NEW SOURCES OF WATER FOR IRRIGATION, MUNICIPAL AND INDUSTRIAL USES

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Across our great Nation, from New York to California, in the steel mills and on the farms, there is a growing concern over the increasing thirst of our ever expanding economy. Some people have expressed fear that we are facing widespread bankruptcy of our water supplies. This may be true, but according to the U. S. Geological Survey, 3/4 of the earth's surface is water, and that if all the land were leveled off, water would stand 1½ miles deep over the entire earth. This leads one to believe that water is still one of our most abundant substances and that the principal problems are treatment and distribution of nature's most valuable resource.

Why then, is there a water shorgage in a land of plenty? True, our population is increasing, but the principal reason is the rising standard of living. We require far more water per person per day here in the United States than any place else in the world. To maintain the average U. S. citizen in this high standard of living requires about 1,500 tons of fresh water per year, and this does not include the water for hydroelectric power. Most of this 1,500 tons of water, required by each of us, cost less than 5¢ per ton and even this is a high price for farmers and ranchers as that amounts to $68 per acre foot. Certainly water for irrigation must be less than dirt cheap. Any old fill dirt at $1 per ton is a bargain and still 5¢ per ton is too much for water.

In the past we have depended upon nature for treatment and distribution of water, and we will probably continue to do so for many years to come. It is possible, and in some cases it might be economically feasible, to take small amounts of water from nature's normal process and transport and treat so that it might be available as needed for domestic, industrial and agricultural purposes.

Diversion of Missouri River Water to New Mexico

One such project has been mentioned many times as the solution to our water problems in New Mexico. The piping of a portion of the flow of the Missouri River into Elephant Butte Reservoir. For the sake of discussion, let us assume that we would take water from the Missouri River at Kansas City and pipe it to Elephant Butte Reservoir, a distance of about 800 miles.

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This envolves pumping the water up for about 4,000 feet. Taking a flow of about 3,450 cubic feet per second for economical design--this is quite a volume of water and amounts to 6,850 acre feet per day or 2½ million acre feet per year. This large volume of water is used to arrive at the minimum cost per acre ft. and would require a conduit around 20 ft. in diameter and 3,900,000 H.P. -- This horse power would be distributed in 50 pumping stations along the line. A project of this type would involve an expenditure of around 2.6 billion dollars. With capital recovery at 3% interest, operation and maintenance and power costs, this would amount to an annual cost of a little over 373 million dollars a year. This would be $149 per acre foot at Elephant Butte Reservoir or around $306 per acre foot delivered to the farms in the Mesilla Valley.

One acre foot of water here in the Mesilla Valley at $306 would have a cost breakdown something like this.

$91	Capital Recovery
$105	Operation and Maintenance
$102	Power cost
$8	Operation of Elephant Butte Distribution system

This pipe line could be built with some modifications of present heavy construction equipment and procedure. The principal difference of this project would be its size. Should this plan be considered feasible, there would still be two major problems to overcome, and their solutions might prove to be the most difficult.

1. Farm lands and cities in the areas of the pipe line would claim a portion of the flow and the 2½ million acre feet would never reach the Panhandle of Texas.

2. It is felt by many, that the Missouri River is being taxed to its utmost to supply the population of its basin. There is no unappropriated water at Kansas City during periods of low flow and the storm flow has been cut to a minimum by the large dams upstream.

During the low flows of the Mississippi River in 1953 and 54, there was low water trouble at New Orleans. Salt water intrusion was creeping up the Mississippi River towards the water intakes at New Orleans. It was necessary to let water out of Fort Peck Reservoir--2,500 miles away on the Upper Missouri River in order to force this salt water back. It has also been necessary to increase the flow of the Upper Missouri River in the last 2 years by letting water out of the dams to help water pollution at Kansas City intakes.

Based on these assumptions and calculations, it appears that the piping of water from the Missouri River at Kansas City to New Mexico is highly unprobable at this time.

