

Utah State University

DigitalCommons@USU

Reports

Utah Water Research Laboratory

January 1966

Proceedings of a Summer Institute in Water Resources: Volume 1 - Philosophical, Institutional, and Legal Aspects of Water Resources

Cleve H. Milligan

Charles E. Corker

Wayne D. Criddle

Follow this and additional works at: https://digitalcommons.usu.edu/water_rep



Part of the [Civil and Environmental Engineering Commons](#), and the [Water Resource Management Commons](#)

Recommended Citation

Milligan, Cleve H.; Corker, Charles E.; and Criddle, Wayne D., "Proceedings of a Summer Institute in Water Resources: Volume 1 - Philosophical, Institutional, and Legal Aspects of Water Resources" (1966).

Reports. Paper 200.

https://digitalcommons.usu.edu/water_rep/200

This Report is brought to you for free and open access by the Utah Water Research Laboratory at DigitalCommons@USU. It has been accepted for inclusion in Reports by an authorized administrator of DigitalCommons@USU. For more information, please contact digitalcommons@usu.edu.



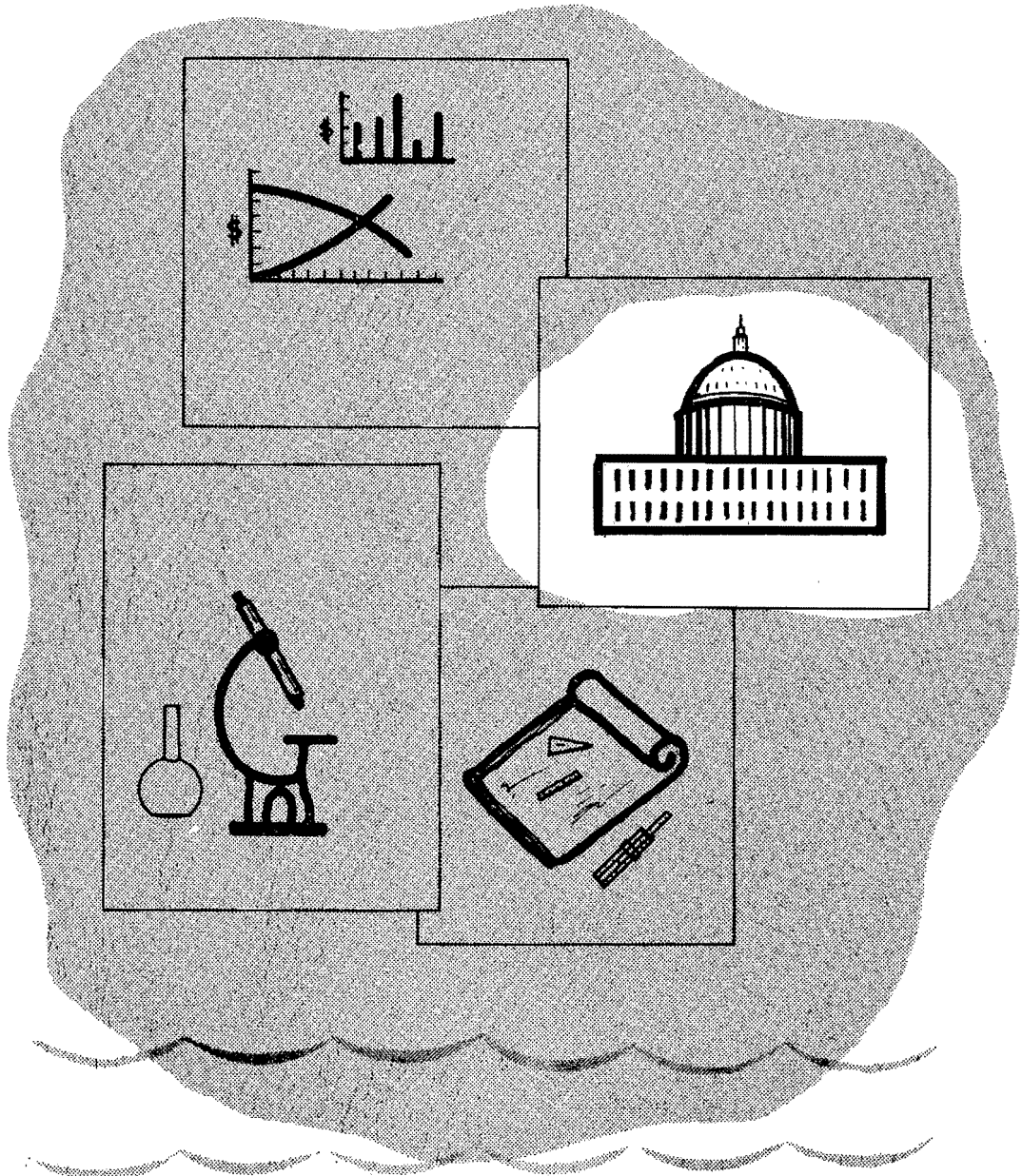


Logan, Utah 84321

Proceedings of a Summer Institute in Water Resources

VOLUME I - PHILOSOPHICAL, INSTITUTIONAL,
AND LEGAL ASPECTS OF WATER RESOURCES

CIVIL ENGINEERING DEPARTMENT SUPPORTED BY THE NATIONAL SCIENCE FOUNDATION



99912

PROCEEDINGS
of a
National Science Foundation Supported
SUMMER INSTITUTE IN WATER RESOURCES

VOLUME I
PHILOSOPHICAL, INSTITUTIONAL,
AND LEGAL ASPECTS OF WATER RESOURCES

Civil Engineering Department

Utah State University

April 1966

Additional copies available from
Utah Water Research Laboratory
Logan, Utah

FOREWORD

Recognizing the need for training of individuals to meet the rapidly rising problems connected with water resources development, Utah State University, with National Science Foundation support, organized a Summer Institute in Water Resources for college teachers. It was hoped that participants carefully selected from all regions of the country would receive additional insight and stimulation to improve and enlarge water resources training programs at their own institutions. Thus, the accelerated dissemination of such knowledge on a national scale could be facilitated.

Realizing further that the key to a successful institute of this nature lay in the excellence of its staff, efforts were made to obtain instructors with intimate knowledge and broad experience in the subject matter area they were asked to present. In nearly every case those selected willingly accepted the invitation to participate, although this meant considerable monetary sacrifice and major adjustment of busy schedules.

The subject matter treated paralleled regular offerings listed in the University catalog and is considered to be "central" or "core" to a water resources planning and management training program. One course treated the philosophical, historical, institutional, political, and legal aspects of water development. The responsibility for this course was shared jointly by Cleve H. Milligan, Charles E. Corker, and Wayne D. Criddle. The second course considered the principles of water resource economics and was presented by B. Delworth Gardner. The third course dealt with concepts of water quality management and was under the direction of P. H. McGauhey. The final course was on principles and procedures of regional resource planning and was presented jointly by Aaron Wiener, W. R. Derrick Sewell, and Harvey O. Banks.

Having assembled a distinguished and diversified staff to present some of the best current professional thinking in the topics suggested in the preceding paragraph, it was felt most appropriate to attempt to put their lectures into writing. A proceedings of the Institute would have considerable utility beyond the Institute itself. Hence, the instructors were encouraged to prepare written material for the proceedings and were given secretarial and other assistance to aid them. This material has been organized according to the four major courses and is issued in four companion volumes.

Clearly, this has been a prodigious effort which required Institute staff and others to "go the extra mile." Special thanks and recognition are due Mrs. Dorothy Riley who not only typed the entire proceedings but also attended to many details necessary for the successful operation of the Institute.

Jay M. Bagley served as director of the Institute and assumed a general coordinating and editing role in the development of these proceedings.

TABLE OF CONTENTS

<u>Chapter</u>		<u>Page</u>
PART I. THE WATER RESOURCE ENVIRONMENT		
by Cleve H. Milligan		
I	Introduction	3
II	Conservation	6
III	The Resource System	7
IV	Water Policy	26
V	Policy as Indicated by Some of the Statutes Dealing with Land and Water	35
VI	Political Model for Development of Resources	38
VII	Legal and Administrative Aspects of Water Development	54
	Selected References	57
PART II. LEGAL ASPECTS OF WATER RESOURCES DEVELOPMENT		
by Charles E. Corker		
	A Tour of Water Law with Gun and Banks	77
I	Water Law for Non-Lawyer Water Specialists	78
II	Water Right Doctrines	89
III	Prior Appropriation	96
IV	The Quasi-Theological Aspects of Water Rights-- California and Colorado Doctrines	101
V	A Comparison of Water Right Systems	104
VI	Federal-State Relations	108

TABLE OF CONTENTS (cont.)

<u>Chapter</u>		<u>Page</u>
VII	Underground Water	119
VIII	Interstate Water Law	124
IX	The Role of the Nonlegal Water Expert in Litigation-- Advice to Litigating Consultants	135

PART III. ADMINISTRATION OF WATER RIGHTS

	by Wayne D. Criddle	149
--	-------------------------------	-----

PART I
Lectures
on
THE WATER RESOURCE ENVIRONMENT, CE 262

Presented at the
SUMMER INSTITUTE IN WATER RESOURCES
UTAH STATE UNIVERSITY

by
Cleve H. Milligan
Professor of Civil Engineering
Utah State University

Logan, Utah
June 20-July 16

1965

I

INTRODUCTION

These lectures will look at the natural, physical, political, and legal environments in which water planning must take place and discuss, from a practical point of view, how the engineer lives with this environment and adapts projects to it.

The objectives are to:

1. Develop a better understanding of physical, biological, ecological, sociological, and legal environments in which water resources planning and development takes place.
2. Consider water resource development with respect to the development of other resources.
3. Indicate consequences of water resource development--for example, the effect that development of the Columbia River had on the fishing industry.
4. Show some interactions between developments and the institutions created.
5. Indicate the need for a broader conceptual basis in water planning and design. In this area there are several things to be done. A broader look needs to be taken on a larger areal basis. A more systematic approach should be used. The methodological problem should be investigated. How is the best alternative to solve the problem chosen? How can a system be developed to insure that the best solution is chosen, or that money is not put on the "wrong horse?" What common denominator can be used to get a consistent evaluation of each objective? How are intangible benefits evaluated? What is meant by making a "design decision?" How can the quality of decision making be improved?

To answer these questions, desirable objectives must be considered, principles and concepts that form a consistent set must be developed, and consequences that will develop from the system must be explored. In addition, an operational plan that leads to action must be developed; and the system must be physically realizable and economically and financially feasible.

These steps indicate a methodology of problem solution called "systems analysis." The following steps are involved in systems analysis:

1. Consider variables
2. Formulate objectives
3. Establish criteria
4. Attempt to set down all possible alternatives
5. Attempt to see all consequences connected with each course of action
6. Thoroughly analyze the consequences
7. Evaluate the alternatives
 - (a) Value judgments
 - (b) Economic analysis
8. Thoroughly consider the restraints
9. Make the decision

The system must be analyzed to determine what variables affect the system. Each variable should be studied sufficiently to determine the degree of importance it has in varying the system. If the system becomes too involved, the negligible variables may be omitted without adversely affecting the system.

The objectives define what is to be accomplished in the project. They may be broad or narrow depending on the designers point of view. The objectives may be chosen to maximize a result for the nation, for a region, for a state, or for an area. The objectives may be to transfer income or achieve the greatest utility for an area or a group.

Criteria must be set up to show how a project measures up to the objectives and to compare the several alternatives. All alternatives must be considered in order to maximize the desired function. This, of course, is very difficult to do. Alternatives are more apparent after completion of the project than when the project is still on paper.

An attempt must be made to see all consequences of each course of action. This is especially important in the economic analysis. Consequences will vary when considered by different disciplines. Political, social, legal, and economic viewpoints will usually not be united on the consequences of a project. The consequences may be single valued, may follow a frequency distribution, or may be a pure chance distribution. Analysis of these consequences may be simple or very complicated, but must be done.

Evaluation must be made on a sound economic basis. Present values are usually used, since cost and benefits occur at different times. Alternatives are evaluated from the same criteria. One of the most difficult parts of evaluation is value judgments. How are intangibles evaluated? Who must pay for uncertainties? Some uncertainties are amenable to rational analysis and some are not. It is difficult to attach a quantitative evaluation to every aspect of a project.

Restraints are considered to determine their effect on the project in relation to the desired objectives. Restraints may be physical, political, ideological, social, or a consequence of local customs. Identical restraints have identical results regardless of their origin.

The last step of systems analysis is to decide which alternative or combination of alternatives to select.

II CONSERVATION

The term "conservation" is some kind of ambiguous, magic term with many meanings depending on the person using it. There have been many attempts to appropriate its magic and its persuasiveness for special interest programs in the natural resources field. If somehow the term can be applied to a water project, the project immediately becomes good because conservation is good.

Gifford Pinchot, sometimes called the father of modern conservation, frequently used the definition: "Conservation is the use of natural resources for the greatest good of the greatest number for the longest time." This definition has a delightful ring to it. How could anyone be opposed to it? But there are conceptual difficulties in it. How can greatest good, greatest number, and longest time all be maximized at the same time?

There are two major themes concerning conservation:

1. The spiritual belief in "Nature"--the earth and everything on it is beautiful and should be preserved inviolate.
2. The practical belief that the earth should be used--the earth and everything on it is useful.

Conservation thus has a different meaning for different individuals. A balance must be reached between preservation and use. Preservationists do not accept the price system as a means of settlement of allocation problems. Increased population and needs for use of resources will accentuate the conflict between preservation of resources on the one hand and use on the other.

III

THE RESOURCE SYSTEM

Land

Land is an important factor in water planning and development. Land irrigation is the largest water user. Land use and, therefore, use of water on the land is not static but dynamic and changes as the society using the land develops. For example, the American Indian did not extensively cultivate the land; but our society intensively cultivates a good portion of the same land.

Several factors influencing land use and its place in the economy are:

1. Room
2. Climate
3. Land forms and topography
4. Water
5. Soil
6. Vegetation
7. Animal life
8. Mineral resources

People desire room to live, to move, to play, to expand, and to be alone. As the desire for room changes, the use of the land will change. The desire for room to play has changed mountain areas from cattle ranges to heavily frequented vacation areas. Designated wilderness areas soon become trampled by hundreds of people. At times the biggest difference in the wilderness area and an urban area is the mode of transportation and the type of dwellings that people use. Horses and tents replace cars and houses, but the large numbers of people persist.

Climate and weather have a pronounced effect on land use. Climate and weather conditions--heat, cold, drought, rainfall--limit or define the use that can be made of the land. Desert areas are not good farming regions mainly because of the lack of water. Once water is provided,

heavy yields may be realized. Regions where no snow falls do not make good ski resorts, and continually cold areas do not provide suitable outdoor swimming facilities. Land forms give a country character for people to see and enjoy. The mountains, canyons, special land forms designated as parks, plains, and deserts influence the choice of land use of the area. The main dam, Echo Canyon, on the Upper Colorado River Project was not built because enough people thought it would detract from the natural majesty of the surrounding land forms. The Wasatch National Forest in the mountains east of Salt Lake City has so many visitors each year that a problem of water use and pollution has developed.

Water is important in the use of land. The President's Water Policy Commission indicated that water development and use are inextricably connected with development and use of land. Some areas are used for military firing and bombing ranges because of the lack of water. Some flood plains are suitable only for agricultural use since the annual floods would destroy anything of a permanent nature. The soil covers the earth like a blanket. Good soil maps are a definite part of planning.

Vegetation often controls land use. The lumber industry, for example, cannot exist on the desert where trees do not grow.

An area may be used as a game refuge, because certain species of animal life exists here. Hunting areas depend specifically on the animal life present. The mining industry can exist only where mineral resources are available. Agriculture may be limited in an area due to the presence or lack of some mineral in the soil.

Besides the individual importance of each of these factors, they normally interact to form those characteristics that are conclusive to specific land uses.

The culture, and the stage of that culture, also determine the use and value of land. The American Indian had the same land at his disposal as we now have, but the use patterns are quite different.

Both physical characteristics and the culture determine land use and

the water production patterns on the land, as well as water requirements and the nature of the water which will be turned back into the water resource pool.

Soil

Conquests of countries have in many cases been motivated by a search for land. The fate of the land acquired by a country depends mainly on public attitude. In this country, for example, the first land users were the land-loving Europeans who were experienced at husbanding the soil. Upon facing an abundance of good land, they underwent a transformation and became agricultural spendthrifts. With ax, plow, fire, and overuse, they destroyed the forest and transformed the land. Their aim was to mine the rich, fertile soil which had accumulated over the ages. The soil user is now more conscious of managing and not mining the soil. However, much fertile soil is being eroded into our rivers and is being covered by concrete and buildings. Perhaps a longer projection into the future should be taken of soil use. In the Near East many towns are on the hills where the soil is unproductive, while the fertile valleys are reserved for agricultural uses. Since land is a factor in the production of water, the management of the land will affect the regime of water.

An important part of soil study is the soil profile. The sequence of soil characteristics from the surface to the bottom is depicted by the soil profile. Most soils exhibit a pattern of layers or horizons. The uppermost zone is called the A Horizon. This horizon is the zone of leaching, the organic zone, and has little or not resemblance to the parent material. The B Horizon is the zone of accumulation. It contains clayey materials, iron oxides, calcium carbonate and other materials leached from the layer above. This zone has some resemblance to the parent material. The C Horizon consists of partially disintegrated and decomposed rock material grading downward to the

unweathered parent rock. Some of the original unweathered materials are present.

Soils are dynamic, teeming with life, and constantly changing. Soil classification is an important part of land use projects. The Soil Conservation Service classifies land on the basis of ability to produce and to resist erosion. The U. S. Bureau of Reclamation classifies land on the basis of ability to repay project construction costs. The U. S. Bureau of Soils classifies land on the basis of physical and chemical characteristics. A mature soil is in equilibrium with the environment. The erosion processes are in equilibrium with the soil forming processes.

Soil management is important because of the amount of "soil mining" that has occurred. Good soil management essentially implies that we add equal amounts of like substances removed by crop production. Plant growth requires nutrients. When a harvest is made, nutrients should be returned. On the other hand, if salts are added through irrigation, an equal amount of salts must be removed or the land will become sterile. The Ghanat system in Iran is an example where salts added through irrigation have been removed through good drainage for thousands of years. There are many fertile areas throughout the world which have gone out of production because of salt accumulation.

Minerals

Many reports have been written about the extent of our natural resources and the projected depletion of these resources, and tend to place a pessimistic outlook on the extent of our resources. The total resource capability is classified into three categories.

1. Reserves--the reserves consist of identified, available resources that can be processed economically with present technology.
2. Potential--the potential is known to exist in an area but with present technology we are unable to process the ore, or it is not economical to do so.

3. Hidden--the hidden resources have not yet been discovered; they may exceed the known deposits.

Most reports also concede that advances in technology will assist in converting potential resources to reserves, and in discovery of the hidden resources. Advances in technology could also increase the reuse and reclamation of mineral resources.

The Paley Report is a report to the President and the Congress made by the President's Materials Policy Commission. The five volumes of the Paley Report include the following ideas as well as many others:

1. The overall objective of a national materials policy for the U. S. should be to insure an adequate and dependable flow of materials at the lowest cost consistent with national security and with the welfare of friendly nations.
2. Develop a good, specific materials policy.
3. A prediction of mineral demands to 1980. The demands on mineral resources will increase from 18 percent on tin to 1845 percent on magnesium.
4. Too much waste exists. Waste results from:
 - (a) Overdesign--more time needs to be spent on design to increase the efficiency of use of mineral resources.
 - (b) Overspecification
 - (c) Lavish desires--for example, bigger, longer, heavier cars than are necessary to provide adequate transportation.
5. Policy should encourage discovery and development of mineral resources.

The Commission recommended:

1. The federal mineral lands be subject to lease.
2. Only leased or appropriated claims be closed to prospectors.
3. Amounts of land leased should be large enough to encourage modern discovery and mining techniques.

4. The system of claims for appropriations should be modified.
5. The percent of depletion allowances should be retained but not raised.
6. The limitations on amount which can be claimed on minerals other than oil and gas be removed.

Many questions arise concerning projections of future requirements. How should a projection be made? What techniques give the best results? How can the use of synthetics be brought into focus? Have all significant variables been considered? Finally, are projections dependable or not? In the past, many composition errors have been made in projection techniques. Economists in Resources of the Future have done considerable research on projection techniques.*

Mineral development coupled with economic conditions affect industrial development. Minerals and industrial development affect water requirements and pollution and should be considered in water resources development planning.

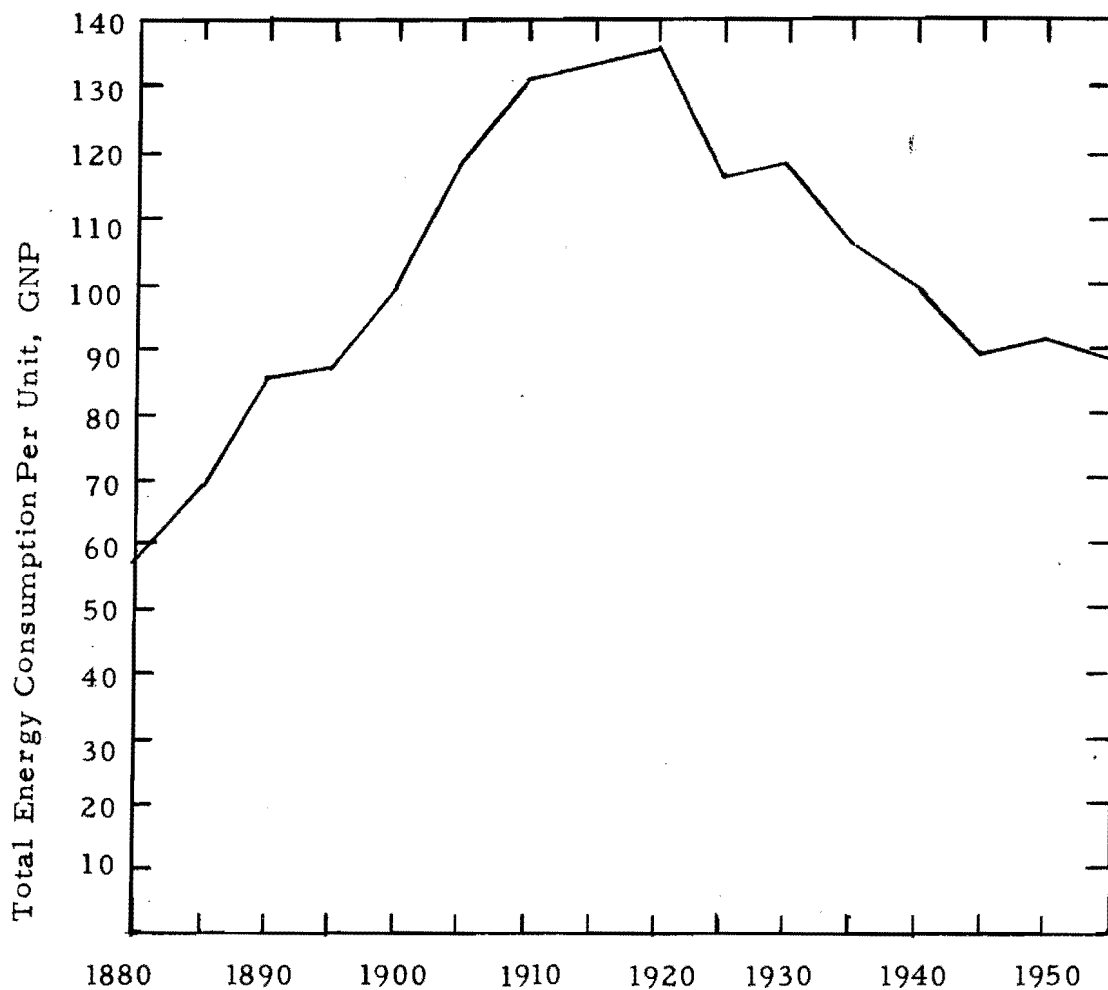
Energy

The main source of energy prior to about 1900 was wood. Wood was used as an energy source in the home and industry. Coal began developing about 1900 and became the main energy source until the late 1940's when petroleum and natural gas became the prime source of the total energy (about 60 percent). Since the late 1950's there has been a trend back to coal as a source of energy.

A plot of energy per unit gross national product versus time is shown in Figure 1. The curve, beginning in 1880, starts with a steep, increasing slope until about 1910 where it levels off until 1920 and then

* Landsberg, Hans H., Leonard L. Fischman, and Joseph L. Fisher. Resources in America's Future. Johns Hopkins Press, Baltimore, Maryland. 1963. 1056 pages.

Figure 1. Energy consumption per unit of gross national product*, 1880-1955 (five-year intervals)



Source: Energy in the American Economy, 1850-1975 (forthcoming publication of Resources for the Future, Inc.). Preliminary figures.

*GNP in constant (1929) dollars.

begins a more gradual decrease until the present time. The initially steep slope may be due to the lack of statistical data for energy consumption for that period.

Efficiency increase has played an important role in energy consumption. In 1890 seven pounds of coal were needed to produce one kilowatt hour of electricity. In 1965 seven-tenths of a pound of coal is required to produce the same amount of electricity. In early industry one large engine operated the whole plant. All of the wheels turned whether needed or not. Today the one large engine has been replaced by many individual electric motors that can be turned off when not in use. Management has also become more efficiency minded.

In the early days a large segment of energy consumption went into the mining industry. Now the majority of energy consumption is in manufacturing and transportation. Transportation alone uses about 20 percent of the energy consumed.

Another factor in the decline of energy per unit gross national product since 1920 is intangible capital. Intangible capital is the improvement in the basic sciences, management, education and training, and technology. One group attributes 60 percent of the capital gains over the years to intangible capital. Others, of course, disagree; but there is room for a projection of the results of intangible capital.

Nuclear energy is on the threshold of becoming an important energy competitor. The cost of nuclear energy is almost equal to that of energy from conventional energy sources. It is likely that the combination of nuclear energy production and water desalinization in Israel will make nuclear energy competitive with conventionally produced energy.

Some progress has been made in the recovery of fossil fuels and the extraction of oil from oil shales. Oil shales are shales containing 25 gallons or more of oil per ton of shale. Utah and western Colorado have an estimated 500 billion barrels of oil in oil shales. Wyoming is estimated to have about an equal amount. Research is being done to find

an economical method of oil extraction without excavation of the shale. Water requirements are high in development of these methods of oil extraction.

About one-half of the oil resources of the world are located in the Middle East. Foreign policy will dictate to what degree the United States will be able to use this source. The United States presently imports from 15 to 20 percent of their oil requirements.

In the face of dwindling oil supplies, available alternative energy sources must be considered. Some of the more important ones are:

1. Import oil. The extremely unstable world relations render this alternative very unlikely.
2. Oil shales. Technology will be an important economic factor in the production of oil from the oil shales.
3. Coal. New techniques are making coal more desirable as an economical energy source. Thermal plants which convert coal into electricity will make the energy from coal available to a widespread market.
4. Nuclear energy. Nuclear energy is arriving at the threshold. The problems of waste disposal and shielding seem to rule out this energy source for a good deal of transportation needs. Resources of the Future, a private foundation studying natural resources, states that atomic energy will not provide any significant portion of energy by 1975. Estimates, however, propose that nuclear energy may provide 50 percent of the energy by 2050.
5. Solar energy. The cost of the installation compared to the amount of energy that is produced indicates that solar energy will not contribute a significant amount of the total energy required. Technology advances may change this picture.

It is generally agreed that all the hydroelectric power available will be used. Hydroelectric power will probably be used chiefly for

regulation and will be available to all markets through interconnection of transmission systems. The location of thermal power plants will be determined by the economics of transportation of the electricity compared to the economics of transportation of the energy source.

Considerable volumes of water are required for thermal production of electricity. Since coal will very likely be used for thermal power plants in the future, planning for future water development must recognize this factor.

Outdoor Recreation

The value of recreation is extremely hard to quantify. A good deal of sentiment is found in the literature dealing with this resource. The enormity of the problem is complicated by value judgments. How are the benefits of recreation synthesized into the economic picture dealing with benefits from all resources? How can a real value be placed on an intangible benefit? What is a life worth? Is the value of lives lost at a recreation site to be deducted from the recreational benefits? How is the value of conservation of recreation value determined? It seems that once the word "conservation" is applied to something, economic analyses may be ignored simply because conservation "is good." Research is needed to determine some method of assigning a real value to intangible benefits of water benefits such as recreation.

Recreation is defined as "the pleasurable and constructive use of leisure time" or "the act of recreating, a state of being recreated, refreshment of the strength of body and spirit after toil, diversion, play." Recreation may be purely physical, it may provide intellectual, aesthetic, or emotional outlets; or it may include varied combinations of these. Recreation must do more than merely enable an individual to occupy idle time. It must enrich, broaden, develop individual capabilities and gratify man's natural desire for new and more satisfying ways of life. As a result of the intangible implications, recreation may never be adequately evaluated.

Consumers' Expenditure for Recreation

The Commerce Department estimates that for 1956 there were \$13 billion spent for recreation. Fortune Magazine estimates that in 1953 there were \$18 billion spent on recreation, or that 5 to 8 percent of the national income was spent for recreation. The phenomenal growth of recreation is demonstrated by the following tabulation:

<u>Year</u>	<u>Millions of visits to National Parks</u>
1910	0.1
1920	1.0
1925	2.0
1928	3.0
1958	60.0

TVA reservoirs have had a 15 percent increase annually in visits since 1953. The Corps of Engineers reports a 28 percent annual increase in visits to reservoirs since 1956. The increase in recreation is a result of several factors. Four important ones are:

1. Increase in population
2. Increase in buying power
3. More leisure time
4. Increased mobility

Recreational areas are classified into three categories:

1. Resource-based areas. These areas have unusual features or beauty such as Yellowstone Park or the Grand Canyon. There are presently 40 million acres of these parks, but there is not much more acreage to be added. These areas will receive more intense use in the future.
2. Intermediate areas. These areas are easy to get to for an overnight excursion. There are presently 9 million acres with a projected need by the year 2000 of 70 million acres.
3. User-oriented areas. These areas are easily accessible and consist of playgrounds, tennis courts, golf greens, swimming pools, etc. There are presently 750,000 acres

with a projected need of 5 million acres by 2000.

Preservation or maintenance of recreation areas will be a problem. Overuse can ruin a recreational area as thoroughly as a bull dozer. The greatest threat will come from users themselves. Much recreation is water based and hence recreation will have increasingly greater impact on water development.

Ecology, Wildlife, Wilderness

Ecology is defined as the relation of living organisms to their environment. The ecological approach is fundamental in resource development and conservation. Ecology warns that compartmentalized dealing with environment may be wasteful or even disastrous. For example, wasteful cropping has completely damaged 100 million acres of land and seriously damaged another 100 million acres. Man is not independent of nature. Natural processes proceed in cycles. Because of the requirements for a continuous process in natural cycles, one group of engineers may be found draining some natural marshes at the same time another group is creating marshes for water fowl.

Ecology is concerned with many fields, some of which are:

1. Soils
2. Water
3. Forest and wildlife conservation
4. Grazing
5. Insect control
6. Fisheries and the seas
7. Life processes (biology)

Some useful ecological terms and concepts are:

1. Autecology--relations of an individual or a single species to his environment.
2. Synecology--relations of a group or community to their environment.

3. Ecosystems--activities of living organisms with nonliving physical and chemical substances and forces around them.
4. Biotic communities--independent and inseparable plant and animal communities.
5. Biomes--plant-animal communities with a characteristic structure and physiognomy.
6. Ecological succession--orderly and systematic replacement of species as a result of interaction with environment.

