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SYMPOSIUM*
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WATER USAGE–WHO CARES?: A PLANNER'S VIEWPOINT

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INTRODUCTION

This paper presents a discussion on the general subject of water. The answer to the question, "Water Usage–Who Cares?" should be easy–everyone. Water is needed for human consumption, for sanitary purposes, for plants, fish and animals, for commerce and industry, and a myriad of other uses. The interest groups are many and varied. A more appropriate question, however, would be "Water–Who Gets It?" This question is not so easy, since it involves a human equation which too many times is based on emotions rather than facts. Also, we can expect a broad spectrum of values that is attached to various water uses.

With this background, I will address the subject through the eyes of the Corps of Engineers. I opted for this approach since I believe it will outline what has been happening in the water resources field in the Missouri River region as well as mirroring the rest of the nation. I will also address the subject in terms of the past, present, and future, since it is the linkage of the past and present that provides us with insights to the future. Lest anyone get the idea that all water development is the private domain of the Corps, let me dispel that notion. Water developments in this region, as well as the nation, reflect a combination of federal programs with those of states, local communities, and the private sector. The development of water resources by these combined efforts over the last three decades has been phenomenal. Addressing the subject through the eyes of the Corps is simply to use a large sample that reflects all the problems inherent in developing, regulating, and managing water resources.

THE PAST

The Corps has been involved in water resources development in the Missouri Region, an area of about 530,000 square miles, since before the turn of the century. These initial efforts dealt primarily with exploration and navigation on the Missiouri. Broad scale resources development did not take place, however, until the late 1930's. In 1944, the "Pick-Sloan" plan was adopted to provide a comprehensive approach to basin development. That plan, a joint undertaking of the Corps and the Bureau of Reclamation, provided for the construction of dams and reservoirs and for levees to protect municipal, industrial, and agricultural areas along the Missouri below Sioux City, Iowa. It was designed to provide four basic services: flood control, irrigation, generation of hydroelectric power, and navigation on the lower river; it also benefitted municipal water supplies, water quality, recreation, and fish and wildlife.

By 1975 the Corps of Engineers had completed 35 reservoirs and 62 local flood protection projects within the basin at a cost of $1.8 billion. Of this amount, $1.2 billion was expended to construct the six large main stem dams on the upper Missouri.

In terms of storage, the Corps has developed over 85 million acre-feet in eight of the MRB states. About 22 percent of this storage is located in Montana, 29 percent in North Dakota, 36 percent in South Dakota, 2 percent in Nebraska, 0.7 percent in Iowa, 0.4 percent in Colorado, 2.7 percent in Missouri, and 7.2 percent in Kansas.

Of the total storage, about 76 million acre-feet, or 89 percent, are in the six main-stem reservoirs above Sioux City, Iowa. Five of these reservoirs were constructed as the result of the 1944 Flood Control Act and became operational in the mid-1950's. Fort Peck Dam and Reservoir, started in 1933, became operational in 1938. I have cited these statistics in order to provide an order of magnitude assessment of the "physical plant" for water service.

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THE PRESENT

The past, as characterized by activities in the 40's, 50's, and 60's, reflects, in my view, a development era. Much of this development had a pure economic thrust, but many goals, both social and environmental, were intertwined into the developmental plans. Maybe they were not explicitly stated as we know them in the present climate, but they were included nevertheless. One must keep in mind that these developments reflected the goals of people a few decades back. With the advent of the consumer and environmental movements in the 60's, profound changes have taken place in the water resources field. A whole new language–and a great number of Buzz words–have emerged, and resources development is being subjected to endless debates and filibusters in the search for the Eternal Truth. This change, for the most part, has positive effects, but much of what is going on is emotionally oriented, and some is nothing but hot air. It is only logical, then, that a significant slow-down of developmental projects should occur. It has. But, I believe this slow-down is not directly, or solely, attributable to the consumerism-environmentalism concerns. Rather, we must recognize that our objectives change, a fact which forces managerial changes to what we have already developed; and, finally, there is always the crucial question of where we put our money. Accordingly, current development programs are much less than what were accomplished in the past.

THE FUTURE

In my view, resource planning and development in the future will focus more on management strategies than on physical additions to our existing plant. Pure development will continue, but at a much lower level than in the past. Water systems for distribution and waste disposal in our urban areas are much more important than those in rural areas, although the latter cannot be ignored. In the flood control area, we are vigorously pursuing non-structural, managerial programs. Water resources planning cannot ignore the land use issue. The uses of the land will determine water needs, problems, and solutions. This, of course, is the overriding jurisdictional question of who the regulator is. So, the future, especially on a short-term basis, will probably be aimed at resolution of issues and conflicts. This will not be easy. In order to illustrate these issues and conflicts, I will address the subject of water supply in the upper Missouri Basin.

