ECONOMIC, POLITICAL, AND LEGAL ASPECTS OF COLORADO WATER LAW

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PREFACE

This report is a synthesis of materials, information, research results and conclusions emanating from the project and discussed in detail in various publications noted in Appendix I. The authors wish to express their appreciation and gratitude to the graduate assistants - David Allardice (Economics), Peter Ashton (Economics), William Miller (Civil Engineering), Reed W. Willis (Economics), Legal Research Assistant Craig Kirkwood, and Sharon Allen, Economics secretary, for their valuable roles in research and documents preparation. Sincere thanks is extended to the water officials, decision-makers, water users and all others conferred with and interviewed for their information and cooperation. Any interdisciplinary approach analyzing one of the country's most complex state water law systems requires the concerted effort of researchers and those directly and indirectly involved with the system, its operation and design. The assistance provided by the latter is beyond reproach.

ABSTRACT

ECONOMIC, POLITICAL, AND LEGAL ASPECTS

OF COLORADO WATER LAW

Water to Colorado is like oil to Iran; the economy of the state relies heavily upon direct and indirect benefits resulting from the utilization for various purposes throughout the state. But, unlike oil, water can be used and reused from the place where it falls until it leaves the jurisdiction of Colorado. Early settlers in the state partially conceived and fully accepted the doctrine of prior appropriation to direct the use of this resource, an action that has determined the destiny of water allocation and distribution up to the present time.

The history of Colorado water law is interesting and important to understanding where we are today, how we got to this stage of development, and what we must cope with in the future. This solidified, institutionalized system of water law provides the basis of solving future water problems and likewise presents the constraints under which water users, administrators and planners must operate.

This project traces the evolution of water law and related organizations, focusing upon changes that have occurred and the effects upon various water user groups. Specific emphasis was placed upon a determination of the use of technology in the legal process and upon identifying the sources and nature of political constraints that operate to restrict and/or facilitate changes in Colorado water law.

It is a general conclusion that, (1) Colorado depends upon its water supply for future prosperity, (2) the water law system taken in the aggregate provides an excellent basis for future water planning, (3) the state must shift from a "use orientation" to a "management orientation" treatment of its waters, (4) technology can and must play a more important role in future litigation and legislative formulation, and (5) the greatest constraints to changing Colorado water law lie with the people themselves.

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KEYWORDS -- water law/ water administration/ technology/ social impacts/ water users/ institutions/ political constraints/ attitudes/ recreation/ economic value/ economic impacts.

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Objectives

The primary general objective of this study is to develop a better understanding of the legal components of the water management system in the State of Colorado through an inter-disciplinary research effort. The study analyzes the interaction of legal, economic, political, and technological factors in the evolution of basic legal structures, institutions, and doctrines that are relevant to the system for water management in the state. The specific objectives of the project are:

(1) The development of an inter-disciplinary approach to the understanding of Colorado water law. The approach makes use of the expertise provided by the disciplines of law, civil engineering, economics, and political science. The goal is to integrate the skills and perspectives of these disciplines into a schema for the evaluation of the present status of and future prospects for water law in Colorado.

(2) The description and analysis of the evolution of legal structures and doctrines through legislation and judicial decisions that shape the water management system of the state. The present status of Colorado water law is described and evaluated.

(3) The analysis of the significance of technological inputs into water law decision-making in Colorado. The means available to introduce technological expertise into decision-making are identified and the historical uses of technological data in water law decisions in Colorado are described and evaluated. Proposals are developed to increase the quality of the technological data that are available to decision-makers within the water management system of the state.

(4) The analysis of selected political factors that influence water law decision-making in the state. The identification of major sources of support and opposition to changes in the basic water law doctrines, institutions, and structures that are operative in the state. The political feasibility of selected proposals for changes in the system of water law in Colorado is evaluated.

(5) The evaluation of the economic impact of selected features of Colorado water law and the development of proposals for doctrinal and institutional changes that would increase the realization of economic benefits from the water management system.

(6) The evaluation of the inter-relationships between legal, economic, technological, and political factors in the evolution of Colorado water law.

(7) Making current and relevant statutory, compact, treaty and case water laws, interpretations, and research findings available to larger numbers of decision-makers within the water management system of the state.

CHAPTER I

Introduction to Water Law Research Needs

Water has been a key element in man's activity from the beginning of time to the present day. It is essential for the very existence of man: his source of food, employment, and pleasures of life. The major civilizations of the world have developed around natural valleys and areas supplied with water. There is an intimate relationship between the economic and social development of a society and the availability and reliability of a water supply.

A second distinguishable factor is obvious upon examination of civilizations or social systems flourishing near natural water sources. There developed some degree of control over the use of these waters. Although some of the regulations and institutions were political by design and enforcement, most early methods of control were espoused through the religion of the region. The basic concepts of the American water law systems can be found in the Christian, Hindu and Islamic holy books. Water was treated with both respect and fear, and consequently, all who were exposed to the religious teaching developed an inalienable understanding of the relationship of man to this resource.

It is interesting to note upon examination of the various legal systems designed to control water, that these systems fall within two general categories depending upon the geo-climatic conditions of their area of origin. Where water is abundant, water regulations are directed toward controlling the harmful effects visited upon the lands and communities. These laws generally refer to government responsibility in

protecting the public interest. Conversely, in arid regions, systems of water allocation and regulation create private rights in the use of water. The codes have become detailed and complex, and possession of water rights is as important as land ownership.

In early American history, water, like air and open space, was considered a common or free good. Initially, as in every developing civilization, there was unrestricted use due to the minimal demands on existing supplies. Those using the water rarely interfered with each other, and when conflicts occurred, the latitude for resolution was wide. The system was able to assimilate the demands upon it. As growth continued, however, the assimilative capacity became taxed beyond its natural limits, and the society began to respond accordingly. In the humid parts of the east and west coasts, concern was expressed over the use of water in its natural channel. Rainfall was sufficient to permit agriculture to develop independently of channels, ditches and reservoirs. Therefore, navigability and flood control were the key issues to solve through the law.

The arid and semi-arid west, however, was concerned with a different problem (Figure I). In the mid-1800s, the common good or res communes was no longer able to meet the demands placed upon it. Many conflicts among water users began to occur. Water had now become a scarce and valuable resource. The economic base generated by the miners and early farmers relied upon this commodity.

Man, by nature, is a greedy animal. He will take what he can, whether he needs that amount or not. No place is this more evident than with the use of water. Because of this characteristic, it became apparent to

