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# POLITICS, ENGINEERING AND ARIDITY -- SUSTAINABLE USE OF WATER IN ARIZONA

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## I. Introduction

Sustainability of water use in the area now called Arizona has been an issue since prior to the disappearance of the Hohokam around 1400 A.D. From the earliest days to the present, the most crucial issue in Arizona has been the availability of sustainable supplies of water, the demand for these supplies, and the developing disparity between supply and demand.

Historically, sustainability has been achieved through the development of the "next" water resource. Native Americans and Arizona's early settlers used water in the surface streams by means of direct diversion. As the settlers' water use depleted the normal flow of streams, they built dams to conserve and regulate seasonal flows. The full development of available surface water resources later resulted in the exploitation of groundwater resources to sustain new agricultural and urban demands. As groundwater resources came to be overused, the state turned to the Colorado River as the "next" source of supply. Now, as the state enters the twenty-first century, there are no "next" sources of supply to develop, and the reliability of many of the old sources, at least for existing uses, is threatened.

"Sustainability" is not a word settlers, Native Americans, judges or legislators in Arizona would have used in reference to water use, but the concept is at the core of what they sought. The settlers built dams, judges elaborated legal doctrines, and the legislature passed laws -- all with the underlying but usually unstated purpose of achieving sustainability in the use of Arizona's water supplies. The process of achieving sustainability has been haphazard, at times rough and tumble, occasionally focused, and generally unsuccessful. While there have been some notable achievements -- the 1980 Arizona groundwater management act, for example -- many issues remain unaddressed or only partially resolved. For example, most water uses in Arizona have not been adjudicated. The State has been unable to meld hydrology and the law when it comes to the relationship of surface water to groundwater; the conjunctive management of water resources remains somewhere over the horizon. Divisions between urban and agricultural water users persist. Environmentalists maintain that water development has occurred at the expense of habitat and species and are demanding that water be made available for both. Indian communities' claims to water have not been resolved, and, however their claims are resolved -- by litigation or settlement -- existing water uses will be affected. And institutions for the allocation of water from the region's greatest stream, the Colorado River, are being strained by growth, new demands, and the intrinsic limitations of the resource itself.

This paper examines briefly the history of water development in Central Arizona, to put into factual context Arizona's attempts to survive in an arid environment.

II. Geography, Population, Water Supply and Demand.

A. Geography.

Arizona's water issues must be considered in the context of the state's size and land ownership patterns. The state is among the largest in the United States in geographic area, consisting of about 73,000,000 acres. Only 17% of the state's land mass is in private ownership. The balance is in public ownership, with the United States owning - in one form or another - the bulk of the state's land. Indian reservations occupy 28% of the state's area and, although Native Americans account for only 6% of the state's population, their reservations are making major claims to the state's water resources. See 1993-94 Arizona Yearbook, at 3.

It is not possible to deal with issues relating to sustainable use of water supplies in Arizona without taking into account federal ownership of land in Arizona and the claims to water of land held by the United States for Indian tribes.

B. Population.

Examination of population trends in Arizona since 1910 tells its own story.

| Year | Population | % Change |
|---|---|---|
| 1910 | 204,354 | |
| 1920 | 334,162 | 64% |
| 1930 | 435,523 | 30% |
| 1940 | 499,261 | 15% |
| 1950 | 749,587 | 50% |
| 1960 | 1,301,161 | 74% |
| 1970 | 1,775,399 | 36% |
| 1980 | 2,716,546 | 53% |
| 1990 | 4,071,650 | 50% |

1993-94 Arizona Yearbook at 148.

The state's population is projected to continue growing dramatically:

| Year | Population | % Change |
|---|---|---|
| 2000 | 4,632,575 | |
| 2010 | 5,652,525 | 22% |
| 2020 | 6,811,900 | 21% |
| 2030 | 8,069,500 | 18% |
| 2040 | 9,334,375 | 16% |

1993-94 Arizona Yearbook at 149.

Increasing population will place increasingly greater demand on Arizona's water supplies.

C. Supply and Demand.

Arizona's demands for water will grow significantly over the coming decades. Except for the 1.3 to 1.5 million acre-feet recently made available to Arizona through the Central Arizona Project ("CAP"), the "swing" water supply will be groundwater, although groundwater usage may be mitigated to some extent by wastewater reuse, conservation and similar practices.

For decades, Arizonans have consumed far more groundwater than has been replenished. In 1975, for example, the state was pumping 2,500,000 acre-feet of groundwater in excess of replenishment, primarily in Central Arizona. Final Report - June 1980, Arizona Groundwater Management Study Commission at I.3. ("Final Report"). Although importation of water from the Colorado River through the CAP will ultimately introduce between 1.3 and 1.5 million acre-feet per year of renewable supply in Central Arizona, a significant overdraft of groundwater will persist. Moreover, the supply from the Colorado River comes with its own peculiar problems (see below).

Demand for water in Arizona will grow from 6,664,000 acre-feet in 1990 to 7,499,000 acre-feet in 2040. The only "new" sources of water to meet increased demand will be effluent, use of Arizona's remaining increment of Colorado River entitlement, and, possibly, a dimunition in the use of water for agricultural purposes accompanied by a shift of water from agricultural uses to other uses.

1990

| Demand | | Supply | |
|---|---|---|---|
| M&I | 1,354,000 (20.3%) | Effluent | 119,000 ( 1.8%) |
| Agriculture | 5,310,000 (79.7%) | CAP | 832,900 (12.6%) |
| | | Groundwater | 3,334,400 (50.6%) |
| | | Colo. River | 1,121,200 (17%) |
| | | Other | 1,185,300 (18%) |

Total Demand: 6,664,000 acre-feet

2015

| Demand | | Supply | |
|---|---|---|---|
| M&I | 1,925,000 (27.2%) | Effluent | 213,900 (2.8%) |
| Agriculture | 5,145,000 (72.8%) | CAP | 1,234,900 (21%) |
| | | Groundwater | 3,351,100 (44%) |
| | | Colo. River | 1,310,200 (17.4%) |
| | | Other | 1,440,400 (19.1%) |

Total Demand: 7,070,000 acre-feet

2040

| Demand | | Supply | |
|---|---|---|---|
| M&I | 2,536,000 (33.8%) | Effluent | 472,500 (5.8%) |
| Agriculture | 4,963,000 (66.2%) | CAP | 1,490,000 (18.2%) |
| | | Groundwater | 3,228,750 (39.5%) |
| | | Colo. River | 1,310,900 (16%) |
| | | Other | 1,669,600 (20.4%) |

Total Demand: 7,499,000 acre-feet

Arizona Water Resources Assessment, Volume I, Inventory and Analysis, August 1994, Arizona Department of Water Resources, Figures 4, 5, and 6 ("Resources Assessment").

III. Water Development.

A. Surface Water in Central Arizona.

1. The Salt/Verde River Systems.

The principal tributary to the Gila River in Arizona is the Salt River. The Verde River is a principal tributary of the Salt River and joins the Salt River just east of Phoenix. The economy of the greater Phoenix metropolitan area has been built and depends upon water from the Salt and Verde Rivers.

Settlers arrived in the Salt River Valley in the mid to late 1800's and developed irrigation uses by means of direct diversions from the Salt River. Large spring flows washed their diversions away. During low flow periods, there came to be too many diversions and too little water. By 1892, however, 120,000 acres of land were being irrigated in the Salt River Valley. See R. Johnson, The Central Arizona Project, University of Arizona Press, Tucson, Arizona, 1977, at 2 ("Johnson").

