

THE NECESSITY OF WATER STORAGE FOR THE OIL SHALE INDUSTRY

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Every industry studying Western Colorado as an area for development has encountered a substantial and serious problem in attempting to arrive at a firm, dependable, water supply. Industry representatives have often been confused, frustrated and discouraged by the seeming paradox, i.e., that while there is adequate surface run off of water to support industries and cities of substantial size, it has been virtually impossible to guarantee that under all conditions at all seasons, in years of extreme drouth, and with expanding demand by competing local users, transmountain diversions, and out-of-state claimants, a firm and dependable water supply will be available.

The oil shale industry is confronted with this problem today. Thus far, efforts toward development of water resources have been marked by an attitude of "every man for himself, and the devil take the hindmost." In many instances these efforts have exhibited a basic misunderstanding or lack of knowledge concerning the legal problems incident to obtaining a firm water right from a natural stream.

For example, on the Colorado River, in the Grand Valley area, major oil companies have applied for and obtained adjudication decrees for hundreds of second feet of water. Such decrees are granted under the strict condition required by law that due diligence be used in developing and completing the appropriation by use. These "paper rights" are vulnerable to cancellation for lack of diligence in development. Furthermore, all they can hope to divert will be flood flows, and some winter flows, because prior decreed rights will cut such late diversions off.

Another practice, which seems to be gaining in popularity is that of purchasing irrigated agricultural land for the water rights, with the expectation that those rights can be held and retained until needed, and then converted to industrial or municipal use. Apparently, in many instances, no careful or detailed study is made of what is actually being purchased on an irrigation right; that is, where an irrigation right is concerned, the adjudication is limited to a defined quantity of water diverted at a defined place from a natural stream during the irrigation season. It does not give the right to divert water during the non-irrigation, or winter season. Also, in order to change the point of diversion, the purchaser is re-

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quired to prove in court that the change will not adversely affect the rights of other water users, even those junior, or inferior, to himself. This is particularly important where an enlarged consumptive use is contemplated and other appropriators can prove that they are adversely affected by lack or loss of return flow, or for many other reasons. The idea of drying up green and verdant agricultural lands and returning them to a semi-desert for the small amount of water that could be beneficially used is certainly repugnant if any other alternative is available.

In recent months a more realistic attitude has been observed, at least on the part of some of the oil companies and land owners, in taking initial steps toward development of supplies of firm water through storage to meet future requirements. A case in point is the contract recently entered between a group of companies and the Colorado River Water Conservation District to participate in water to be impounded in the Iron Mountain Reservoir on the Eagle River. This involves monetary investments in the development and construction of the reservoir in return for a commitment of firm water after construction.

Efforts of this nature, construction of smaller reservoirs by individual companies, sale of a limited amount of stored water by the Bureau of Reclamation, and the use of flood flows may be expected to provide a supply of water for a limited oil shale development. However, it is obvious that if a major oil shale industry develops in Western Colorado, then the water supplies available will be woefully inadequate. This seems too apparent to require discussion, and yet there is either a blind spot toward this major problem, or else an assumption that the problem can be deferred for consideration until the need arises; that at that time the water will still be available for storage and that it can be developed within a relatively short time. This is a dangerous and probably fallacious assumption. The demands and the competition for the waters of the Colorado River are simply tremendous. In the face of declining estimates of the firm water supply from the Colorado River, we should recognize that under existing compact requirements we must bypass over sixty percent of the Colorado River water legal demands of Upper and Lower Basin States. The political pressure exerted by the Lower Basin States, particularly California, to obtain a larger share of the water of the Colorado River is immense. Within Colorado there is, and will continue to be, an ever increasing demand on the river, and the supply of water available for storage is limited.

The problem is not new or unique. It has been recognized from the beginning of serious consideration of oil shale development. In 1953 the Colorado Legislature made an appropriation and a committee was appointed by the Colorado Water Conservation Board to attempt to evaluate and determine the potential water requirements in Western Colorado for

the purpose of determining what water, if any, might be available for exportation to Eastern Colorado. Some six months and \$50,000.00 later, a report was written by a renowned hydrologist and engineer, Raymond Hill, of Leeds, Hill and Jewett, Los Angeles.

