WATER SUPPLIES FOR THE SOUTHWEST - WHAT OF THE FUTURE

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The subject of my discussion here this morning is "Water Supplies for the Southwest - What of the Future." This question is central to the theme of your conference. It is also one of the major resource questions confronting the nation today.

The problem of providing water supplies for an expanding national economy and an exploding national population extends to all regions of the country. The specific technical problems, policy issues, and projected times of crisis vary. In the East, pollution of what is still an overall abundant quantity of natural water places the technical emphasis on pollution abatement and control. At the same time, however, the potentials of drought shortages are serious enough that many localities are investigating costly desalting technology to avoid possible shortage conditions.

In the West specific problems also vary. In many areas intra-regional redistribution of available natural water supplies by means of major storage and conveyance systems will have primary emphasis for many years to come. This is true, for example, in California.

The Southwest, reaching all the way from Texas to the Pacific Coast, is unique among the regions of the nation in that it is the only major geographic region which now is approaching full development of existing surface and groundwater resources. In many localities within the region, which depend to a large measure on groundwater, these resources are already overtaxed. Along the Colorado River, a situation of general shortage is anticipated to occur about 1990, or before.

Water resource planners in the Southwest, therefore, find themselves at the forefront of the effort to exploit more ambitious and unconventional means for augmenting the essentially limited natural water supplies of the region. Augmentation, as you are aware, has been one of the major considerations of the long deliberations over the Central Arizona Project which are currently in progress. A number of the foremost authorities in water resource planning have turned their attention to the problem of augmenting the Colorado River in the course of these deliberations.

Aside from the limited opportunities to conserve the available supplies within the region through water salvage measures, three major alternatives remain as potential sources of new supplies. They are a major interregional

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importation of surface water from areas of surplus, desalting of sea water and brackish groundwater and augmentation of natural runoff by means of weather modification. It will be worthwhile to review briefly the Bureau's experience in studying each of these alternatives in relation to the Colorado River. I believe that they represent the major new sources of water in the foreseeable future, not only for the Colorado River Basin, but for any water-short region of the country, including the upper Rio Grande.

The controversy concerning importation of water into the Colorado River Basin is perhaps illustrative of the major problem of any long-range transfer of water. The success of any such proposal must rest primarily upon positive assurances to the area of origin that the water to be taken is truly surplus to the future needs of that locality. The most comprehensive knowledge possible of available supplies and requirements, both present and projected, must be obtained before exportation can be seriously considered.

There appear to be no absolute physical barriers to even the most ambitious transfers of water which have been suggested for the North American continent. Modern engineering skill is adequate to construct the required works. Aside from the political-social questions raised, the most significant consideration will be that of economics.

It is obvious that major interbasin transfers of water will be costly. A sizable component of the cost will be the cost of power to pump the water. This cost, at least, will be heavily dependent upon the technological advances made in power generation. Both of these factors, availability of water for import and the cost of pumping power, will weigh heavily in our study of the potential import to Texas and New Mexico.

We are well into our second year of reconnaissance study on a proposal to augment the water supplies of the High Plains of west Texas and eastern New Mexico. Other papers on your program discuss many aspects of this program in considerable detail, so I will not dwell on it to any great length. It would be appropriate, however, to emphasize again two basic points which have great relevance to this study, indeed to any scheme involving the movement of water among political jurisdictions.

First, major transbasin and interstate water movement programs should not be undertaken until local resources have been developed fully and efficiently. No state or river basin has a right to seek the property of another until it has exhausted its own capabilities. Simple economics will usually dictate adherence to this rule.

Secondly, interregional movement of water should not be contemplated to a degree that the basin of origin would be deprived of water which it could reasonably and rationally expect to need as a basis for its own economic growth.

There is no question that the first of these points applies to eastern New Mexico. That area has substantially utilized its water supply and is up against an immediate crisis. The west Texas area is not far behind. The Canadian River Project which is now essentially complete will help but is not the total answer. We know that there does not exist within the states of Texas and New Mexico sufficient surplus water to underwrite the High Plains economy.

