Southern Idaho Section

Historic Civil Engineering Landmark Nomination

of

Arrowrock Dam

"The Highest Dam in the World, 1915-1932"

Boise County, Idaho

Arrowrock Dam, Crowe concrete distributing device about the discharge into the hopper. May 22, 1912
Photo Credit: Idaho Historical Society, 61-164.88

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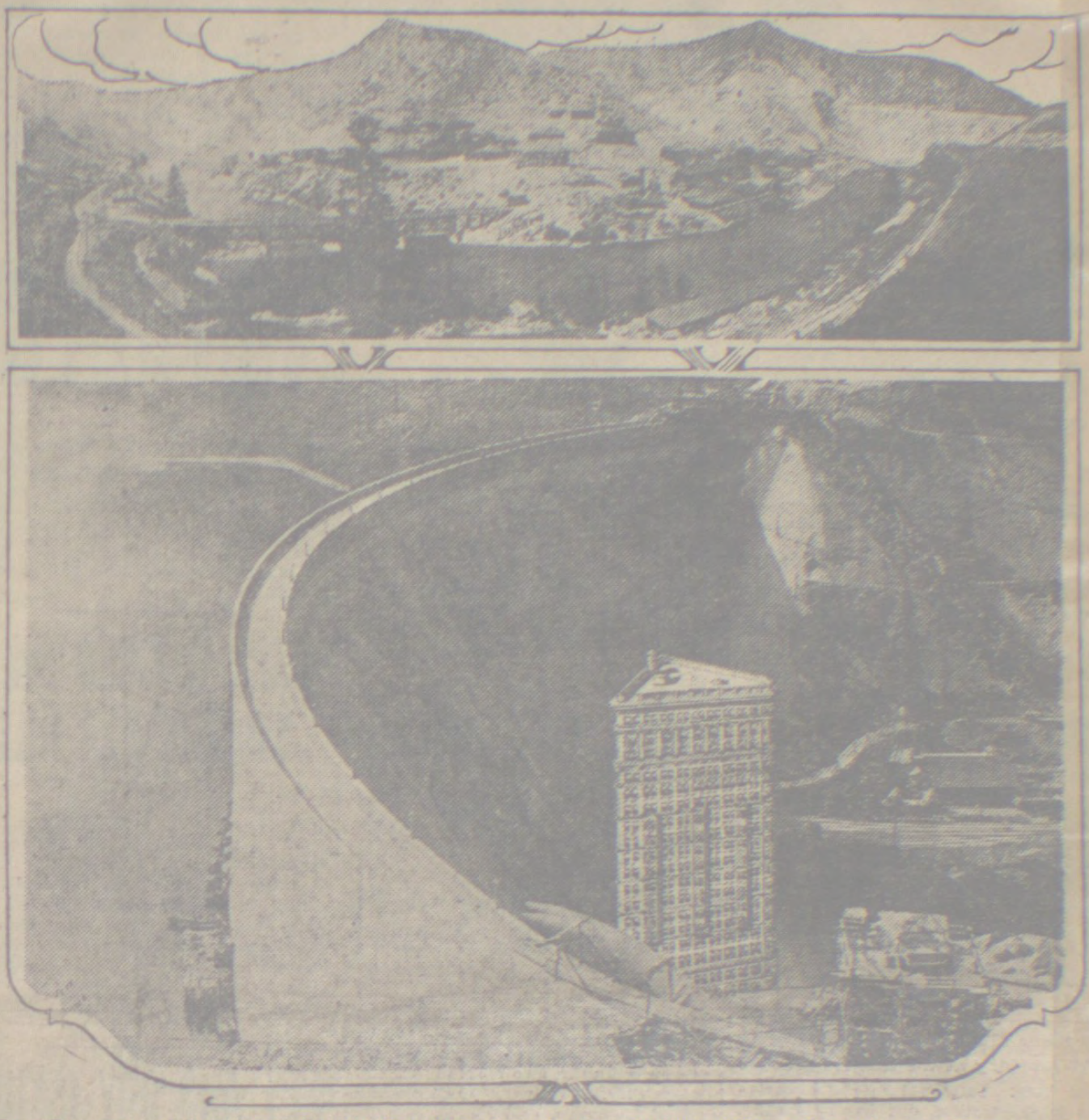
APPENDICES

Cover Photo Credit: Idaho Historical Society, 2646

ARROWROCK DAM, FINISHING TOUCH TO GREAT IRRIGATION PROJECT, IS FORMALLY DEDICATE

OCT 4 1915

Mighty Treasure Will Each Year Be Stored Behind the Dam



Top—Panorama of Boise river looking toward Arrowrock dam. Bottom—Comparison between Arrowrock dam, 348.5 feet high, and the Flatiron building, New York, 286 feet high.

Arrowrock dam, which arrests the flow of the Boise river just above this city, that gigantic vault door of a reserve bank in which is to be stored each year a mighty treasure in liquid millions, is an accomplished fact. After deep planning and years of hard labor it is finished. There it stands today challenging the world as the highest dam yet built, a monument to the efficiency of service, the [illegible] ect that adds 240,000 fruitful acres to

bration unique and long to be remembered. Settlers from all parts of the project, the direct beneficiaries of the water from Arrowrock, placed on the altar on this occasion their tribute to this monument.

Gathered at the dedication were the settlers from all parts of the project, citizens from the large communities of Boise, Nampa and Caldwell who profit

conversion of a vast tract of blistering waste into fruitful gardens, orchards and farms—this transformation of a weary stretch of sagebrush desert into an abode of thrifty and contented citizens with their homes, their villages and their schools. Few, even among those on the land, appreciate the magnitude of the undertaking.

In the reservoir back of Arrowrock

Bowmont, Melba, Greenleaf and Wilder

miles, more than twice the area of the

Photo Credit: Idaho Statesman October 4, 1915 (Courtesy of the Idaho Historical Society)

Historic Civil Engineering Landmark Nomination

To: History & Heritage Committee
ATTN: Jennifer Lawrence
1801 Alexander Bell Drive
Reston, VA 20191-4400

Date: **June 3, 2015** ASCE Section: **Southern Idaho**

This is to nominate the following for designation as a Historic Landmark: **National**

Previously nominated for National: **No**

Located at: **N. Fork Boise River Rd.** County: **Boise County** State: **Idaho**

The latitude and longitude to the nearest minute: **43° 35', -115°55'**

Attach detailed local and vicinity maps that show access from a major city or the interstate:

See Appendix A.

The proposed landmark's owner:

The United States Department of the Interior, Bureau of Reclamation

In support of this nomination the following must be provided:

1.0 Date of Construction (and other significant dates)

- August, 1910 – Final Approval of the Arrowrock Dam Project.
- Early 1912 – Construction begins on the Arrowrock Dam.
- October 4, 1915 – Dedication of the Arrowrock Dam.
- 1915 to 1932 – The Arrowrock Dam is the tallest dam in the world until 1932. In 1932, it is surpassed by the Owyhee Dam in Oregon.
- 2010 – The Arrowrock Dam is retrofitted with a 15 MW Hydroelectric Facility.
- October 4, 2015 - 100th Anniversary (pending)

2.0 Names of Key Civil Engineer and Other Professionals Associated with Project

- Frank Crowe – Design Engineer
- F.E. Weymouth – Supervising Engineer
- Chas. H. Paul – Construction Engineer
- James Munn – Superintendent Of Construction
- W.E. Borah – United States Senator

3.0 Historic (national or local) Significance of this Landmark

- From 1915 to 1932, the Arrowrock Dam was the highest dam in the world at 350 feet.
- Millions across the country read of and celebrated the Arrowrock Dam's completion.
- The Arrowrock Dam provides about 286,000 acre feet of irrigation water storage for the Treasure Valley.
- The completion of the Arrowrock Dam changed sagebrush desert to farmable country, adding "240,000 fruitful acres to the permanent wealth of the nation" (Idaho Statesman, October 4, 1915).
- The Arrowrock Dam was a triumph for the Reclamation Service and provided a proving ground for engineers and construction techniques used during the construction of still larger dams such as the Hoover Dam. In part because of the success of the Arrowrock Dam, the Reclamation Service continued to construct large dams throughout the west, opening arid lands to irrigation and habitation.
- In order to get supplies to the construction site, the nation's first publicly owned rail line was formed, running from Boise to the dam site located 20 miles upriver.
- The Arrowrock Dam is included on the National Register of Historic Places in Idaho.

4.0 Comparable or Similar Projects, Both in the United States and other Countries

- Aswan Low Dam (Egypt). Gravity Dam completed in 1902 with a height of 118 feet.
- Owyhee Dam (Oregon). Arch-Gravity Dam completed in 1932 with a height of 417 feet.
- Hoover Dam (Nevada/Arizona). Arch-Gravity Dam completed in 1936 with a height of 726.4 feet.

- Glen Canyon Dam (Arizona). Arch Dam completed in 1966 with a height of 710 feet.
- Idukki Dam (Kerala, India). Arch Dam completed in 1973 with a height of 554 feet.

