CHAPTER I
INTRODUCTION

Purpose and Scope of the Study

The appropriation doctrine of water law is the basis for groundwater administration in a number of western states. The broad statements presented in individual state statutes are the guidelines for control of the development and location of new wells and the continued operation of existing wells. These guidelines have generally been satisfactory for the period of time when the groundwater resource was being developed. However, many states are now facing conditions of well interference, declining water levels and basin overdraft which require administrative management decisions. The broad guidelines must be interpreted and quantified for resource administration. This report presents an analysis of groundwater management alternatives possible under the broad guidelines of the appropriation doctrine as expressed in the legal code for Idaho.

Legislative phrases such as "full economic development . . . reasonable groundwater pumping levels . . . (and) reasonably anticipated average rate of future natural recharge" are the basis for groundwater administration in Idaho. Each of these phrases is subject to a wide range of interpretation. Pumping levels that are reasonable for whom? What is a reasonably anticipated average rate of future natural recharge for a specific basin? Additional questions arise in the application of these regulatory concepts to a particular basin. Is administration limited to hydrologic units or may separate management subunits

be created? What is the pattern of closure of junior users to protect a senior? How many levels of decision are required to provide a quantitative management plan for a basin? Many alternative management schemes are possible for resource administration under the guidelines presented in the Idaho Code. This report provides an analysis of possible administrative actions and their respective impacts on a selected water resource system.

The project was designed as a multidiscipline effort involving hydrology, engineering, economics and law. The general plan of study included: 1) an evaluation of the physical, economic and legal factors relevant to the management of groundwater resources, 2) construction of a mathematical model of the water resource system in an arid basin in southern Idaho, 3) evaluation of the economics of groundwater utilization within the basin, 4) evaluation of the legal alternatives to resource management under the existing legal framework, and 5) quantification of the management alternatives and application of the alternatives to the mathematical model. Chapter I is an introduction to the report. Chapter II, entitled "Idaho Groundwater Law", includes a legal analysis of management alternatives for groundwater under the Idaho Code. Chapter III, "An Economic Analysis of the Effects of a Declining Groundwater Level in the Raft River Basin", includes an economic analysis of groundwater utilization in the selected study basin. "Alternatives for Groundwater Management in Idaho" is presented in Chapter IV. A combined summary and conclusions and discussion is presented in Chapter V. Detailed conclusions are presented at the end of Chapters III and IV.

Statement of the Problem

Groundwater is one of the most important natural resources present in the western United States. Problems of management of the resource have proven to be almost as large and complex as the resource itself. These problems have resulted primarily from man's development of the resource.

Groundwater is part of the hydrologic cycle, the world's water distribution system. Recharge is from precipitation; discharge is mostly to lakes, streams, oceans and the atmosphere. Although groundwater moves under the same general physical laws as surface water, it possesses some characteristics that make management of the resource very unique. Water is generally considered to be a renewable resource. Groundwater, however, possesses some of the characteristics of a non-renewable mineral resource. The occurrence of groundwater is tied very closely with the geologic environment in which it is found. Water movement is slow, generally measured in terms of feet per year. The resource has both the characteristics of a pipeline and a storage system.

The development of groundwater is generally accomplished by the construction and operation of wells. From an operator's point of view, a well is a diversion point similar to a headgate on a stream. From a groundwater point of view, it is a vertical line sink with the discharge dependent largely on the hydraulic characteristics of the aquifer system.

Management of the groundwater resource must include consideration of a number of factors. Physical factors include the hydrogeologic environment, the location and characteristics

of man-made discharge points and the relation of the resource to other phases of the hydrologic cycle. Management of the resource is bounded by the existing legal framework. Management guidelines presented in the state code must be followed along with any administrative regulations. The field of economics is necessary to provide a measure of the value of legal and physical certainty of an individual right and the cost of administrative decisions. Groundwater is a common pool resource with all the associated problems of economic externalities. Management decisions must also consider the social costs of alternate administrative plans. In short, groundwater management should be the trend toward optimum utilization of the resource within the physical, legal, economic and social constraints.

