

Salt River Project

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Salt River Project

Humanity's resourcefulness inspired two attempts to draw life out of the desolation of Central Arizona's Salt River Valley over the past 1,500 years. Building over the remains of an irrigation culture left behind by lost Indian tribe, the Hohokam, federal and private engineers of the early 20th Century adapted much when the United States Reclamation Service completed first its major work, the Theodore Roosevelt Dam.

The scale of Reclamation's plans separate the two efforts. The Roosevelt Dam was the Bureau's first multipurpose undertaking, designed for flood control, irrigation storage and Central Arizona's first hydroelectric power source. The dam stimulated area boosters to build Phoenix up from a desert outpost to the nation's ninth largest metropolis in less than a hundred years. Hailed as an engineering triumph at its completion in 1911, the preliminary result of the Salt River Valley project was the creation of an agricultural oasis. The project's ultimate consequence was the growth of one of the most urbanized areas in the United States anchored by a city whose name is synonymous with second chances – Phoenix.

Project Location

The Salt River Project is located near Phoenix, and includes an area of about 250,000 acres. Project water comes from the Salt and Verde Rivers drains into a watershed area of 13,000 square miles. Roosevelt Reservoir, and five other private and Reclamation-built storage facilities (Horse Mesa, Mormon Flat, Stewart Mountain, Bartlett and Horseshoe) on the Salt and Verde Rivers form a continuous chain of lakes almost 60 miles long.

Both rivers are controlled by six storage dams. The Theodore Roosevelt Dam and Reservoir on the Salt River is about 76 miles northeast of Phoenix in the Mazatzal mountains. A later Reclamation project, the Bartlett Dam and Reservoir, is located 48 miles northeast of Phoenix, and completed in 1939.

Three other dams on the Salt River, Horse Mesa, Mormon Flat, and Stewart Mountain, were constructed by the Salt River Valley Water Users Association (hereafter known as the Association) between 1924-1930. Horse Mesa is located 65 miles northeast of Phoenix;

Mormon Flat is 51 miles from Phoenix, and Stewart Mountain is 41 miles northeast of the city. An additional dam, Horseshoe, was built between 1944-46 by the Phelps Dodge Corporation under a contract with the Salt River Project. Horseshoe is located 58 miles from Phoenix on the Verde River. Built by Reclamation, Granite Reef Diversion Dam is four miles downstream of the confluence of the Salt and Verde Rivers, 22 miles east of Phoenix, and completed in 1908.¹

The valley's climate is one of extremes. The long growing season of 304 days a year lures farmers to plant almost any crop. However, the annual precipitation of 7.7 inches, with most of it rainfall coming in the winter and early spring is inadequate for farming. Temperatures fluctuate from as low as 20 degrees up to highs of 120 degrees Fahrenheit. The blessings and bad fortune brought by these conditions meant different types of water storage and usage were necessary if agriculture was to succeed.

Despite the dust, drought, unexpected and uncontrollable flooding and days of blazing heat, the Salt Valley had supported the Hohokam, a prehistoric people who were able to harness what nature had given them before the arrival of modern technology. The remnants of their canals and storage methods were the map leading to 20th Century development of the valley.

Historic Setting

Prehistoric irrigation in the Salt Valley is a saga of survival that concludes in mystery. It began around 200 B.C., when an Indian tribe irrigated the valley with water from the Salt River. The Pima Indians, have occupied the nearby Gila River Valley for the past 400 years, labeled the previous tribe "Hohokam," meaning "the dead" or "those who have vanished."²

Archaeologists proclaim the efforts of the Hohokam to bring water to the desert to be the greatest irrigation feat by ancient man on the North American continent. The Hohokam dug nearly 250 miles of canals with stone hoes to irrigate corn, squash and cotton. Some canals measure 30 feet from crown to crown and 10 feet in depth. Except for periodic cleaning, water ran in the ditches for most of the year.

1. U.S., Department of the Interior, Water and Power Resources Service, *Project Data*, (Denver: United States Government Printing Office, 1981), 1083-6.

2. Odd S. Halseth, "Arizona's 1500 Years of Irrigation History," *The Reclamation Era*, Dec. 1947, 251-4; *A Valley Reborn: The Story of the Salt River Project*, (Phoenix: Salt River Project, 1980?), 1.

One of the few examples of an irrigation culture in early North America, the Hohokam population numbered around 4,000 by 700 A.D. in settlements located in what are now modern Phoenix, Tempe, and Mesa. Over the next 500 years, the Hohokam built more than 20 villages and 10 separate canal systems.

For reasons known only to the Hohokam they left the valley around 1400 A.D. Speculation among historians and archaeologists surrounding the Hohokam exodus is that they may have faced a problem that bothered later settlers. The Hohokam might have been victims of their own ability as irrigators, as the capillarity of the desert soil waterlogged the land. Unable to remove the water, the Hohokam tried to escape the moisture by elevating the floors of their homes and granaries. Archaeologists found surviving Hohokam structures built on the highest available ground before they disappeared into history.³

If the Hohokam vanished, their methods survived in the farming practices of nearby tribes. In 1539, the Spanish arriving in Arizona noted the Yaquis, Maricopas and Pimas living in the vicinity of the Salt River Valley, all irrigating their lands using canals. The Spanish did not stay in the valley for long as they moved on to settle other communities in the Southwest. The valley remained unsettled by Anglos even after the United States acquired Arizona in 1848 as a result of the Mexican War. A subsequent rush of homesteaders and gold seekers chose routes bypassing Central Arizona as they headed West.⁴

A government outpost in the new territory, Ft. McDowell, was established in September 1865. The cavalry's demand for horse feed established a hay depot at a spot later called Phoenix.

Phoenix's growth, however, was triggered by creation of a private canal company in December 1867. By the end of the following year, a hundred residents had settled in vicinity. Other companies dug canals, and, within twenty years, more than 100,000 acres were under cultivation. Between 1868 and 1912, a total of 15 canals were dug across the valley.⁵

Because water handling methods were crude and diversion into various canals haphazard,

3. "Arizona's 1500 Years of Irrigation History," 251-4; *A Valley Reborn*, 1.

