

Research Technical Completion Report

# **GROUND WATER MANAGEMENT UNDER THE APPROPRIATION DOCTRINE PART II**

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## ABSTRACT

States that administer ground water under the prior appropriation doctrine experience similar management problems. A comparison of management activities in Washington, Idaho, Oregon, Montana, Arizona, Utah, Colorado, and New Mexico indicates a common pattern of management development in four stages. These stages are initial development, local stress, regional stress, and controlled use.



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## INTRODUCTION

The development of water resources in most of the western United States has been accomplished under the general guidelines of the prior appropriation doctrine. Each state has developed a unique legal framework which incorporates the general concepts of the appropriation doctrine. This has resulted in the management of ground water and surface water through a system of water rights.

Ground water management problems, particularly the problems of ground water overuse and water rights conflicts, have occurred throughout the western states. Every management problem is different because of the unique hydrogeologic character and development history of each basin and the specific state management guidelines applied to the problem.

This paper focuses on ground water management problems which are occurring in the Pacific Northwest states of Washington, Idaho, Oregon and Montana. The information from these states is compared in a preliminary fashion to ground water management problems in Arizona, Utah, Colorado and New Mexico. The Pacific Northwest states share common management problems which fall into three categories: water level declines, water rights conflicts, and problems associated with management actions. Persistent water level declines create a variety of management difficulties which center around the increased cost of obtaining ground water. In some areas the continual decline of water levels signifies the withdrawal of water at a rate which exceeds the natural replenishment of the ground water system. Water rights conflicts involve disputes over the quantities of water used and may involve the conjunctive use of ground water and surface water. State management actions frequently are



inconsistent with the physical characteristics of the ground water systems and are difficult to implement because of legal and institutional barriers.

The purpose of this research is to better understand ground water management problems which occur under the appropriation doctrine and to identify innovative solutions which are possible using this management system. The objective of this report is to describe and compare example ground water management problems from the states of Washington, Idaho, Oregon and Montana. Ground water management activities within the states of Utah, Colorado, New Mexico and Arizona are discussed briefly to illustrate the stages of ground water management. The report presents the progress achieved by the end of the second year of a three-year project.



## SUMMARY OF PACIFIC NORTHWEST GROUND WATER MANAGEMENT PROBLEMS

### Introduction

Ground water management problems in the states of Washington, Idaho, Oregon and Montana are outlined in this portion of the paper. Example problems of water level declines, water rights conflicts, and management actions are discussed for each of these states.

### Washington

#### Water Level Declines

Persistent water level declines are a problem in localized areas of eastern Washington within the Columbia Plateau. These areas include the Odessa-Lind region and the Walla Walla region. Aquifers in these areas are predominantly basalts of the Columbia River Group. Rather than being individual basins, these areas represent parts of the much larger Columbia River Basin. Water level declines have also been identified as a problem in the Duck Lake area of the Okanogan valley. The relationship of pumpage to ground water recharge in all of these areas is understood poorly.

The primary cause of the existing water level declines is irrigation pumpage. Pumpage increased dramatically during the 1960's and 1970's in response to crop prices and export market development. Pumpage in the Odessa-Lind area quadrupled during the 1960's and the number of wells doubled during this time period (Olson, 1983). The result of this development is a continuing pattern of water level declines of 5 to 10



feet per year. Increased irrigation costs and problems of shallow domestic wells going dry are associated with the water level declines.

### Water Rights Conflicts

Water rights conflicts arising from well interference problems have been associated with areas of persistent water level declines. The management response in these areas has focused on a restriction of new appropriations. Generally, existing pumpage has not been reduced. This is due in part to the undesirable economic impacts of reducing pumpage. From a practical standpoint, however, the curtailment of junior ground water pumpage may be impossible in Washington because ground water rights are unadjudicated. Seventy-six surface water adjudications have been completed, but no ground water adjudications have been attempted.

The statutes of Washington envision that ground water rights conflicts will be resolved in the context of an overall management objective. This objective is a safe sustainable yield from ground water resources, which limits pumpage to recharge volumes. The Department of Water Resources is given the power to establish reasonable or feasible pumping lifts, and these pumping-lift limitations are utilized as management tools in attaining the safe sustainable yield objective (Olson, 1986). The primary use of these pumping-lift limitations has been in evaluating the applications for new appropriations in areas where water level declines have generated significant conflicts between competing water users.



### Management Action Problems

Management actions taken by the State of Washington have included the declaration of three ground water management areas (fig. 1). This designation closes the areas to new ground water appropriation. Generally, data collection programs are initiated in the management areas.

