WATER AND PEOPLE IN NEW MEXICO

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Water has been a major factor in the area now known as New Mexico as evidenced by the earliest historical records and by the pattern of population settlements. The first settlements were along the major streams and their headwaters. The Rio Grande, Pecos, and San Juan rivers are the major areas where pueblo ruins and other remnants of early settlements are found. Archeological studies indicate that the earliest pueblos in New Mexico were in the Chaco Canyon in the northwestern part of the state. Stone diversion dams have been found there which evidence a considerable knowledge of irrigation. Tree ring studies at the Pueblo Bonito on the Chaco River have established its construction date at about 919 AD, nearly six hundred years before Columbus discovered America.

From this early period, water has been sought for and fought for. It is said that there have been more lives lost in this area over water than over women. However, no statistical evidence is available to support this claim. As long as the state's population did not grow rapidly and the economy was primarily livestock, with limited irrigation for food and forage production, the water problem grew gradually and did not attract particular attention except as between individuals and very localized communities.

With the advent of large scale irrigation projects along the rivers, the discovery and development of ground water supplies, the intensification of our industrial and agricultural production, and the rapid growth of our population, water has become more important to New Mexico. Just as the available water supply has been a major factor in the molding of our economy to date, it will play a more important role in the development in years immediately ahead and in the more distant future.

In order to point up this inter-relationship between water and people, I should like to cover four points in this paper: (1) average annual supply of water, (2) the average annual disappearance of water, (3) the population from 1850 to 1960 and projections to 2000, (4) the projected needs for water and some of the water problems which are of growing importance due to increasing population growth and increasing demands for water.

Figure 1 shows the drainage basins of New Mexico and the volume of flow in each. The arrows at the edge of this map where the rivers enter and leave the state indicate the volumes of water entering and leaving on each river.

Figure 2 shows the 1960 census population for each county with the percentage change since 1950. The five counties with the large population centers of Albuquerque and Las Cruces on the Rio Grande, Farmington on the San Juan, and Roswell, Carlsbad and Artesia on the Pecos account for about

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one-half the population of New Mexico. These same five counties according to population estimates may be the residence of nearly 60 percent of the states population over 2,000,000 by 1980, or a projected increase of about 750,000 people.

A comparison of Figure 1 with Figure 2 shows that there are large centers of populations dependent on ground water only, and where there is little possibility for that supply being replenished or supplemented by stream flow. The more important of these centers are Hobbs, Portales, Clovis and Deming.

Average Annual Supply of Water

The annual supply of water of about 92,000,000 acre feet comes from precipitation and stream inflow. Ground water is included here but should be considered differently than the annual supply.

Precipitation - An average annual precipitation of 13.88 inches falls on 77,866,240 acres of land, thus an annual average of approximately 90,000,000 acre feet of water falls on the state.

Stream inflow - There is an average annual inflow from streams entering the state, most of which enter through the San Juan and the Rio Grande of about 2,000,000 acre feet.

Ground water - Ground water supplies most of the cities and towns of the state and water for full irrigation for 443,020 acres and as a supplement to surface water for an additional 144,700 acres 2/. Much of this water enters the ground stream flow and from precipitation which perculates from annual precipitation. The balance comes from stored ground water which has been stored for centuries in the ground. No definite figures are available on the amounts from each, so no total will be added to the annual supply.

The average supply for the state then is 90,000,000 acre feet precipitation and 2,000,000 acre feet from stream flow or a total of about 92,000,000 acre feet.