5.0 Unique Features or Characteristics which set this Proposed Landmark Apart from Other Civil Engineering Projects, including those in #4 above

- When completed, the Arrowrock Dam was the highest dam in the world at 348 feet, a civil engineering marvel of its day.
- Frank Crowe developed two practices while working on the Arrowrock Dam which proved pivotal to the future of dam construction, including the Hoover Dam:
  - The first is the use of a pipe grid used to transport cement pneumatically.
  - The second is an overhead cableway system for transporting construction debris and delivering concrete rapidly to any point on the construction site.
- Experimental elements of Arrowrock Dam's gravity-arch design were later applied to larger dams such as the Hoover Dam.
- The Arrowrock Dam is one of only two United States Bureau of Reclamation dams constructed with sand cement.
- The Arrowrock Dam was the first United States Bureau of Reclamation dam to use Ensign Valves to control the flow of water through its outlets.
- During its completion, workers set several records for mixing and placing concrete. In April 1913, they placed 45,700 cubic yards of concrete which was believed to be a world record. They then broke the record two more times by pouring 51,490 cubic yards in May 1913 and then again in June by pouring 56,520 cubic yards.
- Prior to construction of the dam, the Boise River was diverted through a 470-foot-long tunnel, a notable engineering feat for its time.

6.0 Contribution which this Structure or Project Made Towards the Development of: (1) The Civil Engineering Profession; (2) The Nation or a Large Region Thereof.

- During his time working on Arrowrock Dam, Engineer Frank Crowe developed two practices which became invaluable to dam construction in the west: 1) using a pipe grid to pump cement pneumatically, and 2) an overhead cableway system to remove debris and deliver concrete rapidly to any point on the construction site. Frank Crowe later went on to become one of the nation's greatest dam builders. Frank used the techniques pioneered during his time working on the Arrowrock Dam to complete the Hoover Dam, one of the most recognizable dams in the world. These techniques proved invaluable to constructing super dams in the west which helped deserts flourish and new communities begin.
- The Arrowrock Dam Project was a triumph for the Reclamation Service. After the successful completion of the Arrowrock Dam which included several experimental techniques and design elements, the Bureau of Reclamation continued to build on the success and knowledge gained during construction of the Arrowrock Dam to build many more and even taller dams throughout the west.
- The Arrowrock Dam played a major part in bringing irrigation to the Treasure Valley and allowing it to develop economically. Today, the Treasure Valley is Idaho's most populous metropolitan area (616,561 2010 U.S. Census) home to roughly 40 percent of the state's population.

7.0 A List or Published References Concerning this Nomination

"Arrowrock Dam, Finishing Touch to Great Boise Irrigation Project is Formally Dedicated Today," The Idaho Statesman, October 4, 1915.

Evancho, Joe, "Concrete and Steel Give Old Dam New Life," Intermountain Contractor, May 2004, http://intermountain.construction.com/features/archive/0405_feature1.asp.

"Millions Read About Big Dam," Capital News, October 5, 1915.

Rocca, Al M. "I feel that I am simply marking time, 1912-1921" chapt. 4 *America's Master Dam Builder: The Engineering Genius of Frank T. Crowe* (Maryland: University Press of America, Inc., 2001).

"The Arrowrock Dam," Indianapolis News, October 12, 1915.

"Idaho History: Arrowrock Dam Near Boise Was a Colossal Achievement," Idaho Statesman, April 12, 2015.

8.0 A List of Additional Documentation in Support of this Nomination

Arrowrock Dam 50th Anniversary Dinner Program, 1965

Department of the Interior United States Reclamation Service, "Arrowrock Dam and Related Features Summary of Items of General Interest," 1912 or 1913.

"Engineers point to Arrowrock's Solid Anchors," The Idaho Statesman, October 16, 1929.

"The Arrowrock Dam," Idaho Statesman, est 1915.

Photos and Postcards from the Idaho Historical Society Archives:

- Arrowrock Dam, Crowe concrete distributing device about to discharge into hopper, May 22, 1912 (61-164.88)
- Arrowrock Dam, Steam shovel handling 8-ton boulder, November 12, 1912 (61-164.137)
- Arrowrock Dam, Diversion Tunnel, October 30, 1911 (61-164.33)
- Postcard "Arrowrock Dam, Highest in the World," published by Wesley Andres Co. in Baker Oregon (60-72.20).
- Postcard "Arrowrock Dam, 359 feet high, length 1050 feet, Boise River, Idaho," published by Wesley Andres Co. in Baker Oregon (60-11.19).
- Arrowrock Dam, Spillway and Dam, unknown Date (3117).
- Postcard "Great Arrowrock Dam, Boise River, Idaho," published by Wesley Andres Co. in Baker Oregon (2543).

9.0 The Recommended Citation for HHC Consideration

"The Arrowrock Dam, located 20 miles upriver from Boise , Idaho, serves as an essential water storage facility supplying irrigation water to thousands of acres of fertile farmland in the Treasure Valley. At the time of its dedication in 1915, the Arrowrock Dam was the highest dam in the world at 350 feet, a title it would hold until 1932. Civil Engineers tested the technological limits of the time to construct this engineering marvel. The Arrowrock Dam served as a proving ground for design elements and construction methods that would later be incorporated into other large dams in the west. The dam was the first United States Bureau of Reclamation dam to use Ensign Valves to control the flow from the outlet works. While working on the Arrowrock Dam, Engineer Frank Crowe developed a grid system of delivering concrete pneumatically and an overhead cable system for rapidly delivering construction materials throughout the construction site. Crowe later went on construct many more dams, including the Hoover Dam, where he utilized the systems he developed while working on the Arrowrock Dam."

10.0 A Statement of the Owner's Support for the Nomination

See Appendix C

If this nomination is approved for designation as a National Historic Civil Engineering Landmark by the Board of Direction of ASCE, we understand that the section will have the major responsibility for the public presentation ceremony of the plaque and for plaque maintenance.

Chairman, Section History & Heritage Committee:_____

Section Secretary:_____

Section President:_____

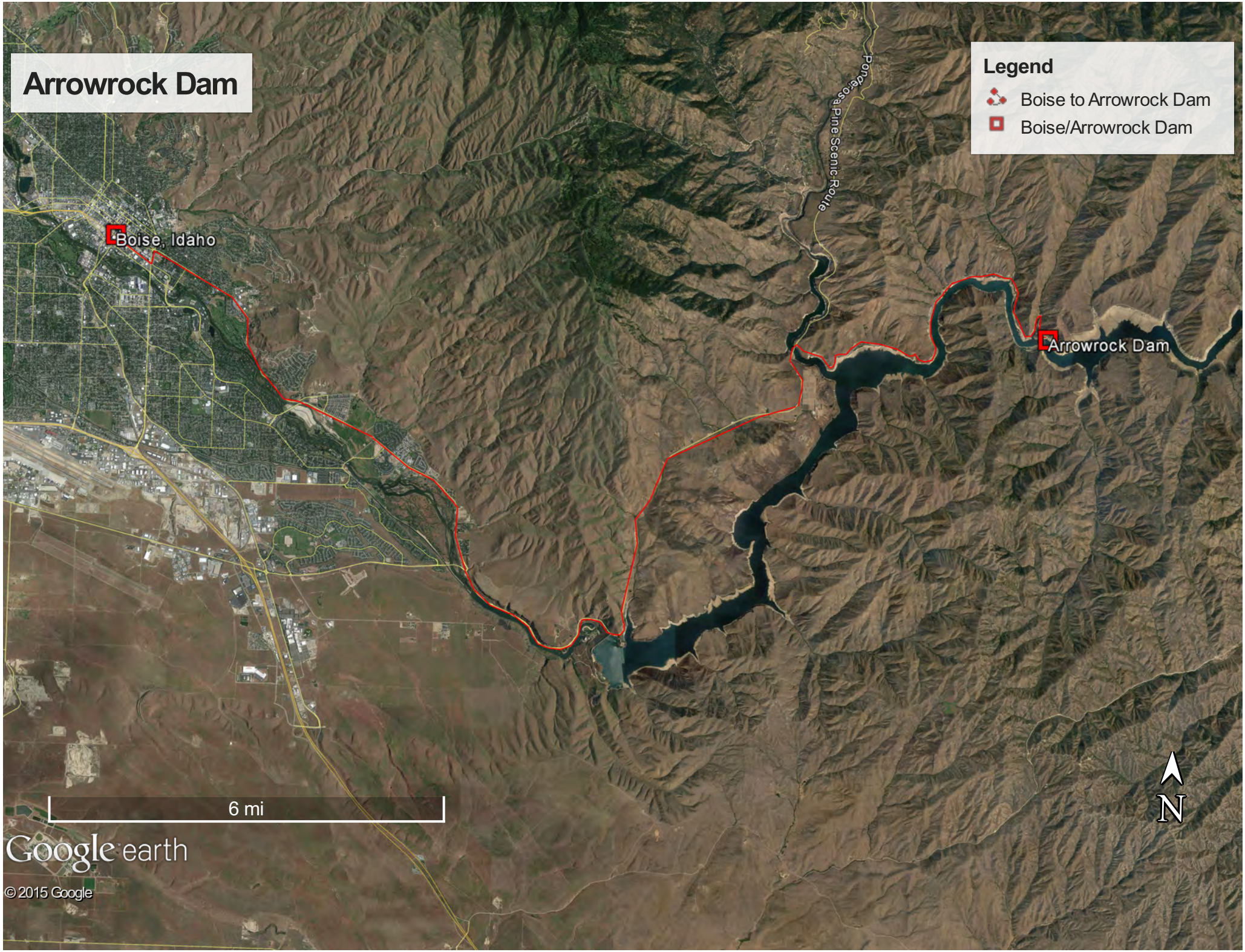
**Note: For State Historic Civil Engineering Landmark designation, the other Section presidents from the state should sign the nomination form or concur with the nomination in writing. If all Sections affected by the nomination agree on dedicating this landmark, the nominating Section should inform the HHC of their decision and send one (1) copy of the nomination package to the staff contact for the HHC.*

Note: Designation by ASCE as a National Historic Civil Engineering Landmark carries no legal commitment on the part of ASCE, the owner, or the governmental jurisdiction in which it is located.