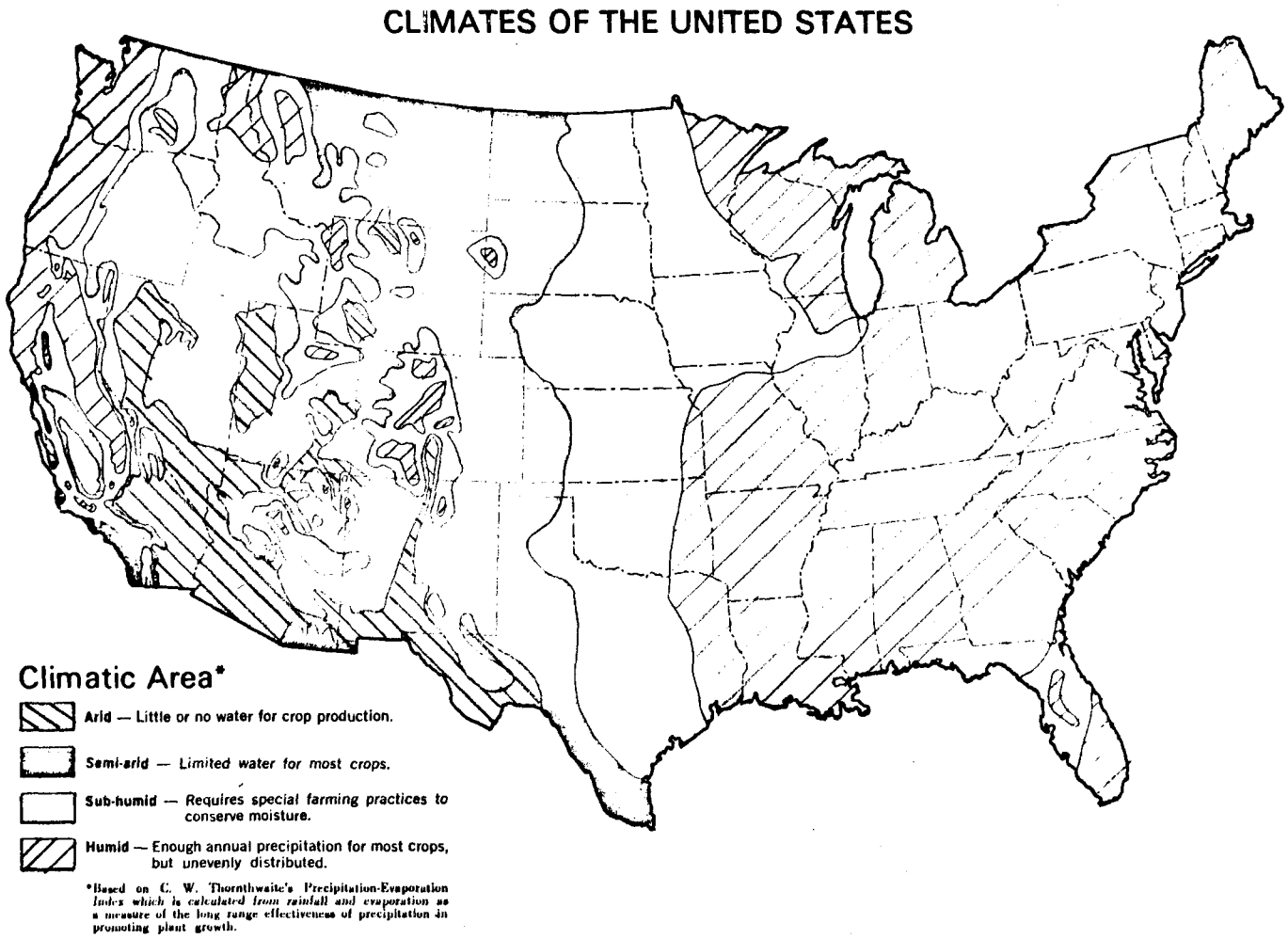

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FIGURE Four climatic areas in the United States: arid, semi-arid, sub-humid and humid.

Source: Planning An Irrigation System AAVIM, Jult,1971

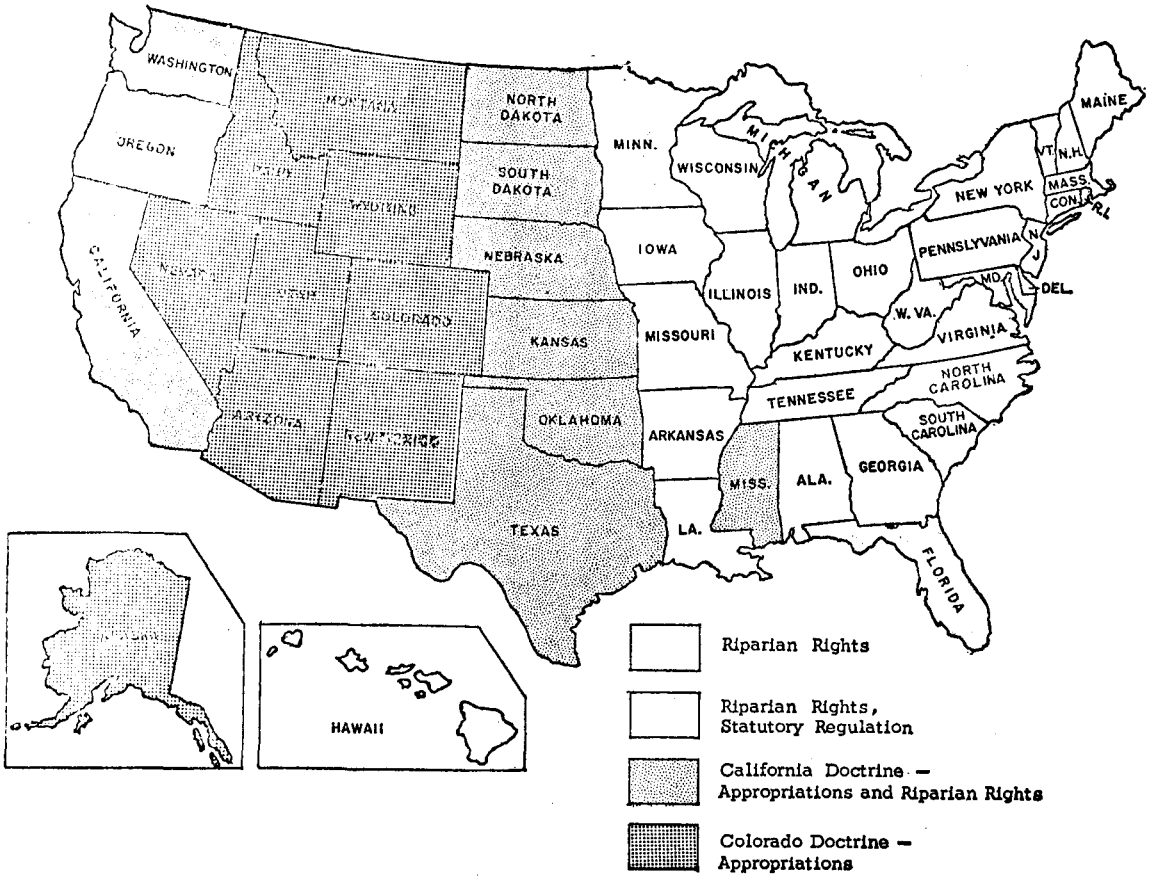
FIGURE 1

western water users of the 1800s that effective rules and regulations must be developed to control the allocation and distribution of water. At this point in time, there was a willingness to internalize the cost of the externalities created through use of this common resource. It is interesting to note that within the institutionalized concept of publicii juris (water is the property of the state, held by it in trust for the people), there was a transformation from the res communes (the common property of all) to the res privatae (the property of the individual) with respect to using water for specific purposes, i.e. agricultural, domestic and industrial uses.

Initially, basic rules for allocation and distribution of water were developed in the arid and semi-arid lands; a property right in the use of water was recognized; and prior users were granted a superior status in the continued use of water over later users. As the country progressed, additional water law provisions were enacted or case laws decided and an administrative system created at the state level.

The legal system devised is commonly called the "Prior Appropriation Doctrine." This conglomeration of customary law, common sense, and legal influence was strictly designed to meet the needs of the water users of that day. It is quantity and use oriented. By contrast, the humid states turned to the "Riparian Doctrine," which allows limited use on lands contiguous to the streams and provides both quantity and quality regulation over water (Figure 2).

The situation of a variation in laws from region to region and state to state was permitted under early federal land and mining acts, and reaffirmed by the courts. Three major pieces of legislation - (1) Section 9



SOURCE: WATER LAW:CASES AND MATERIALS, Trelease,F.J., West Pub. Co.,1967.

FIGURE 2

of The Act of 1866, commonly called The Water Rights Act of 1866, (2) Land Grant Act of 1870, and (3) The Desert Land Act of 1877, created water rights in users on federal lands who appropriated water according to the local customs and laws. Then in 1935, The U. S. Supreme Court in California Oregon Power Company v. Beaver Portland Cement Company[1] laid down the right of states to control the use of water right requisition on federal lands.[2] States had earlier asserted the right to control water on state lands and permitted customary practices to develop. The result of this fragmented and piecemeal development of water laws throughout the country led to the establishment of water laws on a state by state basis, oblivious to hydrological differences and legitimized to the political boundaries that exist. Although two major water law systems emerged, the differences between states having the same system are often times great.

The water laws' variations and conditions were not too serious during those early days of development, and only within the past decade has the problem risen to national consideration; local and state concern has been joined by regional and national issues. Previous research on western state water laws has concentrated primarily on agricultural uses and most often strictly on a legal analysis of a sector influenced. Today's needs require an understanding of how the laws take into account technological factors and innovations, how the political processes and

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[1] 295 U. S. 142 (1935).

[2] For a discussion of these three acts and the case, see: C. J. Meyers, Functional Analysis of Appropriation Law, National Water Commission Report No. NWC-L-71-006, NTIS # PB 202 611, National Technical Information Service, Springfield, Virginia 22151, July 1971.

legal entities are involved, and an assessment of the water law trends and deficiencies.

Colorado, situatedat the headwaters of five major rivers in the Western United States, presents an ideal state to study. Its influence upon neighboring basin states is a subject of increasing national concern. Solutions to water problems have become high on the state government's list of priorities.

