John's Crapes Club
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INTRODUCTION

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Life on earth is bound to the presence of water. It is the one unvarying necessity of all things. (We drink it, we grow crops with it, we use it for a multitude of industrial purposes, for transport and for cooling, as a solvent and as a rawmaterial, for food, funiture, gasoline, automobiles, and everything else you can think of.)

We Americans are the inheritors of a continent once richly endowed with this most precious of all natural resources. Now this is greatly changed. Larger cities, farms and even whole states report water shortages. Wells are running dry. Cities, their own waters over committed or fouled, reach into the countryside draining or diverting rivers across mountains and deserts to the taps and toilets of their citizens. Farmers too move water about on a massive scale with tens of thousands of miles of irrigation ditches. Increasingly, these water transfer systems interlock, the intake pipes of one region creeping into the water system of another. One well-known example is of Denver, Phoenix, and Los Angeles, separated from each other by distances approaching a thousand miles, who battle increasingly over the limited resources of a single stream, the Colorado River.

Even with these massive tranfusion systems in place, there is seldom enough. Tuscons's water is being used at a rate 62% highter than engineers say the water system can safely supply. New York's water demand outstrips its supply by 200 million gallons per day. California's daily deficit is 2.6 billion gallons. On the Great Plains, ground water supplies are expected to be exhausted by about the year 2000, leaving farmers without enough water to grow crops.

All across the country, demand for water is growing while supplies are shrinking. We are close to overtaxing our water supplies on a nationwide basis. We have arrived at the limits of what has been considered a limitless resource.

How has this overdraft come about? The earth contains enormous amounts of water, (about 344 million cubic miles totally, enough to provide 88 trillion gallons to each person on earth.) Only 0.05% of the world's total water is available for human use, however. But even that small percentage works out to be enough to provide every person on earth with 42 million gallons. In addition, this resource is constantly renewing itself. More than four trillion gallons of rainfall each day on the continental United States alone, approximately eighteen thousand gallons for each U.S. citizen. By contrast, our bodily requirements to stay alive is only about two quarts a day. We receive daily almost one and a half times the water, as precipitation, as all of us will drink in our entire lives. Given these figures, one may wonder if there is any shortage at all.

Most water experts say no, we have and always will have all the water we need to live on. However, at the same time, we have water supply resource problems in nearly every part of the country. We have no shortage, but we are running out of water just the same.

How can this be? We use water for many purposes other than drinking. We use it to cook, wash (a five minute shower takes 12 gallons), and water the lawn (five minutes consumes 50 gallons). All in all, the average American uses about 90 gallons daily. It is also the most heavily used natural resource in industry. Your car represents a water investment of about 100,000 gallons plus another 20 or so every time you fill the gas tank. A sugar processing plant

uses roughly 4 million gallons a day, (a large brewery, as much as 15 million. A coal fired power plant uses 900 gallons of water for every kilowatt-hour of electricity produced.) All in all, manufacturing and energy production in this country use a total of 140 billion gallons of water daily, or about 600 gallons per person. Added to the 90 gallon personal use allotments, that is about 690 gallons per person daily.

The greatest use of water is for irrigated agriculture. A bushel of wheat represents a water investment of 15,000 gallons, a thousand pound steer, about 3.5 million gallons.

The total percapita daily water consumption then is not the survival level of two quarts, but close to 1500 gallons a day. This is close to one tenth of the daily per capita rainfall.

Added to the difficulties posed by the fact that our use of water is so enormous are the difficulties posed by another and more ominous fact--the resource itself is shrinking. The amount we have available for most uses is constantly decreasing. The reason is pollution. We are not destroying water, but we are rendering it unusable. Only eight states have had no serious occurrences of ground water pollution, and only two states have no serious occurrences of surface water pollution.

Perhaps the most important problem of all is the question of distribution. Despite pollution and despite the enormous quantities we use, there is really no serious threat that we will run out of water in this country in the forseeable future. The problem is that is is not in the right places.