Following enactment of the 1902 Reclamation Act, Salt River Valley Water Users' Association ("SRVWUA") was formed in 1903. The SRVWUA contracted to repay the costs of constructing Theodore Roosevelt Dam, which was completed

upstream on the Salt River in 1911. Johnson at 3. Roosevelt Dam conserved water that would be used on member lands of the SRVWUA.

Between 1923 and 1930, SRVWUA constructed Horse Mesa, Mormon Flat, and Stewart Mountain Dams on the Salt River, creating Apache, Canyon and Saguaro Lakes respectively. The four reservoirs on the Salt River (including Roosevelt) have combined storage capacity of approximately 1,709,500 acre-feet. See Resources Assessment, Vol. II, at 18; see also, Applicant's Prefiled Testimony In Support of Applications for Primary and Secondary Permits to Appropriate Salt River Water, Modified Theodore Roosevelt Dam, Arizona, January 1995, at II-1 ("Applicant's Testimony"). In the period 1935 through 1946, Bartlett and Horseshoe Reservoirs were constructed on the Verde River with combined reservoir storage capacity of 309,600 acre-feet. Resources Assessment, Vol. II at 24; Applicant's Testimony at II-1, II-2.

Most of the water developed in SRVWUA's Salt and Verde River reservoirs must be used on land within the Salt River Reservoir District ("SRRD") in the Phoenix metropolitan area, an area of approximately 265,000 acres. See Applicant's Testimony at II-1. Only a small portion of the water stored in the reservoirs can be used outside of the SRRD. Water resources for use in the Phoenix metropolitan area outside the SRRD must come from groundwater, the CAP, effluent or from Modified Roosevelt Dam.

Cities in the Phoenix metropolitan area attempted to construct storage for the development of additional water for use outside the SRRD at the Orme Dam site, located at the confluence of the Salt and Verde Rivers, as a part of the Central Arizona Project. Public outcry, the potential relocation of an Indian tribe, and environmental concerns led to the abandonment of the Orme Dam site. Applicant's Testimony at II-3. Subsequently, the United States and Phoenix metropolitan area cities attempted to develop new storage at the proposed Cliff Dam site on the Verde River and also by modifying Roosevelt Dam on the Salt River. Environmental concerns led to the abandonment of the Cliff Dam site; only modified Roosevelt Dam survived. Id. at II-3, II-4.

Construction of modified Roosevelt Dam is proceeding. The maximum amount of water that can be captured in the additional conservation capacity at Roosevelt Dam is 422,908 acre-feet. This amount of water will be available only rarely. For planning purposes, cities in the Phoenix metropolitan area estimate the modifications will yield an average additional supply of only 73,800 acre-feet per year. Id. at IV-1.

Even with the incremental supply to be made available from modified Roosevelt Dam, cities in the Phoenix metropolitan area project that their water supplies outside the boundaries of the SRRD will be in deficit. Demand for water outside of the boundaries of the SRRD are projected to be 536,743 acre-feet in 2035. Nevertheless, even using all renewable supplies, including those from modified Roosevelt Dam and the CAP, the cities will experience a water deficit of 244,973 acre-feet per annum in 2035, which will increase after 2035. Id. at IV-5.

2. The Gila Mainstream.

The Gila River runs through Central Arizona from the state's boundary with New Mexico on the east to the Colorado River, which forms Arizona's boundary with California, on the west.

The Hohokam Indians were the first to use water from the Gila River mainstream for irrigation purposes. They apparently started diverting water from the River around 500 A.D. By 1300 A.D., they had developed over 200 miles of canals in the Gila Valley which irrigated thousands of acres of land. Johnson at 1. For reasons as yet unexplained, the Hohokam disappeared around 1400 A.D. Id.

The Hohokam were followed by the Pima Indians, and later the Maricopa Indians, who are the predecessors of today's Gila River Indian Community. The Pimas and Maricopas farmed successfully along the Gila River from the late 1600's until the late 1880's. See Gila River Pima-Maricopa Indian Community v. United States, 231 Ctr. Cl. 193, 684 F.2d 852 (1982). As of about 1870, they had 12,000 to 15,000 acres of land under cultivation in the Gila Valley south and east of Phoenix and produced a yearly surplus of wheat for sale of up to two million pounds. See Gila River Pima-Maricopa Indian Community v. United States, U.S. Ct. of Claims, Trial Division No. 236-C, January 7, 1981, Finding No. 18. However, with the arrival of settlers, upstream diversions resulted in the destruction of the Pima-Maricopa Indian agricultural economy. See id., Finding No. 25.

The plight of the Pimas and Maricopas, now the Gila River Indian Community, has only been partially resolved and remains a major issue in Arizona water. In 1924, Congress attempted to provide the Gila River Indian Community and their non-Indian neighbors with a reliable supply of water by authorizing the construction of a dam on the Gila River downstream from Safford. See Act of June 7, 1924, 43 Stat. 475. The Coolidge Dam was constructed in 1928, creating San Carlos Reservoir, with a storage capacity of 935,000 acre-feet. Reports supporting the construction of Coolidge Dam overestimated the dependable supply, and there has never been sufficient water to meet all of the Indian and non-Indian uses under the San Carlos Project.

The Gila River Indian Community's rights in the Gila were adjudicated in a decree entered in the United States District Court for the District of Arizona in 1935. United States v. Gila Valley Irrigation District, Globe Equity No. 59, June 29, 1935. Notwithstanding the Decree, the Gila River Indian Community is asserting claims to water in the General Adjudication of the Gila River System and Source, W-1 through W-4, which is a McCarran Amendment general stream adjudication to adjudicate all rights to the use of water in the Gila River system. They have filed claims for approximately 1,500,000 acre-feet of water to irrigate their reservation. These claims purport to extend to water supplies available in the Salt and Verde River systems, including water available within the SRRD. Whether the Community's claims are settled or litigated (and assuming their claims were not fully adjudicated in the Globe Equity No. 59, supra) the Gila River Indian Community's water usage and rights will be a major consideration in all institutional water arrangements in Central Arizona.

3. Summary.

As of 1995, surface water supplies in Central Arizona are, as a practical matter, fully appropriated. Lands in the Phoenix metropolitan area which are also located within the boundaries of the SRRD have a sustainable supply of surface water from reservoirs constructed on the Salt and Verde River system. Outside the SRRD, there is insufficient surface water to meet projected demand in 2035. Since the arrival of non-Indian settlers, there has not been an adequate supply of surface water on the mainstream of the Gila River to meet water demands on the stream, notwithstanding the construction of Coolidge Dam in 1928. The water rights claims of the Gila River Indian Community - whether settled or litigated - are likely to have a significant impact on water uses and water users throughout the Gila River system.

B. Groundwater Development in Central Arizona.

Arizona is well-known for its groundwater overdraft problem. The overdraft began occurring in the early 1930's in areas where no surface water supplies were available. See Final Report at I-3. The convergence of higher cotton prices, better pumps, and the unavailability of surface water to supply new uses resulted in increased groundwater pumping. Id. at I-7.

In 1938, Governor Stanford appointed a groundwater study commission, which led to the state's appropriation of money to finance a USGS survey of groundwater uses. Id. The resulting study, published in 1943, pointed out that restrictions on groundwater pumping were necessary, if for no other reason than to protect surface water uses in existing irrigation districts. Id. Groundwater development at the time was occurring in a legal environment which treated groundwater as being owned by the owner of the overlying land and as not being subject to the doctrine of prior appropriation. See, e.g. Howard v. Perrin, 8 Ariz. 347, 76 P. 460 (1904); McKenzie v. Moore, 20 Ariz. I, 176 P. 568 (1918); Maricopa County Municipal Water Conservation District No. 1, 39 Ariz. 65, 4 P.2d 369 (1931).