CONFLICTS AND ISSUES

I am not sure that anyone can discuss this area with any degree of certainty. The planning environment itself is confused, and planning efforts can best be described as frustrated. This is so, not because of the inability of planners to identify the issues and to get on with the job of planning, but because planners are caught up within the democratic political process which is not yielding the "signals" necessary to shape alternatives that are supportable. And this is taking place in region where the waters of the upper basin are regulated, with tremendous quantities in storage, a region with vast coa deposits that offer a significant energy potential for the regio as well as the nation. Such questions as: How shall coal b mined? What political jurisdictions–state or federal–shoul control the resources? What Indian tribes, if any, should hav ownership of these resources? and on and on, remain unan swered. Reduced to a common denominator, it all boils dow to a problem of allocation of resources.

The development and use of resources will have to re spond to differing goals. The upper basin constitutes a vas agricultural empire with a large productive potential. If th objective is to convert in large part to an irrigated economy at some point the supply capability will be exhausted. And price will be paid. In other words, what will the toll be on th environment? Can such development ameliorate the socia costs of space? One thing is fairly certain: agriculture wil continue to be the dominant form of basin enterprise, but it impact on the basin economy may be less direct, involving smaller proportion of the total population. When we introduc the coal resource and its exploitation, we have the sam questions.

Space does not permit a full discussion of the hydrol ogy of the upper basin–the water supply. Rather, I will limi my remarks to the main-stem reservoir system, which is th key to availability of water. This sytem, consisting of si dams and reservoirs located between Yankton, South Dakota and Glasgow, Montana, became operational in the mid-1950's It contains an aggregate storage capacity of over 75 MAF, o three times the average annual flow of the river at the lowe most dam. In accordance with project authorization, th system is operated for flood control, irrigation, power pro duction, navigation, and complementary functions for muni cipal water supply, fish and wildlife, and recreation. At th present time the system is hydrologically and electrically integrated. It is pertinent to note that the authorization b which this system is operated provides that all *beneficia* consumptive uses in the upper basin have a priority over down stream navigation. This, in essence, was a States Rights Amend ment to the 1944 Act which could lead, theoretically, to commitment of all water supply to uses other than navigation It's not that simple, since no one has determined wher hydro-power fits into the beneficial, consumptive use cate gory. In other words, if power is generated, the release from the operation can supply some of the downstrean water for navigation. Even more fundamental is the question: I hydro-power generation a consumptive use? Physically, it is not

When we look at this storage system, it is hard to believ that a water problem–or water deficit–could exist. Again, w face the water/storage/allocation problem. To illustrate, I wil draw on studies made on the basis of 1970 and long-tern conditions.

Reservoir operation studies, based on a 1970 level of usage, were made for the period 1898 to 1968, adjusted to 1970. I will not describe these studies, but will focus on results. These were as follows:

(1) The system was fully effective for flood control.
(2) Sufficient releases were maintained from the system to meet all irrigation requirements as of 1970.
(3) Eight-month (normal) navigation seasons were maintained for 66 of the 71 years of record—the departure reflecting the drought of the 30's.
(4) Water quality requirements were met for the entire period.
(5) The hydro-generation capabilities—firm and peak—were maintained essentially as originally planned for the system.

The only conclusions that can be drawn are that as of 1970 there were no water deficit problems and essentially full services, as authorized, could be maintained from the system. Therefore, any problems that may arise must be those of the future. Here again, we have a study, the Missouri River Basin Framework Plan, prepared in 1965-70, which provides further insights into the so-called "water-use problem." This plan, a joint federal-state endeavor, reflects, generally, a regional viewpoint on how water should be used through the year 2020. A system reservoir operation study with these "future uses/developments" was also made to determine impacts. The results of this analysis are as follows:

(1) The system could be operated for essentially full services for all functions except hydro-power generation and downstream navigation.
(2) Open river waterway navigation at the 2020 level depletions could not be sustained on an economic basis.
(3) Annual system generation would be reduced by about 37 percent, but system peaking capacity would be reduced by only 4 percent.

With development as outlined, certain options surface. Navigation could probably be sustained by canalization—locks and dams. This would be a very costly option; or the waterway could be abandoned. Another option could be to cut back on projected uses, primarily irrigation. This would be a trade-off. With respect to hydro-power, a viable option would be to convert the system to a "peaking facility"—that to which hydro is best suited. Again, another option would be a trade-off with other uses.

At this point it would be well to zero in on those significant water uses that would result in the situation described. In the upper basin, over three million acres of additional irrigation were projected, with a consumptive use value (depletion) of over 4.7 MAF. In addition, approximately 700,000 AF of consumptive use were projected for development of the coal fields. Although other uses of water were a part of this plan, they are dwarfed in comparison to the values cited.