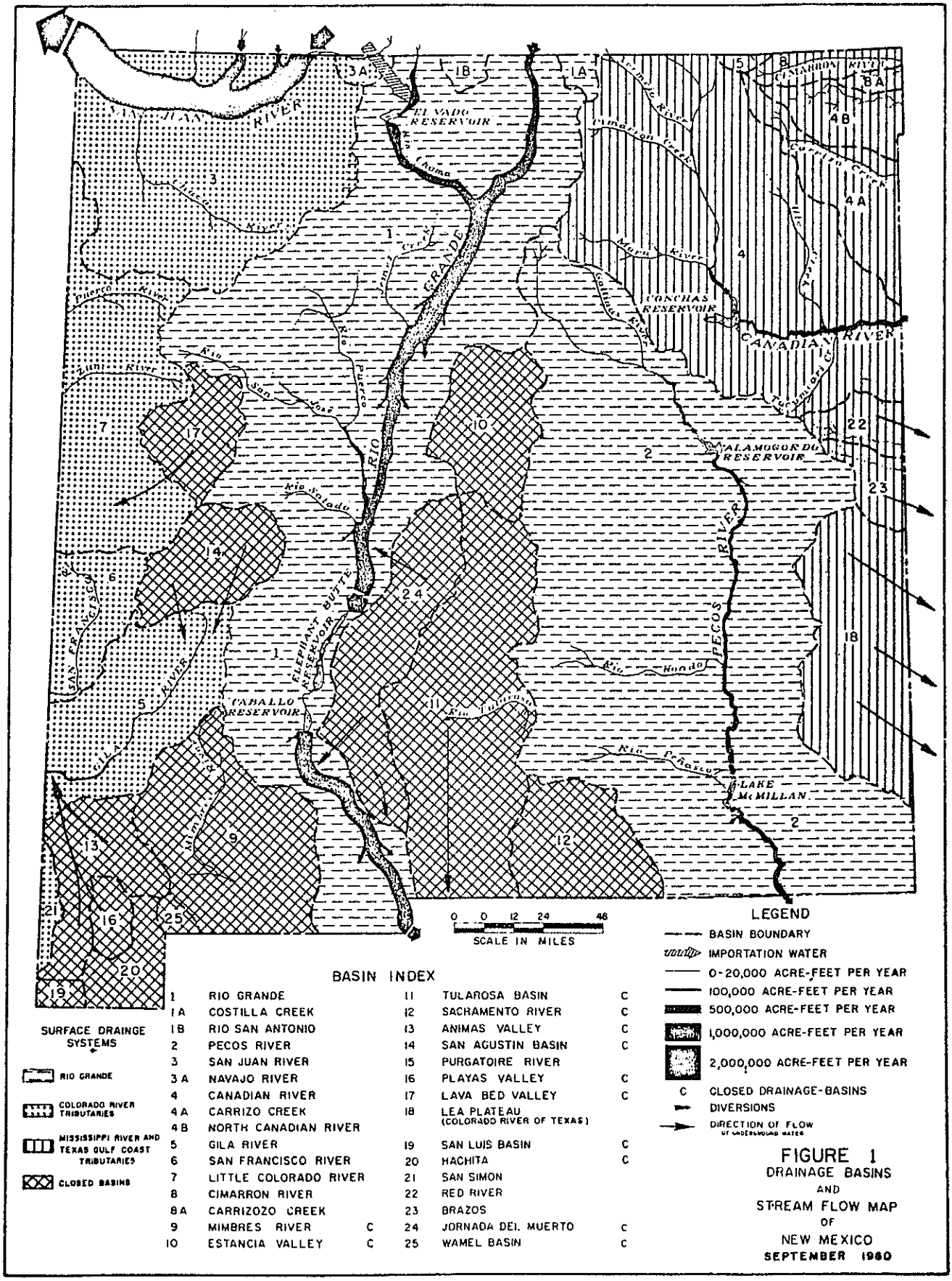
Uses of Water

The following accounts for the major uses of water in New Mexico.