CHAPTER II

Nature of the Water Problem in Colorado

Water has become the focal point of world attention. The FAO has recently published a report on global water supplies, identifying the world water supplies, current uses, and projected shortages through rising demands.[1] In the United States, the President's Water Resources Council published estimates of probable future water shortages and pointed to major problems in this regard in the Colorado River Basin and in the rapidly growing population centers on the eastern slope of the Rocky Mountains.[2] According to a report published by the National Academy of Sciences in 1968 concerning the water resources in the Colorado River Basin, it was determined that a major redistribution in water will have to occur soon. It was stated that "communication to the public and its representatives of knowledge of alternative opportunities for water management and use will result in more rational decisions."[3]

The Colorado State Legislature has also taken note and expressed grave concern in regard to the state's water problems. In Senate Bill 407, Section 1(C), it directed a review of "existing water laws of the State of Colorado to determine their sufficiency and the need for any modification or supplementation thereto in order to provide an effective system for

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[1] Water and the Environment, Irrigation and Drainage Paper # 8, Land and Water Development Division, FAO, Rome 1971.

[2] The Nations's Water Resources, United States Water Resources Council, Washington, D. C., 1968.

[3] Water and Choice in the Colorado River Basin, Publication # 1689, National Academy of Science, Washington, D. C., 1968.

administration, development, and control for water use in Colorado, and to achieve maximum utilization of water resources compatible with the requirements of the state constitution."

The situation at the world, national, regional, and state levels has been evaluated, and efforts are being made to develop long-range improvement plans; but the nature of the problem in Colorado partly stems from a solidified legal system. The laws have become ingrained institutions resistent to change through legislative enactment and subject to interpretive modification only by judicial proceedings.

Although the history of the appropriation doctrine begins in California, Colorado has the distinction of being the first state in the union to constitutionally adopt this concept. The major provisions of the "Colorado Doctrine" set forth in the constitution of 1876 still remain today (See Appendix II). Not only have the times changed significantly in terms of demands placed upon this resource, but also technology has advanced beyond the wisdom of the appropriation doctrine forefathers.

As a consequence, the water resource system in Colorado is being increasingly placed under extreme stress. The goal of providing adequate supplies of useable water to meet the rapidly growing domestic, industrial, and recreational needs within the state and maintaining adequate supplies to support traditional agricultural uses is becoming ever more difficult and costly to achieve. Projected patterns of population growth in the area indicate that the pressures upon the water resource system will continue to intensify. Means must be found to maximize the efficient utilization

of the limited water resources of the state if a water crisis is to be averted. The problem is one of a relatively fixed resource and increased demand for the resource. This state of affairs requires that the water management system be adapted to a changing and threatening environment if it is to effectively order the emerging structure of demands in a manner that results in the efficient allocation of the resource and the meeting of the basic needs of the society.

The present system for the allocation, distribution, and management of water resources is embedded in a complex and relatively rigid legal structure which was developed to deal with problems and conditions quite different from those that dominate the present system. The restrictive and sometimes archaic legal structure patterns the activities of the water management system in a manner that dramatically restricts the range of options that are available to those charged with water planning, management, and policy-making.

Changing environmental conditions require major shifts in the range of alternatives available to water decision makers. One pre-condition for added flexibility in the system is a more innovative approach to the development of legal structures and rules to guide the system. A more creative role must be assumed by both judicial and legislative bodies as they develop rules to govern the integration of the changed requirements of the system into the body of traditional water law of the state. These innovations must take into account the economic, technological, and political realities of the system. It is critical that any new approaches self-consciously take in the economic and technological impact of the alternative rules and doctrines that are designed, as well as their political feasibility. Otherwise, the changes in the legal system may result in destructive, unanticipated consequences that worsen rather than reduce the

problems within the water resource system of the state.

Discontentment among water users with the laws of the state has been strongly voiced within the past two decades. Prior to the 1950s, only minor modifications in statutory enactments have occurred. Shortly after World War II, however, the agricultural sector began tapping the sub-surface water supplies of the High Plains region. As the number of wells increased, effects of groundwater withdrawal became evident both upon prior well owners in closed basins and upon surface water right diverters in areas where the groundwater was tributary to surface flows. The law was not sufficient to properly handle the conflicts that began occurring throughout the eastern part of the state.

Groundwater users became aware of the incompleteness in the law during the past ten years. Although a new groundwater law had been enacted in 1965, the law was nebulous and failed to provide the certainty needed to guarantee an investment. This became particularly evident in 1969 and 1970 when the ultimate solution to the tributary groundwater crisis was installed by including all well owners pumping from waters tributary to the stream into the appropriation system. To strictly enforce this approach would mean virtually eliminating this economic sector of agriculture.

Other irrigators also found dissatisfaction with the law. Agriculture, traditionally provided with a senior position within the law, began realizing the inadequacies within the pure appropriation doctrine. Surface water right diverters became aware of previously unknown constraints as they attempted to increase their efficiency in the utilization of water. Under the Colorado Doctrine, a highly legalistic procedure had developed protecting the property rights of water users. But in order to maintain

this right, it has to be exercised. The result is either a conscious or an unconscious overuse of water during times when lesser amounts could have been applied, simply in order to protect the water right from loss through abandonment proceedings. There is also the problem of lengthy and costly judicial proceedings to transfer water rights from one place or use to another.

Deficiencies in the law also began to affect other water users. Fish and wildlife enthusiasts found that under the appropriation doctrine, virtually every drop of water in a stream can be diverted for an appropriated purpose regardless of the effect upon the fish and wildlife and habitat. Recreationists found that water cannot be appropriated as a beneficial use for this purpose either, and that they must rely upon the generosity of those appropriating water for other uses.

Because of the physical nature of water, its control and management depend fundamentally on knowledge of the resource, how it is used, changes in quality, and what happens to it as it moves through the hydrologic and structural systems of movement and storage. If the legal control of the resource is not based on sound engineering principles, then it may be concluded that the legal procedures will be circumvented by administrative processes to distribute and utilize the water in a practical, but not necessarily efficient or effective, way. Technology has advanced beyond the ability of the law to remain flexible enough to absorb and adopt new techniques. Water users and administrators have, consequently, been faced with a two headed coin.

Major legislative proposals and legal edicts have been formulated but often are ignored or circumvented by the water users, because they do

not include implementation procedures which are realistic in the economic, political, and hydrologic real world. The increasing water demands of urban areas and the countervailing ethic have led to considerable concern over water planning and management in Colorado that it truly serve the best interests of the state and not a few special interest groups.

In addition to the problems that have occurred within the state, many interstate and international problems are rapidly emerging as a result of the use or misuse of the water within our boundaries. For example, the salinity problem in the Colorado River Basin can be traced in part to irrigation practices in Colorado. In addition to surface water problems, the rapid withdrawal of groundwater in the High Plains area has caused an adverse effect upon the groundwater supplies in neighboring Kansas. Likewise, there is the problem of meeting compact commitments on interstate streams, and to what extent development in Colorado can be allowed to progress.

In conclusion, perhaps the most significant single problem of water control through laws is the lack of knowledge of the laws by the population in general and the attendent lack of communication on relevant changes or pronouncements. All too frequently, water users do not know their rights, duties, and liabilities under the law regarding the use of water.

It is encouraging, however, that the problems are being recognized by people capable and able to develop alternative solutions. Federal and state agencies are seeking recommendations and implementation plans, environmentalists have begun to integrate water into the total ecology picture, and recently, the Governor of Colorado has stated there exists the necessity of a thorough examination of the water and means of control picture in Colorado.

CHAPTER III

Project Concepts and Methodologies

Through the recognition that no single discipline can provide a realistic analysis of any situation or solution to any problem, the project investigators in the early stage of proposal drafting embraced the concept of an interdisciplinary at best, integrated at least, approach to analyzing various aspects of Colorado water laws and institutions. To bring together three social science disciplines and one physical discipline was a difficult task. It was discovered early in the project's life that as many differences exist among disciplines of the same general school as among schools. In addition, methodological approaches to analysis and problem solving existed.

During the initial stages of cooperative research, the decision was made to place primary emphasis upon achieving the objectives in a manner which required interdisciplinary cooperation, analysis, and broadening the perspectives of the investigator charged with contributions from his discipline.

Each investigator was assigned objectives for which he was primarily responsible. The team functioned interdisplinarily by providing the objective investigator with the necessary perspectives and assistance of the representative discipline.