The "race to the pumps" which began in the 1930's sparked the initial confrontation between surface water users with groundwater users in Arizona. In 1945, a bill was introduced in the Arizona Legislature to make groundwater subject to prior appropriation. Final Report I-8. The bill did not pass. A similar bill was introduced in 1947, after the USGS had again reported that groundwater depletion threatened surface water uses. Id. at 9. The Legislature avoided the issue but enacted the 1948 groundwater code authorizing the creation of critical groundwater areas (see Ch. 5, Laws, Eighteenth Legislature, Sixth Special Session, June 24, 1948) in which agricultural irrigation of new land with groundwater was limited. Final Report at I-5. In practice, however, the 1948 groundwater code was never effective in limiting groundwater pumping for irrigation or any other purposes.

Although the Legislature did not pass the 1947 bill which would have made groundwater subject to the doctrine of prior appropriation, the Arizona Supreme Court took the initiative in 1952 and declared groundwater to be

appropriable, contrary to previous pronouncements of the Court. Bristor v. Cheatham, 73 Ariz. 228, 240 P.2d 185 (1952) ("Bristor I"). The Bristor I Court's reasons for declaring groundwater to be appropriable were stated as follows:

> We fail to see any danger lurking in a decision of this court holding percolating waters to be public. On the other hand, we definitely can see the inevitable exhaustion of all underground waters in the State of Arizona if the rule of private ownership of such water . . . is still held to be law. If that rule is adhered to the legislature is shackled from enacting an underground water code to meet the present emergency.
>
> . . . .
>
> To permit the present underground water race to continue unabated, without regulation or control, would inevitably lead to exhaustion of the underground supply and consequently to economic disaster.

73 Ariz. at 235, 240 P.2d at 189-190. Following a great outcry by groundwater users, the Arizona Supreme Court reversed Bristor I the following year in Bristor v. Cheatham, 75 Ariz. 227, 255 P.2d 173 (1953) ("Bristor II"), and reaffirmed that groundwater in Arizona is not subject to appropriation and that the doctrine of reasonable use governs rights to the use of groundwater.

The conflict between groundwater and surface water users in Arizona continues to this day. The interrelationship of groundwater to surface water uses, and the extent to which either is to be protected, is one of the central issues of the two Arizona general adjudications presently pending in the Gila River system and the Little Colorado River system. The Arizona Supreme Court has thus far taken a narrow view of what water is appropriable and what is not. See In re Gen. Adjud. of All Rights to Use Water in the Gila River System and Source, 175 Ariz. 382, 857 P.2d 1223 (1993). However, the issue is again before the Arizona Supreme Court and may be decided differently. Fundamentally, the issue is one of sustainability, with surface water users fearing that their rights to use water from streams will be extinguished by groundwater pumping, and with groundwater users fearing their uses will be extinguished by a legal system which will come to treat groundwater as appropriable.

Bristor I and Bristor II both exemplify attempts by Arizona's judiciary to deal with the issue of sustainability, and of its attempts to prevent groundwater supplies from being overdrafted. Subsequent to these decisions, the judiciary used the reasonable use doctrine to limit the transportation of groundwater "off of the land from which it was pumped" in an effort to mitigate the effects of excessive groundwater pumping. The application of the reasonable use doctrine to prohibit the transportation of groundwater from the land from which it was pumped had virtually no effect on agricultural uses of groundwater, did not conserve any groundwater, and resulted in beneficial uses by major cities and industries being threatened by

injunctions. See Jarvis v. State Land Dept., 184 Ariz. 527, 456 P.2d 385 (1969); Jarvis v. State Land Dept., 106 Ariz. 506, 479 P.2d 169 (1970); Jarvis v. State Land Dept., 113 Ariz. 520, 588 P.2d a4 (1976); Farmers Investment Company v. Bettwy, 113 Ariz. 520, 558 P.2d 14 (1976) ("FICO").

Perhaps sensing the limitations of the doctrine of reasonable use as a means of preventing the overuse of groundwater, Arizona's judiciary began to invite the Legislature to invoke the state's police powers as a means of controlling the overuse of groundwater. The Arizona Supreme Court upheld the 1948 groundwater code, which limited the development of new agricultural uses of groundwater in critical groundwater areas, as a legitimate exercise of the State's police power in Southwest Engineering Co. v. Ernst, 79 Ariz. 403, 408, 291 P.2d 764, 768 (1955), stating:

> It can thus be seen that a conflict occurs between appellant and the state by reason of the interest of the public in the preservation from destruction of a resource (i.e., groundwater) essential to the sustenance of life. Where the public interest is thus significantly involved, the preferment of that interest over the property interest of the individual even to the extent of its destruction is a distinguishing characteristic of the exercise of the police power.

The application of the reasonable use doctrine in FICO, supra, to prohibit groundwater transportation to mines and the City of Tucson, together with a renewed threat by the Secretary of the Interior to withhold funding for the Central Arizona Project (see below), ultimately led to the enactment of the 1980 groundwater management act. See A.R.S. § 45-401 et seq. The act was upheld as a valid exercise of the police power in Town of Chino Valley v. City of Prescott, 131 Ariz. 78, 638 P.2d 1324 (1981), four appeal dismissed, 457 U.S. 1101 (1982). The Arizona Supreme held that the Arizona Legislature, under the auspices of the police power, could choose between or among competing interests and that it could both limit and allocate the use of groundwater among competing interests. See also Cherry v. Steiner, 716 F.2d 687 (9th Cir. 1983), cert. denied, 466 U.S. 931 (1984).

The 1980 Arizona groundwater management act, A.R.S. §45-401 et seq. is a remarkable document in many respects. It imposes active groundwater management in areas in Central Arizona where groundwater overdraft is severe. A.R.S. § 45-411. It forbids the irrigation of new land with any water. A.R.S. § 45-452. It governs all uses of groundwater within the state. A.R.S. § 45-453. It requires that three of the four "active management areas" which it created in Central Arizona achieve "safe yield" by 2025, or sooner. A.R.S. § 45-562. It imposes mandatory conservation measures on "all persons withdrawing, distributing or receiving groundwater." A.R.S. § 45-563. And it limits the development of land based on groundwater use. The Arizona Department of Water Resources ("ADWR") recently promulgated rules which effectively prohibit new subdivisions of land based on groundwater usage. See Arizona Administrative Code, Rules R12-15-701 through R12-15-714. From 1995 forward, land subdivision must be based on the use of renewable supplies. Such regulations would have been unthinkable ten years ago.

The central goal of the 1980 groundwater management act was to achieve "safe yield" in areas of Central Arizona which are most severely overdrafted. "Safe yield" is defined as a goal "which attempts to achieve and thereafter maintain a long-term balance between the annual amount of groundwater withdrawn in an active management area and the annual amount of natural and artificial recharge." A.R.S. § 45-561.12. "Safe yield" is to be achieved within the three safe-yield active management areas by means of management plans promulgated by ADWR during five management periods - 1980-1990; 1991-2000; 2001-2010; 2011-2020; and 2001-2025. See A.R.S. § 45-562.

