UPPER WHITE RIVER LOCK & DAM Nos. 1, 2, & 3
Spanning White River
Batesville
Independence County
Arkansas

HAER No. AR-91

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Southeast Region
Department of the Interior
Atlanta, Georgia 30303

HISTORIC AMERICAN ENGINEERING RECORD

UPPER WHITE RIVER LOCK & DAM Nos. 1, 2, & 3

HAER No. AR-91

Location:

No. 1: White River mile 299.8
1 mile south of Batesville
Independence County, Arkansas

U.S.G.S. Batesville, Arkansas, quadrangle
Universal Transverse Mercator coordinates:
15.3957770N623273E

No. 2: White River mile 308.3
Earnheart Vicinity
Independence County, Arkansas

U.S.G.S. Concord, Arkansas, quadrangle
Universal Transverse Mercator coordinates:
15.3956000N611667E

No.3: White River mile 320.1
Marcella Vicinity, Independence County, Arkansas

U.S.G.S. Bethesda, Arkansas, quadrangle
Universal Transverse Mercator coordinates:
15.3966788N603879E

Date of construction: 1900-1908.

Builder: U.S. Army Corps of Engineers

Present Owners:

No. 1: City of Batesville, Batesville, AR 72501
No. 2: Arkansas Power & Light Co., Capitol Tower, Little Rock, AR 72201
No. 3: Arkansas College, Batesville, AR 72501

Present use: Recreation. Locks put on inactive status June 30, 1952

Significance: The Rivers and Harbor Act of March 3, 1899 provided for construction of a series of ten locks and dams to improve navigation on the Upper White River between Batesville and Buffalo, Arkansas (89 miles). Only the first three locks and dams were built before railroads made river transportation obsolete in the Upper White River Valley.

Report Prepared by: Sandra H. Hanson & Thomas A. Herrin
Tom Herrin Associates, Inc.
101 E. Capitol Avenue, Suite 405
Little Rock, AR 72201

Date: January 1988

Summary

The Rivers and Harbor Act of March 3, 1899 authorized the U. S. Army Corps of Engineers to construct ten locks and dams to improve navigation on the upper White River. Only the first three locks and dams were built above Batesville between 1900 and 1908. The dams were built in the manner of the day: large timber cribs were constructed with local timber, floated into position, filled with rocks and sunk. Lock and Dam No. 1 is located at Batesville, Arkansas. The dam is 660 feet long with a lock 175 feet long and 36 feet wide between the lock walls. It is designed to provide a lift of 15.6 feet at low and normal water levels. Lock and Dam No. 2 is eight miles upstream at Earnheart. The dam is 658 feet long with a lock 175 feet by 36 feet with a lift of 12.8 feet. Lock and Dam No. 3 is 12 miles further upstream near Marcella. The dam is 750 feet long with a lock 175 feet by 36 feet with a lift of 14.5 feet. The locks were maintained by the Corps of Engineers until 1952 when they were closed and turned over to the current owners. Construction will begin in late 1988 on hydroelectric generation facilities. A powerhouse containing three turbine generators will be installed where the lock currently stands at all three locations. The dams will be repaired but otherwise unchanged. (See Figures 1-6 for chronology and location.)

Background

Canoes, flatboats and rafts were the first vehicles to use the upper White River. As the valley developed the river figured more and more prominently in the commerce of the region. The steamboat WAVERLY under the command of Captain Pennywit arrived at Batesville on January 4, 1831. It was the first steamboat to ever navigate on the upper White River[1].

The importance of steamboat traffic to the inhabitants of the upper White River Valley is illustrated by the following quote from a letter to the editor of the *Arkansas Gazette* dated March 7, 1831.

> I must inform you, that the late arrivals of the steamboats at our village, has enlivened all branches of business. Many articles of merchandise are reduced one-half--coffee and sugar, which 12 months ago, sold at 50 and 24 cents per pound, of best quality, and many articles in the same proportion.

> It is only about 2 months since the citizens of Batesville had the pleasure of greeting the first arrival of a steamboat . . . . It will not be long, we hope, before the arrival of steamboats at the different landings on White and Black rivers, will become a familiar occurrence, and we know the people will find their interest promoted by giving them all the encouragement in their power[2].

Besides general freight the steamboats carried cotton, passengers, and timber.

The arrival of the railroad increased commerce in the area and, initially, the railroad meant an increase in river traffic. The first passenger coach arrived at Batesville on March 26, 1883 on the Batesville branch of the St. Louis, Iron Mountain and Southern Railroad. It would be another 22 years before the rail line was completed up the White River Valley. This made Batesville a terminal for a wide area including much of the upper White River valley[3].

A. C. McGinnis cites the Handford Cedar Yard as an example of the symbiotic relationship between the railroad and the river. The period of railroad construction meant a ready market for crossties, piling, poles and posts. Cedar logs were rafted down the river to the Yard and the finished products were shipped out in boxcars. The Handford brothers soon branched out into banking, lime, stone and other businesses[4].

> Before the turn of the century, the discovery of several rich deposits of zinc ore in the mountains along the Buffalo River in Marion, Baxter, and Boone Counties increased the need for better transportation facilities for the upper river country. White River was elected as the natural outlet for these mineral deposits, since there was no railroad closer than 100 miles away.
>
> The mine owners and stockholders applied hard pressure to Congress to support a federal act that would improve the upriver navigation system[5].