4. Lauritzen, Jonreed "Valley of the Sun," in *Reclamation Era*, July 1946, 145; Bradford Luckingham, *Phoenix: The History of a Southwest Metropolis*, (Tucson: The University of Arizona Press, 1989), 13.

5. *A Valley Reborn*, 1; Lauritzen, "Valley of the Sun," July 1946, 145.

problems arose among settlers over water rights. Suspicion among neighbors in the valley was as much a part of the atmosphere as the dry air. In May 1879, a group of stockholders confronted a Mormon community six miles east of Tempe over the stockholders' assumption their water was stolen by the Mormons. One look at the dry canals convinced the party the Mormons were innocent. Others were not as lucky. A month later, a farmer wounded his neighbor with a shotgun blast to the head after he discovered him diverting water onto his property.⁶

Periodic droughts during the late 1870s and 1880s emphasized the need for facilities to store excess water in addition to the existing underground wells. Poor water storage represented a lost opportunity compounding the hopelessness of brutal summer months when the Salt River would run at a trickle and crops would die. The land reverted back to its original barrenness during droughts, and some settlers repeated the trek of the Hohokam by moving out of the valley as the heat wore on.

Drought stimulated organization among those remaining in the valley. The Maricopa County Board of Trade named a committee to investigate the feasibility of constructing a dam and a water storage system. On August 31, 1889, committee members meeting in Phoenix's Dorris Opera House recommended a site 80 miles from Phoenix, below where Tonto Creek flowed into the Salt River. The committee felt the site's advantages were a large basin buttressed on both sides by a narrow, rock-lined gorge.⁷

The committee estimated the cost of the reservoir between \$2 to \$5 million. The committee pointed out that, as a territory of the United States, Arizona was prohibited from solely assuming any large-scale debts. It concluded Maricopa County should bond itself and all the land in the county should be assessed at its proportional share of the project's cost. The members picked Benjamin A. Fowler to lobby Congress for permission for Maricopa County to bond itself. Fowler was later joined by a lawyer-engineer, George H. Maxwell, and the duo began to work with congressmen supporting the creation and passage of a reclamation bill.

6. Earl A. Zarbin, *Roosevelt Dam: A History to 1911*, (Phoenix: Salt River Project, 1984), 20.

7. Lauritzen, "Valley of the Sun," *The Reclamation Era*, August 1946, 173.

Their mission was to dispel the myth that the "Great American Desert" was worthless and convince the federal government's most powerful men that the arid lands of the West were worth reclaiming.⁸

Project Authorization

Early in 1901, a joint proposal by Senator Henry Hansborough of North Dakota and Francis G. Newlands of Nevada to set aside money from the sale of public lands to support reclamation projects was defeated by Congress. Bouncing back immediately, Newlands, Fowler and Maxwell's National Irrigation Association launched a lobbying and advertising campaign to convince legislators reclamation was good for the country. The succession of Theodore Roosevelt to the presidency in September 1901, supplied irrigation forces with a powerful ally. Roosevelt's long-time love of the West, and support of a national reclamation policy, was the extra thrust needed to push the Hansborough-Newlands bill through Congress in 1902. He signed Hansborough-Newlands, now the National Reclamation Act, into law on June 17, 1902. The Act combined executive independence from Congress, nationalization and a scientific approach to natural resource management. The measure was the "first truly Progressive" undertaking of the Roosevelt administration.⁹

With the Reclamation Act in place, the just born United States Reclamation Service (USRS) stipulated all local differences between landowners had to be settled. An additional prerequisite was creation of a landowners association. On Feb. 7, 1903, a 25-member committee known as the Salt River Valley Water Users' Association was incorporated. The Association represented 4,800 individual landowners who pledged their lands as collateral to receive federal funding for a Salt River reclamation project. The money the government would put into the project would be paid back by the Association out of water and power revenues once the system was in operation. The Association ensured rights to stored water would be equally available to all members, cost of construction and assessments would be distributed equitably, and creation

8. "Valley of the Sun," 173; *A Valley Reborn*, 2.

9. Donald C. Jackson, *Historic American Engineer Record: Theodore Roosevelt Dam*, (Phoenix: Bureau of Reclamation, 1992), 19.

of a central organization which would assume at a future date, the responsibility for operation and management of the project. They would also negotiate with the Reclamation Service, guarantee repayment of construction costs to the government, and enforce collection of payments from individual landowners. Sometimes the USRS could show its teeth toward local officials. In May 1908, a booklet produced by the Arizona Immigration Bureau crossed the desk of Frederick Newell incorrectly calling the Roosevelt Dam, "Tonto Dam." Newell shot back a response, "The attempt to change the name to 'Tonto Dam' or to perpetuate a local name, or nick-name. . . (is) an insult to the great man for whom (Roosevelt Dam) it is named." Letters of apology were soon forthcoming from the Arizona Commissioner of Immigration.¹⁰

On June 25, 1904, the agreement between the Association and the government was signed by Fowler, the recently elected first president of the Association and the Secretary of the Interior, Ethan A. Hitchcock. With the Association in place, the project was authorized by Hitchcock on March 14, 1903, in accordance with the act of June 17, 1902 (32 Stat. 338). Forty years of confrontations, patience and planning were about to be resolved.¹¹

Construction History

Once the torchlight parades ended and the congratulatory messages stopped reverberating throughout the valley, the task of carving a dam out of rock and riverbed began on the drawing board and in the field.

As the first major project undertaken by the new Reclamation Service, director Frederick A. Newell stressed that Salt River, like other Reclamation projects, should strive for fiscal and structural stability. In charge of the project were Louis C. Hill, supervising engineer, Arthur Powell Davis, chief engineer of the Reclamation Service, and Fred Teichman, design engineer. These three men saw that the trees, stones and water of the valley would provide all the materials necessary to complete the dam. Newell commented in the *Third Annual Report of the U.S. Reclamation Service* that few reservoirs had been constructed in a location where the natural conditions were so favorable and the access so meager. Dam construction began August 24,

10. *A Valley Reborn*, 2; *General Administrative and Project Records*, Box 864.

11. *Project Data*, 1087; *A Valley Reborn*, 2.