In the course of these deliberations, a committee was appointed from the oil shale group; it was considered to be an excellent committee, with the best people available serving. The committee met over many months and much time and effort deliberated on the question of how much water would be required for shale oil. Mr. Boyd Guthrie, then affiliated with the Bureau of Mines, Mr. J. R. Riter, with the Bureau of Reclamation, the Director of the Water Board, and representatives of City Service Company, Continental Oil Company, Eaton Shale Company, Pacific Western Oil Corporation, Shell Oil Company, Sinclair, Standard Oil Company of California and Union Oil Company of California, joined in making the presentation. Their conclusion was that the total water requirements for a two million barrel per day operation would require a diversion or withdrawal from the stream of 625 cubic feet per second, or 455,000 acre feet per year, with a return flow of 225 cubic feet per second, or 165,000 acre feet per year, and a net consumption of 400 cubic feet per second or 290,000 acre feet per year. It was then stated that:

A large scale oil shale operation will require water at essentially a constant rate throughout the year.

also,

From available hydrographic data, it seems evident that the only practical and economic source of water to a shale oil industry is the Colorado River, and its tributaries, in and upstream from the oil shale area. It also seems apparent that storage reservoirs will be required to assure a continuous water supply to an oil shale industry of 625 cubic feet per second.

The industry hopes that the report of the Conference Committee to the Colorado Water Conservation Board and, in turn, the Board's report to the General Assembly of the State of Colorado will show:

- (1) That a potential oil shale development in Western Colorado will require an estimated 625 cubic feet per second of Colorado River Water,
- (2) Whether 625 cubic feet per second of Colorado River Water will be available to a shale oil industry,
- (3) What storage will be required to assure the availability of this amount of water,
- (4) How the financing, construction and operation of such storage facilities can most appropriately be handled, and,
- (5) The availability of reservoir site or sites, which will be required for storage purposes, to assure a continuous water supply to an oil shale industry of 625 cubic feet per second.¹

Despite the passage of over eleven years these very basic, pertinent and vital questions remain largely unanswered.

There have been some developments that will contribute to a partial answer. The plans that are developing for storage on the White River

¹ Water Requirements of an Oil Shale Industry: Colorado Conference Committee, September 24, 1953.

with diversion of water into the Piceance Basin are quite important.

The authorization of the Fryingpan-Arkansas Project, with a depletion of as much as 84,000 acre feet per year, resulting from transmountain diversion is a negative factor, compensated in part by the construction of the Ruedi Reservoir, with an active storage capacity of 100,000 acre feet, part of which should be available for shale oil development.

Some progress has been made in the way of adjudications, planning and engineering with respect to the West-Divide Project, contemplating storage on the Crystal River above Carbondale, and transportation by tunnels and canals of water purity and high quality to the Grand Valley-De Beque area. A limited allocation of this water is being considered for the shale oil industry. The seeming indifference of those most active and interested in shale oil development to this project is surprising to say the least. The water from this project would be particularly valuable because of its relative purity as compared with the main stream of the Colorado River. The weighted average concentration of dissolved solids in the Colorado River near Cameo is estimated at 387 parts per million, and 2300 parts per million of suspended sediment, whereas the Crystal River would be below 225 parts per million of dissolved solids and below 220 parts per million of suspended sediment, according to the United States Geological Survey².

In the report of Raymond Hill, mentioned before, it is stated:

Opportunity exists for the creation of a suitable reservoir by construction of a dam in DeBeque Canyon at the lower end of the valley within which the industrial development would presumably be centered. Diversion requirements of such industries could be satisfied by the withdrawal of water from the reservoir without regard to the inflow at the time. Return waters, except the very small proportion which might be unduly contaminated by chemical processes, could be returned to the same reservoir without waste downstream. All irrigation requirements in the Grand Junction area could be satisfied, without conflict with any other use, by the release of water from the reservoir, and the average quality of the irrigation water would be somewhat improved over that now available in the summer months.

It is recognized that the cost of construction of such a storage project would be large, primarily because of the necessity of relocating the trunk highway and railroad which now follow the Colorado River. This cost, however, would be insignificant in comparison to the tremendous capital investment which must be made to industrialize the region, and which will not be made until there is assurance of ample water.³

It is ironic that bids are being opened in May for a new highway to extend through the Placita reservoir site, the Placita Reservoir being the primary storage unit for the West Divide Project.

Likewise, Interstate Highway No. 70 will, before long, be completed through the site of the proposed DeBeque Reservoir. Both reservoirs in-

² Mineral and Water Resources of Colorado: United States Geological Survey Report, 1964, 247-249.

³ Depletion of Surface Water Supplies of Colorado West of Continental Divide: Leeds, Hill and Jewett, October 31, 1953.

volve expenditure of Federal money and Bureau of Public Roads' approval.