Fresh Water from the Ocean

Many people dream of great new supplies of fresh water from the ocean. Considerable interest is being centered on research and development sponsored by agencies of the Federal Government, principally the Department of Interior and the Navy Department. Many of the schemes brought out this far are technically sound, but they cost too much.

One of the most common methods used commerically to produce fresh water from saline water is by distillation. A portion of the salt water is boiled and the vapor which is slat free, is condensed. This process is more efficient fuelwise, if multiple stage stills are placed together in a series so that the condenser of the first, forms the heat exchange for the next stage, which is operated at a slightly lower pressure than the proceeding stage. Too many stages make the process uneconomic and about three is presently considered to be the limit. One such plant using Westinghouse triple effect evaporators is supplying the water needs for over 170,000 people in the port of Kuwait, on the Persian Gulf. This water is being distilled with natural gas as the fuel. It takes only 5¢ worth of natural gas to produce 1,000 gallons of fresh water in Kuwait, but it is estimated that the cost would be over 50¢ in Texas or New Mexico for the same amount of fuel. The total cost of Kuwait's water is about 65¢ per 1,000 gallons and that is using the 5¢ gas and cheap labor. This amounts to $212 per Acre feet in Kuwait and at least $358 acre feet using New Mexico gas. (Labor at the same price as at Kuwait).

Another method for reclaiming sea water is by the ion exchange process. This is the method used by many of our home water softeners. The big problem is the large quantity of total solids that needs to be taken out of sea water. It will vary from 30 to 40 thousand parts per million over the world (30,000# in 1,000,000), but averages around 34,000 pp.m. The present economic limit for ion exchange equipment is around 2,500 ppm total solids. Fresh water could probably be produced from sea water by ion exchange in a large plant for about $325 per acre foot of fresh water.

Another method, and one we hear a lot about in the southwest, is Solar distillation. This is the same process by which nature provides us with our fresh water. This isn't a new idea and scientist have been working with the principal for years. An instillation in Chile in 1883 gave one gallon per day of fresh water for every 9 sq. ft. of surface. Present equipment will yield about one gallon per day of fresh water for every 4 sq. ft. of surface, under ideal conditions. It has been estimated that it would require 215 square miles of equipment to supply the Colorado River Aqueduct. The high cost of initial equipment makes this process uneconomic at present.

One of the most promising methods for obtaining fresh water from sea water is the electrodialysis process. In this method a plastic membrane is an electric field separates the fresh water from the salty brine.

These permeable membranes are reduced in efficiency as calcium and magnesium salts are precipitated on them, and of course, these are found in sea water. At present this electrodialysis method is considered as the most efficient process cost wise. The estimated cost is around 50¢ per 1,000 gallons of fresh water. This process is new and much remains to be seen. This 50¢ per 1,000 gallon is about $162 per acre foot, so we will have to wait for cotton to go up a little before we put that kind of water in our irrigation system. It is not yet possible to recover fresh wate from sea water at costs competitive with ordinary treatment and supply methods. Then too, the ocean is about 400 miles horizontal and 4,000 feet below us here in the Mesilla Valley, and it costs a lot of money to pump water that distance, especially up hill.

One suggestion has been made, that if you can't economically take the salt out of ocean water for irrigation, work from the other direction and develop plants that can use salt water.

Water from Sewage Effluent

A practical source of untapped water lies in our back yards, sewage effluent. The water that you drank today may have once been in Cleopatra's swimming pool! Science believes that the same water has existed on earth for ages, and that there is virtually no more or less than there ever was.

The use or reclaimed sewage effluent has definite possibilities as a dependable water supply for municipal industrial use. The costs can be expected to compare favorable with those of other sources of supply with the exception of irrigation water. Sewage water is a more dependable source of supply than are many others. Sewage flow in a stable community has a rather definite pattern and the amount of flow can usually be predicted with considerable accuracy for any future point in time.

