construction personnel to form up and make base pours and some subsequent lift pours for Intake Monolith 4. In the Spillway Section, form up continued for the top curve of the ogee section in the monoliths containing the temporary and permanent sluiceways. **Figure 79**, titled **Construction Progress as of 10/3/1909**, shows these construction activities.

Between 10/3/1909 and 10/9/1909, in the Intake/Powerhouse area, construction personnel were concentrating on building up Intake Monolith 4 as well as starting to form up the base level, upstream face, of the West Nonoverflow. **Figure 80**, titled **Intake/Powerhouse Construction Progress as of 10/9/1909**, documents this work effort. Excavations to the existing rock surface were also proceeding on the west abutment. **Figure 81**, titled **West Abutment Excavation**, shows the clearing work.

In the Spillway Section, by 10/9/1909, Spillway Monolith 12 had extra lifts added to it and its construction elevation was roughly equal to the construction elevation of Spillway Monolith 14. These two monoliths had the highest construction elevation of any of the Spillway Monoliths 9 through 14. Spillway Monoliths 11 and 13 were at approximately the same construction elevation but their construction elevation was noticeably below that of Spillway Monoliths 12 and 14. Spillway Monolith 10's construction elevation was only slightly below the construction elevation of Spillway Monoliths 11 and 13. As of 10/9/1909, Spillway Monolith 9 appears to have had its base slab poured as well as a few subsequent lifts. **Figure 82**, titled **Spillway Monoliths as of 10/9/1909**, shows this construction progress.

By Halloween of 1909, all of the lower elevations of the Intake Monoliths had been poured. Foundation excavation work was proceeding for the draft tube for Unit 1. The first form work for the downstream face of the Powerhouse had been erected at the southeast corner of the Powerhouse where it joined the Spillway Section containing the two permanent sluiceways. **Figure 83**, titled **Intake/Powerhouse Area as of 10/31/1909,** shows this construction progress.

Also, by Halloween of 1909, progress had been made on raising the construction elevations of the Spillway Monoliths. Of the Spillway Monoliths 9 through 14, Spillway Monolith 14 had the highest construction elevation. Spillway Monoliths 12 and 13 were roughly equal in construction elevation, although lower in construction elevation than Spillway Monolith 14. Spillway Monolith 11 was just slightly lower in its construction elevation than Spillway monolith 12. Spillway Monolith 10 was just slightly lower in its construction elevation than Spillway Monolith 11. Spillway Monolith 9 had the lowest construction elevation, although it had noticeably increased its construction elevation from the early part of October 1909. **Figure 84**, titled **Spillway Monoliths as of 10/31/1909**, shows the construction progress for these monoliths. Construction personnel had also extended the construction roadway at the toe of the spillway monoliths so that it now reached the east side of the spillway monolith containing the easternmost two temporary sluiceways.

2.1.4.3.11 November 1909

By 11/9/1909, construction personnel had extended the construction roadway at the toe of the spillway monoliths to the west edge of the western spillway monolith containing the two westernmost permanent sluiceways.

Also, by 11/9/1909, a number of construction activities were occurring in the Intake/Powerhouse area. These included:

1) Forming up and pouring lifts for the east wall of the powerhouse substructure.

2) Forming up and pouring lifts in the draft tube area for Unit 1. This included work in the foundation area as well as the east and west walls of the draft tube. **Figure 85**, titled **Unit 1 Draft Tube Foundation Area and Walls**, shows a detail of the work in this area.

3) Drilling and excavating foundation rock in the vicinity of the draft tube area for Unit2. **Figure 86**, titled **Unit 2 Draft Tube Area Rock Drilling**, documents the drilling efforts in this area.

By 11/9/1909, construction efforts were proceeding in the Spillway Section by raising the construction elevation of the various monoliths. Spillway Monolith 14 still had the highest construction elevation. Spillway Monoliths 12 and 13 were still equal in their construction elevations, although they were below the construction elevation of Spillway Monolith 14. Spillway Monoliths 10 and 11 were essentially at the same construction elevation but just below the construction elevation of Spillway Monolith 12. Spillway Monolith 9 showed the most construction activity and its construction elevation was just slightly below the construction elevation of Spillway Monolith 10. **Figure 87**, titled **Spillway Monoliths as of 11/9/1909**, documents the construction activities for these Spillway Monoliths.

By the end of November 1909, forming up and concrete pours were proceeding in the Powerhouse area for Units 1 and 2. **Figure 88**, titled **Typical Draft Tube Area**, shows an elevation view of a draft tube. On 11/28/1909, the upper horizontal portion of the penetration for the Unit 1 draft tube had been formed and poured. The forms were stripped from the downstream portions of the east and west draft tube walls. Semicircular formwork was being erected on the downstream portions of the east and west draft tube walls for Unit 1. On Unit 2, the western draft tube wall downstream section was formed up. Forms were being set for the curved downstream portion of the draft tube area. **Figure 89**, titled **Unit 1 and Unit 2 Draft Tube Areas**, shows this construction work.

Also by 11/28/1909, work was occurring on the East Earth Embankment Core Wall area. **Figure 90**, titled **East Earth Embankment Core Wall Area on 11/28/1909**, documents this construction. It is believed that in many cases, some of the concreting efforts at the East Core Wall were done using a small-batch system. **Figure 91**, titled **Small-Batch Concrete Operation**, is a November 1909 photograph showing such a construction operation. This photograph has a number of interesting elements. It would appear that the motive power for the concrete mixing drum was provided by a steam boiler which was fueled by wooden logs. There also appears to be a second steam boiler which is assumed to be powering a rock crushing and conveyance system. There is also evidence of a sand pile and potentially sacks of concrete near the mouth of the mixing drum. The various components of the concrete mix were apparently conveyed to the mixing drum by a series of board-ramps.

2.1.4.3.12 December 1909

By the early part of December, 1909, construction personnel were thinking ahead regarding the transmission system which would connect the station to the Macon, Georgia. They were performing on-site destructive testing of the transmission tower anchors.

By 12/9/1909, construction personnel had formed up and poured a number of sections of the draft tube west wall for Unit 3. They were forming up the base pours for the west wall of the exciter discharge bay. **Figure 92**, titled **Draft Tube Area as of 12/9/1909**, shows this construction progress.

By 12/11/1909, construction work on the transmission lines had started.

By 12/13/1909, further progress was being made in the form up and pouring of the walls separating either the units, or the exciter areas in the Powerhouse. At this time, some of the first metal components of the Unit 1 turbine had arrived on site and had been set in position. These components included the upstream and downstream head covers, and the discharge ring. It also appears that the Unit 2 discharge ring was also available on site. The installation would occur once the concrete pours were completed in the Unit 2 draft tube sections. **Figure 93**, titled **Unit 1 and 2 Turbine Metal Components**, show these elements.

By 12/18/1909, transmission line construction was fully underway. The Schott Engineering Company of Chicago, Illinois, was performing the work in the field. The transmission line corridor was 100 feet in width.

Figure 94, titled **Partial Powerhouse Elevation**, shows a section of the main operating floor of the Powerhouse with some of the major components/areas indicated. By 12/21/1909, construction activities were occurring in the Powerhouse area for Units 1 through 3, the exciters, and Unit 4. Demolition work had started on the construction roadway at the toe of the Spillway Monoliths.

In the area of Unit 1, the Unit 1 discharge ring had been set. Construction personnel were forming up the roof and downstream wall of the upstream bearing gallery at Unit 1. They were also erecting forms for the downstream face of the downstream headcover area for Unit 1. **Figure 95**, titled **Unit 1 Construction Progress as of 12/21/1909**, shows these construction efforts.

At Unit 2, the discharge ring had been set in its formwork in preparation for concreting it in its final position. In the upstream part of the Unit 3 area, portions of the draft tube formwork had been installed in preparation for subsequent concreting operations. In the downstream section of the Unit 3 draft tube area, semicircular formwork was being erected. **Figure 96**, titled **Unit 2 Through 3 as of 12/21/1909**, documents these work efforts.

In the exciter discharge area, the formwork for the downstream sections of the east and west walls of the exciter discharge bay appeared to have been stripped. The upstream section of the west wall of the exciter bay (east wall of the Unit 4 draft tube area) was formed up.

For Unit 4, the upstream and downstream sections of the west wall of the Unit 4 draft tube area was formed up with the downstream section appearing to have been poured to a higher construction elevation than the upstream section. **Figure 97**, titled **Exciter Discharge Area and Unit 4 Area as of 12/21/1909**, shows the construction progress in the vicinity of the Exciter Discharge Area and the Unit 4 Draft Tube Area.

Between 11/9/1909 and 12/31/1909, other construction personnel were working on the monoliths in the Spillway area and extending the East Earth Embankment Core Wall. By 12/21/1909, some construction forces had started demolishing the western end of the construction roadway at the toe of the spillway monolith containing the westernmost two permanent sluiceways. The demolition consisted of removing the wooden decking and any materials on the deck. The underlying structural support members were left in place. **Figure 98**, titled **Partial Demolition of Construction Roadway**, shows the removal of the decking.

By 12/31/1909, Spillway Monolith 14 had reached its design elevation and its forms had been stripped from the crest. Spillway Monolith 13 was now the highest monolith still under construction and its construction elevation was just slightly below that of Spillway Monolith 14. Spillway Monoliths 10, 11, and 12 were all at approximately the same construction elevation but their construction elevation was below that of Spillway monolith 13. Spillway Monolith 8, whose construction had apparently not been started as of 11/9/1909, now had a construction elevation just below that of Spillway Monolith 10. Spillway Monolith 9 had the lowest construction elevation although it was just slightly below that of Spillway Monolith 8. **Figure 99**, titled **Spillway Monolith Construction as of 12/31/1909**, documents the construction progress on these monoliths. **Figure 100**, titled **East Earth Embankment Core Wall as of 12/31/1909**, shows the continuing form up and construction of the core wall.

2.1.5 1910

2.1.5.1 Overview

In 1910, a twenty-year contract was entered into between the Central Georgia Power Company and the Macon Railway & Light Company. The Central Georgia Power Company agreed to deliver electric current to the Macon Railway & Light Company, at Macon, for about 1 cent per KWH. The Macon Railway and Light company agreed to purchase current from no other sources during the life of the contract and it would maintain its steam plant as an auxiliary plant for supplying current when power was not available from the Central Georgia Power Company's hydroelectric plant. The synergies between the Central Georgia Power Company and the Macon Railway & Light Company were now realized via a contractual agreement.

On 11/15/1910, a contract was issued to the Southern Railway Co. The contract covered the lease of single track railroad from a point on the main line of the Southern Railway between Jackson and Flovilla, Georgia to the west bank of the Ocmulgee River near the site of the dam. It was for $2,213.75.

2.1.5.2 1910 Land Acquisitions

Land acquisition continued in 1910.

2.1.5.3 1910 Construction Activities

2.1.5.3.1 January 1910

By 1/2/1910, the demolition of the construction roadway deck at the toe of the spillway monoliths had proceeded eastward. The decking was now removed almost to the eastern edge of the spillway monolith with the easternmost two temporary sluiceways. Again, the structural roadway members were left in place.

On the same date, form up and concrete pouring were occurring in the Powerhouse area. The wall in the Powerhouse between the Unit 1 and Unit 2 turbine areas had been formed up, presumably in preparation for a pour on the Unit 1 side. At Unit 1 and Unit 2, the construction elevation was either at, or very close to, the elevation of the main operating floor, elevation 442.0. At Unit 3, the upstream portions of the draft tube area still needed to be poured.

In the exciter area, a number of pours had been made in the upstream areas of this section, and the construction elevation at these pours was roughly equal to the construction elevation for the main operating floor elevation for Unit 1 and Unit 2. Piping for the exciters had been delivered to the site.

At Unit 4, the formwork for the downstream sections of the east and west walls for the draft tube area had been stripped. The draft tube itself was also partially formed up.

Figure 101, titled **Powerhouse Construction as of 1/2/1910**, shows the abovementioned construction progress.

By 1/8/1910, construction personnel had apparently completed their destructive testing program on the transmission tower anchors and they were apparently satisfied with the test results. By 1/11/1910, construction personnel were released to start erection of the transmission towers and transmission line from the station. **Figure 102**, titled **Transmission Line Tower**, shows configuration of a transmission line tower. **Figure 103**, titled **Transmission Line Tower Erection**, shows how the transmission line tower was set in place. From a review of the photograph, it in concluded that the transmission line tower was essentially entirely built on the ground, and then tilted into its final position.

The following presents in pertinent part, a contemporary description of the transmission lines and towers:

> “. . . . There are two sets of feeders, . . . carried on the same line of transmission towers. . . . [Two separate transmission lines on each tower].
>
> . . . the transmission towers are of steel construction with four supports resting on concrete foundation. The lines are run in duplicate in order to assure continuous service and enable the switching of current from one line to the other so that work can be done on the disabled line, thus assuring convenience as well as protection. From the power station to the switching station at Bibb, the lines are of copper B. & S. gage 00. . . . The triangular spacing of the lines of the steel towers is six feet six inches, and the towers spaced according to the contour of the region crossed rather than according to any system of spacing. However, the spacing approximates 10 towers to the mile. . . . The lines have been designed and constructed with a

> careful consideration of the tensile strength of conductors, the result giving an appearance of a considerable sag. While the design of this system is more or less experimental, the careful working out of the details makes the operating features of considerable interest and benefit for comparison of operation of other systems where trouble has been met with. A telephone system is installed on the same towers, the wiring being transposed in such a manner as to give good voice transmission features and supplied with special drainage coils to eliminate induction. The upper most point of the tower . . . is the terminal of the ground rod for that particular tower. The height of towers is 80 feet and the insulators used of the four petticoated types, especially designed for the transmission voltage of 66,000.
>
> . . . “.

Also, by 1/11/1910, demolition was continuing on the construction roadway at the toe of the Spillway Monoliths. The roadway decking had been removed up to the western edge of Monolith 14. Again, the structural roadway elements were left in place.

Construction in the Powerhouse area was also progressing as of 1/11/1910. For Unit 1, some of the formwork for the penstock above the top of the water chest, had been set. Construction forces were forming up some of the upper level areas in Intake Monolith 1. The downstream face of the Powerhouse at the main operating floor elevation at Unit 1 had been formed up and apparently poured.

In the Unit 2 area, formwork was being erected to extend the upstream bearing gallery westward and framing of the upstream headcover wall was in progress. Form up work was also occurring on the downstream headcover area. The downstream face of the Powerhouse at the main operating floor elevation at Unit 2 had been formed up, but not apparently poured.

At Unit 3, the discharge ring had been set and concreted into position. The upstream and downstream headcovers had been erected. The downstream face of the Powerhouse at the main operating floor elevation had not yet been formed up.

By 1/11/1910, the discharge piping for the two exciters had been erected in the exciter discharge area, but not yet totally embedded in concrete. On Unit 4, the draft tube formwork had been extended and on Unit 5, a portion of the draft tube formwork had been erected.

Figure 104, titled **Powerhouse Construction Progress as of 1/11/1910**, shows the construction efforts in the Powerhouse area as of this date.

In the Spillway area, by 1/11/1910, Spillway Monolith 13 appears to have been formed up to its final design elevation, but it is not clear if it had been poured to that elevation. Additional work had been done on Spillway Monoliths 8 through 10. Of these three monoliths, Spillway Monolith 10 had the highest construction elevation, while Spillway Monolith 8 had the lowest construction elevation. Spillway Monolith 9 may have had a construction elevation slightly higher than Spillway Monoliths 11 and 12. **Figure 105**, titled **Spillway Monoliths’ Construction Progress as of 1/11/1910**, documents the construction progress made in the spillway area.

By 1/30/1910, a Sunday, something had occurred in the Powerhouse area. The area which would become the tailrace was flooded, with water backing upstream into the draft tube and exciter discharge bays. The cause of the flooding is not conclusively known. Potential causes could include: 1) a freshet which caused a breach in the cofferdam structure, or 2) heavy localized rain which flooded the cofferdam area (essentially rain being trapped inside the cofferdam and being unable to drain away). **Figure 106**, titled **Powerhouse Construction Area Flooding**, shows this event.

Regardless of the cause, by 1/30/1910, construction progress had still been made. On Unit 1, work had continued on extending the penstock forms and pouring additional lifts in Intake Monolith 1. The construction elevation of Intake Monolith 1 was the highest of any of the other Intake Monoliths. On Unit 2, form up of the intake monolith and penstock were in progress. On Unit 3, the forms had been set for a westward extension of the upstream bearing gallery. The downstream face of the Powerhouse at the main operating floor elevation at Unit 3 had been poured, but some of the forms had not been stripped off.

In the exciter area, the discharge piping for the two exciters had been concreted in. On Unit 4, the draft tube area had been concreted. Unit 5 had had some concrete poured around its draft tube formwork. Unit 5 also had semicircular formwork erected on the downstream portion of its draft tube bay. Unit 6 had a portion of its draft tube formwork erected.

Figure 107, titled **Powerhouse Construction Progress as of 1/30/1910**, documents the above described items.

Also, by 1/30/1910, work was continuing in the East Earth Embankment Core Wall area. **Figure 108**, titled **East Earth Embankment Core Wall as of 1/30/1910**, shows the progress on the wall.

<u>2.1.5.3.2 February 1910</u>

For some unknown reason, starting in early February of 1910, there is an almost one month break in the original construction photographic documentation of construction activities at the site. To date, only two original construction photographs from February of 1910 have been identified. The first is dated 2/6/1910 and the second is dated 2/8/1910.

By 2/6/1910, in the Powerhouse area, construction personnel had dried out the tailrace area. Unit 2 had an additional lift added to the upstream and downstream sections of Intake Monolith 2. Unit 3 had the upstream and downstream headcover areas formed up as well as the portions of the penstock which attached to the top of the water chest. The downstream portion of the Powerhouse wall at Unit 3 at the main operating floor level had been formed up, poured, and the forms had been mostly stripped off the upstream face of the wall.

In the exciter area, the interior walls between Unit 3 and the exciters, and Unit 4 and the exciters had been partially formed up. The upstream bearing gallery was also extended westward in the exciter area. The downstream wall of the Powerhouse in the exciter area at the main operating floor level had been formed up and partially poured. Unit 4 had its discharge ring set. The Powerhouse wall at Unit 4 at the main operating floor level had been formed up and partially poured. However, its construction elevation was below the construction elevation of the wall in the exciter area.

Unit 5 had more formwork added to the upstream and downstream sections at the top of its draft tube area. Unit 6 had had some pours made in the area adjacent to the intake monolith. It also had its draft tube formwork augmented.

Figure 109, titled **Powerhouse Construction Progress as of 2/6/1910**, shows the abovementioned construction areas.

By 2/8/1910, a number of new pours had been made at Unit 6 in the area of its draft tube.

2.1.5.3.3 March 1910

On 3/3/1910, a Thursday, the Powerhouse tailrace area was again flooded. The water was backed upstream into the draft tube and exciter bays. As was the case on 1/30/1910, the cause of the flooding is not conclusively known. **Figure 110**, titled **Powerhouse Construction Area Flooding on 3/3/1910**, shows the flooding. A reference dated 3/12/1910 stated the following:

> "As a result of heavy rains $100,000 damage has been done to the dam of the Central Georgia Power Company on Ocmulgee River, eight miles below Jackson."

It is not entirely clear if the above information was related to the 3/3/1910 flooding or perhaps to the earlier 1/30/1910 event.

Between 2/8/1910 and 3/3/1910, construction personnel had made noticeable progress in the Powerhouse area. On Unit 1 a number of additional pours had been made and the construction elevation of Intake Monolith 1 had been raised. Also, the form work for the Unit 1 penstock had been extended. On Unit 2, some of the formwork had been stripped from the west face of some of the intermediate pours. Unit 3 had its upstream and downstream headcover areas poured. Formwork for the section of the Unit 3 penstock tying into the top of the water chest was being erected. At Unit 4, the upstream and downstream headcover areas had been poured, as well as the water chest area. **Figure 111**, titled **Powerhouse Area Construction as of 3/3/1910**, documents this construction progress. Unit 5 and 6 had their downstream head cover areas formed up.

In the Spillway area, by 3/3/1910, both construction and demolition were occurring. Spillway Monoliths 12 and 13 were at their final design elevation and had their forms stripped off. Spillway Monolith 9 and 10 were at approximately the same construction elevation and this elevation was below their ultimate design elevation. Spillway Monoliths 8 and 11 were at approximately the same construction elevation, but this was below that of Spillway Monoliths 9 and 10. **Figure 112**, titled **Spillway Monoliths 8 Through 14 as of 3/3/1910**, shows the various construction/design elevations of the noted spillway sections.

While some construction personnel were building, others were engaged in demolition. Apparently, some portions of the original upstream construction bridge had served their purpose. The sections from the east embankment area going west toward the vicinity of Spillway Monolith 15 appeared to be the sections to be removed. The bridge and its cribwork supports were being demolished. What is not clear is the total scope of the demolition. It appears that the decking was removed as well as some of the dressed structural members which supported the decking. This would make sense since these elements could be 'recycled' or cut to make boards for formwork. The fate of the timber cribwork is not totally clear. For those areas 'in the dry', the cribwork could be totally demolished. The cribbing could then be used as false work supports and the rock could potentially be crushed and used as coarse aggregate in the concrete pours. However, for the cribbing 'in the wet' it is not clear just how far the demolition went. It is possible that it only went down to the then existing water surface and any submerged wood and rock fill could be abandoned in place. No definitive disposition of the demolished materials has been found to date. **Figure 113**, titled **Upstream Original Construction Bridge Demolition**, shows the progress of the demolition as of 3/3/1910.

It also appears from some of the original construction photographs that construction forces started pouring concrete in at least one of the spillway monoliths which were east of Spillway Monolith 8, but not adjacent to Spillway Monolith 8. It appears that all, or at least a portion, of Spillway Monolith 7 was 'skipped'.

From the original construction photographs, Spillway Monolith 7 was located just north and potentially generally aligned with the East Batch Plant. Were Spillway Monolith 7 to be totally constructed, this would essentially cut off and access that the East Batch Plant had to its rock source in the East Quarry Area. With the demolition of the eastern part of the original upstream construction bridge, the West Quarry Area would not be able to supply stone to the East Batch Plant. Given these reasons, there needed to be some access through Spillway Monolith 7. Due to the photographic angles in some of the original construction photographs, knowing exactly where and when construction started on Spillway Monoliths 2 through 6 is hard to determine. As such, **Figure 114**, titled **Spillway Monolith 6**, shows a detail of what is believed to be the start of construction of this monolith.

By 3/12/1910, construction personnel were working on the East Abutment. They were excavating the overburden to expose the foundation rock for Spillway Monoliths 1 through 5. **Figure 115**, titled **East Abutment Foundation Excavation**, shows the removal of the overburden and the foundation rock drilling in progress.

Sometime before or on 3/15/1910, some of the first structural steel components for the construction of the powerhouse superstructure were on site. **Figure 116**, titled **First Structural Steel Members**, shows structural steel beams initially being stored in the Powerhouse area. From later construction photographs, it appears that these beams were temporarily relocated elsewhere on the jobsite.

Between 3/3/1910 and 3/20/1910, further construction advances were being made in the Powerhouse area. At Unit 1, additional pours had been made and the construction elevation for Intake Monolith 1 was the highest of any of the Intake Monoliths. The formwork in many areas of Intake Monolith 1 had been stripped off and the Unit 1 construction elevation was serving as a base platform for a guyed derrick. Additional pours had been made in both the Unit 2 and Unit 3 areas, the penstock forms had been extended, and the construction elevation of the Unit 3 area was now approximately equal to the construction elevation of the Unit 2 area (Intake Monolith 2 was essentially at a relatively level elevation). At both Unit 2 and Unit 3, the formwork on the downstream face of the downstream wall of the Powerhouse had been stripped off. The area of Unit 5 and Unit 6 (Intake Monolith 4) had also received addition pours and their penstock formwork had been extended. The downstream face of the downstream wall of the Powerhouse at Units 5 and 6 was still formed up, in contrast to the condition of the Unit 1 through 3 wall area. **Figure 117**, titled **Powerhouse Construction Progress as of 3/20/1910**, shows the abovementioned construction activities.

By 3/27/1910, additional pours had been made in the Powerhouse area, especially in Intake Monolith 2, and in the vicinity of the Unit 6 penstock. In the exciter area, some of the exciter turbine hardware had been set, including the turbine casing and discharge elbows. More structural steel for the Powerhouse superstructure had also been delivered and stored on the main operating floor of the Powerhouse area. **Figure 118**, titled **Water Driven Exciter Turbine Casing**, shows a detail of the exciter's turbine case which would house the exciter's runner. **Figure 119**, titled **Powerhouse Construction Progress as of 3/27/1910**, shows the construction progress, the installation of the water driven exciters' discharge elbows, and the additional structural steel which had been delivered to the construction site.

2.1.5.3.4 April 1910

By 4/14/1910, it is believed that construction personnel were excavating for the foundation area of the West Nonoverflow. A construction photograph dated 4/14/1910 shows the drilling and excavation operations. Unfortunately, while the photograph does have a date, it does not have a location description. It is believed that **Figure 120**, titled **Foundation Excavation**, presents a photograph of the West Abutment area, with workers with a pneumatic drill and a laborer with a dump bucket.

In the Powerhouse area, between 3/27/1910 and 4/14/1910, construction personnel had partially erected the water supply piping for the water driven exciters and formed up part of the area in preparation for the embedment of the piping. **Figure 121**, titled **Water Driven Exciters, Partial Erection and Form Up of Water Supply Piping**, shows this construction detail. The reason that the erection appears only partial is because on a close examination of the joint where the upstream elbow joins to the water driven exciters' turbine case, only every three bolt holes had a fastener in them

Also in this time period, noticeable changes had occurred in other sections of the Powerhouse area. The construction elevation for Intake Monolith 2 had been extended vertically so that it was essentially on the same elevation as the construction elevation of Intake Monolith 1. The structural steel which had been stored on the main operating floor at Units 1 through 3 was being erected. By 4/14/1910, five of the structural steel columns bearing on the downstream wall of the powerhouse had been erected, as had their corresponding upstream, shorter, corresponding columns. Major upstream-to-downstream structural steel beams had been erected between the two sets of columns and construction personnel were erecting intermediate east-to-west beams between the upstream-to-downstream beams. These steel beams would form the floor support for the high-tension-floor area of the powerhouse.

In Intake Monolith 3, in addition to forming up the water driven exciters area, the formwork for the water driven exciter penstocks had been extended. The formwork for the Unit 4 penstock was also being extended.

In Intake Monolith 4, additional pours had been made which raised the construction elevation of this Intake Monolith, although its construction elevation is still below that of Intake Monolith 2. A guyed derrick had been set on a recently poured section, upstream, and between the formwork for the Unit 5 and the Unit 6 penstocks. Its associated steam boiler was set near the Unit 5 penstock area. The formwork on the face of the downstream headcover area in Intake Monolith 4 had been stripped but the formwork on the downstream face of the downstream wall of the Powerhouse remained in place. **Figure 122**, titled **Powerhouse Construction Progress as of 4/14/1910**, shows the abovementioned construction activities.

On 4/17/1910, a Sunday, the tailrace area of the Powerhouse was flooded once more. Again, the actual cause of the flooding is not known (i.e. heavy rainfall inside the cofferdam area, a freshet, etc.) A review of another construction photograph dated the same day, shows that the downstream east-west wall of the cofferdam was not overtopped. However, that does not mean that it was not overtopped some time prior to 4/17/1910.

Between 4/14/1910 and 4/17/1910, additional pours had occurred between the Unit 2 and Unit 3 penstocks in Intake Monolith 2. Additional superstructure structural steel had been erected at Units 1 and 2. The formwork for the two exciter penstocks had been extended and the east wall of Intake Monolith 4 had upstream-to-downstream formwork added. **Figure 123**, titled **Powerhouse Construction Progress as of 4/17/1910**, shows these construction activities.

By 4/17/1910, Spillway Monoliths 10 and 11 were at their final design elevation and had their forms stripped off. Spillway Monolith 9 appeared to have been formed up to its design elevation but it is not clear if it had been poured yet. Spillway Monoliths 6, a portion of Spillway Monolith 7, and Spillway Monolith 8 were all at approximately the same construction elevation, albeit below their final design elevation. **Figure 124**, titled **Spillway Monoliths Construction Progress as of 4/17/1910**, documents this construction activity.

<u>2.1.5.3.5 May 1910</u>

By 5/1/1910, almost half of the structural steel beams for the high-tension-floor area of the Powerhouse had been set, as well as almost all of the short upstream high-tension-floor columns which ran east to west over the downstream headcover wall. All of the formwork in the vicinity of all of the downstream headcover areas of the Powerhouse had been stripped off except for the area of the water driven exciters. At the east end of the main operating floor of the Powerhouse, stairs had been erected. At Unit 1, the penstock forms had been extended and additional pours had been made to Intake Monoliths 1 and 2, raising their construction elevations. Additional pours had been made to Intake Monolith 3 also raising its construction elevation, although the construction elevation of Intake Monolith 3 was below that of Intake Monoliths 1 and 2. Some additional pours had also apparently occurred at Intake Monolith 4. **Figure 125**, titled **Powerhouse Construction Progress as of 5/1/1910**, shows these conditions.

By 5/1/1910 in the Spillway area, Spillway Monolith 9 was at its final design elevation and had its forms stripped off. Spillway Monolith 8 appeared to be just below its final design elevation and still had to have its forms stripped off. Spillway Monolith 6 was formed up with its construction elevation below that of Spillway Monolith 8. Spillway Monolith 7 had the lowest construction elevation of the spillway Monoliths 6 through 8. **Figure 126**, titled **Spillway Monoliths Construction Progress as of 5/1/1910**, shows this construction progress

Also, by 5/1/1910, construction personnel had made notable progress in construction activities in the vicinity of the East Core Wall. They had apparently excavated the foundation area and had started pouring the area of the East Abutment Training/Retaining Wall. **Figure 127**, titled **East Earth Embankment Core Wall Area Construction as of 5/1/1910**, shows not only a portion of the East Earth Embankment Core Wall but also the from-up of the East Abutment Training/Retaining Wall area.

Regarding construction progress on the transmission towers, by 5/7/1910 a total of forty-five steel towers had been erected with several others assembled in preparation for being raised.

By 5/8/1910, in the Powerhouse area, additional pours had been made to Intake Monoliths 1 through 3, giving them a stair-step appearance with Intake Monolith 1 being at the highest construction elevation and Intake Monolith 3 having the lowest construction elevation of the three monoliths. The penstock forms for Unit 1 had been extended and now were transitioning from an upward-slanting orientation to a more horizontally curving configuration. The formwork for the penstocks for the exciter units and Unit 4 had been noticeably extended. Over the main operating floor of the Powerhouse, the erection of the high-tension-floor structural steel beams had extended to the area of the downstream headcover of Unit 4. Masons had been busy setting a number of courses of brickwork on top of the downstream wall of the Powerhouse for the downstream curtain walls. This work extended from the southeast corner of the powerhouse to near the westernmost water driven exciter. Form up and pouring had occurred between the west abutment and the main operating floor west of Unit 6. This is believed to be associated with Intake Monolith 5. **Figure 128**, titled **Powerhouse Construction Progress as of 5/8/1910**, shows these work efforts.

By 5/15/1910, additional pours had been made in Intake Monolith 1 and Intake Monolith 3, raising their construction elevations. Floor pours for the high-tension-floor had been made in the vicinity of Unit 2. Portions of the curtain wall brick work at the southeast corner of the Powerhouse had been extended vertically almost to the elevation of the high-tension-floor elevation. Five window casings had been installed in the curtain wall bays between the vertical steel columns on the downstream face of the Powerhouse between Unit 1 and Unit 3.

At Intake Monolith 5, additional pours had been placed over the earlier foundation pours. Some initial pours seem to have been made in the foundation area for the West Nonoverflow which was just west of Intake Monolith 5. Not all of the pour lifts had been extended to the same construction elevation. **Figure 129**, titled **Intake Monolith 5 Area Construction as of 5/15/1910**, shows the progress of work at this date.

At the same time in the Spillway area, Spillway Monolith 8 had reached its design elevation and the forms had been stripped off. Construction forces in the Spillway area had apparently set forms and made pours in the area of Spillway Monoliths 1 and 2. **Figure 130**, titled **Spillway Area Construction as of 5/15/1910**, documents this. In the photograph, notice the gap in the spillway monoliths. This is believed to be at Spillway Monolith 7, as discussed previously.

By the end of May 1910, construction activities were occurring both at the construction site and off site in the reservoir area. The off-site construction involved the rebuilding of some of the bridges which would be inundated when the reservoir started filling. On 5/22/1910, construction on Bonnetts Bridge at Tussalea Creek was nearing completion. **Figure 131**, titled **Bonnetts Bridge**, shows the reconstructed bridge.

On site, by 5/23/1910 in the Powerhouse area, construction personnel had formed up the Unit 1 penstock forms so that their openings were now pointing horizontally upstream and formwork was being erected for the pour between Intake Monolith 1 and Intake Monolith 2 on the upstream edge of the monoliths' junction. The erection of the high-tension-floor steel had extended almost to the upstream-downstream centerline of Unit 6. At Unit 2 and Unit 3, the high-tension-floor slab had been poured such that it extended completely upstream to downstream from the Powerhouse wall at the downstream headcover to the downstream wall of the Powerhouse. On the downstream face of the powerhouse, four additional window frames had been erected (bringing the total number of window frames to nine), and brick work was continuing to be erected vertically at the first five window frames. **Figure 132**, titled **Powerhouse Construction Progress as of 5/23/1910**, documents this work progress.

At the Spillway area on 5/23/1910, construction personnel were continuing to raise the construction elevation of Spillway Monoliths 1 and 2. They were also forming up the East Abutment Training/Retaining Wall area. **Figure 133**, titled **Spillway Area Construction Progress as of 5/23/1910**, shows these efforts.

On 5/24/1910, construction on Union School Branch Bridge was nearing completion. This was another of the bridges in the future reservoir area which had to be reconfigured prior to filling the reservoir. **Figure 134**, titled **Union School Branch Bridge**, shows the reconstructed bridge.

<u>2.1.5.3.6 June 1910</u>

In the first weeks of June, 1910, reconstruction work on the bridges in what would be the reservoir area continued at various sites.

Between 5/15/1910 and 6/16/1910, portions of the construction forces had been engaged in building efforts on the west side of the construction site and had made noticeable construction progress. As of 6/16/1910, they had made supplemental pours and had formed up the eastern side of the West Nonoverflow to a construction elevation which was at or just below the construction elevation of Intake Monolith 5 (see below regarding the construction elevations of the Intake Monoliths.). **Figure 135**, titled **West Nonoverflow Construction Progress as of 6/16/1910**, shows the construction progress on the West Nonoverflow in reference to Intake Monoliths 3 and 5.

Between 5/23/1910 and 6/16/1910, additional construction progress had been made in the Powerhouse area. Intake Monolith 1 had additional pours made and additional forms had been added. Its construction elevation was just below the design elevation of the westernmost permanent two sluiceways' monolith. Of the three Intake Monoliths 1 through 3, Intake Monolith 2 had the lowest construction elevation and was being used as a staging area for a guyed derrick. Intake Monolith 3 had a construction elevation between that of Intake Monolith 1 and Intake Monolith 2 and was being actively worked by additional pours and subsequent form ups. Intake Monolith 4 had the lowest construction elevation of any of the Intake monoliths. Intake Monolith 5 had also seen concentrated construction activity. A number of pours had been made to its most upstream sections and form up was still occurring there. Its construction elevation was now just slightly below the construction elevation of Intake Monolith 3.

Over the main operating floor area, structural steel erection (including intermediate steel framing) for the high-tension-floor slab had extended to the vicinity of the west side of the Unit 6 downstream headcover. Over the main operating floor area, floor slab pours for the high-tension-floor had occurred in the area of Unit 1, the exciters, and Unit 4. At Unit 1, the high-tension-floor slab extended from the area of the downstream headcover wall, downstream to the downstream wall of the powerhouse. It was being used as a laydown area for the bricks the masons were using in their construction efforts as well as a support for the second story window frames in the downstream face of the powerhouse. Concrete pours for the high-tension-floor slab in the area of the exciters and Unit 4, had generally extended from the downstream headcover wall to the downstream face of the powerhouse, with only a small section at the upstream end of the pour over Unit 4 not yet being completed. The poured areas were also being used as laydown areas. The roof trusswork at the second story of the Powerhouse on the downstream face had been set

Regarding the masonry activities on the downstream wall of the Powerhouse, on the lower-level window frames, the brick work between the window frames had generally been extended vertically to the approximate elevation of the downstream crane rail. In the vicinity of Unit 1, the brickwork had extended above the crane rail elevation so as to totally enclose the lower window frames and provide bearing support to the easternmost two window frames at the southeast corner of the Powerhouse at the elevation of the high-tension-floor. The third and fourth window frames (as numbered from the east end of the Powerhouse) on the lower level were completely encased in brickwork, while the fifth frame was partially encased. A contemporary reference source stated that the outer and division walls at the first story were 20 inches thick, while on the upper story they were 16 inches thick. **Figure 136**, titled **Powerhouse Construction Progress as of 6/16/1910**, shows the abovementioned construction activities.

On the lowest level of the downstream wall of the Powerhouse, four additional window frames had been set, bringing the total number of window frames in this section to 13. At the time of this report, it is not known just how or if the window frames were numbered/identified. For ease of discussion an arbitrary sequential numbering of the window frames has been made and this is presented as **Figure 137**, titled **Arbitrary Window Frame Designations**.

By 6/24/1910, two additional window frames (L14 and L15) had been set at the lower level in the downstream wall of the Powerhouse. This brought the total number of window frames in this section to 15, which was the total number which were to be installed in this area. These new window frames were encased with brickwork up to the approximate elevation of the crane rail. Masons continued vertically extending the brick work between window frames U1 through U4. Additionally, two window frames were installed on the second story on the east face of the Powerhouse. These had been vertically encased with brick work to approximately three-quarters of their height. Additional structural steel roof trusses had been erected. These spanned from upstream to downstream over the high-tension-floor area which was above the exciters.

By 6/28/1910, in the Powerhouse area, additional concrete pours had been made to Intake Monolith 3 and its construction elevation was now above the elevation of the top of the roof trusses at the high-tension-floor area. Intake Monolith 4 had its penstock forms for Unit 5 and Unit 6 extended in preparation for additional concrete pours. At the west side of the Powerhouse, some upstream structural steel floor beams had been set for the high-tension-floor, these beams ran east-to wet and were bearing on the west wall of the Powerhouse. Floor pours for the high-tension-floor had extended to be over the Unit 6 main operating floor area. Brick masons had partially enclosed window frames U1 through U4 at the east end of the high-tension-floor area and they were working on raising the brickwork elevation of the east side of the powerhouse. **Figure 138**, titled **Powerhouse Construction Progress as of 6/28/1910**, shows the abovementioned activities.

By 6/28/1910, noticeable construction progress had been made in the Spillway Area. Additional pours had been made to Spillway Monoliths 1, 2, and 5. These monoliths now had virtually the same construction elevation as Spillway Monolith 6. The East Abutment Training/Retaining Wall complex was formed up to be either at, or very close to, its final design elevation. **Figure 139**, titled **Spillway Area Construction Progress as of 6/28/1910**, shows these construction activities.

2.1.5.3.7 July 1910

Between 6/28/1910 and 7/6/1910, concreting activities in the Powerhouse area appeared to be concentrated in vicinity of Intake Monolith 2 and Intake Monolith 4. Additional pours were made raising their construction elevations. The formwork for the penstocks for Units 2, 3, 5, and 6 were extended. The erection of structural steel truss work for the roof over the high-tension-floor area continued and was concentrated in the area of Intake Monolith 3, with some limited erection near the eastern end of the Powerhouse. The brick masons were erecting the archway at the access to the main operating floor at the west side of the Powerhouse. Window frames L5 through L8 had brickwork installed to over the archways of the window casings. **Figure 140**, titled **Powerhouse Construction Progress as of 7/6/1910**, documents some of these construction advances.

By 7/17/1910, the penstock formwork for Units 2, 3, 5, and 6 had started transitioning from a generally vertical orientation to an upstream curving orientation. Concreting efforts at Intake Monolith 4 had raised the construction elevation sufficiently that the upstream-to-downstream structural steel roof trusses could be installed in the high-tension-floor area above Units 5 and 6. The final structural steel had been set in the downstream section of Intake Monolith 5. This steel ran in an east-to-west direction. Floor pours for the floor of the high-tension-floor area were being formed up downstream of Intake Monolith 4. Window frames L5 through L12 had been totally encased with brickwork to just below the level of the high-tension-floor. Window frames L13 through L15 were encased with brickwork to at or just over the arch of the window frame.