The annual rainfall is not nearly evenly distributed. More than 40% of the

nation's rain falls east of the Mississippi. Annual rainfall at Baltimore, Maryland, is more than five feet, at Yuma, Arizona, less than three inches.

SLIDE1 The eastern boarder of arid lands can be defined by a line (about the 100th meridian) east of which receives more than 20 inches of rain a year. With more than 20, it is said you can grow crops unirrigated, with less than 20, you cannot. John Wesley Powell pointed this out more than a hundred years ago. This has become a problem because the water use practices in this country developed in the east where there was always plentiful rainfall, and because the historic tendancy in this country has been to move westward. This movement is still going on today. Between 1970 and 1980, the states west of the 100th meridian grew at a rate 2½ times faster than the eastern states. We have water, but we are rapidly and methodically moving ourselves away from it.

As the population has shifted westward, so has the agriculture that supports it. In 1920, fifty percent of all U.S. crops were grown east of the 100th meridian. Today that amount is less than 34%. But because crops cannot grow in the west's meager rainfall, this westward shift in agriculture has led to a veritable explosion in irrigation. Between 1940 and 1980, some areas showed increases up to three thousand percent. Eighty five percent of this nation's consumptive water use (reflecting that part of use that is not returned to the source) takes place in the western 17 states. This of course has put a tremendous burden on the west's scanty water resources.

Many argue that this problem is one of attitudes. We are of a culture which began in a water-rich environment, and we have never really learned how important water is to us. We have learned to understand it, but we do not respect it; we have learned to manipulate it, but have not learned how to manage it. Where

water is cheap and plentiful, we have largely ignored it, where it is rare, it has been spent with alarming haste.)

Cont. one of attitudes:

Because of its renewable (usually) nature and its apparently unlimited supply, water has not been regarded as a precious resource to be conserved and protected. A water utility bill reflects not the cost of the resource, but the cost of drilling, treatment, storage, and distribution systems.

With the assistance of federal spending and government spending, the cost of water has been kept artificially low. Even where water is least plentiful in the U.S., prices rarely reflect supply. The price of water in El Paso (50¢ ($0.53)) is less than one third that in Philadelphia ($1.78 per thousand gallons). This low price of municipal water is high in comparison with what American farmers pay. The price of agricultural irrigation water in the U.S. ranges from $0.009 (a penny) to $0.09 (10¢) per thousand gallons with federal subsidies making up the difference between price and cost. It has been calculated that federal subsidies total, on the average, at least $500 per acre over the life of a project. Between 1956 and 1980, over 75% of federal water resource development funds were spent in the south west, even though the northeast-midwest region accounts for 45% of the national population.

One half

The Great Lakes hold one fifth of the world's surface fresh water. Although the Great Lakes region comprises only 4% of the total U.S. land area, it contains 14% of the nations total population and provides 17% of America's national income and between 30 and 40 percent of its taxes.

Michigan, with 38,500 square miles of surface water within its jurisdiction of the 61,000 square miles of total surface water within U.S. boundaries, is endowed with a large portion of the Great Lakes within the United States.

The Great Lakes have exerted a tremendous influence on the development of Michigan's economy and culture. The Great Lakes historically have been and remain today, Michigan's most valuable natural resource.

To illustrate the value and importance of the Great Lakes to Michigan, consider the following:

--Approximately 75% of all water used in Michigan is from the Great Lakes.

--More than 50% of the States population obtains drinking water from the Great Lakes, and this may increase in the future due to ground water depletion and/or contamination.

--Tourism is a major industry in Michigan, contributing over $10 billion in revenues in 1982 to the state's economy. Access to water, and especially the Great Lakes is the number one criteria for the recreating public.

--81% of the power generating capacity in Michigan is located on the Great Lakes shoreline.

--The Great Lakes and connecting channels provide a commercial navigation system of national importance and provide Michigan's industries and businesses with an energy efficient means of transporting raw materials and finished products.