Our cooperative study of augmentation for west Texas and eastern New Mexico has its most critical aspect, the determination of what can be said to be truly surplus to the lower Mississippi River, both in terms of times and places.

The second major source of augmentation of regional water supplies is desalting of sea water or brackish inland waters. As I have mentioned, this source of water is now being considered on a major scale by metropolitan areas on both coasts. Dr. Ralph Stucky of New Mexico State University is negotiating with the Office of Saline Water on studies proposed by the University of the potential of desalting the brackish water reserves of this state. Office of Saline Water is also establishing a brackish water test station at Roswell.

The Bureau of Reclamation, at the direction of the congress, recently completed a reconnaissance report which appraises the potential for augmenting the Colorado River by desalting of sea water. The basic plan which was evaluated consisted of dual-purpose nuclear desalting and thermal-electric plants located on the coast of southern California and a conveyance system from the desalting complex to the Colorado with delivery points reaching as far upstream as Lake Mead. These works would be constructed in stages with deliveries initiated in 1990 and reaching two million acre-feet annually by 2010. Plans were also analyzed, but in less detail, for locating the desalting plant on the Gulf of California and for alternative routes and discharge points for the conveyance system.

The basic cost estimates of the dual-purpose nuclear desalting and powerplants were developed by the Atomic Energy Commission and Office of Saline Water. Because the augmentation will not be required until 1990, these data reflect technology projected for the period 1990-1995. Fast breeder nuclear reactors were assumed to be available.

It was assumed that the federal government would obtain only desalted water and project pumping power from the dual-purpose nuclear desalting plants and that nonfederal entities would participate to the extent of financing and marketing the commercial power component.

The nonfederal entities would construct and own the electric turbine-generator plant. The United States, through prepayment of an appropriate share of the capital costs, would obtain the rights to the electrical capacity and energy necessary for project purposes. Through such an arrangement, the United States would retain the benefits of federal financing for the prepaid portion of the electrical plant.

Because of the somewhat unique financial assumptions involving provisions of pending legislation for a Colorado River Basin Development Fund, the financial repayment scheme assumed in our studies is not generally applicable elsewhere. The unit costs for product water and pumping power, however, reflect only the technological projections coupled with the provisions of conventional Reclamation financing. These costs are particularly interesting.

The estimated average cost of producing water for the three stages at the desalting plant boundary, before conveyance costs and transportation losses en route, amounts to about 32 dollars per acre-foot or 9.8 cents per 1,000 gallons. The related cost of generation and transmission of project pumping power was assumed to be 1.5 mills per kilowatt hour.

The estimated total economic cost for water delivered to Lake Mead averages 81 dollars per acre-foot or 25 cents per 1,000 gallons.

We believe there are significant opportunities for reducing the cost of the conveyance facilities by going to the Gulf of California as a source of sea water. Should such opportunities be realized, conveyance costs could be reduced as much as 20 dollars per acre-foot. Of course, conveyance costs of a larger capacity aqueduct, such as that envisioned for New Mexico, would show lower unit costs for water because of economies of scale.

During the recent hearings before the House of Representatives Committee on Interior and Insular Affairs, some skepticism was expressed concerning the technological projections utilized in the studies.

I believe it to be appropriate to base the study upon the level of nuclear and desalting technology which is expected, in the judgment of technical experts in these respective fields, to exist in the 1990 to 1995 period when initial construction of the facilities would take place. I do not share the skepticism concerning the anticipated advancement.

We are talking about conditions which will occur 25 years in the future. Such discussion must involve considerable speculation. However, some interesting perspective may be gained by reflecting on the past.

Twenty-five years ago, for example, there were no electronic computers. As recently as the early 1950's, there were only about 10 electronic computers in existence in highly specialized scientific uses. Their dependability was low and their cost high; 100,000 average computations cost 25 dollars. Widespread application seemed distant. Today, there are tens of thousands of computers in use; many in mundane business applications. A similar 100,000 average computations cost less than ¼ of a cent.

