Morgan Falls: Meeting a Century of Needs

The 16.8-MW Morgan Falls hydroelectric project — commissioned in October 1904 — was built to power streetcars in Atlanta. The project, which has operated continuously for 100 years, is the most recent inductee to Hydro Review's *Hydro Hall of Fame.*

By Carol A. Boatright

When the Atlanta Water and Electric Power Company (AW&EP) built the Morgan Falls hydro plant in the early 1900s, the United States was undergoing a significant transition. Urban centers were rapidly developing, and Northern business interests were seeking industrial opportunities in the South. At this same time, advances in hydroelectric generating equipment that linked water turbines with electric generators through a single shaft created a demand for hydro sites within a reasonable distance of cities. Atlanta, Ga., already a fast-growing manufacturing center, soon came under scrutiny by none other than S. Morgan Smith, inventor and builder of one of the most popular water turbines in the U.S.

Building Morgan Falls

The story of Morgan Falls began in 1876, when Smith, who was from York, Pa., invented the Success hydraulic turbine.[1] In 1897, Smith began looking for potential hydro sites near urban areas. Based on a friend's recommendation, Smith obtained options on land and water rights to a site known as Bull Sluice, on the Chattahoochee River just north of Atlanta.

The fact that Smith was arrested in December 1898 helped bring together the plans for Bull Sluice. While Smith was visiting the site, one landowner who had granted an option was having second thoughts and tried to provoke an argument. When that failed, he had Smith arrested for trespassing.

Smith's attorney, who lived in York, contacted Atlanta attorney Jack Spalding. Spalding had Smith released into his custody, then invited Smith to a banquet. Forrest Adair, an Atlanta realtor, joined them. During the banquet, the three men worked out the details for the new plant.

In early 1902, these gentlemen, along with several others, chartered AW&EP to build the Bull Sluice plant. AW&EP contracted with the S. Morgan Smith Company to oversee the construction, and Smith formed a partnership with B.H. Hardaway of Columbus, Ga., to construct the plant.

Construction involved more than 250 workers who removed mud and sand, then drilled and blasted the bedrock. An eyewitness noted that the abutments of the dam were found to be almost entirely solid rock. The base of the dam was founded on solid rock. Contractors blasted to a depth of 12 feet before laying the foundation concrete.

The work was unique in that Hardaway used steam to power much of the heavy equipment. The dam was the first construction job in the South to use a steam-operated rock crusher and concrete mixer. Steam ran the drills and was used to hoist the large rock fragments from the foundation area, as well as to transport concrete to the site in cable cars.

These large steel cars were attached to two steel cables strung between 200-foot-tall towers on each side of the project. The cables were "… as large as the calf of a strong man's leg," and the system was capable of carrying 20 tons of stone across the river at a rate of 850 feet per minute. An operator on the bank manned the system, which was outfitted with automatic clamps that were dropped at about 150-foot intervals to hold the slack in the lines.

Smith died in 1903, before the plant was completed. His son succeeded him at AW&EP, and the company's board of directors renamed the site Morgan Falls in honor of Smith's mother, whose maiden name was Morgan.

Before the plant was even complete, Georgia Railway and Electric (GR&E), Atlanta's electric utility company, signed a contract to purchase the full output to power the city's streetcars. The Atlanta area had 195 miles of streetcar track and transported 325 million passengers in 1902. AW&EP and GR&E split the $4,000 cost of a transformer house to transform the alternating current generated to direct current needed to operate the streetcars.