Other storage possibilities exist on some of the side streams tributary to the Colorado River, but not of major storage significance.

In any consideration of water requirements, it is important to remember that there is a great difference between the amount of water required to be available for diversion from the stream, and the net depletion resulting from the use. In other words, the return flow is of great importance in determining the amount of water that can be withdrawn from a stream because it will serve to fill downstream senior rights and compact commitments. According to Raymond Hill⁴ it is contemplated that a reservoir in the DeBeque Canyon would provide water that could be used and reused, thereby supplying water for large diversion requirements, with only the net depletion charged against the use.

If we accept the fact that large scale oil shale development will occur with a corresponding necessity for large scale water development by way of storage, then prompt planning and action become a matter of necessity. Experience dictates that the individual oil companies, water users and prospective water users will not undertake or arrive at an overall plan of water development adequate for the purpose.

Concluding then, that large scale water storage is a necessity, I pose this question: Considering the tremendous stake the United States has in shale oil, whether through Naval reserves, other public lands, or simply in the national interest according to the Interior Department's avowed policy, why should not the Secretary of Interior promptly proceed with planning and engineering to assure water storage adequate to meet shale oil needs?

Such planning and engineering would be consistent with the duty imposed upon the Secretary by the Boulder Canyon Act: it would answer some of the questions that must be answered to carry out the Secretary's responsibilities under the Upper Colorado River Storage Act. In the recent United States Supreme Court case of *Arizona vs. California* the Secretary was confirmed as the Water Master of the Colorado River; and, for better or for worse, will have the enormously complicated task of administering and dividing its waters according to compact requirements. Within Colorado, because of the necessity of coordinating Federal Reclamation projects constructed, or to be constructed, with State water administration, the Secretary will play an ever increasing role in water administration.

Precedent exists for such planning and engineering. To meet a more immediate, but not less important problem, the Secretary, through the Bureau of Reclamation, formulated and issued its Pacific Southwest Water

⁴ Depletion of Surface Water Supplies of Colorado West of Continental Divide: Leeds, Hill and Jewett, October 31, 1953.

Plan to relieve an acute water shortage in Arizona, Southern California and other Lower Basin States. In speaking of that plan, Commissioner of Reclamation, Floyd E. Dominy defined the role of the Secretary as follows:

Our job is not to make policy. Our job is to investigate and present our findings, first to the Department and the Executive Branch of the Government, and then to the Congress. We then carry out their instructions and authorizations in developing the waters of the West.

The point I would emphasize is that I would not, particularly before this group, advocate enlarging the role of the Secretary of Interior in the shale oil program. I would urge that we be realistic, that we accept the fact that large scale storage developments on the Colorado River must necessarily involve the United States. More important, we haven't time to wait. The average lead time from planning to delivery of water in a large project ranges from ten to thirty years. In the eleven years since the Shale Oil Committee submitted their report, no one has attempted to answer the questions asked, particularly the \$64.00 question, "Whether 625 cubic feet per second of Colorado River Water will be available to a shale oil industry?" Before a major shale oil industry can get off the ground, that question must be answered.

DISCUSSION

QUESTION: Mr. Delaney, did I understand you to voice an opinion that you felt that the Department of the Interior, along with the Bureau of Reclamation, the Upper and Lower River Compact, the Boulder Canyon Act, have interfered with this state's development of its natural resources, and is an indication to the oil shale industry to try to avoid this same problem by not asking too much help from the Federal Government?

DELANEY: No, by no means. I don't submit that the Department of the Interior has interfered in any manner. I think that were it not for the Department of the Interior and the Bureau of Reclamation program, much of what we have in western Colorado would never have existed. I submit, and the point I'm trying to make is, that without the help and assistance of the Bureau of Reclamation and the Department of the Interior, we're simply probably not going to be able to develop a supply of water such as is needed for major shale oil industry.

QUESTION: Mr. Delaney, in connection with the Divide Creek Project, your remark there was seeming indifference on the part of the oil industry to the Crystal River Project — that this was surprising to you, — I'd like to say that I feel that the Crystal River area is a very good source of water for the future shale industry. I think others who have studied the matter indicate that it is. But the indifference on the part of the oil industry is something that I would like to have you enlarge upon. What do you think we ought to be doing about that project, and to whom should we be doing it?