Ground water management activities in the Odessa-Lind area have been limited to regulating the rate of water level decline at or below an average of 10 feet per year. No attempt has been made to reduce the level of pumpage, although new users have been prevented from freely appropriating the resource. Limitations also have been set on the depth to which new wells may be constructed. Based on the results of a computer model, new permits were issued in areas where the rate of decline was less than 10 feet per year. This was done because of the tremendous pressure for continued economic growth in the region (Olson, 1986). The allowed continuation of ground water declines in the area has resulted in the economics of irrigated agriculture being the primary ground water management tool. Ground water pumpage has decreased in the 1980's because of low crop prices and higher pumpage costs.

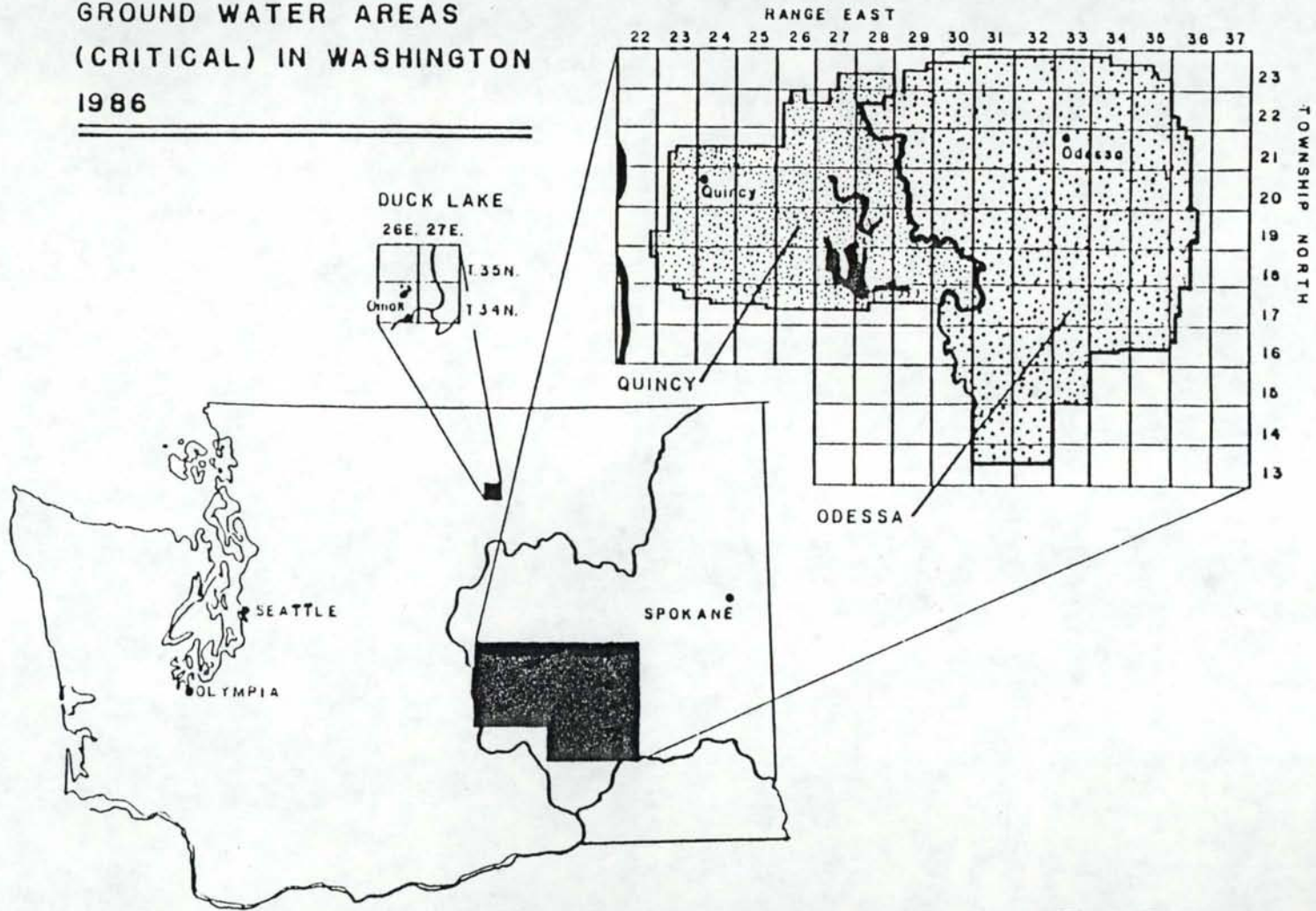
### Idaho

#### Water Level Declines

Areas experiencing continued water level declines are located in the southern portion of Idaho along the southern border of the Snake River Plain (fig. 2). A majority of ground water pumped in this region is used for irrigation. Most of the areas experiencing water level decline are