Morgan Falls' first unit was placed in commercial operation on October 10, 1904. An October 11, 1904, article in the *Atlanta Journal* noted, "For the first time in the history of the city, electricity

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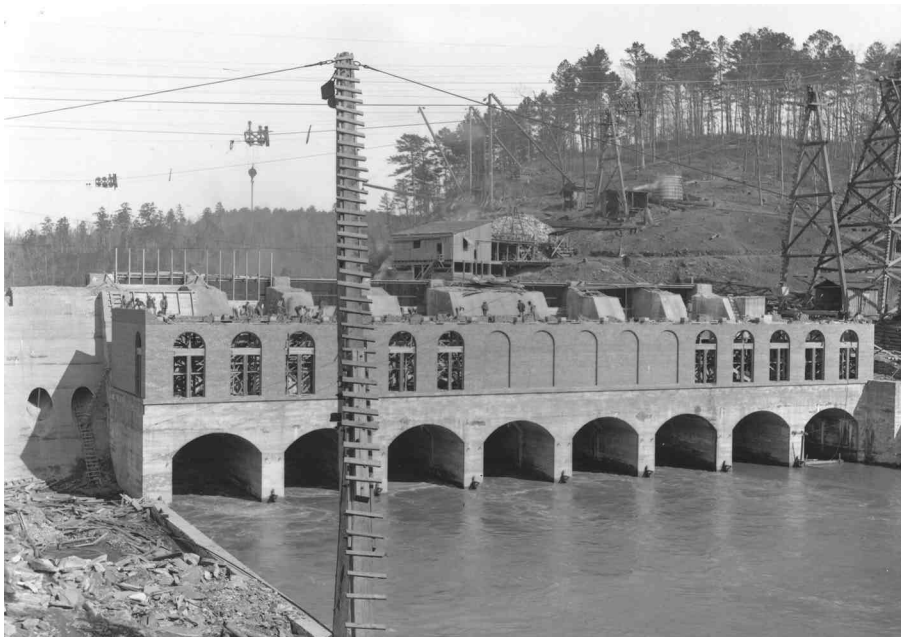
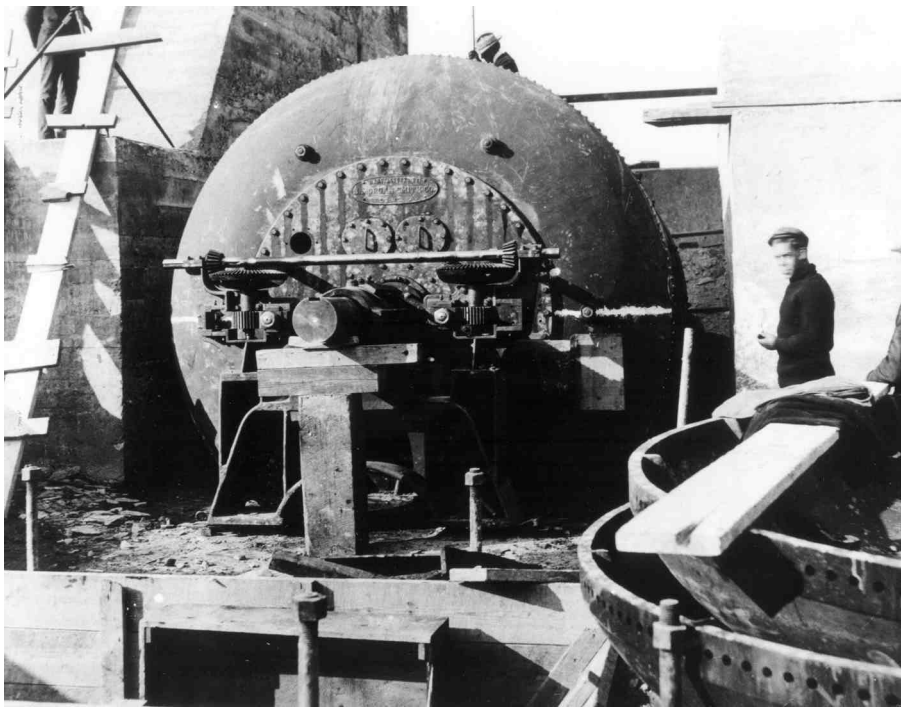


Designers of the 10.5-MW Morgan Falls hydro project combined the powerhouse (top) and intake structure, which features eight intake bays. The original powerhouse, made of brick with concrete trim, is still in use 100 years later.

generated by water power was utilized in Atlanta on Monday, when a portion of the current generated at Bull Sluice dam was fed to the trolley wires of the GR&E Co. During the afternoon and evening, Atlantans were transported from one portion of the city to another upon street cars driven by the muddy waters of the Chattahoochee."