Municipal, Industrial and Domestic Use - It is estimated that the 220,000 people in Bernallio County in 1960 required the diversion of 53,000 acre feet of water. 3/ This is at the rate of 214 gallons of water per capita per day. Other less industrialized communities and the farms would use no more than 150 gallons per day. On the average of 160 gallons per day the

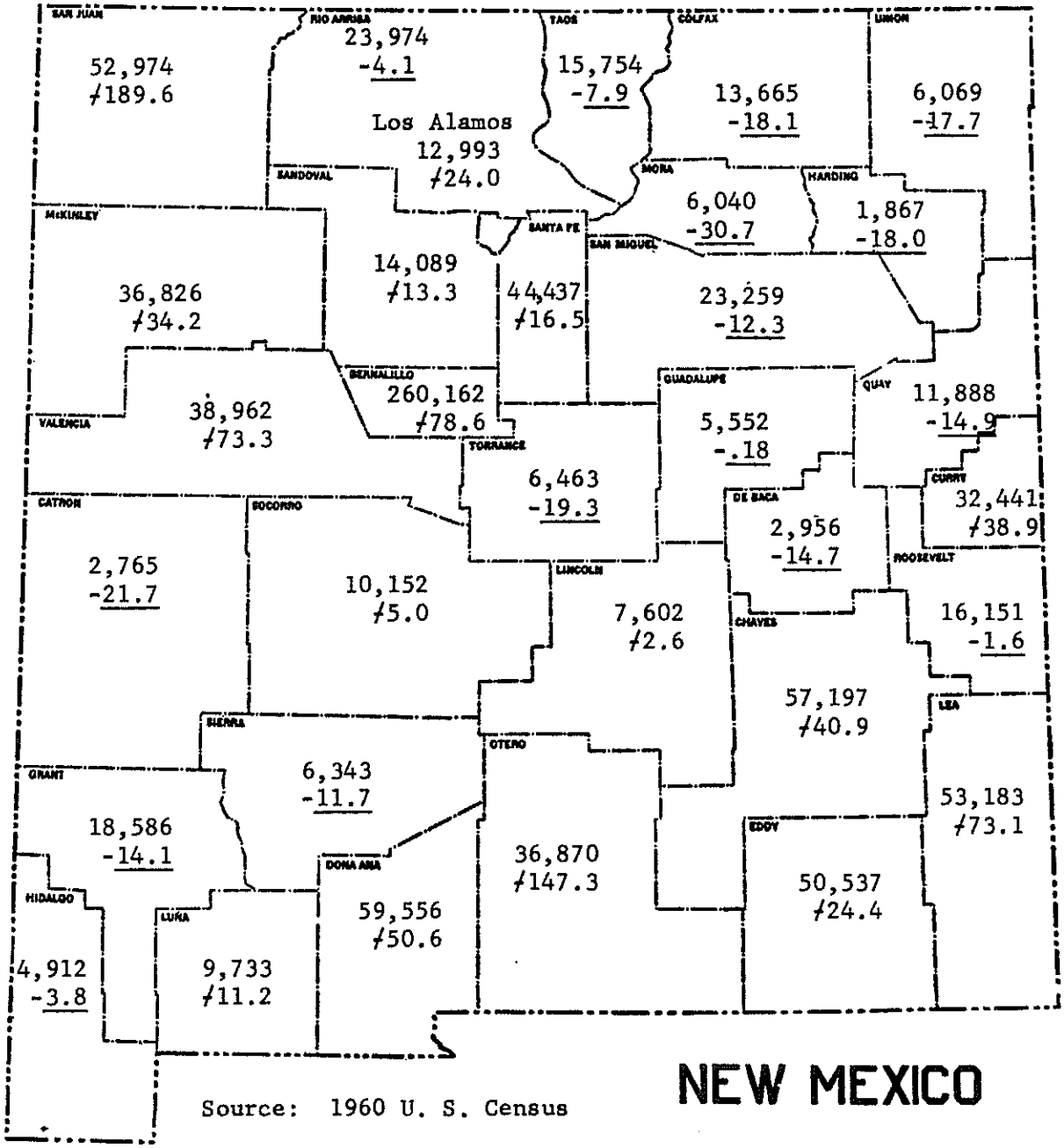
2/ State Engineers Office, New Mexico Statement to the U. S. Senate Select Committee on National Resources - September 1959.

3/ Ibid -- page 24.



