Ground Water: Its Importance to the Economy of New Mexico

By

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It goes without saying that water and its availability are one of the principal factors in the expanding economy of New Mexico. However, it is not so well recognized or known that ground water, as well as surface water, plays a major role in the economy. Also, in the long run, the most efficient use of our water resources will require increasing attention to the interrelation of surface and ground waters and their development as an integrated water supply.

An estimate of the water use in New Mexico for 1955 shows that ground water is used for irrigation on about 66 percent of the irrigated land, or on about 576,000 acres of a total of 873,000 acres. About 13,000 acres of the 576,000 are lands normally furnished surface water but which now are furnished ground water also. Usually it is considered that ground water, when applied to lands normally furnished surface water, is supplemental to the surface water supply. However, because of drought and the interrelation of the waters, such is not always the case. For example, in the Rincon and Mesilla Valleys on the Rio Grande, where until about 1948 ground-water irrigation virtually did not exist, there were in 1955 some 1,700 irrigation wells which furnished all but a few inches of the total irrigation supply. At present, therefore, in the Rincon and Mesilla Valleys the surface water applied to the irrigated lands is supplemental to the ground-water supply. This situation calls for more than a casual consideration of the pumping of ground water, as it will have far-reaching effects on both the economy and the hydrology of the area.

The importance of ground water to New Mexico is further emphasized by the fact that, of the total quantity of municipal water used, 92 percent comes from wells. The 92 percent is used by 87 percent of the population that is furnished public water. That the proportion of ground water used is greater than the proportion of the population using ground water is interesting, for it means that--contrary to the situation in many other States-- the per-capita use of ground water from municipal systems is greater than that of

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surface water. This is because many of the towns using surface water are located where they have access to streams having only limited flows, and also because most of the towns using surface water are in the northern part of the State where the climate is cooler. Where possible some towns that normally use surface water, such as Santa Fe, have drilled wells as a supplemental supply. It is interesting to note that in 1955 Santa Fe used nearly twice as much ground water as surface water, whereas prior to about 1951 only surface water was used. Albuquerque, the largest city in the State, pumped about 26,000 acre-feet of ground water in 1955, an amount sufficient to irrigate 10,000 acres of farmland or to flood the area within the city limits to a depth of about 8 inches. Presently, though municipal use of water is large, it represents only about 5 percent of the water use in the State.

The third important use of water is for industry, although present industrial use of water is only about 1 percent of the total water use in the State. Industrial use now is confined primarily to the refining of petroleum and potash. The need and value of water for industry is emphasized by the potash mines in the vicinity of Carlsbad; there pipelines as much as 35 miles in length have been laid from the potash refineries to the High Plains in Lea County to obtain adequate quantities of fresh water. In addition, appreciable quantities of the saline ground water available locally are used for certain processing. The estimated use of water in New Mexico in 1955 is given in table 1.

Table 1.--Summary of estimated water use in New Mexico, 1955

Irrigation	Acres	Percent	Ac.-ft/yr	Mgd.
Ground water and surface water	131,000	15	-	-
Ground water	445,000	51	1,350,000 1/	1,200
Surface water	293,000	33	778,000	694
Sewage	4,000	1(-)	12,000	11 2/
Total	873,000	100	2,140,000	1,905

Municipal	Population	Percent	Mgd	Percent
Ground water 3/	505,000	87	94.6	92
Surface water	75,000	13	8.6	8
Total	580,000	100	103.2	100

Industrial	Fresh (Mgd)	Saline (mgd)	Total (mgd)	Percent
Ground water	17.3	3.7	21.0	79
Surface water	1.5	4.2	5.7	21
Total	18.8	7.9	26.7	100

Summary	Ground water (mgd)	Surface water (mgd)	Total (mgd)	Percent
Irrigation	1,210	695	1,905	94
Industrial	21	6	27	1
Municipal	95	8	103	5
Sub Total	1,326	709	2,035	100
Rural	9	1	10	
Total (State)	1,335	710	2,045	
Percent	65	35	100	

1/ Including that supplemental to surface water.

