

AN ASSESSMENT OF NEW MEXICO
WATER RESOURCES

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The New Mexico Water Resources Assessment for Planning Purposes was released by the Bureau of Reclamation Southwest Region and the State of New Mexico in November 1976. The objectives of these studies were several: To inventory the water resources and other natural resources that require water for their development; to develop projections of the future distribution of population and economic activities, whether the State's future growth is high, medium, or low; and to determine methods to meet water needs with management of existing water rights, interstate compact agreements, and court decrees, given these projections. A further objective was to analyze the possibilities of augmenting the water supply through water importation, weather modification, desalting, or some other means.

The assessment report lists 24 agencies that cooperated in providing data and assistance in the investigations. We want to especially acknowledge our gratitude to the New Mexico State Engineer Office and to the New Mexico Interstate Stream Commission who provided extensive data, technical expertise, and review. The Governor's office assigned the responsibility for the comprehensive planning of water and related land resources to these two agencies.

In the first phase of the planning work, the State Engineer Office, with the cooperation of the Interstate Stream Commission, completed an inventory of the water resources of New Mexico and the current uses of those supplies for all purposes.

The second phase of the program included the development of projections for the distribution of population and economic activities in the State.

The third phase, involving water and related land resources, determined the manner in which water requirements for the projected distribution of population and economic activities might be met with supplies available to the State under existing interstate agreements and court decrees.

The fourth and last phase in the program determined the prospects for importation of water, for weather modification, and for desalination of waters to maintain present uses and to furnish projected requirements that could not be met with presently available supplies.

The 1976 Assessment includes a brief history of New Mexico. It was the 47th state admitted to the Union, attaining statehood January 6, 1912. From the Sandia culture of 25,000 years ago to the pueblos and reservations of today; from Onate's use of Spanish Saints for village names to the 1821 opening of the Santa Fe Trail; New Mexico has one of the richest histories of any State. It is quite a transition from that period to the base year 1980 with its future population, economic, and water need projections.

In 1967, the Southwest Region of the Bureau of Reclamation initiated studies on the Rio Grande and Pecos River Basins to update water supply and use information. The goal of these basin studies was to develop conservation and optimum use measures for the limited water supplies. State officials requested these studies be combined and focused toward a water resource development approach for the State. Through public meetings and working in conjunction with the 24 agencies mentioned earlier, the Assessment report presents possible alternatives and their combinations to meet present water requirements and future water needs rather than a formal State water plan.

Most of the information presented in the Assessment reflects conditions as they were in 1974. The water requirements were based on 1970 usage statistics, except for irrigation which was based on 1969 usage. For purposes of evaluation, statistics contained in the report are nearly 10 years old. The water requirements for the future are based on projected 1980, 2000, and 2020 population levels. The projections were predicated on the premise that, should the population not attain the growth level at exactly the year predicted, it would eventually reach that level at some future date.

The planning process concepts for water utilization and management began basically with the assumption that existing supplies were inadequate to meet all of the projected requirements. Therefore, a systematic framework was developed for managing the existing water supply to best meet projected needs. The possibilities for augmentation included utilizing the existing supply within the State and importation of surplus water from outside the State. Planning for augmentation and development of projects or facilities takes many years and could not alleviate problems existing today, although they can be considered for long-range planning.

This is a brief historical background of the beginning and development of the New Mexico Water Resources Assessment. The purpose of this address is to share the key findings, problems, and issues documented in the Assessment as they relate to the five topics of Water and Agriculture; Saline Water; Energy and Water, Water Rights; and National Water Policy, which are under consideration in the course of this conference.

Water and Agriculture

Water used for irrigation constitutes New Mexico's largest use, amounting to more than 80 percent of total withdrawals for all purposes. Land in the State receives irrigation water through systems ranging from simple rock and brush structures and hand-dug ditches, to complex systems of permanent concrete diversion dams and storage reservoirs. In 1969, about 51 percent of the water for irrigation was obtained from surface sources and 49 percent was pumped from wells. Irrigated agricultural and grazing lands comprise about 85 percent of the State area and, taking into account reservoir evaporation, deplete nearly 90 percent of the beneficially used water supply.

The role of agriculture in the economy of the State is decreasing, but in relation to the use of the natural resources of land and water, agriculture is of major importance. Significant changes have taken place in the structure of the economy during the last quarter century. The uranium and petroleum industries, along with other expanded mining operations, added to a tremendous economic boom for the State beginning in the 1940's. However, agriculture's contribution to the gross State product has remained about the same.