The research investigators developed a general and specific methodological approach to achieve the established objectives. The general methodology created the interdisciplinary pattern of procedure. The specific methodology prescribed the individual investigator's program

of pursuit cognizant of his discipline's peculiarities.

General Methodology

(1) To jointly select the areas of analysis and establish the parameters of research.

(2) To assign responsibilities for specific objectives to individual researchers.

(3) Together as a unit to serve as discipline experts to each other as research progressed and provide interdisciplinary information for research design and analysis.

(4) To periodically exchange information and synthesize research achievements.

Specific Methodology

Engineering Approach

The broad objective of this part of the overall project was to make an analysis of the effects of interaction between Colorado water law and the technical, engineering , and economic elements as these have historically evolved.

This effort involved two phases, the first of which was the major effort, and involved investigation, assessment , and recommendations regarding the input of water resources technology into the Colorado judicial system.

The second, more limited study was an assessment of the attitudes of selected water managers in the Denver metropolitan area toward implementation of comprehensive water management including the relation of technology and water law, and a survey of water professionals on integrated urban water management.

The basic information source for the first phase was the court record of selected water cases in Colorado. While the assessment of the technological input to the cases was subjective, the nature of the technical questions raised and the quality of this technical information provided to the courts could be evaluated. The chronological review of the various kinds of water law cases permitted general conclusions regarding the response of the courts to advances in water science, engineering, and technology.

(1) Initially, it was desired to investigate how the courts responded to technological advances in water resources. For example, Kinney notes an early Colorado case in which the court refused to accept the results of a more refined discharge formula saying that "there would be no end to litigation, provided new and more accurate tests are discovered." Similarly, it was sought to trace the response of the courts to advances in groundwater pumping and irrigation use. However, the litigation process is too fortuitous and the caliber of the litigation so variable that it is not possible, except in broad terms, to discern an evolutionary development of the courts' use of technology.

(2) The findings in (1) required a shift in technique from searching through a large number of cases for particular types of technology to a more complete analysis of the technology in a selected number of water law cases--water quality, developed water, groundwater, and water transfers. By selecting cases over a wide time span, it was hoped to recognize some response of the courts to technological advances, and more importantly to assess the quality of the technology available to the courts.

The methodology of the second phase involved two surveys, conducted primarily under sponsorship of the National Water Commission, but with some support from this project. The first survey was conducted at the initial technical session of the annual conference of the American Water Works Association held in Denver, Colorado the week of June 14, 1971. Responses from about 150 registrants were obtained, representing a sample of about 15 to 25 percent of those attending the technical sessions.

The second survey was an interview of the majority of the water utility and public works managers in the Denver metropolitan region representing 22 major water utility related agencies. The interviews were conducted during the summer of 1971 and supplemented by mailed questionnaires to the same group on technology and water law.

Political Science Approach

The data in the political science component of the study were drawn from a set of survey instruments administered to three sets of actors within the water resource system of the area. They represent both producers and consumers of water policies for the state. The first data set was drawn from interviews with 31 persons charged with the planning responsibilities in local water distribution agencies. These respondents generally held management positions in their agencies. The respondents were selected by the use of a randomized sampling design in order that they would be representative of the local agency planners in the seven most populous counties in northeastern Colorado. The sampling design was constructed in a manner that assured that both irrigation and domestic agencies would be included and to include agencies of different sizes. The second data set was drawn from interviews with 118 "water influentials." These persons

were identified by local agency planners as persons whose judgment they respected in water matters in the area. These "influentials" are persons with whom the agency planners communicate--directly or indirectly-- in the course of their water planning activities. The third data set includes members of the 1971 Colorado General Assembly. Each member of that legislature was given a questionnaire dealing with a number of issues of Colorado water law and legislation to complete. A total of 56 useable questionnaires were returned and subjected to analysis.

The persons included in the samples stand in strategic positions in the water resource system. The attitudes and orientations of these actors operate as substantial constraints upon the political system as it relates to water resource policy making. The structure of attitudes present in these actors is a major source of direction to the configuration of water legislation that is likely to be enacted.

Legal/Economic Approach

To accomplish the task of describing and analyzing Colorado water law from an historical point of view and to accurately define the present status of the law required a methodology combining traditional legal research techniques as well as the more common social sciences procedures.

The legal study began with a literature review of materials on the subject of Colorado water law. A wide variety of sources was identified, ranging from the pure legal analysis to works of engineers, geologists, economists, etc. describing how the law affected or was affected by their particular discipline.

A cursory examination of these materials along with the Colorado Session Laws dating back to 1876 and the annotations of cases listed after the statutory sections in the various Revised Statutes provided benchmark identification points of significant changes in the law through legislative or judicial interpretation. In addition, the nature of the benchmark signified a specific area of concern in the use and control of water.

At this point, sub-research topics were established for detailed research. These topics focused on both spatial developments and key issues to provide a complete analysis of the law and its changes chronologically. A detailed outline was thereafter prepared, which would result in a complete narrative of Colorado Water law (Appendix III - publication is in press at date of completion report). The specific topics or periods of change were written up in several reports as the work was completed (Appendix I).

The legal research tools used included primary and secondary classified sources. In the former group, constitutional provisions, statutes, and cases were utilized. The secondary sources used included treatises, texts on water law, legal encyclopedias, law journal articles, and other identified information on the topic. Interviews and letters requesting information were used extensively to acquire specific insights into problem areas. These were held with or sent to key water decision makers in the state to include the State Engineer and members of his office, other concerned state agency officials, attorneys, legislators, judges , and water users.

To accurately establish the present status of legislated law and to partly achieve the seventh objective of information dissemination, a

compilation of water laws, compacts, treatises, and selected cases was prepared. Colorado Revised Statutes of 1963 are maintained in several volumes and subsequent legislation contained in yearly session laws. Many volumes and a multitude of sections therein must be examined to determine the present statutory law on a subject. Hence, error through oversight is quite likely. The compilation was designed to reduce the oversight factor and ease identification of specific provisions by combining all relevant water laws under the administration of the State Engineer into one volume (Appendix I). Work on this compilation was conducted with close cooperation from the office of the State Engineer. Publication costs of the volume were paid for by his office.

CHAPTER IV

Findings

Engineering Findings

The engineering segment of this study involved two separate phases. In phase I, a general survey was conducted of the available paths by which expert technological information could be provided to the judiciary, the means used in the state of Colorado identified, and the actual use of technological data in a sample of cases evaluated. Phase II of the project involved the identification of the attitudes of selected water professionals with a number of issues involving the inter-relationships among technological information, problems, water law, and patterns of water resource management.

The analysis in phase I indicated that there are a limited number of ways water resources technology can enter the courts. Although there is considerable overlap among these, for the sake of analysis they were separated into the following:

(a) Expert Testimony
(b) Judicial Notice
(c) Special Jury
(d) Specialized Courts
(e) Court Appointed Master
(f) Administrative Hearing

Expert testimony is by far the most common method by which the courts obtain their technical input. In the water cases analyzed, judicial notice was used only in rare cases and then very conservatively. The special jury has never been used in Colorado water cases; in fact, almost all water cases are tried without a jury. Recent legislation has established specialized courts to handle water litigation, and these "water courts" are

empowered to employ referees to make preliminary determinations. However, the referees do not necessarily bring technical expertise to the courts.

In the areas of non-tributary groundwater and water quality, the state has established administrative tribunals to hold initial hearings, with the contestant later having the right to judicial review. Neither the Colorado Groundwater Commission nor the Colorado Water Pollution Control Commission members are required to have any technical training or expertise. These commissions have not been in existence long enough to provide the necessary number of Supreme Court cases to evaluate their usefulness to the courts as inputs of water resources technology. A preliminary conclusion is that some of the more obvious misinformation is recognized and corrected during the administrative hearings, but that no comprehensive changes in the overall technology can be expected.

The trial courts are presented with a wide variety of technical and practical test results in areas of water resources where it is unrealistic to expect the court to judge the accuracy, reliability, and significance of the results. While the engineering professions have devoted much time and effort to the development of standardized tests, the court may still be presented with and use the results of some "original" test devised by an ingenious layman.

The technical problems placed before the courts in water resources litigation are generally identifiable and amenable to a straightforward scientific analysis. The analysis of such problems is sufficiently complex to require the insight of a qualified investigator.