By 7/25/1910, Intake Monolith 1 had apparently been poured to its upstream design elevation and the upstream formwork had been stripped off. Considering Intake Monoliths 2 through 5, the construction elevation of Intake Monolith 3 was the highest, yet it was not yet at is final design elevation. Intake Monolith 4 had the next highest construction elevation with Intake Monolith 2 perhaps just at a slightly lower construction elevation than Intake Monolith 4. Intake Monolith 5 had the lowest construction elevation and the eastern side of the West Nonoverflow had its construction elevation approximately equal to the construction elevation of Intake Monolith 5. **Figure 141**, titled **Intake and West Nonoverflow Monolith Construction Progress as of 7/25/1910**, shows the various levels of the abovementioned structures.

Also by 7/25/1910, all of the formwork making up the upstream walls of the high-tension floor area had been stripped from all Intake Monoliths. All the upstream-to-downstream structural steel trusses had been installed and construction forces were assembling materials with which to build the actual roof deck. The high-tension-floor had been poured to virtually the downstream face of the Powerhouse. Window frames L4 through L7 had brick work which was extending above the level of the high-tension-floor elevation but the brickwork level had not reached the sill level of the upper windows. Window frames L13 through L15 had been bricked up to near the elevation of the high-tension-floor elevation. **Figure 142**, titled **High-Tension-Floor Area and Roofing**, documents these construction efforts.

2.1.5.3.8 August 1910

Between 7/25/1910 and 8/8/1910, in the Powerhouse area, additional pours and form-ups had occurred at Intake Monolith 2 and Intake Monolith 4. By 8/8/1910, Intake Monolith 4 had the highest construction elevation of any of the Intake Monoliths 2 through 4. Intake Monolith 2 had the next highest construction elevation, while Intake Monolith 3 had the lowest construction elevation.

By 8/8/1910, on the downstream face of the Powerhouse, the brick work for window frames L9 through L15 had been extended vertically upward to the bottom sill elevation of the upper window frames. Brick masons had set all the stone sills for window frames from U9 to U15. Upper window frames U5 through U9 had been set and the brick work had been extended vertically upward to approximately 1/3 of the height of the window frames. Also by 8/8/1910, construction forces had poured roughly one half of the Powerhouse roof slab area. **Figure 143**, titled **Powerhouse Construction Progress as of 8/8/1910**, documents this construction progress.

The roof slabs were constructed by first laying a wire fabric mesh over the forms. The concrete was apparently hand mixed and hand placed (presumably due to the modest thickness of the slab), into the prepared formwork. Also at the roof level, construction personnel had erected the stairwell roof access structure. **Figure 144**, titled **Details of Powerhouse Roof Construction**, documents some of the abovementioned activities.

While work was occurring in the Powerhouse area, other members of the construction forces were working on the East Earth Embankment. They were placing rip-rap on the upstream face of the embankment. As of 8/8/1910, it is approximated that they had the northernmost 1/3 of the upstream face covered.

Between 6/28/1910 and 8/8/1910, in the Spillway Area, Spillway Monoliths 1 and 2 appeared to have reached their design elevation and their forms had been stripped off. Spillway Monolith 3 had received multiple form ups and pours and its construction elevation was approximately equal to Spillway Monolith 5. The construction elevation of Spillway Monolith 6 was just slightly below that of Spillway Monolith 5. From the available data, it is not possible to conclusively state whether any foundation pours had yet been made for Spillway Monolith 4. **Figure 145**, titled **Spillway Area Construction Progress as of 8/8/1910**, documents the construction progress made on these monoliths.

By 8/15/1910, in the Powerhouse area, Intake Monoliths 2 and 4 had been formed up to their final design elevation. Intake Monolith 3 had a construction elevation below that of Intake Monoliths 1, 2, and 4, and Intake Monolith 5 had the lowest construction elevation. Construction personnel had also installed horizontal support steel members for the trash racks in the intakes for Units 1 through 4 as well as for the two exciters. **Figure 146**, titled **Upstream View of Intake Structure as of 8/15/1910**, documents these construction activities.

On 8/15/1910, other members of the construction forces were continuing to rip rap the upstream face of the East Earth Embankment. As had occurred during the construction of the earth portion of the embankment, the rip rap design slope was achieved through the use of slope guides. The slope guides were long straight members attached to stakes driven into the embankment surface and it appears that the height of the attachment of the straight member to the support stakes helped maintain the required depth of the rip rap. **Figure 147**, titled **East Embankment Upstream Slope Rip Rapping**, shows this construction technique.

By 8/19/1910, in the Powerhouse, the main operating floor area had been sufficiently protected from the elements such that the installation of electrical equipment and controls could start in the vicinity of the operator's platform. This included the erection of the instrument rack. **Figure 148**, titled **Operators' Platform as of 8/19/1910**, documents these work efforts.

By 8/20/1910, in the Powerhouse area, Intake Monolith 4 had its forms stripped off from the downstream face. Additional forming and pouring had occurred at both Intake Monolith 3 and Intake Monolith 5.

Between 8/8/1910 and 8/20/1910, the brick masons had continued their work on the exterior of the powerhouse. By 8/20/1910, they had bricked in all the upper window frames U1 through U15 at least up to the bottom of the arch section of the frames. Window frames U13 through U15 had been bricked in to just below the bottom of the downstream east-to-west roof truss.

By 8/29/1910, in the Powerhouse, Intake Monolith 3 had been formed up to its design elevation. Intake Monolith 5 had received additional form up and pours but its construction elevation was not at its design elevation. The eastern part of the West Nonoverflow structure had also received additional form ups and pours and its construction elevation was approximately the same as the construction elevation for Intake Monolith 5. **Figure 149**, titled **Powerhouse Construction as of 8/29/1910**, documents these conditions.

Also, by 8/29/1910, it appears that the rip rapping of the upstream face of the East Embankment was, if not completed, then very near completion. **Figure 150**, titled **East Embankment Rip Rapping as of 8/29/1910**, documents this construction progress.

By 8/31/1910, the Niles overhead gantry crane had been installed in the Powerhouse. This was a Niles, standard, hand-powered, traveling crane. It was bought from the Niles-Bement-Pond Company for $1,100.00. Not only had the crane been installed, but it was put into service. By 8/31/1910, the main operating floor was littered with generator parts and equipment and the station's generators were being assembled/erected.

What is not totally apparent is the construction sequence for the erection/assembly of the turbine/generator units. It is assumed that turbine components of the turbine/generators were erected first. By so doing, after installation of the turbine components, a maximized assembly space on the main operating floor of the Powerhouse would be available for assembly of the generators. Were the generators and their associated equipment to be installed before the turbine components, this would have resulted in much less free space on the main operating floor for the assembly of the turbine components. Additionally, it would have required that the turbine components be raised and manipulated over the generator components, as the turbine elements were upstream of the generator elements.

From the available data sources, it appears that by 8/31/1910, most of the main generator components were on site and being erected in the Powerhouse. **Figure 151**, titled **Powerhouse Generator Erection**, shows the construction progress on assembling the four initial generators at the station.

2.1.5.3.9 September 1910

Between 8/8/1910 and 9/4/1910, in the Spillway area, additional form up, pours, and stripping had occurred in the vicinity of Spillway Monoliths 1 through 6. Spillway Monoliths 1 through 5 appeared to be at their design elevations. Form work was still present on the downstream face of the Spillway in the vicinity of Spillway Monoliths 3, 5, and 6. At the East Earth Embankment, the downstream slope appeared to have been mostly rip rapped. **Figure 152**, titled **Spillway and East Earth Embankment Construction as of 9/4/1910**, shows this construction progress.

Between 8/20/1910 and 9/4/1910, the brick masons had finished the brickwork on the exterior of the downstream wall of the Powerhouse. All the upper story window frames had been bricked in. Additional upstream-to-downstream roof steel had been placed in the vicinity of Unit 4. Construction was occurring on the cornice of the downstream wall of the Powerhouse in the vicinity of Unit 1 and Unit 2.

By 9/4/1910, in the Powerhouse area, Intake Monoliths 1 through 4 were at their design elevation and the forms had been stripped off of the downstream face of the monoliths. Intake Monolith 5 was not at its design elevation and still had some formwork on the downstream face. **Figure 153**, titled **Powerhouse Construction as of 9/4/1910**, documents the abovementioned construction activities.

By 9/10/1910, work on the Powerhouse roof consisted of forming up the roof slab area in the vicinity of Units 5 and 6. The entire cornice on the downstream wall of the powerhouse had been formed. The cornice had also been formed up on the west wall of the Powerhouse. At the same time, in the Spillway area, construction forces had formed up and made initial foundation pours in Spillway Monolith 15. **Figure 154**, titled **Powerhouse and Spillway Monolith 15 as of 9/10/1910**, shows these work efforts.

As was the case for many of the other mass-concrete structures at the station, no information has been found regarding the designations of any of the West Nonoverflow Monoliths. A drawing was found in the files which indicated that the total length of the West Nonoverflow was approximately 143.0 feet, measured east-to-west, along the main axis of the project structures. One of the design drawings for the West Nonoverflow indicates that there were three separate monoliths which measured 40 feet each, east-to-west. These monoliths extended from a retaining wall complex on the west abutment, in an eastward direction along the abutment, and towards the Powerhouse. But the design drawing indicated that the last of the three monoliths did not abut upon the Powerhouse in the vicinity of Intake Monolith 5. An excerpt from the design drawing is presented as **Figure 155**, titled **West Nonoverflow Monoliths**. For ease of discussion the West Nonoverflow Monoliths have been arbitrarily consecutively numbered with West Nonoverflow Monolith 1 bring on the east side of the West Nonoverflow and abutting Intake Monolith 5, and West Nonoverflow Monolith 4 being on the west side of the West Nonoverflow and abutting the West Retaining Wall Complex. In the figure, the top part of the figure presents an elevation view looking upstream at the downstream faces of the West Nonoverflow Monoliths. The bottom part of the figure is a plan view of the West Nonoverflow Monoliths.

By 9/10/1910, the West Nonoverflow Monolith 1 had a construction elevation which was roughly equal to that of Intake Monolith 5. Both of these structures were not yet at their design elevation. Construction personnel had started forming up and pouring foundation pours for some portions of the eastern side of West Nonoverflow Monolith 2.

Between 9/10/1910 and 9/17/1910, construction personnel had done additional form up and pours on portions of the eastern area of West Nonoverflow Monolith 2. This increased the construction elevation of this section of the monolith such that it was somewhat higher than the elevation of the high-tension-floor elevation. Also by 9/17/1910, construction personnel had apparently completed the roof pours on the Powerhouse roof. They had also started erection of the first of a series of transmission line tower frames on the roof of the Powerhouse.

While much has been made of the construction efforts on-site at the station, it is important to realize that there were other off-site construction efforts which were occurring. Without the completion of these off-site construction efforts, the Lloyd Shoals station would not be viable. What is known from the original construction photographs is that transmission line construction was occurring off-site as of 1/11/1910.

As mentioned previously, in 1910, a twenty-year contract was entered into between the Central Georgia Power Company and the Macon Railway & Light Company. The output from the Lloyd Shoals station would be primarily directed to the electrical energy needs of Macon's rail system. Given the interdependence of the two companies (not to mention some of their mutually shared upper management personnel), it would be reasonable to assume that one of the first substations to be built would probably be located in Macon, Georgia. A Mr. T. R. Rossi, who had been connected with the Northern Colorado Power Company, was put in charge of the erection of the Macon Substation. The substation was estimated to cost $50,000.

At that time the surrounding substations were practically the same design. The major difference in the stations reflected the arrangement of the equipment installed in each. The substations appear to have been constructed in a generally similar manner as the Powerhouse of the generating station. That is, the lower sections were typically of a concrete construction, while the exterior walls were of brick. From the outside, one side of the buildings would appear to have exterior brickwork walls approximately 2 stories tall, in that there were two levels of windows. However, in reality, there was only a main operating floor and a basement level. This basement level extended only half way across the building. The roof was composed of timber with a tar and gravel covering and the roof structure was supported on light steel trusses. **Figure 156**, titled **Substation Building Cross Section**, shows the general layout of a substation building.

By 9/24/1910, at least one substation building had been erected and so electrical equipment installation could begin. **Figure 157**, titled **Substation Transformer Installation**, is an original construction photograph dated 9/24/1910. Unfortunately, while the photograph has been dated, there is no indication of the location where the photograph was taken. It is likely that the transformer is being installed in the Macon Substation, given the importance of the 1910 relationship between the Central Georgia Power Company and the Macon Railway & Light Company.

By 9/26/1910, at the Powerhouse roof, construction personnel had erected three transformer towers. They had also installed two sets of Westinghouse electrolytic lightning arrestors, one for each feeder line. At the West Nonoverflow, successive form ups and pours had occurred in the eastern sections of West Nonoverflow Monolith 2. The construction elevation of West Nonoverflow Monolith 2 was now somewhat above the elevation of the Powerhouse roof elevation. However, the construction elevation of West Nonoverflow Monolith 2 was still below the construction elevation of West Nonoverflow Monolith 1. **Figure 158**, titled **Powerhouse and West Nonoverflow Construction Progress as of 9/26/1910**, shows these construction efforts.

By 9/26/1910, in the Spillway area, construction forces had been making additional pours and form ups in Spillway Monolith 15. At this time, the construction elevation for Spillway Monolith 15 was approximately one-quarter of its final design elevation. **Figure 159**, titled **Spillway Monolith 15 Construction Progress as of 9/26/1910**, documents this work effort.

2.1.5.3.10 October 1910

Between 9/26/1910 and 10/1/1910, in the Spillway area, construction personnel continued the pours and form up work on Spillway Monolith 15. The construction elevation of the monolith as of 10/1/1910 was somewhat slightly less than half its final design elevation. **Figure 160**, titled **Spillway Monolith 15 Construction Progress as of 10/1/1910**, shows the progress of construction.

It is likely that the construction forces were doing demolition and cleanup at the upstream face of the spillway monoliths concurrently. **Figure 161**, titled **Upstream Cleanup**, shows a power crane with an orange peel bucket and a tracked dump car. Based on the forms and keyways in Spillway Monolith 15 the **Figure 161** photograph is likely contemporaneous with **Figure 160**.

Between 9/26/1910 and 10/10/1910, notable construction progress had been made in the area of the West Nonoverflow. At the foot of West Nonoverflow Monolith 1, west of the west wall of the Powerhouse, and abutting onto the west wall of the Powerhouse, was located an Administration Building. By 10/10/1910, almost two stories of this building had been erected. On the first floor, at the south wall of this structure, the south wall brickwork had been established such that the two windows and the doorway had been bricked in. On the second story, on the downstream wall, three of the window frames had been bricked in up to the top of the window frames. On the west wall of the structure, the window frame in the south west corner had been partially bricked in.

Regarding the West Nonoverflow structures themselves, between 9/26/1910 and 10/10/1910, pours and form ups had occurred on West Nonoverflow Monolith 2. By 10/10/1910, the construction elevation of this West Nonoverflow monolith was equal to that of West Nonoverflow Monolith 1. The gap between West Nonoverflow Monolith 1 and 2 remained, so as to allow free passage of a construction railroad line. West Nonoverflow Monolith 3 had received foundation pours. Subsequent pours and form ups had raised its construction elevation such that it was noticeably above the elevation of the Powerhouse roof, albeit at a construction elevation below the construction elevation of West Nonoverflow Monolith 2. **Figure 162**, titled **West Nonoverflow Construction Progress as of 10/10/1910**, documents these construction progresses.

Also, over the period of 9/26/1910 to 10/10/1910, in the Spillway area, construction forces had been at work. Form ups and pours had continued at Spillway Monolith 15. By 10/10/1910, the construction elevation of this spillway monolith was at or just slightly above being halfway to its final design elevation. **Figure 163**, titled **Spillway Monolith 15 Construction Progress as of 10/10/1910**, shows the increase in this spillway monolith's construction elevation.

From a mechanical installation standpoint, by 10/10/1910, many, if not all, of the headgate operating mechanisms had been placed on the upstream area of the Intake Section. Erection and final installation of the mechanical components was in progress. This would include the headgate operators for the exciter units. **Figure 164**, titled, **Headgate Operators Installation**, documents the placement of these mechanical devices.

Between 10/10/1910 and 10/31/1910, construction in the Spillway area had reached a major milestone. Pouring and form up at Spillway Monolith 15 had proceeded such that this spillway monolith was now at its design elevation and the forms had been stripped from its downstream face. Foundation pours and subsequent form ups and pours had occurred at Spillway Monolith 7. This spillway monolith still had forms set on its downstream face, but these forms seemed to be either at, or very close to, the design elevation for this spillway monolith. The form ups and pouring at Spillway Monolith 7 resulted in the closure of the construction railroad line between the East Side Quarry Area and the East Batch Plant. Were the East Batch Plant to provide concrete to the job site, it would have to rely on either stone stockpiles located downstream of the Spillway, or on stone transported from the west side of the job site. **Figure 165**, titled **Spillway Construction Progress as of 10/31/1910**, documents these construction activities.

Also, by 10/31/1910, at the West Nonoverflow area, construction personnel had completed erecting the second story brick walls at the Administration Building. They had also poured the roof slab which tied into the high-tension-floor in the Powerhouse. They also appeared to be stockpiling materials for the final construction effort on the Powerhouse roof. The roof top consisted of a five-ply tar and gravel system.

At the same time, construction personnel had formed up both Intake Monolith 5 and West Nonoverflow Monolith 1 to near their final design elevations. The slot for the upstream-to-downstream construction rail line between West Nonoverflow Monolith 1 and West Nonoverflow Monolith 2, had received foundation pours and subsequent form ups and pours. This slot was now at a construction elevation just below that of West Nonoverflow Monolith 1. The remaining sections of West Monolith 2 had been formed and poured up to its design elevation with the forms being stripped off the downstream face of the monolith. With the effective sealing of the upstream-to-downstream construction rail line at the West Nonoverflow, this essentially precluded any movement of rail-carried supplies from the downstream to the upstream areas. However, in contrast to the conditions on the east abutment, since the West Batch Plant was located upstream of the West Nonoverflow, rock for concreting operations could still be brought to this batch plant from the West Quarry area. **Figure 166**, titled **Powerhouse and West Nonoverflow Construction Progress as of 10/31/1910**, shows the above-mentioned construction activities.

<u>2.1.5.3.11 November 1910</u>

From the original construction photographs which have been reviewed to date, there appears to be only one original construction photograph which can be tied to a definite date in November 1910. It is dated 11/12/1910.

By 11/12/1910, construction personnel were working in the tailrace area, apparently clearing out rock debris. Construction rail lines had been established not only on the second cofferdam structures but also extending toward the southeast across the river. Given this, construction personnel had essentially created a second downstream bridge connection between the two sides of the river. **Figure 167**, titled **Tailrace Construction Work**, documents these construction efforts.

While only one original construction photograph has been tied to a date in November 1910, work was likely continuing in the West Nonoverflow area, west of the Administration Building. An undated photograph shows that the Administration Building now had its windows and door installed. Additionally, the area west of the Administration Building had been formed up. The form up work including extending the roof of the Administration Building westward toward the West Abutment. **Figure 168**, titled **Administration Building Area Construction**, shows these work activities.

2.1.5.3.12 December 1910

Sometime between 10/31/1910 and 12/11/1910, the four temporary sluiceways were taken out of service and backfilled with concrete. Backfilling of the four temporary sluiceways marked the end of mass concrete placement operations at the site. **Figure 169**, titled **Last Concrete Pour**, documents the backfilling of the last of the sluiceways. The photograph is captioned "The Last Bucket of Concrete". Unfortunately, to date, it has not been possible to assign a specific date to this photograph. With the concreting of the four temporary sluiceways, water level control was being primarily maintained by the operation of the two permanent sluiceways.

Also by 12/11/1910, it appears that the entire West Retaining Wall Complex had been built to its final design elevation. All portions of the West Nonoverflow were also at their final design elevation. Intake Monolith 5 was also at its final design elevation. The forms had been stripped from all of these structures. **Figure 170**, titled **Sluiceways and West Side Structures as of 12/11/1910**, shows the construction progress on these structures. The figure also shows that there was a guyed-wire derrick still erected on the crest of the dam in the vicinity of the sluiceways as of 12/11/1910.

While the external civil work may have been wrapping up by 12/11/1910, work was progressing in the interior of the Powerhouse with erection and installation of the electrical and mechanical equipment. **Figure 171**, titled **Operator's Platform as of 12/11/1910**, shows the progress on installing meters and switches at the back of the elevated operator's platform. **Figure 172**, titled **Powerhouse Main Operating Floor**, indicates the progress made in erecting the turbines and generators, including the exciter units. Unfortunately, to date, no definitive date can be assigned to this photograph. It is believed to be roughly contemporaneous to **Figure 171** because the packing crate and inclined working surface on the operator's platform, appear in both of the construction photographs in roughly the same places. From this original construction photograph, it is surmised that Units 1 through 3 and both exciter units had their hydraulic turbines connected to their respective generator units.

2.1.6 1911

2.1.6.1 Overview

In 1911, the Central Georgia Transmission Company was organized. It was to act as a selling and carrying concern of part of the power generated by the Central the Central Georgia Power Company.

On 1/19/1911 it was announced that Mr. C. H. Broward was retained as superintendent of the Lloyd Shoals station and Mr. J. J. Cagney as the general manager of the Central Georgia Power Company. Mr. Broward had been connected with the Southern Power Company and had supervision of two of its large hydroelectric developments.

On 9/18/1911, the Georgia Light, Power and Railway Company was formed under the laws of Massachusetts. It was formed to acquire securities of a number of companies, including the Central Georgia Power Company and the Central Georgia Transmission Company. It also was formed to acquire the securities of other companies owning or operating public utilities, power plants, or transmission lines in the State of Georgia.

2.1.6.2 1911 Land Acquisitions

In 1911, land acquisition continued.

2.1.6.3 1911 Construction Activities

2.1.6.3.1 January 1911

On 12/11/1910 when the reservoir elevation was being controlled only by the two permanent sluices, to date, no data has been found in the records stating what the actual reservoir elevation was. If inflows were greater than the discharge capacity of the two permanent sluiceways, the reservoir elevation would rise even with the sluiceways fully opened. Conversely, were inflows to the reservoir to be less than or equal to the capacity of the two permanent sluiceways, the reservoir elevation could be: 1) allowed to rise (by closing the sluiceways), 2) held constant (by opening the sluiceway such that inflow matched outflow, or 3) allowed to fall (by maintaining the sluiceways fully open). What is known is that by 1/2/1911, the reservoir had filled to where its elevation was just below the top of the exciter intake openings. **Figure 173**, titled **Reservoir Elevation as of 1/2/1911**, shows this level. The figure also indicates that the guyed-wire derrick which had been erected on the crest of the dam in the vicinity of the sluiceways as of 12/11/1910 had now been removed. An undated original construction photograph was found in the archives and is presented as **Figure 174**, titled **Spillway Crest Conditions**. This shows the condition of much of the crest of the dam and some of the upstream portions of the East Abutment Training/Retaining Wall area.

It is likely that the panoramic photograph presented as **Figure 175**, titled **Downstream Panorama** was probably taken in late December of 1910 or early in January of 1911because the guyed-wire derrick discussed above was present in the field on 12/11/1910, but was absent by 1/2/1911.

Because the panorama shot is covering so much territory, excerpts from the photograph have been made to document the construction changes which had occurred. The first excerpt is **Figure 176**, titled **Powerhouse Tailrace Area**. In this figure, it appears that the second cofferdam, downstream east-west leg, which was present in 11/12/1910, as well as its overtopping rail line, had been demolished. It appears to have been replaced by a bridge work composed, at least partly, of logs. The actual decking material is not known.

From the evidence in the figure, it is concluded that this is a ‘pedestrian bridge’ i.e. one that would allow workers from the East Work Camp access to the ongoing work in the Powerhouse on the west bank of the river. This figure also shows the most upstream reach of the second cofferdam upstream-downstream segment. This structure carries through this figure and subsequent figures.

The second excerpt from the figure is **Figure 177**, titled **Downstream Middle Spillway Area**, is an extract of conditions just to the east of the Powerhouse. The overlap in the panorama shot is evidenced by a nearly vertical white separation line. What is seen from this figure appears to be the westernmost extent of the southeast construction rail line across the river which had been established by 11/12/1910. The figure also shows the continuation of the second cofferdam, upstream-downstream leg.

The third and final excerpt from the figure is **Figure 178**, titled **East Abutment Area**. This shows the southeast construction rail line which had been established by 11/12/1910 tying into the east side of the river. The further downstream continuation of the second cofferdam, upstream-downstream leg is present at the very bottom of the figure. What is also notable in this figure is the East Batch Plant has been demolished.

In January of 1911, construction personnel were still working on the transmission system both on-site and off-site. On-site, the work was proceeding both inside the Powerhouse and on the roof. It is likely the roof work was associated with erecting the west transmission tower complex. **Figure 179**, titled **West Transmission Tower Complex**, appears to show construction activity at this location and reflects a reservoir level similar to **Figure 174**.

Inside the Powerhouse, installation of step up transformers and associated equipment was occurring on the high-tension-floor. The following description of the energy flow from the generators to, and through, installed equipment on the high-tension-floor area was available in historical archives:

> ". . . . With the four generators installed the output of the station is at present 12,000 kilowatt, the energy being generated at the machines as three phase, 60 cycles at 2,300 volts. This voltage is stepped up to 66,000 for transmission.
>
> At present the high-tension transforming equipment consists of four 3,000 K.V.A, 2,300/66,000-volt, 60 cycle, 3-phase Westinghouse transformers, oil insulated and water cooled, equipped with electric thermostat control; the cooling water pipes being equipped with tell-tale indicators. These transformers are star connected with neutral grounded. The switches are of the remote-control type, provided with condenser type terminals on all of the 66,000-volt sizes. All generator, transformer and line switches are provided with overload time relays designed to open the circuit automatically in case of any trouble.
>
> Another feature of interest in connection with this apparatus is the method of treating the oil for transformers and switches. The oil is drawn from the apparatus through a filter of several layers of fine cloth, and then into a closed tank containing a steam coil of seamless tubing. The oil is boiled under a vacuum and the moisture removed by a pump until all traces are eliminated. This is determined by breakdown tests made with a special high voltage testing transformer. The oil is then returned to the particular apparatus from which it was drawn through a system of piping.

> . . . Above the switchboard are located the three 2,300 volts busses. These run lengthwise of the station directly underneath 6-3000, KVA 60-cycle, 3-phase, 2,300/66,000-volt transformers on the floor above. A transfer truck runs the length of the station on the second floor for shifting transformers, with a chain hoist for lifting out the cores. From each generator the leads run in ducts under the main floor to the upstream side of the power house, then up back of the switchboard to the busses. The generator switches, bus and transformer switches are all located on the top floor in line with the transformers, all switches being remote controlled from the switchboard. . . . [T]he path of the current is from a generator through the leads, to the generator switch, to the bus switch, to the bus bars, to the transformer switch, to the transformer, to the outgoing feeder oil switch with connections to the current transformers, to the outgoing three-wire feeders. A choke coil is connected on the outer side of each transformer switch. . . . "

Figure 180, titled **Powerhouse Transmission Equipment Layout**, provides a visual representation of some of the above equipment. **Figure 181**, titled **High-Tension-Floor 2,300/66,000 Volt Transformer, Piping, and Electrical Lines**, shows three of the 2,300/66,000-volt transformers and associated equipment in the high-tension-floor area of the Powerhouse.

2.1.6.3.2 February 1911

In February of 1911, the transmission line into Macon was completed.

On 2/23/1911, Unit 1 had its initial start-up. Unit 2's start-up was on the same day, indicating that the station was fully operational; the reservoir had filled sufficiently to provide motive power to the turbines, the turbines with their regulating mechanisms were functioning and coupled to the generators, the generators and associated controls functioned to develop an electrical output of 2,300 volts, and the step-up transformers and power systems in the Powerhouse boosted the generator output to the transmission voltage.

By the time Unit 1 and Unit 2 went online, the Central Georgia Power Company had already sold commitments to supply upwards of 10,000 horsepower of electricity to end-use customers.

2.1.6.3.3 March 1911

On 3/25/1911, Unit 3 had its initial start-up. On 3/31/1911, Unit 4 had its initial start-up.

There are a number of original construction photographs to which a date has not been conclusively assigned but they likely represent either: 1) the configuration of the station at the transition from original construction, to initial in-service operations, or 2) the early in-service operational phase. Some of these photographs, as well as pictures from reasonably contemporary sources are discussed below.

Figure 182, titled **Headworks Area**, shows the headworks with the machinery for the headgates for Units 1 through 4 and the exciters installed and in service. **Figure 183**, titled **Powerhouse Interior Viewed Looking West**, shows the interior of the Powerhouse with all four of the units and the exciter units installed. From the blur of the generator rotor on Unit 2, this unit is generating. The same may be true of Unit 3, for the same reason. The generating status of Units 1 and 4 is not known based on the data in the photograph. **Figure 184**, titled **Powerhouse Interior Viewed Looking East**, shows the main operating floor from a different perspective. In this photograph, Unit 4 is installed but apparently is not generating.

Figure 185, titled **Desk Switchboard and Instrument Rack**, shows the operator's switchboard and associated operating instruments. **Figure 186**, titled **Desk Switchboard Detail**, provides a closer view of the controls on top of the switchboard. The following describes the switchboard and associated equipment:

> "The main switch board is of the bench type control equipped with a complete set of dummy busbars installed on the top of the control bench, enabling the operator to tell at a glance the connections that have been made by the operation of the electrically operated switches. This board was designed for the control of the four 3,000-kilovolt-ampere, three phase generators and transformers with provision for two spare units of each, and the two 18,000-kilovolt-ampere, 66,000-volt feeder circuits.
>
> The top of the bench board is composed of slate slabs with the sides, front, and rear of steel plate in the form of removable panels, so arranged as to provide ready access to the interior of the desk for purposes of inspection and adjustment.
>
> All of the circuit-breakers in the station are electrically operated (except the one on the station-lighting panel) and are operated from the control bench by drum-type controllers mounted thereon. The operating handle and dial plate are on the top, while the controllers themselves are mounted inside, so that there is no possibility of the operator coming in contact with even the 250-volt operating circuits. All of the instruments and synchronizing equipments are operated from current and voltage transformers so the operator has no chance of making contact with any live circuits.
>
> Each circuit-breaker controller is provided with two indicating lamps, one red to show the breaker closed and one green to show the breaker open. The red lamps are connected in the miniature bus system in such a manner that the attendant can tell the actual connections that have been made by the oil circuit-breakers.
>
> For the purpose of showing the position of the disconnecting switches two miniature ten-volt lamps are connected in series, one being mounted on the control bench and connected in the mimic bus and the other mounted near the disconnecting switches. These lamps are fed from the ten-volt secondary of a small transformer and the lamp near the switch has connected in parallel with it a snap switch. When the attendant opens the switches, he turns the snap switch, thus short-circuiting the lamp and causing the lamp in the mimic bus with which it is connected in series, to burn at full candlepower, which notifies the operator that the disconnecting switches are open.
>
> A complete set of synchronizing plugs and receptacles are included in the generator sections. The closing circuits of the oil circuit-breakers are so wired that the breakers cannot be closed unless the synchronizing plugs are in their receptacles.

> A full complement of indicating instruments of the vertical edgewise type is included in the equipment. The instruments are mounted on a framework back of the control bench in such a manner that the operator will face the generator room when standing in front of the desk and can look above the top of the bench and underneath the instrument frame to observe the operation of the machines. Watt-hour meters are installed on the rear of the control bench."

Figure 187, titled **Turbine Downstream Headcover Area**, shows the downstream area of one of the turbine units along with the governor machinery. **Figure 188**, titled **High-Tension-Floor Area**, shows the high-tension-floor area. In the picture, the total step-up equipment for Units 1 through 4 is installed. Portions of the equipment for future Units 5 and 6 has also been installed, but the main step-up transformers are not installed. **Figure 189**, titled **East Transmission Tower**, shows the East Transmission Tower on the roof of the Powerhouse.

In addition to the photographs described above, there were also some photographs apparently taken during at least one high-water event. **Figure 190**, titled **Powerhouse and Spillway Downstream Areas**, shows the area downstream of these structures in a high-water event (discharges occurring over the Spillway). Because a number of changes had occurred in this area, excerpts from the photograph were taken to highlight noticeable changes.

Figure 191, titled **Southeast Construction Rail Line**, highlights the area where this rail line was located. What this figure appears to show, in addition to the Spillway discharges, are the remains of the southeast construction rail line which had been established by 11/12/1910, and which was still believed to be in service in late December 1910 to early January 1911 time period as noted before from an undated construction photograph. Whether the southeast construction rail line was demolished by construction forces, by spillway discharges, or a combination of the two is not known. But what can be determined from the photograph is that the line is clearly degraded to an extent it probably was out of service.

Figure 192, titled **Pedestrian Bridge**, documents that the pedestrian bridge which had linked the west side of the river to the upstream-downstream leg of the second cofferdam had been removed. The only hint of the bridge is near the upstream-downstream leg of the second cofferdam. At this point, there appears to be a log in the water. The log is running east to west which may indicate it was part of the pedestrian bridge.

Figure 193, titled **Second Cofferdam Upstream-Downstream Leg**, documents that the upstream-downstream leg of the second cofferdam was still present in the field. However, it appears from the photograph that the upstream-downstream leg has been breached in the vicinity of the southeast corner of the Powerhouse. It appears that spillway discharges are partially flowing through the breach and into the tailrace area. A second original construction photograph was found in the archives which provides some additional information on the breach area. **Figure 194**, titled **Second Cofferdam Upstream-Downstream Leg Breach Area**, documents this.

At the end of the original construction efforts, the spillway was free crested. There was no discharge control other than the elevation of the various spillway sections. **Figure 195**, titled **Spillway Crest and Debris**, shows an event where the reservoir water surface elevation, probably as a result of a freshet, rose above the design elevation of elevation 525 in the area of Spillway Monoliths 6 through 15. **Figure**

196, titled **Completed Spillway Crest**, shows an overview of the Spillway crest as the reservoir was filling. No major items were on the crest which would have impeded flood flows.

However, it appears from a review of the design drawings that provision had been made for the installation of flashboards on the Spillway crest, as least as far back as 10/28/1909. The provisions consisted of installing pipe sockets in the crest. For Spillway sections at elevation 528, these sockets were to consist of 1 ½ standard pipe, 12 inches long, spaced 4 feet 0 inches center to center. For Spillway sections at elevation 525, these sockets were to consist of 3-inch standard pipe, 2 feet 0 inches long, spaced 2 feet 0 inches center to center. Yet in looking at the above-mentioned figures, there is no indication of any such socket pipes.

The sockets were most likely installed in the field but were likely concreted over. This would give the spillway crest its smooth appearance, but still allow the sockets to be easily excavated in the future, should that need arise.

The following table presents information on the quantity of materials which were used to construct the station in 1911.

Structure	**Item**	**Quantity**
Powerhouse	Structural Steel Frame	326,000 lbs.
	Brick Walls	11,906 sq. ft.
Operators Village	Five-room Dwelling	3
	Six-room Dwelling	4
Dam	Excavation	12,300 cu. yd.
	Concrete	158,000 cu. yd.
	Earth/Rock Fill	17,700 cu. yd..
	Riprap	1,200 cu. yd.
Reservoir	Area at Full Pool	4,850 ac
	Cleared Area	2,500 ac

2.2 Full Station Development Period 1912 to 1916

2.2.1 1912

2.2.1.1 Overview

A review of the archives for direct construction activities at Lloyd Shoals between of 3/31/1911 (the startup of Unit 4) and 2/22/1912, has not provided any information. However, by 2/22/1912, the transmission lines of the Central Georgia Power Company consisted partially of double circuit tower pin type and partly of single circuit tower pin type lines. These lines were equivalent to of 163 miles of single circuit lines. The company also had a 15-mile-long pole line from Forsyth to Barnesville.

By the same date, the Central Georgia Transmission Company was before the Georgia State Railroad Commission for permission to issue $2,000,000 in common stock and $2,500,000 in bonds to build a transmission line from Griffin to Atlanta so as to be able to sell the power from the Lloyd Shoals station. The transmission line would be 33 miles long from Griffin to Atlanta and some work had already started. The line would consist of a 9,000 KW substation at Atlanta, with two others at Hampton and Jonesboro.

In September of 1912, the Central Georgia Transmission Company completed construction of the 33-mile transmission line and the substations at Atlanta, Hampton, and Jonesboro.

Based on the above information it is concluded that while the Lloyd Shoals station was producing power, the Central Georgia Power Company was now focused on expanding its electrical service area and its customer base. Having said that, it would appear, based on information in the following sections of this report, that the power company was also contemplating making some changes to the Lloyd Shoals station. The changes involved raising the level of the reservoir. As has been previously mentioned, the Spillway section's configuration in 1911 had a center section 420 feet long at an elevation of elevation 525. It appears, again from information which follows, that there was an idea to put 3-foot-high flashboards in the section. This would have effectively raised the reservoir elevation to elevation 528 which was the elevation of the other sections of the Spillway Section. But this potential change in the reservoir elevation would potentially back water up on additional lands in the reservoir.

As of 12/31/1912, the Central Georgia Power Company had gross revenues of $234,357, operating expenses and taxes of $62,342, bond interest charges of $116,667, for a balance of $55,348.

2.2.1.2 1912 Land Acquisitions

Land acquisition began again in 1912.

2.2.2 1913

By 1/23/1913, the Central Georgia Power Company had developed the design for a flashboard system to be installed on the crest of the Spillway Section. The flashboards were designed to be installed in the 420-foot-long center segment of the Spillway Section whose crest elevation was at elevation 525. The structural support system consisted of a series of vertical and horizontal standard pipe sections which were threaded and joined together by pipe tees.

The vertical pipe sections were set 2 feet 0 inches on center across the horizontal length of this portion of the Spillway Section. The vertical pipe sections were 2 ½ inch diameter pipe, 2 feet 10 11/16 inch-long which were sleeved into 3-inch diameter pipes in the crest of the Spillway Section. These 3-inch pipes had been installed during the original construction. The vertical pipe sections extended from the spillway elevation of 525, in the 3-inch diameter pipes, vertically downward a distance of 2 feet 0 inches.

The horizontal pipe sections were made of 2 ½ inch diameter standard pipe which was threaded and fitted to measure 2 feet 0 inches center to center of the tees. They had their centerline 12 ½ inches above elevation 525.

The actual flashboards were made out of wood. Because of the installation of a 2-inch-high wooden seat running the 420 feet of the Spillway Section just upstream of the vertical pipe support members, the boards had an effective height of 3 feet. A U-bolt was used to connect them to a 3-inch diameter standard pipe section 2 ½ inches long. This 3-inch diameter pipe section was located between the vertical pipe supports and could rotate freely about the 2 ½ inch diameter horizontal pipe sections. The flashboards were to be constructed in 10-foot-long segments.

By 2/4/1913, the details of the flashboards had been determined. The interesting point of the flashboard design was that the flashboards were to act automatically. When the reservoir elevation reached the design trip point elevation, the boards would rotate about the structural support structure to increase the spillway discharges. As the reservoir elevation decreased, the boards would rotate back, ultimately becoming vertical again, and essentially automatically resetting themselves. The 10-foot-long flashboard assemblies were counterweighted with a total of 170 pounds of cast iron weights having a lever arm of 9 ½ inches from the axis of rotation.

In the archives, an undated photograph was found which appears to show the installation of the above-mentioned flashboards. **Figure 197**, titled **Three Foot Flashboard Installation**, presents an extract from the photograph. From the photograph, it appears that the structural support mechanisms had been installed across the entire 420-foot section of the spillway and erection of some of the actual flashboards was in progress.

By August of 1913, the Central Georgia Power Company was going to install three transformers in the Macon Substation. This would increase the substation's capacity from 6,000 to 12,000 horsepower.

As of 12/31/1913, the Central Georgia Power Company had gross revenues of $331,026, operating expenses and taxes of $89,711, bond interest charges of $150,000, for a balance of $91,315.

2.2.3 1914

On 2/1/194, the Central Georgia Power Company leased the property of the Central Georgia Transmission Company. It assumed payment of all taxes and fixed charges of that company.

By 5/30/1914, the Central Georgia Power Company had 154 miles of transmission lines in service.

As of 12/31/1914, the Central Georgia Power Company had gross revenues of $359,021, operating expenses and taxes of $121,126, bond interest charges of $167,370, for a balance of $70,425.

2.2.4 1915

By January 1915, the Georgia Light, Power and Railway Company controlled all but $340,000 of the $4,000,000 capital stock of the Central Georgia Power Company. It also had the entire capital stock of the Central Georgia Transmission Company.

As of 12/31/1915, the Central Georgia Power Company had gross revenues of $355,577, operating expenses and taxes of $98,363, bond interest charges of $169,440, for a balance of $87,773.

2.2.5 1916

On 2/19/1916, the Central Georgia Power Company entered into a contract with the S. Morgan Smith Co. for the purchase of two water wheel turbines for Units 5 and 6. The contract price was $28,000. On 2/23/1916, the company entered into a contract with the Westinghouse Electric and Mfg. Co. for the purchase of two generators with appurtenances for Units 5 and 6. The contract price was $58,500.