It is unrealistic to point to the Great Lakes as a salvation for the regions economic woes. Too many other factors are equally as important as water in many industrial location decisions. However, certain industries are highly dependent on abundant high quality water supplies, and these industries may well provide additional jobs that are so badly needed. Expanding agricultural production also holds great promise for this region. Supplemental irrigation is being used by

more farmers to increase crop yields and more food processing plants, which require large volumes of water, are being planned for this region.

Increasingly, the quality of life is being cited as an important locational factor, especially in the "high tech" industries, and our water resources should be a strong drawing card.

The central issue is, therefore, how can these vast water resources be managed and protected for the benefit of this region's future. William Milliken appointed a task force in November, 1981, to address the emerging issue of potential large scale diversions and water quality. The Task Force is composed of representatives of the public and private sectors to analyze issues and make recommendations concerning future use and management of the state's water resources. Similar topics received much attention at the Governors' and Premieres' Great Lakes Water Conference in June, 1982..

The large scale diversion issue, which raises many legal and economic questions ~~which~~ that are further complicated by the "common stock" nature of the resource, shared as it is by seven other states and Canada.

At the heart of the issue is the potential economic impact, both in terms of the tremendous cost of such a project and the impact on this regions economy of further industrial migration to the west.

Chronic water shortages in other parts of the country seem to indicate that the value of our fresh water could increase in the next two decades. The midwestern states have, in water, a resource for which others will increasingly yearn and which will demand new governmental management tools and new levels of regional cooperation in the 1980's.

PRESENT DIVERSIONS WITHIN THE GREAT LAKES

Over time there have been a number of diversions of Great Lakes water. There are four major permanent long term diversions into and out of the Great Lakes.

The Long Lac and Ogoki diversions have been developed to generate hydroelectic power and divert water into Lake Superior which would normally flow northward into James Bay. These diversions came about through an agreement between the U.S. and Canadian governments in 1940. Through this agreement, the U.S. government agreed to permit Canada to take advantage of the increased water supply by diverting the same amount (5,000 cubic feet per second) at Niagra Falls for power production. The ultimate effect of these diversions has been to increase the mean level of each of the Great Lakes. (see chart).

In The Chicago diversion, water is diverted out of Lake Michigan into the Illinois waterway system and into the Mississippi River since 1848. This diversion is used for water supply, sewage disposal, power generation, and navigation. The rate of this diversion, by Supreme Court decree in 1967, was limited to 3200 cfs. This diversion lowered the mean lake level of each of the Great Lakes. (see chart).

The Welland Canal diversion takes water from Lake Erie and diverts it across the Niagra peninsula to Lake Ontario, thus by passing Lake Erie's natural outlet through the Niagra River. This water is primarily used to operate a deep-draft navigation canal and to generate power at Decew Falls. The diversion recently averaged 9,200 cfs and lowers all the lake levels except Ontario.

The New York State Barge Canal diversion diverts about 700 cfs from the Niagra River for operation of the canal system. It has been in operation since the early part of the 19th century. Since water is withdrawn below the Niagra River hydraulic control section, there is no effect of Lake Erie lavels.

Changes in lake levels affect the economics of the Great Lakes Regions. Major impact areas are hydropower generation, navigation, and costal zone interests with reduction in erosion of shore property and increasing beach area for recreation. Conversely, these lower lake levels would reduce the depths in connecting channels and harbors and thus the drafts to which vessels can load. This would require more trips to transport the total waterborne commerce and increase shipping costs. Hydropower generation would also be adversely affected by the reduction in water supply.

The existing diversions that currently impact on the waters of the Great Lakes provide an indication of what can be expected from any tampering with the basin's water supply. As an example of the relationships of water levels to dollar impact, an increase in the flow of water out of Lake Superior of 5,000 cfs will lower the mean levels of the lakes by the amount in the table. This will result in an annual economic loss to the system of about $53 million. (see table).