1903, but the first necessary engineering feat was construction of a road to the Tonto Basin, site of the proposed dam location.¹²

The damsite was sixty miles away from the community of Mesa and forty miles away from the mining town of Globe. The railhead of the Gila Valley, Globe and Northern Railway ran out of Globe, but the USRS preferred to build their own supply line to the damsite. The Mesa to Roosevelt path followed an ancient Indian route known as the Apache Trail. The trail shadows the southern rim of the Salt River Canyon for two miles below the damsite. The next thirty miles it runs four miles south of the canyon, climbing a steep grade. Near Mormon Flat, the road diverts to the south to Goldfield and then east across the flat land of the valley into Mesa.

In late 1903, the Reclamation Service suspended construction in an attempt to gather financial support from local communities to finish the road. Valley businessmen soon realized the importance of finding money to complete the job. Congress passed special legislation granting the towns of Phoenix, Mesa and Tempe to bond themselves and borrow money to complete the road. Bonded for \$67,500, Phoenix provided the majority of the local funds to proceed with construction. In the spring and summer of 1904, construction resumed where the terrain was more difficult and the weather hotter. Apache Indians were enlisted as part of almost 400 force account laborers to finish the last difficult miles. Once workers carved out the 64 mile Apache Trail, freight and equipment first crossed it in December, 1904. Called "almost as great a monument to [Hill's] engineering ability as the Roosevelt Dam itself," the road cost over \$200,000 to complete. By 1911, at completion of dam construction, a total of 112 miles of roads were built leading to the dam at a cost of more than \$500,000.¹³

In those early days of dam construction, burro teams pulled wagons on a two-rut wagon road leading southeastward to Globe. In the spring and fall of 1905, a succession of torrents

12. U.S., Department of Interior, United States Reclamation Service, *Third Annual Report of the United States Reclamation Service, 1903-1904* (Washington, D.C.: Government Printing Office, 1905), 44. Davis was a nephew of the prophet and martyr of the American reclamation and ecology movement, John Wesley Powell.

13. Karen L. Smith, *The Magnificent Experiment: Building the Salt River Reclamation Project, 1890-1917*, (Tucson: University of Arizona Press, 1986), 72, 77; Jackson, *Theodore Roosevelt Dam*, 58-9.

damaged the road to the point where "flood followed flood, each succeeding one greater than that before it, with hardly enough time intervening to permit repairs to be made before work was again swept away." An estimated three million acre-feet of water wiped out preliminary construction at the dam site three times.¹⁴

In early 1904, a sawmill in the Sierra Ancha Mountains 30 miles northeast of Roosevelt was completed by contract labor. A total of 3 million board feet of lumber was cut for use in everything from bridges to tunnel timbering to camp construction. A narrow gauge railroad was also built to carry limestone and clay for cement from the mountains above the dam site. The cement plant produced 338,500 barrels of cement at a saving of \$600,000 to the project.¹⁵

Twenty bids for construction were opened on February 23, 1905, with the John O'Rourke firm of Galveston, Texas awarded the winning bid on April 8. The O'Rourke proposal was to complete the dam in two years at a cost of a little over \$1.1 million. Losing bids ranged from \$1.3 to \$2.7 million with an average completion time of 30 months. O'Rourke's crew was responsible for securing equipment, installing the machine plant, stripping the quarries for stone and driving piles for a coffer dam and flume. Reclamation laborers would be in charge of providing power, cement, and sand to build the toolhouse, gatehouse, a reinforced bridge on top of the dam, outlet tunnel and sluice gates. In a letter from Davis to Hill, Davis explained the Reclamation Service had its reasons for opening work to contract labor, "Where work is advertised and universal competition invited, no criticism can be made against the award of a contract although the prices may be higher than it was expected the work could cost." In late 1904, Louis C. Hill left the project to become Reclamation's southwest supervising engineer. Hill's replacement as Engineer-in-Charge, Chester W. Smith, would monitor the work of the O'Rourke and government crews.¹⁶

The traditional look of the curved, gravity masonry dam would be Reclamation's

14. Smith, *The Magnificent Experiment*, 72, 77; U.S., Department of Interior, Bureau of Reclamation, *Project Reports, 1910-55*, 510-37 SR, Box 746, 2.

15. *Third Annual Report of the United States Reclamation Service, 1903-1904*, 44; Records of the Bureau of Reclamation, *Project Reports, 1910-55*, 510-37 SR, Box 746, 2.

16. Jackson, *Theodore Roosevelt Dam*, 50; Smith, *The Magnificent Experiment*, 85-9.

"flagship," exuding "permanence and stability" to all who viewed it. As the young Service's first major project, a more modern structural arch dam would not suit the Tonto Basin, or communicate the grandeur and workmanship Reclamation sought to present. The faces of the dam were carved from hand-hewn stones to give each rock a finished appearance. In between the faces, the dam was filled with large boulders and mortar. Laborers cut nearly 350,000 cubic yards of stone out of the mountains. During 1905-06, twenty-six immigrant Italian stonemasons were the most celebrated workers of the hundreds employed by the contractors and government. Known as "rockmen," the stonecutters were brought out from Pittsburgh to carve the limestone that gives Roosevelt Dam its distinctive appearance. Not every aspect of the dam was completed with as much detail. In a November 15, 1904 dispatch from engineer George Wisner to Frederick Newell, Wisner stated the concrete lining of many tunnels was "without exception, the worst concrete construction we have ever inspected." Wisner believed the inspector and contractor did not know how to mix and handle concrete to achieve the results Reclamation was looking for.¹⁷

The rockmen represented only one of the many ethnic groups working on the dam. Living in three separate camps (O'Rourke's Camp, Government Hill, and Roosevelt) surrounding the damsite, the worker's living arrangements offer an insight into the social attitudes of early twentieth century Arizona. In 1910, O'Rourke's Camp consisted of 42 percent white Americans, 15 percent Spanish emigrants, 11 percent black Americans, three percent Mexican nationals and two percent Chinese. No American Indians or Mexican-Americans lived in the contractor's camp. O'Rourke hoped to attract 300 to 500 workers to Roosevelt, but the most contract workers employed at one time was a little over 200. Common laborers of all types were paid \$2 a day; drillers, \$2.75; carpenters, \$3.50 to \$5, and sub-foremen, \$3.50. The government deducted 75 cents per day for meals.¹⁸

17. Jackson, *Theodore Roosevelt Dam*, 50, 56, 78; Smith, *The Magnificent Experiment*, 75; U.S., Department of Interior, Bureau of Reclamation, *General Administrative and Project Reports, 1902-1919*, RG 115, Box 845. Davis estimated the completed dam would be 70 percent sandstone masonry, 15 percent mortar and 15 percent concrete.