Unit 5 at the Lloyd Shoals station was installed in 1916 and it had its start-up on 12/9/1916. The installation of Unit 6 is believed to have started in 1916, based on its startup date in 1917. **Figure 198**, titled **Potential Installation of Unit 6**, which is from an undated photo. Financing of the installation of Unit 5 and Unit 6 was principally through money borrowed on short term notes.

As of 12/31/1916, the Central Georgia Power Company had gross revenues of $406,636, operating expenses and taxes of $127,886, bond interest charges of $168,227, for a balance of $110,423.

2.3 Post-Full Development Period 1917 to 1962

Unit 6 was had its start up on 1/1/1917. **Figure 199**, titled **Georgia Light, Power and Railway Transmission Lines and Lloyd Shoals**, shows the transmission system with Lloyd Shoals fully developed.

By 5/8/1920, the Central Georgia Power Company was operating 231 miles of transmission lines. They also had nine substations with a total rated capacity of 31,350 kw in transformers. At Atlanta, the transmission lines of the company were tied in with those of the Georgia Railway and Power Company.

Sometime after 1926, and potentially as early as 1927, the elevation of the reservoir was raised to elevation 530 as a result of changes to the flashboard system on the crest of the Spillway Section. A hand-written reference was found in the archives dated 10/31/1926 which appears to be a summary of the major equipment and structures at the site. The document states in pertinent part:

> "crest of spillway at El. 528 with a short section having flashboards with crest of boards at El. 528 and crest of masonry at El. 525"

Therefore, by the end of October 1926, the Spillway Section only had 3-foot-high flashboards installed on the 420-foot-long Spillway Section of the dam.

Some undated photographs were found in the archives which appear to show the installation of the complete set of flashboards. In **Figure 200**, titled **Period Dress and Background Flashboards**, a man in period clothing also shows the flashboards installed in the background of the photograph. A second photograph was found in the archives which clearly shows the flashboards. Fi**gure 201**, titled **Full Flashboard Installation**, also shows the installed flashboards.

On 9/25/1928, the Lloyd Shoals project was acquired by GPC when the Central Georgia Power Company was consolidated into GPC.

3.0 Federal Jurisdictional Period 1962-Present

3.1 Background Information

Because the Lloyd Shoals station had been constructed in 1911 and was located approximately 43 miles upstream of the head of navigation on the Ocmulgee River (Macon, Georgia, being the head of navigation), GPC believed that the station was non-jurisdictional. Thus, no licensing was required under the terms of the Federal Power Act. The FERC disagreed.

On 12/19/1962, GPC's Board of Directors issued a resolution directing that the officers of the company be authorized to make an application, on behalf of GPC, for a 50-year license for the station. The Board of Directors took this action in order to avoid an expensive and time-consuming legal proceeding with the FERC. On 1/14/1963, GPC filed with the FERC its license application.

By accepting a FERC license for the station, the Lloyd Shoals project became subject to the requirements of the Federal Power Act (FPA), including submission to FERC jurisdiction and FERC regulatory requirements of the 18 CFR Code of Federal Regulations. One of these requirements was for the performance of Independent Consultant inspections on a 5-year recurring basis.

3.2 Auxiliary Spillway, First Trash Gate, and First Raising of the East Earth Embankment - 1963 to 1972

On 7/22/1963, the FERC required additional information regarding the license application. This additional information involved performing additional studies regarding the safety and adequacy of the plant's existing spillway structures. On 9/5/1963, GPC filed comments with the FERC in response to the FERC's 7/22/1963 letter. They stated in pertinent part:

> "The drainage area at Lloyd Shoals on the Ocmulgee River is approximately 1,400 square miles. U. S. Geological Survey gaging station #2105 is located one mile downstream and has a drainage area of 1,420 square miles. The maximum discharge known since 1906 at this gaging station was that of December 1919, and amounted to 69,000 cfs. 1919 maximum reservoir elevation was 535.2 ft. M.S.L.
>
> The spillway discharge curve contained in our license application and designated Exhibit H, Figure 3, gives a capacity of 123,000 cfs, or 1.8 times the 57 year maximum, with reservoir at the top of the abutments El 540. We are making additional investigations as to the adequacy of the existing spillway capacity."

Between 12/26/1963, and 4/21/1964, the FERC and GPC were in contact regarding the status of flood studies at Lloyd Shoals. On 4/21/1964, GPC file with the FERC the results of their flood studies and FERC required a different analysis be completed. Between 5/26/1964 and 7/24/1964, GPC performed a flood study using a unit hydrograph and probable maximum precipitation analysis methodology and reported their findings to the FERC.

3.2.1 Auxiliary Spillway

On 8/7/1964, GPC was working on securing proposals for performing an exploratory drilling program at the station in the area in and around the company village on the west side of the river. The proposed subsurface investigation was initially to consist of a total of 15 borings. A total of approximately 225 feet of rock coring using BX core barrels of approximately 1-5/8" diameter was to be done in 11 bore holes while the remaining 4 holes were to be wash borings. The maximum depth of the borings was estimated to be 30 feet deep. On 8/13/1964, GPC filed with the FERC a letter stating that they were now engaged in a study to determine the ways and means to increase spillway capacity at the project. GPC also informed the FERC of the need for an exploratory drilling program.

On 11/30/1964, GPC filed a letter with the FERC stating that the exploratory drilling program had been completed. Information from the drilling program indicated the feasibility of constructing a fuse plug type spillway in the area. GPC also stated that they were considering various changes to the existing spillway so as to increase discharge capacity. GPC was evaluating various designs to determine the most economical combination of a fuse plug spillway and spillway improvements so as to be able to discharge 200,000 cfs. By 2/9/1965, GPC had a proposal for increasing the spillway capacity and the memorandum containing the proposal was sent to the FERC on 2/19/1965. GPC indicated that they were planning on perfecting the details of the proposal and that revised Exhibit L drawings would be submitted for FERC approval.

By 5/14/1965, GPC had marked up Exhibit L drawings to show the proposed method of increasing spillway capacity. The following is a summary of the proposal:

> "The portion of the present spillway with crest elevation 528 is lowered three feet so that the entire spillway is at elevation 525. The concrete crest is reshaped and tilting steel flashboards replace the wooden boards. Discharge capacity is gained by an increased coefficient as well as increased area.
>
> The earth dike is raised two feet to elevation 542 to provide additional freeboard.
>
> A fuse plug type auxiliary spillway 300 feet wide is shown on the right bank approximately 800 feet downstream from the main dam. A channel directs flow from the reservoir into the riverbed below the dam. A fuse plug type rock dike prevents flow until such time as the dike is overtopped at El 537. Flow increases as the dike erodes vertically and laterally. Downward erosion is limited by a concrete sill set on rock and having a top elevation of 525."

On 5/24/1965, the proposal and marked up drawings were transmitted to the FERC for review. By 10/14/1965, the FERC was still reviewing the proposal.

On 7/3/1968, GPC filed with the FERC revised Exhibit L drawings for their approval. The drawings showed the proposed additions to the project necessary to increase the spillway discharge capacity to 200,000 cfs. The filing was made in accordance with the requirements of Article 30 of the license. On 10/15/1968, the FERC approved of the submitted Exhibit L drawings.

On 1/29/1969, GPC filed with the FERC a letter stating that they had started construction of the auxiliary spillway enhancements on 11/25/1968 by starting demolition of company houses in the fuse plug area.

GPC's schedule called for the fuse plug and embankment contract to be awarded in the Spring of 1970 with work commencing by May 1970, and an expected completion date of September, 1970. The FERC acknowledged the GPC submittal by a letter dated 2/7/1969.

On 10/27/1969, GPC filed with the FERC a letter containing a revision to the spillway enhancements and requesting information on how to proceed. GPC was now anticipating providing a three-section fuse plug and a number of spillway gates adjacent to the powerhouse. GPC stated that the final decision had not been made on the number of gates, nor the gate design, but they were anticipating four to six vertical lift gates which would cover 80 to 130 feet of the spillway adjacent to the powerhouse.

By May of 1970, GPC adjusted the design because bids for construction of the original design came in excessively high. The modified design would still have the East Earth Embankment raised by 2 feet to provide additional freeboard and there would still be an excavated channel for an auxiliary spillway on the west abutment area. This channel would be trapezoidal in longitudinal cross section with its smaller base being the invert of the channel at elevation 526 and having a total length of 500 feet. However, the fuse plug spillway concept would be abandoned. In its place there would a flood control board structure (large flashboards).

The flood control board structure consisted of two types of flood control boards. The first type of boards were fixed boards and the second type were bottom hinged flashboards. The fixed boards had their top elevation at elevation 536. Where the horizontal boards intersected the sloping sides of the trapezoidal channel, they typically rested on a poured concrete sill set at a 45° angle which sloped vertically downward from elevation 536. The hinged flashboards occupied the 500-foot clear area between the sloping sides of the channel at the invert of the channel. These hinged boards also had their top elevation at elevation 536 and they rested on a poured concrete sill structure.

The other feature of the modified scheme involved the installation of a 20-foot-wide by 6-foot-high trash gate, installed of the crest of the Spillway structure, adjacent to the Powerhouse. (The trash gate is discussed in greater detail in a subsequent section of this report.)

On 6/10/1970, FERC approved the design, stating that a license amendment would not be necessary, and construction began in late July of 1970.

On 4/9/1971, GPC reported to the FERC that they had completed all the spillway capacity enhancements. The enhancements also included the construction of an erodible protective earth berm upstream of the flood control boards in the auxiliary spillway area. This berm had its crest centerline located approximately between 62 feet and 66 feet upstream of the flood control boards. The crest of the berm was at elevation 532 and the crest width was 6 feet upstream to downstream. The upstream and downstream slopes of the berm were 3H to 1V, with the toe of both slopes being at the invert of the auxiliary spillway channel, elevation 526. The purpose of the erodible berm is to reduce maintenance cost and avoid leakage through the flashboards during normal plant operations. To prevent rainwater from ponding between the downstream slope of the erodible berm and the upstream face of the flood control boards, two catch basins were installed in this area. The discharge piping was routed past the downstream face of the flood control boards to a safe discharge point in the downstream section of the auxiliary spillway.

On 6/23/1971, GPC filed with the FERC revisions to Exhibit H, Exhibit L, and Exhibit M which showed the as-built modifications. The FERC approved of the revised Exhibit H and Exhibit L in a letter to GPC date 3/15/1972.

3.2.2 First Trash Gate

As was previously mentioned, part of the spillway capacity enhancements involved the construction of a trash gate structure on the crest of Spillway Structure and adjacent to the Powerhouse.

By 3/4/1970, GPC decided that they wanted to use a roller gate configuration at the station. On 4/30/1970, GPC awarded the contract for the trash gate to the Rodney Hunt Company. The trash gate measured 20 feet wide by 6 feet high. It was operated by an electric hoist which lifted the gate vertically. The trash gate had fabricated steel rollers.

A preliminary construction schedule for the trash gate installation was found in the archives. The following table presents the data from this estimated schedule:

Activity	**From**	**To**
Barge Mobilization	8/30/1970	9/20/1970
Concrete Excavation	9/20/1970	10/14/1970
Embedded Steel	10/5/1970	10/26/1970
New Concrete	10/19/1970	11/7/1970
Bridge Erection	11/13/1970	11/19/1970
Gate Installation	11/10/1970	11/26/1970
Removal of Bulkhead	12/31/1970	1/13/1971

The design of the trash gate involved a construction area which extended approximately 30 feet to the east of the junction of the Powerhouse and Spillway sections. In the first five feet, construction activities involve construction of the west pier which would support the gate hoisting bridge. The next 20 feet were the clear opening for the spillway trash gate itself. The last five feet involved the construction of the west pier which would support the gate hoisting bridge.

In the pier sections, the piers were built upon the existing concrete and they extended from the existing Spillway Section maximum crest elevation of elevation 528 vertically upward to a level section at elevation 530. This is where the structural steel for the trash gate hoisting bridge would be founded. In the clear opening, the concrete had to be cut down from the maximum spillway elevation of elevation 528 to approximately elevation 517.04 on the upstream face to approximately elevation 513 on the downstream face. Between these two elevations, the new trash gate discharge surface would have to be defined by a smooth curve.

It is not known if the original construction schedule was followed but on 4/9/1971, GPC reported to the FERC that they had completed all the spillway capacity enhancements. **Figure 202**, titled **Completed First Trash Gate**, shows the trash gate area.

On 6/23/1971, GPC filed with the FERC revisions to Exhibit H, Exhibit L, and Exhibit M which showed the as-built modifications. The FERC approved of the revised Exhibit H and Exhibit L in a letter to GPC date 3/15/1972.

3.2.3 First Raising of the East Earth Embankment
The final construction activity associated with the increase in spillway capacity at the station involved raising the elevation of the East Earth Embankment so as to prevent overtopping in an extreme storm situation. The East Earth Embankment had a crest elevation of elevation 540. The crest was raised to elevation 542. The original embankment slopes on both the upstream and downstream faces were extended at their existing slopes until they intersected elevation 542. The raising of the embankment crest elevation reduced the upstream-downstream crest width from its original length.

3.3 Electrical Equipment Upgrades 1967
By 1/20/1967, GPC had made upgrades to some of the electrical equipment at the station. These improvements included: 1) replacement of six generator step-up transformers with two step-up transformers, 2) simplification of the 2,300-volt switching arrangement and replacement of the generator breakers, 3) replacement of the generator field breakers, control metering and relaying, and 4) modernization of the excitation and D.C. systems.

3.4 Ga Highway 221 Rim Dikes 1979 to 1981
Between 1979 and 1983 GPC and FERC corresponded and GPC constructed a French drain system for the reservoir rim dikes along Georgia Highway 221.

By 4/9/1981, GPC had developed a design for a trench drainage system. The drain ran in a roughly north-south direction and had a horizontal length of 295 feet, although because the drain followed the contours of a swale, the actual length was more. It had one roughly east-west discharge line at the low point of the system. The drain started at Station 0+90, ran northwards and downhill to the low point at Station 2+45. From here, the drain ran northwards and uphill to Station 3+85 where it terminated. The drain was square in cross section, measuring 2 feet 0 inches on a side. Inside the drain there was a 6 inch diameter perforated flexible drain pipe which ran the north-south length of the drain. This pipe was surrounded by Georgia Number 57 stone and the entire stone/piping installation was surrounded by a Mirafi 140S filter fabric. At Station 2+45, there was an 8-inch T section which joined the 6-inch diameter north-south drain to an 8-inch diameter east-west discharge piping system. The east-west discharge piping system had a similar construction to the north-south drain line: a square cross section 2 foot on a side where the 8-inch diameter discharge piping was surrounded by Georgia Number 57 stone and the stone and piping assembly was surrounded by Mirafi filter fabric. The discharge system piping was somewhat different from the north-south drainage system in that from where it joined to the north south drainage system approximately the first 15 feet going east was perforated and embedded in the porous medium. At the end of the 15 foot run, the pipe transitioned to a non-perforated flexible pipe which ran eastward approximately 45 feet to ultimately discharge in a ditch. Where the perforated and non-perforated piping runs joined, there was a concrete plug. The drainage system was installed and working by 6/16/1983.

3.5 Structural Stability, Subsurface Investigation, Dam Strengthening, and Second Flashboard Construction 1979 to 1991

3.5.1 Structural Stability
In 1980, GPC re-analyzed the concrete gravity structures at the station using the new FERC criteria. The results of the analysis were sent to FERC on 1/20/1982 . The sections met the stability criteria except for

the flood condition, due to the assumption that the concrete cannot withstand tensile loads. GPC started a foundation investigation program and a program to determine the actual uplift profile under the structures.

3.5.2 Subsurface Investigation

This program involved drilling 9 borings (LS 1-6, LS-7A, LS8-9).

On 9/23/1985 , GPC expanded its foundation investigation and drilled an additional 32 borings. The following table provides information on these borings.

Boring	Location	Orientation
LS-1A	West Nonoverflow, crest, near elevation 540	Vertical
LS-3A	Spillway, east sluiceway near elevation 430	Vertical
LS-4A	Spillway, east sluiceway near elevation 430	Vertical
LS-5A	Spillway, east sluiceway near elevation 430	Vertical
LS-7B	Spillway, west 2-foot flashboards section, near elevation 528	Vertical
LS-8A	Spillway, 5-foot flashboards section, near elevation 525	Vertical
LS-9A	Spillway, east 2-foot flashboards section, near elevation 528	Vertical
LS-10	West Nonoverflow, downstream face, near elevation 504	Vertical
LS-11	West Nonoverflow, toe, near elevation 480	Vertical
LS-12	Spillway, 5-foot flashboards section, downstream face near elevation 475	Vertical
LS-12P	Spillway, 5-foot flashboards section, downstream face near elevation 475	Vertical
LS-13	Spillway, 5-foot flashboards section, downstream face near elevation 444	Vertical
LS-14	Spillway, east 2-foot flashboards section, near elevation 510	Vertical
LS-15	Spillway, east 2-foot flashboards section, near elevation 465	Vertical
LS-16	Spillway, 5-foot flashboards section, west end, crest near elevation 525	Vertical
LS-16A	Spillway, 5-foot flashboards section, west end, crest near elevation 525	Vertical
LS-17	Spillway, 5-foot flashboards section, west end, downstream face near elevation 474.5	Vertical
LS-17P	Spillway, 5-foot flashboards section, west end, downstream face near elevation 474.5	Vertical
LS-18	Spillway, 5-foot flashboards section, west end, downstream face near elevation 443	Vertical
LS-18A	Spillway, 5-foot flashboards section, west end, downstream face near elevation 435.5	Vertical
LS-19	Intake, upstream bearing gallery, near elevation 441.5	Angled 25°downstream

Boring	Location	Orientation
LS-20	Intake, upstream bearing gallery, near elevation 441.5	Angled 45°upstream
LS-21	Intake, upstream bearing gallery, near elevation 441.5	Angled 25°downstream
LS-22	Intake, upstream bearing gallery, near elevation 441.5	Angled 45°upstream
LS-23	Intake, upstream bearing gallery, near elevation 441.5	Angled 25°downstream
LS-24	Intake, upstream bearing gallery, near elevation 441.5	Angled 45°upstream
LS-25	Intake, upstream bearing gallery, near elevation 441.5	Vertical
LS-26	Intake, upstream bearing gallery, near elevation 441.5	Vertical
LS-27	Intake, upstream bearing gallery, near elevation 441.5	Vertical
LS-28	Intake, upstream bearing gallery, near elevation 441.5	Vertical
LS-29	Intake, upstream bearing gallery, near elevation 441.5	Vertical
LS-30	Intake, upstream bearing gallery, near elevation 441.5	Vertical

GPC completed re-analyzing the Probable Maximum Flood (PMF) for the station and transmitted its findings to the FERC in a letter dated 8/21/1989. A number of separate analyses/reviews were performed including: 1) a re-evaluation of the 1964 PMF study by Southern Company Services (SCS) of the transposed Elba, Alabama storm of 1929 using precipitation and distribution values based on the Sinclair Dam 1987 PMF study and Hydrometeorological Report (HMR) 52, and 2) reviewing the GPC 1982 PMF study using HMR 51 and 52. The following table presents a summary of the results.

Date and Type of Flood Study	Lloyd Shoals Inflow (cfs)	Lloyd Shoals Outflow (cfs)	Maximum Reservoir Elevation (ft.)
1964 Spillway Design Flood	200,000	200,000	539.3
8/31/1982 PMF Study Using HMR 51 and 52	356,000	352,100	544.7
8/15/1989 PMF Study Using Elba Storm	324,000	323,000	543.8

GPC noted that both of the PMF studies showed that PMF inflows to the project would far exceed the spillway design flood inflow of 200,000 cfs. But since the Elba flood was a site-specific transformation of an actual storm, GPC chose to use the 324,000 cfs inflow due to the transposed Elba storm as the Probable Maximum Flood for strengthening work. GPC also noted that using the Elba storm, the maximum reservoir elevation (elevation 543.8) would exceed the crest elevation of East Earth Embankment (elevation 542.0) and GPC planned to investigate measures to either reduce the maximum headwater level or to protect the East Earth Embankment.

3.5.3 Dam Strengthening

In order to determine the required bond length for the tendons which would be used to strengthen the concrete structures at the station, GPC installed two anchors in the tailrace area. The tendons were tested on 11/15/1989 by performing pull out tests on them.

The design for strengthening called for an installation of a total of 56 tendons which would be installed in the West Nonoverflow, Intake/Powerhouse, and Spillway sections. Of the total of 56 anchors to be installed, 36 were installed in the Spillway section, 16 anchors would be installed in the Intake/Powerhouse section and 4 anchors would be installed in the West Nonoverflow section.

The tendons were of two types. The Type 1 tendons had 35 individual strands and had a minimum bond length of 15 feet. The Type 2 tendons consisted of 53 strands and had a minimum bond length of 22 feet. The West Nonoverflow's tendons consisted of one, Type 2 tendon and the rest being Type 1 tendons. In the Intake/Powerhouse area, all the tendons were Type 2 tendons. In the Spillway Section, all of the tendons were Type 2 tendons, except for the two easternmost tendons which were Type 1 tendons.

Because the majority of the tendons were to be installed in the Spillway section, all the flashboards and their related hardware had to be removed. Additionally, the installation of the anchors in the Spillway section required the reservoir to be drawn down below the crest elevation of the five-foot-high flashboard section. The drawdown was for constructability and safety reasons. As such, the construction sequence was to have the anchors fully installed in the Spillway section first, so as to allow the reservoir to be raised to its normal full pool elevation by the Spring of 1991.

The construction sequence was the same, regardless of which of the three structures was being considered. The following table presents information on the construction sequence.

Step Number	**Activity**	**Comments**
1	Locate Anchor Pocket Locations	
2	Excavate Anchor Pockets	The anchor pockets were typically square in plan and measured 4 feet 6 inches on a side. The bottom elevation of the pocket varied, depending on the location of the tendon.
3	Perform Downhole Drilling	Drilling went through the concrete structure and into the underlying foundation rock. Plumbness of the hole was checked.
4	Pressure Test with Water	The pressure testing with water was done at a pressure of 10 psi for 10 minutes as a check of the water tightness of the drill hole. If a hole failed the water tightness test, the hole was grouted, re--drilled, and retested.
5	Construct Anchor Pocket Bearing Surface	This included installing spiral reinforcing and vertical reinforcing steel. Also 5,000 psi minimum strength concrete was placed to level and strengthen the excavated anchor pocket. The base plate was grouted into the anchor pocket with 5,000 psi nonshrink grout. The typical bearing base plate measured 26-1/2 inches on a side and was 3-1/4 inch thick.
6	Set Anchor Tendon	The entire tendon assembly was lowered into the anchor tendon hole by a crane.
7	Grout Bond Zone	The anchor tendon was grouted in the primary anchor zone with a 7,000-psi grout. The grout was allowed to set for 7 days. No stressing of the anchor tendon was allowed until both the grout in the primary anchor zone and the

Step Number	Activity	Comments
		concrete in the anchor pocket bearing area were at their design strengths.
8	Stress Anchor Tendon	The performance testing of randomly selected anchor tendons consisted of the incremental loading and unloading of the anchor tendon up to the proof load of 80% of the Guaranteed Ultimate Tensile Strength (GUTS). Movement readings (accurate up to 0.001 inch) were taken at each load increment. The proof load was then held for10 minutes with movements recorded at 1 minute, 2, 3, 4, 5, and 10 minute intervals. If the movement between 1 and 10 minutes exceeded 0.04 inch, the proof load was held for an additional 50 minutes. The anchor tendon was accepted if the movement during the 10 to 60 minute increment was less than 0.045 inch. Once this criterion was met, the load was reduced to the lock off load of 70% GUTS. The design load was 60% GUTS.
9	Grout Secondary Zone	
10	Place Final Concrete	

GPC acted as the primary contractor for the anchor tendoning work. Drilling for both the anchor pockets and the anchor tendon holes was performed by Continental Drilling, and they were the only subcontractor. The following table presents information on some of the material/equipment suppliers for this project.

Material/Equipment	Supplier
Tendon Cable Wire	Florida Wire and Cable Company
Tendon Anchor Heads	Lang Tendons, Inc.
Sheathing Tubing	Southeastern Industrial Plastics
Primary and Secondary Grout	Chem-Grout
Anchor Bearing Plates	O’Neal Steel
Grout Tubing	Dywidag Systems International
Grout Water Filter	Hayward Pool Products, Inc.

On 7/9/1990, GPC started the installation of anchor tendons at the station. For details of the construction activities see **Table 1**, titled **Details of Tendon Construction History** in Appendix A. It should be noted that in February, March, and April of 1991, the spillway overflowed and this caused the work to be delayed.

On 10/3/1991, GPC notified the FERC that the final tendoning work on the powerhouse tendons was completed on 9/27/1991. This essentially completed the strengthening work at the station. Clean up work would occur during October of 1991.

3.5.4 Second Flashboard Construction

In order to do the tendoning construction on the crest of the Spillway Section, all the existing flashboards and their support hardware had to be removed. Once the tendoning work was completed the flashboards could be re-installed.

The design for the second flashboard construction efforts used the same sort of design as was used for the first set of flashboards. The boards were made of treated tongue-and-groove Southern yellow pine mounted on a structural piping arrangement. The arrangement had the same design intent as was used in the original installation: when the flashboards tripped, they rotated about a fixed horizontal series of pipes. When the reservoir level dropped to below the flashboard trip setpoint, the boards would rotate back to a vertical position automatically. The design was used for both the 2-foot high boards and the 5-foot high boards.

By 6/25/1991, all of the elevation 528 flashboards were in place.

3.6 Powerhouse Fire and Reconstruction 1983

On 1/20/1983, a large portion of the upper level of the powerhouse was destroyed by fire due to a transformer explosion. **Figure 203**, titled **January 1983 Powerhouse Fire Damage** shows the area which was most heavily damaged. Not only were the switchgear and transformer components damaged, but Unit 6 suffered damage to its generator. **Figure 204**, titled **Fire Damaged Unit 6 Generator** shows the condition of the damaged generator.

Demolition work started as soon as practical after the fire. Between 2/23/1983 and 3/7/1983 the redesign work had been completed and construction drawings were ready for issue. But the design of the reconstruction did not return the structure to its original condition. Because all the original equipment in the upper part of the powerhouse had been destroyed, the replacement equipment could be modern equipment which would take up much less room. Additionally, the decision was made to relocate some of the equipment which had been in the upper part of the Powerhouse to the switchyard to the west of the Powerhouse. The equipment would be connected to controls in the powerhouse by cable tray runs. The relocation of equipment further reduced the needed space for the replacement equipment on the upper level of the Powerhouse.

The reconstruction of the upper level was to be L shaped in plan view. The long leg of the L would be parallel to the main axis of the dam and against the downstream face of the Intake structure. The short leg of the L would run upstream-to-downstream on the west side of the new structure. From the east wall of the original Powerhouse, the long leg of the L would measure 194 feet 3 inches east to west. The short leg of the L would extend from the back of the new structure 47 feet 5 inches to tie into the downstream wall of the original Powerhouse. This short leg of the L measured 20 feet 0 inches east-to-west. In the area between the legs of the L, where there had once been an enclosed area in the original Powerhouse construction, there was now an unenclosed area measuring approximately 173 feet 3 inches east-to-west and 21 feet 7 inches upstream-to-downstream. The majority of the floor of the new structure was at elevation 479.33. At the upstream end of the new structure, the bottom of the built-up roof system was 14 feet 0 inches above elevation 479.33. The exterior of the new building was of 12-inch concrete block wall construction, reinforced at every other course. **Figure 205**, titled **Reconstructed Powerhouse Upper Level**, shows the completed reconstruction.

As was previously mentioned, since much of the original electrical equipment was destroyed by the fire, its function could be replaced by more modern equipment such as solid-state exciters. **Figure 206**, titled **Solid State Exciters,** shows some of this replacement equipment. **Figure 207**, titled **Relocated Electrical Equipment,** shows some of the equipment which was relocated to the substation.

By 6/16/1983 the reconstruction was approximately 90% completed, and 4 units were back in service.

3.7 Second Raising of East Embankment 1990 to 1992

In 1990, the Independent Consultant recommended that because of revised flood study information, GPC should raise the East Earth Embankment's crest elevation so this it would not be overtopped during a Probable Maximum Flood (PMF) event. GPC stated that they planned to construct the crest of the East Earth Embankment to approximately elevation 544.5 which would provide 0.7 foot of freeboard allowance for wave action. GPC stated that they were looking at several methods of doing this. In accordance with the Independent Consultant's recommendation, GPC planned to complete the work at the same time the strengthening work was completed. They estimated that the East Earth Embankment modifications should be completed by 9/1/1991.

On 4/22/1991, GPC personnel met with FERC personnel to present the design for the proposed modification to the East Earth Embankment. The FERC had comments on the integrity of the existing rip rap and they had comments on the design. On 4/24/1991 GPC performed a visual field investigation of the rip rap and concluded that except for one small area the rip rap was in a satisfactory condition.

On 8/30/1991, GPC transmitted the final design drawings for the East Earth Embankment modifications to the FERC. GPC stated that the on-site construction group had mobilized equipment and materials for the work and they were ready to start immediately, however they were on hold pending FERC approval of the final design. The FERC apparently verbally requested that the start of construction be put on hold pending further review.

The FERC gave approval to proceed with the construction following the visual inspection of the existing rip rap on 11/26/1991. By March of 1992, the modification work was complete. **Figure 208**, titled **1991 East Earth Embankment Modifications**, shows the completed east embankment work.

3.8 Oxygenation Weir 1991 to 2008

3.8.1 Weir Installation and Initial Operation 1991 to 1994

During the first relicensing proceeding (circa 1988-1993, with the relicensing application being filed in 1991), GPC performed a number of resource studies so as to be able to provide factual information for an Environmental Assessment (EA). One of those studies involved water quality and water quantity. One of the findings from this study was that there was a high degree of eutrophication in Lake Jackson. This resulted in particular water quality problems during the hot summer months. While the surface waters would be high in Dissolved Oxygen (DO), the water at the suction elevation of the turbines came from a deeper depth and this water was significantly depleted in DO. Thus, when the station was used to meet summer electricity demands (the most critical time for GPC electrical demands), discharges of low (DO) waters would occur from the station.

GPC representatives recognized that an enhancement was needed for the turbine discharges and proposed the use of a specially designed aeration weir. A zig-zag weir was designed. Moving from east to west across the tailrace area, the weir tied into the training wall on the east side of the Powerhouse; had four, downstream points across the middle of the tailrace; and then tied into the west bank of the tailrace. **Figure 209**, titled **Plan View Aeration Weir** shows this configuration.

The general scheme of construction was to drill 10 5/8-inch diameter holes into the rock of the tailrace. Into these holes, extra-strong 8-inch diameter pipes would be grouted in a vertical position. When the grout had set, W8x28 walers would be welded horizontally to the vertical posts. Once the walers were in place, sheet piling (Contech Metric Sheeting – 7 Gage) was fastened on the walers to form the walls of the weir. All the sheet piling was to be founded on rock. Concrete was then placed at the toe of the sheet piling on the upstream face.

The original weir design called for 2 inch and 3 ½ inch diameter pipes to be welded as tension members between the upright 8-inch extra-strong (XS) pipes. During the original construction, it was discovered that these pipes were subject to cracking of their welds due to vibration. Most of the 3 ½ inch diameter pipes were replaced with a tension member constructed of ¾ inch diameter cables and turnbuckles.

On 2/21/1992, GPC filed with the FERC the weir design drawings. On the same day, GPC filed with the FERC the Quality Control Plan. In the same letter, GPC noted that there would not be any impact on the Emergency Action Plan as a result of construction. On 2/25/1992, GPC filed with the FERC a supplement to their license amendment application. The supplement showed the final configuration and sections of the weir.

The following table presents information on the completion rate for the weir.

As of Date	Percent Complete
7/3/1992	24.8
8/7/1992	46.8
9/4/1992*	55.3
10/2/1992	60.6
11/6/1992	70.1
12/4/1992	81.7
12/31/1992	100.0

During July of 1994 severe flooding occurred from Tropical Storm Alberto. **Figure 210**, titled **Flooding from Tropical Storm Alberto**, shows the flooding in the spillway area and a portion of the tailrace which resulted from the storm.

3.8.2 Weir Repair 1995 to 2004

3.8.2.1 1995 Repairs

In the spring of 1995, it became apparent that the Lloyd Shoals Labyrinth Weir was not functioning as designed. When the minimum flow of 400 cfs was passed through the powerhouse, no flow passed over the top of the weir. Numerous boils, visible from the roof of the powerhouse and from the fishing pier indicated that all of the water discharged was passing under the weir. It was concluded that the leakage was probably through erosion holes in the foundation which resulted from the high flow events during 1994.

In 1995, numerous repairs were made to the holes that caused by the flooding and the performance of the weir improved dramatically after them. While the dissolved oxygen in the river did not meet the water quality standards, it did show considerable improvement in dissolved oxygen content. The performance of the weir was discussed with GaDNR and reported to the FERC in a letter dated February 14, 1996. As part of the 2/14/1996 report to the FERC, GPC committed to do future surveys of the weir in May of each year and repairs would be made to bring the weir back to functionality by the summer months when turbine discharges were most in need of oxygenation.

3.8.2.2 1996 Repairs

In accordance with the commitment made in the 2/14/1996 report to the FERC, a survey of the weir was performed on May 23, 1996, by a diving team from SCS Engineering-Atlanta. Additional holes were identified, and subsequent repairs were made. As had been in the case of the 1995 repairs, GPC decided to schedule leakage observations in 1997 to assess the performance of the weir.

3.8.2.3 1997 Repairs

On 5/22/1997, the weir was inspected. Repairs to the weir started on 6/11/1997 and ended on 6/13/1997.

3.8.2.4 Subsequent Repairs

Repairs occurred annually until approximately 2004.

3.8.3 Weir Removal 2004 to 2008

In observations made of the aeration weir in 2004, it was apparent that the structure was potentially experiencing distress. **Figure 211**, titled **Weir Wall as of 8/10/2004**, shows that one of the sides of the weir had a noticeable bow. Further observations at the same day indicated that there were apparent tears in the sheet piling itself. **Figure 212**, titled **Sheet Piling Tear**, documents this condition. By 12/23/2004, a portion of the wall in the tear area had separated and a portion of the wall was out of vertical and tilting to the west. **Figure 213**, titled **Separated Weir Wall**, documents this condition.

While the weir's ability to re-oxygenate turbine discharges was somewhat compromised, it could still help downstream water quality. **Figure 214**, titled **Oxygenation Weir as of 1/10/2005**, shows that in most of the labyrinth weir bays, water was going over the weir as designed. GPC had started exploring other options to re-oxygenate turbine discharges (see the report section titled Turbine Discharge Aeration 1996 to 2006 for details). In unit aeration systems were installed in the summer of 2004 (see subsequent section).

On 7/14/2005, there was a major high-water event at the station. **Figure 215**, titled **Spillway Discharges on 7/14/2005**, shows the spillway discharges. Note that the water is overflowing the wingwall between the southeast corner of the Powerhouse and the Spillway Section. The downstream aeration weir became essentially totally submerged from the discharges. **Figure 216**, titled **High Water Event on 7/14/2005**, shows the drowned-out oxygenation weir. The flood waters apparently inflicted more damage on the weir.

On 10/21/2005, the weir suffered a sheet piling failure. A portion of the labyrinth structure gave way and the weir was no longer a continuous structure which could retain turbine discharge flows. **Figure 217**, titled **Weir Failure**, shows the section which failed and documents the fact that the weir was no longer able to retain water which would then flow over the top of the weir and become oxygenated.

Figure 218, titled **Weir Removal as of 6/26/2008**, shows the start of the demolition of the weir. **Figure 219**, titled **Monitor Piping Removal**, shows the demolition of some of the old oxygen monitor piping system**. Figure 220**, titled **Typical Cutting Method**, shows how the weir was typically disassembled. **Figure 221**, titled **Weir Demolition as of 7/7/2008**, shows the progress of the work as of that date. **Figure 222**, titled **Weir Demolition as of 9/17/2008**, shows the continuing demolition efforts. **Figure 223**, titled **Weir Demolition as of 10/15/2008**, shows that the bulk of the weir walls had been removed.

3.9 Powerhouse Flooding 1994

On 7/6/1994, a near record flood (68,500 cfs) from Tropical Storm Alberto occurred on the Ocmulgee River. The maximum reservoir elevation at the dam was 534.4’. During this flood, water rose in the powerhouse to a depth of eight feet, to approximately elevation 450 feet. This submerged the lower two-thirds of all of the generators. Work required to put the plant back in operation included cleaning up oil and sediment, cleaning and filling bearings, drying out the generators, and replacing the insulators for the generator collector ring mountings. Water overflowed the buffer dike at crest elevation 532 feet and rose on the auxiliary (emergency) flashboards to elevation 534.4 feet, 1.6 feet below the top of the boards. Considerable erosion of the channel and access road occurred downstream of the auxiliary spillway flood boards due to leakage through the flood boards. Although water overflowed the buffer dike, it did not wash away because the auxiliary flashboards did not fail.

3.10 Turbine and Other Work 1994

On 2/14/1994, Unit 3 began a planned maintenance outage.

On 3/19/1994, Unit 2 was taken offline with a damaged water wheel.

On 4/1/1994, Unit 2 started a planned maintenance outage.

On 11/4/1994, the planned maintenance outage for Unit 3 ended.

3.11 Turbine and Other Work 1995

On 3/24/1995 Unit 2 was returned to service, ending the planned maintenance outage which had started on 4/1/1994.

3.12 Turbine Discharge Aeration 1996 to 2006

Since 1996, water quality data had been collected downstream of the oxygenation weir, which had been constructed in 1992. In 2004, unit aeration was constructed at the plant as a replacement for the oxygenation weir. The concept for the aeration system is relatively straight forward. Piping is installed below the bottom of the runner in a low-pressure area near the discharge ring in the upper portion of the draft tube. During generation, the air is passively sucked into the turbine discharge where it is mixed with the water and thus oxygenates the turbine discharge.

On 10/8/2003, Unit 2 entered a planned outage to replace a turbine shaft. The outage lasted until 4/27/2004. During the 2004 portion of the outage, a prototype in-unit aeration system was installed for full scale testing scheduled for the summer of 2004.

While the concept for the aeration system was straight forward, implementing the design required the use of specialized equipment, especially for the piping runs. First, two 8-inch diameter holes had to be cored from the upstream bearing gallery downstream to intersect the water chest. **Figure 224**, titled **Coring Aeration Pipe Penetration**, shows this work. Next, 6-inch diameter air supply pipes had to be installed and supported in the two core holes in preparation for the supply pipes being grouted in place. **Figure 225**, titled **Grouted 6 Inch Diameter Pipes**, shows what these pipes looked like after being grouted in place.

With the air supply piping installed, work could begin on the components which were external to the water chest and those which were internal to the water chest. The components external to the water chest consisted of piping, a gate valve, a check valve and a muffler. The components inside the water chest consisted of two piping runs which ultimately terminated in a series of baffles internal to the discharge ring. In total, there were four baffles: two on the east side of the discharge ring and two on the west side of the discharge ring. **Figure 226**, titled **Plan View of Aeration System**, shows the general layout of the equipment. **Figure 227**, titled **External Aeration Equipment,** shows the typical arrangement of the muffler, check valve, and gate valve. **Figure 228**, titled **Internal Water Chest Aeration Piping**, shows the two branches of the internal aeration piping and the piping penetrations on the downstream end of the camelback at the discharge ring.

The initial qualitative visual observations in the Summer of 2004 of the turbine discharges when the aeration system was off and when it was on, indicated air was being actively entrained in the turbine discharges. **Figure 229**, titled **Qualitative Turbine Discharge Comparisons**, provides a visual indication of the aeration. The initial quantitative results from the Summer 2004 testing backed up the qualitative visual observations. GPC decided that more DO test data should be secured in the summer of 2005.

A unit outage was scheduled for Unit 4 for the latter part of 2005. In preparation, GPC personnel contacted some of the contractors who had done the work in 2004 for an estimate of costs to install an aeration system, similar to the one which had been installed in Unit 2, in Unit 4. The following table presents the estimate.

Entity	**Activity**	**Cost**
Dixie Concrete Cutting	Core two 8-inch diameter holes	$11,000.00
SCS Construction Field Services	Grout two 8-inch diameter holes	$5,214.00
	Construction management	$8,750.00
The Saxon Group	Mechanical portion of work	$48,000.00
Total Cost		$72,964.00

On 9/12/2005, Unit 4 entered a planned outage to replace broken wicket gate links. The outage lasted until 10/4/2005. As part of the outage work, an in-unit aeration system was installed in the unit. This brought the number of units equipped with the aeration technology to a total of 2 units.

While GPC believed that the two units should be able to supply enough aeration to the turbine discharges to meet the State of Georgia's water quality criteria, they wanted to be sure that there was sufficient redundancy in the system such that if one of the two units was out of service, there would be a backup unit which could help with the aeration. As such, they decided to modify Unit 3 to become an aeration unit.