A History of Batesville favorably mentions "the influence of Hon. S. Brundige, Jr., and Senators Berry and Jones"[6] in connection with the legislation authorizing Lock and Dam No. 1. The efforts of these gentlemen and of other supporters of the project were evidently substantial to overcome the recommendations of the Chief of Engineers. In his report of 1896, Brig. Gen W. P. Craighill made the following observations:

> This river is capable of improvement from the engineer's point of view, but the information at hand does not convince me that the needs of commerce justify the expenditure of public money upon it at this time. . . in my judgement the stream is not worthy of improvement.

Less than three years later the U.S. Congress authorized Capt. William L. Sibert's plan for ten fixed dams and concrete locks on the upper White River. The River and Harbor Act of March 3, 1899 authorized a project to provide slack-water navigation from Batesville to Buffalo shoals, a distance of 89 miles, by ten fixed dams with concrete locks. The project was estimated to cost $1,600,000 based on having funds sufficient to construct one lock and dam complete each working season[7].

Construction

The U. S. Army Corps of Engineer's first attempt to improve navigation of the upper White River was in 1879. Wing dams were constructed in an attempt to improve water levels at Buffalo Shoals. Work was extended downriver as far as the mouth of the Black River. Although several types of wing dams were tried the effort was largely unsuccessful[8]. In fiscal years 1890 and 1891 some work was done on shoals in an attempt to obtain a two-foot depth from Buffalo Shoals downriver to Batesville. In fiscal year 1894 some rock obstructions were removed from three shoals.

The River and Harbor Act of August 17, 1894 directed the Corps of Engineers to examine the upper White River to determine the proper method of improvement. This task was entrusted to First Lieutenant William L. Sibert who was in charge of the Little Rock District from August 16, 1894 to September 14, 1898. A preliminary report dated September 14, 1895 was forwarded to the Chief of Engineers by Lt. Sibert (See Appendix). This report first included the concept of ten locks and dams that was to form the basis for eventual construction.

> It is the opinion of Lieutenant Sibert that the upper White River is worthy of improvement, also that the proper method of improving all of it except the alluvial portion is by means of locks and fixed dams. The division engineer, Col. H. M. Robert, Corps of Engineers, concurs in the opinion of the local officer that the upper White River is worthy of improvement by the United States from Batesville, Ark., to Buffalo Shoals, a distance of about 89 miles, and that the proper method of improvement is by locks

> and dams. In the opinion of Colonel Robert the remainder of the upper White River is not worthy of improvement just now[9].

This summary by Brig. Gen. W. P. Craighill was followed by his recommendation against the project referenced earlier.

The Rivers and Harbors Act of March 3, 1899 as passed by the U.S. Congress, included implementation of Lt. Sibert's plan to provide slack-water navigation from Batesville to Buffalo Shoals. The difference of elevation between Batesville and Buffalo Shoals, a total of 145.3 feet, was to be overcome by ten masonry locks and fixed dams. "Total estimate ... [is] $1,600,000. This estimate is based on the supposition that there will be sufficient funds available to construct a lock and dam complete each working season, after work is once commenced[10]." See Figures 7-13 for profile of the river included with the original report. Figures 14, 15 and 16 are diagrams of the three locks and dams that were actually built.

On May 23, 1899 U. S. Government boats arrived at Batesville to begin preliminary work on Lock No. 1.

> Little was done by the [Little Rock] District in 1899 because of financial problems. All new projects on the White River were suspended for fear that they might cause changes in the channel--changes which might necessitate expensive constructions modifications in the proposed White River locks and dams. . . . The District had hoped that in 1900 it would begin construction on the lock and dam projects on the White River, but difficulties in getting the necessary land caused the work to be delayed another year[11].
>
> During the year ending June 30, 1900, the survey of pool No. 1 was completed, and the exact locations of Dams Nos. 1 and 2 determined. Plans have been completed for the locks and dams at sites Nos. 1 and 2. [See Figures 17 and 18 for cross-section of Lock and Dam No. 2.] Owing to delay in procuring land at the site of Lock No. 1, below Batesville, construction could not be begun last season. The land was procured in December, 1899, and the plant has been installed, and work upon the cofferdam for Lock No. 1 is well under way[12].

Actual construction work began on Lock No. 1 in August 1900. The dams were built in the manner of the day: large timber cribs were constructed with local timber, floated into position, filled with rocks and sunk. "It was the

work of men and muscles, but it accomplished its purpose. Periodically a section would wash away, but such an occurrence was expected as a matter of routine. The missing section would be repaired promptly in the same way that it had been built originally[13]."

Lieutenant Robert McGregor was the officer in charge of the Little Rock District at the time construction began. "In 1901 the District changed commands. Captain Charles L. Potter held the appointment one month then in April, Captain Graham D. Fitch assumed command[14]." Captain, later Major, Fitch was in command from April 27, 1901 to July 24, 1906. Locks and Dams No. 1 and No. 2 were completed during his tenure. Construction of Lock and Dam No. 3 was well underway before he left the district. Major Fitch's detailed reports to the Chief of Engineers provide excellent contemporary records of the construction techniques used and will be quoted extensively in this section.