Similar illustrations are possible in the air transport field and, of course, most dramatically in space technology. In 1946, it was newsworthy that a radar beam had reached the moon. Today we accept the fact that manned space vehicles will reach it within a few years.

But to be more specific, in December of 1942, almost exactly 25 years ago, the first controlled nuclear chain reaction took place under laboratory conditions at the University of Chicago. The subsequent technological progress on the peaceful use of nuclear energy has surely been beyond the expectations of even the informed participants in early research. In the late 50's and early 60's nuclear reactors were demonstrating the practicability of electric generation but, with production costs of 10 mills per kilowatt hour and higher, they had not reached the level of economic acceptability.

These earlier reactors did provide the basis for future application as demonstrated by the fact that approximately ½ of the new thermal generating capacity ordered by the American utility industry during 1966 and 1967 was for nuclear plants. Expected costs by the industry are reported to be in the range of 4 to 5 mills per kilowatt hour in the 800 to 1,000 megawatt size. Recent economic studies by the Tennessee Valley Authority estimate the cost of power at less than 2.5 mills.

Only in recent years has desalting of sea water come to be considered an important source of supply except in the most extreme need. Just 14 years ago only a few small plants were in existence and the cost of fresh water produced was in the order of 4 dollars per 1,000 gallons. Present day costs of operating plants in the million-gallon per day size show a reduction in costs to 90 cents per 1,000 gallons.

Estimates for the 150-million gallon per day desalting plant now being designed and to be constructed by the Metropolitan Water District, with participation by other utilities, indicate water product costs of 22 cents per thousand gallons. This will be the first nuclear dual-purpose water and power installation.

In this rapidly developing field which has shown a reduction in desalting water costs in 15 years from 4 dollars per 1,000 gallons to 22 cents per 1,000 gallons, I do not believe it is unreasonable to assume that technology will continue to advance to the point where 9.8 cents per 1,000 gallons will be within reach.

It is true that costs for nuclear plants are currently exceeding estimates, but this is characteristic of a seller's market. Commercial nuclear energy demands are outstripping the capabilities of a new industry to keep pace. The economies of standardization and production capacity are certain to be realized in nuclear desalting applications within another quarter of a century.

I am speaking, of course, as an interested layman, and from a pragmatic point of view. I do not consider myself qualified to evaluate the fine points of nuclear and desalting technological projections, and I rely, with confidence, upon the experts of the Atomic Energy Commission and Office of Saline Water to do so.

I would also like to comment upon the third major augmentation potential, that of weather modification. Advancement in our technical knowledge in this field indicates that we are approaching the time when we will have developed a reliable capability to increase precipitation in the mountainous regions of the western United States through the application of weather modification techniques. From the beginning of the Bureau of Reclamation's research program in weather modification, we have realized that the Colorado River Basin incorporated the combination of an imminent need for augmentation and characteristics which promise early success in weather modification efforts. As a result, we have placed considerable emphasis upon our program for that basin.

Methods which are currently being developed, such as seeding susceptible winter storm at high elevations to increase winter snowpack, will be particularly effective in the upper Colorado River Basin. The highly developed storage reservoir system will permit capture and beneficial use of nearly all of the resulting increase in spring runoff.

We now believe that within ten years, a firm capability to augment the upper basin streamflow by nearly 2 million acre-feet annually could be developed. This would be, if our expectations are realized, the first instances of effective weather modification programs on a region-wide basis, and would provide extremely useful data for the development of programs in other areas.

Our practical research also extends to cumulus cloud seeding which will be of particular value in the high plains area. Results of this research are most promising. The fact that no one has done anything about the weather except talk about it in the past does not mean that we can do nothing about it in the future. I am very optimistic about affirmative results over the next decade or two.

I hope that this brief resume of some of the potentials for augmenting water supplies in the drier regions of the nation will help you to share my enthusiasm. I remain confident that we can develop the means to support the expansion of the economy and the population of the Southwest and the nation.