NEW MEXICO MUNICIPAL, DOMESTIC AND INDUSTRIAL WATER SUPPLY DEMANDS 1968-2068

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A number of New Mexico's cities, towns, and villages have the unique charm and beauty that is a characteristic of "The Land of Enchantment," but with this there is much that is not attractive - whole communities that are ugly, shabby, and unkept. In most towns there are homes and businesses that are well maintained and that are aesthetically pleasant - homes with green lawns, shrubs, trees, and seasonal flowers. But this description does not fit all too many of our residences - a more accurate description would include tumbled down fences, overgrown yards, unpainted houses, and tangles of overhead utility lines.

Perhaps an appropriate question would be "just what does this have to do with water uses?" The charm and beauty of our communities is a manifestation of the cultural, intellectual and material wealth of the people. I hope to prove that the per capita use of water for municipal and domestic purpose, above some minimal base use, is an indirect measure of the per capita income of the people of a community. I also contend that the greater our industrial base becomes, the greater our per capita income and the greater our demands for water for municipal, domestic and industrial purposes will be in the future. I believe that the amount of water used in a community is directly indicative of its wealth and that the amount of water that will be needed 100 years from now will depend directly on the degree of prosperity of the people of our state.

THE PRESENT SITUATION - 1968

Before attempting an analysis of New Mexico's municipal, domestic and industrial (MD & I) water needs a hundred years from now, we should probably find out just where we're starting from - how much water is available for use? How much does it cost us to use this water for these purposes? What our present municipal, domestic and industrial water supply demands? What factors influence the level of these demands?

Present Municipal and Domestic Demands

New Mexico's present resident population is just over a million people with approximately three-fourths served by central water supply systems. (1) Using State Health Department estimates of an average daily use of 159 gallons per person for urban dwellers and 34 gallons per person for rural families, the yearly demand for municipal and domestic purposes can be assumed to be a

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little more than 46 billion gallons if we assume that three-fourths of the residents of the state may be classed as urban dwellers. Some of this water will be used again by virtue of having been discharged into a sewerage system but the part used for lawns and gardens and cooling (about 30 to 40 percent) is lost to evaporation and transpiration. (2, 3) Consumptive uses for these purposes will probably be higher in more arid areas and higher in areas with greater per capita incomes. Based on the previous assumptions of per capita demand, our present consumptive use of water for numicipal and domestic supply is about 18.5 billion gallons per year. The New Mexico State Engineer Office estimated the "urban" demand for water to be 110,080 acre-feet (about 36 billion gallons) diverted annually and 51,690 acre-feet (about 17 billion gallons) depleted per year during the period 1960-64. (4)

Water Costs as a Factor in Present Municipal and Domestic Demands

Municipal and domestic water demands depend in part on the cost of water, on the season, on the climate, on the culture and standard of living of the people served by a supply and on the size of the community. In general, as the standard of living increases so does the use of water increase, up to a certain upper level of per capita use which is attained when most of the homes in a particular community have multiple bathroom facilities, automatic dish-washers, garbage grinders, gardens and lawns, and home laundry facilities. I believe this upper level of use to be about 200 gallons per person per day for urban residents of northern New Mexico. (5) There is a relationship between community growth and per capita requirements: per capita use commonly increases about one-tenth percent for every percent increase in population. (6) Per capita municipal uses may be distorted by unreasonably high distribution losses or by unrealistically low water prices charged to certain classes of large water users as a form of subsidy.

The cost of water to the municipal and domestic user does affect demand, but user response to price is certainly a nonlinear, nonuniform, complex function. Table I is a summary of daily per capita demands for three groups of northern New Mexico communities : (1) villages with populations of less than 1,000, (2) towns with populations of 1,500 to 4,000 and (3) cities with 10,000 to 40,000 residents. Within each group the elevation, climate and growing seasons do not differ greatly.