18. Smith, *The Magnificent Experiment*, 75; Jackson, *Theodore Roosevelt Dam*, 78; Chester W. Smith, *Construction of Masonry Dams*, (New York: McGraw-Hill Book Company, 1915), 206-9. O'Rourke's previous job (continued...)

At Reclamation's Government Hill camp, 80 percent of the 168 people living there were white Americans, followed by 10 percent Italians. Louis C. Hill referred to many of the white workers as "hoboes," but he took a paternalistic tone when describing Apache laborers, "I do not know of any better class of workmen or unskilled laborers than these Apaches proved to be. They were especially valuable to us in view of their ability to maintain themselves without an elaborate camp in some of the out-of-the-way places."¹⁹

An intriguing mixture of peoples lived at the Roosevelt camp. Out of 306 employees in 1910, Roosevelt was home to 28 percent Native Americans, 25 percent Mexican-Americans and 13 percent Mexican nationals. Native-born American whites made up the remaining 34 percent of Roosevelt's population. Because of its isolated location, Roosevelt's worker-citizens built a water and sewage system, a refrigerator plant to produce ice, cottages for engineers and tents for the workers. Soon electric and telephone lines were in place along with a vegetable garden and a bathhouse. As a reminder to workers that this was a government-run job, a jail was built to hold those in violation of the no liquor rules set down by the temperance minded Reclamation Service.²⁰

The 1906 annual Reclamation report listed Roosevelt's population at 2,000. The 1910 census listed only 707 residents. After 1912, the sole inhabitants of the camps were weeds and desert rats. In an abandoned graveyard outside of Roosevelt, 21 markers list the names of laborers who died during the dam's construction. A total of 30 workers died during the project. These fatalities included two Reclamation Service managers: George Greenwald, USRS head carpenter, and engineer Almon H. Demrick, both victims of drowning. At the Roosevelt graveyard, one stone poignantly remembers a man whose life was "one of the unforeseen costs of the Roosevelt Dam." An amalgam of ethnic cultures, from Anglo-Saxon to Apache to Afro-American, broke rock, built roads and drove teams across the Salt Valley, but were for the most

18. (...continued)
was the construction of the Galveston Seawall, a 3.5 mile long concrete barrier built to protect the coastline of Galveston from erosion.

19. Jackson, *Theodore Roosevelt Dam*, 78; George Wharton James, *Reclaiming the Arid West: The Story of the United States Reclamation Service*, (New York: Dodd, Mead and Company, 1917), 75-6. Hill's comments about the Apaches were in response to questions by James incorporated in *Reclaiming the Arid West*.

20. Smith, *The Magnificent Experiment*, 76; Jackson, *Theodore Roosevelt Dam*, 78.

part segregated by position and living quarters.²¹

While the original plan for the dam was solely for storage and control, the Reclamation Service in 1904 began construction of a 20-mile-long power canal. The high cost of using oil as a source of fuel during construction in that remote location was one of many reasons the Reclamation Service designed Salt River as the first multi-purpose reclamation project. The promise of hydroelectricity meant reduced construction costs for Reclamation, that farmers could pump groundwater to irrigate their crops, power for running mining equipment, and electricity for the towns clustered around the project.

In 1906, the Reclamation Service installed a temporary 900 kilowatt (kw) hydroelectric generator to supply the power for the construction of the dam. A permanent 900 kw unit was installed in 1907. Four more generating units later came on line and eventual capacity totaled 4,500 kw. The first power was delivered from the dam site to Phoenix on September 30, 1909.²²

The power canal presented a challenge to Chester Smith and his crew. The Salt River Project's power canal used reinforced concrete pipe, instead of the then standard wood or cast-iron pipes. The new "Pinto pressure pipes" carried water at a higher pressure than the older materials. During 1904-05, placement of the Pinto pipes required thirty men continuously laying concrete around steel reinforcement rings. A special designed movable form helped speed up construction, but the concrete was slow to set. In the ledger books, labor was the highest cost of pipe installation.

The Pinto Pressure Pipes cracked as the concrete cured and shrank in the summer heat while the steel rings inflexibility forced the shrinking concrete to take the entire load. Smith devised a solution where cracks were cut out, oakum caulking was put in place, then stiff mortar was placed over the joints and grout was run into the crack from the outside. The USRS built 2,600-foot-long segments of Pinto pipes at a cost of nearly \$106,000. Another invention designed as a problem solver was a rotating screen placed to keep grass and sticks from lodging

21. Donald N. Bentz, "The Doomed City," in *Frontier Times*, April-May 1968, 27-8; *Arizona Republican*, 12 February 1908, p.10; 3 May 1909, p. 1.

22. *A Valley Reborn*, 5.

in the powerhouse turbine buckets and breaking the turbine. The power canal cost approximately \$1.5 million. The Reclamation Service originally estimated \$91,000, but nature, high labor costs and overruns all conspired to drive up the bill. Despite problems with construction the design was praised: "The engineers of the Reclamation Service deserve great credit for the way the pipe was built and its cheapness under rather adverse conditions. . . it illustrates what can be done by ingenious engineers who are also practical."²³

In September 1906, the cornerstone was laid for the Granite Reef Diversion Dam. The construction site was 50 miles to the south of Roosevelt Dam, below the confluence of the Verde and Salt rivers. Two hundred men were involved in construction, including 20 Mexican laborers who lived in a segregated village near the site. Completed in 1908, Granite Reef is 29 feet high, a thousand feet long and diverts water released from the reservoirs into canals north and south of the river for delivery to water users within the project.²⁴

A combination of floods and the contractor's inexperience in dealing with a project on the scale of Roosevelt Dam stretched the intended two year job to five years. The relationship between O'Rourke's management and Reclamation's engineers was often strained. Smith's frustration with the construction delays caused him to write "the job is not being conducted with energy or brains." Unfortunately, the additional time and men O'Rourke's firm needed to finish the dam cost Association landowners several years irrigation water and extra repayment charges.