**FIGURE 1**  
**GROUND WATER AREAS**  
**(CRITICAL) IN WASHINGTON**  
**1986**



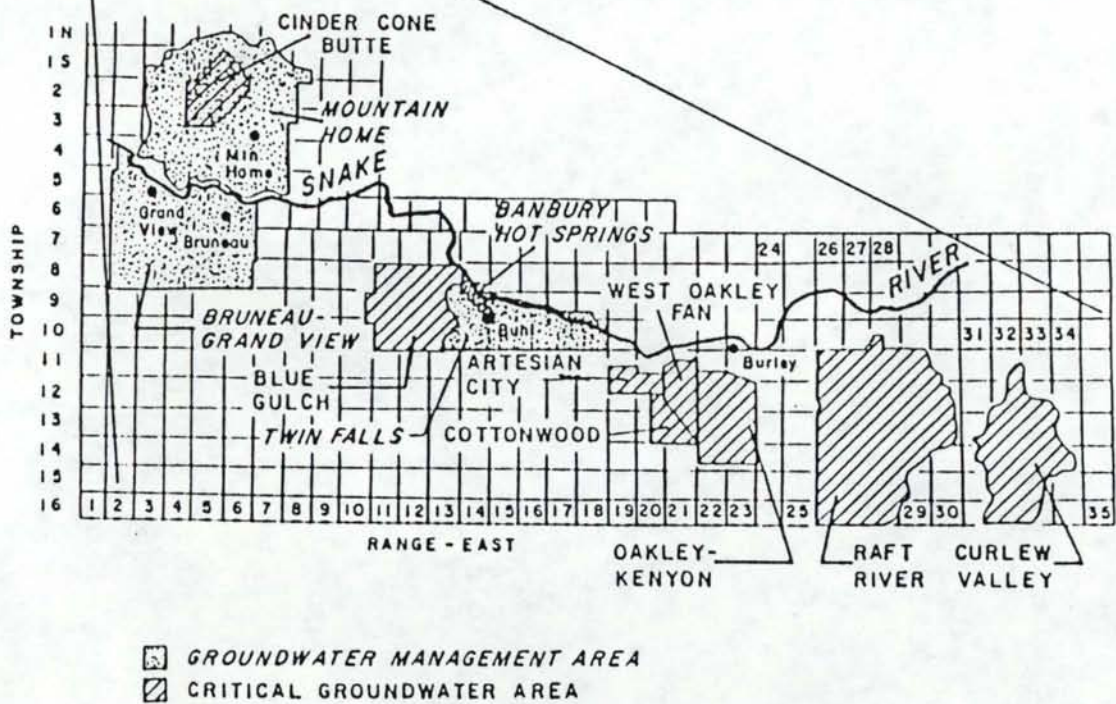
SOURCE: WASHINGTON DEPARTMENT OF ECOLOGY

Figure 1. Ground Water Areas (critical) in Washington - 1986





**FIGURE 2**  
**CRITICAL GROUND WATER**  
**(MANAGEMENT) AREAS IN IDAHO 1986**



SOURCE: IDAHO DEPARTMENT OF WATER RESOURCES

Figure 2. Critical Ground Water (Management) Areas in Idaho - 1986



not hydrologic basins, rather they represent portions of larger basins where water level decline has occurred. Water level declines as large as 10 feet per year have been recorded. The designation of the critical ground water areas and the associated designation of ground water management areas has resulted in the prohibition of the issuance of new permits to appropriate ground water in these areas.

#### Water Rights Conflicts

Water rights conflicts with respect to ground water development in Idaho range from small, single well interference problems to problems associated with the flow of the Snake River which affect the entire southern portion of the state. Adjudication of water rights historically has been associated with surface water users. Only one of the water level decline areas has undergone a water rights adjudication. The basin-wide nature of ground water/surface water problem in southern Idaho has resulted in the initiation of a Snake River Basin adjudication. Excluding domestic and stock uses, the Snake River Basin adjudication will involve over 40,000 claims to individual ground water and surface water rights, and will be the largest single basin adjudication of water rights in the country (Shaw, 1986).

Questions raised by the impacts of ground water development provided the impetus for adjudicating the Snake River Basin (Carlson, 1986). The withdrawal of ground water and its associated impact on surface water in the basin has created a complex network of impairment claims and confused priorities which must be sorted out before management can continue. The present water rights conflicts within the State of Idaho have proven to



be a major impediment to the continued water resource development of the Snake River Basin.