Sometimes the questions before the courts do not lend themselves to a quantitative analysis, and the expert witness must perform in his unique

role of giving basically unsubstantiated opinions. In order to arrive at the "true estimate," the court often uses unrealistic averaging of all the estimates. This not only can lead to some poor decisions, but it gives an advantage to the litigant who parades the most witnesses before the court.

The procedure of using expert witnesses retained by the individual litigants has developed a skepticism of technology among some trial judges. Thus, it is possible to find cases where the court may totally disregard the unrefuted opinion of a well qualified expert witness.

The irregular application of judicial enforcement in water quality cases demonstrates the need for a strong administrative state agency for the surveillance, policing, and preventive activities necessary for effective water quality control.

The technical problems which come before the courts in water resources litigation are sufficiently complex and variable to require a higher level of expertise for their resolution than that which is now utilized.

The technical input to the judicial decision maker is often much more fragmented, disorganized, and unreliable than the information available to an engineer decision maker faced with a comparable but nonjudicial determination.

The courts have a definite need for an unbiased, professional appraisal of the facts in many water resources cases. The use of a panel of experts appointed by the court as set forth by the Commissioners on Uniform State Laws in their model Expert Testimony Act would be of great help to the trial judge in placing the best available technology before him.

The analysis of the survey results in phase II leads to several important conclusions. These are:

1. Water managers and water utility professionals favor both the combining of water and sewer utilities and a total water management system in metropolitan areas.

2. Hindrances to integrated urban water management are recognized. Within the water management structure itself, middle managers are seen as an important hindrance. Likewise, the managing boards, city councils, and similar bodies are seen as major obstacles to comprehensive water management. Water utility customers and the public in general are not viewed as such hindrances.

3. Water professionals do not, in general, endorse citizen participation in policy formulation and planning. Most water managers prefer citizens in advisory rather than decision-making roles.

The need for interdisciplinary team planning for water management is recognized, but difficulties in implementing such a team planning effort are viewed as serious, and gradual movement toward this goal was a typical response. Personal and agency risks are viewed as conflict-producing and likely to impede the establishment of integrated water management. Federal sanctions are seen by many as needed to insure implementation of efficient water management systems.

With regard to the questions on the relation of water law and technology, the Denver area water managers responded as follows:

(a) They favor more careful specification of water rights, in volume as well as flow rate.

(b) They strongly split over the question of using water and sewer service as a control on urban development.

(c) They believe new water supplies will come primarily from additional West Slope diversions and transfers from rural to urban water use before more efficient use of present supplies will prevail.

(d) Of those who have had experience with a failure of a water project, most attribute the cause to inadequate community support of various kinds.

Based on these studies, the establishment of a multidisciplinary team to advise on new technology, social change, and total water system management is recommended. Such a team could advise water utilities in urban areas regarding the feasibility of comprehensive water management from both the physical and social viewpoint. If such a step is proposed, the team could develop methodologies for citizen participation in planning, developing management alternatives acceptable to the decision-making bodies, and monitoring the development and implementation of water management plans to insure responsiveness to the legal, social, and economic constraints of the urban system within which the planning must take place.

Political Science Findings

The political science segment of the study involved the identification of the attitudes of three separate sets of actors in the water resource system toward selected aspects of Colorado water law. The actors were local water agency planners, planning influentials, and state legislators.

Agency Planners

There is general agreement among the planners in both the irrigation and domestic agencies that there will not always be enough water available to meet the needs of the area. There is a clear consensus among the planners that the problem of relative scarcity in the water system will intensify. There is also very broad agreement that the

conflict between farm and non-farm users is growing. The planners recognize the basic interdependence of the system, and they believe that rural and urban problems must be solved simultaneously. Thus, there is a shared perception among the planners that the water supply of the area is inadequate to meet future needs, and that present levels of conflict between different types of users are intensifying. There is apparently general abstract support for the development of solutions to these problems that take into account the needs and the interests of all relevant sectors of the system.

There is general agreement among the water agency planners that the urban and industrial growth of the region should be regulated to protect the farmers' water. There is only slightly more widespread support for the control of urban growth in the irrigation sector than in the domestic sector. However, the intensity of support, as would be expected, is much greater in the irrigation agencies. A majority of the planners in both types of agencies support greater regulation of the distribution of water in the area. Support for this alternative is somewhat stronger in the domestic sector. The most negative reaction to increased regulation is found in the smaller irrigation agencies where there is apparently some fear that any increase in regulation would threaten their interests. The support for increased regulation is based upon an assumption that the primary focus of such regulation would be upon the reduction of waste in the system rather than any general reorientation of the system.

There is general and strong agreement among the planners in both sectors of the system that the body of Colorado Water Law should be made less complicated. Similarly, there is general agreement that lawyers have had

too much influence in the development of water law and in the entire area of water decision making. This negative judgment on the contributions and the present role of lawyers is somewhat more pronounced in the irrigation sector. Approximately two-thirds of the irrigation planners feel that nothing but trouble comes from going to court over water matters. This feeling is not shared in the domestic sector, where about two-thirds of the planners disagree with this formulation. However, the planners in the smaller domestic agencies tend to agree with the irrigation planners that going to court is not a very viable alternative for their organizations.

The most intense disagreements between the planners from the two sectors are related to substantive issues of water law and attitudes toward major changes in the substance of the law. The planners from the domestic agencies strongly agree that most of the water law of the State should be rewritten, and that the prior appropriation doctrine has outlived its usefulness. Virtually all of the domestic planners are agreed that the basic configuration of present water law doctrines is contrary to their interests, and thereby, they should be redesigned. The irrigation planners clearly believe that any major reordering of the basic concepts presently followed would be dangerous to their interests.

A slight majority of the domestic planners agree that the surface and ground waters of the State should be integrated into a single allocation system. The planners in the larger domestics are less likely to agree with this proposal than are those from the smaller agencies. Conversely, a slight majority of the irrigation planners do not support such an integration of water rights. The majority of the irrigation planners believe that recent water legislation, including attempts to bring about

full integration of the two systems, has done more harm than good, while virtually all of the domestic planners disagree with this contention.

These findings clearly indicate that persons within the irrigation agencies in the area are quite fearful of change in the basic doctrines that guide the water law of the State. This fear of change, i.e. change would be detrimental to irrigation interests, presents a very substantial barrier to major innovations in water law. The persons in the domestic sector are much more supportive of change in these basic doctrines. These findings are compatible with the pattern of evolution of Colorado Water Law in that the basic doctrines were formulated in a period in which irrigation interests tended to dominate the water resource decision-making system of the State. The irrigation officials strongly feel that the substance of current water law is more compatible with their interests than any likely changes in the system; and, therefore, they evidence intense support for the maintenance of the status quo. The domestic officials seemingly believe that there has been a substantial shift in the structure of power in the system, and that any basic changes in water law doctrines are more likely to be favorable to their interests than the present configuration of doctrines that dominate the system of water law in the State. Therefore, the major source of support for innovation is likely to come from domestic water agencies and their clients and supporters. Conversely, the fears of the irrigation officials must be mitigated if they are not to serve as a major barrier to innovation in the system.

There is general agreement among the local water distribution agency planners that water problems are becoming more intense and conflict is

growing in the system. There is a generally negative evaluation of the present activities of the courts in cases involving water matters, and lawyers are seen to have much too much power in the present context. The major conflict present between the perceptions of the actors in the two sectors is in possible substantive changes in water law. Irrigation planners generally support the status quo and apparently believe, given recent trends, that any major changes in water law doctrines would likely be destructive to their interest. The converse is apparently true of the perceptions of the planners in the domestic sector. Therefore, personnel in irrigation agencies have a structure of orientations and attitudes that tend to retard innovation in the system. Actors in the irrigation sector can be expected to use the political resources that are available to them to oppose major changes in the basic doctrines that guide Colorado Water Law. Conversely, the persons in domestic agencies tend to believe that changes in the system will be in their interest; and they, therefore, can be expected to be sources of political support for attempts to bring about substantial innovations in Colorado Water Law. However, other analysis of the data reported here has indicated that the irrigation sector is more well integrated into the decisional structures involving water matters than are the domestic agencies. This information would indicate that there are very substantial barriers present in the system to the major reordering of water law doctrines.[1]

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[1]Duane W. Hill and R. L. Meek, Local Water Agencies, Communications Patterns and the Planning Process, (Fort Collins, Colorado: Environmental Resources Center, OWRR Completion Report, 1971).