Major components of the agricultural enterprise are livestock and livestock products. Cotton lint and cottonseed have become among the most important cash crops in the State. Other important livestock related crops are hay, sorghum grains, wheat, and broomcorn. Additional cash crops of significance in the State are chilies, onions, pecans, and apples. On the average, 90 percent or more of the agricultural cash receipts come from the sale of crops from irrigated lands.

The largest land use category in the State is for livestock grazing. This area amounts to almost 64 million acres. Irrigated croplands amount to slightly over a million acres, and dryland farming areas total nearly 1-1/2 million acres. In many areas of the State the water table has lowered as a result of large-scale pumping, mainly for irrigation. Extreme declines in water levels have been experienced in many areas, and surface flows have been diminished in areas where surface and ground supplies are interconnected. Some irrigated lands are being abandoned because ground water storage is inadequate to supply the continuing demands. Drilling deeper wells and locating new wells further apart to spread the mining effect have increased pumping costs.

The problems of ground water mining are becoming especially acute in the Pecos River Basin and Texas-Gulf Basin, an area which begins in the extreme southeastern part of the State. Heavy pumping of water for irrigation has been developed in both areas. There is essentially no recharge in the Texas-Gulf Basin, and serious encroachment of saline water is occurring in the Pecos Basin and in the Roswell Artesian Basin. In some areas around Portales, the economically usable ground water for irrigation purposes has been essentially exhausted.

An issue related to irrigation and agriculture is water used by a broad grouping of plants called phreatophytes consisting of water-consuming grasses, shrubs, and trees. The valid water right holders are prevented from using the water taken by these plants. In New Mexico, the highest consumer of water among this group is saltcedar. Phreatophytes cause accumulation of stream channel sediment and block river channels increasing flood hazards. Saltcedars also prevent access to water by livestock and for recreational use.

Water erosion and sedimentation are also serious problems in New Mexico. Types of erosion present in the State are sheet, rill, streambank, and gully. The most serious in New Mexico is gully erosion which consists of the progressive widening, deepening, and extending of watercourses. This carries sediment which clogs streams, diversion works, and irrigation systems.

Regarding agricultural water as a future issue, the Assessment incorporated several assumptions. The projected irrigation requirement estimates were based on the assumption that all surface water presently used and committed to irrigation, including authorized Federal projects, would remain in irrigation. It was also assumed that available ground water supplies, in areas where possible, would be used to expand irrigated agriculture. It was not expected or assumed that the estimated level could be sustained without augmentation if all projected needs were to be met. It was estimated that an increase in irrigated acreage over that of 1969 could take place in 15 counties. However, many of these areas would be short of available water to serve the total developed area by year 2000 or 2020. Reduction of irrigation would probably occur unless replacement water became available from an outside source.

One of the major assumptions used in the study was that increased needs for municipal, industrial, and mining, uses would be met by retirement of irrigated agriculture. Fundamental to this assumption is the prior assumption that irrigation water produces less cash return than an equal amount of water used in manufacturing or mining. Therefore, it could be purchased and transferred to such a higher economic use. Drying up large acreages of irrigated land to furnish water for municipal, industrial, or mining purposes could have an adverse economic and environmental impact on a large number of people. For this reason, the Assessment stressed the importance of investigating and developing methods of augmenting the State's usable water supply.

Saline Water

The use of water for nearly every purpose results in some degree of deterioration. Every flowing stream at some point is affected by increasing salinity levels. Irrigation, municipal, and industrial use can all degrade the water quality.

The extent and severity of the salt problem in irrigated areas depends on several factors besides the quality of the water supply. It depends on the nature and composition of the soil and subsoil and topography of the land. The amount of water used, method of application, and kind of crop grown are factors. The severity also depends on climatic conditions, ground water, and surface water drainage.

Historically, the Pecos River Basin has carried a heavy load of salts, with certain reaches adding tremendously to the salt concentrations. As long ago as 1942, the National Resources Planning Board summarized the salinity conditions of the Pecos River Basin as being particularly acute. In most areas being mined for ground water, the salinity encroachment is becoming a problem of increasing proportions.

It was pointed out in the Assessment that certain basin areas possessed moderate to severe salinity problems. These areas are quite widespread encompassing the south-central and eastern portions of New Mexico. These sections of the State are generally experiencing a declining water table, and saline waters are encroaching into the freshwater portions of the aquifers. In some widespread areas, manmade and natural discharges not only are now exceeding the recharge, but have been for many years. As present conditions of use and recharge continue, the decline in available freshwater threatens irrigation and municipal supplies.

