

Choices and Consequences: An Overview of Salt River Flooding, 1891-Present

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ABSTRACT

The idea of flooding in the desert metropolis of Phoenix may seem incongruous, especially when one considers that the average rainfall in the Phoenix area is less than eight inches a year. Yet, since the city was founded in 1867 its residents have had to contend with periodic flooding. Particularly damaging have been floods on the Salt River, which runs through the middle of the Phoenix metropolitan area. The largest flood in the historic record struck the Phoenix area in February 1891, causing widespread damage and leaving the city without a rail connection for three months. Even with this recent flood, however, it was drought that valley leaders looked to combat as they pushed for a large-scale water storage dam on the Salt River. When Roosevelt Dam was completed in 1911 its intent and design were for water storage and not flood control. The same is true for the other five dams on the Salt and Verde rivers. By storing the water of the Salt upstream and diverting it into canals in the eastern part of the valley, city leaders made the choice to eliminate a flowing Salt River through the Phoenix metropolitan area. This choice has led to unintended consequences. Even though the dams and reservoirs on the Salt River are not designed or operated for flood control, they do provide some measure of protection for the Phoenix area under most conditions. Because of this protection, and because most people associate the Salt River with the dry, dusty channel that snakes its way through the valley, the majority of valley residents fail to perceive the continued threat of flooding on the Salt. Thus, the elimination of the river and the series of impressive dams on the Salt and Verde have created an illusion of protection. The elimination of the river also changed how valley residents viewed the Salt River and its floodplain. In the past, when the Salt River flowed perennially in its banks, people in the valley were cautious about building too close to the river. Once water was removed from the river this attitude slowly changed. The dry bed of the Salt River no longer seemed part of a living, natural system, rather it gradually became viewed as wasted land, as an area that could and should be used and developed. So, valley residents began to build in the river and on its floodplain, and they also paid less attention to the structural integrity of things built in the riverbed like bridges. Although the river was gone, however, floods were not, and the conflict between the continued reality of flooding and the changing perception and use of the dry Salt River and its floodplain lay at the heart of the history of Salt River flooding over the past fifty years. The floods of 1979-80 and 1993 highlighted several results of this conflict. The extensive damage of these floods, along with the public reaction to the floods, showed what could happen when a very real flood burst through the valley's illusion of protection. The risk involved in placing buildings in the riverbed and floodplain has led and will continue to lead to problems until flooding is eliminated (which is a difficult if not impossible task) or public perceptions and attitudes towards the Salt River change.

INTRODUCTION - THE FLOOD OF 1993

For the first six months of 1993, water flowed in the Salt River as it wound its way through the Phoenix metropolitan area. High runoff from winter and spring storms had filled the six reservoirs located upstream and east of Phoenix on the Salt River and the Verde. This forced the Salt River Project—the agency that oversees the reservoirs and distributes their water and hydropower—to release this stored water downstream into a normally dry riverbed. The water releases, which reached 124,000 cubic feet per second, lasted from 29 December 1992 until 3 June 1993. Over that time period, approximately 4.1 million acre-feet of water—double the capacity of the six reservoirs—flowed down the Salt River and through the Phoenix area. Floodwaters crossed bridges across the river, forced evacuations, damaged dams, and washed out the new Mill Avenue Bridge, which was under construction, causing about \$1.3 million in damage.

The most spectacular damage, however, at least from the standpoint of eliciting public concern, occurred on the eastern edge of the Phoenix metropolitan area where floodwaters washed away the banks of the Tri-City Landfill. The landfill, which served as many as 500,000 east Valley residents, was built on the floodplain of the Salt River and was unlined. To help guarantee the protection of the landfill from potential flooding, the Army Corps of Engineers had placed fortifications around the landfill the previous year. Floodwaters flowed right over these fortifications, breached the landfill, and scattered enough trash down the river to fill 3,500 garbage trucks.

With the benefit of hindsight, we might find ourselves shaking our heads at the sheer ridiculous nature of this incident. After all, who in their right minds would choose to build a landfill in the floodplain of a river and then not even bother to line it? Such a reaction, however, demonstrates the danger of looking at this incident as a discrete event, without examining and trying to understand its historical context. The purpose of this paper, then, is to provide an historic overview of Salt River flooding and therefore supply some context for the events of the more recent past as well as the situation today. With some historic perspective, the events surrounding the Tri-City landfill in 1993 do not appear all that out of place or even unexpected.

EARLY PHOENIX AND AGRICULTURAL DREAMS

From the time of settlement in the 1870s until the 1920s, agriculture dominated the Salt River Valley. By the 1880s, the communities of Phoenix, Tempe, and Mesa dotted the valley, surrounded by agricultural fields. One description of the valley from this time noted the following: "One of the peculiarities of the Phoenix, Tempe, and Mesa is that all are shut in by forests of trees so the buildings are unseen until one is in the town, when the visitor is struck with the wide and regular streets lined on either side by cottonwood trees, water running clear and pure in front of the sidewalks, and the beautiful gardens which are adjacent to every private residence." (*The Oasis of the Desert*, 18) In order to attract even more settlers to the region, boosters promoted the valley's extensive canal-fed irrigation system, the wonderful weather, and the fact that almost any crop known to man could be grown in the Phoenix area.

THE FLOOD OF 1891

A disastrous flood struck Phoenix and the surrounding communities in February 1891. Early in the morning on 18 February, the Salt River was a foot and a half over the wooden Arizona Diversion Dam—a structure about 2.5 miles upstream from the current Granite Reef Dam designed to divert water into the Arizona Canal. Several hours later, it was over five feet above the dam, which itself was fourteen feet high. By the next morning, water was surging some eighteen feet over where the dam had been and the width of the river downstream in the vicinity of Phoenix had grown to some three miles wide. The water almost reached Madison Street and Montezuma (today's First Street). Near the Salt's confluence with the Verde River, the river stretched to nearly eight miles in width. High water continued for most of the day on 19 February, slowly receded, and then rose again on 24 February, when the flow in the channel reached nearly 300,000 cubic feet per second (cfs), the highest flow in recorded history.