Although Roosevelt Dam represents the one the last stone masonry gravity dams built before concrete gravity structures dotted the West, it was designed with many modern features for the time. The introduction of reinforced concrete pressure pipes, unique methods of masonry laying, and new kinds of hydraulic sluice gates made Roosevelt an aesthetic and engineering accomplishment.²⁵

A telegram to Africa informed Theodore Roosevelt that America's newest technological marvel would carry his name after he completed a safari in 1910. On a sunny March 18, 1911,

23. Smith, *The Magnificent Experiment*, 79-81. Accolades came from Thomas Wiggins, an engineer on the New York Board of Water Supply.

24. *A Valley Reborn*, 5; *Roosevelt Dam*, 146; *Project Data*, 1084.

25. *A Valley Reborn*, 3; Smith, *The Magnificent Experiment*, 85-9, Jackson *Theodore Roosevelt Dam*, 106.

greeted by an eleven-gun salute, the former President marched down the roadway to the dam's southern bridge followed by "some hundreds (sic) of his escorts, servants, employees, and workmen, including a phalanx of Apache Indians." After his speech, at 5:48 p.m., Roosevelt touched a button releasing a mighty roar of water down the canyon dedicating the dam before a gathering of a thousand people. Roosevelt Dam is the world's highest masonry dam and is 184 feet thick at the base, 16 feet wide at the crest and rises 284 feet. The reservoir, Roosevelt Lake, held a capacity of 1.28 million acre-feet. To accommodate those visiting Arizona's newest tourist attraction, a 16-foot-wide road for automobiles crossed the top of the dam. Phoenix newspapers reported the United States flag and the blue standard of the Reclamation Service fluttered above the parapets of the dam as Louis C. Hill spoke to the crowd. As the original overseer of the project, Hill advised the crowd to think of the water in the reservoir as money in the bank: "Conserve your water as the careful man does his bank account accumulated by years of self-denial."²⁶

Roosevelt, as the last speaker, improvised his remarks. He said the outstanding achievements of his presidential administration was "this reclamation work in the West and the Panama Canal." He admitted to a touch of flattery over the project's name: "I do not know if it is of any consequence to a man whether he has a monument. I know it is of mighty little consequence whether he has a statue after he is dead. If there could be any monument which would appeal to any man, surely it is this."²⁷

The first major feature of a Reclamation project was completed and immediately was recognized as both an economic and civic achievement. On dedication day, one who was there almost from the beginning, Benjamin A. Fowler, wished "To a great and growing community in an arid region," the dam would serve as "a guarantee for all time of prosperity and happiness, comfort and peace." Leading the hyperbole sweepstakes, Kansas newspaper editor, William Allen White visited the dam three months after completion and proclaimed to a Yuma, Arizona

26. Zarbin, *Roosevelt Dam: A History to 1911*, 15, 244. Zarbin's description of the ceremonies came from the March 18, 1911 *Arizona Gazette* and the March 19, 1911 *Arizona Republican*.

27. *Ibid.*, 244.

newspaper, "The Salt River Valley is about six laps nearer the millennium than any other community in the country." The years of rugged construction work would fade into memory giving way to a different set of struggles of management and control over the river.²⁸

Post-Construction History

Soon after the dedication hard feelings developed between Reclamation and Association landowners over the amount of construction costs. Reclamation engineers referred to these complainers as "kickers" or "street farmers" who neglected their farms to spend "a good deal of (their) time on the streets in town, telling other farmers how they are being abused and wronged by the Reclamation Service and the Water Users' Association." Water users complaints included Reclamation's "inflexibility" over extending the repayment period from ten to twenty years, cost of repayment, and Reclamation's management was too "autocratic" in their dealings with landowners.²⁹

The cost of building the dam and related facilities exceeded original estimates. The Water Users' Association complained to the Secretary of the Interior, who appointed a Board of Review to study the costs. On June 1, 1915, the Board of Review figured the cost to be \$13 million. Two separate review boards examined claims of defective construction, excessive expenses, and bad management that the Association felt should be deducted from the repayable cost of the project. The final total presented to the landowners by the government was \$9.5 million. After some additional haggling by the Reclamation Commission, the final amount due from the landowners was \$10,279,191, working out to a \$60 charge per acre.³⁰

On February 20, 1917, Interior Secretary Alexander T. Vogelsang suggested to an Association delegation that a contract be drawn up turning control of the project over to the landowners. Under the terms of the proposed contract, the Association would assume all future expenditures in operation and control and repay the cost of building the Salt River Project to the federal government. The Association could also use all power receipts in any way it saw fit,

28. *Ibid.*, 244. Quote taken from *Arizona Democrat*, March 20, 1911; *Yuma Morning Sun*, 11 June 1913, p. 1.

29. U.S., Department of Interior, Bureau of Reclamation, *Salt River Project, Annual History*, Vol. 1, 1913, 71.

30. Smith, *The Magnificent Experiment*, 137-9.

especially if they wanted to pay off the general project debt.

The contract was drawn up on September 6, 1917, and the Association took control on November 1, 1917. The Association controlled Roosevelt Dam, Granite Reef Diversion Dam, irrigation canals, laterals and ditches. The water users gained autonomy, but its connection with Reclamation was not completely severed.³¹

The irrigation disasters that doomed the Hohokam came back to haunt farmers after Roosevelt Dam went into use. Before 1911, there were a few areas in the project requiring drainage due to a high water table. The soil in Salt Valley is estimated in some places to be 500 feet deep, but in many places there are hard pans and bedrock holding water from seeping down to form an undersurface water table. Nearly five years of heavy irrigation caused the land to become waterlogged.

In 1917, the Association and Reclamation cooperated to write a study to determine if conditions were favorable to drainage by pumping water out of wells. Before 1917, 10 drainage pumping plants had been built. Between 1917 and 1924, the Association drilled and equipped more than a hundred new wells. The immediate result of pumping was greater availability of water for irrigation. By the 1920s, for every thousand acres irrigated from the reservoir 150 acres could be irrigated from the wells.³²

Backed by private funding, the period from 1925 to 1945 saw a frenzy of dam building on the Salt River. Between 1923 and 1925, the Association built Mormon Flat Dam downstream from Roosevelt Dam providing upgraded electric generation at Roosevelt. The Association financed the dam through issuance of bonds and with money advanced by the Central Arizona Light and Power Company.