#### Management Action Problems

The primary ground water management activities that have occurred to date within Idaho are the designation of critical ground water areas and ground water management areas. A total of eight critical areas and three management areas have been declared (fig. 2). The adjudication of one area was part of a court decree to reduce pumpage to the recharge rate. This resulted in a significant reduction of both ground water pumpage and the number of ground water users. The lack of ground water adjudications in other areas has been a major impediment to management. The Idaho Department of Water Resources attempted to initiate an adjudication of the Blue Gulch critical ground water area as the first step in a management program. The adjudication effort was met with local opposition. Despite continuing declining ground water levels in the area, local individuals were unanimous in their opposition to an adjudication of their water rights and the subsequent elimination of some pumpage to meet management criteria. An adjudication was not initiated in the Blue Gulch area.

### Oregon

#### Water Level Declines

Most areas experiencing persistent water level declines in Oregon are hydrogeologically similar to areas previously noted for Idaho and Washington. In the Columbia Plateau region of the State, the water level declines are associated with irrigation pumpage. Declines in The Dalles



area, however, are associated with competitive use by both municipal and irrigation interests. Water level declines have also been problematic in a Portland suburb where domestic wells tap a fractured basalt aquifer. The most persistent declines have occurred in the Umatilla area, where water levels have dropped as much as 350 feet in 25 years (Young, 1986).

#### Water Rights Conflicts

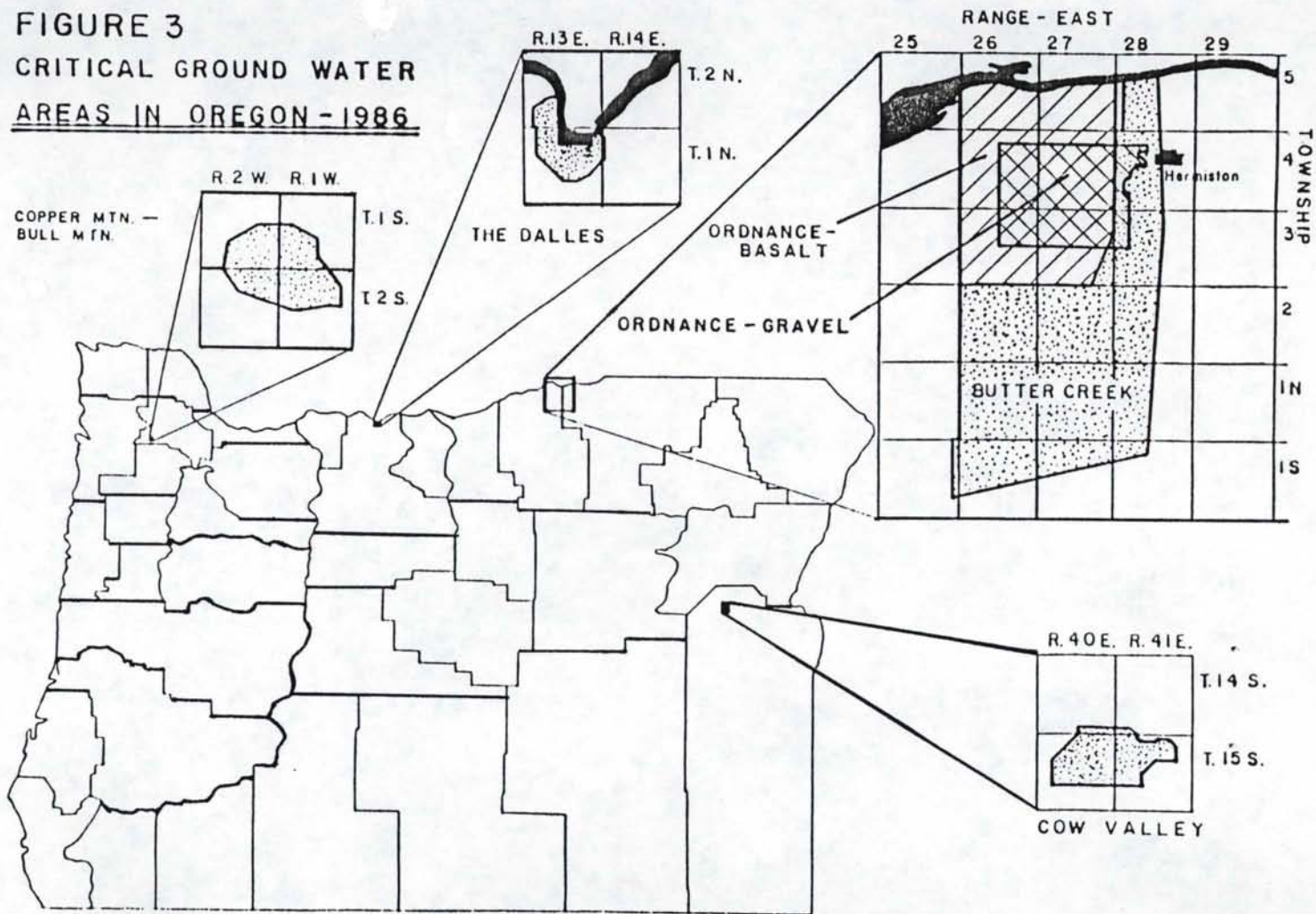
Water rights adjudication has been active with respect to surface water in Oregon; however, ground water adjudication has not occurred (Jebousek, 1986). Oregon does experience significant management difficulties because the state ground water and surface water codes operate independently. A single hydrologic system frequently is subjected to two different sets of water rights (Huffman, 1986; Norton, 1987). This situation has caused considerable difficulty for the Water Resources Department where ground water use interferes with surface water rights which are senior in priority. The Department has authority to limit new appropriations of ground water when the proposed pumpage will interfere with existing surface appropriations. The structure of the law, however, prevents the Department from intervening when established (permitted) ground water use interferes with surface water availability (Lissner, 1987).