The same group of entities (Dixie Concrete Cutting [Dixie] and the Saxon Group [Saxon]) were assembled to perform the work. On 11/27/2006, the unit was taken offline in preparation for the modifications and drilling of the first 8-inch diameter core hole started. On 11/28/2006, Dixie completed the drilling of the west core and started coring on the east core. Saxon's fitters and welders were working on the piping with the materials they had on hand. By 12/4/2006 the air supply pipes were installed in the core holes and the holes were ready to be grouted up. On 12/11/2006, GPC completed the installation of the aeration system on Unit 3. With that installation, GPC had 3 units which were capable of aerating the turbine discharges.

3.13 Turbine and Other Work 1996

On 3/1/1996, Unit 4 entered into a planned maintenance outage.

On 5/13/1996, Unit 6 entered into a planned maintenance outage.

On 10/25/1996, Unit 5 entered a planned maintenance outage.

3.14 Turbine and Other Work 1997

On 1/15/1997, the Unit 6 planned maintenance outage was completed. This closed out the outage which had started on 5/13/1996.

On 3/11/1997, Unit 2 experienced a planned maintenance outage.

On 3/13/1997, the Unit 5 turbine planned maintenance outage was completed. This closed out the outage which had started on 10/25/1996.

On 5/1/1997, Unit 1 entered in a planned maintenance outage.

On 8/29/1997, Unit 3 was removed from service for a planned maintenance outage.

On 12/29/1997, Unit 2 ended its planned maintenance outage which had started on 3/11/1997.

3.15 Turbine and Other Work 1998

On 1/20/1998, Unit 1 ended the planned maintenance outage effort which had started on 5/1/1997.

On 4/1/1998, Unit 3 was returned to service. This ended the planned maintenance outage which had started on 8/29/1997.

On 11/3/1998, filler gate replacement work started on Unit 2.

3.16 Headworks Pipe Sealing 1999

From the original construction of the station, it appears that there were some 4-inch diameter pipes which ran from the region of the exciter intake bay to the downstream side of the Intake section. It appears that these pipes were to supply cooling water to the original electrical transmission equipment formerly occupying the upper level of the Powerhouse. There was a concern that the pipes could rust out and allow an uncontrolled flow of water from the reservoir into the upper level of the Powerhouse.

On 1/13/1999, personnel from SCGE Geotechnical Field Services arrived on site to grout up the pipes. Plant personnel had previously attached piping and hardware to allow grouting of the pipes. As part of the grouting operation, the lines were flushed with water and then grouted. The amount of grout in the piping was estimated as 2.6 cubic feet. The pipes were successfully grouted up.

3.17 Turbine and Other Work 1999

On 2/15/1999, work on the Unit 2 filler gate replacement was completed.

On 6/28/1999, Unit 5 experienced a broken stub shaft and entered into a repair outage.

On 9/20/1999, Unit 6 was removed from service with a broken turbine shaft.

3.18 Turbine and Other Work 2000

On 4/25/2000, the work of repairing the Unit 6 shaft was completed. The unit was returned to service. This closed out the outage which had started on 9/20/1999.

On 6/8/2000, all work associated with repairing the Unit 5 stub shaft had been completed and the unit was returned to service. This closed the outage which had begun on 6/28/1999.

On 9/1/2000, work on the Unit 6 headgates started. The work was to replace the headgates.

On 9/3/2000 Unit 1 was taken out of service due to a broken turbine shaft.

On 11/27/2000, the work on replacing the Unit 6 headgates was completed.

On 12/19/2000, work started on the Unit 5 headgates. This work was temporarily halted on 12/22/2000.

On 12/27/2000, work on installing new headgates on Unit 3 started.

3.19 Turbine and Other Work 2001

On 2/1/2001, work started on replacing the headgates on Unit 2. The work was temporarily suspended on 2/3/2001.

On 2/15/2001, work resumed on replacing the Unit 2 headgates.

On 2/23/2001, the work of installing the new headgates on Unit 3 was completed.

On 3/28/2001, all work on the Unit 2 headgates was complete.

On 3/28/2001, work started on the Unit 4 headgates.

On 4/11/2001, the work on the Unit 4 headgates was completed.

On 4/11/2001, work resumed on the Unit 5 headgates.

On 4/23/2001, additional work was started on the Unit 6 headgates.

On 4/27/2001, the work on the Unit 5 headgates was completed.

On 5/30/2001, the work on the Unit 6 headgates was completed.

On 7/25/2001, Unit 6 entered into an outage. Initially it was believed that there might have been a crack in the turbine shaft.

On 9/24/2001, Unit 1 was returned to service, ending the outage which had started on 9/3/2000 with the broken turbine shaft.

On 10/22/2001, Unit 1 was taken offline to repair the headgates.

On 11/5/2001, divers were installing new headgates on Unit 1.

On 12/14/2001, the installation of the headgates on Unit 1 was complete.

On 12/19/2001, Unit 1 was returned to service after the repair of the headgates.

3.20 Turbine and Other Work 2002

On 4/1/2002, Unit 6 was returned to service. This closed out the outage which had started on 7/25/2001. It was found that the upstream runner was loose on the shaft causing vibrations.

3.21 Turbine and Other Work 2003

On 10/8/2003, Unit 2 was taken out of service due to issues with the turbine shaft. Ultimately the outage resulted in replacing the turbine shaft.

Beginning in Section 3.22 forward, details provided in the Construction History were obtained from documents that normally were filed with a Critical Energy Infrastructure Information (CEII) designation at the FERC. As such, these subsequent sections and associated photos have been relocated to a CEII designated Exhibit C, Appendix A.

4.0 Public Index of Figures

Figure 1. Photograph of Mr. George F. Harley

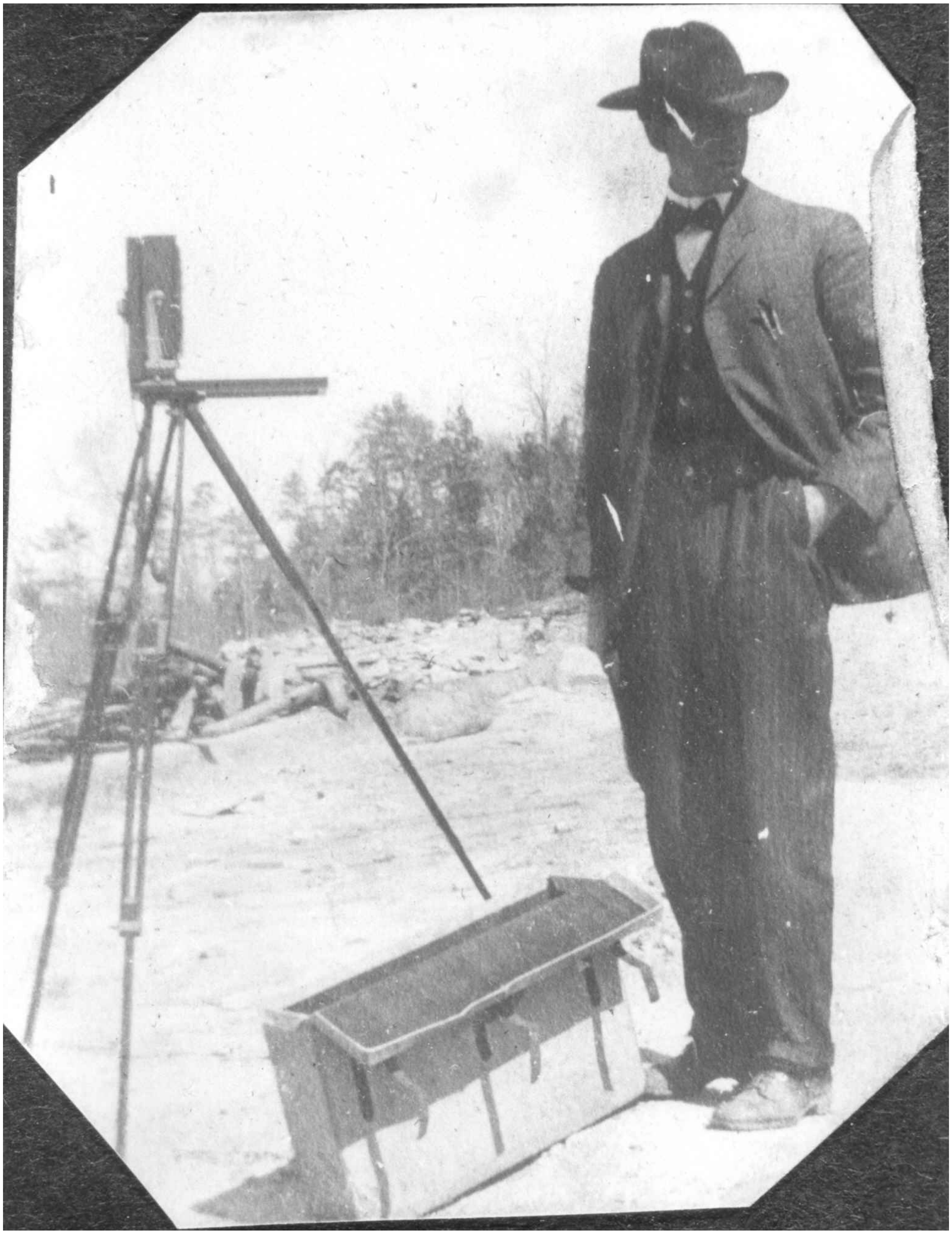

Figure 2. 1901 Ocmulgee River Profile

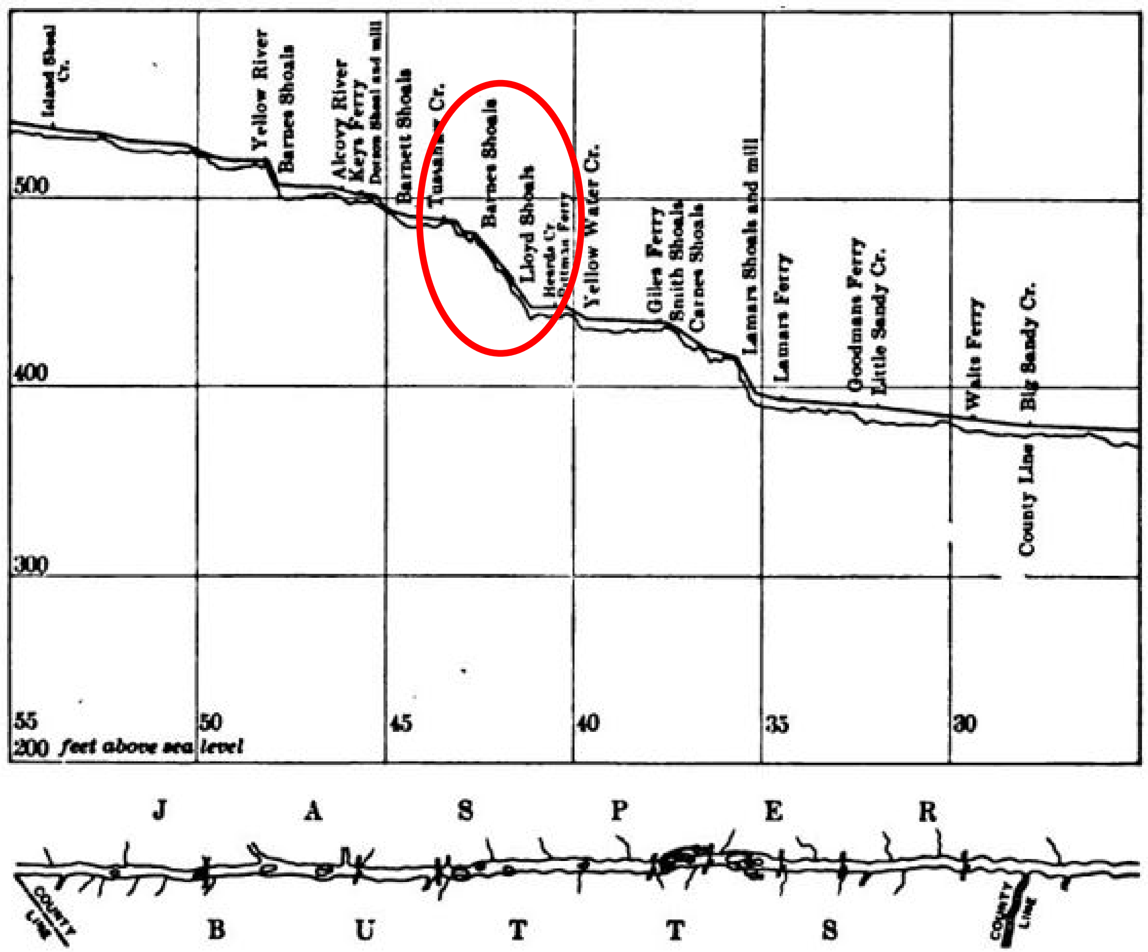

Figure 3. 4/14/1908 Dam Site

Figure 4. Ocmulgee River Conditions

Figure 5. One-Woman Boat

Figure 6. Late Construction Era Camp Buildings

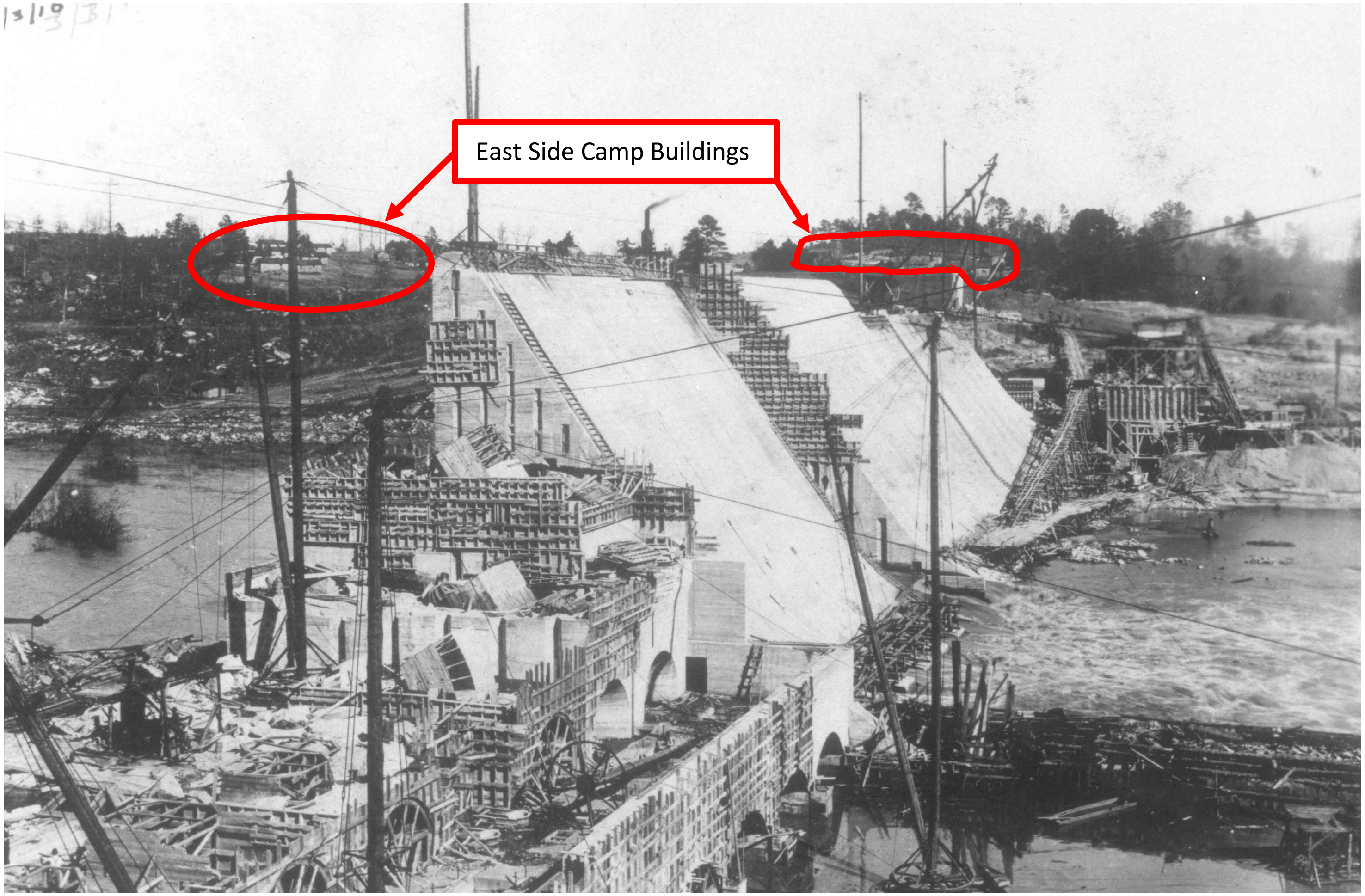

Figure 7. Camp Tents

Figure 8. Family Cabin

Figure 9. Water Storage Tank/Catchment

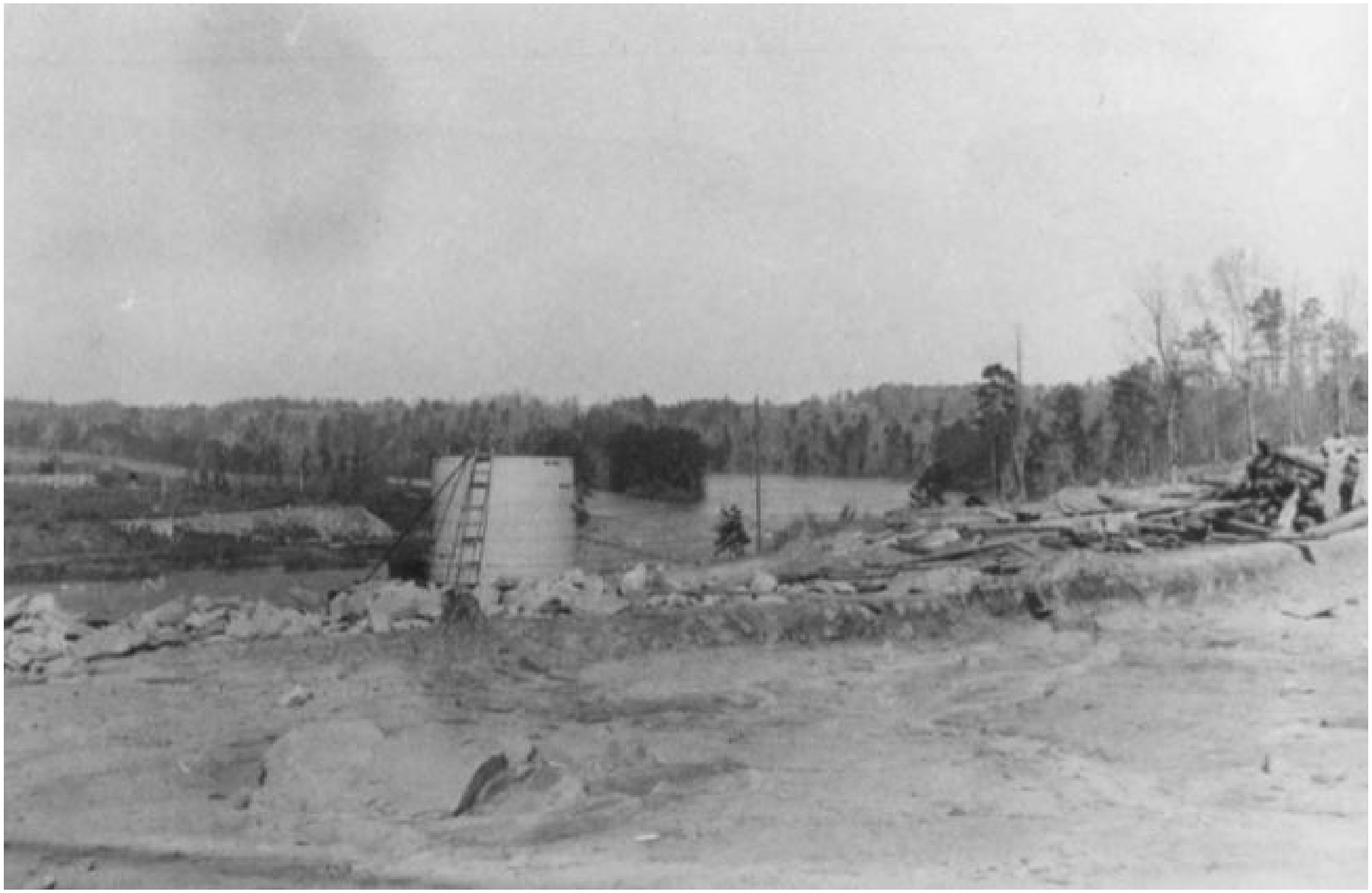

Figure 10. Construction of Assumed Downstream Construction Bridge

Figure 11. Constructed Assumed Downstream Construction Bridge

Figure 12. Loaded Wagon

Figure 13. Railroad Cut Section

Figure 14. Railroad Trestle

Figure 15. Railroad Straight Line Section

Figure 16. Plan of Spillway Section

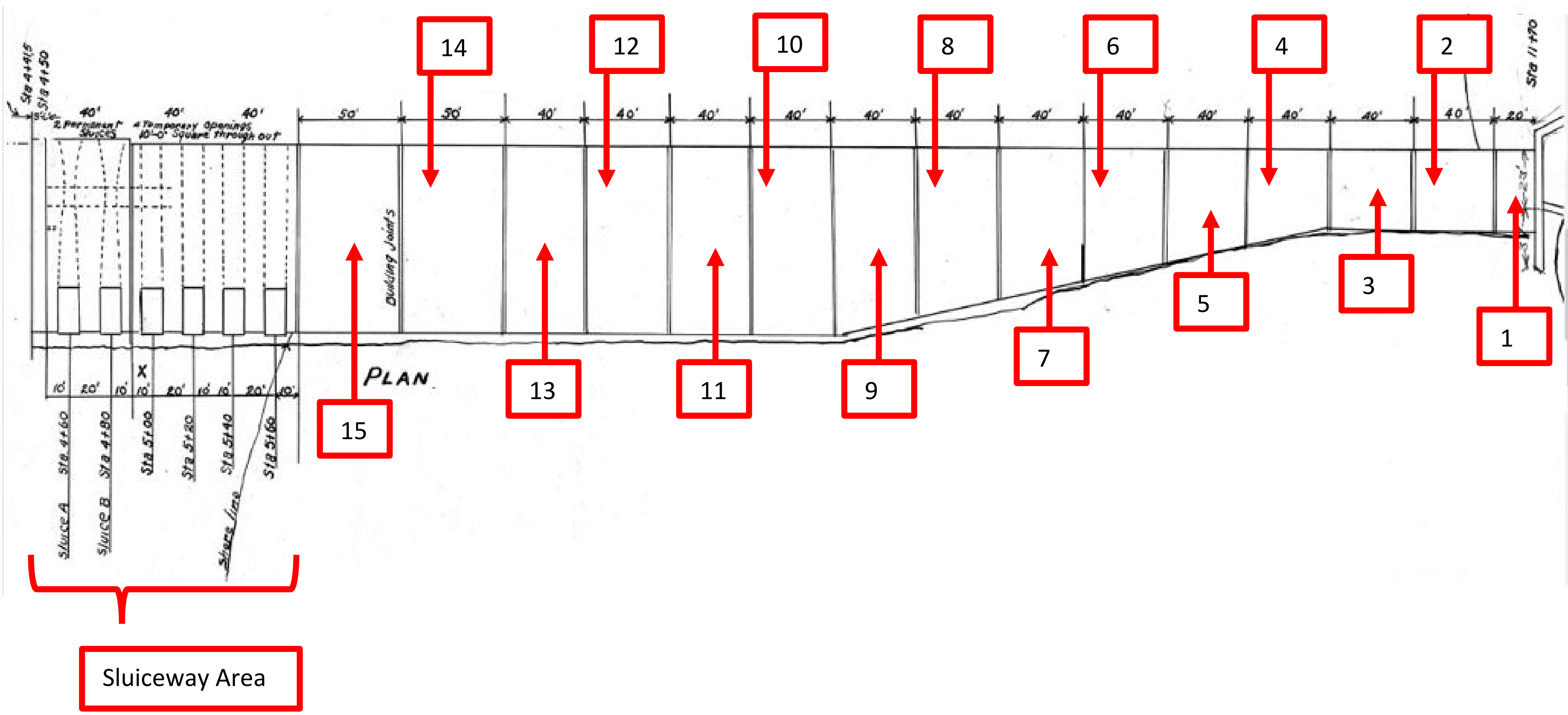

Figure 17. Filling Downstream Rock Filled Timber Crib Cofferdam Section

Figure 18. Detail View of Filling of Downstream Rock Filled Timber Crib Cofferdam Section