Each living species is an ecological indicator of existing conditions. Range men utilize certain species to indicate the condition of the range. During the process of succession, ecosystems may change--the big ones eat the little ones.

The engineer must keep in mind the biotic communities which his project is likely to affect. By breaking one link in the chain, he may bring a project to ruin, or he may destroy a biotic pyramid with man at the top.

Ecology is concerned with competition and cooperation. Competition between the species keeps a natural balance. In 1906 the mule deer in the Kaibab region of southern Utah became quite scarce. The area was proclaimed a national game refuge. The cattle were removed, and the mountain lions were trapped. The deer herd became so large that the vegetation wouldn't support it. In the space of six years, about 80,000 deer starved to death which returned the deer herd to a less than natural balance had man not interfered.

Today's society holds many promises and threats. Atomic energy, the population explosion, water shortages, and water pollution have thrust environmental problems to the forefront of man's thinking. The ability and willingness of man to change his environment have changed much more rapidly than man's understanding of the consequences of such changes has developed. Man should attempt to become thoroughly acquainted with the overall environmental processes and

conditions which make possible the survival and prospering of individual organisms including himself. Questions arise every day which require analysis and understanding. For example:

1. How much radioactive waste can be permitted to flow into our streams without serious consequences in the future?
2. Should coastal marshes be drained to provide building sites or should they be preserved to sustain sea-food production and wild fowl?

New orders of magnitude of problems with biological implications are emerging which require new orders of magnitude of thinking. Alterations in our environment are often reversible only at great expense in time and money. For example, the Copperhill Basin in Tennessee is now a complete desert area of raw, red gullies which virtually defy man's attempts to revegetate them. Before vegetation can be restored, the complete environment which sustains the vegetation must be restored.

Terminology and scope. Ecology comes from the Greek word oikos meaning house or more broadly environments. Ecology is concerned with groups or families of organisms and their interrelationships on the land, in the oceans, in the fresh waters, in the forests, and wherever they may exist. Ecology is the study of the structure and function of nature, the fundamentals common to all life. Ecology may require an understanding of:

1. Botany--plants
2. Zoology--animals
3. Physiology--man
4. Mycology--fungi
5. Entomology--insects
6. Ornithology--birds

Ecology is concerned with the levels of organization of life. (1) protoplasm, (2) cells, (3) cell communities, (4) tissues, (5) organs, (6) systems of organs, (7) population, (8) community, (9) ecosystem, (10) biosphere.

While the biological spectrum includes all ten levels, ecology is more particularly concerned with numbers 7, 8, 9, and 10.

The population means a group of individuals or any one kind of organism, and is not restricted to man. A community includes all of the populations of a given area. An ecosystem includes the community and the nonliving environment functioning together. The biosphere is the portion of the earth in which ecosystems can operate--air, soil, and water portions of the earth.

An ecosystem has certain built-in homeostatic mechanisms which tend to keep the system in balance or equilibrium. For example, a system within man keeps his body temperature nearly constant despite variations in the environment. The homeostatic mechanisms operate at the population, community, and ecosystem level.

"To understand a tree, it is necessary to study both the forest of which the tree is a part, as well as the cells and tissues which make up the tree." To understand completely and advance the science of biology, we must advance along the whole biological spectrum from protoplasm to biosphere.

Each ecosystem has two biotic components:

1. Autotrophic--self nourishing
2. Heterotrophic--other nourishing

The autotrophic components extract elements from the soil and water and synthesize them in the presence of sunlight into nourishment. The heterotrophic are followers and use the nourishment produced by the autotrophic components. These components are arranged in overlapping layers.

Such an ecosystem is composed of the following:

1. Abiotic substances--basic elements and compounds of the environment
2. Producers--autotrophic organisms
3. Macro-consumers--heterotrophic organisms

4. Decomposers--saprophytes, bacteria, and fungi, also heterotrophic.

The problem of explaining the processes in an ecosystem could be attacked from various standpoints: (a) the energy or thermodynamic approach, (b) the chemist's approach, and (c) the biologist's approach. Regardless of the approach used, the scientist could probably explain the quantity of life which a particular ecosystem could support. To restore a particular ecosystem, man must reestablish all phases of the ecosystem.

A comparison can be made of the gross structure of a terrestrial ecosystem, a grassland, and an open-water ecosystem, either a fresh water or marine. The necessary units for functioning are:

1. Abiotic substances. These substances are the basic organic and inorganic compounds in the water and the soil.
2. Producers. The vegetation on the land and the phytoplankton in the water are the producers.
3. Microconsumers or animals
 - (a) Direct or grazing herbivores, including grasshoppers, meadowmice, etc., on land and zooplankton in water.
 - (b) Indirect or detritus-feeding consumers or saprovores, including soil invertebrates on land and bottom invertebrates in water.
 - (c) The "top" carnivores, including hawks on land and large fish in the water.
4. Decomposers. These include bacteria and fungi of decay in both systems. Both systems overlie a parent material.

The producers use the abiotic substances to produce food for the macroconsumers which die and are converted to abiotic substances by the decomposers. The cycle is then ready to start over again.

Wildlife includes the vertebrates--fishes, birds, and animals. There are an estimated 823,000 kinds of animals in the world, each making a contribution.

The estimated capitalized value of wildlife in the U. S. in 1945 was:

	<u>Billion \$</u>
Water fowl	1.5
Fur animals	0.4
Big game	1.3
Commercial fisheries	5.8
Game fish	5.0

These figures do not include the intangible benefits, nor the benefits of insect control. Two essentials to all forms of wildlife are:

1. Adequate cover for living, feeding, and breeding
2. Adequate food supply through the year

These factors are often under control of the engineer. Whenever the engineer manipulates land, water, or both, he has a profound effect on wildlife. The engineer should consider the ecological implications connected with each project he considers.

Marine Resources

The ocean has a tremendous resource potential. It covers 71 percent of the earth's surface and extends to great depths in some areas. Like the land, in years gone by the resources of the ocean have been assumed to be inexhaustible. Man's activity on the ocean has changed only a few aspects of resource potential. The ocean has a pronounced effect on the habits of man. The ocean is an important factor in the location of large cities. Northern areas of the world are inhabited because of the heat carried there by the ocean currents. The development and trade of culture has been greatly affected by the location of the oceans and adjoining seas. The ocean supplies the water that is so necessary for man's existence on the land.

Nature of marine resources. A natural resource consists of an arrangement of matter to which man can apply his activities, labor, and capital, to increase his net welfare. Renewable and nonrenewable

resources exist in the ocean. Renewable resources consist of those dependent on the amount left in the ocean to perpetuate themselves and those not so dependent, or nonregulatory. The self-perpetuating resources such as fish require sound management. The population of some fish species has declined as much as 80 percent, because good management was not practiced.

Water, minerals, waves, and currents are nonregulatory resources. Living resources of the ocean depend upon their environment and the propagating stock for existence. There exists an optimum use rate so far as maintenance of the resource is concerned. The attainment of this optimum use rate requires international agreement and management.

The life cycle in the ocean is similar to the life cycle on land. The cycle on land is GRASS-HERBIVEROUS ANIMALS-CARNIVEROUS ANIMALS-BACTERIAL MICROORGANISMS. The ocean cycle is PHYTO-PLANKTON-ZOOPLANKTON-INTERMEDIATE FLESH EATERS-FISHES. In the ocean cycles, the big ones eat the small ones. The ocean parallels the land in that the ocean, too, has deserts and green pastures. The ocean plows itself and in so doing brings nutrients from the bottom to depths where the nutrients can be utilized by living organisms. Plowing is done by wind action, temperature changes, and turbulence along the boundaries of currents. Many fish species important to man depend on the plowing action of the ocean for nourishment. The fish live in zones where they can find nutrients that they need. Pelagic species live near the bottom. Demersal species live in the zone of sunlight, and anadromous species go to the land for part of their life cycle.

Besides the many fish, the ocean contains many minerals in its depths. Beneath the ocean floor are large deposits of oil and probably other minerals not yet discovered.

The ecosystems of the ocean are interrelated to those of the land. Rivers transport nutrients from the land to the oceans to help sustain life in the oceans. Anadromous fish swim up the river to their spawning

grounds. The projects of man can interfere with these natural processes for both good and evil. These life processes introduce new dimensions to benefit-cost analyses and consequences which should be considered in project evaluations.

IV WATER POLICY

Throughout history water has played a dominant role in human life. Without water, none of the present-day miracles of human achievement would have been possible. Water is not always used in a beneficial manner as evidenced by eroded gullies, muddy streams, deposits in reservoirs, and top soil deposits in the oceans. Water policy has not been efficient and has been slow in developing. Many commissions have been organized to study water policy. President Truman asked his Water Policy Commission to give particular consideration to the following:

1. The extent and character of federal government participation in major water resources programs.
2. An appraisal of the priority of water resources programs from the standpoint of economic and social needs.
3. Criteria and standards for evaluating the feasibility of such projects.
4. Desirable legislation or changes in existing legislation to get a more uniform policy in the country as a whole and among the agencies.

The Commission made certain assumptions in the development of the Commission policy:

1. The U. S. would continue to have an expanding economy.
2. Development of water resources is fundamental to a growing economy.
3. Establishment of world peace depends on the strength of a dynamic economy in America.
4. Proper utilization of resources may be the ultimate determinant of our strength.

Mistakes have been made in the use of resources, but one of the strengths of a free society is that mistakes can be recognized and corrected. There is a growing consciousness in this society that the resources

must be conserved and used wisely. Two facts have become apparent.

1. Water is limited in relation to its many and varied uses.
2. Water management, conservation, and use is inextricably bound up with the management, conservation, and use of the land and both are essential to the expansion of the nation.

If water is not properly used, the full use of other resources will be lost.

The Source of Policy

A well-rounded national water resources policy must be a broad reflection of the concensus of the people of the nation. The experts, the government, and the people should each have a place in policy formation, but one cannot take the place of another. Policy must be infused with a moral relationship between man and nature, and man and man. The nation's water policy must be designed to serve the people. Water policy should be developed for river basins and not for political boundaries. The river basins in the west have become the fundamental sources of strength for regional cultures.

As the development of our culture and economy has proceeded, the relationship of man to rivers has become more complex. Erosion became a national problem and needed immediate attention. Good watershed management became a necessity. Increased transportation needs were partially met by river facilities. Increased energy needs expanded the hydroelectric facilities. The growing population caused people and industry to occupy flood plains which increased the need for flood control. Water quality control has become important since pollution has rendered many streams unfit for beast, bird, fish, and man.

Healthy Regionalism

Economic and national security forces have pushed for regional development as opposed to the centralization and concentration of

industry in a few heavily populated areas. Each region has its own peculiarities of climate, topography, tradition, ideology, and indigenous activities and has insisted on developing them.

Evolution of Water Resources Policy

Although water resources policy has been slow in its development, there have been some advances in this direction as exemplified by the following:

1. The need for comprehensive planning and development of an entire river system or region.
2. More unified planning and development of multiple-purpose, basin-wide projects.

Water policy growth has not yet provided a single uniform federal policy governing comprehensive development of land and water resources, or adequate coordination of efforts of several agencies. It has provided a number of statutes passed at different times devoted to individual segments of river basin development, and a number of separate executive agencies (which may be good or bad because they are often in conflict with each other and have different goals or objectives with considerable overlapping functions).

Long before there was multiple-purpose, basin-wide legislation there was a recognized need for it as evidenced by acts of Congress for navigation, flood control, irrigation, and power in the late 1800's. Many authors advanced water policy concepts which are being echoed today. However, it was not until 1933 that Congress authorized a large-scale effort to treat river basins as units for purposes of planning and development, and there has not been much similar legislation since then. Concepts expressed eighty years ago are still expressed but not applied.

Need for Reappraisal

The ideas of conservation, maximizing benefits, multiple-purpose

projects, avoidance of waste, and of cross-purpose among agencies pose serious problems of coordination of efforts which must be solved. All purposes served by water have legitimate claims in the planning phases of water development. Nothing less than the whole country can be considered as the unit in formulation of federal policies. Past legislation needs to be reviewed. This suggests a national objective: maximization of benefits to the nation as a whole.

Democratic Planning

Planning in the United States must mean intelligent flexibility not rigidity, cooperative and shared responsibility not dictatorship, encouragement of initiative and enterprise not controlled by a strong central committee, and long-range plans for river basins not piecemeal effort. The federal government is not the only agency involved in planning and should not become a great monopoly. The role of the federal government should be in providing:

1. Leadership
2. Coordination
3. Information--physical and economic
4. Investment
5. Environment and climate for comprehensive planning

The federal government is justified in participating because:

1. In many cases no other agency can raise the money required for large basin-wide projects.
2. It can provide competition to monopolies.
3. It can collect all the benefits (in other words, it can internalize externalities).

The federal government can insure that water development obtains the objectives of:

1. Economic stability
2. Balance between regional economies
3. Industrial dispersion for national security, etc.

Goals and objectives of water planning should be established by Congress and should be multi-purpose and nation wide in scope.

Framework of Principles

A framework of principles would provide basic guidelines for policy formation. Such a framework would point out:

1. The importance of clearly defined regional and national goals which water resources programs will be designed to achieve.
2. The necessity of planning for a river basin as a whole instead of having a patchwork of plans by separate agencies for separate purposes.
3. Simple procedures for determining whether money invested in a river basin program will be well spent or not. The procedures should give full weight to broad economic and social benefits.
4. A system of repayment designed to treat alike all who enjoy the advantages of federal investment--and will recognize contributions to the general welfare of the people.
5. The need for recognition of river basin projects as a stabilizing influence on the economy of the basin.
6. The provision of adequate basic data needed in sound planning and design.
7. Sound management principles applied to groundwater basins, watersheds, flood control, etc.
8. Use of all resources in such a way that we contribute to the building of a strong nation.

All programs should be evaluated on the same basis and in terms of a set of national objectives established by Congress. The objectives should (1) safeguard against deterioration of the resource base, (2) safeguard public health, (3) provide for adequate recreation, and (4) provide for transportation, electric power, irrigation, etc. Congress should require the agencies to submit reports on a multiple-purpose, basin-wide basis so

that a clear picture is presented to the Congress and the public. Agencies should be required to cooperate with each other in the development of comprehensive plans. Separate river basin commissions should be set up for each of the major basins to coordinate the work of the agencies involved. Congress should designate the agencies to be represented on the river basin commissions.

Project Evaluation

Evaluation procedures should be revised and extended to multiple-purpose basin-wide programs. Each project should be evaluated as an integral part of the program. Congress should require all agencies to use the same evaluation procedures. The President should establish a detached federal board of review to be approved by the Senate to review all programs and projects. Evaluation should include all direct benefits and costs as well as secondary benefits, and should include all benefits and costs which affect the general welfare. The investment appraisal should be in single form for the guidance of the public and Congress. The investment appraisal of costs should be complete and should include indirect costs such as:

1. Displacement of population
2. Loss of land and minerals
3. Loss of wildlife
4. Loss of scenic or historic values

The investment appraisal of benefits should be complete. Benefits and costs should be estimated on the same basis by all agencies. Where benefits are less than costs the river commission should make a value judgment on the feasibility of the program. All agencies should be requested by Congress to cooperate in preparation of plans and programs. Congress should make ample provisions for obtaining the basic data needed for sound formulation and evaluation of programs. All reports should carry a statement on the adequacy of basic data on which the

report is based. A survey program should begin immediately to obtain adequate basic data on the major river basins. An appropriate agency should compile a report on water use, requirements, and supply for the important river basins. A report should be made on use of water by unnecessary water-loving plants in the West. Basic data should not be restricted to hydrology and engineering facts but should include economic and sociological facts and information so that sound evaluation techniques can be applied.

Financing Plans

Financing of river basin projects should be set up on a long range program. Basins should submit their budget requests to the Congress, and Congress should make annual appropriation to the river basin commissions. Annual water resources investments should be based upon a thorough review of the nation's resources and resource development requirements.

Reimbursement

Congress should develop a uniform national reimbursement policy along with guiding principles to be applied. Reimbursement policy should aim to recover a reasonable portion of the public expenditure. States should use their taxing powers to assure reimbursement to the federal government for primary and secondary benefits not susceptible to direct collection. Reimbursement policy should be uniform for all federal agencies. Reimbursement principles are:

1. Domestic, industrial, and hydropower: full repayment of construction, operation, and maintenance, with interest.
2. Irrigation and drainage and watershed management: based on the ability to pay, without interest, based on landowner's increase in net earnings. (Note: this item is the recommendation of the Water Policy Commission. There is disagreement on this recommendation.)

3. Navigation: on a cost basis including interest.
4. Other benefits: shared by the states.

Federal payment should cover general welfare aspects. Multi-purpose program accounts should be established for each river basin. Irrigation projects should be placed on the same basis as other water resource projects for which full reimbursement is not required as a test of feasibility.

Water Resource Management

Groundwater resources should be included in comprehensive water development programs. The federal government should encourage the enactment of state laws and interstate compacts which would foster the development of groundwater basins. Watershed management should be included as a part of basin programs to control deterioration of the land. Federal support programs should strengthen the effectiveness of watershed management programs. Flood control should begin on the lands of the watershed. Flood control measures by reservoirs should be so located that stored flood waters can be utilized for other purposes. Flood control should include such measures as local flood protection works, flood plain zoning, flood forecasting, etc.

Land Reclamation

Expansion of agriculture to meet the nation's expanding needs should be orderly. The U. S. D. A. should review all projects with irrigation and drainage aspects to determine if they are in harmony with sound land use and needs. Consideration should be given to the increase in production on existing lands likely to occur through improved technology. The justification for public investment in irrigation is that there are public ends to be attained which the commercial price system cannot reflect. Consideration should be given to alternative methods of producing agricultural products as well as to the specific contributions

of irrigation agriculture. The government should give more attention to land development and settlement problems, in getting the land under production. Special attention should be given to rehabilitation of existing irrigation projects. The 160 acre limitations should be enforced. Larger units should be considered only where they receive only a supplemental supply.

There is disagreement with some of the foregoing ideas expressed in the Commission Report, but it does emphasize the need for national policy and objectives and uniform procedures in evaluation of projects in government project planning and design.

V

POLICY AS INDICATED BY SOME OF THE STATUTES
DEALING WITH LAND AND WATER

Prior to 1862 the government acquired and sold property in order to obtain funds to operate the government. The colonies surrendered large areas of land to the federal government which brought about the idea of public domain. The federal government favored land speculation and did not limit the size of land purchase but preferred to sell at least a section at a time. In 1862 the Homestead Act limited the size of tract to 320 acres which was later reduced to 160 acres. A small fee was involved provided the settler, a family unit, made certain improvements on the land. The Act of 1866 dealt with right-of-way across public domain property. This act acknowledged and confirmed rights-of-way for ditches in connection with vested and accrued water rights. The Act of 1877 permitted the individual to acquire land from public domain if the land was desert land. Desert land was land that would not produce enough to make an ordinary crop of hay in a usual season or would not produce a reasonable remunerative crop of any kind including trees. Any person 21 years of age or older could apply to the several land offices for land at a cost of 25 cents per acre. Certain improvements gave the settler the deed to the land. A man and woman could get a maximum of 1,280 acres provided they were both over 21 years of age and qualified otherwise. About 80 million acres were alienated to individuals through this act. During the 1890's federal reservations took out about 281 million acres for special purposes such as forests and mining. Thirty-five million acres were taken for Indian reservations.

The Carey Act of 1894 made available to the states about 14 million areas of federal land which could be granted to the states provided they could show that they intended to improve this land. The states often contracted with private enterprise to provide irrigation for these

Million Acres

256	Taken by the Homestead and Desert Land Acts
40	The Store Act for the construction of buildings and works
242	Granted to the states for schools, etc.
130	Granted to the railroad
68	Military reservations
186	Left in federal domain for grazing, etc.

lands which were then sold to private individuals after subdivision. The contractors usually held the original water rights. Idaho with 30 projects under this act was by far the largest participator. Much of the land along the Snake River was developed under this act. A total of about one million acres was developed by the states under this Act. Each individual was permitted to own only 160 acres. However, there was considerable abuse which allowed "land barons" to gain control of large tracts of land originally granted under this Act. Many developments under the Carey Act were deficient in engineering design and failed as a result.

In 1902 the Reclamation Act was passed. It originally contained ten clauses, but has been amended by several acts of Congress until not it occupies three volumes. Included in these volumes are several important Supreme Court decisions. The first section of the original act set up a revolving reclamation fund. The Secretary of the Interior was required to make studies and report on the feasibility of projects. Projects were subject to approval by Congress. The people were required to return the cost of the project to the fund over a 10-year period. It was necessary for Congress to add to this fund from time to time. The original repayment time was 10 years but has been extended so that now it can be as high as 60 years. There have been certain moratoriums granted during difficult periods such as during the depression of the early 1930's. A high percentage of the funds granted have been repaid. Many of the large projects have necessitated special legislation. Recent legislation has caused some modification of the appropriation doctrine. Acceptance of government

money results in the states giving up points of western appropriation doctrine. All acts have said that they would in no way interfere with the state administration of water rights. In some recent cases there has been a tendency toward reversal of this policy. Recent cases also indicate that water originating on federal lands belongs to the federal government. Seventeen western governors have objected, but so far have been unable to get any national legislation to clarify the states vs. federal rights approved by Congress. The federal government claims that the states have not been protecting the water resources. This is a part of the trend toward national control of the resources. The Federal Power Act of 1920 places the Federal Power Commission as a watch dog over power. The Commission has jurisdiction over power projects on federal lands and navigable streams. It grants licences for a period of 50 years. However, the licenses can be revoked in national interest or the installations can be impounded in time of national emergency. The Commission can exercise power of eminent domain.

VI

POLITICAL MODEL FOR DEVELOPMENT OF RESOURCES*

Functions of the State

The state must understand and in some way interpret the principles which govern the common life, but never seek to prescribe them:

The state has three functions:

1. Guarantee a political and economic environment which will enable all to participate in citizenship.
 - (a) freedom of speech, press, association, voting, fair trial
 - (b) minimum wages, opportunity for employment, social services
 - (c) provide accurate information about the community
 - (d) defend the community against external attack and internal violence.
2. Provide the institutional means for focusing on areas of community agreement and create a set of rules and criteria to guide governmental action.
3. Carry out activities which will accomplish the foregoing.

The Political Model

The political model illustrated in Figure 2 indicates the various steps in the political process. There are four groups in the model:

1. The community, made up of the masses of the people and their institutions for development of broad objectives to be accomplished by society.
2. The electorate, whose function is to select qualified people to further implement broad objectives set up by the community.

* These notes were taken largely from "Design of Water Resources Systems" by Arthur Maas, Maynard M. Hufschmidt, Robert Dorfman, Harold A. Thomas, Jr., Stephen A. Marglin, and Gordon M. Fair. Harvard University Press, 1962. Chapter 15.

What goes on in the circles: Discussion and debate

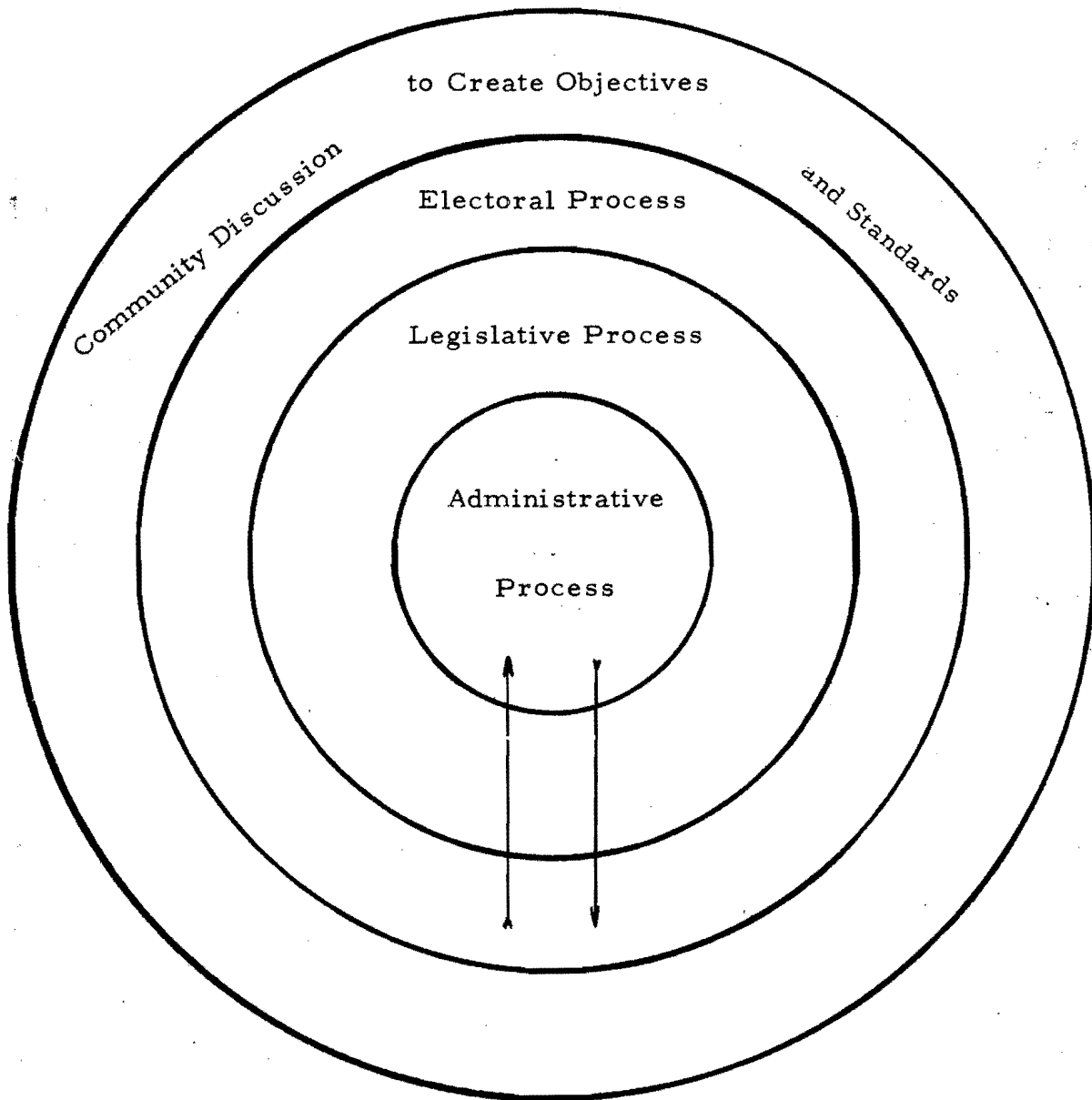


Figure 2. Sketch of political model

(Arrows indicate flow of information and political power in both directions.)

3. The legislative group which further condenses the objectives and enacts laws to implement these objectives.
4. The administrative branch which carries out actual projects to accomplish the objectives.

There is a flow of ideas from the executive branch of the government outward to the community, and a flow of ideas from the community toward the executive branch, so that all levels of government can be integrated and coordinated.

Community Discussion (Community and its groups)

General issues

Broad standards

The state takes no part except to provide facts and to create the proper political and economic environment.

The Electoral Process (Takes over from the community)

Involves further, more specific discussion. Men are selected to represent the community in this further discussion. Specific and detailed programs are not developed at this stage as yet. (This is done in the legislative process.)

"The essence of the selective function of the electorate consists in the choice of men who, in their personal capacity, and in virtue of their character, are fitted to discharge the task of deliberation and discussion at the parliamentary stage."*

The Legislative Process

Translates into rules of law the general programs endorsed by the legislative body.

Integration of views (usually cannot be efficiently accomplished by the community at large).

*Barker, Ernest. Reflections on Government. Oxford University Press, London, 1942.

The synthesis of views should be "so coherent and cohesive that all subsequent decisions at the next level will flow merely on necessary consequences of common goals."^{*}

The Administrative Process

Legislative rules are translated into criteria and action programs.

Leadership, Accountability, and the Public Interest

1. Democratic government, through stages of discussion, provided for leadership and accountability.
 - (a) Division of labor permits leadership among the components of the division.
 - (b) Calls for discretion at each level.
 - (c) Sets standards at each level.
2. The standard is conformity with the agreements arrived at in the outer circles.
 - (a) Works back to the electorate which periodically passes judgment on the legislators.
 - (b) In between elective periods the electors will try to evaluate the sense of public opinion.
3. Administrators have two types of responsibility:
 - (a) Carry out the law with honesty and energy.
 - (b) Report on achievements and recommend changes in the law.

Macmahon^{**} has said: "...the operating administrator's... prime duty in carrying out the law is charted in the law's intent, declared or clearly

^{*} Cooper, Joseph. The Legislative Veto; Its Promise and Its Perils. Senior Honors Thesis, Harvard University, 1955.

^{**} Macmahon, Arthur. Specialization and the Public Interest. In: Democracy in Federal Administration, edited by O. B. Conway. (Graduate School, U. S. Department of Agriculture, 1955) p. 49.

implicit. In addition, still pursuant to the law but beyond its unmistakable guidance, the operating administrator must make innumerable judgments. Here enters his residual duty to take the broadest possible view of the consequences of any action."

- (c) The administrator must look beyond specific provisions of the legislation; he must try to sense the broader consensus of the electorate and the community.
 - (d) He must exercise discretion in his recommendations.
4. Leadership originates with the division of labor but it is also a by-product of accountability. Legislators and top administrators participate in the electoral level of decision-making, defending or criticizing the record of past accomplishments, and through this participation, they become leaders in attracting attention to, and seeking consensus on, important issues.
 5. A similar process takes place in the legislative process.
 6. The worthy objectives of this discussion are:
 - (a) search for consensus on community values
 - (b) de-emphasize power politics based on individual or group pressures or demands.
 7. Interest-oriented debate should be deferred to the last stages of debate.

Example: Issue: Should or shouldn't the government improve inland waterways for recreational boating. This issue is discussed by the community and by the legislators. An act is passed. This act lays down broad standards for the waterway. Administration now plans a specific project which bisects the property of J. Q. Citizen who had previously in the discussion process approved the basic legislation, but now he objects. J. Q. is caught in Rousseau's dilemma where his will for the community is in conflict with his own personal interest. But a good solution for the community interest can probably be reached with him more easily after the public-oriented debate.

Division of Governmental Power

To complete our model we need to identify the units of government which conduct the processes, and the more important relationships among these units.

Reasons for Dividing Government Power

To help realize the basic objectives or values of a political community.

Example: Basic values--liberty, equality, welfare

Liberty--governmental power is divided to protect the individual and groups against arbitrary government action and against great concentrations of political and economic power.

Equality--government is divided to assure that government action on welfare is effective in meeting the needs of society.

No one value can be maximized if all other values are to be achieved in a high degree.

The relations between governmental and non-governmental divisions of power are reciprocal; the government division both reflects the community's power structure and itself influences it.

Government by successive stages of discussion is based on two assumptions:

1. That the social structure is such that, with institutional arrangements which foster it, the community will search for consensus through discussion.

2. That institutional arrangements, including governmental divisions of power can be developed which will foster the process of discussion.

Theories of government which emphasize the struggle for power among competing interest groups are contrary.

Methods of Dividing Governmental Power^{*}

Capital, areal (political geographic areas), process, function, constituency.

Process--Legislation, administration, judicial. Each could be shared by 2 or more bodies.

Areal--Legislation--central government
Administration--provincial } or vice versa

Functions--Some, such as coining of money, to central government; others to states, others to municipalities.

Capital--Power divided among officials and bodies of officials at the capital city of a political community.

Constituency (certain groups in society)--Upper legislative body represents one group in society, the president certain other groups.