Source: State Engineer's Office, Santa Fe, New Mexico

Figure 1. Drainage Basins and Stream Flow Map of New Mexico



Source: 1960 U. S. Census

Figure 2. Population by Counties, 1960 Census, With Percentage Change From 1950.

1960 population of 951,000 people would require a diversion of about 170,000 acre feet for all uses during the year.

Irrigation - An estimated 873,000 acres of land are irrigated in New Mexico. Assuming a diversion of 3 acre feet per acre, there would be 2,619,000 acre feet required.

Other uses - Grass lands, forest lands, ground water basin perculation and the necessary transpiration from normal growths of beneficial grasses, trees, and crops may make use of ½ of the balance 87,000,000 acre feet of the available water or about 43,000,000 acre feet.

Losses - Losses through evaporation from land and water surfaces and those uses by non-beneficial plants account for 43,000,000 acre feet or more. An estimated 70% of the precipitation falling on the state during the summer months may be lost. A report based on 1955 census data, gives an estimated 942,000 acre feet of water lost from 155,000 square miles of surface water (lakes, reservoirs and streams) in New Mexico.

Stream outflow - An annual average of 2,200,000 acre feet of water flow from the state each year. The San Juan, Rio Grande, Pecos, Canadian and Gila rivers account for the majority of this flow.

These disappearances may be summarized as follows:

Uses or Disappearances	Acre feet
Municipal, Industrial, and Residential diversions	170,000
Irrigation on 860,000 acres of land	2,630,000
Other Uses to produce, trees and grass and to supply ground water	43,000,000
Losses - evaporation, transpiration, and use by non-economic plants	44,000,000
Stream Outflow from state	2,200,000
State Total	92,000,000

Opportunities To Adjust Our Available Water Supplies

Even though water is relatively short in New Mexico, there are many opportunities for adjusting the available water to the needs of the economy and the people of the state.

The first opportunity is to develop the water which is allocated to the state by the river compacts. There are 840,000 acre feet of water allocated to New Mexico by the Colorado River Compact. About 92,000 acre feet are now in use. The balance of 748,000 is now in the process of development by the construction of the Navajo Dam and the proposed Navajo and Hammond irrigation

projects, the San Juan - Chama diversion and other projects. The San Juan-Chama diversion proposes to divert from 110,000 to possibly 220,000 acre feet into the Rio Grande Watershed for municipal, industrial recreational and agricultural uses.

Also about 200,000 acre feet are allocated to New Mexico under the Canadian River Compact. The State Legislature has authorized the use of $5,000,000 for the construction of the Canadian River Dam at Logan. This would be the first step in making this water available to our industries.

The second opportunity is to continue work toward conserving the quantity and quality of the water we now have available. The control of seepage and evaporation losses offer large opportunities. For example, over 150,000 acre feet of water per year on the average evaporates from the surface of Elephant Butte Reservoir and over 900,000 acre feet from all the water surfaces in the state. Losses to water-loving plants such as Salt Cedar have increased rapidly in the past 30 years. It is variously estimated that 500,000 to 850,000 acre feet per year are lost to these plants. Work of channelizing the Rio Grande thru the silt delta in the upper reaches of the Elephant Butte Reservoir and the river channel below San Marcelle has made an estimated savings of 165,000 acre feet of water and still more can be saved. This saves water by keeping it moving through the silt delta rather than having it spread out and evaporate and it also keeps water away from thousands of acres of Salt Cedar which use up to 6 acre feet per acre of those plants.

The third opportunity is the conversion of saline ground water to fresh water by processing it through a saline water conversion plant, such as the one approved for construction at Roswell. This is one of the 5 experimental plants authorized by Congress. No estimates can be made on the volume, but it is assumed that the major use of such water will be for municipal and industrial purposes because of the relatively high cost per 1000 gallons converted.

A fourth opportunity is to conserve our present water in all its uses. Water used for irrigation may be used more efficiently than now by more careful uses on the land, by use of lined ditches, and accurately applied amounts of water. Use on the lowest value crops may be eliminated. Losses of water through use in evaporative coolers in homes and in offices may be eliminated. Re-use of water in industrial plants can be increased. Only low water using industries should be established in New Mexico. Industrial and other contaminations of water must be reduced.