Sources of water not presently being used are the large bodies of saline ground water in the Tularosa and Salt Basins in south-central New Mexico. There is an estimated 30 million acre-feet of slightly saline water within the unconsolidated deposits in the Tularosa Basin. The quantities of moderately and very saline ground water are of the same order of magnitude.

As demands for water increase, the shallower freshwater aquifers in most areas will not be able to supply the demand. It may become necessary to use saline water. As desalting processes become more advanced and more economical, the saline ground water may be recognized as a valuable part of New Mexico's total water resources.

Energy and Water

Power is a major industry and one of the fastest growing of all industries within the State. There are several pump storage hydropower sites in the Rio Grande and Rio Chama Basins, which have potential. Some sites have been studied in the past and are regarded as having potential for development, considering the escalating cost of fossil fuels required for thermal power generation.

In the 1950's, the potential for pumped storage development at Elephant Butte Reservoir and at a number of alternative sites in that area were studied.

The Bureau of Reclamation operates the Elephant Butte powerplant, a feature of the Rio Grande Project. The plant has a nameplate rating of 24,300 kilowatts and has been producing electric power since November 1940.

Generally, the Nation's power production doubles every 10 years. However, between 1950 and 1965, the installed capacity of the State's electric plants increased 600 percent and the amount of power generated increased 800 percent. The largest gain has been the development of the Four Corners plant in San Juan County. Across the State there are a number of investor-owned thermoelectric generation plants powered by fossil fuels, the newer of which are in the Four Corners area. At present, no nuclear-powered generating plants are located in the State. The Tularosa Basin area has been viewed with interest for nuclear power development due to its large quantity of saline water, less densely populated area, and fewer environmental problems.

Based on past production, it was projected that New Mexico's power generation will increase 15 times during the 50-year period 1970 to 2020. The two most important factors in estimating future power production are supplies of water and fuel. The estimated water depletion for power in 1970 was 28,600 acre-feet. The State has large known coal reserves but, where the coal is abundant, there is a limited amount of unused or uncommitted surface water.

Although the actual rate of increase between 1950 and 1965 was over 600 percent, the estimated annual rate of increase in power production for both the State and Nation after 1980 is 4 to 5 percent. By 2020, the projected plant capacity for New Mexico was estimated to be almost 36,000 megawatts. The Assessment projected that by 2020, 65 percent of the State's power generation would come from use of nuclear power.

The generation of power by geothermal means is a future possibility. There are known potential areas within the State, for example, the Rio Grande Rift. If this generation process is used, it could reduce the water requirements for cooling.

Another future energy resource of New Mexico is solar power. Studies and experiments are underway to determine solar energy potentials and practical applications. An additional energy source with definite possibilities is wind energy. Research is oriented toward obtaining detailed information about the energy output, maintenance problems, and operational characteristics of small wind-driven generating systems.

Clayton, New Mexico, is the home of the first in a promising line of wind machines, built jointly by the Department of Energy and National Aeronautics and Space Administration. The 200-kilowatt Clayton generator began operating early this year.

Recent advances in wind turbines could make wind energy competitive with expensive petroleum. The advance of this technology could also reduce the water requirement for cooling and free it for other uses.

Water Rights

New Mexico's water laws are based on the doctrine of prior appropriation as set forth in Article XVI of the State Constitution. Administration is vested in the State Engineer. Ground water is subject to regulation within the same general scheme of law applying to surface waters.

New Mexico is under commitment to eight interstate compacts which affect development and use of water in the State. Where there is a close relationship between occurrence of ground water and the flow of surface streams, coordinated administration is required to assure that valid rights will not be impaired.

Water in New Mexico is a commodity or property right owned by the people, and its use is closely governed by law. A change in use, such as retirement of irrigation water rights, was discussed in the Assessment as one plausible method to secure water for municipal and industrial use. Currently, there is a growing trend of transfers from agricultural use to municipal and industrial use. Under the State law, the point of diversion and place and purpose of use of a water right can be changed upon issuance of a permit from the State Engineer.

The regulations governing the use of ground water are also furnished by the State Engineer. These are quite detailed and are quoted in the Assessment.