> ***Location.*** -- [See Figures 19, 20 and 21] A really good location for the first lock and dam of the series was not to be had. The river valley at and below Batesville averages 1 mile in width from bluff to bluff, with bottom lands everywhere on one or both sides of the river, so that no site was available where the banks at each end of the dam would be above overflow. . . . the upper location, where the river has 100 feet less than its average width, was selected *** solely as a matter of economy, there being, of course, less length of dam to construct and the foundation being a few feet nearer the surface. Rock being nearer the surface on the concave side, that side was selected as the cheaper place to build the lock.
>
> Lock No. 2 is located 7.8 miles above Batesville, in a straight reach, where there is ample spillway, but where the foundations are unusually deep and the bed of the river is covered with large bowlders. No better location could be found, however, though two surveys were made for the purpose.
>
> The location selected for Lock No. 3 is at the foot of a bend 12.2 miles above Lock No. 2, at the very head of the pool, that being the first good location as regards foundation to be had.
>
> ***Lock dimensions.*** -- The locks are of concrete masonry, 175 feet long, between hollow quoins. The width of the lock chamber is 36 feet. The lift is 14 feet for Lock No. 1 and Lock No. 2 and 15 feet for Lock No. 3. . . . The guard of the lock walls is 10 feet. [Figures 22 and 23]

Lock foundations. -- The locks are all founded on sandstone bed rock. [See Figures 24 and 25 for geologic map.] Crib cofferdams, though much more expensive than pile cofferdams owing to the greater amount of material required and the previous dredging necessary, were used because the foundation bed afforded no hold for piles; incidentally the further advantage resulted of permitting excavation closer to the dam. The cofferdam for Lock No. 1 was built and sunk in sections from 20 to 30 feet long, each section consisting of round oak logs 7 to 9 inches in diameter, driftbolted together with five-eighths inch round iron. . . . The pens were filled with clay and the dam well banked on the outside; the puddle, which was taken from a bank near by, was loaded by a dipper dredge on a barge and placed in the dam with shovels. . . .

The cofferdam for Lock No. 2 differed somewhat; it was not built with logs, but with sawed timbers which are much more easily and quickly handled, and almost as cheap. . . .

The lock-wall foundations of Lock No. 1 averaged 6 feet in depth below the lock floor, the maximum depth being 6 feet 5 inches, and of Lock No. 2 12 feet, with a maximum of 13 feet. . . As both the chamber and miter walls of Locks No. 1 and No. 2 are founded on bed rock, no water can penetrate into the chamber from below and no excavation was necessary below the elevation for the lock floor, which is the natural surface of the ground. . . .

Forms. -- The lock forms were of the usual type, namely, planks or lagging laid horizontally and held rigidly by outside posts solidly braced to the ground so as to prevent the ramming from springing them. . . . The forms for Lock No. 1 were built in separate alternate sections, the lagging for each section being carried to the full height before concreting was started in that section, and the concreting for each section of wall being completed before another section was begun. However, as work was in two eight-hour shifts the sections are not monoliths. In the construction of Lock No. 2 the forming for the entire lock was erected at the start, except that the lagging was built up gradually as the concreting advanced. . . .

Concrete. -- Portland cement only was used, the brands being Lehigh and Alpha at Lock No. 1 and Lehigh at Lock No. 2. . . . A number of comparative tests of the fine and coarse sands were made and it was found that briquettes of 1 part cement and 3 parts Little Rock sand were

stronger than briquettes of 1 part cement and 2 1/2 parts White River sand, but not so strong as briquettes of 1 part cement and 2 parts White River sand. The gravel used was dredged by hired labor, from the river near the works; . . . The stone used at Lock No. 1 was a sandstone, the so-called bluestone of Cabin Creek, Arkansas, . . . The stone for Lock No. 2 was limestone from a quarry in the vicinity of the work. . . .

The proportions of the mix varied, the concrete being richer in the foundations, on exposed surfaces, and when gravel was used. . . . The plans for Lock No. 3 provide for gravel concrete only. . . .

At Lock No. 1 the mistake was made of leaving the inside edges of the coping of the land and river walls sharp; in Lock No. 2, however, these edges were rounded off not only to prevent chating of the mooring lines but also on account of the liability of chipping. . . .

Lock walls, etc. -- The height of the lock walls is 15 feet above the upper miter sill, 29 feet above the lower sill, and 30 feet above the lock floor. Being founded on solid rock, each wall acts separately, and the design is that of a retaining wall. The land wall is slightly stronger than the river wall, but its top is narrower; opposite the chamber it is stepped in the rear with one-foot offsets every 3 feet 6 inches, which the river wall is battered. Both walls are 14 feet 6 inches thick at bottom; at top the thickness of the river wall is 6 feet and of the land wall 4 feet 9 inches. The ends of the lock walls are necessarily thicker than the side walls of the chamber, as they must not only support the pressure from the gates but also provide work room for the lock tenders, and the thickness of the lock walls at the heels of the gates is accordingly 16 feet. . . . The available length of the lock chamber is 147 feet. In Locks Nos. 1 and 2 the length of the wall below the lower quoin is 25 feet and above the upper quoin 37 feet; in the design for Lock No. 3 these dimensions were reduced to 20 feet and 30 feet, respectively, in order to diminish the quantity of concrete required. The total length of Locks Nos. 1 and 2 is, therefore, 237 feet, and of Lock No. 3 is 225 feet. . . .