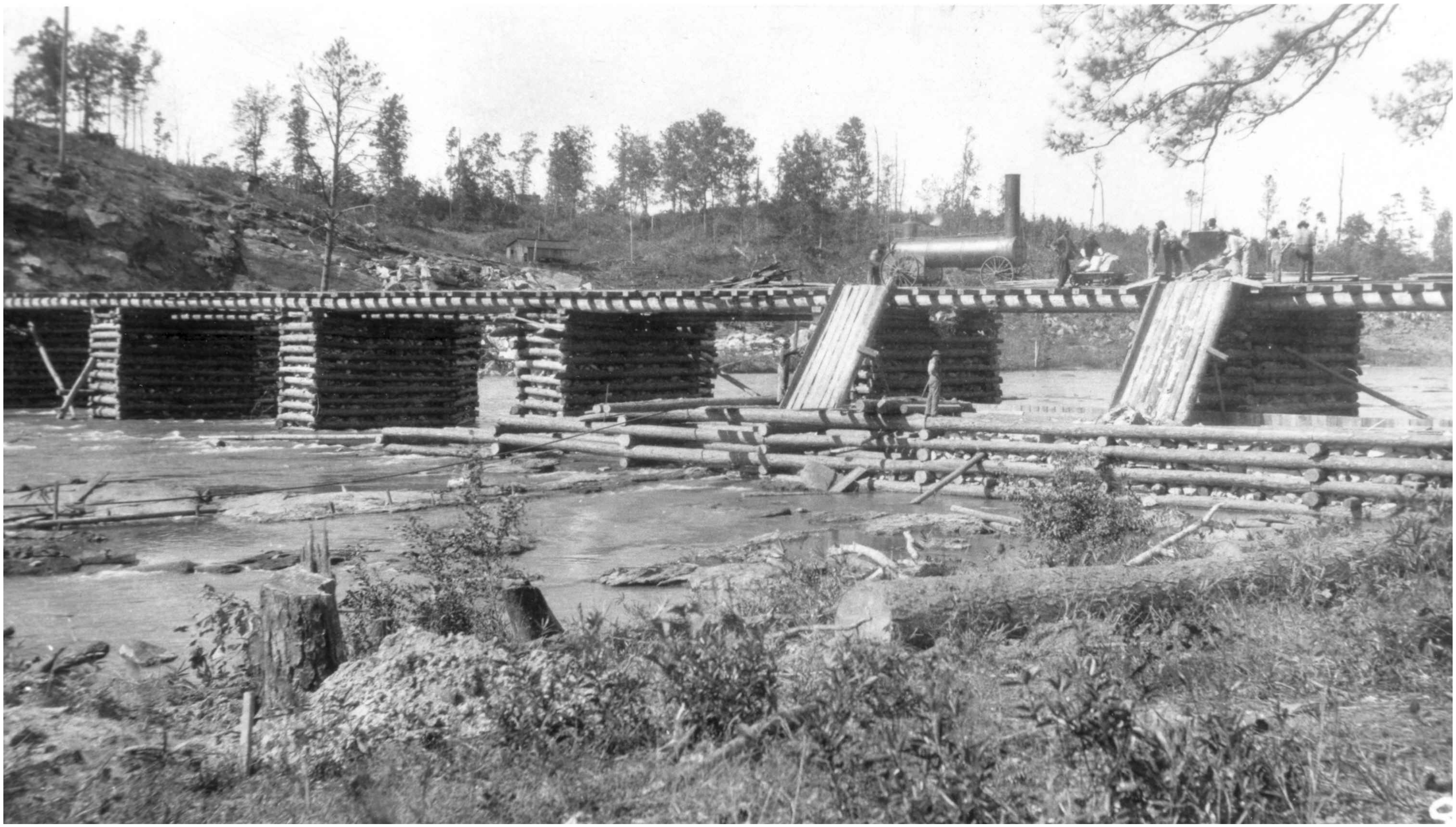

Figure 19. First Cofferdam Puddle Zone Construction

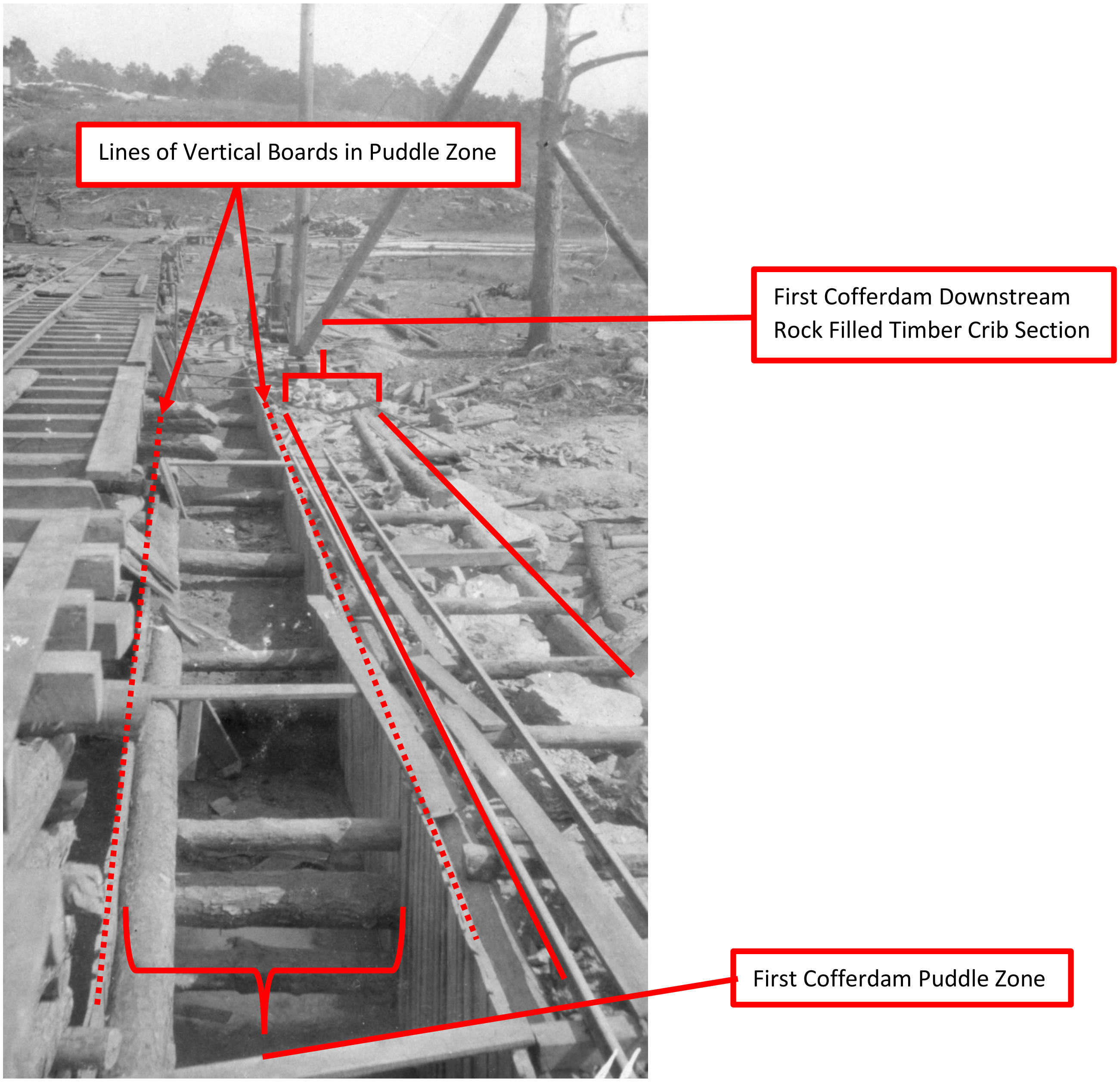

Figure 20. First Cofferdam North-South Leg Construction

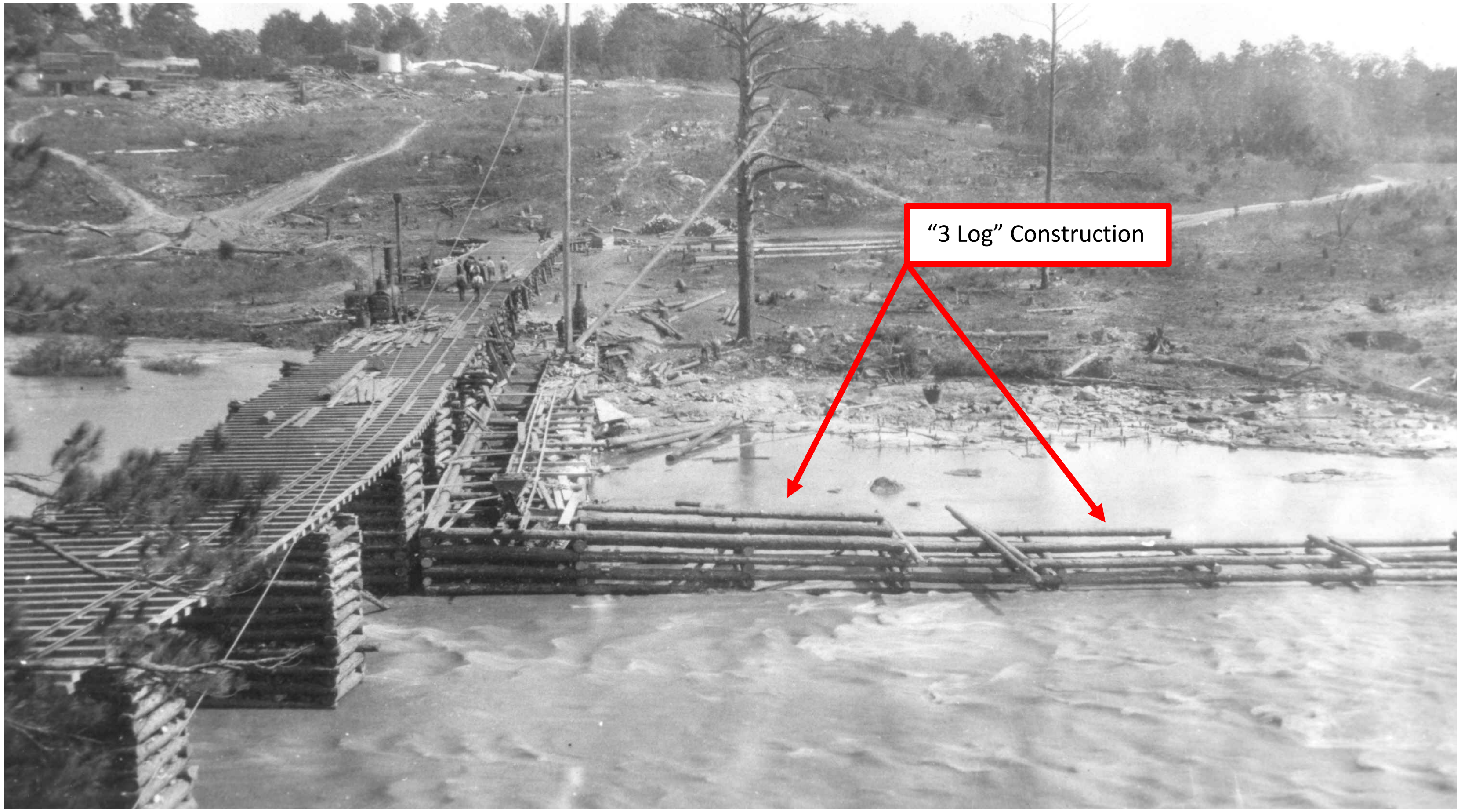

Figure 21. First Cofferdam Completed North-South Leg

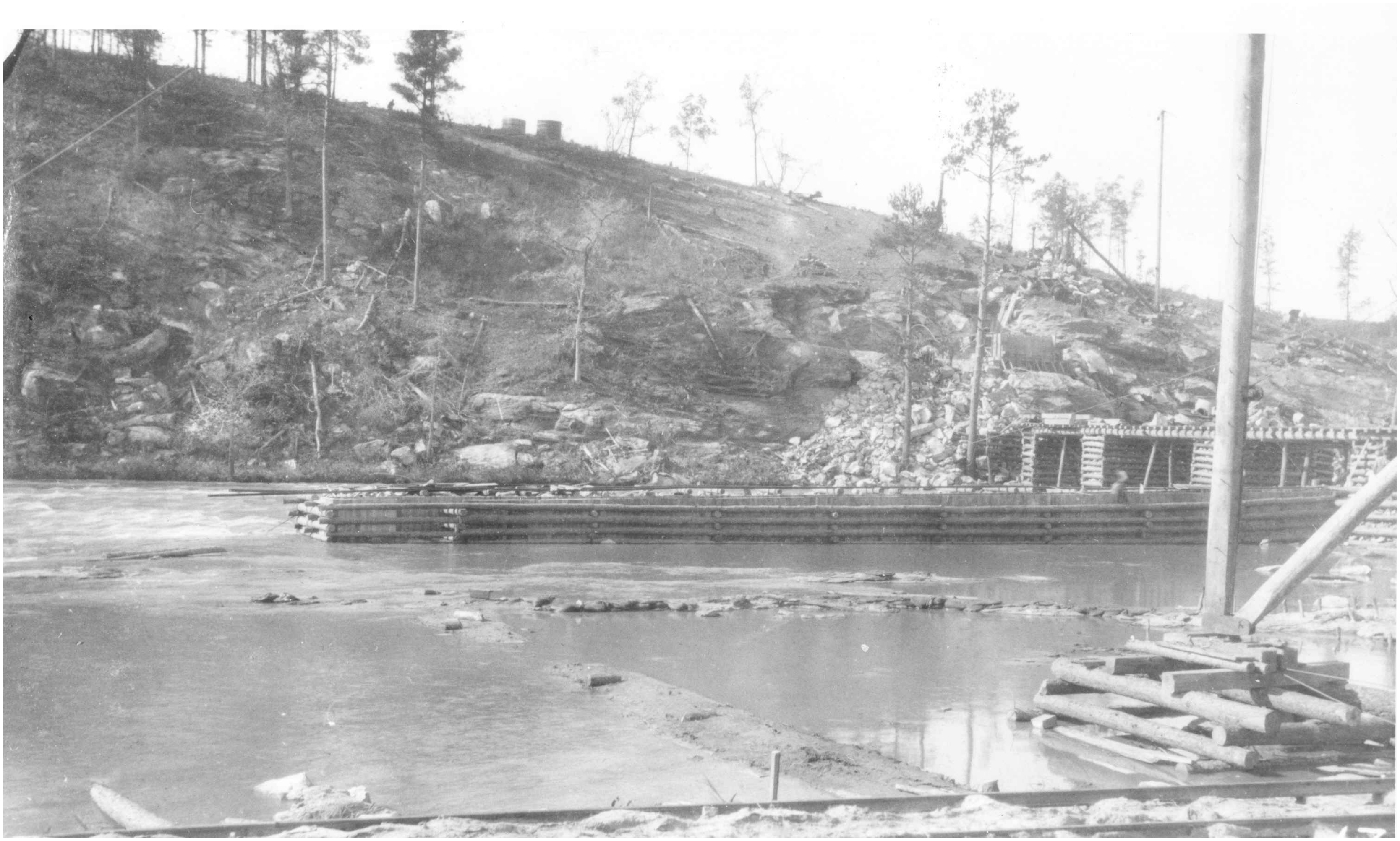

Figure 22. First Cofferdam Interior Faces

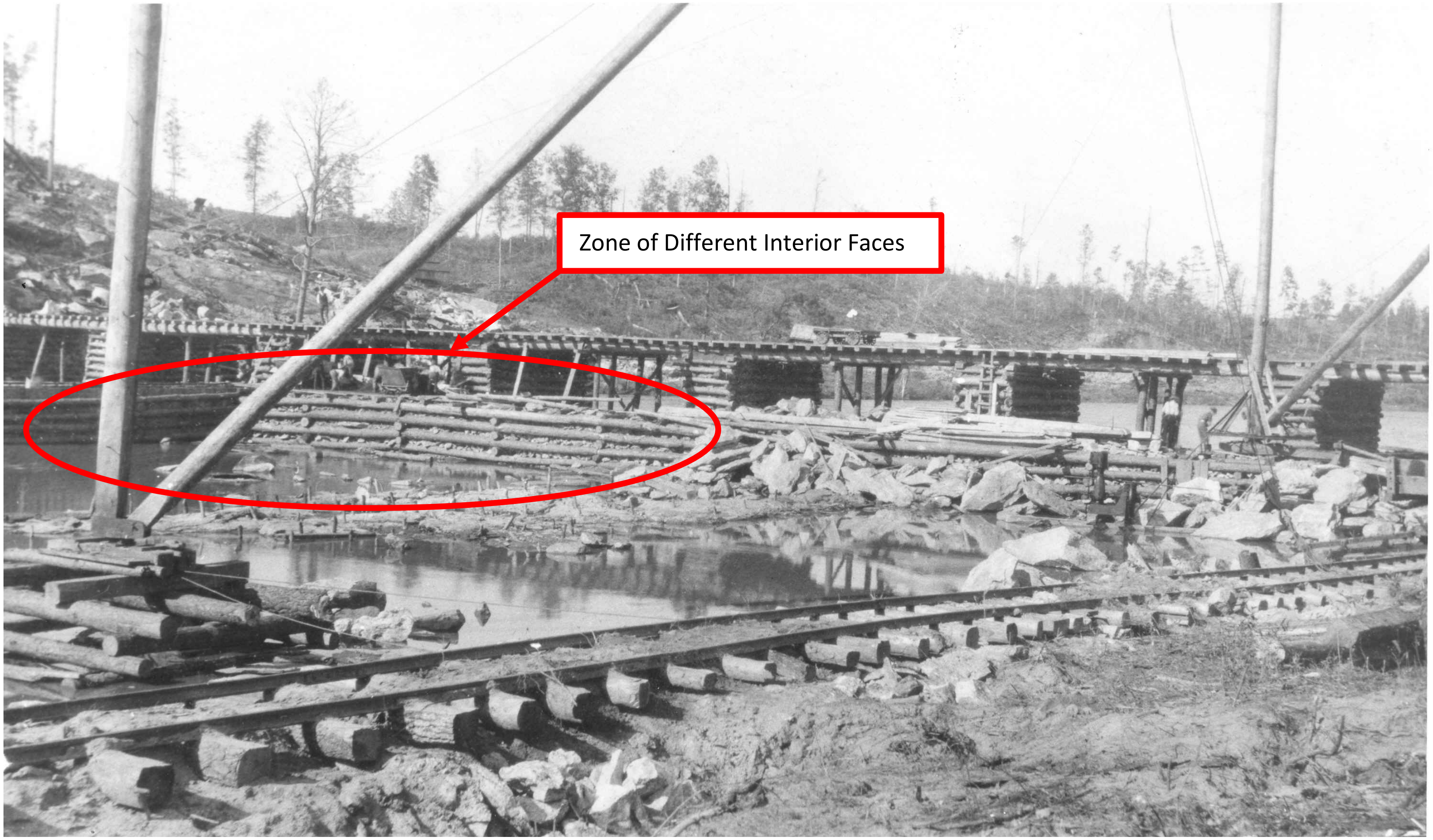

Figure 23. Partial First Cofferdam and Construction Locomotive

Figure 24. Derrick Construction Area

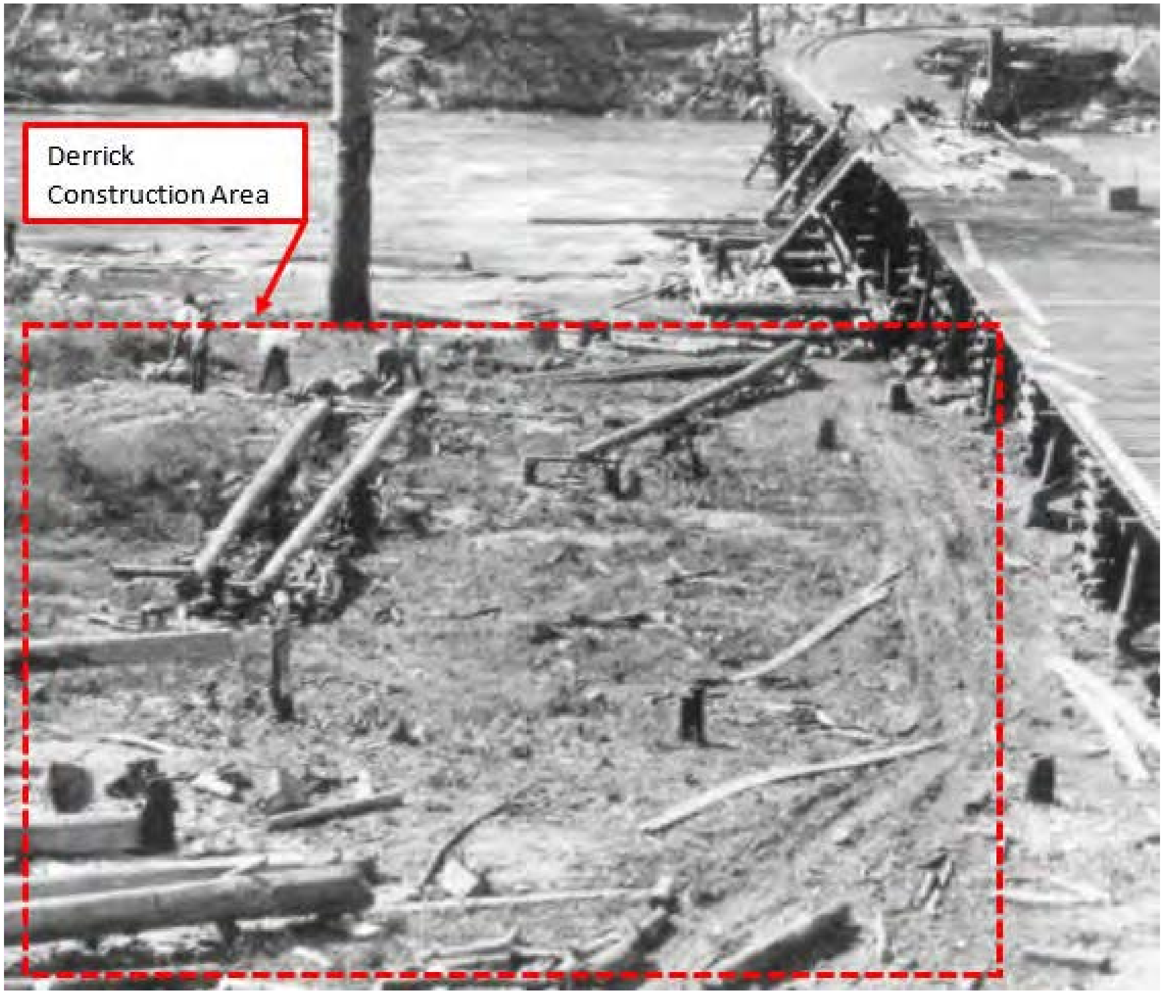

Figure 25. Apparent Extension of Upstream Construction Bridge and Potential Start of Earth Excavation