#### Management Action Problems

Five critical ground water areas have been established in Oregon and three additional areas currently are pending hearings and designation (fig. 3). Four of the critical areas are located in the extreme northern portion of the state. The fifth area is located in southeastern Oregon



**FIGURE 3**  
**CRITICAL GROUND WATER**  
**AREAS IN OREGON - 1986**



SOURCE: OREGON DEPARTMENT OF WATER RESOURCES

Figure 3. Critical Ground Water Areas in Oregon - 1986



(Jebousek, 1986). Two of the three proposed critical management areas, Stage Gulch and Ella Butte, are located in the Umatilla Basin where the Ordinance and Butter Creek areas already have been designated (Norton, 1987).

The third proposed critical area, Fort Rock-Christmas Valley, represents an important development in ground water management in Oregon. Existing critical areas consistently have been designated in response to a water level decline problem which has reached crisis proportions. The Fort Rock-Christmas Valley area is perceived by the Department as an area where such a crisis will occur if development continues unchecked. The designation of this area is intended to prevent the kinds of water level declines which have occurred in other areas of the state, most notably the Umatilla basin. The designation has been frustrated somewhat by the courts which have approved the action for only a two year period, subject to future review (Lissner, 1987).

The primary problem encountered with management action by the Oregon Department of Water Resources is in the establishment of critical management areas when the area designations are not desired by the majority of the appropriators. Affected water users are entitled to judicial review of a critical designation, stalling the management effort. The Butter Creek designation has required ten years to complete and currently is being challenged in the courts for a third time (Young, 1986).



## Montana

### Water Level Declines

Only a few areas of persistent water level decline have been identified within Montana. Large-scale aquifer depletion problems have not been identified. This may be due, in part, to the fact that the nature and disposition of most aquifer systems in the state are unknown (Montana Governor's Ground Water Advisory Council, 1985). The State of Montana is moving to correct this problem by establishing a ground water information center at the Bureau of Mines in Butte.

### Water Rights Conflicts

Most of the water rights conflicts are not areal water level decline problems but rather individual well interference issues (Brasch, 1985). Two critical ground water management areas (South Pine and Larson Creek) have been established to deal with problems of well interference (fig. 4). The South Pine area was created because of a conflict between pumpage for an oil company and pumpage for ranchers. The Larson Creek problem involves domestic well development.