The appropriation doctrine is a water resource development plan presented as a series of general concepts. The individual water user has some degree of certainty to the continuation of his use of water under this doctrine. The measure of his certainty is the date of his first use of the water or his priority. Ownership of the resource, however, is held by the state; the individual user can only obtain a right to the use of the water. Administration of the resource is placed with the individual state. The state legal code usually contains a limited description of the prior appropriation doctrine with a few general statements intended as guides for management of the resource. Use of the resource is regulated based upon court cases and upon administrative interpretation of the law. A wide range of management plans is possible under such legal guidelines.

Many of the western states that apply the doctrine of prior appropriation are now becoming concerned with detailed management

of the groundwater resource. This study is designed to provide a reference for groundwater administration under the doctrine of prior appropriation by the detailed examination of legal constraints presented in the legal code for the state of Idaho.

Model of a Hydrologic System

The Raft River basin in southern Idaho was chosen as a study area for the analysis of the impact of legal constraints on groundwater development. It is the largest of the five areas in Idaho presently declared as critical groundwater areas and the only one that may be considered as a hydrologic unit. A mathematical model of the water resource system in the basin was constructed as an aid in the evaluation of the legal controls for management. An existing finite difference program, developed by Pinder (1970) provided the basis for simulation. This program was modified to fit the objectives of the study and the particular characteristics of the Raft River Basin. The completed model allowed non-steady state analysis of the water resource system with individual well control. Details of model construction and verification are presented by Goldman (1974).

Description of the Study Basin

The Raft River basin includes a drainage basin of approximately 1,510 square miles located in southern Idaho and northern Utah (Walker et al, 1970)(Figure 1). The area is composed of rugged mountains rising above aggraded alluvial valleys. The climate ranges from humid and subhumid in the higher mountains, to semiarid on the floor of the main Raft River valley. Precipitation ranges from less than 10 inches on the valley floor to more