2/ Estimated 10 mgd ground water, 1 mgd surface water.

3/ Includes government installations.

The value in dollars and cents of ground water to New Mexico is difficult to assess. Without ground water, the population of the State probably would have become fixed long ago at a level lower than at present. However, for talking purposes, it may be assumed that irrigation water is worth $10 an acre-foot, municipal water 25 cents per 1,000 gallons, and industrial water 50 cents or more per 1,000 gallons. The latter figure is set high because of the high cost of getting water for some of the principal industrial users. In other terms, the water is worth about 0.7 cent per ton, 6 cents per ton, and 12 cents per ton for the three uses, respectively. Water is still our best buy. Using the above figures, the present annual value of ground water to New Mexico is $13,500,000 for irrigation, $8,600,000 for municipal use, and $3,800,000 for industrial use, a total of about $26,000,000.

The present use and value of the ground water to the State are only a part of the picture that must be known before the potential value of this resource to the economy of the State can be appraised. A study of the increase in development in the past, coupled with evaluation of its effects on the water supply; an inventory of the volume of ground water in storage and of the recharge to and discharge from this supply; and additional knowledge of basic hydrogeologic principles are needed to appraise the ground-water potential of the State. Needless to say, in such a large State with such a varied geologic and hydrologic environment, an accurate answer is difficult to obtain and in addition requires appreciable time. Also, as the availability of water and the need for it vary with time, owing to changes in precipitation and demand, all estimates are subject to continued reappraisal.

Collection and appraisal of basic information on the Nation's water resources are one of the responsibilities of the U. S. Geological Survey. Studies of the ground-water conditions in various areas of the State are being made in cooperation with the State Engineer, the New Mexico Bureau of Mines, various counties and municipalities, the Department of Defense, and other Federal agencies. The program with the State Engineer consists of evaluation of the ground-water resources, generally in irrigated and other areas where water demands are appreciable. The program with the New Mexico Bureau of Mines, in which the State Engineer also is a participant, consists primarily of areal investigations of the occurrence of ground-water, generally on a county basis. Presently 37 ground-water studies are being conducted in the State by the Survey. Those studies in cooperation with the State agencies are listed in table 2. Additional studies will be started as others become completed. The scope of the studies ranges from short reconnaissance investigations of the occurrence of water, such as at Crow Flats, Otero County, through general county or basin studies to intensive evaluation of special problems such as the feasibility of diverting brine inflow from the Pecos River at Malaga Bend south of Carlsbad. Reports on ground-water studies prepared by the Geological Survey are released to the public in the open file and published by the State Engineer, the New Mexico Bureau of Mines, or the Geological Survey itself.

As a sign of the times, it is of interest to point out the two studies being made to determine means of alleviating salinity conditions, east of Roswell and Malaga Bend. Also, investigation of the availability of non-potable water in an area in the Tularosa Basin is being made for the Department of Defense, and a general report on the saline waters of New Mexico is planned next year. The latter report will summarize the availability of saline water as a resource for use as is or for conversion to potable water by methods now under study as a part of the Interior Department's Saline Water Conversion Program.

Table 2.--Cooperative ground-water studies by the Geological Survey in New Mexico, 1955-56

Study	Cooperating agency
Water levels and artesian pressures in observation wells in New Mexico	State Engineer
Ground-water conditions in the Animas Valley Hidalgo County, N. Mex.	State Engineer
Geology and ground-water resources of Torrance County, N. Mex.	Bureau of Mines and State Engineer
Geology and water resources of the Santa Fe area, New Mexico.	Bureau of Mines and State Engineer
Feasibility of diverting brine inflow along Malaga Bend of the Pecos River and disposing of it by evaporation in a nearby depression, Eddy County, N. Mex.	Pecos River Commission
Geology and ground-water conditions in the area between Lake McMillan and Carlsbad Spring, Eddy County, N. Mex.	Pecos River Commission
Occurrence of saline water in the San Andres limestone east of Roswell, Chaves County, N. Mex.	State Engineer and Pecos Valley Artesian Conservancy District
Ground-water conditions in the structural basins west of Tucumcari, N. Mex.	State Engineer, Bureau of Mines and city of Tucumcari
Progress report on ground-water resources of northern Lea County, N. Mex.	State Engineer
Geology and ground-water conditions in southern Lea County, N. Mex.	Bureau of Mines and State Engineer
Progress report on ground-water resources of Mimbres Valley, Luna County, N. Mex.	State Engineer
Ground-water conditions in the Playas Valley Hidalgo County, N. Mex.	State Engineer
Geology and ground-water conditions of Grants-Bluewater area, Valencia County, N. Mex.	State Engineer