A few years ago when television first became popular, an eastern city noticed a change in their sewage flow pattern. The flows were below normal expectancy for about one hour, and then about nine o'clock in the evening a heavy surge of sewage flow would take place. Upon investigation, they found that there were two popular television shows in a row and then a lengthy commercial. When the commerical would come on, the women would wash the dishes and bathe the children.

Psychological reasons make it unlikely that sewage water will be used for drinking purposes in the near future, but there isn't any logical reason why the major portion of our sewage flows couldn't be put to industrial use.

The idea of reclaiming sewage water isn't new, as several industrial firms have been doing it for some time. The Bethlehem Steel Company is taking Baltimore sewage effluent and piping it 7½ miles through a 60 inch reinforced concrete pipe and paying a fair price for this waste water.

The sludge (digested solid material taken out of raw sewage) might prove to be a profitable by-product in complete sewage treatment. It is estimated that $36 million a year is paid out for sludge disposal. Most of this sludge is dumped in the ocean or in our rivers to eventually reach the ocean floor. If sold, this sludge would bring in $400 million a year and it would return to the land the precious organic food elements now being leached from our soil. The sale of sludge wouldn't pay the cost of sewage treatment, but the total benefits, sludge as fertilizer, fresh usable water in our streams plus increased recreational benefits would more than pay the bill.

Our psychological attitudes that we possess regarding sewage water for personal use will have to be overcome if we are to be space travelers or live for a while on a stallite circling the earth. It seems improbably that we will be able to carry along the huge amounts of water necessary to our persons on a trip lasting days, months or even years. In the absence of other available supplies, it might be necessary to treat and reuse the same water many times.

The reclamation of sewage effluent certainly is not the solution to our farm water problem here in the southwest. This could solve the water problem for most all of our city and industrial users. By proper treatment of our sewage flows, most cities in the Southwest could expand at their present rate for a hundred years with their present water supplies.

In general, the city and industrial water users constitute a non-consumptive use of water. The water is taken into the homes and factories and used for cooling, washing and the conveyance of waste material. This same water can be used over and over as long as it is properly treated between each use.

On the other hand, water applied on fields for irrigation is by in large evaporated and transpired into the atmosphere and completely lost to that area.

A small percentage of this water infiltrates into the ground to the river, to drains, or to groundwater. Therefore, agriculture is a high consumptive user of water and all new sources of water to be beneficial to our area, must be produced in large quantities and cheap enough to be used for irrigation.

The domestic sewage and industrial waste could be treated or delayed in such a way that the public would accept it sooner. Industry doesn't possess the physological barrier and will readily take the reclaimed sewage effluent. Business decisions are usually made on an economical basis. The dependance of supply and known cost versus many unpredictable natural water supplies, will attract many additional industrial users in the immediate future. Several things could lessen the public attitude towards sewage effluent. A time lag would help, then a person wouldn't have the feeling of drinking the same water for dinner that they had for breakfast.

One method for providing a time lag would lagooning the effluent for a month or so before picking it up for treatment. The lagoon could be a natural lake or reservoir or series of park ponds. These bodies of water should have a maximum of beauty and recreational use. Public contact with this water would go a long way to prove that it is just like any other water and maybe a lot cleaner than some.

Another method to provide a delay and help some in lean water years, especially in heavily pumped areas, would be ground water recharge. Ground water recharge is being practiced on other waters in many areas. Mr. E. J. Umbanhauer mentioned the other day that the city of El Paso has studied the possibilities of recharge during the irrigation season with river water. This same water could be repumped at some later date with little loss. There would be no evaporation or transpiration loss and little movement in a perched table. Why not use treated sewage effluent for recharge and pump it out at some later date. There are other possibilities, but they all reduce to a particular situation.

In general, there is an ample water supply over the United States for many years to come. Under present conditions, it doesn't appear economical to bring water in from the Missouri River at Kansas City or to make fresh water out of sea water. Industry has proved that it is economical in certain instances to use sewage effluent as a raw water supply.

Remember, water is neither created or destroyed, nor is it changed in form, it merely becomes dirty and all we have to do is wash it.