Arizona is now half-way through the second management period. It is apparent that even with the significant regulation of groundwater use that has occurred, and even assuming the utilization of significant amounts of water from the CAP, groundwater will continue to be mined in Central Arizona in 2025 unless even greater conservation is achieved in management periods subsequent to the second management period. The combined groundwater overdraft within the Phoenix, Tucson, and Pinal Active Management Areas (the Pinal AMA is not a safe yield AMA), are projected to approximate 642,308 acre-feet per annum in 2035, even assuming almost full utilization of CAP, in the absence of further conservation. See Attachments A, B and C.

Although Arizona's groundwater code has been a good tool in attempting to achieve sustainable use of Arizona's groundwater supplies, the state has a long way to go. It is not clear that the goal of "safe yield" will be achieved.

C. Deus Ex Central Arizona Project.

For the better part of this century, Arizonans have thought of the Colorado River as the answer to the state's water supply problems. The precise origins of the idea of the CAP are lost in history, but Arizonans were considering the idea of importing Colorado River into Central Arizona as early as 1918. Johnson, supra, at 13.

Unfortunately, the Colorado River has been -- and continues to be -- a River of contention. California began to view the River as a major source in the early 1900's and moved so aggressively to develop water uses that other states, particularly Arizona, reacted.

In 1921, Congress authorized the negotiation of the Colorado River Compact among the seven Colorado River Basin states. See Act of August 19, 1921 (42 Stat. 171). The Colorado River Compact was executed by the seven states and the United States on November 24, 1922, subject to ratification by the states and Congress. However, Arizonans, fearing that the Compact's apportionment of water of the "Colorado River System" in effect apportioned water in the Gila River system, refused to ratify the Compact.

Not to be deterred by obstinate Arizonans, the crafty Californians outflanked Arizona by securing the enactment of the Boulder Canyon Project Act of 1928, 43 U.S.C. § 617 et seq. ("BCPA"), section 4 of which provided that the BCPA would not be effective until the Colorado River Compact had been

ratified by six of the seven signatory states and California had passed legislation limiting its uses of the River to no more than 4.4 million acre-feet per annum. These preconditions were met, and the BCPA became effective on June 25, 1929.

The effectiveness of the BCPA was kick-off for seventy years of regional warfare between Arizona and California over water, conducted mostly (but not entirely) in the courts and Congress.

Arizona promptly brought suit in the Supreme Court seeking a declaration that the BCPA was unconstitutional. Arizona lost. The Court held that the Act was within Congress' power to enact under its power to regulate navigation. Arizona v. California, 283 U.S. 423 (1931).

Arizona sought leave to perpetuate the testimony of the progenitors of the Colorado River Compact. It lost. Arizona v. California, 292 U.S. 341 (1934).

Meanwhile, the crafty Californians were attempting to build a dam in the River below Hoover Dam so they could divert water to Los Angeles. Arizona sought to stop them. The construction of Parker Dam generated the story of the "Arizona Navy," which was really nothing more than an expedition on the Julia B to find a camp site for the Arizona National Guard to keep an eye on the crafty Californians. See Nadeau, R., The Water Seekers, Chalfont Press, 1974, 223-224 ("Water Seekers"). The more serious incident occurred in November, 1934, when Governor Moeur dispatched 100 troops, 18 trucks, several machine gunners and a hospital truck to Parker, Arizona, to prevent Metropolitan Water District from trespassing in Arizona. The United States secured a restraining order against Arizona, in a case which the United States ultimately lost when the Supreme Court held that the construction of Parker Dam was unauthorized by any act of Congress. See United States v. Arizona, 255 U.S. 174 (1936). Nevertheless, the crafty Californians remedied the situation even before the Supreme Court rendered its decision, in the Rivers and Harbors Act of 1935, section 2 of which authorized the construction of Parker Dam. See Section 2, Act of August 30, 1935. (49 Stat. 1039.)

Finally, Arizona sought a judicial apportionment of the Lower Colorado River. It lost. Arizona v. California, 298 U.S. 558 (1936).

Throughout and subsequent to this litigation, the idea of importing water into Central Arizona persisted and was taken up by the United States. The United States first proposed a Central Arizona Project in 1947, the same year in which the first Central Arizona Project authorization bill was introduced. See Statement of Hon. Carl Hayden, Hearings before the Subcommittee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs, United States Senate, 88th Congress, on S. 1658, August 27, 1963, at 4 ("Hearings"). Interestingly, in 1945, the Bureau of Reclamation initiated what came to be a custom of threatening to hold the Central Arizona Project hostage unless Arizona limited its groundwater pumping. Final Report at I-7, I-8. Similar threats were made in 1947 and in 1977 as a means of securing the enactment in Arizona of legislation limiting groundwater pumping. Id. at 9.

Although the idea of Central Arizona Project persisted and flourished, the crafty Californians thwarted it at every turn. They defeated the adoption of the compact authorized in Section 4 of the BCPA. "Hearing" at 4. They resisted ratification of the Mexican Water Treaty. Id. They prevented a vote on the first Central Arizona Project bill in 1947 and they succeeded in preventing any further consideration of the Central Arizona Project pending resolution of litigation as to the extent of Arizona's right to use water in the Lower Colorado River. Id. That litigation commenced in 1952 and did not culminate until the decision in Arizona v. California, 373 U.S. 546 (1963). See also 376 (U.S. 340 (1964); 439 U.S. 419 (1979); 460 U.S. 605 (1983); 466 U.S. 144 (1984).

The Supreme Court's 1963 decision in Arizona v. California was followed almost immediately by the introduction of legislation authorizing the construction of the CAP. However, even as the bill was introduced, its chief sponsor, Senator Carl Hayden, acknowledged that the purposes of the project were not to initiate new uses, but to sustain existing uses in Central Arizona (an unusual purpose for a reclamation project):

> Arizona is at a crisis point. Arizona urgently needs more water, without which she faces a slowly withering economy as her groundwater bank account shrinks. There is not sufficient water available to her to even permit maintenance of that agriculture which is now extanct. Arizona seeks only to meet her rapidly expanding domestic requirements and to maintain her irrigated agriculture as near as possible at present levels.

Hearings, at 3-4.

The Central Arizona Project was finally authorized in 1968. See Title III, Pub. Law 90-537 (82 Stat 887), September 30, 1968.

Final water allocations from the CAP were not proposed until 1983. In that year, the Secretary allocated 309,828 acre-feet of water to various Central Arizona Indian tribes: 638,823 acre-feet of municipal and industrial water to municipal water providers in Central Arizona; and agricultural supplies of water to 23 water users. Federal Register, Thursday, March 23, 1983, pp. 12446, et seq. Ultimately municipal providers executed subcontracts for all but 66,000 acre-feet of the non-Indian municipal and industrial water. See Discussion Paper on the Relocation of Uncontracted Central Arizona Project Municipal and Industrial Water, Arizona Department of Water Resources, February, 1994. Only ten of the 23 entities which were allocated agricultural water actually signed subcontracts for approximately 70.7% of the agricultural supply from the CAP. Of these ten agricultural subcontractors, none is taking water under its subcontract today because the water is too expensive to use for agricultural purposes. Many, however, are taking water at subsidized rates from the Central Arizona Water Conservation District ("CAWCD"), the agency which delivers water from the CAP. Without the subsidy currently being provided by CAWCD, these districts would be forced to use groundwater, which is cheaper than CAP water, thus defeating one of the purposes for which the CAP was constructed.