The hollow quoins are shaped directly in the concrete, . . . The gate recesses are 22 feet long and 2 feet deep. . . .

The upper coffer walls, the function of which is to support a simple movable dam across the head of the lock when the upper gates of valves need repairing, has its sill 1 foot below the upper miter sill. . . .

With the object of preventing the water from cutting behind the land wall, its upper and lower end is, in each lock, provided with a wing wall running perpendicularly back into the bank far enough to join the rocky bluff which is from 20 to 30 feet in the rear. . . .

Culverts and valves. -- There are two filling culverts each 3 feet 3 inches by 7 feet, which are placed in the gate recesses to keep them from filling with mud: . . . For emptying the lock there are two side culverts, each 4 by 5 feet, which pass around the heels of the lower gates entering near the gate recesses and discharging below the miter wall into the tail bay, thus serving to prevent deposits there.

The valves are in the culverts, and are butterfly or balanced valves of steel plates and angles turning on vertical shafts. Cast-iron valves were adopted for Lock No. 3, because there is a foundry at Newport, Ark., whereas if the valves for Lock No. 1 or Lock No. 2 break the steel must be obtained from St. Louis. In Locks Nos. 1 and 2 there are two valves to each filling culvert because the valves had to be of low height in order to remain submerged during low water. . . . The valves are inexpensive, simple in design, and that they leak is of no consequence, as the minimum discharge of the upper White River is 1,200 cubic feet a second. . . .

The valve operating gear, which is set in a covered recess in the coping, consists of a gear sector keyed to the top of the valve shaft and geared with a pinion turned by a socket wrench and wheel. This simple gearing answers well for the filling valves, which can be operated by one man, but two men were required in opening the emptying valves, so that when one of the valve shafts broke the operating gear for all of the emptying valves was altered . . . to increase the velocity ration between the first driving pinion and the sector.

In the design for Lock No. 3 horizontal instead of vertical butterfly valves were adopted in order that but one valve would be needed for each filling culvert. . . .

The time of complete lockage is thirteen and a half minutes for downstream boats and fourteen minutes for upstream boats, to which figures should be added one minute for passing in and out between the guide cribs.

Lock gates, etc. -- The gates are of the standard form, namely, mitering gates of the girder type with straight front and back. Though timber gates have a shorter life than metal ones and their buoyancy when submerged is a disadvantage, yet owing to their smaller first cost, greater ease of repair, and simpler construction, small gates are almost invariably made of wood, which was the material adopted in this case. The gates are horizontally framed and without quoin or miter posts, the main timbers extending from edge to edge of the gate and the ends, which are built up solid with filling blocks, being shaped to fit the hollow quoin and miter, respectively. . . .

The gates are of white oak, 20 inches thick throughout, each arm consisting of a built-up beam composed of two 10 by 10 inch timbers bolted together with 1-inch bolts and extending in one length from toe to heel. The tops of the gates are flush with the tops of the lock walls, so that the lock can be used until the walls are submerged. The lower gates, which are 29 feet 5 inches in height, are built solid for 10 feet from the bottom. For the upper gates these figures become 15 feet 5 inches and 20 inches, respectively. . . . The upper portions of the gates are paneled: . . .

The anchorage for the gates of Locks No. 1 and No. 2 consists of four wrought-iron bars with cast-iron washers or anchor plates embedded in the concrete and connected in pairs at their exposed ends to two heavy castings in Lock No. 1, and to a wrought-iron forging in Lock No. 2, to which the ends of the wrought-iron gudgeon strap or collar are fastened, the gudgeon pin being held in place by two cast-iron plates worked into the gate timbers. This arrangement was difficult and the design for Lock No. 3 provides for two embedded bars with slotted ends for gib and cotter connection with the gudgeon strap. . . .

The gates are operated by hand power. The maneuvering gear consists of a spar, to each end of which is fastened one end of a chain; the bight of this chain is led through a chain guide consisting of two sheaves to a chain capstan worked by a crank. The gate is opened or closed according as the chain is pulled in one direction or the other.

As wooden lock gates subject to varying lifts, unless made too heavy at low water, are too buoyant at high water, it is necessary at the approach of floods to ballast them, which was done by filling the panels with large stones.

Miter sills, guide cribs, etc. -- The miter sills, which provide an elastic cushion for the bottom of the gates, consist of 12 by 12 inch timbers well bolted to the miter wall, . . .

Loose stone was placed by hand back of the land wall to form a drain for the seepage. . . .

Permanent guard or guide cribs are placed at the head and foot of each lock wall [See Figures 26 and 27]. . . . cribs were built of 10 by 10 inch timbers, framed and driftbolted together, pine being used below pool level and oak above. They were filled with "one-man" stone, large selected stones being set on edge with their flat faces against the side openings and the top being covered with large, well-shaped stones set level with the timbers.

On the coping of each chamber wall there are four snubbing posts of cast iron, the plan for Lock No. 3 provides in addition for twelve line hooks in three rows of four hooks each, built in recesses in the faces of the chamber walls. Two recessed ladders are also place in each chamber wall.