Then, between 1924 and 1927, the Association built Horse Mesa Dam halfway between Roosevelt and Mormon Flat dams. Three 11,000-kw hydroelectric generating units made Horse Mesa the largest hydroelectric system in the project. Developed primarily for the Inspiration

31. *A Valley Reborn*, 3.

32. *Economic Survey of Salt River Project*, September 1942, 9; Lauritzen, "Valley of the Sun," August 1946, 174-5.

Consolidated Copper Company of Miami, Arizona, the Association financed the \$5.3 million dam through the sale of bonds.

Construction of the 212-foot high Stewart Mountain Dam from 1928 to 1930, provided the Association more water storage, increased hydropower and upgraded regulation. Stewart Mountain Dam is a single arch flanked on both sides by gravity buttresses with a gravity overflow spillway on the east side. The arch is 480 feet from buttress to buttress and varies in thickness from eight feet at the crest to 33 feet at the foundation. A massive turbine/generator unit is the powerhouse's most prominent feature. Transformers raise the current from the generator from 11,400 to 45,000 volts for transmission to the Salt River Valley. The dam's cost of \$2.8 million was financed privately through the sale of bonds.³³

Demands on the Association in its early years came from private citizens and businesses seeking more electricity. In rural areas of the Salt Valley, farmers asked for the same power service provided to city-dwellers. The Association hooked up farmer-members during 1928-29, and construction of Stewart Mountain Dam provided a supply of power to shareholders.

The Great Depression hit the United States hard in the early 1930s, but for Central Arizona it signaled an era of great development funded mainly by New Deal money. Central Arizona's most visible monument from that time is the Bartlett Dam on the Verde River. On November 26, 1935, the Association entered into a contract with the federal government for the construction of Bartlett and reconstruction and repairs to Horse Mesa, Mormon Flat, Stewart Mountain and Theodore Roosevelt Dams.

In 1937, in the midst of the reconciliation between the Association and Reclamation, the Salt River Project Agricultural Improvement and Power District was formed with boundaries and interests identical to those of the Association. Under Arizona law, the organization now known as the Salt River Project, was a tax exempt public agency. Its major priority was refinancing of outstanding Association bonds at a lower rate because interest on bonds issued by public agencies is tax exempt. In turn, the Salt River Project agreed to pay 80 percent of the total \$4.7

33. *A Valley Reborn*, 4-5; Donald C. Jackson, *Historic American Engineering Record: Stewart Mountain Dam*, (Phoenix, Bureau of Reclamation, 1992), 2-3.

million price tag on Bartlett Dam. One-fifth of the cost was paid by the federal government on behalf of the Salt River Pima Indian Reservation where the Association delivered 20 percent of the stored water supply.

Work opened on August 26, 1936. Completed in 1939, Bartlett was Reclamation's first multiple arch dam. Depression-era economics meant the dam's design stressed economy above all other qualities. Because the buttresses were hollow and the arches were thin, the Bartlett project saved money in materials and freight. The design was a benefit for unemployed laborers as the dam required more workers to construct the multiple arches because of the sophisticated forms needed to shape its concrete components. Central Arizona was not as wild and woolly in the mid-1930s as it was during the Roosevelt Dam project, but the design and construction of the Bartlett still presented a number of difficult natural and engineering problems.³⁴

The location of Bartlett was ideal in the eyes of engineers. Rock hills framed both sides of the Verde and a pair of stone islands in the channel made a strong structural base. After a thousand days of construction, Bartlett Dam was brought in on time on May 9, 1939. At Bartlett's completion, Reclamation's original plan for storage control on all streams tributary to the Salt River was met. After the last barrel of cement was poured, Construction Engineer E.C. Koppen acknowledged the original irrigators of the valley: "This project is on the site of ancient irrigation developments conceived by pristine engineers and built with tools of stone. From the ashes of the old had sprung a new civilization."³⁵

At completion, Bartlett Dam was the highest multiple arch dam in the world, reaching a height of 286.5 feet and a total length of 800 feet excluding the spillway. The dam achieved its cylindrical look through nine hollow buttresses, 10 arches and a short gravity section at each end; a complete design departure from stone on stone facade of Roosevelt Dam. Barrett & Hilp and Macco Corporation of Los Angeles won the contract as the lowest of eight bidders and built

34. *Project Data*, 1088; Luckingham, *Phoenix*, 109-10; *Economic Survey of Salt River Project, Arizona*, September, 1942, 10. A multiple arch dam buttresses a river's flow and is comprised of a series of connecting arches.

35. "Bartlett Dam, Salt River Project, Arizona," *The Reclamation Era*, January 1937, 17; E. C. Koppen, "Building Bartlett Dam," *The Reclamation Era*, November 1939, 308.

Bartlett Dam. The contractors also built support facilities including bunkhouses for some 200 workers, ten homes for Reclamation staff, a dining-hall, garages, warehouses and other buildings a half mile below the dam site.³⁶

According to Koppen, the engineers did "an extraordinary amount of preliminary study" before designing the dam. Koppen noted many of the difficulties came from "How to prepare lay-out drawings for the closely spaced reinforcement of steel dowels just inside of the trace of the arch on a steeply sloping and imaginary concrete footing so that they could be readily understood by a gang of carpenters."³⁷

The designers and engineers wrestled with the dilemmas of the drafting table while the workmen dug 233,000 cubic yards of rock, poured 181,500 cubic yards of concrete, and set over 6 million pounds of reinforcement steel and 2.7 million pounds of structural steel. Their work was interrupted twice by record breaking floods on the Verde River in 1937 and 1938. Koppen admitted the complicated design of Bartlett was "poorly adapted to fast construction or the making up of lost time," but the contractor managed to bring the job in on schedule. Final cost was \$5 million.³⁸

In addition to the work done on Bartlett, during the mid-1930s, the Salt River Project examined the dam spillways on the Salt River and Reclamation conducted subsequent studies. New spillway gates increased the capacity of Roosevelt Lake to 1.38 million acre-feet. Spillway gates were added to Horse Mesa and Mormon Flat and a spillway discharge channel was installed at Stewart Mountain Dam. The work was done between 1936 and 1938, and the Association agreed to repay the total cost of the upgrades over forty years without interest.³⁹

Bartlett Dam was another milestone in an unprecedented era of economic and population growth for Central Arizona. The 180,000 acre feet of water held by the dam was welcomed by the increasing number of Salt River Valley's irrigators and urbanites. As the last days of the Depression were abruptly ended by World War II, Phoenix became a magnet for federal and

36. "Bartlett Dam, Salt River Project, Arizona," 17.