Process, function, and constituency are interrelated as methods of dividing power. The assignment of processes, functions, or constituencies to governmental units at the capital and to component areas can be either exclusive or shared.

Example: exclusive: coining of money
shared: control of stream pollution

Example: exclusive: legislation--legislature
shared: administration--executive

Shared powers--competitive

"Division of power is the basis of civilized government. It is what is meant by constitutionalism."*

Electoral System

Three criteria for evaluating and choosing among alternative electoral systems are:

* C. J. Friedrich. Constitutional Government and Democracy. Ginn, Boston, 1950. page 5.

1. The system should select delegates who as a group represent the community.
2. The system should select delegates who are qualified to carry out the legislative and administrative processes through the given institutions of government.
3. Division of government based on constituency, when considered along with divisions based on process and function, should be adequate to satisfy community values.

Legislative and Administrative

There is no exact correspondence between the legislative process and the functions of the legislature, or between the administrative process and the functions of the executive.

The chief executive and the legislature both participate in both the legislative and administrative processes.

Reasons for a legislature are related to popular control over legislative and administrative processes.

Oversight of the Administrative Process

Bureaucracy suffers from an inherent tendency toward parochialism and aggrandizement of power by officials that destroys responsibility. Therefore, bureaucracy must be subject to investigation and criticism. Legislative review guarantees the capacity of the people to call the administration to account. Courts, professional standards are necessary but not sufficient for this purpose. Too frequently they are after the fact.

Oversight of the Legislative Process

The executive takes the leadership in this activity. There are actually two initial processes in legislation:

1. Early stages--reducing alternatives and concentrating on the more promising possibilities.

2. Ensuring that policy proposals are coordinated and consistent.

Number 1 requires information and expertise; number 2 requires central direction of the policy formulation process. The executive can better to this. If the legislature were forced to provide its own expertise (standing committees with professional staffs) it would be self-defeating.

3. No presidential leadership--congress takes over.

4. The president relies on the bureaus for expertise.

President's tools: Bureau of Budget legislative clearance
administrative management

5. Intrinsically and practically the legislature cannot provide the central direction to legislation which the executive can.

6. Pinpointing responsibility is easier where the executive takes the initial leadership and gives central direction.

7. The role of the legislature is to criticize and control on behalf of the nation: to modify proposals of the executive in the light of public opinion. It is the political barometer of the nation.

Congress is the focal point for organization and expression of public opinion. It can use hearings to sound out public opinion. These hearings can also be used to educate the public.

Qualitative Contribution of the Legislature

1. The collective non-technical mind may contain insights and sensitivities beyond the perception of the expert.
2. The legislature institutionalizes the open mind--this gives flexibility and capacity for change. These contributions are needed to balance bureaucracy.
3. The legislature's constituency is different from the president's. This gives a valid refinement of community consensus.

Roles of Executive are Defined and Related

In the interaction of the executive and legislative branches we have a division of government power by processes shared.

<u>Institution</u>	<u>Process</u>	<u>Role</u>
Chief executive (Pres.)	Legislative and administrative	initiation
Legislature (Congress)	Legislative and administrative	oversight

The roles of these two institutions, the chief executive and the legislature, can be further defined and related in terms of:

1. Types of policy and administration performance
2. Relations within each institution.

The legislature deals with broad policy and general administration performance. Unless the legislature concentrates on broad issues and policy, it cannot perform its educational function.

People in general cannot be interested in the case of Arizona vs. California, but can be interested in the prevention of speculation on possible benefits from federal improvements.

Detailed statistics on expenditure for pencils by the U. S. Corps of Engineers would not be enlightening to the public, but overall statistics on commerce on the nations waterways might be.

The Executive

1. Deals with narrower issues.
2. The executive bureaus should be responsible directly and primarily to the president for initiative in the legislative and administrative processes, and they should be responsible to congress only through the chief executive.

Committees of the legislature should be directly and primarily responsible to the whole chamber. Techniques must be used to organize the legislature to protect the committee system, on the one hand, and ensure effective legislative action which represents the whole, on the other hand.

Direct relations between committees of the legislature and the bureaus of the executive have been a serious challenge.

Example: U. S. Corps of Engineers (Rivers and Harbors Congress)

Implications for Water Planning for Government's Responsibility
for Organizing the Legislative and Administrative Processes

How do we institutionalize the model?

Objectives of Construction

Three steps are involved:

1. Set the objectives by legislative action.
2. Translate the objectives into design criteria and a budget by the administration.
3. Design of projects for the river system by the planners in the field.

Objectives

Economic efficiency
Income redistribution
Regional economic growth
Control of speculation

Consensus is determined by legislative processes. The executive proposes a program which the legislature modifies and approves.

Design Criteria

Evaluation of benefits and costs
Interest rates
Budgetary constraints

This is part of the administrative process, but the legislature should review to determine if in harmony with broad policy.

Program Formulation and Design

Selection of alternatives .

Evaluation of alternatives to satisfy the objectives and criteria.

As the executive translates objectives into projects, it may find conflicting legislative objectives. The executive makes recommendations for clarification back to the legislature.

Finally, the projects are constructed according to plans and specifications.

1. To do this is an administrative task.
2. The legislature oversees for efficiency, honesty, and conformance.

Two Illustrations

Case 1. The existing process for authorizing plans for navigation, flood control, and other multi-purpose objectives.

- (a) The legislative process is by-passed. No discussion of objectives.
- (b) No translation of legislative objectives into design criteria.
- (c) The process begins with project design with very few policy guides.
- (d) Plans are reviewed by the executive and then sent to congress.
- (e) Congress is not best fitted to pass on specific projects.
 - (i) Hydro, irrigation, flood protection on Columbia River, for example.
 - (ii) Biennially, congress considers an omnibus rivers and harbors and flood control bill (packet).
 - (iii) Hearings and debate do not turn on objectives and policy, but on other details (pork barrel).

The main activity of the legislature should be to establish objectives and policy, and to oversee in a general manner. The process should not begin with project formulation but with objectives, goals, and policy.

Case 2. Efforts during the period 1948 to 1952 to define and declare policy (Objectives for water policy development.)

- (a) First Hoover Commission
- (b) President's Water Resources Policy Commission

Many of the recommendations of these commissions have not been adopted.

Implications for Water Planning of Government's
Responsibility to Inform the Community

Government collects and analyzes intelligence for all four levels of discussion.

The government does not organize the process of community discussion: it only insures the capacity of all citizens to participate actively in it.

The legislature needs facts for:

1. Broad policy determination
2. Oversight of administrative performance.

The community needs facts to discuss broad objectives. Not "details or no details," but "what kind of details?" is the problem in community and legislative debate.

Objective oriented discussion, not interest oriented discussion.

This does not mean that information must be especially directed to national economic efficiency, regional income redistribution, etc., but to alternative objectives and their alternative objectives and impact. This results in a cycling process of continuing discussion. Without this kind of process, systems built in 1960 could be based upon 1902 objectives. With this kind of evaluation, objectives can be changed to keep up with changing reality.

Data for community discussion come from:

1. The legislature
2. The administration
3. Non-governmental sources

It is a unique responsibility of the government to keep the public informed.

Problems in Maintaining Objectivity

What are the requirements imposed by government responsibility to inform the public? The most important requirement is objectivity.

Basic Data: (Data for design)

1. Population
2. National and regional income
3. Projections of water requirements
4. Hydrology, etc.

If a design and construction agency is also responsible for basic data, it may focus data collection and interpretation on the design objective of the moment. But the process in which objectives are being continuously changed demands a greater variety of data than that necessary to pursue a given objective.

Data must be collected and analyzed well in advance of the need for a particular purpose. The process of data collection requires a broad view of community objectives. Probably an agency cannot simultaneously collect data for broad purposes and design projects for narrower purposes.

Intelligence to Evaluate Objectives

Can an agency simultaneously design and construct water projects for agreed-upon objectives and provide the community with full and unbiased alternatives for the purpose of evaluating these objectives?

Professional Standards and Public Objectives

Design objectives deduced from broad values of the community may conflict with professional standards of the planner.

Example: Attitude toward risk in design of flood control structures. A fully informed community may prefer to accept a 25 percent risk of a damaging flood to a 5 percent risk and to use the money saved for a municipal auditorium. Engineers, on the other hand, may prefer a 5 percent risk because of some rather sacred standards, and they may do this with no intent of hypocrisy.

Bias may arise because of the planner's preoccupation with physical development.

Another Example: Design standards in manuals of practice which have become sacred cows.

Interest Group Views

Can an agency that is involved in accommodating interests for one purpose resist involvement for a related purpose?

Example: An agency investigates possible agricultural developments in a certain area. The task is assigned to an area office, which finds that the area is currently being dry-farmed in rather large efficient units. If irrigation is introduced, the area can produce more in smaller units. The area office, looking to its future, that of designing irrigation systems, presents its data and conclusions in such a way as to favor irrigation of the area.

The local organization representing the farmers opposes reduction in size of units. The agency to avoid conflict accommodates its report by leaving out any reference to size of operating unit. The most significant facts in terms of the broad interests of the public have been accommodated out of the report.

Remedies Proposed

1. Separate data collection from action programs.
2. Provide for independent review of project planning and design to avoid:
 - (a) professional bias
 - (b) undue accommodation of special interests
 - (c) excessive concern with design standards
3. Competition in agencies (example in USBR: earth and concrete dam sections.).

Degree of Inclusiveness Required

Should the water agency try to present to the community all information, all sides, and all alternatives of a policy issue? No. The government may not have all of the facts. Government agencies and the legislature should seek information from many sources.

Balancing Data and Action

Overweighting interests of the hydrologist will usually result in too little water resource development; overweighting of the interests of the designer, in efficient development. (Usually from excessive caution.)

Implications for Water Planning of the Division of Governmental Power

The extent to which unified responsibility is an institutional requirement for water planning depends on technologic, economic, and political factors, and on the state of the art of design.

The desires of planners to keep planning for a river basin or a region in the hands of one central agency to increase efficiency of planning is in conflict with the idea of division of power to maintain the democratic process. There must be some sort of balance maintained in this conflict. Compromise is essential.

Note: See "The Road to Serfdom" by Friedrich A. Hayek. Phoenix Books (paper back), University of Chicago Press, 1944.

VII
LEGAL AND ADMINISTRATIVE ASPECTS
OF WATER DEVELOPMENT

Legal aspects of water development are not static but dynamic. Law has evolved with the growth and change of society. Laws which were beneficial to society in the past may not be beneficial to society at the present time. For this reason, it has been said that law is not so much fact as fancy. Probably, in a dynamic system too much emphasis has been placed on past legal decisions. Past decisions that have been outgrown or maybe were not correct in the first place should not be weighted so heavily in present problems. However, in project planning we must consider vested rights which should not be taken away without due process of law.

There are two basic doctrines of water rights: 1. Riparian, and 2. Appropriation. The riparian law came from England and was a result of Common Law. The doctrine of riparian rights states that if a man owns property next to a stream of water, he has the right to have the water flow past that property undiminished in quantity and unpolluted in quality. This doctrine in the strictest sense would prohibit any use of water; however, it has been modified, especially in arid regions, to a reasonable use doctrine. The riparian right essentially fixes the water to the land. Most northwestern, northern, and eastern states follow some form of riparian rights. The riparian doctrine has to be relaxed somewhat in order for people away from the stream to get any water. Water is sometimes acquired by the adverse use right in riparian right areas.

The appropriation system was probably first practiced by the Indians and the Padres in the missions of California, Arizona, New Mexico, and Texas. The miners of California and the pioneers of Utah later adopted the appropriation doctrine. To get water rights the miners would stake the point of diversion and area of use, just like staking a mine claim, and post a notice of the point of diversion and the amount of water to be diverted. If someone protested the claim, a committee of miners decided how the water would be divided. Water appropriation in Utah was originally under

ecclesiastical authority. Brigham Young said, "No man has the right to waste water that would produce another man's bread." The appropriation doctrine includes the following principles:

1. Water belongs to the public. An individual can obtain the right to use the water if he follows the prescribed procedure.
2. Beneficial use. Beneficial use is the measure and limit of the right. The big problem is in defining beneficial use.
3. First in time, first in right.
4. Post notice.
5. The right to protest.
6. Diligence in putting water to beneficial use.

Though the appropriation doctrine includes these principles, they are sometimes modified, waived, and disregarded depending on the problem and its geographical location. Water right law has not always been the same and is not applied in the same manner in different areas even at the same time. However, as need for water increases greater uniformity in application of law is being achieved. Beneficial use is becoming nearer to actual water requirements.

Water rights allocations made in the past do not necessarily optimize the benefits from the water resource. The granting of a water right has not included analysis to determine the allocation resulting in economic efficiency. The principle of first in time, first in right has usually been applied. Programming of water resources considers present water allocations as a restraint. Previous allocations may not be as serious as they appear at first glance. A higher economic priority use can generally afford to buy a prior water right.

Certain recognized elements of a water right are:

1. Quantity (expressed as continuous flow over a period of time or as a volume of water)
2. Time or season of use
3. Point of diversion
4. Nature of the use

5. Place of use
6. Priority of the right.

The law in most states which follows the appropriation doctrine requires a formal application to change any one of these elements. The application is not complete until proof of beneficial use is shown.

The theory of first in time first in right is sometimes overruled by the priority of use by eminent domain. A preferential use must pay for the use of the water taken from lower priority uses. However, water exchange is a valid principle in most states. In Utah, the exchange of water between two areas under separate water rights must be approved by the State Engineer.

Obtaining water rights and providing a distribution system along with operation and maintenance are undertaken by several different local institutions. They are:

1. Mutual or cooperative company
2. Commercial company
3. Irrigation district
4. Water user's association
5. Water conservancy district

In the west, three methods of distribution are used. On a given canal all three methods may be used.

1. Continuous flow--a stream flows continuously to the user.
2. Rotation--a certain time is specified for each user to use the flow in the distribution system on his land.
3. Demand system--the individual user calls the water master and tells him when he needs the water. The water master adjusts requests and provides the water as near the requested time as possible.

These methods may also be used in combination.

Legal and administrative aspects of water development and use are discussed in greater detail by Criddle and Corker.

SELECTED REFERENCES

Planning

1. California Department of Water Resources. The California Water Plan. Division of Resources Planning, 1957.
2. California State Water Resources Board. Water Resources of California. California State Water Resources Board Bulletin No. 1, 1951.
3. California State Water Resources Board. Water Utilization and Requirements in California. California State Water Resources Board Bulletin No. 2, 1955.
4. Davidoff, Palil, and Thomas A. Reiner. "A Choice Theory of Planning." Journal for the American Institute of Planners, May 1962.
5. Finer, Herman. Road to Reaction. Encounter Paperbacks, Quadrangle Books, Chicago, 1945.
6. Hayck, Friedrich A. The Road to Serfdom. Phoenix Books, University of Chicago Press, 1944.
7. Meyerson, Martin, and Edward C. Banfield. Politics, Planning, and the Public Interest. Free Press, Glencoe, Illinois, 1955.
8. United States Study Commission--Southeast River Basins. Plan for Development of the Land and Water Resources of the Southeast River Basins. (12 vols.) 1963. U. S. Government Printing Office, Washington, D. C.
9. United States Study Commission--Texas. Report. Part I. The Commission Plant; Part II. Resources and Problems; Part III. The Eight Basins. U. S. Government Printing Office, Washington, D. C.
10. Water Resources Center, Georgia Institute of Technology. Organization and Methodology for River Basin Planning. Georgia Institute of Technology, Atlanta, Georgia, 1964.
11. Watt, Kenneth E. F. "Computers and the Evaluation of Resource Management Strategies." American Scientist, December 1964.

12. Weinkauff, H. C. C., and C. P. Linder. Current Concepts of Water Resource Project Formulation and their Application to Hydro-Development in the Southeast. ASCE Water Resources Engineering Conference, Mobile, Alabama, March 8-12, 1965. Conference Reprint 139.

Systems Approach to Planning and Development

13. Asimow, Morris. Introduction to Design. (Paperback) Prentice-Hall, Inc., 1963.
14. Baumol, William J. Economic Theory and Operation Analysis. Prentice-Hall, Inc., 1961.
15. Lee, Robert R. Local Government Public Works Decision Making. Ph.D. dissertation, Stanford University, 1964. (Report EEP-9)
16. Maas, Arthur, et al. Design of Water-Resource Systems. Harvard University Press, 1962. Chapters 4-7.
17. McKean, Roland N. Efficiency in Government through Systems Analysis. John Wiley and Sons, 1958.
18. Starr, Martin K. Product Design and Decision Theory. (Paperback) Prentice-Hall, Inc., 1963.
19. Tolley, G. S. "Analytical Techniques in Relation to Watershed Development." Journal of Farm Economics, August 1958.

Land Resources

20. Clawson, Marion, and Irving K. Fox. Your Investments in Land and Water. Resources for the Future, 1961. 20 p.
21. Clawson, Marion, and Irving K. Fox. "Problems of the Public Lands." Congressional Digest, December 1953.
22. Clawson, Marion, and Burnell Held. The Federal Lands. Published by Johns Hopkins Press for Resources for the Future, 1957.
23. Clawson, Marion, and Burnell Held. Land. The Yearbook of Agriculture, 1958. U. S. Department of Agriculture.

24. Clawson, Marion, and Burnell Held. A Place to Live. The Year-book of Agriculture, 1963. U. S. Department of Agriculture.
25. Clawson, Marion, Burnell Held, and Charles H. Stoddard. Land for the Future. Published by Johns Hopkins Press for Resources for the Future, 1960.
26. Devoto, Bernard. "Sacred Cows and the Public Land." Harpers Magazine.
27. Firey, Walter. Man, Mind, and Land: A Theory of Resource Use. The Free Press of Glencoe, Illinois, 1916.
28. Frank, Bernard, and Anthony Netboy. Water, Land, and People. Knopf Company, New York, 1950.
29. Hibbard, Benjamin. A History of Public Land Policies. P. Smith Company, New York, 1939.
30. Huberty, Martin R., and Warren L. Flock. Natural Resources. McGraw-Hill Book Company, 1959. Chapters 7, 8, and 9.
31. Robbins, Roy M. Our Landed Heritage. University of Nebraska Press, 1962.
32. Saunderson, M. H. Western Land and Water Use. University of Oklahoma Press, 1950.
33. Saunderson, M. H. Land and Water: Planning for Economic Growth. Western Resources Conference, University of Colorado Press, Boulder, 1961.
33. Saunderson, M. H. Missouri: Land and Water. U. S. Missouri Basin Survey Commission.
35. Udall, Stewart L. The Quiet Crisis. Holt, Rinehart, and Winston Company, 1963. Chapters 1 and 6. (This book gives a historical review of the development of land and water policy.)
36. White, Gilbert F. The Future of Arid Lands. American Association for the Advancement of Science, Washington, D. C., 1956.

Mineral Resources

37. Brooks, David B. The Supply of Minor Metals. Paper presented at the 4th Annual Resources Conference, Golden, Colorado. Resources for the Future, Inc., 1962.
38. Herfindahl, Orris C. Three Studies in Minerals Economics. Resources for the Future, Inc., 1961.
39. Herfindahl, Orris C. Goals and Standards of Performance for the Conservation of Minerals. Paper presented at the 4th Annual Resources Conference, Golden, Colorado. Resources for the Future, 1962.
40. Huberty, Martin R., and Warren L. Flock. Natural Resources. McGraw-Hill Book Company, 1959. Chapters 14 and 15.
41. Landsberg, Hans H. Natural Resources for U. S. Growth. Published for Resources for the Future by the Johns Hopkins Press, 1964.
42. Leith, C. K. World Minerals and World Politics. McGraw-Hill Book Company, 1931.
43. Netschert, Bruce C., and Hans H. Landsberg. The Future Supply of the Major Metals. Resources for the Future, Inc. 1961.
44. President's Materials Policy Commission. Resources for Freedom. Report of the Mid-Century Conference on Resources for the Future (sometimes called the Paley Report). 5 vols. 1952. U. S. Government Printing Office, Washington, D. C.
45. Riley, Charles M. Our Mineral Resources. John Wiley and Sons, 1959.
46. Thomas, W. L. Man's Role in Changing the Face of the Earth. University of Chicago Press, 1956.
47. U. S. Bureau of Mines and Geological Survey. Mineral Resources of the United States. Public Affairs Press, Washington, D. C., 1948.
48. Western Resources Conference. "Minerals and Energy." Parts I and II, Quarterly of the Colorado School of Mines, Vol. 57, No. 4, and Vol. 58, No. 1, 1962.

49. Zimmerman, Eric W. World Resources and Industries. Harper and Brothers, New York, 1933.

Energy

50. Bartley, E. R. The Tidelands Oil Controversy. University of Texas Press, 1953.
51. Cottrell, Fred. Energy and Society. McGraw-Hill Book Company, 1955.
52. Eckstein, Otto. Water Resource Development. Harvard University Press, 1958.
53. Huberty, Martin R., and Warren L. Flock. Natural Resources. McGraw-Hill Book Company, 1959. Chapters 16, 17, and 18.
54. Krutilla, John V. Sequence and Timing in River Basin Development. Resources for the Future, 1960.
55. Krutilla, John V., and Otto Eckstein. Multiple Purpose River Development. Johns Hopkins Press, 1958.
56. Landsberg, Hans H. Natural Resources for U. S. Growth. Published for Resources for the Future by Johns Hopkins Press, 1964.
57. Mid-Century Conference on Resources for the Future. The Nation Looks at its Resources. Resources for the Future, 1953.
58. President's Commission on Organization of the Executive Branch of the Government. Report on National Resources. (Appendix L) U. S. Government Printing Office, Washington, D. C. 1949.
59. President's Water Resources Policy Commission. A Water Policy for the American People. 3 vols. 1952. U. S. Government Printing Office, Washington, D. C.
60. President's Materials Policy Commission. Resources for Freedom. 5 vols. 1952. U. S. Government Printing Office, Washington, D. C.
61. Riley, Charles M. Our Mineral Resources. John Wiley and Sons, 1959. Chapters 12 and 13.

62. Schurr, Sam H., et al. Energy in the American Economy. Published for Resources for the Future by Johns Hopkins Press, 1960.
63. Schurr, Sam H., and Bruce C. Netschert. Two Statements on the Nation's Energy Position. Resources for the Future, 1959. U. S. Government Printing Office, Washington, D. C.
64. Twentieth Century Fund Power Committee. Electric Power and Government Policy. Twentieth Century Fund, New York, 1928.
65. U. S. Commission on Organization of the Executive Branch of the Government. Task Force Report on Water Resources and Power. 3 vols. 1953-55. U. S. Government Printing Office, Washington, D. C.
66. Western Resources Conference. "Minerals and Energy." Parts I and II, Quarterly of the Colorado School of Mines, Vol. 57, No. 4, and Vol. 58, No. 1, 1962.
67. Williams, Albert N. The Water and the Power. Duell, Sloan, and Pierce Company, New York, 1951.

Recreation and Wildlife

68. Allen, Durward L. Our Wildlife Legacy. Funk and Wagnalls Company, New York, 1954.
69. Allen, Shirley W. Conserving Natural Resources. McGraw-Hill Book Company, 1955.
70. Anderson, Wallace L., and L. V. Compton. "More Wildlife through Soil and Water Conservation." Agricultural Information Bulletin 175. Soil Conservation Service, USDA, 1958.
71. Brockman, C. Frank. Recreational Use of Wild Lands. McGraw-Hill Book Company, 1959.
72. Clawson, Marion. "The Crisis in Outdoor Recreation." American Forests, March and April 1959.
73. Clawson, Marion. Methods of Measuring the Demand for and Value of Outdoor Recreation. Resources for the Future, 1959.
74. Clawson, Marion. Land and Water for Recreation. Rand McNally and Company, Chicago, 1963.

75. Collins, Gerald B., and Carl H. Elling. "Fishway Research at the Fisheries--Engineering Research Laboratory." U. S. Fish and Wildlife Circular 98, 1960. U. S. Government Printing Office.
76. Connery, Robert H. Governmental Problems in Wildlife Conservation. P. S. King and Son, Ltd., London, 1935.
77. Dasmann, Raymond F. Environmental Conservation. John Wiley and Sons, 1960.
78. Duffenbach, Rudolph. "River Development Programs and their Relationship to Fish and Wildlife Resources." Journal of Wildlife Management 12:96-104, January 1948.
79. Fox, Irving K., and Henry P. Caulfield, Jr. Getting the Most out of Water Resources. Resources for the Future, 1961.
80. Gabrielson, Ira N. Wildlife Refuges. The MacMillan Company, 1943.
81. Gabrielson, Ira N. Wildlife Conservation. Funk and Wagnalls, New York, 1954.
82. Hayden, Sherman. The International Protection of Wildlife. Columbia University Press, 1942.
83. Huberty, Martin R. Natural Resources. McGraw-Hill Book Company, 1959. pp. 243-261.
84. Landsberg, Hans H. Natural Resources for U. S. Growth. Johns Hopkins Press, Baltimore, 1964.
85. National Association of Manufacturers. Water in Industry. National Association of Manufacturers, Chamber of Commerce of the United States, and National Technical Task Committee on Industrial Wastes, 1956.
86. Netboy, Anthony. Salmon of the Pacific Northwest. Binford and Mort, Publishers, Portland, Oregon, 1958.
87. Olson, Sigurd F. The Meaning of Wilderness. Address to Utah Academy of Sciences, Arts, and Letters given at Brigham Young University, May 3, 1958.

88. Outdoor Recreation Resources Review Commission. Outdoor Recreation for America. A report to the President and the Congress by the Commission. 1962. U. S. Government Printing Office, Washington, D. C.
89. U. S. Department of the Interior. Bureau of Reclamation. Lake Powell, Jewel of the Colorado. U. S. Government Printing Office, Washington, D. C., 1965.
90. U. S. Department of the Interior. National Park Service. A Study of the Park and Recreational Problems of the United States. U. S. Government Printing Office, Washington, D. C.
91. Wayne, Warner W., Jr. "Fish Handling Facilities for Baker River Project." ASCE Proceedings, November 1961.
92. Wing, L. W. Practice of Wildlife Conservation. John Wiley and Sons, 1951.

Water Resources

93. Ackerman, Edward A. Technology in American Water Development. Published for Resources for the Future by Johns Hopkins Press, 1959.
94. Baker, M. N. The Quest for Pure Water. American Water Works Association, 1948.
95. Carhart, Arthur. Water Or Your Life. J. B. Lippincott Company, Philadelphia, 1959.
96. Clawson, Marion, and Irving K. Fox. Your Investments in Land and Water. Resources for the Future, 1961.
97. Davis, Kenneth S., and John Arthur Day. Water, the Mirror of Science. Anchor Books, Doubleday and Company, 1961.
98. Eckstein, Otto. Water Resources Development. Harvard University Press, 1958.
99. Ellis, C. B. Fresh Water from the Ocean. Ronald Press Company, 1954.
100. Fox, Irving K. Reason in Water Management. Resources for the Future, 1962.

101. Fox, Irving K., and Henry P. Caulfield, Jr. Getting the Most out of Water Resources. Resources for the Future, 1961.
102. Golze, Alfred Rudolf. Reclamation in the United States. Caxton Printers, Caldwell, Idaho, 1961.
103. Harding, S. T. Water in California. N. P. Publications, Palo Alto, California, 1960.
104. Hirshleifer, Jack, James C. DeHaven, and Jerome W. Milliman. Water Supply--Economics, Technology, and Policy. A Rand Corporation Research Study. University of Chicago Press, 1960.
105. Huberty, Martin R., and Warren L. Flock. Natural Resources. McGraw-Hill Book Company, 1959. Chapters 2 and 3.
106. Hurst, C. K. Water in International Affairs. Canadian Institute of International Affairs, 1956.
107. King, Thompson. Water, Miracle of Nature. The Macmillan Company, 1953.
108. Kneese, Allen V. The Economics of Regional Water Quality Management. Published for Resources for the Future by Johns Hopkins Press, 1964.
109. Krutilla, John V., and Otto Eckstein. Multiple Purpose River Development. Published for Resources for the Future by Johns Hopkins Press, 1958.
110. Kuenen, P. H. Realms of Water. John Wiley and Sons, 1955.
111. Langbein, Walter B., and William G. Hoyt. Water Facts for the Nation's Future. Ronald Press Company, New York, 1959.
112. Maas, Arthur. "Congress and Water Resources." American Political Science Review, September 1950.
113. Maas, Arthur. Muddy Waters. Harvard University Press, 1951.
114. Moreel, Ben. Our Nation's Water Resources Policies and Politics. University of Chicago Press, 1956.
115. Morgan, Murray. The Dam. The Viking Press, New York, 1954.
116. Ostrum, Vincent. Water and Politics. The Haynes Foundation, Los Angeles, California, 1953.

117. President's Water Resources Policy Commission. A Water Policy for the American People. 3 vols. 1952. U. S. Government Printing Office, Washington, D. C.
118. Sholett, G. T. Essay on External Use of Water. Johns Hopkins Press, 1935.
119. Smith, Stephen C., and Emery N. Castle. Water Resources Development. Iowa State University Press, 1964.
120. Tay Foundation. Our Water Resources. 1953.
121. Tolley, G. S., and F. E. Riggs. Economics of Watershed Planning. Iowa State University Press, 1961.
122. U. S. Department of Agriculture. Water. Yearbook of Agriculture, 1955. U. S. Government Printing Office, Washington, D. C.
123. U. S. Department of Agriculture. Headwaters: Control and Use. U. S. Government Printing Office, Washington, D. C., 1937.
124. Williams, Albert N. The Water and the Power. Duell, Sloan, and Pierce Company, New York, 1951.
125. Wollman, Nathaniel. The Value of Water in Alternative Uses. University of New Mexico Press, Albuquerque, 1962.

Resources Law

126. Harding, S. T. Water Rights for Engineers. Stanford University Press, 1936.
127. Harding, S. T. Water in California. N. P. Publications, Palo Alto, California, 1960.
128. Hutchins, Wells A. "Summary of Irrigation-District Statutes." U. S. Department of Agriculture Miscellaneous Publication 103. 1931.
129. Hutchins, Wells A. "Selected Problems in Western Water Law." U. S. Department of Agriculture Miscellaneous Publication 418. 1942.
130. Hutchins, Wells A. The Nevada Law of Water Rights. State Engineer of Nevada, Carson City, Nevada, 1955.

131. Hutchins, Wells A. The New Mexico Law of Water Rights. State Engineer of New Mexico, Santa Fe, New Mexico, 1955.
132. Hutchins, Wells A. The Oklahoma Law of Water Rights. Oklahoma Division of Water Resources, Oklahoma City, 1955.
133. Hutchins, Wells A. The California Law of Water Rights. State of California, Sacramento, 1956.
134. Hutchins, Wells A. The Idaho Law of Water Rights. Idaho State Department of Reclamation, Boise, 1956.
135. Hutchins, Wells A. The Kansas Law of Water Rights. Kansas State Water Resources Board, Topeka, 1957.
136. Hutchins, Wells A. "Legal Problems in Water Resources." California Law Review, Vol. 45, No. 5, December 1957. School of Law, University of California, Berkeley.
137. Martz, Clyde. Cases on Natural Resources. American Casebook Series. West Publishing Company, St. Paul, Minnesota, 1951.
138. Sato, Sho. Water Resources Allocation. 3 vols. School of Law, University of California, Berkeley, 1962.
139. Schulz, William F., Jr. Water Resources Law. Report of the President's Water Resources Policy Commission, Vol. 3, 1951.
140. Schulz, William F., Jr. Conservation Law and Administration. Ronald Press Company, New York, 1953.
141. Schulz, William F., Jr. "Law and Contemporary Problems." Water Resources and River Basin Development, Vol. XXII, Nos. 2 and 3, 1957. School of Law, Duke University.
142. Schulz, William F., Jr. Water Resources and the Law. University of Michigan Law School, Ann Arbor, 1958.
143. Thomas, Robert O. Legal Aspects of Groundwater Utilization. Irrigation Division, American Society of Civil Engineers, 1959.
144. Turney, Jack R., and Harold H. Ellis. "State Water-Right Laws and Related Subjects. A Bibliography." U. S. Department of Agriculture Miscellaneous Publication 921, 1962.