All across the valley, floodwaters damaged canals and flooded agricultural fields. The only bridge across the Salt—the railroad bridge—was a mass of tangled wreckage. Phoenix was without rail service for three months. Adobe houses suffered particularly extensive damage from the flood, especially a neighborhood occupied by part of the Mexican population, where chicken coops, outhouses, and homes were destroyed. Across the valley, estimates were that floodwaters washed away fifty adobe structures. One newspaper described the scene: "above the roar of the waters was the dull crashing of adobe houses as they tumbled in rapid succession, as fast as the undermining current could get to them." (*Phoenix Gazette*, 20 February 1891) Remarkably, the flood killed no one.

After the water had receded, valley newspapers set about looking for the silver lining in all of the hardship that the flood had brought. The editors of the *Arizona Republican* commented: "Phoenix, as a city, was benefited. A few dwellings of value were destroyed in the lower portion of the city, but nearly all the buildings wrecked were miserable adobes that have rendered the city unsightly for a number of years. Many owners are rebuilding, but it is to be remarked that the new buildings are of a far better class, constructed of either brick or wood." (*Arizona Republican*, 5 March 1891) Another observer remarked: "the great valley proper, filled with its orchards and vineyards, grain and alfalfa fields, received the blessing of a magnificent rain. While the few lost their hundreds, the great valley is richer by its hundreds of thousands of dollars." (*Phoenix Daily Herald*, 9 April 1891) One valley newspaper, concerned over the negative image that reports of the flood might bring the Phoenix area, even went as far as to criticize the coverage of a fellow paper. In an editorial titled "A Newspaper's Duty," the owners of the *Arizona Daily Gazette* stated the following: "The Republican article on what is termed the 'flood' was a piece of vandalism and void of truth or decency, and would, if permitted to go uncontradicted, do this valley . . . injury." (*Arizona Daily Gazette*, 22 February 1891) It seems that at least some valley residents were more concerned over getting back to the task of promoting the area and bringing in new settlers than worrying about the recent flood.

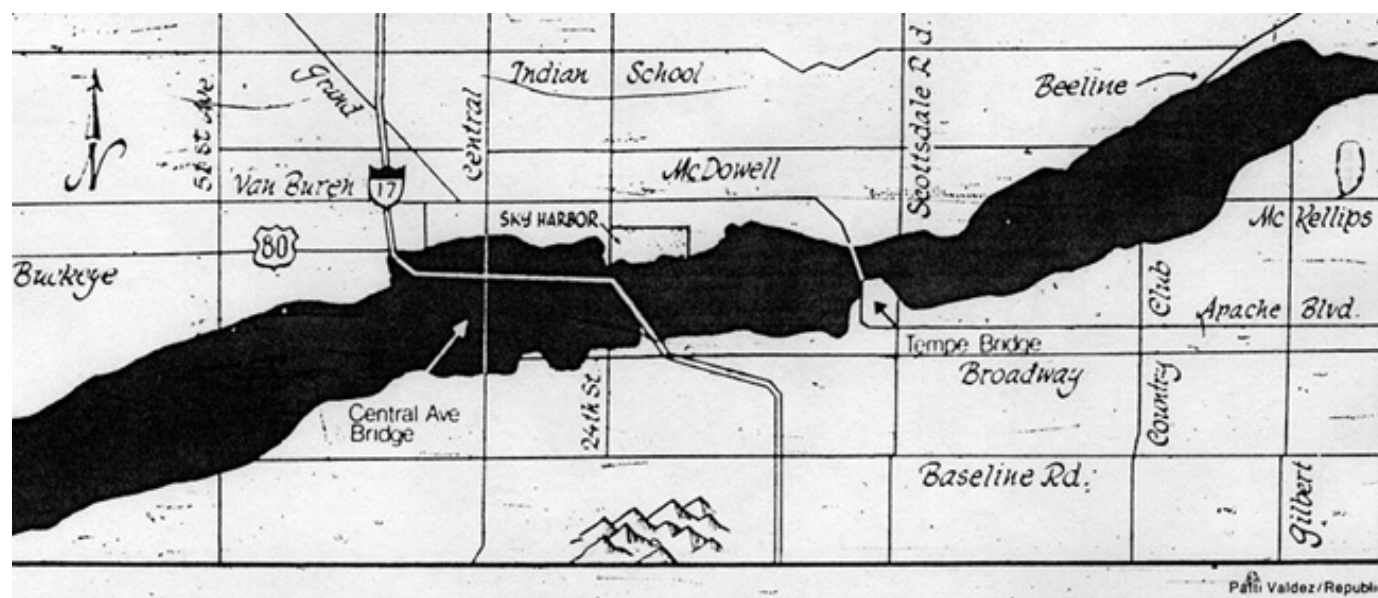
PHOTOS OF THE 1891 FLOOD



Tempe Railroad Bridge Washed out by Flood
(Herb and Dorothy McLaughlin Collection, Arizona Collection, ASU Libraries)



Houses Damaged by Floodwaters
(Herb and Dorothy McLaughlin Collection, Arizona Collection, ASU Libraries)



Extent of 1891 Flood
(Arizona Republic)

THE ROAD TO ROOSEVELT DAM AND ITS LEGACY

In the years following the 1891 flood, the primary focus of valley leaders became the push to build a dam at the confluence of Tonto Creek and the Salt River (the eventual site of Roosevelt Dam). The completion of this dam and its accompanying reservoir would guarantee a steady source of water for valley farmers and was the perfect project to insure continued growth in the Salt River Valley. The idea of placing a dam at this site had been circulating around since the mid-1880s and even received some mention in the coverage of the 1891 flood. Several weeks after the 1891 event, the *Arizona Republican* mentioned the following: "had the Tonto creek storage dam been in position the flood of Salt river [sic] would have been insignificant." (*Arizona Republican*, 11 March 1891)

As the 1890s wore on, however, drought took over as a greater concern among valley leaders than flooding. The winter of 1898 marked the beginning of a severe drought in the Phoenix area. In April 1898, A. Redewil, a piano salesman who traveled the territory from his home in Phoenix, reported that there were no signs of snow visible on the mountains in the Salt River watershed. Without a snowstorm in the mountains, Redewil predicted a water shortage, and he was correct as the period of low water lasted several years. The scarcity of water highlighted the fact that the Salt River was oversubscribed—there were simply too many canal companies and individuals with claims to river water than could be fulfilled during a water shortage (Zarbin, *Roosevelt Dam*, 28; *Two Sides*, 55-56).