The Diversion and Consumptive Uses Board of the International Joint Commission recently completed a study concerning consumptive use of Great Lakes Basin water. (Consumptive use refers to the portion of water withdrawn or withheld from the Great Lakes system for various uses that is not returned.) The Board found that the consumptive uses of the Great Lakes water will increase from the 1975 rate of 4,900 cfs up to about 37,000 cfs in the year 2035 and this consumptive use would reduce the net water supply to the lakes and thereby lower lake levels in Lakes Michigan, Huron, and Erie ~~up to~~ by a weighted average 1.13 feet. The study found that although minor benefits would occure to costal zone owners, huge losses would occur to navigation and power interests. The net economic loss to the region would be over $200 million annually by 2035. The consumptive uses by

the Great Lakes states and neighboring Canadian Provinces would put tremendous demands on the water supply resources of the Great Lakes. These predictions make even more important the careful consideration of diversion of Great Lakes water out of the Great Lakes Basin.

WATER PROJECTS UNDER PROPOSAL

The major inter-water basin diversions operating or under proposal are for agriculture or energy production.

If water was diverted from the Great Lakes, it's most likely direction would be west or southwest for irrigation purposes. (On a national basis, over 80% of all water is consumed by agriculture, and this proportion is higher in the west.) Energy production is another strong possibility, especially if coal slurry pipelines become numerous.

A federal water project is considered economically justified if the total benefits of the importing, transit and exporting regions exceeds the cost. The issue of who gains and who loses, is not a federal consideration. It is likely that any diversion from the Great Lakes Region will impose costs to this region with little if any benefits.

The High Plains Area, the "Great American Desert," was long considered uninhabitable by people depending on agriculture for their subsistance, by a U.S. Army survey in 1819. The farmers that followed the cattle men ran into many non-productive years of inadequate rainfall. The water-lean years of the 1930's led to the discovery of vast quantities of underground water--the Ogallala Aquifer. Drilling became a business and the High Plains an agricultural paradise.

The Ogallala Aquifer is a vast area of a sunken, water-soaked plain, ~~since capped and~~ cut off from its recharging water supply about 3 million years ago. The farmers on the High Plains are irrigating their crops with 3 million year old water. (The meaning of this for the six states whose agricultures depend partially or wholly on this ancient reservoir of stored water is clear. If you are pumping something out of a reservoir and not putting anything back in, eventually, that reservoir is going to run dry.) The fossil water is exactly

like fossil fuels elsewhere, it is a limited resource. The water here is being mined.

A six state High Plains-Ogallala Aquifer Regional Resources study was authorized by Congress in 1976 and completed in 1982 to study this region of perhaps the most serious water-short area of the country. As an element of the study, the U.S. Army Corps of Engineers investigated the feasibility and costs of interbasin transfers from "adjacent areas". Congress was concerned over the continuing depletion of the Aquifer and the prospective effect on regional economy and the food supply of the nation.

The irrigated land in this area comprises about 20% of the irrigated land in the United States, producing 58% of the U.S. annual agricultural products. Forty percent of the fed beef we eat is fattened on the High Plains. Some areas have already reverted to dry land farming or has been abandoned due to the exhaustion of the underlying ground water. It is estimated that after the year 2020 the exhaustion of ground water will rapidly expand and increasing ~~land~~ amounts of irrigated land will have to revert to dry land farming or be abandoned.

The adjacent areas considered in the Ogallala Aquifer Resources Study were the Missouri River and streams in Arkansas. These are all interbasin streams and all have federal projects already in existence with commitments of water ~~and~~ to storage ~~to~~ and flood control, inbasin irrigation, inbasin industrial use, navigation and power generation. The total costs for a diversion of water to the High Plains for irrigation would be $200 to $300 per acre foot of water.