Water which was allocated to agricultural users but for which no subcontracts were executed, approximately 29.3% of the agricultural supply, has been set aside by the United States for use in Indian Water rights settlements and for other federal purposes. Federal Register, Wednesday, February 5, 1992, pp. 4470, et seq. Although ADWR recommended to the Secretary of the Interior that the 66,000 acre-feet of non-Indian municipal and industrial water for which subcontracts were not executed should be reallocated to non-Indian municipal water providers in Central Arizona (see Proposed M&I Reallocation, ADWR, October 21, 1994), it appears at present that this municipal and industrial water, along with 175,000 acre feet of non-Indian agricultural water will be reallocated for federal uses, including the settlement of Indian water rights claims. See, Proposed Repayment Agreement Between the United States and CAWCD for the Central Arizona Project, March 1, 1995. The CAP, which was originally intended to displace agricultural pumping in Central Arizona and to provide water for municipal users, will not do the former and will do the latter only to a lesser extent. Much of the water appears to be destined for use in settling Indian water rights claims in Central Arizona, most notably those of the Gila River Indian Community. To a great extent, water which is used to settle Indian claims will be devoted to new uses, not to substituting surface water for groundwater for existing uses.

The underlying supply of CAP is itself under assault to some degree. Environmental and water quality considerations may operate to reallocate water in the River. For example, the designation of significant portions of the mainstream of the River may operate to limit the quantities of water that are taken from the River or when it can be taken. See Federal Register, Friday, January 29, 1993, pp. 6578 et seq.; Federal Register, Monday, March 15, 1993; p. 13732. Nevada is facing the day when it will exceed its apportionment in the River and has no other source of supply. California has been using more than its apportionment of the River and faces a time when it must reduce its use. Arizona, even after it fully uses its apportionment, will still be mining groundwater. And, finally, many continue to point out that the River is over-allocated and cannot sustain the uses for which its waters have been allocated. See e.g., Testimony, Tom Jensen, Hearings before the Subcommittee on Water and Power, Committee on Energy and Natural Resources, United States Senate, June 1994.

## IV. Conclusion.

As Arizona enters the 21st century, it has not achieved sustainable use of its water resources. Surface water in Central Arizona is fully appropriated, even over-appropriated. Issues on the interrelationship of surface water and groundwater use have not been resolved. Groundwater overdraft persists, and will continue to persist, even taking into account current groundwater conservation measures. Full utilization of the CAP will not eliminate the overdraft. The "next" source of supply - the CAP - is subject to numerous internal and external pressures which may affect the extent to which its water will be available in Central Arizona. The existence of large Indian reservations with as yet unquantified claims to water threatens to reallocate water from existing uses to new uses on reservations, exacerbating problems of overuse and sustainability.

There are no "next" sources of supply for Arizona. To survive and prosper in the future, Arizona will need to turn inward and to concentrate on its existing water uses. It will need to increase its efforts to conserve water. It will need to find politically acceptable ways to reduce the use of water for agricultural purposes and to shift surface water resources currently used for agricultural purposes to municipal uses. The state will need to settle outstanding Indian water rights claims in ways that promote the economic self-sufficiency of the tribes without damaging the non-Indian economy. This will inevitably involve the use of tribal water for non-irrigation purposes and Indian water marketing. The state will need to reuse all of its water. And it will need to find some means of conjunctively managing its surface water and groundwater resources.