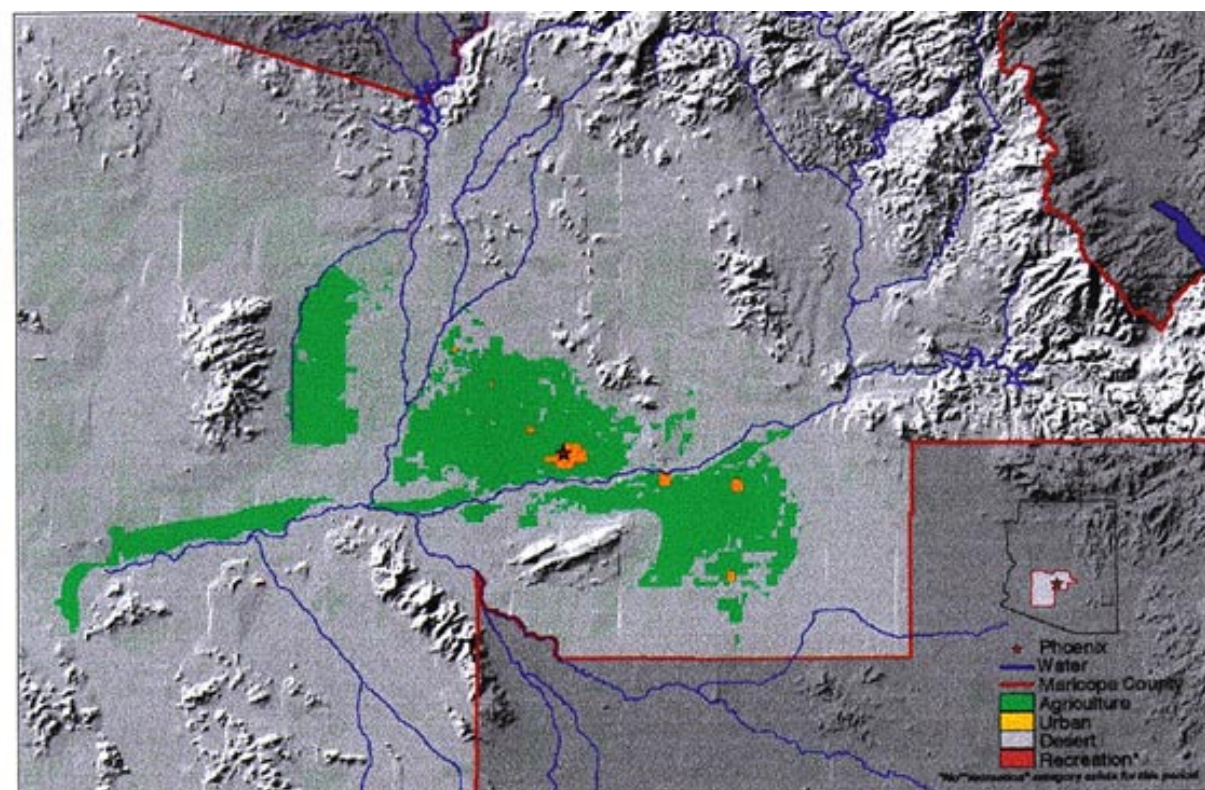
Because of this, it was periods of too little water that Phoenix leaders promoted early in the twentieth century in order to garner federal assistance in controlling the city's water supply. City leaders still mentioned the need to store floodwaters, not in the sense of flood prevention, but because without a means to store this excess water it would be wasted. The success of this approach is evident in a letter from Charles D. Walcott, director of the United States Geological Survey to E. A. Hitchcock, Secretary of the Interior. In the letter, Walcott discusses five reclamation projects under consideration after passage of the Reclamation Act in June 1902. With regard to building a storage dam on the Salt River, Walcott noted, "This project is one of the most important and urgent in the United States, as the population needing the water is on the ground and there is actual suffering and loss of property to the community for want of an adequate supply of water." (Letter, Walcott to Hitchcock, 13)

The contract for building what would become Roosevelt Dam was awarded on 8 April 1905. Flooding throughout that year delayed the laying of the first stone for the dam until 20 September 1906, nearly a year beyond the time originally planned. Even with more flooding in 1908 that delayed construction, the dam that was dedicated by former president Theodore Roosevelt in March 1911 was both designed and intended to provide water storage for the growing agricultural industry in the valley, not flood control. The reservoir behind Roosevelt Dam had no designated flood control space, and engineers designed the dam itself to conserve water not to control floods. In a flood control design, the spillways are located at the bottom of the dam, allowing early release of large amounts of water. Roosevelt Dam was designed with only small valves near its base to release just enough water as needed for users in the valley. Large releases would only be possible when the crest of stored water reached the gates near the top of the dam.