Permanent gauges to show the depth of water on the miter sills were built in the concrete of the river walls in the head and tail bays. . . .[15].

The first abutment at Dam No. 1 was a T-type abutment built of concrete on a pile foundation. It was completed in February 1901 but lasted less than two years. On the night of November 25, 1902, the abutment was flanked and destroyed and the river flowed around the end of the dam. Major Fitch's comments indicate the design flaw which was responsible. The abutment was "not put into the bank as far as practical ... but on the contrary was placed 120 feet in front of the river bank[16]." He concluded that the need to keep costs down rather than a lack of engineering knowledge was responsible for the failed design[17].

New abutment at Dam No. 1. -- The erosion resulting from this contracted flow [during the high water of November 19-26, 1902] and the deflection of the current caused the new bank line to make an angle of about 45º with the line of the original dam. It was decided, however, to prolong the dam in a straight line and also to adhere to the usual practice of building the river face of the abutment normal to it. This caused the new abutment, which was finally located 346.5 feet from the end of the

original dam, to make an angle with the bank line instead of being parallel to it as generally occurs and threw its downstream end well out into the river. . . . The plan then recommended and later carried out with complete success was first suggested by an article in the Engineering News for December 20, 1902, describing how certain lock foundations in Egypt had been built by subaqueous grouting. Materially modified in details and worked out to suit local conditions, this idea was acted upon and the abutment founded on a timber crib filled with grouted rubble, the grout being fed from below to make the voids fill from the bottom upward[18]. [See Figures 28 and 29.]

Abutment at Lock No. 2. -- The abutment at Lock No. 2 . . . is a concrete structure of the T type, founded--without the intervening grillage shown on the plans--on piles driven to bed rock. It is surrounded by triple-lap sheet piling. The concrete was deposited in shallow water from 1 inch to 18 inches deep by skips, the main piles being embedded about 4 feet in the concrete. The river face is 14 feet long on top and 76 feet long at the base. The land arm which enters the bank for its entire length is 60 feet long. The abutment was built to the same height as the lock walls, namely, 10 feet above the crest of the dam. . . . [See Figure 30.]

Abutment at Lock No. 3. -- The abutment at Dam No. 3 . . . is to have its top 15 feet above the crest of the dam as against 2 feet at Lock No. 2 and 10 feet at Lock No. 2, is to be protected by a 100-foot crib below, while at Locks No. 1 and No. 2 no protection whatever was provided for in the original plans. . . .

Dam No. 1. -- Dam No. 1, [See Figures 31 and 32] . . . is a fixed dam normal to the axis of the river, resting against the buttress of the upper river lock gate so as to have the whole length of the lock chamber in the lower pool. The dam as originally built was only 324 feet long, which gave a very inadequate spillway. It is a timber crib dam, for though rock foundation was available for a masonry dam, the former type, though not a really permanent structure, was selected because cheaper in first cost and because it can be built without the use of a cofferdam. . . .

The cribs are of yellow pine except the slope timbers and the face stringers, which are of white oak, all timbers, which are 10 by 10 inch scantling, being driftbolted together at their intersections. . . .

> The dam was built in three separate sections, which were partially completed a short distance upstream, the bottoms being built to suit careful soundings previously taken, and then towed to position and the building continued. . . . After the failure of the abutment this dam was extended and the original portion changed from a step to a slope dam and given a concrete apron[19].
>
> The total length of the dam as rebuilt is 660.5 feet, thus affording 336.5 feet more spillway than the original dam[20].
>
> ***Dam No. 2.*** -- Dam No. 2 . . . will be 655 feet long when completed. It will be founded on rock excepting one section already built on piles. . . . Dam No. 2 is to be a slope dam instead of a step dam as originally proposed . . . . Dam No. 3 will be founded throughout on solid rock 5 feet below lower pool level and will have a spillway 765 feet long. Dams No. 2 and No. 3 not differing otherwise from Dam No. 1, require no further mention[21]. [See Figure 33.]

The completeness and attention to detail of Major Graham D. Fitch leaves the reader no doubt that he was intimately involved with the design and construction of the three locks and dams on the Upper White River. The preceding descriptions, detailed as they are, greatly condense Major Fitch's original report. See Appendix A for the complete text.

Another important figure in the construction of the locks and dams is William Parkin. He was "assistant engineer in local charge at Batesville" as early as 1897[22] and as late as 1916[23]. Most likely Mr. Parkin provided the day to day supervision of construction activities and Major Fitch made regular inspections.

Events During Construction

Construction of the Upper White River improvements was a very significant activity in Independence County and vicinity. From the beginning of construction activity in August 1900 through completion of Lock and Dam No. 3 in 1908 more than $800,000 in federal funds was spent on construction.

The completion of Lock and Dam No. 1 at Batesville was cause for local celebration. On November 18, 1902 townspeople celebrated their good fortune at an event that climaxed with an excursion to Lock and Dam No. 2 for some

400 hundred persons on the OZARK QUEEN and CLEVELAND steamboats. The OZARK QUEEN, captained by Charles B. Woodbury, was built in 1896 and ran on the upper White until summer 1903. CLEVELAND was a government boat used in construction of Lock and Dam No. 2. At the end of the day, encouraged by their passengers, the two captains agreed to a race on the return trip to Batesville. The race was described as an exciting one with the government boat, CLEVELAND, eventually emerging victorious over the local favorite[24].