Conservation

145. Allen, Shirley W. Conserving Natural Resources. McGraw-Hill Book Company, 1955.
146. Bennett, H. H. Soil Conservation. McGraw-Hill Book Company, 1939.
147. Burton, Ian, and Robert W. Kates. Readings in Resource Management and Conservation. University of Chicago Press, 1965.
148. Connery, Robert H. Governmental Problems in Wildlife Conservation. P. S. King and Son, Ltd., London, 1935.
149. Dasmann, Raymond F. Environmental Conservation. John Wiley and Sons, 1960.
150. DeVoto, Bernard. "Shall We Let Them Ruin Our National Parks?" Saturday Evening Post, July 22, 1950. pp. 17-19.
151. DeVoto, Bernard. "The Sturdy Corporate Homesteader." Harper's Magazine, May 1953.
152. DeVoto, Bernard. "Heading for the Last Roundup." Harper's Magazine, July 1953, p. 44.
153. DeVoto, Bernard. "Floods in the Desert." Harper's Magazine, August 1953.
154. Farb, Peter. The Living Earth. Pyramid Publications, Inc., New York, 1959.
155. Frevert, Richard K., Glen O. Schwab, T. W. Edminster, and K. K. Barnes. Soil and Water Conservation Engineering. John Wiley and Sons, 1955.
156. Gabrielson, Ira N. Wildlife Conservation. Funk and Wagnalls Company, New York, 1954.
157. Herfindahl, Orris C. What is Conservation? Resources for the Future, 1961.
158. Huberty, Martin R., and Warren L. Flock. Natural Resources. McGraw-Hill Book Company, 1959. Chapter 19.

159. Kerr, Robert S. Land, Wood, and Water. (Paperback) MacFadden Capitol Hill Books by MacFadden-Bartell Corporation, New York, 1963.
160. Lord, Russell. The Care of the Earth. Mentor Book (Paperback) The New American Library of World Literature, 1963.
161. Osborn, Fairfield. Our Plundered Planet. Little, Brown, and Company, Boston, 1948.
162. Osborn, Fairfield. The Limits of the Earth. Little, Brown, and Company, Boston, 1953.
163. Parkins, A. E., and J. R. Whitaker. Our Natural Resources and their Conservation. John Wiley and Sons, 1936.
164. Parks, Robert W. Soil Conservation Districts in Action. Iowa State College Press, Ames, Iowa, 1952.
165. Parson, Ruben L. Conserving American Resources. Prentice-Hall, Inc., 1956.
166. President's Commission on National Goals. Goals for Americans. Prentice-Hall, Inc., 1960.
167. Resources for the Future. Perspectives in Conservation. Johns Hopkins Press, 1958.
168. Smith, Guy-Harold. Conservation of Natural Resources. 2nd Ed. John Wiley and Sons, 1958.
169. Thomas, Harold E. The Conservation of Ground Water. McGraw-Hill Book Company, 1951.
170. Vogt, William. Road to Survival. William Sloane Associates, Inc., New York, 1948.
171. Wing, Leonard W. Practice of Wildlife Conservation. John Wiley and Sons, 1959.

Political Aspects of Water Development

172. Conway, O. B. Democracy in Federal Administration. Graduate School, U. S. Department of Agriculture, 1955.

173. Dahl, Robert A., and Charles E. Lindblom. Politics, Economics, and Welfare. Harper Torchbooks, Harper and Row, New York, 1963.
174. DeRoos, Robert, and Arthur Maas. "The Lobby That Can't Be Licked." Harpers Magazine 199:21-30, August 1949.
175. Engelbert, Ernest A. American Policy for Natural Resources: A Historical Survey to 1862. Unpublished doctoral dissertation, Harvard University, 1950.
176. Gulick, Luther. American Forest Policy: A Study of Governmental Administration and Government Control. Sloan and Pearch, New York, 1951.
177. Hardin, Charles. The Politics of Agriculture. Glencoe Free Press, Illinois, 1952.
178. Hurst, C. K. Water in International Affairs. Canadian Institute of International Affairs, 1956.
179. Leith, C. K. World Minerals and World Politics. McGraw-Hill Book Company, 1931.
180. Leuchtenburg, William E. Flood Control Politics. Harvard University Press, 1953.
181. Lilienthal, David E. TVA--Democracy on the March. Harper and Bros., New York, 1944.
182. Maas, Arthur. "Congress and Water Resources." American Political Science Review, September 1950.
183. Maas, Arthur. Public Administration and Policy Development. (The King's River controversy) Polygraphic Company, 1950.
184. Maas, Arthur. Muddy Waters. Harvard University Press, 1951.
185. Maas, Arthur, et al. Area and Power. Free Press, Glencoe, Illinois, 1959.
186. Maas, Arthur, et al. The Design of Water Resource Systems. Harvard University Press, 1962.
187. McKinley, Charles. "The Valley Authority and its Alternatives." American Political Science Review, September 1950.

188. Moreel, Ben. Our Nation's Water Resources--Policies and Politics. University of Chicago Press, 1956.
189. Ostrum, Vincent. Water and Politics. Haynes Foundation, Los Angeles, 1953.
190. Shih, Y. American Water Use Administration. Bookman Associates, New York, 1956.
191. Stegner, Wallace. Beyond the Hundredth Meridian. Houghton Mifflin Company, 1954.
192. Strong, B. J. "The Rivers and Harbors Lobby." New Republic, 121:13-15, October 10, 1949.
193. Wengert, Norman. "Natural Resources and the Political Struggle." Short Studies in Political Science, No. 24, Doubleday and Company, Inc., Garden City, New York, 1955.
194. White, Gilbert. "National Executive Organization for Water Resources." American Political Science Review, September 1960.

Economics of Water Development

195. Ackley, Gardner. Macro-Economic Theory. MacMillan Book Company, New York, 1961.
196. Agarwala, A. N., and S. P. Singh. The Economics of Underdevelopment. Oxford University Press, 1963.
197. Alchian, Armen A., and William R. Allen. University Economics. Wadsworth Publishing Company, Inc., Belmont, California, 1964.
198. Bator, Francis M. The Role of the Government in a Private Economy.
199. Bator, Francis M. The Question of Government Spending. Collier Books, New York, 1960.
200. Castle, Emery, Maurice Kelso, and Delworth Gardner. "Water Resources Development: A Review of the New Federal Evaluation Procedures." Journal of Farm Economics, November 1963.

201. Ciriacy-Wantrup, S. V. Resource Conservation--Economics and Policies. (Revised) University of California, Division of Agricultural Sciences, Berkeley, 1963.
202. Davis, Joseph S. "The Population Upsurge and the American Economy." Journal of Political Economy, October 1953, pp. 369-388.
203. Dernberg, Thomas F., and Duncan M. McDougall. Macro-Economics. 2nd Ed. McGraw-Hill Book Company, 1963.
204. Eckstein, Otto. Water Resource Development--the Economics of Project Evaluation. Harvard University Press, 1958.
205. Gardner, B. Delworth, and Seth H. Schick. "Factors Affecting Consumption of Urban Household Water in Northern Utah." Utah Agricultural Experiment Station Bulletin 449, 1964.
206. Grant, Eugene L., and W. Grant Ireson. Principles of Engineering Economy. 4th Ed. The Ronald Press Company, New York, 1960.
207. Heady, Earl O. Economics of Agricultural Production and Resource Use. Prentice-Hall, Inc., Englewood Cliffs, N. Y., 1952.
208. Henderson, James H., and Richard E. Quandt. Microeconomic Theory. McGraw-Hill Book Company, 1958.
209. Higgins, Benjamin. Economic Development. W. W. Norton and Company, Inc., New York, 1959.
210. Hirschleifer, Jack, James C. DeHaven, and Jerome W. Milliman. Water Supply: Economics, Technology, and Policy. University of Chicago Press, 1960.
211. Kneese, Allen V. The Economics of Regional Water Quality Management. John Hopkins Press, Baltimore, 1964.
212. Krutilla, John V. Sequence and Timing in River Basin Development. Resources for the Future, Inc., 1960.
213. Krutilla, John V. Welfare Aspects of Benefit-Cost Analysis. Journal of Political Economy 69(3):226-235. 1961.

214. Krutilla, John V., and Otto Eckstein. Multiple Purpose River Development--Studies in Applied Economic Analysis. Johns Hopkins Press, Baltimore, 1958.
215. Kuhn, Tillo E. Public Enterprise Economics. University of California Press, 1962.
216. Leftwich, Richard H. The Price System and Resource Allocation. Rev. Ed. Holt, Rinehart, and Winston, New York, 1960.
217. Loucks, William N. Comparative Economic Systems. 6th Ed. Harper & Brothers Publishers, New York, 1952.
218. Masor, Edward S. Economic Planning in Underdeveloped Areas. Fordham University Press, New York, 1958.
219. McKean, Roland N. Efficiency in Government through Systems Analysis. John Wiley and Sons, 1958.
220. Musgrave, Richard A. The Theory of Public Finance--A Study in Public Economy. McGraw-Hill Book Company, 1959.
221. National Bureau of Economic Research. Public Finances--Needs, Sources, and Utilization. Princeton University Press, 1961.
222. Ostrum, Vincent. "The Social Scientist and the Control and Development of Natural Resources." Land Economics, Vol. 29, May 1953.
223. President's Water Resources Council. "Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources." Senate Document No. 97, 87th Congress, 2nd Session, 1962.
224. Roberts, N. K. "Economic Foundations for Grazing Use Fees on Public Lands." Journal of Farm Economics, November 1963.
225. Ruttan, Vernon W. The Economic Demand for Irrigated Acreage. Johns Hopkins Press, Baltimore, 1965.
226. Scitovsky, Tibor. Welfare and Competition. Richard D. Irwin, Inc., Chicago, Illinois, 1951.
227. Sewell, W.R.D., J. Davis, A. D. Scott, and D. W. Ross. Guide to Benefit-Cost Analysis. Resources for Tomorrow Conference, Montreal, Canada, 1961. Economic Study Branch, Canada Department of Public Works, Montreal.

228. Smith, Stephen C., and Emery N. Castle. Economics and Public Policy in Water Resource Development. Iowa State University Press, Ames, 1964.
229. Strong, Douglas C. "Some Economic and Legal Aspects of Ground Water Development in Cache County, Utah. Utah Agricultural Experiment Station Bulletin 435, 1962.
230. Subcommittee on Evaluation Standards. Interagency Committee on Water Resources. Proposed Practices for Economic Analysis of River Basin Projects. May 1958.
231. Tolley, G. S., and F. E. Riggs. The Economics of Watershed Planning. Iowa State University Press, Ames, 1961.
232. U. S. Bureau of the Budget. Standards and Criteria for Formulating and Evaluating Federal Water Resource Development. Panel of Consultants to the Bureau of the Budget, Washington, D. C., 1961.
233. Wennergren, Boyd E. "Valuing Non-Market Priced Recreational Resources." Land Economics, August 1964.
234. Wennergren, Boyd E. "Value of Water for Boating Recreation." Utah Agricultural Experiment Station Bulletin 453, June 1965.
235. Wollman, Abel. "Water-Economics and Politics." Journal of Water Pollution Control Federation, February 1965.
236. Wollman, Nathaniel. The Value of Water in Alternative Uses. The University of New Mexico Press, 1962.

PART II
Lectures
on
LEGAL ASPECTS OF WATER RESOURCE DEVELOPMENT, CE 263

Presented at the
SUMMER INSTITUTE IN WATER RESOURCES
UTAH STATE UNIVERSITY

by
Charles E. Corker
Assistant Attorney General
State of California

Logan, Utah

July 19-30

1965

A TOUR OF WATER LAW WITH GUN AND BANKS

by

C. E. Corker

The ten sessions of 50-minute classes were planned with nine chapters. The first two--identified as session 1 and 2--consisted almost entirely of lecture and, as planned, occupied the first two hours. These related to the law as a judicial process, rather than to law consisting of prescribed rules of conduct. This is the part of the subject that most nonlegal water specialists most frequently neglect. They can and should read opinions of appellate courts, and they can read statutes, but it takes some understanding of the judicial process to read either an opinion or a statute and predict its effect on the outcome of litigation.

The subsequent eight sessions were occupied with discussion after the opportunity to read a few selected opinions. As a result, the topic planned for session 9 was never reached. Instead, there is offered as the ninth chapter a paper which was the joint effort of Mr. Harvey O. Banks and C. E. Corker. The opportunity to participate with Mr. Banks was one of the rare opportunities which I most appreciated in the two-week session. He is one of those engineers from whom every water lawyer can learn much, not only because he has large experience, but because he epitomizes the engineer who collaborates with and teaches the lawyer. He teaches well because he learns well.

A few of the barbs in his direction survive the editing process. Any reader not present in Logan in July 1965 should know that Mr. Banks delivered even better than he received, that each bespeaks both affection and vast respect.

I

WATER LAW FOR NON-LAWYER WATER SPECIALISTS

This is a summary, after the fact, of the series of 10 classes conducted from July 19 - 30, 1965, at the Institute at the Utah State University for the benefit of a group of specialists in technical subjects relating to water resources whose primary professional interest is teaching and research at the university level in their respective professions.

Planning such a series involves difficult decisions of what to include and what to exclude. Why do non-lawyers seek to know about water law? It is a doubly difficult question for a lawyer because most non-lawyers intimately concerned with water resources know far more about water law than most lawyers, and indeed, more than many lawyers who specialize in water law. It is my observation that water specialists--lawyers and engineers--are two types:

1. Those who say, if they are lawyers: "This is an engineering (or geology, or economics, or whatever) problem, and not a legal problem. I confine myself to the law." Or, if engineers, they say: "This is a legal problem. I shall confine myself to the engineering."

2. Then there are those who are challenged by the unfamiliar, and to the extent of time and opportunity, seek to know the how, the why, and the wherefore of the unfamiliar discipline. Usually, they are not at all reluctant to speak freely with criticisms, suggestions, and iconoclastic bouquets, regardless of frequent barbed comments that lawyers are engineering, engineers are lawyering. (This is known, in California, as Banksmanship. *)

* Named in honor of one of the best lawyers never admitted to the bar, Professor and first Director of the California Department of Water Resources, Harvey O. Banks, an assiduous contributor to legal literature, most of it good.

The very existence of the enterprise that has produced these ten sessions indicates that we are all in the latter group, we are all practitioners of Banksmanship. We would not be here if we were reluctant to broaden traditional limits of what we are supposed to know within the formal confines of our respective specialties. One of the joys of professional work in water law is the opportunity to work closely with specialists of other professions either in litigation or in project planning. Water suits are big suits, typically lasting for years. Lawyers in such suits risk coming to know their engineering, geological, hydrological, and other difficult colleagues better than they know their own families, and the engineering colleagues may legitimately voice the same complaint. In project planning, the plans are usually big and important--or at least time consuming. Hence, we find the same kind of continuity of association across professional lines shapes our lives and our knowledge.

Best guess is that nonlegal specialists want to be informed about water law for one or both of two reasons:

1. They can work more effectively as a part of the team of which lawyers are a part (and in litigation, inevitably, a leading part).
2. While judge-made law is the creation of law-trained men and women,* legislative-made law is fashioned by those whose only essential qualification is getting elected, and all society has a vital concern in wise and efficient laws for development and use of water resources.

Manifestly, the contribution of the engineer, geologist, or economist is vastly greater if he knows (a) what the law is, (b) how it develops, and (c) its strengths and weaknesses. To this end he must know how lawyers think and work.

The first topic we pursue is what non-lawyers should know about the legal process. We shall touch on things that every educated person

* "Give us men to match our mountains" is an old California inspiration. A newer inspiration: "You ought to see our lady judges!"

should know, but which most do not know unless they are formally trained in the law. Why not?

First, the fault, dear Brutus, is in our educational institutions. Except in professional courses leading to a law degree, most courses which touch on law are taught by political scientists who lack working familiarity with the legal process, or they are business oriented courses designed to acquaint students with rules of law relating to business transactions. Such courses center on legal rules--not the legal process out of which the rules evolve.

Second, the fault is with our news media, concerned primarily with the exciting event that happened yesterday. Newspapers are staffed by specialists--financial editors, travel editors, medical editors, education editors, political editors, religion editors, etc. Their staff rarely includes a legal editor. Legal happenings usually cannot be equated with an event that happened yesterday. Those who explain to the public the significance of legal events need background of a specialized nature that most reporters lack.

This situation is improving, but far too slowly.

If you are to work with lawyers, you should know how a lawyer is trained, what he is equipped by education to do. You should know his weaknesses, as well. Remember that in this country all law is written in the English language. With the aid of a law dictionary, its secrets are almost as accessible to you as they are to a lawyer. Water law, like other classifications of law, is not a discrete specialty. If it were, the nine men who make up the United States Supreme Court could not perform their functions at all. They decide cases of every type, dealing with technology of every description. Sometimes the system doesn't work as we would like, but it works.

Formalized legal education in the United States consists primarily of reading, study, and analysis of the published opinions of appellate

courts.* The textbook and lecture became merely a secondary tool of law study when C. C. Langdell introduced his first casebook on contracts at Harvard in 1871, and law students began to learn law and the legal process from opinions of appellate courts. These opinions constitute precedents which lower courts in the judicial hierarchy must follow, and which the highest court ordinarily follows under the principle of stare decisis ("let it stand"). While courts may and sometimes do overrule their own decisions (more frequently they limit their earlier disfavored decisions so narrowly as merely to sap their authority), the major basis of prediction available to a lawyer is how an appellate court has decided a case presenting similar facts in the past.

There are two types of judicial decisions: (1) Common law, or judge-made law, based exclusively on law formed by judicial precedent; (2) decisions based on statutory law, enacted by a legislature, but construed and applied by a court. Both types of decisions create precedents, "binding" under the rule of stare decisis. In applying a statute, the inquiry is "What did the legislature mean?" This having been once decided, the decision will ordinarily be followed in later decisions unless the legislature changes the statute or the court overrules, expressly or silently, its earlier opinion.**

What we say of statutes is also true of statute-like materials-- constitutions, treaties, regulations, ordinances--which prescribe rules

* If you are interested in a particular case, for its facts or its law, you can usually get access to the briefs and the record of the case. Briefs are lawyers' arguments. The record is a transcript of testimony and the documentary exhibits presented at the trial.

** Courts are more reluctant to overrule decisions construing statutes, since the legislature--if unhappy--may rewrite the "misconstrued" statute. Of course, the legislature may also alter the common law.

which courts construe and apply to the resolution of disputes which litigants bring before them.

To read a judicial decision discerningly requires an understanding of the function of the role of an appellate court. What was the issue before its calling for decision? This in turn requires understanding of the function of the trial court, since an appeal invariably follows some kind of proceeding in a trial court.

First, consider the trial. Courts do not act on their own initiative. In this respect they are unlike legislatures and unlike executive officials of federal, state, or local governments. They act only when one party (the plaintiff) brings a complaint against another party (the defendant) and asks some kind of remedy or relief. The initial document is typically called a complaint, sets forth facts on the basis of which relief is sought, and the nature of that relief. It is filed in a trial court and served on the defendant. The complaint must present a "justiciable controversy," meaning a concrete dispute of a type a court may constitutionally and appropriately resolve.

The defendant when sued usually has one or both of two courses. He can deny that the facts asserted by the plaintiff are true. In this case a trial will take place in which both sides may present evidence before a trier-of-fact (typically a jury, but it may be the judge if jury is waived or the case is one in which the parties are not entitled to a jury). Or, the defendant may alternatively, or in addition, challenge the plaintiff's view of the law and demur to the complaint or move to strike it. In effect, he says to the plaintiff: "Assuming but not conceding everything you say is true, you are not entitled under the law to a remedy."

Pretrial procedures are coming to have a more and more important place in the administration of justice. These procedures, in advance of the taking of evidence, have two major aspects: To ascertain facts which are not the subject of controversy, so that the trial may be more efficiently directed toward those which are in dispute, and to clarify

the contentions and hence the legal issues with which the trial will be concerned.

Discovery is by interrogatories (questions which the opposing party may be compelled to answer about facts or about contentions), by procedures to compel inspection of documents, and by deposition, which is testimony taken under oath and subject to cross-examination, which may be introduced if relevant as evidence, or may serve merely to inform the party taking the deposition.

Pretrial conferences under the direction of a judge may result in telescoping the usual process of identifying the issues exclusively through pleadings. In general, the modern theory of pretrial procedures is that the ends of justice are served better and more economically if the trial is treated as an inquiry into facts and not as a game in which the advantage is to the side which most successfully surprises its adversary. Many seasoned trial lawyers tend to be skeptical of the efficacy of pretrial procedures, but all would acknowledge that the trend toward such procedures is strong.

Challenges to the facts and challenge to the law are not mutually exclusive alternatives, but a full trial with evidence is required only if there are genuine factual disputes. The trier-of-fact (judge or jury) weighs the evidence, determines the facts, and applying the law as determined by the judge, arrives at a decision. The judge is the exclusive determiner of the law. The trier-of-fact may decide the facts either way if there is evidence upon which it may reasonably conclude either way. If there is no such evidence, the judge should decide the facts himself, even if there is a jury, since no facts are in reasonable dispute.

On appeal, the appellate court limits itself to questions of law. In general, this means deciding whether the judge committed error. If he erred, and his error prejudiced the losing party, there should be a reversal. Either a new trial will be ordered (if there are facts still to be established) or a judgment will be ordered to be entered, in accordance

with the appellate court's decision if there are no disputed facts to be established.

Typical errors:

1. Erroneous instruction to the jury with respect to the law. (In a judge-tried case, a judge may state a legal conclusion which reveals he had a wrong (in the appellate court's view) notion of the law.)
2. Erroneous admission of evidence, over appropriate objection from the other side.
3. Erroneous refusal to admit evidence.
4. Failure to direct a verdict in a case where there was no reasonable factual basis for the jury's verdict on any view of the evidence.
5. An error which deprived losing party of a fair trial.

The important thing for the engineer, who is likely to be both testifying and guiding the lawyer through the technical side of a water case, is to remember that the parties are entitled to only one trial on the facts. Appeal is possible, but appeal will correct only errors of law, and not errors with respect to the facts if there were factual evidence supporting a verdict or finding either way. Therefore, preparation for trial should be as careful as General Eisenhower's preparation for D-Day in 1944. There is likely to be only one chance. The expert witness, like the lawyer, has an obligation both to his client and to the court and public which the court serves to see that the decision is not rendered in ignorance of the facts.

In deciding the appeal, the appellate court usually states the facts, its decision, and the reasons for its decision. It decides the appeal on the basis of (a) the record in the trial court, or such part of the record as the parties bring before the appellate court, (b) written briefs (you will not miss the irony in the lawyer's label "brief"), (c) oral argument. The argument and briefs should be confined to (a) facts in the record, (b) questions of law, and (c) facts of which a court (including a trial court) may take judicial notice. (Judicial notice is the doctrine that

courts do not waste their time taking or weighing evidence of facts of common knowledge about which there can be no reasonable dispute: e. g., major events of history, facts of geography, laws of physics (water runs downhill), etc. You can quote the encyclopedia, the World Almanac, or anything else. The other side can bring in another encyclopedia to show that there is so a dispute.)

What an appellate court says must be read in the light of what it decided. The portions of its reasoning essential to its decisions are the authoritative holding. A statement made by a court which is unnecessary to its decision is dictum. A court's unessential conversation, for example, about how it might have decided a different case on other facts is entitled to much less weight. Of course, the weight of a dictum or holding depends on the court, the stature of the judge, whether what he said makes intelligible sense, and a host of other factors. Sometimes, from a distinguished judge unessential dicta are more influential than the essential holding by a less respected court or judge.

Decisions of a sister jurisdiction are said to be persuasive, but not controlling. Sometimes, a court will look to the statutes of a sister jurisdiction as a body of principles which might be applied, but this is more rare than resort to judicial decisions of a sister jurisdiction.

Keep in mind that a decision of the Supreme Court of the United States does not necessarily determine how a state court must decide a like case. If the Supreme Court's decision rested on federal law--such as the construction of the United States Constitution--it must be followed. Not infrequently, however, the Supreme Court will decide a case on a state issue, in which case its decision is controlled by state precedents, if there are any. Finding none, it decides as it thinks the state court would decide the state issue, and such a decision is merely persuasive--not binding--when later cases involving the same point come before the state courts.

Example: A, an appropriator, seeks to enjoin B, an upstream user, from interfering with the water to which A claims a right. B defends on the ground of a prior appropriation. A contends B's right was abandoned. B contends (1) that the state abandonment statute, properly construed, does not on the facts presented apply, but (2) if it does apply, the statute is unconstitutional because it deprives B of property without due process of law in violation of the Fourteenth Amendment to the United States Constitution.

The United States Supreme Court's decision on ground (1) would be controlled by state law, and a decision by the United States Supreme Court on that issue need not be followed by a state court in a later case between other parties. The Supreme Court's decision on ground (2), relating to the United States Constitution, would be a precedent binding all state and federal courts under the Supremacy Clause of the United States Constitution, which makes the United States Constitution, statutes and treaties thereunder, the supreme law of the land.

Jurisdiction

To decide a case there must be a genuine dispute, and not merely an argument about the law, between parties before the court which falls within a court's jurisdiction as to subject matter which the court may decide. Federal courts have jurisdiction with respect to certain cases when the parties are citizens of different states, and when a federal question (one under the laws or Constitution of the United States) is involved. Usually a minimum jurisdictional amount--now \$10,000--must be in dispute.

The United States Supreme Court has jurisdiction to review certain federal questions decided by state courts. Such review is from the highest state court which will hear the case in which review is sought. If the state court has denied the claim that a state law violates the

federal constitution, review is by appeal. Appeal is a matter of right if the federal question is substantial. If the state court has upheld the claim that the state statute violates the federal constitution, review is by certiorari, in which review is discretionary. A major factor in persuading the Supreme Court to review a case on certiorari is not whether the decision of the state court is wrong, but the importance of the question in the administration of justice.

Courts

In the federal system, the United States District Court is the trial court. Many of its decisions are published in the Federal Supplement. (Citation to 127 F. Supp. 286 (S. D. N. Y. 1954) means that the cited decision is by the United States District Court in the Southern District of New York in 1954 and may be found at page 286 of volume 127 of a series of reports devoted to the United States District Court and Court of Claims opinions.)

Intermediate federal appellate court is the Court of Appeals for one of the ten circuits. Most but not all appeals from the United States District Courts go first to the appropriate Court of Appeals prior to reaching the United States Supreme Court. Intermediate appellate review is desirable (a) to sharpen the issues, and (b) to ease the burden of the Supreme Court. The Supreme Court's review of federal court decisions is sometimes a matter of right, sometimes discretionary. Review is a matter of right when a state statute is held to offend the United States Constitution, discretionary when the state statute is held valid.*

* N.B. Denial of certiorari by the Supreme Court connotes only that the Supreme Court denied review, not that it approved the decision. However, lawyers persist in thinking denial adds a little something to the decision of the lower court denied review.

Citations: (1) 127 F.2d 193 (9th Cir. 1942), indicates a decision of the Court of Appeals for the Ninth Circuit decided in 1942. Its reports are in the Federal Reporter (Fed.), the modern ones in the second series (F.2d).

(2) 325 U.S. 589 (1945), is a citation to the official Supreme Court reports published by the Government Printing Office. There are two unofficial reporters of that Court's decisions: Lawyers' Edition and Supreme Court Reporter, cited 89 L. ed. 1915 (later citations: L. ed. 2d), and 65 Sup. Ct. 1332. For practical purposes, all three reporters are interchangeable, the unofficial reporters being somewhat cheaper for the lawyer because they come in fewer volumes, but they give volume numbers and official page numbers.

State courts have no standard names. The New York Court of Appeals is the highest court in New York, while the Supreme Court of that state is an inferior court. Some states have intermediate appellate courts. Some do not.

It is common to have trial courts of different kinds differentiated in terms of the cases which they have jurisdiction to hear.

Generally, only courts of general jurisdiction determine questions involving real property. Water rights are generally treated as a species of real property.

Citation: 25 Utah 321, 98 Pac. 426 (1919). Case reported in both volume 25 of Utah reports (official) and volume 98 Pacific reports (unofficial), decided in 1919.

II WATER RIGHT DOCTRINES

There are two basic systems of water rights in the United States-- riparian and appropriative. Riparian law is the foundation of water rights east of that tier of states on the 100th Meridian from North Dakota to Texas. Appropriative law is now the exclusive basis of water rights in the Rocky Mountain States: Idaho, Montana, Wyoming, Nevada, Utah, Colorado, Arizona, New Mexico. The Pacific Coast States and the tier of states on the 100th Meridian have mixed appropriative and riparian doctrines.

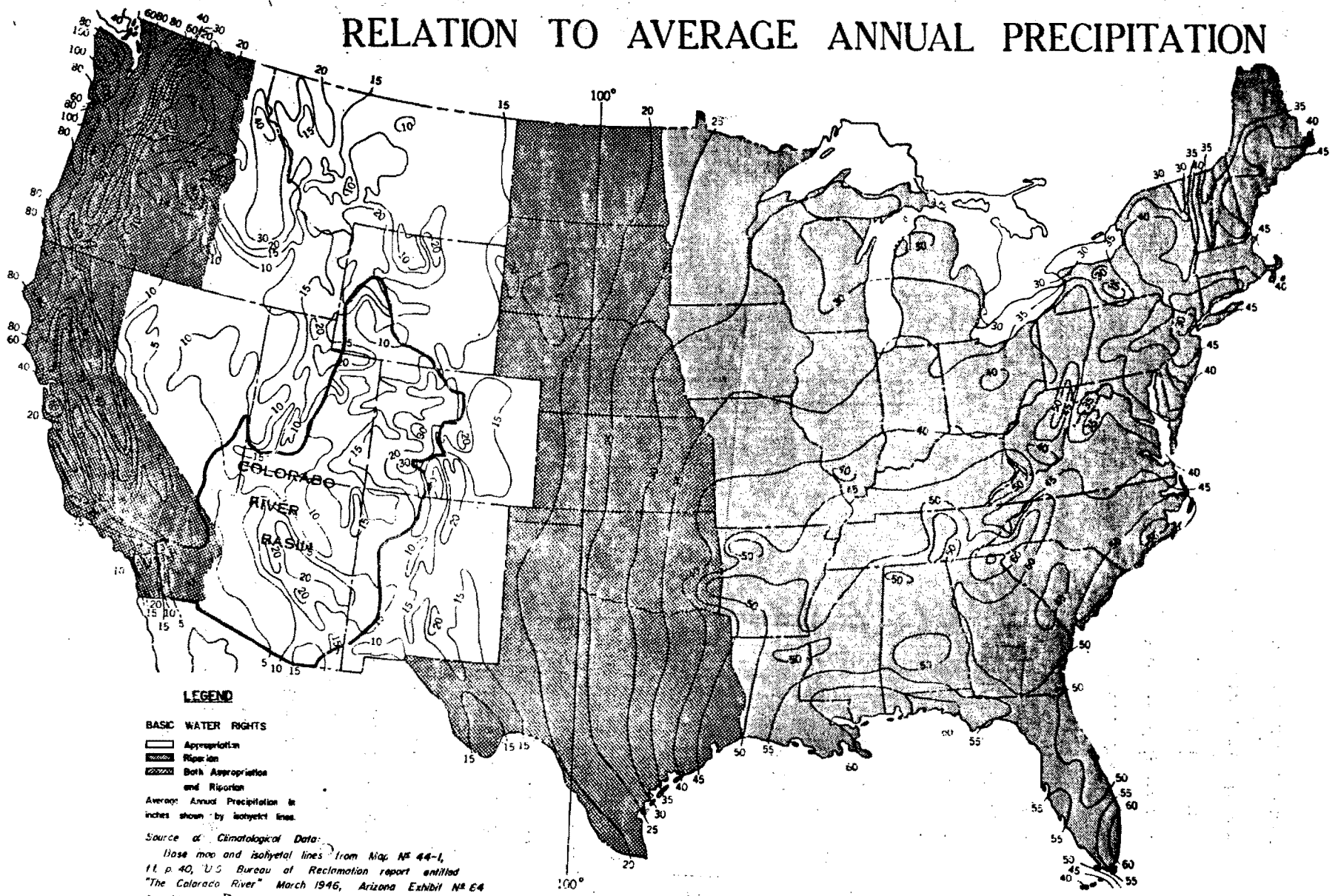
The accompanying map with isohyetal lines to indicate regions of equal rainfall shows that the appropriative states are in the heartland of the Great American Desert. The mixed states are in an area of subhumid conditions. The riparian states are in the region of highest precipitation.