The cost per 1,000 gallons for "the second" 5,000 gallons-used-per-month-per-residence is also included for comparison with the daily per capita uses. The cost of "the second" 5,000 gallons is cited for the following reasons:

1. The cost per 1,000 for "the first" 5,000 gallons-used-per-month-per-residence includes minimum billing charges that vary from

TABLE I

Water Costs and Daily/per Capita Water Demands for Northern New Mexico Communities Grouped by Similarities in Population[1/]

	Community	Daily Per Capita Municipal Diversions in Gallons	Cost per 1,000 gallons for the second 5,000 gallons used-per-month-per residence - in Dollars
GROUP I	Bloomfield	55	1.00
	Logan	50	.50
	Roy	45	.55
	Cuba	40	.90
GROUP II	Aztec	145-165	.25
	Clayton	150	.23
	Belen	125	.23
	Taos	110	.35
	Springer	90	.60
	Chama	80	.63
	Milan	90	.75
GROUP IIIA	Farmington	210	.30
	Grants	110	.30
	Santa Fe	102	.63
	Gallup	75	.75
GROUP IIIB	Los Alamos	250	.36
	Las Vegas	80	.40

1/ Data for this table was abstracted from New Mexico State Engineer Office Reports 29B and 29C, 1964 and 1966 respectively. Interpretational changes have been made in the basic data.

city to city and often does not reflect the costs the municipality must bear to produce water.

2. A family living in an incorporated community must have a supply of running water with the minimal supply for a family of four being approximately 4,000 gallons per month (4 x 34 gallons/capita/day x 30 days/month).

An example of this last point may be noted in the per capita water uses by Group I villages (Bloomfield, Logan, Roy and Cuba) in Table I. Water use in these communities is evidently not influenced by the price of water as the per capita requirements are at, or near, the minimum family requirements and the average family just does not use more than 5,000 gallons per month so that price is not a major factor in their demand pattern. The cost per 1,000 for the first 5,000 gallons per month for the villages in Group I is from $1.00 to $2.00.

In the second group of communities given in Table I, we find daily per capita demands varying from 90 to 165 gallons, far in excess of the minimum so that the amount used in these towns may indeed reflect the cost per 1,000 for "the second" 5,000 gallons used per month. As will be noted from Table I, there is a general trend of increased per capita use as the cost per 1,000 gallons decreases with this same trend observed for the cities in Group IIIA. This would indicate some sensitivity of use to price. Communities that do not have water meters may also exhibit large per capita uses. Professor Gordon Fair notes that "meterage encourages thrift and normalizes water demand" and that meter consciousness will initially depress demand when meters are first installed but that "use" does return eventually to a defensible norm. (6)

There is one other very significant factor that affects the per capita demand - the average per capita income of the residents of the community. The marked effect of income on demand may be observed by comparing the municipal uses in Los Alamos ($3,690.00 income per capita/year for Los Alamos County for 1966) with those in Las Vegas ($1,550.00 income per capita/year for San Miguel County for 1966) as shown for these Group IIIB cities in Table I. The cost of water for "the second" 5,000 gallons (about $0.40 per 1,000) is approximately the same for residents in both communities as are the growing season and elevation, but the personal wealth and standards of living in the two are far different. A family with the high per capita income is not only insensitive to the price of water, this family also has more capital goods that require water for their use and enjoyment. New Mexico's per capita income is one of the lowest in the nation and it would not be surprising to find that our per capita use of water for domestic purposes is also one of the lowest in the nation.

Present Industrial Demands

The 1958 industrial use of water in the state was estimated to be 13 billion gallons by the Department of Public Health. (1) At a previous Water Conference, Ivan Wood, in discussing MD & I uses, noted that New Mexico has the lowest industrial water demand in the nation which he estimated in 1959 to be 43,800 acre-feet per year (14 billion gallons). (7) New Mexico's industrial base is quite small in comparison with those of other states with mining and manufacturing representing only 18 percent of wages and salaries earned in New Mexico in 1964 while this figure was 27 percent for the Pacific coast states, 35 percent for the middle-Atlantic states and 40 percent for the New England area. (8) It should also be noted that the average per capita income in some of these areas exceeds that of New Mexico by almost $1,000.00 per year.

For the period 1960-64, a State Planning Office report listed the "self supplied" industrial water demand as 136,640 acre-feet (44 billion gallons) diverted annually and 74,810 acre-feet (24.4 billion gallons) depleted. (4) The United States Bureau of Mines provided the following figures for 1962 for the mineral industry in New Mexico (potash, uranium, copper, lead-zinc, sand-gravel, cement, coal, oil and gas): 168.2 billion gallons required, 152.3 billion gallons reused, 15.9 billion gallons of "new-water" added and 7.6 billion gallons consumed each year. (9) The Bureau report estimates the "new-water" needs of industries closely related to the mineral industry (petroleum refining, natural gas transmission, and gypsum wallboard manufacture) as one-half billion gallons per year. Of the 15.9 billion gallons of new water, only 9 percent was purchased with 14.5 billion gallons "self-supplied," mostly from groundwater sources (11.9 billion gallons). (10) A more recent report indicates the consumptive use for all MD & I purposes to be about 28 billion gallons per year. (11)