A

Vicinity Map

Photo Credit: Matthew Lamar: matthewlamar.wordpress.com


Arrowrock Dam
Legend
Boise to Arrowrock Dam
Boise/Arrowrock Dam
Boise, Idaho
Arrowrock Dam
Ponderosa Pine Scenic Route
6 mi
N
Google earth
© 2015 Google

B

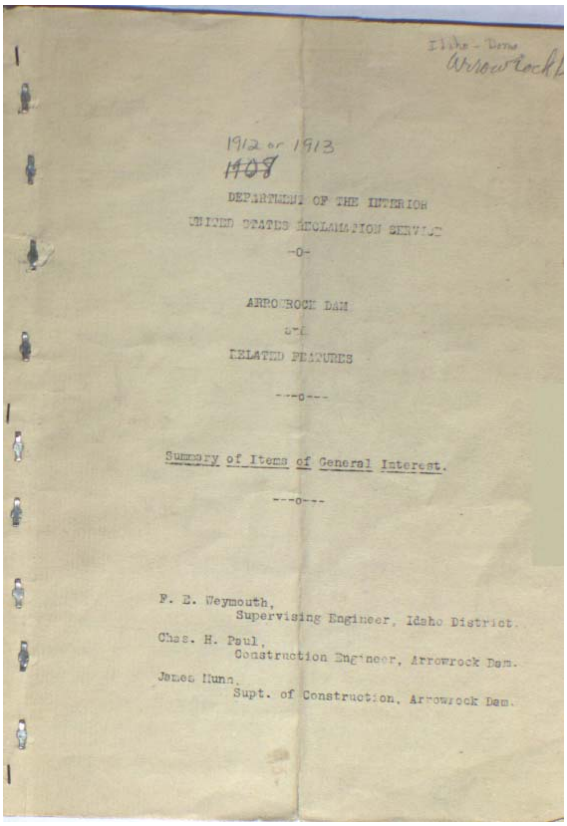
Sample of Historical Sources

Photo Credit: U.S. Bureau of Reclamation

Arrowrock Dam, Crowe concrete distributing device about to discharge into hopper, May 22, 1912.

Photo Credit: Idaho Historical Society, 61-164.88.

Department of the Interior United States Reclamation Service “Arrowrock Dam and Related Features, Summary of Items of General Interest” 1912 or 1913 (Courtesy of the Idaho Historical Society).



1912 or 1913

DEPARTMENT OF THE INTERIOR

UNITED STATES RECLAMATION SERVICE

-o-

ARROWROCK DAM

and

RELATED FEATURES

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Summary of Items of General Interest.

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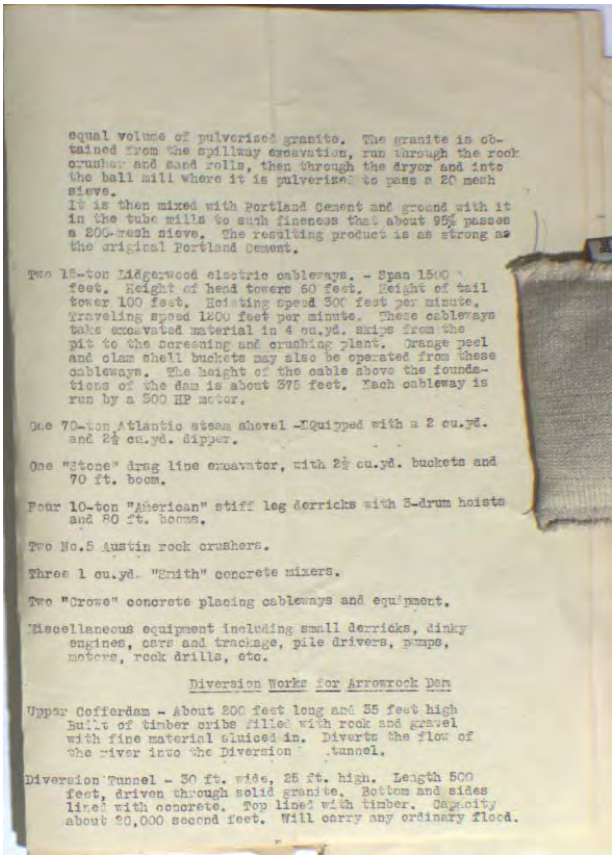
F. E. Weymouth,
Supervising Engineer, Idaho District.

Chas. H. Paul,
Construction Engineer, Arrowrock Dam.

James Munn,
Supt. of Construction, Arrowrock Dam.



equal volume of pulverized granite. The granite is obtained from the spillway excavation, run through the rock crusher and sand rolls, then through the dryer and into the ball mill where it is pulverized to pass a 20 mesh sieve.
It is then mixed with Portland Cement and ground with it in the tube mills to such fineness that about 95% passes a 200-mesh sieve. The resulting product is as strong as the original Portland Cement.

Two 15-ton Lidgerwood electric cableways. - Span 1500 feet. Height of head towers 60 feet. Height of tail tower 100 feet. Hoisting speed 300 feet per minute. Traveling speed 1200 feet per minute. These cableways take excavated material in 4 cu.yd. skips from the pit to the screening and crushing plant. Orange peel and clam shell buckets may also be operated from these cableways. The height of the cable above the foundations of the dam is about 375 feet. Each cableway is run by a 500 HP motor.

One 70-ton Atlantic steam shovel -Equipped with a 2 cu.yd. and 2½ cu.yd. dipper.

One "Stone" drag line excavator, with 2½ cu.yd. buckets and 70 ft. boom.

Four 10-ton "American" stiff leg derricks with 3-drum hoists and 80 ft. booms.

Two No.5 Austin rock crushers.

Three 1 cu.yd. "Smith" concrete mixers.

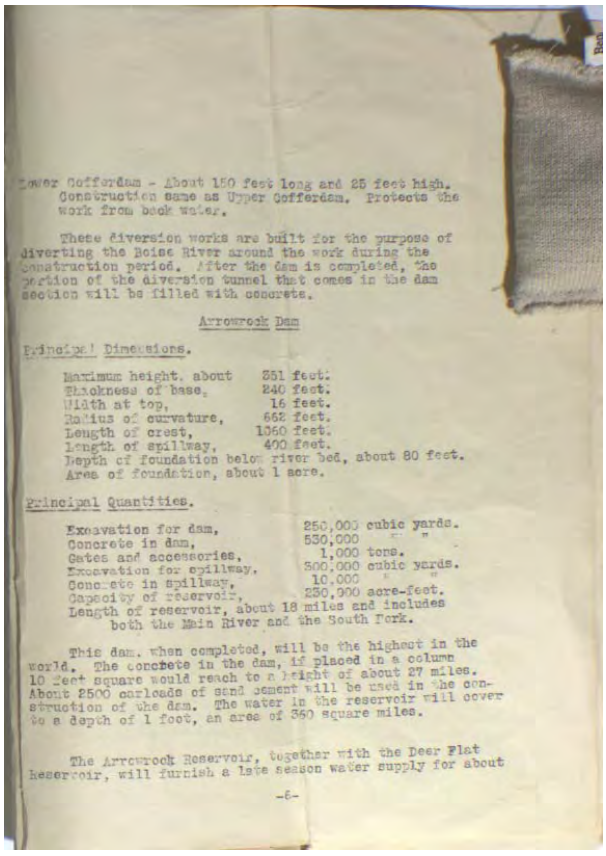
Two "Crowe" concrete placing cableways and equipment.

Miscellaneous equipment including small derricks, dinky engines, cars and trackage, pile drivers, pumps, motors, rock drills, etc.

Diversion Works for Arrowrock Dam

Upper Cofferdam - About 200 feet long and 55 feet high Built of timber cribs filled with rock and gravel with fine material sluiced in. Diverts the flow of the river into the Diversion tunnel.

Diversion Tunnel - 30 ft. wide, 25 ft. high. Length 500 feet, driven through solid granite. Bottom and sides lined with concrete. Top lined with timber. Capacity about 80,000 second feet. Will carry any ordinary flood.