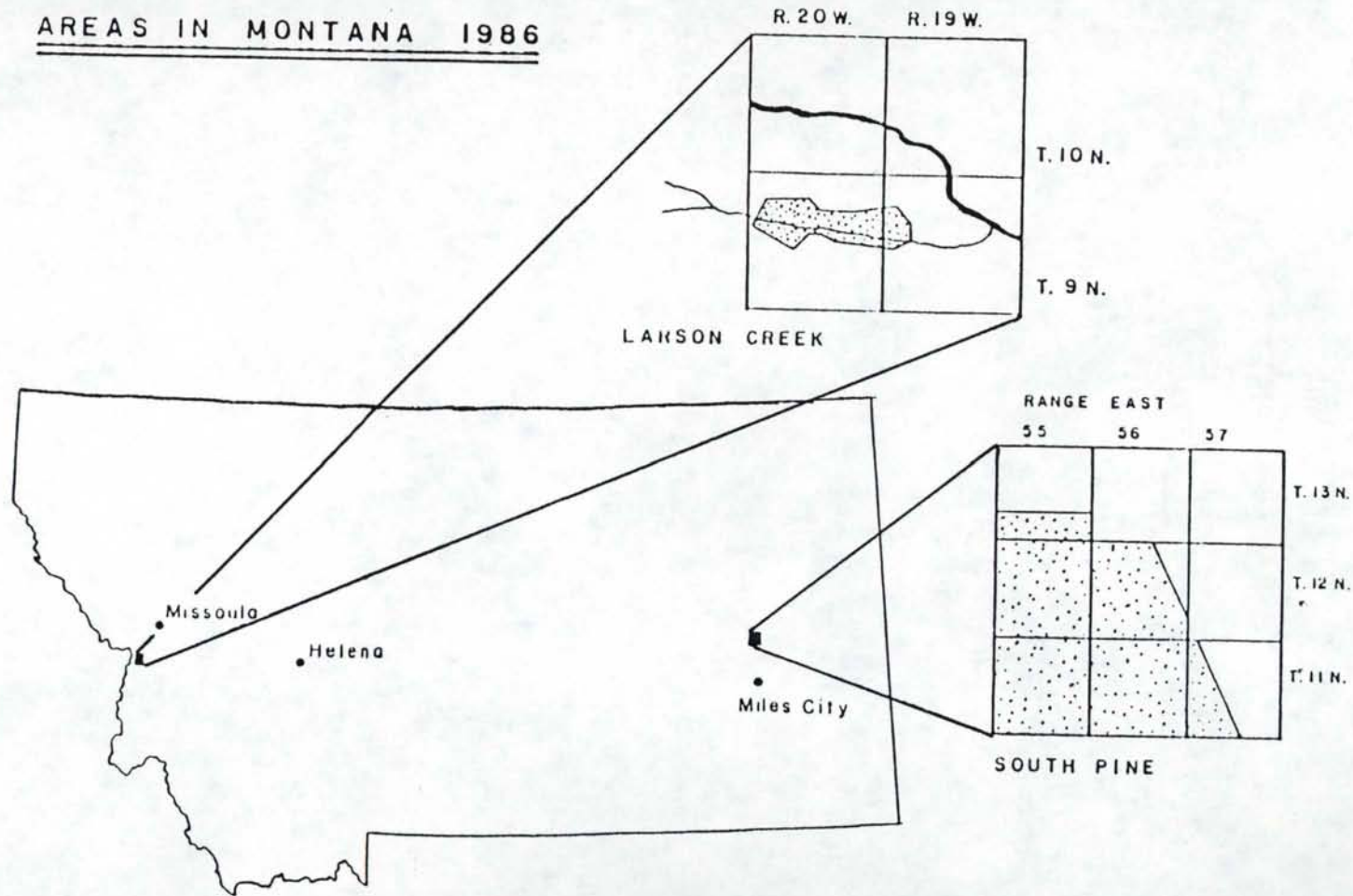
### Management Action Problems

The Montana statutes allow for the establishment of critical management areas where basin discharge is in excess of recharge. This has not occurred, primarily because of the lack of hydrogeologic information.

One distinctive problem within Montana pertains to the designation of a critical area. The state statutes in Montana provide adequate power to the state agency to deal with overuse of ground water. However, the



FIGURE 4  
 CRITICAL GROUND WATER  
 AREAS IN MONTANA 1986



SOURCE: MONTANA DEPT. OF NATURAL RESOURCES

Figure 4. Critical Ground Water Areas in Montana - 1986



Montana Department of Natural Resources will initiate a critical designation only with the support of the affected water users. Typically, water users have been reluctant to support a critical designation because the perceived potential personal loss for individuals far outweighs the potential gain of stable ground water levels (Montana's Governor's Ground Water Advisory Council, 1985; Brasch, 1985).



## MANAGEMENT STAGES

### Introduction

Similarities are evident in the ground water management experiences of Washington, Idaho, Oregon and Montana. All of the states base ground water management on the doctrine of prior appropriation, manage ground water using a system of water rights, and utilize critical management areas as a management tool. Water rights conflicts and management action problems are present in all four states. Three of the four states are experiencing some serious problems of water level decline.

A pattern of management history is evident from the examination of the four northwestern states. Four management stages may be identified: I) initial development, II) local impacts of ground water development, III) regional impacts of ground water development, and IV) controlled use. The stages are temporal in that each state goes through the stages in numerical order. All of these states, and individual basins within each state, are currently at some unique position on this progression of ground water management.