The cost estimates for a large scale diversion from Lake Superior to the Missouri River Basin was resently calculated by Jonathan Buckley of the University of Michigan. The study estimates the costs of diverting 10,000 cfs ~~a distance of~~ 984 kilometers. The annual system costs for water were approximately $400 per acre foot.

If we assume that water diverted from Lake Superior to the Missouri River would be "surplus" and then available for irrigation, the unit costs for bringing water from the Great Lakes to the High Plains region would exceed $500 or $600 per acre foot, a sum that obviously no farmer can pay and which would require massive federal subsidy.

A study recently conducted estimated the value of new or increased crop yields as acreage is irrigated. The estimated benefits of irrigation of a field of corn in the west amounted to $165 per acre at best.

The combined estimates of benefits and costs of water diversion makes it apparent that water diversions from the Great Lakes for agricultural needs in the west cannot be justified on economic grounds. The lowest cost estimate of a diversion to the High Plains region exceeds $500 per acre foot. This is three times greater than the highest benefit estimate of $165 per acre foot. If this disparity exists for diversions to the High Plains, it is difficult to imagine diversions from the Great Lakes being considered for points farther west.

What is a much more realistic project in economic terms is diversion of water for a coal slurry pipeline such as that negotiated with the state of South Dakato by Energy Transportation Systems, Inc. (ETSI). ETSI is willing to pay $200 per acre foot, 50,000 acre feet per year of water from the Missouri River for a project that will rove coal from Wyoming to powerplants in Oklahoma, Arkansas, and Louisiana.

Another operating coal slurry pipeline runs from the Black Mesa Arizona coal mine to a powerplant at Mohave, Nevada. This pipeline is 275 miles long and transports approximately 5 million tons of coal annually.

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and 15 million tons of coal would be transported annually.

Diversion of water for energy projects such as coal slurry pipelines is considered economicallly profitable. The amount of water projected to be used for presently conceived energy projects has not been so great as to be a cause of immediate concern. The cummulative effects of such projects, however, needs to be carefully considered.

Western states have a history of viewing any source of water as available for long distance transport. The west's largest project, the Central Arizona Project, will carry 2.2 million acre feet of water per year, hundreds of miles. The project has already cost more than two billion federal tax dollars.

The states of the Pacific Northwest, fearing the Southwests desire for water, have persuaded Congress to pass and renew a ten year moratorium on even a discussion of diversions of water from the Columbia River to Arizona and California.

Other than the major economic loss to navigation and power production of the withdrawal of Great Lakes water for these proposed diversions, an additional and equally serious economic threat to the Great Lakes region is the likelihood that diversions of water would also divert industrial growth and jobs out of the region.

AVAILABLE LEGAL PROTECTION

There appears to be two possible means that proposals for diversion of Great Lakes water are likely to arise. The first is dedication or sale of some portion of basin waters by a single state. South Dakota's proposed water sale, and a recent court decision defining groundwater as an "article of commerce" are both omminous in this regard. The second means is action at the Federal level to assert Federal powers to deal with a "national crisis" and assert its Commerce or General Welfare responsibilities.

Population and therefore political power has dramatically shifted toward the south and west in recent decades. That shift in political power coupled with the interests of the nation as a whole in manufacturing agricultural products of the west could lead to the introduction and consideration of legislation in Congress to initiate a diversion project at some time in the future. That such legislation could pass the Congress is not out of the question. In the recent past, Congress has adopted legislation to increase the diversion at Chicago on two separate occasions. Each of these underwent presidential veto.

The Congress has adopted legislation allocating water in other areas of the nation. Decisions that have been made in this regard include the decision that Congress can apportion water of an interstate navigable stream among states lying on that stream (1963 Arizona vs. California); and the court suggests that Congress may have the right to create legal interests in favor of one state even if waters do not cross into that state. Citing the power of Congress to provide for the general welfare though " projects for reclamation, irrigation, or other internal improvements", the court concluded that "where Congress has so exercised its constitutional powers over waters, the courts have no power to substitute their own notions".