The final opportunity, as municipal, industrial and recreational needs increase, it is always possible for these higher value uses to secure additional water through the normal functioning of our economic system. When a housing development or an industry needs land it goes out into the normal land market and purchases the desired amount at the normal existing price. Water for such developments can be purchased in the same manner as land and there are relatively large quantities of water available.

A recent New Mexico study developed the following estimated values for water. These values were based on what an acre foot of water would yield in

value added when put to various uses.

	Value per acre foot
Municipal & industrial	$3,304
Recreational	198
Agricultural	18

The higher values will, of course, apply only to limited quantities. For example, Albuquerque and vicinity now diverts 53,000 acre feet of water per year. How much would the people there be willing to pay now for an additional 53,000 acre feet? Not very much, until there is an immediate use but, as the demand for more water develops the city will make the necessary expenditures to supply the needs and the people can and will pay the necessary rate to supply their needs.

As indicated in the population tables below an increase of over 1.3 million in our population from 951,000 in 1960 to 2,256,000 will require about 340,000 additional acre feet of water. The estimated use for irrigation assuming 3 acre feet per acre on 850,000 acres of irrigated land would be 2,550,000 acre feet. Thus the water required for an addition of 1.3 million people would require a transfer of about 14 percent of that presently used by agriculture. However, a transfer of this amount is not required since we have the 200,000 acre feet of water in the Canadian River and the 600,000 acre feet in the San Juan yet to be put to use. If only ½ of this 800,000 were used for municipal and industrial uses, the 1,300,000 people could be added to our present population without any change in our present water uses. Of course, the problem of having the water available where the people are will cause certain shifts in the present uses in most areas of the state, even with these amounts of additional water available.

The following shows the estimated population, use per day increases, and the approximate acre feet of water required for diversion to meet these needs:

Year	New Mexico population	Estimated water diversion per person per day (gallons)	Estimated diversion required (acre feet)
1950	681,187	147	112,000
1960	951,023 *	160	170,000
1970	1,583,000	185	328,000
1980	2,256,000	200	505,000

* U. S. Census

The New Mexico Problem

The problem in New Mexico is for all persons interested in water development, conservation, and use to understand the above conditions of supply and disappearance. It is necessary for all to understnad that much of the water now in use is allocated to that use by the laws of prior appropriation and beneficial use by the State Constitution and by many court decisions.

Considering these three points it is then necessary to determine the answers to each of these three questions. One, how can the water supply be increased, or two, how can the present use be made more efficient, or three, how can the water needed for a particular use be transferred from its present use?

All three of these questions will receive much more consideration as the demand for water increases with the expanding population. The volume of water for municipal and industrial use is so great that needed water for these purposes can attract funds to either develop water sources or purchase water from present uses, especially from agriculture. The volume of water needed for recreation is not large relative to that used in irrigated agriculture. Also the value of water for recreation is roughly 10 times the value for agriculture. This water can be secured by investments in new sources or by attracting it through our present economy by purcahse from agriculture by offering the necessary price to secure the needed water.

The mechanisms by which municipal and industrial developments secure the needed water is well developed. These groups have sources of funds and can purchase or develop the needed water. Recreation may have to arrange to have its demands for water expressed more directly by offers to develop or purchase its needs. This could be effectively implemented if the many thousands of recreational users of water were organized in such a way that each user would be paid something for his use privilege rather than depending entirely from public funds. Disneyland is an example of a recreational enterprise paid for entirely by use payments. Small payments for camping, boating, and picnicking would make large amounts of money available. Recreation probably should pay something for certain uses of water just as does irrigation, municipal and industrial uses.

The increasing population in New Mexico will cause each citizen of the state to be more concerned about the economical use of water in all its uses. This conference and the discussion here today is intended to stimulate thinking regarding the availability of water for each use.