It is ironic that this celebration was followed one week later by high water that damaged the dam. The abutment at Lock and Dam No. 1 was flanked and destroyed. Major Fitch's report details the midnight efforts to save the abutment and subsequent efforts to save the dam[25].

"Unworthy of Further Improvement"

In his report for fiscal year 1903 Major Fitch states, "I deem this river between Batesville and Buffalo shoals as unworthy of further improvement after the completion of Locks and Dams Nos. 1 and 2."[26]

> When this project was adopted there was no railway in the upper White River Valley above Batesville . . . . Neither the large quantities of zinc ore in Marion, Boone, Baxter, Newton, and Searcy counties, of Arkansas, nor the fine marble beds in this section could be operated with profit because no facilities existed for cheap transportation; hence it appeared that the improvement of this stream for all the year round navigation should be undertaken by the General Government. Batesville, being a railway point, and Buffalo shoals, being near the southeastern border of the mineral belt, were selected as the terminals of the section of the river to be improved[27].

On Monday, August 24, 1903 the first passenger train ran from Batesville to Cotter. That this particular train included as freight any of the resources Major Fitch mentions is unclear. That the completion of this stretch of track spelled the death knell for commerce on the upper White River had been clear to river captains for some time. The winter 1902 through spring 1903 season was the last for steamboats on the upper White River. The OZARK QUEEN and JOE WHEELER were the last two steam packets above Calico Rock and they left the upper White in mid 1903[28].

The project on the upper White River was designed as an isolated improvement. The White River from Batesville downriver to Jacksonport (38 miles) is not navigable during much of the year. Any freight shipped on the river had to be transferred to another transportation mode. When the choice of transportation was river or unimproved road, steamboat was the preferred method. The railroad changed the entire transportation equation. In the words of Major Fitch, "It is hardly probably that shippers will elect to transfer freights from a railway to boat for only a short-distance shipment on the river when the railway from which it was transferred passes through the same point of destination[29]."

Major Fitch's recommendation was ignored or argued down by Congress just as Brig. Gen W. P. Craighill's recommendation had been dealt with in 1896. Major Fitch repeated his recommendation in his 1904 report[30]. The River and Harbor Act of March 3, 1905 required that a board of engineers be appointed to investigate the situation. This board reported that construction of further locks and dams was not desirable. Construction on Lock and Dam No. 3 had begun in 1905 and its completion was funded by the River and Harbor Act of March 2, 1907. However, further construction work was abandoned and the language of the act fixed the appropriation for construction as the final one[31].

Later History and Alterations

Although steamboats no longer plied the upper White River after the close of the 1903 season, there was still river traffic. The following statistics taken from the 1910 *Report of the Chief of Engineers* illustrates the gradual reduction in value of the commodities shipped.

Year	Short tons	Value
1895	73,759	$2,494,377
1896	74,882	2,045,991
1897	42,962	2,435,814
1898	102,337	1,415,013
1899	117,891	1,619,351
1900	134,696	2,244,222
1901	148,574	1,700,355
1902	184,066	1,242,438
1903	140,013	882,225
1904	193,498	1,021,778
1905	134,588	770,689
1906	100,083	766,138
1907	127,812	830,659
1908	161,246	962,508
1909	134,200	671,230
1910	141,771	619,718

"Forest products made up the bulk of the commerce. Twenty-three per cent of the commerce reported was rafted saw logs floated with the current[32]."

The Corps of Engineers continued to maintain the three locks and dams. The associated cost figures appear in the regular reports of the Chief of Engineers.

Lock and Dam No. 2 was seriously damaged by a flood of February 1, 1916. The dam was broken in two places, riprap and fill were washed out and some of the bank area was scoured. Both lower gates to the lock were washed away. Locks and Dams Nos. 1 and 3 sustained no appreciable damage during this flood. See Figure 34 for a report from William Parkin, assistant engineer stationed in Batesville.

Soon after the 1916 flood concrete decking was applied to the surface of all three dams. See Figure 35.

During the early 1940s the wooden lock gates were replaced by steel gates. The existing hand-operating mechanisms remained unchanged. The map files of the U. S. Army Corps of Engineers District Office in Little Rock contain plans for five gates as listed below:

	to accompany specifications dated:
Lock & Dam No. 1, New Upstream Lock Gate	April 10, 1940
Lock & Dam No. 2, New Downstream Lock Gate	no date
Lock & Dam No. 2, New Upstream Lock Gate	Jan. 6, 1941
Lock & Dam No. 3, New Upstream Lock Gate	Jan. 6, 1941
Lock & Dam No. 3, New Downstream Lock Gate	April 1, 1941

The writer speculates that the original wood downstream gates at Lock and Dam No. 1 were never replaced. No plans or other reference to new gates could be located. At present Lock No. 1 has no downstream gates. Conventional wisdom, though undocumented, indicates that these gates "burned" in the 1950s.

The locks and dams continued to operate until January 1952, "amid frequent rumors about 'blowing' the works. By the 1950's river traffic on the White had deteriorated to a few shell barges and rock barges[33]."