## TABLE 2-B

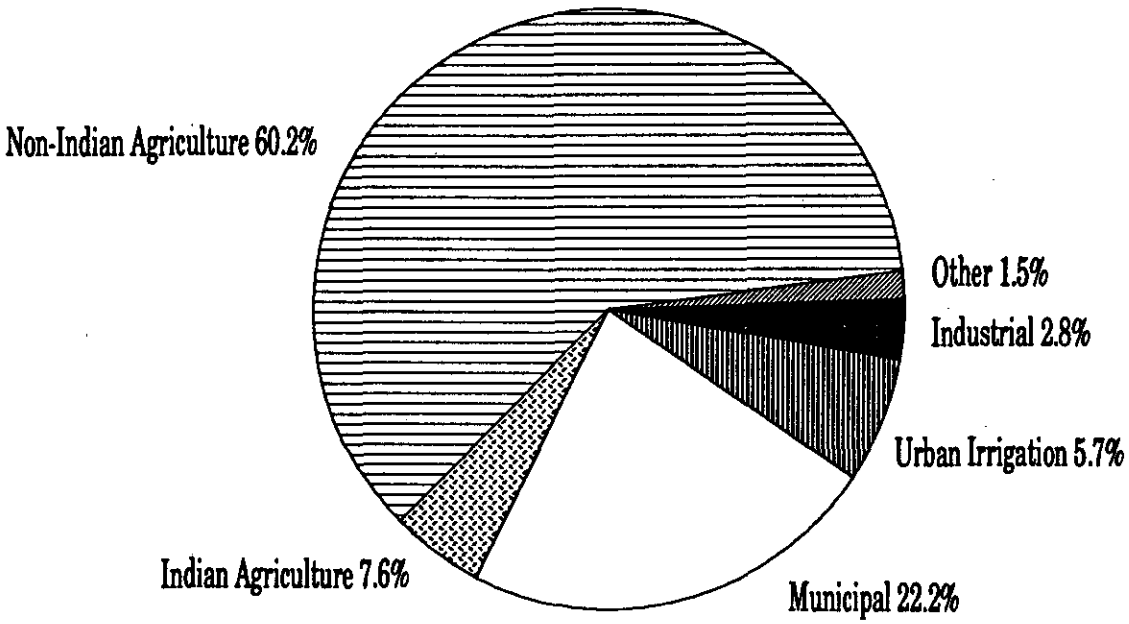
## PROJECTED CONDITIONS UNDER SECOND MANAGEMENT PLAN PROGRAMS

## PHOENIX AMA

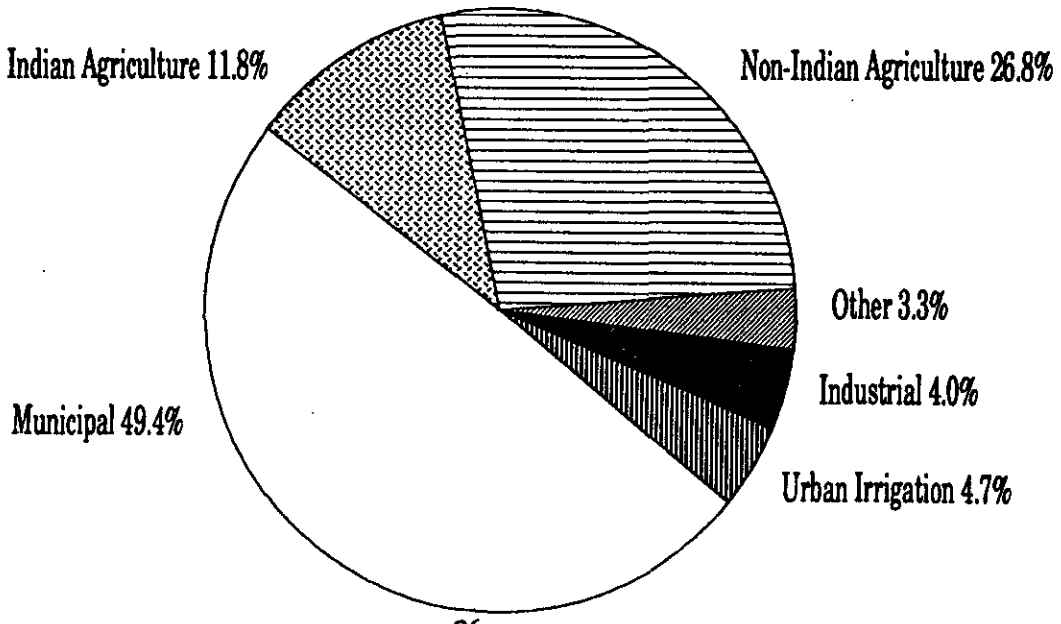
| | 1985 | 1990 | 2000 | 2010 | 2020 | 2025 |
|---|---|---|---|---|---|---|
| POPULATION | 1,850,393 | 2,277,957 | 3,275,182 | 4,080,107 | 4,923,037 | 5,335,649 |
| IRRIGABLE ACREAGE (total) | 419,064 | 405,377 | 372,314 | 337,573 | 300,778 | 282,381 |
| WATER DEMANDS (acre-feet) | | | | | | |
| Municipal | 503,668 | 620,048 | 796,102 | 991,757 | 1,196,649 | 1,296,943 |
| Urban Irrigation | 128,907 | 128,907 | 122,462 | 112,462 | 122,462 | 122,462 |
| Industrial | 63,608 | 68,778 | 80,836 | 90,569 | 100,760 | 105,743 |
| Agricultural | 1,536,232 | 1,772,511 | 1,326,663 | 1,206,286 | 1,078,791 | 1,015,046 |
| Other | 34,019 | 86,532 | 86,532 | 86,532 | 86,532 | 86,532 |
| Total | 2,266,434 | 2,676,776 | 2,412,596 | 2,497,605 | 2,585,194 | 2,626,725 |
| WATER SUPPLIES (acre-feet) | | | | | | |
| Surface Water | 891,756 | 891,756 | 891,756 | 891,756 | 891,756 | 891,756 |
| Natural Recharge | 41,300 | 41,300 | 41,300 | 41,300 | 41,300 | 41,300 |
| Incidental Recharge | 684,120 | 777,985 | 375,858 | 356,921 | 351,060 | 347,944 |
| Central Arizona Project | 0 | 264,143 | 508,352 | 508,372 | 500,000 | 495,878 |
| Effluent Use | 52,755 | 109,210 | 209,114 | 325,634 | 392,909 | 425,839 |
| Augmentation | 0 | 5,000 | 168,700 | 178,700 | 178,700 | 178,700 |
| Total | 1,669,931 | 2,089,394 | 2,195,080 | 2,302,683 | 2,355,724 | 2,381,417 |
| OVERDRAFT | 596,503 | 587,382 | 217,515 | 194,922 | 229,469 | 245,308 |