Table 2.--Cooperative ground-water studies by the Geological Survey in New Mexico - Continued

Study	Cooperating agency
Geology and water resources of the Carlsbad area, Eddy County, N. Mex.	City of Carlsbad and State Engineer
Geology and ground-water resources of Quay County, N.Mex.	Bureau of Mines and State Engineer
Geology and ground-water conditions in Grant County, N. Mex.	Grant County Comm. and State Engineer
Geology and water resources of Guadalupe County, N. Mex.	State Engineer
Progress report on Chaves-Eddy County Ground -water Basin, N. Mex.	State Engineer
Water resources and geology of the Hondo Valley, Lincoln County, N.M.	State Engineer
Reconnaissance of ground-water conditions in the Sunshine Valley area, Taos County, N. Mex.	State Engineer
Geology and ground-water occurrence in the Gallup area, McKinley County, N. Mex.	City of Gallup and State Engineer
Geology and ground-water resources of the Albuquerque area, N. Mex.	City of Albuquerque and State Engineer
Ground-water conditions in the McMillan delta area, Eddy County, N. M.	Pecos River Commission
Geology and ground-water conditions in eastern Valencia County, N.M.	Bureau of Mines and State Engineer
Hydrologic atlas of northern Lea County, N. Mex.	State Engineer
Reconnaissance of ground-water conditions in Crow Flats area, Otero County, N. Mex.	State Engineer

One of the important programs with the State Engineer is that of continuing evaluation of changes in ground-water storage as represented by changes in water levels in observation wells. At present water levels are measured annually in some 1,700 wells in 18 main areas of development. Such records, however, are not now being obtained in some important areas--for example, the Rincon and Mesilla Valleys.

The amount of land irrigated by ground water in New Mexico has increased appreciably in the last few years, from about 140,000 acres in 1940, to 320,000 acres in 1950, and to about 576,000 acres in 1955. Ground-water irrigation is practiced in about 20 major areas. Part of the increase, some 130,000 acres since 1940, represents lands previously served exclusively by surface water, such as those in the Rincon and Mesilla Valleys and some in the Carlsbad area.

Much of the ground-water development has occurred in areas where the recharge is small, such as the High Plains of Lea and Curry Counties, the Mimbres Valley near Deming, and the Animas Valley southwest of Lordsburg. However, the volume of water contained in ground storage in these areas is very large, and development over a long period will be possible if this valuable resource is used wisely and efficiently. For instance, fairly reliable information indicates that some 25,000,000 acre-feet of water is stored in the Ogallala formation in Lea County. The hydrologic conditions in Lea County are such that essentially all water pumped is taken from storage. At present most water in Lea County is being used for irrigation. Appreciable development for irrigation began in 1948, and to date water levels have lowered about 25 feet locally where pumping is concentrated. However, in areas distant from pumps, water levels have declined only a few feet. Because of the slow rate of movement of ground water, long-term development is favored by conservative pumping which allows time for water to move from distant areas to the pumped wells. Under present controls established in Lea County by the State Engineer, a minimum safe life of development of 40 years appears assured. Increased conservation of water, and increased industrial use of water, would maintain the economy at a high level for many years.