### Stage I: Initial Development

The ground water management history of Montana typifies the initial development stage of ground water management. This stage has three distinguishing characteristics. First, water level declines are not occurring on a significant scale. Montana derives only a small portion of its water use from ground water systems. Second, ground water management activities primarily focus on the maintenance of a system of



water rights. In Montana, the majority of management energy is expended on interference issues and water rights conflicts. The designation of critical ground water areas has been in response to water rights conflicts. Third, information on the ground water resources is limited. Generally, the expense of major ground water resource investigations is not justifiable when a simple system of water rights management adequately resolves problems that are occurring.

### Stage II. Local Stress

This management stage characterizes areas where the system of water rights management activities noted as Stage I have failed to adequately resolve issues of water level declines from localized areas of ground water development. Localized areas of water level decline and perceived ground water mining are present. This stage of ground water management also has three distinguishing characteristics. First, persistent water level declines are occurring in localized, sub-basin scale areas. Serious conflicts are developing between individual ground water users. Second, critical ground water areas have been designated as the primary management tool for the state. Typically, the critical area boundaries are not based on hydrologic criteria. The designation of the critical ground water area suspends further ground water appropriations but does not control existing users. Pumpage in most areas has not been reduced by the management actions. Third, knowledge of the ground water resource system is gained at a fairly rapid rate as part of management activities. The Odessa-Lind area of Washington, The Dalles and Cow Valley areas of



Oregon, and the Bruneau-Grandview area of Idaho all typify the local stress management stage.

### Stage III. Regional Stress

The regional stress management stage represents a breakdown of the "system of water rights" approach to ground water management. Entire basins are removed from further development and comprehensive management schemes involving conjunctive management of surface water and ground water are initiated. This stage also has three distinguishing characteristics. First, serious ground water level declines are occurring on a regional scale. In some cases, this represents the overlapping of localized areas of water level decline. Water rights controversies are widespread and include conflicts between surface water and ground water users. Management based on the administration of individual water rights lacks effectiveness because of the scope of the ground water problems. Second, the local stress type critical ground water areas are interconnected with one another and overlap in a patchwork which covers much of the basin. Third, knowledge of the hydrologic system continues to increase as management decisions become increasingly complex. Typically, large-scale ground water modeling is involved at this stage of management.

The Snake River Basin in Idaho and the Umatilla Basin in Oregon display many aspects of this management stage. The Snake River Basin adjudication will delineate ground water and surface water rights over a broad portion of southern Idaho. Difficult questions of ground water/surface water interrelationships in a large-scale, hydrologically



complex basin are being attacked. The areas presently designated under either a critical designation or a ground water management designation include broad areas within the Snake River Basin in southern Idaho. Similarly, the Umatilla Basin is covered by a patchwork of five designated and proposed critical areas. Management activities in this basin are frustrated by divisive water rights conflicts.

#### Stage IV. Controlled Use

None of the Pacific Northwest states considered in this paper have reached the delineated fourth stage of ground water management, controlled use. A brief mention of Arizona as the prime example of this stage of ground water management is pertinent and provides perspective to the problems of Washington, Idaho, Oregon and Montana. This stage of management has four distinguishing characteristics. First, ground water management problems have occurred in large portions of the state. Control of water level declines is perceived as a survival issue, making dramatic water policy changes politically feasible. Second, ground water and surface water are managed as a single resource. Quantitative large-scale water resource investigations are undertaken and water code enforcement becomes much more strict, imposing criminal penalties. Third, the water rights system is reorganized. The quantities of water associated with individual rights may be reduced and many rights are placed on a scheduled reduction of use and retirement. Patterns of use are altered through the sale of water rights. Agricultural uses, in particular, are shifted to municipal and industrial uses. Fourth, long range conservation plans are devised and implemented. This step is made



possible by the political importance of water management as a statewide issue. Arizona's management goal is a recharge/discharge balance for ground water by the year 2025. A series of 10-year plans have been implemented using mandatory conservation measures for irrigated agriculture, industry, and municipalities (Arizona Department of Water Resources, 1984).



APPLICATION OF MANAGEMENT STAGES TO THE STATES OF  
UTAH, COLORADO, AND NEW MEXICO

The assessment of ground water management in the states of Utah, Colorado, and New Mexico is currently in progress. The following descriptions of each state summarize state management activities in the context of the four management stages defined previously in this report.