Price as a Factor in Present Industrial Demands

An often heard excuse for the lack of industrial development in New Mexico is that water is just too scarce and not available. I don't believe this to be true except in a very few areas of the state and in most cases water can be transported to these cities at a reasonable cost. I don't believe that the relative cost of water is a significant factor in the decision to locate an industrial plant at a given place for, as Sener has stated:

> "Water availability alone has rarely been the determining factor in attracting industry to an area. Nor has its scarcity seriously impeded industrial investment when all other economic, social and cultural conditions were available." (14)

The average cost of "self-supplied" new water for New Mexico's mineral industry in 1962 was reported to be $.08/1000 gallons or far below the price of water to municipal users given in Table I. (15) Reuse and recirculation of plant water is responsible for the low ratio of "new water" to total industrial use which is approximately 1:10 with the average cost of treatment and recirculation reported to be $0.088/1000 gallons. (15) The median price paid for "purchased water" at five New Mexico industrial plants was $0.15/1000 but the variation was from $0.02 to $2.14/1000. (15)

The cost of water to industrial users must be compared with the "value of product" per unit volume of "new water" needed with these values ranging from $4.00/1000 gallons used by the sand and gravel industry to $89 for coal and $42/1000 the average for the entire mineral industry in New Mexico in 1962. (13) The "value added" to water, when used by New Mexico industry, was given by Wollman, et al to vary from almost four to about ten dollars per thousand gallons. (16) It may be seen that the average cost of industrial water, "new" or recirculated, represents less than one percent of the "value of the product" produced. For most industries, the price of water is not a significant factor in the amount of water used. Alternatives in production methods, or in water use, will be selected when and if, the price of water exceeds some unspecified upper level for a given industry. Industries will be attracted to locations where low cost water is readily available if other location factors are also favorable. (17)

Present Total MD & I Requirements

On the surface there appears to be some difference in these estimates of municipal, domestic and industrial water uses but because of a lack of common base this is not surprising. Present average annual water diversions in New Mexico for MD & I purposes are probably in the neighborhood of 70 to 100 billion gallons with about 50 percent of this volume consumed. Municipal and domestic uses probably constitute 40 to 45 percent of this demand with the self-supplied industrial use the remaining 55 to 60 percent. If the state's population is assumed to be one million and the combined MD & I demand to be 300,000 acre-feet, then the average annual per capita diversion for these uses is 100,000 gallons and the consumptive use 50,000 gallons per capita per year. At $0.30 per 1,000 gallons this represents an expenditure of only $15.00 per capita per year for our MD & I supply.

Present Water Supply

Most of our municipal and domestic supplies and most of the self-supplied water used by industry comes from groundwater sources with only one-fourth of the MD & I water being surface supplied. (1, 4, 9, 11) A current, easily understood and candid accounting of the water resources of New Mexico is

provided by Hale, Reiland, and Beverage with their estimate of the total average annual surface supply being 888,000 acre-feet available for consumptive use and 966,000 acre-feet as the annual consumptive use of groundwater. (11) They state the following with respect to the available groundwater resources:

> "Data are not available from which to compute the portion of this water that is being mined nor to compute annual recharge to groundwater aquifiers which are not connected with surface streams in New Mexico (aquifiers from which water is being mined)."(11)

Figures in Appendix E of their report indicate that there are at least six groundwater basins in New Mexico with declining water levels. A reasonable assumption is that these declines are indicative of a progressive depletion of the groundwater reserves in these basins. To permit safe, long-term yields from these basins, pumping will have to be reduced below the present levels. In summary, the total consumptive use of both ground and surface waters is now approximately 1.85 million acre-feet per year with MD & I consumptive uses representing only six to eight percent of the present supply.

With very few exceptions there is sufficient supply of useable quality water available to New Mexico communities and in these few exceptions a supply is available although transportation costs may make the source unattractive. The adequacy of industrial supplies is similar:

> "The water supply situation at New Mexico mineral industry operations ranges from satisfactory to critical. In no large section of the state, however, are existing mineral production operations seriously affected by water shortage; the areas of serious shortage, although widely distributed, are of local extent.
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> "One operator reported seasonal curtailment of production because of a critical water shortage. Another reported insufficient water for a desired increase in production. Quality of product is adversely affected at a few operations as a result of a limited water supply. An inadequate supply in the vicinity of many operations necessitates long-distance pumping or hauling." (18)

Industrial water needs can be met by the purchase of water rights from existing users who achieve lower "value of product" levels per unit volume consumed. This so-called "market place" system is somewhat inefficient and is subject to institutional constraints by both the state and the federal government. Municipalities may now obtain needed water rights through the exercise of the power of eminent domain.