In contrast to areas where water essentially is being mined, there are certain areas in the State, particularly along the Rio Grande in places such as the Rincon and Mesilla

Valleys, where ground-water reservoirs are or can be replenished from surface-water supplies. In such areas efficient utilization of the ground-water resource revolves around the long-term availability of surface water taking into account the need of downstream users, the capture of water being wasted by native vegetation, and maintenance of soil-moisture salinity at a safe level. In other words, in such stream valleys the total water supply must be considered as a unit, ground water plus surface water. Full integration of the ground-water and surface-water use in stream valleys apparently could increase measurably the amount of water dependably available for beneficial use. The ground-water reservoir in the Rio Grande Valley is very large when compared with present surface reservoirs constructed in the State. For instance, in the middle Rio Grande Valley, it is estimated that nearly half a million acre-feet of ground water is stored within 100 feet of the surface under each area of valley floor equivalent to a township (36 square miles); in other words, there is more water stored under 5 townships than can be stored in Elephant Butte reservoir. Underground storage generally has the advantage of being relatively immune to direct evaporation losses, a major item in surface reservoirs in this dry country. Because of the large underground storage, utilization of the ground as a regulating reservoir would result in a firmer supply, during droughts, than could be obtained through man-made surface reservoirs alone.

Full utilization of the ground-water reservoir in the Rio Grande Valley would result in an appreciable lowering of water levels during droughts. This would have a three fold effect: (1) waste of water by water-loving plants would be measurably reduced, resulting in an effective increase in water supply; (2) the quality of the ground water would deteriorate temporarily, owing to cessation of drain flow; and (3) nearly all water users would of necessity use ground water to secure a dependable water supply.

In considering the water potential of the State, mention is made many times of the total precipitation as a measure of potential water supply. Using 13.9 inches as the average precipitation for the State, it might be stated that the potential water supply is 90,000,000 acre-feet. However, the real potential is only a very small fraction of this, as evapotranspiration must take its toll. If it were not for the fact that prcipitation comes mainly in showers of short duration and in snow, evapotranspiration would claim all the precipitation. We must therefore content ourselves with essentially the water that appears as runoff to the streams and as recharge to the ground-water bodies. This amount is only a small fraction of the precipitation, on the order of 5 percent. Of this amount, nature takes a further toll in the form of evaporation from streams and surface reservoirs and evapotranspiration from areas of shallow water table where dense growths of native vegetation exist. The remaining 95 percent includes the soil moisture that benefits mankind by maintenance of range, forest, and cropland. There are two main areas in New Mexico where large areas of native vegetation exist, the delta areas of Elephant Butte Reservoir and McMillan Reservoir. The Bureau of Reclamation has spent considerable sums in salvaging water in the Elephant Butte delta by construction of a river channel and drains. The Pecos River Commission is proposing a similar project in the McMillan delta to salvage about 25,000 acre-feet of water annually. Further, in considering the water available for development in the State, allowance must be made for downstream users such as Texas and Arizona.

Considering the future, it has been estimated that the population of New Mexico will increase by more than 50 percent by 1975. The need for water will undoubtedly increase by a greater percentage, as the tendency is for continued increase of per-capita use of water. Though our water supplies are limited and generally are fully utilized at present, the future is not exactly bleak. Much can be done and undoubtedly will be done to assure the continuing availability of water. Solution to many of the water problems revolves around economics. As water becomes more scarce, it becomes more valuable, and certain conservation and developmental measures can be undertaken in the future which at the present may be uneconomical. Measures that need to be considered in evaluating and providing for our water supply in the future are: Reduction of nonbeneficial use by native vegetation, such as in the middle Rio Grande Valley and along the Pecos; conservation of present supplies by increasingly efficient use of water, such as by using closed conduits in irrigation; utilization of nonpotable water for certain industrial processes, such as water flooding of oil fields; reclaiming waste waters such as sewage in certain areas for other uses; substitution of low-water-requirement industries for irrigation in some areas; utilizing additional water supplies, such as water from the San Juan and ground water in areas presently undeveloped; utilizing underground storage to conserve surface waters; and conversion of saline water for municipal and industrial use. There also remain the possibilities, which as yet are only remote, of artificially increasing the precipitation and increasing the percentage of runoff.

Solution to these problems will not come easily or in a short time and will require a consistent, continuous effort to collect and interpret water facts. Further, effective solution will depend upon concentrated effort on the part of many agencies and individuals, actively supported by the public.