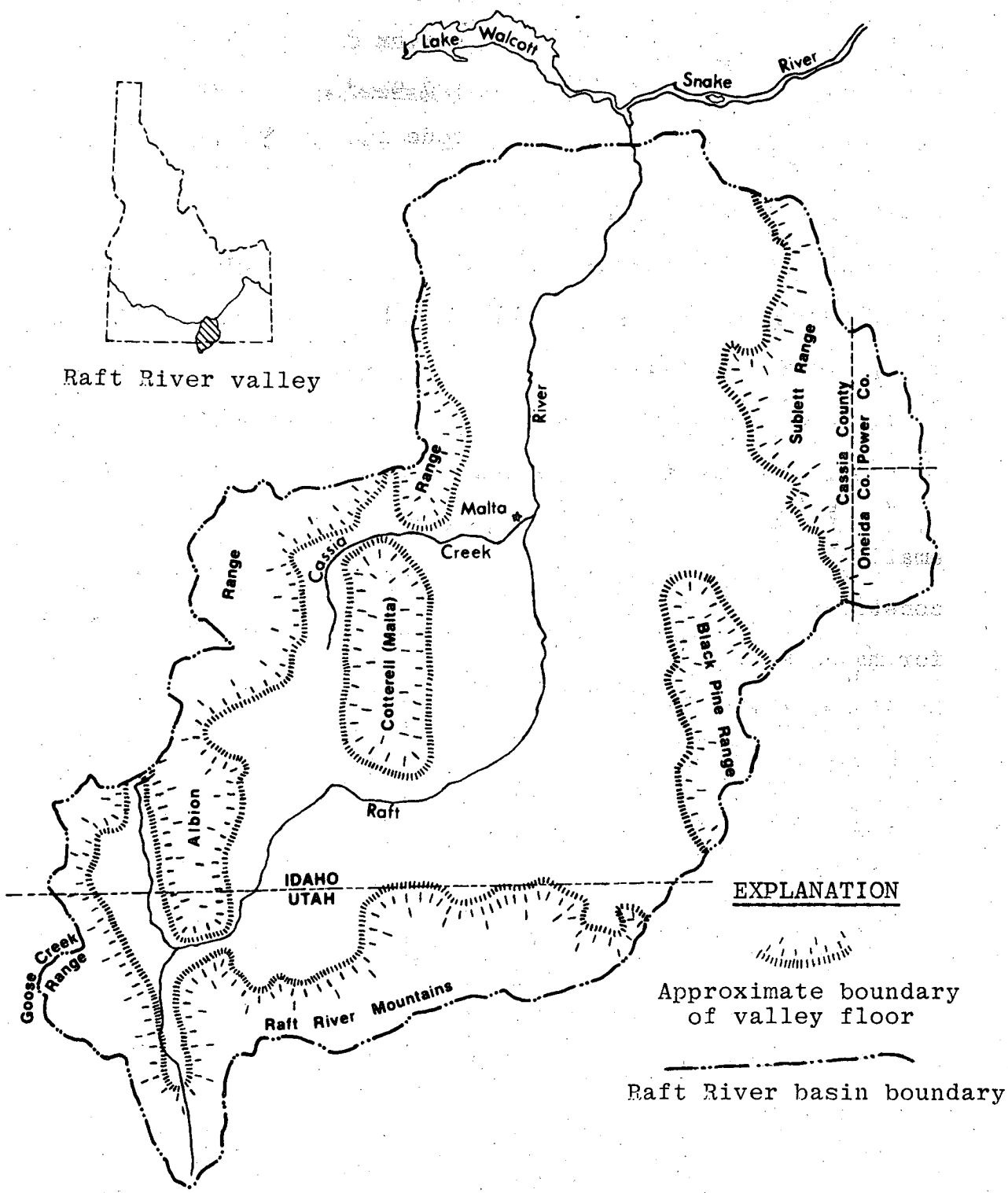

Figure 1
Location Map for the Raft River Basin

than 30 inches near the summits of several ranges. The streams in the basin are tributary to the Raft River which in turn flows north into the Snake River. The lower reaches of the streams are dry in the late summer during most years because of surface water diversion and groundwater pumpage.

The primary aquifers in the basin consist of gravel and sand of the Salt Lake Formation and the Raft Formation and recent alluvium. Basalt of the Snake River Group is also important as an aquifer in the northern part of the basin. The main body of groundwater in the basin occurs under unconfined or water table conditions (Walker et al, 1970, p. 58). Perched groundwater occurs beneath parts of the lowlands; artesian aquifers have been penetrated in several local areas. The depth to water varies from near land surface in the center of the main valley to greater than 400 feet. The known depth of the aquifer system is greater than 700 feet in most parts of the valley and greater than 1,400 feet in the area of greatest pumping.

An estimated 290 irrigation wells were in operation in the basin in 1963 with an increase to 330 in 1966 (Figure 2). The mean discharge from these wells is about 1,300 gallons per minute. The total pumpage in the area increased from approximately 14,000 acre feet in 1950 to an estimated 235,000 acre feet in 1966. About 84,000 acres of land are presently irrigated in the basin. Much of the additional 340,000 acres that lie in the lowlands area could be irrigated if water were available. Walker et al (1970) calculated the total water yield of the basin to be approximately 140,000 acre feet per year. An estimated 9 million acre