The Riparian Doctrine

There are said to be two systems of riparian law in the United States, sometimes called "natural flow" and "reasonable use" systems. Under the natural flow theory it is said that every riparian owner is entitled to the full flow of the stream to which his property is contiguous, not sensibly diminished in quantity or quality except by natural uses. Natural uses include domestic use for the contiguous owner, watering of his stock, and minor gardening. It excludes "artificial uses," large scale irrigation or industrial use.

The reasonable use theory permits use of water for irrigation and industrial uses--in fact, for all beneficial uses. Every riparian owner's right is said to be correlative with every other riparian owner's right. In the event of contest between riparian owners, their needs are balanced and each is given a share in the supply without regard to when

MAP OF THE UNITED STATES SHOWING
 WATER RIGHTS DOCTRINES AND THEIR
 RELATION TO AVERAGE ANNUAL PRECIPITATION



LEGEND

BASIC WATER RIGHTS

- Appropriation
- ▨ Riparian
- ▩ Both Appropriation and Riparian

Average Annual Precipitation in inches shown by isohyets lines.

Source of Climatological Data:

Base map and isohyetal lines from Map No 44-1, p. 40, U.S. Bureau of Reclamation report entitled "The Colorado River" March 1946, Arizona Exhibit No 64 for identification.

his use was initiated. A riparian right depends on ownership of land, it is neither gained by use nor lost by nonuse.

The classification of states between "natural flow" and "reasonable use" is hard to make in practice. Courts may confuse the two theories. Moreover, there is reason to doubt that any state will truly follow the natural flow theory after a genuine and urgent need for irrigation or industrial use has developed. "Natural flow" is the law only until a real emergency arises.

However, even the "reasonable use" states are likely to prefer natural uses--domestic, stock-watering, gardening--to artificial uses, such as irrigation and manufacturing. Another common characteristic may be described, a bit facetiously, as "highority."* The upstream natural user is preferred over the lower natural uses. Perhaps it is more realistic to say that in such a case a court may be reluctant to intervene, and hence the upstream user prevails.

Justice Joseph Story of Massachusetts and Chancellor Kent of New York are credited by Samuel Wiel with originating the riparian theory. For Story's early case, decided while on circuit (a chore shared by all early U. S. Supreme Court Justices), see Tyler v. Wilkinson, 24 Fed. Cas. 472 (C. C. D. R. I. 1827). In fact, the case has strong appropriative elements. Story recognized that a use of water continued unchallenged for the prescriptive period would not be disturbed.

You should note, in this connection, that there are two doctrines of prescription. The older one rests on the fiction that after undisturbed possession of real property for the statutory period, a "lost grant" is conclusively presumed. This doctrine would work upstream as well as downstream.

* Compare the dogma that possession is nine points of the law. I never discovered the total number of points necessary to win the game.

Contrast the modern theory that prescription really rests on adverse possession. One who has held adverse possession to real property for the minimum period of the statute of limitations becomes the owner because the rightful owner has lost his right to challenge possession. However, the adverse possession must be open, notorious, adverse, under claim of right, and generally any taxes must be paid by the adverse possessor. With respect to water rights, this doctrine permits an upstream user to prescribe a downstream user, but it will not work in reverse. The downstream user in ordinary circumstances cannot interfere with an upstream user's right, and hence he cannot acquire the upstream right by prescription.

(Caveat: In jurisdictions entrusting acquisition of appropriative rights to a water rights agency or official, prescription should not be permitted to work at all against another appropriator. One of the important benefits of such a system--centralized records of water rights--would be defeated if prescription continued as an alternative means of acquiring water rights.)

In Embrey v. Owen, 6 Ex. Ch. 353 (1851), the British court reviewed Story's learning and ended a period of wobbling in British courts in favor of riparian rights, the reasonable use version. Earlier cases in England had referred to a right to "appropriate." One can agree that appropriative principles were to some extent recognized in England some decades before Embrey v. Owen, but one should never attach undue significance to the use of isolated words in judicial opinions. Issues that are very clear to the researcher in 1965 probably did not occur to the courts that used these words a century and a half ago.

There are many limitations on the riparian doctrine. Western courts and courts in arid regions have been eager to increase these limitations as water shortages have grown acute. Here are the limits which exist in California.

1. Riparian use is limited on land of the riparian owner.

2. Riparian use must take place entirely within the watershed, probably in order to assure the lower riparians of the advantage of return flow.

3. A conveyance of land which cuts it off from access to the stream destroys the riparian right associated with the severed land, unless the deed of conveyance expressly preserves it. Reconveyance to unite the severed tract with one contiguous to the stream does not revive the riparian right. (A judicial partition or condemnation does not destroy the riparian right attached to the land whose connection with the stream is cut.)

4. If A patents noncontiguous tract X and later patents contiguous tract Y, so that he now owns a single tract X and Y, the whole of which is contiguous to the stream, his riparian right nevertheless extends only to tract Y and not to tract X.

5. A riparian right may be prescribed against by upstream use for the 5-year period of the California statute of limitations.

6. A riparian owner may not store water for seasonal or cyclical use. His right is to the natural flow only, and hence cannot be augmented by a changed regimen of the stream.

7. The riparian right does not attach to "foreign waters"--those imported from another watershed, even when transported through a natural channel in the watershed of use.

In 1928, the voters of California put a further limitation on the riparian right. This followed the decision by a divided California Supreme Court in Herminghaus v. Southern California Edison Co., 200 Cal. 89 (1926). Here it was held that riparian owners, who utilized one percent of the flow of the San Joaquin River for flood irrigation, could compel this flow to continue despite the waste thereby required of 98 percent of the water of the stream. The result could not be tolerated, and the voters in 1928 approved a constitutional provision (art. XIV, § 3) which limits all water use to a reasonable use and a reasonable method of use.

The effect of the amendment is not in all cases clear. Its history is discussed by Mr. Justice Jackson in his opinion in United States v. Gerlach Live Stock Co., 339 U.S. 725 (1950). He says that a riparian owner may still get damages, although not injunctive relief which would compel large waste. Query whether he is right. The answer rests in the bosom of the California courts which will continue to decide on a case-to-case basis what is "reasonable."

Query: If the Court decides in 1965, as it did in 1922, that growing rice is reasonable, will it still be reasonable in 1990 when water is shorter, or the wise men of medicine have discovered that rice causes deciduous dandruff and is therefore worse than whisky?

Some of California's sister states have limited riparian rights by legislation more severely than California. It is apparently permissible to cut off, without compensation, the right to future exercise of a riparian right if the statute that does so gives a reasonable time to the riparian owner to exercise his right by use. There is authority to the contrary. Tulare Dist. v. Lindsay-Strathmore Dist., 3 Cal. 2d 489, 530 (1935).

The major mystery of the riparian right is how any portion of the United States can survive under a law that would forbid use of water on land not contiguous to a stream. There are probably several answers:

1. Any large municipal project is likely to be protected by specific state legislation which, while it does not change the system of water rights generally, declares in effect that the city has a water right, even though the term "water right" may not be used. The law in such cases is probably in the stage of the law of domestic relations before general divorce laws were enacted, when the legislature could sometimes be persuaded to grant a divorce to John Smith by name if John were of sufficient prominence, or his domestic difficulties sufficiently appealing to legislative mercies. This, of course, proved to be transitional.

2. While a riparian right is not transferable, any riparian purporting

to transfer his right for valuable consideration surrenders the right to protest the use of water on nonriparian land. A city or anyone else can buy up the interests of all who might object, perhaps an expensive business, but the way in which Los Angeles got the right to dry up Owens Valley.

3. State legislation may not speak of water rights at all, but of the necessity to secure permits to build diversion works, dams, etc. These work on the basis of water, not water rights. If no one else can build an upper diversion dam, without satisfying some official that it is in the public interest, a downstream city is likely to be fairly secure.

III

PRIOR APPROPRIATION

The law of prior appropriation may or may not have had its roots in ancient or foreign systems of law. My own belief is that it did not, because the early opinions which applied the law of prior appropriation do not show much indication that the judges were either aware of or sensitive to ancient or foreign law. They had immediate problems. Study of prior appropriation is of intense importance to westerners because our civilization depends on water, and no scarce essential of life long exists without protection from the legal order. It is now important in the East and Midwest, because it is being intensively studied as the need for water law--which arises when demand outruns supply--grows. Some would say its importance is to serve as a model to follow; others, that it is a pattern for mistakes to be avoided.

The study of water law is also important to lawyers because it teaches them much about the workings and development of legal institutions. The law of appropriation is a little over a century old. Within that century records of decisions are far better preserved than over the earlier centuries in which the English common law has developed from the time of William the Conqueror.

Three characteristics are noteworthy, in addition to the recent origins. First, the law of appropriation is very similar in its outline in every state where it exists, both in its present development and in its history. There is a unity in state water law that elsewhere has been achieved only because the common law of England has served as an identical pattern for each American jurisdiction. Its admirers say that the unifying element in appropriation is necessity, a word repeatedly emphasized in the 19th century American reports.

Second, there is an adaptability, clearly arising out of necessity. The principles of law applicable to Skunk Creek and to Louse Creek may

be identical, but to appreciate the law in action one has to be intimately familiar with the geography, the hydrology, the social history, and often the personality of the first judge who wrote the original Louse Creek decree. Water law cases are hard to read, because rarely do reporters of official decisions indulge the luxury of a published map. An ideal water law casebook would include a map for each reported case, but none so far has done so. But see the colored map in Arizona v. California, 373 U.S. 546 (1963).

Finally, water law decisions tend to become rules of property, i. e., unchangeable because they are relied on in acquisition of property titles. Water law is treated as a branch of the law of real property. Real property law tends to preserve archaic distinctions far longer than the bar can remember the reasons for the distinctions. The reason is that in real property great fortunes are invested. It is better that the law be certain than that it be "right" or enlightened. In water law-- in the areas where appropriation holds sway--certainty is the goal most avidly sought.

The law of prior appropriation originated not with lawyers and courts, but with miners and irrigators. The miners were in the Sierra Nevada Mountains of California; the irrigators were Mormon pioneers in Utah. The first appellate decision recognizing prior appropriation is Irwin v. Phillips, 5 Cal. 140 (1885), where both competing appropriators were miners on the public domain.

The court had no precedents, but two principles:

1. First in time is first in right. This is familiar to all of us who line up at the movies or the cafeteria, as the only orderly way of getting in.

2. The other, almost as familiar to the law as the first: Plaintiff, in possession of any kind of property, can recover in trespass from one who injures that property, and defendant cannot defend on the ground that the property really belonged to X, a third party. In Irwin v. Phillips,

the miners did not own the land; the United States did. Who "owned" the water is a contentious matter, not yet fully settled, but as between the two appropriators the court decided only that the first appropriator had the better right.

Next to "first-in-time-first-in-right" is the principle of relation back. Water projects take time to construct. A problem arises if A starts construction of his project first, B starts his project later but completes it first. Who should be protected as between A and B?

The principle of relation back protects A, provided he pursues his project to completion with diligence, i. e., within a reasonable time. Absent statutory codification, or regulation by an administrative agency, a reasonable time must be measured in the light of the circumstances, the size of the project, etc.

The right is fully perfected when water is fully put to beneficial use. It relates to the quantity of water beneficially used. It is acquired by use, and it is lost by nonuse. It is thus said to promote conservation by giving a premium to him who gets there first with the largest and most successful plans to use water.

The second stage--and all states have followed this--is the stage of legislative codification. It came in California in 1872 with enactment of the Field Civil Code (David Dudley, brother of Stephen J., Lincoln's appointee to the Supreme Court from California, who wrote the most significant early opinions on water law in the Supreme Court.)

The Field Code was typical. It required posting of a notice near the point of diversion and recording in the county recorder's office. Quantities appropriated were typically very large indeed--sometimes embarrassingly so to modern lawyers who litigate early appropriations. The common law appropriation was not outlawed. The only penalty for failing to comply with the Field Code: Priority in such case dated from putting water to use, not from the date of initiating works. In other words, compliance with the code was necessary for relation back. Of course,

evidence of the notice and its recording was in some cases more than a convenience, and lacking to the appropriator who merely built his dam and ditch and used the water without leaving evidence of when he did so.

A third stage applies to most of the western states, under which appropriations are secured by permit and license granted by an administrative agency. In California, this law was the Water Commission Act, effective in 1914. Currently, it is administered by a three-man board, consisting of one lawyer, one engineer, and one human being, called the State Water Rights Board.

Application by the intending appropriator requires detailed information about the quantity, purpose, place of use, and works to be constructed. The Board's permit secures the right to continue through construction. At the completion, license is granted. Even the license, however, is not the source of right. The license confers a right to appropriate, which means, as always, putting the water to beneficial use.

Judicial review is available. The Board has wide discretion in the public interest to choose among applicants, or to withhold approval. Fifty years ago this would have been an unconstitutional delegation of legislative power. That doctrine has pretty much given way before the recognition (1) that legislative bodies can determine policies in broad outline, and (2) that administrative expertise is required for technical adjudications which require hydrologic skill not possessed by a mere judge.

Even courts are aided by technical experts in California. A reference procedure is available in water rights adjudications under which the Water Rights Board enters upon fact gathering, at the expense of the parties, often long and costly. Federal courts, if they choose, may make use of the reference procedure. It is available in groundwater adjudications with respect to which the State Water Rights Board has no jurisdiction, unless the groundwater is flowing in an underground channel with known and definite limits.

Place of use, point of diversion, and purpose of an appropriative right may be changed, unless such change works to the prejudice of other water users. Example: An in-basin use, with return flow to the stream, is converted to an out-of-basin use with no return flow. Under the administrative system the Water Rights Board has jurisdiction to approve or disapprove such changes.

It is significant that the administrative system was the accomplishment of a distinguished engineer, Dr. Elwood Mead (for whom Lake Mead, behind Hoover Dam, is named), when he was State Engineer of Wyoming in the 1890's. Generally, it is regarded as a salutary accomplishment, although administrative agencies are frequently understaffed in relation to the tasks they are expected to perform.

Example: In every jurisdiction appropriative rights are lost through one or both of two causes: (1) Abandonment, which is the cessation of use, plus an intent to abandon; (2) nonuse for a statutory period, in California five years. Abandoned or forfeited water becomes subject to appropriation, but the program of maintaining records of abandonments which have in fact taken place, of permits not exercised, tends to lag where the fact-gathering and policing function is larger than the staff available to accomplish it. Additional complications are the existence of riparian rights, of which there is no record, and water rights antedating 1914.

IV

THE QUASI-THEOLOGICAL ASPECTS OF WATER RIGHTS--
CALIFORNIA AND COLORADO DOCTRINES

I use the term "quasi-theological" for several reasons. First, courts and writers speak in terms of doctrine, and writers about "doctrine" tend to have deep feeling on the subject about which they write. However, there are skeptics who are not sure that the choice of doctrine makes any necessary difference except to deep feeling groups who become uncomfortable in the presence of doctrinal heresy. Also, it must be confessed, no skeptic can prove that the choice of doctrine will not, in the hereafter, make a great difference. Perhaps it did make a difference in the Pelton Dam* case, of which we shall say more later. Perhaps it did not. I think I could rationalize any particular result with either doctrine, given a bit of leeway in how the doctrine is stated. Like most doctrines, leeway in statement is encouraged by a rather wide body of literature from which one can pick and choose variant statements.

Both doctrines start like the book of Genesis: "In the beginning..."

The Colorado doctrine, which I would choose if forced to a choice, goes like this: In the beginning unappropriated water was like the beasts of the forests, and the breezes that blow. It was owned by no one. The first owner was the first appropriator who put the water to beneficial use.

The California doctrine goes like this: In the beginning the public domain was owned by the United States (no doubt about that) and its ownership included ownership of the water (we should say "water right") which flowed on the public lands. A series of statutes enacted by Congress in 1866, 1870, and 1877 (all these are quoted in California Oregon Power Co. v. Beaver Portland Cement Co. 295 U.S. 142 (1935),

* Federal Power Commission v. Oregon, 349 U.S. 435 (1955).

which you should read) recognized the right of the prior appropriator. The appropriator is, therefore, a grantee of the United States, and (here is where it is asserted to make a difference) the United States is still the owner of the unappropriated water except where a grant from the United States has become effective through a recognized appropriation.

Now consider situations where it may be asserted that the choice of doctrine did make a difference. X received a patent of land from the United States, and asserts that he has a riparian right appurtenant to the land which he patented. The case is like Lux v Haggin, 69 Cal. 255 (1886), which decided that X has a riparian right. The court looked at a statute enacted in the year of California's admission to the Union which provided that the English common law should be the rule of decision, and also at the English common law, and found that English common law means riparian rights. The decision, 4 to 3, is the longest in the California reports, and you may or may not want to read it.

Of course, if Y, an appropriator, had made his appropriation on the public lands prior to the patent of land to X, Y would have, by virtue of the federal statutes referred to in the last paragraph, an appropriative right superior to X's riparian right.

Could the result have been achieved consistently with the Colorado doctrine? Certainly, if the Colorado court had said that Colorado's law of real property, either because it incorporated English common law or was based on original principles recognized in Colorado, gave a user contiguous to the stream the right to use water, not dependent on use.

This is about where the Supreme Court in Beaver Portland Cement* came out. Prior to that time a number of "California doctrine" courts had treated water rights as a question of federal law, resting on the construction of the Desert Land Act of 1877 and related legislation. The

* California Oregon Power Co. v. Beaver Portland Cement Co., 295 U.S. 142 (1935).

Court, in a somewhat muddled opinion, said (1) that the appropriator at least as of 1877 had an appropriative right, but (2) this was a matter for each state through its courts or legislature to decide. There may have been some backtracking on this conclusion in Pelton Dam, at least if that case is read as deciding that the Federal Power Commission's licensee possesses not only a right to build Pelton Dam on federally reserved lands, but also a water right. Even that backtracking, however, assuming that the FPC's licensee has a water right, applies only to cases where the United States, its licensee, or grantee, asserts rights. At least since Beaver^{*}, the states have been free to decide for themselves how water rights as among their own users, not licensed by the United States, are to be adjusted.

(This, of course, is subject to a constitutional limitation in the due process clause of the Fourteenth Amendment. A property right, once created, cannot be destroyed without due process of law, which generally means necessity of condemnation and the payment of compensation. This, again, is subject to inroads of indefinite extent: Under the police power, states can regulate how property shall be used. For example, a zoning ordinance may prohibit a brickyard from operating in the heart of a city, and this may impair property values without constituting a taking of property for which compensation must be paid.)

^{*} See United States v. Rio Grande Dam & Irrigation Co., 174 U. S. 690 (1899), which foreshadows Beaver.

V

A COMPARISON OF WATER RIGHT SYSTEMS

Having disposed of the doctrinal underbrush in a way that would be unsatisfactory to most of my meticulous comrades at the bar, we (i. e., we engineers) can approach the question of comparing riparian and appropriative systems. Both have their advocates. Even the advocates tend to be critical of details. Comparison requires loose generalization that frequently overlooks sharp differences that exist from one state to another.

Even the process of comparison requires this word of caution. "Vested rights" cannot be altered without payment of compensation. The definition of "vested rights" is "rights which cannot be altered." The "due process clause" is a high level abstraction which cannot be captured in a single verbal formula. It is and will probably always be a fluid concept depending on the prevailing judicial concept of abstract fairness in its relation to prevailing conditions. Moreover, like every other constitutional doctrine, it only sets limits, and does not tell us what the law should be within those limits.

We frequently give voice to generalizations which begin "The United States can..." or "The State can..." Always make this distinction: Does the speaker mean that the United States can, with the aid of a statute, or does he mean, the United States can, without the aid of a statute? The difference is vast. Without some kind of statute there wouldn't even be a Secretary of the Interior, or a Secretary of Agriculture to argue with.

Riparian and appropriative rights have two basic points of similarity:

1. Both kinds of rights relate to waters in a water course. Vagrant waters on the surface of the land are probably free for the use of the landowner. Percolating groundwater, not in an underground

stream, may, depending on the jurisdiction, be subject to a different set of rules.

2. Both rights are usufructuary. That is, they constitute a right to the use of the renewable resource, and not a right to water as personal property. The water will become personal property when bottled, and perhaps before when reduced to possession in pipes. It will then be subject to sales, to theft, etc., like other personal property. This can be the result of the exercise of a water right, but it is not the water right--real property--about which we are concerned.

Now the contrasts:

	Riparian	Appropriative
1. Place of use	On riparian land in watershed	Anywhere in the jurisdiction

Based on social utility, the advantage here is to the appropriative right. Water must be used where it is most needed. Civilization cannot exist clustered on a river bank, and to attempt to so locate it would advantage neither civilization nor the river's environs. Of course, owners of riverside property become embittered watching water which must flow by to downstream appropriators, but appropriation does in the economic process give some consideration to location. Other things being equal, water is likely to be first appropriated where it can be used without expensive pumping or aqueduct costs, and where it will produce the most net benefit.

	Riparian	Appropriative
2. Priority date	no	yes

The riparian right is correlative with that of other riparians. This means a balancing of needs, and a decree typically stated in a percentage of flow. It has a sound of fairness and equity, but gives half a right to as much water as one needs.

Appropriators allocate shortages in inverse order of priority. The newest proposing appropriator can ascertain the quantity of water already

committed, can calculate the probable future water supply, and determine whether to risk a new project, and if so, of what size, and for what purpose. What losses will be encountered if there are (a) sometime, or (b) frequent shortages to his project?

Caveat: Rights for Indian reservations recognized in Arizona v California, 373 U.S. 546 (1963), are like riparian rights, attaching only to Indian lands located within the basin, * based not on use but on needs of the irrigable soil, but they have priority dates: the date of creation of the Indian reservation by statute, treaty, or executive order.

	Riparian	Appropriative
3. Fixed and definite quantity	no	yes

Riparians must balance their needs against those of other riparians, who may hereafter desire to use water, against changing needs in relation to competing needs. The appropriator gets a right to a stated quantity of water, a kind of certainty essential to most large or small project planning.

	Riparian	Appropriative
4. Right to store	no	yes

The riparian right is a right to natural flow. The appropriator may appropriate for storage and later use, regulating the natural flow. Storage is essential to maximize use from streams, all of which are both seasonally and cyclically erratic in flow.

	Riparian	Appropriative
5. Transferability	no	yes

The riparian can be estopped to protest a purported transfer, but the device is ineffective unless the distant user buys out all riparians likely to protest. Transfer is essential to creation of an economic market for water rights, for building new projects where new, i. e., unappropriated water is available.

*In Arizona v. California, the United States withdrew its claim to water rights for three Indian reservations in Coachella Valley outside the Colorado River basin.

	Riparian	Appropriative
6. Municipal right	no	yes

A municipality cannot acquire a riparian right, which inheres in the ownership of land. A city can have riparian rights for city owned real estate, but not otherwise. Municipal use requires an appropriative water right. This is probably the earliest point at which riparian principles give way to sheer necessity.

	Riparian	Appropriative
7. Prescription	yes	no

A downstream riparian right can be prescribed by an upstream user. An appropriative right, under a modern administrative statute, should not be prescribed. Prescription is desirable where riparian rights exist, because it mitigates the uncertainties to some extent when a statute of limitations has run.

	Riparian	Appropriative
8. Expert administration	no	yes

Theoretically, riparian rights could perhaps be administered by a State Engineer or Water Rights Board. This has not been achieved. What is there to administer when the right relates to the quantity that may be needed in the future, balanced against other unknown future needs?

	Riparian	Appropriative
9. Flexibility	?	?

Arguments can be made in favor of either system in terms of flexibility. Appropriative rights have flexibility because once a quantity has been fixed, reallocation can more readily be achieved than when the reallocation right is unknown and unknowable. Riparian rights have flexibility in that needs are balanced against competing needs, and changing conditions can be accommodated. Moreover, under a riparian regime, decisions tend to be put off, and water right problems are of a kind which most people are glad to delay in resolving.

VI
FEDERAL-STATE RELATIONS

There is one aspect, the most important aspect quantitatively, of federal-state relations to which we shall make only passing reference: securing federal funds for local or state projects. This is perplexing, but it offers no water rights problems. Constitutional problems were solved in Massachusetts v. Mellon, 262 U.S. 447 (1923).

In that case, the Court dealt in a single opinion with a suit by Massachusetts and a suit by a Mrs. Frothingham to prevent the Secretary of the Treasury from spending in administration of the Maternity Act which offended Massachusetts sensibilities. Held: (1) a state has no standing to protect its political rights or its citizens against the operation of a federal law; (2) a taxpayer's interest in expenditure of public money is too remote to give the taxpayer standing to enjoin the expenditure.

Hence, the Court could not reach the issue of constitutionality. As of 1923, constitutionality of the act was doubtful, had the question been reached. As of 1965, I opine that it would probably be covered by the general welfare clause of Article I, section 8. * See the Gerlach case, previously discussed. However, the issue is still generally outside the range of constitutional challenge in the courts.

The starting point for this discussion should be the Supremacy Clause which is clear, unchallenged, and unchallengeable:

This Constitution, and the law of the United States which shall be made in the pursuance thereof; and all treaties made, or which shall be made, under the authority of the United States, shall be the supreme law of the Land; and the judges in every state shall be bound thereby, anything in

* "The Congress shall have power to lay and collect taxes, duties, imposts and excises, to pay the debts and provide for the common defense and general welfare of the United States; . . ."

Cf. Amendment 10: "The powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people."

the Constitution or law of any State to the contrary notwithstanding." Art. VI.

It is my own view that the United States could (some would disagree) constitutionally enact a water rights law for the United States. It would be quite an undertaking. The project would predictably meet with negative enthusiasm in every federal agency except perhaps the Department of Justice which of course would have no administrative responsibility for a federal water rights law.

The states, particularly those with long standing water problems, have carefully evolved water rights laws. None of the laws are perfect, but they are in the process of improvement. Hence, there is no necessity for any real clash between federal and state governments. Yet dispute has waxed hot for many decades. Demand for legislation by Congress has been expressed by the National Association of Attorneys General on repeated occasions--the most recent in June, 1965, when the Association approved a resolution by Attorney General Thomas C. Lynch of California (Dem.) favoring S. 1636 by Senator Kuchel (Rep.) and others (Rep. and Dem.) in the 89th Congress.

What is this shooting about?

(1) Compensability of water rights taken by the United States which relate to waters of navigable streams. The states say these rights should be compensable. Justice Department lawyers disagree.

This much is clear. The United States has a navigation servitude arising from the Commerce Clause of the Constitution,* which permits it to utilize navigable water for purposes of navigation without compensation. Most streams in the United States are today legally navigable.

Suppose a project is not for navigation purposes, but Congress nevertheless says it is. Congress got in the habit of so saying when congressional power under the Commerce Clause was extremely limited on dry land. Congress lacked power even to forbid child labor in a factory manufacturing goods for interstate sale and shipment. So,

* Art. I, § 8, cl. 3: "The Congress shall have power...to regulate commerce with foreign nations, and among the several states, and with the Indian Tribes:...."

Congress recited in many acts, like the Boulder Canyon Project Act, that the act was "for the purpose of controlling the floods, improving navigation and regulation of the flow of the Colorado River." In fact, Hoover Dam ended possibilities of commercial navigation on the Colorado, had any earlier existed.

Arizona challenged the Secretary of the Interior's right to build Hoover Dam on the river between Nevada and Arizona, on riverbed lands belonging to the two states. The Court, speaking through Mr. Justice Brandeis, upheld the Secretary's authority under the statute, invoking the power of Congress under the Commerce Clause over navigable waters:

(1) The river is legally navigable, as the Court would judicially recognize despite Arizona's allegations to the contrary.

(2) To the Arizona charge that the congressional recital of purpose was "a mere subterfuge and false pretense" because consumption of the water contemplated would destroy the navigable capacity of the river, the Court said: "Into the motives which induced members of Congress to enact the Boulder Canyon Project Act, this Court may not enquire. . . . As the river is navigable and the means which the Act provides are not unrelated to the control of navigation, . . . the erection and maintenance of such dam and reservoir are clearly within the power conferred upon Congress."

Arizona v. California, 283 U. S. 423, 455-56 (1931).

In the trial of the fourth Arizona v. California case, 373 U. S. 546 (1963), Arizona was joined by the United States in a contention that would, if upheld, have ended every water right from every navigable stream in the West: (1) The right to appropriate rests upon the Desert Land Act of 1877 (see Beaver Portland Cement case, supra), and (2) that act in its terms applies to water "not navigable." This sweeping contention rather dropped from sight after California proved that the Secretary had expressly approved thousands of desert land patents on the basis of proved appropriative rights under state law from the navigable Colorado and other navigable streams. However, the contention may be heard from again.

In United States v. Twin City Power Co., 350 U. S. 222 (1956) (5-4 decision), the Supreme Court decided that the United States could condemn a power site on navigable waters paying compensation only for the land valued without reference to its location on the navigable stream. This was upsetting, since the same doctrine would seem to permit condemnation of an irrigated farm served by water from the Snake or the Sacramento rivers, paying the farm only desert land values-- essentially zero. (However, note that the power site was not developed, a ground of distinction that should be good for more than one vote from the Court.)

In United States v. Gerlach Livestock Co. 339 U. S. 725 (1950), the Court held that despite the recital of what it called a "fictional" navigational purpose, the United States in the Central Valley Project reclamation legislation had intended to provide compensation to owners of riparian rights, and hence, the constitutional issue of whether Congress might have denied compensation for these rights was not reached. Mr. Justice Jackson strongly implied that no such constitutional power exists. Mr. Justice Douglas disagreed with respect to the constitutional issue, but joined in the result because he had satisfied himself by examining the administrative practice of the Bureau of Reclamation in making appropriations for its projects, regardless of the navigability of the water source, that Congress intended to recognize compensability of the rights it authorized the United States to take.

The solution: S. 1636, 89th Congress.

"Sec. 3. No vested right to the diversion, storage, or use of any waters, navigable or nonnavigable, acquired under the laws of a State and recognized by the laws in force as of the effective date of this Act in that State as being compensable if taken or used by or under the authority of the State, shall be taken or used by or under the authority of the United States without just compensation. 'Vested Right' shall mean either (1) an appropriative right initiated in accordance with the

general laws of the State applicable to the appropriation of water rights, which has been exercised either by the commencement of actual diversion, storage, or use of water, or by the commencement of construction of works for such purposes, and which is thereafter maintained with reasonable diligence in the completion of such works and application of water to such purposes, or (2) a riparian, overlying, or pueblo right, to the extent that such laws of the State recognize such rights, or (3) a prescriptive right or any other water right to the extent that water has been put to beneficial use."