John Morrow, Sr. of Batesville, a politically active figure sometimes called the "Father of the White River Projects" summed up local feeling when he stated that the whole White River project was a disappointment to the local people. The White River dams were constructed for navigation, not flood control. They were designed so that flood waters merely welled over the top. "The dams did not control the floods, and the locks were on the only part of the river that was navigable without locks[34]." The latter comment referred to the fact that the worst stretch of river was between Newport and Batesville; the narrower river above Batesville tended to be deeper and more navigable even before construction of the locks and dams.

On June 30, 1952 the entire upper White River project was put on inactive status.

> In accordance with the policy of the Corps of Engineers to suspend lock operation and maintenance of waterways affording little or no benefit to general commerce and navigation, and to eliminate nonessential maintenance expenditures, all concerned were informed on June 23, 1952 by public notice that Federal operation and maintenance of the three locks and dams would be terminated at midnight June 30, 1952, and that the city of Batesville, Ark., would

assume responsibility for operation and maintenance of all facilities at lock and dam No. 1 on or about July 1, 1952. The gates of locks Nos. 2 and 3 have been secured in a closed position and the real estate in the vicinity of these locks will be offered for lease during fiscal year 1953[35].

The city of Batesville turned the property at Lock and Dam No. 1 into an attractive picnic area known as Riverside Park. According to Batesville historian Wilson Powell, "The locks and dams were always used like a public park although they never were. As long as they were maintained, it was essentially used like a park. When they [Corps of Engineers] pulled out, the parks came under city administration[36]." Lock and Dam No. 1 and the lake behind the dam played an important role in the origination of the annual White River Carnival in Batesville.

The houses and property at both upper locks have stood vacant most of the time since the federal government pulled out in 1952 although the property at Lock Number 2 was rented at one time[37]. Access to both upper locks is now difficult and becomes impossible during wet weather.

Current Condition[38]

Following the period when the locks and dams received an inactive status in 1952, it appears that maintenance has been neglected.

Concrete efflorescence, dusting, scaling, spalling, and crazing is evident on all of the locks' concrete walls. Horizontal and vertical cracks and voids are evident at the cold joints. Settlement cracks are prominent.

The timber crib guide walls appear to be in fairly good shape except for the riverward guide wall at Lock and Dam No. 1 which appears to have been undermined.

Both gates at Lock and Dam No. 2 and Lock and Dam No. 3 are rusting. This is also the case with the one remaining gate at Lock and Dam No. 1. The valves, gears, pinions, plates, and other related hardware are also rusted at each lock. All are incapable of operating the gates in their present condition.

Underwater inspection of Lock and Dam No. 1 on September 21, 1987 determined that the abutment and lock structure are in need of only minor repair[39]. No undermining of the lock wall was discovered. Because of large percolation holes and deteriorating downstream face timber the dam at No. 1 will require a fair amount

of repair work. The dam has many small holes under the concrete cap and one large hole of five feet wide by 25 feet high at a depth of six feet. Because the original wood sheeting facing has deteriorated water percolates rapidly through the crib stone.

Underwater inspection of Lock and Dam No. 2 on September 23, 1987 confirmed that the lock is in good condition with the exception of about five feet of u dermining at the downstream end of the river side lock wall. The dam has one large hole about three feet high and 18 feet wide about five feet under the water level. This and other smaller holes will require repair.

Underwater inspection of Lock and Dam No. 3 on September 22, 1987 determined that the facility is in poor condition. In addition to holes in the dam similar to those at Nos. 1 and 2 two major problems were identified. A portion of the dam toe near the lock wall has collapsed. It appears that the original dam facing deteriorated and eventually led to the crib timber deterioration and subsequent collapse of the dam toe.

The downstream third of the abutment at Lock and Dam No. 3 has rotated toward the river due to poor foundation condition or erosion from heavy flow. Currently, the crack at the top of the wall is about 14 inches wide and the downstream portion is about eight inches offset from the main structure. During preparation of an earlier report on underwater conditions examination of historic photographs indicated that the crack first appeared while the dam was still under construction in 1905[40]. If this is true, then the crack initiated as a result of poor design or settlement of the foundation material and continued to rotate as the foundation was slowly eroded.

Hydroelectric Project

Presently in the planning stages is a hydroelectric project for all three locks and dams. At Lock and Dam No. 1 the proposed project would consist of: (1) the existing White River Lock and Dam, approximately 660 feet long and 27.6 feet high; (2) a reservoir with a surface area of approximately 773 acres and storage capacity of approximately 12,500 acre-feet; and (3) a new powerhouse containing one generating unit with a total capacity of 6,029 kW; (4) a concrete, open-flume tailrace structure approximately 280 feet long; (5) a new 34.5 kV transmission line approximately 10,000 feet long; and (6) appurtenant facilities[41].

At Lock and Dam No. 2 the hydroelectric project would consist of (1) the existing 685-foot-long and 29-foot-high concrete and timber crib dam and the 36-foot-wide and 175-foot-long lock; (2) a reservoir with a surface area of approximately

1,072 acres and a gross storage capacity of approximately 8,581 acre-feet; (3) a new multi-level intake flume, utilizing the existing defunct navigation lock; (4) a new powerhouse containing one generating unit with a total capacity of 6,307 kW; (5) an open flume tailrace, approximately 120 feet long; (6) a 34.5 kV transmission line, approximately 6 1/2 miles long; and (7) appurtenant facilities[42].