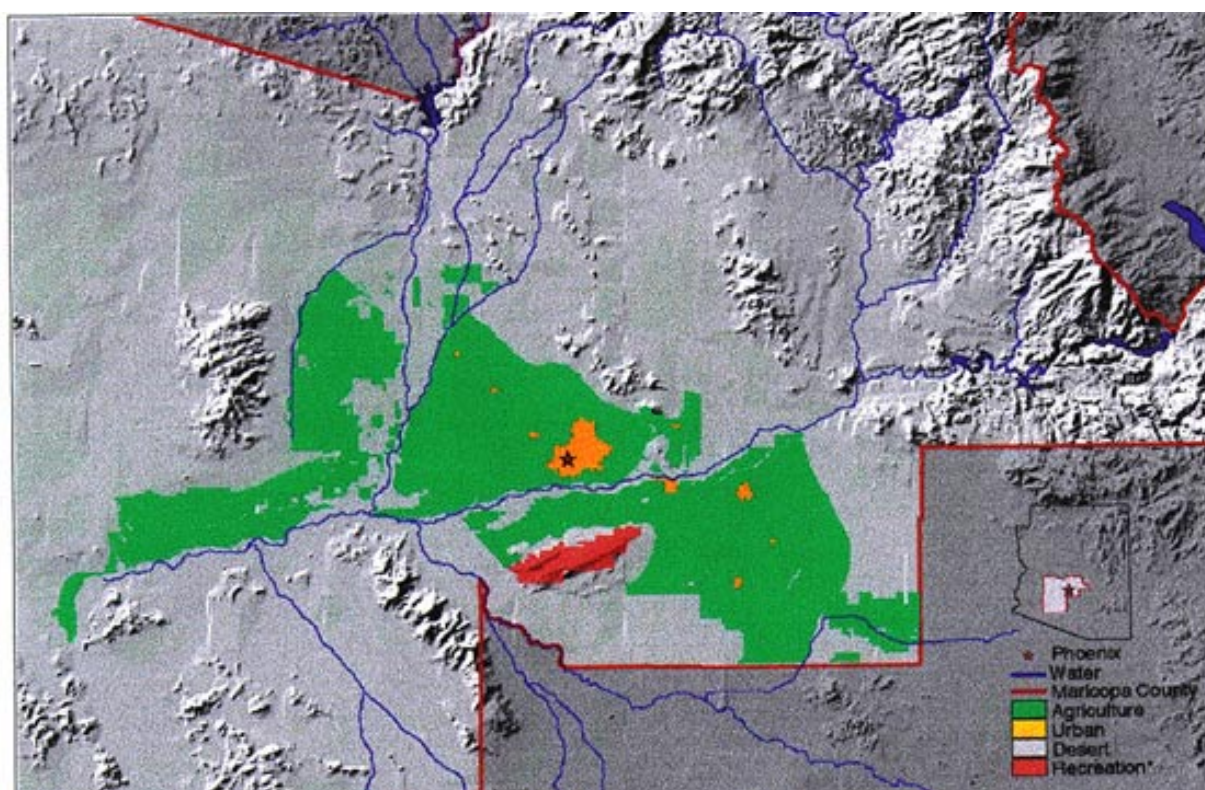
Between 1920 and 1930, the Salt River Project and the federal government completed three more dams on the Salt River, all downstream from Roosevelt. Plans to dam the Verde River stalled due to the Depression, but by the early 1940s, the Verde had two dams as well. All of these dams, which form the current SRP system, followed the precedent set by Roosevelt in their intention and design and are meant for water storage and hydropower generation, not flood control. All dams in the SRP system are designed on the water conservation concept. SRP is an agency that supplies water and power and has never been a flood control agency.

GENERAL CHANGES IN HISTORIC LAND USE

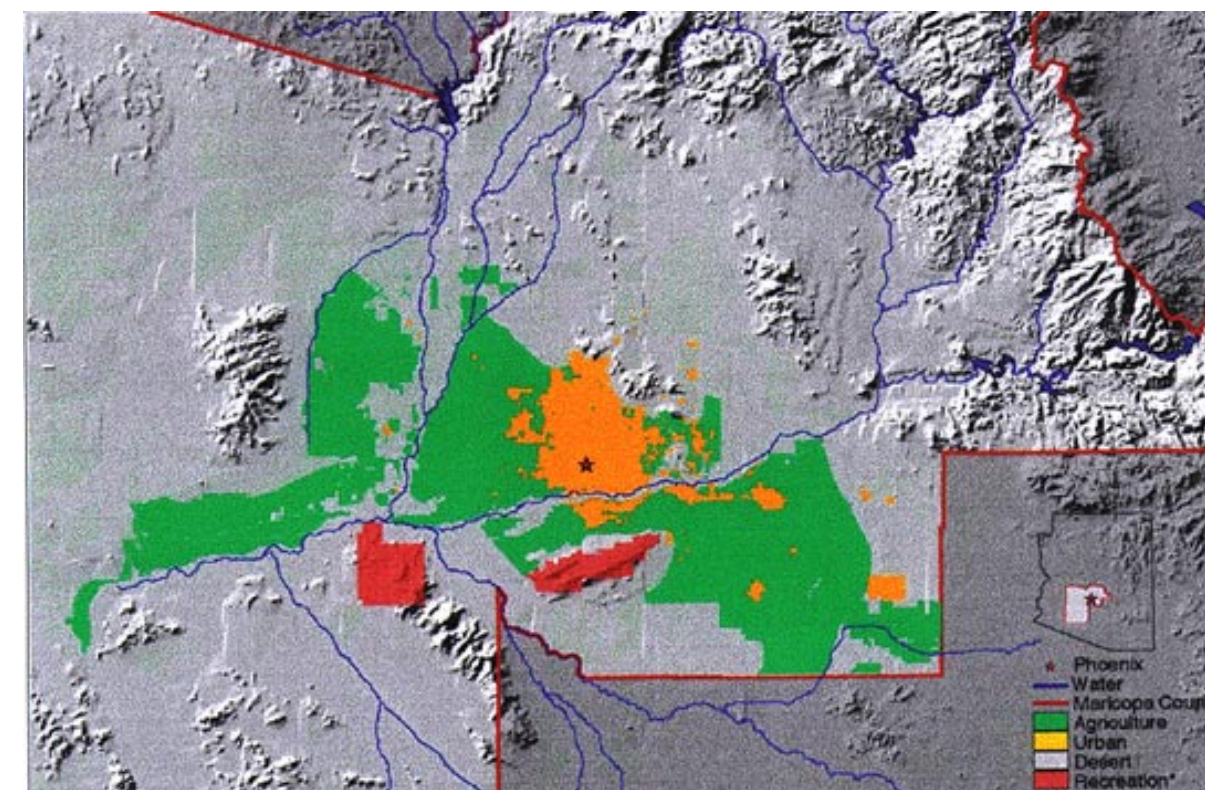
(Source: Central Arizona-Phoenix Long-Term Ecological Research Project Historic Land-Use Phase 1 Report, 1998 (Revised 3/24/99))