All seven units were in commercial operation as of January 1, 1905. The total nameplate capacity was 10.5 MW, the largest plant in Georgia at the time. The cost was more than $1.5 million, an astounding sum in 1905. Smith used the best materials and workmanship available. One hundred years later, much of the original plant is still in operation, including the gravity dam and powerhouse.



Each of the seven turbines installed in 1904 at the 10.5-MW Morgan Falls hydro project were supplied by the S. Morgan Smith Company. These turbines operated until 1922, when they were upgraded to 3,300-horsepower units.

Changing with the times

In March 1912, the directors of GR&E organized a new company, called Georgia Railway & Power Co. (GR&P). The company purchased many small surrounding companies to create a larger utility to meet growing demand. GR&P purchased AW&EP and all its assets: the Morgan Falls hydro plant and a 22,000-volt transmission line extending into Atlanta. GR&P was the predecessor to the Georgia Power Company.

The Morgan Falls plant suffered a major flood in 1919, but the efforts of a dedicated staff kept the damage minimal. Superintendent W.C. Sullivan and his crew of 12 men spent three days and nights pumping, bailing, and otherwise propelling water from the floor of the powerhouse to protect the machinery.

When the flood waters reached a height even with the base of the powerhouse windows, water began seeping through the floor. For a time it seemed that, in spite of all efforts, water would rise high enough to reach the machinery and cause heavy losses.

Sullivan himself worked the entire time, with only four hours of sleep, leading his crew to similar exertions. "I don't mean that we were just on duty for that length of time, but we were working just as hard as our physical strength would allow," Sullivan later said.

Because of growing demand for electricity, GR&P decided to upgrade Morgan Falls in 1922 to a capacity of 16.8 MW. The company installed new turbines and rebuilt the generators. This equipment required modification of the intakes, which involved adding concrete draft tubes and reinforcing the structure.

Then, in 1956, the U.S. Army Corps of Engineers completed the upstream 105-MW Buford Dam and began regulating flows in the Chattahoochee. Large variations in water levels between generation and minimum flow releases caused problems for downstream users, including Atlanta. In 1957, the city and Georgia Power entered into a contract to raise Morgan Falls Dam to re-regulate peak power releases from Buford Dam.

Before this redevelopment, Morgan Falls did not operate under a federal license, having been in place before the Federal Power Act was signed into law. Because the operating level was chang-

Technical Information
Morgan Falls

General Information

Location: Chattahoochee River, 12 miles upstream of Atlanta, Ga.

Owner: Georgia Power Company

Capacity: 16.8 MW

Average Yearly Output: 56,562 megawatt-hours (MWh)

Gross Full Pond Operating Head: 55.2 feet (ft)

Average Streamflow: 2,317 cubic ft per second (cfs)

On-Line Date: October 10, 1904

Development Team

Design: Atlanta Water and Electric Power Company (Georgia Power's predecessor) and Westinghouse, Church, Kerr and Company

Construction: S. Morgan Smith Company (General contractor); Smith & Hardaway (Masonry and superstructure); Westinghouse, Church, Kerr and Company (Electrical engineers)

Equipment

Turbines (7)

Original installed in 1904:

Double runner, horizontal Francis turbines, each rated 2,000 horsepower (hp) at 48 ft

Manufactured by S. Morgan Smith Company

1922 Upgrade:

Replaced with double runner, horizontal Francis turbines, each rated 3,300 hp at 48 ft

Manufactured by S. Morgan Smith Co.