Water Influentials

A total of 118 influentials were identified and interviewed. The majority of these respondents were proprietors or managers who held management positions in water agencies or who were local or state officials. These included a number of officials who held positions of state-wide responsibility in the area of water resources. The remainder of the respondents were nearly equally divided among lawyers, engineers, and farmers. Therefore, these persons represent a broad range of interests and functions which are normally associated with water management problems. These actors stand at strategic points in the communications pattern which dominates the water resource system. This factor places them in a position to have a substantial influence in the shaping and blocking of demands for changes in the patterns of water law and legislation in the State. They are in a position that they can determine to some extent which of the alternative proposals for future water policy making have the best chances of success. Thus, the perceptions they hold of present water law problems and proposed alternatives have a great potential of being reflected in future policy choices made in the water resource system.

The influentials, like the agency planners, strongly agree that there will not always be plenty of water to meet the needs of the area. They also agree that the conflict between farm and non-farm users is growing, and that the problems of these two sectors must be solved together if a viable solution is to be found. There is very general agreement that the use of water should be expanded. There is apparently deep concern over the future of the water supply for the area and strong support for measures to augment that water supply.

There is strong support among all segments of the influentials that there should be broader regulation of the distribution of water within the State, and that there should be stricter enforcement of beneficial use requirements for maintenance of a water right. There is very strong agreement that the regulation and enforcement mechanisms should be retained in the hands of state officials, and further federal intervention, control or regulation would be very undesirable. These orientations seem to be directed toward the increase of useable water supply by restricting water use in the system, and the water users of the State can be best protected by maintaining as much State control as possible over the water resource system.

These dimensions indicate clear and deep concern of the need for state regulation and state controlled mechanisms to prevent waste and to maximize the use and reuse of this increasingly scarce resource.

The influentials evidence a positive orientation toward the activities of the judiciary. Approximately two-thirds of them believe that the courts are the best place to resolve conflicts over water, and they strongly reject the contention that nothing but trouble comes from going to court over water matters. The influentials in all sectors clearly are more satisfied with the activities of the courts than are the water planners. This, in part, is a result of an apparently broad level of satisfaction with the present status of water law as it is being interpreted and applied by the courts. However, the influentials do agree with the water planners that lawyers have substantially too much influence in water matters in the State.

There is very general agreement that water law should be made less

complicated. There is broad support for the integration of well and surface water rights into a single system, and this system should be incorporated into the prior appropriation doctrine. These orientations are, in general, quite compatible with recent changes in Colorado Water Law. Therefore, it is not surprising that the influentials reject the contention that most recent water legislation has done more harm than good. More specifically, over two-thirds of the respondents agree that the Water Right Determination and Administration Act of 1969 is a good piece of legislation. This legislation has as its goal the rationalization and better integration of the water resource system of the State. Those persons who are most closely tied to the irrigation sector are the least favorably disposed to the act. Parenthetically, the roll call analysis of voting patterns in the 1969 Colorado General Assembly indicates that there was very substantial rejection of this legislation by representatives from rural districts. Again, the indication is that persons in the irrigation sector are likely to see any major changes in Colorado water law to be a potential threat to their interests and well being.

Generally, the influentials reject a number of other proposals for changes in the water rights and distribution systems. A majority of the respondents reject the proposal that there should be more restrictions on the transfer of water rights among different uses, and that there should be stricter limitations upon the transfer of water between water basins. There is apparently fairly common agreement that current regulations, rules and the market system are quite adequate to deal with any problems related to these issues. A majority of the influentials disagree that most of water law should be redone, and they very strongly reject the

contention that the prior appropriation doctrine has outlived its usefulness. Finally, there is clear rejection of the idea that either recreation or industrial uses should be given higher priority as beneficial uses than they presently hold within the water rights system.

These data indicate that, even though there is general agreement among the influentials that there are increasing water problems in the area, there is relatively little need for substantial changes in basic water law doctrine to deal with these problems. There is general satisfaction with present judicial and legislative efforts in this area. There is strong support for on-going attempts to bring about further integration of the entire water rights system of the State. On the other hand, there is broad support for the status quo, and there seems to be very limited support for major changes in the system. This is markedly true among those persons near the center of the communications process, where the respondents report that they play a very large role in water resources activities. These persons are the most satisfied with the present system, and these orientations would appear to present a formidable barrier to any major changes in the system of water law which governs the allocation, distribution and use of water in Colorado.

Legislators

The 56 legislators that returned useable questionnaires included 15 persons who reported they were very active in the area of water legislation, 15 who reported they were somewhat active, and 26 persons who indicated that they were not active in this area at all. There were 36 republicans and 20 democrats, which reflects to some extent

the republican control of the legislature during this period.

There have been frequent claims that water legislation is not provided with adequate technical information to make it effective. This contention cannot be evaluated in the context of the study, but the legislators' perceptions of the level of technical information available to them was measured. Generally, there is agreement that there is at least adequate technical information available to the legislature. However, only about one-third of the legislators report that it is very adequate, and about one-third beieve that it is not adequate. There is a very similar distribution of evaluations of the quality of technical information that is available to the individual legislator. The more active the person is in water matters, the more likely he is to believe that he has adequate technical information available to him. Conversely, those who are least active in water matters are the least satisfied with the quality of legal advice available to them.

There are a wide variety of experts and structures that were identified as important sources of information on issues involving water legislation. The most frequently mentioned sources of information were water lawyers. Roughly equal numbers of active and inactive legislators indicated them as important sources of information. However, five of the most active legislators volunteered very negative evaluations of the information provided by water lawyers. Thus, there is apparently some discontent among the most active legislators about the role played by water lawyers in the formulation of water relevant legislation. The next two most important sources of information were engineers and state administrative officials. The active legislators much more frequently indicated these roles as

important sources of information than did those who reported they were not active in water legislation. Irrigators were frequently mentioned by active legislators as important sources of information, and they were virtually never mentioned by those not active in water legislation. Members of legislative committees were the last major source of information that was identified. This was relatively a more important source of information for inactive legislators than for active legislators. The leadership role of these legislators seems to be more important for those persons who have little interest in or understanding of water resource problems.

Approximately two-thirds of the respondents indicated that they agreed that groundwater users should be completely integrated into the prior appropriation system; a similar percentage favor the use of economic incentives and/or sanctions to influence groundwater users to enter the appropriation system for the allocation of water. However, one-third of the respondents indicated that they were undecided on this issue. The more active legislators were somewhat less favorably disposed toward the use of such techniques to bring about full integration of the water distribution system under the prior appropriation doctrine. The majority of legislators agreed that Colorado has sufficient enabling legislation to permit and encourage the integrated use of ground and surface water in the State. Those legislators who were most active were the least likely to agree that present regulations were adequate for this purpose. Similarly, when asked to evaluate the success of the Water Right Determination and Administration Act of 1969, the most active legislators were least likely to indicate that it is too early to evaluate its success, and they were more likely to judge it unsuccessful than those who indicated they were not

active in water legislation. These data indicate that there is broad legislative support by the legislators for the integration of ground and surface water inputs. There is substantial agreement that current law is adequate for this purpose, but those that are most active in water legislation are least likely to agree with this contention. There is a substantial amount of indecision among the legislators as to what techniques should be used to bring about this goal, and the more drastic measures are least likely to be supported by the persons who are most active in these matters.

The respondents very strongly reject the contention that recent water legislation has done more harm than good. There is similarly broad rejection of the argument that the prior appropriation doctrine should be substantially amended in Colorado. The rejection of this argument is most intense among those who indicate that they are very active in water legislation. These data indicate a general level of satisfaction with the basic doctrines which guide the system, and there is actually strong support for a broader use of presently available doctrines to integrate the system. The use of present doctrine seems more capable of support than do basic changes and innovative approaches to the system of water law.

A majority of the respondents reject placing more restrictions upon the sale and transfer of water rights in Colorado. There is virtually unanimous rejection of greater involvement of the federal government in water administration in the State and of greater federal involvement in the administration of water rights on interstate streams. These data indicate a general support of state control of water resources of the State and a general satisfaction with the present patterns of acquiring, using and transfering water rights in the State.