THE FUTURE SITUATION - 2068 AND BEYOND

Future Institutional Constraints

There now exists, and there will continue to exist, competition amongst potential users for the available water supply. I believe that the following statements will characterize the nature of future competition and the nature of future institutional constraints that will function to control the amount and purpose of our water uses 100 years from now with these concepts being projections of the principal factors that now influence the present level of demand for water for MD & I purposes:

1. Because water plays such a significant role in the life of our people, there exists a compelling need to protect the public's interest in the management of the present and potential supply. In the future the Federal Government, and to a smaller extent the state government, will exercise increased control on the use, reuse, development, transportation and allocation of existing and future supplies. The social implications of use and reuse will be a dominant factor in determining the level and nature of future governmental control.

2. Domestic requirements will be given first priority in the use of the available supply with condemnation powers being used to secure the necessary rights.

3. Users offering the greatest "value added" per unit volume of water consumed will be permitted the next highest priority of use. To obtain the most efficient use of the available supply, allocations will be made and changed on the basis of the user's relative contributions to the economy. It is extremely unlikely that the present "market place" system of transfer of water rights to more economically successful users will continue to function because of the inevitable presence of government in the planning, financing and development of new sources of supply.

4. To promote the economic development of certain communities or of certain industries, the government will subsidize the use of water for these purposes just as we have subsidized irrigated agriculture in the past.

5. Requirements for increased reuse and for higher levels of treatment for waste-waters will be demanded. The reuse levels now attained by some New Mexico industries now approach the maximum practical.

The New Mexico of the Future

Economic growth is the key to New Mexico's future; this growth must and can only come about through industrial development as it is unreasonable to believe that much increase in our per capita income will be generated through agriculture unless massive water importation plans are put into effect. In the absence of these large interbasin and interstate transfer projects, New Mexico will have to rely on industry (mining, milling, manufacturing, tourists, recreational) to produce the income needed to maintain any significant increase in our population. If we maintain our present per capita industrial base we will remain a poor state with a low per capita income and a low per capita water use for MD & I purposes; uses that are lower than the national average. The present ugliness of parts of our cities and towns will continue to reflect this lack of wealth and will in fact be more pronounced. The price of water can only increase, will never be any cheaper than it is today, and if the 2068 New Mexician has a low per capita productivity and income, then the cost of water will deter his using it to maintain green lawns, trees and flowers and we will have barren desert communities. I prefer to believe that we will do the planning and develop the project necessary to make New Mexico a rich state, towns that are garden spots in the desert, beautiful tree-lined street, "breaking continually into park and garden, and with everywhere a scattering of houses - smart white gates and palings everywhere, good turf, - garden districts all set with gables and roses, holly hedges, and emerald lawns: pleasant homes---." This 1902 quote from H. G. Wells, although not characteristic of New Mexico in many respects, is a prophecy that can become a reality only if we are a wealthy state. If we are, we will enjoy high per capita incomes, we will use more water for domestic purposes as our uses will not reflect a sensitivity to the price of water, and we will use more water for industry because it will be through increased industry that we can attain higher per capita incomes.

MD & I Demands in the New Mexico of the Future

New Mexico's present water supply is sufficient, without augmentation, to meet any reasonable increase in MD & I requirements during the next 100 years because the present demands represent less than 10 percent of the available annual supply and because water rights will be transferred to MD & I uses so they generate relatively high "value of product" per unit volumes consumed compared with irrigated agriculture. The level of our future MD & I demands will depend on our productivity - high productivity, high per capita income and high per capita water demands; low productivity, low per capita incomes and low per capita water needs.

I recommend the following actions and programs be undertaken at once to insure

a prosperous New Mexico in 2068:

1. Provide funds for an accurate and complete inventory of the natural resources of our state.

2. Make funds available for definite and specific steps toward the realization of presently proposed massive water importation projects.

3. Provide funds (or forego taxes) to encourage and attract industrial capital to New Mexico. The magnitude of these expenditures should be comparable to those provided for agricultural subsidies by the state and federal governments.

4. Support research and development projects at our state universities to find and perfect products, production techniques and markets for New Mexico's natural resources.

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