Utah

Ground water management activities in Utah are characteristic of both stages I and III. Stage I activities are evident in the fact that management attention is focused on maintaining a system of water rights priorities through active adjudication. Knowledge of ground water resources in Utah has grown as a result of a strong cooperative agreement between the state Department of Natural Resources (DNR) and the U.S. Geological Survey (USGS). Water level declines are occurring in essentially all ground water basins in this state, which in some respects indicates a Stage III, regional stress, development level. These water level decline problems do not correlate well with those observed in the Pacific Northwest, however, because the DNR emphasizes the protection of water levels in their management activities. This protection of water levels for senior appropriators has led to the suspension of further ground water appropriations throughout most of the state. Management attention currently is focused on surface water.



## Colorado

Ground water management activities in Colorado are characteristic of both Stage III and Stage IV management. Water level declines are occurring throughout entire basins in Colorado, indicative of Stage III. Ground waters which are hydraulically connected to streams are considered "Tributary", and are managed in conjunction with the surface water. Tributary ground water is managed to insure the maintenance of senior surface water rights. This conjunctive use strategy also is indicative of Stage III management.

Non-tributary ground waters are mined. The Water Resources Department determines the quantities of non-tributary ground water which are available, determines a resource "life" (e.g. 25 years), and restricts pumpage to sustain usage throughout the projected time period. This controlled mining of ground water is characteristic of management under Stage IV. Nevertheless, Colorado differs from previously discussed states in that it does not define water level declines as a "problem." Tributary water levels are maintained to support stream flows, and non-tributary water levels are allowed to decline at a controlled rate.

Colorado differs from previously discussed states in one additional respect. Non-tributary ground water is administratively managed but tributary ground water is managed through litigation. The control of pumpage from tributary sources is achieved by legal suits brought by stream water users against the ground water appropriators. The water courts serve an important function in Colorado's water management system.



## New Mexico

Ground water management activities in New Mexico are best characterized by Stage IV, controlled use. Ground water is administrated by the State Engineer in ground water basins which he "declares." Basin development is unchecked up until declaration. Ground water rights in a declared basin are subject to a permit process, and a basin management program is devised.

Basin management programs are based on determining the quantity of water available, establishing a projected "life" of the resource, and monitoring pumpage accordingly. This controlled mining of ground water is similar to Colorado's non-tributary management activities and is characteristic of Stage IV management. Unlike Colorado, however, New Mexico actively controls ground water near streams through administration rather than litigation. Management of near stream ground water frequently hinges on the State Engineer's definition of water right impairment. Many other important decisions in New Mexico's management system also are determined on a case by case basis by the State Engineer. As a result, the management activities in New Mexico are dominated by the discretion of the State Engineer. One man, Steve Reynolds, has been State Engineer for over 30 years and has greatly influenced the management of water in this state.



## SUMMARY AND CONCLUSIONS

The experiences of ground water management under the appropriation doctrine in the Pacific Northwest states of Washington, Idaho, Oregon and Montana suggest a similarity in ground water management problems and a similarity in ground water management stages. The problems may be grouped under the headings of water level declines, water rights conflicts, and management action problems. The stages of development are: I) initial development, II) local stress, III) regional stress and IV) controlled use. Montana is the best example of ground water management under Stage I. Portions of Idaho, Oregon and Washington illustrate the management of ground water classified as local stress. The Snake River Basin of Idaho and the Umatilla Basin of Oregon are approaching levels of regional management difficulty which typify Stage III. Arizona defines the fourth stage of development, controlled use. Utah's management of ground water is characteristic of both Stage I and Stage III. Ground water development has been curtailed in Utah by preventing new appropriations. Both Colorado and New Mexico utilize a controlled mining approach to ground water management which is indicative of Stage IV management. Colorado manages "tributary" ground waters in conjunction with surface water in a Stage III management setting. Ground water management in New Mexico is dominated by the discretionary authority of the State Engineer.

The four-stage development pattern facilitates the comparison of management problems in different states. The value of this approach lies in the enhanced ability of each state to anticipate future management difficulties. Additionally, it is important to recognize that the



Pacific Northwest states are attempting to administer ground water as a renewable resource. This management objective is reflected in many of the observed management problems which define the development stages.

A non-renewable approach to ground water management is utilized by Colorado and New Mexico. The mining of ground water in these two states is centrally controlled in a manner which has been labeled in this report as Stage IV management. This contrasts sharply with the renewable resource approach utilized in Arizona's Stage IV management activities. This illustrates that Stage IV, controlled use, is best defined by administrative control of resource use as opposed to management goals and objectives. Further work is needed to define better Stages III and IV.



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