The results of the legislative survey indicate there is substantial concern over water matters in the Colorado General Assembly. The legislators do not feel that they must make decisions based on inadequate technical information. There is general agreement that the ground and surface water rights should be integrated into a single system. There is more disagreement among the legislators as to whether present legislation is adequate for achieving their goal. There is very little support for fundamental changes in the basic concepts upon which the body of Colorado Water Law is based. There is broad and fundamental rejection of any broader involvement of the national government in controlling the basic processes of allocation and distribution of water resources in Colorado.

Legal and Economic Findings

The legal and economic portion of this study centered upon three major areas. The first was to prepare a narrative of the history and status of Colorado water law. This includes not only legislated and case law but also the complex administrative and water right adjudicative system. Several distinct studies were undertaken concentrating upon a temporal or sectoral trend or problem.

The second areas of legal concern led to the precise identification, compilation and publication of the relevant water laws, treatise and compacts administered by the traditional state water agency--the Office of the State Engineer. Historically, western water law is concerned with water quantity diversion, use and management and the administration of a water right system. In Colorado, as with the majority of appropriation doctrine states, water quantity and quality are not integrated under one administrative agency.

The third segment undertaken was an economic analysis of groundwater development and use. Particular emphasis was placed upon the role of

groundwater legislation as it affects development and use.

Detailed results of the three-pronged approach to the legal and economic analysis of Colorado water law are reported in the several publications listed in Appendix I. The following is an abbreviation of the findings.

From the historical analysis of Colorado water law various legal limitations and avenues to effective water allocation, distribution and management were identified. Perhaps the most significant constraint is the solidified and narrow concept of beneficial use. Traditionally, domestic, agricultural, municipal and industrial uses have been recognized as "beneficial" for purposes of acquiring a water right. Other socially valuable uses in situ or diverted such as recreational[2] or aesthetics[3] have been interpreted by the courts as "non-beneficial" uses. In spite of the major changes made in water law by the 1969 Water Right Determination and Administration Act,[4] the definition of beneficial use still reflects the predominance of private over public interest in the law-making body. The term was expanded to include water for recreational purposes, including fishing and wildlife, but constrained by the requirement of impounding the water so put to use.[5]

Pertaining to the use of water for fish and wildlife, the Colorado Supreme Court dealt the public interest another blow in Colorado River Water Conservation District v. Rocky Mountain Power Co. It held "There

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[2]Several test cases involving the Colorado Division of Wildlife have focused on recreation as a proposed beneficial use of water issue.

[3]Empire Water and Power Co. v. Cascade Town Co., 205 Fed. 123 (Cir. Colo. 1913).

[4]Colorado Revised Statutes 148-21-1 to 21-45.

[5]Colorado Revised Statutes 148-21-3(7).

is no support in the law of this state for the proposition that a minimum flow of water may be 'appropriated' in a natural stream for piscatorial purposes without diversion of any portion of the water 'appropriated' from the natural course of the stream."[6]

The appropriation of water for future use under the conditional decree system was liberalized in a series of 1950-1967 cases. The change occurred in the doctrine of relation back where major transmountain diversion projects are involved. Reversing a previous holding on the same issue, the court held in Metropolitan Suburban Water Users Association v. Colorado River Water Conservation District that a preliminary survey constituted sufficient evidence of the "first step" to perfect a water right entitling the claimant to a conditional decree of that date.[7] This was clarified in Four Counties Water Users Association v. Colorado River Water Conservation District where the court stated the act evidencing the first step must be based upon an intent to take the water and apply it to beneficial use, not just for information purposes while formulating the project.[8]

The Four Counties Water User Association Case[9] also produced an important holding with respect to future allocation and development of water resources. Economic efficiency was enunciated as the primary criterion in pursuing plans for transmountain diversions of water by cities.

Water quality as an element of a water right traditionally does not exist in the appropriation doctrine. This doctrine, constitutionally adopted by Colorado, is based on quantity not quality aspects of water. An examination and analysis of Colorado case law produced several decisions

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[6] 406 P2d 798 (Colo. 1965).

[7] 148 Colo. 173, 365 P2d 273 (1961).

[8] 425 P2d 259 (Colo. 1967); See A Decade of Judicial Developments and Changes in Colorado Water Law: 1960-1970, Ashton and Radosevich, WRE - 13, Department of Economics, Colorado State University, June 1972.

[9] Ibid.

protecting the water rights of downstream users from upstream mine and mill discharges where such discharges rendered the water unfit for the appropriated downstream use.[10]

Colorado temporarily removed the requirement of actual diversion of water from the watercourse to effectively establish a water right in Town of Genoa v. Westfall,[11] but five years later reinstituted the qualification in Colorado River Water Conservation District v. Rocky Mountain Water Co.[12]

The State is gifted by nature in beauty of mountains, scenery, rivers, lakes and wildlife, yet paradoxically, Colorado is one of two or three remaining states that denies public access to fishing and recreation waters flowing through private property. The law of inter-property stream use is based upon a 1905 Supreme Court case -- Hartman v. Treise.[13] This case held unconstitutional a statute granting the public right to fish in any stream in the state. Consequently, fishermen, canoeists and other water craft recreationists cannot float, wade or otherwise use that portion of any stream flowing through private property, even though the fish in the stream are stocked at public expense. A vast majority of the western states granting private ownership to the beds of streams and lakes have by case or legislated law permitted such action.

In 1971, S. B. 96 entitled "Public Use of Streams" was introduced. The bill was patterned after the holding in Day v. Armstrong[14] by opening

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[10] Suffolk Gold Mining and Milling Co. v. San Miguel Consolidated Mining and Milling Co., 48 P. 823, (Colo. 1897);

[11] Town of Genoa v. Westfall, 141 Colo. 533, 349 P2d 370 (1960).

[12] Colorado Water Conservation District v. Rocky Mountain Water Co., 158 Colo. 331, 276 P2d 992 (1965).

[13] 36 Colo. 146, 84 P. 685.

[14] 362 P2d 137 (Wyo. 1961).

up all streams in the state for public use where such could be done by floating or pleasure crafting the streams. Wading and using the landowner's river banks or beaches were not allowed. Where a landowner was damaged, compensation would be paid. The bill was not reported out of committee.

The economic study revealed the use of groundwater for irrigation has contributed greatly to the economic growth of the Northern High Plains. This is based upon a showing of increased net revenues per farm, increased capitalization of farm land, population increase and phenomenal increase in well registration. Table 3 contains the statistics on well registration from 1935 to 1969.

There is increasing concern throughout the state over the utilization of groundwater. The 1972 legislation has attempted to block a loophole created by the 1969 Act, in which an exemption from filing for wells pumping 50 gallons per minute or less was allowed. (In 1971, this was changed to 15 gallons per minute or less.) The 1972 Act requires the issuance of a permit to drill any exempt well. This change was strongly objected to by subdevelopers, who have been using the exemption to circumvent the law which requires that non-exempt wells must comply with provisions necessary for a valid appropriation.

Conclusions

The conclusions drawn from phase I of the engineering segment of this study are:

(1) The irregular application of judicial enforcement in water quality cases demonstrates the need for a strong administrative state agency for the surveillance, policing, and preventive activities necessary for effective water quality control.

CUMULATIVE IRRIGATION WELL REGISTRATIONS
ON THE COLORADO HIGH PLAINS

Year	No. of Wells
1935	1
1940	10
1945	17
1950	87
1955	247
1960	366
1963	435
1967*	1514*
1969**	2200**

Source: Bowden, Diffusion of the Decision to Irrigate, p. 59.

*Official Registry of the Office of the State Engineer.

**Estimated number of wells from the State Engineer's Office.

FIGURE 3

(2) The technical problems which come before the courts in water resources litigation are sufficiently complex and variable to require a higher level of expertise for their resolution than that which is now utilized.

(3) The technical input to the judicial decision maker is often much more fragmented, disorganized, and unreliable than the information available to an engineer decision maker faced with a comparable but non-judicial determination.

(4) The courts have a definite need for an unbiased, professional appraisal of the facts in many water resources cases. The use of a panel of experts appointed by the court as set forth by the Commissioners on Uniform State Laws in their model Expert Testimony Act would be of great help to the trial judge in placing the best available technology before him.

Based on phase II of the engineering segment of the study, the establishment of a multidisciplinary team to advise on new technology, social change and total water system management is recommended. Such a team could advise water utilities in urban areas regarding the feasibility of comprehensive water management from both the physical and social viewpoint. If such a step is proposed, the team could develop methodologies for citizen participation in planning, developing management alternatives acceptable to the decision-making bodies, and monitor the development and implementation of water management plans to ensure responsiveness to the legal, social and economic constraints of the urban system within which the planning must take place.