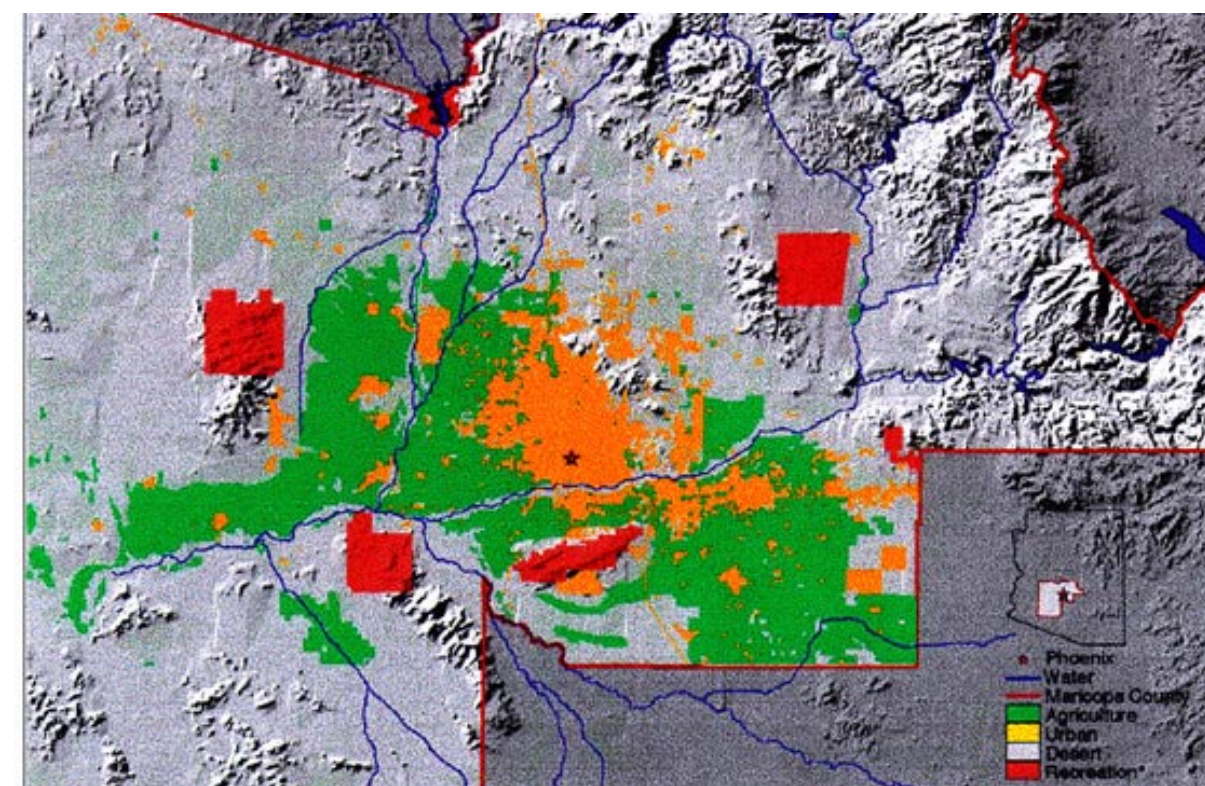
1912 - Urban areas located some distance from Salt River



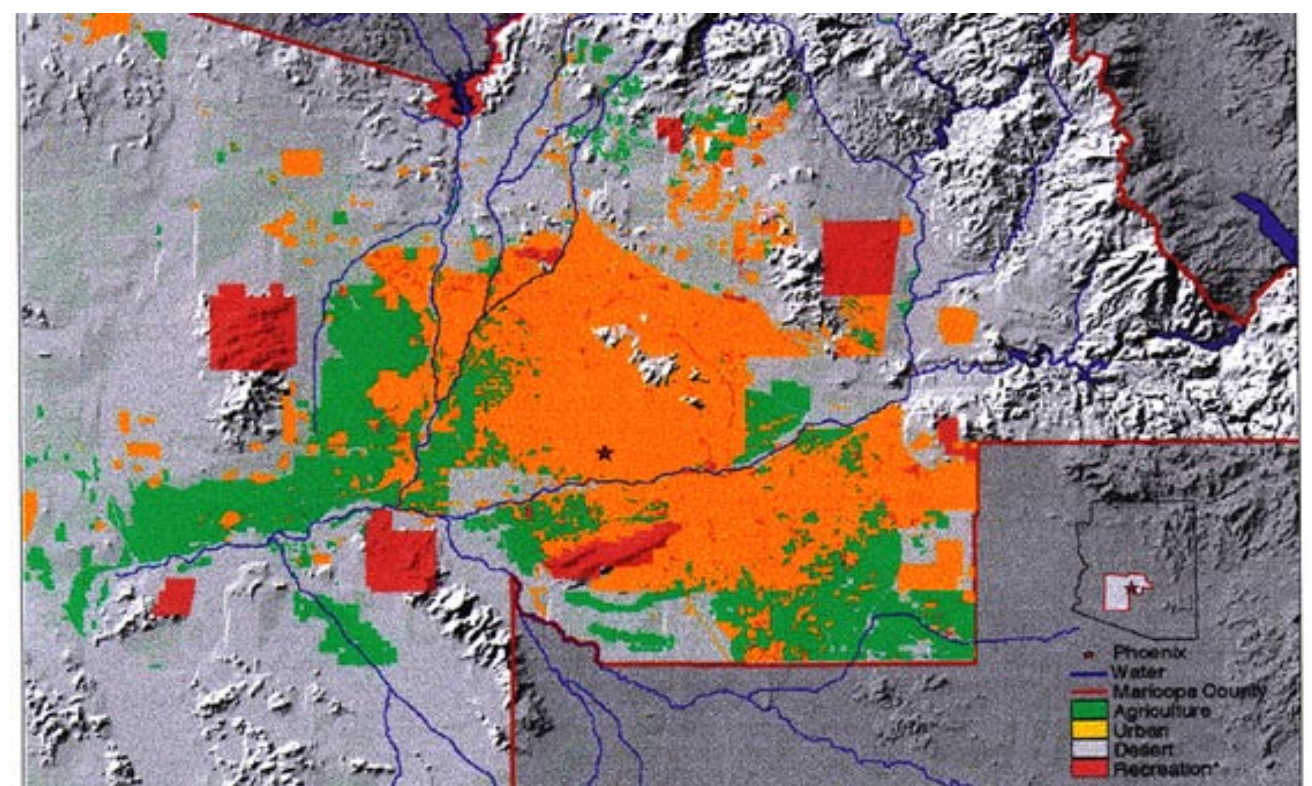
1934 - Still little encroachment on the river channel