A key word in the foregoing is "general laws of the state." The intention is to prevent the states from getting away with what was attempted in United States v. Grand River Dam Authority, 363 U.S. 229 (1960); where the Oklahoma Legislature sought to create, by a special law, a compensable right needed by the United States to construct a project which Oklahoma was anxious to get. The Court of Claims awarded compensation; the Supreme Court unanimously reversed, in an overenthusiastic opinion which indicates that section 3 is probably much needed.

(2) The appurtenant right attached to lands reserved from the public domain is a second major cause of concern. In the Pelton Dam case (Federal Power Comm. v. Oregon, 349 U.S. 435 (1955)), the Court sustained the right of the FPC's licensee to build a dam on a nonnavigable stream over the protests of the State of Oregon which was interested in preserving anadromous fish.* Reasoning followed that in Beaver Portland Cement, with this difference: Since the abutments of the dam were on an Indian reservation and a long reserved power site set apart from the public domain, the Desert Land Act was not applicable. That act applies only to public lands open to entry.

Given a broad reading, this decision might permit the United States to declare that every appropriation of water initiated since a national

* The FPC required the licensee to spend a substantial sum on fish; whether these expenditures saved the fish, I do not know.

forest was set aside from the public domain is subordinate to the United States right to the water "appurtenant" to the forest. This is all right, perhaps, if only modest forest service purposes are served, but quite disastrous if the United States wishes vastly to broaden the purpose for which the water is used, perhaps to use it elsewhere than on forest lands. The United States claimed such a right in the Fallbrook litigation, where it wanted to use such water arising on the forests for a recently acquired Marine base site at the mouth of the river. The United States lost because of a stipulation, but the next time it is unlikely that the Government will stipulate that state law prevails. Query: what result then?

Solution: Section 1 of S. 1636: "...the withdrawal or reservation of surveyed or unsurveyed lands of the United States, heretofore or hereafter made, shall not affect any right to the use of navigable or non-navigable water acquired pursuant to State law either

"(1) before the establishment of such withdrawal or reservation, or

"(2) after the establishment of such withdrawal or reservation, unless, in the latter event, a Federal statute, or an officer of the United States authorized to make such a withdrawal or reservation, shall have promulgated the purpose, quantity, and priority date of the water right reserved to the United States or otherwise established under its own laws, and such promulgation shall have antedated the initiation of the conflicting right under State law; provided, That if such promulgation shall be made otherwise than by an Act of Congress, it shall not become effective until sixty days after it shall have been published in the Federal Register and transmitted by the head of the department having jurisdiction of the lands affected to both Houses of Congress (counting only days on which both Houses are in session); and it shall be vacated if disapproved within said sixty days by resolution of the Committee on Interior and Insular Affairs of either House."

The proviso is a suggestion from the Honorable Harvey O. Banks, former Director of Water Resources of the State of California, and a

stout supporter of S. 1636 and its predecessor in the 88th Congress, S. 1275. I understand that Senator Kuchel favors the amendment. Purpose of the amendment is to prevent an overambitious declaration by an executive official that all the water of Louse Creek is hereby reserved.

(3) A third major purpose relates to inverse condemnation, i. e., compensation after seizure and taking. Section 4 provides that water rights compensable under section 3 (quoted above) shall be acquired by the United States only by initiation of proceedings to condemn. This would prevent inverse condemnation. However, if the United States should nevertheless take a water right without initiating a judicial proceeding (or a negotiated purchase), the statute of limitations shall not run against the water right owner's claim to compensation.

The purpose is to deal with the following kind of problem. A dam is built on a river, the effect of which on the regimen of the stream or underground water bodies may be uncertain for many years. If the dam is later discovered to have interfered with the flow of the stream to a user who has a water right, he might, without the protection afforded by this section, have lost his right to compensation before he could discover the taking had occurred.

A final provision of section 4 makes clear that the bill is not intended to authorize injunctions against the United States except to the extent that they are now available prior to enactment of S. 1636.

Note that section 5 contains a number of significant disclaimers. Subsection (1) preserves section 8 of the Reclamation Act of 1902. Subsection (2) disclaims any interference with treaty obligations of the United States. Subsection (3) disclaims any alteration of the 160-acre limitation, quieting an apprehension expressed by opponents of the predecessor, S. 1275. Subsection (4) disclaims interference with any interstate compact or judicial decree, or any Indian water right, any water right of other than the United States, any water right of the United States exercised by use prior to the date of enactment, or any right by the United

States under authority of any present or future act of Congress or state law when initiated prior to acquisition of a competing right by others, or the public power preference clause.

Final consideration of the problem requires a look at section 8 of the Reclamation Act of 1902. It provides:

Nothing in this act shall be construed as affecting or intended to affect or to in any way interfere with the laws of any State or Territory relating to the control, appropriation, use, or distribution of water used in irrigation, or any vested right acquired thereunder, and the Secretary of the Interior, in carrying out the provisions of this act, shall proceed in conformity with such laws, and nothing herein shall in any way affect any right of any State or of the Federal Government or of any landowner, appropriator, or user of water in, to, or from any interstate stream or the waters thereof; Provided, That the right to the use of water acquired under the provisions of this act shall be appurtenant to the land irrigated and beneficial use shall be the basis, the measure, and the limit of the right.

The provision of section 8 with respect to waters of an interstate stream was described by Mr. Justice Van Devanter as arising from a congressional desire to leave the issues in Kansas v. Colorado, 206 U. S. 45 (1907), pending before the Court in 1902, unaffected by the Reclamation Act. See Wyoming v. Colorado, 259 U. S. 419, 463 (1922).

The proviso indicates that Congress was not doctrinaire in its attachment to state law: (1) Water right should be appurtenant to the land, and (2) should be confined to beneficial use. Both provisions apply as federal law regardless of what state law might say on these subjects. Query, however, what "appurtenant" means.

Judicial decisions have further limited the effect given to the apparently broad command of section 8 that water rights for a reclamation project shall be acquired under state law. Problems are ably discussed by Dean Frank Trelease, "Reclamation Water Rights," 32 Rocky Mt. L. Rev. 464 (1960). See also his essay in the 1963 Supreme Court Review (a hard cover book published by the University of Chicago Press), entitled "Arizona v. California: Allocation of Water Resources

to People, States, and Nation."

It has been determined, for example, that the right acquired by the United States through condemnation "is merely to leave to the state law the definition of the property interests, if any, for which compensation must be paid." Fresno v. United States, 372 U.S. 627, 630 (1963).

Reservations in California statutory law, in favor of area and counties of origin, do not inhibit the United States in the water right it acquires.

See also United States v. Ivanhoe Irrigation Dist., 357 U.S. 275 (1960), which held that section 5 of the Reclamation Act, which prescribes the 160-acre limitation, prevails over the countervailing restrictions which the California Supreme Court discovered in California law, and despite any contrary implications from section 8.

Sovereign Immunity

The major area of federal-state difficulty left untouched by S. 1636 is sovereign immunity. This is probably ascribable to a desire of the sponsors to achieve what they can, without foundering on an attempt to achieve the politically impossible.

Sovereign immunity stems from the notion that the King can do no wrong. It has been pointed out that, realistically applied to the United States, this notion should lead to the conclusion that the wrong done by the Bureau of Reclamation to John Smith was not the act of the ever-right-doing sovereign, but the act of an official who should be subject to suit because he did a wrong not at the will of the sovereign.

Sovereign immunity has caused many lawsuits to come a cropper without reaching an adjudication of the merits. E.g., Arizona v. California, 298 U.S. 558 (1936), where Arizona was denied an opportunity to present her grievance against six other states for adjudication because (1) the United States was an indispensable party, and (2) covered by sovereign immunity. In Arizona v. California, 373 U.S. 546 (1963),

the Attorney General of the United States decided to intervene, and thus conferred jurisdiction on the Court.

Should this power of decision rest in the absolute discretion of a federal official, and if so, should that official be the United States Attorney General? His job description makes him, by definition, the nation's top lawyer, but there is nothing in the legal education of most lawyers, or the political education of most Attorneys General, that gives any assurance that this decision will be appropriately made. The Department of Justice is an agency somewhat remote from problems of natural resource development. Better choose the Chief Hydraulic Engineer of the U. S. Geological Survey, who is the federal father of waters, but it is doubtful that any incumbent would want the responsibility.

On the Rio Grande, Texas, New Mexico, and Colorado either settled or thought they had settled their problem by compact. Years of litigation by Texas to enforce the compact came to nothing when the Supreme Court, without opinion and after two references to a Special Master, dismissed the complaint because of indispensability of the United States. Texas v. New Mexico, 352 U.S. 991 (1952). Moral: In negotiating a compact which may require judicial enforcement, and with reference to which the United States has interests perhaps (this is always a difficult question) making it indispensable. Congress should, in the act conferring the constitutionally required consent to the compact, waive sovereign immunity.

Sovereign immunity is waived for ordinary state and federal litigation not in the Supreme Court's original jurisdiction by the McCarran Amendment of 1952, 66 Stat. 560, 43 U.S.C. sec. 666 (1958). This statute has, however, received a narrow construction and may apply only to a general adjudication of all rights on a stream, not to a suit between two parties. The problem is discussed in Trelease, "Reclamation Water Rights," op. cit. supra.

Conclusion

Issues related to S. 1636 are both political and legal. The major problem of proponents of the legislation is to preserve it from its friends who sometimes (a) overstate the "crisis" which calls for such legislation, (b) overstate the extent of what will be accomplished by such legislation, and (c) confuse it with a constitutional amendment.

Overstating the crisis exacerbates the problem. In fact, S. 1636 as now drawn will not change the present law very much, if at all. It is important to recognize this, before bench and bar are wrongly persuaded that state water rights have indeed been wiped out. Repeated exaggerated assertions may make it so. In fact, all that needs wiping out are repeated assertions of the Department of Justice (see, e. g., Nebraska v. Wyoming, 325 U. S. 589, 611-13 (1945) (U. S. owns all unappropriated water), which the Supreme Court has not yet accepted.

What would be accomplished by S. 1636 is salutary, but not earth-shaking, a fact which should be brought home to the opponents. The Department of Justice would be in an unenviable position if it established that the United States "owns" all unappropriated water, since the United States lacks laws to effectively administer that resource.

Confusion with a constitutional amendment is apparent whenever opponents or proponents suggest that powers of the United States would be dangerously limited if S. 1636 were passed. Powers of Congress would not be limited at all, and most projects in which it will make a difference are built under special legislation in which Congress would remain free to follow or reject any principle or precedent established by S. 1636.

VII UNDERGROUND WATER

The historic common law notion, before the Wright Brothers and before vast exploitation of underground water resources, was that every man owns his land to the center of the earth, if not beyond, and to the heavens above. Acton v. Blundell, 12 M & W. 324 (1843), in harmony with this principle, decided that the right to pump water from beneath one's real estate is unlimited, unless the pumper acts only for the purpose of malicious injury. The view has some following in the United States.

Conversely, a number of western states have decided, either by judicial decision or by statute, that groundwater is subject to appropriation as is surface water. The State Engineer of Utah, for example, administers groundwater rights just as he does surface water rights. This is desirable. Groundwater, whether "percolating" or not is likely to be inextricably interconnected with a surface stream. Some groundwater basins feed surface streams; some are fed by surface streams. A typical condition finds basins sometimes feeding, sometimes fed by surface streams.

The California law distinguishes between percolating water and underground water flowing in a known and defined channel. Engineers are unhelpful, as are geologists, in deciding which is which. In fact, they say the distinction makes no sense. Burden of proof is on the party asserting that water from the underground comes from a stream.

Katz v. Walkinshaw, 141 Cal. 116 (1902), rejected the English view with respect to percolating waters. It held that competing pumpers from an underground basin are subject to the doctrine of reasonable use, which is indistinguishable from the doctrine of correlative rights applicable to adjust rights of competing riparian users. The case demonstrates that the Court had learned something since deciding Lux

v. Haggin, in 1886, where it decided that the 1850 act adopting English common law imported riparian rights. This 1850 act did not import Acton v. Blundell, because its rule was clearly not adaptable to conditions of water scarcity.

Pasadena v. Alhambra, 33 Cal. 2d 908 (1949), established the major prevailing method by which groundwater rights are secured in California. Each user of groundwater from an underground basin is, to the extent he contributes to an overdraft on the supply, a prescripitor against every other user. Hence, overdraft is determined. A reduction in total uses is generally made to eliminate the overdraft, and users are cut back proportionately.

The rules are complicated in their application. Determination of the facts--how much is the overdraft, what are the contours and limits of the basin--are even more complicated. The expense of litigation--with a disproportionately large share going to the engineering and hydrologic specialists--is sufficiently large that settlements are encouraged. The real issue in a number of such adjudications is to determine how the cost of importing water from the Colorado or northern California shall be shared.

Another criticism of Pasadena v. Alhambra is that prescription is a technically inappropriate doctrine. It requires open, notorious, continuous, and adverse possession of a claim of right for the prescriptive period--five years in California. Pumping groundwater from one point in a basin many square miles in surface area cannot well be described in these terms. The prescriptee does not know he is being prescribed against if he is uninformed about the pumping or the fact of the overdraft; he does not know the extent until a complicated hydrologic study has been completed.

However, necessity is a mother of law, and this doctrine has produced progress in permitting the development of water resources. Perhaps it has produced overdevelopment, since a right depends on the

extent of use during the critical period. The tendency of water users to use cheap groundwater in preference to expensive imported water is accentuated.

Another difficulty deserving attention stems from the fact that in southern California, as in many other areas, imported water is the concern of one public agency. Groundwater is the concern of other public agencies created to buy imported water from revenue produced by taxation or pump taxes. For many years pumping continued unabated because groundwater is relatively inexpensive, despite the hazard of salt water intrusion from resulting overdrafts. Capacity in the Colorado River Aqueduct was unused for nearly two decades, simply because groundwater was cheap.

One solution is a public agency which will manage and control both surface and groundwater supplies. It has been persuasively argued that this is essential to maximum utilization of the total resource and scientific management of the groundwater basins.

Federal claims complicate the groundwater picture, as they do the surface water situation. Wise laws passed by the states, or by local agencies, must be adapted to the physical and economic situation of the localities. There are no federal laws in existence. The federal government resists groundwater controls by states and localities. A federal groundwater law sufficiently adapted to local conditions to be useful is not within the realm of realistic possibility.

I suspect that hydrologic science--or at least hydrologic information--has not sufficiently developed to permit a truly scientific groundwater law to be written. "Safe annual yield" is a concept which is hard to reduce to satisfactory definition. Even when defined, quantities are hard to fix. Even when fixed, what to do about overdraft is still subject to divergent answers in different basins. In some situations, perhaps overdrafts should be encouraged, where large supplies are available for mining, and natural replacement is minimal. Extension of federal income tax

depletion allowance to this type of mining may make this a welcome solution in some areas. Not, of course, if "mining" is the only foreseeable prospect for an industrial complex.

It is often assumed that overdrafts should be avoided except where replenishment possibilities are insignificant, and water must be mined or not used at all. This is not necessarily so. Economies have been built on overdrafts and have developed sufficient economic resources to be able to afford expensive developments of imported water. Most often this takes place in unplanned fashion, but who is to say that deliberate planning to this end is not desirable. The risk is that miscalculation may result in exhausting groundwater supplies before replenishment can take place, but planning can come closer to avoiding that catastrophe than an absence of planning.

The exchange principle is common to both surface and underground water rights. It is more often used, perhaps, in groundwater development. The underlying premise is that the water right is a right to water, not water from a particular source. Hence, a possible solution to a controversy is to let those with the best physical access to groundwater pump more than their legal share and to make the others whole by an alternative source of surface water at the same price as the groundwater.

Groundwater law varies more, from state to state, than the law relating to surface streams. This is true with respect both to the substantive rules and their administration. Hence, we shall not attempt in the limits of our time to follow them in detail. Rather, thinking aloud, we leave one generalization.

When the water flows from beneath the surface of the soil, there is the greatest fact uncertainty with respect to where it comes from, how it is replenished, and how other users are affected by one user's withdrawals. Fact uncertainty makes for uncertainty in the rules, and therefore it is not surprising that we find more uncertainty about the

rules in respect to groundwater law than we find with surface water law.

This generalization is both an apology and a challenge. Before lawyers can be criticized unduly for the results, engineers, geologists, and related specialists will have to achieve more in the way of producing adequate data without costing the average litigant a fortune--or leaving him too poor to compensate his lawyer.

VIII
INTERSTATE WATER LAW

No American state corresponds perfectly with the boundaries of a river basin. I am not sure that it would be a good idea if one did. There would be one advantage, of course: The water destiny of such a state would be in its own hands. It could at least inventory its own resources without a legal divining rod.

One great disadvantage would accrue if all states were coextensive with the boundaries of a river basin. There would be no transbasin diversions under the legal institutions that existed until 1963. Until 1963, the interstate law of intrastate streams was entirely encompassed by a case captioned Hudson County Water Co. v. McCarter, 209 U.S. 349 (1908), affirming 70 N.J. Eq. 525, 61 Atl. 710 (1905); 70 N.J. Eq. 695, 65 Atl. 489 (1906). (This is a bone I throw to the eastern Professors who are sick and tired of western cases.)

Hudson County Water Co. was a New Jersey corporation which made a contract to provide water from New Jersey's navigable Passaic River to Staten Island and to the Borough of Richmond in New York. This was an intrastate stream, or at least a stream not shared by nature with New York except through the ocean. (Current pollution legislation pending in the Congress might define it as interstate since it is a tributary to the ocean, but I regard that at best as legal fiction.)

The legislature did not like this development. By statute it directed its Attorney General, Mr. McCarter, to put a stop to this proposed enterprise. McCarter did so, with a great show about how essential the Passaic is to New Jersey. McCarter pulled out all the stops except the cliché that a river is more than an amenity, it is a treasure, because this cliché hadn't yet come from Mr. Justice Holmes' facile pen.

McCarter persuaded the New Jersey courts. Then the Water Company took him to the Supreme Court. The Supreme Court took note of McCarter's

forensic endeavors, but said the exercise was unnecessary. It was persuaded by McCarter's cause without getting into any justification for New Jersey's attachment to its river: "The constitutional power of the State to insist that its natural advantages shall remain unimpaired by its citizens is not dependent upon any estimate of the extent of present use or speculation as to future needs.... The State finds itself in possession of what all admit to be a great public good, and what it has it may keep and give no one a reason for its will." 209 U.S. at 357.

There were dissents by Justices Harlan and Field, which suggest limits to the doctrine. They thought that the New Jersey statute which forbade export of New Jersey water by means of pipes or ditches offends the Commerce Clause. Doubtless, they would have had more supporters had the prohibition against export covered water in bottles, either pure or mixed with flavored or fermented effervescence. And as a personal hunch, the dissenters would probably have commanded a majority if the New Yorkers had come to rely on existing exports of New Jersey water. In Pennsylvania v. West Virginia, 262 U.S. 553 (1923), some years later, the Court held that West Virginia might not prefer its own citizens by forbidding export of West Virginia natural gas on which citizens of sister states had come to depend. Holmes, J., dissented.

Interstate streams are another matter when the claimant is also a state with access to the stream. (So also, conceivably, may be exports of intrastate water for irrigation, because Holmes in McCarter's case said: "The problems of irrigation have no place here." 209 U.S. at 356. I think this may be dismissed as Holmesian judicial caution--a reminder that the Court does not decide cases not before it. If you disagree, you may indulge in the intellectual exercise of articulating a reason why exports of intrastate irrigation water are permissible, against the will of the state of origin, but exports of municipal water may be forbidden.)

We now turn to interstate streams. Prior to 1963, there were two methods of resolving interstate controversies: (1) An adjudication in

the original jurisdiction of the United States Supreme Court; (2) interstate compact, which under the Constitution requires the consent of Congress.

Arizona v. California, 373 U.S. 546 (1963), decree, 376 U.S. 340 (1964), provides an excellent vehicle for an exploration of these devices, as well as the innovation in that case which held (1) that Congress may allocate the waters from an interstate stream, and (2) may delegate its powers to do so to an executive official.

The Colorado River controversy had its roots as a local problem when the Colorado River, shortly before the San Francisco fire, broke away from those who were diverting water to irrigate Imperial Valley in California. The river threatened to create a great fresh water lake in the area below sea level which constitutes the Imperial, Coachella, and Mexicali valleys. It was restored to its course into the Gulf of California only after heroic efforts, and only after the Southern Pacific Railroad became the owner of the major equity in the works. The San Francisco fire almost, but not quite, derailed the effort.

The problem was continuing. So was the attention attracted to Imperial Valley. Silt deposition in the channel made constantly more difficult the task of confining the river to its course. The natural flow, concentrated in the spring, was overappropriated in seasons of summer irrigation need. A wider problem was in the great power and water resource of the Colorado being wasted. Waste could be prevented only by a great multipurpose dam, such as was finally built during the Hoover-Roosevelt administrations.

Construction of the creaky legal machinery for Hoover Dam was a far more difficult task than the efficient engineering. First, upper basin fears of Colorado, Wyoming, Utah, and New Mexico created implacable opposition from those states. A dam would permit appropriation of the entire regulated flow in the lower basin, to the prejudice of their hopes for future development. These fears were fully realized when, in 1922,

the Supreme Court applied appropriation across state lines in a suit by Wyoming against Colorado over the Laramie River. Wyoming v. Colorado, 259 U.S. 419 (1922).

An attempt to quiet these fears resulted in the Colorado River Compact, negotiated in 1922. It is the first interstate river compact. Efforts to divide the river among seven states failed. Secretary of Commerce Herbert Hoover achieved a compromise--in essence to divide what was then thought to be only a part of the water between upper and lower basins, divided at Lee Ferry in northern Arizona.

The Compact in Article III (a) allocated 7.5 million acre-feet of beneficial consumptive use from the Colorado River system, defined as main stream and tributaries, to the upper and lower basins respectively.

In Article III (b), it gave the lower basin an additional one million acre-feet per year, a device which permitted negotiator Delph Carpenter of Colorado, the James Madison of the Compact, to take home what looked like a 50-50 split, but what in fact was a 7.5-8.5 allocation as between basins.

The Compact became a political football in Arizona. Arizona refused to ratify it, in part because Arizona was not assured a royalty on power manufactured from what Arizonans regarded as a local resource, and in part because the allocations appeared to include all Arizona's uses from the Gila, a tributary which Arizona alleged it had fully appropriated.

Arizona intransigence was unbroken by protracted negotiations, nor could the Compact become effective without Arizona. By its terms it required all seven states to ratify.

A unique solution was at last developed in 1928 when Congress passed the fourth Swing-Johnson Bill (Boulder Canyon Project Act), still over the Arizona delegation's opposition. The bill authorized Hoover Dam and the All-American Canal, which provides a diversion route entirely in the United States to serve Imperial Valley in place of the old route across a part of Mexico.

The act was not to become effective until the President proclaimed that one of two things had happened. (1) Arizona had ratified the Compact in six months; (2) six states, including California, had ratified the Compact waiving the seven-state requirement, and California had enacted a statute in prescribed terms reciting that California agreed to limit its use of III (a) waters to 4.4 million acre-feet per year, and its use of surplus waters to one-half.

Arizona continued its refusal to ratify the Compact. California enacted the limitation act in terms prescribed. Hoover Dam was built, and the Secretary wrote contracts with California agencies to supply them with a total of almost 5.4 million acre-feet per year.

Arizona in the early 1930's brought three unsuccessful suits to rectify what Arizona regarded as an injustice. First, to enjoin construction of the dam on Arizona-owned soil. Second, Arizona sued to perpetuate testimony of the Colorado River Compact negotiators to the effect that the negotiators had agreed that the III (b) waters belonged exclusively to Arizona. This was denied because the secret agreement, even if proved, had not been reported to the states which ratified or the Congress which consented to the Compact. Finally, a suit for a judicial apportionment of the unappropriated water failed because the United States was an indispensable party and had not consented to be sued.

A fourth suit was brought by the United States to enjoin Arizona's navy and militia from interfering with construction of Parker Dam by California's Metropolitan Water District which serves the Los Angeles-San Diego municipal complex. The United States lost in court, because Congress had not authorized Parker Dam, but Congress immediately legislated to provide the authority.

Finally, agricultural expansion in Arizona during World War II based on groundwater overdrafts produced a change in tactics. Arizona ratified the Compact and negotiated a contract with the United States for 2.8 million acre-feet. Arizona pressed legislation in Congress to

authorize the Central Arizona Project which would alleviate the ground-water overdraft in the Phoenix and Tucson areas.

Three successive bills were passed by the Senate and were stopped in the House. The last such failure was marked by a House Interior Committee resolution advising that the Committee would not consider legislation until water rights were settled by agreement between the states or litigation.

Arizona chose to litigate, and sued California in 1952. The United States and Nevada intervened. On motion by California, New Mexico and Utah were joined in their lower basin capacities (they have small lower basin areas), but joinder of the upper basin states was denied.

Arizona identified three major issues as requiring decision: (1) Definition of beneficial consumptive use under the Colorado River Compact; (2) whether a share of main stream reservoir losses, about 1 million acre-feet a year in total, is included in the 4.4 million acre-feet to which California is limited; (3) whether California is excluded from using any of the million acre-feet described by Article III (b) of the Compact.

After three years of trial, the Special Master appointed by the Court to hear the case recommended a decision which resolved all these issues in California's favor. However, it was sharply adverse to California in two respects, neither of which corresponded with the contention of any party.

1. The Tributary Issue. The Master said that although the lower basin's Compact allocation is from the Colorado River system, main stream and tributaries, the California limitation prescribed in the Project Act is from the main stream only. The words in the limitation referring to the Compact could not, in part because of legislative history, bear their plain meaning.

2. The Shortage Issue. Shortages were to be prorated among Arizona, California, and Nevada. California was entitled to 44/75 of the main stream supply if it were less than 7.5 million acre-feet,

Arizona to 28/75, and Nevada 3/75. However, present perfected rights-- water used under state law as of the date of the Project Act in 1929-- retained interstate priority. California had argued that shortages should be allocated under the law of equitable apportionment, which rests primarily on prior appropriation.

The case was argued twice before the Supreme Court by Attorney General Stanley Mosk and Northcutt Ely. Its decision on the first issue-- elimination of the tributaries--was adverse to California. The allocation of 7.5 million acre-feet to Arizona, California, and Nevada is entirely from the main river, and Arizona's and Nevada's tributary uses are therefore 3.1 million acre-feet of water from which California is excluded in the first part of the limitation. Elimination of the tributaries makes existence of any excess or surplus, of which California may use one-half, highly unlikely.

On the shortage issue, the Court reversed the Master's decision. The Project Act does not compel proration. However, only three Justices-- Douglas, Harlan, and Stewart--accepted California's contention that the law of equitable apportionment should apply to allocation of shortages. The majority held that allocation of shortages is left to Congress or to the Secretary of the Interior.

Elimination of the tributaries obviously increased the likelihood of shortages. Two million acre-feet of tributary uses were now unavailable to satisfy the 7.5 million acre-feet, all of which must be supplied from the main river. The shortage issue was thus rendered extremely critical.

In less than two years after the decision, Arizona and California have discovered a way to live--and they both hope to prosper--with the decision. Legislation (S. 1019 in the 89th Congress, with counterparts in the House) on which a healthy majority of both states' congressional delegations agree provides the following:

1. Immediate authorization for Arizona's Central Arizona Project.

Arizona needs this project very much. It was Arizona's motive for starting suit.

2. Subordination of the Central Arizona Project to the rights of all existing projects in Arizona and Nevada, and of existing projects in California limited to 4.4 million acre-feet. This subordination is to last until not less than 2.5 million acre-feet is imported in the Colorado River in the lower basin from some other source, the Secretary of the Interior to study such sources and to recommend a project to Congress.

3. The first 7.5 million acre-feet of imported water is to be made available to users at Colorado River prices. The project is to be financed by power revenues from existing and future main stream power dams.

The proposal has not met with complete acceptance outside Arizona and California, but it has not met with impliable opposition. The Bureau of the Budget has indicated that it will approve only 1.5 million acre-feet of imports available to users at Colorado River prices, the component of anticipated shortage identified with the Mexican Treaty of 1944 which guaranteed that quantity of annual deliveries to that country. It has objected to the inclusion of Bridge Canyon Dam as a power and revenue producer until objections of nature groups have been studied by an impartial body.

Some opposition has been voiced by upper basin interests. The Central Arizona Project is a new demand on an overcommitted river. I hope that these objectors may become persuaded that imports of water are not only in the interest of, but are essential to upper and lower basins alike.

Columbia River interests have opposed, on the ground that imported water may come from that source. However, the situation is still fluid, and it is at least possible that a regional project of benefit to all regions may be achieved. California's experience serves as a precedent. A deadlock between northern areas of origin (don't prejudice our future) and southern areas of need (don't expect us to pay for a project with water

which areas of origin may take away) threatened the program with abandonment for many years. Today a project is being built with large and tangible benefits for all regions, and it is popular throughout the state.

An Appraisal of Methods

The strictly judicial method--"equitable apportionment"--is sound in doctrine. Among western states, it gives primacy to priority of appropriation, but is flexible to include a large and uncatalogued number of other criteria. Principal among them is protection of existing projects, even when they depend on junior uses.

The method is cumbersome in practice. The Supreme Court is ill suited to sit as a trial court. Reference to a special master is the only available expedient, but it is far from satisfactory. Trial in a lower court, with right of appeal, would be better than a trial in which only one court decides a case, with no appeal possible.

The compact has been the device most frequently used. It also has weaknesses. Chief among them is inflexibility. A compact may be more difficult to amend than the United States Constitution. The Constitution is amendable by consent of three-fourths of the states. However, as the Supreme Court has many times indicated, the compact is far superior to litigation. None of its rigidities is incapable of being overcome. Even compact enforcement is possible, as we have indicated earlier, if concurrently with its consent, Congress waives sovereign immunity of the United States.

One perplexing problem, however, is the relation of individual water right owners to the right determined by compact in the state. Hinderlider v. LaPlata River & Cherry Creek Ditch Co., 304 U. S. 92 (1938), indicates that a user's right is confined to the agreed right of the state, and that the state in the absence of manifest fraud may thereby limit the right of the user when it negotiates a compact. Such a power can be

disquieting, but we know of no evidence that it has been abused. Even the risk of abuse appears more acceptable than any alternative which might preclude an effective interstate compact.

Literature on interstate compacts is substantial. See Frankfurter & Landis, The Compact Clause of the Constitution, 34 Yale L.J. 691 (1925); Zimmermann & Wendell, The Interstate Compact Since 1925 (Council of State Governments 1951); Witmer, Documents on the Use and Control of the Waters of Interstate and International Streams (U. S. Interior Dept. 1956).

The judicial method is less satisfactory. The doctrine of equitable apportionment is satisfactory among appropriation states. It is less so when one or more of the litigant states does not follow the law of prior appropriation.

The reasons for following priority without regard to state lines are two in number: (1) Neither state can well complain, as between them, of the rule which both apply internally. (2) The same necessity which shaped appropriation within the states exists without limitation by state lines.

The first reason would dictate riparian principles applied to two riparian states. In fact, the Court has not done so. This probably relates to dissatisfaction with the results of riparian doctrine, and the difficulty in applying it to a situation where even a bad decision may be better than a decision whose only vice is continued uncertainty.