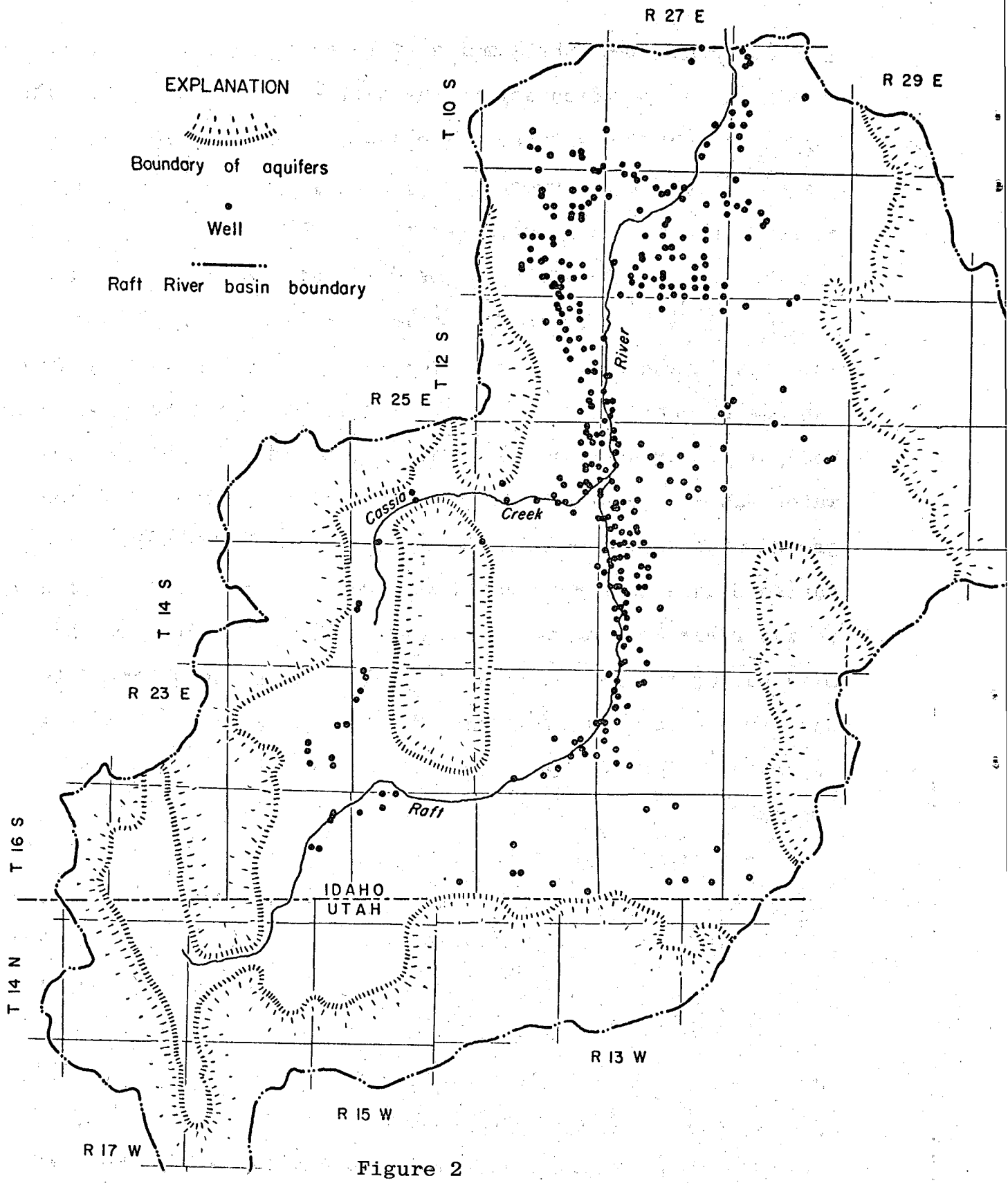

Figure 2

Location of Wells in the Raft River Basin, Idaho and Utah

feet of water is in storage in the top 200 feet of the saturated aquifer in the main valley.

The entire Raft River basin was declared a critical groundwater area and closed to future applications to appropriate groundwater in July 1963 because of declining water levels. Aside from changes in the critical designation for several small areas not directly related to the primary problem, the basin has remained closed for groundwater development.

Publications

Results of project investigation are presented in one Ph.D. dissertation, two master's theses, one professional report and two journal articles. Details on the construction of the mathematical model of the water resource system have been presented by Goldman (1974) in a masters thesis in Hydrology. Schatz (1974) has presented the economics portion of the project in a thesis in agricultural economics. The evaluation of groundwater management was reported by Ralston (1974) in a Ph.D. dissertation in Civil Engineering. Grant (1974) has prepared a report on the legal aspects of groundwater management within the state of Idaho. Ralston (1972, 1973) also published several papers on the administration of groundwater as a renewable and nonrenewable resource. These papers were presented at professional meetings. In addition, investigators Ralston, Grant and Schatz, plus Dr. Edgar Michalson and Mr. R. Keith Higginson presented a two-hour panel discussion of groundwater management in Idaho at the 1974 Rocky Mountain Groundwater Conference. Dr. Michalson was an advisor on the economics portion of the study. Mr. Higginson is Director of the

Idaho Department of Water Resources, the water administrative agency in the state.