1955 - Urban development begins to encroach on the channel



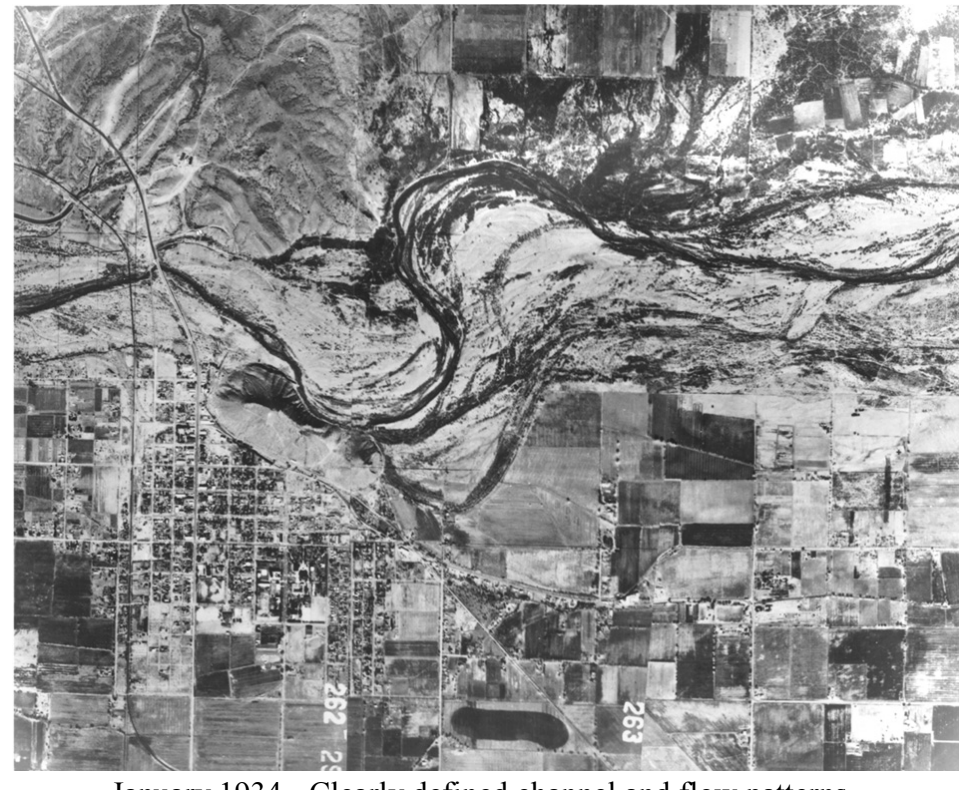
1975 - Even more urban space abutting or in the channel



1995 - Extensive urban use of land in and around Salt River

A MORE SPECIFIC CASE STUDY - THE AREA AROUND TEMPE BUTTE, 1934-1969

(Source: Paul F. Ruff, *A History of the Salt River Channel in the Vicinity of Tempe, Arizona, 1868-1969*. Tempe: Paul F. Ruff, 1971)



January 1934 - Clearly defined channel and flow patterns



January 1954 - Encroachment changing geometry and location of river course



January 1965 - Urban and industrial development, roadway construction, gravel operations, and so forth, proceed with gross oblivion to the river's priority for its channel



December 1965 - During 65,000 cfs flood - Obstructions in the channel direct the flow southward



January 1969 - Occupancy of the channel continues . . .

The construction of irrigation storage dams in the headwaters of the Salt and Verde, and the lowering of the groundwater table in the Central Valley of Arizona, have, for all practical purposes eliminated flows in the Salt River below Granite Reef irrigation diversion dam (located about four miles downstream of the confluence of the Salt and Verde). The choice was made that the waters of the Salt would be better used by storage upstream and diversion east of the city. Perhaps one of the greatest ironies in the development and growth of the Phoenix area is that it took the elimination of a flowing Salt River through the city—the very river that first attracted people to the area—to make possible the explosive and continued growth of the last sixty years. However, the elimination of the river has led to unintended consequences.

Even though the dams and reservoirs on the Salt River are not designed or operated for flood control, they do provide some measure of protection for the Phoenix area under most conditions. Because of this protection, and because most people associate the Salt River with the dry, dusty channel that snakes its way through the valley, the majority of valley residents fail to perceive the continued threat of flooding on the Salt. Thus, the elimination of the river and the series of impressive dams on the Salt and Verde have created an illusion of protection.

The elimination of the river also changed how valley residents viewed the Salt River and its floodplain. In the past, when the Salt River flowed perennially in its banks, people in the valley were cautious about building too close to the river. Following the 1891 flood, one observer had noted: "If the flood taught nothing more, it did teach where it is safe to build houses and plant orchards and vineyards. . . . this high water mark has settled forever the question of where and how to build." (*Phoenix Daily Herald*, 9 April 1891) Once water was removed from the river this attitude slowly changed. The dry bed of the Salt River no longer seemed part of a living, natural system, rather it gradually became viewed as wasted land, as an area that could and should be used and developed.

So, valley residents began to build in the river and on its flood plain. A 1958 report of the Maricopa County Flood Protection Improvement Committee noted: "Works of man have been such as to almost completely obliterate the original channel in many areas. . . . Sand and gravel companies have operated in the river bottom; subdivisions have encroached upon the old original flood channels; a large sanitary fill has been built, and other types of work by man have tended to constrict or to obliterate the original channel." (Ruff, 11) By the 1970s, the area around the river appeared much different than in the nineteenth century. The area near Tempe, once described as swampy and lined with trees, was described as an "area that possesses little native vegetation, and a stream channel occupied by urban and industrial development." (Ruff, ii) People have also paid less attention to the structural integrity of things built in the riverbed like bridges. A special newspaper section on flooding in April 1978 contained an article on the structural design of the bridges that crossed the Salt River in the Phoenix metropolitan area. Of thirteen bridges, only three were designed to withstand and continue functioning during a water flow of more than 25,000 cfs in the Salt River, a minor flood by any measure.