The proposed hydroelectric generating project at Lock and Dam No. 3 is essentially the same: (1) the existing dam, approximately 750 feet long and 21 feet high; (2) installation of steel sheeting along the face of the dam; (3) a new intake structure; (4) a new powerhouse containing one turbine-generator unit with a total rated capacity of 6,755 kW; (5) a tailrace returning flow to the river approximately 300 feet downstream of the dam; (6) a 34.5 kV transmission line approximately 7 miles long; and (7) appurtenant facilities[43].

It is anticipated that construction will start in December 1988 at Lock and Dam No. 3, in March 1989 at Lock and Dam No. 2, and in June 1989 at Lock and Dam No. 1. Repairs indicated by the surface and underwater on-site inspections will be made to the locks and dams. The locks will be altered when power generation equipment is installed. The lock gates, land side lock walls, and guide walls will be removed and a power house will be constructed at each facility.

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[1] *Arkansas Gazette*, January 19, 1831.

[2] *Arkansas Gazette*, March 16, 1831.

[3] A.C. McGinnis, "A History of Independence County, Ark.," *Independence County Chronicle* XVII (April 1976): 75.

[4] McGinnis, 77.

[5] Vaughn R. Brewer, "Romancing the 'Rock,'" *Arkansas Gazette*, December 2, 1987, sec. B.

[6] Billy Sensabaugh et al., Fourth Year History Class of Batesville High School, *A History of Batesville* (1919; reprint, Batesville: 1951), 27.

[7] U. S. Army Corps of Engineers, *Report of the Chief of Engineers, 1904* (Washington: Government Printing Office), 402-404.

[8] *Report 1904* , 3751.

[9] U.S. Army Corps of Engineers, *Report of the Chief of Engineers, 1896* (Washington: Government Printing Office), 107.

[10] House Committee on Rivers and Harbors, *Survey of White River, Arkansas*, House Document 78, 54th Congress, 2d session, 3.

[11] *A History of the Little Rock District, U.S. Army Corps of Engineers, 1881-1979* (Washington: Government Printing Office), 11.

[12]U. S. Army Corps of Engineers, *Report of the Chief of Engineers, 1902* (Washington: Government Printing Office), 419.
[13]*A History*, 13.
[14]*A History*, 11.
[15]*Report 1904* , 3752-3762.
[16]*Report 1904* , 3763.
[17]*Report 1904* , 3764.
[18]*Report 1904* , 3768-9.
[19]*Report 1904* , 3764-3766.
[20]*Report 1904* , 3774.
[21]*Report 1904* , 3766-3767.
[22]U. S. Army Corps of Engineers, *Report of the Chief of Engineers, 1897* (Washington: Government Printing Office), 1996.
[23]See memo, Figure 34.
[24]Duane Huddleston, "The Ozark Queen and Her Competitors; the Last Steam Packets Above Calico Rock," *Independence County Chronicle*, Vol. X, No. 2 (January 1969) 14.
[25]U. S. Army Corps of Engineers, *Report of the Chief of Engineers, 1903* (Washington: Government Printing Office), 1422-23.
[26]*Report 1903*, 1428-9.
[27]*Report 1903*, p. 1426.
[28]Huddleston, 20.
[29]*Report 1903*, 1427.
[30]*Report 1904*, 3778.
[31]U. S. Army Corps of Engineers, *Report of the Chief of Engineers, 1952* (Washington: Government Printing Office), 1011.
[32]U. S. Army Corps of Engineers, *Report of the Chief of Engineers, 1910* (Washington: Government Printing Office), 606.
[33]*A History*, 13.
[34]*A History*, 13.
[35]*Report 1952* , 1012-13.
[36]Mike Kemp, "Despite environmental changes, White River rolls on," *River Country*, August 2-8, 1986, p. 3.
[37]*Arkansas Democrat Magazine*, August 25, 1957, 7.
[38]Taken from a report in the files of the Arkansas Historic Preservation Program entitled "Construction History and Description of Existing Conditions of the Locks at Locks and Dams Nos. 1, 2, and 3; White River, Independence County, Arkansas" attached to the Nomination Form, National Register of Historic Places.
[39]Except as noted information on underwater conditions is from a report entitled "White River Hydroelectric Projects: Dam Inspection Report, Lock and Dam No. 1, No. 2 and No. 3, October 1987," Morrison-Knudsen Engineers, Inc., Norwalk, Connecticut.
[40]"Condition Survey--White River, Lock and Dam No. 2 and No. 3, April & October, 1982," a report by Garver and Garver, Inc., Little Rock, Arkansas.
[41]Federal Energy Regulatory Commission, *Order Issuing Unconstructed License (Major), City of Batesville, Arkansas, Project No. 4204-002*, 34 FERC 62,437, February 28, 1986, p. 1.
[42]Federal Energy Regulatory Commission, *Order Issuing Unconstructed License (Major), Independence County, Arkansas, Project No. 4660-001*, 33 FERC 62,182, November 8, 1985, p. 1.
[43]Federal Energy Regulatory Commission, *Order Issuing Unconstructed License (Major), Independence County, Arkansas, Project No. 4659-002*, 34 FERC 62,430, February 28, 1986, p. 1.

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