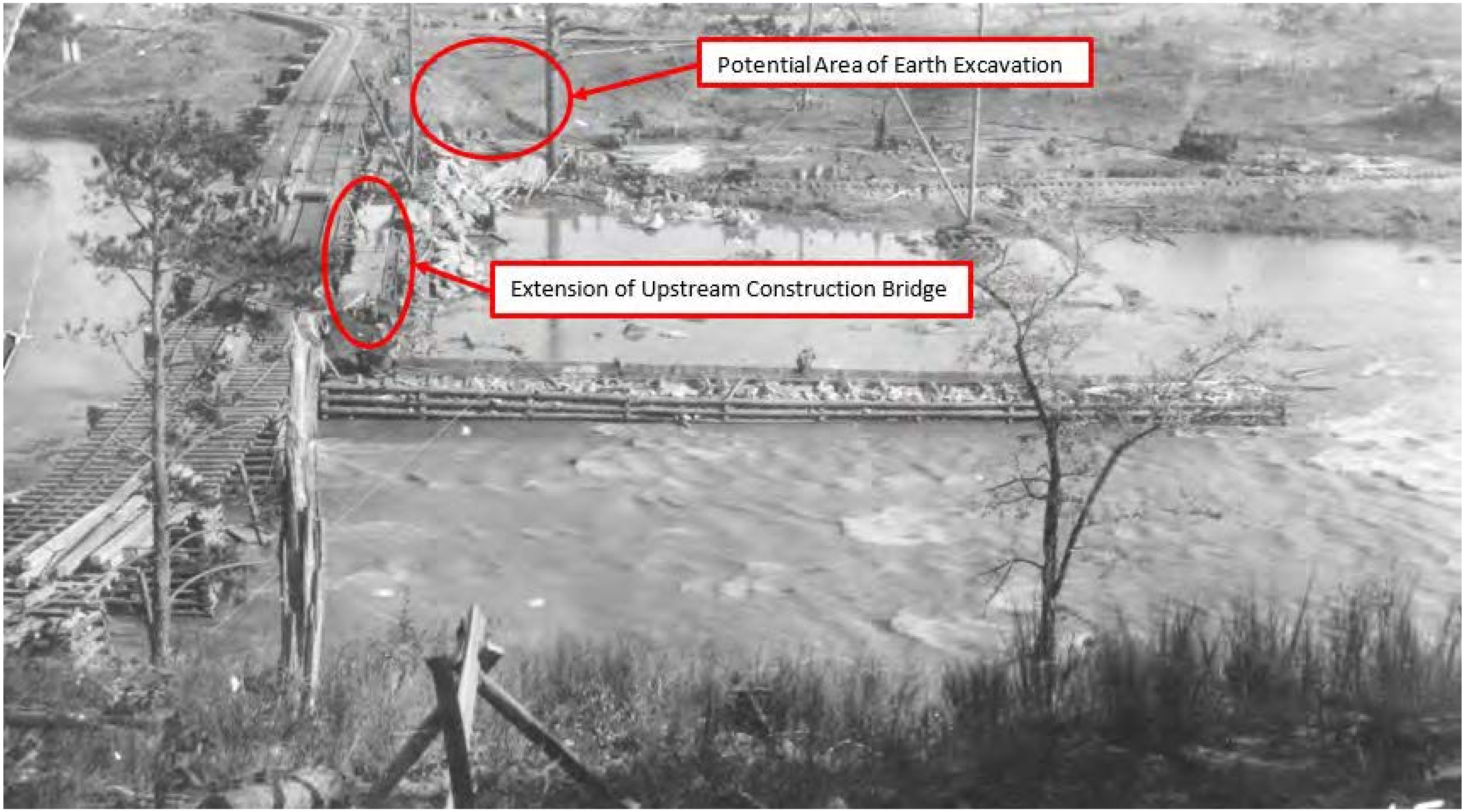

Figure 26. Start of West Batch Plant Construction

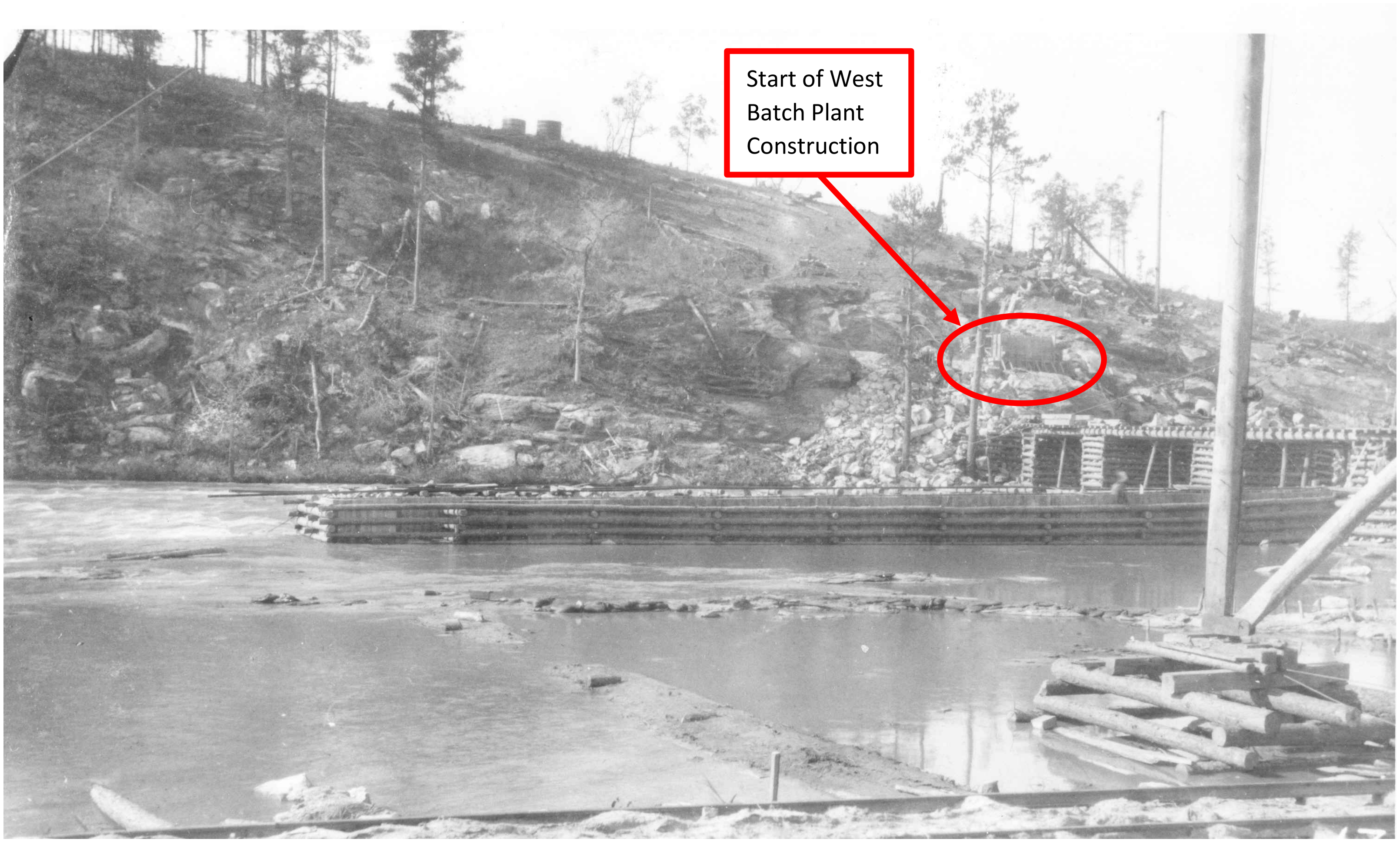

Figure 27. Completed West Batch Plant

Figure 28. Construction Locomotive

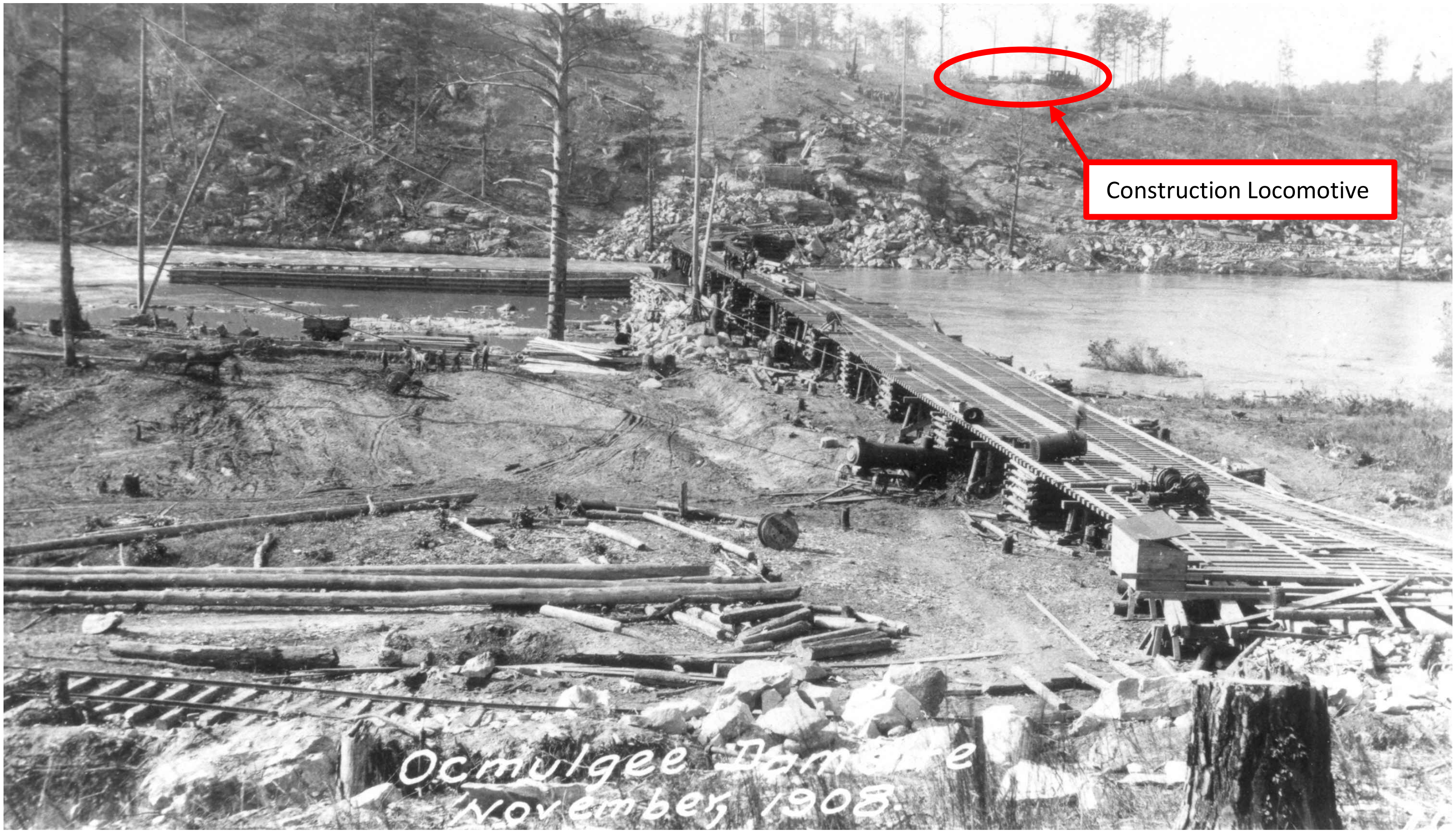

Figure 29. Construction Site November 1908

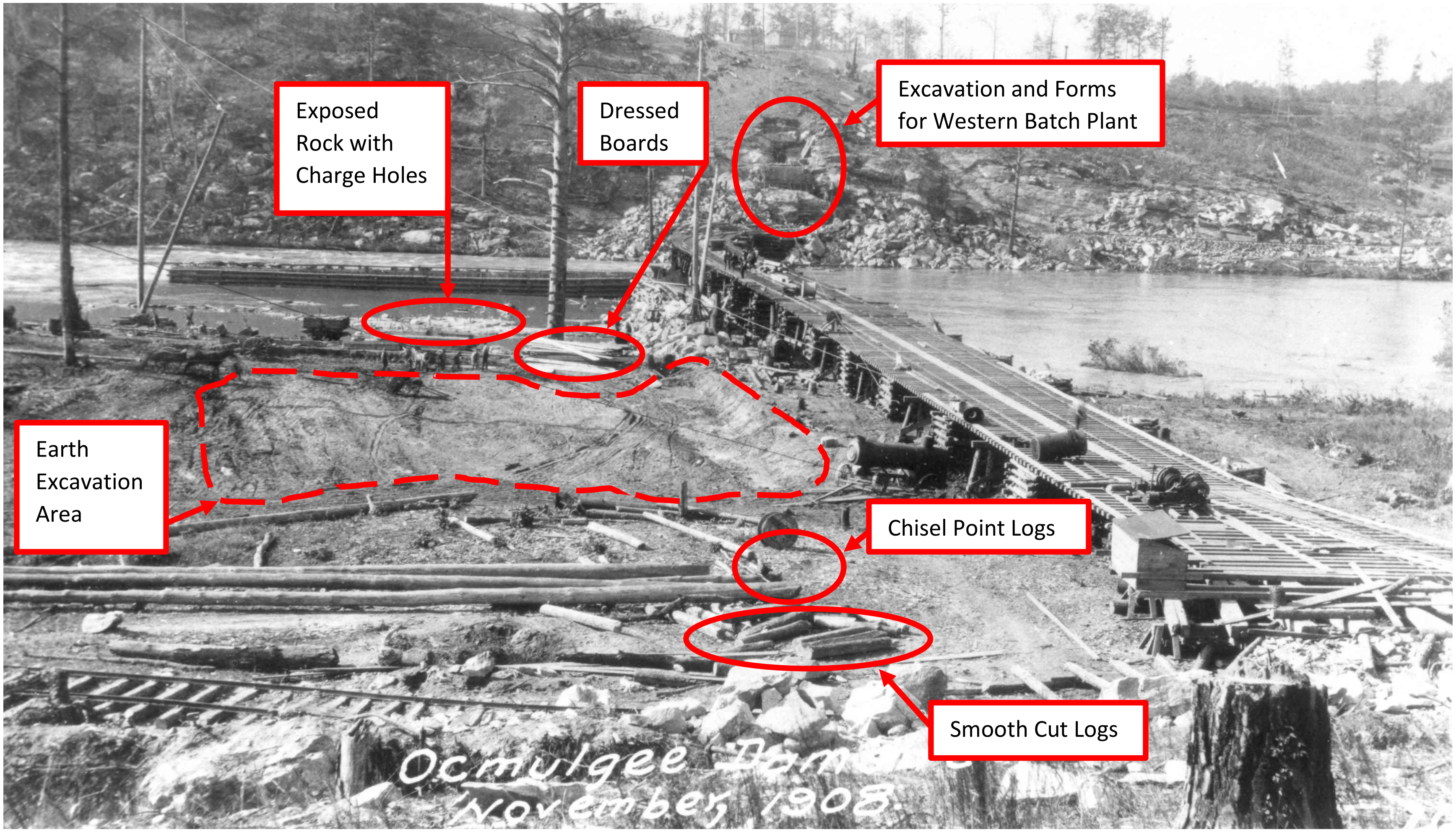

Figure 30. East Quarry Site and Railroad Extension

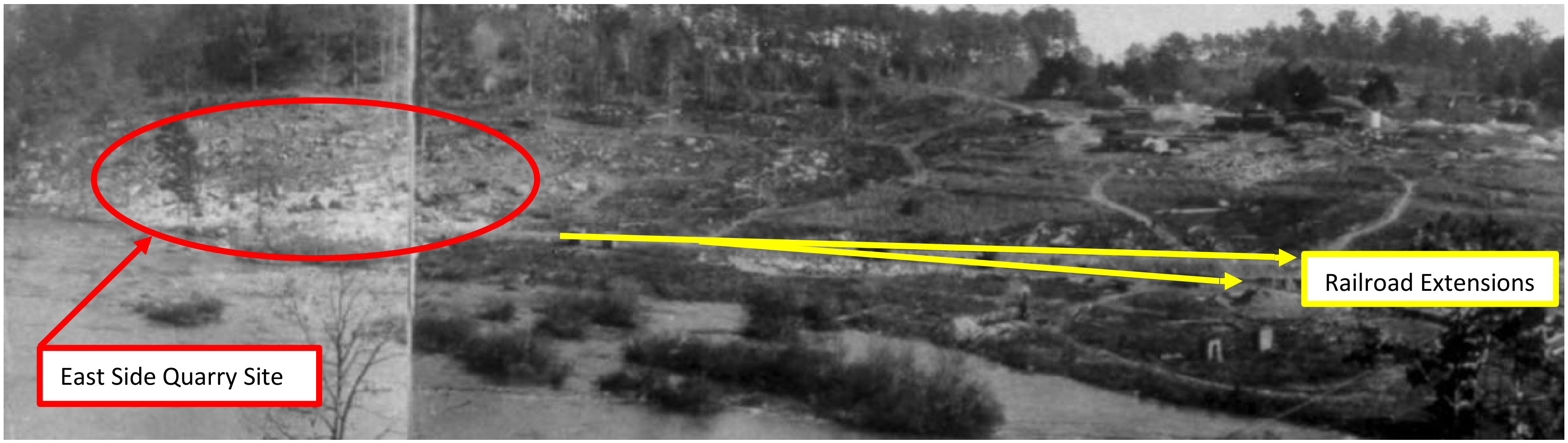

Figure 31. West Quarry Site

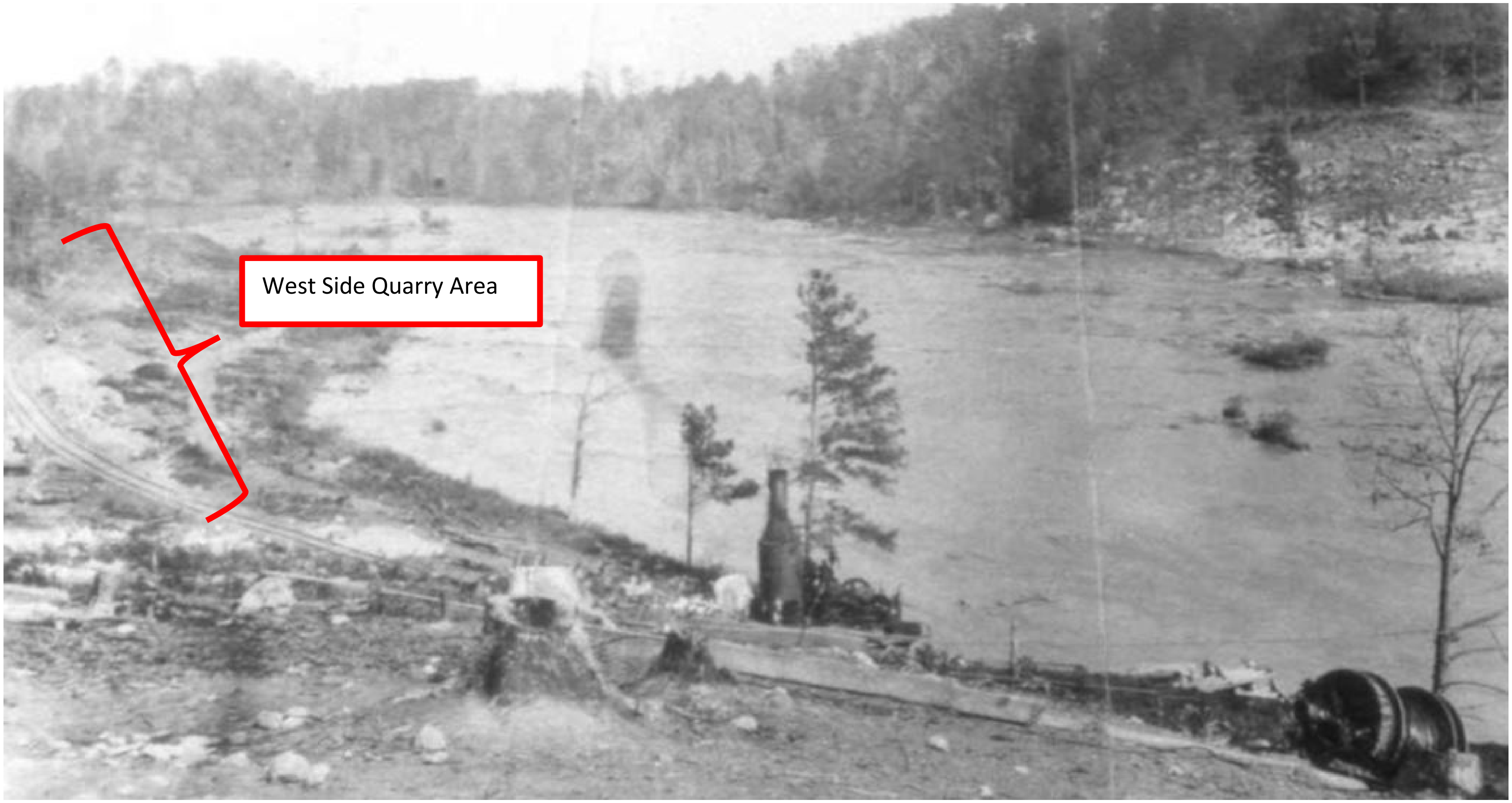

Figure 32. Cofferdam Area 12/14/1908

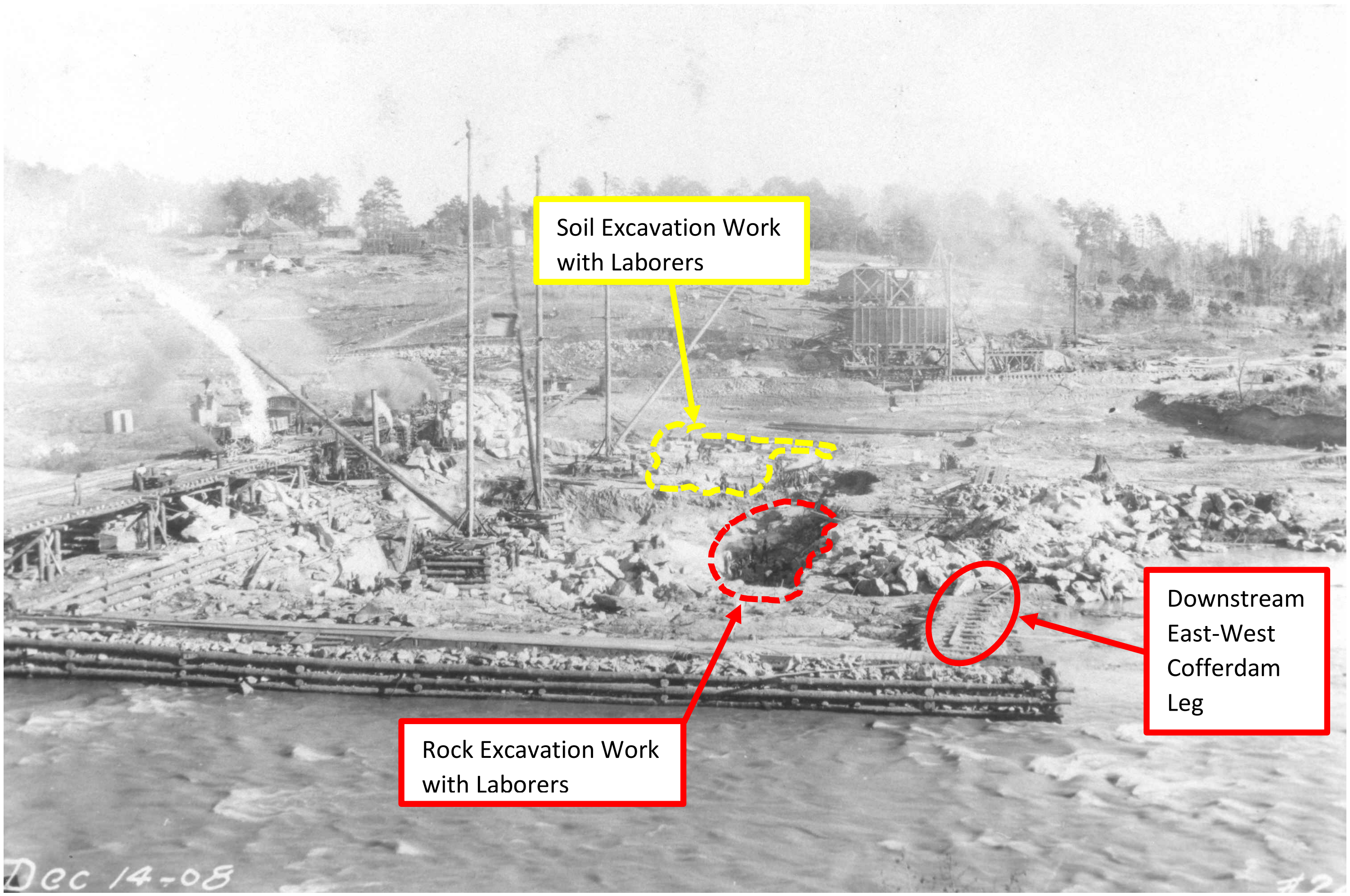

Figure 33. Freshet of 12/23/1908

Figure 34. Large Stone Stockpiles

Figure 35. Direct Sand Transfer

Figure 36. Railroad Dump Car, Barge, and Dredge

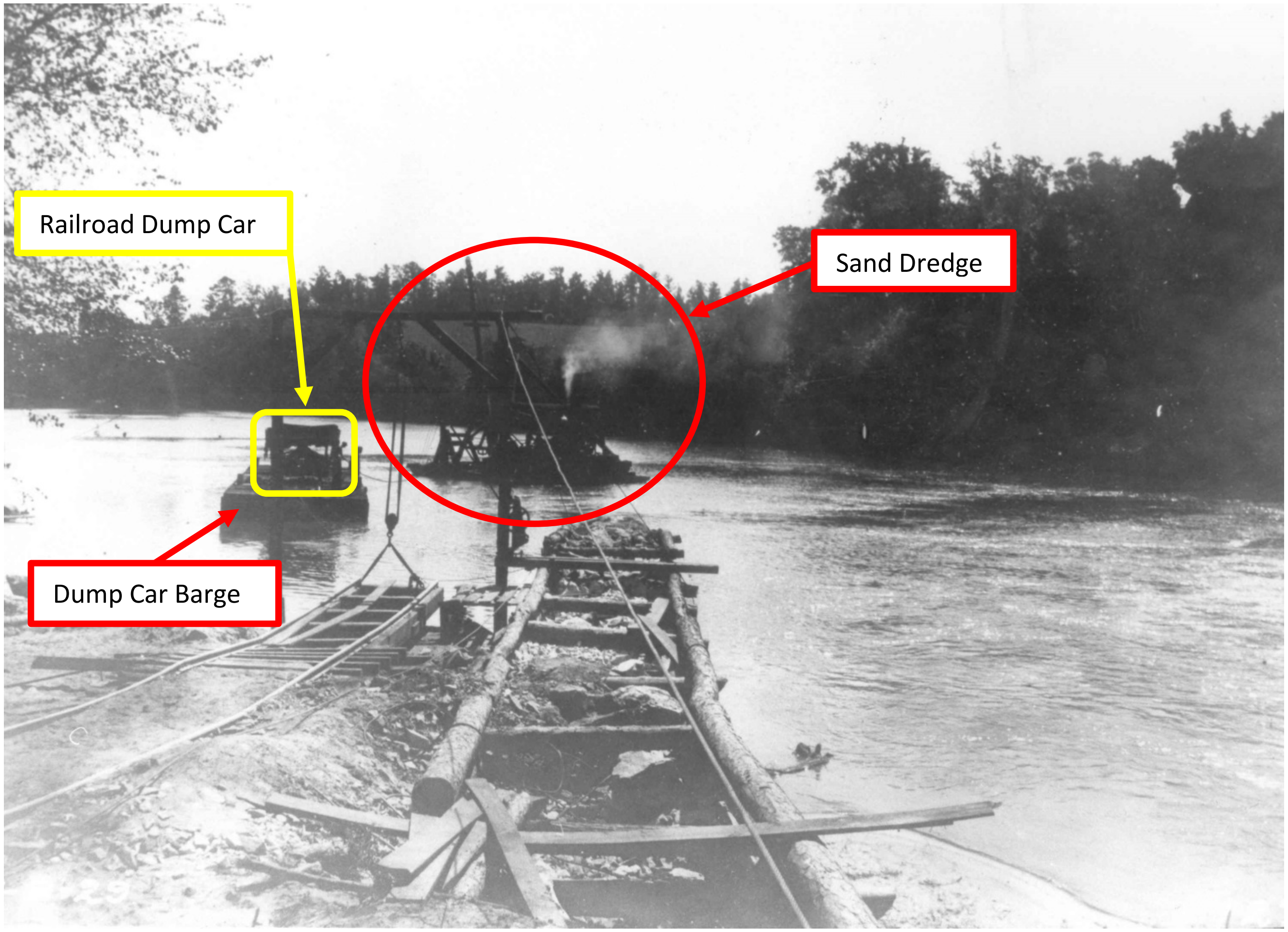

Figure 37. First Concrete Pour

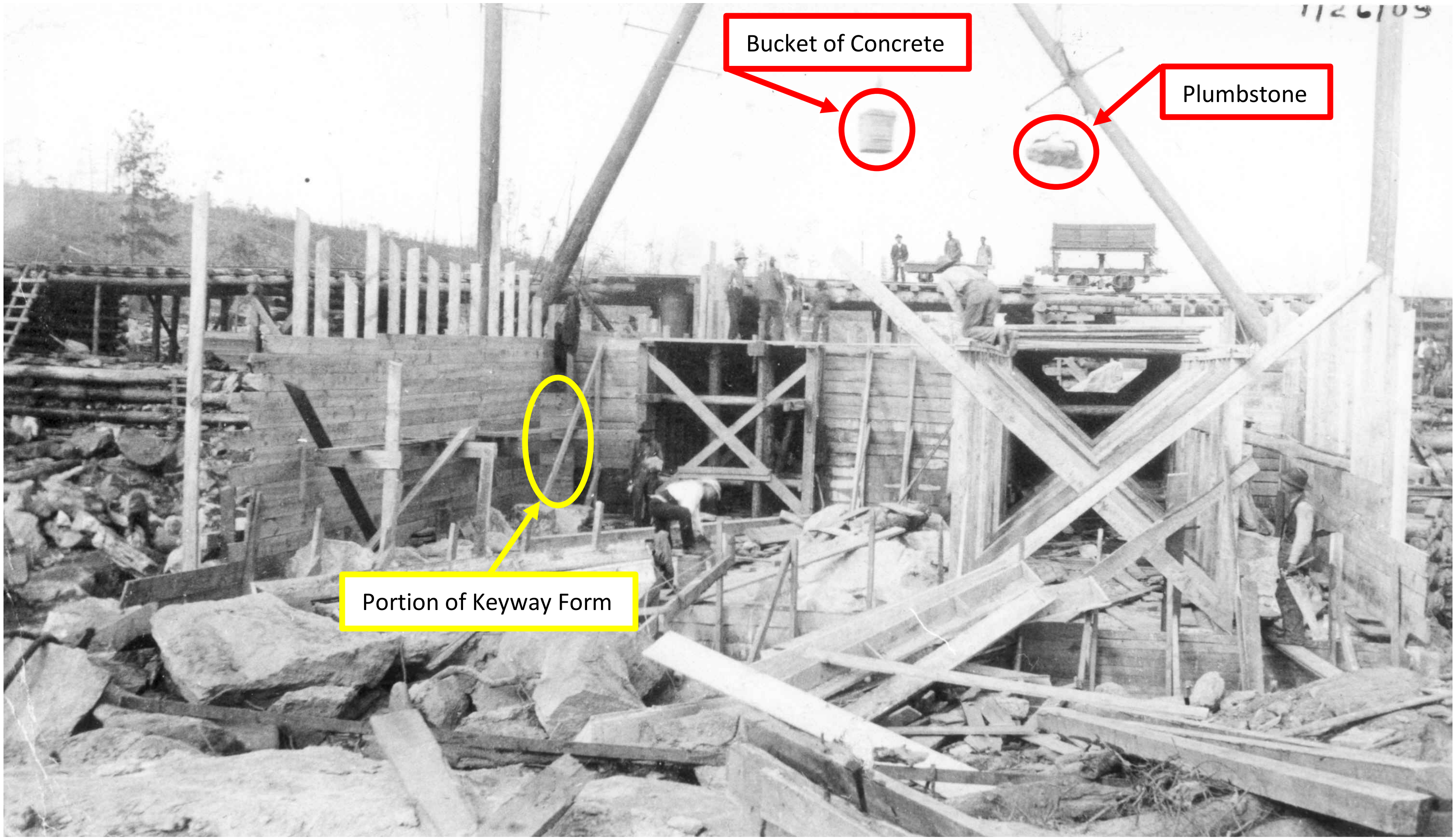

Figure 38. East Batch Plant 1/31/1909

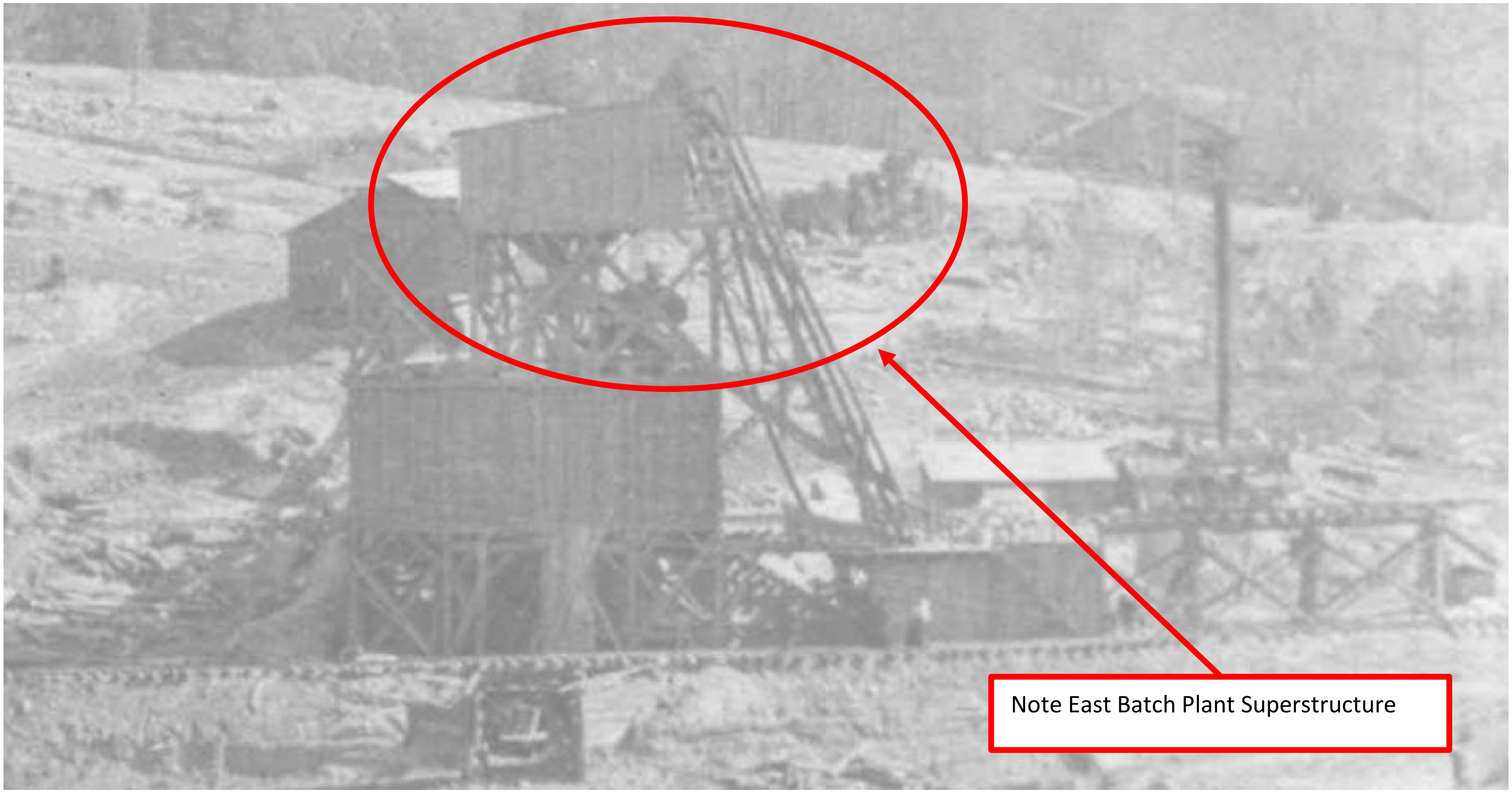

Figure 39. East Batch Plant on 2/2/1909

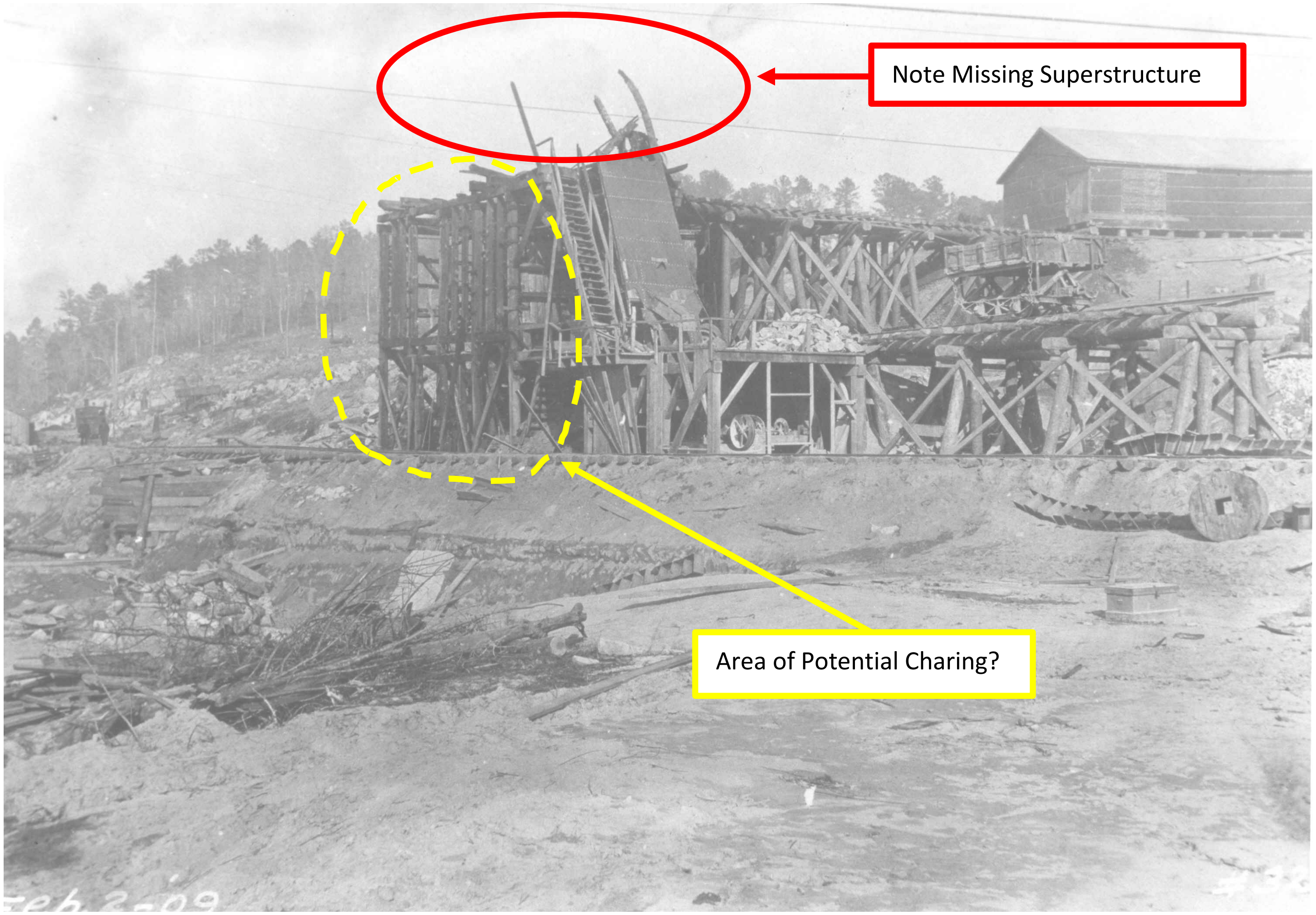

Figure 40. Freshet of 2/10/1909

Figure 41. Freshet of 3/10/1909 On 3/12/1909

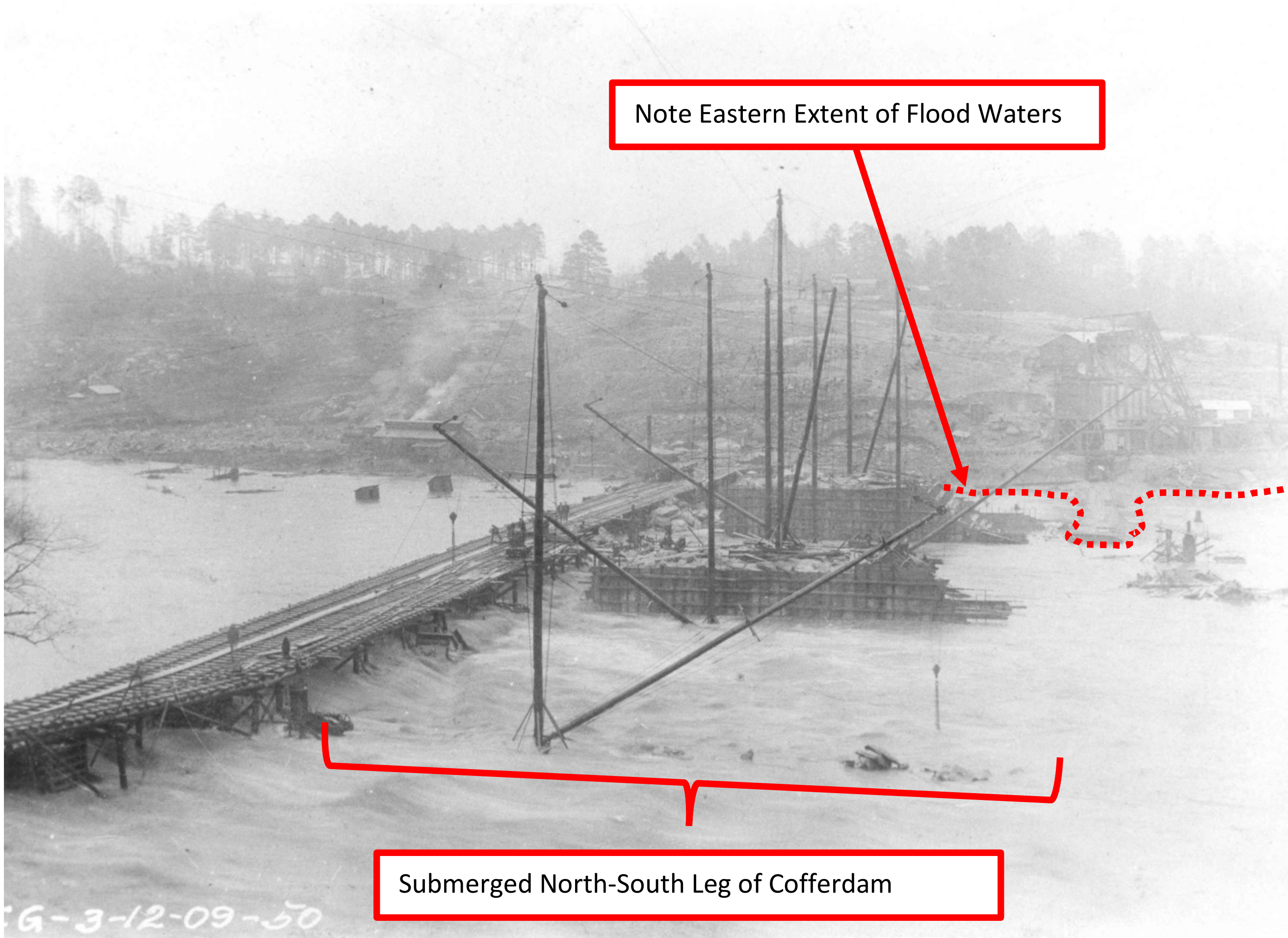

Figure 42. Freshet of 3/10/1909 On 3/15/1909

Figure 43. Start of East Trestlework

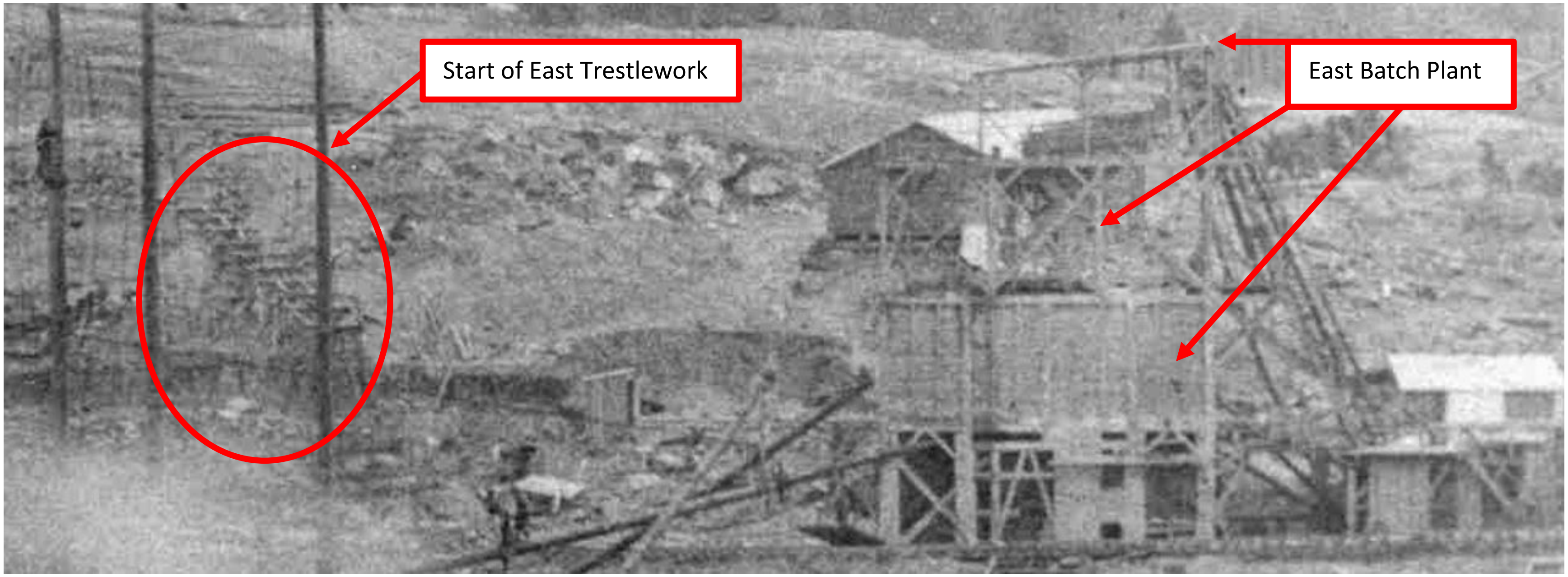

Figure 44. Construction Site as of 3/27/1909

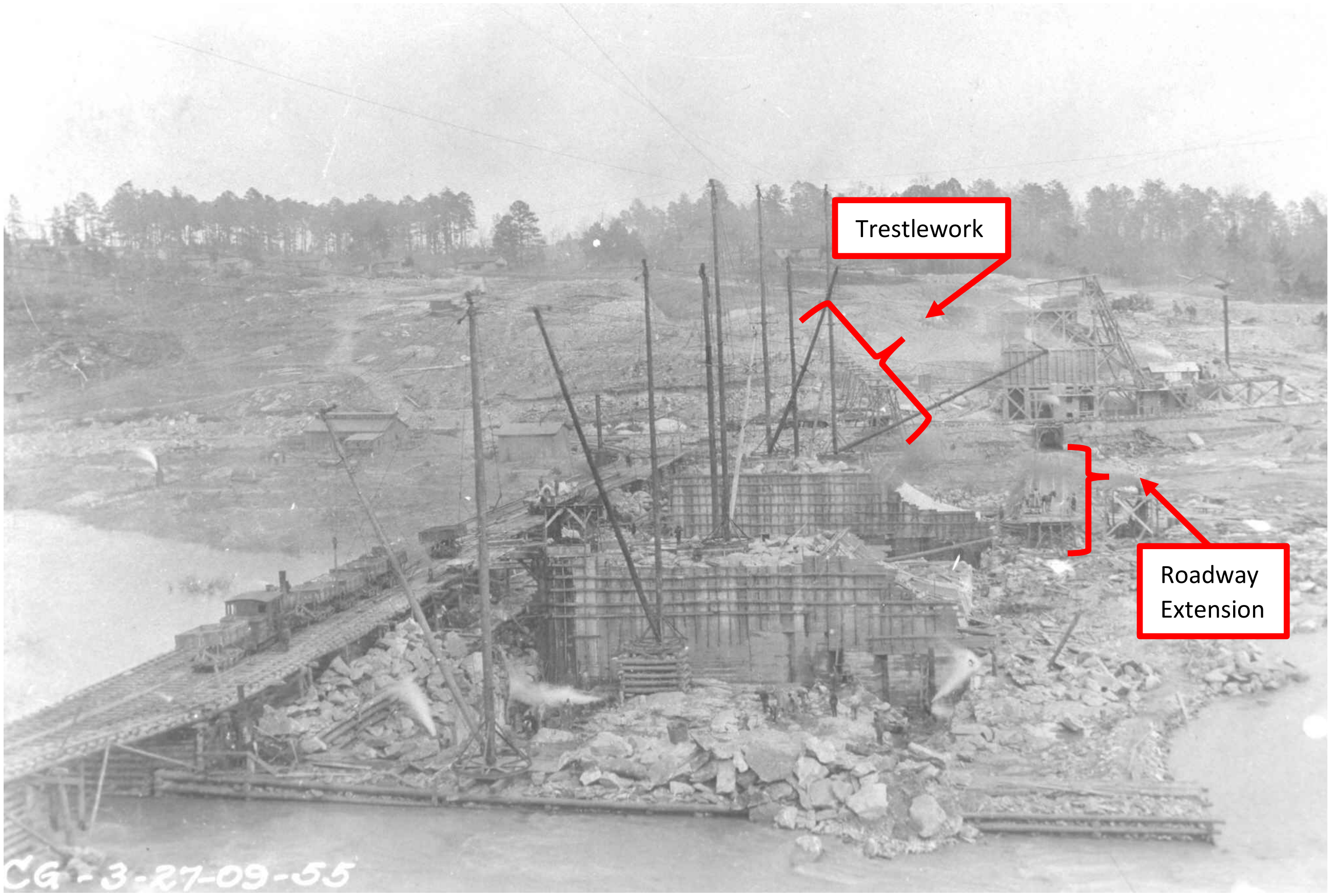

Figure 45. Construction Site as of 4/26/1909

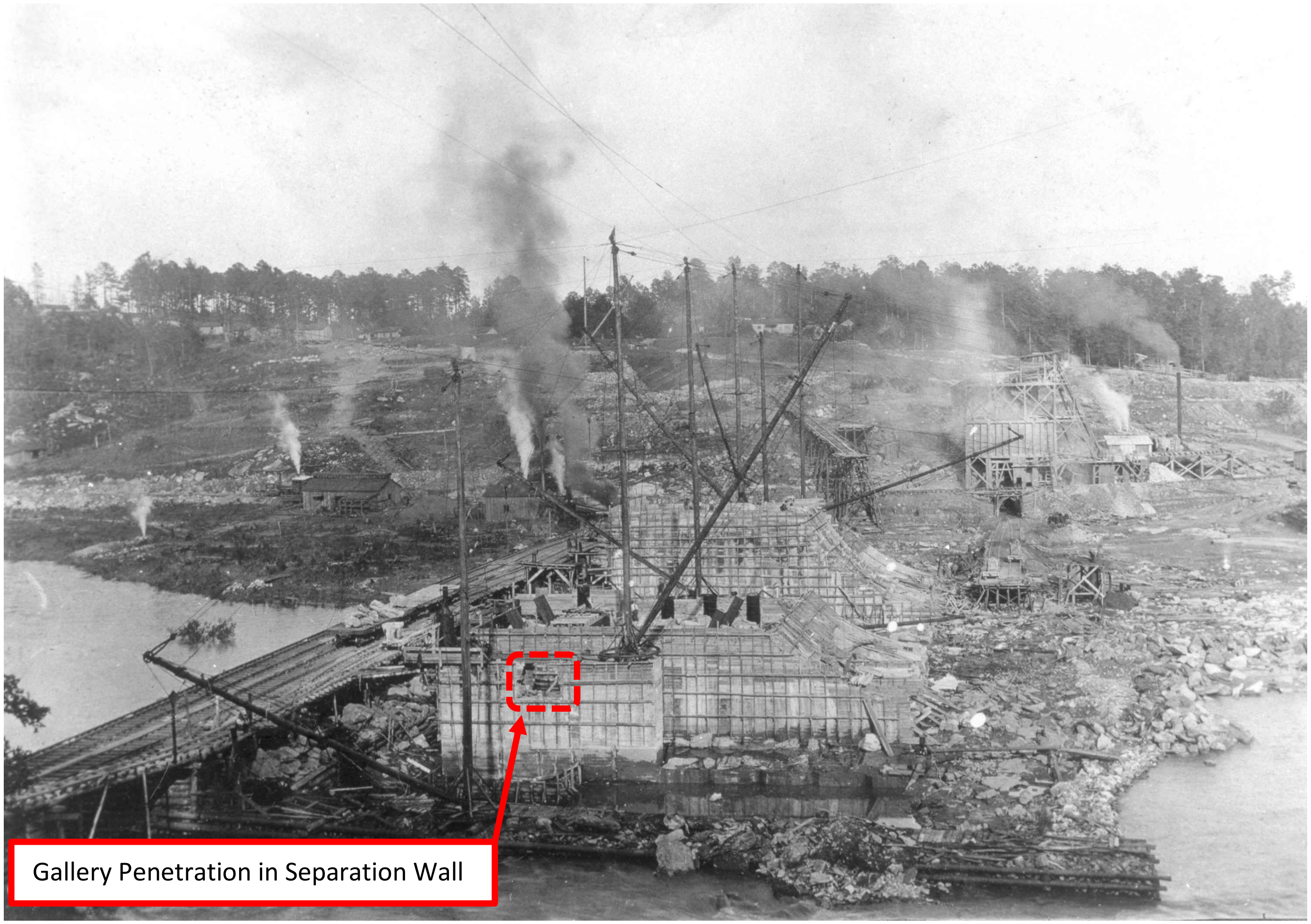