The flood of March 1938—which originated primarily in the Verde watershed and came down the Verde River, not down the dammed and dominated Salt—was the last significant flow in the Salt River for almost thirty years. Thus, during a time period when the Phoenix area underwent explosive growth, there was never any significant amount of water in the channel. The thousands and thousands of newcomers that swarmed to the valley during this time had no personal experience to connect the dry riverbed to the hazard of flooding. By the 1970s, if not long before, the Salt River no longer settled the question of where and when to build.

THE FLOODS OF 1979-80 AND THE PUBLIC RESPONSE

Although the river was gone, however, floods were not, and the conflict between the continued reality of flooding and the changing perception and use of the dry Salt River and its floodplain lay at the heart of the history of Salt River flooding over the past fifty years. The floods of 1979-80 highlighted several results of this conflict. The winter of 1979-80 brought unusually large amounts of warm rain to the state of Arizona. By mid-February, the heavy rains had saturated the ground and nearly filled the reservoirs to the northeast and northwest of Phoenix. The normally dry riverbed of the Salt River became a raging torrent, and experts warned that conditions might bring a 500-year flood down on the city. Governor Bruce Babbitt declared a state of emergency in Maricopa County and warned of a possible evacuation of some 200,000 people: "I don't know if it's going to happen, but I think we must be prepared. We must be prepared for the unthinkable." (*Arizona Republic*, 16 February 1980)

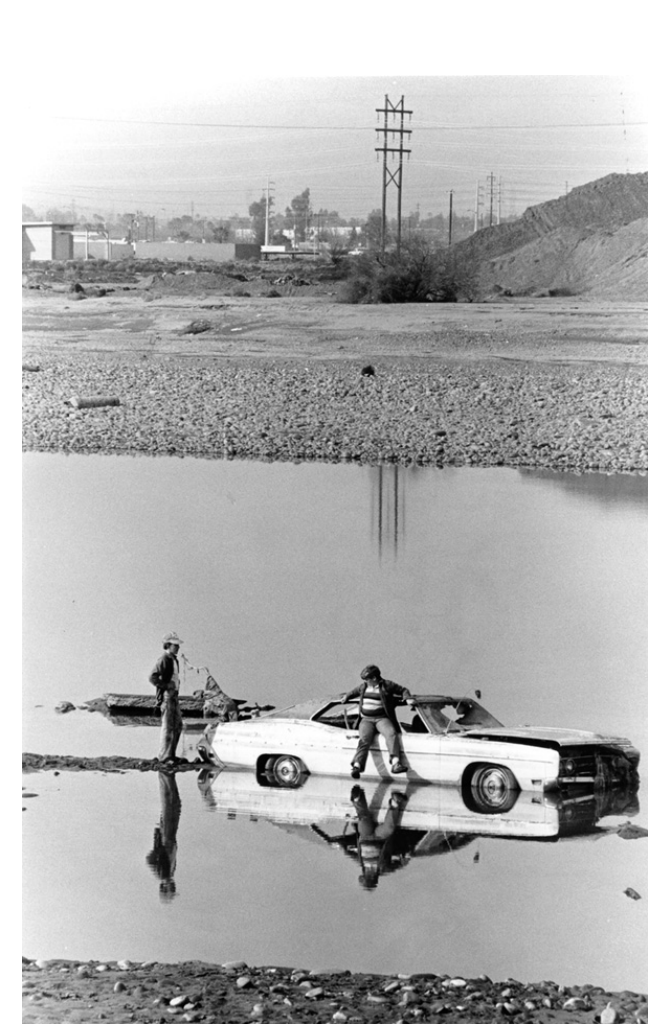
Luckily for the citizens of Phoenix the rains dried up and the unthinkable did not occur. Even still, the floods of February 1980 did extensive damage. The greatest damage occurred along the Salt River channel in the Greater Phoenix area. Flood waters and debris destroyed or damaged eleven of the thirteen bridges or crossings of the Salt River, turning the daily flow of tens of thousands of vehicles into a motorist's nightmare. At rush hour, traffic lined up for miles, with cars waiting as long as three to six hours to cross the river. At Sky Harbor International Airport, water damaged radio and radar equipment and turned a large portion of the east and main runway into a temporary lake. In the western part of the city, the floods damaged around 600 homes, permanently destroying many, while a severed 66-inch sanitary sewer line serving 500,000 people spewed raw sewage into the Salt River. Finally, high water and debris did extensive damage to crops and farmland in Western Maricopa County. In the Phoenix metropolitan area, physical damages, net income losses, and emergency costs totaled \$63.7 million.

The extensive damage of the 1979-80 flooding, along with the public reaction to the floods, showed what could happen when a very real flood burst through the valley's illusion of protection. Most of the damage occurred in or near the channel of the Salt River, where builders had not had to contend with a large flow down the river for over forty years. The damage and the inconvenience, especially with the bridges crossing the river, demonstrated that the Salt was still part of a living system, one which should not be ignored during zoning and planning.