New Mexico receives water from upstream states, mostly from Colorado, by way of the San Juan River and Rio Grande. Commitments to downstream states under existing interstate compacts and court decrees require apportionment of water to those states. When New Mexico has fully developed its surface water resources, within the allowances of interstate compacts and court decrees, river outflow will approximate river inflow, and the State will be using only the amount of streamflow produced within the State.

Other legalities affecting water use in New Mexico are the three treaties between the United States and Mexico. These treaties impact on the State in its use of Rio Grande water and as a Colorado River Basin State.

Except for small quantities of available undeveloped surface water, the surface supply is fully appropriated. These surface waters are being used beneficially within the terms of international treaties, interstate compacts, court decrees, and State laws.

New Mexico's water laws have a long history of controversy. At the time the Assessment was written, there were over 100 water law adjudications by the New Mexico Supreme Court. Some of the decisions that have far-reaching effects were discussed in the study. These include the Hope Decree, Arizona vs. California, Colorado River Basin Project, San Juan River Decree, Sugarite or Chico Rico River Decree, and Globe Equity or the Gila Decree.

Four important cases before the Federal District Court which were pending at the time the Assessment was prepared, and which are still pending, regard the water rights of the Pueblo Indians. Each of the four suits, each dealing with a specific stream, is requesting court determination of the water rights of all users, both Indian and non-Indian.

National Water Policy

Secretary of the Interior, Cecil D. Andrus, in a news release last month, discussed the key role of the States in reforming national water policies. Secretary Andrus told the National Conference of State Legislatures that State and Federal water policies are so intertwined that they must be jointly developed if they were to be effective at all. The Secretary reported that there is an urgent need for a national policy which will inventory water resources, calculate future demands, establish priorities for water project construction or improvement, and better coordinate the many water programs that now exist. One primary problem concerns the need to repair and improve severely overburdened domestic water systems.

Regarding the critical ground water situations, he observed that certain States have acted to provide for local control, but others were in dire need of an effective ground water management act. This responsibility is primarily the State's and it urgently needs action. Secretary Andrus told the State Legislatures that they were the people who could get the job done.

The Secretary suggested that consideration should be given to having State Governments pay a portion of the cost of proposed water projects. He believes that this would give each State the incentive to establish priorities for projects that have merit. Priorities are needed for the approximately \$34 billion backlog of water projects that have been authorized, but are not yet funded by the Federal Government.

Noting the escalating costs and environmental implications of water project construction, he remarked that the States must start looking at alternatives, such as improving the systems they already have and at conservation practices. Less wasteful water policies can save us both the water and the billions of dollars required for additional projects.

In applying the Secretary's remarks to the State of New Mexico, it is apparent that this State, through its State Planning Office and New Mexico Interstate Stream Commission and State Engineer Office, has already accomplished the majority of items discussed in the news release. You have inventoried your water resources, calculated future demands, and prioritized construction programs. You have instituted local and State control of the surface and ground water. You are evaluating conservation and improvement of existing systems, as evidenced by the New Mexico Water Resources Assessment, and by this conference itself.

Conclusion

In summarizing the Assessment, it is evident that one of the most apparent features of State's water supply is the unevenness of its distribution. Water problems and needs differ from basin to basin due to differences of climate, source of supplies, and distribution of population.

New Mexico is a water-deficient area regarding availability of freshwater to maintain present irrigated agriculture and to meet other projected needs. Since the State water supply is limited, development and management should be planned accordingly. The total quantity of water physically available to the State is adequate to sustain only a certain level of economic growth through the time frames of the Assessment, but there is not enough water to meet all of the projected requirements.

Some problems confronting New Mexico are urban water quality, mining of ground water, rural water quantity and quality, infestations of phreatophytes, sedimentation and erosion, flooding, and ground and surface water salinity.

In the interest of developing an augmented water supply, the Assessment briefly presented four alternatives: importation, weather modification, desalination, and geothermal. Further consideration was recommended for nuclear and solar power development.

The Assessment does not treat in detail such problems as air pollution, solid waste disposal, or the social, psychological, or environmental effects of high population density.

The authors of this report have neither the authority nor the desire to set the State's policy regarding population or economic growth. Without advocating any one of the projections, the report does provide an opportunity to look at a wide range of possibilities.

All planning and research which could result in a solution to New Mexico's water supply problems should be carried forward at every opportunity. This presentation on the New Mexico Water Resources Assessment for Planning Purposes has reviewed the problems and issues facing the State. Hopefully, this will provide substantial background for consideration in the workshop discussions as this conference continues.