Figure 46. Easternmost Permanent Sluiceway Cast Iron Members

Figure 47. Plan View of East Embankment Core Wall

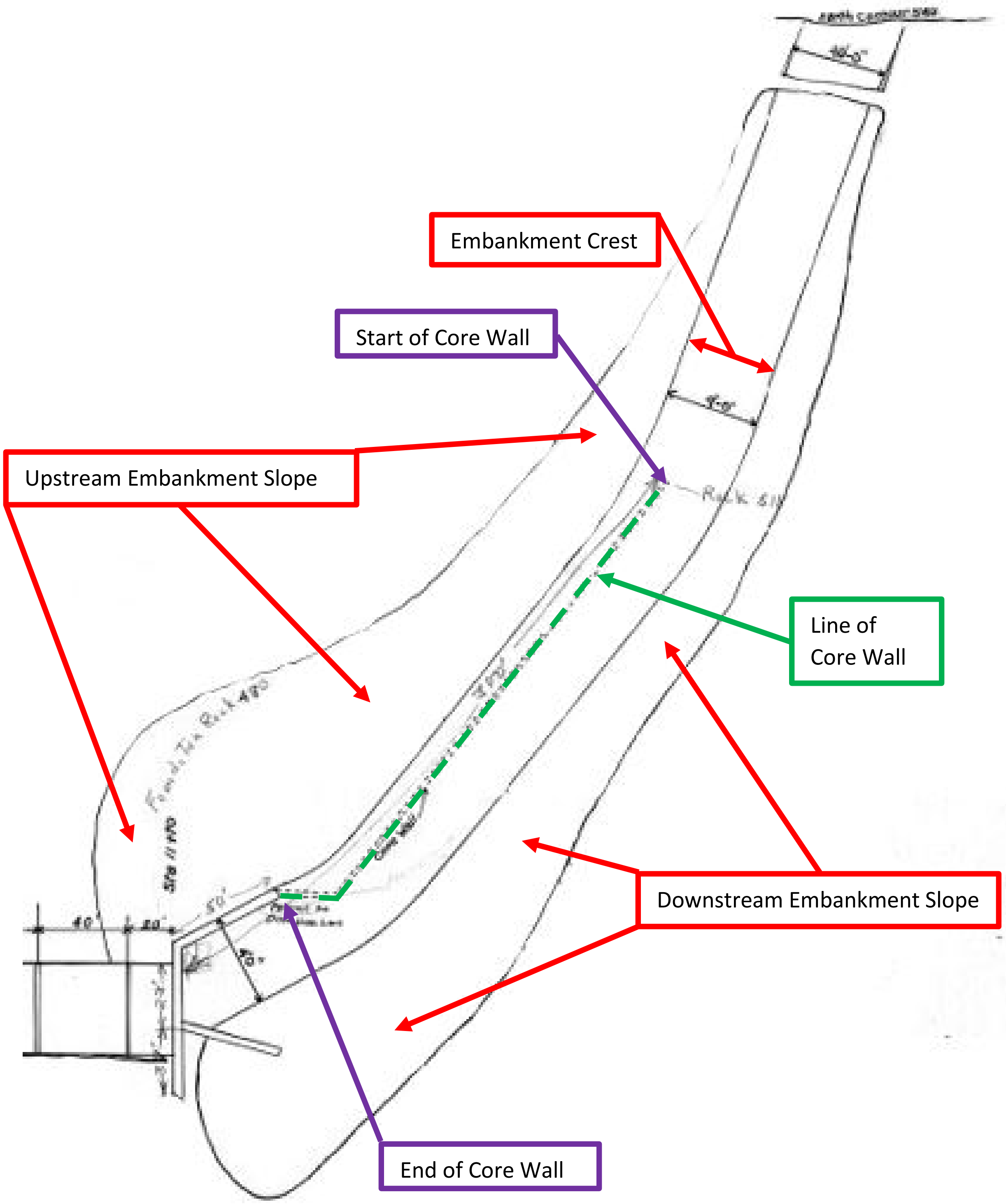

Figure 48. Cross Section of East Earth Embankment Core Wall

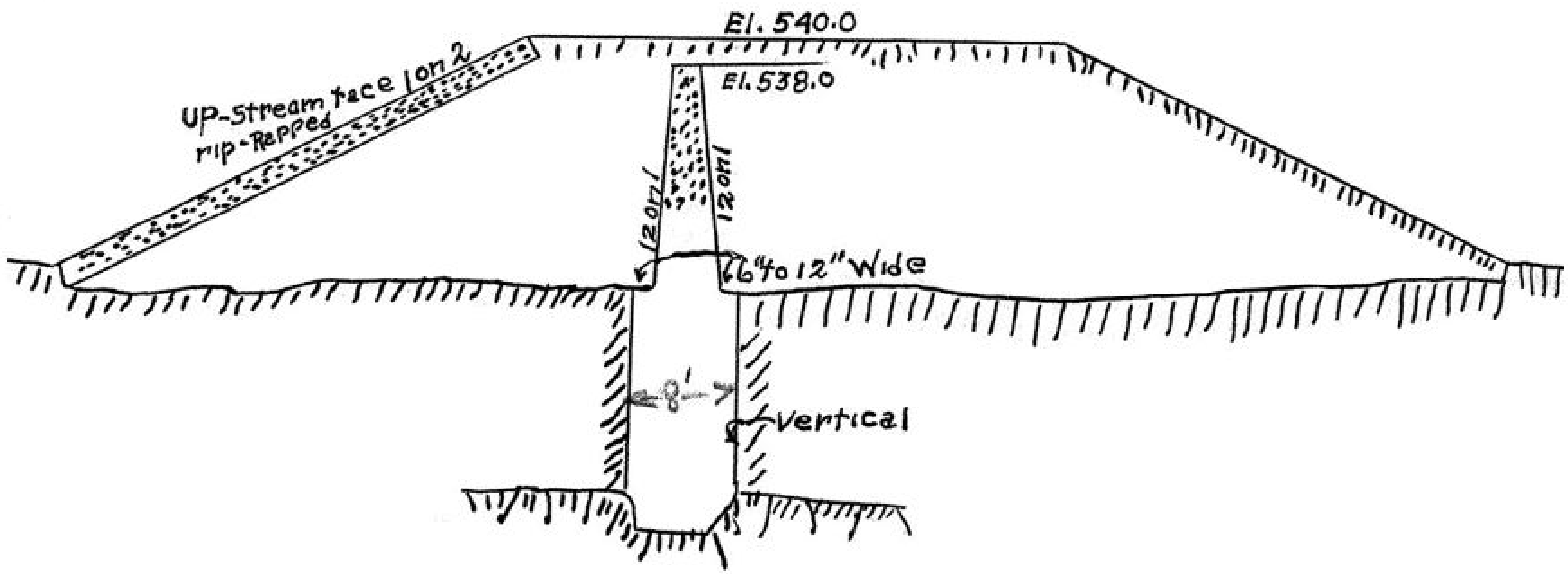

Figure 49. East Earth Embankment on 5/9/1909

Figure 50. Westernmost Permanent Sluiceway Venturi Members

Figure 51. Start of Core Wall Construction

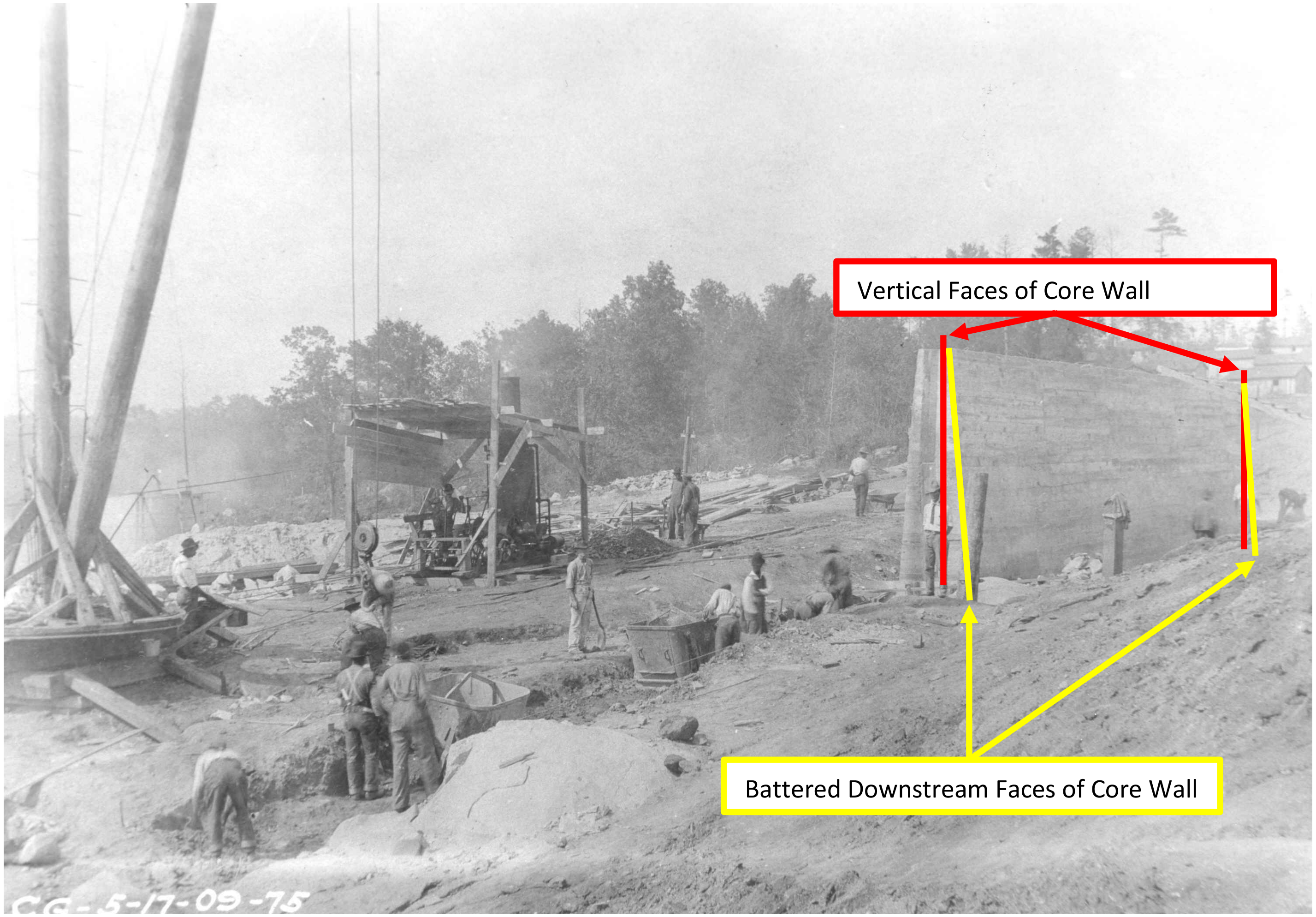

Figure 52. Form Work Extension and Crib Work Erection

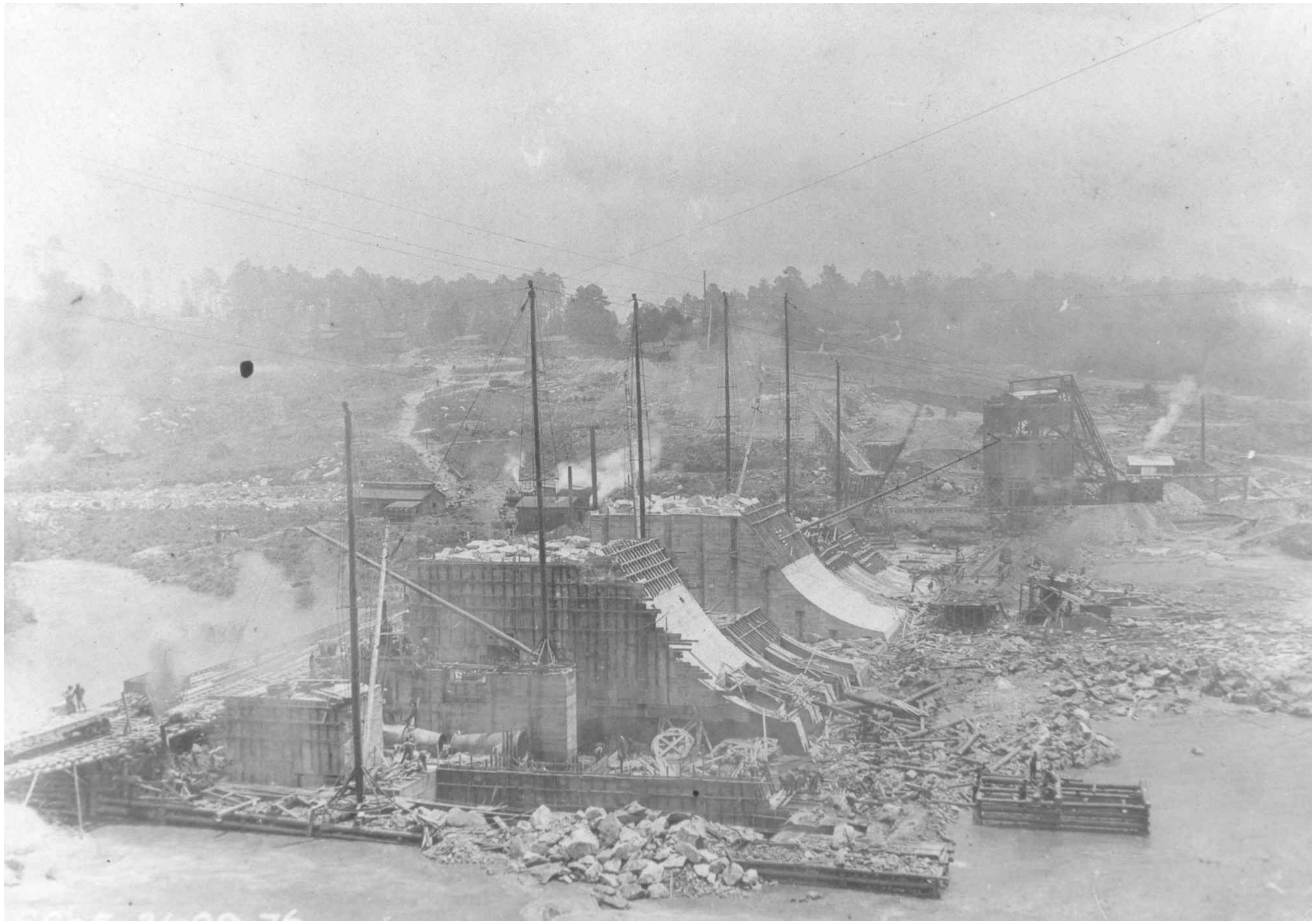

Figure 53. Initial Slope Grading East Earth Embankment Downstream Slope

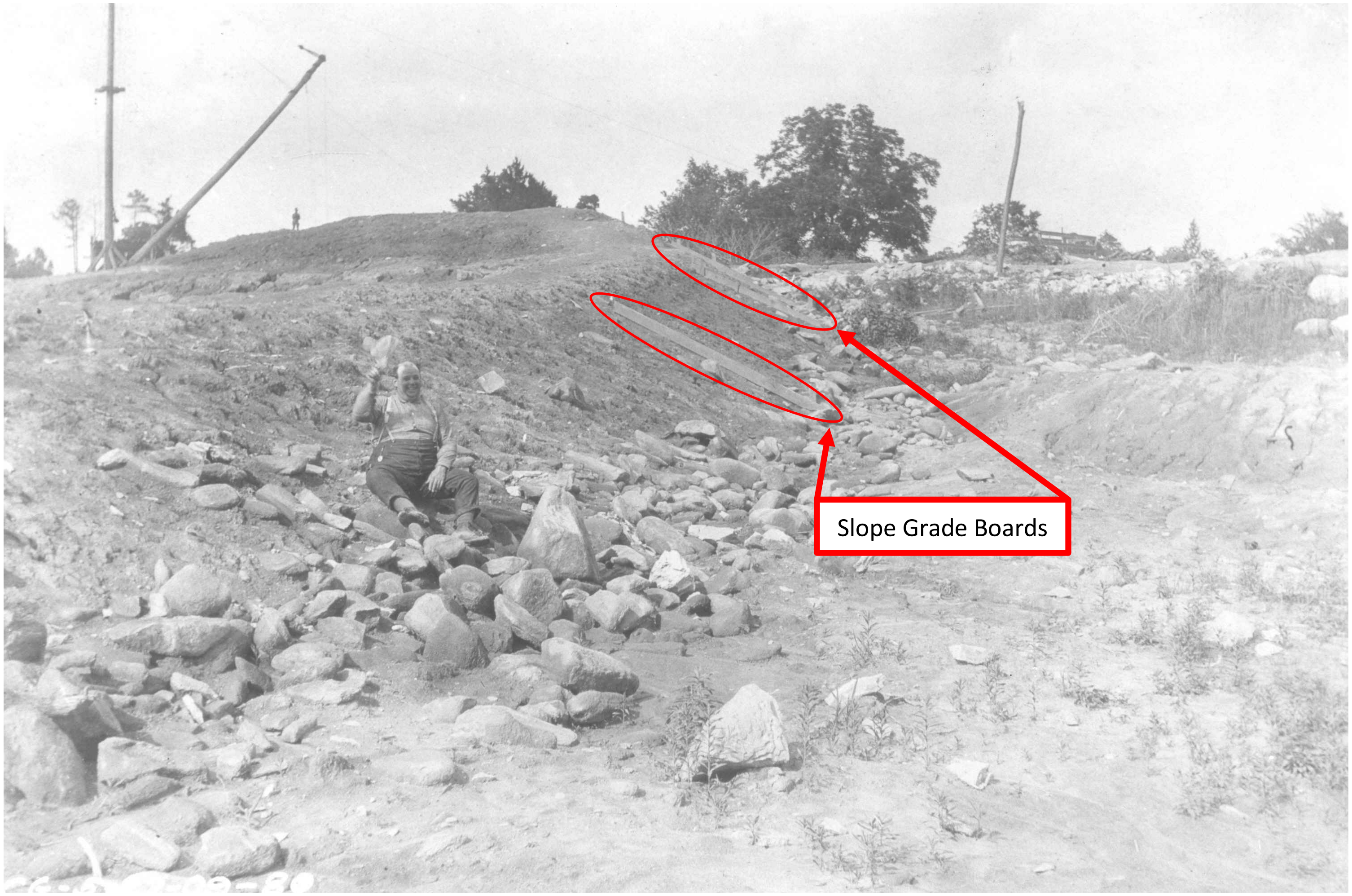

Figure 54. Potential Light Fixtures

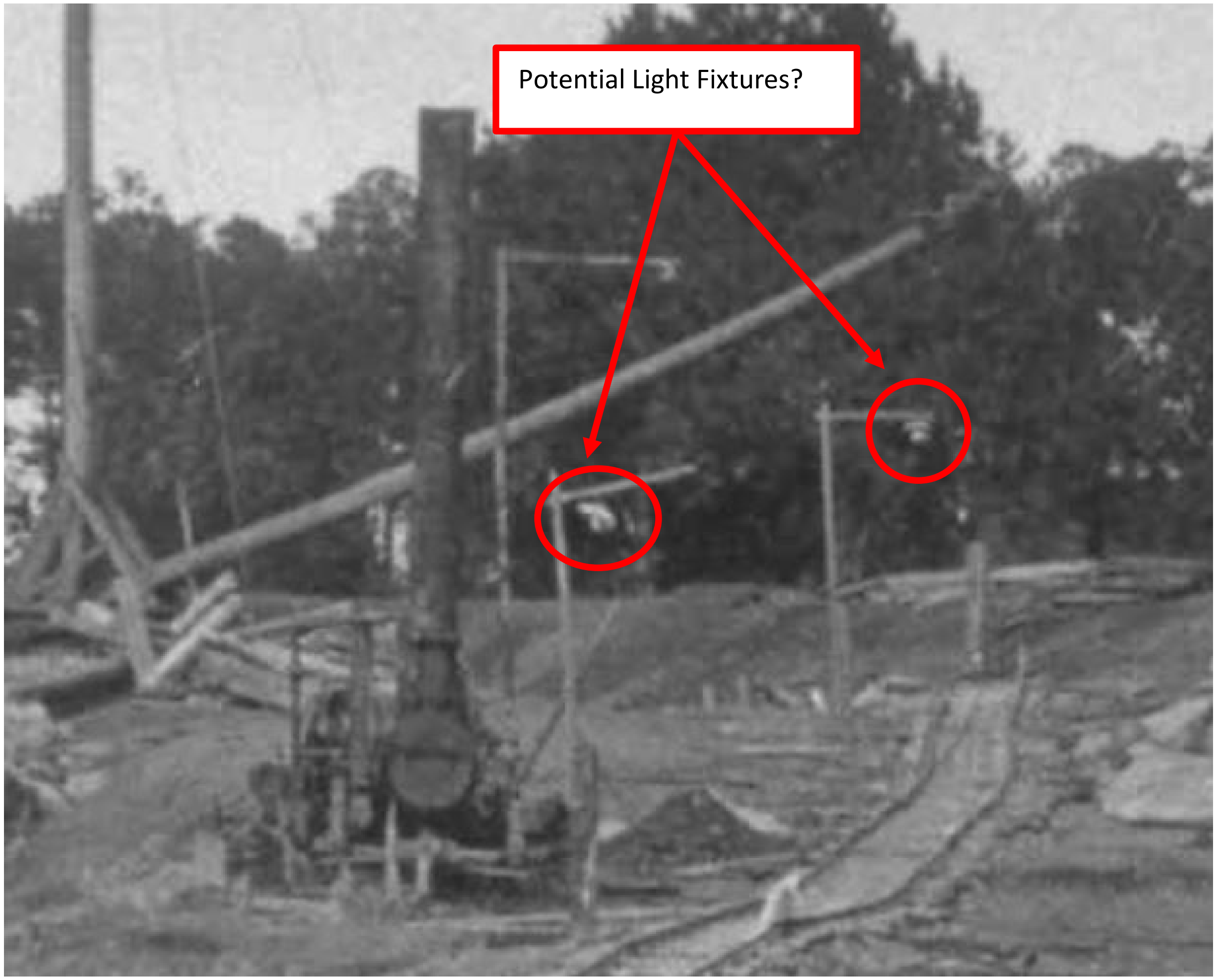

Figure 55. East Earth Embankment Upstream Slope Potential Electrical Lines

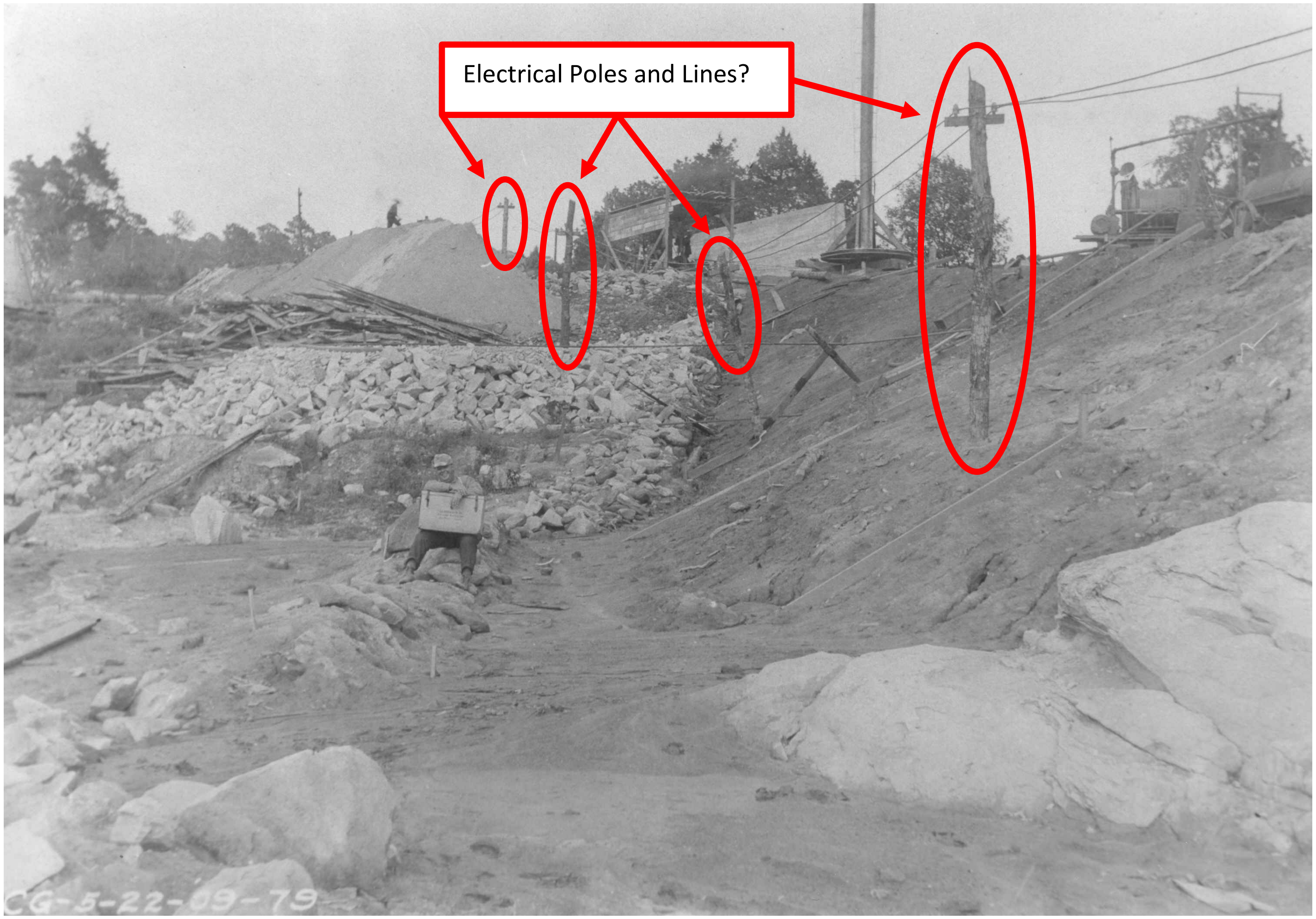

Figure 56. Cast Iron Venturi Section Suction Form Up

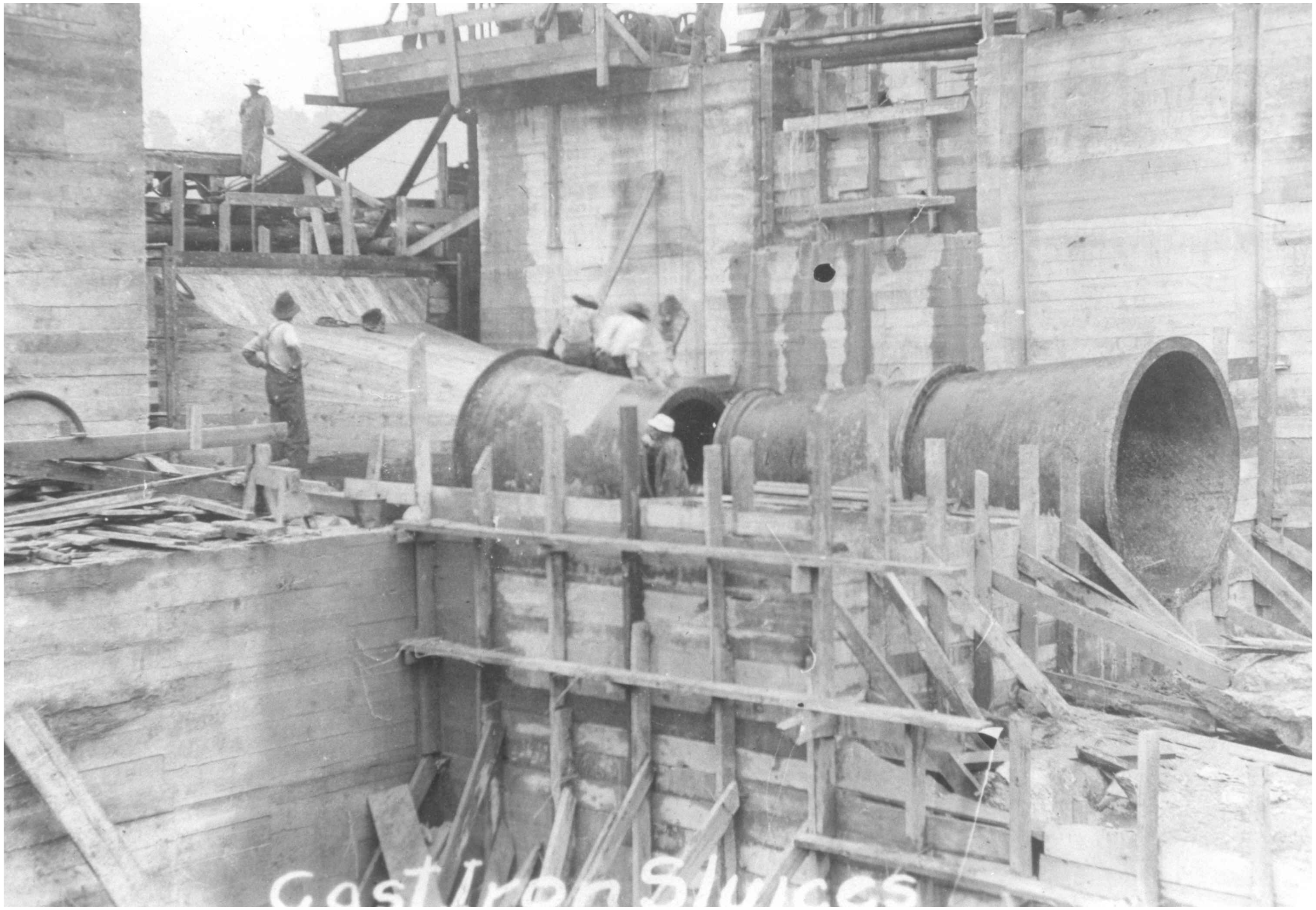

Figure 57. Concreting Westernmost Permanent Sluiceway Section on 5/25/1909

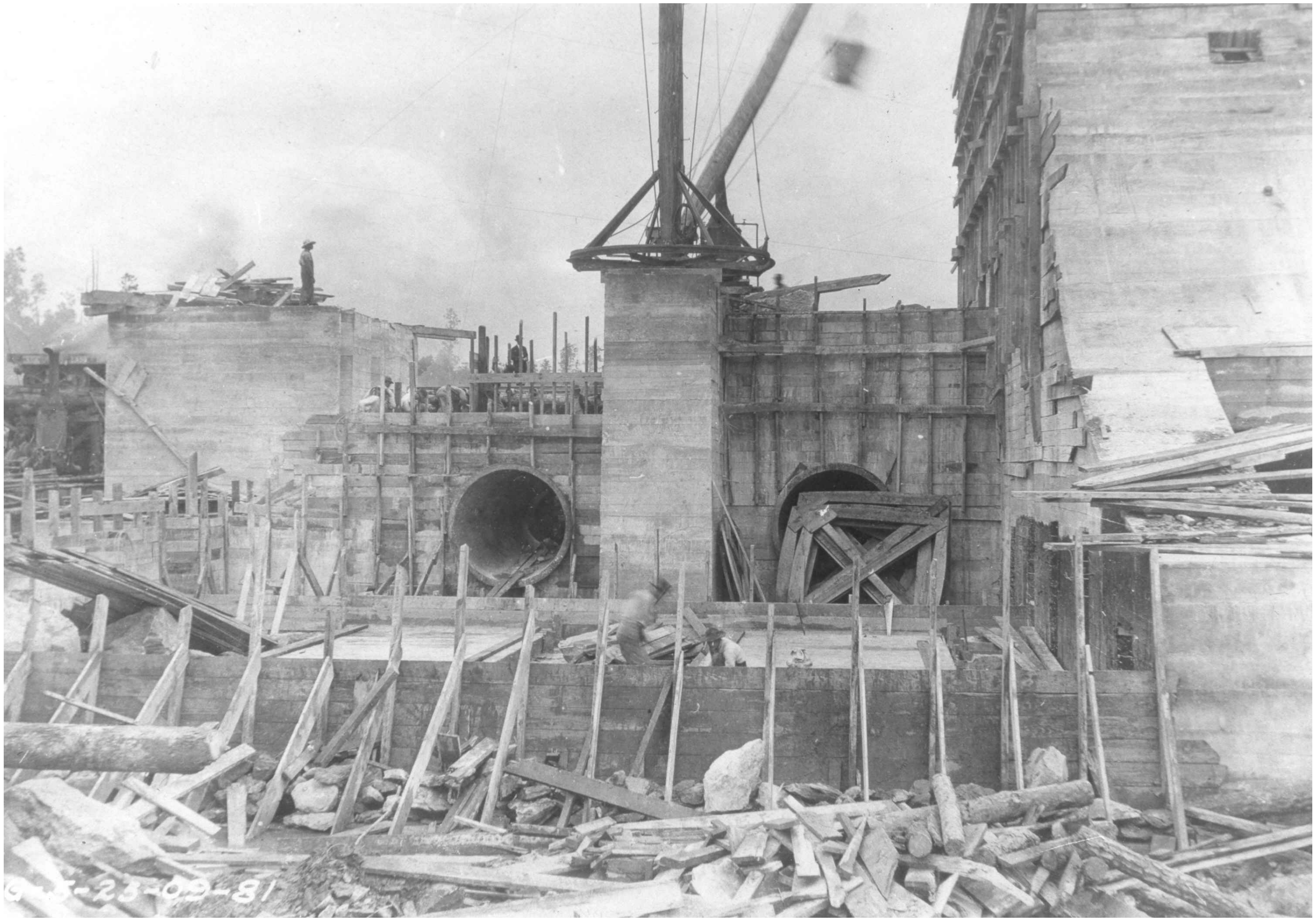

Figure 58. Project Construction Site as of 6/6/1909

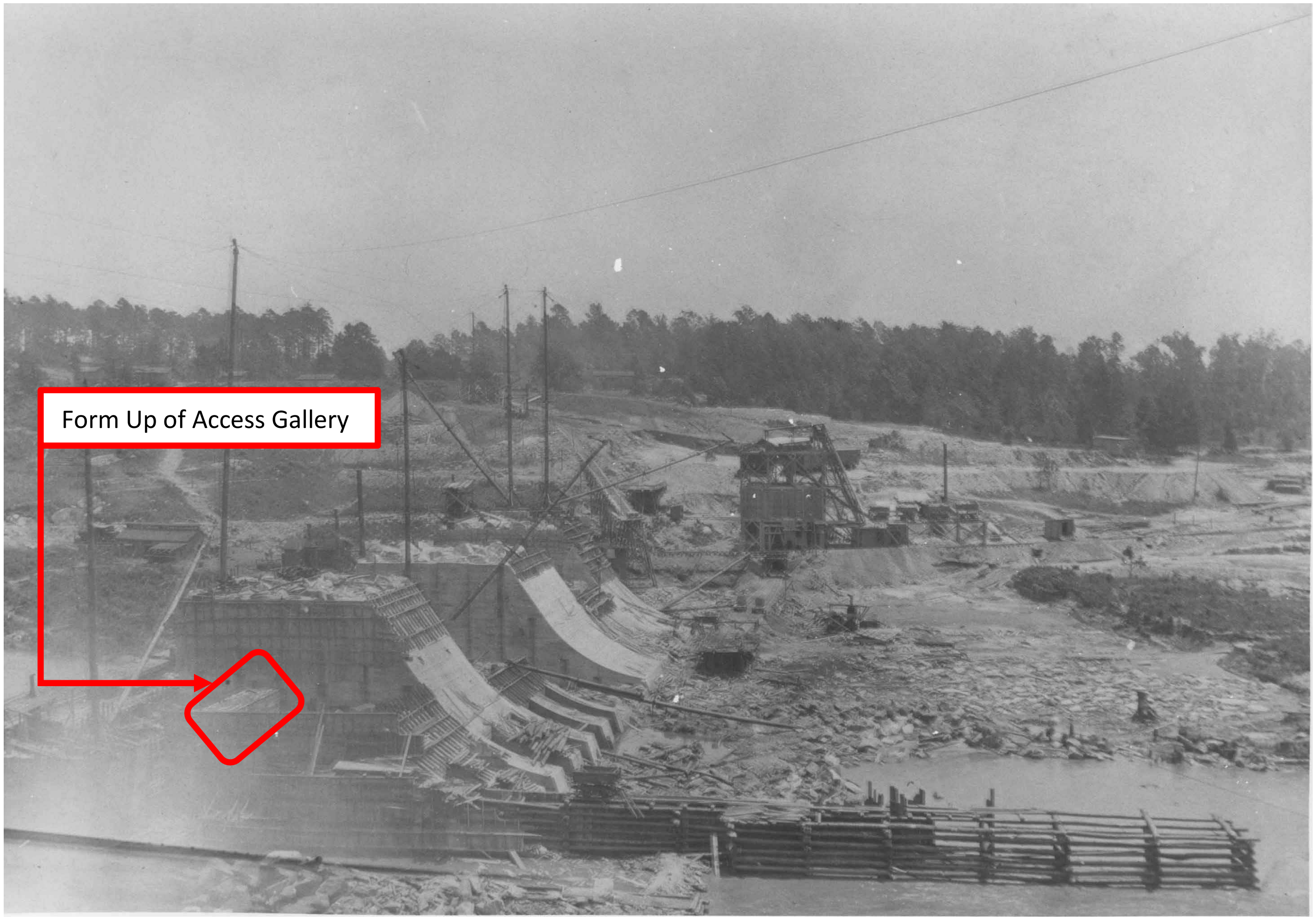

Figure 59. East Earth Embankment Core Wall as of 6/21/1909

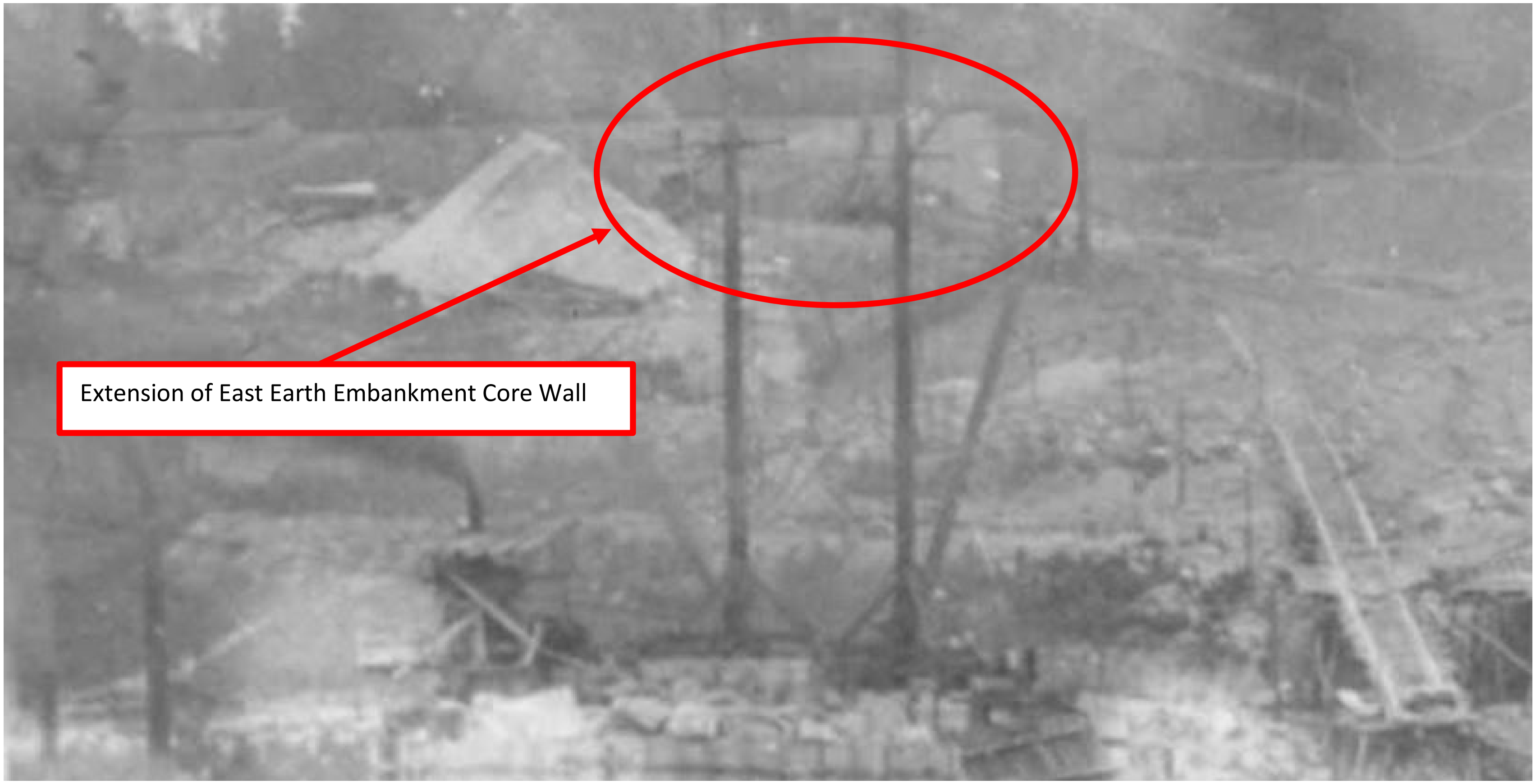

Figure 60. East Quarry Rail Line Extension

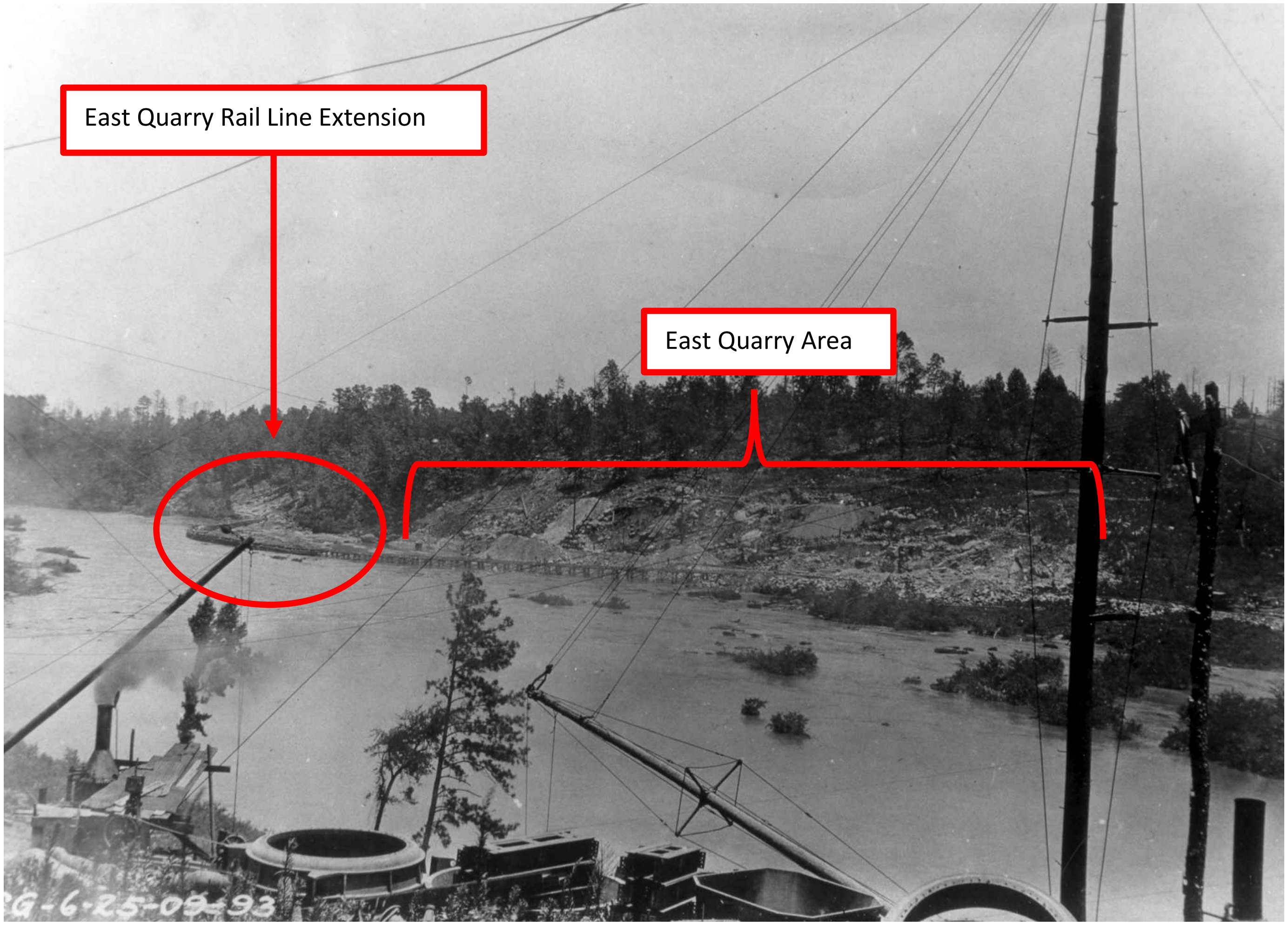

Figure 61. Construction Progress as of 6/25/1909

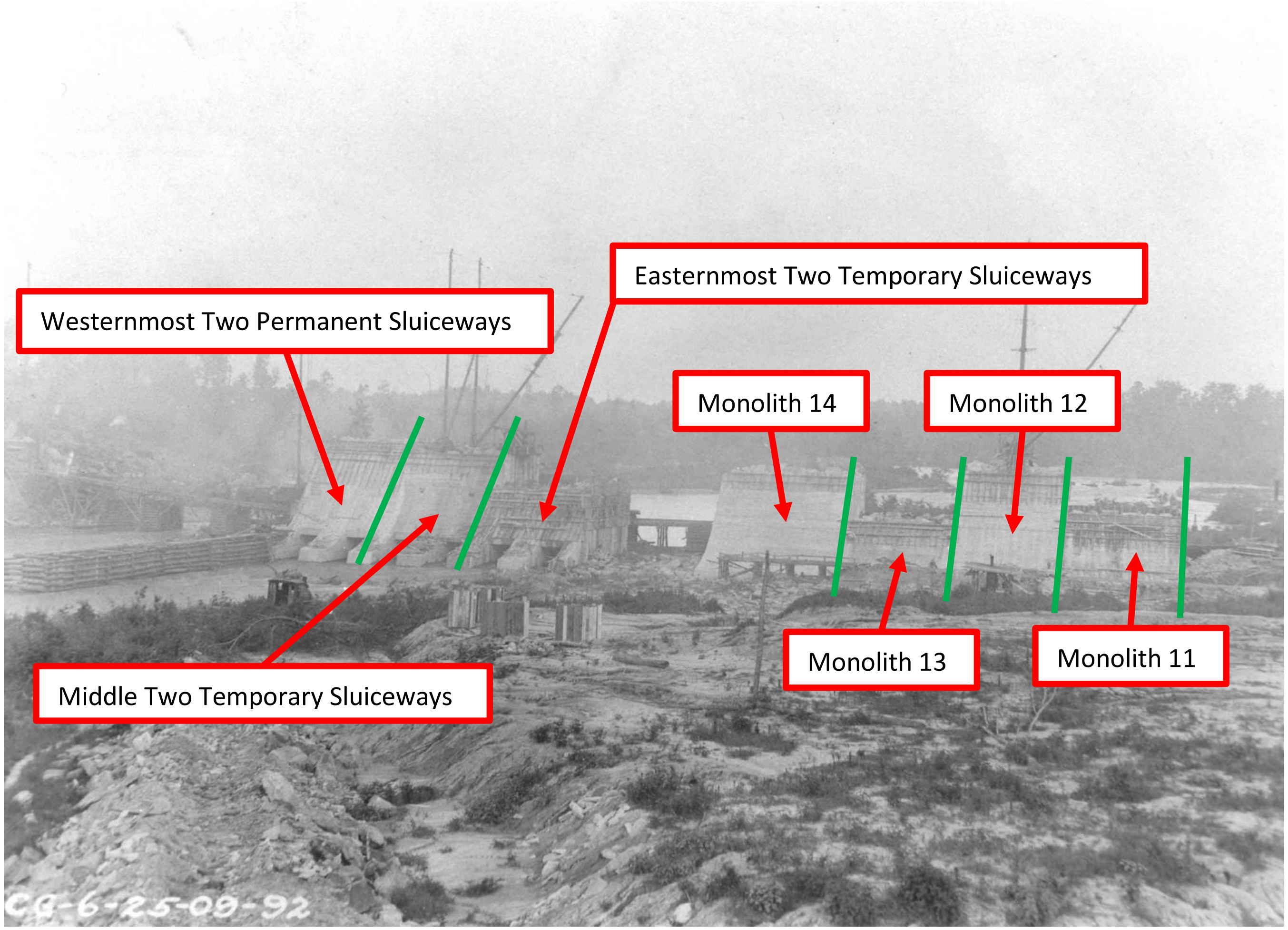