Even before the Laramie River decree in 1922, many private suits across state lines had been decided. In many cases these may continue as an alternative to litigation in the original jurisdiction. Since the grant of original jurisdiction to the Supreme Court is not exclusive, perhaps jurisdiction can be conferred on lower federal courts with appeal to the Supreme Court. The possibility should be studied.

Finally, the congressional apportionment illustrated in Arizona v. California has much to recommend it, if it is clear that Congress knows that it is making or authorizing such an apportionment. Many members

of Congress in 1928 did not think so. Until such an apportionment is concluded with a full awareness of the congressional power, judgment should be withheld.

Mexican Treaty

There have been questions about the Mexican Treaty.

This treaty was negotiated in 1944, effective in 1945, and guarantees 1.5 million acre-feet per year from the Colorado to Mexico. Recent disputes center on quality of water. After use and reuse, quality of water in the lower river is not good, and substantial quantities of water are required to leach salts from the soil. Expensive tile drainage systems are installed in the lands in Imperial and Coachella Valleys. These are lacking in Mexico.

The present acute problem results from pumping salty water from the Wellton-Mohawk Project in Arizona in order to facilitate drainage, and putting it in the river where it is said to cause damage to Mexican crops. The current solution, worked out on a five-year basis, calls for bypassing this salty water, and it is hoped that this step will be effective.

IX

THE ROLE OF THE NONLEGAL WATER EXPERT IN LITIGATION--
ADVICE TO LITIGATING CONSULTANTS

The first function of the nonlegal expert--we shall call him "engineer" for simplicity, although he may be a geologist, an agriculturist, an economist, or something else--takes place before litigation starts. Of course, if he is retained by a client who did not realize that he was about to be sued, the engineer may have no role prior to the start of litigation, but that situation is rare. In water controversies plaintiffs usually rattle well before they strike. And of course the plaintiff always has an option to sue or not to sue.

Advising the prospective plaintiff whether to sue or not to sue, and advising a present or prospective defendant about whether to seek to settle or not to settle, are the hardest part of the engineer's job, just as these are the hardest part of the job for a lawyer. The client is usually irate and responds favorably to fight talk:

"They can't do that to us. Let's show 'em good!"

The client doesn't like to hear:

"Our position may not be altogether sound."

The lawyer must take responsibility for legal tactics, including appraisal of possibilities of success in litigation, but he needs to know all you can tell him and probably a great deal more than you or anyone else can tell him about the facts. Most decisions in life are made on less than adequate information, but there is little excuse in a lawsuit for not having as complete information as can be obtained.

One of your main jobs is educating the lawyer. In doing so, keep three things in mind:

1. Never tell him more than you know. If you have an opinion, but you feel you may not be able to support it by testimony under oath, make the limitation clear. In fact, you should state the uncertainties first, lest

the attorney or client, hearing a tentative opinion which he greatly desires, turns his hearing aid off before you get to the qualifier: "But I may change my mind about that after study."

2. Never, under any circumstances, be afraid to say; "I don't know." Those three words have a clarity and a simplicity which would prevent fully half of the entanglements and embarrassments into which experts and nonexperts fall. Reflect on all the questions you might be asked, and remember that if you do know answers to two percent, you are doing well. "I don't know" is good on the witness stand or off, whenever it is the fact, and you can't possibly improve on the form of the statement.

3. If you think for any reason that a case is no good, based on either the facts or the law, have the courage mixed with whatever tact you can command, to tell the lawyer you think so, and why. He may disagree with you, and this may not add to your popularity with either client or lawyer, since no one likes to pay money to be told he is wrong. But most people are happier to get that message from their own experts very early after only a modest expenditure, rather than from a judge much later after a vastly larger expenditure.

The lawyer's duty, within his competence, is to tell his client everything the client needs to know, including especially the fact that the client is wrong. Often the client can be helped to achieve a part of his objective simply by being reasonable. A degree of success is far better than total failure.

The technical adviser has the same responsibility within the adviser's competence. Neither lawyer nor engineer has a legitimate excuse to evade this responsibility on the ground that, narrowly viewed, advice withheld in the one case does not relate to law, or in the other case does not relate to engineering. Your job is to give advice, and you can qualify it as not relating to law or engineering as you choose, but if client or lawyer should have the advice, your duty is clear.

We should like to assure you that both lawyer and client will surely

respect you in the end for candor and courage. Maybe they will, and maybe they will take a permanent dislike to the frustrator of their hopes. You can at least be assured that you will respect yourself. This is the beginning and it may be the end of success.

We have made a rather good thing on several occasions of mildly funny trade witticisms about lawyers who are engineering, and engineers who are lawyering. The only difficulty is deciding who is to be the straight man. Here is one in which we join in enthusiastic unity, without that embarrassment: Not all shysters have been admitted to the bar.

The commonest source of miscalculation is not, however, shystering. Law students argue most court cases (i. e., cases on imaginary facts) as part of their training. Most of them become persuaded after two or three weeks that the argument is one-sided and in their favor, even though the problem is usually as carefully balanced as a skilled law professor can make it. How much easier it is to become identified with a real client, after months or years. This tendency to self-persuasion is a human failing. Recognize it and try to compensate for it.

In gathering and analyzing facts, put yourself on the other side. Outline the factual presentation you would prepare if you had been retained by the adversary. Appraise it as objectively as you can. Acquaint the lawyer on your side and the client with the result.

If your client can possibly afford it, by all means take all the time required to educate the lawyer. Don't stop with giving him your conclusions, or conclusions plus a report which he doesn't understand. Teach him the technology and make sure he understands it. It is particularly important that the lawyer understand clearly the distinction between physical facts, i. e., physical measurements or observations, and derived values obtained through engineering analysis based, hopefully, on physical facts. He must be fully cognizant of the assumptions underlying the derived values and the techniques used in obtaining these values.

This may be a bit difficult, as some lawyers have an unfortunate tendency to regard anything expressed in quantitative terms as a "fact."

Lawyers are supposed to be adept at mastering technical facts outside the compass of law books, and if you cannot communicate the technology to the lawyer, it is because one or both of two unfortunate things is true: Your client lacks either a good lawyer or a good engineer.

Costs of litigation are important. Your help is essential in planning and calculating how much full preparation and trial will cost. Of course, you don't know. But about the engineering costs, you know more than anyone else. Client and lawyer are entitled to your best estimate at the decision-making stage.

Even if it is clear that your client has suffered injustice, that the law is clearly on his side, litigation may not be the best solution. Your advice in seeking a solution to his problem is needed, and the best solution may not be through litigation. Although the client and lawyer are determined to litigate, you should advise about any available alternative that might secure the objective. Don't be like the miscreant doctor who cut off the lady's leg without diagnosis because she said, "I want an amputation."

Do everything you can to make sure that you have a full comprehension and all information available about just what the problem is. Many clients aided by competent lawyers come to disaster because the client asked the wrong question. Or he may have treated his lawyer and his engineer with less than full candor, and fudged the facts a bit.

The lawyer who first comes to the truth when his own client is being cross-examined is deeply embarrassed. The client is even more embarrassed. When the facts are technical, within your specialized competence, it is your job to make sure nothing like this happens.

Understand as much as you can about the whole case, and all its facets. If you are an engineer, and it involves engineering, geology,

and law, the common enterprise will be furthered if you are as fully informed as possible about all three subjects relating to the controversy.

Encourage your client and his lawyer to get additional technical assistance if you think that will be helpful. If you feel that you are not the best qualified specialist available to your client, tell him so. Happily, he may disagree. In any event you will be better off if that fact is disclosed early, and by you, rather than by someone else in an unfortunate courtroom experience later.

The Trial

Now we assume that the parties have failed to find a nonlitigious solution and the case comes to trial. Your major role now may be that of witness. You will be called to testify under oath. Your testimony will be developed under questioning by a lawyer on your side.

Normally your testimony will include several things. First, your qualifications as an expert, which will permit you to express an opinion. This is something that a lay witness may not do, since the lay witness is limited to stating facts from which judge or jury are as qualified as the lay witness to arrive at an opinion.

We think it best not to overdo your qualifications. If you are testifying as an expert on dam design, the court should know that you designed Hoover Dam. It will not help very much for you to tell the court that in addition you won the Burnished Palm Medal as the brightest engineering student in the class of 1919 Siwash.

Your qualifications may be attacked, but if so, don't get angry-- about this or about anything else. At least until you are out of the courtroom. You may even be asked how much you are being paid. You should answer the question, without indignation. Of course, you are being paid for your opinion, whatever it is, and not simply to

favor your client. If this is not so, you should be neither in the courtroom nor in your profession.

You will then come to the substance of your testimony. On direct examination, you may be asked questions only to establish that you have an opinion on certain facts, real or hypothetical, and to state what that opinion is. The basis for the opinion may be developed, if the other side chooses, on cross-examination. Or you may be asked on direct examination to state in detail the basis of the opinion.

You should keep in mind the distinction between two kinds of matters about which you may testify: (1) objectively observed facts, and (2) calculations from those facts.

The water level in the well at such and such a time was so many feet from the surface, as you yourself observed. A layman who could and did use the tools of measurement might so testify. This is an objective fact.

Opinion might relate, by reason of the foregoing and other observations and analysis, to how much water there is in the groundwater basin. This is a calculation which you must be prepared to describe. Your testimony is likely to be more persuasive if it is clear that it is a calculation, and that it is not a precisely observed or measured condition.

On direct examination a statement that the calculation is in your judgment accurate within 15 percent sounds far more persuasive than your reluctant admission on cross-examination that there may be a 15 percent error in your calculation.

All these matters take careful planning with the lawyer. Advance collaboration and joint preparation are essential. You and he should know your answer to any question he will ask you, and as nearly as possible to any question you may be asked on cross-examination.

Questions to be asked on direct examination should be carefully planned and phrased in advance. If the lawyer is not available for this kind of joint preparation, you may well consider seeking a different employment. Your professional reputation is at stake. Furthermore, none of us likes to be a party to a sloppiness which jeopardizes a client's case.

Your attitude in the courtroom is important. Remember when you take the stand you are an engineer, not a lawyer. The expert who is obviously a partisan nearly always makes an unfavorable impression. If there is an objection from the other lawyer to a question asked by your lawyer, wait until the objection is ruled upon, and don't try to sneak in an answer. Let the lawyers wrangle about the objection. When they have finished, and if the objection is overruled, you will probably have forgotten the question, but the reporter will read it.

An always hilarious moment is the following: Question: Objection. Hour long argument on objection. Ruling: The witness may answer. Answer: "I don't know."

Remember that in court you have a very limited audience--the judge, and if there is one, the jury. No one else counts. Neither judge nor juror is a member of your profession. The object of the whole exercise is to make sure that judge or juror understands your testimony.

Speak clearly, and speak simply. You are not making a speech. You are imparting information that must be understood. Keep firmly in mind what the message is that must be conveyed. Here, advance preparation helps. Both witness and lawyer should understand that objective.

This is even more important in cross-examination. In cross-examination, you can make your answers complete, at least unless there is a sustained objection. In that case the answer can be explained on redirect examination by the lawyer for your side.

Here is an example of the dull-witted or unprepared expert. In a trial involving an issue whether water was being wasted, the question was

asked on cross-examination: "Wouldn't Jones have been able to save that water by installing a regulatory reservoir?"

Answer: "Yes."

The far better and full truthful answer: "If there were a place to put a regulatory reservoir, yes. But there isn't any place."

Redirect examination did not repair this damage. Redirect examination occurred immediately after the witness answered "yes." The lawyer conducting redirect examination wasn't informed enough to be very sure whether there was a place for a regulatory reservoir, and he didn't ask his witness.

Even when covered on redirect, the damage may not be completely repaired. An impression once gained tends to linger, and attention of judge or jury may wander to another point when redirect examination takes place.

How about the "answer-yes-or-no" technique of the cross-examining lawyer? This is not troublesome when it is apparent to everyone that "yes" or "no" is inappropriate. But suppose only you know why the question cannot be answered yes or no.

Say so: "I doubt that I can answer yes or no," and explain why. If the judge thinks you should answer yes or no, perhaps you should try:

"If it must be answered yes or no, I think the answer is probably yes, but may I explain?"

In all probability you will get an opportunity to explain.

One common and damaging mistake: Attempting to answer a question you haven't clearly heard or which you don't understand. You can always have the question repeated. If you don't understand, ask to have the question explained, or state yourself what you think the questioner meant. Don't fire blindly by an answer that in fact will be linked with a quite different question from the question you thought you were answering.

What about exhibits?

A map, a table, a diagram, a chart may be far better in clarity and persuasiveness than any verbal explanation. Preparation well before trial is essential. Be able to testify that the exhibit was prepared under your direction, that you identify the data and their source, that the exhibit and data are accurate, and that you can fully explain the exhibit.

In discussing an exhibit, it is vitally important to remember that you are making a record through the court reporter which may have to be intelligibly read later. "There was a two foot abutment here, and a post about this far from the abutment."

This makes no sense at all when read from the record. Try again: "There was a two foot abutment indicated by this X two inches from the left side of the map, which is defendant's exhibit 7, and there was a post about two feet west of the abutment." Now, from the record including exhibit 7, an appellate court gets the complete message.

In some cases, "canned" testimony of experts is used. The parties stipulate that a written statement constitutes the substance of the testimony you would give if called as a witness, and that you may be cross-examined. Many lawyers dislike this. The judge may not be an avid reader of documents, and his vivid impression may be the one you make on cross-examination--usually not as favorable as on direct examination. Of course, this technique is sometimes a baited hook, the witness and his lawyer expecting cross-examination and an opportunity for the witness to "unload" on the adversary in the most damaging fashion possible.

In any event, the canned testimony makes a clean record, easier to interpret on appeal than questions and answers, with possible failure to distinguish between "Uh huh," "huh uh", and an inadvertent burp.

You will probably be called on to read the transcript of your testimony as soon as it is available. If the client can afford the expense, a daily transcript is useful in planning the next trial day. It is important

that errors be corrected, and that any you find be called to the attention of the attorney promptly. Errors will be minimized if your testimony is distinct, clear, and not too rapid. It helps to spell any unfamiliar words, or to assist with any formulas or the like which may cause difficulty. Indeed, a list of unfamiliar technical terms can be handed to the reporter-- a courtesy not only appreciated but one which helps the person whose testimony would otherwise be misunderstood.

Truthful testimony is a goal which you will seek, not only because you are under oath, but because it generally will serve your client best. Don't fudge the facts. If you make a mistake, correct it as soon as possible: "I was mistaken when I said a moment ago...."

Other Tasks

You are likely to be called on to help prepare for cross-examination of witnesses for the other side. A daily transcript of today's direct testimony is most useful if cross-examination is tomorrow. Your knowledge of the case helps in suggesting weaknesses or inadequacies in the testimony. Knowledge of the witness to be cross-examined, what he has written, etc., may be even more helpful.

Of course, you may be on the other side when someone is combing through what you have written for prior inconsistencies. If you foresee the possibility, don't let the attorney on your side be surprised by the discovery. Tell him, even though you think the possibility is remote.

A lawyer cross-examining an engineer usually wants his own engineer at his elbow. Obviously, consultation in the courtroom between cross-examining lawyer and his engineer needs to be unobtrusive, but it is quite proper.

After the trial, there will very possibly be the preparation of findings of fact, conclusions of law, and judgment. The nonlegal expert has a most important place in each of these tasks. Findings of fact are

particularly important if there is to be an appeal. If they are to be based on technical testimony and data in the record, the lawyer needs technical help in the interpretation of what the record shows. The judgment, particularly if it is in the form of a decree, must be workable. It can resolve the controversy. It can be the prelude to renewed and debilitating litigation over just what it was that the court in fact decided.

The decision whether to appeal may be difficult. Here help of the nonlegal expert may be particularly helpful. He can assist in appraising the result if there is no appeal. If appeal is sought with the object of gaining a new trial, he can assist in forecasting whether a new trial, with an opportunity to present new evidence, would bring a better result.

On appeal, there will be a record to prepare and briefs to write. What part of the technical evidence should be brought to the appellate court's attention? Are the summarized facts in the briefs accurate? Can the facts be better stated, within the bounds of accuracy, to further the client's cause?

After appellate briefs are filed by both sides, there will probably be argument by counsel. The appellate court may consider (1) evidence in the record, and (2) any indisputable facts which are said to be judicially noticeable. Hence, collecting scientific or technical writings may not end with the trial. The expert is invaluable in examining the record, suggesting interpretations of fact, locating literature useful to persuade the court to take judicial notice, analyzing facts recited in briefs submitted by the other side.

At every stage, before, during, and after trial, settlement conversations may take place. The engineer's peculiar competence is as much needed as that of the lawyer. While the lawyer is interested in resolution of issues, the engineer is likely to be more interested in solutions.

In California, the "physical solution" is simply a refinement of the traditional injunctive remedy whereby the court attempts to order

some relief which will end or minimize the problem for both litigants. The engineering questions to be answered when such a solution is proposed: Will it work? What are the benefits, and what are the costs? How will it affect my client? It is well to remember that physical solutions are generally formulated using historical data with the benefit of hindsight. In operating under the physical solution in the future, the court, the watermaster, or the litigants, as the case may be, will not have the benefit of hindsight. Workability must be judged in this light. These are most complex questions likely to arise in water litigation, and your client needs all the skill you can command in getting answers.

If settlement by physical solution takes place, the lawyer will have the responsibility for the decree, but the engineer will have responsibility of workability of the solution itself. Perhaps the moral here should be directed to neither lawyer nor engineer, but to client: Be sure to retain on your team professionals who work well together, because their respective responsibilities can never be sorted out.

These suggestions have been cursory. Any of them should yield to any instruction from the lawyer with whom you are working. The end in view, of course, is to assist the court in its decision. We are dedicated to the proposition that facts are best established by the diligent efforts of opposing adversaries, and generally that system works because the participants make it work.

No departure from courtesy, much less any departure from honor, is ever called for in the courtroom. The expert witness is participating in a public endeavor in which his role is likely to be more significant than that of the lawyer. His is the direct concern with facts. In result, no legal decision can be sounder than the determination of facts on which it rests.

Finally, you will not need to be reminded that while the world may think well of good losers, it does not think any the less well of those who win. This is what the expert is retained to help accomplish.

The expert should think large in terms of the ultimate result to be accomplished. The hydrologist may have a much better notion of what it means to win than the client who retains him. He may discover a result better for both parties to litigation than either had envisioned. He may, on the other hand, realize, as the antagonists do not, that neither party can win because of physical limitations aside from resolution of any legal issue.

The technical specialist should be the idea man. He should test objectives, he should develop theories, he should constantly challenge the lawyer's ingenuity with the probing question: "Suppose we establish the law as you contend, what then?"

"Is there a better way? If so, how do we achieve it?"

In at least nine out of ten times, answers to these questions turn up nothing useful. Then back to the drawing board with no hurt feelings, and let us look for that elusive tenth attempt. The nonlegal water expert must be a part of a team. As a part of a team, yours will be a sense of accomplishment in a collaborative effort in which the team's achievement is greater than the sum of the contributions by each of the members.

Harvey O. Banks

Charles E. Corker

PART III
Lectures
on
ADMINISTRATION OF WATER RIGHTS, CE 263

Presented at the
SUMMER INSTITUTE IN WATER RESOURCES
UTAH STATE UNIVERSITY

by
Wayne D. Criddle
Clyde, Criddle, and Woodward
Salt Lake City, Utah

Logan, Utah

August 2-13

1965

ADMINISTRATION OF WATER RIGHTS

by

Wayne D. Criddle

Water resources development and administration entail many complex and interwoven questions. Who should control water and how should it be controlled? Should control be through the federal government, the state government, or the local government? What basic policies should be used in water control? How should these policies be developed and by whom? What laws or legislation is necessary to provide authority for water control? Are the laws of your state adequate or do they need revision and can administration be improved? These questions and many others are difficult to answer in this important area of water utilization. Administration of water laws must be fair to all users. A most perplexing problem is the evaluation of beneficial uses. In a developing economy, beneficial use cannot be a constant. It is dynamic and therefore must be reevaluated from time to time. What is beneficial at one time may not be considered to be so at some other time because of new needs for water, new technology, etc. How can existing water rights best be evaluated in terms of beneficial use? Laws may develop as a result of successful pressures by special interest groups, but all beneficial uses should be recognized under an efficient water law. Water right problems are frequently discussed but too often do not receive honest, constructive consideration in terms of the technical facts and in light of what is best for the general public as a whole.

The above is illustrated by the problems in Ecuador where water supply is not the most serious problem but water rights and their administration are major obstacles. Most countries have a way of recording water rights. Sometimes the procedures follow a sophisticated paper system, but a notice may be merely carved in a tree or

written on a piece of paper and placed in a tin can which is nailed to a tree. Developed water rights are normally recognized by society regardless of the method of recording. Water physically "put to work" gives the first user the best known right to its continued use in the future.

In the United States there are few small streams containing unappropriated water in the eyes of the past users, and additional development always infringes on their rights, they feel. However, it must be recognized that in the future there will be a limit to new water development in certain areas. In fact, there are cases where even culinary and domestic water right applications (generally considered of highest priority) have been rejected. But it is difficult to limit an old right to any specified amount regardless of apparent misuses unless an overwhelming amount of evidence is first collected. A more common and direct means for measuring beneficial use is badly needed.

Water rights are now acquired in Utah only by application. Application must be made with the State Engineer for either groundwater or surface water since Utah law considers all water, whether above or below the ground surface, to be the property of the State. Water laws, compacts, etc., should not be made for surface water alone. Control of both surface and groundwater is necessary because of their interrelationships. Often using water from one source will affect the other. Although water rights are considered as property rights, the water must be used beneficially.

As the science of water uses advances, the amount of water needed for beneficial use may also be altered. The water users, the general public, and the courts must be educated as to beneficial water requirements. However, better knowledge on how to use water more efficiently seldom causes a user to use less water. Economics and law are the motives that enforce efficient use. But technology must first show that production will not suffer if less water is used. Unnecessary water then may be taken from the user, if not voluntarily, through adjudication procedures. The older users generally do not want an adjudication. The old users feel that adjudication merely deprives them of water, for they have rights. The

newer users feel that only through adjudication can they receive water they require.

Either the State Engineer (water administrator) on his own initiative, or individuals through the State Engineer, can initiate adjudication. Important items that must be remembered in the adjudication processes are:

1. Old rights must be recognized and allowed water but limited to beneficial needs.
2. All rights from each water source must be evaluated, one vs. all others, and given their proper priority and allotments.

Class Problem

To make each individual become more involved in problems of water administration, water rights and their importance in water resource planning, a class problem is suggested. Each student should prepare a paper on the following hypothetical problem to include but not be limited to the indicated questions.

You have been hired as a consultant by a small developing country to prepare a water resources project development plan. The project contains 100,000 irrigable acres. Government is through a president and his ministers, but water resource development is limited to a single ministry. The education level of the people is low. Although water development should be multi-purpose, the ministry has specified that irrigation will have the number one priority. Agricultural potential is high because of good soil, climate, and adequate water. There has been water development in the past, but it has been development only of the natural flow of the rivers with no stream regulation. Existing water laws are inadequate, and administration has been largely according to custom. Like most, this developing country is badly in need of foreign exchange. It must have an organization to

manage the resources and to serve as a contracting agency for financing. Since the water development project will be multi-purpose, and since there is a usable power drop of 750 meters for water not used for irrigation, irrigation demands must be kept to a minimum.

The growing season is during the full year, and the average annual precipitation of 36 inches is rather well distributed throughout the year. We might assume the effective annual precipitation to be 18 inches for alfalfa, which will consume 38 inches of water annually. The average crop consumption would be 24 inches, and the average effective precipitation for all crops would be 11 inches. Economists calculate that as much as \$500 per acre could safely be spent for irrigation, including the farm developments necessary for irrigation. Hydrologic records are of poor quality. The power market for small industrial development as well as for home purposes is expanding rapidly.

Questions

1. What general policies would you recommend to the government in the overall development?
2. Suggest necessary features of a water law for the country. Assume that groundwater is of minor importance but should be subject to control if and when needed.
3. What organization would you recommend for water and power distribution?
4. Should the basic water organization under the ministry wholesale and/or retail water?
5. How should the multi-purpose project be financed? How would you go about the financing and repayment program to make it acceptable to the government and to the water users?

An Example of Water Laws Administration*

The State Engineer is responsible for administering the water laws of Utah. He is appointed by the Governor and approved by the Senate. The office of State Engineer deals with (1) water resources, and (2) water rights. Appropriation, adjudication, and distribution are all part of water rights, but are heavily dependent upon information from water resource studies.

In Utah, about one-third of the budget is spent in gathering water resource information and two-thirds on actual water right administration. Water resource information is also used by all agencies and individuals.

Cooperative investigation programs are carried on by the State Engineer with other organizations, for example, Agricultural Research Service, Utah State University, U. S. Geological Survey, etc.

The State Engineer has full control over all water used, both underground supplies as well as surface waters, and he may limit the amount of water used. Under his direction, area or river commissioners distribute the water to the users in accordance with their rights. However, the commissioner is not responsible for distribution of water within an irrigation company. He distributes to each right, and if the rights are held in the names of companies, each company must distribute to its stockholders.

If adjudication proceedings have been initiated on a water system, the State Engineer assembles and presents facts to the court in a proposed determination. The district court reviews the water rights as evaluated and has a copy of the determination served on each individual user. The user has the right to protest and present evidence if he disagrees. The district court then makes a final decision in view of evidence available to him, but any user may ask for a review of the

* See "Water Laws of Utah," 2nd edition, 1964. Office of the State Engineer, Salt Lake City, Utah.

lower court's decision by the Supreme Court of Utah. Decisions from the highest court of the state are considered carefully in water administration of the future.

Copies of a preamble to a proposed adjudication and sample sheets showing proposed awards of water rights are attached. (Appendix A)

In some states, a water right is tied to the land; but in Utah, a water right may be transferred to another beneficial use if other rights are not injured by the transfer. The transfer is made by filing an application with the State Engineer to change the point of diversion and/or the place of use. This procedure allows for early development for agriculture or some other use and then a transfer to industry or for municipality purposes if needed at a later date. Transfer can only be made through formal application and approval. The application is necessary so the complete picture can be analyzed to prevent infringement on other users' rights. For example, a power company although not using the water consumptively may not arbitrarily change its point of diversion if other rights will be adversely affected. Changes may deprive users below the new point of diversion of part or all of the water they are entitled to under their water right. Also, changes may require more elaborate and costly turn-out structures for downstream users, and consideration should be given as to who should bear this added cost. A sample question that often arises is: Should one user be allowed to improve the efficiency of his conveyance system at the expense of other water rights? For example, for many years an upstream user has diverted 10 cfs and transported it in a leaking canal to his field. From the conveyance channel he loses 5 cfs through seepage, most of which returns to the stream channel and has served as the source for other rights. Can he line the canal and increase the delivery to his field to 10 cfs if it reduces the flow to downstream users significantly? A situation like this often arises now and requires consideration of all facts and the decision based on the law court decisions and the general policies of the office.

Water laws are never fully defined or tested. The water users and the public in general are never fully aware of the effects on the whole system of changes in point of diversion or place of use. Changes in efficiency of water use and delivery, and changes in points of diversion and places of use can alter a system to such an extent that a new adjudication may become necessary. Change applications apply equally to ground and surface water.

In Utah, the state owns the water and companies or individuals may apply for and develop the right to use what they need for beneficial purposes. Normally, each user asks for more water than may really be needed, and the administration must limit diversions to beneficial use. Users generally pay water distribution costs based on the amount of water delivered, but they do not pay for the water.

In granting water rights, the state must determine how much water is required for a beneficial use. For example, in one area of Utah, a maximum of four acre feet per acre are allowed per growing season as being beneficial use. Actually, under the site conditions, crops grown require an average of only two acre feet per acre per season for consumptive use and get 0.35 acre feet from rainfall. This leaves a net water requirement of 1.65 acre feet per acre per growing season. However, the amount of rainfall that is effective will vary from place to place and is not entirely dependable. However, water now allowed as necessary losses may, and probably will, be decreased later as the demand for water grows and as the distribution efficiency increases. Under Utah conditions, farm headgate efficiency usually does not exceed about 65 percent even under reasonably good practices. The "losses" from deep percolation will generally provide adequate leach water to maintain a good salt balance in the soil if drainage exists.

Our experience indicates that it is not desirable for an adjudication to become a final decree. Each case should be left interlocutory so that

desirable adjustments, particularly the duty of water, can be made at a future time. Adjudication is not an elimination of rights or a tampering with appropriations, but rather a revaluation of the term "beneficial use."

The place of water use can be altered with the approval of the State Engineer of Utah. If the diversion point is to be changed more than 660 feet, the State Engineer must advertise the change. If the change is to move the diversion point less than 660 feet, advertising is at the option of the State Engineer. Additional depletion of the source and interference with the rights of others is the critical measure as to whether advertising of the change becomes necessary.

A particularly interesting question just came to my attention. Is there a legal procedure under which industry can relocate an irrigation canal for better utilization of the property where the irrigation company owns the right-of-way in its name? The original right-of-way may have been obtained by the irrigation company by gift, or through condemnation proceedings, or purchase. The resulting revised distribution section could be better than the existing. However, if the company resists, there seems to be no legal precedent to force the change. There should be some procedure by which such a move could be made, even against the wishes of the canal company. This, of course, assumes that no injury would result to the company.

Depletion

A new public concept with respect to water administration is that of resource depletion. A farmer in the High Plains area of Texas filed with the Bureau of Internal Revenue for a reduction in taxes due to depletion of groundwater under his land. The claim was rejected by the Bureau and subsequently taken to the court of appeals. The court ruled that water table drawdown was in fact a depletion and should be tax deductible. The formula uses the difference, in dollars, in the value of the land after and before irrigation, times the rate of drawdown per year in feet, divided by

the aquifer thickness in feet below the water table, which equals the dollar deduction per acre per year. This procedure, although appearing to be simple, is not quite so easy as it might appear at first glance, since one must establish the variables used in the equation, and once they are established they must be retained throughout the life of the groundwater basin. It is said that the action by the court of appeals is merely an interpretation of a clause already passed by Congress and not a new court ruling which may become law.

Compacts, Treaties, and Agreements

Since administration differs from state to state and from government to government, any large basin development must consider several sets of laws. The best solution to the legal problems seems to be a contract or agreement among the parties involved which describes the water rights and how they are to be administered. These compacts or agreements seldom satisfy all participants, but they do provide a workable solution to the problems of water administration. Subsequent revision of a compact may become desirable and advantageous to all parties concerned, but is most difficult to do, probably more difficult than getting the original versions.

From the viewpoint of the administrator, the compact is the best form of agreement between states yet devised. However, many inherent problems exist, and there are no laws and few precedent court cases to guide the participants. The river is considered in view of past flow records which may or may not be repeated in the future. Past and possible future developments and various other factors must be considered to equitably divide the water supply. State compacts may also be imposed upon by federal court actions.

In 1922 the Colorado River Compact divided the waters of the Colorado River between the upper and lower basins. Subsequently, these basins have each divided their share of water among the individual

states. The Colorado River Compact provides water for Mexico in accordance with an international treaty. An important point: Compacts should definitely include groundwater. Ground and surface water are usually too interrelated to be regarded separately.

There are three compacts affecting Utah:

1. the Colorado River Compact,
2. the Upper Colorado River Basin Compact, and
3. the Bear River Compact.

The Columbia River Compact will, when completed, affect a small portion of the state.

The administration of Pot Creek between Utah and Colorado is an example of informal agreement worked out by the two state engineers, approved by the governors, and this agreement is without prejudice to the legal rights of either state. It seems to be functioning entirely satisfactorily.