# FIGURE 2-E
# CHARACTERISTICS OF WATER DEMAND
# PHOENIX AMA

## 1985

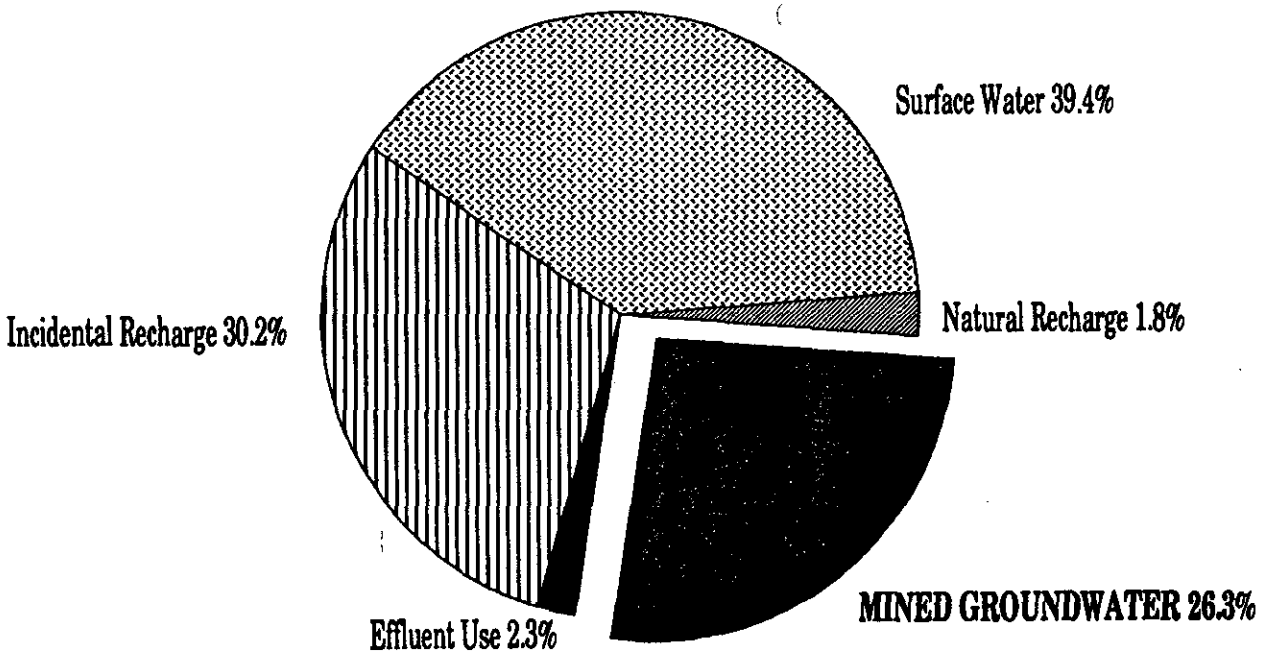



## 2025

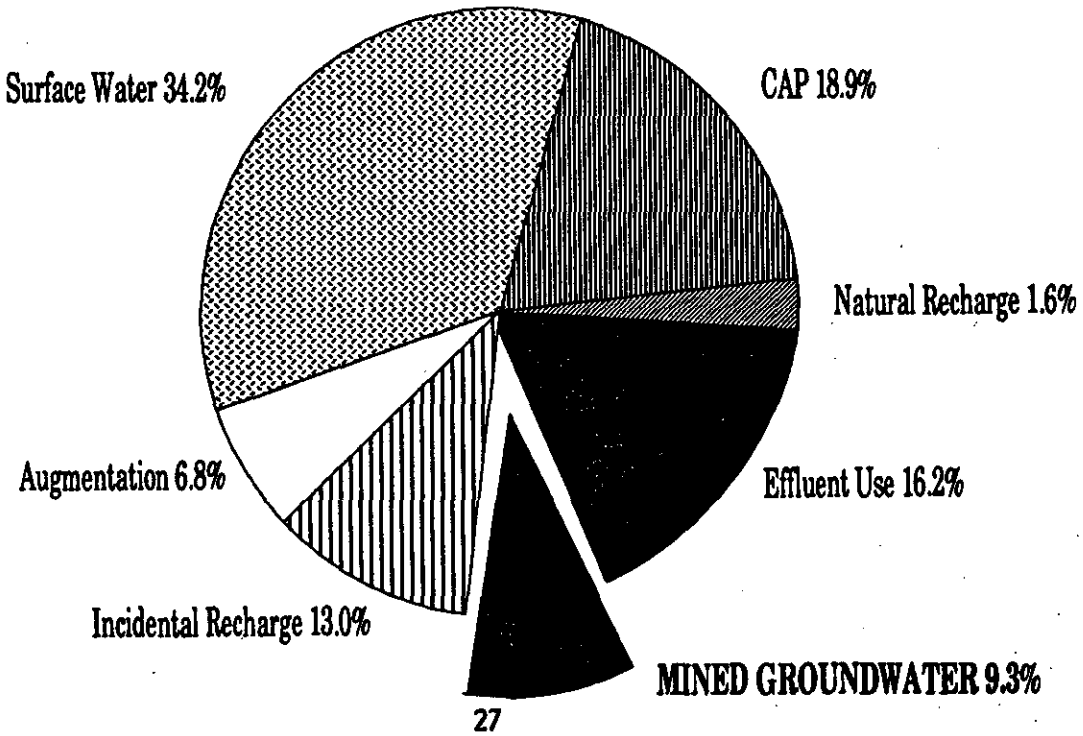


# FIGURE 2-F
# CHARACTERISTICS OF WATER SUPPLY
# PHOENIX AMA

## 1985




## 2025



## TABLE 2-B

## PROJECTED FUTURE CONDITIONS ASSUMING SECOND MANAGEMENT PLAN CONSERVATION

## TUCSON AMA

| | 1985 | 1990 | 1995 | 2000 | 2025 |
|---|---|---|---|---|---|
| POPULATION | 634,000 | 751,000 | 865,000 | 996,000 | 1,693,000 |
| IRRIGABLE ACRES | | | | | |
| Irrigation Grandfathered Rights | 53,300 | 45,000 | 40,000 | 28,000 | 21,000 |
| Tohono O'odham Indian Reservation | 1,000 | 1,000 | 11,300 | 11,300 | 11,300 |
| WATER DEMANDS (acre-feet) | | | | | |
| Municipal | 123,000 | 143,000 | 162,000 | 181,000 | 297,000 |
| Industrial | 57,000 | 69,000 | 73,000 | 76,000 | 98,000 |
| Agricultural | 122,000 | 113,000 | 142,000 | 120,000 | 99,000 |
| Other Demands | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 |
| Total Demands | 307,000 | 330,000 | 382,000 | 382,000 | 499,000 |
| WATER SUPPLIES (acre-feet) | | | | | |
| Renewable Groundwater | | | | | |
| Net Natural Recharge | 62,000 | 62,000 | 62,000 | 62,000 | 62,000 |
| Incidental Recharge | 59,000 | 58,000 | 59,000 | 44,000 | 52,000 |
| Central Arizona Project | 0 | 0 | 204,000 | 206,000 | 215,000 |
| Effluent | 7,000 | 10,000 | 19,000 | 41,000 | 70,000 |
| Other Augmentation | 0 | 0 | 0 | 10,000 | 10,000 |
| **Mined Groundwater (Overdraft)** | **179,000** | **200,000** | **38,000** | **19,000** | **90,000** |
| Total Supplies | 307,000 | 330,000 | 382,000 | 382,000 | 499,000 |

FIGURE 2-E

WATER DEMAND: BASE CONDITIONS AND PROJECTIONS
WITH AND WITHOUT SECOND MANAGEMENT PLAN CONSERVATION

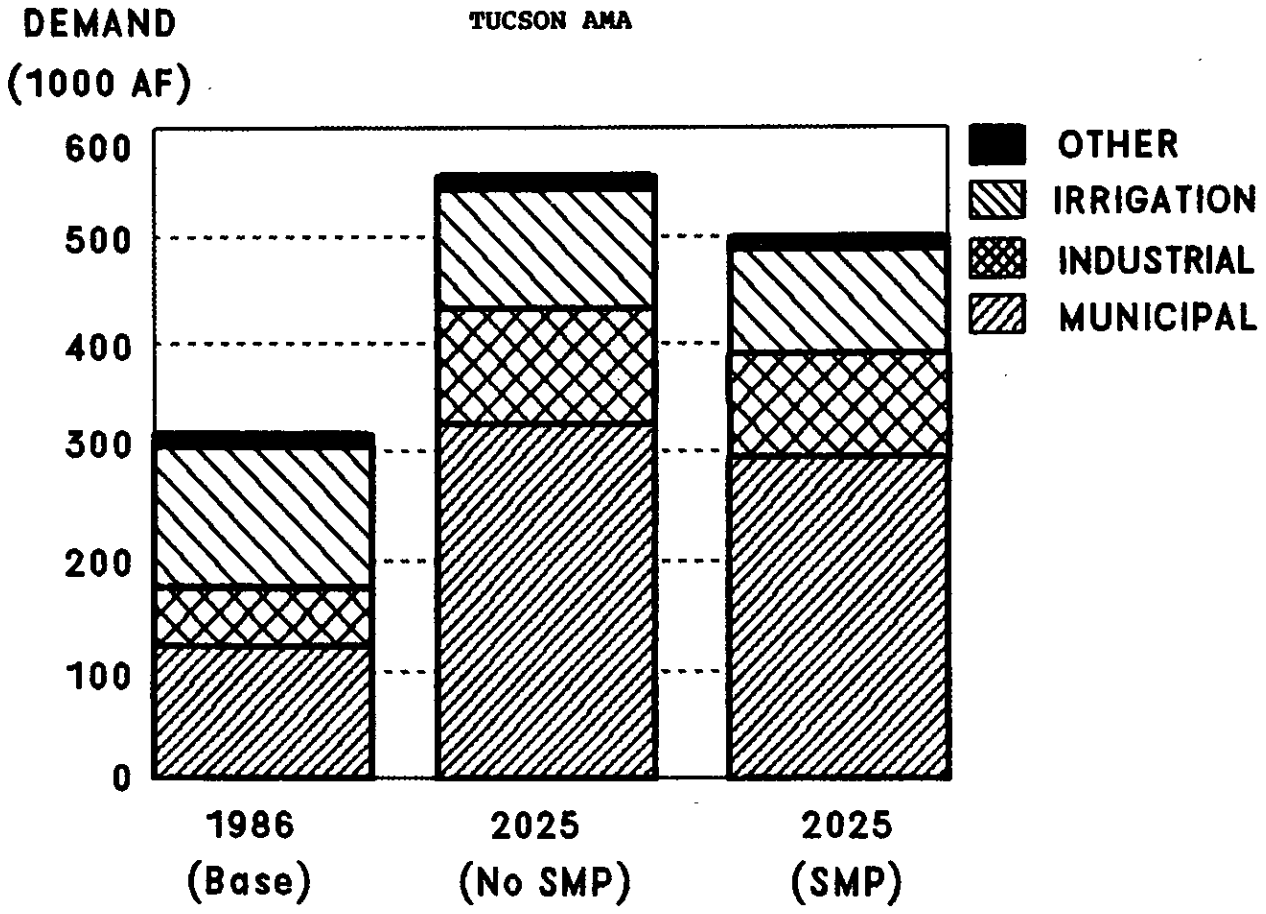
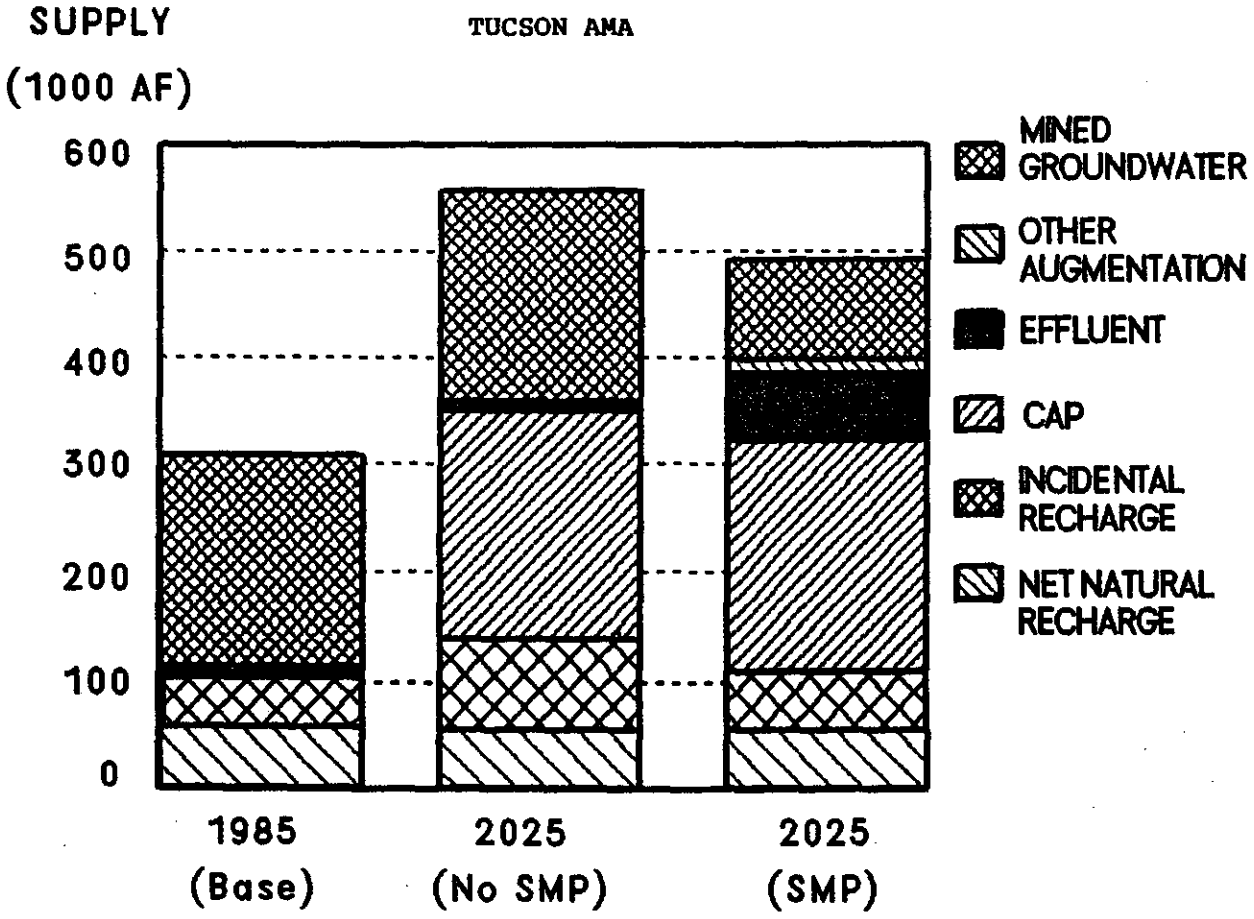