The Commerce Clause of the U.S. Constitution gives Congress the power "to

regulate commerce with foreign nations and among several states". As mentioned above, water recently has been defined as an article of commerce.

Presently existing legal doctrines do not offer unequivocal protection against large scale diversion.

The doctrine of riparianism would prevent a diversion only if the complainant could demonstrate that the water for which transfer is proposed is needed by the complainant for his own reasonable uses. The volume of water in the Great Lakes may make such a demonstration difficult.

The Boundary Waters Treaty of 1909 with Canada, requires a permit from the International Joint Commission for a diversion project. However, diversions are not prohibited by this treaty. A complainant of damage from a diversion project would have to seek relief on the basis of riparianism which, as previously stated, may be a difficult case to prove. The Boundary Waters Treaty applies to waters that form or traverse the United States--Canada boarder. It would therefore not apply to a diversion from Lake Michigan.

CONCLUSIONS AND SOLUTIONS

Before a water project is considered feasible and an optimal solution, alternatives must be considered. With regard to water diversions, there are non-structural alternatives that need evaluation.

There is room for substantial increases in efficency of water use in the west. Presently, on farms that irrigate from surface water supplies, which are federally financed and inexpensive, the irrigation efficiencies are typically less than 45%. At farms dependent primarily upon ground water, which the farmers must pump themselves, efficiencies are better than 60%. With improved irrigation systems, these figures could go above 75%. Drip irrigation, in which small amounts of water are fed directly to root systems, has been shown to reach efficiencies as high as 95%.

Many say that if water and water rights were freely bought and sold, the demand for water would be easier to control. The market would help establish the most efficient use of the resource. Most water supplies and rights are now protected under legal and institutional arrangements that have been worked out over time toward objectives other that economic efficiency.

No state can be expected to refuse a dam or waterway so long as the federal government subsidies the project even though this subsidy will delay the confrontation of the true problem of a shortage. No consumer can be expected to use less water as long as his bills do not reflect the need to do so. Prior to the energy crisis, one would not have believed that Americans could curb their taste for oil, but years of rising prices have provoked dramatic changes in behavior and energy conservation technologies.

As groundwater sources dry up and the water pumping costs escalate,

conversions to crops that can be grown with little or no irrigation (e.g., sorghum, wheat, soybeans) is an alternative to irrigation with diverted water.

Arizona's Groundwater Management Act, the first comprehensive state law to limit the pumping of groundwater, is an encouraging example toward the thoughtful redistribution of water. The act calls for wells to be registered and fees charged for the water withdrawn. Farmers must improve irrigation efficiencies adequately by 2005 or surrender these lands to the state. The act also requires housing developers to secure state certification that a 100 year supply of water is available before construction can proceed.

A leading research group on American agricultureal needs has predicted that, using existing technologies, the nation's irrigated acreage can be reduced by about one half and still meet the demand for food and fiber in the United States by the year 2000. If irrigated acreage can safely decline by one half over the next twenty years, it seems the country does not desperately need to water the desert or divert so much of the water it consumes to this task.

Regardless the size of the diversion proposal, we as a region are poorly prepared and poorly organized to evaluate and respond well to a serious attempt to divert Great Lakes water. Through recent studies, the economical and enviromental impact of the diversion of water out of the Great Lakes Region has become better understood. The region has also not prepared a mechanism for assaying an economic value to the water itself, which has been traditionally viewed as a free-good with only the costs of distribution a matter of concern.

If a small scale diversion was beneficial and acceptable to the states and provinces of the Great Lakes Basin, how would the profits be shared?

The existing institutional mechanisms for cooperation between the Basin's states and provinces, through a modified Great Lakes Compact or through greater

involvement in the International Joint Commission, must manage this vast resource in a manner which will insure adequate supplies of high quality water for all its varied present users and the future economic vitality and quality of life in the Great Lakes Region.

* The handout includes the resolutions of the Michigan Environmental Policy Conference, April 23, 1983.