Record Keeping

The many water right records of a state are bulky to store and often get lost. Utah has solved these problems by microfilming the records. Working copies of the microfilm and security copies are made and properly stored. The work copies are readily available to the public or anyone wishing to review the status of a right.

A water right is considered as personal property in Utah and can be transferred to another user or willed to an heir. However, a transferred water right must recognize beneficial use and be limited as was the original use or as might be imposed in the future.

International treaties are never completely satisfactory to all parties concerned but are necessary when two or more countries cannot agree on the distribution of a common water source.

The Indus River problem is a good example of a river dispute settled by treaty. Extensive development had taken place in the Punjab area from the three eastern rivers, which lands are now in Pakistan. India then

wanted to develop her land on the upper portion of these same tributaries. The World Bank recognized that there was not enough water in these tributaries to satisfy both countries, so she acted as an arbitrator and advisor to formulate a treaty which both countries signed. The western tributaries are to supply the water for Pakistan's developments, while India was allowed to develop and use the land on the upper portion of the three eastern tributaries. The treaty does not completely satisfy either country, but it is considered a reasonably sound, workable solution, and certainly the Bank has made a great contribution to peace in this part of Southeast Asia.

The Jordan River is an example of a river dispute which is being operated under a third party understanding. The original proposal was to ignore boundaries and develop the whole basin as a unit. However, this is politically impractical under the state of tension existing between the countries. Finally an arrangement was worked out whereby the total land potentials and total water supplies within the basin were considered. It was decided to (1) serve all the irrigable Arab lands in the basin first, and (2) let Israel use the remainder of the water either inside or outside the basin as desired. Once the division was agreed to, any country could take its allocation of "stream depletion" and use the share as she saw fit to do so. There has never been a signed water treaty or any agreement of any kind between the Arab nations and Israel. However, so far, both sides have respected the understanding of the United States on how the waters would be divided.

The Euphrates is one of the large rivers of the world which needs to be placed under an international treaty in the near future. Upstream, Turkey is planning the huge Keban Dam and storage reservoir for power production. Syria, in the middle section of the river, has already developed some storage, and considerable land and water is planned for development in her portion of the Euphrates basin. Iraq, on the downstream end, has limited storage potentials and must

depend largely on the natural flow of the river for water. When Turkey completes her storage reservoir, the regime of the river will be changed and Syria will be able to capture more water, leaving less for Iraq. A treaty must be made or Iraq seems to be the country that might not get its fair share of water.

Very often other than engineering facts enter into the making of a treaty. Engineers and other technicians should present hydrologic and technical facts in an unbiased manner, for theirs is the information needed for a sound solution that will be manageable from an administrative standpoint.

Finding a rational basis on which to develop an International Treaty between underdeveloped countries may be difficult because of the lack of hydrologic records. In some instances, even though records do exist, their reliability may be doubtful. The only solution is to use the best tools we have, extrapolate and interpret hydrology by standard and accepted procedures, and to set the best hydrologic basis for the treaty that is possible.

Even good hydrology by itself is far from being a sufficient base. Some formula must be found that will allow each riparian country to get what it considers to be its fair share of water. Solution of the Jordan River dispute, such as it is, required a determination of the irrigable land and the beneficial water requirements of that land. Policy matters had to be developed such as the decision that Hula Swamp was a natural water user within Israel and the existing consumptive uses were not a natural part of the water source. Water salvaged from developing the swamp were waters that had never formerly gone to make up the stream below and should not be so considered. Each situation requires a new formula and sound considerations.

Interagency Committees

The basin interagency committees are composed of representatives

from all federal agencies directly interested in land and water and from the states involved. Such a committee can iron out a lot of problems and has been quite effective in the Pacific Southwest and other areas of the country. An example of problems this committee wrestles with had to do with water rights. Ranchers have sometimes built stock watering ponds on the headwaters of rivers that have been considered as fully appropriated. It was soon discovered that diverting water from the "stock ponds" around the side of the canyons increased the surrounding grass growth. So, during slack periods they often put their bulldozers to work and built numerous ponds and stored an appreciable amount of water which affected the users downstream. The Pacific Southwest Interagency Committee discussed the problem fully, then published a report defining the maximum requirements of stock watering ponds. This guide has been most useful in water administration. In Utah construction of stock watering ponds and storage of water must be applied for, and the agencies of the U. S. Government using water on the federal domain is no different than individual farmers or ranchers on their private lands.

Water Institutions

What type of institutions are required to distribute water to the farmer from the water development projects? Since most large projects are financed by public moneys, should the government distribute the water on down to individual user, or should mutual companies or co-ops be formed among the users to handle the distribution responsibilities? Under early developments in the western United States, mutual companies were formed and distributed the water. In fact, some private companies constructed complete projects and "sold" the water. However, except for a few small ones, most commercial companies have gone out of existence.

The present trend is to look to an irrigation district or to a

valley authority type organization as the water institution for wholesaling the water. Such an institution with limited taxing powers can force the stockholders to pay their water bills, etc. Such institutions are likely to dominate the irrigation water field in the future.

A rational and likeable arrangement for farmers is to have the district act as a wholesaler delivering water to cooperatives or mutual companies owned and managed by the farmers who in turn deliver to their individual stockholders. There are places, however, such as in Puerto Rico, where the government distributes the water to the farmer. Since the farmer has no direct representation at any level, this system is generally unsatisfactory to the farmer. When the irrigators have no active voice in water distribution, they do not develop the necessary interest and initiative to do the best job possible with the water, and they often receive inadequate service.

In a community association or a mutual company, social pressures help force individual users to supply labor for operation and maintenance and to pay water costs, and organized efforts force higher authorities to listen to complaints. Individuals should have some means of making their wants known to those who may be managing the system with a certain amount of indifference to the needs of individual users.

If one must consider stream depletion as the basis of a water right, what kind of law is best and what kind of organization is needed to enforce the laws? How are we going to properly integrate the different levels of water organizations to assure the most efficient use of water? These and other questions must be answered in the not too distant future. Attached is a preliminary statement of principles desirable for inclusion in state water rights laws recently developed under an Irrigation Division Committee of the American Society of Civil Engineers. This subject is currently being studied by several divisions of the Society as is being done by many organizations interested in water development. (Appendix B)

Appendix A

Preamble to a Proposed Adjudication
and
Sample Sheets Showing Proposed Awards of Water Rights

IN THE DISTRICT COURT OF THE FOURTH JUDICIAL DISTRICT IN AND FOR DUCHESNE COUNTY, STATE OF UTAH

IN THE MATTER OF THE GENERAL DETERMINATION OF ALL
THE RIGHTS TO THE USE OF WATER, BOTH SURFACE AND
UNDERGROUND, WITHIN THE DRAINAGE AREA OF THE
UINTAH BASIN IN UTAH

NOTICE TO ALL WATER USERS WITHIN THE ABOVE DESCRIBED DRAINAGE AREA:

Attached hereto is your copy of the Proposed Determination of Water Rights in Uintah Basin, Nine Mile Division as prepared by the State Engineer's Office in the above entitled cause. This Proposed Determination will be on file at all times with the Clerk of this Court in Duchesne, Utah and additional copies thereof may be obtained from the Office of the State Engineer of Utah in Salt Lake City, Utah upon payment of the actual cost of printing.

Pursuant to Section 73-4-11 U. C. A. 1953, you are hereby notified that any claimant dissatisfied with said Proposed Determination must file with the Clerk of the above entitled Court a written objection thereto duly verified on oath within ninety (90) days from and after the date of service of this Proposed Determination upon you. A copy of said Protest should also be filed with the State Engineer.

Dated this _____ day of _____, 19 _____.

A. Pratt Kesler
Attorney General

Dallin Jensen
Assistant Attorney General
Attorneys for State Engineer

Wayne D. Criddle

WAYNE D. CRIDDLE
STATE ENGINEER
State Capitol
Salt Lake City, Utah

IN THE DISTRICT COURT OF THE FOURTH JUDICIAL DISTRICT IN AND FOR DUCHESNE COUNTY
STATE OF UTAH

IN THE MATTER OF THE GENERAL
DETERMINATION OF ALL THE RIGHTS
TO THE USE OF WATER, BOTH SURFACE
AND UNDERGROUND, WITHIN THE
DRAINAGE AREA OF THE UINTAH BASIN
IN UTAH

PROPOSED DETERMINATION OF WATER
RIGHTS BY THE STATE ENGINEER
NINE MILE CREEK DIVISION

CODE NO. 47

Comes now, Wayne D. Criddle, as State Engineer of the State of Utah, and respectfully represents and shows unto this Honorable Court.

1. That the area comprising this general determination proceeding includes all of the water sources, both surface and underground, within the drainage area of the Green River and all its tributaries in Utah below the confluence of Pot Creek and above the confluence of the Green River with the Colorado River, but excluding therefrom the drainage area of the San Rafael River and the Price River.

2. That on the 20th day of March, 1956, after petition filed by the State Engineer of Utah in this cause and in the case of Huber v. Deep Creek Irrigation Company, Civil No. 3067, now pending before this Court in Uintah County, an Order was made and entered by this Honorable Court directing that a general determination of water rights be made by the State Engineer of Utah and submitted herein.

3. That the State Engineer has followed the provisions and requirements of Chapter 4 of Title 73 Utah Code Annotated, 1953, and has given and published the notices therein required, and has caused summons to be issued and served and has secured the filing of claim by the users of water in said area and the filing of disclaimers by property owners whose only use is through irrigation of water companies or municipalities, that the State Engineer has examined decrees relating to water rights in Uintah, Carbon, Emery, and Duchesne Counties, and has searched the files of his office and the office of the County Recorder in said counties, to the end that no right to the use of water within said drainage area shall have escaped his attention, that he has given careful consideration to the claims of the water users as filed herein, completed his hydrographic surveys as to the Nine Mile Creek vicinity and its tributaries and now certifies to the Court the completion of said surveys as to that source, and the State Engineer is now prepared and does herewith submit to this Honorable Court his proposed determination of all rights to the use of water, both surface and underground within the drainage area of the Nine Mile Creek vicinity and all its tributaries, a water source within the above-entitled proceeding. This area will be known on the

records of the State Engineer's Office as Code No. 47. In recommending this proposed determination of water rights, the State Engineer has adhered to the principles of water appropriation as set forth in the Constitution and Statutes of the State of Utah and as propounded by the decisions of the Supreme Court of the State of Utah, by which constitution, statutes and decisions, it is declared that beneficial use shall be the basis, the measure and the limit of the right to the use of water.

4. That diligence rights from surface water sources are those which were initiated by beneficial use prior to 1903 and were obtained and established in accord with the intent of the appropriator and the laws of the State of Utah then existent; that diligence rights from underground water sources are those which were initiated and fully attained by beneficial use prior to March 22, 1935. Other rights to the use of water, either pending or perfected, must have been initiated by an application filed in the office of the State Engineer. Perfected rights are represented by a certificate of appropriation issued by the State Engineer and details of such rights are included in this proposed determination for confirmation by the Court. Pending applications are simply permits to put the water to beneficial use within a specified time or an extension thereof. In several special instances, the water user has claimed and has substantiated a right based upon an adverse use and the details of such right are also included herein for confirmation by the Court. In preparing the details of the right as listed in this proposed determination, it has been the rule to consider a flow of water as being only a rate of withdrawal from the underground supply and/or surface source, the real appropriation is the quantity or volume of water actually withdrawn or diverted in acre feet during a calendar year.

5. In the instance of irrigation, the diversion requirements have been considered to be 4 acre feet per acre per calendar year, regardless of the source of supply. The irrigated land lies generally between 5,000 feet and 7,000 feet elevation. Annual rainfall is about 10 inches of which nearly 4 inches comes during the frost-free period of about June through September. Consumptive use or evapotranspiration from the land and hay crops is considered to be a total of 2.0 acre feet per acre per growing season of which precipitation normally furnishes 0.35

acre feet per acre, giving a net consumptive requirement of 1.65 acre feet per acre. The balance of 2.35 acre feet per acre reflects both application and conveyance losses that, under present physical and economical conditions may be liberal but are not considered unreasonable for this area with limited storage. This allowance will vary depending upon economics and the development of the area. It is recommended that the Court reserve the right to change, at some future date, this liberal allowance in the interest of full development of the area.

6. In determining the amount required for stockwatering purposes, a water allowance has been made of 5 gallons per day for each sheep, goat, horse or swine, 25 gallons per day for each cow or horse, and .75 gallons per day for each chicken or turkey. For domestic or household use, a water allowance of 650 gallons per day for each family has been made. Wherever an award has been made for winter stockwatering on other than a natural source, a return of any unconsumed water to the natural source is both contemplated and required.

7. This proposed determination is intended to cover all existing rights and pending applications initiated in the office of the State Engineer, all within the area described. The rights listed herein, which are founded upon contemplated appropriations of water by subsisting applications filed in the office of the State Engineer, are subject to inclusion in a final decree conditional upon compliance with the terms of the application upon which the respective contemplated appropriations are based and upon compliance with the provision of the laws of the State of Utah relating thereto. At the end of the periods as hereinafter mentioned, the status of said applications shall be reported by the State Engineer to the Court for inclusion in such supplemental report and decree as the Court may deem proper.

8. The period of use for irrigation of April 1 to October 31, allows at least one month

in advance and one month following the average frost-free period of each year, but the State Engineer, or his duly appointed water commissioner, should be entitled to vary this period of use when necessary to insure the most beneficial use of water; but this variance shall not establish any right as against storage, or other beneficial uses, either present or future.

9. The State Engineer, or his duly appointed water commissioner, may authorize temporary changes when conditions merit such changes without notice or upon such notice and upon such conditions as the State Engineer shall determine.

10. Such headgates, diversion and measuring devices, must be installed as deemed necessary by the State Engineer and such maintenance of the natural channel and diversion canals should be effected as directed by the State Engineer.

11. It is recommended that the rights to the use of water within the area included in this proposed determination be decreed to the various parties substantially as set forth herein. It is further recommended that the Court require that the State Engineer, at periodic intervals of not less than five years, make his report to the Court of adjustments, corrections of names of owners and of their addresses, action taken on pending applications, and such other matters as time may indicate to the Court to be just and proper for inclusion in a supplemental order or decree.

12. In all matters whatsoever pertaining to this proposed determination of water rights, the services and assistance and advice of the office of the State Engineer are and shall remain available to the Court.

Dated March 1964


WAYNE D. CRIDDLE
State Engineer of Utah

**GREEN RIVER, DAGGETT, SUMMIT & UINTAH COUNTIES, PROPOSED DETERMINATION OF WATER RIGHTS
CARTER CREEK, GREEN RIVER & TRIBUTARIES**

CLAIM NO.	NAME & ADDRESS OF CLAIMANT	SOURCE & TYPE OF RIGHT INCLUDING WELL NUMBER, DEPTH & DIAMETER	TIE: POINT OF DIVERSION	YEARLY PERIOD OF USE	PURPOSE & PRIORITY
2931	United States of America Forest Service, Ogden, Utah	South Browne Lake Spring, Application No. 29079 - Election Filed	S. 25°39'W. 2853 ft. from E $\frac{1}{4}$ cor. Sec. 31, T3N, R19E, SLB&M.	May 1 to Nov. 30, both incl.	Domestic April 19, 1957
3016	United States of America Forest Service Ogden, Utah	North Browne Lake Spring, Diligence	Stock water directly on spring located S. 26°24'W. 2733 ft. from E $\frac{1}{4}$ cor. Sec. 31, T2N, R19E, SLB&M.	July 1 to Aug. 31, both incl.	Stockwatering 1900
3015	United States of America Forest Service Ogden, Utah	South Browne Lake Spring, Diligence	Stock water directly on spring located S. 25°39'W. 2853 ft. from E $\frac{1}{4}$ cor. Sec. 31, T3N, R19E, SLB&M.	July 1 to Aug. 31, both incl.	Stockwatering 1900
2941	State of Utah, Fish & Game Department 1596 West North Temple Salt Lake City, Utah	Beaver Creek, Application No. 27700, Certificate of Appropriation No. 5655	S. 230 ft. E. 1900 ft. from W $\frac{1}{4}$ cor. Sec. 32, T3N, R19E, SLB&M.	Jan. 1 to Dec. 31, both incl.	Fish Culture Nov. 29, 1955
2971	Steinaker, Elbert Mamila, Utah	Well, Application No. 31461 Election Filed	N. 1970 ft. E. 550 ft. from SW cor. Sec. 18, T3N, R19E, SLB&M.	Jan. 1 to Dec. 31, both incl. April 15 to Oct. 15, both incl.	Domestic Oct. 14, 1959 Irrigation Oct. 14, 1959
2412	State of Utah State Land Board State Capitol Building Salt Lake City, Utah	Green River, Diligence	Stock water directly on stream from point where stream enters NE $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 2, T2N, R20E, SLB&M, to point where stream leaves SW $\frac{1}{4}$ SE $\frac{1}{4}$ Sec. 2, T2N, R20E, SLB&M.	Jan. 1 to Dec. 31, both incl.	Stockwatering 1870
2251	United States of America Forest Service Ogden, Utah	Hideout Spring, Diligence	N. 1900 ft. E. 2080 ft. from SW cor. Sec. 13, T2N, R20E, SLB&M.	July 1 to Sept. 10, both incl.	Stockwatering 1892
2793	United States of America Forest Service Ogden, Utah	Sink Spring, Diligence	S. 50°19'W. 3071 ft. from NE cor. Sec. 36, T1N, R21E, SLB&M.	March 1 to Dec. 31, both incl.	Domestic 1900
2513	United States of America Forest Service Ogden, Utah	Green River, Diligence	Stock water directly on stream from point where stream enters Lot 1, Sec. 31, T3N, R21E, SLB&M, to point where stream leaves Lot 1, Sec. 31; T3N, R21E, SLB&M.	Jan. 1 to Dec. 31, both incl.	Stockwatering 1878

**GREEN RIVER, DAGGET, SUMMIT & UTAH COUNTIES, PROPOSED DETERMINATION OF WATER RIGHTS
CARTER CREEK, GREEN RIVER & TRIBUTARIES**

EXTENT & PLACE OF USE	FLOW S. F.	DIVERSION PER ACRE AC. FEET	YEARLY DIVERSION AC. FEET	SUPPLEMENTAL TO CLAIM NO.	REMARKS	CLAIM NO.
DOMESTIC: 200 campers and fishermen	0.045		14.60			2931
STOCKWATERING: 2000 sheep, 5 horses - Beaver Creek, Carter Creek Allotment SEE SUPPLEMENTAL CLAIM NUMBERS	0.20			70, 161, 470, 471, 490, 491, 492, 493, 494, 495, 496, 497, 1470, 1474, 1513, 1514, 1515, 1520, 1525, 1823, 1950, 2224, 2226, 2227, 2233, 2239, 2241, 2242, 2244, 2243, 2245, 2246, 2358, 2384, 2385, 2386, 2387, 2729, 2724, 2725, 2730, 2731, 2727, 2726, 2728, 3015		3016
STOCKWATERING: 2000 sheep, 5 horses - Beaver Creek, Carter Creek Allotment SEE SUPPLEMENTAL CLAIM NUMBERS	0.50			70, 161, 470, 471, 490, 491, 492, 493, 494, 495, 496, 497, 1470, 1474, 1513, 1514, 1515, 1520, 1525, 1823, 1950, 2224, 2226, 2227, 2233, 2239, 2241, 2242, 2244, 2243, 2245, 2246, 2358, 2384, 2385, 2386, 2387, 2729, 2724, 2725, 2730, 2731, 2727, 2726, 2728, 3015		3015
FISH CULTURE: 157,757 Lahontan Cutthroat Trout	5.0 See Remarks				Storage in Browne Lake Reservoir located in the SE $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 31, T2N, R19E, SLBGM, SE $\frac{1}{4}$ NW $\frac{1}{4}$, SW $\frac{1}{4}$ NW $\frac{1}{4}$, NW $\frac{1}{4}$ SW $\frac{1}{4}$, NE $\frac{1}{4}$ SW $\frac{1}{4}$ Sec. 32, T2N, R19E, SLBGM, with a maximum capacity of 494,500 ac. ft.	2941
DOMESTIC: 1 family	0.10		0.730			2971
IRRIGATION: 0.50 ac. NW $\frac{1}{4}$ NW $\frac{1}{4}$ Sec. 19, T3N, R19E, SLBGM. SEE SUPPLEMENTAL CLAIM NUMBER	See Remarks	3.0	See Remarks	1557	Flow for this purpose is part of flow for domestic. Diversion any, each, or all claims. Total yearly diversion under all claims mentioned 1.500 ac. ft.	
STOCKWATERING: 30 cattle, 150 sheep						2412
STOCKWATERING: 1200 sheep - Dowd Hole, Spring Creek Allotment SEE SUPPLEMENTAL CLAIM NUMBER	0.010			486, 487, 2011, 2247, 2248, 2249, 2272, 2373, 2374, 2375, 2377, 2378		2251
DOMESTIC: 20 families	0.027		14.600			2793
STOCKWATERING: 2500 sheep, 255 cattle - Green River Addition & Common Use Allotment SEE SUPPLEMENTAL CLAIM NUMBERS				191, 193, 195, 196, 197, 303, 312, 607, 608, 609, 610, 611, 878, 1224, 2020, 2037, 2038, 2039, 2043, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2510, 2670, 2673, 2700, 2699		2513

Appendix B

General Statement of Principles

To be Included in State Water Rights Laws

(Proposed by the Technical Committee on
Water Rights Laws, Irrigation and Drainage
Division, American Society of Civil Engineers)

Policy--States that have not done so should be encouraged to declare water use policy.

Policy ought to:

1. Declare all water in its natural environment to be public wealth and a natural resource.
2. Establish the right, interest, and responsibility of the state in controlling development and use of water resources.
3. Recognize the need to provide adequate protection of private and public investments in water-use facilities.
4. Encourage the conservation and wise use of water.
5. Encourage the collection of basic hydrologic data.

1. Vested Rights. Since the eastern states now generally operate under the Common Law of Water Rights, it will be necessary to recognize existing beneficial uses as vested rights. Provision should be made for those people claiming vested rights to offer proof of such right within reasonable time after the passage of the Act, after which time existing uses would be expected to go through the usual procedure to secure right (application, permit, license, whatever). These established rights would then have priority in time with other rights.

Because among vested rights there is neither priority in use nor time, there will be instances where the natural flow of a stream is not sufficient to fill all vested rights. This will normally lead to lawsuits to establish priority in right. The law ought to provide that in case of such actions, all people claiming an interest in the use of water from

the same source would be served and given an opportunity to appear and present their claim. The interrelation between surface water and ground water should be recognized where relevant. Further, provision should be made for a state agency to prepare findings for the courts' consideration. The court then should decide both the amount of appropriation and the relative priority between users.

2. Fundamental Principles of Priority. The principle of "first in time is first in right" should be followed in all circumstances where the water supply is not sufficient to meet the demand for water. Priority of an appropriate right is the superiority of the right over all later appropriative rights that attach to the same source of supply. Priority should determine the question of whether the holder of a particular right is entitled to divert water when the supply is not sufficient to meet the total entitlement of all rights.

The date of priority of an appropriative right should be the time that an acceptable application therefor is filed in the office of the state official who is charged with the responsibility for administration of water, provided that all of the subsequent requirements relating to the acquisition of the right are complied with. Reasonable diligence in proceeding with construction of the necessary facilities and application of water to the proposed beneficial use should be required. Failure to proceed within a reasonable time after filing an application should result in cancellation of the application and loss of the date of priority.

3. Water Filings. Other than vested rights, a water right should be obtained only by application to the appropriate state administrator (or office. A water right should not be obtained by prescription.

4. Appropriation Should be Limited to a Specific Quantity. The public interest demands that certain limitations be placed on the amount, place,

time, and nature of use of water which may be used in the exercise of a right to the use of water. Reasonable beneficial use should be the basis, the measure, and the limit of all appropriations. The quantity of water required to fulfill the needs of reasonable beneficial use will vary from one area to another, and any limits set forth in the law should provide sufficient flexibility to set different standards where variations are indicated in different areas.

5. Regulations for Filing. No right to the use of water should be acquired unless the statutory procedure set out therefor is followed. Full compliance with all requirements must be accomplished. No right to the use of water should be acquired through adverse use, or possession, or by estoppel.

In order to acquire a right to the use of water, the first step required is the filing of an application in the office of the appropriate state office. This application should set forth

- (a) The name and mailing address of the applicant.
- (b) Source of supply.
- (c) Proposed point of diversion, defined in such a way that it may be readily located, either on the ground or on a map of the area.
- (d) The means of storage, diversion, and conveyance of the water.
- (e) Quantity of water involved, both on a flow-rate basis and the total quantity per season.
- (f) Period of the year during which the proposed use will be made.
- (g) Purpose of the proposed use.
- (h) The proposed place of use defined accurately by legal land description. To illustrate, for irrigation uses the acreage to be irrigated should be stated, and for municipal uses the population to be served should be stated.

- (i) Length of time required to complete construction of the necessary facilities, and to apply the water to the use proposed.

The application may be accompanied by a map or maps showing in detail all of the pertinent information relative to the application. Applications for speculative purposes should not be allowed. Any application which is not in the best interests of the public should be rejected.

The maximum period of time should be specified during which any application could remain in good standing without some action having been taken by the proper authority to either approve or reject it. Any requirement for payment of fees in connection with the acquisition of water rights should be left to the discretion of the state.

6. Commencement and Completion of Work. The permit should set forth the time limits within which the proposed work involved must be completed. Substantial construction should be initiated within a reasonable time from the date of approval of the application, and should be completed within a reasonable time, which would depend on the size and complexity of the proposed project. The applicant should submit validated evidence of completion of the proposed work. Requirements involving time should provide authority for extension of such time limits upon proper showing by the applicant. In the event an extension of any time limit is requested, this should be submitted in writing prior to the expiration of the time period involved and should state in full the work accomplished to date and the reasons why such extension is needed. All time periods should start with the date of approval of the application.

7. Proof of Beneficial Use. Time limits should also be stated in the permit within which the proposed beneficial use of the water must be accomplished. On small projects, the total time required for completion of construction and application of water to the proposed use might be only one year. Larger projects might require longer periods of time. Authority to grant

extensions beyond the periods provided for in the permit should be granted to the State Engineer or other administrative authority. A maximum period of time beyond which extensions could not be granted should be stated. A map or maps prepared and certified by a qualified land surveyor or engineer should accompany proof of beneficial use.

8. Adjudication. Rights may be adjudicated either by the Court, as in Idaho, or by a Commission as in Wyoming. Provision should be made for surveys to determine current water uses. At the time of an adjudication each person claiming a right to use water should be served with a legal notice in ample time for him to be present at any hearing. This will include those people claiming vested rights. If a person, who has been duly notified, does not appear and present his claim, he would be judged to have no right. The Court or Commission, after hearing all claims, would determine both priority and amount of the right. Of course, provision should be made for appeal to the appropriate Court.

9. Abandonment and Statutory Forfeiture. When the holder of a water right fails to use beneficially all or part of his right for a specified period of time, except in case of water for storage reservoirs, such unused water right is lost. However, forfeiture shall not necessarily occur if circumstances beyond the control of the owner have caused non-use, such that the water could not be placed to beneficial use by diligent efforts of the owner. In humid areas forfeiture shall not necessarily occur due to nonuse of water when the use of such water is not required for the purpose in the permit.

10. Administration. The responsibility for administration of all water rights within a state, and the control over distribution of water, should be vested in the State Engineer or other appropriate official who is chief

of the state water administrative organization. Provision should be made for the establishment of water administrative areas as needed.

The use of water under all rights should be limited to that amount provided for by statute, whether it be a specific rate of application or only a beneficial use limitation. It should be the water administrator's responsibility to enforce this limitation and to regulate all water uses according to priority as needed.

Records of the rate and total quantity of each diversion of water should be kept by the water administrator and submitted periodically to the State Engineer or appropriate official. Storage water should be administered in such a fashion that it is made available to those who are entitled to its use, with a reasonable reduction in quantity being made to provide for transportation losses.

Authority to require the installation of adequate structures for the control and measurement of water diverted should be vested in the state water administrator, or his assistants or deputies.

Provision should be made for the regulation of groundwater use in conjunction with surface water use, with priority of right being the controlling factor where the two are interrelated and have an effect on one another.

Provision should be made for any person who feels that he has been injured or discriminated against by the act of a water administrative official, or by the latter's failure to act, to appeal to the proper official, following through the various levels of authority up to and including the state water administrator, and thence to the courts.

11. Eminent Domain. Duly constituted governmental bodies should have the right of eminent domain. Generally, private appropriators should have recourse to a "way of necessity" to secure relief in acquiring rights-of-way for canals and laterals, and for dams and reservoirs, and whatever other works are required to perfect an appropriation.

12. Change in Point of Diversion, Place, or Purpose of Use. The law should provide that the diversion point, place, or purpose of use may be changed by application to the proper administrative agency so long as it is not detrimental to the rights of other appropriators. All declarations of intent to change point of diversion, place, or purpose of use should be published. In the event of protest, a time and place should be set for hearing by the appropriate official or commission. A certificate or permit authorizing the change should be given to the appropriator and appropriate entries made in the official records.

13. Developed Water. Water developed by constructed works are subject to beneficial use by the owner or developer under permit. When such waters are deposited in a natural water course beyond the domain of the developer and have not been applied to beneficial use in a specified period, the water is subject to appropriation and use; but the appropriator can acquire no right as against the creator of the flow to require him to continue supplying such waters to the stream.

14. Ground water. The appropriation of groundwater should follow the same general principles as surface water. The interrelation of groundwater to surface water should be established by a competent agency, and this interrelationship recognized, where germane, by the state. The state commission or administrative agency should be given the power to determine the rate at which water may be withdrawn from each aquifer. This normally would be equal to the rate of recharge to the aquifer. The rate of recharge should be established by a competent technical agency.

It may be desirable to have a somewhat different set of principles for appropriation of mined groundwater. In groundwater mining situations, where recharge is insignificant, rights should be granted for a period of time sufficient to amortize investment. In

granting new rights a hydrologic study is necessary to prevent such rights from shortening the life of existing rights to a period shorter than the calculated amortization time.

The state should require drill logs to be filed by a qualified driller with the appropriate agency.

15. Drainage Water. The law should establish the responsibility for handling drainage water, and provide for joint responsibility of contributing landowners. Individuals should be given the right to dispose of drainage water by obtaining a "way of necessity" when required.

16. Quality of Water. Quality standards based on economic considerations and the public welfare should be developed by the state for each stream, or reach-of-stream. The law should recognize that water is a renewable natural resource that should work for the benefit of the public. The concept that water should be beneficially used both quantity-wise and quality-wise to the maximum extent possible, consistent with the public welfare, is recommended.

17. Safety of Structures. Applications for a permit for the construction or alteration of dams should be made to an appropriate state agency. All applications should be accompanied by plans and specifications prepared by a qualified engineer. State approval should be required prior to construction. Exemption from such requirement may be made for minor structures.

Provision should be made for official inspection of dams and structures during and after construction at such times as the administrative agency considers advisable, and for the periodic inspection of constructed dams when there is a doubt regarding their stability.

States should be encouraged to adopt dam standards on a regional basis in conformity with hydrologic and other requisites. The administrative agency should be encouraged to adopt and publish rules and regulations relating to dams and other structures that may come within its jurisdiction.

18. Interstate Water Resources. Planning for and development of interstate water resources should be governed by interstate compacts as the most effective, economical, and equitable means of resolving problems of water allocation among the states concerned. Compacts are generally preferable to judicial procedures for the resolution of controversies over interstate waters because they can provide the flexibility necessary to meet changing physical and economic conditions in the areas involved. This flexibility is not usually provided in court decrees.