FIGURE 2-F

WATER SUPPLY: BASE CONDITIONS AND PROJECTIONS
WITH AND WITHOUT SECOND MANAGEMENT PROGRAMS

TUCSON AMA



Attachment C

Pinal Active Management Area

**TABLE II-1**

**PROJECTED WATER DEMAND and SUPPLY 1985-2025**
**UNDER BASELINE CONDITIONS [1]**

**- PINAL AMA -**

| | 1985 | 1990 | 2000 | 2025 |
|---|---|---|---|---|
| Population | 56,000 | 66,000 | 85,000 | 137,000 |
| Irrigable Acreage | | | | |
| Non-Indian | 225,000 | 276,000 | 264,000 | 234,000 |
| Indian | 15,000 | 35,000 | 42,000 | 42,000 |
| **WATER DEMANDS** (Acre-Feet) | | | | |
| Agricultural | | | | |
| Non-Indian | 980,000 | 960,000 | 918,000 | 814,000 |
| Indian | 65,000 | 152,000 | 198,000 | 198,000 |
| Municipal | 11,000 | 13,000 | 16,000 | 33,000 |
| Industrial | 22,000 | 25,000 | 33,000 | 53,000 |
| Transfers | 0 | 0 | 30,000 | 30,000 |
| Other Demands[2] | 41,000 | 178,000 | 145,000 | 133,000 |
| Total Demands | 1,119,000 | 1,328,000 | 1,340,000 | 1,261,000 |
| **WATER SUPPLIES** (Acre-Feet) | | | | |
| Groundwater | | | | |
| Net Natural Recharge | 26,000 | 26,000 | 26,000 | 26,000 |
| Incidental Recharge | 314,000 | 334,000 | 336,000 | 305,000 |
| CAP Water | | | | |
| Non-Indian | 0 | 521,000 | 409,000 | 271,000 |
| Indian | 0 | 75,000 | 170,000 | 170,000 |
| Other Surface Water | 182,000 | 182,000 | 182,000 | 172,000 |
| Effluent Use | 4,000 | 5,000 | 6,000 | 10,000 |
| Augmentation | 0 | 0 | 0 | 0 |
| **Mined Groundwater (Overdraft)** | **593,000** | **185,000** | **211,000** | **307,000** |
| Total Supplies | 1,119,000 | 1,328,000 | 1,340,000 | 1,261,000 |

[1] Baseline conditions assume that 80 percent of the eligible non-Indian acreage shown is irrigated under First Management Plan conservation requirements for the years 1985-2025.

[2] *Other Demands* include: 1) evaporation and seepage losses from canals, and 2) phreatophyte losses.

## TABLE II-2

## PROJECTED WATER DEMAND and SUPPLY 1985-2025
## ASSUMING SECOND MANAGEMENT PLAN CONSERVATION UNDER EXPECTED CONDITIONS [1]

### – PINAL AMA –

| | *1985* | 1990 | 2000 | 2025 |
|---|---|---|---|---|
| Population | *56,000* | 66,000 | 85,000 | 137,000 |
| Irrigable Acreage | | | | |
| Non-Indian | *225,000* | 276,000 | 264,000 | 234,000 |
| Indian | *15,000* | 35,000 | 42,000 | 42,000 |
| **WATER DEMANDS** (Acre-Feet) | | | | |
| Agricultural | | | | |
| Non-Indian | *980,000* | 960,000 | 692,000 | 613,000 |
| Indian | *65,000* | 152,000 | 198,000 | 198,000 |
| Municipal | *11,000* | 13,000 | 15,000 | 25,000 |
| Industrial | *22,000* | 25,000 | 33,000 | 53,000 |
| Transfers | *0* | 0 | 30,000 | 30,000 |
| Other Demands[2] | *41,000* | 178,000 | 117,000 | 107,000 |
| Total Demands | *1,119,000* | 1,328,000 | 1,085,000 | 1,026,000 |
| **WATER SUPPLIES** (Acre-Feet) | | | | |
| Groundwater | | | | |
| Net Natural Recharge | *26,000* | 26,000 | 26,000 | 26,000 |
| Incidental Recharge | *314,000* | 334,000 | 116,000 | 107,000 |
| CAP Water | | | | |
| Non-Indian | *0* | 521,000 | 409,000 | 271,000 |
| Indian | *0* | 75,000 | 170,000 | 170,000 |
| Other Surface Water | *182,000* | 182,000 | 182,000 | 172,000 |
| Effluent Use | *4,000* | 5,000 | 6,000 | 10,000 |
| Augmentation | *0* | 0 | 0 | 0 |
| **Mined Groundwater (Overdraft)** | *593,000* | 185,000 | 176,000 | 270,000 |
| Total Supplies | *1,119,000* | 1,328,000 | 1,085,000 | 1,026,000 |

[1] Pinal AMA baseline conditions are assumed for 1985. Expected irrigated acreage conditions assume that 80 percent of the eligible non-Indian acreage shown is irrigated for the years 1990-2025.

[2] *Other Demands* include: 1) evaporation and seepage losses from canals, and 2) phreatophyte losses.