DELANEY: I didn't mean anything, of course, critical of the oil industry. I think that there are some major questions of policy involved insofar as the procedures of the Bureau of Reclamation and the Department of the Interior are concerned. Now, for example, on that project, there will be, as I understand from the Bureau of Reclamation, a preliminary report issued sometime within the next five or six months, and from what I can learn I think there are two possible alternatives. One alternative would set the project up, as it has been historically conceived, as primarily an agricultural use. An alternate project, in the event there were justification, or need, or, as a matter of policy (the Bureau of Reclamation is directed to plan it), would contemplate a much larger storage, and a much better adaptation, to the shale oil industry. I know that the Bureau of Reclamation in its planning made inquiry, and I think they started out with 14,000 acre feet that they could justify out of the entire project. Subsequently, I believe, (this is not a published report or anything, and it's partly hearsay), I believe they've raised that somewhat. But, for some reason, whether it be through the lack of coordination, lack of common policy or demands, a lack of solidified support, or some other reason, the fact simply remains that they're proceeding on the basis of this project apparently simply as a primarily agricultural development, without taking into account the larger scope. That's why I'm posing the proposition that I think this thing needs a re-evaluation whereby the Secretary of the Interior would take into account this report, and they would set up machinery whereby this quantity of water would ultimately be available.

QUESTION: Bob, I'm Ralph Sargent of Public Service Company. I understand at the last meeting of your District, there was some open discussion of the possibility of a reservoir which would be contemplated to be constructed by the District, which might lie between De Beque and Grand Valley. In fact, I understand that the discussion contemplated that this reservoir might be jointly constructed by the District and the Denver Water Board. Can you comment on that at all at this meeting?

DELANEY: Some preliminary, as I understand, ideas, have been advanced about constructing such a reservoir. I might say that in past years there have been various projects advanced by the Bureau of Reclamation, one of which would even contemplate taking water from the Gunnison River, dropping it into the Colorado to make replacement to enlarge the amount that could be used out of the Colorado. Another one that was investigated a few years ago was the idea of building this De Beque Canyon reservoir, that Mr. Raymond Hill commented about. The project that was discussed the other day in the Colorado River Water Conservation District Board of Directors meeting pertained to a smaller reservoir upstream from this, and primarily related to the development. I think (as far as the Bureau is concerned), of the Blue Stone Project. I think. prob-

ably, that in a sense the development of that for agricultural purposes is somewhat incompatible with the larger development of the available waters in the river, and while it's true there is some thinking about it, it doesn't envision or contemplate anywhere near the quantities available for shale that the Shale Oil Committee discussed.

JACK PHILLIPS, BUREAU OF MINES, WASHINGTON, D.C.: As I recall, at the time the Hill report was written in 1953, it was concluded that there was enough water available at that time, potentially, to support a 2,000,000 barrel a day industry. I don't recall the exact figure. What is the picture now? Have there been commitments made since that time that materially reduce the amount of water that's potentially available, assuming in each case that you have an adequate reservoir system?

DELANEY: Assuming there's an adequate reservoir system, I understand there would be water available, according to either Mr. Hill's estimate of some 350,000 acre feet per annum, or according to the larger estimate of the Shale Oil Committee of in excess of 445,000 acre feet. That's my understanding.

QUESTION: Your comments that immediate action might be required I think are well founded. Last Tuesday they had a meeting of the Colorado Planning Commission in Grand Junction with the commissioners of the Fourth District. Engineer McCoy pointed out that the interstate would be completed by 1972. At this time we only have 30 miles of that 260 between Denver and Grand Junction. If the De Beque Dam is to be built, it will be real important as to which side of the lake reservoir that the highway goes, from the development of shale. They are about to let contracts for feasibility studies of the location of this highway within the next few months. So I think we do have some immediacy involved here. My question, based on that, is how far along is this De Beque Dam Project?

DELANEY: As to how far along it is, I don't think the project as such has really gotten anywhere. It's merely one additional tentative idea. In other words, I think when we speak of the project, why, there have been about four or five different ideas entertained over the years. Now I know, a few years ago, the Colorado River Water Conservation District proceeded to the point of drilling out some reservoir site holes to test the materials. Planning had progressed with a view to relocating the highway that would go over the top in such a way that it wouldn't interfere with it. Plans had progressed, and some consultations occurred about moving the railroad, but unfortunately, those things fell by the wayside. Then the Interstate Highway Program came along, and now apparently the possibility of the reservoir site there is being disregarded, or it's simply figured that the interstate highway would have to be relocated if it's ever constructed.