The data analyzed in the political science segment of the study indicate that there is broadly based, intense concern among water relevant publics vis-a-vis the future availability of adequate water resources

in the area. There is general acceptance of the fact that the system is under stress which results from increasing demands being placed upon available water resources. The actors in the system also perceive growing conflicts among different types of users within the system.

There is general support for the integration of ground and surface uses of water into an integrated system and for the simplification of water regulations. There is very little support for restricting the present patterns of water transfers or reducing the generation of the market mechanism in this area. There is very limited support for fundamental changes in the basic system for the allocation of water rights within the system and for a general overhauling of the water code.

These data indicate that major changes in water law are not seen as necessary or desirable means of dealing with the increasing water problems of the State. There is broad support for the basic concepts of the system, and substantial innovations cannot be expected. The political support is not present among the water relevant publics for major changes in the present system. The major support for change is apparently related to using presently developed and accepted concepts to bring about somewhat better integration of the system. Changes that do occur can be expected to be relatively limited incremental changes engrafted upon present concepts rather than broad and fundamental redesign of the water code for the State.

The legal research of statutory and case law produced the following conclusions:

(1) Holdings in the series of transmountain diversion cases for municipal supply grant recognition and validity to the Great and Growing City doctrine. This doctrine simply holds that courts recognize the

importance of municipal demands for water and the domestic rights of inhabitants to available supplies superior to all other uses -- present and prospective.

(2) The public has neither gained sufficient clout nor been willing to internalize the costs of making available for public use, the waters flowing through private lands.

(3) The failure to recognize recreation as a beneficial use of water indicates the economic potential for this purpose has not been properly appraised.

(4) As demonstrated by the legal and institutional developments in Colorado water law, certain types of water users have been willing to internalize the externalities associated with the use of water for those purposes and have consequently transformed the status of water for those uses from a common or free good to a marketable, valuable and private commodity. These users have built into the legal system the assurances necessary to protect their investments. For example, irrigation, municipal and industrial users can appropriate water and be given a water decree equivalent to rights held in real property.

Likewise, certain other users, represented by the public in general have (in Colorado) failed to reveal their true preferences and have continued to treat water as a common good. Consequently, this common good is subject to the prior rights of appropriators. Some progress has been made by the State Division of Wildlife in its attempt to acquire water necessary for fish rearing and recreation parks in reservoirs,[15] but generally, the public interest in State waters is secondary.

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[15]The John Martin Reservoir case illustrates this problem.

(5) From an examination of the administrative system, it is clear that Colorado is still "use-oriented" as opposed to "management-oriented" in its utilization of available waters. Some progress has been made in the Water Right Administration and Determination Act of 1969 by the establishment of special water courts and referees coordinating their adjudications with the recommendations of the State Engineer. There still exists the undeniable fact that the courts adjudicate the water rights, the State Engineer's Office administers the water laws and the Colorado Water Conservation Board is charged with responsibility for developing a state water plan. No water management plan can be effectively implemented where allocation of unappropriated water cannot be denied.

(6) The primary conclusion from the comparison of Colorado groundwater law with criteria for a "good" law is that irrigation users are subjected to constraints preventing them from realizing the full potential of the available supplies.

The study indicates the clear need for more careful analysis of relationships between the evolution of water law and technological factors and the political context within which they operate. The solution of problems of water law in the state require better use of advances in technology designed to more efficiently manage the water system of the state. There are numerous political, institutional and management barriers to bringing together the necessary perspectives in decision making. This study indicates the need for such integration.

CHAPTER V

Achievement of Objectives

The objectives were acheived in the following manner and extent:

(1) Reference to project concepts and methodology to explain the interdisciplinary approach taken.

By working together as a team, four investigators have accomplished a sense of understanding the complexity of interdisciplinary research and an appreciation of alternative and opposing ways of problem analysis and procedures.

(2) The objective was accomplished through pursuit of traditional legal research methodology and the integration of technology and political processes perspectives.

(3) The technological involvement objectives were found to be extremely difficult to completely and satisfactorily resolve due to the inadequacy in the legal reporting system of district court cases and court transcripts. However, key cases were identified which signify the deficiencies in the present legal structure to incorporate technological expertise and methodology in resolving water disputes.

(4) The attitudes of key actors in the water resource system toward current doctrines and proposed changes were identified. Potential areas of resistence to changes and trends of acceptable change were determined.

(5) A case study of the economic effect of changes in groundwater legislation was undertaken as a Ph.D. dissertation project by Reed W. Willis.

(6) The objectives were accomplished by publication of several articles and reports emanating from the project research results, constitutional laws and various seminar and conference presentations (See appendix for complete list).

CHAPTER VI

Prospects for Colorado Water Law

Water has played a significant role in the development of Colorado's growth from the earliest days when the first farmers diverted water for agricultural purposes. Present day uses - including domestic, agricultural, industrial and recreational - have been placing an increasing burden on the limited supplies of water within the state. The indication for the future is that the state will be faced more and more with the problem of allocating its limited supplies of water among a larger number of users demanding increasing quantities of high quality water.

The laws established by the state must be dynamic and flexible enough to solve this allocation problem. In 1876, the state incorporated the appropriation doctrine into its constitution in an attempt to effectively handle the allocation problem. As more demands have been placed upon the water resource, the system of laws has had to change to solve the numerous problems. There has been a direct relation between the increased number and complexity of laws and the increasing demands placed on the system.

The earliest laws concerned themselves with the rights of the individual appropriator. As the state has grown and the number of water users increased, the number of questions surrounding water use increased. The newer laws concerned themselves more and more with the question of the rights of the "public" in the water.

The water problem now encompasses a wide range of legal, economic, political and social factors, all of which must be considered in solving the problem. The law, to be effective, must reflect the changing values of the

society in which it operates. For example, up until this day, the only beneficial uses of water recognized by the state constitution have been domestic, agricultural and industrial. No change has been made concerning the use of water for recreational, aesthetic or fish and wildlife purposes. Looking at the increased demands that society is placing on water based recreational resources indicates that use should be given some consideration with respect to the general system of water resource uses.

New laws have been enacted that take into consideration the quality as well as the quantity aspects of water. It is evident that laws of this nature will become more relevant on state, interstate and national levels. More laws will be required that protect and define the rights and duties of water users.

It has been mentioned by several authors that the appropriation system is more conducive to market transfers of water than is that of the riparian system. As water becomes more highly valued in one use as compared to another, it is logical on economic grounds that water should be transfered to that use. One of the major road blocks to effecting these transfers lies in the inadequate records and complicated transfer procedures. To solve many of the legal problems, what may be called for is not more information on water uses and users, but a higher level of accuracy in the present system.

Many of the definitions in the present Colorado water law may have to be reconsidered. These include such concepts as what is a beneficial use of water, a diversion, how is the groundwater-surface water conflict going to be effectively resolved, etc.

Two issues must clearly be resolved and accomplished, however, if Colorado is to be successful in fully utilizing the tremendous potential of its water resources: (1) There must be an integration of water quantity

and quality into one law and agency; and (2) There must be greater and more satisfactory state and public involvement in control and management of distribution and use of all waters within the state.

It would be easy enough to describe the prospects for Colorado water management in terms of the legal and political responses to increased economic competition for limited water resources noting such aspects of water control and management as increased groundwater regulation, greater specification of water rights, increased efficiency of use in agriculture and domestic use, increased control of pollution, the adoption of reuse over the full scale of present day uses, the increased importance of water-related recreation; all of these are viable predictors of the future water scene. But such an approach cannot ignore the social dimension of the problem. That is, if effective rules and regulations are to be formulated, if Colorado is to move toward a more efficient use of its water resources, allocating and reallocating them in the best interests of the citizenry, then a more viable decision-making process must be established. Knowledge of the water resource, demands on the resource, consequences of use, and the involvement of the public require a new level of communication and interaction among the public, special interest groups, the State legislature, water managers, state agencies and the water users themselves. Otherwise, the uneven kind of approach which we have herein described will continue to the ultimate disadvantage of the State and its citizens. There are formidable political barriers to the kinds of changes that are required for more rational use of the water resources of the State. Foremost among these are the resistance to change by those who have a vested interest in the present configuration of allocations, rules and structure and the strong positions acquired by these persons within the political system that can be used to effectively limit changes in the status quo.

LIST OF APPENDICES