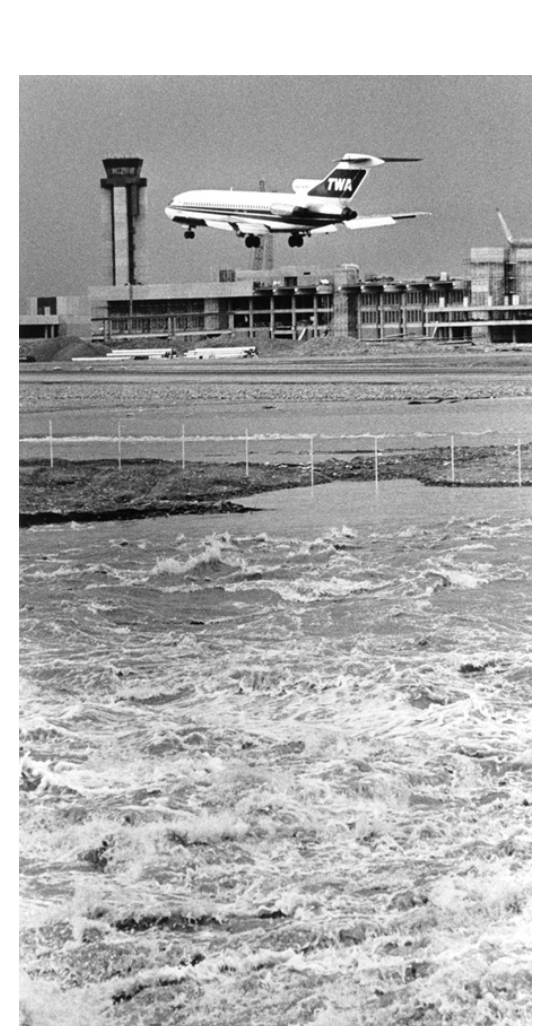
The public reaction to the floods of 1979-80 came from the discrepancy between the public perception of the state of flood control on the river and reality. The *Arizona Republic* and other valley newspapers were inundated with a flood of a different form—letters expressing anger, placing blame, and suggesting improvements for the future. A number of letters blamed SRP for the problem. A reader from Payson wrote, "When are we going to begin to hold SRP accountable? In any other business—four mistakes such as they have made in the past 23 months—someone would have had to answer to this ridiculous series of events." A Phoenix resident complained, "For the fourth time in less than two years the Salt River Project has managed to completely foul up Phoenix traffic across the Salt River." (*Arizona Republic*, 23 February 1980)

Some valley residents did defend the Salt River Project and they employed an old argument to do so: that being prepared to handle potential drought was much more important than worrying about occasional flooding. Kenneth A. Wallace of Phoenix wrote: "Now my family has been trying to make a living on these Southwestern deserts since 1918. We have seen several floods. We have also seen years of drought. The floods are more spectacular but the droughts more disastrous. . . . Leave the Salt River Project alone." Jay Starke, also of Phoenix, added: "I am thoroughly horrified everytime I hear some short-sighted public official announce that the Salt River Project should keep our surface lakes partially empty for the purpose of flood control. . . . Time will come again when winter rains and snow do not arrive to replenish this supply. With Arizona's water demands increasing yearly, SRP's first and foremost priority must continue to be maximal storage, *not* flood control." (*Arizona Republic*, 23 February 1980)

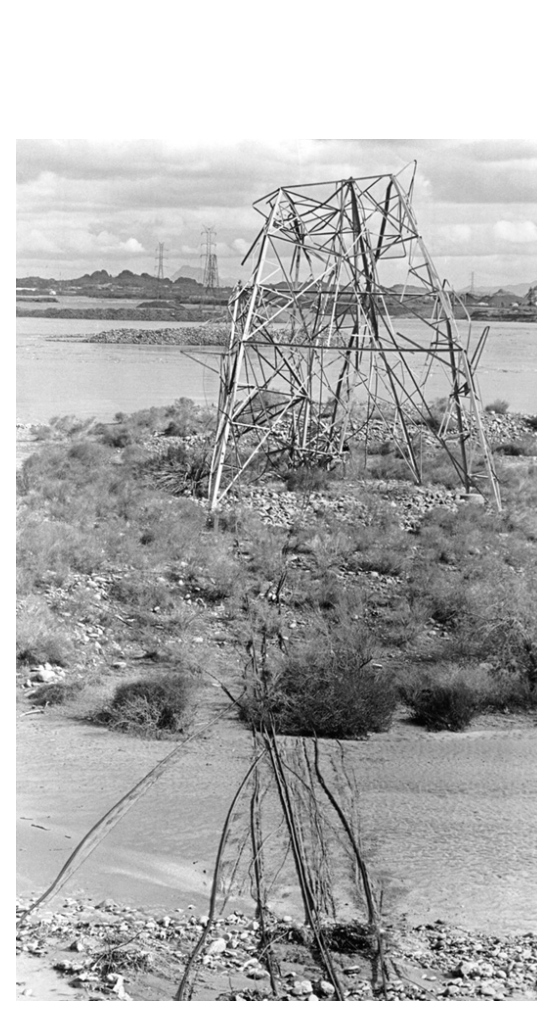
PHOTOS OF THE 1979-80 FLOODS



Boys and Car in Salt River
(Mesa Tribune Collection, Arizona Collection, ASU Libraries)



Floodwaters Near Sky Harbor Airport
(Mesa Tribune Collection, Arizona Collection, ASU Libraries)



Destroyed Electrical Tower in River
(Mesa Tribune Collection, Arizona Collection, ASU Libraries)

CONCLUSIONS

Within this overview of the history of flooding on the Salt River it is prudent to rethink the incident with the Tri-City Landfill in 1993. In the broad historical context, landfills are just one way that people have used the riverbed and adjoining land. Gravel companies, dairy farms, interstate, power lines, airports, and homes have all occupied, and in many places continue to occupy part of this land. The risk involved in placing buildings in this area has led and will continue to lead to problems and incidents such as occurred in 1993 until flooding is eliminated (which is a difficult if not impossible task) or public perceptions and attitudes towards the Salt River change.

Two of the present initiatives to use the riverbed form a fine conclusion to this overview. Both Phoenix and Tempe have plans to put water back into the dry riverbed—Phoenix's effort is still in the planning stage. Tempe filled its town lake over the summer of 1999. These present initiatives have really come full circle in terms of use of the river. The Salt River once attracted people to come to Phoenix in the nineteenth century, removing the river and storing it in a series of reservoirs created a water supply for the present massive metropolis, and putting water back into the river, city leaders hope, will help attract even more people to the area. The motivation behind the move to store water and put it back into the river is the same—the progressive idea of needing to put a resource to its best use, for the largest number of people. Tempe cannot grow outward any longer, so it looks to use the river and to grow upward. Wrapped up into this push for even more growth is the continuing perception of the dry riverbed and surrounding land as unused space. Tempe Mayor Neil Giuliano, right before the opening of Tempe Town Lake commented: "This is the culmination of 33 years of dreaming. We have transformed one-sixth of unused wasteland of the Salt River bottom into a recreational area for our citizens." (*Arizona Republic*, 6 November 1999) It remains to be seen, however, exactly what will happen if the Salt River ever meets the lake that has usurped its bed, and the combined flow of river and lake rushes through the rest of the city.

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