Lower Cofferdam - About 150 feet long and 25 feet high. Construction same as Upper Cofferdam. Protects the work from back water.

These diversion works are built for the purpose of diverting the Boise River around the work during the construction period. After the dam is completed, the portion of the diversion tunnel that comes in the dam section will be filled with concrete.

Arrowrock Dam

Principal Dimensions.

Maximum height, about	351 feet.
Thickness of base,	240 feet.
Width at top,	16 feet.
Radius of curvature,	662 feet.
Length of crest,	1060 feet.
Length of spillway,	400 feet.

Depth of foundation below river bed, about 80 feet.
Area of foundation, about 1 acre.

Principal Quantities.

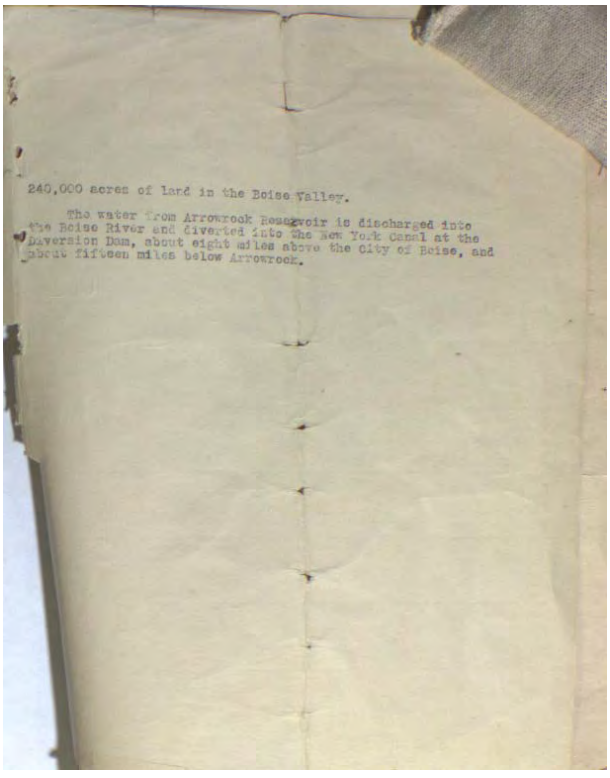
Excavation for dam,	250,000 cubic yards.
Concrete in dam,	530,000 " "
Gates and accessories,	1,000 tons.
Excavation for spillway,	500,000 cubic yards.
Concrete in spillway,	10,000 " "
Capacity of reservoir,	230,000 acre-feet.

Length of reservoir, about 18 miles and includes both the Main River and the South Fork.

This dam, when completed, will be the highest in the world. The concrete in the dam, if placed in a column 10 feet square would reach to a height of about 27 miles. About 2500 carloads of sand cement will be used in the construction of the dam. The water in the reservoir will cover to a depth of 1 foot, an area of 360 square miles.

The Arrowrock Reservoir, together with the Deer Flat reservoir, will furnish a late season water supply for about

-6-



240,000 acres of land in the Boise Valley.

The water from Arrowrock Reservoir is discharged into the Boise River and diverted into the New York Canal at the Diversion Dam, about eight miles above the City of Boise, and about fifteen miles below Arrowrock.

Article from the October 4, 1915 edition of The Idaho Statesman describing the dedication of the Arrowrock Dam. The article also includes a scale drawing of the dam, comparing it to the Flatiron Building in New York City (Courtesy of the Idaho Historical Society).

ARROWROCK DAM, FINISHING TOUCH TO GREAT BOISE IRRIGATION PROJECT, IS FORMALLY DEDICATED TODAY

OCT 4 1915

Mighty Treasure Will Each Year Be Stored Behind the Dam

OCT 4 1915

FIVE THOUSAND PERSONS ATTEND THE CEREMONIES

Crowd Sings "America" at the Conclusion of the Program.

MESSAGES OF CHEER FOR THE SETTLERS

Carrier Pigeons Are Released From Crest of the Great Dam.

Top—Panorama of Boise river looking toward Arrowrock dam. Bottom—Comparison between Arrowrock dam, 348.5 feet high, and the Flatiron building, New York, 286 feet high.

(Capital News Special Service.)

Arrowrock, Oct. 4.—Five thousand people today invaded this government city to attend the dedication ceremonies which mark the completion of one of the government's greatest achievements in reclamation work—the building of the Arrowrock dam, the highest structure of its kind in the world.

The first train which left Boise at 8 o'clock this morning carried 2100 people from Boise and vicinity while the settlers' train bringing a crowd from Parma, Caldwell, Nampa, Kuna and Meridian carried 2000 passengers. This train arrived at the dam at 1:30 o'clock and immediately thereafter the dedication exercises were begun.

Dr. W. J. Boone, president of the College of Idaho at Caldwell, pronounced the invocation. J. H. Lowell, gave a brief history of the project. H. H. Hayward, president of the Boise-Payette Water Users' association spoke of the turning of the irrigation works over to the settlers. Governor M. Alexander spoke on the great work of the reclamation service and what the storage of water had done for the home tillers of the soil who were making Idaho great. The great crowd joined in the singing of America at the conclusion of the governor's address.

An interesting feature of the dedication was the liberation of carrier pigeons taken to Arrowrock from various parts of the project. The birds flew from the crest of the great dam to bear messages of cheer and prosperity to the settlers.

The crowd was escorted through the dam, which was explained in detail by engineers who have been on the work. The weather for the trip was ideal and many who had never before seen the project were awe stricken as they gazed upon the mammoth structure behind which water was stored this summer that next summer will furnish [illegible] for irrigating [illegible]

Arrowrock dam, which arrests the flow of the Boise river just above this city, that gigantic vault door of a reserve bank in which is to be stored each year a mighty treasure in liquid millions, is an accomplished fact. After deep planning and years of hard labor it is finished. There it stands today challenging the world as the highest dam yet built, a monument to the efficiency of the government reclamation service, the key to an irrigation project that adds 240,000 fruitful acres to the permanent wealth of the nation.

At a time when other communities in other countries are celebrating the accomplishments of war, it seems fitting that this community, in the heart of America, should celebrate this great accomplishment of the arts of peace.

Its site was the scene today of a celebration unique and long to be remembered. Settlers from all parts of the project, the direct beneficiaries of the water from Arrowrock, placed on the altar on this occasion their tribute to this monument.

Gathered at the dedication were the settlers from all parts of the project, citizens from the large communities of Boise, Nampa and Caldwell who profit directly from the reclamation of this land; residents of Meridian, Kuna, Bowmont, Mellin, Greenleaf and Wilder—towns that have sprung to life on the project since the water was given to the thirsty soil; men, women and children from all sides to take part in the general rejoicing.

Few Appreciate Benefits.

Few outside the semi-arid sections of the west realize what this means, this conversion of a vast tract of blistering waste into fruitful gardens, orchards and farms—this transformation of a weary stretch of sagebrush desert into an abode of thrifty and contented citizens with their homes, their villages and their schools. Few, even among those on the land, appreciate the magnitude of the undertaking.

In the reservoir back of Arrowrock dam, a reservoir 15 miles long, capable of draining a basin of 2619 square miles, more than twice the area of the state of Rhode Island, there is to be stored each year 244,000 acre-feet of water for irrigation in the late summer months when the normal flow of the river is exhausted. By throwing the dam across a narrow gorge in the canyon the channel of the river is con-

(Continued on Last Page)

(cont.)

Mighty Treasure Will Each Year Be Stored Behind the Dam

(Continued from First Page)

[illegible]

Big Problem Is Solved.

[illegible]

Completed Ahead of Time.

[illegible]

Sentiment Plays Its Part.

[illegible]

How Task Was Accomplished.

[illegible]

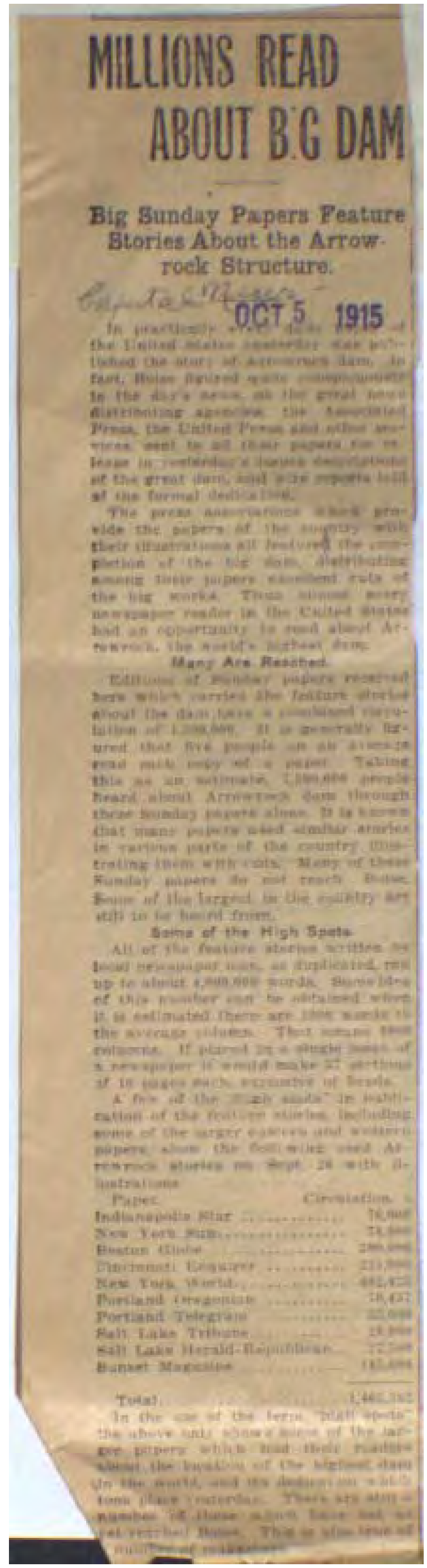
Is Highest in the World.