Unit 4:

Upgraded in 1997 to a double runner, rated 3,900 hp at net head of 50 ft

Manufactured by American Hydro

Unit 3:

Upgraded in 2000 with a unit similar to Unit 4

Manufactured by American Hydro

Generators (7)

Original installed in 1904:

Horizontal shaft generators each rated 1500 kW, 25 Hertz (Hz)

Manufactured by Westinghouse

1922 Upgrade:

Rebuilt by Westinghouse and rated 2,400 kW, 60 Hz

Construction

Powerhouse

198 ft long by 42 ft wide by 35 ft high

Superstructure of brick with concrete trim

Combined powerhouse and intake structure containing eight intake bays (one bay housed the old exciter units) and a wave wall

Penstock

Original:

12-ft-diameter concrete intakes that discharged directly to the tailrace

1922 upgrade:

Intakes modified to a rectangular configuration, 15 ft tall and 13 ft wide at the headgate, and concrete draft tubes added to each unit discharge to improve hydraulic efficiency

Dam

Concrete gravity

1,031 ft long, with a maximum height of 56 ft

680-foot-long concrete spillway section

1960 redevelopment:

Installed 16 8-ft-high by 40-ft-long steel tainter gates on the spillway

Removed 2-ft-high flashboards

Removed spillway crest to a minimum depth of 9 inches and replaced with reinforced concrete

1980s reinforcement:

Reinforced spillway with post-tensioned steel anchors

Reservoir

Bull Sluice Lake

673 acres

23.5 miles of shoreline at 866 feet plant datum (full pool)

Tailrace

200 ft wide

Separated from spillway area by concrete wing wall extending 85 ft downstream

Tailrace channel and spillway area merge immediately downstream of the wing wall

ing from its initial design, the Federal Power Commission (FPC) required a license for the project. Georgia Power filed a formal license application in September 1957 and received a 50-year license in March 1959.

The utility completed significant upgrades in 1986 to bring Morgan Falls into compliance with new Federal Energy Regulatory Commission (FERC) standards for concrete gravity dams. The $2.6 million project involved installing 100 post-tensioned rock anchors. Workers drilled holes from the top of the concrete dam into the bedrock. These holes were grouted and sealed for water tightness, and then post-tensioned anchors were cemented into the bedrock. Each anchor, composed of 20 to 22 high-strength steel strands bundled together, was stressed to a load of about 500 tons. This pressure or "anchoring effect" brought the dam well within the new FERC guidelines.

Today, river flow re-regulation for water quality and supply remains one of the plant's primary purposes. In addition, it provides enough electricity to power 4,400 homes and support peak load requirements.

The city of Atlanta has expanded well beyond the Bull Sluice reservoir. The area is now an important recreation site, providing opportunities for rowing, boating, and hiking, as well as wildlife habitat.

Georgia Power recently set another milestone, becoming the first utility to commit to using FERC's new Integrated Licensing Process (ILP) for Morgan Falls. On January 15, 2004, company officials filed a Notification of Intent and Pre-Application Document under the ILP.[2] The first public scoping meeting was held in April. The company plans to file its formal license application in February 2007, with a final decision from FERC by February 2009.

Celebrating a milestone

The Morgan Falls plant and its reservoir have been an integral part of the north Atlanta landscape for 100 years and have played an important role in its evolution to a modern city. To commemorate past accomplishments and look forward to future contributions, Georgia Power marked the plant's centennial with a celebration on October 12, 2004, at the facility.

An exhibit tracing Morgan Falls' background served as a backdrop while company executives and local political and environmental leaders recognized the project's contributions to water quality and supply, recreation, environmental resources, and emissions-free electricity generation. Once the gala was over, the exhibit went on display at the Atlanta History Center. ■

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Notes

[1]Zirnkilton, Stephen M., "S. Morgan Smith and His Turbine," *Hydro Review*, February 2004, pages 46-47.

[2]Industry News: "Georgia Power Applies to Use Integrated Licensing Process," *Hydro Review*, April 2004, pages 58-59.