Figure 62. Construction of Second Cofferdam, Northwest-to-Southeast Upstream Leg

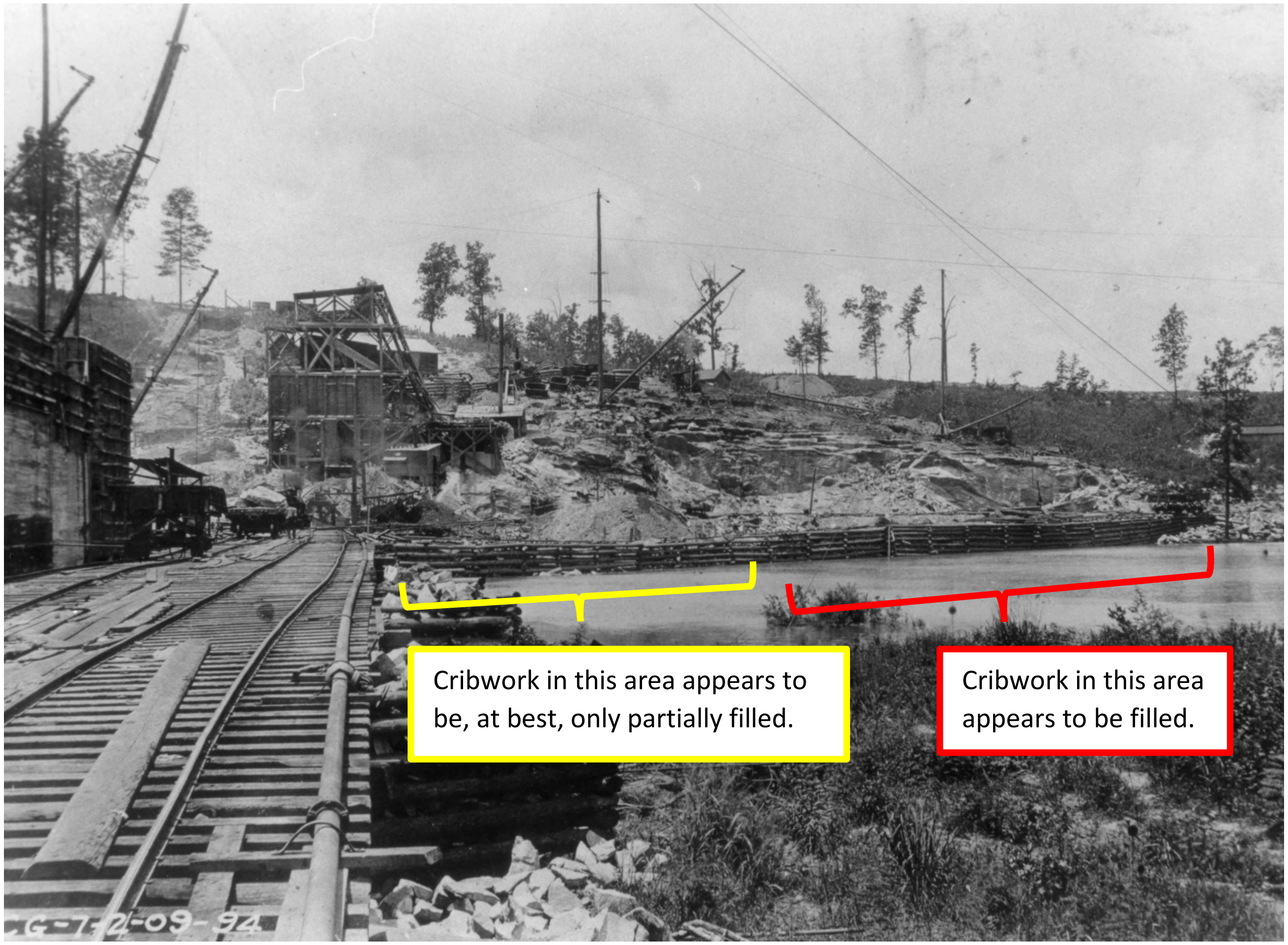

Figure 63. Spillway Monolith 15 and Sluiceway Flows

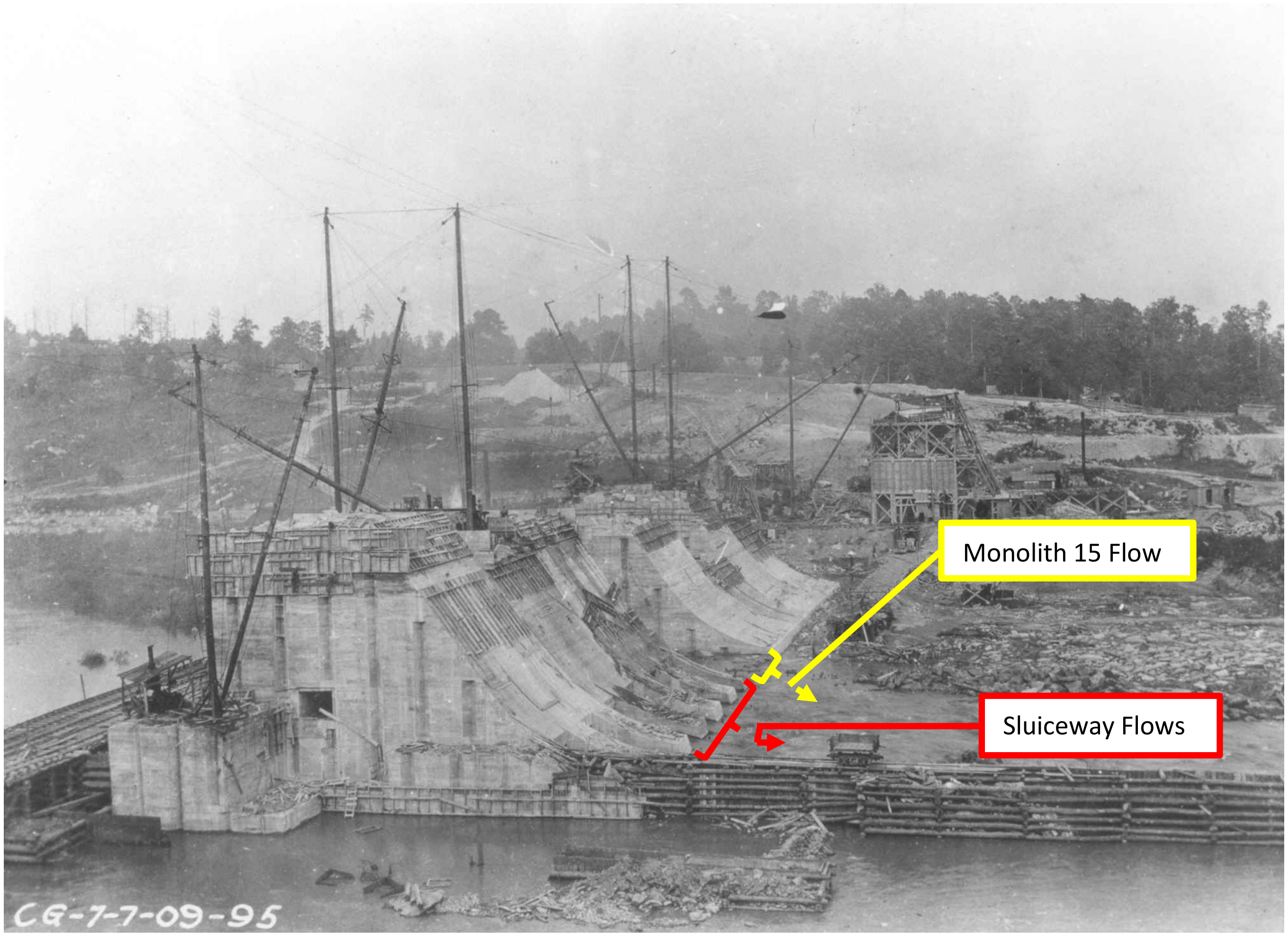

Figure 64. Partially Demolished First Cofferdam Upstream East-West Leg

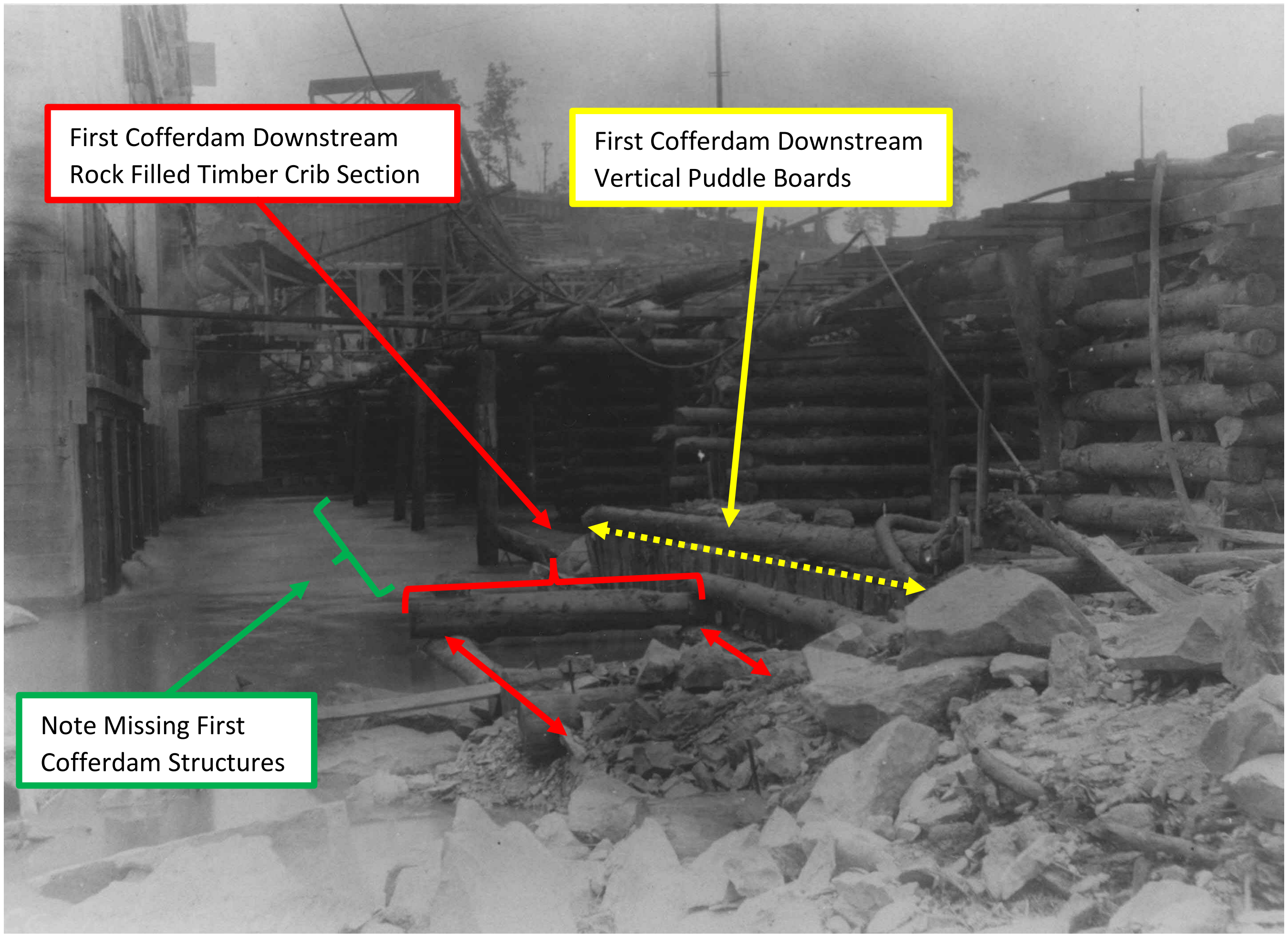

Figure 65. Second Cofferdam, Northwest-to-Southeast Cribwork Failure

Figure 66. Replacement Cribwork

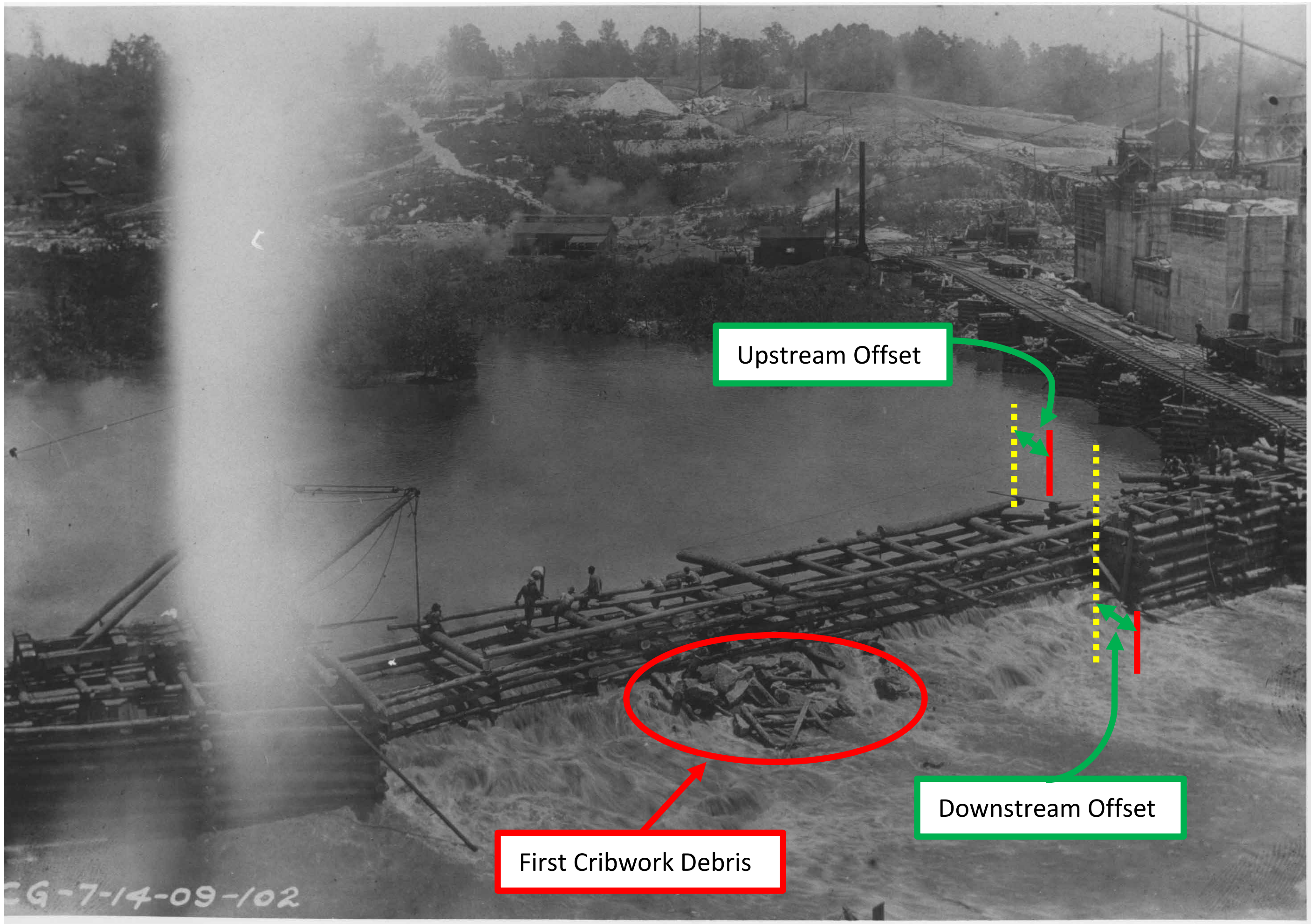

Figure 67. Construction Progress as of 7/17/1909

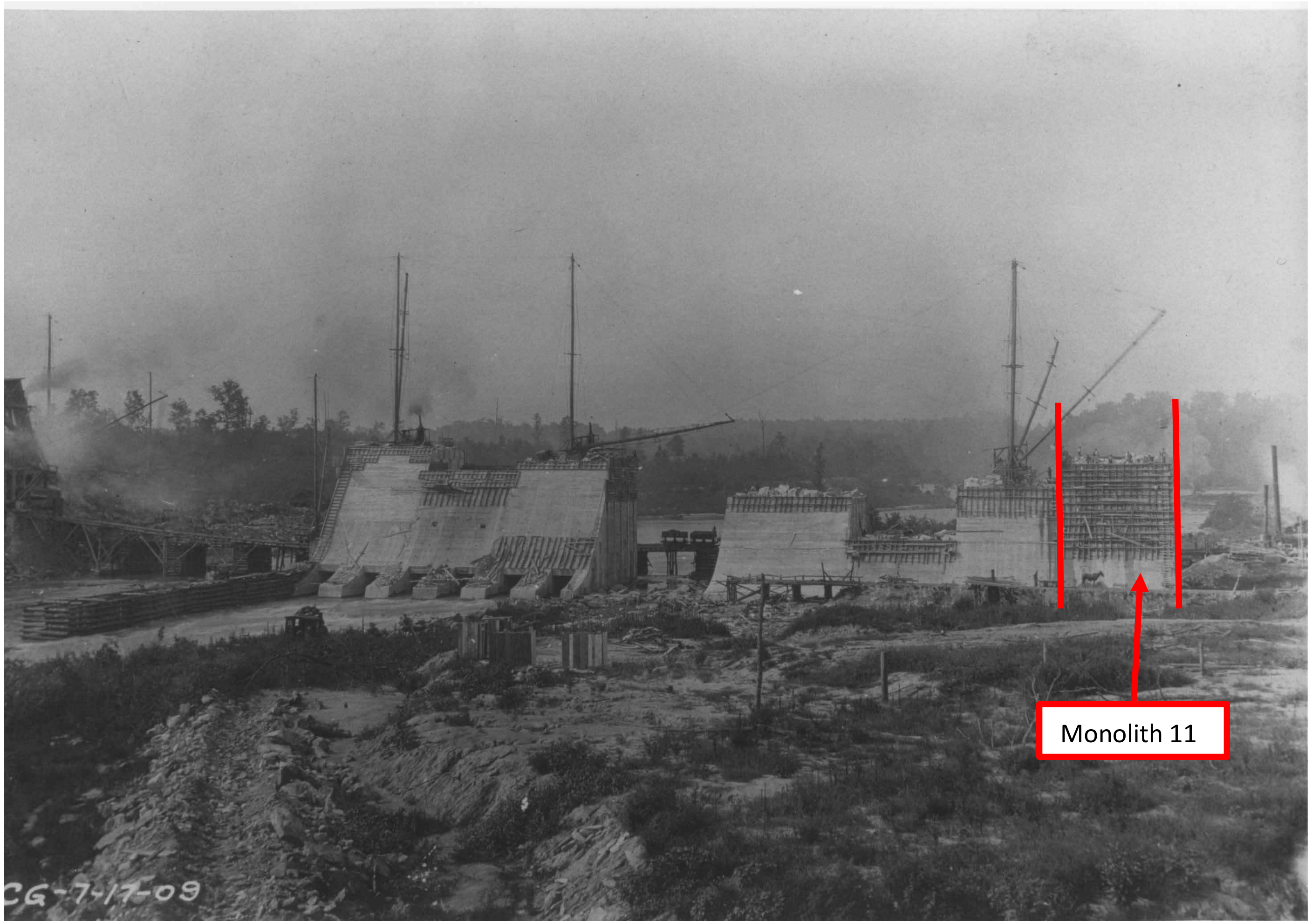

Figure 68. Upstream Second Cofferdam Puddle Zone Construction

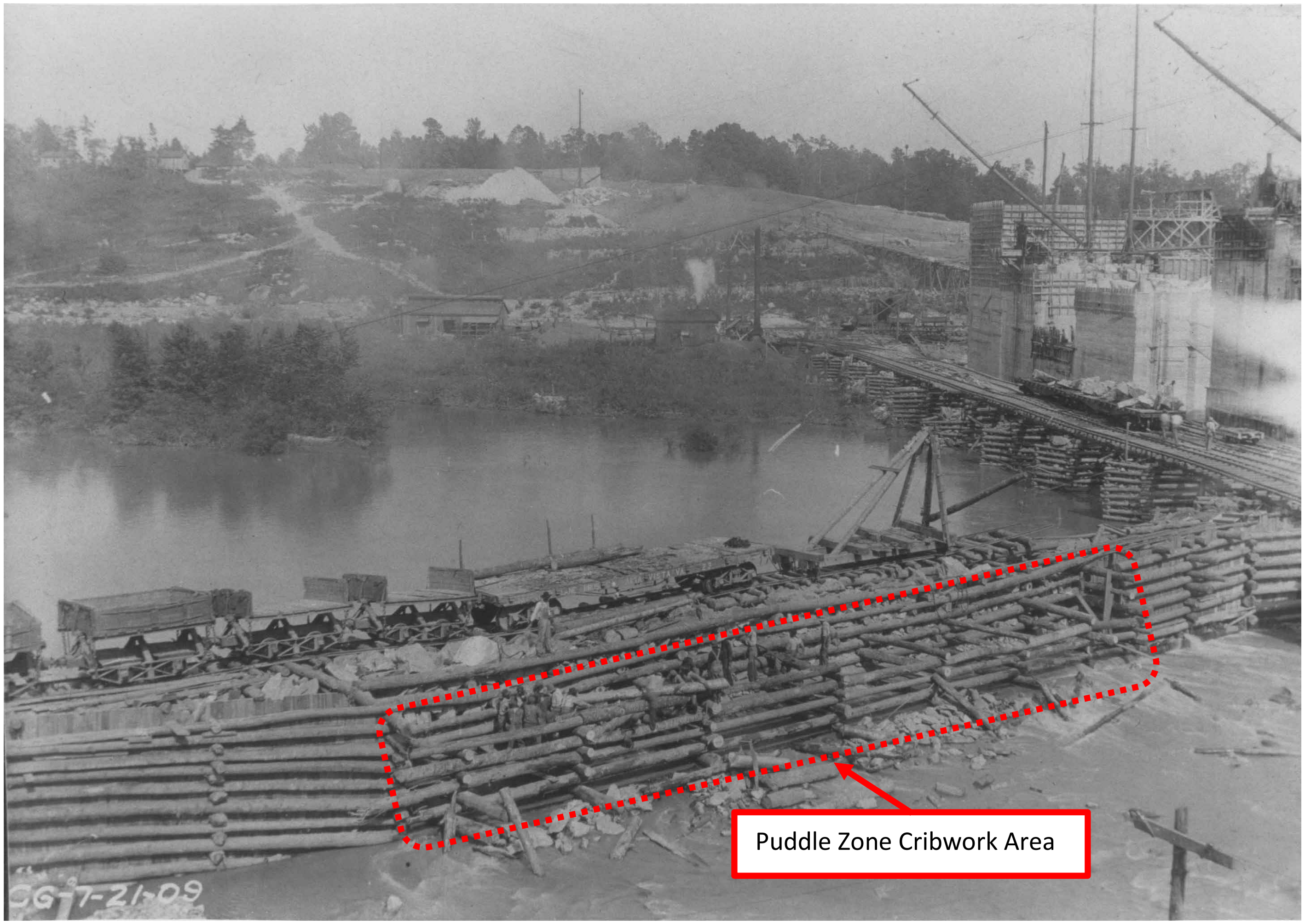

Figure 69. Construction Progress on 7/31/1909

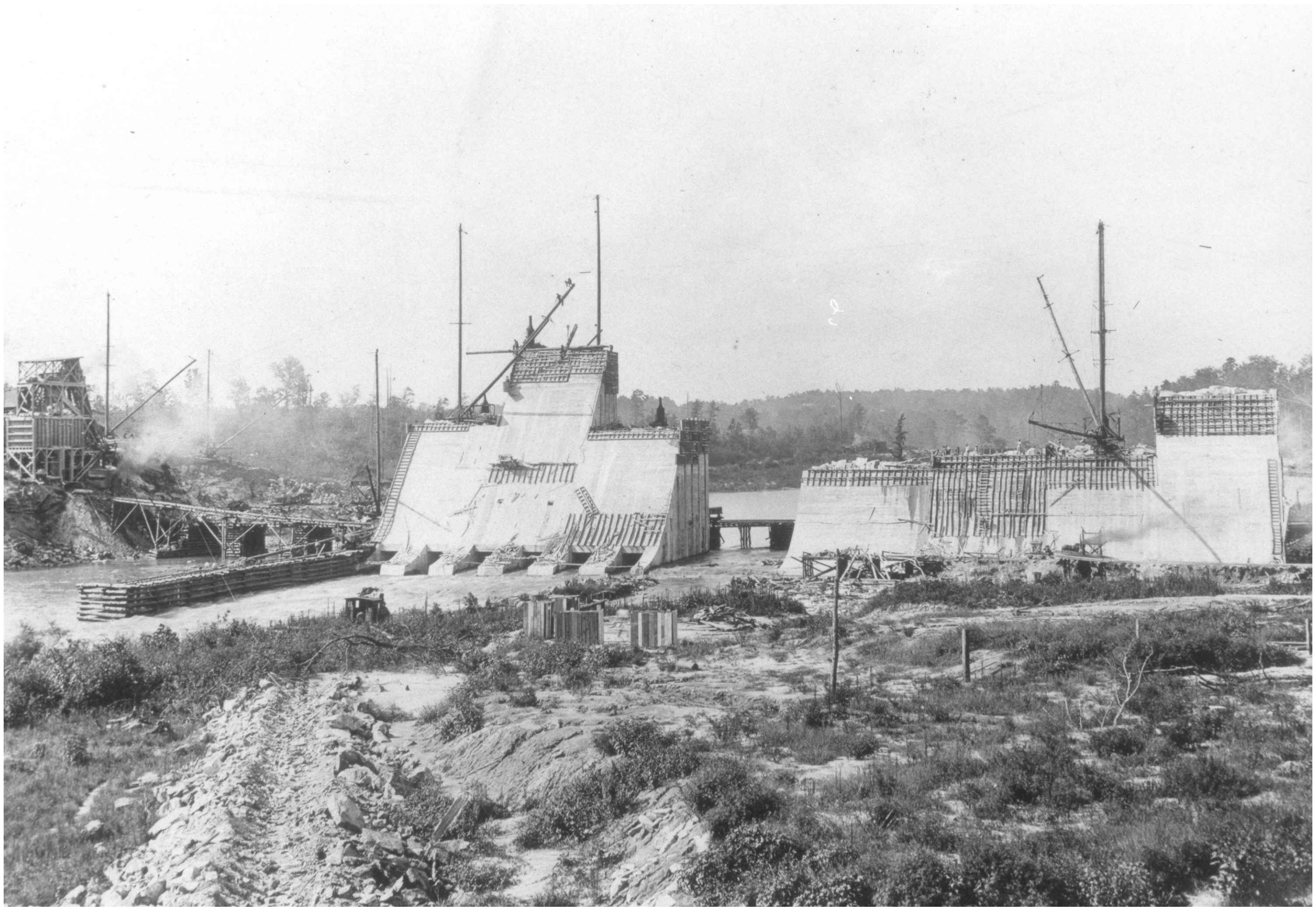

Figure 70. Intake/Powerhouse Foundation Area as of 7/30/1909

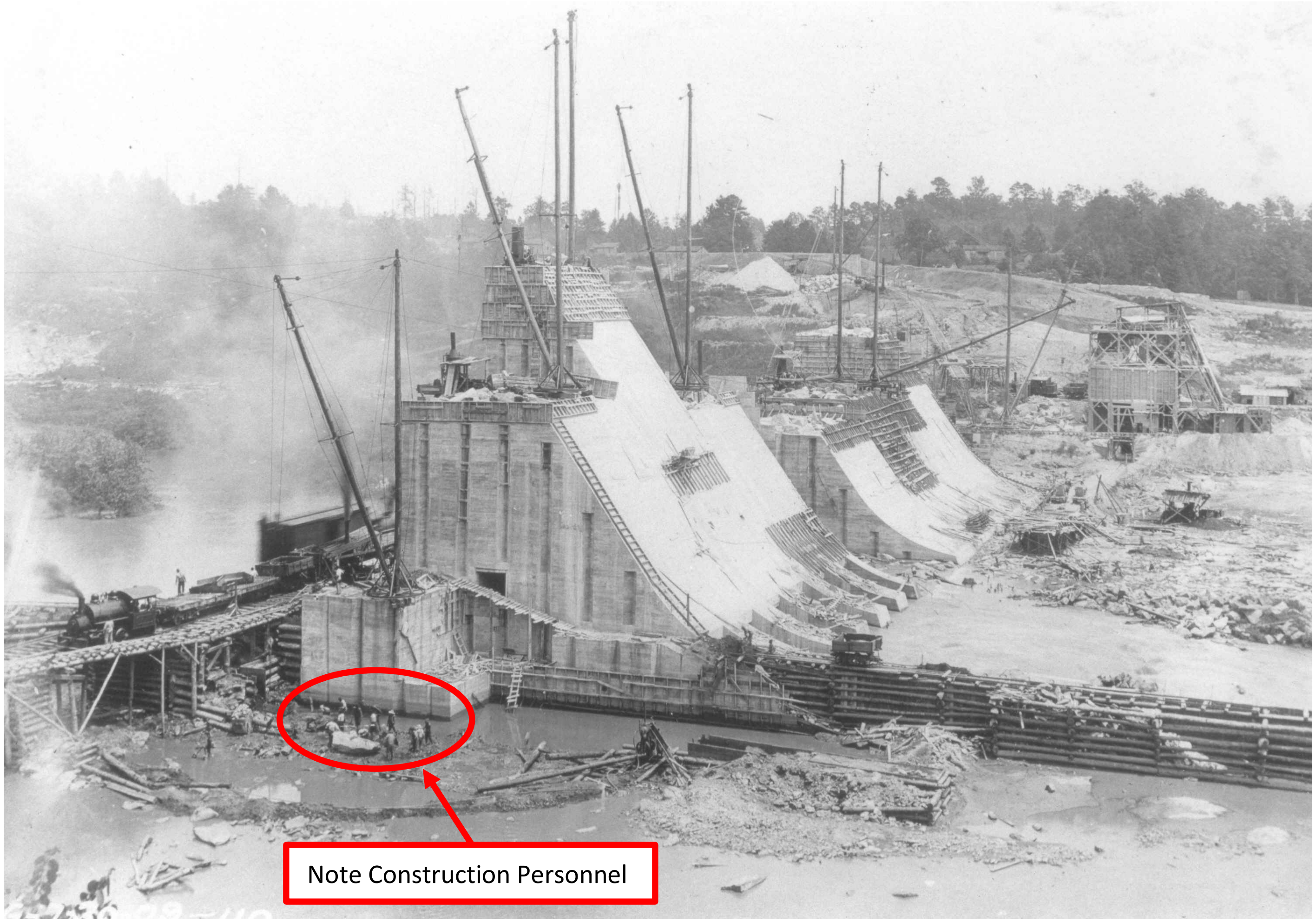

Figure 71. Construction Status as of 8/13/1909

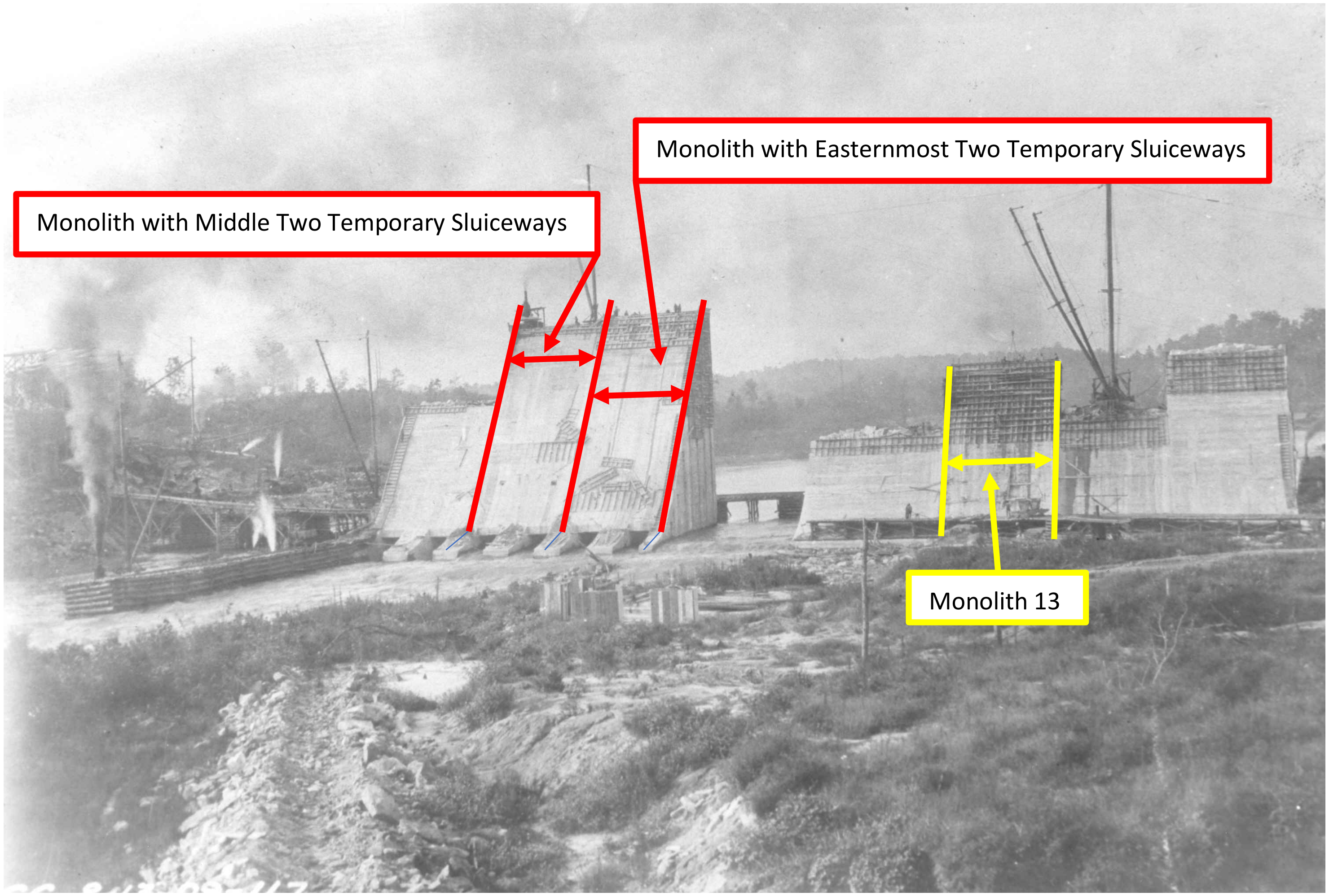

Figure 72. Second Cofferdam, West Wall, North-South Leg

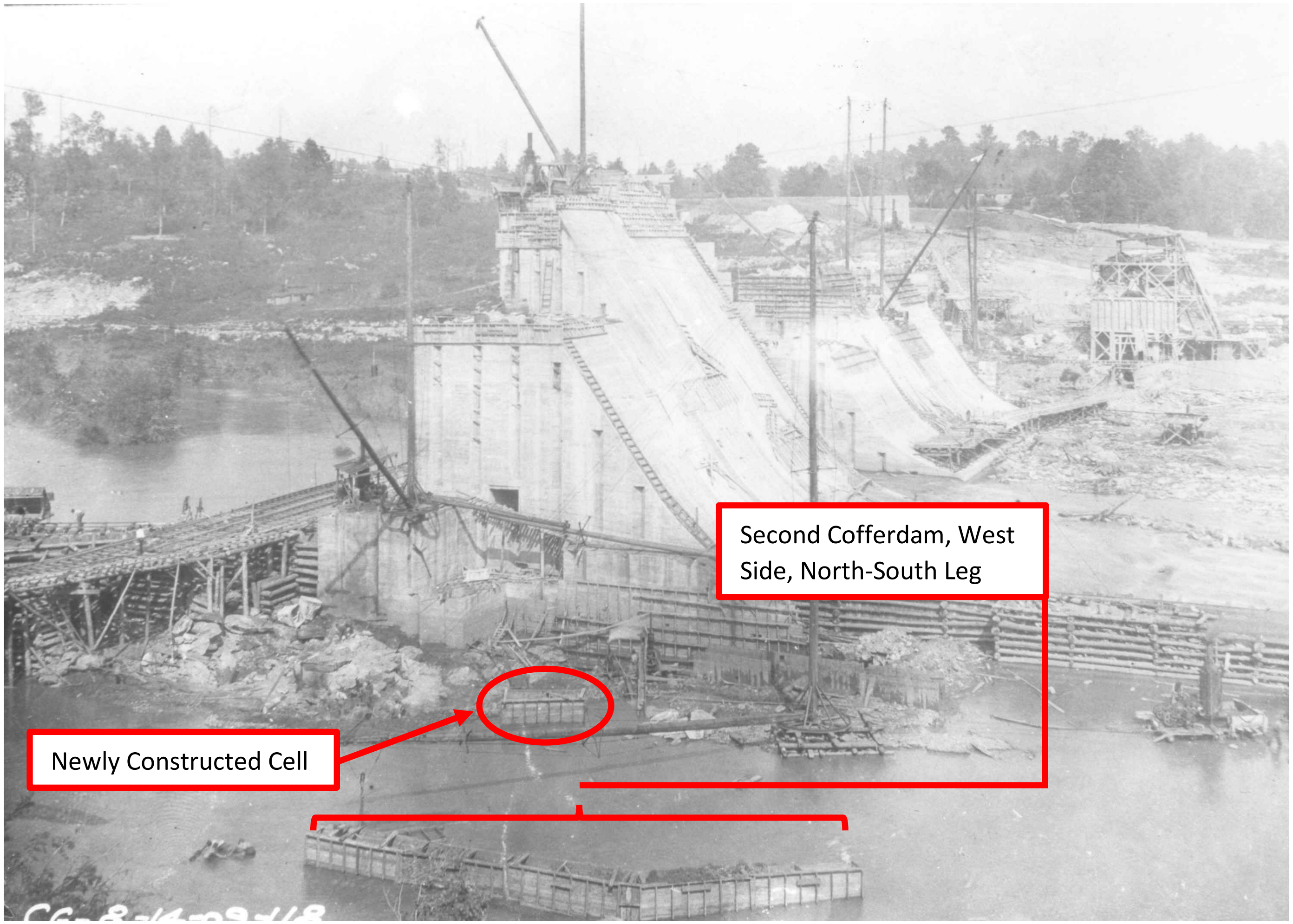

Figure 73. Intake Monoliths

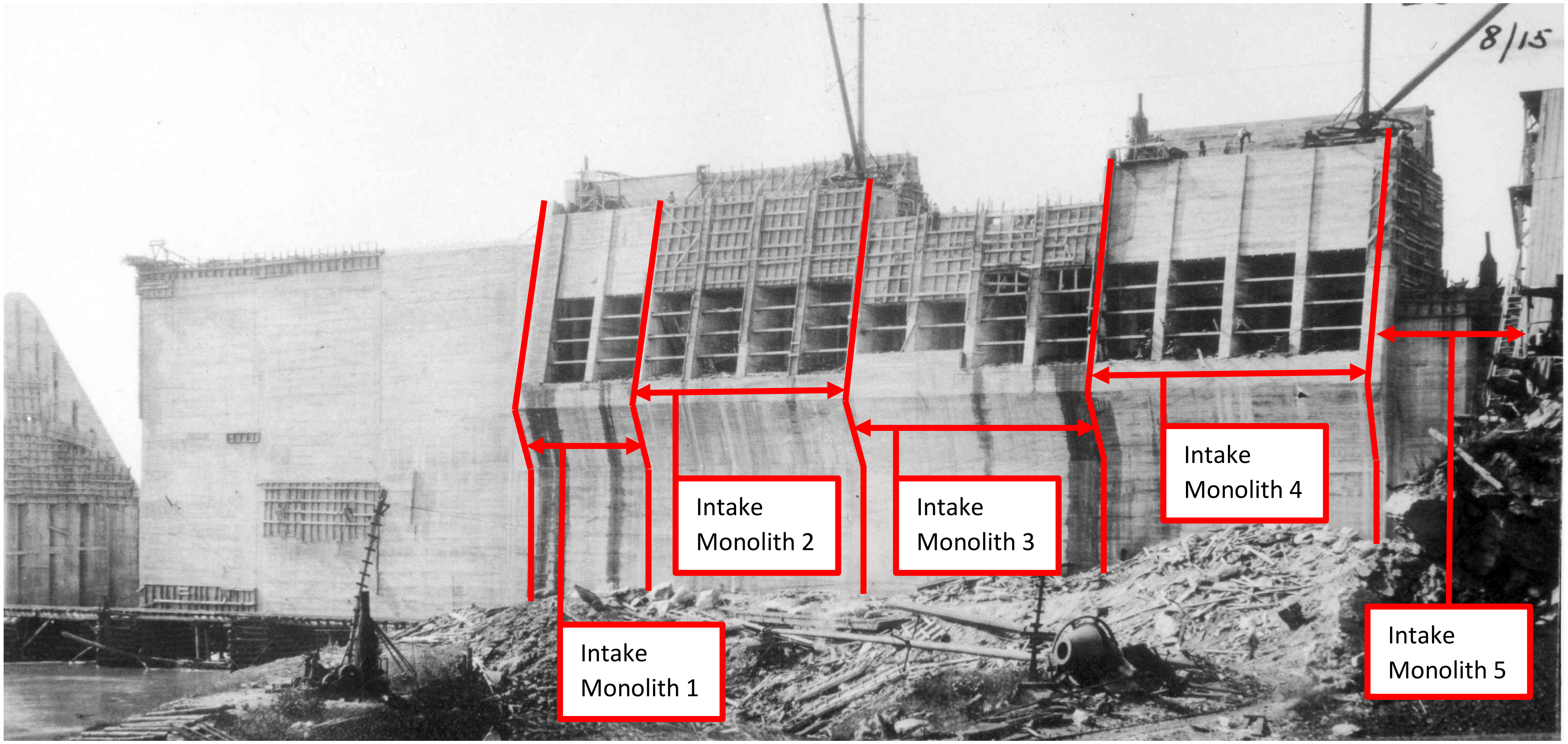

Figure 74. Powerhouse Foundation Excavation

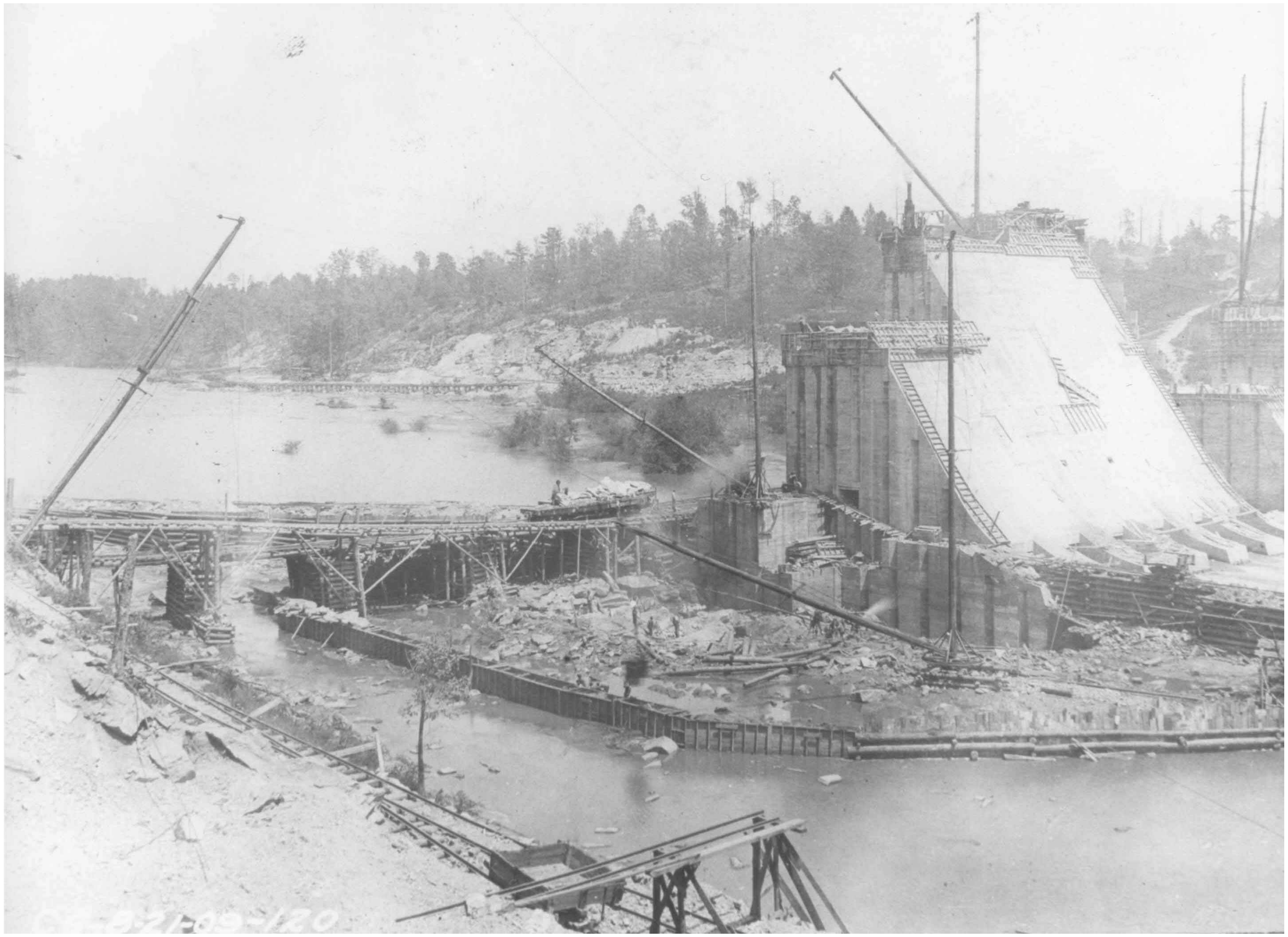

Figure 75. Construction Progress as of 8/21/1909

Figure 76. Construction Progress as of 9/24/1909

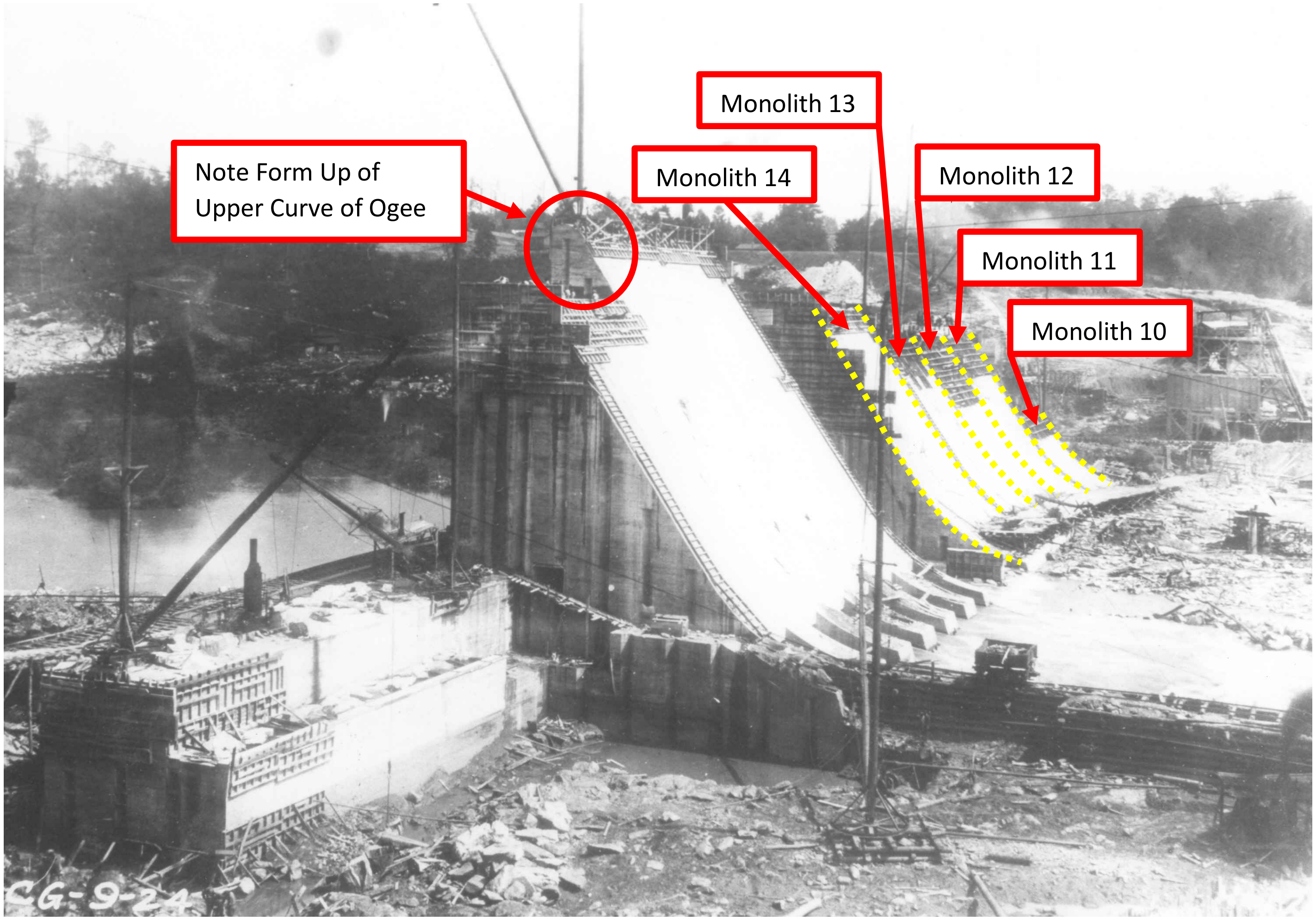

Figure 77. East Earth Embankment Core Wall Extension as of 9/28/1909

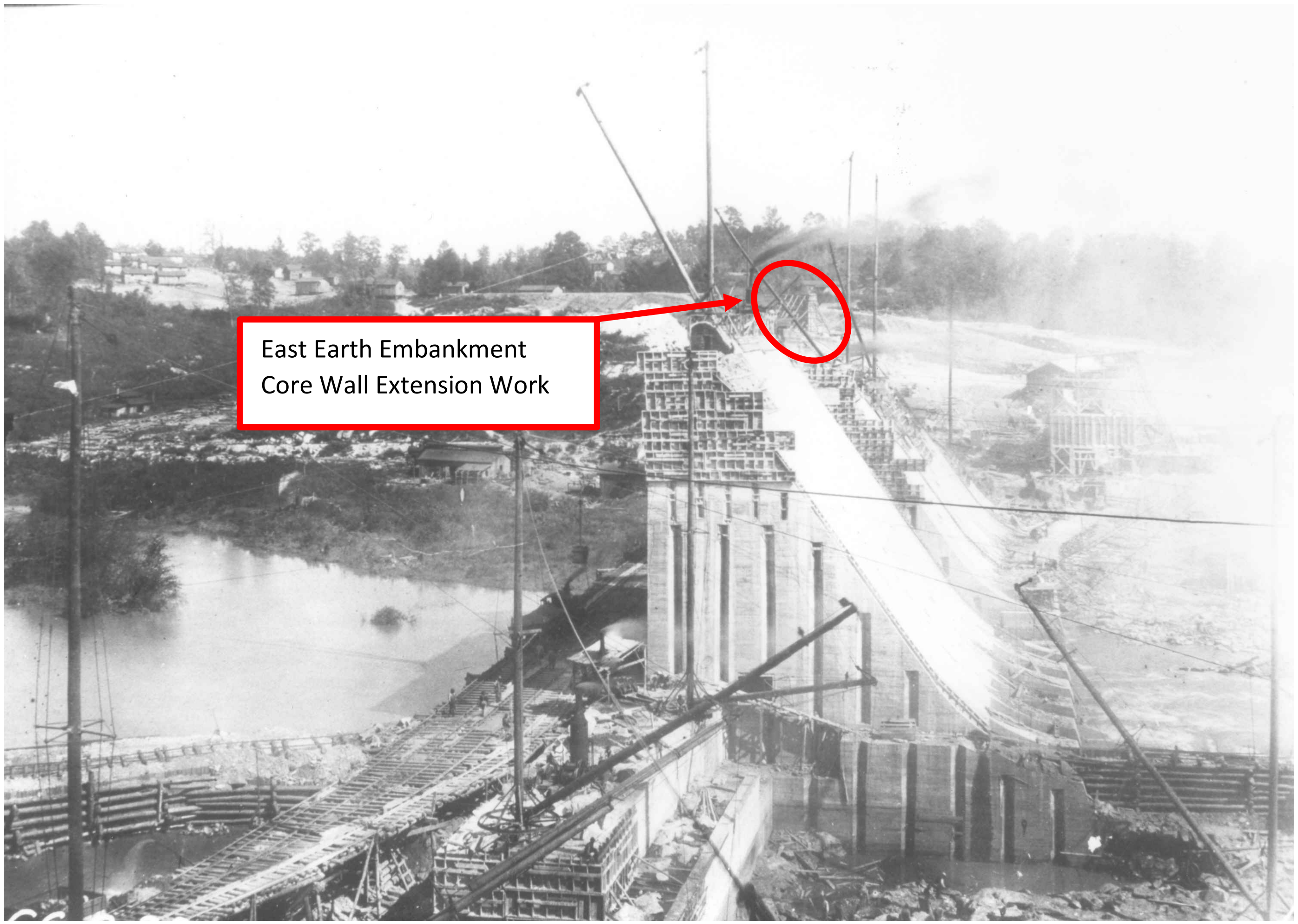

Figure 78. Upstream Saddle Dikes