[illegible]

Makes It Worth While.

[illegible]

Article from the October 5, 1915 edition of Capital News (Boise) telling how millions across the country read about the completion of the historic Arrowrock Dam (Courtesy of the Idaho Historical Society).



MILLIONS READ ABOUT BIG DAM

Big Sunday Papers Feature Stories About the Arrow-rock Structure.

OCT 5 1915

[illegible]

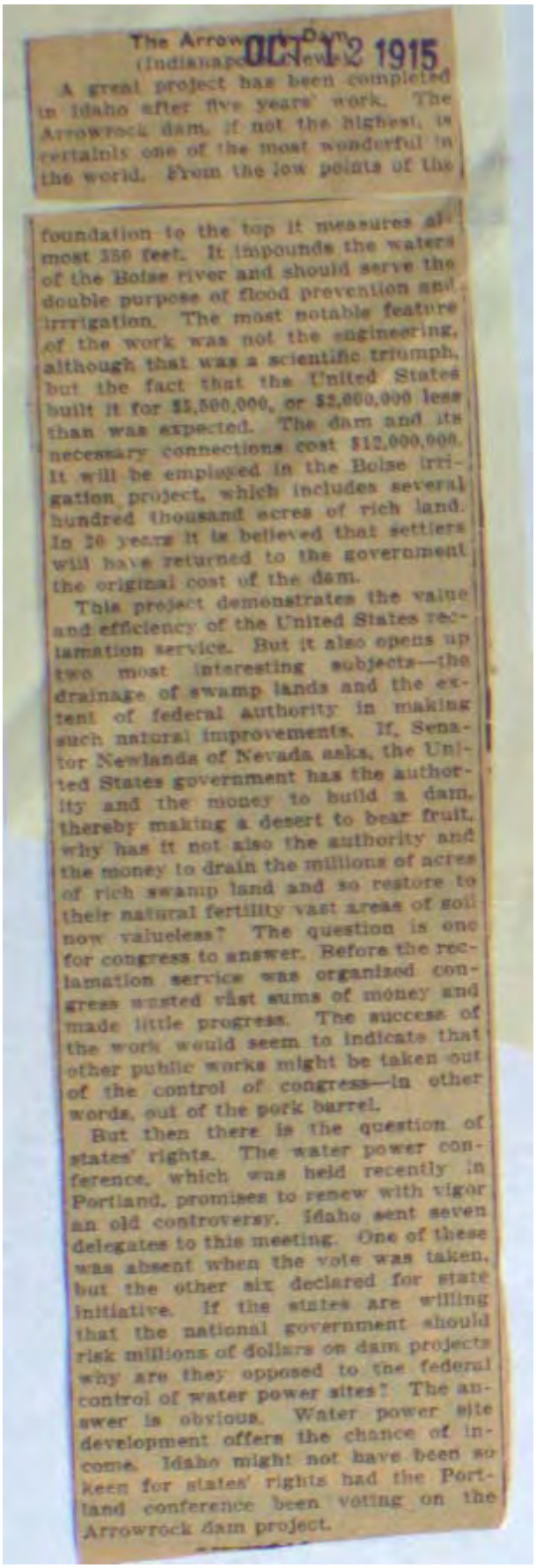
Many Are Reached

[illegible]

Some of the High Spots

[illegible]

Article from the October 12, 1915 edition of the Indianapolis News describing the Arrowrock Dam Project (Courtesy of the Idaho Historical Society).



The Arrowrock Dam

(Indianapolis News)

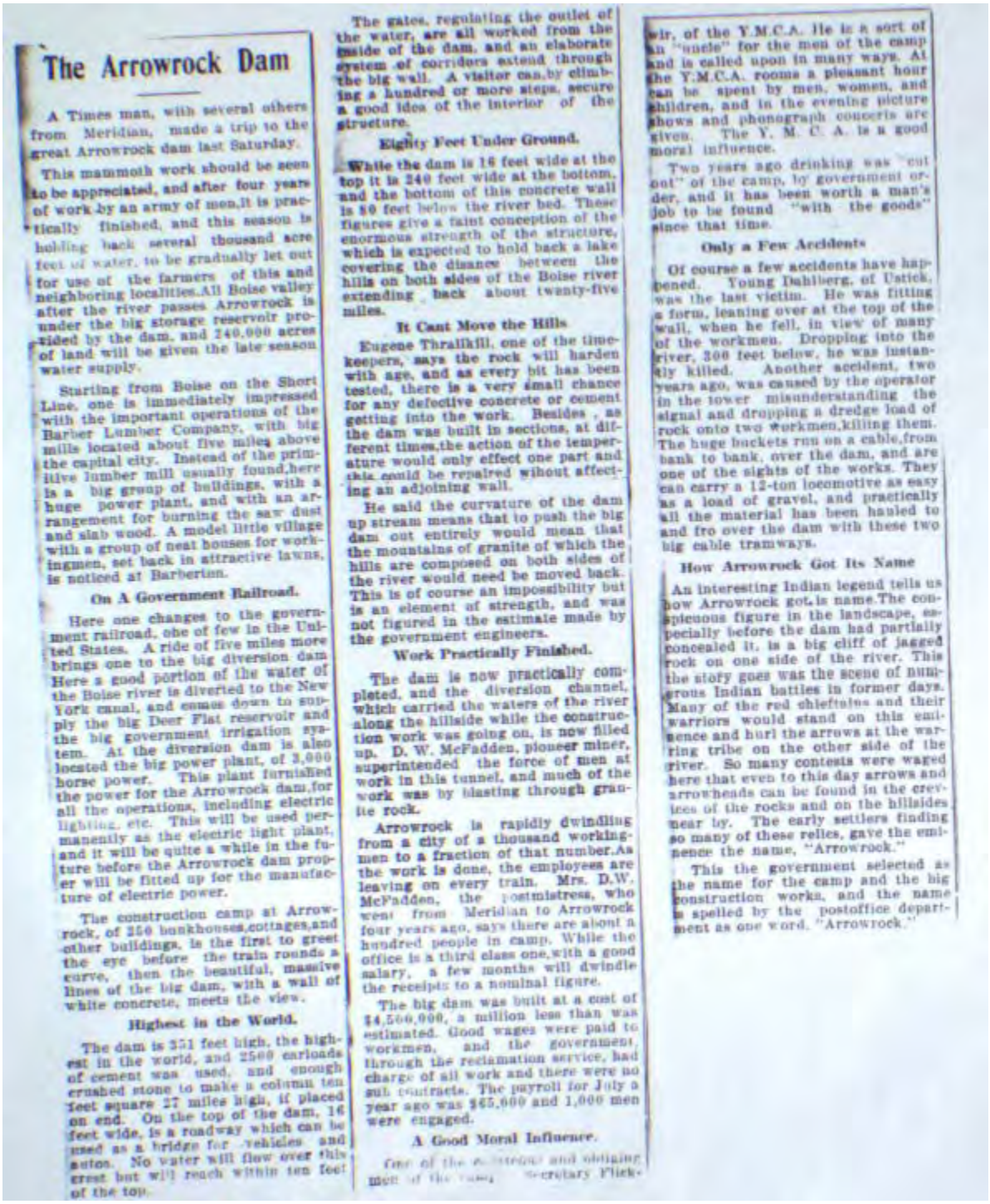
OCT 12 1915

A great project has been completed in Idaho after five years' work. The Arrowrock dam, if not the highest, is certainly one of the most wonderful in the world. From the low points of the foundation to the top it measures almost 350 feet. It impounds the waters of the Boise river and should serve the double purpose of flood prevention and irrigation. The most notable feature of the work was not the engineering, although that was a scientific triumph, but the fact that the United States built it for $5,500,000, or $2,000,000 less than was expected. The dam and its necessary connections cost $12,000,000. It will be employed in the Boise irrigation project, which includes several hundred thousand acres of rich land. In 20 years it is believed that settlers will have returned to the government the original cost of the dam.

This project demonstrates the value and efficiency of the United States reclamation service. But it also opens up two most interesting subjects—the drainage of swamp lands and the extent of federal authority in making such natural improvements. If Senator Newlands of Nevada asks, the United States government has the authority and the money to build a dam, thereby making a desert to bear fruit, why has it not also the authority and the money to drain the millions of acres of rich swamp land and so restore to their natural fertility vast areas of soil now valueless? The question is one for congress to answer. Before the reclamation service was organized congress wasted vast sums of money and made little progress. The success of the work would seem to indicate that other public works might be taken out of the control of congress—in other words, out of the pork barrel.