37. Koppen, "Building Bartlett Dam," 312.

38. *Ibid.*, 308, 312.

39. *A Valley Reborn*, 3; *Economic Survey of Salt River Project*, September 1942, 9.

private contracts and war work. The war brought new projects and people into the valley. Reclamation completed transmission lines from Parker Dam on the Colorado to Phoenix in 1941. Customers in the valley received an additional 30,000 kw to keep up with the increasing demand for electricity. In 1943, due to the shortage of manpower, as many as 325 Italian Prisoners of War were put to work in ditch maintenance. Once hostilities ceased between the U.S. and fascist Italy in 1944, 80 German prisoners took over those duties. The annual report for 1945 commented on the greatly improved efficiency of the war prisoners' work once the fighting ended in Europe.⁴⁰

By the end of the war, the heaven on earth promised by the founders of the Salt Valley project was almost in the area's grasp. The 1945 Reclamation report described the potential in the area as "amazing," with "no serious unemployment in the area" and the only cloud on the horizon was a shortage of housing.

A wartime alliance between the Project, private industry and a federal agency delivered the Horseshoe Dam. Between 1944 and 1946, the Phelps-Dodge Copper Corporation, with additional funding from the United States Defense Plant Corporation, worked to complete Horseshoe Dam. Horseshoe's purpose was to increase Phoenix's water supply in exchange for 250,000 acre-feet diverted to the Phelps-Dodge Morenci copper mine in eastern Arizona. The military-federal-industrial troika blocked local irrigators from building the first collection system on the Verde River. Located 66 miles northeast of Phoenix on the Verde, the 140-foot-high dam cost approximately \$2.5 million. Horseshoe was the first major earth and rockfill dam on the Salt River Project and the last dam built on the Salt or Verde by Reclamation or any local group.⁴¹

This period also initiated a growing change in attitudes towards water usage in the valley. As people came to Central Arizona to make their fortunes in ways other than agriculture, dams

40. U.S., Department of Interior, Bureau of Reclamation, *Salt River Project, Annual History*, Vol. 5, 1943; *A Valley Reborn*, 7; U.S., Department of Interior, Bureau of Reclamation, *Salt River Project, Annual History*, Vol. 5, 1945, 3.

41. Donald C. Jackson, *Historic American Engineering Record: Horseshoe Dam*, (Phoenix, Bureau of Reclamation, 1991), 2, 5, 27, 50.

and reservoirs were needed more for supplying electricity than for irrigation. More power plants were built to generate kilowatts, and development of nuclear power was the direction Arizona went in the decades after the war.⁴²

Reclamation's role in the Salt River Valley gradually ebbed during this period. In 1950, Reclamation and the Salt River Project initiated a rehabilitation and betterment (R&B) program. Work done under the agreement included lining 42 miles of canals and the rehabilitation of 8,259 structures. The series of R&B contracts between Reclamation and the Project concluded in June 1982.⁴³

The ecological and engineering impact of the Salt River Project created a new environment in the desert of southern Arizona. But a socio-economic shockwave touched off by Reclamation's efforts is responsible for the greatest changes in the valley.

Settlement of the Project

It is fair to say without the construction of the Salt River Project, Phoenix would still be the domain of the cactus and snake instead of the corona of the "Valley of the Sun." In 1902, Phoenix's population was 5,000, and had held at that level over the previous five years. Exactly two decades later, the population had shot up to 35,000. By 1940 and the dedication of the Bartlett Dam, the census listed 65,414 people in the new metropolis of the sunbelt.

This land rush was rooted firmly in water and power provided by the Salt River Project. In 1902, land value was \$25 to \$50 per acre with assessed valuation of \$3.5 million. By 1921, land was \$188 per acre and total assessment was \$128 million. In the same year, Maricopa County built more concrete roads than any other county in the nation.⁴⁴

Central Arizona's boosters induced the rest of America to come to the Salt River Valley and drink of the bounty made possible by the water. Arizona was promoted nationwide as a land where anything was possible; a garden of Eden with AC current.

In 1914, William S. Cone, Superintendent of Construction for the Salt River Project

42. *A Valley Reborn*, 7.

43. *Project Data*, 1101.

44. Orme, John P. "What Reclamation Has Done for the Salt River Valley," *Reclamation Record*, June 1922, 118; Luckingham, *Phoenix*, 195.

pinpointed the hopes and desires of landowners who saw electricity as the key for future economic development: "The farmers (sic) dream of making a Utopia of the Salt River valley, and look to electric power to furnish them with the cooling breezes of the electric fan, and the comforts of electric lights. . . and many other electric devices."⁴⁵

Examining the evolutionary growth of Central Arizona, farmers were the first epoch before developers, boosters, businessmen and bureaucrats took control of the land to pave and build over. Phoenix, and the adjacent communities of Tempe, Mesa, Scottsdale, Glendale, and Chandler were magnets for Easterners and Midwesterners in search of employment, better health, warm winters, or relaxation. In 1934, a local advertising agency found the Salt River Valley too mundane a description for promoting the area to the rest of the country. Their suggestion of "The Valley of the Sun" soon was adopted by the chamber of commerce and city administration to promote the area nationally in newspapers and magazines. The popular perception of endless warm days combined with private and federal dollars to light an economic fire under Central Arizona that continues to burn as hot as Phoenix's sun in the July sky.⁴⁶

By the 1980s, the small farming communities that first brought life to the valley were being eaten up by commercial builders and housing developers. As the tract home replaces the cotton field, Phoenix, its suburbs and neighboring communities, have to face the prospect of whether or not there will be enough good life to go around if the water runs dry.