Since everyone is most concerned now with the energy potential of the upper basin, a brief discussion of these resources is in order. There are 160 billion tons of coal in a three-state area of the Northern Great Plains. Of this amount, 80.2 billion tons are surface mineable, which represents about 37 percent of the nation's mineable reserves by weight and 60 percent of the nation's surface mineable coal.

The most recent study dealing with coal resources is contained in "Effects of Coal Development in the Northern Great Plain," a report by the Department of Interior in cooperation with federal, state, regional, local, and private organizations. Generally, this report presents a review of major issues and the consequences of different rates of coal development. Let's consider some of the more significant numbers—which become the issues.

The study considered three coal development profiles (CDP). CDP-1 and 2 reflected low and intermediate levels of development. CDP-3 is a "High" profile that foresees the NGP responding to a long-range national energy emergency. The effects of these three levels of development on the environmental, social, and economic structure were estimated through the year 2000. I will limit my remarks to CDP-3, the "High" profile.

For the "High" development profile, the total acres required approximate just over 1 million (of which 843,000 acres are mined land) by the year 2020. The figure for the year 2000 is about 397,000 acres, which means more than doubling the land area impacted between 2000 and 2020. These totals include the land mined, plant facilities, and such ancillary facilities as railroads, highways, transmission lines, etc.

The study projected water demands, during the year 2000, to support the "High" coal development profile at just over 915,000 AF, of which almost 850,000 AF would be depleted through use, primarily for coal conversion processes. The latter value compares quite closely to the 700,000 AF of consumptive use estimated in the MRB Framework Studies conducted almost a decade before. So, the water uses for coal—industrial development—are potentially on the order of about 1 million AF/year over the next 50 years. Recall that the consumptive use for irrigation as developed in the Framework was 4.7 MAF/year.

It should now be readily apparent that the issues narrow to three areas—energy, irrigation, and navigation—all of which could conflict in the long term (about 2020). This, then, introduces the uncertainty of projections.

The existing hydro-power system can be modified, operationally, to produce peaking power. Any reductions in hydro-energy because of water diverted to coal development would be offset many times over by the greater energy potential of

the coal. This, then, reduces the issues to irrigation and navigation. The project authorization places navigation in last priority compared to upstream consumptive uses. By law, this problem would be erased. It's really not that simple; laws can be changed and amended.

I would suggest a closer scrutiny of the *projected* irrigation development. There is tremendous uncertainty associated with the projected 4.7 MAF/year of irrigation-consumptive use 50 years in the future. The climate of the area, environmental considerations, and the costs of development suggest that the projected level may be unattainable by the year 2020. Moreover, statistical evidence of the past decade does not support a rate of development sufficient to meet the projection. Yes, there will be some expansion of irrigation in the future, but how much? Therefore, with the high uncertainty associated with this major use function, especially 50 years in the future, it makes no sense to preclude industrial uses on a "2020 maybe." In other words, take no action now while you await the fulfillment of a prophecy.

Everyone is aware that coal development will require water as an essential ingredient. But the industrial development of coal will *not* turn on the availability of water. Rather, decisions will be addressed more to environmental and socio-economic impacts. In my mind, water availability is being used as the "whipping boy" to mask choices in these other areas. The NGPR study goes into these areas in some detail. It is true that there will be environmental degradation and changes in the socio-economic structure. There is no doubt that coal development can induce economic activity and can overcome, to some extent, the social cost-of-space problem. On the environmental side of the ledger we are talking about an impacted area on the order of 1 percent of the total area of the region. But in spite of this, there are ameliorating actions that can be taken, such as land reclamation and other mitigating measures.

As I see it, additional exhaustive studies and continual debates are not needed—and there are enough underway and proposed. Rather, the real need is to resolve jurisdictional problems on the use of the water resource that is now available.

A discussion of water would not be complete without addressing conservation. It has become quite fashionable of late to invoke the Conservation Ethic as a solution to a problem, or as an alternative to a project by opponents of such a project.

In some quarters, conservation is viewed as a "sacrifice," a drastic change in lifestyle, or a delay of the inevitable. As an engineer, I view conservation from an efficiency standpoint. This means optimizing uses of water by designing efficient water systems. I recognize the need for proper pricing, metering, and minimizing transmission losses in water delivery as a means to "conserve"—or, more correctly, to optimize economic efficiency. In the final analysis, conservation will not solve a problem, but will only make it somewhat easier to deal with the problem since accelerating demands will be dampened and provide more time to allow some semblance of managing the problem.

Those of us in the water resources field, and others, have an affinity for addressing issues statistically. Especially in the West, we tend to ward "gloom & doom." I believe it is time to address the allocation of the resources within the bounds that are available. At the same time, we must face up to the legal-institutional forces with which we must contend. In many areas, such as the Upper Missouri Valley, water doesn't appear to be in short supply; only magic is in short supply.