But then there is the question of states' rights. The water power conference, which was held recently in Portland, promises to renew with vigor an old controversy. Idaho sent seven delegates to this meeting. One of these was absent when the vote was taken, but the other six declared for state initiative. If the states are willing that the national government should risk millions of dollars on dam projects why are they opposed to the federal control of water power sites? The answer is obvious. Water power site development offers the chance of income. Idaho might not have been so keen for states' rights had the Portland conference been voting on the Arrowrock dam project.

Article from The Idaho Statesman (about 1915) describing the Arrowrock Dam's construction (Courtesy of the Idaho Historical Society).



The Arrowrock Dam

A Times man, with several others from Meridian, made a trip to the great Arrowrock dam last Saturday.

This mammoth work should be seen to be appreciated, and after four years of work by an army of men, it is practically finished, and this season is holding back several thousand acre feet of water, to be gradually let out for use of the farmers of this and neighboring localities. All Boise valley after the river passes Arrowrock is under the big storage reservoir provided by the dam, and 240,000 acres of land will be given the late season water supply.

Starting from Boise on the Short Line, one is immediately impressed with the important operations of the Barber Lumber Company, with big mills located about five miles above the capital city. Instead of the primitive lumber mill usually found, here is a big group of buildings, with a huge power plant, and with an arrangement for burning the saw dust and slab wood. A model little village with a group of neat houses for workingmen, set back in attractive lawns, is noticed at Barberton.

On A Government Railroad.

Here one changes to the government railroad, one of few in the United States. A ride of five miles more brings one to the big diversion dam Here a good portion of the water of the Boise river is diverted to the New York canal, and comes down to supply the big Deer Flat reservoir and the big government irrigation system. At the diversion dam is also located the big power plant, of 3,000 horse power. This plant furnished the power for the Arrowrock dam, for all the operations, including electric lighting, etc. This will be used permanently as the electric light plant, and it will be quite a while in the future before the Arrowrock dam proper will be fitted up for the manufacture of electric power.

The construction camp at Arrowrock, of 250 bunkhouses, cottages, and other buildings, is the first to greet the eye before the train rounds a curve, then the beautiful, massive lines of the big dam, with a wall of white concrete, meets the view.

Highest in the World.

The dam is 351 feet high, the highest in the world, and 2500 carloads of cement was used, and enough crushed stone to make a column ten feet square 27 miles high, if placed on end. On the top of the dam, 16 feet wide, is a roadway which can be used as a bridge for vehicles and autos. No water will flow over this crest but will reach within ten feet of the top.

The gates, regulating the outlet of the water, are all worked from the inside of the dam, and an elaborate system of corridors extend through the big wall. A visitor can, by climbing a hundred or more steps, secure a good idea of the interior of the structure.

Eighty Feet Under Ground.

While the dam is 16 feet wide at the top it is 240 feet wide at the bottom, and the bottom of this concrete wall is 80 feet below the river bed. These figures give a faint conception of the enormous strength of the structure, which is expected to hold back a lake covering the distance between the hills on both sides of the Boise river extending back about twenty-five miles.

It Cant Move the Hills

Eugene Thrailkill, one of the timekeepers, says the rock will harden with age, and as every bit has been tested, there is a very small chance for any defective concrete or cement getting into the work. Besides, as the dam was built in sections, at different times, the action of the temperature would only effect one part and this could be repaired without affecting an adjoining wall.

He said the curvature of the dam up stream means that to push the big dam out entirely would mean that the mountains of granite of which the hills are composed on both sides of the river would need be moved back. This is of course an impossibility but is an element of strength, and was not figured in the estimate made by the government engineers.

Work Practically Finished.

The dam is now practically completed, and the diversion channel, which carried the waters of the river along the hillside while the construction work was going on, is now filled up. D. W. McFadden, pioneer miner, superintended the force of men at work in this tunnel, and much of the work was by blasting through granite rock.

Arrowrock is rapidly dwindling from a city of a thousand workingmen to a fraction of that number. As the work is done, the employees are leaving on every train. Mrs. D.W. McFadden, the postmistress, who went from Meridian to Arrowrock four years ago, says there are about a hundred people in camp. While the office is a third class one, with a good salary, a few months will dwindle the receipts to a nominal figure.

The big dam was built at a cost of $4,500,000, a million less than was estimated. Good wages were paid to workmen, and the government, through the reclamation service, had charge of all work and there were no sub contracts. The payroll for July a year ago was $65,000 and 1,000 men were engaged.

A Good Moral Influence.

One of the courteous and obliging men of the camp, Secretary Flickwir, of the Y.M.C.A. He is a sort of an "uncle" for the men of the camp and is called upon in many ways. At the Y.M.C.A. rooms a pleasant hour can be spent by men, women, and children, and in the evening picture shows and phonograph concerts are given. The Y. M. C. A. is a good moral influence.

Two years ago drinking was "cut out" of the camp, by government order, and it has been worth a man's job to be found "with the goods" since that time.

Only a Few Accidents

Of course a few accidents have happened. Young Dahlberg, of Ustick, was the last victim. He was fitting a form, leaning over at the top of the wall, when he fell, in view of many of the workmen. Dropping into the river, 300 feet below, he was instantly killed. Another accident, two years ago, was caused by the operator in the tower misunderstanding the signal and dropping a dredge load of rock onto two workmen, killing them. The huge buckets run on a cable, from bank to bank, over the dam, and are one of the sights of the works. They can carry a 12-ton locomotive as easy as a load of gravel, and practically all the material has been hauled to and fro over the dam with these two big cable tramways.

How Arrowrock Got Its Name

An interesting Indian legend tells us how Arrowrock got its name. The conspicuous figure in the landscape, especially before the dam had partially concealed it, is a big cliff of jagged rock on one side of the river. This the story goes was the scene of numerous Indian battles in former days. Many of the red chieftains and their warriors would stand on this eminence and hurl the arrows at the warring tribe on the other side of the river. So many contests were waged here that even to this day arrows and arrowheads can be found in the crevices of the rocks and on the hillsides near by. The early settlers finding so many of these relics, gave the eminence the name, "Arrowrock."

This the government selected as the name for the camp and the big construction works, and the name is spelled by the postoffice department as one word, "Arrowrock."

Article from the October 16, 1929 edition of the Idaho Statesman describing the solid foundation of the Arrowrock dam after the St. Francis Dam disaster in California (Courtesy of the Idaho Historical Society).

ENGINEERS POINT TO ARROWROCK'S SOLID ANCHORS

Construction of Idaho Masterpiece Characterized by Elaborate Precautions to Prevent St. Francis Misfortune.

Construction of Arrowrock dam was characterized by elaborate precautions to prevent just such a misfortune as has befallen the St. Francis dam in California, engineers said Wednesday.

When the dam was being built the foundation was sunk 90 feet below stream level to place the structure on bedrock. To make sure that this was actually bedrock, hence not likely to give way under the weight of the dam and impounded waters, diamond drill holes were sunk deeper yet.

On this foundation, 238 feet wide at its widest point, a mass of concrete masonry was erected. Each wing was securely anchored in living granite and the upstream face curved to resist the pressure of the water.

Technical Description.

The dam, says a technical description in "The Design and Construction of Dams," a standard work on the subject, has radial contraction joints at intervals of 100 feet, where adhesion is prevented by oiling and forming.

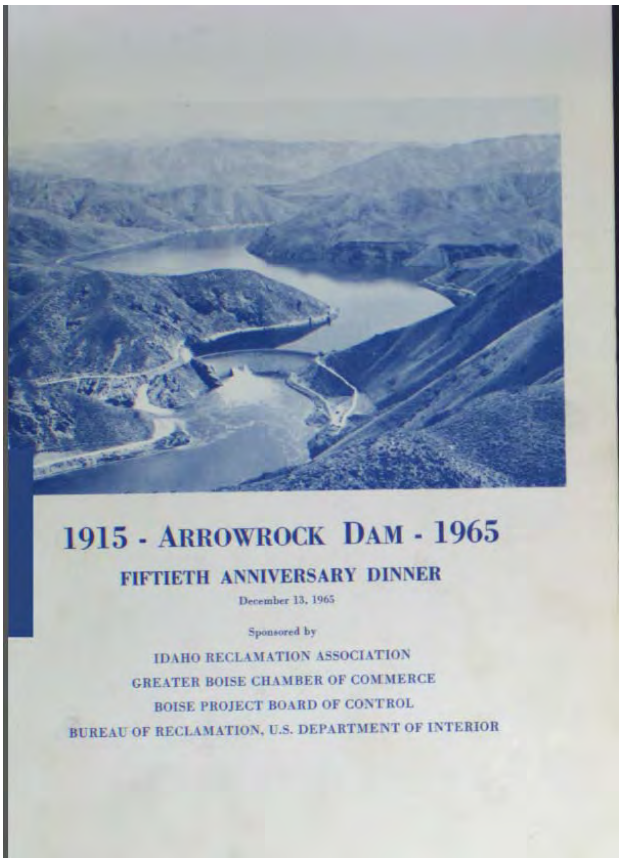
"To prevent leakage from the foundation of the dam," says the book, "a line of holes was drilled in the foundation, just below the upstream face, to depths of 30 to 40 feet. About 20 feet downstream from the line of holes, a line of drainage holes was drilled, to relieve the dam from upward pressure.