Uses of Project Water

A hundred years ago it seemed like a dream. Fruits and vegetables of all varieties grew where there had been only ocotillo, saguaro and cactus. It was a place where "The winter grains of the North thrive beside the citrus fruits and dates of the South." A place which inspired a poet to compose a paean to the Reclamation engineers who made it possible: "Where the cactus ruled for half a million years/Over dusty trails forlorn/Now there's cotton, wheat and corn/Thanks to U.S. Reclamation engineers." Later in the 20th century, irrigated fields gave way to manicured lawns, only after Central Arizona earned a reputation for growing almost every crop known to

45. William S. Cone, "The Salt River Valley Power Situation," in *Reclamation Era*, May 1914, 176.

46. Luckingham, *Phoenix*, 110, 266.

man.⁴⁷

Water was first made available May 15, 1907, as a ditch rider (or *zanjero*) rode to the different farms to notify each grower of his turn. In the first years after Roosevelt Dam was built, 55 percent of the lands in use grew alfalfa. In addition to alfalfa, other popular crops were Egyptian long staple cotton, corn, and other grains. Soon, the valley was the laboratory for other kinds of produce like head lettuce, beans, cantaloupes, olives, dates, sugar cane and beets, oranges, peaches and watermelons. New rail connections to Eastern markets caused a Reclamation publication boast, "New York will soon be enjoying Arizona head lettuce," and the "100 acres now in this crop will not suffice to meet the demand."⁴⁸

Cattle and poultry also found a home in the valley as a direct result of irrigation. Range cattle were brought in from the nearby mountains to be fattened on the products of the valley. It was said a rancher with 20 or 40 acres could own enough cows to make a good living. More exotic kinds of stock, like ostrich, were also introduced onto reclaimed land. The demand for ostrich feathers in millinery created an opportunity for producers to breed 4,000 of the birds on the project. Even the native Indians of the valley got in on the act, as cotton producers put to work "Indian pickers that were brought from the adjacent Indian Reservations." The report added the Indians "were very enthusiastic about the work and desire to return next season." For those lucky enough to own a piece of land instead of being hired on to work it, it was a heady time where "Alfalfa was King, Cotton was Queen, and every Dairy Cow was a Princess."⁴⁹

The valley's pastoral period was brief. The population boom from 1920 to the present day diverted water from irrigation to hydroelectrical generation. As rural electrification of the valley began in earnest in the late 1920s-early 1930s, there was a larger demand for customers who lived in the city. In 1947, 12,400 customers received electricity on the project, and by 1978, there were approximately 280,000. In the same year, farm irrigation served 15,997 farmers, municipal water customers totaled 1,098,700, and other use totaled 5,090 for a grand total of

47. "Salt River Project Described in Verse," in *Reclamation Record*, April 1923, 147. Berton Braley authored "U.S. Reclamation Engineers."

48. *Reclamation Record*, December 1914, 446.

49. *Annual Project History, Salt River Project*, Vol. 1, 1913, 45-8; Smith, *The Magnificent Experiment*, 143.

1,119,787 water users. In the 1970s, about half of the water used by residents and businesses in the Phoenix area came from the Salt River Project. As a response from the Salt River Project District, between 1941-1976, five generating stations were built in the valley desperately trying to keep up with increasing electrical demands.⁵⁰

Tourism and recreation activities also were a direct result of the project. In a location with very few water-based recreational opportunities, total visitor days to Reclamation built reservoirs exceeded 1.5 million by the early 1970s. The number was almost equal to the entire population of the state of Arizona.⁵¹

By the close of the century, many had forgotten the reasons and the struggle which created the water dependant culture of Arizona in the first place. Since the end of the Second World War, the local economy has diversified to include manufacturing, trade and services, tourism and government. By the 1970s, 14,400 people, or less than four percent of total number of Maricopa County's employed (including Phoenix), were making a living from agriculture. As Arizona's growth intensified, a small, but important statistic was uncovered by one of Reclamation's sister agencies. In 1970, the Army Corps of Engineers' discovered without Reclamation dams taming the unpredictable Salt and Verde Rivers, an estimated \$18.5 million was saved from potential flood damage from 1950 to 1970. The life and death issues of the Salt Valley's past were now redundant as only consumption mattered.⁵²

The agricultural lifestyle that had sparked the growth of Central Arizona, ironically, was perceived by many as a hindrance on the image, water supply and future direction of the area. In 1987, speaking on behalf of those living in the city and suburbs, a critic stated, "Agriculture is a dead industry in Arizona, kept alive only by government subsidies paid to grow surplus, water-intensive crops, such as cotton. Eliminate the subsidies, and Arizona could begin to solve her water problems."⁵³

50. *A Valley Reborn*, 7, 12.

51. U.S., Department of Interior, *The Federal Reclamation Program: Its Impacts, Issues and Future Considerations*, (Denver: Bureau of Reclamation, 1972), 48.

52. *The Federal Reclamation Program*, 48; U.S. Department of Interior, Bureau of Reclamation, *Water and Land Resource Accomplishments, 1970*, (Washington: Government Printing Office, 1971), 27.

53. Luckingham, *Phoenix*, 247.

A final nostalgic sign of changing times arrived in the mid-1980s. Reclamation proposed that Theodore Roosevelt Dam be raised to provide flood control space and additional safety. The height of the dam was raised from 280 to 357 feet over a period from 1991 to 1995. Despite its 1963 listing on the National Register of Historic Places, the rubble facade carved by an army of nameless stonecutters was cemented over in the early 1990s.⁵⁴

Conclusion

As metropolitan Phoenix and her sister communities balloon out from the confines of the Salt River Project service area, residents will need to become more involved with conservation instead of taking for granted the achievements of the dam builders who have gone before. The lesson of how tightly you hold on to a fragile oasis when you reclaim it from the desert is not given a second thought.

Reclamation's first major project on the Salt River was a success that served as a model for later endeavors. The achievement of the Salt River Project not only was a showcase for Reclamation's engineering competence, over the next decade it inspired the Bureau to develop other large scale storage facilities across the West. The living tribute to the creators of the Salt River Project is the millions of people currently making the valley their home.

54. U. S. Department of Interior, Bureau of Reclamation, *Theodore Roosevelt Dam: Sacrificing a National Historic Landmark*, (March 1984), 1.

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