"These holes were continued upward in the masonry and terminated in a large drainage tunnel, extending the whole length of the dam. This tunnel is 25 feet inside of the water face of the dam. Drainage wells, 10 feet apart, extend upward from the tunnel nearly to the top of the dam to intercept and discharge water percolating through the masonry. The water collected by this tunnel is discharged by a branch tunnel leading to the down-stream toe of the dam."

The damage to the St. Francis dam, testimony said, was partly caused by leakage which these precautions are designed to prevent.

Statesman
Oct. 16-1929.

The Arrowrock Dam 50th Anniversary Dinner Program, 1965 (Courtesy of the Idaho Historical Society).



1915 - ARROWROCK DAM - 1965

FIFTIETH ANNIVERSARY DINNER

December 13, 1965

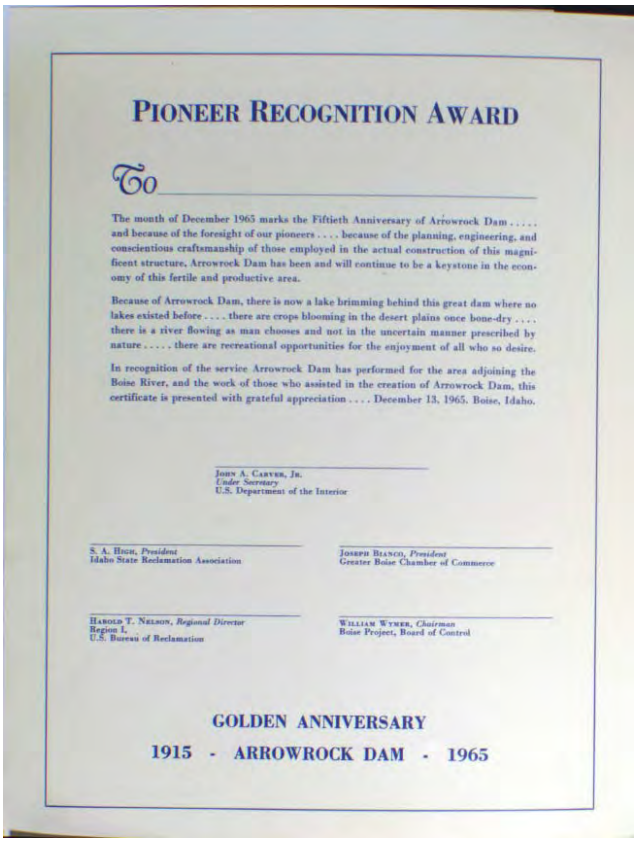
Sponsored by

IDAHO RECLAMATION ASSOCIATION

GREATER BOISE CHAMBER OF COMMERCE

BOISE PROJECT BOARD OF CONTROL

BUREAU OF RECLAMATION, U.S. DEPARTMENT OF INTERIOR



PIONEER RECOGNITION AWARD

To _____

The month of December 1965 marks the Fiftieth Anniversary of Arrowrock Dam . . . . . and because of the foresight of our pioneers . . . . because of the planning, engineering, and conscientious craftsmanship of those employed in the actual construction of this magnificent structure, Arrowrock Dam has been and will continue to be a keystone in the economy of this fertile and productive area.

Because of Arrowrock Dam, there is now a lake brimming behind this great dam where no lakes existed before . . . . there are crops blooming in the desert plains once bone-dry . . . . there is a river flowing as man chooses and not in the uncertain manner prescribed by nature . . . . . there are recreational opportunities for the enjoyment of all who so desire.

In recognition of the service Arrowrock Dam has performed for the area adjoining the Boise River, and the work of those who assisted in the creation of Arrowrock Dam, this certificate is presented with grateful appreciation . . . . December 13, 1965. Boise, Idaho.

JOHN A. CARVER, JR.
Under Secretary
U.S. Department of the Interior

S. A. HIGH, *President*
Idaho State Reclamation Association

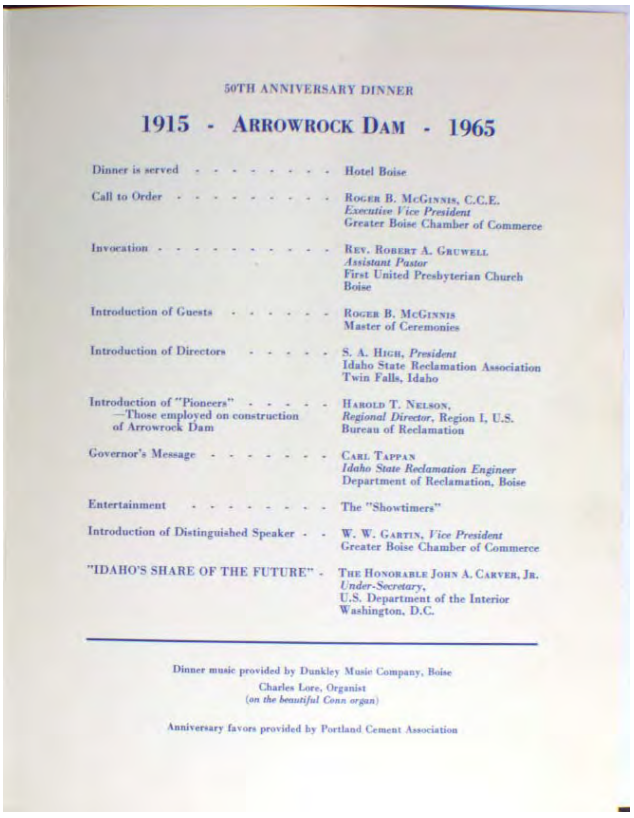
JOSEPH BIANCO, *President*
Greater Boise Chamber of Commerce

HAROLD T. NELSON, *Regional Director*
Region 1,
U.S. Bureau of Reclamation

WILLIAM WYMER, *Chairman*
Boise Project, Board of Control

GOLDEN ANNIVERSARY

1915 - ARROWROCK DAM - 1965



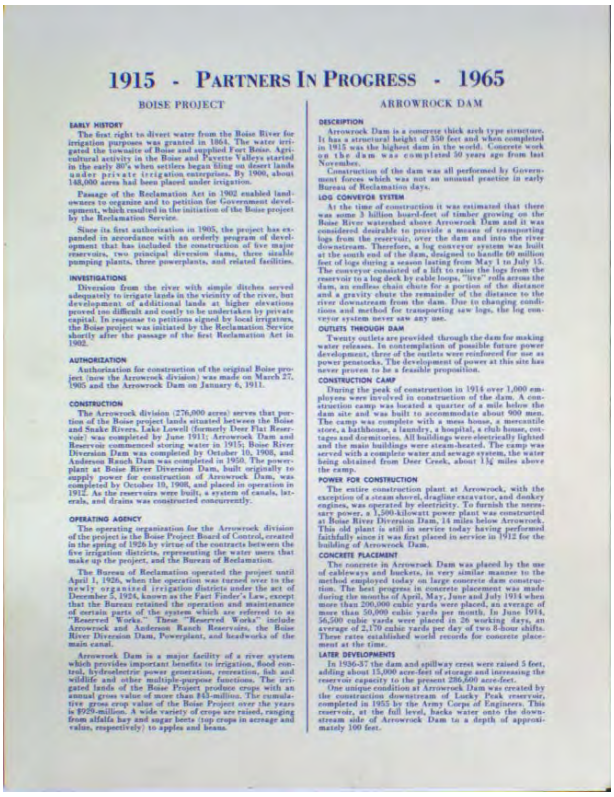
50TH ANNIVERSARY DINNER

1915 - ARROWROCK DAM - 1965

Dinner is served	Hotel Boise
Call to Order	ROGER B. MCGINNIS, C.C.E. *Executive Vice President* Greater Boise Chamber of Commerce
Invocation	REV. ROBERT A. GRUWELL *Assistant Pastor* First United Presbyterian Church Boise
Introduction of Guests	ROGER B. MCGINNIS Master of Ceremonies
Introduction of Directors	S. A. HIGH, *President* Idaho State Reclamation Association Twin Falls, Idaho
Introduction of "Pioneers" —Those employed on construction of Arrowrock Dam	HAROLD T. NELSON, *Regional Director*, Region I, U.S. Bureau of Reclamation
Governor's Message	CARL TAPPAN *Idaho State Reclamation Engineer* Department of Reclamation, Boise
Entertainment	The "Showtimers"
Introduction of Distinguished Speaker	W. W. GARTIN, *Vice President* Greater Boise Chamber of Commerce
"IDAHO'S SHARE OF THE FUTURE"	THE HONORABLE JOHN A. CARVER, JR. *Under-Secretary*, U.S. Department of the Interior Washington, D.C.

Dinner music provided by Dunkley Music Company, Boise
Charles Lore, Organist
(on the beautiful Conn organ)

Anniversary favors provided by Portland Cement Association



1915 - PARTNERS IN PROGRESS - 1965

BOISE PROJECT

EARLY HISTORY

The first right to divert water from the Boise River for irrigation purposes was granted in 1864. The water irrigated the townsite of Boise and supplied Fort Boise. Agricultural activity in the Boise and Payette Valleys started in the early 80's when settlers began filing on desert lands under private irrigation enterprises. By 1900, about 148,000 acres had been placed under irrigation.

Passage of the Reclamation Act in 1902 enabled landowners to organize and to petition for Government development, which resulted in the initiation of the Boise project by the Reclamation Service.

Since its first authorization in 1905, the project has expanded in accordance with an orderly program of development that has included the construction of five major reservoirs, two principal diversion dams, three sizable pumping plants, three powerplants, and related facilities.

INVESTIGATIONS

Diversion from the river with simple ditches served adequately to irrigate lands in the vicinity of the river, but development of additional lands at higher elevations proved too difficult and costly to be undertaken by private capital. In response to petitions signed by local irrigators, the Boise project was initiated by the Reclamation Service shortly after the passage of the first Reclamation Act in 1902.

AUTHORIZATION

Authorization for construction of the original Boise project (now the Arrowrock division) was made on March 27, 1905 and the Arrowrock Dam on January 6, 1911.

CONSTRUCTION

The Arrowrock division (276,000 acres) serves that portion of the Boise project lands situated between the Boise and Snake Rivers. Lake Lowell (formerly Deer Flat Reservoir) was completed by June 1911; Arrowrock Dam and Reservoir commenced storing water in 1915; Boise River Diversion Dam was completed by October 10, 1908, and Anderson Ranch Dam was completed in 1950. The powerplant at Boise River Diversion Dam, built originally to supply power for construction of Arrowrock Dam, was completed by October 10, 1908, and placed in operation in 1912. As the reservoirs were built, a system of canals, laterals, and drains was constructed concurrently.

OPERATING AGENCY

The operating organization for the Arrowrock division of the project is the Boise Project Board of Control, created in the spring of 1926 by virtue of the contracts between the five irrigation districts, representing the water users that make up the project, and the Bureau of Reclamation.

The Bureau of Reclamation operated the project until April 1, 1926, when the operation was turned over to the newly organized irrigation districts under the act of December 5, 1924, known as the Fact Finder's Law, except that the Bureau retained the operation and maintenance of certain parts of the system which are referred to as "Reserved Works." These "Reserved Works" include Arrowrock and Anderson Ranch Reservoirs, the Boise River Diversion Dam, Powerplant, and headworks of the main canal.

Arrowrock Dam is a major facility of a river system which provides important benefits to irrigation, flood control, hydroelectric power generation, recreation, fish and wildlife and other multiple-purpose functions. The irrigated lands of the Boise Project produce crops with an annual gross value of more than $45-million. The cumulative gross crop value of the Boise Project over the years is $929-million. A wide variety of crops are raised, ranging from alfalfa hay and sugar beets (top crops in acreage and value, respectively) to apples and beans.

ARROWROCK DAM

DESCRIPTION

Arrowrock Dam is a concrete thick arch type structure. It has a structural height of 350 feet and when completed in 1915 was the highest dam in the world. Concrete work on the dam was completed 50 years ago from last November.

Construction of the dam was all performed by Government forces which was not an unusual practice in early Bureau of Reclamation days.

LOG CONVEYOR SYSTEM

At the time of construction it was estimated that there was some 3 billion board-feet of timber growing on the Boise River watershed above Arrowrock Dam and it was considered desirable to provide a means of transporting logs from the reservoir, over the dam and into the river downstream. Therefore, a log conveyor system was built at the south end of the dam, designed to handle 60 million feet of logs during a season lasting from May 1 to July 15. The conveyor consisted of a lift to raise the logs from the reservoir to a log deck by cable loops, "live" rolls across the dam, an endless chain chute for a portion of the distance and a gravity chute the remainder of the distance to the river downstream from the dam. Due to changing conditions and method for transporting saw logs, the log conveyor system never saw any use.

OUTLETS THROUGH DAM

Twenty outlets are provided through the dam for making water releases. In contemplation of possible future power development, three of the outlets were reinforced for use as power penstocks. The development of power at this site has never proven to be a feasible proposition.

CONSTRUCTION CAMP

During the peak of construction in 1914 over 1,000 employees were involved in construction of the dam. A construction camp was located a quarter of a mile below the dam site and was built to accommodate about 900 men. The camp was complete with a mess house, a mercantile store, a bathhouse, a laundry, a hospital, a club house, cottages and dormitories. All buildings were electrically lighted and the main buildings were steam-heated. The camp was served with a complete water and sewage system, the water being obtained from Deer Creek, about 1½ miles above the camp.

POWER FOR CONSTRUCTION

The entire construction plant at Arrowrock, with the exception of a steam shovel, dragline excavator, and donkey engines, was operated by electricity. To furnish the necessary power, a 1,500-kilowatt power plant was constructed at Boise River Diversion Dam, 14 miles below Arrowrock. This old plant is still in service today having performed faithfully since it was first placed in service in 1912 for the building of Arrowrock Dam.

CONCRETE PLACEMENT

The concrete in Arrowrock Dam was placed by the use of cableways and buckets, in very similar manner to the method employed today on large concrete dam construction. The best progress in concrete placement was made during the months of April, May, June and July 1914 when more than 200,000 cubic yards were placed, an average of more than 50,000 cubic yards per month. In June 1914, 56,500 cubic yards were placed in 26 working days, an average of 2,170 cubic yards per day of two 8-hour shifts. These rates established world records for concrete placement at the time.

LATER DEVELOPMENTS

In 1936-37 the dam and spillway crest were raised 5 feet, adding about 15,000 acre-feet of storage and increasing the reservoir capacity to the present 286,500 acre-feet.

One unique condition at Arrowrock Dam was created by the construction downstream of Lucky Peak reservoir, completed in 1955 by the Army Corps of Engineers. This reservoir, at the full level, backs water onto the downstream side of Arrowrock Dam to a depth of approximately 100 feet.

Arrowrock Dam, Steam shovel on spillway handling 8-ton boulder, November 12, 1912.

Photo Credit: Idaho Historical Society, 61-164.137.

Arrowrock Dam, Diversion Tunnel, October 30, 1911.

Photo Credit: Idaho Historical Society, 61-164.33.

Postcard “Arrowrock Dam, Highest in the World,” published by Wesley Andres Co. in Baker Oregon (Courtesy of the Idaho Historical Society, 60-72.20).

Postcard “Arrowrock Dam, 359 feet high, 1050 feet, Boise River, Idaho,” published by Wesley Andres Co. in Baker Oregon (Courtesy of the Idaho Historical Society, 60-111.19).

Arrowrock Dam, Spillway and Dam, date unknown.

Photo Credit: Idaho Historical Society, 3117

Postcard “Great Arrowrock Dam, Boise River, Idaho,” published by Wesley Andres Co. in Baker Oregon (Courtesy of the Idaho Historical Society, 2543).

C Statement of Owner's Support

Photo Credit: U.S. Bureau of Reclamation

United States Department of the Interior

BUREAU OF RECLAMATION
Pacific Northwest Region
Snake River Area Office
230 Collins Road
Boise, ID 83702-4520

IN REPLY REFER TO:

SRA-1218
LND/ENV-1.10

JAN 2 3 2015

Mr. Ryan Van Leuven, PE
Geotechnical Engineer
American Geotechnics
5260 W. Chinden Blvd.
Boise, ID 83714

Subject: Support of the Nomination of Arrowrock Dam to the Historic Civil Engineering Landmark Program, Boise Project, Idaho

Dear Mr. Van Leuven,

The Bureau of Reclamation has learned of the wish of the Southern Idaho Section of the American Society of Civil Engineers to nominate Arrowrock Dam to the Historic Civil Engineering Landmark Program. As you know, Arrowrock Dam, completed in 1915, was the highest dam in the world at the time. Experimental elements of its gravity-arch design would be applied to later dams that were built even higher. In addition, it was only one of two Reclamation dams built with sand cement for the concrete, and it was the first United States Reclamation Service (USRS) dam design that required Ensign valves for the release of water through its outlets.

Arrowrock Dam represented a civil engineering marvel of its day, and served as a key component of the Boise Project, an irrigation project designed by the USRS to provide irrigation water throughout Boise and Payette Valleys, making them the most agriculturally productive region in Idaho. Arrowrock Dam will be celebrating the 100th anniversary of its construction this year, and continues to serve the Boise Project well. An honor such as being included in the Historic Civil Engineering Landmark Program would be entirely apropos.

Reclamation adamantly supports this nomination.

Please direct any questions to Jenny Huang, SRAO archeologist, at 208-383-2257 or JHuang@usbr.gov.

Sincerely,

Jerrold D. Gregg
Area Manager